



User And Developer Documentation of ARS Facade Simulator And Control 1.0.3

Valid since 2009-03-06

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1. Introduction

The ARS Facade Simulator And Control application provides the following features:

- 3d visualization of new ARS Electronica's museum building with user interaction.
- 2d visualization of each ARS Electronica's museum building sides.
- Network server interface (UDP protocol), that allows client applications to control the colour of every single window on the building.
- Visualization (simulation) of the window colours in the 3d model.
- Translation and forwarding of the window colours to the DMX protocol in life or playback mode.
- Recording of the received transmission.
- Playback of the recorded transmissions with designated speed (frames per second).

2. Prerequisites For Installation

The ARS Facade Simulator and Control Application is compatible with the recent Windows platforms Windows XP SP2 or better and Windows Vista. Linux and Mac OS X are not supported.

For use only in simulator mode, the setup kit contains all required software. If the application is used in life or playback mode to control the real facade, DMX-Workshop by Artistic Licence has to be installed as prerequisite. This installs the device drivers, applications, DOS software and software development kit. The description of this mode is beyond the scope of this document.

2.1. Required Hardware

2.1.1. Computer

Standard PC computer hardware with at least 512 MB RAM and 50 MB free disk space.

2.1.2. Input And Output-Devices

Standard graphic card.

2.2. Required Software

2.2.1. Operating System

Windows XP SP 2 or better. Windows Vista should work, but was not tested.

2.2.2. Other Software Packages

No other requirements if used in simulator mode. If used in life or playback mode DMX-Workshop by Artistic License has to be installed.

3. Installation Description

The software is installed via a Windows Installer package.

3.1. Content of The Software Package

The software is delivered as a ZIP file containing

- FacadeControl.msi (Windows Installer package).
- setup.exe (setup program)
- vcredist_x86 (Microsoft runtime DLLs)
- WindowsInstaller3_1 (Windows Installer 3.1)

3.2. Execution of The Installation

Unpack the ZIP file into a temporary folder and execute setup.exe. This will install the prerequisite components and install the ARS Facade Simulator And Control application. During the setup you can choose the installation directory and which users are allowed to use this application.

The setup creates a shortcut on the desktop and a menu entry in the Windows start menu in "Ars Electronica Futurelab". Use the shortcut or the menu entry to start the application after the setup.

3.3. License System

ARS Facade Simulator And Control is secured by a digital license key. It is not possible to use the application without a valid license key. On first start after setup the application will present the following screen to ask for a valid license key:

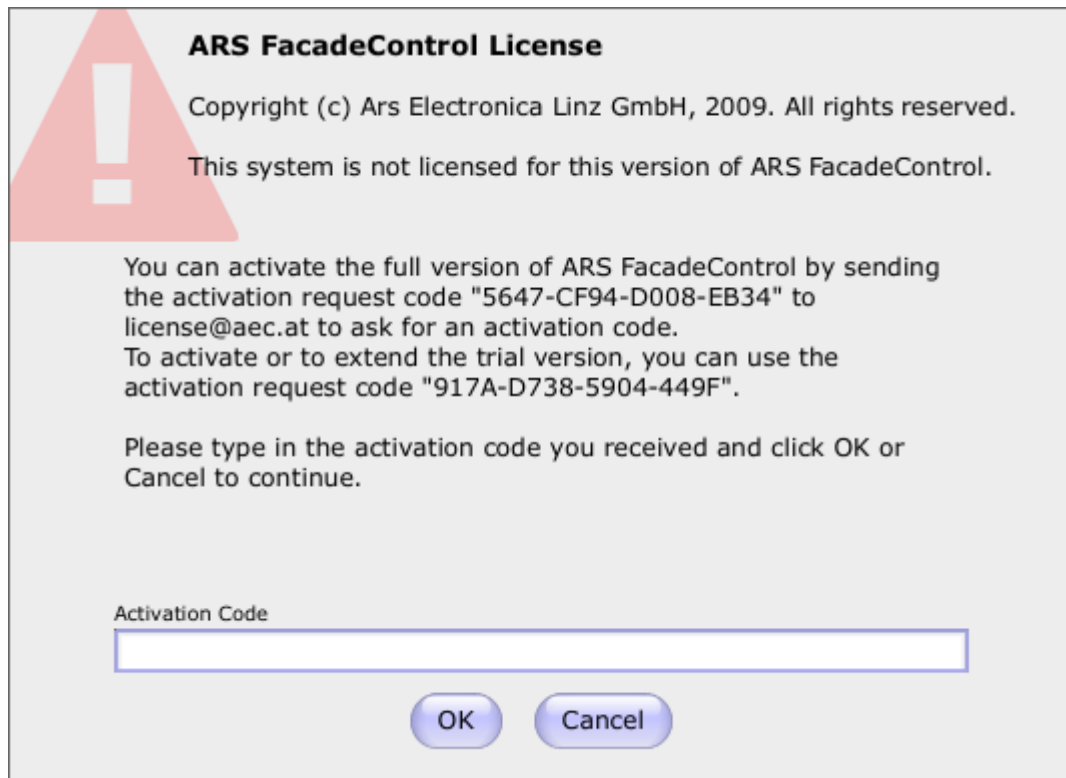


Fig. 1: License Key

ARS Facade Simulator And Control can be used as a full version and as a trial version. The trial version expires on 2009-09-30. If a trial version is expired, it is possible to request an extension of the trial version for an additional period of time.

It depends on the version that you are allowed to use, you have to send one of the keys to ARS Electronica Futurelab (license@aec.at). You will get back the authorization key, that must be entered into the input field to activate your copy of the application.

The trial version will display an expiry message during startup and shutdown of the application:

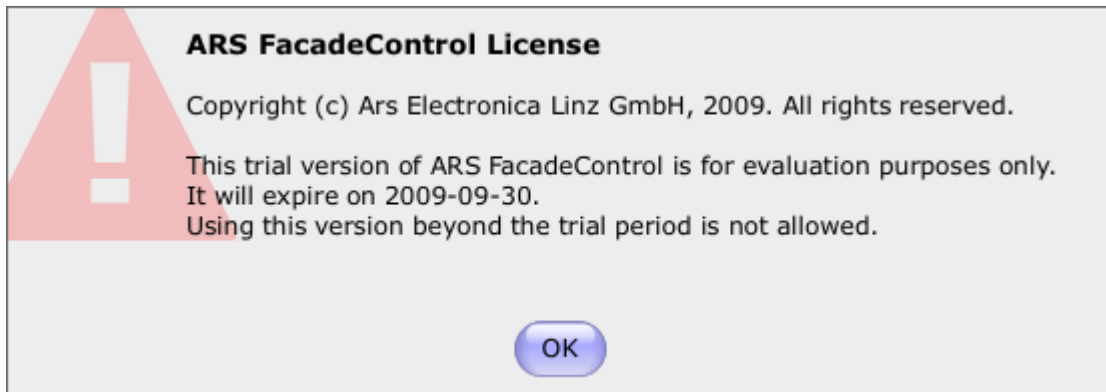


Fig. 2: Expiry Message

3.4. Configuring The Application

Various application settings can be configured in the configuration file "data\ConfigFiles\ConfigFile.xml" located in the installation folder of the application. The file is in XML format and by default looks like this:

```
<?xml version="1.0"?>
<Settings Version="0.0.1">
  <OutputsShown>0</OutputsShown>
  <PlaybackModeFps>25</PlaybackModeFps>
  <DirectDmxAccess>1</DirectDmxAccess>
  <ReceivedPort>8080</ReceivedPort>
  <ArtNet>
    <WhiteFilter>0</WhiteFilter>
    <StripesNum>1085</StripesNum>
    <UniverseNum>10</UniverseNum>
    <ShowDiagButton>1</ShowDiagButton>
    <FacadeSidesUniv>
      <South>3,4,5,9</South>
      <North>0,8</North>
      <West>6,7</West>
      <East>1,2</East>
    </FacadeSidesUniv>
  </ArtNet>
</Settings>
```

