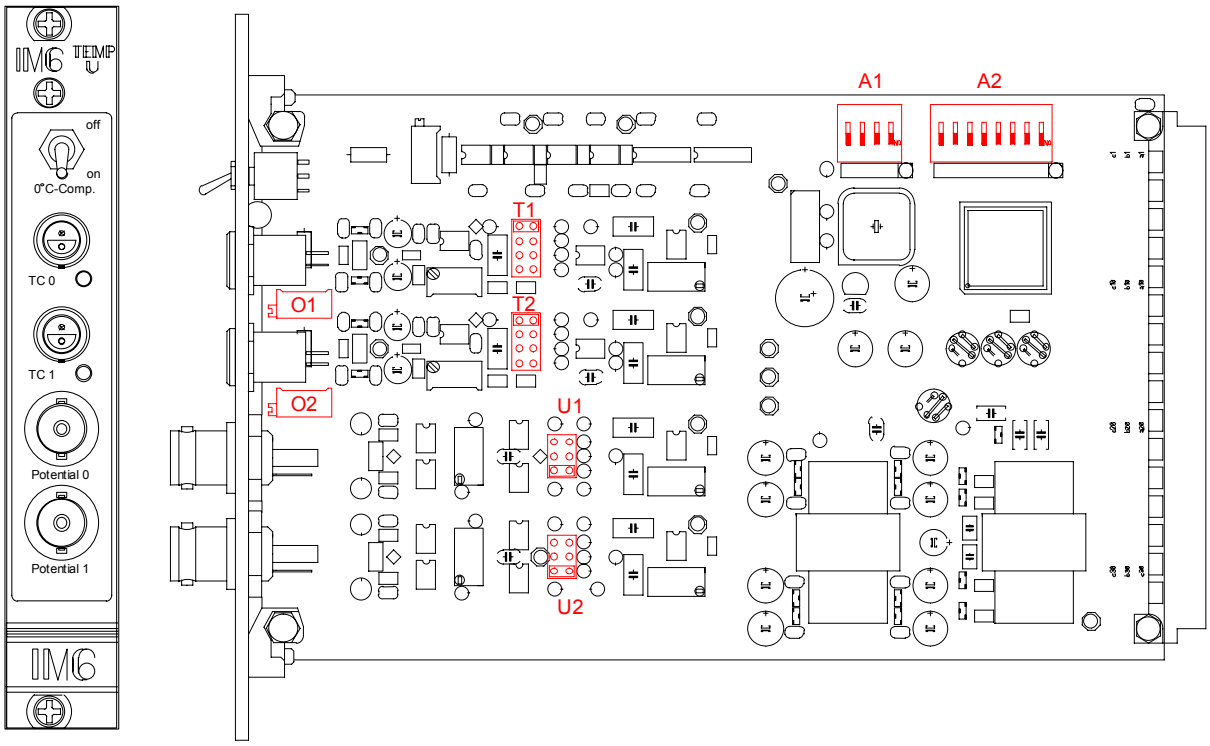
TEMP-U

data acquisition extension plug in board



Introduction

TEMP-U is a member of the extension board family available for the Zahner Electrochemical Workstations. Generally they support measuring data acquisition and process control in parallel to the electrochemical experiments.

TEMP-U enables the acquisition of two low level plus two high impedance medium level electrical signals. The typical application is temperature measurement by direct connection of thermocouples to the low level inputs and electrochemical potential measurements can be done by connecting auxiliary electrodes to the medium level inputs.

Low- and high level inputs may be hardware adapted to the needs by changing the sensitivity (signal amplification) for the inputs individually. Optional scaling and linearising of the primary measurement data and assignment of physical meanings is generally done within the data acquisition set-up menu by the logical channel description. It defines the data flow from a selected hardware channel into a logical channel.

Unless otherwise noticed, the TEMP-U is delivered pre-configured for two NiCrNi-(type K)-thermocouples, temperature range –70C to +250C and two voltage inputs in the range of ±4V. An optional automatic cold junction compensation can be activated by a switch at the top of the front plate. All channels are bandwidth limited by means of anti aliasing filters.

