

# Communication Alternatives & Tools

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## Communication Alternatives

### RS232 Serial Communication

- point-to-point
- bytes (characters) are sent one bit at a time
- speed specified in bps (bits per second) or baud
- connection to a device is called a serial port
- range is limited - maximum of a few hundred feet

The terms "bps" and "baud" are often used interchangeably, though strictly speaking they are not always the same.

On a PC the serial port is usually named COMn: (n is usually 1).

On DEC/Compaq Alpha machines, serial ports are named TTA:n: or TTBn:.

On terminal servers, serial ports are usually named LTA:n:.

### RS232 Devices

#### DTE - Data Terminal Equipment (terminal)

- the source or destination of data
- e.g. computer, terminal server, printer, RTU

#### DCE - Data Communication Equipment (modem)

- it's purpose is to transfer data between DTE's
- e.g. modem, data radio

## RS232 signals

### DTE signals (from DTE to DCE)

- **TD** - transmit data
- **DTR** - data terminal ready
- **RTS** - request to send

### DCE signals (from DCE to DTE)

- **RD** - receive data
- **DSR** - data set ready
- **CTS** - clear to send
- **DCD (or CD)** - data carrier detect

### Common

- **SG** - signal ground (reference)

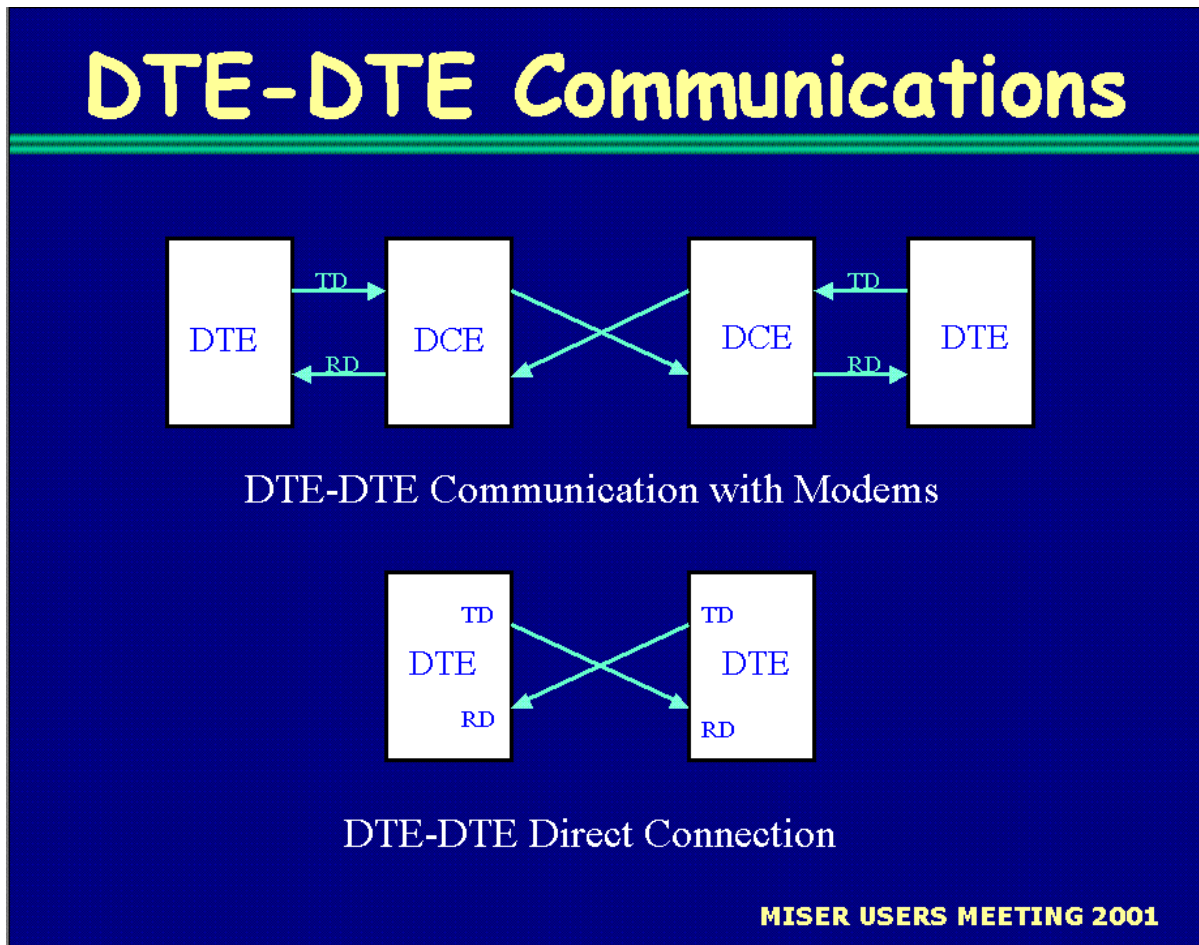
There are more RS232 signals but the above seven are the most common.

