Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

red lion

Tel +1 (717) 767-6511
Fax +1 (717) 764-0839
www.redlion.net

MODEL APLCL - APOLLO CURRENT-LOOP INDICATOR

- *DUAL RANGE, 4 to 20 mA or 10 to 50 mA* *
- *3 1/2-DIGIT, 0.56" (14.2 mm) HIGH LED READOUT*
- *SEALED METAL FRONT BEZEL (NEMA 4/IP65)*
- *24 VDC EXCITATION SUPPLY (Optional)*
- *WIDE RANGE SPAN & OFFSET SCALING*
- *FRONT ACCESS TO CALIBRATION TRIM CONTROLS*
- *OVER-RANGE INDICATION*
- *PLUG-IN TERMINAL STRIPS*
- *SELECTABLE DECIMAL POINTS*

* Also adapts to 0 to 50, 0 to 20, 0 to 10, 1 to 5 mA ranges as well as bi-polar inputs.

DESCRIPTION

The premium features of the Apollo Series can now be applied to measurement of process variables. With its high sensitivity and programmability, the Apollo Current-Loop Indicator (APLCL) can be set up for a wide variety of applications. In most plants the APLCL can be used for 90 to 95% of current-loop indicator needs for readout of pressure, flow, temperature, level and other variables.

The rugged construction and sealed metal front bezel meet the requirements of NEMA 4/IP65, when properly installed. This allows the APLCL to be used in dirty, hostile environments and in wash-down areas. In addition, the attractive flat-black and brushed aluminum front dresses up any control panel.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
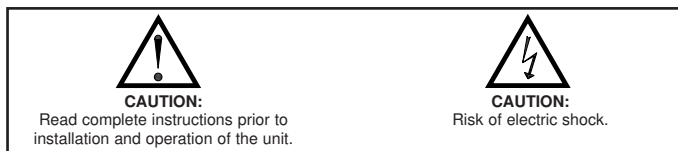
SPECIFICATIONS

1. **DISPLAY:** 3 1/2-digit (1999), 0.56" (14.2 mm) L.E.D., minus sign displayed on negative current flow. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP programming switches.
2. **POWER:** Available for 115 or 230 VAC ±10%, 50/60 Hz, 6 VA.
3. **INPUT SENSITIVITY:** *(Numerical Readout Change/mA)*
   260 units/mA @ 4 to 20 mA input
   105 units/mA @ 10 to 50 mA input
   (max. allowable input current, 170 mA)
4. **COMPLIANCE:** Voltage drop across input at max. signal current, less than 600 mV for both 4 to 20 and 10 to 50 mA ranges.
5. **INPUT RESISTANCE:**
   4 to 20 mA - 29.2 Ω
   10 to 50 mA - 11.8 Ω
6. **SCALING RANGE:**
   SPAN: 32 coarse steps *(binary progression with 5 DIP switches, rear*

access). Each step providing approx. 8.125 numerical units/mA/step sensitivity for 4 to 20 mA input and 3.25 units/mA/step for 10 to 50 mA input. Fine adjust *(front access)* brackets the coarse step increments.
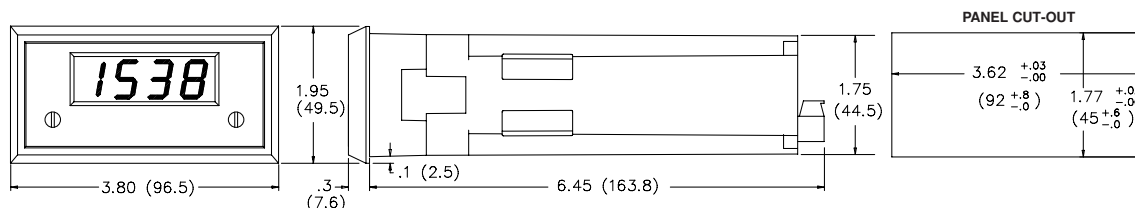
OFFSET: 16 coarse steps *(binary progression with 4 DIP switches, rear access)* with ± switch to add or subtract offset. Each step adds or subtracts approximately 175 from the numerical display for a total offset range of ±2700. Front access fine control brackets the steps.

