

“AX Control Objects”

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Ed Merwin - Channel Sales Director

James Johnson - Sales Engineer

Scott Muench - Technical Sales Manager



Welcome!

- The goal of TridiumTalk is to share with the Niagara community timely content on sales, products and technical topics. Each session will last between 45-60 minutes and will be a mix of presentation, demonstrations and Q&A.
- This session and past sessions will be posted on our community web site at www.Niagara-Central.com (more details to come)
- The content presented here is representative of Tridium's Niagara technology and products in general, please contact your channel partner for specific details and pricing.
- As a courtesy to others in the conference, please place your phone on mute until the Q&A portion of the program

AX Control Objects

Agenda:

- Introduction / KitControl Overview
- NDIO Configuration
- Binary Control Logic Sequence
- Analog Control Logic Sequence
- PID Loop
- Question and Answer Session

NDIO Module and Point Discovery

- Add NDIO Network under Config/Drivers
- Use NDIO Board Manager to discover and add modules to database
- Use NDIO Point Manager for each module to discover and add points to database (max of 32 UI, 18 RO, 16 AO per Jace2 with attached modules)
- Configure analog inputs for specific type (thermistor, voltage, etc)
- If changing facets for analog points, modify the conversion to match (includes scale and offset calculations)

The screenshot shows a software window titled "Ndio Point Discovery" with a "Success" status. It contains two main sections: "Discovered" and "Database".

Discovered (34 objects):

Io Type	Address
Universal Input	1
Universal Input	2
Universal Input	3

Database (18 objects):

Name	Type	Address	Out
SFanWFD	VoltageOutputWritable	1	70.0 % {ok} @ 16
Economizer	VoltageOutputWritable	2	10.0 % {ok} @ 16
CWValve	VoltageOutputWritable	3	100.0 % {ok} @ 16
analogOutputPoint3	VoltageOutputWritable	4	0.0 % {ok} @ def
analogOutputPoint4	VoltageOutputWritable	5	0.0 V {ok} @ def

At the bottom of the window, there is a toolbar with buttons for "New", "New Folder", "Edit", "Discover", and "Add".

Setup For NDIO Voltage Inputs and Outputs

When changing the facets from default (volts), then you must change the conversion from default to linear.

Calculating Linear Scale (y1 & y2 desired units, x1 & x2 NDIO voltage)

