STUDICA ROBOTICS × WORLDSKILLS

TROUBLESHOOTING GUIDE

WORLDSKILLS BASE ROBOT



VMX Controller + Dual Titan Quad Motor Controller Platform

Document Revision: August 2026
Scope: Hardware & Electrical Fault-Finding Only
Prepared competition-day use with the Studica Base Robot

Table of Contents

1 Introduction **3**

2 Safety Summary **4**

3 Robot System Overview **5**

4 Hardware & Electrical Fault-Finding Method **6**

5 Pre-Diagnostic Toolkit & Checklist **7**

6 Troubleshooting Charts — Electrical & Power **8**

6.1 Power & Battery 8
6.2 Control Panel & E-Stop / Safety Circuit 9
6.3 HCPDB & Fusing 10
6.4 Titan Motor Controllers & CAN Bus 11
6.5 Drive Motors & Encoders 12
6.6 VMX Controller & Communications 12
6.7 LiDAR & Sensor Wiring 13
6.8 Light Tower & Indicators 14
6.9 Wiring, Connectors, WAGO & Ferrules 14

7 Troubleshooting Charts — Mechanical & Hardware **16**

7.1 Fasteners, Frame & Panels 16
7.2 Wheels, Casters & Drivetrain 16
7.3 Motor Mounts & Couplings 17

8 Appendix A — Wiring Diagram & Reference **18**

9 Appendix B — Major Hardware Components **20**

10 Fault Log / Diagnostic Record Sheet **21**

1 Introduction

1.1 About This Guide

This guide covers hardware and electrical fault-finding for the WorldSkills Base Robot — the Studica VMX + Titan Quad Motor Controller mobile platform used for Mobile Robotics training and competition. It is scoped deliberately to hardware and electrical faults only: power, wiring, fusing, motor controllers, connectors, and physical/mechanical hardware. Control-system logic, firmware, and software calibration faults are out of scope and should be referred to the platform's software documentation.

The intent is to give competitors and technical assessors a single, quick-reference document for diagnosing the faults that most commonly appear— the kind that are found with a multimeter, a screwdriver, and a systematic method, not by opening source code.

1.2 How to Use This Guide

- Start with Section 4 (Fault-Finding Method) if you are unsure where to begin — it gives the standard sequence for isolating a fault under time pressure.
- Use Section 6 and Section 7 as quick-lookup charts once you have a specific symptom — each entry gives a likely cause, how common it is, and numbered steps to confirm and fix it.
- Use Appendix A to trace a specific wire or connector back to its source using the wiring diagram's reference numbers.
- Use Section 10 to log your diagnosis as you go

2 Safety Summary

2.1 General Electrical Safety

WARNING

Always power down the robot and disconnect the main battery connector(s) before inspecting, handling, or repairing any wiring. Never work on live power wiring.

WARNING

Verify the E-stop circuit is not latched before re-powering the unit and confirm the E-stop itself functions correctly before every session. A robot with a faulty E-stop must not be operated.

2.2 Working Safely

- Use insulated tools when working near battery terminals or live circuits.
- Allow the power system to cool before inspection if overheating is suspected — a hot connector or wire is a sign of a genuine fault, not something to push through.
- Keep hands, hair, and loose clothing clear of wheels, drivetrain, and any moving mechanism while power is connected.
- Check for visibly damaged, hot, swollen, or leaking battery cells before proceeding with any diagnostic step — do not power up a robot with a suspect battery.
- Never bypass, jumper, or defeat the E-stop or any safety interlock, even temporarily for testing.
- Secure any loose wiring or harness with cable ties once a repair is complete, so the fault cannot silently recur.

2.3 Definitions

Term	Definition
WARNING	A procedure or condition which, if not strictly observed, may result in injury to personnel.
CAUTION	A procedure or condition which, if not strictly observed, may result in damage to equipment.
NOTE	Clarifies or emphasizes a preceding or following instruction.

3 Robot System Overview

The Base Robot's hardware is organized around a central power path (batteries → control panel → HCPDB → motor controllers) and a central data path (VMX → CAN bus → Titan controllers, plus direct sensor connections). Understanding these two paths is the fastest way to localize a fault — most symptoms trace to a break or fault somewhere along one of them.

