Level Plus® LT420
Analog Level Transmitter

Installation and Instruction Manual
& Ordering Guide

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GENERAL INFORMATION

MTS PHONE NUMBERS	
To place orders:	800-633-7609 or 919-677-0100
Application questions:	919-677-0100
Service:	800-248-0532
Fax:	919-677-0200
SHIPPING ADDRESS	***HOURS***
MTS Systems Corporation Sensors Division 3001 Sheldon Drive Cary, North Carolina 27513	**Monday - Thursday** 8:00 a.m. to 6:30 p.m. EST/EDT **Friday** 8:00 a.m. to 4:30 p.m. EST/EDT

1 INTRODUCTION

The Level Plus Analog Level Transmitter (LT420) is an accurate, highly reliable, loop-powered level sensing device. Utilizing magnetostrictive technology, the LT420 design works with no contact between sensing elements; and only one moving part -- the float. This allows for reliable, long-term performance. The continuous 4-20 mA output is proportional to the stroke length (lengths available up to 149 inches). And, the LT420 is suitable for use in intrinsically safe applications (FM certified for use in Class I, Division 1, Groups C D, E, F and G hazardous locations).

2 OPERATION

The output from the LT420 magnetostrictive level transmitter represents a time interval between the initiation of a current (or interrogation) pulse and the detection of a return pulse. The interrogation pulse is generated in the level transmitter's electronics and induces a magnetic field along the length of the waveguide. When this magnetic field interacts with a magnetic field of the reference magnet, mounted inside a float, a torsional pulse (waveguide twist) results. The waveguide twist acts as the return pulse and travels at a very predictable sonic speed along the waveguide back to the level transmitter's electronics. Here, the time interval is converted into a 4-20 mA loop powered output that indicates level with a very high degree of accuracy.

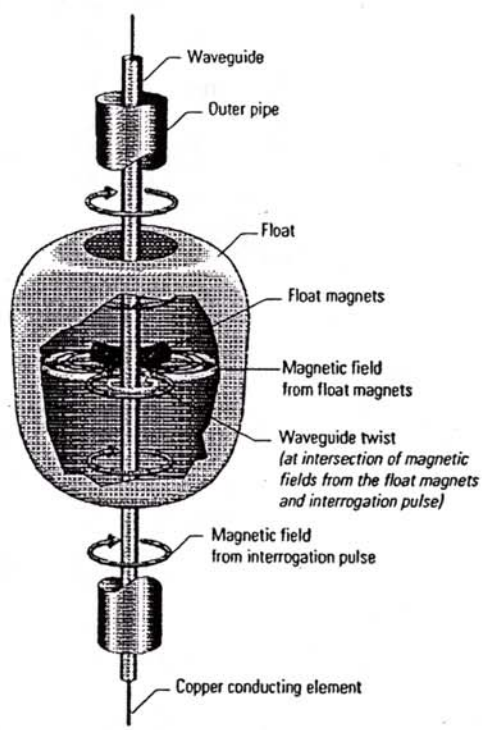
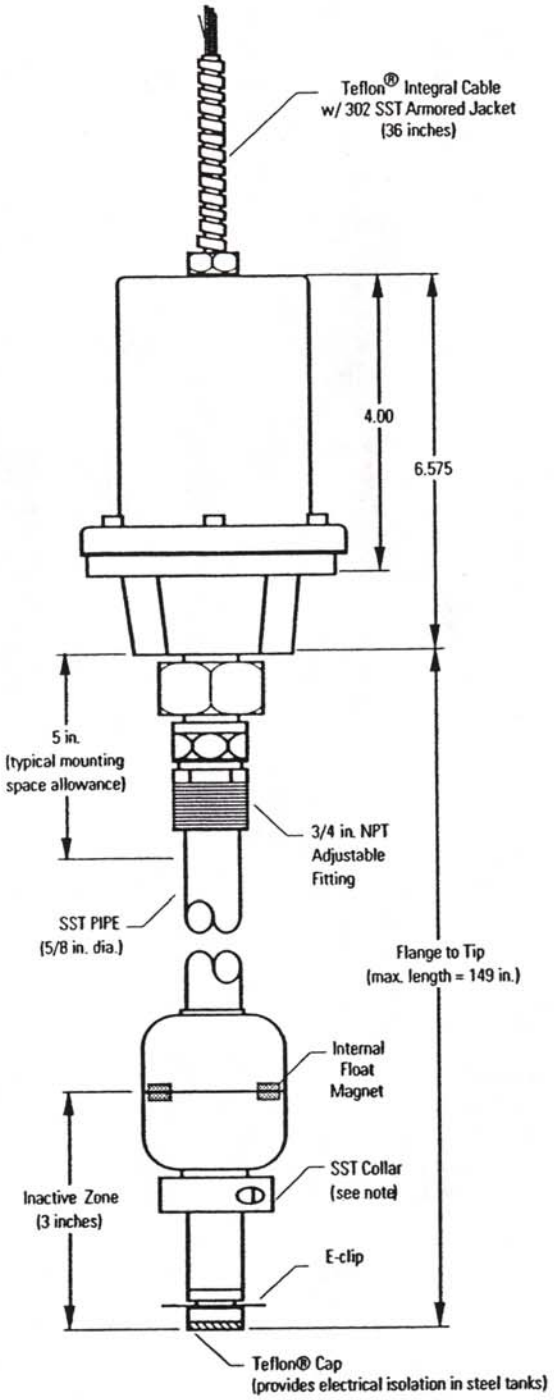


