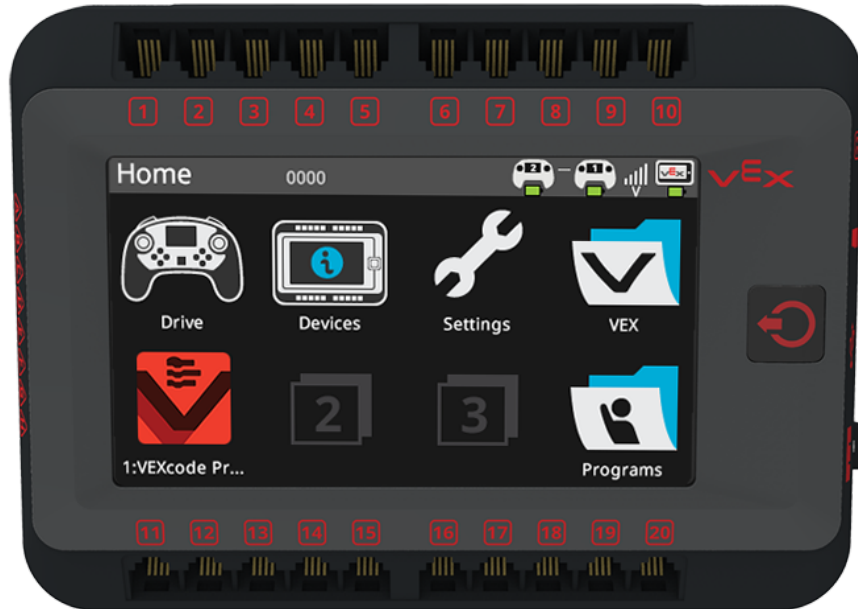


Team 80J: Reverse Engineering Challenge Chester Springs, PA

Inside Of A VEX Brain



Adarsh, Walter, Sankalp, Ishaan, Neel, Sai

Why We Chose The VEX Brain

The item we reverse engineered is the Vex V5 brain. The brain is used to boot up and program our robot.

We know all the parts that are used to build a VEX robot, other than what is inside the brain. Not many people have studied it or know the internals of the brain. We wanted to do this project, so we and other VEX competitors can learn how something they use everyday works.

