



AUTODESK RECAP PRO USER MANUAL

Vittorio Scolamiero, Fulvio Rinaudo

TABLE OF CONTENTS

Overview	1
General workflow	2
Interface overview	3
Capitolo 1 Scan registration process	4
• Importing Scans and Scan Setting	4
• Automatic Registration	7
• Manual Registration	8
• Adding Survey Points	9
Capitolo 2 Starting Project	10
• Index Scans	10
• Cleaning, organizing and analyzing Point Cloud	11

Overview

ReCap Pro is a 3D program for complex laser scanning projects. Generally the final goal of ReCap processing are a point cloud or mesh ready for CAD and BIM tools. It exports files into a proprietary format, which can seamlessly integrate into other Autodesk software applications.

ReCap is a cloud-based software solution to support the 3D survey industry, it offers a simple process to obtain 3D models.

ReCap Pro supported the follows files format:

Import formats	Export formats
CL3 (Topcon)	E57
CLR (Topcon)	PTS
E57	PCG
FLS (Faro)	RCP/RCS
FWS (Faro)	Note: ReCap 360 support exporting to the structured E57 format (individual scans, with row/column info, including registration transforms). The structured E57 export does not apply any deletions or clips created in the project; it is a complete export of all data.
LSPROJ (Faro)	
LAS	
PCG	
PRJ (Leica)	
PTG (Leica)	
PTS	
PTX	
RCS	
RDS (3D only; Riegl)	
TXT	
XYB	
XYZ	
ZFS (Zoller+Fröhlich)	

General workflow

Before starting any operation it is necessary to check the scans acquired. Processing of scans with ReCap Pro includes the following main steps:

- Selecting scans;
- Importing scans;
- Configuring scan setting;
- Automatic registration / Manual registration;
- Adding Survey Points to Scan Projects;
- Indexing scans;
- Starting project;
- Cleaning, organizing and analyzing Point Cloud

ReCap Pro permit you to view the result of the register scans, this allows you to check the accuracy of the project.

Interface Overview

The Project screen is where you do most of your work with point cloud data. It is divided into several areas:

- The Home tile menu provides ways to work with the point cloud project as a whole.
- The Project tile menu analyzes and organizes components of the point cloud.
- View cube navigation provides a quick way to change the orientation of 3D views.
- Undo and Redo tools reverse previous actions that you've taken.
- XYZ coordinates display for the point your mouse is over.
- The Contextual tile menu changes to reflect current activities. For example, if you are editing a Limit Box, the tool set changes to display tools related to Limit Boxes.
- Project navigation tile menu; The Project Navigation tile menu provides access to tools such as Pan, Zoom, and Orbit. This menu is most useful to those with a single-button mouse. Flyout navigation tips on these tiles provide information about navigating with a three-button mouse.



Figura 1 Interface

1_Scan Registration process

IMPORTING SCANS AND SCAN SETTING

Once the application has started the first step is open a **New project** and after click on **Import** command. Now you can elect to either select individual files or folders through the Microsoft® Windows® Explorer pop-up, or simply drag and drop files onto the target area in the center of the screen:



Figura 2 Importing screen

The files can be either traditional scans from a fixed location (structured files), scans from multiple locations, such as those produced by a UAV (unstructured files), or a mixture of both. Once the desired files are selected, import options are presented. These allow you to define several settings that affect the result of the import. Once the desired files are selected, import options are presented. These allow you to define several settings that affect the result of the import.



Figura 3 Setting screen

A variety of settings can be applied before the project is indexed and finalized into the unified point cloud:

- **[Noise] filter:** Determines how aggressively stray points are excluded from the imported scan file;
- **Distance range:** Sets which points are included in the imported scan based on a minimum and maximum distance from the scanner;
- **Intensity range:** Sets the range of points that are imported based on intensity (reflection) values;
- **Decimation grid:** Controls the number of points to import by specifying the smallest cubic volume that a single point can occupy. Lower values improve the quality of the point cloud but also increase the file size;
- **Coordinate system:** Aligns the point cloud with a specific EPSG Geodetic Parameter Dataset coordinate reference system;
- **Up axis:** Appoints the "up" axis;

It's possible to determines how aggressively stray points are excluded from the imported scan file.

