Dension WiRC Communication Protocol Specification

Version 1.3

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Overview

Smartphones or other client devices can control the WiRC using the communication protocol described below. The participants of the communication: one WRCD (the control service running on a WiRC device) and one or more transmitters (client applications running on smartphones).

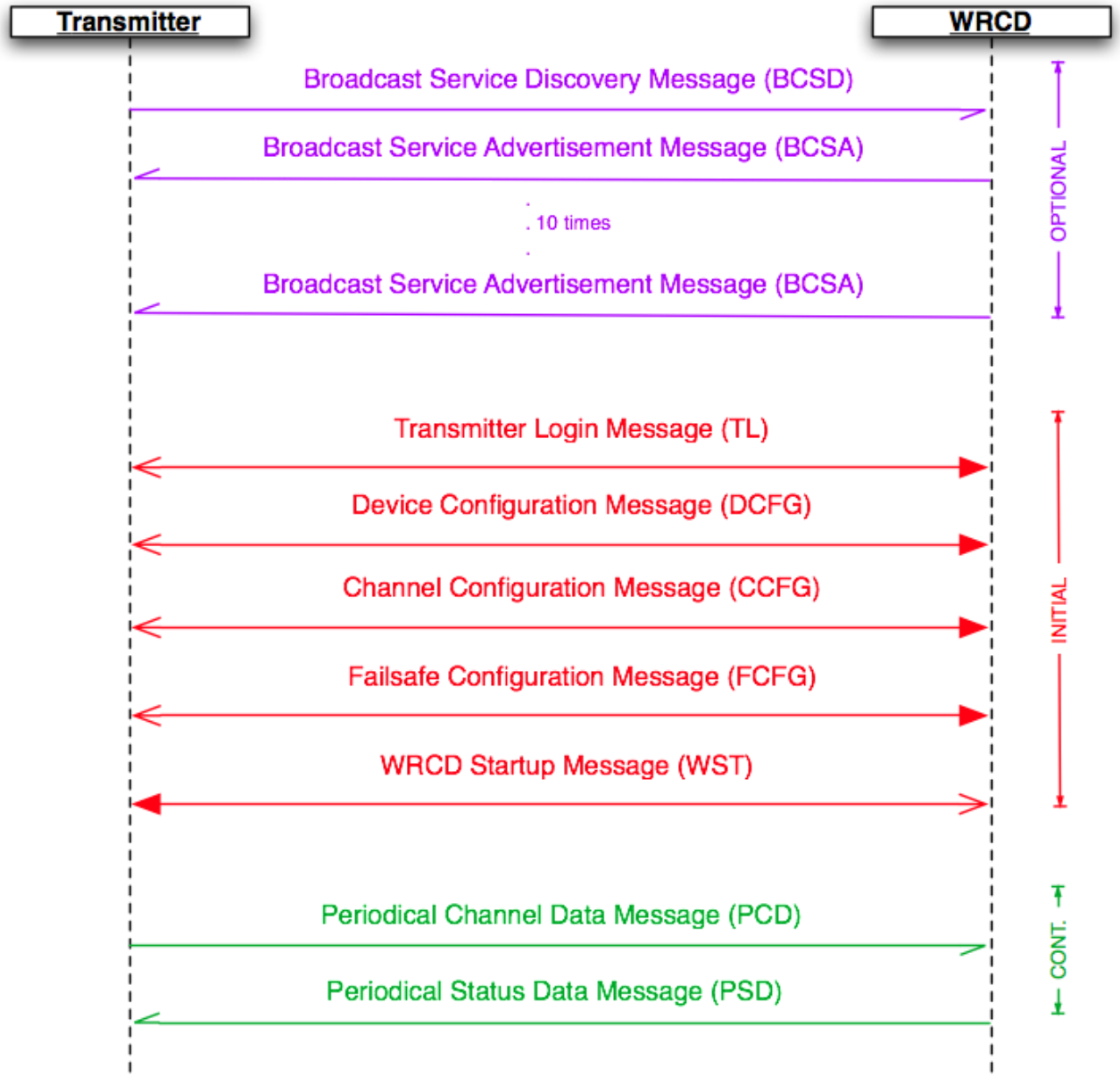
The communication protocol uses multiple network connections, see the summary of network connections table below.