Figure 2.1 *Magnetostriction Operating Principle*

2.1 LT420 Dimensions



NOTE:
SST Collar is installed on the gauge so that the internal float magnet is at the 4 mA position and above the 3-inch inactive zone.

***Figure 2.1** LT420 Dimensions*

2.2 Analog Transmitter Specifications

Parameter	Specification
Performance	
Measured Variable:	Single level
Full Range:	29 to 149 inches (610 mm to 3.6 m) minus 5 in. (127 mm) required for mounting (See Figure 2.1)
Non-linearity:	0.035 % F.S. (Independent best straight line) or 1/32 in. (0.794 mm)*
Hysteresis:	0.01 % F.S. or 0.015 in. (0.381 mm)*
Repeatability:	0.01 % F.S. or 0.015 in.(0.381 mm)*
Time Constant:	1 second
Input Voltage Range:	10.5 to 36.1 Vdc (See Figure 4.2)
Reverse Polarity Protection:	Series diodes
Accuracy	The absolute accuracy of the transmitter is a function of the manufacture of the waveguide. That is, any imperfections in the waveguide are reflected in the linearity of its output. The tolerances reflect a non-linearity of 0.035% full scale. Due to its high degree of repeatability, the differential accuracy is extremely high.
Safety Approval:	FMRC intrinsically safe entity approval for: Class I, Division 1, Groups C-G
Calibration	
Zero Adjust Range:	3.6 to 5 mA
Span Adjust Range:	80 to 100 % of full range
Factory Setting:	0.1 % of span or 1/16 in. (1.59 mm)*
Environmental	
Sealing:	Gasket sealed for outdoor use (NEMA 6)
Humidity:	0 to 100 % R.H.
Operating Temperature:	-25 to 71°C (-13 to 160°F)
Temperature Sensitivity:	Zero: < 0.009 % per °C (0.005% per °F)
Vessel Pressure:	Up to 275 psi
Materials of Construction:	
Electronics Housing:	Epoxy painted aluminum
Rod:	316 stainless steel
Float:	Various (316 SST std)
Gaskets:	Viton™
End Cap:	Teflon®
Cable:	Teflon cable with 302 SST armored jacket
Minimum Life Expectancy:	10 years
Field Installation Requirements	
Transmitter Lengths :	29, 41, 53, 65, 77, 89, 101, 113, 125, 137, and 149 inches
Mounting:	3/4 in. NPT adjustable fitting

All specifications are subject to change without notice. Consult MTS for verification of specifications critical to your needs.

* Whichever is greater

The LT420 is typically mounted in a blind flange that has been drilled and tapped to accept it. First, remove the float from the transmitter by removing the float securing clip (E-ring) and the stainless steel collar (See important note, below).

NOTE

The SST collar is installed on the transmitter so that the float magnet is at the 4 mA position. Make note of this position before temporary removal of the collar. When re-installing the collar, secure it in its original position.

Second, mount the transmitter in the flange and re-install the float along with the securing clip and collar. Third, mount the transmitter, flange and float as a unit onto the tank or vessel.

The tank geometry may change with filling, the transmitter must be appropriately positioned to take this into account. In most applications, the transmitter should be raised off the tank bottom approximately 2 inches before the fitting is tightened to allow for tank dimensional changes due to temperature or other factors.

