ART-NET PROTOCOL PRESENTATION

V1.0

SUMMARY

INTRODUCTION

Art-Net is a communication protocol based on the UDP/IP standard that aims to simplify the transfer of DMX 512 instructions and data. It integrates DMX 512 frames into Ethernet frames allowing simpler and more convenient wiring using switches and/or WIFI terminals.

This protocol is notably used to control stage equipment (moving heads, spotlights, power units, effects, smoke machines, etc.).

VOCABULARY

Node: A device that transmits DMX512 packets from or to an Art-Net network. Basically an Artnet do DMX convertor.

Universe: Allows to send a simple DMX512 frame or channels of 512 values, it is the equivalent of a simple DMX512 network.

Sub-Net: A group of 16 consecutive universes (not to be confused with the subnet mask).

Net: A group of 16 consecutive subnets or 256 universes. There are 128 nets in total.

Address Port: One of the 32,768 available addresses through which it is possible to transmit a DMX512 packet, it is the combination: Net + Sub-Net + Universe.

Kiloverse: A group of 1024 universes.

IP: IP address that governs networks.

Subnet Mask: Allows you to define the address and configuration of the IP network.

Directed Broadcast: A packet is sent in broadcast to identify all the nodes. This allows the discovery of the Art-Net network.

Controller: A software or device that generates data.

All Art-Net communications are based on UDP (User Datagram Protocol), one of the main protocols of the transport layer of the TCP/IP protocol. This protocol has the advantage of being simple, an entity can communicate with another one as soon as it shares this protocol through an IP address and a port. It works without negotiation (contrary to TCP) which implies that UDP is not necessarily able to guarantee the good reception of packets and their order.

This is what a UDP packet can look like:

Source Port (16bits)	Destination Port (16bits)
Length (16bits)	Checksum (16bits)
Data (variable length)	

It contains the following four fields:

Source Port: indicates from which port the packet was sent.

Destination Port: indicates to which port the packet should be sent.

Length: indicates the total length (in bytes) of the UDP segment (header and data). The minimum length is therefore 8 bytes (header size).

Checksum: this is used to ensure the integrity of the packet received when it is different from zero. It is calculated on the entire UDP header and data, but also on a pseudo-header (extracted from the IP header).

Data : Content the informations to send or receive.

It is in the data area that the Art-Net frame is located.

The advantage of UDP is that it is very powerful, and some mechanics are present to anticipate errors.

Each Art-Net node has an IP address, by default an Art-Net device starts with a class A IP address. This makes it possible to agree on a network typology and to dispense with a DHCP (Dynamic Host Configuration Protocol) server. Nevertheless, it can be useful to address a node with a particular IP address. When a node is identified, it indicates if it supports DHCP, if it does, the address can be used via the DHCP protocol.

The IP address being class A, it is therefore a network that must be closed (local) and not routed to Internet. In general, when an Art-Net hardware boots, an IP address of the 2.x.x type will be assigned on the 255.0.0.0 network. An addressing strategy exists to avoid collisions with different manufacturers. It is based on the MAC address (Media Access Control or simply the hardware address, unique to the hardware).

This part is quite complex and some network bases are necessary, nevertheless you can abstract from the IP address calculation methodology, just remember that by default a class A IP address is assigned and that if you want to change it is possible via DHCP.

Art-Net 1

The first version of Art-Net, now called Art-Net I, was written in 1998 and released soon after. Art-Net I used broadcast data for all transactions including the streaming level data. The reason for the use of broadcast was simply to remove the need for any network configuration on the part of the user.

Art-Net I was implemented on 10BaseT networks and used for a relatively small quantity of universes (the effective limit was approximately 40 universes).

With the wide scale adoption of RGB LED devices, the demand for channels grew and the broadcast topology became problematic. Broadcast data floods the entire network and appears at every node whether it needs it or not. Too much broadcast data overloads switches and nodes alike.

Art-Net 2

In order to address this problem, Art-Net II was released in 2006. At power on, the Art-Net II output of a console is identical to Art-Net I, all broadcast. However, with Art-Net II, the console uses a simple algorithm to learn which nodes are consuming which universes. It then switches to unicasting to the nodes. The reduction in network loading achieved with Art-Net II is massive, allowing Art-Net II networks to scale up to the bandwidth of the network. Art-Net II has an effective limit of 256 universes.

