IMAGING™ GAUGE Quality Test System

Operator's Manual for the Deployment Edition

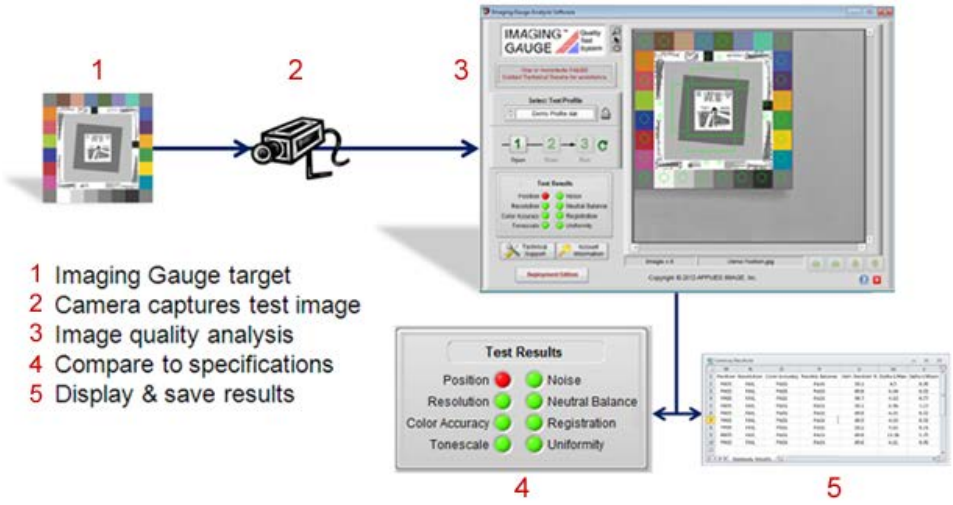
Copyright © 2013 APPLIED IMAGE, Inc.

Table of Contents:

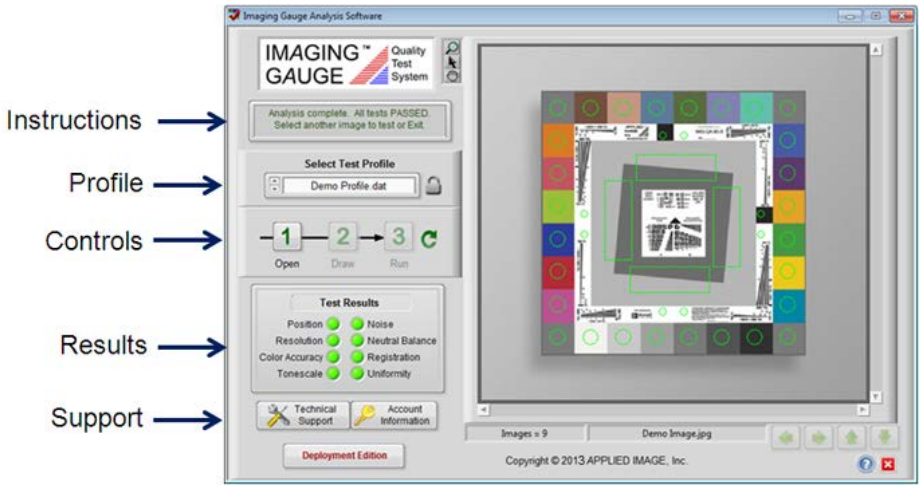
Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Imaging Gauge™ System Overview

Imaging Gauge™ software analyzes a camera's image quality (IQ) using one of the three sizes of the QA-90 precision test chart. Targets are constructed with high-resolution silver-halide paper and Munsell color patches for accuracy and durability. The software is powerful but requires no specialized knowledge to get started.



The compiled program is easily installed on the latest Windows platforms. Image formats include: jpeg, tif, bmp, and png.



Detailed results and specification profiles can be easily accessed by advanced users. Primary Image Quality metrics include:

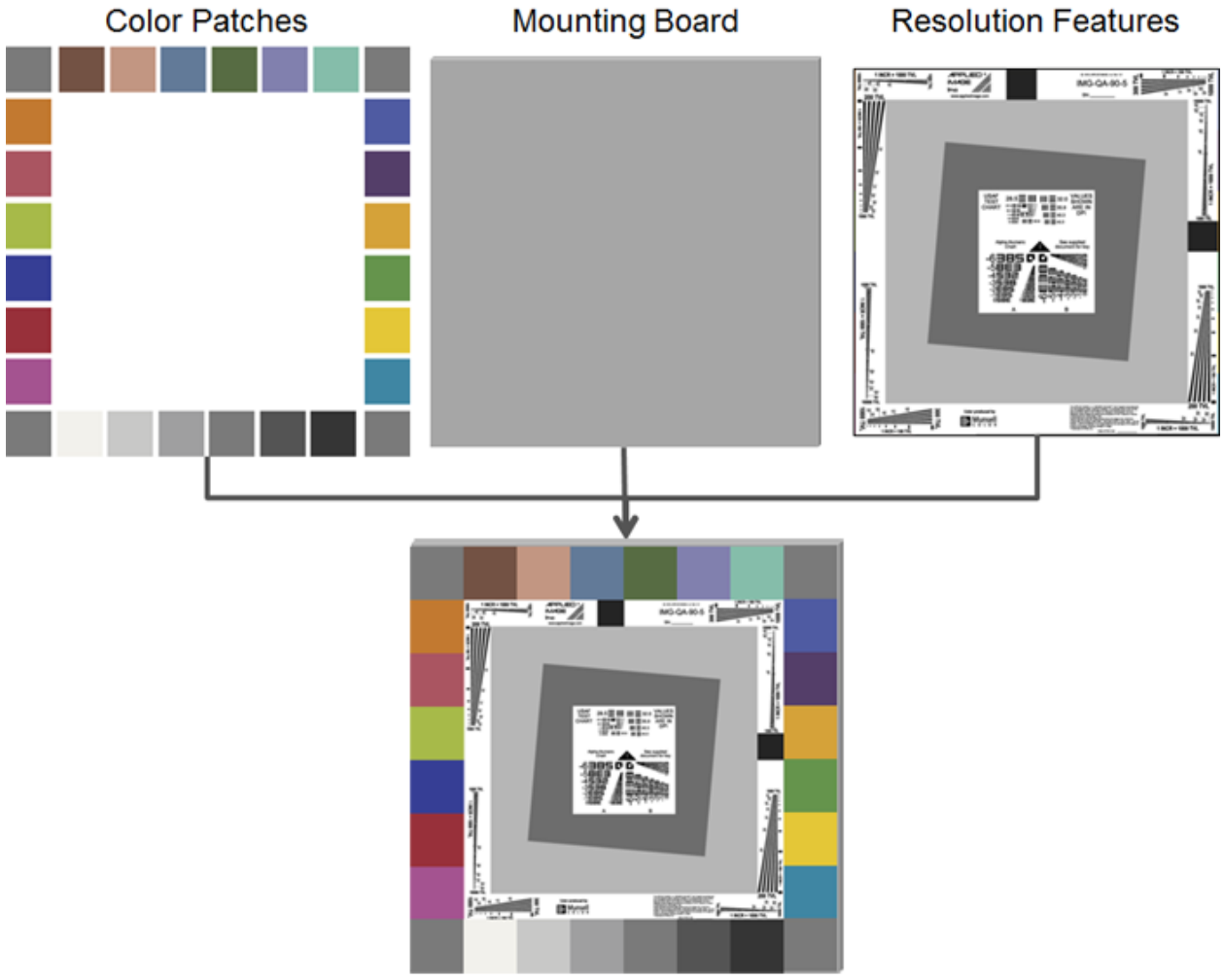
- ✓ Color Accuracy for standard color spaces
- ✓ Tonescale characteristic curve (OECF)
- ✓ Neutral Balance of gray color patches
- ✓ Color Channel Registration
- ✓ Lighting and Sensor Uniformity

Copyright © 2013 APPLIED IMAGE, Inc.