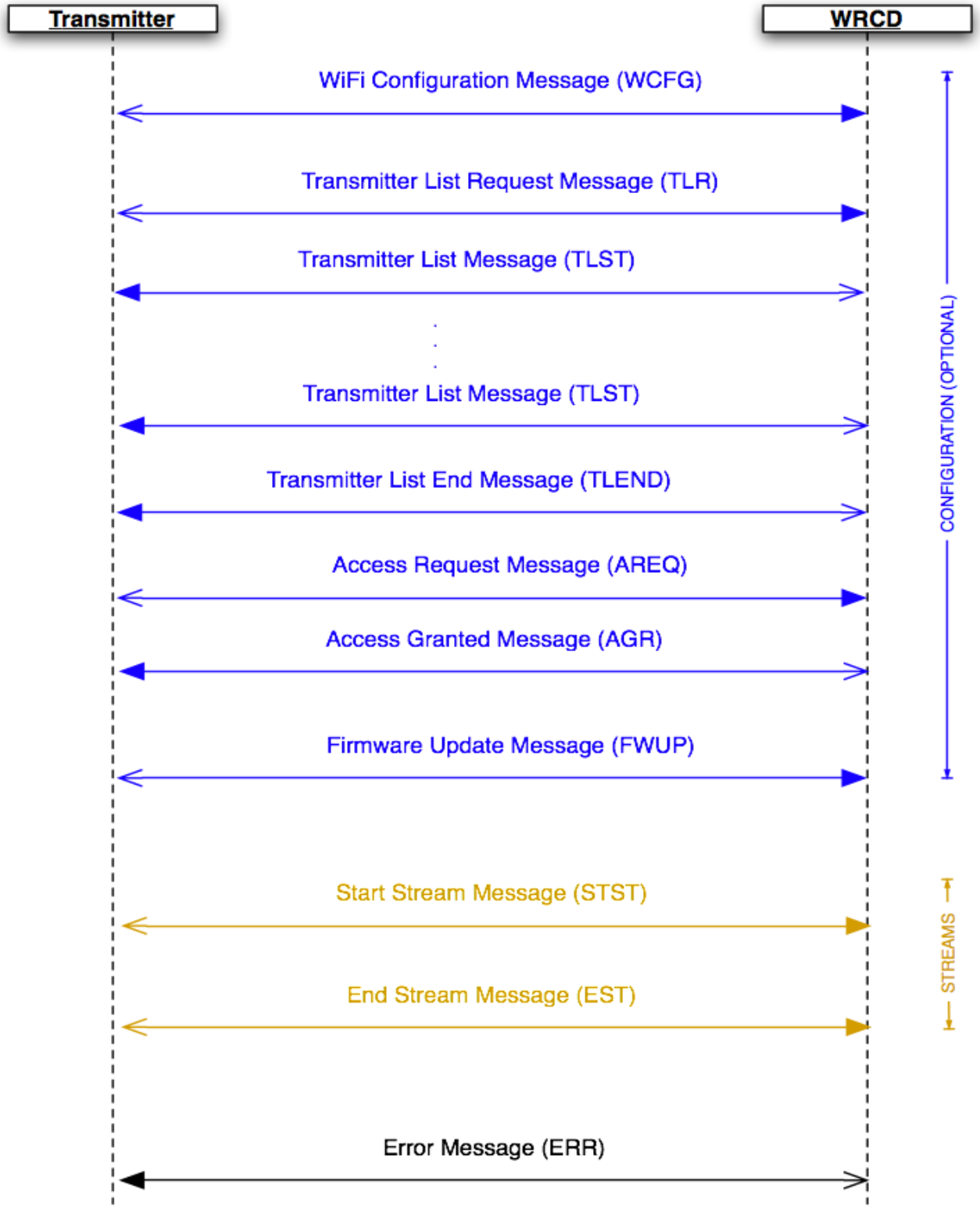
- **Discovery**: WRCD receives broadcast UDP messages during discovery, and sends answer UDP messages, the WRCD listens on the fixed 1984 UDP port for the discovery messages.
- **Control and Config**: The transmitters connect to a TCP socket of the WRCD and use this TCP connection to login and configure the WiRC device. WRCD listens on the 1984 TCP port.
- **Periodical Channel Data**: One of the transmitters shall send channel data periodically using UDP messages. The channel signals are generated by the WiRC device according to the fields of these messages. During login WRCD sends in a message (WST) the UDP port number where the periodical messages shall be sent by the transmitter.
- **Periodical Status Data**: The WRCD sends the current states of the WiRC device inputs and the measured voltages periodically using UDP messages to the transmitters. During login the transmitter shall send in a message (TL) the UDP port number where the transmitter status messages are received.
- **MJPEG stream**: The WRCD uses an UDP based protocol to stream the images of the WiRC's camera to the transmitters. The UDP port number where the stream is received by the transmitter shall be sent in a message (STST) by the transmitter.

