

Magtech MLT-350FF Series

Magnetostrictive Level Transmitter for Liquid Level Measurement
Instruction and Operations Manual



 **WARNING**

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.
- Do not perform any services other than those contained in this manual unless you are qualified.

Explosions could result in death or serious injury.

- Verify the operating environment of the Magtech MLT-350FF Series Transmitter is consistent with the appropriate hazardous locations certifications.
- Do not remove the gauge cover in explosive atmospheres when the circuit is alive.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

High voltage that may be present on leads could cause electrical shock.

- Make sure the main power to the Magtech MLT-350FF Series Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the instrument.



NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure that you thoroughly understand the contents before installing, using or maintaining this product.

For Equipment service or support needs:

Customer Central: +1-800-221-3653 (8:00 a.m. to 5:00 p.m. CST US)

TABLE OF CONTENTS

Transmitter Overview5
 General Description5
 Level Transmitter5
 MLI Mounted Transmitter5
 Direct Insertion Transmitter5
 Instrument Description6
 Transmitter Detail Description6
 Theory of Operation6
 Installation and Wiring8
 MLI Mount Transmitter Installation8
 Direct Insertion Transmitter Installation8
 General Installation Guidelines8
 Recommended Wiring10
 Specifications10
 Transmitter Electrical Specifications10
 Transmitter Sensor Tube10
 Transmitter Sensor Tube10
 Menu Structure and Features10
 Pushbutton Operation10
 Menu Structure11
 Features Description13
 Advance Menus13
 Transmitter Calibration and Troubleshooting16
 Calibration16
 General Troubleshooting17
 Basic Troubleshooting17
 Changing Signal Parameters18
 Foundation Fieldbus Protocol19
 Foundation Fieldbus Protocol: General Information & Specification19
 MLT-350FF Parameters20
 MLT-350FF Fieldbus Configuration Troubleshooting21
 Field Insulation of MLI with Transmitters21

Field Insulation21

Insulation Warning Label Supplied22

Warranty.....22

 Warranty.....22

China RoHS23

 MLT-350 Model Disclosure.....23

TRANSMITTER OVERVIEW

GENERAL DESCRIPTION

The MLT-350FF 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 instrument is a two wire, loop powered smart transmitter, designed to measure and transmit a digital [FF] signal proportional to liquid level in a tank.

Note: The complete assembly includes a dual compartment explosion proof enclosure, and attached sensor tube.

The Model number is MLT-350 followed by up to four letters that can describe additional features such as mounting configuration (G for Gage Mount, S for Standalone), or communications protocol (FF for fieldbus).

Optional Features of the MLT-350FF include:

- Second digital output proportional to an interface level (requires a second float of different specific gravity)
- Digital temperature output gives the liquid temperature and is typically used for display and/or calculation of mass.
- Advanced diagnostics and features highly beneficial for commissioning, troubleshooting or monitoring.
- A variety of lengths and wetted materials to accommodate many different applications.

The Model MLT-351FF is a Model MLT-350FF that is contained in a stainless steel housing.

LEVEL TRANSMITTER

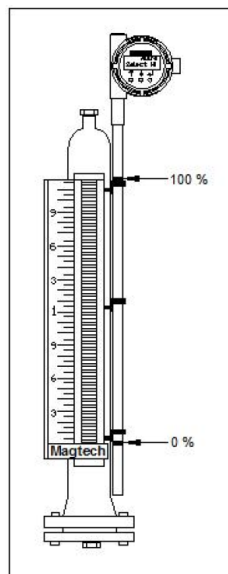
In its simplest configuration, a single-purpose float rides up and down the sensor tube, totally surrounding it. A multi-purpose float may also be used to activate the sensor, such a float being placed inside a liquid isolation pipe, (i.e. MLI) and strategically located within a certain longitudinal 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 a digital [FF] signal. This signal is precisely proportional to the liquid level in the tank.

MLI MOUNTED TRANSMITTER

The MLT-350FF may be strapped to the side of the Magtech MLI series (Magnetic Level Indicator). In such an installation, it is used as an accessory transmitter for the visual level indicator. The same float used to activate the magnetic level indicator is also used to transmit a signal to the piezoelectric sensor of the MLT-350FF.

In the illustration below, the transmitters may be calibrated for the same range as the visual indicator on the MLI, or for part of the range (See Section 3).

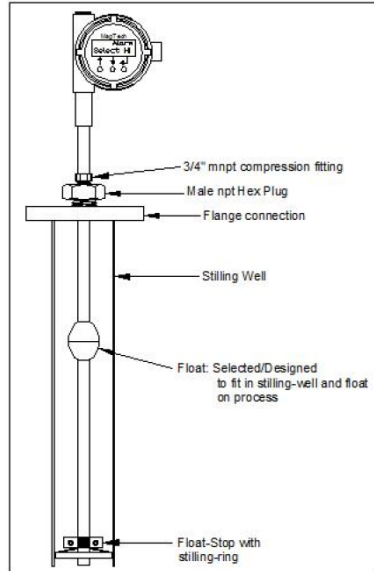


Typical MLT-350FF Mounting Configuration on a MLI

DIRECT INSERTION TRANSMITTER

When a companion Magnetic Level Indicator is not present, the MLT-350FF is inserted into the tank with its own float around the sensor tube. A stilling well may be optionally used inside the tank.

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 entire length of the probe. Stilling wells are required for transmitters over 10 feet.



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.

INSTRUMENT DESCRIPTION

TRANSMITTER DETAIL DESCRIPTION

The MLT-350FF is an assembly of two major components:

The Sensor Tube Assembly.

This 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 piezoelectric sensor. The tube is made to lengths 2 – 30 ft. in rigid construction.

The Electronics Housing.

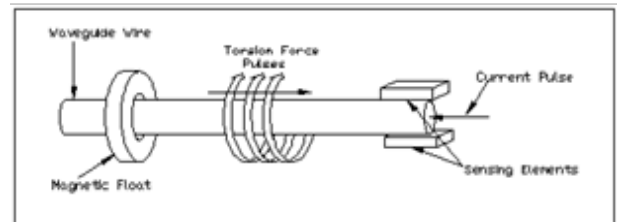
The extruded aluminum housing has two separate compartments. One side contains the microprocessor board assembly and calibration pushbuttons. The other side contains the wiring termination board. The electronics module is connected to the detector board of the sensor tube assembly via a plug-in cable.

The main board is surface mounted component construction utilizing the latest in integrated circuit technology.

