HED271 ■ HED272 ■ DPM961 ■ DPM962

Panel Mount Digital Multimeters

CE

Features

- **Low power consumption**
- **5 or 9 volt dc operation (customer selectable)**
- **Multi-turn voltage-reference potentiometer for accurate adjustment of display reading (HED271/HED272)**
- **Annunciators for common engineering units**
- **Low battery warning (9 volt operation only)**
- **Hold function with annunciator**
- **Large character height, 10mm on HED271/DPM961 and 14mm HED272/DPM962**
- **DIN standard housings, 24x48mm HED271/ DPM961 and 36x72mm on HED272/DPM962**
- **Low cost versions available (DPM961/DPM962)**

These modules are low profile LCD digital panel meters conforming to DIN standard panel cut-outs. They use advanced components and construction techniques to provide performance combined with elegant appearance at a cost previously unattainable. The LED backlight (-T/BL version) provides a clear, easy to read display under all lighting conditions. The very low power consumption makes either module ideally suited to battery powered applications.

Features include 200mV full scale reading, programmable annunciators and decimal point, auto-polarity and operation from 5V or 9V supplies. In 5V mode each module generates its own -5V supply which enables it to measure signals with the same common zero as the supply. Connections are brought out to enable the module to operate in various modes including single ended, ratio measurement and differential. Different modes are selected by linking PCB solder pads which are provided for the purpose.

Specification

	Min	Typ	Max	Units
Accuracy (±1 Count)		0.1	0.1	%
Linearity			± 1	count
Sample Rate		3		per sec
Temperature Stability		30		ppm/°C
Operating temp range	0		50	°C
Storage temp range	-20		70	°C
Supply voltage (5V mode)	3	5	7	Vdc
Supply voltage (9V mode)	7	9	12	Vdc
Supply current		2		mA
Backlight current (HED271-T/DPM961-BL)			80	mA
Backlight current (HED272-T/DPM962-BL)			160	mA
Input impedance	100			MΩ

Connections

Rear views showing connections and links
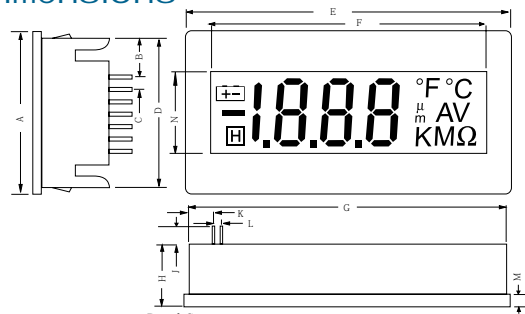HED271/ DPM961

Annunciator Connectors
- De-select
- LEGEND
- Select

HED272/ DPM962
CN2 not present on DPM962

Supplied with 0Ω link in R$_A$ and R$_B$ open.
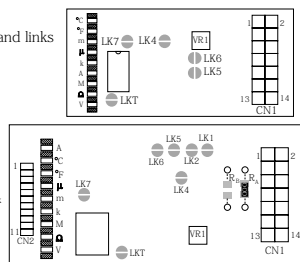
Dimensions

Panel Cut-out:
HED271/DPM961: 45.3 (+ 0.5/-0) x 22.2 (+ 0.3/-0) mm
HED272/DPM962: 68.2 (+ 0.5/-0) x 33.3 (+ 0.5/-0) mm

	HED271 / DPM961	HED272 / DPM962
A	24mm (0.95")	36mm (1.42")
B	3.5mm (0.14")	9mm (0.35")
C	2.54mm (0.1")	2.54mm (0.1")
D	22mm (0.87")	33mm (1.3")
E	48mm (1.89")	72mm (2.83")
F	37mm (1.46")	61mm (2.4")
G	45mm (1.77")	68mm (2.68")
H	14mm (0.55")	14mm (0.55")
J	5mm (0.2")	6mm (0.24")
K	5mm (0.2")	6mm (0.24")
L	2.54mm (0.1")	2.54mm (0.1")
M	3mm (0.12")	3mm (0.12")
N	13mm (0.51")	18mm (0.7")

