

A green tractor with a trailer is parked in a field. In the background, there is a gazebo and some trees. The image is slightly blurred and has a dark overlay.

# Right To Repair: Tractors, Hackers, And Property Rights

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Ciaran Conliffe





```

H:INTRO  PAGE 1 LINE 9 COL 11          INSERT ON
          < < <      M A I N      M E N U      > > >
--Cursor Movement--      | -Delete- |   -Miscellaneous-   | -Other Menus-
^S char left ^D char right | ^G char  | ^I Tab  ^B Reform | (from Main only)
^A word left ^F word right | DEL chr lf| ^V INSERT ON/OFF | ^J Help  ^K Block
^E line up  ^X line down  | ^T word rt|^L Find/Replce again|^Q Quick ^P Print
      --Scrolling--      | ^Y line  | RETURN End paragraph|^O Onscreen
^Z line down ^W line up   |          | ^N Insert a RETURN  |
^C screen up ^R screen down|          | ^U Stop a command   |
      !----!----!----!----!----!----!----!----!----!----!----!-----R

```

1. Introducing WordStar

WordStar is highly flexible and very visible. Watch the screens as you give commands, and information in various parts of the screen will guide you. You won't see all the information all the time, but it will be there when you need it.

WHERE YOU ARE

The seven WordStar menus are your greatest aids. They are like signposts at the top of your screen, showing you where you are.

```

1HELP  2INDENT 3SET LM 4SET RM 5UNDLIN 6BLDFCE 7BEGBLK 8ENDBLK 9BEGFIL 10ENDFIL

```





## John Deere's Chief Technology Officer Jahmy Hindman:

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"As much as they are doing productive work in the field, planting as an example, they are also data acquisition and computational devices."

"...we have more software development engineers today within Deere than we have mechanical design engineers."

In some cases, the manufacturer of the vehicle may not have title or ownership interest in the software and can transfer no more rights than the manufacturer has. For example, the vehicle owner may license software from one or more suppliers of components or licensors of software. If the manufacturer elects to use open-source software in the vehicle, the vehicle software may be subject to the restrictions of various third-party, open source licenses.<sup>11</sup> In the absence of an express written license in conjunction with the purchase of the vehicle, the vehicle owner receives an implied license for the life of the vehicle to operate the vehicle, subject to any warranty limitations, disclaimers or other contractual limitations in the sales contract or documentation. Even if TPMs for the vehicle software did not exist, accessing the vehicle software in contravention of these licenses could violate copyright, trade secret, or contractual





