

BuildingName
The Description of the Project
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SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230924 - SYSTEMS INTEGRATION (HOSPITAL PROJECTS)

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DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 230924 - SYSTEMS INTEGRATION (HOSPITAL PROJECTS)

REVISION NOTES:

MARCH 2024: MODIFIED 1.3.B AND 3.1.G FOR DESCRIPTION OF SIEMENS SERVER ARCHITECTURE AND INTEGRATION REQUIREMENTS. UPDATED LINK PROVIDED UNDER 3.5.B

FEBRUARY 2023: NEW SPEC

EDITOR'S NOTE:

THESE SPECIFICATIONS MUST BE CUSTOMIZED APPROPRIATELY FOR EACH PROJECT. IN ADDITION TO THESE SPECIFICATIONS, THE PLANS ARE TO INCLUDE THE FOLLOWING, AS A MINIMUM:

- **TEMPERATURE CONTROL DIAGRAM / SCHEMATIC OF EACH SYSTEM (AIR HANDLING UNIT, CHILLED WATER, HOT WATER, AIR TERMINIALS, ETC.) INDICATING ALL CONTROL AND MONITORING INSTRUMENTS AND COMPONENTS. ALL POINTS AND POINT TYPES (AI, DO, ETC) SHALL BE CLEARLY INDICATED.**
- **A DETAILED SEQUENCE OF OPERATION, INCLUDING ALL SETPOINTS**
- **INDICATION OF WHICH DDC POINTS ARE ALARMED AND TRENDED, INCLUDING ALARM THRESHOLDS. INDICATION WHERE ALARM/ TREND RESIDES, IE IN FIELD DDC PANEL OR AT THE BMS FRONT END.**
- **INDICATION OF WHAT NEW OR MODIFIED GRAPHICS ARE REQUIRED FOR THE PROJECT.**

PART 11 - GENERAL

1.1 DEFINITIONS

- A. BMS: Building Management System
- B. BBMD: BACnet Broadcast Management Device
- C. BDT: BACnet Distribution Table
- D. CxA: Commissioning Authority
- E. DDC: Direct Digital Control
- F. UMH Facilities Applications: UMH department responsible for maintaining the hospital's Building Management System application
- G. UMH BAS Controls: UMH department responsible for maintaining the hospitals BMS hardware and devices
- H. FLN: Field Level Network
- I. FPD: UMH Facilities Planning and Development department responsible for design & construction
- J. HITS: Health Information Technology & Services

- K. HMI: Human Machine Interface Panel
- L. MSCC: Mechanical Systems Controls Contractor
- M. SI: Systems Integrator
- N. Systems Monitoring: UMH department responsible for operating the hospital's Building Management System
- O. TC: Temperature Controls
- P. UMH: University of Michigan Health

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.
- B. Related Sections
 - a. Division 26: Electrical
 - b. 230905 Mechanical Systems Controls (Hospital Projects)

1.3 SCOPE OF WORK

- A. The complete control system work shall be split between the Mechanical Systems Controls Contractor, the Systems Integrator and UMH's HITS department as described below and under section 1.4 "Related Work by Others". As it relates to the extent of responsibility for work within this specification section, "provide" shall mean the identified party both furnishes and installs such item(s). "Furnish" shall mean the identified party furnishes the item for installation by others.
- B. University of Michigan Health (UMH) maintains an existing Siemens Desigo CC BACnet Advanced Workstation (B-AWS), which provides system monitoring, alarming, scheduling, reporting and historical trend functions via graphical user interface. This software is installed on application servers located in the HITS data center. For a description of Desigo application servers, see "Hospital Facilities - Desigo BMS Integration Guidelines" (https://michmed.servicenow.com/sp?id=kb_article_view&sysparm_article=KB0023632) .
- C. Desigo client workstations are located in University Hospital, Systems Monitoring, Room B2C204. All BMS installations shall be integrated into this front-end thru BACnet IP over UMH HITS's layer 3 network.
- D. The Systems Integrator shall be responsible for integrating the DDC systems provided by the MSCC under 230905. Physical connection of BACnet devices supplied under Section 230905 shall be via Ethernet and utilize BACnet/IP over the HITS network.
- E. Summary of work by the Systems Integration Contractor shall include, but not be limited to:
 - a. Engineering of all integration work.

