PingCx

Lifecycle Commissioning™

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PingCx.com

May 2025

Autonomous Commissioning

The Foundation for Smart Building Success

PingCx

About me

Saheel Chandrani
Co-founder & CEO

1. Motivated to improve the lives of the people who serve the buildings we live and work in.
2. 20 years in BAS/Controls industry, experience at ABB, Honeywell, JCI, and Siemens.
3. 2x BS, Mechanical Engineering + Management – NJIT
4. MBA – Drexel
5. Home: Princeton, NJ
6. Office + team: Farmingdale, NY

Agenda

1. System Integrators perspective
2. Importance of standardization for other applications
3. The problem we solve
4. Some examples of success
5. Questions

2025 Haystack Connect
Smart Data. Smart Devices. Smart Buildings. Smart Business.

A System Integrator's perspective

Commissioning: it's a critical foundation

1. **Problem Statement:** Smart building applications fail without properly commissioned systems

2. **Reality Check:**
    1. Greater than 50% of first year building faults stem from incomplete commissioning, resulting in a median whole-building energy loss of 16%
    2. Majority of work performed by small/medium System Integrators, utilizing traditional tools and methodologies
    3. Traditional procurement models leads to multi-vendor, multi-protocol, and multi-generational implementations

3. **Integrators dilemma:**
    1. **Construction Tiers:** BAS integrators often 3-4 tiers removed from owner
    2. **Timeline Pressure:** Last in the construction sequence, first to face schedule compression and trade dependence
    3. **Budget Constraints:** Expected to absorb upstream delays without additional compensation
    4. **Technical Demands:** Integrating diverse systems from multiple manufacturers
    5. **Opportunity:** Thorough commissioning creates the bedrock for all other smart building technologies

The standardization imperative

1. **Integration Challenge:**
    1. Multi-generational + multi-vendor installations
    2. Inconsistent installing contractor processes
2. **Data Context:** Raw point names vs. semantic understanding
3. **Scalability Issue:** Proprietary naming conventions don't scale across enterprises
4. **Analytics Foundation:** Consistent tagging enables advanced analytics and AI applications– **best suited during the initial implementation of building technology**

2025 Haystack Connect
Smart Data. Smart Devices. Smart Buildings. Smart Business.

Purpose-built commissioning tools

Right tools at the right time

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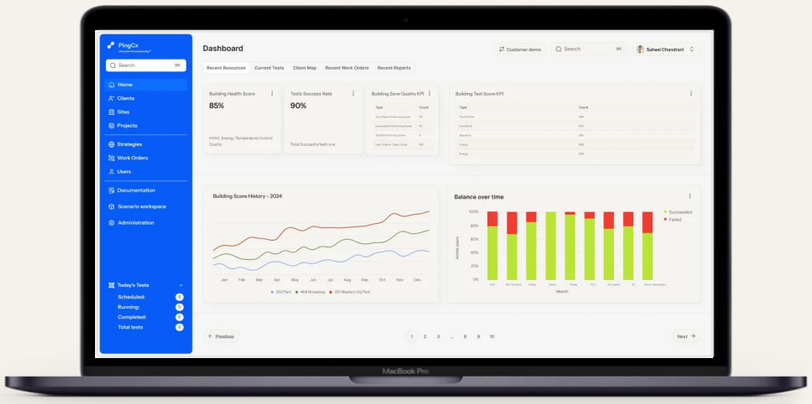
Fundamentals of autonomous commissioning



1. Lives on the BAS network as an Administrative user; is performing tasks and recording results much like a user normally would, however, able to do this automatically
2. BAS and HVAC system databases and documentation imported into Cx tool
3. Tool leverages parser engine + tagging to automatically homogenize and normalize data, automated test sequences are selected and customized, assigned to the appropriate project, and scheduled for execution
4. Data is collected and analysis engines computes results
5. Reporting and documentation provided for variety of stakeholders

Key differences from FDD

(Fault Detection and Diagnostics)

FDD		Autonomous Commissioning
Trend based Passive monitoring with rule-based or model-based anomaly detection against trend data	→	**Real-time Functional Testing** Automated functional testing and verification of current operating condition for all equipment types
Reference baseline Compares against learned normal operation	→	**Test and Verify** Compares against design docs, specs, and SOO
Learns to be effective Trends and algorithms must observe and learn over several weeks before system can be effective	→	**Effective from Day 1** Can deploy and begin testing on Day 1, delivering results instantaneously
Data dependent Based on data quality, accuracy, and reliability	→	**Condition dependent** Analyzes currently observed reactions

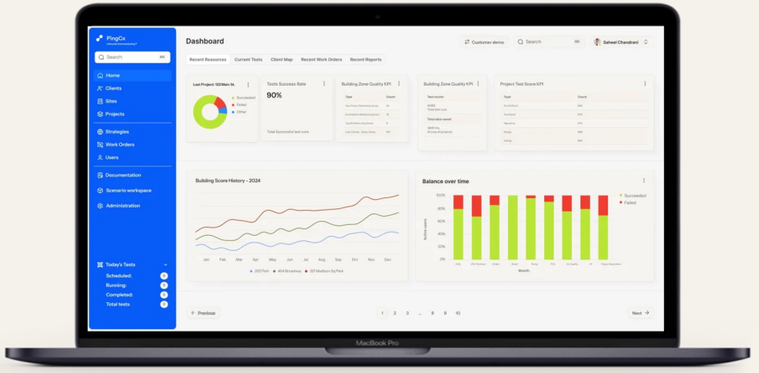
Autonomous Cx ensures FDD algorithms learning from properly commissioned systems to enable high performance buildings

Introducing PingCx

PingCx is a Lifecycle Commissioning™ platform for building automation systems

Focus on Cx

The only platform that automates the full **Lifecycle Commissioning™** of any building automation system to uncover hidden faults, proactively test each system, and deliver peace of mind at every stage of a buildings lifecycle



30M
sqft enrolled in Lifecycle Commissioning™

1,600+
Cx instances completed

200k+
BACnet points actively managed

500k+
BACnet points tested

How we define Lifecycle Commissioning™

Lifecycle Commissioning™

1

Initial Commissioning (Cx)

For new construction or major renovations

2

Retro-Commissioning (RCx)

First-time commissioning for existing buildings

3

Re-Commissioning (Re-Cx)

Periodic recommissioning of previously commissioned buildings

4

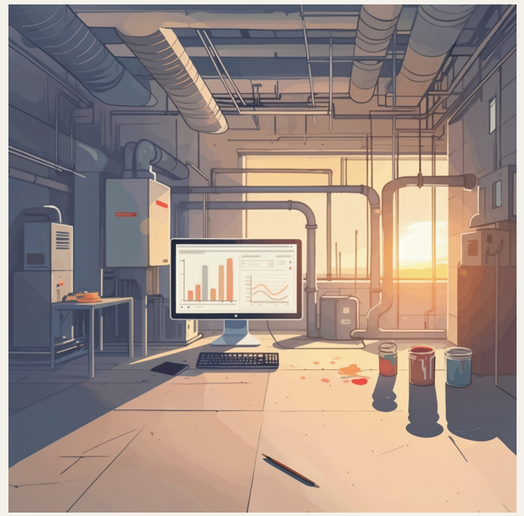
Ongoing Commissioning (OCx)

Regular review and optimization of building performance

The evolution of commissioning

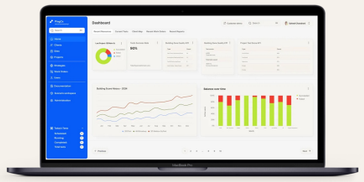
In the way back when

In the recent past



Today

How it works

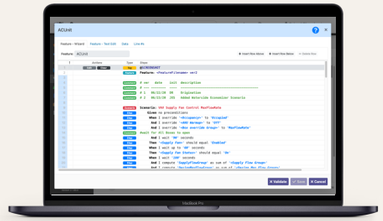


Project initiated in PingCx or other tools

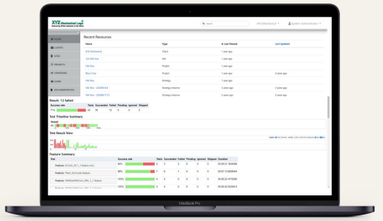
Database file is uploaded

Possible due to Haystack etc.

