



U.S. DEPARTMENT OF
ENERGY



NI 9871 Module Testing Progress Report

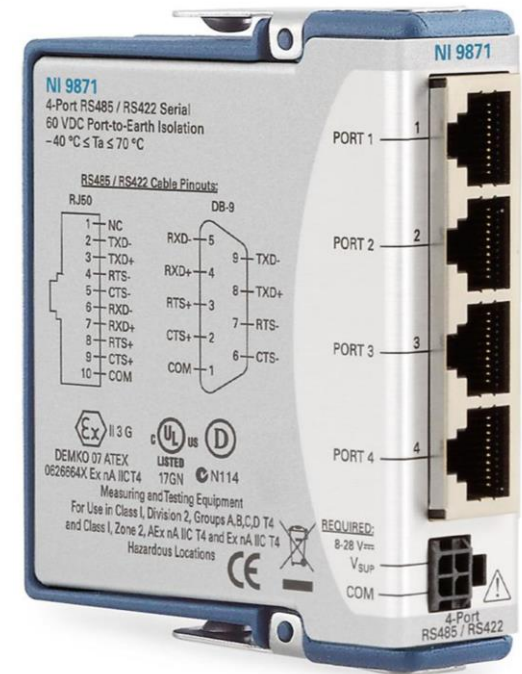
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September 11, 2019

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NI-9871

- 4-Port RS485/RS422 Serial Module
 - Used in conjunction with NI USB-to-485 4-Port Serial Interface Device



RS485 / RS422 Cable Pinouts:

RJ45	DB-9	
1 - NC	RXD- 5	9 - TXD-
2 - TXD-	RXD+ 4	8 - TXD+
3 - TXD+	RTS+ 3	7 - RTS-
4 - RTS-	CTS+ 2	6 - CTS-
5 - CTS-	COM - 1	
6 - RXD-		
7 - RXD+		
8 - RTS+		
9 - CTS+		
10 - COM		

Technical Specifications

	NI-9871	NI USB-485
Type	4-Port RS485 Serial Module	USB-to-RS485 Serial Interface
S/N	1A71D6E	1A3FAC6
Max Baud Rate	3686.4 kbps	460.8 kbps
Voltage Range	8-28 VDC	9-30 VDC

Both module and USB-485 are connected to their own 24 VDC power supplies.

Tests

- Read/write capability tests
 - Can module read from USB-485 and write back to it? ✓
 - Are there any special characters that this module cannot handle? ✓
 - Does this module read back *exactly* what has been written to it? ✓
 - Does this module write *exactly* what it has been instructed to write? ✓
- Test different baud rates
 - Can module read/write data at rate specified by manufacturer? ✓