The meaning of the XML nodes:

- OutputsShown – in each canvas the diagnostics overlays will be shown

- PlaybackModeFps – life playback mode frames per second speed
- DirectDmxAccess – option to control the universes dmx channels by directly sending the dmx data to nodes (on by default)
- ReceivedPort – the port number on which the application will read frame data from client applications
- ArtNet – xml nodes related with ArtNet
- WhiteFilter – enables the filtering out the other colours while white LED has value greater than 0
- StripesNum – the number of all LED stripes for real museum facade
- UniverseNum – the number of all universes used
- ShowDiagButton – shows or hides the diagnostic button
- FacadeSidesUniv – the universe numbers which belongs to each facade side

If the ConfigFile.xml is changed the ARS Facade Simulator And Control must be restarted to adopt the new values. Any wrong set of the values in the configuration file can result in malfunctioning or crashes of the application.

Most of these settings are only relevant in life or playback mode. When using the ARS Facade Simulator And Control application as a developer in simulator mode, the most important setting is the "ReceivedPort". This is the UDP port, where the ARS Facade Simulator And Control application reads input frame data and where client applications, that want to display something on the facade, have to send their frame data.

4. Using The Application

4.1. Main application window

The Main application window provides the following information:

On top four simulation canvases (South View, North View, West View and East View) are displayed. By default the refreshing of these canvases is disabled because of performance reasons on low-end PCs. To enable refreshing of the canvases the user has to choose the option "OGL canvas" from main menu bar and the preferred panel to refresh. For these canvases no user interaction is possible.

If data is received from a client application or a playback is started, these top canvases show the facade side changes. Note, that the West View and the East View are currently displayed side reversed in these canvases in the current version.

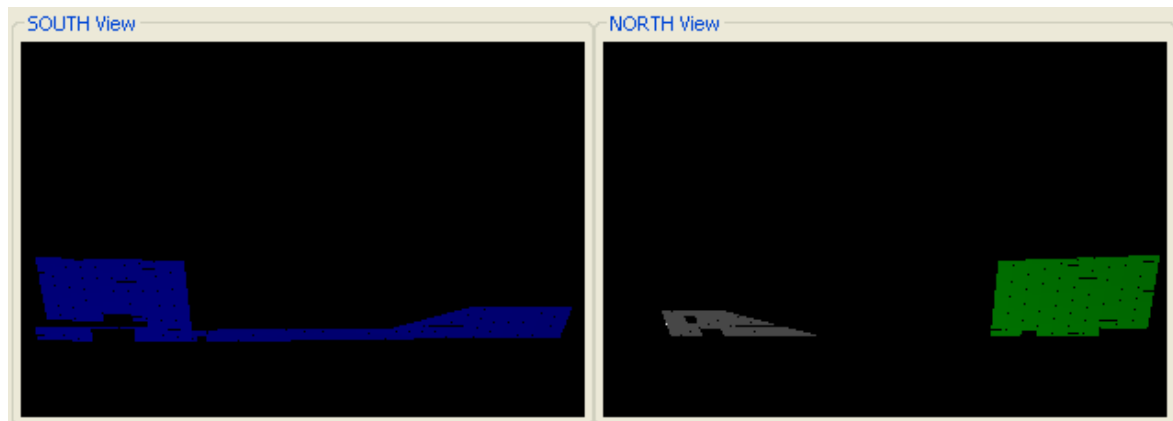


Fig. 3: "SOUTH View" and "NORTH View" top panels

The main application panel is called "3d Free View" and is placed centered in the main window. The 3d Free View shows the 3d model of the ARS Electronica's museum building with surroundings of nearby structures which exist in reality. The canvas shows the facade illumination changes triggered by frame data received from client applications or recorded in a playback.

