

Alltrax TOOLKIT Instruction Manual XCT – SR - SPM

Toolkit now works with all Series SPM controllers, the Shunt wound controller XCT (2015), and the new Series SR (in 2016).



XCT & SR



SPM

These instructions cover:

- Installing Controller Toolkit V3.7 and newer
- Programming
- Troubleshooting, SPM, XCT, and SR controllers

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Note: Document revision history and EC information also located in “Revision History” section on page 3



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1. Document Scope

The following is the manual for using Alltrax's Controller Toolkit communications program.

Items needed:

Hardware:

- A computer with Windows XP SP2 /Win7/Win8/Win10
- .NET Framework 3.5 or higher (run Windows Update)
- USB A to B 2.0 Cable - A Male to B Female



Software:

- Alltrax Toolkit program (The newest version is always available at www.alltraxinc.com/)

1.1. Revision History:

At each revision, all the changes made to the document should be discussed; including the principal author of each revision should be included.

- **Rev P1** — Initial revision. The principal author Alltrax Engineering.
- **Rev P2** --- 2nd Revision. Principle author William Hopper, Tech Support Extraordinaire.
- **Rev A** --- 3rd Revision. Aesthetic updates, Added '8.3' and general streamlining
- **Rev B** --- 4th Revision. Adding Glossary of Terms, fixing typos / word choice. Centering images.
- **Rev C** --- 5th Revision. Relocate glossary, grammatical reformation – WH
- **Rev D** --- 6th Revision. Update nomenclature and picture examples, changed SRX to SR – WH
- **Rev E** --- 7th Revision. Massive update to match current Toolkit

1.2. References:

All of our schematics, documentation and manuals can be found on our website www.alltraxinc.com. The Document Depot page of our website is a good source for technical notes, vehicle specific schematics and a lot of the same information that is mentioned in this manual.

2. Warnings:

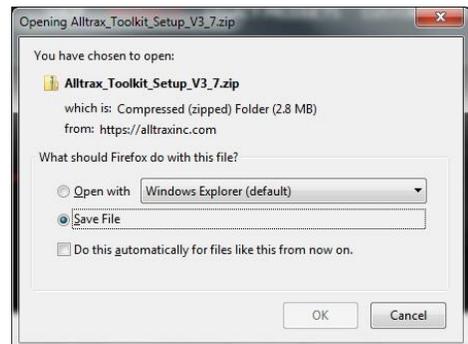
Disconnect all battery charging sources while programming the Alltrax Controller.



All programming changes done in the vehicle should be performed with the vehicle safely disabled. Either put the drive wheels on jack stands, or position the vehicle where it is safe to drive while altering the controller.

3. Controller Toolkit Program Installation:

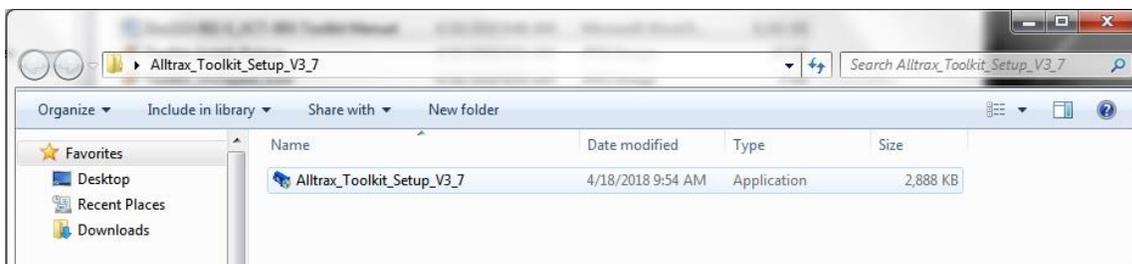
- Run Windows Update before installing the Toolkit for the first time.
- Go to the SPM, XCT or SR software page at <http://www.alltraxinc.com>
- Click on the download button for the newest version of the Alltrax Toolkit Program and a window that looks similar this will appear:



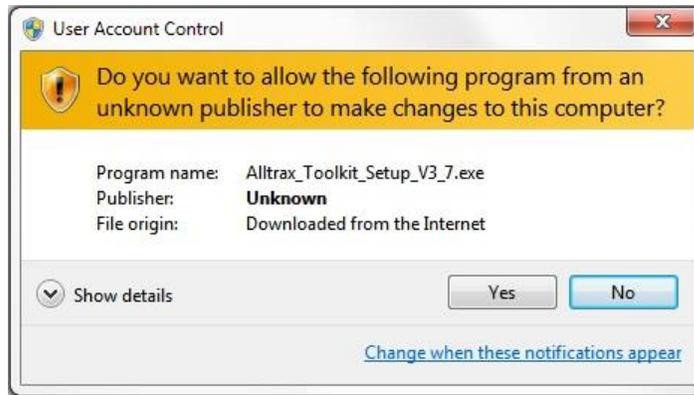
- Save the file to your desktop. When complete a new icon will appear that looks similar to this:



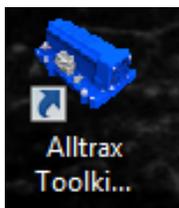
- Double left click on the Alltrax_Toolkit_Setup icon to open a new window.



- Run the Alltrax toolkit setup file to install the program. When the following window appears select “Run”

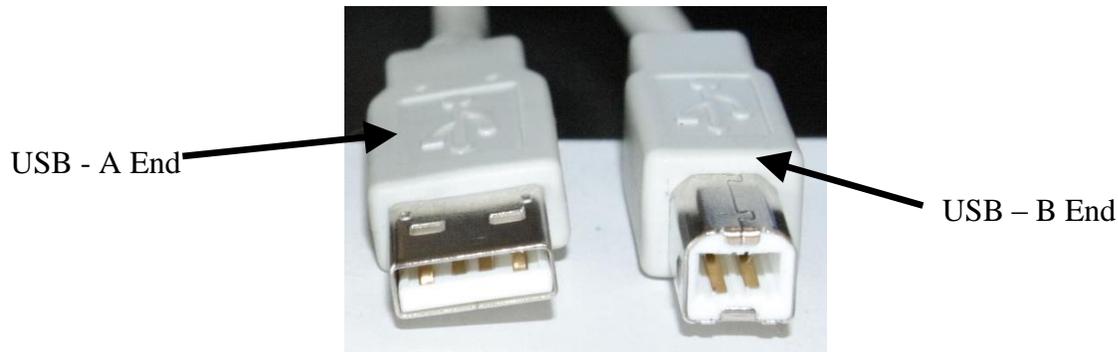


- If your computer doesn't have the required Windows updates to allow installation, you will be prompted to update your computer.
- The program is now installed on your computer. To run the program, double click the Alltrax Toolkit icon. The Alltrax Toolkit will automatically create a shortcut on your desktop, if you have an older version of the Toolkit program the new version will automatically update icons.



4. Installing the Adapter Cable

The Alltrax Toolkit and SPM/XCT/SR controllers utilize a USB port for programming. There is no driver installation needed to get the computer to talk to the USB powered controllers. The required cable to program the controller is a USB A male (Computer side) to B female (Controller side). This is identical to most USB printer cables.



5. Powering up the controller:

5.1. Powering up the controller

Powering the controller outside of the vehicle is very simple. The USB cable connection to the computer will provide the power to the controller to program it. There is no need to use an external power supply or to turn on the vehicle to power up the controller.

When the controller is connected to the USB and there is no KSI signal, the controller WILL NOT power the motor. While in this mode, the controller will flash out the throttle code continuously.





WARNING:

Running a Separately Excited motor unloaded (i.e. wheels off the ground) can damage the motor. Be sure to take necessary precautions to prevent this by disconnecting the motor or removing the throttle wires for programming.

6. Getting Started

Before you connect to the Alltrax controller you need to make sure of a couple of things.