Options:

- **Minimal:** Preserves virtually all points;
- **Standard:** Preserves most points, filtering only isolated points that do not appear to be part of the surface or object;
- **Aggressive:** Preserves only points that are part of a surface or object;

Move the sliders to set values for one or both of the following settings:

- **Range Clipping:** Determines the minimum and maximum distance from the scanner at which the points should be included;
- **Intensity Clipping:** Determines the range of intensity values to allow for included points;

Once the settings are selected, the import process begins automatically. All files must be imported before Auto Registration begins. Manual Registration is available as soon as the first scan has been imported. Import may take a few minutes, depending on your number of scans and density of their data. The import progress is displayed on each scan's individual progress wheel:

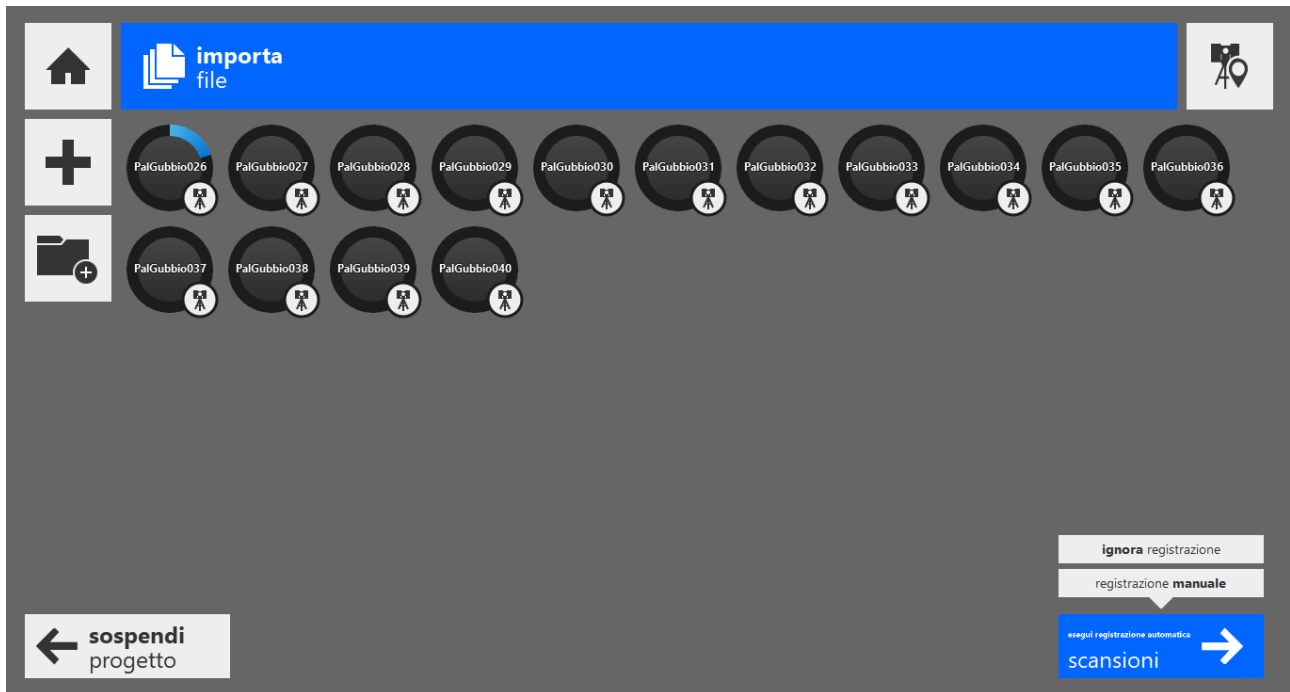


Figura 4 Importing progress screen

You can import additional files at any time with the Add File and Add Folder buttons on the left side of the screen. Also it's possible to remove individual files from the list by hovering the cursor over the file and pressing the "remove/X" button that appears. It might take a few seconds for the "X" to appear after a scan has finished importing.