7. **LINEARITY:** ±(0.05% ±1 digit)
8. **READING RATE:** 2 1/2 updated readings/second, nominal.
9. **RESPONSE TIME:** 1 second to settle for step change.
10. **NORMAL MODE REJECTION:** 63 dB, 50/60 Hz.
11. **COMMON MODE REJECTION:** 100 dB, DC to 50/60 Hz.
12. **ENVIRONMENTAL CONDITIONS:**
    Operating Range: 0° to 60°C
    Storage Temperature: -40° to 80°C
    Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.
    Span Temperature Coeff.: 100 PPM/°C
    Offset Temperature Coeff: 100 PPM/°C
    Altitude: Up to 2000 meters
13. **EXCITATION SUPPLY (Optional):** 24 VDC @ 60 mA max. Regulated and isolated *(floating)*. (See Ordering Information.)
14. **CONSTRUCTION:** Die cast metal front bezel with black, high impact plastic insert. Front panel meets NEMA 4/IP65 requirements for indoor use when properly installed. (Panel gasket and mounting clips included.) Installation Category II, Pollution Degree 2
15. **CONNECTIONS:** Plug-in, compression type barrier terminal strip.
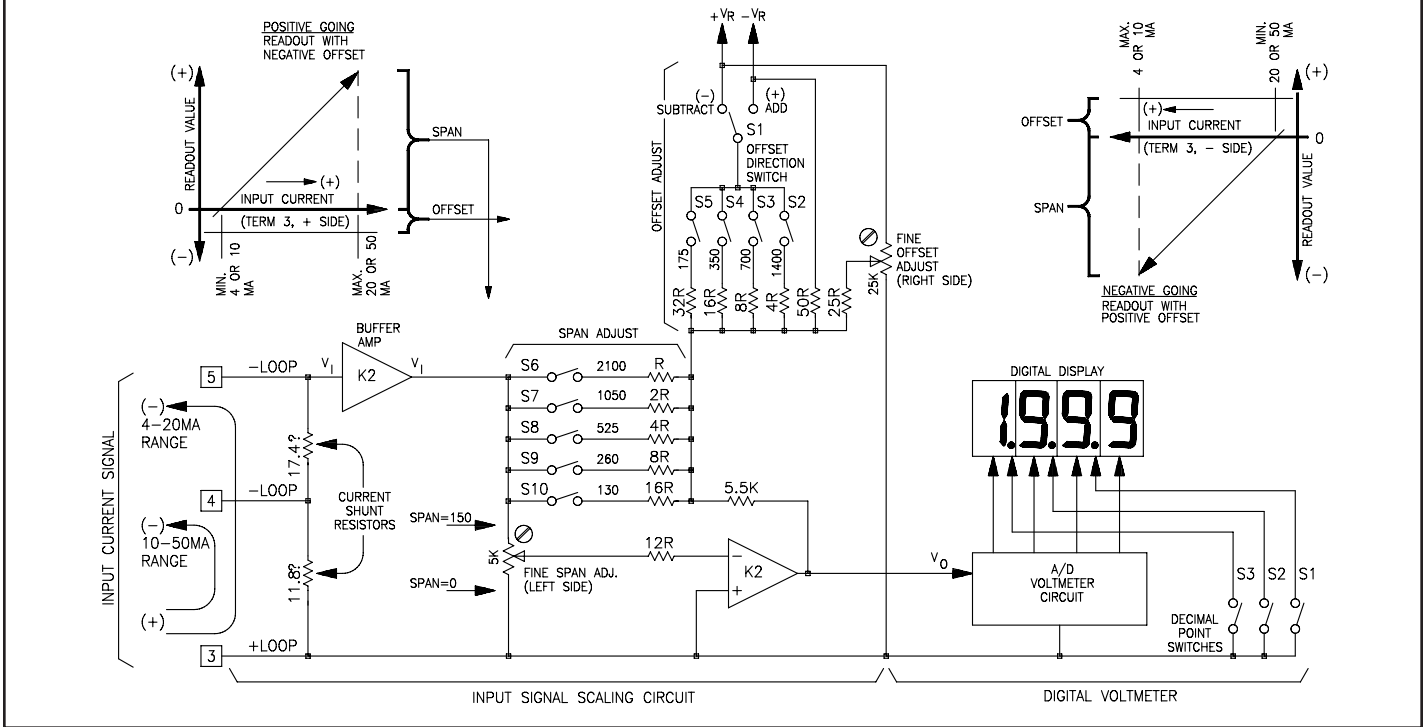16. **WEIGHT:** 1.2 lbs (0.54 Kg).

