

COMMISSIONING GUIDE SPECIFICATIONS

SECTION 15950 AUTOMATIC CONTROLS

Spec writer:

The following guide specifications are intended to be reviewed, modified and inserted into the noted specification section to meet the specific commissioning needs and requirements for the current project. Any modifications to these specifications shall only be made after consultation with the Owner's representative and with approval of the engineer of record. Where there are check boxes or fill-in blanks, fill in as appropriate and delete all but the choice(s) that apply. Delete all direction boxes.

In Part 1 - GENERAL, include the following text about quality assurance and commissioning and qualification of the controls manufacturer, lead programmer and lead installing technician.

1.1 COMMISSIONING AND QUALITY ASSURANCE

- A. Quality Assurance. Quality assurance for automatic controls systems shall be accomplished through the commissioning process consisting of submittal review of system engineering work, documented prefunctional testing and initial checkout, documented functional performance testing, operator training and O&M documentation. In addition there will be a qualification procedure for the manufacturer and lead installation technician.
- B. Related Sections. The general commissioning process procedures and requirements are given in Section 17100 with responsibilities unique to Division 15 included in Section 15995, including O&M manual documentation and training requirements. The common process requirements for initial system checkout are found in Section 17100. Specific functional testing requirements are identified in Section 15997. Specific prefunctional checklists are found in Section 15998 and sample functional test procedure formats are found in Section 15999.

1.2 QUALIFICATION OF MANUFACTURER AND LEAD INSTALLING TECHNICIAN

- A. Manufacturer and Vendor. Within 14 days after notice to proceed, the controls contractor shall submit to the GC, CM and PM a certified statement, signed by an officer of the manufacturer and vendor which includes the following: name and address of company; name, address and telephone number of the local representative; a general sales bulletin covering the full line of products manufactured; a certification that the products proposed for this contract have been in continuous and successful use for at least 1 year, not including beta testing, and general information covering the functions and characteristics of the systems proposed. In addition, provide a list of four projects which the vendor has installed that are similar in size and complexity to this contract, with the name and telephone number of the contracting officer and facility administrator, size of project, location and brief description and date of completion.

- B. Lead Programmer (LP). The majority of the programming for this project will be completed by the lead programmer. The LP will personally review and approve all programming by others. Within 14 days after notice to proceed, the controls contractor shall submit the following regarding the LP: name; address; telephone number; certification of training on this system; list of two projects of similar size and complexity to this contract which were primarily programmed by the LP; and for each project the project name, location, description, cost, name and telephone number of the contracting officer and current facility administrator and date of completion. A replacement to the LP must be approved in writing by the Owner.
- C. Lead Installation Technician (LIT). The automatic controls will be installed under the direct and continuous supervision of a lead technician authorized by the manufacturer. Within 14 days after notice to proceed, the controls contractor shall submit the following regarding the LIT: name; address; telephone number; certification of training on this system; list of two projects of similar size and complexity to this contract which were directly supervised by the LIT; and for each project the project name, location, description, cost, name and telephone number of the contracting officer and current facility administrator and date of completion. A replacement to the LIT must be approved in writing by the Owner.
- D. Acceptance. A review of the qualifications and action upon the acceptance of the manufacturer and the LIT and LP will be completed by the Owner. If the manufacturer, the proposed product line or the qualifications of the LIT or LP are not in accordance with the Contract Documents or, in the opinion of the Owner, will not result in a satisfactory completed product, alternatives must be submitted for approval.

Under PART 2 - PRODUCTS, provide requirements for trend logging capabilities of the system which will aid in the commissioning process and the operation and maintenance of the building.

2.1 TREND LOGGING CAPABILITIES

- A. The control system installed shall be capable of, and set up to readily trend data with the following minimum features.
1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC controller's point group.
 2. Collection may be by either pre-defined time interval or upon a pre-defined change of value (COV).
 3. Each DDC controller panel shall have a dedicated RAM-based buffer for trend data and shall be capable of storing at least _____ (e.g., 10,000 to 25,000) samples.
 4. At least six columns of data can be viewed on the screen at once and can be graphed using a graphing program integral to the control system, with at least four parameters graphed against time on the same graph. The columnar format shall have time down the left column with columns of data to the right (one column for each parameter).

