| **Connection Tab**  **Control Name** | **Minimum Limit** | **Maximum Limit** | **Step** | **Default Value** | **Configuration File Keyname** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| TPG Gauge COM Port: | COM1 | COM30 | 1 | N/A | tpg com | Set the COM Port for the TPG Gauge |
| TPG Gauge Baud Rate: | 300 | 38400 | N/A | 9600 | tpg baud | Must be set to 9600 for the TPG-36x. |
| LIN Motor COM Port: | N/A | N/A | N/A | N/A | lin com | Ports must be discovered prior to selection (refresh). |
| Process Interval: | 1 | 60 | 0.1 | 10 | interval | Time interval between calculating motor steps and performing the motor jog. |
| Lakeshore Setpoint Alias: | N/A | N/A | N/A | N/A | setpoint alias | The process uses the Search Devices by Class and Device Name.vi located in the Devices Utility Library. This VI  looks at any motor class that uses a driver with “lakeshore” in the device name. A dropdown is populated with all device alias names found in the search. The user selects the name to be associated with the PID calculation. |
| Lakeshore Temperature Alias: | N/A | N/A | N/A | N/A | temp alias | The process uses the Search Devices by Class and Device Name.vi located in the Devices Utility Library. This VI  looks at any parameter class that uses a driver with “lakeshore” in the device name. A dropdown is populated with all device alias names found in the search. The user selects the name to be associated with the PID calculation. |
| Auto-Reconnect Enabled | N/A | N/A | N/A | True | reconnect | Switch to determine if the program attempts to re-establish a connection to the controller after a fault. Faults related to obtaining a measurement (PRx command) are exempt from this process. These faults will immediately generate a notification if configured and will not automatically reconnect. A “notification” includes posting a message in the experiment log and sending an email message to the recipients defined in the *recipients* keyname in **se\_temperature** section of the notifications.config file if enabled. |
| Auto-Reconnect Attempts: | 1 | 10 | 1 | 3 | attempts | Number of attempts to reconnect. Once reconnected, there needs to be a minimum of 30 successful measurement cycles before the code sets the reconnect counter back to the user set value. If the number of attempts to reconnect are met and a successful connection could not be established a notification will be generated as defined in the Auto-Reconnect Enabled Notes column. |
| Auto-Reconnect Interval: | 1 | 60 | 1 | 10 | attempt interval | Time interval to delay between automatic reconnection attempts. |
| ENABLE LIN Motor-Valve Controller | N/A | N/A | N/A | False | lin enabled | Setting this switch will begin the process of logically connecting SpICE to the hardware in the controller and setting the basic parameters. While the hardware is being initialized the button will display ‘Initializing…’ to indicate the progress in making the connection.  When the switch is set the other controls on this tab will become disabled. Changing these control values after the hardware has been initialized would induce erratic behavior in the program.  Resetting this switch will logically disconnect SpICE from the hardware. |

| **Manual Control Tab**  **Control Name** | **Minimum Limit** | **Maximum Limit** | **Step** | **Default Value** | **Configuration File Keyname** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| Continuous Control: Open | N/A | N/A | N/A | N/A | N/A | When switched on drives the needle valve motor continuously in the Open direction. Switching the button Off or pressing the STOP button will discontinue driving the motor. |
| Continuous Control: Close | N/A | N/A | N/A | N/A | N/A | When switched on drives the needle valve motor continuously in the Closed direction. Switching the button Off or pressing the STOP button will discontinue driving the motor. |
| STOP | N/A | N/A | N/A | N/A | N/A | Pressing the STOP button sets any of the other motion control buttons to the OFF state an in turn discontinues driving the motor. |
| Jog Control: Steps per Jog | 1 | Inf | 1 | 5 | N/A | Sets how many pulses or steps are sent to the motor per Jog command. |
| Jog Control: Jog Direction | N/A | N/A | N/A | N/A | N/A | Sets the direction for performing a jog on the needle valve motor. |
| Jog Control: Commit Jog | N/A | N/A | N/A | N/A | N/A | Pressing this button begins the Jog function on the needle valve motor. |
| Query LIN Controller: | N/A | N/A | N/A | N/A | N/A | Drop down selection of query calls to the needle valve motor controller. |
| LIN Query Response: | N/A | N/A | N/A | N/A | N/A | Raw data response for the Query LIN Controller: command selected. |

