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*Uw partner in Modelspoortechniek*

# DTS Tutorial:
# Dinamo RS485 Network



Dinamo is a product from VPEB

# www.domburgtrainsupport.nl

# Content

# Introduction

Dinamo is known for its stability and enormous network capacity. Whereas conventional digital systems soon must deal with a "ceiling", a limitation in the number of trains and accessories that can be controlled simultaneously, Dinamo is not bothered by this. This is due to its internal communication structure based on RS485. The structure consists of two types called the Data and Clock.

In this Tutorial we will talk about the operation and the correct connection and termination of the Dinamo communication network.

If you have any questions or comments, you can post them by sending an email to info@domburgtrainsupport.nl

Best regards,
Martin Domburg

# What does Data means?

The data network is a two-wire communication link between two modules over which (bidirectional) data can be transported in two directions. The Dinamo system uses the RS485 principle, without going too far into the technical details:

The data network ensures that the TM44 and OC32 modules can communicate with the central RM-C. The RM-C, for example, gives assignments that it receives from the software to the modules. And the modules tell the central unit what happens on the layout.

### TTL, RS232 en RS485

Especially the users of Dinamo Classic know the protocols, they were part of the predecessor of the RM-C called the RM-U. At this exchange the user had the choice to communicate with the other modules via three protocols.

TTL was often used when the modules were mounted together in a system cabinet. The disadvantage of TTL was that the length should not be longer than 1 meter. RS232 (also known as a serial network) was more efficient but also had a limitation, it communicates only unilaterally. RS485 is the most efficient, long distances are possible and it also offers two-way communication. Nowadays all Dinamo modules only have RS485. Old Dinamo modules must then be converted to RS485 to be part of this network.

# What does Clock means?

The clock network is just as important as the data network. The clock network is a synchronization network that runs along all TM block cards (TM-H and / or TM44) modules. This network has the task to synchronize all modules so that each command is executed exactly at the same time. If this did not happen, trains would start to show strange behaviour if it travels from a block of one TM card to a block of another TM card.

The synchronization is led by 1 TM module in the network, called the Master module. The other TM modules are slaves and therefore listen to the Master module. That is why there can only be 1 Master module in the network.

# How is the network structured

Basically, a simple matter of looping through. An RS485 network can be 1000 meters long, in terms of data traffic it has enough capacity for a full Dinamo system. The only point of attention in the design is that it allowed to make a branch of the network up to a maximum of 1 meter long!

There are several forms within Dinamo to build the network. For this I used pictures from the manual RM-C from VPEB. On these images you can still see the old OC32, which has since been replaced by the OC32NG which, just like the TM44, has RJ45 terminals to carry out the network with network cables. Nevertheless, the images are still relevant because many of the old OC32 modules are still part of the current systems. It also shows nicely in the picture why branching can be useful.
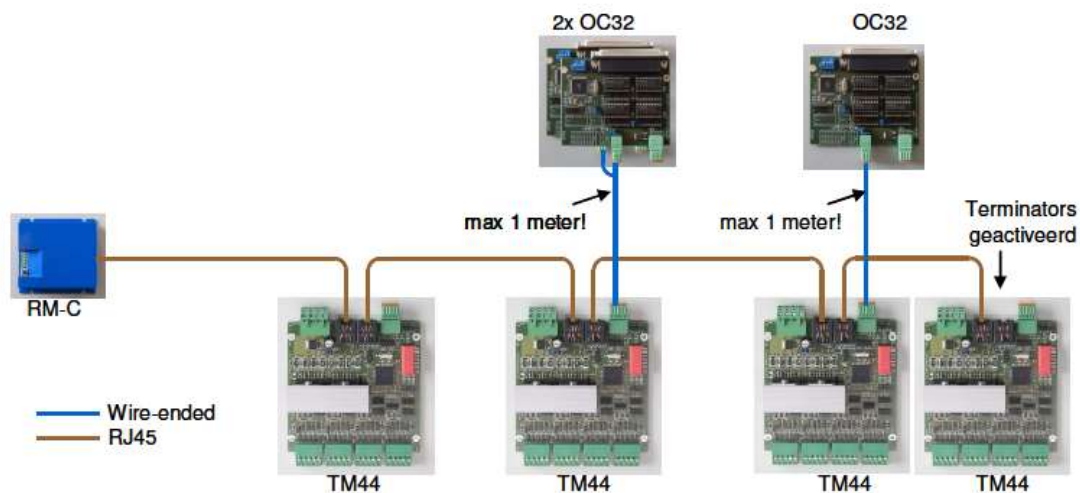