- b. Integration of all DDC points into the UMH BMS front-end, as indicated on the contract documents, for a complete and operational control system. Integration shall include creation of all graphics, floor plans, point mapping, alarm/ trend collection and/ or generation of alarm/ trends as indicated on contract documents. Including:
 - i. BACnet device and object discovery.
 - ii. BACnet object instantiation (creation of object classes, naming and location meta data).
 - iii. Collection of all required alarming and point/object trending from the local DDC panel, as indicated by project documents.
 - iv. Configuration of all required alarming and point/object trending at the Desigo CC frontend, as indicated by project documents.
 - v. Generation of Desigo system graphics, alarm summary pages and point/object trend views.
- c. Re-establish and validate existing DDC controller communication/integration to the BMS frontend, modified by the scope of work.
- d. All other work and components required for complete and operational temperature control systems as specified herein, excluding work specified below in "Related Work by Others" section that is to be provided or furnished by the MSCC.
- e. Project management services as a single point contact to coordinate construction related activities.
- f. Commission all mechanical controls provided. Provide a detailed list of every control point integrated, as well as all trends, alarms and graphics to the project Commissioning Authority (CxA) and verify proper integration of each component prior to commissioning the controls with the CxA.
- g. Participation in point-to-point verification with MSCC for all control points.
- h. Coordination with MSCC as well as UMH's HITS, Facilities Applications and Systems Monitoring groups.
- i. Review with UMH personnel to familiarize operations staff with the configuration and operation of project's BMS front-end changes.
- j. Provides systems integration for temporary heating/cooling/ventilation during construction, as required by the owner's construction manager.

1.4 RELATED WORK BY OTHERS

- A. BMS related work by the Mechanical Systems Controls Contractor (MSCC)
 - a. See specification SECTION 230905 - MECHANICAL SYSTEMS CONTROLS
- B. BMS related work by UMH HITS:
 - a. Providing IP Layer 3 networking for all IP communication between the Desigo front-end and DDC controllers, mechanical equipment, and electrical equipment. The MSCC shall be responsible for coordinating implementation of the mechanical control system on the HITS network without disruption.
 - b. HITS will verify network connectivity and establish a TCP connection between the BMS server and the network drop termination.
 - c. HITS will provide all required patch cables. MSCC shall be responsible for connecting all patch cables at respective IP devices (controllers, routers, UPS's, etc).

- d. Confirmation of Telecommunication Rooms to extend network communications to IP devices.
- C. BMS related work by UMH Facilities Applications:
 - a. Management of existing and assignment of new:
 - i. IP addresses
 - ii. BACnet Device Instance and Network numbers
 - iii. BACnet Broadcast Management Device (BBMD) and Broadcast Distribution Table (BDT)
 - iv. MS/TP MAC Addresses
 - b. Validation that network devices meet the HITS "UDEW Process" to validate network security.
 - c. Onboarding IP devices onto HITS network.
- D. BMS related work by UMH Systems Monitoring:
 - a. Removal/ decommissioning of all graphics, alarms, trends on UMH's legacy BMS front ends (ie Honeywell EBI & JCI Metasys) related to points, devices & controllers that have been modified as part of the MSCC's work.
 - b. Validation of final integration services.
- E. BMS related work by UMH BAS Controls:
 - a. Removal/ decommissioning of all legacy DDC panel databases (ie Honeywell EBI & JCI Metasys) related to points, devices & controllers that have been modified as part of the MSCC's work.
 - b. Review IP configuration of IP controllers.

1.5 ACCEPTABLE SYSTEMS INTEGRATION CONTRACTORS

- A. The following SIs are acceptable for the furnishing and installation of pneumatic, electric and DDC components as specified in this section:
 - a. Siemens Industry Inc.
 - b. Fontanesi & Kann
 - c. Syenergy

1.6 QUALITY ASSURANCE

- A. Systems Integration contractor shall be trained and experienced in the integration, graphic & alarm/ trend creation within the Siemens Desigo frontend.
- B. At a minimum, SI shall have graduated from Siemens training sessions Desigo CC Workstation I ST 9202/ 9203 and Desigo CC Workstation II ST 9263/ 9254.

