HR1 – high resolution spectrometer

Weight:	1400 grams
Dimensions:	224 mm x 122 mm x 59 mm
Detector:	Toshiba TCD1304AP linear array
Detector range:	200 – 1100 nm
Pixels:	3648
Pixel size:	8 µm x 200 µm
Pixel well depth:	100,000 electrons
Signal-to-noise ratio:	300:1
A/D resolution:	14 bit
Fiber optic connector:	0.39 NA, 600 µm Core SMA Connectors Multimode
Wavelength	774.8 – 827.8 nm with 1800 gr/mm diffraction grating(1)
Optical resolution:	0.2 nm with 50 µm slit(1)
Exposure time:	2.5 ms – 10 s
CCD reading time:	14 ms
Power consumption:	200mA @ 5V from USB interface
Onboard memory capacity:	64 spectra
Data transfer speed:	200 ms / 100 ms (2 points binding)
Trigger:	3 modes
Computer interface:	USB 2.0, HID 2.0
Operational system:	Windows 98/Me/XP/Vista
Software:	application software, driver, LabView software, examples

Hardware:	USB cable, 1 meter optical fiber with SMA connectors

(1) Spectral range and spectral resolution can be customized

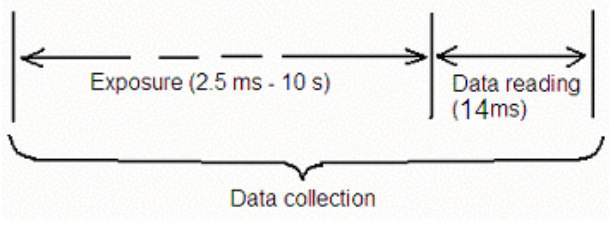
Most typical spectral ranges and resolutions:

Spectral range (nm)	Diffraction grating (gr/mm)	Resolution with 50 μ slit (nm)
600	300	1.8
320	600	0.8
130	1200	0.4
53	1800	0.2
40	2400	0.15
27	3600	0.1

Trigger options

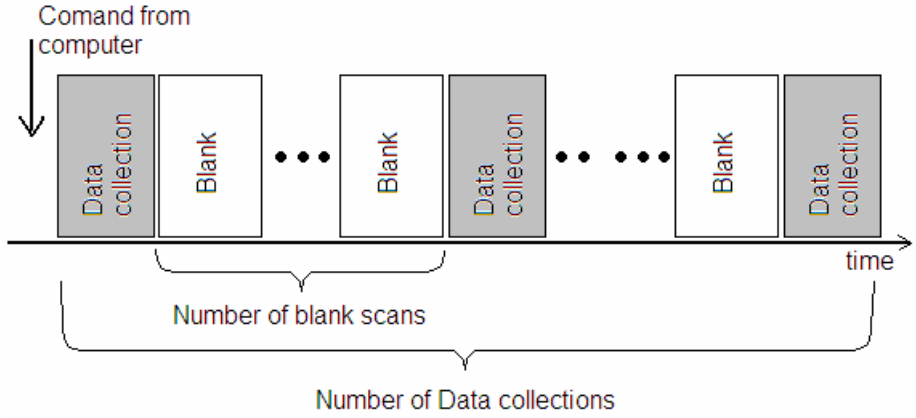
HR1 spectrometer has internal memory SRAM. Memory is able to store 64 collected spectra.

Data collection consists of two stages: exposure and reading and transferring to onboard memory SRAM. Data reading and transferring takes 10 ms.



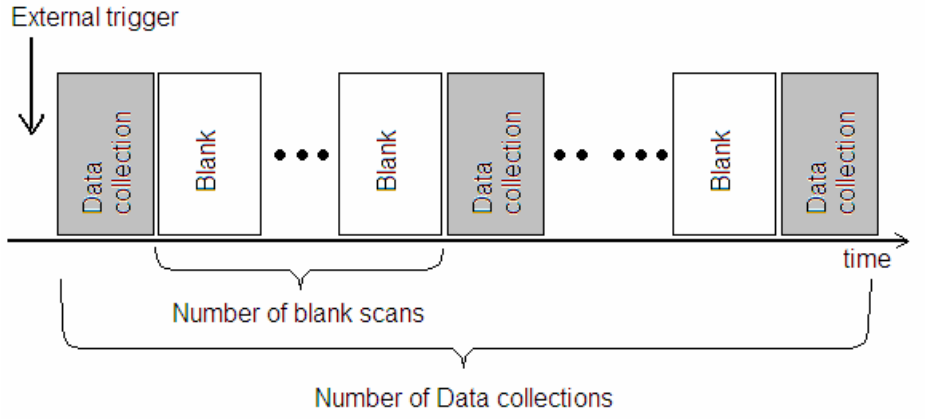
There are three trigger modes available:

a) Data is acquired after getting command from computer without external trigger.

