



CENTRALIZED Marine Gauging With Modular Readouts & Alarms





CUSTOM CENTRALIZED GAUGING SYSTEMS FROM PROVEN STANDARDIZED BUILDING BLOCKS

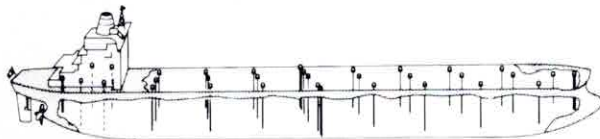
Metritape offers more than the world's most advanced Level and Level/Temp sensors. It also offers the widest variety of standardized-format, shipboard-proven instrumentation modules with which the customer can configure a gauging system to meet his operational, spatial, and economic requirements. Only Metritape offers both Centralized line-powered and On-Deck battery-powered gauging equipment. And only Metritape has performance experience based on over 150 Centralized marine gauging systems, dating back to 1967. Study the following Questions and Answers, and look for these important features in any marine gauging system you may be considering.

1 Q: Why *Metritape* in-tank sensors?

A: Patented, elongated Metritape resistive sensors, suspended throughout full tank height, have become the performance standard for modern marine deep-tank gauging. Thousands of these sensors have been in trouble-free marine service for years. They are simple, have no moving parts and can be installed totally from above deck. Being purely resistive, Metritape sensors are intrinsically safe for the most hazardous of liquids and vapors.

2 Q: Why *combined* Level/Temp gauging?

A: For the safe transfer of liquid cargos, the operator should know cargo temperature as well as level. Other gauging systems generally require independent temperature probes having separate tank penetrations and cabling. In contrast, a single Metritape Level/Temp™ sensor makes both measurements, is easily installed and cabled as a single unit, and uses a single circuit card and digital display module. Today, most Metritape marine deep-tank gauging is combined, cost-economic Level/Temp.



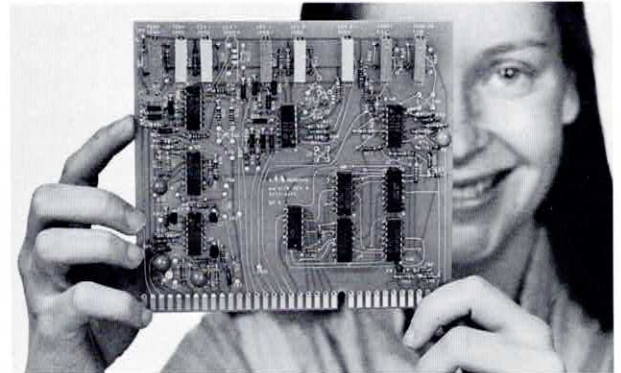
Shipwide sensors send Level/Temp signals to centralized cargo control room.

3 Q: What is **MULTIFUNCTION-4**?

A: For a single tank, the Multifunction-4 plug-in circuit card performs all required electronic functions, including level, temperature, and level alarming. It carries its own precision voltage reference and, when coupled to the four terminals of a Metritape Level/Temp sensor, provides scaled and zero-referenced level and temperature outputs to drive analog meters and digital readouts and, to operate loading control computer or data logger. The Multifunction-4 card also provides multiple adjustable high and low level alarms with flashing-light and audible alarm indication.

4 Q: Why *independent* gauging channels?

A: Using the unique Multifunction-4 card, Metritape makes the instrumentation for each tank separate, independent and self-contained. For tanks of similar geometry, Multifunction-4 cards are identical and interchangeable (although calibration settings may differ). Most important, an electronic component failure on any of these cards can affect *only* the one gauging channel and no other, and full gauging function can be restored by use of a common spare card or by card interchange. Other systems, including those that are computerized, have numerous cards and components that affect *all* system



Unique Metritape Multifunction-4 PC card.

channels. A failure of any one of these shared elements can cause *total* system malfunction. The use of independent gauging channels, is the way to build critical marine gauging systems that have zero downtime.

5 Q: Why *packaged* Modules?

A: A single Metritape Display Module may carry up to 30 mounted elements and require as many as 50 power and signal leadwires from the central Metricircuit panel. Metritape could supply these components loose and require the panel builder or shipyard to mount and wire them. Instead, each of these modular display groupings is totally assembled under factory controlled conditions. Module wiring and components are fully tested prior to shipment, and each module is installed on shipboard as a complete and proven system building block.