**TD** and **RD** are the actual data signals being transmitted and received by the **DTE**. Note that **TD** is an output from a **DTE** but is an input to a **DCE**.

The other signals are referred to as "modem control" signals. **DTR/DSR** and **RTS/CTS** are sometimes called "handshaking" signals. With dial-up modems, **DTR** can be used to tell the modem to hang up or reset itself. With other modems and radios, **RTS** is used to key the carrier.

**DCD** indicated when a modem is receiving a carrier from another modem.

**SG** is not a signal but is the reference point for all of the signals.



## RS232 Cables

The simplest RS232 connection consists of only 3 wires: **SG**, **TD**, and **RD**.

To connect a computer to a modem, use a "straight through" cable:

- **TD** connected to **TD**, **RD** connected to **RD**.

To connect one computer to another computer, use a "crossed" cable:

- **TD** on one connected to **RD** on the other, **RD** on one connected to **TD** on the other.

## RS232 Connectors

- Most modems use DB25
- Most computers use DB9 (sometimes called DE9)
- Some DEC/Compaq terminal servers use RJ45 (8-pin modular)

- Some DEC/Compaq terminal servers and HSQ failover panel use MMJ (6-pin modified modular)

## Carrier

- a signal that can travel a long distance
- generated by a modem or radio
- data is used to modify or "modulate" the carrier
- receiving modem or radio "demodulates" the carrier to recover the data
- "carries" the data signal to a distant location

