EA001A

**Thermocouple Simulation
& Measurement Adapter**

Operation Manual

Guarantee and service

Transmille Ltd. guarantees this instrument to be free from defects under normal use and service for a period of 1 years from purchase. This guarantee applies only to the original purchaser and does not cover fuses, or any instrument which, in Transmille's opinion, has been modified, misused or subjected to abnormal handling or operating conditions.

Transmille's obligation under this guarantee is limited to replacement or repair of an instrument which is returned to Transmille within the warranty period. If Transmille determines that the fault has been caused by the purchaser, Transmille will contact the purchaser before proceeding with any repair.

To obtain repair under this guarantee the purchaser must send the instrument in its original packaging (carriage prepaid) and a description of the fault to Transmille at the address shown below. The instrument will be repaired at the factory and returned to the purchaser, carriage prepaid.

Note :
TRANSMILLE ASSUMES NO RESPONSIBILITY FOR DAMAGE IN TRANSIT

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- **Low noise & Thermally stable**

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- **11 thermocouple types : Type B**
  - **Type C**
  - **Type E**
  - **Type J**
  - **Type K**
  - **Type L**
  - **Type N**
  - **Type R**
  - **Type S**
  - **Type T**
  - **Type U**

- **Direct control from the 3000A Series front panel**

- **Compatible with ProCal calibration software**

Main Features

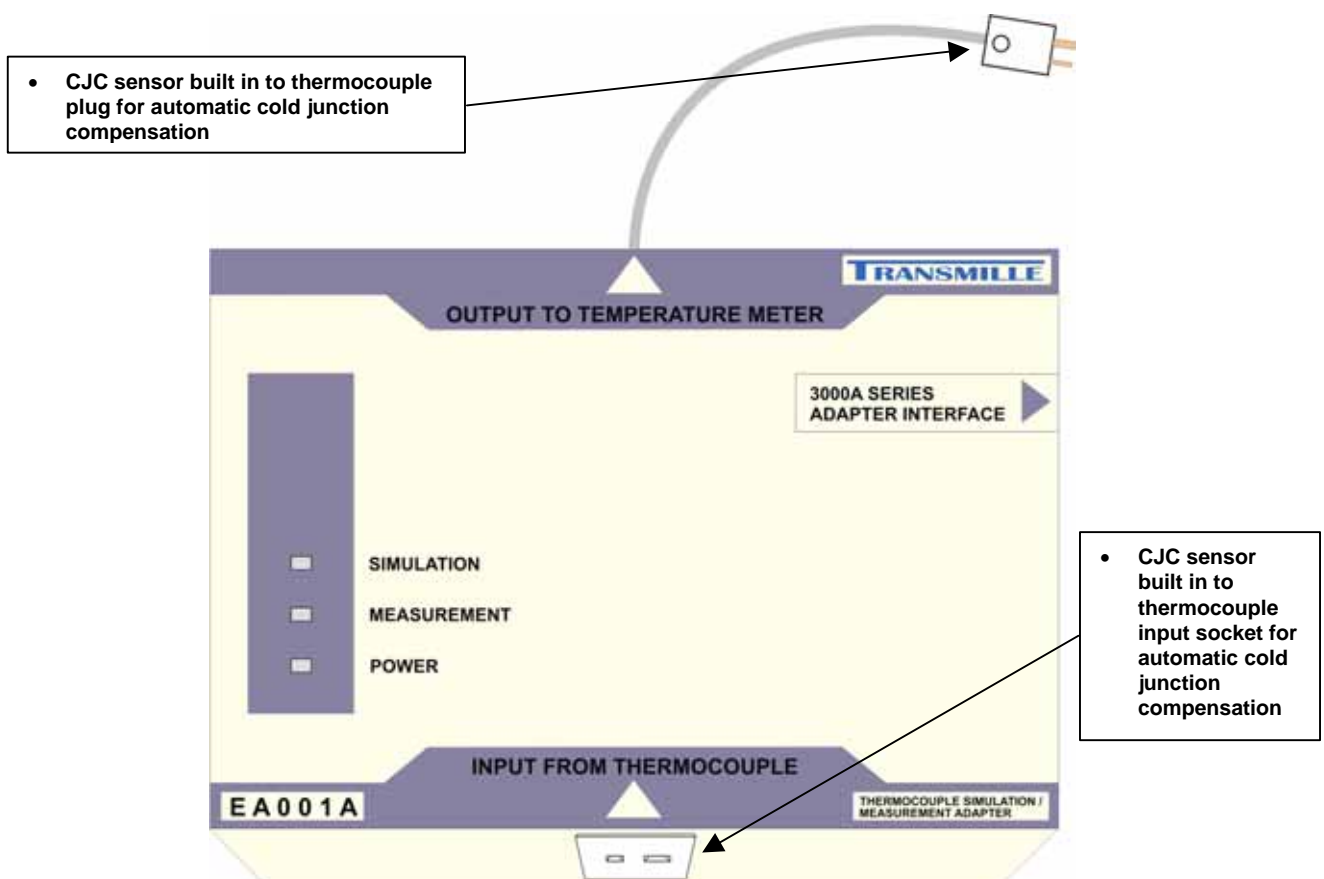## Dedicated External Adapter For the Ultimate in Accuracy

Temperature gradients / thermal EMFs which can be introduced by internally mounted thermocouple simulation methods are one of the greatest sources of error with thermocouple temperature calibration.

