Art-Net 4

Specification for the Art-Net 4 Ethernet Communication Protocol

www.Art-Net.org.uk

Winner of the PLASA 2016 Innovation Award

Contents

Document History

Comments on Revisions AJ-BD:

- Concept of Binding Address added to ArtPollReply.
- Error in Filler count in ArtPollReply corrected.
- DHCP Flag added to ArtPollReply.
- ArtDiagData packet added.
- ArtCommand packet added.
- Detail of ArtDmx unicast corrected.
- Notes on ArtDmx length added.
- ArtTimeCode packet added.
- Art-Net 3 release.
- 15 bit universe addresses added.
- Error in description of 'Net' corrected.
- Confusion over limited vs. directed broadcast resolved.

Comments on Revision BE:

- Typing error in ArtFirmwareMaster corrected - incorrectly defined FirmwareLength as Int32.
- ArtNzs packet added.
- EstaCode in ArtPollReply redefined as two bytes.
- Port-Address programming authority explanation improved.
- Error in default IP address example corrected.

Comments on Revision BF:

- Clarification of Endian in ArtRdmSub.
- Description of Universe Subscription improved.

Comments on Revision BG:

- Clarification that ArtTodControl must be replied to with ArtTodData.

Comments on Revision BH:

- Clarifications.
- Readability improvements.
- Added definition of ArtCommand.
- Added definition of ArtNzs.
- Added definition of ArtTrigger.

Comments on Revision BI:

- Typographic corrections.
- ArtSync added.

Comments on Revision BJ:

- Noted OpMac OpCodes as deprecated.
- Corrected casting error in ArtTodControl definition.

Comments on Revision BK:

- ArtVlc added
- Vlc management added to ArtPoll
- Recommended ArtDmx keep alive time changed to 800mS to 1000mS for sACN compatibility.
- Clarification to array length in ArtTodRequest.

Comments on Revision DA:

- First release of Art-Net 4.
- Requirement that bound nodes have a different IP address to the root node has been dropped in order to avoid the need to multi-home products with more than four ports.
- BindIndex added to ArtTodData
- sACN / Art-Net protocol selection added to ArtPollReply and ArtAddress

Comments on Revision DB:

- ArtPollReply->Status2.Bit4 defined.

Comments on Revision DC:

- All spellings of “Port Address”, “PortAddress” changed to “Port-Address”.
- TCP/IP Port Number programming in ArtIpProg now shown as deprecated.

Comments on Revision DD:

- Missing filler fields in ArtTrigger corrected.

Art-Net overview:

Art-Net is an Ethernet protocol based on the TCP/IP protocol suite. Its purpose is to allow transfer of large amounts of DMX512 data over a wide area using standard networking technology.

Art-Net 4:

This latest revision of the protocol implements a number of new features and also simplifies the data transfer mechanism. The changes are all based on feedback from manufacturers who are using the protocol.

Art-Net 4 incorporates a new scheme to handle gateways that support multiple DMX ports. Previously, gateways that supported more than four DMX ports would need multiple IP addresses (multi-homing). This was an annoyance for both users and developers and indeed could not be achieved on some hardware platforms. The new scheme allows a gateway (or any Art-Net product) to support over 1000 DMX ports. It is achieved by adding a field called BindIndex to 4 Art-Net packets, namely: ArtPollReply, ArtAddress, ArtInput and ArtTodData. The BindIndex allows all Art-Net devices to identify the 'page of DMX ports' to which a packet refers.

The change is, from a developer perspective, very small and will be very quick to a product design. It has also been added in such a way that it is 100% backwards compatible with previous releases.

Art-Net can address over 30,000 universes. Previously, each group of 4 DMX ports were limited to universes from a consecutive block of 16. Art-Net 4 allows this limit to be resolved as the developer can choose to identify each DMX port individually. This simply means encoding a single DMX port in each ArtPollReply. Using this mechanism, all DMX ports can be assigned a fully independent universe.

sACN is gaining in popularity as a method of transporting DMX data. However it lacks any ability discover devices, configure devices or transport RDM data. Art-Net 4 incorporates the ability to manage sACN by selecting whether a given gateway port should convert

sACN or Art-Net to the DMX output. This allows users to choose Art-Net as the discovery, management and RDM tool, while using sACN for the live control data.

Developers updating from Art-Net 3 to Art-Net 4 should review the following change summary:

- ArtPollReply->BindAddress can now be identical in all BindIndex.
- ArtAddress->BindIndex added to discriminate packets from same IP
- ArtInput->BindIndex added to discriminate packets from same IP
- ArtTodData->BindIndex added to discriminate packets from same IP.
- ArtAddress->Command options added to select sACN or Art-Net conversion

Universe Addressing:

A theoretical limit of 32,768 universes exists in the Art-Net 4 specification. The actual number of universes that can be transmitted is dependent upon both the network physical layer and the casting used. The following table provides a rule of thumb.

Addressing	Physical: 10BaseT	Physical: 100BaseT	Physical: 1000BaseT
Unicast	40	400	4000+

The Port-Address of each DMX512 Universe is encoded as a 15-bit number as shown in the following table.

Bit 15	Bits 14-8	Bits 7-4	Bits 3-0
0	Net	Sub-Net	Universe
Port-Address			

The high byte is called the 'Net'. This was introduced at Art-Net 3 and was previously zero. The Net has a single value for each node. The high nibble of the low byte is referred to as the Sub-Net address and is set to a single value for each Node. The low nibble of the low byte is used to define the individual DMX512 Universe within the Node.

This means that any Node will have:

- One “Net” switch.
- One “Sub-Net” switch.
- One “Universe” switch for each implemented DMX512 input or output.

A product designer may opt to implement these as hard or soft switches.

Credits:

Any person or entity which implements Art-Net in their products shall include a user guide credit of: "Art-Net™ Designed by and Copyright Artistic Licence Holdings Ltd".

Terminology:

Node: A device that translates DMX512 to or from Art-Net is referred to as a Node.

Port-Address: one of the 32,768 possible addresses to which a DMX frame can be directed. The Port-Address is a 15 bit number composed of Net+Sub-Net+Universe.

Net: A group of 16 consecutive Sub-Nets or 256 consecutive Universes is referred to as a net. There are 128 Nets in total.

Sub-Net: A group of 16 consecutive universes is referred to as a sub-net. (Not to be confused with the subnet mask).

Universe: A single DMX512 frame of 512 channels is referred to as a Universe.

Kiloverse: A group of 1024 Universes.

Controller: A central controller or monitoring device (lighting console) is referred to as a Controller.

IP: The IP is the Internet protocol address. It is expressed in either a long word format (0x12345678) or dot format (2.255.255.255). Convention is that the former is hexadecimal and the latter is decimal. The IP uniquely identifies any Nodes or Controllers on a network.

Subnet Mask: Defines which part of the IP represents the Network address and which part represents the Node address. Example: A Sub-Net mask of 255.0.0.0 means that the first byte of the IP is the network address and the remaining three bytes are the Node address.

Port: Actual data transmission on Art-Net uses the UDP protocol that operates 'on top of' the TCP/IP protocol. UDP data transfer operates by transferring data from a specific IP:Port on a Node or Controller to a second specific IP:Port on a second Node or Controller. Art-Net uses only one port of 0x1936.

Directed Broadcast: When a network first connects, the Controller does not know the number of Nodes on the network, nor does it know their IP addresses. The Directed broadcast address allows the Controller to send an ArtPoll to all Nodes on the network.

Limited Broadcast: Art-Net packets should not be broadcast to the Limited Broadcast address of 255.255.255.255.

Controller: A generic term describing an Art-Net device with the primary task of generating control data. For example, a lighting console.

Media Server: A generic term describing an Art-Net device capable of generating control data based on the 'mx' Media Extensions to Art-Net.

Ethernet Implementation:

General Notes:

All communication is UDP. Each packet format defined in this document forms the Data field of an enclosing UDP packet.

Packet formats are specified in a manner similar to C-language structures, in which all data items are considered to be unsigned integers of type INT8, INT16 or INT32 according to the number of bits. There are no hidden padding bytes, except at the very end of a packet, which may be rounded up to a multiple of 2 or 4 bytes. Extra bytes at the end of a valid received packet are ignored.

The protocols are generalised for handling future versions with increased numbers of ports.

Many bit data fields contain unused positions. These may be used in future versions of the protocol. They should be transmitted as zero and not tested by receivers.

All packet definitions are designed such that their length can be increased in future revisions, whilst retaining compatibility. For this reason, only minimum packet length is checked in this protocol.

Protocol Operation

A Node operates in one mode, each Node having a unique IP address derived from its Ethernet MAC address. The UDP port used as both source and destination is 0x1936.

IP address configuration

The Art-Net protocol can operate on either a DHCP managed address scheme or using static addresses. By default an Art-Net product will factory start using a Class A IP address scheme. This allows Art-Net products to communicate directly and without the need for a DHCP server to be connected to the network.

IP address configuration - DHCP

Nodes report whether they are DHCP capable in the ArtPollReply packet. This document details packets on the assumption that static addressing is used. When DHCP is used, the addressing and subnet masks will be modified as dictated by the DHCP server.

IP address configuration – Static Addressing

The use of Class A addressing is allowed within a closed network. It is important to ensure that Art-Net data is not routed onto the Internet.

Products implementing Art-Net should default to the Primary IP address of 2.?.?.?.

The IP address consists of a 32 bit number designated as A.B.C.D. The bytes B.C.D are calculated from the MAC address. The high byte 'A' is set to one of two values as shown in the following table.

The MAC address is a 48 bit number designated u:v:w:x:y:z. This is a globally unique number. The upper three bytes 'u:v:w' are registered to a specific organisation. The lower three bytes 'x:y:z' are assigned by that organisation. In order to ensure that there is minimal possibility of IP address conflicts between different manufacturers supporting Art-Net, the product OEM code is added to the MAC address.

The 'B' field of the IP address is calculated by adding the high byte of the OEM code with the low byte of the OEM code and the 'x' field of the MAC address.

