

2019

# EV Controls T1C User Guide



EVControls

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## Introduction

Thank you for purchasing the EV Controls© Tesla drive unit controller. The EVControls© controller is a microprocessor equipped standalone programmable controller designed to provide a user friendly interface for the control of a Tesla drive unit. The T-1C is equipped with a 7" information panel and touch screen that provides flawless drive unit control and live access to detailed system operation information via CAN communication with the Tesla drive unit. In addition to flawless motor control the EV Controls T-1C is the only controller to provide microprocessor controlled outputs that automate the startup procedures and provide important monitoring and control functions that simplify your build while adding drive-ability and reliability to your completed project.

Every effort has been made to ensure the accuracy and completeness of the information in this manual, and we reserve the right to change, alter and/or improve the product and this document at any time without prior notice.

The EV Controls T-1C controls both the S-85 and P-85 drive units as well as dual motor setups with support for the smaller "D" drive units currently in development.

## Disclaimer

The installation of the EV Controls© controller requires that the end user have a thorough understanding of applicable electrical principles and is fully aware of the inherent dangers of working with electric vehicle high voltage systems as they apply to the design, construction and operation of an electric vehicle. Take the time to review this product guide and other related product information thoroughly to ensure that you are fully aware and knowledgeable of the design, operation, and inherent dangers of working with electric vehicle components.

**Under no circumstances shall EV Controls© be liable for direct, indirect, consequential or incidental damage or injury resulting from the use of EV Controls© components in the construction and operation of custom built electric vehicle.**

## What's included with your purchase

The purchase of the Ev Controls interface includes the 7" touch control panel equipped with a female multi-pin connector and matching male connector with a supply of terminals. The T-1C will arrive in a ready to use state however a reflash of the Tesla drive unit may be required. The new drive unit firmware if required will be uploaded from our servers at no additional cost.

## Note:

Please ensure that the system SD card slot on the left side of the controller remains accessible and can be removed for firmware updates.

## What you must provide

This guide is based on the assumption that you will have the following components in your possession. Be sure to request these components when purchasing your Tesla drive unit.



- Suitable drive unit (please email our support department to verify suitability)
- Drive unit wiring harness including inverter connector and shielded encoder harness with connector
- Tesla accelerator pedal with connector and a portion of the associated harness
- Brake switch with connector and a portion of the associated harness
- All associated wiring, fuses, contactors and switches
- A 12volt power source

## Wiring diagrams

The following pages include details of the wiring schematics to help with your installation. Wiring color codes and pin locations assume you are using Tesla components.

## Wiring Guidelines

The following diagrams use Tesla color codes where possible and assume that you will be using Tesla connectors for:

- The drive inverter
- Accelerator pedal
- Brake switch
- The controller is equipped with the female side of a multi pin connector
- Your purchase includes a matching male side for the connector and required weather pack insulators and crimp connectors
- Connection details for the connector are included in the controller pinout diagram
- You must observe the fusing information provided in the included drive inverter diagram, failure to do so may result in controller damage
- Additional fusing should be added post controller for other controlled devices. Note that total load should not exceed 10 amps total.
  - Brake Lights
  - Reverse Lights
  - Coolant pumps
  - High Voltage Contact relays
- All CAN communication wiring must be twisted pairs
- Can communication wiring must be located as far as possible from high voltage wiring to prevent CAN communication interference
- It is recommended that you begin your project by drawing a color coded wiring diagram for your completed project

## **Controller Pinout**

Provides mapping image and numbering of the female plug located on the rear of the T-1C controller

## **Tesla Inverter Plug Pinout**

Image of Tesla multi pin connector with related mapping

## **Drive Inverter Connections**

A JPEG image of the required circuit diagram. Diagram contains both single and dual motor circuits.

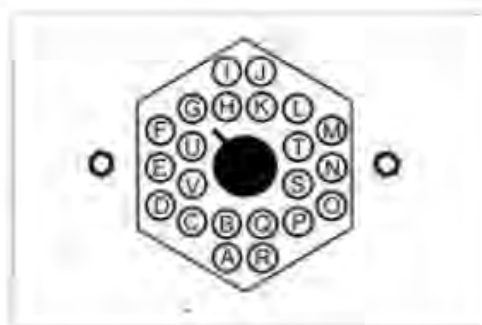
## **High Voltage Contactor Circuit**

Circuit diagram of required high voltage supply circuit. Follow closely this circuit is essential to the required system circuit startup

## **OBD 2 data connection**

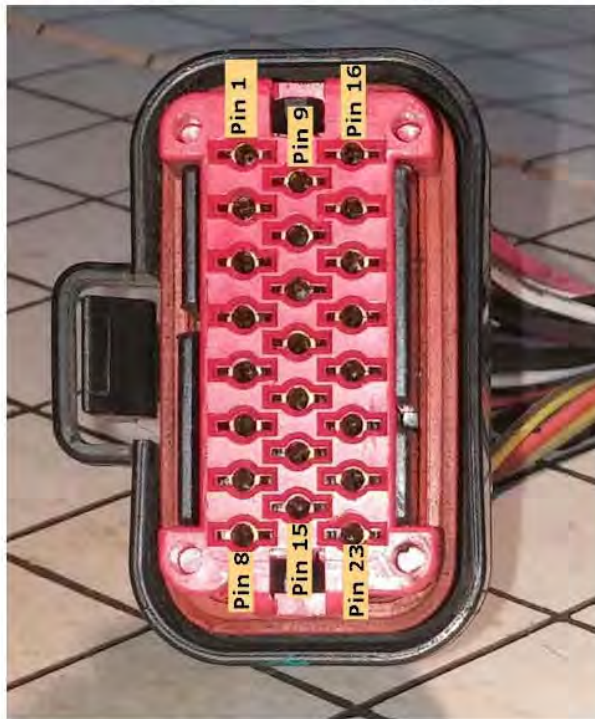
Allows data communications with the controller required for firmware updates

