



TECHNICAL BULLETIN : PRODUCT INFORMATION

RS-485 Communication Function **Standard on all DH & DHD Invitrocell Incubators** **Models NU-5800 thru 5841** **Set Up and Operation instructions**

General

The Direct Heat Incubator has the capability to output its operating performance or to modify existing set-points by use of the built in RS-485 communication function. The RS-485 access point is a RJ-12 connector mounted on the upper rear panel of the Incubator. Unlike the USB log, which has similar output data, this feature allows the communication to occur to and from the Incubator. The purpose of this document is to explain the hardware and software hookup required to make this data link operational between your PC and the Incubator. See Appendix C for the steps required to setup data streaming to a unidirectional communication device such as a printer.

Minimum Tools required interfacing with a Computer:

- ✓ Cable with RJ-12 connector to connect to the incubator socket plus connector to attach to the converter module chosen
- ✓ RS-485 to USB converter module (example: NuAire uses an Adam 4561 RS-485 module or B&B Electronics USOPTL4)
- ✓ A laptop or PC to receive the RS-485 data stream
- ✓ Putty, EZ Terminal, Hyper Terminal (on older PC's) or other license free (shareware) PC terminal emulation software tool

NOTE: If you are not familiar with the Incubator and its screen commands, please refer to your NU-58xx Operator's Manual.

Current Software Versions: CCBA: 149 / LCBA: 45.2 or greater

Setup/Installation Summary

The steps involved to setup PC communication to the Incubator, using RS-485, are as follows:

1. Power the Incubator on, if not already running
2. Plug the RJ-12 (6-pin) cable connector into the RJ-12 socket (Incubator back panel)
3. Connect the other end of the RJ-12 cable to the RS-485 converter module
4. Connect the RS485 module to the PC using the correct USB cable for the device you have chosen
5. Install the Putty tool if you have not already done so
6. Launch the Putty communication tool
7. Set the communication protocol parameters (57600, 8, N, 1)
8. Getting started (your first communication commands)
9. Speed things up with removing the need to send the address every time
10. Reading and setting temperature and CO2
11. Turning on the output measurement log (OMV)
12. A look at all the commands

After you have done this a few times, you will be able to shorten your bucket list to the following steps:

- Connect the RS485 module to the Incubator
- Connect the RS485 module to your PC
- Launch Putty, load the protocol information file, and use it

A more detailed look at each of the 12 steps is now provided on the following pages:

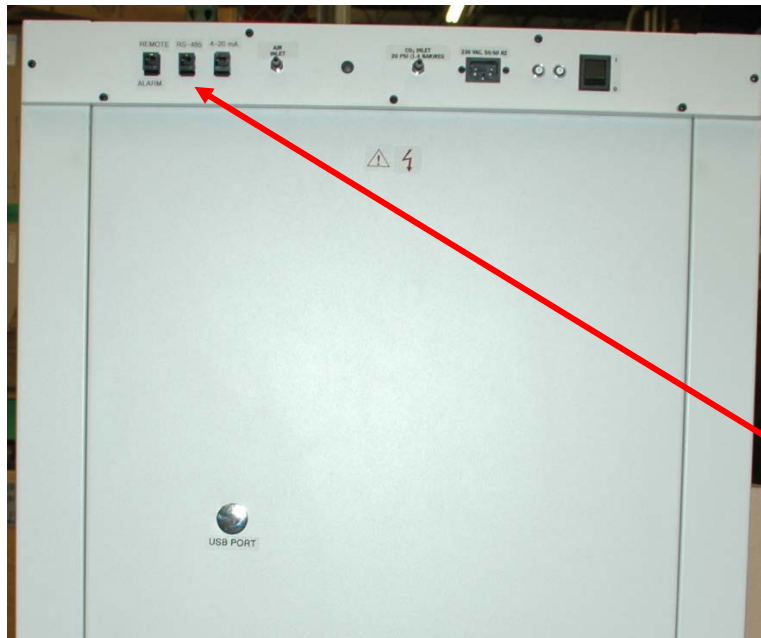
➤ Step 1 – Power the Incubator on, if not already running

If the Incubator is not already on, please turn it on now. Reach back to the upper corner of the panel of push the upper part of the switch in. This applies power to the heaters and the control boards. A power interrupted message will appear on the screen; touch it and it will go away.

➤ Step 2 – Plug the RJ-12 (6-pin) cable connector into the RJ-12 socket (Incubator back panel)

Plug the RS-485 cable (6-wire flat cable) into RJ-12 connector marked “RS-485” on the rear panel (Photo 1).

This is the middle connector of the group of three connectors.



RS-485 Remote
Communication RJ-12
connector

Photo 1 – Location of RS-485 communication connector

➤ Step 3 – Connect the other end of the RJ-12 cable to the RS-485 converter module

If the module is not already wired and connected, use Photo 2 as a guide in getting the wires connected properly.

If you are using a cable that has a different color scheme, do use the wires in positions 1, 2, 3 in the same manner as shown in the figure (Photo 2).