CAUTION:
Read complete instructions prior to installation and operation of the unit.

CAUTION:
Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.5" (140) W.

PANEL CUT-OUT

1.95 (49.5)
1.75 (44.5)
3.80 (96.5)
.3 (7.6)
.1 (2.5)
6.45 (163.8)

3.62 +.03/-.00 (92 +.8/-.0)
1.77 +.02/-.00 (45 +.6/-.0)

SIMPLIFIED SCHEMATIC, APOLLO CURRENT-LOOP INDICATOR

(Simplified schematic diagram. Labels include: POSITIVE GOING READOUT WITH NEGATIVE OFFSET; READOUT VALUE; INPUT CURRENT (TERM 3, + SIDE); MIN. 4 OR 10 MA; MAX. 20 OR 50 MA; SPAN; OFFSET; +VR −VR; SUBTRACT (−) / (+) ADD; S1 OFFSET DIRECTION SWITCH; OFFSET ADJUST; S5 S4 S3 S2; 175 350 700 1400; 32R 16R 8R 4R; 50R 25R; FINE OFFSET ADJUST (RIGHT SIDE); 25K; MAX. 4 OR 10 MA; MIN. 20 OR 50 MA; OFFSET; INPUT CURRENT (TERM 3, − SIDE); SPAN; NEGATIVE GOING READOUT WITH POSITIVE OFFSET; READOUT VALUE; BUFFER AMP K2; VI; SPAN ADJUST; S6 2100 R; S7 1050 2R; S8 525 4R; S9 260 8R; S10 130 16R; 5.5K; DIGITAL DISPLAY 1.9.9.9; −LOOP; INPUT CURRENT SIGNAL; 4−20MA RANGE; 10−50MA RANGE; +LOOP; 17.4Ω; CURRENT SHUNT RESISTORS; 11.8Ω; SPAN=150; SPAN=0; 5K FINE SPAN ADJ. (LEFT SIDE); 12R; K2; VO; A/D VOLTMETER CIRCUIT; S3 S2 S1 DECIMAL POINT SWITCHES; Terminals 5, 4, 3; INPUT SIGNAL SCALING CIRCUIT; DIGITAL VOLTMETER)

DESCRIPTION OF OPERATION

The Apollo Current-Loop Indicator *(APLCL)* consists of a digital voltmeter combined with an analog scaling circuit*(shown above)*. The unit was designed primarily for use with 4-20 mA and 10-50 mA current-loop signal circuits. However, it can also be adapted to other current ranges, such as 0-50 mA, 0-20 mA, 0-10 mA, and in a great many applications it can be used even with 0-5 mA and 1-5 mA current loops. In addition, input current can be reversed in polarity resulting in negative numerical readout with a minus (-) sign displayed.

Input terminals 3 and 4 are connected in series with 10-50 mA current-loops, and Terminal 3 and 5 are series connected with 4-20 mA loops. In either case, the voltage drop "V_I" generated across the shunt resistor*(s)* ranges from approximately 0.12 V min. *(@ 4 or 10 mA)* to 0.59 V max. *(@ 20 or 50 mA)*. The buffer amplifier *(K1)* conditions and filters the input signal voltage and applies it to the input of the scaling circuit.

