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MODEL CUBVD - MINIATURE D.C. VOLTMETER & MODEL CUBID - MINIATURE D.C. CURRENT METER

- *4 SELECTABLE D.C. RANGES*
- *0 to 199.9 mV, 1.999 V, 19.99 V, 199.9 V (CUBVD)*
- *0 to 199.9 µA, 1.999 mA, 19.99 mA, 199.9 mA (CUBID)*
- *3½-DIGIT, 0.35" (9 mm) LCD DISPLAY*
- *+5 VDC & 7 to 28 VDC POWERED VERSIONS*
- *BUILT-IN SCALING PROVISION*
- *AUTO ZEROING CIRCUIT*
- *SELECTABLE DECIMAL POINTS*
- *SEALED METAL FRONT BEZEL (NEMA 4/IP65)*

DESCRIPTION

The Cub Volt and Current Meters are high quality, compact, affordable instruments well suited for the typical industrial environment. Their compact size makes these units a first choice when choosing a product to fit in a crowded control panel.

The attractive, rugged metal bezel not only enhances the appearance of any control panel, but it can also provide a functional protective seal for use in wash-down areas and harsh industrial settings, when properly installed.

Connections to the unit are made via reliable, high integrity, clamp-type terminal blocks. Up to two 18-gage stranded wires can be accommodated per terminal block position.

Both the Volt and Current Meter models are available in two D.C. powered versions; a +5 VDC and a 7 to 28 VDC version.

SPECIFICATIONS

1. **DISPLAY:** 3½-digit *(-1999 to 1999)*, 0.35" (9 mm) high LCD display. Minus *(-)* sign is displayed when voltage or current is negative.
2. **DECIMAL POINTS:** Three DIP switch selectable, decimal points allow the display to be read in tenths, hundredths or thousandths.
3. **POWER:** Available in +5 VDC *(±10%)* or 7 to 28 VDC versions @ <4 mA.
4. **INPUT RANGES:**

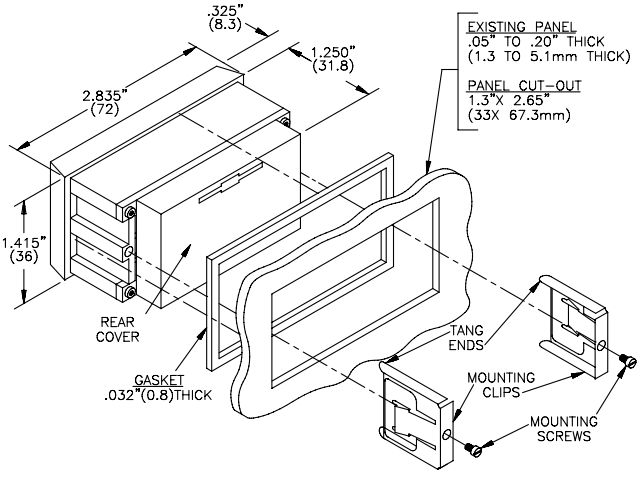
D.C. VOLTAGE (DIP Switch Selectable)	D.C. CURRENT (JMPR. Selectable)
±199.9 mVDC	±199.9 µADC
±1.999 VDC	±1.999 mADC
±19.99 VDC	±19.99 mADC
±199.9 VDC	±199.9 mADC

