KELLER

Level and Pressure Transmitter User's Guide

Thank you for your purchase of quality pressure measurement instruments by KELLER Pressure. They are designed to be robust and should provide years of reliable service. However, as with any precision instrument, mishandling of these transmitters can lead to premature failure. Should any question(s) arise during the installation process, STOP and call (toll-free) 877-253-5537.

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I. Company Information

KELLER Pressure, Inc. is the North American subsidiary of KELLER Pressure AG, which continues as the leader in level and pressure sensing and measurement. From humble beginnings, KELLER Pressure now provides its products and expertise through a world-wide network of factory-trained professionals.

With the application of inexpensive, miniaturized microprocessors, KELLER Pressure 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.

Doing business with KELLER Pressure 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 Pressure, providing customers with superior value is a way of life.

II. Contact Information

KELLER Pressure, Inc.
351 Bell King Rd
Newport News, Virginia, 23606
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F: 757-596-6659
Web: www.keller-pressure.com
Email: sales.us@keller-pressure.com

III. Product Applicability

Unless otherwise noted, this manual contains user information for the following level and pressure instrumentation provided by KELLER Pressure, Inc: 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 us.keller-pressure.com/users_guide.

IV. Installation:

The following is important installation and general maintenance information for KELLER transmitters. Please contact KELLER Pressure for additional instruction.

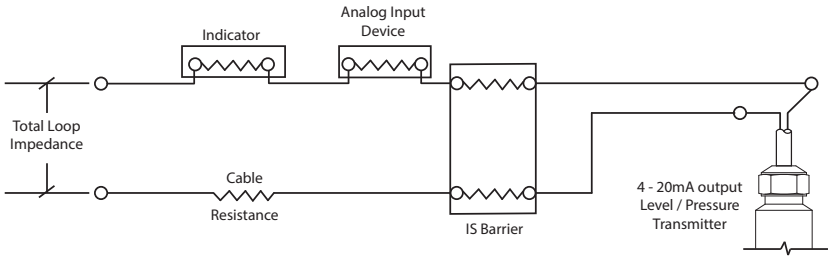
NOTE: When installing instruments in hazardous locations, applicable hazardous location installation codes must always be followed and take precedence over KELLER Pressure installation recommendations.

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 Pressure'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 x 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 VDC + (Total loop impedance x 0.022)

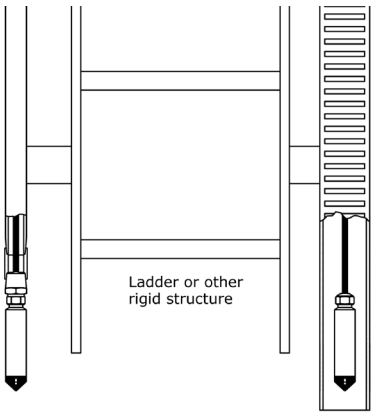
Minimum supply voltage without lightning protection option installed:
8 VDC + (Total loop Impedance x 0.022)

Maximum allowable loop impedance with lightning protection option installed:
(Supply VDC – 11 VDC) / 0.022

Maximum allowable loop impedance without lightning protection option installed:
(Supply VDC – 8 VDC) / 0.022

Transmitter Anchoring - It is recommended that KELLER Pressure 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.



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.

Transmitter Submersion - Damage to submersible cable can lead to failure of the transmitter. KELLER Pressure employs 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 which could damage the diaphragm when it impacts the water surface.

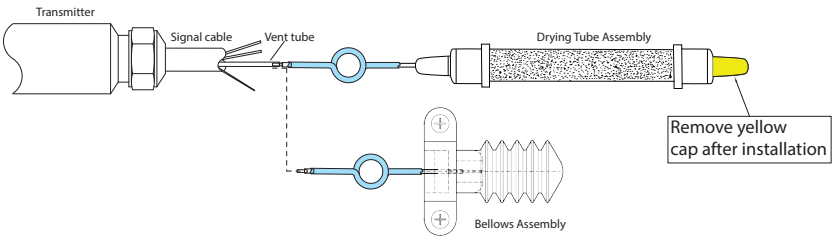
NOTE: Do not submerge the electrical connection end of the cable.

