



Luxriot Face Recognition Manual



Introduction

General

Luxriot FR (further referred to as LFR) is a biometric face recognition application designed to work with Luxriot VMS. Leading-edge technology assures optimal system performance and reliability with real time face detection, concurrent multiple face recognition and instant face matching in 1-to-1 and 1-to-many modes.

Key features:

- Efficient face recognition engine with low error rate
- Face liveness detection preventing cheating with a photo in front of camera
- Variety of supported IP cameras, encoders and analog CCTV devices
- Simultaneous multiple video stream processing
- No imposed limitation on amount of cameras
- User friendly interface for easy setup, monitoring and data retrieval
- Simple installation with ready-to-go database
- Possibility to use own database

Luxriot Face Recognition is perfectly suited for HR control systems as well as for security and enforcement applications.

This document will guide you through the process of product installation, configuration and usage, as well as provide basic troubleshooting procedures.

Licensing

Luxriot Face Recognition is available in two editions: Basic and Enterprise. Differences between versions are summarized in the table below.

Features	Luxriot FR Basic Edition	Luxriot FR Enterprise Edition
Max number of faces per 10s	5	500*
Max number of simultaneous video streams	2	10**
Max number of simultaneous faces per second per system	1	50*
Min face presence time	1 second*	0.1 second

*Server hardware must comply with recommendations

**Up to 200FPS per system, server hardware must comply with recommendations



Prerequisites

Supported OS

Microsoft Windows 64-bit versions only, no 32-bit (x86) version support.

Supported editions: Windows 7, Windows 8, Windows Server 2008, Windows Server 2012, Windows Server 2012 R2

Important note: there is no support for virtual environment.

System Hardware Requirements

LFR requires that .NET 4.5 framework is installed on the server.

The following recommended hardware specifications refer solely to the LFR; other modules like Luxriot VMS are NOT included into this estimation.

Edition	Luxriot FR Basic		Luxriot FR Enterprise	
Connected video streams	1	2	1-2	3-10
CPU	Intel i3 2.8GHz+ (4 threads)	Intel i5 3.0GHz+ (4 threads)	Intel i7 3.2GHz+ (8 threads)	Intel i7 or Xeon* 3.2GHz+ (16 threads)
RAM	8GB		16GB	
Storage	~1GB** per 1000 recognition results			

*Single CPU systems are recommended

** Calculated for a FullHD stream. Exact size depends on actual video stream resolution.

Recommendations

Face recognition result precision greatly depends on the quality of input image quality; therefore, sufficient attention should be paid to camera installation and preliminary work with LFR configuration. Please consider the recommendations below and use them as a checklist when deploying an LFR system.

Utmost attention is required at the subjects' enrollment stage. The input image is converted into a set of facial features, forming a template that is saved into the database and used for identification and verification of people. Therefore, it is crucial to provide highest possible quality of the enrollment images:

- Use clear, sharp images with distinct facial lines with no blurring effect and normal to high contrast range
- Use near-frontal, full face view with minimum rotation (less than 15°) in any direction
- Upload multiple images to cover slight differences of face views from different sides



- Neutral face expression during enrolment is strongly recommended: avoid frowned faces, closed eyes or eyes looking away from camera, raised eyebrows, broad smiles; however, slight changes in facial expression are recommended to “train” the engine
- For people wearing glasses, make sure to enrol both images – with and without glasses
- Same recommendations are applicable to people who are likely to have changes in appearance because of facial hair like beards and moustache, or due to seasonal variations – hats, makeup etc.
- Glasses with thick, heavy frames and sunglasses decrease recognition accuracy
- Person should occupy 50 to 100% of screen height
- Minimum distance of 50 pixels between eyes is recommended, and 75 is advisable in order to obtain better recognition rate (note that this distance should be native and not obtained by stretching the image)
- Minimum stream resolution is VGA (640x480 pixels), and you need to make sure that it is also native resolution, not a scaled-up low quality image
- Avoid scenes where extraneous objects can distort the face, e.g. glass, rain, mirrors

If light conditions of the scene can be controlled:

- Direct frontal light or diffused lighting is recommended in order to have minimum shadowing within the face region, so that light is evenly distributed on each side of the face (both left to right and top to bottom) and face does not coalesce with background
- Make sure that light amount does not depend on the hour and other environmental factors
- Avoid additional illumination that can appear unpredictably, sunlight in the first place
- Use such light sources that will not produce bright shiny reflections and glares on glasses and skin

Camera choice:

- Use cameras of similar quality (or the same camera) for both enrolment and identification images
- If camera is set up to mirror the image, make sure that faces have the same orientation across all images because facial features’ template is different for the mirrored and non-mirrored pictures of the same person

When deploying the system:

- Train operators to check if the person is facing camera the right way

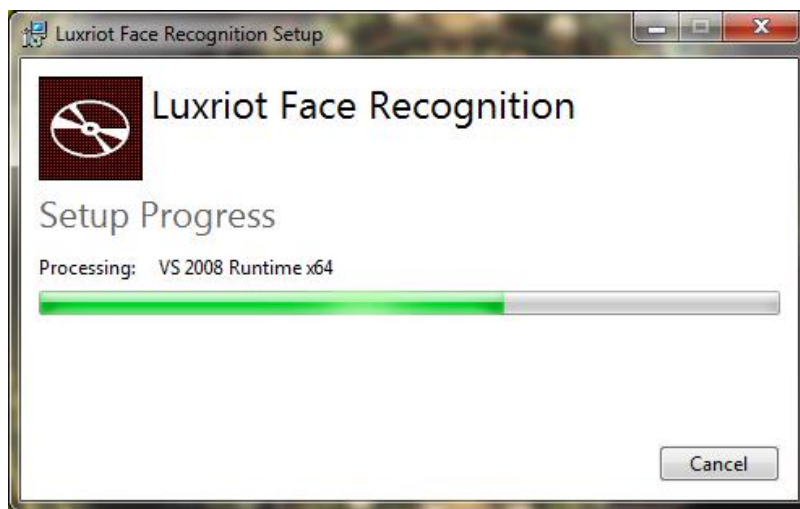


Getting Started

Product Installation

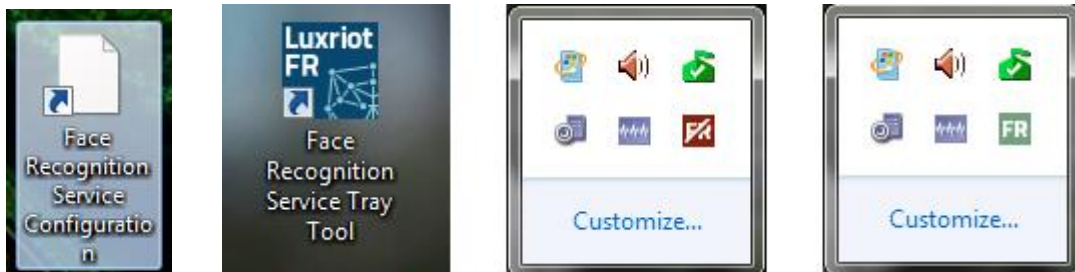
Run Luxriot FR installation package and wait until it is set up on your system. Immediately after setup has been complete, you will be able to run LFR directly from the setup wizard finish page. Alternatively, you can always run LFR as described below.

Before launching installation, press *Options* in case you wish to change the installation directory.



First Run

Start Luxriot Face Recognition service shell by launching *Face Recognition Service Tray Tool* shortcut from your Desktop. LFR icon will then appear in your system tray, allowing you to start and stop the service simply by right-clicking the tray icon and choosing the corresponding option.



Luxriot Face Recognition server itself has no graphics user interface, running silently as a Windows service, but has a Web based management console, easy to access and to use.



Having installed and launched LFR service, you can access its control center by clicking *Face Recognition Service Configuration* icon or your Desktop, or manually via Web browser using the following default parameters:

Address: localhost or local IP address

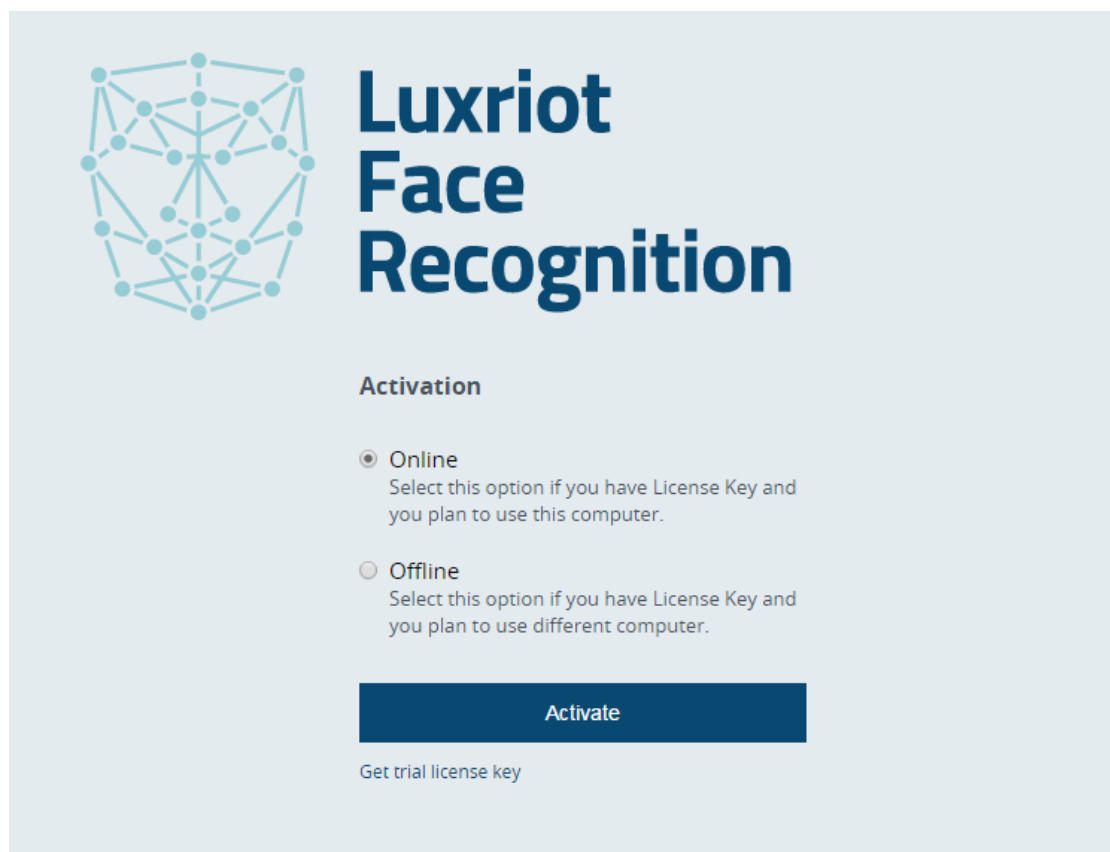
Port: 8081

Username: admin

Password: admin

You will be able to change these settings later via Service Settings.

For the parameters above, console access link will look like *http://localhost:8081*.



License Activation

When you first open the Web management console, you will be asked for license key activation. Later, if system will already have a license installed, you will see your current license edition; in case of Basic License, you will also have an option to upgrade to Enterprise.

When navigated away from the Web Management console main page, you will still see your license information and a link to license manager in the page bottom left corner.



Following options are available:

Online activation: choose this option to activate your license on the current computer. This mode is suitable if the computer in use has Internet access and will be operating as face recognition server.

Offline activation: if your face recognition server has no Internet access, follow the procedure described below in order to activate your license.

Trial license: request a demo license key to unlock all features of Luxriot Face Recognition for a limited time period. You can choose between Basic and Enterprise license editions.

Note that Luxriot Face Recognition license is bound to the server hardware set, therefore hardware changes may cause license activation failure.

Trial LFR license

For Basic Edition license, simply hit *Activate* button. 30-day evaluation license will be automatically generated and applied to the current system, and you will be redirected to the Luxriot Face Recognition start page.

License edition limitations are described in the corresponding chapter of this document.

If you wish to obtain Enterprise Edition license for extended testing, select *Enterprise License Trial Edition* option, copy your Trial Request ID and contact Luxriot representative, who will provide you with Trial Key. Once you have received it, enter your Enterprise Trial key into Trial Access Activation form and click *Activate*.

Important note: trial licenses require Internet connection in order to operate.

[< Manage License](#)

Trial Access Activation

Edition

- ☐ Basic License Trial Edition
☒ Enterprise License Trial Edition

Trial Request and Key

Please contact Luxriot with provided Trial Request ID and enter Trial Key

Trial Request ID:

271570E618F00101

Input Trial Key:

Activate

Cancel



Offline Activation

If your LFR server is located in an isolated environment with no Internet connection, you can use another computer with Internet access to activate your LFR server license.

[< Manage License](#)

Offline Activation

Step 1. Licence key

Enter licence key:

[Download ID File](#)

Step 2. ID file

Send ID file to Luxriot support to receive the activation file.

Step 3. Activation file

Upload Activation File

[Browse](#)

No file selected.

[Activate](#)[Cancel](#)

First, enter the FR license key that you have purchased from Luxriot or authorized reseller, and then hit *Download ID File* button. System will not generate any files for empty or incorrect license keys.

Next, copy the ID file to a computer with Internet access and send it to Luxriot representative or technical support center support@luxriot.com. Luxriot will process your license activation and will provide you with another file to confirm license registration process.

Having received the activation file, click *Browse* and upload it, then hit *Activate* button to complete the activation process.



Service Management

Service homepage offers quick access links to *system settings* and *subjects' database management*. Subjects are also accessible from within Service Settings; once you are done with server/camera setup, you do not have to browse the settings but rather use the quick access link to open the subjects' gallery.

Service homepage summary also shows information about current registered license and offers an opportunity to upgrade the license.

The screenshot shows the Luxriot Face Recognition service management interface. The main panel on the left has a large header "Luxriot Face Recognition" and a status indicator "Service is running". Below this are two main sections: "Subjects Management" with a person icon and "Service Settings" with a gear icon. At the bottom of the main panel, it says "Enterprise License Trial Edition" with a link to "Upgrade to Enterprise Edition". On the right, a sidebar menu lists "Luxriot Face recognition" at the top, followed by "Service Settings" (gear icon), "Servers" (server rack icon, highlighted), "Cameras" (camera icon), "Subjects" (person icon), and "Diagnostics" (wrench icon).



Service Settings

You can change connection settings and administrator user account details here. Initial parameter values are listed below, with default password being *admin*. Note that these values will also be used if server configuration is corrupt or has been deleted.

Service Settings

HTTP Interface Settings

HTTP Username:

HTTP Password:

HTTP Port:

Language:

Database Settings

ODBC Connection String:

Frame Archive Settings

Frame Archive Location:

Frame Archive Quota (%):

Apply Changes

Single user profile is available, but you can pick any username and password you like considering that it is allowed to use uppercase and lowercase Latin characters *A-Z* and *a-z*, and digits *0-9*. No special characters are permitted.