Remote connectivity is established



Test scenarios selected

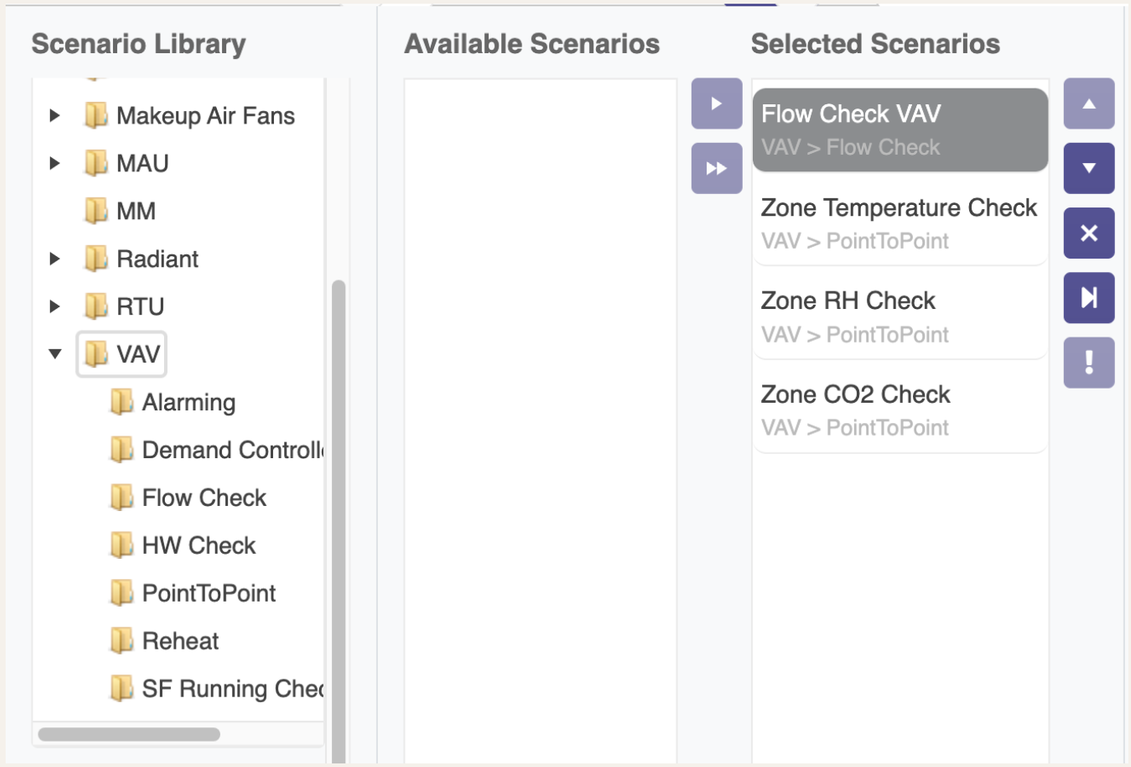


Cx process is initiated and completed

Results presented to Service Provider for resolution

Test scenarios

As simple as pre-configured

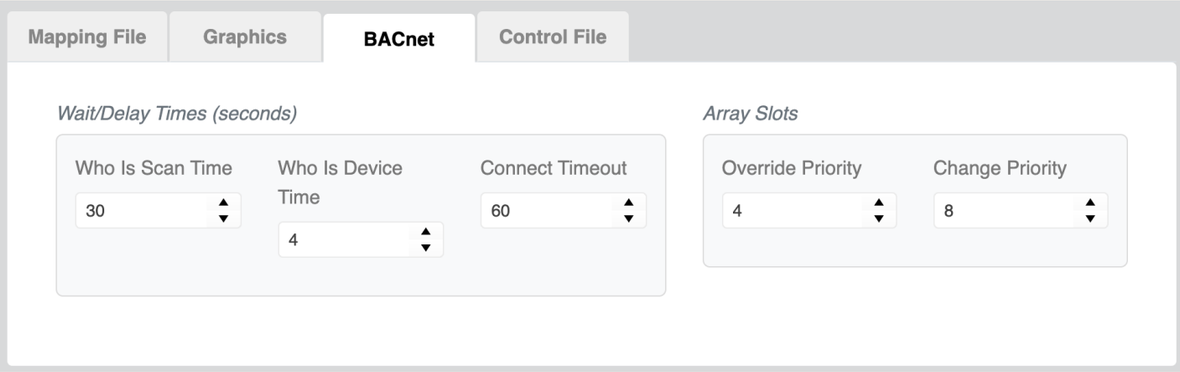


As complex as needed

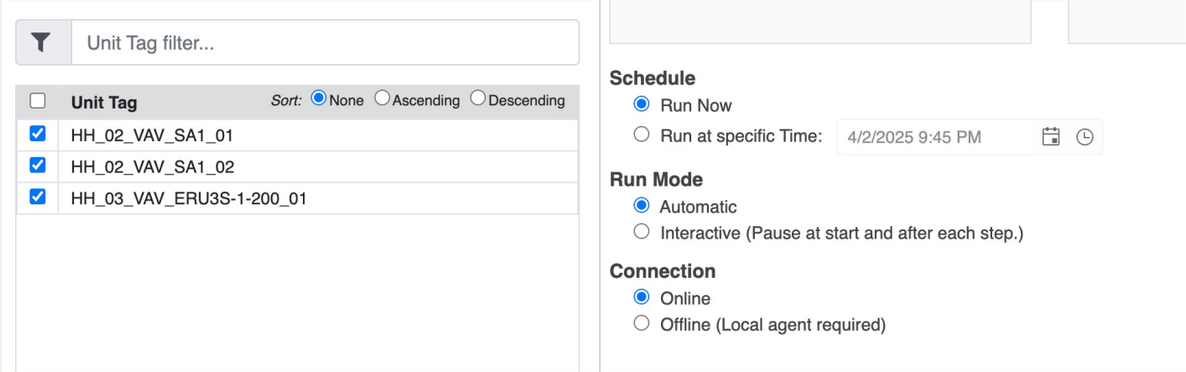
Type	Steps
Tag	@Debug=All
Feature	Feature: <FeatureFilename>
Comment	********** Read Tests **********
Tag	@ReadValues
Scenario	Scenario: Read Values
Step	Given no preconditions
Step	When I read '<Unit Tag>.*'
Step	Then I should pass
Tag	@PointToPoint
Scenario	Scenario: Supply Air Temperature Check
Step	Given no preconditions
Step	Then '<Supply Air Temperature>' should be between '40 F' and '100 F'

Paying attention to the details

BACnet Priorities



Highly flexible



