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<center>Milestone 3: Acquiring ECU data</center>

Tuning a BMW ECU is an exciting and daunting task that requires the right tools and knowledge to follow the correct steps to safely access and modify the engine's control data. In this guide, we'll explore how to use two reliable tools: MS4X Flasher for full and partial reads, which is ideal for partial reads through the OBD port, enabling quick access to specific calibration data. With MS4X, you can perform necessary tweaks without engaging in full ECU access, making it convenient for simpler updates and re-calibrations. This method allows for program adjustments while preserving the bootloader section, ensuring that the ECU's core structure remains intact. For more advanced tasks, the JM Garage software provides complete ECU access by enabling "boot mode." This method requires grounding pin 104 on the ECU's C167 processor, bypassing flash protections to enable full reads and writes. Boot mode is essential when you need unrestricted access, such as for cloning, deep parameter adjustments, or VIN and security code updates. This approach ensures you have a comprehensive backup of the ECU's entire 512KB flash memory, covering all program, calibration, and boot-loader data. Whether you're looking to fine-tune specific parameters or fully customize your BMW E46's ECU, these tools offer a versatile pathway to unlock its potential safely. This guide will help you understand the steps and precautions needed to make precise modifications to your ECU setup.

Description of Learning Completed:

To begin the tuning process we first must acquire a full read of our ECU data to create a backup file in case any problems occur while tuning or preforming a firmware update.
Items needed:

- OBD2 cable
- Laptop using Win OS
- Ms4x Flasher installed
- JMGarage installed
- Definition and patch-list files
- Battery Charger (optional)
- Ground wire for boot mode pin. (Random copper wire)

Once the vehicle is in ignition 2 position and OBD2 is plugged into the laptop we are ready to start.