Connection	Protocol	Transmitter Port	WRCD Port	Direction	Message types
Discovery	UDP	Dynamic	fix - 1984	Bi-direction	BCSD, BCSA
Control & Configuration	TCP	Dynamic	fix – 1984	Bi-direction	TL, DCFG, CCFG, FCFG, WST, WCFG, TLR, TLST, TLEND, AREQ, AGR, FWUP, STST, EST
Periodical Channel Data	UDP	Dynamic	Sent in WST	To WRCD	PCD
Periodical Status Data	UDP	Sent in TL	Dynamic	To Transmitter	PSD
MJPEG stream	UDP	Sent in STST	Dynamic	To Transmitter	-

Communication

The following diagram shows the communication between WRCD and a transmitter in time:




Transmitter
WRCD
WiFi Configuration Message (WCFG)
Transmitter List Request Message (TLR)
Transmitter List Message (TLST)
Transmitter List Message (TLST)
Transmitter List End Message (TLEND)
Access Request Message (AREQ)
Access Granted Message (AGR)
Firmware Update Message (FWUP)
CONFIGURATION (OPTIONAL)
Start Stream Message (STST)
End Stream Message (EST)
STREAMS
Error Message (ERR)

Discovery

The communication starts with discovery, see the purple BCSD and BCSA messages on the diagram. The transmitter broadcasts BCSD messages (using UDP) to detect WiRC devices on the network. WRCD receives the BCSD message and sends a BCSA message as a reply to the IP and UDP port where the BCSD comes from. The transmitter stores the IP address where the BCSA message comes from as the IP address of the WiRC device. The BCSA message contains the name, the serial number and the version numbers of the WiRC device, so the transmitter can manage a list of the available WiRC devices on the network.

Login

A transmitter connects to the WRCD by connecting to the TCP socket of the WRCD. After the TCP connection is initialized the transmitter shall login (see the red messages on the diagram). The login starts when the transmitter sends a TL message to the WRCD and ends when the WRCD sends a WST message to the transmitter. After TL message the transmitter shall configure the WiRC device by sending CCFG and FCFG messages to the WRCD, the DCFG message is optional in the login sequence. When these messages are processed by the WRCD a WST message is sent back to the transmitter and the login process is completed.

Periodic Messages

There are two type of periodic messages: Periodic Channel Data (PCD) and Periodic Status Data (PSD) messages (see the green messages on the diagram).

Periodic Channel Data messages shall be sent by one and only one transmitter to the WRCD. A PCD message contains the values for all output channels of the WiRC. The pulse width of the signals generated by the WiRC are set according to the values in the last received PCD message.

The transmitter has the “control right” shall send the PCD messages. Only one transmitter can have the control right, but it can be passed to an other transmitter. The transmitter is notified by AGR messages if it gained or lost the control right.

The WRCD checks the time elapsed since the last PCD message has been received. If this time exceeds a limit (see the Constants section), then WRCD disconnects the transmitter that has the control right.

Periodic Status Data messages are sent by the WRCD to all connected transmitters. A PSD message contains the level of the digital inputs, the measured value of the analogue input and the measured battery voltage. The periodicity of the PSD message sending can be found in the Constants table.

Configure and Control

The transmitter can send configuration and control messages to the WRCD (see the blue messages on the diagram).

WiFi and WiRC Name Configuration

The transmitter can set the name of the WiRC device using DCFG message and the transmitter can also set the WiFi configuration settings in the WiRC using WCFG message.

These configuration messages have effect only if the transmitter is the first connected transmitter. WiRC uses these settings after next start-up, so after setting these parameters WiRC device should be restarted.

