PHOTO RESEARCH®

a JADAK Brand

A-TAKT V-7HS
User Manual

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Notice

The information contained in this document is subject to change without notice. If there are any questions pertaining to the use of this system, contact JADAK.

Jadak and Novanta shall not be liable for errors contained herein or for incidental consequential damages in connection with the furnishing, performance, or use of this system.

Customer Support

PHOTO RESEARCH, Inc. has support services available to users in case of problems using the A-TAKT V-7HS.

PHOTO RESEARCH, Inc. personnel are available from 8:00 AM to 5:00 PM (Eastern Time) Monday through Friday, except legal holidays, to aid in technical support.

Call (315) 701-0678, FAX: (315) 701-0679 or e-mail:

service.pr@photoresearch.com for instrument repair or calibration
support.pr@photoresearch.com for technical support.

If calling, please have the following information ready:

- Instrument Model
- Instrument Serial Number
- This manual
- Any printed data you feel might aid in resolving the problem - such as test data.

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Chapter - 1 INTRODUCTION

The A-TAKT V-7HS is designed for high-speed in-line testing/verification of flat panel displays (FPD). It is a true spectroradiometer and consists of an objective lens, sampling aperture, diffraction grating, and 512 element, thermoelectrically cooled detector.

Target viewing is accomplished by the built-in, high-resolution full color CCD camera. The camera output provides an image of the sample under test, in the center of which is a black spot--the sampling aperture. The black spot is the entrance to the optical system and unambiguously represents the precise area being sampled.

The V-7HS is supplied with a USB 1.1 and RS232 interface. Control of the V-7HS is by the included Software Developers Kit (SDK). Please see the SDK section of this manual for full details.

STANDARD EQUIPMENT

The standard A-TAKT V-7HS includes:

- A-TAKT V-7HS Spectroradiometer
- Objective Lens.
- USB 1.1 Port.
- RS232 Port
- 6’ Universal input AC Adapter.
- CD with drivers, Instruction manual and SDK software.
- NIST Traceable Calibration (certified for six months).

Chapter - 2 SYSTEM OVERVIEW

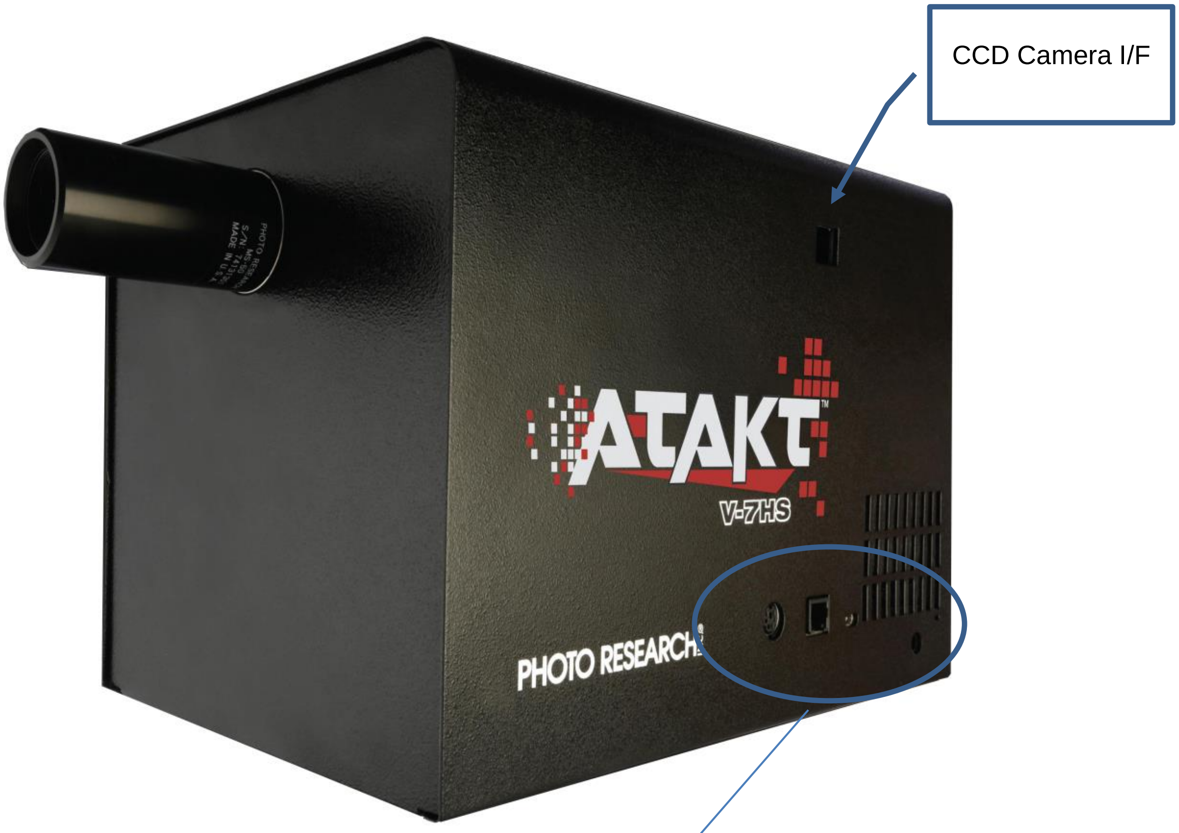


FIGURE 1 – A-TAKT V-7HS SIDE VIEW

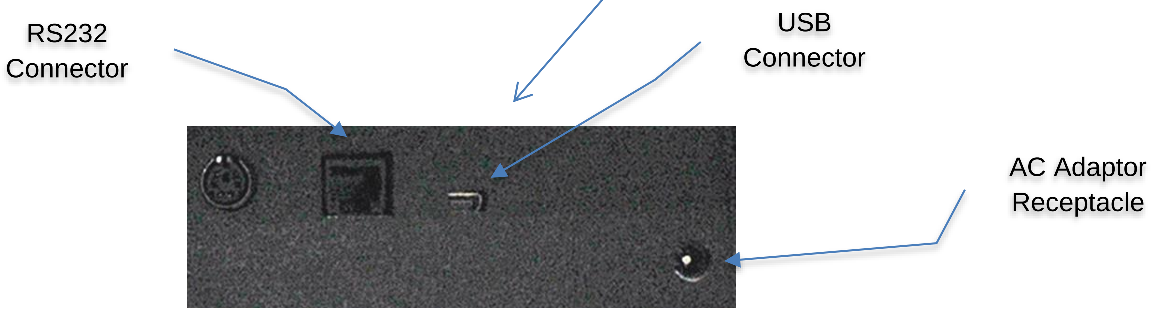
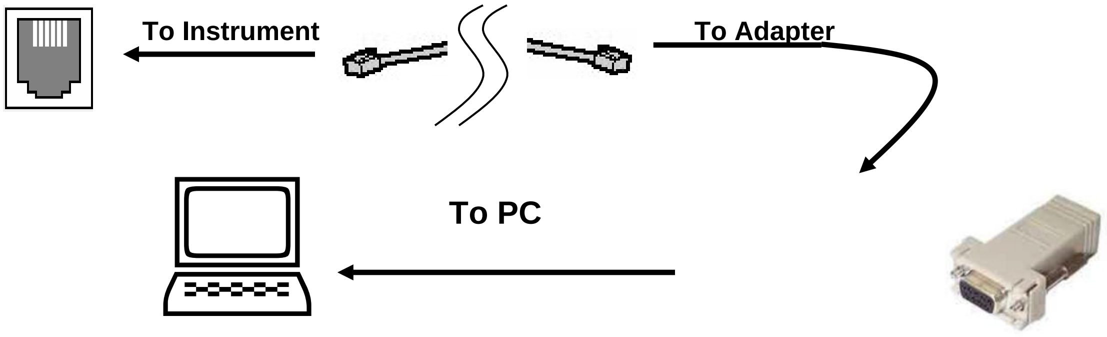


FIGURE 2 - I/O PANEL ENLARGEMENT

RS232 CONNECTOR

For applications requiring traditional RS232 communications, the RS232 is available. An RJ-12 connector is available on the V-7HS allowing the user to connect the instrument to the controller RS232 port using the included RJ-12 to DB-9 adapter.



Items Included with the RS232 Interface:

1) RJ-12 Jack on A-TAKT V-7HS.
2) RJ-12 to DB-9 adapter.
3) 6 ft. (1.83 m) RJ-12 cable.

Please contact factory for custom RJ-12 cable lengths.

Mini USB 1.1 Connector

The A-TAKT is equipped with a Mini-B USB connector, providing remote communication.

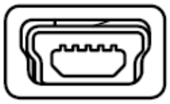


Figure 3 - Mini-B USB connector.

Power Connector

Connecting the A-TAKT power (AC Adapter) supply:

Connecting the AC Adapter

1. Insert the AC power cord into an appropriate AC source.
2. Insert the AC power cord into the AC Adapter body.
3. Insert the small round DC connector located on the opposite end of the adapter into the AC Adapter receptacle.

MS-75 Standard Objective Lens

If your A-TAKT V-7HS was equipped with the MS-75 objective lens, it is a 75mm f/2.8 MacroSpectar® lens that focuses from 1:4 magnification (at 14” from the target) to infinity. This feature allows the instrument to be focused at different distances from the sample providing the ability to change the measured spot size. The further from the sample, the larger the spot size.

