

Jayex Patient Call Displays

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The Jayex patient call display is a dot-matrix LED display board commonly encountered in General Medical Practice. The device is typically wall-mounted in the GP's waiting room, and connected to the GP's computer system. When a clinician is ready to see their next patient, they operate a function on the computer, and a signal is sent to the board. The patient's name is displayed and a buzzer is sounded to alert the patient. Between calling patients in this way, the board is usually set up to display a series of topical messages.

Problems connecting the Jayex board to the GP clinical system are not uncommon. Since Jayex is a third party supplier, and the provision of cabling infrastructure is typically the responsibility of the PCT or landlord, there is scope for confusion. This document seeks to clarify how Jayex boards are connected, for the benefit of any technician who is called upon to resolve associated problems.

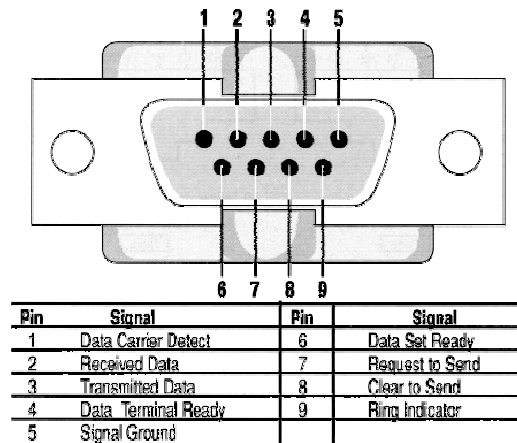
The Jayex display is connected to the computer by means of an RS-232 serial link. RS-232 is a well established communication method using 12-volt signals, much used to connect terminal devices with modems from the late 1960's onward (see <http://en.wikipedia.org/wiki/RS-232#History>). RS-232 enables both-way communication between two devices: device A is able to transmit data which is received by device B, and device B is able to transmit data which is received by device A.

RS-232 is often implemented using D-Type connectors like the one shown below:



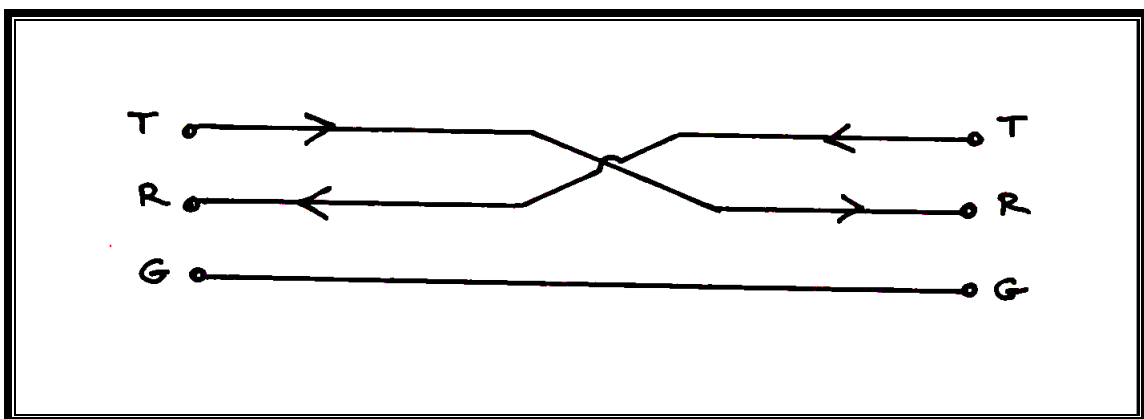
D-Type Pin-Out

The diagram below illustrates a full implementation of RS-232 using a 9-way D-Type connector:



In a typical modern application of RS-232, most of the pins illustrated above are known as 'modem control signals' and would not be used. One example is the means of 'flow control', whereby a receiving device indicates to the sender that it is not ready to receive data, and asks the sender to pause. Pins 7 and 8, which were used in early implementations for 'hardware flow control', are usually not required to be connected because 'software flow control' is used instead.

In a typical modern-day installation, only three wires are required between devices. Device A's 'Transmit' pin is connected to device B's 'Receive' pin and vice versa. The 'Ground' wire then provides a common return path for both signals. This is illustrated below.

