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E2L Limited

# User Manual for J331 Ultrasonic NDT Matrix Controller



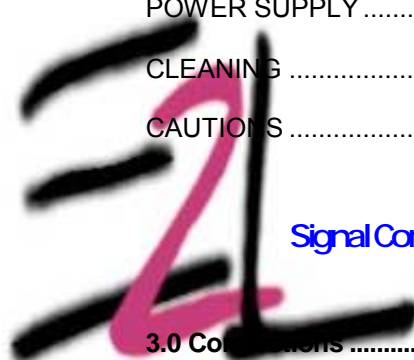
*A manual for users of the E2L Ultrasonic  
Laboratory Array Matrix Switching Controller. Its  
operation, deployment and maintenance.*



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# J331 Ultrasonic Laboratory Array Matrix Switching Controller

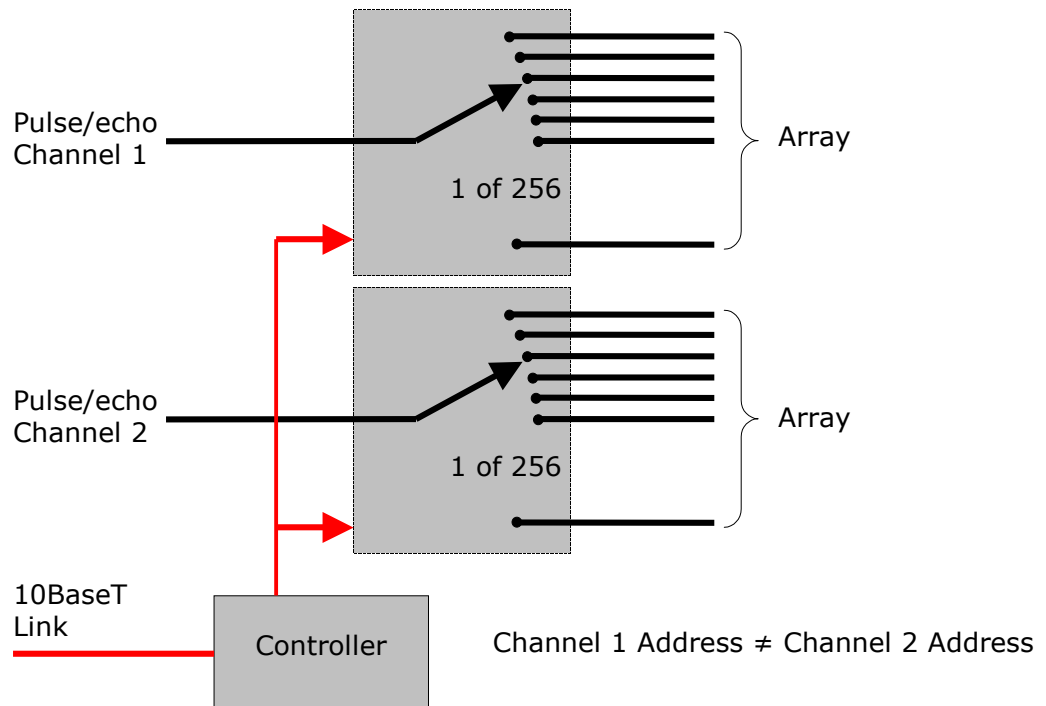
*This manual provides necessary operating instructions for successfully configuring and driving the J331 ultrasonic matrix controller which allows two ultrasonic channels to be exclusively assigned to any two of 256 possible routes.*

## 1.0 Principle

For certain applications using ultrasonic pulse-echo techniques there is a requirement for multiple matrix configurations. The J331 switch provides an automatic means of routing two ultrasonic channels exclusively into any two of 256 routes.

The instrument is provided as a standalone 19" rack system which can be interfaced directly to investigation equipment such as the NDT solutions 'EUI'. It is driven by a computer via a 10BaseT Ethernet link.

The whole system is capable of addressing up to 256 routes and can be expanded up to this limit by installing additional PCB cards of 16 routes capacity each. For systems in excess of 128 routes an additional 19" enclosure is required. This is summarised diagrammatically as:



Prior to any route selection for either of the channels, all channels are disengaged ensuring no high voltage return paths are open. All switching is achieved using mechanical relays.

Channel selection is mutually exclusive ensuring the path is not short circuited internally.

## 2.0 Introduction

We have endeavoured to make the J331 simple to use but please read this manual to familiarise yourself with all of the operations and especially the safety instructions.

The J331 is a mains powered system intended for investigative tests, typically in a laboratory environment. It requires a local AC supply of 110/240V to operate.

As with any machine the care that you give it will reflect on its operational life and reliability. Please read this manual and take note of the safety and care instructions.

Spares and expansion modules are available from E2L or their approved agents. There are no user serviceable components below board replacement level.

This machine comes with a one-year warranty, if you have any problems or questions please contact your agent.

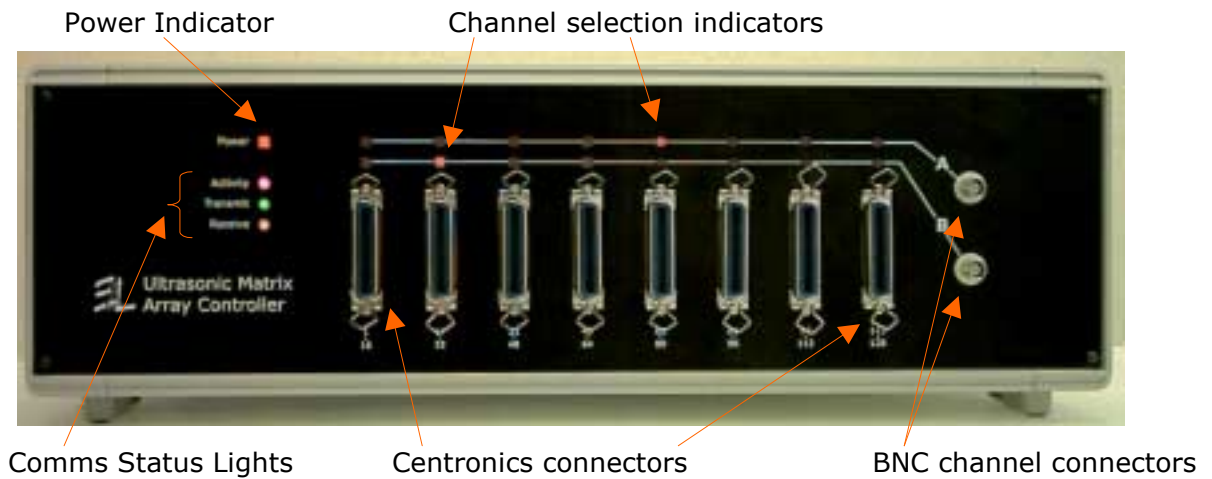
If you have any questions or any advice on improving both the J331 and this manual please contact your agent.