Transmitter Listing

Transmitter can list the connected transmitters by sending TLR (Transmitter List Request) message. WRCD sends as many TLST messages as many transmitters are connected. One TLST message describes one connected transmitter. Finally WRCD sends a TLEND message after TLST messages to sign that all transmitters have been listed.

Access Request

If multiple transmitters are connected to the WRCD the transmitters can get or pass over the control right of the WiRC device.

The transmitter can send an AREQ (Access Request) message to the WRCD. In the AREQ message the transmitter specifies the connection ID belongs to the transmitter should get the control right. WRCD sends AGR (Access Granted) message(s) as reply. Transmitters are notified about their control right state by these AGR messages.

The transmitter that has the control right shall send PCD messages (else the transmitter is disconnected by the WRCD when the PCD timeout is exceeded). The transmitters that do not have the control right shall not send PCD messages. For more details about the use case when more than one transmitters are connected to the WiRC, see the multiple users section.

Camera Streaming

The camera streaming can be started by sending an STST (Start Stream) message, in the message the camera ID and the UDP port shall be specified where the stream shall be sent by WRCD. The number of cameras is received in the WST message at the end of the login process. The camera streaming can be stopped by an EST (End Stream) message. The detailed description of the UDP streaming protocol can be found in a separate chapter.

Error Messages

WRCD can send error messages when it receives an inappropriate message or a message with invalid content.

Message types

Messages are in the following binary format:

Frame (2 bytes)	CMD (1 byte)	LEN (1 byte)	Message Body (0 .. 255 bytes)	CRC (2 bytes)

- The first two bytes are the same of all messages: 0xAA and 0xBB.
- The third byte is the command code that specifies the message type.
- The fourth byte is the length of the message body in bytes.
- The next part of the message after the length field is the message body (its length is specified by the LEN field)
- The last two bytes of the message represent the CRC can be used to validate the message.

The details of CRC calculation:

- this is a 16bit wide CRC algorithm also known as CRC-CCITT (X modem)
- the polynomial is $x^{16} + x^{12} + x^5 + 1$
- the initial value is 0x0000
- the CMD, LEN and the Message Body fields take part in the calculation (the first two 0xAA and 0xBB bytes are not involved)
- the result is stored in network byte order in the last two bytes of the messages.

An example message with valid CRC:

```
AA BB 1A 04 01 01 01 00 67 35
```

Bytes of the message are in hexadecimal format and separated by spaces.

BCSD – Broadcast Service Discovery Message

- Network connection type: Discovery UDP
- Destination: WRCD
- Command Code (CMD): 0x01
- Message Body Length (LEN): 3
- Fields in the message body:
  1. [0] **Sys** (1 byte): Transmitter system type (0:PC client, 1: iPhone, 2: Android)
  2. [1..2] **Version** (2 bytes): Version number of the transmitter first byte is the major version and the second is the minor version number.

The BCSD message is intended to be broadcasted in the network where the transmitter is connected to discover the WiRC devices. The fields of the message specifies the type and the version number of the transmitter.

BCSA – Broadcast Service Advertisement Message

- Network connection type: Discovery UDP
- Destination: Transmitter
- Command Code (CMD): 0x02
- Message Body Length (LEN): 75
- Fields in the message body:
  1. [0..1] **HW Version** (2 bytes): HW Version number of the WiRC device, the first byte is the

major version and the second byte is the minor version number.

2. [2..3] **SW Version** (2 bytes): SW Version number of the WiRC device, the first byte is the major version and the second byte is the minor version number.
3. [4..67] **WRC Name** (64 bytes): Name of the WiRC device, ASCII string, terminated by 0 byte if the length is less than 64 characters.
4. [68..74]**Serial Number** (7 bytes): Serial Number of the WiRC device, ASCII string, terminated by 0 byte if the length is less than 7 characters.

The BCSA message is a response message sent by the WRCD when a BCSD message has been received. The message contains information about the WiRC device to be identified by the user.