## Carrier Control

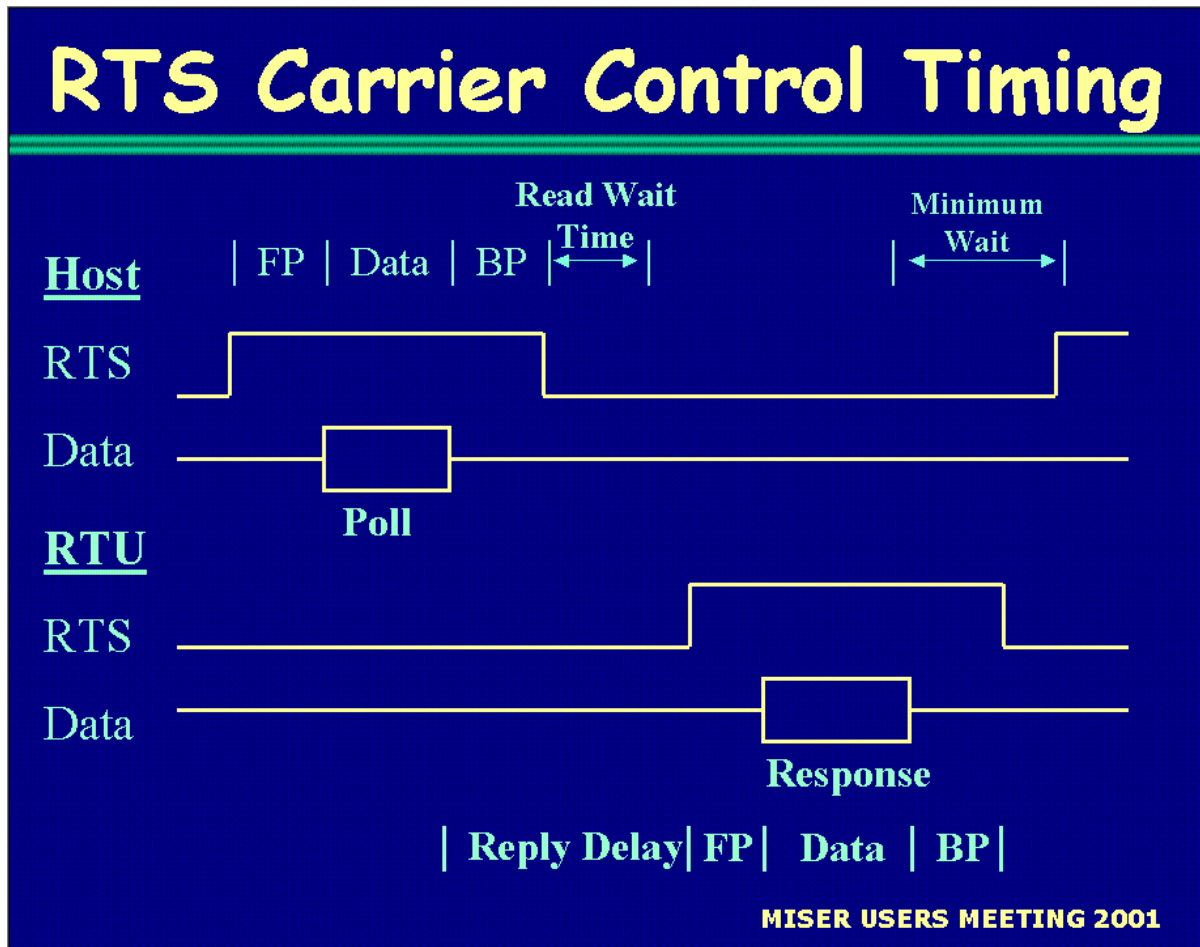
- carrier must be turned on or "keyed" to send data
- may need to be turned off or "unkeyed" to receive data
- usually controlled by RTS (request-to-send) signal
- Front Porch (carrier settling time)
- Back Porch

When the carrier is always keyed, it is referred to as "constant carrier".

The front porch is a delay from the time the carrier is keyed until the first data is sent. This delay allows the carrier to stabilize to avoid corrupting the data.

The back porch is a delay from the time the last data is sent until the carrier is unkeyed. This delay prevents "cutting off" the last data byte.

If carrier control is required and the transmitting device cannot generate the RTS signal, an HSQ RTS Generator ("blue box") can be used.



## Modems

### Leased line modem - e.g. HSQ1354

- point-to-multipoint (multidrop)
- 4-wire vs. 2-wire
- keyed vs. constant carrier
- audio frequency carrier

In a 4-wire system, the host sends messages to the remotes on one pair of wires. Since no other unit transmits on this pair, the host modem can be configured for constant carrier. The remotes send their answers to the host on the other pair of wires. Since the remotes share this pair of wires, each one must key its carrier while sending data.

In a 2-wire system, the host sends messages on the same pair of wires as the remotes. The host must key its carrier while sending data, then unkey it to receive the response from the remote.

## Dial-up modem

- point-to-point
- connection through the telephone system
- audio frequency carrier
- primary or backup communication path

A dial-up modem uses constant carrier when it has a connection with another modem.

An RTU with a dial-up modem can always accept a call from the host.

An RTU that uses a dial-up modem as it's only connection to the host and be configured to call the host if an alarm condition occurs.

An RTU with radio communication to the host can have a dial-up modem as backup. If the radio connection fails the host can be commanded to call the RTU.

## Fiber optic modem

- point-to-multipoint (ring arrangement)
- light-beam carrier
- immune to electrical noise

The optical fiber begins at the host modem, passes successively through each remote modem, and ends back at the host modem. The host receives its own transmitted data. Read-wait-time must be set to discard this data.