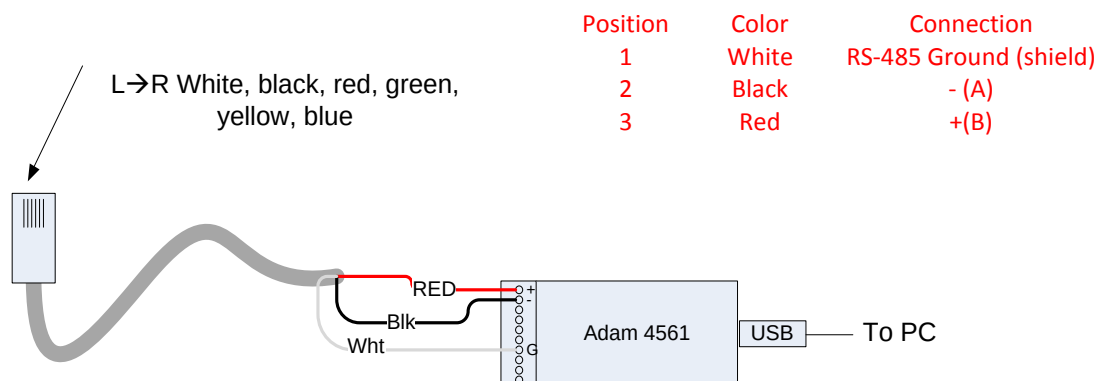


Photo 2 – A look at the wiring, wire positions, and color codes for the RS-485 module

- Step 4 – Connect the RS485 module to the PC using the included USB cable
Connect the USB cable end Type B (the square connector) into the RS-485 adapter box.
Connect the other end of the USB cable, connector type A, into your PC or laptop USB port
- Step 5 – Install the Putty tool if you have not already done so
Putty is a license free Telnet/SSH software tool that can be used to communicate between your Incubator and your PC. You could also use another program EZ Terminal, or even your own PCs hyper Terminal (prior to Windows 7).
Putt is easy to install, just extract Putty from the downloaded zip file, drop it on your desktop and you are ready to go.
Putty is available at the following website: <http://www.chiark.greenend.org.uk/~sgtatham/putty/>
Download the zip file, double click the file and follow the installation instructions. It may also be helpful to install a desktop icon of the software tool.
- Step 6 – Launch the Putty communication tool
This is the easy part; just double click the file Icon and a window will pop up on your PCs desktop (Photo 3).

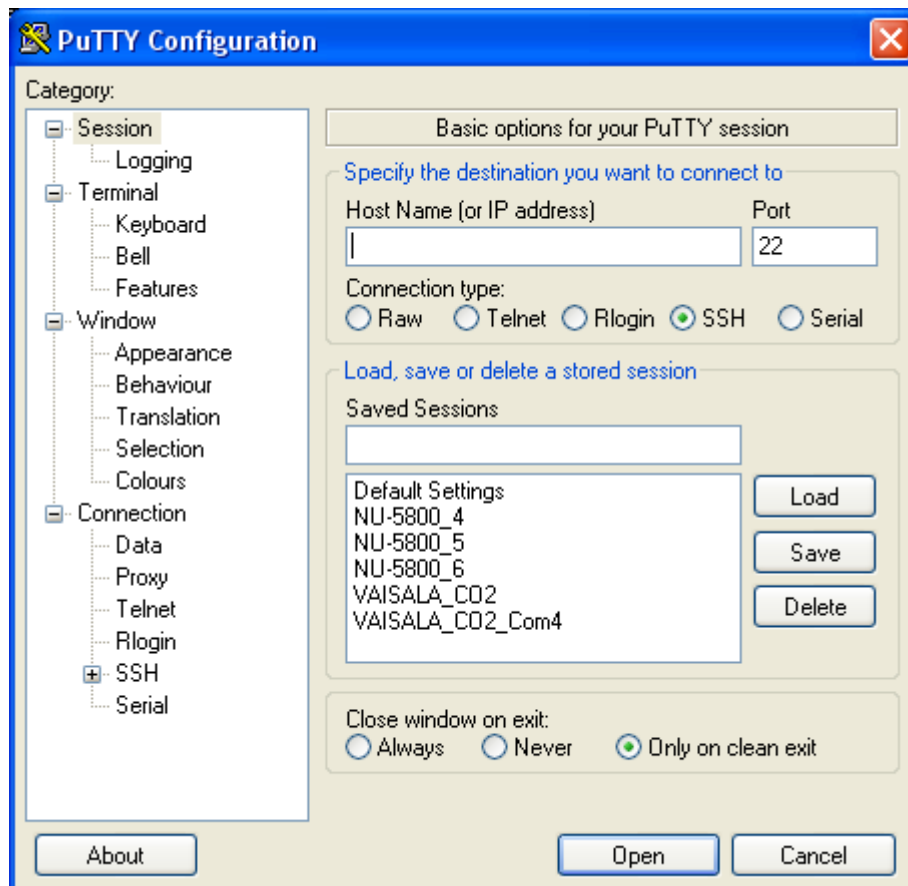


Photo 3 – A view of the configuration screen when the Putty software tool is opened.

