

# AT500

## Magnetostrictive Level Transmitter

Compact magnetostrictive liquid level transmitter for direct insertion

K-TEK Level products



### Introduction

The AT500 Magnetostrictive Transmitter is based on the same magnetostrictive principle as the AT100 model. The AT500 is a compact magnetostrictive liquid level transmitter for direct insertion for total and interface measurement.

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# 1. STORAGE INFORMATION

If required, storage prior to installation should be indoors at ambient temperature, not to exceed the following:  
Temperature range: -40 to 150 degrees F.  
Humidity: 0 to 100% R.H. non-condensing.

## 1.1 AT600

AT600 transmitters are typically mounted to KM26 Magnetic Level Gauges. These operate off the magnet assembly in the float of the level gauge.

## 1.2 AT500

AT500 transmitters are directly inserted into the vessel. They operate off of the magnet assembly within the float riding on the sensor tube.

# 2. INSTALLATION AND STARTUP

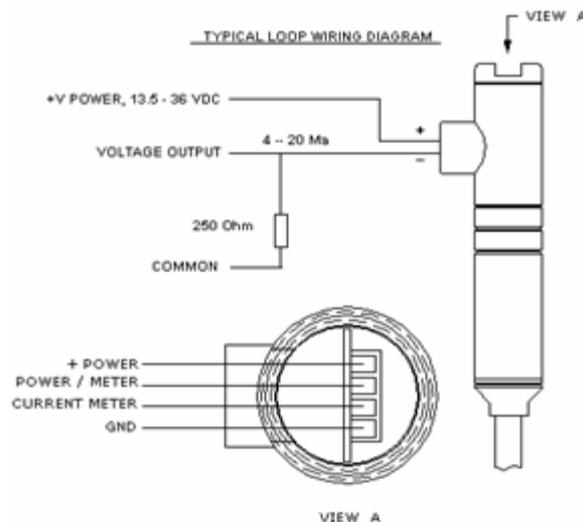


**WARNING:** When fitted with a compression fitting, the sensor tube is shipped with a set of TEFLON® (registered trademark of DuPont) ferrules, and a set of STAINLESS STEEL ferrules in a separate bag. The TEFLON® (registered trademark of DuPont) ferrules are only intended for low-pressure applications; for higher operating pressures and/or permanent installation, replace the TEFLON® (registered trademark of DuPont) ferrules by the STAINLESS STEEL ferrules.

## 2.1 Wiring

Install conduit to 1/2" NPT pipe nipple seal, and run 18 Gauge twisted shielded pair to housing. Use appropriate conduit seal fitting to eliminate possible moisture infiltration.

Apply loop power to transmitter as follows:



## 2.2 Establishing 4mA & 20mA Setpoints

The unit is a digital transmitter with no routine calibration required.  
If re-calibration is required, calibration can be changed using the built in switchpoints as follows:

### 2.2.1 Setting the 4mA / 0% point

- Establish a tank level of 0%
- Enter the calibration mode by placing Magnet at position X for 2 seconds.
- Slide magnet from position X to position Z to set the ZERO (4.00mA) setpoint; this step is verified by checking that the output is now at 4.00 mA

### 2.2.2 Setting the 20mA / 100% point

- Establish a tank level of 100%
- Enter the calibration mode by placing Magnet at position X for 2 seconds.
- Slide magnet to position S to set the SPAN (20.00mA) setpoint; this step is verified by checking that the output is now at 20.00 mA