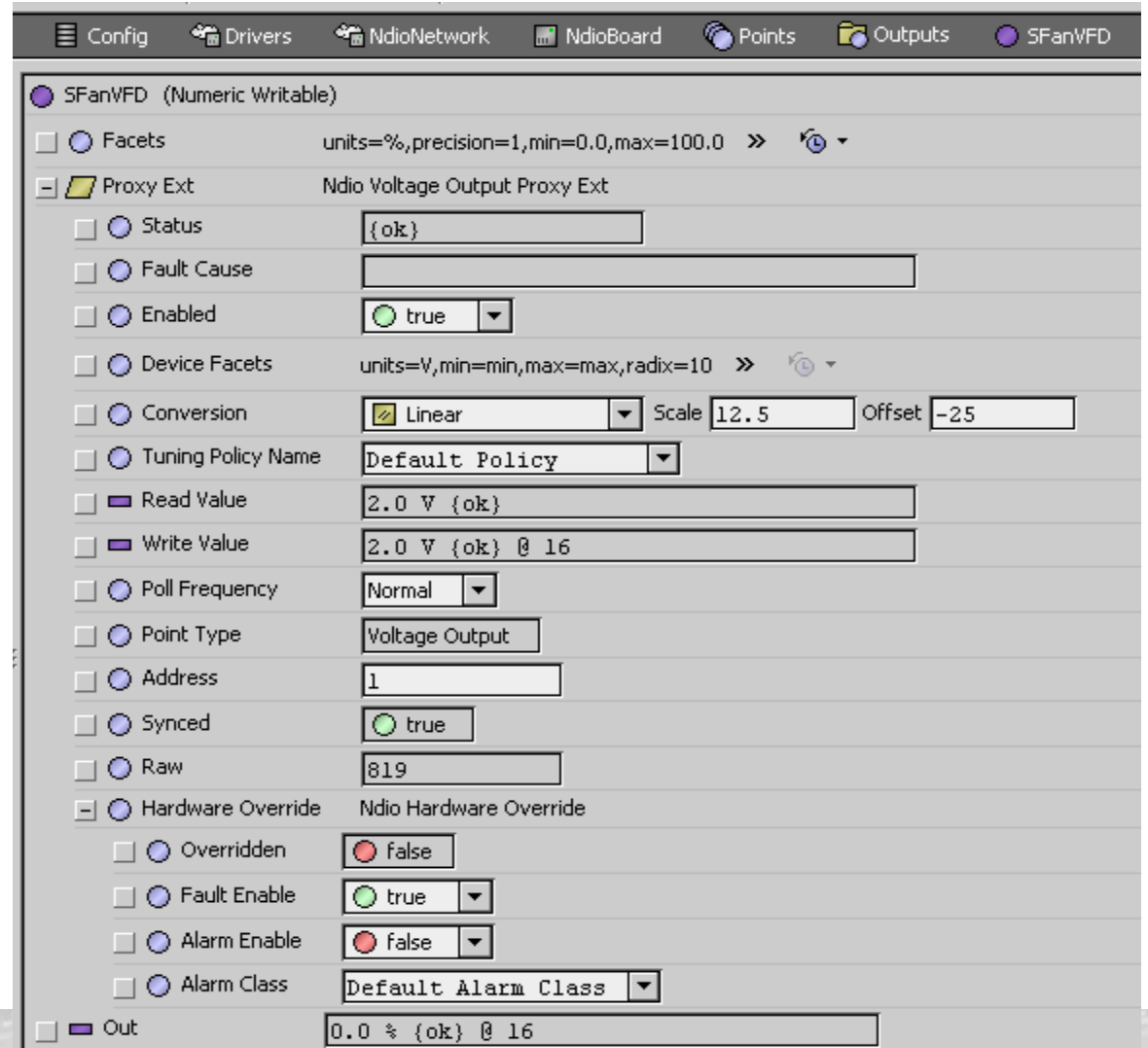
- $Scale = (y2 - y1) / (x2 - x1)$
- $Scale = (100\% - 0\%) / (10v - 2v)$
- $Scale = 12.5$