On power up, the Node checks its configuration for IP addressing mode. If it has been programmed to use a custom IP address, the following procedure is not used.

	IP Address A.B.C.D				Subnet Mask
Product Switch Settings	A	B	C	D	
Custom IP Programmed	As Programmed				As Programmed

	IP Address A.B.C.D				Subnet Mask
Network Switch Off	2	x+OEM	y	z	255.0.0.0
Network Switch On	10	x+OEM	y	z	255.0.0.0

The sub-net mask is always initialised to 255.0.0.0, unless a custom IP address is in use. This means that the network address is the most significant 8 bits and the Node address is the least significant 24 bits of the IP address. This is a Class A network address and for this reason care must be exercised when connecting to other networks. If an installation requires connection of an Art-Net network to another network that has Internet access, then the connection must be implemented via a router that filters out the Class A addresses.

IP address Example

Given the following settings, the IP address calculation will be as follows:

- Network Switch = Off
- MAC address = 12:45:78:98:34:76 (hexadecimal number)
- OEM code = 0x0010

Calculation:

- IP Address A = 2.
- IP Address B = 168 (0x98 + 0 + 16).
- IP Address C = 52 (0x34 from MAC address).
- IP Address D = 118 (0x76 from MAC address).
- IP Address = 2.168.52.118.

Controller Default Poll

By default a Controller should poll both the primary and secondary Art-Net addresses:

- 2.255.255.255:0x1936 Primary Art-Net Address
- 10.255.255.255:0x1936 Secondary Art-Net Address

Network Topology:

Art-Net allows two network topologies to operate simultaneously:

Peer to Peer: This is an unmanaged network where multiple Nodes transfer data without the intervention of a controller. All data transfer uses ArtDmx packets. All data is Directed Broadcast. This is the power on mode of operation for all Art-Net compliant nodes designed to receive DMX512.

Controller to Peer: This is the most sophisticated implementation whereby one or more Nodes communicate with one or more central controllers (lighting consoles). This mode of operation data transfer operates by unicast transmission of ArtDmx packets.

Art-Net packet definition

All UDP packets accepted by the Node conform to the Art-Net protocol specification as defined below. Any other packets are ignored.

ArtPoll:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Send ArtPollReply.
	Unicast Transmit	Not Allowed.
	Directed Broadcast	Controller broadcasts this packet to poll all Controllers and Nodes on the network.
Node	Receive	Send ArtPollReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	Send ArtPollReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

The ArtPoll packet is used to discover the presence of other Controllers, Nodes and Media Servers. The ArtPoll packet is only sent by a Controller. Both Controllers and Nodes respond to the packet.

A Controller broadcasts an ArtPoll packet to IP address 2.255.255.255 (sub-net mask 255.0.0.0) at UDP port 0x1936, this is the Directed Broadcast address.

The Controller may assume a maximum timeout of 3 seconds between sending ArtPoll and receiving all ArtPollReply packets. If the Controller does not receive a response in this time it should consider the Node to have disconnected.

The Controller that broadcasts an ArtPoll should also reply to its own message (to Directed Broadcast address) with an ArtPollReply. This ensures that any other Controllers listening to the network will detect all devices without the need for all Controllers connected to the network to send ArtPoll packets. It is a requirement of Art-Net that all

controllers broadcast an ArtPoll every 2.5 to 3 seconds. This ensures that any network devices can easily detect a disconnect.

Multiple Controllers

Art-Net allows and supports multiple controllers on a network. When there are multiple controllers, Nodes will receive ArtPolls from different controllers which may contain conflicting diagnostics requirements. This is resolved as follows:

If any controller requests diagnostics, the node will send diagnostics. (ArtPoll->TalkToMe->2).

If there are multiple controllers requesting diagnostics, diagnostics shall be broadcast. (Ignore ArtPoll->TalkToMe->3).

The lowest minimum value of Priority shall be used. (Ignore ArtPoll->Priority).

ArtPoll packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int 16	-	The OpCode defines the class of data following ArtPoll within this UDP packet. Transmitted low byte first. See Table 1 for the OpCode listing. Set to OpPoll.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14. Controllers should ignore communication with nodes using a protocol version lower than 14.
5	TalkToMe	Int8	-	Set behaviour of Node
			7-5	Unused, transmit as zero, do not test upon receipt.
			4	0 = Enable VLC transmission.
				1 = Disable VLC transmission.
			3	0 = Diagnostics messages are broadcast. (if bit 2).
				1 = Diagnostics messages are unicast. (if bit 2).
			2	0 = Do not send me diagnostics messages.
				1 = Send me diagnostics messages.
			1	0 = Only send ArtPollReply in response to an ArtPoll or ArtAddress.
				1 = Send ArtPollReply whenever Node conditions change. This selection allows the Controller to be informed of changes without the need to continuously poll.
			0	0 = Deprecated.
6	Priority	Int8	-	The lowest priority of diagnostics message that should be sent. See Table 5.

Table 1 - OpCodes:

The following table details the legal OpCode values used in Art-Net packets:

Opcodes		
Name	Value	Definition
OpPoll	0x2000	This is an ArtPoll packet, no other data is contained in this UDP packet.
OpPollReply	0x2100	This is an ArtPollReply Packet. It contains device status information.
OpDiagData	0x2300	Diagnostics and data logging packet.
OpCommand	0x2400	Used to send text based parameter commands.
OpOutput / OpDmx	0x5000	This is an ArtDmx data packet. It contains zero start code DMX512 information for a single Universe.
OpNzs	0x5100	This is an ArtNzs data packet. It contains non-zero start code (except RDM) DMX512 information for a single Universe.
OpSync	0x5200	This is an ArtSync data packet. It is used to force synchronous transfer of ArtDmx packets to a node's output.
OpAddress	0x6000	This is an ArtAddress packet. It contains remote programming information for a Node.
OpInput	0x7000	This is an ArtInput packet. It contains enable – disable data for DMX inputs.
OpTodRequest	0x8000	This is an ArtTodRequest packet. It is used to request a Table of Devices (ToD) for RDM discovery.
OpTodData	0x8100	This is an ArtTodData packet. It is used to send a Table of Devices (ToD) for RDM discovery.
OpTodControl	0x8200	This is an ArtTodControl packet. It is used to send RDM discovery control messages.
OpRdm	0x8300	This is an ArtRdm packet. It is used to send all non discovery RDM messages.
OpRdmSub	0x8400	This is an ArtRdmSub packet. It is used to send compressed, RDM Sub-Device data.
OpVideoSetup	0xa010	This is an ArtVideoSetup packet. It contains video screen setup information for nodes that implement the extended video features.

Opcodes		
OpVideoPalette	0xa020	This is an ArtVideoPalette packet. It contains colour palette setup information for nodes that implement the extended video features.
OpVideoData	0xa040	This is an ArtVideoData packet. It contains display data for nodes that implement the extended video features.
OpMacMaster	0xf000	This packet is deprecated.
OpMacSlave	0xf100	This packet is deprecated.
OpFirmwareMaster	0xf200	This is an ArtFirmwareMaster packet. It is used to upload new firmware or firmware extensions to the Node.
OpFirmwareReply	0xf300	This is an ArtFirmwareReply packet. It is returned by the node to acknowledge receipt of an ArtFirmwareMaster packet or ArtFileTnMaster packet.
OpFileTnMaster	0xf400	Uploads user file to node.
OpFileFnMaster	0xf500	Downloads user file from node.
OpFileFnReply	0xf600	Server to Node acknowledge for download packets.
OpIpProg	0xf800	This is an ArtIpProg packet. It is used to re-programme the IP address and Mask of the Node.
OpIpProgReply	0xf900	This is an ArtIpProgReply packet. It is returned by the node to acknowledge receipt of an ArtIpProg packet.
OpMedia	0x9000	This is an ArtMedia packet. It is Unicast by a Media Server and acted upon by a Controller.
OpMediaPatch	0x9100	This is an ArtMediaPatch packet. It is Unicast by a Controller and acted upon by a Media Server.
OpMediaControl	0x9200	This is an ArtMediaControl packet. It is Unicast by a Controller and acted upon by a Media Server.
OpMediaContrlReply	0x9300	This is an ArtMediaControlReply packet. It is Unicast by a Media Server and acted upon by a Controller.
OpTimeCode	0x9700	This is an ArtTimeCode packet. It is used to transport time code over the network.
OpTimeSync	0x9800	Used to synchronise real time date and clock
OpTrigger	0x9900	Used to send trigger macros
OpDirectory	0x9a00	Requests a node's file list
OpDirectoryReply	0x9b00	Replies to OpDirectory with file list

Table 2 - OemCode:

The registered OEM codes are detailed in “Art-NetOemCodes.h” which is found in the SDK directory of the DMX-Workshop installation.

The OEM code defines a specific manufacturer’s product type. The OemCode is returned in the ArtPollReply.

Table 3 – NodeReport Codes:

The following table details the NodeReport codes. TheNodeReport code defines generic error, advisory and status messages for both Nodes and Controllers. The NodeReport is returned in ArtPollReply.

Code	Mnemonic	Description
0x0000	RcDebug	Booted in debug mode (Only used in development)
0x0001	RcPowerOk	Power On Tests successful
0x0002	RcPowerFail	Hardware tests failed at Power On
0x0003	RcSocketWr1	Last UDP from Node failed due to truncated length, Most likely caused by a collision.
0x0004	RcParseFail	Unable to identify last UDP transmission. Check OpCode and packet length.
0x0005	RcUdpFail	Unable to open Udp Socket in last transmission attempt
0x0006	RcShNameOk	Confirms that Short Name programming via ArtAddress, was successful.
0x0007	RcLoNameOk	Confirms that Long Name programming via ArtAddress, was successful.
0x0008	RcDmxError	DMX512 receive errors detected.
0x0009	RcDmxUdpFull	Ran out of internal DMX transmit buffers.
0x000a	RcDmxRxFull	Ran out of internal DMX Rx buffers.
0x000b	RcSwitchErr	Rx Universe switches conflict.
0x000c	RcConfigErr	Product configuration does not match firmware.
0x000d	RcDmxShort	DMX output short detected. See GoodOutput field.
0x000e	RcFirmwareFail	Last attempt to upload new firmware failed.
0x000f	RcUserFail	User changed switch settings when address locked by remote programming. User changes ignored.

