Tamarisk®640

17 µm 640x480 Long Wave Infrared Camera

Camera Control Software User Guide

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Revision: B

DRS Technologies

A Finmeccanica Company

13532 N. Central Expressway
Dallas, TX 75243
877.377.4783
www.drsinfrared.com

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Rev History

Revision Number	Release Date	Description
A	3/26/2012	Initial Release Use with Firmware older than V01.00.0080
B	11/15/2013	Updated Document to include latest SW/FW including ICE Strength Slider etc. Prepared for Public Release

Camera Link® is a registered trademark of the Automated Imaging Association.

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Description	Abbreviation	Description
°C	Celsius	mm	millimeter
°F	Fahrenheit	ms	milliseconds
AGC	automatic gain control	MSB	Most Significant Bit
BPR	bad pixel replacement	MTU	Maximum Transfer Unit
CCA	circuit card assembly	MWIR	Mid-wave infrared
CL	center line	NETD	noise equivalent temperature difference
COMM	communication	NTSC	National Television System Committee
CSC	Computer Software Component	NUC	non-uniformity correction
CSCI	Computer Software Configuration Item	NVTHERM	Night Vision Thermal Analysis Tool
CSU	Computer Software Unit	OEM	original equipment manufacturer
dB	decibels	OLA	Optical Lens Adapter
DSP	digital signal processor	P	probability
ESD	electrostatic discharge	POL	polarity
E-Zoom	electronic zoom	psi	pound per square inch
FOV	field of view	Rev	revision
FPA	Focal Plane Array	ROI	region of interest
ft	feet	SC	split configuration
G	gravitational force	SWIR	Short-wave infrared
g	gram	TBD	To Be Determined
GUI	graphical user interface	TCR	Temperature coefficient of resistance
H	height	TIM	Thermal Imaging Module
HFOV	horizontal field of view	UART	Universal Asynchronous Receiver Transmitter
I/O	input/output	UAV	unmanned aerial vehicle
ICD	Interface Control Document	UFPA	Un-cooled Focal Plane Array
ICE	Image Contrast Enhancement	USB	Universal Serial Bus
ID	identification	V	Vertical or Voltage
IR	infrared	VDC	volts direct current
IRS	Interface Requirements Specification	VGA	video graphics array
km	kilometer	VOx	Vanadium Oxide
LR	lower right	W	width or Watt
LWIR	long-wave infrared	µm	micron (micrometer)

REFERENCE DOCUMENTS

The following documents form part of this specification. In the event of a conflict between documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Document No: 1002593 Tamarisk®$_{640}$ User Manual

Document No: 1012820 Tamarisk®$_{640}$ Electrical Interface Control Document

Document No: 1012819 Tamarisk®$_{640}$ Software Interface Control Document

Document No: 1003727 Tamarisk®$_{640}$ Mechanical Interface Control Document

SAFETY INSTRUCTIONS

NOTIFICATIONS: CAUTION, WARNING AND NOTE

The following is a list of notifications and their accompanying symbol that may be found through this document to alert the reader to potential risks and to minimize the potential for personal injury and or damage to the product. When a notification is present, it is important that the user review and understand all statements related to the notification before proceeding. If questions arise, please contact your authorized dealer or DRS Technologies.

Notifications are preceded by a symbol and followed by highlighted text. Three types of notifications are typically used and are defined below:

CAUTION

A caution is a procedure, practice, or condition that, if not strictly followed, may result in personal injury or damage to the equipment that may impede product performance.

WARNING

A warning is intended to alert the user to the presence of potentially harmful circumstances and provide precautionary guidance for mitigating risk of personal injury and or damage to the product.

NOTE

A note is a statement that clarifies or is used to emphasize important information.

1. Read all instructions
2. Keep these instructions for future reference.
3. Follow all instructions
4. Heed all warnings.
5. Do not submerge this apparatus in liquid of any kind.
6. Clean per recommended instructions using dry non-abrasive cloth.
7. Do not install near any sources of intense heat such as radiators, furnaces, stoves or other apparatus that regularly produce excessive heat.
8. Refer all servicing to qualified service personnel.

1 INTRODUCTION

The Camera Control Software provides an easy to use, graphical interface which allows the user to fully evaluate the camera's functions and features. This user guide describes the installation requirements, installation procedure, and provides details on how to use the Camera Control Software to configure the camera, display status information, and perform image processing.

NOTE

This guide is based on version 1.6 or later of the DRS Camera Control Software.

1.1 SUPPORTED CAMERAS

This User Guide explains the operation of with the Camera Control Software version 1.6 or later. This version supports the following cameras:

1. Tamarisk®$_{640}$
2. Tamarisk®$_{320}$
3. Zafiro™$_{640}$
4. UC640

1.2 SYSTEM REQUIREMENTS

To install and run the Camera Control Software, ensure the host PC supports the following:

1. Operating System: Microsoft Windows7 (64-bit/32-bit), or Windows XP (64-bit/32-bit) with SP3
2. CPU: 1GHz or faster
3. Memory: 512MB of RAM (1GB recommended) and 500 MB of available hard-disk space
4. CD/DVD-ROM drive
5. USB 2.0 port or a serial port
6. Display: 1024×768 resolution or above
7. Adobe PDF reader – for viewing the help files
8. The following are optional
9. Analog frame grabber which supports Microsoft's DirectShow API
10. Camera Link frame grabber which supports Microsoft's DirectShow API

1.3 LENS CALIBRATION REQUIREMENTS

The following hardware is needed to calibrate the camera successfully:

1. Pass Key to enable the Lens Calibration tab
2. A Tamarisk® with lens focused at infinity running:
    a. FPGA RTL ver: V01.00.0080 or newer
    b. CPU SW ver: X1.P1.01.13.13 or newer -OR- X1.Px.00.xx.xx
3. A USB cable or RS232 cable and power
4. One or two thermally stable black bodies. Ideally, the calibration process uses a controllable black body, but any thermally stable and uniform body is acceptable. The black body must completely fill the field of view with a uniform scene. DRS recommends the following black body manufactures and models:
    a. Santa Barbara Infrared, Inc.

        www.sbir.com

        Model: Infinity black body and controller
    b. CI Systems

        www.ci-systems.com

        Model: sR-800

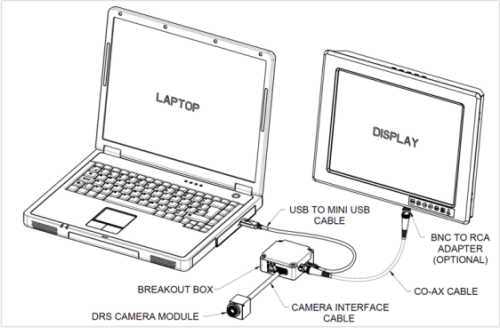
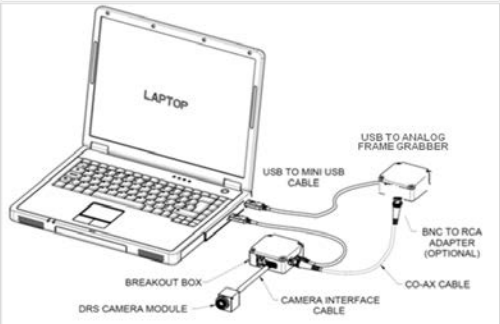
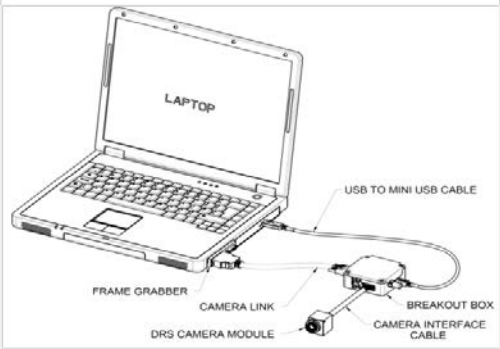
2 HARDWARE SETUP

2.1 HARDWARE CONFIGURATION

In this section, three different configurations for viewing your camera's output video will be presented, including solutions for both analog and digital video. Although the physical interface may vary from camera to camera, the schema outlined below will remain valid for the products listed in section 1.1 above.

Table 1, presents three different approaches for viewing your camera's output video as well as the recommended hardware to support that given approach. An illustration is provided to document each connection and demonstrate what the given set-up may look like.

Table 1. Hardware Configuration Set-up Overview

Display Configuration	Required Hardware	Illustration
Analog video to an external monitor	Laptop Analog Display USB to USB mini cable Camera Module Camera Interface Cable Camera break out box Coax cable	
Analog video displayed on the PC	Laptop USB to analog frame grabber USB to USB mini cable Camera Module Camera Interface Cable Camera break out box Coax cable	
Camera Link (digital) video displayed on the PC	Laptop Camera Link frame grabber Camera Link cable USB to USB mini cable Camera Module Camera Interface Cable Camera break out box	

2.1.1 Connecting to an Analog Monitor

The simplest way to evaluate the camera is to configure the hardware as shown in Figure 1. The user simply needs to apply power and connect the RS-170 cable to an analog monitor. For some

cameras, a USB cable may be used to provide both power and control. The user will immediately see video displayed on the analog monitor. To manipulate or change the camera settings a serial communication link (serial RS232 or USB) is required. The camera may be control through issuing serial commands via the serial link or by using the Camera Control Software described herein.

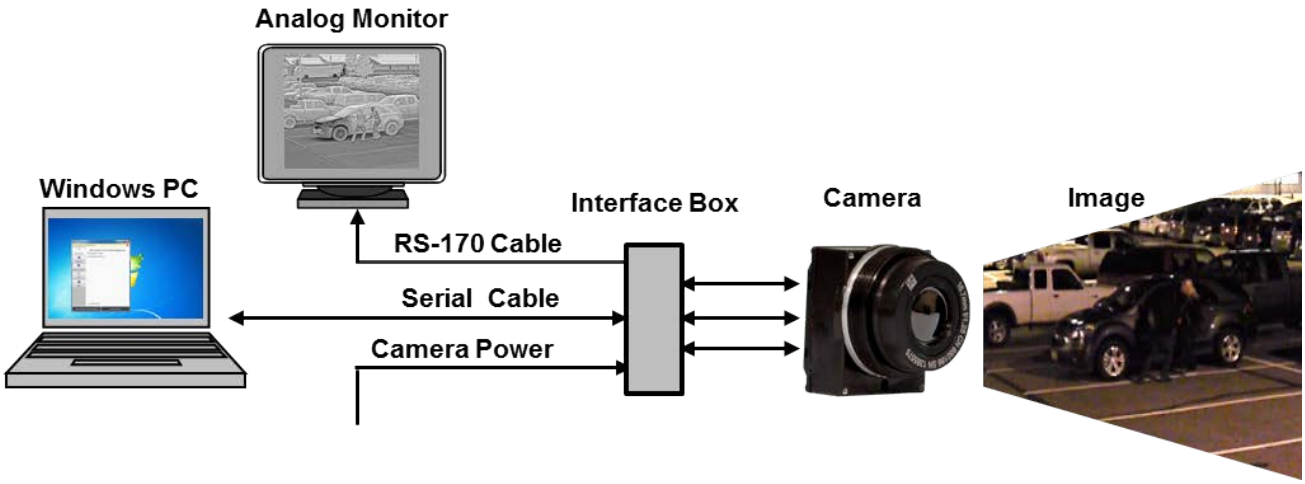


Figure 1. Analog Video Displayed on an Analog Monitor

2.1.2 Connecting to an Analog Frame Grabber

Alternatively, an analog video-to-USB frame grabber (as shown in Figure 2) may be used to display the camera's output video. In this case, the RS-170 feed from the camera or interface box is connected to an analog video-to-USB frame grabber. To display the video on screen please follow the instructions that came with your analog-to-USB frame grabber.

The frame grabber allows the user to capture video or images and analyze or view them later.

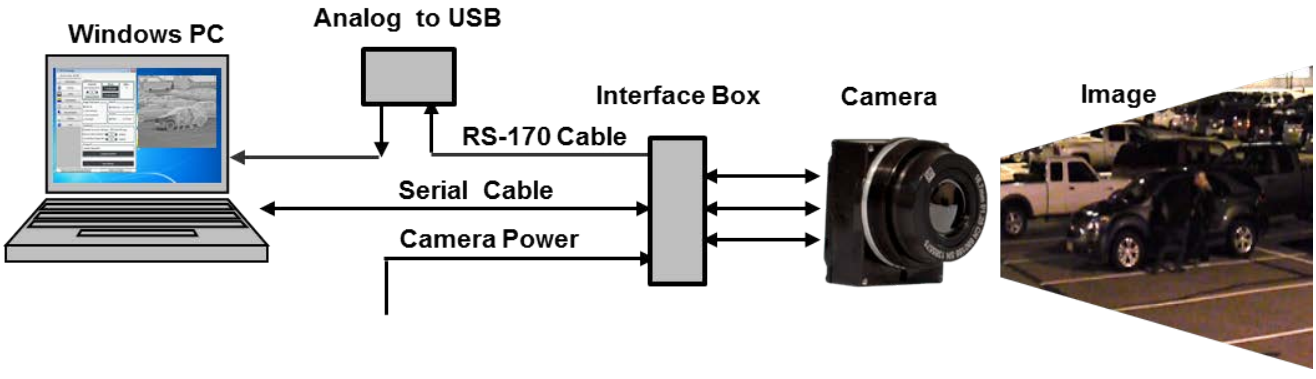


Figure 2. Analog Video Displayed on a PC, via Analog Frame Grabber

2.1.3 Connecting to a Camera Link Frame Grabber

This method provides the highest quality image for display. Figure 3, illustrates the set-up for viewing digital video (14-bit or 8-bit) using CameraLink®. Simply connect the CameraLink® cable to the PC's CameraLink® frame grabber card on one end and to the CameraLink® connector on the interface box. Besides capturing digital video and images, Camera Link adapters provide a host of control features such as data capture rates and video compression formats. Please follow the instructions that came with your CameraLink® capture card to display the image on screen. A list of compatible frame grabbers is available and can be found in your Tamarisk® Product Documentation Package.

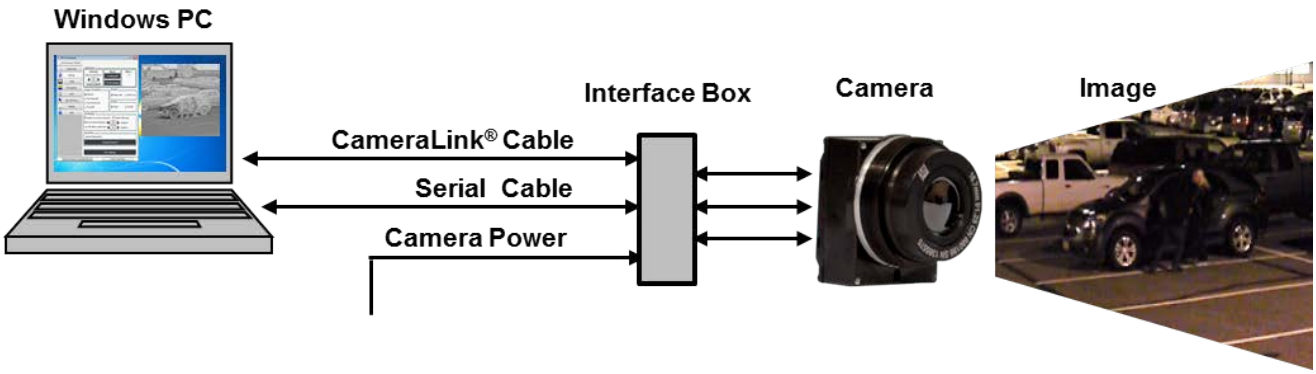


Figure 3. Digital Video Displayed on a Digital Display via Digital Frame Grabber

3 SOFTWARE INSTALLATION

DRS provides Tamarisk® Camera Control Software in various media formats. Please refer to the Tamarisk® User Manual and or www.drsinfrared.com for a list of accessory items including part numbers. The Tamarisk® Camera Control Software may be download directly from our web site.

3.1 LAUNCHING THE CAMERA CONTROL SOFTWARE INSTALLER

Follow the instructions below to install the Camera Control Software GUI on your PC or laptop.