Calculating Linear Offset

- $Offset = y1 - (scale * x1)$
- $Offset = 0\% - (12.5 * 2v)$
- $Offset = -25$

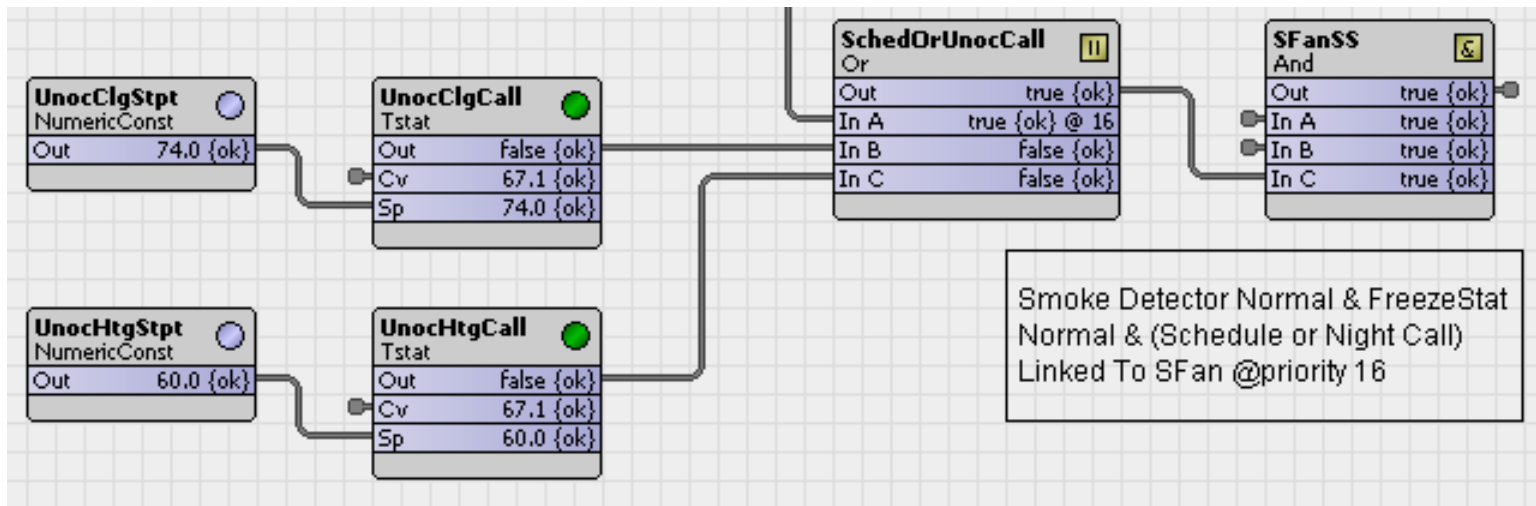
Jace 2 NDIO Output Configuration

- Change facets to %
- Change conversion to linear
- Set scale and offset



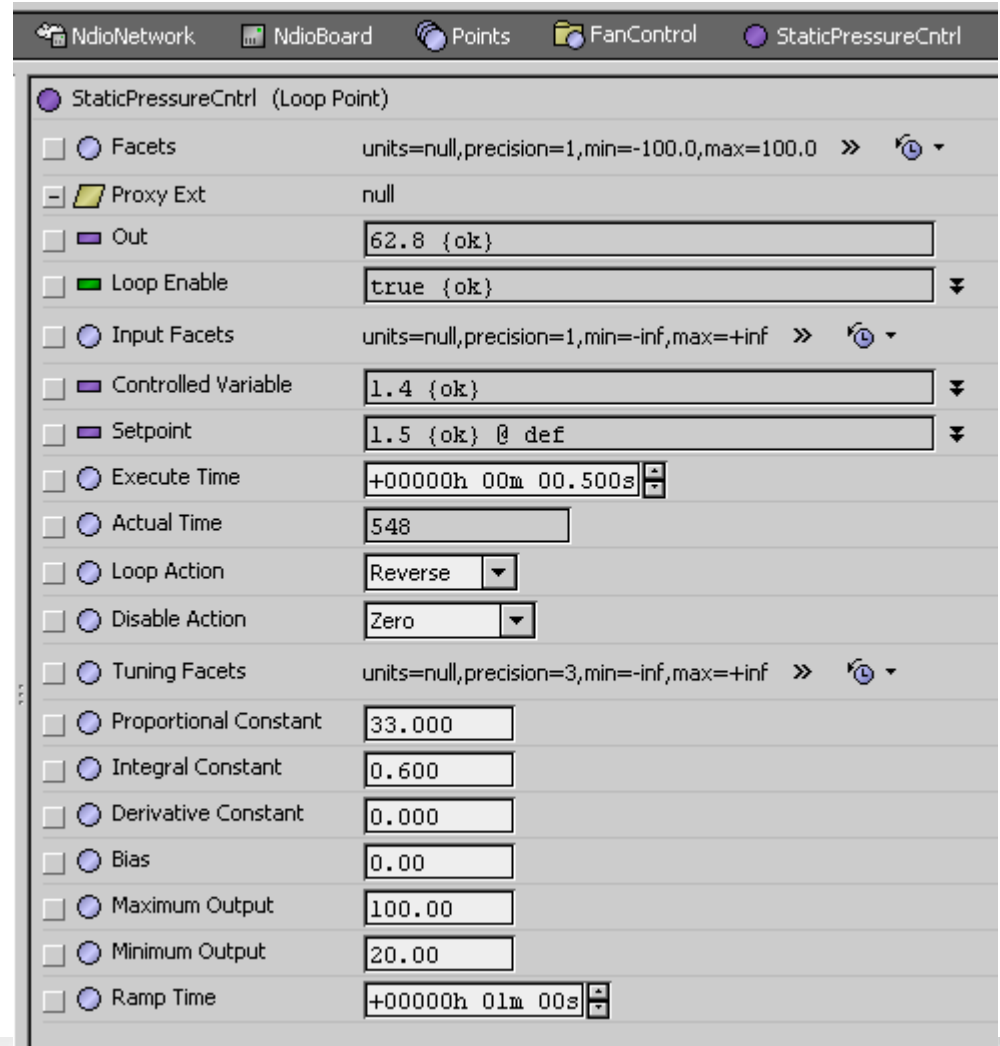
Basic Boolean and Analog Control Objects

- Numeric and Boolean Constants used for set points and default states
- Objects in palette for analog comparisons (compare less than, compare greater than, TStat, etc) and boolean logic (or, and, not, xor, etc)
- Timers, triggers, math functions, latches, simulation objects, energy functions, and conversion objects round out the list



