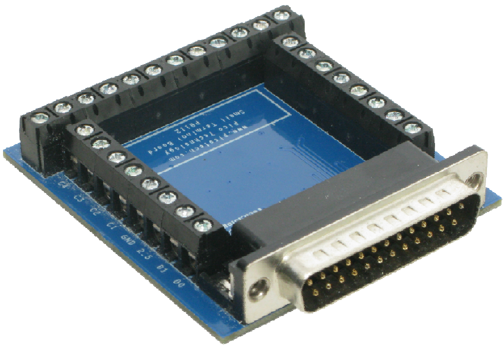
Small Terminal Board

User's Guide



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Issues:

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1 Overview

1.1 Introduction

The Small Terminal Board is an accessory for the PicoLog 1012 and 1216 Data Loggers. The screw terminals allow sensor wires to be attached to the data logger without soldering. The terminal board also has solder pads where you can fit resistors to extend the input ranges of the logger.

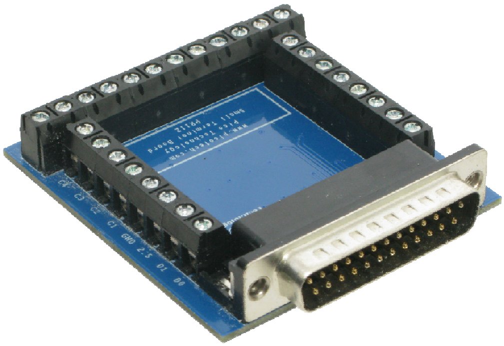

Figure 1 - Small Terminal Board

1.2 Specifications

Dimensions	62 x 72 x 18 mm (approx. 2.44 x 2.83 x 0.71 in.)
Weight	50 g nominal (approx. 1.76 oz)
Terminal wire size	0.6-1.6 mm (14-22 AWG)

1.3 Connecting the Terminal Board to the Data Logger

You can plug the Terminal Board directly into the analog connector on the PicoLog Dta Logger, or you can use a standard 25-way male-D to female-D parallel cable to connect the two units.

Using a cable will increase the noise and crosstalk between channels. If you make your own cable, you can minimise this problem by using a signal/ground twisted pair for each channel.

1.4 Terminals and solder pads

The table below shows the purpose of each of the screw terminals and solder pads on the Terminal Board. For details of the inputs and outputs of the data logger, see the PicoLog 1012 and 1216 User's Guide.

Marking on Terminal Board	**Description**
C1…C16 *	Analog input channels 1 to 16 *
D0…D3	Digital outputs
GND	Circuit ground
2.5	2.5 volt power output for sensors
PWM	Pulse-width modulated output
R1, R3, R5 etc.	Solder pads for 0805 series resistors in analog inputs (see Figure 4). Before you fit a resistor in one of these sites, you must cut the track between the two solder pads (see Figure 5).
R2, R4, R6 etc.	Solder pads for 0805 shunt resistors between each analog input and GND (see Figure 4).

* The PicoLog 1216 has channels 1 to 16.
The PicoLog 1012 has channels 1 to 12.

Table 1 - Terminals and resistor sites

2 Making measurements

2.1 Measuring voltages up to +2.5 V

For voltage sources from 0 V to +2.5 V, you can connect directly to any analog input channel. With this method, there is no need to fit any additional components to the Terminal Board.

Figure 2 shows analog channel 1, but the connections are similar for the other channels.

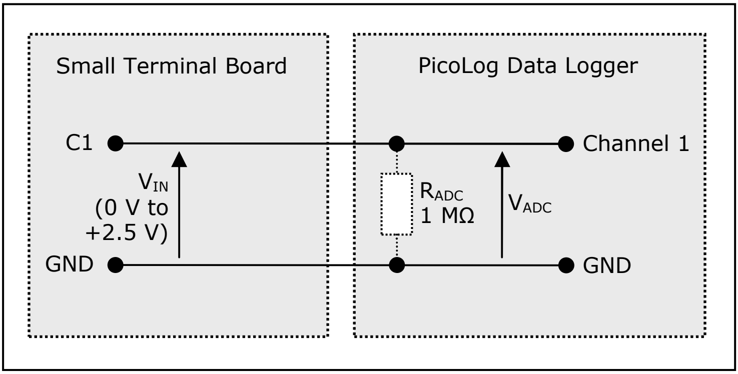

Figure 2 - Direct input to channel

2.2 Measuring voltages above +2.5 V

For voltages above +2.5 V, use a voltage divider connection. You will need to cut one track on the Terminal Board and fit two 0805 surface-mount resistors for each channel that you wish to use in this way.