Component	Function
Battery 0 / Battery 1	Two 12V battery packs (wire refs 1001, 1002) supplying the robot's main power bus.
Power Control Panel	Houses the E-stop, START/RESET/STOP switches, and main power relay (ref 5000). Distributes switched power to the HCPDB and light tower.
HCPDB (High-Current Power Distribution Board)	Fused power distribution block (rated 60 A, 24 VDC max) with numbered channels (0–9) feeding both Titan controllers and the VMX.
Titan 0 / Titan 1 Quad Motor Controller	CAN-bus motor controllers, each driving up to 4 DC motors with built-in per-channel fusing, encoder ports, and limit-switch inputs.
VMX Controller	Main robot controller — coordinates the Titans over CAN, reads sensors, and runs the robot's control software. Not covered here beyond its power/wiring.
Drive Motors	Four DC gear motors (one per wheel) with integrated encoders, wired to the Titan controllers.
LiDAR Front / Rear + Converters	Front and rear 360° LiDAR units, each with a power/data converter board feeding the VMX over USB.
Light Tower + PCB	Status beacon (green/red/amber) driven by a small controller PCB, wired to the control panel and VMX.
WAGO 221 / Lever-Nut Connectors	Tool-free splice connectors used for ground and signal distribution between subsystems.

3.1 Power Path

Battery 0 / Battery 1 → Power Control Panel (E-stop, main relay, ref 5000) → HCPDB (fused distribution, channels 0–9) → Titan 0 / Titan 1 (per-channel fused motor outputs) → Drive motors. A parallel feed from the HCPDB / WAGO distribution also supplies the VMX, LiDAR converters, and light tower.

3.2 Data / Control Path

VMX Controller ⇄ CAN bus ⇄ Titan 0 and Titan 1 (motor commands and encoder feedback). VMX also connects directly to the LiDAR converters (USB) and the light tower PCB (signal wiring) for status and sensing.

> **NOTE**
> Wire reference numbers in this guide (e.g. 0011, 5000, 4050) correspond to the labels on the official Base Robot wiring diagram, reproduced in Appendix A. Always confirm against the diagram supplied with your specific robot before cutting into or re-terminating any wire.

4 Pre-Diagnostic Toolkit & Checklist

4.1 Toolkit

- Digital multimeter (DC voltage, continuity, resistance)
- Small flathead and Phillips screwdrivers, terminal screwdriver
- Wire strippers / crimpers, ferrule crimper
- The Base Robot wiring diagram (Appendix A) and this guide
- Torch / inspection light, magnifier
- Cable ties, spare ferrules and WAGO lever-nut connectors (if permitted)
- Spare fuses matched to the HCPDB, Titan and battery fuse ratings
- Notepad or the Fault Log in Section 10, to record symptom → test → result → fix

4.2 Before You Start — Checklist

☐ Robot powered off, or motors disabled, before touching any wiring.
☐ No visibly damaged, hot, or swollen battery cells present.
☐ E-stop tested and confirmed functional before the session begins.
☐ Battery voltage measured at the terminals and within normal range for the pack type.
☐ Main power switch on the control panel confirmed in the correct position.
☐ All main power connectors visually inspected and confirmed fully seated.
☐ HCPDB fuses visually inspected for an obviously blown element.
☐ Wiring diagram (Appendix A) on hand for reference during diagnosis.

5 Troubleshooting Charts — Electrical & Power

These charts cover the electrical and power faults most frequently encountered on the Base Robot, grouped by subsystem. Probability reflects how often each issue is typically the cause of the stated symptom in training and competition settings — always confirm with a meter or the wiring diagram before replacing a component. Disconnecting the battery first is mandatory for any step that involves opening a connector or touching wiring (Section 2).