Code	Mnemonic	Description
0x0010	RcFactoryRes	Factory reset has occurred.

Table 4 – Style Codes:

The following table details the Style codes. The Style code defines the general functionality of a Controller. The Style code is returned in ArtPollReply.

Code	Mnemonic	Description
0x00	StNode	A DMX to / from Art-Net device
0x01	StController	A lighting console.
0x02	StMedia	A Media Server.
0x03	StRoute	A network routing device.
0x04	StBackup	A backup device.
0x05	StConfig	A configuration or diagnostic tool.
0x06	StVisual	A visualiser.

ArtPollReply:

Packet strategy.

Entity	Direction	Action
All devices	Receive	No Art-Net action.
	Unicast Transmit	Not allowed.
	Broadcast	Directed Broadcasts this packet in response to an ArtPoll.

A device, in response to a Controller's ArtPoll, sends the ArtPollReply. This packet is also broadcast to the Directed Broadcast address by all Art-Net devices on power up.

ArtPollReply packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	-	OpPollReply Transmitted low byte first.
3	IP Address[4]	Int8	-	Array containing the Node's IP address. First array entry is most significant byte of address. When binding is implemented, bound nodes may share the root node's IP Address and the BindIndex is used to differentiate the nodes.
4	Port	Int16	-	The Port is always 0x1936 Transmitted low byte first.
5	VersInfoH	Int8	-	High byte of Node's firmware revision number. The Controller should only use this field to decide if a firmware update should proceed. The convention is that a higher number is a more recent release of firmware.
6	VersInfoL	Int8	-	Low byte of Node's firmware revision number.
7	NetSwitch	Int8	-	Bits 14-8 of the 15 bit Port-Address are

Field	Name	Size	Bit	Description
				encoded into the bottom 7 bits of this field. This is used in combination with SubSwitch and SwIn[] or SwOut[] to produce the full universe address.
8	SubSwitch	Int8	-	Bits 7-4 of the 15 bit Port-Address are encoded into the bottom 4 bits of this field. This is used in combination with NetSwitch and SwIn[] or SwOut[] to produce the full universe address.
9	OemHi	Int8	-	The high byte of the Oem value.
10	Oem	Int8	-	The low byte of the Oem value. The Oem word describes the equipment vendor and the feature set available. Bit 15 high indicates extended features available. Current registered codes are defined in Table 2.
11	Ubea Version	Int8	-	This field contains the firmware version of the User Bios Extension Area (UBEA). If the UBEA is not programmed, this field contains zero.
12	Status1	Int8	-	General Status register containing bit fields as follows.
			7-6	Indicator state.
			00	Indicator state unknown.
			01	Indicators in Locate / Identify Mode.
			10	Indicators in Mute Mode.
			11	Indicators in Normal Mode.
			5-4	Port-Address Programming Authority
			00	Port-Address Programming Authority unknown.
			01	All Port-Address set by front panel controls.
			10	All or part of Port-Address programmed by network or Web browser.

Field	Name	Size	Bit	Description
				11 Not used.
			3	Not implemented, transmit as zero, receivers do not test.
			2	0 = Normal firmware boot (from flash). Nodes that do not support dual boot, clear this field to zero.
				1 = Booted from ROM.
			1	0 = Not capable of Remote Device Management (RDM).
				1 = Capable of Remote Device Management (RDM).
			0	0 = UBEA not present or corrupt
				1 = UBEA present
13	EstaManLo	Int8	-	The ESTA manufacturer code. These codes are used to represent equipment manufacturer. They are assigned by ESTA. This field can be interpreted as two ASCII bytes representing the manufacturer initials.
14	EstaManHi	Int8	-	Hi byte of above
15	ShortName [18]	Int8	-	The array represents a null terminated short name for the Node. The Controller uses the ArtAddress packet to program this string. Max length is 17 characters plus the null. This is a fixed length field, although the string it contains can be shorter than the field.
16	LongName [64]	Int8	-	The array represents a null terminated long name for the Node. The Controller uses the ArtAddress packet to program this string. Max length is 63 characters plus the null. This is a fixed length field, although the string it contains can be shorter than the field.
17	NodeReport [64]	Int8	-	The array is a textual report of the Node's operating status or operational errors. It is primarily intended for 'engineering' data

Field	Name	Size	Bit	Description
				rather than 'end user' data. The field is formatted as: "#xxxx [yyyy..] zzzzz…" xxxx is a hex status code as defined in Table 3. yyyy is a decimal counter that increments every time the Node sends an ArtPollResponse. This allows the controller to monitor event changes in the Node. zzzz is an English text string defining the status. This is a fixed length field, although the string it contains can be shorter than the field.
18	NumPortsHi	Int8	-	The high byte of the word describing the number of input or output ports. The high byte is for future expansion and is currently zero.
19	NumPortsLo	Int8	-	The low byte of the word describing the number of input or output ports. If number of inputs is not equal to number of outputs, the largest value is taken. Zero is a legal value if no input or output ports are implemented. The maximum value is 4. Nodes can ignore this field as the information is implicit in PortTypes[].
20	PortTypes [4]	Int8	-	This array defines the operation and protocol of each channel. (A product with 4 inputs and 4 outputs would report 0xc0, 0xc0, 0xc0, 0xc0). The array length is fixed, independent of the number of inputs or outputs physically available on the Node.
			7	Set is this channel can output data from the Art-Net Network.
			6	Set if this channel can input onto the Art-Net Network.
			5-0	000000 = DMX512 000001 = MIDI

Field	Name	Size	Bit	Description
				000010 = Avab 000011 = Colortran CMX 000100 = ADB 62.5 000101 = Art-Net
21	GoodInput [4]	Int8	-	This array defines input status of the node.
			7	Set – Data received.
			6	Set – Channel includes DMX512 test packets.
			5	Set – Channel includes DMX512 SIP's.
			4	Set – Channel includes DMX512 text packets.
			3	Set – Input is disabled.
			2	Set – Receive errors detected.
			1-0	Unused and transmitted as zero.
22	GoodOutput [4]	Int8	-	This array defines output status of the node.
			7	Set – Data is being transmitted.
			6	Set – Channel includes DMX512 test packets.
			5	Set – Channel includes DMX512 SIP's.
			4	Set – Channel includes DMX512 text packets.
			3	Set – Output is merging ArtNet data.
			2	Set – DMX output short detected on power up
			1	Set – Merge Mode is LTP.
			0	Set – Output is selected to transmit sACN. Clr – Output is selected to transmit Art-Net.
23	SwIn [4]	Int8	-	Bits 3-0 of the 15 bit Port-Address for each of the 4 possible input ports are encoded into the low nibble.
24	SwOut [4]	Int8	-	Bits 3-0 of the 15 bit Port-Address for each of the 4 possible output ports are encoded into the low nibble.
25	SwVideo	Int8	-	Set to 00 when video display is showing local data. Set to 01 when video is showing ethernet data. The field is now deprecated
26	SwMacro	Int8	-	If the Node supports macro key inputs, this byte represents the trigger values. The Node is responsible for 'debouncing' inputs. When the ArtPollReply is set to transmit

Field	Name	Size	Bit	Description
				automatically, (TalkToMe Bit 1), the ArtPollReply will be sent on both key down and key up events. However, the Controller should not assume that only one bit position has changed. The Macro inputs are used for remote event triggering or cueing. Bit fields are active high.
			7	Set – Macro 8 active.
			6	Set – Macro 7 active.
			5	Set – Macro 6 active.
			4	Set – Macro 5 active.
			3	Set – Macro 4 active.
			2	Set – Macro 3 active.
			1	Set – Macro 2 active.
			0	Set – Macro 1 active.
27	SwRemote	Int8	-	If the Node supports remote trigger inputs, this byte represents the trigger values. The Node is responsible for 'debouncing' inputs. When the ArtPollReply is set to transmit automatically, (TalkToMe Bit 1), the ArtPollReply will be sent on both key down and key up events. However, the Controller should not assume that only one bit position has changed. The Remote inputs are used for remote event triggering or cueing. Bit fields are active high.
			7	Set – Remote 8 active.
			6	Set – Remote 7 active.
			5	Set – Remote 6 active.
			4	Set – Remote 5 active.
			3	Set – Remote 4 active.
			2	Set – Remote 3 active.
			1	Set – Remote 2 active.
			0	Set – Remote 1 active.

Field	Name	Size	Bit	Description
28	Spare	Int8		Not used, set to zero
29	Spare	Int8		Not used, set to zero
30	Spare	Int8		Not used, set to zero
31	Style	Int8		The Style code defines the equipment style of the device. See Table 4 for current Style codes.
32	MAC Hi	Int8		MAC Address Hi Byte. Set to zero if node cannot supply this information.
33	MAC	Int8		MAC Address
34	MAC	Int8		MAC Address
35	MAC	Int8		MAC Address
36	MAC	Int8		MAC Address
37	MAC Lo	Int8		MAC Address Lo Byte
38	BindIp[4]	Int8		If this unit is part of a larger or modular product, this is the IP of the root device.
39	BindIndex	Int8		This number represents the order of bound devices. A lower number means closer to root device. A value of 1 means root device.
40	Status2	Int8	0	Set = Product supports web browser configuration.
			1	Clr = Node's IP is manually configured. Set = Node's IP is DHCP configured.
			2	Clr = Node is not DHCP capable. Set = Node is DHCP capable.
			3	Clr = Node supports 8 bit Port-Address (Art-Net II). Set = Node supports 15 bit Port-Address (Art-Net 3 or 4).
			4	Clr = Node not able to switch between Art-Net and sACN. Set = Node is able to switch between Art-Net and sACN.
			5	Clr = Not squawking. Set = squawking.
41	Filler	26 x 8		Transmit as zero. For future expansion.

