

Wellsite Data Node Configuration System

Authors

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NI Products Used:

LabVIEW 2011
cFP 2120
cFP AI 111
cFP AO 210
cFP CB-1
cFP-RLY_425
cFP four slot back plane
cRIO-9025
NI 9208
NI 9264
NI 9481
cRIO-9112

Categories:

Advanced Control Systems
Energy

The Challenge

The client needed to have a complete system to guide a non-technical operator through the process of installing an application onto a real-time target based on the type of equipment it would be controlling or monitoring. The application also needed to allow the operator to test the installation.

The Solution

Using LabVIEW, Data Science Automation was able to create an application that allowed the user to select the type of equipment and guide the operator through setting the parameters needed, and then applying the correct code to the real-time target. The application selected the type of real-time target provided.

Introduction

Data Science Automation (DSA) is the premier National Instruments Alliance Partner. DSA integrates commercial off-the-shelf (COTS) components from automation technology vendors to create custom, adaptive automation solutions for a diversity of research, manufacturing, government and business operations to:

- acquire, analyze, present and manage data
- design, simulate, test and validate products
- monitor, predict, control and optimize processes
- invent, draft, prototype and build machines

for maximum productivity, quality, profit and understanding.

DSA is a certified member of the Control Systems Integrators Association (CSIA) and staffs multiple National Instruments Certified Training Centers with more certified LabVIEW Architects than other integrators.

DSA was selected by the client because of our depth of experience in the development of oil and gas industry field applications that required following a disciplined software engineering approach that would ensure robust performance when deployed. DSA's extensive number of Certified LabVIEW Architects with extensive industrial experience also provided the client a level of confidence that his investment would be compounded.

Approach

This process was needed when the equipment of a leading well fracturing company was to be automated and most of the users had little or no programming knowledge. It was necessary to make an application that operators could still make the needed changes to the parameters and apply the code to the real-time target without the use of Measurement and Automation Explorer (NI MAX) or the LabVIEW development environment. .

The application created walks the user through the process of installing code onto a compact Fieldpoint (cFP) or a compact RIO (cRIO). It was necessary to have the application determine as much information as possible about the connected cFP or cRIO and the modules placed in the backplane. This was to save time and help optimize the configuration process in order to apply the correct code in the form of an image to the real-time target. The user only needed to enter the correct truck number and a template with the correct parameters to apply a working application to the target. The first step in the process of applying an image was to first determine the type of target and if an image needed to be applied, or if it was already applied and only needed to be modified. The main menu screen allows the operator to pick one of four tasks based on if a unit is connected and if that unit already has functioning code on it. Figure 1 shows the main screen and all the controls or tasks enabled. If no unit was connected the operator would only be able to select the template tools that would allow them to either create a new template or modify an existing template. When a unit is connected but has no running software the operator would have the option to apply an image or use the template tools. If the unit connected had operating software on it the operator would then be allowed to use any of the configuration tools. When using the template tools as shown in Figure 2, the operator can create a new template and the application will walk the operator through the process for selecting the type of equipment that will monitor or control and then allow the user to select the appropriate signals needed for the unit. Figure 3 shows the setup screen for a pump control node and allows the operator access to all the parameters needed to control a pump. All the parameters are saved as a template and placed on the real-time target and read on the reboot that takes place after the target has been imaged and all needed files are applied. The test selection shown in Figure 4 will allow the operator to test the unit once it has been imaged. This will also allow the operator to make sure that all the set parameters selected are correct. The pump control node test screen shown in Figure 5 allows the operator to read the analog inputs while modifying the throttle and changing gears. All tests are set up to place the pump truck into a safe state if the output pressure goes higher than 500 PSI as a safety precaution. If a test shows that a parameter has been set incorrectly the operator may just load the template from the target or the file and modify it the send it back to the target. The target will reboot and allow the operator to retest it to make sure it functions as desired. This application can be used to test units that have been out in the field or modify the template due to the changing of a sensor or controlling component.

LabVIEW software provided a simple, customizable interface for making custom controls and indicators to allow the code to have a modern look. VI server was used to handle the majority of communication between the real-time targets and the application to transfer data and status of the target.

This application is user-friendly for the untrained operator to apply the code to a real-time target and test the install. By allowing the code to guide the operator through the process and internally making decisions of the type of platform (either cFP or cRIO), managing the IP addresses, placing files in the correct location, and programmed reboots, allow for a faster, more consistent process. This code was created to also make changing parameters in the field quicker and easier for the operator.

Being a LabVIEW Certified Developer (CLD) and working with other CLDs and LabVIEW Certified Architects (CLA) on a daily basis made creating this application a joy to work on.

Overall, the application designed by DSA using LabVIEW was able to fill the customers need and provide them with a time saving, practical and valuable tool to complete the task of configuring cFP's or cRIO's with code to perform different tasks. These targets, combined with other applications developed in LabVIEW are used to automate multiple operations on a well fracturing site and provide a higher level of safety for the employees working around the equipment.

