# ASD Wavelength Interpolation Guide

## 1 INTRODUCTION

To help gain a better understanding of your ASD FieldSpec and the acquired spectral data it is possible to disable the interpolate to 1nm feature and receive the data with its sampling interval intact. This is also necessary if you wish to create a new wavelength calibration and recalculate wavelength polynomial coefficients. This guide will show the steps necessary the change the instrument's configuration settings, disable wavelength interpolation, acquire spectra from spectral emission lamps and analyze the data in an Excel spreadsheet including using the existing polynomial coefficients to calculate the wavelength scale.

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# 2 Disable Wavelength Interpolation

The configuration file (ASDCFG.INI) for the ASD Field Spec has three flags to enable or disable the Interpolate feature. These flags are located towards the end of each Detector's settings, *VInterpolate* for the visible NIR detector up to 1000nm, *S1Interpolate* and *S2Interpolate* for the SWIR-1(1000-1800nm) and SWIR-2 (1800-2500nm) detectors respectively.

## 2.1 Modify the ASDCFG.INI File

- Locate the ASDCFG.INI file for your field spectroradiometer, FS3 or above. This is usually saved in the Program Files\ ASD\ RS3 directory.
- Save a backup copy of this file before proceeding.
- Use text editor (eg Notepad) to change the interpolated data flags from True to 0 (False) for each of the three detectors, VInterpolate=0 S1Interpolate=0 S2Interpolate=0

```
[ASDCFG.INI]
Version=5.5

[INSTRUMENT]
SerialNumber=160XX
CalibrationNumber=1
Detectors=3
StartingWavelength=350
EndingWavelength=2500
InstrumentType=13
InstrumentHours=815
InstrumentMinutes=19
OptType=2
IOType=Net
AutoConnect=True
IPAddress=10.1.1.77
IPPort=8080
NetCommand=0
Wifi=1
EnableTrigger=1

[DETECTOR1]
DetectorType=vnir
StartingWavelength=350
EndingWavelength=1000
RealChannels=512
UseLinear=0
CalWavelengthStart=1
CalWavelengthStep=1
CalStartingWavelengthBlockV=307.226174005785
CalWavelengthStepBlockV=1.44494125697899
DeltaStepBlockV=-2.12775453561614E-05
DeltaSquareStepBlockV=-4.24214907170748E-08
DriftChannelStart=1
DriftChannelCount=5
StartingIntegrationTimeIndex=2
MaxIntegrationTimeIndex=3
DarkCurrentCorrection=0
DarkSampleCount=25
Interpolate=True
Vertex=673
MinIntegrationTimeIndex=0

[DETECTOR2]
```

**NOTE:**

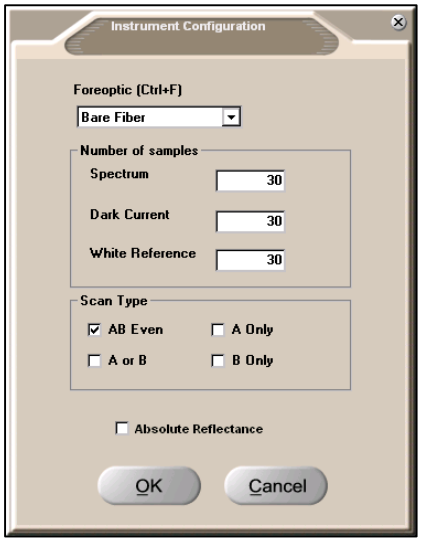
Any changes to the ASD configuration file MUST BE "downloaded" from the PC into the instrument's memory using the "Net Configuration" tool.