ArtIpProg:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Controller transmits to a specific node IP address.
	Broadcast	Not Allowed.
Node	Receive	Reply with ArtIpProgReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	Reply with ArtIpProgReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

The ArtIpProg packet allows the IP settings of a Node to be reprogrammed.

The ArtIpProg packet is sent by a Controller to the private address of a Node. If the Node supports remote programming of IP address, it will respond with an ArtIpProgReply packet. In all scenarios, the ArtIpProgReply is sent to the private address of the sender.

ArtIpProg packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	OpIpProg Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	-	Pad length to match ArtPoll.
6	Filler2	Int8	-	Pad length to match ArtPoll.
7	Command	Int8	-	Action this packet as follows:
			-	Defines the how this packet is processed. If all bits are clear, this is an enquiry only.

Field	Name	Size	Bit	Description
			7	Set to enable any programming.
			6	Set to enable DHCP (if set ignore lower bits).
			5-4	Not used, transmit as zero
			3	Set to return all three parameters to default
			2	Program IP Address
			1	Program Subnet Mask
			0	Program Port
8	Filler4	Int8		Set to zero. Pads data structure for word alignment.
9	ProgIpHi	Int8		IP Address to be programmed into Node if enabled by Command Field
10	ProgIp2	Int8		
11	ProgIp1	Int8		
12	ProgIpLo	Int8		
13	ProgSmHi	Int8		Subnet mask to be programmed into Node if enabled by Command Field
14	ProgSm2	Int8		
15	ProgSm1	Int8		
16	ProgSmLo	Int8		
17	ProgPortHi	Int8		(Deprecated)
18	ProgPortLo	Int8		
19-26	Spare1-8	Int8		Transmit as zero, receivers don't test.

ArtIpProgReply:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Node	Receive	No Action.
	Unicast Transmit	Transmits to specific Controller IP address.
	Broadcast	Not Allowed.
Media Server	Receive	No Action
	Unicast Transmit	Transmits to specific Controller IP address.
	Broadcast	Not Allowed.

The ArtIpProgReply packet is issued by a Node in response to an ArtIpProg packet. Nodes that do not support remote programming of IP address do not reply to ArtIpProg packets. In all scenarios, the ArtIpProgReply is sent to the private address of the sender.

ArtIpProgReply packet definition

Field	Name	Size	Description
1	ID[8]	Int8	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-’ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	OpIpProgReply Transmitted low byte first.
3	ProtVerHi	Int8	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	Low byte of the Art-Net protocol revision number. (14)
5	Filler1	Int8	Pad length to match ArtPoll.
6	Filler2	Int8	Pad length to match ArtPoll.
7	Filler3	Int8	Pad length to match ArtIpProg.
8	Filler4	Int8	Pad length to match ArtIpProg.
9	ProgIpHi	Int8	IP Address of Node.
10	ProgIp2	Int8	
11	ProgIp1	Int8	
12	ProgIpLo	Int8	
13	ProgSmHi	Int8	Subnet mask of Node.
14	ProgSm2	Int8	

Field	Name	Size	Description
15	ProgSm1	Int8	
16	ProgSmLo	Int8	
17	ProgPort Hi	Int8	(Deprecated).
18	ProgPort Lo	Int8	
19	Status	Int8	Bit 7 0
			Bit 6 DHCP enabled.
			Bit 5-0 0
20	Spare2	Int8	Transmit as zero, receivers don't test.
21	Spare3	Int8	Transmit as zero, receivers don't test.
22	Spare4	Int8	Transmit as zero, receivers don't test.
23	Spare5	Int8	Transmit as zero, receivers don't test.
24	Spare6	Int8	Transmit as zero, receivers don't test.
25	Spare7	Int8	Transmit as zero, receivers don't test.
26	Spare8	Int8	Transmit as zero, receivers don't test.

ArtAddress:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Controller transmits to a specific node IP address.
	Broadcast	Not Allowed.
Node	Receive	Reply by broadcasting ArtPollReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	Reply by broadcasting ArtPollReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

A Controller or monitoring device on the network can reprogram numerous controls of a node remotely. This, for example, would allow the lighting console to re-route DMX512 data at remote locations. This is achieved by sending an ArtAddress packet to the Node's IP address. (The IP address is returned in the ArtPoll packet). The node replies with an ArtPollReply packet.

Fields 5 to 13 contain the data that will be programmed into the node.

ArtAddress packet definition

Field	Name	Size	Description
1	ID[8]	Int8	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	OpAddress Transmitted low byte first.
3	ProtVerHi	Int8	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	Low byte of the Art-Net protocol revision number. Current value 14
5	NetSwitch	Int8	Bits 14-8 of the 15 bit Port-Address are encoded into the bottom 7 bits of this field. This is used in combination with SubSwitch and SwIn[] or SwOut[] to

Field	Name	Size	Description
			produce the full universe address. This value is ignored unless bit 7 is high. i.e. to program a value 0x07, send the value as 0x87. Send 0x00 to reset this value to the physical switch setting. Use value 0x7f for no change.
6	BindIndex	Int8	The BindIndex defines the bound node which originated this packet and is used to uniquely identify the bound node when identical IP addresses are in use. This number represents the order of bound devices. A lower number means closer to root device. A value of 1 means root device.
7	Short Name [18]	Int8	The array represents a null terminated short name for the Node. The Controller uses the ArtAddress packet to program this string. Max length is 17 characters plus the null. The Node will ignore this value if the string is null. This is a fixed length field, although the string it contains can be shorter than the field.
8	Long Name [64]	Int8	The array represents a null terminated long name for the Node. The Controller uses the ArtAddress packet to program this string. Max length is 63 characters plus the null. The Node will ignore this value if the string is null. This is a fixed length field, although the string it contains can be shorter than the field.
9	SwIn [4]	Int8	Bits 3-0 of the 15 bit Port-Address for a given input port are encoded into the bottom 4 bits of this field. This is used in combination with NetSwitch and SubSwitch to produce the full universe address. This value is ignored unless bit 7 is high. i.e. to program a value 0x07, send the value as 0x87. Send 0x00 to reset this value to the physical switch setting. Use value 0x7f for no change.
10	SwOut [4]	Int8	Bits 3-0 of the 15 bit Port-Address for a given output port are encoded into the bottom 4 bits of this field.

Field	Name	Size	Description
			This is used in combination with NetSwitch and SubSwitch to produce the full universe address. This value is ignored unless bit 7 is high. i.e. to program a value 0x07, send the value as 0x87. Send 0x00 to reset this value to the physical switch setting. Use value 0x7f for no change.
11	SubSwitch	Int8	Bits 7-4 of the 15 bit Port-Address are encoded into the bottom 4 bits of this field. This is used in combination with NetSwitch and SwIn[] or SwOut[] to produce the full universe address. This value is ignored unless bit 7 is high. i.e. to program a value 0x07, send the value as 0x87. Send 0x00 to reset this value to the physical switch setting. Use value 0x7f for no change.
12	SwVideo	Int8	Reserved.
13	Command	Int8	Node configuration commands:

Val	Mnemonic	Action
0x00	AcNone	No action
0x01	AcCancel Merge	If Node is currently in merge mode, cancel merge mode upon receipt of next ArtDmx packet. See discussion of merge mode operation.
0x02	AcLedNormal	The front panel indicators of the Node operate normally.
0x03	AcLedMute	The front panel indicators of the Node are disabled and switched off.
0x04	AcLedLocate	Rapid flashing of the Node's front panel indicators. It is intended as an outlet identifier for large installations.

Field	Name	Size	Description		
			0x05	AcResetRx Flags	Resets the Node's Sip, Text, Test and data error flags. If an output short is being flagged, forces the test to re-run.
			Node configuration commands: Note that Ltp / Htp settings should be retained by the node during power cycling.		
			0x10	AcMergeLtp0	Set DMX Port 0 to Merge in LTP mode.
			0x11	AcMergeLtp1	Set DMX Port 1 to Merge in LTP mode.
			0x12	AcMergeLtp2	Set DMX Port 2 to Merge in LTP mode.
			0x13	AcMergeLtp3	Set DMX Port 3 to Merge in LTP mode.
			0x50	AcMergeHtp0	Set DMX Port 0 to Merge in HTP (default) mode.
			0x51	AcMergeHtp1	Set DMX Port 1 to Merge in HTP (default) mode.
			0x52	AcMergeHtp2	Set DMX Port 2 to Merge in HTP (default) mode.
			0x53	AcMergeHtp3	Set DMX Port 3 to Merge in HTP (default) mode.
			0x60	AcArtNetSel0	Set DMX Port 0 to output both DMX512 and RDM packets from the Art-Net protocol (default).
			0x61	AcArtNetSel1	Set DMX Port 1 to output both DMX512 and RDM packets from the Art-Net protocol (default).
			0x62	AcArtNetSel2	Set DMX Port 2 to output both DMX512 and RDM packets from the Art-Net

Field	Name	Size	Description		
					protocol (default).
			0x63	AcArtNetSel3	Set DMX Port 3 to output both DMX512 and RDM packets from the Art-Net protocol (default).
			0x70	AcAcnSel0	Set DMX Port 0 to output DMX512 data from the sACN protocol and RDM data from the Art-Net protocol.
			0x71	AcAcnSel1	Set DMX Port 1 to output DMX512 data from the sACN protocol and RDM data from the Art-Net protocol.
			0x72	AcAcnSel2	Set DMX Port 2 to output DMX512 data from the sACN protocol and RDM data from the Art-Net protocol.
			0x73	AcAcnSel3	Set DMX Port 3 to output DMX512 data from the sACN protocol and RDM data from the Art-Net protocol.
			0x90	AcClearOp0	Clear DMX Output buffer for Port 0
			0x91	AcClearOp1	Clear DMX Output buffer for Port 1
			0x92	AcClearOp2	Clear DMX Output buffer for Port 2
			0x93	AcClearOp3	Clear DMX Output buffer for Port 3

ArtDiagData:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Application Specific.
	Unicast Transmit	As defined by ArtPoll.
	Broadcast	As defined by ArtPoll.
Node	Receive	No Action
	Unicast Transmit	As defined by ArtPoll.
	Broadcast	As defined by ArtPoll.
Media Server	Receive	No Action
	Unicast Transmit	As defined by ArtPoll.
	Broadcast	As defined by ArtPoll.