## Main Connector Pin Identification



| PIN | Purpose                                     |
|-----|---|
| A   | Can 1 High                                  |
| B   | Push Button Input Regen Select (Optional)   |
| C   | Push Button Input Drive Select (Optional)   |
| D   | Not Used                                    |
| E   | Inverter Coolant Pump Output                |
| F   | Charger Output                              |
| G   | Positive contactor Relay + Terminal         |
| H   | Negative contactor Relay + Terminal         |
| I   | Controller (Chasis) Ground                  |
| J   | Key Power                                   |
| K   | Not Used                                    |
| L   | Not Used                                    |
| M   | Inverter Precharge Relay                    |
| N   | Controller Power Input (fused max 10 amps)  |
| O   | Controller Power Input (fused max 10 amps)  |
| P   | Push Button Input Neutral Select (Optional) |
| Q   | Push Button Input Reverse Select (Optional) |
| R   | Can 1 Low                                   |
| S   | Terminal 1 On Inverter                      |
| T   | Reverse Lights                              |
| U   | Brake Lights                                |
| V   | Inverter Cooling                            |

Drive inverter connector (Not Supplied)

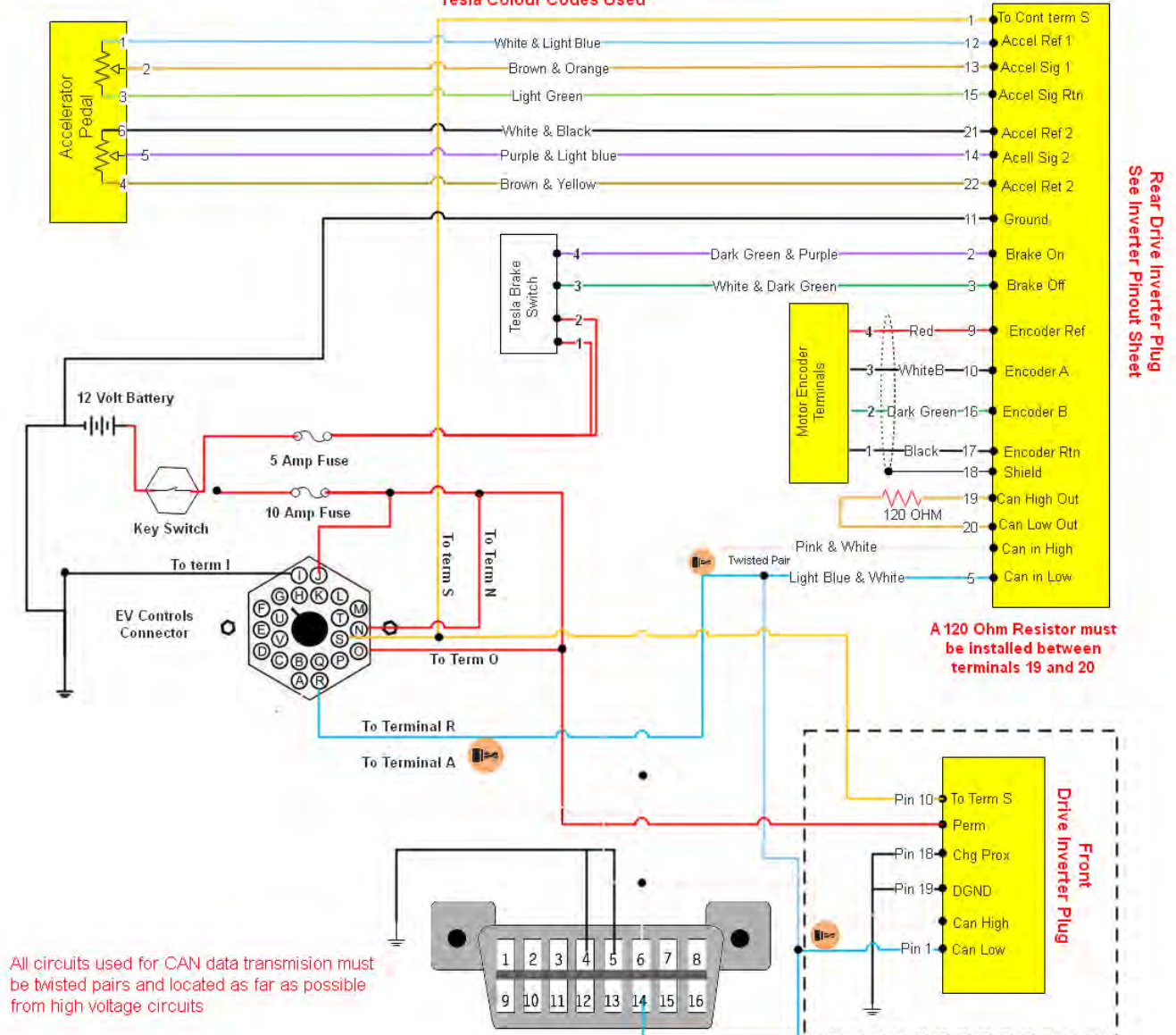


| Cav | Col   | Gauge |
|-----|-------|-------|
| 1   | BN    | 1     |
| 2   | DG/VT | 0.5   |
| 3   | WH/LG | 0.5   |
| 4   | PK/WH | 0.5   |
| 5   | LB/WH | 0.5   |
| 6   | OG/VT | 0.5   |
| 7   | YE/GY | 0.5   |
| 8   | YE/BN | 0.5   |
| 9   | RD    | 0.5   |
| 10  | WH    | 0.5   |
| 11  | BK    | 1     |
| 12  | WH/LB | 0.5   |
| 13  | BN/OG | 0.5   |
| 14  | VT/LB | 0.5   |
| 15  | LG    | 0.5   |
| 16  | DG    | 0.5   |
| 17  | BK    | 0.5   |
| 18  | SH    | 4.01  |
| 19  | LG/RD | 0.5   |
| 20  | LG/DB | 0.5   |
| 21  | WH/BK | 0.5   |
| 22  | BN/YE | 0.5   |