**Note:** These steps can be repeated as many times as needed.

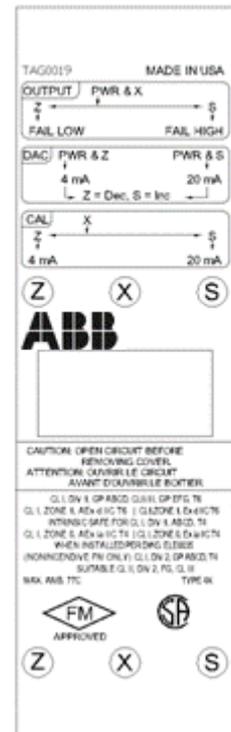
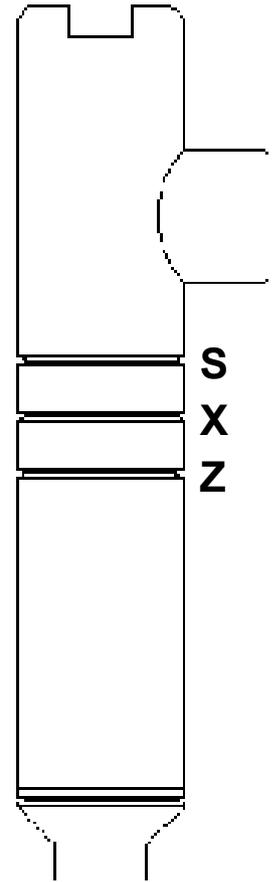
## 2.3 Reversing Action

If required, transmitter output can be reversed by following these steps (Note: this reverses the 4-20 mA output):

- **Bring the level to 50% ( + or - 10% ).**
  - Enter the calibration mode by placing Magnet at position X for 2 seconds.
  - Slide magnet from position X to position Z to temporarily set the ZERO (4.00mA) setpoint; this step is verified by checking that the output is now at 4.00 mA
- **Bring the level to the new 20mA point.**
  - Enter the calibration mode by placing Magnet at position X for 2 seconds.
  - Slide magnet from position X to position S to set the SPAN (20.00mA) setpoint; this step is verified by checking that the output is now at 20.00 mA
- **Bring the level to the new 4ma point.**
  - Enter the calibration mode by placing Magnet at position X for 2 seconds.
  - Slide magnet from position X to position Z to set the ZERO (4.00mA) setpoint; this step is verified by checking that the output is now at 4.00 mA.

## 2.4 High/Low Alarm Setting

The Unit enters an alarm state when no float is detected. The desired alarm state can be set as follows:



### 2.4.1 Setting ALARM to 3.6mA (Low Alarm)

- Enter the ALARM SETUP MODE by applying power to the unit while Magnet is at position X.
- Slide magnet to position Z to set the unit to 3.6 mA / Low Alarm; this step is verified by checking that the output is now at 3.6 mA

### 2.4.2 Setting ALARM to 21mA (High Alarm) default

- Enter the ALARM SETUP MODE by applying power to the unit while Magnet is at position X.
- Slide magnet to position S to set the unit to 21.0 mA / High Alarm; this step is verified by checking that the output is now at 3.6 mA

**Note:** Once in ALARM SETUP MODE, you can toggle the High & Low alarm settings as many times as needed. After 5 seconds of no switch activity, the unit will time out and resume normal operation using the new alarm setting.

### 2.5 4 mA / 20 mA DAC Trim

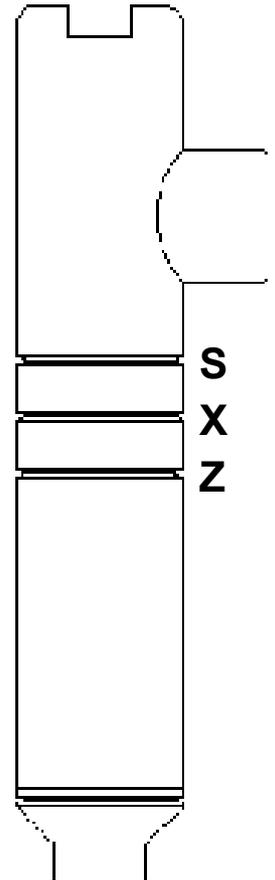
If required, the unit's 4 ma and 20 ma outputs can be trimmed as follows:

#### 2.5.1 Setting 4.0 mA DAC Trim

- Enter the 4 mA DAC TRIM MODE by applying power to the unit while Magnet is at position Z.
- Magnet at position Z will decrease the output at - 0.01 mA intervals
- Moving the magnet to position S will increase the output at + 0.01 mA intervals
- Continue to Increase/Decrease the output until the output is at 4.00 mA
- The unit will time out after 5 seconds of no switch activity and resume normal operation using the new 4.0 mA trimmed value.