Here you see the standard structure of the system, the RM-C is at the beginning of the network. By using a network cable, you can easily connect the TM44 and OC32/NG modules. The Data network and Clock network are then transported in that network cable.

The OC32 modules, unlike the OC32/NG (Next Generation), do not have an RJ45 connection to loop through with network cables. With this you must wire the data network yourself from the 5-pin connector on a TM44 to the 3-pin connector on the OC32. The Clock network does not have to be included because only the TM44 and TM-H uses the clock network.



*1 Network cable*

Hint:

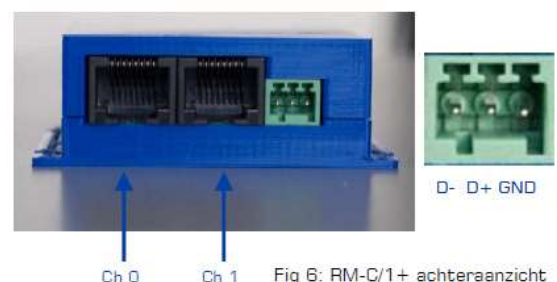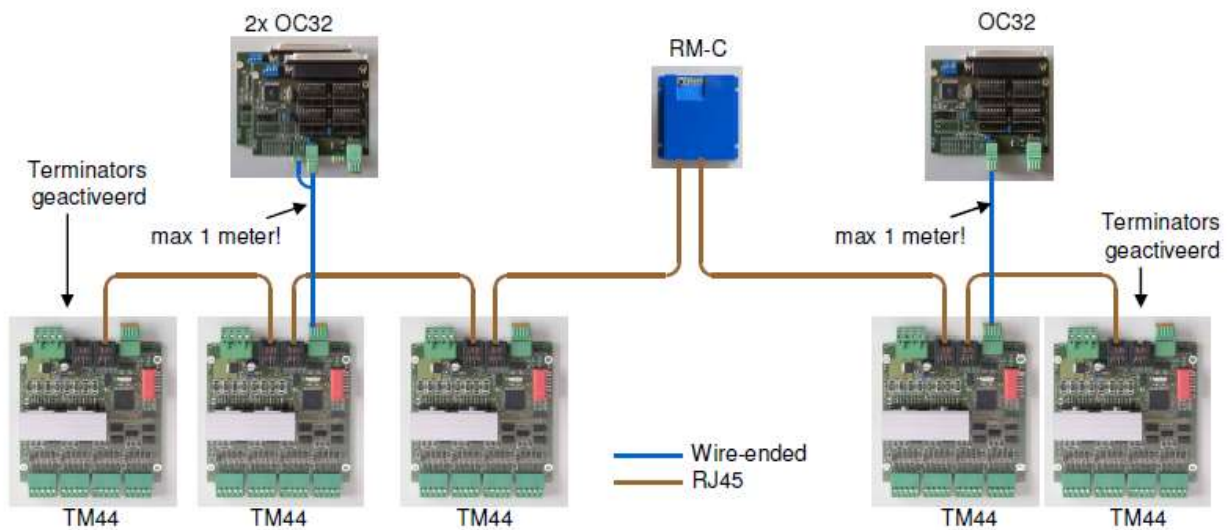Plug the network cable into the middle port of the RM-C, CH 1.

In addition, there is a possibility to run the network:



Here you are that the central RM-C is in the middle of the network. This is only possible with the RM-C/1 + because it has two ports. The RM-C/1 has only 1 RJ45 port, but you will not find this RM-C/1 quickly. Of these, at least as good as none have been sold by us, we deliver the RM / C1 + to new users as standard.