Art-Net 3

The need for ever more channels, driven by the expansion of pixel-based systems, continues unabated. This led to the release of Art-Net 3 in 2011. Art-Net 3 increased the number of universes that can be addressed from 8-bit to 15-bit (meaning that a total of 32,768 universes can be addressed). Art-Net 3 added a concept called Binding, which allows product designers to develop gateways with more than four ports. However, each logical block of four ports must have a unique IP address, which can be difficult to implement on some hardware platforms (the use of multiple IP addresses is called multi-homing).

Art-Net 4

Art-Net 4 was released in September 2016. It is the most powerful and flexible version to date.

Art-Net 4 overcomes the multi-homing problem, by incorporating a new method of handling gateways that support multiple DMX ports. The scheme allows a gateway (or any Art-Net product) to support over 1000 DMX ports, all on a single IP address. It has been added in such a way that it is 100% backwards compatible with previous releases of Art-Net.

Art-Net 4 also offers a unique new feature that facilitates management of the gateway data source. This allows users to choose Art-Net as the discovery, management and RDM tool, while using sACN for the live control data. While many users are happy to work completely within the Art-Net realm, some installations and specifiers require or prefer the use of sACN, the accredited ANSI E1.31 standard. However, unlike Art-Net, sACN does not support network management or RDM, which could leave users disadvantaged. Art-Net 4 solves this problem, offering an elegant solution that enables the protocols to be used in a complementary manner.

Developers will also appreciate a new software feature that enables all DMX ports to be assigned a fully independent universe.

Finally, in a node to the future, Art-Net 4 already has built-in support for VLC (Visible Light Communication).

CONFIGURATION

Art-Net protocol usually requires subnet mask **255.0.0.0** with an IP address of the following types : **2.x.x.x.** Fixtures compatible with Art-Net protocol shall always have a default IP address of **2.x.x.x.**

In reality, default address may sometimes differ, that is why our software allows to send Art-Net frames with any network configuration. However, it is necessary to check the compatibility between the configuration of your Art-Net fixtures and your computer. **Be careful to apply the same subnet mask with common class for each fixture on the network or the fixtures wont be find**.

Examples :

- If you are using an Art-Net fixture with the IP address 2.0.0.4. and a subnet mask of 255.0.0.0, your computer shall have a subnet mask of 255.0.0.0 with an IP address 2.x.x.x (2.0.0.5 for example).