#### 2.5.2 Setting 20.0 mA DAC Trim

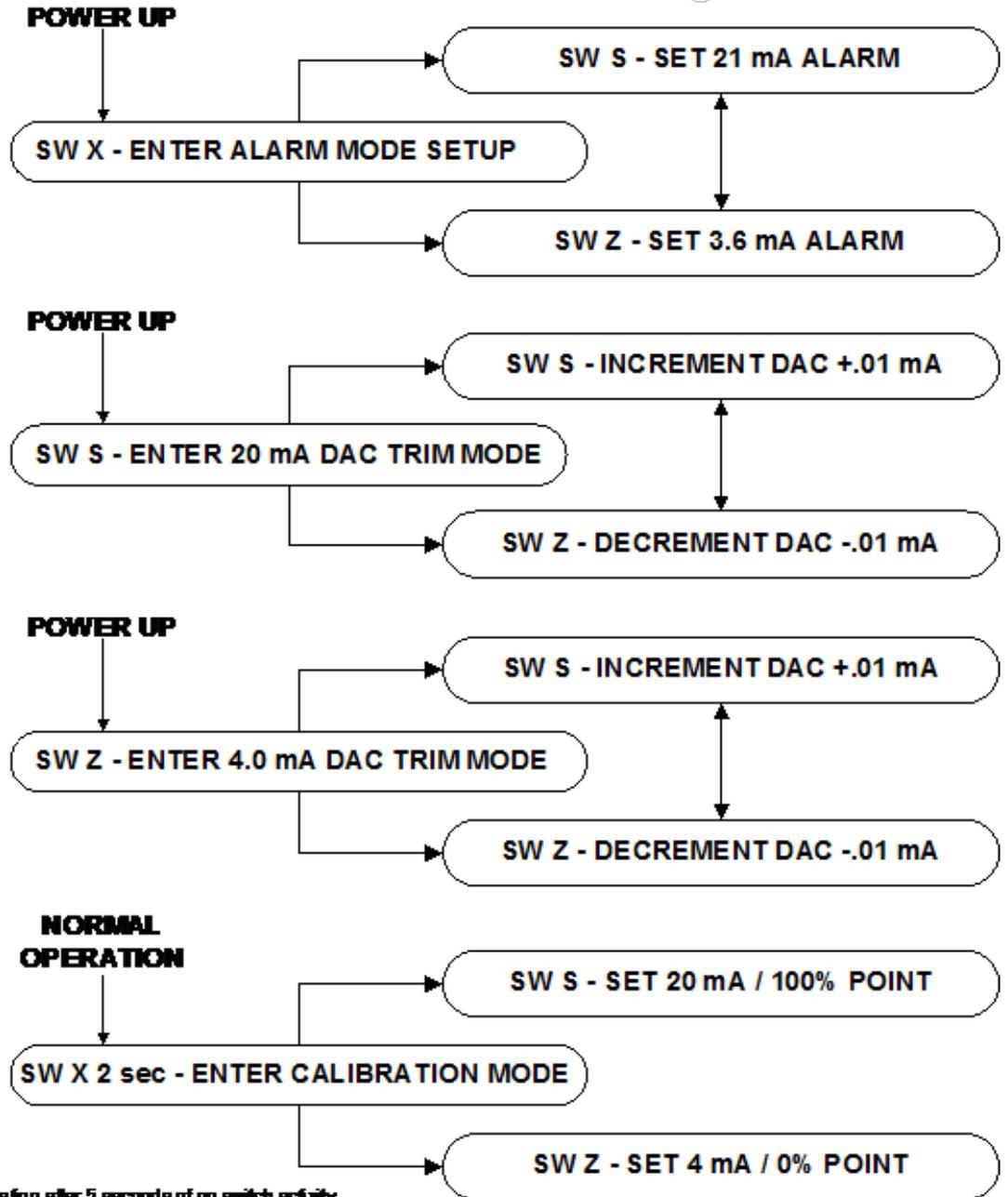
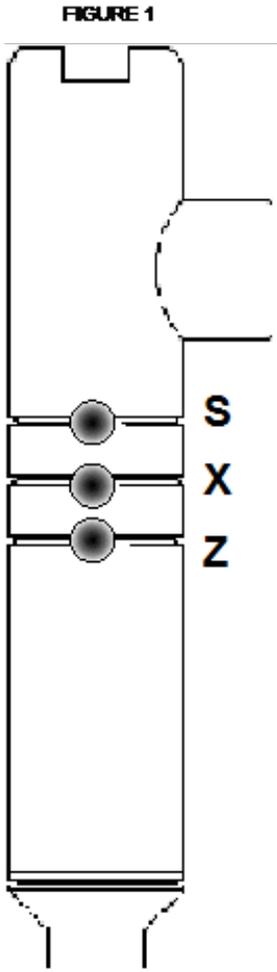
- Enter the 20 mA DAC TRIM MODE by applying power to the unit while Magnet is at position S.
- Magnet at position S will increase the output at + 0.01 mA intervals
- Moving the magnet to position Z will decrease the output at - 0.01 mA intervals
- Continue to Increase/Decrease the output until the output is at 20.00 mA
- The unit will time out after 5 seconds of no switch activity and resume normal operation using the new 20.0 mA trimmed value.