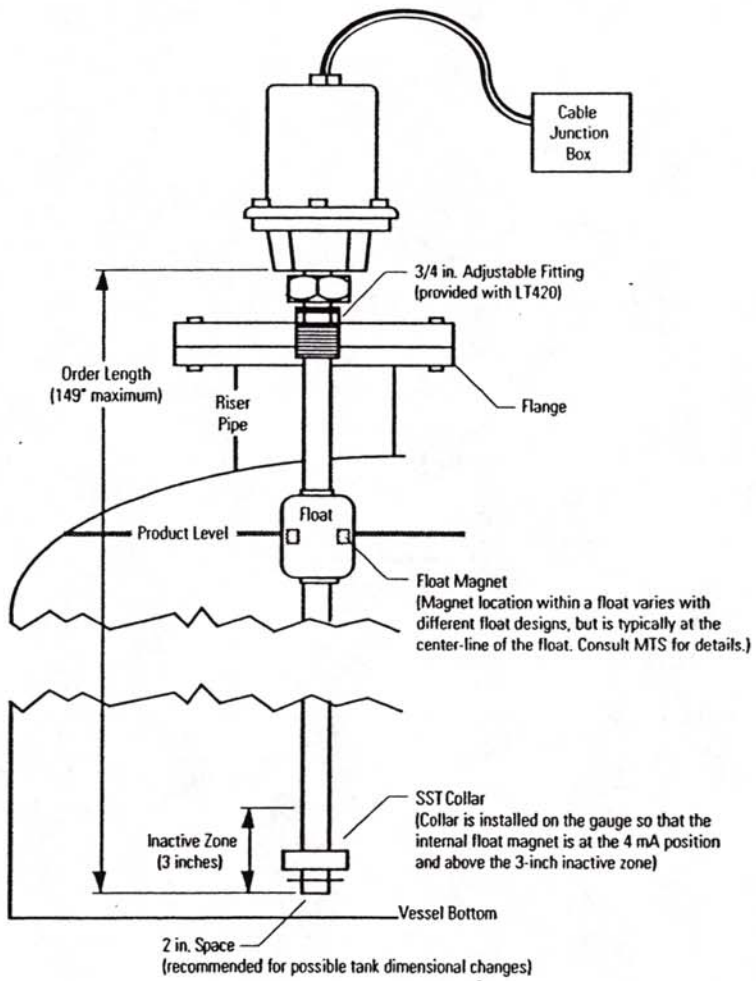
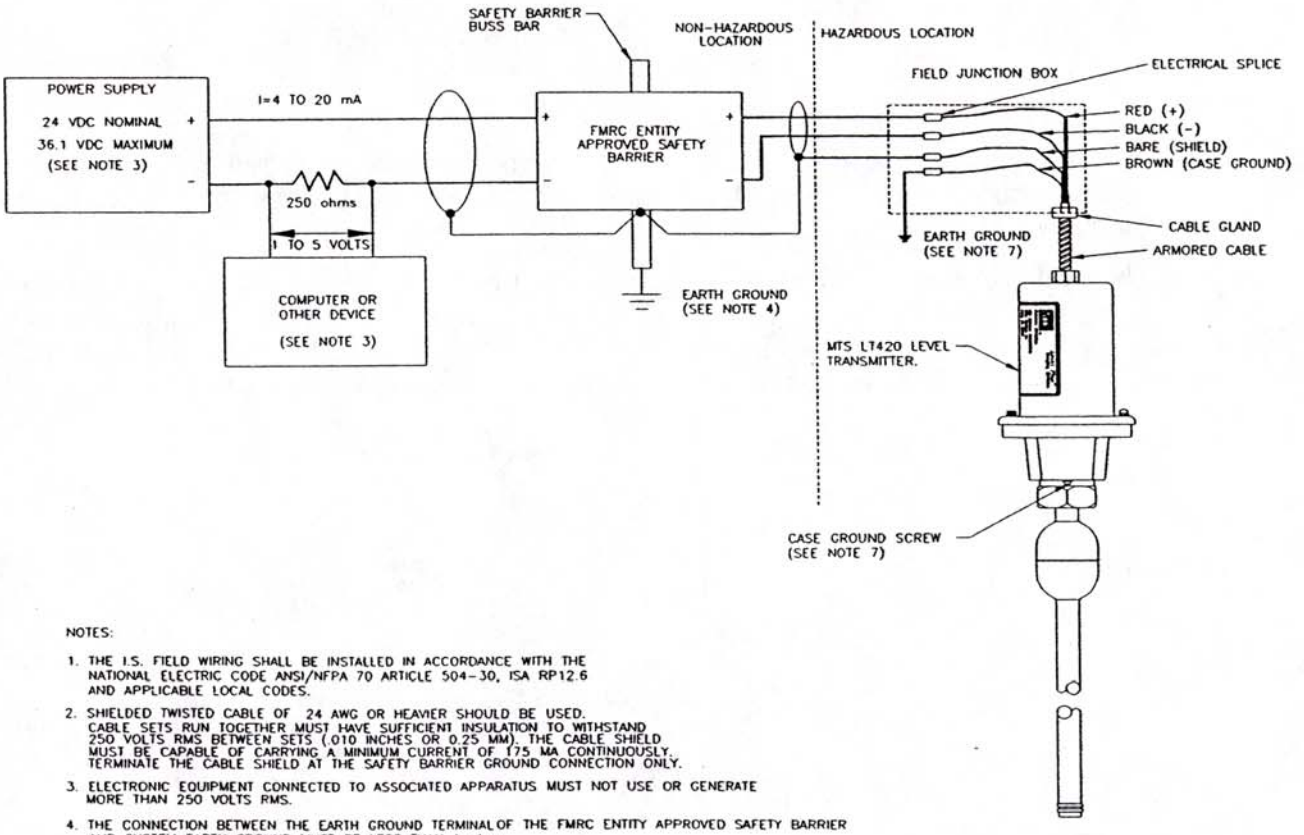


Figure 3.1 *Flange Mounting*

4 ELECTRICAL TERMINATIONS

Refer to the drawing below (Drawing. No. 650575, *Installation Drawing/LT420 Level Transmitter*) when installing the LT420. **All notes and instructions in this drawing must be followed to insure intrinsic safety of the system.**

Refer to Figure 4.2 (pg. 5) to determine the system power supply voltage requirements and maximum loop resistance.