## 2.1 Equipment Identification

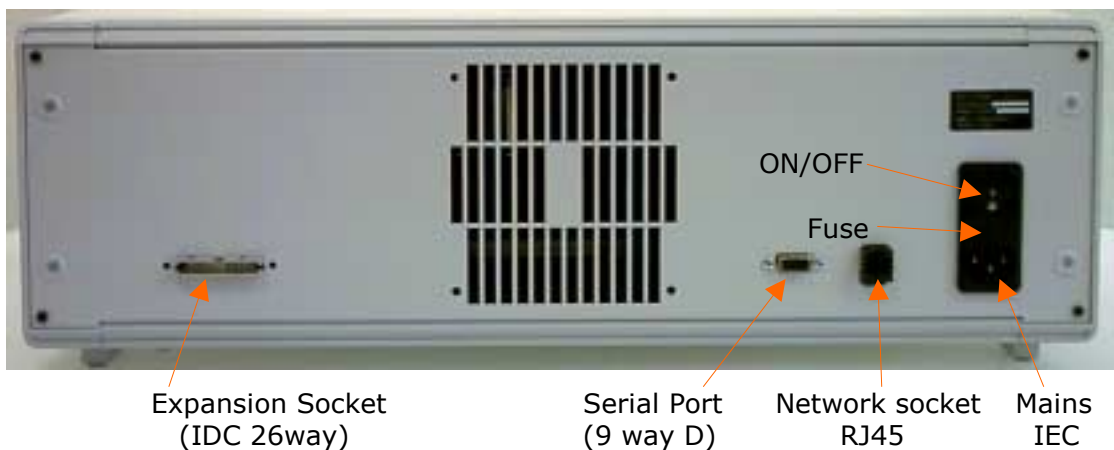
The J331 is supplied in a 19" standalone case which contains the main control unit as well as up to 8x16 route switching boards (Channels 1 to 128). If more switches are needed then an additional 19" standalone case is required to house channels 129-256.

The front of the unit provides access for the two pulse channels and up to 128 connections via 36way 'Centronics' connectors for the matrix array. Each connector provides 16 switches and if channel 'A' or 'B' are active in this group it is indicated by means of an LED.

The front panel also has indicators for power, 10BaseT link activity, receive and transmit activity.

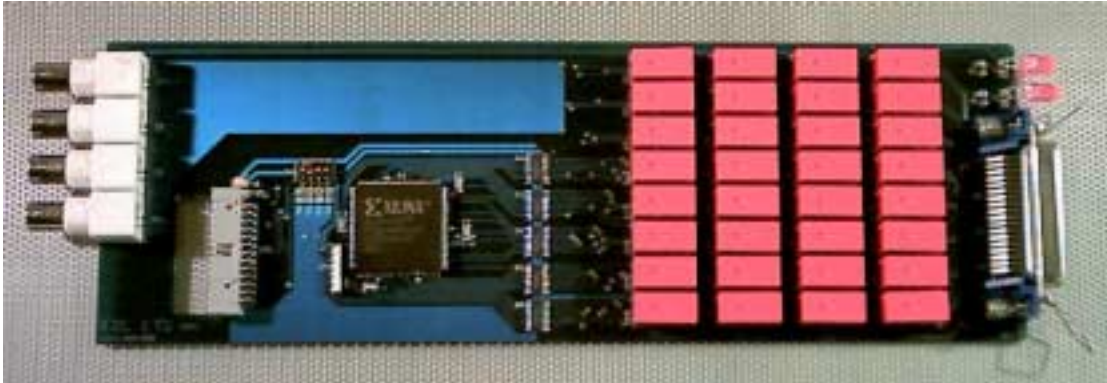


The rear panel provides for the more permanent connections. These include a 9-way serial connector for 10baseT configuration (IP address, etc), a 10baseT network socket, mains power, switch, fuse and an expansion socket.



## 2.2 Spare parts

The J331 can be expanded by the user in blocks of 16 switches. This is achieved by adding a pcb (Part Number J331.010.000) and patching in some channel routing connectors. Full details are given in the section 6.



The controller card and other components are not user serviceable or replaceable.

## 2.3 Care and Maintenance

### POWER SUPPLY

The J331 requires an AC power supply between 110 to 240V, 50 to 60Hz.



***The back panel should never be removed with the power lead connected.***

Whilst the J331 has a filtered power supply but it is advisable to avoid using it on the same power outlet as a motor, dimmer or any other equipment that generates noise or consumes a large amount of power. Similarly closeness to neon tubes, fluorescent lamps, television sets, cathode ray tubes, or other such equipment could cause erroneous noise and interference.

Protect the J331 from direct sunlight, temperature and humidity extremes (heaters etc.), dust and vibration.

Avoid Damage to the power cable.

### CLEANING

Always switch off the power. For routine care, wipe the casing with a dry soft cloth. To remove more stubborn dirt, clean the casing with a cloth coated with a neutral detergent, then wipe it dry with a soft cloth. Ensure that the cloth is just damp (not wet) and has been wrung out fully before use – the J331 will be damaged by water ingress.

Never use paint thinners, benzene, or other organic solvents which could damage the casing.

**CAUTIONS**

Do not allow fluid or foreign matter, such as water, beverages, wires to enter the J331.

Do not examine or modify the internal components or circuits, electrical shocks or damage may result.

Do not subject the unit to severe impact.

If the J331 fails to operate correctly, turn the power off and contact your agent.

When not in use the unit must be stored in a warm dry place.

