EN: This Datasheet/Document is presented by the manufacturer.

Please visit our website for pricing and availability at www.hestore.hu.

USB Control and Configuration of the

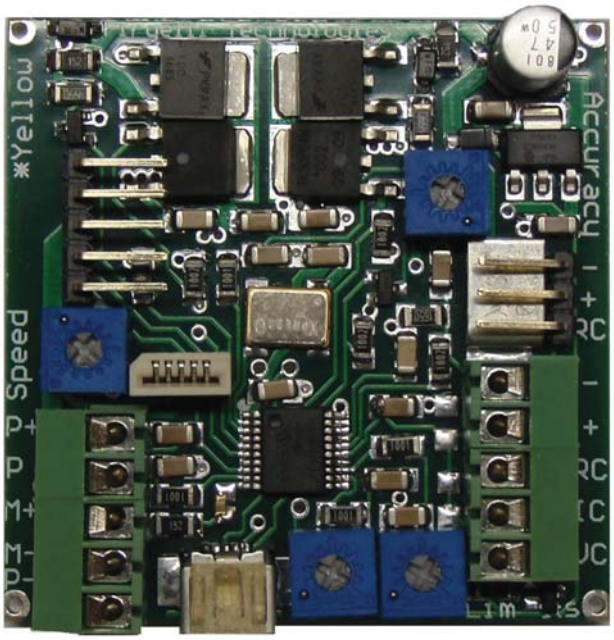
LAC

(Linear Actuator Control Board)

Compatible Products:

LAC
L12-SS-GG-VV-P
L16-SS-GG-VV-P
PQ12-GG-VV-P
P16-SS-GG-VV-P
T16-SS-GG-VV-P

This note provides further information regarding the Linear Actuator Control board, with the intent to allow custom computer control and configuration.



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Manual Quick Start:

The LAC board is static sensitive. Ensure your work area is static safe prior to removing the board from the static bag or optional housing.



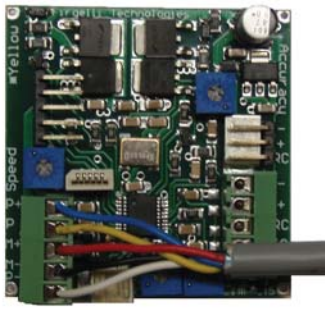
With all power and USB cables disconnected, connect an actuator to either the screw terminal header or the Actuonix connectors as described in the datasheet.



PQ12–P : Copper faces contacts

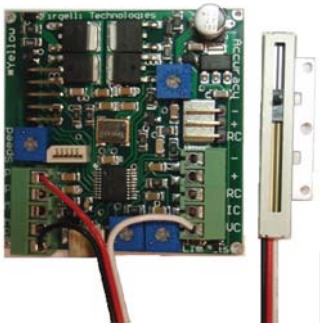


L12–P and L16-P

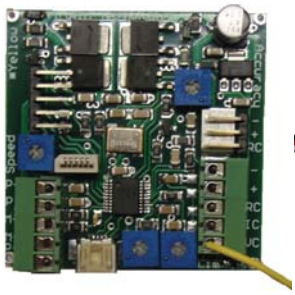


Other –P : Wire colours may differ

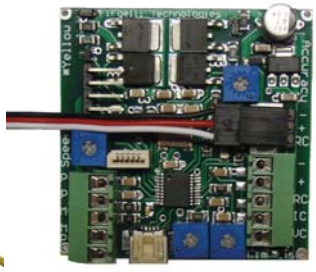
Connect the external potentiometer, control signal, or RC connector.



External Pot : Wiper wire to VC



Signal : Connect RC, IC, or VC

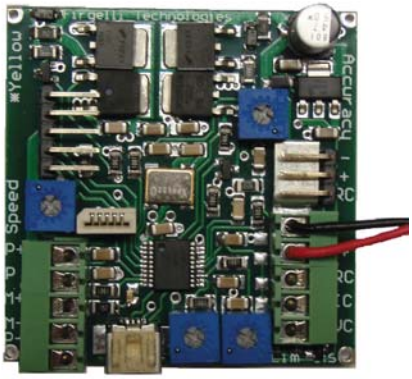


RC Receiver : Standard Connector

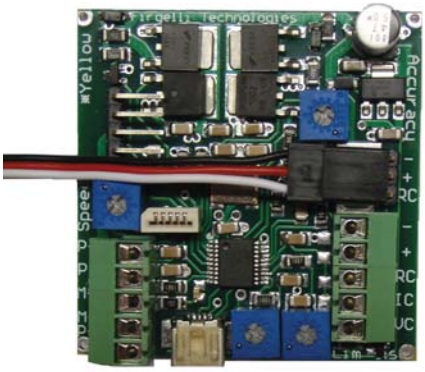
If connecting a signal to RC, IC, or VC, make sure the signal ground is connected to the power supply ground (-).