High	Medium	Low
Frequently reported — check first.	*Occurs occasionally — check after ruling out High items.*	*Uncommon — usually points to a specific fault.*

5.1 Power & Battery

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Robot completely dead — no lights, no sound	High	Battery disconnected or flat, battery fuse missing or blown, or battery connector not fully seated.	**1.** Measure Battery 0 and Battery 1 voltage individually at the terminals (wire refs 1001, 1002). **2.** Confirm the control panel main power switch is ON and the E-stop is released (see Section 6.2). **3.** Check the battery connectors are fully seated and correctly polarised. **4.** If voltage is present at the battery but absent at the control panel output (5000), suspect the panel's internal relay. **5.** If voltage reaches the HCPDB but a downstream board still has no power, check the relevant HCPDB fuse (Section 6.3) — the HCPDB fuses are the only fuses in the power path.
Robot browns out or resets under load	Medium	Voltage sag under motor current draw, a weak or aging battery pack, or undersized/high-resistance wiring.	**1.** Load-test the battery, not just its resting voltage — measure voltage while the robot is actively driving. **2.** Compare against a known-good battery of the same type if available. **3.** Check main power wiring gauge and connector quality along the battery → panel → HCPDB path. **4.** If only one pack sags under load, isolate Battery 0 and Battery 1 and test each independently.

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Battery charges slowly, incompletely, or not at all	Medium	Charger fault, degraded NiMH cells, or poor contact at the charging connector.	1. Confirm the charger itself is functioning on a known-good battery. 2. Inspect the charging connector for corrosion, bent pins, or looseness. 3. Check individual cell/module condition if the pack allows — a single degraded cell can prevent a full charge even if the pack appears to accept charge. 4. Do not continue using a pack that won't hold a normal charge — replace it.
Robot seems underpowered even though both batteries read normal at rest	Low	One pack is silently degraded and sags disproportionately under load when paralleled with a healthy pack.	1. Disconnect the packs from each other and load-test Battery 0 and Battery 1 independently. 2. Compare voltage sag between the two under an equivalent load. 3. Retire and replace whichever pack sags significantly more than the other.

5.2 Control Panel & E-Stop / Safety Circuit

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Robot won't power on / motors won't enable, even with good battery voltage	High	E-stop latched (not twisted/released), START sequence not completed, or the safety relay not energised.	1. Confirm the E-stop mushroom button is released (twist to release if latched). 2. Press START and listen/feel for the main relay engaging on the control panel. 3. Confirm RESET was pressed if your panel requires a reset-then-start sequence. 4. Inspect control panel internal wiring (refs 4008–4014) to the relay coil and indicator lamps for a loose connection. 5. If the relay does not click at all, suspect the relay itself or its coil wiring rather than downstream power.
E-stop does not stop the robot when pressed	High	Miswired safety relay, welded/stuck relay contacts, or a bypassed E-stop loop.	1. Immediately disconnect the battery — do not operate the robot until this is resolved. 2. Do not attempt to "test" a suspected faulty E-stop by running the robot. 3. Inspect the relay contacts and E-stop loop wiring against the wiring diagram (Appendix A). 4. Replace the relay or E-stop switch if contacts are found welded or the loop is mis wired — this is a safety-critical repair and must be verified before any further operation.

5.3 HCPDB & Fusing

Symptom	Probability	Likely Cause	Step-by-Step Resolution
One motor or channel completely dead, others work normally	**High**	Blown fuse on that HCPDB channel (numbered 0–9), or the fuse is loose in its holder.	**1.** Identify the HCPDB channel feeding the affected motor from the wiring diagram (Appendix A). **2.** Remove the fuse and visually inspect the element; confirm with a multimeter in continuity mode — a blown fuse reads open even if it looks intact. **3.** Check the fuse holder contacts for corrosion or looseness and reseat or clean as needed. **4.** Replace with a fuse of the correct rating — never a higher rating than specified.
Fuse blows repeatedly on the same channel	**Medium**	A genuine short circuit or a stalled/binding motor on that channel, or an incorrectly rated fuse fitted.	**1.** Do not simply keep replacing the fuse with the same or a higher rating. **2.** Disconnect the motor on that channel and check the wiring alone for a short to ground or between conductors. **3.** With the motor disconnected mechanically (see Section 7.2/7.3), confirm it turns freely by hand. **4.** Confirm the fitted fuse rating matches the specification for that channel before returning to service.
HCPDB body or wiring feels warm/hot to the touch	**Low**	Undersized wiring for the current being drawn, or a poor/loose crimp connection causing resistive heating.	**1.** Power down and disconnect the battery immediately — do not continue operating. **2.** Allow the system to cool before inspecting further. **3.** Check wire gauge against the current draw for that circuit, per the wire-gauge legend in Appendix A. **4.** Inspect and re-crimp or replace any connection showing discoloration.