5. **ACCURACY:** (@ 23°C, less than 85% RH)
   D.C. Voltage: *±(0.1% + 1 digit)*
   D.C. Current: 199.9 µA, 1.999 mA, 19.99 mA ranges - *±(0.1% + 1 digit)*; 199.9 mA range - *±(0.15% + 1 digit)*
6. **OVERRANGE RATINGS, PROTECTION & INDICATION:**
   Max Voltage:
   0 to 199.9 mVDC range - 75 VDC
   All other voltage ranges - 300 VDC
   Max Shunt Currents: *(on current meters)*
   199.9 µA through 19.99 mA **-** 10 x max. range current
   199.9 mA **-** 1 amp
   Overrange Indication: Overrange is indicated by a one in the most significant digit and the blanking of the three least significant digits.
7. **READING RATE:** 2.5 per second
8. **RESPONSE TIME:** 1.5 seconds to settle for a step change
9. **NORMAL MODE REJECTION:** 60 dB 50/60 Hz
10. **INPUT IMPEDANCE:**
    Voltmeter - 1 MΩ
    Current Meter - 199.9 µA - 1 KΩ
    1.999 mA - 100 Ω
    19.99 mA - 10 Ω
    199.9 mA - 1 Ω
11. **TEMPERATURE EFFECTS:**
    Operating Range - 0 to 60° C
    Storage Temperature - - 40 to 80° C
    Temperature Coefficient - 100 PPM/°C
12. **CONSTRUCTION:** Die cast metal bezel with black, high impact plastic insert. Front panel meets NEMA 4/IP65 requirements for wash-down and dusty environments when properly installed. (Panel gasket and mounting clips included.)
13. **WEIGHT:** 5.4 oz (153 g)

PANEL INSTALLATION

The Models CUBVD and CUBID are designed to be panel-mounted. A cut-out of the size given below should first be cut in the panel. After cutting the opening in the panel, slide the panel gasket over the rear of the unit, up against the rear of the bezel. Slide the unit through the panel cut-out. Install mounting clips on each side of the unit body with the recesses in the side of the body so that the *"tang ends"* wedge between the panel opening and the body as the screws are tightened.

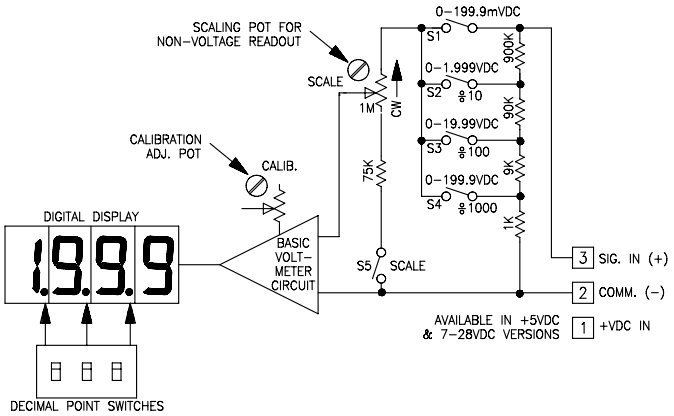
DIMENSIONS In inches (mm)



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES	
		7 to 28 VDC	+5 VDC
CUBVD	Cub DC Voltmeter	CUBVD002	CUBVD001
CUBID	Cub DC Current Meter	CUBID002	CUBID001

CUB D.C. VOLTMETER INPUTS & CONNECTIONS



The simplified schematic *(left)* shows all the features that permit the Cub Voltmeter to cover most in-plant D.C. voltage related measurements. There are 4 basic voltage ranges that can be selected by the setting of DIP switches S1 - S4.

Note: No more than one Voltage Range switch (S1-S4) is to be on at any time.

The *"SCALE"* switch *(S5)* and *"SCALING ADJ. POT."*, are used when a non-voltage *(other engineering units)* readout is required. The *"SCALE"* switch should be left in the *"OFF"* position when the application requires direct voltage displays.

The *"CALIBRATION ADJ. POT."* has been set at the factory. This pot should not be adjusted unless the unit is being re-calibrated with an accurate voltage source.

The Power supply common and the measurement common are to be connected together at the *"COMM.(-)"* position on the terminal block. If the power supply is not floating with respect to the two measurement connections, the measurement common *(-)* must be at the same voltage potential as the power supply common. In other words, the voltmeter cannot measure a voltage with a reference that is different than the power supply common.