- Any battery charging devices must be disconnected before programming, failure to do so could damage the controller or the computer.
- Make sure the vehicle is up on jack stands (preferred) or is in a safe position to be programmed while driven.
- Any changes made to the settings of the controller do not take effect in the controller until the SET button has been pushed. Switching Tabs will lose any changes not programmed with the SET button.
- When a button is pressed that causes the program to read/write to the controller it will turn blue until it is finished. If the operation fails, it will turn red and report an error at the bottom of the screen and/or in a message window.
- Microsoft Windows users should run the Windows Updater to ensure your computer is fully updated before installing the Alltrax Toolkit program for the first time.
- Visit our website for instructional videos at www.alltraxinc.com

7. Quick Programming Guide

Programming the controller is a very simple operation.

- Turn on the computer
- Connect cable from computer to controller
- Start AlltraxToolkit.exe
- Change the setting(s) to the desired value.
- Press the SET button to program the changes into the controller

8. Upgrading Controller Software

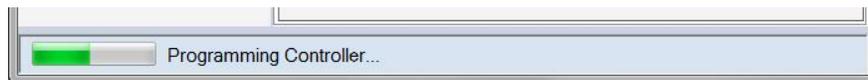
8.1. Automatic Upgrade

One of the new features of the Alltrax SPM and XCT/SR controllers is ease of upgrading the controller's firmware. When the controller is connected to Toolkit program, the program will check the version of controller firmware. If there is a new update available, the user will be prompted to upgrade the controller with a screen similar to this:



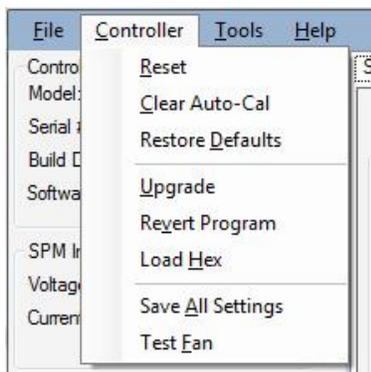
Note: *Upgrading the firmware does not change controller configuration. All user settings remain unchanged.*

Clicking “Yes” starts the automatic upgrade of the controller. The program will upgrade the software in the controller to the current version that is included with the Toolkit program. As it is upgrading the controller, you will see this on the bottom of the window:



8.2. Manual Upgrade

The controller can also be manually upgraded if needed. Under the Controller Menu are the Upgrade, Revert and Load Hex commands. Upgrade allows the user to manually start the automatic update feature, which keeps your controller firmware current and up to date. The Revert Program option lets the user go back to a previous software version, this should not be done unless instructed by Alltrax Tech Support. Load Hex allows you to upload hex files into the controller (See Warning).



Toolkit program gives the user the option to revert to a previous version of the software in the controller, and upload hex files. *This is not to be done unless instructed by someone at Alltrax as it can cause problems with the controller and void the warranty. Loading a .hex made for the DCX line of controllers will also void your warranty, do not Revert or Load Hex unless specifically instructed by Alltrax.*

8.3. Upgrading XCT Field Maps (Custom Motors)

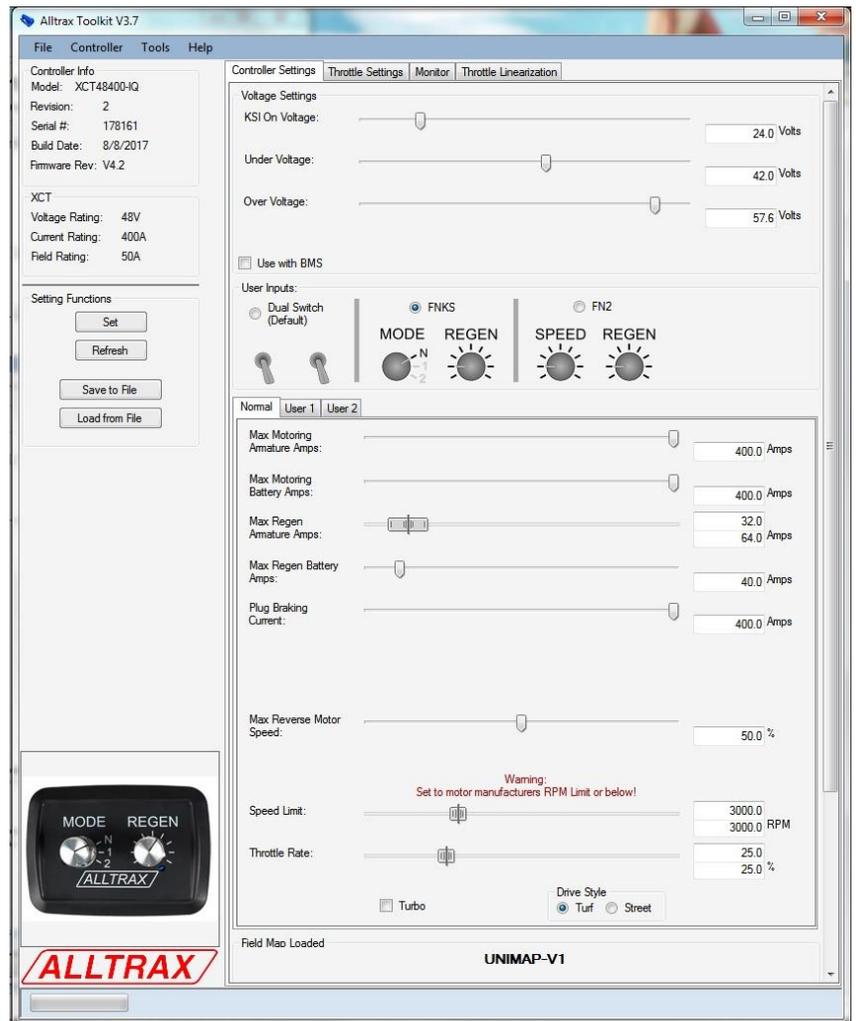
The Field Maps used for the new XCT are significantly different than the ones used for the DCX line of controllers.

The DCX controllers use a .HEX while the XCT controllers use a .txt file. Do not attempt to load .HEX files into an XCT controller.

Directions for Upgrading Field Map:

Push the 'Load from File' button located under the Setting Functions of the Controller Settings tab. When prompted select the proper field for your motor. If you do not already have the field map for your specific motor, contact Alltrax Tech Support and they can supply it.

Once the new Field Map is loaded, it will show in the 'Field Map Loaded' section of Controller Settings window.

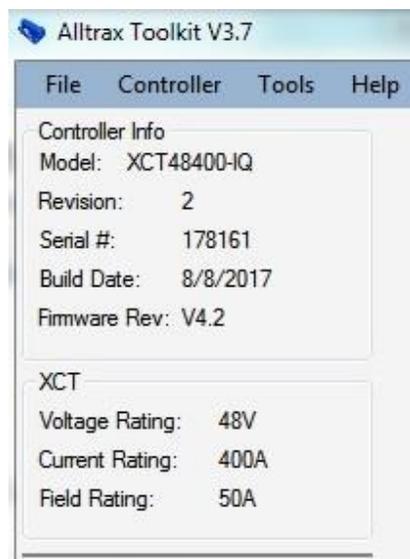


9. The Interface

The interface for the Controller Toolkit is split into several sections that display information about the controller with drop down menu at the top of the interface. The Controller Info Section and the menu options are the only parts that do not change between various tabs. The Function and Tab sections of the screen will display different information between tabs and controllers.