Technical data

2 low level inputs:

Socket:	Lemosa RA0102
Input resistance:	100 KΩ
Amplification:	201 (standard), 101, 51, 26
Offset voltage/drift:	± 5μV, ± 0.05μV/C, ± 0.2μV/year max.
Input current:	± 100pA max. @ 20C, -1 μA optionally
Bandwidth:	300 Hz, 3rd order Bessel characteristic
Isolation impedance:	200KΩ // 100pF
Max. isolation voltage :	± 200V
Cold junction compensation :	At the front plate, switchable, range 0-40C ± 0.5C.

2 high level inputs:

Socket:	BNC
Input resistance:	10^{12} Ω min.
Input range:	±4V (standard), ±10V, ±2V
Offset voltage/drift:	± 0.5mV, ± 5μV/C, ± 0.2mV/year max. @ 2V range
Input current:	± 10pA max. @ 20C
Bandwidth:	300 Hz, 3rd order Bessel characteristic
Isolation impedance:	10^{12} Ω // 20pF
Max. isolation voltage :	± 20V

Hardware description

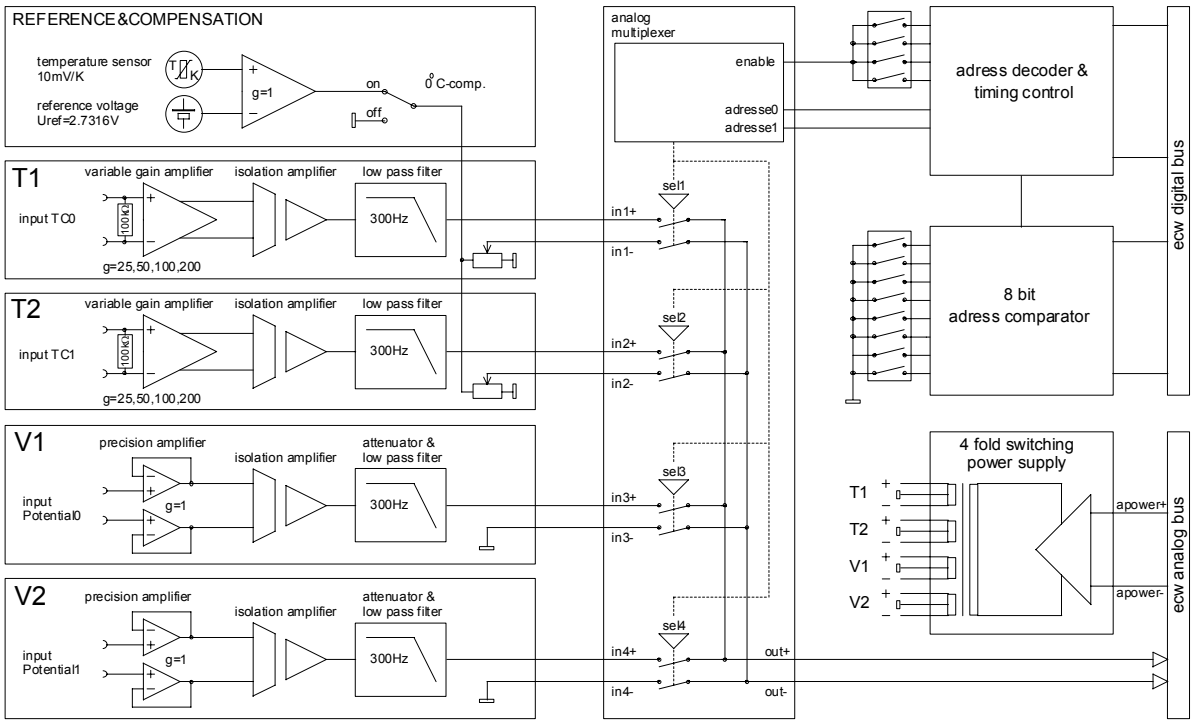
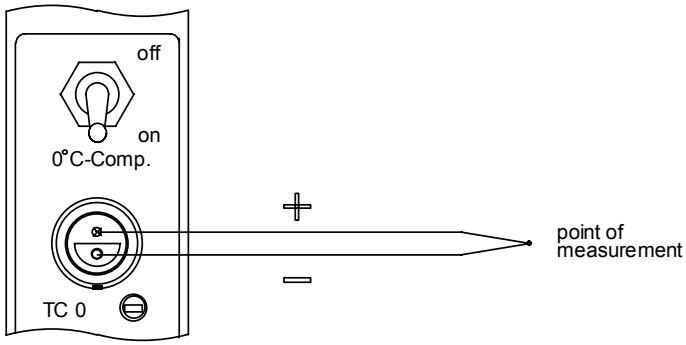


