

**TN0005****LabVIEW interfaces to Pyramid devices using serial ASCII communications**

Many Pyramid devices include a serial ASCII communications interface based on the SCPI standard with modifications. The relevant devices are IC101, I200, I400, I404, I3200, F100, C400 and N2400. National Instruments LabVIEW™ and NI-VISA includes tools for communicating with serial ASCII devices. This note provides guidelines for creating LabVIEW VIs using this means. Example VIs are included in the product download area, or upon request.

*LabVIEW worked examples*

Most of the LabVIEW examples available from national Instruments only support the most basic ASCII serial communication that assumes a device is silent upon receiving a valid command, and only sends information when prompted by a request. This is the standard SCPI arrangement. There is support provided for termination characters. In any case where a device differs from this basic scenario, a custom VI will usually be required to handle more complex communication features. Many LabVIEW examples demonstrate use of the

LabVIEW VISA Clear VI. However it should not be used with Pyramid devices as it causes unpredictable behavior such as corrupt echo responses.

*String termination characters*

Pyramid devices expect a line feed character (LF, ASCII 10, 0x0A, ctrl-J, \n) as a termination character for all commands and queries. When responding to valid commands, Pyramid devices use TWO termination characters in succession, carriage return (CR, ASCII 13, 0x0D, ctrl-M, \r) and line feed. Because the final termination character is the same in both cases, you can configure LabVIEW to use only \n as the termination character.

*Command echo*

Pyramid devices will echo any character that they receive, character by character.

*Acknowledge character*

Pyramid devices send the non-printing acknowledge character (ACK, ASCII 6, 0x06, ctrl-f) when a command is parsed by the device with no errors. If there is an error, the response is the bell character (BEL, ASCII 7, 0x07, ctrl-g, \a). A LabVIEW VISA VI must consume this character from the message queue, or it will be appended to the next query response.

*OK response*

A terminal mode is provided to make communications more user-friendly when using a basic terminal host program like Hyperterminal, puTTY or RealTerm. In this mode, instead of the ACK or BEL response, every message gets the immediate printing response "OK<CR><LF>" from the device, or an error code string. If the command was a query, then the response string will follow when the data is available.

## *Numeric data*

By default, all the information that LabVIEW receives from Pyramid devices will be formatted as a character data type and, as such, cannot be directly wired to any numeric controls or displays. Pyramid numeric output also usually contains units and may include status bytes, so expect to process incoming messages in LabVIEW to separate out the numeric section of the character message and explicitly convert it to a numeric type.

## *Periods of non-responsiveness:*

Some Pyramid devices become nonresponsive to commands (including command echoes) while in the process of completing a complex command. This is typically seen when enabling and setting a High Voltage for the first time, where the device slowly raises the voltage over time. The length of the delay is variable depending on the voltage number set and can be handled in a number of ways -- by calculating the anticipated delay based on the High Voltage entered and the formula used in the device, by including a fixed delay that encompasses even the longest case (generally around 30 seconds), or by looping in LabVIEW and sending commands approximately every second until one receives a response.

## *Using USB/serial adaptors*

Since few PCs now include an RS-232 port, it is common to use a USB to RS-232 converter. If a VI manual abort has to take place because the VI is in error, this may cause a situation where the serial communication is still active via the USB adaptor (and therefore busy) but now inaccessible. Attempting to re-run the VI or even use another program to communicate with the device will show that the communication is busy and unavailable. This can be avoided by removing the force stop button from a VI, and handling the closure of any LabVIEW communication on error with program code. If the problem does occur, close LabVIEW completely, disconnect and reconnect the USB to RS-232 converter, and restart LabVIEW.

## *Debugging*

Knowing exactly what information is being sent between a VI and the device is probably the single most helpful debugging tool. LabVIEW provides a serial communication monitor that, if not already included with your installation, can be downloaded from the National Instruments website. The RealTerm terminal communication program can be used to create examples of message exchanges to be replicated in LabVIEW, including display of non-printing characters.

## *Further information*

Contact Pyramid at [support@ptcusa.com](mailto:support@ptcusa.com) for further information.