



PICKERING INTERFACES AN-001

55 x 8 Ultra High Density Matrix Application Note

CONCEPT

In the customers system, a failed PCBA (printed circuit board assembly) is being analyzed and repaired. The PCBA has a combination of 55 inputs and outputs, all spec'ed at between 5 - 60 volts D.C. and less than 200 milliamperes. In addition, 16 pieces of test equipment were required to interface to the Device Under Test (D.U.T.). Bandwidth requirements for this system, were less than 10 MHz. Twenty (20) gauge wire was requested for the cabling, as this was a system for testing known bad PCBA's and problems due to cabling failures (shorts or opens) was to be minimized. Maximum cable length was to be 2 meters long.

SIGNAL CHARACTERISTICS of the chosen hardware, (40-538-021 55 x 8 Matrix card) very closely matched the signal demands of the Device Under Test (D.U.T.) outlined above. 40-538-021 switching characteristics (typical):

Max Standoff Voltage	100Volts
Maximum Switch Current	0.5Amps (Hot)
Maximum Carry Current	1.0Amps (Cold)
Expected Contact Life	>10 ⁸ Low power load >5 x 10 ⁶ Full pwr load

CONTACT RESISTANCE in the signal path should look like a non-resistive short when closed and infinite resistance when opened. Typical "Path" characteristics for the 40-538-021 card:

Path Resistance ON	<300mΩ
Path Resistance OFF	>10 ⁹ Ω

OPERATE AND RELEASE TIMES are measured from the time power is applied or removed until the contacts have settled including bounce. 40-538-021 characteristics follow.

Operate Time	<1mS, 0.5mS typ.
Release Time	<1mS, 0.5mS typ.

SIGNAL BANDWIDTH of the 40-538-021 card is up to 10 MHz (One relay closed).

MATRIX SIZE was configured to connect any of 16 Instrument I/O's to any of 55 I/O points on the D.U.T. See Figure 1.

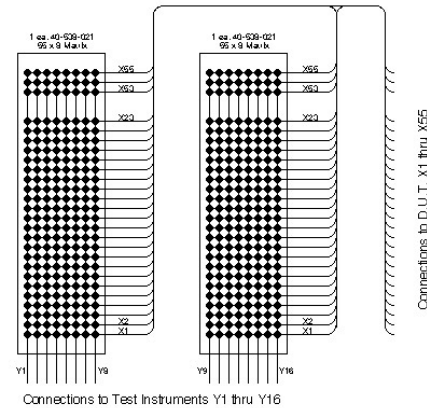


Figure 1. 55 x 16 Ultra High Density Matrix Configuration

CABLE CONSTRUCTION for the matrix was using discrete wire twenty (20) gauge Teflon coated. Maximum cable length was not to exceed 2 meters.

EQUIPMENT SELECTION

Test system requirements and the matrix size of the 40-538-021 (55 x 8) dictated the selection of this equipment, however, a similar matrix using other size matrix cards could also easily be configured. Additional customer system requirements included, but were not limited to:

PXI 18 Slot Chassis	40-930-001
PXI Embedded Controller	NI-PXI-8155B
PXI Power Relay Card	40-150-002
96 pin terminal blocks	40-965-096
PXI Digital I/O card	40-410-001
PXI DMM	41-200-040
PXI ARB Generator	41-600-001
Device Under Test	D.U.T. - user supplied
Additional Instruments	as required

MATRIX CONFIGURATION

For the purposes of the described PXI system the required

matrix size was 55 x 16, that is 55 I/O signal lines from the D.U.T. were to be interfaced to 16 pieces of test equipment. The test equipment includes the input stimulation devices required for the output testing and troubleshooting of the D.U.T.

A matrix designed with the 40-538-021 (55 x 8) can be configured in a variety of other configurations. Daisy-chaining the Y1 thru Y8 connections of one card to an additional card, an 8 x 110 matrix is configured, even larger matrices may be configured by daisy-chaining common signal connections from multiple cards. For example; connecting the X1 - X55 connections of 7 each 40-538-021 cards yields a 55 x 56 matrix, totaling 3080 crosspoints.

To maximize crosstalk performance it is wise to space sensitive signals apart by at least 2 channels, i.e. Y1 - X1, Y3 - X3.

The 40-538 is a true matrix, any combination of crosspoints may be selected.

SOFTWARE

The software for test control was written in C+ and therefore only DLL's were required to control all the system elements. In addition to, user control at all stages of testing, the ability to setup a specific test or suite of tests and repeat them indefinitely was also a requirement, as this was a failure analysis and repair system not a high throughput automated PASS /FAIL testing system.

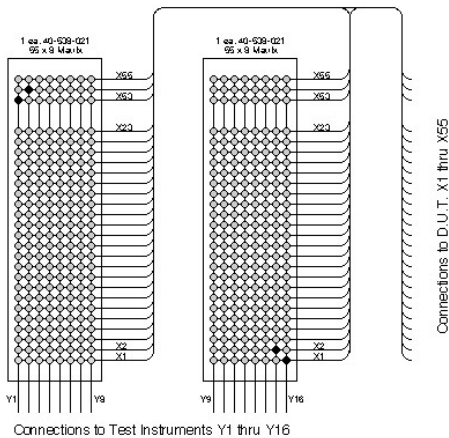


Figure 2. Matrix connections Y1 - X53, Y2 - X54 & Y15 - X2, Y16 -X1 selected for test

Pickering Interfaces also supplies a full suite of LabView drivers for all our switching cards and our more popular instruments.

INTERCONNECT CABLING

The 40-538-021 Matrix card uses a 96 pin male (PCS-E96LMD) connector as its front panel interconnect. Several mating choices are available for interconnecting. First is the 40-961-096 96 pin female IDC connector (PCS-E96Fx), this allows either flat ribbon or discrete wire to be utilized, however wire gauge is limited to 28 - 30 gauge.

Requirements for this test system dictated the use of larger 20 AWG Teflon coated wire, this requirement was quickly facilitated by the use of the Pickering Interfaces 40-965-096 96 pin screw terminal block. One terminal block is used on each 40-538-021 Matrix card and the required connections are made to the adjacent block / card using 20 gauge Teflon coated wire. The signal wires out to the D.U.T (X1 - X55) should be kept as short as possible and shielded in order minimize signal attenuation and crosstalk.

The connections to the Instrument I/O (Y1 - Y16) are routed in a similar manner to a separate connector paying attention to wire length, shielding, type, and gauge. See Figure 3.



Figure 3. Cabling solution for connecting two 40-538-021 cards together also showing interconnect for instrument I/O & connection pigtail to D.U.T.

Cables should be properly dressed with connectors and strain relief. Bundling of similar cables in a card-by-card or by signal level is helpful during maintenance or troubleshooting. Label the cables with information such as card location, bus address and channel or crosspoint number.

Should additional system requirements specify control of power to the D.U.T., it is wise to select a power relay card which utilizes an entirely different connector and cabling scheme in order to minimize the risk of damage by misplacement of similar style connectors.