Download software from www.drsinfrared.com or insert flash media into your PC. Refer to Figure 4.

Figure 4. Internet Download or Flash Media Install

Using Windows Explorer, select the drive corresponding to the media was just inserted. Look for the file name: DRS Camera Control Software Setup. Refer to Figure 5.

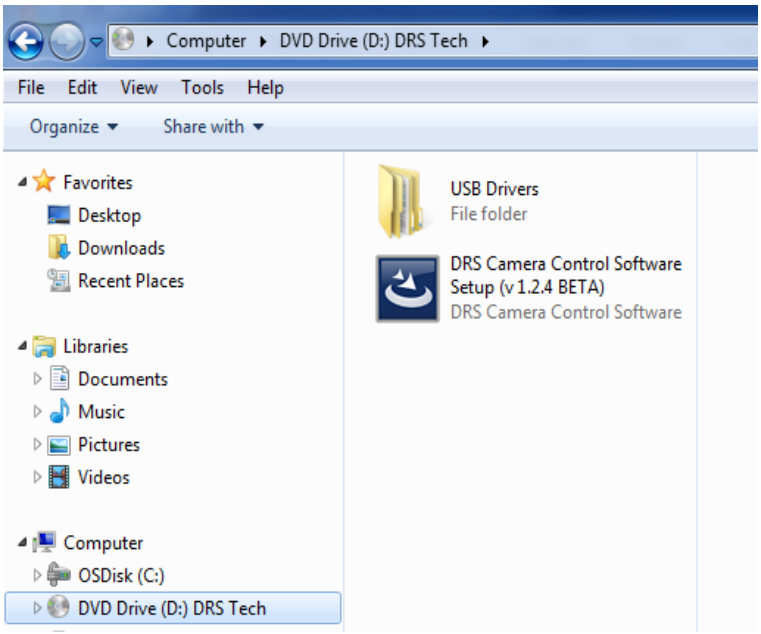


Figure 5. Software Install

Initiate the installation process by selecting (double mouse click) DRS Camera Control Software Setup icon; Refer to Figure 6.

Figure 6. Software Install

3.2 INSTALL CAMERA CONTROL SOFTWARE

Once the user double clicks the DRS Camera Control Software Setup icon, the image shown in Figure 7 appears. If the Install Wizard detects that an older version of the Camera Control Software is installed, the user will be asked if he wants to install a new version. It is highly recommended to exit setup and uninstall the previous version prior to installing the new version. At any point prior to clicking the "Install" button; the user can cancel the installation by clicking the "Cancel" button.

Figure 7. Welcome to the InstallShield Wizard

Software License Agreement: The Software License Agreement screen is shown in Figure 8. Once the agreement is read the terms accepted, the user selects "I accept the terms in the license agreement". The user can print the agreement by selecting the "Print" button.

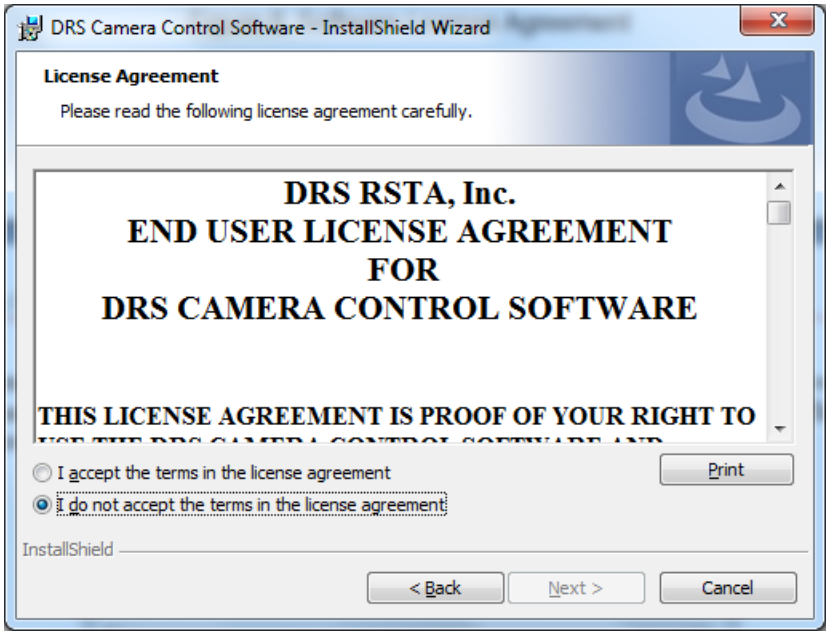


Figure 8. Software License Agreement

LGPL License: The LGPL License Agreement is shown in Figure 9. Once you have read the agreement and accept the terms, select "I accept the terms in the license agreement". The user can print the agreement by selecting the "Print" button.

Figure 9. LGPL License Agreement

Destination Folder: The default installation directory is shown in Figure 10. The user can change the installation directory by clicking on the "Change" button. Select next to confirm installation destination.

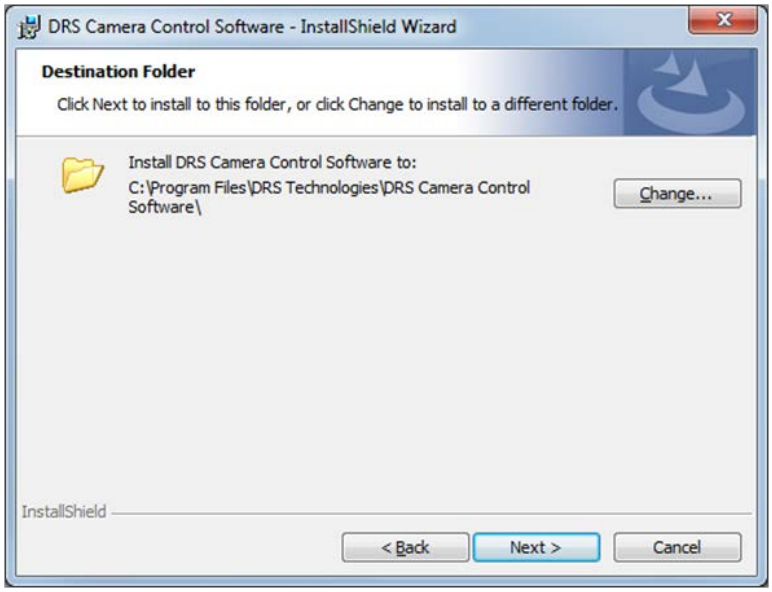


Figure 10. Destination Folder

Setup Type: Figure 11 shows the Setup Type screen. The user can select between a "Complete" (recommended) or "Custom" install, then select Next.

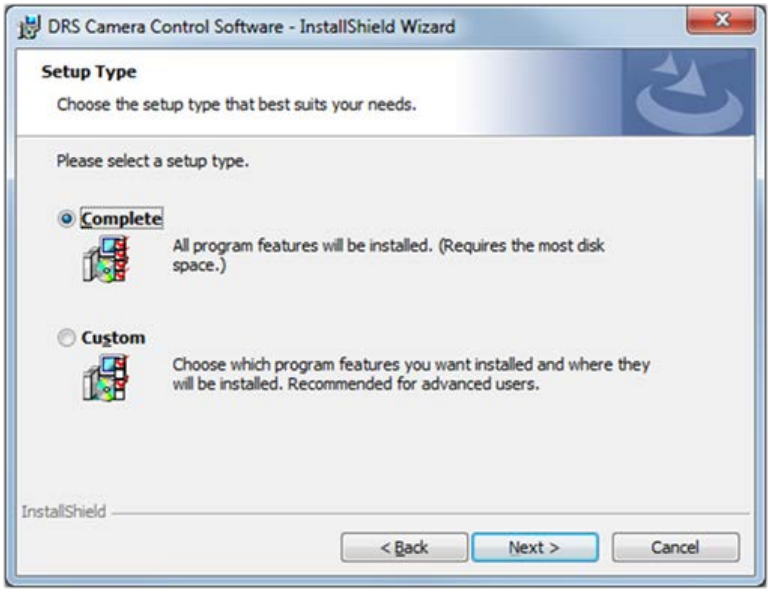


Figure 11. Setup Type

Ready to Install the Program: The InstallShield Wizard has enough user information to complete the installation. At this point the user can cancel the installation. Once the "Install" button is pressed, the Wizard will make sure the system meets the minimum installation requirements and complete the installation. The Ready to Install the Program screen is shown in Figure 12.

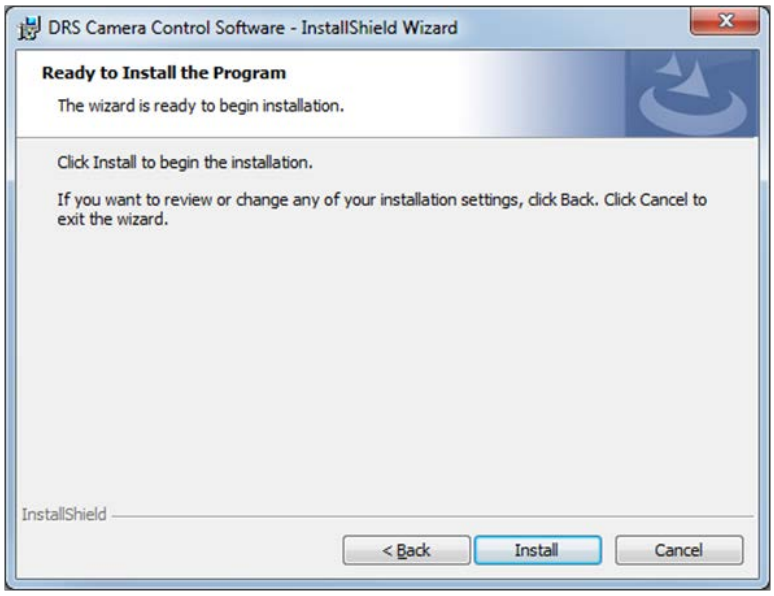


Figure 12. Ready to Install the Program

Installing DRS Camera Control Software: The InstallShield Wizard status shows the changes that are made during the installation; a progress bar also is provided. A command prompt window may briefly appear; this is a normal part of the installation. Figure 13 shows the Installing DRS Camera Control Software screen.

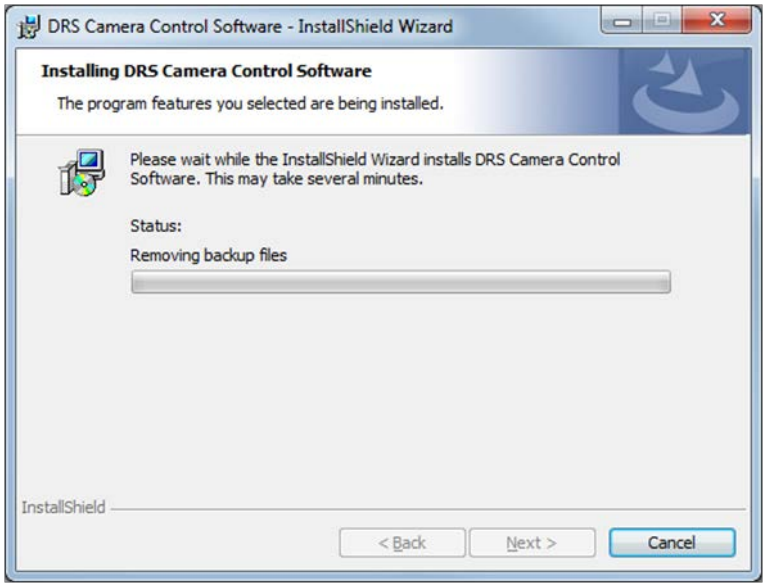


Figure 13. Installing DRS Camera Control Software

Within approximately three minutes the InstallShield Wizard Completed screen appears. The installation is now complete. Select Finish. By default the DRS Camera Control Software will not

immediately start when the “Finish” button is pressed. The user can select the “Launch DRS Camera Control Software” checkbox and upon selecting “Finish” and the DRS Camera Control Software will start. Figure 14 shows the InstallShield Wizard Complete screen.

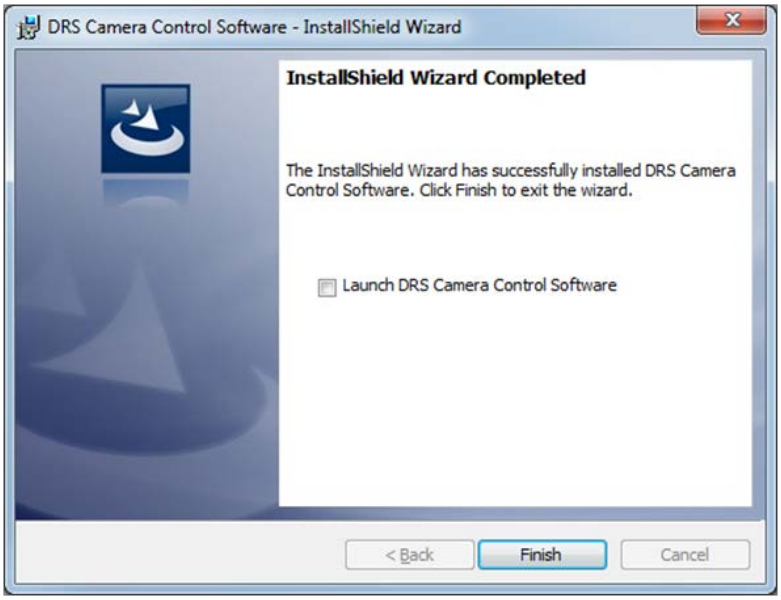


Figure 14. InstallShield Wizard Completed

Once the installation is complete the user will notice that an icon was added to the desktop and a DRS Technologies folder is added to the programs list.

4 SET-UP AND OPERATION

4.1 GETTING STARTED

Make sure your camera is connected and powered up. Refer to the user manual for your specific camera to ensure the proper power-up procedure is followed.

Connect the USB or RS232 serial cable to the proper port on your PC or laptop. If connecting to the camera via USB for the first time, drivers will need to be installed. You can skip obtaining the drivers from windows update since these drivers were installed on the PC as part of "Launching the Camera Control Software Installer" on page 8.

4.2 STARTING THE CAMERA CONTROL SOFTWARE

Once your device is properly connected and powered, start the Camera Control Software by clicking on the icon (refer to Figure 15).

Figure 15. DRS Control Software Icon

The software will automatically search for and connect to any supported and attached camera(s) (refer to Figure 16).

Figure 16. DRS Control Software Icon

While the system is searching you may press the ESC key to manually add a camera.

If the key ESC is pressed or no device is found, the No Attached Devices Found dialog box is displayed (refer to Figure 17). Check to verify that the device drivers have been installed. Go to Control Panel, select programs and features and look for FTDI Driver Install Package. If drivers are present then follow the steps below to manually connect the camera. If drivers are not found, then install drivers from the media used when installing the software.

Click Manually Add Device to open the Add Devices dialog box (refer to Figure 18).

Figure 17. DRS No Attached Devices Found

Select the camera from the pull-down menu or select "Auto Detect Device." Additionally, the user may select the COM port and Baud rate. The default baud rate for connecting through USB is 921600. The default baud rate for connecting through a RS232 serial interface is 57600. Figure 18 illustrates the configuration needed to connect to the camera via the RS232 interface; The COM port used is PC dependent. Click "Add Device" to connect to the selected camera.

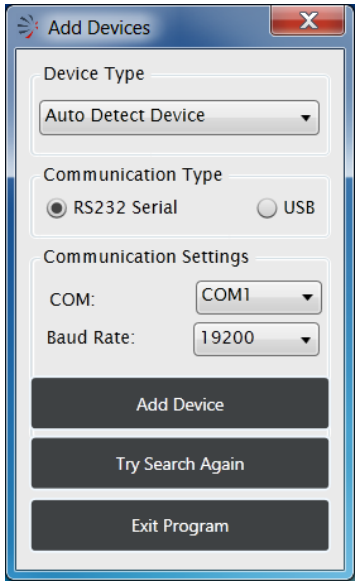


Figure 18. DRS Control Software Icon

5 CAMERA CONTROL SOFTWARE OPERATION

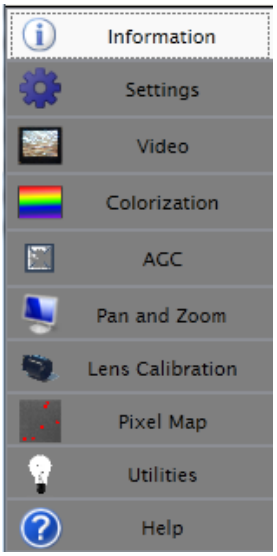
In this section the operation of the Camera Control Software GUI is explained by stepping through the various tabs and providing an explanation of features and functions.

