

NOAA serial data acquisition system

System description

The Data Acquisition System (DAS) is a 1U rack mount server on the rear of the APIMS rack with an 8-port SeaLevel PCIe serial expansion card. The serial ports may be independently configured to RS232/422/485 with the [PortManager](#) app.

The computer runs the NOAA Services suite of data acquisition programs written by Dan Gottas (NOAA/ESRL/PSD), which are briefly described below. For MOSAiC we are using the Data Acquisition and File Manager services. The primary purpose of this computer is logging serial data streams. The secondary purpose is to communicate with and remotely configure sensors mounted on the bow mast.

The computer name, [user name](#) and login [password](#) are all set to [DAS100](#).

The system has two internal 1 Tb SSD drives: [C :](#) has the Windows 10 OS and application software. [D :](#) is where data is stored. But, there's plenty of free space on [C :](#) for data if [D :](#) begins to fill up.

There's a backup 1 Tb clone SSD of the DAS100 [C :](#) drive in the Computer Supplies drawer. If something unrecoverable happens to the system it's possible to install the clone drive to return the system drive to the state at the start of the project. In this case you'll probably need to set up some of the serial acquisition channels in NOAA services again but all other software should be intact and functional. You may also need to reconfigure serial ports and some network settings.

If the computer freezes and you need to do a hard shutdown, hold down the red power button on the 1U box until it quits, then press again to reboot. If problems persist, consider swapping the [C :](#) drive for the clone, or replace DAS100 with the spare 1U computer.

System cabling and keyboard/monitor setup

This computer shares a monitor and keyboard with the Picarro CRDS analyzer. The keyboard and touchpad are in a pull out tray below the APIMS laptop. Double tap the Scroll Lock key on the keyboard to switch between systems. It takes 2-3 seconds so be patient. The VGA and mouse/keyboard USB cables are connected to the KVM switch on the back of the rack.

The serial expansion card has an interface cable with eight DB-9 serial jumpers attached. These are numbered 1-8, for COM11 to COM18.

Network

The computer has two network interface cards. The upper ethernet connector on the rear of the computer goes to a switch on the side of the rack for the bow tower and associated devices. This is an isolated subnet, invisible to the larger ship network. The network settings for this NIC are:

```
Unidentified network
IPv4: 192.168.127.1
```

It may be a good idea to change the base address for the tower network to something other than 192.186 if you encounter problems or funny behavior, since this is the same base address as the ship network. So far we haven't had any problems though.

The other ethernet connection from the lower jack on the rear of the computer is to a switch on the ship network for the Univ. of Colorado VLAN with the addresses in the 192.168.202.xxx range. The settings are:

```
Network 2
IPv4: 192.168.202.106
DNS: 192.168.20.1
     192.168.20.2
```

Remote login is possible to this IP address from anywhere on the ship network using the Microsoft Remote Access app. The project iMac is already set up to do this.

Installed Utility Software

There are a variety of utility apps installed on the computer, including:

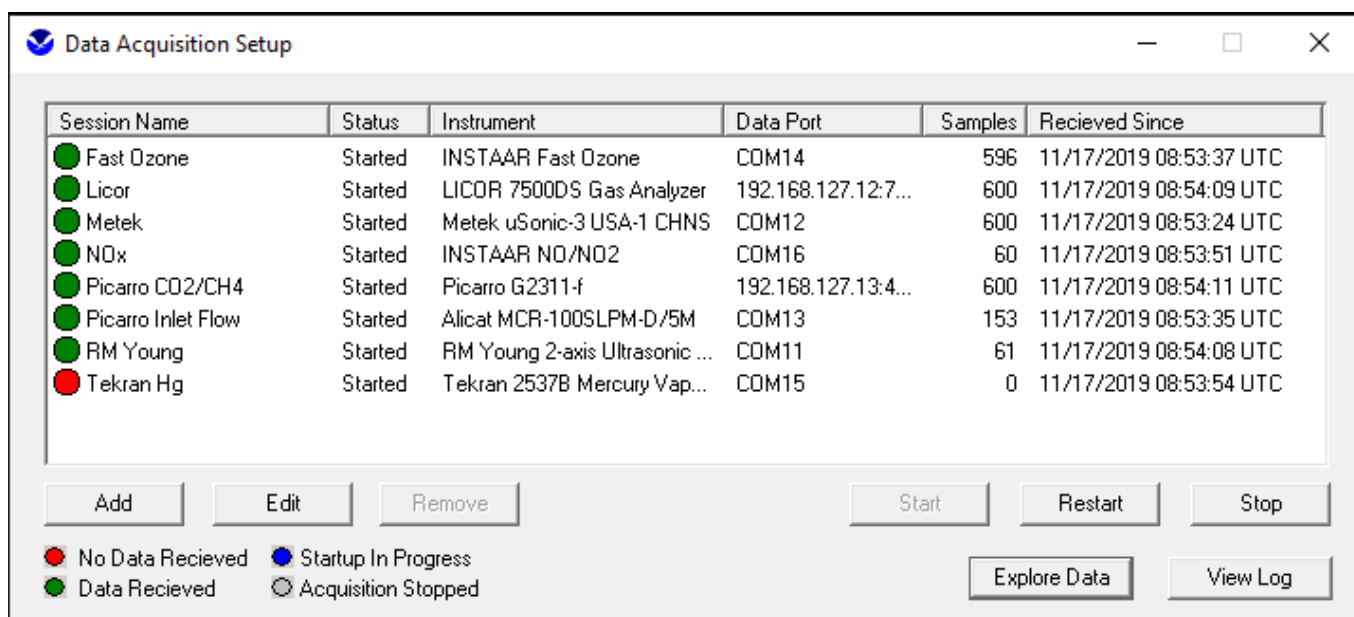
- **NPort Administrator**, for configuring MOXA N-Port serial device servers.
- **uSonicConfig**, for testing and configuring the Metek uSonic 3D anemometer.
- **86SETUP**, for configuring the RM Young 86000 sonic anemometer
- **LI-7x00 A RS DS**, for configuring and testing the Licor 7500DS IRGA
- **LI 7x00 File Viewer**, for looking at 7500DS data files
- **PortManager**, for configuring the 8-port PCIe serial expansion card
- **Putty**, a general purpose comms terminal which doesn't seem to work with the serial ports on this computer, unfortunately
- **Notepad++**, a general purpose programmer's text editor, for looking at ascii data files

- **Matlab R2019a**, for quick plots maybe, but don't do heavy data analysis on the serial data acquisition computer...
- **Anaconda Python v 3.7.3**
- and other stuff...

NOAA DAS setup and operation

The NOAA Services suite consists of **Data Acquisition**, **Clock Sync** and **File Manager**. Data Acquisition is the application we use to log serial data streams. For MOSAIC, DAS is logging 8 separate serial feeds from a variety of sources at a variety of rates. Each acquisition session is programmed as a service in Windows OS, which means data continues to be saved even if you close the DAS app, and acquisition restarts automatically if the computer is rebooted. To halt a session in the Data Acquisition Setup window, highlight the line and press the **Stop** button.

The normal state of the acquisition window is shown below. Each acquisition session is listed showing status, instrument, data port, samples received per minute, and last time the sample total was reported. A Green icon indicates samples have been received within the last minute. In this example the Tekran is Red because it only sends a record at 10 min intervals; so once every 10 min it will be Green. A stopped session is shown with a Gray icon. To edit an existing session double click on the line or highlight the line and hit the **Edit** button.



The following figures show session setup windows for two of the sessions above. The session setup window for the Fast Ozone is shown on the left. The top panel contains required fields that define the serial data acquisition, including the Session Name, Site ID (which will be the first 3 characters in the data file name), model and serial number information for the sensor, Instance Index (which will be the 4th character in the data file name and is used to distinguish between several similar devices such as son0, son1, son2; usually a number from 0 to n), and

Serial Data Acquisition Session Setup

Session Name: Site ID:

Instrument Settings:

Make and Model:

Serial Number: Instance Index:

Port: Data Bits: Stop Bits:

Baud: Parity: Event Byte:

Data Acquisition Settings:

Raw Data

Archive Path:

File Foramt: Data Time Stamping:

Statistics

Archive Path:

Averaging Period: seconds

Disable data archiving during clock synchronization

Data archive blackout period: seconds

File Compression

Compress all data files older than hours

Licor Ethernet Data Acquisition Session Setup

Session Name: Site ID:

Instrument Settings:

Make and Model:

Serial Number: Instance Index:

IP Address: TCP Port:

Chopper Housing Temp (C):

Output Bandwidth (Hz): Sample Rate (Hz):

Data Acquisition Settings:

Raw Data

Archive Path:

File Foramt: Data Time Stamping:

Statistics

Archive Path:

Averaging Period: seconds

Disable data archiving during clock synchronization

Data archive blackout period: seconds

File Compression

Compress all data files older than hours

the specific COM port settings for this acquisition. The other panels are optional information, but we always use the Raw Data setting to define the root path for saving the files, the time length of a file, and if a timestamp should be appended to each line. The Archive Path should already exist. The Statistics option is only available for certain types of sensors.