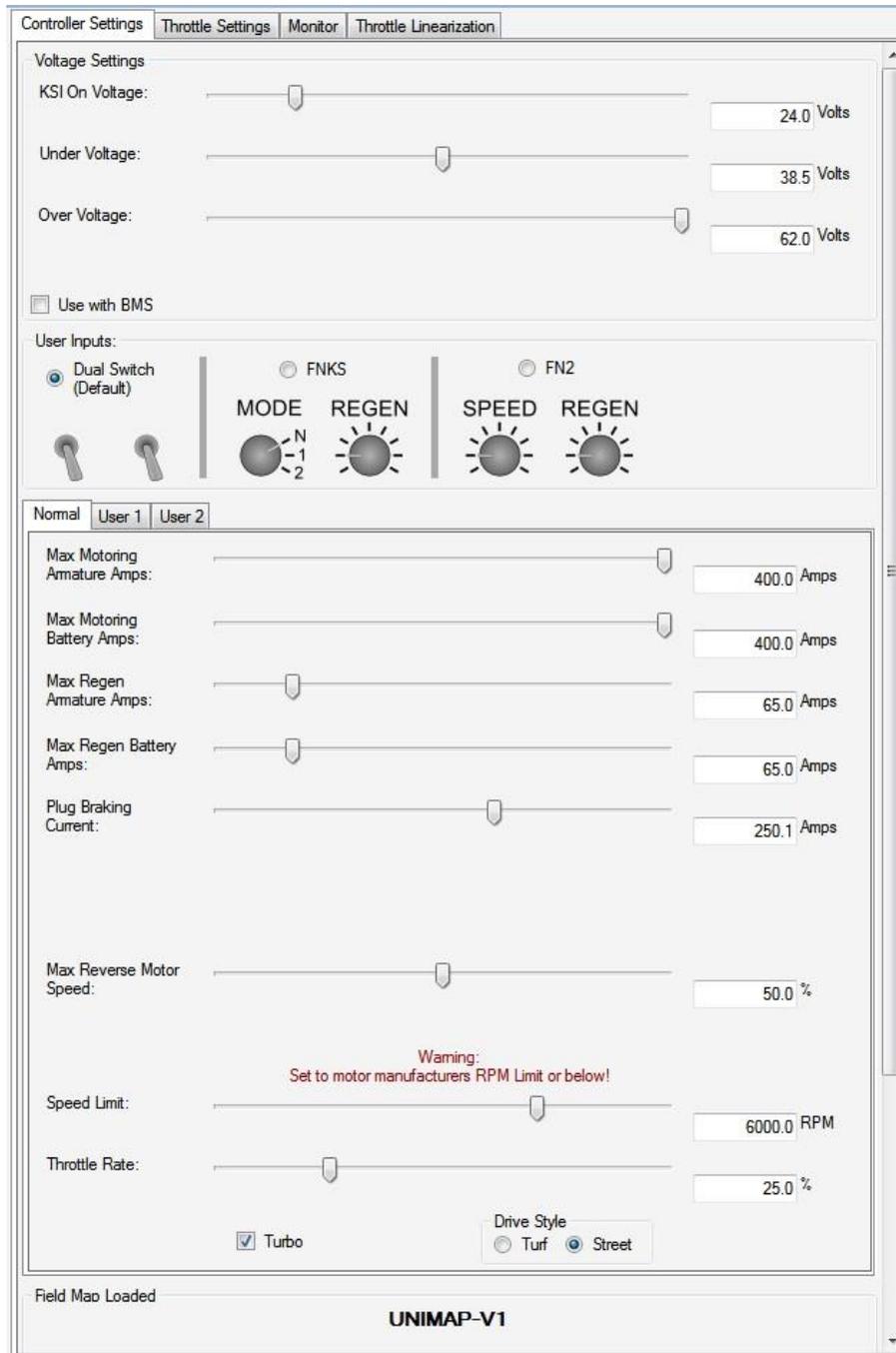
9.1. Controller Info

This section of the program doesn't change as you switch through tabs. It gives you vital information of the controller such as Model and Serial Numbers, date built and software revisions.



9.2. XCT Controller Settings

The Controller Settings Tab will automatically display the available settings for the controller that is connected. The available settings are completely dependent upon the controller connected, if no controller is connected this will be a blank screen.



Controller Settings | Throttle Settings | Monitor | Throttle Linearization

Voltage Settings

KSI On Voltage: 24.0 Volts

Under Voltage: 38.5 Volts

Over Voltage: 62.0 Volts

Use with BMS

User Inputs:

Dual Switch (Default) | FNKS | FN2

MODE REGEN | SPEED REGEN

Normal | User 1 | User 2

Max Motoring Armature Amps: 400.0 Amps

Max Motoring Battery Amps: 400.0 Amps

Max Regen Armature Amps: 65.0 Amps

Max Regen Battery Amps: 65.0 Amps

Plug Braking Current: 250.1 Amps

Max Reverse Motor Speed: 50.0 %

Warning: Set to motor manufacturers RPM Limit or below!

Speed Limit: 6000.0 RPM

Throttle Rate: 25.0 %

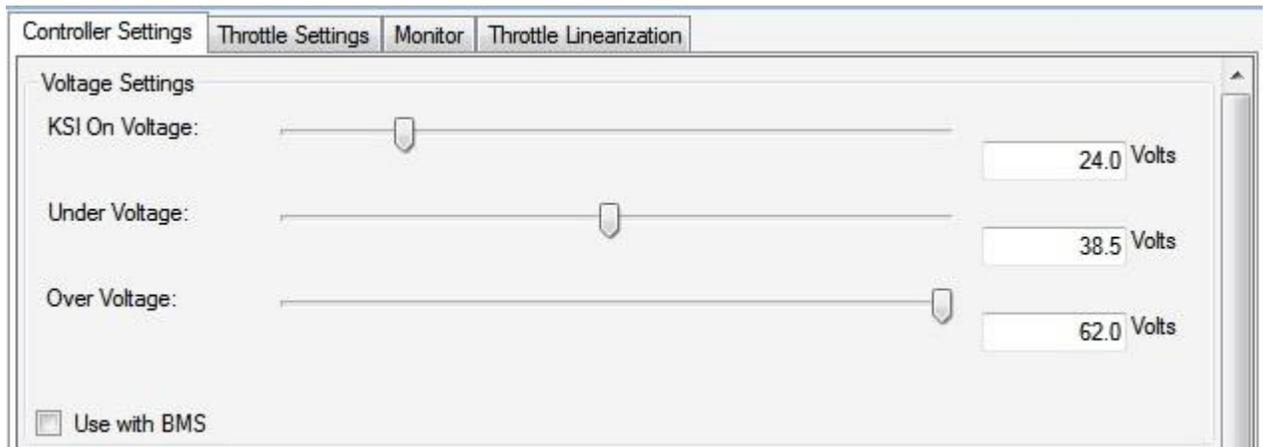
Turbo | Drive Style: Turf Street

Field Map Loaded

UNIMAP-V1

9.2.1. Voltage Settings

This top part of the tab allows the user to change the voltage limits for the controller.



KSI On Voltage:

The KSI slider determines the lowest voltage that the controller will accept as a valid key on signal and power up

Default = 24V

Under Voltage:

This is the lowest voltage from the battery pack that the controller will operate for.

If the B+ voltage of the controller falls below this setting the controller will go into a safety mode and begin to blink 1 green 2 red repeatedly.

Typical settings:

36v battery pack = 28V Under Voltage

48v battery pack = 38V Under Voltage

(Always follow Battery mfg's suggested Low Voltage setting)

Over Voltage:

This is the maximum voltage the controller will operate for. If the controller sees a higher voltage it will go into a safety mode and blink 1 green 3 red repeatedly.

NOTE: You want this setting to be at least 8V higher than your battery pack voltage. IE: 48V pack you want a minimum Over Voltage of 58V. This will compensate for overcharge when you take the cart off its charger.

9.2.2. User Profiles

This section gives the user three quick change “character profiles” for the cart. This allows you to customize three separate controller options so that you can have one maxed out for play, one tuned down for the kids and one that’s legal on the links.