The Camera Control Software is capable of supporting multiple cameras within the same application. A new camera tab, identified by the camera's serial number (see Figure 19) is displayed for each additional camera. This feature is available only when using a USB cable (and not a USB-to-serial RS232 cable) to communicate with your camera. For example, to configure and control three Tamarisk® cameras, connect each camera (via USB) from the camera's break out box to the PC as shown in Table 1. Hardware Configuration Set-up Overview. Open the Camera Control Software. The software will display three separate camera tabs; each tab is uniquely identified by the camera's serial number.

Additionally, multiple instances of the Camera Control Software may be opened at a time by launching multiple Camera Control Software applications and manually connecting your cameras as desired.

There are several tabs available to assist you in communicating with and controlling your connected Tamarisk®cameras. They are:

1. Information
2. Settings
3. Video
4. Colorization
5. AGC
6. Pan and Zoom
7. Lens Calibration
8. Pixel Map
9. Utilities
10. Help



Additionally, there are two functions that may be present on the Camera Control Software window, namely, *Search for New Connected Devices* and *Show Live Video*. See section 5.9 for details.

5.1 INFORMATION TAB

Once a supported camera is located the “Information” tab is displayed (refer to Figure 19).

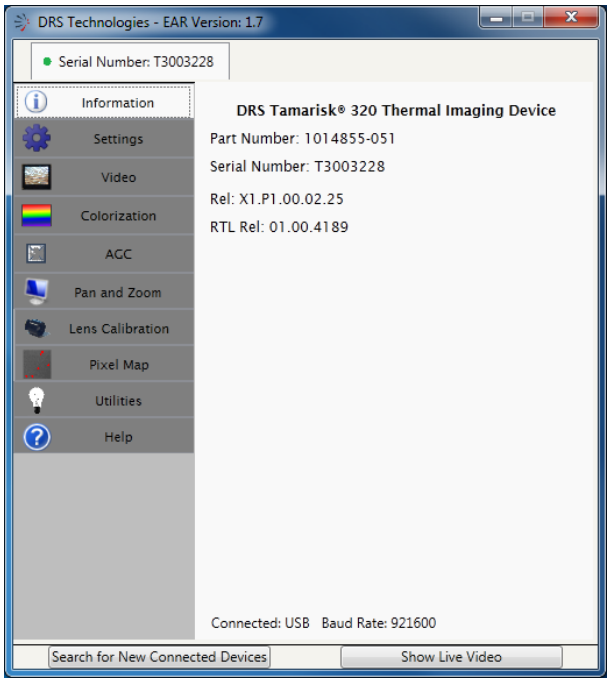


Figure 19. Information Tab

Table 2 provides an overview of the features and functions that are available on the *Information* tab.

Table 2. DRS Control Software Information Tab Overview

Item	Description
Part Number	Displays the DRS Technologies part number. For a detailed description of the part number refer to the Tamarisk® User Manual or data sheet
Serial Number	Displays the serial number. This is a unique number which is used to track the camera through the manufacturing process
Rel	Displays the Firmware version that is loaded and running in the camera. The Firmware is upgradable – See the utilities tab for details
RTL Rel	Displays the FPGA code revision. The FPGA code is upgradable – See the utilities tab for details
Connected	The two types of connections are RS-232 and USB
Baud Rate	When connected via USB the baud rate is fixed at 921600. When connected via RS-232 the default baud rate is 57600. Refer to the Software Interface Control Manual for details on how to change the default baud rate.

5.2 SETTINGS

Figure 20 illustrates the *Settings* tab. This tab has been organized into 6 task panes, *Calibration, Image Orientation, Polarity, Shutter, Symbology and Password* to help the user configure the camera. To change a setting, hover over the setting of interest and select with your mouse or pointer device.

The selected command is immediately applied to the camera and the results will appear on the output video. Note, the settings are not saved until you select the *Save Settings* tab at the bottom of the window. Once *Save Settings* has been selected, all indicated settings will be saved to the cameras non-volatile memory; this may take a few seconds. When the camera is powered cycled the settings are retained.

NOTE

To save settings, select the *Save Settings* tab at the bottom of the window. This may take a few seconds and will store all selected settings to non-volatile memory.

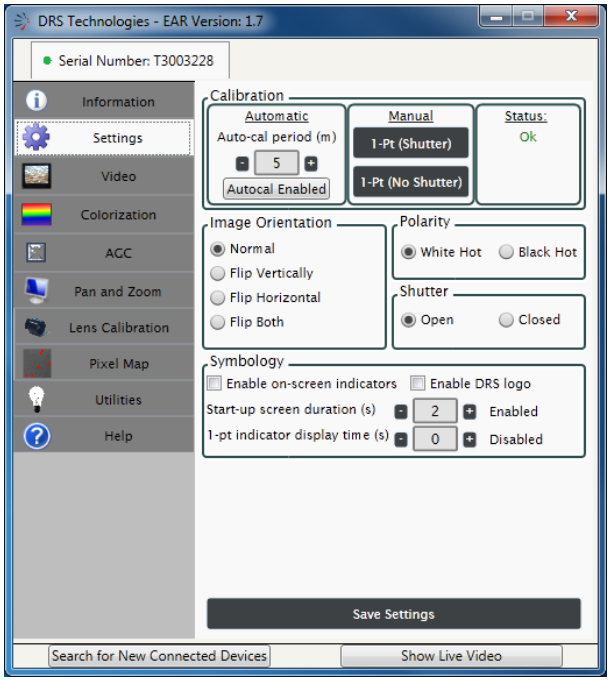


Figure 20. Settings Tab

Table 3 provides an overview of the features and functions available on the *Settings* tab.

Table 3. Settings Overview

Task Pane	Description	Function
Calibration	1-Point Calibration	Performs calibration / non-uniformity correction (NUC) – shutter is used
	1-Point (No Shutter)	Performs NUC through the lens – shutter is not used

Automatic Calibration	Period (in minutes) Set Period	Sets time between calibrations Sets new calibration period (default is 5 minutes) Setting the "Autocal Enabled" button to "0" turns auto calibration off. Click "Save Settings" to save changes to the camera's non-volatile memory
Calibration Status	Provides the current calibration status	The camera will periodically update the calibration status. This is especially important if the user has disabled the automatic calibration by clicking "Autocal Enabled."
Image Orientation	Normal Flip Vertically Flip Horizontally Flip Vertically/ Horizontally	Normal display mode Flips the image from top to bottom Flips the image from left to right Flips the image from top to bottom and left to right Click "Save Settings" to save changes to the camera's non-volatile memory
Shutter	Shutter Open Shutter Closed	Opens shutter Closes shutter
Polarity	White Hot Black Hot	Hot pixels are shown as white and cold pixels are shown as black Hot pixels are shown as black and cold pixels are shown as white Click "Save Settings" to save changes to the camera's non-volatile memory
Symbology	Enable on-screen indicators Enable DRS logo Start-up screen duration 1-pt indicator display time	Enables/disables zoom, 1-pt calibration, and polarity indicators. The 1-pt calibration indicator also requires the 1-pt indicator display time to be set greater than 0 to be enabled. Enables/disables the DRS logo. Sets the time in seconds that the DRS splash screen is displayed on camera power-up. Sets the time in seconds that the 1-pt calibration indicator will be shown prior to a shutter event. Changes on the Symbology task pane are automatically saved to the camera's non-volatile memory

5.2.1 Calibration (One-Point Calibration) Non-Uniformity Correction

To optimize a thermal scene, the processor software performs NUC or 1-Point calibration of the video images through internal calculations. To provide the best possible image, a non-uniformity correction is performed based on information provided by factory calibration, user-commanded 1-point calibrations, and bad pixel replacement (BPR) algorithms. Initiating a NUC activates a one-point single-temperature correction sequence that will reset the level offset of each pixel to improve overall image uniformity and contrast.

A NUC is performed automatically at start up, per the AutoCal setting and when the FPA temperature transitions into another temperature zone – these zones are static with a

corresponding set of offsets determined as part of the factory calibration process. The operator can also initiate a NUC at anytime and has the option of selecting "1-Point Calibration" or "1-Point (No Shutter)" from the camera software control GUI.

"1-Point Calibration" (shutter closed)

Calibration is performed with the shutter closed preventing scene IR energy being received by the detector. With the shutter closed, the sensor sees a uniform temperature when performing the NUC. The shutter will momentarily close while calibration is performed.

"1-Point (No Shutter)" (Shutter open, "Through-the-lens")

Shutterless calibration is use for optimal image performance by removing unwanted optical noise. This calibration is a, "through-the-lens," one-point calibration. In this case, a uniform temperature object must be placed in front of the lens while the one-point calibration is performed.

5.2.2 Automatic Calibration (One-Point Calibration)

The camera is programmed at the factory to automatically perform a 1-point on power-up, when the FPA temperature transitions across predefined temperature zones, and every 5 minutes (per the default automatic calibration time setting). The user can disable the automatic calibration timer by entering a 0 in the automatic calibration field.

5.2.3 Image Orientation

The image can be displayed in four operator-selectable orientations as shown below:

Figure 21. Normal Orientation

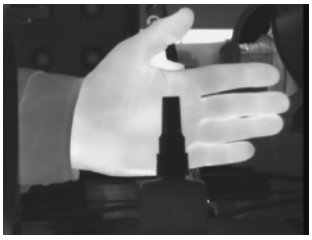


Figure 22. Flip Horizontally

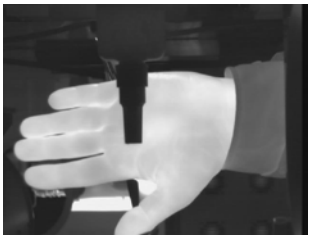


Figure 23. Flip Vertically

Figure 24. Flip Vertically and Horizontally

5.2.4 Polarity

Polarity switches the displayed image from White Hot to Black Hot polarity (refer to Figure 25 and Figure 26). White Hot polarity is set as factory default. Reversing the image polarity can improve the apparent detail in some scenes, especially in the presence of bright ambient lighting

around the display screen. In general, there is no correct polarity setting but a matter of operator preference.

Figure 25. White Hot Polarity

Figure 26. Black Hot Polarity

5.2.5 Symbology

By selecting the *Enable on-screen indicators* check box, the camera will display symbology for the current polarity, 1-point indicator time (if a value of greater than 0 is entered) and the current electronic zoom value. These three symbology indications are displayed at the top of the screen as shown below:

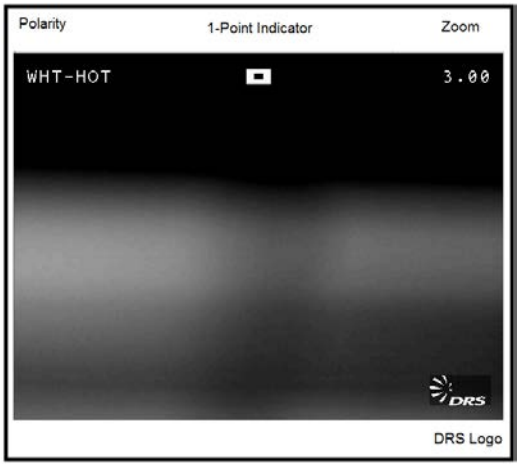


Figure 27. On Screen Symbology

Durig a 1-point event the camera's shutter closes and the video output is temporarally frozen. The 1-point indication is used in instances when the user desires advanced notice of an imminent 1-point. The user may want to pospone an event until after the 1-point is complete. For maximum flexability, the 1-point indication time is adjustable by the user.

The user may also, independently, enable or disable the DRS logo. The DRS logo symbology is displayed in the lower right-hand corner of the screen.

Additionally, the user may adjust the time interval for displaying the start-up screen between power-up and the output of live video. A value of "0" disables the start up screen.

When displaying 14-bit digital video, symbology is not displayed. Refer to Figure 28 for more details.

5.3 VIDEO

Figure 29 illustrates the Video tab. The *Video* tab comprised of two task panes, *Analog Video* and *Digital Video*. Factory default settings are *Analog Video* Enabled and *Digital Video* Camera Link enabled. *Analog Video* and *Parallel Digital Video* are mutually exclusive. To save changes to the video output, the user must click on *Save Settings* before moving to another tab or closing the Camera Control Software application.

5.3.1 Video Overview

Within the Camera Control Software, the video output of the camera is broken into the Settings, Video, Colorization, AGC, and the Pan and Zoom tabs. Since all of these tabs are related to each other a high level explanation of the camera video functions is helpful. Figure 28 is a block diagram of the video chain.

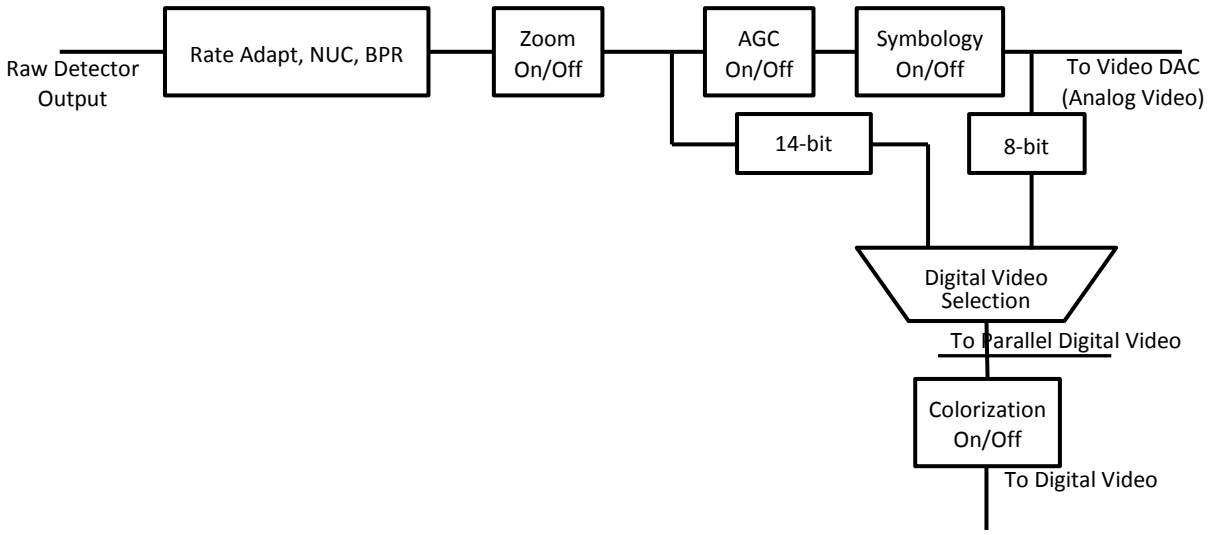


Figure 28: Video Block Diagram

On the left side of the block diagram, the detector (or FPA) output feeds into the rate adaptation, Non Uniformity Correction, and Bad Pixel Replacement block. The output of this block is a 14-bit corrected image and it feeds into the Zoom block.

The zoom block can perform up to a 4X digital zoom and also allows the user to perform a digital pan and tilt. The Zoom block feeds into the Frame buffer block.

The frame buffer block performs the white-hot, black-hot and allows the user to change the image orientation. The 14-bit output of the Frame buffer block feeds into the Digital Video Selection block and the AGC block.

The AGC block allows the user to select several different AGC modes. The AGC block also converts the 14-bit video to 8-bit digital video. The output of the AGC block feeds into the Symbology block.

The Symbology block allows the user to display camera information on-screen. The output of the symbology block is input to the digital to analog converter (DAC) block where the 8-bit digital

data is converted into RS-170 analog video. The RS-170 video is not colorized. The output of the symbology block also feeds into the digital video selection.

