

User's Guide

Level and Pressure Transmitters

Keller America Inc

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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.
 351 Bell King Rd
 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™, Econolevel™, 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/manuals/Keller_America_Users_Guide.pdf

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 Levelgagge including the NSF 61 and NSF 372 certifications, 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 and 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 Levelgagge, with a standard accuracy of 0.25% BR TEB and an optional 0.1% BR TEB. The Acculevel can be manufactured in 316L stainless steel or titanium for increased resistance to corrosion, notably from seawater.

Acculevel SDI

The Acculevel SDI is a version of the Acculevel high accuracy submersible level transmitter that is available with SDI-12 or RS485 digital communication protocols. It is available with standard accuracy of $\pm 0.1\%$ FS TEB in ranges up to 900 ftWC and optional USGS OSW accuracy for ranges up to 70 ftWC. The Acculevel SDI can be manufactured in standard 316L stainless steel or optional titanium for increased resistance to corrosion, notably from seawater, carries the NSF 61 and NSF 372 approvals.

Levelgagge

The Keller Levelgagge is a general purpose submersible level transmitter available in 1% and 0.5% BR TEB accuracy. Constructed from 316L stainless steel, it is ideally suited for most fresh water monitoring applications. With standard construction (i.e. EPDM and XLPE) materials, the Levelgagge has been certified to NSF 61 and NSF 372 standards for use in drinking water. It is available in custom ranges from 0...3 ftWC to 0...900ftWC. Cable lengths are cut to user specifications. The Levelgagge 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 0.5% BR TEB accuracy for 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 unique diaphragm material that offers the non-stick properties of Teflon and provides added resistance to damage from debris. The LevelRat provides dual outputs; your choice of analog outputs (4...20mA, 0...5VDC, or 0...10VDC) plus one digital (RS485) for level ranges from 0...5ftWC 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%BR TEB and 0.1% BR TEB 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% BR TEB and 0.1% BR TEB 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.

Econolevel

The Econolevel by Keller is a low cost general purpose submersible level transmitter designed for high volume applications. It is available in nominal pressure ranges for tank and well level monitoring applications. The Econolevel provides a 4...20mA analog output that is compatible with most SCADA systems and PLCs. Minimum order quantities apply.

B. Pressure Transmitters

Econoline

The Econoline by Keller is a low cost general purpose pressure transmitter. It is available in nominal pressure ranges between 5psi and 10,000psi and with a threaded 1/4" 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...15,000PSI 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. The Valueline also carries the NSF 61 and NSF372 approvals for drinking water applications.

Preciseline

The Preciseline is our most accurate above-ground pressure transmitter. With standard accuracy of 0.25% BR TEB and optional 0.1% BR TEB, a 1/4" 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. Like the Valueline, the Preciseline is included in the NSF61 and 372 approvals.

Preciseline SDI

The Preciseline SDI is highly precise pressure transmitter that is available with

SDI-12 or RS485 digital communication protocols. It is available with standard accuracy of $\pm 0.1\%$ FS TEB in ranges up to 900 ftWC and optional USGS OSW accuracy for ranges up to 70 ftWC. It comes with your choice of attached cable or MIL-C-26482 connector electrical connections. The cable version is fully submersible, making it the ideal choice in environments prone to periodic flooding, while the NSF 61 and NSF 372 approvals make the Preciseline SDI suitable for use in drinking water applications.

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: Levelgage, Acculevel, LevelRat, Microlevel, 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 and Preciseline. 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, Econolevel, Microlevel, Nanolevel, 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, LevelRat, Nanolevel, Microlevel, or Preciseline transmitter via the RS485 digital interface. Available in RS232 and USB versions, along with cable adapters, as needed, and CCS30 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 $\varnothing 21$ 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.
Cable Hanger -	Single eye for 0.230" diameter cable. Designed to grip the cable jacket and provide a suspension point for installation of cabled transmitters.
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:

Supply Voltage

Adequate supply voltage is critical to ensure proper operation of 4-20 mA pressure and level transmitters. Without the minimum required voltage available at the transmitter, the transmitter will not output the correct analog value.

