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Building Management System

نظام إدارة وتحكم المباني

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الإصدار الثاني

المقدمة

إن الحمد لله نحمده ونستعينه ونستغفره ، ونعوذ بالله من شرور أنفسنا وسيئات أعمالنا من يهده الله فلا مضل له ، ومن يضلل فلا هادي له وأشهد أن لا إله إلا الله وحده لا شريك له ، وأشهد أن محمداً عبده ورسوله.

[يَا أَيُّهَا الَّذِينَ آمَنُوا اتَّقُوا اللَّهَ حَقَّ تَقَاتِهِ وَلَا تَمُوتُنَّ إِلَّا وَأَنتُمْ مُسْلِمُونَ] [آل عمران: ١٠٢]

[يَا أَيُّهَا النَّاسُ اتَّقُوا رَبَّكُمُ الَّذِي خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ وَخَلَقَ مِنْهَا زَوْجَهَا وَبَثَّ مِنْهُمَا رِجَالًا كَثِيرًا وَنِسَاءً وَاتَّقُوا اللَّهَ الَّذِي تَسَاءَلُونَ بِهِ وَالْأَرْحَامَ إِنَّ اللَّهَ كَانَ عَلَيْكُمْ رَقِيبًا] [النساء: ١]

[يَا أَيُّهَا الَّذِينَ آمَنُوا اتَّقُوا اللَّهَ وَقُولُوا قَوْلًا سَدِيدًا يُصْلِحْ لَكُمْ أَعْمَالَكُمْ وَيَغْفِرْ لَكُمْ ذُنُوبَكُمْ وَمَنْ يُطِيعِ اللَّهَ وَرَسُولَهُ فَقَدْ فَازَ فَوْزًا عَظِيمًا] [الأحزاب: ٧٠-٧١]

أما بعد

أحبتى فى الله لقد رأيت كثير من الإخوة الكرام لايعرفون كثيرا عن علم إدارة المباني نظرا لأنه لم يدرس فى جامعاتنا ولامعاهدنا فأصبح علم التحكم والمراقبه من أهم العلوم التى يجب علينا معرفتها لمتطلبات سوق العمل وبالذات علم إدارة المباني فقد قمت بحمد الله شرح هذا النظام فى هذا الكتاب الذى أعتقد بإذن الله سوف يكون البدايه لمعرفة علم إدارة المباني .

ونظرا لأنه يوجد كثير من الشركات التى تقوم بهذا النظام كشركات سيمينس او هانى ويل او حتى جونسون فنظرا لانتشار نظام إداره المباني من سيمينز فقامت بشرح معظم مكونات المنتج من شركة سيمينز وأعتذر ابتداءً بين يدي رسالتي هذه لأهل العلم وطلابه ممن قد يقف عليها إن قصر باعي، أو قل اطلاعي، أو ضعفت عبارتي، أو أخطأت في مسألة، فإنى معترف بقله بضاعتي وضعف إفادتي

قال سعيد بن المسيب (٩٣هـ): " ليس من عالم ولا شريف ولا ذي فضل إلا وفيه عيب، ولكن من كان فضله أكثر من نقصه ذهب نقصه [لفضله، كما أنه من غلب " جامع بيان العلم وفضله لابن عبد البر ٤٨/٢

وقال عبد الله بن المبارك (١٨١هـ): " إذا غلبت محاسن الرجل على مساوئه لم تذكر المساوئ، وإذا غلبت المساوئ على المحاسن لم تذكر المحاسن ". سير أعلام النبلاء للذهبي [٣٥٢/٨ ط. الأولى].

مهندس /أحمد محمود مصطفى عيسى

موبيل ٠٥٠٣٨١٨٧٩٢

٠١٠٦٢٩٠٦٦١٢

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الرياض-المملكة العربية السعودية

BMS

WHAT IS THE BMS SYSTEM ?

ماهو نظام تحكم ومراقبة المباني ؟

هو نظام مراقبة مثبت في المباني التي تسيطر عليه وتراقب معدات المبنى الميكانيكية والكهربائية مثل التهوية والإضاءة وأنظمة الطاقة وأنظمة الحريق و أنظمة الحماية نظام إدارة بناء يتكون من برمجيات ؛ برامج السوفتوير عادة ما يتم تكوينه بطريقة هرمية ويمكن أن (hardware) وأجهزة (software) وهلم (Profibus) و بروفى باص (C-bus) تكون ملكية واستخدام إلى درجة بروتوكولات مثل سي باص التي تعمل على دمج (BMSs) جرا، في الآونة الأخيرة، ومع ذلك، باعة جدد ينتجون أنظمة بناء الإدارة XML BACnet و SOAP و DeviceNet استخدام بروتوكولات الإنترنت ومعايير مفتوحة مثل LonWorks Modbus.

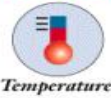
- Building Management Systems (BMS) also known as Building Automation Systems (BAS), Building Management and Control System (BMCS), Direct Digital Controls (DDC) and Building Controls
- Other terms associated with Control Systems include:
 - Supervisory, Control and Data Acquisition (SCADA)
 - Programmable Logic Controllers (PLC)
 - Energy Management System (EMS)
 - Data gathering panels (DGP)
 - Modbus, Lonworks, and Bacnet – All refer to communications protocols
 - 'Front End' – legacy term used to refer to the BMS Operator Workstation

- **A micro-processor based system which centralizes and simplifies...**

- ♦ controlling
- ♦ monitoring
- ♦ operation and...
- ♦ management



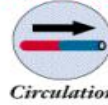
...of heating, air-conditioning, ventilation & other building services to achieve...



Temperature



Moisture



Circulation

- » safe and comfortable working environment
- » energy saving & efficient operation
- » at reduced time & cost



What is the difference between BMS & PLC?

Object Oriented

Bits & Bytes



Machine Efficiency

Human Comfort & Safety

PLC	BMS
Centralized architecture Single point of failure High installation costs High engineering costs Limited connectivity Very limited sub-system integration capabilities Inconsistent support Limited channel expertise General purpose Fully programmable	Distributed intelligence High availability & resilience Low installation costs Low engineering costs Good connectivity Excellent sub-system integration Broad support coverage Excellent channel expertise Application focused Configurable and programmable

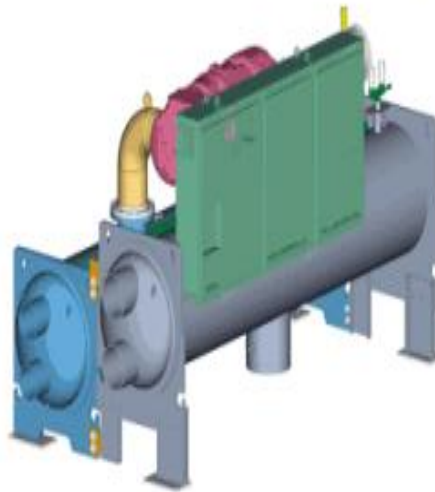
DCS	PLC
1. Single vendor	Multiple
2. Small Area /LAN	Large Area/WAN
3. Many I/O	Less I/O
4. Use for Monitoring	Used for Controlling

WHAT IS THE BMS PROVIDE?

Comfortable & safe environment
for your building
by controlling.....

- ♦ Air Handling Units
- ♦ Fan Coil Units
- ♦ Chillers
- ♦ Pumps
- ♦ Boilers
- ♦ VFD's

and many more.....



COMPONENTS OF BMS?

مكونات نظام مراقبة المباني

- Centralized WorkStation Computer

- ♦ With powerful user-friendly software.
- ♦ Used for everyday building operation.



- DDC Controllers

- ♦ Micro-processor based
- ♦ Pre-configured / Freely programmable
- ♦ Controls the HVAC equipment of the building



- Field devices

- ♦ Temperature, Humidity, Pressure sensors
- ♦ Valves, Actuators



ROLE OF BMS SYSTEM

- The most common primary function of the BMS is the control of a buildings Heating, Ventilation and Air Conditioning Systems (HVAC) including;

- Air Handling Units
- Chilled Water Plant
- Cooling Towers
- Tenant Condenser Water
- Heating Water Plant
- Exhaust Systems
- Zone Controls
- Computer Room AC



- Control of Building Systems and Services
- Graphic User Interface (GUI)
- Real Time Monitoring of Building Operation and Performance
- Trending and Logging of Building Operation and Performance
- Time Scheduling of Building Systems
- Fault Management and Alarming
- Control Application Programming
- User Event Management
- Energy Management and Reporting (NABERS)

Typical System Components – BMS Hardware

Range to Suit Applications

Operator Workstations

High Point Counts

Built In Displays

Limited Features

Application Specific

Small Point Counts



Typical System Components – Field Devices

Damper Actuators

Variable Speed Drives (VSD)

Air Flows Pressures

Voltages Currents

Valve Actuators

Pumps Fans Motors

Water Flows Pressures

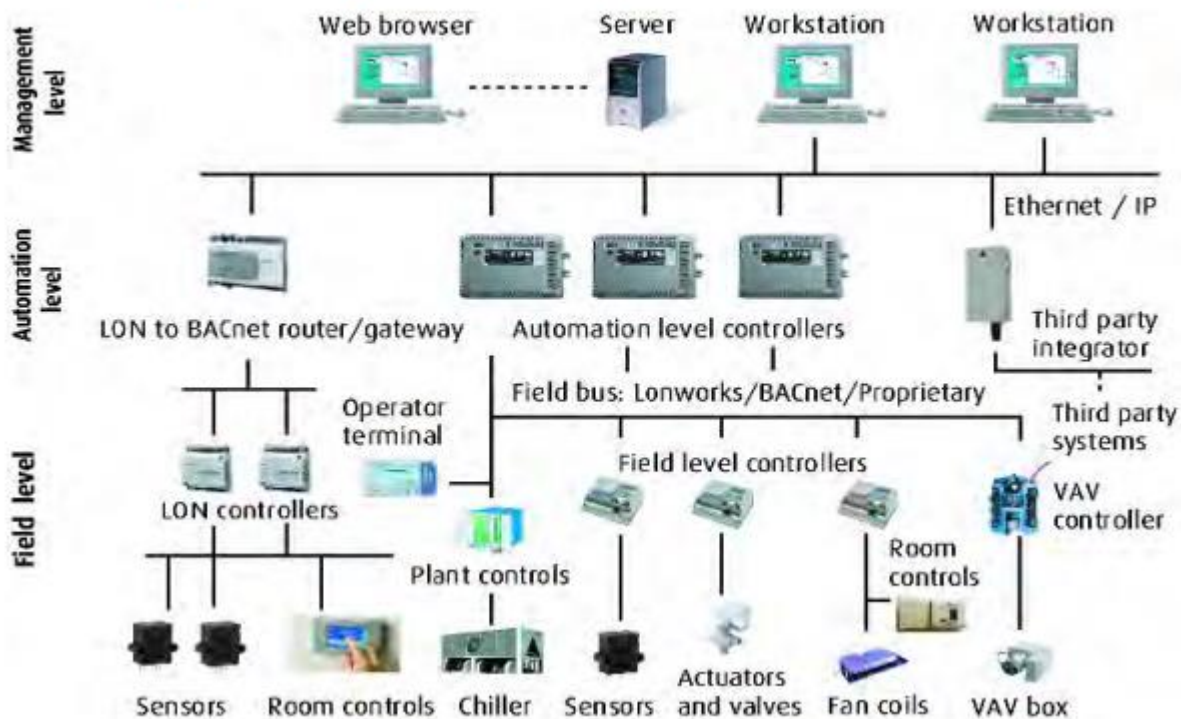
Temperature Relative Humidity CO2

Chillers / Boilers Cooling Towers

Low Level and High Level (HLI) Connections

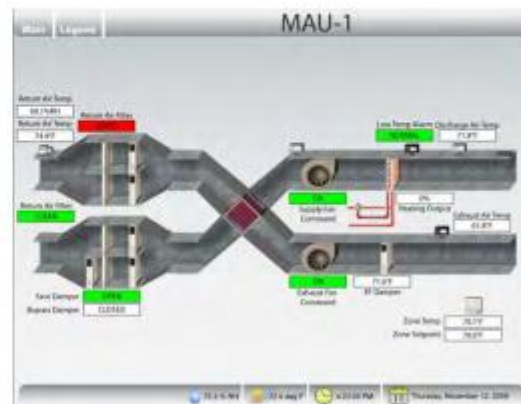


Typical System Components - Networks



BMS Simple User Interfaces – WEB Server

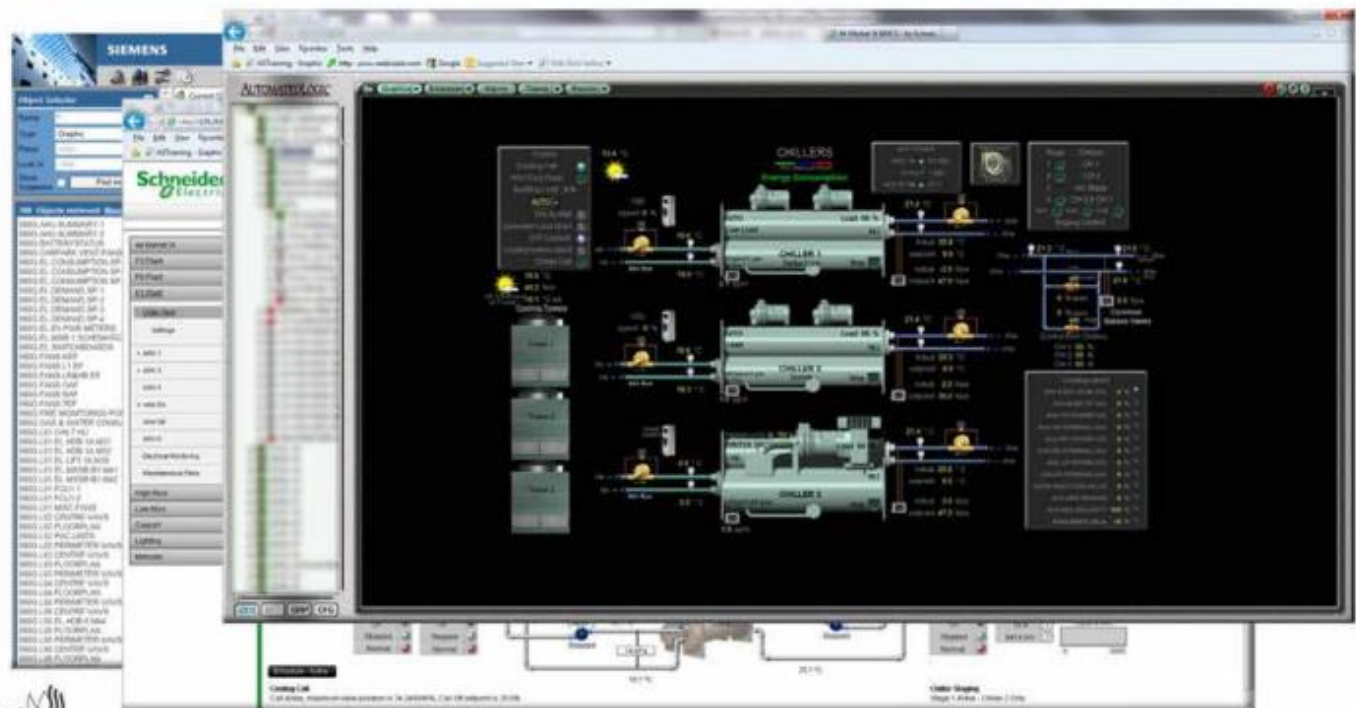
- WEB Server built into a BMS network controller
- User defined menus and graphic pages
- Password protected, multiple access levels
- Monitor and control field points, operating setpoints, time schedules, alarm management, even trend data



BMS Workstation - AHU Graphic Display Sample



BMS Workstation - Chiller Graphic Display Sample



BMS FEATURES?

مميزات نظام مراقبة المباني ؟

- **Man / Machine Interface**

- interact with the connected technical building equipment.
- user friendly
- for operators...
- engineers....
- and building managers



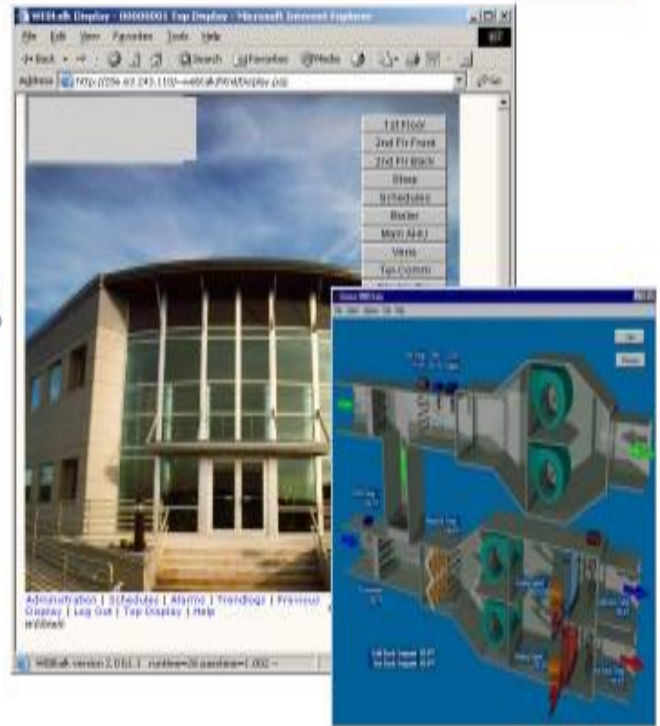
- **System Security**

- To prevent unauthorized use
- Password protection
- Operator specific access
- Operator log summary



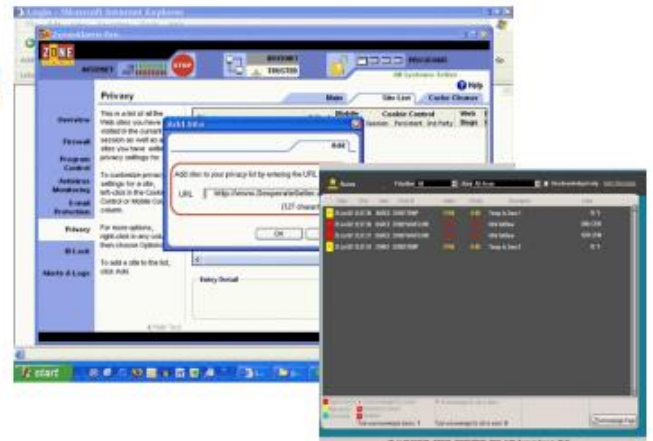
- User-friendly data presentation

- co-ordination of the flow of information through the system by implementing customized graphics.
- floor plans of the building
- graphical representation of the equipment.



- **Alarm Management**

- **the presentation in the sequence of importance and time of..**
 - ♦ potentially dangerous situations
 - ♦ process value deviations
- **guiding the operator to take appropriate action through..**
 - ♦ audible and visual indications
 - ♦ Email, SMS
- **alarm summary**
 - ♦ Time, date, priority and description



File Number

• **Reporting**

- present customized subsets of data
- actual or historical state
- export as a word or excel document or..
- to a printer.



• **Data Logging**

- The automatic gathering and storage of data from the field equipment for later analysis and reporting
- Dynamically or historical
- Customized charts and graphs
- Tabular reports



- Time Scheduling

- time-based start/stop of the equipment
- saves energy cost and efficient operation
- effective for lighting, occupancy control
- can be as daily, weekly, for holidays or events



- Event recording

- automatic logging of...
 - ♦ operator activities and commands
 - ♦ processes related to connected devices
 - ♦ workstations and printers.

[illegible]

- Remote connectivity

- provide remote access to the system with full functionality through..
 - ◆ **local area network**
 - ◆ **dial-up**
 - ◆ **internet via web browser**

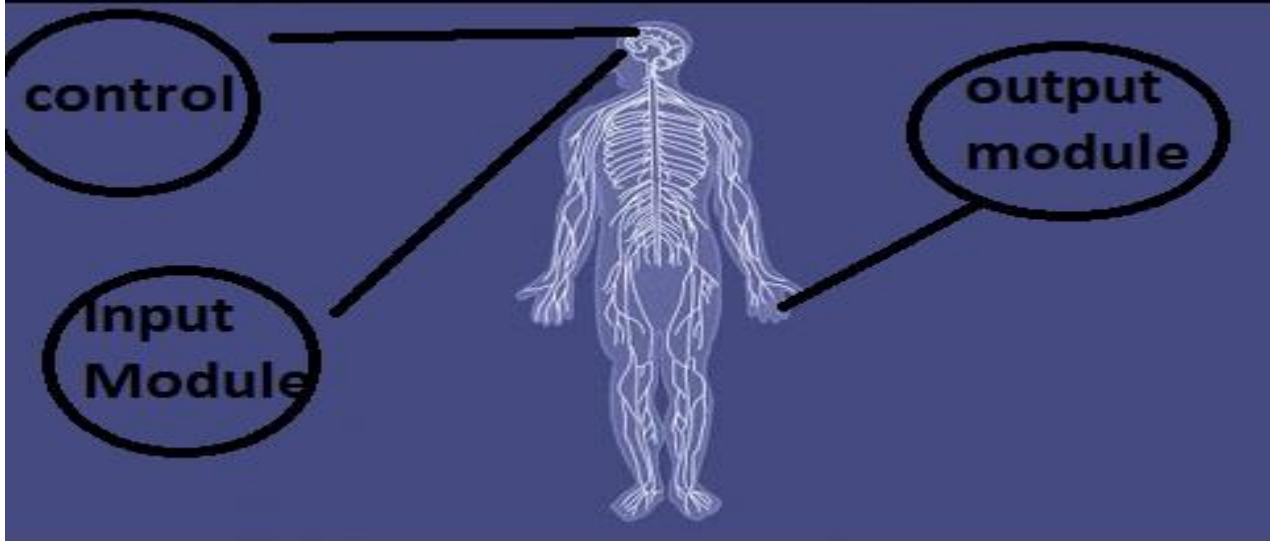


نظام ادارة المبانى بيتكون مثل جسم الإنسان

الكنترول هو مخ الإنسان الذى يتحكم فى كل شئ (وحدة التحكم)

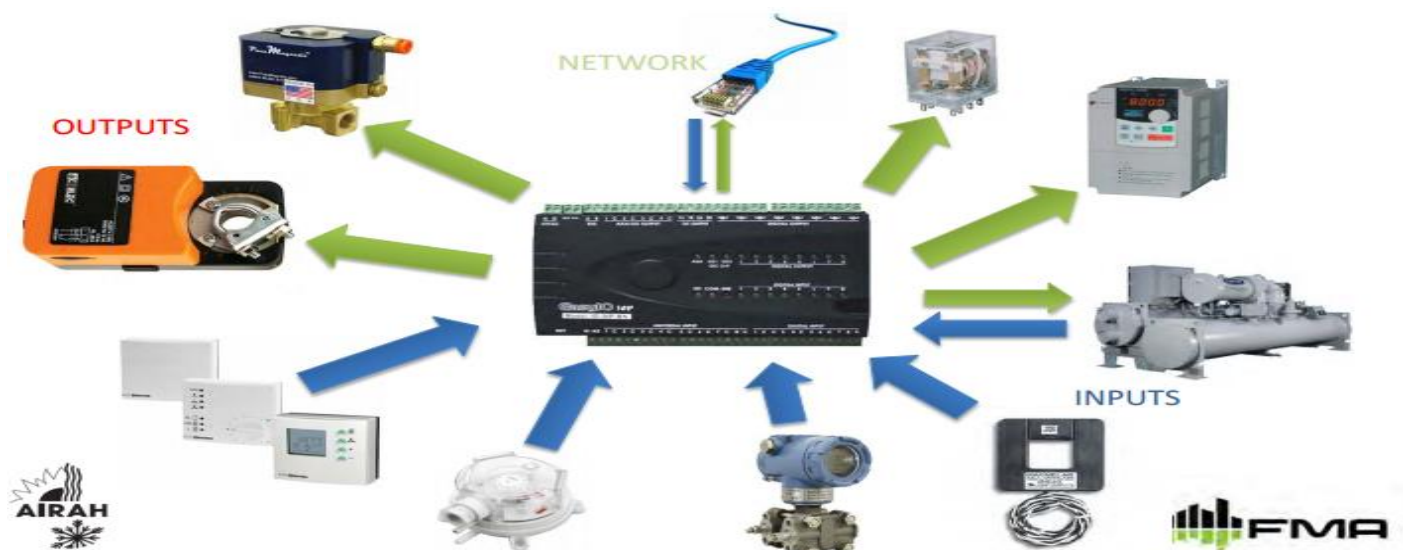
وحدات المراقبة مثل العينين (وحدات الدخول)

وحدات التحكم مثل اليدين والرجلين(وحدات الخروج)



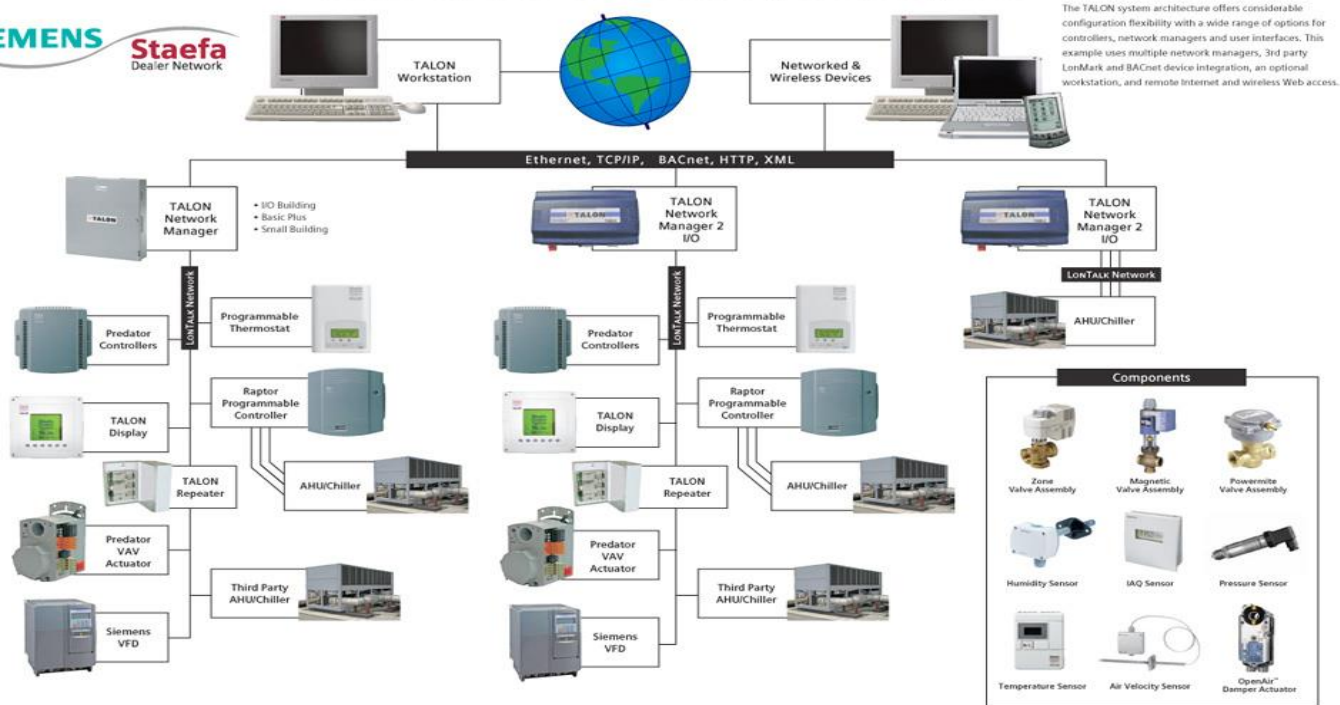
ويتكون أيضا مثل جهاز الكمبيوتر من وحدات تحكم وإدخال وإخراج





TALON Open Protocol Building Control System

SIEMENS **Staefa**
Dealer Network



The TALON system architecture offers considerable configuration flexibility with a wide range of options for controllers, network managers and user interfaces. This example uses multiple network managers, 3rd party LonMark and BACnet device integration, an optional workstation, and remote Internet and wireless Web access.