ArtDiagData is a general purpose packet that allows a node or controller to send diagnostics data for display.

The ArtPoll packet sent by controllers defines the destination to which these messages should be sent.

ArtDiagData packet definition

ArtDiagData				
Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	OpDiagData, transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	-	Ignore by receiver, set to zero by sender.
6	Priority	Int8	-	The priority of this diagnostic data. See Table 5.
7	Filler2	Int8	-	Ignore by receiver, set to zero by sender.
8	Filler3	Int8	-	Ignore by receiver, set to zero by sender.
9	LengthHi	Int8	-	The length of the text array below. High Byte.

ArtDiagData				
10	LengthLo	Int8	-	Low Byte.
11	Data [Length]	Int8	-	ASCII text array, null terminated. Max length is 512 bytes including the null terminator.

Table 5 – Priority Codes:

The following table details the Diagnostics Priority codes. These are used in ArtPoll and ArtDiagData.

Code	Mnemonic	Description
0x10	DpLow	Low priority message.
0x40	DpMed	Medium priority message.
0x80	DpHigh	High priority message.
0xe0	DpCritical	Critical priority message.
0xf0	DpVolatile	Volatile message. Messages of this type are displayed on a single line in the DMX-Workshop diagnostics display. All other types are displayed in a list box.

ArtTimeCode:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.
Node	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.
Media Server	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.

ArtTimeCode allows time code to be transported over the network. The data format is compatible with both longitudinal time code and MIDI time code. The four key types of Film, EBU, Drop Frame and SMPTE are also encoded.

Use of the packet is application specific but in general a single controller will broadcast the packet to the network.

ArtTimeCode packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	OpTimeCode Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	-	Ignore by receiver, set to zero by sender.
6	Filler2	Int8	-	Ignore by receiver, set to zero by sender.
7	Frames	Int8	-	Frames time. 0 – 29 depending on mode.

Field	Name	Size	Bit	Description
8	Seconds	Int8	-	Seconds. 0 - 59.
9	Minutes	Int8	-	Minutes. 0 - 59.
10	Hours	Int8	-	Hours. 0 - 23.
11	Type	Int8	-	0 = Film (24fps) 1 = EBU (25fps) 2 = DF (29.97fps) 3 = SMPTE (30fps)

ArtCommand:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.
Node	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.
Media Server	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.

The ArtCommand packet is used to send property set style commands. The packet can be unicast or broadcast, the decision being application specific.

ArtCommand packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	-	OpCommand Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	EstaManHi	Int8	-	The ESTA manufacturer code. These codes are used to represent equipment manufacturer. They are assigned by ESTA. This field can be interpreted as two ASCII bytes representing the manufacturer initials.
6	EstaManLo	Int8	-	Hi byte of above
7	LengthHi	Int8	-	The length of the text array below. High Byte.
8	LengthLo	Int8	-	Low Byte.

Field	Name	Size	Bit	Description
9	Data [Length]	Int8	-	ASCII text command string, null terminated. Max length is 512 bytes including the null term.

The Data field contains the command text. The text is ASCII encoded and is null terminated and is case insensitive. It is legal, although inefficient, to set the Data array size to the maximum of 512 and null pad unused entries.

The command text may contain multiple commands and adheres to the following syntax:

Command=Data&

The ampersand is a break between commands. Also note that the text is capitalised for readability; it is case insensitive.

Thus far, two commands are defined by Art-Net. It is anticipated that additional commands will be added as other manufacturers register commands which have industry wide relevance.

These commands shall be transmitted with EstaMan = 0xFFFF.

Table 6 – ArtCommand Commands:

The following table details the commands defined for use in ArtCommand.

Command	Description
SwoutText	This command is used to re-programme the label associated with the ArtPollReply->Swout fields. Syntax: "SwoutText=Playback&"
SwinText	This command is used to re-programme the label associated with the ArtPollReply->Swin fields. Syntax: "SwinText=Record&"

ArtTrigger:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.
Node	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.
Media Server	Receive	Application Specific.
	Unicast Transmit	Application Specific.
	Broadcast	Application Specific.

The ArtTrigger packet is used to send trigger macros to the network. The most common implementation involves a single controller broadcasting to all other devices.

In some circumstances a controller may only wish to trigger a single device or a small group in which case unicast would be used.

ArtTrigger packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	-	OpTrigger , transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	-	Ignore by receiver, set to zero by sender.
6	Filler2	Int8	-	Ignore by receiver, set to zero by sender.
7	OemCodeHi	Int8	-	The manufacturer code (high byte) of nodes that shall accept this trigger.
8	OemCodeLo	Int8	-	The manufacturer code (low byte) of nodes

Field	Name	Size	Bit	Description
				that shall accept this trigger.
9	Key	Int8	-	The Trigger Key.
10	SubKey	Int8	-	The Trigger SubKey.
11	Data [512]	Int8[]	-	The interpretation of the payload is defined by the Key.

Key

The Key is an 8-bit number which defines the purpose of the packet. The interpretation of this field is dependent upon the Oem field. If the Oem field is set to a value other than 0xffff then the Key and SubKey fields are manufacturer specific.

However, when the Oem field = 0xffff the meaning of the Key, SubKey and Payload is defined by Table 7.

Table 7 – ArtTrigger Key Values.

The following table details the commands defined for use in ArtCommand.

Key	Name	Purpose
0	KeyAscii	The SubKey field contains an ASCII character which the receiving device should process as if it were a keyboard press. (Payload not used).
1	KeyMacro	The SubKey field contains the number of a Macro which the receiving device should execute. (Payload not used).
2	KeySoft	The SubKey field contains a soft-key number which the receiving device should process as if it were a soft-key keyboard press. (Payload not used).
3	KeyShow	The SubKey field contains the number of a Show which the receiving device should run. (Payload not used).
4-255	Undefined	Undefined

SubKey

The SubKey is an 8-bit number. The interpretation of this field is dependent upon the Oem field. If the Oem field is set to a value other than ffff16 then the Key and SubKey fields are manufacturer specific.

However, when the Oem field = $ffff_{16}$ the meaning of the SubKey field is defined by the table above.

Payload

The Payload is a fixed length array of 512, 8-bit bytes. The interpretation of this field is dependent upon the Oem field. If the Oem field is set to a value other than 0xffff then the Payload is manufacturer specific.

ArtDmx:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Application Specific.
	Unicast Transmit	Yes.
	Broadcast	No.
Node	Receive	Application Specific.
	Unicast Transmit	Yes.
	Broadcast	No.
Media Server	Receive	Application Specific.
	Unicast Transmit	Yes.
	Broadcast	No.

ArtDmx is the data packet used to transfer DMX512 data. The format is identical for Node to Controller, Node to Node and Controller to Node.

The Data is output through the DMX O/P port corresponding to the Universe setting. In the absence of received ArtDmx packets, each DMX O/P port re-transmits the same frame continuously.

The first complete DMX frame received at each input port is placed in an ArtDmx packet as above and transmitted as an ArtDmx packet containing the relevant Universe parameter. Each subsequent DMX frame containing *new data* (different length or different contents) is also transmitted as an ArtDmx packet.

Nodes do not transmit ArtDmx for DMX512 inputs that have not received data since power on.

However, an input that is active but not changing, will re-transmit the last valid ArtDmx packet at approximately 4-second intervals. (Note. In order to converge the needs of Art-Net and sACN it is recommended that Art-Net devices actually use a re-transmit time of 800mS to 1000mS).

A DMX input that fails will not continue to transmit ArtDmx data.

Unicast Subscription:

ArtDmx packets must be unicast to subscribers of the specific universe contained in the ArtDmx packet.

The transmitting device must regularly ArtPoll the network to detect any change in devices which are subscribed. Nodes that are subscribed will list the subscription universe in the ArtPollReply. *Subscribed means any universes listed in either the Swin or Swout array.*

If there are no subscribers to a universe that the transmitter wishes to send, then the ArtDmx must not be broadcast. If the number of universe subscribers exceeds 40 for a given universe, the transmitting device may broadcast.

ArtDmx packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	-	OpOutput Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Sequence	Int8	-	The sequence number is used to ensure that ArtDmx packets are used in the correct order. When Art-Net is carried over a medium such as the Internet, it is possible that ArtDmx packets will reach the receiver out of order. This field is incremented in the range 0x01 to 0xff to allow the receiving node to resequence packets. The Sequence field is set to 0x00 to disable this feature.
6	Physical	Int8	-	The physical input port from which DMX512

Field	Name	Size	Bit	Description
				data was input. This field is for information only. Use Universe for data routing.
7	SubUni	Int8	-	The low byte of the 15 bit Port-Address to which this packet is destined.
8	Net	Int8	-	The top 7 bits of the 15 bit Port-Address to which this packet is destined.
9	LengthHi	Int8	-	The length of the DMX512 data array. This value should be an even number in the range 2 – 512. It represents the number of DMX512 channels encoded in packet. NB: Products which convert Art-Net to DMX512 may opt to always send 512 channels. High Byte.
10	Length	Int8	-	Low Byte of above.
11	Data [Length]	Int8	-	A variable length array of DMX512 lighting data.

Refresh Rate:

The ArtDmx packet is intended to transfer DMX512 data. For this reason, the ArtDmx packet for a specific IP Address should not be transmitted at a repeat rate faster than the maximum repeat rate of a DMX packet containing 512 data slots.

Synchronous Data:

In video or media-wall applications, the ability to synchronise multiple universes of ArtDmx is beneficial. This can be achieved with the ArtSync packet.

Data Merging:

The Art-Net protocol allows multiple nodes or controllers to transmit ArtDmx data to the same universe.

A node can detect this situation by comparing the IP addresses of received ArtDmx packets. If ArtDmx packets addressed to the same Universe are received from different IP addresses, a potential conflict exists.

The Node can legitimately handle this situation using one of two methods:

- Consider this to be an error condition and await user intervention.
- Automatically merge the data.

