**LFEV-Y6**

v0.7

**Lafayette College: Electrical and Computer Engineering**

Acceptance Test Plan: v0.7

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This document outlines all of the tests required to deliver LFEV-Y6. The plan is presented as an overview with the ATP number next to the test. This refers to the document that describes the test procedure. The requirements are from the SoW for 2018

08

**Fall**

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# ATP overviews

None of these tests can be viewed as completed until appropriate documentation has been uploaded to the webpage.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Item description | Demonstrated Requirements | Successful Test Criteria | Verification Method |
| ATP-01 | Accumulator integration | R001a  R001c  R001d  R001e  R002a  R002c  R004a (TSV part)  R005a  R005b (Manual) | Packs power motor and all telemetry is recorded by VSCADA. Control by using the throttle.  Verify by accelerating and looking at dash, pack screens, and log files remotely | Test |
| ATP-02 | Charging Accumulator | R001b  R001g  R002b  R002h | Packs charge by the charging port and open the safety loop  VSCADA reacts correctly  Verify by looking at the dash | Test |
| ATP-03 | CAN Bus link | R002a  R002c  R002d  R002e  R002f  R002g  R002j  R002k  R003a(8)  R003d  R004a (CAN Bus part)  R005a (CAN Bus part)  R005c (CAN Bus part)  R007c  R007d | DAQ by VSCADA of TSI, GLV, TSV, Cooling. Verify by looking at GLV Screen. All DAQ methods should happen simultaneously | Test |
| ATP-04 | Safety loop | R001g  R002b  R002c  R002d  R002k  R002m  R003b  R003c  R003d  R004a (Safety loop part)  R005c (IMD fault)  R007b | Fault by:  Crashing  BRB  IMD  Cooling  VSCADA limit  Pack fault  Throttle fault  Brake fault  User defined limit (halt)  Pack charging  Verify by looking at the dash, the remote computer and the cellphone | Test |
| ~~ATP-06~~ | ~~24h endurance test~~ | ~~GPR006~~ | ~~At the end of all other tests leave the car running for 24h~~ | ~~Test~~ |
| ATP-07 | Shutdown | R002k  R002i | VSCADA works after unexpected GLV shutdown  All hardware in safe state  Packs stop powering motor with GLV shutdown  TSI works after unexpected TSV shutdown | Test |
| ATP-08 | GLV grounding | R003a(2) | Ensure that there is only 1 connection between ground and chassis ground | Inspection |
| ATP-09 | Documentation | GRP001 | Complete and accurate documentation | Inspection |
| ATP-10 | Hazmat | GPR004 | No hazardous materials used | Analysis |
| ATP-11 | Safety practice | GPR005 | Good practice used for safety | Inspection |
| ATP-12 | Maintainability | GPR007 | Ensure that the project is maintainable | Analysis and test |
| ATP-13 | Demonstration | GPR011 | Have a video and demo setup | Inspection |
| ATP-14 | Disposal | GPR012 | Dispose of all materials as required | Inspection |

# Compliance Matrix

All requirements should also have a QA by each subsystem before integration.

|  |  |
| --- | --- |
| Requirement | Test(s) to demonstrate acceptance |
| R001a | ATP-01 |
| R001b | ATP-02 OR https://sites.lafayette.edu/ece492-sp16/files/2016/05/QAR001b.pdf |
| R001c | ATP-01 |
| R001d | ATP-01 |
| R001e | ATP-01 |
| R001f | https://sites.lafayette.edu/ece492-sp16/files/2016/05/QAR001e.pdf |
| R001g | ATP-02 |
| R002a | ATP-01 or ATP-03 |
| R002b | ATP-02 |
| R002c | ATP-01 OR ATP-03 OR ATP-04 |
| R002d | ATP-01 OR ATP-03 OR ATP-04 |
| R002e | ATP-03 |
| R002f | ATP-03 |
| R002g | ATP-03 |
| R002h | ATP-02 OR ATP-03 |
| R002i | ATP-02 |
| R002j | ATP-03 |
| R002k | ATP-03 |
| R002l | Waived |
| R002m | ATP-04 |
| R003a(1) | Any ATP |
| R003a(2) | ATP-08 |
| R003a(3) | QA by GLV |
| R003a(4) | ATP-02 |
| R003a(5) | ATP-02 |
| R003a(5) | ATP-02 |
| R003a(6) | ATP-02 |
| R003a(7) | ATP-02 |
| R003a(8) | ATP-03 |
| R003b | ATP-04 |
| R003c | QA by GLV |
| R003d | ATP-03 |
| R004a | ATP-01 AND ATP-03 AND ATP-04 |
| R004b | QA by Interconnect |
| R005a | ATP-01 AND ATP-03 |
| R005b | ATP-01 AND ATP-07 |
| R005c | ATP-04 |
| R005d | QA by TSI |
| R006 | Any ATP |
| R007a | QA by Cooling |
| R007b | ATP-04 |
| R007c | ATP-03 |
| R007d | ATP-03 |
| R007e | Waived |
| R007f | QA by Cooling |
| R007g | QA by Cooling |
| GPR001 | ATP-09 |
| GPR003 | Inspection |
| GPR004 | ATP-10 |
| GPR005 | ATP-11 (MTBF + power waived) |
| GPR006 | ATP-06 and ATP-11 |
| GRP007 | ATP-12 |
| GPR008 | ATP-09 |
| GPR011 | ATP-13 |
| GPR012 | ATP-14 |