THEORY OF OPERATION

The MLT-350FF 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 level measurement application, however, a resolution of 0.03 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 6-10 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

converted by the microprocessor into a proportional level and transmitted as a digital FF signal. 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 the 0% and 100% points for any distance desired. Even reverse calibration is a simple task using the software routines. Reverse calibration is desirable if ullage instead of level is required, or when the probe is installed with bottom mount electronics.

Level Transmitter. This 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 output as a digital FF signal. The scale is defined by the calibration procedure and it corresponds to the output span (0%-100%).

The MLT-350FF transmitter has four output configurations.

NOTE: Configuration options must be chosen at quoting stage.

The MLT-350 transmitter has four output configurations.

1. 1. Primary Level: The most basic version of this transmitter is that it computes the distance between the float and the detector from the elapsed time measurement. A specific 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 a number representing the distance and output as a digital FF signal.

2. Primary Level and Interface Level: A second float may be added below the first, and the second output will be calibrated automatically. The second time interval is timed in the same manner as the first one to derive the position of the heavier float. The two floats require a separation of approximately three inches. The float size, geometry, and magnetic strength all play a factor in how close the two floats can be without interfering with each other.
3. Primary Level and Temperature: An optional temperature sensor is embedded inside the bottom tip of the probe, and it is configured to be the third digital output of the transmitter, and comes factory calibrated for the operating range of -58 °F to 300 °F (-50 °C to 149 °C).
4. Primary Level, Interface Level, and Temperature: This options is called a ‘full- blown” unit and offers all three possible outputs.

A deadband of approximately three inches, next to the detector, is fixed in the software and the float is not permitted to enter this area. If this happens output readings maybe erratic or go to fail mode.

INSTALLATION AND WIRING

MLI MOUNT TRANSMITTER INSTALLATION

! WARNING

If the instrument is used as an explosion proof (exp) device then exp conduit must be sealed within 18 inches of the termination point – at the instrument.

Under rated conditions, the branching point at the entry point may reach 85.6 °C, therefore, when choosing cables and cable glands this shall be taken into account.

CAUTION

During Installation, do not attempt to twist or turn the head of the transmitter. Damage to the detector assembly can occur if the head is rotated. If head is loose, contact factory immediately.

The MLT-350FF can be mounted to the side of a Magtech MLI series level indicator using a special mounting bracket and stainless steel hose clamps. When mounting the transmitter to a MLI the active sensor region of the probe should fall within the centerline of the process connections on the MLI. 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 MLI it is important to indicate the style of the MLI, 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.

! WARNING

The sensor probe of the transmitter **SHOULD NOT BE BENT, BOWED, OR KINKED** in any way or the transmitter will not work (will most likely go into fail mode).

! WARNING

Flameproof joints are not intended to be repaired.

If a transmitter is being purchased for an interface MLI, 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 MLI for easy access.

NOTICE: This must be specified at time of purchase.

DIRECT INSERTION TRANSMITTER INSTALLATION

The MLT-350FF stand-alone transmitter comes equipped with a 3/4" compression fitting, mounted approximately 3.00" to 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 mounting configurations are available upon request.

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 PVDF (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.

NOTICE: If using a Transmitter configured for interface measurements, remember to slide the float with the lightest gravity range first.

GENERAL INSTALLATION GUIDELINES

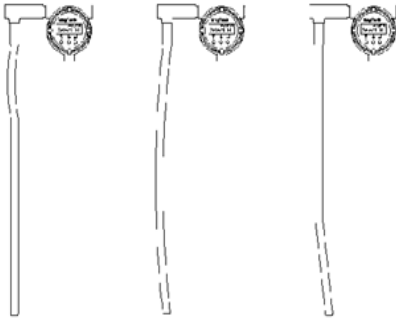
The basic steps to installing the MLTs are:

Inspection of equipment

Inspect the parts that are listed on the packing slip. Make sure nothing appears to be damaged such as a broken glass from the MLI (flags), damaged float, or a damaged transmitter. Please file a claim with the shipping company

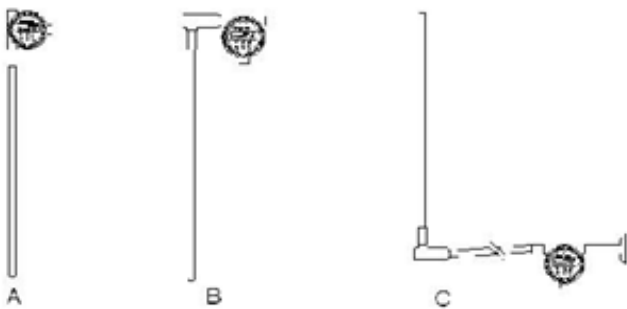
immediately if it is believed the shipment has arrived damaged and be prepared to provide pictures.

The following is a depiction of damaged probes:



Identify Proper Orientation of Transmitter

There are a few possible orientations of the MLT Series transmitters:



Transmitter A is a standard top mount configuration.

Transmitter B is a top mount with elbow, usually utilized when there are temperature or head room issues. There is also a bottom mount with elbow configuration which is not depicted.

Transmitter C is a bottom mount transmitter with remote electronics. This configuration is utilized in more extreme temperatures or for accessibility. There is also top mount with remote electronics which is not depicted.

Mounting the Transmitter.

Align the 4/20 mA (or 0% and 100%) markings with the center of the top and bottom process connection. Mount the transmitter along the level gage and use a nut driver to tighten the clamps so the sensor probe of the transmitter is held securely (will not slip up and down). Keep the transmitter supported while the clamps are being tightened (this can require more than one person).

WARNING

Do not overtighten the clamps because they will bend and distort. (Will go into fail mode).

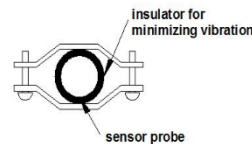


A: Is the correct way to have clamps tightened. The clamps do not have to meet.

B: Is incorrect because the clamp is flipped around and will not grip the sensor probe.

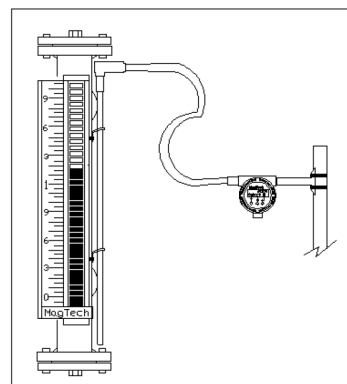
C: Is incorrect because the clamp has been tightened too much and the probe may be damaged/distorted.

NOTE: Effects of high vibration can be minimized early on by notifying the factory at time of order. The electronics can be remote mounted and special insulators can be installed. Please see the depiction below.



