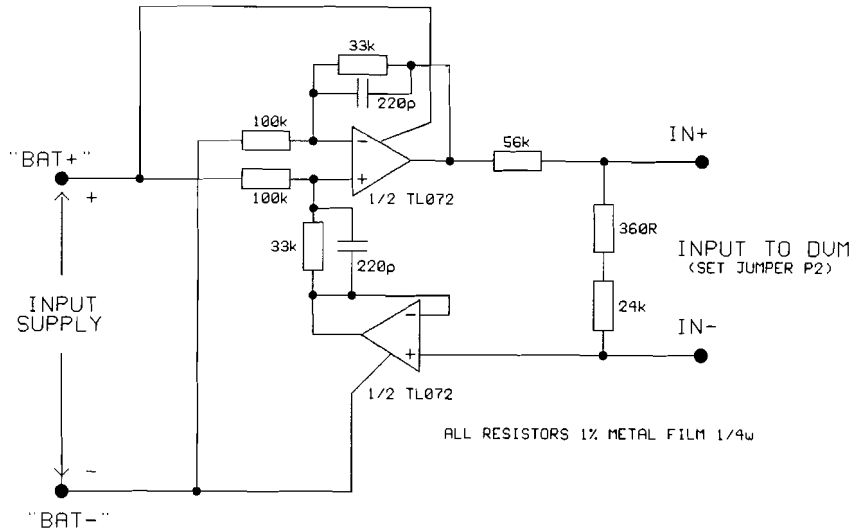


**Circuit to enable the panel meter to measure
its own supply voltage**



CIRCUIT TO READ INPUT SUPPLY ON PM-438

Circuit Function

The DVM cannot measure its own supply by direct connection of the supply to the measurement input terminals, because both IN+ and IN- inputs sit at approximately 6.3V above the supply 0V.

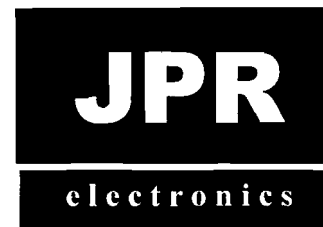
There are several ways to scale and level-shift the monitored supply voltage. The solution given above, using the *Howland* current source is probably the most economical in components.

The accuracy obtained with typical op-amp offsets and 1% resistors is approximately $\pm 2\%$. For improved accuracy, trim R5 to give the correct reading for a known power supply input.

**LCD Panel Meter
PM438**

Product Code:
375-102

Distributed by:



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Introduction

This DVM is a 3½ digit panel meter with FSD ± 199.9 mV, automatic polarity indication, with accuracy $\pm 0.5\% \pm 1$ digit.

Technical Data

Input impedance	>100M Ω
Accuracy	$\pm 0.5\% \pm 1$ digit
Measurement range	199.9mV
Indication method	LCD display
Measurement method	Dual-slope integration A/D
Power supply	8 — 12V DC (9V battery)
Supply current	≈ 1 mA
Operating temperature range	23°C $\pm$ 5°C
Size	68mm x 44mm

DC Supply

The input required is 8 — 12V DC @ 1mA from battery or power supply. Connections are labelled V+ and V-. Check the polarity “+” and “-” before connection.

General Description

Analogue-to-digital Converter

This panel meter uses a low power CMOS 3½ digit analogue-to-digital converter.

The DC voltage at the input measurement connection (IN-) is approximately +6.3V relative to the negative terminal (V-) of the power supply or battery).