You use this method the moment you place the computer in the middle of the layout. Because we want the RM-C to be as close to the computer as possible. Please note that you must change the jumper configuration within the RM-C.

Then there is also a third method:
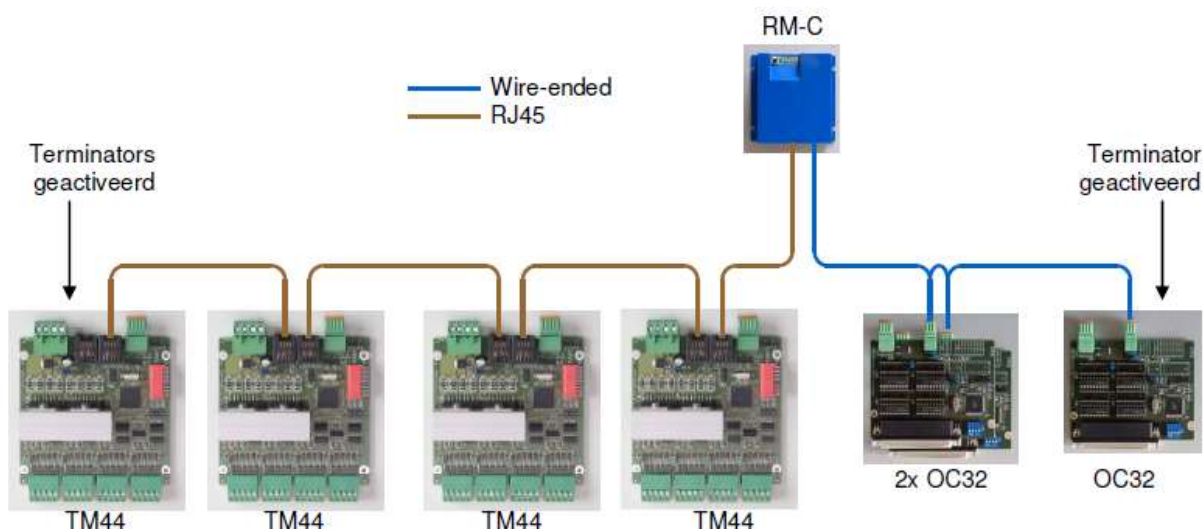


This method is useful if you want to give the TM44 modules their own network and the OC32 modules also have their own network. In that case you use Ch1 for the TM44 modules and you use the wired plug to connect the OC32 network.

Here too you need to change the configuration of the RMC/1+.

*The RM-C module has several jumpers internally with which you can change the configuration to use the ports. The standard method first described here is the setting in which the RM-C standard is supplied.*

*To change the setting, please refer to the RM-C manual that you can find at:*
*www.vpeb.nl under the section Support*

# What should I pay attention to when installing the network

When constructing the network, it is important that you keep an eye on the termination of the network, you can read more about this later.

Furthermore, you do not have to pay much attention to the way you use the network cables. However, if you use the wired ports, pay attention to the polarity of the Data network and the Clock network.

It is also important that the RM-C is placed as close as possible to the computer so that the USB connection continues to work optimally. This can function well up to 3 meters, above which there may be a chance of connection problems.

# Connecting the network to the Dinamo modules

Connecting the network to the Network connection is very easy when using network cables, just plug in one of the ports and you're done, make sure the plug gives a click when you plug it into the terminal. Which of the two terminals on the modules you use does not matter. On the RM-C you always use CH 1. This is the port in the middle of the module. CH 0 only becomes active after adjusting the jumpers in the RM-C/1+ modules

It only becomes interesting in this chapter if you start using the wired outputs. These are connected to the two rj45 terminals on the modules and offer the option of branching (up to 1 meter) or continuing the network with a Cat5e cable. Preferably use this Cat5e UTP or FTP cable for this.
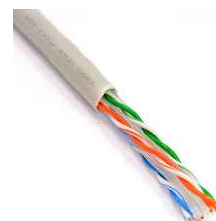
On the TM44 modules you will see the following indications for the 5-pin plugs:

| D-  | Data network -                                  |
| --- | ----------------------------------------------- |
| D+  | Data network +                                  |
| GND | Ground (is supplied by the USB cable from the PC.) |
| C+  | Clock network +                                 |
| C-  | Clock network -                                 |