Figure 3 shows the voltage divider circuit for analog channel 1, but the connections are similar for the other channels.

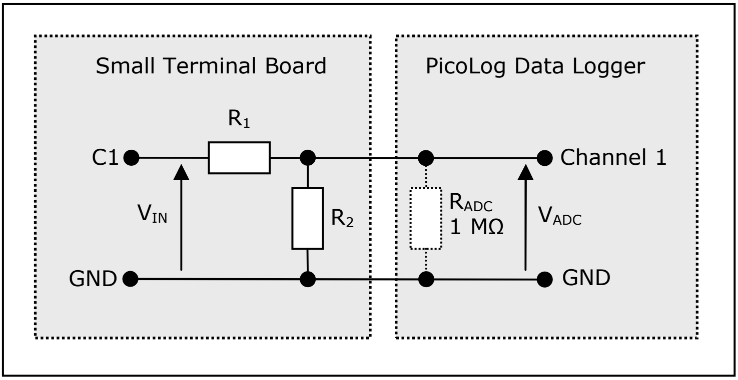

Figure 3 - Voltage divider

The voltage that the ADC sees, V_{ADC}, depends on V_{IN} and the values of R_1 and R_2, and is given by the following equation:

$$V_{ADC} = \frac{V_{IN} \cdot R_2}{R_1 + R_2}$$

Choose values of R_1 and R_2 so that V_{ADC} is approximately +2.5 V when V_{IN} is at its highest.

To minimise errors in the measured voltage, V_{ADC}, caused by loading of the source voltage V_{IN}, ensure that the combined resistance of R_1 + R_2 is much greater than the resistance of the voltage source. If you are unsure of the resistance of the voltage source, use large values for R_1 and R_2 such that R_1 + R_2 is about 10 kΩ.

If you have chosen a value for R_2 that is greater than 10 kΩ and you need high accuracy, then you will need to take into account the ADC's input resistance R_{ADC}, which is in parallel with R_2. Use the following formula to obtain a value for the parallel equivalent resistance of R_2 and R_{ADC}, R_P:

$$R_P = \frac{R_2 \cdot R_{ADC}}{R_2 + R_{ADC}}$$

where R_{ADC} = 1 MΩ, and then use R_P instead of R_2 in the previous formula.

The resistors on the Small Terminal Board are connected as shown in Figure 4.