PID Loop Configuration

- Set loop action to direct or reverse as needed
- Configure disable action
- Set proportional, integral and derivative constants
- Set bias and min/max output
- Configure ramp time to limit output on loop enable



Proportional Only Control

- Throttling range is expected variation in PV
- Output range max must be greater than min
- Bias should allow for control of PV above or below setpoint

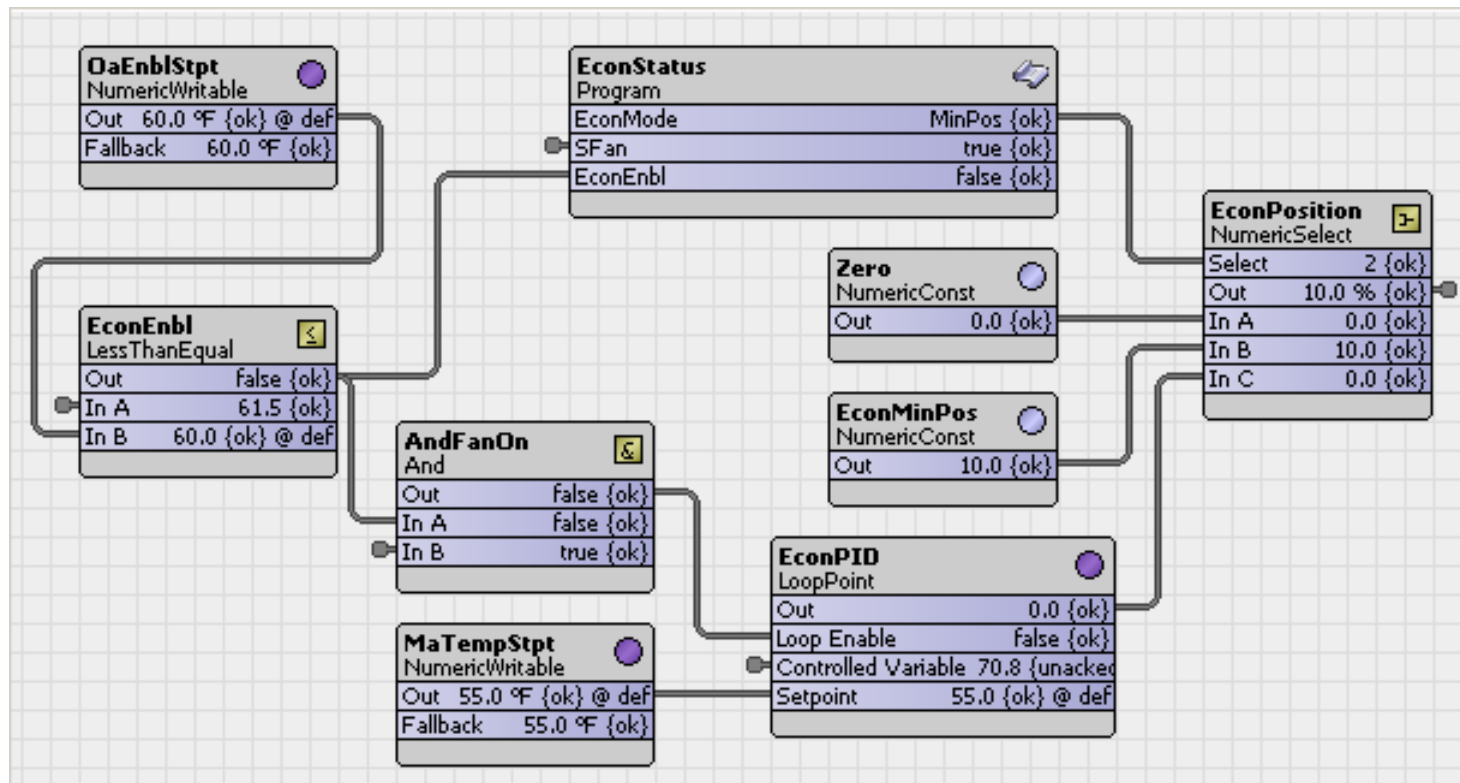
- $K_p = [\text{output range (max - min)}] / \text{throttling range}$
- $K_p = (100\% - 0\%) / 20 \text{ }^\circ\text{F}$
- $K_p = 5$

Proportional With Integral Control

- Set proportional constant same method as P-only
- Output range max must be greater than min
- Bias should be zero. Integral term effectively creates an “adjustable bias” .
- Integral constant specifies the integral gain in “Repeats per minute” , sometimes called reset rate.
- K_I is typically less than 1.0, a value of 0.5 is a good starting point for many loops.