- If you are doing it in the car, connect a battery charger to ensure vehicle stays above 12V.
- Connect OBD cable to car and computer then turn ignition to position 2. If you are using a bench setup, turn on power supply.
- Open MS4x flasher
  - In previous guides, Ms4x flasher has been used to do full reads. Considering the state of your vehicles ECU and your flashing hardware, you might receive "Error "Could not read the data from the control unit"
  - This issue could be caused by operating system configuration. Users have reported windows 11 may cause communication issues with during full reads or the current ECU being read is.
  - Another possibility is that some ECU's are read locked for DS2 reading, which is the protocol used by MS4x Flasher to communicate with the ECU.
  - For this example, using Ms4x flasher on windows 11 , initially it would not allow a full read. I would receive the error `could not read data from the control unit`
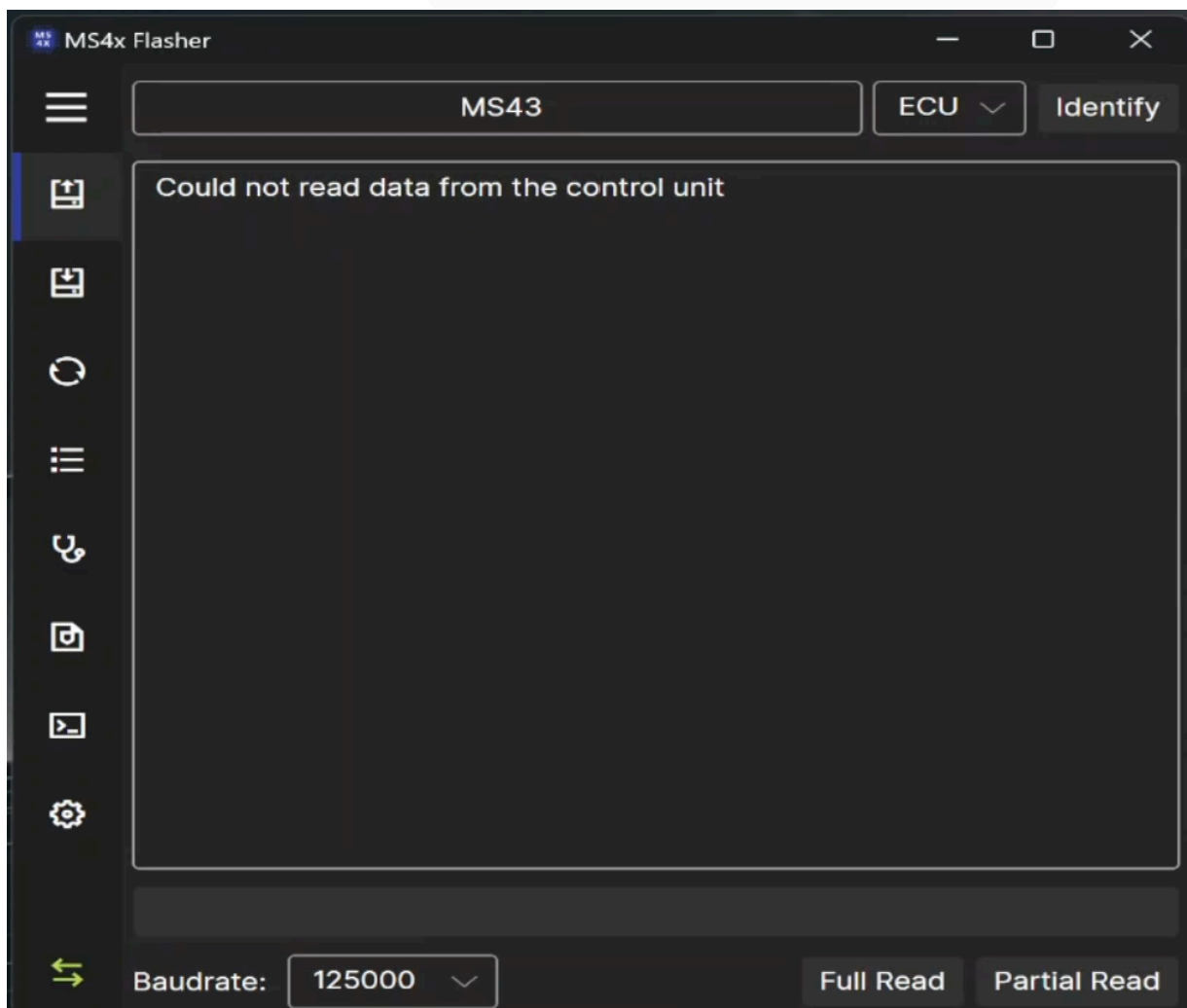

- During this stage my initial thought was the DME was DS2 locked, which can be added to the ECU's read block to deny any reads on the ECU.
- Through many troubleshooting attempts, the issue was found to be the K-DCAN cable being set to the wrong pins due to the usage of the cable with multiple BMW

models.

- The switch on the K-DCAN cable will bridge and de-bridge the connections between pins 7 and 8.
- Pin 7 (k-line) is used to communicate with older BMW's, while pin 8 normally left unconnected can be bridged with pin 7 allowing backward compatibility.