# Deliverables

## D000: PDR

## <https://sites.lafayette.edu/ece492-sp18/files/2017/11/PDR_fall2017.pptx.pdf>

## D001: CDR

<https://sites.lafayette.edu/ece492-sp18/files/2018/03/Critical-Design-Review-1-1.pdf>

## D002: User Manuals

Note this is a checklist for the video

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System | Getting started | FAQ | Functions and controls | Troubleshooting calibration and maintenance |
| TSI |  |  |  |  |
| TSV |  |  |  |  |
| GLV |  |  |  |  |
| Cooling |  |  |  |  |
| VSCADA |  |  |  |  |
| Dyno room |  |  |  |  |

Attach link to each of the videos to demonstrate competing the deliverable.

## D003: Final Report and Maintenance Manual

### Final report

|  |  |
| --- | --- |
| Check | Completed |
| Maintenance manuals completed |  |
| 3x DVD presented (or flash drive) |  |
| DVD artwork |  |
| ATP-09 completed |  |

Attach image of DVD or flash drive. Attach link to the final report with all of the documentation.

### Maintenance manual

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Part | TSI | TSV | GLV | Cool | VSCADA | Dyno | Andriod |
| Maintenance |  |  |  |  |  |  |  |
| Calibration |  |  |  |  |  |  |  |
| PCB schematic |  |  |  |  |  |  |  |
| PCB BOM |  |  |  |  |  |  |  |
| Mechanical drawing |  |  |  |  |  |  |  |
| Mechanical BOM |  |  |  |  |  |  |  |
| Block diagram |  |  |  |  |  |  |  |
| Wiring diagram |  |  |  |  |  |  |  |
| Gerber files |  |  |  |  |  |  |  |
| QA testing |  |  |  |  |  |  |  |
| Principal of operation |  |  |  |  |  |  |  |
| Software binaries |  |  |  |  |  |  |  |
| Software source |  |  |  |  |  |  |  |
| Software make file |  |  |  |  |  |  |  |
| ATP-12 completed |  |  |  |  |  |  |  |

Attach link to each of the maintenance manuals for this document.

## D004: ATP

|  |  |
| --- | --- |
| Check | Completed |
| Compliance matrix |  |
| Forms present |  |

<http://sites.lafayette.edu/ece492-sp17/testing/atp/>

## D005: ATR

|  |  |
| --- | --- |
| Check | Completed |
| All tests included |  |
| Test date for all tests |  |
| Photos as required |  |
| Tester named |  |
| Witness signature if available |  |
| Test results |  |

Attach link to the ATR.

## D007: Project Website

|  |  |
| --- | --- |
| Check | Completed |
| All documents as portable static documents (PDF/TXT/XML) |  |
| Original version present |  |
| Links to any cloud storage |  |

Attach link to the site for each document required.

## D008: Final Presentation and Delivery

|  |  |
| --- | --- |
| Check | Completed |
| GPR006 |  |
| GPR007 |  |
| GPR008 |  |
| GPR011 |  |
| D010 |  |
| Video for D009 |  |
| Video of GPR011 |  |
| Delivered per GPR012 |  |
| Any other items disposed per GPR012 |  |

Links to the final presentation provided. Link to the video.