CAN NODE 1

PREPARE DATA

SEND DATA

CAN NODE 2

ACCEPT DATA

CHECK DATA

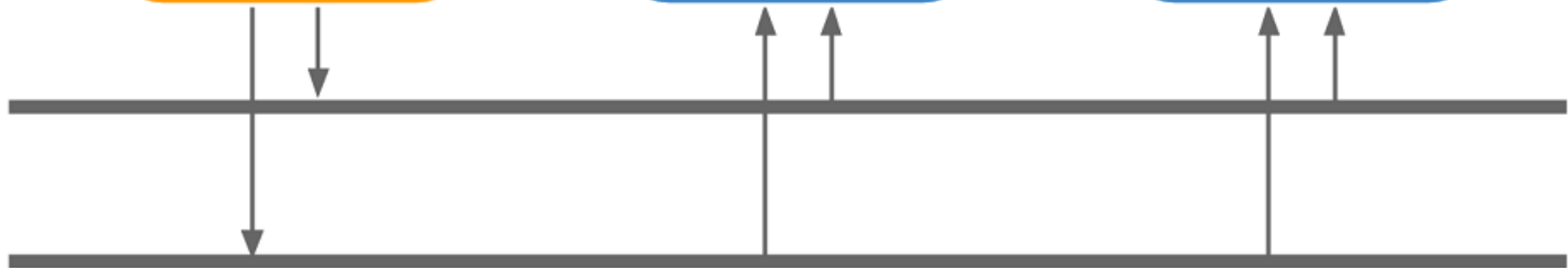
RECEIVE DATA

CAN NODE 3

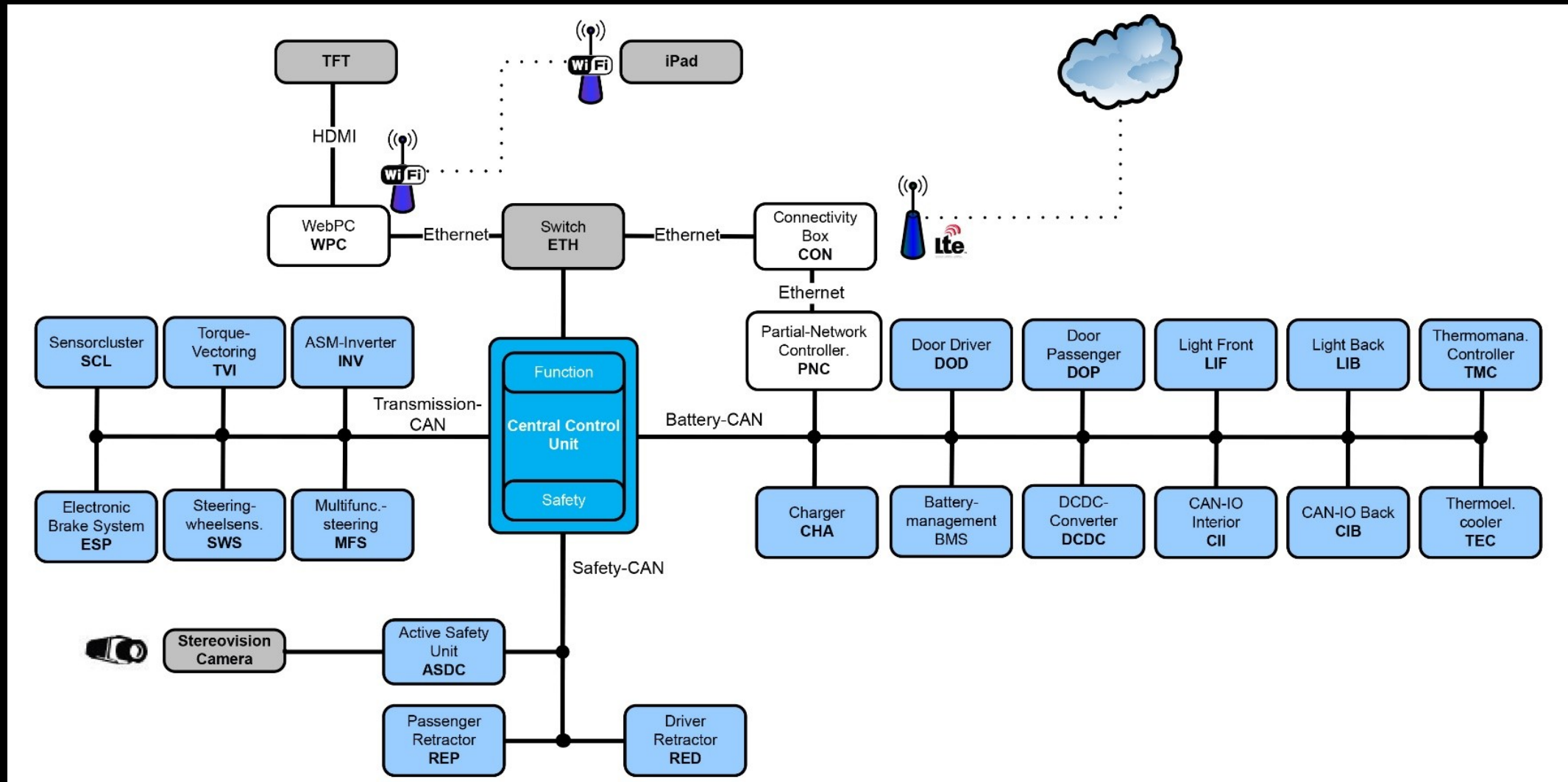
IGNORE DATA

CHECK DATA

RECEIVE DATA







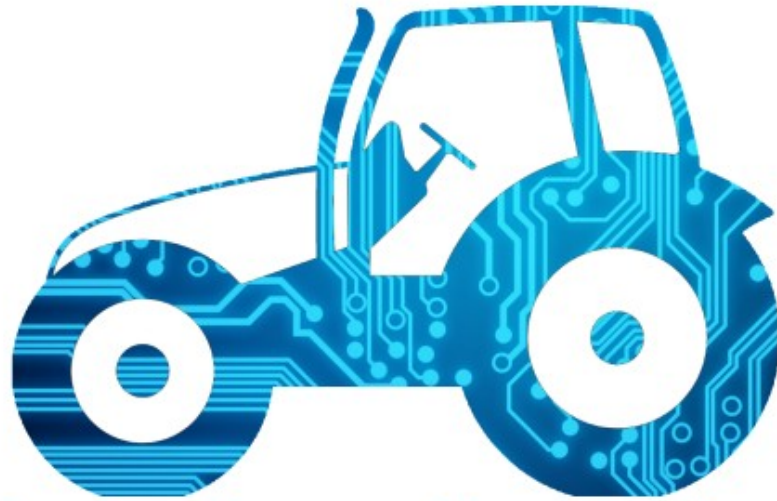








# IFIXIT



## Tractor Hacking

[TractorHacking.github.io](https://TractorHacking.github.io)

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**CAL POLY**  
College of Engineering

### Project Description

John Deere farm equipment is used by farmers worldwide. Unfortunately the company is overly restrictive on the maintenance they allow the machines' owners to carry out. The company has imposed software checks that require a mechanic from a John Deere specific dealer, using equipment made available only to these dealers, to diagnose and fix errors. The errors have the potential to shut down the entire machine, even if it is isolated to a small or unimportant part of the tractor. If an owner tries to replace a faulty part without John Deere Software, the tractor can reject the part until a technician verifies the part. This is extremely limiting for the equipment owners, because it increases the downtime of the machinery, and transport and repair costs can be expensive.

