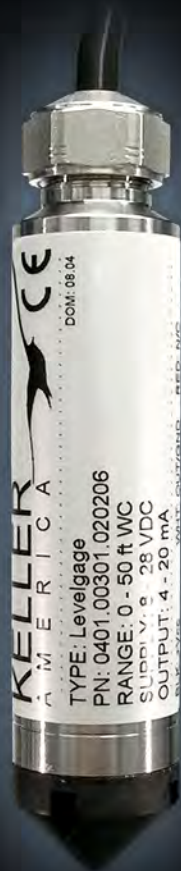


LEVEL & PRESSURE TRANSMITTER USER'S GUIDE



KELLERAMERICA

WWW.KELLERAMERICA.COM 877-253-5537 SALES@KELLERAMERICA.COM

Table of Contents

I.	Company Information	2
II.	Contact Information	2
III.	Product Applicability	2
IV.	Product Overview.....	3
V.	Lightning/Surge Protection.....	4
VI.	Options / Accessories.....	4
VII.	Use and Care.....	5
VIII.	Installation	7
IX.	General Maintenance	7
X.	Warranty / Repair	8
XI.	Appendix.....	9
a.	Generic 2-wire Current Loop Configuration.....	A-1
b.	Generic 3-wire Voltage Output Configuration.....	A-1
i.	Econoline	
1.	4-20 mA, Cable.....	A-2
2.	4-20 mA, mPm Connector.....	A-2
3.	0.5-4.5 VDC, Cable.....	A-2
4.	0.5-4.5VDC, mPm Connector.....	A-2
ii.	Valueline	
1.	4-20 mA, Cable.....	A-3
2.	4-20 mA, DIN43650 Connector.....	A-3
3.	4-20 mA, MIL-C-26482 Connector.....	A-4
4.	0-5/10 VDC, Cable... ..	A-3
5.	0-5/10 VDC, DIN43650 Connector	A-3
6.	0-5/10 VDC, MIL-C-26482 Connector	A-4
iii.	Preciseline	
1.	4-20 mA + RS485, Cable.....	A-5
2.	4-20 mA ONLY, DIN43650 Connector.....	A-5
3.	4-20 mA + RS485, MIL-C-26482 Connector.....	A-6
4.	0-5/10 VDC +RS485, Cable.....	A-5
5.	0-5/10 VDC+ RS485, DIN43650 Connector.....	A-5
6.	0-5/10 VDC +RS485, MIL-C-26482 Connector	A-6
iv.	Levelgage	
1.	4-20 mA, Cable.....	A-7
2.	0-5/10 VDC, Cable	A-7
v.	Acculevel	
1.	4-20 mA + RS485, Cable.....	A-7
2.	0-5/10 VDC + RS485, Cable.....	A-7
vi.	LevelRat	
1.	4-20mA, Cable.....	A-8
vii.	Microlevel / Nanolevel	
1.	4-20 mA + RS485, Cable.....	A-8
c.	Submersible Level Transmitters	
i.	Installation Tips.....	A9-10

I. Company Information

Keller America Inc is the North American subsidiary of Keller AG für Druckmesstechnik, which continues as the leader in level and pressure sensing. From humble beginnings, Keller now provides its products and expertise through a worldwide network of factory-trained professionals.

With the advent of inexpensive, miniaturized microprocessors, Keller continues to advance the state-of-the-art in fully packaged pressure transmitters, with Total Error Band performance not possible just a few short years ago. Annual sensor production now exceeds 1 million pieces.

Doing business with Keller is easy and most inquiries are answered within 24 hours. Standard delivery on U.S.-assembled products is 3 days ARO. We offer convenient terms with approved credit and accept most major credit cards.

At Keller, providing customers with superior value is a way of life.

II. Contact Information

Keller America, Inc.
813 Diligence Drive
Suite 120
Newport News, Virginia, 23606
P: 877-253-5537
F: 757-596-6659
Web: www.kelleramerica.com
Email: sales@kelleramerica.com

III. Product Applicability:

Unless otherwise noted, this manual contains user information for the following level and pressure instrumentation provided by Keller America: Acculevel™, Levelgage™, LevelRat™, Microlevel™, and Nanolevel™ submersible level transmitters; Econoline™, Valueline™, and Preciseline™ above ground pressure transmitters.

Electronic copies of this user's guide can be found at: <http://www.kelleramerica.com/manuals-and-software/>

IV. Product Overview:

A. Level Transmitters

Acculevel

The Acculevel from Keller is a high accuracy submersible level transmitter. Incorporating all of the features of the Levelgage, the Acculevel has additional features that provide enhanced functionality, including dual outputs; i.e., one analog (4...20mA, 0...5 VDC, 0...10VDC) and one digital (RS485). The RS485 interface provides level and temperature information. Also, it allows the user to rescale the analog output from 10...110% of the basic range. Additionally, the Acculevel is capable of greater accuracy than the Levelgage, with a standard accuracy of 0.25% FS TEB and an optional 0.1%. The Acculevel can be manufactured in 316L stainless steel or titanium for increased resistance to corrosion, notably from seawater.

Econolevel

The Keller Econolevel is a general purpose submersible level transmitter intended for OEM integration applications where small size, light weight, and low cost are required. This proven design is known to be highly reliable in thousands of applications around the globe. Featuring nominal ranges, 4 - 20 mA analog output and Total Error Band accuracy, the Econolevel is an ideal solution for high volume OEM requirements. Minimum order quantities apply. Please contact your sales engineer for more detail.