Nodes should document the approach that is implemented in the product user guide. The Merge option is preferred as it provides a higher level of functionality.

Merge is implemented in either LTP or HTP mode as specified by the ArtAddress packet.

Merge mode is implemented as follows:

> If ArtDmx is received from differing IP addresses, the data is merged to the DMX output. In this situation, *ArtPollReply-GoodOutput-Bit3* is set. If *Art-Poll-TalkToMe Bit 1* is set, an ArtPollReply should be transmitted when merging commences.

Exit from Merge mode is handled as follows:

> If *ArtAddress AcCancelMerge* is received, the Next ArtDmx message received ends Merge mode. The Node then discards any ArtDmx packets received from an IP address that does not match the IP address of the ArtDmx packet that terminated Merge mode.
>
> If either (but not both) sources of ArtDmx stop, the failed source is held in the merge buffer for 10 seconds. If, during the 10 second timeout, the failed source returns, Merge mode continues. If the failed source does not recover, at the end of the timeout period, the Node exits Merge mode.
>
> If both sources of ArtDmx fail, the output holds the last merge result.

Merging is limited to two sources, any additional sources will be ignored by the Node.

The Merge implementation allows for the following two key modes of operation.

- Combined Control: Two Controllers (Consoles) can operate on a network and merge data to multiple Nodes.

- Backup: One Controller (Console) can monitor the network for a failure of the primary Controller. If a failure occurs, it can use the *ArtAddress AcCancelMerge* command to take instant control of the network.

When a node provides multiple DMX512 inputs, it is the responsibility of the Node to handle merging of data. This is because the Node will have only one IP address. If this were not handled at the Node, ArtDmx packets with identical IP addresses and identical universe numbers, but conflicting level data would be transmitted to the network.

ArtSync:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No action.
	Unicast Transmit	Not Allowed.
	Directed Broadcast	Controller broadcasts this packet to synchronously transfer previous ArtDmx packets to Node's output.
Node	Receive	Transfer previous ArtDmx packets to output.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	Transfer previous ArtDmx packets to output.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

The ArtSync packet can be used to force nodes to synchronously output ArtDmx packets to their outputs. This is useful in video and media-wall applications.

A controller that wishes to implement synchronous transmission will unicast multiple universes of ArtDmx and then broadcast an ArtSync to synchronously transfer all the ArtDmx packets to the nodes' outputs at the same time.

Managing Synchronous and non-Synchronous modes

At power on or reset a node shall operate in non-synchronous mode. This means that ArtDmx packets will be immediately processed and output.

When a node receives an ArtSync packet it should transfer to synchronous operation. This means that received ArtDmx packets will be buffered and output when the next ArtSync is received.

In order to allow transition between synchronous and non-synchronous modes, a node shall time out to non-synchronous operation if an ArtSync is not received for 4 seconds or more.

ArtSync packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	The OpCode defines the class of data within this UDP packet. Transmitted low byte first. See Table 1 for the OpCode listing. Set to OpSync.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14. Controllers should ignore communication with nodes using a protocol version lower than 14.
5	Aux1	Int8	-	Transmit as zero.
6	Aux2	Int8	-	Transmit as zero.

Multiple controllers

In order to allow for multiple controllers on a network, a node shall compare the source IP of the ArtSync to the source IP of the most recent ArtDmx packet. The ArtSync shall be ignored if the IP addresses do not match.

When a port is merging multiple streams of ArtDmx from different IP addresses, ArtSync packets shall be ignored.

ArtNzs:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Application Specific.
	Unicast Transmit	Yes.
	Broadcast	No.
Node	Receive	Application Specific.
	Unicast Transmit	Yes.
	Broadcast	No.
Media Server	Receive	Application Specific.
	Unicast Transmit	Yes.
	Broadcast	No.

ArtNzs is the data packet used to transfer DMX512 data with non-zero start codes (except RDM). The format is identical for Node to Controller, Node to Node and Controller to Node.

ArtNzs packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	-	OpNzs Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Sequence	Int8	-	The sequence number is used to ensure that ArtNzs packets are used in the correct order. When Art-Net is carried over a medium such as the Internet, it is possible that ArtNzs packets

Field	Name	Size	Bit	Description
				will reach the receiver out of order. This field is incremented in the range 0x01 to 0xff to allow the receiving node to resequence packets. The Sequence field is set to 0x00 to disable this feature.
6	StartCode	Int8	-	The DMX512 start code of this packet. Must not be Zero or RDM.
7	SubUni	Int8	-	The low byte of the 15 bit Port-Address to which this packet is destined.
8	Net	Int8	-	The top 7 bits of the 15 bit Port-Address to which this packet is destined.
9	LengthHi	Int8	-	The length of the data array. This value should be a number in the range 1 – 512. It represents the number of DMX512 channels encoded in packet. High Byte.
10	Length	Int8	-	Low Byte of above.
11	Data [Length]	Int8	-	A variable length array of DMX512 lighting data.

ArtVlc:

ArtVlc is a specific implementation of the ArtNzs packet which is used for the transfer of VLC (Visible Light Communication) data over Art-Net. (The packet's payload can also be used to transfer VLC over a DMX512 physical layer).

Fields 2, 6, 11, 12 and 13 should be treated as 'magic numbers' to detect this packet.

ArtVlc packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	-	OpNzs Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Sequence	Int8	-	The sequence number is used to ensure that ArtNzs packets are used in the correct order. When Art-Net is carried over a medium such as the Internet, it is possible that ArtNzs packets will reach the receiver out of order. This field is incremented in the range 0x01 to 0xff to allow the receiving node to resequence packets. The Sequence field is set to 0x00 to disable this feature.
6	StartCode	Int8	-	The DMX512 start code of this packet is set to 91_{16}. No other values are allowed.
7	SubUni	Int8	-	The low byte of the 15 bit Port-Address to which this packet is destined.
8	Net	Int8	-	The top 7 bits of the 15 bit Port-Address to which this packet is destined.
9	LengthHi	Int8	-	The length of the Vlc data array. This value

Field	Name	Size	Bit	Description
				should be in the range 1 – 512. It represents the number of DMX512 channels encoded in packet. High Byte.
10	Length	Int8	-	Low Byte of above.
11	Vlc [Length]		-	A variable length array of VLC data as described below:
11	Vlc[0] ManIdHi	Int8	-	41_{16} Magic number used to identify this packet.
12	Vlc[1] ManIdLo	Int8	-	$4C_{16}$ Magic number used to identify this packet.
13	Vlc[2] SubCode	Int8	-	45_{16} Magic number used to identify this packet.
14	Vlc[3] Flags	Int8		Bit fields used to control VLC operation. Bits that are unused shall be transmitted as zero.
	Flags.Ieee		7	If set, data in the payload area shall be interpreted as IEEE VLC data. If clear, PayLanguage defines the payload contents.
	Flags.Reply		6	If set this is a reply packet that is in response to the request sent with matching number in the transaction number: TransHi/Lo. If clear this is not a reply.
	Flags.Beacon		5	If set, the transmitter should continuously repeat transmission of this packet until another is received. If clear, the transmitter should transmit this packet once.
15	Vlc[4] TransHi	Int8	-	The transaction number is a 16-bit value which allows VLC transactions to be synchronised. A value of 0 indicates the first packet in a transaction. A value of $ffff_{16}$ indicates the final packet in the transaction. All other packets contain consecutive numbers which increment on each packet and roll over to 1 at $fffe_{16}$.
16	Vlc[5] TransLo	Int8	-	Lo byte of above

Field	Name	Size	Bit	Description
17	Vlc[6] SlotAddrHi	Int8	-	The slot number, range 1-512, of the device to which this packet is directed. A value 0f 0 indicates that all devices attached to this packet's Port-Address should accept the packet.
18	Vlc[7] SlotAddrLo	Int8	-	Lo byte of above
19	Vlc[8] PayCountHi	Int8	-	The 16-bit payload size in the range 0 to 480_{10}.
20	Vlc[9] PayCountLo	Int8	-	Lo byte of above
21	Vlc[10] PayCheckHi	Int8	-	The 16-bit unsigned additive checksum of the data in the payload.
22	Vlc[11] PayCheckLo	Int8	-	Lo byte of above
23	Vlc[12] Spare1	Int8	-	Transmit as zero, receive does not check.
24	Vlc[13] VlcDepth	Int8	-	The 8-bit VLC modulation depth expressed as a percentage in the range 1 to 100. A value of 0 indicates that the transmitter should use its default value
25	Vlc[14] VlcFreqHi	Int8	-	The 16-bit modulation frequency of the VLC transmitter expressed in Hz. A value of 0 indicates that the transmitter should use its default value.
26	Vlc[15] VlcFreqLo	Int8	-	Lo byte of above
27	Vlc[16] VlcModHi	Int8	-	The 16-bit modulation type number that the transmitter should use to transmit VLC. 0000_{16} – Use transmitter default.
28	Vlc[17] VlcModLo	Int8	-	Lo byte of above
29	Vlc[18] PayLangHi	Int8	-	The 16-bit payload language code. Currently registered values:
				0000_{16} – BeaconURL – Payload contains a simple text string representing a URL.

Field	Name	Size	Bit	Description
				0001_{16} – BeaconText – Payload contains a simple ASCII text message.
30	Vlc[19] PayLangLo	Int8	-	Lo byte of above
31	Vlc[20] BeacRepHi	Int8	-	The 16-bit beacon mode repeat frequency. If Flags.Beacon is set, this 16-bit value indicates the frequency in Hertz at which the VLC packet should be repeated. 0000_{16} – Use transmitter default.
32	Vlc[21] BeacRepLo	Int8	-	Lo byte of above
33	Vlc[22] Payload	Var	-	The actual VLC payload.

ArtInput:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Controller transmits to a specific node IP address.
	Broadcast	Not Allowed.
Node	Receive	Reply with ArtPollReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	Reply with ArtPollReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

A Controller or monitoring device on the network can enable or disable individual DMX512 inputs on any of the network nodes. This allows the Controller to directly control network traffic and ensures that unused inputs are disabled and therefore not wasting bandwidth.