### Objectives

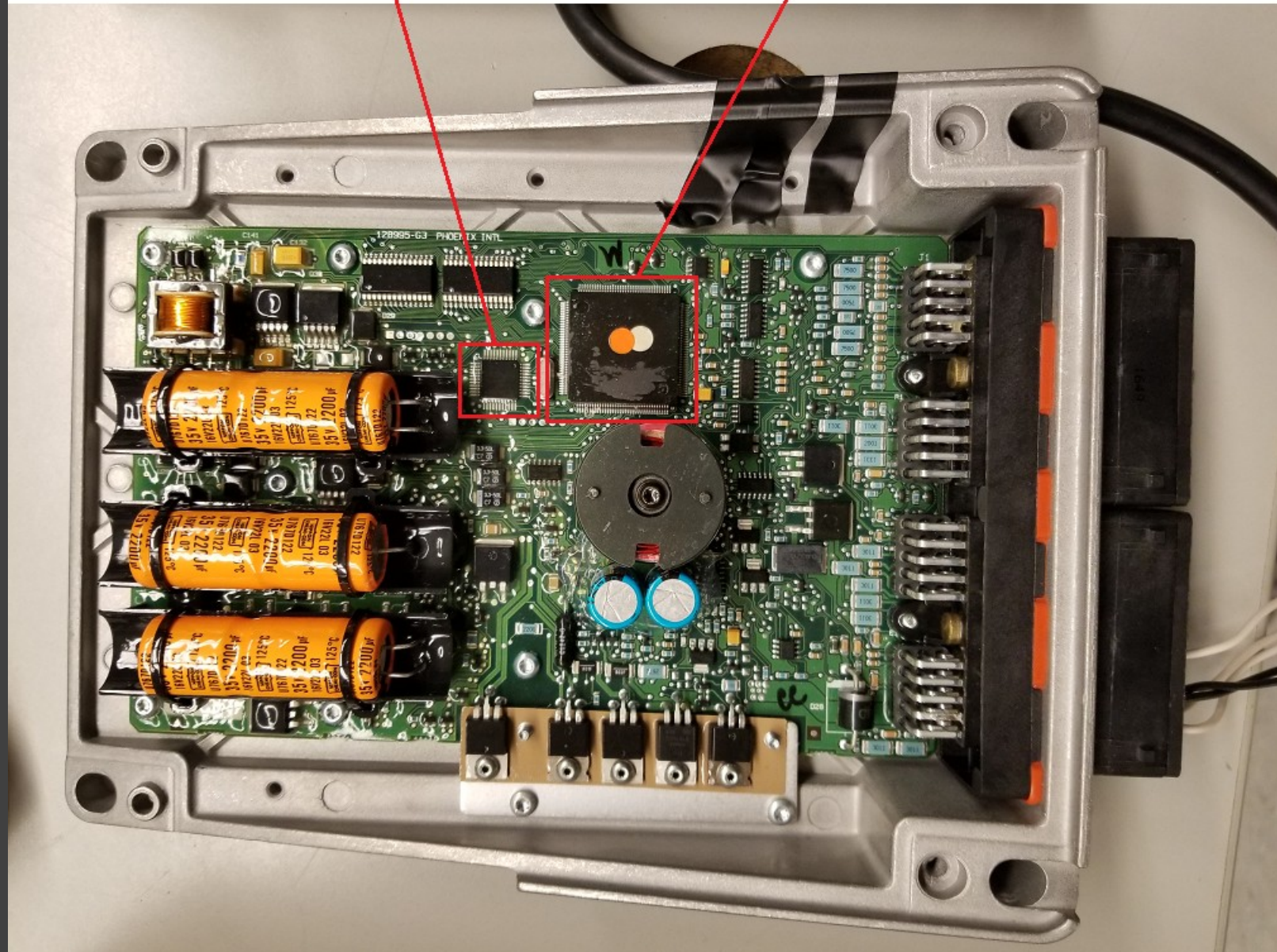
This group intends to learn more about the computer architecture of John Deere tractors in an attempt to avoid their software restrictions. Our main objectives are:

- Obtain an engine control unit (ECU), which acts as the base of all communications on a tractor, learn about its architecture, and have it running in a benchtop setup
- Gain access to a live John Deere tractor and tap into its communication lines, to learn about the type of messages being sent during operation and periods of error
- Document our process on a publicly available webpage, so that others can pick up our work and continue where we left off