## D009: Conference Paper, Presentation, and Video

Waived

## D010: Project Poster

Waived

## D012: Software Maintainability Plan

Waived by Professor Nadovich upon demonstration during CDR

## D013: Purchasing Report

|  |  |
| --- | --- |
| Check | Completed |
| Table for all purchases |  |
| Summary based on team |  |
| Summary based on week |  |

Link to purchasing reports provided.

## D014: Project Management and Status Letters

|  |  |
| --- | --- |
| Check | Completed |
| Status letter submitted |  |
| WBS delivered |  |

Link to WBS and status letter provided.

# Waived or modified requirements and questions

|  |  |
| --- | --- |
| Requirement | Reason |
| ~~R003a(4)~~ | ~~Cannot tell if GLV is from the battery or 24VDC~~ |
| ~~R002h~~ | ~~Cannot tell if GLV is from the battery or 24VDC~~ |
| ~~R007e~~ | ~~Waived~~ |
| ~~R005d~~ | ~~We’ve changed the switches~~ |
| ~~R002l~~ | ~~Waived~~ |
| ~~GPR003~~ | ~~Waived~~ |
| ~~GPR005~~ | ~~(Power and MTBF/MTTR waived)~~ |

# ATP-01 checklist: Accumulator integration

|  |  |
| --- | --- |
| Test | Pass |
| 1. Packs can deliver 200A through TSI |  |
| 1. Voltage measured at TSVMP is as expected |  |
| 1. Throttle controls RPM |  |
| 1. Throttle implausibility causes exit of drive mode |  |
| 1. Two moves required to enter drive mode |  |
| 1. Throttle and brake together prevent drive mode from starting |  |
| 1. Throttle and brake together exit drive mode |  |
| 1. TSAL lights come on when HV present outside packs |  |
| 1. TSEL lights come on when AIRS closed |  |
| 1. RTDS come on for 1-3 seconds when drive mode entered |  |
| 1. HV present light comes on when HV present |  |
| 1. Packs display telemetry on GLV screen |  |
| 1. Dyno can set the throttle |  |
| 1. Dyno can set the valve on the dyno |  |

Pass count: /14

|  |  |
| --- | --- |
| (Test) Variable to measure | Value |
| (a) Current according to current sensor |  |
| (a+l) Current according to pack 1 |  |
| (a+l) Current according to pack 2 |  |
| (a+l) Current according to pack 3 |  |
| (a+l) Current according to pack 4 |  |
| (a) Current according to TSI |  |
| (b) Voltage at TSVMP with 50A load |  |
| (b) Voltage at TSVMP with no draw |  |
| (c) Max RPM |  |
| (d) APPS1 voltage at implausibility |  |
| (d) APPS2 voltage at implausibility |  |
| (m) Max RPM |  |
| (n) Max torque |  |

# ATP-02 checklist: Charging Accumulator

|  |  |
| --- | --- |
| Test | Pass |
| 1. Safety loop opens when charging |  |
| 1. VSCADA shows that packs are charging |  |
| 1. Packs can be left charging after they are full |  |

Pass count: /4

Attach VSCADA data dump showing voltage and current with respect to time. This should be an excel document with data as well as a graph.

# ATP-03 checklist: CAN Bus link

|  |  |
| --- | --- |
| Test | Seen by VSCADA |
| Cell Temperature | /28 |
| Cell Voltage | /28 |
| Pack Current | /4 |
| Pack SoC | /4 |
| Pack Status | /4 |
| Pack Voltage | /4 |
| GLV Voltage |  |
| GLV SoC |  |
| GLV Current |  |
| GLV Temperature |  |
| Safety loop status |  |
| RPM gauge (Dyno) |  |
| Strain gauge |  |
| Throttle position |  |
| Brake status |  |
| IMD resistance |  |
| FWD/REV status |  |
| Precharge status |  |
| MC temp |  |
| MC current |  |
| Cooling temp in |  |
| Cooling flow |  |
| Cooling temp out |  |
| TSI temp |  |
| Speed |  |
| Safety loop status |  |

Pass count: /26

Attach excel document of data for VSCADA receiving data. Attach graphs from the android application. Attach screen shots of the remote computer in operation.