Connector CN1

| Pin	Name	Function
1	IN HI	Positive measuring input
2	IN LO	Negative measuring input
3	VDD	Module DC positive supply + 5V or + 9V
4	VSS	Module DC negative supply 0V
5	COMMON	Analog common input
6	BACKLIGHT (+ ve)	Connect to + 5V or with external resistor for + 9V supply. *See below
7	HOLD	Connect to VDD (pin 3) to freeze display
8	REF HI	Positive reference voltage input
9	ANNUNCIATOR ON (BP)	Connect to pin 12, 13 or 14 to select decimal point position
10	ANNUNCIATOR OFF (BP)	Connect to all unused annunciators or decimal point inputs
11	BACKLIGHT (-ve)	Backlight 0V supply
12	DP3	Decimal point 1.999
13	DP2	Decimal point 19.99
14	DP1	Decimal point 199.9

*Resistor value for HED271/DPM961 Backlight = 68Ω
*Resistor value for HED272/DPM962 Backlight = 33Ω

Panel Mount
Digital Multimeters

Block Schematic Diagram showing PCB Links

Note: Links LK1 and LK2 are not present on HED271/DPM961
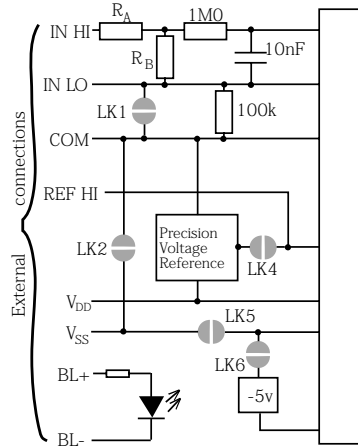
Links & Mode Connections

Function (Note: There is no LK3 link on either model)	On HED271/ DPM961	On HED272/ DPM962
Links ANALOGUE COMMON to IN LO	Connect CN1 pins 2-5	Solder LK1
Links ANALOGUE COMMON to VSS	Connect CN1 pins 4-5	Solder LK2
Links REF HI to VR1 (remove link if using external reference voltage circuit)	Solder LK4	Solder LK4
Power supply voltage mode link (see Power Supply Mode Selection)	Solder LK5	Solder LK5
Power supply voltage mode link (see Power Supply Mode Selection)	Solder LK6	Solder LK6
Disables low battery function. Always disable for 5V operation	Solder LK7	Solder LK7
TEST LINK. Forces display to 1888. Do not use for more than 2 seconds or damage to the display may occur	Briefly bridge LKT	Briefly bridge LKT

Internal Reference Voltage

The internal reference voltage (REF HI) is set by VR1. This is a 9 turn pot for greatest accuracy. (Single turn for DPM961 and DPM962) The voltage is factory set at 100.0mV but may be trimmed to suit individual applications, eg. to compensate for the inaccuracy of external resistors when using scaling configurations.

Analogue Inputs

IN HI, IN LO and REF HI are all differential inputs. They respond to the voltage across them and not to the voltage with respect to the power supply. The only exception to this is in 5V mode where the analogue common and VSS have been connected together (using pins 4/5 on HED271/DPM961 and LK2 on HED272/DPM962).

There is a limit to the voltage which can be measured using a differential input and this is known as the common mode range. No input may be taken outside the range V+ minus 0.5V and V- plus 1.0v. If there is a danger that any input may be taken outside these limits, it is necessary to fit a resistor of suitable value to limit the current to 100µA in series with the input or damage to the unit may occur.

Power Supply Mode Selection

The following power supply mode connections apply to both models. The low battery function must be disabled in 5V operation. In 9V operation, it may be enabled or disabled.

5 volt mode	9 volt mode
LK5 Open	LK5 Shorted
LK6 Shorted	LK6 Open

Annunciators

There are annunciator connections, each with its legend, provided on the PCB. Refer to the connections diagram. To display an annunciator, solder a connection between the required LEGEND solder pad and the adjacent SELECTED solder pad. For the annunciators that are not in use, solder a connection between the associated LEGEND and the adjacent NOT SELECTED solder pad to ensure that they do not appear.