- Make sure MS4x Flasher identifies ECU as MS43 by clicking "Identify"
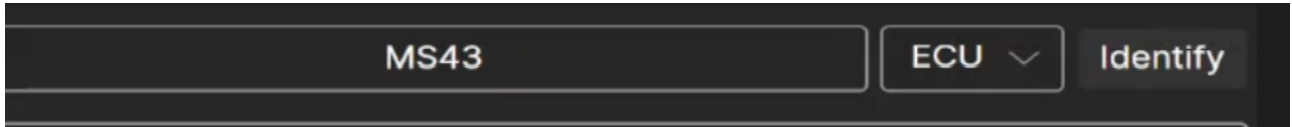
- Hit "full read" or "Partial Read" for tuning using correct firmware and wait for it read.
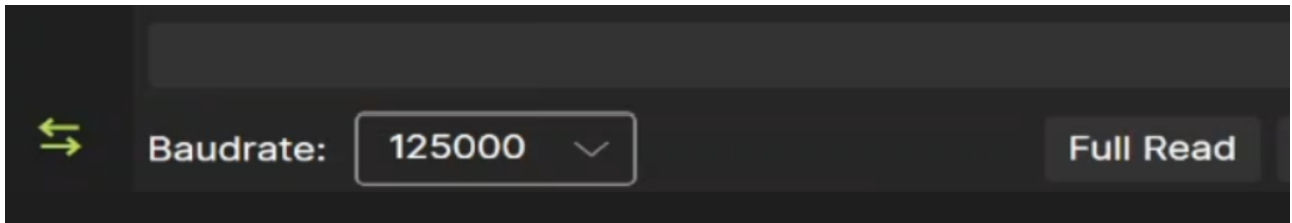
- If Ms4x is successful, Hit "save binary"
  - Save this binary in a safe place as a backup.
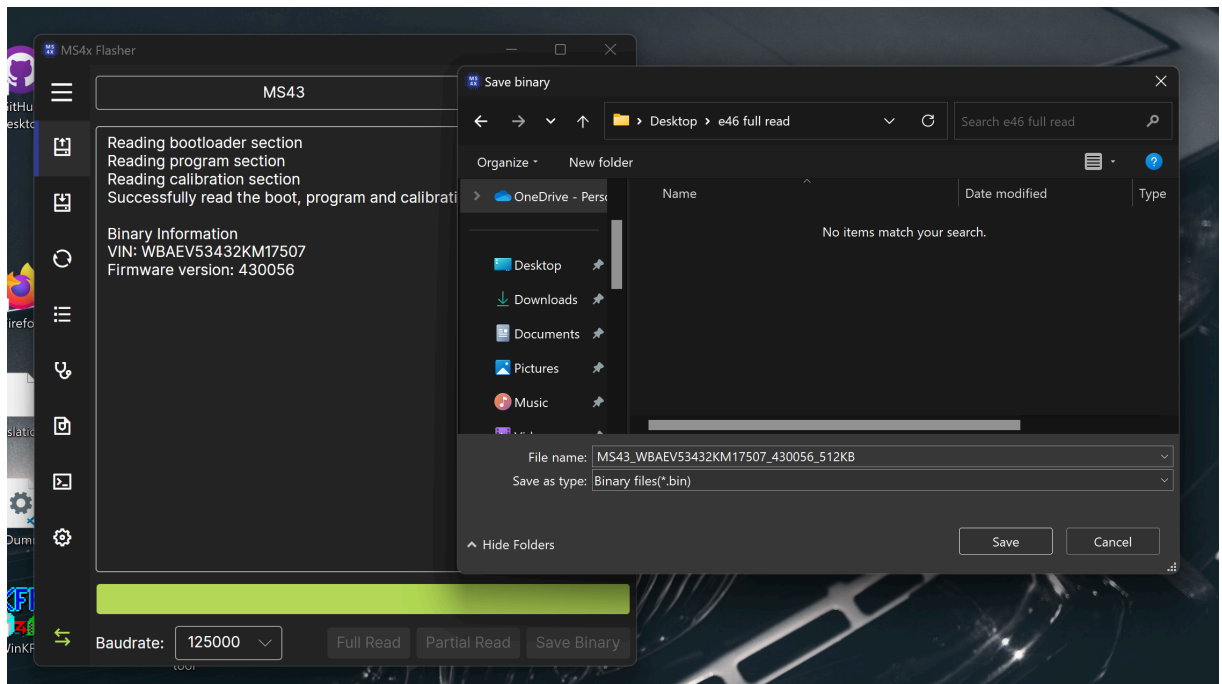
- For maximum tuning capabilities it is recommended to update the vehicles firmware to the most recent version which is: MS430069, for the BMW e46 M54B30. Note the current firmware is version 0056, as shown in the firmware version section after the Full Read.
  - This firmware update is necessary to unlock new features and bug fixes. Also improves stability and performance along with compatibility with Tuning tools.
  - It is important you select the correct .bin file corresponding to your vehicles engine specifications.
  - When selecting definition files for tuning software such as tuner pro, you will only see that

only 0069 patch-list files (latest update) are being presented., this means you must be up with firmware updates to date to allow communication with TunerPro or other logging and tuning software.