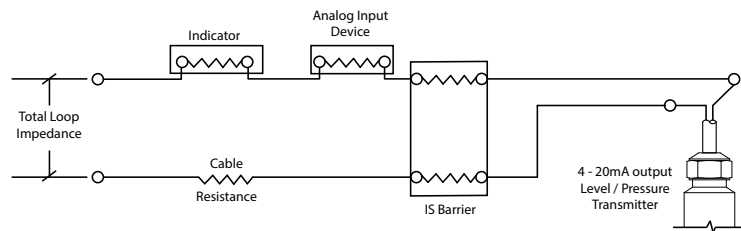
Many analog transmitters will appear to operate properly even when the supply voltage is not adequate to power the loop when the transmitter should be outputting 20 mA. For example, a 10 volt supply may appear to be enough to power an analog transmitter when it is outputting 4 mA with zero pressure applied, but as the transmitter's output increases with increasing pressure,

voltage drops across other devices in the loop (analog input devices, cable and/or external barrier devices) may reduce the supply voltage to the transmitter and prevent it from providing the correct output above a certain input pressure/level threshold.

Keller America's 4-20 mA pressure and level transmitters feature microprocessor based signal conditioning. During power up, the circuit performs a check sequence which determines whether there is sufficient supply voltage to power all devices on the loop, by setting the output to ~110% of the maximum value, i.e., ~22.5mA. If the supply voltage is not sufficient to supply 22.5 mA to the circuit, then the maximum possible current will be seen on the analog output, e.g., 17 mA, and the transmitter will not initiate normal operation.

The benefit of this technology is that total loop impedance is accounted for prior to placing the equipment into service, preventing false indications when the voltage supply is insufficient to support the loop with maximum pressure applied.

Most current loops contain analog input devices, indicators or other components having input impedances which must be considered when calculating the supply voltages needed. For example an analog input device with a 250 Ohm Input Impedance will require an additional voltage of 5.5 VDC ($250 \times 0.022 = 5.5$) in addition to the minimum supply voltage necessary for the transmitter to operate properly over the entire range.



The calculations below are useful in identifying the minimum supply voltage needed for a current loop with additional line impedances or conversely, the maximum current loop impedance allowed for a given supply voltage.

Minimum supply voltage with lightning protection option installed:

$$11 \text{ VDC} + (\text{Total loop impedance} \times 0.022)$$

Minimum supply voltage without lightning protection option installed:

$$8 \text{ VDC} + (\text{Total loop Impedance} \times 0.022)$$

Maximum allowable loop impedance with lightning protection option installed:

$$(\text{Supply VDC} - 11 \text{ VDC}) / 0.022$$

Maximum allowable loop impedance without lightning protection option installed:

$$(\text{Supply VDC} - 8 \text{ VDC}) / 0.022$$

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 cable jacket materials 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. Do not submerge electrical connection end of cable.
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 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. Terms and Conditions:

Offers

Unless otherwise indicated, the prices set forth in this quotation are valid for 60 days from the date of the quotation and apply to products that are scheduled for shipment within twelve months from the date of the Buyer's purchase or at Keller America, Inc. shipping capabilities at the time the order is entered, whichever is later.

Acceptance of order

Any purchase order to be accepted has to refer to a quotation, whether delivered by surface mail, e-mail or facsimile. All oral orders must be confirmed in writing. By referring to this quotation, Buyer accepts and adopts the General Terms and Conditions of Sale ("Terms and Conditions") to the exclusion of any additional or different terms appearing in Buyer's purchase order and waives any right Buyer may have to enforce any such additional or different terms. Our Confirmation of Order or Invoice validates orders.

Orders for custom-configured products are built to your specification and therefore may not be cancelled once the order has been confirmed.

