

VISIR RELAY SWITCHING MATRIX VERSION 4.1 – DATA SHEET

The VISIR Relay Switching Matrix is a tele-manipulator designed especially for electrical experiments in remote instructional laboratories. Relays and sockets for components are integrated into a 3D structure (stack of printed circuit boards) optimizing the performance. The VISIR matrix has 17 columns and circuits with up to the same number of nodes can be created remotely.

Matrix organization

The organization of a VISIR matrix is shown in Fig. 1. There are 17 matrix columns. Physically, one connector on each printed circuit board propagates the columns through the stack of boards. There are two types of columns:

1. The ten columns denoted A – I and 0 are called visible nodes because they can be nodes of a circuit and corresponds to tie-points of a solderless breadboard. Node 0 is special. If an oscilloscope and/or a function generator is connected, node 0 will be connected with protective earth as such instruments always are connected with protective earth.
2. The seven columns denoted X1 – X6 and COM are called concealed nodes. The instruments cannot connect with concealed nodes directly only the sources can. However, a concealed node may be connected with any other node by a relay switch.

So far five boards are defined:

1. The *Source Board* connects sources such as a function generator and a triple power supply. The AUX input connected with X4 is omitted in Fig. 2.
2. The *Oscilloscope Board* connects a dual channel oscilloscope
3. The *DMM Board* connects a DMM (multi-meter).
4. The *Configurable Component Board* accommodates a number of components with up to a total of 20 leads or pins and it contains 20 free relay switches. Each switch can connect any component lead or pin with any of the 17 nodes by wiring on the board much like wiring on a solderless breadboard. This wiring will be further explained in the configuration section.
5. The *Dual Component Board* connects up to two components each with two leads or a low frequency instrument such as a DMM with two of the nodes A, 0, D, F and H (board version 4.1B).