NOTES:

1. THE I.S. FIELD WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE ANSI/NFPA 70 ARTICLE 504-30, ISA RP12.6 AND APPLICABLE LOCAL CODES.
2. SHIELDED TWISTED CABLE OF 24 AWG OR HEAVIER SHOULD BE USED. CABLE SETS RUN TOGETHER MUST HAVE SUFFICIENT INSULATION TO WITHSTAND 250 VOLTS RMS BETWEEN SETS (.010 INCHES OR 0.25 MM). THE CABLE SHIELD MUST BE CAPABLE OF CARRYING A MINIMUM CURRENT OF 175 MA CONTINUOUSLY. TERMINATE THE CABLE SHIELD AT THE SAFETY BARRIER GROUND CONNECTION ONLY.
3. ELECTRONIC EQUIPMENT CONNECTED TO ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS RMS.
4. THE CONNECTION BETWEEN THE EARTH GROUND TERMINAL OF THE FMRC ENTITY APPROVED SAFETY BARRIER AND SYSTEM EARTH GROUND MUST BE LESS THAN 1 ohm.
5. SAFETY BARRIERS MUST BE FMRC ENTITY APPROVED SAFETY BARRIERS USED IN AN APPROVED CONFIGURATION WHERE TRANSMITTER Vmax IS GREATER THAN BARRIER Voc OR Vt AND TRANSMITTER Imax IS GREATER THAN BARRIER Isc OR It.
6. TRANSMITTER Ci PLUS TOTAL CABLE CAPACITANCE FOR WIRING LOOP MUST NOT EXCEED BARRIER Ca. TRANSMITTER Li PLUS TOTAL CABLE INDUCTANCE FOR WIRING LOOP MUST NOT EXCEED BARRIER La.
7. THE TRANSDUCER FRAME SHALL BE GROUNDED TO EARTH GROUND DIRECTLY OR THROUGH THE EQUIPMENT ON WHICH IT IS MOUNTED. THE BROWN CONDUCTOR (CASE GROUND) OR THE CASE GROUNDING SCREW MAY BE USED FOR THIS PURPOSE.
8. APPROVED FOR INTRINSICALLY SAFE USE IN CLASS I, II, III, GROUP C,D,E,F AND G HAZARDOUS AREAS. SENSOR HOUSING APPROVED FOR NEMA 6 OUTDOOR USE.
9. TRANSMITTER LOOP ENTITY PARAMETERS (AS PRINTED ON LABEL)
   Vmax= 36.1V
   Imax= 118mA
   Ci = 0uF
   Li = 500uH
10. TRANSMITTER TEMPERATURE CODE IS T4.

NO REVISIONS SHALL BE MADE WITHOUT NOTIFICATION OF APPROVAL AGENCY(S).

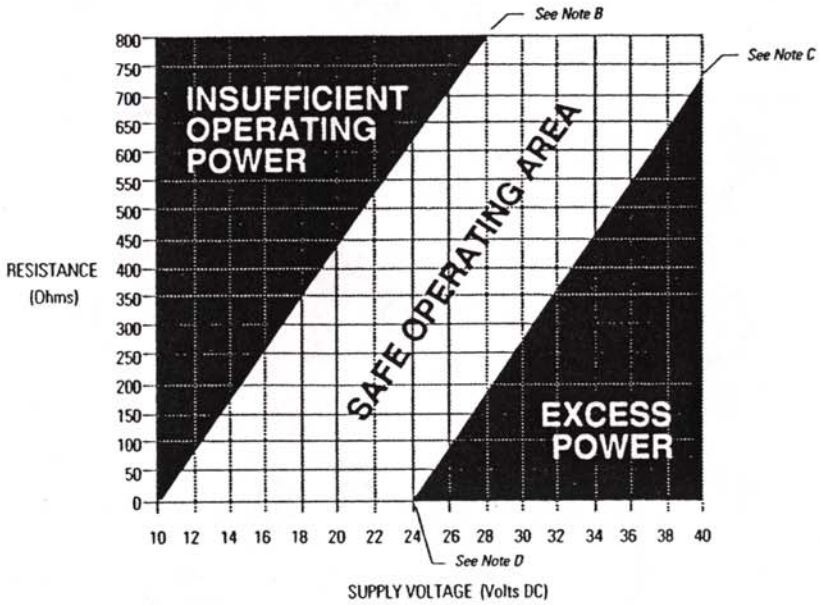
REV.	DATE	BY	ECO #	DESCRIPTION
B	8-93	RB	2531	CHG,D NOTES 3 & 6 FOR FMRC
A	8-93	RB	2515	RELEASE TO PRODUCTION