➤ Step 7 – Set the communication protocol parameters (57600, 8, N, 1)

To communicate on the RS-485 bus with the Incubator, you need to set the protocol communication information parameters to those being used by the Incubator. In the lower left window of the screen (below SSH in Photo 3), you will see the word serial.

Do a mouse click on serial.

That will open up a new screen (right side of current screen) that you can use to enter the communication protocol information (Photo 4). The settings are 57600, 8, N, 1.

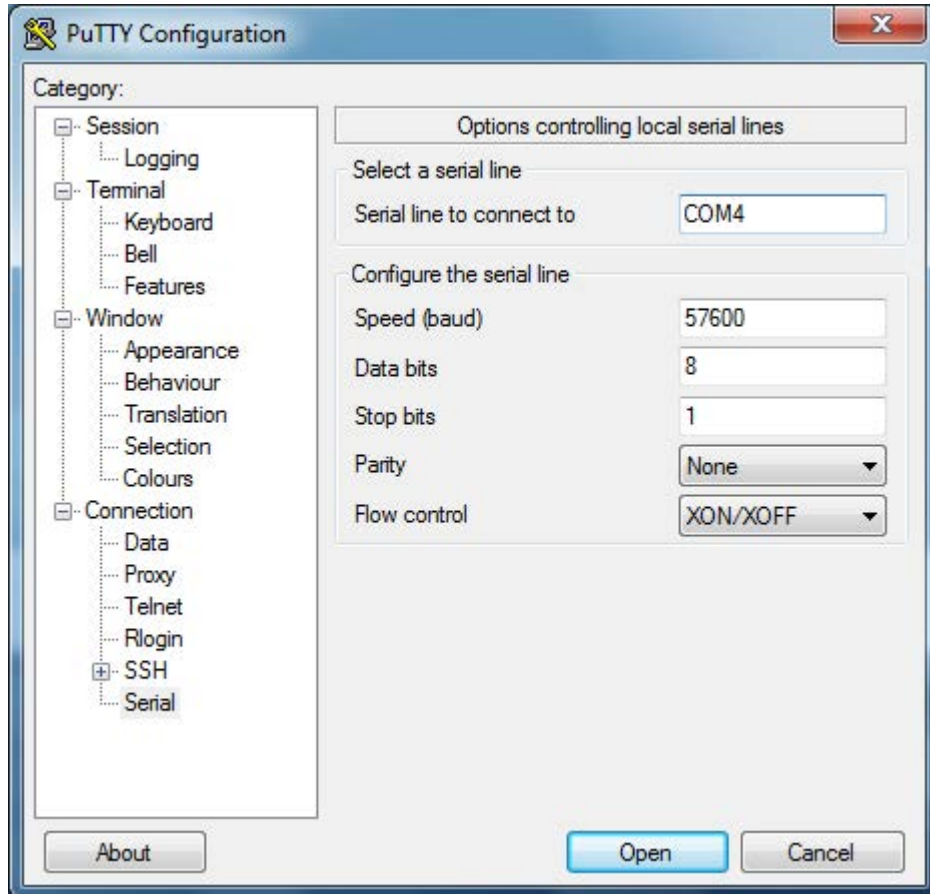


Photo 4 – Putty showing the Serial portion and the settings for serial communication

You will have to set the communication port number to the port number actually being used by your PC and your RS-485 driver.

If you are not familiar with finding the port number, you can experiment by using COM1, COM2, COM 3, COM 4, COM5, until you get communication established.

If it is the wrong number, Putty closes but gives you an error message saying “unable to open connection to ComX”. Then you can launch Putty and try again.

Or contact your IT service person for assistance.

More help is also provided in appendix A at the end of this bulletin.

The other settings are just typed in:

Speed: 57600
Data bits: 8
Stop bits: 1
Parity: None

Once you have all the settings in place, click “session” in the upper left corner (Photo 5)

