Functions

The module BE474 is designed for a complete thermal control of test fixture:

- PID regulator for Peltier up to 20V 10A with PT100 or Thermocouple K.
- BB474 booster module allows to drive a second Peltier with the same temperature consign (sold apart).
- Control and regulation of the heat sink reference temperature.
- Supplementary measurement channel available to monitor DUT (Device Under Test).
- Test fixture and set up identification using a simple resistor.

Example of application: power stress test bench with temperature cycling

A device dissipating 20W is tested using temperature cycling steps (25°C/125°C ±0.2°C).

The temperature slope is controlled and assigned to 3°C/mn

The device is screwed to a copper base plate placed on 2x2 40x40mm Peltier element.

2 Peltier are driven by the main module BE474, and the 2 others by the BB474 booster module. This allows to drain larger amount of power and/or to use large base plates.

The temperature regulation is provided by a PT100 sensor included into the copper base.

The Peltier bottom face temperature is controlled by an aluminum heat sink. Following the set up (25°C/125°C), the heat sink is either cooled down to 40°C or heated up to 72°C.
Characteristics

3 simultaneous temperature measurements

<table>
<thead>
<tr>
<th>function</th>
<th>Main Peltier regulator and supplementary measurement</th>
<th>Auxiliary control</th>
</tr>
</thead>
<tbody>
<tr>
<td>sensor</td>
<td>Thermocouple</td>
<td>Platinium resistor</td>
</tr>
<tr>
<td>type</td>
<td>type K</td>
<td>100Ω</td>
</tr>
<tr>
<td>Tmin / Tmax</td>
<td>-50°C / +400°C</td>
<td>-50°C / +250°C</td>
</tr>
<tr>
<td>resolution</td>
<td>0.07°C</td>
<td>0.01°C</td>
</tr>
<tr>
<td>accuracy</td>
<td>±2°C</td>
<td>±0.5°C</td>
</tr>
</tbody>
</table>

Type K and PT100 measurements are linearized and calibrated with software tools

Peltier element supply
- Bipolar voltage source (symmetrical DC/DC converter)
- Voltage control range from -20V to +20V, resolution 5mV
- Available power 140W, maximum current 10A.
- Current and voltage limitation are programmable.
- The BB474 booster module allows to bias a second Peltier element up to 140W.
  Both must be mounted on the same base plate: they use the same voltage level and the same temperature control.

Heat sink Fan and Heater control
- Two independents 24V switched voltage outputs with a maximum current level of 0.8A (FAN) and 1.8A (HEATER).
- on/off temperature control with the auxiliary sensor.

Temperature control
- Peltier regulation with programmable P.I.D.
- Programmable temperature slope generator.
- Programmable thresholds on temperature measurements.
- Heat sink regulator working point and over temperature threshold are programmable using relative levels attached to the main regulation working point.

Test fixture and Set up file identification
Appropriated set up is checked using a simple resistor soldered on the test fixture (100R to 100K). The dedicated value of the resistor is included in the memorized parameters, thus preventing mismatch when loading set up file.

Connections
- Caution with thermocouple sensors connection: isolated is requested between thk wire and test fixture.
- Type K standard Thermocouple connector.
- Sabre type 2 points connector (Molex) for power output.
- All other signals are available on a SudD type 15 points connector.
- Internal HE10 connector for board to board connection when BB474 is used.

Software
- standard EasyStress driver
- standard SCPI commands and protocol available with GPIB, RS232, RS422 interface.
### Main SCPI commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Comments</th>
<th>Défaut</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;*idn?&quot;</td>
<td>Identification of the device (ex. BE474A/TEC CONTROLLER/TELSS-N000 SN0000 Y2009V1000)</td>
<td>--</td>
</tr>
<tr>
<td>MEASure:DUT?</td>
<td>Reading of additive temperature measurement (°C scale)</td>
<td>-</td>
</tr>
<tr>
<td>MEASure:REGulation?</td>
<td>Reading of regulation temperature measurement in °C (selected sensor: reg:sens val)</td>
<td>-</td>
</tr>
<tr>
<td>MEASure:POWer?</td>
<td>Reading of power measurement in W (+0 for heating and -0 for cooling)</td>
<td>-</td>
</tr>
<tr>
<td>MEASure:VOLTage?</td>
<td>Reading of voltage measurement in V (+0 for heating and -0 for cooling)</td>
<td>-</td>
</tr>
<tr>
<td>MMX:DUT?</td>
<td>Reading of additive sensor envelope measurement</td>
<td>-</td>
</tr>
<tr>
<td>MMX:REGulation?</td>
<td>Reading of regulation sensor envelope measurement</td>
<td>-</td>
</tr>
<tr>
<td>OUTPut[?][0/1/on/off]</td>
<td>Enabling/Disabling outputs</td>
<td>-</td>
</tr>
</tbody>
</table>

