



Process Level Technology, Ltd.

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# MAG-TRANS®

Magnetostrictive Level Transmitters

MT2523 IT2523



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**ISO 9001:2008**  
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## Installation and Operating Manual

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### 1.0.0 Introduction

#### 1.1.0 Forward

The Process Level Technology, Ltd. MAG-TRANS® series transmitter represents the next generation in magnetostrictive level transmitter technology. Suitable for most liquid level applications, the MAG-TRANS® transmitter provides a very accurate and reliable output for remote level control with zero maintenance. With greater ease of communication and programmability, the MAG-TRANS® contains the latest state-of-the-art electronics and sensor technology. The MAG-TRANS® is available in two different configurations; the IT2523 and the MT2523. All transmitters are factory calibrated to the specifications required with each order and installation.

**The MAG-TRANS® IT2523 transmitter is designed for direct insertion into a storage tank, process vessel or bypass chamber.** The IT2523 is top mounted, with optional stilling well. Remote mounted transmitter head locations are available.

**The MAG-TRANS® MT2523 series transmitter is designed exclusively for magnetic level indicators and non invasive bypass chambers.** The waveguide probe is installed externally on the outside of the magnetic level gage chamber or bypass chamber and is not exposed to process conditions. Based on the level gage specifications, top, bottom or remote mounted transmitter head locations are available.

#### 1.2.0 Theory Of Operation

Magnetostrictive level transmitters operate in conjunction with a magnetic field that originates from a liquid level float designed for the process media. A two wire waveguide probe of variable length is connected to the transmitter sensor and electronic assembly. The two wire waveguide is housed within a sealed 3/8 inch (OD) sensor probe and receives a short current pulse at timed intervals. Disruption of the waveguide is caused by torsion generated by the float's lateral magnetic field at any elevation. This torsion or deflection of the waveguide is detected by the transmitter sensor, which produces a very accurate signal proportionate to the level elevation.



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### 2.0.0 Preparation

#### 2.1.0 Introduction

Process Level Technology, Ltd. MAG-TRANS® level transmitters are built and designed to exact customer specifications as defined in each model number. Wiring terminations are required and need to follow proper procedures.

#### 2.2.0 Unpacking Freight

Upon receipt, all packages containing PLT products are to be opened carefully and inspected for freight damages. If damage to the product has occurred due to freight, a claim needs to be made at the point of product receipt and initial inspection within 24 hours. Process Level Technology, Ltd. **does not insure freight or make freight claims on behalf of the owner.** Do not discard the shipping container until all components are accounted and inspected for.

#### 2.3.0 Storage

If the transmitter requires storage for prolonged periods, care must be given to ensure product protection from physical and ambient conditions. Seal the entire device completely from condensation and store it with the shipping materials provided. Do not leave any auxiliary conduit connection open. Recommended storage temperatures are -10 to +130° F.

#### 2.4.0 Electronic Static Discharge

Process Level Technology, Ltd. level transmitters are manufactured from the highest quality electronic components of which can be damaged by static electricity. Care must be taken to eliminate static discharges surrounding the transmitter upon installation. All equipment proximal to the transmitter must be grounded to a secure source. Grounding terminals are provided both inside and outside of the instrument enclosure.

#### 2.5.0 Equipment and Recommended Tools

To attach the PLT MAG-TRANS® series transmitter to an existing piping or vessel connection, the operator will need the following tools:

- Nut drivers for MT attachment to piping clamps
- Phillips and flat head screwdrivers
- Wrenches for MT and IT installation
- Digital volt meter to verify and troubleshoot voltage



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### 2.6.0 Temperature Ratings

The maximum ambient temperature rating of the PLT MAG-TRANS® series electronics is -25 to +175° F. The ambient temperature range of the LED readout is -25 to +175° F. Ambient temperatures above and below that rating may cause the LED readout to malfunction. The transmitter head may require protection from prolonged direct sunlight exposure. Low temperature cryogenic or high temperature insulation blankets should be installed during extreme process operating temperatures.

The maximum process temperature rating of the MAG-TRANS® IT2523 transmitter is -50°F to +300° F, MT2523 transmitter is -50°F to +800° F and applies to the waveguide probe.

### 2.7.0 Pressure Ratings

The maximum process pressure rating of the IT2523 MAG-TRANS® transmitter waveguide probe is 2000 PSIG. This rating applies to IT2523 MAG-TRANS® which is a direct insertion model for level gage applications only. The MT2523 MAG-TRANS® is an externally mounted transmitter and is not subject to process pressure.