5.4 Titan Motor Controllers & CAN Bus

Symptom	Probability	Likely Cause	Step-by-Step Resolution
A Titan controller is not detected / no CAN communication	Medium	CAN wiring (refs 0050 for Titan 0, 0150 for Titan 1) loose or with CAN-H/CAN-L reversed, or the Titan is unpowered.	1. Confirm the Titan's power input LED/indicator is lit before suspecting CAN. 2. Inspect the CAN wiring at both the Titan and the HCPDB/VMX end for a secure, correctly oriented connection. 3. Check for a reverse-power indicator (red) on the Titan — this points to a wiring polarity fault, not a CAN fault. 4. Reseat connections and re-test; if still undetected, swap CAN leads with a known-good Titan's leads to isolate a cable fault.
All motors on one Titan unresponsive, the other Titan is fine	Medium	That Titan's power input or CAN connection has failed, rather than a fault shared across both controllers.	1. Isolate logic power from motor power per Section 4.1 before assuming a controller fault. 2. Check the affected Titan's power input wiring and fuse feed from the HCPDB. 3. Test a single motor channel on the affected Titan in isolation to confirm the controller itself responds.
One motor channel on a Titan is dead, the other three work	Medium	Per-channel wiring fault, or the Titan's internal fuse for that specific motor output has blown.	1. Swap the affected motor to a known-good channel on the same Titan to confirm whether the fault follows the motor or stays with the channel. 2. If the fault stays with the channel, inspect that channel's internal fuse (motor outputs are fused up to 20A) and wiring. 3. If the fault follows the motor, inspect the motor and its wiring instead (Section 6.5).
Titan reverse-power indicator (red) is lit	High	Battery polarity is reversed at that Titan's power input.	1. Power down and disconnect the battery immediately. 2. Do not operate the Titan while the reverse-power indicator is lit. 3. Trace the power input wiring against the diagram and correct the polarity before re-powering. 4. After correcting, inspect the Titan for any signs of damage before returning to service.

5.5 Drive Motors & Encoders

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Motor spins in the wrong direction	**Medium**	Motor lead polarity swapped at the Titan output, or a channel/position mapping mismatch.	**1.** Check the physical wiring at the motor and Titan terminal against the wiring diagram's channel/motor labelling. **2.** Confirm which physical wheel position (e.g. Left Front, Right Rear) is wired to which Titan channel. **3.** Swap the two motor leads to correct direction or correct the channel mapping — pick one approach and document it so it isn't "fixed" twice.
Motor draws high current or stalls	**Medium**	Usually mechanical (binding, misalignment, a seized bearing) rather than electrical — verify before replacing electrical parts.	**1.** Power down and disconnect the motor from the drivetrain mechanically. **2.** Turn the wheel/mechanism by hand — if it doesn't move freely, the fault is mechanical (see Section 7), not electrical. **3.** If it turns freely disconnected, reconnect and check wiring/fuse for that channel per Section 6.4 before suspecting the motor itself.
No encoder feedback, or position reads erratically	**Medium**	Encoder cable unseated at the Titan's encoder port, or a slipping coupling between the motor shaft and encoder.	**1.** Reseat the encoder cable at both the motor and the Titan encoder port. **2.** Gently flex the encoder harness while monitoring the reading (if a dashboard/console is available) for intermittent drop-outs. **3.** If wiring checks out, inspect for a slipping mechanical coupling between the motor shaft and the encoder.
Motor runs but with weak or inconsistent torque	**Low**	Worn motor brushes, or a poor connection at the motor's M0–M3 terminal.	**1.** Check the motor terminal connection for looseness or corrosion. **2.** Compare current draw against a known-good equivalent motor if possible. **3.** If wiring and connections are sound, the motor itself may be worn and require replacement.