For the ultimate in accuracy, Transmille has designed a dedicated external adapter. This keeps the electronics required to generate the low level signals used for thermocouple simulation as close as possible to the measuring input of the thermometer. This allows the signal to be as free from electrical noise as possible, and also eliminates errors caused by heat generated by surrounding electronics in the calibrator.

Direct Connection - No compensation cables required

- **Uses neutral (copper) thermocouple connectors**

- **CJC sensor built in to thermocouple plug for automatic cold junction compensation**

OUTPUT TO TEMPERATURE METER

TRANSMILLE

3000A SERIES
ADAPTER INTERFACE

SIMULATION

MEASUREMENT

POWER

- **CJC sensor built in to thermocouple input socket for automatic cold junction compensation**

INPUT FROM THERMOCOUPLE

EA001A

THERMOCOUPLE SIMULATION / MEASUREMENT ADAPTER

For direct connection to any thermocouple type input without the need for compensation cables

Design Notes

Special care has been taken over the cold junction compensation - a common source of errors in thermocouple calibration. The cold function compensation (CJC) sensor is mounted in the thermocouple plug itself. By measuring the cold junction at the instruments input allows any type of thermocouple to be simulated without using compensation cables.

Intuitive Operation & Control

- Easy selection of thermocouple type
- Auto / Manual Cold Junction compensation

Quick and easy to use, simply plug in the temperature adapter into the 3000 Series calibrator, select thermocouple simulation mode and thermocouple type using the soft keys and enter the temperature required.
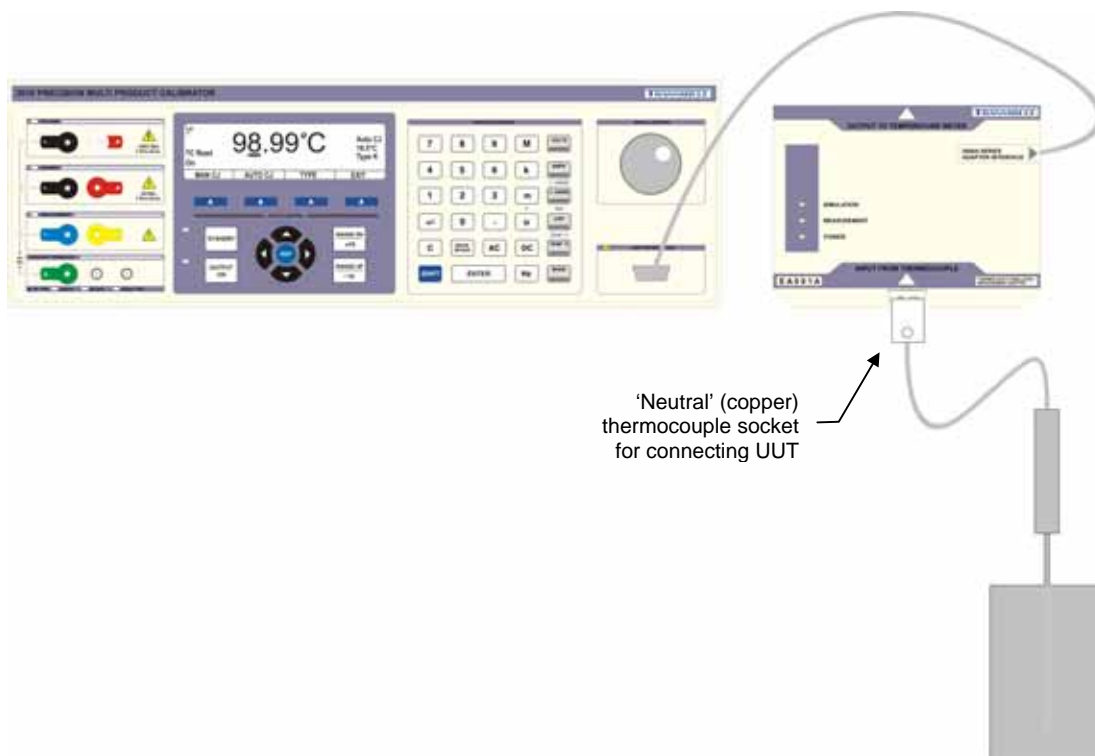
Connections

Using the supplied adapter connection lead (9 way 'D' type to 9 way 'D' type), connect the thermocouple adapter to the adapter interface connection on the front panel of the 3000 series calibrator.

