



## DATA COMMUNICATION AND RS-232

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Within a potentially noisy environment, we need a reliable means of data communication. Most commonly used standard is still the archaic RS-232C (**R**ecommended **S**tandard 232 Version C - adopted by the EIA [Electronic Industries Association] in August 1969).

### Advantages of RS-232:

- ⊗ Popularity - all PC's (but not Mac's) have at least one RS-232 port
- ⊗ Easy to obtain readily-made cables
- ⊗ Hardware handshaking is possible (but often not used!).

### Disadvantages of RS-232:

- ⊗ Point to point (DTE ↔ DCE)
- ⊗ Slow by today's standards (usually 9600 baud [bits per second])
- ⊗ Works over short distances (limited to 30 feet)

Wiring between DTE and DCE is not well defined. The standard specifies the *function* of up to 25 wires for interconnecting, but whether the wire is to be used or not is not specified.

**RS-422** is a (technologically) better communication standard. This allows communication over two pairs of wires, and the transmitted signal is not limited to being received by only one device.

**RS-485** (enhanced **RS-422**) uses one pair of wires, which may be used for transmission and reception for multiple devices.

### Characteristics and advantages RS-422 / RS-485:

- ⊗ May be used for multi-drop applications
- ⊗ De-facto standard in much of the broadcast video industry!!
- ⊗ May be used for distances up to 1.2km
- ⊗ High noise immunity due to use of differential (balanced) line drivers.

### KRAMER VP-43 Range Extender:

- Developed to overcome the distance limitation of our products which have RS-232 control.
- Converts to RS-422 and then back to RS-232, for using two pairs of wires as the physical interface medium.
- Can be used to extend the range for *any* null-modem RS-232 device.
- Could also be used for controlling our products via RS-422; or as a general RS-232 to RS-422, and RS-422 to RS-232 converter.
- Works for all communication modes (number of bits, baud-rate, parity setting, etc), and does not require setting up of these parameters.

### KRAMER VP-14 Port Extender:

- Developed to overcome the point-to-point limitation of RS-232, allowing several RS-232 controlled products to communicate.
- Data received on any of the ports of the unit is sent to the unit's 3 other ports.
- Could be used for control of a switcher via 3 DTE's (eg. 3 PC's)
- Works for all communication modes (number of bits, baud-rate, parity setting, etc), and does not require setting up of these parameters

# Trouble-shooting RS-232 communication problems

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The following are steps which may help trouble-shoot problem(s) when attempting to communicate with a Kramer RS-232 controlled device.

1. Ensure that there is a **null-modem** connection between the machine (eg. switcher, or router) and the communication device (eg. the PC).

The simplest method, when working with a 25-pin port on the PC, is to use the null-modem adaptor provided with the machine. Plug the 25-pin end of the adaptor into the serial port of the PC, and use a flat-cable - ie. a one-to-one connection - from the 9-pin end of the adaptor to the serial port of the machine. (If using the adaptor without a flat-cable, then the *minimum* connections required between the 9-pin end of the adaptor and the machine's 9-pin port are: pin **2** to pin **2**, pin **3** to pin **3**, and pins **5** to pin **5**).

If connecting directly from the **25-pin** port of the PC to the 9-pin port of the machine (ie. without the null-modem adaptor provided with the machine), then connect as follows:

- Connect pin **2** of the 25-pin to pin **2** of the 9-pin
- Connect pin **3** of the 25-pin to pin **3** of the 9-pin
- Connect pin **7** of the 25-pin to pin **5** of the 9-pin
- Short pins **6** and **20** on the **25-pin** side
- Short pins **4**, **5** and **8** on the **25-pin** side

If connecting directly from the **9-pin** port of the PC to the 9-pin port of the machine, then connect as follows:

- Connect pin **2** of the PC port to pin **3** on the machine port
- Connect pin **3** of the PC port to pin **2** on the machine port
- Connect pin **5** of the PC port to pin **5** on the machine port
- Short pins **4** and **6** on the PC's port
- Short pins **1**, **7** and **8** on the PC's port