The second type of session setup window for direct acquisition from a TCP/IP port is shown in the right figure. Most fields are similar, but in this case the IP address and port number are specified. Other options shown here are specific to the instrument type (Licor 7500DS).

The **Add** button on the main window lets you define a new session, in which case you are first presented with the Add Session window where you choose between standard serial or TCP/IP

Add Data Acquisition Session

Instrument Type:

Data Interface: Serial TCP/IP

interface modes and select from a list of instrument types. The Generic ACSII type is used for any type of serial data stream, like the fast ozone above, while the specific instrument types in the drop down list offer custom instrument control options through the serial interface, as shown for the Licor above. Only a few custom instrument configurations are available at this time.

Clock Sync setup

The NOAA Clock Sync service provides a more flexible and precise way to control clock synchronization compared to the Windows OS internet time server option. This can be used when you have access to a \$GPRMC serial message from a GPS unit or other serial feed which can be logged through a COM port:

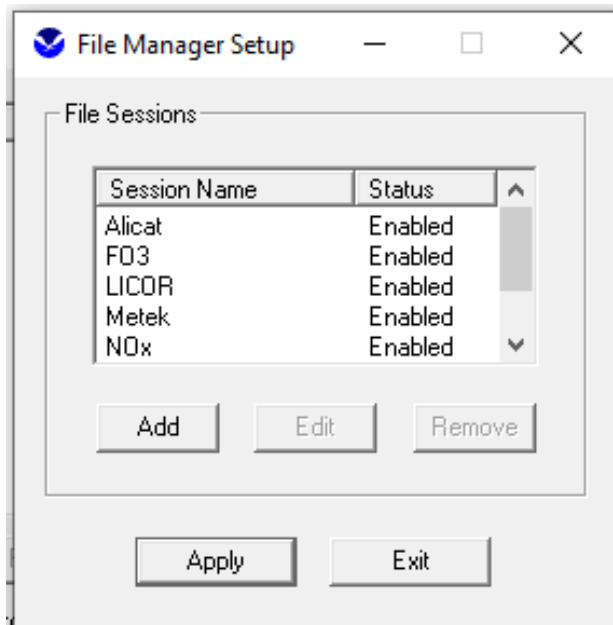
```
$GPRMC, hmmm.ss, A, llll.ll, a, yyyy.yy, a, x.x, x.x, ddmmyy, x.x, a*hh  
          1         2         3         4         5         6 7         8         9         10 11 12
```

- 1 = UTC of position fix
- 2 = Data status (A = valid; V = invalid - navigation receiver warning)
- 3 = Latitude of fix
- 4 = N or S
- 5 = Longitude of fix
- 6 = E or W
- 7 = Speed over ground in knots
- 8 = Track made good in degrees True
- 9 = UT date
- 10 = Magnetic variation degrees (Easterly var. subtracts from true course)
- 11 = E or W
- 12 = Checksum

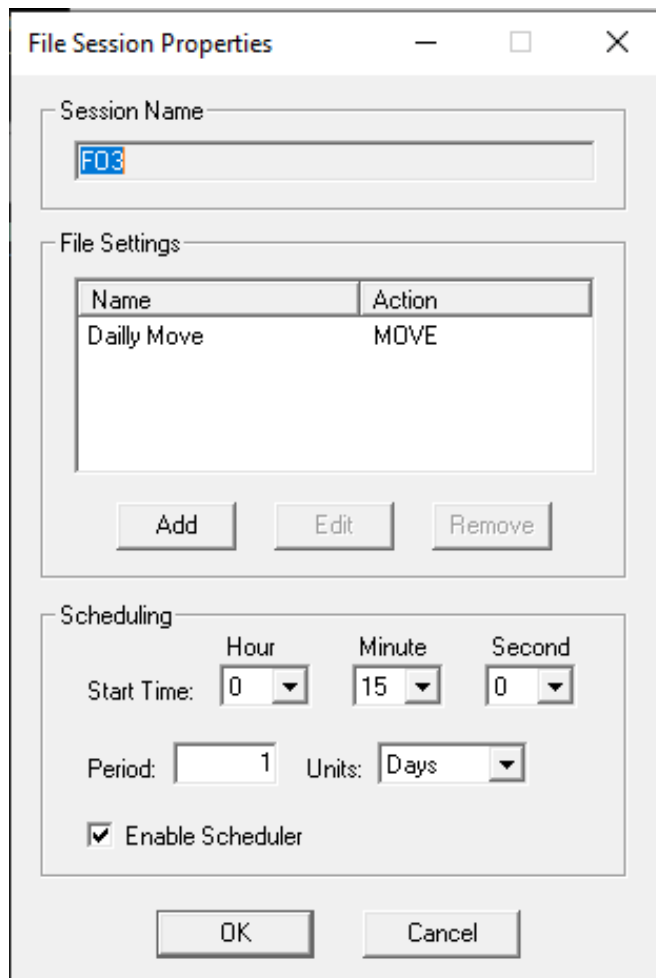
The Clock Sync service will only use fields 1 (time), 2 (status), and 9 (date). Note that the time resolution can be expressed to the nearest 10 milliseconds within the seconds sub-field (ss.ss) in field 1. Also, the time will only be set by the service when the data status is valid (field 2 = 'A').