Simulation Function Connection

9 way 'D' to 9 way 'D' connection

'Neutral' (copper) thermocouple plug - connects to UUT
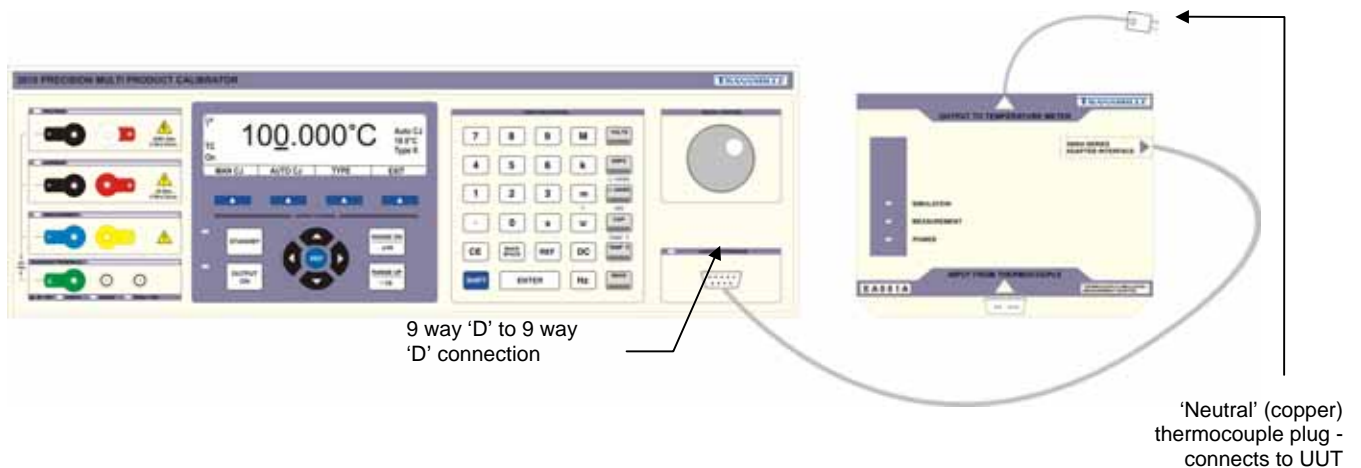
Measurement Function Connection

'Neutral' (copper) thermocouple socket for connecting UUT
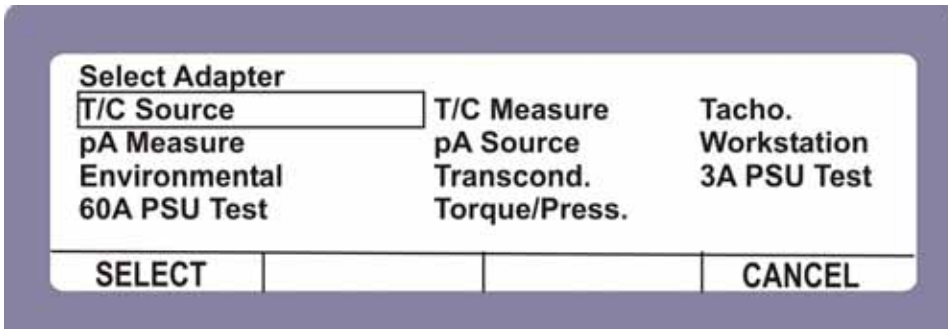
Note : The simulation and measurement functions are designed to be used one at a time.

Using The Thermocouple Simulation Function

To use the thermocouple simulation function, press the [MODE] key and select the following :
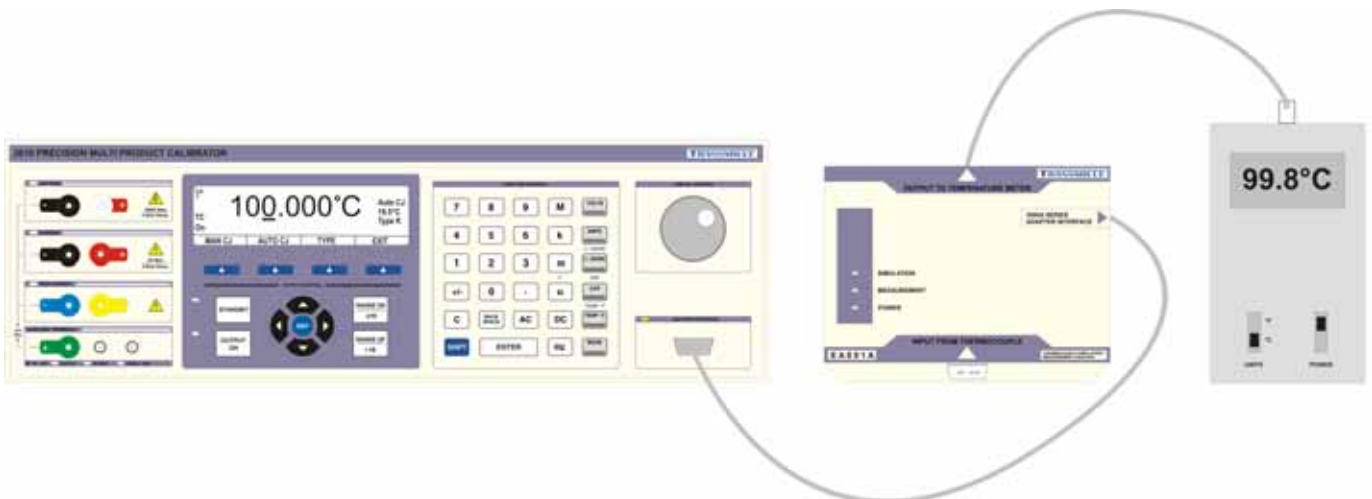
Connecting the UUT