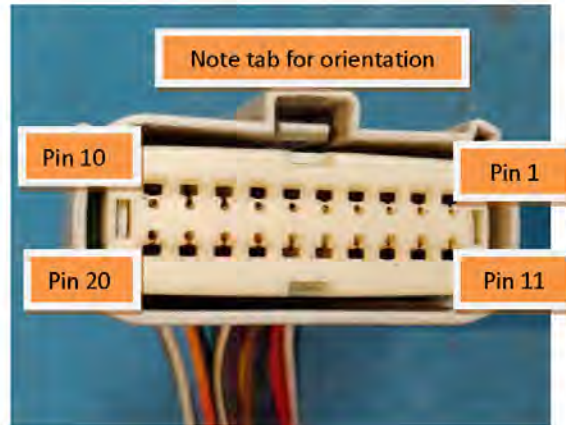
| PIN NUMBER | Application      |
|------------|------------------|
| 1          | Key Power        |
| 2          | BRAKE ON         |
| 3          | BRAKE OFF        |
| 4          | CAN HIGH IN +    |
| 5          | CAN LOW IN -     |
| 6          | NOT USED         |
| 7          | NOT USED         |
| 8          | NOT USED         |
| 9          | ENCODER REF      |
| 10         | ENCODER A        |
| 11         | GROUND           |
| 12         | ACCEL REF 1      |
| 13         | ACCEL SIG 1      |
| 14         | ACCEL SIG 2      |
| 15         | ACCEL 1 SIG RTN  |
| 16         | ENCODER B        |
| 17         | ENCODER RETURN   |
| 18         | ENCODER SHIELD - |
| 19         | CAN HIGH OUT     |
| 20         | CAN LOW OUT      |
| 21         | ACCEL REF 2      |
| 22         | ACCEL SIG RTN    |