5.6 VMX Controller & Communications

Symptom	Probability	Likely Cause	Step-by-Step Resolution
VMX not powering on / no status indication	Medium	Power input connector not seated, or input voltage outside the VMX's 6–16 VDC operating range.	**1.** Check the VMX's 2-pin power connector is fully seated. **2.** Measure voltage at the VMX power input and confirm it falls within 6–16 VDC.
VMX loses CAN communication with one or both Titans	Medium	CAN wiring (refs 4050, 0140) loose, or a wiring/ID conflict.	**1.** Inspect CAN wiring at the VMX and at each Titan for secure connections. **2.** Confirm CAN-H and CAN-L are not swapped at either end. **3.** Power-cycle the robot after reseating connections and re-check communication status.
VMX powers on but the robot does not behave as expected	Low	This is frequently a software/control-system issue rather than hardware — confirm hardware first before escalating.	**1.** Confirm all power and CAN wiring per Sections 6.4/6.6 checks above is sound. **2.** If hardware and wiring check out, this fault is outside the scope of this guide — refer to the software/firmware documentation.

5.7 Wiring, Connectors, WAGO & Ferrules

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Fault comes and goes, especially with vibration or flexing a harness	Medium	A loose WAGO 221 lever-nut terminal, an unseated ferrule, or a chafed wire making intermittent contact.	**1.** With power off, gently flex each harness along the suspect circuit while a helper watches for the fault to reappear (or use the dashboard/console if available). **2.** Inspect WAGO lever-nut connections — reopen the lever, reseat the wire fully, and close firmly. **3.** Check ferrule crimps are fully seated and not backing out of their terminal. **4.** Re-secure the harness with cable ties once resolved so it cannot recur.
Wire or ferrule shows discoloration or heat damage	Low	Undersized wire gauge for the current on that circuit, or a loose crimp causing resistive heating.	**1.** Power down and disconnect the battery immediately. **2.** Check the wire gauge against the current draw expected for that circuit (Appendix A gauge legend). **3.** Replace the damaged wire/ferrule section **4.** Re-crimp with the correct ferrule and confirm a secure, tug-tested connection before returning to service.
Connector won't seat fully or feels loose	Medium	Worn connector housing, a bent pin, or the wrong mating connector.	**1.** Inspect both halves of the connector for bent pins or debris. **2.** Confirm it is the correct mating connector per the wiring diagram. **3.** Replace the connector if the housing itself is worn or cracked.

6 Troubleshooting Charts — Mechanical & Hardware

Mechanical faults often present with electrical-looking symptoms (a stalling or high-current motor, an erratic encoder) — the quickest way to tell them apart is an isolation test: disconnect the mechanism and turn it by hand. If it doesn't move freely, the fault is here, not in the wiring.

6.1 Fasteners, Frame & Panels

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Chassis rattles during operation	Medium	Loosened structural fasteners on panels, motor mounts, or the frame itself — vibration from normal operation loosens these over time.	1. Go over all structural fasteners with a screwdriver or torque wrench and check against spec. 2. Pay particular attention to panel edges, motor mounts, and any bracket carrying a sensor or PCB. 3. Apply thread-locker on fasteners that repeatedly loosen if permitted by your competition rules.
Panel or bracket vibrates loose over time	Medium	Vibration loosening from normal operation, or a missing lock washer/thread-locker.	1. Press firmly on each cover panel, sensor mount, and bumper one at a time while the robot runs to localize which one is loose. 2. Re-tighten to spec and add a lock washer or thread-locker where appropriate.
Visible crack, bend, or damage to a frame member	Low	Impact damage, typically from a collision or hard drop.	1. Do not operate the robot until the damage is assessed. 2. Photograph and log the damage. 3. Replace the affected frame section per the manufacturer's approved parts — do not attempt a field repair with adhesive alone on a structural member.