Levelgage

The Keller Levelgage is a general purpose submersible level transmitter available in 1% and 0.5% FS TEB accuracy. Constructed from 316L stainless steel, it is ideally suited for most fresh water monitoring applications. It is available in custom ranges from 0...3 ftWC to 0...900ftWC. Cable lengths are cut to user specifications. The Levelgage is also available in various output configurations, including 4...20mA, 0...5 VDC, and 0...10VDC.

LevelRat

The Keller LevelRat is specifically designed to provide accurate level indication in grease-laden environments commonly found in lift stations serving commercial concerns. The Levelrat design takes a step away from the large and bulky protection cage designs by utilizing a flush™ Kynar diaphragm. Kynar offers the non-stick properties of Teflon and provides added resistance to damage from debris. The LevelRat is offered with various analog outputs (4...20mA, 0...5VDC, or 0...10VDC) and in level ranges from 0...10ftWC to 0...100ftWC.

Microlevel

The Microlevel combines the capability of the Acculevel with a class leading 0.63" (16mm) outside diameter. The Microlevel is available in full scale ranges from 0...3 ftWC through 0...900 ftWC and is available with standard accuracy 0.25% FS TEB and 0.1% optional. Like the Acculevel, it also provides both 4...20mA analog and RS485 Digital output. The RS485 interface provides level and temperature information. It also allows the user to rescale the analog output from 10...110% of the basic range.

Nanolevel

The Nanolevel is uniquely designed for high accuracy measurement of very low pressure ranges. The Nanolevel is available in full scale ranges from 0...4 inWC through 0...10 ftWC and is available with standard accuracy 0.25% FS TEB and 0.1% optional. Like the Acculevel, it also provides both 4...20mA analog and RS485 Digital output. The RS485 interface provides level and temperature information. It also allows the user to rescale the analog output from 10...110% of the basic range.

B. Pressure Transmitters

Econoline

The Econoline by Keller is a low cost general purpose pressure transmitter. It is available in nominal pressure ranges between 15psi and 10,000psi and with a threaded ¼" NPT pressure connection. Ideal for tank and pipe pressure monitoring application, it provides either 4...20mA or 0.5...4.5VDC (ratiometric or non-ratiometric) analog outputs that are compatible with most SCADA systems and PLCs.

Valueline

The Valueline by Keller is a highly versatile and accurate pressure transmitter. It is available in custom pressure ranges from 0...2 through 0...10,000PSI and your choice of electrical connections including attached cable, DIN 43650, and MIL-C-26482 connectors. The attached cable version is fully submersible, making it the ideal choice when installed in a valve pit or other environment prone to periodic flooding.

Preciseline

The Preciseline is our most accurate above-ground pressure transmitter. With standard accuracy of 0.25% FS TEB and optional 0.1% FS TEB, a ¼" NPT pressure connection, and dual outputs (analog and digital) the Preciseline offers versatility in design and application. Like the Acculevel, the analog output can be rescaled via the RS485 interface. The RS485 interface also allows temperature data to be retrieved if the application demands.

V. Lightning / Surge Protection:

As of this writing, Keller is the only pressure/level transmitter manufacturer in the world to provide, at no additional charge, a lifetime warranty against damage caused by lightning and/or electrical surge. This guarantee applies to the 4...20 mA output version of the following products: Levelgate, Acculevel, LevelRat, Valueline, and Preciseline.

This warranty applies even in the case of a direct lightning strike. The user's liability is limited to shipping costs to Keller America.

VI. Options /Accessories:

Titanium Construction - Optional for the Acculevel only and highly recommended for brackish and sea water

applications

External Surge Protector -	Recommended for lightning/surge protection of user's power supply/readout/PLC, etc. To be used in conjunction with Levelgage, Acculevel, LevelRat, Valueline, or Preciseline transmitters.
½" NPT Pipe conduit fitting -	½" NPT male fitting, allows rigid mounting to ½" conduit for Levelgage, Acculevel, or LevelRat submersible transmitters. It can also be added to our Preciseline and Valueline pressure transmitters.
Drying Tube Assembly -	Clear tube filled with indicating desiccant, attaches directly to cable vent tube, intercepts water vapor. Highly recommended when operating in high humidity conditions. Must be periodically renewed as desiccant becomes saturated, turning color from blue (dry) to pink (saturated).
Bellows Assembly -	Alternative to the drying tube, this aneroid bellows attaches to cable vent tube and requires no periodic maintenance. Recommended where a slight sacrifice in accuracy can be tolerated.
Electrical Connectors -	mPm393 is optional for the Econoline, DIN43650 and MIL-C 26482 are optional for Valueline and Preciseline. The mPm393 and MIL-C 26482 mating connectors feature solder cups while the DIN43650 incorporates screw terminals.
RS485 Converter/Cable -	For the user who wishes to communicate with their Acculevel, Preciseline, or Microlevel transmitter via the RS485 digital interface. Available in RS232 and USB versions, along with cable adapters, as needed, and Read 30/Prog 30 Software (also available for download, free of charge from www.kelleramerica.com). Consult factory for details.
Termination Enclosure -	Convenient option complementing gauge-type pressure/level transmitters, where it is desired to terminate the transmitter cable close to the measurement point. It includes a NEMA 4X clear front enclosure (7.9 X 4.7 X 3.5 inches) with two, liquid-tight cable fittings (one in, one out), a terminal strip, and ample room for mounting a drying tube or bellows assembly.
Stabilizing Weight -	Zinc prop shaft anode adapted to fit Ø21 mm O.D. of Levelgage, Acculevel, and LevelRat submersible level transmitters. Aids in corrosion resistance as well as helps ensure that the cable remains taut in turbulent conditions.
Pressure Test Adapters -	Designed to facilitate calibration and maintenance testing, these specialty adapters allow for connection of the various Keller level transmitters to a pressure calibrator.
Digital Display / Meter -	The TRIDENT display by Precision Digital is a versatile and cost effective process meter providing an easy to use and read display / controller for your level and pressure measurement application. For more information and technical support, please contact Precision Digital at (800)343-1001 or online at www.predig.com .

