Supplementary Material

Advancing ocean acidification biology using Durafet® pH electrodes

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Honeywell UDA2182-Durafet Setup for LabVIEW

This document provides instruction for connecting UDA2182-Durafet data streams to a PC via the computer program National Instruments LabVIEWTM. UDA2182-Durafets should be set up with two pH input cards and a communication card, according to the manufacturer's manual (Honeywell, 2009. "UDA2182 Universal Dual Analyzer Product Manual", Honeywell International Inc., Phoenix, Arizona)

Example LabVIEW[™] VI

An example VI for data logging is currently under review for publication at <u>http://www.ni.com/examples/</u>. Temporarily, the VI can be downloaded using the link to the current submission: <u>https://forums.ni.com/t5/Example-Program-Drafts/Polling-multiple-Honeywell-Durafet-pH-electrodes-using-the/ta-p/3639829</u>

OS and Hardware Requirements

The steps outlined below were completed on PCs running Windows 7 & 10, LabVIEW[™] 2013, and with an Ethernet switch (TP-Link TL-SG108) and Cat6 Ethernet cables. Successful setup will require additional steps to identify your computer's and/or subnetwork's IP address which are not described here. Contact your system administrator for assistance setting up a subnetwork and identifying its IP address or follow a procedure found via a web search when you reach the steps below that require you to do so.

Instructions are written in Times New Roman font; computer commands, options, and user-entered text are written in Courier New.

Software Requirements

Before setting up communication for the UDA via LabVIEW, make sure the following National Instruments (NI) software has been installed (last hyperlink access: 30 May 2017).

1. NI LabVIEW

http://www.ni.com/download-labview/

2. NI Measurement and Automation Explorer (NI MAX)

Instructions for downloading MAX, as part of NI System Configuration package, can be found here:

http://digital.ni.com/public.nsf/allkb/F046BF3874E45BFF862574E2006EA83B

- 3. NI Distributed System Manager (NI DSM) <u>http://www.ni.com/download/ni-distributed-system-manager-2016/6199/en/</u>
- 4. NI LabVIEW Datalogging and Supervisory Control (DSC) <u>http://www.ni.com/labview/labviewdsc/</u>

Procedure

Physical Setup

- 1. With UDA and PC turned off, connect UDA and PC to same subnetwork using an Ethernet switch and Ethernet cables (Cat6). Alternatively, UDA and PC can be connected directly using an Ethernet crossover cable.
- 2. Turn on PC, then UDA.
- Set IP and subnet on UDA by selecting the following options on the UDA: Setup > Communication > Ethernet.
- 4. Manually enter subnetwork (if wired through Ethernet switch) or PC (if wired directly using crossover cable) IP address into UDA.
- 5. Once IP is changed, select: Port Reset > Enable to save new IP address.

Software

The following steps must occur in the order they are written and using the prescribed software.

- 1. NI Measurement and Automation Explorer
 - a. Open NI MAX.
 - $b.\ Under\,\mbox{My System}\\mbox{Devices}$ and Interfaces, $click\ on\ \mbox{Network}\ \mbox{Devices}.$
 - c. In the panel that opens, click Add Network Device\VISA TCP/IP Resource...
 - d. Select Manual Entry of Raw Socket & enter IP address and Port Number (e.g., 124.238.221.7; Port #: 5), then click Finish.
 - e. Verify successful entry by double-clicking on the new Network Device and click Validate. If NI MAX successfully opens a VISA session, this step is complete.
- 2. NI Distributed System Manager (DSM)
 - a. Open NI DSM under National Instruments software in PC's programs list: LabVIEW > Tools > Distributed Systems Manager.
 - b. In the file tree on left side of DSM, click Network Items and right-click (Your PC Name).
 - c. Select Add Process and name UDA2182_DSM for reasons described below.
 - d. Right click UDA2182_DSM and select Add I/O Server...

Select Modbus, enter new name (e.g., Modbus, or Modbus_1 if using multiple UDAs), and Configure Modbus I/O Server window should open. For Model, select Modbus Ethernet and enter IP Address of the UDA. Click OK.

e. Right click UDA2182_DSM and select Add Variable...

Name variable (Variable, Name: pH, or pH_1a, if using multiple UDAs and two Durafets per UDA), check the box for Enable Aliasing, Bind to PSP URL, and Browse... for (Your PC Name) \UDA2182_DSM\(Your Modbus Name) and scroll down to F300001. Click OK twice and new variable pH should appear at bottom of file tree on left. The Current Value: should read what you see on the UDA screen for pH.

- f. Repeat previous step for temperature (e.g., Temp_1a), this time selecting F300001 again, Click OK once and change from F300001 to F300005. Again, the *Current Value*: should be what you see on the UDA screen for temperature.
- g. If using two Durafets, repeat Steps 2e and 2f. Use new variable names for pH where the first Durafet is "a" and the second Durafet is "b" (e.g., pH_1b, and rename F300001 to F30003) and temperature (e.g., Temp_1b, and rename F300001 to F300007).
- h. If using multiple UDAs, repeat Step 2d (e.g., Modbus_2) for each additional UDA. Repeat Steps 2e-2g for each new Modbus connection using updated variable names (e.g., pH_2a and Temp_2a for the first Durafet of the second UDA, and pH_2b and Temp_2b for a second Durafet of the second UDA).
- i. IMPORTANT: Keep DSM open for Step 3.

3. NI LabVIEW

- a. REMINDER: DSM must be open during this procedure.
- b. Open LabVIEW and a New Blank Project (File > New > Project > Empty Project).
- c. Right click My Computer and select New\Library.
- d. Right click Untitled Library and select New\Variable. Name variable as in Step 2e (e.g., pH_1a), check Enable Aliasing, Bind to: PSP URL, and browse for (Your PC Name)\UDA2182_DSM\(variable name as in Step 2e).
- e. Repeat previous step for temperature (e.g., Temp_1a), and all other remaining Durafet connections created in Step 2.
- f. You should now have all pH and temperature Network Variables within your Untitled Project.
- g. Right click My Computer and select New\VI. Drag each Network Variable (e.g., pH_1a, Temp_1a, etc.). The Network Variable can now be configured into a VI (e.g., create indicators wired to the Network Variables' outputs. You should now be able to run this VI to see the pH and temperature outputs of the UDA2182). An example VI for data logging will be uploaded to <u>http://www.ni.com/examples/</u>.
- h. Click CTRL+SHIFT+s to save entire library with your desired names.
- i. *** DO NOT NAME YOUR NEW LIBRARY (.lvlib) THE SAME AS YOUR DSM PROCESS! *** Instead, name it something like UDA-Durafet_LIB.lvlib. If you name it the same, there will be a conflict between processes and you'll lose communication with the UDA2182.

NB:

Always open the DSM before opening LabVIEW for smooth communication with the UDA2182.

All subsequent VIs written to use the UDA2182 outputs should be contained within this new LabVIEW Project in order to access the .lvlib with the newly created Modbus connections and Network Variables. If you need to begin a completely new project, repeat entirety of Step 3.

There seem to be endless chances to mess up the naming within the structure in such a way that communication with the UDA is lost. We recommend that you name your DSM process in such a way that it is recognizable as part of the DSM (e.g., UDA2182_DSM) and your library in a similar fashion (UDA2182_LIB.lvlib) and your UDA variable reader program similarly (UDA2182_READER.vi).