Contact Information

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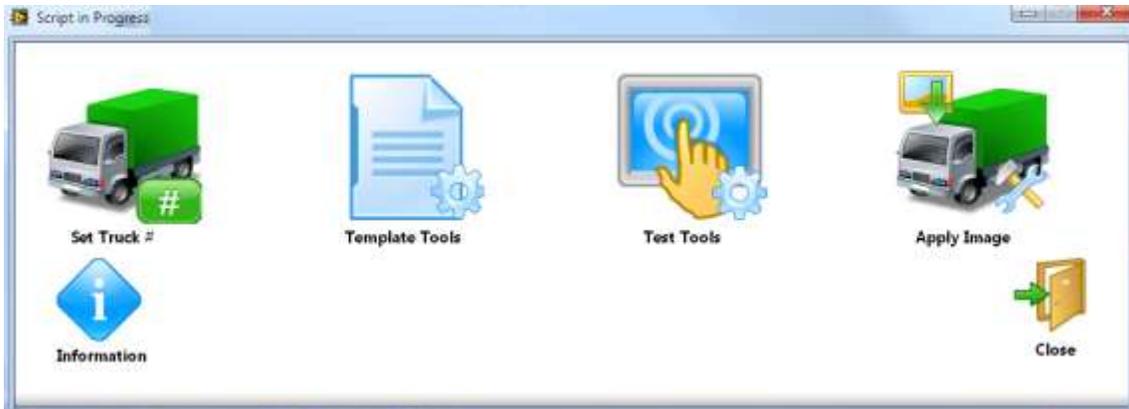


Figure 1. This is the main screen that allows the operator to select a task. This allows a calibration to be used by future users without the need to recalibrate each time it is used.

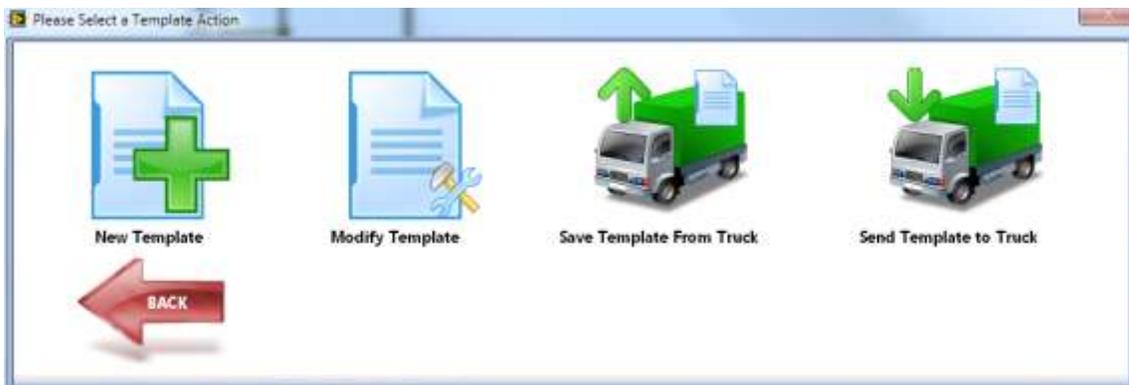


Figure 2. This screen is the template screen that allows the operator to create a new template, modify an existing template, save a template from a truck, or send a template to a truck.