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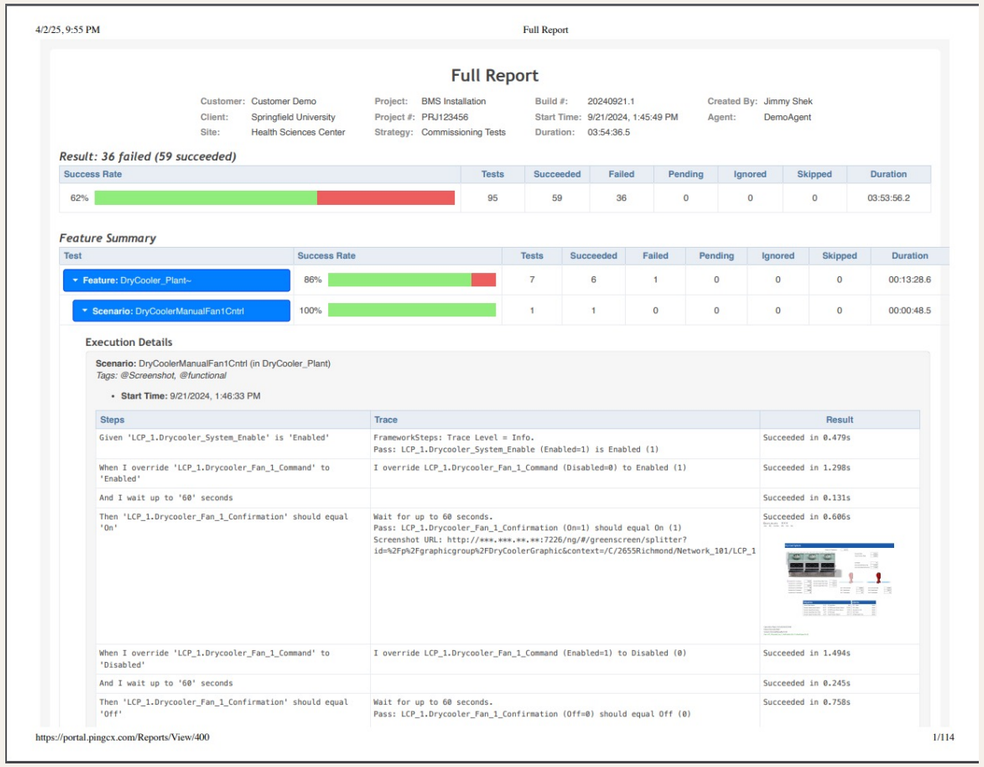
Reporting capabilities

System generated



4/2/25, 9:55 PM Full Report

Full Report

Customer: Customer Demo | Project: BMS Installation | Build #: 20240921.1 | Created By: Jimmy Shek
Client: Springfield University | Project #: PRJ123456 | Start Time: 9/21/2024, 1:45:49 PM | Agent: DemoAgent
Site: Health Sciences Center | Strategy: Commissioning Tests | Duration: 03:54:36.5

Result: 36 failed (59 succeeded)

Success Rate	Tests	Succeeded	Failed	Pending	Ignored	Skipped	Duration
62%	95	59	36	0	0	0	03:53:56.2

Feature Summary

Test	Success Rate	Tests	Succeeded	Failed	Pending	Ignored	Skipped	Duration
Feature: DryCooler_Plant~	86%	7	6	1	0	0	0	00:13:28.6
Scenario: DryCoolerManualFan1Cntrl	100%	1	1	0	0	0	0	00:00:48.5

