Operating Manual

LabVIEW Driver

VI Tree
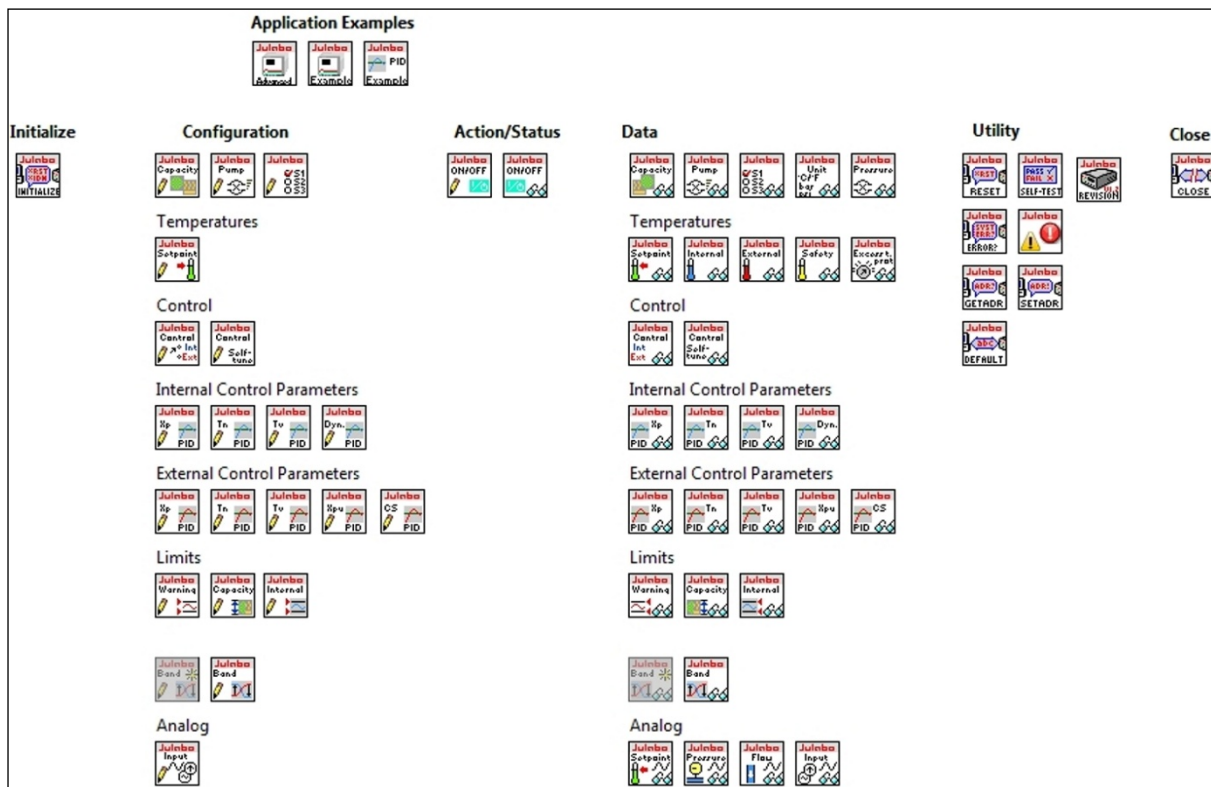
Table of Content

Application Examples

Advanced event triggered example.

Basic example how to read temperatures and adjust setpoint.

This example shows how to change control parameters in the unit.

1   Introduction

This is the instrument driver for JULABO units with serial interface. The VI Tree displays all the user-callable VIs of the instrument driver in an organized table.

System information for the LabVIEW Driver
Instrument Driver Technology: LabVIEW Plug and Play (project-style)
Manufacturer: JULABO Labortechnik GmbH
Supported Language(s):   LabVIEW
Interface(s):   Serial
Required: LabVIEW 8.2, NI VISA 4.1

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2   Installation

Please unzip the zip-file to <LabVIEW>\inst.lib directory, where <LabVIEW> is the path to your LabVIEW installation.
After that, LabVIEW has to be restarted. The driver should appear under Instrument I/O ➡ Device drivers.

3   Initialize

Establishes communication with the instrument and optionally performs an instrument identification query and/or an instrument reset. It also places the instrument in a default state needed for other instrument driver operations. Therefore, call this VI before calling other instrument driver VIs for this instrument. Generally, you need to call the Initialize VI only once at the beginning of an application.

4 Configuration

This VI **adjusts** the **capacity** with which the instrument heats or cools.
Adjustable range. -100 ... +100 %

Note:
This function is not available for all instruments. See operating manual to check whether your instrument supports adjustment of capacity via the serial interface.

