

Z21 Maintenance Tool User Manual

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Revision history

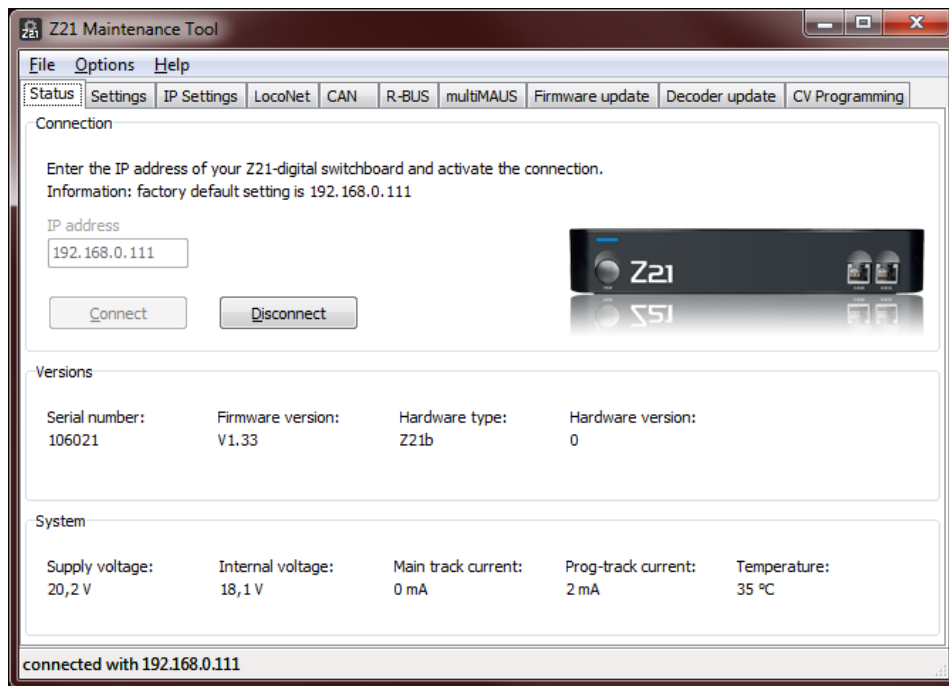
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21/08/17	1.12	Z21 firmware version V1.30 CAN feedback module
13/04/18	1.13	first English edition Z21 firmware version V1.32 multiMAUS firmware V1.05 (F0 to F28) CAN feedback module firmware version V3.1.20 Settings: DCC turnout-addressing according RCN-213, DCC turnout invert straight/branch
19/12/18	1.14	Z21 firmware version V1.33 CAN booster

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1 Introduction

The Z21 Service Application "Z21_Maintenance.exe" has been created at the request of the Z21 Community. With this application you can configure and maintain your Z21 system equipment (white and black Z21, smartRail) via Ethernet or WLAN.



In addition to the settings that you may be familiar with from the app, advanced users can also change the network settings (at your own risk!) or update the Z21 firmware.

Even more settings are also offered for smartRail.

In addition, a Zimo decoder update is provided for the Z21. However, as there are numerous possible sources of problems here – from inadequate contact on the track to conversions with buffer capacitors on the decoder – the information provided is also provided at the user's own risk.

Please take into account in the settings of your Windows firewall and potentially also of your virus scanner, that "Z21_Maintenance.exe" must be able to access the ports 21105, 21106 and 34472 via UDP in order to communicate with your Z21. Very strict settings on the virus scanner and firewall may cause communication on these ports to be reported as "suspicious network traffic" and be blocked.

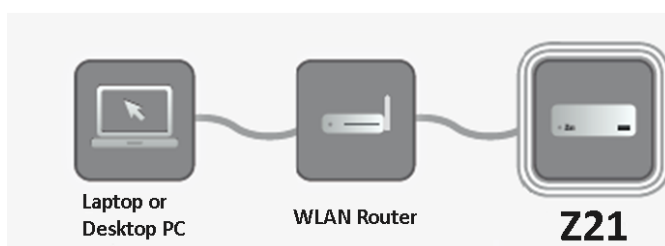
The application can be started directly after downloading. No installation is required. However, certain network settings need to be implemented; these are described in the sections below.

2 Connection from the PC to the Z21

2.1 Connection options

There are numerous options to connect the PC to the Z21:

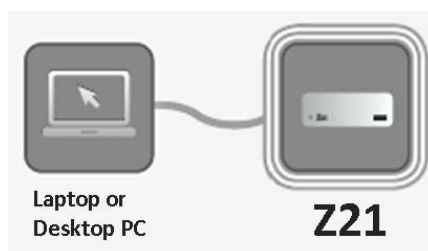
- **Cable connection from PC via the router included as standard.**
The connection is the easiest to set up. Both the PC and the Z21 are connected to the WLAN router via Ethernet cable.



- **Connection using WLAN via the router included as standard.**
To do this, the PC must be registered on the WLAN router and the Z21 connected to the WLAN router via Ethernet cable. With smartRail, only a connection via WLAN is possible.



- **Direct connection without router using patch cable from the Ethernet port on the PC directly to the LAN port on the Z21.** This is the most stable connection. Omitting the router and manually configuring the PC interface eliminates many potential sources of problems. This type of connection is recommended for firmware and decoder updates should unexpected problems occur during the update.



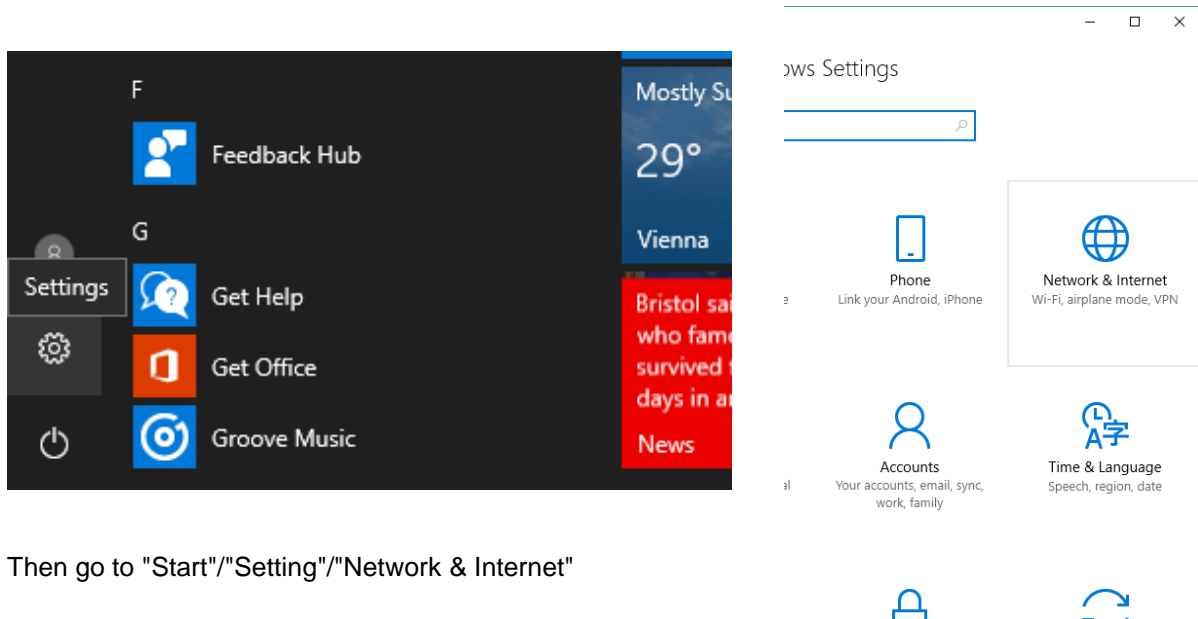
In all examples shown in this manual, it is assumed that the IP settings have not been changed in the Z21 and, where appropriate, the WLAN router supplied is being used.

2.1.1 Connection using Ethernet cable via the router included as standard

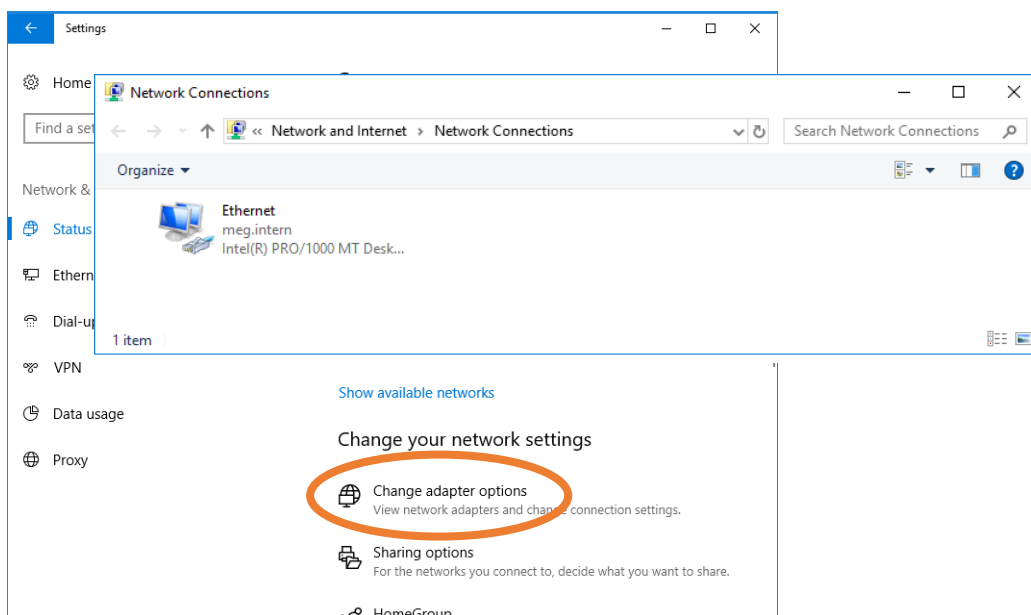
The connection is the easiest to set up. Where necessary, first disconnect any Ethernet cables already connected to the Ethernet port (100 MBit/s) on your PC.

Then insert an Ethernet cable (patch cable) into a free, yellow Ethernet port on the router supplied and connect the other end to the Ethernet port on your PC. The Z21 is also connected to a yellow port on the router.

The PC should now be assigned an IP address by the router. If this is not the case, the network settings of the PC have been changed. Please check the following setting in the event of a problem:

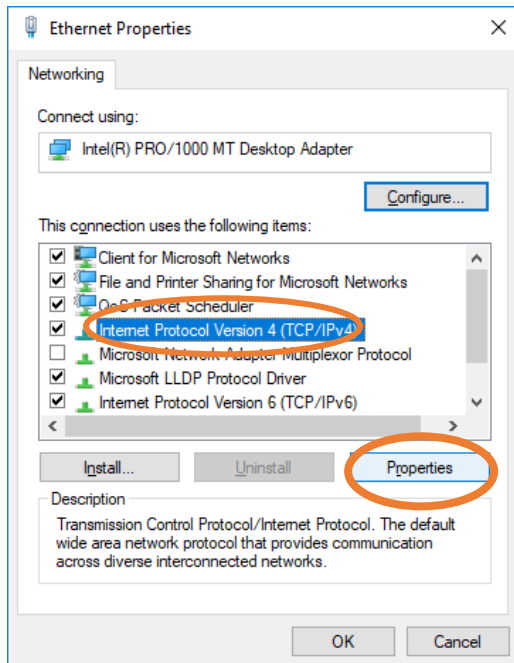


Then go to "Start"/"Setting"/"Network & Internet"

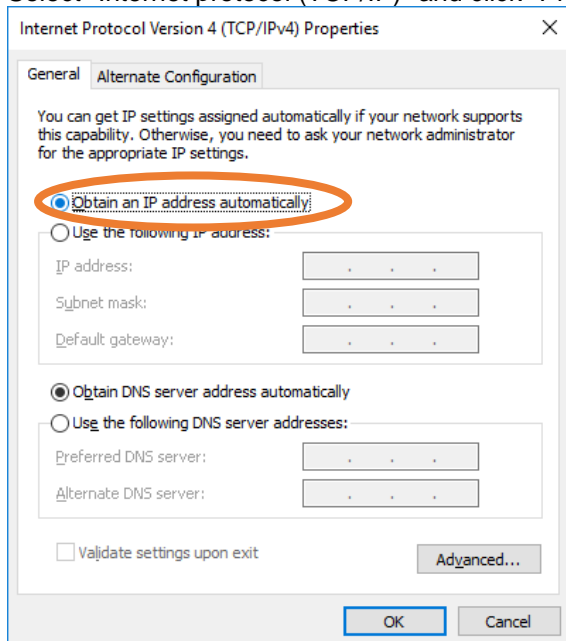


Select the option "Change adapter options"

Select "Properties" for the port to which the Z21 now relates (right mouse button).



Select "Internet protocol (TCP/IP)" and click "Properties".

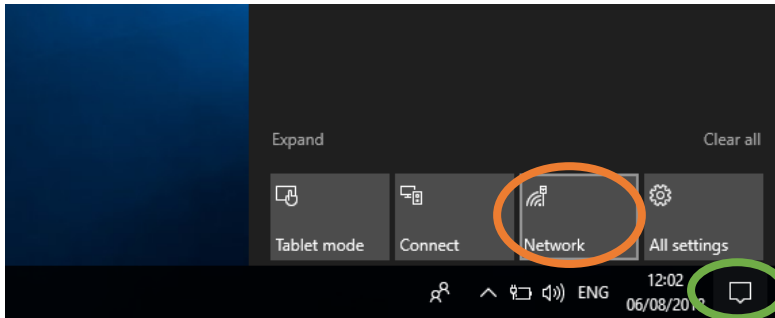


The default setting is "Obtain IP address automatically".

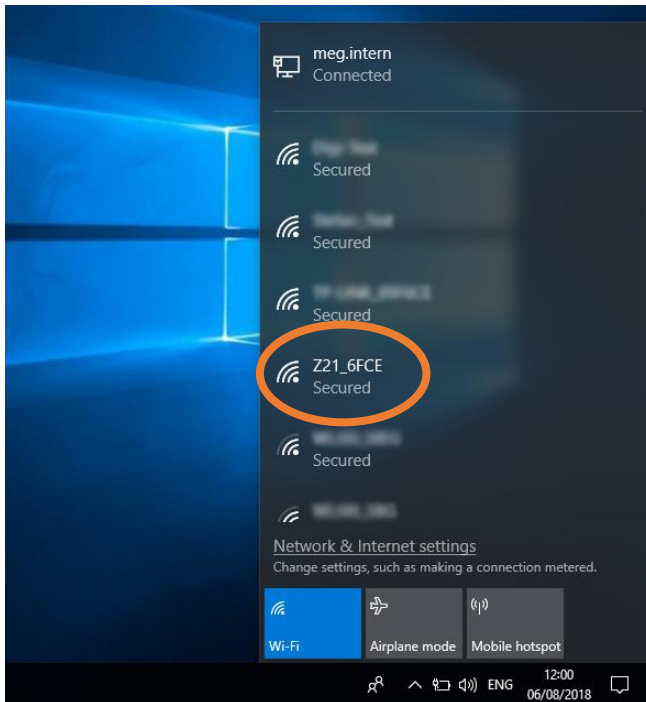
If the firewall is activated on your PC, you can now continue with step **2.2** "Firewall", otherwise go to step **2.3** "Making and testing the connection".

2.1.2 Connection using WLAN via the router included as standard

Switch on Z21 and router.



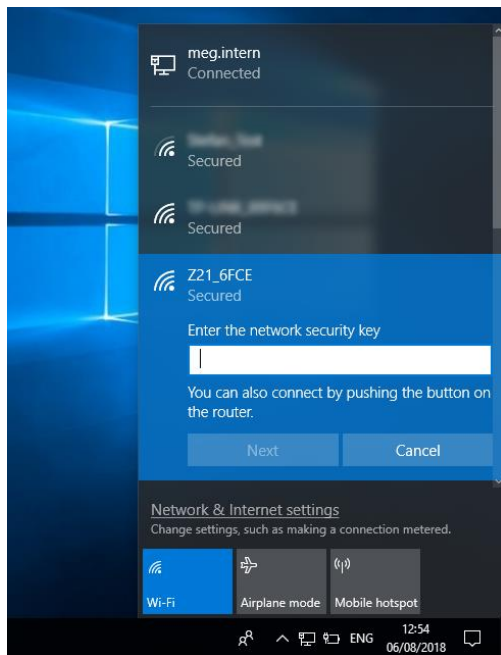
Click the mouse on the bubble (circled green) at the very bottom of the task bar and then on the network settings above.



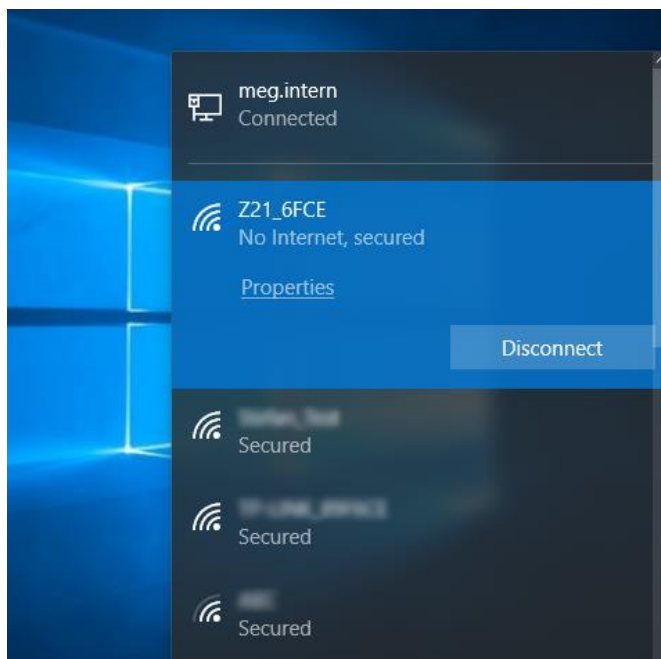
You can see a list of available networks

The name of the WLAN network of the WLAN router is “**Z21-wxyz**”, where wxyz are the end digits of the router serial number (see “S/N” field on the underside of the router).

Click on the relevant Z21 network.



Then enter the password for the network login.
This can be found in the "**PIN**" field on the underside of the router.
Then click "Next".

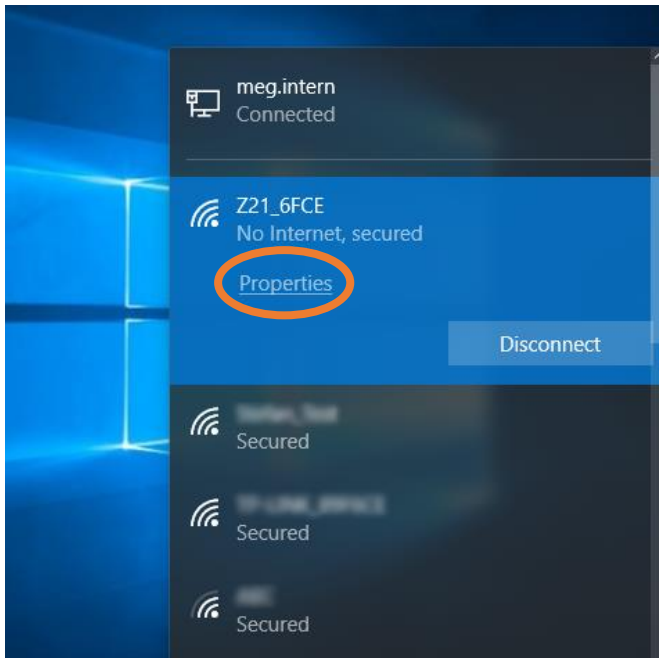


Now the WLAN router is connected.