Date of shipment

The estimated shipping capability stated on the quotation is given solely for the Buyer's information and does not constitute a commitment to deliver products in accordance herewith. Buyer may request a specific shipping date or shipping schedule. Keller America, Inc. will schedule shipments based upon Buyer's request and Keller America, Inc.'s shipping capabilities at the time Buyer's purchase order is processed, at which time Keller America, Inc. will issue to Buyer a formal Acknowledgment of Order that will indicate the estimated shipping date(s). After the shipments have been scheduled, Buyer may not cancel or postpone a scheduled shipment unless Buyer submits its request in writing and Keller America, Inc. consents by issuing a new acknowledgment. Any request to cancel or to reschedule the shipment that is received less than 21 days from the date scheduled for the shipment of the products covered by the request may be rejected as untimely, or may be accepted upon payment of the cancellation charge of 20% or a rescheduling charge of 10% of the sales price shown on this quotation at Keller America, Inc.'s option. Keller America, Inc. will use its best efforts to ship on or even before the estimated shipping dates indicated, but will not be liable for any delay or failure to deliver. Keller America, Inc. shall not be liable for any special, incidental or consequential damages resulting for delivery delays or inability to deliver.

All goods or materials supplied by Keller America, Inc. remain its property until total payment is received. All such goods and materials are at the sole risk of the Buyer and in the event of being damaged, destroyed or lost after delivery. Keller America, Inc. is entitled to receive the total payment of those goods.

Price

Unless otherwise specified in the quotation, our prices are in US dollars (USD). They are exclusive of freight costs and of all state and local sales, use, excise, privilege and similar taxes. Such taxes imposed on Keller America, Inc. or which Keller America, Inc. has a duty to collect in connection with the sale or delivery of the products described on the quotation shall be paid by Buyer and will appear as separate items on the invoice.

Shipment / freight

Deliveries are F.O.B. Newport News, VA. Title and risk of loss shall pass to Buyer upon tender of the products by Keller America, Inc. to a common carrier. In absence of specific written instruction from Buyer, Keller America, Inc. will select the common carrier, but Keller America, Inc. shall not thereby incur any liability in connection with shipment. Buyer shall be responsible for any freight charge. Declared value for each shipment will be a maximum of \$100 regardless of the actual value of the goods, notwithstanding written instructions from the Buyer specifying a higher declared value. If the products are shipped freight prepaid, Buyer shall pay Keller America, Inc. the appropri-

ate freight charges, which will be shown as separate items on the invoice.

Payment

Terms are indicated on our Confirmation of Order and on our Invoices. Keller America, Inc. will submit an invoice to Buyer for each shipment at the time of shipment. Except as otherwise provided on the quotation, Buyer shall pay the amount invoiced by Keller America, Inc. within 30 days from the date of the invoice. If in the judgment of Keller America, Inc. the financial condition or payment record of Buyer at any time does not justify shipment under the payment terms specified above, Keller America, Inc. may refuse to ship unless it receives payment in advance, or at its option, payment upon delivery. 2% interest per month is charged on overdue accounts.

Documentation

The information given in our documentation, printed matter, data sheets and price lists is without commitment. This information specifies the product but is no warranty, unless agreed in writing.

Warranties

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 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, and Valueline products is 24 (twenty-four) months from date of shipment. Warranty period for all other products herein 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.

Complaints

All claims or disputes must be made in writing to Keller America, Inc. a maximum of 60 days from receipt of the goods, including discovery of faults not previously apparent. If the warranty claims are justified, Keller America, Inc. is free at its discretion to repair, replace or issue credit. No further compensation for damages will be made. Any disputes or claims of Buyer must be initiated in a proper court or other adjudicative body, as applicable, within one (1) year from the date of shipment by Keller America, Inc., or its representative(s), or such claim shall be deemed invalid or expired and cannot be renewed. To the extent allowed, this limitation period shall trump any applicable statutory limitations period that may state a longer period.