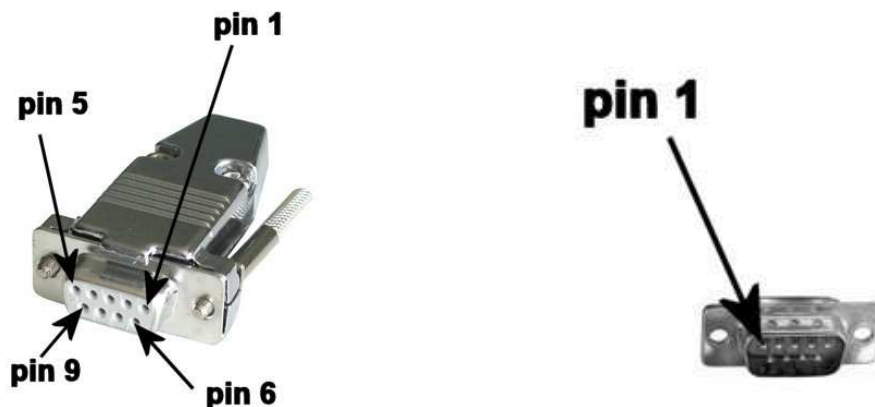


Note that local loopback wiring may sometimes be used to simulate modem control signals, e.g. pins 7 and 8 might be connected together within the plug.

A typical Jayex installation is usually even simpler: the computer only sends data to the board, and there is no requirement for flow control. Only two wires are needed to:

- (a) connect the Transmit Pin of the computer to the Receive Pin of the Jayex Board, and
- (b) connect the two Ground pins together.

The only exception to this rule is where a board in a branch surgery is connected over a VPN to a remote computer, and consequently flow control is required.



The illustration above shows how the pins of a 9-way D-Type connector are numbered. The female connector, or socket is shown on the left, and the male connector, or plug, is on the right.

A computer will often present its serial connection as a COM port using a 9-way **male** connector. These used to be standard on desktop PC's but it may now be necessary to use a USB Serial Adaptor to provide such a connection, particularly with laptop computers. If you have to use such a device, you will typically need to install software drivers distributed by the manufacturers of the device.

On the computer, the pin-out of the connector should always follow the standard for a terminal device or DTE. Pin 5 will be ground, and pin 3 will be transmit from the computer.

Where a Jayex board is connected to an EMIS file server, there may be insufficient D-Type COM ports and a multi-port serial card may be used. In this case the connector required may be an RJ-11, similar to the jack used on American telephones. These types of connection are not covered in this paper.

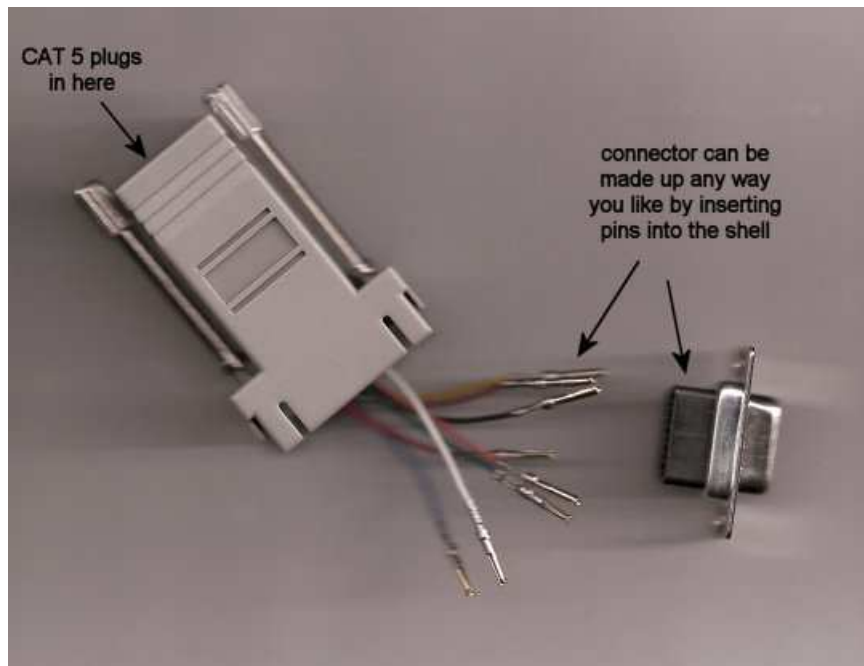
Jayex boards typically present a 9-way female connector, with pin 5 as ground. However different models vary as to how they present transmit and receive. On some models, 3 is receive and 2 is transmit, whereas others have 2 as receive and 3 as transmit. You may well find that the connector is labeled to show which system has been used, e.g.