### 2.8.0 Voltage

**The PLT MAG-TRANS® transmitter is designed to operate at 24 Volts DC, nominal.** Please ensure that the power supply to the transmitter is the same 24 VDC voltage required. Although the voltage range of the MAG-TRANS® transmitter is +12 to +30 VDC, it is highly recommended that the service voltage is established at a stable and continuous 24 VDC. Higher voltages will damage the transmitter. ***Do not connect to AC current since this will damage the transmitter and violate the transmitter warranty.***



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### 3.0.0. Mounting

#### 3.1.0 Introduction

Determine if the installation requires a top, bottom or remote mounted location. Consideration should be given to electrical conduit connections before the transmitter is installed. It is important to verify chemical compatibility with all wetted components.

#### 3.2.0 MT – Magnetic Level Indicators

- The second bend in the waveguide should be placed at the same elevation of the centerline of the upper or lower process connection, depending upon the preferred transmitter head location.
- The transmitter head contains a special pipe clamp groove for chamber attachment first.
- Insulating L brackets are supplied for the waveguide. These maintain an even distance of the waveguide away from the magnetic level gage chamber.
- Corresponding pipe clamps are provided for each L bracket position, which should be spaced evenly apart throughout the waveguide.
- Secure the L brackets by tightening each pipe clamp accordingly after the transmitter head is secured.

#### 3.3.0 IT – Direct Tank Insertion

- The assembly includes a sensor and float
- A
- B
- C
- D
- E

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### 4.0.0 Wiring

Connection to the MAG-TRANS® transmitter requires an electrical conduit connection of ¾ inch NPT. The enclosure contains two conduit connection ports wiring between the power supply and the MAG-TRANS® transmitter should be made with 18 – 22 AWG shielded twisted pair instrument cable.

#### 4.1.0 Connections

Once the electrical conduit is properly connected, the terminal block needs to be accessible for wiring connections. The terminal block is located on the back side of the dual compartment enclosure

**Wiring to the terminal block is as follows:**

Terminal Block:	POS (+)	Positive 24 VDC	<b>Red Wire</b>
Terminal Block:	NEG (-)	Negative	<b>Black Wire</b>
Ground Screw:	8-32 NC	Inside Enclosure Back	<b>Green Wire</b>
TP 1	TEST POINT		
TP 2	TEST POINT		



**Photograph No. 1**  
Enclosure – Front



**Photograph No. 2**  
Enclosure – Back



**Photograph No. 3**  
Electronics– Front

**Warning:** *Electrical connections may induce an explosion hazard. Do not connect or disconnect equipment unless power has been turned off and the installation area has been rendered non-hazardous. Determine the correct polarity before connecting.*

The MAG-TRANS® is designed for Class 1, Division 1, Groups B, C and D hazardous locations. Explosion proof installations could have flammable vapors and liquids present. If disconnecting, instrument covers must remain tight until power is turned off. Make sure that power is off in any junction box if exposed to hazardous atmospheres. Power to the instrument can only be turned on after the installation is complete, instrument covers are tight and secure, the area is non-hazardous and the installation has been checked by the appropriate electrical engineers.



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### 5.0.0 Transmitter Configuration

#### 5.1.0 Introduction

The transmitter is factory configured to probe length, float density and positioning. The internal parameters that are important to the basic configuration of the transmitter are protected by a factory password and cannot be changed by the end user. The operator is provided with a user password that will be necessary to change some of the basic transmitter settings that are fundamental to transmitter performance.

#### 5.2.0 Operation

Each MAG-TRANS® can be programmed by the three push buttons (keypad) located on the transmitter head. They are the Up and Down keys and the Enter key which are used to navigate the displays and to calibrate the transmitter. The Up and Down keys move forward and backward in the menu structure when in the *scroll* mode and increase and decrease the value displayed when in the input mode. The Enter key selects the input mode when on a menu screen where it is available. The Enter key also accepts a value and moves to the next step when in the *set* mode.

The *scroll* or *set* mode is indicated by the lack or presence of the set mode symbol (small circle containing the letter "i") at the upper right hand corner of the screen. Screen scrolling is in ascending order of screen number when the down arrow is depressed and descending order when the up arrow is depressed.