The procedure for scaling Apollo Current-Loop Indicators is simplified by dividing the scaling process into two separate components, span adjustments and offset adjustments which are defined in the following discussion.
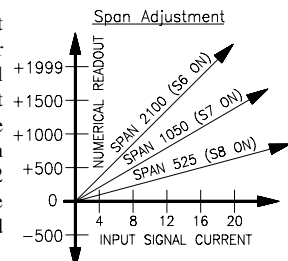
SPAN ADJUSTMENTS

Span is defined as the numerical range that the display traverses, disregarding decimal points, when the input signal current is varied from minimum *(4 or 10 mA)* to maximum *(20 or 50 mA)*.

For example, if a unit is to display 25.0 @ 4 mA and 100.0 @ 20 mA, the span is 750 *(the difference between 250 and 1000)*. Had the minimum display been -25.0 @ 4 mA and +100.0 @ 20 mA, the span would be 1250 (1000 - (-250) = 1250). *(Note: the terms "GAIN", "SCALE", and "SENSITIVITY" are also frequently used interchangeably with the term "SPAN".)*

The Apollo Current-Loop Indicator can be set up over a very wide span range by means of the coarse DIP switches S6-S10 *(on the rear)*, and the fine screwdriver adjustment pot, located behind the sealing screw on the front bezel *(left side)*. The coarse span switches add parallel input resistors to the summing amplifier *(K2)*, thereby increasing its gain, or sensitivity, as more summing resistors are added.

Effectively, adding more parallel input resistors, increases the slope of the transfer curve *(at right)* and increases the numerical readout for a given input signal current change. The input summing resistor values are weighted in a binary progression, so they can be switched in combinations to give 32 discrete steps of span. The front panel fine adjust control brackets these coarse steps and can be adjusted to the exact span needed.

Span Adjustment

(Graph: NUMERICAL READOUT vs INPUT SIGNAL CURRENT; curves labeled SPAN 2100 (S6 ON), SPAN 1050 (S7 ON), SPAN 525 (S8 ON); vertical axis +1999, +1500, +1000, +500, 0, −500; horizontal axis 4 8 12 16 20)

The approximate span contributed by each switch is shown on the rear label. These values are based on the standard current-loop spans of 4 to 20 mA *(16 mA current variation)* and 10-50 mA *(40 mA current variation)*. In other words, if S7 only is turned *"ON"*, the numerical readout will display a change approximately 1050 for a current swing of 16 mA *(4-20 mA input)* or 40 mA *(10-50 mA input)*. If S8 were also turned *"ON"*, the numerical readout would swing approximately 1575 *(1050 for S7 + 525 for S8)* for the same signal current variation. The fine control has a continuous span range of approximately 0-150.
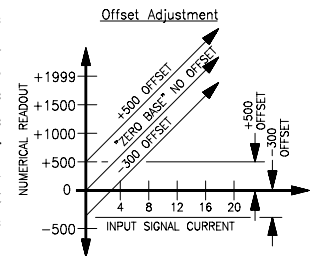
OFFSET ADJUSTMENTS

In the foregoing discussion of span, the transfer curves were shown as *"ZERO-BASED"*, i.e., the numerical readout displays *"0"* when the signal current goes to zero. With current-loop ranges such as 0-5 or 0-10, or 0-20 mA, and with Bi-Polar *(+/-)* signals, this is often the desired condition. However, with 4-20 and 10-50 mA current-loops, the minimum current level of 4 or 10 mA usually represents the zero level of the parameter being displayed. There are also many applications where the minimum *(or zero level)* represents some value that does not fall on a zero based transfer curve.

To accommodate non-zero based applications, the Apollo Current-Loop Indicator has provisions for offsetting the transfer curve over a wide range. Essentially, offset moves the transfer curve up or down to change its intercept with the numerical readout axis, but it does not change the slope *(SPAN)* of the transfer curve.