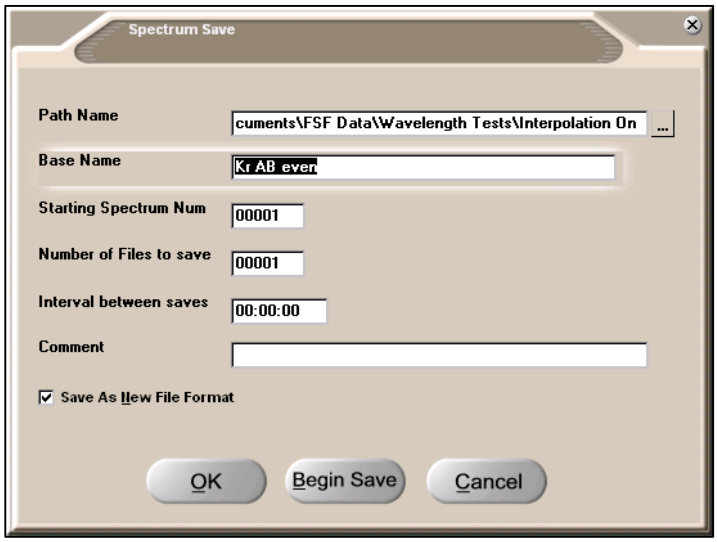
Refer to Section 4 for guidance on using the Net Configuration tool.

## 2.2 Acquire Interpolation Free Data

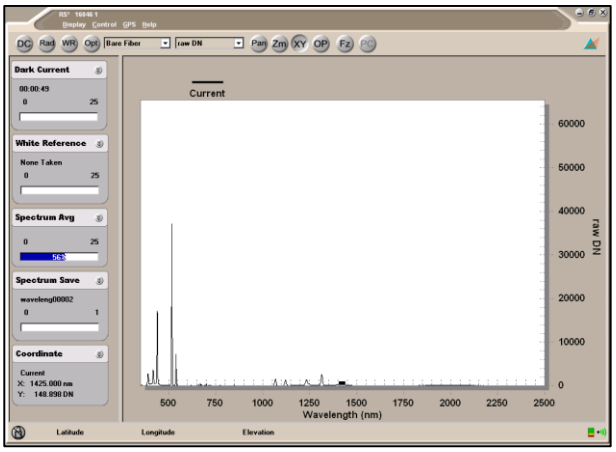
This demonstration uses emission lamps to acquire spectral data for demonstration and analysis.

- Setup the FieldSpec with the fiber viewing a Mercury-Argon spectral line lamp. Take great care to avoid any exposure to UV light and ozone gas.
- Start RS3 application, Optimize integration time and gain settings.
- Open Instrument Configuration dialog and set the Number of samples to 30 for each measurement.

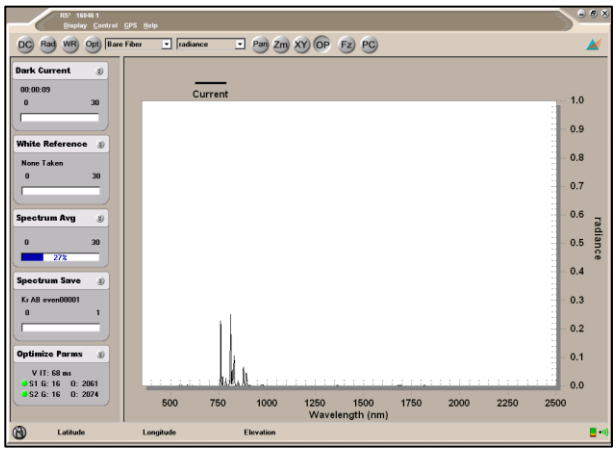



- **Change Scan Type to "A only".**
- Open Spectrum Save dialog and set and Path, Base Name etc.
- Collect and save spectral data for Hg-Ar lamp.
- Change Instrumentation / Scan Type to "B Only", collect and save spectral data (Optional Measurement)
- Repeat "AB Even" and "A or B" Scan types.(Optional Measurements)
- Replace Hg-Ar lamp with Argon and Krypton lamps. Repeat measurements as per Hg-Ar lamp.




*Hg-Ar Spectral Line Lamp*




*Argon Spectral Line Lamp*

## 2.3 RESET THE ASDCFG.INI FILE AND FIELDSPEC SETTINGS

- Re-instate the Interpolated True flags in the ASDCFG.INI files and download to the instrument using the Net Configuration tool –ref Section 4
- Open the RS3 application, change the Measurement Type to AB Even and acquire interpolated spectral data of the emission lamps for comparison – ref "ASD Wavelength Interpolation and Polynomials" Excel spreadsheet.