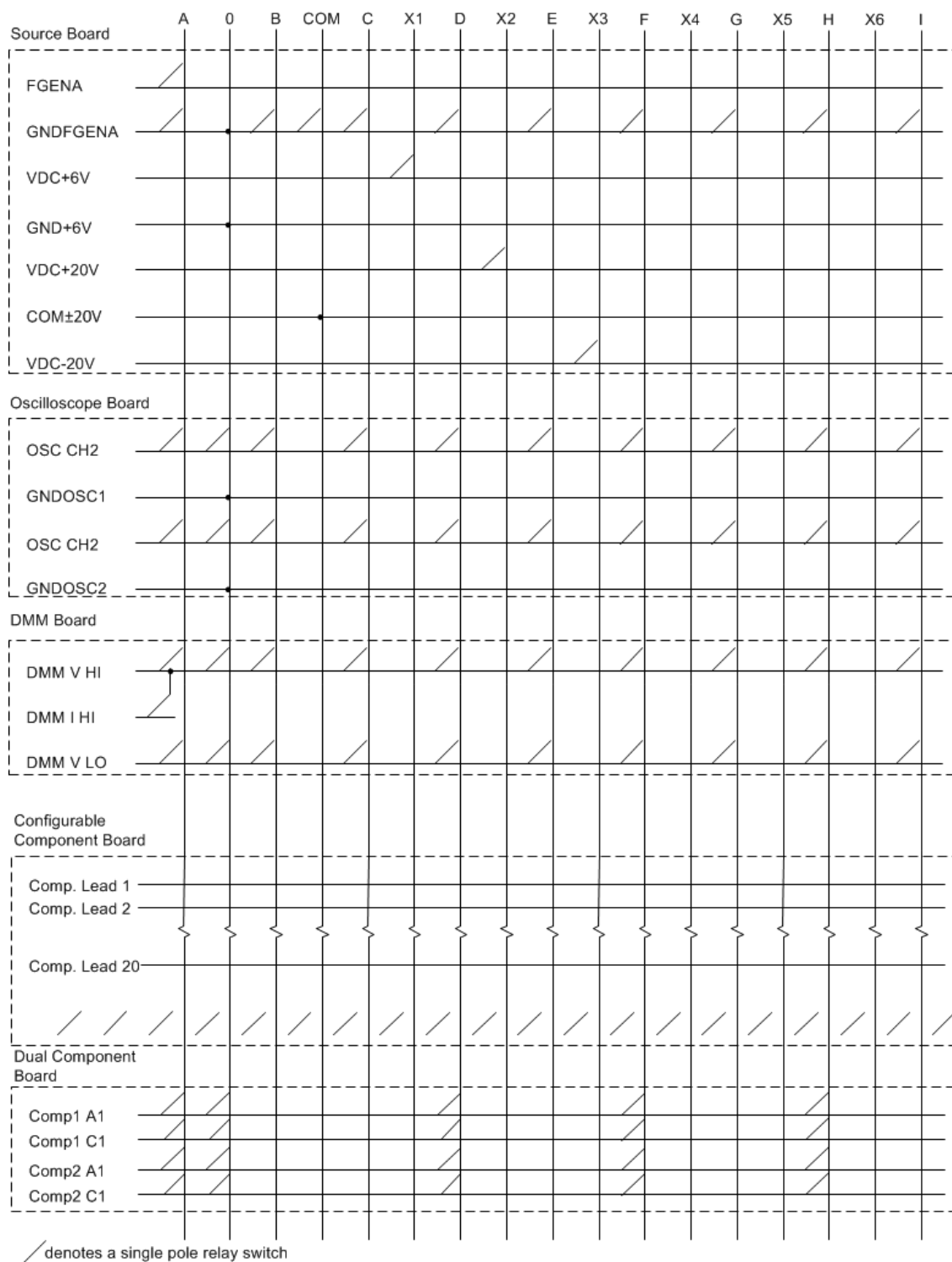


Figure 1. Connection possibilities in a matrix with five boards

Matrix hardware

The switching matrix is composed of a stack of PC/104 sized printed circuit boards. PC/104 is a common international standard for embedded systems¹. This rugged and reliable stacking technology allows multiple modules to be added to a system without the burden of backplanes and card cages. Putting the matrix into a closed case is not recommended because it should be easy to swap components and to reconfigure the matrix. However, such cases are commercially available from a number of vendors.

A matrix with four boards is shown in Fig. 2. The boards are, starting from the bottom, a Source Board, a DMM Board, an Oscilloscope Board and a Configurable Component Board on the top. The matrix is microprocessor controlled. The Matrix Controller (PIC18F4550) hosted on the source board communicates with a PC via USB and with Board Controllers (PIC16F767) on each board via an I²C bus. The I²C address (seven bits) is written in the firmware of each board. The current maximum number of boards carrying components in a matrix is 15.

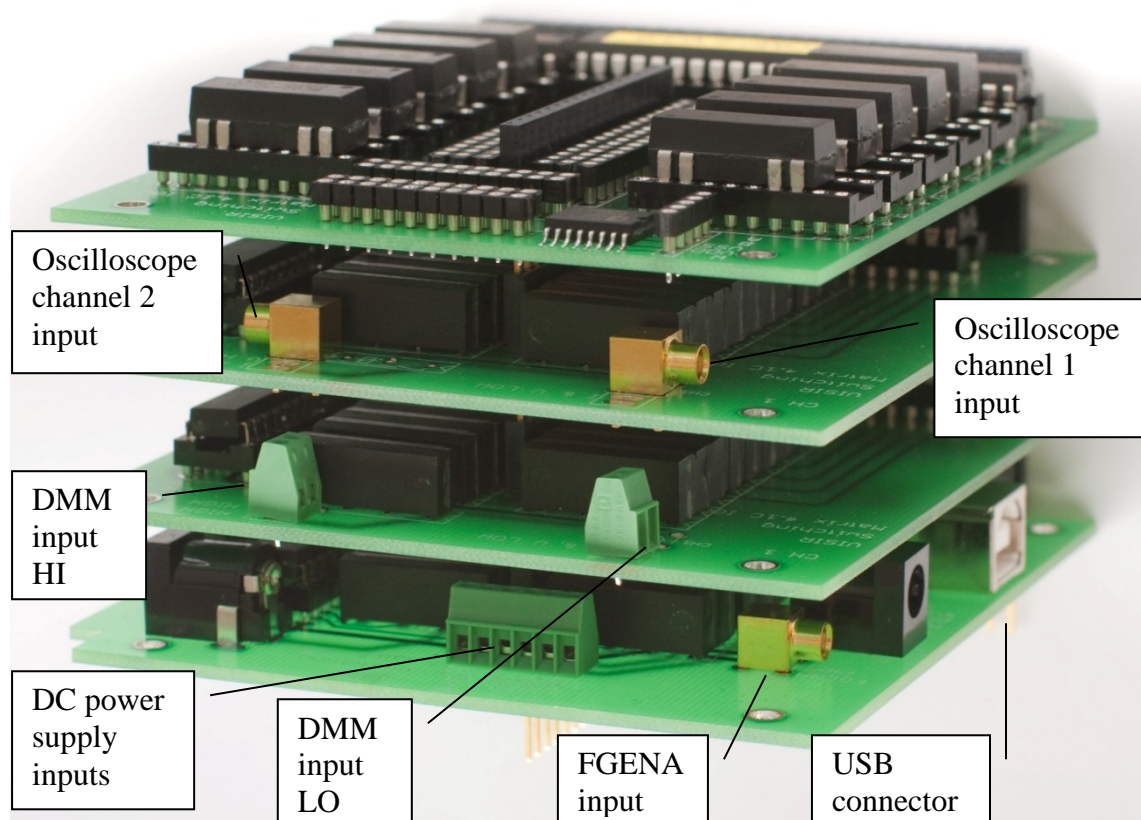


Figure 2. Matrix with four boards

¹ <http://www.pc104.org/>

Matrix software

The Matrix software can be downloaded from <http://svn.openlabs.bth.se/trac/>.