### REGulation:
- **SENSor[?][0/1/THK/PT100]**: Selection of active regulation sensor. The selected sensor becomes the regulator sensor (REG) and the other becomes the supplementary sensor (DUT).
- **TYPE[?][0/1/2/3/4]**: Regulation type setting:
  - 0: NONE
  - 1: PELTIER
  - 2: HEATER
  - 3: COOLER
  - 4: OL: Open Loop, the power supply output follow set up of REG:VOLT and REG:CURR
- **CURRent[?][val]**: Maximum current allowed in A
- **VOLTage[?][val]**: Maximum voltage allowed in V
- **SLOPE[?][val]**: Slope measurements speed setting to meet the consign (°C/min scale)
- **TEMPerature[?][val]**: Regulation temperature setting in °C
- **CURRent:TYPE[?][val]**: Maximum current allowed in A
- **VOLTage:TYPE[?][val]**: Maximum voltage allowed in V
- **CURRent:TYPE[?][val]**: Slope measurements speed setting to meet the consign (°C/min scale)
- **VOLTage:TYPE[?][val]**: Regulation temperature setting in °C
- **CURRent:[?][val]**: Proportional parameter of the PID
- **VOLTage:[?][val]**: Integral parameter of the PID
- **DELay:[?][val]**: Derivative parameter of the PID

### LImit:
- **DUT:UPPer[?][val]**: Upper threshold value setting on the additive sensor in °C
- **DUT:LOWer[?][val]**: Lower threshold value setting on the additive sensor in °C
- **DUT:STATE[?][0/1/on/off]**: Selection on/off for additive sensor threshold monitoring
- **REGulation:DELay[?][val]**: Delay before applying thresholds setting on the additive sensor(0-60000)(seconds scale)
- **REGulation:UPPer[?][val]**: Upper threshold value setting on the regulation sensor in °C
- **REGulation:LOWer[?][val]**: Lower threshold value setting on the regulation sensor in °C
- **REGulation:STATE[?][0/1/on/off]**: Selection on/off for additive sensor threshold monitoring
- **DELay[?][val]**: Delay before applying thresholds setting on the regulation sensor(0-60000)(seconds scale)
- **DELta[?][val]**: Delta setting between the regulation value and the auxiliary sensor value in °C
- **DELta[?][val]**: Delta setting between the regulation value and the auxiliary sensor value in °C
- **DELta[?][val]**: Delta setting between the regulation value and the auxiliary sensor value in °C

### AUXiliar:
- **DELTa[?][val]**: Consign auxiliary temperature setting in °C
- **DELTA[?][val]**: Consign auxiliary temperature setting in °C
- **STATE[?][0/1/on/off]**: Selection On/Off for the auxiliary channel control. It activates the sensor measurement, the regulation(heater/fan) and thresholds.
- **DELTA[?][val]**: Consign auxiliary temperature setting in °C

### LIMit:
- **FAIL[?][0/1/on/off]**: Reading of alarm return:
  - 0: No alarm
  - 1: DUTL = lower threshold for the additive sensor
  - 2: DUTH = upper threshold for the additive sensor
  - 3: REGL = lower threshold for the regulation sensor
  - 4: REGH = upper threshold for the regulation sensor
  - 5: OVL = lower limit of the measurement range
  - 6: OVR = upper limit of the measurement range
  - 7: SENS = No sensor
  - 8: TEMP = Abnormal temperature on the power supply
  - 9: MID = Abnormal current measurement (>1A)
  - 10: MINN = Short circuit on the power supply (<0.5R)
  - 11: POW = Too high power delta between BE474 and BOOSTER (>1A)
  - 12: AUXL = lower threshold for the auxiliary sensor
  - 13: AUXH = upper threshold for the auxiliary sensor
  - 14: RADT = Delta threshold between regulation sensor and auxiliary sensor

### Identification:
- **SN**: Hardware revision.
- **TELSS-N000**: Serial number
- **Y2009**: Date of last calibration.
- **V1000**: Software revision.
- **BOOSTER MODE**: Booster activated
CPL? - Reading of board coupling
0:NC: No BOOSTER connected
1,ON: BOOSTER activated

CPLEXP[*][val] - Status for expected coupling. If CPL? and CPLEXP? are different when loading set up file, a warning message appears.

CONFNAME[*][val] - Configuration name in module memory

SUPPID? - Reading of the connected test fixture identification number (resistor of 100R to 100K)

SUPPIDE[X]*[val] - Setting of the expected identification of the test fixture. If SUPPID? and SUPPIDE[X] are different when loading set up file, a warning message appears.

All values greater than 28 are not verified (test fixture not connected).


Connection

BE474

ADC

out+
in+

ADC

out+
in+

ADC

out+
in+

25V

DAC

25V

DAC

+10A
+20V

DAC

+10A

TEC+

-20V

TEC-

Thermocouple

platinum sensor

auxiliary sensor

Identification resistor

24V 1.8A

DUT junction

Heat sink junction

SUBD 15 points

iTest SARL, 119, Rue de la Providence, 31500 TOULOUSE
05 61 54 81 30 05 61 54 81 39 itest@itest.fr www.itest.fr
**Memories**: The module enables the creation of ROLL or INFINITE memories for temperature and power measurements. The PT100 and thermocouple memories can be sample or envelope type. In this later case the sampling frequency for the measurement is 1,9Hz.