Target Design & Construction

Targets have three major components: color accuracy patches, the mounting board and the resolution test feature.

Color Patches:	**Mounting Board:**	**Resolution:**
Pigment-based color patches using the gamut of the X-Rite ColorChecker® .	Lightweight, 6mm. rigid board of expanded closed-cell polyvinyl chloride (PVC)	High-resolution silver halide target includes visual and automatic analysis features



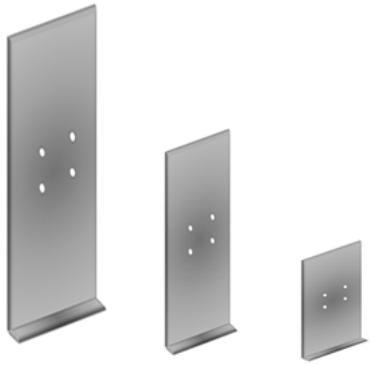
Components are 100% inspected using National Institute of Standards and Technology (NIST) traceable measurement equipment and assembled with high quality adhesives. Industrial Velcro is attached to the back of the mounting board to enable assembly onto the stand mounting brackets.

Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Mounting Stand

A mounting system is available to allow accurate target positioning and adjustment. Components include a tripod, sheet-metal mounting bracket, mounting hardware and rubber-grip handle. Mounting stands can be easily assembled and disassembled for mobility.

The mounting stands are vertically adjustable for different heights and can be rotated to accommodate cameras installed from ground-level to ceilings. Off-the-shelf hardware allows users to adapt the mounting brackets to other tripod systems, if necessary.



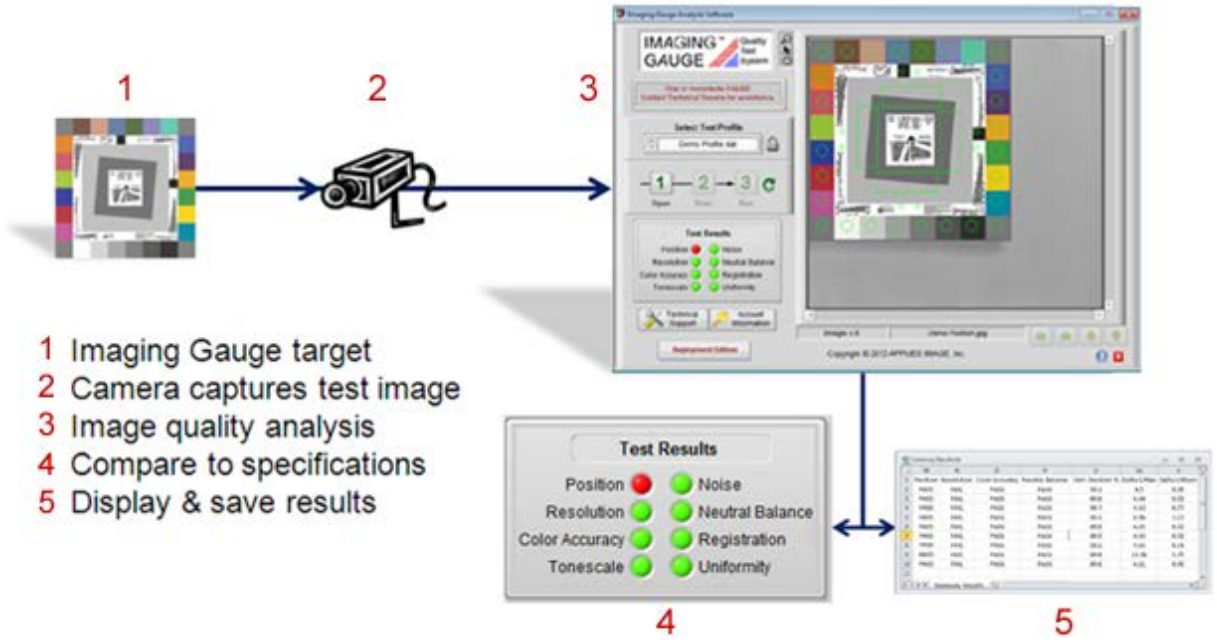
Mounting brackets are scaled for the three target sizes (1x1 ft, 2 x 2 ft, and 4 x 4 ft.)

Item	Description
1	Heavy-duty Tripod enables secure and repeatable placement of the target in field or lab environments.
2	Aluminum Target Arm with foam grip handle enables easy adjustment of the target position.
3	Grip head secures the target arm and allows rotational adjustment.
4	Target mount adapter allows quick-release of the target for easy setup in the field.
5	Brackets are available for the three target sizes. Industrial Velcro is used to attach targets to the bracket. Brackets are attached to the target mount adapter.

Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Program Overview

The Imaging Gauge™ program receives two (2) inputs from the operator: a test profile and a test image. The program displays and saves results of the analyzed image.



The test profile is a text file that contains all the information required to test a particular image capture system. The file contains image quality specifications, system information such as the test site name and camera information including the color profile (sRGB, Adobe RGB, etc.)

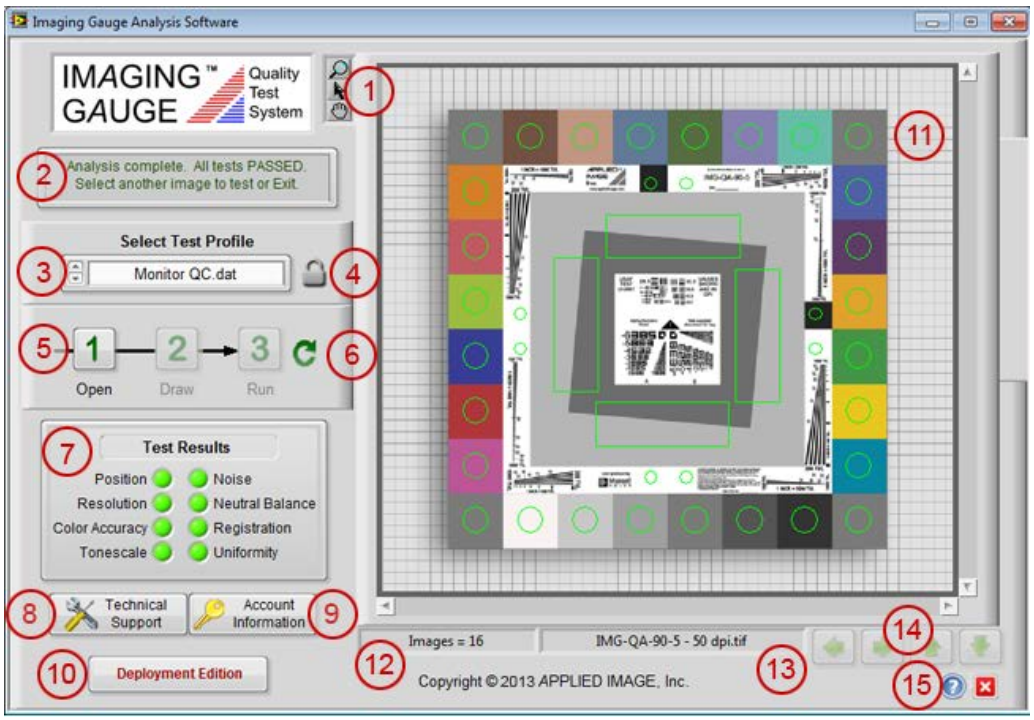
The test image is captured with the typical camera setup but with the Imaging Gauge™ test target located at a specific position in the camera Field of View (FOV). Images are saved to a location for subsequent processing.