# SWITCH OPERATIONS

Summary of operations using the three switch points: SW S, SW X, SW Z.

Magnetic switchpoints are located on lines S, X & Z at points 90 degrees from the conduit connection indicated by:  on FIGURE 1



Note: Unit will return to normal operation after 5 seconds of no switch activity.

## 3. TROUBLESHOOTING INFORMATION

### 3.1 Proper Power-Up

Use a mA meter to measure the output current (see section 2.2 for mA monitor connections). When power is applied, the output should go to 4.00 mA for at least 1 second, and then to either the measured level or an alarm condition output. If this does not happen, the transmitter may not be receiving enough power, or the main electronic is defective. Excessive current above 21 mA is also an indication of improper power-up or defective electronics.

- **Valid Current Loop Outputs:**

- **21.0 mA** If HI ALARM was selected, a loss of signal, no float detected, problem with the configuration, or a malfunction, will cause the output to be set to the alarm condition of 21.0 mA.
- **20.6 mA** OVERRANGE: When the level increases above the 20 mA point, the output will continue up to 20.6 mA and then latch at that value, until the level comes back down again.
- **3.8 mA - 20.6 mA** Normal output range
- **3.8 mA** UNDERRANGE: When the level increases below the 4 mA point, the output will continue down to 3.8 mA and then latch at that value, until the level comes back up again.
- **3.6 mA** If LOW ALARM was selected, a loss of signal, no float detected, problem with the configuration, or a malfunction, will cause the output to be set to the alarm condition of 3.6 mA.

### 3.2 Output Stability

If the current output occasionally jumps up or down but not to an alarm condition:

This can be an indication of noise or grounding problem. Field wiring should be run with an individually shielded cable. Insure that the transmitter housing is effectively connected to earth ground.

There may be a location on the tube that has retained some magnetization, and needs to be cleared. This can happen if a magnet or float was used to manually calibrate the sensor and if it was pulled away at 90 degrees from the tube. To avoid this, always slide the magnet parallel to the tube and remove it by going past either end of the tube. To clear any remaining magnetization, slide a magnet or float against and parallel to the tube, from one end to the other.

