

APPLICATION NOTE



NIKIRA LABS – AN05 - OEA

App Note Series: Optical Extinction Analyzers

Interfacing the OEA Analyzer with a Campbell Scientific Data Logger

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Introduction

In many situations, the Nikira Labs Optical Extinction Analyzer (OEA) will be used in conjunction with a suite of other air quality monitoring devices. Often, a Campbell Scientific Data Logger (e.g., CR1000 or CR6) is used to log and aggregate the data output from all of these devices into a single data record. In this brief Application Note, we show how the OEA RS-232 serial output can be easily connected to a Campbell Scientific Data Logger and the data stream recorded into a user-defined data record.

Hardware Connections

The OEA has a single USB output on the side panel. When the provided USB → RS-232 adapter cord is connected to the instrument *prior* to starting the analyzer, the OEA will automatically output a serial data stream via the RS-232 cable. This cable can then be connected to the Campbell Scientific Data Logger via a suitable cable (e.g., Campbell Part #17855 or #31056). It is important to note the following:

- The provided USB-to-RS-232 cable must be connected *prior* to powering the OEA unit. If the cable needs to be connected during a run, please connect the cable first and then restart the OEA unit.
- If you intend to use other USB peripherals to access the instrument (e.g., USB thumb drive for data transfer or mouse/keyboard for interfacing), you are advised to connect a USB splitter to the OEA USB port, then connect the USB-to-RS-232 cable prior to starting the analyzer.

A typical interfacing diagram is shown in Figure 1. The OEA USB port is connected to 4:1 USB splitter. One leg of the splitter is connected to the provided USB → RS-232 cable. The RS-232 end of this cable is then connected to the Campbell Scientific CR6 Data Logger via the Campbell Part #31056 cable.

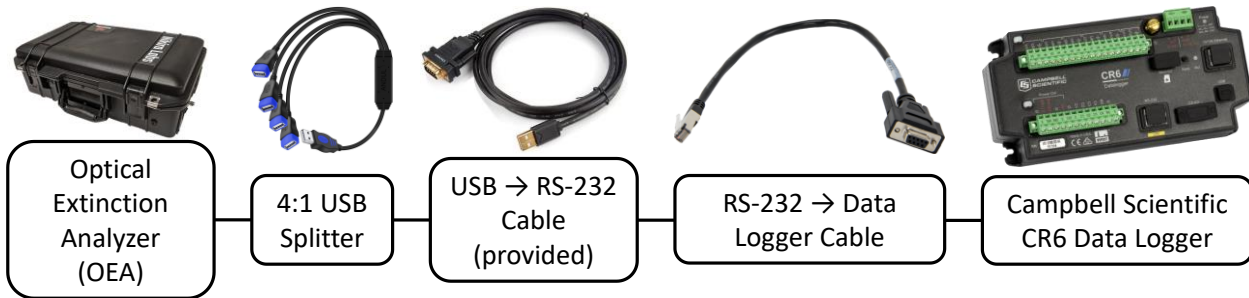


Figure 1: Interfacing diagram for connection of the Optical Extinction Analyzer (OEA) to a Campbell Scientific Data Logger CR6.

Data Logger Software

The serial output stream from the OEA includes 9 comma-separated values. A sample output is shown below:

```
20210825-151658,63.02,47.54,45.5,22.86,22.96,8.6178,3.8573,Closed
```

These values are:

1. The timestamp from the OEA in YYYYMMDD-HHMMSS format
2. The measured extinction coefficient in Mm^{-1} .
3. The meteorological optical range in km.
4. The relative humidity calculated from the temperature and humidity at the computer.
5. The inlet temperature in $^{\circ}C$.
6. The outlet temperature in $^{\circ}C$.
7. The cavity ringdown time in ms.
8. The purge flow rate in SLPM.
9. The cavity state.

The serial settings are:

Baud Rate	115200
Parity	None
StopBits	1
ByteSize	8

As noted in detail in the “Campbell Scientific Data Logger Manual” document, the Data Logger can be programmed to log and save these serial values. A sample program is included on the next page for reference.

```

Public PTemp, Batt_volt
Public RawString As String * 1000
Public SplitStrings(9) As String * 16
Public OEATime As String
Public Visibility As Float
Public MOR As Float
Public RH As Float
Public Tin As Float
Public Tout As Float
Public RDT As Float
Public FR As Float
Public State As String

DataTable (Test,1,-1) 'Set table size to # of records, or -1 to
autoallocate.
    DataInterval (0,1,Sec,10)
    Minimum (1,batt_volt,FP2,False,False)
    Sample (1,PTemp,FP2)
    Sample (1,OEATime,String)
    Sample (1,Visibility,Float)
    Sample (1,MOR,Float)
    Sample (1,RH,Float)
    Sample (1,Tin,Float)
    Sample (1,Tout,Float)
    Sample (1,RDT,Float)
    Sample (1,FR,Float)
    Sample (1,State,String)
EndTable

BeginProg
    SerialOpen (ComRS232,115200,0,0,10000)
        Scan (1,Sec,0,0)
            PanelTemp (PTemp,15000)
            Battery (Batt_volt)

