Template and Sample Diagnostic Monitoring Plans

These plans are developed by the commissioning provider or test engineer. Building staff, maintenance service contractors, and control service contractors may assist in their implementation, depending on the scope of work. The examples provided are intended to give the reader a sense of the level and rigor involved in the diagnostic portion of retrocommissioning process. A basic template and corresponding filled-out sample is provided for each of the two types of diagnostic monitoring plans presented:

- **Diagnostic Plan for Portable Data Loggers**
- **Energy Management Control System Trend Log Plan**

Template

Diagnostic Monitoring Plan for Portable Data Loggers

Project Name: _____

Name of individual responsible for setting the data loggers: _____

Name of individual responsible for removing the data loggers: _____

Brand Name(s) of data loggers: _____

General Run-Time Parameters:

- **Start Date:** _____
- **Start Time:** _____
- **Stop Date:** _____
- **Stop Time:** _____
- **Duration:** _____

Logger # [ ]

Logger ID [serial number]: _____

Logger installed location: _____

Sampling Frequency: _____

Battery status: _____

Data status when memory is full: ☐ Wrap data ☐ Stop collecting data

Description:				
Channel	Point Name	Sensor Type	Units	Notes

Logger # [ ]

Logger ID [serial number]: _____

Logger installed location: _____

Sampling Frequency: _____

Battery status: _____

Data status when memory is full: ☐ Wrap data ☐ Stop collecting data

Description:				
Channel	Point Name	Sensor Type	Units	Notes

Logger # [ ]

Logger ID [serial number]: _____

Logger installed location: _____

Sampling Frequency: _____

Battery status: _____

Data status when memory is full: ☐ Wrap data ☐ Stop collecting data

Description:				
Channel	Point Name	Sensor Type	Units	Notes

Logger # [ ]

Logger ID [serial number]: _____

Logger installed location: _____

Sampling Frequency: _____

Battery status: _____

Data status when memory is full: ☐ Wrap data ☐ Stop collecting data

Description:				
Channel	Point Name	Sensor Type	Units	Notes

Logger # [ ]

Logger ID [serial number]: _____

Logger installed location: _____

Sampling Frequency: _____

Battery status: _____

Data status when memory is full: ☐ Wrap data ☐ Stop collecting data

Description:				
Channel	Point Name	Sensor Type	Units	Notes

Logger # [ ]

Logger ID [serial number]: _____

Logger installed location: _____

Sampling Frequency: _____

Battery status: _____

Data status when memory is full: ☐ Wrap data ☐ Stop collecting data

Description:				
Channel	Point Name	Sensor Type	Units	Notes

Sample

Diagnostic Monitoring Plan for Portable Data Loggers

Project Name: Best Office Building

Name of individual: responsible for setting the data loggers: Carl Commissionson

Name of individual: responsible for removing the data loggers: Joe Electrician

Brand Name of data loggers: Four Channel Woopers

General Run-Time Parameters:

- Start Date: March 1, 2007
- Start Time: 12:00 Noon
- Stop Date: March,15, 2007
- Stop Time: 12:00 Noon
- Duration: Minimum of 2 weeks including 2 full weekends

Logger # 1

Logger ID [serial number]: H08#384786
Logger installed location: AHU-3
Sampling Frequency: every 5 minutes
Battery status: Good
Data status when memory is full: ☐ Wrap data ☒ Stop collecting data

Description:	Zone humidity is controlled based on return air %RH and the economizer is controlled based on differential change-over strategy (outdoor air vs. return air temperature). The logger will be used to verify reasonableness of the existing humidity and temperature sensor readings by comparing the logger data with trend data collected through the BAS for each sensor. The data logger was put directly in return air plenum next to existing temperature and %RH sensors.			
Channel	Point Name	Sensor Type	Units	Notes
1	Return air temp.	Internal temp sensor	°F	
2	Return air %RH	Internal RH sensor	%RH	
3	Outdoor air temp.	-30°F to +200°F probe	°F	20 ft long probe with temperature sensor mounted next to existing sensor in outdoor air stream

Logger # 2

Logger ID [serial number]: H08#384866
Logger installed location: ACU-1
Sampling Frequency: every 5 minutes
Battery status: Okay
Data status when memory is full: ☐ Wrap data ☒ Stop collecting data

Description:	This HVAC unit is not being trended by the BAS. The logger will be used to verify proper economizer operation.			
Channel	Point Name	Sensor Type	Units	Notes
1	Supply air temp.	-30°F to +200°F probe	°F	
2	Outdoor air temp.	-30°F to +200°F probe	°F	
3	Return air temp.	-30°F to +200°F probe	°F	
4	Mixed air temp.	-30°F to +200°F probe	°F	

Logger # 3

Logger ID [serial number]: H08#384652
Logger installed location: AHU-1
Sampling Frequency: every 15 minutes
Battery status: Low – replace when done
Data status when memory is full: ☒ Wrap data ☐ Stop collecting data

Description:	Supply air flow is controlled by inlet guide vanes. Logger will be used to develop a flow profile on the supply fan by monitoring fan input amperage. Duct static pressure will also be monitored using 0 to 10 psig pressure transducer with a 0 to 5 Volt output signal.			
Channel	Point Name	Sensor Type	Units	Notes
1	Supply fan amps	0 to 100 amp CT	amps	
2	Supply static pressure	1 to 5 volt signal	volts	

Logger # 4

Logger ID [serial number]: H08#384288
Logger installed location: AHU-8
Sampling Frequency: change of value
Battery status: Good
Data status when memory is full: ☐ Wrap data ☒ Stop collecting data

Description:	The zone served by AHU-8 is programmed to enable the supply fan during Scheduled-Off hours based on an occupancy sensor. The logger will verify actual motor operation during Scheduled-Off hours.			
Channel	Point Name	Sensor Type	Units	Notes
1	Supply fan	Vibration type	ON (1) OFF (0)	Adjust sensitivity as necessary to detect fan operation.