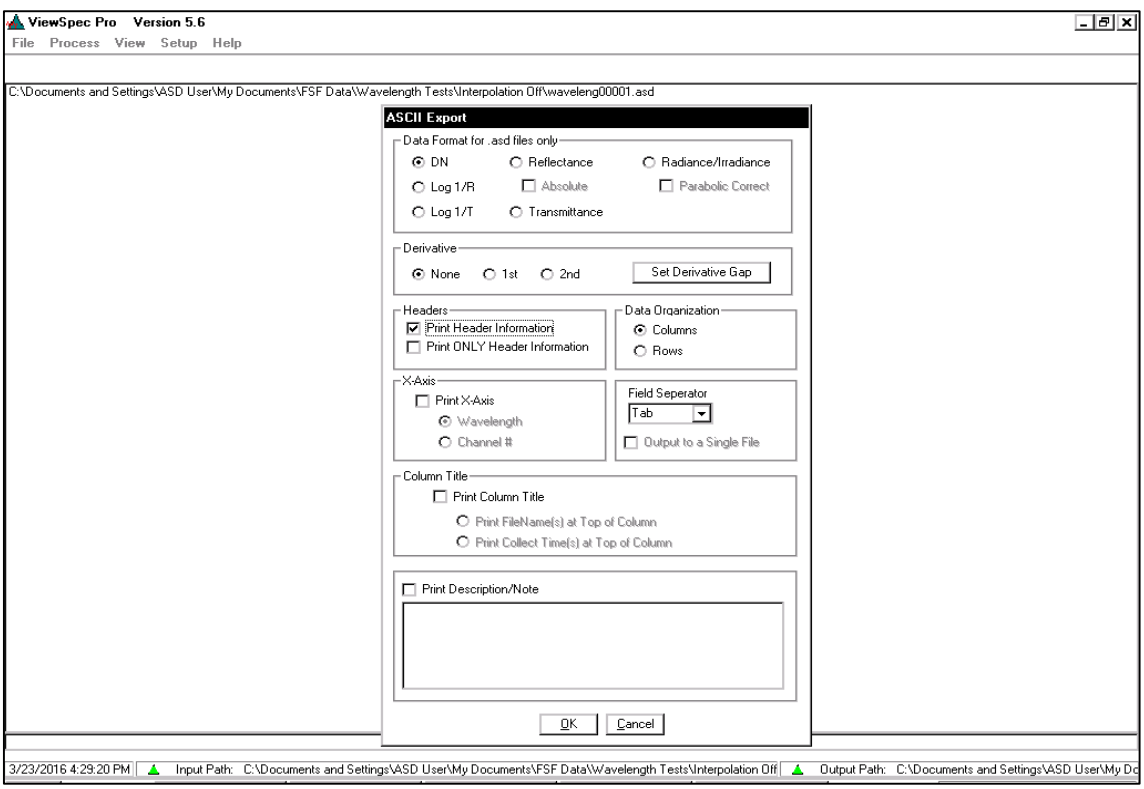
# 3 USE POLYNOMIAL COEFFICIENTS TO CALCULATE 'PIXEL' CENTERED WAVELENGTH SCALE

Spectral data files with data interpolation disabled do not have the correct wavelength markers for each data point but instead have the default integer markers 350 – 2500. It is necessary to calculate a wavelength scale based on the polynomial coefficients stored in the ASDCFG file for each Detector (spectrometer). The FSF Excel spreadsheet *ASD Wavelength Interpolation and Polynomials.xlsx* details the calculations required for this. Note however that Detector 2 and 3 (SWIR-1 and SWIR-2) have two sets of wavelength coefficients for "Block A" and "Block B". The spreadsheet only shows the calculations for Block A coefficients for Scan Type ***A Only*** data.

## 3.1 CONVERT ASD BINARY DATA FILES TO ASCII FORMAT FILES

ASD spectral data files are saved in a binary format together with header information. Some applications can view this data directly but Excel spreadsheets require the data to be converted into an ASCII text file before importing. ASD's ViewSpec Pro application provides a simple tool for this conversion.

- Open ASD data file in ViewSpec Pro and open each of the (non-interpolated) spectral data files for the spectral lines lamps.
- Use the Process/ASCII Export to create an ASCII text file from each ASD file.