VII. Use and Care:

Safe Handling

Safe handling of KELLER pressure measurement devices is accomplished if a nominal amount of care is taken.

Things to avoid are:

- Sharp impact against hard surfaces
- Contact with chemicals known to be corrosive to the materials of construction
- Probing of pressure sensing membrane with ANYTHING

Limits of Pressure

KELLER pressure sensors, transducers and transmitters are designed to withstand a certain amount of overpressure without damage or calibration shift. It can range from 15X for the lower pressure ranges to 1.1X for the highest ranges. This value is different for each product and is referred to in the product literature as "Over pressure". It is the user's responsibility to ensure that the proper KELLER product is chosen for the particular pressure conditions expected.

Environmental conditions

Each KELLER product is designed to be compatible with a particular environment. It is the user's responsibility to ensure that the KELLER product is not exposed to an environmental condition for which it is not designed. These conditions can include operating temperature range and exposure to high-pressure water jets, media not compatible with the materials of construction, submergence of transmitters not designed for that purpose, or potentially explosive atmospheres. A KELLER engineer can help the user determine the correct choice of enclosure to suit the particular application.

Electrical conditions

Each KELLER product is designed to operate properly within a specific range of electrical conditions. The specific product label defines the rating(s), if any, that applies to the product to which it is affixed. All transmitters are designed to withstand reverse polarity as well as over voltage to a certain extent. It is the user's responsibility to ensure that all electrical connections are made to the KELLER products in accordance with KELLER recommendations as well as local electrical code. Wire colors or connector pin-outs are either printed on the label affixed to the product or provided separately.

Cleaning

Regarding media-isolated products, should the pressure input to the sensor, transducer or transmitter become fouled, it may be cleaned in the following manner. In the simplest case, and depending upon the specific KELLER product in question, the device should be slowly lowered membrane-first into a solution of warm, soapy water. Care should be taken not to submerge the entire device, unless it is specifically designed for continuous submergence. Agitate the solution with the device and the fouling should disperse after a time. Continue agitating until the input to the device is clear. Should the fouling be of a nature that it cannot be dissolved with soapy water, use of a solvent is recommended, but only after compatibility with any o-ring seals in the KELLER product is determined. Follow the solvent manufacturer's recommendations for safe handling.

WARNING! Under no circumstances should the membrane or pressure input port to the KELLER device be probed with any object. Damage to the sensing membrane is permanent and, in most cases, requires repair or replacement.

VIII. Installation:

The following is important installation and general maintenance information for submersible transmitters. Please contact Keller America for additional instruction.

1. **Transmitter Anchoring:** It is recommended that Keller submersible transmitters be installed in a stilling well or attached to rigid conduit via a conduit fitting integral to the transmitter, in order to prevent damage to the transmitter from impact with immovable objects. It is not advisable to tie the transmitter to a pump or to piping, as any problem with the transmitter could require that the pump be pulled from the installation.

Some applications require the transmitter to be suspended without a protective stilling well or conduit attachment. In all installations, care should be taken to prevent damage to the submersible cable.

2. **Transmitter Submersion:** Damage to submersible cable can lead to failure of the transmitter. Keller employs a rugged, Hytrel® cable jacket to minimize the risk of cuts and abrasion. Still, take care when lowering your transmitter into the well, making sure the cable does not drag over sharp edges. Avoid dropping the transmitter from the surface.
3. **Condensation protection:** Keller has optimized the size of the cable vent to minimize the occurrence of water vapor incursion. In areas of high humidity, it may be desirable to use a Drying Tube Assembly (desiccant) or Bellows Assembly to prevent water vapor from entering the vent tube. Contact Keller America for ordering information.
4. **Bending of Cable:** Our Hytrel-jacketed cable is quite flexible. However, care must be taken to ensure the vent tube integral to the cable is not crimped when bending the cable to suit your installation. It is recommended that the cable not be bent to a radius smaller than 1 inch.
5. **Cable Compression:** Many users employ a compression fitting to secure our cable as it enters a junction box. Care must be taken that the fitting is not over tightened, causing damage to the cable and/or crimping the vent tube.
6. **Position Sensitivity:** The transmitter should be installed in a vertical position, otherwise it may exhibit an offset. If the transmitter must be installed in any position other than vertical, measure the output with no pressure applied prior to connection to your display, PLC, or controller. Use the measured value for your zero point.