Caution: *When in the 0 to 199.9 mVdc range (switch S1 on), the voltage applied to the signal inputs must not exceed 75 V, or the unit may be damaged.*

VOLTMETER SCALING

In many industrial applications, a voltage sensing instrument is required to display a reading in terms of PSI, RPM, or some other variable. The signal voltage being measured is normally generated by a transducer which senses the variable and delivers a linearly proportional output voltage. In order to provide the desired readout at the specified voltage, the voltmeter must be scaled. The Scale switch, when in the *"ON"* position, inserts the Scale Adj. Pot. into the circuit. The Scale Adj. Pot., in conjunction with the Voltage Range Selection switches provides a means of scaling the unit. The range switches are used to select among 4 coarse Division Factor ranges and the Scale Adj. Pot. is then used to fine scale within the selected range. The chart below shows the division factor range associated with each range selection switch.

DIVISION FACTOR RANGE SELECTION CHART

S1 - 0-199.9 mVDC ($0.1 \leq D.F. \leq 1.2$)
S2 - 0-1.999 VDC ($1.2 \leq D.F. \leq 10.5$)
S3 - 0-19.99 VDC ($10.5 \leq D.F. \leq 100.5$)
S4 - 0-199.9 VDC ($100.5 \leq D.F. \leq 1300$)

Note: The normal decade division factors (÷10, ÷100, ÷1000) have been adjusted to account for the extra loading that occurs when the Scale Adj. pot. is switched into the above circuit ("SCALE" switch is "ON").

In order to determine the proper range switch set-up for an application requiring scaling, the *"Division Factor"* that will be required to provide the proper display must first be determined.

USING THE FORMULA:

$$\frac{VT \times D.D.P.}{D.R.} = D.F.$$

WHERE:

VT = Maximum Transducer Output
D.D.P. = Display Decimal Point
D.F. = Division Factor
D.R. = Desired Reading

D.D.P.
0.000 = 1
00.00 = 10
000.0 = 100
0000 = 1000

The DISPLAY DECIMAL POINT (D.D.P.) is determined by the desired decimal point placement in the readout.

After the Division Factor for the application has been calculated, the proper range switch that will provide for the Division Factor is set to the *"ON"* position. Use the *"Division Factor Range Selection Chart"* to choose the proper switch setting.

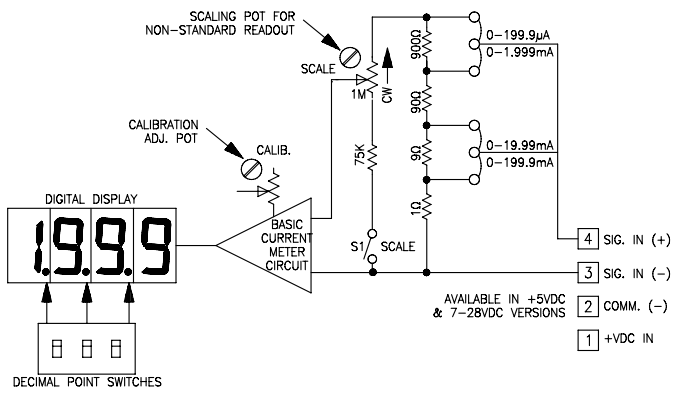
Note: Only one switch should be turned on. Set the switches before the voltage that is to be measured is applied.

EXAMPLE #1: A relative humidity transducer delivers a 7.0 VDC voltage at a relative humidity of 75%.

$$D.F. = \frac{VT \times D.D.P.}{D.R.} = \frac{7.0 \times 1{,}000}{75} = 93.3$$

This Division Factor falls between 10.5 & 100.5, so set DIP switch position S3 to the *"ON"* position. The *"SCALING ADJ. POT."* is then adjusted to get the desired readout at a known relative humidity.

CUB D.C. CURRENT METER INPUTS & CONNECTIONS



The Cub Current Meters have four basic current ranges which cover 0 to 199.9 µADC to 0 to 199.9 mADC. The schematic *(left)* shows a functional overview of the unit. The desired range is selected by plugging a 2-position female mini-jumper in the proper position on a 6-position male header strip.

The *"SCALE"* DIP switch *(S1)* and *"SCALING ADJ. POT"* is used when the readout is to be in units other than microamps or milliamps. The *"SCALE"* switch should be left in the *"OFF"* position when direct current displays are required.