6.2 Wheels & Drivetrain

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Wheel wobbles or has noticeable play	Medium	Loose axle nut or hub set screw, or a worn wheel bearing.	1. With power off, grab each wheel and wiggle it side-to-side and front-to-back to feel for slack. 2. Re-tighten the axle nut or hub set screw to spec. 3. If play remains after tightening, the bearing is likely worn — replace it.
Robot veers to one side while commanded to drive straight	Medium	Uneven wheel wear or friction, or one motor underperforming relative to the others.	1. Check tire condition and wear evenly across all wheels. 2. Cross-reference Section 6.5 to rule out a motor/electrical cause before assuming a mechanical one. 3. Compare free-spin resistance by hand across all four wheels with power off.
Grinding, clicking, or rubbing noise from a wheel	Low	Bearing failure, or debris caught in the wheel/roller assembly (mecanum rollers in particular trap debris easily).	1. Power off and manually rotate the wheel, listening and feeling for the source of the noise. 2. Clear any debris from between rollers or around the axle. 3. Replace the bearing if the noise persists with the wheel clear of debris.

6.3 Motor Mounts & Couplings

Symptom	Probability	Likely Cause	Step-by-Step Resolution
Clunk or backlash during acceleration/deceleration	Medium	A worn coupling between the motor shaft and gearbox/wheel, or loose motor mount bolts.	1. Check for looseness where the motor bolts to the chassis. 2. Inspect the flexible coupling or gearbox interface for visible wear or play. 3. Re-torque motor mount bolts to spec; replace the coupling if worn.
Motor mount bolts loose or missing	Low	Vibration loosening over time from normal operation.	1. Inspect all motor mount fasteners for tightness and completeness. 2. Torque to spec and consider thread-locker if the fault recurs.

7 Appendix A — Wiring Diagram & Reference

This is the official Base Robot wiring diagram (V0.1). Use it to trace any wire reference number back to its physical location. Always confirm against the diagram supplied with your specific unit, as wiring can be revised between builds.

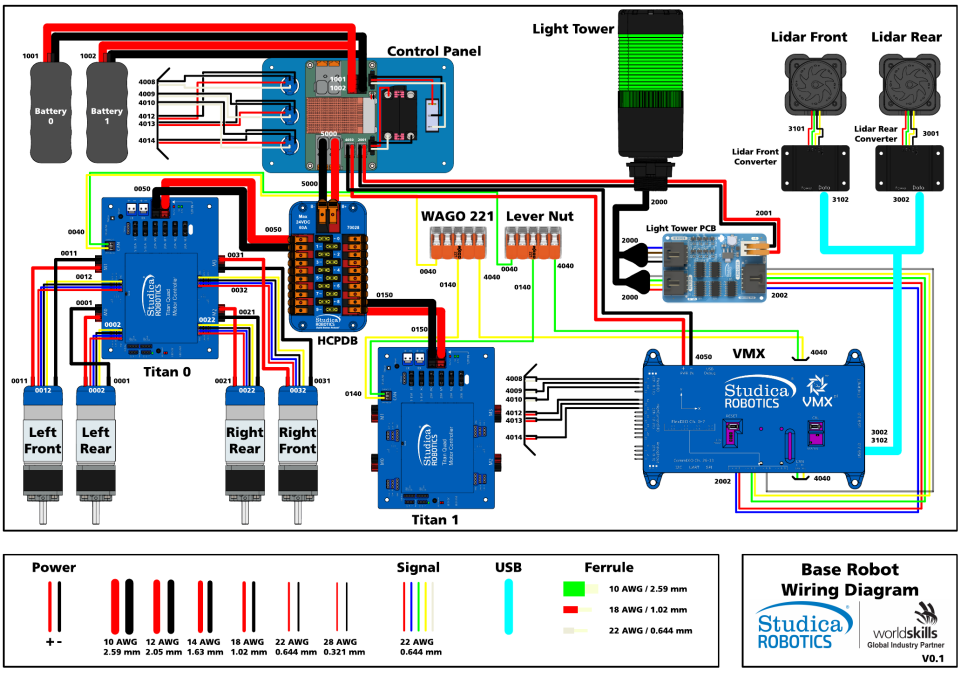


Figure A-1. Base Robot Wiring Diagram V0.1 (Studica Robotics × WorldSkills).

