



Building Automation, Energy Management Controller

Guide Specification P864

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1. GENERAL REQUIREMENTS

The controller shall provide the means to interface with the building automation field devices and sensors.

The software shall comply with the following requirements:

- Provide access to all functionality via a standard web browser using a LAN/WAN or Internet
- English language support with downloadable help
- Factory provided e-learning (online training course)
- The communication protocols supported at a minimum shall be:
 - BACnet MSTP
 - BACnet IP
 - Modbus RTU
 - Modbus TCP/IP
 - REST API
- The controller shall have BTL certification (B-AAC, BACnet Protocol Revision 19), listed on the BACnetinternational.net web site for PICS, BTL listing and certificate documentation
- Web users shall optionally connect to SSL (HTTPS) when using an internet or LAN connection to the device(s)
- System shall require username or password authentication and have management of the authorization or expiration of users
- Software shall support user and role based access with the ability to restrict users or groups to only the actions an administrator allows
- The software will allow for configuration of the inputs and outputs and the ability to view data in real-time
- The software shall support configuration of Device configuration (Network, BACnet, and Modbus)
- The device shall support automatic restart and diagnostic LED to indicate normal or abnormal operation
- The software will have the ability to be pre-engineered and configured prior to set up using a Backup restore mechanism.
- Software shall support Metric and US Customary units
- Software shall be easily identifiable via version number
- All software updates shall be made free and available for the period of the warranty/defects and liability period

2. LICENSING

- Products shall support a perpetual license and never lose functionality.

3. SYSTEM STATUS

- The software shall provide the following information at a minimum:
 - Software, version
 - The CPU (central processing unit) shall show the utilization of this system. As the load on this system increases so will CPU utilization
 - Memory showing the amount of RAM that is currently being used
 - Diagnostic points to be made available as BACnet Objects include but not limited to
 - Analog Input Airflow Sensor Air Velocity Reading 97
 - Analog Input Airflow Sensor DP Reading 98
 - Analog Input Airflow Sensor Reading 99
 - Analog Input Software uptime 20000
 - Analog Input Last boot timestamp 20001
 - Analog Input Reboot count 20002
 - Analog Input Software restart count 20003
 - Analog Input MSTP Active MAC Addresses 20004
 - Analog Input System CPU Usage 20005
 - Analog Input System Free Memory (MB) 20006
 - Analog Input AI Objects count 20010
 - Analog Input AV Objects count 20011
 - Analog Input BI Objects count 20012
 - Analog Input BV Objects count 20013
 - Analog Input Notification Class Objects count 20014
 - Analog Input Trendlog Objects count 20015
 - Analog Input Schedule Objects count 20016
 - Analog Input Calendar Objects count 20017
 - Analog Input Alarm Objects count 20018
 - Analog Input DDC Cycle time 20030

- The software shall respond to a BACnet Object List (in accordance to BACnet) from any BACnet client to report the identification of its objects.

4. BUILDING AUTOMATION

4.1. Web-based Access

- The software shall be accessible via a web browser and be located on a local area network, a wide area network or the internet.
- The software shall allow an unrestricted number of users to be assigned within the system.
- The software shall allow an unrestricted number of concurrent web requests subject only to network bandwidth and hardware resources.
- No software plugins shall be required to be installed on the web browser used for access, or engineering.
- The web presentation shall include a user interface (GUI) with access to physical point data.
- Control programming shall be created/edited/viewed live on demand using a standard web browser.

4.2. System Navigation

- System menus are configured based on user, role and permission.
- A minimum timeout of 8 hours after a successful login shall enable engineering users to work uninterrupted.

4.3. User Authentication and Permissions

- Each user shall have a strong password and user authentication shall be enforced on log-on to the software.
- Users shall be able to be assigned to one or more permission groups which define access permissions.
- A permission group shall define access to display and the ability to add or modify users.
- The software shall have the capability to assign password change permissions on a per-user basis.
- The user will be logged out automatically if there has been no activity after a predefined period of time.

4.4. Security

- The system shall support remote connectivity via SSL (HTTPS) encryption.
- Repeated wrong passwords shall incur a timer that prevent brute force access
- The system shall redirect users from unencrypted HTTP to encrypted HTTPS automatically
- A reset mechanism shall allow only physical users access to a hardware button that will reset IP address and Admin password only
- No remote reset mechanism shall be exposed to a non administrator user
- REST API shall use secure web tokens as security measure

4.5. Data Storage

- Data shall be stored in non-volatile memory (8 GB)
- The data points are backed up periodically every 10 m so that upon restart memory shall be restores.