Connect the EA001A to the adapter interface on the calibrator front panel using the supplied connection lead. Connect the Unit Under Test (UUT) to the connector marked Output to Temperature Meter (fixed cable).

The thermocouple simulation option allows the user to enter a temperature in °C and set the calibrator to the specific voltage output which corresponds to the thermocouple type selected.

Using the menus

On entering thermocouple simulation mode, type K will be the default function.

The display below will be shown indicating the currently selected range and output status :

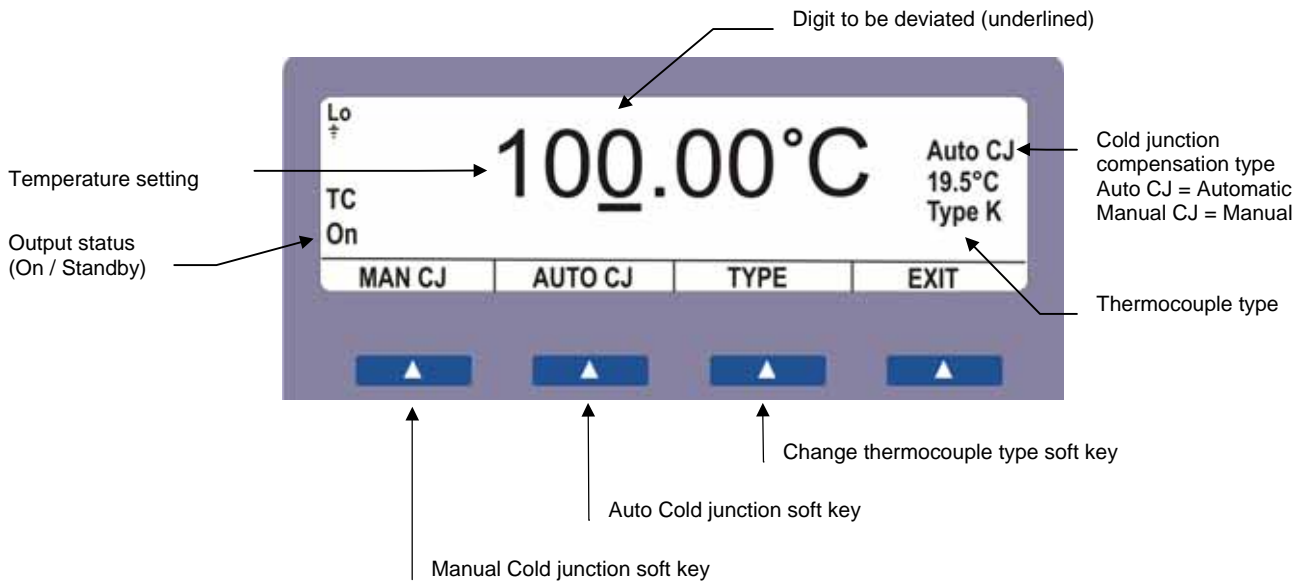Digit to be deviated (underlined)

Temperature setting

Output status
(On / Standby)

$100.00°C$

Lo

TC
On

Auto CJ
19.5°C
Type K

Cold junction
compensation type
Auto CJ = Automatic
Manual CJ = Manual

Thermocouple type

MAN CJ   AUTO CJ   TYPE   EXIT

Change thermocouple type soft key

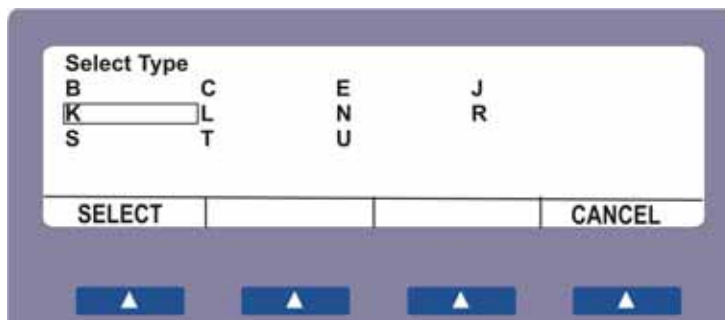Auto Cold junction soft key

Manual Cold junction soft key

Once in thermocouple mode, the menus available at the bottom of the screen will change to reflect the thermocouple mode options - the available menu items are :

MAN CJ   Selects the manual cold junction compensation mode
              This allows cold junction value to be set to zero.