1.7 COORDINATION

- A. Coordinate with the Systems Integrator, as well as UMH's HITS, Systems Monitoring, and Facilities Applications groups as specified.
- B. All correspondence with UMH Facilities Applications shall be via email directed to bmsIntegrationRequest@umich.edu.
- C. All correspondence with Systems Monitoring shall be via email directed to HFAC-OPERATIONS-SYSTEMS-MONITORING@med.umich.edu.

- D. All correspondence with the Mechanical System Controls Contractor (MSCC) or other UMH departments (ie HITS, Fac Apps, Systems, BAS Controls) involved in the project shall copy the respective owner's project manager (ie AEC).

1.8 WARRANTY

- A. All Systems Integration work on UMH's BMS shall be guaranteed for a period of one year after final approval has been granted by the Owner and the project Architect/Engineer. The warranty shall be provided for a completely installed system, including all components, parts and assemblies. The warranty shall cover parts, materials and labor to correct any defects in materials and workmanship.
- B. The SI shall initiate the warranty period by formally transmitting to the Owner commencement notification of the period for the system and devices accepted.

1.9 SUBMITTALS

- A. Submit shop drawings to the project AE of record for their review and approval and to UMH FPD Engineer.
- B. No work shall be done until the final submittals are approved by project AE.
- C. Shop drawings shall contain, as a minimum, all changes to UMH's Desigo frontend, including the following:
 - a. Main campus and building screens
 - b. Floor plans
 - c. Dashboards
 - d. Equipment Graphics
 - e. Applications Graphics
 - f. Alarm configuration
 - g. Schedule Configuration
 - h. Trend Configuration and Data Archiving
 - i. Naming Convention for Desigo Point Descriptors
- D. Where graphics are existing and need to be modified to reflect project changes, SI shall clearly indicate changes to be made (ie cloud changes, notes, etc).
- E. Submittal Requirements
 - a. Shop drawings shall be 8-1/2" x 11" and 11" x 17" size, in PDF format.
 - b. All schematics and drawings shall be done on CAD. The electronic files shall be in the latest version of AutoCAD (or as noted otherwise)
- F. Project Record Documents
 - a. Submit Project Record Documents at the time of substantial completion.

- b. Revise shop drawings to reflect actual installation and operating sequences and provide final electronic files in PDF.
- c. All files shall be dated and shall contain the UMH project RTN number and UM AEC P100 number when applicable.

PART 12 - PRODUCTS

2.1 NOT APPLICABLE

PART 13 - EXECUTION

3.1 INSTALLATION

- A. Provide integration of all DDC input / output points as defined in point lists and control sequences on the Contract Documents and MSCC's final approved shop-drawing submittal to the existing Desigo front-end.
- B. SI shall only import those DDC points called for on the Contract Documents and MSCC's temperature control submittal. Spare DDC points, or DDC points not called for on the Contract Documents or temperature control submittal, shall NOT be imported into Desigo.
- C. All points shall be made available to be overridden from the front-end.
- D. DDC point naming conventions shall be consistent with UMH's point naming standards outlined in specification 230905. Work with the MSCC contractor to ensure BACnet point naming is consistent with UMH standards and auto-discovery can be executed without renaming.
- E. The SI shall utilize point descriptors in Desigo to further define the point functionality. See section 3.4 for descriptor requirements.
- F. All alarms, trending, schedules shall be through standard BACnet objects and shall not utilize proprietary software that would be incompatible with ANSI/ASHRAE Standard 135-2001 BACnet technology communication protocol.
- G. All new DDC points added to the UMH front-end, and associated graphics, alarms and trends, shall be properly integrated consistent with "Hospital Facilities - Desigo BMS Integration Guidelines" (https://michmed.service-now.com/sp?id=kb_article_view&sysparm_article=KB0023632).
- H. SI shall provide any temporary integration to the UMH BMS frontend to provide building temporary heating or cooling during construction. SI shall remove all temporary integration and decommission any graphics/ alarms & trends upon project completion.

