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## 1.0 TRANSMITTER OVERVIEW

### 1.1 GENERAL DESCRIPTION

The Series 1210-LTM200D is an electronic field instrument, suitable for installation in hazardous and non-hazardous industrial areas. Testing and certification has been obtained from different agencies for installation in specific areas.

This is a two wire, loop powered instrument, designed to measure and transmit an analog 4-20 mA signal proportional to liquid level in a tank. The complete assembly includes a dual compartment explosion-proof enclosure and attached sensor tube.

Optional features of the Series 1210-LTM200D include:

- A variety of lengths and wetted materials to accommodate many different applications
- Mass or volume information

### Product Serial Number

Norriseal assigns a unique serial number for each unit. The first two digits indicate the month of production followed by two digits, indicating the year of production. For example, serial number 0609/1234 describes a unit manufactured in June of 2009 with a serial number 1234.

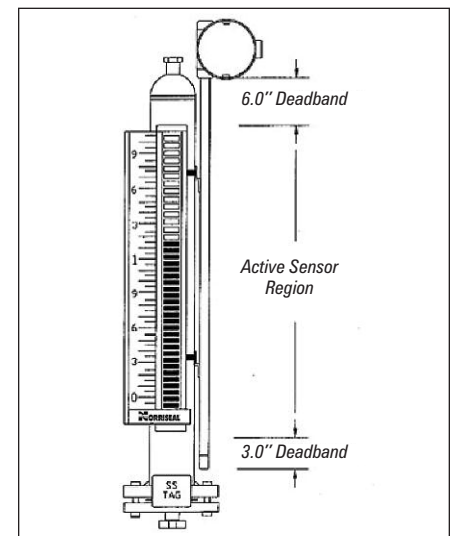
### 1.2 LEVEL TRANSMITTER

In its simplest configuration, a single-purpose float rides up and down the sensor tube, totally surrounding it. A multi-purpose float may also be used to activate the sensor, such a float being placed inside a liquid isolation pipe (i.e. gauge), and strategically located within a certain longitudinal distance from the sensor tube. In either case, the float has

a somewhat lighter specific gravity than the liquid whose level is to be measured, so that it is partially submerged at the interface of interest. As the tank level changes, the float tracks the change and continuously activates the sensor in the tube. The electronics in the housing process the changing signal and update an analog 4-20 mA output. This analog output is precisely proportional to the liquid level in the tank.

### 1.3 GAUGE MOUNTED TRANSMITTER

The 1210-LTM200D may be strapped to the side of a Norriseal 1200 series magnetic level indicator. In such an installation, it is used as an accessory transmitter for the visual level gauge. The same float used to activate the magnetic gauge is also used to transmit a signal to the magnetostrictive sensor of the 1210-LTM200D. The transmitter may be calibrated for the same range as the visual indicator on the gauge, or for part of the range (See below).



Series 1210-LTM200D Mounting Configuration  
Style B & C Series 1200 Gauge

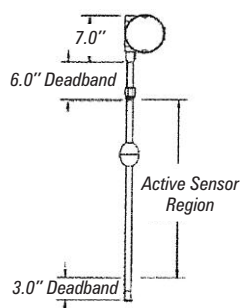


### 1.4 STANDALONE TRANSMITTER

When a companion magnetic gauge is not present, the 1210-LTM200D is inserted into the tank with its own float around the sensor tube. A stilling well may be optionally used inside the tank or, in case of high temperatures, an external chamber may house the probe and float assembly.

#### NOTE:

When a stilling well is used, care should be exercised when installing the tube to center it in the chamber so that the float can freely travel the the entire length of the probe. Stilling wells are required for transmitters over 10 feet.



Single Float Transmitter

The calibration range of the transmitter may be field stored in non-volatile memory by using the float and push buttons. The push buttons are located on the front panel inside the conduit. See section on Calibration for more details.

## 2.0 INSTRUMENT DESCRIPTION

### 2.1 TRANSMITTER DETAILED DESCRIPTION

The 1210-LTM200D is an assembly of two major components:

- **Sensor Tube Assembly.** This is a 5/8" diameter stainless steel probe, sealed on one end, with the magnetostrictive waveguide in its center. In addition to the magnetostrictive waveguide, the tube also houses the optional temperature sensor and the detector electronics.
- **Electronics Housing.** The extruded aluminum housing has two separate compartments. One side contains the microprocessor board assembly and calibration push buttons. The other side contains the wiring termination board. The electronics module is connected to the detector board of the sensor tube assembly via a plug-in cable.

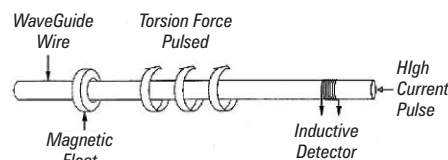
The main board is surface mounted component construction utilizing the latest in integrated circuit technology. It contains a high-speed micro controller, D/A Converters and all other accessory components.

### 2.2 THEORY OF OPERATION

The 1210-LTM200D level transmitter is based on the principle of magnetostriction first used for digital delay lines and later for precision distance or displacement in the machine tool industry. The principle, if designed and applied properly, has potentially very high measurement resolution, typically better than 0.001 inch. In the machine tool industry, such a high resolution is desirable. In the liquid

measurement application, however, a resolution of 0.01 inch is more than adequate.

In a brief description, the magnetostrictive principle consists of a wire extruded and heat treated under carefully chosen conditions to retain desired magnetic properties, which is pulsed by a circuit with a relatively high current pulse. The high current pulse produces a circular magnetic field as it travels down the wire at the speed of light. Another magnetic field generated by a permanent magnet (placed near or around the wire at some distance from the point of entry of this pulse) interferes with the magnetic field of the pulse and torsional force results at the collision point. The effect of this torsion force is to twist the wire at this point producing



a torsion wave traveling towards both ends of the wire. The propagation time of this wave is measured precisely and, if the wire properties remain stable, it is very repeatable at about 5-10 microseconds per inch (which is approximately the speed of sound in that medium). By measuring the exact number of microseconds it took the torsion wave to reach a designated termination point of the wire, the distance to the magnet from this termination point can be easily calculated.

A high-speed micro controller is utilized in the design to process and calculate the elapsed time measurement. Accurate crystals are used for

the time base to resolve sub-microsecond timing increments. The binary number, equivalent to the microseconds of the echo travel time, is written to an output D/A Converter and subsequently converted to a 4-20 mA signal proportional to the item measured. The larger the number of microseconds there are, the greater the distance of the float from the head of the transmitter.

Calibration routines are included in the software to scale the 4 and 20mA points for any distance desired. Even reverse calibration is a simple task using the software routines. Reverse calibration is desirable if ullage instead of full level is required, or when the probe is installed with bottom mount head. See Section 5.0 on Calibration for further details.

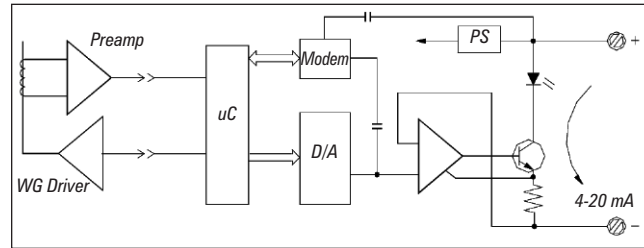
**Primary Level Transmitter** – The transmitter computes the distance between the float and the detector from the elapsed time measurement. A specific time window becomes active only for a short time after the interrogation pulse is applied to the waveguide. Any feedback signal, received before and after this window, is rejected as noise. Even signals received during the active window are evaluated and filtered so that only high integrity data is accepted.