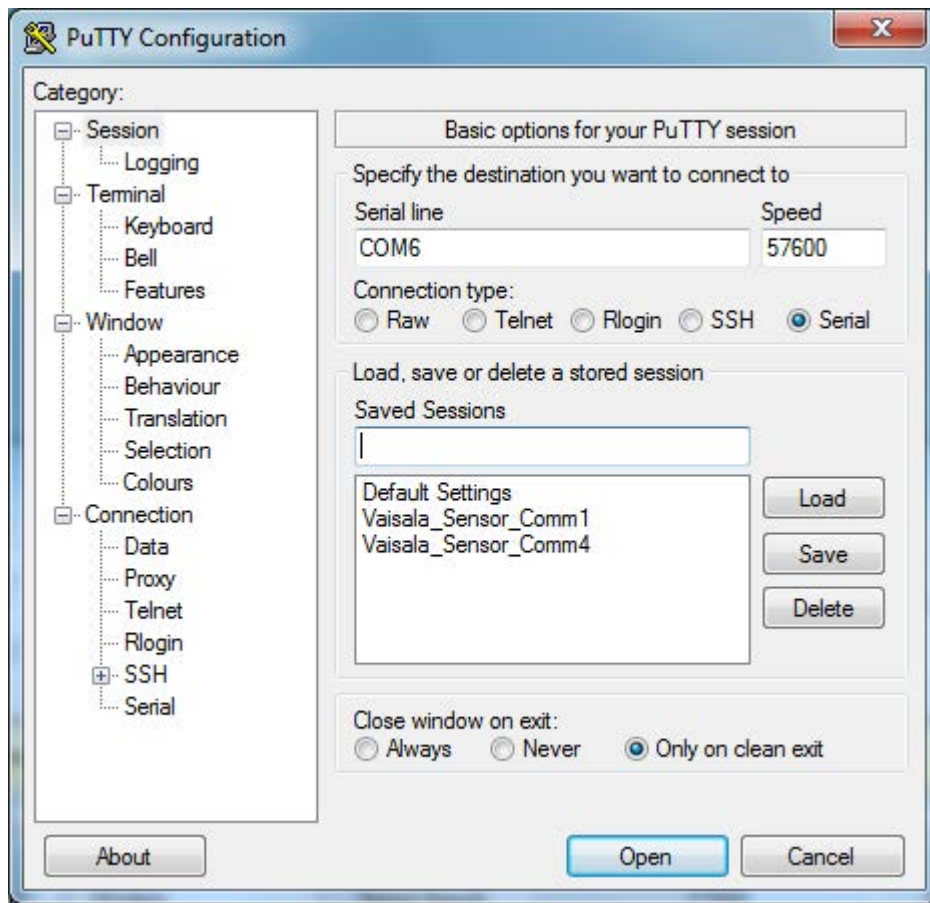


Photo 5 – Putty is now set for serial communication, its protocol is set, and it’s ready to run.

Would you like to save these settings so that it is much easier next time to set the protocol and port number? In the Saved Sessions window, type in NU-5810_Comm6 (or your preferred file name), and hit the save button. Now next time, all you will have to do is:

- 1) Double click Putty,
- 2) Click on the saved file name in the names window
- 3) Hit the load button

The screen comes up and the settings are what you asked for.

Did you want to log the data you are recording?

You can do this also by hitting the Logging button (upper left).

A browse button appears (again in the right section of the current window) permitting you to establish a file name and location of the file of saved data.

At this point, all you need do is hit the Open button which will take you to the data collection screen (Photo 6).

➤ Step 8 – Getting started (your first communication commands).

In step 11, all the RS-485 commands are recorded. To get you started, we are going to do a couple simple things.

Let's look at the devices assigned address:

We can do this by typing \$00 RA c/r, RA being the command to "Return Address" and c/r is the line feed carriage return command (enter key on PC/laptop).

In commands below, the c/r is left off but it is still applicable for all commands sent to the incubator.

Find the device's current set temperature set-point: We can do this by typing \$02 RTP

Now the screen in Photo 6 shows Terminal→local echo set to automatic.

If you were to force the local echo "on", what you would see in the screen would be \$02 RRAA an R sent to the Incubator and an R being returned, and the same with the A.

If you have a preference, you can set this in the Terminal tab (Terminal in the upper left of the configuration screen).

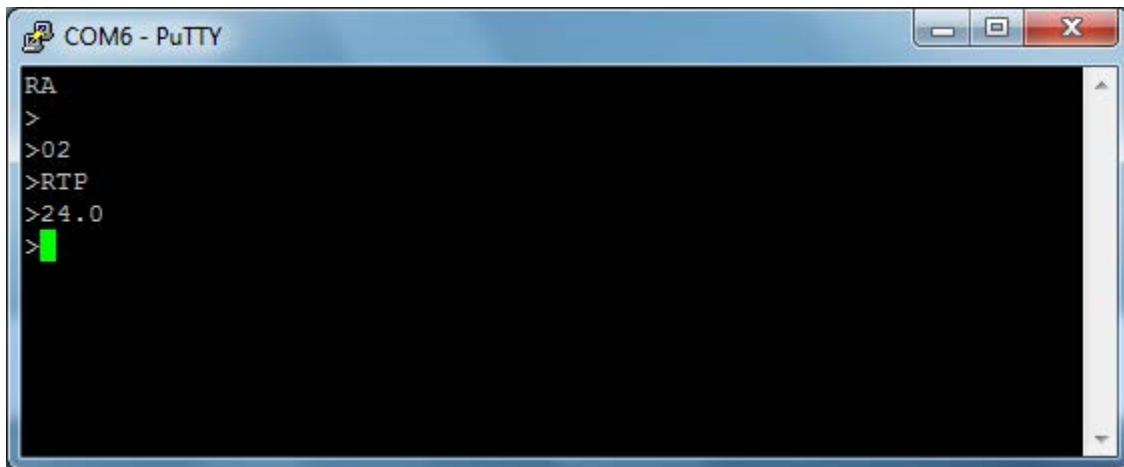


Photo 6 – Putty communication window

➤ Step 9 – Speed things up with removing the need to send the address every time

Would you like to simplify the command structure by not typing in the address all the time?

What you can do is enter \$02 PTP.

This is the (data entry) point to point command.

It returns the on message and all you have to do now is type in the command, such as RTP.