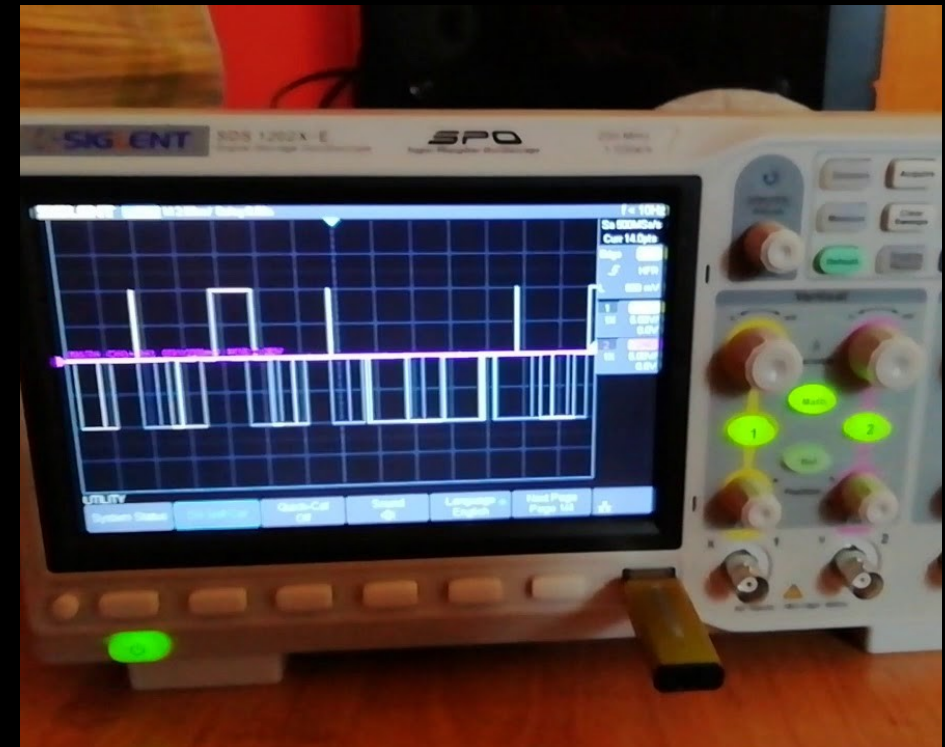
CPLD

Microcontroller Unit

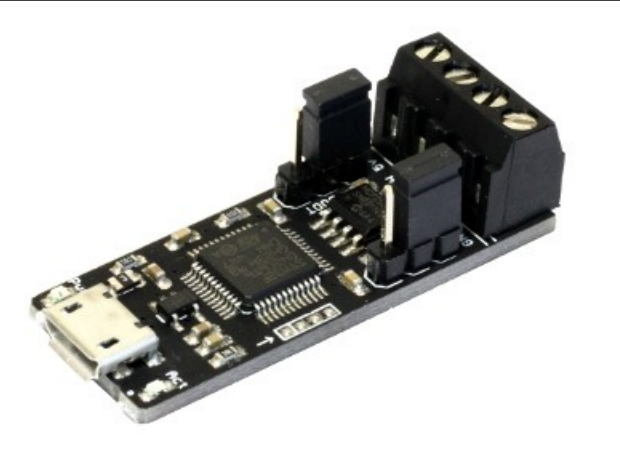


[tractorhacking.github.io](https://github.com/tractorhacking)