File Manager setup

The File Manager service can be used to schedule a variety of file copy and move actions to automatically organize and backup the raw data files logged by the DAS service. On MOSAiC we use it to copy the previous day's hourly files into daily folders after 0000 hours UTC. A specific file management session is set up for each type of file, as shown in the main window below. From this window you can **Add**, **Edit** or **Remove** a management session. Note that the changes you may make only take effect if the **Apply** button is clicked.

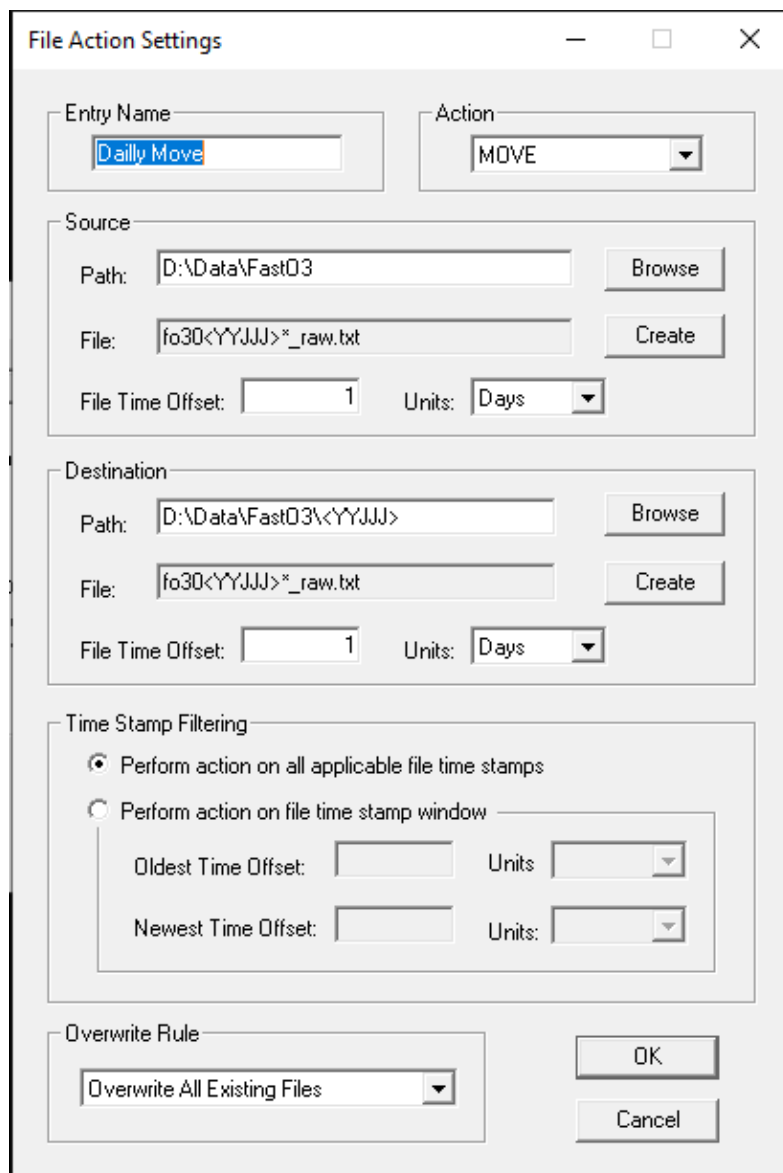


Double-clicking or clicking Edit for a highlighted session brings up the Session Properties window, where any number of file activities can be scheduled for a given session or file type. For example, you could have one action to move a day's hourly files into a daily folder, and another action that copies this folder to a local backup hard drive. This window shows we have one action defined for the fast ozone files – to move them on a daily schedule. The action is scheduled to occur at 0015 hrs.