The Digital Video Selection allows the user to select either 14-bit (pre AGC) or 8-bit (post AGC) digital data. This is an important note because the two video streams look very different from each other. The output of the Digital Video Selection block feeds into the Colorization block

If the Colorization block is off, the digital video data passes through and is unchanged; 14-bit and 8-bit data is output from the colorization block. If the Colorization block is enabled, the incoming digital video data is mapped to 24-bit RGB data. The user has the ability to select the color pallet.

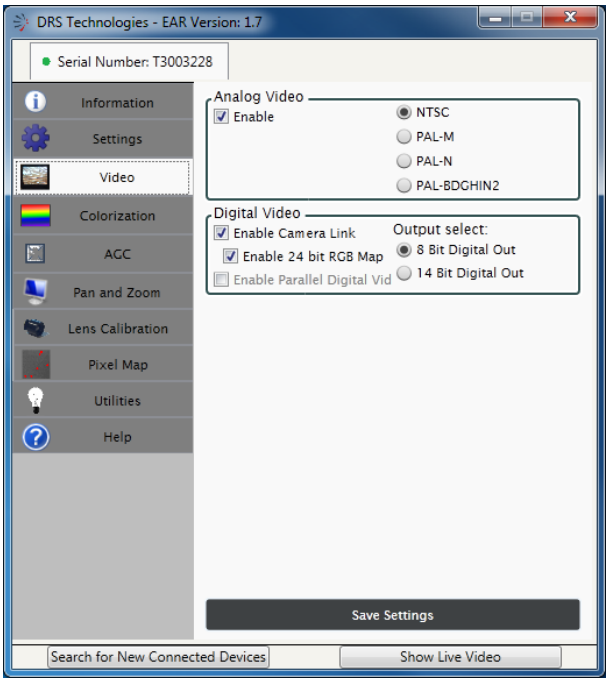


Figure 29. Video Tab

Table 4 provides an overview of the features and functions that are available on the *Video* tab.

Table 4 – Video Overview

Item	Description	Function
Digital Video Output Select	Enable Camera Link	Enables/disables the Camera Link Output
	Enable Parallel Digital Video	Enables/disables Digital Video Output
	Parallel Digital Video	Enables/disables the parallel digital video output (Note: Parallel digital video cannot be enabled while analog video is enabled)
		Changes are automatically saved to the camera's non-volatile memory

Analog Video Select	NTSC	Sets analog video output to the National Television System Committee standard
	PAL-M	Sets analog video output to the Phase Alternating Line (M)
	PAL-N	Sets analog video output to the Phase Alternating Line (N) standard
	PAL-B,D,G,H,I,N2	Sets analog video output to the Phase Alternating Line (B,D,G,H,I,N) standards
		Changes are automatically saved to the camera's non-volatile memory
Digital Video Output Selection	8-bit Digital Out	Sets the Camera Link and parallel digital video output to display 8 bits
	14-bit Digital Out	Sets the Camera Link and parallel digital video output to display 14 bits
		Click "Save Settings" to save changes to the camera's non-volatile memory
Colorization Selection	Enable 24 bit RGB Map	Enables 8-bit to 24 bit colorization palette mappings. Once colorization is enabled, the user can select the colorization pallet by selecting the Colorization Tab.
		Click "Save Settings" to save changes to the camera's non-volatile memory

5.3.1.1 Video Output Select

The camera outputs monochrome analog or digital video. When Camera Link and colorization is enabled and a colorization palette is selected, the camera outputs 24-bit RGB color digital video. Time to first video image is typically < 2 seconds.

5.3.1.2 Analog Video

The camera outputs RS-170/NTSC (or PAL)-compatible analog video. The output is 1 volt peak-to-peak when properly terminated.

5.3.1.3 Digital Video

The camera outputs Camera Link digital video signal. When colorization is disabled the output video is either 8-bit or 14-bit gray scale. When colorization is enabled, the output video is 24-bit RGB; the colorization block maps the 8-bit gray scale video to 24-bit RGB video. The digital video output is progressive scan with a 4:3 display ratio. The format will vary with the type of camera core you have connected and is typically either 640x480 or 320x240.

5.4 COLORIZATION

Figure 30, illustrates the *Colorization* tab. The user is presented with 8-bit to 24-bit colorization pallet mappings. The user may select any one of eleven different pallets. The results are immediately applied to the output video. To save the settings, the user must select *Save Settings* button before moving to another tab or closing the Camera Control Software application.

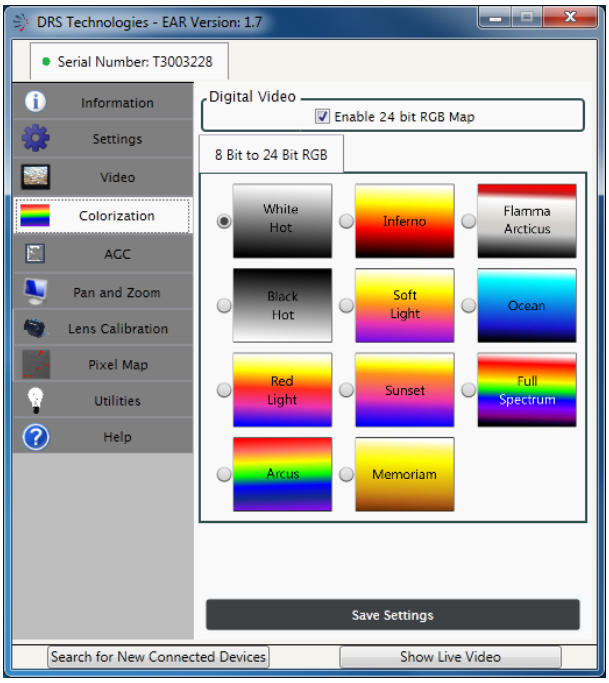


Figure 30. 8-Bit Colorization Tab

5.5 AGC

Figure 31 illustrates the Automatic Gain Control (*AGC*) tab. This window includes two task panes, *Gain/Level Control* and *Gain/Level Bias.* The factory default setting is AGC enabled. When enabling *Image Contrast Enhancement* (ICE) for the first time, the default setting is ICE Strength 3. Additional user selectable settings are also available.

NOTE

The utility of AGC, (automatic or manual) is highly dependent upon the scene content Operators are encouraged to experiment with various scenes, alternately enabling, disabling, and varying the controls to develop a familiarity with this feature.

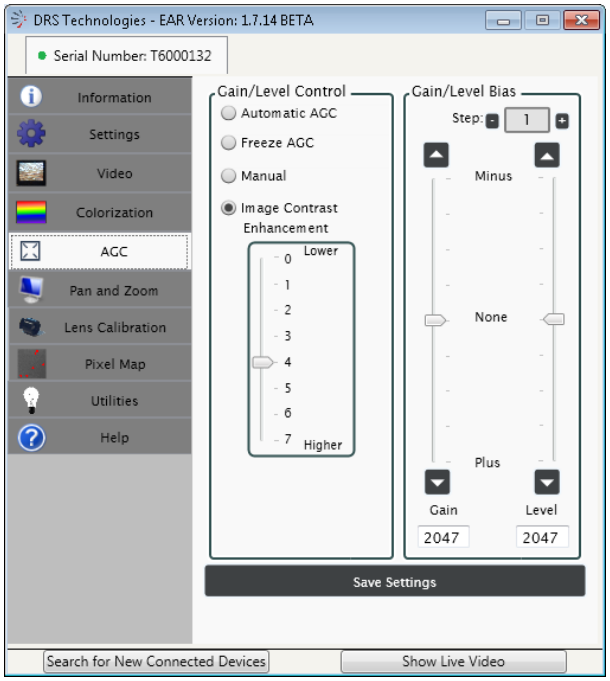


Figure 31. AGC Tab

Table 5, provides an overview of the features and functions that are available on the *AGC* tab.

Table 5 – AGC Overview

Item	Description	Function
Gain/ Level Control	Automatic AGC	Enables AGC mode
	Freeze	Turns off/freezes AGC at its current level
	Manual	Operator adjustment
	Image Contrast Enhancement	Turns on ICE and enables the adjustment of the ICE Strength (Range = 0 - 7)
Gain/Level Bias	Gain	Displays current Gain (Range = 0 - 4095)
	Level	Displays current Level (Range = 0 - 4095)

5.5.1 Gain and Level Control

Adjusting the gain and level, may improve how the detected energy is displayed on a video monitor. By adjusting the gain and level, an operator can control image output intensity and contrast. There are four *Gain/Level Control* modes to select from as noted in Table 5.

5.5.2 Automatic AGC Mode

Automatically adjusts the gain and level of the entire scene, in real-time, providing an image with optimum average contrast and brightness. AGC limits the adjustment range when enabled but allows the operator to fine tune by adjusting the gain and level bias. *Automatic AGC* enabled is the factory default setting. This setting can be disabled by selecting one of the other gain control modes such as *Manual AGC, Freeze AGC or Image Contrast Enhancement*.

5.5.3 Manual Gain and Level

This mode is used to enhance specific objects or areas in the scene. This mode is not recommended for overall global adjustment but to quickly discriminate targets from background. Gain and level can be lowered for very bright objects to reduce pixel saturation, maintain image detail and increase dark objects to improve their visibility. This is a variable setting from 0 – 4095 counts. The default is set to 2048 counts, the midpoint of the full dynamic range.

In Manual Mode, a three-piece linear transformation is used to convert a 12-bit input image to an 8-bit output image. These transfer functions are defined by three lines with $y = mx + b$ format.

The three-piece transfer function is defined by X0 and X1 boundaries (see Figure 32). These boundaries are determined using the following equations and controlled by adjusting the Manual Gain and Level sliders in the Camera Control Software:

X0 = Manual Level –floor((4095 – Manual Gain) / 2).

X1 = 1 + Manual Level + floor((4095 – Manual Gain + 1) / 2).

This effectively sets the Manual Level to the center point of the central-piece of the 3-piece transfer function. This Manual Level value can be any value from 0-4095 (212, 12-bits of values). The Manual Gain value then determines the span or how far the central-piece of the 3-piece transfer function spreads apart. At the same time, it also determines the "slope" of the central-piece; hence it is also referred to as the Gain of the image.

NOTE

Care should be taken when using Manual Mode AGC so that the output video is not saturated solid black or solid white. This often occurs when the majority of the scene histogram falls outside the span defined by X0 and X1, see Figure 32: Manual Gain and Level. If this occurs, adjust the Manual Gain and Level to re-center the histogram.

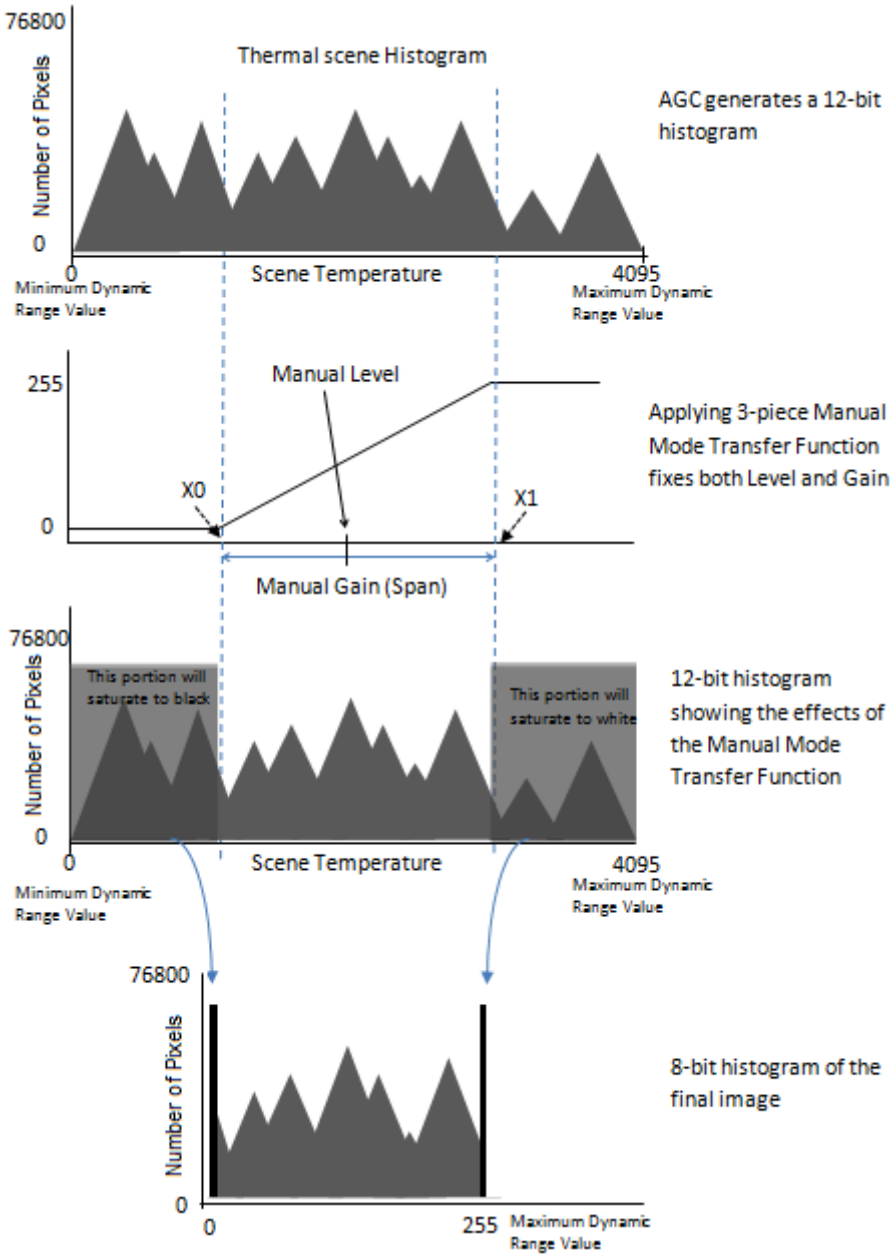


Figure 32: Manual Gain and Level

5.5.4 Freeze AGC

As the name implies, *Freeze AGC* locks or freezes the current gain and level settings for a particular scene preventing AGC from making adjustments; however, logarithmic equalization continues to be applied to the scene information. This is useful when one wants to establish a background scene, possibly discriminating certain objects in the scene and does not want the displayed image characteristics of the object or background to change when there is a dramatic change in the thermal signature of objects entering or exiting the scene. In such a case, if AGC mode were enabled, the camera would automatically adjust the scene gain and level to accommodate the new object and potentially affect the displayed image characteristics and /or wash-out other objects of interest.

5.5.5 Image Contrast Enhancement - ICE

Unlike *Automatic AGC* mode (which makes global image adjustments via the Gain and Level controls), *Image Contrast Enhancement* independently adjusts the gain and level settings for different "localized" areas of the image based on spacial frequency and an object's individual brightness and contrast; it functions in real-time. Figure 33 and Figure 34 illustrate the differences in the thermal image with and without *Image Contrast Enhancement*.

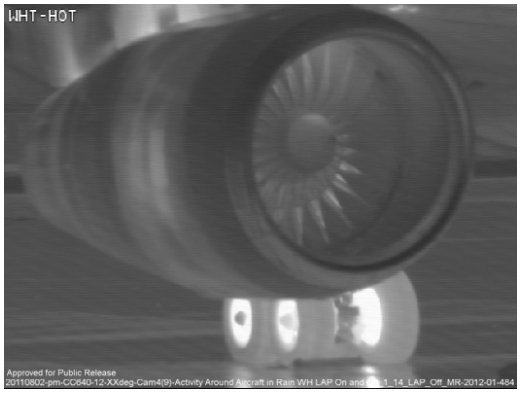


Figure 33. Automatic AGC Mode w/o Image Contrast Enhancement

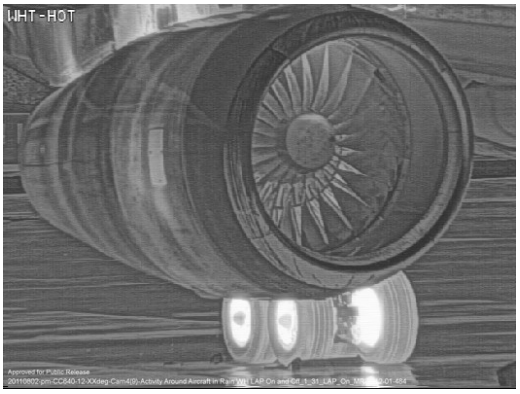


Figure 34. Image w/ High Contrast Enhancement

ICE can be tuned for lower contrast or higher contrast scenes by adjusting the ICE strength slider. Lower contrast scenes typically include indoor or bland outdoor environments where the scene temperature variance is minimal. Higher contrast scenes typically include outdoor environments or thermal scenes with significant thermal variations. The degree of contrast enchancement may be adjusted by moving the slider between 0 and 7.