By default, LFR uses its own database file. Do not change the ODBC connection string unless you wish to use your own database and you know exactly what you are doing.

Pre-defined directory for the frame archive is *C:\ProgramData\Luxriot\Luxriot Face Recognition\Frame Archive*, and default storage limitation is 50% of the total disk size. This means, a maximum total of 50% of disk is allowed to be full. If your disk is already 60% full even without FR archive, and you set quota to 50%, no frames will be saved.

Storage quota mechanism does not know about any other quotas applied to the same disk: e.g., if Luxriot VMS is set to use the same storage location and it fills up the storage so that LFR quota is exceeded, no frames will be recorded as well. For instance, if your disk is currently 20% full and you set quota to 50%, LFR will use a maximum of 30% of disk space.

Server Setup

To start actually using the recognition engine, it is necessary to connect to Luxriot VMS server that contains FR cameras pre-configured, and then add desired cameras to LFR. If you have not set up your Luxriot VMS Server yet, proceed with VMS setup and get back when you are ready.

First, you need to choose a VMS Server to connect to.

[< Servers](#)

Add Server

Server Settings

Server:

localhost

Port:

60554

User:

admin

Password:

VMS Notification Settings

Title:

Luxriot Face Recognition Service

☐ Use custom identifier

Identifier:

Add Server



Server: VMS Server computer IP address or hostname.

Port: VMS Server port for Client connections (default is 60554). When connecting to a remote VMS Server, make sure this port is allowed on all intermediate routers and firewalls.

User and password: VMS Server user account to connect with. Depending on the connection type, user must have corresponding privileges (*connect locally* or *remotely*) and must be allowed to receive video from FR camera. For full description on VMS security setup, please refer to Luxriot VMS user manual.

VMS Notification – Title: the name that will appear in VMS as external event source.

VMS Notification – ID: unique LFR server identifier. ID is assigned automatically, so you do not need to enter anything in this field. The only case when you need to use custom ID is when you want multiple LFR servers to look like single FR source in VMS Client: in such case, you need to copy one server's ID to 'add-on' servers' *Identifier* field.

Once you have entered all settings, click **Add Server**. Connection with VMS will be established automatically: if VMS Server is online and reachable, you will see server status saying *connected*. If VMS Server is offline, LFR will endeavor to connect every few seconds until it reaches the server. Open Diagnostics section to see the details on unsuccessful connection attempts.

You can add one or more VMS servers to a single Face Recognition server.

To edit or delete existing server, simply move your mouse over the server name and corresponding controls will appear on the right side.

Servers

SERVER ▼	PORT	USER	STATUS	
localhost	60554	admin	Connected	Edit 

Add Server



Camera Setup

Cameras

CAMERA NAME ▾	SERVER	USER	FR STATUS			
Main Entrance	localhost	admin	Enabled	Test	Edit	

Add Camera

Server setup only establishes connection between LFR and VMS on the service level. In order to start recognizing people, you now need to choose video streams and define recognition parameters for each one. It is strongly advisable that you read and follow recommendations regarding camera positioning, which are available within this document.

To start new camera setup, click *Add Camera* button below the camera list. To edit any of the existing cameras' settings, as well as disable/enable face recognition for specific device, simply click *Edit* for the desired camera – this is similar to editing server settings.

Add Camera

Select VMS Server from the list of your connected servers and then select one of the cameras. Note that camera must be enabled in VMS and server must be connected in LFR.

< Cameras

Add Camera

Target Camera

Server:

localhost

Select

Camera:

Main Entrance

Select

Face Detection Engine Settings

Settings below affect the process of face recognition, that is, the identification of human faces based on the set of specific features. For all settings, recommended values are provided based on two conceptually different typical scenarios:



#1 “Quick harvesting”: on-fly detection in crowded regions and large flows of people, certain amount of false recognition acceptable.

#2 “Double check”: authorization or identity verification of a single person, high demands for accuracy.

Face Detection Engine

☒ Recognition Enabled

Minimum Confidence Level:

10 ▼

Minimum Quality Level:

10 ▼

Matching Similarity Level

4 ▼

Face Deviation Angle:

15 ▼

Minimum Ocular Distance (pixels):

40

By default, *recognition is enabled* for the camera being added, so that face detection engine can start working at once right after the camera is added. However, you can uncheck this option if you wish to start recognition manually later.

Minimum Confidence Level: is considered when searching for faces in the image. With higher confidence level, faces are selected more strictly; therefore, larger value is advisable for case #2.

Minimum Quality Level: images with lower quality will not be considered. Scenario #1 allows lower quality level, while #2 requires bigger value of this parameter.

Matching Similarity Level: this parameter should be set according to the desired false acceptance rate. The higher probability of false rejection is required, the higher threshold should be set: increased similarity level is recommended for scenario #2.

Face Deviation Angle: max yaw angle deviation from frontal face, in degrees; max value is 45° in one direction.

Minimum Ocular Distance: defines minimal distance between eyes in pixels, must be in range [10..10000]. Faces with smaller distance between eyes will be ignored.