The Imaging Gauge™ program can be installed and operated in a different location from the image capture system. Images are opened and loaded individually through an image dialog control. With input from the test operator, the image is analyzed.

Test results are displayed in summary with clear pass/fail indicators. Complete detailed results are automatically exported to a tab-delimited text file for documentation and further analysis.

Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Main Program User Interface



The front panel of the Imaging Gauge™ program has the following features:

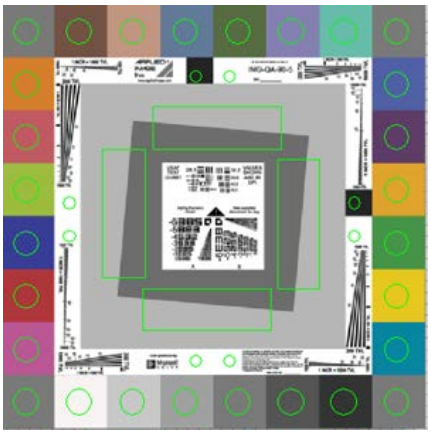
Number	Name	Description
1	Image Controls	Zoom button to magnify a region of the image. Use Shift key with this button to Zoom out Selector for moving individual regions Pan button to move within a magnified image Rectangle button to draw a box around the target
2	Operator Instructions	Instructions are provided as guides through the analysis process
3	Profile Selection	Select a specification profile from previously created profiles or import a new profile for use with the program
4	Default Profile Button	Set the current profile as the default profile loaded whenever the program is launched
5	Program Controls	1 Opens a dialog box of images to select 2 Select the target region within the image 3 Analyze the image with ROIs shown

Copyright © 2013 APPLIED IMAGE, Inc.

6	Reset Button	 Erases ROIs and resets the image
7	Test Results	Pass / Fail indicators for each test classification
8	Technical Support	Opens a window for the Technical Support interface
9	Account Information	Launches the account management interface for activating software and adding image actuations
10	Program Info	Displays the software version and copyright information
11	Test Image Window	Test image being analyzed. This view also shows the Regions-of-Interest (ROIs) that indicate where each measurement is performed
12	Image Count	Current number of image actuations available for use
13	Image Name	Test image currently being analyzed
14	Adjustment Tools	 Adjusts all ROIs in the direction selected: up, down, left or right.
15	Program Controls	 Launches online help screens  Stops and Closes the program.

Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Target Test Regions



Imaging Gauge™ software selects specific regions-of-interest (ROIs) within the target to analyze. Green circles denote regions of the target that are analyzed for their color accuracy, uniformity, noise, tonescale and neutral color balance. Rectangular gren ROIs denote areas that are analyzed for resolution and registration.

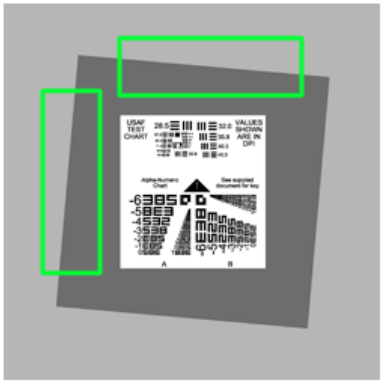
The program automatically places ROIs after the user selects the target in an image. An incorrect placement of the ROIs may result in inaccurate analysis. For this reason, a verification step is included in the analysis for the user to check the location of the ROIs and move them if necessary.

Circular ROIs should be located over a single color patch, without overlapping any neighboring patches. It is ***not*** required that these ROIs be perfectly centered on the color patches.

Eight small circular ROIs are located inside the main color patches. These are located over white or black areas and are used to decode target information such as size and color specifications.

Rectangular ROIs should be located such that each slanted edge is completely captured as shown below.

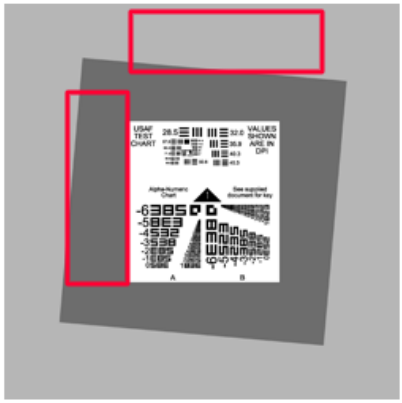
Correct ROI Placement
Black to gray transitions occur between the short ends of the rectangle.



Incorrect ROI Placement

Black to gray transition occurs on long side of top rectangle.

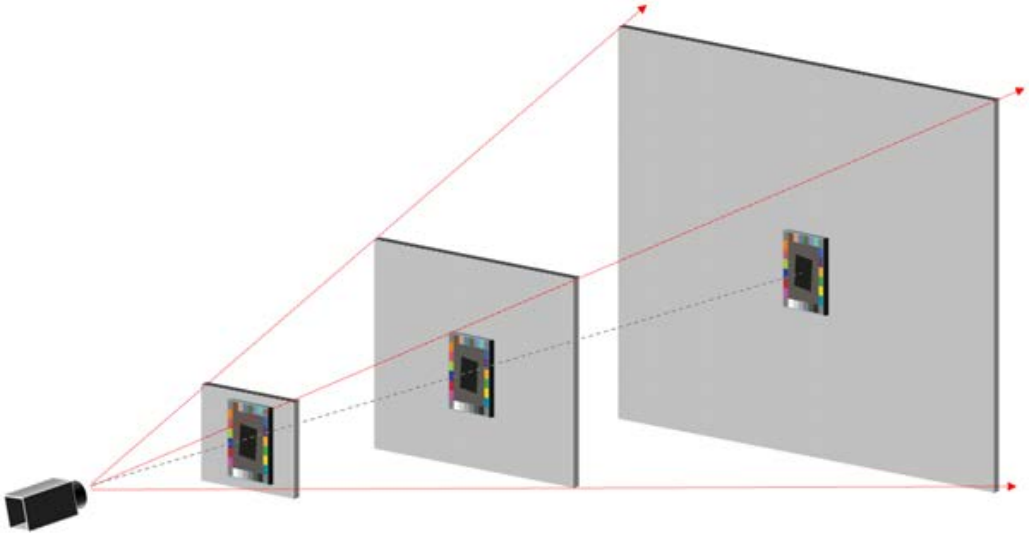
Side rectangle includes part of the white visual target.



Copyright © 2013 APPLIED IMAGE, Inc.