Figure: simplified schematic of the TEMP-U module

Reference temperature

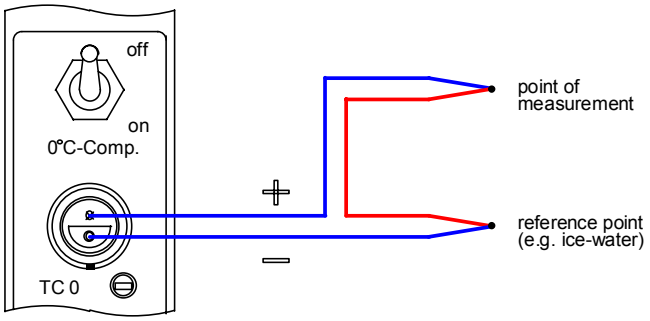
Internal reference

The reference temperature is the temperature of the front plate of the TEMP-U module. The reference temperature is measured by a semiconductor temperature sensor (TK=10mV/K).



External reference

The reference temperature will be defined by an external reference (e.g. ice-water).



Configuration

The TEMP-U can be user configured for different types of thermocouples and temperature ranges. For that purpose a script program is delivered within the general installation.

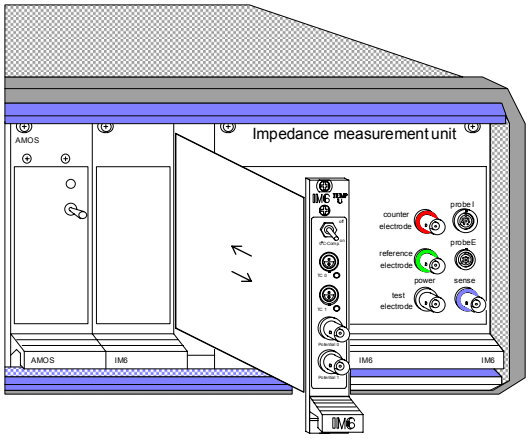
The user will find the script source in the instruments hard-disk, partition *a* :

Zhda:\hardware\tempu\tempreg

For a detailed description of script handling and programming please refer to the appropriate chapter. Apart from that follows here a short guide how to start the TEMP-U configuration script:

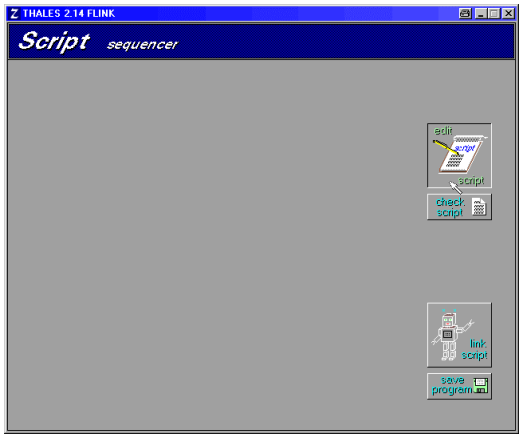
1. Be sure to know, which thermocouple type for which temperature range you like to use at which input.

