

USING THE EX1200-3048 AS A SCANNER WITH AN EXTERNAL VOLTAGE MEASURING INSTRUMENT

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APPLICATION INFORMATION

Automated test equipment (ATE) systems are a fundamental component in any high-volume manufacturing environment. One major objective in any ATE development is to embed efficiency into the design which results in more products moving through production as well as saving time and cost for each test development.

A key component of virtually any ATE system is a multi-channel measurement system. System designers will often use a single measurement instrument and distribute the measurement I/O to multiple points through the use of switching subsystems. By integrating a single measurement instrument (such as a digital multimeter) and switching, the ATE system can be optimized for size and cost.

However, it is important to note that measuring multiple channels using a switching subsystem can lead to system inefficiencies since only one channel can be measured at any point in time. Unnecessary delays can be caused by switching from channel to channel in inefficient switching subsystems. These delays will become more significant as the channel count increases resulting in adversely impacting the overall throughput of the system. Therefore, it is critical to design the system architecture for maximum efficiency in order to sustain production demands.

This application note will examine how VTI Instruments EX1200 series can be used to create a highly efficient multi-point measurement system by minimizing any system latencies and wiring complexity.

Many ATE systems use scanners to switch between multiple test points of the DUT, and VTI Instruments provides multiple options for switching solutions. The EX1200-3048 is a 48-channel multiplexer module designed for scanning of multiple points to a common bus. It is consisted of two individual (1x24) 2-wire multiplexer banks programmatically combinable to form a 1x48 multiplexer. If the EX1200-3048 is used in a VTI EX1200 series chassis with an internal DMM such as the EX1262 or the EX1266, the common bus of this module can be routed internally to the DMM saving the user the hassle of having the external wiring. However, if using an existing DMM or digitizer from another vendor is desired, it is also possible and this application note will cover how to set up the instruments to accomplish this.

In order to have the EX1200-3048 cards to interface with an external voltage measurement device, the DIO channels on the EX1200 series chassis can be configured to trigger measurement and detect measurement completion on the external device. Figure 1 below shows how the two instruments need to be connected. There are 8 DIO channels on the chassis, and each DIO channel can be independently configured as an input or an output. In this example, DIO CH0 will be used as the output and DIO CH1 will be used as the input. In addition to having the trigger connections, the voltage outputs of the EX1200-3048 cards should also be connected to the input of the external instrument as indicated by the orange line.