| **Auto Control Tab**  **Control Name** | **Minimum Limit** | **Maximum Limit** | **Step** | **Default Value** | **Configuration File Keyname** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| Table Selection | N/A | N/A | N/A | Auto Table | table selection | Drop down selection box providing the user the option of which parameters to use for calculating steps the PID loop output sets for controlling the needle valve motor. If Auto Table is selected the program compares the temperature setpoint to the temperature measurement. There are 3 conditions that determine which table parameters are used.   1. If the temperature is within the **Temperature Tolerance** the Heating Table values are used. 2. If the setpoint is less than the measurement the Cooling Table is used. 3. If the setpoint is greater than the measurement the Heating Table is used. |
| Cooling Table: Lakeshore Setpoint | 0 | Inf | 1 | [0,3,10,1000] | cooling setpoint | Threshold steps in temperature used to determine the target pressure listed in the Cooling Table: Flow Setpoint list. This list is saved in the configuration file in tab ordered values, i.e. 0,3,10,1000. |
| Cooling Table: Pressure Setpoint | 0 | Inf | 0.5 | [4,8,20] | cooling pressure | Target pressure values when the Cooling Table is in use. The target pressure is determined by searching the range in which the Lakeshore Setpoint Alias value falls within the Cooling Table: Lakeshore Setpoint list. This list is saved in the configuration file in tab ordered values, i.e. 4,8,20. |
| Heating Table: Lakeshore Setpoint | 0 | Inf | 1 | [0,50,100,1000] | heating setpoint | Threshold steps in temperature used to determine the target pressure listed in the Heating Table: Flow Setpoint list. This list is saved in the configuration file in tab ordered values, i.e. 0,50,100,1000. |
| Heating Table: Pressure Setpoint | 0 | Inf | 0.5 | [4,2,1] | heating pressure | Target pressure values when the Heating Table is in use. The target pressure is determined by searching the range in which the Lakeshore Setpoint Alias value falls within the Heating Table: Lakeshore Setpoint list. This list is saved in the configuration file in tab ordered values, i.e. 4,2,1. |
| Manual Table: Pressure Setpoint | 0 | Inf | 0.1 | 1.0 | manual pressure sp | When Manual Table is selected in the Table Selection drop down this value is used as the target pressure. |
| Manual Table: Step Increments | 1 | 1000 | 1 | 5 | manual step | Jog steps to use in either the Open or Close direction when using the Manual Table. |
| PID Controls:  P  I  D  PID Enabled (Hidden) | 0  0  -1.00  False | Inf  Inf  Inf  True | 0.01  0.01  0.01 | 15.00  5.00  1.00  True | pid | PID values used for the PID control loop. Values are saved in the configuration file in tab ordered values followed by a ‘true’ or ‘false’, i.e. 15.0,5.0,1.0,true.  PID Enabled is hidden due to currently being unnecessary. |
| Pressure Tolerance | 0.1 | Inf | 0.1 | 0.2 | pressure tolerance | This tolerance is used for the pressure. If the pressure is within tolerance a 0 will be output for motor steps. |
| Temperature Tolerance | 0.1 | Inf | 0.1 | 2.0 | temperature tolerance | When the temperature measurement read for the Lakeshore Temperature Alias: is within this tolerance two actions take place. The first is that temperature and pressure values used to determine motor steps are pulled from the Heating Table. The second action is the PID values are reduced by a factor of 3. This is carry over from previous code. |
| Motor Limits: Upper | -Inf | Inf | 0 | 26000 | upper limit | Upper limit value for the motor position step accumulator. The motor controller in this chassis does not maintain a position with any confidence. Also, the method in which the code was originally written, when the motor is driven in the opposite direction the value in the motor controller memory is reset to 0. It was necessary to construct a motor step accumulator in software to keep a relative position.  This value can only be modified if the Motor Limits: State checkbox is unchecked. The Motor Limits: State checkbox must be checked for the accumulator limits to be in effect. If the Position Accum reaches this limit the indicator background color will change as a visual representation. The **Target Steps** for driving the motor will be set to 0 if the motion continues in the direction of upper limit.  NOTE: There are 51200 steps in one full rotation of the motor. |
| Motor Limits: Lower | -Inf | Inf | 0 | -26000 | lower limit | Lower limit value for the motor position step accumulator.  This value can only be modified if the Motor Limits: State checkbox is unchecked. The Motor Limits: State checkbox must be checked for the accumulator limits to be in effect. If the Position Accum reaches this limit the indicator background color will change as a visual representation. The **Target Steps** for driving the motor will be set to 0 if the motion continues in the direction of upper limit. |
| Motor Limits: State | False | True | N/A | False | limit lock | Controls both editing of the Motor Limits values and places limit checks in effect. |
| Zero Accumulator | False | True | N/A | False | N/A | Sets the Position Accum (motor step accumulator) to 0. |
| Lock Automatic Control | False | True | N/A | False | autolock enabled | When set this will disable all controls on the Needle Valve tab. |