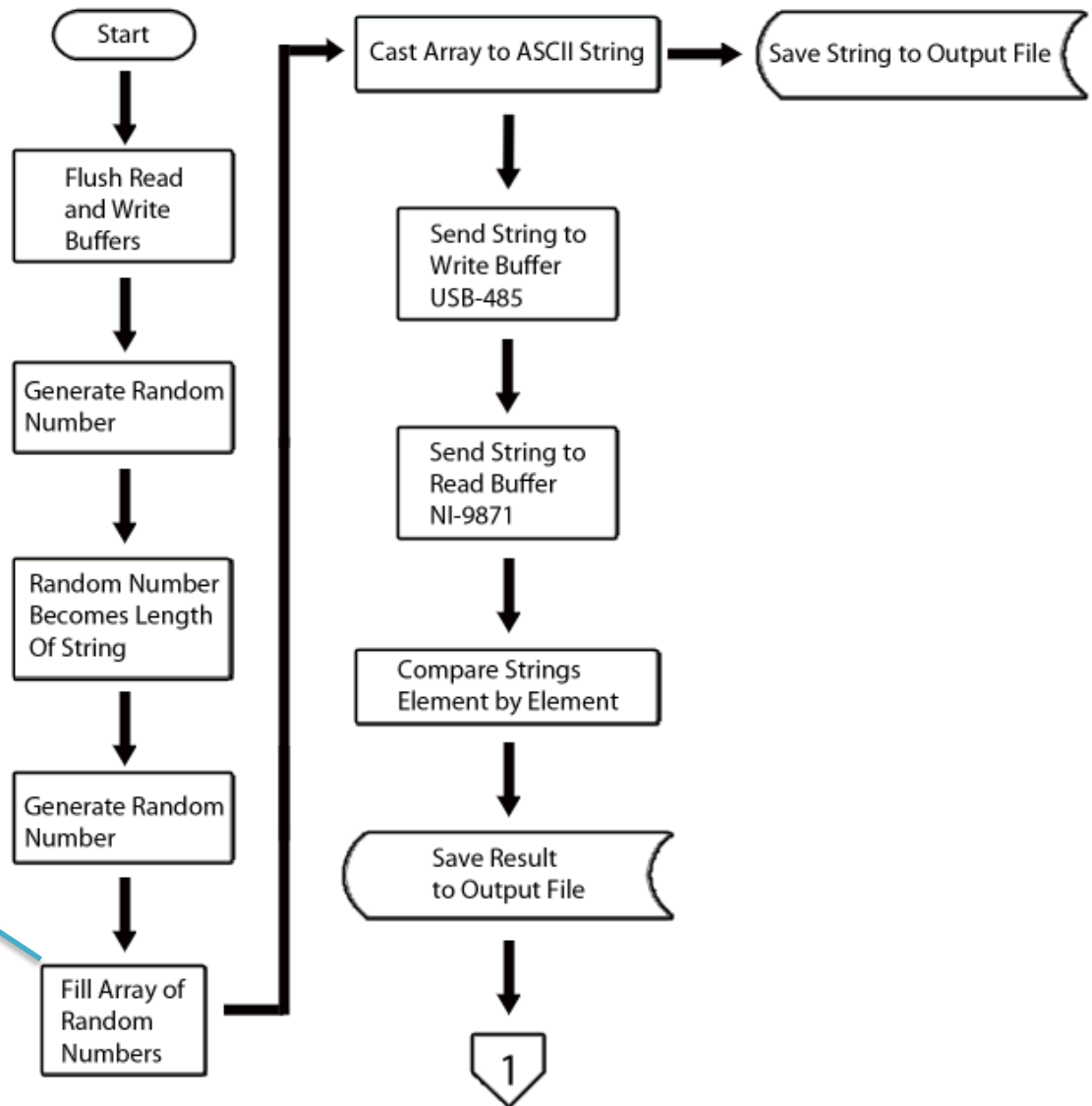
Previous Tests

- Margin of error was 22.4%
 - Should be $\leq 5\%$
 - Only 20 input/output strings per baud rate, per port
- Randomness of strings
 - Strings were not randomly generated
- Automation
 - Each string had to be entered manually before each test

New and Improved Tests

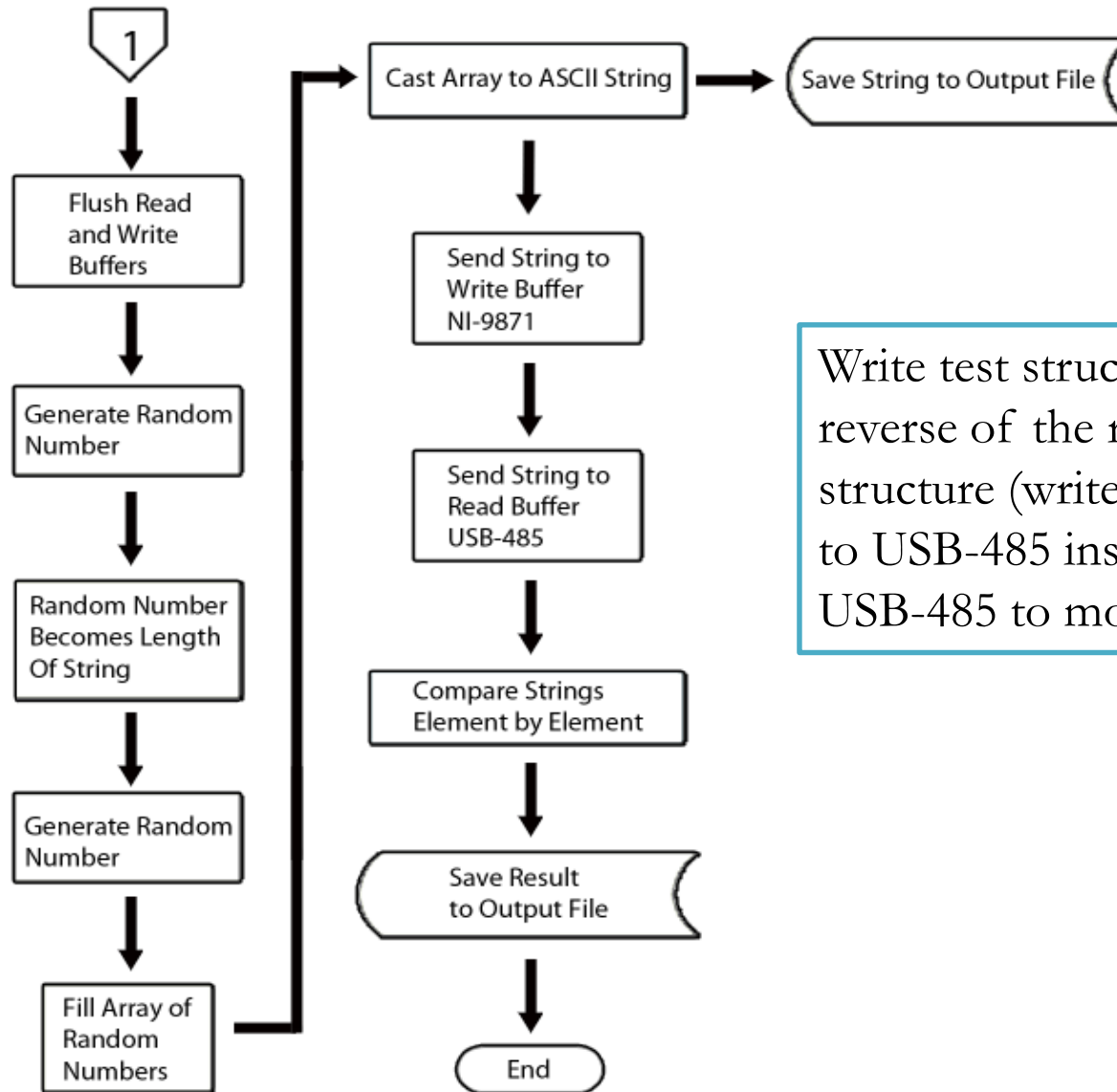
- Increased number of read/write tests to improve (lower) margin of error
- Input and output save files allow for automation
- Random number generators determine the length of the string as well as the content