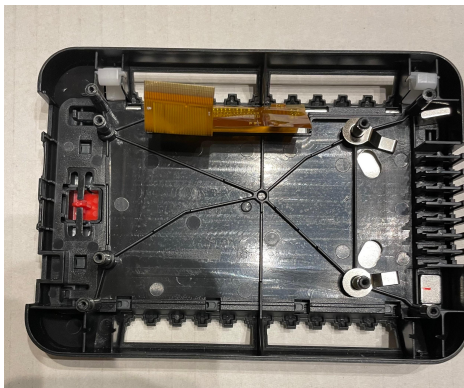
The Brain



Front of Brain



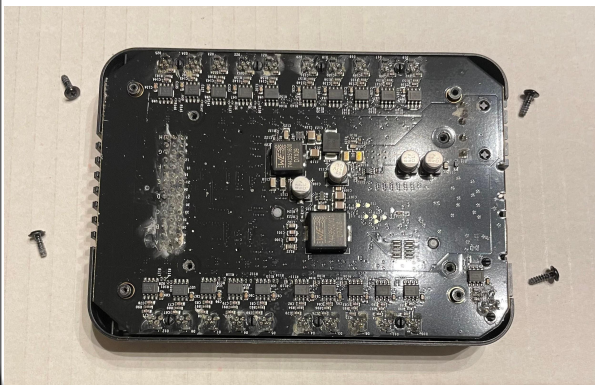
Back of Brain



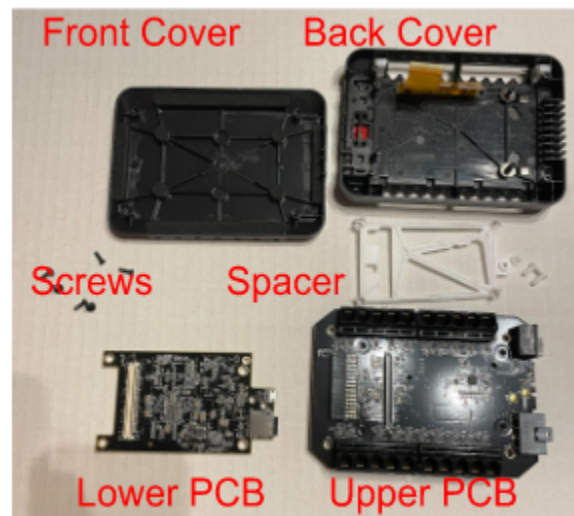
Front Cover Opened



Back Cover Opened



Inside Circuit Boards



Front Cover

Back Cover

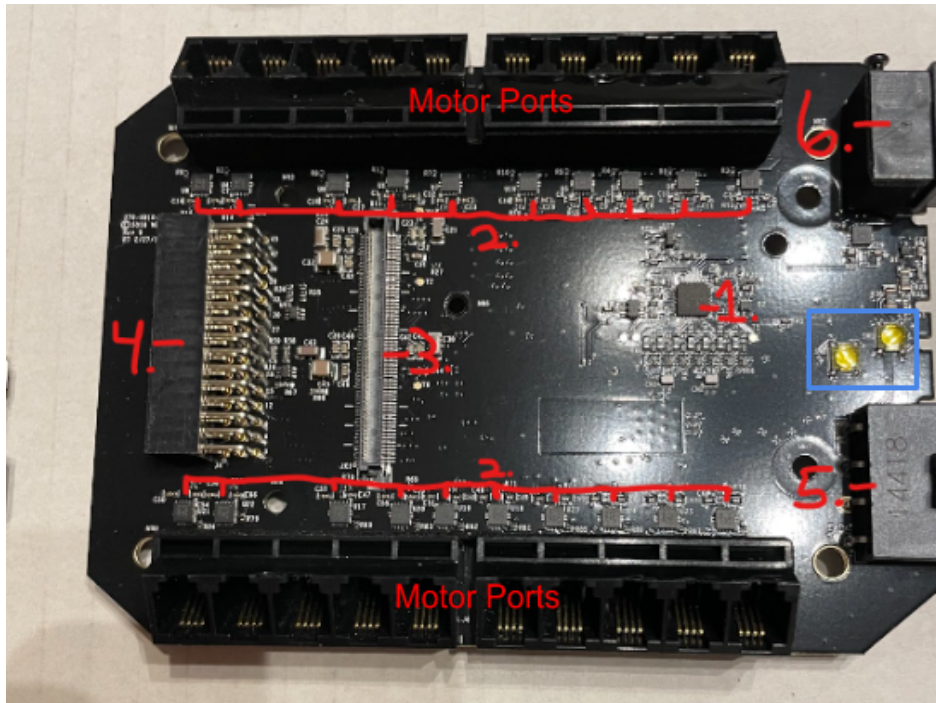
Screws

Spacer

Lower PCB

Upper PCB

Upper PCB



1. NXP 824J 26 06 X17101A Low-Cost Microcontroller
The main controller of this PCB

2. 259271 TI 8CI ADQH Integrated Circuit
Circuit protection and power management device. It protects the PCB from the motor currents, as it connects to the motor ports.