Wiring Examples for Options
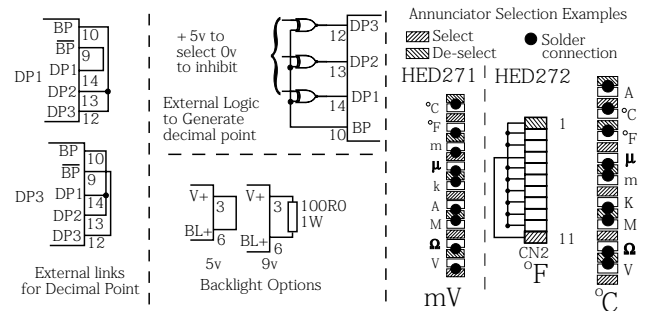
Connector CN2 (HED272 only)

(Note: provision is made for this connector on the DPM962 but is not included).

Pin	Annunciator	Function
1	BP	SEGMENT NOT SELECTED
2	A	Amps
3	°C	degrees Celsius
4	°F	degrees Fahrenheit
5	µ	micro
6	m	milli
7	K	Kilo
8	M	Mega
9	Ω	ohms
10	V	Volts
11	$\overline{BP}$	SEGMENT SELECTED

Application Circuits

**Note:** In the application circuits, power is supplied on pins V+ and V-.

Caution: Where the measurement voltage is referenced to the supply voltage (in either current or voltage applications) the voltage on IN HI or IN LO must not exceed ± 4.5V for 5V supply or ± 3.5V for 9V supply.

Scaling Configuration

You can configure the module (semi-permanently) for different voltage ranges by soldering resistors in the positions RA and RB. As supplied RA has a 0Ω resistor fitted. (For switching between ranges see Multi-voltage). On the HED271/DPM961 RA and RB must be fitted externally.
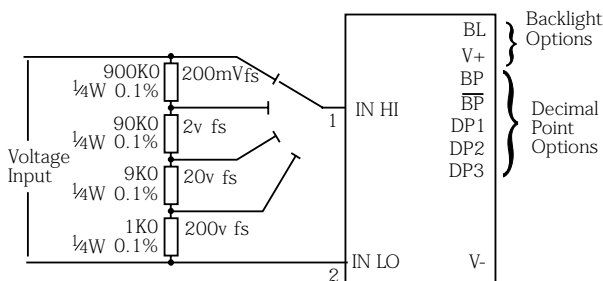
Note: 0.1% resistors are required to maintain an accuracy of 0.1%. This may be relaxed if an accuracy less than this is required.

Voltage Measurement
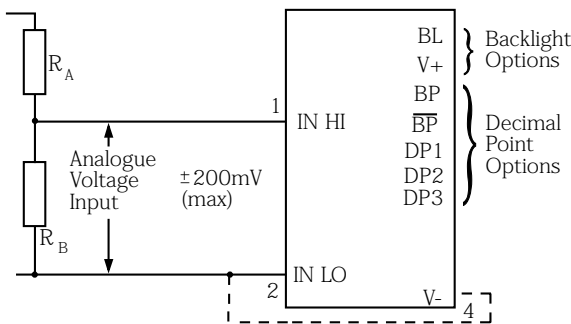
Required full scale	$R_A(\Omega)$	$R_B(\Omega)$
200mv	0R	Open
2V	900K	100K
20V	990K	10K
200V	999K	1K

Multi - Voltage Measurement

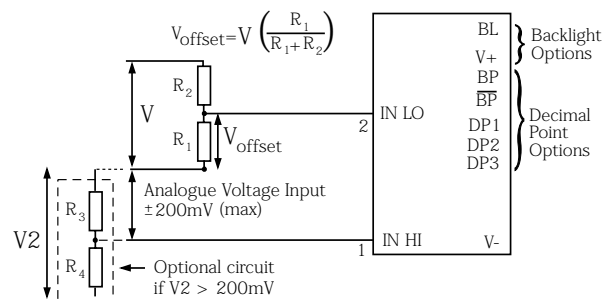| Link:	HED272/DPM962	HED271/DPM961
Floating I/ P voltage (5V)	LK2, 4, 6 & 7	LK4, 6 & 7 and connect CN1 pins 4 & 5
Floating I/P voltage (9V)	LK4 & 5	LK4 & 5
I/P common to 0V (5V)	LK1, 2, 4, 6 & 7	LK 4, 6 & 7 and connect CN1 pins 2, 4 & 5
I/P common to 0V (9V)	Not possible	Not possible