Read Test Structure



Array is filled with randomly generated whole numbers between 32 and 95 and then cast to a string of ASCII characters

Write Test Structure



Write test structure is the reverse of the read test structure (write from module to USB-485 instead of from USB-485 to module).

Read/Write Test: Front Panel

The screenshot displays the front panel of a Read/Write Test application. It features several control panels and data displays:

- Path Indicators:** A red-bordered box at the top left contains four file paths:
 - path: C:\Users\ambrown\Documents\TESTS\RESULTS\NI-9871\module_input.txt
 - path 2: C:\Users\ambrown\Documents\TESTS\RESULTS\NI-9871\module_output.txt
 - path 3: C:\Users\ambrown\Documents\TESTS\RESULTS\NI-9871\match_input.txt
 - path 4: C:\Users\ambrown\Documents\TESTS\RESULTS\NI-9871\match_output.txtAn arrow points from this box to a callout: "Path indicators for saved input/output files".
- Control Panels:** Two green indicator lights are present. The left one is labeled "COMM BUFFER: WRITE Same As Module Read Buffer?". The right one is labeled "Module Write Buffer Same As COMM BUFFER: READ?". A "Counter" display shows the value "2".
- Port and Rate Settings:** "USB COMM PORT" is set to "COM3" and "Module Port" is set to "visa://172.22.11.2/ASRL2:". Both "Module Bd Rate" and "USB Bd RATE" are set to "9600".
- Buffers:** A red-bordered box at the bottom left contains four buffer displays:
 - COMM BUFFER: WRITE: MhGk/d!L-Q.RF[x248K/g`bm9IW|Ar1>/DM|LPew7toK;
 - Module Read Buffer: MhGk/d!L-Q.RF[x248K/g`bm9IW|Ar1>/DM|LPew7toK;
 - COMM BUFFER: READ: "6md ;_4)UT[*g0li8AF;
 - Module Write Buffer: "6md ;_4)UT[*g0li8AF;An arrow points from this box to a callout: "Read/write buffers display strings being read and written. They should match."
- Error Displays:** A red-bordered box on the right contains four error status panels:
 - COMM READ ERROR: status (green checkmark), code (1073676294), source (VISA Read in 9871_test_2.vi)
 - Module Read Error: status (green checkmark), code (1073676294), source (VISA Read in 9871_test_2.vi)
 - USB ERRORS: status (green checkmark), code (1073676294), source (VISA Read in 9871_test_2.vi)
 - Module Errors: status (green checkmark), code (0), source (empty)An arrow points from this box to a callout: "Error buffers show any read/write error messages in real time".