6 Q: Why *factory-furnished* cables?

A: Work conditions on a ship in final stages of construction are chaotic and make difficult the accurate wiring of advanced electronic systems. Signal wires can be crossed and sometimes interchanged with power leads, with resultant damage when the system is powered up. Metritape prefers to supply all interconnect cables that join Display Modules to central Metricircuit chassis. Keyed and labelled Mil-style connectors segregate power and signal wiring, and can be plugged in quickly and accurately. In addition, the interconnect cables are used during factory system checkout, allowing hundreds of wiring connections to be carefully tested for accuracy and signal isolation prior to shipment. After such operational testing, factory-furnished cables are packed with the system for rapid, trouble-free reassembly on shipboard.

7 Q: Why *full-system* factory "burn-in"?

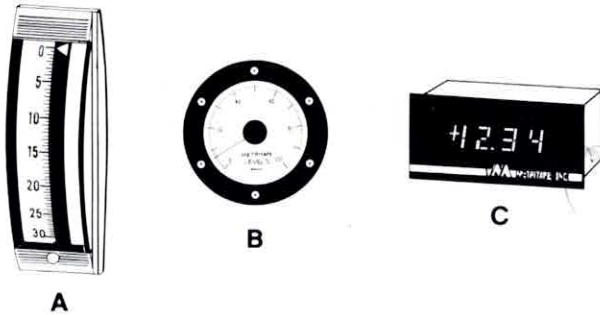
A: When power is applied to your Metritape Centralized gauging system on board ship, this will not be the first time. Complete Metritape system instrumentation, including interconnect cables, has been powered up and



operated for at least a week in the Metritape factory. This period is called "burn-in", and it serves to cause faulty electronic components, if present, to exhibit abnormal behavior. The burn-in period also allows preliminary factory calibration, system stability testing, and operational inspection by marine regulatory agencies, if required.

8 Q: Why both analog and digital displays?

A: Early marine instrument systems made extensive use of pointer-on-scale analog indicators. Recent developments in low-cost, digital number displays have made these

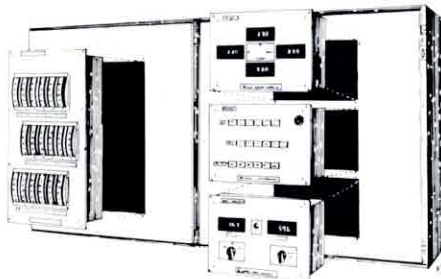


Analog meters (A and B) or digital readout (C). Each has its purpose.

popular because of their readout resolution and unambiguous numeric indication, free from individual interpretation and parallax error. Analog indicators, while offering less accuracy, are more graphic than digital and can be interpreted more quickly in large groupings. Thus for an overview of full-ship loading condition, an array of *analog* indicators is preferred; but *digital* displays must be used for precise calibration and for accurate readout of level and temperature in a selected tank.

9 Q: Why automatic alarms?

A: Audible alarm sounding and visual flashing-light indication when a preset alarm level has been reached (called alarm "annunciation") are imperative for safe monitoring of multi-tank ship installations. The potential cost of tank overfills and spills is great, and closed inerted tanks may rupture if they are overfilled. Metritape Centralized systems provide multiple high-level fill alarms, Open-Circuit alarms to monitor the integrity of deck cables, plus the option of adjustable low-level alarms. Alarm thresholds are screwdriver-settable from the central console, provide flashing-light indication of most-recent alarm condition, allow pushbutton alarm acknowledgement, and offer local audible warning and the option of high-intensity horn sounder.



Metritape modules recess into panel boxes or console.

10 Q: Why built-in central circuit diagnostics?

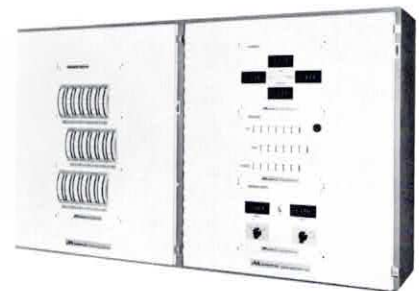
A: Because of distributed (vs common) signal processing, utilizing a separate Multifunction-4 circuit card for each tank, it is particularly easy to locate a failure within the central Metricircuit electronics. To assist such diagnosis, Metritape builds a digital voltmeter (DVM) into each Metricircuit panel, plus a selector switch to allow all dc supply voltages to be rapidly scanned and checked. Most electronic failures once located, can be corrected by simple card substitution.