Remote Mount Electronics Option

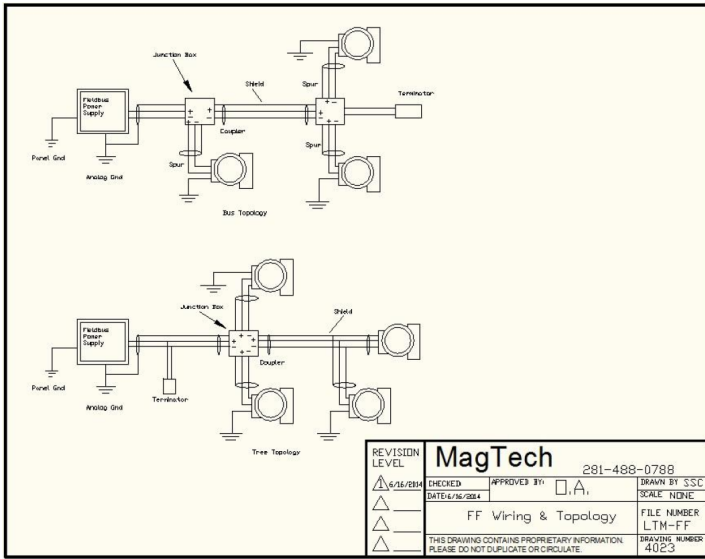
Due to process temperature, vibration or accessibility the housing/electronics of the MLT transmitter can be remote mounted as far as 25 ft. The housing/electronics are supplied with a pipe-mount bracket that can be mounted most nearby posts or pipes with hose clamps. The drawing below depicts a gage mounted transmitter in the top mount remote electronics configuration.



A typical Remote Mount Electronics Option

In REMOTE MOUNT electronic options please support the sensor probe at the elbow/condulet and then every 3 feet (depending on length of cable). Support at every 2 feet may be required if explosion proof conduit is utilized by the end user.

RECOMMENDED WIRING



Recommended Loop Wiring

NOTE: Please visit www.fieldbus.org to learn more about HART Protocol.

SPECIFICATIONS

TRANSMITTER ELECTRICAL SPECIFICATIONS

TRANSMITTER SENSOR TUBE

Supply Voltage:	10 to 35 VDC
Resolution:	0.039 in (1mm)
Repeatability:	.005% of full scale or .010" whichever is greater
Non-Linearity:	.01% of full scale or .030", whichever is greater
Level Sensor Accuracy:	.01% of full scale or .020", whichever is greater
Output:	One digital FF Signal
Calibration:	Zero and span field adjustable with pushbuttons

Dampening:	1 to 26 seconds (field adjustable) via push-buttons
Operating Temperature: (Electronics)	-58 to 185 °F (-50 to 85 °C)
Housing:	Explosion Proof, Dual Compartment, 1/2" npt, Epoxy Coated Aluminum (Standard) Explosion Proof, Dual Compartment, 1/2" npt, Stainless Steel (Model MLT-351FF only)

Hazardous Location Approvals:	CSA Class I, Division 1 or Division 2, Groups B, C, D Class II, Division 1 or Division 2, Groups E, F, G Class III	-
	IECEX Ex db IIC T5 Gb Ta = -40°C to 85°C Ex tb III C T100°C Db IP66	-
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	

TRANSMITTER SENSOR TUBE

Material:	316ss standard, optional Hastelloy, Monel, Kynar-coated
Operating Temperature:	-50 to 302 °F (-50 to 160 °C)
Maximum Pressure:	2000 psig @ 300 °F
Range:	16 inches up to 30 feet

MENU STRUCTURE AND FEATURES

PUSHBUTTON OPERATION

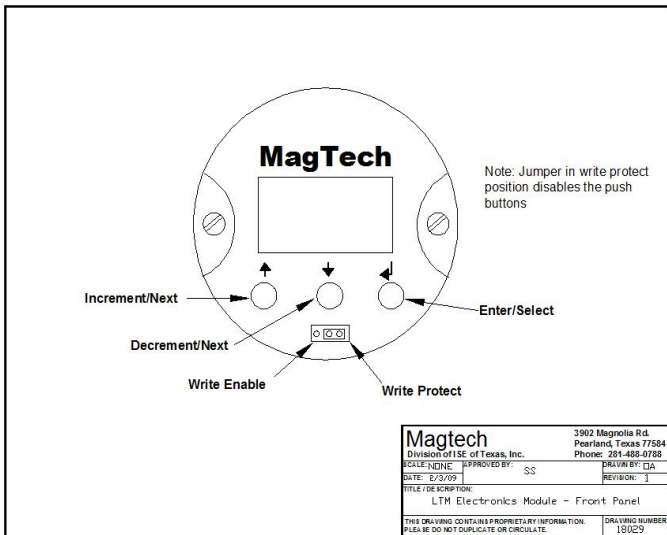
The menu structure and pushbutton operation of the MLT series transmitters is simple and user-friendly. The electronics module has 3 pushbuttons (from left to right):

- ↑ This button is used to increment values and change "Yes" to "No" and "No" to "Yes".

↓ This button is used to decrement values and change “Yes” to “No” and “No” to “Yes”.

← This is the enter button used to execute functions and enter/exit into or out of submenus.

NOTICE: The pushbuttons are timed not pressurized. It does not matter how hard/firm you press them. The buttons depend on the length of time they are pressed. The longer you hold the button the faster it will increment/decrement values. Hold the enter button down for 2 seconds to enter the configuration menus and 1 second for all subsequent menus.



MENU STRUCTURE

The menu structure has been designed so the end user can make parameter changes relatively fast and easy. Below is a detailed description of these menus.

The MLT-350FF LCD is a 2 x 8 character screen. The main screen scrolls between the following parameters:

1. Level (in selected engineering units, i.e. 60.00 in or 1524 mm)
2. Interface (when option is provided - in selected engineering units)
3. Temperature (when option is provided - in selected engineering units)
4. Percent of range corresponding to level (in %, i.e. 100.00 %)

If the user desires to enter into the configuration menus simply press/hold the enter button for 2 seconds.

NOTICE: Make sure that the electronics are not in write - protect mode. The menu order can change and new menus can be introduced based on transmitter output options and hardware or software revisions.