Face Matching Settings

Turn ON *detection of unknown persons* if you want to save every single recognized face. With this setting OFF, only persons matching one of your subjects will be available, and other recognition results will be ignored. If you know that no unknown persons should be there – e.g., when LFR is used as an additional security check in the scenario #2 – it may be advisable to disable this option in order to eliminate cases when a subject present in the database is detected as unknown because of unusual facial expression or rapid head movement.

Face Matching Settings

☒ Detect Unknown Persons

☒ Generate Thumbnails

Minimum Presence Duration (milliseconds):

2000

Save Recognitions:

All ▼

Face Absence Timeout (seconds):

30

Maximum Match Result Count:

3 ▼

Generation of thumbnails allows you to have small pictures of recognized faces when performing camera Test (see corresponding chapter of this document for details on this procedure). Disabling generation of thumbnails will save CPU resource.

Minimum Presence Duration: minimum amount of time necessary for a person to be present in the picture in order to generate a recognition event. Faces staying for shorter period of time will not be reported. For scenario #1 above, lower value is better as it allows more faces to be considered, especially in case of high speed people flows.

You can choose to *save recognitions* of every face, including those yet unknown – in case these are detected – and use these images to enhance your subjects database later on; or, stick to saving pictures of known persons only. In the latter case, you will still have events of unknown persons' detection but there will be no pictures saved in the LFR frame archive.

Face Absence Timeout: minimum time period in seconds to wait until a face triggers recognition event. Set higher parameter value if you do not want a face to be reported as recognized repeatedly when it is likely that the person will stay in the area for some time.

Maximum Match Result Count: maximum amount of matches for a single recognized face. Set value to 1 if you want only the best match to be displayed as a result, or pick 2 or 3 whenever you want to see other possible matches if there are any.



When finished with camera setup, click *Add Camera* to save and return to the camera list. You can get back to these settings any time you want simply by clicking *Edit* button. Correspondingly, the bin icon will delete camera from the list with all existing settings: an attempt to add the same camera again will not restore its previous parameter set.

Camera Test

Cameras

CAMERA NAME ▾	SERVER	USER	FR STATUS			
Main Entrance	localhost	admin	Enabled	Test	Edit	

Add Camera

Aside from showing real-time recognition status for every camera (*Disabled/Enabled*), camera list offers one more useful feature: *test* recognition with current camera parameters. This should be used to check actual recognition if you do not receive any events in VMS Client.

Using *Test* you will see if:

- Recognition actually works for your camera and settings
- Recognized persons are added to the database

Those subjects' recognitions that have *in database* status will be sent to VMS as recognition events.

FR test

[Edit Camera Settings](#)

SUBJECT NAME ▾	FIRST MATCH TIME	LAST MATCH TIME	PRESENCE	BEST MATCH TIME	BEST MATCH SCORE	STATUS
James	4/7/2015 12:55:05 PM	4/7/2015 12:55:18 PM	13237	4/7/2015 12:55:05 PM	339	In Database
Unknown person #2131	4/7/2015 12:55:13 PM	4/7/2015 12:55:13 PM	0	4/7/2015 12:55:13 PM	0	
Phillip	4/7/2015 12:55:24 PM	4/7/2015 12:55:30 PM	6001	4/7/2015 12:55:24 PM	2758	In Database

Done



Subjects Management

You can create your own database which will be used for comparison and identification of detected persons.

Once you have entered the initial set of subjects and LFR has been deployed and operating for some time, it is possible to get back to the subjects management to update their face galleries. In such a way, recognition engine is trained to identify the person more precisely and easily, and also keep up with the changes in persons' appearance.

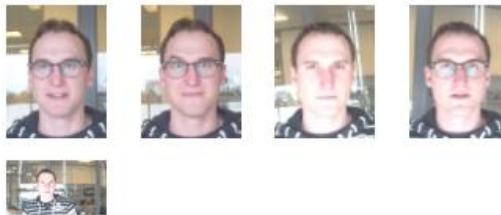
[< Subjects](#)

Edit Steven

Subject Details

Name:

Face Gallery



Tag

Important note: Please consider [Recommendations](#) section of this document to develop best techniques of adding subject pictures. Requirements for the picture quality here are very strict: this is necessary in order to obtain high recognition rate during system operation.

Each entry has the following attributes:

Subject Name: usually, person's title/name/surname or other ID used to distinguish him/her from others, and also to enable subject database search.

Subjects (4)

☒ Show face gallery

SUBJECT NAME	FACE GALLERY	TAG
Shakespear		
Steven		
Patrick		

Rows per page: 50 < 1 of 1 >

Face Gallery: set of photographs a bit different from each other so that recognition engine can detect the person from various angles and with slightly different appearance/facial expression. Browse for and add multiple pictures, then hit Apply: application will automatically crop the picture so that it only contains the face.

Tag: subject's attribute based on the access level, can further be used for white/black lists. Select one of previously created tags from the drop-down list or click *Manage Tags* to add/change existing ones. Select one of the suggested colors for the tag or pick your own one, and click *Add* to create a new tag. Create classification to suit your project specialty. Selected color will be used to highlight the recognition result in Luxriot VMS Client panel with recognition events.