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Apply power to the LAC board. If using the RC connector, **do not** connect a separate power supply. This can result in large currents flowing between power supplies. If you do wish to connect a separate supply, ensure the Red RC wire is disconnected.

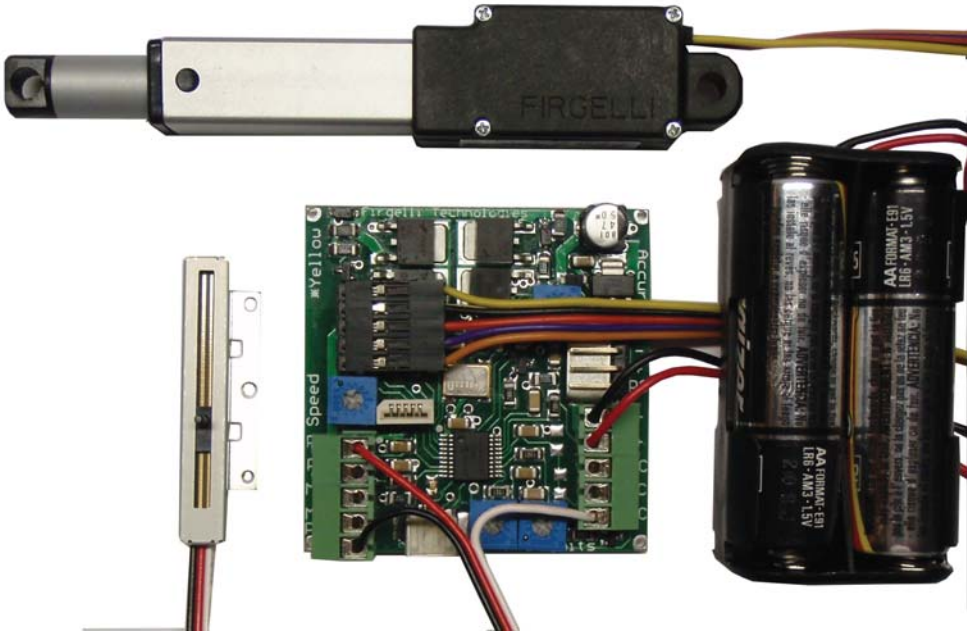


+/- Power terminals



RC connector : No other power

You system should now operate normally with Actuonix's default configuration.



Actuonix LAC : Battery Powered, L12-P Actuator, Potentiometer Controlled

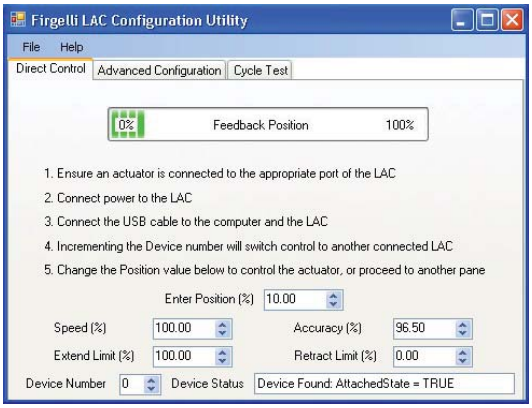
To manually adjust the LAC configuration, rotate the four potentiometers on the LAC to the desired locations. Counter clockwise reduces the corresponding value, while clockwise rotation increases the value. Power must be cycled before changes take effect.

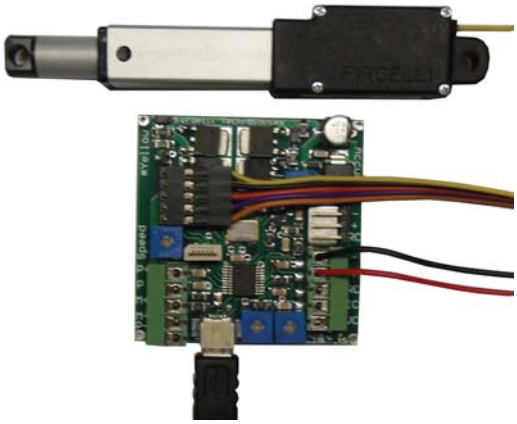
Limits – The Potentiometer closer to the USB connector is the retract limit, and the one further away is the extend limit. For maximum stroke, set each potentiometer to fully clockwise. Rotating counter clockwise from this position will move the limits inward, from either end. If your settings overlap, the actuator will not move at all.

