Data communication...

...is extremely important in order to increase productivity

Increases in automation also place demands on reliable data communications between units and the systems that control and those producing and measuring. Data communication is the nervous system that forms the basis of increased efficiency and competitiveness. Irrespective of whether it concerns manufacturing, installation, transport or healthcare.

Interface

Agreement regarding the signal type, how they should be converted and transmitted is not enough. Agreement is also required regarding the type of connector and the voltage levels they need to support, in other words, the physical and electrical interface. There is also a logical interface, which defines the significance of the signal.
A protocol controls how the signals are built up, how communications are initiated, how they are terminated, the order of transmitting and sending, how to acknowledge a message, etc. There are many different protocols, for example, PROFIBUS, Comli, Modbus, etc.

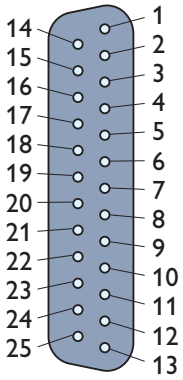
The physical interface	defines how equipment is connected as well as the design of the connector.
The electrical interface	defines the electrical levels and what these denote (ones or zeros).
Logical interface	defines what the signals signify.

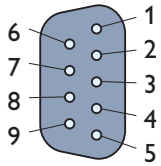
The most common interfaces

The most common interface for data communication via computer equipment's serial port is RS-232/V.24, which usually uses a 9-/25-pos. D-sub connector. According to the recommendations for RS-232/V.24, the cable between connected units should not exceed 15 metres (49 ft). Different modems can be used to achieve greater transmission distances depending on the communications media available (e.g. fibre, copper, telecommunication circuit). V.24 (European CCITT standard) or RS-232-C (American ITU-T standard) are two standards that are in principle identical, see the table on page 25. V.24 describes the physical standard while V.28 is the electrical standard. That is why you sometimes see the interface described as V.24/V.28.
The interface describes and defines the connector's pins, the signals and voltage levels supported.

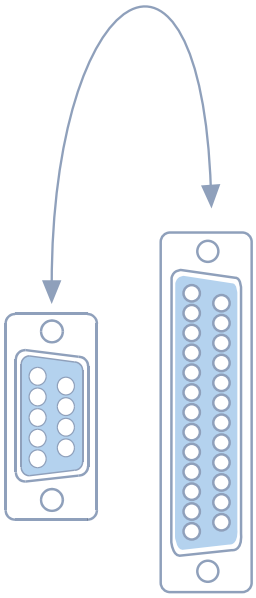
Signals in V.24/RS-232-C

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**





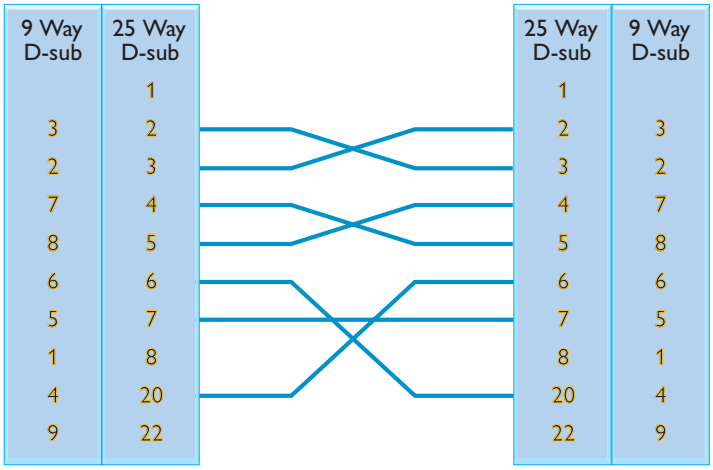
Bold type indicates the most common signals in local communications using short-haul modems. Direction **I/O** indicates the direction to/from the modem (DCE) where **I** is an input and **O** an output. Accordingly, the TD (Transmit Data) signal is the output in a DTE yet the input in a DCE. The definition of DCE and DTE is one of the most common sources of error, when these are linked to RS-232 equipment, see page 26.



Cable configuration

How the connection between 9-/25-pos. D-sub connectors is made for all combinations with DTE and DCE units is shown below.

DTE to DTE or DCE to DCE



DTE to DCE

Key to the most important signals

Explanation of the most important signals

GND	Protective Ground	Pin 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 pin 7 (25-pin) pin 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 from DCE which tells the DTE that it can 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, but from a DTE.
DCD	Data Carrier Detect	The output signal from a DCE which indicates that there is a carrier between the DCEs 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 into 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.