T	2
R	3
G	5

In the case illustrated above, pin 3 is receive on the Jayex board and thus needs to be connected to transmit on the computer (pin 3 on the computer's 9-way connector).

Patching over CAT 5

The situation is somewhat further complicated because Jayex boards are rarely connected directly to computers using only 9-way connectors. In modern installations the connection is made over CAT 5 building infrastructure using 9-way D-type to RJ-45 adaptors at each end. A male adaptor is plugged in to the Jayex board, a female adaptor is plugged into the computer, and thereafter the link is formed by CAT 5 cable.



An RJ-45 to 9-way adaptor is illustrated above. At the time of writing this is part number RJ459ADF available from Comms Express at £1.25 plus VAT. As can be seen, the correspondence between the pins of the RJ-45 connector, and those of the 9-way connector, is entirely at the discretion of the person making up the connector.

EMIS provide notes to their field engineering staff (see Appendix 2) as to how these adaptors should be made up. Unfortunately they only describe this in terms of the colours of the wires within the adaptors which EMIS use. There is no guarantee that different manufacturer's adaptors use similar colours of wires (see Appendix 1).

The installation examined by the author had an adaptor supplied by Jayex connected to the display board in which the correspondence between the RJ-45 and 9-way connectors was:

RJ-45	9-way
4	3
5	5

There is likely to be some consistency between different installations, although the EMIS notes for field engineers call attention to the possible reversal of transmit and receive, and advise that further investigation may be required, particularly in older installations.

In the Comms Express adaptor obtained by the author, the correspondence between RJ-45 pins and cable colours is as follows:

1	blue
2	orange
3	black
4	red
5	green
6	yellow
7	brown
8	white

It should not be assumed that adaptors obtained in future will follow the same use of colours, even if from the same source.

A 'standard' adaptor for use with a PC or server COM port would therefore have the red wire in pin 5 of the D-type, and the green wire in pin 3.

Investigation Kit and Diagnostic Software.

A kit has been assembled which includes a CAT5 patch lead, a CAT5 socket, a 9-way socket, and a 9-way plug, together with a continuity testing device. Where further investigation is needed, this kit can be used to determine which pins are connected in any existing 9-way to RJ-45 adaptor.

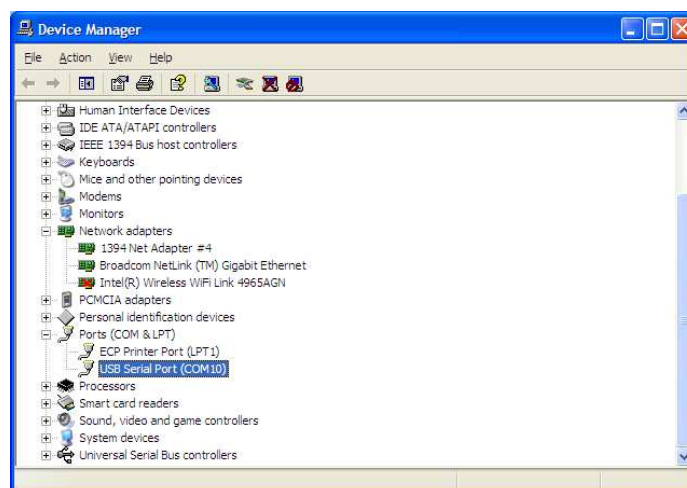
Jayex have supplied a diagnostic software package called "D300 Tester". This can be installed on a laptop in order to test wiring to the display.