# Signal Connections

*This section details the physical connections required to interface the J331 to an EUI (or similar) and a test array.*

## 3.0 Connections

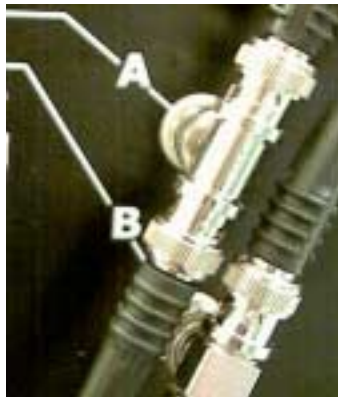
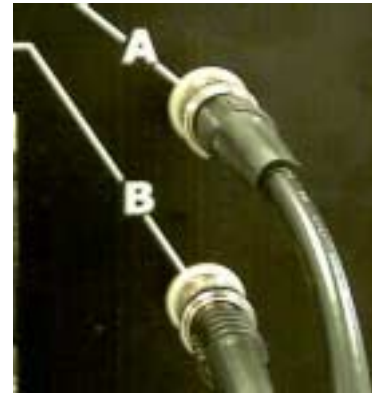
### 3.1 Main signals

Connection of main signal paths from a pulser-receiver, or similar ultrasonic research tool, is by means of the 50Ω BNC connector on the front panel.

Channels A and B are clearly marked and their usage is depends on the objectives of the researcher.

Electrically there are no differences between channels A and B.

Both channels have isolated earths.

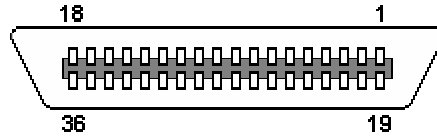


If an expanded system is being used (more than 128 switches) then the channels need to be routed to both units via a 50Ω BNC 'Tee' connector

### 3.2 Switched connections (Array connections)

Channels A and B are routed via the J331's switch controller to a series of 'Centronics' connectors on the front panel. The number of these connectors depends on the size of system purchased but the switch ranges are clearly marked underneath the corresponding connector.

Each connector caters for 16 possible switch routes and are common earthed.



Signal	PIN	PIN	Signal
N/C	1	19	GND
Switch 1	2	20	GND
Switch 2	3	21	GND
Switch 3	4	22	GND
Switch 4	5	23	GND
Switch 5	6	24	GND
Switch 6	7	25	GND
Switch 7	8	26	GND
Switch 8	9	27	GND
Switch 9	10	28	GND
Switch 10	11	29	GND
Switch 11	12	30	GND
Switch 12	13	31	GND
Switch 13	14	32	GND
Switch 14	15	33	GND
Switch 15	16	34	GND
Switch 16	17	35	GND
N/C	18	36	GND

The switch number in the table above applies to the first (most left hand) slot in the front panel. Subsequent slots require a multiple of 16 to the switch number for determining the correct address. These addresses are clearly marked on the front panel underneath the relevant slots.

# Configuring the system

*This section defines the necessary configuration of the network interface required prior to an investigation.*

## 4.0 Administrative requirements

As a 10BaseT network device the J331 requires various networking parameters to be defined.

To achieve this the unit comes with a software utility which allows changes of MAC address, IP address, Sub-net mask and Gateway addressing. It also allows inspection of the settings.

If the J331 is being run as a standalone system then the setting of the network parameters will normally conform to the TCP/IP settings of the controlling PC.

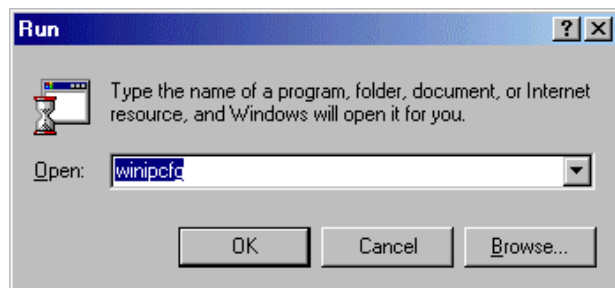


***If the system is being run on a larger network then you should consult your IT administrator for addressing which conforms to your organisations system.***

### 4.0.1 Parameters for a standalone system

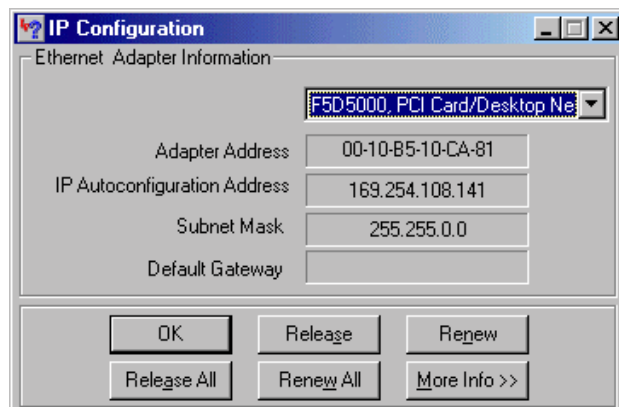
You can access your PC's network configuration by running the system utility 'winipcfg':

This will then inform you of the current IP configuration settings of your PC.



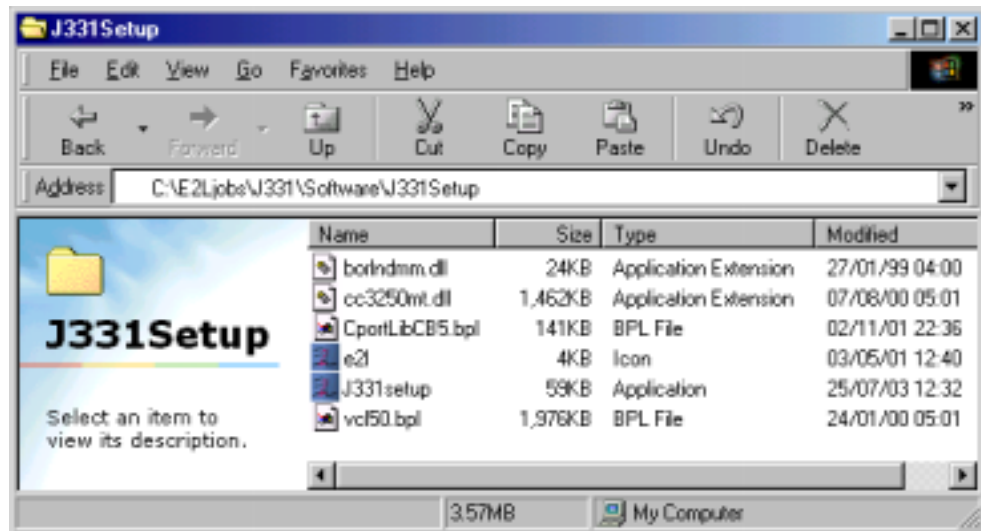
This facility is particularly useful if you have selected automatic IP addressing in your initial TCP/IP setup.