2. **Be sure, that the instrument is switched off.**



3. Pull out the TEMP-U plug after loosening the two screws at the top and the bottom of the TEMP-U front plate.

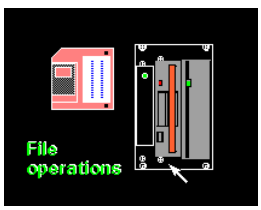
4. Start the instrument and get into the Thales main menu in the usual way.



5. Call the *script* icon. The script menu comes up with an empty user section.

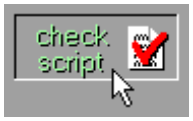
6. Use the *edit script* button to get into the integrated text editor menu

and enter the text file menu by clicking the *file operations* button.

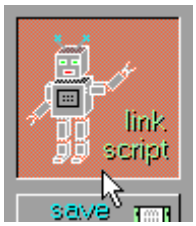


7. Select the *unit/device Z* (the instrument), partition *a*, and the path *hardware\tempu* (by means of the *path* button). Open the file *tempreg* into the text editor.

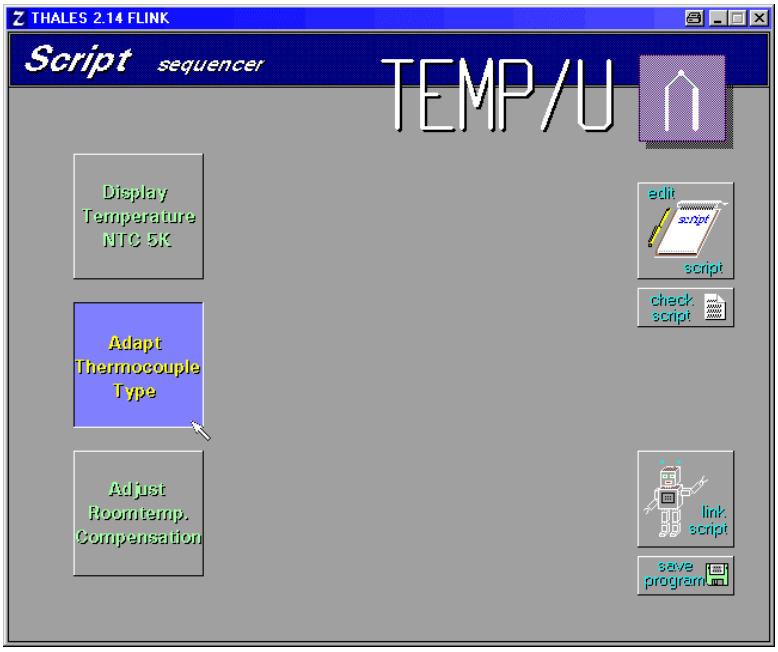
8. Escape by clicking the middle mouse button in order to get back to the script menu. Check the script by clicking the *check script* button.



9. Link the script after escaping the “check successful” message by clicking the *link script* button.



10. The script menu will come up now including the user section of the TEMP-U configuration script.

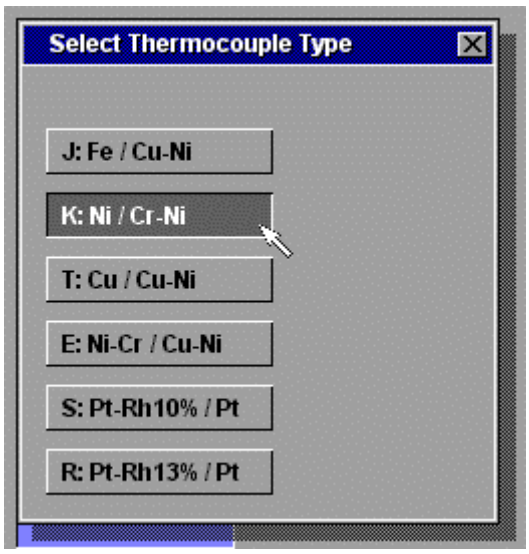


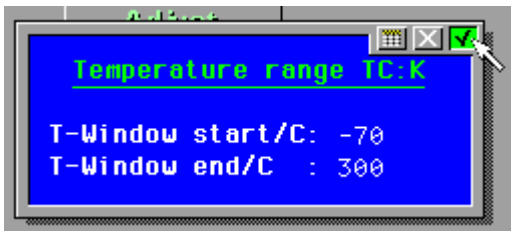
Configuration step one:

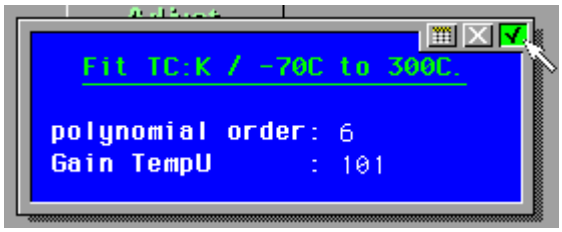
Now you can perform the basic adjustment steps by calling the *adapt thermocouple type* menu. The menu will offer you to choose between six different types of standard thermocouples:

J (Fe/Cu-Ni),	-210 – 1200C, (not rec. for T> 800C)
K (Ni-Cr/Ni),	-270 – 1372C, (not rec. for T> 900C)
T (Cu/Cu-Ni),	-270 – 400C
E (Ni-Cr/Cu-Ni),	-270 – 1000C
S (Pt/Pt with 13 % Rhodium)	-50 – 1767.6 C
R (Pt/Pt with 10 % Rhodium).	-50 – 1767.6 C

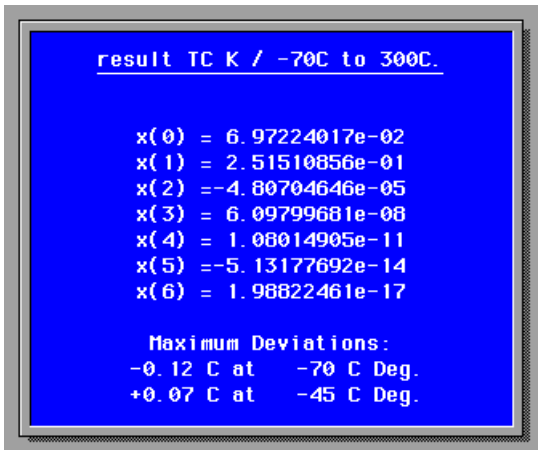
Choose the appropriate thermocouple type. The program will ask you for the expected temperature range. Type in the temperature window start and end of the chosen temperature range and confirm.
The program will now propose an amplification factor and a polynomial order for the linearisation polynomial to calculate.







Do not alter, but note the amplification. You may alter the polynomial order up to a value of nine.
After confirming your selection the program will calculate the polynomial coefficients and prompt them in addition with an information about the accuracy.

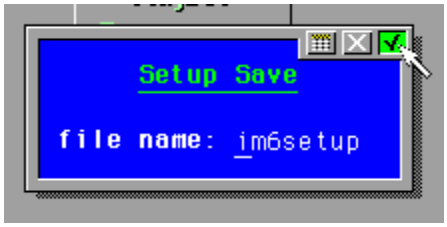


Check, if the accuracy fits your requirements. If not, escape, start again with the basic adjustment step and try other polynomial orders and/or slightly modified temperature ranges. Consider, that the accuracy normally has an optimum for a specific polynomial order and will not generally increase with higher orders. Usually one should take higher orders for wider temperature windows.

If the accuracy fits your requirement, use the *select output* menu to assign the resulting polynomial to the first (normally the physical channel address is 32) or second (normally the physical channel address is 33) logical data acquisition channel.

The program will ask you for the filename of the set-up. Do not change but confirm the proposed name 'im6setup', if you want to use the adjustment instantly as standard.

Altering the filename enables you to establish different set-ups for preserve, which may be activated optionally by removing (renaming) the original one from the instruments hard-disk, partition *a*, and by renaming the optional one to 'im6setup'.



Alternatively you can export the coefficient list into the text editor for control.
After successful assignment of one temperature channel continue step one by repeating the procedure with the second channel.