11 Q: Why dual sensors/dual redundant systems?

A: Critical gauging specifications may require an independent high-level alarm, in addition to continuous full-height tank gauging. To accomplish this, other gauging systems require an additional tank penetration and level detector, separate deck cabling and alarm annunciation, all for monitoring a single high-level point. In contrast, Metritape offers a second independent and *continuous* ullage gauging system throughout the critical topping zone and, in many cases, throughout the full tank height. This is accomplished by use of an added topping or full-height Metritape sensor, mounted in the same tank penetration and using the same deck cabling run. Dual, adjustable high-level alarms are derived from both topping and full-height sensors, and resultant independent pairs of High and Overfill alarms provide highest reliability protection against tank overfill and spill. Metritape also provides dual continuous ullage readings for visual or automatic self-checking, and assuring uninterrupted tank level information for safe loading control.

12 Q: Why Metritape gauging for retrofit?

A: With tanker operations being continually upgraded for higher performance efficiency, positive pollution prevention and maximum safety, Metritape Centralized or On-Deck gauging systems are used widely for tanker retrofit and upgrade. Metritape Centralized systems are easily added to an existing cargo control room, and even to a control console already in place. When completed, the Metritape modular retrofit system will provide just the functions the user desires, and in a format that looks like original equipment. Metritape sensors can be installed with the ship en route, into prepared still pipes totally from above deck. Metritape central instrumentation can also be hooked up, checked out and calibrated from the Centralized location while the ship is underway.



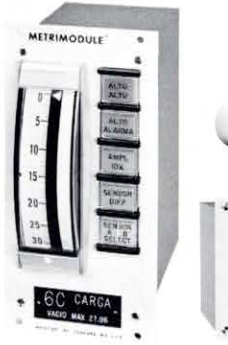
Centralized readout and alarm console . . . by Metritape

TO SEE HOW . . . Centralized Metritape gauging is built up of sensors, Metribarrier and Metricircuit panels, plus service-proven Display Modules. See the system flow diagram on the following pages. This also depicts Metritape Display Modules in convenient 1/10 scale so you can easily lay out your own Centralized gauging system panel.

INDIVIDUAL METERS. Metritape can supply unmounted indicators for installation in console or panelboard by others. May carry pig-tail leads or in-line connectors to facilitate factory checkout and hookup on site. Shown are sealed analog meter (R65S), digitals D1999, D3999, and smaller D999.



METRIMODULES, Series 51,000. All indications and alarms for a single tank are grouped on a Metrimodule, and these arranged in plan layout of tanks. Metrimodule-Analog has vertical-edge analog meter; Metrimodule-Digital has digital readout; both may carry alarm lights/pushbuttons and local sounder.



SCALE: 1/15

SENSOR HOUSING, Series 26,000. Steel weldment has bottom transition plate mounted to deck flange (6 in., 150 lb., ASA), and carries sensor mounting nipple(s), tank pressure return(s) and stuffing tube for cable entry. Bottom flange of Housing mates to transition plate, is O-ring sealed and bolted.



SENSOR DECK STAND, by shipyard, welded to deck or bolted to Butterworth opening; accommodates one or two sensors. Flange placed uniform distance off tank bottom to make all sensors same length. Steel nozzle reduces 6" to 3" below deck to join still pipe of steel or plastic, extending to tank bottom.

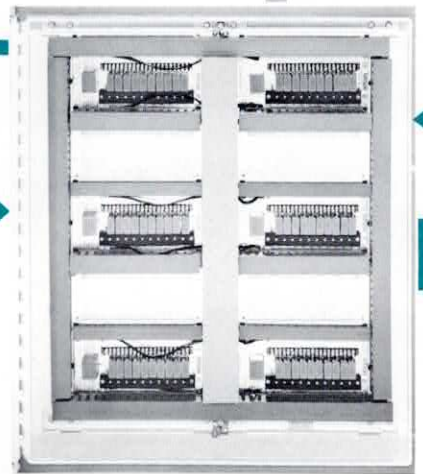
TANK-TOP ULLAGE METER, Series 27,000. Sealed, round analog meter (R65S) mounted under protective window atop Sensor Housing. Displays tank ullage continuously on 6.5 inch (165 mm) scale. Intrinsically-safe meter drive signal received via Metribarrier from Metricircuit.