MAIN LEVEL FOR BMS SYSTEM

1-OPEARITING LEVELS FOR BMS SYSTEM

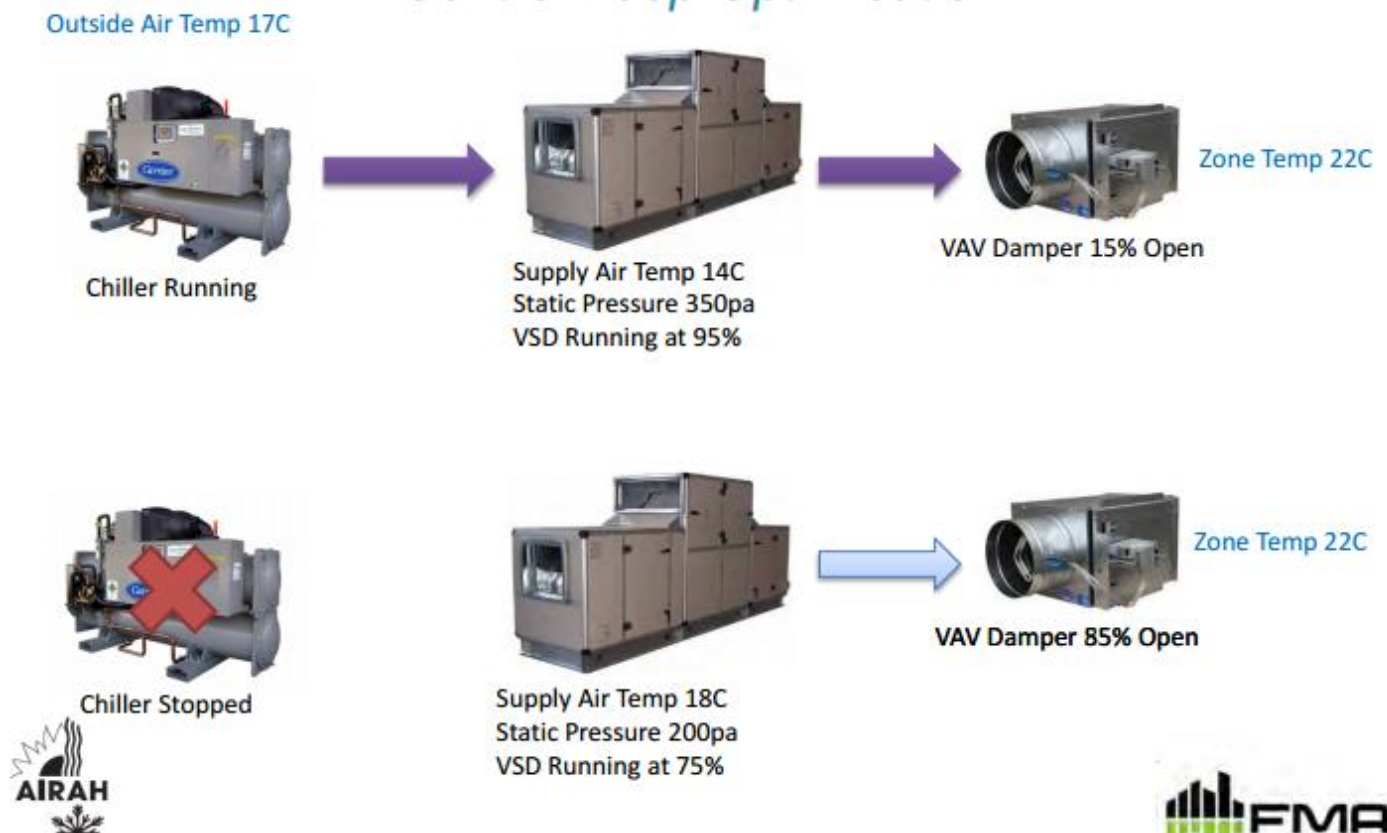
أنواع أنظمة المراقبة فى نظام ادارة المبانى ؟

Operator station	Desigo Touch and Web  Desigo CC 
Room operator unit	QMX3...  QMX7.E38  QAX... 
Operation in the control panel	PXM40 / PXM50  PXM20 local & central  PXM10 local 
Manual operation	TX-I/O 

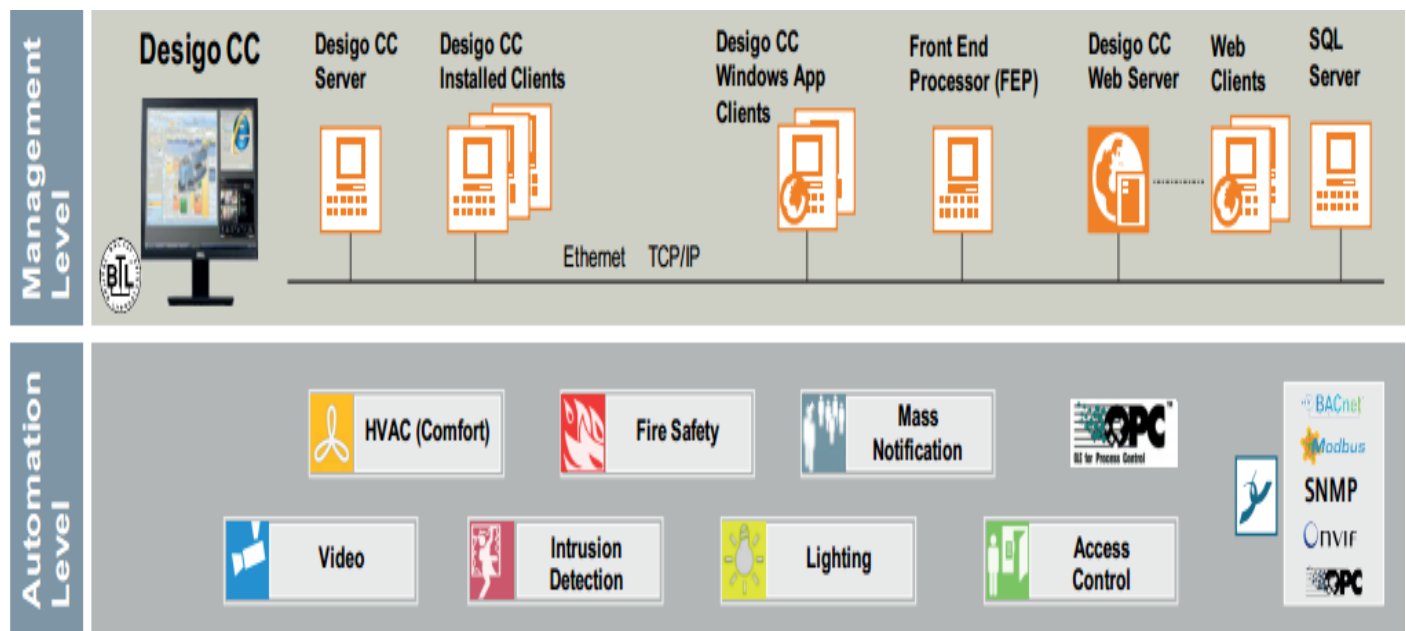
2- CONTROL LEVELS FOR BMS SYSTEM

- Building control applications include for following:
 - Zone temperature monitoring and control
 - Zone Variable Air Volume (VAV) control to zones
 - Zone CO2 monitoring and control (Air Quality)
 - Air handling unit supply air temperature control
 - Air handling unit supply air flow / pressure control
 - Main Plant Chiller and Boiler sequencing
 - Toilet, car park, kitchen and general exhaust fan control
 - After Hours Building Control

Control Loop Optimisation

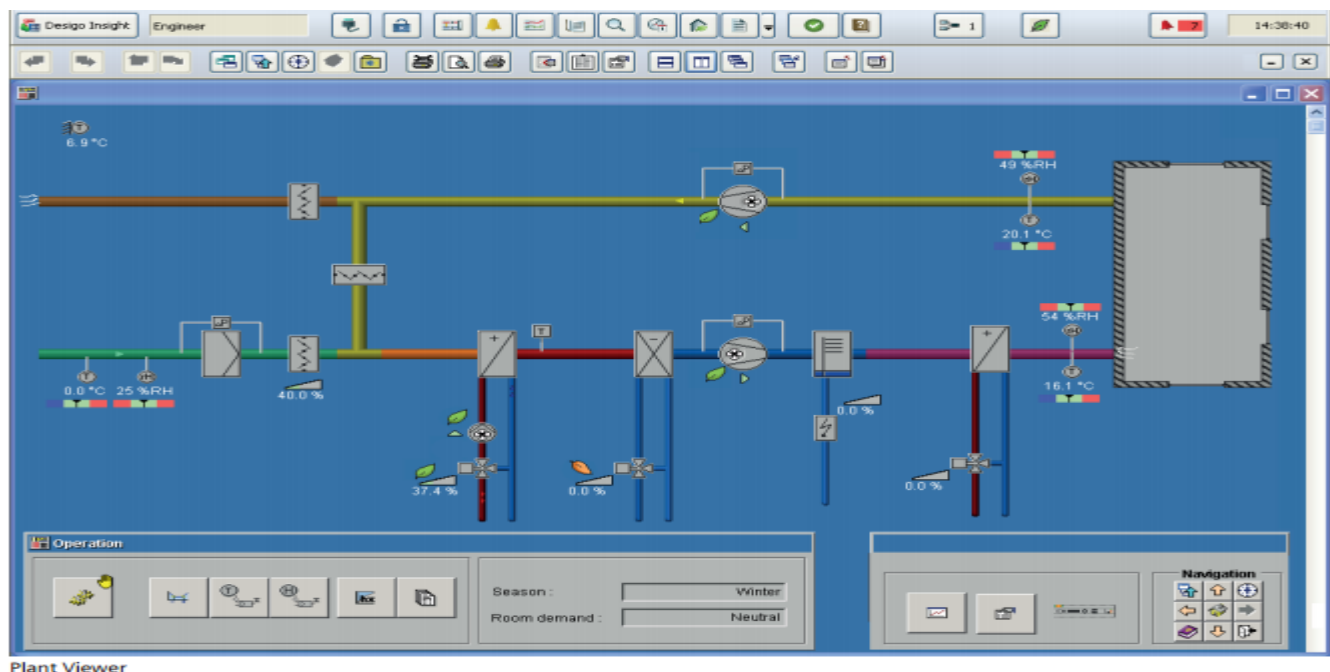


3- MANAGEMENT & AUTOMATION LEVELS FOR BMS SYSTEM

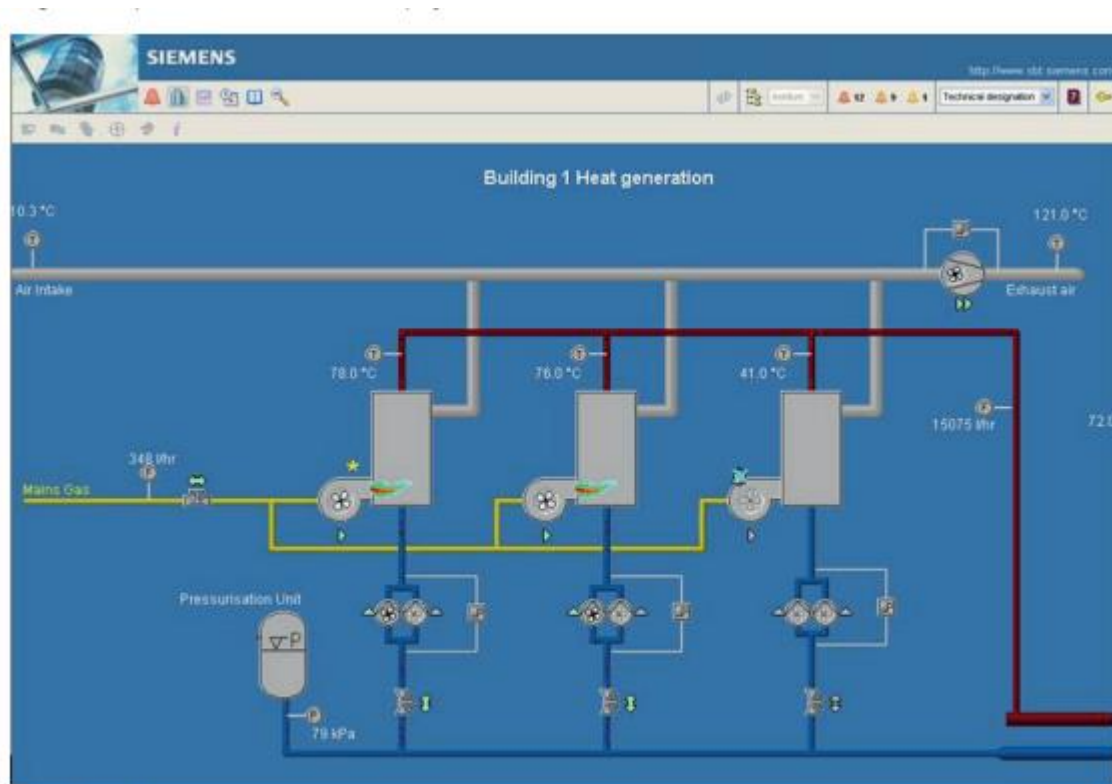


A- DESIGO INSIGHT

1-PLANT VIEWER



2- WEB PLANT VIEWER



Web Plant Viewer

3-ENERGY REPORT



The Input and Output Module Divides to :

1-Digital Module (DI)

المدخلات الرقمية

وغالبا تستخدم مع الملامسات التى بدون جهد أى تكون ١ أو ٠ مثل

1-Duct Smoke Detectors

2-Air /Water Pressure Switch

3- Diff Pressure Switch (DPS)

4-Air Flow Switch (AFS)



Differential Pressure Switch QBM81-...

for air and nonaggressive gases

-
- For ventilation and air conditioning plants
 - To monitor air filters, air flow, fan belts
 - To monitor pressure in clean rooms, kitchens etc.
 - Easy to mount
 - >1 mio switching cycles
 - Highly precise setting
 - Long-term stability

Use

In ventilation and air conditioning plants to:

- Monitor differential pressure, underpressure and overpressure
- Monitor air filters and air flows
- Recognize torn fan belts

Differential pressure switches can be used in clean rooms, kitchens, etc.

Differential Pressure Detector

for monitoring of air pressure

QBM81-...



Differential pressure detector for ventilation and air conditioning systems

- For monitoring of air filters, air flow, fan belts
- For monitoring of pressure in clean rooms, kitchens etc.
- Easy to mount

2-Analogue Module (AI)

إشارات دخل تناظريه

ويكون مصدرها الحساسات وأجهزة القياس بحيث يتم تحويل الكمية التناظريه الى
كمية كهربيه كالتالى

اشارة جهد مستمر

From (0 to 10 VDC) or (0 to 1VDC)

اشارة تيار

From (0 to 20 mA)

مقاومة جهد

From (0 to 140 Ω)

Type Of Sensor

أنواع الحساسات المستخدمة فى الإشارات التناظرية

Type of Sensor using in (Analogue Module)

1-Temperature Sensor

2-Pressure Sensor

3-Hum/Tem Sensor

4-Immersion Temp Sensor

5-Diff Pressure Sensor

6- Level Transducer

7- Gas Detectors Transducer

8- Current & Voltage Transducer



Symaro™

**Immersion Temperature
Sensors**

QAE21...

Use

Passive sensors for acquiring the water temperature in pipes and tanks.

The QAE21... immersion temperature sensors are for use in ventilation and air conditioning plants for:

- Controlling or limiting the flow temperature
- Limiting the return temperature
- Controlling the DHW temperature



Symaro™

Duct sensors

QFM21...

for relative humidity and temperature

- Operating voltage AC 24 V / DC 13.5...35 V
- Signal output DC 0...10 V / 4...20 mA for relative humidity
- Signal output DC 0...10 V / 4...20 mA / T1 / LG-Ni 1000 for temperature
- Measuring accuracy ± 3 % r. h. within the comfort range
- Range of use $-15...+60$ °C / 0...95 % r. h. (non-condensing)

Use

The QFM21... duct sensors are for use in air ducts of ventilation and air conditioning plant for acquiring:

- The relative humidity and
- The temperature.

The sensors are used as:

- Control sensors in the supply or extract air
- Reference sensors, e.g. for shifting the dew point
- Limit sensors, e.g. in connection with steam humidifiers
- Limit sensors, e.g. for measured value indication or for connection to a building automation and control system
- Sensors for enthalpy and absolute humidity, together with SEZ220 (see Data Sheet N5146)



Differential Pressure Sensors

QBM66...

for air or nonaggressive gases

-
- Pressure-linear characteristic with selectable pressure measuring range
 - Operating voltage AC 24 V or DC 13.5...33 V
 - Output signal DC 0...10 V
 - Delivery with tubing connection set

Use

For acquiring the differential pressure of air or nonaggressive gases in ventilation, air conditioning and heating plant.

The differential pressure sensors are used to:

- Acquire over- or underpressure in air ducts in relation to ambient pressure
- Monitor filters and to control fans
- Acquire pressure differentials between different rooms



Pressure Sensors

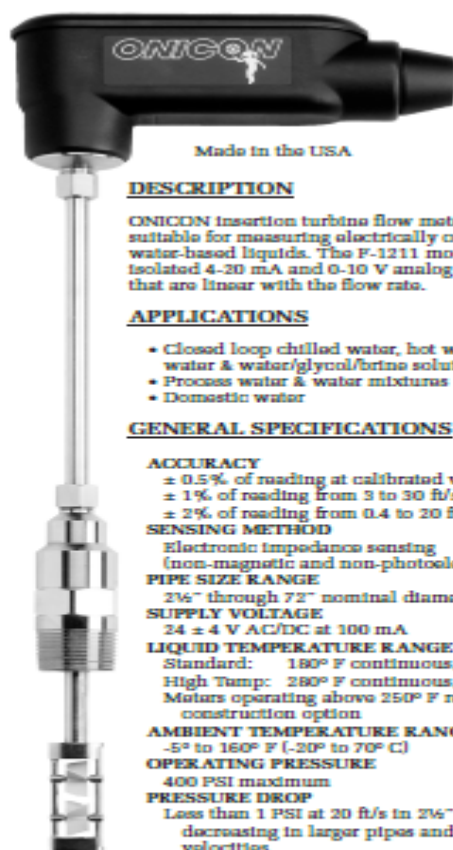
for liquid and gaseous media

QBE2002-P...
QBE2102-P...

-
- Piezo-resistive measuring system
 - DC 0 ...10 V or DC 4...20 mA output signal
 - Measurement unaffected by changes in temperature
 - High temperature stability
 - No mechanical aging or creepage
 - External thread G½"
 - Excellent EMC characteristics

Use

The pressure sensors are suitable for the measurement of static and dynamic positive pressure in HVAC plant, particularly in hydraulic and pneumatic systems using liquid or gaseous media (steam applications).



Made in the USA

DESCRIPTION

ONICON Insertion turbine flow meters are suitable for measuring electrically conductive water-based liquids. The F-1211 model provides isolated 4-20 mA and 0-10 V analog output signals that are linear with the flow rate.

APPLICATIONS

- Closed loop chilled water, hot water, condenser water & water/glycol/brine solutions for HVAC
- Process water & water mixtures
- Domestic water

GENERAL SPECIFICATIONS

ACCURACY

- ± 0.5% of reading at calibrated velocity
- ± 1% of reading from 3 to 30 ft/s (10:1 range)
- ± 2% of reading from 0.4 to 20 ft/s (50:1 range)

SENSING METHOD

Electronic impedance sensing (non-magnetic and non-photoelectric)

PIPE SIZE RANGE

2½" through 72" nominal diameter

SUPPLY VOLTAGE

24 ± 4 V AC/DC at 100 mA

LIQUID TEMPERATURE RANGE

Standard: 180° F continuous, 200° F peak
High Temp: 280° F continuous, 300° F peak
Meters operating above 250° F require 316 SS construction option

AMBIENT TEMPERATURE RANGE

-5° to 160° F (-20° to 70° C)

OPERATING PRESSURE

400 PSI maximum

PRESSURE DROP

Less than 1 PSI at 30 ft/s in 2½" pipe, decreasing in larger pipes and lower velocities

OUTPUT SIGNALS PROVIDED

Analog Output (isolated)
Voltage output: 0-10 V (0-5 V available)
Current output: 4-20 mA
Frequency Output
0 - 15 V peak pulse, typically less than 300 Hz

(continued on back)

• F-1211 DUAL TURBINE • INSERTION FLOW METER ISOLATED ANALOG OUTPUT



CALIBRATION

Every ONICON flow meter is wet calibrated in our flow laboratory against primary volumetric standards that are directly traceable to N.I.S.T. A certificate of calibration accompanies every meter.

FEATURES

Unmatched Price vs. Performance - Custom calibrated, highly accurate instrumentation at very competitive prices.

Excellent Long-term Reliability - Patented electronic sensing is resistant to scale and particulate matter. Low mass turbines with engineered jewel bearing systems provide a mechanical system that virtually does not wear.

Industry Leading Two-year "No-fault" Warranty - Reduces start-up costs with extended coverage to include accidental installation damage (miswiring, etc.) Certain exclusions apply. See our complete warranty statement for details.

Simplified Hot Tap Insertion Design - Standard on every Insertion flow meter. Allows for insertion and removal by hand without system shutdown.

OPERATING RANGE FOR COMMON PIPE SIZES	
0.17 TO 20 ft/s ±2% accuracy begins at 0.4 ft/s	
Pipe Size (inches)	Flow Rate (GPM)
2 ½	2.5 - 230
3	4 - 460
4	8 - 800
6	15 - 1,800
8	26 - 3,100
10	42 - 4,900
12	60 - 7,050
14	72 - 8,600
16	98 - 11,400
18	120 - 14,600
20	150 - 18,100
24	230 - 26,500
30	360 - 41,900
36	510 - 60,900



Symaro™

Duct Temperature Sensors QAM21...