Figura 5 How to remove scan

AUTO REGISTRATION

Auto-Registration becomes available once all files have started importing. Simply click the "Register Scans" command in the lower right corner of the application to begin:



Figura 6 Auto registration command

Once initiated, any files yet to be imported will complete and then the registration process will begin. Any pre-existing registration information will be lost. Feedback is provided for both import and registration processes, with estimates for completion as well as elapsed time:

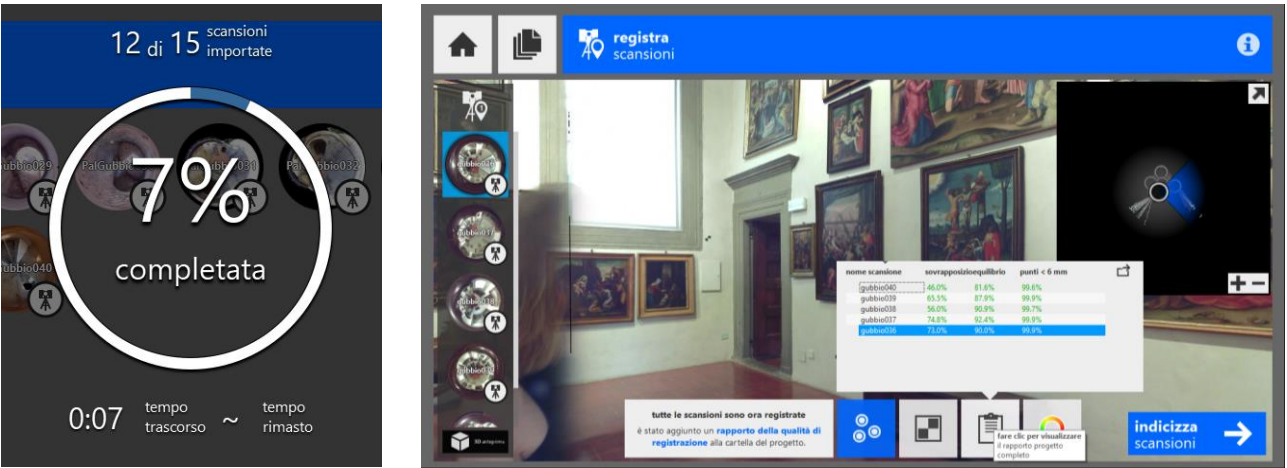


Figura 7 Registration process, percentage of completion / Figura 8 End of auto registration process



Figura 9/10 Data Report

Recap after the end of the auto registration process will show us the result of this registration process, through the data report. This report shows us in percentage the overlap of rhe scans, the balance and the points under 6 mm.

In this mode the scans has been registered whitout the survey point, so the project is oriented in a local coordinate system, and is not possible to check the accuracy of the survey.

MANUAL REGISTRATION

Manual-Registration becomes available once all files have started importing. Simply click the "**Manual registration**" command in the lower right corner of the application to begin:

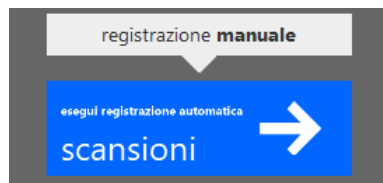


Figura 11 Manual registration command

Manual registration can be completed through the cloud-to-cloud technique. The left pane contains your primary scan group that you are registering. To register a scan, select a scan in each pane then place three points in corresponding locations between the two. At least three points are required for each scan, and X, Y, and Z coordinates must be supplied for each point.



Figura 12 Manual registration process screen

nome scansione ▼	sovrapp.	equilibrio	punti < 6 mm
gubbio036	73%	89.9%	99.9%
gubbio037	74.8%	92.3%	99.9%
gubbio038	55.9%	90.9%	99.8%
gubbio039	65.5%	87.8%	99.9%
gubbio040	46%	81.4%	99.6%

A circular gauge with three segments. The top-left segment is labeled 'sovrapp.' with '63%' below it. The top-right segment is labeled 'equilibrio' with '88.4%' below it. The bottom segment is labeled 'punti < 6 mm' with '99.8%' below it. A blue button with a checkmark and the text 'chiudi' is at the bottom.

Figura 13/14 Data Report

Also in this case Recap after the end of registration process will show us the report. The report is similar to the previous one, and yet in this mode the scans have been registered without the control point, so the project is oriented in a local coordinate system, and it is not possible to check the accuracy of the survey. Note that manual registration cannot be started with unstructured data.