Complete now step one by adjusting the TEMP-U card hardware to the necessary amplification settings for each temperature channel by setting the appropriate jumpers. If necessary, change the settings of the potential channels to your requirements as well.

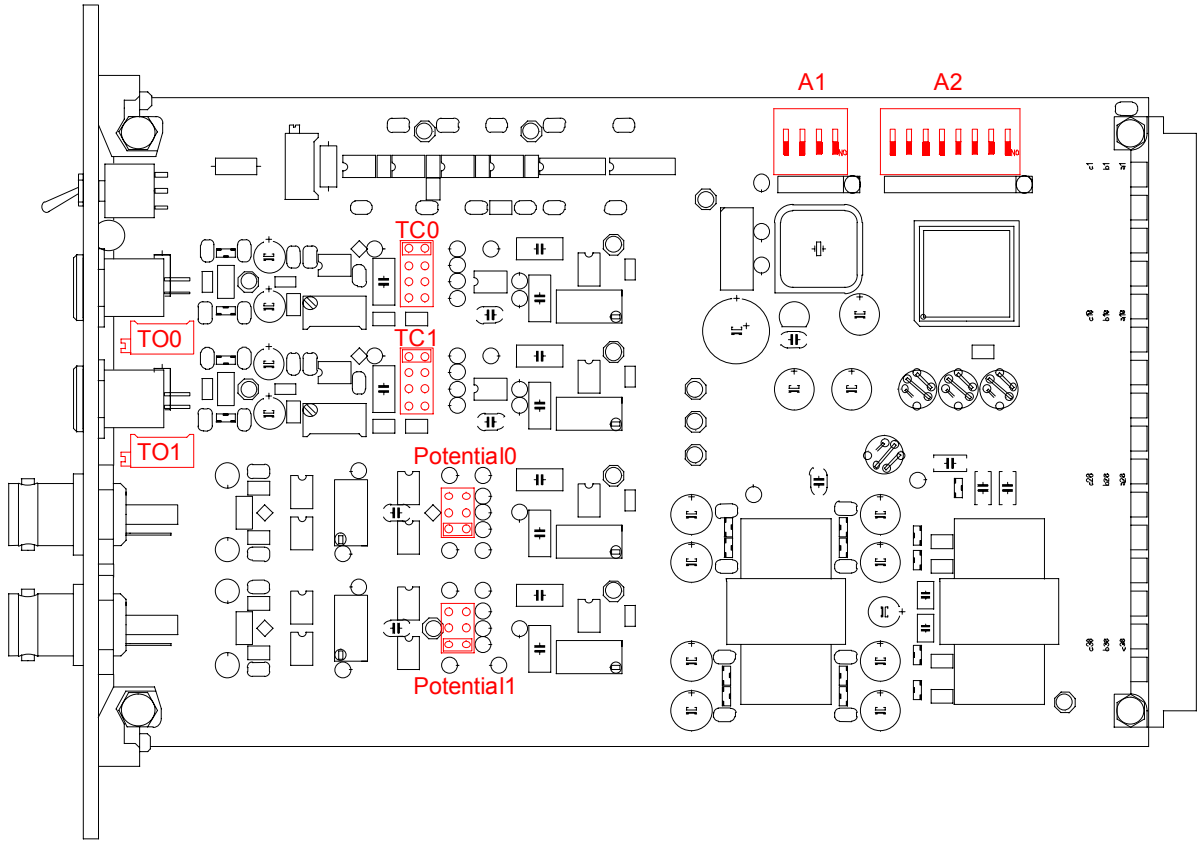


Figure: Jumper locations for the amplification settings of the TEMP-U.