Take note of the IP address and the Subnet Mask. In this example, since the Subnet mask is 255.255.0.0, the J331 will need to have an address which starts 169.254.



## 4.1 Configuration Utility

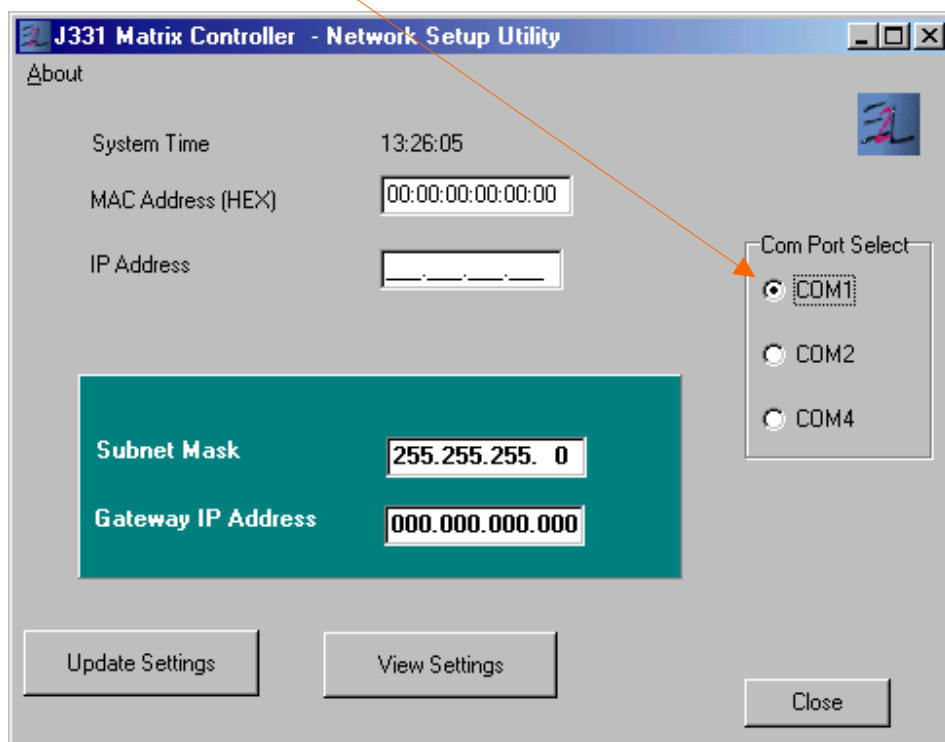
With your supplied CD there is a zip file called J331Setup.zip. Copy this directory to your PC and unzip it. This will result in a folder with the following files:

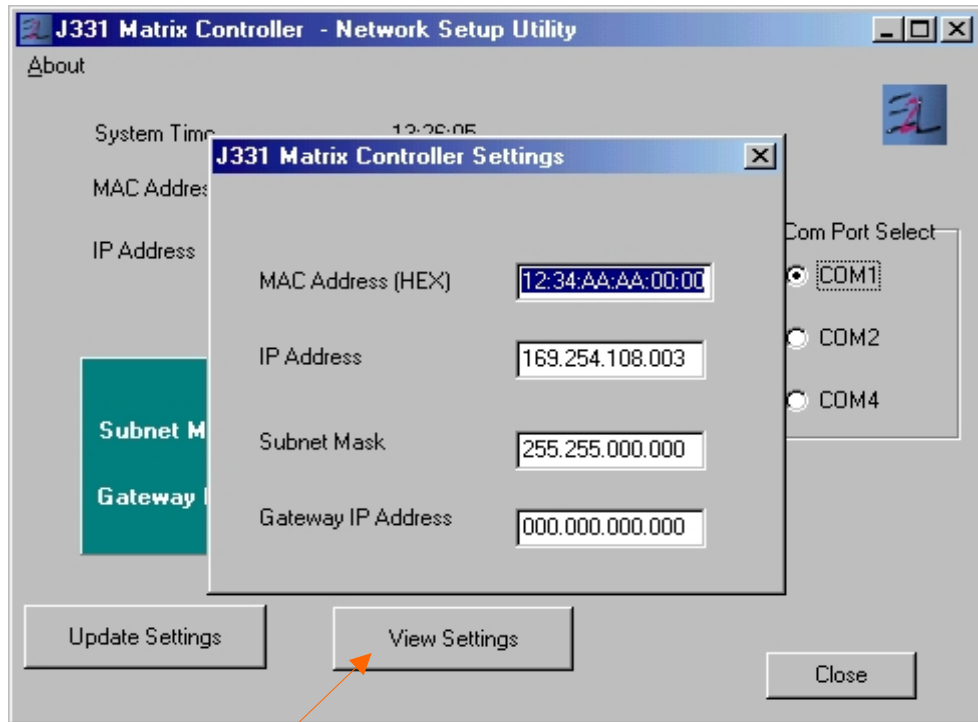


Double click on J331setup to evoke the configuration utility.

Connect a 9way serial RS232 lead between your PC and the socket on the rear of the Matrix Array Controller.