The conditioned signal is converted to a percent of full-scale number and written to the D/A Converter. The scale is defined by the calibration procedure and it corresponds to the output span (4-20mA) of 16.00 mA.

A deadband, corresponding to approximately six inches next to the detector, is fixed in the software and the float is not permitted to enter this

area. If this happens, readings may be erratic or the output may go to FAIL.

Facilities are provided to field calibrate the range of the 4-20 mA output using actual position of the float and pressing a push-button on the front panel to set the 4-20 mA point.



Basic Level Transmitter Simplified Block Diagram

Provision, accessed via the front panel, is made for a FAIL mode to High (20.8 mA), Low (3.75 mA) or "Hold Last Value!"

### 3.0 INSTALLATION AND WIRING

#### 3.1 STRAP-ON TRANSMITTER INSTALLATION

**CAUTION:**

*During installation, do not attempt to twist or turn the head of the transmitter. Damage to the detector assembly may occur if the head is rotated. If the head is loose, please notify the factory.*

The 1210-LTM200D can be mounted to the side of a Norriseal 1200 Series level gauge using a special mounting bracket and stainless steel hose clamps. When mounting the transmitter to a 1200 Series gauge the active sensor region of the probe should fall within the centerline of the process connections on the gauge. If the transmitter deadband region

is inside the centerline of the process connections the transmitter will not output an accurate measurement because the active region of the probe is too short. When placing an order for a transmitter to accompany an existing gauge it is important to indicate the

style of the gauge, the temperature and the center-to-center dimensions. Calibration of the probe will be factory set along the active region of the probe; however, a field calibration may have

to be performed to match the probe to the desired control room specifications.

If a transmitter is being purchased for an interface gauge, the calibration for the probe should be done in the field to ensure a proper control room reading. For long transmitters it may be desirable for the operator to have the electronics housing mounted at the bottom of the gauge for easy access. THIS MUST BE SPECIFIED AT TIME OF PURCHASE.

#### 3.2 STANDALONE TRANSMITTER INSTALLATION

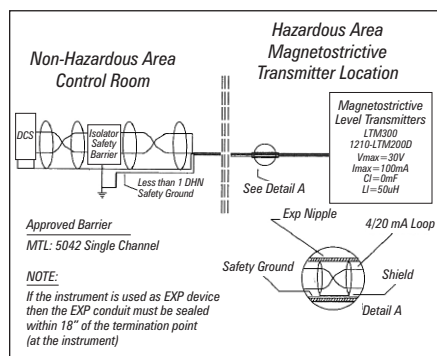
The 1210-LTM200D stand-alone transmitter comes equipped with a 3/4" compression fitting, mounted approximately 6.00" below the electronics housing. The fitting is placed in this area to ensure the transmitter is calibrated in the sensor tubes active region. Refer to the stand-alone drawings for a visual description of the transmitter features. Optional configurations are available upon request.

# OPERATING AND MAINTENANCE MANUAL

## Series 1210-LTM200D Magnetostrictive Level Transmitter

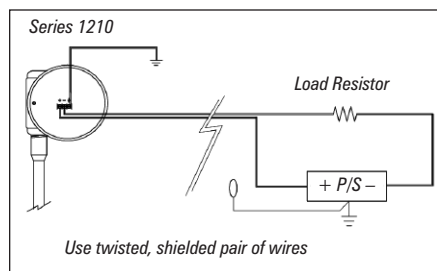
The magnetic float used in the stand-alone unit is designed to travel up the sensor tube with the change in fluid level. If build-up of process or contaminates should restrict the movement of the float, the transmitter sensor tube will have to be cleaned or the float may have to be replaced with one that has a wider inside diameter. The floats are designed to match the pressure and specific gravity for the process being measured and come in various materials ranging from stainless steel to Kynar.

The magnetic float can be changed out at any time to accommodate the processes being measured. The float stop, located at the bottom of the transmitter, can be removed to allow the float to slide off the sensor tube.