# ATP-04 checklist: Safety loop

|  |  |  |
| --- | --- | --- |
| Fault | Safety loop trip  (Fault lit) | Seen on VSCADA |
| Driver resettable BRB |  |  |
| Non driver resettable BRB |  |  |
| Crash protection |  |  |
| Over temperature cooling |  |  |
| Under flow cooling |  |  |
| IMD fault |  |  |
| Cell overtemp |  |  |
| Cell overcurrent |  |  |
| Cell overvoltage |  |  |
| Cell undervoltage |  |  |
| Brake overtravel |  |  |
| VSCADA defined violation |  |  |

Pass count: /24

Add logs from VSCADA showing faults. Add screen shots from the remote computer showing the faults. Add screen shots from the android application showing the faults.

# ATP-07 checklist: Shutdown

|  |  |
| --- | --- |
| Test | Pass |
| VSCADA powers up with no user input |  |
| GLV shutdown prevents TSV being present at TSVMP |  |
| TSVMS shutdown prevents TSV being present at TSVMP |  |
| VSCADA has recorded data up to the shutdown |  |
| TSVMS shutdown while under load does not create any issues |  |

Pass count: /5

Shutdown time (yyyy-mm-dd hh:mm:ss UTC):

Attach log from VSCADA showing data up until GLV shutdown.

# ATP-08 checklist: GLV grounding

Attach image of the grounding connection.

# ATP-09 checklist: Documentation

For every subassembly in a subsystem this checklist should be completed. I have attempted to capture them all but if there are parts not included they need to be added. Part numbers should go in a tree structure all the way down to commercial parts.

## TSV: Pacman

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSV: AMS

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSV: Pack

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSV: Pack panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSV: Bus bar

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSV: Control panel PCB

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: Container

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: Front Panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: Back Panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: Bus bar 1 (AIR to connector)

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: Bus bar 2 (connector to connector)

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: PCB

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## TSI: Dyno panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## GLV: Container

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## GLV: Front panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## GLV: Back panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## GLV: PCB

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## GLV: Dyno panel

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

## Cooling: Assembly

|  |  |
| --- | --- |
| Check | Pass |
| Unique part number |  |
| Document delivered to instructor |  |
| Document uploaded to website |  |
| Units defined on diagram clearly |  |
| Have a complete BOM with document if required |  |
| Part number on title block |  |
| Part number on file name |  |
| Part number on fabricated object |  |
| Lafayette Electrical and Computer Engineering marked |  |
| BOM had alternative or justification of only 1 supplier |  |

Pass count: /10

Part number:

Link:

# ATP-10 checklist: Hazmat

|  |  |
| --- | --- |
| Check | Pass |
| All PCBs are RoHS |  |
| No NiCd/Pb-Acid batteries |  |
| Dispose pre 2002/96/EC WEEE Directive |  |

Attach link to hazmat documentation.

# ATP-11 checklist: Safety practice

## Wires

### Internal wiring

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System | Clean cabling | No rats-nest | Color coded | Labeled |
| TSI |  |  |  |  |
| TSV |  |  |  |  |
| GLV |  |  |  |  |
| Cooling |  |  |  |  |

Attach pictures of the inside of each system to document.

### W1

Count: 3

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /9

Attach image as evidence

### W2

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W3

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W6

Count: 6

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /18

Attach image as evidence

### W7

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W11

Count: 5

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /15

Attach image as evidence

### W12

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W13

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W15

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W18

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W20

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W21

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W22

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W23

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W24

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W25

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W26

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W28

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W31

Count: 7

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /21

Attach image as evidence

### W32

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W33

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W34

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W35

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

### W36

Count: 1

|  |  |
| --- | --- |
| Check | Pass |
| Wires correctly color coded |  |
| Cable labeled with gauge/max temperature/max voltage |  |
| Cable labeled with reference designator |  |

Pass count: /3

Attach image as evidence

## Indicators

### IMD fault light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Red LED |  |
| Located in cockpit |  |
| Illuminates when IMD resistance is low |  |

Pass count: /4

Attach image of illuminated light

### Fault light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Red LED |  |
| Located in cockpit |  |
| Illuminates when fault detected |  |

Pass count: /4

Attach image of illuminated light

### AIRs Light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Green LED |  |
| Located in cockpit |  |
| Illuminates when AIRs closed detected |  |