DECK CABLES
(By Others)

SIGNALS FROM
ALL SENSORS

HAZARDOUS AREA

NON-HAZAR



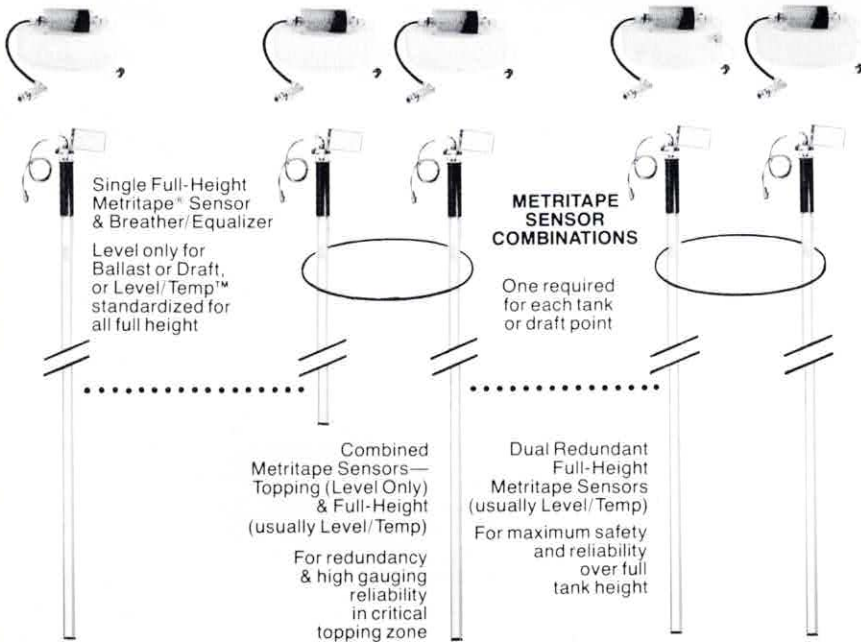
SCALE: 1/15

METRIBARRIER™ Series 3000A. All signal wires into hazardous area pass through Metribarrier and are energy-limited by zener diode barriers. System carries formal intrinsic safety approvals of principal regulatory agencies; must be in segregated compartment.

HAZARDOUS AREA

NON-HAZAR

Capillary Breather Equalizers, one each sensor



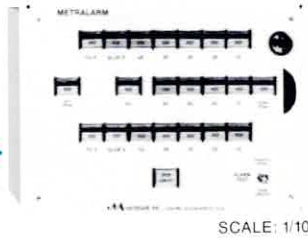
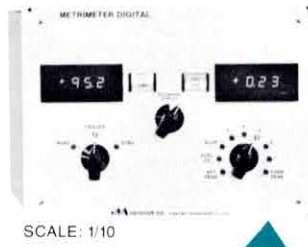
CAPILLARY BREATHER/EQUALIZER, Series 25,000. Pneumatic isolator, couples inner Metritape sensor to tank space to equalize pressure directly, yet prevents entry of tank vapors. One used each sensor. Filter/desiccant cartridge cleans and dries tank atmosphere; capillary tubing holds air volume several times sensor inner volume.

METRITAPE® LEVEL SENSOR, Series 21,000. Unique 2-terminal resistive sensor, measures liquid level, extends over full tank height or in topping region only. Supplied in 1 m dia. coil for easy installation or retrieval from above deck.

METRITAPE LEVEL/TEMP™ SENSOR, Series 22,000. Resistive level sensor has temperature-sensing RTD mounted on back at specified location. Level/Temp sensor is 4-terminal, has one resistive output indicating ullage, the other temperature at RTD location. May be used in pairs for continuous self-checking.

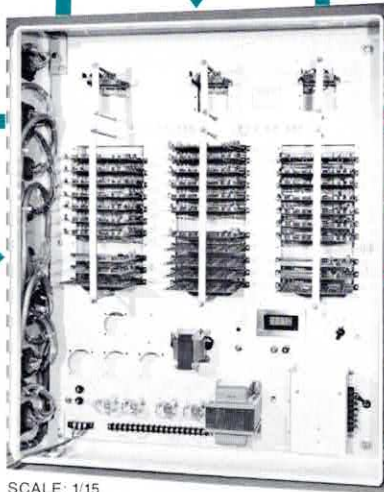
SHARED DIGITAL, Series 52,000. Dual digital readout simultaneously indicates level and temperature of tank selected by rotary switches; has an Exchange Display switch to swap readout functions should one meter fail.

MODULAR DISPLAYS. Adjacent modules display one function for all tanks in grouping; offer multiple display elements in plan layout of tanks. Each has rear cover and electrical connector to receive supplied interconnect cable; require approx. 305 mm (12 inch) behind-panel clearance.



AREA

Ship's Line Power
110-220
VAC
50-60
Hz



FACTORY-SUPPLIED CABLES join modular displays to central Metricircuit chassis, are factory-tested at system final checkout and burn-in, and are error-free to hook up at shipboard installation.