Interconnect Wiring (CSA and FM)

### 3.3 RECOMMENDED WIRING, SINGLE LOOP



## 4.0 SPECIFICATIONS

### 4.1 TRANSMITTER ELECTRICAL SPECIFICATIONS

Supply Voltage	15 to 36 VDC
Repeatability	0.05% of full scale or .010", whichever is greater
Non-Linearity	0.1% of full scale or .030", whichever is greater
Level Sensor Accuracy	.01% of full scale or .020", whichever is greater
Analog Output Resolution	0.25% of full scale, (1) 4/20 mA primary level.
Output	One 4-20 mA output
Calibration	Zero and span field adjustable with push buttons
Diagnostics	On board diagnostics for troubleshooting
Dampening	1 to 25 seconds (field adjustable)
Oper. Temp. (electronics)	-58 to 185°F (-50 to 85°C)
Housing	Explosion proof, dual compartment, H" NPT, epoxy coated aluminum
Polarity Protection	Diode in series with the loop
Hazardous Location Approvals	FM - Exp Cl I, Div. I, Grps. B, C, D CL II, Div. 1 Grps. E F G, Cl ILL N4X, IP66 CSA - Ex IA (intrinsically safe): CL I, Div. I, GRPS. C, D EXP (Expl. Proof): CL I, Div. I, Grp. B, C, D, Cl II, Div. 1 Grps. E F G, Cl III, N4X, IP66
Ambient Temp. Range	-20°C to +40°C (-4°F to 104°F)
Humidity Limits	SAMA PMC 31.1-5.2
Vibration Limits	SAMA PMC 31.1-5.3
RFI Limits	SAMA PMC 31.1-20 to 1000 MHz up to 30V/m

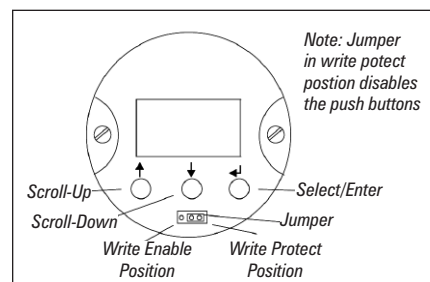
### 4.2 TRANSMITTER SENSOR TUBE

Material	316 ss standard, optional Hastelloy, Monel, Kynar coated
Operating Temperature	-50 to 302°F (-50 to 150°C)
Maximum Pressure	2000 psig @ 300°F
Range	12" to 30 ft.

## 5.0 CALIBRATION

### Pushbutton Calibration

- Step 1- Move jumper to the write enable position (see below)
  - Step 2- Move your float or magnet to the 4mA (0%) point on the probe
  - Step 3- Press the ENTER button on the display until "Trm Snsr" is displayed. Press the UP arrow to display "Yes" and press ENTER.
  - Step 4- The display will read "Trim Zero". Press ENTER.
  - Step 5- Move the float or magnet to the 20mA (100%) point on the probe.
  - Step 6- The display will read "Trim Span" with a value above. Using the arrow buttons, input the correct distance from the zero point and press Enter. Calibration is now completed.
- Note: "Sel Lngth" value is factory set and should not be changed. Doing so will cause a level error indication.*