- **E46 3-series**
  - M52TUB28: EU4 LHD
  - M54B22: EU4 LHD || EU4 RHD
  - M54B25: EU4 LHD || EU4 RHD || US || Compact EU4 LHD
  - M54B30: EU2 LHD || EU2 RHD || EU4 LHD || EU4 RHD || US

Siemens_MS43_MS430069_E46_M54B30_US.bin (file size: 512 KB, MIME type: unknown/unknown)

Warning: This file type may contain malicious code. By executing it, your system may be compromised.

File history

Click on a date/time to view the file as it appeared at that time.

	Date/Time	Dimensions	User	Comment
current	17:18, 3 May 2020	(512 KB)	Sda2 (talk | contribs)	rebased to 7551615 code for earlier MS43 boards
	11:37, 30 July 2019	(512 KB)	Sda2 (talk | contribs)	Added flash validation entries and seed keys
	09:13, 3 June 2019	(512 KB)	Sda2 (talk | contribs)	

Download links for e46 firmware update.
https://www.ms4x.net/index.php?title=Firmware_Files
https://www.ms4x.net/index.php?title=File:Siemens_MS43_MS430069_E46_M54B30_US.bin

- Once new firmware is downloaded, in Ms4x flasher go to the next tab down in the flasher and hit "load binary"
  - For this example i will not load the binary into the vehicle at this time for a firmware update.
  - For best practices i will use JMgarage to acquire a true full flash 512kb bin file, through boot-mode, which extracts all ECU information. including VIN and ISN and save a full backup of the ECU's data. This process can be seen in the next section.
  - Note that upgrading and downgrading software via boot-mode is not recommended due to overwriting the ISN which will desync the EWS from the ECU, EWS can be resynced using INPA or Ms4x flasher. This is being done to secure a complete 1:1 clone of your ECU data incase any errors occur in the future, your ECU can be cloned to its original state.

- Another key note is to avoid flashing full readouts made with OBD programs in boot mode such as MS4x flasher, this is because the program routines in the ECU blocks where ECU unique keys are contained, flashing in boot mode will permanently delete these keys and can only be restored if you have a full boot-mode backup.
- Once you are ready to update your firmware, Select BIN file for the 069 firmware that you downloaded from MS4x.net and hit open
- Hit full write then wait for it write.
- Once file has been written go back up to the first tab in the flasher and do a another full read of the updated firmware on your vehicle.
- Once full read is done, hit save binary.
  - Would be wise to save a copy of your untuned firmware update for safe keeping.
  - At this stage remove key from ignition for 10 seconds after the flash and make sure the vehicle starts up like normal.
- To begin tuning we will be using a partial read of our ECU data.
  - Go to Ms4x flasher again and do a partial read of your updated firmware.
  - This will allow us to only tune the parameters we need.
- Tuner Pro requires two XDF files to be able to operate, the definition file, and a patch-list file. Both available on ms4x.net, if needed download the correct files as shown below and continue.

Siemens MS43

Visibility level 1 applies to all items with proper description. Set visibility level to all levels to see the other entries as well.

- **MS430037**: Partial [64kb] || Full [512kb]
- **MS430055**: Partial [64kb] || Full [512kb]
- **MS430056**: Partial [64kb] || Full [512kb]
- **MS430064**: Partial [64kb] || Full [512kb]
- **MS430066**: Partial [64kb] || Full [512kb]
- **MS430069**: Partial [64kb] || Full [512kb]

Updated last on 16th January 2023

Download it here: Siemens_MS43_MS430069_Community_Patchlist_v2.9.2.xdf

Old Versions:

- Siemens_MS43_MS430069_Community_Patchlist_v2.9.1.xdf
- Siemens_MS43_MS430069_Community_Patchlist_v2.9.xdf
- Siemens_MS43_MS430069_Community_Patchlist_v2.5.xdf
- Siemens_MS43_MS430069_Community_Patchlist_v1.0.xdf