Execution Details

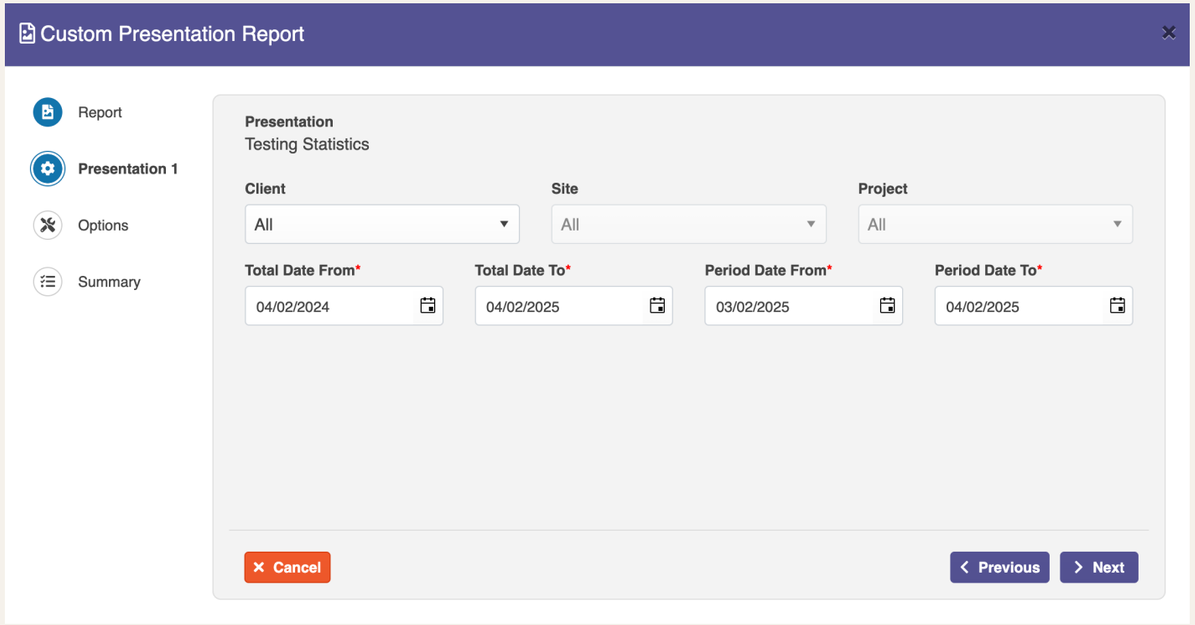
Scenario: DryCoolerManualFan1Cntrl (in DryCooler_Plant)
Tags: @Screenshot, @functional

- **Start Time:** 9/21/2024, 1:46:33 PM

Steps	Trace	Result
Given 'LCP_1.Drycooler_System_Enable' is 'Enabled'	FrameworkSteps: Trace Level = Info. Pass: LCP_1.Drycooler_System_Enable (Enabled=1) is Enabled (1)	Succeeded in 0.479s
When I override 'LCP_1.Drycooler_Fan_1_Command' to 'Enabled'	I override LCP_1.Drycooler_Fan_1_Command (Disabled=0) to Enabled (1)	Succeeded in 1.298s
And I wait up to '60' seconds		Succeeded in 0.131s
Then 'LCP_1.Drycooler_Fan_1_Confirmation' should equal 'On'	Wait for up to 60 seconds. Pass: LCP_1.Drycooler_Fan_1_Confirmation (On=1) should equal On (1) Screenshot URL: http://***.***.**.**:7226/ng/#/greenscreen/splitter?id=%2Fpk%2Fgraphicgroup%2FDryCoolerGraphic&context=/C/2655Richmond/Network_101/LCP_1	Succeeded in 0.606s
When I override 'LCP_1.Drycooler_Fan_1_Command' to 'Disabled'	I override LCP_1.Drycooler_Fan_1_Command (Enabled=1) to Disabled (0)	Succeeded in 1.494s
And I wait up to '60' seconds		Succeeded in 0.245s
Then 'LCP_1.Drycooler_Fan_1_Confirmation' should equal 'Off'	Wait for up to 60 seconds. Pass: LCP_1.Drycooler_Fan_1_Confirmation (Off=0) should equal Off (0)	Succeeded in 0.758s

https://portal.pingcx.com/Reports/View/400 1/114

Customized



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Cast study: Large commercial office building

Commercial office building – New York, NY

Project overview:

1. 46 story, 990,000sqft, 19,007 points – midtown Manhattan
2. Niagara front end – JCI Metasys + FX across base building + several tenant BAS implementations
3. Chief engineer new to the building, strong concerns that ‘things aren’t working’ and we ‘have to override everything’
4. While many energy efficiency projects implemented, still room for improvement
5. Incumbent controls contractor facing heavy lift to normalize data across many installations, struggled to perform service work. Labor effort seemed overwhelming.