Front Panel

### 5.1 LCD MENUS FOR THE LTM200

#### Displays

Level Measurement <i>Display - in inches</i>	123.45 in Level
Level Measurement <i>Display - in centimeters</i>	4567.8 cm Level
Level Measurement <i>Display - in millimeters</i>	90123. mm Level
Level Measurement <i>Display - in feet</i>	56.789 ft Level
Level Measurement <i>Display - in meters</i>	23.456 m Level
Output Current	12.34 mA Output
Percent of Range	56.78% % Range
Configuration Screens <i>(Up/Down arrows choose options) Press Select to Enter.</i>	
Model Number	Series 1210- LTM200D
Select sensor length <i>Input overall sensor length (Length = end to weld)</i>	xxx.x In SelLength
Level Units <i>rotates starting at present units (&gt;ft&lt;&gt;m&lt;&gt;in&lt;&gt;cm&lt;&gt;mm&gt;)</i>	In Sel Unit
Alarm <i>rotates starting at present alarm (&gt;High&lt;&gt;Low&lt;&gt;Hold Out&gt;)</i>	Hold Out Sel Alarm
Range Change <i>Choose Yes to Select Range - Display starts with NO</i>	No ChgRnge?
Lower Range Value	12.34 in Sel LRV
Upper Range Value	45.67 in Sel URV
Damping <i>From 1 to 25 - Will not allow 0 or negative numbers.</i>	3. s SelDamp
Sensor Calibration <i>Choose Yes to perform Sensor Trim (Display starts with No)</i>	No TrnSnsr?
Zero Trim <i>Set float to the 4 mA mark (0%) and then Select. Data not required.</i>	TrimZero

#### Span Trim

Move the float to the 20mA mark (100%) on the probe.

123.45 in  
TrimSpan

Using the arrow buttons input the correct distance from the zero point and then Select.

#### Level Offset

Enter the desired value of the offset from the current zero

.00 in  
Set Off

and Press Enter. This will show a level offset at 4mA., i.e., 4mA will be reported @ 5.0" if 5.0" was selected.

#### Dac Trim

Choose Yes to perform Dac Trim - Display starts with No

No  
TrimDac?

#### Dac Trim - 4mA Point

Press raise or lower depending on value of loop current.

Trim 4mA

#### Dac Trim - 20mA Point

Press raise or lower depending on value of loop current.

Trim 20mA

#### Loop Test - Input Value

This will continuously vary the loop current as the user presses the Raise or Lower buttons. Exits when user depresses Select button.

8.00 mA  
LoopTest

#### Exit to Displays

### 6.2 MAGNETIC INTERFERENCE

It is possible for the Series 1210-LTM200D to be magnetically biased or have residual magnetic energy stored along the length of the waveguide. These magnetic anomalies can interfere with the signal-to-noise ratio and the stability of the output signal itself.

If this appears to be the case, a gauge float magnet (or any magnet available) may be run along the length of the sensor tube, past the head of the transmitter, in an even motion and without stopping. This will usually clear all such magnetic anomalies.

#### CAUTION

Never move a magnet in a perpendicular motion from along the sensor tube. This will always leave a residual field in the waveguide which will cause the transmitter to give an erratic output

## 6.0 TROUBLESHOOTING AND MAINTENANCE

### 6.1 CALIBRATION PROBLEMS

If the transmitter does not appear to calibrate properly, or has an erratic output, check the deadband of the sensor tube and ensure that the float is within the active region of the probe. The active region of the sensor tube is typically marked with 20mA and 4mA stickers when the unit is calibrated before shipment.

If the output is still erratic, try disconnecting the power momentarily by unplugging and plugging-in the terminals. If a glitch was stored in RAM memory, this will generally clear it.

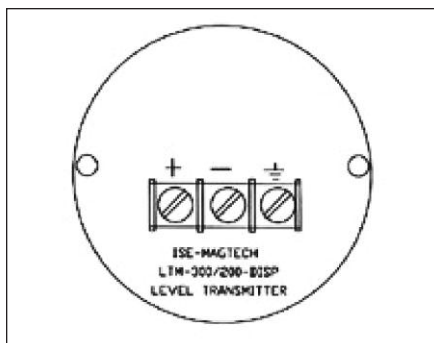
### 6.3 TROUBLESHOOTING POWER SUPPLY PROBLEMS

The Series 1210-LTM200D is designed to operate with a supply voltage of 15-36 vdc (at 20 mA) across its terminals without affecting the mA signal. The most common loop supply used is 24vdc.