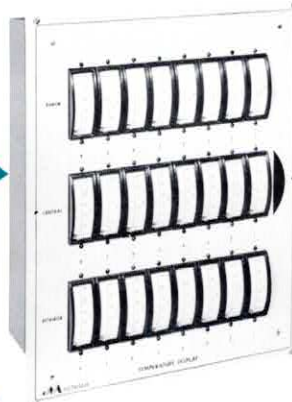
METRALARM,™ Series 56,000. Alarm indicator lights/annunciator pushbuttons in plan layout of tanks. Dual-window indicators show High and High-High (Overfill) alarm conditions; serve as Alarm Acknowledge pushbuttons for silencing audible, converting flashing light to steady.

METRIDRAFT,™ Series 58,000. Separate digital indicators for each of 2 or 4 Metritape draft sensors. Readings are damped and zero-referenced to keel.

MODULE PHOTOS are shown to scale indicated. For Metritape system planning, make photocopy of page, cut out module panels, and do trial layouts of various display arrangements on scaled drawing of your console or panel.

AREA

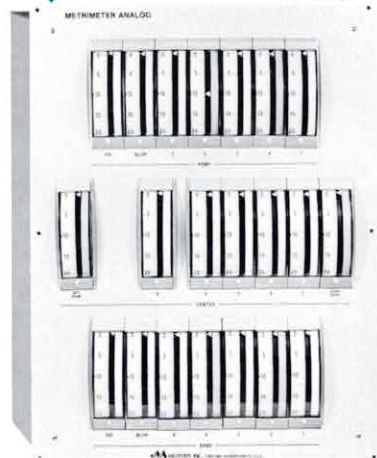
METRICIRCUIT,™ Series 40,000. Centralized line-powered panel receives sensor signals via Metribarrier, produces scaled and referenced drive signals for indicators, alarm annunciators, and external loading computer. New plug-in Multifunction-4 card performs all functions for one tank. Panel can be mounted on frame, or in box.



ANALOG ARRAY, Series 54,000. Analog meters in plan layout of tanks, one meter for each tank; vertical edge Model VE27 meters (2.7 inch scale) shown upper photo; Model VE45 meters (4.5 inch scale) lower photo.



DIGITAL ARRAY, Series 55,000. Digital indicators in plan layout of tanks, one for each tank. Small momentary pushbutton at each meter for readout of product temperature. Frontal dimensions dependent on selected meter and tank layout.



CENTRALIZED METRITAPE GAUGING

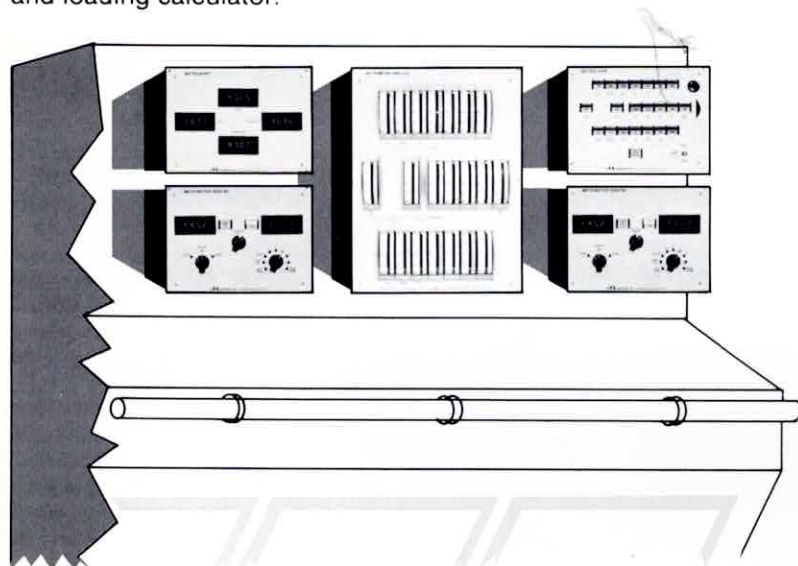
Offers unique Metritape sensors, Metribarrier energy limiter, line-powered Metricircuit and modular displays to suit varied user needs.



Wide Selection of modular elements gives the Metritape user an almost infinite variety of gauging, displaying and alarming functions, to fit the space available. These pages show examples of the 150 centralized marine gauging systems delivered to date by Metritape.