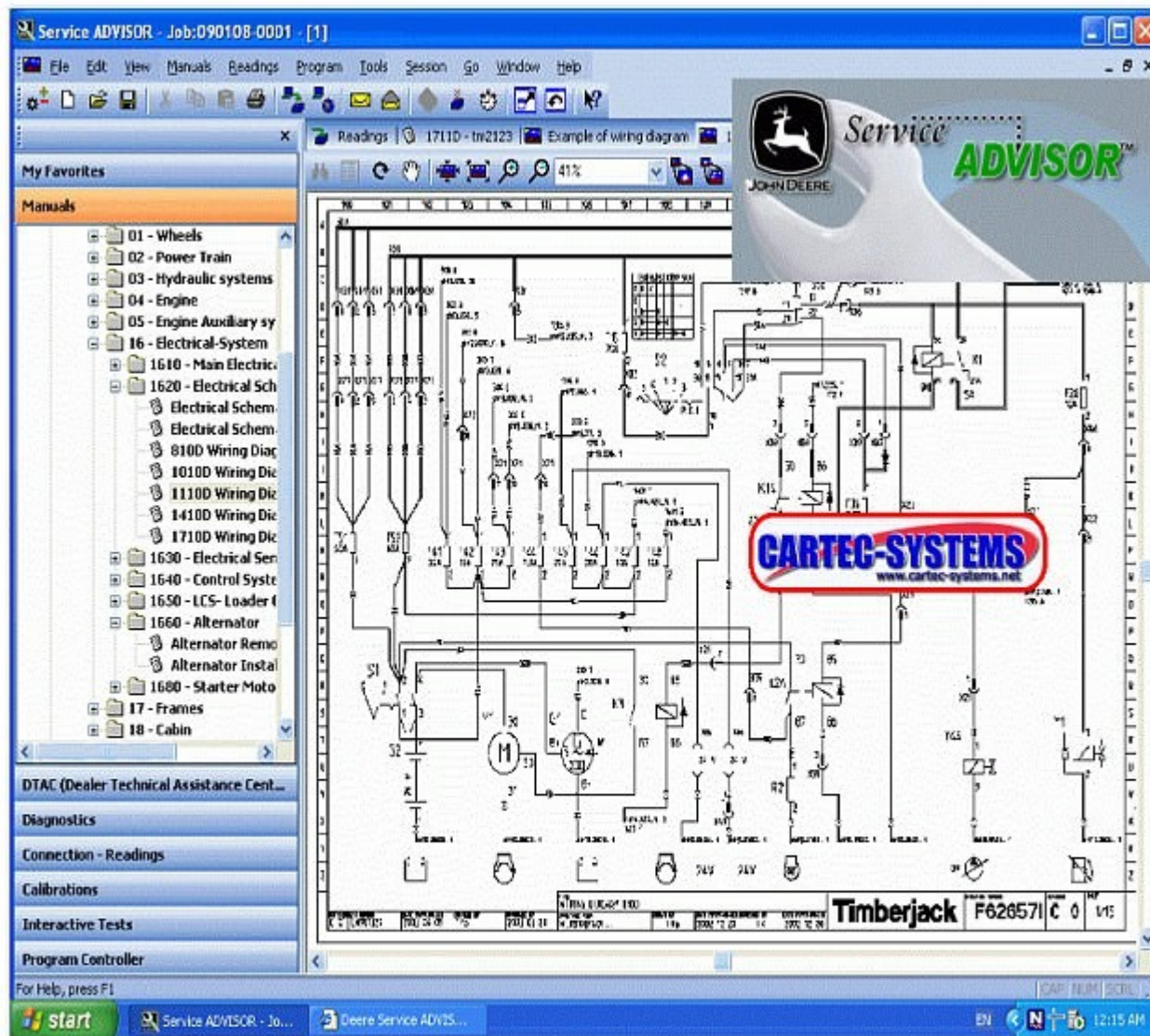




index	pgn	data	amount	diff	bytes	index	diff	bytes	pgn Name	data x
0	64947	FFFF1A27FFFFFFFF	3	[4, 5, 7]					Aftertreatment 1 Outlet Gas 2	xxxx1Ax7xxxxxxxx
1	64947	FFFF8E27FFFFFFFF	2	[4, 7]					Aftertreatment 1 Outlet Gas 2	xxxx8xx7xxxxxxxx
2	64947	FFFF0C27FFFFFFFF	2	[4, 7]					Aftertreatment 1 Outlet Gas 2	xxxx0xx7xxxxxxxx
3	65269	C5FFFFFFFF37FFFF	1	[11]					Ambient Conditions	xxxxxx7xxxx
4	65269	C6FFFFFFFF37FFFF	1	[11]					Ambient Conditions	xxxxxx7xxxx
5	64892	F88F8F88CF83FC	1	[10]					Diesel Particulate Filter Control 1	xxxxxxCxxxx
6	64892	F88F1F88CF83FC	1	[10]					Diesel Particulate Filter Control 1	xxxxxx1xxxx
7	61443	FF0000FF04FFFFFF	1	[9]					Electronic Engine Controller 2	xxxxxx0xxxx
8	65247	7D641DFFFFFFFF	1	[2]					Electronic Engine Controller 3	xx6xxxxxxxx
9	65247	7D261DFFFFFFFF	1	[2]					Electronic Engine Controller 3	xx2xxxxxxxx
10	65247	7D081DFFFFFFFF	1	[3]					Electronic Engine Controller 3	xx0xxxxxxxx
11	65247	7D061DFFFFFFFF	1	[3]					Electronic Engine Controller 3	xx6xxxxxxxx
12	65247	7D0C1DFFFFFFFF	1	[3]					Electronic Engine Controller 3	xxCxxxxxxxx
13	65247	7D021DFFFFFFFF	1	[2]					Electronic Engine Controller 3	xx0xxxxxxxx
14	65362	463EFFFFFFFF	2	[1, 3]					Engine Temperature 1	xx6Exxxxxxxxx