Speed – Fully counter clockwise, sets the speed to zero. Fully clockwise, sets the speed to maximum.

Accuracy – Fully clockwise rotation sets the precision to maximum. Rotating counter clockwise increases the distance around the desired position where the actuator will stop moving. If the actuator is jittery, reduce the precision slightly.

Advanced USB control options:

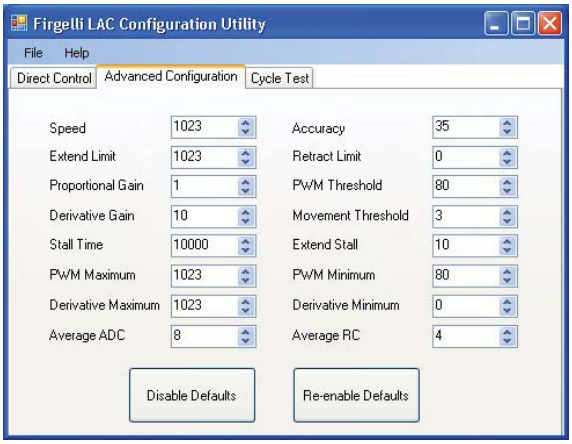




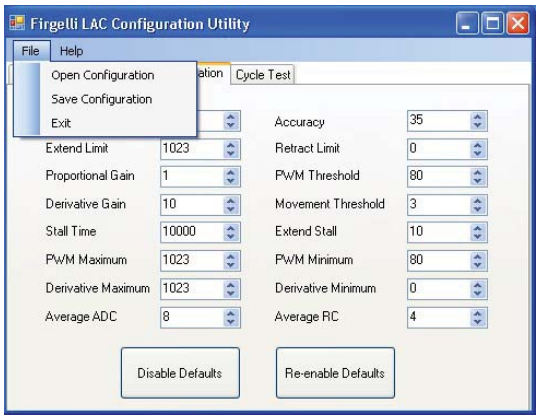
The included Advanced Configuration Program allows all the manual settings, and many other control values, to be set by USB.

The Direct Control Tab, shown above, allows simple USB control of Position and the four regular potentiometer controls. All these controls accept values from 0 to 100 percent.

The Advanced Configuration Tab provides full configuration control. Values can be set to override the defaults, and the potentiometers, by pressing the Disable Defaults button. The entered values will then be retained even when power is cycled. To return to the default state, reconnect to the LAC Configuration Utility and press the Re-enable Defaults button.



Advanced configuration settings can be saved and re-opened, through the File menu.



Brief descriptions for each value can be seen by moving the mouse over the corresponding label ("Stall Time", "Accuracy", etc). More detailed descriptions are given in the Custom Windows Programs section of this document.

Custom Control Programs:

The supplied .dll file can be used to interface with the Actuonix LAC using a variety of Windows based programming languages, including Visual C++ and Labview. The standard functions are described in the mpusbapi.h file, while the LAC specific details are described below.

The MPUSBOpen function is used to retrieve INHandle and OUTHandle. Once a valid connection is established, all LAC functions are accessed using MPUSBWrite(...) and MPUSBRead(...). Be sure to close any openHandles with MPUSBClose before exiting your program. Labview example code is available.

Format: 3-byte packet

Control, Data Low, Data High

Buffer[0]=Control
Buffer[1]=Data Low
Buffer[2]=Data High

Write: MPUSBWrite(OUTHandle, Buffer, 3, &ActualLength, 1000)
Read : MPUSBRead(INHandle, Buffer, 3, &ActualLength, 1000)

Control Values:

0x01 SET_ACCURACY
0x02 SET_RETRACT_LIMIT
0x03 SET_EXTEND_LIMIT
0x04 SET_MOVEMENT_THRESHOLD
0x05 SET_STALL_TIME
0x06 SET_PWM_THRESHOLD
0x07 SET_DERIVATIVE_THRESHOLD
0x08 SET_DERIVATIVE_MAXIMUM
0x09 SET_DERIVATIVE_MINIMUM
0x0A SET_PWM_MAXIMUM
0x0B SET_PWM_MINIMUM
0x0C SET_PROPORTIONAL_GAIN
0x0D SET_DERIVATIVE_GAIN
0x0E SET_AVERAGE_RC
0x0F SET_AVERAGE_ADC

0x10 GET_FEEDBACK

0x20 SET_POSITION
0x21 SET_SPEED

0x30 DISABLE_MANUAL

0xFF RESET

Note: Whenever a command is sent, the LAC will echo back the command. The exception is SET_POSITION, which returns the current position.