3.2 DESIGO SOFTWARE PROGRAMMING

- A. User Access Permissions shall be managed configured by MM Facilities Applications.
- B. Alarm, Trend and Event Management:

- a. Configuration of all required alarm and point/object trending is a shared responsibility between the MSCC & SI, as indicated by project documents.
 - i. In general, all alarms and trends shall be configured by the MSCC at the local DDC panel and shared via BACnet objects with the BMS front-end.
 - ii. Alarms and trends that are indicated on the contract documents to be configured at the front-end shall be by the SI.
 - iii. See "Monitoring Points, Alarm & Trend Requirements" Table on Contract Documents for alarm & trend requirements.
 - iv. All setpoints, time delays, and other control parameters shall be integrated and available for override or adjustment from the Desigo front-end.
 - b. SI shall configure the front-end to receive BACnet alarm event notifications from individual controllers and manage system alarm/event notification and routing.
 - c. SI shall configure the front-end to monitor status of each IP-based controller and provide alarms on loss of communication/status.
 - d. All alarms, trending, schedules shall be through standard BACnet objects and shall not utilize proprietary software that would be incompatible with ANSI/ASHRAE Standard 135-2001 BACnet technology communication protocol.
 - e. Alarm logs shall be configured to be accessible for a minimum of 1 year.
- C. Scheduling:
- a. SI shall configure the front-end to provide scheduling interface for individual HVAC system, space and lighting Occupied/Unoccupied operation as indicated in Control Sequences.
- D. Trending & Data Archiving:
- a. SI shall configure the front-end to provide data archiving for all inputs, outputs, setpoints, integration points and calculated values, as shown on the contract documents
 - b. All trend log information shall be displayed in standard engineering units.

3.3 GRAPHICS PROGRAMMING

- A. Graphics shall be designed to match graphic displays on the existing system following existing UMH graphics standards and utilizing owner furnished templates. Transition from existing graphics to new graphics shall be seamless transition for operator in look, functionality, and operation.
- B. SI shall follow UMH BMS Graphic Template standards included under design guideline 230924-H: [SYSTEMS INTEGRATION](https://docs.google.com/document/d/1fm_s8-OUOBcRcx4mNF-Tuggcu7yQ_d0cU/edit)
(https://docs.google.com/document/d/1fm_s8-OUOBcRcx4mNF-Tuggcu7yQ_d0cU/edit)
- C. Navigation Scheme: System graphic displays of HVAC, plumbing and electrical systems and points shall be hierarchical displays using a building-to-equipment point-and-click navigation scheme. Each display shall show the building/ area name and number.

- D. Program color graphic displays for each system as described herein. Graphic displays shall consist of pictorial presentations with text description, system schematic, or picture; alarm fields; and database fields for associated points, including dynamic input values, output values, set points, gains, time schedules, etc.
- E. Make use of color to highlight system components.
 - a. Color and texture meanings shall be consistent across all displays. Components of similar type shall be of same color for graphics.
 - b. Point in alarm shall have their background turn yellow.
- F. Each display shall clearly distinguish between the following point data types and information:
 - a. Real-time data
 - b. User-entered data (setpoints)
 - c. Overridden or operator-disabled points
 - d. Devices in alarm (unacknowledged)
 - e. Out-of-range, bad, or missing data
- G. Dynamic graphics depicting chillers flowing water, fans/ pumps rotating, etc. shall be used to depict status of equipment. Status shall be determined by status indicating equipment such as current sensing switches, auxiliary contacts, or position switches. Commands to field devices shall be shown separately.
- H. Graphics shall be configured to automatically update values without any action by the operator.
- I. A description of a point shall be included on the Graphic next to the object's value whenever there is any ambiguity about the value's meaning. For example, when status and command points are both shown on a graphic, they shall both be labeled with separate identifying descriptions. If a description of a point in a point block is not adequate, then a separate note may be added to the graphic background near the point block clarifying function or purpose.
- J. Display all control loop and alarm setpoints on respective system graphic. Provide ability to change control loop setpoints, alarm setpoints and start/stop equipment from system graphic, provided user has appropriate access. If system graphic seems too cluttered, provide separate, text-based, System Overview page.
- K. Graphic displays shall be designed to be easily understood. When display screen is too cluttered due to size, limit information to important monitoring data. Provide sub-graphic(s) to display data not displayed on main display.
- L. Each graphic shall have a shortcut to the main menu graphic and to previous graphic.
- M. Main menu graphic shall be automatically displayed when user logs on to system.