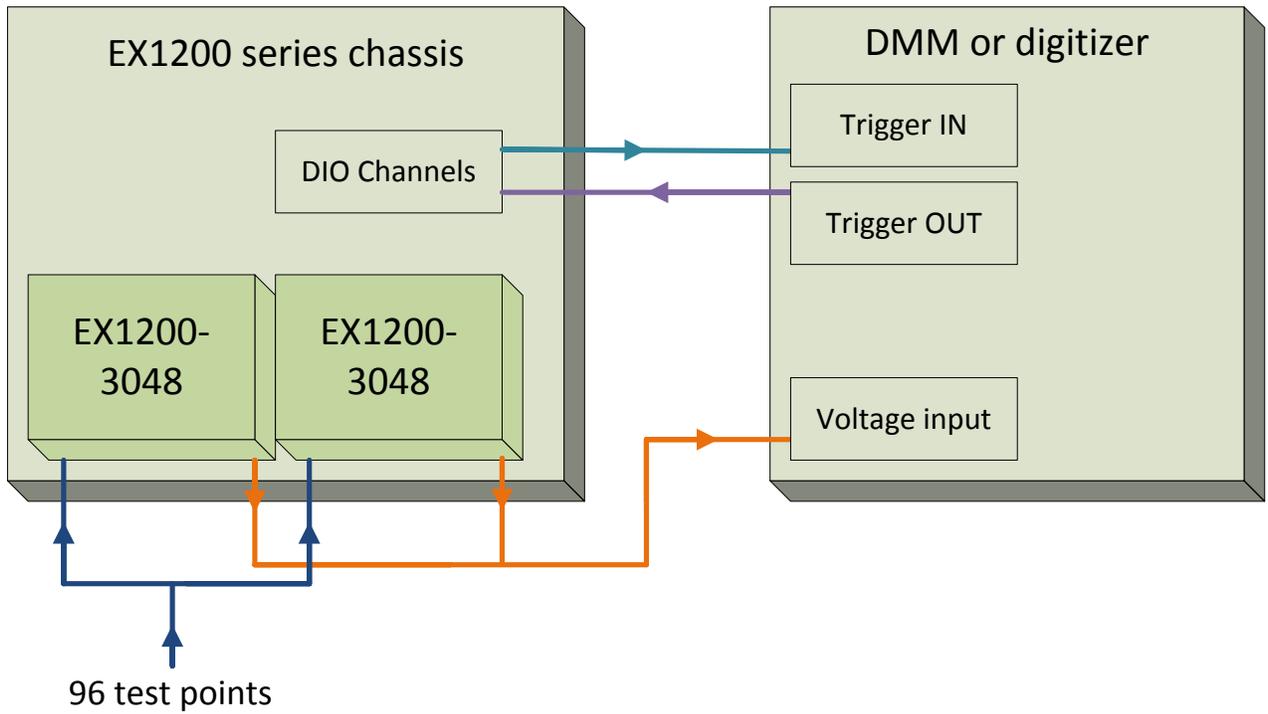


Figure 1: Interface between EX1200 series chassis and external device

Lastly, the test points of the DUT need to be connected to the inputs of the EX1200-3048 cards. To utilize all channels of the cards, we can divide 96 channels into two to connect 48 channels on each card. VTI Instruments also has the EX1200-3072 (72-channel multiplexer; 300V/2A) and the EX1200-3096 (96-channel multiplexer; 100V/0.5A) if higher density cards are needed. The diagram below shows the internal connections of the EX1200-3048.

Since there are two COM buses, it's possible to configure an EX1200-3048 as two 1x24 multiplexers. In this example, we will utilize the K49 relay to combine the two making it a 1x48 multiplexer. Alternatively, the input channels can be routed to BPL_HI/LO of the DMM bus if the chassis has an internal DMM. This simplifies wiring as only one output bus from each chassis needs to be connected to the external device for any number of cards.