0x01 SET_ACCURACY:

This is the value controlled by the Accuracy Potentiometer. A value between 0-1023 is accepted. When the feedback position is plus or minus this value, the actuator will stop moving. Reducing this too far will result in the actuator continuously moving back and forth, never reaching the set point. The default value is four. To find the equivalent distance, use the formula:

$$\frac{Value}{1024} \times Stroke$$

For example, a value of four will give you +/- 0.117mm accuracy when controlling a 30mm actuator.

$$\frac{4}{1024} \times 30\text{mm} = 0.117\text{mm}$$

0x02 SET_RETRACT_LIMIT and 0x03 SET_EXTEND_LIMIT

These are the values that are set with the Limits Potentiometers. Setting the Extend_Limit to 1023 and the Retract_Limit to zero will allow movement over the full range. However, it is recommended to offset these values to ensure the actuator is never driven into the physical end stops. This increases cycle life considerably. To set the desired limits take the distance (mm) from the physical stop you wish to limit the actuator to, and plug it into the following equation.

$$\frac{Distance}{Stroke} \times 1023$$

For example, to set the limits to 1mm from the end stop of a 30mm stroke actuator, set EXTEND_LIMIT to 34.

$$\frac{1}{30} \times 1023 = 34$$

0x04 SET_MOVEMENT_THRESHOLD

This value determines the minimum actuator speed that is considered a stall. When the actuator speed drops below this value, the stall timer begins counting.

0x05 SET_STALL_TIME

This is the amount of time in milliseconds that the actuator will wait before turning off the motor when a stall is detected. This timer is triggered when the actuator determines the speed of movement is below an acceptable level. The actuator will exit this state when the input signal tells the actuator to move in the opposite direction.

0x06 SET_PWM_THRESHOLD

This value sets the distance around the set point where the PWM PD controller is active. When the distance between the feedback and set point is greater than this value the actuator speed is set to maximum.

0x07 SET_DERIVATIVE_THRESHOLD

This value is compared to the measured speed to determine when the PWM should be increased to attempt to exit a stall condition. This is normally set to the same value as the MOVEMENT_THRESHOLD.

0x08 SET_MAX_DERIVATIVE

This value sets the maximum value that the derivative term can contribute to the control speed.

0x09 SET_MIN_DERIVATIVE

This is the minimum value that the derivative can contribute to the control speed.

0x0A SET_MAX_PWM_VALUE

This is the value that is manually controlled by the speed potentiometer. This is the speed that the actuator runs at when outside the PWM_THRESHOLD. Setting this to

1023 will allow the actuator to achieve full speed. The actuator may exceed this value while attempting to overcome a stall condition.

0x0B SET_MIN_PWM_VALUE

This is the minimum PWM value that can be applied by the PD control.

0x0C SET_Kp

This is the constant for the proportional control term. Increasing this value will make the actuator approach the set point faster; reducing this will make the approach slower. If the actuator is overshooting the set point before stopping, then reducing this value will reduce the amount of overshoot.

0x0D SET_Kd

This value sets the rate at which the differential portion of the controller increases during a stall condition. This is not a true differential term. However, the effect is similar. As long as the actuator detects a stall condition, the derivative term is incremented. If the stall condition is resolved the stall timer will be reset, otherwise the stall timer will elapse and stop the motor.

0x0E SET_AVERAGE_RC

This value determines the number of samples used in filtering the RC input signal before the actuator moves to a new position. Increasing this value can increase stability but does effect response time. The default value is four. The delay time can be calculated by multiplying this value by 20ms. This value does not affect the feedback filter delay. The actuators control response to a valid input signal will not be affected.

0x0F SET_AVERAGE_ADC

This value determines the number of samples used in filtering the feedback and analog input signals (if active). Increasing this value has a similar delay effect as described above, however this delay does affect actuator control response. Since this delay allows the actuator to move a certain distance before updating the speed based on the PD values, other values may need to be re-tuned if this value is changed.

0x10 GET_FEEDBACK

This command causes the actuator to respond with a feedback packet containing the current actuator position. This is read directly from the ADC and may not be equal to the set point if the actuator has not yet reached it.

0x20 SET_POSITION

This command allows USB control and disables RC, I, and V inputs until the system is rebooted. The data sent with this command determines what position the actuator moves too.

$$\frac{Distance}{Stroke} \times 1023$$

For example, to half way extend(25mm) a 50mm actuator, send 512. (The calculated value is rounded to a whole number).

0x30 DISABLE_MANUAL

This command saves the current configuration settings to EEPROM and disables the four potentiometers. On reboot, these values will continue to be used instead of the potentiometer values. Analog inputs will still function as normal.

0xF0 RESET

This command turns the manual control potentiometers on and resets the configuration settings to factory default.

Related Documents:

- Extending actuator life

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