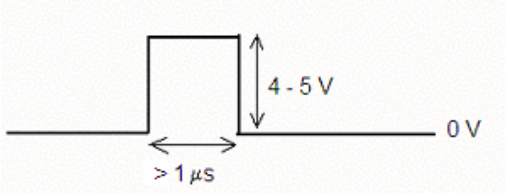


Data collection events are specified. Data collection events are separated by specified equal amount of Blank scans. Blank scan is identical to the real Data collection scan except data is not stored in device onboard memory.

b) Data is acquired after external trigger

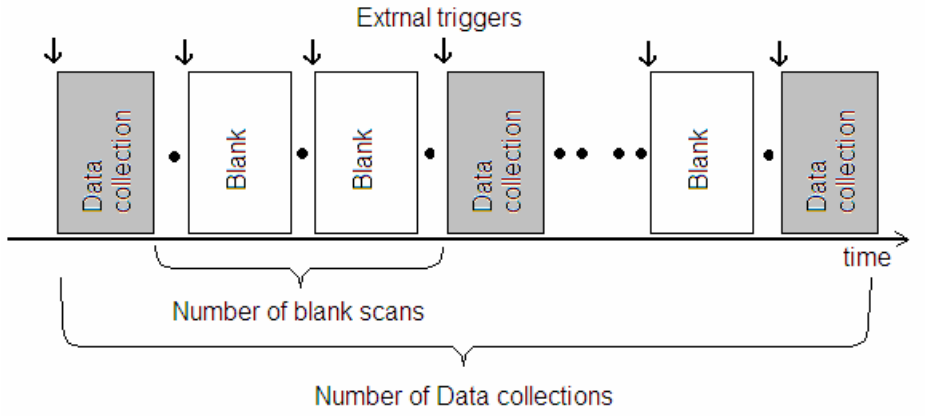


External trigger specifications: TTL pulse, amplitude: 4 – 5 V, minimum duration: 1µs.



This trigger mode can be used to detect system temporal response on some event synchronized with external trigger.

c) Every spectra is collected after external trigger



Application software (included in standard configuration)

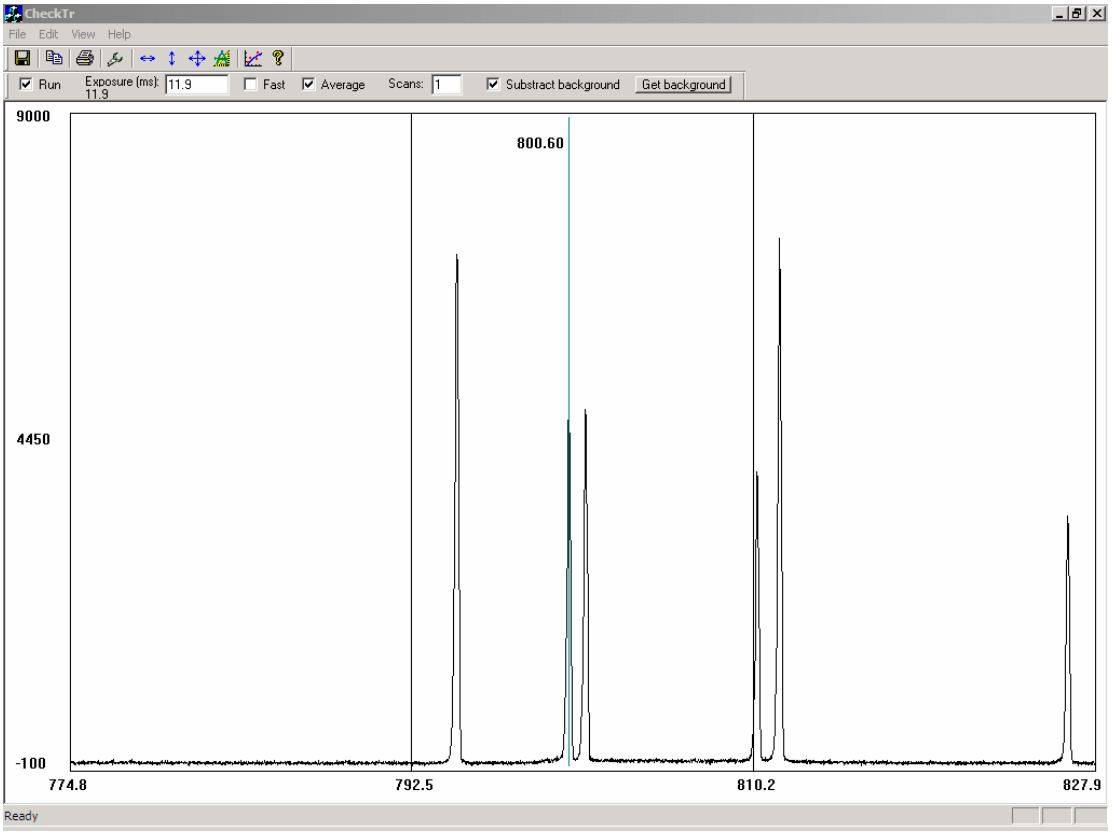
Connection

HR1 is recognized by Windows operational system as standard HID device. That is why there is no need to install any special drivers to use HR1 spectrometer.

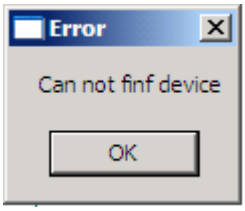
Operational system recognizes device after spectrometer has been connected to USB port. As usually it takes less that one minutes. In the end of this process windows shows message on the Toolbar that device is installed and ready to use.

It is possible to start “CheckTr.exe” program as soon as device is recognized by operational system.

After program is started it reads configuration information including calibration information from spectrometer FLASH memory. Typical view of the program main window:



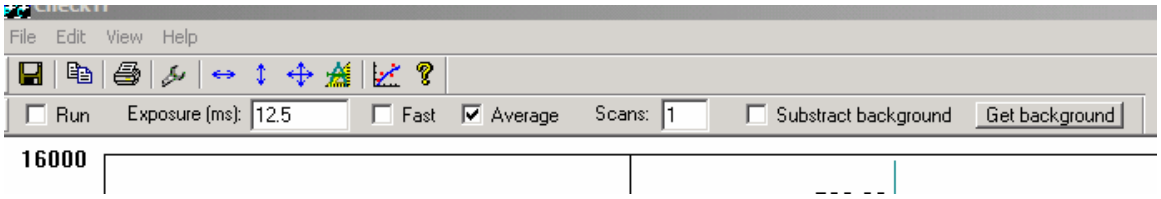
If software can not recognize connected device it shows Error message:

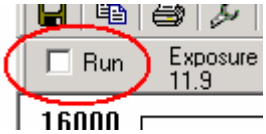


If so check connection and version of the USB port on your computer.

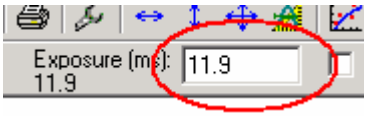
Toolbar

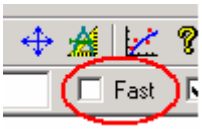
Toolbars contains functions to set data acquisition parameters and save data.



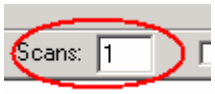
To start data collection check Run: 

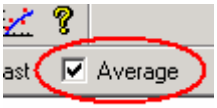
To stop data collection uncheck it.

Exposure time (in ms) is set: 

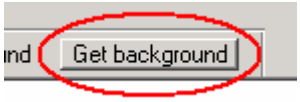
To increase speed of spectral data transfer and plotting to computer check: 

It causes transfer one out of every two consecutive spectral data points. Uncheck it to return to normal data transfer.

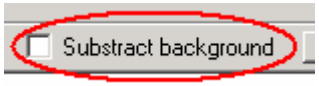
To set number of data collections (ref. Trigger options): 

It is possible to plot averaged spectra to increase Signal to Noise ratio: 

All spectra specified in “Scans” are plotted if this Check Button is unchecked.

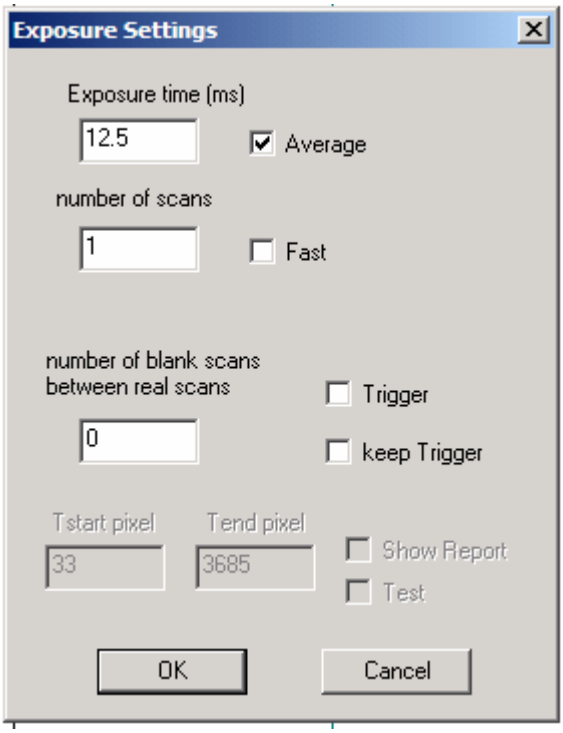
Push “Get background” 

to acquire Background. (We recommend to use average several spectra to get Background with better Signal to Noise level).

It is possible to subtract acquired background: 

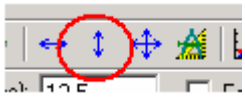
Push “Settings” 

To set exposure parameters and trigger mode. It calls dialog window “Exposure Settings”:

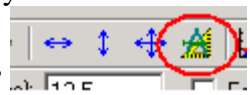


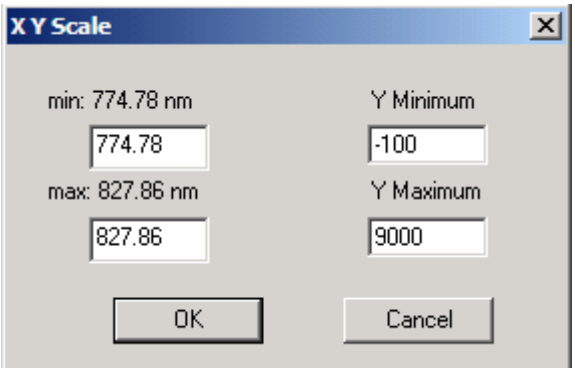
It duplicates controls described previously: “Exposure time”, “Number of scans” (the save as “Scans”), “Fast”. It has control Box to specify “number of blank scans between real scans” (see Trigger options). Combination of Check Buttons “Trigger” and “Keep trigger” sets one of three trigger options. It sets first trigger regime (no trigger) if both Check buttons are uncheck. If “Trigger” is checked and “keep Trigger” is unchecked it selects second trigger mode. If both Boxes are checked it selects third trigger mode.

Button “x autoscale”  sets horizontal wavelength scale to its maximum values

Button “y autoscale”  sets vertical intensity scale to the minimum and maximum of current acquired data.

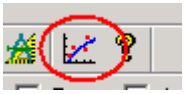
Button “x and y autoscale”  is a combination of previous two.

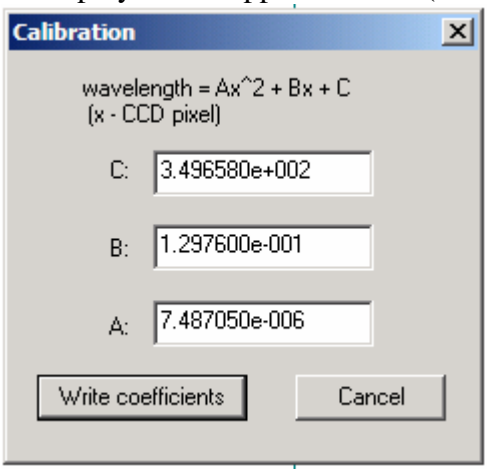
Button “scale”  calls dialog window to set vertical and horizontal scale:



(Note: Picture is representative. Minimum and maximum wavelengths presented here can be different for each device)

The same dialog windows can be called by double clicking on the vertical or horizontal scale of the main window.

"Calibration" button  calls Dialog window. It allows writing new calibrations coefficients (A, B, C) into the FLASH memory of spectrometer. Calibration is done based on third order polynomial approximation (wavelength = Ax^2+Bx+C, where x – CCD pixel number).