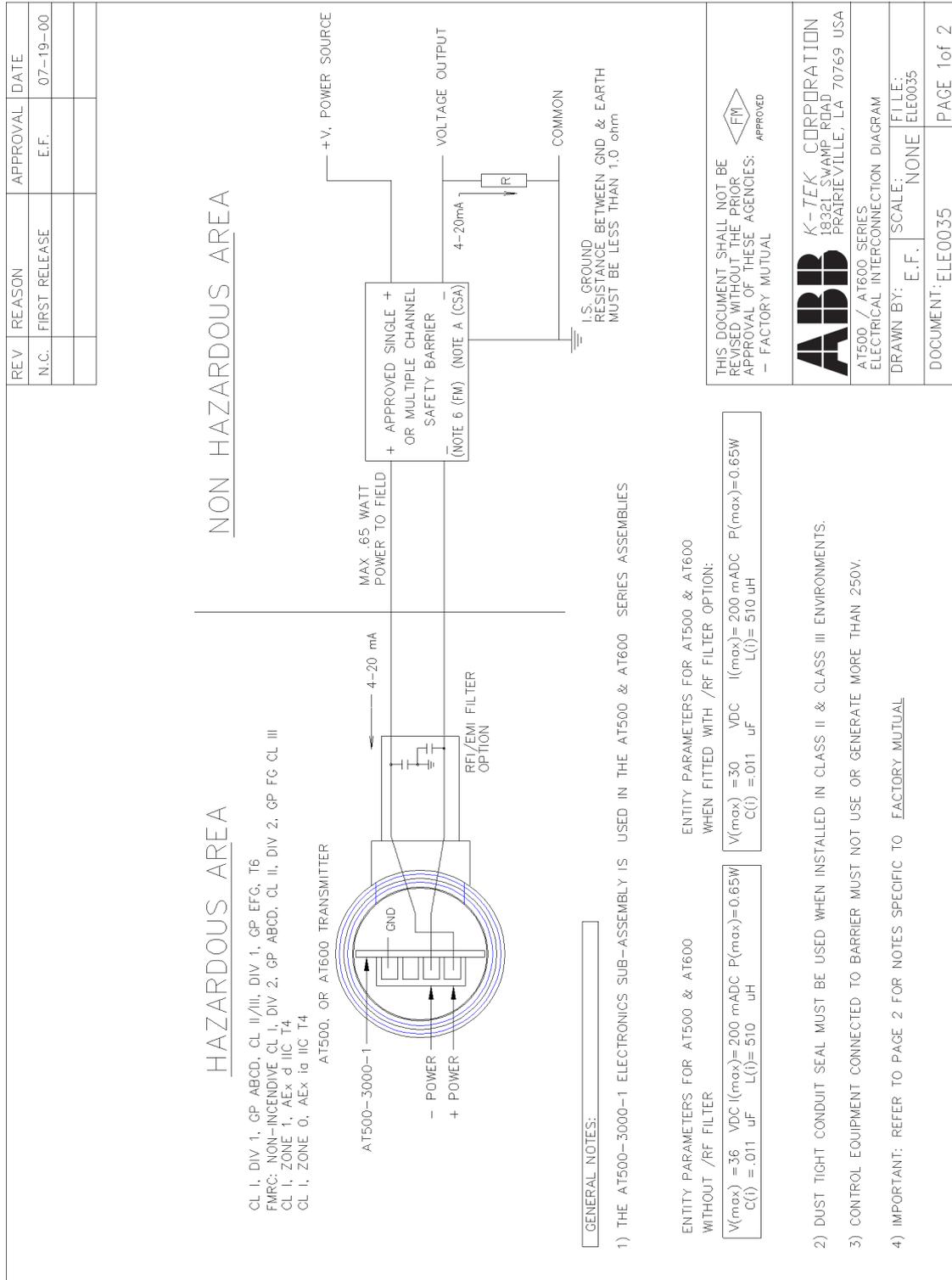
### 3.3 Conversion from AT500 to AT600 or AT600 to AT500

It is possible to convert a bottom connected AT600 to an AT500 by adding a float and other parts. It is also possible to convert an AT500 to a bottom connected AT600 by adding mounting clips. Please consult the factory.

It is not possible to convert a top connected AT600 to an AT500 or vice versa. If you wish to make this change, the transmitters will have to be replaced.

# 4. APPENDIX A

## 4.1 Installation Drawings



THIS DOCUMENT SHALL NOT BE REVISED WITHOUT THE PRIOR APPROVAL OF THESE AGENCIES:  
 - FACTORY MUTUAL

**ABIB** K-TEK CORPORATION  
 832 SWAMP ROAD  
 PRAIRIEVILLE, LA 70769 USA

AT500 / AT600 SERIES  
 ELECTRICAL INTERCONNECTION DIAGRAM

DRAWN BY: E.F. SCALE: NONE  
 FILE: ELE0035

DOCUMENT: ELE0035 PAGE 1 of 2

# 4.1 Installation Drawings (continued):

REV	REASON	APPROVAL	DATE
N.C.	FIRST RELEASE	E.F.	07-19-00

NOTES RELATED TO FM APPROVAL:

- 5) THE AT500 & AT600 SERIES ELECTRONICS CONFORMS TO FMRC APPROVAL STANDARD NO.3610.
- 6) SAFETY BARRIER MUST MEET THE FOLLOWING REQUIREMENTS:  
 $V(oc) \text{ or } V(t) \leq V(max)$ ,  $I(sc) \text{ or } I(t) \leq I(max)$ ,  $C(o) > ( C(i) + C(cable) )$ ,  $L(o) > ( L(i) + L(cable) )$
- 7) FOR DIV 2 APPLICATIONS, THE TRANSMITTER MUST EITHER BE INSTALLED IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE FOR DIVISION 2 WIRING METHODS OR CONNECT TO AN FMRC APPROVED BARRIER.
- 8) ASSOCIATED EQUIPMENT MUST BE FMRC APPROVED.
- 9) NONINCENDIVE FIELD WIRE PARAMETERS:  
 ENTITY PARAMETERS FOR AT500 & AT600  
 WITHOUT /RF FILTER  

$V(max) = 36 \text{ VDC}$     $I(max) = 90 \text{ mADC}$     $P(max) = 0.65W$   
 $C(i) = .011 \text{ uF}$     $L(i) = 510 \text{ uH}$
- 10) INSTALLATION SHALL BE IN ACCORDANCE WITH ANSI/ISA RP12.6 AND THE NEC ANSI/NFPA 70.  
 11) SYSTEM CALCULATIONS: ADD CABLE CAPACITANCE & INDUCTANCE TO TRANSMITTER ENTITY PARAMETERS (I.E., ALL FIELD INSTALLED CAPACITANCE & INDUCTANCE MUST BE CONSIDERED)  
 IF CABLE PARAMETERS ARE NOT KNOWN, 60pF/ft & 0.2uH/ft SHOULD BE USED.  
 ENTITY PARAMETERS FOR AT500 & AT600  
 WHEN FITTED WITH /RF FILTER OPTION:  

$V(max) = 30 \text{ VDC}$     $I(max) = 120 \text{ mADC}$     $P(max) = 0.65W$   
 $C(i) = .011 \text{ uF}$     $L(i) = 510 \text{ uH}$

THIS DOCUMENT SHALL NOT BE REVISED WITHOUT THE PRIOR APPROVAL OF THESE AGENCIES:  
 - FACTORY MUTUAL



**ABB** K-TEK CORPORATION  
 18321 SWAMP ROAD  
 PRAIRIEVILLE, LA 70769 USA

AT500 / AT600 SERIES  
 ELECTRICAL INTERCONNECTION DIAGRAM

DRAWN BY: E.F.   SCALE: NONE  
 FILE: ELE0035

DOCUMENT: ELE0035   PAGE 2 of 2

## 5. APPENDIX B

### 5.1 FMEDA Certificate

# Certificate of Analysis

## K-TEK

### Failure Mode and Effect Diagnostic Analysis on Compact Magnetostrictive Level Transmitter AT500 / AT600

The AT500 / AT600 Compact Magnetostrictive Level Transmitter is a 2-wire, 4 – 20 mA smart device. The AT500 / AT600 Compact Magnetostrictive Level Transmitter is classified as a Type B device according to IEC61508, having a hardware fault tolerance of 0. The analysis shows that the device has a Safe Failure Fraction between 60 and 90% (assuming that the logic solver is programmed to detect over-scale and under-scale currents) and therefore may be used up to SIL 1 as a single device.