This function is only available if you have set the actuating variable of the instrument to >**serial**<

This VI **sets** the **pump power level** that ranges from 1 to 5. The valid range can differ in dependence on the connected instrument. See operating manual for valid range.

Note:
This function is not available for units which do not support changing the pump stage. Refer to the units operating manual.

This VI **adjusts which** of the 3 **setpoints** should be used by the temperature controller.

Note:
This function is not available for all devices. Please see operating manual to see whether your instrument supports this function.

4.1 Temperatures

This VI sends a **new setpoint** to the connected instrument. The adjustable setpoint range may range in dependence on the type of instrument and the adjusted limits. On using any value outside these limits an error occurs. The resolution is up to two digits (0.01 °C).

Note:
Most devices support up to three setpoints. Please note that the correct setpoint is selected for controlling.

4.2 Control

This VI sets the instrument to **use** the **internal sensor** (0: Default) or the **external sensor** for **temperature control**.

Note:
This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

When performing a **selftuning** for the controlled system (temperature application system), the control parameters Xp, Tn and Tv are automatically determined and stored.

Note:
As the PID-parameters where recalculated during the selftuning process, you should not use selftune when you want to adjust custom PID-parameters.

Possible parameters:
>**off**< - no selftuning
The control parameters ascertained during the last identification are
used for control purposes.
>**once**< - single selftuning
The instrument performs a single selftuning of the controlled system
after each start with the key or after receiving a start command via
the interface.
>**always**< - continual selftuning
The instrument performs a selftuning of the controlled system
whenever a new setpoint is to be reached. Use this setting only
when the temperature application system changes permanently.

4.2.1 Internal Control Parameters

This VI **adjusts** the **Proportional range Xp** in case of internal
temperature control.

The proportional range is the temperature range below the setpoint
temperature value in which the control circuit reduces the heating
power from 100% to 0%.
Adjustable range: >**0.1 ... 99.9**<

This VI **adjusts** the **Resetting time Tn** (Integral component) in case
of internal temperature control.

Compensation of the remaining control deviation due to proportional
control. An insufficient resetting time may cause instabilities to
occur. An excessive resetting time will unnecessarily prolong
compensation of the control difference.
Adjustable range: >**3 ... 9999**<

This VI **adjusts** the **Lead time Tv** (Differential component) in case
of internal temperature control.

The differential component reduces the control settling time. An
insufficient lead time will prolong the time required to compensate
for disturbance effects and cause high overshoot during run-up. An
excessive lead time could cause instabilities (oscillations) to occur.
Adjustable range: >**0 ... 999**<

This VI **adjusts** the **control type** in case of internal temperature
control.

Possible parameters:
>**standard**<
Allows for reaching the setpoint faster – with setpoint change or
ramp function – but overshooting of up to 5 % is possible.
>**aperiodic**<
Ramp function: the increase of temperature occurs temporally offset
and achieves the target temperature without overshooting.
Setpoint change: The temperature increases at the same rate, the
target temperature is achieved without overshooting.

Note:
With both settings constant temperature is achieved after
approximately the same time.

4.2.2   External Control Parameters

This VI **adjusts** the **Proportional range Xp** in case of external temperature control.

The proportional range is the temperature range below the setpoint temperature value in which the control circuit reduces the heating power from 100% to 0%.
Adjustable range: >**0.1 ... 99.9**<

Note:
This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

This VI **adjusts** the **Resetting time Tn** (Integral component) in case of external temperature control.

Compensation of the remaining control deviation due to proportional control. An insufficient resetting time may cause instabilities to occur. An excessive resetting time will unnecessarily prolong compensation of the control difference.
Adjustable range: >**3 ... 9999**<

Note:
This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

This VI **adjusts** the **Lead time Tv** (Differential component) in case of external temperature control.

The differential component reduces the control settling time. An insufficient lead time will prolong the time required to compensate for disturbance effects and cause high overshoot during run-up. An excessive lead time could cause instabilities (oscillations) to occur.
Adjustable range: >**0 ... 999**<

Note:
This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

This VI **adjusts** the **Proportional range Xpu** in case of external temperature control.

The proportional range Xpu of the cascaded controller is only needed for external control.
Adjustable range: >**0.1 ... 99.9**<

Note:
This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

This VI **adjusts** the **CoSpeed of the controller**. The higher the CoSpeed the shorter is the tuning time (needed time to reach the setpoint), but overshoot can occur in the internal system.
Adjustable range: >**0 ... 5**<

Note:
This function affects the adjusted parameters Xp, Tn, Tv. If you change the CoSpeed factor, these parameters will be recalculated.