Not mandatory but it does make it simpler if you are just talking to one Incubator.

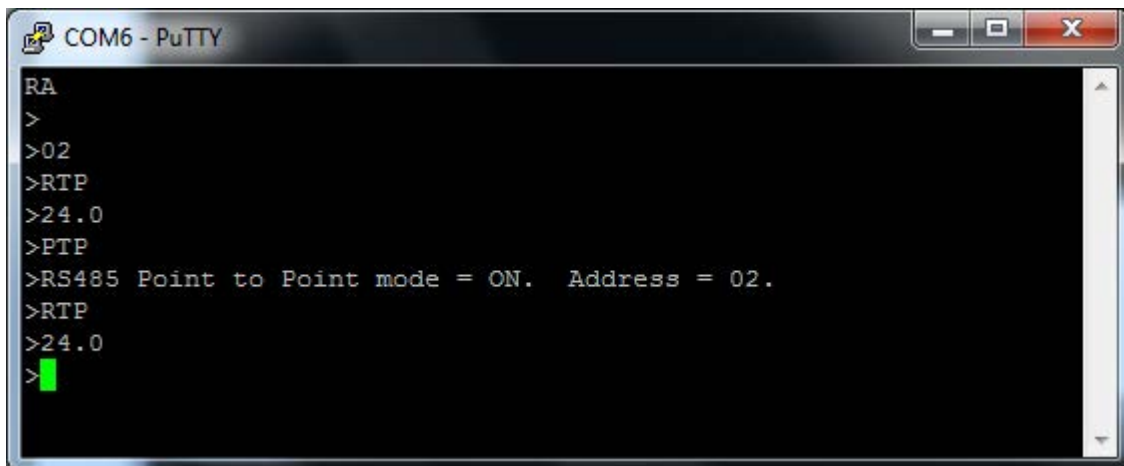


Photo 7 – Point to point communication is about simplifying data entry commands;
Data entry is just the command only (no address needed).

➤ Step 10 - Reading and setting temperature and CO2

Now let's say you want to set your Incubator to run at a temperature set-point of 37.0 degrees C and to 5% CO2 environment.

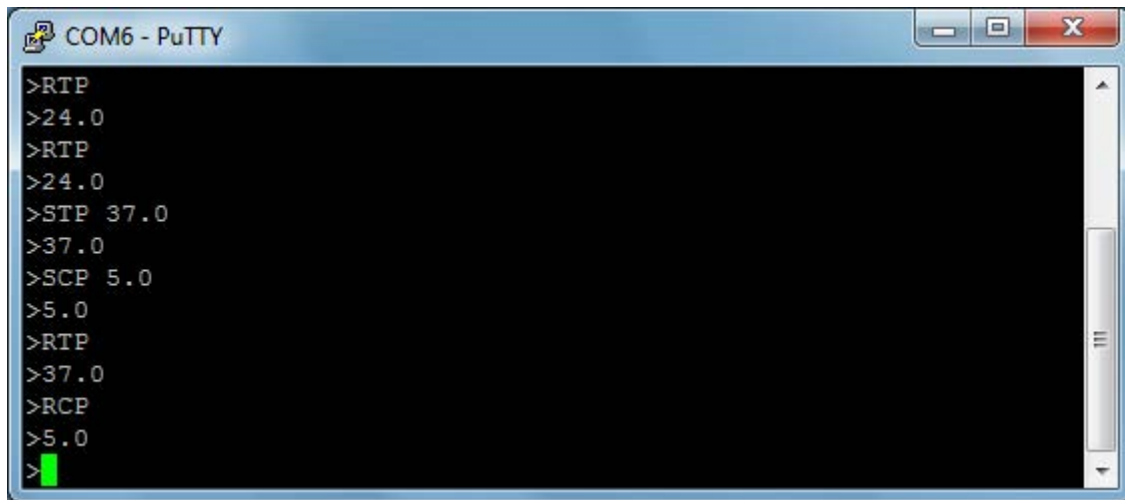
With RTP, we read that the temperature set-point is 24.0 in this example.

All we need do now is change it with the STP command, STP 37.0.

Likewise, we can change CO2 set-point by typing SCP 5.0.

Now you can go verify that these changes took place with the RTP command and the RCP command.

An example of this is provided in Photo 8



```
>RTP
>24.0
>RTP
>24.0
>STP 37.0
>37.0
>SCP 5.0
>5.0
>RTP
>37.0
>RCP
>5.0
>
```

Photo 8 Set-point changed to 37.0 C temperature and 5.0% CO2 gas.