15	65129	C424E825FFFF68FE	1	[4]					Engine Temperature 3	xxxxExxxxxxxxx
16	65129	A624EA25FFFF68FE	3	[0, 4, 5]					Engine Temperature 3	AxxxxAxxxxxxxxx
17	65129	A424EC25FFFF68FE	2	[0, 4]					Engine Temperature 3	AxxxxExxxxxxxxx
18	65129	AA24EE25FFFF68FE	3	[0, 4, 5]					Engine Temperature 3	AxxxxEExxxxxxxxx
19	65129	AC24F025FFFF68FE	3	[0, 4, 5]					Engine Temperature 3	AxxxxF0xxxxxxxx
20	65129	AE24F025FFFF68FE	3	[0, 4, 5]					Engine Temperature 3	AxxxxF0xxxxxxxx
21	65129	B024F225FFFF68FE	2	[4, 5]					Engine Temperature 3	xxxxF2xxxxxxxx
22	65129	B224F225FFFF68FE	2	[4, 5]					Engine Temperature 3	xxxxF2xxxxxxxx
23	65129	B424F425FFFF68FE	2	[4, 5]					Engine Temperature 3	xxxxF4xxxxxxxx
24	65129	B624F425FFFF68FE	3	[0, 4, 5]					Engine Temperature 3	BxxxxF4xxxxxxxx
25	65129	B824F625FFFF68FE	2	[4, 5]					Engine Temperature 3	xxxxF6xxxxxxxx
26	65129	BA24F625FFFF68FE	2	[4, 5]					Engine Temperature 3	xxxxF6xxxxxxxx
27	65129	BC24F825FFFF68FE	2	[4, 5]					Engine Temperature 3	xxxxF8xxxxxxxx
28	61184	641510F00000930E	2	[12, 13]					Unknown	xxxxxxPjxx
29	65534	5C371b2710FFFFFF	4	[2, 3, 6, 7]					Unknown	xx27xx27xxxxxxxx
30	61184	641513F00000930E	2	[12, 13]					Unknown	xxxxxx93xx
31	65226	01FFF4FEFF80FFFF	7	[1, 4, 5, 6, 7, 8, 9]					Unknown	x1xxF4FEFFxxxxxx

