**En bild som visar logotyp, symbol, clipart, skiss

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**NTJ Wi-Fi Turnout Control**

**Users Manual**

**Version 1.1, 2025-07-04**

**En bild som visar verktyg, elektronik, krets, av trä

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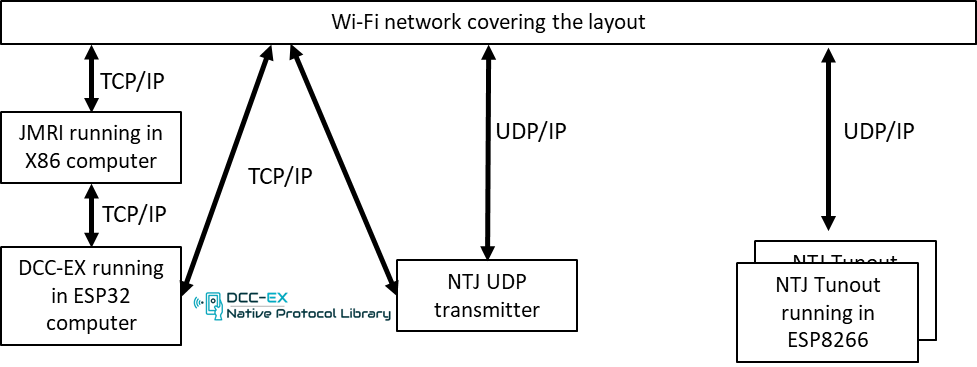
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# Description

NTJ Wi-Fi points (turnout) control is an implementation done in Arduino IDE based on various software packages, put together to constitute a complete points control system. The goal has been to make an easy to install and maintain system with minimum of wiring required. The latter as it is originally designed for garden railway use. The original design is based on using DCC-EX as command station and if wanted JMRI as master control system if the capabilities of DCC-EX is not sufficient. Later in the document I will discuss interfacing the system to any DCC Command Station, in case you already have that in place.

The control system is based on use of cheap ESP8266 development boards, an SG90 servo and a 3-D printed housing placed in the track. Below is a block diagram of the components and surrounding systems.



More information about DCC-EX and JMRI can be found following these addresses:

<https://dcc-ex.com/index.html#gsc.tab=0>

<https://www.jmri.org/>

In short the NTJ UDP transmitter, which is a separate ESP8266 or ESP32 computer gets information about points movements via Wi-Fi and the DCC-EX protocol. Software for that protocol is available to download in the Arduino IDE. The NTJ transmitter translates the orders to a simple protocol and broadcasts that on the W-Fi. The UDP transmitter also stores and retransmits the messages a configurable number of times or until the message has been acknowledged.

All points controllers interpret all UDP messages and acts and acknowledges only messages with its own (DCC) address set.

As remote controller for both points and locomotives “EngineDriver” is used. This software is free and runs in android telephones or tablets.

<https://enginedriver.mstevetodd.com/index.html#gsc.tab=0>

# Software

In this section the software in the UDP Transmitter and the points controller is presented. For knowledge about JMRI and DC-EX software you will have to visit their websites.

Source code for the UDP transmitter and Points Controller is available from NTJ free of charge.

## **UDP transmitter**

The UDP transmitter software is based on code from DCC-EX. You can import their software to Arduino IDE by searching for DCC-EX in the library manager. To compile the software, you need to have that library downloaded.

The DCC-EX protocol publishes all commands, plus more, that goes out as DCC commands in the track. The UDP transmitter acts on these messages, translates them into its own protocol and sends them as broadcast messages over the Wi-Fi. Each message is amended with a sequence number and expects the receiving points controller to return that number. If the sequence number is not returned the message is repeated. A system variable sets how many times the message should be repeated until discarded. Before compiling and loading the software you need to set system specific variables.

If you scrutinise the software, you will find that it also transmits messages to locomotives. NTJ also has an implementation of an ESP8266 based locomotive controller that gest its orders in a similar way. If you are not interested in that you might want to comment that function out. More information about the NTJ locomotive controller can be found on <https://g.elestedt.com/NTJ-Wi-Fi> , some of it in Swedish.

### **Adjustable parameters for UDP transmitter**

Before you compile and download you need to set/change the following parameters

SSID

The name on your local Wi-Fi network. Note that you need to make sure your access point can handle as many simultaneous connections as you need.

PASSWORD

Yor private password on the Wi-Fi.

RESEND\_QUEUE\_SIZE

#define RESEND\_QUEUE\_SIZE 30

The maximum number of messages held for retransmit. The needed size of the que depends on number of controllable objects you have and the possible size on available RAM in your ESP.

MAXRETRY

#define maxretry 10  //resends before message is deleted

When using DCC-EX as CS you also need to define how to connect to the CS

The hostname set in the DCC-EX software

const char\* command\_station\_hostname = "NTJdccex";

The network port of your EX-CommandStation

int serverPort = 2560;

## **Points controller**

The points controller connects to the same Wi-Fi as the UDP transmitter and listens for incoming points orders. When a message with the same ID as set in the points controller the points are thrown and the message is acknowledged by returning the sequence number of the accepted message. The points controller has an MDNS name and the name is automatically set to VX+ “the address of the points” (ex. Vx21). This name is used when configuring the controller to the address it shall have in the railway. It also helps to identify the controller in case of software updates.