Passive sensors for acquiring the air temperature in air ducts.

Use

The duct temperature sensors are for use in ventilation and air conditioning plants as:

- Supply or extract air temperature sensors
- Limit sensors, e.g. for minimum limitation of the supply air temperature
- Reference sensors, e.g. for shifting the room temperature as a function of the outside temperature
- Measuring sensors, e.g. for measured value indication or for connection to a building automation and control system

3-Digital Output

أشارات خرج رقمية

وهي تخرج من لوحة التحكم الى ريلاي للقيام بعمليات التحكم (تشغيل/إيقاف) و (غلق وفتح)

مثل محركات المراوح ومحركات المضخات ومحابس التحكم الثنائية)

4-Analogue Output (AO)

وهي التي تخرج من لوحة التحكم على هيئة اشارات كهربية تناظرية من ٠ الى ١٠ فولت
مثل

١-محابس التحكم

Modulating Valves (2 Way Valve Actuator)

٢-خوانق التحكم

Modulating Dampers (Damper Actuator)

٣-وحدات التحكم فى سرعة المواتير

Variable Speed Drives (VSD) , Variable Frequency Drives(VFD)



OpenAir™

Air damper actuators

GDB...1

GLB...1

GSF...1

Rotary version, AC 24 V / AC 230 V

Electronic motor driven actuators for three-position and modulating control, nominal torque 5 Nm (GDB), 10 Nm (GLB) or 2 Nm (GSF), mechanically adjustable span between 0...90°, pre-wired with 0.9 m long connection cables.

Type-specific variations with adjustable offset and span for the positioning signal, position indicator, feedback potentiometer, self-adaption of rotational angle range and adjustable auxiliary switches for supplementary functions.

Types

Device	Type	Data point mix			
		UI	DI	AO	DO
Automation station for 52 physical data points	PXC52	16	16	8	12



Acvatix™

2-port seat valves PN16 with VVF41.. flanged connection

- Grey cast iron EN-GJL-250 valve body
- DN 50...150
- k_{vs} 19...300 m³/h
- Can be equipped with SAX- electromotoric or SKD...-, SKB...- or SKC...- electrohydraulic actuators

Use

For use in district heating, heating, ventilating, and air conditioning systems as a control or shutoff valve.

For open and closed circuits (mind Cavitation, refer to page 5).

Silicon-free valve versions with type suffix ..5 available.



Electrohydraulic actuators for valves

with a 40 mm stroke

SKC32..
SKC82..
SKC62..
SKC60

- SKC32.. Operating voltage AC 230 V, 3-position control signal
- SKC82.. Operating voltage AC 24 V, 3-position control signal
- SKC6.. Operating voltage AC 24 V, control signal DC 0...10 V, 4...20 mA or 0...1000 Ω
- SKC6.. Choice of flow characteristic, position feedback, stroke calibration, LED status indication, override control
- SKC62UA with functions choice of direction of operation, stroke limit control, sequence control with adjustable start point and operating range, operation of frost protection monitors QAF21.. and QAF61..
- Positioning force 2800 N
- Actuator versions with or without spring-return function
- For direct mounting on valves; no adjustments required
- Manual adjuster and position indicator
- Optional functions with auxiliary switches, potentiometer and stem heater
- SKC...U are UL-approved

Use

For the operation of Siemens 2-port and 3-port valves, types VVF.. and VXF.. with a 40 mm stroke as control and safety shut-off valves in heating, ventilation and air conditioning systems.



VFD

BACnet PROTOCOL

What is BACnet?

BACnet is "a data communication protocol for building automation and control networks." A data communication protocol is a set of rules governing the exchange of data over a computer network. The rules take the form of a written specification (in BACnet's case they are also on compact disk) that spells out what is required to conform to the protocol.

What kinds of things are covered by BACnet's "rules"?

Everything from what kind of cable to use to how to form a particular request or command in a standard way. What makes BACnet special is that the rules relate specifically to the needs of building automation and control equipment, i.e., they cover things like how to ask for the value of a temperature, define a fan operating schedule, or send a pump status alarm.

Is BACnet limited only to HVAC equipment? Can it be used with fire/life safety, lighting control, and other building automation systems?

Absolutely. In fact, if you think about it, BACnet already contains most of the capabilities required for non-HVAC communications. These include the ability to read and write binary, analog, and text data; schedule control actions; send event and alarm notifications; and so on. Nonetheless, the committee realized that these capabilities might not cover all situations and developed the standard with an eye toward accommodating future, unknown building automation and control applications. As a result, one of the real strengths of the BACnet model that emerged from this consideration is that it can be easily extended. If a vendor comes up with some new functionality for which communication is required, the vendor can add new properties to existing object types or create new object types that are accessed in exactly the same way as the eighteen defined in the standard. This is not only expected, it is encouraged. Moreover, a vendor could even dream up new services that go beyond the standard ones. Of course, proprietary features may not be interoperable without vendor cooperation.

What is the difference between BACnet, Modbus and LonWorks?

Building Automation Controls Network (BACnet): BACnet is a network protocol specifically used for multiple devices to communicate across building automation systems by system users and building system manufacturers

Modbus: Modbus is a network protocol best used for industrial automation systems specifically for connecting electronic equipment. Although Modbus is best for industrial applications, its simplicity allows it to be a useful tool for building automation as well.

LonWorks: LonWorks is a communication network protocol useful for building automation applications designed on a low bandwidth, for networking devices through power lines, fiber optics, and other media.

	BACnet	Modbus	LonWorks
Developed By:	ASHRAE	Modicon Inc.	Echelon Corporation/ Motorola
Use	Communication across devices	Connection between devices	Networking devices through power lines, fiber optics, and other media
Markets	Industrial, Transportation, Energy Management, Building Automation, Regulatory and health and safety	HVAC, Lighting, Life Safety, Access Controls, transportation and maintenance	Home automation, industrial, transportation, and public utility control networks.
Examples	Boiler Control, Tank Level Measurements	Tasks such as request temperature reading, send status alarm, or fan schedule	Security, lighting systems, HVAC, machine control, manufacturing, metering
Proprietary	No	No	Yes
Transmission Modes	Ethernet, IP, MS/TP, Zigbee	ASCII, RTU, TCP/IP	MS/TP, network, SNVT
Standards	ANSI/ASHRAE Standard 185 ;ISO-16484-5; ISO-16484-6	IEC 61158	ANSI/EIA 709.1; ISO/IEC 14908-1, 14908-2, 14908-3, 14908-4
Costs	Low; No charge for usage or licensing fees	Low; No charge for usage or licensing fees	High (proprietary); Limited users (exclusive to actual members; mostly manufacturers)
Network Interfaces	Existing LANs and LANs infrastructure	Traditional serial and Ethernet protocols	U10/U20 USB Network Interface; i.LON SmartServer; i.LON 600
Testing	BACnet Testing Labs	Modbus TCP Conformance Testing Program	Products must conform to LonWorks protocol

Advantages	- Scalability between cost, performance and system size - Endorsement and adoption by nearly every major vendor in North America and many other countries - Robust internetworking including multiple LAN types and dial-up - Unrestricted growth and the ability to add new innovations and new features anytime	- Easy connection to Modicon - Suitable for small/medium volumes of data (≤ 255 bytes) - Data transfer designed for industrial applications - Openly published and royalty-free - Easy to deploy and maintain - Moves raw bits or words without placing restrictions on vendors	- Web based tool; saves time and cost - Numerous developers of Lonworks products in the market - Less Architecture at device level
	- Limited the number of field devices that can connect to a master station except Ethernet TCP/IP - MT/TP-Wire Length - Ethernet-Infrastructure - New standard has security standard but not implemented in all devices	- Limited the number of data types; Large binary objects are not supported. - No standard method for a node to find the description of a data object, i.e. finding a register value represents a temperature between 30° and 175°. - No security against unauthorized commands or interception of data - Transmissions must be contiguous which limits the types of remote communications devices to those that can buffer data to avoid gaps in the transmission. - Great amount of configuration and programming required - Protocol is not common in the SIMATIC family	- Outdated - Controlled devices & variables are connected to a separate control device. (Not recommended due to network interruptions producing system failures) - Extensions are allowed only through the LonMark Consortium. - Hardware specific, and requires the Neuron chip for network movement of the protocol. - Close to "plug & play" ability, yet still far from achieving interconnectivity using Microsoft Windows.
Disadvantages			

BACNET MSTP

The **MS** stands for *Master - Slave* although in practice there are not many slaves out there.
The **TP** stands for *Token Passing*.

This flavor of BACnet is most commonly used to connect field devices to controllers / routers / control applications.

The physical layer uses RS485 which allows up to 128 devices to be installed on a single network, with a max physical length of 4000ft, and speeds up to 115k baud. Using repeaters allows the length to be increased. You can compare to Ethernet, where the spec allows a max of 100 meters (330ft) on a single, unrepeatd segment.

Common baud rates are 19200, 38400 and 76800. All devices must operate at the same baud rate. More and more devices can auto sense the baud rate and configure themselves correctly.

We divide the messages on a MSTP network into two categories:

1. Overhead (token, poll for master...)
2. Application. These carry payloads that we have an interest in.

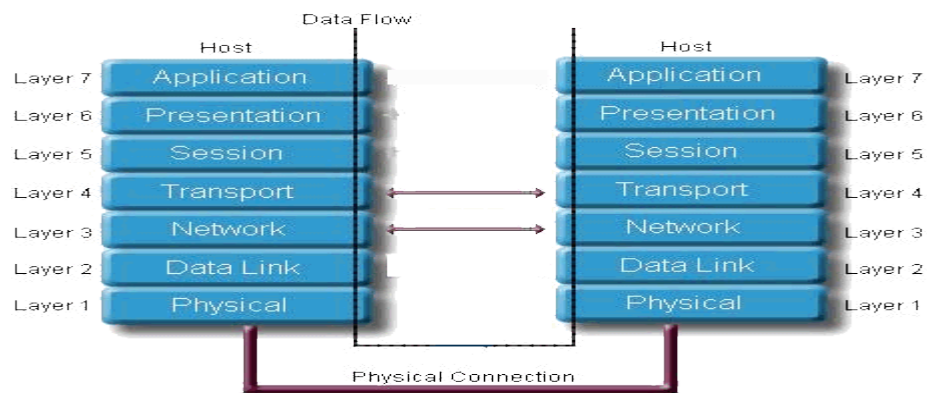
Only a device with the token can initiate an application layer message. It can send the message to any device on the network. Some messages demand an instantaneous reply, some don't. The receiving device doesn't need the token to respond. There is a limit to how many application layer messages a device can send before it must pass the token on.

The benefits of token passing networks are the following:

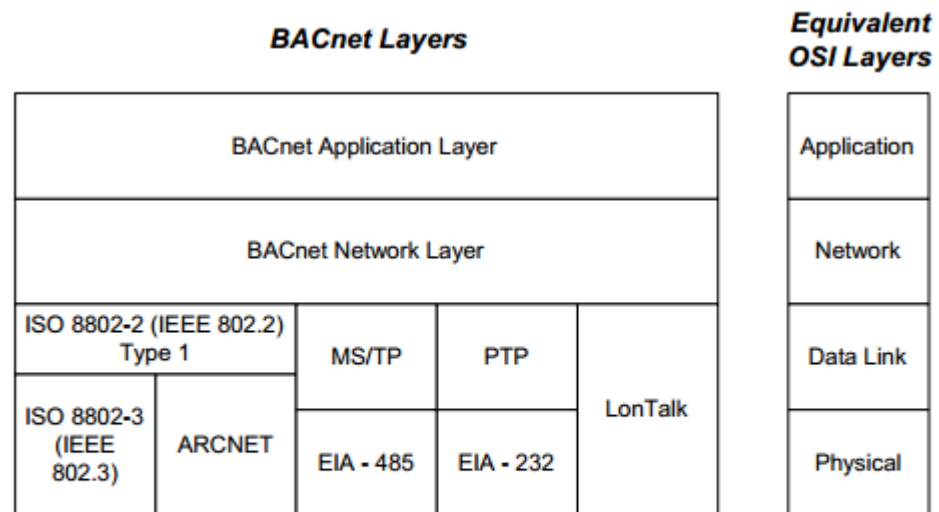
1. They are self healing
2. They can discover new devices
3. They ensure each device gets its chance
4. They avoid collisions, making network performance (somewhat) deterministic

A disadvantage of the token system is that any one device gets a limited use of the bandwidth. Thus, a device may need to keep an internal queue of application layer messages it wants to send, waiting to use the token. We have encountered some vendor systems which fill their queue and then drop subsequent messages without notifying the user of the problem. Limited access, combined with the overhead, makes it easy to use up all the bandwidth on the network if there are many devices with many objects and many properties of interest.

طبعا كلنا فاكرين مكونات نظام الداتا الذى كان يتكون من ٧ طبقات



طبعا مثل هذه الطبقات فى نظام الشبكات قاموا بعمل طبقات جديده لنظام مراقبة المباني



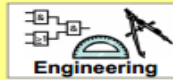
[adapted from Fig 4-2, p10 of ASHRAE Standard 135-1995.]

Figure 1: BACnet Collapsed Architecture

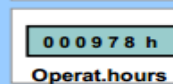
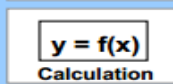
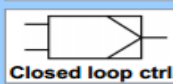
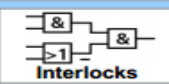
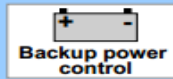
Operator functions



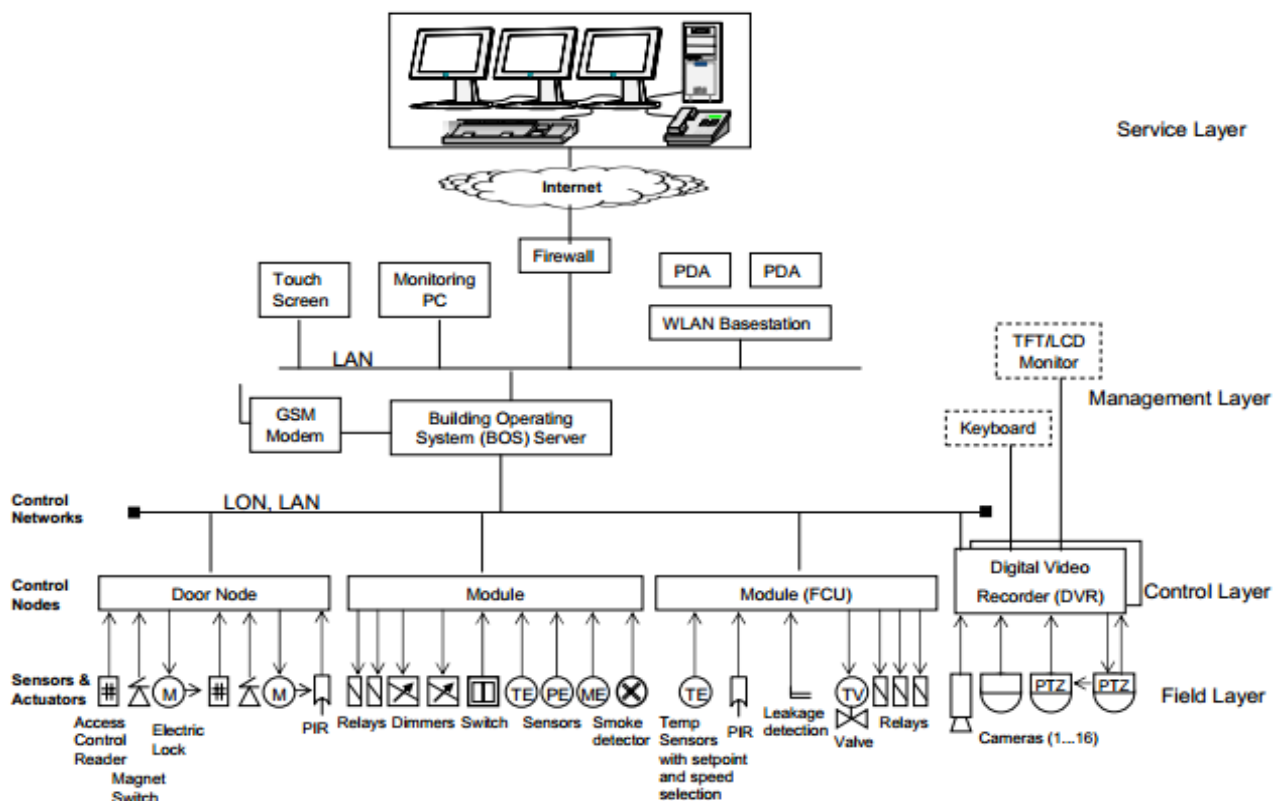
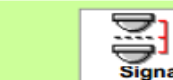
Management functions

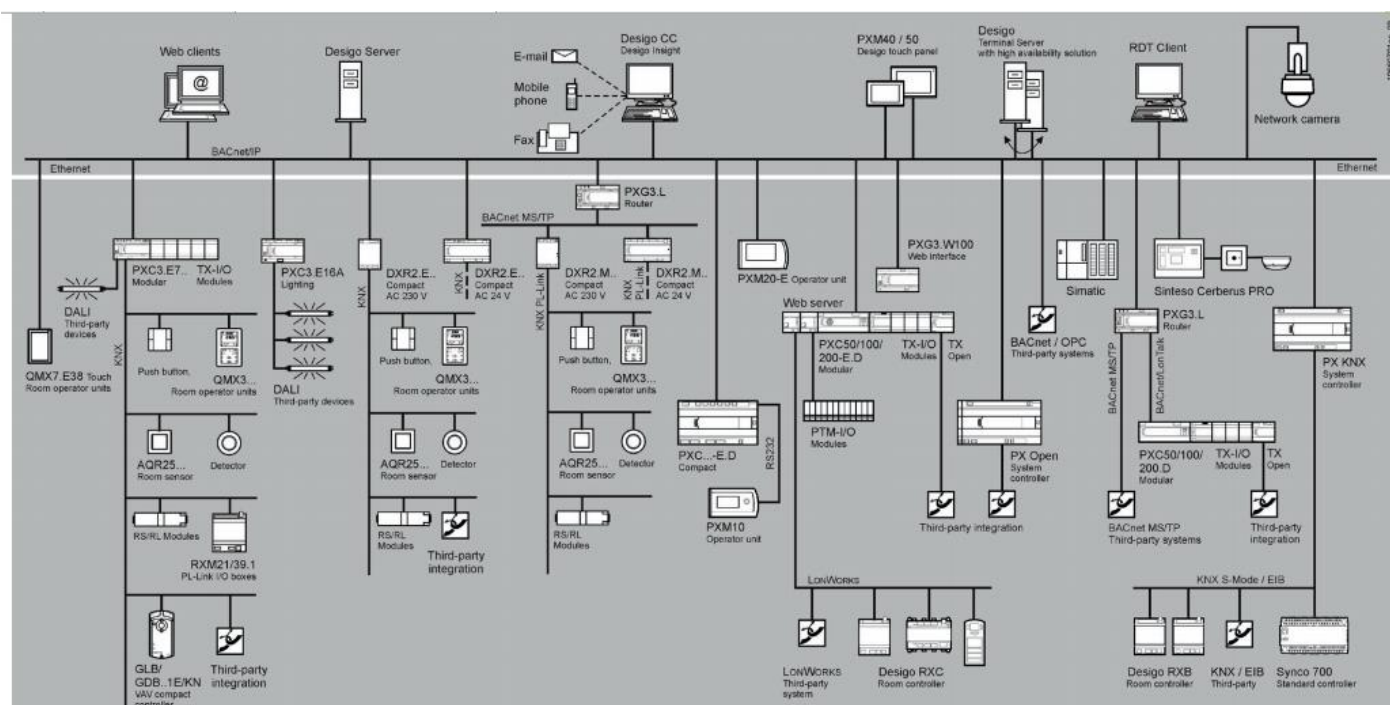


Processing functions



I/O functions (field devices)



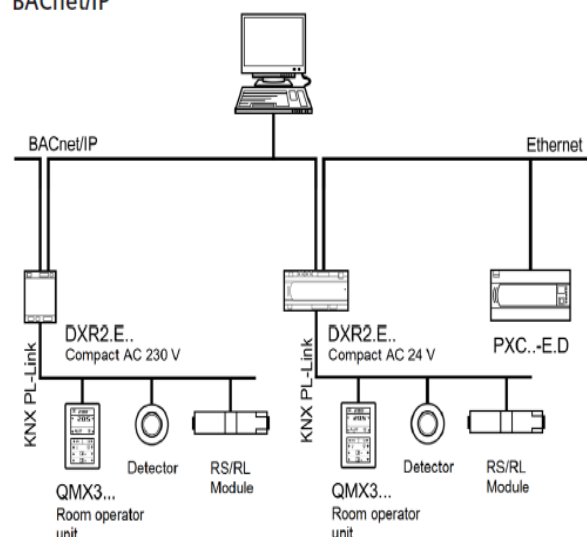


What is the difference between BACnet ,KNX&LON?

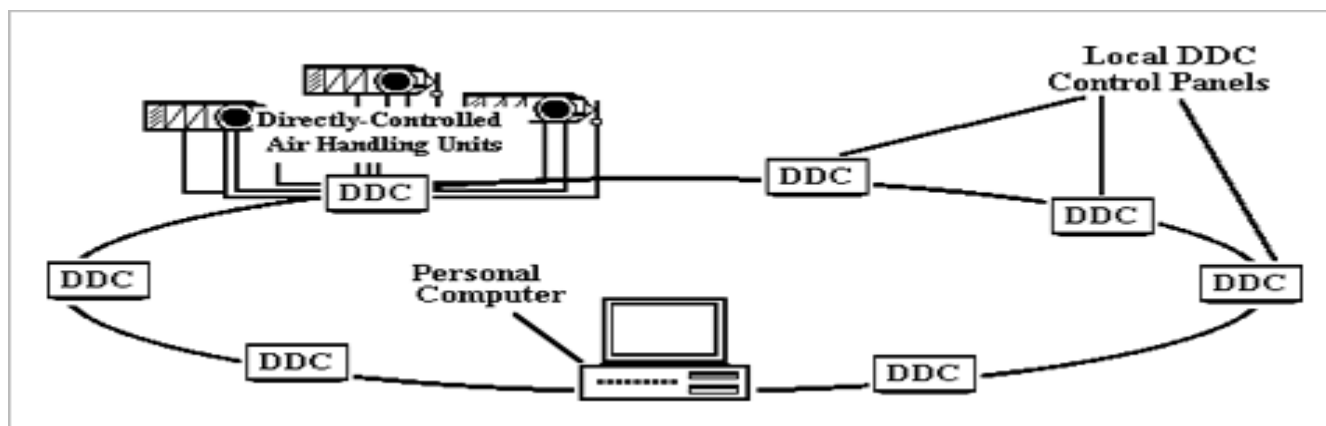
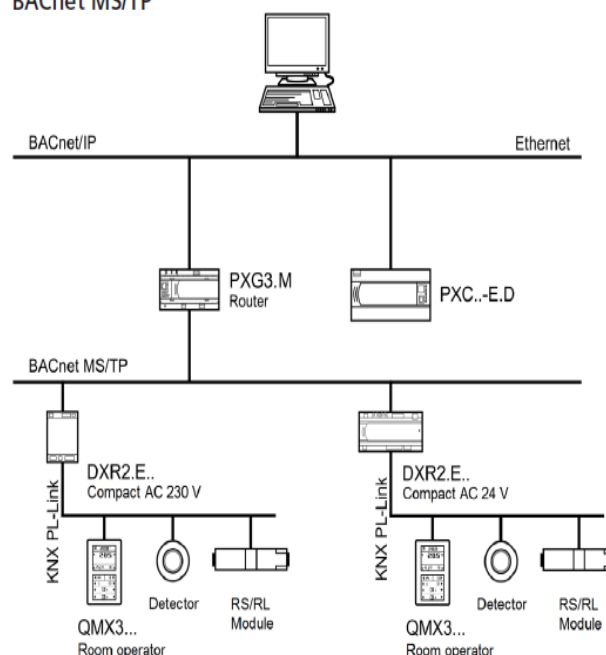
Product range	Desigo Total Room Automation (BACnet) 		Desigo Room Automation (KNX)	Desigo Room Automation (Lon)
Communication (Backbone)	BACnet/IP	BACnet MS/TP	KNX	Lon
Communication with Sensors/Actuators in room (Integrations)	KNX Dali		KNX	
System integration / *System functions	PXC...-E.D	PXG3.L PXC...-E.D	PXC001-E.D	PXC...-E.D
Modular controller I/Os	PXC3.E.. TXM			
Compact controller	DXR2.E..	DXR2.M..	RXB.. RDG.. RDF.. RDU..	RXC..
Thermostats				
Communication with room units	KNX PL-Link	KNX PL-Link	PPS2	PPS2 Lon
Room units	QMX3..	QMX3..	QAX..	QAX..
Touch screen	**QMX7..			

