# iMet-1-RSB Radiosonde XDATA Protocol & Daisy Chaining

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One or more external instruments may be attached to the iMet-1-RSB radiosonde for transmitting wireless data packets to ground reception setups.  These instruments currently include the NOAA Frostpoint Hygrometer (FPH), the EN-SCI ECC Ozonesonde, and several other devices in development.  To send data to the radiosonde for transmission, the connections and protocol detailed in this document must be followed.

## Physical Connection

Instruments are attached to the iMet radiosonde using "XDATA UART" cables and connectors.  The connectors are standard single-row pin headers with 4 pins spaced 0.100 inches apart.  The typical male header used on circuit boards is the 3-641215-4 from TE Connectivity.  The female receptacle is the 3-640442-4 with the 643075-4 strain relief cover.  The crimping tool used to attach wires to the receptacle is the 59803-1 T-Handle Tool MTA-100.

A single external instrument may be plugged straight into the iMet radiosonde.  Two or more external instruments may be attached to the radiosonde through "daisy chaining."  Packets transmitted from one instrument are received by another instrument closer to the radiosonde.  These packets are then modified to have the "daisy chain index" incremented before being transmitted further down the chain, eventually reaching the iMet.  See Figure 1 for more information, including the pinout of the connector. Note that the receive (RX) line of one instrument is tied to the transmit (TX) line of the other instrument, and vise versa.
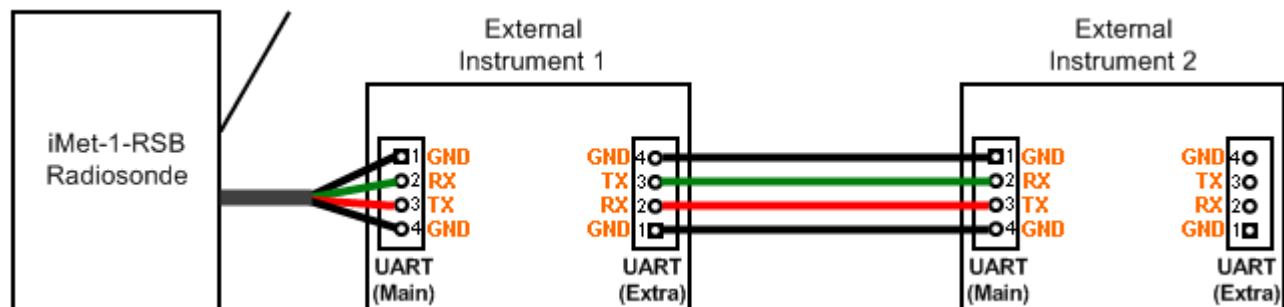


*Figure 1: External instrument connection by daisy chaining through UART cables.  The protruding plastic alignment key on the male headers is towards the orange text in this diagram.*

## UART XDATA Protocol

The UART connection is at 9600 baud, 8 data bits, no parity, 1 stop bit, and (optional) XON/XOFF flow control.  The logic levels for communication need to be at 3.3v TTL when attaching to the iMet radiosonde directly and for most other xdata instruments (though the EN-SCI/DMT ECC Ozonesonde's

V7 board will allow a 5v external instrument to be attached if the "5.0" jumper is closed and the "3.3" jumper is open).

To communicate with the iMet, packets must conform to the "XDATA" protocol, with data sent as **ASCII with numbers represented by hexadecimal bytes** (two characters per byte).

| 0 | 6 | 8 | 10 |
|---|---|---|---|
| xdata= | | | |
| Packet Header | Instrument ID | Daisy Chain Index | Data Bytes... |

In this table, the first row is the ASCII character index / offset from the start of the packet, the second row shows the default value for the field, and the third row contains field descriptions. Each packet must be **terminated with carriage return and line feed ASCII characters**.

XDATA fields:

- The packet header must always be the ASCII text "xdata="
- The instrument ID is a single byte, formatted as ASCII hexadecimal, indicating the type of instrument attached. The current instrument ID byte allocation is in the document "XDATA Instrument ID Allocation". To add new instruments, contact Allen Jordan (allen.jordan@noaa.gov) or Emrys Hall (emrys.hall@noaa.gov).
- The daisy chain index (also in ASCII hex) is initially set to 1 when first creating an XDATA packet. If there are multiple instruments daisy chained to the iMet, this index will be incremented by each instrument that forwards the packet down the chain. In this way, several of the same instruments may be attached to a single iMet and the packets will be distinguishable.
- If you are building a new instrument with two UARTs that can receive and daisy chain external instrument packets, be sure to increment this index before forwarding incoming packets.
- Finally, any data bytes may be transmitted in ASCII hexadecimal format. The number of data bytes should not exceed about 50 per packet. The iMet can transmit about 80 bytes/second, aka 160 hex characters/second total for xdata instruments.

Here is an example packet from an ozonesonde (not showing the CR-LF pair terminating the packet):