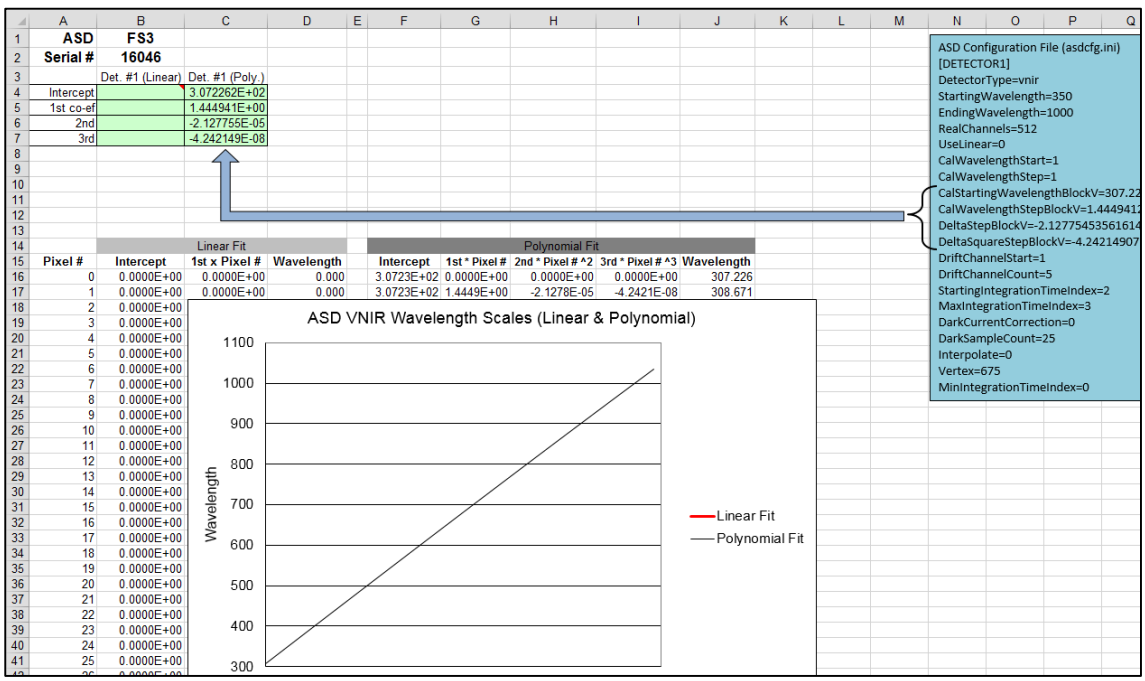
## 3.2 Wavelength Interpolation & Polynomial Spreadsheet

This Excel spreadsheet is used to demonstrate the calculations necessary to generate a wavelength scale from the polynomial coefficients and generate full range spectra showing the overlapped regions and switching points between VNIR and SWIR-1 and SWIR-1 and SWIR-2.

- Open the "ASD Wavelength Interpolation and Polynomials" Excel spreadsheet and copy and paste the wavelength polynomial coefficients for each detector into their respective worksheets cells C4 to C7 as shown.

A wavelength scale for the non-interpolated data will be calculated for the VNIR, SWIR-1 and SWIR-2 spectrometers. The switch from Detector 1 (VNIR) to Detector 2 (SWIR-1) and Detector 2 to Detector 3 is listed in the header part of the data file. Typically this is 1000 and 1800nm respectively.

- Use Excel to open each of the ASCII data files (Tab Delimited) created by ViewSpec Pro. Copy the two columns of data from the non-interpolated files into columns AB of their respective worksheets.
- Copy the two columns of the interpolated data files into columns AD and AE of their respective worksheets.




The interpolated and non-interpolated data can now compared. This process will also allow new wavelength coefficient to be calculated to re-calibrate the wavelength scales of the spectroradiometers. Note however, that SWIR-1 and SWIR-2 have two sets of coefficients for Type A and B scans.

