

Interfacing with the California Analytical Model ZRH Analyzers

The CPP offers an interface to the California Analytical ZRH series of analyzers.

1.0 Initialization

In the channel initialization, instead of asking for a model number, the CPP asks for either component number one or component number two. More detail is provided below. The Baud rate should be set for 1200 Baud. The CPP automatically sets the protocol for 7 data bits, 1 stop bit and even parity.

2.0 Status

Any command sent to the CAI Instrument from which a proper response is received results in the CPP sending a second command to the instrument requesting the composite instrument status. This status response is checked, and if the instrument has any abnormal operations conditions set flags the data point with a status flag. If no status conditions are set, the data point does not have a flag.

A breakdown of how the CPP interprets the status information returned by the instrument is provided below.

<u>Operation Mode Status Byte</u>		
<u>Mode</u>	<u>Bit</u>	<u>Status</u>
Measuring Mode	8	1 is good, 0 sets bad, L flag for instrument off line
Setting Mode	7	0 is good, 1 sets bad, L flag for instrument off line
Sys Failure	6	0 is good, 1 sets bad, P flag for instrument parameter
Check Failure	5	0 is good, 1 sets bad, P flag for instrument parameter
Not used	4	
Auto Cal	3	0 is no cal, 1 cal in progress, data flag is a C
Span Cal	2	0 not in span, 1 in span, data flag is a C
Zero Cal	1	0 not in zero, 1 in zero, data flag is a C

<u>Error Information Status Byte</u>		
<u>Error</u>	<u>Bit</u>	<u>Status</u>
Span Calibration exceeds Allowable range	6	Entire, sets other, cal drift flag
	5	Single range, sets other, cal drift flag
Calibration quantity exceeds The specified value	2	Zero point, sets other, cal drift flag
	1	Span point, sets other, cal drift flag

<u>Range Over Information Status Byte</u>		
<u>Range over</u>	<u>Bit</u>	<u>Status</u>
Component #2	2	0 is good, 1 range over, sets other, A flag
Component #1	1	0 is good, 1 range over, sets other, A flag

3.0 Connections

The interface connector to the CAI instruments is a DB-25F connector. Presented below is the wiring for connecting the instrument to a CPP.

Signal	RJ-11	DB-25F	Color
TxD from CPP	2	2	Yel
RxD into CPP	5	3	Blk
Gnd	3,4	7	Red/Grn

4.0 Detailed Initialization

The CPP is initialized via the operator port, comm port #4. Entering an **I<cr>** results in the CPP bringing up a Main Menu selection. Selecting the channel initialization results in the CPP asking a series of questions as presented below. Operator responses are in **bold**, and **<cr>** means a carriage return. The numbers 1.), 2.) and so forth are used for discussion purposes only and are not printed in an actual system initialization.

- 1.) Channel # = **1<cr>**
- 2.) Name = NAME **NOX<cr>**
- 3.) Units = UNITS **PPB<cr>**
- 4.) Full Scale = 100.0 **500.0<cr>**
- 5.) Zero = 0.0 **0.0<cr>**

- 6.) Instrument Manufacturer
00 = Other
01 = API
02 = CAI
03 = ML
04 = Siemens
05 = Thermo
- 7.) Setting = 00 **2<cr>**

- 8.) CAI - ZRH
01 = Comp #1
02 = Comp #2

- 9.) Setting = 01 **<cr>**
- 10.) Comm Port (3-00 Thru 3-08) = 3-00 3- **02<cr>**
- 11.) Baud Rate
1 = 300, 2 = 1200, 3 = 2400, 4 = 4800, 5 = 9600, 6 = 19.2K, 7 = 38.4K = **2<cr>**

- 12.) Instrument ID = 0000 **<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>**
- 18.) Channel # = **<cr>**

Line one simply asks which channel is to be initialized. A carriage return here exits back to the Main Menu. In other steps, a carriage return input leaves the setting unchanged and the CPP goes to the next question. In cases where the operator must provide an input, the CPP asks the same question again.

Lines 2 through 5 request information that is not required for proper operation when interfaced to an instrument over the serial port. It is, however, good operating procedures to set these inputs to match those in the instrument. The correct full scale and zero values are required if data stored in the CPP is being output to some other device (for example, over a Modbus connection) in a binary format. This is also true of channels set up as ADC input channels.

Channel names and the units can be up to six characters in length. The full scale and zero values can be four digits in length and the number of digits after the decimal point (if a decimal point is used) must be the same in the full scale and zero inputs. The inputs can also have a minus sign.

Line 6 lists all of the manufacturer drivers that are resident in this software version. In the example, only five manufacturers are presented. As the manufacturers are alphabetized, the numbers delineating the various manufacturers will change depending on how many drivers are installed.

In Line 7 of our example, the operator selected CAI as the manufacturer. The CPP then asks which component is to be associated with this channel.

In Lines 8 & 9, the operator input a **01** which selects component number 1.

In Line 10 the CPP asks to which comm port this analyzer is going to be connected. This is the connector on the CPP into which the cable from the instrument is plugged. The allowable inputs are 00-08, which totals nine comm ports.

The comm port nomenclature should not be made overly complicated or confusing. Although comm Ports 3-00 through 3-08 are independent serial ports, internally the comm port 3 designation references interfacing to the instrumentation. Comm port 3-00 addresses comm port #3 physically located on the CPP printed circuit board and labeled comm #3 on the CPP back panel. Comm ports 3-01 through 3-08 address comm ports physically located on the expansion printed circuit board and are labeled comm 3-01 through comm 3-08 on the CPP back panel.

It should be noted that comm port #2 can be used to interface to some instrumentation. The CAI line of instrumentation is **not** included in that group, and should always be assigned to a comm port number 3 designation. Comm port #2 is usually used with instruments that broadcast, which is normally meteorological instrumentation.

In line 11, the CPP is asking what baud rate should be used to communicate with this instrument. This setting must be 1200 Baud.

Line 12 asks if an instrument ID is required. An ID is not required with the CAI instruments. It is recommended that an ID not be used. If an ID is set up, Input the appropriate digits ID. In the example, the user did not input an ID.

Line 13 is asking if an IMD (Intelligent Multidrop Device) is installed in this comm port cabling. The IMD, manufactured by H2NS, allows a number of different instruments to be connected to a single comm cable. The instruments can have different protocols and even different baud rates. This is very useful when a collection of instrumentation is located remotely from the CPP. The IMD allows only one cable to be run between the CPP and the instruments, with the IMD providing the instrument multiplexing locally at the instruments. The IMD supports addresses from 01 through 60. An address of 00 indicates that an IMD is not installed in this comm cabling.

Lines 14 & 15 are questions regarding data validity qualifiers. The first (line 14) asks how many valid one minute samples the CPP must have to qualify the interim average as valid. Question 15 asks the same in regards to the final average.

Lines 16 & 17 allow negative data values to either be accepted or set to zero. Usually, negative values are set to zero, except during calibrations.

5.0 Communicating directly with CAI Instrumentation

The CPP supports two modes in which an operator can communicate directly with the connected instruments. One is an on line mode, in which the CPP interleaves operator and polling commands, and the second is an off line, unabated pass through mode.

5.1 On Line Communications

Via comm port #4, the CPP has a menu that defines the appropriate commands associated with the instrument selected. Via comm port #1, enter SETQ to switch comm port #1 into comm port #4. Input **D43<cr>** and the CPP responds with a list of instrumentation that is connected to the CPP, as shown below;

Chn#	Manu	Mdl#	Type
01 =	CAI	ZRH	- Comp #1
02 =	THERMO	SO2-43C	- SO2
03 =	API	NOX-200A	- NOX
04 =	API	NO2-200A	- NOX
05 =	API	NO- 200A	- NO

Selection = **1<cr>**

CMD> **?<cr>**

0898<cr> Composite data

0D8C<cr> Status

0C8E<cr> Range

CMD> **0B98<cr>** [Operator entered string]

0898 [String sent to instrument - % Not sent]

!0801507.0PED [Instrument response]
[No response from instrument – if instrument does not respond]

CMD> ^<cr> [Exit]

>

In the pass through mode, strings can then be sent to the instrument with the %[string]<cr> inputs. The brackets are not included in the string, and are presented here for clarity only. At the command prompt, entering a question mark results in the CPP returning a menu of some commands used by the instrument.

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 **D43xx** 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 or interrogation commands.

5.2 Off Line Pass Through

The CPP offers an off line, unabated pass through mode to connected instruments. Over comm port #1, a command is entered commanding the CPP to connect one of the comm ports to comm port #1 and back off. Information can be passed via the instrument and the user without adhering to any CPP protocol. Any manufacturer supplied diagnostics can be conducted remotely. Only the channel being passed through is off line. Data is being collected from all other channels.

Using this feature may require that the user change the communications protocol to communicate with the CAI Instrument. The CPP is normally set up for 9600 Baud, 8 data bits, no parity, and one stop bit. The CAI uses 1200 Baud, 7 data bits, even parity, and one stop bit.

More discussion of this is provided in Tech Note 36.

6.0 Calibrations

The CPP checks the status response of the instrument and if the instrument is in calibration, flags the retrieved data with a C modifier and removes this data from the sampling data base. If the channel connected to the CAI instrument has been set up as a calibration channel in the CPP, the data retrieved is broken out and stored in the calibration table along with start and stop times. Reference the appropriate section of the CPP manual for calibration set up.

7.0 Error Log

The CPP maintains a running error log that lets the user determine if communications are occurring properly. After connecting instrumentation clear the error log by inputting an **EC<cr>**. After some period of time (two to three minutes) check the error log (**E<cr>**) for errors. In proper operation, there should be no errors. The Error Log lists the following.

No Response	- No response from the instrument to an interrogation
Response Error	- CPP received response but detected an error in the data field
Unknown Resp	- CPP received a response but could not decode the response
Model # Error	- CPP received a response but not from the type of instrument it is configured to interrogate on this channel

The three most common causes of errors are, the cable does or does not need a null modem, or the cable is connected to the wrong comm port on the CPP, or the Baud rate set in the CPP does not match that set in the instrument.

8.0 H2NS

A complete list of manufacturers supported by the CPP, and a list of all Tech Notes and Application Notes offered by H2NS can be found at www.h2ns.com. The telephone number at H2NS is (512) 918-8035.