TIP!

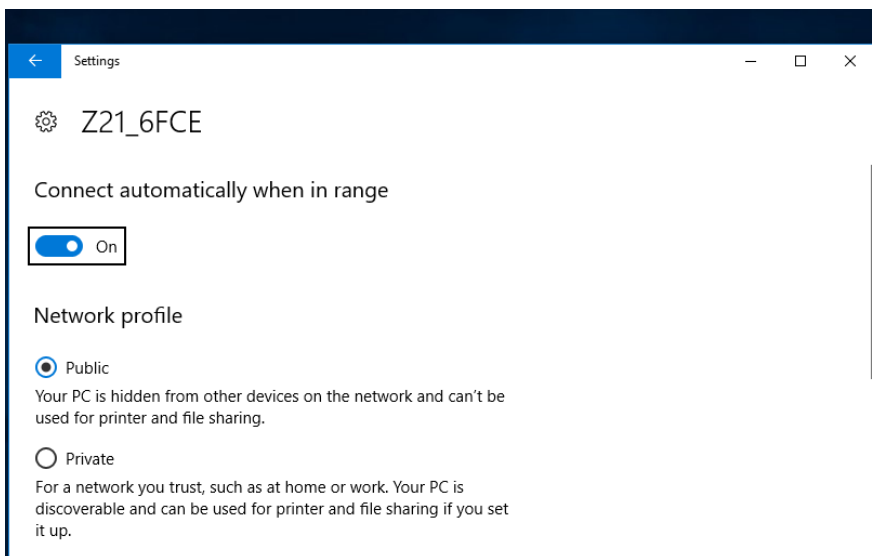
You probably don't want your PC to automatically connect to the Z21's wireless router in the future. This could be quite annoying when you want to use the wireless port on your PC for your normal internet connection. For this reason, proceed as follows:

In the dialogue shown above, select "Change advanced settings" (marked orange in the screenshot above).



Go to the "Wireless networks" list again.

Select the wireless router to which the Z21 is connected and select "Properties".



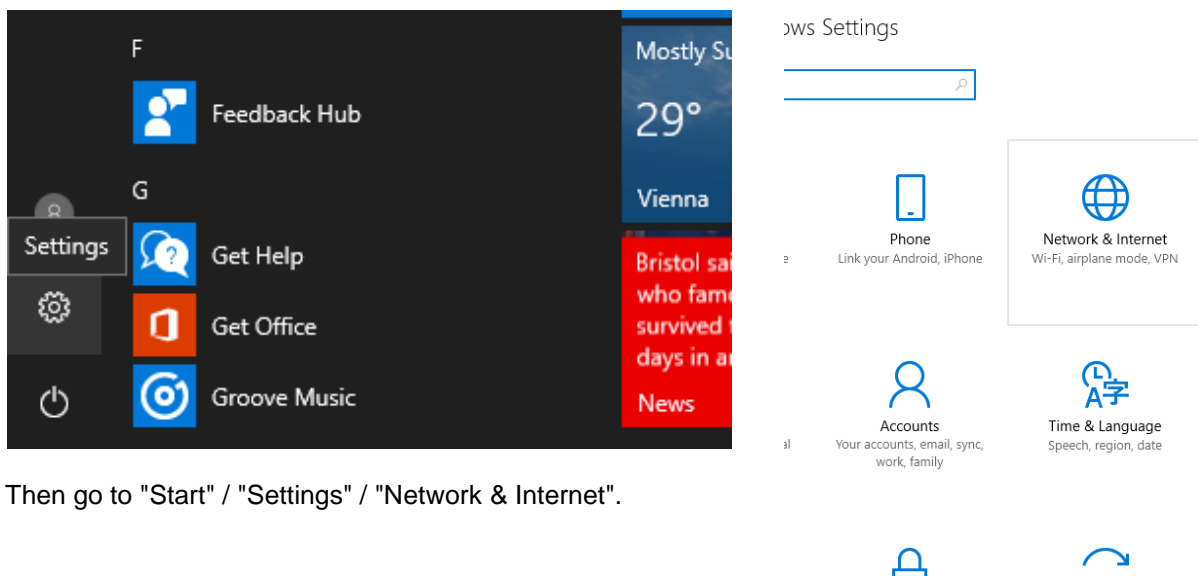
On the "Connection" tab, uncheck *"Connect automatically when this network is in range"*. Then close the dialogue with "OK". This means that the connection to the Z21-WLAN needs to be actively set manually when you actually want to use it.

If the firewall is activated on your PC, you can now continue with step **2.2 "Firewall"**, otherwise go to step **2.3 "Making and testing the connection"**.

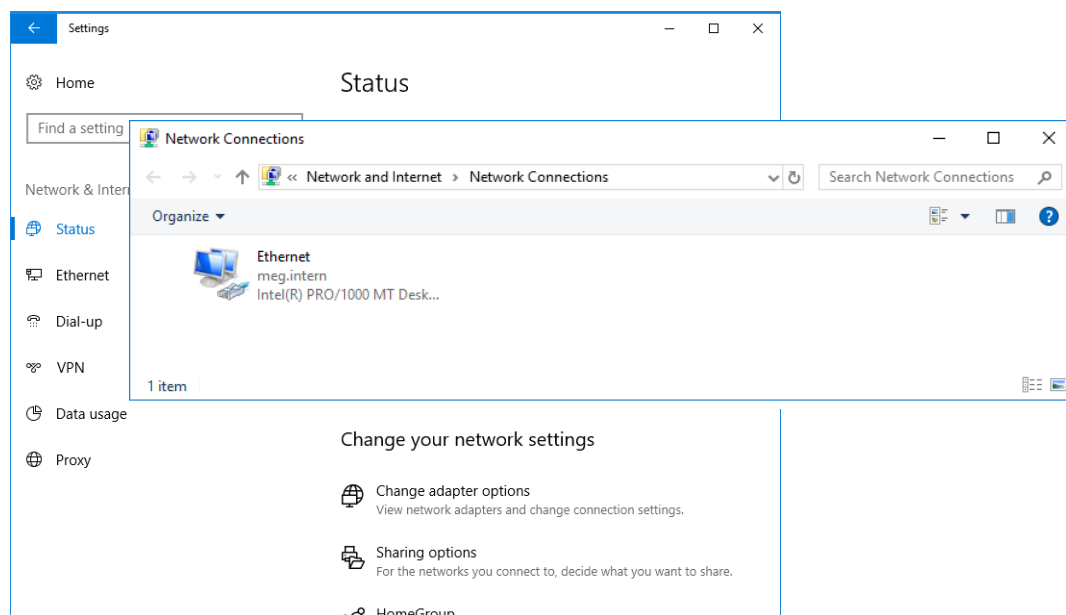
2.1.3 Direct connection via Ethernet cable without router

The most stable connection to your Z21 can be made via a direct connection using a network patch cable. Omitting the router will remove a further potential source of error.

Where necessary, first disconnect any Ethernet cables already connected to the Ethernet port (100 MBit/s) on your PC. Then plug a patch cable into the LAN port on the Z21 and plug the other end into the Ethernet port on your PC.

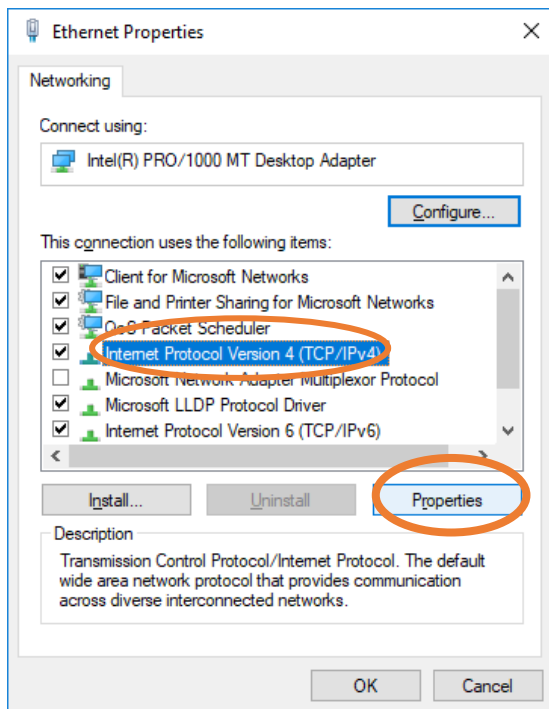


Then go to "Start" / "Settings" / "Network & Internet".

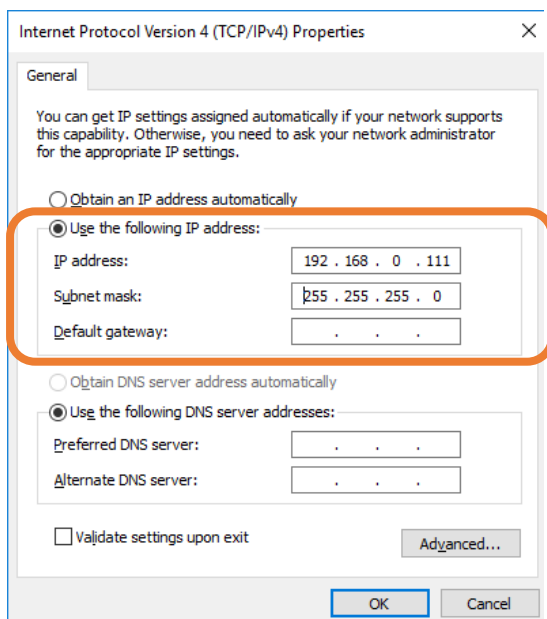


Select the option "Change adapter options"

Select "Properties" for the port to which the Z21 now relates (right mouse button).



Select "Internet protocol (TCP/IP)" and click "Properties".



Warning! MAKE A NOTE OF YOUR CURRENT SETTINGS BEFORE CHANGING THEM SO THAT YOU WILL BE ABLE TO RECONFIGURE THIS PORT FOLLOWING MAINTENANCE ON THE Z21.

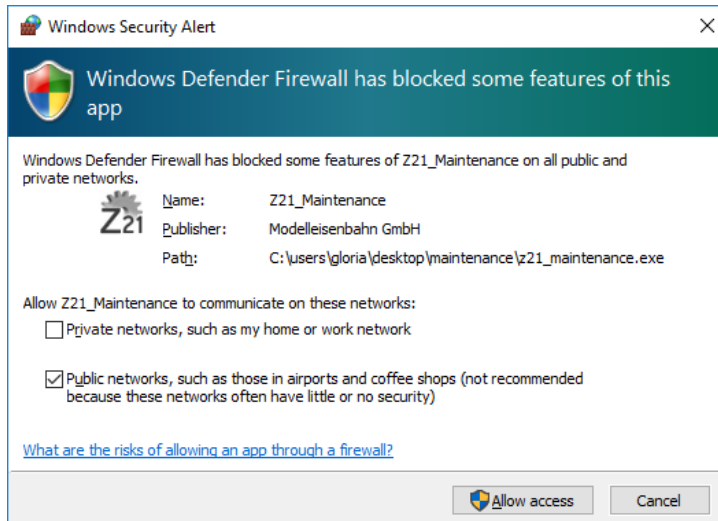
In this dialogue, configure the properties exactly as shown in this screenshot and confirm with "OK".

Warning! Do not forget to reconfigure this network port in accordance with the settings you previously noted down after working with the Z21 Maintenance Tool.

If the firewall is activated on your PC, you can now continue with step 2.2 "Firewall", otherwise go to step 2.3 "Making and testing the connection".

2.2 Firewall

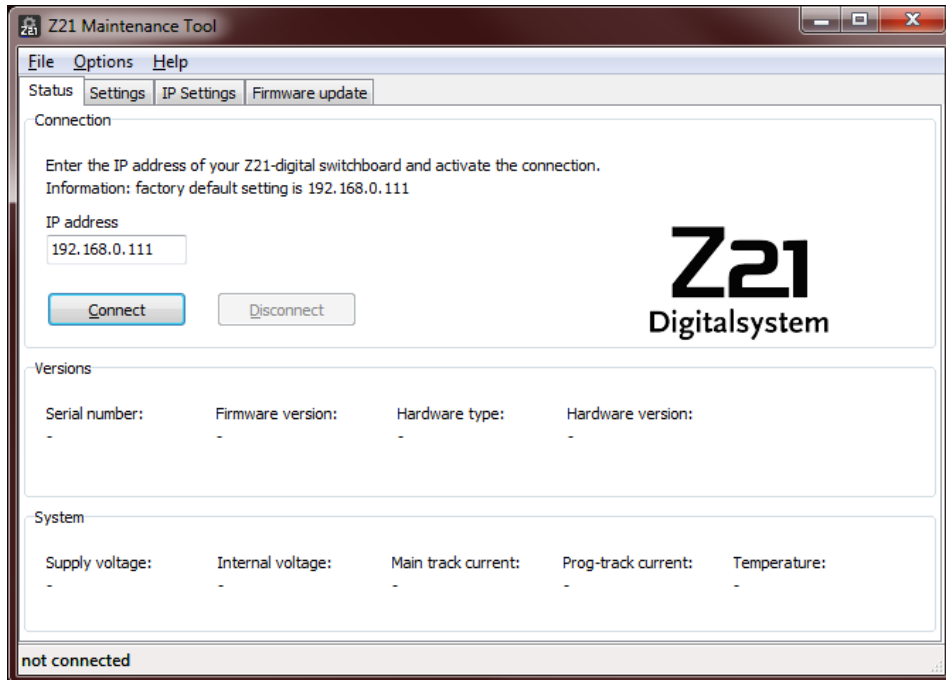
If the following message appears when you have activated the Windows firewall and when first starting "Z21_Maintenance.exe", the firewall settings must be modified for the Z21 Maintenance Tool:



The context to this message is that "Z21_Maintenance.exe" communicates with the Z21 via **UDP** using the **IP ports 21105, 21106 and 34472**. It may even be that very strict settings on a virus scanner mean that an alarm is issued due to "*suspicious network traffic*". Communication via these ports is a little different in comparison to a "normal" PC application, but you already know that the Z21 likes to do things a little differently!

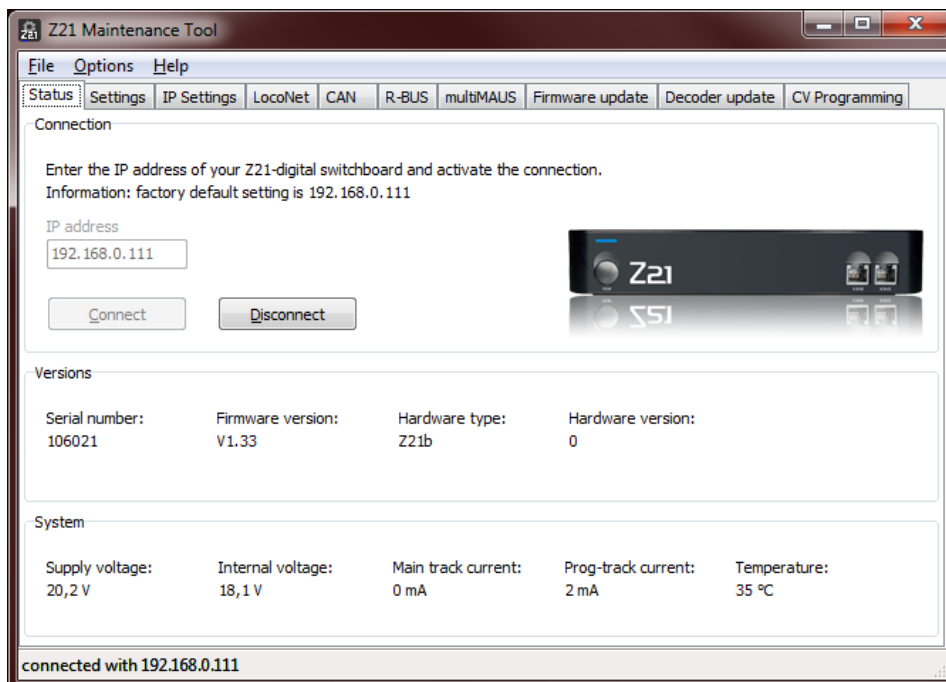
The simplest option is to click "*Do not block*" in the dialogue shown above. If you are using a different firewall, it is very likely that a similar message will be displayed and you will be able to set up a similar rule that achieves the same purpose.

2.3 Making and testing the connection



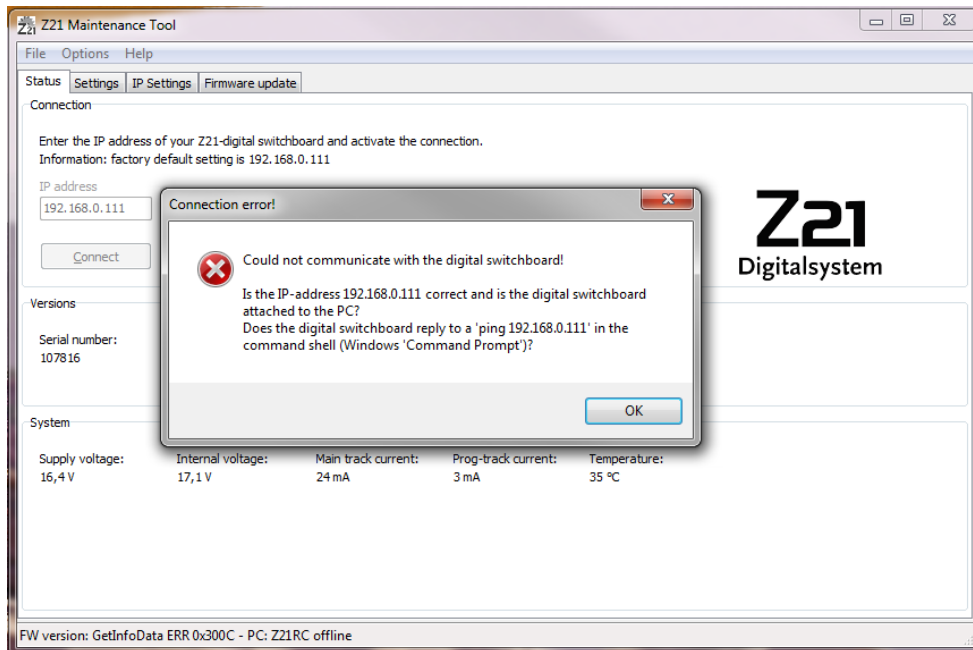
Start Z21_Maintenance.exe and click "Connect".