Logger # 5

Logger ID [serial number]: H08#384444
Logger installed location: CT-1
Sampling Frequency: every 15 minutes
Battery status: Good
Data status when memory is full: ☒ Wrap data ☐ Stop collecting data

Description:	The 2-speed cooling tower fan motor should modulate as necessary to maintain condenser water supply temperature. The logger will monitor outdoor dry-bulb, outdoor %RH, and condenser water supply temperature to help verify tower approach. CT fan amperage will also verify proper fan control based on condenser water supply temperature setpoint.			
Channel	Point Name	Sensor Type	Units	Notes
1	Outdoor air temp	Internal temp sensor	°F	
2	Outdoor air %RH	Internal RH sensor	%RH	
3	Condenser water temp	-30°F to +200°F probe	°F	
4	CT fan motor	0 to 100 amp CT	amps	

Template

Energy Management Control System Trend Log Plan

Project Name: _____

Name of individual responsible for setting the trend logs: _____

Name of individual(s) responsible for obtaining and analyzing the trend logs: _____

Brand name of control system: _____

Data Format: _____

Duration: _____

Procedure Description:

Control Sequence: _____

Sequence Description	Point Names	Sample Rate	Analysis Summary

Control Sequence: _____

Sequence Description	Point Names	Sample Rate	Analysis Summary

Control Sequence: _____

Sequence Description	Point Names	Sample Rate	Analysis Summary

Control Sequence: _____

Sequence Description	Point Names	Sample Rate	Analysis Summary

Control Sequence: _____

Sequence Description	Point Names	Sample Rate	Analysis Summary

Sample

Energy Management Control System Trend Log Plan

Note: This plan provides example sequence of operations, points for trending, and analysis techniques to verify system operation. The example is not intended to be a comprehensive plan.

Project Name: Best Office Building

Name and Title of individual responsible for setting the trend logs:
George Facilities-Control Technician

Name and Title of individual(s) responsible for obtaining and analyzing the trend logs:
Carl Commissioning – Sr. Engineer

Brand name of control system: Best Control System

Data Format: CSV or other delimited text file; Importable to Microsoft Excel®

Duration: Minimum of two weeks including two full weekends

Procedure Description:

The following section outlines the trend plan for the Best Office Building. Building staff is responsible for entering and initiating the trends using the building's energy management control system (EMCS) per this plan. Calibration of critical sensors should be completed two weeks prior to initiating trends. Trending and any supplementary short-term data logging are to be done simultaneously. Key trends may be compared to the data gathered by the portable data loggers to determine whether the selected sensors and control points are providing reliable data. This trend plan will be used during both pre-implementation of the improvements and during post-implementation. Any changes to the plan for post-implementation will be noted in *italics.* The intent is to describe the sequence of operations to be verified, and outline the trend points and analysis necessary to verify proper system operation.

Control Sequence: Chilled Water Distribution-loop Pumping Control

Sequence Description	Point Names	Sample Rate	Analysis Summary
The chilled water distribution-loop pumps are controlled by a VFD to maintain loop pressure differential setpoint. The differential pressure setpoint is reset based on maintaining one cooling coil valve at 90% open.	scwp1-vfd scwp2-vfd scwp1-rpm scwp2-rpm cwloop-dp cwloop-dpstpt ccv-max	5 to 10 minutes	1. Compare scwp#-vfd (command) with scwp#-rpm (feedback) to verify VFD response. 2. Compare cwloop-dp with cwloop-dpstpt to verify pressure setpoint control. 3. Compare cwloop-dpstpt to ccv-max to verify reset control.

Control Sequence: Condenser Water Temperature Control

Sequence Description	Point Names	Sample Rate	Analysis Summary
Condenser water temperature is maintained by modulating each cooling tower fan VFD as necessary to meet setpoint. Minimum setpoint is maintained by modulating the by-pass valve. Condenser water temperature setpoint is reset based on maintaining a constant tower approach temperature (ct-approach).	ct1-vfd ctp2-vfd ct1-rpm ct2-rpm cdw-temp cdw-tempstpt ct-bypassvlv oa-t oa-rh	5 to 10 minutes	1. Compare ct#-vfd (command) with ct#-rpm (feedback) to verify VFD response. 2. Compare cdw-temp, ct#-vfd, and ct-bypassvlv with cdw-tempstpt to verify temperature setpoint control. 3. Use oa-t and oa-rh to calculate oa wet-bulb temperature (oa-wb). Compare ct-approach and oa-wb with cdw-tempstpt to verify reset control.

Control Sequence: VAV Box Control

Sequence Description	Point Names	Sample Rate	Analysis Summary
The primary air damper and reheat valve for VAV3 are modulated as necessary to maintain zone temperature setpoint. As zone temperature drops below setpoint, the primary air damper modulates from maximum to minimum flow setpoints. If zone temperature is still below setpoint, the reheat valve is modulated between 0% to 100% open at minimum flow setpoint. The reverse occurs if zone temperature is above setpoint.	vav3-maxstpt vav3-minstpt vav3-flow vav3-flowcmd vav3-vlv% vav3-dmpr% vav3-znt vav3-znstpt	2 minutes (short sample rate to spot system "hunting")	1. Compare vav3-maxstpt and vav3-minstpt with design values to ensure programmed correctly. 2. Compare vav3-flow and vav3-dmpr% with vav3-flowcmd to verify proper flow control. 3. Compare vav3-flow, vav3-flowcmd, and vav3-vlv% with vav3-znt and vav3-znstpt to verify zone temperature control.