2. Ensure that all the DIP-switches on the machine have been set correctly.
3. Ensure that the PC's baud-rate setting is the same as the machine's setting, and that you have selected the correct comm port on the PC.
4. If several machines are used together, then ensure that all the machines are turned on. If **any** machine is turned off in a system using a "master / slave" setup, then all communication within the system is unreliable.
5. If the machine has a "DISABLE TXD" function, make sure that it is **not** set; similarly, if a DIP-switch may be used to "disable reply", then ensure that the reply is **enabled**.
6. On pin 3 of the machine's RS-232 plug, it transmits to the PC (ie. machine's TXD; PC's RXD). On pin 2 of the machine's RS-232 plug, information from the PC is received (ie. machine's RXD; PC's TXD). It may be useful to use a digital storage oscilloscope to see if the machine transmits / receives data on these pins.
7. Most of the machines use a "bi-directional" protocol. This means that the same code is used to command the machine to perform an action, as the code which the machine sends (to the PC) if a *front-panel switch* was pressed to perform this action. For example, if the user pressed the front-panel switches to connect input 4 to output 5, and this resulted in the machine sending hex code 7B, then this implies that if the machine *receives* hex code 7B, it would implement a connection of input 4 to output 5. This being the case, it may be useful to monitor the codes

sent by the machine when the front-panel buttons are pressed, in order to help understand the machine's protocol.

8. When trouble-shooting, it may be a good idea to use a communications program such as Procomm, or Viewcom, to first monitor the codes which the machine sends. Then try sending same codes back (see paragraph 7. above) and check if the machine corresponds appropriately. Lastly, send the code to instruct the machine to download its status.
9. If a user-written program is to be used, then, if possible, first use the factory-written program to check if the communication between the PC and the machine is OK.
10. For our equipment in which RS-232 control is an optional feature, and is installed in the machine as additional hardware, check that the board is inserted correctly (as described in the user manual). In particular, for the X02 series of switchers, inspect the flat cables to the module, and ensure that none of the pins on these connectors are bent.
11. Some of our equipment may be controlled via other pieces of equipment in the range, and may be configured for communication with the other equipment rather than communication with a PC via RS-232. In this case, it is necessary to set up the machine correctly. For example, our BC-2216 and BC-2616 (16X16 audio matrix switchers) have been set (factory-default) for use with a BC-2516 (16X16 video matrix switcher). In this case, the audio matrix would communicate with the PC *via* the video matrix. If the audio matrix is to be used independently, it must be set up accordingly (in this case as an "audio only" unit).
12. If several commands are to be sent, then, before sending an additional command, the sender must ensure that the machine has finished processing previous commands. Wait for the machine's reply from the previous instruction before sending the next command in order to ensure this.
13. Ensure that the device communicating with the machine is true RS-232C! Some peripheral equipment (such as the standard Macintosh serial port) - although similar to RS-232 - use other modes of communication.
14. Take care if intending to use a PC with Windows NT4.0 (and lower versions). This operating system does not have "plug and play" features, and it is no simple task to configure the computer's ports. Consult your Windows NT documentation! Check if your system works on a "non-NT" system - if so, chances are that the port on the NT system has not been set up correctly.
15. Note that RS-232 (by definition) is limited in range to only 30 feet! Our VP-43 "range extender" could be used if a greater distance is required.
16. RS-232 (by definition), is for communication between 2 ports only (in our case, the PC and the switcher). The VP-14 may be used if several pieces of RS-232 equipment are to be hooked together, (for example, if the switcher is to be controlled by 2 PC's and a BC-2000 controller).  
(NOTE: In several machines in our line, we allow control of a number of units by daisy-chaining them on a flat-cable - which seems illegal, given the above statement! What we actually do, is configure the machines in a "master / slave" setup, wherein only the master communicates with the PC via the RS-232 link. The communication between the master and the slaves is not via RS-232. In this way, the *master* passes information to and from the PC and the slaves, and the RS-232 communicates between two devices only).

*Additional trouble-shooting tips would be welcomed!*