Project goals:

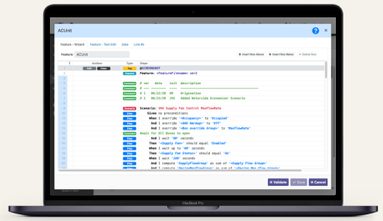
1. Perform baseline analysis of ‘how are my systems working’
2. Perform a thorough seasonal recommissioning of the BAS
3. Create a unified points list across all base building + tenant systems to allow future technology deployments

Implementation approach

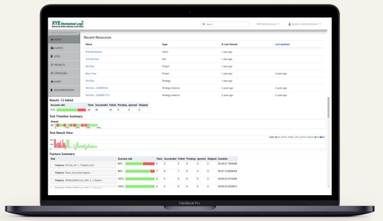
Project initiated in PingCx or other tools

Database file is uploaded, points unified

Remote connectivity is established



Test scenarios selected



Cx process is initiated and completed

1 day

2 days

2 days

Results presented to Service Provider for resolution

Fall-Winter 2024 seasonal test result

1. Total of 3,143 automated functional tests were run, delivering 72% success score.
2. Tool runtime: 2 days 4hr 5 min; Labor saved: 120hrs+
3. 100% testing and validation of:
    1. Chilled Water System (CH-1, 2, 3, CHWP-1, 2, 3, 4, 5, CWP-1, 2, CT-1, 2, 3, + VFDs)
    2. 8 AHUs (S-1, 2, 3, 4, 5, 6, 9 & R-5, 6, 7, 8, 9, 10 + VFDs)
    3. ~600 Terminal units (VAVs + PIUs)

Result: 812 failed (2222 succeeded)

Success Rate	Tests	Succeeded	Failed	Pending	Ignored	Skipped	Duration
72%	3143	2222	812	66	0	43	2.04:05:30.2

Sample test result

Feature Summary

Test	Success Rate	Tests	Succeeded	Failed	Pending	Ignored	Skipped	Duration
Feature: Floor9.S1_R5_AC Units_Averaging~	100%	1	1	0	0	0	0	00:02:14.3
Feature: Floor9.S1_R5_AC Units_OAT~	50%	2	1	0	1	0	0	00:04:35.3
Feature: Floor9.S1_R5_AC Units~	80%	39	16	1	3	0	19	00:03:20.0
Feature: Floor9.S2_R6_AC Units_Averaging~	100%	1	1	0	0	0	0	00:00:54.9
Feature: Floor9.S2_R6_AC Units_OAT~	50%	2	1	1	0	0	0	00:01:15.5
Feature: Floor9.S2_R6_AC Units~	68%	34	23	7	4	0	0	01:42:07.8
Feature: Floor9.S3_AC Units_OAT~	100%	2	2	0	0	0	0	00:01:13.9
Feature: Floor9.S3_AC Units~	62%	21	13	5	3	0	0	00:14:32.0

Sample test detailed result

Scenario: Minimum Flow Check - SumWinTRISP	0%	1	0	1	0	0	0	00:06:04.8

Execution Details

Scenario: Minimum Flow Check - SumWinTRISP (in Park_Ave_90_F40.VAVS_41FL.VAV_41_5_VAV)
Tags: @Screenshot, @?vavsw&trisp, @functional