UNLESS OTHERWISE SPECIFIED
.XX = ± .02
.XXX = ± .005
ANGULAR = ± 1°
REMOVE BURRS AND SHARP EDGES .015 MAX
DIM LIMITS HELD AFTER PLATING OR CONVERSION COATING
DRILL DEPTHS ARE TO FULL DIAMETER
TAP DEPTHS ARE MINIMUM FULL THREADS

MATERIAL: ---
FINISH: ---
DRAWN: R BARR 7-28-93
DOCUMENT OWNER: KAP
PRODUCT LINE: LT420
SCALE: 1:1 DRAWING SIZE: C
SHEET 1 OF 1
DO NOT SCALE DRAWING

MTS SYSTEMS CORPORATION SENSORS DIVISION
SEDALIA, TRIANGLE PARK, NORTH CAROLINA 27709
TITLE INSTALLATION DRAWING LT420 LEVEL TRANSMITTER
DWG NO 650575 REV B

Figure 4.1 *Installation Drawing/LT420 Level Transmitter*



LT420 Level Transmitter:
Loop Resistance vs. Supply Voltage

$R_{Lmax.} = (V_{supply} - 10.5\ Vdc) \div (0.022\ A)$

$V_{supply\ max.} = 24\ Vdc + (R_{Lmax.} \times 0.022\ A)$

(See Note A, below)

NOTES:

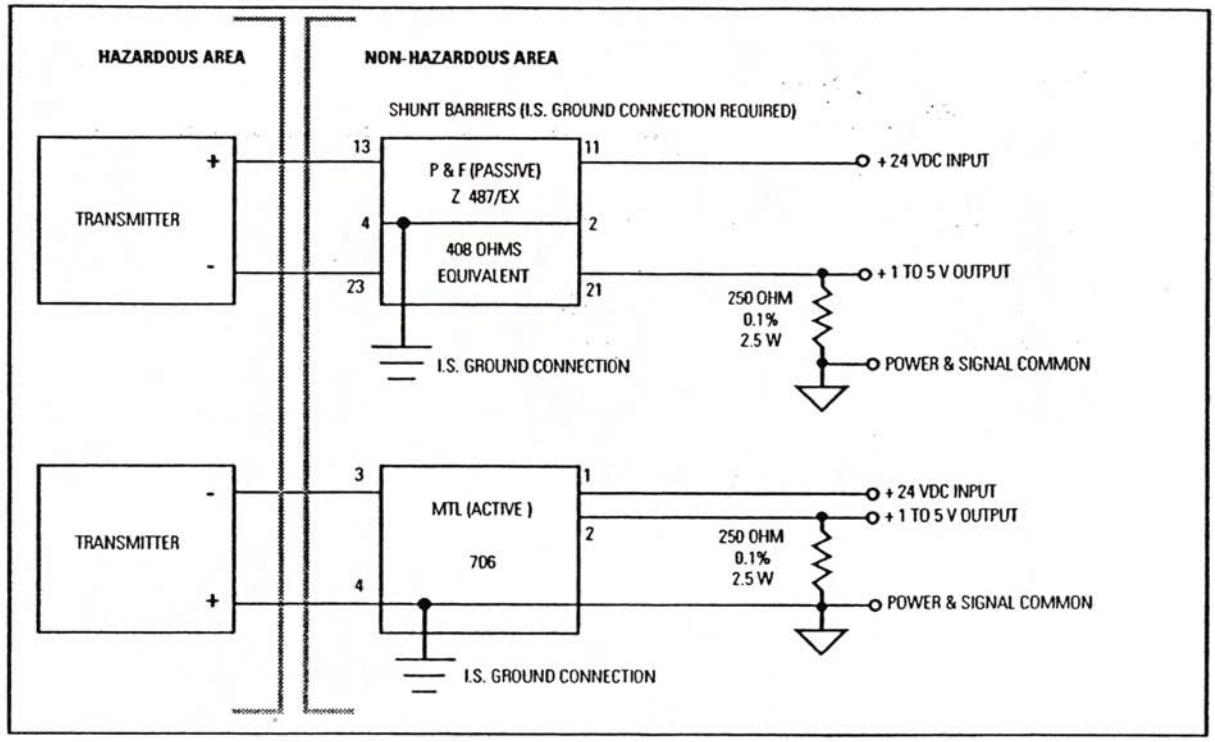
A. Maximum voltage for intrinsically safe applications is 36.1 volts.