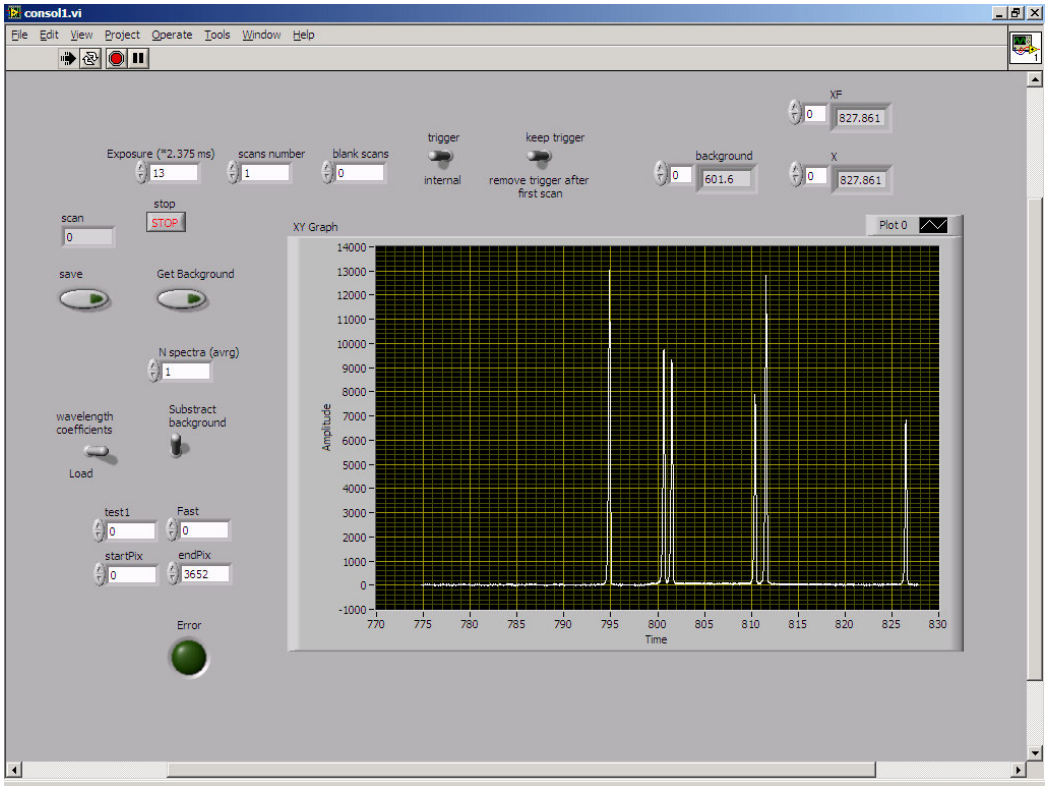


(Note: Picture is representative. Calibration coefficients presented here can be different for each device)

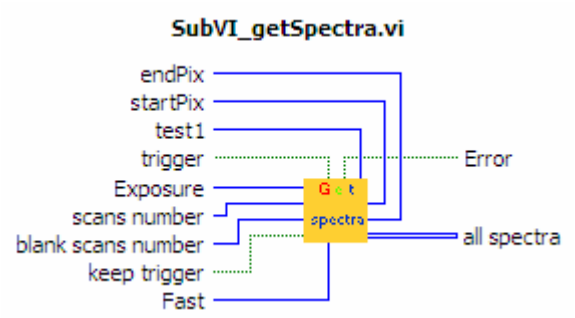
WARNING!!! Old coefficients are lost as soon as new coefficients have been written in to FLASH memory.

LabView software (included in standard configuration)

Save included “adcDLL_xxxx.dll” file in the directory you want.
After first run of the subVI LabView will try to find location of “adcDLL_xxxx.dll” file and will ask user to specify it. Specify path to the “adcDLL_xxxx.dll” file. Initially it sets to C:\CLR1\adcDLL_xxxx.dll. It is not necessary to specify path to the “adcDLL_xxxx.dll” file if this file is saved in the “C:\CRL1” directory.