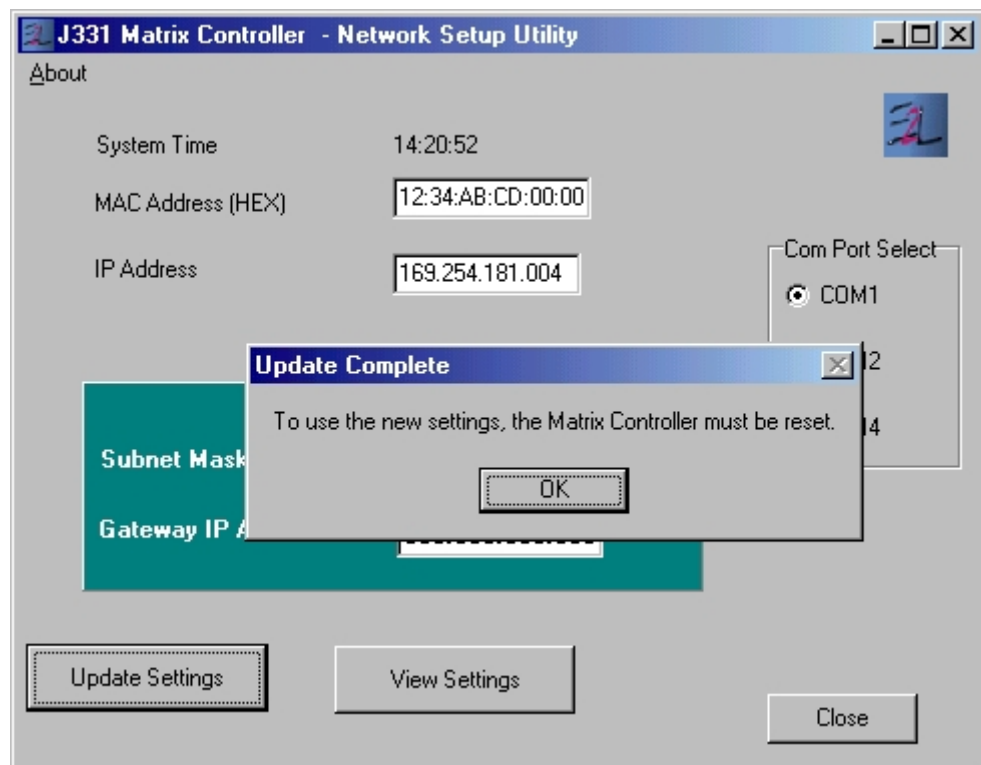
When J331setup is evoked it checks to see which communications ports on the PC are active and then displays them. Select the relevant port by clicking on the appropriate radio button:





The current configuration of the J331 can be checked by clicking on the 'View Settings' button:

To change the address settings, fill in the relevant boxes with MAC Address, IP Address, Subnet Mask and Gateway Address. When the form is filled out, press 'Update Settings' and wait for the following response message:



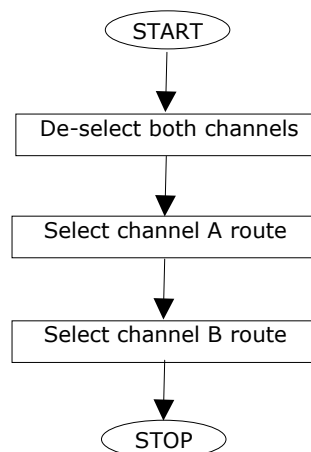
Now switch off the J331. The new addresses are now permanently stored in non-volatile memory.

# Software operation of the J331

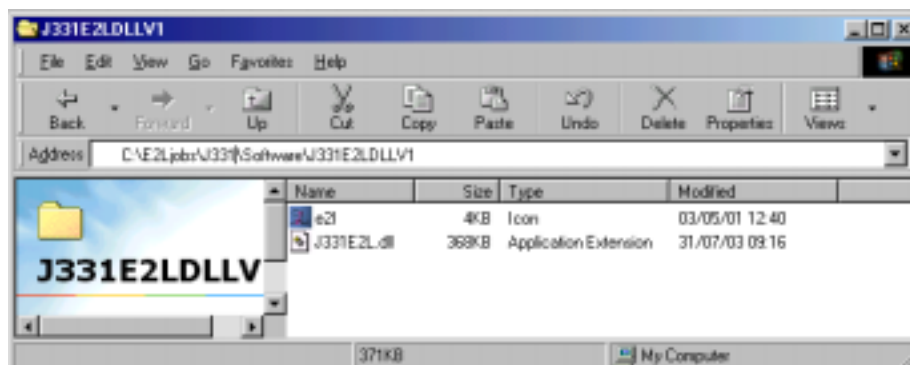
*How to use the supplied DLL files in your own software to drive the J331. This section is aimed at competent software writers who are conversant with concepts of DLLs and IP addressing.*

## 5.0 Introduction

The only task required to drive the unit is to define which routes are required for which channels. In effect the process is:



To enable third party organisations to interface to the J331 Matrix controller easily, a dynamic link library is provided J331E2L.DLL. This is supplied on the CD in the file J331E2LDLLV1.01.zip. Unzipping the file will produce the following folder:



The J331E2L.dll achieves the process defined above by passing explicitly defined routes for channel A and channel B. The DLL also provides a UDP over Ethernet connection to the J311 Matrix Controller and thus communicates the routing information over an existing network.

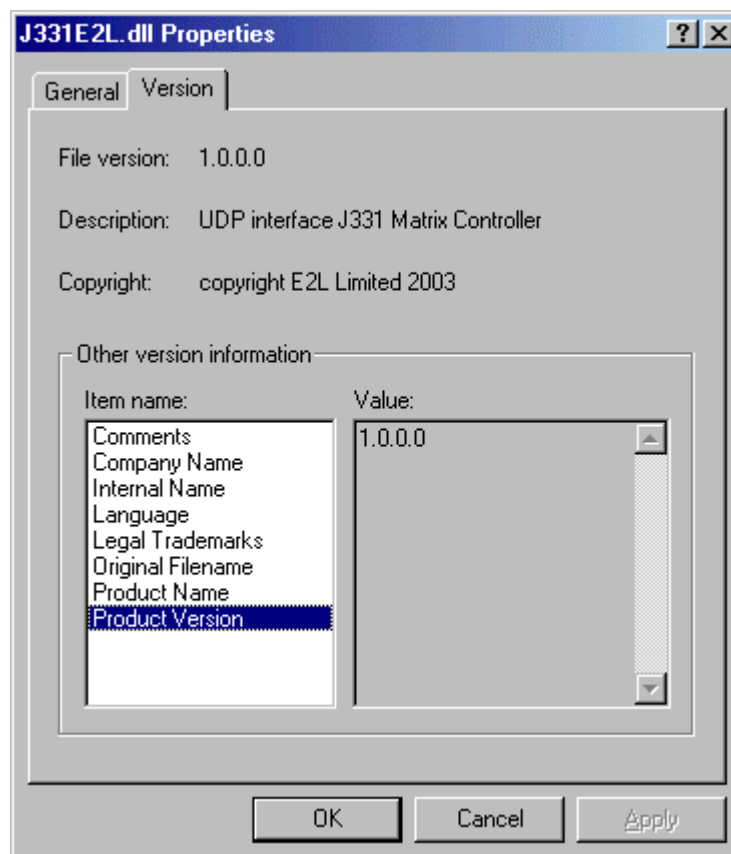
The DLL has been tested on windows 95 and 98.