Limitation of responsibility

Our responsibility concerns the correct function of our products only. It cannot be extended to the whole system in which they are used. Our responsibility is limited to the replacement, repair or reimbursement of the goods we agree are defective or non-conforming. The claim must be in writing within 60 days from receipt of the goods.

Place of jurisdiction / applicable law

The contract made by acceptance of this offer shall be deemed made in the State of Virginia and shall be governed by and construed in accordance with the laws of that state without reference to or application of any conflicts of laws principles and without consideration of the place of execution. Buyer expressly agrees to the subject matter and personal jurisdiction of the Circuit Courts for the City of Newport News, Virginia, or the federal District Court for the Eastern District of Virginia, Newport News Division.

Assignment

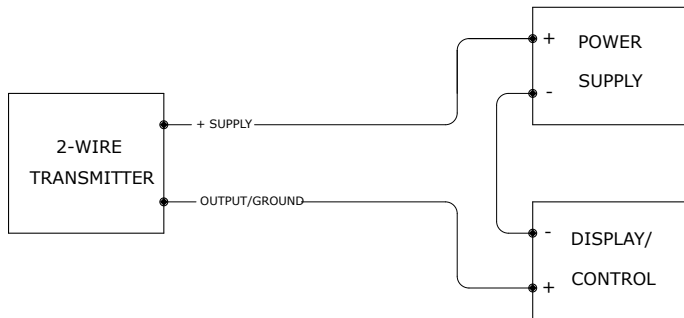
Neither this offer nor any contract resulting there from may be assigned or transferred in whole or part without the prior written consent of Keller America, Inc. No assignment or transfer in violation of this provision shall be valid or binding on Keller America, Inc.

Attorney's fees

Upon any breach of this Agreement, the reasonable attorney's fees and costs of the substantially prevailing party, whether by litigation or settlement, shall be paid by the breaching party.

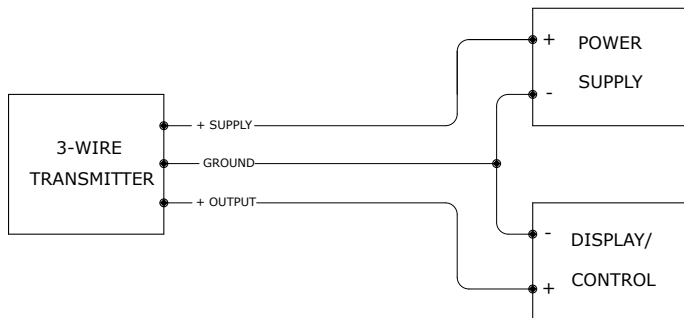
XI: Appendix

2-WIRE CURRENT LOOP

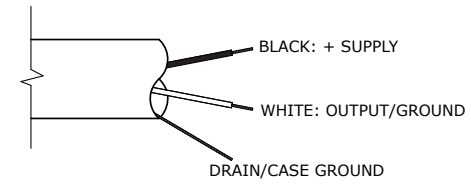


Please refer to Section VII: Use and Care for minimum supply voltage information.

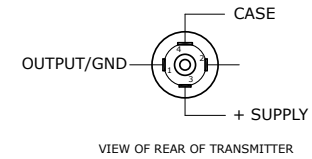
3-WIRE VOLTAGE OUTPUT



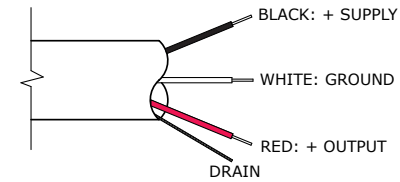
ECONOLINE w/CABLE...4-20mA



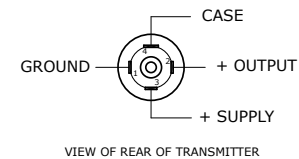
ECONOLINE w/mPm393...4-20mA



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



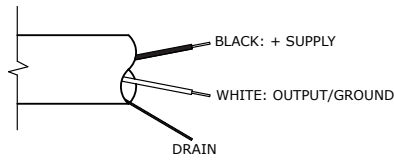
ECONOLINE w/mPm393...0,5-4,5VDC



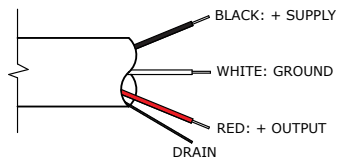
NOTES:

- 1: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.