Pass count: /4

Attach image of illuminated light

### Drive light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Green LED |  |
| Located in cockpit |  |
| Illuminates when Drive mode entered |  |

Pass count: /4

Attach image of illuminated light

### Safety light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Green LED |  |
| Located in cockpit |  |
| Illuminates when safety loop closed |  |

Pass count: /4

Attach image of illuminated light

### Safety System OK lights

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Orange LED |  |
| Located Either Side |  |
| Illuminates when safety loop closed |  |

Pass count: /4

Attach image of illuminated light



### High Voltage Present light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Red LED |  |
| Located in cockpit |  |
| Illuminates when HV outside of packs |  |

Pass count: /4

Attach image of illuminated light

### Grounded Low Voltage Present light

|  |  |
| --- | --- |
| Check | Pass |
| Clear indicator of function |  |
| Green LED |  |
| Located in cockpit |  |
| Illuminates when GLV powered |  |

Pass count: /4

Attach image of illuminated light

### Tractive System Active Lamp

|  |  |
| --- | --- |
| Check | Pass |
| 2Hz-5Hz frequency when on |  |
| Red Strobe |  |
| Mounted on the main hull, above driver helmet |  |
| Illuminates when AIRs closed |  |

Pass count: /4

Attach image of illuminated light



### Brake light

|  |  |
| --- | --- |
| Check | Pass |
| 1 light present |  |
| Red light |  |
| Located on dyno specific panel (will be on car in future) |  |
| Illuminates when brake pressed and GLV on |  |

Pass count: /4

Attach image of illuminated light

## Buttons and switches

### FWD/REV switch

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Key switch 2 position |  |
| Key can be removed in either state |  |
| Mounted on TSI box |  |

Pass count: /4

Attach image of button/switch:

### Driver Reset

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Green button |  |
| Momentary switch |  |
| Mounted in cockpit |  |

Pass count: /4

Attach image of button/switch:

### Driver BRB

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Red button |  |
| Latching button, twist to unlatch |  |
| Mounted in cockpit |  |

Pass count: /4

Attach image of button/switch:

### Inertial switch

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Inertial switch |  |
| Resettable by driver |  |
| Mounted in cockpit |  |

Pass count: /4

Attach image of button/switch:

### Drive button

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Tactile switch |  |
| Momentary button |  |
| Mounted in cockpit |  |

Pass count: /4

Attach image of button/switch:



### Scroll button

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Tactile switch |  |
| Momentary button |  |
| Mounted in cockpit |  |

Pass count: /4

Attach image of button/switch:

### Record Button

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Tactile switch |  |
| Momentary button |  |
| Mounted in cockpit |  |

Pass count: /4

Attach image of button/switch:

### GLV Master Switch

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Red key switch |  |
| 2 position |  |
| Mounted on RHS panel |  |

Pass count: /4

Attach image of button/switch:

### TSV Master Switch

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Red key switch |  |
| 2 position |  |
| Mounted on RHS panel |  |

Pass count: /4

Attach image of button/switch:

### RHSBRB

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Red button |  |
| Latching button, twist to unlatch |  |
| Mounted on RHS panel near shoulder of Driver |  |

Pass count: /4

Attach image of button/switch:

### RHS MReset

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Green button |  |
| Momentary switch |  |
| Mounted on RHS panel near shoulder of Driver |  |

Pass count: /4

Attach image of button/switch:

### LHSBRB

|  |  |
| --- | --- |
| Check | Pass |
| Clearly labeled |  |
| Red button |  |
| Latching button, twist to unlatch |  |
| Mounted on LHS panel |  |

Pass count: /4

Attach image of button/switch:

## PCBs

### AMS

|  |  |
| --- | --- |
| Check | Pass |
| Silkscreens marking reference designators |  |
| Silkscreens marking power and critical signals |  |
| Silkscreen showing Lafayette College, Made in USA, Electrical and Computer Engineering, part number |  |
| Space for serial number |  |
| Bottom copper has part number and rev |  |

Pass count: /5

Attach picture of front and back of PCB.

### Pacman

|  |  |
| --- | --- |
| Check | Pass |
| Silkscreens marking reference designators |  |
| Silkscreens marking power and critical signals |  |
| Silkscreen showing Lafayette College, Made in USA, Electrical and Computer Engineering, part number |  |
| Space for serial number |  |
| Bottom copper has part number and rev |  |

Pass count: /5

Attach picture of front and back of PCB.