An example of a LabVIEW program that can be used to control the matrix is shown in Fig. 3. When sent, the message displayed in the front panel will connect the function generator to CH1 of the oscilloscope.

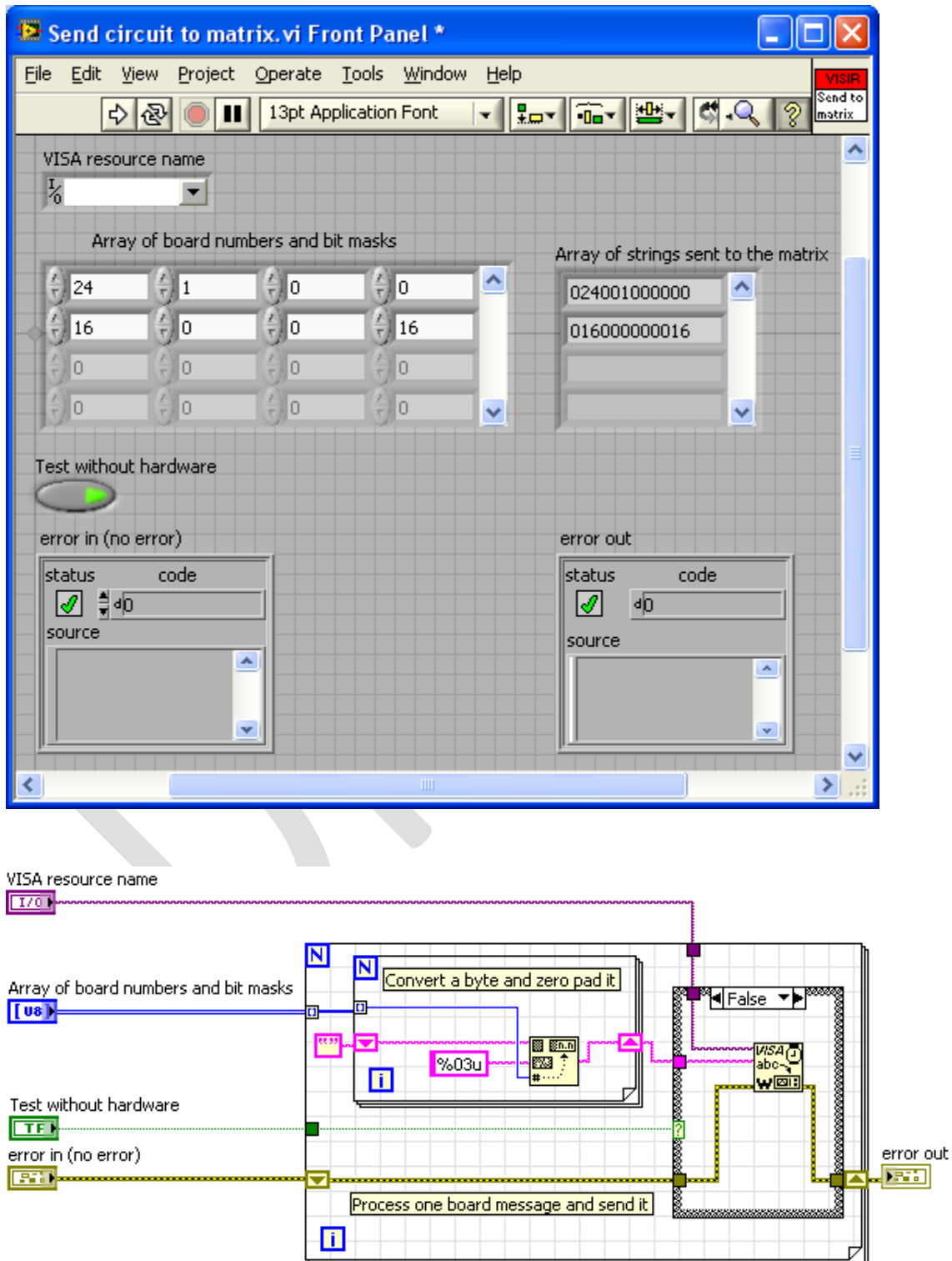


Figure 3. Minimal Matrix Driver in LabVIEW