- If you are using an Art-Net fixture with the IP address 192.168.0.4 and a subnet mask of 255.255.255.0, your computer shall have a subnet mask of 255.255.255.0 with an IP address 192.168.0.x (192.168.0.5 for example).
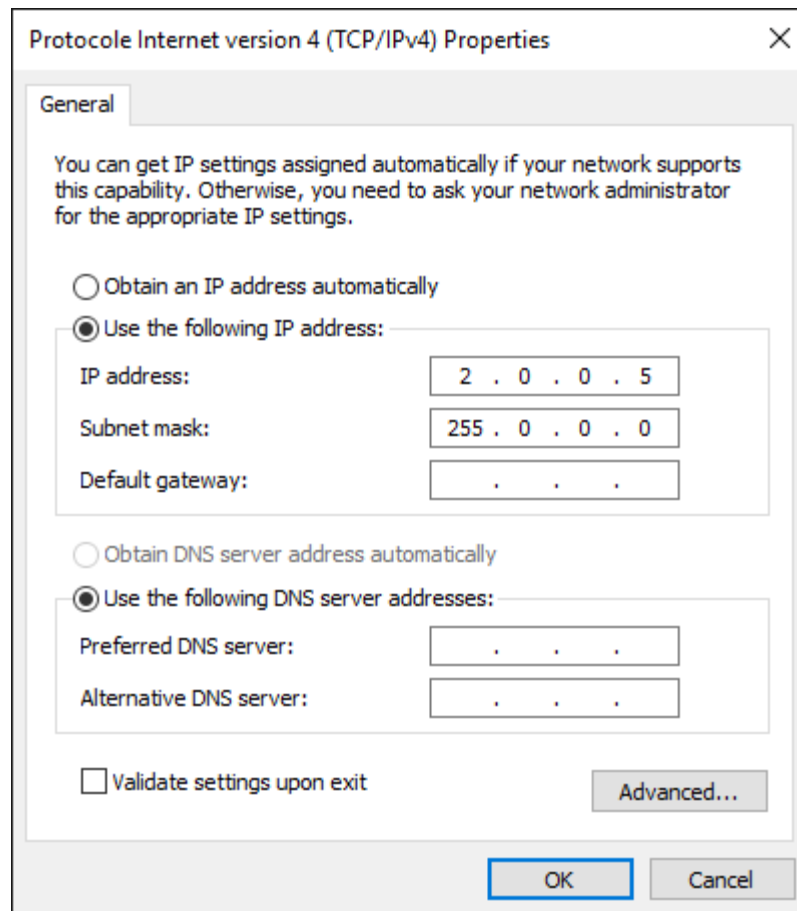
Open the **Network and sharing center** and click on the **Ethernet** link (you have to connect a device to the Ethernet port of your computer to allow the Ethernet network to be visible).