Max Motoring Armature Amps

This setting allows you to adjust the maximum amperage the controller will produce in the armature of the motor. This determines how much acceleration torque the motor can produce.

Max Motoring Battery Amps

This setting allows you to adjust the maximum amperage the controller will pull from the battery. This limits how much HP the motor can produce.

Max Regen Armature Amps

The Max Regen Armature and Battery amps determine the braking force felt when easing up on the throttle while in motion. Typically they are set to the same value as one another.

Max Regen Battery Amps

Max Regen Battery and Armature amps determine the braking force felt while decelerating, I.E, slowing from 100% throttle to 50% throttle while the vehicle is in motion. In lithium applications this is a very important limit while lead acid batteries can take a higher current.

Plug Braking Current

This setting controls armature current and thus the amount of braking force, when in plug braking mode.

SPM only: Braking force when the F&R switch is flipped to the opposite position of the vehicles direction. So if you're traveling in forward and flip the switch to reverse, this is your felt braking force.

XCT: Affects the amount of braking while changing directions under power.

Max Reverse Motor Speed

This setting allows you to control how fast your cart will go in reverse, It comes from the factory preset at 50% or 1/2 speed.

Speed Limit

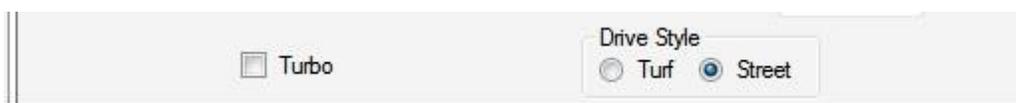
This allows you to set the maximum RPM limit of the motor (speed sensor must be connected). You should never set this number higher than the manufacturers RPM limit for your specific motor, setting the limit too high on a Separately Excited motor will result in the motor coming apart. If you are uncertain on your motors RPM limit, call Alltrax Tech Support before adjusting.

The controller can produce full current in the motor, up to a few hundred RPM below the speed limit. At speed limit, the controller produces little power in the motor. When over speed the controller produces braking forces up to the limits of the associated settings: Max Regen Arm Amps, Max Regen Battery Amps and Over Voltage.

Throttle Rate

Throttle Rate is your felt acceleration rate. The higher the number the more aggressive off the line the car will feel. The lower the number the more aggressive the car will feel, this slider will have no affect over your top speed it ONLY affects your acceleration.

Turbo

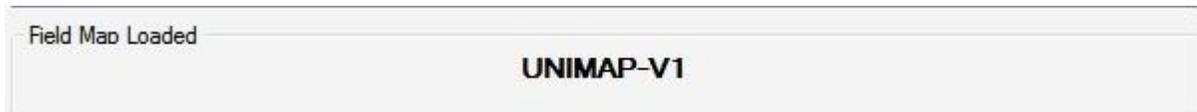


The Turbo feature on our new line of Separately Excited controllers is much different than our original Turbo feature. The XCT uses speed feedback, not just throttle position, to increase both low speed torque and high speed power.

The Turf and Street selections are also a unique new feature:

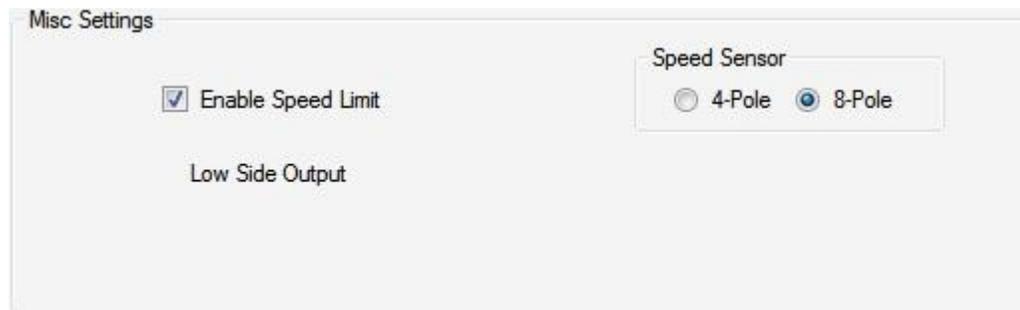
- The Turf option has strict limitations on rate of acceleration. This setting keeps the controller from allowing the tires to break loose and spin on grass.
- The Street selection is a nice, aggressive, wide open setting that will put no limitations on your rate of acceleration. This is a performance setting, similar in feel to our original controllers.

Field Map Loaded



The Field Map Loaded section displays the current field map that is being used with your motor, I.E. PDS, IQ, G19, etc.

Misc Settings



Enable Speed Limit

This checkbox determines if the controller uses a speed sensor to limit the RPM of the motor. This uses the value of the speed limit setting in the user profile section above. The controllers regen feature is based off the RPM of the armature, which is monitored by your speed sensor. If you choose to not use the speed sensor it will affect REGEN and the controller will not prevent over-speed while going downhill. What this basically means is that if you have a speed sensor, and don't use it, you run a high risk of your motor coming apart if you're not vigilant with it. Your motor should have a manufacturers recommended max RPM, but if you have to adjust these settings yourself we recommend calling our Tech Support for assistance or an Alltrax dealer.

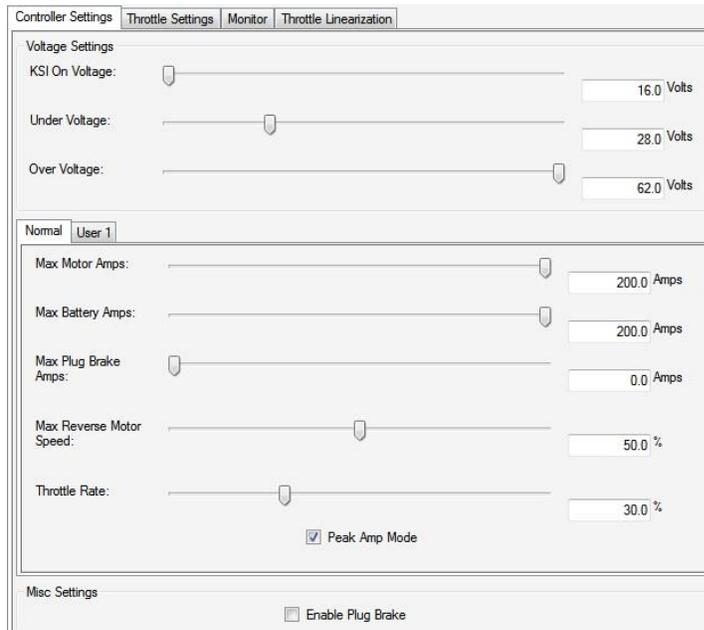
Roll Detect function must be selected, and the motor equipped with a speed sensor for roll detect braking function to operate.

Speed Sensor

- Allows you to choose between a 4 pole and 8 pole speed sensors, 8 pole are the most commonly used.

9.3. SPM Controller Settings

A little different than our XCT layout, the Controller Settings page for the SPM line of controllers still allows you to adjust your Voltage settings, Current setting as well as adjust your half speed limit and plug braking.



9.3.1. Voltage Settings

Under Voltage: Allows the user to set the lowest voltage that the controller will operate for, if the controller sees the B+ voltage drop below this number it will go into a safety mode and blink 1 Green + 2 Red continuously.

Recommended Setting:

36V battery pack = 28V

48V battery pack = 38V

(Always follow battery mfgs recommended Low Voltage setting)

Over Voltage: Allows the user to set the highest voltage that the controller will operate for. If the controller gets a higher reading than this setting on the B+ connection, it will switch into an error mode and flash 1 Green + 3 Red continuously.

KSI On Voltage: Sets the minimum voltage required to power the controller using the KSI (Key Switch Input) pin. Default KSI is 16V.



9.3.2. Current Settings

Max Motor Amps: Lets you set the maximum amount of amperage from the motor.