- Once all files are downloaded corresponding to your ECU, Open tuner pro.
    - Hit XDF tab
    - Go down and hit Select XDF
    - Select Siemens_MS43_430069_512k.xdf that you downloaded from MS4x.net definition files
- Once that is loaded, hit XDF tab again
    - Hit Select XDF
    - Select your 069 community patchlist you downloaded from MS4x.net
- Once those two XDF's are in there, select File tab
    - Hit Open Bin
    - Open your newest partial read Bin file that you saved after the firmware update
    - the reason for using the partial read, is because a full read will include sensitive data unrelated to our tuning interest.
- You now have full access to tuning your BMW's ECU parameters, which will be covered in the next milestone.
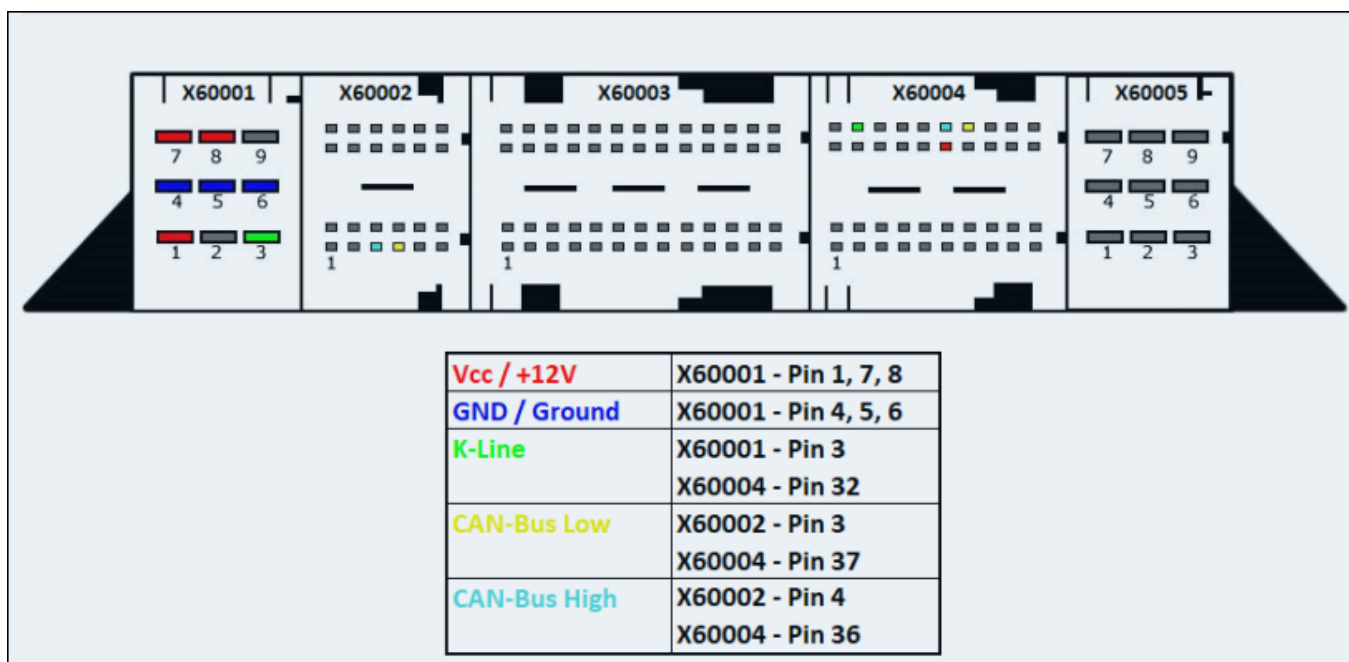
JMgarage boot-mode method

To secure a full backup file the ECU must be read using boot-mode, JMgarage was specifically created to work in boot mode and allow full reads and flashes. To enter boot-mode on Ms43 ECU's, pin 104 needs to be shorted to allow the ECU to enter boot-mode allowing full unrestricted access to the ECU's memory. As pin on the C167 processor needs to be grounded when powering up the ECU it is best to perform these steps with a bench setup, but it can be performed in the car as well but extra care has to be taken that nothing is accidentally shorted. To prevent connection issues verify in the device manager on the computer that the OBD cables com port is configured with a latency timer of 16 milliseconds.