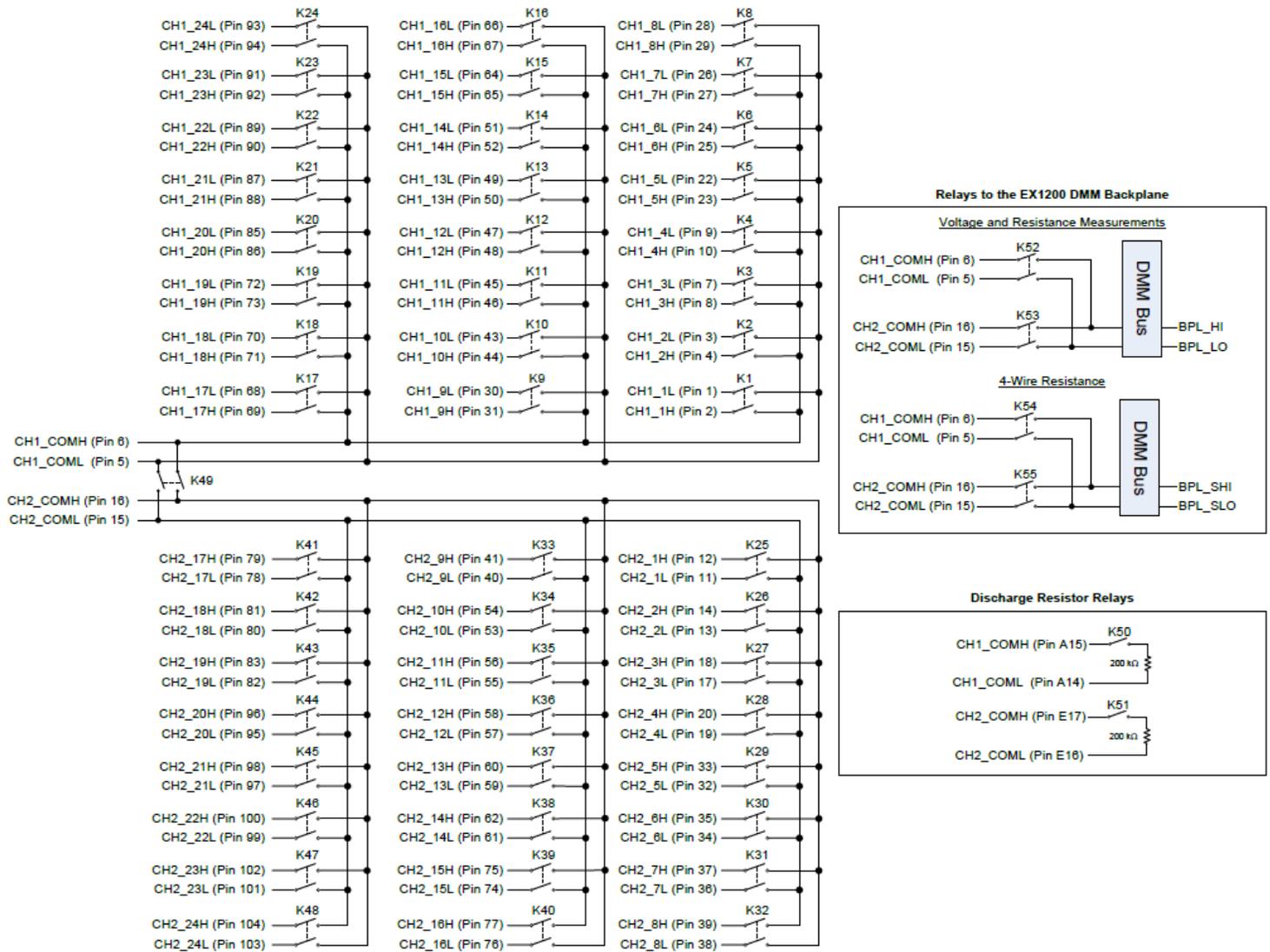


Figure 2: EX1200-3048 logical diagram



Figure 3: Timing diagram of interface between EX1200 series chassis and external device

In order to scan multiple test points using the EX1200-3048 modules and an external instrument, a simple program needs to be written. VTI Instruments provides drivers in multiple languages, but C# will be used for this example. Since the DIO channels are used for trigger connections, the VTEXSystem driver needs to be installed in addition to the VTEXSwitch driver and both drivers are available on the VTI Instruments website under EX1200-3048. The timing diagram in Figure 3 shows how the EX1200 series instrument interfaces with an external instrument. DIO0 signal (or Trigger IN signal for the external instrument) is asserted when the relays have been closed and settled to create a path. This triggers the external device to take a measurement and sends a signal (DIO1 / Trigger OUT) back to the EX1200 series instrument to let it know that the measurement for this test point is complete. This will trigger the VTI scanner to move onto the next test point and generate the DIO0 signal after the new path is established. The above timing diagram is for reference only, and your external instrument's timing may be different depending on the specifications of the instrument and how it's configured. The example code starting below is to be used with an EX1200 series chassis with or without an internal DMM. If a chassis with a DMM is used, there is an option of using the DMM bus port which makes the external wiring simpler as mentioned previously. To use the DMM bus port, the statements below the comment "[Using the DMM bus port option \(BPL_HI/LO\)](#)" should be uncommented. It is important to check that the instrument is accessible using the instrument's soft front panel (SFP) before running the program. Please see the user's manual on the VTI Instruments website for more details on how to access the SFP.

```

using System;
using System.IO;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Runtime.InteropServices;
using VTI.VTEXSwitch.Interop;
using VTI.VTEXSystem.Interop;
using System.Threading;

namespace SimpleScan
{
    class SimpleScan
    {
        static void Main(string[] args)
        {
            try
            {
                //Create a new VTEXSwitch object
                VTEXSwitch Switch = new VTEXSwitch();
                VTEXSystem System = new VTEXSystem();

                try
                {
                    string ip;
                    string scanList="";
                    Console.WriteLine("Enter the IP address of the instrument (e.g. 169.254.1.1): ");
                    ip = Console.ReadLine();

                    //Initialize a new session
                    Switch.Initialize("TCPIP::" + ip + "::INSTR", true, true, "");
                    System.Initialize("TCPIP::" + ip + "::INSTR", true, true, "");

                    //Setup the scanlist and scan mode

                    //Using the front panel bus output option
                    for (i = 1; i <= 24; i++)
                    {
                        scanList = scanList + "1!CH1_" + i + "H->1!CH1_COMH;";
                    }
                    for (i = 1; i <= 24; i++)
                    {
                        scanList = scanList + "1!CH2_" + i + "H->1!CH1_COMH;";
                    }
                    for (i = 1; i <= 24; i++)
                    {
                        scanList = scanList + "2!CH1_" + i + "H->2!CH1_COMH;";
                    }
                    for (i = 1; i <= 24; i++)
                    {
                        scanList = scanList + "2!CH2_" + i + "H->2!CH1_COMH;";
                    }
                }
            }
        }
    }
}