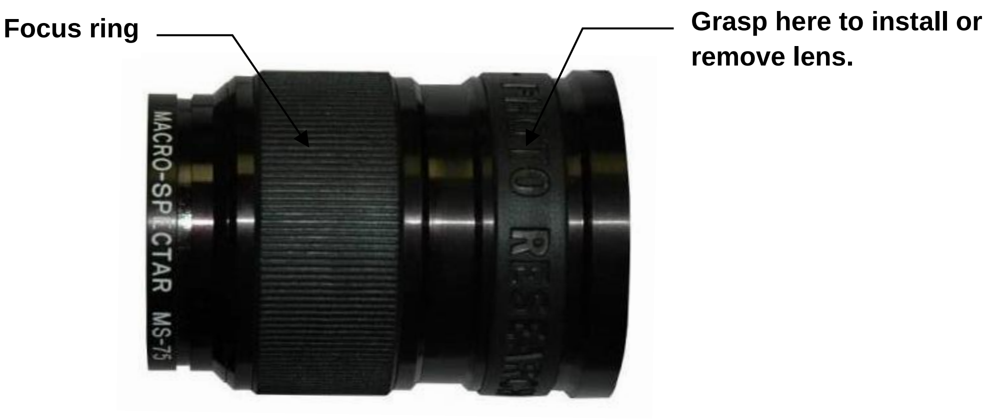
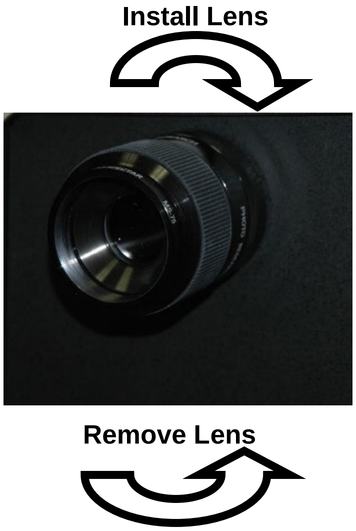


Figure 4 - MS-75 objective lens.

Installing and / Removing the Standard Lens

The standard objective lens is installed by aligning the lens thread with the instrument’s lens mount thread and rotating clockwise while grasping the rubber ring toward the rear of the lens (see **Figure 4**). The thread should offer minimum resistance during installation.

Full details including spot size versus working distance for all available lenses for MS-75, please refer to the table at the end of this manual.



Removing the Objective Lens

1. Grasping the rear rubber ring (see **Figure 4**) turn the lens counter-clock-wise until the lens separates from the lens mount.

Installing the Objective Lens

1. Grasping the rear rubber ring (see **Figure 4**) turn the lens clock-wise until the lens seats on the lens mount.

⚠ **Warning: Hand tighten only! Do not over tighten as permanent damage may occur.**

Chapter - 3 THEORY OF OPERATION

The A-TAKT V-7HS are true Spectroradiometers. It collects the optical radiation (light) through the objective lens. The signal then passes through the aperture (hole) in the aperture mirror to the diffraction grating (see Figure 6). The grating breaks up the light into its component wavelengths much like a prism turns white light into a rainbow. A broad band source of light such as the sun emits radiation at all wavelengths throughout the visible spectrum. When the diffraction grating is exposed to this type of light, it will refract the light at several angles thus creating a dispersed spectrum much like a rainbow. Similarly, if the grating is exposed to a source such as a laser which emits a nearly monochromatic wavelength of light, only the wavelength(s) of the laser will be refracted.

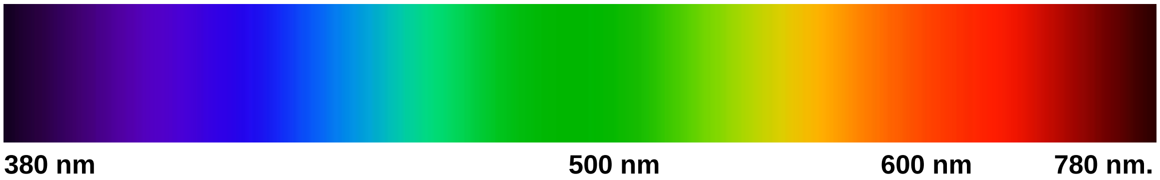


FIGURE 5 – SPECTRUM MEASURED BY THE V-7HS

The measurement wavelength range is 380 nanometers (nm) (violet) to 780 nm (deep red) – the visible band of the electromagnetic spectrum (see Figure 5).

The diffracted spectrum is then dispersed onto the detector. The detector is comprised of 512 individual elements. Thus, each of the detector elements samples a unique color.

During a measurement, the diffracted optical radiation (light) is sampled for a period of time determined by the Adaptive Sensitivity™ algorithm. Adaptive Sensitivity automatically determines the correct integration (exposure) time on the detector based on the available signal. Following the light measurement, a measurement of the dark current of the detector is made for the same length of time that was used for the light measurement. The dark measurement is then subtracted from the light measurement yielding the contribution of light for each detector element.

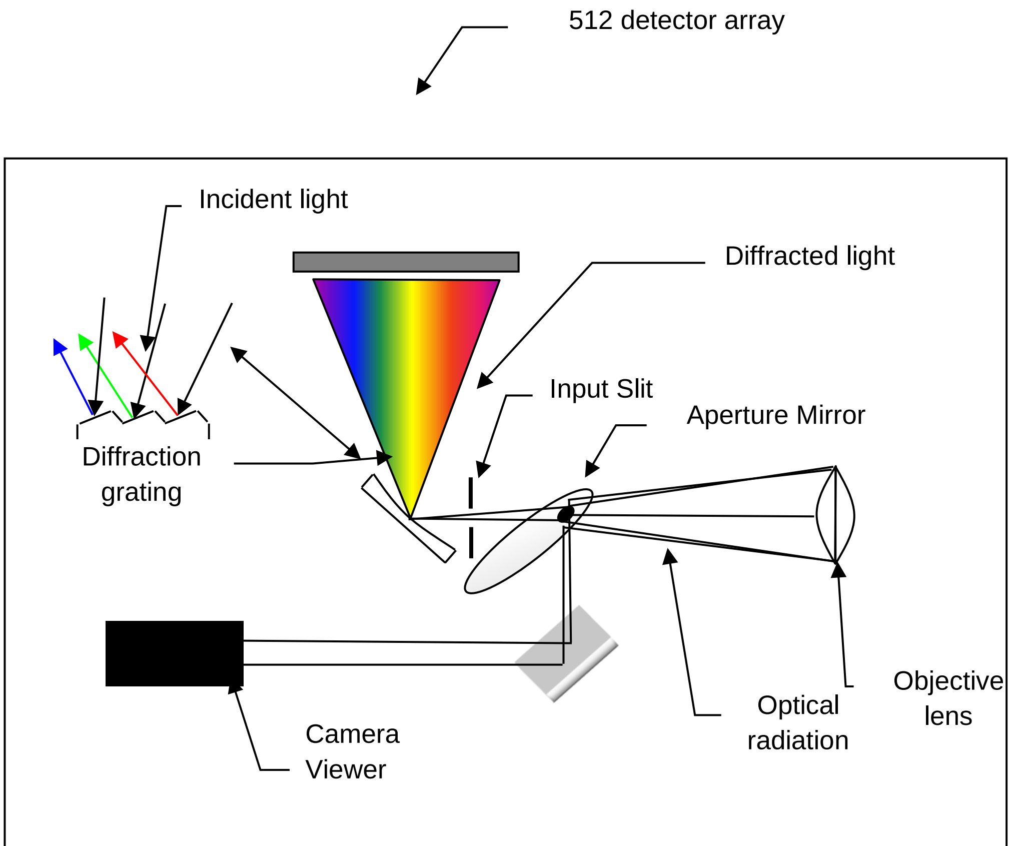


FIGURE 6 – V-7HS SPECTROMETER

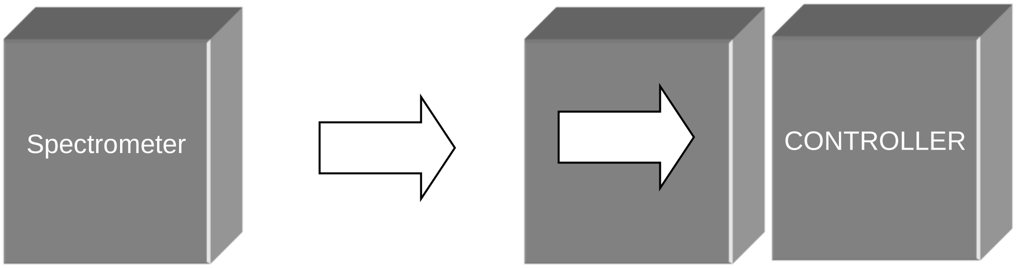


FIGURE 7 - V-7HS BLOCK DIAGRAM

The uncorrected or ‘raw’ spectrum is corrected using factors established during the factory calibration of the instrument. These factors include wavelength accuracy correction, spectral distribution correction, and photometric correction. The wavelength calibration is performed using a helium spectral line source. The line source provides known spectral emission lines that the software uses to map the dispersion of the grating to the multi-element detector. The helium lines used during the wavelength calibration are 388.6 nm, 447.1 nm, 471.3 nm, 587.6 nm, 667.8 nm, 706.5 nm and 728.13 nm.

Next, spectral correction factors are established using a continuous source with known intensities at each wavelength. These factors insure that the proper spectral power distribution (SPD) of the target is determined following a measurement, and that calculated values such as CIE Chromaticity, based on the measured spectral quantities, are accurately reported. Lastly, a scaling factor (photometric factor) is applied ensuring the proper photometric levels such as luminance or illuminance are displayed.