Condensation protection - KELLER Pressure has optimized the size of the cable vent to minimize the occurrence of water vapor incursion. In areas of high humidity, it is recommended to use a Drying Tube Assembly or Bellows Assembly to prevent water vapor from entering the vent tube.

The drying tube assembly is a clear tube filled with indicating desiccant that attaches directly to cable vent tube, intercepts water vapor. Highly recommended when operating in high humidity conditions. Must be periodically replaced as desiccant becomes saturated, turning color from blue (dry) to pink (saturated). remove yellow cap from free end after installation.

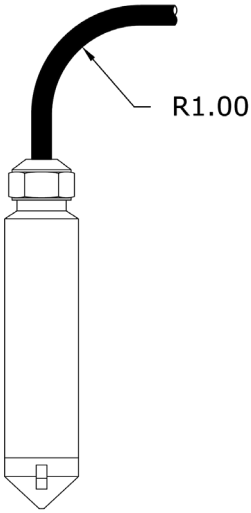
A bellows assembly is an alternative to the drying tube that attaches to cable vent tube and requires no periodic maintenance. Recommended for applications where a slight

VENT TUBE TERMINATION - DRYING TUBE OR BELLOWS



sacrifice in accuracy can be tolerated. Contact KELLER Pressure for ordering information.

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



Minimum bending radius for submersible cable

MINIMUM PIPE BEND RADIUS

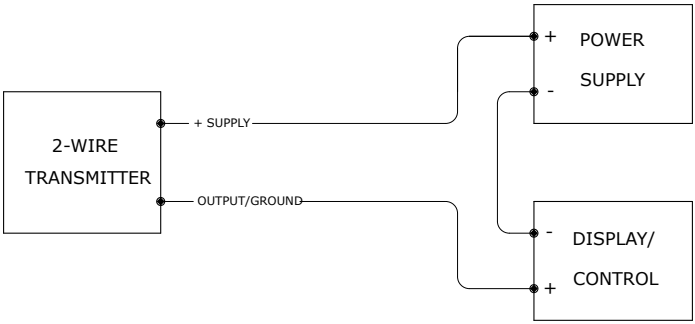
	Acculevel/ Levelgage Ø 0.83"	Microlevel Ø 0.63"
Schedule 40		
1" IPS (Ø1.315 x 0.133"w)	22"	18"
1.5" IPS (Ø1.900" x 0.145" w)	4"	5"
2" IPS (Ø2.375 x 0.154"w)	3"	3"
Schedule 80		
1" IPS (Ø1.315 x 0.179"w)	22"	22"
1.5" IPS (Ø1.900 x 0.200"w)	4"	6"
2" IPS (Ø2.375 x 0.218"w)	4"	4"

your installation. It is recommended that the cable not be bent to a radius smaller than 1 inch.

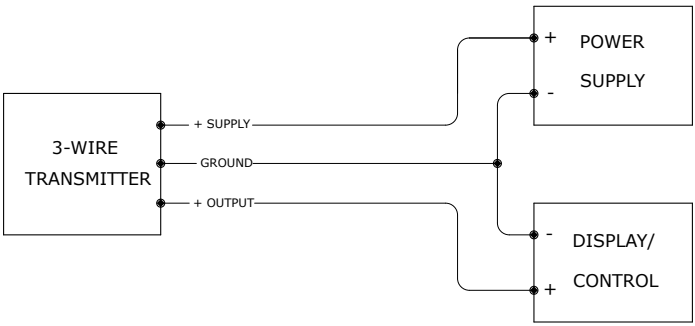
Cable Compression - Many users employ a compression fitting to secure our cable as it enters a junction box. Care must be taken that the fitting is not over tightened, causing damage to the cable and/or crimping of the vent tube.

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.