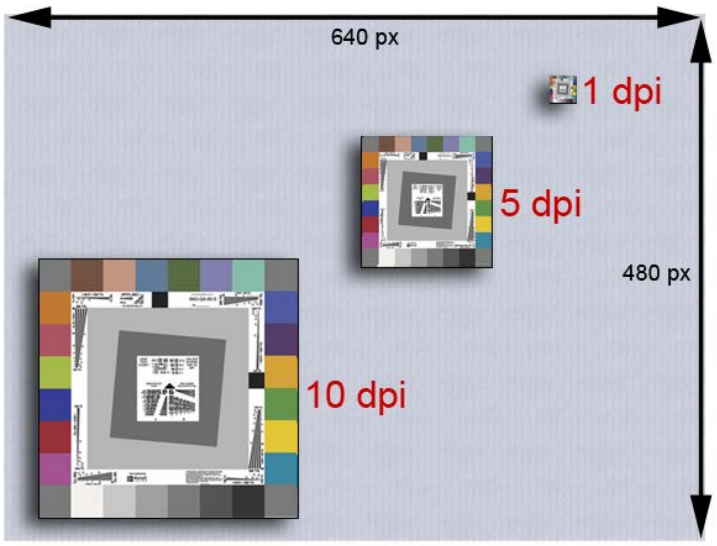
Locating the Target in a camera Field-of-View

The test target is typically located in the center of the camera Field-of-View (FOV), but is not required to be centered. Targets positioned too close to the camera may exceed the size of the FOV and targets placed too far away may not have sufficient resolution to make accurate measurements.



Placement of the target further from the camera results in fewer camera pixels used to define the target. This is measured as the Sensor Resolution of the camera at that distance. Depending of the Optical Efficiency of the camera, the minimum sensor resolution is typically between 1 - 5 dpi for the 2 ft. x 2 ft. target. The minimum sensor resolution can be increased 2X by using the larger target..

The chart below shows the relative size of a 2 ft. x 2 ft. target when captured with a 480 x 640 pixel camera at three different distances from the camera. The 10 dpi sample is positioned closest to the camera.

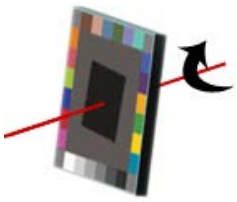
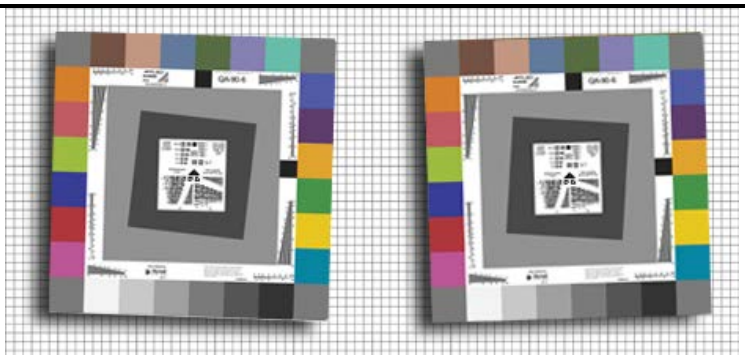
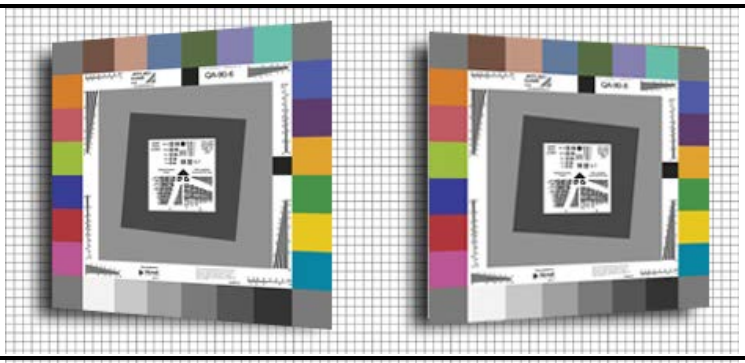
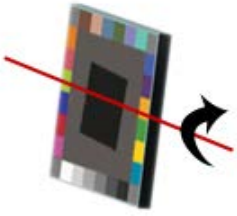


Copyright © 2013 APPLIED IMAGE, Inc.

Target Alignment to the Camera Sensor

The target should be aligned parallel to the plane of the camera sensor to assure accurate placement of the test regions and to assure that the Slanted-Edge feature is captured at an angle close to 5° to the sensor plane.

Misalignment occurs on three axes relative to the sensor plane. The alignment for all axes should be within +- 2°.

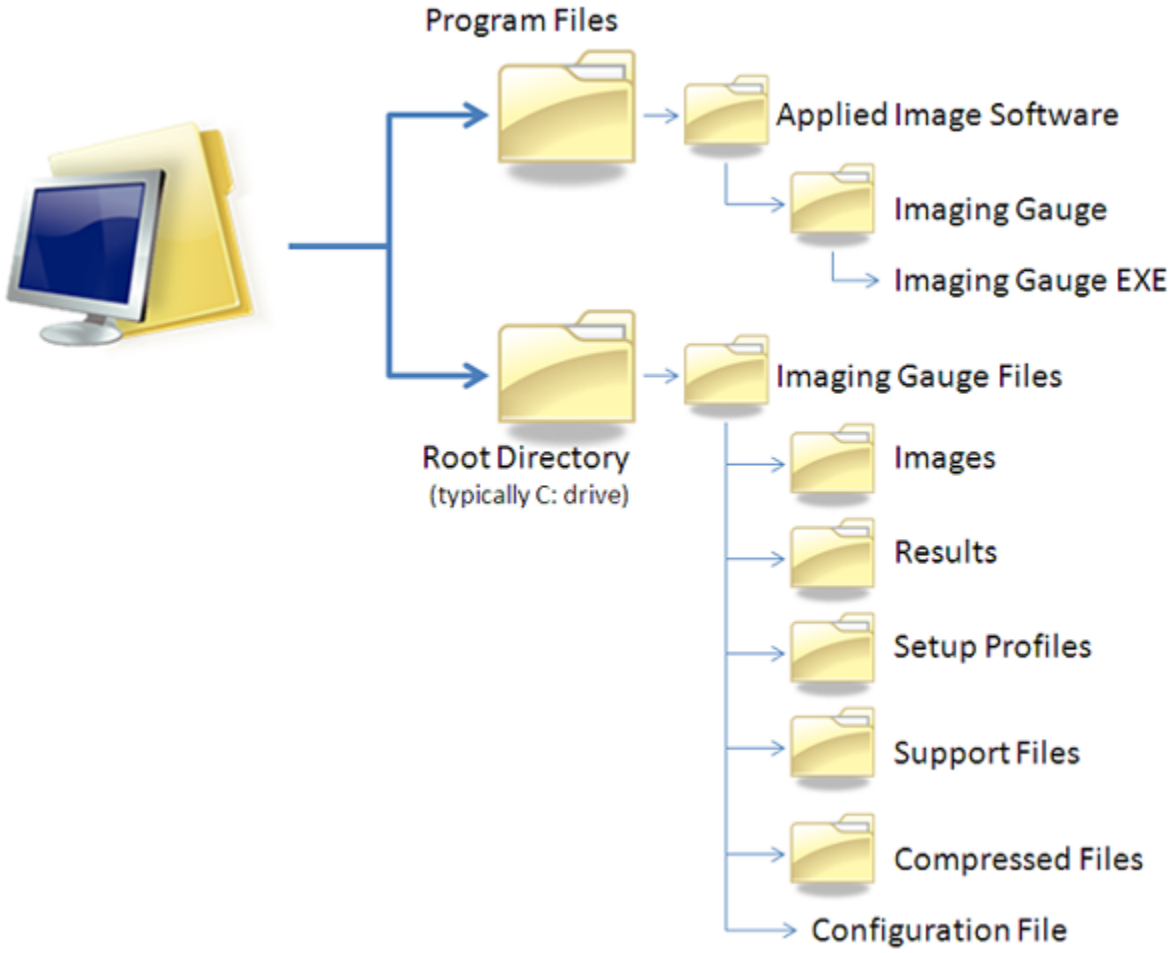
Planes are parallel but rotated axially 	
Horizontal misalignment 	
Vertical misalignment 	

Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Program File Structure

The files installed to a target computer are organized to comply with the latest Windows® operating systems. Beginning with Windows® Vista, users were prevented from writing data to files located in the **Program Files*** directory. For this reason, the Imaging Gauge™ application is located in the "Program Files" directory and the write-able files are located in the **Imaging Gauge Files** directory on the root directory.

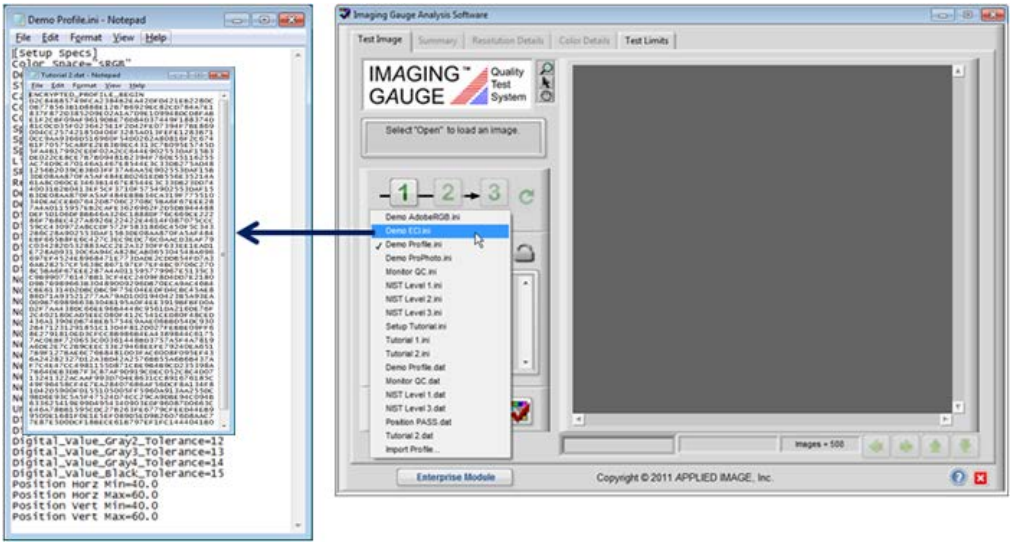
* note: the "Program Files" directory is called "Program Files (x86)" on 64-bit computers



Copyright © 2013 APPLIED IMAGE, Inc.

Test Specifications Profiles

Test specification profiles are used to define system information and test limits for each of the image quality metrics. The profile is a text-readable file that can be sent between installations to convey system requirements. The profiles available for use are populated in a drop-down menu on the front panel user interface. The encrypted version is shown below in front of the text-readable version.



Exported Results Files

Imaging Gauge™ data is saved as a tab-delimited, ASCII text file. The data are exported into an appended summary file that contains data from all images analyzed. This file is used for comparing data between a number of camera systems or for a single camera system tested over a period of time. This file contains:

- Image and system information
- Target position data
- Delta E for all 24 patches, including the mean and maximum measurements
- Digital Code Values for all 24 patches
- CIELab values for all 24 patches
- Noise and Neutral Balance for six neutral patches
- Uniformity
- Registration
- Resolution measurements for all colors and directions

Summary Results.txt

	A	B	I	J	K	L	M	N	O
1	Image Name	Date Time	Target Size	Delta E Method	Color Space	Horiz. Position %	Vert. Position %	Delta E Max	Delta E Mean
2	Test-Image-1.jpg	10/11/2012 12:38	1 ft. x 1 ft.	2000	sRGB	46.1	47.9	14.41	5.39
3	Test-Image-2.jpg	10/11/2012 12:58	1 ft. x 1 ft.	2000	sRGB	46	47.4	14.38	5.41
4	Test-Image-3.jpg	10/16/2012 15:10	1 ft. x 1 ft.	2000	sRGB	50	49.8	2.33	1.2
5	Test-Image-4.jpg	10/19/2012 8:58	1 ft. x 1 ft.	2000	ProPhoto	49.9	49.5	23.05	10.35
6	Test-Image-5.jpg	10/19/2012 10:24	1 ft. x 1 ft.	2000	ProPhoto	50.3	49.9	23.05	10.35
7	Test-Image-6.jpg	10/19/2012 10:37	1 ft. x 1 ft.	2000	sRGB	46.5	47.7	23.24	16.49
8	Test-Image-7.jpg	10/19/2012 10:43	1 ft. x 1 ft.	2000	sRGB	46.5	47.7	23.24	16.49
9	Test-Image-8.jpg	10/19/2012 13:09	1 ft. x 1 ft.	2000	sRGB	49.5	49.6	2.36	1.2

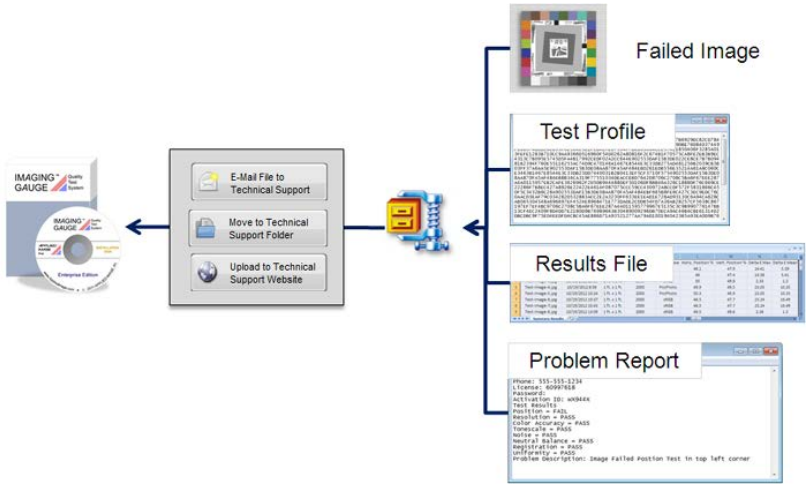
Summary Results

Copyright © 2013 APPLIED IMAGE, Inc.