|  |  |  |
| --- | --- | --- |
| **Status Indicators**  **Field Name** | **Configuration File Keyname** | **Notes** |
| Target Pressure | N/A | Displays the pressure determined by the list selected either manually or automatically and the temperature setpoint assigned in the Lakeshore Setpoint Alias: drop down list box. |
| Pressure Reading | N/A | The measurement from the pressure gage, typically the VTI pressure. |
| Sample Pressure | N/A | Currently not in use. Future goals are to have the pressure measured in the sample chamber. |
| Valve Status: Target Steps | N/A | Calculated or set steps to drive the motor. |
| Valve Status: Position Accum | last position | Accumulated steps driven tallied in the software. This value is stored whenever a difference of more than 100 steps is achieved or on any other save. |
| Opening | N/A | Indicate when the motor is being driven in the open direction. |
| Closing | N/A | Indicate when the motor is being driven in the close direction. |
| Lakeshore: (temp) | N/A | This indicator displays the setpoint of the motor that was selected in the Lakeshore Setpoint Alias: drop down list box. The label on the indicator displays the alias name of the motor. |
| Lakeshore: (vti) | N/A | This indicator displays the setpoint of the parameter that was selected in the Lakeshore Temperature Alias: drop down list box. The label on the indicator displays the alias name of the parameter. |
| Status | N/A | Green when operating nominally. Red when a fault is registered. |
| Error Code | N/A | Displays the error code generated, 0 being no errors. |

Saving of configuration values: This code automatically saves all values when any value is changed with exception of controls on the Manual Control tab. Data is also saved when the automatic control PID process is functioning and there is a difference in the position accumulator greater than 100 steps.

Restoring values are read upon startup is performed as part of the launching of the code. Alias links are re-established for the Lakeshore Setpoint Alias: and the Lakeshore Temperature Alias:. If the lin enabled key is true the program will automatically initialize connection to the LIN controller and the TPG gauge as if the ENABLE LIN Motor-Valve Controller button was pressed. If the autolock enabled key is true the program will automatically switch to the Auto Control tab to begin the regulation process and set the Lock Automatic Control button.

Add the following line in the [Instrument] section of the configure.ini file:

LINMVCConfig=linmvc.config

linmvc.config

;Do not change the key names or the order of the key names in this file.

;The Read and Write functions require this ordered structure.

[communications]

tpg com = "COMx"

tpg baud = "9600"

lin com = "COMy"

interval = "10.000"

setpoint alias = ""

temp alias = ""

reconnect = "true"

attempts = "3.000"

attempt interval = "10.000"

lin enabed = "false"

[tables]

table selection = "Auto Table"

cooling setpoint = "0,3,10,1000"

cooling flow = "4,8,20"

heating setpoint = "0,50,100,1000"

heating flow = "4,2,1"

manual pressure sp = "1.0"

manual step = "5"

pid = "15.0,5.0,1.0,true"

pressure tolerance = "0.2"

temperature tolerance = "2.0"

upper limit = "26000"

lower limit = "-26000"

limit lock = "false"

last position = "0"

autolock enabled = "false"

notifications.config

[server]

notifications\_enabled = true

mail\_server = hfir-daq.ornl.gov

return\_address = HFIR-{instrument]@hfir-daq.ornl.gov

[se\_temperature]

enable = true

subject = Temperature Control Fault Detection Notification

message =

recipients = abc@ornl.gov

'NOTE\_separate multiple Recipients with a semicolon ;