TL – Transmitter Login Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x11
- Message Body Length (LEN): 70
- Fields in the message body:
  1. [0] **Sys** (1 byte): Transmitter system type (0:PC client, 1: iPhone, 2: Android)
  2. [1..2] **Version** (2 bytes): Version number of the transmitter, first byte is the major version and the second is the minor version number.
  3. [3] **Prio** (1 byte): Priority of the transmitter, 0 is the lowest priority, 255 is the highest.
  4. [4..67] **Transmitter Name** (64 bytes): ASCII identifier of the transmitter, this name is sent in TLST messages. If the length of the transmitter name is less than 64 characters then the unused bytes shall be filled by 0 bytes.
  5. [68..69] **Status port** (2 bytes): The UDP port number where the PSD messages shall be sent by WRCD. The 16 bit wide value shall be in network byte order.

The TL message is intended to be the first message sent by the transmitter after it has connected to the TCP port of the WRCD. The message contains the identifiers of the transmitter (system type, version and name), the priority of the transmitter (used when multiple transmitters are connected to the WiRC), and an UDP port number. Transmitter should listen on this UDP port to receive PSD messages sent by WRCD.

DCFG – Device Configuration Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x12
- Message Body Length (LEN): 68
- Fields in the message body:
  1. [0..63] **WRC Name** (64 bytes): New ASCII identifier for the WRC device. This name is sent in BCSA messages by WRCD. If the length of the name is less than 64 characters then the unused bytes shall be filled by 0 bytes.
  2. [64..65] **Cam off V** (2 bytes): Integer voltage value in millivolts. The 16 bit wide value shall be in network byte order. This value is not used by the WRCD.
  3. [66..67] **WRC off V** (2 bytes): Integer voltage value in millivolts. The 16 bit wide value shall be in network byte order. This value is not used by the WRCD.

The transmitter can modify the name of the WiRC with this message. The WiRC name is sent in the

BCSA messages during discovery. The modification of the name has effect after the WiRC is restarted. This message can be sent only by the first connected transmitter, else WRCD replies an ERR message.

CCFG – Channel Configuration Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x13
- Message Body Length (LEN): 24
- Fields in the message body:
  1. [0..1] **Ch 1 T** (2 bytes): Repeat period time of channel 1 in microseconds. The 16 bit wide value shall be in network byte order.
  2. [2..3] **Ch 2 T** (2 bytes): Repeat period time of channel 2 in microseconds. The 16 bit wide value shall be in network byte order.
  3. [4..5] **Ch 3 T** (2 bytes): Repeat period time of channel 3 in microseconds. The 16 bit wide value shall be in network byte order.

     ... up to

     [22..23] **Ch 12 T** (2 bytes): Repeat period time for channel 12 in microseconds. The 16 bit wide value shall be in network byte order.

The transmitter can set the period time of the generated pulses on the channel outputs. This message can be sent only by the first connected transmitter, else WRCD replies an ERR message. This message shall be sent by the first transmitter during the login process. Period time can be reconfigured after the login anytime by the first connected transmitter.
There are some restrictions for the period time settings:

- The period time shall be between 5 ms and 20 ms, so all values in the fields shall be between 5000 and 20000.
- The ch1 – ch2, the ch3 – ch4 and the ch5 – ch6 channel pairs shall be set to the same period time.
- The ch7 and ch8 period time is not configurable the period time is fixed 20 milliseconds, these fields are not used.
- The last four channels ch9...ch12 belongs to the digital outputs, and they do not have a period time parameter, so these fields are not used.

FCFG – Failsafe Configuration Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x14
- Message Body Length (LEN): 24
- Fields in the message body:
  1. [0..1] **Ch 1 V** (2 bytes): Failsafe value for channel 1. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.
  1. [2..3] **Ch 2 V** (2 bytes): Failsafe value for channel 2. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.
  1. [4..5] **Ch 3 V** (2 bytes): Failsafe value for channel 3. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.

     ... up to

     [22..23] **Ch 12 V** (2 bytes): Failsafe value for channel 12. Pulse width in microseconds. The 16

bit wide value shall be in network byte order.
The transmitter can set the failsafe value for every channel. When the connection is broken, then WiRC generates pulses according to these failsafe settings. This message can be sent only by the first connected transmitter, else WRCD replies an ERR message. This message shall be sent by the first transmitter during the login process. Failsafe can be reconfigured after the login anytime by the first connected transmitter. The values in the fields can be between 800 and 2200 or the values can be 0x0000 or 0xFFFF other values are invalid. If the failsafe value is between 800 and 2200, then the WiRC generates pulses with the specified width on the channel in failsafe mode. If the failsafe value is 0x0000 then the WiRC produces a constant level on the signal output in failsafe mode. If the failsafe value is 0xFFFF then the WiRC generates signals according to the last received channel data (PCD).