2.3.1 Successful connection established with control centre



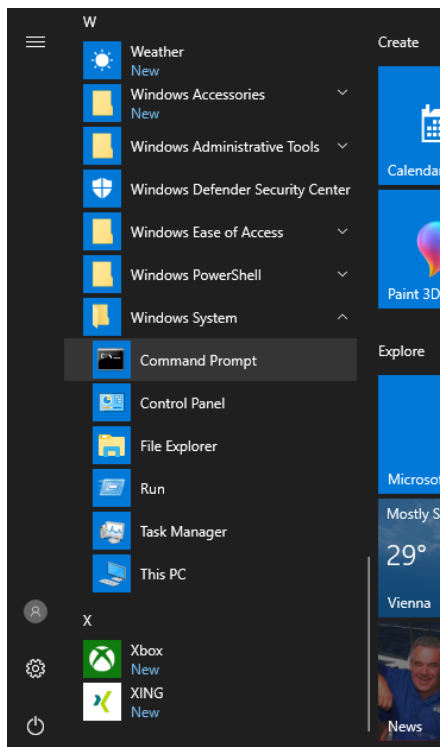
Ideally this image will appear: The Z21 is detected and the connection is established.

2.3.2 Connection problems



This image shows you that the connection cannot be established.

Check the connection using "ping":



To do this, launch the Windows command prompt.
In the command prompt, enter the command **"ping 192.168.0.111"** and press the Enter key.


```
Command Prompt
Microsoft Windows [Version 10.0.16299.214]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Users\Gloria>ping 192.168.0.111

Pinging 192.168.0.111 with 32 bytes of data:
Reply from 192.168.0.111: bytes=32 time=3ms TTL=254
Reply from 192.168.0.111: bytes=32 time=1ms TTL=254
Reply from 192.168.0.111: bytes=32 time=1ms TTL=254
Reply from 192.168.0.111: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.0.111:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 1ms

C:\Users\Gloria>
```

In this case, the connection is already working in principle. Check the firewall settings (see previous section) and the virus scanner (log, where applicable).

Try connecting again in the Z21_Maintenance.exe file. Often Windows needs a little more time after plugging in the cable until the connection is completely established. The status of the network can usually be seen in the Windows task bar (bottom right, if necessary click on the corresponding network icon).

```
C:\Users\Gloria>ping 192.168.0.111

Pinging 192.168.0.111 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.0.111:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)

C:\Users\Gloria>
```

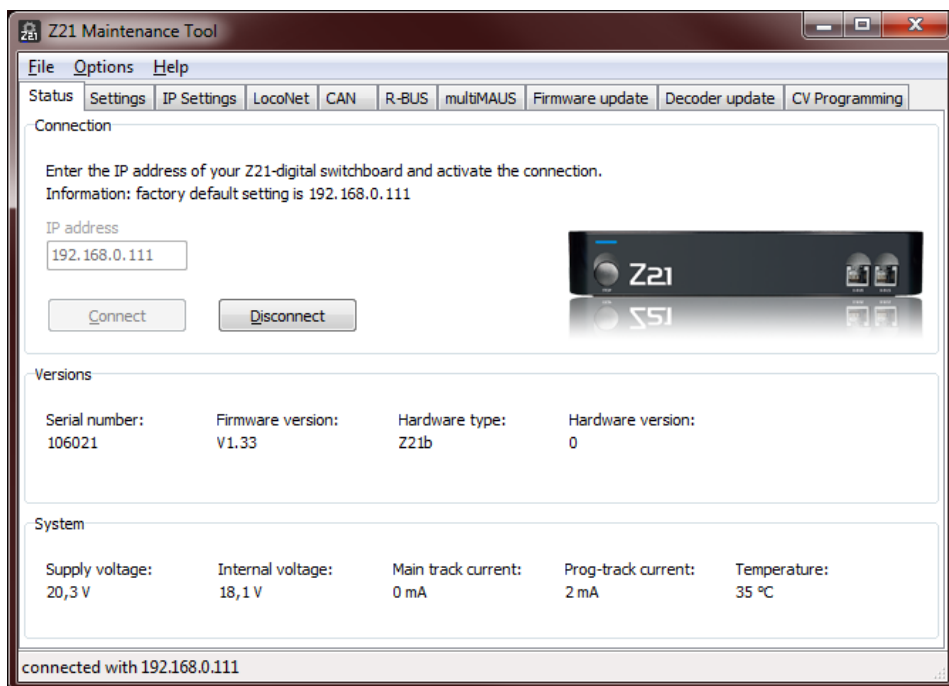
If the control centre does not respond to a ping, the Z21_Maintenance.exe file can be ruled out as the cause of the problem, but instead relates to the network or the network configuration.

Check the connection again, paying attention to unimportant details and things that seem obvious.

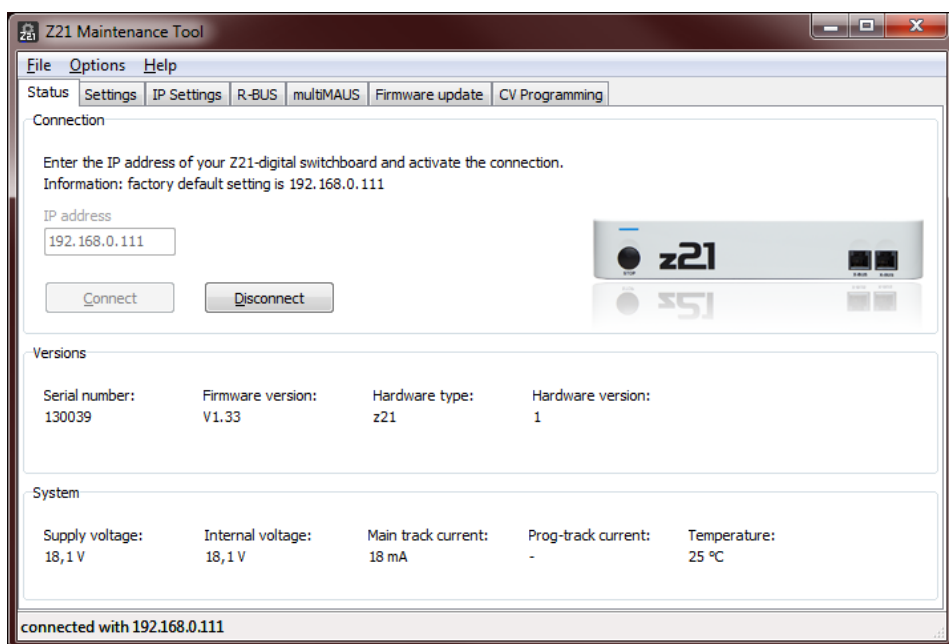
- Is the cable plugged into the correct ports and is there a power supply to the Z21?
- Does this network cable normally work?
- Is it possible to access the router, where a wireless network is set up (ping to 192.168.0.1, for example)?
- Is the port being blocked by the firewall or the virus scanner?
- Repeat and check the network port settings (as described in the previous sections) until the ping works.

3 Z21 Maintenance Tool Features

3.1 Status

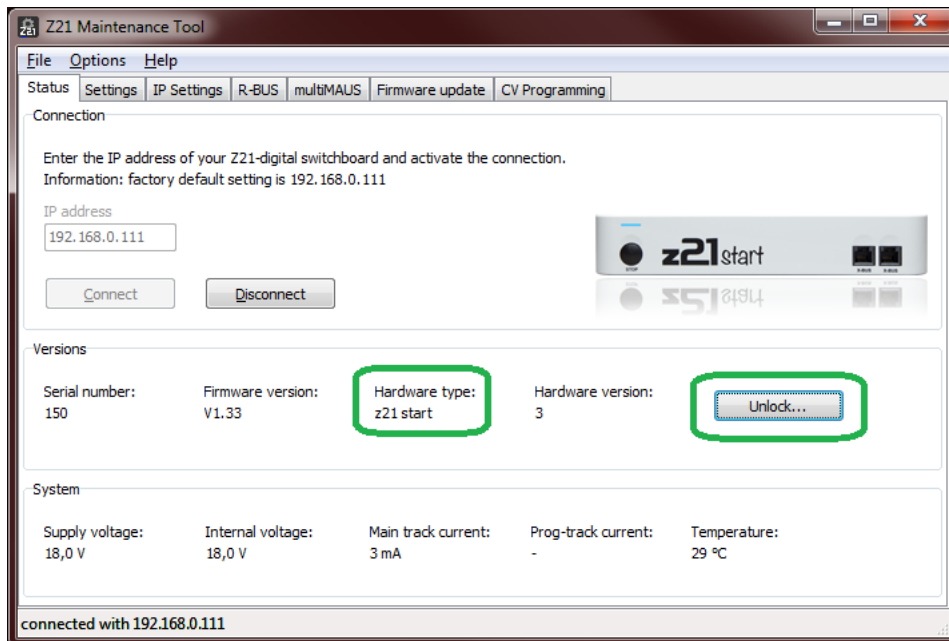


When the connection is successfully established, you can check the FW version and other operating parameters of your control centre. The "internal voltage" corresponds to the current track voltage. The Z21 Maintenance Tool automatically detects which type of hardware it is connected to.



3.1.1 z21start Unlock Code

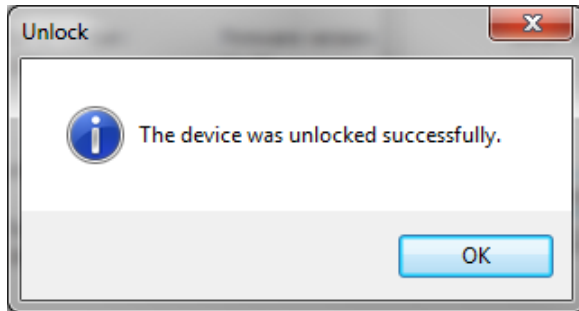
If the z21start is not yet unlocked, an "Unlock..." button will be displayed after connection.



This button can be used to open the dialogue window where you can enter the activation code (article number 10814).

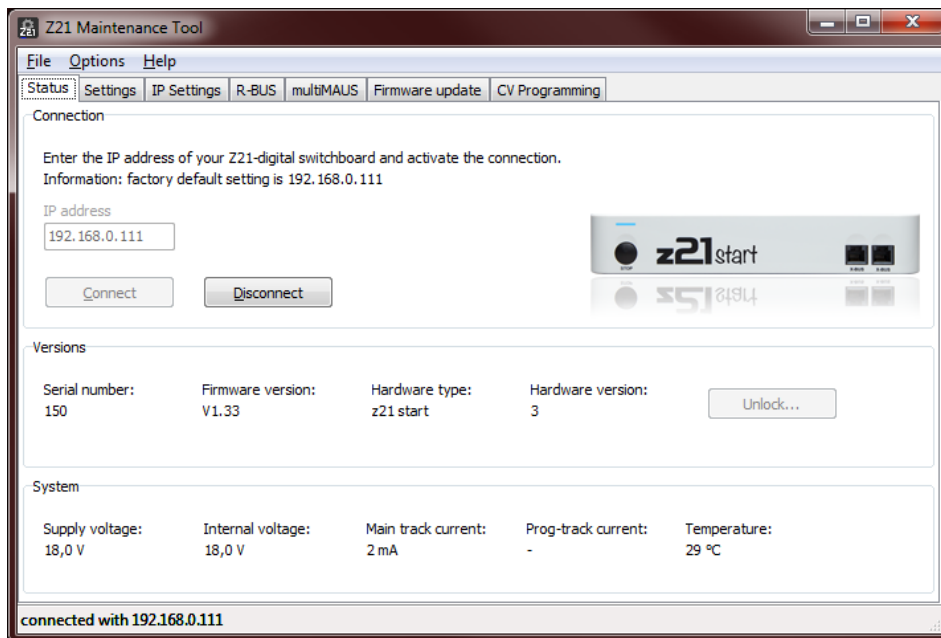


The unlock process can take up to 10 seconds.



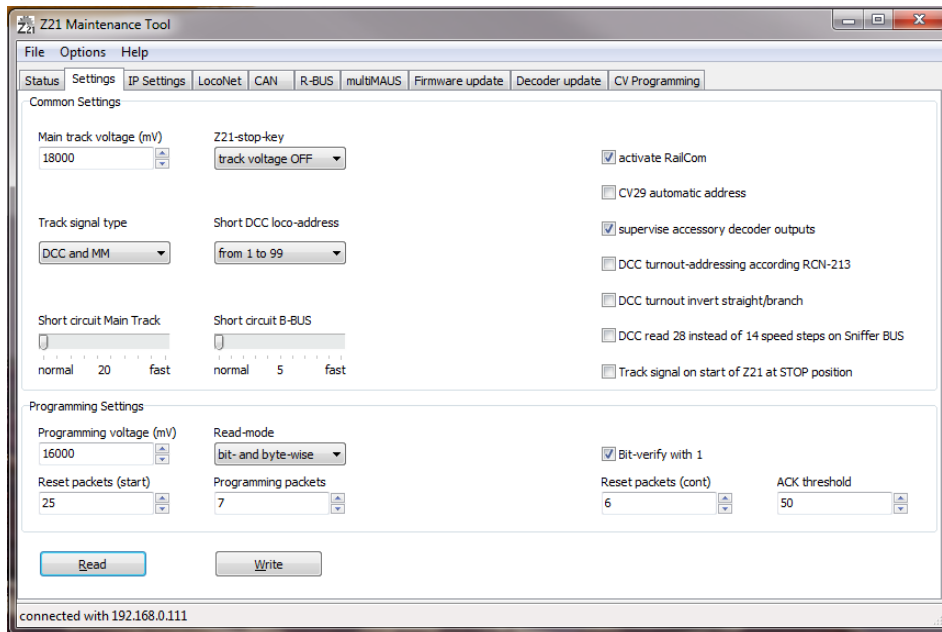
This means that the z21start picks up the loco and turnout commands via the LAN port and processes them.

If the z21start has been successfully unlocked, the "Unlock..." button remains greyed out.

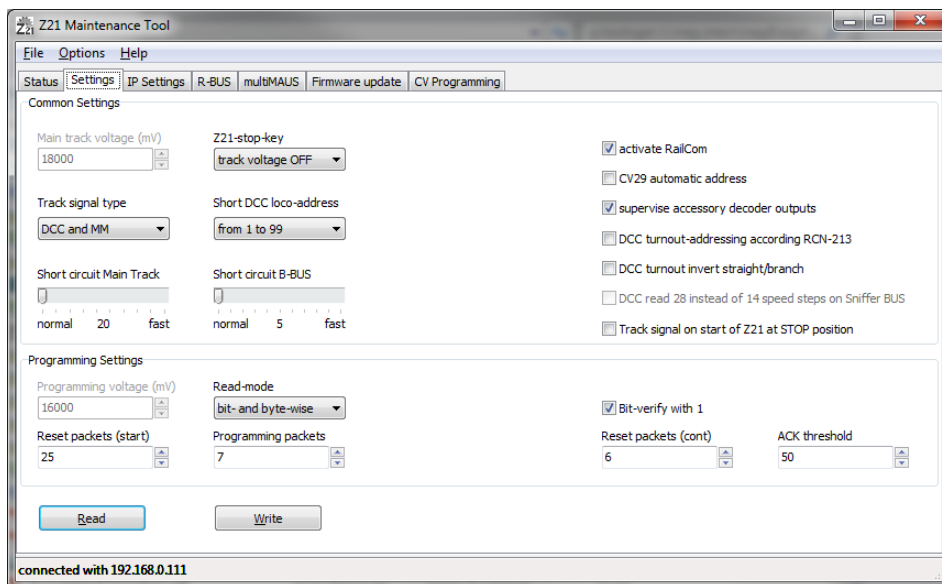


3.2 Settings

The available setting options are automatically modified according to the detected hardware type.



Settings for the "Z21 version for experts" (black box)



Settings for the "z21 version for beginners" (white box)

3.2.1 General settings

Main track voltage: the track voltage on the main track can be set here on the black Z21. However, the main track voltage cannot be higher than the voltage from the power supply unit. With the white z21 and z21start, the track voltage cannot be set by the hardware and is instead specified by the voltage from the power supply unit.

Centre stop key: This option is used to set the function of the STOP key on the control centre. Either the **track voltage can be switched off**, or with the power supply maintained, an **emergency stop** command can be sent to the locomotives.

Track signal type: This option can be used to select the command type on the track.

- **DCC and MM:** The Z21 functions as a multi-protocol control centre and sends the data packets of the corresponding vehicle/turnout in DCC or Motorola format. The format of the individual vehicles/turnouts can be configured via the app. This setting remains permanently stored on the Z21.
- **DCC only:** Regardless of the vehicle/turnout setting, the data packets are only issued in DCC format.
- **MM only:** Regardless of the vehicle/turnout setting, the data packets are only issued in Motorola format.

This option is available from Z21 firmware V1.23.

Short DCC loco address: This option can be used to set the address range in which "short addresses" are generated for DCC locos on the track output. This should be taken into account in the loco decoder (see decoder descriptions CV1, CV17, CV18, CV29).

- **From 1 to 99:** This is the backward compatible default setting of the Z21. For locos with addresses from 1 to 99, DCC packets with short addresses are generated; from address 100, DCC packets with long addresses are generated.
- **From 1 to 127:** For locos with addresses from 1 to 127, DCC packets with short addresses are generated; from address 128, DCC packets with long addresses are generated.

This option is available from Z21 firmware V1.23.

Short circuit main track and Short circuit B-BUS: These options can be used to increase the response speed of the short circuit detection on the main track (DCC Main) and on the B-BUS (Booster-Bus). This can be used for systems on track N in particular.

Activate RailCom: RailCom, in other words communication from the decoder to the control centre is required, for example, if you also want to export a RailCom-compatible decoder in the main track programming (POM) or if the feedback module 10808 is to report the locomotive addresses. With some, generally very old decoders developed before the introduction of RailCom, however, incompatibilities may occur when operating with RailCom. For this reason, RailCom can normally be deactivated here.

CV29 automatic address: This option is only important for operation with the multiMAUS. If you are using the multiMAUS to program a short or long address, this option on the decoder can be used to set or delete bit 5 in CV29 ("long address") automatically.

Supervise accessory decoder outputs: This option is used to monitor the outputs of function decoders using a timer and where necessary shut them down automatically after several seconds assuming a faulty controller (handheld controller, app, PC control, ...) has not already done so. This prevents overheating of the drive coils.

This option is available from Z21 firmware V1.20.

DCC turnout-addressing according RCN-213 (identical to previous option "DCC turnout addressing +4"): This option can be used to correct incompatibilities relating to the numbering of turnout and signal addresses. Roco numbers the turnouts from module 0 (each with 4 turnouts), other DCC control centre manufacturers only from module 1. This different numbering has originated historically from a weakness in the **NMRA S-9.2.1** specifications where neither of the two numbering systems could essentially be called "incorrect". The numbering of the turnout addresses has only been clearly defined since the more recent specifications from the RailCommunity **RCN-213** (2015).

The default setting for this option is "deactivated" to remain backward compatible with older Roco devices. When switching from an existing third-party system to the Z21, it can therefore happen that the previously known turnout addresses appear shifted by the value 4 due to the different counting method of the module groups. If a turnout on the former third party system has been set below 1, for example, it is addressed on the Z21 as 1+4=5. To make it easier for our customers to change over, this option has now been introduced that can be used to re-use the turnouts and signals with former known turnout addresses or address them in accordance with RCN-213.

This option is available from Z21 firmware V1.21.

From Z21 firmware V1.22, the setting not only affects the DCC packets on the track output, but also determines how turnout switching commands are interpreted on the Sniffer BUS input.

DCC turnout invert straight/branch: This option was created by customer request and can be used to invert the logic of the DCC switching commands for turnouts (straight/branch) and signals (green/red). This option can be useful for users who are switching their current system from an older third party system to the Z21.