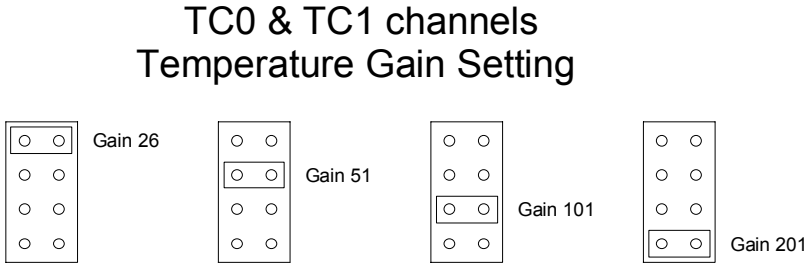


Figure: Jumper settings for gain selection of the temperature channels of the TEMP-U.

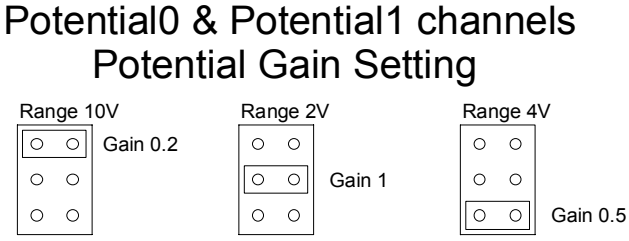


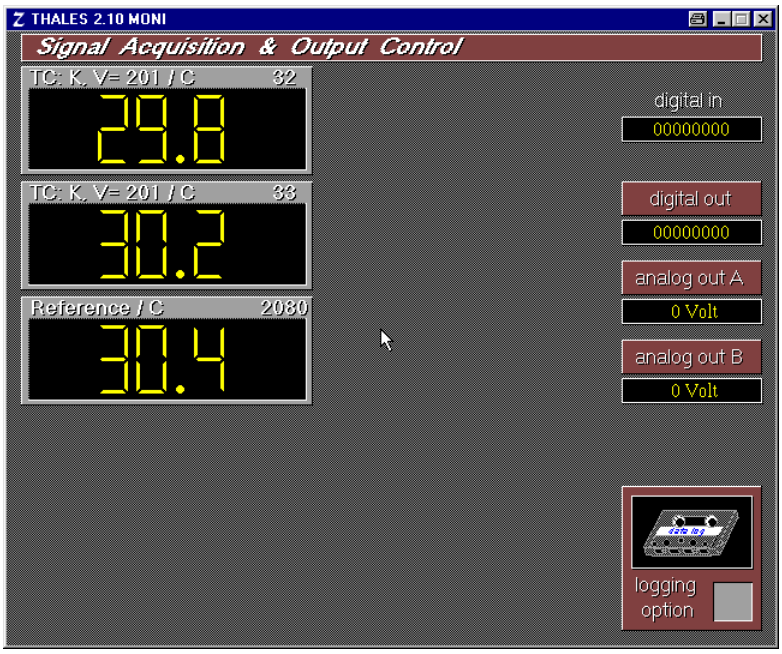
Figure: Jumper settings for gain selection of the potential channels of the TEMP-U.

Configuration step two:

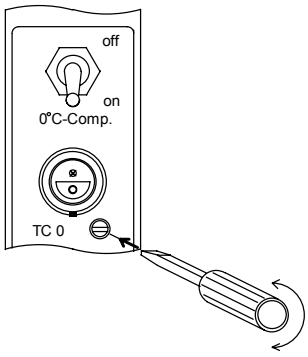
The second configuration step starts with the re-insertion of the TEMP-U plug-in in the instrument after power down:

1. **Be sure, that the instrument is switched off.**
2. Plug in the TEMP-U card and fix the two screws of the TEMP-U front plate.
3. Perform the steps 4 to 8 from the step one procedure.

Select now the function *adjust room temperature compensation* to tune the automatic cold junction circuit. Do not connect any thermocouple at this moment, but set the "0^0C.Comp" switch to "on".



The program will prompt with the (normally unadjusted) temperature display for thermocouple input voltages of zero at both channels. Additionally the actual reference temperature is shown on a third virtual instrument. It is sensed at the plug-in front plate.



Use now a small (∅ 2mm max.) screwdriver and adjust the potentiometers behind the front-plate through the appropriate holes. Both thermocouple channels should display the value of the reference temperature within sufficient accuracy.
Now the adjustment is finished.