Calculations

The corrected spectral data is then used to calculate CIE photometric and colorimetric values including luminance, CIE 1931 x, y and 1976 u', v' chromaticity coordinates, correlated color temperature in Kelvin and dominant wavelength. Following are some of the basic calculations used to generate photometric and colorimetric parameters:

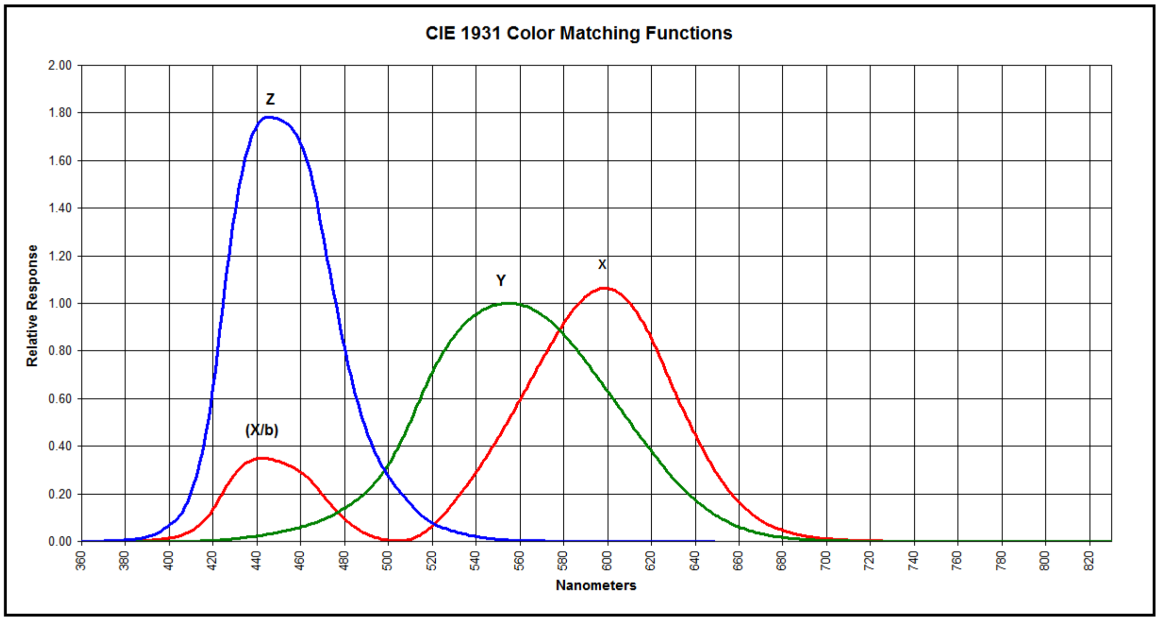


FIGURE 8 - CIE 1931 TRISTIMULUS FUNCTIONS

CIE XYZ Tristimulus and Photometric Values

$$\boxed{X = 683 \int_{380}^{780} S(\lambda)\overline{X}(\lambda)\Delta(\lambda)}$$

$$\boxed{Y = 683 \int_{380}^{780} S(\lambda)\overline{Y}(\lambda)\Delta(\lambda)}$$

$$\boxed{Z = 683 \int_{380}^{780} S(\lambda)\overline{Z}(\lambda)\Delta(\lambda)}$$

Where:

X, Y, and Z are the three CIE Tristimulus values. X represents the red component, Y is the green component and Z is the blue component.

Y also serves as the photometric value – when using the standard MS-75 lens, Y gives candelas / meter² - the SI unit for luminance. To find footlamberts (English unit of luminance), multiply cd/m² by 0.2919.

683 is a constant used to convert lumens to watts. There are 683 lumens per watt at 555 nm for photopic (daylight) vision.

S(λ) = the corrected spectral data, $\overline{X}(\lambda),\overline{Y}(\lambda),\overline{Z}(\lambda)$ are the three CIE Tristimulus functions (curves) and Δ(λ) is the data increment 1.0 for the A-TAK V-7HS.

Once the three Tristimulus values (X, Y, Z) have been derived, useful colorimetric values such as CIE 1931 x, y and CIE 1976 u', v' can be calculated by the following formulae:

CIE 1931 x, y

$$x = \frac{X}{X+Y+Z}$$

$$y = \frac{Y}{X+Y+Z}$$

CIE 1976 u', v'

$$u' = 4X/(X+15Y+3Z)$$

$$v' = 9Y/(X+15Y+3Z)$$

Chapter - 4 BASIC SETUP PROCEDURES

INTRODUCTION

This section provides instructions and set-up procedures prior to making measurements with the A-TAKT V-7HS. For the location of components referred to in this section, please see Chapter 1 of this manual.

POWER-UP

1. To turn on and initialize the instrument, simply plug the AC Adaptor into the AC Receptacle.
2. Allow at least 5 minutes of warm-up for the detector and internal circuitry to stabilize.

CONNECTIVITY

USB

1. Connect the V-7HS USB interface to the PC using a mini-B type USB Cable.

RS232

1. Using the RJ-12 cable and RJ-12 to DB9 converter, connect the V-7HS to a suitable DB-9 RS232 port on your PC.

CCD Viewing Camera

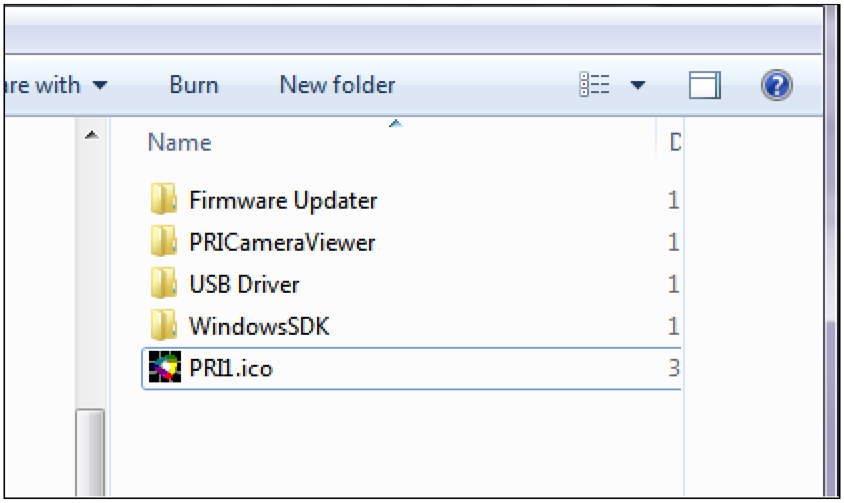
1. Use a Type B USB cable to connect the V-7HS Viewing Camera to the PC.

Target Alignment and Focus

1. Using either the programmable SDK function, **Int32 prDeviceStartCamera (string viewerPath)** (see SDK software section) or the Camera Viewer application (see the Software/Camera Viewer section), align the measuring spot in the field of view on the area of interest.
2. If using a fixed focus lens (e.g. FF-50), there is no need to focus the lens. If using a variable focus lens like the MS-75, adjust the focus ring until the image (not the aperture) is in sharp focus.

Chapter - 5 Software

Included with your A-TAKT V-7HS is a CD containing a Firmware Updater, Camera Viewer, USB Driver Installer and the A-TAKT SDK files.



Name D

Firmware Updater 1

PRICameraViewer 1

USB Driver 1

WindowsSDK 1

PRI1.ico 3

FIGURE 9 - CD DIRECTORY

CD Folder Descriptions

Firmware Updater

Contains **FWInstaller.msi,** firmware updater software installer.

PRICameraViewer

Contains **ATaktCameraSetup.msi,** Camera Viewer software installer.

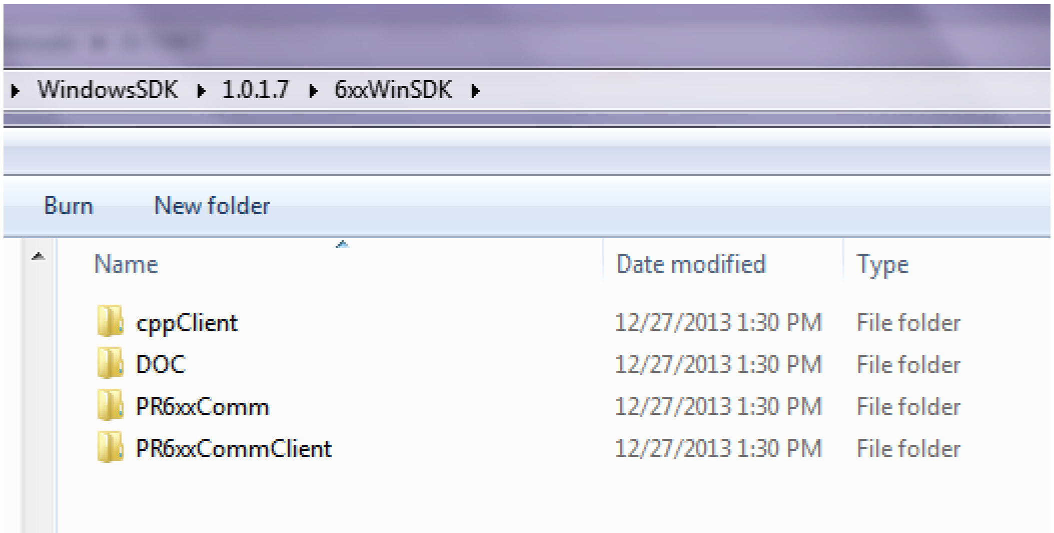
USB Driver

Contains **PRI-USBInst.msi** USB driver installer.