7.1 Key Wire Reference Numbers

Ref. Range	Circuit
1001 / 1002	Battery 0 / Battery 1 main leads
5000	Control panel main power output to HCPDB
4008–4014	Control panel internal wiring (relay, indicators)
0011 / 0012, 0001 / 0002, 0021 / 0022, 0031 / 0032	Titan 0 motor power leads (Left Front, Left Rear, Right Rear, Right Front)
0050 / 0150	CAN bus, Titan 0 / Titan 1 to HCPDB
4040 / 0140	WAGO / lever-nut ground and CAN distribution
4050	CAN bus, HCPDB/VMX
2000 / 2001 / 2002	Light tower power and signal wiring
3001 / 3002, 3101 / 3102	LiDAR Rear / Front converter power and USB data

7.2 Internal Layout Reference

The photo below shows the standard internal component layout — HCPDB (centre), VMX controller (upper left), Servo Power Block (upper right), and harness routing to each corner motor.

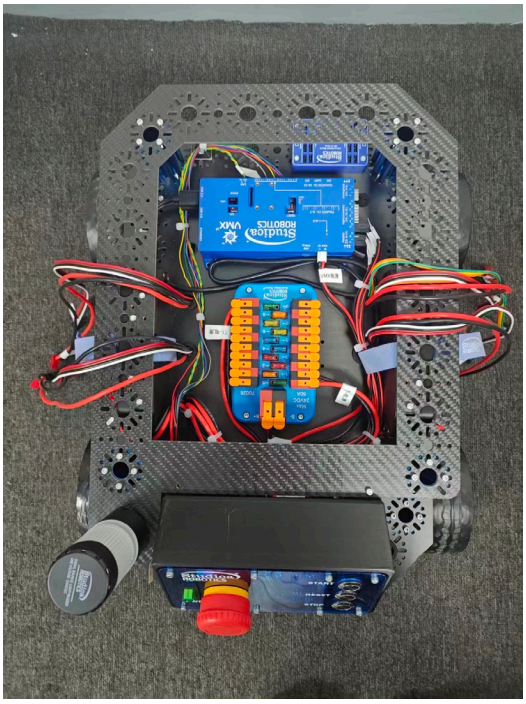


Figure A-2. Internal component layout, top-down view.

8 Appendix B — Major Hardware Components

Electrical characteristics for the core boards, for quick reference during diagnosis. Confirm exact values against the manufacturer documentation for your specific board revision.

Component	Key Specifications
VMX Controller	Input 6–16 VDC; outputs 5V/3.3V; USB, I2C, SPI, CAN, UART; 2-pin JST VH power connector; built-in navX IMU.
Titan Quad Motor Controller (×2)	CAN-bus, 4-channel motor controller; 10–14 VDC input/output; up to 20 A per motor channel (fused); 4× hardware encoder ports; 2× limit-switch inputs per motor; 2× 12 VDC power extension ports.
HCPDB (High-Current Power Distribution Board)	Fused distribution block, 60 A / 24 VDC max, 10 numbered channels (0–9).
Power Control Panel	Integrated E-stop, START/RESET/STOP momentary switches, run/stop indicator lights, main on/off switch and relay.
Drive Motors	DC gear motors with integrated encoders, one per wheel, driven by the Titan controllers.
LiDAR Front / Rear	360° LiDAR units, each with a dedicated power/data converter board feeding the VMX over USB.
Light Tower	Multi-colour status beacon driven by a dedicated PCB, wired to the control panel and VMX.

9.1 Titan Electrical Characteristics

Function	Min / Nom / Max
Input Voltage	10 VDC / 12 VDC / 14 VDC
Output Voltage	10 VDC / 12 VDC / 14 VDC
Motor Output Current	0 A / — / 20 A
Encoder Voltage Output	4.5 V / 5 V / 5.5 V
Limit Switch Output	4.5 V / 5 V / 5.5 V
LED Output Current	0 A / — / 6 A

9 Fault Log / Diagnostic Record Sheet

Log every fault you diagnose here: symptom, the test performed, its result, and the fix applied. This is good competition practice, speeds up re-diagnosis if a fault recurs, and builds a personal reference of "this smells like..." pattern recognition over time.

9.1 Session Details

Team / Competitor:

Date:

Session Start Time:

9.2 Fault Log

Time	Symptom from Customer	Test Performed	Result	Fix Applied

NOTE

State your diagnosis before beginning a repair and always re-verify the full behaviour of the robot — not just the repaired subsystem — before declaring the fault resolved.