In the Apollo Current-Loop Indicator, offset is accomplished by adding *(or subtracting)* a constant at the input of the summing amplifier *(K2)*. This offset constant is summed in with a switched binary resistor network and a fine adjust offset control in a similar manner to that used for span adjustment. Switches S2-S5 *(at the rear)* can be turned on in combinations to give 16 different coarse offset levels.

Each switch is labeled to show the approximate amount of offset contributed when it is turned *"ON"*. Switch 1 selects the polarity of the switched-in offset value and allows offsetting the transfer curve *"UP" (adding the offset constant)* or *"DOWN" (subtracting)*. The fine control *(front panel, right)* has a numerical readout range of ±100 and brackets all the coarse switched ranges.

Offset Adjustment

(Graph: NUMERICAL READOUT vs INPUT SIGNAL CURRENT; curves labeled +500 OFFSET, "ZERO BASE" NO OFFSET, −300 OFFSET; +500 OFFSET / −300 OFFSET; vertical axis +1999, +1500, +1000, +500, 0, −500; horizontal axis 4 8 12 16 20)

CALIBRATION

Direct calibration in the signal loop is usually not practical due to the difficulty in varying the measured parameter and the confusing interaction that occurs between span and offset adjustments. However, the APLCL can be quickly and easily bench calibrated using a commercially available current calibrator or the calibration set-up shown below.

BENCH CALIBRATION SET-UP
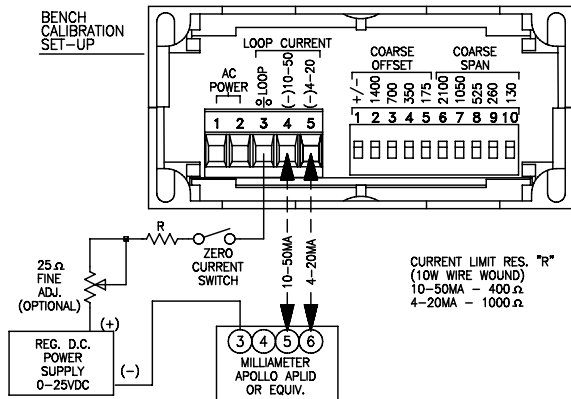
CALIBRATION PROCEDURE

The procedure outlined below, minimizes span/offset interaction and simplifies calibration. In Steps 1, 2 and 3 the unit is "nulled" to zero readout with zero input signal current. In Steps 4 and 5, the span adjustments are made to establish the required slope of the transfer curve.Then in Step 6, the transfer curve is shifted up or down as required by setting the offset adjustments. In Step 7, the final "tweaking" adjustments are made at minimum and maximum signal current. Setting the decimal points in Step 8 completes the calibration.

Before calibrating, the READOUT SPAN (R_S), SWING CURRENT (I_S) must be determined.

R_S = *(Max. Numerical Display) - (Min. Numerical Display)*
(Disregard Decimal Points)

I_S = *(Current @ Max. Display) - (Current @ Min. Display)*

Example: Readout is to be 5.00 @ 4 mA and 15.00 @ 20 mA.

READOUT SPAN (R_S) = 1500 − 500 = 1000
SWING CURRENT (I_S) = 20 mA − 4 mA = 16 mA

ADJUSTMENTS

SETTING ZERO

1. Turn off all coarse offset and span adjustment switches *(S2-S10 down)*. S1 has no effect when zeroing and can be in either position.
2. Apply zero current by opening the external zero current switch. Adjust the indicator to read zero using the fine offset adjustment *(R.H. side, front panel)*.
3. Close the external zero current switch and set the SWING CURRENT, I_S, *(16 mA in the example)* by adjusting the power supply voltage and the external fine adjust pot. Then, turn the fine span control *(front, left)* to get a near zero reading *(Adjustment fully CCW)*

SPAN

4. With the SWING CURRENT I_S, applied to the input, set up a combination of coarse span adj. switches *(S6-S10)* to obtain a display readout closest to the READOUT SPAN desired *(1000 in the example)*. Set the exact READOUT SPAN with the fine span adj. *(front, left)*.
5. Repeat Step 2 to see if the zero value has shifted. If it has, re-zero with fine offset *(front, right)*, then repeat Step 3 and 4.