WindowsSDK

Contains all files necessary for SDK programming. Please see the SDK section of this manual for programming information. Navigate to the following folder to view contents.

\WindowsSDK\1.0.1.7\6xxWinSDK



Name	Date modified	Type
cppClient	12/27/2013 1:30 PM	File folder
DOC	12/27/2013 1:30 PM	File folder
PR6xxComm	12/27/2013 1:30 PM	File folder
PR6xxCommClient	12/27/2013 1:30 PM	File folder

FIGURE 10 - SDK FOLDER CONTENTS

SDK Folder Content Descriptions

cppClient

C++ sample console app to call SDK functions

PR6xxComm

SDK library DLL

PR6xxCommClient

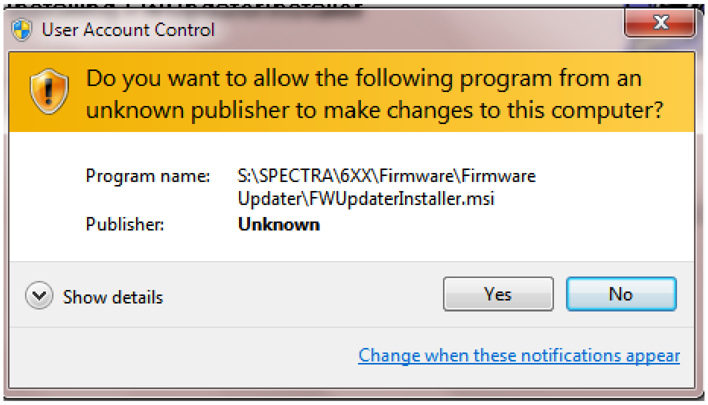
C# sample console app to call SDK functions

Updating the Firmware

If it is necessary to update the firmware for your A-TAKT instrument, it must be done from the PC. This is accomplished using the Firmware Updater application located on the CD.

Installing the Updater

1) Run the file **FWInstaller.msi** located on the CD in the **Firmware Updater** folder. If you encounter a User Account Control message, click on ***Yes.***



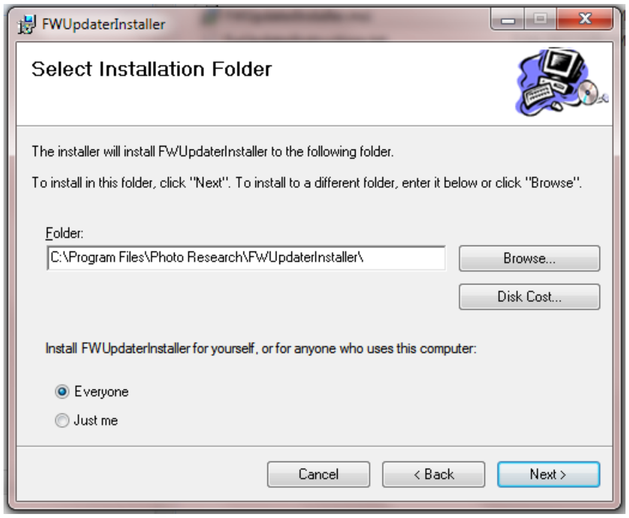
User Account Control

Do you want to allow the following program from an unknown publisher to make changes to this computer?

Program name: S:\SPECTRA\6XX\Firmware\Firmware Updater\FWUpdaterInstaller.msi

Publisher: **Unknown**

2) Follow the on-screen prompts to complete the installation. Accept the defaults for file location during the process.



FWUpdaterInstaller

Select Installation Folder

The installer will install FWUpdaterInstaller to the following folder.

To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

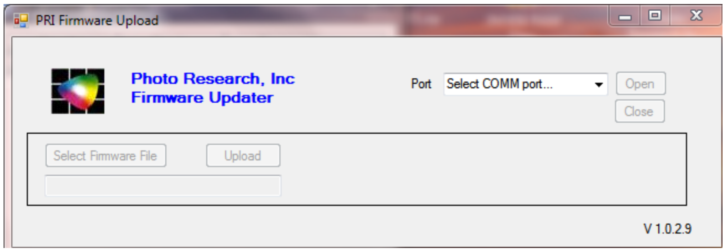
Folder: C:\Program Files\Photo Research\FWUpdaterInstaller\

Install FWUpdaterInstaller for yourself, or for anyone who uses this computer:

● Everyone
○ Just me

Running the Installer

1) Navigate to C:\Program Files\Photo Research\FWUpdaterInstaller and launch the file **PRFWUdate.exe**.

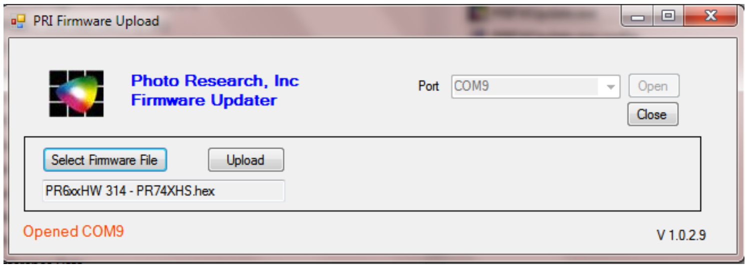


PRI Firmware Upload

Photo Research, Inc
Firmware Updater

Port: Select COMM port...

2) Click the ▼ icon in the Port field. Select the COM port assigned to the PR Instrument. The COM port can be found using Windows Device Manager.

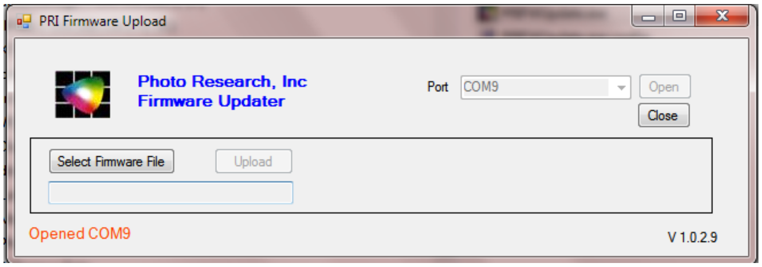


Port COM9

PR6xxHW 314 - PR74XHS.hex

Opened COM9

3) Click ***Open*** to connect to the A-TAKT.



Port COM9

Opened COM9

4) Click on ***Select Firmware File.*** Navigate to the CD and choose the file with the **.hex** extension. For example PR6xxHW 314 – PR74XHS.hex.

WARNING: DO NOT INSTALL THIS FIRMWARE ON ANY OTHER PHOTO RESEARCH MODEL – E.G. PR-740. DOING SO WILL DISABLE THE INSTRUMENTS SCREEN AND FUNCTION KEYS RENDERING IT UNUSABLE.

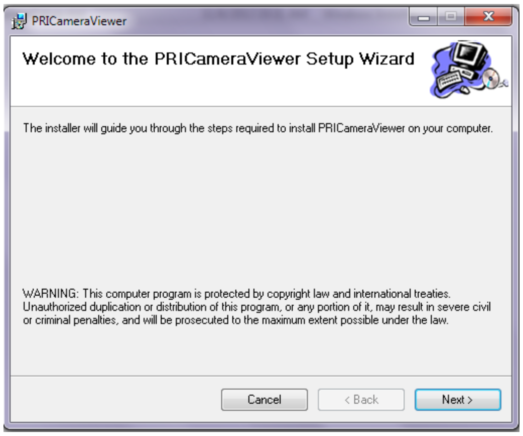
Click on ***Upload.*** Follow the on-screen prompts to complete the process. Several confirmation screens appear during the process. Before accepting, make sure you are installing the correct firmware version.

A-TAKT CAMERA VIEWER

INSTALLING THE CAMERA VIEWER SOFTWARE

INSTALLING THE CAMERA VIEWER

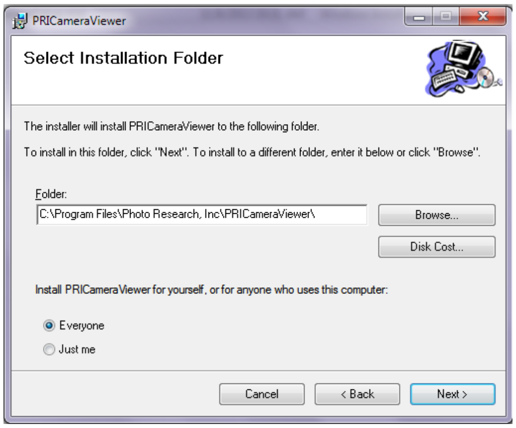
1) Launch the file **ATaktCameraSetup.msi** located on the CD in the PRICameraViewer folder. If you encounter a User Account Control message, click on ***Yes*** run the Installer.
2) Click next through the following screens to complete the installation.



Welcome to the PRICameraViewer Setup Wizard

The installer will guide you through the steps required to install PRICameraViewer on your computer.

WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.



Select Installation Folder

The installer will install PRICameraViewer to the following folder.