Topology for configurable room automation stations

BACnet/IP



BACnet MS/TP



الغرض من منظومة المراقبة و التحكم فى المباني ؟

المراقبة والتحكم مركزياً في كل الأجهزة المعنية في مبنى أو مجموعة مبانٍ فالمساحات الكبيرة وعدد الطوابق الكبير وتنوع الاستعمالات في المباني الحديثة مما يجعل من الصعب مراقبة جميع الفراغات والطوابق

التحكم مركزياً في كل الأجهزة المعنية في المبنى، العدد الكبير للتجهيزات الكهربائية والميكانيكية في المبنى الواحد من أجهزة تكييف وإنارة ومساعد ومولدات كهرباء جعل من الصعب تشغيل وصيانة ومراقبة أداء هذه التجهيزات ومعرفة ما إذا كانت هذه التجهيزات في حالة عمل أو عطل أو أنها تقوم بالوظيفة المنوطة بها بما يتناسب مع الطاقة المصروفة على تشغيل هذه التجهيزات

خفض استهلاك الطاقة، الارتفاع الكبير في أسعار الطاقة جعل من الضروري ضبط تشغيل التجهيزات والإدارة ضمن المبنى لخفض الاستهلاك والاستفادة القصوى من الطاقة المستهلكة حيث تبين من خلال الدراسات أن ٤٠ % من الطاقة المستهلكة تذهب هدرا دون الاستفادة منها

WHAT IS THE FUNCTION OF BMS SYSTEM?

ماهى وظيفة نظام مراقبة المباني ؟

- Controlling
- Monitoring
- Optimizing
- Reporting

the building's facilities, mechanical, and electrical equipment for comfort, safety, and efficiency.

A BMS normally comprises

- Power systems
- Electric power control system
- Heating, Ventilation and Air-conditioning HVAC System
- Security and observation system
- Magnetic card and access system
- Fire alarm system
- Lifts, elevators etc.
- Plumbing system
- Burglar alarms, CCTV
- Trace Heating
- Other engineering systems
- Home Automation System
- Fire alarm and Safety system
- Manage the sensors of alarm

المجالات التي يمكن أن نراقب ونتحكم بها من خلال ادارة المباني

(HVAC) التحكم بالتكييف والتبريد والتهوية

إدارة الإنارة

التحكم بالمضخات والمحركات

البوابات والمصاعد والسيور المتحركة

الإنذار عن الحريق وأنظمة التحكم بإطفاءه

أنظمة الأمان والحماية من السرقة

(CCTV) كاميرات المراقبة

(Access control) التحكم بالدخول للمبنى

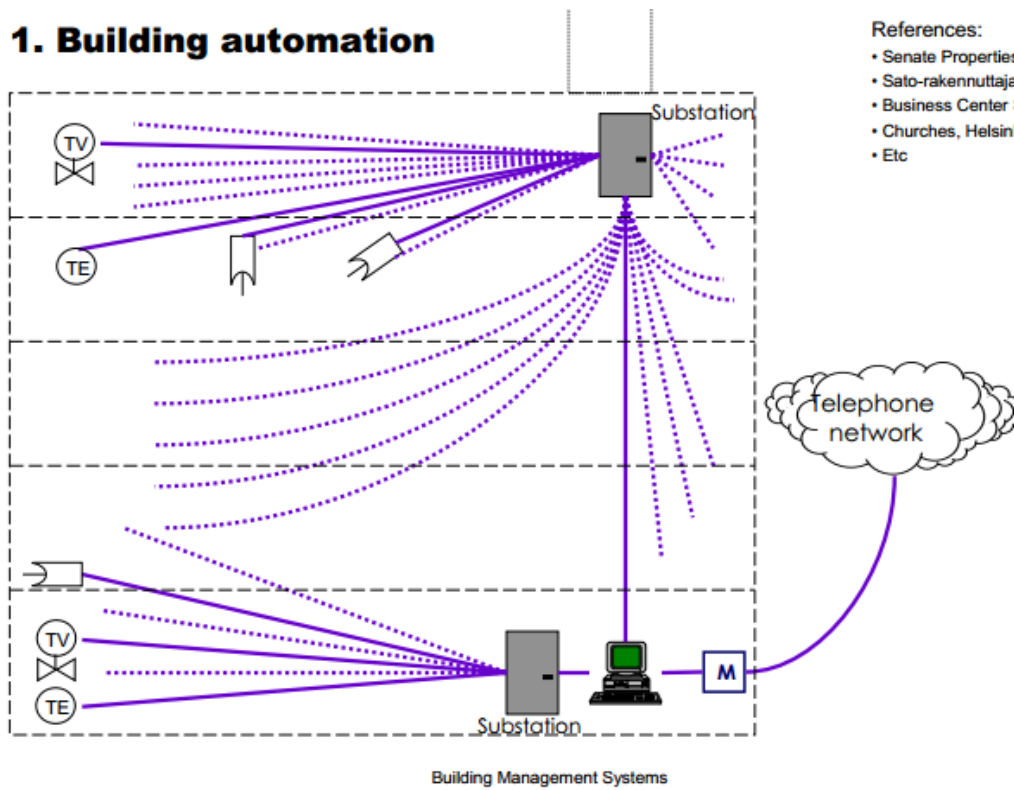
مراقبة والتحكم بالمولدات والشبكة واللوحات الرئيسية

أنظمة الصوتيات

انابيب المياه

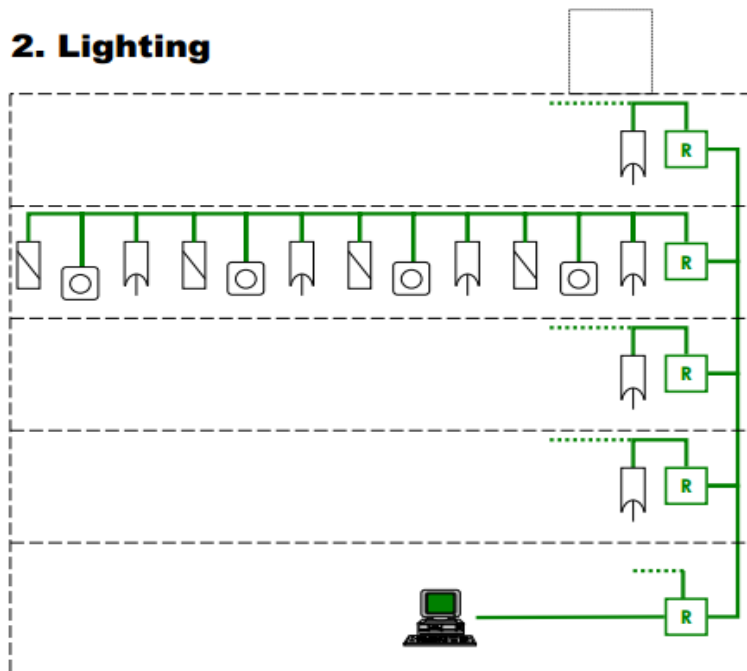
نظام فوترة الكهرباء المستهلكة

1. Building automation

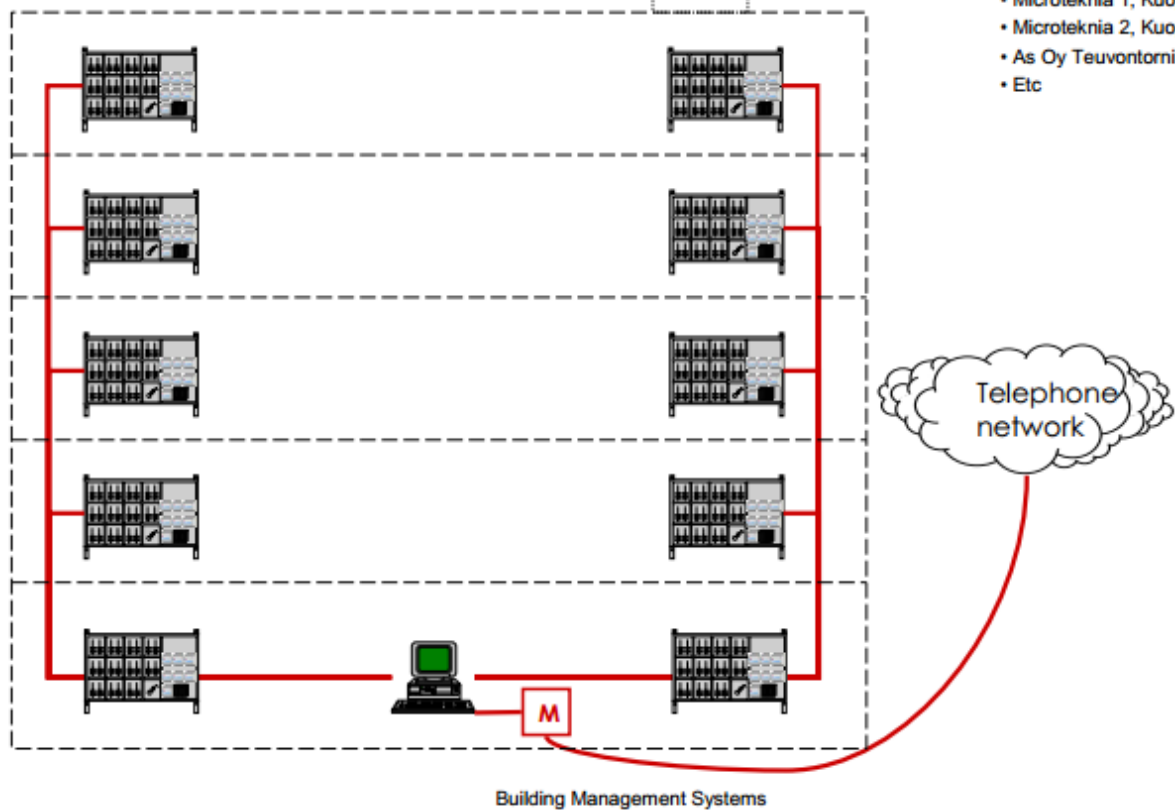


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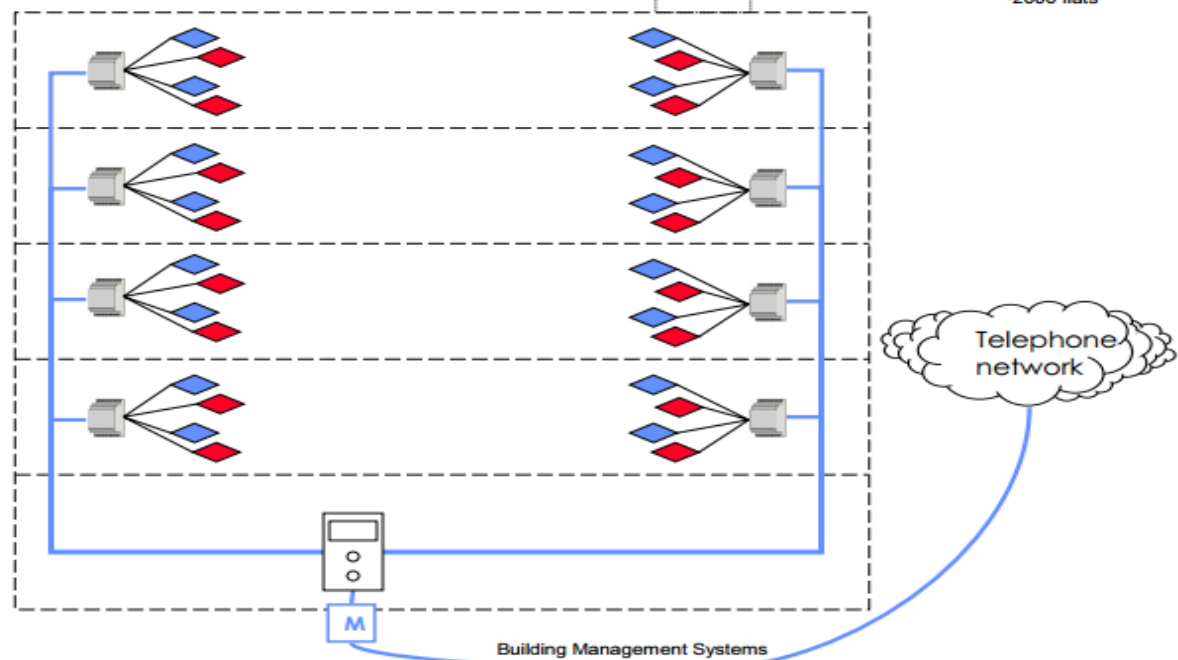
2. Lighting



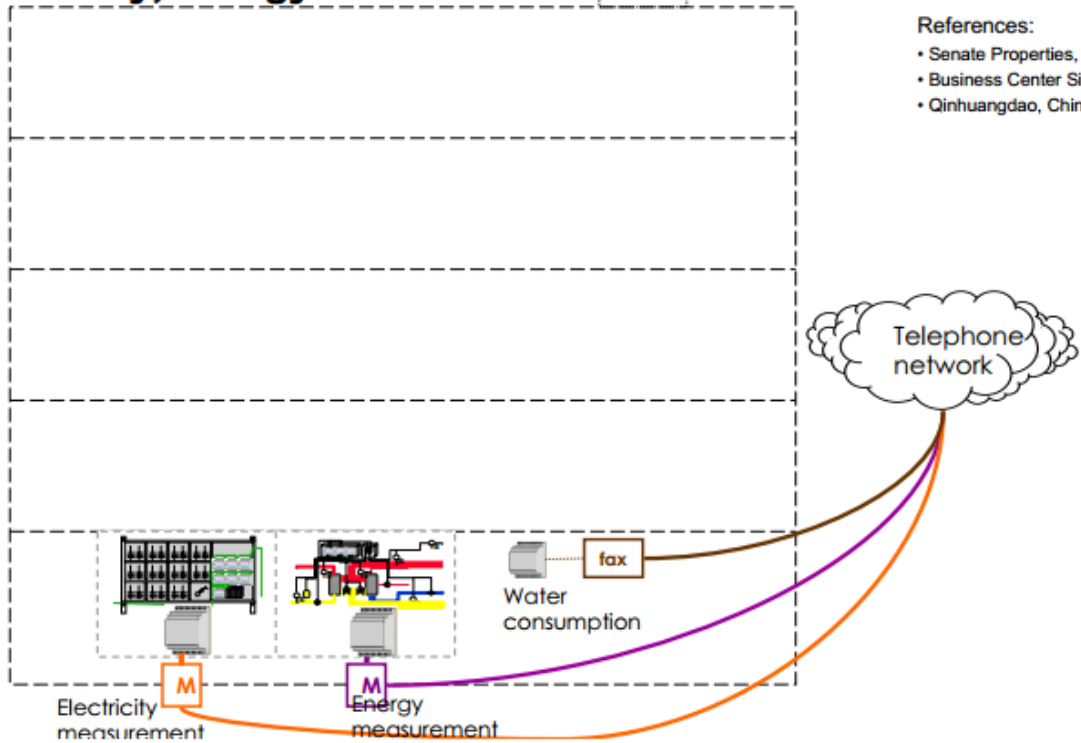
3. Electricity measurement per area



4. Water measurement per area

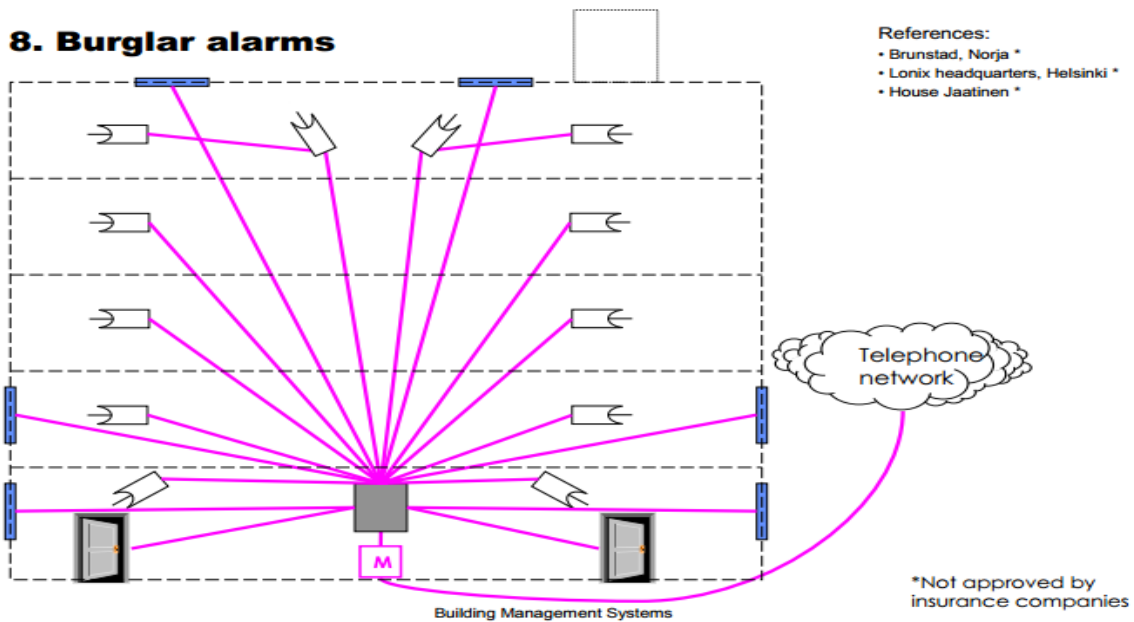


5.-7. Facility consumption measurements of electricity, energy and water



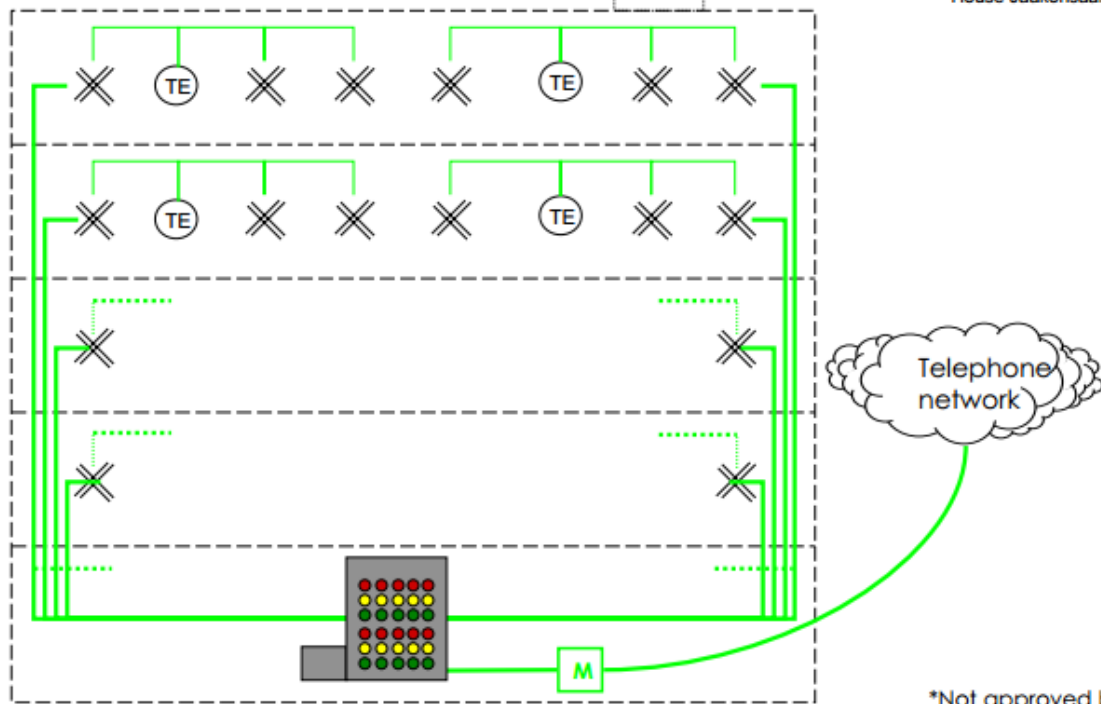
8

8. Burglar alarms



9

9. Fire alarms



References:

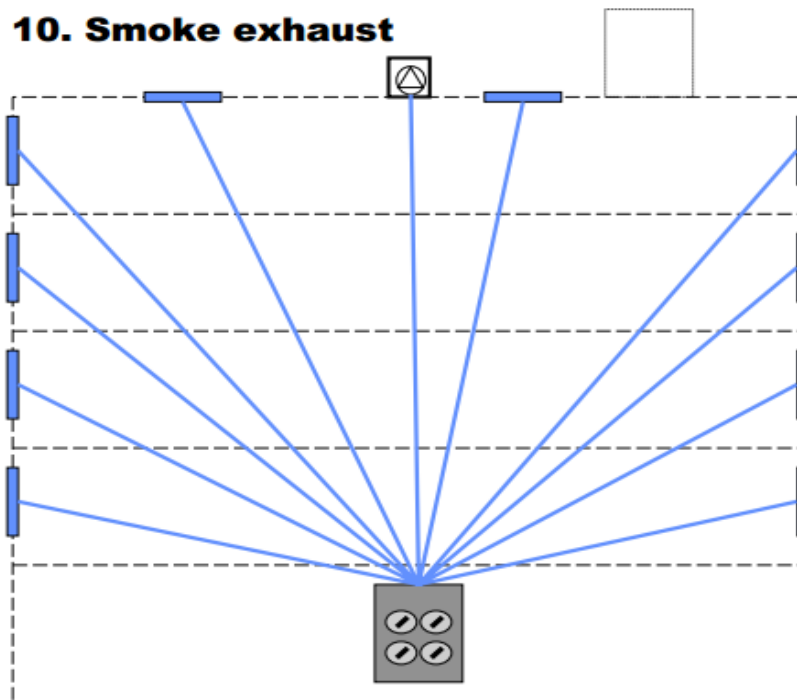
- Lonix headquarters, Helsinki *
- House Jaakonsaari *