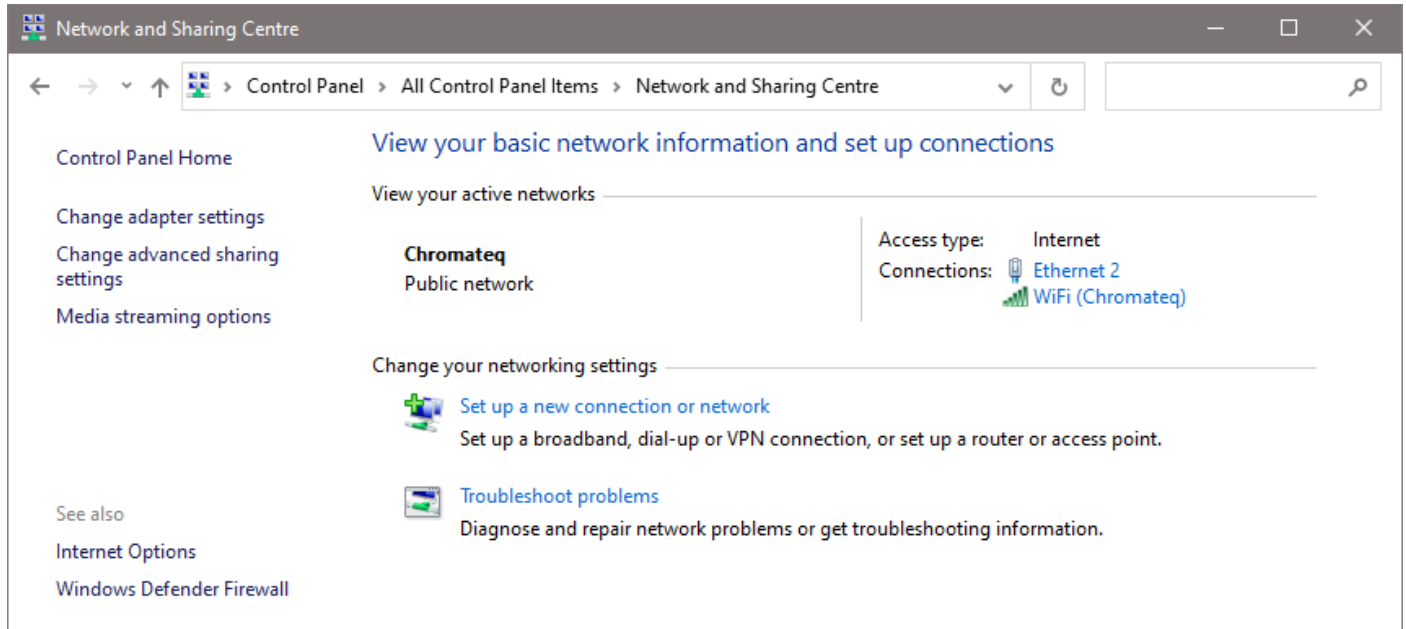
Click on **Properties**, then double click on **Internet Protocol version 4 (TCP/IPv4)** :
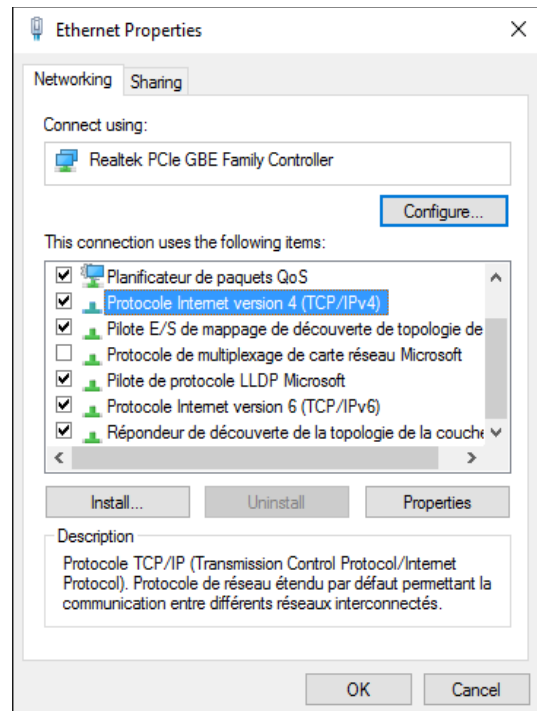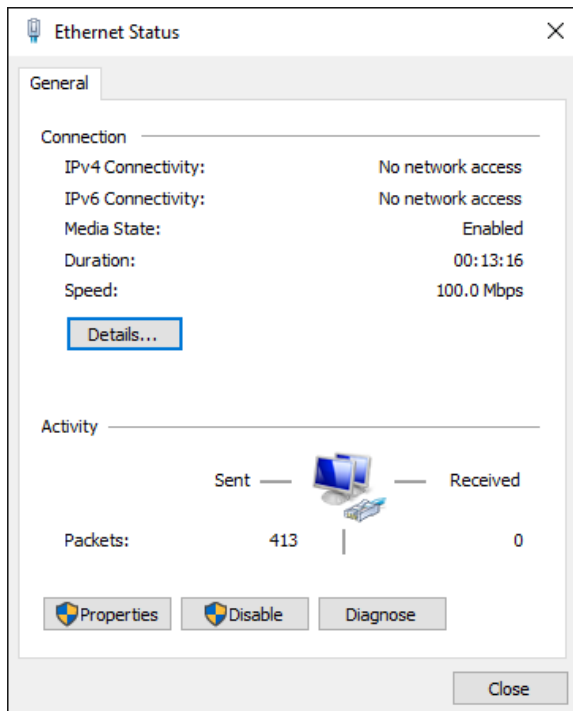
Finally, select **Use the Following IP address** and enter your IP address and the correct subnet mask :
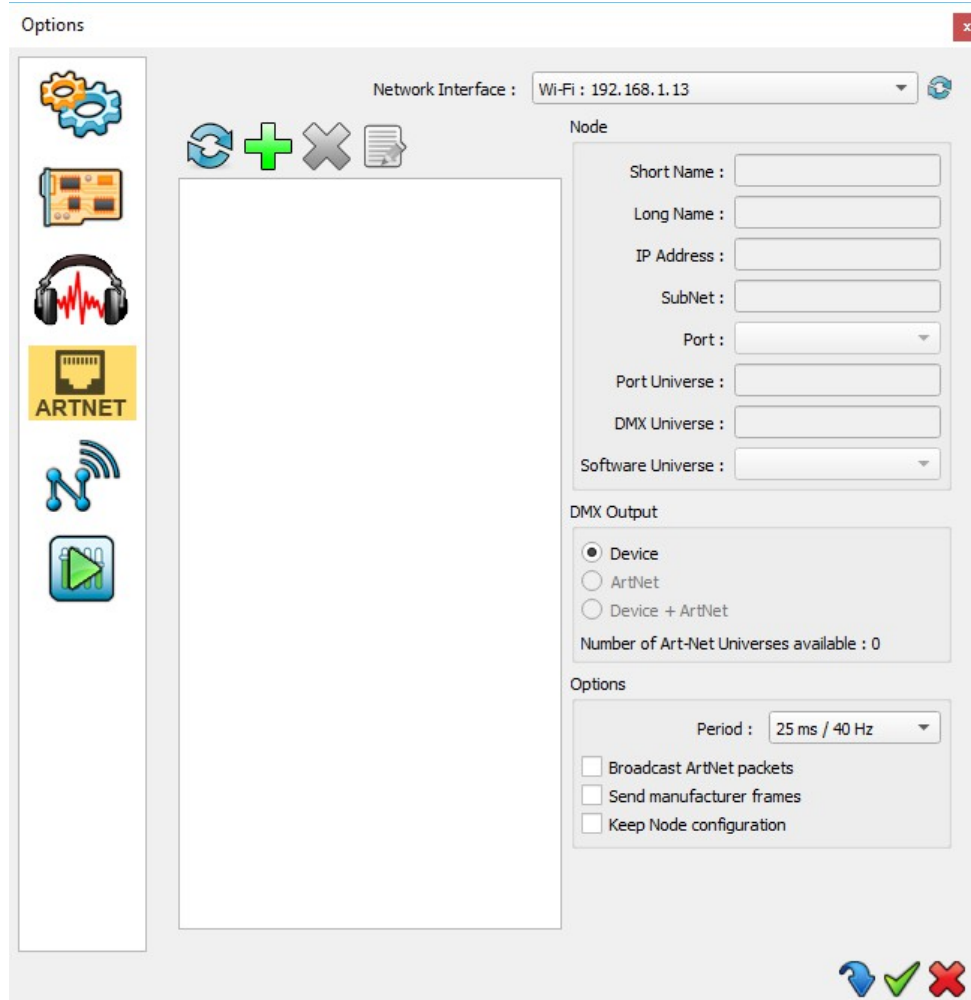