2-WIRE CURRENT LOOP

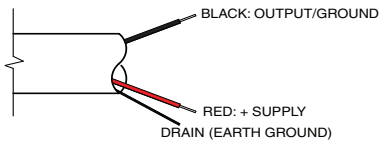


3-WIRE VOLTAGE OUTPUT



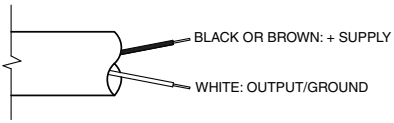
4-20 mA - IS-Approved

Applies only to Valueline, Levelgage, and LevelRat transmitters approved for use in hazardous areas



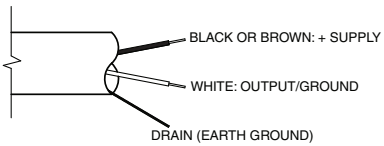
Standard 4-20mA

Applies to Econoline transmitters



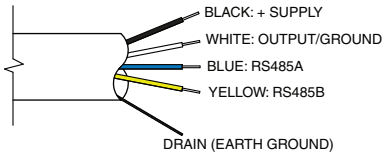
Standard 4-20mA

Applies Valueline, Levelgage, and Econolevel transmitters



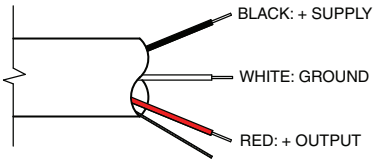
4-20mA + RS485

Applies to Preciseline, Acculevel, Microlevel, Nanolevel and LevelRat (non-IS) transmitters.



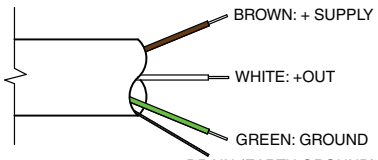
Standard VDC

Applies to Valueline, and Levelgage transmitters



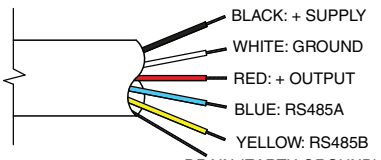
Ratiometric VDC

Applies to Econoline transmitters



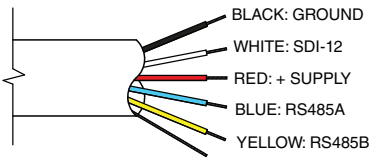
VDC + RS485

Applies to Acculevel and Preciseline transmitters



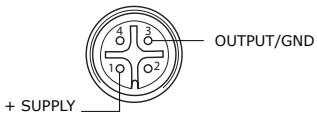
SDI-12 + RS485

Applies to Preciseline SDI and Acculevel SDI transmitters.



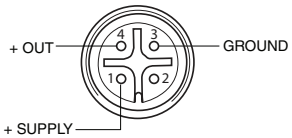
M12 Connector - 4-20mA

Applies to Econoline transmitters



M12 Connector - VDC

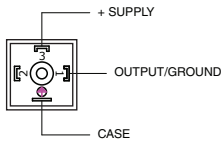
Applies to Econoline transmitters



mPm393 Connector - 4-20 mA

EN 175301-803 Form C 9.4mm

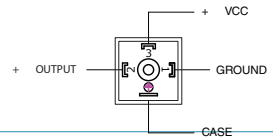
Applies to Econoline and Valueline transmitters