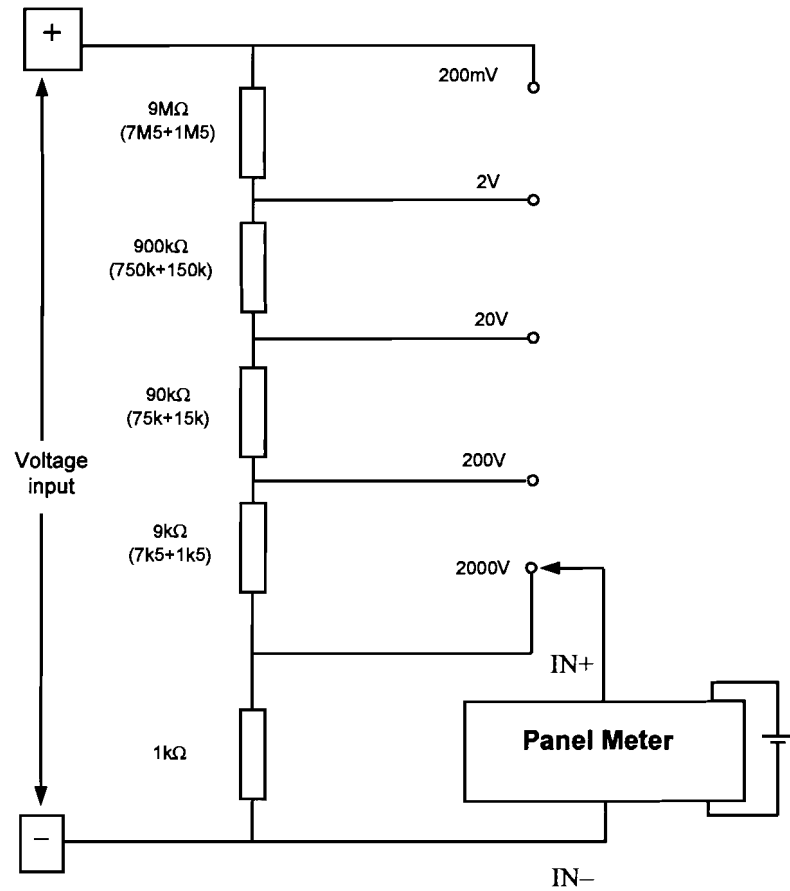
Reference Adjustment

The internal reference is factory-set to give the correct reading for a known voltage applied to the input terminals.

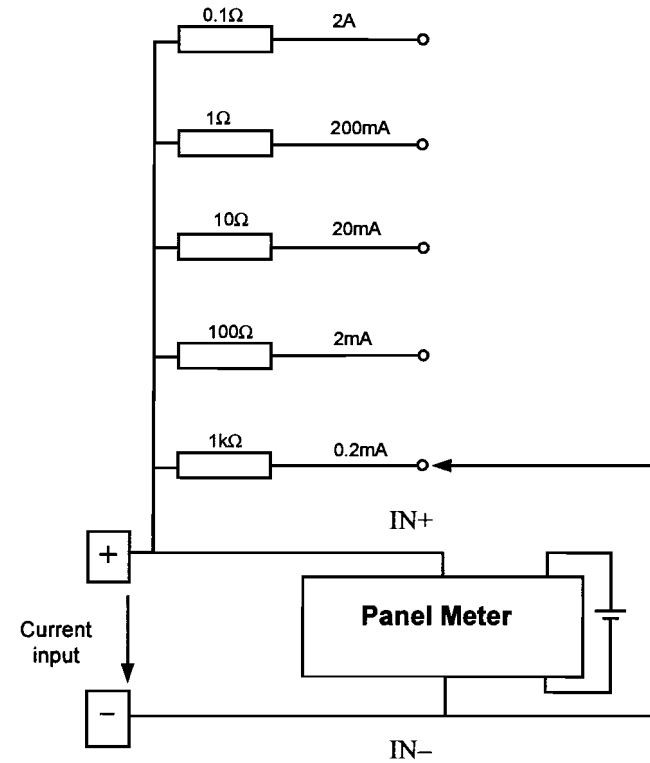
Decimal Point

The decimal point is set by jumpers P1, P2 and P3 (see “How to expand”).

Multirange Voltmeter Expansion

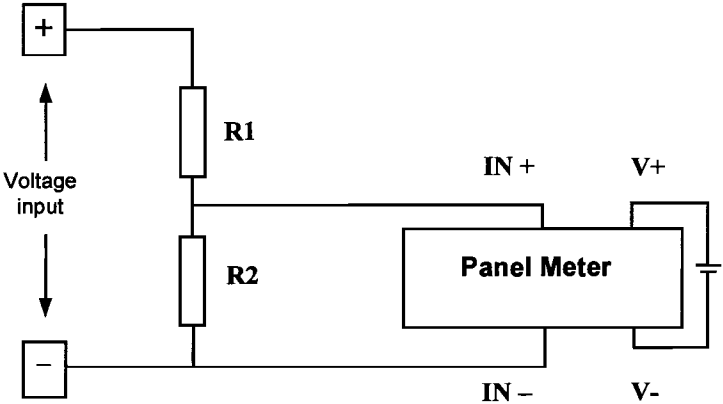


Multirange Current Meter Expansion



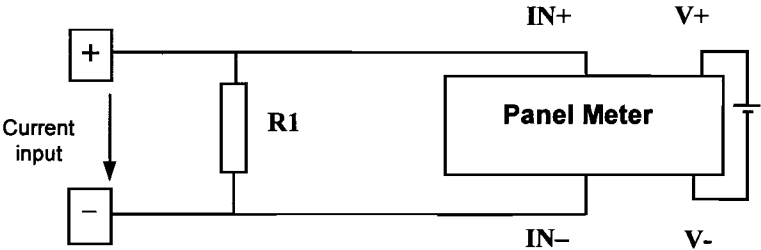
How to Expand

To expand the range of voltage to be measured, remove RA (10MΩ) and RB (s/c link) from meter PCB and connect external resistors as follows:



Range	R1 (Theoretical value)	R1 (Practical combination)	R2	Fit Jumper link
20V	9.9MΩ	7.5MΩ + series 2.4MΩ	100kΩ	P2
200V	9.99MΩ	10MΩ	10kΩ	P3
2000V	9.999MΩ	10MΩ	1kΩ	no jumper

To expand the range of current to be measured, use the correct value of shunt resistor R1 as shown below:



Range	R1
0.2mA	1kΩ
2mA	100Ω
20mA	10Ω
200mA	1Ω
2A	0.1Ω