The MAG-TRANS® has an LCD full graphic display. All transmitter menu screens are shown on the LCD display. The display defaults to the scrolling measurement screen that shows the level height (inches or metric), percentage and milliamp outputs. The scrolling default display can be changed to any of the individual three output values at the operator's choice.

#### 5.3.0 Screen Menus

- 5.3.1 Screen 1: Default Display  
Category: Display  
Description: Displays one of the following: Level in units, Level in percent, Loop Output in milliamps, Tile Mode, List Mode, or Error messages. Tile and List Modes show units, percent, and mA on one screen. The Default Display screen is denoted by the "d" symbol in upper left of screen. Cycle Mode can be selected (see Default Display selection, Screen 8, below) which cycles through Units, Percent, and mA.  
Notes: In the event of a transmitter fault/error, the corresponding error message will be displayed in place of the output.





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- 5.3.2 Screen 2: Level  
Category: Display  
Description: Displays the absolute measurement in level units (inches or cm)  
Notes: In the event of a transmitter alarm condition, ALARM will be displayed in place of the level value.
- 5.3.3 Screen 3: Level %  
Category: Display  
Description: Displays the value of the primary variable in percent of span. The range is 0.00% to 100.00%  
Notes: In the event of a transmitter alarm condition, ALARM will be displayed in place of the level value.
- 5.3.4 Screen 4: Loop  
Category: Display  
Description: Displays the value of the 4-20 mA current loop in milliamps.  
Notes: In the event of a transmitter alarm condition, ALARM will be displayed in place of the level value
- 5.3.5 Screen 5: Tile  
Category: Display  
Description: Display shows units in large numerals with percent, and mA shown in small numerals all on one screen.  
Notes: In the event of a transmitter alarm condition, ALARM will be displayed in place of the level value
- 5.3.6 Screen 6: List  
Category: Display  
Description: Display shows units, percent, and mA in a list format all on one screen.  
Notes: In the event of a transmitter alarm condition, ALARM will be displayed in place of the level value
- 5.3.7 Screen 7: Module Temperature  
Category: Display  
Description: Displays internal temperature of electronic module and enclosure. Units are automatically selected for °F or °C via Units menu i.e. temperature is shown in °F when Inch selected and °C when Centimeters is selected. Minimum and maximum temperatures are displayed in small numeric text at bottom of display. During operation, minimum and maximum temperatures should never exceed the ratings shown in the specification section of this manual.  
Notes: In the event of a transmitter alarm condition, ALARM will be displayed in place of the level value



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- 5.3.8 Screen 8: Default Display  
Category: User Setting  
Input: Scroll, Level, Level%, Loop, Tile, List  
Description: Selects the default screen display as either Scroll, Level, Level %, Loop, Tile or List  
Notes: None
- 5.3.9 Screen 9: Fast 4/20 Set  
Category: User Setting  
Input: Select 4 mA and 20 mA points based on float position.  
Description: Allows the setting of the 0% and 100% points based on the current float position. The 0% and 100% points may be configured at either end of the probe (i.e. provides for direct OR reverse action). If the 4.00 mA button (UP button) is pressed, then the current float position is set as the 4 mA elevation. If the 20 mA button (DOWN button) is pressed, the current float position is set as the 20 mA elevation. The 0 measured value of the PV is then equated to the 0% level point by setting the value of the offset.  
Notes: This function takes into account the mounting type and also checks for reverse action settings when computing the offset value.
- 5.3.10 Screen 10: Units  
Category: User Setting  
Input: Inches, Centimeters  
Description: Selects the level units in cm or inches.
- 5.3.11 Screen 11: Fault  
Category: User Setting  
Input: Low, High, Latch (scroll selectable)  
Description: Determines the value of the current loop output during a fault condition. Loop current can be set to 3.60 mA, 22.0 mA or latched to the value of the current loop just before fault condition occurred.  
Notes: If HART communication is detected, the Low value of the current loop will be set to 3.70 mA instead of 3.60 mA to ensure reliability of communication.
- 5.3.12 Screen 12: 4 Ma Set  
Category: User Setting  
Input: Position of the 4 milliamp (0%) point in inches or cm.
- 5.3.13 Screen 13: 20 Ma Set  
Category: User Setting  
Input: Position of the 20 milliamp (100%) point in inches or cm.