AUTO CJ   Selects the automatic cold junction compensation mode
              This allows the calibrator to use the built in temperature sensor within the
              adapter's thermocouple plug to compensate for the cold junction measured
              between the adapter plug and the UUT socket.

TYPE   Pressing this soft key displays a menu allowing the user to select the
              required thermocouple type :

Select Type
B   C   E   J
K   L   N   R
S   T   U

SELECT   CANCEL

EXIT   Exit thermocouple simulation mode.

Setting Temperature Outputs

The output can be entered manually via the keypad or alternatively the output can be deviated using the digital control.
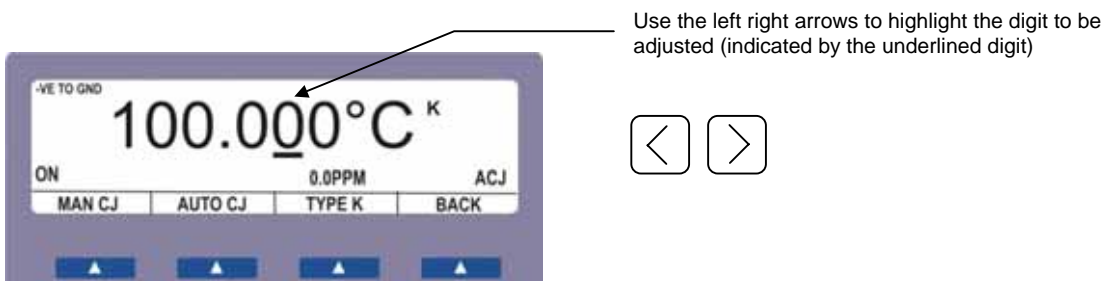
Manual Keypad Entry

Use the calibrator keypad to key in the required CJC temperature, for example 24.5°C :

$$\boxed{1} \; \boxed{0} \; \boxed{0} \; \boxed{.} \; \boxed{0} \qquad \boxed{\text{ENTER}}$$

Deviate Output

To deviate the temperature output from the nominal value, use the deviation function. This is controlled by using the left and right arrow keys to select the digit to be increased or decreased

Use the left right arrows to highlight the digit to be adjusted (indicated by the underlined digit)

$$\boxed{<} \; \boxed{>}$$

To increase or decrease the digit, simply use the up down keys on the calibrator's keyboard or use the digital potentiometer

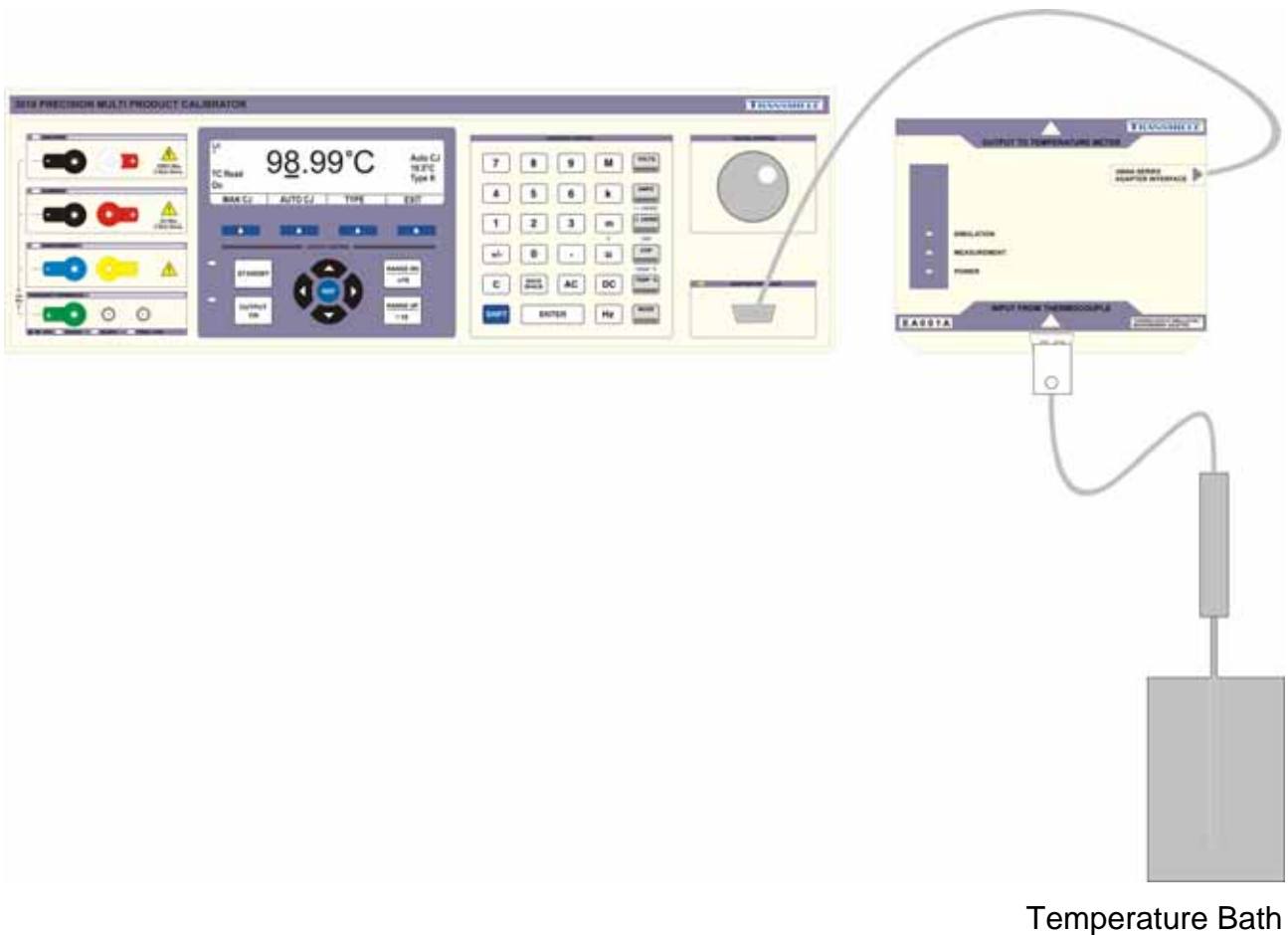Increment   Decrement   *OR*   Increment   Decrement

