Soft_Stops.vi

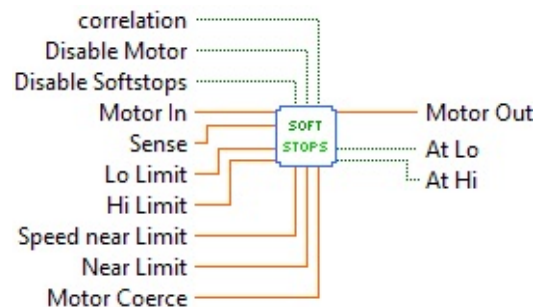Help by FRC Team 836 - The RoboBees

VI DESCRIPTION:

This VI provides 'soft stop' behavior to control a motor (or mechanism's) range of motion. It requires a sensor input that is used to determine if the position is within or near range limits.
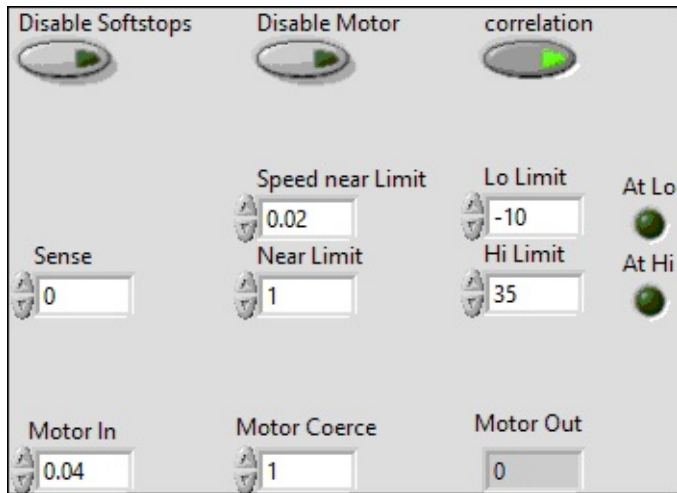
VI output (Motor Out) will equal input (Motor In) as long as sensed position is within the defined range. When position is near the hi or lo limit, the output can be no higher than a 'slow'

value if (and only if) the position is continuing toward that limit - this reduces momentum prior to reaching a hard limit, which reduces positional overshoot. Output will become zero

upon reaching a limit, but still allow for a reverse motor command to move position away from the limit.

Use this only when the motor is NOT in a control loop (i.e. when under direct control from joystick). To limit motor travel when using a control loop, simply coerce the setpoint to limits.

DBL **Speed near Limit**

DBL **Near Limit**

DBL **Lo Limit**

DBL **Hi Limit**

DBL **Sense**

DBL **Motor In**

TF **Disable Motor**

DBL **Motor Coerce**

TF **Disable Softstops**

TF **correlation**

At Lo

At Hi

Motor Out

Disable Softstops

Soft Stops prevent MECHANISM from hitting Mechanical Hard Stops

At Lo

True

At Lo limit

False

Allow only opposite correlated motor travel

Motor In

Speed near Limit

True

Lo Limit

Sense

Hi Limit

Near Limit

Tr

0

Motor Out

At Hi

correlation

Disable Motor

Motor Coerce

VI DESCRIPTION:
This VI provides 'soft stop' behavior to control a motor (or mechanism's) range of motion. It requires a sensor input that is used to determine if the position is within or near range limits.
VI output (Motor Out) will equal input (Motor In) as long as sensed position is within the defined range. When position is near the hi or lo limit, the output can be no higher than a 'slow' value if (and only if) the position is continuing toward that limit - this reduces momentum prior to reaching a hard limit, which reduces positional overshoot. Output will become zero upon reaching a limit, but still allow for a reverse motor command to move position away from the limit.

Use this only when the motor is NOT in a control loop (i.e. when under direct control from joystick). To limit motor travel when using a control loop, simply coerce the setpoint to limits.