Luxriot Face Recognition Service

Filter: All

Time	Person	Camera
4/30/2015 12:28:16 PM	James	Main Entrance
4/30/2015 12:27:59 PM	Matthew	Main Entrance
4/30/2015 12:28:04 PM	Unknown person #2232	Main Entrance
4/30/2015 12:27:52 PM	Philip	Main Entrance
4/30/2015 12:27:12 PM	James	Main Entrance



Manage Tags

COLOR ▾

TAG NAME

Swatches:

Color: #

COFFEE

Tag Name:

Worker

Add

Cancel

Done

Diagnostics

Diagnostics page provides you with important server events like: information on LRF service start, license check, server and camera connection. In the example here, LFR service has successfully started, connected to its database and validated the license, but VMS server on localhost is not running so connection could not be made.

You are kindly requested to provide information from this page when applying for technical support.

Alerts (7)

DATE/TIME ▾	TARGET	ALERT	PROPERTY
3/31/2015 10:08:24 AM	Database	Information	ODBC data source connected
3/31/2015 10:08:25 AM	RecognitionEngine	Information	face recognition engine component licenses obtained
3/31/2015 10:08:25 AM	Service	Information	connecting to admin@localhost:60554
3/31/2015 10:08:28 AM	Service	Information	server admin@localhost:60554 disconnected (8007274D)
3/31/2015 10:08:32 AM	Service	Information	server admin@localhost:60554 disconnected (8007274D)
3/31/2015 10:08:34 AM	Service	Information	service started
3/31/2015 10:08:35 AM	Service	Information	server admin@localhost:60554 disconnected (8007274D)

Rows per page: 50 ▾ < 1 of 1 >

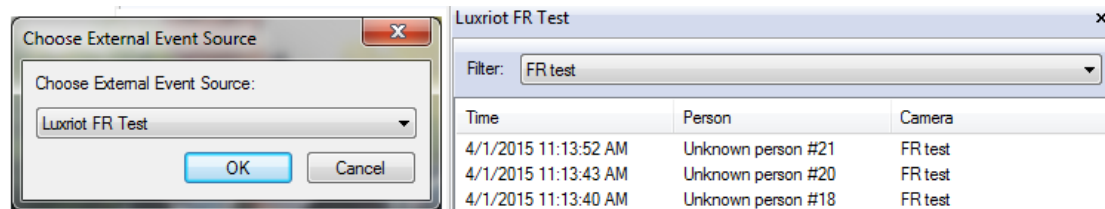


Events in VMS

Luxriot VMS Client can receive recognition events from LFR as incoming messages containing information about recognized persons.

Real Time

In order to receive live events from LFR, go to VMS Client main menu View -> Panes -> External Events (or simply press Alt+Shift+X) and then select desired LFR server from the drop-down list to bring the External Events pane. Multiple panes can be brought to the screen.



Live events can be filtered by camera name or displayed all at once.

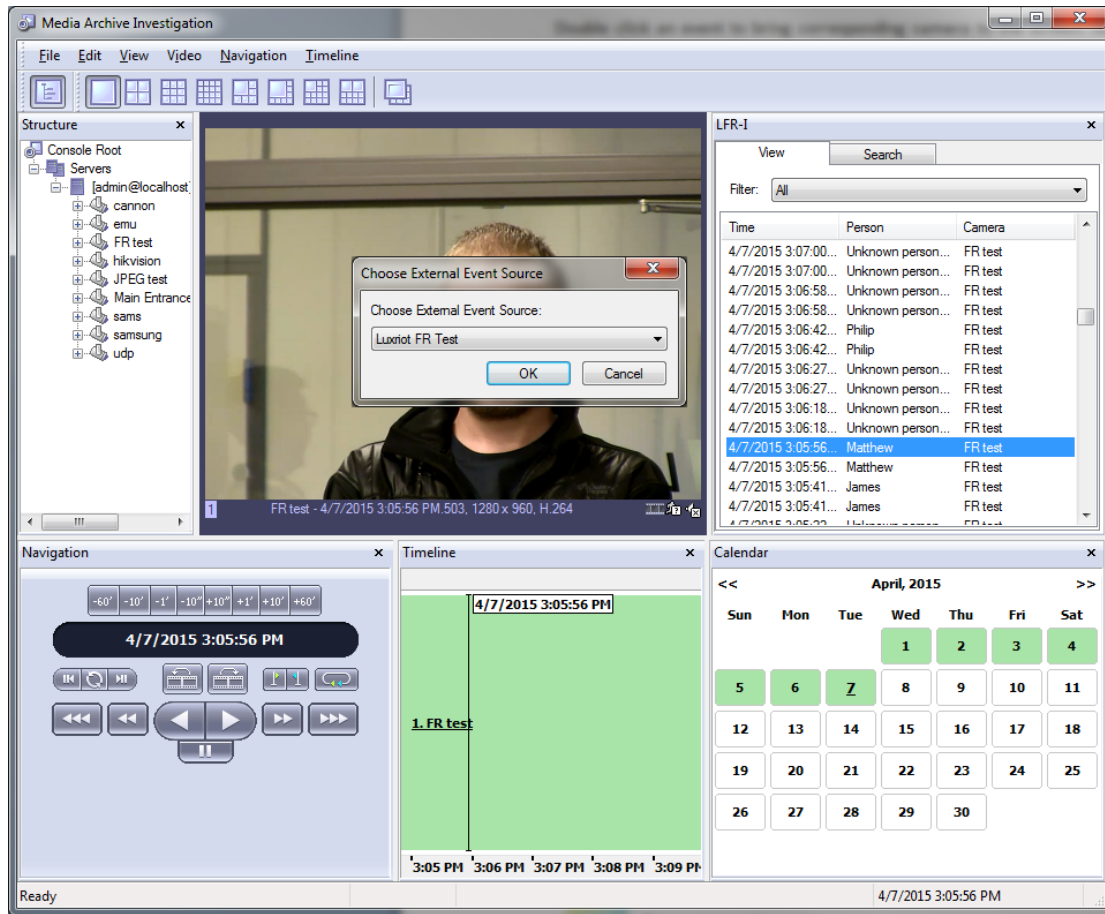
Double click an event to bring corresponding camera to the screen. Same can be done by right-clicking event -> Map onto first available screen. Camera will be mapped to the first empty screen in the camera layout, or, if there are no empty screens, replace the first non-pinned camera.