Note : The thermocouple type, temperature and cold junction compensation settings can be changed at any time by re-entered / selecting the setting required

Using The Thermocouple Measurement Function

To use the thermocouple measurement function, press the [MODE] key and select the following :
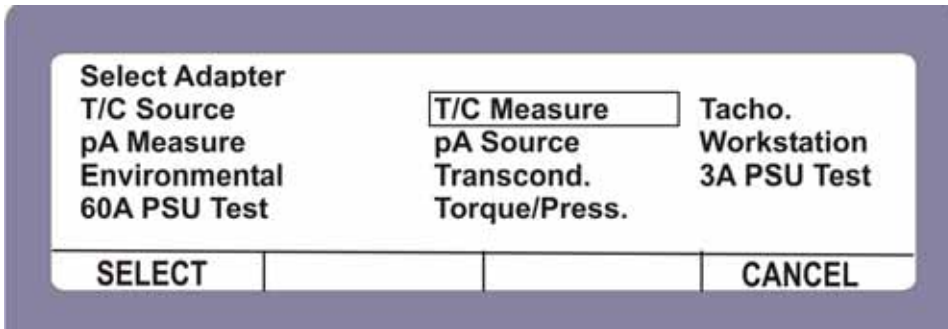
Connecting the UUT

Temperature Bath

Connect the EA001A to the adapter interface on the calibrator front panel using the supplied connection lead. Connect the Unit Under Test (UUT) to the connector marked Input From Thermocouple (socket).
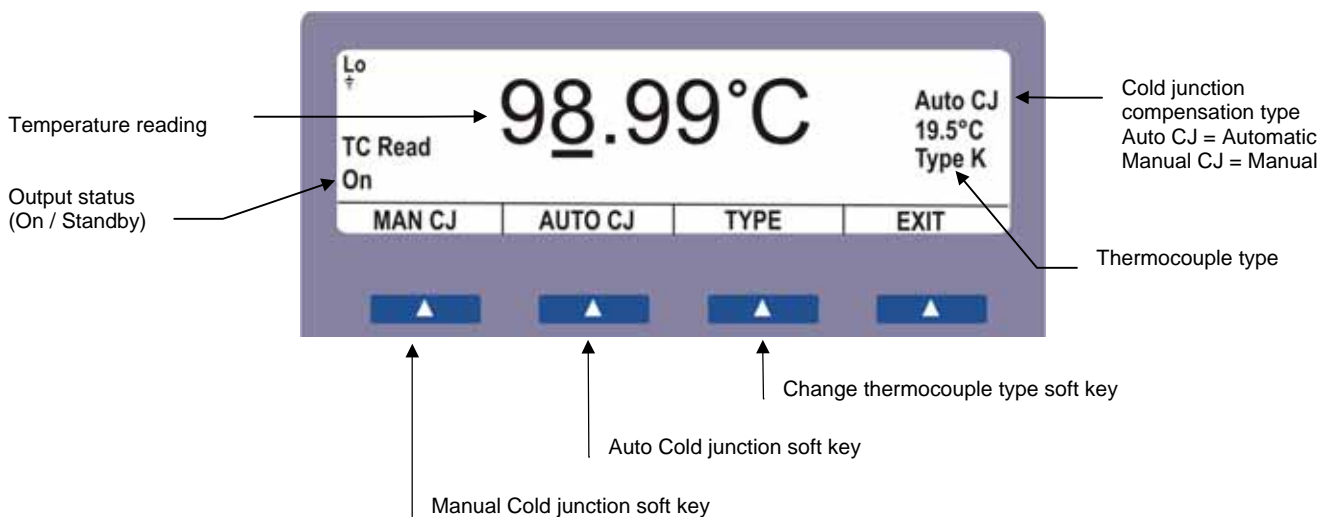
The thermocouple measurement option allows the user to measure thermocouple probes of the types supported by the EA001A adapter.