This option is available from Z21 firmware V1.31.

DCC read 28 instead of 14 speed steps on Sniffer BUS: With Z21 firmware version V1.22, the Sniffer BUS has been implemented. This means that you can also control the locos on the Z21 using an older DCC control centre by simply connecting the track output on the old control centre to the Sniffer BUS on the Z21. The Z21 attempts to map the format of the old control centre to the format of the loco set on the Z21 as far as possible. This makes it possible to use a very old control centre that only utilises the DCC format "14 speed steps" to control a modern loco with 128 speed steps or even one loco with MM decoder (Motorola).

However, it is not always technically possible to reliably detect the format "14 speed steps" and "28 speed steps" on the Sniffer input (comparison: loco decoder CV29 Bit 1) and to map it to the sets output format. In case of doubt, the Z21 uses "14 speed steps":

Setting of loco speed steps on the Z21:		14	28	128
Speed steps of loco n on the Sniffer input:	14	Ok	(a)	Ok
Speed steps of loco n on the Sniffer input:	28	(b)	OK	(b)
Speed steps of loco n on the Sniffer input:	128	Ok	OK	OK

(a) The light cannot be switched on because the Z21 also takes on the format "28 speed steps" with the "28 speed steps" loco setting for this loco on the Sniffer input, and for this reason has a futile wait for the light info in DCC function group1.

(b) Front light flickers with speed step. This can be corrected as follows:

- either the format in the third party control centre and as far as possible in the Z21 is configured appropriately (ideally with 128 speed steps),
- or in the third party control centre for this loco, the light (F0) is switched on to support automatic format detection,
- or in the Maintenance.exe file, the setting "DCC read 28 instead of 14 speed steps on Sniffer BUS" is activated.

This option is available from Z21 firmware V1.22.

Track signal on start of Z21 at STOP position: With this option the track output on the Z21 or z21 remains switched off after the control centre is started.

This option is available from Z21 firmware V1.28.

3.2.2 Programming settings

Programming voltage: in this case the black Z21 can be used to set the track voltage for the CV programming process on the programming track. However, this voltage cannot be higher than the voltage from the power supply unit. With the z21 and z21start, however, there is no separate programming output with a voltage that can be set.

Read mode: One CV of a decoder can be exported either bitwise or byte-wise on the programming track. While only a few accesses are required for **bitwise** reading, with **byte-wise** reading all possible values can be tested until the correct value is found. This can take a long time depending on the value, as in the worst case scenario up to 256 attempts are required. Very old decoders can only be exported byte-wise. Proceed as follows for the "**Bitwise and byte-wise**" setting: An attempt is first made to export the CV bitwise. Byte-wise reading is only started as a second attempt if bitwise is not successful.

ACK threshold: A loco decoder responds to CV read and CV write queries with a slightly increased power supply in accordance with "*Basic Acknowledgement*" from RP-9.2.3: "... *increased load (positive-delta) on the programming track of at least 60 mA for 6 ms +/- 1 ms*".

Although the Z21 is already set slightly more sensitively from FW V1.20, in practice it can unfortunately occur even more often that some decoders deviate from the standard and cannot therefore be read. However, this can also occur when a buffer capacitor is used. To be able to successfully export these decoders, the threshold for detecting the "*Basic Acknowledgement*" can be set lower here, or even higher if necessary.

This option is available from Z21 firmware V1.20.

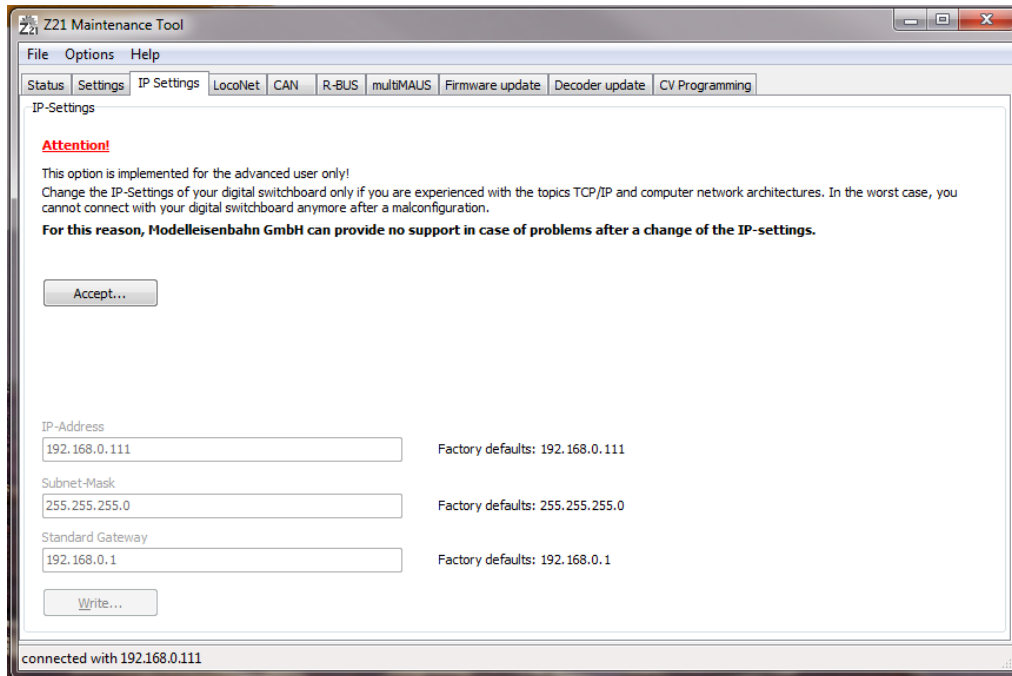
Reset packets (start): Determines the number of DCC reset packets right at the start of the CV programming sequence (CV read/write). The higher this value is, the more time the decoder has to restart.

Programming packets: Determines the number of DCC read/write commands in the CV programming sequence (RP-9.2.3).

Reset packets (continue): Determines the number of DCC reset packets within the programming sequence.

If you have problems during CV read/write with a specific decoder, you can change this packet number, e.g. 25/10/10 or 30/15/15.

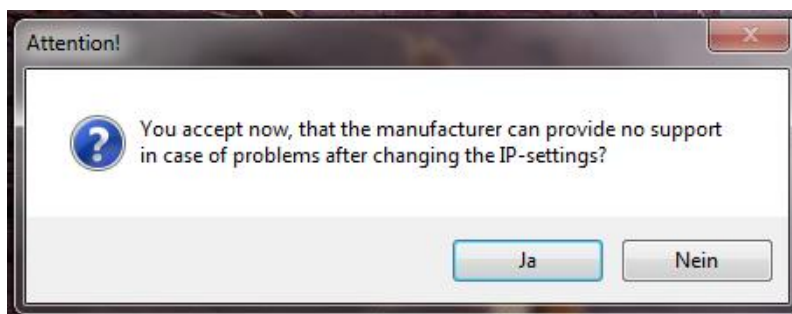
3.3 IP settings



As requested by some customers, the IP address of the Z21 can be changed.

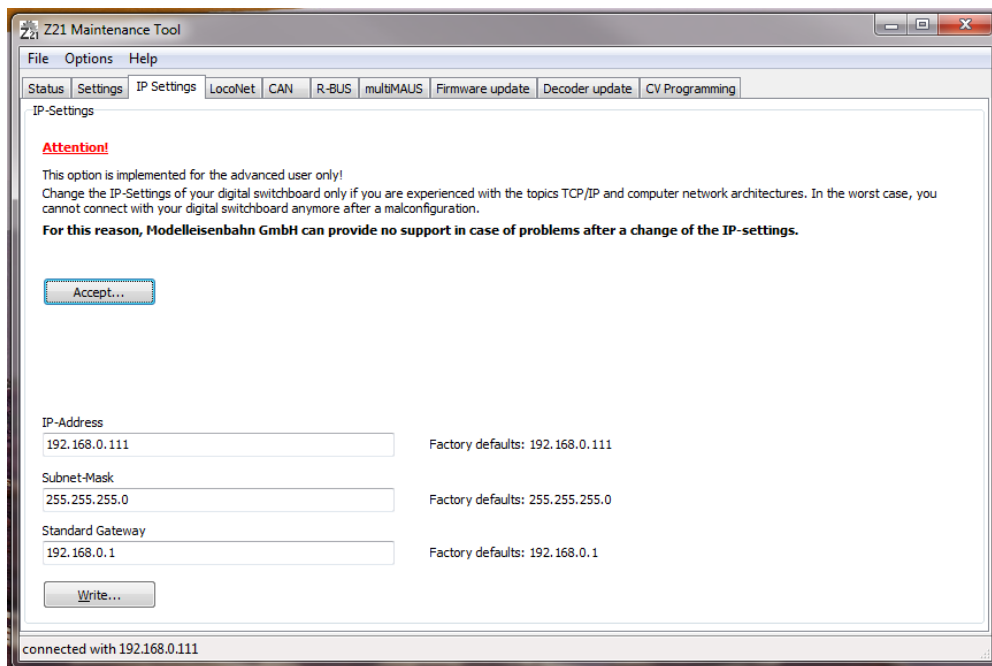
This is not required for the average consumer and is definitely not recommended by the manufacturer. Please note the relevant notes in the screenshots.

Known issues: The routers from some internet service providers may reserve certain LAN ports for IP-TV. Old HUBs can also cause communication problems.

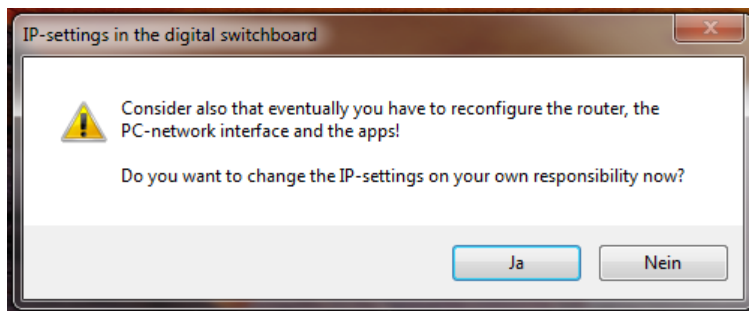


Before the user can enter a new IP address, the compulsory disclaimer must first be explicitly accepted:

The input fields only become active once the user has clicked "Yes".

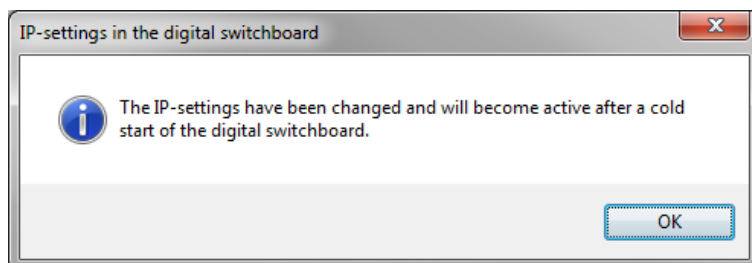


Only then is it possible to change the address to "192.168.0. **123**" for example and – following another



warning prompt – write it to the Z21:

and after "Yes":



Important: The new IP address is only active in the Z21 following a cold start (i.e. disconnect supply voltage) on the control centre!

The last change is also displayed in the program as "Your last change was...", see above.

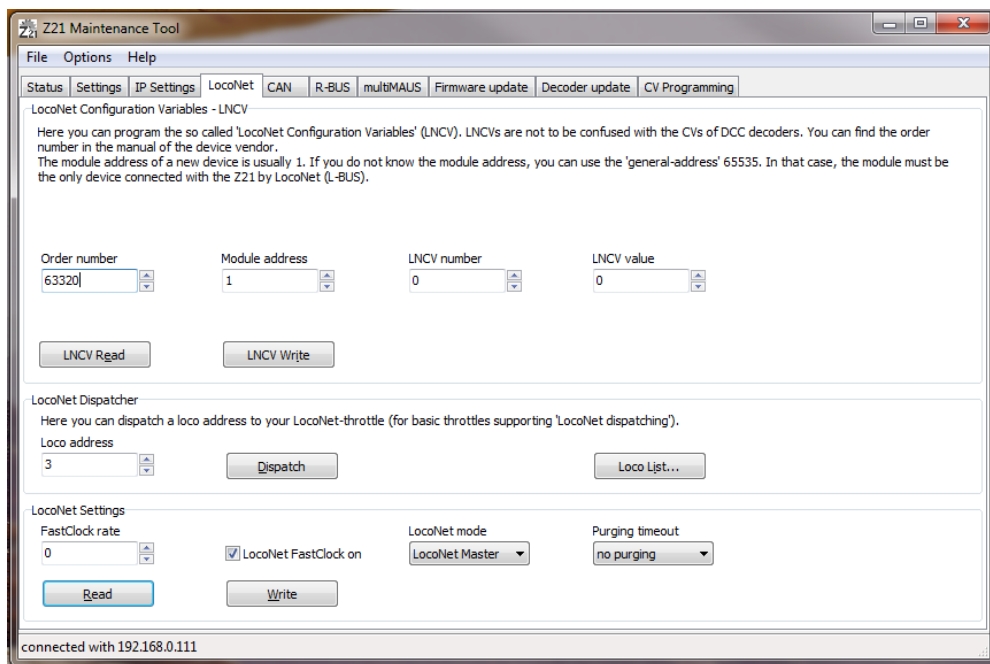
Please note that every change in the IP address on the Z21 also requires a network reset, beginning with the subnet masks, router, own Ethernet port on the PC to the app settings on the smartphone or tablet, etc.

The following applies up to firmware V1.26: This modified IP address is retained even after resetting to the factory settings (hold down stop key until LED flashes purple).
From V1.27 the IP settings are reset to the factory setting.

3.4 LocoNet

LocoNet is enabled from Z21 firmware V1.20.

With firmware V1.20 the first step was completed on the Z21 towards LocoNet integration.

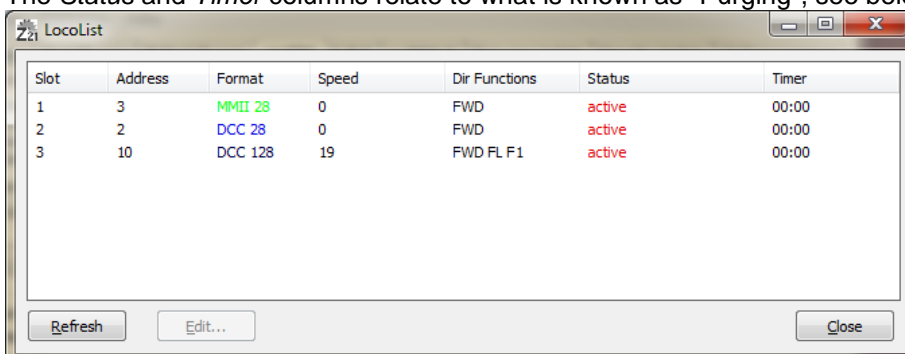


LNCV Read and **LNCV Write** can be used to program what are known as "LocoNet Configuration Variables" that are used in some LocoNet accessory articles (e.g. Uhlenbrock 63410 "LocoNet Switch Module"). Details and meanings of the individual LNCVs can be found in the relevant operating instructions from the manufacturer.

LocoNet Dispatch can be used to prepare a loco address which you can then transfer using the LocoNet Dispatch process to your LocoNet handheld controller (e.g. FRED).

From [Z21 firmware V1.25](#) the **Loco List** provides you with an overview of all vehicles that have been used since the last time the Z21 was switched on. In addition to the vehicle address, the rail format used, the speed and the active functions used are displayed. "*Edit...*" or the right mouse button can be used to change the rail format of the selected loco. The LocoNet Dispatch can also be initiated in the loco list using the right-hand mouse button.

The *Status* and *Timer* columns relate to what is known as "Purging", see below.



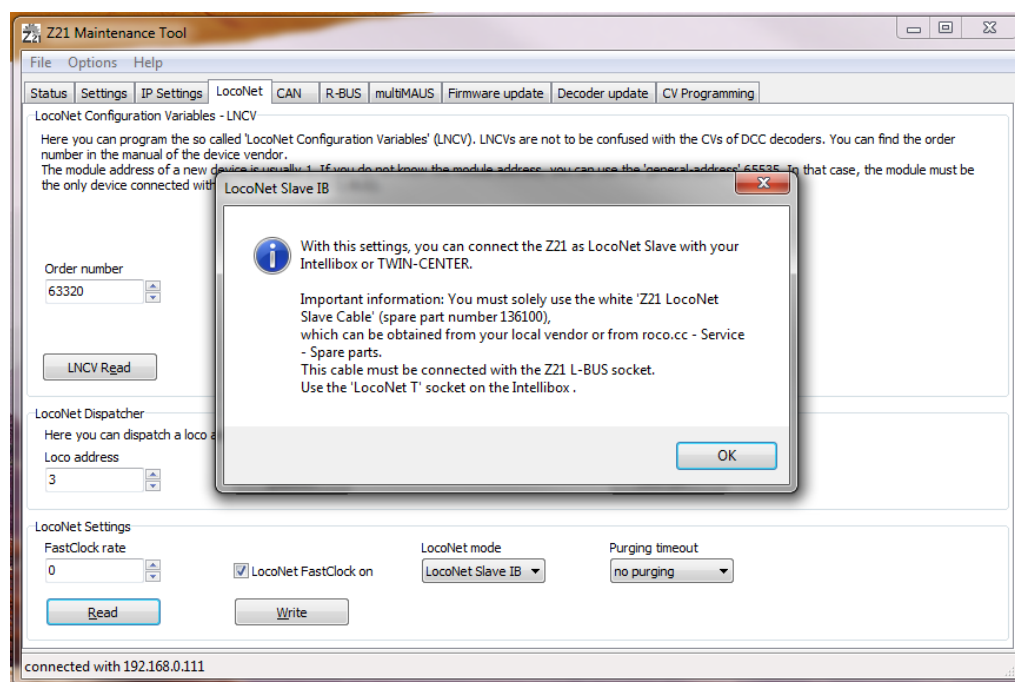
Under **LocoNet Settings** you can activate the LocoNet Fastclock ("model time") and the rate. Rate 0 means "Stop". Disable "LocoNet Fastclock on" if you want to use a device other than the Z21 on your LocoNet to generate the model time.

Note: Once the Z21 has no realtime clock internally, the model time begins with each restart at "12:00 a.m."