CRUDE OIL/PRODUCT TANKERS

Marine carriers of crude oil, petroleum products and chemicals, having pump and valve controls in central control room, require centralized high-reliability tank gauging and alarms, plus outputs for hull stress analyzer and loading calculator.

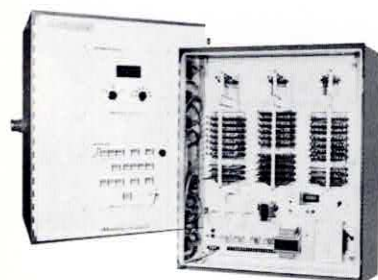


Primary Full-Height Gauging

Metritape display modules recess neatly into cargo control console, with Metribarrier and Metricircuit panels mounted within, to form primary tanker gauging, above. System uses 21 Metritape Level/Temp sensors for cargo, ballast, slop, and fuel oil; four level sensors for draft.

Independent Topping

Compact, independent high-level alarm system below uses short Metritape topping sensors, provides independent ullage level and alarm indications in critical upper tank region. Gives added protection against tank overfilling, possible tank bursting and costly oil spill.



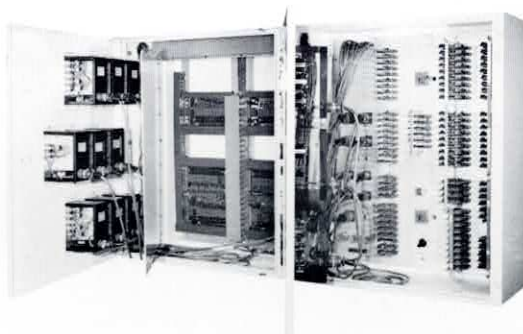
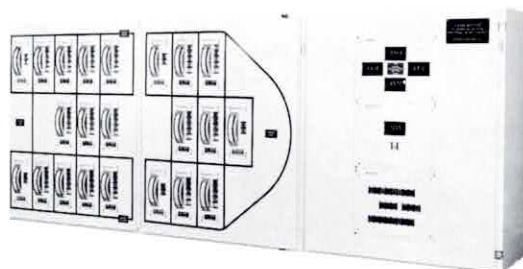
Dual Metritape gauging and alarming systems, for six 51,000 d.w.t. crude-oil shuttle tankers, are standardized for ease of operator use.

COVER PHOTO: One of 6 Japanese-built tankers equipped with Metritape centralized level gauging and alarms.

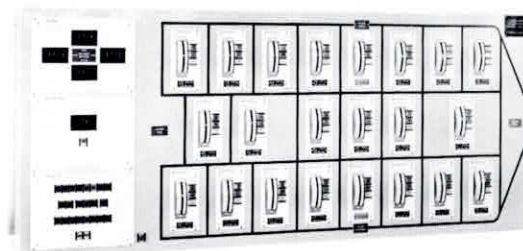


METRIMODULE™ DISPLAYS

Analog or digital, these combine all functions for a single tank into one module. Metrimodule-Analog (at left) serves centralized system below, using dual full-height Level/Temp sensors. Horizontal format Metrimodule-Digital displays (shown top center of pages 4 and 5) are in increasing use.



Dual-sensor Metrimodule system above is bulkhead mounted, holds Metribarrier and Metricircuit panels which are accessible through hinged front-panel doors. System serves 17 cargo, five ballast, and four draft points. Offers both analog and digital displays and multiple level alarms, based upon automatic-checking dual Metritape sensors.



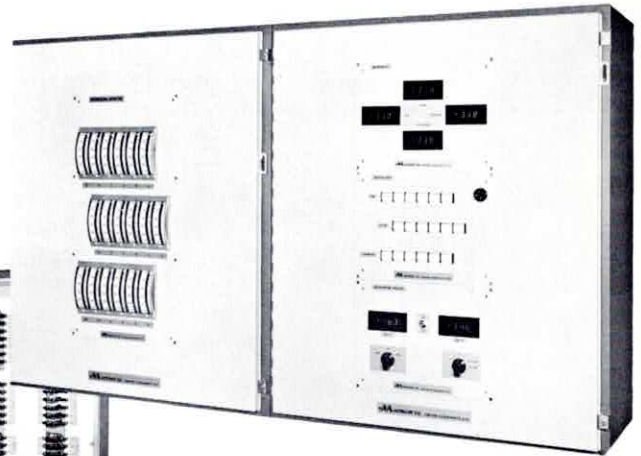
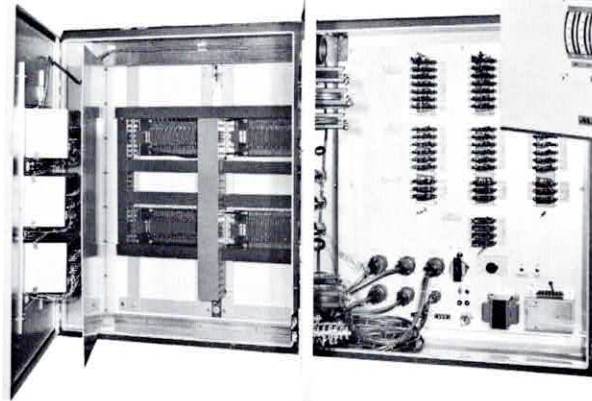
Metrimodule system above is one of seven, each gauging 22 cargo/ballast, two fuel oil and four draft points. Unitized panel box contains Metribarrier and Metricircuit panels, is free standing and serviceable through rear access doors.