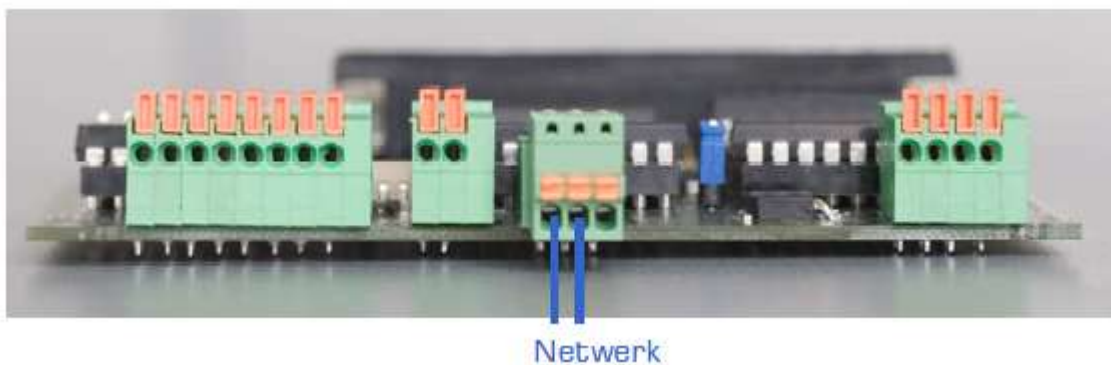On the old OC32 and the current OC32/NG modules you only see the D connections and the GND. Only with the OC32/NG does the Clock network also run via the OC32 modules, but only via the RJ45 connections.
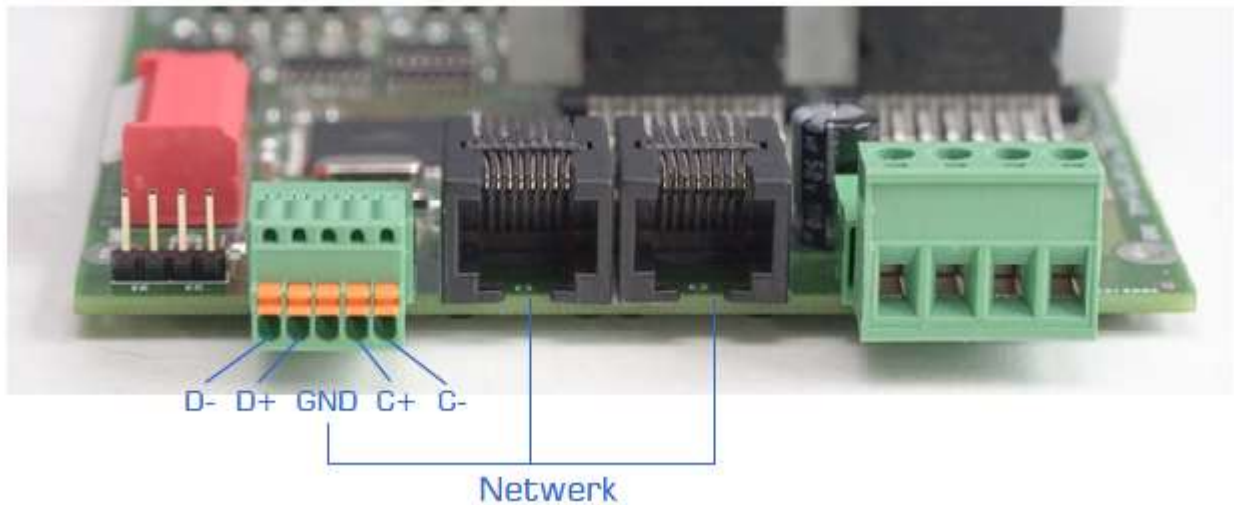