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**Interpolated Data Off**

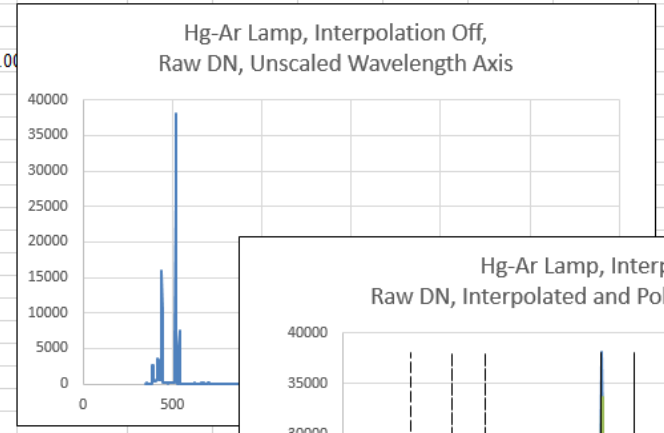
Text conversion of header file \1_FSF Projects\2016\Disable ASD Wavelength Interpolation\Data\Hg-Ar A only00000.asd

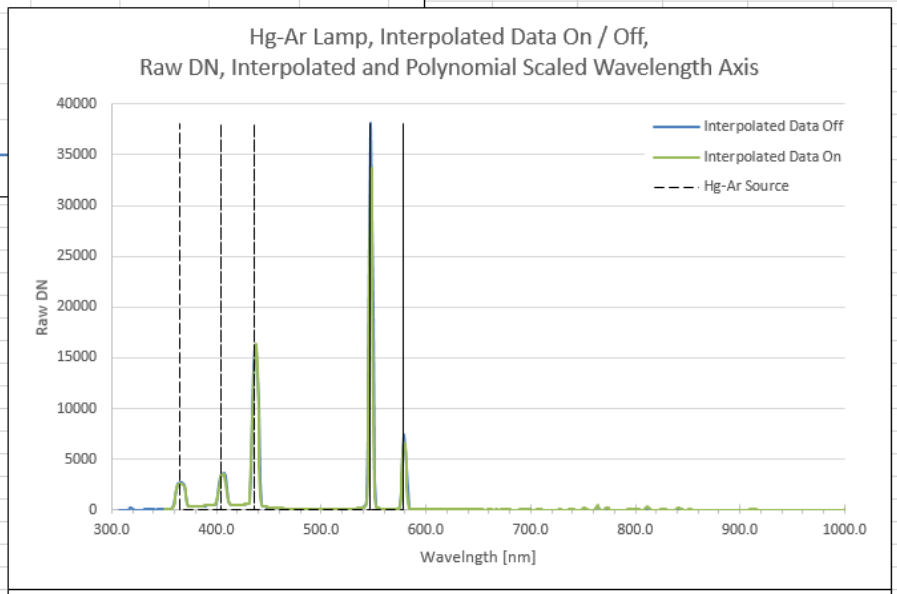
---

The instrument number was 16046/1
New ASD spectrum file: Program version = 5.06 file version = 7.0
Spectrum saved: 03/24/2016 at 10:20:28
VNIR integration time : 68
VNIR channel 1 wavelength = 350 wavelength step = 1
There were 25 samples per data value
xmin = 350 xmax= 2500
ymin= 0 ymax= 65535
The instrument digitizes spectral values to 16 bits
SWIR1 gain was 16 offset was 2063
SWIR2 gain was 16 offset was 2067
**Join between VNIR and SWIR1 was 1000 nm**
**Join between SWIR1 and SWIR2 was 1800 nm**
VNIR dark signal subtracted
25 dark measurements taken Thu Mar 24 17:20:09 2016
DCC value was 0
Data is not compared to a white reference
There was no foreoptic attached
Spectrum file is raw data with embedded reference
GPS-Latitude is S0
GPS-Longitude is E0
GPS-Altitude is 0
GPS-UTC is 00:00:00

Smart Detector
Serial# 0
Signal (A) 0.000E00
Dark (A) 0.000E00
Ref (A) 0.000E00
Status 0 - Uninitialized
Gain E-4
Averaging 0
Temp (C) 0.0
Humid (%) 0.0

| Wavelength | Hg-Ar A only00000.asd | Data # | Wavelength | Raw DN |
|---|---|---|---|---|
| 350 | 0.400024 | 0 | 307.2 | 0.400024 |
| 351 | 1.400024 | 1 | 308.7 | 1.400024 |
| 352 | 0.400024 | 2 | 310.1 | 0.400024 |




Hg-Ar Lamp, Interpolated Data On / Off,
Raw DN, Interpolated and Polynomial Scaled Wavelength Axis