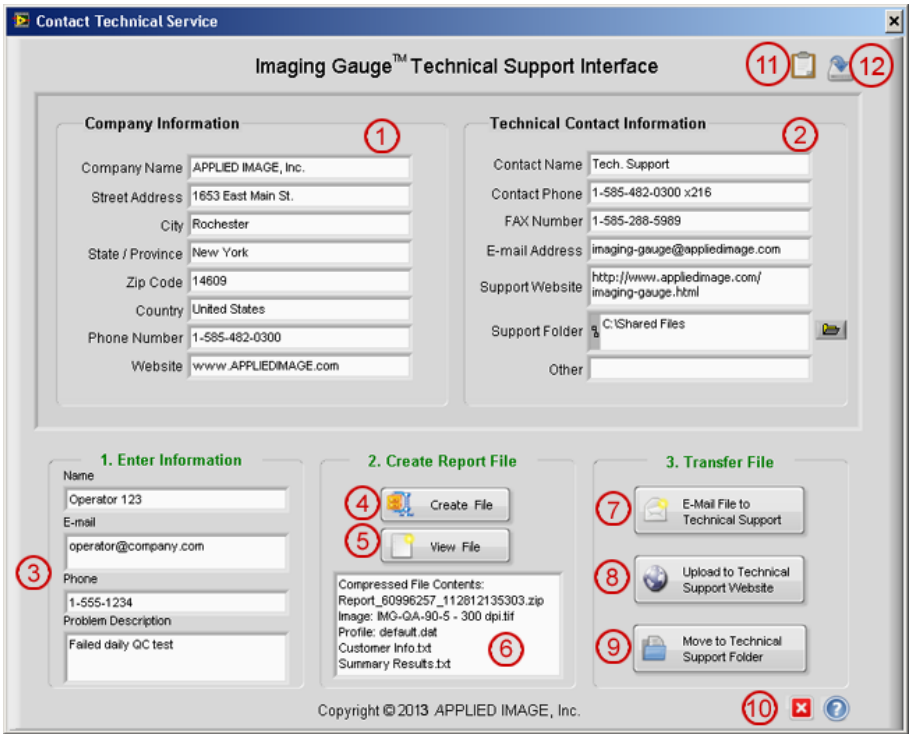
Technical Support

The technical support interface is designed to enable users of the deployment edition to easily bundle and send all necessary files associated with a failed image to their technical contact. These include the test image, test results, profile and information about the problem, including contact information. With these files, the technical contact can re-run the failed image on their Enterprise Edition and provide corrective action to the user.

After the information is bundled into a compressed file, the file can be sent automatically to the contact's e-mail address; uploaded to a support website or copied to a mapped folder location. As a separate file it can also be copied manually to another media type and delivered manually to another workstation. A schematic of the process is shown below:



The interface has the following components:

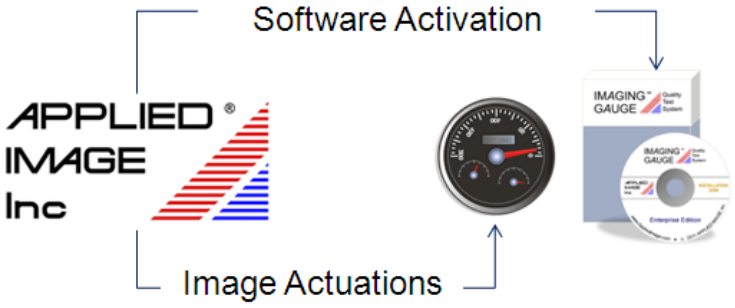


Copyright © 2013 APPLIED IMAGE, Inc.

Number	Name	Description
1	Company Information	Name and information of the company that provides technical support to the Deployment Edition customer.
2	Technical Contact Information	Contact information of the individual at the company that supplied technical support to the user of the Deployment Edition.
3	End User Information	End user name, e-mail, and phone as well as a problem description. This is used to communicate the problem for corrective action.
4	Create File Button	Creates a compressed file that includes the latest image analyzed, the current specification profile, the summary results file and the information provided by the end user in "End User Information".
5	View File Button	Opens the compressed file to inspect file contents
6	File Contents Window	Displays the file names of the contents of the compressed file.
7	E-Mail to Technical Support Button	Opens the default e-mail application and enters the technical contact e-mail address as a recipient. Also fills in the subject field. File must be attached manually.
8	Upload to Technical Support Website Button	Opens the web-page specified in the "support website" field. This website should be set up by the company providing technical support with functionality to upload the compressed file.
9	Move to Technical Support Folder Button	Copies the compressed file to the location specified in the "Support Folder" field. This can be a mapped server location or another shared folder available to the user's workstation.
10	Help and Stop Buttons	Opens the online support file. Stop button closes the Technical Support window and returns the user to the main program.
11	Import Contact Info Button	Opens a dialog box to allow a new contact information file to be copied to the "Imaging Gauge Files/Support Files" folder for use with the program.
12	Save Contact Info Button	Saves the Company Information and Technical Contact Information to the "Technical Contact.ini" file located in the "Imaging Gauge Files/Support Files" folder

Copyright © 2013 APPLIED IMAGE, Inc.

Account Information



Imaging Gauge™ software has two conditions required for an installation to operate: license activation and sufficient number of image actuations. Both are managed through an interface that communicates with the *A*PPLIED IM*A*GE servers to validate the installation.

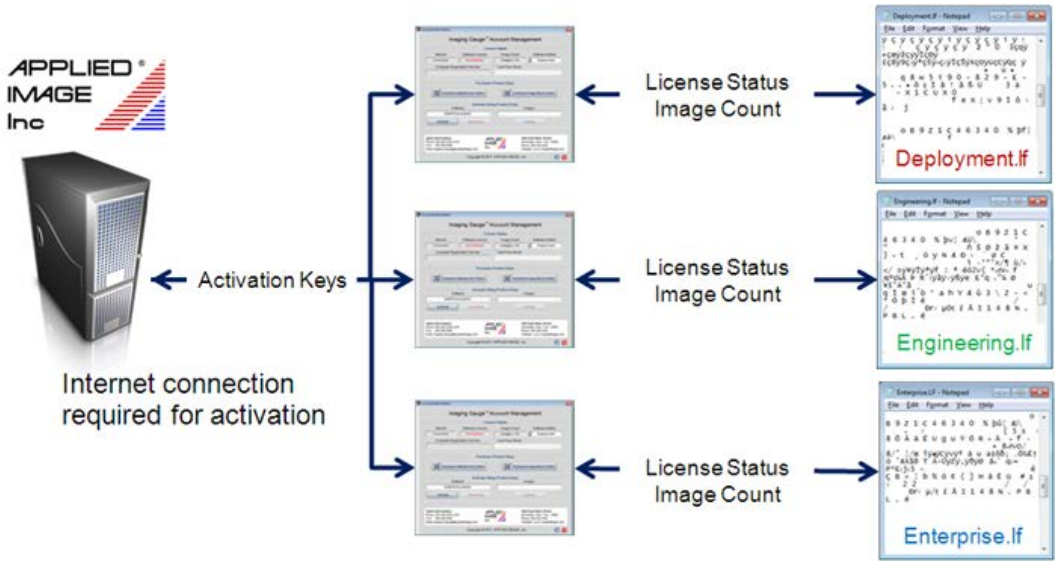
Software:

- Software is copy-protected
- Software can be used on one workstation at a time
- Each software edition (Enterprise, Engineering & Deployment) is licensed independently

Image Actuations:

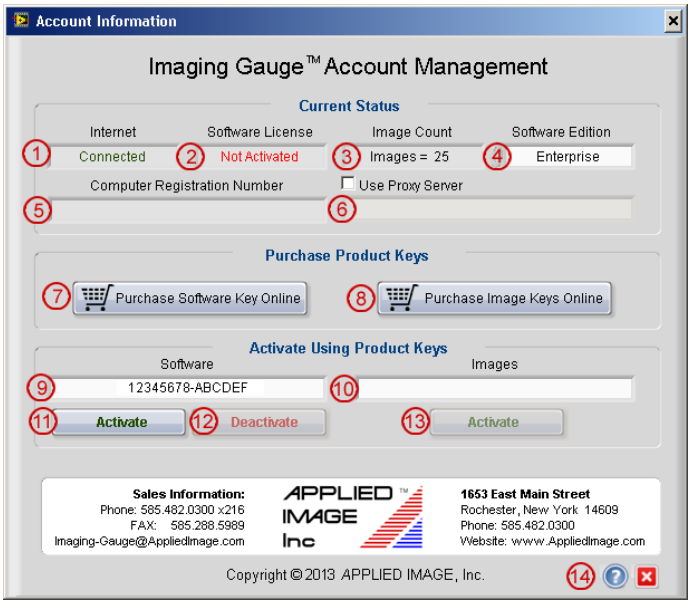
- A supply of image "actuations" is required for the software to operate
- The supply is decremented by one each time an image is analyzed
- Additional blocks (250, 500 & 1000) of image actuations are added using activation keys

The account management interface enables easy access to the encrypted license files for each of the software editions.



Copyright © 2013 *A*PPLIED IM*A*GE, Inc.

Features of the Account Management interface are shown below.

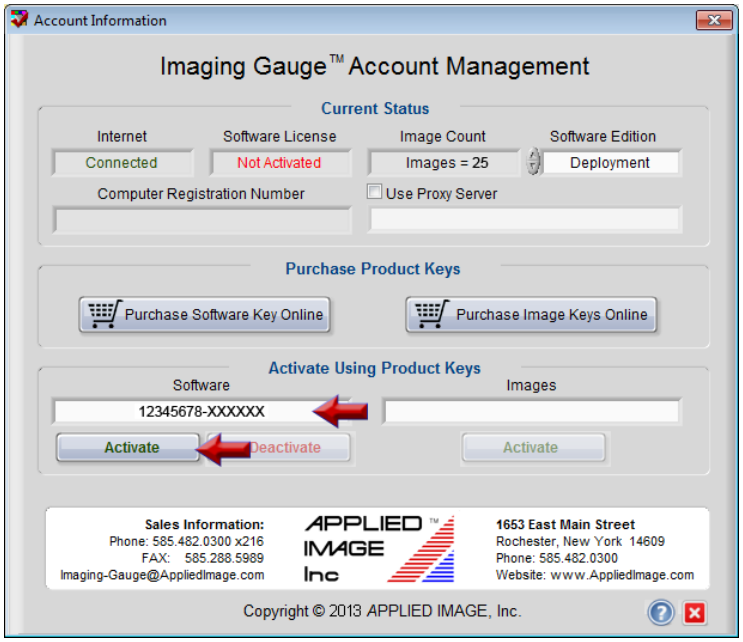


Number	Name	Description
1	Internet Connection Status	Displays the connection status of the workstation. Connection is required to activate, de-activate the workstation and add images
2	Software License Status	Displays "Activated" or "Not Activated" status
3	Image Count	Displays current number of image actuations available to analyze images.
4	Software Edition	Selection of software edition (Deployment, Engineering or Enterprise) for which the information and actions are associated.
5	Computer Registration Number	This number is automatically created and assigned when software activation is run. The number is used in the de-activation process.
6	Proxy Server	Field to allow the use of a proxy server for communicating with the activation servers, if necessary.
7	Purchase Software Keys Online	Opens the web store section of the Applied Image website for purchasing a software key. One key is required per workstation. Each edition requires a separate software key.
8	Purchase Image Keys Online	Opens the web store section of the Applied Image website for purchasing a image activation keys. Images can be applied to any of the three software editions.
9	Software	Location to enter the software key.
10	Image	Location to enter the image activation key
11	Activate Software Key	Communicates with server to ensure a valid key is entered. Activates software license if key is valid.
12	De-Activate Software	Communicates with server to allow the current software key to be used on another workstation. Shuts down current version of Imaging Gauge™ if deactivated successfully.
13	Activate Image Key	Communicates with server to ensure a valid key is entered. Adds image actuations to the image count if key is valid.
14	Navigation Buttons	Opens online help. Stop button closes the window and returns to the main program.

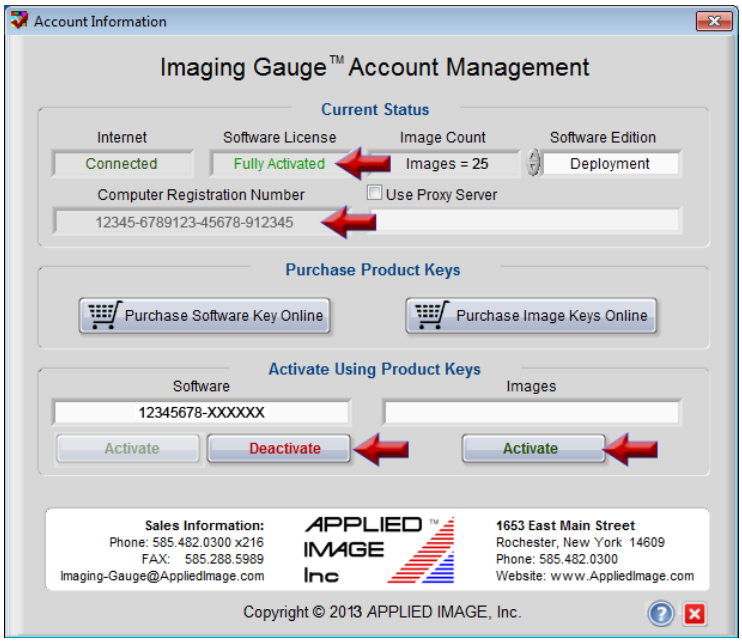
Copyright © 2013 APPLIED IMAGE, Inc.

Activating a Software License

Software activation requires the 14-digit activation key that was shipped with the installation CD or sent online. An internet connection is required to activate the software and a field is available if a proxy server is used. To activate the software, enter the software activation key in the field labeled "Software" and select the **Activate** Button.