```

```

//Using the DMM bus port option (BPL_HI/LO)
/*
for (i = 1; i <= 24; i++)
{
    scanList = scanList + "1!CH1_" + i + "H->1!BPL_HI;";
}
for (i = 1; i <= 24; i++)
{
    scanList = scanList + "1!CH2_" + i + "H->1!BPL_HI;";
}
for (i = 1; i <= 24; i++)
{
    scanList = scanList + "2!CH1_" + i + "H->2!BPL_HI;";
}
for (i = 1; i <= 24; i++)
{
    scanList = scanList + "2!CH2_" + i + "H->2!BPL_HI;";
}
*/

```

```
Switch.Scan.ConfigureList(scanList,VTEXSwitchScanModeEnum.VTEXSwitchScanModeBreakBeforeMake);
```

```

/*By setting the scan mode to "BreakBeforeMake", the Switch driver will first break
the previous connection before making the next one.*/

```

```

//Configuring DIO1 as input routing it to BPL0
System.InstrumentSpecific.Route.Destinations.Item["BPL0"].SoftwareState = 0;
System.InstrumentSpecific.Route.Destinations.Item["BPL0"].InvertedSourcesList = "";
System.InstrumentSpecific.Route.Destinations.Item["BPL0"].SourcesList = "DIO1";
System.InstrumentSpecific.Route.Destinations.Item["BPL0"].DriveMode =

```

```
VTEXSystemEventDriveModeEnum.VTEXSystemEventDriveModeDriven;
```

```

//Configuring DIO0 as output routing from BPL1
System.InstrumentSpecific.Route.Destinations.Item["DIO0"].SoftwareState = 0;
System.InstrumentSpecific.Route.Destinations.Item["DIO0"].InvertedSourcesList = "";
System.InstrumentSpecific.Route.Destinations.Item["DIO0"].SourcesList = "BPL1";
System.InstrumentSpecific.Route.Destinations.Item["DIO0"].DriveMode =

```

```
VTEXSystemEventDriveModeEnum.VTEXSystemEventDriveModeDriven;
```

```

//Setup the delay, trigger input and output
Switch.Scan.ConfigureTrigger(0,

```

```
VTEXSwitchTriggerInputEnum.VTEXSwitchTriggerInputBPL0,
```

```
VTEXSwitchAdvancedOutputEnum.VTEXSwitchAdvancedOutputBPL1);
```

```

//Set Continuous to true
Switch.Scan.Continuous = true;

```

```

//By default, the common channels are set to be non-configuration channels. A non-
configuration
//channel can only be used in the beginning or the end of a scanlist as a terminated
channel.

```


After the program is compiled successfully, the operation of the EX1200 series can be tested and verified before connecting to the external device. This can be done using an oscilloscope and a function generator. The scope should be connected to DIO CH0 and the function generator should be connected to DIO CH1. After setting the function generator to output 5Vpp 1Hz square wave and setting the scope to capture 10ms pulse, the program can be run. As the frequency of the square wave is increased with the increment of 1Hz, the frequency of the EX1200-3048's scanning sound will increase as well as the output pulse frequency. Figure 4 below shows the DIO CH0 output pulses displayed on the scope. For more information on the VTI Instruments switching solutions, please contact us at support@vtiinstruments.com.



Figure 4: Output pulse (DIO0 / Trigger IN) displayed on scope