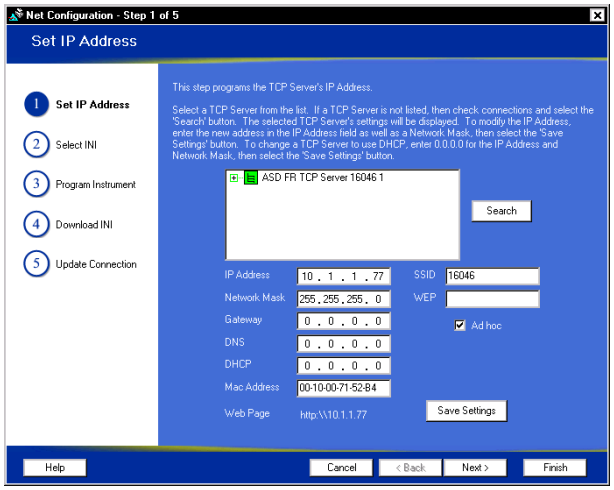
ASD VNIR Wavelength | ASD SWIR-1 Wavelength | ASD SWIR-2 Wavelength | **Hg-Ar A only** | Ar A only | Kr A only

# 4 FIELDSPEC'S INTERNAL MEMORY CONFIGURATION SETTINGS

The ASD FieldSpec is supplied with various factory settings and calibration files including the ASDCFG.INI file. This includes information on the wavelength calibration polynomials and switches to enable or disable the Interpolate feature for each of the Detector channels. The default settings is for all spectral data to be interpolated to a 1nm interval. It is also possible to modify the configuration file, for example to update or change the wavelength calibration coefficients but these changes have to be DownLoaded to the instrument using the ASD Tools for the changes to apply.

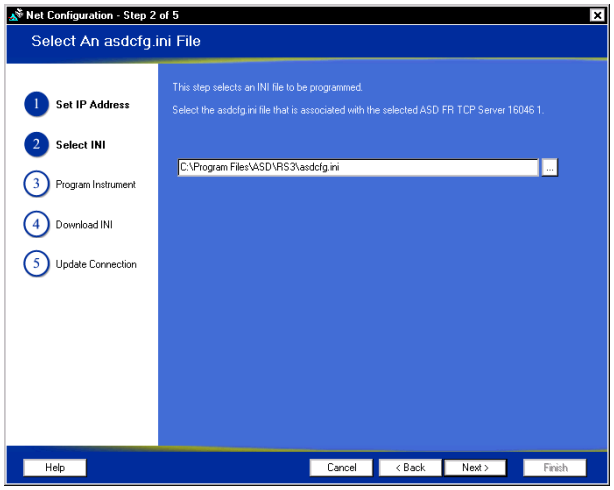
Before making any changes it is wise to back up the ASDCFG.INI file and to UpLoad and copy the instrument's internal configuration settings.

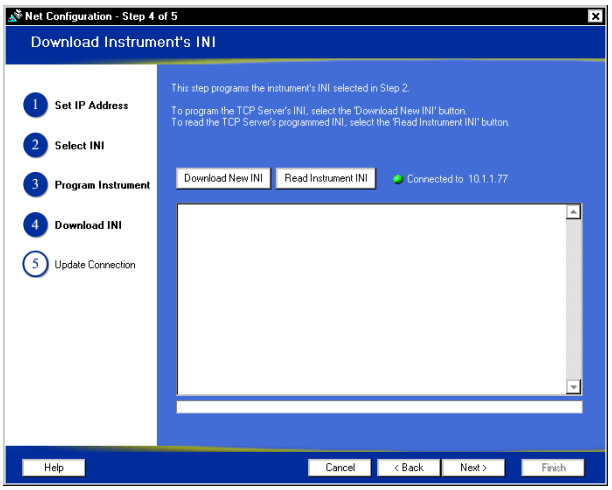
- Switch on the FieldSpec. Ensure the RS3 application is closed.
- Open the Net Configuration tool. (Note the "Instrument Configuration" tool will always reset the Interpolate flag to 1 (True).
- Allow a few seconds for the program to locate the instrument through WLAN or LAN.