Max Battery Amps: Sets the maximum amount of amperage pulled from the battery pack.

Peak Amp Mode: Click this check box activates Peak Amp Mode which allows the controller to pull 15% over its maximum rating. Once the box is checked the controller will automatically go into Peak Amp Mode anytime it is under 50C.

9.3.3. Speed Settings

Max Reverse Motor Speed: This allows you to adjust the top speed of our “half-speed mode”. The slider allows a range from 0 to 100% of the carts top speed.

Throttle Rate: This is your felt acceleration rate, adjusting this won't affect your top speed only how quickly you get there. (Higher number = more aggressive starts)

9.3.4. Plug Brake Settings

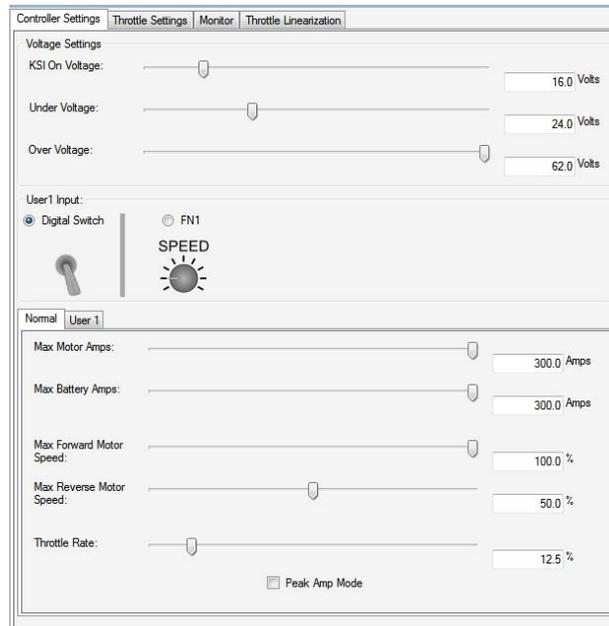
For use with the SPB (Series Plug Braking) line of SPM controllers. This is the braking force when the F&R switch is flipped to the opposite position of the vehicles direction. So if you're traveling in forward and flip the switch to reverse, this is your felt braking force.

Enable Plug Brake: This checkbox allows you to activate, or deactivate the plug braking feature of SPB controllers.

Max Plug Brake Amps: Allows you to set the maximum current used to slow the vehicle when Plug Braking is enabled. Higher Amperage equals more braking force.

9.4. SR Controller Settings

The SR Series and Permanent Magnet Motor Controller replaces the AXE product line for 12, 24, 36, 48, and 72V applications. Unlike the SPM and AXE controllers, the SR do not come with a ‘plug brake’ option.



9.4.1 Voltage Settings

Under Voltage: Allows the user to set the lowest voltage that the controller will operate for, if the controller sees the B+ voltage drop below this number it will go into a safety mode and blink 1 Green + 2 Red continuously.

Recommended Setting:

36V battery pack = 28V

48V battery pack = 38V

(Always follow battery mfgs recommended Low Voltage setting)

Over Voltage: Allows the user to set the highest voltage that the controller will operate for. If the controller gets a higher reading than this setting on the B+ connection, it will switch into an error mode and flash 1 Green + 3 Red continuously.

KSI On Voltage: Sets the minimum voltage required to power the controller using the KSI (Key Switch Input) pin. Default KSI is 16V.

9.4.2 User Profiles



User1 Input:

Digital Switch is the standard setting, this option allows you to connect a simple ON/OFF toggle switch to the Green 'USER' terminal on the controllers J1 connection. When the switch is activated and power is applied to the pin, you change from the 'NORMAL' profile to the 'USER 1' profile. This allows you to have a full power mode as well as a reduced power mode for golfing or kids.

FN1 is used with the Alltrax FN-1 function box, once plugged into the controller you need to select this setting. After selecting this your User tabs will change to look like this:

For detailed information on how to set up your FN1 control see our FN1 operators manual, Which can be found on our website (www.alltraxinc.com) or also located in the box your FN1 came in.

The screenshot shows a software interface for configuring an Alltrax controller. It features a 'Normal' tab at the top left. Below the tab are five settings, each with a slider and a numerical input field:

- Max Motor Amps:** Slider is at the right end, input field shows 300.0 Amps.
- Max Battery Amps:** Slider is at the right end, input field shows 300.0 Amps.
- Max Forward Motor Speed:** Slider is in the middle, input field shows 50.0 and 100.0 %.
- Max Reverse Motor Speed:** Slider is at the left end, input field shows 50.0 %.
- Throttle Rate:** Slider is at the left end, input field shows 6.5 and 12.5 %.

At the bottom of the interface, there is a checkbox labeled 'Peak Amp Mode' which is currently unchecked.

9.4.3 Current Settings

Max Motor Amps: Lets you set the maximum amount of amperage from the motor.

Max Battery Amps: Sets the maximum amount of amperage pulled from the battery pack.

Peak Amp Mode: Click this check box activates Peak Amp Mode which allows the controller to pull 15% over its maximum rating. Once the box is checked the controller will automatically go into Peak Amp Mode anytime it is under 50C.

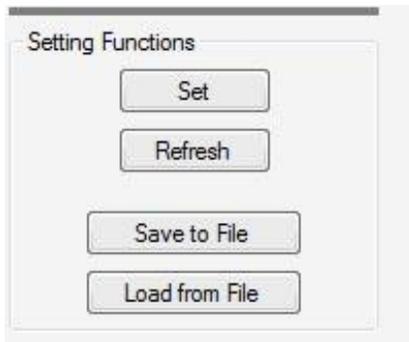
9.4.4 Speed Settings

Max Forward Motor Speed: This allows you to adjust your max Forward Speed, when the controller arrives this should already be at 100%

Max Reverse Motor Speed: This allows you to adjust the top speed of our "half-speed mode". The slider allows a range from 0 to 100% of the carts top speed.

Throttle Rate: This is your felt acceleration rate, adjusting this won't affect your top speed only how quickly you get there. (Higher number = more aggressive starts)

9.5. Settings Functions



These buttons control the reading and writing of the settings to any of the SPM, XCT, or SR controllers as well as loading and saving configurations.

The new Alltrax Controllers have the ability to save the settings of the controller as a configuration file. Once saved, this file can be used to program controllers with the same settings repeatedly.

9.5.1. Set Button

This button writes the current values of the settings to the controller. No changes will be made to the controller until the Set button is pressed. While the controller is receiving the information the Set button will turn blue until it is finished.

9.5.2. Refresh Button

Reads and then displays the current settings from the controller to your screen.

9.5.3. Save to File Button

Saves the settings of the controller to a configuration file. The information for the file is read from the controller. Any changes made in the Toolkit program need to be saved to the controller by using the SET button before making a configuration file. A save file dialog box will open up and prompt for a name and location for the file. The program defaults to the “/Alltrax/Toolkit/Data/” directory. This file can be used to quickly program many controllers with the same settings quite easily. Note this is only for the settings, any throttle curves must be saved separately.

9.5.4. Load from File Button

Loads a configuration file to the controller that was created with the “Save to File” button. When pressed the button will open a new window where the correct configuration file can be chosen. The program will write the settings contained in the file to the controller.

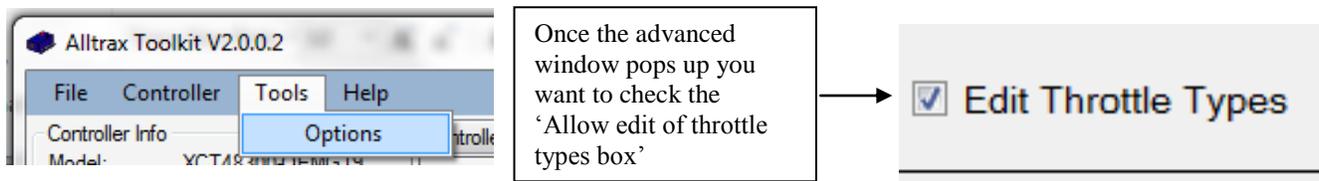
9.6. Throttle Settings Tab

The throttle settings tab is the same for SPM, XCT, or SR controllers and allows you to select which throttle type the controller will respond to. It is also where we can fully customize your Speed and Torque curves with our throttle mapping.