Results: Read

Random Input String	MATCH? Y/N	Random Input String	MATCH? Y/N	Random Input String	MATCH? Y/N	Random Input String	MATCH? Y/N
PORT 0		PORT 1		PORT 2		PORT 3	
~WyBew,<*K4!X&t1 i&C\R"	Y	k-O%q/V F ZE97CS*Z"@/oe!IMO]P+<W#8\$Q	Y	WGPIJC*jNeZbX4)-Vn?<~.,yu^:]JQ!UUbq[K1	Y	t#>~dTnkDBJc7[Xb!Ro=l@* [aa"kl,;SL	Y
[D<iFqC=7*;;=H8cszj'((O; &Zn [B7<Ft"yn4*0KqBJ,b	Y	nFB4[bsUnz,@:v'A#kz1HT* tqT#@'+I8\VBhSubHyG3>Ga2,<b	Y	8?JV@&6os\$D5Lk!s`BmQ"zx. b. XsV9dWirKf[Fb\$K=w K>QJ@,]\	Y	#wZDMs_8+Bu"fbx{#v2`1hx2Du^7z) Cwk29[&G!sPhNSgQwC?"ZvHx7IM)x~ORhR"	Y

- Content and length for each input string is randomly generated and saved to an output file

- Written string is compared to read string for accuracy



Results: Write

Random Output String	MATCH? Y/N	Random Output String	MATCH? Y/N	Random Output String	MATCH? Y/N	Random Output String	MATCH? Y/N
PORT 0	PORT 1	PORT 2	PORT 3				
NLA=9.OvvNWg29z1/lg<TpD>>?Gp/2yx"ArVG=w\4NIR +F+5:aDE<%TmedJ^'-WW^NH	Y	hNJ(XjG.%Q_JA _i,> WB'EM,V=m+A^W4a"S^!8	Y	ks,"=fu?SG<wcmBk%ArJ:U 5qc'&,_CFPTKq>naiqE=hoS2Qj_gIW	Y	r^wvylmbj-W4zS&TC):0 Ervk*^dzW4ofE]L@l&Vm !L.F&R	Y
hY5O+++*3zHU37s!5I!o:asf\$ 2@vX[_XBC1Q(iQINb## [g:d!z7	Y	Dj/ m)m\$[c]-vz"8*/yIG.+&XTX<a(Bz<x,w1*Gw`j]g#R.W)lwCH#@d`x;x 7r0	Y				

- Read/write tests were conducted for each of the 4 ports for three different baud rates

Random Output String	MATCH? Y/N
PORT 0	
NLA=9.OvvNWg29z1/lg<TpD>>?Gp/2yx"ArVG=w\4NIR +F+5:aDE<%TmedJ^'-WW^NH	Y
hNJ(XjG.%Q_JA _i,> WB'EM,V=m+A^W4a"S^!8	Y
ks,"=fu?SG<wcmBk%ArJ:U 5qc'&,_CFPTKq>naiqE=hoS2Qj_gIW	Y
r^wvylmbj-W4zS&TC):0 Ervk*^dzW4ofE]L@l&Vm !L.F&R	Y
hY5O+++*3zHU37s!5I!o:asf\$ 2@vX[_XBC1Q(iQINb## [g:d!z7	Y
Dj/ m)m\$[c]-vz"8*/yIG.+&XTX<a(Bz<x,w1*Gw`j]g#R.W)lwCH#@d`x;x 7r0	Y

- Results shown are from the highest baud rate tested: 115,200 bps



Results

- Tested read/write capability for three different baud rates
 - 9,600 bps ✓
 - 19,200 bps ✓
 - 115,200 bps ✓
- Compared read string with written string element by element
 - All ports passed for each baud rate tested ✓
- Each port of NI-9871 module behaved as expected
 - 900 input/output strings per baud rate for each port
 - Margin of error: 4.71%
 - No discrepancies ✓

Possible Improvements

- Was unable to test the module at its maximum baud rate
 - Highest rate attainable in scan mode is 115,200 bps
 - FPGA mode must be used to reach maximum rate of 3686.4 kbps

- Include new-line character in new test

Conclusion

- Using LabVIEW code developed
 - Tested multiple baud rates up to allowable maximum rate
 - Tested all 4 ports of module
- NI-9871 serial module performs according to technical specifications
 - Module was able to read and transmit randomly generated alphanumeric characters accurately at rates within technical specifications

Thank You