*Aansluitingen op de TM44*



*Wired connections OC32 (v.l.n.r. D-/ D+/ GND)*



*Wired connections on the OC32/NG (v.o.n.b. GND/ D+/ D-)*

# Connect OC32 directly to the PC

It is possible to connect the OC32 modules directly to the PC. In that case you create your own RS485 network for the OC32 modules. This can be wired as well as with network cables (from the OC32/NG)

In that case, wire the first module to a U485. That is a USB stick that generates RS485. The big advantage is that software like iTrain can do more with the OC32 and that you can use the OC32 in Extended mode. Instead of 16 modules, 96 modules can then be connected to the network.
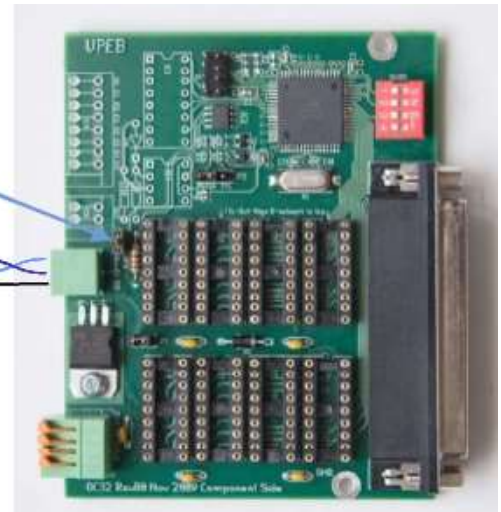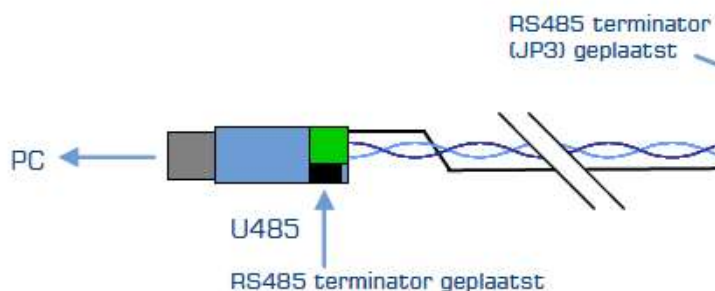


# Termination of the Data- and Clock network

Now we come to a piece of text that is not complicated but can be. A communication network over RS485 is very stable but to work properly, the beginning and the end of the network must be terminated by a 120-ohm resistor.
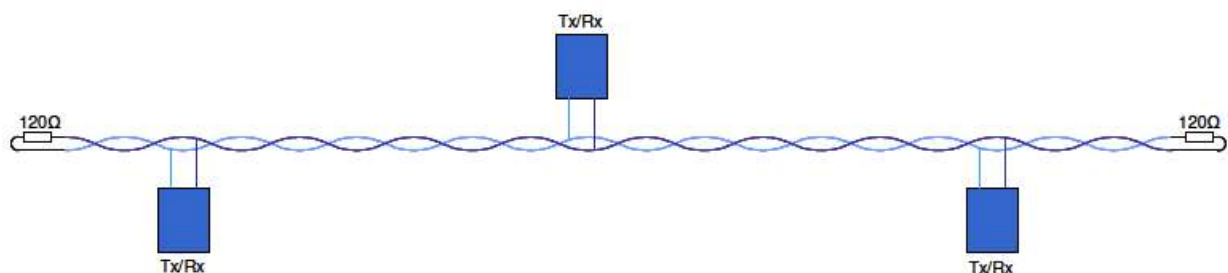


*This is how an RS485 network looks schematically with the Termination at the end, which is a technical word for closure*

The technical name for this terminating resistor is "Terminator". On the Dinamo modules indicated by TD (termination Data) and TC (Termination Clock). Fortunately, you don't have to solder resistors yourself, this has already been done for you on the modules! And as you have already guessed, the Clock network also needs a terminator.

- ➢ On the TM44 modules you can close the Data network with S7 on the Dipswitch block.
- ➢ The TM44 modules allow you to close the Clock network with S8 on the Dipswitch block.
- ➢ On the OC32 modules you can close the Data network by placing a jumper on the two pins behind the data connector
- ➢ On the OC32/NG you will find the TD1 jumper in the middle with which you can close the Data and the TC1 to close the clock network.