*Not approved by authorities

Building Management Systems

10

10. Smoke exhaust

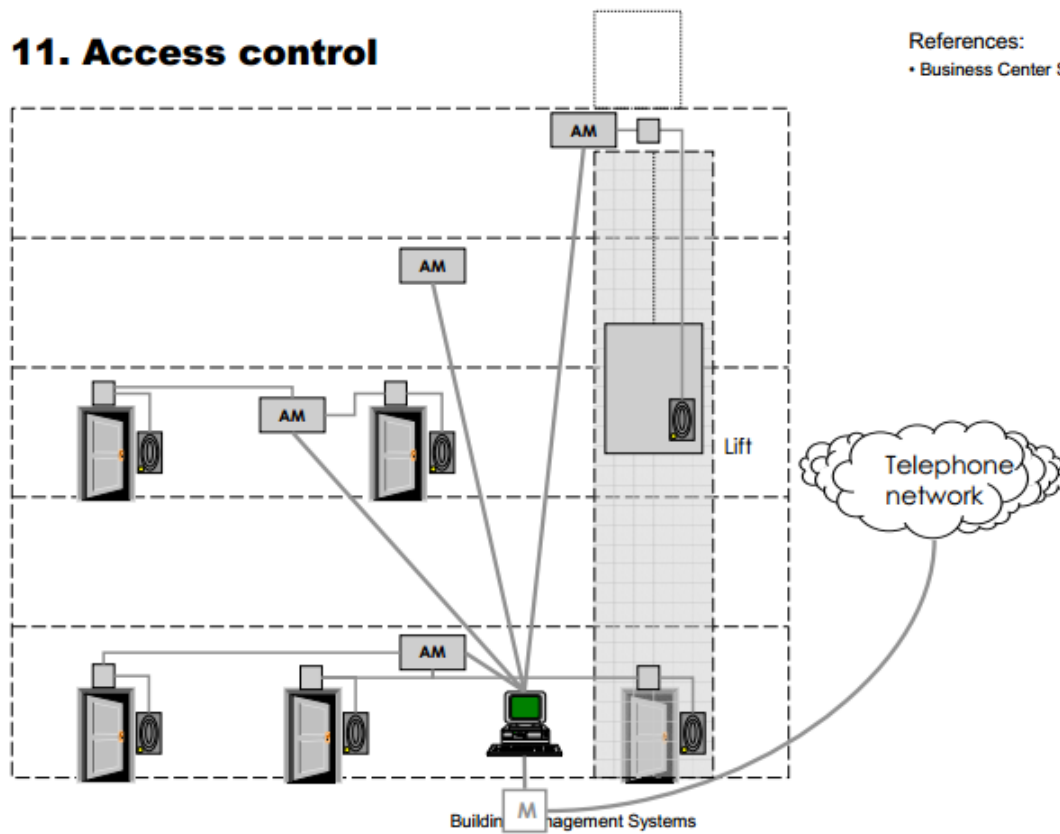


Building Management Systems

11

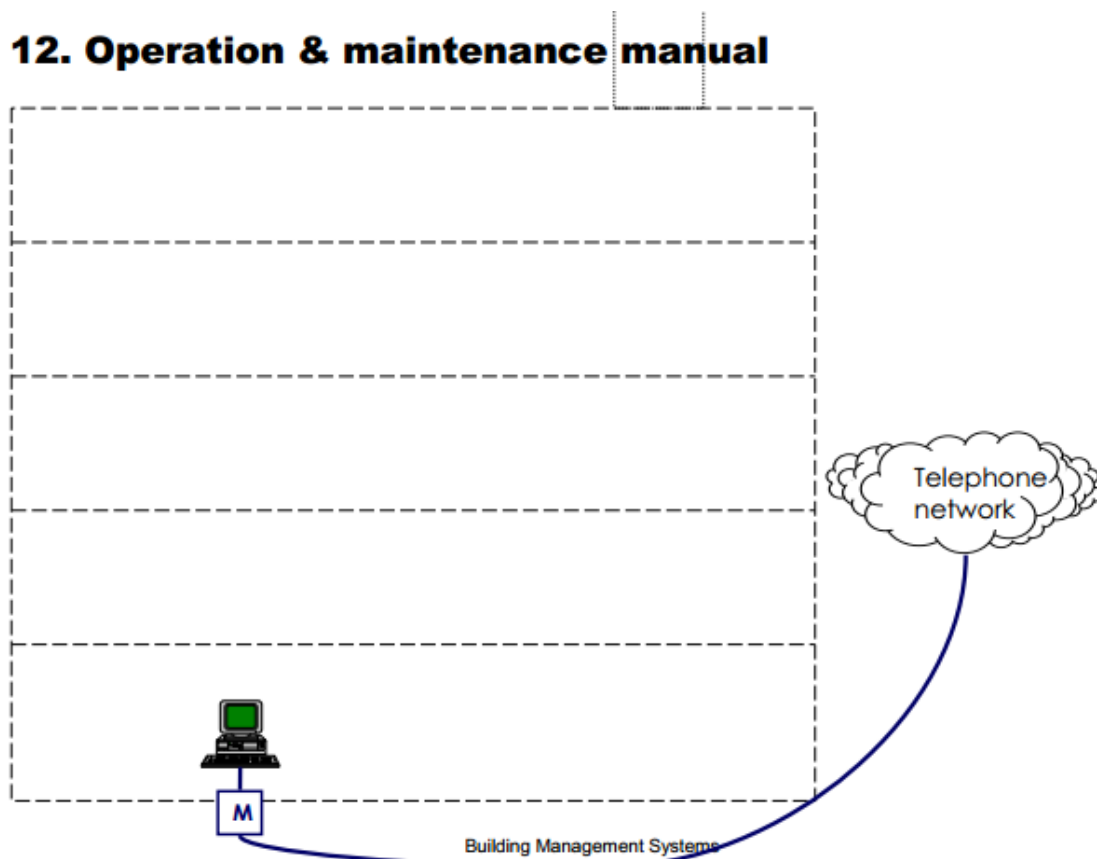
11. Access control

References:
• Business Center Sinihelmi



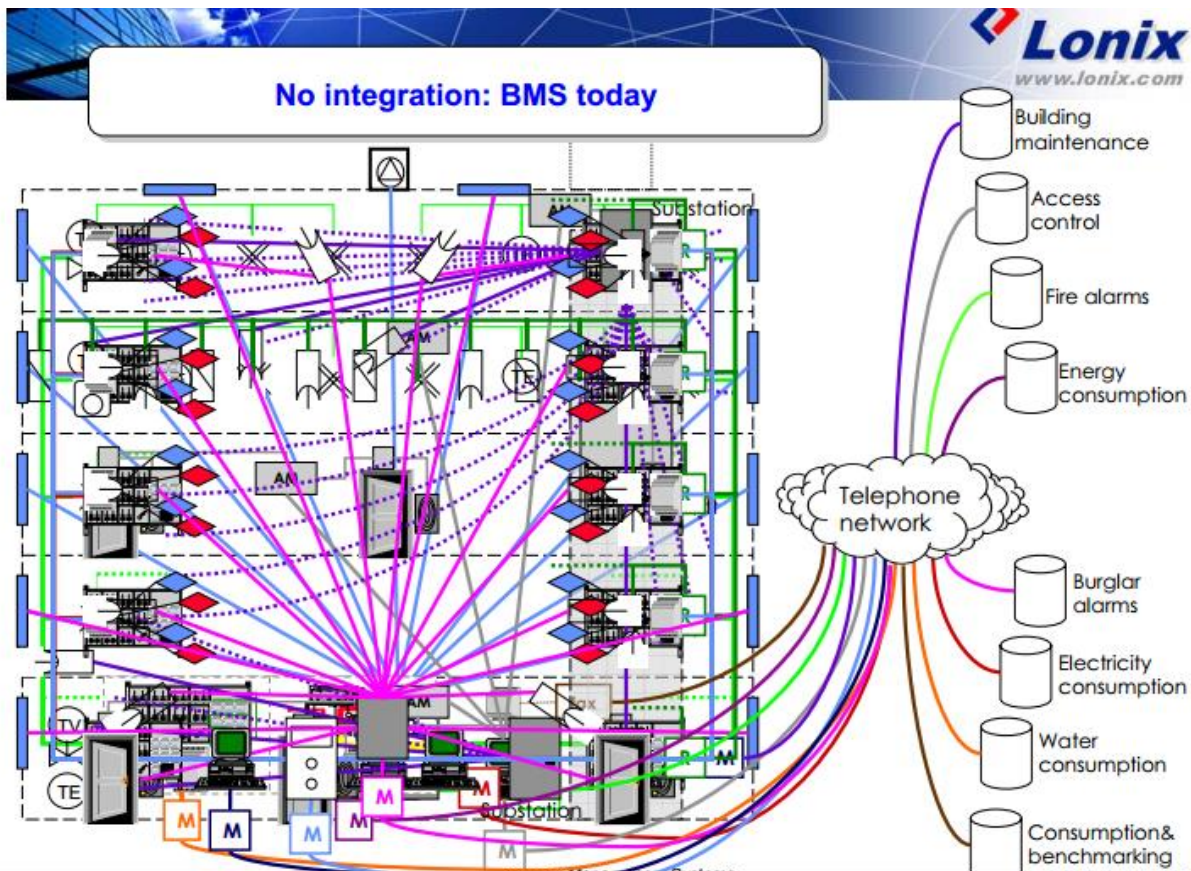
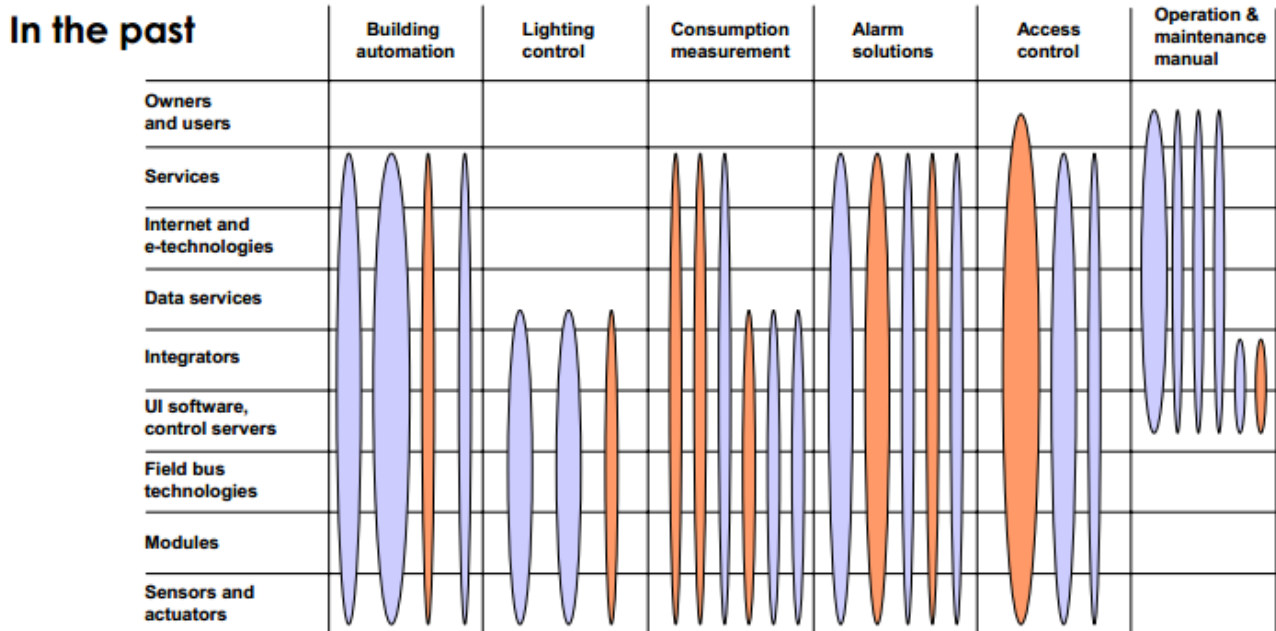
12

12. Operation & maintenance manual



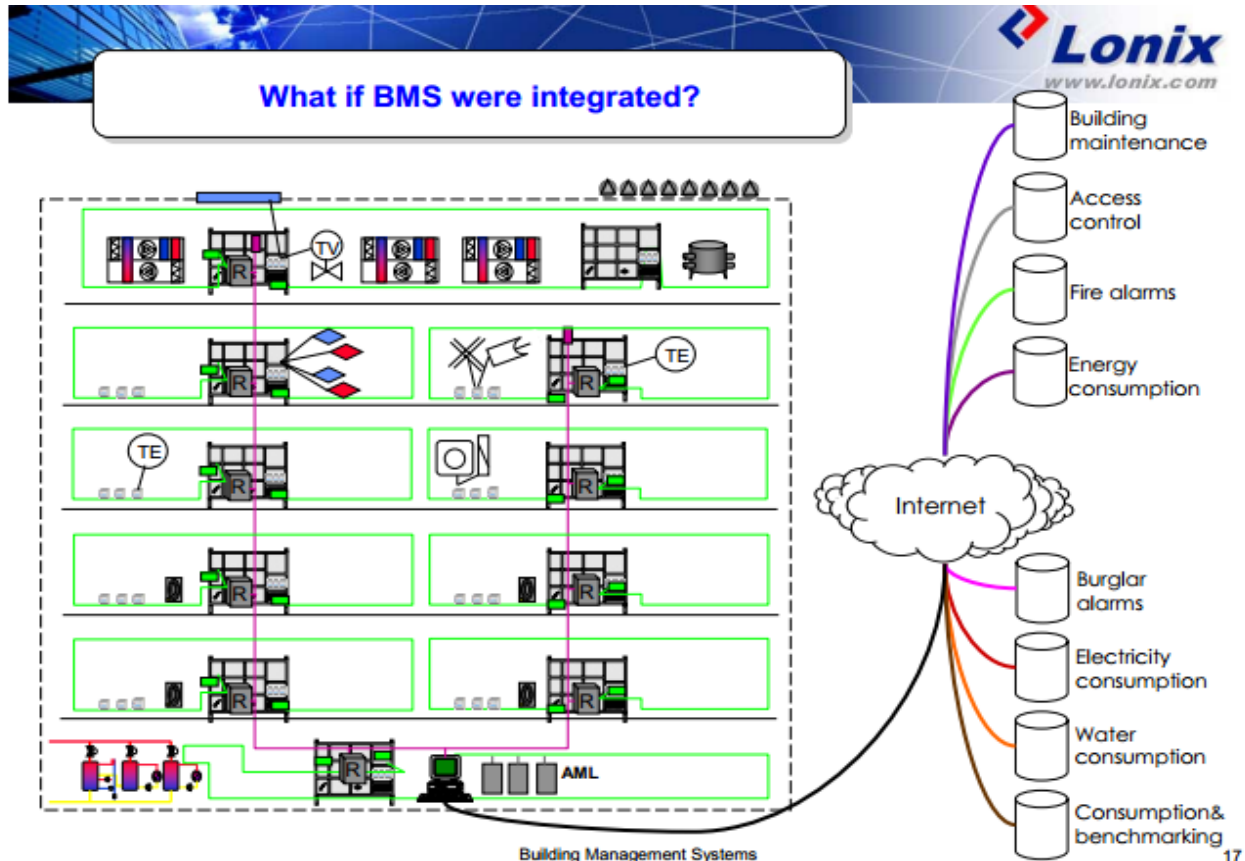
13

Building management system market: from vertical to horizontal



Building management system market: from vertical to horizontal

Today	Building automation	Lighting control	Consumption measurement	Alarm solutions	Access control	Operation & maintenance manual
Owners and users						
Services	ISS ABB SOL	VTT		Securitas		ISS ABB SOL
Internet and e-technologies	XML, Solid FE TCP/IP					
Data services	Elisa					
Integrators	ABB ARE			Securitas		ABB NCC YIT
UI software, control servers	Citect			Timecon		Airix Granlund
Field bus technologies	Bacnet Modbus	Dali EIB	LON M-bus		nn	
Modules				nn	Securitas	
Sensors and actuators	Produal Belimo	Releco Strömfors	Suve		KABA Idesco	



DDC COMPONENTS

مكونات لوحة تحكم ومراقبة المباني

1-WEB INTERFACE BACnet \IP to Desigo touch panel

PXG3-W.100

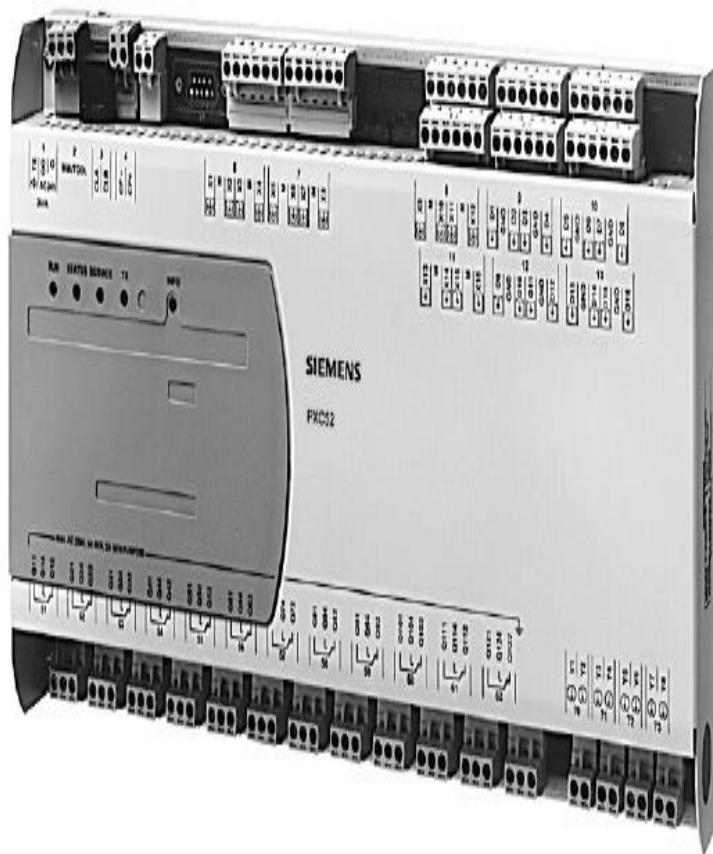
وهو مثل الراوتر يقوم بتحويل نظام

BACnet MS/TP to BACnet IP

PXG3.W100



Data sheet	N9294
Operating voltage	AC 24 V DC 24 V
Frequency	50/60 Hz
Degree of protection	IP20
Dimensions (W x H x D)	162 x 109 x 77.5 mm



PXC52

Desigo™ PX

**Automation stations
compact model**

PXC52



DESIGO™ PX

BACnet Router for LON® – Ethernet/IP

PXG80-N

-
- BACnet Router for LON – Ethernet/IP
 - BBMD BACnet Broadcast Management Device
 - Communication statistics
 - BACnet device object
 - Connection for tool and MMI

2-Control Module (Main Processor)

وهو عقل المنظومة و منه أنواع تتحمل ٥٢ نقطة أو ١٠٠ نقطة أو ٢٠٠ نقطة

AUTOMATION CONTROLLER

Automation functions Overview and selection tools Overview of product details

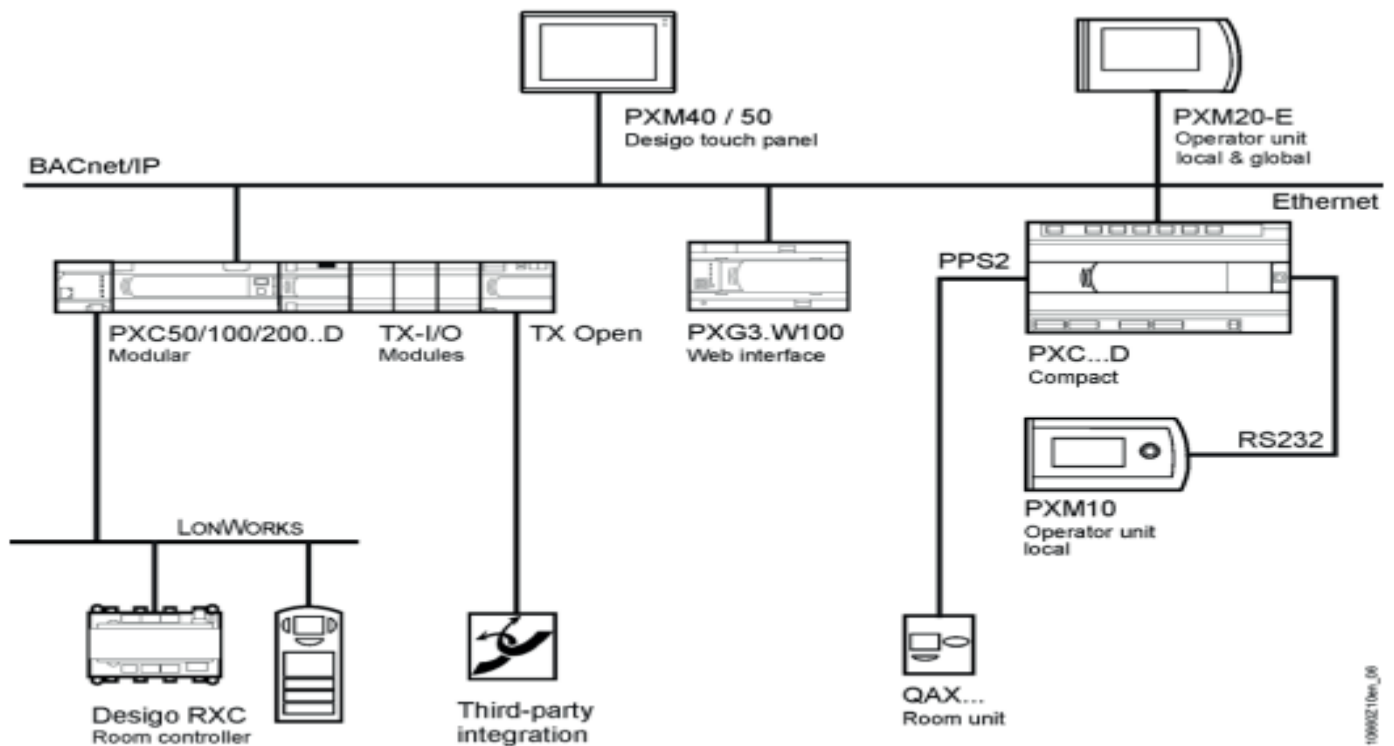
Overview of modular PX automation stations and PX system controllers

	PX Automation station series		PX System controllers	
	modular PXC50/100/200..D	compact PXC12/22/36..D	PXC00..D	PXC001..D
Alarms	■	■	■	■
Time schedules	■	■	■	■
Trend	■	■	■	■
Programming with D-MAP	■	■	■	■
Inputs / Outputs	I/O Module TXM1..	onboard		
Subsystem via Island bus	TX Open			
Subsystem	LonWorks via PXX-Lxx I/O Module PTM.. via PXX-PBUS		LonWorks via PXX-Lxx	Modbus, M-Bus, KNX, ...
Operating / Web				
Web Interface	■	■	■	■
Touch Panel PXM50	■	■	■	■
Touch Panel PXM40	■	■	■	■
PXM20	■	■	■	■
PXM10	■	■		
QAX3x		■		

3

Overview of inputs and outputs of compact PXC... automation stations

BACnet / LONTALK	PXC12.D	PXC22.D	PXC36.D
BACnet / IP	PXC12-E.D	PXC22-E.D	PXC36-E.D
Number of I/Os complete	12	22	36
Universal inputs outputs, number	8	18	24
Digital inputs, number	2	0	4
Digital outputs, number	2	6	8



10000210en_06

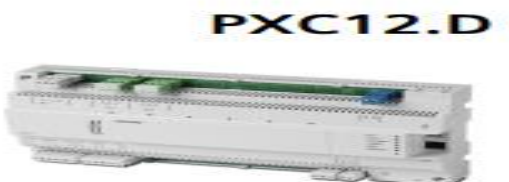
TYPES OF AUTOMATION COMPONENTS

1-PXC-D (AUTOMATION COMPONENTS SERIES)



Data sheet	N9215
Communication	Bus: BACnet / LonTalk, PTP (point to point) or IP Room unit: PPS2
Universal inputs/outputs	Configurable software
Digital input, contact query	7 mA DC 20...25 V
Relay outputs	Monostable, changeover contact

2-PXC-12.D (12 DATA POINT AND BACnet ON lontalk)



Data sheet	N9215
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	24 VA
Communication	Bus: BACnet on LonTalk Room unit: PPS2
Universal inputs/outputs, number	8
Digital inputs, number	2
Digital outputs, number	2
Dimensions (W x H x D)	272 x 150 x 62 mm

3- PXC-12.E.D (12 DATA POINT AND BACnet ON IP)

PXC12-E.D



Data sheet	N9215
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	24 VA
Communication	Bus: BACnet on IP Room unit: PPS2
Universal inputs/outputs, number	8
Digital inputs, number	2
Digital outputs, number	2
Dimensions (W x H x D)	272 x 150 x 62 mm

4-PXC-22.D (22 DATA POINT AND BACnet ON Iontalk)

PXC22.D



Fixed data point mix for 22 physical data points per automation station.

Data sheet	N9215
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	26 VA
Communication	Bus: BACnet on LonTalk Room unit: PPS2
Universal inputs/outputs, number	16
Digital outputs, number	6
Dimensions (W x H x D)	272 x 150 x 62 mm

4- PXC-22.E.D (22 DATA POINT AND BACnet ON IP)

PXC22-E.D



Data sheet	N9215
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	26 VA
Communication	Bus: BACnet on IP Room unit: PPS2
Universal inputs/outputs, number	16
Digital outputs, number	6
Dimensions (W x H x D)	272 x 150 x 62 mm

5-PXC-36.D (36 DATA POINT AND BACnet ON Iontalk)

PXC36.D



Fixed data point mix for 36 physical data points per automation station.

Data sheet	N9215
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	35 VA
Communication	Bus: BACnet on LonTalk Room unit: PPS2
Universal inputs/outputs, number	24
Digital inputs, number	4
Digital outputs, number	8
Dimensions (W x H x D)	293 x 176 x 77 mm

6- PXC-36.E.D (36 DATA POINT AND BACnet ON IP)

PXC36-E.D



Fixed data point mix for 36 physical data points per automation station.

Data sheet	N9215
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	35 VA
Communication	Bus: BACnet / IP Room unit: PPS2
Universal inputs/outputs, number	24
Digital inputs, number	4
Digital outputs, number	8
Dimensions (W x H x D)	293 x 176 x 77 mm

7-PXC-50.D/PXC-100.D/ PXC-100.D

MANAGEMENT FUNCTION SAME (ALARM MANGMENT, TIME SCHUDLE, REMOTE MANGMENTELC)

PXC50..D/PXC100..D/ PXC200..D



Range overview PXC50..D/PXC100..D/PXC200..D

Product Title	Communication	Data sheet	Stock No.	Product No.
Automation station BACnet/Lon-Talk, with up to 52 data points	Bus: BACnet / LonTalk	N9222	S55372-C109	PXC50.D
Automation station BACnet/IP, with up to 52 data points	Bus: BACnet / IP	N9222	S55372-C110	PXC50-E.D
Automation station BACnet/Lon-Talk, with up to 200 data points	Bus: BACnet / LonTalk	N9222	BPZ:PXC100.D	PXC100.D
Automation station BACnet/IP, with up to 200 data points	Bus: BACnet / IP	N9222	BPZ:PXC100-E.D	PXC100-E.D
Automation station BACnet/Lon-Talk, with more than 200 data points	Bus: BACnet / LonTalk	N9222	BPZ:PXC200.D	PXC200.D
Automation station BACnet/IP, with more than 200 data points	Bus: BACnet / IP	N9222	BPZ:PXC200-E.D	PXC200-E.D

Range overview PXC001..D/ PXC00..D

Product Title	Communication	Data sheet	Stock No.	Product No.
System controller for the integration of KNX, M-Bus, Modbus or SCL over BACnet/LonTalk	Bus: BACnet / LonTalk	N9223	S55372-C113	PXC001.D
System controller for the integration of KNX, M-Bus, Modbus or SCL over BACnet/IP	Bus: BACnet / IP	N9223	S55372-C114	PXC001-E.D
System controller BACnet/Lon-Talk	Bus: BACnet / LonTalk	N9222	BPZ:PXC00.D	PXC00.D
System controller BACnet/IP	Bus: BACnet / IP	N9222	BPZ:PXC00-E.D	PXC00-E.D

AUTOMATION CONTROL STATION?