When the power supply is floating *(unreferenced)* to the desired measurement points, the *(-)* signal input and the power supply common should be connected together. If the power supply is not floating *(is referenced)*, the common mode voltage between the *"SIG.IN(-)"* and *"COMM."* terminal must not be greater than 1.0 V peak. A common mode voltage higher than 1.0 VP will cause display error in the measurement.

The *"CALIBRATION ADJ. POT."* has been set at the factory. This pot should not be adjusted unless the unit is being re-calibrated with an accurate current source.

Caution: The Maximum Current for each shunt position must not be exceeded or the unit may be damaged (See Specifications).

CURRENT METER SCALING

The numerical value displayed by the Cub Current Meter can be scaled down to almost any lower numerical value by setting the *"SCALE"* switch to the *"ON"* position, and utilizing the *"SCALE"* adjustment pot along with the current range selection mini-jumper. The *"SCALE"* pot can be set to divide the normal numeric current reading by any division factor between ÷1 and ÷13. The shunt resistance can be changed by moving the mini-jumper to the desired resistance.

EXAMPLE - The Cub Current Meter has been connected to measure a circuit current to 120.0 mA maximum. However, in this application, the readout is to be in percent of load current, with 120.0 mA being equivalent to 100.0% readout. The scale adj. pot. can be adjusted to reduce the normal 120.0 mA display to the 100.0 display that is desired.

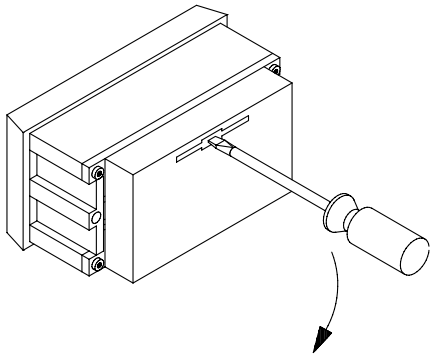
Scaling to obtain a numerical readout higher than the numerical value of the current can also be done in most cases by selecting a lower range. However, the maximum shunt current for the range must not be exceeded. *(See "Specifications" for maximum shunt currents.)*

DECIMAL POINT SELECTION

The Cub Volt and Current Meters can be set-up to read in 10ths, 100ths, or 1000ths. The decimal points are DIP switch selectable to select one of three decimal point locations. The DIP switches are located behind the rear cover.

REAR COVER REMOVAL

The rear cover can be removed by placing a small screwdriver in the slot and applying a small amount of downward pressure.



TYPICAL VOLT & CURRENT MEASUREMENT APPLICATIONS

VOLTMETER APPLICATION

Measuring the Speed of a D.C. Motor

A foreman in a plant wants to get a more accurate indication of the speed at which a variable speed DC motor drive is operating. The only indication he has had is the position of a dial on the control panel.

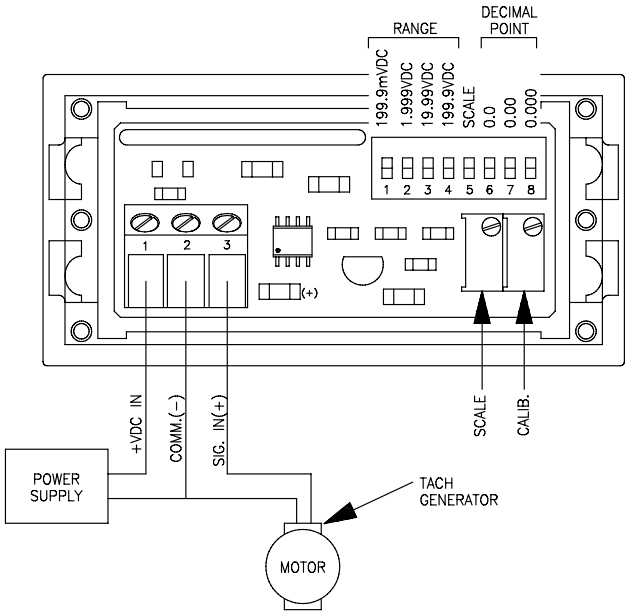
The motor has a tach generator that will output a 10 VDC signal when the motor is running at its maximum speed of 1800 RPM. The power supply of the control has a 15 VDC output which can supply power to the Cub.