Archive Investigation

Note that it is necessary to set up video recording for your camera in order to be able to view it in the Archive.

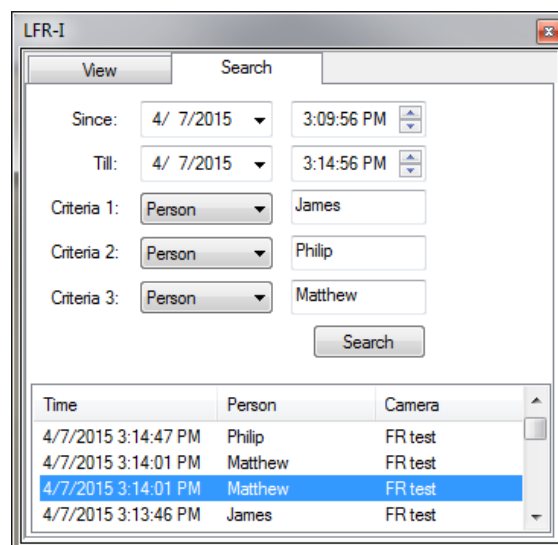
Right-click recognition event in Live View mode and choose Open Archive to bring up the multichannel archive window. Archive view will automatically switch to single camera view and jump to the exact moment of time when the clicked event has happened.

Similarly to the Live View mode, External Events pane can be placed on screen to enable fast browsing among all reported events. Here, double-clicking an event will instantly display the corresponding moment of video stream, jumping along the timeline. You can add one or multiple LFR external event sources.



Search tab allows browsing recorded events using Subjects' *name* criteria. Options:

- Select up to three names to be matched as search criteria
- Define desired time period