5. The system shall have the ability to graph real-time data of up to four points on the EMS at once, giving each point its own scale.
6. Without any special or difficult conversions, this data shall be able to be designated to be stored as an ASCII delimited file in the same columnar format for use in graphing with normal commercial spreadsheet software.
7. The trend log data is automatically downloaded at appropriate intervals onto the hard drive when space in the field cabinets becomes full, so that no data is lost. This is done without the user having to calculate the size of the trends and download frequency.
8. Any limitations in the trending as to speed of sampling vs number of sampled points in a given trend, and the effect on actual sampling rate and simultaneousness of the sampling across parameters shall be clearly explained in writing. Programming and trending setup examples of all representative situations shall be provided.
9. The trends shall be capable of being set up to start sampling all trended points in a given trend or group of trends at the same exact time.
10. Specifications for standard trends shall be able to be set up by the user and be saved by a name and initiated by only recalling the name. The control contractor shall assist the operators in setting up at least six standard trends during training.
11. A key for the names and definitions of all point abbreviations (both physical and virtual) shall be provided.
13. The system shall have the ability to automatically accumulate and store run-time hours of digital input and output points and to count events (totalization and counting functions).
14. Ideal, but not required, shall be the capability to graph with the control system software, one or more points against another, rather than just against time.

Under PART 2 - PRODUCTS, require that if there is a significant difference in update time the controls contractor provide a temporary second programming and testing terminal through the entire TAB and commissioning process for text format (no graphics) to speed up the point readout updating time.

2.2 TEMPORARY PROGRAMMING AND TESTING TERMINAL

- A. If the permanent terminal and display is graphical for viewing values and setpoints, and the update time for the graphical display is considered by the CA to be too slow, the controls contractor shall provide and set up, during the entire functional testing process, a second input and output terminal with a text based format (in addition to the graphics-capable permanent terminal), which will significantly speed up the point readout update time. Both terminals will be simultaneously active.

Require that the system be capable of making global commands, which simplifies the TAB and commissioning processes and operation of the building.

2.3 GLOBAL COMMAND CAPABILITY

- A. The system shall be capable of executing from the central control terminal, temporary or permanent global commands, such as a change in space temperature setpoint.

Under PART 2 - PRODUCTS, provide requirements for including additional control points for commissioning and better operation of the system over time.

The A/E and the design phase CA should review this list and determine which points should be included in this project (including any not listed). TAB and commissioning costs will be lower when appropriate additional points are included, and the troubleshooting process for the building operators will be improved. It is not assumed that all those points listed are needed. The value of any given point is dependent on the equipment and system, the expertise of the operating staff to make use of the points, the size of the equipment, etc. Those marked with an asterisk (*) are considered generally more valuable by the author.

2.4 COMMISSIONING AND MONITORING POINTS

- A. All control points of the central building automation system, required to automatically control the equipment specified in the Contract Documents and to execute all specified control sequences, shall be installed and be able to be monitored. To simplify TAB and commissioning of the systems and to provide better control during occupancy, the following points shall be provided as monitored points in the control system, even if they are part of equipment integral controls, or are not required in any control sequence or intermediate calculation. Some points may be measured values or output signals, while others may be calculated or virtual points. Many points listed below may already be required to control the equipment.