ADDING SURVEY POINTS

After the registration process we can add the survey point through the **target identification mode**. Pointing the cursor on the target is possible to recognize and add the survey points. Now you have to click on **make survey points** and add the coordinates (x,y,z) of the point.



target_0005

x -4.193 m y 2.811 m z -0.771 m

make survey point

target_152

x -0.432 m y -1.206 m z -0.770 m

x 84.095 y 136.565 z 98.703

overall RMS N/A mm

alignment confidence 0.00 mm

Figura 15 Target identification mode

Figura 16 How to make survey point

Now it's possible to check the accuracy of the project through the new data report and the Point-Cloud will come geolocated in the established position. Some practical uses of survey points are as follows:

- Add specific x, y, z coordinates to your model so it appears in a specific location in space in relation to an existing CAD or BIM model.
- Add real world coordinates taken from a professional survey station.
- Improve the accuracy of your scan and correct problem areas.

scans

scan location	RMS (mm)
gubbi009	1.77mm
gubbi008	1.75mm
gubbi006	1.45mm
gubbi007	1.16mm
gubbi040	0.80mm

connections

scan location	target	RMS (mm)
gubbi009	target_150	4.10mm
gubbi009	target_151	2.85mm
gubbi008	target_153	2.56mm
gubbi009	target_154	2.36mm
gubbi008	target_154	1.86mm
gubbi008	target_158	1.75mm
gubbi007	target_154	1.75mm
gubbi006	target_155	1.75mm
gubbi009	target_155	1.71mm
gubbi006	target_152	1.60mm
gubbi007	target_156	1.60mm
gubbi009	target_149	1.60mm
gubbi009	target_156	1.57mm
gubbi008	target_156	1.57mm
gubbi009	target_152	1.53mm
gubbi006	target_158	1.46mm
gubbi006	target_151	1.38mm
gubbi009	target_151	1.38mm
gubbi006	target_153	1.36mm
gubbi006	target_149	1.15mm
gubbi040	target_149	0.91mm
gubbi009	target_157	0.89mm
gubbi008	target_157	0.89mm
gubbi009	target_159	0.85mm
gubbi040	target_159	0.85mm
gubbi040	target_150	0.81mm
gubbi009	target_152	0.81mm
gubbi040	target_152	0.22mm
gubbi007	target_151	0.06mm

targets

target	alignment confidence	RMS (mm)
target_150	1.86mm	2.27mm
target_154	1.46mm	2.03mm
target_153	2.06mm	1.72mm
target_155	2.37mm	1.71mm
target_156	1.96mm	1.57mm
target_151	2.73mm	1.38mm
target_149	2.20mm	1.24mm
target_152	2.57mm	1.15mm
target_157	2.50mm	0.88mm
target_159	4.24mm	0.85mm
target_150	1.18mm	0.81mm

registration data

targets data

RMS (mm)

1.87708mm

✓

ok

Figura 17 Data Report

2_Starting Project

INDEX SCAN

Completed the registration process is necessary to click the **Index** command. Indexing time can range from a few minutes to a few hours, depending on the number and size of the files you import. Now a new screen will open, after waiting for the scans to load you must click on the **Launch** command. After this process you can start working on the point cloud scene. So when the project is ready it's possible to edit the generated point cloud.

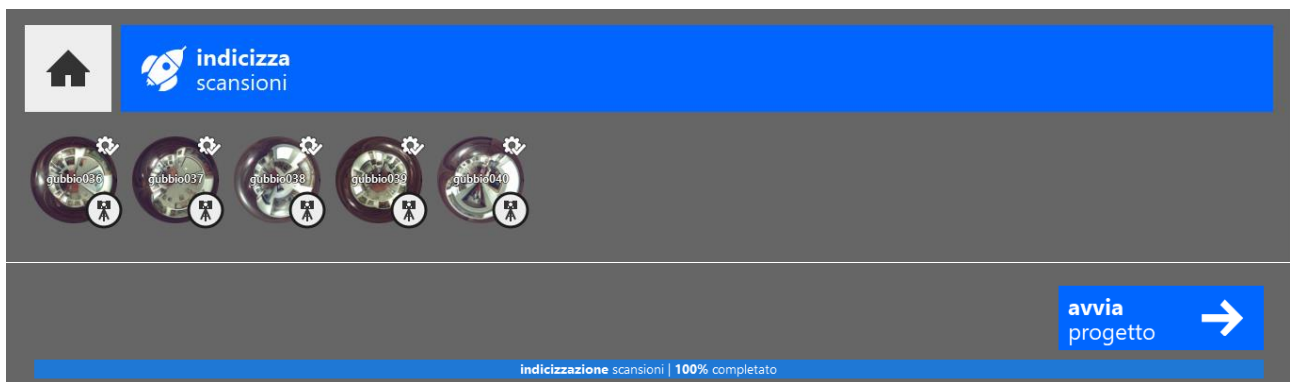


Figura 18 Indexing process screen



Figura 19 Point cloud scene (the scene shows us the mirror balls that representing the scan location)

CLEANING, ORGANIZING AND ANALYZING POINT CLOUD

From this moment you can operate different actions on the point cloud. From the contextual tile menu it's possible: clean the point cloud through selection tool, edit the limit box, measure distances, open nearest real view and return to 3D view. While from the project tile menu it's possible: sets the color mode used to display points, set up the lighting, sets the display option for points, show or hides elements like a mirror balls (scan position), change background color. Finally from the home tile menu you can save the project, recover the deleted point, import or export the project or image, views the registration result and modifies project setting.

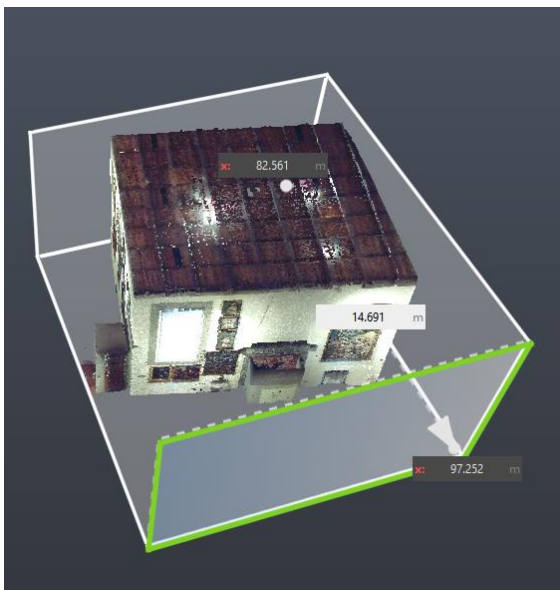


Figure 20 How to edit the limit box



Figure 21 How to measure the distance

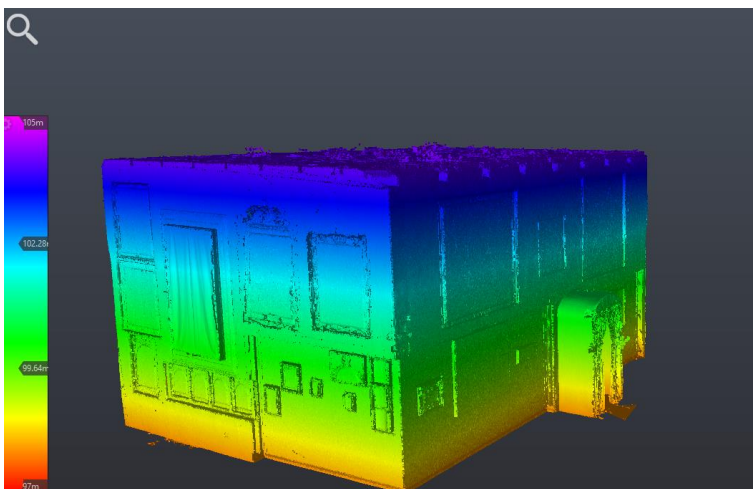


Figure 22 Example of Setup the color mode used to display points (Elevation Mode)

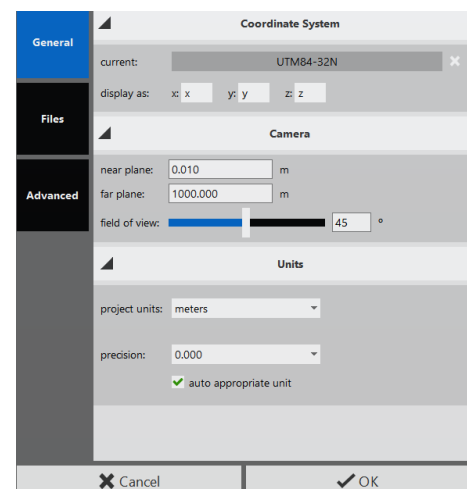


Figure 23 Project setting