WST – WRCD Startup Message:

- Network connection type: Control & Config TCP
- Destination: Transmitter
- Command Code (CMD): 0x1A
- Message Body Length (LEN): 4
- Fields in the message body:
  1. [0] **ID** (1 byte): Connection ID of the transmitter.
  2. [1] **CN** (1 byte): Number of camera devices connected to the WiRC.
  3. [2..3] **Ctrl Port** (2 bytes): UDP port where the PCD messages shall be sent by the transmitter. The 16 bit wide value is in network byte order.

The login procedure is finished by the WRCD when it sends this message to the transmitter.

PCD – Periodic Channel Data Message

- Network connection type: Periodic Channel Data UDP
- Destination: WRCD
- Command Code (CMD): 0x21
- Message Body Length (LEN): 24
- Fields in the message body:
  1. [0..1] **Ch 1 V** (2 bytes): Value for channel 1. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.
  2. [2..3] **Ch 2 V** (2 bytes): Value for channel 2. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.
  3. [4..5] **Ch 3 V** (2 bytes): Value for channel 3. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.

     ... up to

     [22..23] **Ch 12 V** (2 bytes): Value for channel 1. Pulse width in microseconds. The 16 bit wide value shall be in network byte order.

The transmitter shall send this message periodically if it has the control right, else the WRCD disconnects the transmitter after a timeout is exceeded. The pulse width generated on channels are specified by the values sent in this message for the 8 channels of the WiRC (ch1..ch8). Values for ch9..ch12 specifies the states of the digital outputs, if the value is greater than 1500 than the digital output is switched on else it is switched off. The values in the fields of the message shall be between 800 and 2200.

PSD – Periodic Status Data Message

- Network connection type: Periodic Status Data UDP
- Destination: Transmitter
- Command Code (CMD): 0x22
- Message Body Length (LEN): 8
- Fields in the message body:
  1. [0..1] **Batt 1** (2 bytes): The measured battery voltage, integer value in millivolts. The 16 bit wide value is in network byte order.
  2. [2..3] **Batt 2** (2 bytes): The measured analogue input voltage, integer value in millivolts. The 16 bit wide value is in network byte order.
  3. [4] **IN 1** (1 byte): State of the digital input 1.
  4. [5] **IN 2** (1 byte): State of the digital input 2.
  5. [6] **IN 3** (1 byte): State of the digital input 3.
  6. [7] **IN 4** (1 byte): State of the digital input 4.

The WRCD sends PSD messages periodically to all connected transmitters. The transmitters should receive these messages.

WCFG – WiFi Configuration Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x31
- Message Body Length (LEN): 102
- Fields in the message body:
  1. [0..31] **WiFi SSID** (32 bytes): SSID of the WiFi network, ASCII string. If the length of the string is less than 32 characters then the unused bytes shall be filled by zeros.
  2. [32..95] **WiFi Password** (64 bytes): Password for the WiFi network, ASCII string. If the length of the string is less than 64 characters then the unused bytes shall be filled by zeros.
  3. [96] **AP** (1 byte): The field can be 1: the WiRC is the Access Point creating WiFi network with the specified parameters, or 0: the WiRC is in Station (Client) mode and connects to an existing WiFi network using the specified parameters.
  4. [97] **Sec** (1 byte): If the field is 1: Creating or connecting to a WPA secured WiFi network, if 0 then open network is created or used.
  5. [98] **Ch** (1 byte): Channel number of the created WiFi network.
  6. [99..101] **Country** (3 bytes): Country code of the WiFi network. 2 characters and a zero byte.

The transmitter can modify the WiFi configuration settings of the WiRC by sending a WCFG message. The new configuration has effect only after the WiRC is restarted (the restart shall be performed manually). Please note that if you set up station (client) mode, and the configured network does not exist etc., then you will not able to connect to the WiRC to reconfigure. In this case the factory reset shall be performed by copying the reset file to a pendrive and attaching it to the WiRC.