All nodes power on with all inputs enabled.

Caution should be exercised when implementing this function in the controller. Keep in mind that some network traffic may be operating on a node to node basis.

ArtInput packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	OpInput Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14

Field	Name	Size	Bit	Description
5	Filler1	Int8	-	Pad length to match ArtPoll.
6	BindIndex	Int8	-	The BindIndex defines the bound node which originated this packet and is used to uniquely identify the bound node when identical IP addresses are in use. This number represents the order of bound devices. A lower number means closer to root device. A value of 1 means root device.
7	NumPortsHi	Int8	-	The high byte of the word describing the number of input or output ports. The high byte is for future expansion and is currently zero.
8	NumPortsLo	Int8	-	The low byte of the word describing the number of input or output ports. If number of inputs is not equal to number of outputs, the largest value is taken. The maximum value is 4.
9	Input [4]	Int8	-	This array defines input disable status of each channel. (Example = 0x01, 0x00, 0x01, 0x00 to disable first and third inputs)
			7-1	Not currently used
			0	Set to disable this input.

Firmware and UBEA upgrades:

This section defines the packets used to send firmware revisions to a node. In all instances, communication is private. Under no circumstances should the broadcast address be used.

The transaction involves the controller sending multiple ArtFirmwareMaster packets to a Node's IP address. Each packet is acknowledged by the Node with an ArtFirmwareReply.

The controller allows a 30 second maximum delay for reception of the ArtFirmwareReply.

If the reply is not received in this time, the controller aborts the transaction. The large time period is to allow for Nodes that are writing directly to slow non-volatile memory.

The Node allows a 30 second delay between sending an ArtFirmwareReply and receipt of the next consecutive ArtFirmwareMaster. If the next consecutive block is not received within this time, the Node aborts the transaction. In this instance the Node returns to its previous operating system and sets ArtPollReply->Status and ArtPollReply ->NodeReport accordingly.

The firmware update file contains a header that defines the Node OEM values that are valid for this update. The Controller must check this value before sending to a Node. The Node also checks this data on receipt of the first packet. If the Node receives a packet with an invalid code, it sends an error response.

The UBEA is the User Bios Expansion Area. This is a limited firmware upload mechanism that allows third party firmware extensions to be added to a Node.

Manufacturers who implement this feature must document the software interface requirements.

ArtFirmwareMaster:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Controller transmits to a specific node IP address.
	Broadcast	Not Allowed.
Node	Receive	Reply with OpFirmwareReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	Reply with OpFirmwareReply.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

ArtFirmwareMaster packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	OpFirmwareMaster. Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	-	Pad length to match ArtPoll.
6	Filler2	Int8	-	Pad length to match ArtPoll.
7	Type	Int8	-	Defines the packet contents as follows:

Value	Mnemonic	Function
0x00	FirmFirst	The first packet of a firmware upload.
0x01	FirmCont	A consecutive continuation packet of a firmware upload.
0x02	FirmLast	The last packet of a firmware upload.

Field	Name	Size	Bit	Description		
				0x03	UbeaFirst	The first packet of a UBEA upload.
				0x04	UbeaCont	A consecutive continuation packet of a UBEA upload.
				0x05	UbeaLast	The last packet of a UBEA upload.
8	BlockId	Int8	-	Counts the consecutive blocks of firmware upload. Starting at 0x00 for the FirmFirst or UbeaFirst packet.		
9	Firmware Length3	Int8	-	This Int64 parameter describes the total number of words (Int16) in the firmware upload plus the firmware header size. Eg a 32K word upload plus 530 words of header information == 0x00008212. This value is also the file size (in words) of the file to be uploaded.		
10	Firmware Length2	Int8	-			
11	Firmware Length1	Int8	-			
12	Firmware Length0	Int8	-	LSB		
13	Spare[20]	Int8	-	Controller sets to zero, Node does not test.		
14	Data[512]	Int16	-	This array contains the firmware or UBEA data block. The order is hi byte first. The interpretation of this data is manufacturer specific. Final packet should be null packed if less than 512 bytes needed.		

ArtFirmwareReply:

Packet strategy.

Entity	Direction	Action
Controller	Receive	Send next OpFirmwareMaster.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Node	Receive	No Action.
	Unicast Transmit	Node transmits to a specific Controller IP address.
	Broadcast	Not Allowed.
Media Server	Receive	No Action.
	Unicast Transmit	Node transmits to a specific Controller IP address.
	Broadcast	Not Allowed.

This packet is sent by the Node to the Controller in acknowledgement of each OpFirmwareMaster packet.

ArtFirmwareReply packet definition

Field	Name	Size	Bit	Description		
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00		
2	OpCode	Int16	-	OpFirmwareReply. Transmitted low byte first.		
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.		
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14		
5	Filler1	Int8	-	Pad length to match ArtPoll.		
6	Filler2	Int8	-	Pad length to match ArtPoll.		
7	Type	Int8	-	Defines the packet contents as follows. Codes are used for both firmware and UBEA.		
				Value	Mnemonic	Function
				0x00	FirmBlockGood	Last packet received successfully.

Field	Name	Size	Bit	Description		
				0x01	FirmAll Good	All firmware received successfully.
				0xff	FirmFail	Firmware upload failed. (All error conditions).
8	Spare[21]	Int8	-	Node sets to zero, Controller does not test.		

Firmware File Format:

All firmware and UBEA upload files should be of the following format.

The firmware file extension is .alf.

The UBEA file extension is .alu.

Byte	Name	Description
1	ChecksumHi	This is a 16 bit, one's-complement checksum of the firmware data area.
2	ChecksumLo	LSB of above
3	VersInfoHi	High byte of Node's firmware revision number. The Controller should only use this field to decide if a firmware update should proceed. The convention is that a higher number is a more recent release of firmware.
4	VersInfoLo	LSB of above
5-34	UserName	30 byte field of user name information. This information is not checked by the Node. It is purely for display by the Controller. It should contain a human readable description of file and version number. Whilst this is a fixed length field, it must contain a null termination.
35-546	Oem[256]	An array of 256 words. Each word is hi byte first and represents an Oem code for which this file is valid. Unused entries must be filled with 0x0000.
547-1056	Spare[255]	An array of 255 words. Currently unused and should be set to zero.

Byte	Name	Description
1057	Length3	The total length in words of the firmware information following this field.
1058	Length2	
1059	Length1	
1060	Length0	LSB
1061	Data[]	The firmware data as an array of 16 bit values ordered hi byte first. The actual data is manufacturer specific.

RDM Support:

This section defines the packet structure used to gate the Remote Device Management (RDM) protocol across Art-Net. It is assumed that the reader is familiar with the RDM document.

Art-Net devices support RDM as follows:

- All RDM discovery commands are proxied; Art-Net devices hold local RDM device lists and conduct their own discovery.
- All RDM Get / Set commands are non-proxied; they are passed to end devices for response.

This document defines the following terms:

Input Gateway: A device that inputs DMX512 onto the Art-Net network (e.g. Art-Lynx IP).

Output Gateway: A device that outputs DMX512 from the Art-Net network (e.g. Art-Lynx OP)

Table of Devices (TOD): The list of RDM devices maintained by both Input and Output Gateways.

RDM Discovery

Output Gateway Operation

Output Gateways perform RDM discovery independent of network operation. This includes full discovery upon power-on and incremental discovery as a background task. The Output Gateway informs the network about its TOD as follows:

Upon receipt of an ArtTodRequest packet, the Output Gateways Directed Broadcast an ArtTodData packet containing the entire TOD. All Input Gateways parse the ArtTodData

packets. If the Sub-Net and Universe fields match, the Input Gateway adds the TOD contents to their own internal TOD. This allows Input Gateways to respond to any physical layer RDM discovery commands they receive.

Upon completion of initial RDM discovery, Output Gateways Directed Broadcast their TOD in an ArtTodData packet.

When an RDM device is added to or removed from the Output Gateway's TOD (during incremental discovery), an ArtTodData packet is broadcast automatically.

Input Gateway Operation

Input Gateways generate a TOD by monitoring Art-Net traffic. The TOD is then used to reply to RDM discovery commands by proxy. Operation is as follows:

Upon power-on, Input Gateways Directed Broadcast an ArtTodRequest packet.

The network is monitored for ArtTodData packets. If the Sub-Net and Universe fields match, the Input Gateway adds the TOD contents to its own internal TOD. This allows Input Gateways to respond to any RDM discovery commands they receive.

Input Gateways do not transmit any RDM discovery messages to the network.

Controller Operation:

Controllers emulate the operation of Input Gateways.

ArtTodRequest:

This packet is used to request the Table of RDM Devices (TOD). A Node receiving this packet must not interpret it as forcing full discovery. Full discovery is only initiated at power on or when an ArtTodControl.AtcFlush is received. The response is ArtTodData.

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Controller Directed Broadcasts to all nodes.
Node Output Gateway	Receive	Reply with ArtTodData.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Node Input Gateway	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Input Gateway Directed Broadcasts to all nodes.
Media Server	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

ArtTodRequest packet definition

Field	Name	Size	Bit	Description
1	ID[8]	Int8	-	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	-	OpTodRequest. Transmitted low byte first.
3	ProtVerHi	Int8	-	High byte of the Art-Net protocol revision number.

Field	Name	Size	Bit	Description
4	ProtVerLo	Int8	-	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	-	Pad length to match ArtPoll.
6	Filler2	Int8	-	Pad length to match ArtPoll.
7	Spare1	Int8	-	Transmit as zero, receivers don't test.
8	Spare2	Int8	-	Transmit as zero, receivers don't test.
9	Spare3	Int8	-	Transmit as zero, receivers don't test.
10	Spare4	Int8	-	Transmit as zero, receivers don't test.
11	Spare5	Int8	-	Transmit as zero, receivers don't test.
12	Spare6	Int8	-	Transmit as zero, receivers don't test.
13	Spare7	Int8	-	Transmit as zero, receivers don't test.
14	Net	Int8	-	The top 7 bits of the 15 bit Port-Address of Nodes that must respond to this packet.
15	Command	Int8	-	Value: 0x00 — Mnemonic: TodFull — Function: Send the entire TOD.
16	AddCount	Int8	-	The number of entries in Address that are used. Max value is 32.
17	Address [32]	Int8	-	This array defines the low byte of the Port-Address of the Output Gateway nodes that must respond to this packet. The high nibble is the Sub-Net switch. The low nibble corresponds to the Universe. This is combined with the 'Net' field above to form the 15 bit address.