IX: General Maintenance Tips

1. **Cleaning a Clogged Nose Cap:** A clogged nose cap could result in erroneous readings from your transmitter. Never attempt to clean your transmitter's nose cap or diaphragm with a sharp object. This could dent the sensor diaphragm and cause permanent damage to the transmitter. To clean the transmitter, it is recommended that a soap, scum, and hard-water stain remover be used. Fill a suitable container with the cleaner. Fill another bowl with a mixture of the cleaner and fresh water. Fill a third bowl with fresh water. Beginning with the first bowl, hold the cable about six inches from transmitter and stir gently in the solution for 20-30 seconds. Second, repeat in the mixture bowl. Finish by stirring in the fresh water bowl. Wipe dry with a soft rag or towel.

X. Warranty / Repair:

Warranty

Keller America, Inc. warrants that the products that it sells are delivered free from defects in material and workmanship. Keller America, Inc.'s liability under this warranty is limited to replacing or repairing or issuing a credit note, at its option, for any product which is returned to the factory, transportation charges prepaid, and which is determined by Keller America, Inc. to be defective. This warranty does not apply to batteries and accumulators and to any product which has been subjected to or damaged due to misuse, misapplication, negligence or accident, or which has been repaired or altered without express prior and written consent from Keller America, Inc. In order to obtain service under the terms of the warranty, Buyer must notify Keller America, Inc. of any defects before the expiration of the warranty period and make suitable arrangements for the performance of services. In all cases, Buyer shall be responsible for packaging, cleaning and shipping the products to the Keller America, Inc. plant with shipping charges prepaid. Keller America, Inc. shall pay for the return of any products to Buyer if the shipment is to a location within the continental USA. Buyer shall be responsible for paying all shipping duties, taxes, and other charges for products returned to any other location. Keller America, Inc. will provide on-site service only upon prior agreement and upon payment of all travel expenses by Buyer.

Warranty period for the Levelgage, LevelRat, Acculevel, Microlevel, Preciseline, Econoline, and Valueline products is 24 (twenty-four) months from date of shipment. In addition, a lifetime warranty against damage caused by lightning/electrical surge applies to 4...20 mA output versions of the Levelgage, Acculevel, LevelRat, Valueline, and Preciseline (See Section V). Warranty period for all other products is 12 (twelve) months from date of shipment. Warranty repair covers all applicable parts and labor. This warranty is given in lieu of any other warranty, express or implied. Keller America, Inc. explicitly disclaims any implied warranties of merchantability and fitness for a particular purpose. There are no warranties, express or implied, that extend beyond the description herein. The sole and exclusive remedy for any claims against Keller America, Inc. shall be the warranty described in this document. All damages, direct or consequential, limited to the described warranty are excluded.

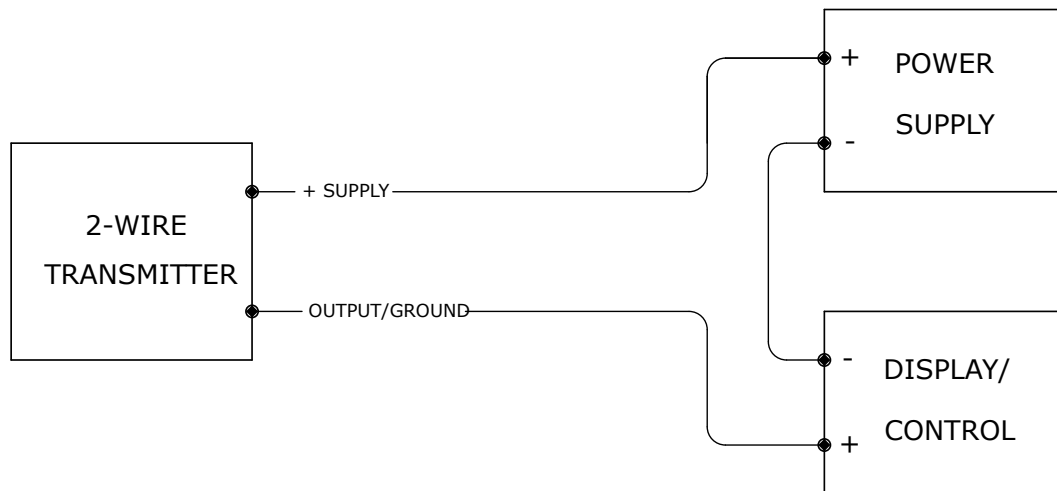
Repairs

Unless otherwise requested in writing by the Buyer, all products returned to Keller America, Inc. under the terms of the warranty will be checked and analyzed in order to determine the cause of the default(s) claimed by the Buyer. A report will then be submitted to the Buyer pointing out the nature of the default(s), the party responsible for the default(s) and the quotation of the repair, if needed. For further repair instructions go to www.kelleramerica.com.

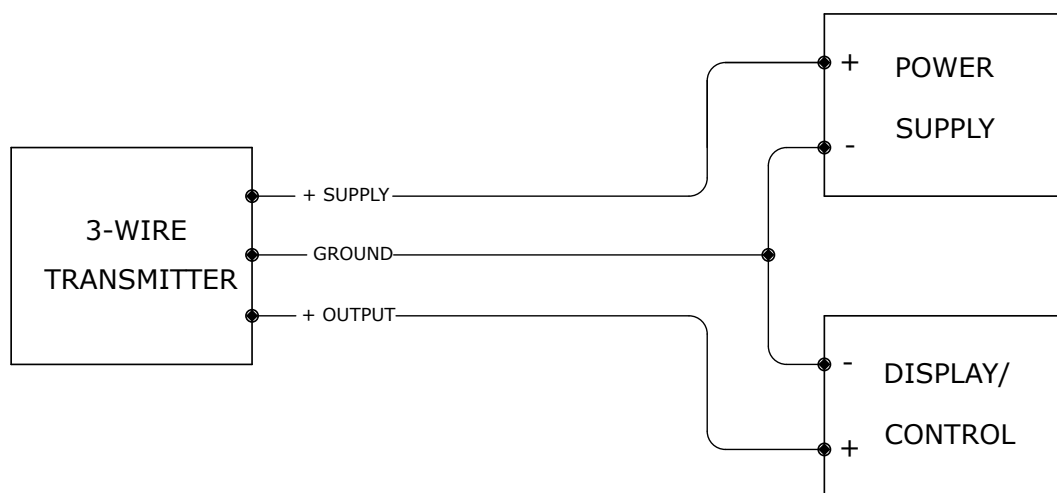
*Hytrel is a registered trademark of DuPont Company