To begin the process of entering boot mode:

- Turn off ignition and open the ECU compartment under the hood. Disconnect all connectors to the ECU and remove the ECU from the compartment.
- Remove the protective covers on the ECU by undoing the four bolts.
- Place the ECU circuit board on an ESD safe surface on bench or near ECU connections in the car. For this example we do not have a current bench setup.
- Connect the computer to the OBD plug in the car.
- Start JMGarage boot mode programming software.
- Short pin 104 on the C167 processor to ground with a piece of wire or something similar on the pin showed in the screenshot below.
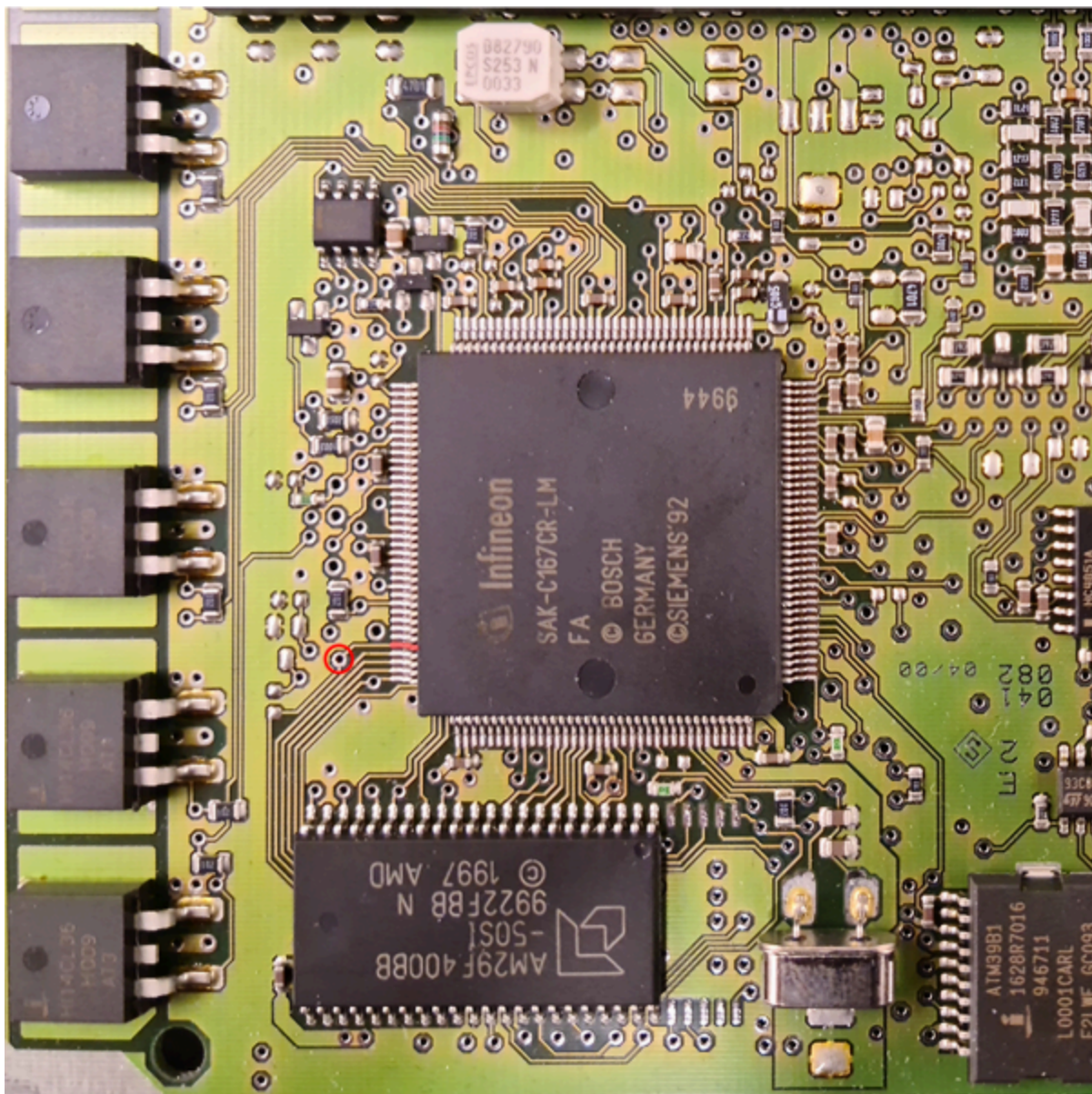
- Power up the ECU and keep shorting pin 104 for approximately 10 seconds. If you are working in the car you can power up the ECU by turning the ignition key to position 2 and then connecting the X60001 connector which powers the Vcc/+12V, Ground, and CAN-Bus low/ TCU K-line functions as shown in the screenshots below.