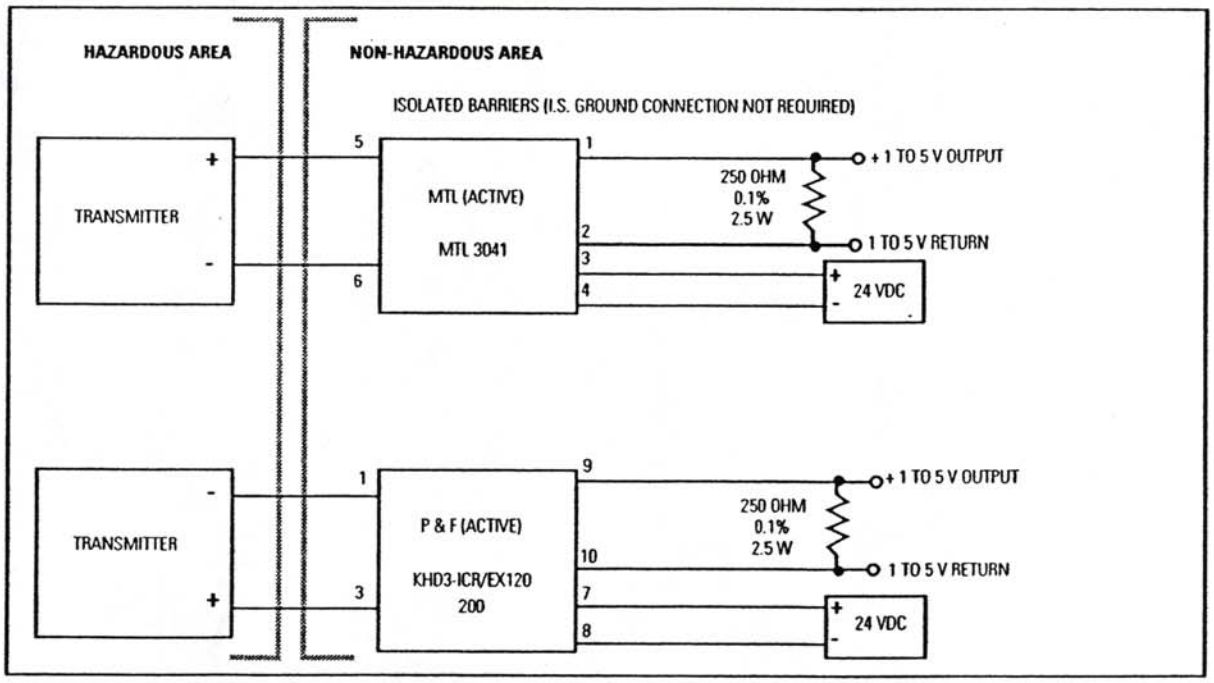
B. Using R_{Lmax} formula, if the supply voltage is 28.1 volts (the maximum loop resistance is 800 ohms).

C. Using $V_{supply\ max.}$ formula, if the loop resistance is 727 ohms, the maximum supply voltage is 40 volts (non intrinsically safe applications only).

D. Using $V_{supply\ max.}$ formula, if the loop resistance is 0 ohms, the maximum supply voltage is 24 volts.

Figure 4.2 *LT420 Loop Resistance vs. Supply Voltage*





NOTES:

1. When selecting barrier types, the entity parameters for the LT420 are:
   Vmax = 36.1 Vdc, Imax = 118 mA (total current), Ci = 0 µF, Li = 500 µHy
2. P&F = Pepperl and Fuchs (Phone: 216-425-3555); MTL = MTL Incorporated (Phone: 703-361-0111)

Figure 4.3 Suggested Barrier Types for the LT420

5.1 LT420 Model Number Generation

When ordering the LT420 level transmitter, the only variable to consider is the length. There are 11 lengths available ranging from 29 to 149 inches (See Figure 5.1). When determining what length transmitter you require, it is important to allow adequate sensor length for mounting -- typically 5 inches is adequate (See Figure 5.2).

A three (3) inch length at the tip of the transmitter is inactive. With specially designed floats (Part Nos. 200383, 201126, 201127; see Section 5.3 for float specifications), level measurements can be acquired to the bottom of the tank or vessel.

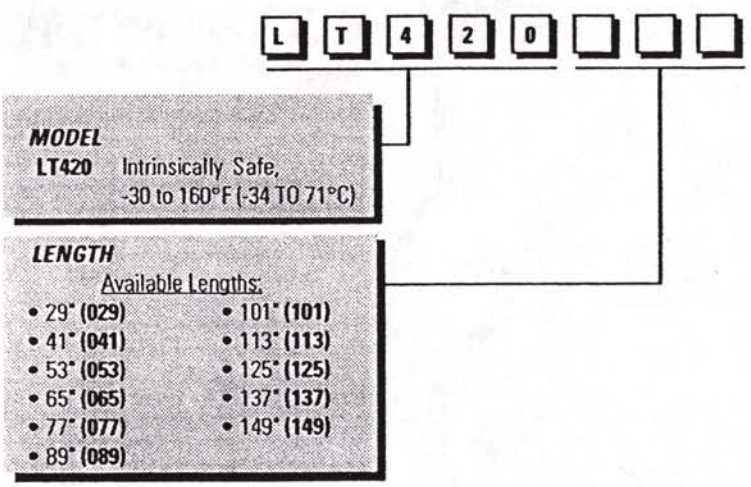


Figure 5.1

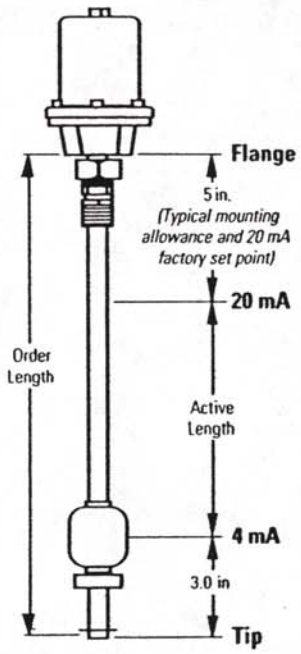


Figure 5.2

5.2 Floats

Each LT420 comes equipped with a standard 316 stainless steel float (P/N 250553). This float meets the requirements for most applications (See Section 5.3 for float specifications). If, however, this float does not meet your requirements, other (optional) floats are available.

5.3 Float Specifications

Standard Float						
Part No.	**Material**	**Use**	**I.D.**	**O.D.**	**Height**	**Specific Gravity**
250553	316 SST	Product	0.700	2.050	2.675	0.57 - 0.66
Optional Floats						
Part No.	**Material**	**Use**	**I.D.**	**O.D.**	**Height**	**Specific Gravity**
250554	316 SST	Interface (s.g. <1)	0.700	2.050	2.675	0.90 - 0.93
250854	316 SST	Interface (s.g. >1)	0.700	2.050	2.675	1.04 - 1.11
200383	Nitrophyl	Product	0.720	3.750	3.000	0.44
200384	Nitrophyl	Gas Interface	0.720	3.750	3.000	0.79
200385	Nitrophyl	Diesel Interface	0.720	3.750	3.000	0.89
201126	Nitrophyl	Gas Interface (plated)	0.720	3.750	3.000	0.79
201127	Nitrophyl	Diesel Interface (plated)	0.720	3.750	3.000	0.89
250535	Nitrophyl	Product	0.720	2.000	3.000	0.35
250536	Nitrophyl	Diesel Interface	0.720	2.000	3.000	0.89
250537	Nitrophyl	Gas Interface	0.720	2.000	3.000	0.79
251875	316 SST	Product	1.100	3.725	5.250	0.45 - 0.52
251066	316 SST	Interface (s.g.. <1)	1.100	3.725	5.250	0.90 - 0.93
251067	316 SST	Interface (s.g.. >1)	1.100	3.725	5.250	1.04 - 1.11
250709	316 SST	Product	1.100	5.110	5.000	0.36 - 0.437
250714	316 SST	Interface (s.g. <1)	1.100	5.110	5.000	0.90 - 0.96
250855	316 SST	Interface (s.g. >1)	1.100	5.110	5.000	1.03 - 1.10
201108	Kynar	Product	0.700	2.380	3.000	0.70
251117	Kynar	Interface (s.g. <1)	0.700	2.380	3.000	0.90 - 0.95
251118	Kynar	Interface (s.g. >1)	0.700	2.380	3.000	1.04 - 1.11
201107	Kynar	Product	1.100	4.500	4.500	0.70
251121	Kynar	Interface (s.g. <1)	1.100	4.500	4.500	0.90 - 0.95
251122	Kynar	Interface (s.g. >1)	1.100	4.500	4.500	1.04 - 1.11
200941	Nitrophyl	Product	1.220	3.750	1.070	0.45
200931	316 SST *(Sanitary)*	Product	0.680	2.340	3.000	0.60
200938	316 SST	Product	0.700	1.610	1.295	0.61 - 0.72
201109	Teflon (FEP)	Product	0.700	2.380	3.000	0.86
251115	Teflon (FEP)	Interface (s.g. <1)	0.700	2.380	3.000	0.90 - 0.95
251116	Teflon (FEP)	Interface (s.g. >1)	0.700	2.380	3.000	1.04 - 1.11
201112	Teflon (FEP)	Product	1.100	4.500	4.500	0.86
251119	Teflon (FEP)	Interface (s.g. <1)	1.100	4.500	4.500	0.90 - 0.95
251120	Teflon (FEP)	Interface (s.g. >1)	1.100	4.500	4.500	1.04 - 1.11

Nitrophyl is a Registered Trademark of Rogers Corporation
Kynar is a Registered Trademark of Pennwalt Corporation
Teflon is a Registered Trademark of DuPont Corporation

6 ADJUSTMENTS FOR LT420

Each LT420 is factory calibrated per customer specified stroke length. Zero (4 mA) is pre-set by the factory at three (3) inches from the tip of the level transmitter; Span (20 mA) is pre-set by the factory at five (5) inches from the flange of the transmitter. If minor adjustments to the factory settings are required in the field, follow the procedure below.

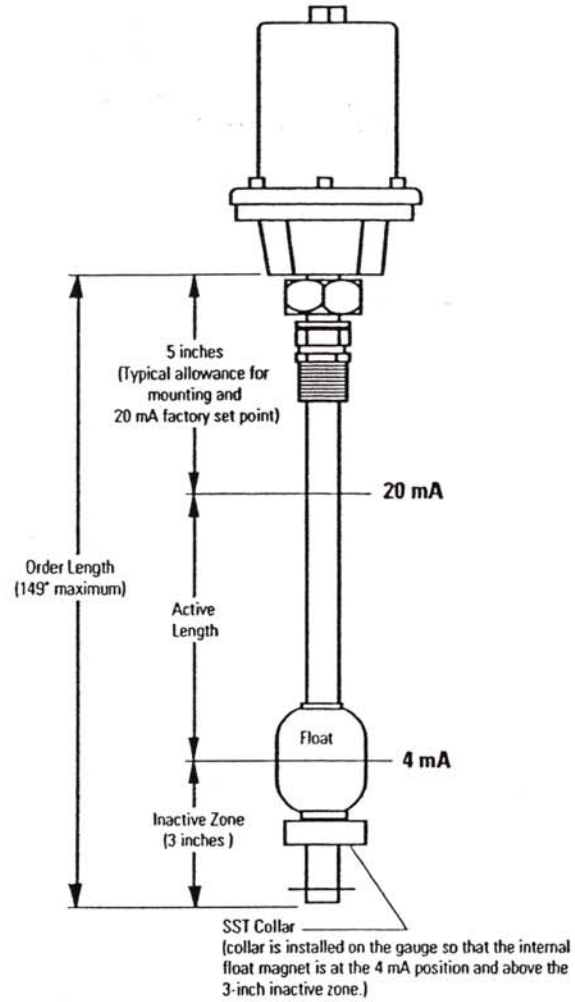


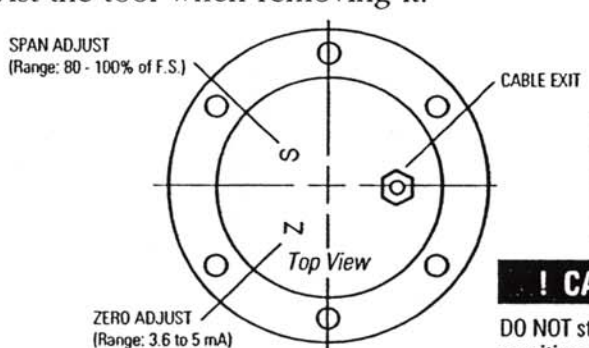
Figure 6.2

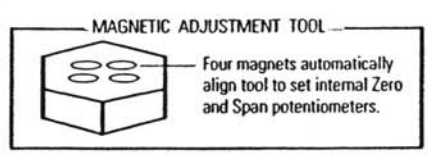
Zero and span adjustment procedure:

NOTE

Adjustment of the zero and span requires the user to move the float to the 4 mA and 20 mA positions. It is important to adjust the 4 mA position first.

1. Set the adjustment tool directly over either the "S" (Span) or "Z" (Zero) as indicated on the top of the electronics enclosure of the LT420. The tool will automatically align itself by magnetic attraction.
2. Move the float to the 4 mA position. While viewing the output display, turn the adjustment tool until you reach the desired setting. Adjustment range for the Zero setting is 3.6 to 5 mA.
3. Move the float to the 20 mA position. While viewing the output display, turn the adjustment tool until you reach the desired setting. Adjustment range for the Span setting is 80 - 100% of full range of the LT420.
4. Remove the tool by pulling it directly away from its seated position. Do not slide or twist the tool when removing it.





! CAUTION !

DO NOT store or locate the magnetic adjustment tool near sensitive equipment or media.

Figure 6.1

7 REPAIR

7 REPAIR

The LT420 is completely sealed in a NEMA 6 rated enclosure and has no serviceable electronic components. Any attempt to enter the electronic housing of this transmitter by anyone other than an authorized agent of MTS will void all warranties, either expressed or implied.

In the unlikely event that the LT420 fails, return the transmitter to MTS for repair or replacement at no cost within the warranty period.

Ship to:

MTS SYSTEMS CORPORATION
Sensors Division
3001 Sheldon Drive
Cary, North Carolina 27513

Before returning any items, call the MTS Customer Service Department at 1-800-248-0532 to receive a Return Material Authorization (RMA) number.

MTS Systems Corporation
Sensors Division
Box 13218
Research Triangle Park, North Carolina 27709
Telephone: 919-677-0100 Fax: 919-677-0200

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