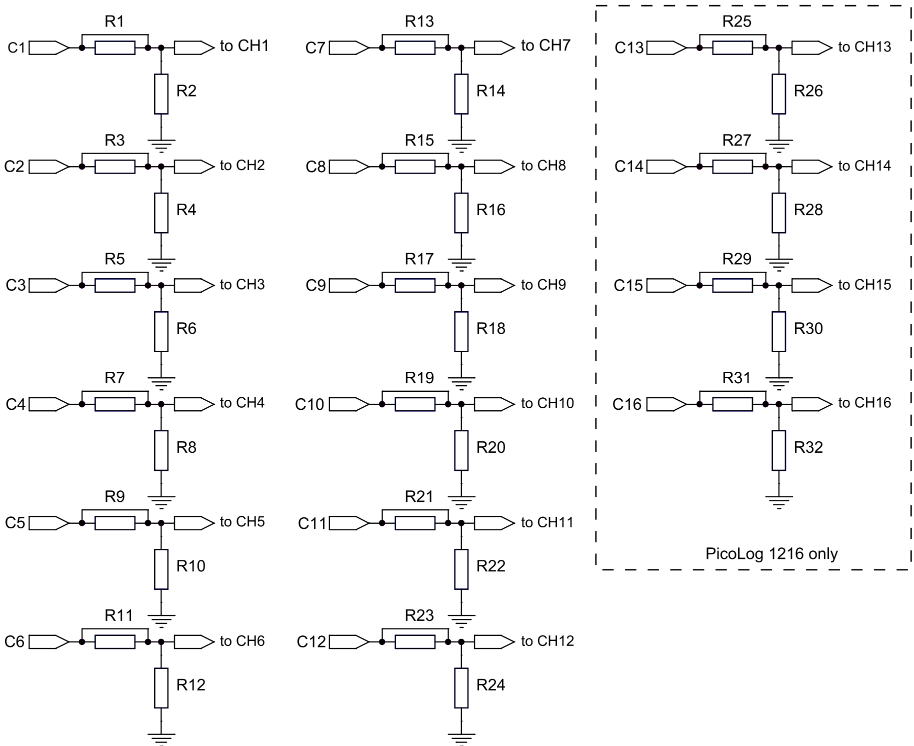

Figure 4 - Voltage divider resistor sites

The location for each series resistor (R1 and so on) is bypassed by a copper link. You must cut this link (see Figure 5) before fitting the resistor.

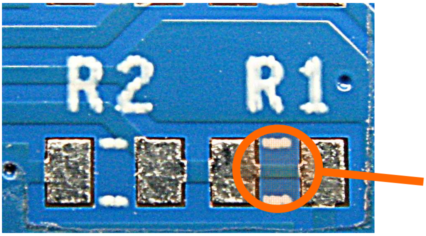

Figure 5 - Location of copper link under R1

The following noise problems are often associated with potential divider circuits:

1. Noise from source voltage	Try fitting a capacitor as described below.
2. RF interference picked up at high-impedance points	Smaller values for R_1 and R_2 may help
3. Noise on the earth connections	The signal 0 V line is connected to mains earth. Try to avoid this situation.

Should either 1 or 2 above occur and you want to try a capacitor, ensure that you have fitted resistor R_1 and cut the corresponding track beneath the resistor. Fit the capacitor in place of or in parallel with R_2, as necessary. Use the following formula for C, the value of the capacitor:

$$C = \frac{1}{2\pi f R}$$

where R is R_1 or the smaller of R_1 and R_2, and *f* is the highest signal frequency in hertz.

2.3 Measuring current

You can use measure current towards ground by using a simple shunt resistor to convert the current into a voltage before measuring with the ADC.

Figure 6 shows the circuit for analog channel 1, with shunt resistor R_2. A similar circuit can be used for the other channels.

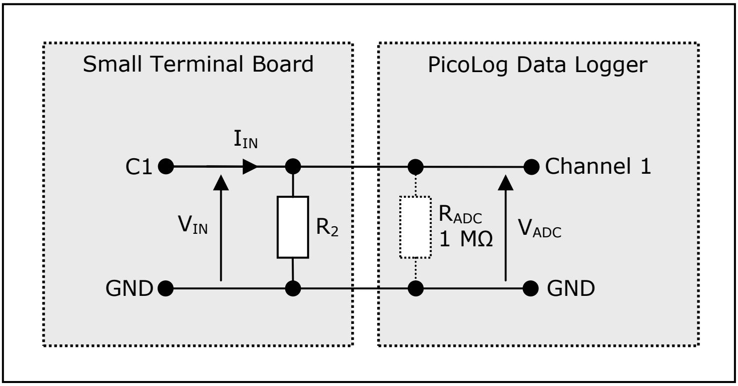

Figure 6 - Shunt resistor circuit

You will need to calculate the resistor value R_2 from the following equation:

$$R_2 = \frac{2.5\ \text{V}}{I_{MAX}}$$

where I_{MAX} is the highest current you want to measure.

Warning!
Under no circumstances use this method for measuring mains (house) currents. The Small Terminal Board is not designed to be connected to the mains. Attempting to do so could result in serious property damage and personal injury.

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