9.6.1. Throttle Settings



If your throttle select settings are locked you will get the above screen for throttle settings. Throttles are vehicle specific and should not be changed without contacting Alltrax Tech Support. If you wish to change throttle types or see all the ones available you must go to the top right corner of the Toolkit, select Tools, and options:



Now your Throttle settings will look like this:





Throttle Sensor Types

The following is a list of all the supported throttle types and the most common vehicle that uses the throttle. If a controller does not support a throttle it will be grayed out or not shown. If unsure about the type of throttle used in the vehicle, verify with the manufacturer or with an ohm meter.

0-1k 3-Wire (SPM)

Used on the Yamaha Mid 92-94, G9, G14 & G16. G8 vehicles - verify throttle as that vehicle could also be a 0-5k throttle.

0-5k 2 Wire – All models

Typically used on 95 and older Club Cars, 94 and older EZ-GO Medalists, Yamaha G8. It is also the most common and generic form of throttle available. Alltrax recommends this type of throttle when building a custom application that uses a pedal or twist grip for throttle control.

0-5k 3 Wire (XCT)

For use on Yamaha G19/G22 and the CC IQ, CC I2 and CC EXCEL

5k-0 2 Wire– All models

Typically used on Melex Cars. This throttle is NOT the Club Car throttle. It uses only the Wiper and High terminals of potentiometer. The Club Car throttle uses all 3 terminals. For Club Cars use the Club Car 5k-0 3 Wire throttle.

0-5 Volts – All models

Standard throttle for the Yamaha Drive. Also used on applications that requires remote operation and is controlled by a PLC or microcontroller circuit. Also a typical output from Hall Effect sensor throttles. The Signal line of the 0-5v goes to Pin 3 of the SPM/SPB controllers.

Taylor-Dunn 6-10.5 Volts – All models

Typically used on Taylor Dunn cars

CLUB CAR – (SR/SPM)

Used on all series Club Cars with the V-Glide and MCOR throttles.

E-Z-GO ITS – All models

Typically used on all PDS and DCS, 95 and newer Medalist and TXT Series E-Z-GO

Pump – All models

This setting the controller will go to 100% (or the max speed set by the speed curve) when the controller powers up via the KSI. The throttle is fixed and can not be varied. The throttle rate effect the speed at which the controller ramps up to max speed.

USB Mode – All models

A digital throttle input for the controller that comes from the Alltrax ToolKit program. This is predominantly used for testing purposes. (See the Monitoring section for more information).

High Pedal Disable

A safety feature that will shut down the cart if the throttle is activated before the key is engaged. This is to prevent accidental run away of the cart. This feature in no way affects the performance of the cart, whether you leave it on or deactivate it. If the High Pedal Disable is triggered the controllers LED will give you a red and green blink code to identify the problem.

ABSOLUTE Mode – All Models

Absolute Throttle allows you to manually set the minimum and maximum for your throttle, rather than relying on the controllers auto calibration feature. To use absolute throttle, you must first select it and hit the ‘set’ button on the left. After the controller is done setting you will have a new tab at the top of the screen:



After selecting the ‘Absolute Throttle’ tab you’ll be given the program will give you instructions on how to set up your new custom throttle. As shown on the next page:

Directions:





- Put the vehicle on a jack to lift the wheels off the ground for safety
- Select 'Throttle Mode' and 'Throttle Slope' and 'Set' these to the controller

Throttle Mode

Single Ended Differential

Single Ended:
Voltage/3 wire throttles

Differential:
2 wire resistive throttles

Throttle Slope

Normal Inverted

Normal:
0-5K, 0-5V

Inverted:
5K-0, 5-0V

- Click on 'Start Auto-Calibration'
- Starting with the throttle off, slowly go to full throttle and hold for a few seconds
- Click on 'Stop Auto-Calibration'
- Click the 'Set' button to save these settings

Low Throttle Min: 0

Low Throttle Max: 0

Throttle Range Min: 0

Throttle Range Max: 0

High Throttle Min: 0

High Throttle Max: 0

HPD Value: 0.0 %

If the throttle is above HPD value at Keyswitch, then the controller won't run until throttle goes below.

Make sure you read and follow the directions given on the screen of the 'Alltrax Toolkit' they should look like the picture above.

Throttle Rate

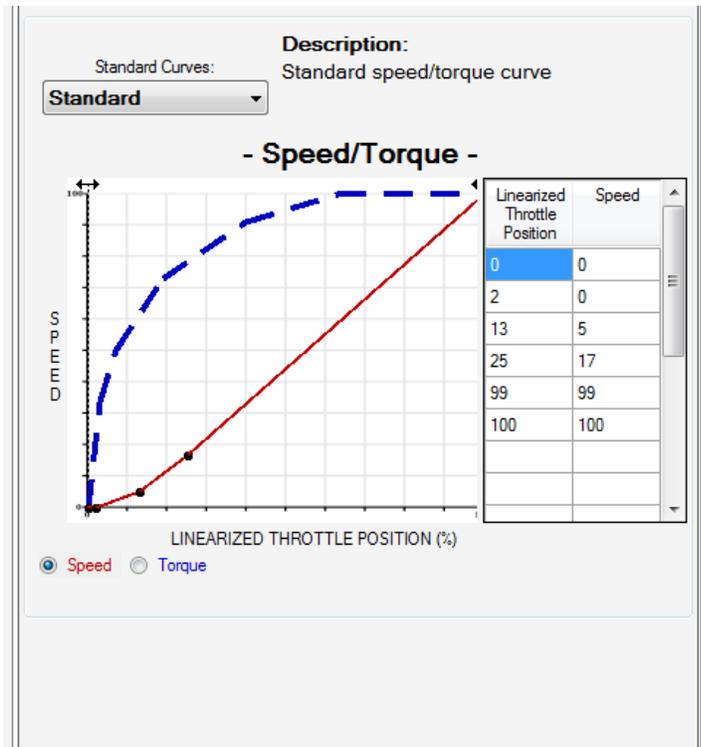
The throttle rate is your basic control over throttle response, if you want a more aggressive pedal push you would go up in percentage, if you want a more gradual increase in speed and throttle control then you would decrease the percentage.

9.6.2. Throttle Curves

The Speed and Torque maps allow you to control the performance of your controller based off your throttle position.

You can choose between the standard factory recommended map or you can build your own custom curves to fit the applications needs.

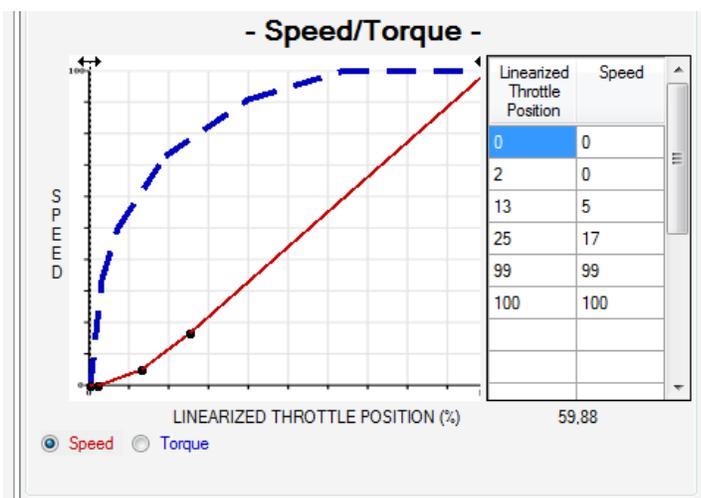
You can save Custom Curves to a file for future use and/or quick performance changes.