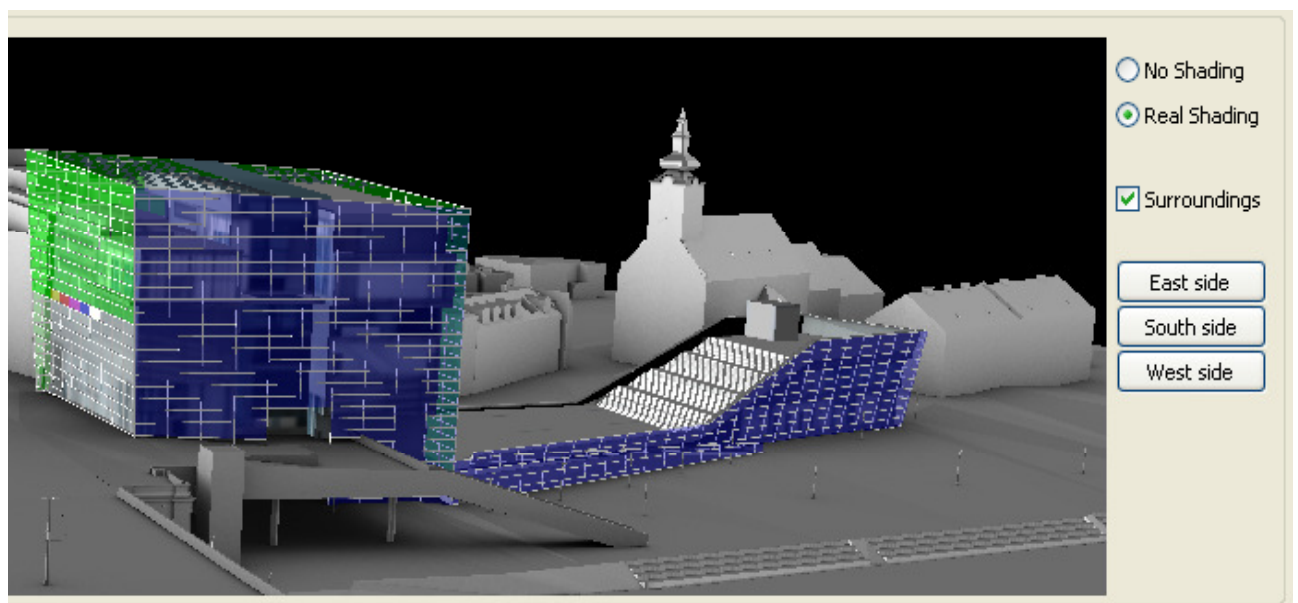


Fig. 4: 3d Free View canvas

The user can rotate, translate and zoom the facade model along with surroundings by mouse interactions. These are the interactions:

- pressing left mouse button and dragging allows the user to rotate the 3d models in designated direction.
- pressing right mouse button and moving cursor up and down allows the user to zoom in and out the 3d models.
- pressing the middle mouse button/or scrolling wheel allows the user to translate the 3d models in window.

Additionally on the right edge of the 3d Free View panel there are some controls. The "Surroundings" check box allows the user to switch of and on the

nearby structures of the museum model. The buttons show the view of the building from predefined sides – east side, south side, west side.

Two additional radio buttons – “no shading” and “real shading” for now have no functionalities bound to them.