1-PXC – NRU

A- PXC – NRUF



Data sheet	N9760
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	26 VA
Communication	Bus: BACnet / LonTalk Bus: BACnet / PTP (point to point) Room unit: PPS2
Dimensions (W x H x D)	265 x 295 x 100 mm
Universal inputs, number	16
Universal outputs, number	8
Digital inputs, number	24
Digital outputs, number	16

2-1-PXC – NRUD

PXC-NRUD



Data sheet	N9761
Operating voltage	AC 24 V
Frequency	50/60 Hz
Power consumption	18 VA
Communication	Bus: TX-I/O island bus to TXB1.PBUS
Universal inputs, number	16
Universal outputs, number	16
Digital inputs, number	8
Digital outputs, number	8

3-Power Supply Unit (PSU)

ACCESSORIES DESIGO TX-I\O

TXA1.IBE



Island bus expansion module for decentralized sub-islands with TX-I/O-modules

- Expand island bus to a distance of up to 2 x 200 meters
- Compact design per DIN 43 880, requires little space
- With LED to monitor communication status
- Easy installation and setup:
 - Mounted on standard rails
 - Self-connecting bus (island bus) for the easiest possible installation
 - Plug-in screw terminals for island bus expansion
 - No programming / parameterization tool required

TXS1.12F10



TX-I/O Power Supply Modules 24 VDC Supply 1200 mA, 10 A Fuse

Up to 4 power supply modules can be operated in parallel
AC 24 Volt input

Generation / transfer of DC 24 V, 1.2A for the supply of TX-I/O modules and field devices
Fresh provision of AC 24 V for field device supply
Transfer of the bus signal

TXS1.EF10



BUS Connection Module, 10A Fuse

Transfer of DC 24 V for the supply of TX-I/O modules and field devices
Fresh provision of AC / DC 12 ... 24 V for field device supply
Transfer of the bus signal

Data sheet

N8183

Dimensions (W x H x D)

32 x 77.5 x 98 mm

Weight

0.082 kg

4-Digital Modules

AUTOMATION CONTROL

INPUT MODULE

TXM-1

TXM-1 – 8D

يتحمل ٨ نقط مراقبه

TXM1.8D



8 Digital Input Module

8 digital input, signaling per input with three-colored LED (green, yellow, red), without local operation.

8 DI, individually configurable as:

- Message signal
- Message impulse with storage functions
- Counter impulse for up to a maximum of 10 Hertz

TXM-1 – 16D

يتحمل ١٦ نقط مراقبه

TXM1.16D



16 Digital Input Module

16 digital input, signaling per input with green LED, without local operation.

16 DI, individually configurable as:

- Message signal
- Message impulse with storage functions
- 8 inputs as counter impulse for up to a maximum of 10 Hertz

5-Analogue Modules

8 Universal I/O Module

8 inputs/outputs signaled with green LED, without local operation

8 universal I/O points, individually configurable as:

- DI: Message signal, message impulse or counter impulse (25 Hertz)
- AI: Temperature sensor or DC 0...10 V
- AO: DC 0...10 V

TXM1.8U



8 Universal I/O Module, Override and LCD

8 inputs/outputs signaled with green LED, with local operation as per ISO 16484 with LCD signal display.

8 universal I/O points, individually configurable as:

- DI: Message signal, message impulse or counter impulse (25 Hertz)
- AI: Temperature sensor or DC 0...10 V
- AO: DC 0...10 V

TXM1.8U-ML



وهو يتحمل ٨ نقط

6-OUTPUT MODULE

هو الذى يقوم باعطاء اوامر

1- (RELAY OUTPUT MODULE BISTABLE)

6 Relay output module, bistable

6 outputs signaled with green LED, without local operation.

6 DO (voltage-free, bistable), individually configurable as:

- Switching of fluorescent lamps (number of ballasts see data sheet)
- Configurable behavior in case of power failure and bus failure
- Max. inrush current 800 A (20 μ s), 165 A (20 ms)
- Switching voltage AC 24...277 V
- Switching current max. 10 A ($\cos \phi = 0.8$)

TXM1.6RL



2- (RELAY OUTPUT MODULE)

6 Relay output module

6 outputs signaled with green LED, without local operation.

6 DO (relay switch), individually configurable as:

- Continuous or impulse contact
- Single-stage or multi-stage
- Three-point positioning output with internal stroke model
- Switching voltage AC 12...250 V / DC 12...30 V
- Switching current max. 4 A

Hardware bolting device is by means of external wiring the two-way contacts.

TXM1.6R



3- (RELAY OUTPUT OVERRIDE)

TXM1.6R-M



6 Relay output module with Override

6 outputs, signaling per output with three-colored LED (green, yellow, red), with local operation as per ISO 16484.

6 DO (relay switch), individually configurable as:

- Continuous or impulse contact
- Single-stage or multi-stage
- Three-point positioning output with internal stroke model
- Switching voltage AC 12...250 V / DC 12...30 V
- Switching current max. 4 A

Hardware bolting device is by means of external wiring the two-way contacts.

Overview I/O module TXM1..

							
Product	TXM1.8D	TXM1.16D	TXM1.8U	TXM1.6R	TXM1.6RL	TXM1.8RB	TXM1.8T
Number of Input/Output	8	16	8	6	6	8	8
Functionality							
3-colored I/O status LED	■						
Green colored I/O status LED		■	■	■	■	■	■
Digital inputs (DI)							
Message signal (open/closer)	■	■	■				
Message impulse	■	■	■				
Counter 25 Hz (Bouncer free)		■ ¹⁾	■				
Analog inputs (AI)							
LG-Ni1000			■				
Pt1000 / 0...2500 Ohm			■				
T1			■				
DC 0...10V			■				
Analog outputs (AO)							
DC 0...10V			■				
Digital outputs (DO)							
Continuous contact on/off				■			■
Continuous contact 3-stage				■			
3-point output (stroke model)				■			■
Impulse on/off				■			
Impulse				■			
Impulse 3-stage				■			
Bistable contact					■		
Contact for control of blinds						■	

3

Overview TX-IO™ module range TXM1..



Type	TXM1.8D	TXM1.16D	TXM1.8U	TXM1.8U-ML	TXM1.8X	TXM1.8X-ML	TXM1.6R	TXM1.6R-M	TXM1.8P	TXM1.6RL	TXM1.8T
Number of I/Os	8	16	8	8	8	8	6	6	8	6	8
Functionality											
Local operation				■		■		■			
LC-Display				■		■					
3-colored I/O status LED	■							■			
Green colored I/O status LED		■	■	■	■	■	■		■	■	■
Digital Inputs (DI)											
Message signal (open/closer)	■	■	■	■	■	■					
Message impulse	■	■	■	■	■	■					
Counter 10 Hz (with debouncing)	■	1-8 ¹⁾									
Counter 25 Hz (Bouncer free)			■	■	■	■					
Analog Inputs (AI)											
LG-Ni1000			■	■	■	■			■		
Pt 1000 / 0...2500 Ohm			■	■	■	■			■		
T1			■	■	■	■					
DC 0...10V			■	■	■	■			■ ⁴⁾		
4...20 mA / 0...20 mA					■	■			■ ⁴⁾		
Analog outputs (AO)											
DC 0...10 V			■	■	■	■					
4...20 mA					5-8 ²⁾	5-8 ²⁾					
Digital outputs (DO)											
Continuous contact on/off							■	■			
Continuous contact, 3-stage							■	■			
3-stage output							■	■			
Impulse on/off, 3-stage							■	■			
Multistate							■	■			
Triac-continuous contact											■
Triac-impulse (3-stage)											■
Triac pulsewidth-modulated											■
Light control, bistable										■	

All I/O points of a module are configurable on any, implemented functionality. The module TX1.OPEN enables the integration of Modbus, M-bus etc. via RS232 on the PXC50/100/200..D.

¹⁾ On the TXM1.16D the counters are implemented only on the inputs 1 to 8

²⁾ On the TXM1.8X.. the current exists 4...20 mA are implemented only on the I/Os 5 to 8

³⁾ 0...250 Ohm

⁴⁾ Pt100 4-wire

OPERATION AND MONITORING PXM

هو جهاز مراقبه وتحكم يدوى

1-PXM-20(OPERATOR WITH BACnet ON LON)

PXM20



2-PXM-20-E (OPERATOR WITH BACnet ON IP)

PXM20-E



3-PXM-10 (OPERATOR UNIT LOCAL)

PXM10



Types of Controls

ماهو أنواع التحكم المستخدم فى نظام مراقبة المباني ؟

1-Stop Mode

عندها يتم توقف الوحدة عن العمل ومن أمثلة ذلك

1- Close Supply Fan and Return Fan

2- Close Water supply Valves

3- Close Dampers

2-Alarm Mode

وهو عندها يتم عرض الإنذارات

1- إتساخ الفلتر لوحدات المكيفات

Differential Pressure Sensor

2- حالة حريق من خلال

Duct Smoke Detectors

3- إنقطاع سير المروحة من خلال

Differential Pressure Sensor

٤- الحمل الزائد

Overload

3-Fire Mode

بواسطة حساس الحريق لمجاري الهواء لوحدات المكيفات

(Duct Smoke Detector)

يتم الإستشعار بوجود حريق فيتم الآتي

اغلاق مرواح الهواء للمصدر القادم من الخارج

Supply fan will be close and return fan work only

Electric Heater Will be Close

Damper Actuator Will be Close for Fresh Air and water valve

Exhaust Air Damper will be Work 100%

4-General Mode

We will select the Switch to Auto

1-Fresh Damper &Exhaust Damper will be open

**2-Supply and Return Fans will be Works after 1 second
between both and doing Interlock.**

3-Measuring temperature for Supply, Return and Fresh Air

4-Measuring temperature for Chiller Water

What is the Point Will be used for All Systems?

Fire Alarm System

-Monitoring

A-Status

B-Fault and Alarm

C-Fire Alarm

Switch gear

-Monitoring

A- Status

B- Alarm

C-Trip

Transformer

-Monitoring

A- Oil Level

B- Oil Temperature Alarm

Generator

-Monitoring

A- Status

B- Alarm

ATS

-Monitoring

A- Status normal power

B- Status emergency power

-Fault and Alarm Reporting

Breaker 1 trip Alarm

Breaker 2 trip Alarm

Main Distribution Board (MDB)

-Monitoring

Main Breaker Status

-Fault and Alarm Reporting

Main Breaker Trip Alarm

General Distribution Board (GDB)

-Monitoring

Main Breaker Status

-Fault and Alarm Reporting

Main Breaker Trip Alarm

Lighting and Power Distribution Board (LDB/PDB)

-Monitoring

Main Breaker Status

-Fault and Alarm Reporting

Main Breaker Trip Alarm

Low Current System

-Monitoring

Status

Fault and Alarm Reporting

Public Address System

CCTV

PABX System

Master Clock System

Nurse Calling System

Access Control

Data System (MDF-IDF)

Fuel Pumps

Control

Pump Start/Stop Command

Monitoring

Fuel Pump Run Status

Under Ground Fuel Tank Level

Fault and Alarm Reporting

Water Tank

Monitoring

Water Level

Air Handling Unit (AHU), Fan Coil Unit (FCU)

Monitoring&Control

1-Digital

1-Diff Press Sensor for primary filter

2- Diff Press Sensor for Bag filter

3-Electrical Heater

4-Air Flow Switch for Supply Fan

5- Air Flow Switch for Return Fan

6- Diff Press Sensor for Sand filter

2-Analouge

- 1-Duct Hum/Temp Sensor for Fresh Air**
- 2-Valve Damper Actuator for fresh air**
- 3- Valve Damper Actuator for exhaust air**
- 4- Valve Damper Actuator for mixing air**
- 5- Immersion/Temp sensor for Child Water Supply**
- 7- Immersion/Temp sensor for Child Water Return**
- 8- Valve Way Actuator for Return Child Water**
- 9- VFD**
- 10- Duct Temp Sensor for Fresh Air**
- 11- Immersion/Temp sensor for Supply**

Example : PROJET FOR BMS SYSTEM

أولا يجب تكوين جدول به جميع أنواع الأنظمة في المشروع كل دور على حده

FOR BASMENT, GROUND, FIRST, SECOND FLOOR...ELC

MAY BE WE HAVE

- 1-SUBSTATION (Switch gear,Transformer,Generator,UPS,MDB,Fire Fighting Pumps...ELC)**
- 2-General Distribution Board (GDB)**
- 3-Electrical Panels (LDB/PDB1) or (PDB)**
- 4-MDF**
- 5-IDF**
- 6-FACP**
- 7-CCTV, Public Address, Access Control.**
- 8-ELEVATORS**
- 9-AHU**
- 10-CHILLER**
- 11-EXHUST FANS**

BMS SYSTEM-SCHEDULE OF ELECTRICAL ITEMS		
Sl. No	Description	Location
BASEMENT FLOOR		
Electrical Panel Boards		
<u>1</u>	<u>MV Switchgear</u>	<u>Basement Substation Room</u>
<u>2</u>	<u>Transformer</u>	<u>Basement Substation Room</u>
<u>3</u>	<u>Generator</u>	<u>Basement Substation Room</u>
<u>4</u>	<u>MDB</u>	Basement Electrical Room
<u>5</u>	GDB (Normal & Emergency)	Basement Electrical Room
<u>6</u>	LDB/PDB-BS-1 (Normal & Emergency)	Basement Electrical Room
<u>7</u>	Exhaust Fan panel-PDB-5 (Normal)	Basement Electrical Room
Intermediate Distribution Frame (IDF)		
1	MDF	Basement Floor Telecom Room
2	IDF	Basement Floor Telecom Room
Lighting Control		
GROUND FLOOR		
Electrical Panel Boards		
1	LDB/PDB-GF-1 (Normal & Emergency & UPS)	Ground Floor Electrical Room-1
2	LDB/PDB-GF-2 (Normal & Emergency & UPS)	Ground Floor Electrical Room-2
3	LDB/PDB-GF-3 (Normal & Emergency & UPS)	Ground Floor Electrical Room-3
Fire Alarm Control		
1	Fire Alarm Control Panel (FACP)	Ground Floor Telecom Room
Lighting Control		
Intermediate Distribution Frame (IDF)		

1	IDF-2	Ground Floor Telecom Room
FIRST FLOOR		
Electrical Panel Boards		
1	LDB/PDB-FF-1 (Normal & Emergency &UPS)	First Floor Electrical Room-1
2	LDB/PDB-FF-2 (Normal & Emergency &UPS)	First Floor Electrical Room-2
3	LDB/PDB-FF-3 (Normal & Emergency &UPS)	First Floor Electrical Room-3
Intermediate Distribution Frame (IDF)		
1	IDF-3	First Floor Telecom Room-1
2	IDF-4	First Floor Telecom Room-2
Lighting Control		
SECOND FLOOR		
Electrical Panel Boards		
1	LDB/PDB-SF-1 (Normal & Emergency &UPS)	Second Floor Electrical Room-1
2	LDB/PDB-SF-2 (Normal & Emergency &UPS)	Second Floor Electrical Room-2
3	LDB/PDB-SF-3 (Normal & Emergency &UPS)	Second Floor Electrical Room-3
Intermediate Distribution Frame (IDF)		
1	IDF-5	Second Floor Telecom Room-1
2	IDF-6	Second Floor Telecom Room-2
Elevators		
1	Elevator-02 (MRL)	Control Panel in Second Floor
2	Elevator-04 (MRL)	Control Panel in Second Floor
MAIN ROOF		
Electrical Panel Boards		
1	Exhaust Fan panel-PDB-1 (Normal)	Main Roof Machine Room-1
2	Air Conditioning Panel-PDB-2 (Normal)	Main Roof Machine Room-2

3	Air Conditioning Panel-PDB-3 (Normal)	Main Roof Machine Room-2
4	Elevator Panel-PDB-4 (Normal)	Main Roof Machine Room-2
Elevators		
1	Elevator-01	Main Roof Machine Room-1
2	Elevator-03	Main Roof Machine Room-2
3	Toilet and Kitchen Exhaust Fan	Main Roof
4	Car Parking Exhaust Fan	Main Roof
5	Package Unit	Main Roof
6	AHU	Main Roof

VAV QTY

1	VAV for ground floor	48 No's
2	VAV for first floor	63Nos
3	VAV for second floor	30Nos

S#	PART NO.	DESCRIPTION	QTY
1		Building	
2		DDC-RF-1	
3		PDB-ELEV-1	1
4		Status\ CMD	1
5		Alarm	1
6		PDB-PACU-1	1
7		Status\ CMD	1
8		Alarm	1
9		PACU-01 to PACU-8	8
10		On/Off Status	8
11	QAM2120.040	Supply Air Duct Temperature	8
12		EF.Fan-01 to EF.Fan-08	8
13		Exhaust Fan Start/Stop Command	8
14		Exhaust Fan Run Status	8
15		Exhaust Fan Trip Alarm	8
16		Exhaust Fan A/O/H Status	8
17	QBM81-5	Exhaust Fan Air Flow Status	8
18	PXC100.D	BACnet Controller	1
19	TXM1.6R	Output Module	4
20	TXM1.16D	Input Module	4
21	TXM1.8U	Universal Module	2
22	TXS1.12F10	Power Supply	1
23	TXS1.EF10	Communication Module	1
24	TXA1.K12	Address Key 12	1
25	TXA1.K24	Address Key 24	0
26	TXA1.K-48	Address Key 25-48	0
27	CONTROL PANEL	Control Panel	1
28		With Spare	25%
29			
30		DDC-RF-2	

31		PDB-PACU-2	1
32		Status\ CMD	1
33		Alarm	1
34		PACU-09 to PACU-16	8
35		Status\ CMD	8
36	QAM2120.040	Supply Air Duct Temperature	8
37		EF.Fan-09 to EF.Fan-16	8
38		Exhaust Fan Start/Stop Command	8
39		Exhaust Fan Run Status	8
40		Exhaust Fan Trip Alarm	8
41		Exhaust Fan A/O/H Status	8
42	QBM81-5	Exhaust Fan Air Flow Status	8
43	PXC100.D	BACnet Controller	1
44	TXM1.6R	Output Module	4
45	TXM1.16D	Input Module	4
46	TXM1.8U	Universal Module	2
47	TXS1.12F10	Power Supply	1
48	TXS1.EF10	Communication Module	1
49	TXA1.K12	Address Key 12	1
50	TXA1.K24	Address Key 24	0
51	TXA1.K-48	Address Key 25-48	0
52	CONTROL PANEL	Control Panel	1
53		With Spare	25%
54			
55		DDC-2F-1	
56		IDF	3
57		Status	3
58		Alarm	3
59		Split Unit #1, Split Unit #2	2
60		Status	2
61		Alarm	2
62		LDB/PDB-SF-1 (Normal, Emergency, UPS)	3
63		Status	3
64		Alarm	3
65		Lighting Command, Alarm	3
66		LDB/PDB-SF-2 (Normal, Emergency, UPS)	3
67		Status	3
68		Alarm	3
69		Lighting Command, Alarm	3
70		LDB/PDB-SF-3 (Normal, Emergency, UPS)	3
71		Status	3
72		Alarm	3
73		Lighting Command, Alarm	3
74		ELEV-1 CP	1
75		Status	1
76		Alarm	1
77		ELEV-2 CP	1
78		Status	1
79		Alarm	1
80		ELEV-3 CP	1
81		Status	1
82		Alarm	1
83		ELEV-4 CP	1
84		Status	1
85		Alarm	1
86	PXC100.D	BACnet Controller	1
87	TXM1.6R	Output Module	2
88	TXM1.16D	Input Module	4

89	TXM1.8U	Universal Module	0
90	TXS1.12F10	Power Supply	1
91	TXS1.EF10	Communication Module	0
92	TXA1.K12	Address Key 12	1
93	TXA1.K24	Address Key 24	0
94	TXA1.K-48	Address Key 25-48	0
95	CONTROL PANEL	Control Panel	1
96		With Spare	25%
97			
98		DDC-1F-1	
99		IDF	3
100		Status	3
101		Alarm	3
102		Split Unit #1, Split Unit #2, Split Unit #3	3
103		Status	3
104		Alarm	3
105		LDB/PDB-FF-1 (Normal, Emergency, UPS)	3
106		Status	3
107		Alarm	3
108		Lighting Command, Alarm	3
109		LDB/PDB-FF-2 (Normal, Emergency, UPS)	3
110		Status	3
111		Alarm	3
112		Lighting Command, Alarm	3
113		LDB/PDB-FF-3 (Normal, Emergency, UPS)	3
114		Status	3
115		Alarm	3
116		Lighting Command, Alarm	3
117	PXC100.D	BACnet Controller	1
118	TXM1.6R	Output Module	2
119	TXM1.16D	Input Module	4
120	TXM1.8U	Universal Module	0
121	TXS1.12F10	Power Supply	1
122	TXS1.EF10	Communication Module	0
123	TXA1.K12	Address Key 12	1
124	TXA1.K24	Address Key 24	0
125	TXA1.K-48	Address Key 25-48	0
126	CONTROL PANEL	Control Panel	1
127		With Spare	25%
128			
129		DDC-GF-1	
130		IDF	3
131		Status	3
132		Alarm	3
133		Split Unit #1, Split Unit #2	2
134		Status	2
135		Alarm	2
136		LDB/PDB-GF-1 (Normal, Emergency, UPS)	3
137		Status	3
138		Alarm	3
139		Lighting Command, Alarm	5
140		LDB/PDB-GF-2 (Normal, Emergency, UPS)	3
141		Status	3
142		Alarm	3
143		Lighting Command, Alarm	5
144		LDB/PDB-GF-3 (Normal, Emergency, UPS)	3
145		Status	3
146		Alarm	3

147		Lighting Command, Alarm	5
148	PXC100.D	BACnet Controller	1
149	TXM1.6R	Output Module	4
150	TXM1.16D	Input Module	4
151	TXM1.8U	Universal Module	0
152	TXS1.12F10	Power Supply	1
153	TXS1.EF10	Communication Module	1
154	TXA1.K12	Address Key 12	1
155	TXA1.K24	Address Key 24	0
156	TXA1.K-48	Address Key 25-48	0
157	CONTROL PANEL	Control Panel	1
158		With Spare	25%
159			
160		DDC-BF-1	
161		IDF	1
162		Status	1
163		Alarm	1
164		Split Unit #1, Split Unit #2	2
165		Status	2
166		Alarm	2
167		LDB/PDB-BF-1 (Normal, Emergency)	2
168		Status	2
169		Alarm	2
170		Lighting Command, Alarm	5
171		EF/PDB-1 (Normal)	1
172		Status	1
173		Alarm	1
174		Lighting Command, Alarm	5
175		GDB-1 (Normal, Emergency, UPS)	3
176		Status	3
177		Alarm	3
178		Drinking Water Pipe Pressure	1
179	QBE2003-P10	Water Pressure Sensor	1
180	AQB2001	Accessory for QBE2003	1
		MV Switch gear	3
		Status	
		Alarm	
		Transformer	1
		Status	
		Alarm	
		Generator	1
		Status	
		Alarm	
		MDB	3
		Status	
		Alarm	
181	PXC50.D	BACnet Controller	1
182	TXM1.6R	Output Module	3
183	TXM1.16D	Input Module	2
184	TXM1.8U	Universal Module	1
185	TXS1.12F10	Power Supply	1
186	TXS1.EF10	Communication Module	0
187	TXA1.K12	Address Key 12	1