The following is the MLT-350FF LCD Menu Flowchart

```

SW Rev      1.00.00
HW Rev      1.00.00
Display?    Scroll→Level→Interface*→Temp**→% Range
SelLngth    30.00in
Lvl Unit    in → ft → mm → cm → m
Temp Unit** C → F → R → K
ChgRnge? → Sel LRV → Sel URV
Yes → No (yes) 0.00in 24.00in
SelDamp     1 sec
ROC Fltr    10.0in/s
TrmSnsr    →TrimZero → TrimZero →TrimSpan → TrimSpan →
?           Span
Yes→No (yes) - Busy - 24.00in - Busy - Error
              (if incorrect)

Offset      0.00in
Exit?       Yes → No
    
```

* Only Applies when an Interface Float is included

** Only Applies when a Temperature Sensor is included

Configuration Screens (Up/ Down arrows choose options)

Press Select to Enter

Scrolling Option:

Allows the user to stop the main menu from scrolling and choose 1 of 4 possible parameters: Engineering Units (level or interface), Current (mA), or Percentage. Select the desired parameter and then press enter. “Scroll” is the default parameter this



option keeps the main menu scrolling. See section “5.2 Features” for more details.

Select Length:

THIS IS NOT THE MEASURING RANGE. This parameter should only reflect the overall sensor length. It can be adjusted by incrementing and decrementing the value and then pressing enter.

Level Units:

This menu can be used to change the level engineering units. It can be changed by incrementing/decrementing to one of the following units: in, ft, mm, cm, m and then pressing enter.

Change Range:

This menu allows the user to change the measuring range or span. Enter the menu by changing the “No” to a “Yes” and press enter.

Select Lower Range Value (LRV):

This is the 0.00% point on the sensor. This value should only be incremented. For example if the value is changed from “0.00in” to “3.00in” the 0.00% point will shift 3.00 inches higher than the original point. It is recommended to leave this at 0.00 most of the time unless a special circumstance arises. Press enter to go the next screen.

Select Upper Range Value (URV):

This is the 100.00% point on the sensor. This value should only be decremented. Changing this parameter will change the measuring range or span of the transmitter.

Select Damping:

SelLngh	30.00in
LvlUnits	in
ChgRnge?	No
Sel LRV	0.00 in
Sel URV	0.00 in
Sel Damp	1s

This parameter is used to slow down the reaction of the instrument in order to ignore or average out any agitation on the process surface that may be causing an unsteady output. The units are fixed in seconds and values can be from 1 to 26 seconds.

Rate of Change (RoC) Filter:

This parameter helps ignore erroneous readings from the transmitter’s surroundings. If the user knows how fast the level can change in the vessel (i.e. inches per second) then this parameter should be set at a rate that the level in the vessel cannot suddenly jump to. See section “5.2 Features” for more details.

Trim Sensor:

This menu can be used to recalibrate the transmitter

NOTE: There is no need to recalibrate the instrument. Simply use the “Change Range” menu and change the LRV and URV as desired. If the need arises to use this menu then level simulation will be required at 0 and 100 percent.

Offset (digital only):

This parameter simply adds a digital value to the measuring range or span it does NOT shift or move the measuring range. See section “5.2 Features” for more details.

Exit:

This signifies the last menu before the main screen. If the user desires go back through the configuration menus then change the “Yes” to “No” and review the configuration again else press enter while the screen shows “Yes” and return to the main screen.

Exit to Displays

RoC Fltr	10.0in/s
TrmSnsr?	No
Offset	0.00 in
Exit?	Yes

FEATURES DESCRIPTION

Scrolling Option:

When choosing not to scroll the main menu the following options can be chosen by pressing the up and down push buttons.

Display?	Display?	Display?	Display?	Display?
Scroll	Level	Intrface	Temp	%
(or)	(or)	(or)	(or)	Range

NOTE: The “Scroll” option will vary depending on how many outputs are configured.

Rate of Change (RoC) Filter:

The RoC filter is a continuous monitor of how fast (the rate) the level is rising and falling. It is also an excellent tool to help eliminate any temporary spontaneous noise that may be present in-field. For example if the level in a tank cannot rise or fall faster than 15.0 in/s then the setting for the RoC filter should be set to 15.0 in/s or less to help filter/ignore erroneous readings.

NOTE: The engineering units will change according to units selected (i.e. cm/s).

Offset:

The offset is a digital number that gets added to both the LRV and URV to account for any distance below the sensor probes measuring distance. For example if the offset is changed from “0.00in” to “2.00in” the ‘Level’ on the main screen will show “2.00in” at 0.00% and the 100.00% value will simply have 2.00 inches added to it.

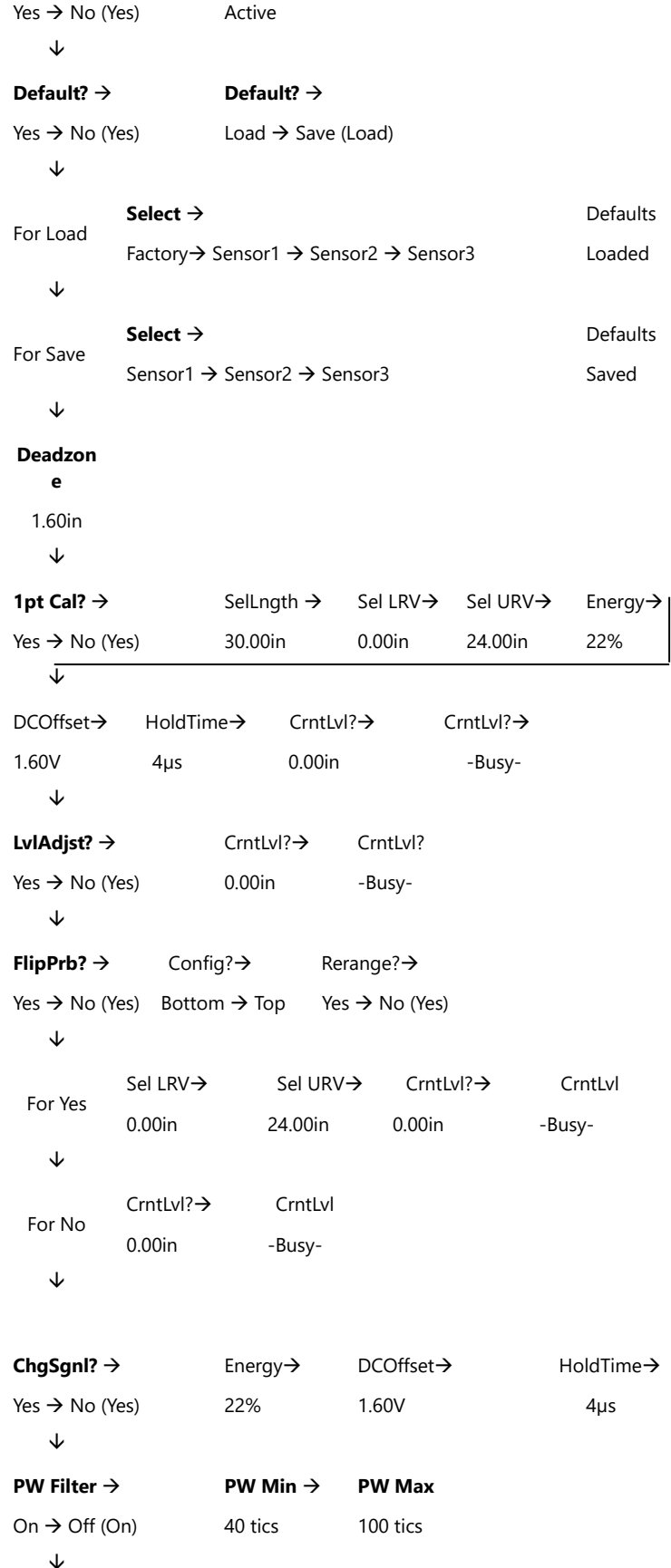
NOTE: The span will not change. This offset value will also add to the interface level when available.