## Dual / Single Motor Encoder & Drive Inverter Connections Tesla Colour Codes Used

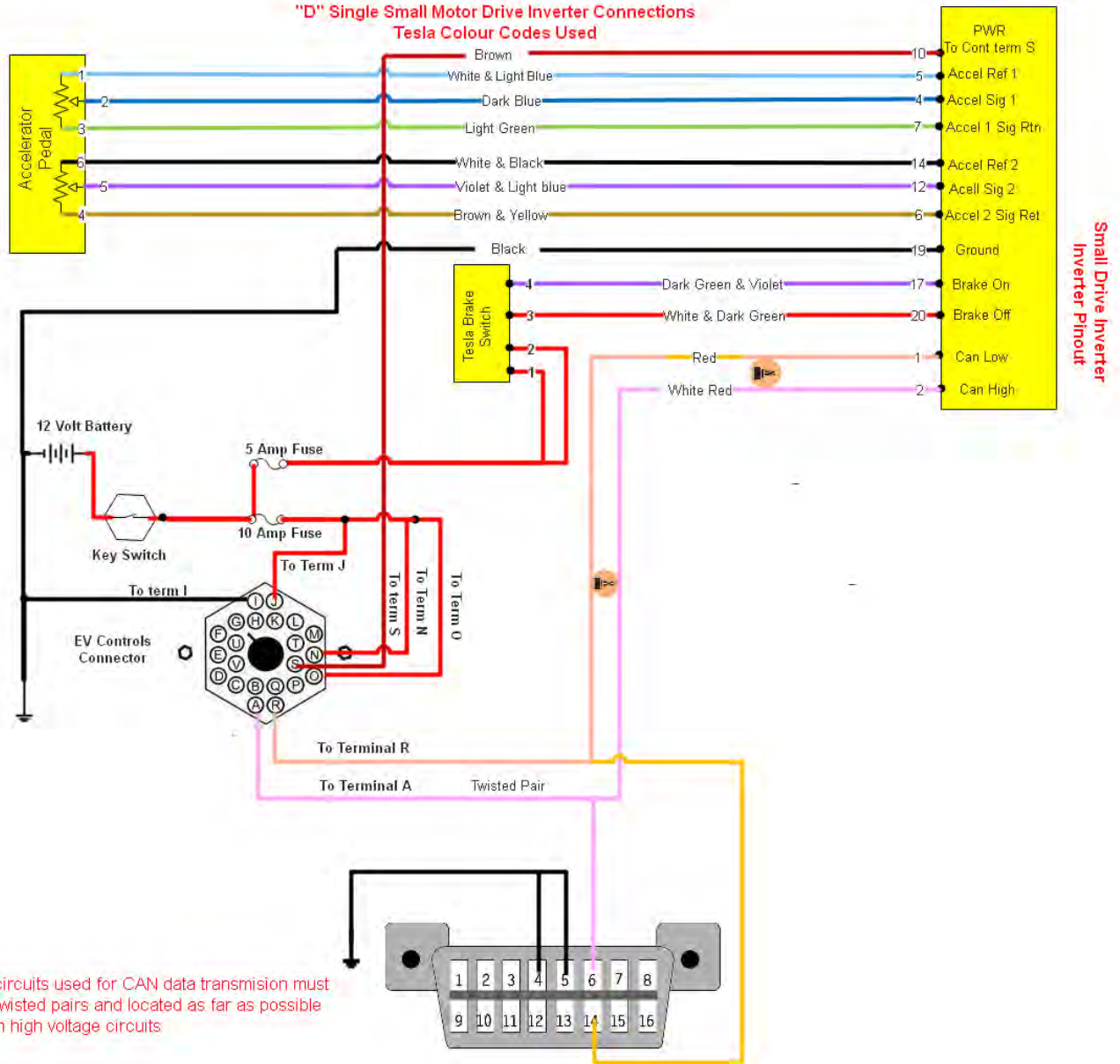


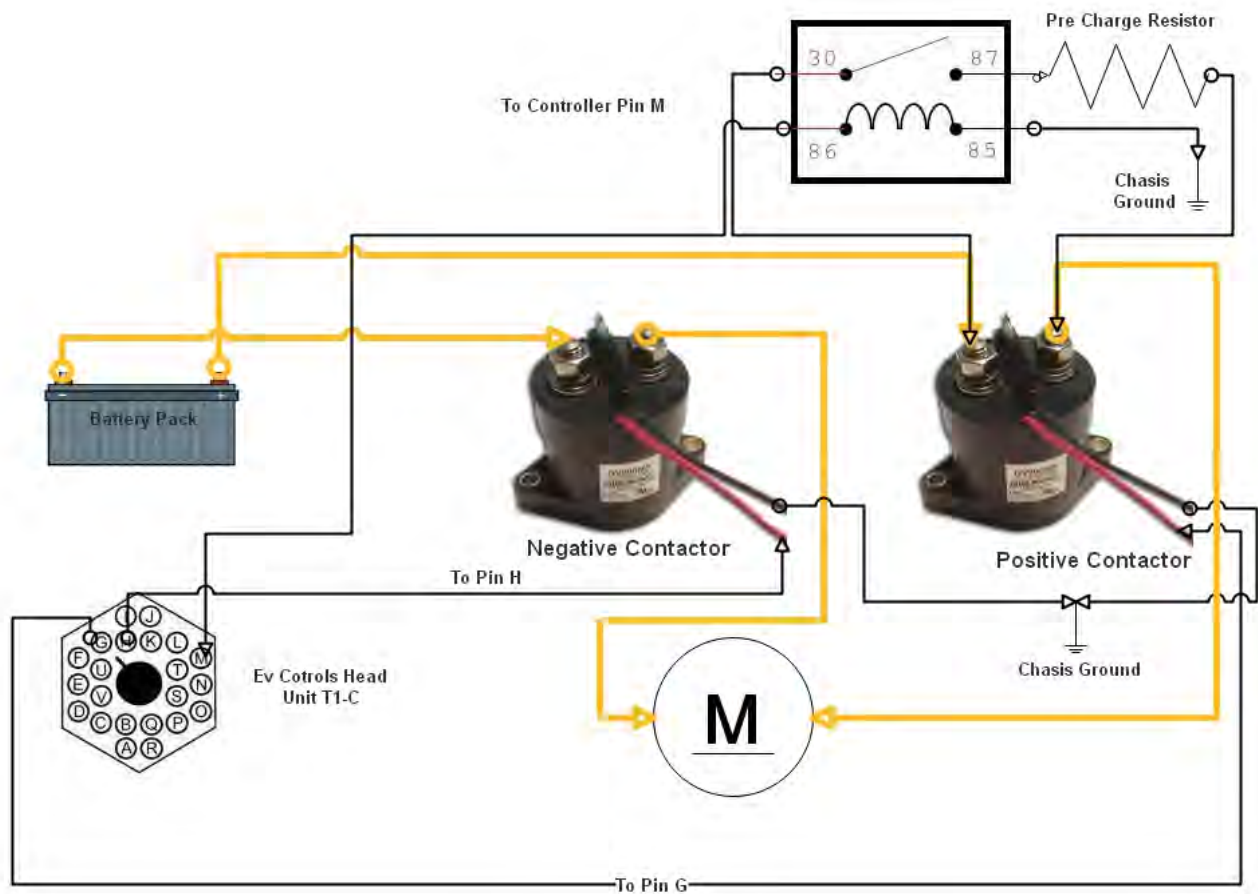
## Pin Identification and Connection points for Small "D" Motor