XI: Appendix

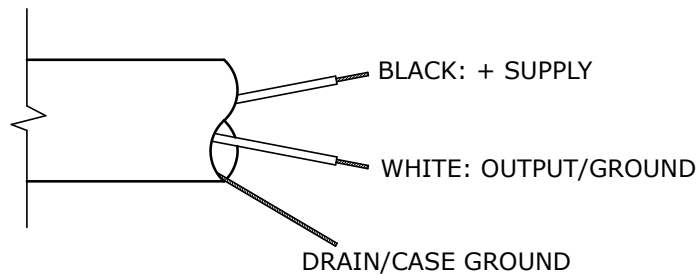
2-WIRE CURRENT LOOP



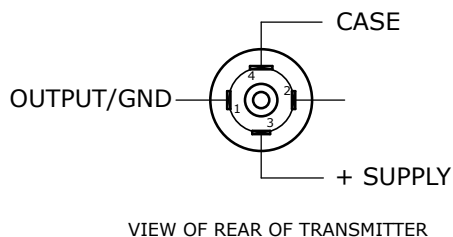
3-WIRE VOLTAGE OUTPUT



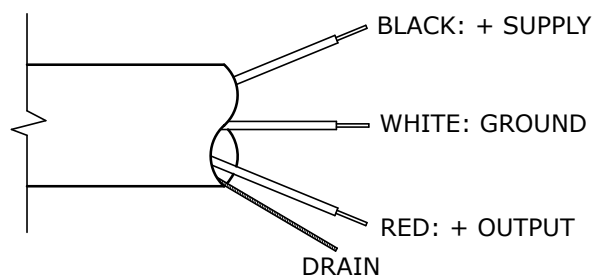
ECONOLINE w/CABLE...4-20mA



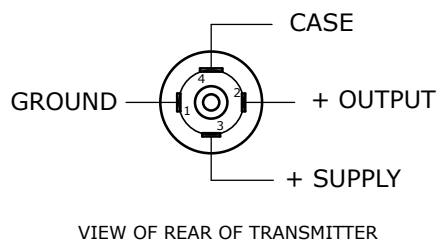
ECONOLINE w/mPm393...4-20mA



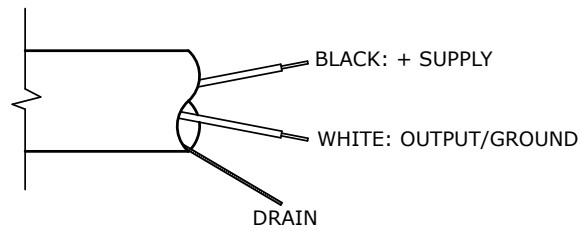
ECONOLINE w/CABLE...0,5-4,5VDC



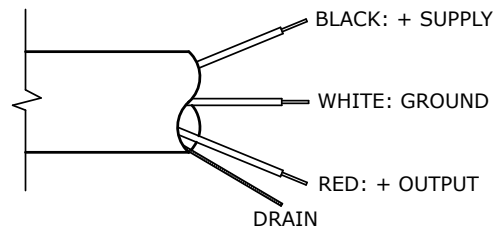
ECONOLINE w/mPm393...0,5-4,5VDC



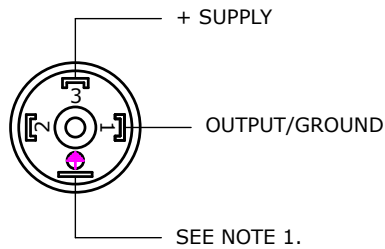
VALUELINE w/ATTACHED CABLE...4-20mA



VALUELINE w/ATTACHED CABLE...0-5...10VDC

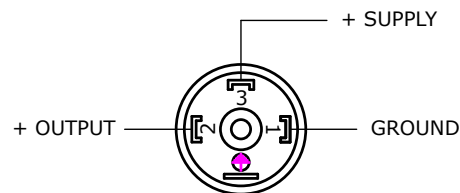


VALUELINE w/DIN43650...4-20mA



VIEW OF REAR OF TRANSMITTER

VALUELINE w/DIN43650...0-5...10VDC

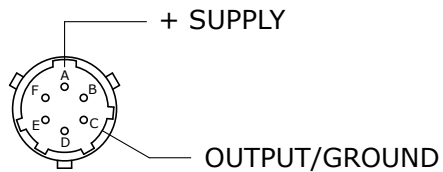


VIEW OF REAR OF TRANSMITTER

NOTES:

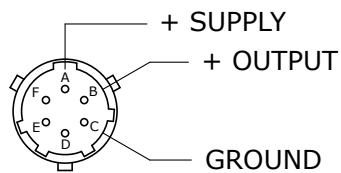
- 1: FOR TRANSMITTERS WITH LIGHTNING/SURGE PROTECTION, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND. FOR TRANSMITTERS WITHOUT LIGHTNING/SURGE PROTECTION, THIS PIN IS CONNECTED TO THE TRANSMITTER CASE.

