

Interfacing with the Julabo Heating Immersion Circulator

1.0 Introduction

The CPP offers an interface to the Julabo Heating Immersion Circulator. Section 11 of the Julabo manual describes setting up the Julabo for remote operation and the commands supported by the instrument.

The CPP defaults to the factory set up of 7 data bits, even parity and 1 stop bit. The operating Baud rate can be set up in the initialization of the CPP, but the rate set up must match that set up in the Julabo.

2.0 Connection

The Julabo has a DB-9F connector installed for the RS-232 interface.

Signal	RJ-11	DB-9M
TxD from CPP	2	3
RxD into CPP	5	2
Gnd	3,4	5
RTS		7
CTS		8

3.0 Initialization

The CPP is initialized via the operator port, comm port #4. Entering an **I<cr>** results in the CPP bringing up a Main Menu selection. Selecting the channel initialization results in the CPP asking a series of questions as presented below. Operator responses are in **bold**, and **<cr>** means a carriage return. The numbers 1), 2) and so forth are used for discussion purposes only and are not printed in an actual system initialization.

- 1.) Channel # = **1<cr>**
- 2.) Name = NAME **T1<cr>**
- 3.) Units = UNITS **DEGC<cr>**
- 4.) Full Scale = 100.0 **<cr>**
- 5.) Zero = 0.0 **<cr>**

- 6.) Instrument Manufacturer
 - 00 = Other
 - 01 = API
 - 02 = Ander
 - 03 = Julabo
 - 04 = ML
 - 05 = Siemens
 - 06 = Thermo

- 7.) Setting = 00 **3<cr>**

- 8.) Julabo Ht Im Cir
 - 01 = Wrking T1
 - 02 = Wrking T2
 - 03 = Hi Lmt
 - 04 = Lo Lmt
 - 05 = Bth Tmp
 - 06 = Ht Watt
- 9.) Setting = 01<cr>
- 10.) Comm Port (3-00 Thru 3-08) = 3-00 3- 02<cr>
- 11.) Baud Rate
 - 1 = 300, 2 = 1200, 3 = 2400, 4 = 4800, 5 = 9600, 6 = 19.2K, 7 = 38.4K = 5 4<cr>
- 12.) Instrument ID = 0000 <cr>
- 13.) IMD Installed = 00 <cr>
- 14.) # Points For Interim Avg = 01 04<cr>
- 15.) # Points For Final Avg = 01 9<cr>
- 16.) Unip(U)/Bip(B) = U <cr>
- 17.) Unip(U)/Bip(B) Cals = B <cr>
- 18.) Channel # = <cr>

Line one simply asks which channel is to be initialized. A carriage return here exits back to the Main Menu. In other steps, a carriage return input leaves the setting unchanged and the CPP goes to the next question. In cases where the operator must provide an input, the CPP asks the same question again.

Lines 2 through 5 request information that is not required for proper operation when interfaced to an instrument over the serial port. It is, however, good operating procedures to set these inputs to match those in the instrument. The correct full scale and zero values are required if data stored in the CPP is being output to some other device (for example, over a Modbus connection) in a binary format. This is also true of channels set up as ADC input channels.

Channel names and the units can be up to six characters in length. The full scale and zero values can be four digits in length and the number of digits after the decimal point (if a decimal point is used) must be the same in the full scale and zero inputs. The inputs can also have a minus sign.

Line 6 lists all of the manufacturer drivers that are resident in this software version. In the example, only five manufacturers are presented. As the manufacturers are alphabetized, the numbers delineating the various manufacturers will change depending on how many drivers are installed.

In Line 7 of our example, the operator selected Julabo as the manufacturer.

In Lines 8 & 9, Select the parameter for this channel.

In Line 10 the CPP asks to which comm port this analyzer is going to be connected. This is the connector on the CPP into which the cable from the instrument is plugged. The allowable inputs are 00-08, which totals nine comm ports.

The comm port nomenclature should not be made overly complicated or confusing. Although comm Ports 3-00 through 3-08 are independent serial ports, internally the comm port 3 designation references interfacing to the instrumentation. Comm port 3-00 addresses comm port #3 physically located on the CPP printed circuit board and labeled comm #3 on the CPP back panel. Comm ports 3-01 through 3-08 address comm ports physically located on the expansion printed circuit board and are labeled comm 3-01 through comm 3-08 on the CPP back panel.

It should be noted that comm port #2 can be used to interface to some instrumentation. The Julabo line of instrumentation is **not** included in that group, and should always be assigned to a comm port number 3 designation. Comm port #2 is usually used with instruments that broadcast, which is normally meteorological instrumentation.

In line 11, the CPP is asking what baud rate should be used to communicate with this instrument. This setting should be 9600 Baud.

Line 12 asks if an instrument ID is required. An ID is not required with the Jubalo instruments.

Line 13 is asking if an IMD (Intelligent Multidrop Device) is installed in this comm port cabling. The IMD, manufactured by H2NS, allows a number of different instruments to be connected to a single comm cable. The instruments can have different protocols and even different baud rates. This is very useful when a collection of instrumentation is located remotely from the CPP. The IMD allows only one cable to be run between the CPP and the instruments, with the IMD providing the instrument multiplexing locally at the instruments. The IMD supports addresses from 01 through 60. An address of 00 indicates that an IMD is not installed in this communication cabling.

Lines 14 & 15 are questions regarding data validity qualifiers. The first (line 15) asks how many valid one minute samples the CPP must have to qualify the interim average as valid. Question 16 asks the same in regards to the final average.

Lines 16 & 17 allow negative data values to either be accepted or set to zero. Usually, negative values are set to zero, except during calibrations.

4.0 Communicating directly with the Julabo

The CPP supports two modes in which an operator can communicate directly with the connected instruments. One is an on line mode, in which the CPP interleaves operator and polling commands, and the second is an off line, unabated pass through mode.

4.1 On Line Communications

Via comm port #4, the CPP has a menu that defines the appropriate commands associated with the instrument selected. Via comm port #1, enter SETF to switch comm port #1 into comm port #4. Input **D43<cr>** and the CPP responds with a list of instrumentation that is connected to the CPP, as shown below;

Chn#	Manu	Mdl#	Type
01 =	Julabo	Ht Im Circ	
02 =	THERMO	SO2-43C	- SO2
03 =	API	NOX-200A	- NOX
04 =	API	NO2-200A	- NOX
05 =	API	NO- 200A	- NO

Selection = 1<cr>

CMD>?<cr>

A question mark results in the CPP printing a menu of the commands that it uses.

4.2 Unabated Pass Through

Tech note TN36 describes the unabated pass through mode of the CPP.

5.0 Status

With each data poll the CPP issues a status poll. Based on the status message returned by the Julabo, the data point is flagged as good or bad. A message response of -05 Temperature Measurement Alarm, or -07 Internal Error will result in the CPP flagging the data point bad. All other status messages result in the data point being flagged good.

6.0 Temperature Feedback Control

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

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°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°C . With output bit number 30 not set, the CPP will set the temperature in the Julabo to 53.0°C . With output bit number 30 set, the CPP will send commands to the Julabo to set the temperature at 58.0°C . When the low alarm goes away, the CPP returns the Julabo temperature setting to 53.0°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 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.