ADVANCE MENUS

There is an “advance” menu incorporated into the MLT-350FF model. To access this menu press and hold the increment (↑) button first then while holding the increment button press and hold the enter button for 3 seconds. A new menu will appear on the LCD screen.

The following is a flow chart of the “advanced” menus

ComPort? → Serial



Exit? →

Yes → No

* Avg PW and 4mA Sat menus/options are available in software revisions 1.02.00 or higher.

ComPort:

This menu is currently only utilized at the factory and will not assist in any troubleshooting. When the menu first appears the “No” option is defaulted, simply press enter to bypass this option. If “Yes” is selected and this menu is accidentally entered into then the push buttons will be locked out. Simply cycle the power to the instrument to clear the effect of entering into this option.

Default:

The next menu is the “Default Configurations” menu. This option allows the user to “load” the original factory settings or load settings saved in slots labeled “Sensor 1”, “Sensor 2” or “Sensor 3” (if utilized by end user). If desired one electronics module can save settings for 3 other sensor probes by calibrating the electronics module to a particular sensor probe then saving those settings into slots labeled sensor 1, 2, or 3. Change the menu screen from “load” to “save”. Then the user can save current setting into slots labeled sensor 1, 2 or 3 and load from these slots as desired. If the output is still erratic, try disconnecting the power momentarily by unplugging and re-plugging-in the terminals. If a glitch was stored in RAM memory, this will generally clear it.

Loading Factory Defaults:

Enter into the “Defaults” menu by changing the “no” to a “yes”. Then the option to “Load” will appear. Press enter and the “Factory” option will appear then press enter on more time to execute the load from defaults (settings can also be loaded from Sensor 1, 2, or 3 by using the up or down arrows on the “Factory” screen if the user has utilized the other slots).

Saving Settings:

Enter into the “Defaults” menu by changing the “no” to a “yes”. Then the option to “Load” will appear. Use the up or down arrow to change the “Load” to “Save” option. Press enter and the next menu will appear with “Sensor 1”. By pressing enter the current settings of the transmitter will be saved. At the “Sensor 1” menu screen

if the up or down arrow is pressed the user has the option to save the transmitter settings into “Sensor 2” or “Sensor 3” slots. Note: One electronics module can potentially hold up to 3 other transmitter settings.

NOTE: The factory settings can never be overwritten (or saved to), only loaded from.

Deadzone:

This menu is mainly utilized at the factory to achieve optimal linearity near the deadband close to the electronics. This feature was released just in case in-field adjustments are necessary.

1-point Calibration Procedure (1pt Cal):

NOTICE: Please consult factory before attempting this procedure. Document transmitter’s serial number for better assistance.

The following menu is the 1 –point Calibration procedure. This procedure was designed to help the user get up and running in an emergency. If electronics have to be shared in an emergency the following procedure guides the user through a “quick” calibration procedure that does not require level simulation but instead works with the current level (1 point) in the vessel/tank.

1. Enter into the “1pt Cal” menu by changing the “no” to a “yes” and pressing enter.
2. The first menu is “SelLngh” or select length. This is not the measuring range but the overall probe length. This information can be found on the label of the instrument housing. (See Section 2.1 Product Identification). Enter the value in using the up or down arrows and press enter.
3. The second menu is “Sel LRV” or select lower range value. Most of the time this value is at 0.00in. It is recommended to leave this value at zero and press enter.
4. The next menu is “Sel URV” or select upper range value. Enter in the desired measuring range and press enter.
5. The “Energy” menu is next. This parameter controls the amount of energy being sent down the sensor probe. Longer sensor probes require more energy shorter sensor probes require less

energy. Please contact the factory for guidance with this parameter.

6. The "DCOffset" menu is the DC voltage the signal is offset by, It is useful for eliminating some noise. Please contact the factory for guidance with this parameter.
7. The "HoldTime" menu is the amount of time the energy being sent down the probe is sustained. Note: a longer hold time can increase the deadband near the electronics. Please contact the factory for guidance with this parameter.
8. The last menu is the "CrntLvl" or current level menu. Enter the known current level in the vessel/tank (in engineering units) and press enter. The calibration should take place and the transmitter should be operational. If the next menu appears then the operation was successful. If the menu reverts back to the beginning of the "1pt Cal" menu then the operation was unsuccessful. Further troubleshooting may be necessary if the operation is unsuccessful. See Section 6 for troubleshooting guide.

NOTE: The 1-point calibration may not be within the published accuracy specification. Again this procedure was designed to get a critical application up and running. A recalibration (two point calibration) may be highly desirable as soon as the opportunity presents itself.

Level Adjustment (LvlAdjst):

If the level gage indicator and level transmitter reading do not match or appear to be incorrect by a few inches then the "LvlAdjst" function can be utilized. Enter into the menu and simply use the up and down push buttons to enter the current level being displayed by the level gages visual indicator and then press enter. The transmitter will adjust the calibration and output accordingly. Note: Be careful make sure this is what is desired.

Field Reversible Transmitter (FlipPrb):

An important and key feature of the MLT-350FF Model is the ability to flip (rotate) the entire transmitter 180 degrees. This procedure is only for MLI mount transmitters with an elbow connection on them. If the transmitter does not have an elbow connection please contact factory for assistance. If the need arises and a

bottom mount transmitter is preferred over a top mount transmitter or vice versa then following these simple steps. THIS PROCEDURE IS FOR MLI MOUNT TRANSMITTERS ONLY.

1. Physically flip (rotate) the entire transmitter (this includes the sensor probe) and mount it accordingly.

NOTICE: Be careful not to damage the sensor probe while rotating the transmitter.

2. Remove the front glass cover of the transmitter enclosure and then using needle nose pliers pull on the protruding screws (spanner screws) to pull out the electronics module. Alternate pulling on the screws in order to prevent damage to the electronics module.
3. Rotate the electronics module 180° and insert it back into the enclosure. The module should now be right side up.