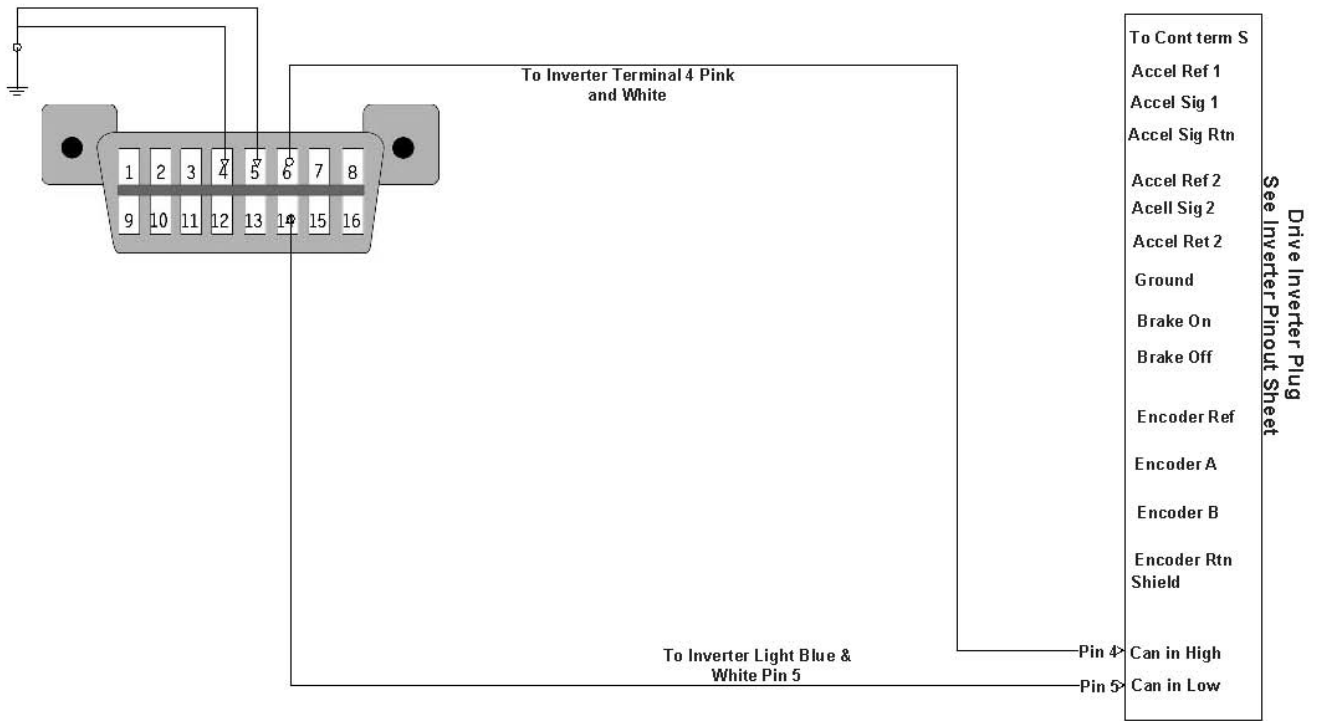
| Controller Pin Number | Wire Color        | Connection                                |
|-----------------------|-------------------|---|
| 1                     | Red               | CAN Low - To Controller Term R            |
| 2                     | White/Red         | Can High - To Controller Term A           |
| 3                     | Yellow/green      | Not used                                  |
| 4                     | Dark Blue         | Accelerator Signal Voltage 1- Accl. Pin 2 |
| 5                     | White/Blue        | Accelerator Ref. Voltage 1 - Accl. Pin 1  |
| 6                     | Brown/Yellow      | Accelerator Signal Return 1 - Accl. Pin 4 |
| 7                     | Light green       | Accelerator Signal Return 2 - Accl. Pin 3 |
| 8                     | Empty             |   |
| 9                     | Empty             |   |
| 10                    | Brown             | To Controller Terminal S                  |
| 11                    | Yellow/Red        | Not Used                                  |
| 12                    | Violet/Light Blue | Accelerator Signal Voltage 2              |
| 13                    | Brown             | Permanent Power (12+) To Ign Switch       |
| 14                    | White/Black       | Accelerator Ref. Voltage 2 - Accl. Pin 6  |
| 15                    | Empty             |   |
| 16                    | Empty             |   |
| 17                    | Dark Green/Violet | Brake On - Brake SW Pin 4                 |
| 18                    | Orange/Violet     | Charge Proximity                          |
| 19                    | Black             | Chassis Ground                            |
| 20                    | White/Dark Green  | Brake Off - Brake SW Pin 3                |

## "D" Single Small Motor Drive Inverter Connections Tesla Colour Codes Used





**EV Controls T1- C  
High Voltage Contactor Circuit**



## **Driver Information Screen**

This is the screen that you will provide dynamic information on system conditions