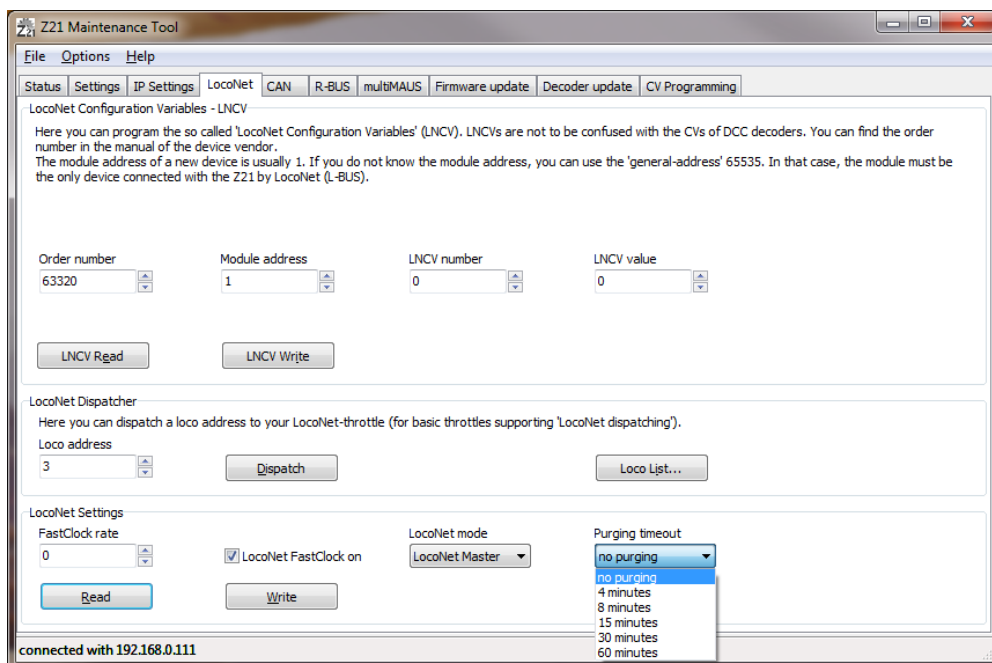
From [Z21 Firmware V1.22](#) you can use **LocoNet Mode** to configure the Z21 as "LocoNet Master" (default setting) or as "LocoNet Slave on Intellibox".

In contrast to original plans, we have implemented a LocoNet Slave Mode based on customer requests relating to the Z21. This means you can connect the Z21 (Slave, L-BUS interface) via LocoNet to a TWIN-CENTER or Intellibox (Master, LocoNet T-jack). The Z21 then establishes the interface between the app and Intellibox. This means it is possible to control your system simultaneously both with the TWIN-CENTER and any LocoNet control devices present, as well as with the Z21 App on a smartphone or tablet and multiMAUS!

Important information: Because as mentioned above, no LocoNet Slave was originally planned for the Z21, it is essential to observe the following points: To prevent the Z21 and the existing master from supplying in the supply voltage on the LocoNet bus at the same time, which can cause considerable electrical problems in the control centres, the supply voltage at the L-BUS interface on the Z21 must be isolated from the rest of the LocoNet. To do this, please use the white "**Z21 LocoNet slave cable**" with art.no. **136100** that has been produced specifically for this purpose. This cable is available from your dealer or online in the [spare parts shop for Roco](#).



From [Z21 Firmware V1.25](#) you can use the **Purging timeout** option to configure what is known as **Purging**. "Purging n minutes" means that for a *stationary* loco, no more drive commands are sent via the track to the decoder if it has not been used by the user or by a control program for n minutes. As soon as the locomotive is used again, the repeat cycle of the drive commands for that vehicle is reactivated and the purging timer restarts.



Purging increases data throughput for the vehicles actually being used. Purging can be of interest for particularly large systems or modular group meetings with many participants, where there are significantly more than 50 vehicles on the system at the same time. For the normal operation of smaller and medium-sized systems with fewer than 50 vehicles, the priority-regulated repetition cycle of the drive commands on the Z21 will normally be sufficient even without purging.

You can see the status of the loco and the current value of the purging timer in the loco list, see above. The purging can also be specifically deactivated for individual locomotives here.

3.5 CAN

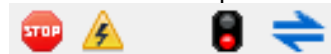
The boosters Roco 10806 and 10807 are fully supported on CAN by Z21 Firmware V1.33 or higher.

The Z21 Single Booster 10806 and Z21 Dual Booster 10807 can be connected either with the B-BUS or the CAN-BUS.

However, using the CAN-BUS offers more options in comparison to the B-BUS:

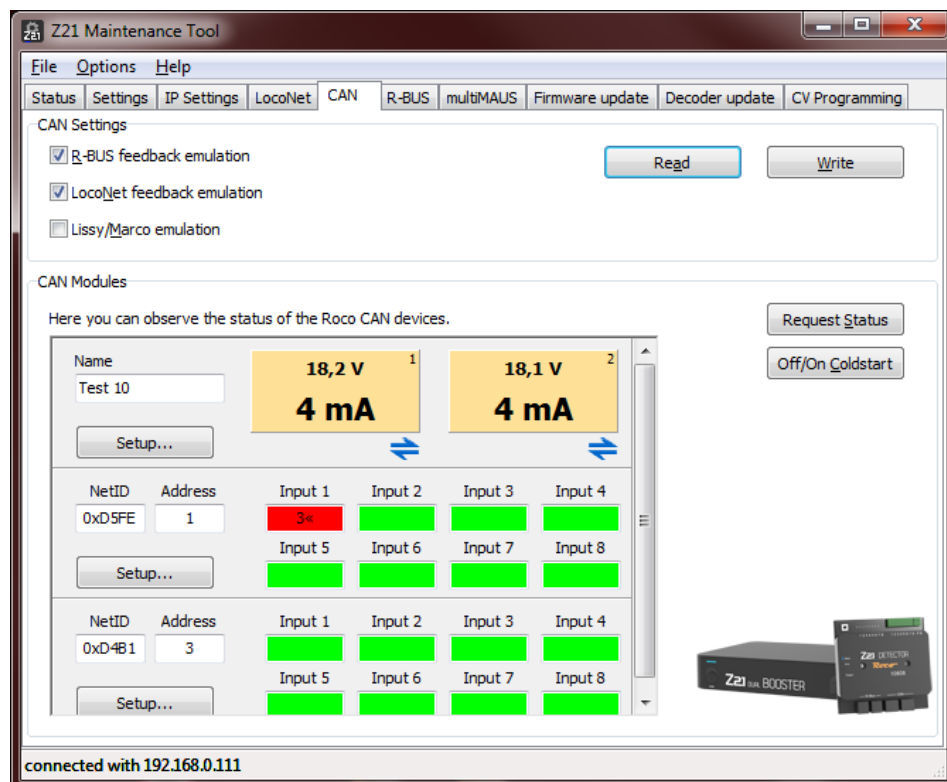
- The received RailCom data (RailCom channel 2) are also transmitted from the booster to the Z21 via CAN by means of the ZCAN20 protocol. This makes it possible to e.g. read out a vehicle decoder using the POM read command not only on the main track of the control centre, but also in the booster sections.
- The track voltage and the RailCom settings can be automatically read from the Z21 (Auto-Settings) and applied on the boosters.
- Configuration of the booster
- Firmware update of the booster

If the Z21-Booster is connected with the Z21 via CAN, it appears automatically in the Z21 Maintenance Tool under each other in the tab sheet "CAN". For each booster, there are one or two panels (depending on the booster type) presenting the actual voltage and current for the corresponding track output. The icons under each panel show the status of the track output:



From left to right: "Track output off", "Short circuit detected", "Brake generator mode active", "RailCom active" (i.e. the RailCom cutout is generated in the DCC track signal).

The **Setup** button is used to go to the corresponding booster setup dialogue.



The feedback module Roco 10808 is supported on CAN by Z21 Firmware V1.30 or higher.

The feedback module Roco 10808 can be operated either via the R-BUS or the CAN-BUS.

The CAN-BUS offers more options in comparison to the R-BUS:

- Transmission of the detected RailCom loco addresses
- Configuration of the feedback module
- Firmware update of the feedback module

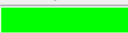
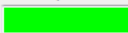
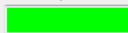
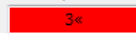
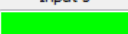
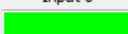
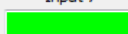
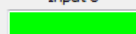
When the feedback module is connected via CAN, the Z21 offers R-BUS and LocoNet emulation. This means that the feedback module can be used immediately in existing PC software for model railroad computer control without having to wait for its CAN implementation. The feedback module can be configured in the PC software or in the Z21 app either like a Roco 10787 or like a LocoNet feedback module.

- **R-BUS feedback emulation**
This option enables the emulation of the R-BUS. The 10808 can be used in the PC controller as for a Roco 10787.
The factory setting is "on".
- **LocoNet feedback emulation**
This option enables the emulation of LocoNet feedback modules. The corresponding LocoNet occupancy messages are generated with locomotive address information.
The factory setting is "on".
- **Lissy/Marco emulation**
Corresponding Lissy/Marco messages are generated with locomotive address information.
The factory setting is "off".

You can transfer these emulation settings that are stored on the Z21 from and to the Z21 using the **Read** and **Write** buttons.

In the **CAN Module** section you can view the connected Roco 10808 feedback modules.

The **Request status** button can be used to request the status of all connected feedback modules. The **Off/On Coldstart** button can be used to re-start the feedback module by switching the track voltage briefly off and on again. This will also update the status again.

NetID	Address	Input 1	Input 2	Input 3	Input 4
0xD42B	3				
		Input 5	Input 6	Input 7	Input 8
					

Setup...

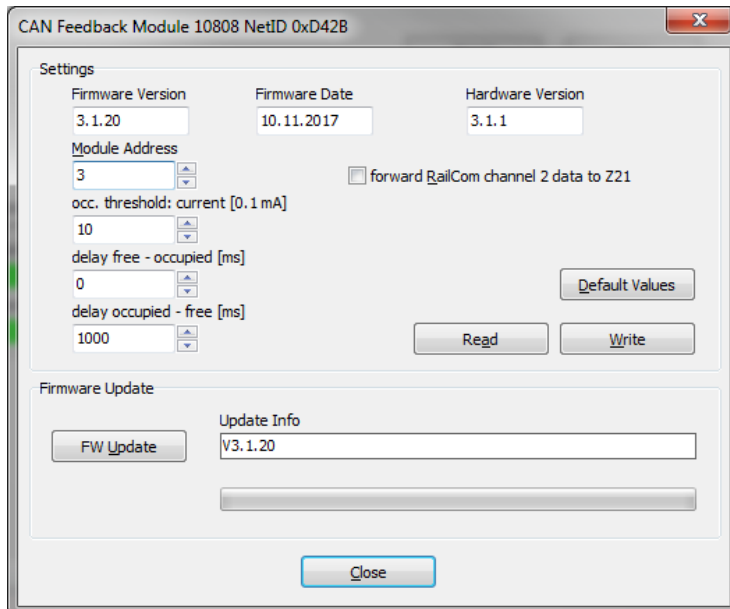
In the list of feedback modules you will see the relevant permanent **NetID**, the programmable module **address** as well as the **Status** of the inputs with the detected RailCom-loco **addresses**. A small arrow next to the loco address indicates the **direction information** to the loco.

- Red means "occupied".
- Green means "free".
- Grey means "no current occupancy information yet received" (e.g. if the feedback module is not being supplied with voltage).

The **Setup** button is used to go to the corresponding feedback module setup dialogue.

3.5.1 Roco 10808 feedback module setup

In the feedback module setup dialogue you can configure the selected feedback module Roco 10808 or perform an update on the feedback module firmware.



Under **Module address** you can assign a new address. Please note that all feedback modules on your system are each assigned a different module address. As an alternative, you can also use the hardware button on the feedback module and a turnout command following swiftly afterwards to change the module address.

Forward RailCom channel 2 data to Z21 can be used to activate forwarding of the RailCom data from channel 2 (speed, POM-Read-Result, QoS, etc.) to the Z21. Normally this should not be necessary, however, as this task is already carried out by the RailCom Global Detector on the Z21. The forwarding of the RailCom loco address does not depend on this option, incidentally. With feedback module firmware V3.1.20 or higher, POM-Read-Results are always forwarded to the control centre.

The **Occupancy threshold: Current** defines the sensitivity of the inputs of the feedback module in increments from 0.1 mA (= 100 µA). The factory setting when the feedback module is supplied is "10" (i.e. 1 mA).

The **delay free – occupied** function determines the time response of the feedback module for the transition from "free" to "occupied" in milliseconds. The factory setting is 0 ms.

The **delay occupied – free** function determines the time response of the feedback module for the transition from "occupied" to "free" in milliseconds. The factory setting is 1000 ms.

Default values can be used to restore the factory settings of the feedback module in the dialogue window input fields.

The values of the input fields are transferred to the feedback modules using the **Write** button.

Read is used to read and display the settings from the feedback module.

FW Update can be used to update the firmware on the feedback module. In the Update Info field, the target version or information on the update progress is displayed.

3.5.2 Roco 10806 and 10807 booster setup

In the booster setup dialogue you can configure the selected Z21 Single Booster 10806 or Z21 Dual Booster 10807. You can also perform an update of the booster firmware.

Z21 Single Booster 10806 NetID 0xC19B

Settings

Firmware Version	Firmware Date	Hardware Version	Name
1.10.0	05.12.2018	1.0.1	

Track Output

Track output voltage & RailCom: ☒ apply same settings as in Z21 automatically (CAN only) Track output voltage [mV] 18000 ☒ activate RailCom

Short circuit detection: normal 20 fast Auto inversion speed: fast 20 slow

☒ forward RailCom channel 2 data to Z21 (CAN)
☐ activate DCC braking generator
☒ forward short circuit to control centre
☐ activate auto inversion

Default Values Read Write

Firmware Update

FW Update Update Info V1.10.0

Close

For the Z21 dual booster 10807, both of the track outputs can be configured individually:

Z21 Dual Booster 10807 NetID 0xC196

Settings

Firmware Version	Firmware Date	Hardware Version	Name
1.10.0	05.12.2018	1.0.1	Test 10

Track Output 1

Track output voltage & RailCom: ☒ apply same settings as in Z21 automatically (CAN only) Track output voltage [mV] 18000 ☒ activate RailCom

Short circuit detection: normal 20 fast Auto inversion speed: fast 20 slow

☒ forward RailCom channel 2 data to Z21 (CAN)
☐ activate DCC braking generator
☒ forward short circuit to control centre
☐ activate auto inversion

Track Output 2

Track output voltage & RailCom: ☒ apply same settings as in Z21 automatically (CAN only) Track output voltage [mV] 18000 ☒ activate RailCom

Short circuit detection: normal 20 fast Auto inversion speed: fast 20 slow

☒ forward RailCom channel 2 data to Z21 (CAN)
☐ activate DCC braking generator
☒ forward short circuit to control centre
☐ activate auto inversion

Default Values Read Write

Firmware Update

FW Update Update Info V1.10.0

Close

Track voltage & RailCom: read settings from the Z21 control centre automatically via CAN (=“Auto-Settings”).

If the Z21-Booster is connected to the control centre via the CAN-Bus, the booster can automatically read the track voltage and RailCom settings from the Z21 control centre (“Auto-Settings”). If the booster is unable to read those settings (because the booster is connected via the B-Bus or the CDE port), then the track voltage and RailCom settings stored in the booster will be used.

If necessary, you can deactivate these “Auto-Settings” by deactivating this option. This enables you to force a setting of the booster that deviates from that of the control centre (not recommended).

Track voltage

The desired value for the track voltage can be set here. This entry field is greyed out as long as the “Auto-Settings” (see above) are activated. This desired value for the track voltage will be used only, if the settings of the control centre cannot be read automatically (i.e. B-Bus, CDE), or if the “Auto-Settings” are deactivated.

Activate RailCom

With this option, you can activate or deactivate the generating of the RailCom cutout. This checkbox is greyed out as long as the “Auto-Settings” (see above) are activated. This RailCom setting will be used only, if the settings of the control centre cannot be read automatically (i.e. B-Bus, CDE), or if the “Auto-Settings” are deactivated.

IMPORTANT: This option must be deactivated if neighboring booster sections do not generate a RailCom cutout. See also booster manual.

Forwarding RailCom Channel 2 to the control centre

The forwarding of the RailCom data (RailCom Channel 2, i.e. speed, POM-Read-Result, QoS, etc.) received by the booster is activated with this option. The Z21-Booster 10806 is equipped with one RailCom receiver, and the 10807 is equipped with one RailCom receiver for each of the track outputs. Both are able to forward the received data to the Z21 via the CAN-Bus. This way it is possible e.g. to not only readout a loco decoder by means of POM read commands on the main track of the control centre, but also in the booster sections.

Activate DCC brake generator

This option makes it possible to use the track output of the Z21-Boosters as a replacement for item 10779 “brake generator”. See also booster manual.

Forward short circuit to control centre

If this option is deactivated, short circuits are not reported to the control centre. The operations can continue in the booster sections that are not affected or at the main track of the control centre respectively.

The Z21-Booster then deactivates only the concerned track output and attempts to reactivate it every 3 seconds automatically.

Activate auto-inverting

This option activates the auto-inverting, i.e. an automatic reversing of the polarity of the track signal if the booster is used as a terminal loop module for example. It can also be useful because it ensures that you do not permanently need to ensure that the track signal is correctly poled.

IMPORTANT: In the case of neighboring booster sections, this option is only to be activated for one of them, else both of them would be reversing the polarity, resulting in a short circuit.

Short circuit detection

With this option, you can increase the reaction speed of the short circuit detection of the booster track output. This can especially make sense when using systems in track N.

Auto inversion speed

Here you can change the reaction time for the automatic reversing of the polarity. Our long-term tests have shown that auto inverting values of under 15 (very fast polarity reversal) and exceeding 200 (very slow polarity reversal) can cause difficulties. We therefore recommend that you retain the standard setting of 20 and that you only change this value should there be conflicts.

Default values can be used to restore the factory default settings in the dialogue window input fields.

The values of the input fields are transferred to the booster by pressing the **Write** button.

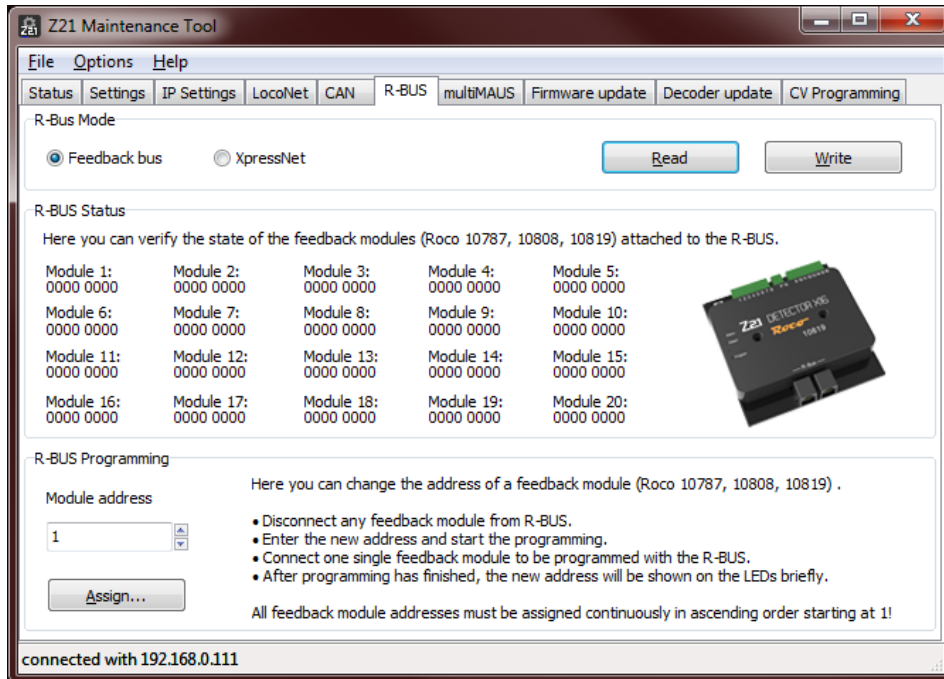
Read is used to read and display the settings from the booster.