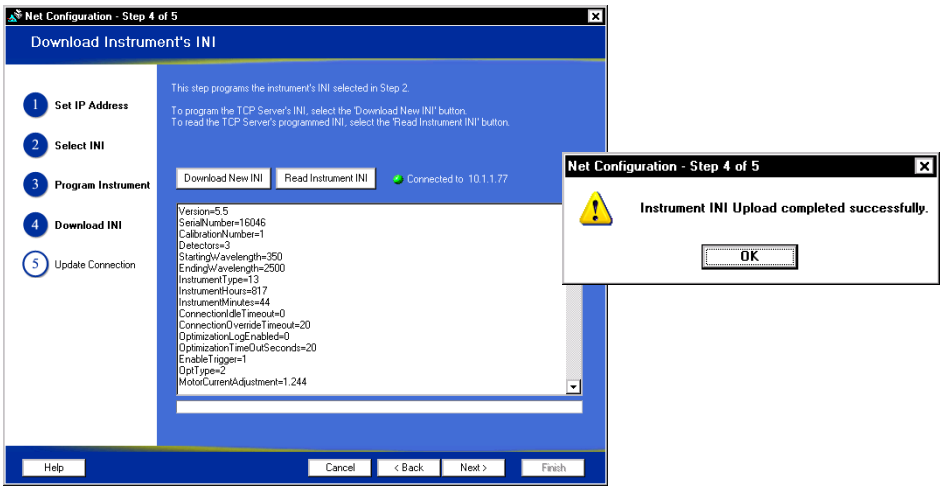

## 4.1 READ AND COPY INSTRUMENT'S INTERNAL CONFIGURATION SETTINGS

- Click next to advance to Step 2 of 5 and browse to the directory with the ASDCFG.INI file.



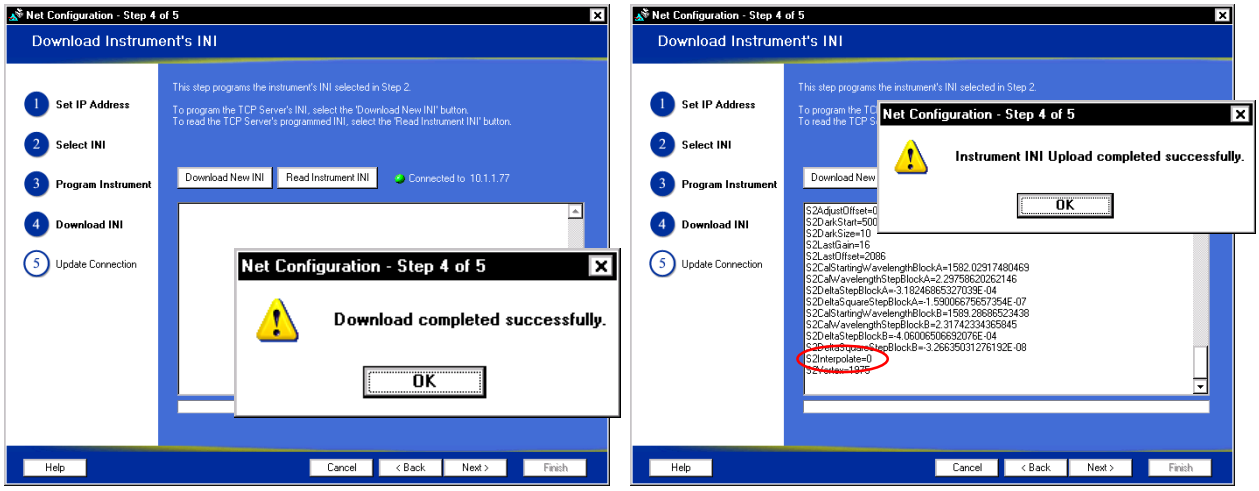
- Click Next twice to skip Step 3 and advance to Step 4.
- Click “Read Instrument INI” to Upload the configuration settings stored in the instrument to the computer.




- Close “Instrument INI Upload ….” dialog and select and copy the configuration values shown in the Net Configuration text window.
- Open a text editor, paste save the configuration settings as a backup copy.
- Close and restart the Net Configuration Tool.

## 4.2 Download New Instrument INI Configuration Data

- Repeat Steps 1 to 4 above.
- Click "Download New INI" button to download instrument ASDCFG.INI data into the instrument.




- Check the New CFG Data has been successfully installed by clicking on “Read Instrument INI” button and scroll to each of the Interpolate flags to ensure they are set to 0 (False)
- Click Next to Advance to Step 5 and Finish to exit the tool.