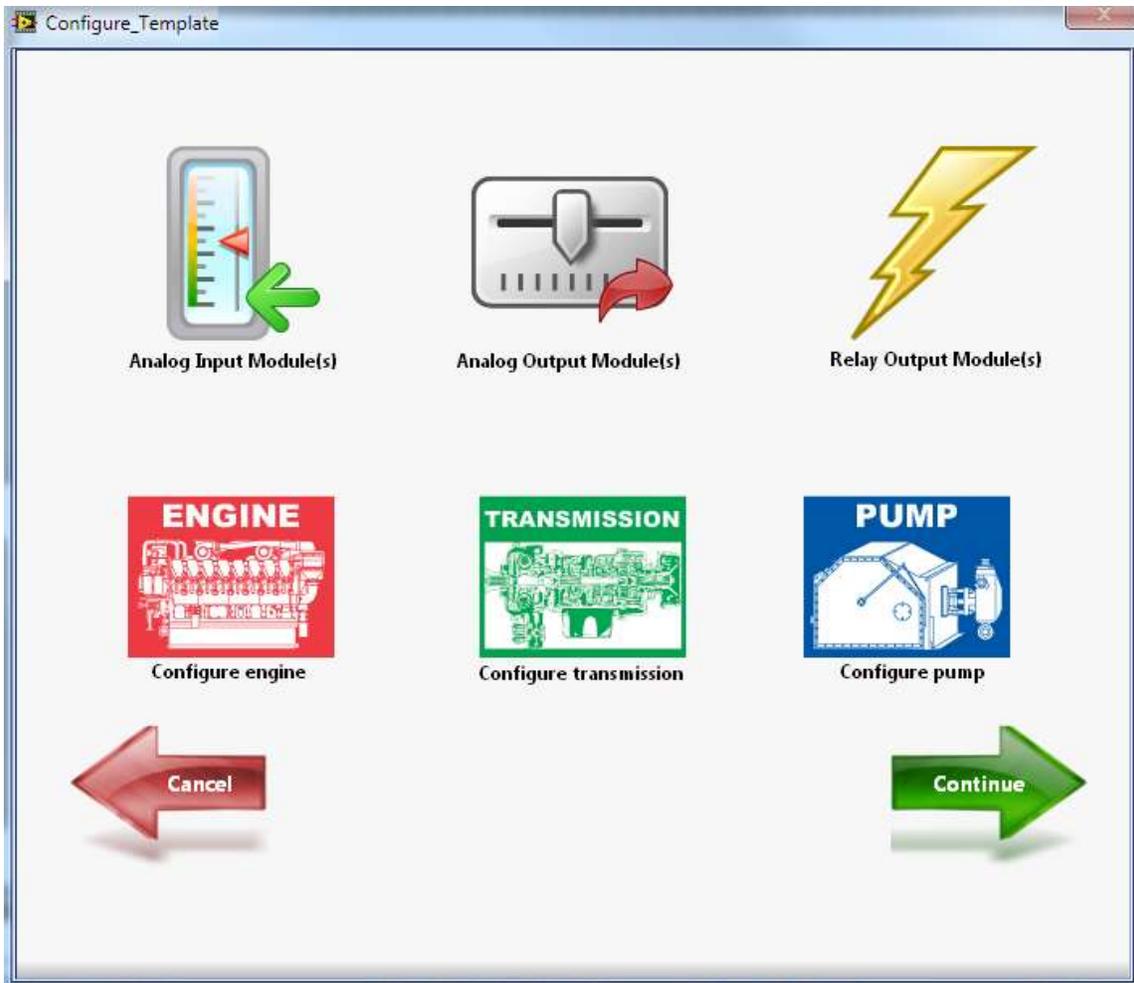


Figure 3. This screen is the pump control node setup screen that allows the operator to select the analog inputs, analog outputs, relays, engine parameters, transmission parameters, and pump parameters to be saved into a template.



Figure 4. This screen is the test selection screen to allow the operator to test analog inputs, analog outputs, pump control node, and Bench Test.

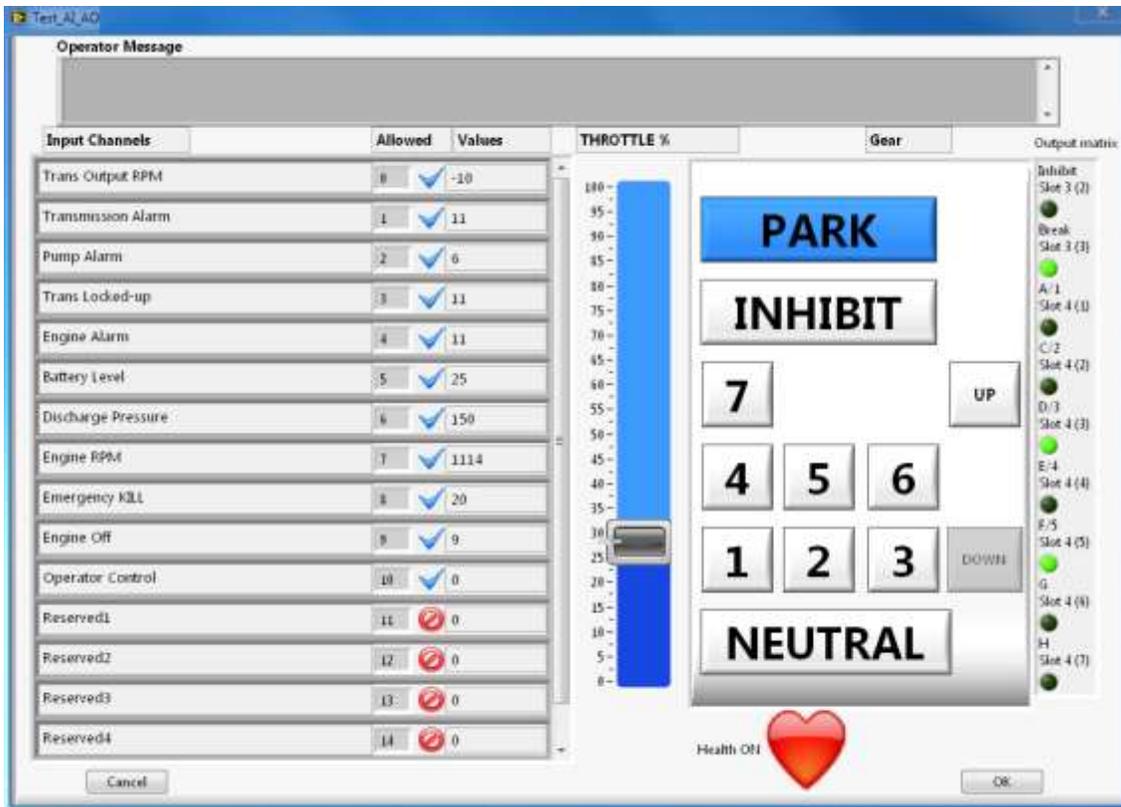


Figure 5. This screen is the pump control node test screen that allows the operator to read analog inputs and having gear and throttle selection available.