## **Home Screen**

Access to setup screen to adjust system variables

## **Setup Screen**

Provides easy to use interface to customize your specific system configuration

## **System Status Screen**

Real time feedback on system operation



## Home Screen



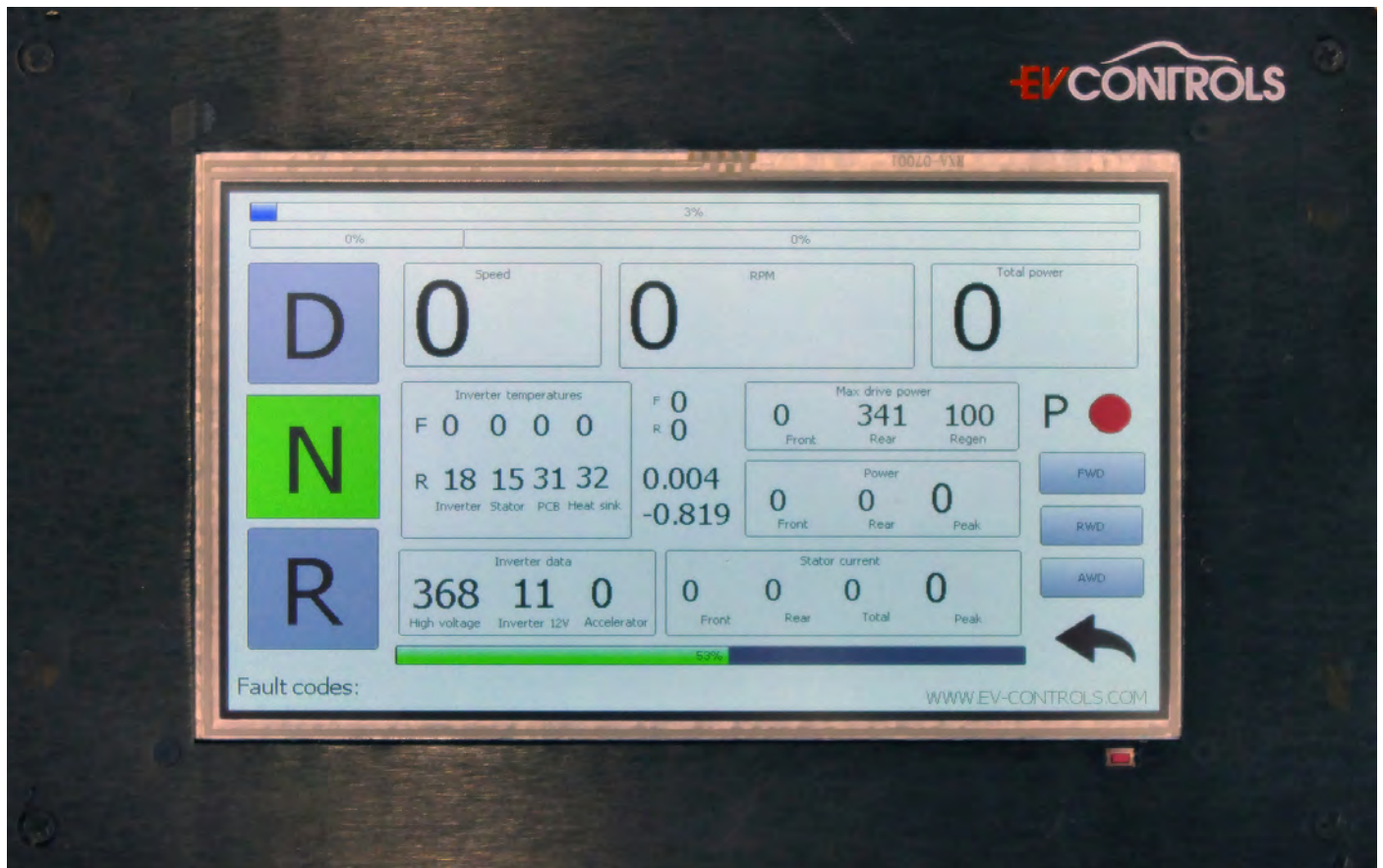
Provides access to the settings screen. Steering wheel icon will return you to the main driving screen.



## Driving Screen

This is the main driving screen for the T-1C and will come up as soon as the T-1C is powered up. This screen keeps the operator informed of critical system values

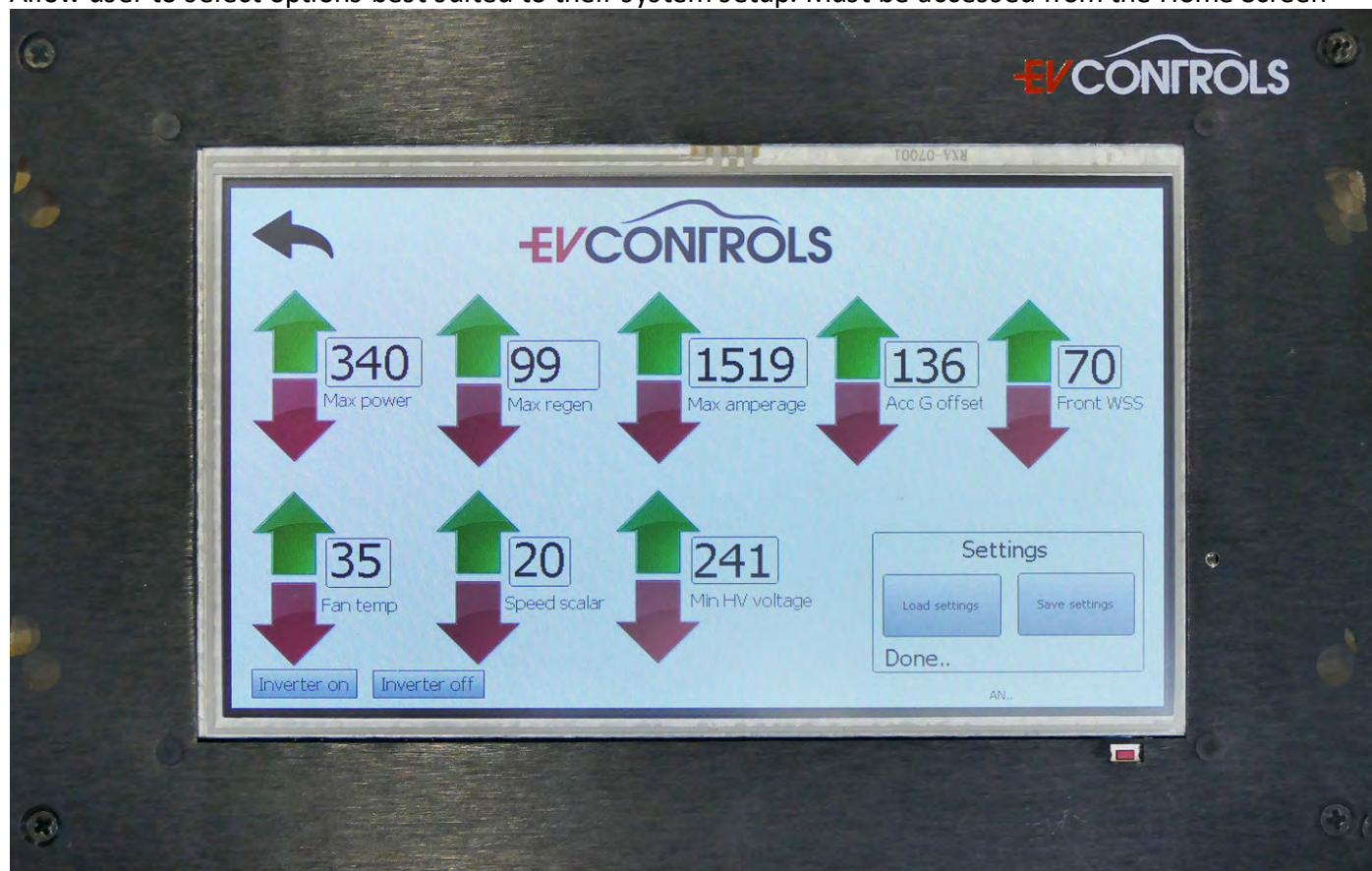
- Select and monitor drive range ,forward neutral or reverse modes via the 7" touch screen
- Select dual or single motor AWD, FWD, RWD
- Monitor brake on brake off signal
- View peak power output and regenerative braking power levels via the touch screen
- Monitor available battery/inverter voltage (HV) available
- Monitor inverter 12V supply voltage
- Monitor internal inverter temperature readings
- Monitor Stator current
- View actual power in kilowatts, positive or negative (regenerative braking)
- Monitor fault codes