Sample Economizer Control

- Numeric select used to switch damper signals based on mode
- Loop disabled to prevent integral windup when not economizing



Numeric Select Configuration

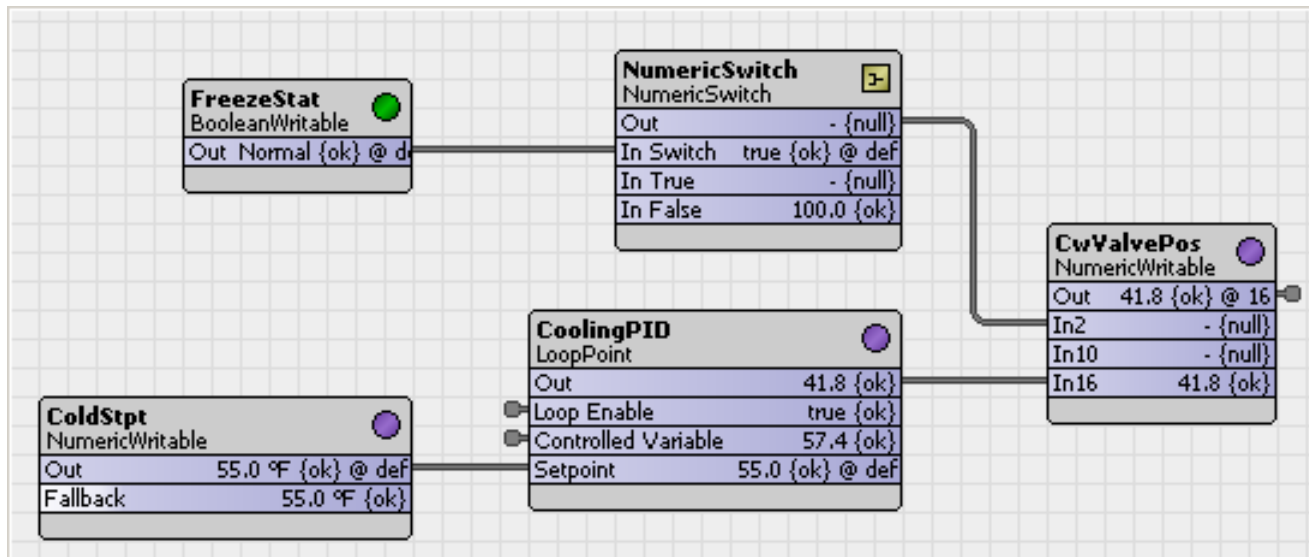
- Each select can have between 3 and 10 inputs
- Set “zero based select” to true if enumerated select link has a zero in the ordinal index
- Boolean, Enum and String Selects configure same way

The screenshot shows the configuration window for a 'CwValvePos (Numeric Select)' device. The interface includes a menu bar with 'Config', 'Drivers', 'NdioNetwork', 'NdioBoard', 'Points', 'DaTempControl', and 'CwValvePos'. The configuration area is divided into several sections:

- Facets:** units=null,precision=1,min=-inf,max=+inf
- Propagate Flags:** disabled, fault, down, alarm, stale, overridden, null, unackedAlarm
- Select:** 1 {ok}
- Number Values:** 3 [3 - 10]
- Zero Based Select:** false
- Out:** 4.6 {ok}
- In A:** 4.6 {ok}
- In B:** 100.0 {ok}
- In C:** 0.0 {ok}