This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

4.3 Limits

This VI **adjusts** the **warning/alarm levels** for Overtemp and Subtemp.

If for a sensitive temperature application task adherence to a working temperature value Setpoint is to be supervised, then set high and low temperature warning values. In case the internal bath temperature exceeds the specified limits, the instrument will show a warning message or will switch to alarm state depending on the settings in the according menu.

Note:
The limits reaction is not adjustable via this driver. Please adjust the reaction in the according menu.

This VI **adjusts** the **maximum** allowed **heating and cooling capacity** in percent. 100 % corresponds to the technical specification of the equipment.
Adjustable range:
Heating capacity: >**0 ... 100 %**<
Cooling capacity: >**-100 ... 0 %** <

Values outside the allowed range are coerced to fit the valid range and no error occurs.

Note:
The maximum cooling capacity is only adjustable for models with >**proportional cooling control**>.

This VI **adjusts** the upper and lower **temperature limit** for the **internal temperature** during external temperature control.
>**InternMax**< and >**InternMin**< determine fixed limits for the temperature within the internal bath. The temperature controller cannot exceed these limits even if it would be necessary for achieving the temperature in an external system. Therefore it is possible that the external setpoint cannot be achieved.

Note:
This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

This VI adjusts the maximum allowed difference between internal and external temperature during heating up and cooling down. Adjustable range: **0 ... 200 K**

Note:
This function is not available for instruments which do not support different values for upper and lower bandlimit. Please use >**JULABO_Configure_SetBand.vi**< in case your instrument supports only one bandlimit. See operating manual to check whether your instrument supports different values for lower and upper bandlimit.

This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

This VI **returns** the **setting** of the **maximum difference** between the temperatures in the internal bath and external system. Adjustable range: **0 ... 200 K**

Note:
This function is only available for certain instruments (e.g. PRESTO). Circulators mostly use different settings for upper and lower bandlimit. For these instruments, please use >**JULABO_Data_SetBandLimits.vi**<
See operating manual to check whether your instrument uses different values.

This function is not available for devices which do not have an external sensor plug. For these instruments the VI will return an error (-08 INVALID COMMAND).

4.4   Analog

This VI **adjusts** the **type of external programmer input:**
0 = Voltage 0 V to 10 V
1 = Current 0 mA to 20 mA
Note:
This function is not available for all instruments. See operating manual to check whether your instrument supports this feature.

5   Action / Status

This VI returns true if the instrument is started or false if it is in Standby-Mode.

This VI starts the instrument (>**true**<) or stops it (>**false**<)

6   Data

This VI **returns** the actual **heating** or **cooling capacity**.

This VI **returns** the actually adjusted **pump stage**.

Note:
This function is not available for units which do not support changing the pump stage. Refer to the units operating manual.

This VI **returns** which **setpoint** is **selected** for temperature controlling.

Note:
This function is not available for all devices. Please see operating manual to see whether your instrument supports this function.

This VI **returns** the actual **temperature unit** (°C/°F) and **pressure unit** (bar/psi) of the device.

Note:
This function is only available for Hightech-Circulators HL/SL. In case of °F, all temperatures are adjusted / returned in °F. Please use this VI to check whether the temperatures have to be adjusted in °C or in °F. Use this VI to check the unit of the return value of **Get Analog Pressure.vi.**

The temperature unit is not adjustable via this driver. Please adjust the temperature unit in the menu of your instrument (see operating manual).

This VI **returns** the actual **pump pressure.**

Note:
This function is only available for **PRESTO**® instruments.

6.1   Temperatures

This VI **returns** the **actual value** of the selected **setpoint**.

This VI **returns** the actual **temperature value** measured by the **internal bath** sensor.

This VI **returns** the actual **temperature value** measured by the **external** sensor.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **temperature value** measured by the **safety sensor**. This value is used for safety reasons. It is compared with the temperature measured by the internal bath sensor. In case these values differ more than the specified maximal sensor difference, Alarm Code 06 is created.

This VI **returns** the actual setting for the **excess temperature protection**. Please refer to operating manual for this safety setting.

6.2   Control

This VI **returns** the **status** (internal, 0 or external, 1) to indicate the **type of control**, which is actually used.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **status** of the **optimization** process for internal and external **control parameters**.

Meaning:
>**off**< - no selftuning
The control parameters ascertained during the last identification are used for control purposes.
>**once**< - single selftuning
The instrument performs a single selftuning of the controlled system after each start with the key or after receiving a start command via the interface.
>**always**< - continual selftuning
The instrument performs a selftuning of the controlled system whenever a new setpoint is to be reached. Use this setting only when the temperature application system changes permanently.