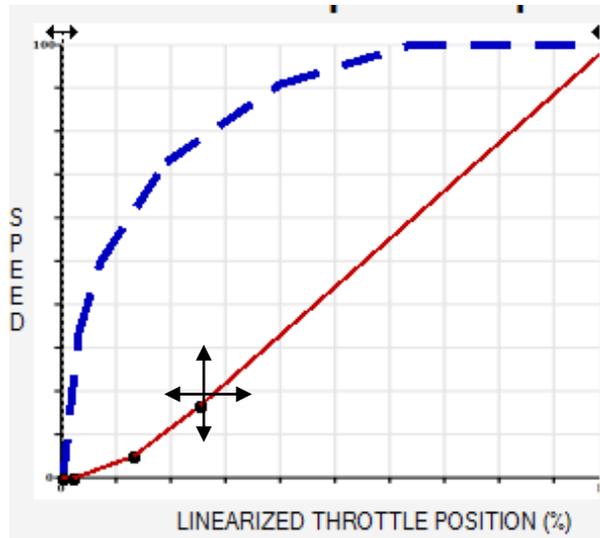
How to change a curve:

There are 2 ways to change the values of the curves,

- 1) Mouse click on the line itself
- 2) By entering the numerical values in the table on the right.



- **Clicking the Line**
 The standard curves can be adjusted by clicking and holding down the left mouse button and dragging to the desired position. Adding points is as simple as double left clicking on the graph, the point can then be moved to the desired position. A total of 16 points can be used to define the curve. The Solid line is the line being edited. To switch between Speed and Torque curves use the buttons below the curves.



- **Manually entering data into the table**
 Values can be input manually using the table to the right of the graph. The data in the left column is always throttle position for all the graphs. It is expressed as 0-100% throttle and is the X axis of the graph. The Y axis is the right column and these values change depending on the graph you are on. The Speed graph is 0-100% of the max battery voltage setting slider and the Torque graph is 0-100% of the max output current.

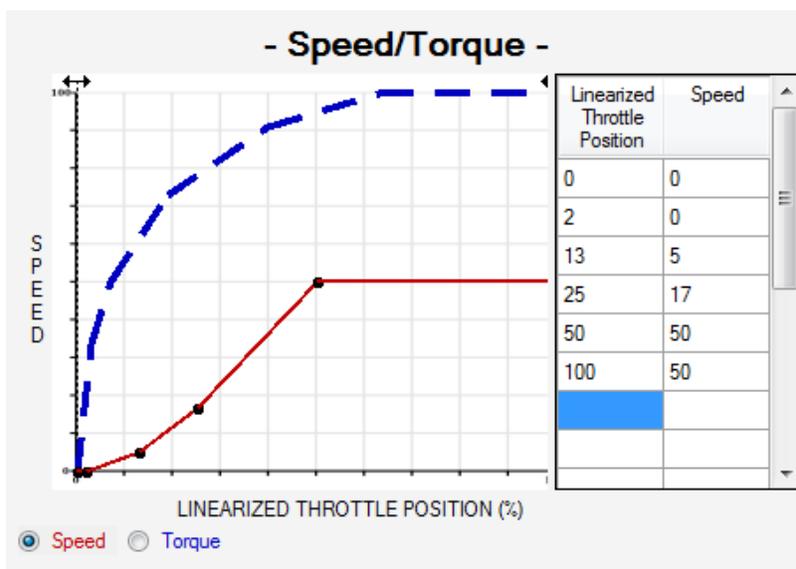
Linearized Throttle Position	Speed
0	0
2	0
13	5
25	17
99	99
100	100

Both methods can be used interchangeably when adjusting any of the various curves. All changes are visible real time to make adjusting the curve as easy as possible. Any changes made to the curve are not changed in the controller until the SET button is pressed. If more than one curve is planned to be adjusted, SET needs to be pressed before moving onto the next screen, otherwise the changes will not get sent to the controller.

9.6.3. Speed Curve

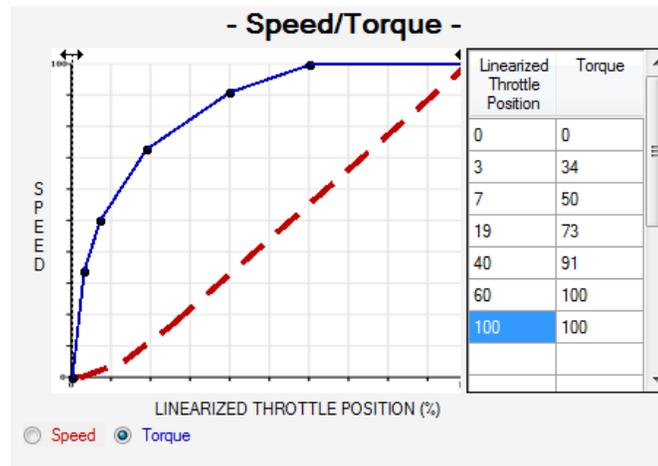
Speed Curve controls the voltage the controller outputs to the motor for any given throttle position. On a series motor, speed is voltage.

By adjusting the curve, the user can modify how fast the motor spins at any given throttle position. If the vehicle needs to have a slower top speed, set the curve accordingly. The graph below shows a typical curve for a cart that is limited to approximately 50% of its top speed.



9.6.4. Torque Curve

Torque Curve controls the maximum output current for any given throttle position. The curve allows the user to set the current limit as a percentage of max current for any given throttle position. Below is a curve typical for use in a golf cart. The shape of the curve allows the driver to have fine control at low throttle positions and gives almost full current limit by 60% throttle.



9.7. Monitor

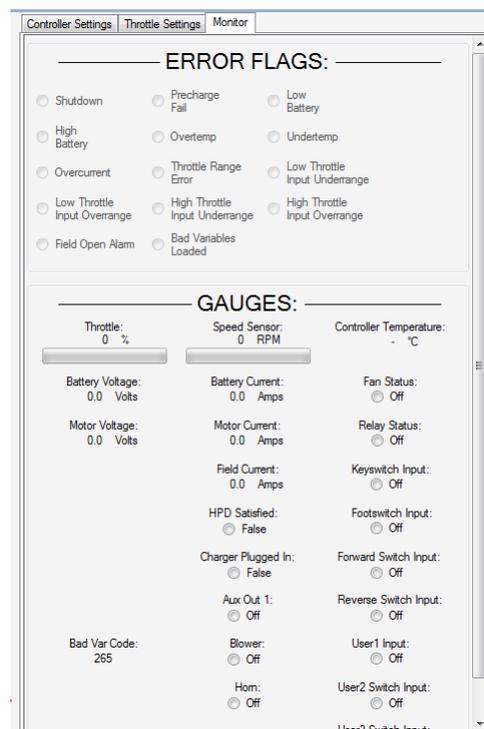
This screen is the status monitor of the controller, it gives you the ability to measure and record numerous operating parameters of the motor controller and the vehicle in which it is installed.

When used with a laptop computer, both real-time data display and data logging may be performed while the vehicle is in use.

This gives the vehicle designer significant insight to the interaction of the motor controller with other system components.

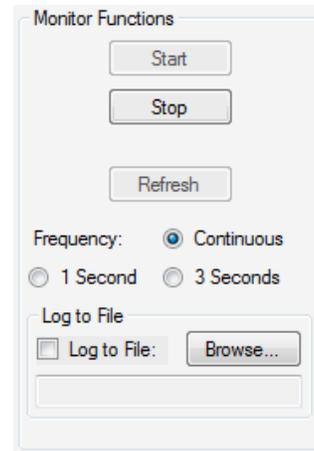
Log files may be used for problem analysis and diagnostics.