3. Connector to Lower PCB

4. Optional Connector

5. Battery Connector Port
The battery plugs into the port which gives the brain its power to run.

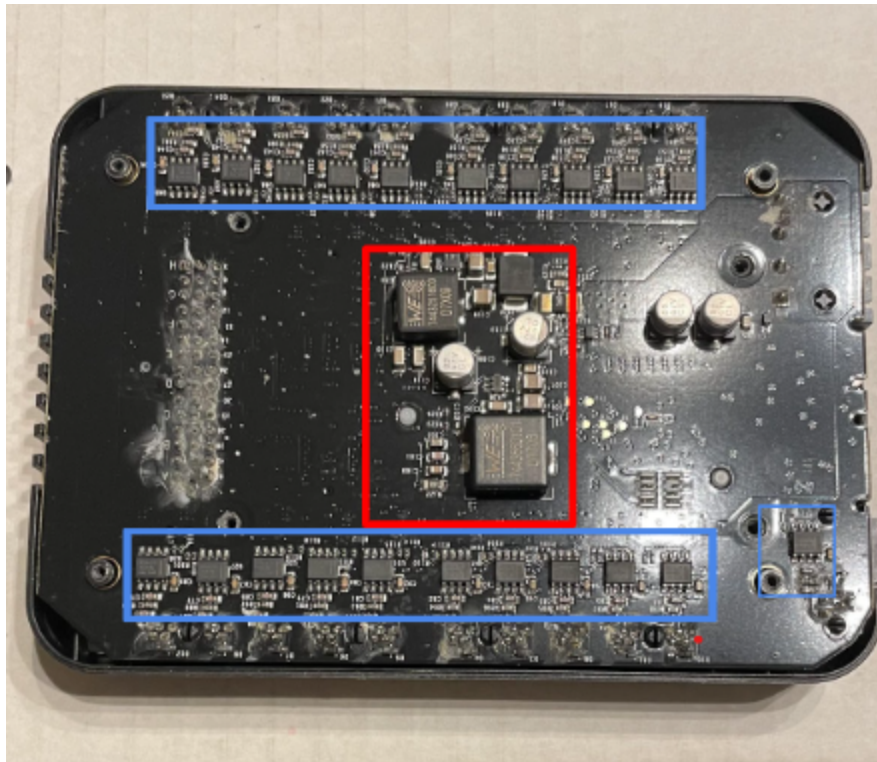
6. Controller Cable Connector Port

This port is used to connect the controller directly into the brain, if the V5 radio does not work.

7. Blue Box

Tactile switches that connect to the power button in the front of the brain.

Backside of Upper PCB



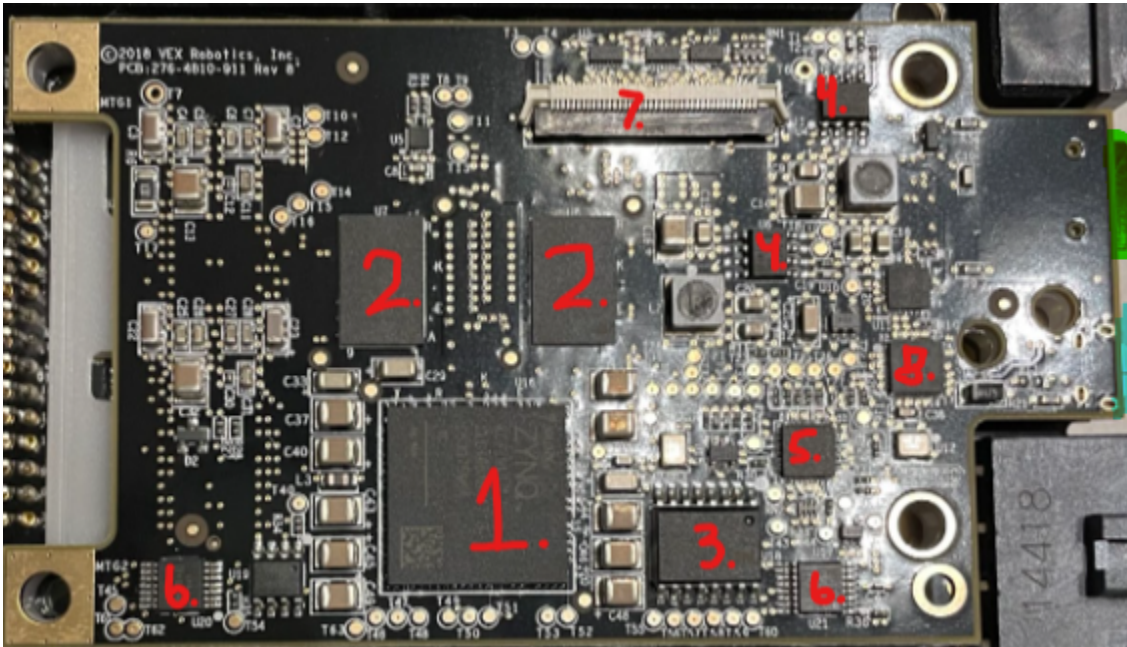
Blue Box- TI VP1782 Fault Protection Circuit

Fault protection devices designed to survive miswiring false, connector failures, ESD failures, etc.