It is found sometimes that additional resistance in the loop is necessary, either in the form of a second load resistor or higher resistance safety barrier. This will appear to limit the maximum output of the transmitter to below 20 mA. The transmitter will generally perform correctly up to this point. To resolve this problem, the voltage of the loop supply must be increased somewhat. Even a slight increase by one volt may be sufficient and many supplies have such an adjustment.

All connections must be checked for improper wiring or polarity before

power is applied. The Series 1210-LTM200D has series diodes preventing the reverse polarity from entering and damaging the circuitry. If power is applied and the signal is 0.0 mA, chances are good that the polarity is reversed.



Terminal Board

### 6.4 START-UP FOR GAUGE-MOUNTED LTM TRANSMITTERS

#### Gauge and Transmitter Installation

1. Visually inspect gauge and transmitter installation to insure transmitter is positioned with the 4 mA and 20 mA labels directly adjacent to the process connections. Make sure transmitter is securely clamped and parallel to gauge chamber.
2. Remove bottom flange and install float. Each float is clearly tagged with serial number of the gauge and process parameters. Top of float is clearly marked "TOP" to insure float is in right-side-up.
3. Inspect bottom flange for proper gasket and spring. This spring protects float and keeps it from dropping below the bottom process connection. To determine proper spring length measure "A" dimension of gauge. This is the length from the center of the bottom proc-

ess connection to face of the bottom drain flange. Length of spring should be

("A" DIMENSION) (-) Minus (Float Length + 2 inches)

EXAMPLE: "A" Dimension is 14", Float length is 12", + 2" = 4" Spring Length 14 - 12 + 2 = 4" spring

4. Float is properly installed if the bottom 2-3 flippers on gauge indicator have flipped.

#### NOTE:

There is a top spring in the gauge to protect the float and prevent it from passing the top process connection. DO NOT REMOVE EITHER SPRING.

### Transmitter Check-out and Calibration

NOTE: Series 1210-LTM200D transmitters are 24VDC Loop powered (2-wire) and require a minimum of 15 Volts at 20 mA.

1. With the float in the gauge, the output of the LTM should be 4mA.
2. With float in the gauge at 20mA, the output of the LTM should be 20mA.
3. If no float is present, or magnetic field is lost, the transmitter will display "LEVEL SIGNAL LOST".

#### NOTE:

In service over 400° F (204°C) gauges and transmitters should be properly insulated with transmitter OUTSIDE the blanket.

Note: During the installation or calibration of the Series 1210-LTM200D level transmitter, the technician should be very careful not to move the magnet perpendicular to the sensor tube as this could leave magnetic indentation in the sensor wire. The Series 1210-LTM200D level transmitter has an induc-

tor located inside the bulkhead of the sensor tube. During operation of the transmitter, this inductor emits a magnetic field as current passes through the sensor wire. If an external magnet or the float comes in contact with the bulkhead, this can cause temporary magnetization of the coil, which means the coil is biased. In other words, the phase is reversed. If this occurs, the inductor should quickly recover. It may be manually reversed or demagnetized very simply by "swiping" a magnet parallel to the bulkhead in an arching motion.

## 7.0 FIELD INSULATION OF GAUGES WITH TRANSMITTERS

### 7.1 FIELD INSULATION

We strongly recommend that experienced Norriseal personnel perform any insulation of the magnetic level gauges with externally mounted transmitters.

If cryogenic "Hard Skin" cold service type insulation is required, it MUST be done at the factory due to the custom "TUBE in TUBE" design necessary for removal of the transmitter if needed.

If insulation is going to be installed in the field, then the following guidelines MUST be followed:

1. Flexible type insulation jackets (NOT HARD SKIN) are required and must be installed around the gauge chamber only. DO NOT cover the Series 1210-LTM200D transmitter tube, as this may burn up the sensor and possibly the electronics.
2. After the insulation jacket is installed, the Series 1210-LTM200D sensor tube must be re-mounted at its factory-preset distance from

the gauge chamber and must be parallel to the chamber as well. (Small cut-outs in the jacket are required to re-attach the transmitter properly).