5.6 PAN AND ZOOM

Figure 35 illustrates the *Pan and Zoom* tab. This feature enables the user to define a region of interest (ROI) using a combination of the *Zoom* and *Pan* functions. Once a region has been defined, the user may reposition the ROI using the up, down, left, and right arrow keys or selecting the ROI box and moving it with a mouse/pointer device. The user also has the option to perform an electronic zoom between 1x and 4x. See Figure 35.

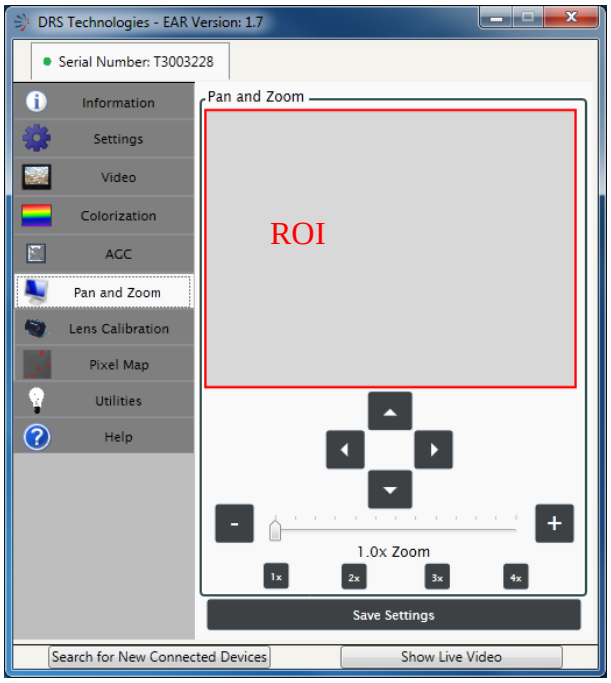


Figure 35. Pan and Zoom Tab

Table 6 provides an overview of the features and functions that are available on the *Pan and Zoom* tab.

Table 6 – Pan and Zoom Overview

Item	Description	Function
Pan and Zoom	Pan and Zoom Area	To change the region of interest, hold down the right mouse button and draw a new region of interest on the gray area. To move the current region of interest, hold down the left mouse button and drag.
	Arrows	The up, down, right, and left arrows can be used to move the region of interest
	E-Zoom	The e-zoom value can be set using the plus and minus buttons or by moving the slider to the desired value.
	Presets	The 1x, 2x, 3x, and 4x buttons will move the e-zoom to the corresponding zoom positions.

5.7 LENS CALIBRATION

All Tamarisk® camera cores are calibrated as stand alone units prior to leaving the factory to ensure product specifications are met. This includes all lensed and no-lens versions commonly referred to as thermal imaging modules or TIMs. TIMs start as fully assembled cameras and are calibrated with a specified lens. After calibration, the lens is removed and the unit is ready for shipment.

However, as cores are often just one component of an integrated systems, the factory calibration may not always prove to be the most optimal. Therefore the Lens Calibration Utility has been designed to enable integrators to compensate for nonuniform conditions that may have been introduced when embedding the Tamarisk® camera core into a system or when installing a new lens or any other process that may have altered the isothermal nature of the camera core.

Please refer to section 3.1 (Lens Calibration Requirements) for a list of recommended equipment and software version requirements.

5.7.1 Lens Calibration – Theory of Operation

During the calibration process, the camera stares at two uniform scenes of different temperature; the response of each pixel is automatically captured, tabulated and saved to one of 5 user selected memory locations known as Tables. Using this pixel data, individual gain and offset values for each pixel are calculated resulting in a matrix or table of correction coefficients for the entire pixel array. When applied, these correction coefficients compensate for the non-uniformities of the system and pixel behavior characterized for the given set of conditions under which the calibration was performed. When performed with an optical assembly between the focal plane array and the uniform scenes, these coefficients will “calibrate out” the non-uniformity of the the optical design.

Additionally, the Lens Calibration utility permits the upload/download of calibration tables; this is very useful when configuring multiple cameras with the same configuration as the data may be stored on an external PC and uploaded to each camera during its build/configuration cycle.

Other useful applications include: In the case of an optical zoom lens, the user may want to calibrate the zoom lens at different zoom settings and store the data for future use. Or, the user may calibrate the camera under different environmental conditions (hot, cold, mild temperatures) and save this data to one of the 5 tables and then call on the table as needed.

5.7.2 Lens Calibration - Getting Started

In this section a step-by-step procedure for accessing the Lens Calibration Utility.

1. To install the latest version of the Camera Control Software including the Lens Calibration utility please follow instructions outlined in section 3.2.
2. Clicking the Lens Calibration tab for the first time, the user is prompted to enter a pass key. To obtain a pass key, please contract your DRS representative. Figure 36 illustrates the pass key screen. The hash number is used to generate a unique pass key. The computer and pass key are tied together. The pass key is a 25 character alpha numeric string which is typed or pasted into the text box.

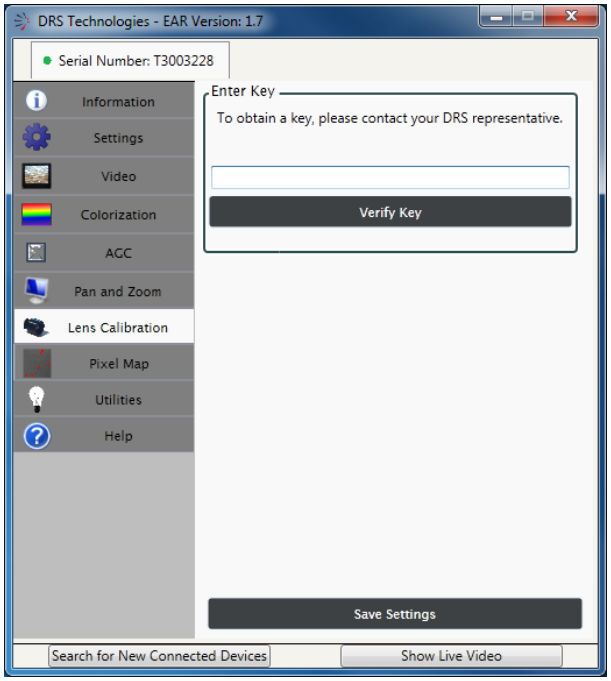


Figure 36. Pass Key

3. After entering a valid pass key, select Verify Key. Once the pass key is verified, the Lens Calibration tab (shown in Figure 38) is displayed. If the pass key is invalid, a pop up message provides a warning and the user is returned to the Verify Key screen.

5.7.3 Lens Calibration - Setup

This section provides a step-by-step proceduree and recommended conditions for performing lens calibration.

4. Set-up. Figure 37 illustrates the hardware setup to perform a custom calibration. Connect the serial data cable (USB or RS232) and power the camera. Please allow the camera to sit for 30 minutes to stabilize its temperature before beginning the calibration process.
5. Place the camera at the appropriate distance from the black body/thermal scene such that the entire field of view is flooded with the uniform thermal scene, but not so close as to affect the thermal equilibrium of the camera. The recommended calibration temperature set points are:
    - Cold set point -10°C below camera ambient temperature
    - Hot set point +10°C above camera ambient temperature

    The exact temperature is not critical. For best results a black body should be used but any thermally uniform scene is acceptable.

NOTE

For best results, please allow the camera to reach steady state operating temperature before starting the custome calibration process - it is recommended that the camera sit in a powered-on stated for at least 30 mins prior to starting.

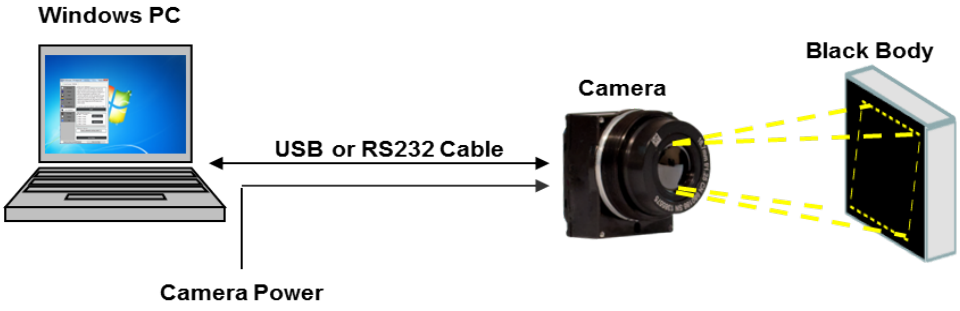


Figure 37. Lens Calibration Setup

5.7.4 Lens Calibration: Start

6. In Figure 38, the user is prompted to start the custom lens calibration process, See START button at the bottom of the Custom Lens Calibration task pane. One of the 5 custom tables may be selected. In this example, Table 1 is occupied with existing data (note, this is not the factory calibration settings. Factory calibration data is stored elsewhere and will always be available to return the camera to its original factory calibration settings). The user may select or the Return to Factory Calibration Settings from the pull-down menu located in the Calibration Selection task pane.

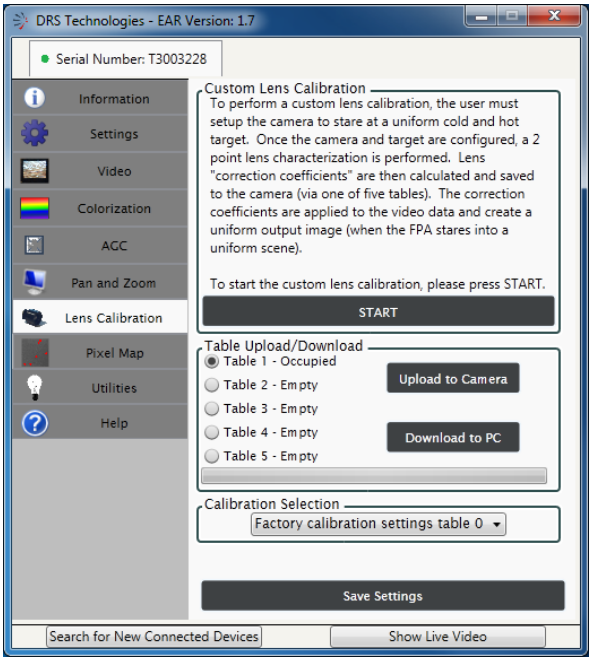


Figure 38. Lens Calibration Tab

5.7.5 Lens Calibration - Selecting a Table to Store your Data

7. Next, select the location to store your calibration. During the calibration process, lens "correction coefficients" are calculated and saved to the camera, via one of the 5 tables.

   Tables that have been previously populated are labeled "Occupied;" tables that have not been used are labeled "Empty." The user can save the correction coefficients to any of the five tables. Selecting an occupied table will overwrite the table with new correction coefficients.

   Factory calibration coefficients are permanently stored in the camera. To restore factory default settings go to the *Calibration Selection* task pane found on the *Lens Calibration* tab, see Figure 39, and select *Return to Factory Calibration Settings* found in the *Calibration Selection* pull-down menu.

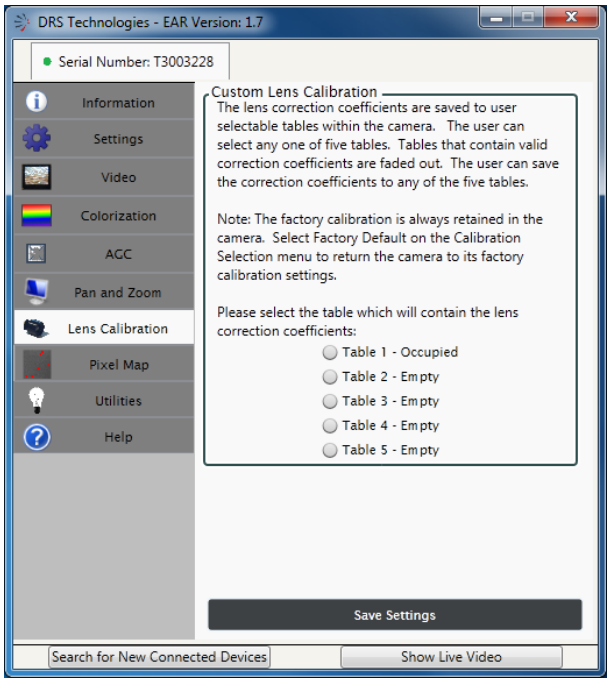


Figure 39: Table Selection

8. Once the table is selected, the first step in the 2-point lens characterization is to capture the uniform cold target data. The recommended temperature of the cold target is approximately 10C below the ambient temperature (or 12C if the ambient temperature is 22C). The exact temperature is not critical; the temperature delta between the cold and hot target should be approximately 20C. Click *Cold Target Ready* button, as shown in Figure 40.

NOTE

Once the cold target data is captured, the user has 180 seconds to begin capturing the hot target data. If the 180 second timer expires the lens calibration process must be started over again.

Figure 40: Cold Target

The Camera Control Software application will send setup information to the camera and command it to start collecting cold target data. Several frames are integrated together to reduce noise and provide an average pixel response for each pixel in the FPA. The cold data collection takes a few seconds; once complete, the user is prompted to capture the hot data.

9. The next step is to capture data from a uniform "hot" thermal scene. The recommended temperature for the hot target is approximately +10C above ambient temperature. The exact temperature is not critical; the temperature difference between the cold and hot target should be approximately 20C.

   When the screen changes to Continue – Hot Target is Ready, flood the camera field of view with the "hot" scene. Once the FOV is flooded, click Continue – Hot Target is Ready button as shown in Figure 41.

Figure 41: Hot Target

The application will send setup information to the camera and command it to start collecting hot target data. Several frames are integrated together to reduce noise and provide an average pixel response for each pixel in the focal plane array for the second point of the two-point calibration. The hot data collection takes a few seconds. Following the hot target data collection, the application will calculate the gain correction factors for each pixel as shown in Figure 42.

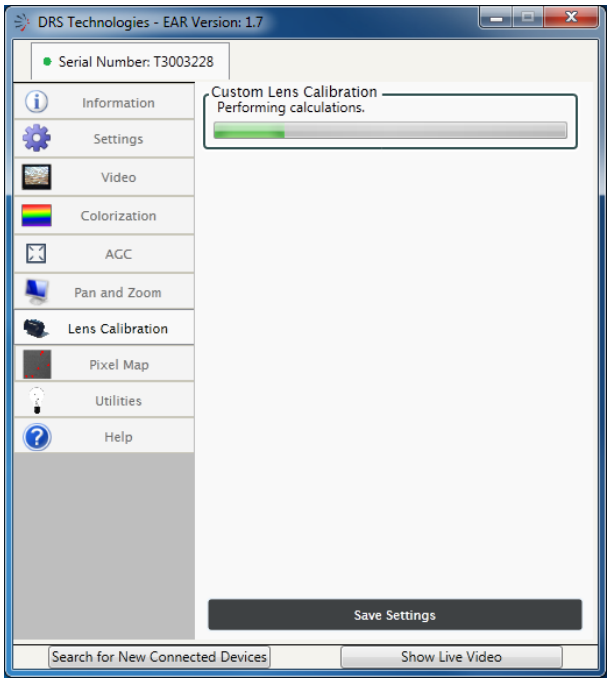


Figure 42: Performing Calculations

10. Once the calculations are complete, the lens calibration settings are immediately applied to the camera video output. The user is prompted to use or discard the settings by answering "Yes" or "No," see Figure 43. If the user selects yes, the lens settings are saved in non-volatile memory; power cycling the camera is not required.

Figure 43: Save Settings

The Lens Calibration procedure is now complete and the application returns to the Lens Calibration tab, see Figure 44. Notice, Table 2 is now occupied and in use as indicated by the pull-down menu in the Calibration Selection task pane.