4.6. Alarm, Event and Trend Log Notification

- The software shall be able to host BACnet alarms and provide event notifications and notify a BACnet client as needed. This shall include the priority assigned to the notification.
- Where the notification is a trend log buffer-full notification, the software shall be able to send a notice that trend log buffer from the BACnet system and permit the BACnet client to retrieve trendlog records

4.7. Alarms

- The software shall support hosting BACnet alarms.

4.8. Trend logs

- The software shall have the ability to host trend logs, including BACnet compliant trend logs, this includes trend intervals and number of stored trend logs before archiving.
- The system shall support COV or Polling trendlog objects

4.9. BACnet Data Access

- The software shall be able to access BACnet data points in attached BACnet building automation controllers. If the BACnet point is writeable, then the software shall support writing user-entered data to the BACnet point.

4.10. Schedules & Calendars

- The software shall have the ability to host BACnet schedules. These shall include standard weekly schedules, and special event schedules.
- The software shall also support calendars. Multiple schedules can be linked to a calendar. The calendar may have entered items like public holidays or special events that will override standard schedule entries.

4.11. Software Backup

- The software shall allow for on demand backups to be created.
- The software shall back up the following at minimum:
 - Points
 - Program
 - Schedules
 - Trendlogs
 - Alarms
 - Calendars
 - Notification Classes

4.12. System Restore

- In the event of a hardware failure or damage, system backups shall be used to restore the system back to the state at the time of backup.

4.13. Time

- System time shall be based on system location settings and will respond to BACnet time synchronization
- The system hardware shall operate a real time clock that is battery backed up
- The system shall use a real time clock with BACnet scheduling

4.14. REST API (Application Program Interface)

- The system shall connect (Read and Write) via a built-in REST Application Program Interface (API) using secure web tokens.
- The REST API shall provide access to read and write (R/W) to the following items:
 - Authorization (R/W)
 - Device Configuration (R/W)
 - System time settings (R/W)
 - Object list retrieval (R)
 - Users (create/edit/delete) (R/W)
 - Analog Input (edit) (R/W)
 - Analog Output (edit) (R/W)
 - Analog Value (edit) (R/W)
 - Binary Input (edit) (R/W)
 - Binary Value (edit) (R/W)
 - Binary Output (edit) (R/W)

4.15. Modbus Gateway

- The software shall have a built in gateway function to help bring Modbus devices (RTU RS-485) to aid in the commissioning and interrogation of the attached network devices.
- Modbus settings shall support Protocol setting (8 Data bits-No Parity-1Stop bit)
- Modbus gateway shall bring the content to Modbus TCP/IP on Port 502 (user definable)
- Modbus gateway shall have support for 9.6k, 19.2k, 38.4k, 76.8k and 115.2 kbps baud rates

4.16. BACnet MS/TP Routing

- The software shall have a built in router port that will allow connected devices (BACnet MS/TP RS-485) to aid in the commissioning and interrogation of the attached network devices.
- BACnet settings shall support standard BACnet MS/TP protocol settings
- Baud rates shall have support for 9.6k, 19.2k, 38.4k, 76.8k and 115.2 kbps
- Shall support routing the devices through to BACnet IP
- Shall support non routable connection, such as a dedicated sensor network, where the points can only be used by the device the network is connected to
- This port shall be disable by default and have user interface control

5. HARDWARE AND SOFTWARE

5.1. Hardware Specifications

- The software hardware shall be designed for installation in non-controlled spaces and use the following hardware specification:
 - Environment -20°C to + 60°C
 - -4°F to + 140°F
 - 0 to 95% RH, non condensing
- All software updates and changes to the software shall be capable of being performed remotely using the Local network.
- The hardware shall have a minimum of:
 - Processor Arm Quad-core Cortex A7 1.2 GHZ processor
 - 512 MB RAM
 - 8 GB Flash Memory

5.2. Hardware features

- The device shall support multiple power configurations:
 - P864: 24 VAC ½ wave Class 2, min load: 7 VA 24 VA max
 - P864: 24 VDC min load: 7 W, max load: 24 W max
 - PoE+ max load: 24 W (PoE+ 802.3 AT), 48 VDC, type 2, Mode B
- Hardware Inputs shall support 8 Universal inputs with 24-bit resolution, software selectable:
 - Thermistor 10 K Ohm Type NTC
 - Thermistor 3K Ohm NTC
 - Dry Contact
 - 0-10 VDC
 - 4-20 mA
 - Pulse inputs support up to 100 Hz
- Hardware outputs shall support
 - Binary outputs 6 each rated at 24 VDC, 0.5 A (MOSFET)
 - Analog Output 4 outputs with 12-bit resolution.
 - Software selectable 0-10 VDC
 - 4-20 mA. (0-10 VDC min load resistance is 500 ohm)
- The hardware shall support a power supply to power external 24 VDC Output devices
- The hardware shall support battery backed real time clock 3.0 V replaceable coin cell battery