OFFSET

6. After the span has been adjusted, set the signal current to the minimum level *(4 mA in example)*. Then set the offset add/subtract switch *(S1)*, the coarse offset switches *(S2-S5)* and the fine offset control *(front, right)* to obtain the readout corresponding to this minimum current value *(500 in the example)*.

MAX/MIN CHK.

7. Adjust the input signal current to its maximum value to see if the proper readout is obtained *(1500 @ 20 mA in the example)*. If the readout is slightly off, adjust the fine span *(front, left)* to obtain the true reading. Then, recheck the reading at minimum input current *(4 mA)* and readjust fine offset *(front, right)* if necessary. Repeat the maximum and minimum readout adjustments until the unit displays the proper readout at both extremes.
8. Set decimal points as desired using the three switches on the side of the case and replace the front panel sealing screws. The unit can now be installed.

APPLICATION EXAMPLES

Example 1: An APLCL is to be calibrated to match a flow transducer whose output is 10 mA @ 0 GPM and 50 mA @ 1375 GPM.

READOUT SPAN (RS) = 1375 − 0 = 1375
SWING CURRENT (IS) = 50 mA − 10 mA = 40 mA

ADJUSTMENTS (Refer to the transfer curve below)

Ⓐ Null the unit to zero readout @ 0 current per Steps 1, 2, and 3 of the calibration procedure.
Ⓑ Set the coarse and fine span adjustments to get a readout of 1375 @ 40 mA per Steps 4 and 5. *Note: With the full standard swing of 40 mA, the coarse span switch reference markings can be used to determine settings as follows:*
S7 ON (1050) + S9 ON (260) = 1310 Span set with switches.
375 (needed) - 1310 (with SW's) = 65 w. fine span adj.
Ⓒ Set offset to readout 0 @ 10 mA per Step 6. *Note: The readout observed when the 10 mA min. current is first applied can be used to determine the offset switch settings.)* In this example the readout will be *(+)* 344 when the 10 mA min. current is first applied. Applying -344 offset then reduces the readout to zero @ 10 mA.
Ⓓ Check readout at max. *(50 mA)* and min. *(10 mA)* and fine tune *(tweak)* as required per Step 7.
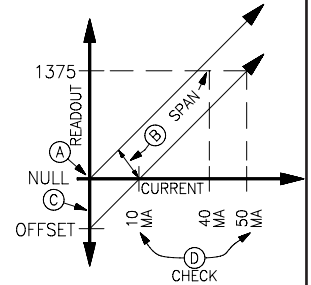
Example 2 (Negative Slope): A level measuring device puts out 6 mA when a storage tank is full and 15 mA when the tank is empty. The APLCL is to readout 90.0 tons at full tank and zero when empty.

READOUT SPAN (RS) = 900 − 0 = 900   (Disregard Decimal Points)
SWING CURRENT (IS) = 6 mA (@ max rdg) - 15 mA (@ min rdg) = -9 mA

In this case, the signal current is reverse [Term 3 *(-)* with respect to Term 5 *(+)*] causing the readout to go *"down" (increasingly negative)* as the negative current increases.