NOTICE: Do not twist or rotate the transmitter housing to adjust the conduit entry. The conduit entry must be left in the opposite position.

4. Go into the "advanced" configuration menu by holding the increment (↑) button and hold the enter button for 3 seconds.
5. Press the (←) "Enter Button" until the "FlipPrb?" (Flip Probe) menu appear. Use the up or down buttons to select "Yes" and press enter.
6. When "Yes" is selected the next menu is the "Config" (Configuration/Orientation) menu. This is where the "Top" or "Bottom" mount configuration is selected. This configuration/orientation is with reference to where the sensor probe "bulkhead" is located on top or bottom. Select the appropriate "Config" and press enter. If the original orientation is selection the menu will revert back to "FlipPrb?" menu.
7. The next menu is "Rerange?" (Change Range) menu. Select "Yes" if the measuring range (or span) is changing from the original span. Select "No" if the span is to remain the same. Selecting

- “Yes” will then go through the change range procedure discussed in section 5.1 of this manual.
8. After the “Rerange?” menu is the “CrntLvl?” (Current level) menu. Simply enter where the existing level is in the vessel and a one-point calibration will take place automatically and the next menu will appear. If the next menu appears then the operation was successful. If the menu reverts back to the beginning of the “FlipPrb” menu then the operation was unsuccessful. Further troubleshooting may be necessary if the operation is unsuccessful. See Section 6 for troubleshooting guide.

Change Signal (ChngSgnl):

The next menu in the advanced features menu is “ChngSgnl” or change signal option. The feature allows the adjustment of the signal being sent down the sensor probe. It can be utilized when one electronics module is being utilized to save settings for various different length sensor probes.

This menu has 3 parameters that can be adjusted. The first is “Energy” [%], it is increased for a longer sensor probe and decreased for a shorter sensor probe. The second parameter is “DCOffset” or DC Offset [v], this is the DC voltage that the signal is offset by. It is useful for eliminating some noise. The third (and final) parameter is the “HoldTime” or hold time [μ s], this is how long the Energy is held for. This parameter is recommended to stay within a certain range. Also see section “6.3 Changing Signal Parameters”

NOTICE: This option is also intended for mainly factory use. Changing these parameters can cause undesirable results. Please consult factory with any questions. The “factory” default configurations can be loaded if the parameters have been drastically changed.

NOTE: There is purposely not much detail on this option as it is recommended that these parameters not be changed unless the electronics module is being utilized for more than one sensor probe. It is also recommended that the user be guided by the factory if this option is being utilized.

Pulse Width Filter (PW Filtr):

The pulse width filter can be utilized for dual output (level and interface) applications if there are any erroneous readings being transmitted or displayed. This feature can be adjusted so the unique signal from the magnetic float can be concentrated on and all other false signals are ignored.

TRANSMITTER CALIBRATION AND TROUBLESHOOTING

CALIBRATION

NOTICE: There really is no need to re-calibrate this instrument. The MLT-Series arrive calibrated to specified measuring ranges at order placement.

If the need arises and a recalibration is deemed necessary please follow these instructions carefully.

NOTE: Level simulation will be required at 0% and 100% positions.

1. Verify the “probe length” is not the same as the “measuring range” desired. If so please change accordingly. See Section 5.1.
2. Go to the “Change Range” menu and set the desired URV (measuring range).
3. Go to the “Trim Sensor” menu and enter.
4. At the “Trim Zero” screen place the level (or magnet/float) at 0% and then press enter.
5. At the “Trim Span” screen move the level (or magnet/float) to 100% and then press enter.
6. “Exit” the configuration menus and the instrument should be calibrated. If not begin to troubleshoot or consult factory for assistance.

Error Preventative Calibration:

The MLT-350FF transmitters are protected from incorrect calibration so if something is done incorrectly it will display “Span Error” on the LCD for 6 seconds and then return to the beginning of the “Trim Sensor” menu.

Recommendation:

Again there is no need to recalibrate the instrument simply go to the “Change Range” menu and adjust the LRV or URV as desired.

contact the factory to arrange for a replacement.

GENERAL TROUBLESHOOTING

Magtech manufactures custom built products so each transmitter has been specifically designed to fit on a MLI or be inserted into a tank/vessel and has been approved by the end user at some point during the ordering/purchasing process. Each transmitter has been factory calibrated to meet end user requirements so there is no need to recalibrate these transmitters unless the requirements have changed from the time of purchase/delivery to installation. If the need arises to calibrate these units to a new range please carefully read and follow the calibration procedure in the instruction and operation (I/O manual) or consult the factory. Always feel free to contact the factory if any questions or uncertainties arise. The following guide has been established to guide the end user through some troubleshooting procedures if the need arises.

Water damage

Water damage to the electronics module or sensor probe. This is potentially the most severe case as the symptoms are unpredictable. If there is any suspicion that the transmitter may have incurred water damage please contact the factory to make arrangements to have the unit sent back for factory inspection.

There are 3 basic scenarios that can potentially cause issues:

NOTE: Physical and water damage are not covered under warranty.

Physical damage to the sensor probe.

Accidents can happen during the installation process and if the sensor is permanently bent, bowed, or kinked it will no longer work properly. Some symptoms of damage to the sensor probe are:

Magnetic Indentation

It is possible for any magnetostrictive instrument to have residual magnetic energy stored along the length of the waveguide. These magnetic anomalies can interfere with the output response signal. If this appears to be the case a level gage float (or a bar magnet preferably) may be run along the length of the sensor tube, past the head of the transmitter, in an even motion without stopping. This will usually clear all such magnetic anomalies.

- a) Erratic output, unit jumping to full scale (alarm mode) randomly, usually around the damage point.
- b) Unit in constant alarm condition
- c) Unit going into alarm condition after a certain point.

NOTICE: Never move a magnet in perpendicular motion away from the sensor tube. This will always leave a residual magnetic field in the waveguide which causes the transmitter output to be erroneous or unstable.