STATION TANKER

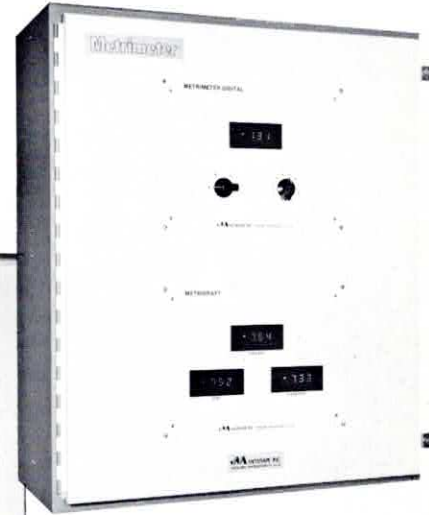
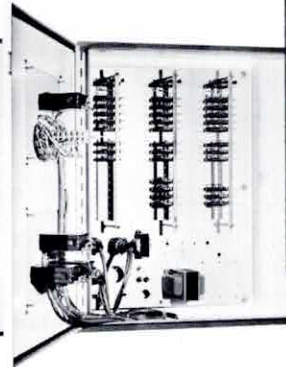
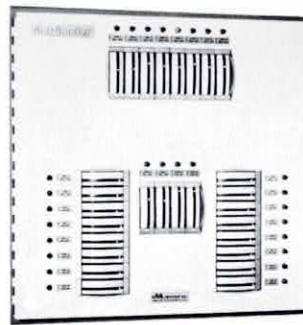
An important application for Metritape centralized gauging is the moored station tanker, providing intermediate storage between producing wells and transit tankers. For such gauging, Metritape offers a rugged, reliable system with no moving parts; tank level, temperature, and draft measurements, adjustable high and low alarms.

Station tanker system at right includes Metritape Level/Temp gauging for 15 crude oil, 2 slops and 1 fuel oil tank; digital and analog displays, adjustable level alarms, and 4-point digital draft.



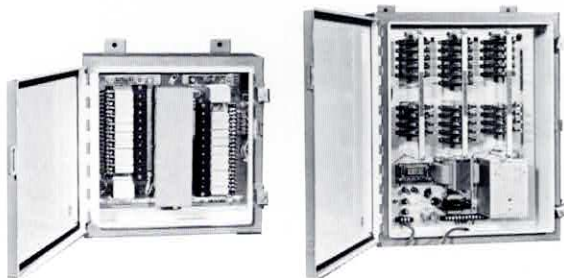
DRILL RIG

Metritape centralized marine systems offer full range of rugged, low-maintenance, high-accuracy gauging required by drill rigs. Consoles at right are for 3-leg jackup rig. Level-measurements include 12 drill water, 12 pre-load, two potable water, two fuel oil and three draft. Displays are Analog Array, plus precision Shared Digital for tanks, and three separate digitals for draft.

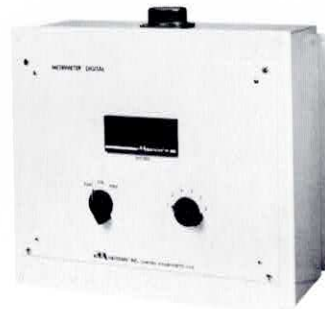


RETROFIT SYSTEMS

Metritape modular approach is designed for easy retrofit, with central displays mounted on bulkhead or in console, and factory-supplied cables allowing fast, error-free systems interconnect. Refit gauging system may be customized, but uses standardized Metritape elements, including barriers, circuit cards and displays.