188	TXA1.K24	Address Key 24	0
189	TXA1.K-48	Address Key 25-48	0
190	CONTROL PANEL	Control Panel	1
191		With Spare	25%
192			
193		DDC-VAV	
194		VAV-2F	48
195	RDU341	VAV (Pressure Dependant) Room Thermostat AC 24 V	48
196	GDB161.1E	VAV Damper Actuator	48
197	SEM62.1	24V Transformer	48
198		CAV-2F	3
199	RDU341	VAV (Pressure Dependant) Room Thermostat AC 24 V	3
200	GDB161.1E	VAV Damper Actuator	3
201	SEM62.1	24V Transformer	3
202		VAV-1F	63
203	RDU341	VAV (Pressure Dependant) Room Thermostat AC 24 V	63
204	GDB161.1E	VAV Damper Actuator	63
205	SEM62.1	24V Transformer	63
206		CAV-1F	3
207	RDU341	VAV (Pressure Dependant) Room Thermostat AC 24 V	3
208	GDB161.1E	VAV Damper Actuator	3
209	SEM62.1	24V Transformer	3
210		VAV-GF	30
211	RDU341	VAV (Pressure Dependant) Room Thermostat AC 24 V	30
212	GDB161.1E	VAV Damper Actuator	30
213	SEM62.1	24V Transformer	30
214		CAV-GF	3
215	RDU341	VAV (Pressure Dependant) Room Thermostat AC 24 V	3
216	GDB161.1E	VAV Damper Actuator	3
217	SEM62.1	24V Transformer	3
218	PXC001.D	BACnet Controller	3
219	5WG11251AB22	Power supply unit DC 29 V, 640 mA	3
220	5WG11401AB13	Line/backbone coupler	0
221	CONTROL PANEL	Control Panel	3
222			
223		BUILDING MANAGEMENT SYSTEM	
224	PXM20	Portable Operator Unit	1
225	PXA-C1	Interface Cable for PXM20	1
226	CMM.05	Desigo Insigt software	1415
227	PXG3.L	BACnet Router	1
228	CONTROL PANEL	Control Panel	1

ثانياً يجب معرفة كل نظام ماذا نريد منه

1-MONITOR

2-CONTROL

APPENDIX-1

Imam University - Expanding the Buildings of Male Students Academic Area BUILDING MANAGEMENT SYTEM

SIEMENS

S#	PART NO.	DESCRIPTION	QTY	DO	DI	AI	AO	TOTAL POINTS	RESPONSIBLE FOR SUPPLY
1		Building 316							
2		DDC-RF-1							
3		PACU-01 to PACU-5	5						
4		On/Off Status	5		5				
5	QAM2120.040	Supply Air Duct Temperature	5			5			Siemens
6		EF-01 to EF-03	3						
7		Exhaust Fan Start/Stop Command	3	3					
8		Exhaust Fan Run Status	3		3				
9		Exhaust Fan Trip Alarm	3		3				
10		Exhaust Fan A/O/H Status	3		6				
11	QBM81-5	Exhaust Fan Air Flow Status	3		3				Siemens
12		EF-5.1 & EF-5.2	2						
13		Exhaust Fan Start/Stop Command	2	2					
14		Exhaust Fan Run Status	2		2				
15		Exhaust Fan Trip Alarm	2		2				
16		Exhaust Fan A/O/H Status	2		4				
17	QBM81-5	Exhaust Fan Air Flow Status	2		2				Siemens
18		SS-01 to SS-04 (Split Unit)	4						
19		Status	4		4				
20		Alarm	4		4				
21		Exhaust Fan panel-PDB-1 (Normal)	1						
22		On/Off Command	1	1					
23		Status	1		1				
24		Elevator-01	1						
25		Status	1	1					
26		Alarm	1		1				
27	PXC100.D	BACnet Controller	1						Siemens
28	TXM1.6R	Output Module	2						Siemens
29	TXM1.16D	Input Module	4						Siemens
30	TXM1.8U	Universal Module	1						Siemens
31	TXS1.12F10	Power Supply	1						Siemens
32	TXS1.EF10	Communication Module	1						Siemens
33	TXA1.K12	Address Key 12	1						Siemens
34	TXA1.K24	Address Key 24	0						Siemens
35	TXA1.K-48	Address Key 25-48	0						Siemens
36	CONTROL PANEL	Control Panel	1						Siemens
37		With Spare	25%	9	50	7	0	66	
38									

39		DDC-RF-2							
40		PACU-06 to PACU-10, PACU-16	6						
41		On/Off Status	6		6				
42	QAM2120.040	Supply Air Duct Temperature	6			6			Siemens
43		EF-04 to EF-06	3						
44		Exhaust Fan Start/Stop Command	3	3					
45		Exhaust Fan Run Status	3		3				
46		Exhaust Fan Trip Alarm	3		3				
47		Exhaust Fan A/O/H Status	3		6				
48	QBM81-5	Exhaust Fan Air Flow Status	3		3				Siemens
49		EF-5.3	1						
50		Exhaust Fan Start/Stop Command	1	1					
51		Exhaust Fan Run Status	1		1				
52		Exhaust Fan Trip Alarm	1		1				
53		Exhaust Fan A/O/H Status	1		2				
54	QBM81-5	Exhaust Fan Air Flow Status	1		1				Siemens
55		Pressurization Fans	3						
56		Fan Start/Stop Command	3	3					
57		Fan Run Status	3		3				
58		Fan Trip Alarm	3		3				
59		Fan A/O/H Status	3		6				
60	QBM81-5	Fan Air Flow Status	3		3				Siemens
61	QBM2030-30	Shaft Static Pressure	3			3			Siemens
62	AQB2000	Accessory for QBM2030	3						Siemens
63	GBB161.1E	Modulating Damper Actuator	3				3		Siemens
64		FACP Alarm	3		3				
65		SS-05 to SS-08 (Split Unit)	4						
66		Status	4		4				
67		Alarm	4		4				
68	PXC100.D	BACnet Controller	1						Siemens
69	TXM1.6R	Output Module	2						Siemens
70	TXM1.16D	Input Module	5						Siemens
71	TXM1.8U	Universal Module	2						Siemens
72	TXS1.12F10	Power Supply	1						Siemens
73	TXS1.EF10	Communication Module	1						Siemens
74	TXA1.K12	Address Key 12	1						Siemens
75	TXA1.K24	Address Key 24	0						Siemens
76	TXA1.K-48	Address Key 25-48	0						Siemens
77	CONTROL PANEL	Control Panel	1						Siemens
78		With Spare	25%	9	65	12	4	90	
79									

80		DDC-RF-3							
81		PACU-11 to PACU-15	5						
82		On/Off Status	5		5				
83	QAM2120.040	Supply Air Duct Temperature	5			5			Siemens
84		EF-07 to EF-069	3						
85		Exhaust Fan Start/Stop Command	3	3					
86		Exhaust Fan Run Status	3		3				
87		Exhaust Fan Trip Alarm	3		3				

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BT SSP 50

APPENDIX-1

Imam University - Expanding the Buildings of Male Students Academic Area
BUILDING MANAGEMENT SYTEM

SIEMENS

S#	PART NO.	DESCRIPTION	QTY	DO	DI	AI	AO	TOTAL POINTS	RESPONSIBLE FOR SUPPLY
88		Exhaust Fan A/O/H Status	3		6				
89	QBM81-5	Exhaust Fan Air Flow Status	3		3				Siemens
90		EF-5.4	1						
91		Exhaust Fan Start/Stop Command	1	1					
92		Exhaust Fan Run Status	1		1				
93		Exhaust Fan Trip Alarm	1		1				
94		Exhaust Fan A/O/H Status	1		2				
95	QBM81-5	Exhaust Fan Air Flow Status	1		1				Siemens
96		SS-09 to SS-11 (Split Unit)	3						
97		Status	3		3				
98		Alarm	3		3				
99		Air Conditioning Panel-PDB-2 (Normal)	1						
100		On/Off Command	1	1					
101		Status	1		1				
102		Air Conditioning Panel-PDB-3 (Normal)	1						
103		On/Off Command	1	1					
104		Status	1		1				
105		Elevator Panel-PDB-4 (Normal)	1						
106		Status	1	1					
107		Alarm	1		1				
108		Elevator-02	1						
109		Status	1	1					
110		Alarm	1		1				

111	PXC100.D	BACnet Controller	1						Siemens
112	TXM1.6R	Output Module	2						Siemens
113	TXM1.16D	Input Module	3						Siemens
114	TXM1.8U	Universal Module	1						Siemens
115	TXS1.12F10	Power Supply	1						Siemens
116	TXS1.EF10	Communication Module	0						Siemens
117	TXA1.K12	Address Key 12	1						Siemens
118	TXA1.K24	Address Key 24	0						Siemens
119	TXA1.K-48	Address Key 25-48	0						Siemens
120	CONTROL PANEL	Control Panel	1						Siemens
121		With Spare	25%	10	44	7	0	61	
122									
123		DDC-2F-1							
124		SS-08 & SS-09 (Split Unit)	2						
125		Status	2		2				
126		Alarm	2		2				
127		LDB/PDB-SF-1 (Normal & Emergency)	2						
128		On/Off Command	2	2					
129		Status	2		2				
130		LDB/PDB-SF-2 (Normal & Emergency)	2						
131		On/Off Command	2	2					
132		Status	2		2				
133		LDB/PDB-SF-3 (Normal & Emergency)	2						
134		On/Off Command	2	2					
135		Status	2		2				
136		Elevator-02 & 4 (MRL) control panel	2						
137		Status	2		2				
138		Alarm	2		2				
139	PXC36.D	BACnet Controller	1						Siemens
140	TXM1.6R	Output Module	0						Siemens
141	TXM1.16D	Input Module	0						Siemens
142	TXM1.8U	Universal Module	0						Siemens
143	TXS1.12F10	Power Supply	0						Siemens
144	TXS1.EF10	Communication Module	0						Siemens
145	TXA1.K12	Address Key 12	0						Siemens
146	TXA1.K24	Address Key 24	0						Siemens
147	TXA1.K-48	Address Key 25-48	0						Siemens
148	CONTROL PANEL	Control Panel	1						Siemens
149		With Spare	25%	8	18	0	0	26	
150									

150									
151		DDC-1F-1							
152		SS-05, SS-06, SS-07 (Split Unit)	3						
153		Status	3		3				
154		Alarm	3		3				
155		LDB/PDB-FF-1 (Normal & Emergency&UPS)	3						
156		On/Off Command	3	3					
157		Status	3		3				
158		LDB/PDB-FF-2 (Normal & Emergency&UPS)	3						
159		On/Off Command	3	3					
160		Status	3		3				
161		LDB/PDB-FF-3 (Normal & Emergency&UPS)	3						
162		On/Off Command	3	3					
163		Status	3		3				
164	PXC36.D	BACnet Controller	1						Siemens
165	TXM1.6R	Output Module	0						Siemens
166	TXM1.16D	Input Module	0						Siemens
167	TXM1.8U	Universal Module	0						Siemens
168	TXS1.12F10	Power Supply	0						Siemens
169	TXS1.EF10	Communication Module	0						Siemens
170	TXA1.K12	Address Key 12	0						Siemens
171	TXA1.K24	Address Key 24	0						Siemens
172	TXA1.K-48	Address Key 25-48	0						Siemens
173	CONTROL PANEL	Control Panel	1						Siemens
174		With Spare	25%	12	19	0	0	31	
175									

S#	PART NO.	DESCRIPTION	QTY	DO	DI	AI	AO	TOTAL POINTS	RESPONSIBLE FOR SUPPLY
176		DDC-GF-1							
177		SS-03 & SS-04 (Split Unit)	2						
178		Status	2		2				
179		Alarm	2		2				
180		LDB/PDB-GF-1 (Normal & Emergency&UPS)	3						
181		On/Off Command	3	3					
182		Status	3		3				
183		LDB/PDB-GF-2 (Normal & Emergency&UPS)	3						
184		On/Off Command	3	3					
185		Status	3		3				
186		LDB/PDB-GF-3 (Normal & Emergency&UPS)	3						
187		On/Off Command	3	3					
188		Status	3		3				
189		Fire Alarm Control Panel (FACP)	1						
190		Alarm	1		1				
191	PXC36.D	BACnet Controller	1						Siemens
192	TXM1.6R	Output Module	0						Siemens
193	TXM1.16D	Input Module	0						Siemens
194	TXM1.8U	Universal Module	0						Siemens
195	TXS1.12F10	Power Supply	0						Siemens
196	TXS1.EF10	Communication Module	0						Siemens
197	TXA1.K12	Address Key 12	0						Siemens
198	TXA1.K24	Address Key 24	0						Siemens
199	TXA1.K-48	Address Key 25-48	0						Siemens
200	CONTROL PANEL	Control Panel	1						Siemens
201		With Spare	25%	12	18	0	0	30	
202									

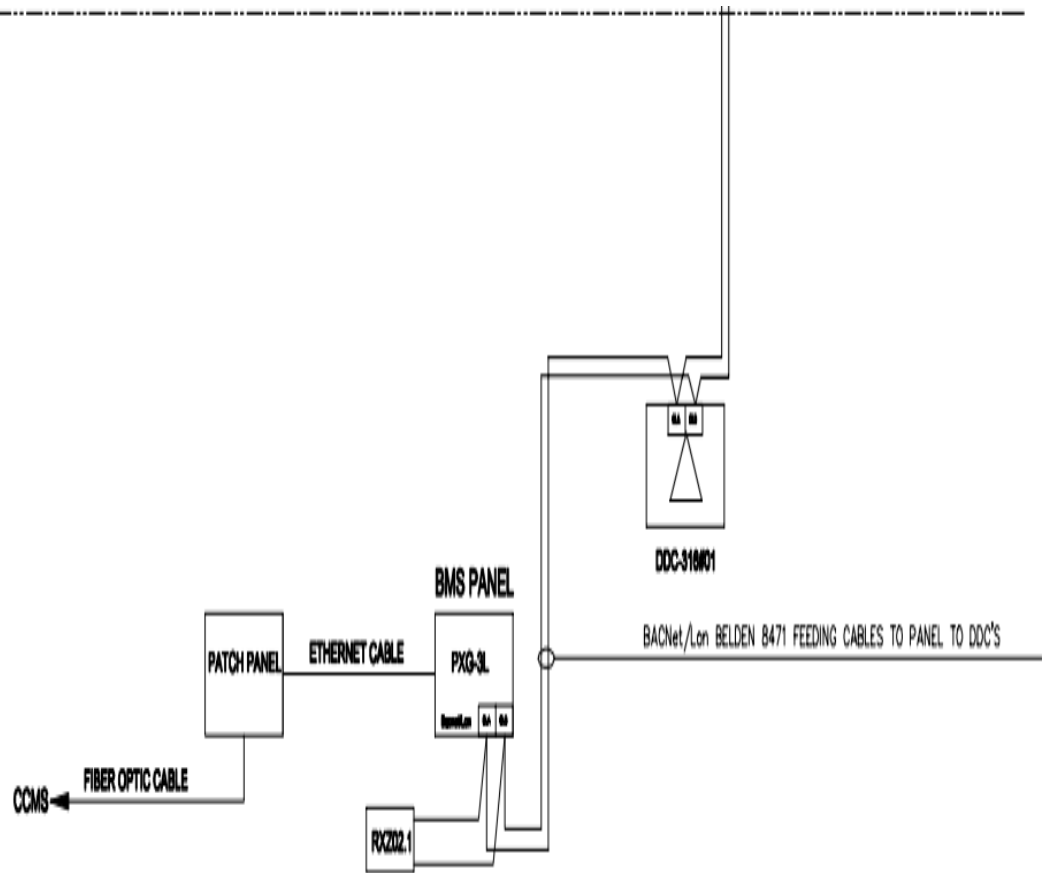
203		DDC-BF-1							
204		SS-01 & SS-02 (Split Unit)	2						
205		Status	2		2				
206		Alarm	2		2				
207		EF-1	1						
208		Exhaust Fan Start/Stop Command	1	1					
209		Exhaust Fan Run Status	1		1				
210		Exhaust Fan Trip Alarm	1		1				
211		Exhaust Fan A/O/H Status	1		2				
212	QBM81-5	Exhaust Fan Air Flow Status	1		1				Siemens
213		GDB (Normal & Emergency & UPS)	3						
214		On/Off Command	3	3					
215		Status	3		3				
216		LDB/PDB-BS-1 (Normal & Emergency & UPS)	3						
217		On/Off Command	3	3					
218		Status	3		3				
219		Exhaust Fan panel-PDB-5 (Normal)	1						
220		On/Off Command	1	1					
221		Status	1		1				
222		Drinking Water Pipe Pressure	1						
223	QBE2003-P10	Water Pressure Sensor	1			1			Siemens
224	AQB2001	Accessory for QBE2003	1						Siemens
225		CO PANEL	1						
226		Panel Status, Alarm (Interlocked with Exhaust Fan)	1		2				
227	PXC36.D	BACnet Controller	1						Siemens
228	TXM1.6R	Output Module	0						Siemens
229	TXM1.16D	Input Module	0						Siemens
230	TXM1.8U	Universal Module	0						Siemens
231	TXS1.12F10	Power Supply	0						Siemens
232	TXS1.EF10	Communication Module	0						Siemens
233	TXA1.K12	Address Key 12	0						Siemens
234	TXA1.K24	Address Key 24	0						Siemens
235	TXA1.K-48	Address Key 25-48	0						Siemens
236	CONTROL PANEL	Control Panel	1						Siemens
237		With Spare	25%	10	23	2	0	35	
238									

239		DDC-VAV							
240		VAV-2F	67						
241	RDG400KN	VAV (Pressure Dependant) Room Thermostat AC 24 V	67					335	Siemens
242	GDB131.1E	VAV Damper Actuator	67						Siemens
243	SEM62.1	24V Transformer	67						Siemens
244		CAV-2F	3						
245	RDG400KN	VAV (Pressure Dependant) Room Thermostat AC 24 V	3					15	Siemens
246	GDB131.1E	VAV Damper Actuator	3						Siemens
247	SEM62.1	24V Transformer	3						Siemens
248		VAV-1F	63						
249	RDG400KN	VAV (Pressure Dependant) Room Thermostat AC 24 V	63					315	Siemens
250	GDB131.1E	VAV Damper Actuator	63						Siemens
251	SEM62.1	24V Transformer	63						Siemens
252		CAV-1F	3						
253	RDG400KN	VAV (Pressure Dependant) Room Thermostat AC 24 V	3					15	Siemens
254	GDB131.1E	VAV Damper Actuator	3						Siemens
255	SEM62.1	24V Transformer	3						Siemens
256		VAV-GF	30						
257	RDG400KN	VAV (Pressure Dependant) Room Thermostat AC 24 V	30					150	Siemens
258	GDB131.1E	VAV Damper Actuator	30						Siemens
259	SEM62.1	24V Transformer	30						Siemens
260		CAV-GF	3						
261	RDG400KN	VAV (Pressure Dependant) Room Thermostat AC 24 V	3					15	Siemens
262	GDB131.1E	VAV Damper Actuator	3						Siemens

S#	PART NO.	DESCRIPTION	QTY	DO	DI	AI	AO	TOTAL POINTS	RESPONSIBLE FOR SUPPLY
263	SEM62.1	24V Transformer	3						Siemens
264	PXC001.D	BACnet Controller	6						Siemens
265	SWG11251AB22	Power supply unit DC 29 V, 640 mA	6						Siemens
266	SWG11401AB13	Line/backbone coupler	6						Siemens
267	CONTROL PANEL	Control Panel	6						Siemens
268									
269		BUILDING MANAGEMENT SYSTEM							
270	PXM20	Portable Operator Unit	1						Siemens
271	PXA-C1	Interface Cable for PXM20	1						Siemens
272	CMM.05	Desigo Insiqt software	1415						Siemens
273	PXG3.L	BACnet Router	1						Siemens
274	CONTROL PANEL	Control Panel	1						Siemens
275									
276									