FW Update can be used to update the firmware of the booster. In the Update Info field, the target version or information concerning the progress of the update is displayed.

3.6 R-BUS

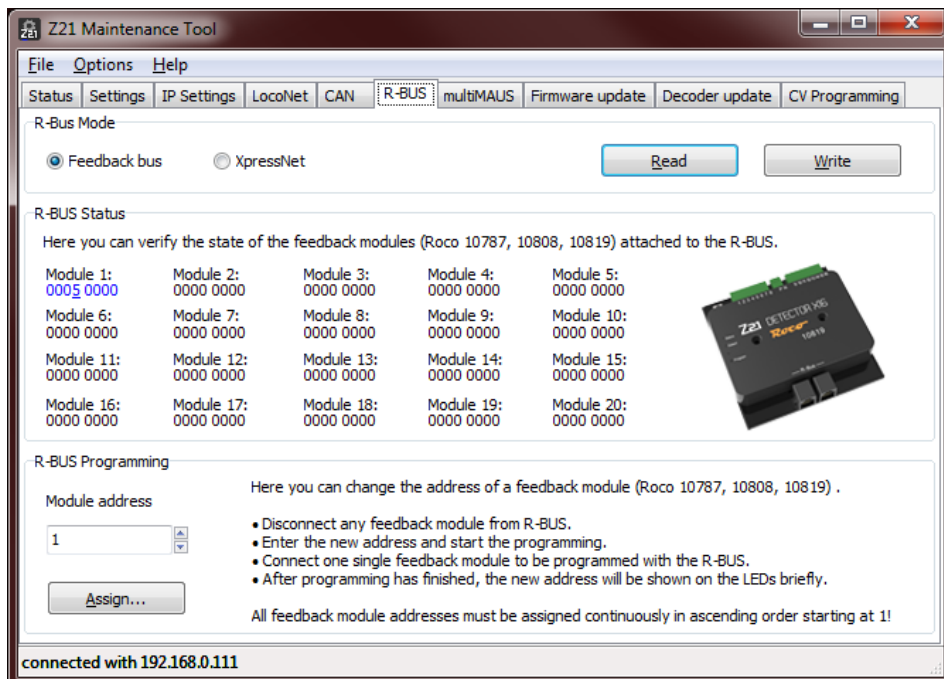
3.6.1 Feedback BUS

From Maintenance Tool V1.02 you can view the current status of the inputs of your feedback modules (Roco 10787, 10808 and 10819) as well as assign a new module address to individual feedback modules.



An active feedback input is displayed as an underlined number on the corresponding input on the module in question. A non-active input is shown as '0'.

In addition, status changes of a module are displayed in blue for easier detection.

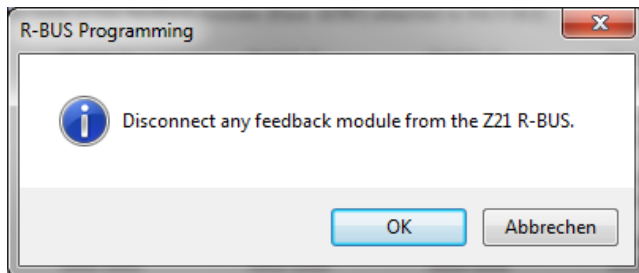


Example with activated input 5 on module 1.

As already mentioned, the module address of a feedback module (Roco 10787, 10808 and 10819) can also be changed here. It is important here that before this process all other feedback modules are disconnected from the R-BUS on the Z21 to prevent these from also being re-programmed to the new address.

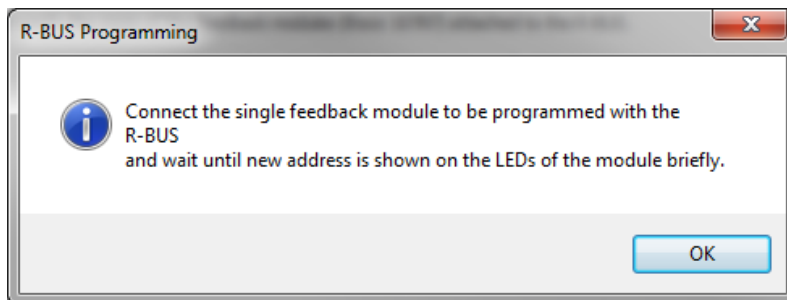
Enter the desired new module address; the permitted range here is 1 to 20. Please also note that the feedback modules are numbered in ascending order from 1 onwards. See also the operating instructions for the module. The factory setting is 1.

Then press "Programming..." and follow the dialogues.



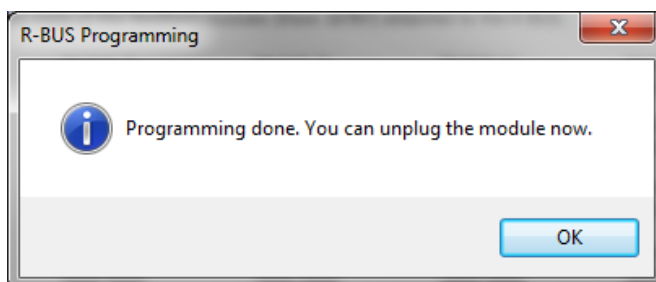
Once all modules are disconnected from the R-BUS port on the Z21, press "OK".

The Z21 then switches the R-BUS into programming mode and the next dialogue appears.



Plug the 10787 to be programmed as a single module into the R-BUS. The eight status LEDs on the module first light up in sequence. The old module address is then displayed on the LEDs and shortly afterwards the new address is shown to confirm successful programming. The address coding via the LEDs can be found in the operating instructions for the feedback module. Click "OK" in the display shown at the top first.

The following message will be displayed:

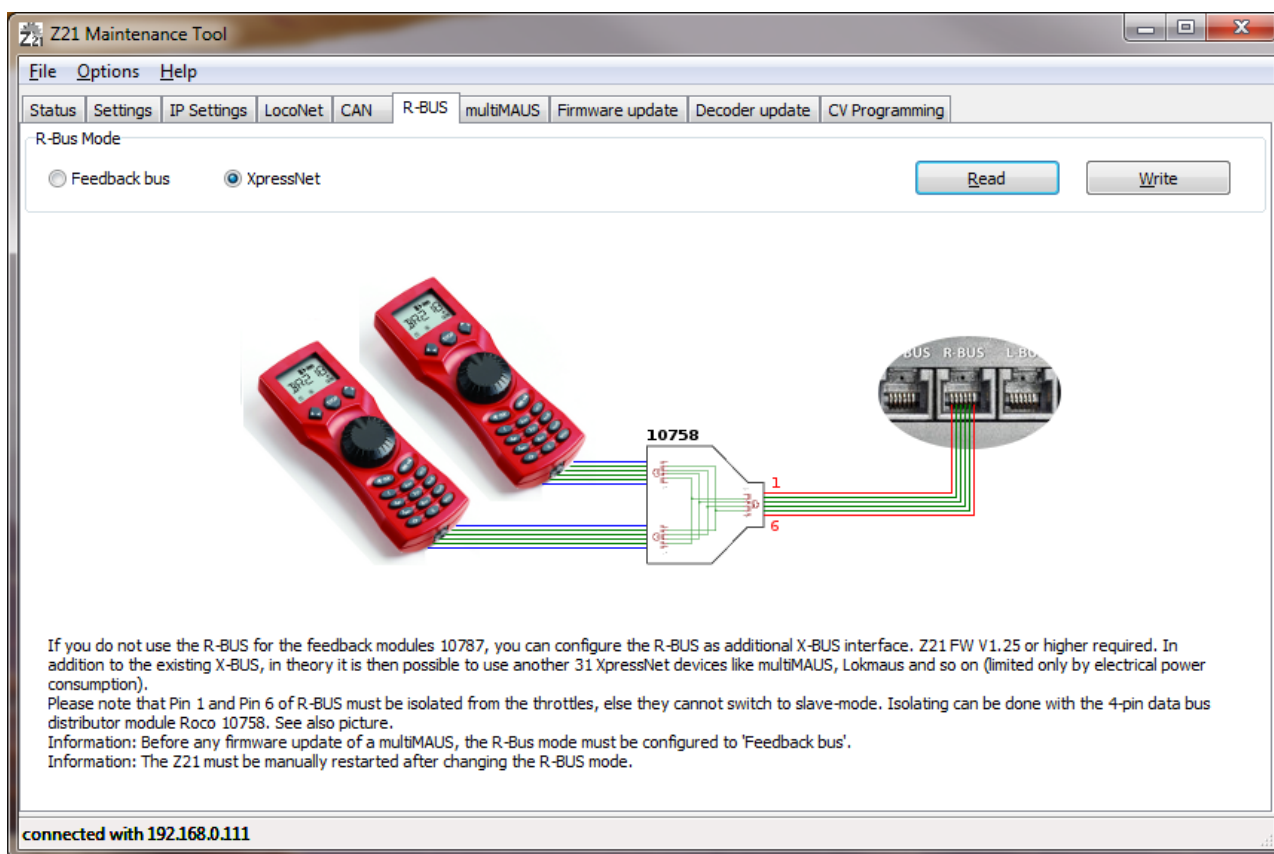


The module is now fully programmed and can be disconnected.

After closing this last dialogue, programming mode on the R-BUS is exited and the system changes to normal mode. You can now re-connect all feedback sensors to the Z21.

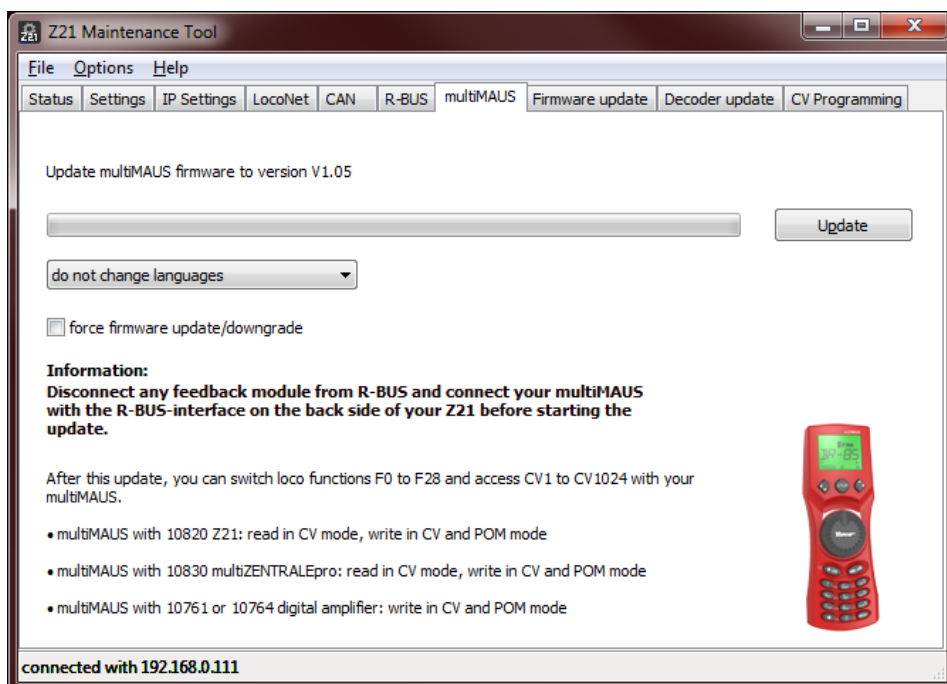
3.6.2 XpressNet

If you are not using feedback sensors on the R-BUS and if at the same time the existing X-BUS is not adequate for your requirements, from [Z21 firmware V1.25](#) as an alternative you will be able to use the R-BUS as a further X-BUS with the XpressNet V3.6 protocol. This could be useful at modular group meetings with more than 31 X-BUS handheld controllers, for example.



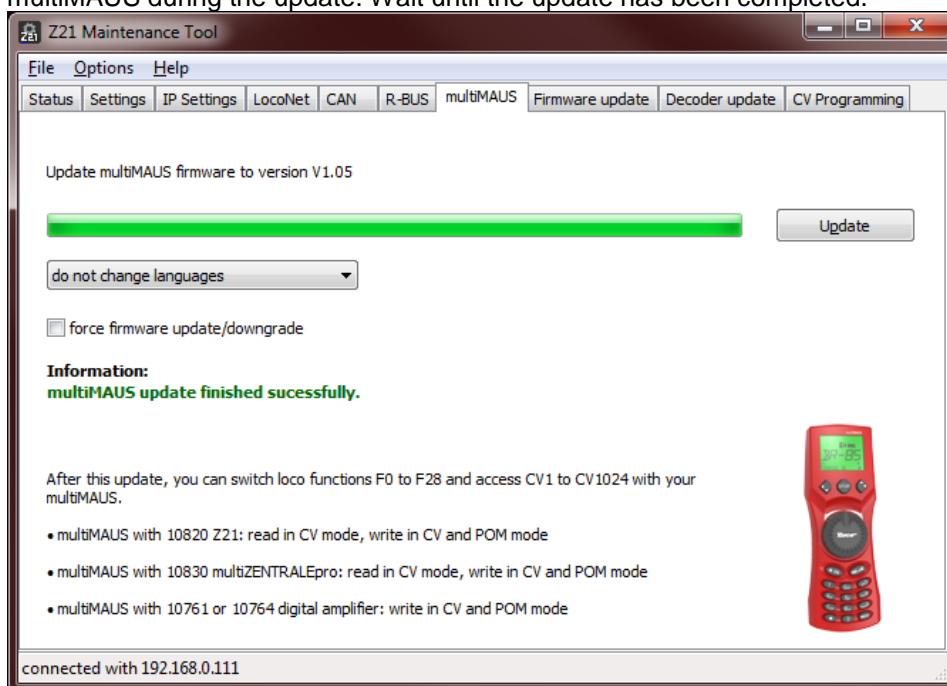
Please carefully read through the information relating to Pin1 and Pin6 in the dialogue window as well as the note on the firmware update for the multiMAUS.

3.7 multiMAUS Update

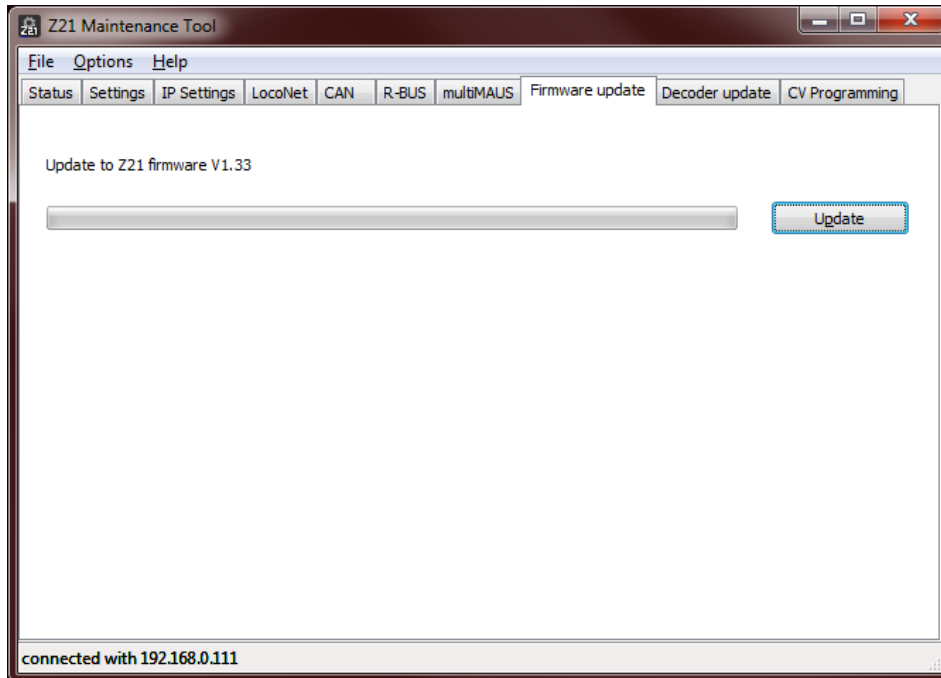


Here you can update your multiMAUS (Roco 10810, Fleischmann 686810) to the latest firmware version. With this new firmware you can also use the multiMAUS to switch loco functions F0 to F28 and access CV1 to CV1024 (previously only F0 to F20 as well as CV1 to CV255).

With the firmware update, you can either leave the languages on your multiMAUS unchanged or alternatively choose one or six language packages, each including four languages. Then connect the multiMAUS to the feedback bus as a single device (R-BUS port) and click "Update". Do not unplug the multiMAUS during the update. Wait until the update has been completed.



3.8 Firmware Update

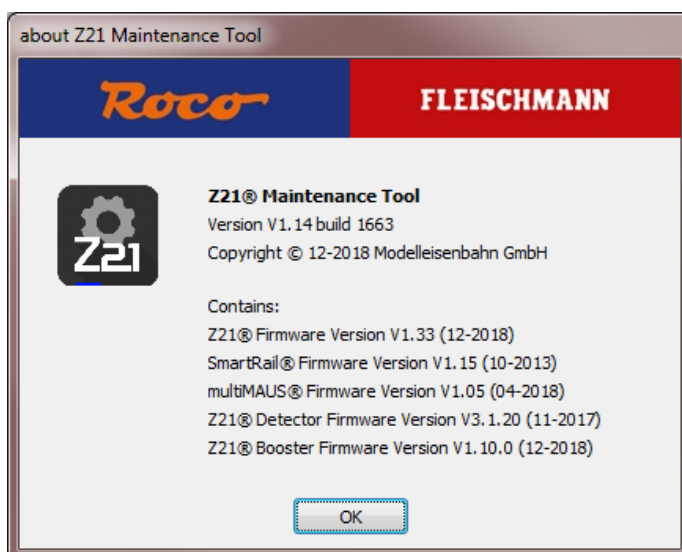


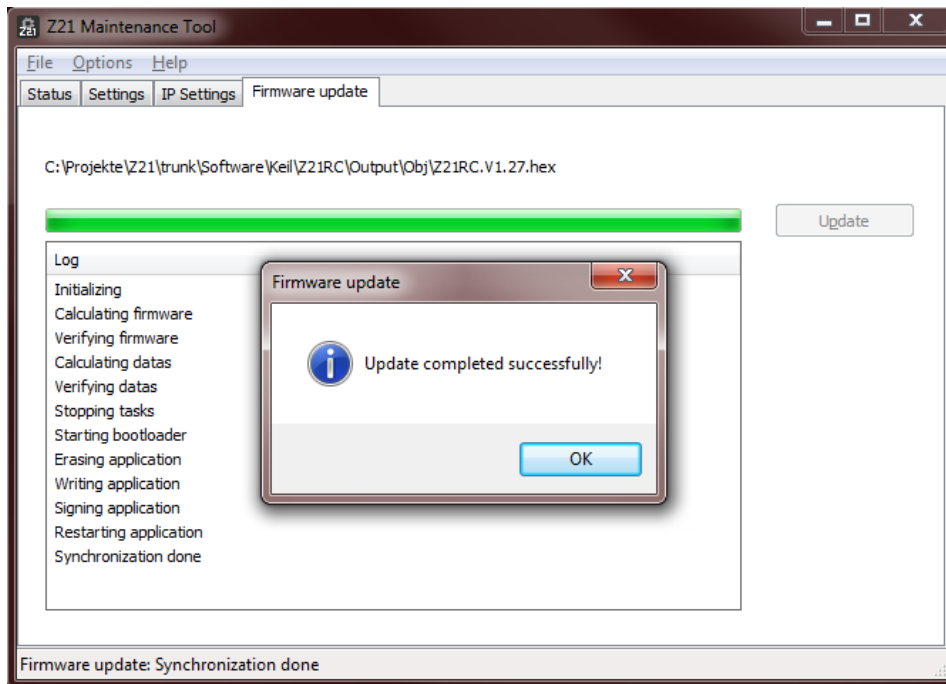
The firmware on the Z21 or smartRail can be updated here (depending on which device is connected to the PC; automatic detection)

Z21 firmware V1.33, smartRail firmware V1.15, multiMAUS firmware V1.05, feedback module 10808 firmware V3.1.20 as well as booster 10806 and 10807 firmware V1.10.0 are already included in Z21_Maintenance.exe V1.14. This means that nothing needs to be downloaded in addition for the firmware update.