Your computer is now configured and you can use our software to communicate with Art-Net devices.

From the Tool/Options menu, select the **Art-Net** page.

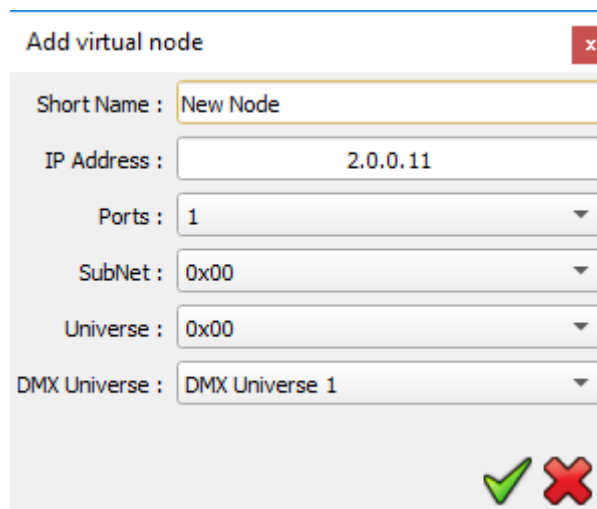To detect the devices on the network, click « **Refresh**».

An Art-Net device is represented by a node which contains many ports, each port can receive 1 DMX universe. A simple Art-Net fixture shall be shown as a single port while an Art-Net convertor/ DMX with 4 DMX outputs for example shall be shown as a 4 ports.

ADD A VIRTUAL NODE

Add a virtual node will depend on the equipment installed,

It is possible that the Art-Net/DMX converter does no respond to all the node and respond only to its first node (refers to the manufacturer notice). In this case, user must add a virtual node manually from the software to create the other nodes (not detected).

To manually add a virtual node from the software, you must specify the correct IP address of the fixture, its sub network, its Art-Net universe and the number of ports used (Universe DMX).

NB : With a fixture of several node, the Art-Net protocol uses consecutive universes for each of its ports. That is why it is needed to inform one universe only (the one which belongs to the device, same as for the SubNet). However, it is possible to send any software universe to each used port.

DMX UNIVERSES

For each fixture, you can choose the DMX universes of the software you want to send on the network.

Select the relevant node in the list, then for each port choose which software universe should be applied.