The failure rates for the Compact Magnetostrictive Level Transmitter AT500 / AT600 are as follows:

$$\lambda^H = 35 * 10^{-9} \text{ failures per hour}$$
$$\lambda^L = 258 * 10^{-9} \text{ failures per hour}$$
$$\lambda^{DU} = 131 * 10^{-9} \text{ failures per hour}$$

**Failure rates according to IEC 61508**

Failure Categories	$\lambda_{sd}$	$\lambda_{su}^*$	$\lambda_{dd}$	$\lambda_{du}$	SFF
Low trip	258 FIT	55 FIT	35 FIT	131 FIT	72.7%
High trip	35 FIT	55 FIT	258 FIT	131 FIT	72.7%

(\*Note that the SU category includes failures that do not cause a spurious trip)

These failure rates are valid for the useful lifetime of the product, which is > 50 years. A user of the AT500 / AT600 Compact Magnetostrictive Level Transmitter can utilize these failure rates in a probabilistic model of a safety instrumented function (SIF) to determine suitability in part for safety instrumented system (SIS) usage in a particular safety integrity level (SIL).

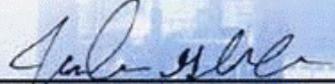
The full background, methods, and analysis are documented in the complete FMEDA report Ktek 03-10-21 R001 v110 FMEDA AT500-600



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exida.com, Inc  
USA - Germany



John C. Grebe Jr., Product Analyst



Dr. William M. Goble, P.E., CFSE

## 6. APPENDIX C

### 6.1 Warranty Statement

#### 5 YEAR WARRANTY FOR:

KM26 Magnetic Liquid Level Gauges; MagWave Dual Chamber System; LS Series Mechanical Level Switches (LS500, LS550, LS600, LS700, LS800 & LS900); EC External Chambers and ST95 Seal Pots.

#### 3 YEAR WARRANTY FOR:

**KCAP300 & KCAP400 capacitance switches.**

#### 2 YEAR WARRANTY FOR:

AT100, AT100S and AT200 series transmitters; VF20 and VF30 vibrating fork switches; RLT100 and RLT200 reed switch level transmitters; TX, TS, TQ, IX and IM thermal dispersion switches; IR10 and PP10 External Relays; MT2000 radar level transmitters; RI100 Repeat Indicator; KP paddle switches; A02, A75 & A77 RF capacitance level switches and A38 RF capacitance level transmitters; Buoyancy Level Switches (MS50, MS10, MS8D & MS8F); Magnetic Level Switches (MS30, MS40, MS41, PS35 & PS45).

#### 1 YEAR WARRANTY FOR:

KM50 gauging device; AT500 and AT600 series transmitters; LaserMeter and SureShot series laser transmitters; LPM200 digital indicator; DPM100 digital indicators; APM100 analog indicators; KVIEW series digital indicators and controllers; SF50 and SF60 vibrating fork switches, KB Electro-Mechanical Continuous Measuring Devices, KSONIK ultrasonic level switches, transmitters & transducers.

#### SPECIAL WARRANTY CONSIDERATIONS:

ABB does not honor OEM warranties for items not manufactured by ABB (i.e. Palm Pilots). These claims should be handled directly with the OEM.

ABB will repair or replace, at ABB's election, defective items which are returned to ABB by the original purchaser within the period specified above from the **shipment date** of the item and which is found, upon examination by ABB, to its satisfaction, to contain defects in materials or workmanship which arose only under normal use and service and which were not the result of either alterations, misuse, abuse, improper or inadequate adjustments, applications or servicing of the product. **ABB's warranty does not include onsite repair or services.** Field service rates can be supplied on request.

If a product is believed to be defective, the original purchaser shall notify ABB and request a Returned Material Authorization before returning the material to ABB, with transportation **prepaid** by the purchaser. (Request door to door delivery via New Orleans International Airport located in Louisiana, USA.) The product, with repaired or replaced parts, shall be returned to the purchaser at any point in the world with transportation prepaid by ABB for best-way transportation only. ABB is not responsible for expedited shipping charges. If the product is shipped to ABB freight collect, then it will be returned to the customer freight collect.

If inspection by ABB does not disclose any defects in material or workmanship, ABB's normal charges for repair and shipment shall apply (minimum 250.00 USD).

The materials of construction for all ABB products are clearly specified and it is the responsibility of the purchaser to determine the compatibility of the materials for the application.