5.3. Agency Approvals

- The controller shall have the following agency approvals
 - UL Operating Control, Network Energy Management Controller
 - FCC
 - CE

6. COMMUNICATIONS

6.1. BACnet MS/TP

- The system shall support:
 - 2 x RS-485 communication ports that can be configured for BACnet MS/TP. 1 Port can be configured for Modbus RTU
 - Ports that can be enabled or disabled in software.
 - Operate in accordance with BACnet MS/TP protocol rev 14.
 - Each port can have adjustable baud rates (9.6k, 19.2k, 38.4k, 76.8k and 115.2 kbps).
 - Use on board diagnostic tools for setup and troubleshooting.

6.2. BACnet IP and Routing

- The system shall support:
 - BACnet MS/TP to BACnet IP routing.
 - Operate in accordance with BACnet protocol rev 14.
 - Support a configurable IP network.
 - Support a configurable IP and MSTP network number

6.3. Modbus RTU

- The system shall support:
 - 1x RS-485 communication ports that can be configured for Modbus RTU.
 - Enabled or disabled in software.
 - Operate in accordance with Modbus RTU.
 - Can have adjustable baud rates (9.6k, 19.2k, 38.4k, 76.8k, 115.2kbps).

6.4. Modbus TCP/IP

- The system shall support:
 - Enabled or disabled in software
 - Configurable Modbus Port (default 502)
 - Configurable Modbus gateway to BACnet

7. ENGINEERING TOOLS

7.1. Programming Logic-Direct Digital Control (DDC)

- The Programming tool shall be built into the controller software so that no external software or software dongle is needed. Any browser can engineer the system
- The Programming tool shall support encrypted file support (to safeguard intellectual property)
- The Programming tool shall support password protection for each program file
- The software shall support real time operating programming that:
 - Uses predefined logic blocks that have specific functions, those blocks are executed based on fixed values or values coming from other BACnet points.
 - Logic functions shall include at a minimum the following functionality:
 - Addition
 - AND Gate
 - Comment
 - Comparator / Hysteresis
 - Delay on Make
 - Delay on Break
 - Division
 - Exclusive OR Gate
 - Gated Transfer
 - High / Low Limiter
 - High Selector
 - Increment/Decrement
 - Input
 - Latch Gate
 - Linear Converter
 - Low Selector
 - Multiplication
 - OR Gate
 - Output
 - PID Controller
 - Runtime
 - Single Shot
 - Subtraction
 - Switch
 - Transfer Data
 - Two Input Linear Converter
 - Within
 - Power Of
 - Pulse Width Modulation
 - Anti-Short Cycle
 - Enthalpy
 - Floating Motor Controller
 - Restrictor
 - Change of State Detector
 - Velocity to FPM Converter

- The programming tool shall allow the user to create custom function blocks that can have their own executable code
- Custom blocks shall be importable and exportable for re-use.
- Operate in HTML5 environment using a common web browsers with no plugins needed to operate, configure, view live data, and publish the programming code.
 - The programming environment shall support four distinct environments in the web interface:
 - Toolbox (holds all the logic blocks).
 - The Workspace (the area where the program elements are added).
 - Logic Block Properties (permits user to adjust logic block configuration).
 - Toolbar workspace tools (to manage viewing and file management properties).
 - The software shall have the ability to create and store multiple work spaces with the ability to link programming across workspaces.
 - The software shall permit the users to view the program elements live data both in the web user interface within the programming tool in the browser.
 - The software shall permit inserting a live programming workspace into custom display.
 - The software shall support using subroutine programming which is used to run the same programming across multiple devices.
 - The software shall support self-programming “validation” which can be run prior to publishing to check and advise of errors that need fixing before publishing.
 - The software shall support a file repository that can hold multiple files available from the web user interface or via remote file sharing (if enabled)
 - The files can be edited live on any device and exported to be used in another like device
 - The access to Control Programming shall be controlled by user and group permission
 - The manufacturer shall provide help to assist using the system, and provide regular updates as new features, enhancements or fixes are made available
 - The manufacturer shall provide DDC programming content using online eLearning training to train users how to use the programming tool. The subjects covered shall include:
 - Introduction and Basics
 - Workspace and Function Blocks
 - Create and Publish
 - Subroutines
 - The manufacturer shall provide downloadable Help that can be used to inform users how to use the programming tool. The help shall be updated with each update and shall be exportable to use as an operator’s manual
 - The Programming (DDC) online help content shall include:
 - DDC Introduction
 - DDC Environment
 - Workspace Menu and Canvas
 - Logic Blocks (functional description)
 - Null Values Interpretations