VALUELINE W/MIL-C-26482...4-20mA



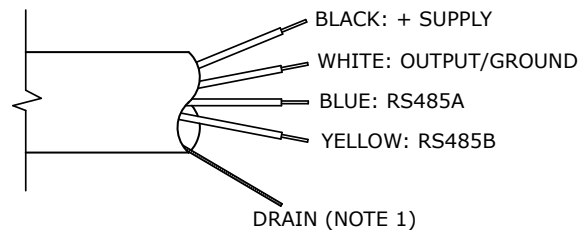
REAR VIEW OF TRANSMITTER

VALUELINE W/MIL-C-26482...0-5...10VDC

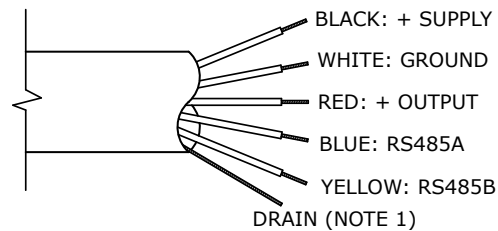


REAR VIEW OF TRANSMITTER

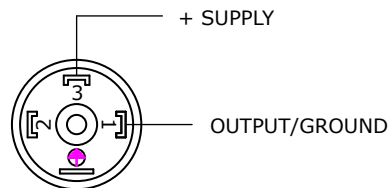
PRECISELINE w/ATTACHED CABLE...4-20mA + RS485



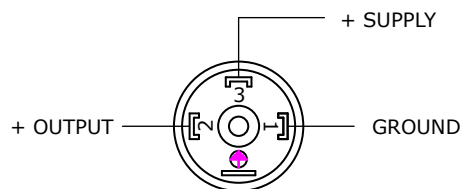
PRECISELINE w/ATTACHED CABLE...0-5...10VDC + RS485



PRECISELINE w/DIN43650...4-20mA



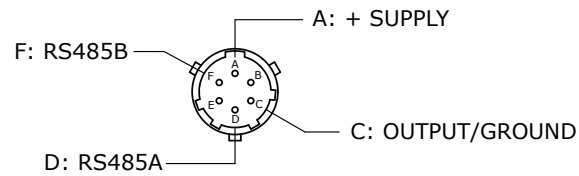
PRECISELINE w/DIN43650...0-5...10VDC



NOTES:

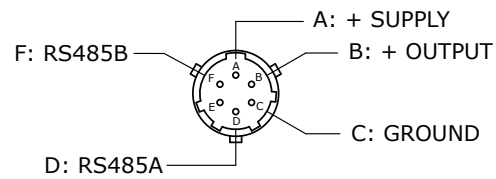
- 1: FOR TRANSMITTERS WITH LIGHTNING/SURGE PROTECTION, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND. FOR TRANSMITTERS WITHOUT LIGHTNING/SURGE PROTECTION, THIS WIRE IS CONNECTED TO THE TRANSMITTER CASE.

PRECISELINE w/MIL-C-26482...4-20mA + RS485



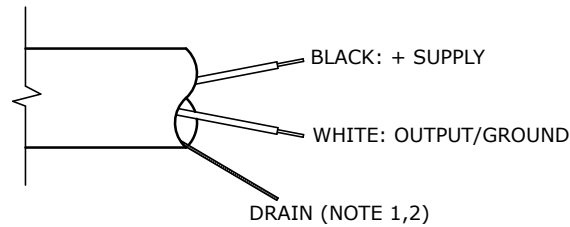
REAR VIEW OF TRANSMITTER

PRECISELINE w/MIL-C-26482...0-5...10VDC + RS485

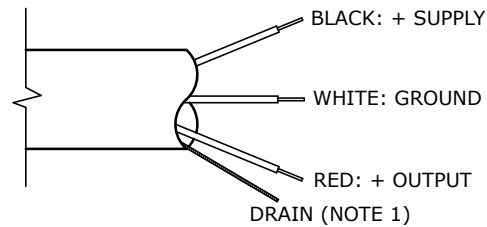


REAR VIEW OF TRANSMITTER

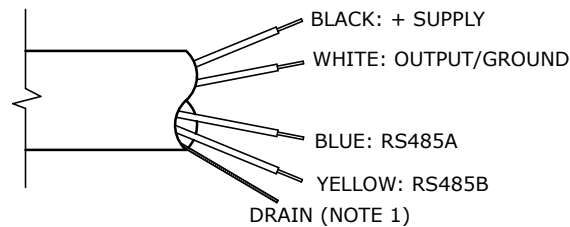
LEVELGAGE & ECONOLEVEL w/ATTACHED CABLE...4-20mA



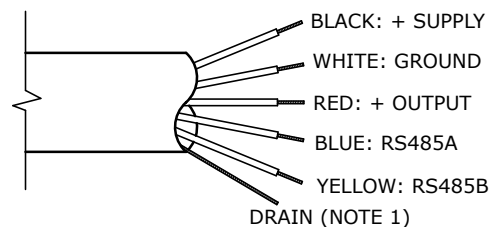
LEVELGAGE w/ATTACHED CABLE...0-5...10VDC