### TSI PCB

|  |  |
| --- | --- |
| Check | Pass |
| Silkscreens marking reference designators |  |
| Silkscreens marking power and critical signals |  |
| Silkscreen showing Lafayette College, Made in USA, Electrical and Computer Engineering, part number |  |
| Space for serial number |  |
| Bottom copper has part number and rev |  |

Pass count: /5

Attach picture of front and back of PCB.

### GLV PCB

|  |  |
| --- | --- |
| Check | Pass |
| Silkscreens marking reference designators |  |
| Silkscreens marking power and critical signals |  |
| Silkscreen showing Lafayette College, Made in USA, Electrical and Computer Engineering, part number |  |
| Space for serial number |  |
| Bottom copper has part number and rev |  |

Pass count: /5

Attach picture of front and back of PCB.

## Fuses

### Accumulator fuse

|  |  |
| --- | --- |
| Check | Pass |
| UL listed socket as a holder |  |
| 5 spares |  |
| Easy to access |  |

Pass count: /3

Holder part number:

Fuse part number:

Attach image of fuse location

### Pacman fuse

|  |  |
| --- | --- |
| Check | Pass |
| UL listed socket as a holder |  |
| 5 spares |  |
| Easy to access |  |

Pass count: /3

Holder part number:

Fuse part number:

Attach image of fuse location

### TSI precharge relay fuse

|  |  |
| --- | --- |
| Check | Pass |
| UL listed socket as a holder |  |
| 5 spares |  |
| Easy to access |  |

Pass count: /3

Holder part number:

Fuse part number:

Attach image of fuse location

### GLV high current Circuit Breaker

|  |  |
| --- | --- |
| Check | Pass |
| UL listed socket as a holder |  |
| 5 spares |  |
| Easy to access |  |

Pass count: /3

Holder part number:

Fuse part number:

Attach image of fuse location

### GLV low current circuit Breaker

|  |  |
| --- | --- |
| Check | Pass |
| UL listed socket as a holder |  |
| 5 spares |  |
| Easy to access |  |

Pass count: /3

Holder part number:

Fuse part number:

Attach image of fuse location

## Enclosures

### Pack

|  |  |
| --- | --- |
| Check | Pass |
| Access panel present |  |
| Pilot lights and indicators present |  |
| All interconnect cables have at least 1 return signal |  |
| PCBs are not mounted directly to enclosure |  |
| Enclosures are grounded if they are conductive |  |
| Labeled internally and externally |  |

Pass count: /6

Attach 6 images of enclosures (All views)

### TSI

|  |  |
| --- | --- |
| Check | Pass |
| Access panel present |  |
| Pilot lights and indicators present |  |
| All interconnect cables have at least 1 return signal |  |
| PCBs are not mounted directly to enclosure |  |
| Enclosures are grounded if they are conductive |  |
| Labeled internally and externally |  |

Pass count: /6

Attach 6 images of enclosures (All views)

### GLV

|  |  |
| --- | --- |
| Check | Pass |
| Access panel present |  |
| Pilot lights and indicators present |  |
| All interconnect cables have at least 1 return signal |  |
| PCBs are not mounted directly to enclosure |  |
| Enclosures are grounded if they are conductive |  |
| Labeled internally and externally |  |

Pass count: /6

Attach 6 images of enclosures (All views)

# ATP-12 checklist: Maintainability

## Software

### Pacman code

|  |  |
| --- | --- |
| Check | Pass |
| Version controlled |  |
| Can startup with no input from the user |  |
| Have an install script (.exe/make/RPM) |  |
| Configurable without requiring a recompile |  |
| Data stored in a well-supported format |  |
| Any files that grow should be automatically trimmed |  |
| A procedure for backing up data |  |
| Passwords should be avoided |  |
| If a port is needed it should enumerate automatically |  |

Pass count: /9

### AMS code

|  |  |
| --- | --- |
| Check | Pass |
| Version controlled |  |
| Can startup with no input from the user |  |
| Have an install script (.exe/make/RPM) |  |
| Configurable without requiring a recompile |  |
| Data stored in a well-supported format |  |
| Any files that grow should be automatically trimmed |  |
| A procedure for backing up data |  |
| Passwords should be avoided |  |
| If a port is needed it should enumerate automatically |  |