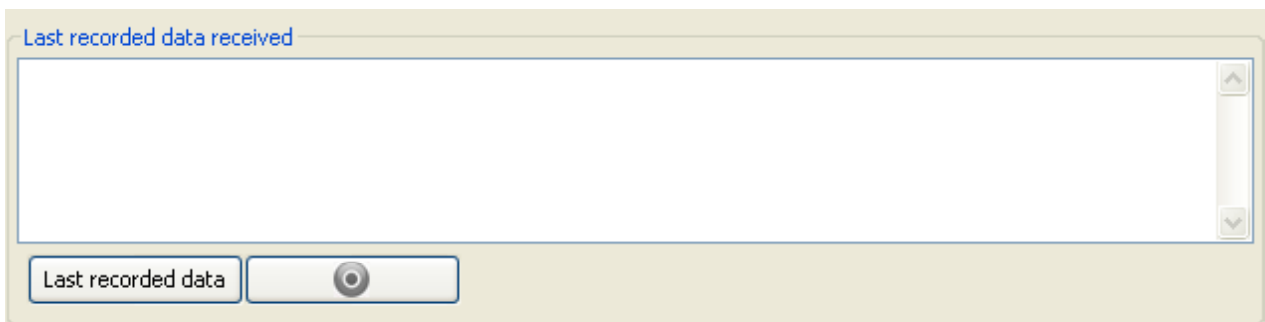
4.2. Recording and Playback

On the bottom of main window panel two additional panels exist. One is related to received data while the other on the right is related to sent data.

On the left side there is the text list called “last recorded data received”. By clicking “last recorded data” button, the user will see the last received data from a client application, which were recorded most recently. If there were no recordings since the last application start “No file” will be shown in this list.

Next to the “last recorded data” button a button exists for starting the recording of the received data. All recordings are placed in the “data\Records” directory inside main application directory. If there is no received data than no file will be saved.

The recording process could be stopped by pressing recording button again – the red dot on the recording button, which represents the recording process



will become grey.

Fig. 5: The received data panel

On the right of the received data panel exists the panel related to the data sent. The main part of the panel is taken by text list where the user can see the last recorded data sent to the real museum building facade LEDs.

This panels gives also the possibility to diagnose the transmission of art net protocol packages and to perform testing phase on the whole facade or facade sides. These diagnostics are only relevant when used in life mode to control the real facade and need the DMX-Workshop software installed.

Getting back to data sent panel additionally four radio buttons exist:

- Life Mode
- Life Playback Mode
- Life Test Mode
- Simulator Mode

When **life mode** is chosen the application converts the data received from client applications to ArtNet protocol and sends it to real facade along with showing the facade illumination changes in the 3d free view and top panels.

Choosing **life playback mode** opens a file dialog to start the playback from a recorded file. Users can see the changes in 3d free view panel and top panels while translated data packages are sent to real facade control hardware. The playback control buttons are enabled at this time and give the possibility to pause/play and stop the playback completely. The user is able to stop the playback also by switching to the another mode.

For convenience purposes the user is also able to change the modes of the playback. There are three playback modes:

- Straight Loop - plays data forward
- Reverse Loop - plays data backward
- Bounce Loop - plays data forward then backward, etc.

Life test mode starts the diagnostic/control dialog to allow the user to chose the designated test to perform on real museum facade. The application will also automatically switch to life test mode wherever user starts one of the test while other mode is enabled. This option is only available, if the DMX-Workshop software is installed.

Simulator mode blocks the transfer to the real facade control hardware and only shows the illumination changes in 3d free view and top panels. This is the default mode and should always be used when using the ARS Facade Simulator And Control for development. Otherwise you would pollute your network with useless ArtNet packages.

5. Network Server Interface

ARS Facade Simulator And Control provides a simple network interface that allows client applications to control the facade illumination. It reads data from the UDP port configured in "data\ConfigFiles\ConfigFile.xml" (by default 8080). A client application must send the data for a whole frame (the colour codes for all of the 1085 windows of the building) in one UDP package. The highest allowed frame rate is 25 frames per second. It is no problem if a client application uses a lower frame rate or varies the frame rate, but 25 fps is the maximum.

5.1. Mapping of Window Addresses

For client applications the 1085 windows of the building are numbered from 0 to 1084 in a particular sequence. The default sequence is just the same as the ARS Facade Simulator And Control application uses internally but it can be changed for particular client applications if really necessary.

The default sequence is defined in "data\ConfigFiles\IdentityMapping.map" located in the main application directory. It can be changed by using the menu entry "File"->"Load external mapper file". In the same directory an additional mapping file is located "4VfacadeAddressMapping.map", which might be more convenient, if 4V is used to build a client application.