- **Start Time:** 3/3/2025, 9:30:12 AM

Steps	Trace	Result
Given precondition 'SF Running'	FrameworkSteps: Trace Level = Info. Pass: SF Running	Succeeded in 0.351s
And I override 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.SUM_WIN' to '1'	I override Park_Ave_90_F40.VAVS_41FL.VAV_41_5.SUM_WIN (WINTER=0) to 1 (SUMMER)	Succeeded in 3.420s
And I override 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.SYSTEM_MODE' to 'Cool Only'	I override Park_Ave_90_F40.VAVS_41FL.VAV_41_5.SYSTEM_MODE (Heat Only=2) to Cool Only (1)	Succeeded in 3.325s
When I override 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.CLGOCC_SP' to '8 °F' above 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZN_T'	I override Park_Ave_90_F40.VAVS_41FL.VAV_41_5.CLGOCC_SP (73) to 8 °F (8) above Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZN_T (75.01) ==> 83.01	Succeeded in 3.463s
And I override 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.HTGOCC_SP' to '8 °F' below 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZN_T'	I override Park_Ave_90_F40.VAVS_41FL.VAV_41_5.HTGOCC_SP (70) to 8 °F (8) below Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZN_T (75.01) ==> 67.01	Succeeded in 3.461s
And I override 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZNT_SP' to 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZN_T'	I override Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZNT_SP (72) to Park_Ave_90_F40.VAVS_41FL.VAV_41_5.ZN_T (75.01)	Succeeded in 3.499s
And I wait '1' minutes	Wait 60 seconds	Succeeded in 60.616s
Then 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.SAFLOW_SP' should equal 'Park_Ave_90_F40.VAVS_41FL.VAV_41_5.CLGOCC_MINFLOW'	Pass: Park_Ave_90_F40.VAVS_41FL.VAV_41_5.SAFLOW_SP (37) should equal Park_Ave_90_F40.VAVS_41FL.VAV_41_5.CLGOCC_MINFLOW (37) Screenshot URL: https://172.29.92.100/ord/station:|slot:/Drivers/NiagaraNetwork/Park_Ave_90_F40/points/VAVS_4	Succeeded in 0.416s 

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Results highlights

1. Energy: Automated Control Limitations
    1. AC units are improperly locked out of heating/cooling modes based on rigid outside air temperature thresholds
    2. Supply air temperature reset functionality is limited by hard-coded values
    3. Winter mode (warmup) sequences activate unnecessarily and remain engaged without proper reset capabilities
    4. Floor dampers require manual adjustment due to poor automatic control
2. Comfort: Sensor and Measurement Issues
    1. Significant discrepancies (20°F+) exist between outside air temperature sensors
    2. Return/mixed air temperature sensors provide poor representation of actual zone condition
    3. VAV boxes become stuck in purge mode without manual intervention
    4. CFM measurements appear inaccurate, leading to improper air distribution
3. Safety: Safety and Scheduling Concerns
    1. At least one freeze-stat safety device was found bypassed, creating potential system damage risk
    2. PIUs (Powered Induction Units) operate continuously instead of following floor occupancy schedule
    3. Inconsistent control methodologies exist across different building floors

Energy impacts

	Concern	Est. Annual Energy Impact ($)	Est. Annual Energy Impact (Tons CO2)
1.	AC Units are hard coded to enter Economizer mode	$11,826	138.4
2.	Economizer lockout	$50,640	592.3
3.	OAT Sensor Discrepancy	$60,000	432.6
4.	Hard-coded Supply Air Setpoints	$18,600	109.9
5.	VAV Purge Mode	$9,358	37.3
6.	PIU without Setback	$84,450	638.8
	TOTAL	**$234,874 potential savings**	**1,949.3 Tons of CO2**

Case Study 2: College campus

College campus – Hoboken, NJ

Project overview:

1. Prestigious engineering college with 43 academic, housing, and administrative buildings across 55 acres, approx. 1.7m sqft, 27,000+ pts (5 bldgs.)
2. Niagara front end – Honeywell WEBs + JCI FX, by several installing contractors over many new construction, retrofit, and upgrade projects leading to inconsistent naming convention and sequences across similar equipment types.
3. Many comfort complaints and new Controls contractor on site managing service facing many issues
4. Needed a thorough ReCx across campus BAS + workorder management to track issue resolution

Project goals:

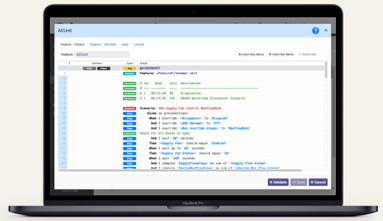
1. Establish a unified and homogenized campus BAS points list & standardize campus sequences
2. Utilize Autonomous Commissioning platform to perform baseline understanding of current operating condition of equipment against design guidance
3. Integrate with existing work-order management system

Implementation approach

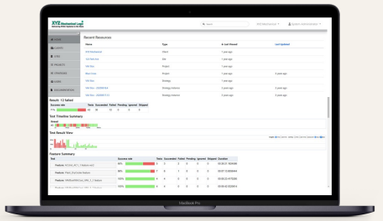
Project initiated in PingCx or other tools

Database file is uploaded, points unified

Remote connectivity is established



Test scenarios selected



Cx process is initiated and completed

1 day

3 days

5 days

Results presented to Service Provider for resolution

Implementation notes

1. Working with campus IT department, Autonomous Commissioning platform was provided with appropriate credentials and virtual machine for data aggregation
2. Also delivered through partner, perform pilot across 5 buildings before campus wide rollout
3. Existing supervisory controller databases imported, automatic point discovery and homogenization process completed point naming standardization
4. In collaboration with retained MEP consulting engineer, updated sequences of operation established, and appropriate tests were written

Initial results – 1 bldg.