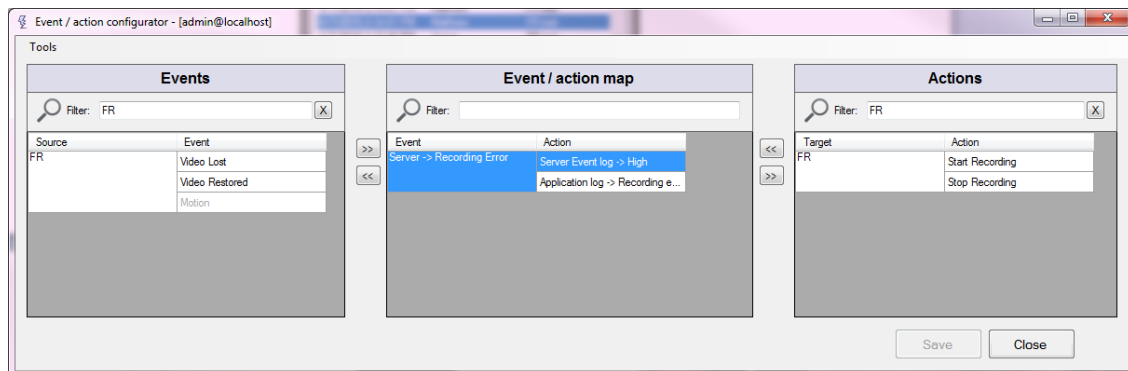




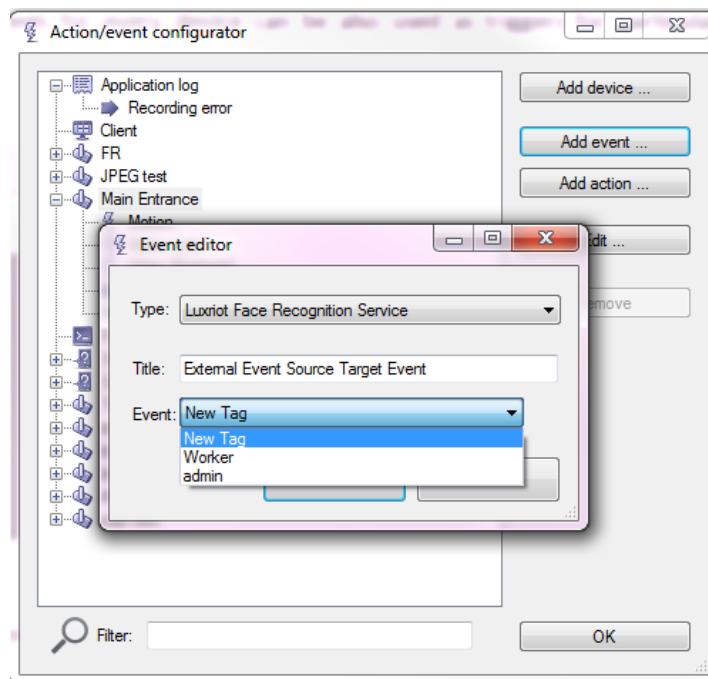
Event/Action Configurator

Luxriot Face Recognition events for every device can be also used as triggers for particular actions inside Luxriot VMS, such as: start or stop recording, send e-mail, pop up camera, go to a PTZ preset, run third-party application and others.

To set up event and action map, open the configurator in VMS – either via Wizards -> Configure server's events, or by right-clicking your server -> Tasks -> Configure server's events.



In order to add events for specific camera, right-click camera in the Events column and select Add Event, or go to Tools -> Configure devices and do the same. In the Type drop-down list, select your Luxriot FR instance that is handling this camera and then, in the Event drop-down list, choose a tag to be treated as an event. Click *OK* to save your new event.

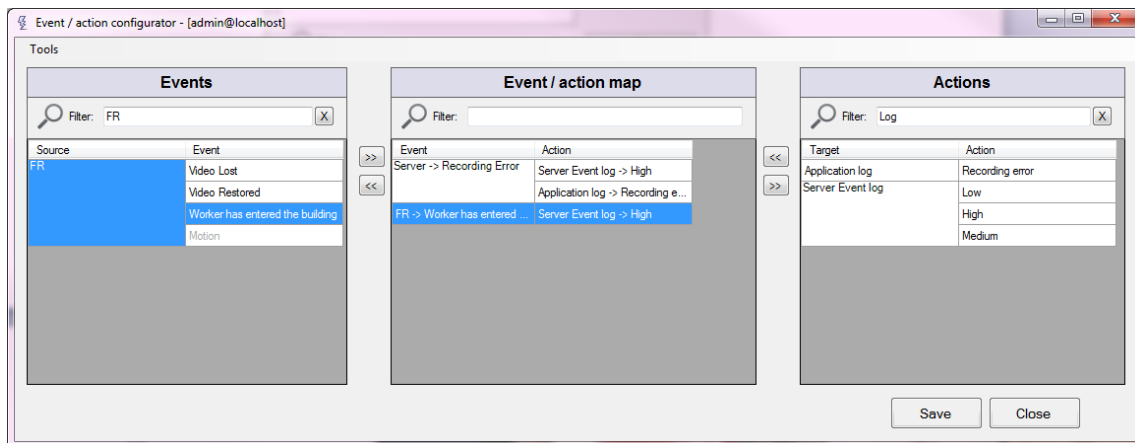




After you have created one or multiple recognition events, they will appear under corresponding camera and will be available for mapping. Use >> and << buttons to create a map of what will happen when recognition events occur. Do not forget to click **Save** button after you have finished.

Note that here, once created with LFR Event type source, Event/Action Configurator objects are not automatically updated when FR settings are changed. This means, if subject/tag settings are modified, corresponding old events in the Event/Action Configurator should be deleted and new events should be created instead, in order to maintain event/action map operability.

For more details on event setup in VMS, please see [Luxriot VMS User Guide](#), under “Event and Action Management Wizard” section.





Troubleshooting

Q: During installation, setup shows errors or takes forever to finish.

A: Abort installation and reboot your server computer, then try again. If the issue persists, contact Luxriot [support](#), providing exact error messages and/or snapshots.

Q: I have activated my license key but no faces are detected from cameras.

A: Check bottom left corner of the Web console for activation errors: click Retry to attempt to fix the error; then, check Diagnostics page for details. If the error cannot be corrected automatically, contact Luxriot support.

Q: I have trouble uploading pictures in Subjects Management, LFR says *No faces detected*.

A: Please refer to [Recommendations](#) section of this document and go through all steps carefully, making sure that pictures' quality is suitable. Engine requirements for sharp facial lines and no inclination are strict. Use Paint or any other graphics editor to make sure that distance between eyes (in pixels) satisfies required minimum.

Q: I set archive quota to <percentage> but no frames are saved.

A: Check your disk space. Defined quota refers to total disk space, not just LFR: for example, if your disk is already 60% full even without FR archive, and you set quota to 50%, no frames will be saved.

Q: Server status shows *Disconnected* in the servers list.

A: Make sure your VMS Server is running and reachable. If you are able to connect via *telnet* <VMS IP/hostname> <VMS port>, LFR will successfully connect as well. Then double check server settings in the LFR.

If you have been unable to determine the reason of disconnect, open [Diagnostics](#) section to see details on connection attempts, and provide these to the support team when reporting the problem.