➤ Step 11 - Turning on the output measurement log (OMV)

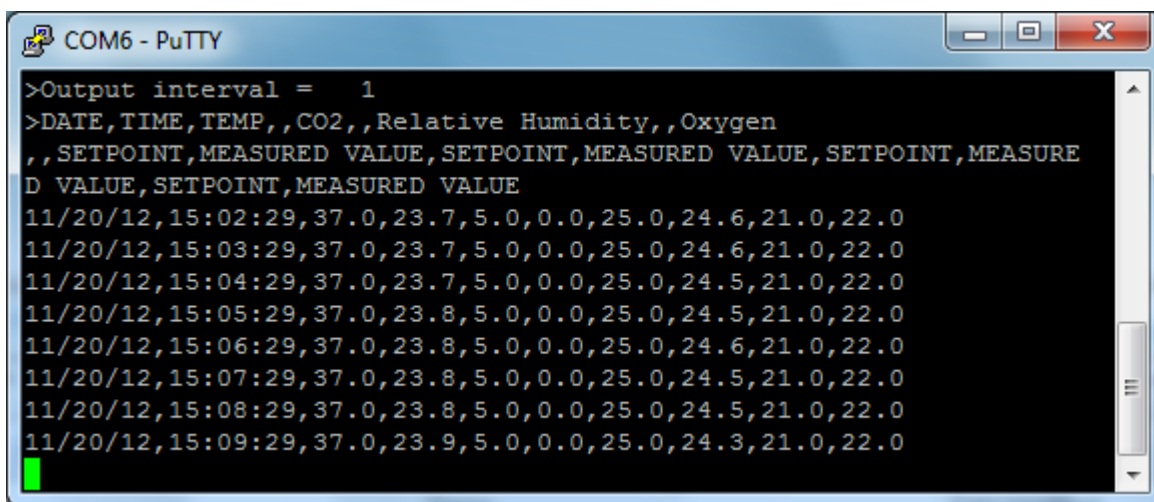
The RS-485 capability allows you to create a current data stream of measured values for temperature, and CO2 (it also includes RH and O2 for the appropriate models).

The command is OMV 1 where 1 refers to "1 minute intervals".

This output looks as shown in Photo 9.

If you choose to have the data put in a txt file you can then copy the data into an excel data, tabulate the data, graph the data and perform additional analysis.

If you prefer, you can actually set the time interval from 1 minute to 999 minutes in 1 minute increments.



```
>Output interval = 1
>DATE,TIME,TEMP,,CO2,,Relative Humidity,,Oxygen
,,SETPOINT,MEASURED VALUE,SETPOINT,MEASURED VALUE,SETPOINT,MEASURED VALUE
11/20/12,15:02:29,37.0,23.7,5.0,0.0,25.0,24.6,21.0,22.0
11/20/12,15:03:29,37.0,23.7,5.0,0.0,25.0,24.6,21.0,22.0
11/20/12,15:04:29,37.0,23.7,5.0,0.0,25.0,24.5,21.0,22.0
11/20/12,15:05:29,37.0,23.8,5.0,0.0,25.0,24.5,21.0,22.0
11/20/12,15:06:29,37.0,23.8,5.0,0.0,25.0,24.6,21.0,22.0
11/20/12,15:07:29,37.0,23.8,5.0,0.0,25.0,24.5,21.0,22.0
11/20/12,15:08:29,37.0,23.8,5.0,0.0,25.0,24.5,21.0,22.0
11/20/12,15:09:29,37.0,23.9,5.0,0.0,25.0,24.3,21.0,22.0
```

Photo 9 – Data output streaming from the NuAire Incubator

➤ Step 12 - A look at all the commands (Appendix B)

Appendix B lists all the commands that you can take advantage of when communicating with your Incubator.

If the command is not currently available, it is so identified (with an invalid command or a command not implemented message).

You have the ability to remotely change settings and to also change measured values (the calibration points).

So you do need to pay close attention to what specific changes you do make to the Incubator remotely.

Appendix A - PC communication Ports

Finding your communication port.

Usually a PC will assign comm port 1 to your main serial port; often times this is a DB9 connector at the back of your laptop or PC. (Newer equipment may not even have this older style port.)

But your PC also assigns comm ports to devices that get plugged into the USB port.

Now there are some serial tools that will actually tell you which comm ports are active.

If you have one of those tools, launch it and see which ports are active once you plug your RS-485 adapter in.

Now that you have the correct port number, you can then add it in the Putty software tool (step 7, Photo 4).

Another sure way of finding the port is to key in different port numbers as mentioned earlier.

This can be a bit more time consuming, if for instance your RS-485 driver wants to use port # 14.

Once found, make note of the comm number for future reference.

Another method is to use a tool already on your PC in its windows32 folder.

Do the following: go to location C:\windows\system32 and find a file called compmgmt.msc.

You can create a shortcut to this file on your desktop or folder of choice (so you can find and use this tool again).

Double click the file and that will open up the Computer Management Window (Photo 10)

Double click the words "Device Manager" (left window) this will open the window showing numerous computer functions.

Double click on the "Ports" button (middle window) and it will expand showing you all the active ports being used.

This example tells me that Comm Port 6 is being used by my RS-485 device.

"6" is now the key port number that needs to be assigned in the software tool (step 7, Photo 4) which will allow the software Putty tool to communicate with the NuAire Incubator.