The remote modems normally pass data through from the input to the output. To send data, the RTU turns on RTS, which causes the modem to break the loop and send the RTU data through the optical fiber to the host.

## RS485

- point-to-multipoint
- driver and receiver
- data and control signals
- 4-wire vs. 2-wire
- more tolerant of electrical noise than RS232
- greater range than RS232 (4000 ft. or more)

Multiple devices can share a single line because the RS485 driver is a "tri-state" device, which can be switched to an off state so that it sends no signal.

## Radios and Repeaters - wireless communication

- point-to-multipoint
- radio frequency carrier
- keyed vs. constant carrier
- timing and delays
- license required

The host and remotes may all transmit and receive on the same frequency. This is similar to a 2-wire leased line. The host must key its carrier to send data.

In some cases, the host transmits on one frequency, which the remotes receive, and the remotes transmit on another frequency, which the host receives. This is similar to a 4-wire leased line. The host can use constant carrier.

With a repeater, the host and remotes all transmit data on one frequency, which the repeater receives. The repeater retransmits the data on a different frequency, which the host and remotes receive. The host must key its carrier to send data.

## RTU Repeater

- store and forward
- regeneration of data signal
- additional delays

An HSQ RTU with a radio can act as a store-and-forward repeater. This means that the RTU receives messages from the host and retransmits them to other RTU's. It also receives the RTU responses and retransmits them to the host. Each message is received completely before being retransmitted, hence the term "store-and-forward". This process also prevents small bit timing shifts in the incoming data from being repeated in the outgoing data.

An RTU repeater delays the transfer of data more than other repeaters because each message is transmitted twice.

The repeater RTU is configured with a list of RTU Id's and only repeats messages for RTU's that are on the list. Each message is error checked, and only error-free messages are retransmitted.

## Spread Spectrum Radio

- point-to-multipoint
- radio frequency carrier

- carrier control is automatic
- low power, limited range
- unlicensed
- can be used to extend a standard radio system

Spread spectrum radios change frequency many times each second. This is called "frequency hopping". A "master" radio in the group coordinates the frequency hopping to keep all of the radios in the group synchronized. The radios key their carriers automatically so RTS control is unnecessary.

When spread spectrum radios are used with a standard radio to extend the range of a standard radio system, the spread spectrum radio can use RTS to key the standard radio when there is data to send to the host.

## Ethernet

- wiring and connectors
- addressing - IP address, RTU Id



## Communication Tools

### RTUDIAG - PC program

Set HSQ RTU communication parameters

- Baud Rate
- Reply Delay
- Front Porch
- Back Porch

### NCCGEN - Miser host program

*See Miser Technical Reference - Communication section*

#### SHOW CONFIG command

This command shows all of the NCCs in a Miser system, all of the communication lines used by each NCC, and which communication line each RTU is assigned to.

#### Communication timing parameters

- FPTM - front porch time
- BPTM - back porch time
- RWTM - read wait time
- MINIMUM\_WAIT
- FIRST\_READ\_TIMER
- SECOND\_READ\_TIMER
- RTS, PARALLEL, BLUE\_BOX

### LINMON - Miser host program

#### Monitor and troubleshoot communication

- timing problems
- corrupted data

#### HSQ protocol

- poll/response

- 8-bit - 2504, 2500/180, 2500/86, 25X86 RTU Id's and point numbers are 8 bits
- 16-bit - 2500/86, 25X86 RTU Id's and point numbers are 16 bits
- *See Miser Technical Reference - Communication Section*

LINMON can monitor a communication line or an individual RTU.

## Data Line Monitor

The DLM is a hardware device used to monitor RS232 communication.

LINMON show communication from the host's point of view. A DLM allows an independent view of the communication data.

## UCX - Miser Host Program

### Commands

- PING /ADDRESS=xx.xx.xx.xx <-- the xx's are the IP address
- SHO ARP
- SET NOARP xx.xx.xx.xx