THE FOREGOING WARRANTY IS ABB'S SOLE WARRANTY AND ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE, ARE EXCLUDED AND NEGATED TO THE MAXIMUM EXTENT PERMITTED BY LAW. NO PERSON OR REPRESENTATIVE IS AUTHORIZED TO EXTEND ANY OTHER WARRANTY OR CREATE FOR ABB ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF ABB'S PRODUCTS. THE REMEDIES SET FORTH IN THIS WARRANTY ARE EXCLUSIVE OF ALL OTHER REMEDIES AGAINST ABB. ABB SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR SPECIAL DAMAGES OF ANY KIND. ABB'S SOLE OBLIGATION SHALL BE TO REPAIR OR REPLACE PARTS (FOUND TO BE DEFECTIVE IN MATERIALS OR WORKMANSHIP) WHICH ARE RETURNED BY THE PURCHASER TO ABB.



**K-TEK CORPORATION**  
 18321 Swamp Road  
 Prairieville, Louisiana 70769  
 Phone : (225) 673-6100 Fax (225) 673-2525  
 1-800-735-5835

RA # \_\_\_\_\_

**Return Authorization Form**

Customer : \_\_\_\_\_ Date : \_\_\_\_\_  
 Contact : \_\_\_\_\_ Returned Product : \_\_\_\_\_  
 Fax : \_\_\_\_\_ Serial # \_\_\_\_\_  
 Phone : \_\_\_\_\_ Service Representative : \_\_\_\_\_

**TO BE COMPLETED BY CUSTOMER**

☛ **Warranty Status to be verified. Purchase Order Number Required If Unit Is Not Under Warranty.**  
 ☛ **This Information is Important. Missing or Incomplete Information Will result in a delay in processing.**

Reason For Return : \_\_\_\_\_  
 \_\_\_\_\_

Action Requested : \_\_\_\_\_  
 \_\_\_\_\_

Is expedited return shipping requested ?  YES  NO  
If yes , Please provide a purchase order number. K-Tek pays return transport via standard ground shipment only.

Is K-Tek authorized to repair items determined to be non- warranty ?  YES  NO  
If yes , Please provide a purchase order number.

Customer PO # : \_\_\_\_\_ Date : \_\_\_\_\_

Has product been in contact with any hazardous chemical ?  YES  NO  
If yes , Decontaminate product and forward MSDS to K-Tek attn : REPAIRS

Return Repaired Product To : \_\_\_\_\_ Bill To : \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Ship VIA : \_\_\_\_\_

**\*\*\*\* IMPORTANT NOTE TO CUSTOMER:**  
 Be sure to include the RA number on the shipping label or package. A copy of this document should also be included. K-Tek Corporation wants to maintain a safe work environment for its employees. Customer must note if the returned material has been in contact with any hazardous chemicals, per federal regulations, please have product or material decontaminated before shipment. Forward applicable MSDS information to K- Tek, per federal requirements. Evaluations will be delayed if these safety aspects of handling the returned material is unknown or unclear.  
 10-19-98

## 6.3 EU Declaration of Conformity

### EU DECLARATION OF CONFORMITY

**The EU Directives covered by this Declaration:**

89/336/EEC Electromagnetic Compatibility Directive, amended by 92/31/EEC & 93/68/EEC  
72/23/EEC Low Voltage Equipment Directive, amended by 93/68/EEC

**The Products Covered by this Declaration:**

**AT500 and AT600 Series 2 Wire Loop Powered Level Transmitters**

**The Basis on which Conformity is being declared:**

The product identified above complies with the requirements of the above EU Directives by meeting the following standards:

EN50081-2 Radiated and Conducted Emission  
EN50082-2 Radiated and Conducted Immunity

EN61000-4 Electro Magnetic Immunity

The technical documentation required to demonstrate that the product meets the requirements of the Low Voltage Directive has been compiled by the signatory below and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in 2001.

The products described above comply with the essential requirements of the directives specified.

Signed: Eric P. Fauveau

Authority: Vice President Research & Development

Date: January 8, 2010

#### ATTENTION!

The attention of the specifier, purchaser, installer, or user is drawn to the following special measures and limitations to use which must be observed when the product is taken into service to maintain compliance with the above directives:

- 1) Proper Installation of the instrument requires use of shielded cable for the loop wiring.

Details of these special measures and limitations are also contained in the product manuals.





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