Since this application requires a non-voltage readout, it will be necessary to scale the display. The *"SCALE"* DIP switch is set to the *"ON"* position to enable the *"SCALE"* adjustment pot to be used. The division Factor is calculated utilizing the formula:

$$\text{D.F.} = \frac{\text{(Maximum output)}}{\text{(Desired Display)}} \times \text{D.D.P.} = \frac{10 \times 1{,}000}{1800} = 5.5$$

Utilizing the *"DIVISION FACTOR SELECTION CHART"*, it can be seen that with a Division Factor of 5.5, DIP switch position S2 should be set to the *"ON"* position, since the division factor falls between 1.2 and 10.5.

To calibrate the Cub Voltmeter, the motor is run at full speed and a photo tach is used to obtain the exact speed. The *"SCALE"* adjustment pot on the Cub Voltmeter is then adjusted until the display reading agrees with the tach.



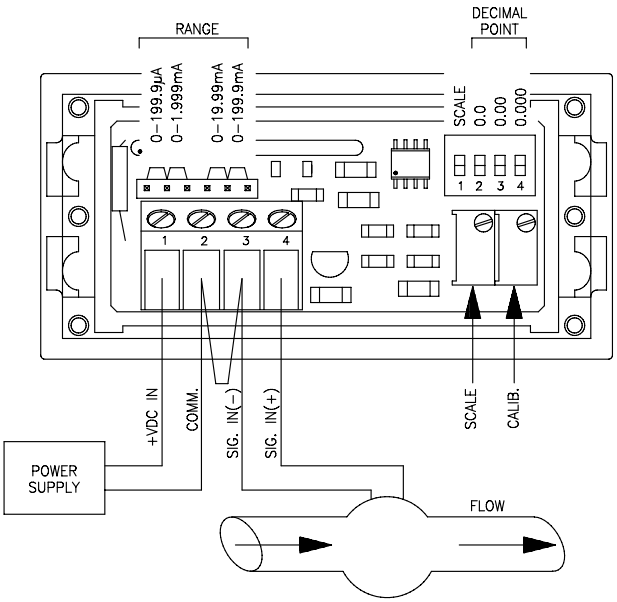
CURRENT METER APPLICATION

Analog Meter Replacement

A manufacturer wants to replace several 1 mA DC analog meter movements with easily readable Cub Current Meters. One particular application involves measuring the flow rate of a liquid. The analog meter had indicated the amount of flow, 0 to 250 gallons per minute.

Since 1 mA of current flow is to give a reading of 250, the Cub Current Meter will need to be scaled. To enable the *"SCALE"* adjustment pot, the *"SCALE"* switch must be set to the *"ON"* position. The proper current range for the application must then be selected. The *"SCALE"* pot will allow us to divide the display reading by 1 to 13, for the particular current range selected. Since the reading of 250 is 4 times less than what the non-scaled reading would be when in the 0 to 1.999 mA range, that range is chosen. The 2-position female mini-jumper is installed in the 0-1.999 mA range position. No decimal point is selected because the resolution is 1 gallon.

The Cub Current Meter can now be calibrated. At a known flow rate the Cub's *"SCALE"* pot is adjusted to read the same. An easy way to check the calibration of the Cub would be to compare the actual current measurement *("SCALE" switch off)* with the scaled reading *("SCALE" switch on)*. The scaled reading should be exactly 4 times less than the actual non-scaled reading. For example, if 1.000 mA of current is flowing, the unit will read 1000 *(decimal point switch is not on)* with *"SCALE"* off and 250 with *"SCALE"* on, if the unit has been calibrated properly.



LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

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