The format of such a mapping file is:

```
*Identity mapping*
#Universe A (0) North#
1 0
2 1
3 2
```

```
4 3
5 4
6 5
7 6
8 7
...
#Universe B (1) East#
121 120
122 121
123 122
124 123
125 124
126 125
127 126
...
```

The first line contains the name of the mapping preceded and followed by a '*'. Next line is the universe name (DMX divides it's addressing in universes). The following lines contain the internal address and separated by a space the external address (the one to be used by a client application). Note that the internal address must be a number between 1 and 1085 and the external address must be a number between 0 and 1084. What can be varied in the mapping is the assignment between internal and external address.

5.2. Default Window Addresses

The window addresses defined by the default mapping are illustrated in the following figures. These are schematic sketches of the sides of the building and are not an exact representation of the geometry.

Main Building North

			0	1
2	3	4	5	6
7	8	9	10	11
12	13	14	15	16
17	18	19	20	21
22	23	24	25	26
27	28	29	30	31
32	33	34	35	36
37	38	39	40	41
42	43	44	45	46
47	48	49	50	51
52	53	54	55	56
57	58	59	60	61
62	63	64	65	66
67	68	69	70	71
72	73	74	75	76
77	78	79	80	81
82	83	84	85	86
87	88	89	90	91
92	93	94	95	96
97	98	99	100	101
102	103	104	105	106
107	108	109	110	111
112	113	114	115	
116	117	118	119	

Main Building East

								120	121
122	123	124	125	126	127	128	129	130	131
132	133	134	135	136	137	138	139	140	141
142	143	144	145	146	147	148	149	150	151
152	153	154	155	156	157	158	159	160	161
162	163	164	165	166	167	168	169	170	171
172	173	174	175	176	177	178	179	180	181
182	183	184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199	200	201
202	203	204	205	206	207	208	209	210	211
212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231
232	233	234	235	236	237	238	239	240	241
242	243	244	245	246	247	248	249	250	251
252	253	254	255	256	257	258	259	260	261
262	263	264	265	266	267	268	269	270	271
272	273	274	275	276	277	278	279	280	281
282	283	284	285	286	287	288	289	290	291
292	293	294	295	296	297	298	299	300	301
302	303	304	305	306	307	308	309	310	311
312	313	314	315	316	317	318	319	320	321
322	323	324	325	326	327	328	329	330	331
332	333	334	335	336	337	338		339	340
341	342	343	344	345	346	347		348	349

Main Building South

350	351	352	353						
354	355	356	357	358	359	360	361	362	363
364	365	366	367	368	369	370	371	372	373
374	375	376	377	378	379	380	381	382	383
384	385	386	387	388	389	390	391	392	393
394	395	396	397	398	399	400	401	402	403
404	405	406	407	408	409	410	411	412	413
414	415	416	417	418	419	420	421	422	423
424	425	426	427	428	429	430	431	432	433
434	435	436	437	438	439	440	441	442	443
444	445	446	447	448	449	450	451	452	453
454	455	456	457	458	459	460	461	462	463
464	465	466	467	468	469	470	471	472	473
474	475	476	477	478	479	480	481	482	483
484	485	486	487	488	489	490	491	492	493
494	495	496	497	498	499	500	501	502	503
504	505	506	507	508	509	510	511	512	513
514	515	516	517	518	519	520	521	522	523
524	525	526	527			528	529	530	531
532	533	534	535			536	537	538	539
						540	541	542	543
							544	545	546

Main Building South Street Level

547	548	549	550	551	552	553	554	555	556	557									
558	559	560	561				562	563	564	565	566	567	568	569	570	571	572	573	
574	575	576	577				578	579	580	581	582	583	584	585	586	587	588	589	590
596	597	598	599				600	601	602	603	604	605	606	607	608	609	610	611	612
620	621	622	623				624	625	626	627	628	629	630	631	632		613	614	615
																	616	617	618
																	619		