Vcc / +12V	X60001 - Pin 1, 7, 8
GND / Ground	X60001 - Pin 4, 5, 6
K-Line	X60001 - Pin 3
	X60004 - Pin 32
CAN-Bus Low	X60002 - Pin 3
	X60004 - Pin 37
CAN-Bus High	X60002 - Pin 4
	X60004 - Pin 36

Pin Description	Pin Location
VCC / +12V	X60001 – Pin 1, 7, 8
GND / Ground	X60001 – Pin 4, 5, 6
CAN-Bus Low / TCU	X60002 – Pin 3
CAN-Bus High / TCU	X60002 – Pin 4
CAN-Bus Low / Auxiliary	X60004 – Pin 37
CAN-Bus High / Auxiliary	X60004 – Pin 36

- After 10 seconds have passed remove the shorting wire from pin 104 (do not leave it connected as that will result in a corrupted read/write)
- Try connecting with the boot mode programming software. If connection failed power down the ECU and redo steps by cycling the power and shorting pin 104 for 10 seconds, then connecting with boot-mode.
- After connection is successful you can fully read and write to the ECU.

Note that During the read/write process JMGarage can sometimes state that it's not responding. If this happens do not panic the program is still working in the background so just wait until it finishes.

In the event of something still going wrong during the read/write process like a laptop shutting down then power down the ECU and redo step to short pin 104 and load JMgarage .

It is recommended to always start with performing a full read of the ECU so that you have a backup that can be restored if anything goes wrong. Also remember to correct checksums on all

binaries you write to the ECU which can be done using ms4x flasher checksum validator if you plan on writing using boot-mode.

Once all is this process is complete, while it can be a confusing and intimidating process, you will now have full access to Tune your BMW to your preference, unlocking new levels of performance, customization, and adaptability. This guide has walked you through the steps of using MS4X Flasher for partial reads and essential firmware updates if full reads are allowed, as well as JM Garage for complete access to the ECU in boot mode. By following these instructions carefully, you'll have the flexibility to apply performance patches, resolve immobilizer issues, and ensure compatibility with the latest firmware like MS430069 to modify your engine. It is important when performing any ECU tuning to always back up your original ECU data by performing a full read before making changes. With your original binary file safely stored, you'll have a fail-safe to restore the ECU if any issues arise. Also, maintaining stable power during read/write processes and ensuring that all connections are secure is critical to prevent data corruption or errors. Whether you're aiming for basic re-calibrations or full customization of ECU data, MS4X Flasher and JM Garage provide a versatile toolkit to achieve your tuning goals. Take your time, follow each step precisely, and you'll unlock the full potential of your BMW's ECU, turning your vehicle into a uniquely tuned vehicle that reflects your performance preferences and driving style. In the next milestone we will secure a boot-mode backup, and explore Tuner pro and how these .bin files can be changed to allow for the most popular modifications on the market.