ADJUSTMENTS

Ⓐ Null the unit per Steps 1, 2 and 3.
Ⓑ Set slope of transfer curve with span adjustments to get readout of -900 @ -9 mA per Steps 4 and 5.
Ⓒ Move transfer curve up by applying *(+)* offset per Step 6 until readout is +900 @ -6 mA.
Ⓓ Check extreme readings per Step 7, 0 readout @ -15 mA and +900 readout @ -6 mA.
Set D.P. Switch S1 and replace front panel sealing screws.
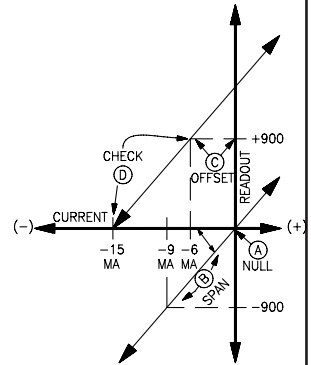
Example 3 (± Display): A differential pressure transducer has a range of ±1500 PSI with a 4 to 20 mA output *(-1500 @ 4 mA, +1500 @ 20 mA)*.
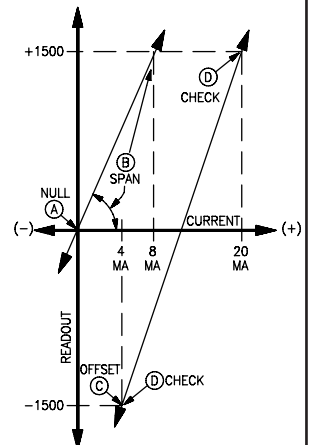
READOUT SPAN (RS) = +1500 −(−1500) = 3000
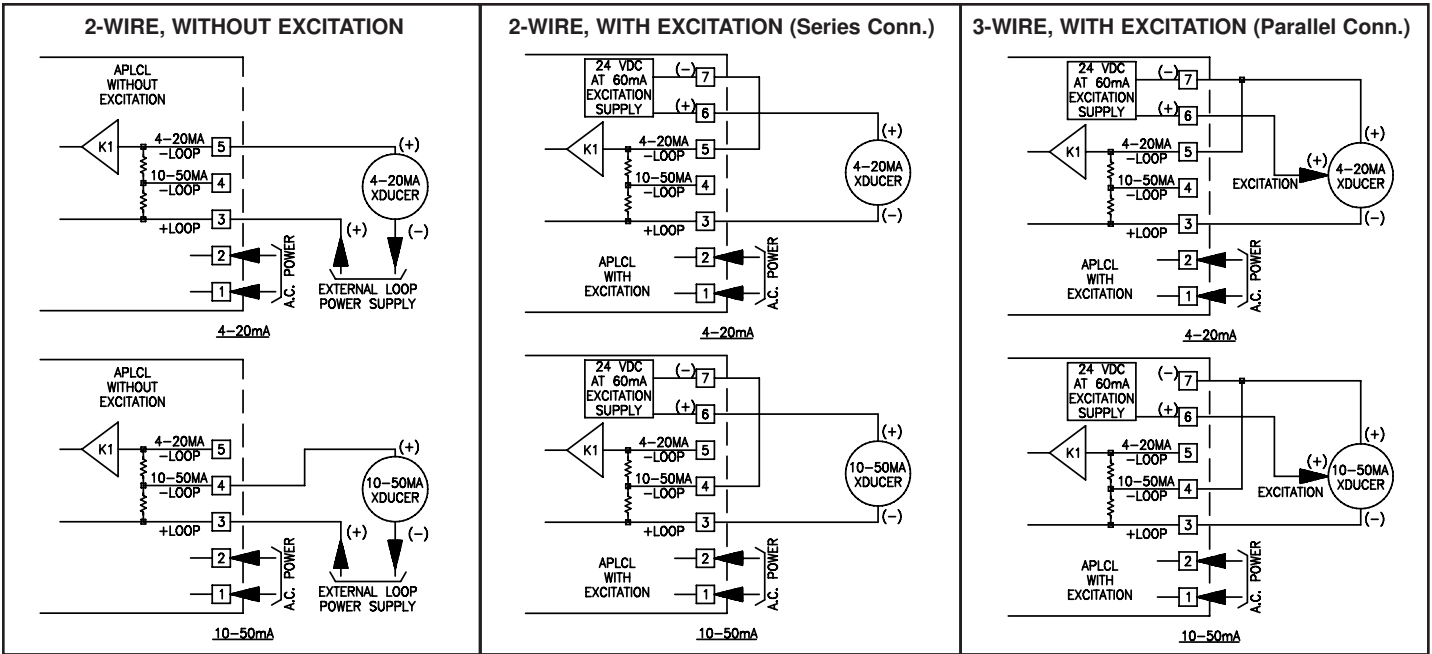SWING CURRENT (IS) = 20 mA(max) - 4 mA(min) = 16 mA

Note: Since the display readout is limited to 1999 numerical indication, the full READOUT SPAN of 3000 cannot be obtained during zero based span adjustment. However, dividing both the READOUT SPAN and SWING CURRENT by two, i.e. 1500 readout @ 8 mA, allows the span adjustment to be made for the proper transfer curve slope.