1. Total of 1,034 automated functional tests were run, delivering 84% success score.
2. Tool runtime: 11hr 19 min; Labor saved: 120hrs+
3. 100% testing and validation of: Boiler (3), CHW Plant (1), CleanBench (5), Exhaust Fan (10), FCU (8), Flow Meter (9), Heat Wheel (3), HV (2), HW Plant (5), VAV (83), VFD (22).
4. Unified points list total: 27k + (across 5 buildings)

Result: 153 failed (860 succeeded)

Success Rate	Tests	Succeeded	Failed	Pending	Ignored	Skipped	Duration
84%	1034	860	153	13	0	8	11:19:36.4

Sample test result

Execution Details

Scenario: Return Duct Static Pressure Sensor 11/22/2024 19:54:14 (in ACS_UR_1_AC Unit_ACS_UR)
Tags: @Screenshot, @pointtopoint

- **Start Time:** 11/22/2024, 2:54:14 PM

Steps	Trace	Result
Given no preconditions	FrameworkSteps: Trace Level = Info.	Succeeded in 0.967s
Then 'ACS_UR_1.RA_P' should be between '0 inWC' and '2 inWC'	**Failure: ACS_UR_1.RA_P (-0.04) should be between 0 inWC (0) and 2 inWC (2)** **Screenshot URL:** **https://155.246.10.134/ord/station:|slot:/Drivers/NiagaraNetwork/UCC_MCP2/points/ACS_**	Failed in 1.181s 

Sample unified points list

VAV

Feature - Wizard | Feature - Text Edit | Data | Line #s

Columns | Rows

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Unit Tag	Active	@?ZT	@?ZT2	@?CAV	@?VAV	@?HWRH	@?CO2	@?RAD	@?FPB	Supply Fan Confirmation	SF On	Zone Temperature	Zone Temperature 2	Supply Air Te
2	VAVs.M_100_M_VAV_1	Y			Y						Misc.HV_NM_1.SF_S	1			
3	VAVs.M_100_M_VAV_2	Y			Y						Misc.HV_NM_1.SF_S	1			
4	VAVs.M_100_M_VAV_3	Y			Y						Misc.HV_NM_1.SF_S	1			
5	VAVs.M104_VAV_02	Y	Y			Y	Y				Misc.ACS_N4_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
6	VAVs.M104_VAV_06	Y	Y			Y	Y		Y		Misc.ACS_N4_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
7	VAVs.M104_VAV_07	Y	Y			Y	Y				Misc.ACS_N4_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
8	VAVs.M101B_VAV_01	Y	Y			Y	Y				ACS_UR_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
9	VAVs.M101B_VAV_02	Y	Y			Y	Y				ACS_UR_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
10	VAVs.M101B_VAV_03	Y	Y			Y	Y				ACS_UR_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
11	VAVs.M101B_VAV_04	Y	Y			Y	Y				ACS_UR_1.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
12	VAVs.M102B_VAV_01	Y	Y			Y	Y		Y		ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
13	VAVs.M102B_VAV_02	Y	Y			Y	Y		Y		ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
14	VAVs.M102B_VAV_03	Y	Y			Y	Y		Y		ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
15	VAVs.M102B_VAV_04	Y	Y			Y	Y				ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
16	VAVs.M102B_VAV_05	Y	Y			Y	Y				ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
17	VAVs.M102B_VAV_06	Y	Y			Y	Y				ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
18	VAVs.M102B_VAV_07	Y	Y			Y	Y				ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
19	VAVs.M102B_VAV_08	Y	Y			Y	Y		Y		ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
20	VAVs.M102B_VAV_09	Y	Y			Y	Y		Y		ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA
21	VAVs.M102B_VAV_12	Y	Y			Y	Y				ACS_UR_2.SF_S	1	<Unit Tag>.ZN_T		<Unit Tag>.DA

Results highlights

1. ReCx of all 5 buildings in <2 weeks by team of 2
2. Estimated $400k annual energy savings from easy to implement corrective actions across 5 buildings; near instantaneous ROI.
3. Unified points list + ReCx'd buildings allow for deployment of FDD and other analytics platforms

Q+A

Appendix

Our team

We're building an industry-leading team

Saheel Chandrani
Co-founder & CEO

Haris Dervisevic
VP, Sales

Melissa Perry
COO

Tere DeMicco
Operations Mgr

Jimmy Shek
Head of Product

Joseph King
UI/UX Developer

Dennis Rosen
Backend Developer

Michael Munson
VP, Customer Success

Ankush Nng
Systems Engineer

Abuzar Hussain
Systems Engineer