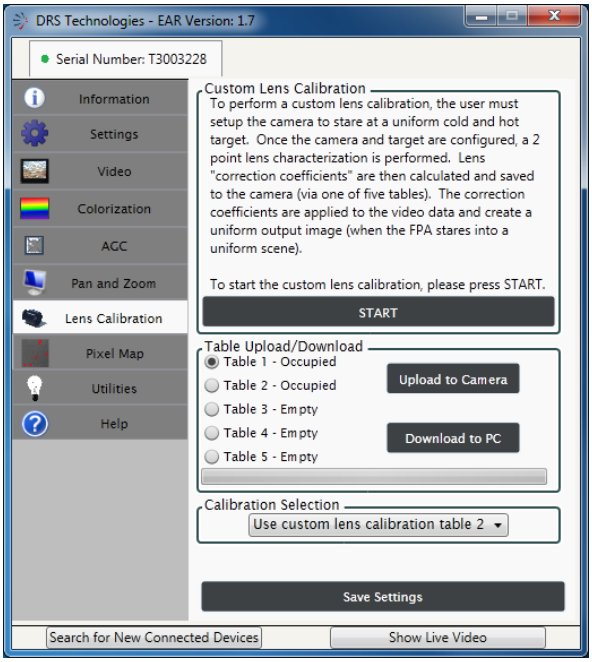


Figure 44: Lens Calibration

5.7.6 Lens Calibration - Table Upload/Download Procedure

Using the upload/download feature the user may easily move calibration data to and from the camera. This feature is useful if building multiple cameras with the same configuration. Lens calibration performed on one camera may be stored to an external PC and uploaded to multiple cameras.

1. To download, select an occupied table followed by Download to PC.

   The user is prompted to save the file to the PC, see Figure 45. In the example shown, Table 2 was selected. The downloaded file is named Table_2. The saved file will have an extension of .nuc. The .nuc table contains both the gain and offset data, file size will vary depending on the Tamarisk® array format.

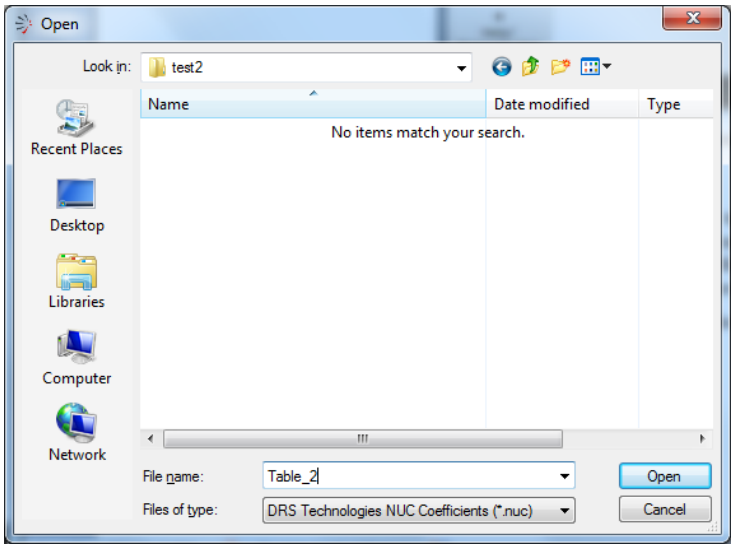


Figure 45: Download to PC

2. To upload table data to the camera, select any one of the 5 tables to receive the data. If data is written to an occupied table, the uploaded data will overwrite the current data. In this example, Table 3 is selected. Upon selecting Upload to Camera, the user is prompted to select a file. See Figure 45.

   Once the upload is complete the data is saved to the selected table, Table 3, in this case, now indicates it is occupied. See Figure 46.

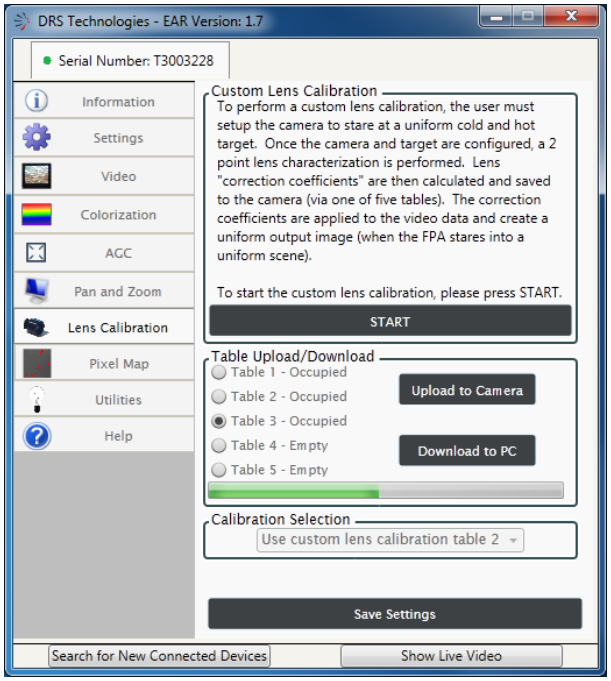


Figure 46: Table 3 Occupied

5.7.7 Lens Calibration - Calibration Selection

Calibration Selection (shown in Figure 47) allows the user to select one of the occupied tables for use or to *Restore Factory Calibration Settings*. To enable a specific calibration table, simply highlight one of the options in the pull-down menu found in the *Calibration Selection* task pane. Upon selection, the table is immediately applied to the camera and saved to non-volatile memory and will remain persistent through power cycles until it is changed.

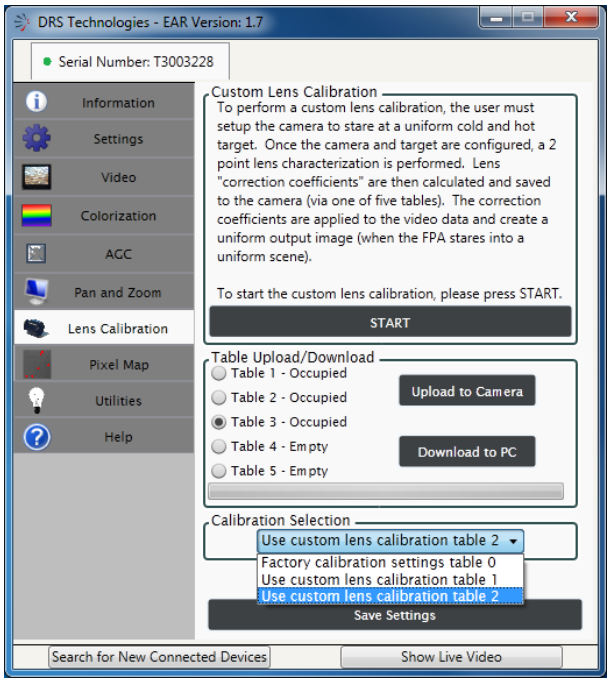


Figure 47: Calibration Selection

5.8 PIXEL MAP

The Custom Pixel Map allows the user to mark and substitute pixels, rows, and columns. A keyboard with a number pad is required to mark the pixels. Figure 48 illustrates the Custom Pixel Map Tab. The hot keys are defined at the top. The hot keys allow the user to quickly maneuver around the screen and mark and unmark pixels. The user also can mark/unmark pixel, column, and row by using the defined buttons. The user can upload and download the Custom Pixel Map; this is useful if the user wants to us an offline program or algorithm to mark pixels and then upload the Custom map back to the PC.

To manually mark pixels, columns, and rows, the Custom Pixel Map must be selected as the active windows application.

The Pixel Map Utility allows the user to mark/unmark pixels, rows, and columns and to upload/ download custom pixel maps via several user controls. The Pixel Map utility window is divided into three task panes as shown in Figure 48. In this section, a reference table is first presented followed by an explanation of each of the three task panes found in Pixel Map tab.

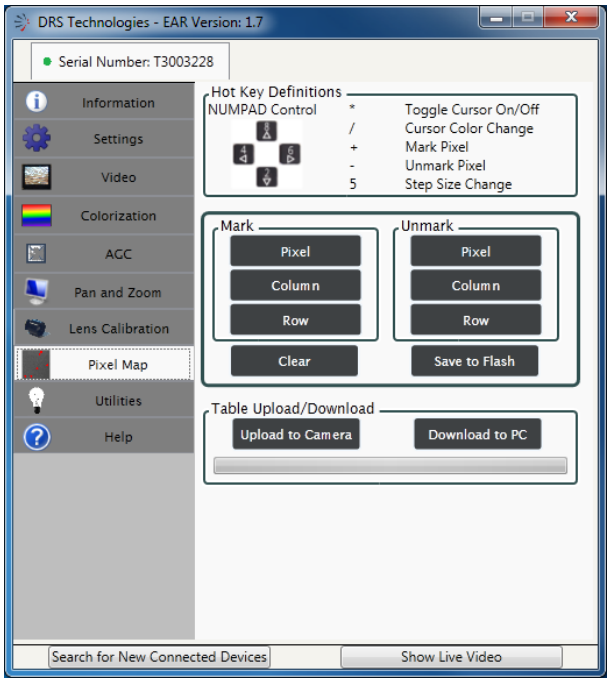


Figure 48: Pixel Map

Table 7: Pixel Map Utility Features provides an outline of the features/functions of the Pixel Map Utility. A keypad is required to enter hotkeys. Even if a keyboard does not have a number keypad, the keypad functionality is typically provided as part of a function “Fn” key.

Table 7: Pixel Map Utility Features

Item	Description	Function
Toggle Cursor On/Off	* hotkey	Toggles the cursor on and off. The cursor shows the current location and which pixel, row, or column will be replaced.

Cursor Color Change	/ hotkey	Toggles the color of the cursor between white and black. This helps the user see the cursor when looking at a hot or cold scene.
Mark Pixel	+ hotkey	Marks the current pixel for substitution
Unmark Pixel	- hotkey	Unmark the current pixel for substitution
Step Size Change	5 hotkey	Toggles the step size between 1 and 5 pixels for each arrow key that is pressed. This helps move the cursor to a position quickly. The user can moves in steps of 5 and when in the correct region, switch to moving the cursor in steps of 1.
Mark	Pixel, Column or Row	Allows the user to mark the pixel, column or row associated with the cursor
Unmark	Pixel, Column, or Row	Allows the user to unmark a pixel, column, or row associated with the cursor
Clear	Clear the custom pixel map	Allows the user to clear the custom pixel map. Once the user selects clear, all marked pixels, rows, or columns are cleared. The original factor pixel map is still retained and unchanged. Clearing is immediately applied to the camera but not saved between power cycles
Save to Flash	Save custom pixel map to non-volatile memory	Allows the user to save a custom pixel map to non-volatile memory. To use the original factory pixel map, the user must perform a *Clear* and *Save* to Flash.
Upload to Camera	Upload a pixel map from a PC to the camera	Allows the user to upload a custom pixel map from the PC to the camera. This is useful if generating a custom pixel map off line.
Download to PC	Download a custom pixel map from the camera to the PC	Allows the user to download the custom pixel map from the camera to the PC.

5.8.1 Pixel Map – Hot Key Definitions

Figure 48 illustrates the *Pixel Map* tab. Hot keys are detailed in the Hot Key Definitions task pane at the top portion of the window. Hot keys allow the user to quickly maneuver around the screen to mark/unmark pixels. A keyboard with a number pad is required to mark pixels.

5.8.2 Pixel Map – Mark Unmark

Pixels, columns and rows may be marked/unmarked using the defined buttons located in the *Mark* and *Unmark* task panes. Selecting *Mark* and *Unmark* saves the results to temporary flash memory. To keep the markings press *Save*.

NOTE

The factory pixel map is permanently retained/used in/by the camera. The customer pixel map is an additional map which is overlaid on the factory pixel

map. To return back to the default factory pixel map, press the *Clear* and *Save to Flash*.

5.8.3 Pixel Map – Table Upload/Download

The Camera Control Software allows the user to upload or download a custom pixel map. This feature is useful if a pixel substitution algorithm is run off line. The user can capture a digital image via the Camera Link interface, calculate the custom pixel map, and upload the custom pixel map to the camera. To upload or download, select the *Upload to Camera* or *Download to PC* button and follow the windows prompts.

If downloading a custom pixel map, the user is prompted to save the file to PC. The saved file has an extension of .cpm. The .cpm table contains only the pixel substitution data. File size will vary depending on the detector array format but is typically between 20-100Kbytes.

$$\frac{320\ \text{bits}}{\text{row}} * \frac{240\ \text{rows}}{\text{frame}} * \frac{\text{characters}}{4\text{bits}} = \frac{19200\ \text{characters}}{\text{frame}}$$

Hence each row contains exactly 80 characters and each character represents 4 pixels; for a total of 320 pixels per row.

5.9 UTILITIES

The *Utilities* tab provides several functions as indicated by the task panes seen in Figure 49, namely, *Firmware Upgrade*, *Camera Communication.* and *Customer Camera Info* The option to *Restore Factory Settings* is also made available through the *Utilities* tab.

Figure 49: Utilities

5.9.1 Firmware

Updating/upgrading the camera's firmware: simply click on *Select File* in the *Firmware Upgrade* task pane. Choose the appropriate version of DRS supplied Firmware. The firmware file name should look similar to the following:

Tamarisk [column size] CPU - X1.P1.01.13.13 FPGA - 01.00.0080.zip

Where column size is either 320 or 640 depending on your detector array

CAUTION

Only unaltered files provided by DRS are approved for upload. Use of any file to the contrary may render the camera inoperable and void the camera warranty. The user should not attempt to modify the file name or the contents of DRS provided firmware, so doing may invalidate/corrupt the file. During the firmware upgrade, the user should not power cycle the camera.

Once the firmware upgrade is complete, the user must power cycle the camera for the upload to take effect. During the firmware upgrade, the user should not power cycle the camera. After the firmware is uploaded and the camera has been power cycled, select "Search for New Connected Devices" in the lower left hand corner of the Camera Control Software window and verify that the firmware was correctly upgraded. On the Information tab, the CPU code version is displayed as "Rel:" and the FPGA code version is displayed as "RTL Rel:"

While the upgrade is underway, a green progress bar is displayed (as shown in Figure 50). Once completed, the user will see a pop-up message indicating that the upgrade is complete. If the upgrade fails for any reason, an error message is displayed at the top of the Camera Control Software screen.

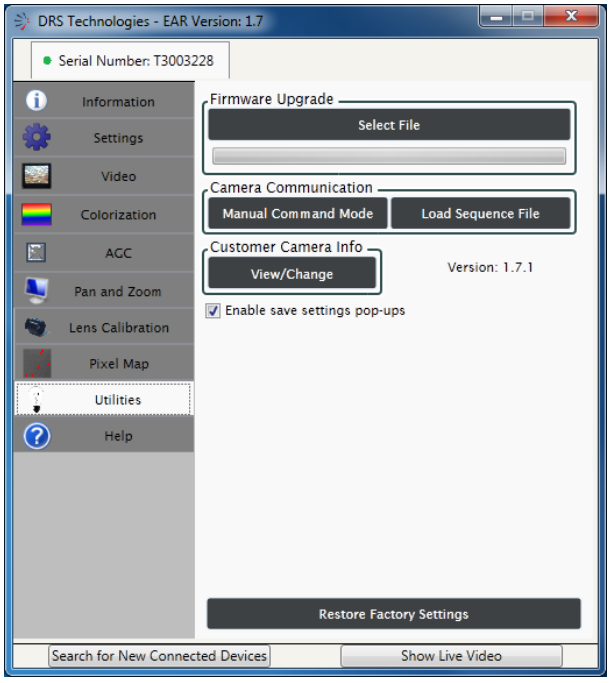


Figure 50: Firmware Upgrade

5.9.2 Camera Communications

Under the Camera Communications section, a Manual Command Mode is provided. Clicking Manual Command Mode will open a command line window for direct communication with the camera (as shown in Figure 51).

CAUTION

Manual Command Mode requires advanced knowledge of the camera's registers; improperly writing commands to the camera may result in camera malfunction. The user is encouraged to review the camera's Interface Control Document before using Manual Command Mode.