6.2.1   Internal Control Parameters

This VI **returns** the **Proportional range Xp** (Proportional component) in case of internal temperature control.

This VI **returns** the **Resetting time Tn** (Integral component) in case of internal temperature control.

This VI **returns** the **Lead time Tv** (Differential component) in case of internal temperature control.

This VI **returns** the **control type** (aperiodic/standard) in case of internal temperature control.

Meaning:
>**standard**<
Allows for reaching the setpoint faster – with setpoint change or ramp function – but overshooting of up to 5 % is possible.
>**aperiodic**<
Ramp function: the increase of temperature occurs temporally offset and achieves the target temperature without overshooting.

6.2.2 External Control Parameters

This VI **returns** the **Proportional range Xp** (Proportional component) in case of external temperature control.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **Resetting time Tn** (Integral component) in case of external temperature control.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **Lead time Tv** (Differential component) in case of external temperature control.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **Proportional range Xpu** in case of external temperature control.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **CoSpeed of the controller**. The higher the CoSpeed shorter is the tuning time (needed time to reach the setpoint), but overshoot can occur in the internal system.

Note:
This function is not available for devices which do not have an external sensor plug.

6.3 Limits

This VI **returns** the **warning/alarm** levels for **Overtemperature** and **Subtemperature**.

If for a sensitive temperature application task adherence to a working temperature value Setpoint is to be supervised, then set high and low temperature warning values. In case the internal bath temperature exceeds the specified limits, the instrument will show a warning message or will switch to alarm state depending on the settings in the according menu.

This VI **returns** the **maximum** allowed **heating and cooling capacity** in percent. 100 % corresponds to the technical specification of the equipment.

This VI **returns** the **upper** and **lower temperature limit** for the **internal temperature** during **external temperature control**.

Note:
This function is not available for devices which do not have an external sensor plug.

This VI **returns** the **maximum** allowed **difference** between **internal** and **external temperature** during **heating up** and **cooling down**.

Note:

This function is not available for instruments which do not support different values for upper and lower bandlimit. Please use JULABO_Configure_GetBand.vi in case your instrument supports only one bandlimit. See operating manual to check whether your instrument supports different values for lower and upper bandlimit.

This function is not available for devices which doe not have an external sensor plug.

This VI **returns** the **setting** of the **maximum difference** between the **temperatures** in the **internal bath** and **external system**.

Note:

This function is only available for certain instruments (e.g. PRESTO®). Circulators mostly use different settings for upper and lower bandlimit. For these instruments, please use JULABO_Data_GetBandLimits.vi.
See operating manual to check whether your instrument uses different values.

This function is not available for devices which do not have an external sensor plug.

6.4   Analog

This VI **returns** the actual **setpoint adjusted** via the analog interface **EPROG**

Please set the EPROG meaning to SETPOINT. See operating manual.

Note:

This function is not available for all instruments. See operating manual to check whether your instrument supports this feature.

This VI **returns** the actual **pressure** measured via the analog interface **EPROG**. Use *Get Units.vi* to determine the pressure unit.

Please set the EPROG meaning to >**PRESSURE**<. See operating manual.

Note:

This function is not available for all instruments. See operating manual to check whether your instrument supports this feature.

This VI **returns** the actual **flow** measured via the analog interface **EPROG** in l/m.

Please set the EPROG meaning to FLOW. See operating manual.

Note:

This function is not available for all instruments. See operating manual to check whether your instrument supports this feature.

This VI **returns** the **type** of **external programmer input**:
0 = Voltage 0 V to 10 V
1 = Current 0 mA to 20 mA

Note:
This function is not available for all instruments. See operating manual to check whether your instrument supports this feature.

7   Utility

Resets the instrument and then **sends** a set of **default setup commands** to the instrument.

Runs the instrument's **self-test routine** and returns the test results.

Queries the current instrument **firmware revision** and instrument **driver revision**.

Refer to the Readme file for detailed driver information including modification history.

Queries the instrument **for any errors** in the instrument's error queue. It will continue to read errors until all errors have been read from the instrument. Any errors will be returned in the Error Out cluster.

Note:
This VI is called automatically by most drivers VIs so it is not usually necessary to call this in an application.

Checks whether the error in the **error cluster** is a device specific error and checks whether device has **an alarm or a warning**.

This VI **returns** the adjusted **RS485 address**.

This VI **adjusts** the **RS485 address**.

This VI **identifies** the **connected unit** by the units VERSION string.

8   Close

Performs an instrument **error query** before terminating the software connection to the instrument.