3. Make sure the 4mA markings on the sensor tube are re-aligned at the centers of the process connections.

### 7.2 INSULATION WARNING LABEL SUPPLIED

#### **WARNING (WHEN INSULATING GAUGES)**

*Norriseal level transmitters have a maximum operating temperature of 300°F. When insulating a gauge and transmitter assembly in HOT service, keep the transmitter OUTSIDE the insulating material. Special blankets for this type of insulation are available from Norriseal. For further information consult Norriseal: 713.466.3552*

## 8.0 WARRANTY AND HART PROTOCOL

### 8.0 WARRANTY

All Norriseal products are warranted against defects in materials and workmanship of one year from date of shipment. Floats are guaranteed for two years. Norriseal will repair or replace at its discretion those products that fail to perform as specified, with the following exceptions:

1. Products repaired or modified by persons that are not authorized by Norriseal.
2. Products subjected to misuse, negligence or accidents.
3. Products that are connected, installed, or otherwise used in such a way not in strict accordance with manufacturer's instructions.

This warranty is in lieu of any other warranty expressed or implied by any party other than Norriseal. Repairs and/or replacements shall be at the sole discretion of Norriseal based on the terms and conditions of this warranty. Defective products shall be returned to the factory prepaid by the buyer after obtaining a Return Authorization Number from Norriseal. All warranty repairs or replacements will be preformed at the factory in Houston. Surface return freight will be paid by Norriseal. Factory warranties do not include field service. Field service warranty repairs will be at the buyer's expense. Consult Norriseal for field service rates. Any modifications to terms and conditions of this warranty will not be binding unless made in writing and signed by an authorized agent or official of Norriseal.

#### **NOTE:**

*All Norriseal gauges should be unpacked and thoroughly inspected upon receipt. Gauges are shipped FOB factory and are fully protected against damage or loss during shipment. Any claims for parts damaged during shipment should be submitted within 15 days of receipt of goods by customer.*

## 8.0 WARRANTY AND HART PROTOCOL

### 8.1 WARRANTY

All Norriseal products are warranted against defects in material and workmanship of one year from date of shipment. The level gauge chamber and process connections are guaranteed for the life of the tank or vessel to which it is attached. Floats are guaranteed for two years. Norriseal will repair or replace at its discretion those products that fail to perform as

specified, with the following exceptions:

1. Products repaired or modified by persons that are not authorized by Norriseal.
2. Products subjected to misuse, negligence or accidents.
3. Products that are connected, installed, or otherwise used in such a way not in strict accordance with manufacturer's instructions.

This warranty is in lieu of any other warranty expressed or implied by any party other than Norriseal. Repairs and/or replacements shall be at the sole discretion of Norriseal based on the terms and conditions of this warranty. Defective products shall be returned to the factory prepaid by the buyer after obtaining a Return Authorization Number from Norriseal. All warranty repairs or replacements will be preformed at the factory and will be paid by Norriseal. Factory warranties do not include field service. Field service warranty repairs will be at the buyers expense. Consult Norriseal for field service rates.

Any modifications to terms and conditions of this warranty will not be binding unless made in writing and signed by an authorized agent or official of Norriseal.

#### **NOTE:**

*All Norriseal gauges should be unpacked and thoroughly inspected upon receipt. Gauges are shipped FOB factory and are fully protected against damage or loss during shipment. Any claims for parts damaged during shipment should be submitted within 15 days of receipt of goods by customer.*

# OPERATING AND MAINTENANCE MANUAL

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## Series 1210-LTM200D Magnetostrictive Level Transmitter

HEADQUARTERS, MANUFACTURING PLANT AND SALES



11122 West Little York • Houston, Texas USA 77441  
Tel: 713-466-3552 • Fax: 713-896-7386  
[www.norriseal.com](http://www.norriseal.com)

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