The *Manual Command Mode* requires advanced knowledge and should be used only after reviewing the camera's Interface Control Document.

Selecting *Load Sequence File* will open up your PCs file manager. The user may select a file/script/sequence to be loaded. A sequence file is a sequence of manual commands where each line of the command file contains only one command. Please refer to Tamarisk®$_{640}$ Software Interface Control Document for more information.

<Command><Parameter upper byte><Parameter lower byte><Additional Parameters>

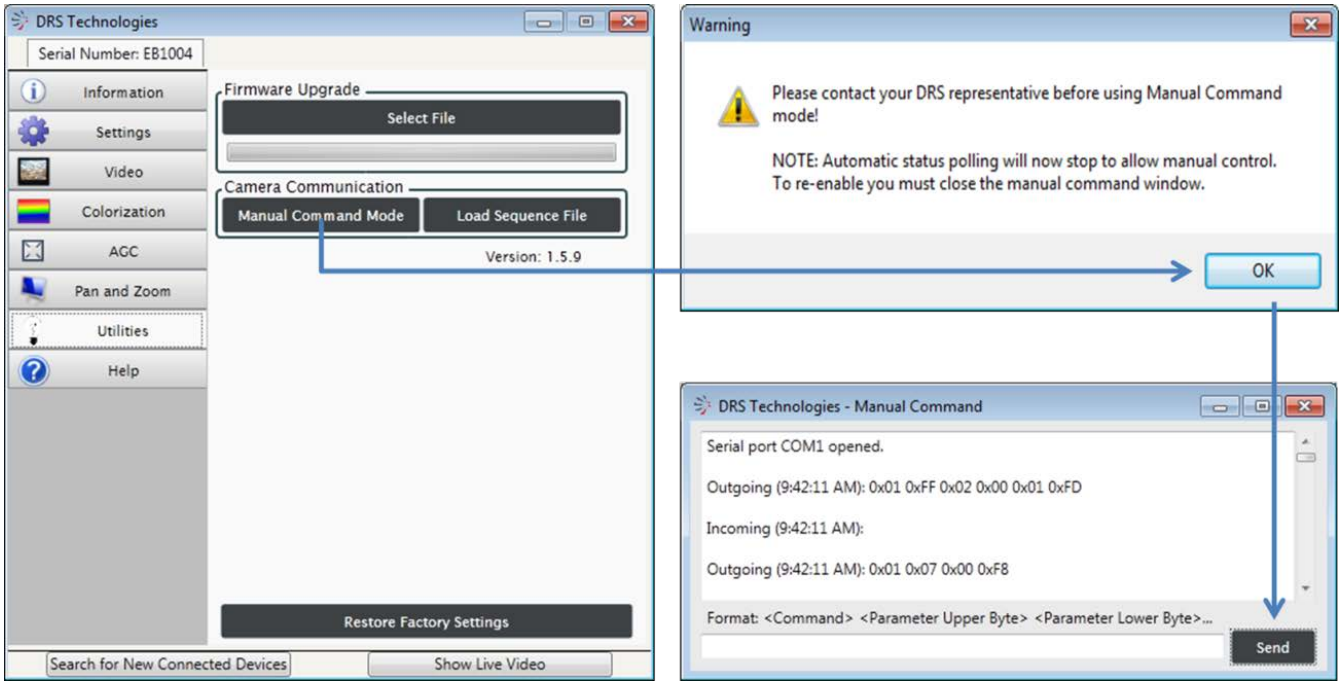


Figure 51. Camera Communications

5.9.3 Camera Info

The Camera Info button allows the user to save (and read back) up to 252 ASCII characters. The characters are stored in non-volatile memory and hence they are retained across power cycles.

The Camera Info feature allows users to add their own unique camera identification or serial number. Figure 52 illustrates the Camera Info screen. To change the characters, simply edit the text and select update to save the characters to non-volatile memory. In this example Custom Camera Info Field is saved in non-volatile memory.

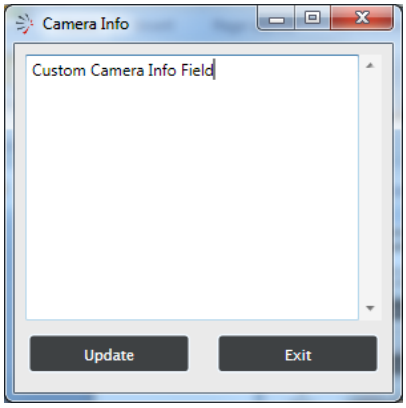


Figure 52: Camera Info

5.9.4 Reset to Factory Defaults

Restore Factory Settings returns all camera settings back to their factory defaults. This feature is sometimes useful if the user would like to return the camera to a known state. To restore reset to factory defaults, select *Restore Factory Settings* at the bottom of the *Utilities* window.

NOTE

Restoring factory settings will return all camera settings, including non-volatile parameters and custom lens calibration settings, if applicable, to their factory default values. Any marked pixels, rows, columns saved to the camera (i.e. overlaid on top of the factory pixel map) will remain, i.e. will not be affected by the *Restore to Factory Settings* command.

5.9.5 Help

To view the help file, select the *Help* tab. This will open up a pdf version of the Camera Control Software User Manual in a separate window. See Figure 53 below:

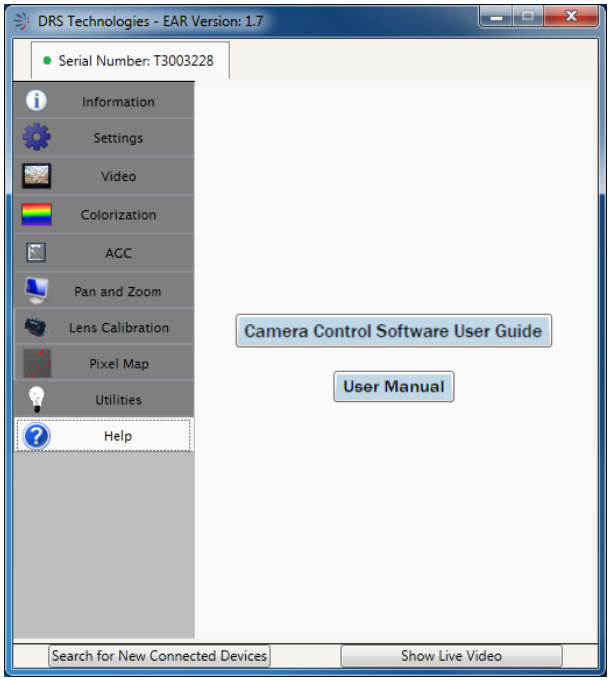


Figure 53: Help Tab

5.9.6 Show Live Video

If a frame capture device which supports Microsoft's DirectShow AP is plugged into the PC (prior to launching the Camera Control Software Icon and starting the application), the user may select *Show Live Video* located in the bottom right corner of the Camera Control Software window to display live video.

5.9.7 Search for New Connected Devices

At any time, the user may select the Search for New Connected Devices button located in the bottom left corner of the Camera Control Software window. This will close the current window, search for connected devices, and display the information tab for the first device and a separate Serial Number tab across the top of the Camera Control Software window for all devices found.

6 UNINSTALLING THE SOFTWARE

There are multiple methods for uninstalling the DSR Camera Control Software.

1. Running the Install Shield Wizard and selecting “Remove”
2. Running the uninstall utility
3. Using Microsoft’s uninstall utility through the Program and Features control panel.

In this section all three approaches are reviewed.

6.1 REMOVING THE SOFTWARE USING THE INSTALL UTILITY

The DRS Camera Control Software may be removed by launching the DRS Camera Control Software InstallShield Wizard; Refer to Figure 54. Since the DRS Camera Control Software is already installed, the user has the option to “Modify”, “Repair”, or “Remove”. Select the Remove button, select Next and follow the final on-screen menu to completely remove the program. When finished, a notification is displayed to confirm the uninstall operation has been completed.

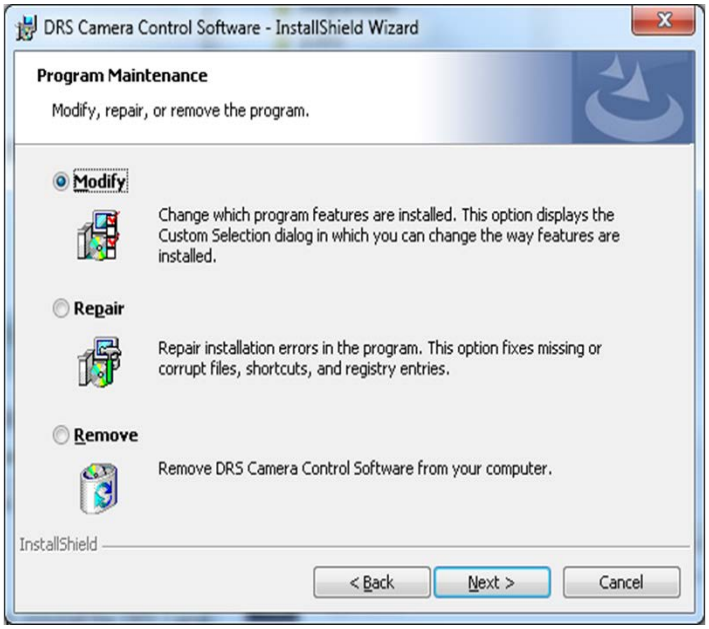


Figure 54. InstallShield Wizard (Uninstall)

6.2 UNINSTALLING THE SOFTWARE USING THE UNINSTALL PROMPT

During the installation process, the InstallShield Wizard creates a DRS Technologies folder within the Start Programs menu. To uninstall the DRS Camera Control Software, perform the following:

1. From the Start menu, select All Programs
2. Open the DRS Technologies folder
3. Select Uninstall DSR Camera Control Software icon

Once the icon is selected, the window shown Figure 55 will appear. Click “Yes” to continue the uninstall procedure. When finished, a notification is displayed to confirm the uninstall operation has been completed.

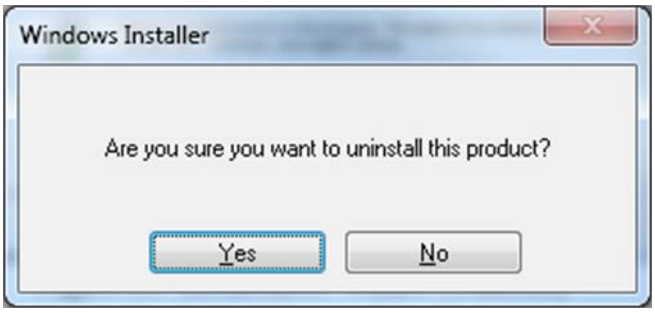


Figure 55. DRS Camera Control Software Uninstall

6.3 UNINSTALLING THE SOFTWARE VIA CONTROL PANEL

Microsoft Windows has a built in uninstall mechanism. To uninstall the DRS Camera Control Software, perform the following:

1. From the Start menu, select Control Panel
2. In Large or Small icon view, click Programs and Features. If you're using Category view, under "Programs", click Uninstall a program
3. Select the DRS Camera Control Software and click Uninstall. Alternatively, right-click the program and select Uninstall

Once the icon is selected, the window shown in Figure 56 will appear. Click on Yes to continue the uninstall procedure. When complete a notification window will tell you that the uninstall was completed

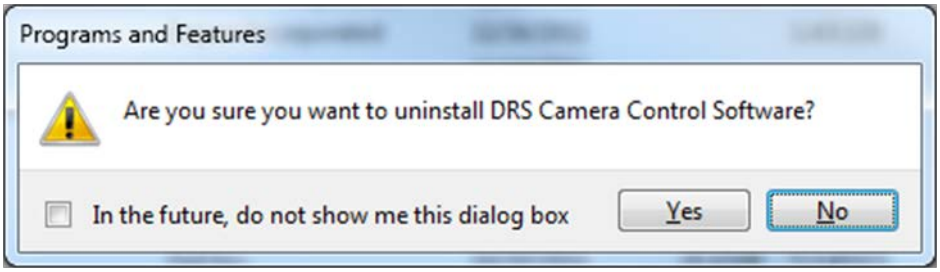


Figure 56. Control Panel Uninstall

7 TROUBLESHOOTING

In this section troubleshooting guides are presented to aid the user in diagnosing potential problems.

7.1 NO ATTACHED DEVICES FOUND

If the DRS Camera Control Software does not detect a camera, the "*No attached devices found!*" window appears - see Figure 57. Symptoms and solutions for remedying this issue are outlined below.

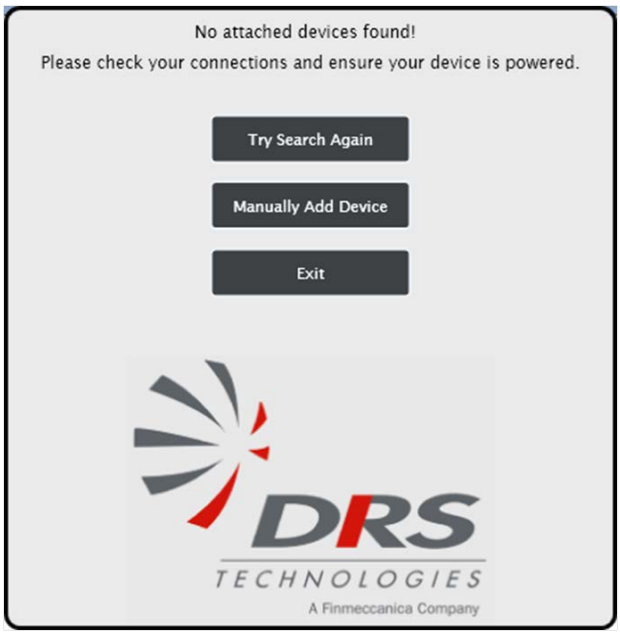


Figure 57. No Attached Devices Found

- ***Symptom: An audible shutter click is not heard when the camera is powered:***

  - ☐ Verify that the camera interface cable is inserted correctly into to both the 30-pin electrical interface on the back of the camera as well as the 30-pin connector on the break out box. The connectors are keyed such that they can only be inserted one way

  - ☐ If your set-up uses USB for camera communication and power, verify that the mini-USB to USB cable is properly connected to their respective ports on the break out box and on the PC

  - ☐ If your set-up uses RS232 for camera communication then an auxiliary power supply is required. Be sure the external DC power supply is connected to the camera's break out box and that the supply is turned on. Verify that the serial RS232 cable is properly connected between the camera's break out box and the PC

  - ☐ Verify that the communication cable (ie.USB) is not damaged.

- ☐ If using a DC power supply to power the camera, verify that the power supply is on and supplying the correct voltage and is capable of sourcing enough current.

- ***Symptom: A continual audible shutter click is heard when the camera is powered. This commonly occurs when the supply current drops below the minimum operating requirement. Refer to the Tamarisk® Electrical ICD for specifications. Check for the following:***

  - ☐ Voltage drop or marginal supply current:

    - Verify supply voltage and current capabilities of the power source. If batteries are being used it may be necessary to exchange them for new ones

    - Excessively long USB cables may cause a voltage drop in the cable which results in a temporary power cycle of the PC's USB port; this behavior is typically seen as the camera's shutter closes.

    - If connecting the camera to a hub, it is recommended to limit the number of USB devices connected to the hub. The user may also want to power the hub from an external power supply.

    - If connecting the camera directly to the PC, it is recommended to limit the number of USB devices connected to the PC. Too many USB devices may overload the PC's USB ports.

- ***Symptom: A single audible shutter click is heard when the camera is powered via the USB cable but the Camera Control Software does not detect the camera. Check the following:***

  - ☐ Open Windows Device Manager and verify that the camera hardware is detected and installed properly. A yellow exclamation mark indicates a problem Figure 58 shows the camera is not installed properly.

