NTC Thermistor Simulator

with WF 3144 – Programmable Resistor Module

Figure 1. The WF 3144 Programmable Resistor Module

Abstract

This application note demonstrates how the WF 3144 Programmable Resistor Module can be used to simulate NTC thermistors.

Problem

To simulate NTC thermistors.

Solution

The WF 3144 Programmable Resistor Module can be used to simulate resistive sensors such as pressure sensors, thermistors (NTC and PTC) and resistance temperature detectors (RTDs). Thermocouples however, produce a temperature-dependent voltage and can therefore not be simulated using this module. This application note shows how to access the WireFlow C Series module using the FPGA Read/Write control to simulate an NTC thermistor.

The first step is to add the WireFlow module under the FPGA target. To access the channels of the module, add a simple FPGA VI with front panel controls wired to FPGA I/O Nodes.

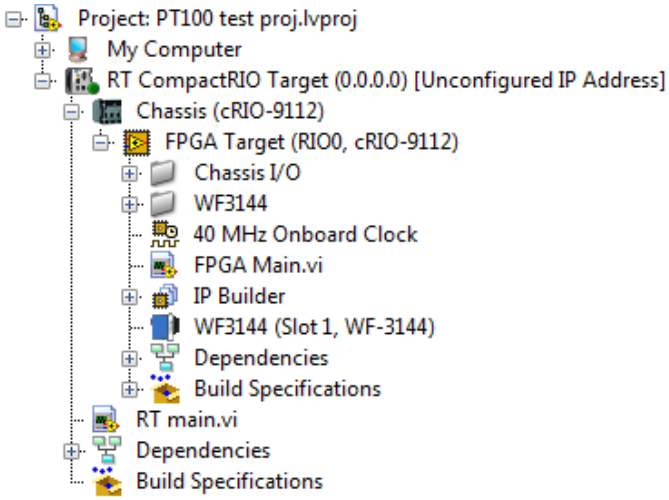

Figure 2. Add the WF 3144 module under the FPGA target

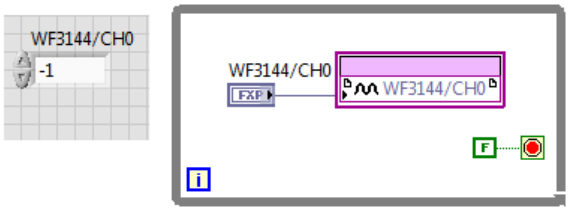

Figure 3. The FPGA VI with an FPGA I/O node

Once the FPGA VI has been compiled, the WireFlow module can be accessed using the FPGA Interface methods: Open FPGA VI Reference, Read/Write Control and Close FPGA VI Reference.

WireFlow AB

Theres Svenssons gata 10
SE-417 55 Göteborg
Sweden

www.wireflow.se

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The Read/Write Control node automatically shows the items that can be accessed for the WireFlow module (that exist on the FPGA VI front panel). Using this technique, an application can be created that takes temperature values from front panel controls, converts to ohms and programs the WF 3144 module to output the resistance between two channels (in this example between Ch0a and Ch0b).

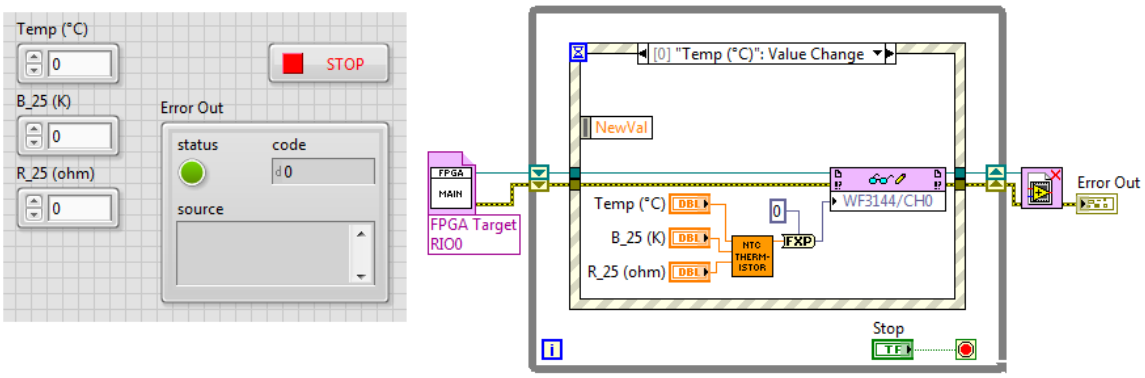

Figure 4. The RT main VI

The subVI that converts from temperature to resistance is available as a zip-file from wireflow.se/downloads (AB0005-088 AN10 Thermistor Simulator examples.zip). The subVI is an implementation of the B (or β) parameter equation which is derived from the Steinhart–Hart equation. The $B_{25/100}$ and R_{25} parameters can typically be found in NTC thermistor data sheets.

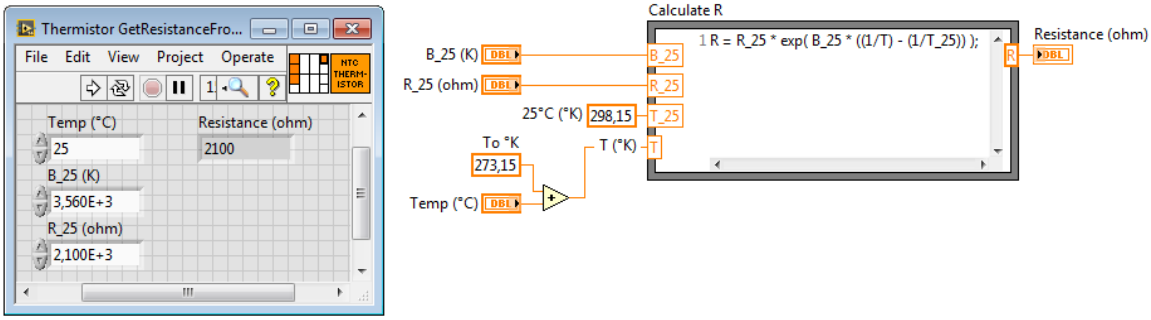

Figure 5. Thermistor GetResistanceFromTemp.vi

EPCOS

Temperature measurement	B57871
Leaded NTCs, lead spacing 2.5 mm	S871

R/T characteristics

	B57871S0212F000					
R/T No.	1008					
T (°C)	$B_{25/100}$ = 3560 K, R_{25} = 2100 Ω, T_R = 25 °C, $\Delta R_R/R_R$ = ± 1%					
	R_{nom}[Ω]	R_{min}[Ω]	R_{max}[Ω]	$\Delta R_R/R_R$[±%]	ΔT[±°C]	α (%/K)
−55.0	111520	105460	117570	5.4	0.9	6.1
−50.0	82567	78386	86747	5.1	0.8	6.0

Figure 6. Example of $B_{25/100}$ and R_{25} in a data sheet of an NTC thermistor

WireFlow C Series modules can also be accessed using User-Defined Variables, which is the preferred way to access third party modules when used in an EtherCAT slave chassis. This method is demonstrated in application note 4 (AB0005-056 AN4 Mixing WF and NI modules).

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Theres Svenssons gata 10
SE-417 55 Göteborg
Sweden

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