Interfacing To Rupprecht & Patashnick Samplers

1.0 General
The R&P samplers all use a data transfer protocol named AK Protocol. This protocol provides two way communications between the R&P unit and a central polling device. The R&P units are connected to the CPP with a standard, 9 pin, male to female RS-232 cable. The protocol supports five global command sets. Detailed information on the command sets and structures, and program register codes can be obtained from either Rupprecht & Patashnick or from H2NS. The information are sections from the R&P operating manual and are respectively, Appendix D and Appendix B.

2.0 Connections
Presented in the following section are the serial connections between the CPP and an R&P unit.

RJ-11 Comm Port Connections
H2NS installs a 6 pin, RJ11, connector into the CPP rear panel. The majority of applications only use four of the 6 pins, which are pins 2,3,4,5. A null modem can be readily implemented by either twisting or not twisting the cable, which is readily detectable because the cable is color-coded. **Standard, purchased telephone cables are twisted.** Presented below are the pin assignments set up by H2NS for the RJ11 connector.
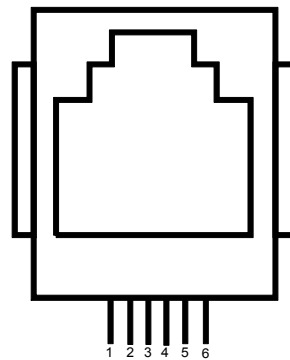
1   RTS Output
2   TX+ Output of CPP
3   Gnd (TX- in RS-422/485)
4   Gnd (RX- in RS-422/485)
5   RX+ Input to CPP
6   CD Input

DB9 to RJ-11 Connectors
H2NS can also provide RS-232 connectors that are terminated in an RJ11 connector. One of the RS-232 connectors can be connected to an instrument and then connected with an RJ11 cable to the CPP. The wire colors for the 9 pin, DB male and female

connectors that are provided by H2NS are given below. It should be noted that all manufacturers do not use the same color coding scheme.

Pin	9 Pin Male	9 Pin Female
1	Blu	Wht
2	Yel	Blk
3	Grn	Red
4	Red	Grn
5	Blk	Yel
6	Wht	Blu

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The rear panel connector is a 9 pin female DB connector. The proper wiring for the mating 9 pin male DB to RJ-11 is given below. The pin assignments assume that a standard, twisted telephone cable is used.

9Pin DB To R&P			
9 Pin	Color	RJ-11	RJ-11 Signal
2 Tx	Blk	5	2 – Rx
3 Rx	Yel	2	5 - Tx
5 Gnd	Grn	3	3 – Gnd

3.0 Model 2025

To add a R&P device to the CPP, bring up the Main Menu with the **I<cr>** keyin, and select channel set up. The CPP responds as follows.

1.)   Chan # = **12<cr>**
2.)   Name = Name   **Flow 1<cr>**
3.)   Units = Units   **l/min<cr>**
4.)   Full scale = 100.0 = **<cr>**
5.)   Zero = 0.0 **<cr>**
6.)   Manu
       00 =   Other
       01 =   API
       02 =   MLabs
       03 =   R&P
       04 =   THERMO
       Selection = 00 **<03>**

7.)   R&P Model #
       01 =   PM-10
       02 =   M 2025
       Selection = 01 **2<cr>**

8.)   M 2025-Enter PRC = 008 = **133<cr>**

9.)   Comm Port (3-00 Thru 3-08) = 3-01 3- **02<cr>**

10.)   Half Dplx(H), Full Dplx(F) = F **<cr>**

11.)   Baud Rate
        1 = 300, 2 = 1200, 3 = 2400, 4 = 4800, 5 = 9600, 6 = 19.2K, 7 = 38.4K = 5 **<cr>**

12.)   Instrument ID = 00 **<cr>**
13.)   IMD Installed = 00 **<cr>**
14.)   # Points For Interim Avg = 01 **04<cr>**
15.)   # Points For Final Avg = 01 **9<cr>**
16.)   Unip(U), Bip(B) = U **<cr>**
17.)   Unip(U), Bip(B) Cals = B **<cr>**

16.)   Channel # = **<cr>**
        Return To Main Menu

Line 1 asks which channel is to be set up. The user selected channel # 12.

Line 2 asks for the channel's name. The user entered Flow 1.

Line 3 asks for the channels units. The user entered liters/minute.

Lines 4 and 5 ask for the full scale and zero values of the channel. These inputs are not required as the R&P unit transfers the data as real numbers, not in a binary format.

Line 6 asks from where the data is coming. The user selected R&P.

Line 7 prints the R&P model numbers supported by the CPP.   At this point, the initialization deviates from the standard and asks for the PRC code to be sent to the R&P instruments. A list of the Main Program Register Codes (PRC) for the R&P Model 2025 is presented below in Table 1.0. The remainder of the channel initialization is the same as for other channels. The R&P devices do not require an ID code.

Table 1.0
Main Model 2025 Program Register Codes

Code	Description	Units
002	Serial Number	N/A
003	Operating Mode	N/A
005	Status Code	N/A
133	Current Flow1	l/min
134	Current Flow 2	l/min
135	Current Flow 3	l/min
139	Electronics Temp	^{o}C
140	Ambient Temp	^{o}C
141	Ambient Pressure	mmhg
144	Relative Humidity	%

146	Filter #1 Temp	°C
147	Filter #2 Temp	°C
148	Filter Comp Temp	°C
151	Wind Direction	deg
153	Wind Speed	km/h
319	Sampling Under serial Ctrl	N/A

There are many more program register codes, but these are presented as the main program register codes. Reference the R&P manual for details for other program register codes. The CPP has been designed to collect, average, store and print data values. Therefore, to set up a R&P channel with PRC 002 would be meaningless. Averaging the serial number would be of no value. Only PRC's representing operating parameters are of value.

To communicate directly with the instruments from comm port #4 input **D43<cr>**. Over comm port #1, enter SETQ <crcr>, then D43<cr>. The CPP responds with:

```
Chn#    Manu        Mdl#        Type
01 =  R&P          M-2025      -SMPLR
02 =  API          NOX-200A    - NOX
03 =  API          NO2-200A    - NOX
04 =  API          NO- 200A    - NOX
05 =   CLI         WS          - WS
06 =   CLI         WD          - WD
Selection = 1<cr>
01 = R&P     M-2025        SMPLR    Selected

CMD> = ?<cr>
A? =  AREG - Ask Reg
E? =  EREG -  Enter Reg
F? =  STxx  - Set Function
S? =  SSTO  - Set Stg Marker
I?  =  ASTO - Ask Stg
CMD> A?<cr>
```

#AREG133   Current Flow1
#AREG134   Current Flow 2
#AREG135   Current Flow 3
#AREG139   Electronics Temp
#AREG140   Ambient Temp
#AREG141   Ambient Pressure
#AREG144   Relative Humidity
#AREG146   Filter #1 Temp
#AREG147   Filter #2 Temp
#AREG148   Filter Comp Temp
#AREG151   Wind Direction
#AREG153   Wind Speed

CMD> = **AREG144<cr>**

4AREG K0 144   (command sent)
4AREG 0 144 54.8   (response received)

The CPP prints a listing of all instrumentation that has been initialized, and asks for a selection. In the example, the user selected the R&P connected to channel #1. Inputting a question mark results in the CPP providing a menu of the five main command categories supported by the R&P instruments. Inputting an A?<cr> results in the CPP providing a listing of the main ASK Register (AREG) program codes. To send the PRC enter the number, preceded by a # sign (**#AREG144<cr>**) and terminated with a carriage return. The CPP will assemble the string, send it to the R&P unit, and print out the instrument response. Any of the instruments ASK Register codes can be sent to the instrument. They must be entered as three digit codes as presented above. The printed responses for the commands sent and the responses received print only the printable characters. The starting STX (002) character and the ending ETX (003) character do not print.

To send other commands to the R&P units use the % string command presented below.

Once in the pass through mode, strings can be sent to the instruments using the following format;

%[string]<cr>

The CPP will take the string inside the brackets, send it to the instrument, and print the instrument response. **The brackets are for clarity only and should not be contained in the string. If the STX character and the ETX character are not present in the input string, the CPP will insert these characters, as they are required for communications with the R&P units.** It can be confusing, and error prone to generate these characters from the key board, therefore the CPP will insert them. In a computer generated command these characters can easily be inserted.

In the pass through mode, strings can then be sent to the instrument with the **%[string]<cr>** inputs. The CPP remains in the pass through mode with this channel until it is exited as discussed below, or the pass through times out from inactivity. To select another channel, the pass through mode can be exited and reentered with another **D43** input, or at the CMD> prompt, enter an **M<cr>**. The CPP will present a listing of all instruments connected and ask for a selection. Select the channel desired.

To terminate the pass through mode input [**^<cr>**] at the CMD> prompt. If a character is not input for two minutes, the CPP times out and the pass through mode is exited automatically.

> **The CPP remains on line collecting data even in the pass through mode. Operator commands are interlaced with the CPP normal polling and interrogation commands.**

4.0 PM 10

When a channel is set up as having a R&P PM 10 connected, the CPP response is similar to above, but the menus are somewhat different. An example is presented below.

```
Chn#    Manu        Mdl#           Type
01 =  R&P          PM-10
02 =  API          NOX-200A    - NOX
03 =  API          NO2-200A    - NOX
04 =  API          NO- 200A    - NOX
05 =   CLI         WS          - WS
06 =   CLI         WD          - WD
```
Selection = **1<cr>**
01 = R&P   PM-10   Selected

CMD> = **?<cr>**
A? = AREG - Ask Reg
E? = EREG - Enter Reg
F? = STxx   - Set Function
S? = SSTO - Set Stg Marker
I? = ASTO - Ask Stg
CMD> **A?<cr>**

```
#AREG007    Mass Rate
#AREG008    Mass Concentration
#AREG009    Total Mass
#AREG013    Noise
#AREG025    Case Temp
#AREG027    Cap Temp
#AREG028    Enclosure Temp
#AREG039    Main Flow
#AREG041    Status Conditions
#AREG060    24-Hr Avg Conc
#AREG130    Amb Temp
#AREG131    Amb Pressure
```

CMD> = **AREG008<cr>**

```
4AREG K0 08                (command sent)
4AREG 0 08 154.8           (response received)
```

Operation is identical to that presented above for the Model 2025 sampler.

5.0 Off Line Pass Through
The CPP also supports an off line, unabated pass through mode. This allows the user to communicate with a connected instrument without adhering to any CPP protocol. Even

the manufacturers diagnostic routines can be conducted remotely using this feature. More discussion of this is provided in Tech Note 36 included below.

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Comm #1 Pass Through

General
Communication port number 1 is the port that is normally connected to a central facility and is the port over which data is retrieved from the CPP. Using simple commands, comm port #1 can be electrically connected to comm port #4 or the comm #3 ports.

On Line Pass Through to Instruments
The CPP supports two types of pass through operation. One is an on line mode in which commands received on comm port #1 are interleaved with CPP polling commands and sent to connected instrumentation. The instruments response is then returned to comm port #1. This mode has the benefit of the instrumentation staying on line with the CPP, but has the drawback that a certain protocol must be maintained for proper operation.

To communicate with an instrument, connect to comm port #1 with the $ID, and enter SETQ<cr>. Then enter D43<cr> and the CPP will respond with a list of instruments connected to the unit. Select the channel of the desired instrument and begin communications. The on line pass through is discussed in more detail in the CPP manual and in each application note for each manufacturer.

Off Line Pass Through
The second type of pass through places the instrument in an off line mode with the CPP. In this mode, commands from comm port #1 are passed unabated to the instruments comm port, and instrument responses are returned to comm port #1. The CPP does not send commands to an instrument that is this type of pass through. This allows the user to conduct manufacturer supplied diagnostics on the instrument without interference from the CPP. The disadvantage is that the instrument is off line with the CPP and data is not being collected during this time.

Commands
Connect with comm port #1 by entering $ID ($1 for example). The CPP echoes the ID. Table 1 below presents the commands used to pass through comm port #1 to another comm port in a CPP offline mode.

Table 1
Pass Through Commands

SETQ<cr> = Pass comm port #1 to comm port #4
SET0<cr> = Pass comm port #1 to comm port #3-0
SET1<cr> = Pass comm port #1 to comm port #3-1
SET2<cr> = Pass comm port #1 to comm port #3-2
SET3<cr> = Pass comm port #1 to comm port #3-3
SET4<cr> = Pass comm port #1 to comm port #3-4
SET5<cr> = Pass comm port #1 to comm port #3-5
SET6<cr> = Pass comm port #1 to comm port #3-6

To pass through to an instrument, select the appropriate comm port, *e.g.* SET0<cr>. This connects comm port #1 to comm port #3-0. Commands and instrument responses can now be exchanged between the user and the instrument, without interference from the CPP. The CPP

will remain in this mode until either a $ is received on comm port #1, or one hour elapses, at which time the CPP will switch out of the pass through mode and return to normal operation.