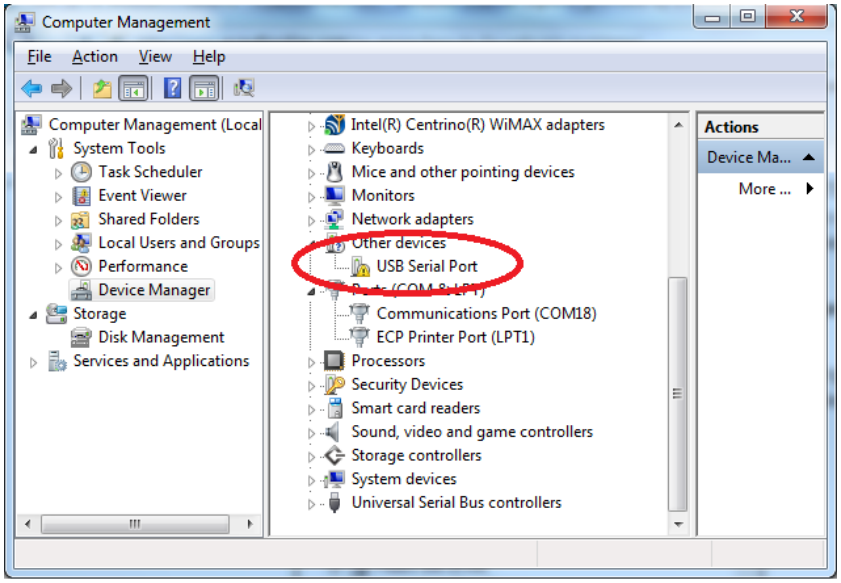


Figure 58 Windows Device Manager

- ☐ Verify that the yellow exclamation mark belongs to the camera and not some other device. While looking at the Windows Device Manager, unplug the camera's USB cable. If (after the screen updates) the yellow exclamation mark disappears from the list, the camera hardware is not detected or installed properly. Confirm hardware configuration, refer to Table 1. Hardware Configuration Set-up Overview.

- ***Symptom: Windows Device Manager shows the camera is not detected or installed properly. Check the following:***

  - ☐ Verify/update installed drivers. From the Windows Device Manager, Right-click the device with the yellow exclamation mark. In the popup menu select Update Driver Software. Then follow the instructions on screen. If you know where the drivers are located you may select the "Browse my computer for driver software" option. The other option is allow Windows to search the web for updated drivers. If allowing Windows to search make sure the PC is connected to the web.

  - ☐ If you are using a USB-to-serial port adapter, follow the manufactures procedure to verify the serial port is properly configured.

- ***Symptom: After the Windows Device Manager searches for drivers, the drivers cannot be found or would not install properly. Check the following:***

  - ☐ Sometimes a conflict will occur during the installation process and the drivers will not load properly. Run the Camera Control Software installer again, the software will automatically attempt to install/re-install the drivers.

  - ☐ Follow the on screen menu. When the InstallShield Wizard displays the "*Modify, repair, or remove the program*" menu, select *Modify*. The *Custom Setup* screen in Figure 59 will appear. It indicates the USB drivers were not installed during the initial installation process. Select the USB Drivers pull down and ensure this feature will be installed to the local hard drive option is selected. Select Next to continue the installation

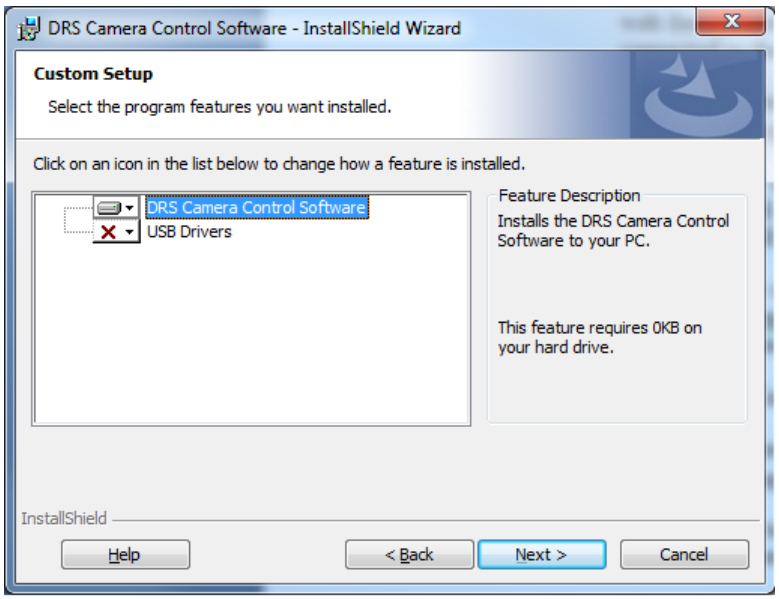


Figure 59 InstallShield's Custom Setup

The installer will load the drivers and the hardware will be detected and installed correctly.

- ***Symptom: The installer was re-run and the drivers were installed on the local hard drive but the camera is not detected and a yellow exclamation mark appears in the Windows Device Manager window. Check the following:***

  - ☐ Sometimes a conflict will occur during the installation process and the hardware is not properly detected. If connecting via USB, try disconnecting and reconnecting the USB cable. If connecting via a serial interface, try power cycling the camera. If this does not work, restart your computer.

- ***Symptom: The camera is powered and the Windows Device Manager shows that the hardware is detected and installed properly but the Camera Control Software does not detect the camera. Check the following:***

  - ☐ Close all Camera Control Software windows. Re-launch the software by double-clicking the DRS Camera Control Software icon. If the camera is still not discovered, proceed to net step.

  - ☐ Ensure that only one instance of the Camera Control Software is running. Windows will allow multiple instances of the Camera Control Software but the first instance is tied to the first serial port/camera detected.

  - ☐ If using a serial RS232 cable:

    - Make sure the serial port is properly connected to the camera and make sure that the pin out is correct; refer to the Electrical Interface Control Document for pin out details.

    - If using a serial RS232 cable, ensure that other applications running on the PC are not using the serial port. Shut down any other applications that may be using the serial port.

  - ☐ If connecting via USB cable, when the Camera Control Software displays the menu shown in Figure 57, select “Try Search Again”. Sometimes the camera itself is not fully initialized when the Camera Control Software is first run.

- ***Symptom: The camera is powered and the Windows Device Manager shows that the hardware is detected and installed properly but the Camera Control Software does not start or immediately closes. Check the Following:***

  - ☐ The Camera Control Software is built upon Microsoft’s .net framework. In order for the Camera Control Software to operate correctly, the .net framework (version 4.0) must be installed on the PC. To check if the .net framework is installed, perform the following steps

    - Open Windows Explorer and go to the following directory:

      %windir%\Microsoft.NET\Framework\

Where "%windir%" represents "Windows" directory present in the system drive where Windows is installed in your system e.g. C:\Windows\

- Within the Framework folder, ensure that the v4.0 directory is present (as shown in Figure 60). If it's not present, re-run the Camera Control Software Installer or download the Framework from the following link:

  http://www.microsoft.com/en-us/download/details.aspx?id=17113

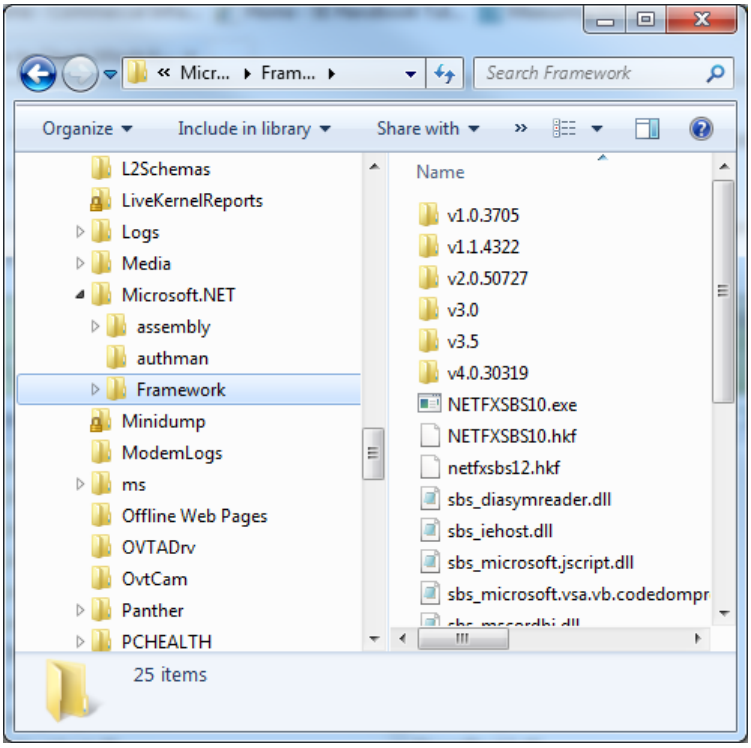


Figure 60. Microsoft.net

- ***Symptom: The camera is connected via USB-to-serial port adapter, the Windows Device Manager shows that the serial port is detected and installed properly, and the serial port pin out is correct but the Camera Control Software will not automatically connect to the camera. Check the following:***

  ☐ If Figure 57 is displayed, the user can manually connect to the camera by selecting "*Manually Add Device*". The user will then see the window show in Figure 61.

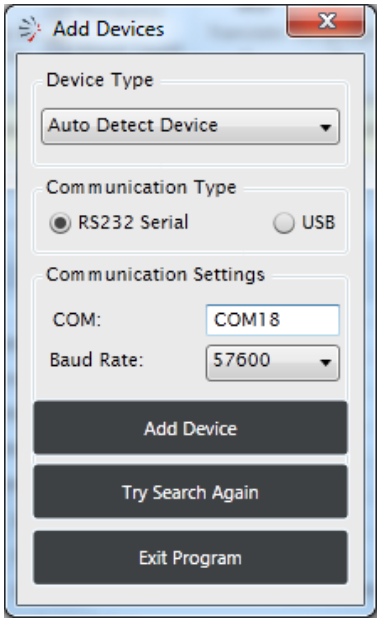


Figure 61 Add Device

The user can now manually select the Device Type, the Communication Type, and Communications Settings.

- Select the Tamarisk® device type.
- Select RS232 Serial or USB as the Communications Type
- To set the COM port the user needs to open Windows Device Manager and determine the port number. If the COM port is not listed in the Communications Settings window, the user should select "custom" and then enter the COM port. The COM port number must be in the format of COMX where X = any number from 1 – 99. For example if the Window's device manager reports that the USB-to-serial cable is COM18, the user must select "custom" and then type COM18 into the port number. The user also must select the correct baud rate for RS232 (57600 is factory default) or 921600 as the baud rate for USB.

NOTE

Adding Devices: The USB-to-serial cables are uniquely identified by the USB driver but the Camera Control Software does not always recognize these as camera interfaces; hence the user must manually connect to the camera. In addition the Camera Control Software will only allow one (1) manual connection at a time. If the user has manually connected to a second camera, the first camera connection is lost and the second camera is connected

7.2 NO VIDEO OR POOR VIDEO FROM THE CAMERA

The DRS Camera Control Software will display video data taken from a frame capture device which supports Microsoft's DirectShow AP. If no video or poor video is seen, review the following symptoms and solutions:

- ***No video data is displayed, check the following:***

  - ☐ Verify that a video cable is connected between the camera and the video display device.
  - ☐ Verify that the camera and the video display device are powered and operational
  - ☐ Use a different video source to verify that the video cable and video display device are functioning correctly
  - ☐ Verify the bits per pixel and ensure that the frame grabber or video display is configured correctly. Having the wrong pixel mapping will give strange video effects. Typically the frame grabber hardware will include software which allows the user to configure the frame grabber.
  - ☐ If using a USB port frame grabber, make sure you use a USB 2.0 (or greater) USB port
  - ☐ The frame grabber device driver must be installed. This device driver is provided by the frame grabber manufacturer. The DSR Camera Control Software uses the DirectShow interface of the manufacturer's device driver to display video.
  - ☐ Make sure that the cameras' shutter is not closed or that the lens is not block from seeing thermal energy. When the camera is first powered on, you should hear the shutter "click" indicating both power to the camera and that a 1-pt NUC has been performed. Refer to the Tamarisk® User Manual for more details
  - ☐ Make sure your video display device supports the cameras' output. For analog display devices, make sure the device can supports the RS-170 protocol and supports the camera's resolution.
  - ☐ Make sure the camera is set to the proper video output mode. The camera supports NTSC, several PAL modes and 8-bit and 14-bit digital video. Refer to section 5.2.

- ***Symptom: The frame grabber is installed and operating correctly but the video quality is very poor. Check the following:***

  - ☐ Make sure the camera is not zoomed out too far. Some cameras support a very narrow field of view and when an image is viewed close up the image will look very poor.
  - ☐ Verify the operating range of the camera as well as the scene temperature is within specified limits. The image may look poor because the camera is operating out of its designed operating or scene temperature range.

7.3 CUSTOM LENS CALIBRATION AND CUSTOM PIXEL MAP TABS ARE NON FUNCTIONAL

- ***The Custom Lens Calibration and Custom Pixel Map tabs are non-functional but the other tabs are functional***

  - ☐ The Custom Lens Calibration and Custom Pixel Map tabs are only enabled for cameras that have FPGA firmware version 01.00.0076 or higher.

7.4 CUSTOM LENS CALIBRATED CAMERA HAS POOR VIDEO

- ☐ Focus on an object far in the distance. Do not focus the camera on the uniform black body.
- ☐ Ensure that the uniform black body is truly uniform and stable before beginning the custom lens calibration
- ☐ Ensure that the custom lens calibration option is enabled by selecting the correct calibration table.
- ☐ Power cycle the camera to ensure that the calibration settings are applied
- ☐ The dynamic range may be too small or too large. Adjust the temperature of the black bodies to ensure adequate dynamic range over the scene temperature desired.
- ☐ Ensure that air conditioning or air is not blowing on the camera or the black body during the Custom Lens Calibration process. The air movement can cause thermal gradients which will show up as gain or offset errors and cause poor image uniformity. For best results the test environment should be thermally static.
- ☐ Ensure that the custom lens and lens mount are tightly coupled to the TIM. For best results the TIM, lens mount, and lens should be isothermal.
- ☐ Do not rely on the analog video output to determine the video quality. If the image is extremely uniform the AGC will cause the image to look like it has more noise. To properly evaluate the image quality, the user should look at the pre AGC, Camera Link video data. The user should plot the histogram of the output image while looking at a uniform black body. Figure 62 shows the same camera (with a custom lens) while looking at the same black body. The histogram on the left is with the custom lens calibration disabled. The histogram on the right is with the custom lens calibration enabled. Notice that the pixel distribution on the right is much tighter (which is expected and desired). But while looking at the analog output image (while looking at the same black body), the image with the custom lens calibration looks worse; this is because the AGC is trying to apply gain correction over a narrow (uniform) scene.

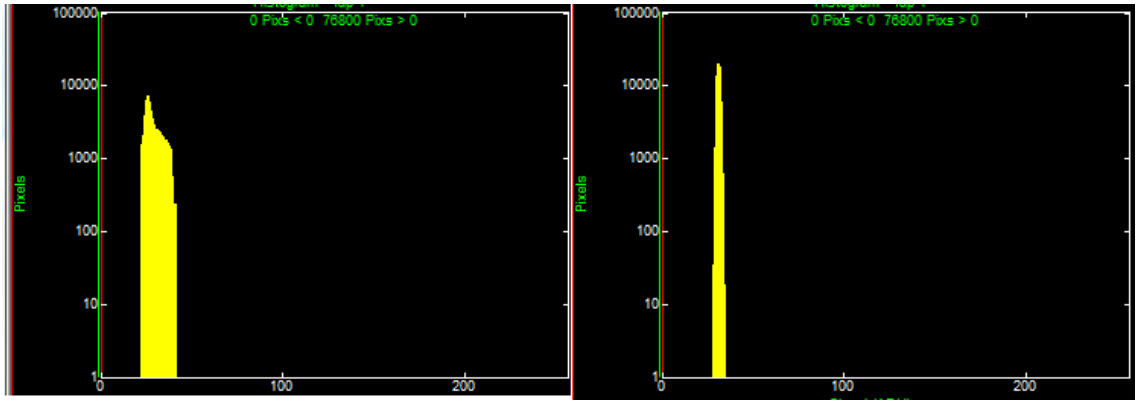


Figure 62: Pre AGC Camera Link Output

DRS RSTA, Inc.

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Table 8

Item	File Name	Web Site
1.	LibUsbDotNet USB Driver:	http://fsf.org
2.	FTDI USB Driver:	http://www.ftdichip.com