It is assumed that the J331 matrix controller has been correctly configured with its relevant IP address, sub-net mask, gateway IP address and MAC address using the configuration utility supplied.

## 5.1 The J331E2L.DLL

The legal limits for values of channel A and B are 1 to 256. Any values exceeding 256 will cause a 'no-route' condition. This can be used as a master clear or as a means of selecting only one channel.

The current version is found in the DLL's unit's properties bar:



The DLL has been designed to be compatible with C++ Builder, Microsoft Visual Basic, Microsoft Visual C++ and Delphi.

The DLL exports just one routine, <J331udptx>

```
int J331udptx (char *ipAddr, int ChnIA, int ChnIB, bool showForm, int *ChnIAResponse, int *ChnIBResponse)
```

J331udptx formats and sends a UDP datagram, containing the data values ChnIA and ChnIB to the network IP address specified by ipAddr. If the Boolean showForm is true, the following informative form is displayed

The successful transmission of the UDP data gram is indicated by a non-zero return value.



**Note:** the data that is reported in the received data channel screen is the 'machine address' which is one less than the actual 'Channel address'. For example the last six digits of 001044 represent Channel  $(001+1)=2$ , and  $(044+1)=45$ .



**Note:** When using the DLL itself a successful response is indicated when the value returned in ChnIAResponse equals the value sent in ChnIA, and ChnIBResponse equals the value sent in ChnIB.

## 5.2 DLL usage example C++ Builder 5.0

At the top the calling module, the function must be declared along with a handle to the import library and a pointer to the function.

```
typedef int __declspec(dllimport) J331udptx(char *ipAddr, int Chn1A, int Chn1B, bool
showForm, int *Chn1AResponse, int *Chn1BResponse);

HINSTANCE      hLib;                                /* A handle for the import library */
J331udptx*      pJ331udptx;                          /* A pointer to the function. */
```

In the body of the code the library must be loaded and the address of the function extracted.

```
hLib = LoadLibrary("j331e21.dll");                    /* load Library */

if (hLib)                                             /* check for successful load */
{                                                     /* Get the function address */
    (pJ331udptx = (J331udptx*)::GetProcAddress(hLib, "J331udptx"));

    if (pJ331udptx)
    {
    }
    else
        ShowMessage(SysErrorMessage(GetLastError())); /* error accessing function*/
}
else                                                 /* error loading library */
{
    ShowMessage(SysErrorMessage(GetLastError()));
    ShowMessage("Unable to load DLL");
}
}
```

The function can now be called

```
success = (*pJ331udptx)(ipAddress,Chn1A,Chn1B,displayDebugForm,&Chn1AEcho,&Chn1BEcho);
```

## 5.3 DLL usage example Visual Basic 6.0

At the top the calling module, the function must be declared.

```
Private Declare Function J331udptx Lib "c:\j331e21.dll" _
    (ByVal ipAddr As String, ByVal Chn1A As Integer, ByVal Chn1B As Integer, _
    ByVal showForm As Boolean, Chn1AResponse As Integer, _
    Chn1BResponse As Integer) As Integer
```

Call the function

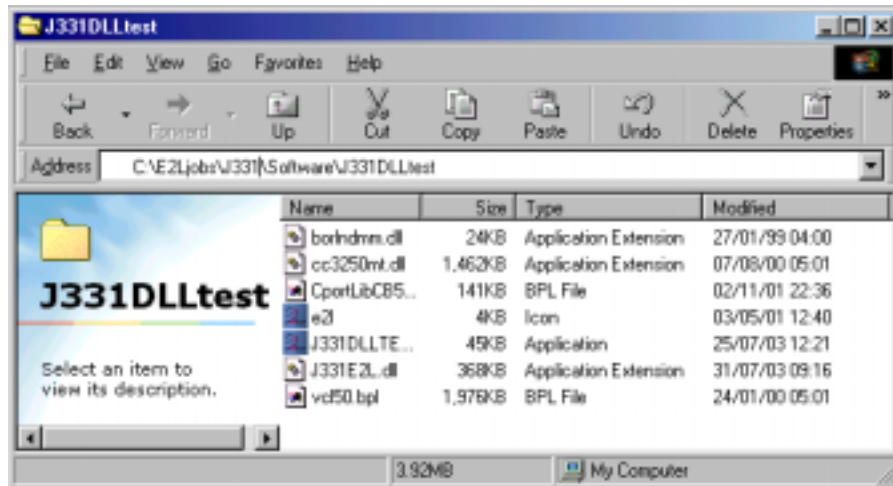
```
Private Sub Command1_Click()
    Dim success As Integer
    Dim ipAddr As String
    Dim Chn1A As Byte
    Dim Chn1B As Byte
    Dim showForm As Boolean

    success = 0
    Chn1A = 123
    Chn1B = 122
    ipAddr = "127.000.000.001"
    showForm = True

    success = J331udptx(ipAddr, Chn1A, Chn1B, showForm, Chn1AResponse, Chn1BResponse)
```

