Interfaces

It is not enough to agree on the appearance of the signals and on how they are to be transformed and transmitted. The next level is to agree on the appearance of the connectors and the voltage levels for which they are designed, i.e. the physical and electrical interfaces. Furthermore, there is a logical interface which defines what a signal means.

The way in which signals fit together, how the communication is started, how it is terminated, whose turn it is to send or receive data, how messages are confirmed etc. are controlled by *a protocol.* Many different protocols exist. For example: *Profibus, Comli, Modbus.*

The physical interface defines how units should be connected to each other and defines the appearance of the connector.
The electrical interface defines the electrical levels and what these mean (1s or 0s).

The logical interface defines how the signal should be interpreted.

RS-232-C/V.24

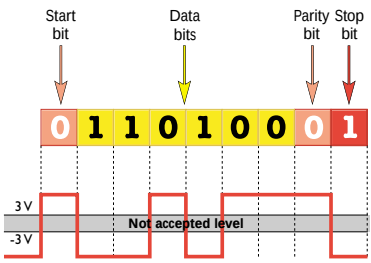
The most common interface for data communications via the serial port of the computer is the 9- or 25-pin V.24 standard.

V.24 recommends that the cable should be no longer than 15 metres. At greater distances, up to several kilometres, short-haul modems are used to transform the V.24 signal into a signal that is less vulnerable to interference.

V.24 (the ITU-T standard) or *RS-232-C* (the EIA standard) are two standards which are similar, in principle, see table. V.24 is the physical standard while V.28 is the electrical standard. For this reason, the interface is sometimes described as V.24/V.28.

RS-232/V.24

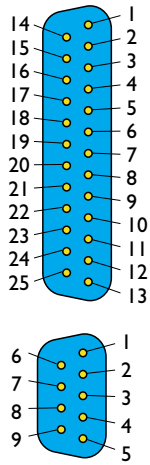
The interface describes and defines the 25-pin male connector and the signals and voltages for which they are designed.



Signals in V.24/RS-232-C

Pin 9/25	V.24 Code	RS-232 Code	Signal	Signal name	Direct. DCE
1	**101**	**AA**	**GND**	**Protective Ground**	–
3 2	**103**	**BA**	**TD**	**Transmitted data**	**I**
2 3	**104**	**BB**	**RD**	**Received data**	**O**
7 4	**105**	**CA**	**RTS**	**Request To Send**	**I**
8 5	**106**	**CB**	**CTS**	**Clear To Send**	**O**
6 6	**107**	**CC**	**DSR**	**Data Set Ready**	**O**
5 7	**102**	**AB**	**SG**	**Signal Ground**	–
1 8	**109**	**CF**	**DCD**	**Data Carrier Detector**	**O**
9	–	–		can be + 12 V	–
10	–	–		can be – 12 V	–
11	126	SCF	STF	Select Transmit Frequency	**I**
12	122	SCB		Secondary DCD	**O**
13	121	SBA		Secondary CTS	**O**
14	118	SBA		Secondary TD	**I**
15	**114**	**DB**	**TC**	**Transmit Clock**	**O**
16	119	SBB		Secondary RD	**O**
17	**115**	**DD**	**RC**	**Receive Clock**	**O**
18	–	–		–	–
19	120	SCA		Secondary RTS	**I**
4 20	**108/2**	**CD**	**DTR**	**Data Terminal Ready**	**I**
21	110	CG	SQD	Signal Quality Detect	**O**
9 22	**125**	**CE**	**RI**	**Ring Indicator**	**O**
23	111	CH/CI		Data Signal Rate Selector	**O**
24	**113**	**DA**	**EC**	**External Clock**	**I**
25	133	–	RFR	Ready For Receiving	**I**

Male D-subs



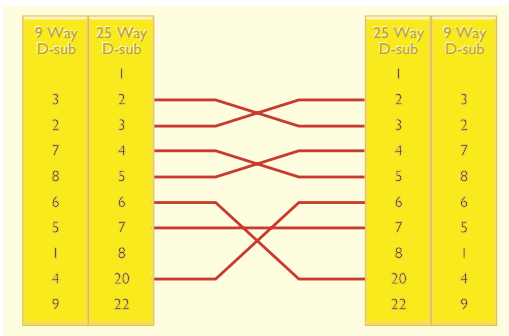
The most common signals used in local communication with modems are printed in bold type. The **I/O** direction indicates the direction from the modem (DCE) where **I** is an input signal and **O** an output signal.

The TD (Transmit Data) signal is an outlet in a DTE and an inlet in a DCE.

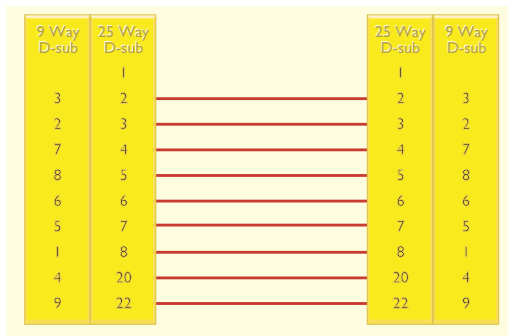
Cable configuration

The picture below shows how the pin configuration for 9- and 25-pole connectors should be made for all combinations of DTEs and DCEs.

DTE to DTE or DCE to DCE



DTE to DCE



Explanation of the most important signals

GND	*Protective Ground*	Connector no. 1 is reserved for protective ground between the devices.
SG	*Signal Ground*	Signal ground is a signal reference and must always be connected to connector 7 (25-pin)/connector 5 (9-pin) in V.24.
TD	*Transmitted Data*	This signal transmits data from a DTE to a DCE.
RD	*Received Data*	This signal is the data that a modem or a DCE transmits to a DTE.
RTS	*Request to Send*	This signal is a request to send data from a DTE. The device waits for the CTS answer signal.
CTS	*Clear to Send*	The answer signal which tells the DTE that it is ready to transmit data.
DSR	*Data Set Ready*	The signal from a DCE which indicates that the device is switched on, connected and ready.
DTR	*Data Terminal Ready*	The same as DSR, although from a DTE.
DCD	*Data Carrier Detect*	The output signal from a DCE which indicates that there is a carrier between the devices and that the connection is ready for communication.
EC	*External Clock*	This signal is used in synchronous transmission when it is necessary to clock data. The signal is the input in the DCE.
TC	*Transmit Clock*	Transmits the DCE clock in synchronous systems.
RC	*Receive Clock*	Clock received in the DTE for decoding data.
RI	*Ring Indicator*	Output signal from a modem indicating that it has received a ring signal.