Using the menus

On entering thermocouple simulation mode, type K will be the default function.
The display below will be shown indicating the currently selected range and output status :

Temperature reading

Output status (On / Standby)

Cold junction compensation type
Auto CJ = Automatic
Manual CJ = Manual

Thermocouple type

Change thermocouple type soft key

Auto Cold junction soft key

Manual Cold junction soft key

Once in thermocouple mode, the menus available at the bottom of the screen will change to reflect the thermocouple mode options - the available menu items are :
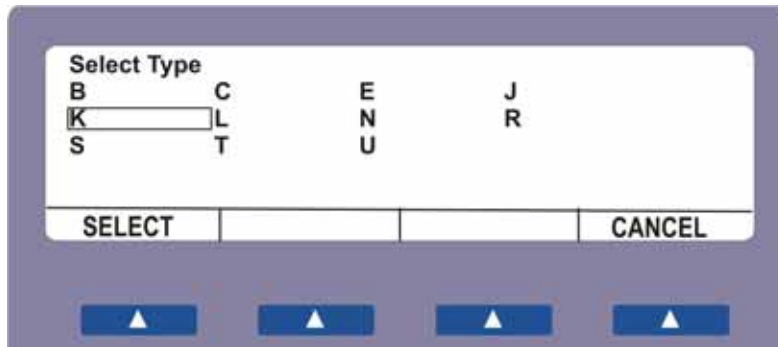
MAN CJ   Selects the manual cold junction compensation mode
This allows cold junction value to be set to zero.

AUTO CJ   Selects the automatic cold junction compensation mode
This allows the calibrator to use the built in temperature sensor within the adapter's thermocouple plug to compensate for the cold junction measured between the adapter plug and the UUT socket.

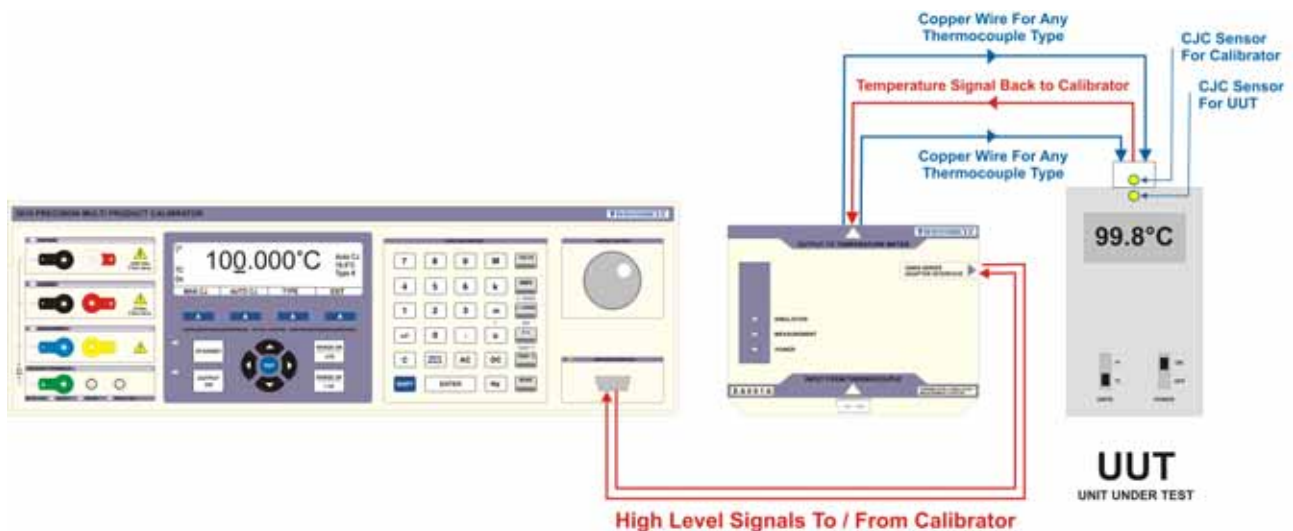TYPE   Pressing this soft key displays a menu allowing the user to select the required thermocouple type :

EXIT   Exit thermocouple measurement mode.