## Settings Screen

Allow user to select options best suited to their system setup. Must be accessed from the Home Screen



### Purpose

Allow user to select options best suited to their system setup. Must be accessed from the home screen.

Click on using the settings 1 selection buttons

**Up/Down Arrows**

### Max Power

This function will allow user to set the maximum power level in kilowatts

### Maximum Regen

Adjust sensitivity of regenerative braking force in KW

### Maximum amperage

Max amperage is not currently active, may be enabled later with a firmware update

### Accelerator G Offset

Accelerator G offset is for zeroing the internal accelerometer that is used for traction control/regen and peak G measurement.

## Front Wheel Speed Sensor

Front wheel speed scalar must be set in dual motor applications where the front and rear wheel diameter is not identical. Adjust this until the front and rear wheel speed readings match when the car is driven in a straight line at a steady speed. (Needed for the traction control/torque split to work properly).

## Fan Temp

Fan temp is for inverter coolant fan

## Speed Scaler

Setting allows user to select different multipliers used in calculating the control panel speed readout

## Min HV (High Voltage)

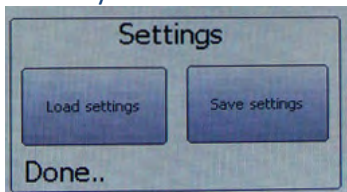
Also allows operator to set a low voltage cutoff to protect battery pack (set to 241 volts in the picture).

## Inverter On Off Selection

Allows activation (powering up the inverter processor and communication) without closing the HV contactors when flashing updated inverter software.

## Settings Selection Box

Allows you to save the settings to the SD card so that they persist between powerup cycles.