ArtTodData:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Node Output Gateway	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Output Gateway always Directed Broadcasts this packet.
Node Input Gateway	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Media Server	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

ArtTodData packet definition

Field	Name	Size	Description
1	ID[8]	Int8	Array of 8 characters, the final character is a null termination. Value = 'A' 'r' 't' '-' 'N' 'e' 't' 0x00
2	OpCode	Int16	OpTodData. Transmitted low byte first.
3	ProtVerHi	Int8	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	Low byte of the Art-Net protocol revision number. Current value 14
5	RdmVer	Int8	Art-Net Devices that only support RDM DRAFT V1.0 set field to 0x00. Devices that support RDM STANDARD V1.0 set field to 0x01.

Field	Name	Size	Description
6	Port	Int8	Physical Port. Range 1-4.
7	Spare1	Int8	Transmit as zero, receivers don't test.
8	Spare2	Int8	Transmit as zero, receivers don't test.
9	Spare3	Int8	Transmit as zero, receivers don't test.
10	Spare4	Int8	Transmit as zero, receivers don't test.
11	Spare5	Int8	Transmit as zero, receivers don't test.
12	Spare6	Int8	Transmit as zero, receivers don't test.
13	BindIndex	Int8	The BindIndex defines the bound node which originated this packet. In combination with Port and Source IP address, it uniquely identifies the sender. This must match the BindIndex field in ArtPollReply. This number represents the order of bound devices. A lower number means closer to root device. A value of 1 means root device.
14	Net	Int8	The top 7 bits of the Port-Address of the Output Gateway DMX Port that generated this packet.
15	Command Response	Int8	Defines the packet contents as follows.

Value	Mnemonic	Function
0x00	TodFull	The packet contains the entire TOD or is the first packet in a sequence of packets that contains the entire TOD.
0xff	TodNak	The TOD is not available or discovery is incomplete.

16	Address	Int8	The low 8 bits of the Port-Address of the Output Gateway DMX Port that generated this packet. The high nibble is the Sub-Net switch. The low nibble corresponds to the Universe.
17	UidTotalHi	Int8	The total number of RDM devices discovered by this Universe.
18	UidTotalLo	Int8	
19	BlockCount	Int8	The index number of this packet. When UidTotal exceeds 200, multiple ArtTodData packets are used. BlockCount is set to zero for the first packet, and incremented for each subsequent packet containing

Field	Name	Size	Description
			blocks of TOD information.
20	UidCount	Int8	The number of UIDs encoded in this packet. This is the index of the following array.
21	ToD [UidCount]	48 bit	An array of RDM UID.

ArtTodControl:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Allowed.
	Broadcast	Controller Directed Broadcasts to all nodes.
Node Output Gateway	Receive	Reply with ArtTodData.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.
Node Input Gateway	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Input Gateway Directed Broadcasts to all nodes.
Media Server	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

The ArtTodControl packet is used to send RDM control parameters over Art-Net. The response is ArtTodData.

ArtTodControl packet definition

Field	Name	Size	Description
1	ID[8]	Int8	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	OpTodControl. Transmitted low byte first.
3	ProtVerHi	Int8	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	Low byte of the Art-Net protocol revision number. Current value 14
5	Filler1	Int8	Pad length to match ArtPoll.
6	Filler2	Int8	Pad length to match ArtPoll.

Field	Name	Size	Description		
7	Spare1	Int8	Transmit as zero, receivers don't test.		
8	Spare2	Int8	Transmit as zero, receivers don't test.		
9	Spare3	Int8	Transmit as zero, receivers don't test.		
10	Spare4	Int8	Transmit as zero, receivers don't test.		
11	Spare5	Int8	Transmit as zero, receivers don't test.		
12	Spare6	Int8	Transmit as zero, receivers don't test.		
13	Spare7	Int8	Transmit as zero, receivers don't test.		
14	Net	Int8	The top 7 bits of the Port-Address of the Output Gateway DMX Port that should action this command.		
15	Command	Int8	Defines the packet action.		
			Value	Mnemonic	Function
			0x00	AtcNone	No action.
			0x01	AtcFlush	The node flushes its TOD and instigates full discovery.
16	Address	Int8	The low byte of the 15 bit Port-Address of the DMX Port that should action this command.		

ArtRdm:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Allowed – Preferred.
	Broadcast	Allowed.
Node Output Gateway	Receive	No Action
	Unicast Transmit	Allowed - Preferred.
	Broadcast	Allowed.
Node Input Gateway	Receive	No Action.
	Unicast Transmit	Allowed - Preferred.
	Broadcast	Allowed.
Media Server	Receive	No Action.
	Unicast Transmit	Allowed - Preferred.
	Broadcast	Allowed.

The ArtRdm packet is used to transport all non-discovery RDM messages over Art-Net.

ArtRdm packet definition

Field	Name	Size	Description
1	ID[8]	Int8	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	OpRdm. Transmitted low byte first.
3	ProtVerHi	Int8	High byte of the Art-Net protocol revision number.
4	ProtVerLo	Int8	Low byte of the Art-Net protocol revision number. Current value 14
5	RdmVer	Int8	Art-Net Devices that only support RDM DRAFT V1.0 set field to 0x00. Devices that support RDM STANDARD V1.0 set field to 0x01.

Field	Name	Size	Description		
6	Filler2	Int8	Pad length to match ArtPoll.		
7	Spare1	Int8	Transmit as zero, receivers don't test.		
8	Spare2	Int8	Transmit as zero, receivers don't test.		
9	Spare3	Int8	Transmit as zero, receivers don't test.		
10	Spare4	Int8	Transmit as zero, receivers don't test.		
11	Spare5	Int8	Transmit as zero, receivers don't test.		
12	Spare6	Int8	Transmit as zero, receivers don't test.		
13	Spare7	Int8	Transmit as zero, receivers don't test.		
14	Net	Int8	The top 7 bits of 15 bit Port-Address that should action this command.		
15	Command	Int8	Defines the packet action.		
			Value	Mnemonic	Function
			0x00	ArProcess	Process RDM Packet.
16	Address	Int8	The low 8 bits of the Port-Address that should action this command.		
17	RdmPacket	Int8 [Vari]	The RDM data packet excluding the DMX StartCode.		

ArtRdmSub:

Packet strategy.

Entity	Direction	Action
Controller	Receive	No Action.
	Unicast Transmit	Yes.
	Broadcast	Not allowed.
Node Output Gateway	Receive	No Action
	Unicast Transmit	Yes.
	Broadcast	Not allowed.
Node Input Gateway	Receive	No Action.
	Unicast Transmit	Yes.
	Broadcast	Not allowed.
Media Server	Receive	No Action.
	Unicast Transmit	Not Allowed.
	Broadcast	Not Allowed.

The ArtRdmSub packet is used to transfer Get, Set, GetResponse and SetResponse data to and from multiple sub-devices within an RDM device. This packet is primarily used by Art-Net devices that proxy or emulate RDM. It offers very significant bandwidth gains over the approach of sending multiple ArtRdm packets.

Please note that this packet was added at the release of Art-Net II. For backwards compatibility it is only acceptable to implement this packet in addition to ArtRdm. It must not be used instead of ArtRdm.

ArtRdmSub packet definition

ArtRdmSub			
Field	Name	Size	Description
1	ID[8]	Int8	Array of 8 characters, the final character is a null termination. Value = ‘A’ ‘r’ ‘t’ ‘-‘ ‘N’ ‘e’ ‘t’ 0x00
2	OpCode	Int16	OpRdmSub. Transmitted low byte first.
3	ProtVerHi	Int8	High byte of the Art-Net protocol revision

ArtRdmSub			
			number.
4	ProtVerLo	Int8	Low byte of the Art-Net protocol revision number. Current value 14
5	RdmVer	Int8	Art-Net Devices that only support RDM DRAFT V1.0 set field to 0x00. Devices that support RDM STANDARD V1.0 set field to 0x01.
6	Filler2	Int8	Transmit as zero, receivers don't test.
7	UID	Int8[6]	UID of target RDM device.
8	Spare1	Int8	Transmit as zero, receivers don't test.
9	CommandClass	Int8	As per RDM specification. This field defines whether this is a Get, Set, GetResponse, SetResponse.
10	ParameterId	Int16	As per RDM specification. This field defines the type of parameter contained in this packet. Big-endian.
11	SubDevice	Int16	Defines the first device information contained in packet. This follows the RDM convention that 0 = root device and 1 = first subdevice. Big-endian.
12	SubCount	Int16	The number of sub devices packed into packet. Zero is illegal. Big-endian.
13	Spare2	Int8	Transmit as zero, receivers don't test.
14	Spare3	Int8	Transmit as zero, receivers don't test.
15	Spare4	Int8	Transmit as zero, receivers don't test.
16	Spare5	Int8	Transmit as zero, receivers don't test.
17	Data	Int16 [Vari]	Packed 16-bit big-endian data. The size of the data array is defined by the contents of CommandClass and SubCount:

CommandClass	Array Size
Get	0
Set	SubCount
GetResponse	SubCount
SetResponse	0

Display of status:

Most Art-Net compliant equipment will provide some level of status indication. The following format is suggested:

Name	Mnemonic	Function	
Power	Pow	Normally on, flashes if fault detected.	
Communication	Com	On if any Art-Net packets detected on network, timeout after 6 seconds.	
DMX512	DMX x	DMX Input	On if good DMX received, Flashing if errors detected. Alternative Start Codes are not errors!
		DMX Output	On if receiving ArtDmx for this output. Timeout after 6 seconds.

Data Integrity:

Art-Net receivers should check one item:

Compare the ID[8] field

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