Low-profile display above mounts atop existing console, uses separate Metribarrier and Metricircuit boxes; offers 13 mounted digital meters, each with high and low level alarm indicator lights/acknowledge pushbutton.



Display Module can also be separately packaged in the surface-mounted box above, which allows top or bottom cable entry.



What You Have Come to Expect . . . From Metritape

For a decade, Metritape, Inc., has been supplying advanced, reliable, high-performance gauging equipment for a wide range of demanding marine applications. Such Metritape equipment includes —

- Elongated, purely-resistive Metritape level sensors
- Integral, Metritemp resistive temperature detectors
- Centralized readout and alarm consoles for cargo control room, engine room, bridge or dockside
- Battery-powered Digilert digital Level/Temp readouts with audible level alarms for on-deck mounting or portable use

*PROVEN AT SEA...*to be rugged under the toughest of marine operating conditions...to provide longterm gauging reliability and accuracy second to no other marine gauging method...to satisfy the highest intrinsic safety ratings...to operate maintenance-free, voyage after voyage, year in, year out.

Ask about Metritape's realistic performance specifications...about Metritape gauging performance data derived from shipboard operational testing...about Metritape's 4-year Pro Rata sensor warranty.

For more about Metritape user benefits, send for comprehensive 24-page brochure "Metritape...The Marine Level Gauge You've Been Waiting For", and product-line description "Metritape ON-DECK Marine gauging with DIGILERT™ Readouts & Alarms." See how Metritape marine gauging can improve the safety and efficiency of your marine operations.



METRITAPE FACILITIES (above left) for manufacture and QC of unique 30 m (100ft) precision resistive Metritape Level/Temp sensors



ELECTRONICS FABRICATION (above right) of Metritape packaged instruments and systems, using the most advanced solid-state technology.

DIGILERT™ line (below) of unique marine instruments for on-deck digital readout of tank ullage and product temperature, plus audible and visual fill alarms. Battery-powered and intrinsically safe, for use with Metritape Level/Temp sensors.



*Model 1555
Portable*



*Model 1552
Level/Temp
Readout &
Alarm*



*Model 1553
Audible
Sounder*

DIGILERTS (Port, Center & Starboard), plus horn, in deck enclosure



Metritape® Marine Sales and Service

World Headquarters

Metritape, Inc.
33 Bradford Street
Concord, Massachusetts 01742 USA
Tel (617) 369-7500, Tlx 92-3492

United States

East Coast — Smedley, Tel (215) 664-7880
Gulf Coast — Wilson Markham, Tel (713) 445-5780,
Twx 910-881-7027
West Coast — Wickert, Tel (415) 647-3500,
Tlx 34-0140

Canada

Quebec Province — Baker, Tel (514) 321-6625
Ontario Province — Baker, Tel (416) 889-8642,
Tlx 06-96-4572
British Columbia — Canadian Dynamics Nova,
Tel (604) 324-3116, Tlx 04-55365

METRITAPE PATENTS United States: 3,153,342; 3,511,090; 3,583,221; 3,653,262; 3,663,881; 3,753,200; 3,783,689; 3,792,407. Australia: 462,821. Canada: 909,907; 927,948; 958,099; 973,949. France: 72,32646. Germany: 1,932,175; 2,061,154; 2,057,113; 2,244,518. Great Britain: 1,232,359; 1,338,593; 1,396,021. Japan: 637,024; 745,130; 802,594; 938-289. Russia: 644,403. Sweden: 378, 451. Other patents pending.

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Europe

Headquarters — Metritape, Inc., Avda Generalísimo, 73-A, 8º, Madrid 16, Spain
Spain — Nornaval, Tel 270-1371 or 3671, Tlx 43586
Belgium — Sait Electronics, Tel 032 31 31 18 70, Tlx 31547
Denmark — Instrumatic, Tel 6-57-1911, Tlx 63125
England — Marine Ventures, Tel 01-930-0515, Tlx 24760
France — Sofraret, Tel 522-40-84, Tlx 280430
Germany — Deckma, Tel 40-880-1566, Tlx 215792
Greece — Spanoudis, Tel 36-12-451, Tlx 21-3254
Holland — Manotherm, Tel 010-16-90-11, Tlx 28604
Israel — S. Nir, Tel 04-718779, Tlx 46400
Norway — Tanksystem, Tel 14-17-43, Tlx 17590
Sweden — Gotaverken Motor, Tel 031-22-8300, Tlx 20937

Far East

Hong Kong — Ship Repairers, Tel 3-622084, Tlx 73547
Singapore — Panda, Tel 37 2651. Tlx 25440