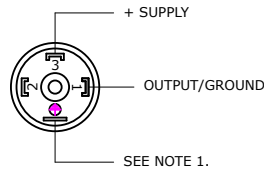
VALUELINE w/ATTACHED CABLE...4-20mA



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

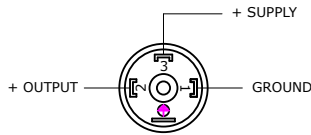


VALUELINE w/DIN43650...4-20mA



VIEW OF REAR OF TRANSMITTER

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

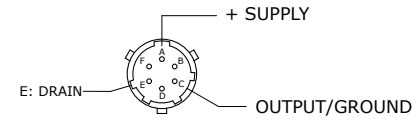


VIEW OF REAR OF TRANSMITTER

NOTES:

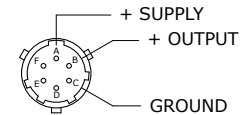
- 1: FOR TRANSMITTERS WITH LIGHTNING/SURGE PROTECTION, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND. FOR TRANSMITTERS WITHOUT LIGHTNING/SURGE PROTECTION, THIS PIN IS CONNECTED TO THE TRANSMITTER CASE.
- 2: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.

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



REAR VIEW OF TRANSMITTER

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

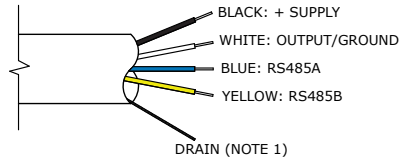


REAR VIEW OF TRANSMITTER

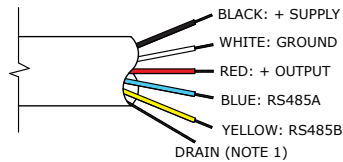
NOTES:

- 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.
- 2: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.

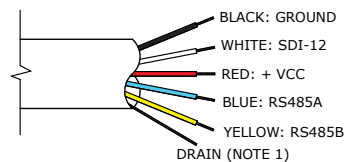
PRECISELINE w/ATTACHED CABLE...4-20mA + RS485



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



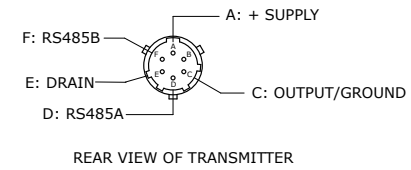
PRECISELINE SDI w/ATTACHED CABLE...SDI-12+ RS485



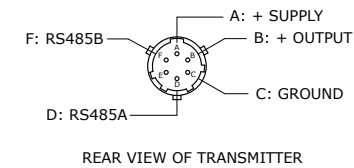
NOTES:

- 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.
- 2: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.

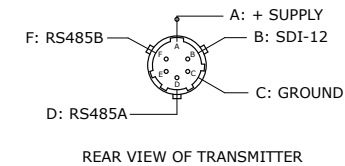
PRECISELINE w/MIL-C-26482...4-20mA + RS485



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



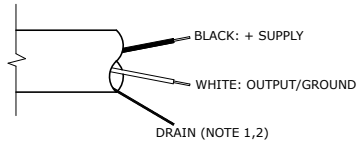
PRECISELINE SDI w/MIL-C-26482...SDI-12 + RS485



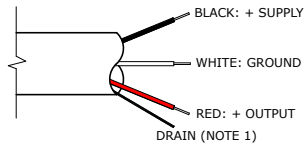
NOTES:

- 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.
- 2: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.