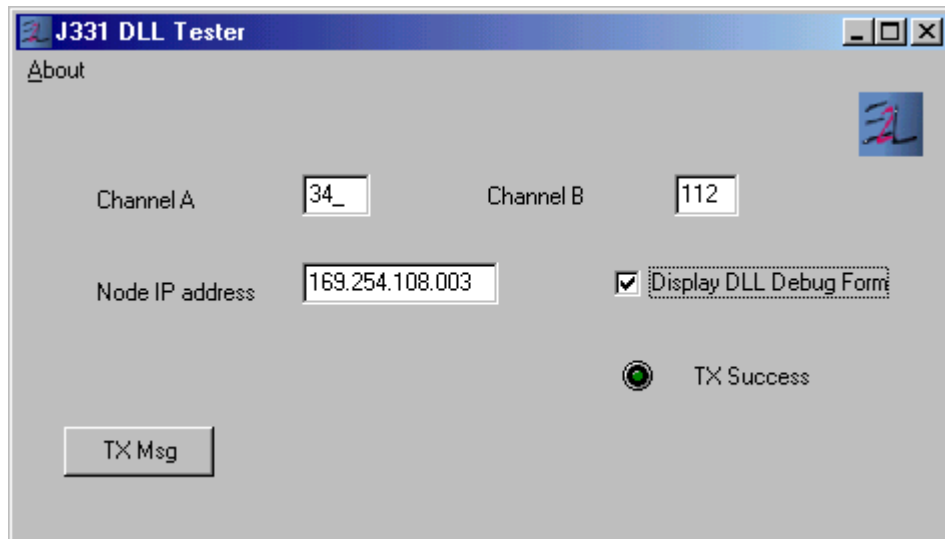
## 5.4 J331 DLL Test Program

A simple test application (J331DLLTESTER.zip) has been provided on the CD so that individual channels can be exercised one-by-one. Unzipping the file will produce the following folder:



Running J331DLLTEST will provide a simple screen which allows selection of specific channels so that they can be 'one-shot' tested.

The IP address of the J331 must be inserted prior to transmission.



In the example above Channel A will be routed through switch 34, and Channel B through 112. This will happen after the 'TX Msg' button is pressed. The 'TX Success' indicator changes colour: Green for success, Amber for pending transmission, and Red for a failed communication.

If the 'Display DLL Debug Form' box is checked then the UDP debug form is displayed.

# Expanding the switching capability of the J331

*How to upgrade the switch capacity by adding more hardware to the J331. This operation is only meant for users with sufficient technical competence to undertake electronic system building.*

## 6.0 Introduction

As research programmes develop there may be need to increase the switching capacity of the J331 from time to time. This is possible by adding PCBs which provide an additional 16 switching channels. Any number of PCBs can be added providing a maximum of 256 channels.

An upgrade purchase pack consists of a 16 switch PCB (Part Number J331.010.000) and two BNC interconnection leads (Part Number J331.510.020).

There is no software management to perform but some hardware configuration by means of PCB mounted switches is required.



***Normal safety and anti-static precautions are absolutely necessary when carrying out these operations.***

The only tools required are an M3 spanner or nut runner, and medium and a small crosshead screwdriver.

## 6.1 Adding an extra 16 switches

For this example we shall take a 48 switch system and add a single card to provide for a total of 64 switches.



***Disconnect all cables from the front and the rear of the unit. You will need easy access to both ends of the unit.***

### 6.1.0 Setting the address

The only configuration operation required for hardware is to set its address switches. These tell the PCB which switch numbers they are being assigned. The addresses are slot specific.

The table overleaf defines the slot to address relationship:

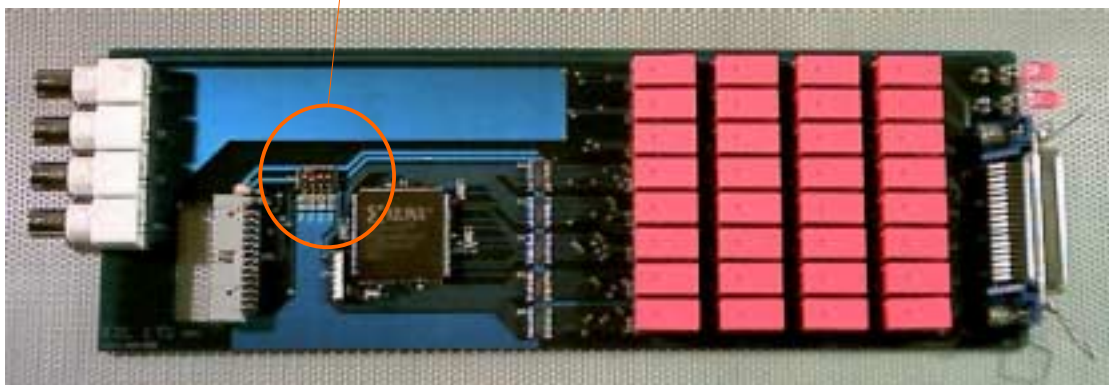
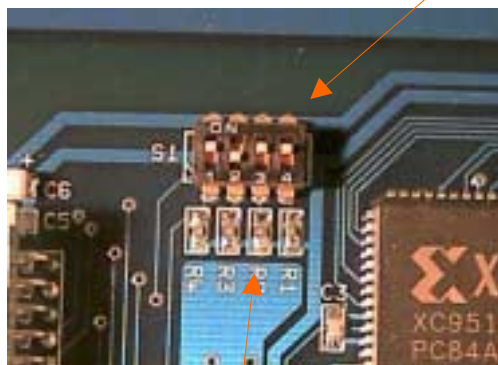
Identify the four-bit switch, S1, on the pcb.

The switch is binary coded with the least significant bit to the right hand side.

With a small screwdriver adjust the switch positions to give the right address for the relevant slot. 'Up' or 'ON' for '0'; Down for '1'.

The example below shows address '4' (0100).

Address	Switch	Range
0	----	1-16
1	---_	17-32
2	--_-	33-48
3	--__	49-64
4	-_--	65-80
5	-__-	81-96
6	-___	97-112
7	-____	113-128
8	_---	129-144
9	_--_	145-160
10	_--_	161-176
11	_--_	177-192
12	__--	193-208
13	__-_	209-224
14	___-	225-240
15	_____	241-256



Once this has been done the board can then be added to the main housing.

### 6.1.1 Adding the PCB to the J331

Remove the four screws from the corners of the front and back plates. Tilt the back panel backwards and lay it flat.



Now undo the two screws fixing the IDC bulkhead connector to the back panel, and then free the connector from the panel.



Disconnect the main signal input from the card in the highest slot. These are the only two BNC cables coming from the front panel.



Insert the new card in the next available slot. Then thread the IDC cable through the hole in the PCB until the 26-way connector on the board is opposite the last available connector on the IDC cable. Push clip them together.