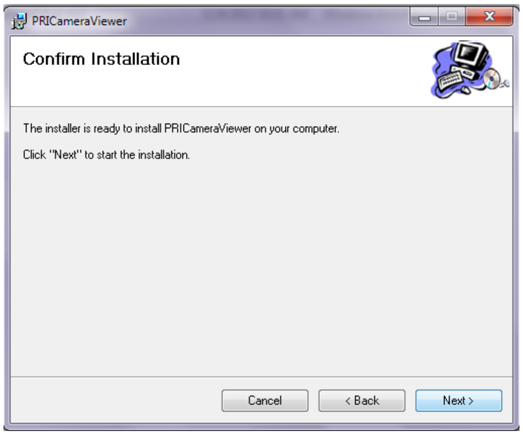
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

Folder: C:\Program Files\Photo Research, Inc\PRICameraViewer\

Install PRICameraViewer for yourself, or for anyone who uses this computer:

● Everyone

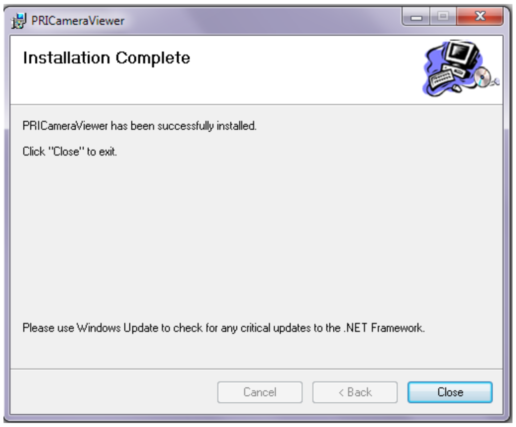
○ Just me



Confirm Installation

The installer is ready to install PRICameraViewer on your computer.

Click "Next" to start the installation.



Installation Complete

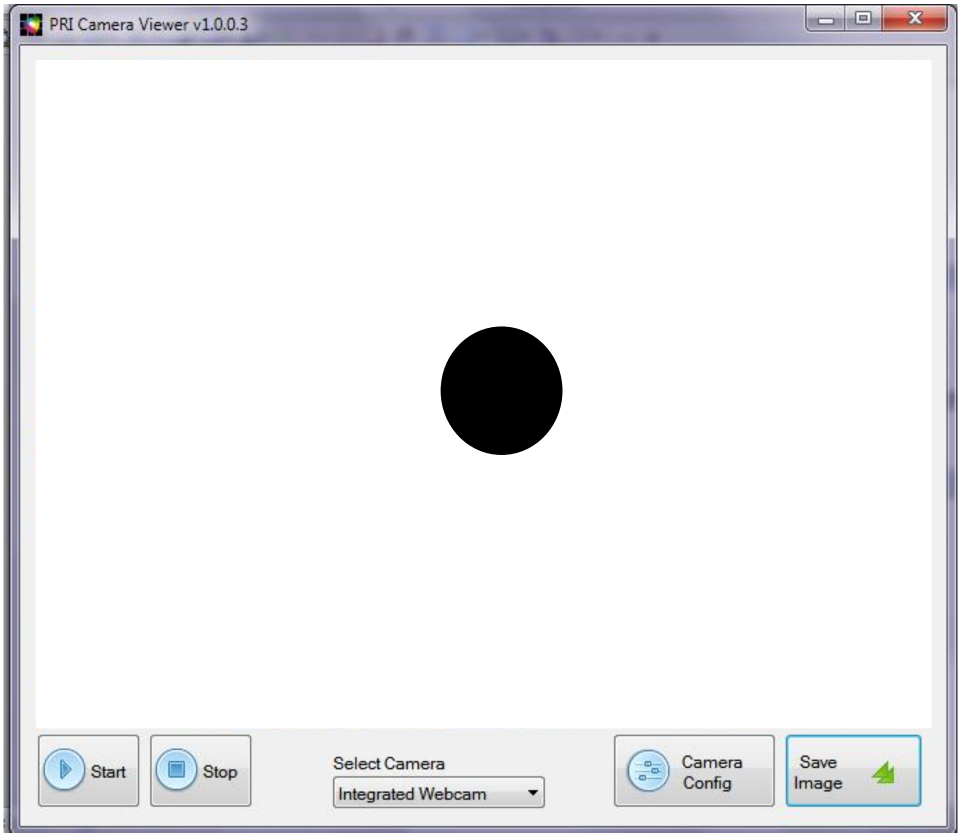
PRICameraViewer has been successfully installed.

Click "Close" to exit.

Please use Windows Update to check for any critical updates to the .NET Framework.

RUNNING THE CAMERA VIEWER

1) Make sure that the A-TAKT camera is connected to the PC by a Type B USB Cable.
2) Launch the file **WebCamViewer.exe.** If you installed the viewer using the default settings, this file will be located in the \Program Files\Photo Research, Inc**PRICamViewer** folder. A screen similar to the following appears.



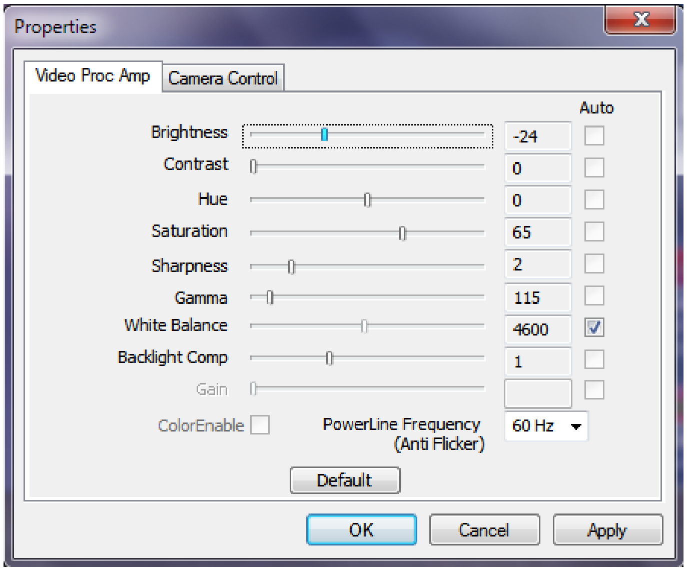
Select Camera: Integrated Webcam

FIGURE 11 - MAIN CAMERA VIEWER SCREEN

Note the image of the measuring aperture in the center of the field of view.

Adjusting the Image

1) Click on **Camera Config** to bring up the following screen:



		Auto
Brightness	-24	□
Contrast	0	□
Hue	0	□
Saturation	65	□
Sharpness	2	□
Gamma	115	□
White Balance	4600	☑
Backlight Comp	1	□
Gain		□

ColorEnable □ PowerLine Frequency (Anti Flicker) 60 Hz

FIGURE 12 - CAMERA VIEWER CONTROL PANEL

2) Use the controls to adjust the quality of the image.

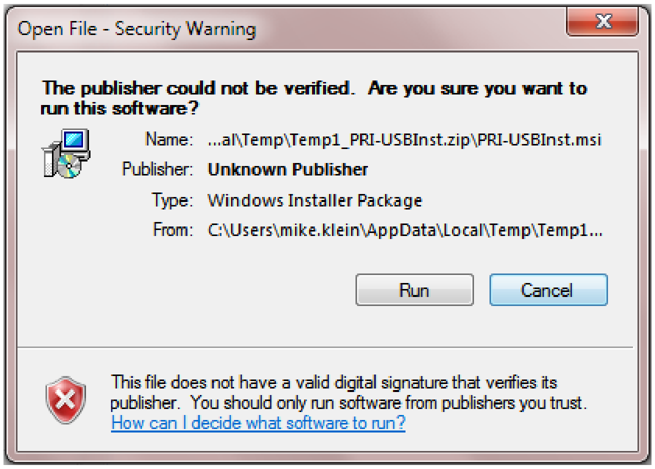
Focusing the Image

1) If using a fixed focus lens, there is no need to focus the image if within the published focus range.
2) If using a variable focus lens such as the MS-75, adjust the lenses focus ring until the sample is in sharp focus. The measuring aperture focus is set at the factory and cannot be adjusted.

Installing the USB Driver

If your computer does not have a PR USB driver installed, it must be installed for successful communication with the A-TAKT V-7HS from application using the SDK. The driver assigns a COM port to the instrument when connected to the PC.

1) Launch the **PRI-USBInst.msi** program from the CD located in the **USB Driver** folder.
2) The first screen that appears will be a security warning screen. Click ***Run.***



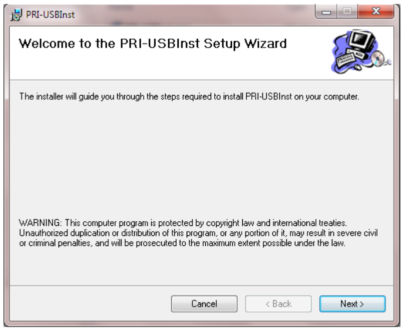
Open File - Security Warning

The publisher could not be verified. Are you sure you want to run this software?

Name: ...al\Temp\Temp1_PRI-USBInst.zip\PRI-USBInst.msi
Publisher: **Unknown Publisher**
Type: Windows Installer Package
From: C:\Users\mike.klein\AppData\Local\Temp\Temp1...

This file does not have a valid digital signature that verifies its publisher. You should only run software from publishers you trust.
How can I decide what software to run?

3) Follow the on screen instructions. Click ***Next*** when asked. The program will automatically determine your operating system and whether the operating system is 32 or 64 bit. On the final screen, click ***Finish.***

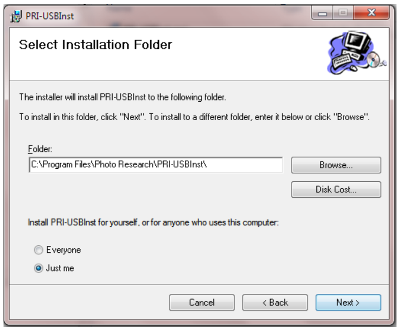


PRI-USBInst

Welcome to the PRI-USBInst Setup Wizard

The installer will guide you through the steps required to install PRI-USBInst on your computer.

WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.



PRI-USBInst

Select Installation Folder

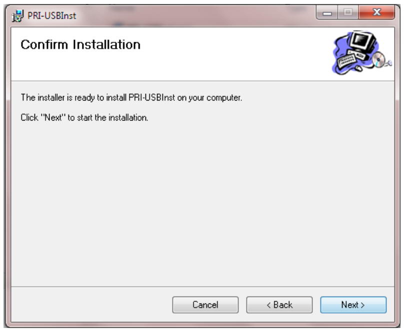
The installer will install PRI-USBInst to the following folder.

To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

Folder: C:\Program Files\Photo Research\PRI-USBInst\

Install PRI-USBInst for yourself, or for anyone who uses this computer:

○ Everyone
● Just me



PRI-USBInst

Confirm Installation

The installer is ready to install PRI-USBInst on your computer.

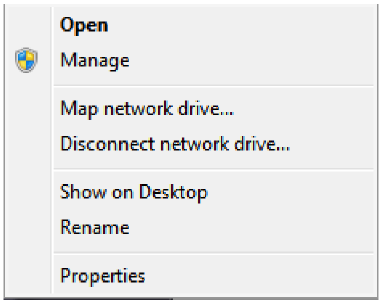
Click "Next" to start the installation.

DETERMINING THE COM: PORT

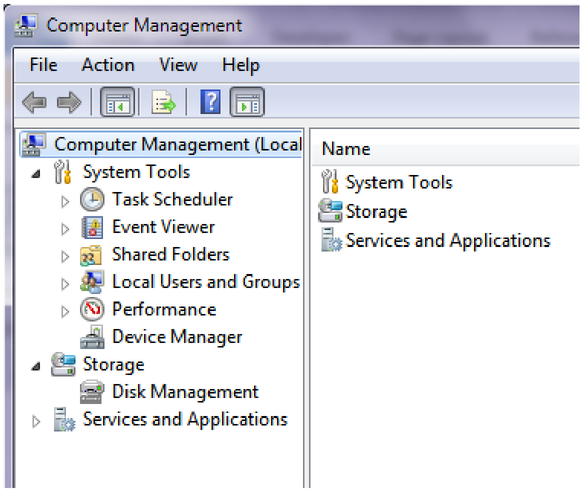
NOTE: The V-7HS must be powered up and connected to the PC for this procedure.

After installing the USB driver, and before communicating with the V-7HS, use the following steps to determine the COM: port assigned by the driver to your V-7HS.

1. Click on **Start** .
2. Right click on **Computer.**
3. Click on **Manage.**



4. Click on **Device Manager**



5. Click on **Ports (COM + LPT).**
6. Use the COM port assigned to **PR Instrument** when communicating with the V-7HS.

NOTE: If an instrument is not connected to the PC, PR Instrument will not appear in the list of Ports.

SOFTWARE DEVELOPMENT KIT (SDK)

CLASS DOCUMENTATION

PR6XXCOMM.COMMBASE CLASS REFERENCE

The **CommBase** Class provides a high level software interface to the Photo Research family of spectrometers.

PUBLIC TYPES

```
enum UnitsType {
        UnitsType.ImperialUnits,
        UnitsType.MetricUnits }
    Selectors for set measurement units method


enum SpeedMode {
        SpeedMode.SpeedNormal,
        SpeedMode.SpeedFast,
        SpeedMode.Speed2XFast,
        SpeedMode.Speed4XFast }
    Available instrument speed settings (the tradeoff is accuracy for speed)


enum DriverErrorCodes {
        DriverErrorCodes.Success = 0,
        DriverErrorCodes.BadArguments = -5001,
        DriverErrorCodes.WriteTimeout = -5002,
        DriverErrorCodes.ReadTimeout = -5003,
        DriverErrorCodes.BadData = -5004,
        DriverErrorCodes.BadUploadFile = -6001,
        DriverErrorCodes.UnknownFirmware = -6002,
        DriverErrorCodes.FileNotFound = -6003,
        DriverErrorCodes.ProtocolError = -6004 }
    Additional error codes for problems detected by the SDK.


enum TaktLearnPhases {
        TaktLearnPhases.GetFrequency,
        TaktLearnPhases.MaxWhite,
        TaktLearnPhases.StandardDark,
        TaktLearnPhases.EndPhases }
    enumeration of interactive phase or steps used to generate a synch frequency adjusted takt table.


 enum SynchMode {
        SynchMode.None,
        SynchMode.Auto,
        SynchMode.User }
    SynchMode  enumeration of synch mechanisms the instrument will use when taking measurements
```

PUBLIC MEMBER FUNCTIONS

string prVersionInfo ()

Get SDK version information.

int prOpenLogFile (String FilePath)

Creates SDK level log file and starts logging process.

int prDeviceOpen ()

prDeviceOpen Finds and opens PRI spectral device. Also reads maximum exposure time from detected instrument.

void prDeviceClose ()

prDeviceClose Closes previously opened PRI spectral device

Int32 prDeviceModel (ref string szModel)

prDeviceModel Gets the model number of the currently opened PRI spectral device

Int32 prDeviceInstCalDue (ref string szDueDate)

Report the date and time when the instrument will be out of calibration.

Int32 prDeviceSerialNumber (ref string szSerialNumber)

prDeviceSerialNumber Gets the serial number of the currently opened PRI spectral device

Int32 prDeviceFirmwareVersion **(ref string szFirmwareVersion)**

prDeviceFirmwareVersion Gets the firmware version of the currently opened PRI spectral device

Int32 prDeviceUnits (UnitsType units)

Sets returned measurement units to either metric or imperial

Int32 prDeviceSpeed (SpeedMode mode)

Adjusts the device measurement speed by altering the gain for the measurement

Int32 prDeviceObserver (int dataSet)

Set CIE standard observer for subsequent measurements

Int32 prDeviceExposure (int mSecs)

Set exposure time for subsequent measurements.

Int32 prDeviceSmartDark (bool bTurnOn)

Enable/disable mandatory capturing of a dark frame before each measurement. When this feature is enabled the spectrometer determines if a dark frame is required.

Int32 prDeviceMeasure (ref double brightness, ref double cieX, ref double cieY)

Take luminance measurement

Int32 prDeviceLastMeasurementInfo (ref Int32 pixel, ref Int32 lightDark, ref double exposure, ref double brightness, ref Int32 cct, ref double temperature)

Get additional information for last luminance or spectral measurement.

Int32 prDeviceSpectralMeasure (ref string spectralData)

Take spectral measurement

Int32 prDeviceGetTakt (ref int Takt1, ref int Takt2, ref int Takt3, ref int Takt4)

Get previously configured TAKT table values. (These are saved in the SDK)

Int32 prDeviceTaktTable (int Takt1, int Takt2, int Takt3, int Takt4)

Set TAKT table using user provided values.

Int32 prDeviceTaktIndex (int index)

Set TAKT table index for previously applied TAKT table.

Int32 prDeviceUserCorrelationTable (string table, ref double brightness, ref double cieX, ref double cieY)

Provide instrument with user specified spectral correlation table. This table must be applied while the instrument is measuring the same light source used to generate the table. The application measurement will be executed as part of this procedure.

Int32 prDeviceEnableCorrelationTable (bool bTurnOn)

Enable (/disable) correlation table loaded with previous method.

Int32 prDeviceStartCamera (string viewerPath)

Launch instrument viewing camera application.

Int32 prDeviceStopCamera ()

Kill instrument viewing camera application.

int prUpdateFirmware (string FWFile)

Load new firmware image on to the instrument. Both the new image and the current image checked to insure that the load will succeed.

Int32 prDeviceGetMinExposure (ref Int32 minExposure)

Get instrument minimum exposure time

Int32 prDeviceGetFrequency (ref Int16 synchFrequency)

prDeviceGetFrequency retrieves the synch frequency detected by the last luminance measurement.

Int32 prDeviceSetFrequency (Int16 synchFrequency)

prDeviceSetFrequency sets the synch frequency for subsequent luminance measurements.

Int32 prDeviceSetSynchMode (SynchMode synchMode)

prDeviceSetSynchMode sets the synch frequency for subsequent luminance measurements.

Int32 prDeviceLearnFreqAdjustedTakt (TaktLearnPhases learnPhase, int frequency)

Interactive method to use when determining takt table values for customer target. Each phase or pass requires that the DUT be set to a specified luminance/color level. Upon completion of all the required phases a takt table is generated and applied to the instrument.

Detailed Description

The **CommBase** Class provides a high level software interface to the Photo Research family of spectrometers.

Member Enumeration Documentation

enum PR6xxComm.CommBase.DriverErrorCodes

Additional error codes for problems detected by the SDK.

Enumerator

Success SDK operation succeeded.

BadArguments An invalid argument was detected.

WriteTimeout The instrument interface code timed out while writing to the instrument.

ReadTimeout The instrument interface code timed out while reading from the instrument.

BadData An SDK data validation test failed.

BadUploadFile Firmware update method detected problem with the specified firmware upload file name.

UnknownFirmware Firmware update method detected unsupported firmware version on the instrument.

FileNotFound Firmware update method could not load the specified firmware upload file.

ProtocolError Firmware update method encountered a protocol during the firmware update process.

enum PR6xxComm.CommBase.SpeedMode

Available instrument speed settings (the tradeoff is accuracy for speed)

Enumerator

SpeedNormal slowest and most accurate

SpeedFast faster and less accurate

Speed2XFast even faster and even less accurate

Speed4XFast too fast

enum PR6xxComm.CommBase.SynchMode

SynchMode enumeration of synch mechanisms the instrument will use when taking measurements

Enumerator

None No synch frequency adjustment is required.