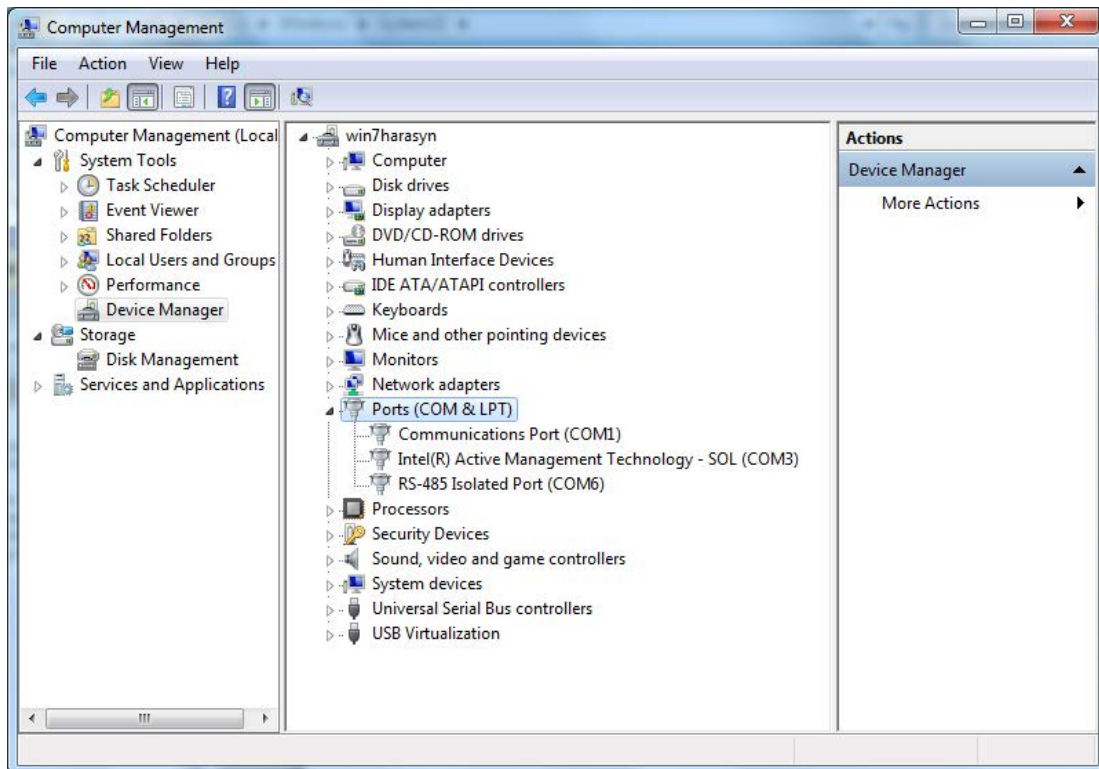


Photo 10 – The computer management screen showing which comm. ports are currently being used by the computer

Appendix B – All RS485 commands

Following is a table that provides all the current RS-485 commands for the NU-58xx Incubator line.

RS485 Communication access to a PC (PC ⇔ RS485 ⇔ CCBA only).

Recommended

- ✓ Hardware Tools: Adam 4561, Integrity Instruments XP485-9E1, or B&B Electronics USOPTL4
- ✓ Software Tools: EZ Term, Hyper Terminal, Putty, MSCOMM1 (Microsoft tool used to control a PCs serial port).
- ✓ Settings: 57600,8,N,1

Protocol (Format): Two Letter or three letter commands + c/r with a response c/r return

\$xx CCC ddd.d or CCC ddd.d (see Note 1) ddd.d or ddd.dd as appropriate

\$xx CC ddd.d or CC ddd.d Address range xx is two (2) decimal characters: 02-99. Default is 02
(00 is reserved for broadcast & 01 for Master)