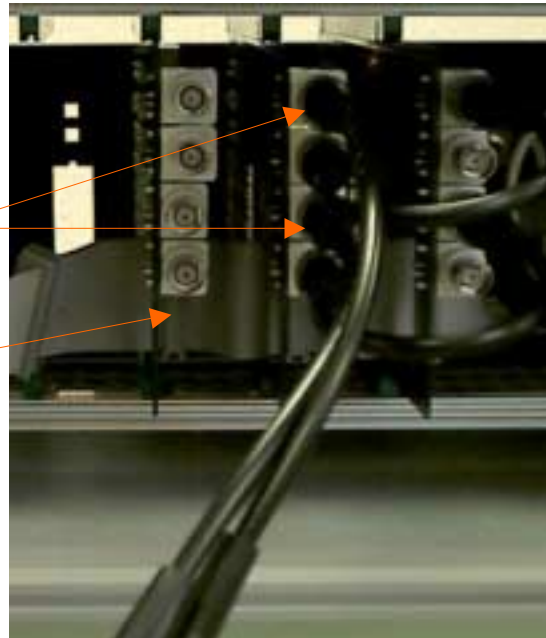
Attach the two new BNC patch cables to the adjacent card where you originally disconnected the main signal cables.



The resulting assembly should look like this:

New BNC patch cables

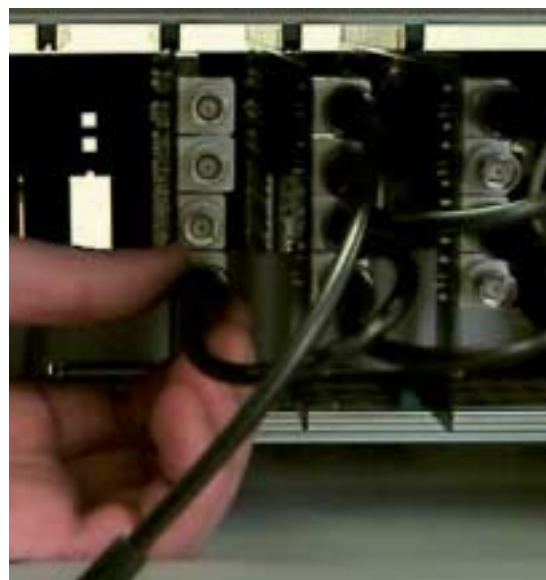
Threaded and connected IDC cable

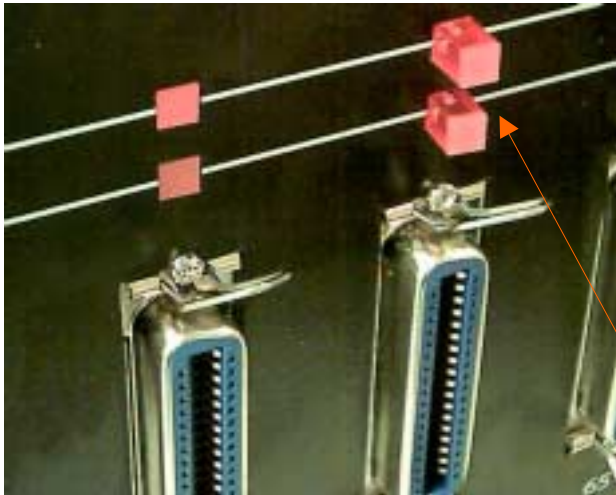


Now connect the BNC patch cables and the main BNC signal cable from the front panel to the new board. They should follow a daisy chain pattern as in the photograph.

Re-install the IDC bulkhead connector to the back panel.

The back panel can now be refitted and secured using the four corner screws.





Gently pull forwards the front panel. The existing fitted boards will slide forward with the front panel since they are fixed to it.

Next remove the screws from the new PCB's Centronics connector and set aside.

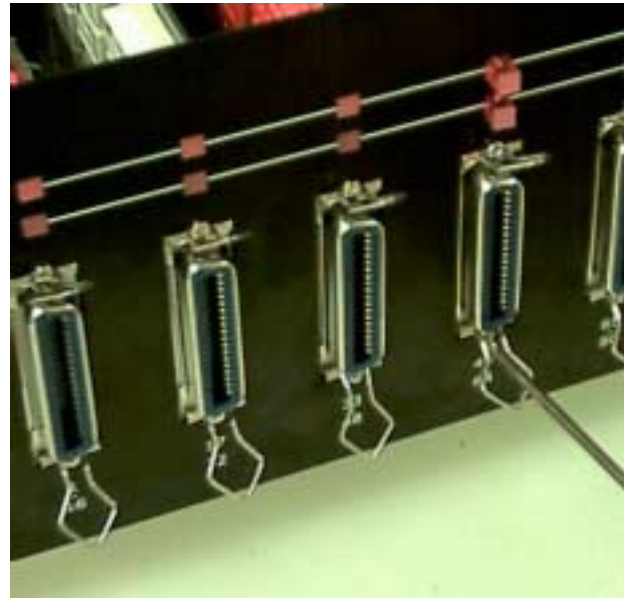
Slide the connector through the front panel, ensuring that the LEDs are located in the square holes provided.

Using the two connector screws previously removed, secure the PCB to the front panel.

Carefully press the LEDs so that they become flush with the front of the panel.

Now gently push the panel back into the enclosure and secure it with the four corner screws.

The unit is now ready to use in its expanded state.



# Appendix A

## *Technical Specification of the J331 Laboratory Matrix Array Controller.*

Signal I/O:	2 channel A & B. 50ohm BNC with isolated earths. 100V pulse capability.
Bandwidth:	DC to 50MHz
Switching capability:	Either channel into 256 routes (mutually exclusive)
Switch connection:	Centronics 36way, 16 switches/connector, common earth
Off channel isolation:	400V
Display:	Power LED, 10BaseT status LEDS. A & B 'ON' LEDS
I/O:	RS232 interface for PC configuration 10BaseT connection (RJ45) for network via hub.
Power:	240V AC 2A fuse via filtered IEC inlet
Enclosure:	Standalone 19" rack system. 180 x 430 x 535mm
Weight:	11kg (full system)
Environmental:	IP33