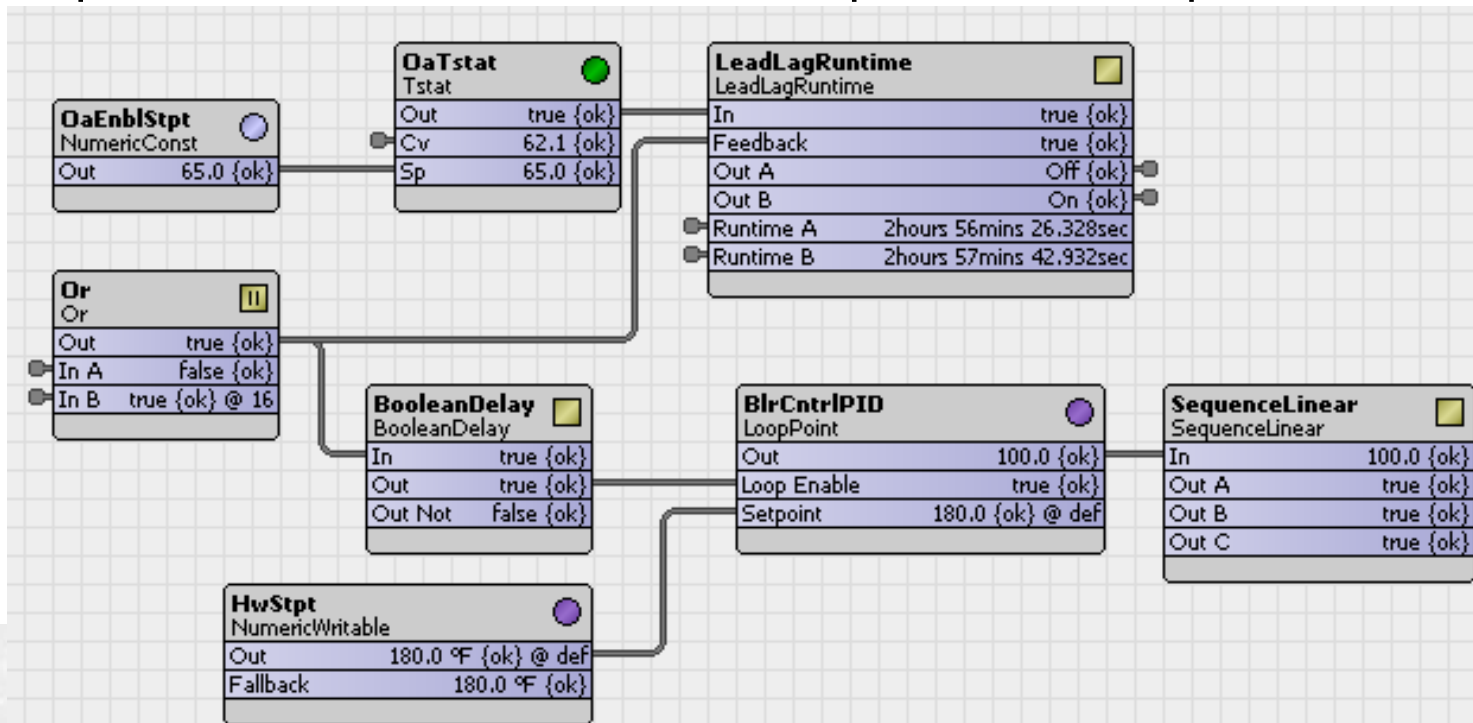
Sample Cooling Control

- Numeric Switch used to toggle between PID Loop output and full open signal when freeze protection tstat tripped
- Numeric Switch and PID Loop outputs are linked to different priority array inputs instead of using Numeric Select object in Sample Economizer Control



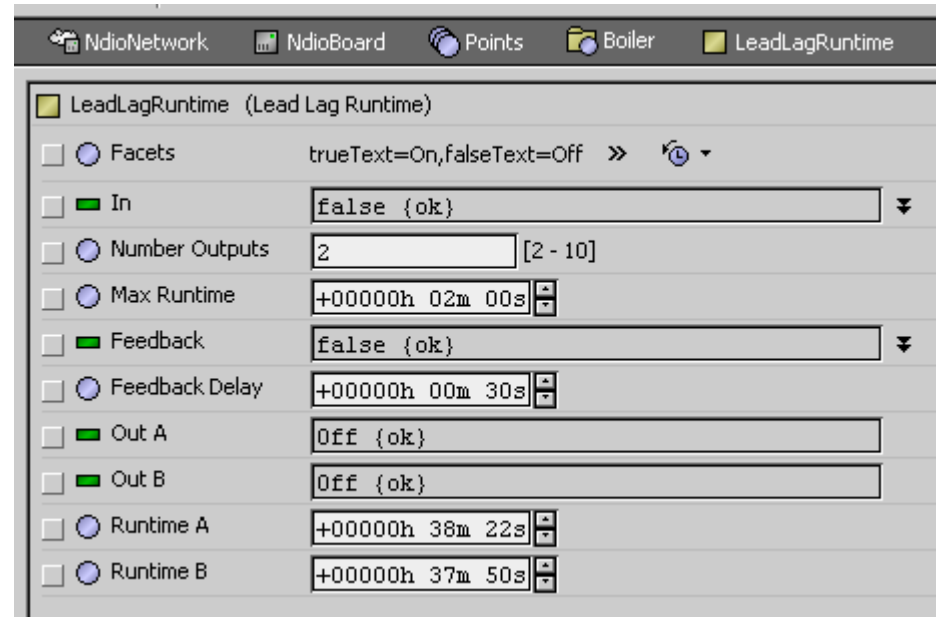
Pump Control With Lead Lag Runtime Equalization