Future firmware updates will be included in new versions of the Maintenance Tool.

The information about the included firmware versions can be found in the Help – About menu:





After the FW update of the control centre.

If a connection problem occurs during the update, or if anything goes wrong for any reason, this is still not normally an issue. You can restart the update. (Note: The control centre can log on with FW V1.0x if necessary following a failed update).

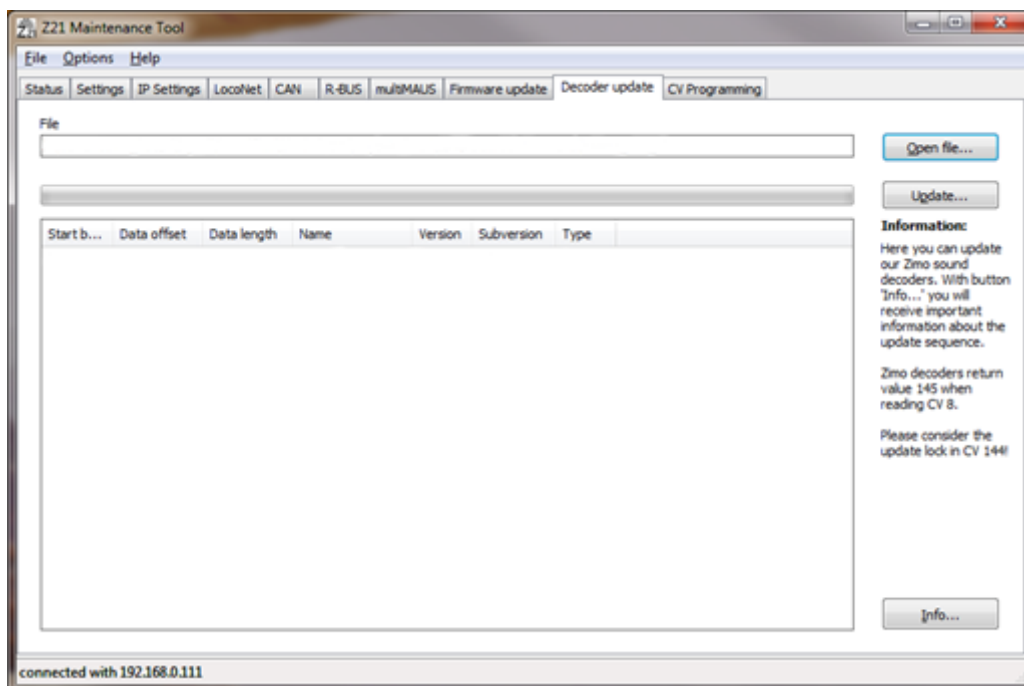
Following a failure, the best option is to cold start the Z21, then give Windows enough time until the network port is ready again (icon at the bottom right of the task bar, ping as necessary) and then run the firmware update again.

In the event of repeated problems, we recommend using a direct cable connection instead of wireless if possible.

3.9 Decoder Update

The *Decoder Update* feature is intended solely for the Zimo decoder. This feature can be used to import both *Decoder* updates (file extension "zsu") as well as *Sound* updates (file extension "zpp"). Please ensure excellent contact from the Z21 to the decoder. A direct cable connection from the PC to the control centre is also recommended to avoid wireless network problems of all types.

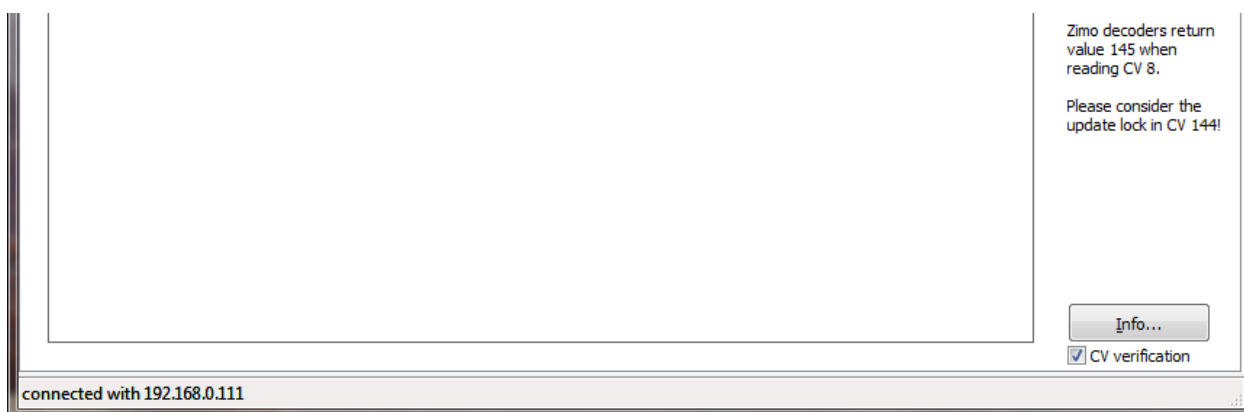
Also observe the notes from Zimo in the relevant decoder manuals.



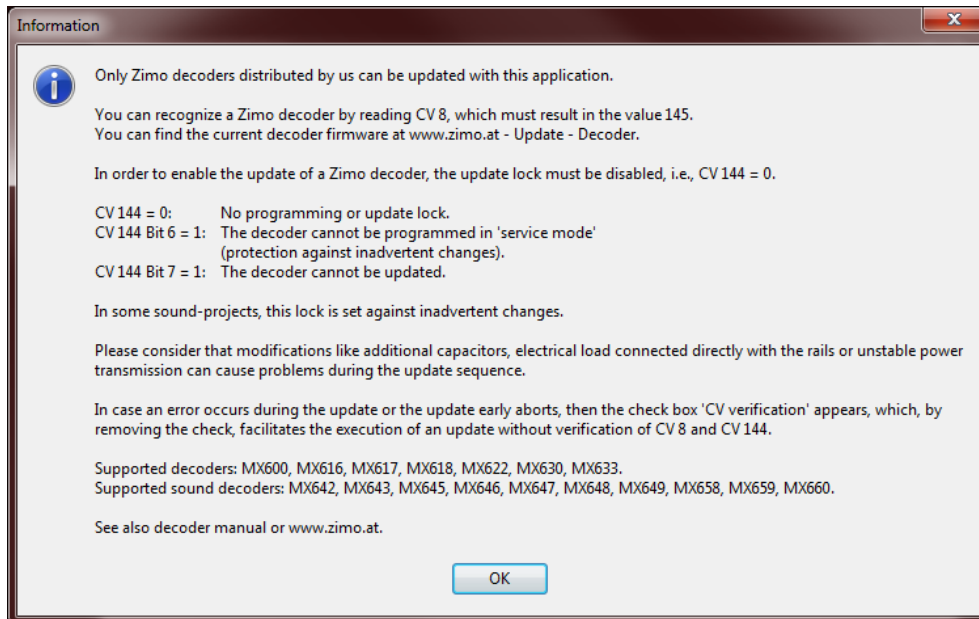
Only Zimo decoder types sold by Roco can be updated – both decoder firmware and sound projects.

The Zimo firmware must first be downloaded from Zimo (www.zimo.at – Update – Decoder) and unzipped on the PC.

The same applies to sound projects; these must first be downloaded and unzipped from Zimo (www.zimo.at – Update & Sound – Sound database).



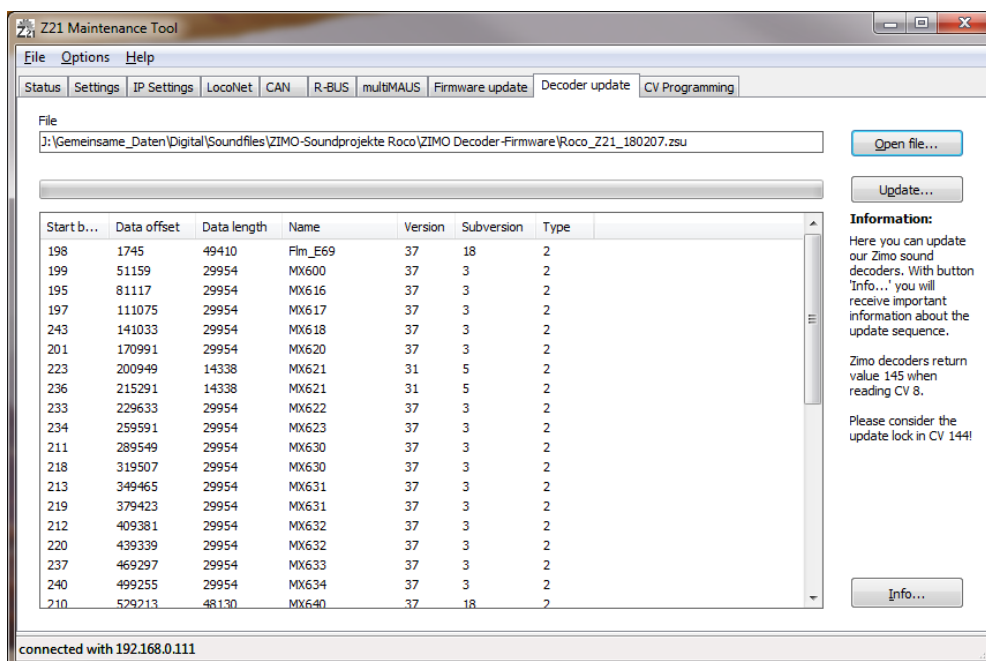
If there are any CV read problems during the check, this can be circumvented by deactivating the "**Read CV**" checkbox.



Please also note the Zimo update lock in CV144

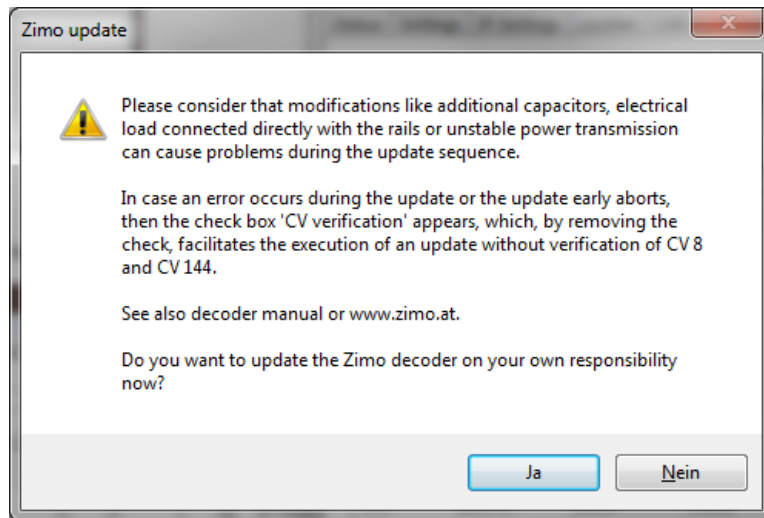
Dialogue on "About..." button

First select the Zimo firmware file already downloaded and unzipped.



The list shows which decoders are included in this Zimo firmware file. The decoder is automatically detected and selected during the update. Note: The list looks a little different for sound updates.

For an "Update..." there is again the compulsory disclaimer.



TIP:

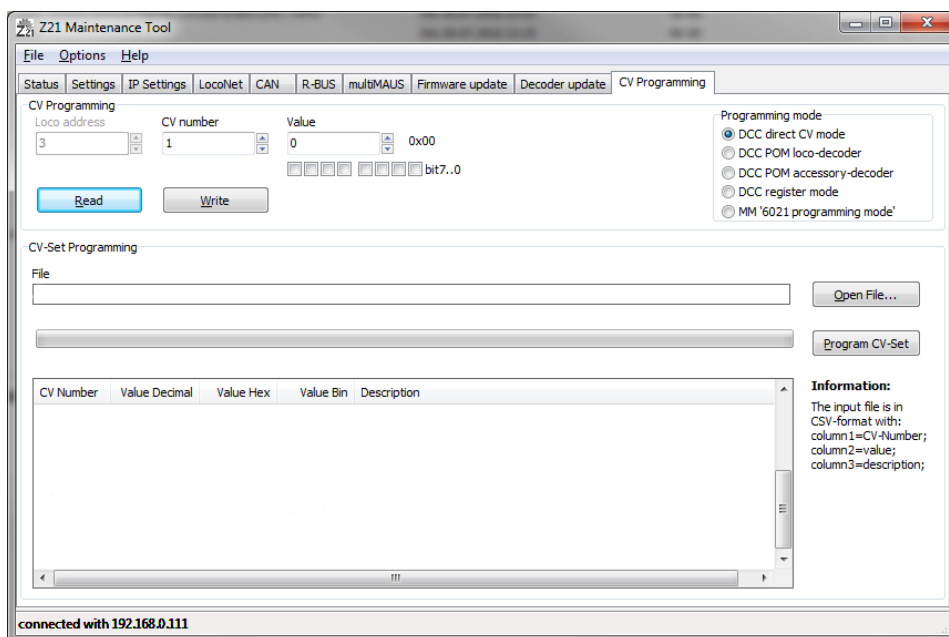
If the decoder update fails, check the contact with the decoder and try again. If the event of persistent problems, try plugging the decoder into another loco if possible. It may well be that it works better on another loco PCB (capacitors, etc...). Also check the content of CV144 (About button).

3.10 Program CV

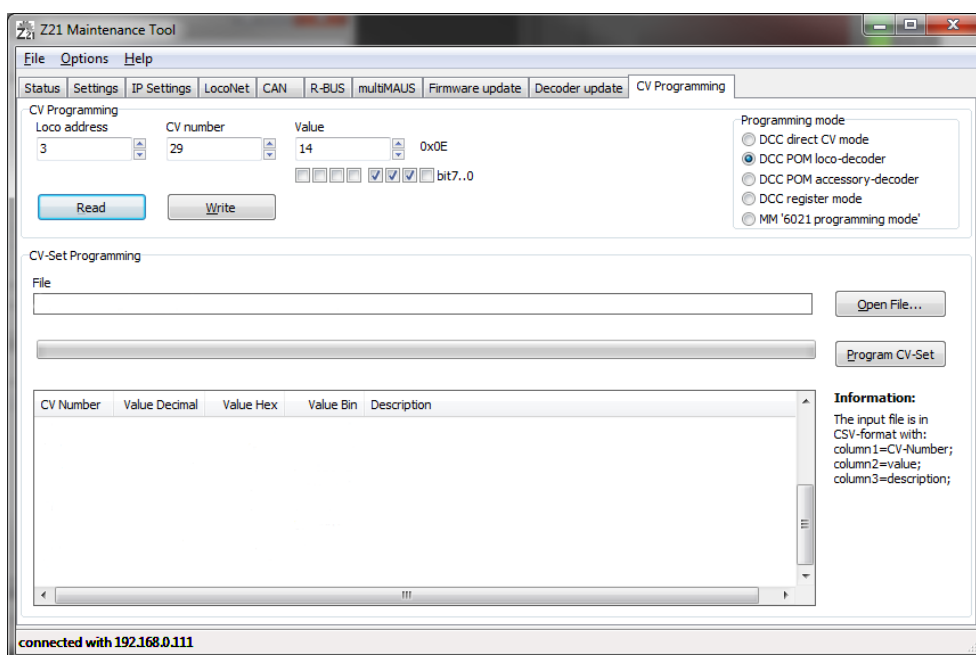
The "Program CV" dialogue is displayed from Z21 firmware V1.22.

3.10.1 Programming DCC decoders

On this dialogue you can program the CV of loco and switching article decoders – both on the programming track in **DCC direct CV mode** and on the main track (POM "Programming on Main").

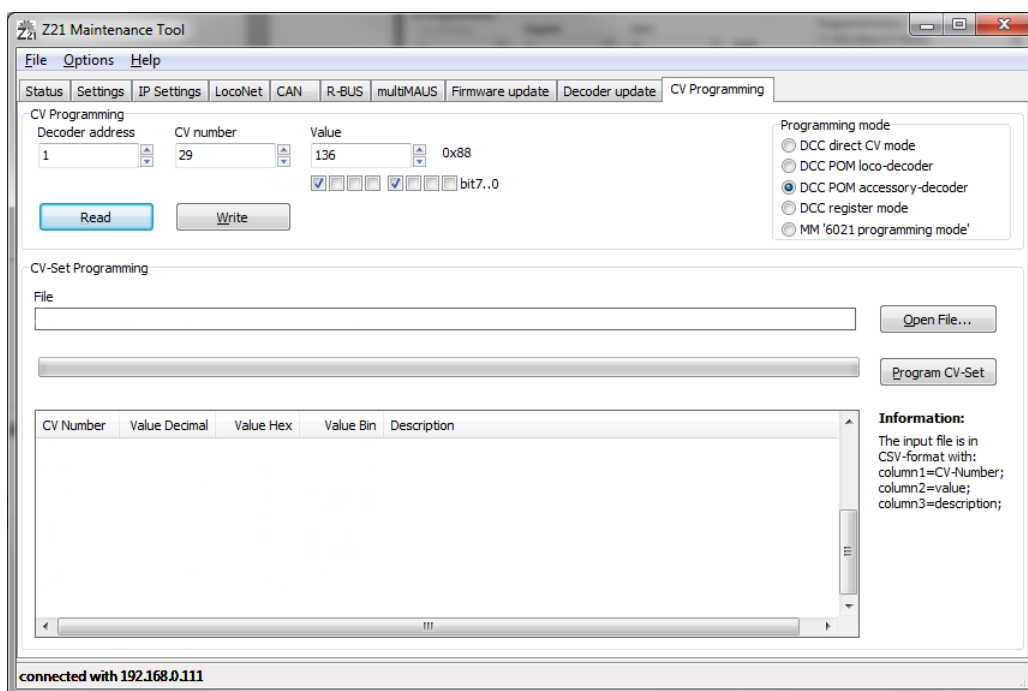


By selecting the **DCC POM loco-decoder** option, it is also possible to write the CV on the main track (POM) and even export the CV if RailCom is activated both on the Z21 as well as on the RailCom-compatible decoder (normally CV28=3 and CV29 bit 3=1, see also decoder instructions). With main track programming, the address of the decoder being programmed must be specified.