ADJUSTMENTS

Ⓐ Null the unit per Steps 1, 2, and 3.
Ⓑ Set transfer curve slope with span adjustments per Steps 4 and 5, to get a readout of +1500 @ 8 mA.
Ⓒ Apply *(-)* offset per Step 6 to get a reading of -1500 @ 4 mA.
Ⓓ Check min. and max. extremes and tweak if required to get desired readout @ 4 and 20 mA per Step 7.

CONNECTIONS

| 2-WIRE, WITHOUT EXCITATION	2-WIRE, WITH EXCITATION (Series Conn.)	3-WIRE, WITH EXCITATION (Parallel Conn.)

NOTES:

1. When shielded wire leads are used, connect the shield to Terminal 3 at the indicator and insulate the other end to avoid contact with machine ground.

2. Never run signal leads in conduit, bundles, or race ways with power conductors. Avoid runs close to contactors, relays, solenoids, transformers, and other potential sources of electrical noise.

INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel.
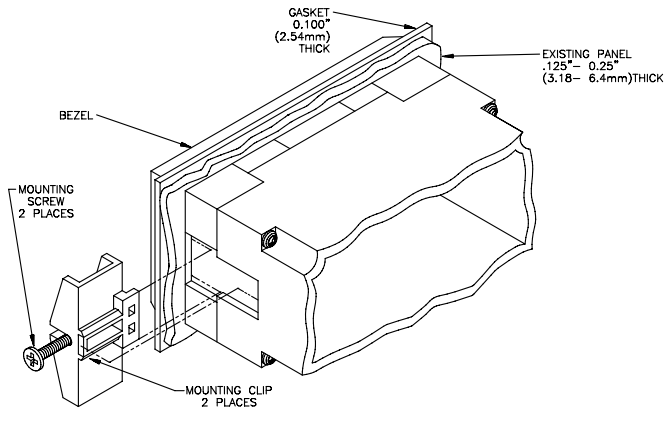
Installation

The Apollo Current-Loop Indicator is designed to be panel-mounted into an enclosed panel with a gasket to provide a water-tight seal. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin may distort and not provide a water-tight seal. The APLCL meets NEMA 4/IP65 requirements for indoor use when properly installed. (Recommended minimum panel thickness is 1/8".)

Cut the panel opening to the specified dimensions. Remove burrs and clean around the panel opening. Slide the panel gasket over the rear of the unit to the back of the bezel. Insert the unit into the panel. As depicted in the drawing, install the screws into the narrow end of the mounting clips. Thread the screws into the clips until the pointed end just protrudes through the other side.

Install each of the mounting clips by inserting the wide lip of the clips into the wide end of the hole, located on either side of the case. Then snap the clip onto the case. Tighten the screws evenly to apply uniform compression, thus providing a water-tight seal.

*Caution: Only minimum pressure is required to seal panel. Do **NOT** overtighten screws.*
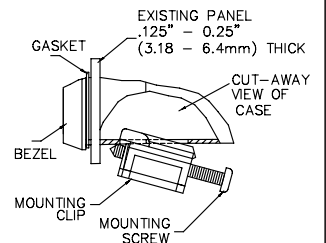
TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES	
		230 VAC	**115 VAC**
**APLCL	Apollo Current-Loop Indicator w/o Excitation	APLCL410	APLCL400
	Apollo Current-Loop Indicator w/24 VDC Excitation Supply	APLCL411	APLCL401
For information on Pricing, Enclosures, & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.			

** Units are shipped calibrated to read 000.0 to 100.0 with 4 to 20 mA input.