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- 5.3.14 Screen 14: Offset  
Category: User Setting  
Input: PV measurement offset in inches or cm.  
Description: A positive or negative adjustment to the PV zero reference mark.
  
- 5.3.15 Screen 15: Trim 4  
Category: User Setting  
Input: Integer number in the range of 0 – 4095.  
Description: Trims the 4 mA output of the 4 – 20 mA loop.  
Notes: Performs a trim of the Digital to Analog Converter (DAC).
  
- 5.3.16 Screen 16: Trim 20  
Category: User Setting  
Input: Integer number in the range of 0 – 4095.  
Description: Trims the 20 mA output of the 4 – 20 mA loop.  
Notes: Performs a trim of the DAC.
  
- 5.3.17 Screen 17: Poll Adr  
Category: User Setting  
Input: Integer number in the range 0 – 15.  
Description: Sets poll address of the transmitter for use in HART multi-drop mode.
  
- 5.3.18 Screen 18: Mnt Pos  
Category: User Setting  
Input: Top, Bottom (scroll selectable)  
Description: Defines type of mounting as either top or bottom mounted.
  
- 5.3.19 Screen 19: Loop Tst  
Category: User Setting  
Input: Current output in tenths of a mA.  
Description: Trims the 20 mA output of the 4 – 20 mA loop.  
Notes: Performs a trim of the DAC.
  
- 5.3.20 Screen 20: Damping  
Category: User Setting  
Input: Value of the damping time constant in seconds.  
Description: Sets value of the damping time constant. Input range is 0-15 seconds in 0.10 second intervals up to 1.0 second followed by 1.0 second intervals.
  
- 5.3.21 Screen 21: Dead Zone  
Category: Factory Setting  
Input: Distance in inches or cm  
Description: This is an ignored region (dead zone) measured from the sensing element. Any signal generated by a magnetic field in this region will not be detected, and will not affect signals in the valid range of the detection.



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- 5.3.22 Screen 22: Contrast Adjust  
Category: User Setting  
Input: Up, Down  
Description: Adjusts proper contrast ratio of Liquid Crystal Display (LCD).
- 5.3.23 Screen 23: Display Factory  
Category: User Setting  
Input: Yes, No  
Description: Determines whether Factory designated settings are visible i.e. must be set to Yes in order to see the settings listed below.
- 5.3.24 Screen 24: Device ID  
Category: Factory Setting  
Input: Yes, No (scroll selectable)  
Description: If Yes is selected, the Device ID will be set equal to the Final Assembly Serial Number and stored in non-volatile memory. Device ID is used to create a unique transmitter ID for use in HART communication.
- 5.3.25 Screen 25: Probe Length  
Category: User Setting  
Input: Length of sensor probe in inches or cm.  
Description: Defines the length of the sensor probe. This is the valid range of detection of a magnetic field along the length of the sensor probe. The length is defined as increasing from the center point of the sensor element.  
Notes: If a signal is detected beyond the set probe length, it will be ignored.
- 5.3.26 Screen 26: Gradient  
Category: Factory Setting  
Input: Hundredths of a microsecond per inch.  
Description: This is the conversion factor for the time of flight measurement in microseconds per inch.
- 5.3.27 Screen 27: Threshold  
Category: Factory Setting  
Input: Integer number in the range 0 – 255.  
Description: Adjusts the threshold voltage level. This is the level of voltage that the return signal must exceed in order to be detected. The range 0-255 represents a linear range of voltage from 80 mV to 1.55 V for the positive threshold and -80 mV to -1.55 V for the negative threshold.
- 5.3.28 Screen 28: Polarity  
Category: Factory Setting  
Input: Negative, Positive (scroll selectable)  
Description: Sets the polarity of the threshold detector.



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- 5.3.29 Screen 29: Sensitivity  
Category: Factory Setting  
Input: Integer from 0-15 representing the sensitivity of the sensing element.  
Description: Gain setting for signals received from the sensing element.  
Notes: The level of signal gain should be kept at a minimum needed level due to the amplification of any noise present in the level signal.
  
- 5.3.30 Screen 30: Pulse Amp  
Category: Factory Setting  
Input: Integer from 0-255 representing the amplitude of the sensor wire current pulse.  
Description: Gain setting for sensor wire current pulse.
  
- 5.3.31 Screen 31: New Password  
Category: User Setting  
Input: Integer Value 0-255  
Description: Sets the password for menu items in the user setting category.  
Notes: Default value is zero.
  