NOTICE: NEVER bend, bow or cause a kink in the sensor probe, this will damage the instrument and void the warranty. Do not attempt to straighten the sensor probe, this will not help the instrument work. If the shipment arrives damaged please file a claim with the shipping company and

BASIC TROUBLESHOOTING

Symptom	Potential Issue/Problem	Possible Solution
Transmitter is not powering up. The LCD is not turning on and there is zero mA current draw.	Polarity Check	The transmitter is polarity protected. Check the field wiring to make sure the plus and minus connections are not reversed.
	Electronics not making proper connection to power connector.	Make sure the electronics module is seated properly. Open the front cover (where the LCD is) and firmly push on the “Magtech” text. A good way to tell if the electronics are not seated properly

		is by making sure the protection screws are not physically higher than the outside of the housing. Sometimes pulling the electronics module out and putting it back in can reseal the electronics correctly. Use cutters or needle nose pliers to grip the protection screw and lightly pull on each screw (alternate).
Output of transmitter is erratic OR in constant failure mode	Configuration settings not optimized	Change signal parameters. See section " " or contact factory for assistance.
	Electronics module failure	Replace electronics with known working electronics from a sensor of similar length and/or contact factory for replacement assistance.
	Sensor probe failure	Consult factory for assistance.
Local display showing dark black squares or blinking "please standby"	LCD did not initialize properly	Cycle power rapidly (this may have to be done a few times).
	Electronics module failure	Replace electronics with known working electronics from a sensor of similar length and/or contact factory for replacement assistance.
Cannot enter into menus local display menus using push buttons	Write protect jumper is locking buttons	Move the blue jumper from the right (2pins) to the left (2pins).

- Energy [%] is the amount of energy (a voltage correlated to percentage) being sent down the sensor probe.
- DCOffset [V] is the DC voltage that the signal is offset by. It is useful for eliminating some noise.
- HoldTime [µs] is how long the Energy is sent down for.

Symptom: Transmitter is erratic (i.e. output going from correct reading to failure mode).

Possible Resolution: Increase Energy Settings:

1. Unlock the pushbuttons by moving the blue jumper to the left, Hold the UP button for 1sec
2. While holding the UP button also hold ENTER button (together) for 3 secs
3. The menu should change to "COMPORT" release buttons
4. Bypass this menu by pressing enter.
5. Keep by-passing the menus until you see "ChgSgnl",
6. Use the up or down arrows to change the "no" to a "yes" and press enter.
7. The next Menu will say "Energy" and a percentage, increase this number by 10 [%] and press enter. (I.e. 20 to 30 %)
8. The next Menu will say "DCOffset", and a voltage, leave this value unchanged and press Enter.
9. The next menu will say "HoldTime" and a number; increase this number by 2 [µs] and press enter. (i.e. 4 to 6 µs)
10. Then simply press enter until you see the "Exit" menu and then press enter one last time.

The above procedure can also help if the output is in constant failure mode. If the procedure does not help please contact factory for further assistance. 1-800-221-3653.

CHANGING SIGNAL PARAMETERS

There are 3 parameters involved with "Energy Settings". These parameters are Energy, DCOffset and HoldTime.

FOUNDATION FIELDBUS PROTOCOL

upgraded across
bus? (Yes / No)

FOUNDATION FIELDBUS PROTOCOL: GENERAL INFORMATION & SPECIFICATION

The MLT-350FF is currently compliant to ITK-6.2.0 allowing for a wide range of interoperability with host manufacturers. Softing's FFeasy-HART software/hardware architecture was utilized to achieve FF protocol.

General

1	Manufacturer Name	Emerson	Process Management / Magtech
2	Model	MLT-350FF	
3	Device Type	Level	
4	Device Revision	1.0.1	

DD and CFF

1	Device Description File	0101.ffo and 0101.sym	
2	Capabilities File Name	010101.cff	
3	Methods	Basic configuration	

Physical

1	Polarity (Yes/No)	Sensitive	Yes
2	Quiescent Draw (mA)	Current	27
3	Physical Profile Class	Layer	31PS

Communications

1	Stack	Softing AG	
2	Class (Basic or Link Master Stack)	Link Master	
3	Number of VCRs	24 (one fixed)	

User Layer (General)

1	Function Application	Block	Softing AG
2	Function Provided	Blocks	Analog Input (4) - 3 of 4 utilized for MLT-350FF
3	Instantiation	No	
4	Number of Linkage Objects	22	
6	Minimum Time (ms)	Cycle	100
6	Registration Status	Registered	
7	Can the device be	No	

Resource Block

1	Block Class	(Std, Enhanced, Custom)	Enhanced
---	-------------	-------------------------	----------

Transducer Blocks

1	Block Class	(Std, Enhanced, Custom)	Custom
---	-------------	-------------------------	--------

Function Blocks

3 - AI Blocks	Block Class	(Std, Enhanced, Custom)	Enhanced
			AI1 - Level (total level or interface only)
			AI2 - Interface (configured only when there are 2 floats/levels present in predetermined applications)
			AI3 - Temperature (RTD output for process temperature configured in predetermined applications)

MLT-350FF is a registered device and appropriate configuration files can be found at:

http://www.fieldbus.org/index.php?option=com_mtree&task=search&Itemid=324&ffbstatus=Registered&ffbmfg=Emerson+Process+Managemen t&ffbcategory=Level

MLT-350FF PARAMETERS

The Transducer block has all parameters needed to configure the MLT-350FF. Please note all MLT-Series transmitters are preconfigured to customer specifications at the factory. Magtech has utilized Softing's FF-Easy- HART Interface for the MLT-350FF. The parameter map below shows what generic parameters are mapped to MLT-350FF parameters.

Please note all Hosts will not display the MLT-350FF parameter names some Hosts will default to the generic names.

Generic DD: FFeasy-HART Parameters	MLT-350FF: Parameters	Factory Comments / Recommendations
GENERIC_FLOAT_PARAM_1	Probe Length "SelLngh"	Should be greater than measuring range. Probe Length = Measuring Range + Deadbands
GENERIC_FLOAT_PARAM_2	Level Offset "Offset"	See Section 5.1
GENERIC_FLOAT_PARAM_3	RoC "RoCFltr"	See Sections 5.1 and 5.2
GENERIC_FLOAT_PARAM_4	DC Offset "DCOffset"	See Section 6.3
GENERIC_FLOAT_PARAM_6	LRV "LRV"	See Section 5.1; This value is typically zero (zero reference point).
GENERIC_FLOAT_PARAM_6	URV "URV"	See Section 5.1; This value is the measuring range.
GENERIC_FLOAT_PARAM_7	Damping "Damping"	See Section 5.1; Damping can be utilized when surface of liquid level is agitated.
GENERIC_FLOAT_PARAM_8	Sensor Gain	This is the calculated slope for the particular sensor. DO NOT CHANGE
GENERIC_FLOAT_PARAM_9	LCP	NOT USED