3.4 CONTROL POINT DESCRIPTION NAMING CONVENTION

- A. The contractor shall use the following convention for point description naming convention in Desigo. In instances where naming convention is not covered below, contact project engineer for direction.

- B. Point descriptions shall generally follow the DDC point naming convention as outlined under section 3 of specification 230905 "MECHANICAL SYSTEMS CONTROLS", with the exception that
 - a. Descriptors shall fully spell out the point functionality so its clear to the BMS operator (ie use Discharge Air Temperature, not DAT).
 - b. Descriptors shall include a prefix of the building # and building abbreviation (ie 0317 THC or 0316 UH, etc).
- C. Where pre-programmed point names are imported (ie INP-1 off a VAV controller), the SI shall provide a point description in Desigo following this standard.
- D. All points imported into Desigo shall have point descriptions. The exception are points that are not indicated on contract documents to be monitored, alarmed or trended, which are not required nor desired to be imported into Desigo.
- E. See below for several examples of implementation of this point naming convention:

DDC Point	Desigo Point Description
AHUC4.DAT_SP off a controller in THC	0317 THC AHU-C4 Discharge air temperature setpoint
AHU18.SAF_STS off a controller in UH	0316 UH AHU-18 Supply Fan Status
CHW.SUPT off a controller in CC	0301 CC Chilled water supply temperature
SCHW.SUPT off a controller in CC	0301 CC Secondary loop chilled water supply temperature
HHW.HX1SCV_CMD off a controller in UHS2	0312 UHS2 Heating Hot Water heat exchanger HX-1 Steam control valve command
SCHW.DP_SP off a controller in UHS3	0314 UHS3 Secondary chilled water loop differential pressure setpoint
C9VAV9938.DPR_POS off a controller in Brehm	5102 AHU-C9 VAV-9938 Damper Position
AC2VAV1345.HTG.RMT.SP off a controller in Brehm	5102 AC-2 VAV-1345 Heating temperature setpoint

3.5 COORDINATION WITH OTHERS

- A. The SI shall provide all necessary coordination with the Mechanical Systems Controls Contractor (MSCC) and Facilities Applications to achieve an operational front-end user interface for the project.

- B. Coordination requirements are outlined in the UMH BMS Integration Process flow diagram: [BMS Project Integration Process.pdf \(drop-box.com\)](#)
- C. All correspondence with the Mechanical System Controls Contractor (MSCC) or other UMH departments (ie HITS, Fac Apps, Systems, BAS Controls) involved in the project shall copy the respective owner's project manager (ie AEC).

3.6 START-UP AND COMMISSIONING

- A. Perform commissioning activities as described here-in and in accordance with Related Sections. Participate in the commissioning process in accordance with the project commissioning documents. This applies to all controls including those provided as part of 3rd party equipment.
- B. Each integration point (ie 100%) shall be checked to confirm mapping, ranges, engineering units, tagging and point description align what is shown on the building control system being integrated.
 - a. Perform point-to-point verification for all control inputs and outputs to confirm that all points are integrated properly, and alarms are configured correctly. SI shall schedule a verification exercise with the MSCC for this. Verification shall involve validating proper performance from device (i.e. sensor) to BMS graphic.
 - b. Alarms, including network failures, shall be tested for each integrated point. Ensure that alarms are properly acknowledged at operator's workstation. Each point shall be checked for proper setting of alarm values, per values on the contract documents. Where deviations are found, submit to UMH FPD Engineer for direction.
 - c. Schedules for each system/device shall be verified.
 - d. Graphics shall be verified for functionality including password protection, floor plan displays, system displays, alarm messaging, historical trends, report generation and HVAC schedules.
- C. Confirm all integrated output points and virtual point can be overridden thru the frontend graphic.
- D. Confirmation that integrated points follow the UMH standard point naming convention indicated under 230905 Mechanical Systems Controls. Where deviations are found, submit to UMH FPD Engineer for direction.
- E. Create and run a report of all integrated controllers and respective COV limits. Validate COV limits are per specification 230905 Mechanical Systems Controls.
- F. Provide any trend setup, reporting and trend graphs in advance of functional testing and by dates specified by the Commissioning Authority to verify proper operation of controls and systems. Trend intervals and storage duration shall be as designated by the commissioner. All such trends shall be deleted before each panel is connected to the BAS server.

END OF SECTION 230924