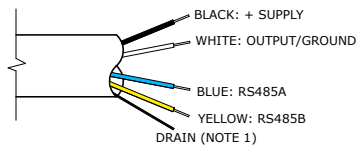
LEVELGAGE & ECONOLEVEL w/ATTACHED CABLE...4-20mA



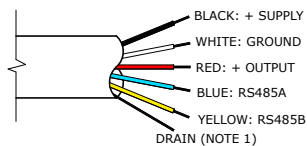
LEVELGAGE w/ATTACHED CABLE...0-5...10VDC



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



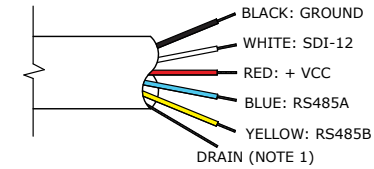
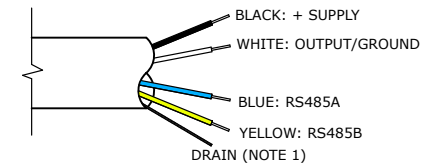
ACCULEVEL & LEVELRAT w/ATTACHED CABLE...0-5...10VDC + RS485



NOTES:

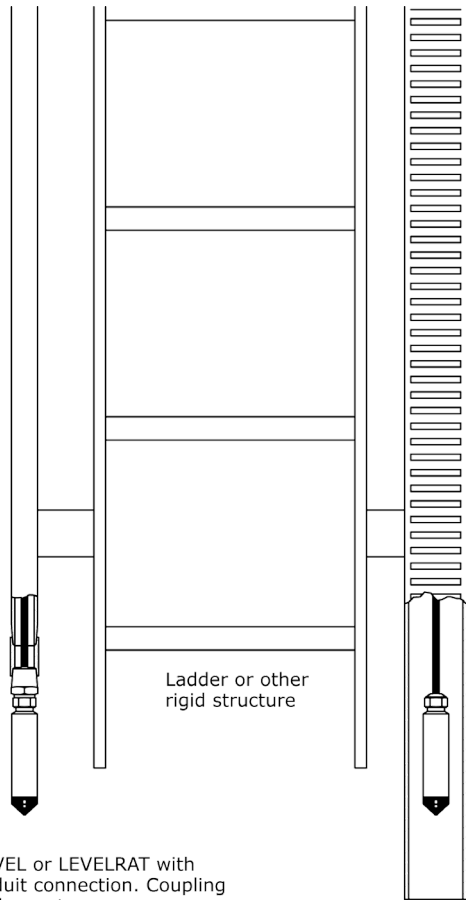
- 1: FOR LIGHTNING/SURGE PROTECTION TO BE EFFECTIVE, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND.
- 2: LIGHTNING PROTECTION NOT AVAILABLE ON ECONOLEVEL. DRAIN WIRE CONNECTION NOT REQUIRED.
- 3: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.

ACCULEVEL SDI w/ATTACHED CABLE...SDI-12+ RS485

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

NOTES:

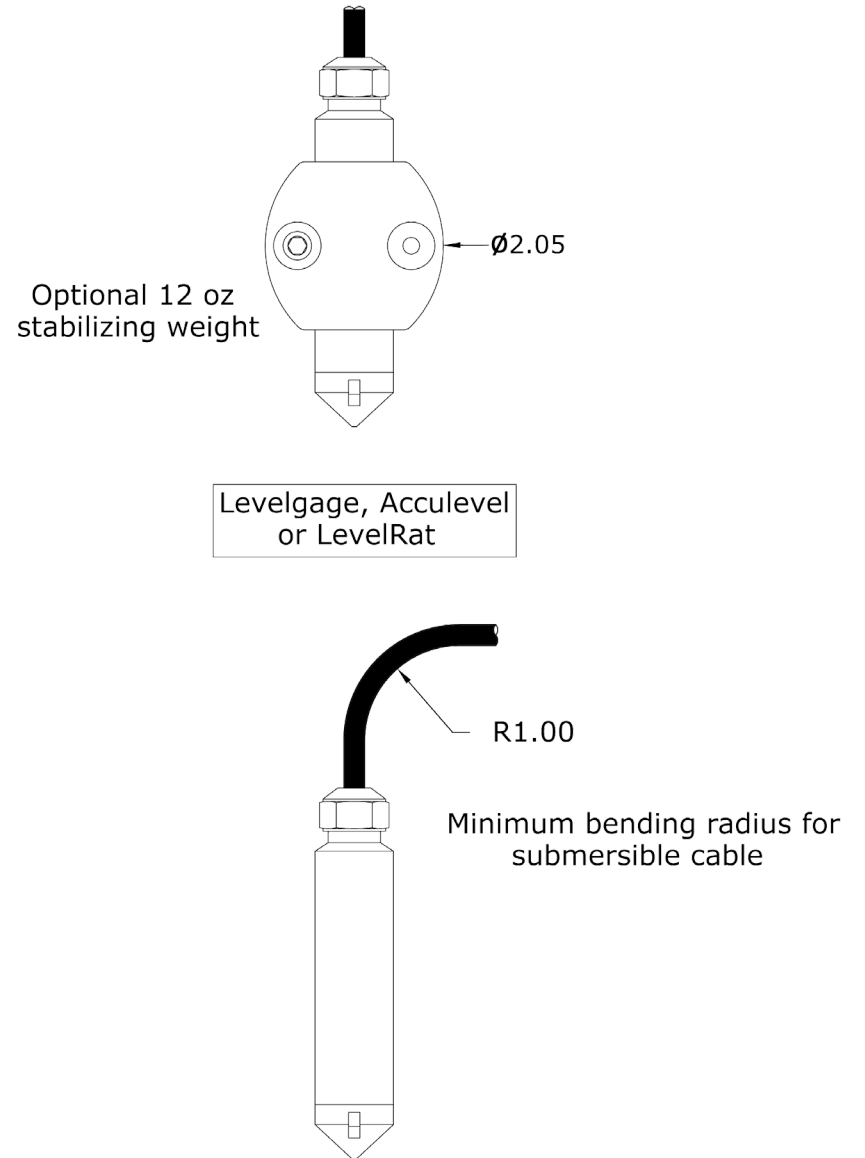
- 1: FOR LIGHTNING/SURGE PROTECTION TO BE EFFECTIVE, CONNECT DRAIN WIRE TO A LOW-IMPEDANCE EARTH GROUND.
- 2: DO NOT SUBMERSE ELECTRICAL TERMINATION IN LIQUID. IT WILL DAMAGE THE INSTRUMENT.



Ladder or other rigid structure

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.



Optional 12 oz stabilizing weight

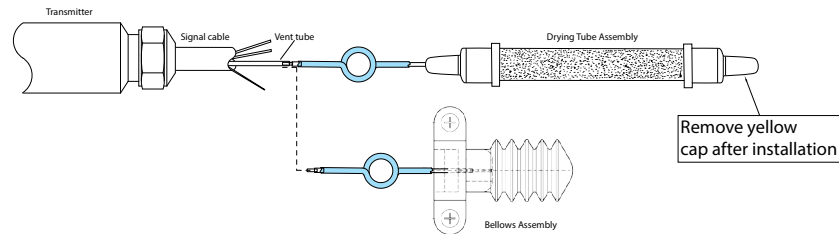
Ø2.05

Levelgauge, Acculevel or LevelRat

R1.00

Minimum bending radius for submersible cable

VENT TUBE TERMINATION - DRYING TUBE OR BELLOWS



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.
- 2: 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). REMOVE YELLOW CAP FROM FREE END AFTER INSTALLATION.
- 3: 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.



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