TLR – Transmitter List Request Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x32
- Message Body Length (LEN): 0

- Message body is empty

The transmitter sends this message to get a list of the connected transmitters. WRCD sends as many TLST messages as many transmitters are connected to the WiRC, and finally WRCD sends a TLEND message.

TLST – Transmitter List Message

- Network connection type: Control & Config TCP
- Destination: Transmitter
- Command Code (CMD): 0x33
- Message Body Length (LEN): 66
- Fields in the message body:
  1. [0] **ID** (1 byte): connection identifier of the transmitter
  2. [1] **Prio** (1 byte): priority of the transmitter
  3. [2..65] **Transmitter name** (64 bytes): Name of the transmitter, ASCII string, if its length is less than 64 characters, the string is terminated by a 0 byte.

WRCD sends this message as a response to the TLR message. This message contains that information about a transmitter that has been sent in the TL message.

TLEND – Transmitter List End Message

- Network connection type: Control & Config TCP
- Destination: Transmitter
- Command Code (CMD): 0x34
- Message Body Length (LEN): 0
- Message body is empty

WRCD sends this message as a response to the TLR message after TLST messages to sign that no more TLST messages will be sent for this TLR request.

AREQ – Access Request Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x35
- Message Body Length (LEN): 1
- Fields in the message body:
  1. [0] **ID** (1 byte): connection identifier of the transmitter should have the control right

If more than one transmitters are connected to the WiRC this message can be used to select the transmitter that should control the WiRC. This message sends a request to the WRCD to let the specified transmitter to get the control right. The ID of a transmitter can be determined from the received STST messages during transmitter listing. The decision is made by the WRCD (using the priority level of the transmitters). Transmitters are notified by AGR (Access Granted) messages if the control right has been transferred to an other transmitter.

AGR – Access Granted Message

- Network connection type: Control & Config TCP

- Destination: Transmitter
- Command Code (CMD): 0x36
- Message Body Length (LEN): 67
- Fields in the message body:
  1. [0] **ID** (1 byte): connection identifier of the transmitter
  2. [1] **Prio** (1 byte): priority of the transmitter
  3. [2..65] **Transmitter name** (64 bytes): Name of the transmitter, ASCII string, if its length is less than 64 characters, the string is terminated by a 0 byte.
  4. [66] **Notif** (1 byte): This byte signs the type of the access granted message
     - 0: Access granted – The transmitter that receives this message has the control right from now
     - 1: Access denied – The transmitter requested the control request, but it has been denied by the WRCD
     - 2: Access revoked – The transmitter that receives this message has lost the control right
     - 3: Access notification – All transmitters got an AGR message with this flag when the controller transmitter changes

WRCD sends this message as a response to the AREQ message or when the controller transmitter has been changed. The transmitter information (ID, Prio and Name) belongs to the transmitter that currently has the control right. When a transmitter gets the control right (notif flag is 0) then the transmitter shall start to send PCD messages, else the WRCD disconnects the transmitter after a timeout. When a transmitter looses the control right (notif flag is 2) then the transmitter shall stop sending PCD messages.

FWUP – Firmware Update Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x37
- Message Body Length (LEN): 16
- Fields in the message body:
  1. [0..15] **MD5** (16 bytes): the binary MD5 sum of the update file

The transmitter sends this message to start the firmware upgrade process in the WiRC. The message specifies the MD5 sum of the update file uploaded previously via FTP. During the upgrade process the WRCD disconnects all transmitters, and after the upgrade the WiRC restarts automatically.

STST – Start Stream Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x41
- Message Body Length (LEN): 3
- Fields in the message body:
  1. [0] **ID** (1 byte): ID of the camera which images shall be started
  2. [1..2] **Port** (2 bytes): UDP port where the transmitter listens to the stream. The 16 bit wide value shall be in network byte order.

The transmitter sends this message to start the image streaming of a camera. The camera images will be sent to the UDP port specified in the message. The camera ID numbering starts from 0 and the number

of cameras is received by the transmitter in the WST message during the login process.

EST – End Stream Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x42
- Message Body Length (LEN): 1
- Fields in the message body:
  1. [0] **ID** (1 byte): ID of the camera

The transmitter sends this message to stop the image streaming of a camera. The camera ID numbering starts from 0 and the number of cameras are received by the transmitter in the WST message during the login process.