Highlight the 'Daily Move' action item and double-click or choose Edit to bring up the Action Settings window where we define what the action will do. Here, we give the action a name and choose MOVE as the desired type of action. Then we define the source path to the files we want to move, a name filter indicating which files are affected, and the time offset compared to the current time.

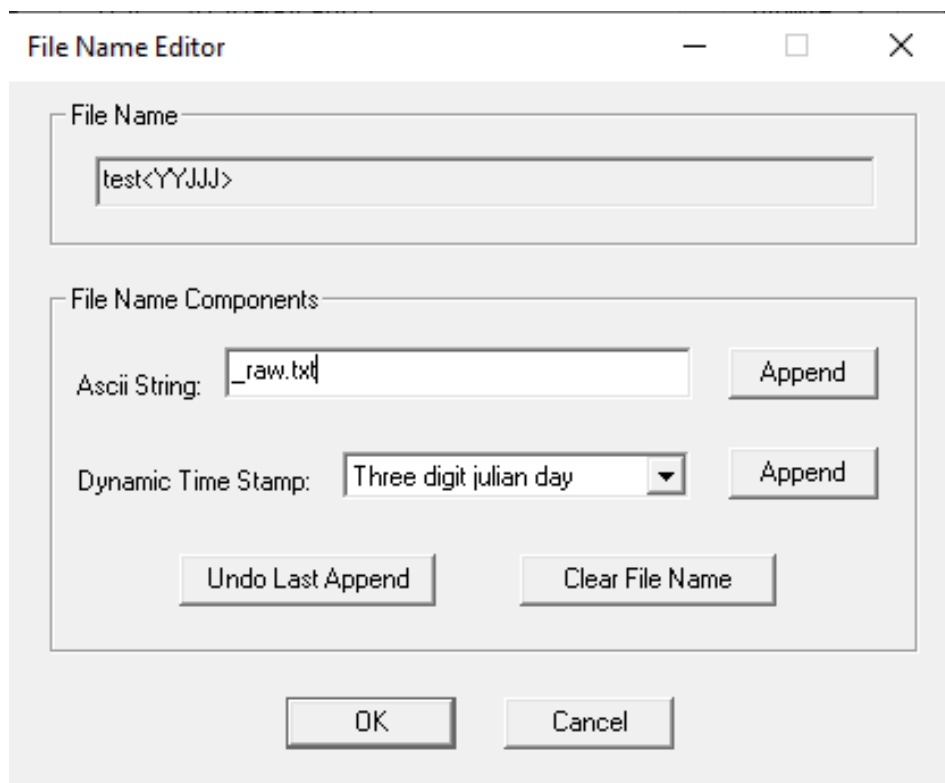
In this case we choose all files beginning with 'fo30' followed by the two digit year and 3 digit julian day, <YYJJJ>, followed by a wildcard for unspecified characters (in this case '*' is place holder for the hour), followed by '_raw.txt'. The affected files will be all those matching the filter from 1 day ago compared to the current time. Since we start this just after midnight, we are targeting all the prior day's hourly files (current JJJ minus 1).



In the next box we define the destination path for the MOVE as a new subfolder in the same root folder, named with the two digit year and three digit julian day YYJJJ. The time offset here is also set to 1 day, so JJJ in the folder name is for the prior day, as above. The destination file name filter is set to be identical to the source - we don't want to change the file names, but

could in principle. Time Stamp Filtering is not necessary in this case. The Overwrite Rule can be set as shown but really doesn't apply in this case. It would apply if the daily subfolder already existed and contains older (partial) data files compared to the ones being moved. In our case we are creating a new folder and all the files we move are closed and complete.

All this is fairly straight forward. The part that usually confuses people is where you create the file name filter in the Source and Destination boxes above. You can't type directly into the File box but instead use the Create button. This brings up an edit box where you 'assemble' the string to represent the file filter. Again, you can't type directly into the File Name box in the Editor. Instead, you type text into the Ascii String box and this is added (appended) to the File Name box when you click the Append button. The drop down menu lets you to append specific codes for a variety of wild card time and date formats, all of which are enclosed in <> brackets. But, you can also just type these codes directly into the Ascii String box and append them if you know what you want. In our case it's almost always <YYJJ>. In most cases for what we do, the file filter to look exactly like the one on the example above. The first 4 characters of the file name and path specifics are usually the only difference.



Click OK on all these boxes and don't forget to click Apply in the main window to schedule your new file action. Because this utility is capable of some very complex and significant file manipulation actions, it's always a good idea to test your session action thoroughly before you trust it with actual data.