ACCULEVEL w/ATTACHED CABLE...4-20mA + RS485



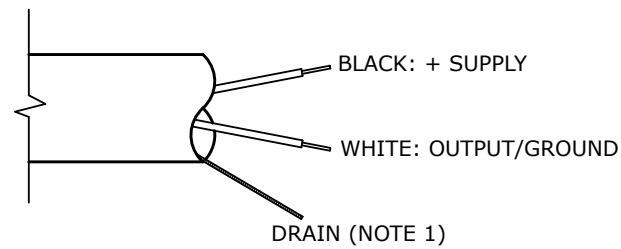
ACCULEVEL w/ATTACHED CABLE...0-5...10VDC + RS485



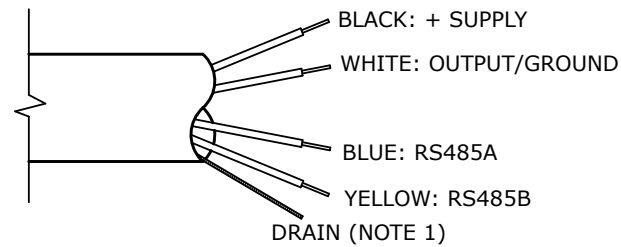
NOTES:

- 1: FOR LIGHTNING/SURGE PROTECTION TO BE EFFECTIVE, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND.
- 2: LIGHTNING PROTECTION NOT AVAILABLE ON ECONOLEVEL. DRAIN WIRE CONNECTION NOT REQUIRED.