Cold Junction Compensation

Overview

THE EA001A adapter measures the CJC temperature as close as possible to the sensor in the UUT. Using a high accuracy resistance temperature sensor mounted inside the EA001A copper plug, the measured temperature is used by the firmware in the calibrator to calculate the millivolt output required. This method allows any type of thermocouple to be calibrated without the need for compensation cables, and also reduces the number of connections, with only high-level signal connections to the calibrator. Transmille have adopted this method for 3 major advantages.

> 1: There is no need for a compensation cable for each type of thermocouple to be simulated. This greatly reduces the number of additional compensating leads required and reducing errors introduced by using compensation cable.

> 2: There is only the need for one thermocouple plug working at low levels to connect to the UUT - other connections to the calibrator are at high signal levels and are unaffected by thermal emf.

> 3: The calibrator uses high signal levels and divides the signal down to uV levels in the EA001A external unit. This results in a quieter, more thermally and emf stable output and eliminates any self heating effects from the calibrator.
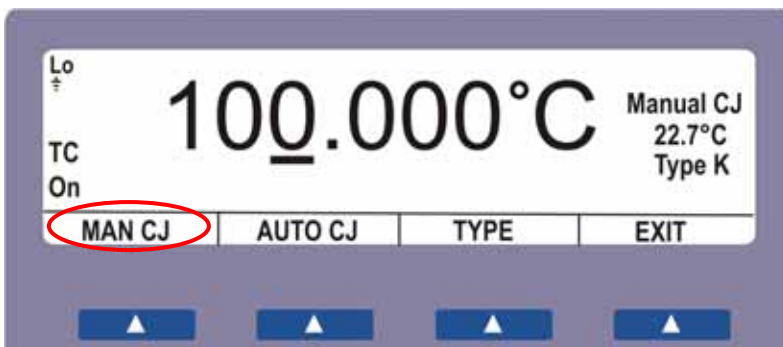
Automatic Cold Junction Compensation
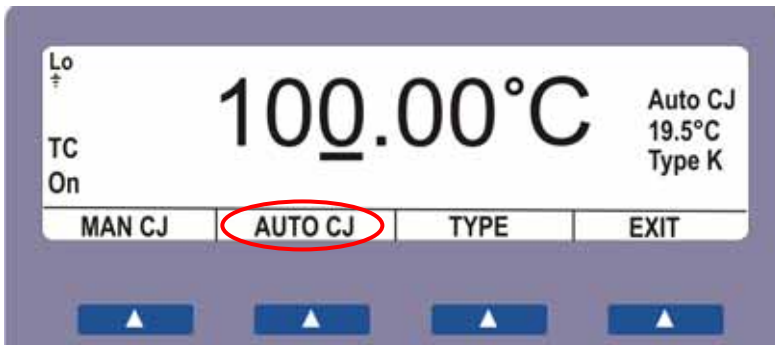
Click on the softkey marked   AUTO CJ

This activates the built in temperature sensor in the thermocouple plug to accurately compensate for the temperature at the point of connection.

Manual Cold Junction Compensation

Click on the softkey marked   MAN CJ

Use the calibrator keypad to key in the required CJC temperature, for example 24.5°C :

2 4 . 5   ENTER

> Manual cold junction mode is ideal for checking the temperature sensor in the temperature meter (UUT) to ensure it is correctly measuring the cold junction temperature. Simply set the manual cold junction temperature to *zero* in order to allow the temperature meter to indicate the simulated temperature + CJC temperature (as measured by the UUT).

Automated Calibration using ProCal

Calibration times using the thermocouple adapter to calibrate temperature instrumentation can be significantly reduced by using the ProCal calibration software available from Transmille which allows a pre-defined sequence of tests (known as a procedure) to be set up. This allows the computer to automatically step through these tests, control the calibrator, set the correct outputs and record the amount of deviation in relation to the instrument's specifications.

Care & Maintenance

The only maintenance instructions for the adapter is periodic cleaning.

See below for details on the cleaning procedure and precautions for handling.

Cleaning the Adapter

To keep the external enclosure of the adapter in good condition, clean the outer case with a soft cloth. <u>Do not use any liquids in cleaning the enclosure</u> – removal of surface dust is all that is recommended.

⚠️ **CAUTION**

Do not use cleaning fluids or solvents for cleaning as these may damage the enclosure and affect the plastic materials used in the adapter.

Handling Precautions

The adapter is designed for mechanical stability, but should not be subjected to excessive shock or be dropped. Transportation is recommended using the original packaging with avoidance of extreme changes of temperature.

Servicing Information

The adapter is provided certified from the factory, and uses precision components and are not user repairable. If the adapter is damaged it should be returned to the factory for repair and recalibration.

EA001
Thermocouple Simulation Adapter

Appendix A
Specifications