mPm393 Connector - VDC

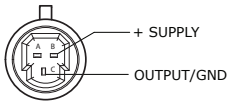
EN 175301-803 Form C 9.4mm

Applies to Econoline and Valueline transmitters



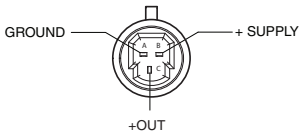
Aptiv Packard Connector - 4-20mA

Applies to Econoline transmitters



Aptiv Packard Connector - VDC

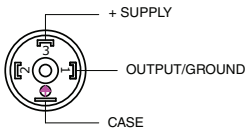
Applies to Econoline transmitters



DIN43650 Connector - 4-20mA

EN 175301-803 Form A 18mm

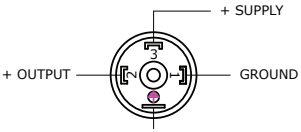
Applies to Valueline transmitters



DIN43650 Connector - VDC

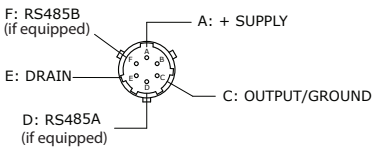
EN 175301-803 Form A 18mm

Applies to Valueline transmitters



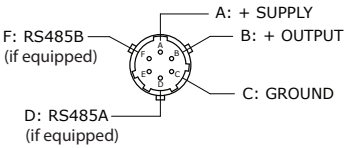
MIL-DTL-26482 Connector - 4-20mA

Applies to Valueline and Preciseline transmitters



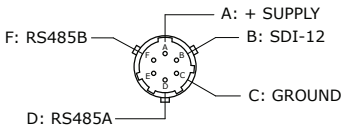
MIL-DTL-26482 Connector - VDC

Applies to Valueline and Preciseline transmitters



MIL-DTL-26482 Connector - SDI-12

Applies to Preciseline SDI transmitters



Wiring

V. Lightning / Surge Protection:

As of this writing, KELLER Pressure is the only pressure/level transmitter manufacturer in the world to provide standard, at no additional charge, a lifetime warranty against damage caused by lightning and/or electrical surge. This guarantee applies to the standard 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 Pressure.

NOTE: Guaranteed lightning protection raises the minimal supply voltage requirements for equipped transmitters. Applications relying on battery-power may need to increase and maintain available voltage to accommodate the higher requirement.

NOTE: KELLER Pressure instruments equipped with guaranteed lightning protection require that the equipped drain (unshielded) wire be connected to a good earth ground. However, circumstances exist where it is not advised, as the connection would create a ground loop that has the potential to irreparably damage the instrument. Do not connect drain wire if:

- A separate earth ground connection from the system is not available. Single, isolated earth ground connection is required.
- The installation site is known to have a voltage potential in the media different the drain connection point.

VI. 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 "proof pressure". It is the user's responsibility to ensure that the proper KELLER Pressure product is chosen for the particular pressure conditions expected.

Environmental conditions - Each KELLER Pressure product is designed to be compatible with a particular environment. It is the user's responsibility to ensure that the 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 trans-

mitters not designed for that purpose. A KELLER Pressure engineer can help the user determine the correct choice of enclosure to suit the particular application.

Electrical conditions - Each KELLER Pressure 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 Pressure products in accordance with KELLER Pressure's recommendations as well as local electrical code. Wire colors or connector pin-outs are either printed on the product or provided separately.

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

Regarding media-isolated products, should the pressure input or nose cap to the sensor, transducer, or transmitter become fouled, it may be cleaned in the following manner:

The device should be slowly lowered membrane-end 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 in the solution for 20-30 seconds or until the input/nose cap to the device is clear. Finish by stirring in fresh water. Wipe dry with a soft rag or towel.

A soap scum and hard-water stain remover may also be used, if necessary, but only after compatibility with any o-ring seals in the KELLER Pressure product is determined. Follow the solvent manufacturer's recommendations for safe handling.

Warranties - KELLER Pressure, Inc. (hereinafter "KELLER Pressure") warrants that the products that it sells are delivered free from defects in material and workmanship. KELLER Pressure'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 Pressure 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 Pressure. In order to obtain service under the terms of the warranty, Buyer must notify KELLER Pressure 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 Pressure plant with shipping charges prepaid. KELLER Pressure 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 Pressure 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 Pressure, 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 Pressure 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 Pressure under the terms of the warranty will be checked and analyzed in order to determine the cause of the fault(s) claimed by the Buyer. A report will then be submitted to the Buyer pointing out the nature of the fault(s), the party responsible for the fault(s) and the quotation of the repair, if needed. To begin the repair process, visit www.us.keller-pressure.com/rma or scan the QR code below.