**Load Settings:** Loads current system settings

**Save Settings:** Saves new settings to memory

## Return to Main Menu

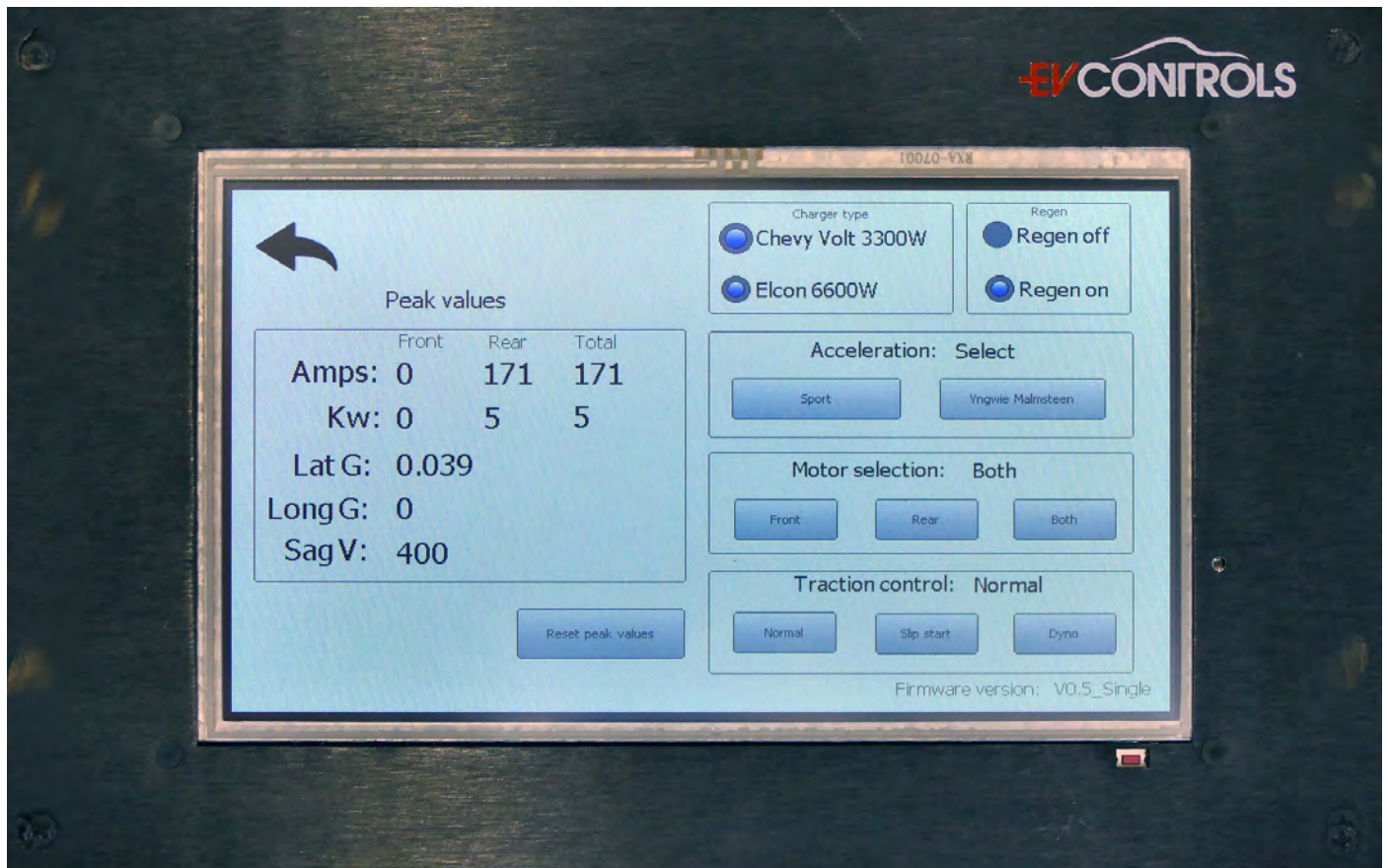


Return user to [Home Screen](#) when settings are completed and saved to system memory.

## System Status Screen

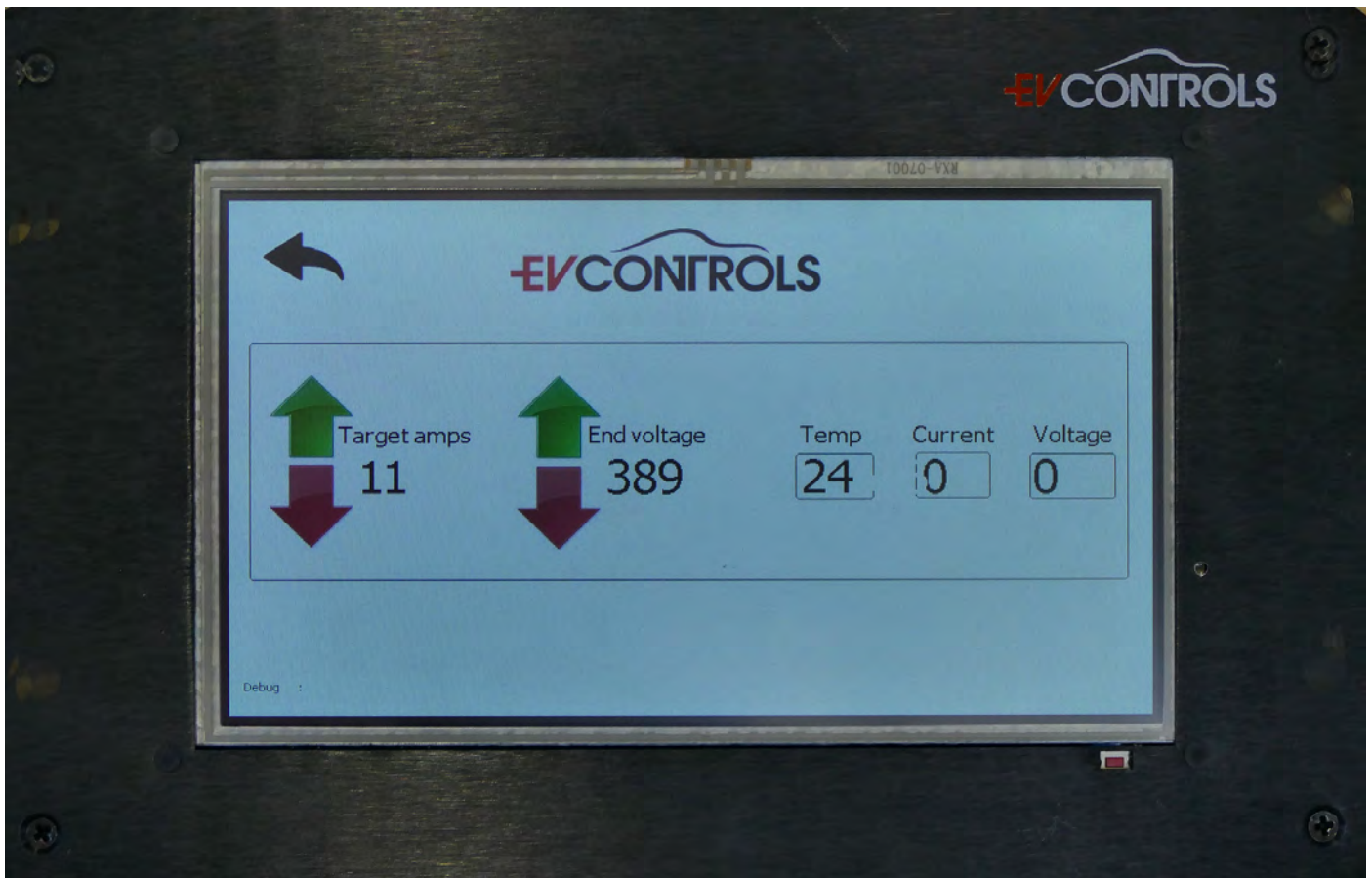
Access using setup 2 from [Home Screen](#) provides a data logging function to monitor peak values reached during actual driving conditions. Allows operator to select the following system settings:

1. Select Charger type
2. Select regen On or off
3. Select acceleration mode
4. Select single or dual motor operation
5. Select traction control mode
6. Return to peak values adjustment screen



## Battery Charger Control Screen

Operator selectable values for the control of the battery charger. Please note that only older style Chevy Volt and Econ 6.6KW chargers are supported.



### Target amps:

- user selectable charge rate

### End voltage

- charger shut off voltage

### Temp

- Charger/battery temperature