Red Box- Voltage Regulator Circuit

This includes TPS 54202 Voltage Regulator and other inductors and capacitors

Lower PCB



1. Zynq 7010
A processor with hardware programmability, and mixed signal functionality. This
2. Micron D9SBJ 512Mb SDRAM Memory
This is where it stores all the VEX software.
3. Macronix Mb Flash Memory
This stores the codes we put in.
4. TI 54239 Voltage Regulator
This takes in power and distributes it across the different devices.

5. NXP 824J Low-Cost Microcontroller

This is similar to the microcontroller of the upper PCB

6. TI 74HC175 Quad Storage Register

A circuit used to hold and control certain devices on the PCB

7. Connector

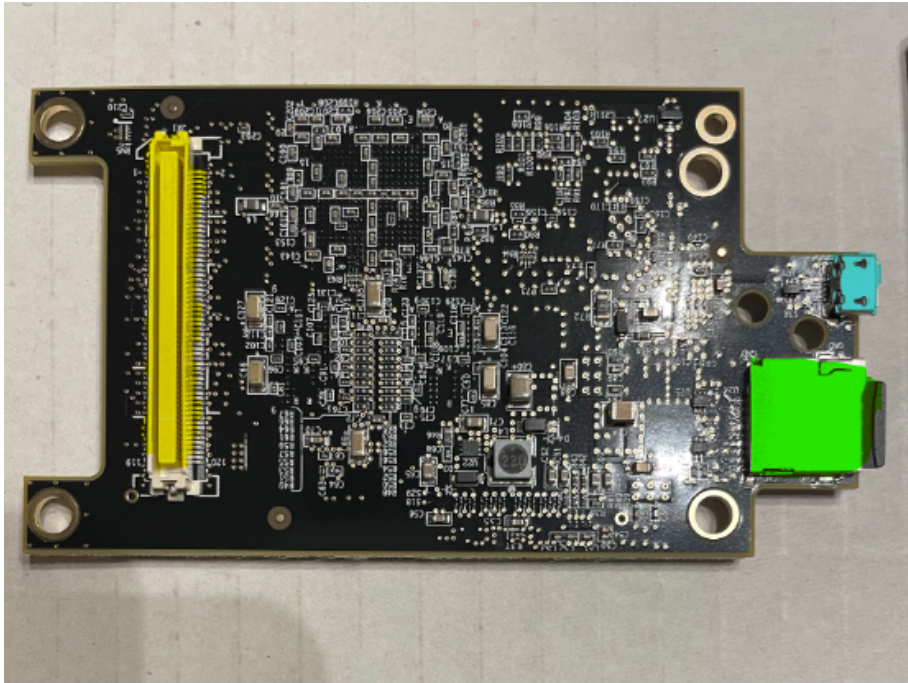
It connects the flex cable from the lower PCB to the LCD panel of the brain.



8. T1 USB1210

USB transmitter and receiver chip, which connects between the processor and the USB connector shown in blue.

Backside Of Lower PCB



1. **Blue**
USB connector
2. **Green**
SD card connector for extra brain memory.
3. **Yellow**
Connector that connects the lower PCB with the upper PCB

Conclusion

Opening a VEX brain and researching all the parts have been a great learning experience for our whole team. We were amazed to learn about all the processors, memory, protection circuits, connectors and devices that all go into this one tiny unit. Now that we know the internals of the brain, we can fix any brain issues that come up.

*“Tell me and I forget.
Teach me and I remember.
Involve me and I learn”.*
- Benjamin Franklin