Main Building West

633	634	635	636	637	638				
639	640	641	642	643	644	645	646	647	648
649	650	651	652	653	654	655	656	657	658
659	660	661	662	663	664	665	666	667	668
669	670	671	672	673	674	675	676	677	678
679	680	681	682	683	684	685	686	687	688
689	690	691	692	693	694	695	696	697	698
699	700	701	702	703	704	705	706	707	708
709	710	711	712	713	714	715	716	717	718
719	720	721	722	723	724	725	726	727	728
729	730	731	732	733	734	735	736	737	738
739	740	741	742	743	744	745	746	747	748
749	750	751	752	753	754	755	756	757	758
759	760	761	762	763	764	765	766	767	768
769	770	771	772	773	774	775	776	777	778
779	780	781	782	783	784	785	786	787	788
789	790	791	792	793	794	795	796	797	798
799	800	801	802	803	804	805	806	807	808
809	810	811	812	813	814	815	816	817	818
819	820	821	822	823	824	825	826	827	828
829	830	831	832	833	834	835	836	837	838
839	840	841							

FutureLab North

842	843	844	845	846	847														
848	849	850	851	852	853	854													
855	856		857	858	859	860	861												
862	863		864	865	866	867	868	869											
870	871	872	873	874	875	876	877	878	879										
880	881	882	883	884	885	886	887	888	889	890									
891	892	893				894	895	896	897	898	899	900							
901	902	903				904	905	906	907	908	909	910	911						

FutureLab East

912	913	914	915	916
917	918	919	920	921
922	923	924	925	926
927	928	929	930	931
932	933	934	935	936
937	938	939	940	941
942	943	944	945	946
947	948	949	950	951
952	953	954	955	956
957				

FutureLab South

[illegible]

5.3. Frame Data Format

The frame data consists of a sequence of a 2 byte window address followed by 3 bytes in the format RGB. The structure of a single unit is:

byte - low byte of window address

byte - high byte of window address

byte - colorRed (between 0 and 255)

```
byte - colorGreen (between 0 and 255)
```

```
byte - colorBlue (between 0 and 255)
```

A single frame is made up of 1085 such consecutive units. It is very important that a client application, that sends the UDP protocol package to ARS Facade Simulator And Control, sends the full frame address and colour package, meaning addressing all windows with specified colours. A single UDP package has to contain 1085 consecutive protocol packages with 5 bytes each. Sending a UDP package with no full sequence will result in wrongly illuminated facade or application crash.

Using C or a similar programming language the network package could be declared and initialized in the following way:

```
#pragma pack(push, 1)
struct Packet
{
    unsigned short address;
    unsigned char r;
    unsigned char g;
    unsigned char b;
};
#pragma pack(pop)
struct Packet frameBuffer[1085];
for (unsigned short address = 0; address < 1085; address++)
{
    frameBuffer[address].address = address;
    frameBuffer[address].r = 0;
    frameBuffer[address].g = 0;
    frameBuffer[address].b = 0;
}
```

5.4. 3d Model

Client applications can also use the 3d model of the facade for their internal implementation. The 3d model of the windows is provided in 3D Studio format in the file "data\aec_models\aec_facade_03_resort.3ds". This might be useful, if client applications want to use the exact 3d position and shape of the windows in there implementations.

If you use the 3d model of the facade directly, number the windows just in the sequence as they are read from the file from 0 to 1084 and then you have the exact addresses that are expected by the default "Identity Mapping".

6. Deinstallation Description

The ARS Facade Simulator And Control can be deinstalled via the "Add/Remove Programs" icon in the Windows control panel by using the "Remove" option.

Note that the license control file "data\ConfigFiles\FacadeControl.ini" is not deleted by the deinstallation. Also recordings in the "data\Records" folder are not deleted automatically. If you want the completely remove the application, delete the main installation folder manually. If you do that and you reinstall the application afterwards, you will have to recover your license, which requires an extra step.