Enter the relevant COM port number and press the 'Send Message' button to operate the software.

Test Procedure

To test the connection to a Jayex board, use a laptop with the D300 tester software installed. Ensure you know what COM port is to be used: if you need to identify the COM port number used by a USB serial adaptor, right-click on 'My Computer', select 'Properties' and click the 'Hardware' tab; click 'Device Manager' and view the COM ports as shown below:



Connect up to the Jayex board through the CAT5 cabling using the 'standard' Jayex adaptor.

Try the DT300 tester software. If it works, fine - you should be able to use a standard adaptor to connect to the GP clinical system.

If it doesn't work, you will need to investigate the Jayex board and its adaptor further.

Use the table below to plot the marking on the board, and the connections found using the continuity tester, then assemble an adaptor to suit:

T, R, G	Jayex board 9-way	RJ45	Computer pin required	Adaptor wire colour
	2			
	3			
	5		5	

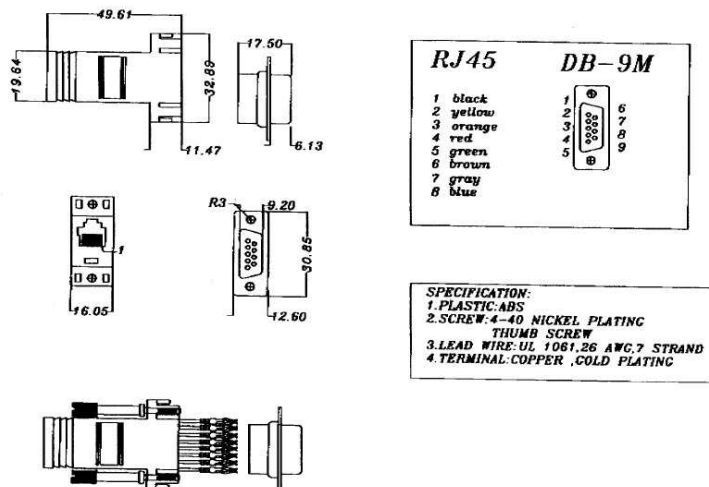
Pin 3 on the computer 9-way needs to be connected to R on the display board.

Appendix 1

The 'standard' adaptor has a female 9-way connector and is wired as shown below:

RJ-45	colour *	D-Type
1	blue	n/c
2	orange	n/c
3	black	n/c
4	red	5
5	green	3
6	yellow	n/c
7	brown	n/c
8	white	n/c

* note that these colours only apply to the particular batch of adaptors obtained from Comms Express. To illustrate this, below is presented a spec of a product from RS Components, which uses different colours of wire; whilst the red and green wires happen to correspond in this case, this cannot be guaranteed for other products:



Appendix 2

EMIS Field Engineers' Notes

Available from EMIS

Appendix 3

"Standard" Serial Port Connections on a PC

D-9	D-25	SIGNAL	SIGNAL DESCRIPTION	DIRECTION
n/a	1	Chassis/ Ground		Common
3	2	TxD	Transmit Data	Output
2	3	RxD	Receive Data	Input
7	4	RTS	Request To Send	Output
8	5	CTS	Clear To Send	Input
6	6	DSR	Data Set Ready	Input
5	7	SG	Signal Ground	Common
1	8	DCD	Data Carrier Detect	Input
4	20	DTR	Data Terminal Ready	Output
9	22	RI	Ring Indicator	Input

The above diagram shows the pin-out used by a 25-way D-type connector, as well as that used by a 9-way. This should not be confused with the 25-way D-type connector which is used on a PC for a parallel printer port.

Appendix 4

Long Distances and Multiple Displays

Where a GP practice has more than one waiting room, it may have two or more Jayex patient call displays. In this case Jayex recommend the use of a device supplied by Black Box to divide the signal.

Where distances in excess of 100m are involved, the RS-232 transmission system may not perform adequately. These long distances are possible where the connection is patched over lengthy building infrastructure routes. In this case, Jayex recommend the use of RS-485.

In either of these circumstances, Jayex should be asked to supply and prove the required connections.