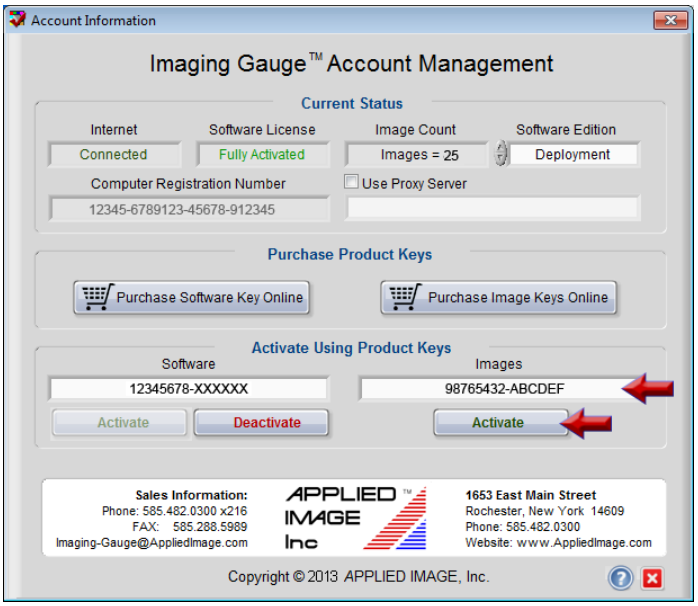
If activation is successful, the Software License status will display **Fully Activated** and a Computer Registration Number will be assigned. The **Deactivate** software and **Activate** images buttons will be enabled. Image actuations cannot be added to the workstation unless the software is activated.



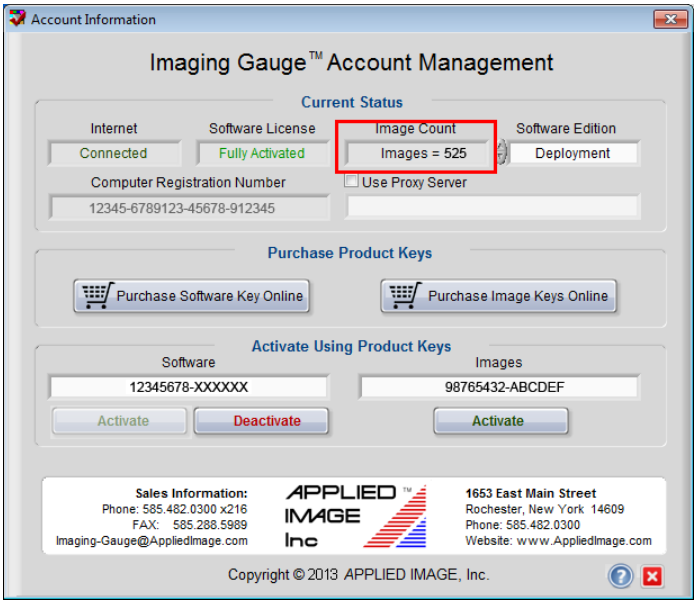
Copyright © 2013 APPLIED IMAGE, Inc.

Adding Image Actuations

Activating Image Keys to add actuations requires the 14-digit activation key that was shipped with the installation CD or sent online. An internet connection is required to add image actuations and a field is available if a proxy server is used. To add a block of image actuations, enter the image activation key in the field labeled "Images" and select the **Activate** Button.



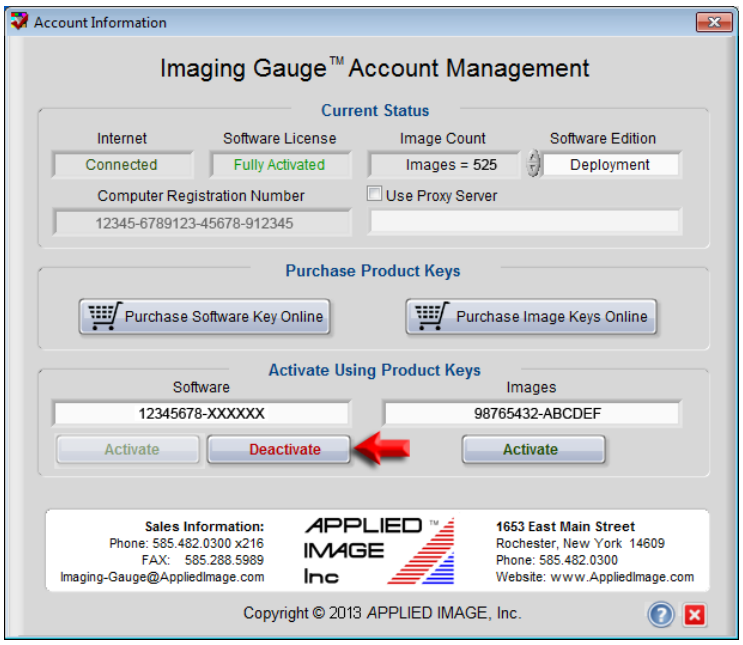
If activation is successful, the Image Count will be increased by the number of actuations associated with the activation key (250, 500 or 1000). The example below added 500 image actuations.



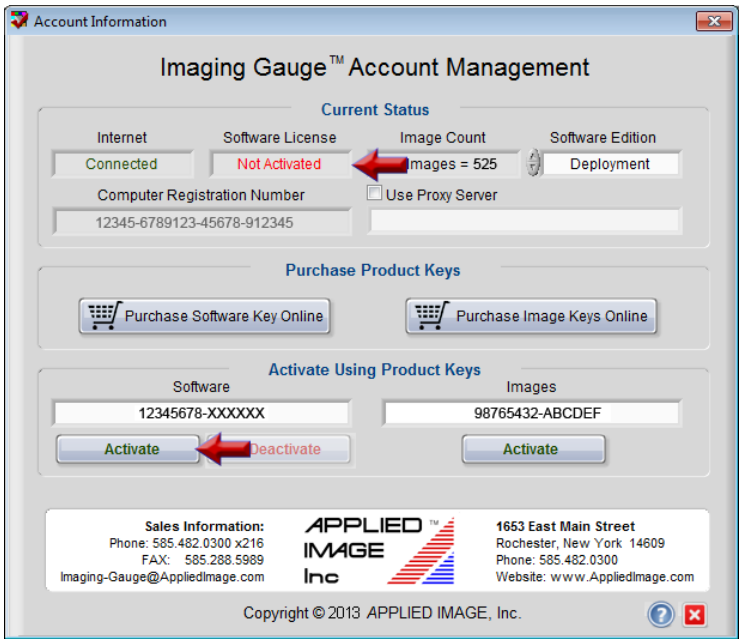
Copyright © 2013 APPLIED IMAGE, Inc.

De-Activating a Software License

Software de-activation requires internet connection and a field is available if a proxy server is used. To de-activate the software, select the **Deactivate** button.



If de-activation is successful, the Software License status will display **Not Activated.** The **Activate** software button will be enabled. The software activation key can then be used to activate another workstation. The Imaging Gauge™ program will automatically close after the interface window is closed.



Copyright © 2013 APPLIED IMAGE, Inc.

*A*PPLIED IM*A*GE, Inc.

*A*PPLIED IM*A*GE is a world leader in the field of Custom Opto-Imaged components and Standard Calibration tools. We achieved this distinction because of our wide range of unique capabilities, many years of experience, and our quality assurance & control processes.

At *A*PPLIED IM*A*GE, quality is assured at each stage of the production process from design & engineering through final production. This commitment to engineering excellence, combined with controlled environmental facilities, NIST traceable standards, and a highly qualified staff assures you that our products will meet or exceed your original specifications. And we've gone the extra step, using ISO Certification guidelines and National Laboratory Calibration Standards, to assure that our systems are in compliance with your unique needs.

Phone: 585-482-0300 x216
FAX: 585-288-5989
Website: www.AppliedImage.com

Company Headquarters:
*A*PPLIED IM*A*GE, Inc.
1653 East Main Street
Rochester, New York 14609

Copyright © 2013 *A*PPLIED IM*A*GE, Inc.