- 5.3.32 Screen 32: Level Counts  
Category: Display  
Description: Displays a count that is directly proportional to the distance between the sensing element and the detected level signal.  
Notes: The count displayed is taken at the output of the damping filter. Therefore the count will be damped in the same manner at the primary variable.
  
- 5.3.33 Screen 33: Version  
Category: Display  
Description: Displays the current transmitter type and version.
  
- 5.3.34 ICON: HART Icon  
Category: Display  
Description: Displays a large blinking "H" in top right of screen.  
Notes: The "H" icon appears when HART traffic is present on instrument loop.



**6.0.0 Maintenance**

6.1.0 Standard

The MAG-TRANS® transmitters are designed for long life and maintenance free performance. Periodic inspection by the owner/operator should be performed at regular scheduled intervals. If any component of Process Level Technology, Ltd.'s MAG-TRANS® series transmitter reveals signs of extensive corrosion or wear, please contact the factory immediately for recommended corrective action. Programmable changes to transmitter operations that are required after initial start up can be performed at the MAG-TRANS® transmitter head location. Please refer to Section 5.2.0 on display menus for normal operations.



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### 7.0.0 References

#### 7.1.0 Warranty

Process Level Technology, Ltd. electronic level controls are warranted from defects, both parts and complete assemblies, for 365 days from the date of factory direct shipment to the operator / owner. The warranty does not commence at the time of process system start up.

In the event of product return during the warranty period, all components are first inspected for abnormal physical and electronic defects. If the subject item is determined covered under the standard warranty, Process Level Technology, Ltd. will replace or repair the device at no cost to the owner.

Process Level Technology, Ltd. is not liable for warranty claims on any level control that has been misapplied, mishandled, or installed improperly based on the parameters outlined in this manual. This also applies to products damaged by freight without claims filed in a timely manner.

#### 7.2.0 Quality Control

Process Level Technology, Ltd.'s quality control program is certified ISO-9001 domestic and international standards. All PLT MAG-TRANS® transmitters and component parts are fabricated and in compliance with international and domestic ISO guidelines. Process Level Technology, Ltd. is committed to full customer satisfaction both in products and in service.

#### 7.3.0 Model Numbers

<u>Model</u>	<u>Description</u>
IT2523	Direct tank or Bypass Chamber insertion
MT2523	Magnetic level gage or Bypass chamber, externally mounted, <i>waveguide probe is non-intrusive.</i>



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**7.4.0 Specifications**

**7.4.1 Performance**

Accuracy	+/- 0.015 inches
Repeatability	0.001% of full span
Linearity	0.020% of full span
Rate of Change (Max)	6 inches per second
Refresh Rate	10 times per second
Initiation	0.00 seconds
Damping	0.00 to 1.00 @ 0.01 second increments 1.00 to 25.0 @ 1.00 second increments
Unusable Region	1.00 inch (at end of probe)
Dead Zone	0.00 inch (user specify)
Humidity	0.00 – 99.0% (non-condensing)

**7.4.2 Electrical**

Input	12-30 VDC (24 VDC Nominal)
Output	4-20 mA
Resistance	600 Ohms (max) @ 24 VDC
Power Consumption	0.66 Watt (30 VDC x 0.022 ohms = 0.66 W)
Error Signal	3.60 or 22 mA
Interface	3 button keypad, HART, or PACT software
Display	Full Graphic LCD
Values	Inches or centimeters, percent of level, mA

**7.4.3 Ratings**

Process Pressure	2000 PSIG @ 100° F	IT-only
Ambient Temperature	-25° to +175° F (-31° to +79° C)	All Models
Process Temperature:		
Standard	-50° to +300° F (-45° to +148° C)	IT2523
HT Version	-50° to +800° F (-45° to +426° C)	MT2523

**7.4.4 Enclosure**

Type	Dual Compartment
Material	Cast Aluminum (optional 316 SS)
Finish	Polyester Powder Coat
Rating	FM, FMc Approved, Type Nema 4X

**7.4.5 Sensor**

Material	316 SS, (optional CPVC, Hastelloy, Alloy 20)
Length	6.00 to 300 inches





7.5.0 Industry Approvals

Agency	Model	Protection	Area Classification
FM	IT2523 MT2523	Explosion Proof	Class I, Division 1: Groups B, C, & D Class II, Division 1: Groups E, F, G Nema Type 4X