Pass count: /9

### VSCADA code

|  |  |
| --- | --- |
| Check | Pass |
| Version controlled |  |
| Can startup with no input from the user |  |
| Have an install script (.exe/make/RPM) |  |
| Configurable without requiring a recompile |  |
| Data stored in a well-supported format |  |
| Any files that grow should be automatically trimmed |  |
| A procedure for backing up data |  |
| Passwords should be avoided |  |
| If a port is needed it should enumerate automatically |  |

Pass count: /9

### Cell application code

|  |  |
| --- | --- |
| Check | Pass |
| Version controlled |  |
| Can startup with no input from the user |  |
| Have an install script (.exe/make/RPM) |  |
| Configurable without requiring a recompile |  |
| Data stored in a well-supported format |  |
| Any files that grow should be automatically trimmed |  |
| A procedure for backing up data |  |
| Passwords should be avoided |  |
| If a port is needed it should enumerate automatically |  |

Pass count: /9

### TSI code

|  |  |
| --- | --- |
| Check | Pass |
| Version controlled |  |
| Can startup with no input from the user |  |
| Have an install script (.exe/make/RPM) |  |
| Configurable without requiring a recompile |  |
| Data stored in a well-supported format |  |
| Any files that grow should be automatically trimmed |  |
| A procedure for backing up data |  |
| Passwords should be avoided |  |
| If a port is needed it should enumerate automatically |  |

Pass count: /9



## Hardware

### Packs

|  |  |
| --- | --- |
| Check | Pass |
| Recommended list of spare hardware |  |
| Basic troubleshooting guidelines for a beginner |  |
| Advance troubleshooting for an expert |  |
| A beginner can diagnose a simple problem (loose connector) |  |
| An expert can diagnose a complex problem (TBA) |  |

Pass count: /5

Link to documentation:

### TSI

|  |  |
| --- | --- |
| Check | Pass |
| Recommended list of spare hardware |  |
| Basic troubleshooting guidelines for a beginner |  |
| Advance troubleshooting for an expert |  |
| A beginner can diagnose a simple problem (loose connector) |  |
| An expert can diagnose a complex problem (TBA) |  |

Pass count: /5

Link to documentation:

### GLV

|  |  |
| --- | --- |
| Check | Pass |
| Recommended list of spare hardware |  |
| Basic troubleshooting guidelines for a beginner |  |
| Advance troubleshooting for an expert |  |
| A beginner can diagnose a simple problem (loose connector) |  |
| An expert can diagnose a complex problem (TBA) |  |

Pass count: /5

Link to documentation:

### Cooling

|  |  |
| --- | --- |
| Check | Pass |
| Recommended list of spare hardware |  |
| Basic troubleshooting guidelines for a beginner |  |
| Advance troubleshooting for an expert |  |
| A beginner can diagnose a simple problem (loose connector) |  |
| An expert can diagnose a complex problem (TBA) |  |

Pass count: /5

Link to documentation:

# ATP-13 checklist: Demonstration

|  |  |
| --- | --- |
| Check | Pass |
| 1080p compressed video supplied |  |
| Video ~5min in length |  |
| Slideshow of final project |  |
| Demonstration of final project |  |
| Standalone self-contained display provided |  |

Pass count: /5

Attach link to video, slides and image of display.

# ATP-14 checklist: Disposal

|  |  |
| --- | --- |
| Check | Pass |
| All materials stored in the same room |  |
| Webpage updated to a final version |  |
| Old material removed from webpage |  |
| Test equipment returned |  |
| Trash cleaned in 400 and 401 |  |
| Items disposed in accordance with Hazmat procedures |  |
| Paper recycled |  |
| Webpage matches demonstration |  |

Pass count: /8

Attach link to disposal procedure. Attach image of clean lab at the end.