Voltage Ratio Measurement

Voltage Ratio $= 1000\,V2/V1$

(Note: in 5V mode common is linked to VSS)
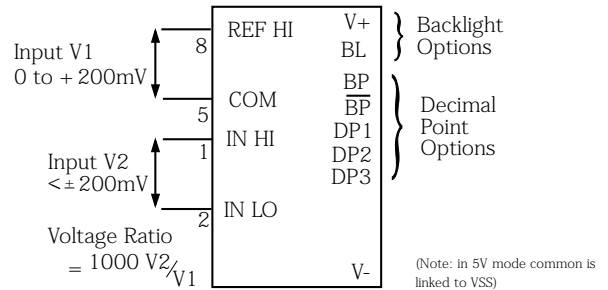
Link:	HED272/DPM962	HED271/DPM961
Floating I/P voltage (5V)*	LK2, 6 & 7	LK6 & 7 connect CN1 pins 4 & 5
Floating I/P voltage (9V)	LK5	LK5
I/P common to 0V (5V)	LK1, 2, 6 & 7	LK6 & 7 connect CN1 pins 2, 4 & 5
I/P common to 0V (9V)	Not possible	Not possible

*In 5V mode, the supply 0V and common (terminal 5) are linked together. V1 input is therefore not floating, V2 is floating
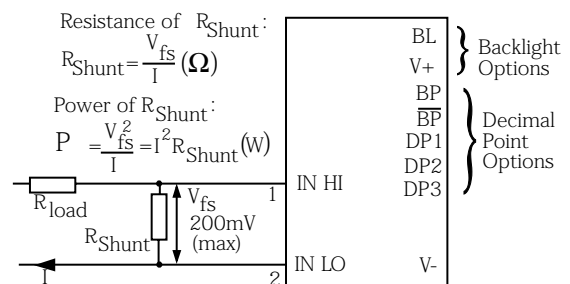
Voltage Offset Measurement

$$V_{offset} = V\left(\frac{R_1}{R_1 + R_2}\right)$$

Current Measurement

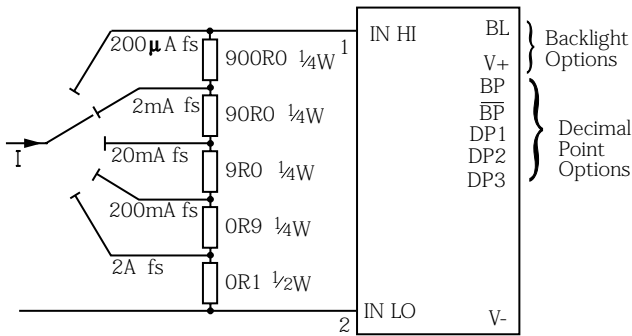| Link:	HED272/DPM962	HED271/DPM961
Floating I/P voltage (5V)	LK2, 4, 6 & 7	LK4, 6 & 7 and connect CN1 pins 4 & 5
Floating I/P voltage (9V)	LK4 & 5	LK4 & 5

(Note: in 5V mode common is linked to V5)

Resistance of R_{Shunt}:

$$R_{Shunt} = \frac{V_{fs}}{I}\,(\Omega)$$

Power of R_{Shunt}:

$$P = \frac{V_{fs}^2}{I} = I^2 R_{Shunt}\,(W)$$

Current	R Shunt (Ω)	P (R Shunt) (W)
200 mA	1	0.04
2A	0.1	0.4
20A	0.01	4

Application Circuits

Multi-current Measurement

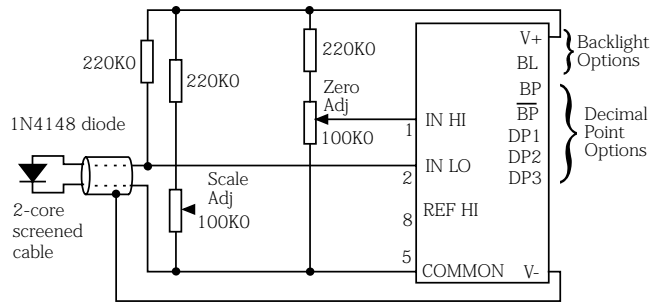| Link:	HED272/DPM962	HED271/DPM961
Floating I/P voltage (5V)	LK2,4, 6 & 7	LK4, 6 & 7 and connect CN1 pins 4 & 5
Floating I/P voltage (9V)	LK4 & 5	LK4 & 5
I/P common to 0V (5V)	LK1, 2, 4, 6 & 7	LK4, 6 & 7 and connect CN1 pins 2, 4 & 5
I/P common to 0V (9V)	Not possible	Not possible

Caution: In 5V operation on both the HED271/DPM961 and HED272/DPM962, the shunt resistor must be between the load and OV/ground or the module will be damaged.

Two HED27 measuring current and voltage from common supply
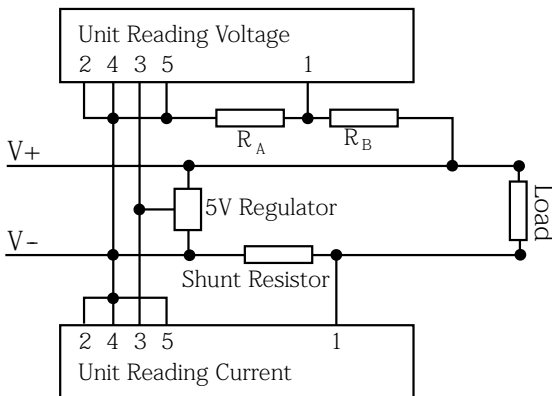
The shunt resistor must be between the load and Ov/ground or the module will be damaged.

## Temperature Measurement using a Signal Diode

Temperature Measurement Set Up

Link:	HED272/DPM962	HED271DPM961
5V Supply	LK2, 6 & 7	LK6, 7 and connect CN1 pins 4 & 5
9V Supply	LK5	LK5

1 Adjust the SCALE ADJ pot to read 100mV between REF HI (pin8) and COM (pin 5)
2 With the temperature probe diode at 0ºC adjust the ZERO ADJ pot to indicate 00.00 on the display.
3 Increase the temperature of the probe to a known value (xºC). When the display has stabilised, take a reading (yºC).
4 Calculate the new value for REF HI voltage as yºC/xºC x 100mV.
5 Adjust the SCALE ADJ pot to read the new REF HI value between REF HI (pin 8) and COM (pin 5)

Temperature Measurement using a Thermocouple
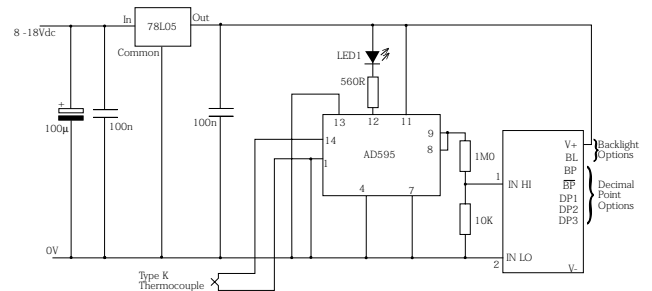
Theoretical Range using 'K' Thermocouple: 0-2,000ºC (Practical range depends on range of thermocouple used) LED1 provides indication of overload or themocouple open circuit.

Link:	HED272/DPM962	HED271/DPM961
	LK1, 2, 4, 6 & 7	LK4, 6 & 7 and connect CN1 pins 2, 4 & 5

Ordering Information

HED271-R / DPM961-R   24x48mm Multimeter.
HED271-T / DPM961-T   24x48mm Multimeter with backlight.
HED272-R / DPM962-R   36x72mm Multimeter.
HED272-T / DPM962-T   36x72mm Multimeter with backlight.