Chiller System

- *Primary CHW supply flow (gpm)
- *Primary pump status
- *Percentage of load on chiller
KW of chiller
KW/ton (instantaneous value)
- *Secondary CHW supply flow (gpm)
- *Secondary pump status
System load (calculation from temperature difference and gpm)
- *Secondary pump rpm or Hz
- *Return CHW temperature
- *Supply CHW temperature
- *Alarm

Cooling Tower

- *Tower status (lead, lag, etc.)
- *Fan step status, current or speed
Damper status
Spray pump status

- *Leaving water temperature
- *Entering water temperature
- *Bypass valve position
- *Condenser pump status
 - Condenser pump current
 - Sump level
- *Alarm (low water, fan vibration)

Boiler System

- Primary HW supply flow (gpm), if no secondary
- *Primary pump status
- *Lead/lag status of boiler
 - Firing rate status (high/low)
- *Primary HW return temperature
- *Primary HW supply temperature
 - Secondary HW supply flow (gpm)
 - Secondary HW return temperature
 - System load (calculation from temperature difference and gpm)
- *Secondary pump rpm or Hz
- *Boiler in alarm
- *3 way mixing valve position

Air Handler Units (AHUs) of 100 tons capacity or greater

Supply Fan

- *Discharge static pressure
- *Flow at discharge (cfm)
- *Supply fan rpm or Hz if on VFD, else vane or vane-axial blade position or current
- *Mixed air temperature (unless a tight packaged unit where a good mixed air reading is difficult)
- *Cooling coil leaving air temperature
- *Heating coil leaving air temperature
- *Supply air temperature
- *Return air temperature
- *Outside air temperature
- *Mixed air damper position
- *Return air damper position
- *Exhaust or relief damper position, optional
- *Outside air dampers position (min. damper and economizing damper)
 - Leaving RH
 - Inside RH
 - Outside RH
- *Cooling coil valve position
- *Heating coil valve position
 - Coil CHW supply temperature
- *Coil CHW return temperature
 - Coil HW supply temperature
- *Coil HW return temperature

*Duct static pressure

Return Fan/Relief Fan (associated with AHUs of 100 tons capacity or greater)

Flow near inlet

*Return fan rpm or Hz, if on VFD or current

*Relief damper and return damper position, optional

Flow of minimum outside air (OSA), if varies with VAV boxes

CO₂ sensor for OSA control

*Building static, if control point

Air Terminal Units

*Flow (primary)

*Percentage of design flow cooling

*Percentage of design flow heating

*Reheat fan status

Supply air temperature to zone

*Zone space temperature

*Reheat valve position

The Spec Writer should specify all additional monitoring points desired for all systems in the project.

Air Handler Units (AHUs) of less than 100 tons capacity

Packaged Rooftop Units (RTUs) greater than or equal to 100 tons capacity

Packaged Rooftop Units (RTUs) less than 100 tons capacity

Computer Room AC Units

Spot AC Units (greater than 1.5 ton)

Spot Unit Heaters (greater than 1.5 ton)

Elevator Shaft Fans

Stairwell Fans

Restroom Central Exhaust Fans

Garage Exhaust Fans

Emergency Generator

Domestic Hot Water Systems

(boiler, HW heaters, leaving temp, recirc pumps)

Domestic Water Booster Pump

Sewage Ejector

Fire Alarm Interface

Lighting and Controls

2.5 TEST PORTS

- A. The controls contractor shall provide test ports for handheld instrument readings near all piping system sensors in the primary system (not at the zone level).

2.6 GAGES

- A. The controls contractor shall provide gages in the following locations, even if included as a sensor and monitored point in the control system:
 - 1. Pressure gages on both sides of all pumps greater than 1 hp.
 - 2. Mercury thermometers in the return and supply of all primary thermal plant equipment (chillers, cooling towers, boilers, converters, etc.).

In PART 3 - EXECUTION (or in Part 1), include a reference to the submittal requirements related to commissioning in other sections and to the submission of qualification data.

3.1 SUBMITTALS

- A. The controls contractor shall submit the manufacturer and lead installation technician data according to Part 1 of this section. Upon acceptance, proceed with shop drawings and other submittal data.
- B. The controls contractor shall follow the other submittal requirements in Section 15995, 01300 and 17100.

END OF GUIDE SPECIFICATION SECTION

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AUTOMATIC CONTROLS