On the DIP switch of the TM44: Switch on ON means network closed, Switch on OFF means that the network is not closed

With the jumpers of both OC32 variants, if the jumper is placed, the network is closed, if the jumper is removed, the network is not closed
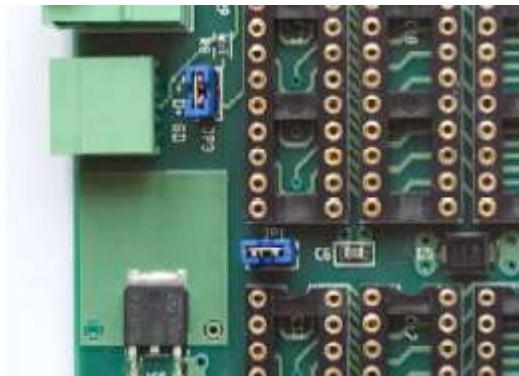


*Data Terminator JP3 op OC32*
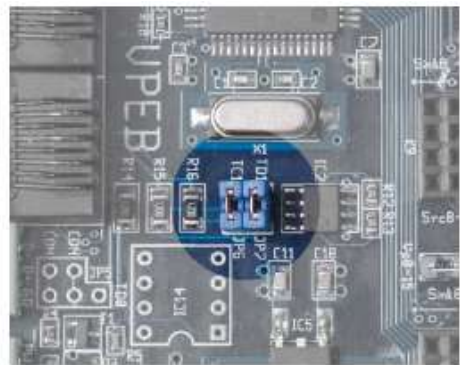


*Data Terminator TD1 op OC32/NG*

The rules for concluding the Data network are very simple:

The Termination may only be active on the first and the last module in the network

It does not matter whether that module is an RM-C, TM44, OC32, OC32/NG. If both ends are closed.

## Termination in the standard method

In the standard method discussed, the RM-C is at the beginning of the network, in the RM-C the TD and TC are active as standard. The RM-C is also equipped with a TD and TC jumper. That means the beginning, the RM-C is closed.

- ✓ All modules in the network have not activated the Termination, except the very last module in the network.
- ✓ If a TM44 is connected as the last module in that network, then you set S7 and S8 to ON
- ✓ If an OC32/NG is connected as the last module in the network, put TC1 and TD1.
- ✓ TC1 and TC2 are not placed on all intermediate OC32/NG modules
- ✓ S7 and S8 are set to OFF on all intermediate TM44 modules
- ✓ JP3 is not placed on all intermediate OC32 modules.

The OC32 (not the OC32/NG) is best branched off from a TM44, which means it can never be the last module in the network. This is because it is a branch and the Termination is not affected by that.

**Exception**

After the last TM44 you continue with the network to more than 1 OC32, so you continue the network as a network instead of a branch of a maximum of 1 meter. It is not convenient to do because it is impractical, but it is possible. Then on the last TM44 set S8 to on (TC) and S7 to OFF (TD). Then you move the TD to the last OC32 module where you place JP3. Then the TD is closed there.

## Termination when the RM-C is in the middle of the network.

In the second method discussed, the RM-C is in the middle of the network, in the RM-C the TD and TC are active as standard. The RM-C is also equipped with a TD and TC jumper.

You must remove these two jumpers. This is described in the RM-C manual.

That means that the beginning, just like the end, is not yet closed

Also, with this you proceed as with the standard method where the difference has arisen that from the RM-C you have two ends instead of a start and an end. In this case, the last two modules must be closed, and all modules in between have **not** been closed.

## Termination such as the TM44 and the OC32 each have their own network.

In the third method discussed, the RM-C is in the middle of the data network, and in the beginning of the clock network. This is because only the TM44 uses a clock network. The Data network runs along all modules, so both the TM44 and the OC32 and OC32/NG. The TD and TC are active as standard in the RM-C. The RM-C is also equipped with a TD and TC jumper.

**You only need to remove the TD jumper. This is described in the RM-C manual.**

That means that at the start of the TC is closed, the TD is not closed.

Now you make a combination of the two methods described above.

For the Clock network the RM-C is the beginning and the last TM44 the end.

For the Data network, the RM-C is a module in the network and the network starts with the last TM44 and ends with the last OC32.

# Master and slave

In the Dinamo network there must and may only be 1 module "master", this module directs the synchronization of the clock network.

If you only have TM44 modules, then you make the TM44 that is closest to the RM-C in the network master, and the rest slave.

If you use a combination TM-H and TM44 then one of the TM44 modules must be a master, not a TM-H. And preferably the TM44 that is closest to the RM-C in the network.

To make a module master or slave, use the 6th switch on the Dipswitch module, S6. In the ON position the module is master, in the OFF position the module is Slave.

From TM44 Firmware 1.21 it is possible to check the master slave via DinamoConfig in combination with DinamoConfig 1.32. Make sure the TM44 is equipped with firmware 1.21 or higher, the TM-H is equipped with firmware 5.21 or higher and install DinamoConfig 1.32. Then proceed as follows in DinamoConfig once the RM-C has recognized all modules. The orange LED lights up continuously on all modules.

1. Open DinamoConfig
2. Select the Compoort
3. Click on "Reset Fault"
4. Click on "Status"
5. Check whether the system has seen all TM44 modules and that they are all equipped with firmware 1.21 or higher
6. Exit the status menu and go to the left tab
7. Select the text "All_TMxx" in the drop down
8. Click on "check MS" in the bottom right
9. You will receive a pop-up stating whether the Master / slave configuration is correct
10. The pop-up asks if you also want to check the clock network, click on OK.
11. The pop-up now indicates whether the clock network is OK.
12. Close DinamoConfig again

If the MS test is not satisfactory, you probably indicate that the master is missing or that there are several masters in the network. Then change the configuration, restart the system and perform these steps again.

* The firmware update is described in the manual TM44, possibly we can do this for you with our DTS Update Service.

# Inspection of the Data- en Clock network

It is possible to check whether the Data and the clock network are properly configured. The Clock network is discussed in the "Master and Slave" chapter and is part of the MS Check.

The data network is somewhat more difficult, at least not really. Because if something is not right then the network simply does not work. There is a good chance that the polarity will be wrong somewhere if you have wired it, the addressing may be wrong, the termination may not have been performed correctly, or the network cables may not be inserted correctly.

First, it is important that you see a blue LED on the RM-C, which means that the computer sees the control panel and can communicate with it. If you don't see it, your computer will miss the FTDI drivers. If so, please contact us, we can assist you from a distance.

The moment the USB connection is established, the RM-C will receive power and it will scan the network for existing modules. You will see a yellow LED flash very fast on the RM-C. As soon as you have put the voltage on the modules, you can see that the modules sometimes also briefly light up the orange LED. That is very short and almost invisible, but when you see it, that is the first sign that the network is good.

After the control panel has seen all the modules and confirmed that they are present, awake and fresh, the orange LED lights up on all modules, so also on the RM-C. This means that the RM-C sees the module and the communication is in order.

If you then request the status in DinamoConfig you will see that he has found all modules. If he now misses a module, something is wrong there. The first point of attention then is: Is the voltage on that module? Otherwise something is wrong with the addressing, firmware is outdated, or the data plug is not properly inserted.

# Epilogue

I have written this tutorial for general use. You do not have to pay for this manual and it can be downloaded free of charge on our website. If you want to copy the text for private or club use, please contact us.

Domburg Train Support is an official partner of VPEB and an official reseller of the products. You can also contact Domburg Train Support for advice, support and help at home or via TeamViewer. If this manual does not work with the Dinamo modules, please contact us via our website. We have used the photos of the Dinamo modules from the VPEB manuals.

I hope this tutorial will help you connect the communication in the Dinamo system. If you have any comments or remarks, please let me know. I can then process this in a new version. You can report this by sending an email to info@domburgtrainsupport.nl

Thank you for reading and using this tutorial.

Sincerely,
Martin Domburg

Domburg Train Support
www.domburgtrainsupport.nl