You can email the log file to Alltraxinc.com for a detailed analysis by our applications engineers.



9.7.1. Monitor Functions

The Monitor Functions section controls the starting, stopping and speed of the monitoring as well as the ability to log information to a file



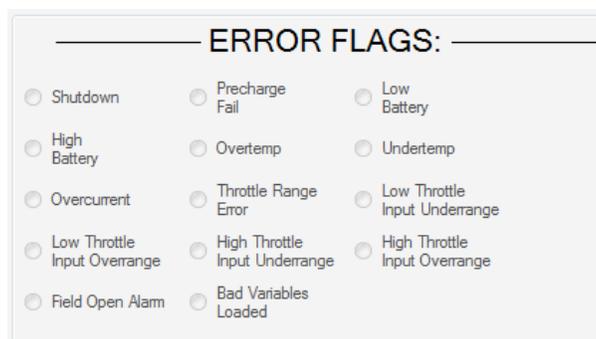
Frequency is the rate at which the controller updates information, continuous gives you the most accurate read outs, but also the largest data files.

Log to File allows you to save your monitor file so that you can review what the controller was seeing after you've finished doing a test run. After selecting a location to save the file with the Browse button you push Stop to end the current monitor, then when you hit Start the file will begin to save to the location on the browser, after you finish driving then hit the stop button which will save the completed file. If you don't hit stop the file will remain "open" and you will not be able to check it.

9.7.2. Error Flags

This section of the monitor page shows the various error flags that the controller can detect. All of these errors are hard alarms and will lead to a shut down condition of the controller. If an event triggers an alarm flag, the check box will have a check mark and change color.

The alarms are self clearing when the condition that caused the alarm has passed, the controller will resume operation. Since some alarms happen quickly or the operator may not have seen an alarm pop up, if an alarm triggers and clears the check box will have the check removed but will remain highlighted for 10 seconds.





Shutdown

This flag alerts the user that the controller's output has been shut off. The alarm that caused the shutdown will also light up.

Pre-charge Fail

Pre-charge fail happens when the B+ voltage is 6 or more volts below the voltage on the KSI Input pin. An occurrence of this alarm could be caused by a failed pre-charge resistor, incorrect wiring, bad solenoid or the controller has failed.

Low Battery

The voltage on the B+ to B- terminals is lower than the Under Voltage slider setting in the Settings Tab. This is not a shutdown error, but the controller is limiting current to keep the voltage above the setting.

High Battery

The voltage on the B+ to B- terminals is higher than the Over Voltage slider settings in the Settings Tab.

Over Temp

If the controller temperature is between 85°C and 95°C, this flag will turn on and the controller output will start to decline to keep the temperature under 95°C. If the temperature climbs above 95°C, the controller will shutdown the output of the controller and the Shutdown flag will activate.

Over Current

This is the current limit alarm. If there is a condition where the motor's current draw exceeds the Max Motor Amps or Max Battery Amps settings, this alarm will become active.

Throttle Range Error

If there is a problem with the throttle, this flag will activate. This is not a stand alone alarm and will trigger one of the following flags.

High Throttle Input Over-range & Low Throttle Input Over-range

The 2 over-range flags are caused when either of the throttle signals exceeds an internal range limit.

High Throttle Input Under-range & Low Throttle Input Under-range

The 2 over-range flags are caused when either of the throttle signals is below an internal range limit.

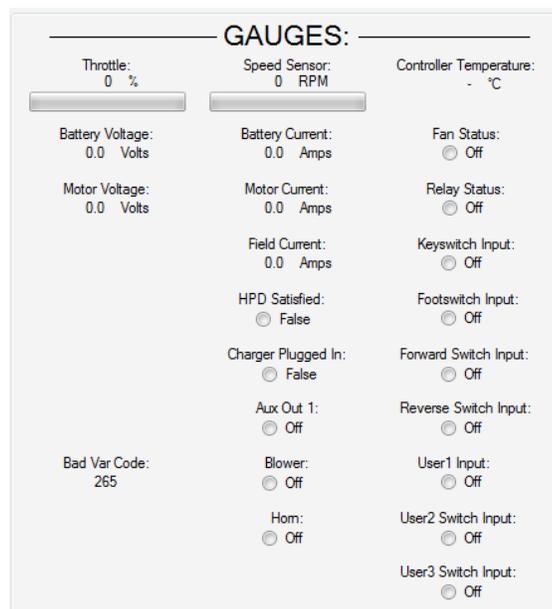
Field Open Alarm

The controller does not see the proper resistance from the field of the motor, make sure F1/F2 are properly connected to both the motor and controller. *Note: A higher order alarm may trigger field open alarm.*

Bad Variables Loaded

When settings are changed and uploaded to the controller there is an error checking routine for the data. If bad data is passed to the controller this alarm will become active and the new settings will not take effect until all of the data is passed without any errors.

9.7.3. Gauges



Throttle

The Throttle gauge shows the throttle position as both a percentage and a graph.

Speed Sensor

Our new line of XCT controllers utilizes the motors speed sensor to monitor the armatures RPM. This gauge gives you an exact readout as well as a graphical read out.

Battery Voltage

Displays the battery voltage as seen across the Controller's B+ and B- terminals



Motor Voltage

Motor Voltage displays the voltage in the motor loop of the vehicle.

Battery Current

The Battery Current gauge displays the current being drawn from the battery. This is limited by the Max Battery Current slider.

Motor Current

Displays the current being drawn by the motor to provide the required torque for the application. This is limited by the Max Motor Current slider.

Controller Temperature

The Controller Temperature gauge displays the temperature of the controller. As the temperature rises above 85°C, the controller starts to pull back the PWM output to keep the temperature under 95 °C. If the controller temperature hits 95 °C, the controller shuts the output of the controller off until the temperature drops below 95 °C.

Fan Status

Displays if the Fan is turned On or Off with a check mark in the box.

Relay Status

Displays if the solenoid is currently active. This status gauge only works if the relay is connected to the Rly Coil + and Rly Coil – terminals on the controllers and the solenoid is working correctly.

Key Switch Input

Displays if the KSI pin voltage is above the KSI On Voltage slider.

Reverse Switch Input

Displays if the ½ Speed Reverse pin has voltage.

HPD Satisfied

When the controller powers it, performs a check to see if the throttle is out of range, if it passed the HPD Satisfied box will show a check mark.

Charger Plugged In

When using the Alltrax BMS, the motor controller is disabled during charging.



10. Glossary of Terms:

Field Maps: Field maps are files written for a specific motor to govern the relationship between the field and the armature currents. While some field maps are used for multiple motors for the most part they are not interchangeable. Please contact Alltrax Tech Support if you're not sure which Field Map to use or when upgrading motors.

Plug Braking: Plug braking or dynamic braking, uses energy from the battery to produce braking torque to slow the vehicle. It's essentially trying to motor one way while rolling the opposite direction. The motor field is driven such that the motor armature is shorted by the controllers freewheel diode, producing drag. Polarity of field current depends on direction of motor rotation. During plug braking, all energy is dissipated as heat in the motor and controller. Plug braking permits controlled deceleration to stop followed by reacceleration in the opposite direction.

Regen: Regen or Regenerative braking returns energy to the battery while slowing the vehicle. It does this by causing the motor to work as a generator. The motor controller boosts the motors low armature voltage up to battery voltage by modulating the armature and field current. The ability to produce braking torque requires the motor be spinning and generating some voltage. As the motor slows, the generated voltage effectively reaches zero around a few hundred RPM. Thus regen braking only slows the vehicle, it can't bring it to a stop.

Thank you for purchasing Alltrax Motor Controller products. Check out our website, www.alltraxinc.com for more details, tech notes, Instructions, or, please contact our Tech Support at (541) 476-3565