LEVELRAT w/ATTACHED CABLE...4-20mA

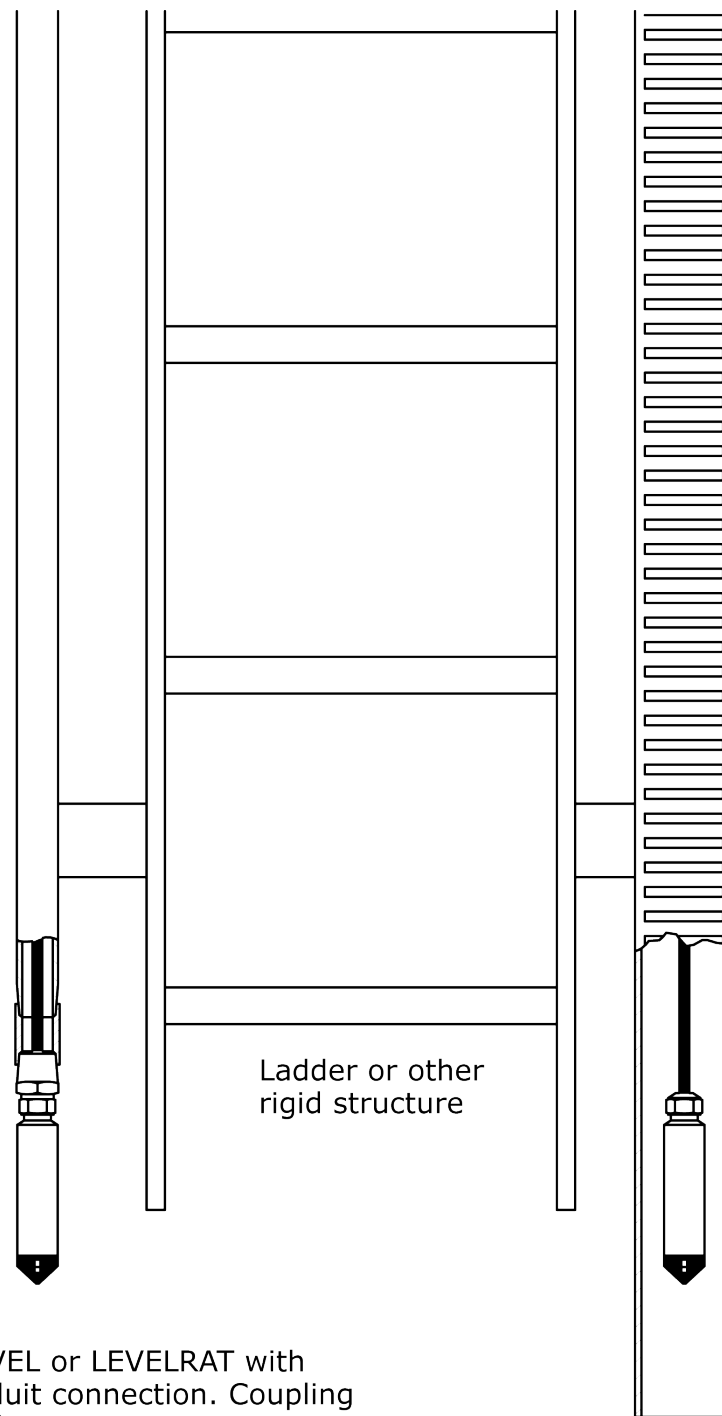


MICROLEVEL/NANOLEVEL w/ATTACHED CABLE... 4-20mA + RS485



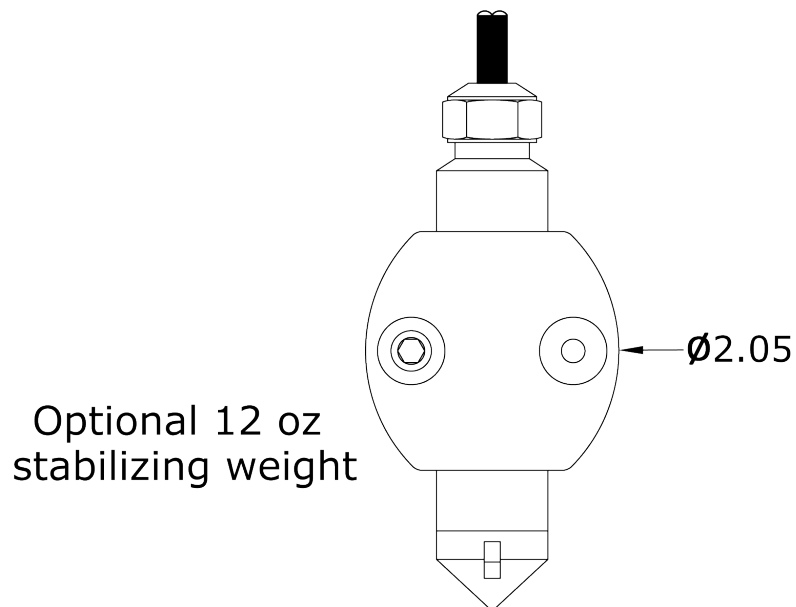
NOTES:

- 1: FOR LIGHTNING/SURGE PROTECTION TO BE EFFECTIVE, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND.

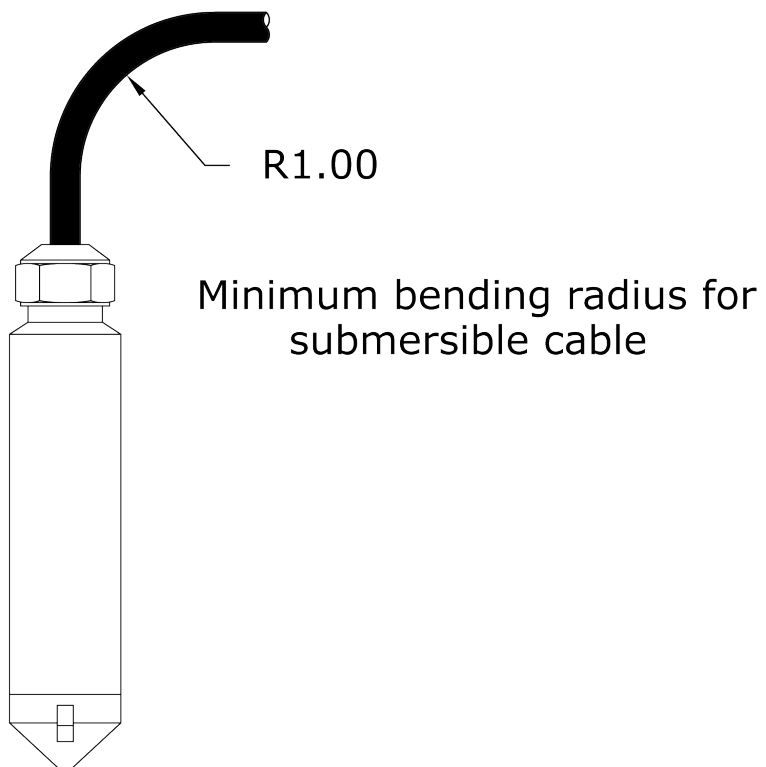


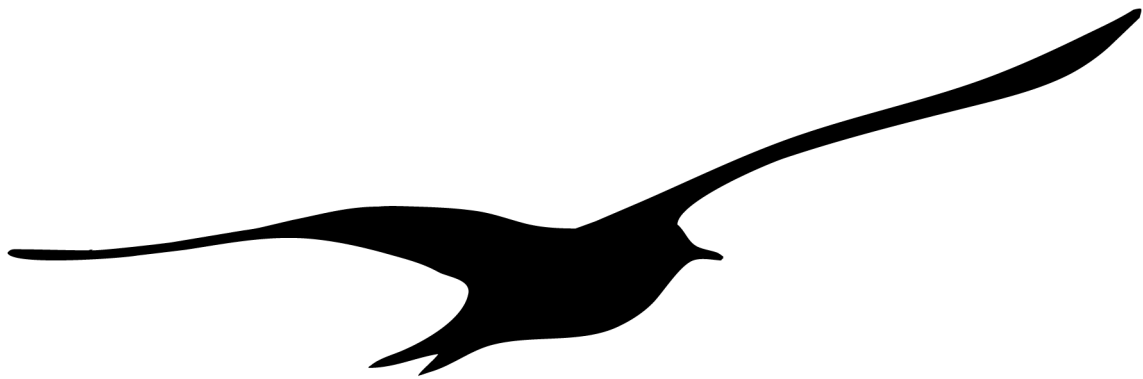
LEVELGAGE, ACCULEVEL or LEVELRAT with optional 1/2"NPT conduit connection. Coupling and conduit provided by customer.

LEVELGAGE, ACCULEVEL or LEVELRAT installed in customer-supplied stilling well.



Levelgage, Acculevel
or LevelRat





KELLER AMERICA INC

813 DILIGENCE DRIVE, SUITE 120 NEWPORT NEWS, VIRGINIA 23606

PHONE: 877-253-5537 FAX: 757-596-6659

WWW.KELLERAMERICA.COM

Electronic copies of this user's guide can be found at: www.kelleramerica.com/downloads.html