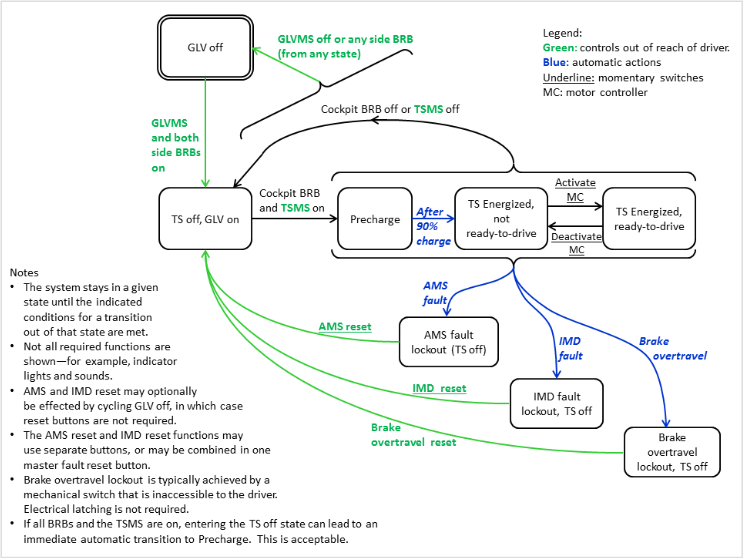


Figure - FSM for TSI

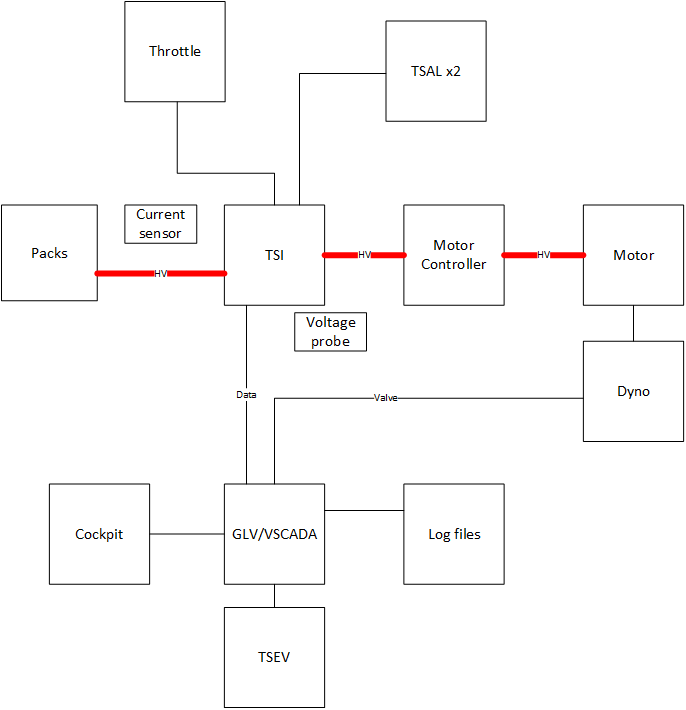


Figure - ATP-01 block diagram

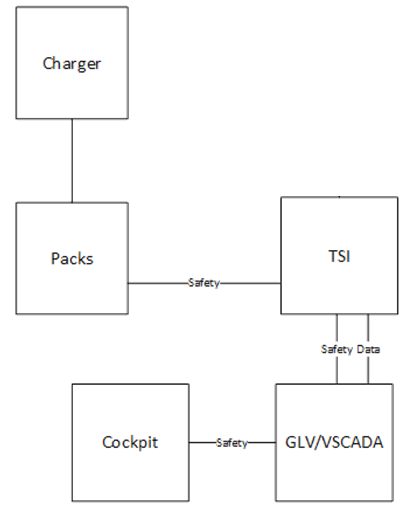


Figure 3 - ATP-02 block diagram

Figure - ATP-03 block diagram

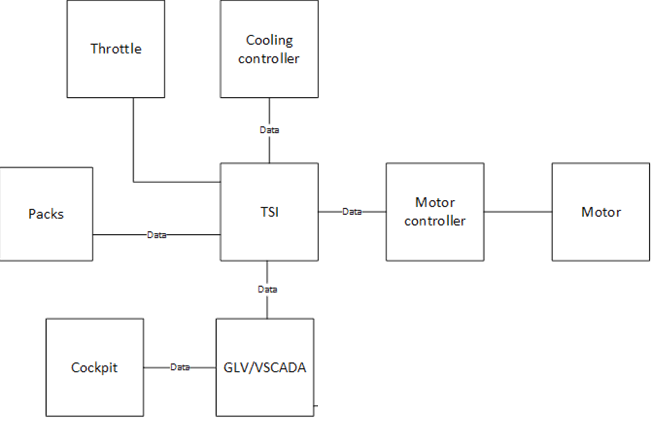


Figure - ATP-04 block diagram