Cmd Start	Address	Command	Response	Description	Data Entry variable range	Notes:	Status
\$	xx	Esc		Abort entry/terminate command			C
		Bksp		Re-enter last character			C
\$	xx	SA aa	dd	Set Address	00 to 99	Note 5	C
\$	00	RA	dd	Read Address	00 to 99	Note 5	C
\$	xx	RC	dd.d	Read CO2 Value (in %)	0.1 to 20.0	Note 8	C
\$	xx	SC dd.dd	dd.d	Set CO2 Value (in %)	0.1 to 20.0		
\$	xx	RR	dd.d	Read Rh Value (in %)	00.0 to 90.0	Note 8	C
\$	xx	SR dd.dd	dd.d	Set Rh Value (in %)	00.0 to 90.0		
\$	xx	RO	dd.d	Read O2 Value (in %)	00.0 to 21.0	Note 8	C
\$	xx	SO dd.dd	dd.d	Set O2 Value (in %)	00.0 to 21.0		
\$	xx	RS	dd.d	Read Safety temp Value (in °C)	5.0 to 55.0	Note 8	C
\$	xx	RT	dd.d	Read Temperature Value (in °C)	5.0 to 55.0	Note 8	C
\$	xx	ST dd.dd	dd.d	Set Temperature Value (in °C)	5.0 to 55.0		
\$	xx	RCP	dd.d	Read CO2 Set point	0.1 to 21.0		C
\$	xx	SCP dd.dd	dd.d	Set CO2 Set point	0.1 to 21.0		C
\$	xx	RRP	dd.d	Read Rh Set point	00.0 to 90.0		C
\$	xx	SRP dd.dd	dd.d	Set Rh Set point	00.0 to 90.0		C
\$	xx	ROP	dd.d	Read O2 Set point	00.0 to 21.0		C
\$	xx	SOP dd.dd	dd.d	Set O2 Set point	00.0 to 21.0		C
\$	xx	RTP	dd.d	Read Temperature Set point	5.0 to 55.0		C
\$	xx	STP dd.dd	dd.d	Set Temperature Set point	5.0 to 55.0		C
\$	xx	RCH	dd.dd	Read Chamber heater Duty	00.00 to 100.00		C
\$	xx	SCH dd.dd	dd.dd	Set Chamber heater Duty	00.00 to 100.00	Note 7	C
\$	xx	RDH	dd.dd	Read Door heater Duty	00.00 to 100.00		C
\$	xx	SDH dd.dd	dd.dd	Set Door heater Duty	00.00 to 100.00	Note 7	C
\$	xx	RPH	dd.dd	Read Perimeter heater Duty	00.00 to 100.00		C
\$	xx	SPH dd.dd	dd.dd	Set Perimeter heater Duty	00.00 to 100.00	Note 7	C
\$	xx	SRO	SR = ON	Set Safety Relay Output	01		C
\$	xx	RRO	SR = OFF	Reset Safety relay	00		C
\$	xx	OMV min 0-999	Note 12	Output Measurement Values	ESC turns logging off.	Note 5,6	C
\$	xx	RVPT	dd.dd	Read +12 Volt power	11.00 to 12.99		C
\$	xx	RVF	dd.dd	Read +5 Volt power	4.80 to 5.20		C
\$	xx	Save		Save all changes from Sxx commands.			
\$	xx	RSR	Note 9	Reset system to Run			C
\$	xx	RSS	Note 10	Reset system to Standby			C
\$	xx	RSM	dd	Master Reset			C?

Cmd Start	Address	Command	Response	Description	Data Entry variable range	Notes:	Status
		RSF	dd	Factory Reset			
\$	xx	ID n	N xxxx	Read firmware version No.	1,2	Note 4	C
\$	xx	PTP	PTP = ON/OFF/Addr = xx	Toggle Point to Point mode			C
		XX	{ INVALID }	Command other than those above			C

Additional Notes:

- For Point to Point (PtoP) wiring (1 master and 1 Incubator), address may be omitted; e.g., SCP 5.0
- Assigned for future expansion. (These are assigned a status of "C" (complete) when a "command not implemented" message will be displayed when the command is entered.)
- Needs additional input from NuAire, Inc. to quantify/qualify complete the command function
- n=1, 2, x; 1 for CCBA SW version, 2 for LCBA SW version, x produces "parameter out of range".
- Works in PtoP only
- min:sec specifies output interval. Currently this is fixed at 15 seconds. For production, we are looking for min:sec from 00:01 to 60:59. Escape ends transmission. Runs in PTP only
- Incubator needs to be in standby mode (RSS) for this command to operate
- Value = Current measured value + offset
- Reset to Run Mode Complete
- Reset to Standby Mode Complete.
- For Point to Point (PtoP) wiring (1 master and 1 Incubator), address may be omitted; e.g., SCP 5.0
- Currently this field is defined as:
Date,Time,CTemp,Triac Out%,1MR Count,STemp,CO2,DFS,RHTemp,AvgErr,1MR Flag
In production, we would like this field to be defined as:
Date,Time,CTemp, CTemp Set-point, CO2 %, CO2 Set-point, RH %, RH Set-point, O2 %, O2 Set-point, and Events (same as defined in history log).
- blank

Appendix C - Output to a Printer or other unidirectional recording devices

Recording Performance and Event data with a Printer:

The incubator's RS-485 communication system can be set up to output Performance data for all active control systems (Temperature, CO2, RH & O2) and Events (alarms, Power outages & door openings) to a device not capable of retrieving this data such as a printer.

Minimum Tools Required:

- ✓ Cable with RH-12 one end to connect to the incubator and other end to plug into the chosen printer
- ✓ The printer (user defined)

Printer requirements:

- ✓ Capable RS-485 communication
 - o If it is not a converter will be required to receive the RS-485 streaming from the incubator.
- ✓ Capable of the following communication settings:
 - o Speed: 57600
 - o Data bits: 8
 - o Stop bits: 1
 - o Parity: None

Setting up the incubator output of the performance/event data:

After connecting the communication cable to the incubator and the printer you will start the data output from the incubator.

To do this, navigate to the Service Settings Screen (NuAire→9876 Enter).

Locate the "Option" button in the "General" category (bottom row) press it.

Locate Digital output interval and enter the time in minutes (Press the number, nominally 0, and enter 1. You may enter a number from 0-300) between outputting the performance data.

For example if you enter 1 in that option the incubator will output this data every minute.

Entering 2 causes the incubator to output every 2 minutes, 3 = output every 3 minutes and so on.

When exiting the General Options screen, you will be asked if you want to save the change. You must save the changes for the change to take effect.