The software supp0rts OTA and once it has been loaded with a version of the software, new software can be downloaded via Wi-Fi. It will appear in the Arduino IDE as possible to connect to.

The software also includes a WEB-server and the controller can be configured via Wi-Fi using a browser. You connect to the controller using its MDNS name with ”.local” added.

A new controller has the ID 999. New configuration is stored in EEPROM in the ESP.

Apart from setting the ID you can also define if the curved track “thrown” is to the right or left. Messages to the controller contains the ID and the wanted position as 0 or 1 and the controller needs to be configured with the direction of those numbers.

The software moves the servo with one degree per 20ms.

### **Adjustable parameters for points controller**

Before you compile and download you need to set/change the following parameters

SSID

The name on your local Wi-Fi network. Note that you need to make sure your access point can handle as many simultaneous connections as you need.

String STASSID = "NTJ";        //Your network name (SSID)

PASSWORD

String STAPSK = "NTJNTJ01";    //Network password

DIGITAL OUTPUT

#define Servo1 D1              //Digital output to control servo

INITIAL ADDRESS

#define InitialDCCaddress 999  //DCC address assigned to controller by default

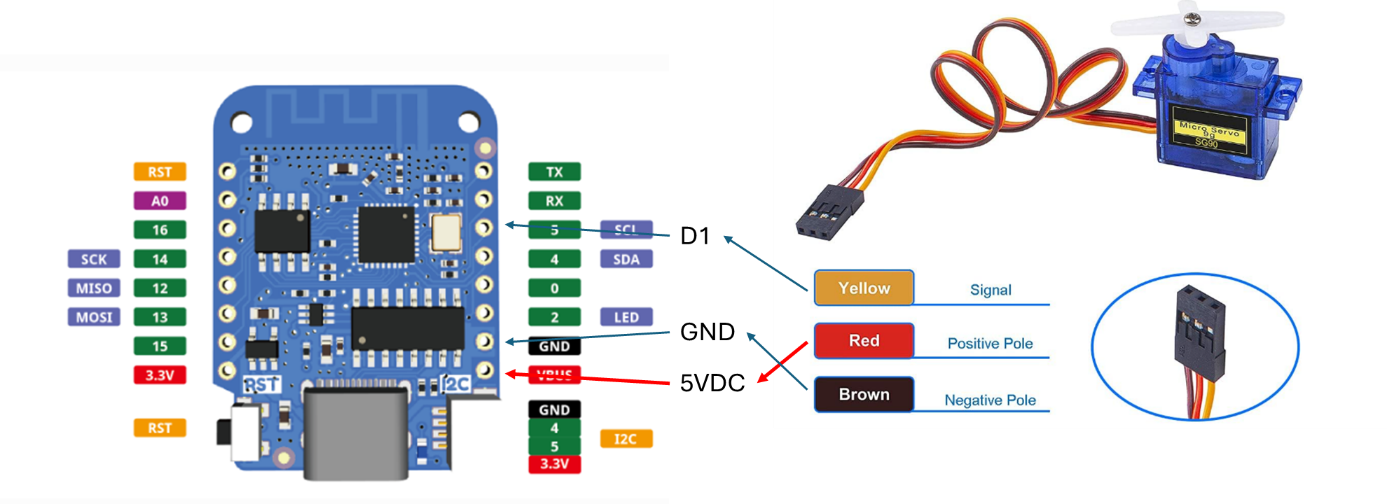
OTA PASSWORD

const char\* OTApassword = "NTJNTJ01";     //Password to update software OTA

# Hardware

The computer board used in the points controller is a WeMos D1 mini and in the UDP transmitter a WeMos D1R2. Those boards are ESP8266 based. If you need a bigger retransmit-queue you might consider using an ESP32 as UDP transmitter.

The servo is a 180-degree SG90 or equivalent.



There are two versions of the housing, one with a slot for power cables and one for mounting a two pin connector. The connector used is of type XH2.54 and was bought from pchbutik.se

<https://shop.pchbutik.se/sv/xh-kablar-med-kontakter/2173-5-st-xh-254-2p-hona-med-kabel-och-hane-med-kabel.html>

En bild som visar elektronik, Elektrisk ingenjörskonst, Elkabel, kabel

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# Other CS than DCC-EX

If you do not want to use DCC-EX as your command station a solution I have used in other applications is to decode the DCC messages from the track. This would replace the connection the UDP transmitter has to DCC-EX. The replacement is some simple hardware that can be added as a shield to the WeMos D1R2 and replacing the parts of the UDP Transmitter software that converts DCC-EX messages to NTJ messages. Software for decoding DCC messages is available to download to the Arduino IDE. Search for DCC or NMRA DCC.

If you need this solution contact NTJ and I will assist.

En bild som visar text, diagram, linje, Teckensnitt

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