INPUTS:
Motor In - Motor control value, typically between -1 to +1, (but not required to be).
Sense - Sensed value of motor or mechanism position. Any defined engineering unit.
Motor Coerce - Constraint placed on VI output, will limit output value to +/- this value around zero. Used to limit max motor speed.
Lo Limit - The lowest value allowed for the motor or mechanism's range of motion. Units are same as Sense.
Hi Limit - The highest value allowed for the motor or mechanism's range of motion. Units are same as Sense.
Near Limit - Value 'inside' the Lo/Hi Limits where the output is constrained to slow as the position approaches the defined limits. Can be set to zero if momentum does not need to be arrested.
Speed Near Limit - A motor speed value coercing output when position is within Near Limit of Lo/Hi Limit locations. Used with Near Limit to limit positional overshoot.
Correlation - Set to True (default) for positive correlation between the signs of motor value and resultant sensor change. Set to False if positive motor values cause decreasing sensor values.
Disable Softstops - Set to True to over ride the softstop behavor and pass Motor In directly to Motor Out.
Disable Motor - Set to True to send value zero to Motor Output. If both Disables are selected, Disable Motor takes precedence over Disable Softstops.
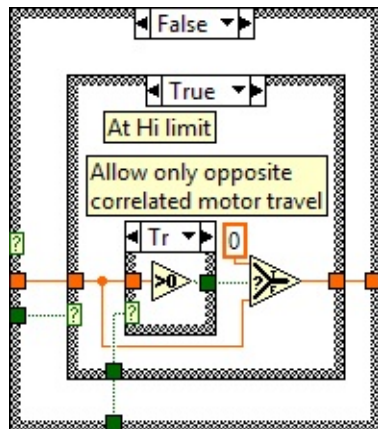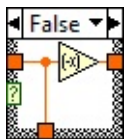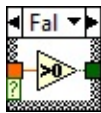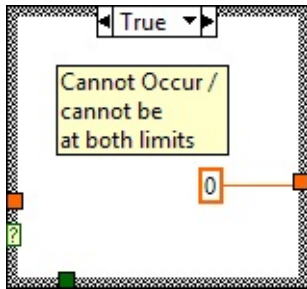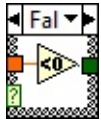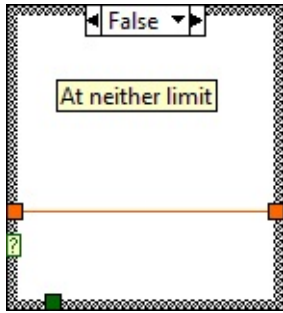
OUTPUTS:
Motor Out - Motor control value modified by VI behavior.
At Lo - Boolean indicating status of sensed position, True if equal or lower than Lo Limit.
At Hi - Boolean indicating status of sensed position, True if equal or higher than Hi Limit.

IMPLEMENTATION:
Do not use in a control loop, use setpoint coercion instead for this situation. For direct motor control:
Determine the correlation of the mechanical arrangement; if positive motor values cause increasing sensor values, set Correlation to True.
Determine the physical limits of the mechanism and set Lo and Hi Limits just short of these limits, by an amount that will accomodate any small overshoot that might remain after tuning.
To limit positional overshoot, create a region just inside each limit to slow the motor by setting Near Limit.
Set Speed Near Limit to a value slow enough to bring the mechanism to a stop prior to reaching physical limits.
Set Motor Coerce to the maximum speed that the mechanism is allowed to travel.
Experimentally determine values that minimize the Near Limit region and maximize Speed Near Limit, without striking the mechanism's physical limits when approaching at full speed.
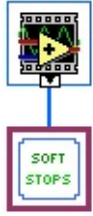

FIRST Team 836, RoboBees

False

True

At Hi limit

Allow only opposite correlated motor travel

Tr

0

False — At neither limit

Fal — <0

Fal — >0

True — Cannot Occur / cannot be at both limits — 0

Fal — <0

Fal — >0

False — (-x)

"Soft_Stops.vi History"

Current Revision: 19

Position in Hierarchy

Iconified Cluster Constants