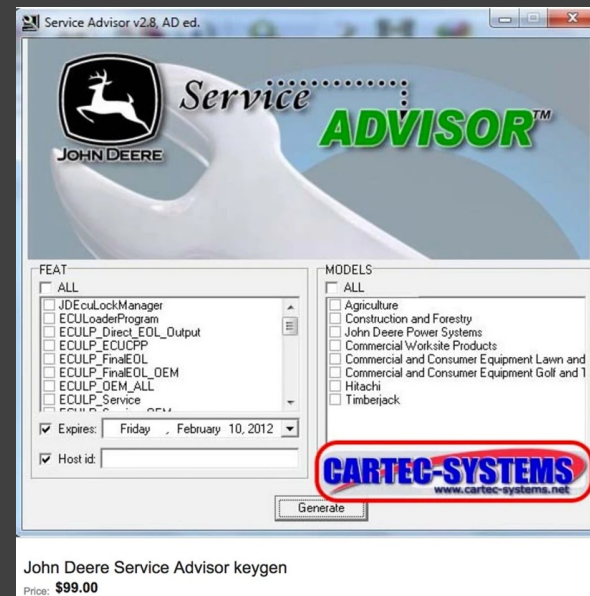






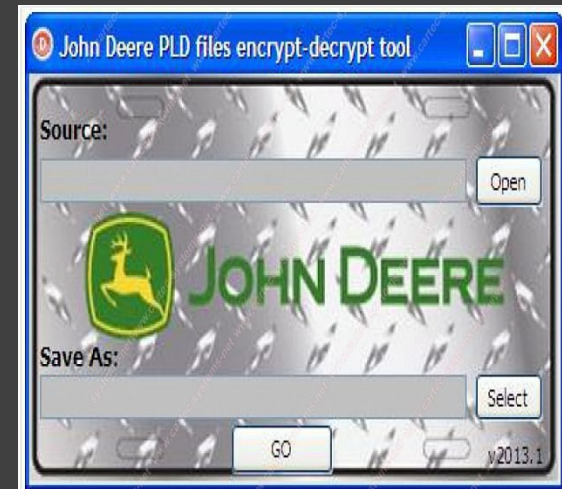
## John Deere Service Advisor

Price: \$165.00



John Deere Service Advisor keygen

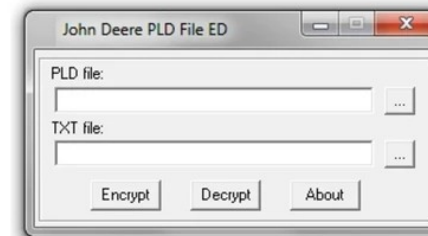
Price: \$99.00



John Deere PLD PayLoad encrypt-decrypt tool

Price: \$165.00

## JOHN DEERE PLD FILE ENCRYPTOR/DECRYPTOR (EDITOR) v0.1



PRICE: 499 EUR

☐ PLD File DataBase : 999 EUR

## DESCRIPTION

Very powerfull Developer level tool, you can use it to:

- Decrypt PayLoad (PLD) file to txt/ini format;
- Modify PLD file expiration;
- Modify PLD factory options such as speed limit (for example change 40 km/h to 50 km/h);
- Adjust PLD file to different product serial;
- Encrypt PLD file;
- Program controller with modified PLD using Service ADVISOR;
- Support Windows XP;
- Shipped with USB key.















# The Agricultural Data Arms Race: Exploiting a Tractor Load of Vulnerabilities In The Global Food Supply Chain.



(in good faith)

*Sick.CODES*

DEFCON 29

















# Summing Up

## **Don't be a snob**

- People outside the tech industry still understand tech
- All jobs are tech jobs now

## **It's not just John Deere**

- Companies are “disrupting” the concept of ownership
- Commercial thinking is not good for engineering

## **Owning things is a human right**

- If all you have is a license to use, it can be taken away from you
- Ownership is becoming more and more nebulous

## **We need to start talking about ethics**

- These systems didn't magically appear
- Someone made all of these things



# REPAIR MANIFESTO

WE HOLD THESE TRUTHS TO BE SELF-EVIDENT

IF YOU CAN'T FIX IT, YOU DON'T OWN IT.

## REPAIR IS BETTER THAN RECYCLING

Making our things last longer is both more efficient and more cost-effective than mining them for raw materials.

## REPAIR SAVES YOU MONEY

Fixing things is often free, and usually cheaper than replacing them. Doing the repair yourself saves you money.

## REPAIR TEACHES ENGINEERING

The best way to find out how something works is to take it apart.

## REPAIR SAVES THE PLANET

Earth has limited resources. Eventually we will run out. The best way to be efficient is to reuse what we already have.



REPAIR **CONNECTS**  
PEOPLE AND THINGS

REPAIR IS WAR ON  
**ENTROPY**

REPAIR IS  
**SUSTAINABLE**

ifixit.com



CFP: Open now! [bsidesbelfast.org/speak/](https://bsidesbelfast.org/speak/)

Early Bird tickets: 11am Monday 26<sup>th</sup> May!

General ticket release: 14<sup>th</sup> July!

BSides Belfast: 11<sup>th</sup> September!