Auto Instrument will detect synch frequency to be used.

User User will use prDeviceSetFrequency to specify the synch frequency.

enum PR6xxComm.CommBase.TaktLearnPhases

Enumeration of interactive phase or steps used to generate a synch frequency adjusted takt table.

Enumerator

GetFrequency Phase to get DUT synch frequency. Assumes DUT set to W255 / 50% back light.

MaxWhite Phase to get DUT maximum white exposure time. Assumes DUT set to W255 / 100% back light.

StandardDark Phase to get DUT standard dark exposure time. Assumes DUT set to W0 / 100% back light.

EndPhases Used as phase count

enum PR6xxComm.CommBase.UnitsType

Selectors for set measurement units method.

Enumerator

ImperialUnits selects imperial units

MetricUnits selects metric units

Member Function Documentation

void PR6xxComm.CommBase.prDeviceClose ()

prDeviceClose Closes previously opened PRI spectral device

Int32 PR6xxComm.CommBase.prDeviceEnableCorrelationTable (bool *bTurnOn*)

Enable (/disable) correlation table loaded with previous method.

Parameters:

bTurnOn	Boolean: true selects loaded correlation table, false selects factory table.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceExposure (int *mSecs*)

Set exposure time for subsequent measurements.

Parameters:

mSecs	Exposure time in milliseconds. If the argument is zero the instrument will adaptive mode.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceFirmwareVersion (ref string *szFirmwareVersion*)

prDeviceFirmwareVersion Gets the firmware version of the currently opened PRI spectral device

Parameters:

szFirmwareVersion	Firmware version identification string

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceGetFrequency (ref Int16 *synchFrequency*)

prDeviceGetFrequency Retrieves the synch frequency detected by the last luminance measurement.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Parameters:

synchFrequency	The parameter is a passed by reference 16 bit integer. Upon successful completion of the method the parameter will contain the synch frequency hertz.

See Also:

System.Int16

Int32 PR6xxComm.CommBase.prDeviceGetMinExposure (ref Int32 *minExposure*)

Get instrument minimum exposure time.

Parameters:

minExposure	The parameter is a passed by reference 32 bit integer. Upon successful completion of the method the parameter will contain the minimum suppor instrument exposure time in microseconds.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceGetTakt (ref int *Takt1*, ref int *Takt2*, ref int *Takt3*, ref int *Takt4*)

Get previously configured TAKT table values. (These are saved in the SDK).

Parameters:

Takt1	Last exposure time in microseconds for bright light/color levels
Takt2	Last exposure time in microseconds for medium light/color levels
Takt3	Last exposure time in microseconds for low light/color levels
Takt4	Last exposure time in microseconds for very low light/color levels

Returns:

Int32 PR6xxComm.CommBase.prDeviceInstCalDue (ref string *szDueDate*)

Report the date and time when the instrument will be out of calibration.

Parameters:

szDueDate	Instrument calibration due date/time string

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceLastMeasurementInfo (ref Int32 *pixel*, ref Int32 *lightDark*, ref double *exposure*, ref double *brightness*, ref Int32 *cct*, ref double *temperature*)

Get additional information for last luminance or spectral measurement.

Parameters:

pixel	Measured pixel with highest A/D count.
lightDark	Average light minus dark A/D count for last measurement.
exposure	Exposure time of last measurement.
brightness	Luminance value returned from last measurement.
cct	Color correction temperature returned for las measurement.
temperature	CCD temperature for last measurement.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code.

Int32 PR6xxComm.CommBase.prDeviceLearnFreqAdjustedTakt (TaktLearnPhases *learnPhase*, int *frequency*)

Interactive method to use when determining TAKT table values for customer target. Each phase or pass requires that the DUT be set to a specified luminance/color level. Upon completion of all the required phases a takt table is generated and applied to the instrument.

Parameters:

learnPhase	The specified learn mode phase that the user has configured the DUT for. Phases should be executed in order. If frequency argument is not zero the GetFrequency phase is omitted.

See Also:

TaktLearnPhases

Parameters:

frequency	Frequency to use during learn mode. If this argument is zero, the learned mode sequence requires an addition phase (GetFrequency) to detect the required frequency.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceMeasure (ref double *brightness*, ref double *cieX*, ref double *cieY*)

Take luminance measurement.

Parameters:

brightness	Measured photometric brightness
cieX	Measured CIE 1931 x
cieY	Measured CIE 1931 y

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceModel (ref string *szModel*)

prDeviceModel Gets the model number of the currently opened PRI spectral device.

Parameters:

szModel	Model name string

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceObserver (int *dataSet*)

Set CIE standard observer for subsequent measurements.

Parameters:

dataSet	2 = 2 degree set, 10 = 10 degree set

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

int PR6xxComm.CommBase.prDeviceOpen ()

prDeviceOpen Finds and opens PRI spectral device. Also reads maximum exposure time from detected instrument.

Returns:

32 bit integer indicating the method completion status; 0 = success, -1 = failed to open device

Int32 PR6xxComm.CommBase.prDeviceSerialNumber (ref string *szSerialNumber*)

prDeviceSerialNumber Gets the serial number of the currently opened PRI spectral device.

Parameters:

szSerialNumber	instrument serial number string

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceSetFrequency (Int16 *synchFrequency*)

prDeviceSetFrequency Sets the synch frequency for subsequent luminance measurements.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Parameters:

synchFrequency	The parameter is a passed by value 16 bit integer. Upon successful comp of the method the instrument will incorporate the specified synch frequen all subsequent measurements.

See Also:

prDeviceSetSynchMode

This method assumes that the client has previously used the prDeviceSetSynchMode method to configure the instrument for user synch mode operation.

Int32 PR6xxComm.CommBase.prDeviceSetSynchMode (SynchMode *synchMode*)

prDeviceSetSynchMode Sets the synch frequency for subsequent luminance measurements.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code.

Parameters:

synchMode	The parameter is a defined enumeration. Upon successful completion of method the instrument will incorporate the specified synch mode in all subsequent measurements.

See Also:

prDeviceSetFrequency

This method assumes that the client will subsequently use the prDeviceSetFrequency method to configure the instruments sync frequency.

See Also:

SynchMode

SynchMode enumerates the available instrument synch options.

Int32 PR6xxComm.CommBase.prDeviceSmartDark (bool *bTurnOn*)

Enable/disable mandatory capturing of a dark frame before each measurement. When this feature is enabled the spectrometer determines if a dark frame is required.

Parameters:

bTurnOn	A boolean: true = smart dark on, false = smart dark off

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceSpectralMeasure (ref string *spectralData*)

Take spectral measurement

Parameters:

spectralData	String containing an array of spectral frequencies and corresponding ene values.

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Data Format:

```
..........
483,5.731e-04
484,5.703e-04
485,5.735e-04
486,5.779e-04
487,5.860e-04
 ..........
```

Int32 PR6xxComm.CommBase.prDeviceSpeed (SpeedMode *mode*)

Adjusts the device measurement speed by altering the gain for the measurement

Parameters:

mode	One of the available SpeedMode settings

See Also:

SpeedMode

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceStartCamera (string *viewerPath*)

Launch instrument viewing camera application.

Parameters:

viewerPath	

Returns:

Int32 PR6xxComm.CommBase.prDeviceStopCamera ()

Kill instrument viewing camera application.

Returns:

Int32 PR6xxComm.CommBase.prDeviceTaktIndex (int *index*)

Set TAKT table index for previously applied TAKT table.

Parameters:

index	0 = adaptive (instrument picks best fit value from tabel), 1-4 = use value a specified index

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceTaktTable (int *Takt1*, int *Takt2*, int *Takt3*, int *Takt4*)

Set TAKT table using user provided values.

Parameters:

Takt1	Desired exposure time in microseconds for bright light/color levels
Takt2	Desired exposure time in microseconds for medium light/color levels
Takt3	Desired exposure time in microseconds for low light/color levels
Takt4	Desired exposure time in microseconds for very low light/color levels

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceUnits (UnitsType *units*)

Sets returned measurement units to either metric or imperial.

Parameters:

units	Units selector: Imperial or Metric

See Also:

UnitsType

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Int32 PR6xxComm.CommBase.prDeviceUserCorrelationTable (string *table*, ref double *brightness*, ref double *cieX*, ref double *cieY*)

Provide instrument with user specified spectral correlation table. This table must be applied while the instrument is measuring the same light source used to generate the table. The application measurement will be executed as part of this procedure.

Parameters:

table	Reference to spectral correlation table that is to be loaded into the instrur
brightness	Photometric brightness value return from measurement of correlated light source
cieX	CIE 1931 x value return from measurement of correlated light source
cieY	CIE 1931 y value return from measurement of correlated light source

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

Sample .txt File:

M1	(name)
380	(starting freq)
780	(ending freq)
1	(step size)
1.90791E-05	(380)
1.59371E-05	(381)
1.35959E-05	(382)
1.35331E-05	(383)
1.37608E-05	(384)
1.07864E-05	(385)
1.3296E-05	(386)

....

int PR6xxComm.CommBase.prOpenLogFile (String *FilePath*)

Creates SDK level log file and starts logging process.

Parameters:

FilePath	Path and name of log file to be created

Returns:

int PR6xxComm.CommBase.prUpdateFirmware (string *FWFile*)

Load new firmware image on to the instrument. Both the new image and the current image checked to insure that the load will succeed.