```

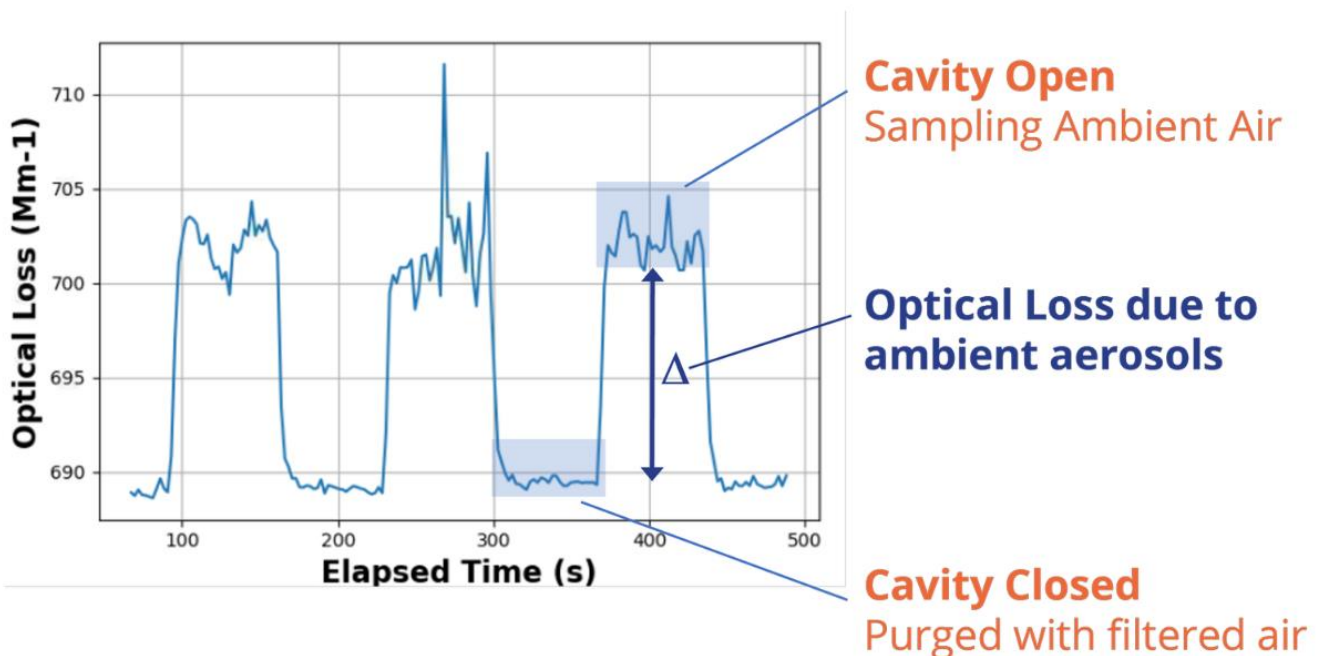
```
SerialIn (RawString,ComRS232,1,CHR(13),1000)
SplitStr (SplitStrings(),RawString,",",9,5)
OEATime = SplitStrings(1)
Visibility = SplitStrings(2)
MOR = SplitStrings(3)
RH = SplitStrings(4)
Tin = SplitStrings(5)
Tout = SplitStrings(6)
RDT = SplitStrings(7)
FR = SplitStrings(8)
State = SplitStrings(9)
CallTable Test

NextScan

EndProg
```

How Does the OEA Work?

1. Ambient air is pulled through a duct by fans at a speed of ~ 1 m/s.
2. Open-path cavity ringdown spectroscopy is used to make a direct measurement of the optical extinction coefficient (β) in the sample.
3. The duct is periodically closed and the cell is purged with filtered air to a background measurement.
4. The difference between the open and closed duct values provides a direct, calibration-free measurement of the aerosol optical extinction.



The OEA Harnesses 3 Technologies:

