Building Automation Systems

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Building Automation Systems

Working Tasks

- Chiller Plant Control
- Water Pump Control
- Cooling Tower Control
- Waste Water Treatment
- Heat Pump Control
- HVAC Equipments Control
- Environment Monitoring (Temp., Humidity, Smoke...)
- Other Facility Control/Monitoring Functions
- BACnet/Modbus Protocal

BAS Architecture

The figure above shows the typical Building Automation architecture. Various devices and sensors are controlled and monitored by BAS-2000 Controller, ADAM-4022T PID Controller, ADAM-4000/5000/6000 series modules. Through serial and Ethernet networks, data is transferred to WebLink communication gateway, as well as WebView SCADA and HMI hardware. Operators can monitor and control the system locally on WebView. People in the control center can connect to the WebLink and WebView through Internet, and this makes the system convenient & flexible. Advantech provides complete Building Automation solution:

1. Software: Advantech WinCE WebAccess
2. Communication gateway: WebLink
3. SCADA and HMI hardware: WebView
4. DDC controller: BAS-2000 series
5. PID controller: BAS-4022T
6. I/O modules: ADAM-4000, ADAM-5000, ADAM-6000 series modules

Controller for Building Automation

A Building Automation system is a different purposed application from typical industrial automation applications. It is designed for commercial building requirements, not for industrial environment requirements. So the controller should be designed for this purpose.

The DDC (Direct Digital Controller) is a controller dedicated to Building Automation applications. The DDC controller must be a standalone operating unit, and in order to satisfy the requirements of building I/O and control applications, the I/O design of DDC is universal. Because of wiring costs and wiring installation environments, RS-485 is the major physical layer of the network. Most importantly, the DDC must be a standalone operation. Advantech provides BAS-2000 series as the DDC controller.

System Network

Because of the lower wiring costs and simpler installation, RS-485 is the standard network protocol in the control and device layer of building automation system networks.

Power Supply Requirements

The power supply requirements of typical BAS devices are quite different from industrial equipment. Most industrial controllers and devices are designed with 110/220 V AC or 24 V DC power supply, while most BAS controllers use 24 V AC.

Powerful WebLink Communication Gateway and WebView SCADA

Installed Advantech WinCE WebAccess, WebLink and WebView become ideal gateway and SCADA hardware for Building Automation application. They are web-based solutions which implement the latest web and internet technology. Programmers can easily configure and build the application through internet, intranet or LAN. Operators can simply control and monitor WebView and WebLink using ordinary Web Browser such as Microsoft Internet Explorer(IE), without purchasing any other software. Moreover, Advantech WinCE WebAccess features rich functionality such as graphics, calculation, data logging, real-time and historical trends, alarms, scheduler, and recipe. This helps the system integrator to save more time and money to complete their own project. The WebView and WebLink provide device driver, which gives them ability to connect to different devices like PLC, PAC, and I/O modules.

Communication Protocol

BA system networks have their own standards. There are two major standards for BAS networks: BACnet and LonWorks. BACnet (Building Automation Control network) was defined by ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers), the major institute of HVAC vendors in the world. Because it was defined by ASHRAE, it is widely used and accepted for HVAC equipment. LonWorks was defined by Echelon, which is a private company. The basic system architectures of these two standards are different. The BACnet system architecture is quite similar to a typical industrial control system network, so it is more suitable for BA systems in commercial buildings. It has therefore gained the position of almost becoming the de-facto standard for BA systems in commercial buildings. The Advantech BAS-2000 system is designed with this protocol as its standard communication protocol, and for compatibility with 3rd party devices, MODBUS/RTU is also supported.

Why BACnet ?

BACnet (Building Automation Control network) protocol is developed by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). It has become the most popular Building Automation network standard worldwide, and most BAS devices and HVAC equipment have been built with this protocol now. Because the main physical layer of the network in the BAS controller layer is RS-485, the format of the BACnet protocol being used in RS-485 is BACnet MS/TP. This is a good reason why the BAS-2000 series use the BACnet MS/TP as its default protocol.

Why Modbus ?

Modbus is the most popular protocol in automation systems so far. Almost all traditional control systems or equipment support or is compatible with this protocol. It is widely used in general-purpose devices and equipment.

In a typical building there are power systems, water supply systems, HVAC systems, water treatment systems and so on. These systems require quite a lot of machinery, and most of this machinery is not designed for building automation systems. They are designed for both building and industrial applications, and therefore do not support the BACnet protocol. But the Modbus protocol can usually be found in these machines.

For a complete building automation system, all equipment should be controlled by one system. The easiest method to implement this is by using a BAS DDC controller. But most traditional DDC controllers don't support this feature. The BAS-2000 series controllers supprts Modbus, which means you can create Modbus compatible building automation control systems and control all equipment in a building with one system.

1 PAC & Software
2 BAS
3 UNO
4 RS-485 I/O
5 Ethernet I/O
6 TPC
7 IPPC
8 FPM
9 AWS
10 Plug-in I/O
11 CompactPCI
12 Signal Conditioning
13 USB I/O
14 Motion Control I/O
15 Ethernet Switch
16 EDG
17 ICOM

Advantech BAS Solutions

Introduction

Advantech offers a total solution for Building Automation systems including facility management (HVAC, water treatment, power, etc.), security (access control, door/window alarm, etc.) and CCTV systems. Equipped with Advantech's BAS-2000, WebLink, WebView, and ADAM modules, system integrators can easily create powerful and flexible BAS applications.

Facility Management System

The facility management system includes the control of :

- Chiller Plants
- Water Pumps
- Waste Water Treatment
- Cooling Towers
- Heat Pumps
- Other HVAC Equipment
- Environment Monitoring System (Temperature, Humidity, etc.)
- Other Facility Control/Monitoring Applications
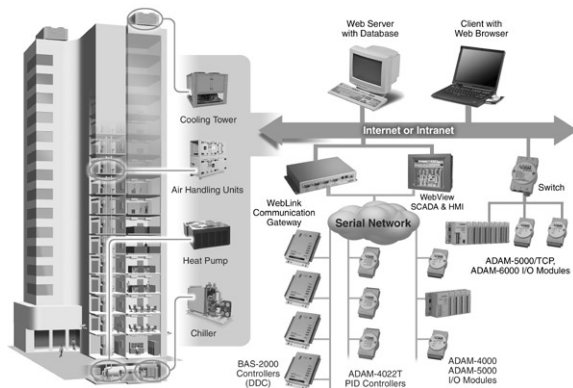
For facility control applications like chiller plant automation, water pump control and cooling tower control, the BAS-2000 system with KW's BA function block library can help build a powerful control system. For distributed zone temperature control, the BAS-4022T dual-loop PID controller would be a perfect selection, and the ADAM-4000 and ADAM-5000 I/O data acquisition modules can be used for facility and environment monitoring systems.

Security System

The scope of a typical security system can include :

- Access Control
  - Card reader for system access
  - Access history record
- Illegal access monitoring/alarm system
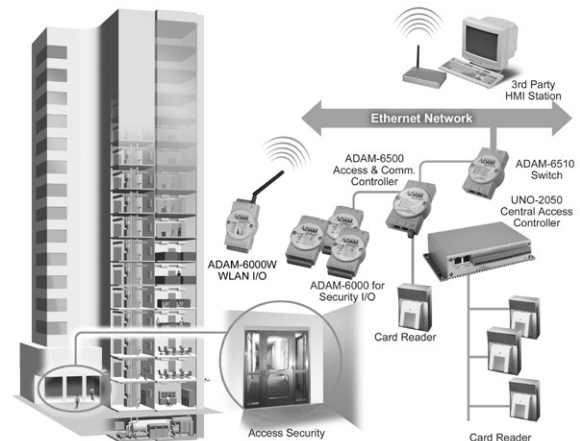
For access control systems, the UNO-2000 series and ADAM-6500 PC-based platform would be an ideal choice. The ADAM-6000 DI/O module with an event trigger function via the UDP protocol can be a real-time response to start security alarms.

Video System
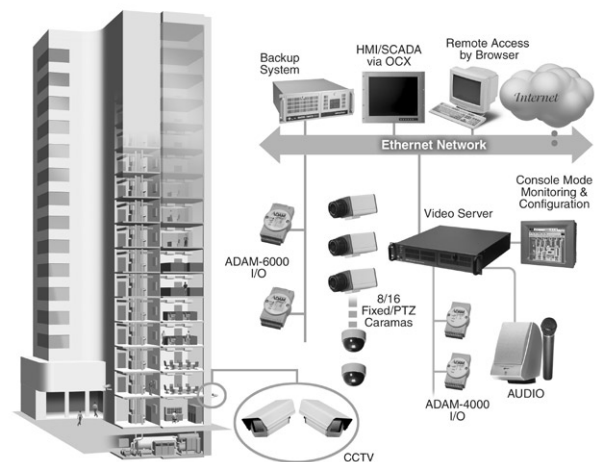
By combining a video server with ADAM I/O modules as a security interlock I/O, you have a system that can satisfy any requirement for CCTV and security applications.

Building Automation Systems

1 PAC & Software

2 BAS

3 UNO

4 RS-485 I/O

5 Ethernet I/O

6 TPC

7 IPPC

8 FPM

9 AWS

10 Plug-in I/O

11 CompactPCI

12 Signal Conditioning

13 USB I/O

14 Motion Control I/O

15 Ethernet Switch

16 EDG

17 ICOM

Complete Product Line

SoftLogic

WebLink

BAS-2000

Air Handling Units

Security

Heat Pump

Cooling Tower

CCTV

Chiller

WebAccess

WebView

Remote I/O

Open Network

BACnet

Modbus-IDA
the architechure for distributed automation
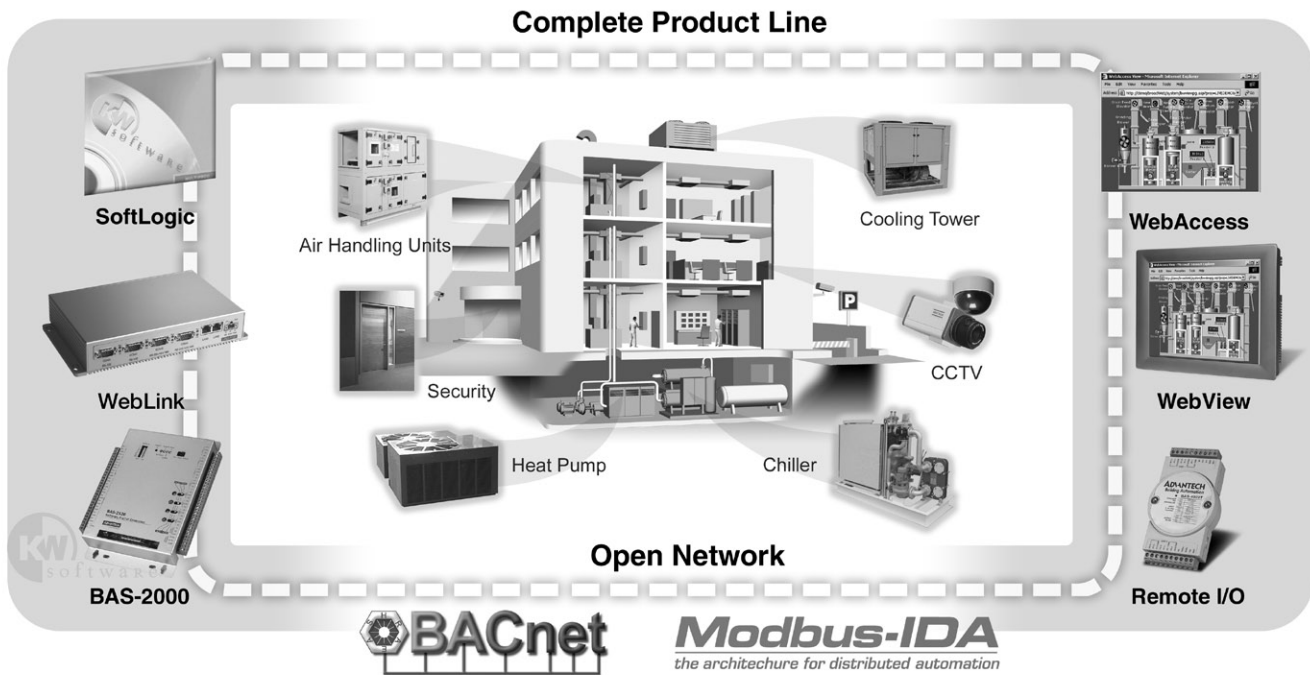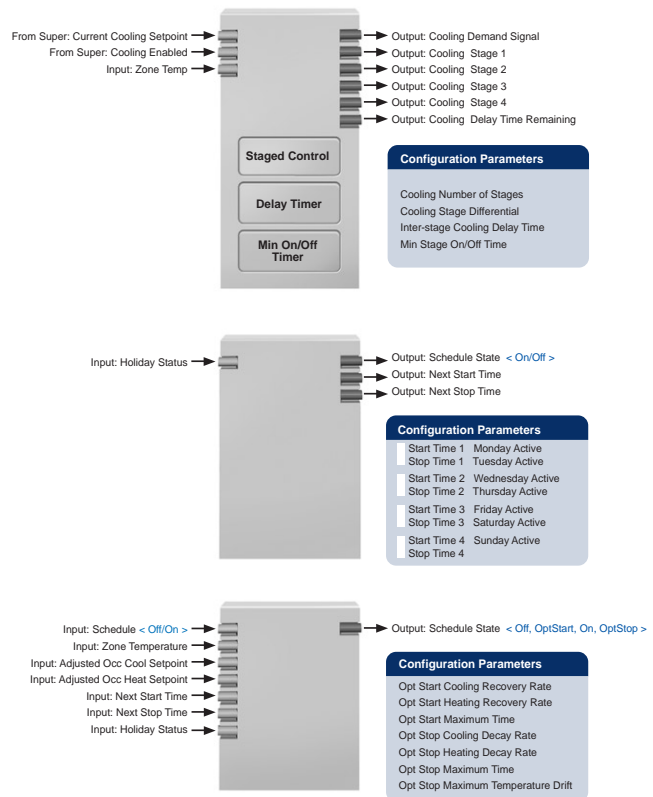
Special Control Functions for BAS

BA systems must be designed for the behavior of the people inside the building, and since the operators and users are unlikely to be engineers or familiar with BA systems, the BAS controls must be designed to be as simple as possible.

For example, a commercial building can be used for offices, hotels and apartments simultanously. To save energy and operating costs, some parts of the building may be scheduled to reduce/increase the temperature to a level closer to the outside temperature. A schedule function is therefore very important for building automation systems.

HVAC is usually the major control system used in buildings and air-conditioning is a major part of HVAC. Air-conditioning is an industry with much technology know-how, but it has traditionally been the domain of mechanical engineers. Most programmers have difficulties making a solid control program for such applications. So building automation control software must have many built-in HVAC control functions.

Advantech BAS-2000 products have built-in these control functions into a function block library for easy access and development.

From Super: Current Cooling Setpoint
From Super: Cooling Enabled
Input: Zone Temp

Output: Cooling Demand Signal
Output: Cooling Stage 1
Output: Cooling Stage 2
Output: Cooling Stage 3
Output: Cooling Stage 4
Output: Cooling Delay Time Remaining

Staged Control

Delay Timer

Min On/Off Timer

Configuration Parameters

Cooling Number of Stages
Cooling Stage Differential
Inter-stage Cooling Delay Time
Min Stage On/Off Time

Input: Holiday Status

Output: Schedule State < On/Off >
Output: Next Start Time
Output: Next Stop Time

Configuration Parameters

Start Time 1   Monday Active
Stop Time 1   Tuesday Active
Start Time 2   Wednesday Active
Stop Time 2   Thursday Active
Start Time 3   Friday Active
Stop Time 3   Saturday Active
Start Time 4   Sunday Active
Stop Time 4

Input: Schedule < Off/On >
Input: Zone Temperature
Input: Adjusted Occ Cool Setpoint
Input: Adjusted Occ Heat Setpoint
Input: Next Start Time
Input: Next Stop Time
Input: Holiday Status

Output: Schedule State < Off, OptStart, On, OptStop >

Configuration Parameters

Opt Start Cooling Recovery Rate
Opt Start Heating Recovery Rate
Opt Start Maximum Time
Opt Stop Cooling Decay Rate
Opt Stop Heating Decay Rate
Opt Stop Maximum Time
Opt Stop Maximum Temperature Drift

Note: This version of Opt Start/Stop does not include self adaptive algorithm

Advantech WinCE WebAccess

Browser-based HMI/SCADA Software
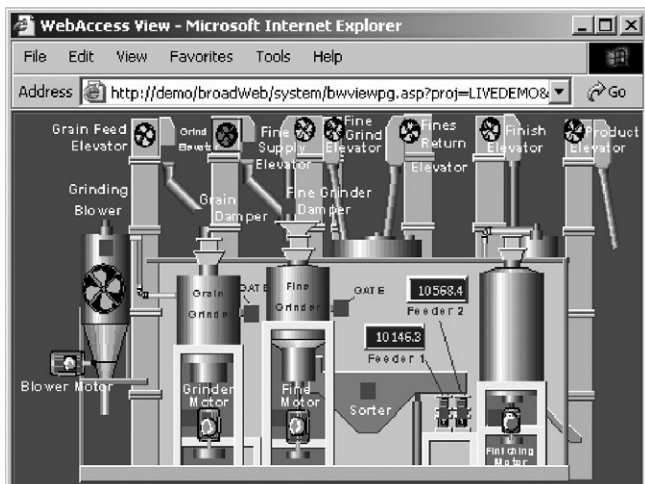
Features

- View, control, configure system remotely over an intranet or the Internet using ordinary Web browser
- Real-time and historical trending
- Communicate with Programmable Controller (PLC), I/O system via Serial, Ethernet and proprietary communications
- Support Vector-based Graphics
- Use the open standard programming TCL script
- Control equipment based on pre-defined schedule (time, date and holiday)
- Complete alarm function
- Import AutoCAD DXF
- Import BMP, JPEG, GIF

Introduction

Advantech WinCE WebAccess is fully web browser-based software package for human-machine interfaces (HMI), and supervisory control and data acquisition (SCADA). All the features found in conventional HMI and SCADA software packages are available in an ordinary Web browser including Animated Graphics Displays, Real-time Data, Controllers, Trends, Alarms and Logs. WebAccess is totally based on standard internet architecture, its basic component includes:

1. SCADA Node: it communicates in real-time with automation equipment and control the equipment via Serial, Ethernet or proprietary communications. The SCADA Node can provide supervisory control and data acquisition functions, includes supplying communication driver (Modbus, PLC, and I/O systems), real-time and historical trending. It also can monitor and log alarm and event. The SCADA Node has its own run-time database and all graphics.

2. Project Node: it is the developing platform for WebAccess, and all system configuration and project development is implemented on the Project Node. It is a web server for all Client and SCADA node to connect with.

3. Client: through an ActiveX control inside Internet Explorer Web browser, it has the ability to monitor and control the SCADA Node simultaneously. The Client connects to the Project Node only to get the address of the SCADA Node. The Client then communicates directly with the SCADA Node using proprietary communications over a TCP/IP network connection. Data is displayed in real-time with dynamically updated graphics, and user can monitor real-time and historical trending with alarm record. Besides, user can acknowledge alarms and change setpoints, status and other data.

Specifications

Web Browser Client to View and Control

Using a standard Web browser, users can view and control automation equipment used in industrial, manufacturing, process and building automation systems. Data is displayed to users in real-time with dynamically updated graphics using full-motion animation.

Powerful Remote Diagnose and Maintenance Functionality

The unique feature, which distinguishes WebAccess from the competition, is that all engineering project, configuration, graphics building (DRAW) and software management (download, start and restart remote nodes) is performed using a standard Web browser. If there is any troubleshooting needed, no matter wherever the operator is located, he can use the standard internet to operate the system. This can significantly increase the efficiency of maintenance operation and reduce the maintenance cost.

Vector-based Graphics

WebAccess features Vector-based graphics. Vector-based graphics provide smaller file sizes and faster download. Because Vector-based graphics use mathematic algorithm to save image, its file size is much smaller than Bitmap graphics. Therefore it is much faster to transfer Vector-based graphics on internet. Besides, WebAccess features user interface self-adaptive adjustment technology, no matter how user adjust the screen ratio of monitor, WebAccess can ensure all the user interface will be displayed on the screen. When the resolution of screen increases, the display performance will also become better respectively.

Import BMP, JPEG and GIF

Except Vector-based graphics, WebAccess also support the most popular BMP, JPEG and GIF Bitmap format file, and user can zoom in or zoom out these image as well as animation configuration. WebAccess also provide build-in animation image libraries.
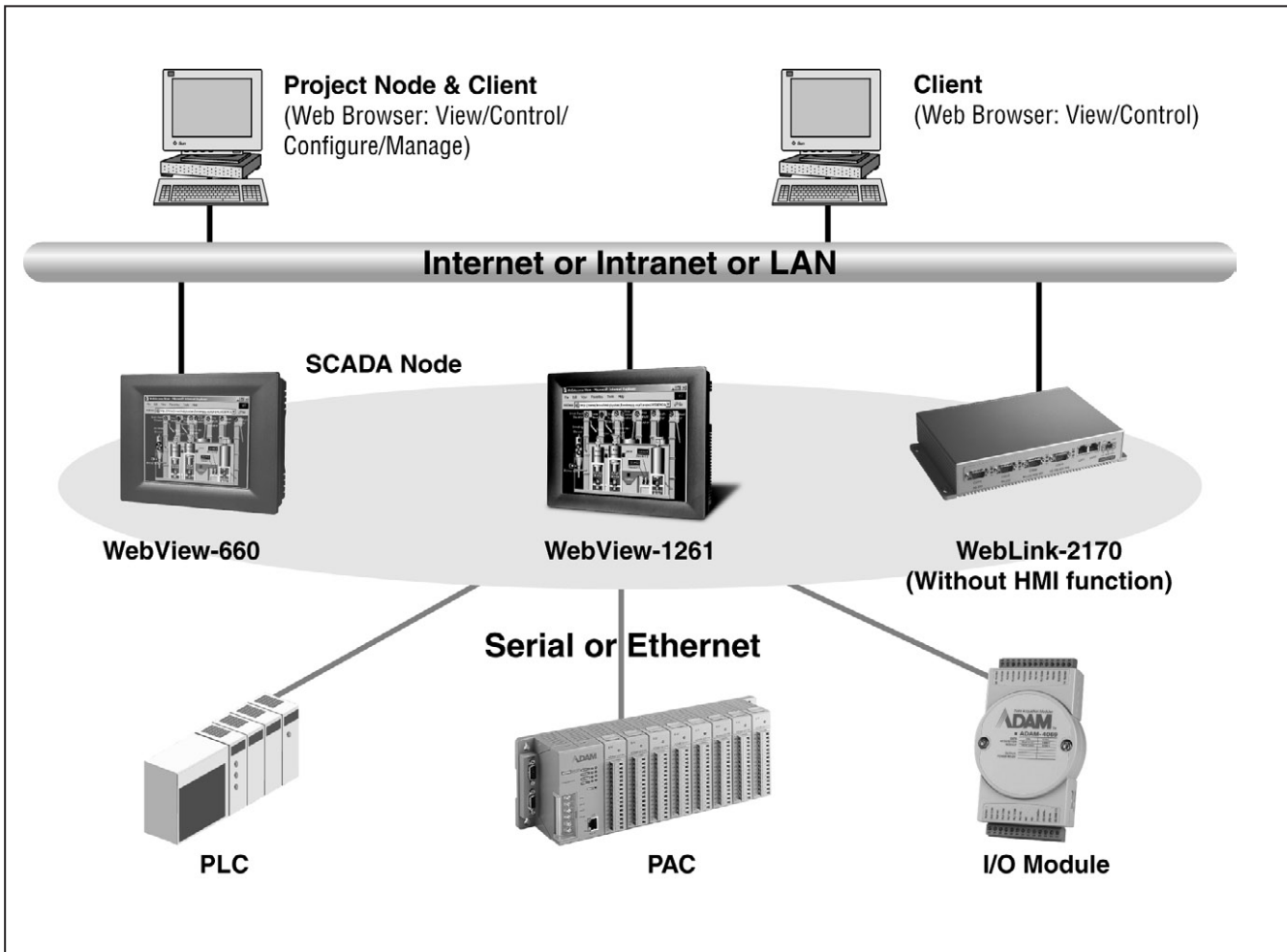
Import AutoCAD DXF

WebAccess environment is similar to AutoCAD, and this can make engineer who is familiar with AutoCAD can get used to WebAccess in short time. User can even import the DXF format file into WebAccess. User can edit the imported data and decide the animation configuration.

Scripts Using TCL

Scripts in WebAccess use the open standard programming languages TCL scripting and allow users to develop customized actions, calculations and reports.

Scheduler

The Scheduler provides control and changes setpoint status based on time and date. Lights, Fans, and HVAC equipment are turned on and off based on the time, day of week and date. The Scheduler is also used in process control and manufacturing applications. All these schedule configurations can be modified remotely through internet.

WebAccess

1 PAC & Software

2 BAS

3 UNO

4 RS-485 I/O

5 Ethernet I/O

6 TPC

7 IPPC

8 FPM

9 AWS

10 Plug-in I/O

11 CompactPCI

12 Signal Conditioning

13 USB I/O

14 Motion Control I/O

15 Ethernet Switch

16 EDG

17 ICOM

Data Logging and Real-time/Historical Trending

Advantech WinCE WebAccess can log 50 tags. Please note the CF size to prevent from running out of storage space.

Each tag is logged to a separate file on the SCADA node, and user can view the real-time and historical data from the historical trend. Besides, new tags can be added to a historical trend display without losing history of other tags. User can decide the background, color and type of real-time and historical trend display.

Alarm

Each tag comes with multiple alarm type. User doesn't need to use extra program for the alarm, instead, user only need to configure the alarm type (HH, H, L, LL, DEV and ROC) for each tag. The alarm for analog tag also support Deadband. WebAccess features alarm filter, alarm grade, alarm sorting, alarm historical record, and alarm value on-line adjustment.

Recipe Function

Recipes provide an easy method for operators and users to change the value of hundreds of settings.

Supported I/O Drivers

- Modicon Modbus Serial/Ethernet
- Siemens S7-300/400 Ethernet
- Echelon iLON 100/500/600 (SOAP/XML)
- Allen-Bradley SLC 500 Serial
- Omron C Series Serial
- ADAM-4000 Series
- ADAM-5000 Series
- ADAM-6000 Series
- Others (Contact with Advantech for detail)

Customized Functional Toolbox

User can use standard ICON file or BBN file to customize functional toolbox. The BBN file can be created by graphics tool.

Advantech Solution

Advantech provide WebView-660, WebView-1261 and WebLink-2170 as SCADA Node. When users purchase these three products, they will get one CD containing the programming tool. So users can program their application on their PC (Project Node), and download their application into the the SCADA Node through Internet, intranet or LAN. When the application is running on the SCADA Node, users can monitor and control the application on another computer (Client) through the same network. The three SCADA Node hardware provided by Advantech can connect with Advantech BAS-2520, BAS-2514, BAS-2014, BAS-2020, BAS-4022T, ADAM-4000 series, ADAM-5000 series, ADAM-6000 series and PLC. The complete structure can be seen from picture above.

WebView-660

6.4" Web-enabled HMI

Features

- 6.4" TFT LCD
- Super slim and compact design with plastic housing
- NEMA4/IP65 compliant front panel
- Built-in Windows® CE with Advantech WinCE WebAccess
- Support Vector-based graphics
- Support various protocol driver to communicate with different devices
- Multi-thread communication, response time is fast
- Remote control and monitor by Web browser
- All project programming, database and display configuration, alarm setting and schedule configuration can be done remotely
- Easy to diagnosis and maintenance, help to reduce maintenance cost
- Import BMP, JPEG, GIF

Introduction

Advantech WebView-660 is fanless SCADA and HMI hardware, featuring 6.4" TFT LCD display, AMD LX800 500 MHz CPU and rich interfaces (such as serial, USB and LAN). Installed Advantech WinCE WebAccess, WebView-660 is a complete browser-based HMI, whose powerful Microsoft IIS Web Server function increases the flexibility and convenience, and makes the user easy to configure and maintain the system via Internet. With built-in driver, WebView-660 can connect with variety of Building Automation equipment and devices, and get data from them.

Specifications

General

- **Cooling System** — Fanless design
- **Dimensions (W x H x D)** — 195 x 148 x 44.4 mm (7.68" x 5.83" x 1.75")
- **Enclosure** — ABS and ABS + PC
- **Mounting** — Panel
- **Power Consumption** — 43.52 W
- **Power Input** — 18 ~ 32 V_{DC}
- **Weight (Net)** — 0.8 kg (1.76 lb)

System Hardware

- **Audio Ports** — 1 x Line-out, 1 x Microphone
- **CPU** — AMD LX800 500 MHZ
- **Expansion Slots** — 1 CompactFlash slot
- **Graphics Controller** — Controlled by CPU
- **LAN** — 1 x 10/100Base-T
- **Memory** — 256 MB DDR SDRAM (up to 1 GB DDR SDRAM)
- **Serial Ports** — 1 x RS-232 / 1 x RS-232/RS422/RS485
- **USB Ports** — 2 x USB 2.0

LCD Display

- **Backlight Life** — 20,000 hrs
- **Contrast Ratio** — 180
- **Display Size** — 6.4"
- **Display Type** — TFT LCD
- **Luminance (cd/m²)** — 150
- **Max. Colors** — 262 K
- **Max. Resolution** — 640 x 480
- **Viewing Angle (H/V)** — 90/50

Touchscreen

- **Lifespan** — 10 millions times with a silicone rubber of 8 mm diameter finger
- **Light Transmission** — Above 75%
- **Resolution** — 1024 x 1024
- **Type** — 4-wire, analog resistiver

Environment

- **Humidity** — 10 ~ 95% RH @ 40° C, non-condensing
- **Ingress Protection** — Front panel: NEMA4, IP65
- **Operating Temperature** — 0 ~ 50° C (32 ~ 122° F)
- **Storage Temperature** — -20 ~ 70° C (-4 ~ 158° F)
- **Vibration Protection** — 1 Grms (Random, Operating)

Software Specifications

- **Operating System** — Windows CE
- **Installed Advantech WinCE WebAccess with specification listed below:**

I/O Tag Number	150/600
Internal Tag Number	150/600
Web Client	2
Alarm Logging	1000
Action Logging	1000
Message Characters	50

- **Graphics**

Graphic Pages Capacity	100
Macro Key	Yes
Local Script	Yes
Variable per Graphic Page	255

- **Data Trend Log**

Data Logging Tag number	50 Tags

- **Recipe**

Recipes per Project	100
Unit per Recipe	100
Item per Unit	999

- **Scheduler**

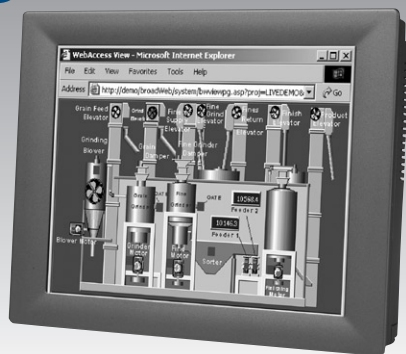|	
Holiday Configuration group	10
Time Group	99
Loop Group	99
Device Group	99

Ordering Information

- **WVIEW-660-150-W50** — 6.4" Web-enabled HMI with WinCE WebAccess 150 tags
- **WVIEW-660-600-W50** — 6.4" Web-enabled HMI with WinCE WebAccess 600 tags

WebView-1261

12.1" Web-enabled HMI

1 PAC & Software
2 BAS
3 UNO
4 RS-485 I/O
5 Ethernet I/O
6 TPC
7 IPPC
8 FPM
9 AWS
10 Plug-in I/O
11 CompactPCI
12 Signal Conditioning
13 USB I/O
14 Motion Control I/O
15 Ethernet Switch
16 EDG
17 ICOM

NEW

Features

- 12.1" SVGA TFT LCD
- Super slim and compact design with Al-Mg housing
- NEMA4/IP65 compliant front panel
- Built-in Windows® CE with Advantech WinCE WebAccess
- Support Vector-based graphics
- Support various protocol driver to communicate with different devices
- Multi-thread communication, response time is fast
- Remote control and monitor by Web browser
- All project programming, database and display configuration, alarm setting and schedule configuration can be done remotely
- Easy to diagnosis and maintenance, help to reduce maintenance cost
- Import BMP, JPEG, GIF

Introduction

Advantech WebView-1261 is fanless SCADA and HMI hardware, featuring 12.1" SVGA TFT LCD display, AMD LX800 500 MHz CPU and rich interfaces (such as serial, USB and LAN). Installed Advantech WinCE WebAccess, WebView-1261 is a complete browser-based HMI, whose powerful Microsoft IIS Web Server function increases the flexibility and convenience, and makes the user easy to configure and maintain the system via Internet. With built-in driver, WebView-1261 can connect with variety of Building Automation equipment and devices, and get data from them.

Specifications

General

- **BIOS** — Award® 4 MB
- **Cooling System** — Fanless design
- **Dimensions (W x H x D)** — 311 x 237 x 50 mm (12.24" x 9.33" x 1.97")
- **Enclosure** — Al-Mg and ABS
- **Mounting** — Desktop, swing arm or wall (with mounting kit)
- **Power Consumption** — 60 W
- **Power Input** — 18 ~ 32 V_{DC}
- **Weight (Net)** — 2.2 kg (4.85 lb)

System Hardware

- **CPU** — AMD LX800 500 MHz
- **Expansion Slots** — 1 x CompactFlash® slot
- **Graphics Controller** — LX800
- **Keyboard/Mouse Ports** — 1 x PS/2
- **LAN** — 1 x 10/100Base-T
- **Memory** — 256 MB DDR SDRAM (up to 1 GB DDR SDRAM)
- **Parallel Ports** — 1 x Parallel Port
- **Serial Ports** — 3 x RS-232 and 1 x RS-232/485/422
- **USB Ports** — 2 x USB 2.0

LCD Display

- **Backlight Life** — 50,000 hrs
- **Contrast Ratio** — 1:300
- **Display Size** — 12.1"
- **Display Type** — SVGA TFT LCD
- **Luminance cd/m²** — 340
- **Max. Colors** — 262 K
- **Max. Resolution** — 800 x 600
- **Viewing Angle (H/V)** — 100/60

Touchscreen

- **Lifespan** — 1 million touches at single point
- **Light Transmission** — Above 75%
- **Pixel Pitch (H x V)** — 0.3075 x 0.3075 mm
- **Resolution** — 1024 x 1024
- **Type** — 8-wire, analog resistive

Environment

- **Humidity** — 10 ~ 95% RH @ 40° C, non-condensing
- **Ingress Protection** — Front panel: NEMA4, IP65
- **Operating Temperature** — 0 ~ 50° C (32 ~ 122° F)
- **Storage Temperature** — -20 ~ 70° C (-4 ~ 158° F)
- **Vibration Protection** — 2 grms (5 ~ 500 Hz) (Operating, random vibration)

Software Specifications

- **Operating System** — Windows CE
- **Installed Advantech WinCE WebAccess with specification listed below:**

I/O Tag Number	150/600
Internal Tag Number	150/600
Web Client	2
Alarm Logging	1000
Action Logging	1000
Message Characters	50

- **Graphics**

Graphic Pages Capacity	100
Macro Key	Yes
Local Script	Yes
Variable per Graphic Page	255

- **Data Trend Log**

Data Logging Tag number	50 Tags

- **Recipe**

Recipes per Project	100
Unit per Recipe	100
Item per Unit	999

- **Scheduler**

Holiday Configuration group	10
Time Group	99
Loop Group	99
Device Group	99

Ordering Information

- **WVIEW-1261-150-W50** — 12.1" Web-enabled HMI with WinCE WebAccess 150 tags
- **WVIEW-1261-600-W50** — 12.1" Web-enabled HMI with WinCE WebAccess 600 tags

WebLink-2170

Web-enabled Communication Gateway

NEW

Features

- Two RS-232 and two RS-232/422/485 ports with automatic flow control
- Two 10/100Base-T RJ-45 ports
- Two USB ports
- Built-in Windows® CE with Advantech WinCE WebAccess Communication Gateway
- Support various protocol driver to communicate with different devices
- Multi-thread communication, response time is fast
- All project programming, database and display configuration, alarm setting and schedule configuration can be done remotely
- Easy to diagnosis and maintenance, help to reduce maintenance cost

Introduction

Advantech WebLink-2170 is fanless communication gateway, featuring Celeron® M 1 GHz and rich interfaces (such as serial, USB and LAN). Installed Advantech WinCE WebAccess, WebLink-2170 is a complete browser-based communication gateway, whose powerful Microsoft IIS Web Server function increases the flexibility and convenience, and makes the user easy to configure and maintain the system via Internet. With built-in driver, WebLink-2170 can connect with variety of Building Automation equipment and devices, and get data from them.

Specifications

General

- **Dimensions (W x D x H)** 255 x 152 x 50 mm (10" x 6.0" x 2.0")
- **Enclosure** Aluminum
- **Mounting** Wall
- **Power Consumption** 24 W (Typical)
- **Power Input** Min. 48 W (9 ~ 36 V_{DC}) (e.g +24 V @ 2 A)
- **Weight** 1.6 kg

System Hardware

- **CPU** Celeron M 1 GHz
- **Keyboard/Mouse** 1 x PS/2
- **Memory** 512 MB DDR DRAM
- **VGA** DB15 VGA connector

Communications

- **Serial Ports** 2 × RS-232, 2 x RS-232/422/485 with DB9 connectors
  Automatic RS-485 data flow control
- **Serial Port Speed** RS-232: 50 ~ 115.2 kbps
  RS-422/485: 50 ~ 921.6 kbps (Max.)
- **LAN** 2 x 10/100 Base-T RJ-45 ports
- **USB Ports** 2 x USB, UHCI, Rev. 2.0 compliant
- **Parallel Ports** 1 x Parallel Port

Environment

- **Humidity** 95% @ 40° C (non-condensing)
- **Operating Temperature** -10 ~ 50° C (14 ~ 122° F) @ 5 ~ 85% RH.
- **Shock Protection** IEC 68 2-27
  50 G @ wall mount, half sine, 11 ms
- **Vibration Protection** IEC 68 2-64 (Random 1 Oct./min, 1hr/axis.)
  2 Grms @ 5 ~ 500 Hz
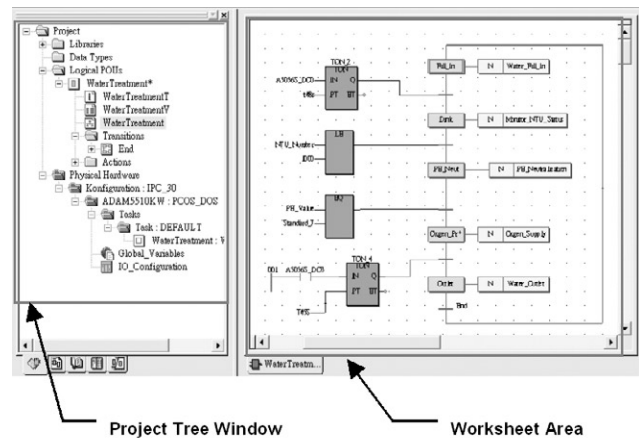
Software Specifications

- **Operating System** Windows CE
- **Installed Advantech WinCE WebAccess Communication Gateway with specification listed below:**
  I/O Tag Number 600
  Internal Tag Number 600
  Web Client 2
  Action Logging 1000

Ordering Information

- **WLINK-2170-600-W50** Web-enabled Communication Gateway with WinCE WebAccess 600 tags

ADVANTECH | **Building Automation Systems**

KW SoftLogic & BA Function Library

1
PAC & Software

2
BAS

3
UNO

4
RS-485 I/O

5
Ethernet I/O

6
TPC

7
IPPC

8
FPM

9
AWS

10
Plug-in I/O

11
CompactPCI

12
Signal Conditioning

13
USB I/O

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Motion Control I/O

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Ethernet Switch

16
EDG

17
ICOM

MULTIPROG

Project Tree Window   Worksheet Area

Introduction

To make it easier for system integrators to approach the building automation market, the BAS-2000 series is not only embedded with KW SoftLogic software, Advantech has also developed several function blocks that are especially made for building automation applications. These function blocks were developed by experienced BAS consultants in USA. The 30+ building automation function blocks are bundled with the BAS-2000 series, so the control programming work on the BAS-2000 series is the same as a typical DDC. There is no need to create control programs by complicated basic functions such as block and ladder assembly. Just pull the required BA function block into the KW programming worksheet for the specific building control application. It will save programming time, and by using the qualified BA function block, it can reduce potential programming errors for the controller application.

Flexible Expansion

The BAS-2000 series use KW SoftLogic as its control engine. KW SoftLogic opens the function block editing interface for Advantech, that is, new function blocks can be added into the BAS-2000 series controllers at any time. You can use C programming to make a control application program, then compile it to become a function block for KW SoftLogic. Advantech will continuously develop and collect more value-adding building automation function blocks for the BAS-2000 system. Compared with traditional DDCs, the BAS-2000 series of controllers will be much more powerful in the future.

Function Block Libraries

Unitary Zone Temperature-Based Function Blocks
Stage Cooling Control

Provides control of up to four mechanical cooling stages based on the HVAC unit's zone temperature. The Device Supervisor block enables or disables the mechanical cooling section.

Modulating Cooling Control

Provides control of any modulating cooling device such as a valve or damper based on the HVAC unit's zone temperature. The Device Supervisor block enables or disables the mechanical cooling section.

Staged Heating Control

Provides control of up to four heating stages based on the HVAC unit's zone temperature. The Device Supervisor block enables or disables the heating section.

Modulating Heating Control

Provides control of any modulating heating device such as a valve or damper based on the HVAC unit's zone temperature. The Device Supervisor block enables or disables the heating section.

Heat Pump Reversing Valve Control

Provides control of Heat Pump points based on outputs from Staged Cooling and Heating Control Blocks and the values of the listed configuration parameters.

Economizer Control
Enthalpy Calculation

Calculates the Total Heat Content for one zone or air stream.   Typically two zones or air streams are compared and the air stream with the least total heat content is identified as the lowest cost cooling source.

Single Speed Fan Control

Provides On/Off control of a single speed fan. The Device Supervisor block sets the Occupancy Mode and HVAC Mode.

VFD Fan Control

Provides control of a Fan Start/Stop point and Fan Speed based on the HVAC unit's Supply Air Static Pressure. The Device Supervisor block sets the Occupancy Mode and HVAC Mode.

Return Fan Tracking

Provides control of Return Fan Start/Stop and Return Fan Speed based on either a percentage of Supply Fan speed, or a fixed CFM offset in the Return Air-stream versus that of the Supply Air-stream.

Sliding Window Smoothing

Smoothes out fluctuating values by performing a sliding window average of a number of separate readings of the same value using the parameters listed.

CFM Calculation

Converts measured Velocity Pressure into CFM airflow, using the parameters listed.

Device Supervisor Control "Super"

The Device Supervisor reads in all building-wide information pertaining to the status of Schedules, Holidays, Free Cooling, Electrical Demand, Emergency and other conditions. It also contains all zone-specific setpoints and settings for how to respond to changes in the building-wide values.
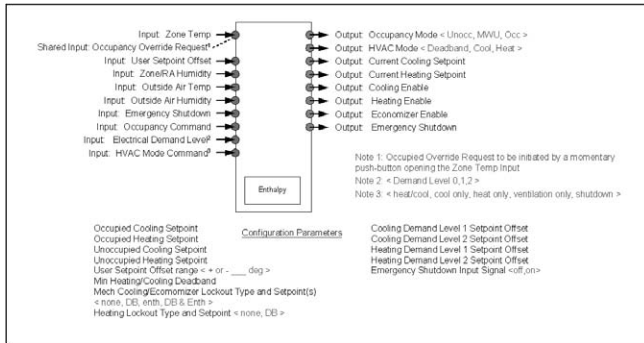
Schedule

Provides scheduling capabilities within the unitary controller. The user may enter up to 4 start and stop time pairs, and identify which days of the week those times apply to. Multiple schedules may be used to handle different start and stop times on different days of the week.

Optimum Start/Optimum Stop

Calculates the amount of Early Start Time required to achieve Adjusted Occupied Cooling or Heating zone setpoint at the Next Start Time (from schedule), and the amount of Early Stop Time permissible (which will result in no more temperature drift from setpoint than that specified in Opt Stop Maximum Temperature Drift) by the Next Stop Time. The Schedule State Output will take the Schedule and Optimum Start/Stop times into account and set the integrated Schedule State accordingly.

Alarm

Provides High and Low Zone temperature Alarming capabilities during Occupied periods, based on user entries. Enable Delay sets the amount of time to hold off alarms upon first transitioning to Occupied for the day (this will allow for warm-up, etc.). Alarm Delay sets the amount of time the Zone Temperature may be outside of the safe range before an Alarm is generated. This type of delay is helpful to reduce nuisance alarms, etc.

Minimum Timer

Minimum On Satisfied will be set on once the Monitored Value has been on at least the amount of time specified in Min On Time. Similarly, the Minimum Off Satisfied will be set on once the Monitored Value has been off at least the amount of time specified in Min Off Time.

Delay Timer

On Delay Wait Satisfied will be set on once the Monitored Value has been on at least the amount of time specified in On Delay Wait Time. Off Delay Hold Active will be set on when the Monitored Value goes on. It will stay on until the Monitored Value has transitioned to off, and has been off at least the amount of time specified in Off Delay Hold Time.

"Generic" Function Blocks Add Air Handler and Other Additional Functionality
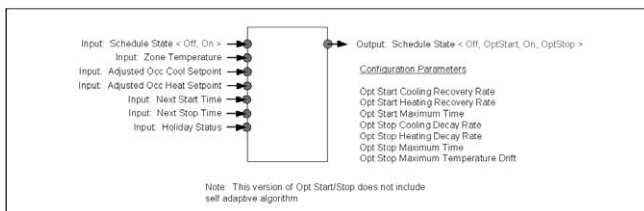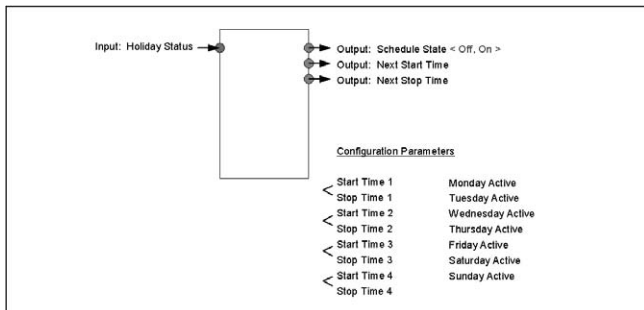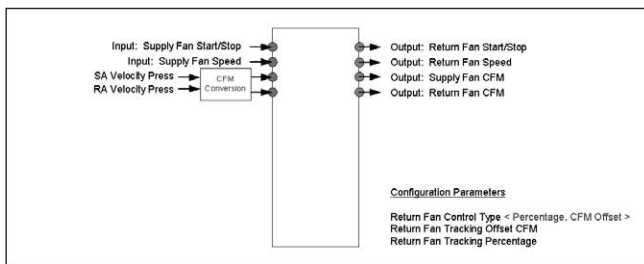
Modulating Control/Modulating Control with Reset

Provides control of any modulating device such as a cooling or heating valve or damper, or a pressure controlled VFD, based on the Control Input. The Enable Input enables or disables the block. When disabled, the Demand Signal Output will be set to 0.0%.

Staged Control/Staged Control with Reset

Provides control of up to eight stages of heating, cooling, pressure, etc., based on the Control Input. The Enable Input enables or disables the block. When disabled, the Demand Signal output will be set to 0.0% and all stages will be set off.

General Alarm
Signal Inversion

BAS-2520

20-ch SoftLogic Digital Controller

1
PAC & Software

2
BAS

3
UNO

4
RS-485 I/O

5
Ethernet I/O

6
TPC

7
IPPC

8
FPM

9
AWS

10
Plug-in I/O

11
CompactPCI

12
Signal Conditioning

13
USB I/O

14
Motion Control I/O

15
Ethernet Switch

16
EDG

17
ICOM

Features

- Standalone programmable controller
- Pre-built BA Control Function Blocks
- Supports IEC61131-3 control languages
- Supports Modbus/RTU and BACnet MS/TP protocols
- Up to 115.2 kbps communication speed
- Max. I/O expansion up to 80 points for unique controller
- Built-in Watchdog Timer
- Wall mounting panel case

RoHS COMPLIANT 2002/95/EC CE FCC

Introduction

BAS-2520 is a 20-channel standalone controller for building automation control applications. Designed as a typical DDC (Direct Digital Controller), but customized for use in buildings, it is designed with universal I/O, a thin wall mountable case, and comes with embedded control algorithms for HVAC, lighting, security and other algorithms that are used in building automation applications.

SoftLogic Programming

This powerful, standalone controller is intuitive and easy to use. All controllers in the BAS-2000 series use KW SoftLogic for their programming, which is fully compatible with the IEC61131-3 standard. You can use multiple languages such as: Function Block Diagram (FBD), Sequential Flow Chart (SFC), Ladder Diagram (LD), Structure Text (ST) and Instruction List (IL) for control function configuration. This reduces engineering efforts, as there is no need to learn proprietary programming languages, and development time can be drastically reduced.

Open Modbus/RTU Protocol

The controllers of the BAS-2000 series use the Modbus/RTU protocol, which is the most popular and cost effective solution for field data communication, with transmission speeds up to 115.2 kbps. By using the Modbus/RTU protocol, it is much easier to integrate control data between a BAS-2000 series controller and field machinery such as compressors, chillers, inverters and power panels. BAS-2000 series also support BACnet MS/TP protocol.

Specifications

General

- **Certifications**   CE, FCC class A
- **Channels**   Analog Inputs: 4
  Analog Outputs: 4
  Digital Inputs: 8
  Digital Outputs: 4
  (Local bus for expansion up to 80 channels)
- **Dimensions (W x L x H)**   171 x 242 x 35 mm
- **LED Indicators**   Battery, power, communication (for RS-485), DO
- **Mounting**   Wall
- **Power Consumption**   15 W
- **Power Input**   24 V_{AC} or 18 ~ 36 V_{DC}
- **Watchdog Timer**   Yes (Programmable)

Communications

- **Analog Input Signals**   4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 10 V_{DC},
  RTD (PT100/PT1000), Thermistor (3 K, 10 K)
  (Software configurable)
- **Analog Output Signals**   4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 10 V_{DC}

- **Digital Input Signals**   Dry Contact   Logic level 1 : close
     Logic level 0 : open
     Wet Contact   Logic level 1 : 10 ~ 30 V_{DC}
     Logic level 0 : 3 V_{DC} max.
- **Digital Output Signals**   Relay Output (Rating : 240 V_{AC}, 3 A), LED indicator, manual switch for ON/AUTO/OFF selection
- **Interface**   Port 1 : RS-232 for programming,
  Port 2 : RS-485 for network
  Plug-in screw terminal (#14~22 AWG)
  1 x expansion bus connector
- **Network Nodes**   Up to 64
- **Transmission Distance**   1.2 km (4000 feet)
- **Transmission Protocol**   Modbus/RTU, Bacnet MS/TP
- **Transmission Speed**   1200, 2400, 9600, 19200, 38.4 k, 57.6 k, 115.2 kbps

Environment

- **Humidity**   5 ~ 95% non-condensing
- **Operating Temperature**   -10 ~ 60 °C (14 ~ 140 °F)
- **Storage Temperature**   -25 ~ 85 °C (-13 ~ 185 °F)

Ordering Information

- **BAS-2520**   20-ch SoftLogic Digital Controller

BAS-2514

14-ch SoftLogic Digital Controller

Features

- Standalone programmable controller
- Pre-built BA Control Function Block
- Supports IEC61131-3 control languages
- Supports Modbus/RTU and BACnet MS/TP protocols
- Up to 115.2 kbps communication speed
- Max. I/O expansion up to 74 points for unique controller
- Built-in Watchdog Timer
- Wall mounting panel case

RoHS COMPLIANT 2002/95/IEC   CE   FCC

Introduction

BAS-2514 is a 14-channel standalone controller for building automation control applications. Designed as a typical DDC (Direct Digital Controller), but customized for use in buildings. It is designed with universal I/O, a thin wall mountable case, and comes with embedded control algorithms for HVAC, lighting, security and other algorithms that are used in building automation applications.

SoftLogic Programming

This powerful, standalone controller is intuitive and easy to use. All controllers in the BAS-2000 series use KW SoftLogic for their programming, which is fully compatible with the IEC61131-3 standard. You can use multiple languages such as: Function Block Diagram (FBD), Sequential Flow Chart (SFC), Ladder Diagram (LD), Structure Text (ST) and Instruction List (IL) for control function configuration. This reduces engineering efforts, as there is no need to learn proprietary programming languages, and development time can be drastically reduced.

Open Modbus/RTU Protocol

The controllers of the BAS-2000 series use the Modbus/RTU protocol, which is the most popular and cost effective solution for field data communication, with transmission speeds up to 115.2 kbps. By using the Modbus/RTU protocol, it is much easier to integrate control data between a BAS-2000 series controller and field machinery such as compressors, chillers, inverters and power panels. BAS-2000 series also support BACnet MS/TP protocol.

Specifications

General

- **Certifications** — CE
- **Channels** — Analog Inputs: 4
  Analog Outputs: 3
  Digital Inputs: 4
  Digital Outputs: 3
  (Local bus for expansion up to 74 channels)
- **Dimensions (W x L x H)** — 171 x 242 x 35 mm
- **LED Indicators** — Battery, power, communication (for RS-485), DO
- **Mounting** — Wall
- **Power Consumption** — 15 W
- **Power Input** — 24 V_{AC} or 18 ~ 36 V_{DC}
- **Watchdog Timer** — Yes (Programmable)

Communications

- **Analog Input Signals** — 4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 10 V_{DC},
  RTD (PT100/PT1000), Thermistor (3 K, 10 K)
  (Software configurable)
- **Analog Output Signals** — 4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 10 V_{DC}
  (Software configurable)

- **Digital Input Signals** — Dry Contact — Logic level 1 : close
  Logic level 0 : open
  Wet Contact — Logic level 1 : 10 ~ 30 V_{DC}
  Logic level 0 : 3 V_{DC} max.
- **Digital Output Signals** — Relay Output (Rating : 240 V_{AC}, 3 A), LED indicator, manual switch for ON/AUTO/OFF selection
- **Interface** — Port 1 : RS-232 for programming,
  Port 2 : RS-485 for network
  Plug-in screw terminal (#14 ~ 22 AWG)
  1 x expansion bus connector
- **Network Nodes** — Up to 64
- **Transmission Distance** — 1.2 km (4000 feet)
- **Transmission Protocol** — Modbus/RTU, Bacnet MS/TP
- **Transmission Speed** — 1200, 2400, 9600, 19200, 38.4 k, 57.6 k, 115.2 kbps

Environment

- **Humidity** — 5 ~ 95% non-condensing
- **Operating Temperature** — -10 ~ 60 °C (14 ~ 140 °F)
- **Storage Temperature** — -25 ~ 85 °C (-13 ~ 185 °F)

Ordering Information

- **BAS-2514** — 14-ch SoftLogic Digital Controller

BAS-2014
BAS-2020

14-ch I/O Expansion Module

20-ch I/O Expansion Module

1 PAC & Software
2 BAS
3 UNO
4 RS-485 I/O
5 Ethernet I/O
6 TPC
7 IPPC
8 FPM
9 AWS
10 Plug-in I/O
11 CompactPCI
12 Signal Conditioning
13 USB I/O
14 Motion Control I/O
15 Ethernet Switch
16 EDG
17 ICOM

Features

- BAS-2014: 14-ch I/O Expansion Module for BAS-2514 and BAS-2520
  BAS-2020: 20-ch I/O Expansion Module for BAS-2514 and BAS-2520
- Local Bus Connection with BAS-2514 and BAS-2520
- Expand up to 2 meters
- Power Supplied by BAS-2514 and BAS-2520 through Local Bus Cable, no External Power Supply Required
- Wall Mounting panel case

Introduction

BAS-2014/2020 is a 14/20 channel expansion module for a BAS-2000 system. The I/O capacity of a BAS-2000 system can easily be expanded by cost-effective I/O expansion modules. Up to three expansion modules can be added to the controller, so you can get the number of I/O points you need. Combine a controller with different expansion modules for: 28, 34, 40, 42, 48, 54, 56, 60, 62, 68, 74 or 80 I/O points.

No External Power Required

To reduce wiring costs and make the modules easier to configure, the BAS expansion modules were designed to be powered by the connected BAS-2000 controller.
The required power for the I/O expansion module is tranferred through the local bus from the BAS-2000 controller. No additional power supply module or power wiring is required.

Specifications

General

- **Certifications** — CE
- **Channels** — BAS-2014:
  Analog Inputs: 4
  Analog Outputs: 3
  Digital Inputs: 4
  Digital Outputs: 3
  BAS-2020:
  Analog Inputs: 4
  Analog Outputs: 4
  Digital Inputs: 8
  Digital Outputs: 4
- **Dimensions (W x L x H)** — 171 x 242 x 35 mm
- **LED Indicators** — Power, DO
- **Mounting** — Wall
- **Power Consumption** — 15 W
- **Power Input** — N/A (Powered by controller through local bus)
- **Watchdog Timer** — Programmable

Communications

- **Analog Input Signals** — 4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 10 V_{DC}, RTD (PT100/PT1000), Thermistor (3 K, 10 K) (software configurable)
- **Analog Output Signals** — 4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 10 V_{DC} (software configurable)
- **Digital Input Signals** — Dry Contact — Logic level 1 : close / Logic level 0 : open
  Wet Contact — Logic level 1 : 10 ~ 30 V_{DC} / Logic level 0 : 3 V_{DC} max.
- **Digital Output Signals** — Relay Output (Rating : 240 V_{AC}, 3 A), LED indicator, manual switch for ON/AUTO/OFF selection
- **Interface** — Plug-in screw terminal (#14 ~ 22 AWG)
  2 x expansion bus connectors

Environment

- **Humidity** — 5 ~ 95% non-condensing
- **Operating Temperature** — -10 ~ 60 °C (14 ~ 140 °F)
- **Storage Temperature** — -25 ~ 85 °C (-13 ~ 185 °F)

Ordering Information

- **BAS-2014** — 14-ch I/O Expansion Module
- **BAS-2020** — 20-ch I/O Expansion Module

RoHS COMPLIANT 2002/95/EC   CE

BAS-4022T

Dual Loop PID Controller

Features

- 2 loop PID control algorithms built in one package
- 2 Analog Input/1 Analog Output/1 Digital Input/1Digital Alarm Output for 1 PID loop
- Analog Input Signal : 4 ~ 20 mA. 0 ~ 10 V_{DC}, 3 k & 10 k Thermistor
- Analog Output Signal : 0 ~ 10 V_{DC}, 0 ~ 20 mA, 4 ~ 20 mA
- Heating/Cooling (Direct/Reverse) Action Mode
- Loop Open/Close (PID Disable/Enable) and Analog Output Manual Control Modes
- 512 KB Prog. Memory
- First Order Filter
- System Emergency Shutdown
- Modbus/RTU Protocol Support

Introduction

Temperature PID controllers have been widely used in HVAC systems in building automation. Advantech offers the compact dual loop controller BAS-4022T. In addition to dual-loop design for economic reasons, BAS-4022T can be applied to various signals in the field such as: 4-20 mA, 0-10 V_{DC}, 3 k and 10 k thermistor. BAS-4022T also supports the Modbus/RTU protocol. HMI software can be used to easily access the module to monitor I/O data and change the control parameters through a Modbus interface, Modbus driver or Modbus OPC server.

Built-in PID Loop Control Algorithms

BAS-4022T has been built with 2 PID control loops. There are two analog inputs, one analog output, one digital input and one digital output for I/O control parameters for each loop. For the two analog input signals, AI#1 is for Pv1, and AI#2 is for Pv2. The analog output signal is for the Mv output value. Digital input can be used for the emergency shutdown input signal. It could remotely stop the PID loop action if there is an emergency situation. One digital output is then designed to be an alarm output if the analog input/output signal value is over its limit and action is required.

Built-in Watchdog Timer

The programmable watchdog timer is designed to automatically reset the CPU if the system fails.

Specifications

General

- **Certifications**   CE, FCC Class A
- **Channels**   Loop PID controller: 2
  Analog input : 4
  Analog output : 2
  Digital input : 2
  Digital output : 2
- **Dimensions (W x H x D)** 70 x 112 x 25 mm
- **Power Consumption**   2 W/Typical, 3 W/Max
- **Power Input**   Unregulated +10 ~ +30 V_{DC}
- **Mounting**   DIN 35 rail, stack, wall
- **Watchdog Timer**   Yes (Programmable)

Input/Output Channels

- **Analog Input Signals**   Differential Input, effective resolution : 16-bit
  Input types : 4 ~ 20 mA, 0 ~ 10 V_{DC}, 3 k & 10 k thermistor
- **Analog Output Signals**   Effective resolution : 12-bit
  Output types : 0 ~ 10 V, 0 ~ 20 mA, 4 ~ 20 mA
- **Digital Input Signals**   Logic Level 0: close to GND
  Logic Level 1: Open
- **Digital Output Signals**   Open collector to 30 V, 30 mA max. load
  Power dissipation: 3000 mW

Environment

- **Humidity**   5 ~ 95% non-condensing
- **Operating Temperature**   -10 ~ 50 °C
- **Storage Temperature**   -25 ~ 85 °C

Special Features

- **Individual Wire Burn-Out Detection**

Ordering Information

- **BAS-4022T**   Dual Loop PID Controller for Building Automation

Building Automation Systems