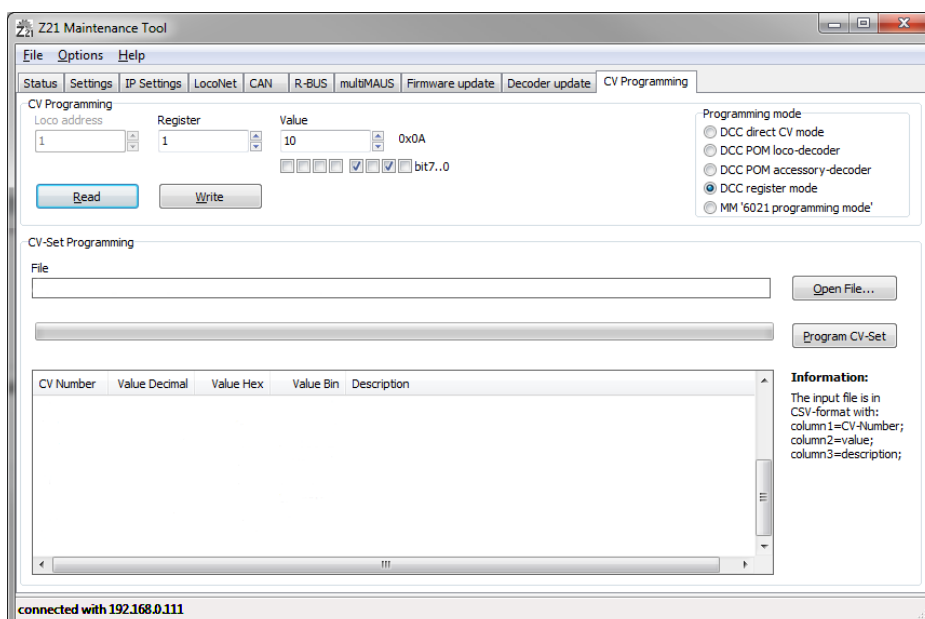


Some modern switching article decoders (turnout decoder) also permit CV programming on the main track (see also decoder instructions). The latest turnout decoders even permit the export of the CVs on the main track using RailCom. To do this, RailCom must be activated both on the Z21 and in the RailCom-compatible decoder (e.g. ESU SwitchPilot CV28=6 and CV29 Bit 3=1). For programming the turnout decoder, select the **DCC POM accessory-decoder** options.

It is now necessary to know the address of the decoder. The *decoder address* should not be confused with the *turnout number*. Up to four different turnouts are actuated under one decoder address. To visualise the assignment for you, the corresponding turnout numbers are displayed automatically in the dialogue under the selected decoder address.

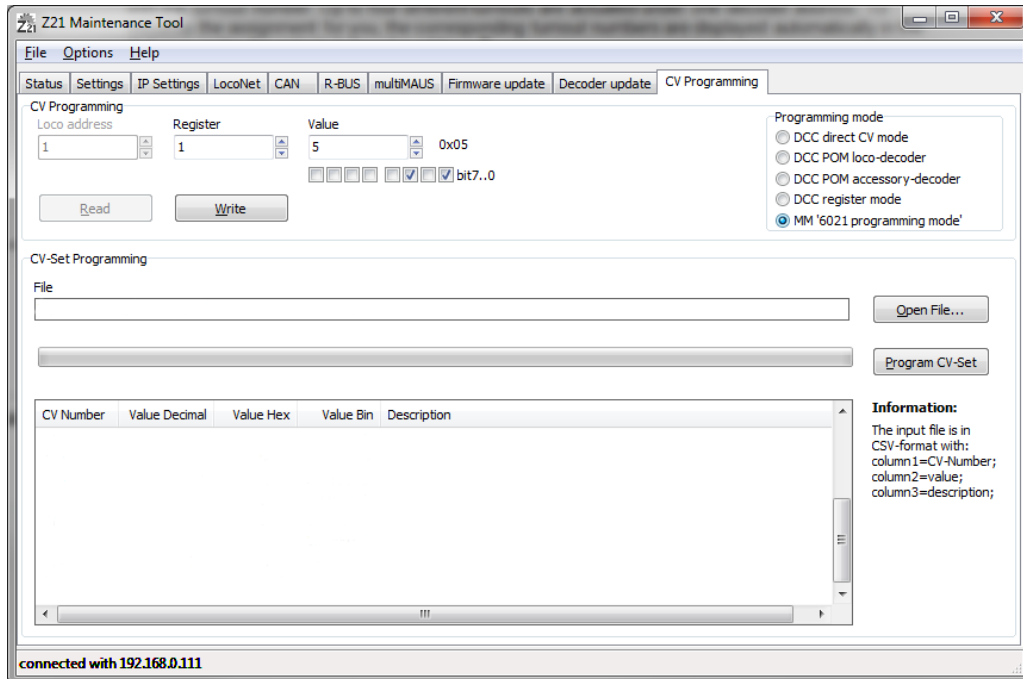


Very old DCC loco decoders do not have any CV programming in "DCC Direct CV mode". So that you can also program these decoders, [from Z21 firmware V1.25](#) programming in what is known as **DCC register mode** is integrated.



3.10.2 Programming MM decoders

From Z21 firmware version V1.23, you can also select **MM '6021 programming mode'** to program modern **Motorola decoders**.



The programming of Motorola decoders was not intended in the original Motorola format, however. For this reason, there is no standardised and binding process for programming Motorola decoders.

For programming Motorola decoders, what is known as the "6021 programming mode" introduced later on has been implemented on the Z21. This permits the writing of values, but not exporting. In the same way, the success of the write operations cannot be checked automatically.

This programming process works for many decoders from ESU, Zimo and Märklin, but not necessarily for all decoders. For example, Motorola decoders cannot be programmed with DIP switches. Unfortunately we do not have any details on the part of the decoder manufacturers on which of their decoders support this programming process and which don't.

The permitted range for CV numbers is 1 to 79. Some decoders only accept CV values from 0 to 80, other values from 0 to 255. For more info, see the relevant decoder description.

For multiprotocol decoders, DCC CV programming is very much recommended due to the greater range of options!

3.10.3 Programming CV-Sets

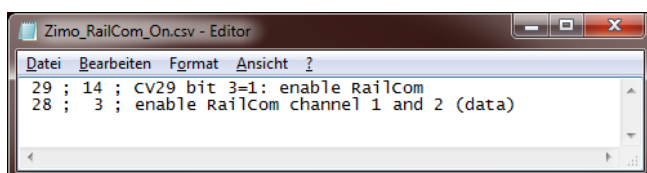
The **CV-Set Programming** option can be used to automate frequently used programming sequences. Here's how it works: Using a basic text editor you can create what is known as a CSV file. Each row then corresponds to a CV write command and has the following format:

CV number ; Value ; Description

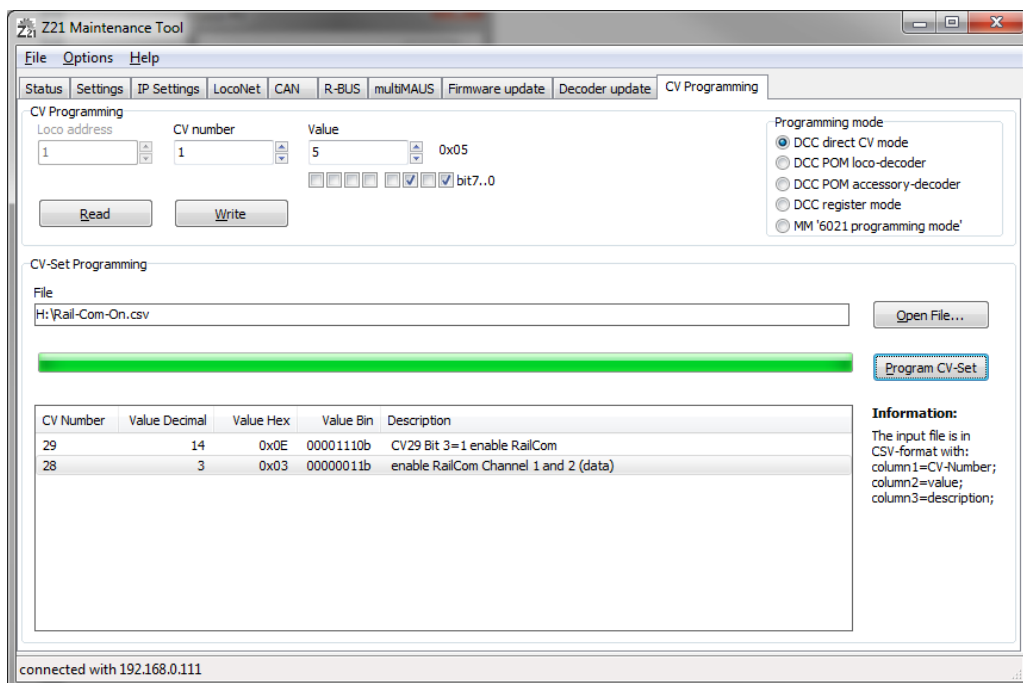
Enter *CV number* and *Value* as decimal figures. The *Description* is any text. Separate each entry with a semicolon. Empty spaces are permitted. Advanced users can also specify the desired value in hexadecimal notation if preferred (e.g. **0x1C**).

Example for activating RailCom on a Zimo decoder:

```
29 ; 14 ; CV29 bit 3=1: enable RailCom
28 ; 3 ; enable RailCom channel 1 and 2 (data)
```



Save the file in the editor with the extension *.csv. Then select that same file in the Z21 Maintenance Tool.

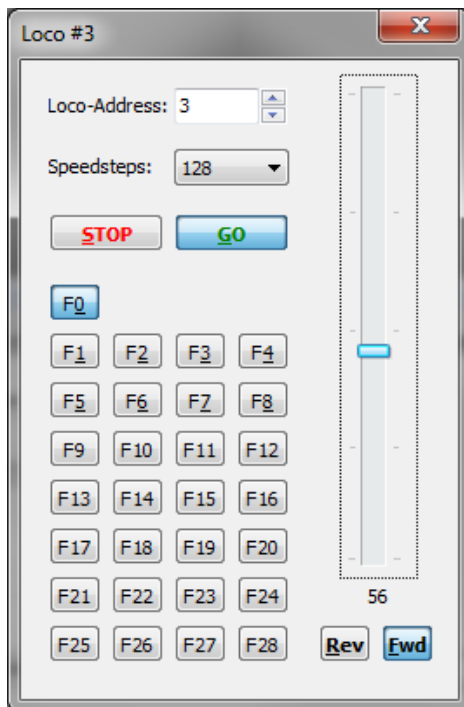


Clicking "Program CV-Set" will write this programming sequence to the loco decoder.

3.11 Loco Controller

If you want to try out your changes to the decoder CVs straight away or simply want to control a loco via the PC simply as a test, you can do this via the loco controller. It is even possible to use multiple controllers simultaneously with different loco addresses.

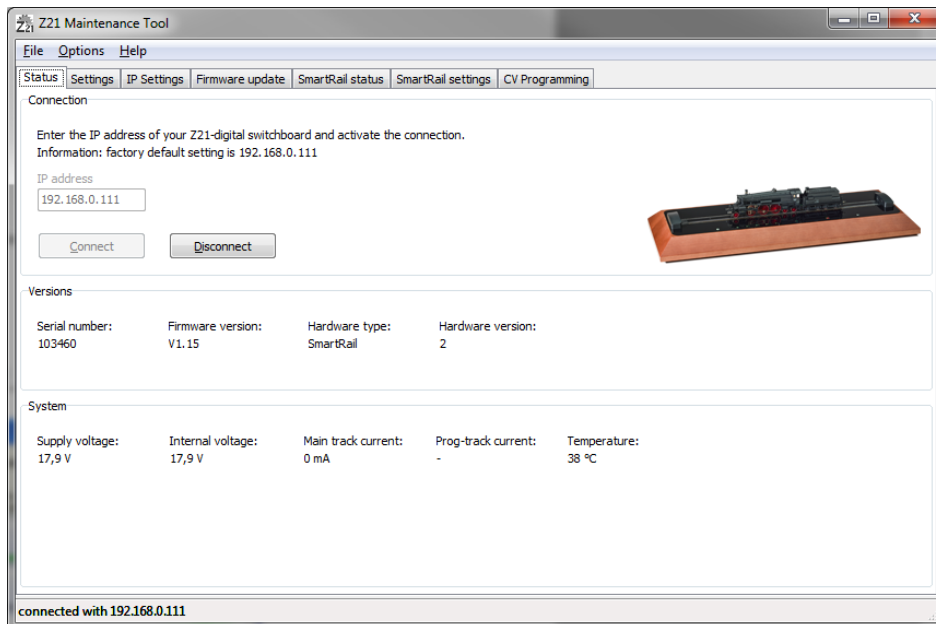
The loco controller is opened in the Z21 Maintenance Tool via the main menu → Options → Loco controller.



You can then enter the desired loco address on the controller. It is also possible to regulate the set speed steps of the loco and to change them. When you send a drive command or a function to the loco, the set speed steps are saved on the Z21.

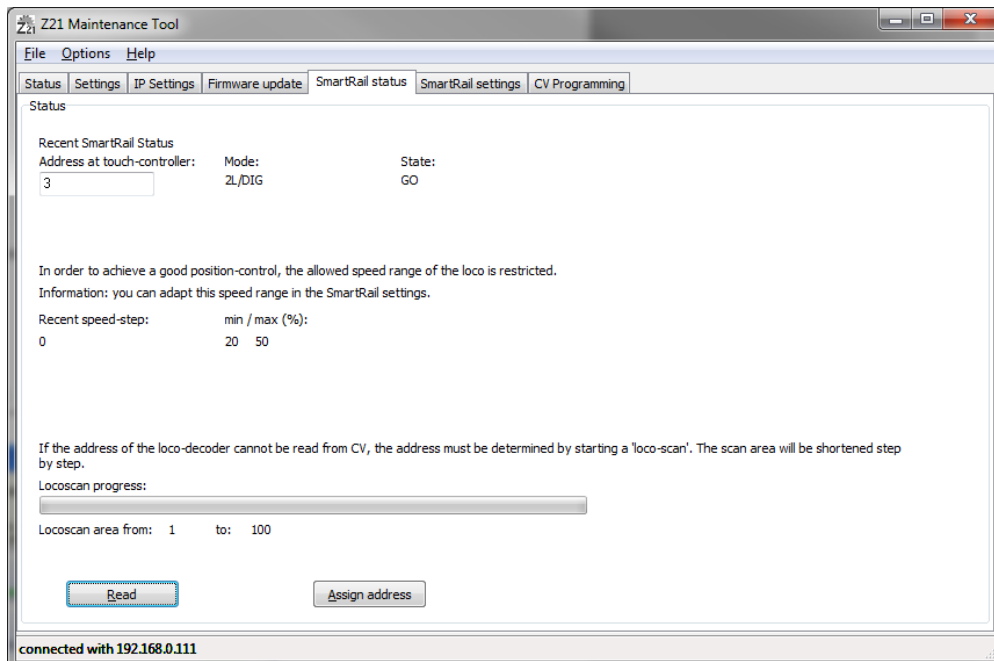
The loco can be operated with the PC mouse and the keys R, F, S, G and 0 to 9. The speed can be changed via the cursor keys.

3.12 smartRail



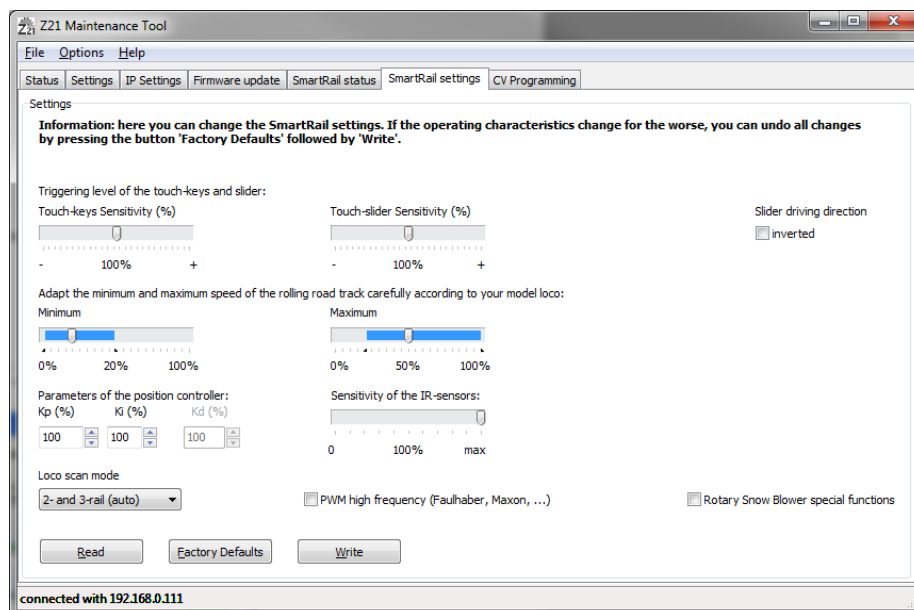
The Z21 Maintenance Tool automatically detects the type of hardware it is connected to. With smartRail, two additional tabs are displayed that are described below.

3.12.1 smartRail Status



The current operating status of your smartRail can be imported here. In addition, the touch user interface can be assigned a specific loco address (only in "GO" status).

3.12.2 smartRail Settings



Here the user can make various fine adjustments for smartRail, such as the touch sensitivity, as required.

If the drive characteristics become poorer as a result, all changes can be reversed by clicking "Factory settings", followed by "Write".

New from smartRail firmware V1.14 are the options that can be used to reverse the occupancy of the slider for the "forward" and "backwards" **driving direction** and restrict the **Loco scan mode** for your own collection. This normally makes the scan process slightly faster, and there are fewer potential sources of error. There are the following setting options:

- **2- and 3-rail (auto):** An attempt is made to detect both digital 3-rail locos (MM II, DCC) and digital (DCC) and analogue (PWM) 2-rail locos automatically. This is the default setting for smartRail.
- **3-rail only:** The scanning process for 2-rail locos is omitted.
- **2-rail only (DCC, PWM):** The scanning process for 3-rail locos is skipped. An attempt is made to detect automatically whether there is a digital or analogue 2-rail loco on the smartRail.
- **2-rail DCC only:** The scanning process for 3-rail locos and analogue 2-rail locos is skipped.
- **2-rail PWM only:** After measuring the loco length, the system changes immediately to analogue 2-rail mode (PWM).

Analogue locos are controlled on the smartRail using low frequency pulse width modulation (PWM). The low frequency is essential due to interference suppression capacitors installed in the analogue locos. Depending on the model and manufacturer, these capacitors may be of different sizes and can result in unnecessarily high power consumption and excessive heating at high frequency. Low frequency PWM is not suitable for **coreless motors** (e.g. from Faulhaber, Maxon, ...). The new **"PWM high frequency"** option has been added so that you can also operate your high-quality models equipped with coreless motors on the smartRail. **Note:** This feature is in the test phase and is expressly not recommended for analogue locomotives with conventional DC motors.

New from smartRail firmware V1.15 is the "**Rotary Snow Blower special functions**" option. If this option is activated, an advanced loco scan is performed to detect the Beilhack snow blower. If a snow blower is detected, special handling of the touch function keys F0 and F4 is activated.

A short press of the F0 key activates the normal front lights as usual. A long press of the F0 key will switch on the step lights for around two seconds. After a further two seconds, the rear red warning lights are activated.

The F4 key is used to start rotating the coachwork. This is only possible with speed step 0. During the rotating process, the conveyor is braked to prevent uncontrolled movement due to the geometry change in the model being monitored.