

## Feedback Loops in CPP

### 1.0 Julabo Heating Immersion Circulator

The CPP has a feedback loop that allows the CPP to control the temperature settings of the Julabo by sending temperature set commands (TSET) over the serial port. From the Main Menu select Feedback Loops. The CPP responds as follows. Operator inputs are in bold.

Feedback Loop (1,2,3) = **1**<cr>

Feedback Loop #1

1 – Julabo

C – Clear

Choice = **1**<cr>

Out Bit # = **30**<cr>

TSET = **53.0**<cr>

TSET+ = **58.0**<cr>

CPP Chn# (For Comm Port) = **3-2**<cr>

Feedback Loop (1,2,3) = <cr>

Return to Main Menu

### Example

As an example, it is desired to keep  $T_{OUT}$  between  $28^{\circ}\text{C}$  –  $30^{\circ}\text{C}$ . A Julabo Heating Immersion Circulator is connected to comm port 3-2 of the CPP, and temperature  $T_{OUT}$  is being monitored on channel 4 of the CPP.  $T_{OUT}$  can be a direct reading from a temperature sensor, an average reading calculated by the CPP, or it can be a rolling average computed by the CPP.

Using the above feedback set up, set a low alarm of  $29.0^{\circ}\text{C}$  on channel 4, ( $T_{OUT}$ ) and have it set output bit number 30 when the temperature of  $T_{OUT}$  is less than  $29.0^{\circ}\text{C}$ . With output bit number 30 not set, the CPP will set the temperature in the Julabo to  $53.0^{\circ}\text{C}$ . With output bit number 30 set, the CPP will send commands to the Julabo to set the temperature at  $58.0^{\circ}\text{C}$ . When the low alarm goes away, the CPP returns the Julabo temperature setting to  $53.0^{\circ}\text{C}$ .

The alarm set point, TSET, and TSET+ can be set up by the user to meet a system's physical operating parameters such as the latency time between a temperature change in the Julabo to an actual change in  $T_{OUT}$ , and the transfer of heat in the water bath to  $T_{OUT}$ .

Multiple alarm levels can be set on any channel in the CPP; this coupled with the Boolean feature in the CPP, allows many creative feedback loops to be created.

**Feedback Operation**

At the 36 second mark of each minute, the CPP checks all feedback loops. If a feedback loop is set up and the control bit is not set, the CPP sends TSET out the comm port associated with the entered channel. If the control bit is set, the CPP sends TSET+ out the comm port.

More information on the Julabo interface can be found in application note AN\_JUL.