		CURRENTLY
GENERIC_FLOAT_PARAM_10	UCP	NOT USED CURRENTLY
GENERIC_USIGN16_PARAM_1	Charge % "Energy"	See Section 6.3
GENERIC_USIGN16_PARAM_2	Hold Time "Holdtime"	See Section 6.3
GENERIC_USIGN16_PARAM_3	Orientation	0 - Bottom mount electronics 1 - Top mount electronics <i>Do not change without consulting factory.</i>
GENERIC_USIGN16_PARAM_4	Load Index	Load From: 0 - Factory Defaults 1 - Sensor 1 2 - Sensor 2 3 - Sensor 3
GENERIC_USIGN16_PARAM_6	Save Index	Save To: 1 - Sensor 1 2 - Sensor 2 3 - Sensor 3
GENERIC_USIGN16_PARAM_6	NOT USED	Currently not being utilized
GENERIC_USIGN16_PARAM_7	NOT USED	Currently not being utilized
GENERIC_USIGN16_PARAM_8	NOT USED	Currently not being utilized
GENERIC_USIGN32_PARAM_1	Level LTP	Lower Calibration Point. This value is captured during initial calibration. There are no units to this value. <i>DO NOT CHANGE</i>
GENERIC_USIGN32_PARAM_2	Level UTP	Upper Calibration Point. This value is captured during initial calibration. There are no units to this value. <i>DO NOT</i>

		<i>CHANGE</i>
GENERIC_USIGN32_PARAM_3	Cal Status	NOT USED CURRENTLY
GENERIC_USIGN32_PARAM_4	Temp LCP	NOT USED CURRENTLY
GENERIC_USIGN32_PARAM_6	Temp UCP	NOT USED CURRENTLY
GENERIC_STRINGV_PARAM_1	S/N	Serial Number (for traceability)
GENERIC_STRINGV_PARAM_2	S.O.#	Sales Order Number (for traceability)

NOTICE: Changing any of the parameters above can affect transmitter output. If unsure about the parameter please do not hesitate to contact factory first.

NOTE: Parameters in “quotes” are how they are shown on the local display of the transmitter.

MLT-350FF FIELDBUS CONFIGURATION

TROUBLESHOOTING

The MLT-350FF leaves the factory initialized and with all applicable blocks in AUTO mode (in operating condition). If the need arises to change configuration parameters or scaling parameters please follow general FF guidelines. Below are steps common to all standard FF devices.

There are just a few things to check to get an AI block into AUTO mode:

- Make sure that the AI block parameters CHANNEL, L_TYPE and XD_SCALE are set correctly.
- Make sure the Resource Block Mode is AUTO

Configure a FF Analog Input Function Block (AI)

1. Set the parameter MODE_BLK.TARGET of the AI block to 'OOS'(out of service). Some parameters can be written only if MODE_BLK.ACTUAL is 'OOS'.
2. Remove possible configuration error from BLOCK_ERR at this AI block. Initialize some uninitialized Parameters:

- a. L_TYPE: should be 'Indirect'. It can also be 'Direct' if XD_SCALE and OUT_SCALE parameters have the same values.
 - b. CHANNEL: should be initialized with a value that is not 0. If a fixed channel is assigned, parameter CHANNEL should have appropriate value.
 - c. XD_SCALE: the component UNITS_INDEX must have the same unit like the unit of the corresponding process value in the transducer block. The corresponding process unit depends of the configured CHANNEL.
 - d. BLOCK_ERR parameter should be now 'OutOfService'.
3. Set the parameter MODE_BLK.TARGET to 'Auto'.
 - a. If all conditions are complied, MODE_BLK.ACTUAL parameter of AI block should be 'Auto'.

The “status” element of the FFeasy-HART transducer block’s PV, SV and TV parameters are computed by the transducer block depending on the proper function of the HART communication.

If the HART interface works, the status is set to 'Good, Non Cascade'.

If the HART communication fails the status of the PV, SV and TV changes to 'Bad, Input-Failure'.

This does not reflect device’s failure mode. The MLT-350FF is programmed to send its output to '-99999, Bad' (irrespective of engineering units) when it goes into 'alarm' (failure mode). If output is configured for percentage then the calculated output will be a large negative number. For troubleshooting due to failure mode see sections 6.1 – 6.3 or contact factory for assistance.

FIELD INSULATION OF MLI WITH TRANSMITTERS

FIELD INSULATION

We strongly recommend that experienced Magtech personnel do any insulation of the magnetic level indicators 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 done 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 MLI chamber only. DO NOT cover the MLT-350FF transmitter tube, as this may burn up the sensor and possibly the electronics.
2. After the insulation jacket is installed, the MLT-350FF sensor tube must be re-mounted at its factory-preset distance from the MLI 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.

INSULATION WARNING LABEL SUPPLIED

WARNING

When Insulating MLI's, Magtech Level Transmitters have a maximum operating temperature of 300 °F. When insulating a MLI and transmitter assembly in HOT service, keep the transmitter OUTSIDE the insulating material. Special blankets for this type of insulation are available from Magtech. For further information, consult the factory. 1-281-488-0788

WARRANTY

WARRANTY

All Magtech products are warranted against defects in materials and workmanship for eighteen months from the date of shipment or twelve months from the date of installation, whichever period expires first. The MLI 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. Magtech 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 Magtech.
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 Magtech. Repairs and/or replacements shall be at the sole discretion of Magtech 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 Magtech. All warranty repairs or replacements will be performed at the factory in Pearland. Surface return freight will be paid by Magtech. Factory warranties do not include field service. Field service warranty repairs will be at the buyer's expense.

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 Magtech.

NOTE: ALL MAGTECH INSTRUMENTS SHOULD BE UNPACKED AND THOROUGHLY INSPECTED UPON RECEIPT. MAGTECH INSTRUMENTS 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 16 DAYS OF RECEIPT OF GOODS BY CUSTOMER.

Emerson Automation Solutions- Magtech

3902 Magnolia Road, Pearland, Texas, 77584-1610, USA

CHINA ROHS**MLT-350 MODEL DISCLOSURE**

含有China RoHS管控物质超过最大浓度限值的部件型号列表 MLT-350/351

List of MLT-350/351 Parts with China RoHS Concentration above MCVs

部件名称 Part Name	有害物质 / Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr +6)	多溴联苯 Polybrominated biphenyls (PBB)	多溴联苯醚 Polybrominated diphenyl ethers (PBDE)
电子组件 Electronics Assembly	X	O	O	O	O	O

本表格系依据SJ/T11364的规定而制作。

This table is proposed in accordance with the provision of SJ/T11364.

O: 意为该部件的所有均质材料中该有害物质的含量均低于GB/T 26572所规定的限量要求。

O: Indicate that said hazardous substance in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: 意为在该部件所使用的所有均质材料里，至少有一类均质材料中该有害物质的含量高于GB/T 26572所规定的限量要求。

X: Indicate that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.