Parameters:

FWFile	File path of image to be loaded onto the instrument

Returns:

A Int32 instrument operation result code: 0 = success, negative number is error code

string PR6xxComm.CommBase.prVersionInfo ()

Get SDK version information.

Returns:

String containing Assembly name, version, and copyright.

ROUTINE MAINTENANCE

The A-TAKT V-7HS has been designed to give long, trouble-free service requiring minimal routine maintenance. This section gives guidelines for insuring optimum service from your instrument.

CLEANING LENSES / OPTICAL ACCESSORIES

1. Keep the V-7HS clean and dust-free. Store the instrument in a clean, dry environment, preferably in a storage case when not in use. Dust optical surfaces with a soft camel's-hair brush or blow them off with clean, dry air.

△ **Note: Avoid touching optical surfaces**.

2. If the exterior optical surfaces become dirty, clean them as you would any high-quality coated lens. Use lens cleaning fluid or anhydrous alcohol on a piece of lens cleaning tissue or cotton. Do not soak.

△ **Do not use acetone or other organic solvents or excessive pressure! Do not soak or allow water to enter the instrument!**

CLEANING EXTERIOR SURFACES

If the exterior plastic surfaces, such as the display face plate or instrument case becomes dirty or full of fingerprints, use a mild dish washing liquid and a slightly damp, nonabrasive cloth to gently remove fingerprints and dirt. **Do not use acetone or other organic solvents or excessive pressure!** Do not soak or allow water to enter instrument!

RECALIBRATION

The A-TAKT V-7HS is designed to maintain stable calibration for long periods of time and is certified for six months from the factory. However, changes in calibration are inevitable, due to the effects of aging, temperature and dirt accumulation. Therefore, for best results, periodic recalibration is recommended.

To maintain the instrument's accuracy, recalibration checks or recalibration is recommended at six-month intervals. Please consult factory for availability of optional user self-calibration.

Please contact the Customer Service Department for a Return Material Authorization (RMA) number before returning the instrument.

FACTORY REPAIR

IN-WARRANTY REPAIR

If the instrument malfunctions within the one-year warranty period, it will be repaired at no charge to the customer (provided the warranty has not been voided by tampering, physical damage or other abuse).

Note: Any *unauthorized* tampering with the instrument, including opening of the case, automatically voids the warranty. Batteries are not covered under the warranty.

Visit our web site, www.photoresearch.com to assign a Returned Material Authorization (RMA) number to your instrument before returning it to Photo Research for service. The entire instrument, including all accessories, should be brought or shipped prepaid to the Photo Research Service Department in North Syracuse, NY USA (or contact Photo Research for information concerning authorized repair facilities in your area).

Pack the instrument and all attachments and accessories in suitable protective packaging, along with a note describing the nature of the malfunction.

The instrument will be returned by a commercial surface transportation method of Photo Research's choice.

If Air Freight or other rapid delivery is desired, the user should include a check or money order to cover the cost of return shipping, or contact Photo Research and supply a shipper account number (e.g. FedEx, UPS etc.) to expedite collect delivery.

Out-of-Warranty Repair

If the instrument is out of warranty, visit our web site, www.photoresearch.com to assign a Returned Material Authorization (RMA) number to your instrument before returning it to Photo Research for service. The instrument should be brought or shipped prepaid to the Photo Research Service Department (or call Photo Research for locations of authorized repair facilities in your area).

Pack the instrument and all attachments and accessories in suitable protective packaging along with a note describing the nature of the malfunction.

Photo Research will evaluate the damage and advise the user of the estimated repair and recalibration costs before proceeding.

Chapter - 6 - Specifications

General Specifications

Detectors	512
Cooled Detector	Yes
Standard Aperture	1.25°
Objective Lenses	Fixed Focus 50 mm Variable Focus 75 mm Custom (contact factory)
Standard Bandwidth	2 nm
Luminance Range for White LED	0.001 to 600 cd/m^2
Total Cycle time for Illuminant A	250 ms @ 0.5 cd/m^2
Luminance Accuracy for Illuminant A	± 2% @ 0.005 cd/m^2
Luminance Range for Illuminant A	0.0005 to 2,900 cd/m^2
Luminance Repeatability for Illuminant A	0.15% @ 0.5 cd/m^2 at 250 ms total measuring time
Size (L x W x H)	10.79 x 6.69 x 7.40 in. 270 x 170 x 188 mm
Weight	9.55 lbs. 4.33 kg

A-TAKT V-7HS Sensitivity[1, 2]

		Aperture			
Lens	**Spectral Bandwidth**	**1.5°**	**1.25°**	**1°**	**0.5°**
FF-50, MS-75	**2 nm**	0.00069 - 416	0.001 -600	0.0016 - 937	0.0065 – 3,748
FF-50, MS-75	**5 nm**	0.00029 - 166	0.0004 - 240	0.00062 - 375	0.0026 – 1,500
FF-50, MS-75	**8 nm**	0.000174 - 104	0.00025 - 150	0.00039 - 234	0.0163 – 936

[1] All values are in cd/m^2.

[2] Values listed are for A-TAKT high speed mode measuring a white LED.

A-TAKT V-7HS Sample Area Coverage [1, 2]

		Aperture			
Objective Lens	**Spot Size**	**1.5°**	**1.25°**	**1°**	**0.5° [3]**
FF-50	5.0			299.1	299.1
	5.5			316.9	316.9
	6.0			335.2	335.2
	6.5			353.5	353.5
	7.0			371.9	371.9
	7.5	299.0	335.2	390.3	390.3
	8.0	310.4	350.1	396.3	396.3
	8.5	328	364.4		
MS-75	5.0			451.1	451.1
	7.5	450.9	505.3	588.0	588.0
	8.0	469.0	526.9	615.6	615.6
	8.5	487.0	549.1	643.9	643.9

[1] All dimensions are in millimeters.

[2] Distances are from the front mounting hole (See Envelope Drawing).

Specifications subject to change without notice.

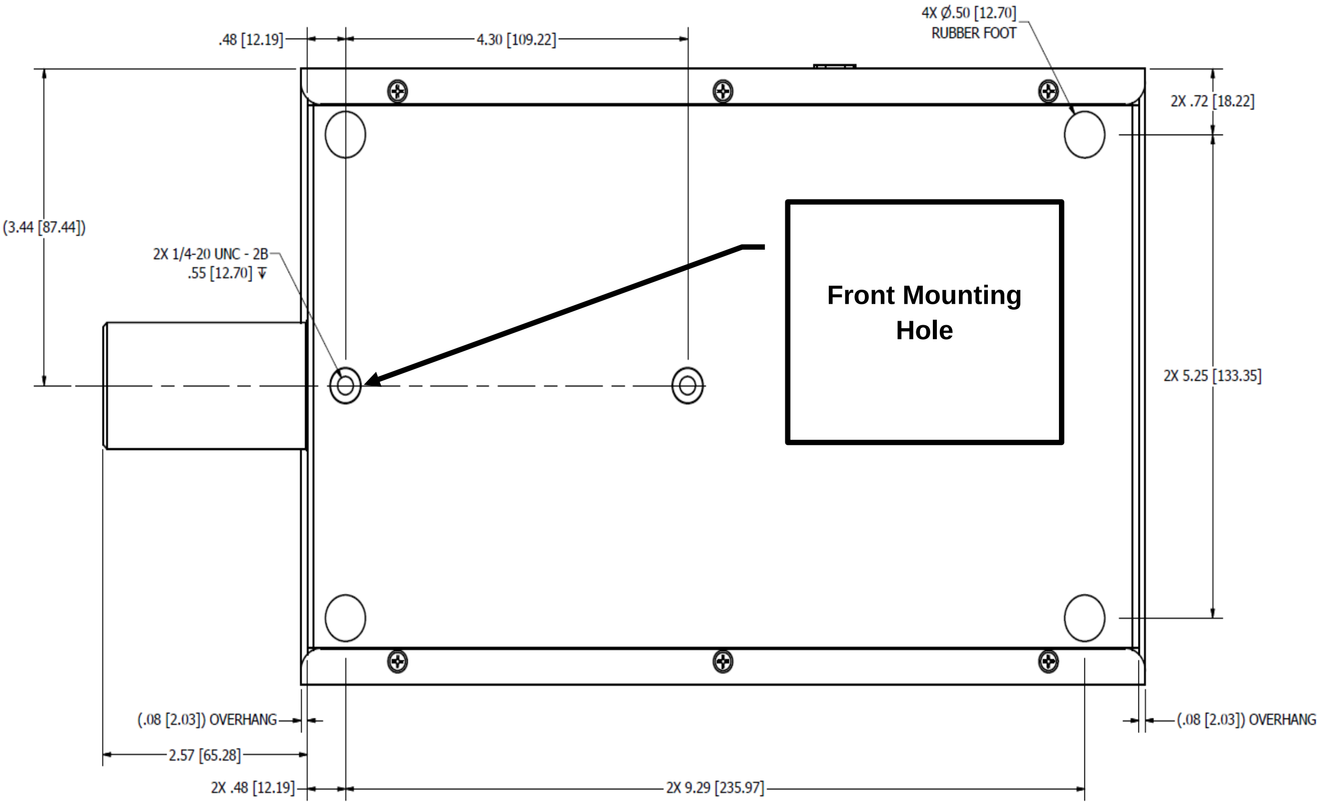


FIGURE 13 - A-TKT V-7HS ENVELOPE DRAWING