- Single boolean input to LeadLagRuntime object
- The object balances the active runtimes
- Starts alternate pump if feedback does not prove that a pump is running
- Boolean Delay used to allow pumps to circulate water before Boiler PID Loop is enabled
- Sequencer used to link numeric output of PID Loop to boolean stages



Lead Lag Runtime Configuration

- Set max runtime to accumulated runtime that will cause an automatic shift in loads
- Can use between 2 and 10 connected loads
- Configure feedback delay to allow system response before starting alternate loads
- Lead Lag Cycles used when balancing start cycles instead of runtime



Linear Sequencer Configuration

- Support 2-10 stages
- Configurable inter stage delay
- Can be configured to rotate which load is started first by changing action

SequenceLinear (Sequence Linear)	
<input type="checkbox"/> Facets	trueText=true,falseText=false >> ↻
<input type="checkbox"/> In	76.9 {ok} ▾
<input type="checkbox"/> In Minimum	0.00
<input type="checkbox"/> In Maximum	100.00
<input type="checkbox"/> Number Outputs	3 [2 - 10]
<input type="checkbox"/> Out A	true {ok}
<input type="checkbox"/> Out B	true {ok}
<input type="checkbox"/> Out C	false {ok}
<input type="checkbox"/> Delay	+000000h 01m 00s ⌵
<input type="checkbox"/> On Delay Active	<input checked="" type="radio"/> true
<input type="checkbox"/> Off Delay Active	<input type="radio"/> false
<input type="checkbox"/> Desired Stages On	2
<input type="checkbox"/> Current Stages On	2
<input type="checkbox"/> Next Stage On	3
<input type="checkbox"/> Next Stage Off	2
<input type="checkbox"/> Action	<input checked="" type="radio"/> linear ▾
<input type="checkbox"/> Rotate Time	+000000h 00m 01s ⌵
<input type="checkbox"/> Rotate Timer Active	<input type="radio"/> false

Question and Answer Session

- Select the Q&A icon in the netspoke menu bar to type your questions
- Feel free to speak up for further discussion
- Please introduce yourself, company name, and where you are calling from.

Thank you!

- We would like your feedback on today's TridiumTalk
- Please take a moment to answer our short survey
- If you have any further questions, comments or topic suggestions, please email them to SalesSupport@tridium.com



Ed Merwin



James Johnson



Scott Muench

Upcoming TridiumTalk topics:

First Session	Second Session	2006 Topics
● October 10	October 12	What's new in Niagara AX 3.1 – New capabilities (Software, NXS, double memory JACEs)
● October 26		Driving Internet Connectivity to the Building Device Level JACE-2 - Equipment Controller / New Applications and Architectures Hosted by HPAC Engineering Magazine
● November 14	November 16	AX Control Objects – Tech Session for tuning PID loops and Commissioning
● December 12	December 14	OBIX – Introduction / R2 to AX Integration and Migration plan
2007 Topics		
● January 9	January 11	Niagara Portal – Introduction to the entry point to the Niagara Community
● February 13	February 15	Selling Niagara – The Value Proposition (annual event)
● March 13	March 15	The Niagara Community - Products Based on Niagara Show and Tell?
● April 10	April 12	AX Graphics - Tech Session for Building PX pages using HX and WB profiles
● May 8	May 10	How to Demo AX – Step by Step
● June 12	June 14	Wireless – The World Unwired, What does it mean to you?