EXTOUT – External Out Message

- Network connection type: Control & Config TCP
- Destination: WRCD
- Command Code (CMD): 0x50
- Message Body Length (LEN): 1..255
- Fields in the message body:
  1. [0] **Destination:** Specifies the destination of the message
  2. [1..254] **Data**: Bytes shall be sent to the external output port (the length of the field is arbitrary between 0 and 254)

The WRCD forwards the data field of this message to the specified external port of the WRC device.

ERR – Error Message

- Network connection type: Control & Config TCP
- Destination: Transmitter
- Command Code (CMD): 0xFF
- Message Body Length (LEN): 3
- Fields in the message body:
  1. [0] **CMD** (1 byte): Command code of the message where the error occurred.
  2. [1..2] **ERR code** (2 bytes): Code that describes the error type. The 16 bit wide value shall be in network byte order.

The WRCD sends this message to a transmitter as a reply when the values are invalid of a message or the message is inappropriate.

Multiple users

More than one transmitters can connect to a WiRC device. In this case only one transmitter has the control right. The control right can be passed between the transmitters, this functionality depends on the priority level of the transmitters.

Each transmitter has a name, a system type, a version number, a priority level and a connection ID. Except the connection ID the other parameters are set by the transmitter during the login procedure. At the end of the login procedure the connection ID is sent by the WRCD to the transmitter.

There are two transmitters with special rights. One is the first connected transmitter and the other one is the transmitter with the highest priority level.

Only the first connected transmitter can configure the WiRC with CCFG, FCFG, WCFG etc. messages.

The transmitter with the highest priority level can assign the control right to every transmitters using AREQ messages. If more than one transmitters have the highest priority (ie.: all transmitters have the same priority level) than all of these transmitters can use AREQ and assign the control right.

If a transmitter disconnects that has the control right, then the WRCD will assign the control right to the transmitter with the highest priority level or with the least connection ID (if the priority level are the same).

Constants

The following table contains the constants like ranges, limits etc.:

Name – Description	Value
Periodic Channel Data timeout – If no PCD messages are received after this timeout WRCD enters to failsafe mode and disconnects the transmitter that has the control right	800 ms
Periodic Status Data period – WRCD sends PSD messages with this period time	500 ms
Periodic Channel Data range – Values in the PCD message shall be in this range. WiRC can generate pulses in this range.	800 µs … 2200 µs
Period time of the generated pulses – Values in the CCFG message shall be in this range. WiRC can generate pulses with period time in this range.	5000 µs … 20000 µs
Camera image format	JPEG
Camera image resolution	CIF: 352 × 288
Camera image streaming – Frames Per Seconds	15

MJPEG streaming protocol

This chapter describes the protocol used by WRCD to stream image frames (MJPEG) in UDP packets. An UDP server application (WRCD) is the producer and one UDP client application (a transmitter connected to the WRCD) is the consumer of the stream. The frames in the stream are fragmented into packets. The server sends the packets to a specified port of the client.

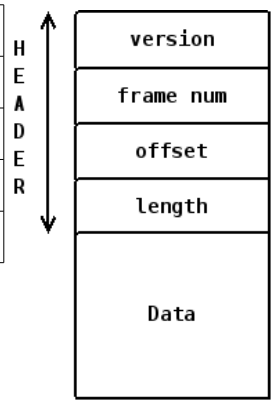
Packet specification

The protocol uses UDP packets to transfer the MJPEG stream. The MJPEG stream consists of independent JPEG frames. A JPEG frame is sent in several packets. The fragment size is determined by the server application.

The first 16 bytes of a packet is the header. The packet header has four fields containing 32-bit words in network byte order (big-endian).

name	offset	width	description
version	0	32 bit	protocol version and flags
frame num	4	32 bit	index of the JPEG frame in the stream
offset	8	32 bit	offset of the packet data in the JPEG frame
length	12	32 bit	number of data bytes in the packet beyond the header

Packet structure



Version field

Flags are encoded in the upper 16 bit of the version field, the lower 16-bit contains the version number (mind the host byte order during interpreting the version field).

name	bits	description
reserved flag bits	31..17	these bits shall be ignored
last packet flag	16	if set this is the last packet of a JPEG frame
version information	15..0	Protocol version, expected value is 0x5503