Get Spectra subVI

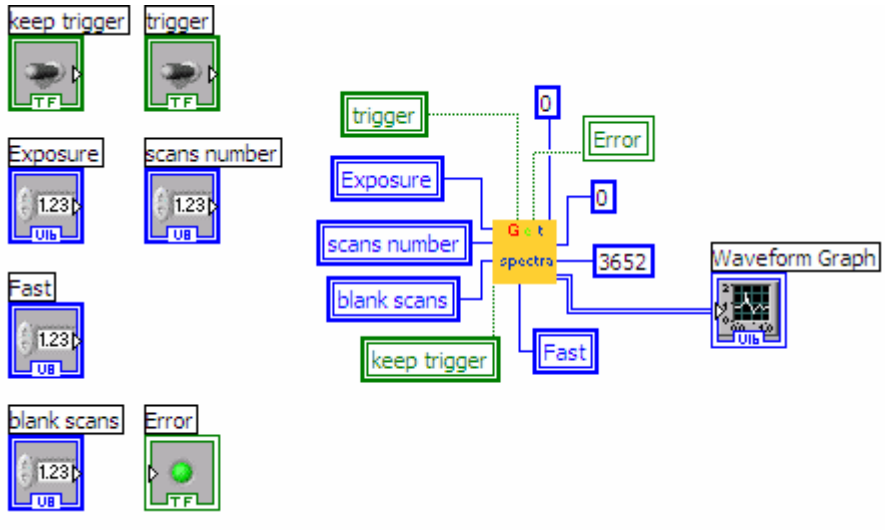


Parameters can be changed:
“Exposure” – exposure time. Equals to Exposure of the device in millisecond divided by 2.375 ms.
“scans number” – number of data collections (see “Trigger options” section);
“blanc scans number” – number of blanc scans between each data collection (see “Trigger options” section);
“trigger” – use trigger option (see “Trigger options” section);
“keep trigger” – if false data is acquired after external trigger (mode b), see “Trigger options” section). If true every spectra is collected after external trigger (mode c), see “Trigger options” section). Parameter is valid if parameter “trigger” = true.

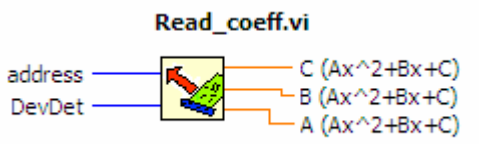
"Fast" – increase speed of spectral data transfer if 1. It causes transfer one out of every two consecutive spectral data points. If 0 – normal mode.

Parameters should be kept as it set by default:
"endPix" equal to 3652,
"StartPix" equal to 0,
"test1" equal to 0.

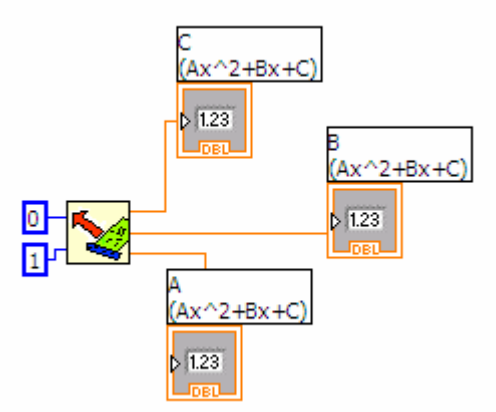
Typical diagram to acquire and read specified number of spectra in specified regime:



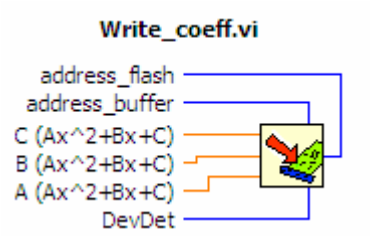
Read Calibration coefficients



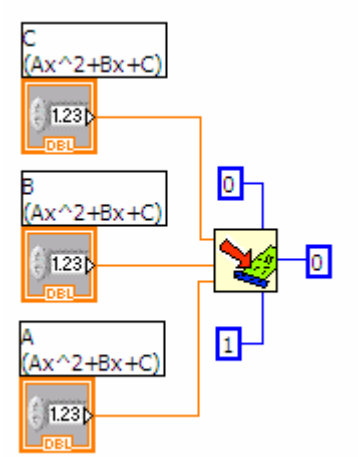
Keep parameter "address" equal to 0 and "DevDet" equal to 1.
Typical diagram to read calibration coefficients A, B, C (wavelength = Ax^2+Bx+C, where x – CCD pixel):



Write Calibration coefficients



Keep parameter “address_flash” and “address_buffer” equal to 0 and “DevDet” equal to 1.
Typical diagram to write calibration coefficients A, B, C (wavelength = Ax^2+Bx+C, where x – CCD pixel):



WARNING!!! Old coefficients are lost as soon as new coefficients have been written in to FLASH memory.

General Dimensions

(millimeters [inches])