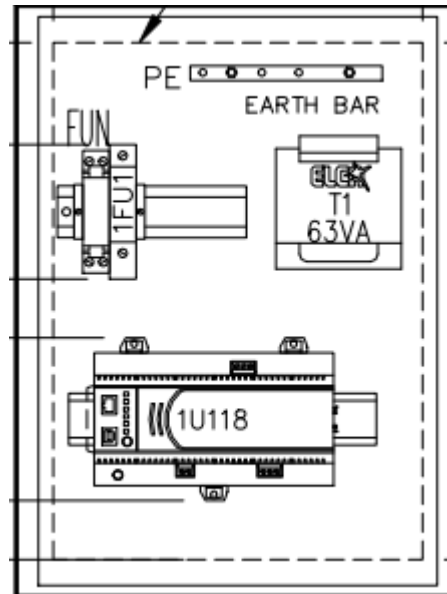
RISER DIAGRAM FOR PROJECT

1-BASEMENT FLOOR



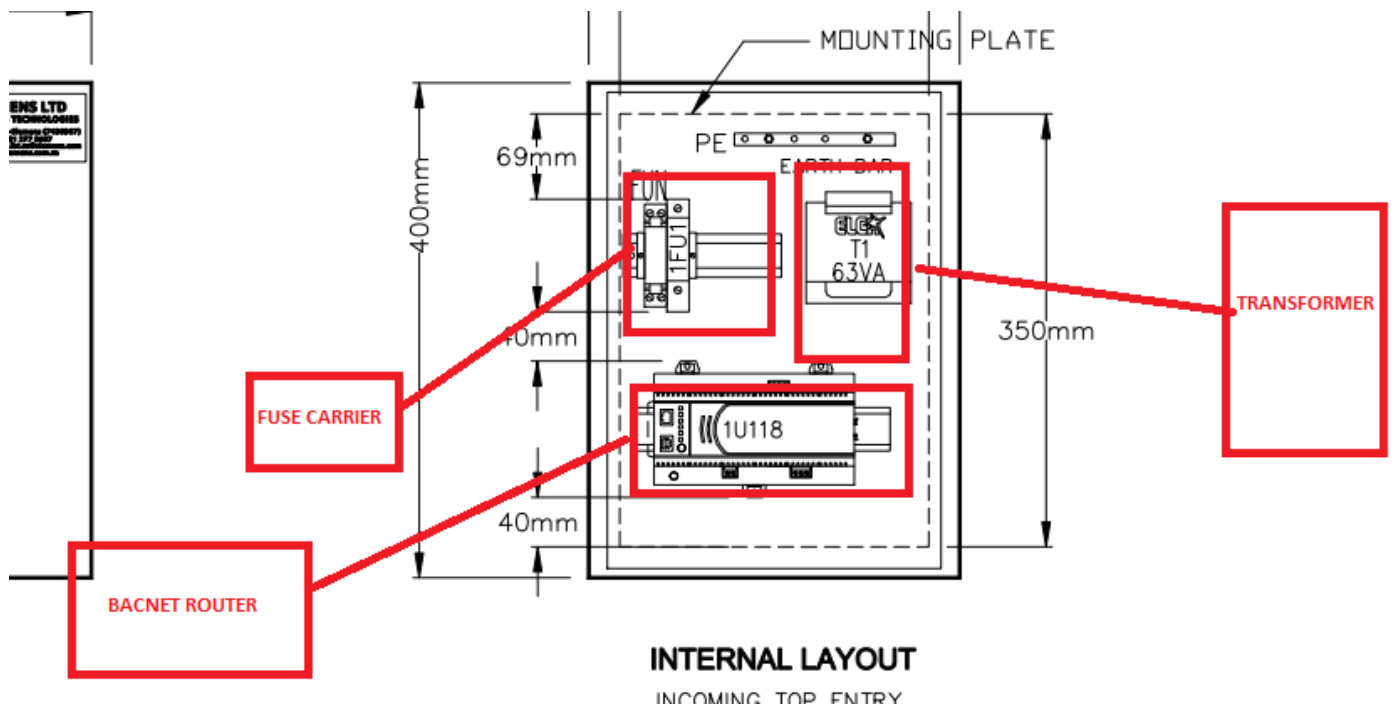
BA

1-BMS MAIN PANEL

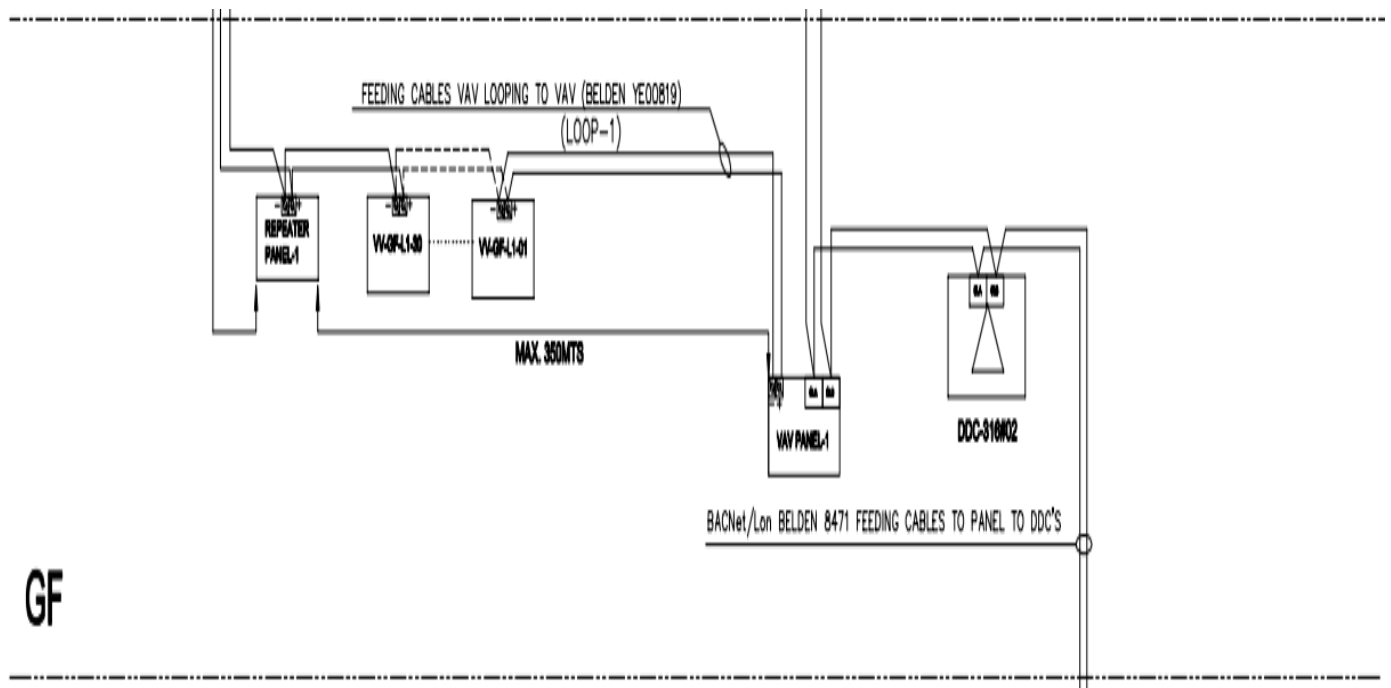


LIST OF MATERIALS

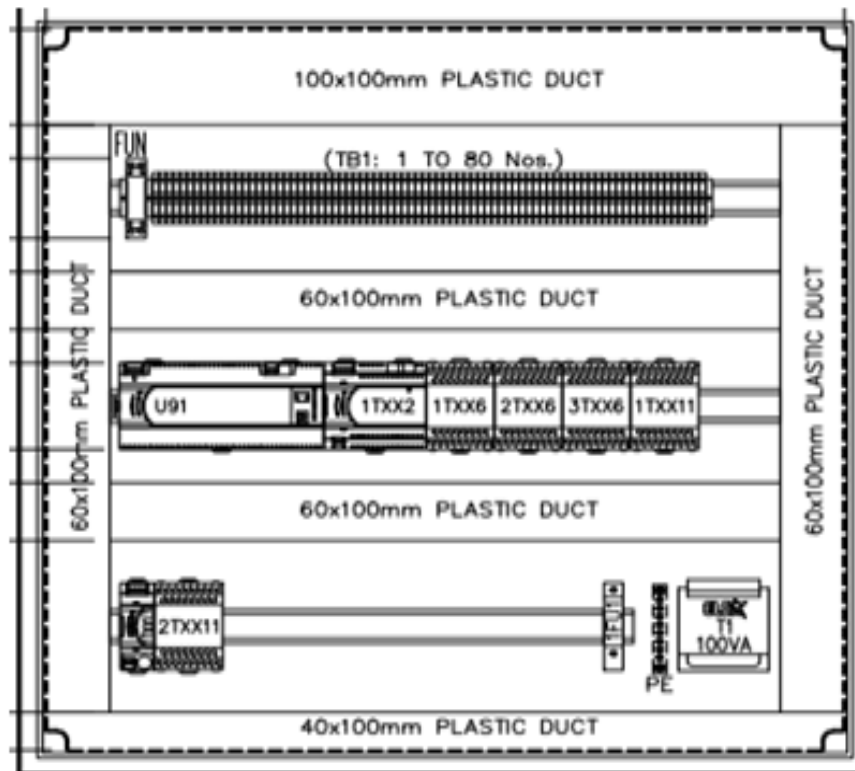
TAGNAME	CATALOG NUMBER	CATALOG DESCRIPTION
1FU1	0058 08 + 2A FUSE.	1P (FUSE CARRIER + 2A FUSE (10x38mm) aM
1FUN	0058 18 + 1A FUSE	1P+N (FUSE CARRIER + 1A FUSE (10X38mm) aM
BMS PANEL	047-SB403020+047-MP4030	H=400 x W=300 x D=200mm. + MOUNTING PLATE
HP	PLML2L24	SINGLE LED INDICATOR
T1	TMSN 063 S24 (ITALY)	TRANSFORMER
U118	PXG3.L	BACNET ROUTER



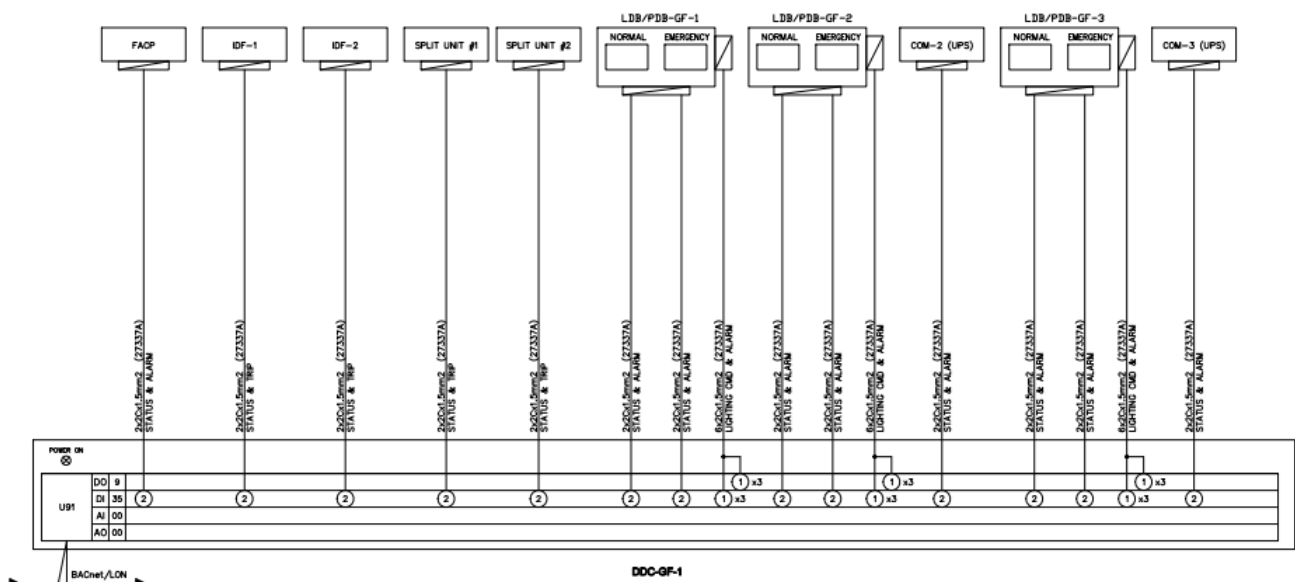
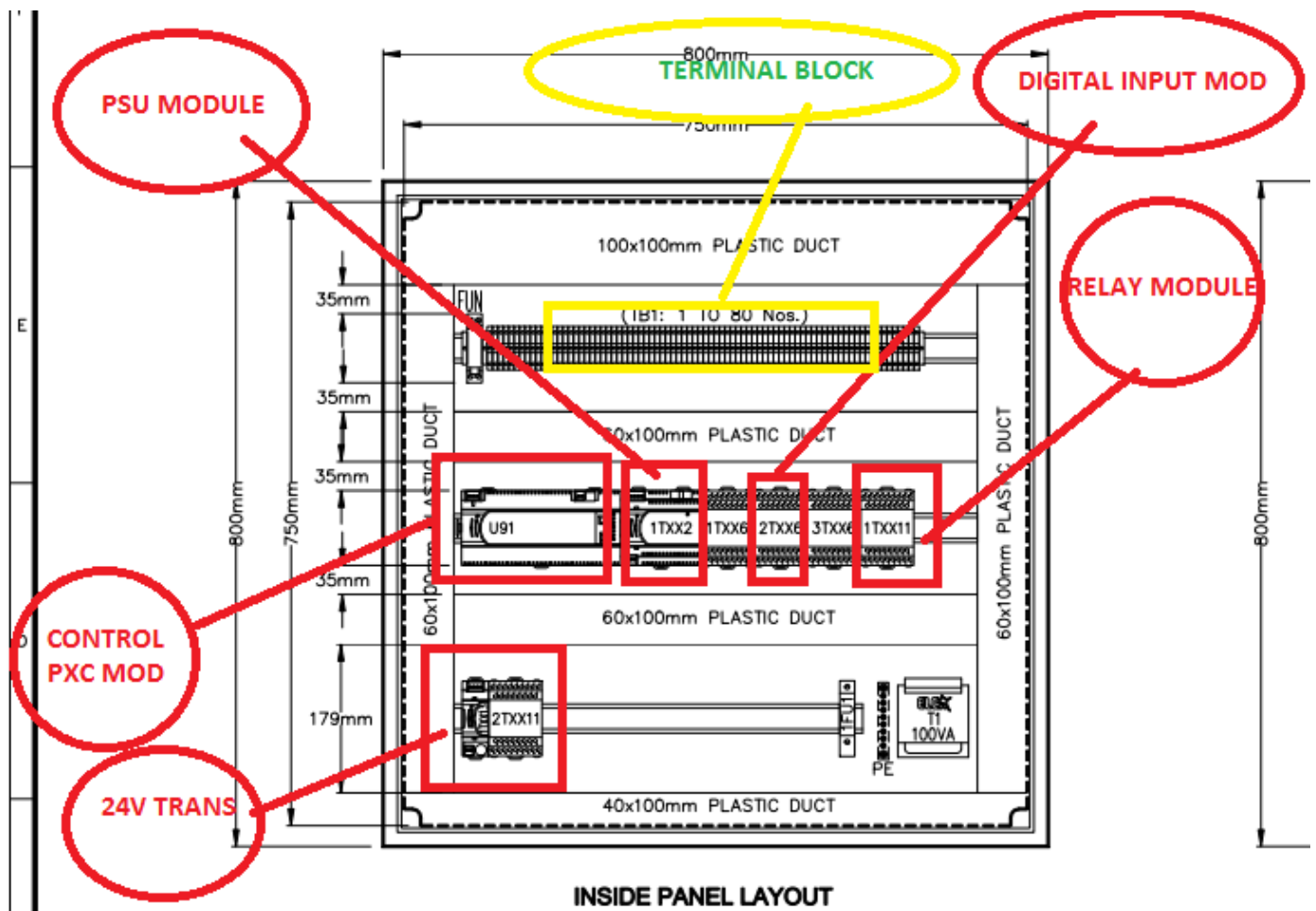
1- DDC PANELS IN GROUND FLOOR



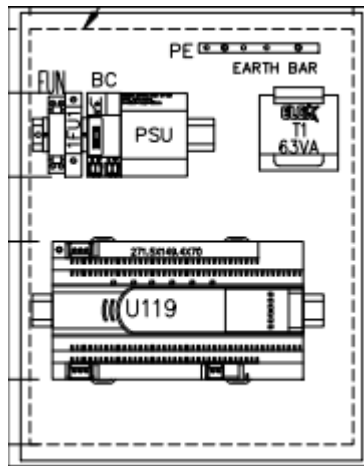
DDC#1 FOR GROUND FLOOR



CATALOG NUMBER	CATALOG DESCRIPTION
005B 08 + 2A FUSE.	1P (FUSE CARRIER + 2A FUSE (10x38mm) aM
TXS1.12F10	POWER SUPPLY MODULE
TXM1.16D	DIGITAL INPUT MODULE
TXM1.6R	RELAY MODULE
TXS1.EF10	BUS CONNECTION MODULE
TXA1.K12	ADDRESS KEYS 1-12 + RESET
TXM1.16D	DIGITAL INPUT MODULE
TXM1.6R	RELAY MODULE
TXM1.16D	DIGITAL INPUT MODULE
047-SB808030 + 047-MP8080	H=800 x W=800 x D=300mm. + MOUNTING PLATE
005B 18 + 1A FUSE	1P+N (FUSE CARRIER + 1A FUSE (10x38mm) aM
PLML2L24	SINGLE LED INDICATOR
TMSN 110 S24 (ITALY)	TRANSFORMER
ONKA-1019/MRK2.5mm2	MRK SCREWED TYPE RAIL TERMINAL BLOCK-GREY
PXC100.D	AUTOMATION STATION - MODULAR SERIES



2-DDC PANEL FOR VAV



CATALOG NUMBER	CATALOG DESCRIPTION
5WG1 140-1AB13	LINE/BACKBONE COUPLER N 140/13
0058 08 + 2A FUSE,	1P (FUSE CARRIER + 2A FUSE (10x38mm) aM
5WG1 125-1AB22	POWER SUPPLY UNIT N 125
047-SB504025+047-MP5040	H=500 x W=400 x D=250mm. + MOUNTING PLATE
0058 18 + 1A FUSE	1P+N (FUSE CARRIER + 1A FUSE (10x38mm) aM
PLML2L24	SINGLE LED INDICATOR
TMSN 063 S24 (ITALY)	TRANSFORMER
PXC001.D	SYSTEM CONTROLLER BACNET/IP

VAV
(TYPICAL - 153 NO6)

SPACE

1MVD14

SA

U145

2Cx16AWG 24VAC

2Cx16AWG 24VAC

2Cx16AWG 24VAC

KNX BUS

FROM VAV

TO VAV

POWER SUPPLY
230VAC/1PH/60HZ

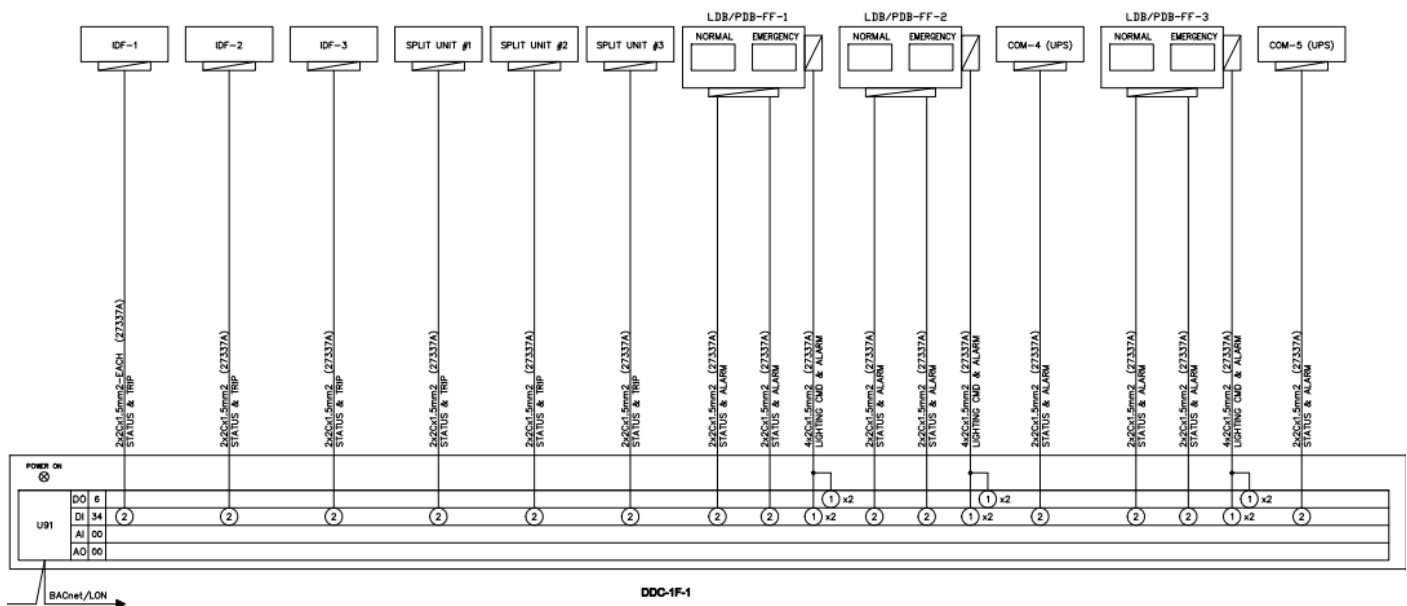
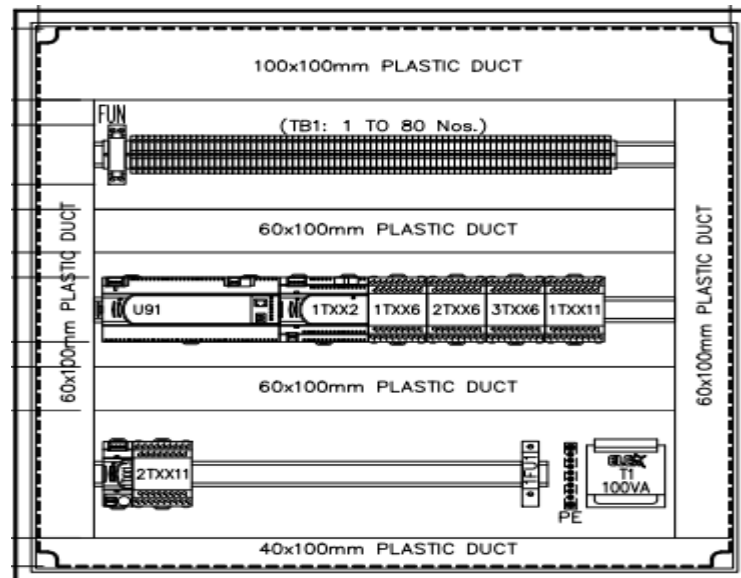
L N PE

T1
30VA

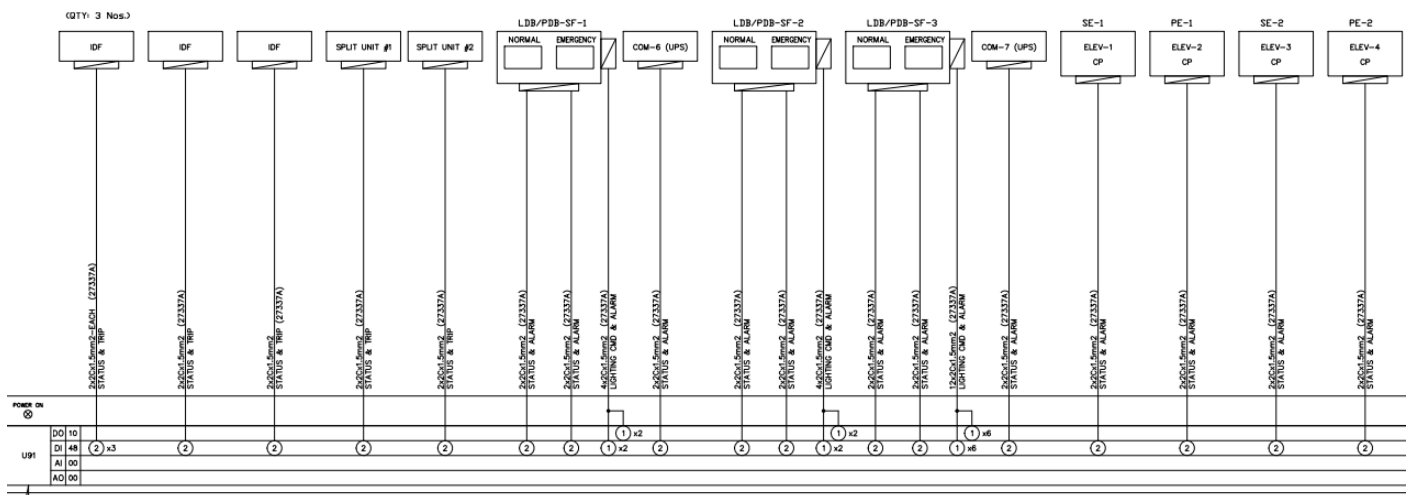
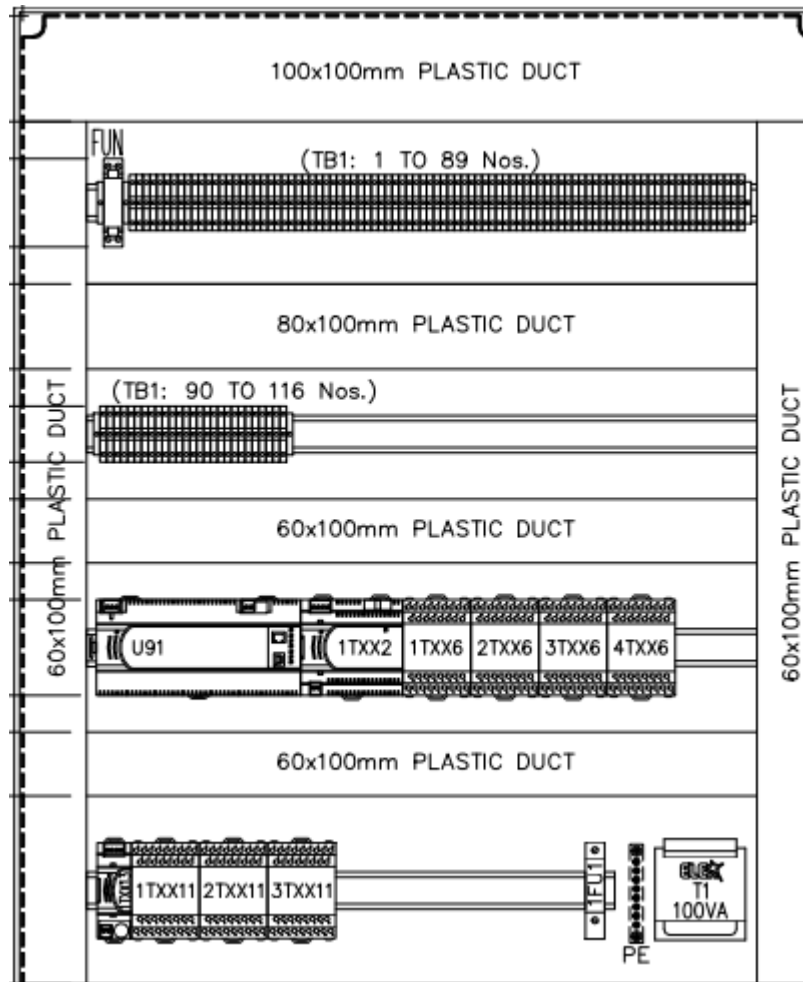
230VAC
24VAC
(SEM62.1)

EIB-Y(st)Y 2X2.0.0.8 KNX (BELDEN YE00820)

A- DDC-1 FOR FIRST FLOOR

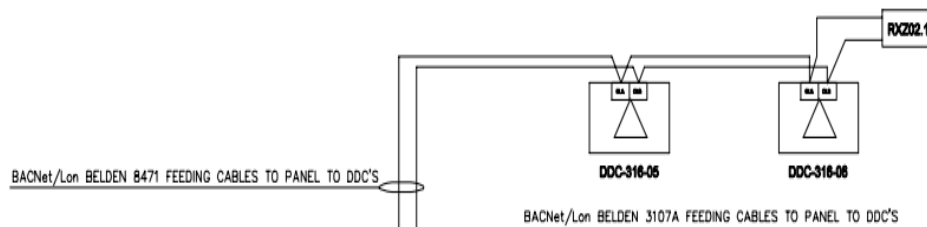


B-DDC-2 FOR SECOND FLOOR

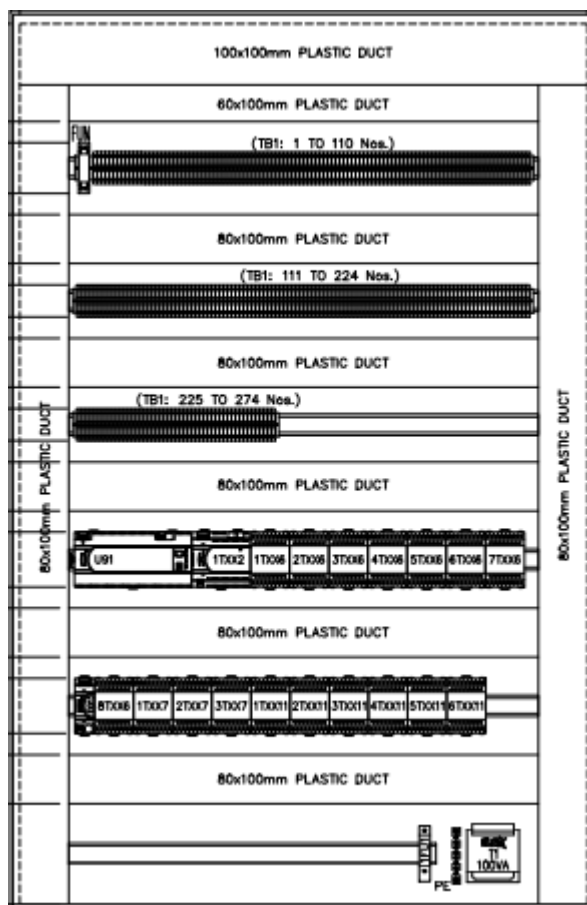


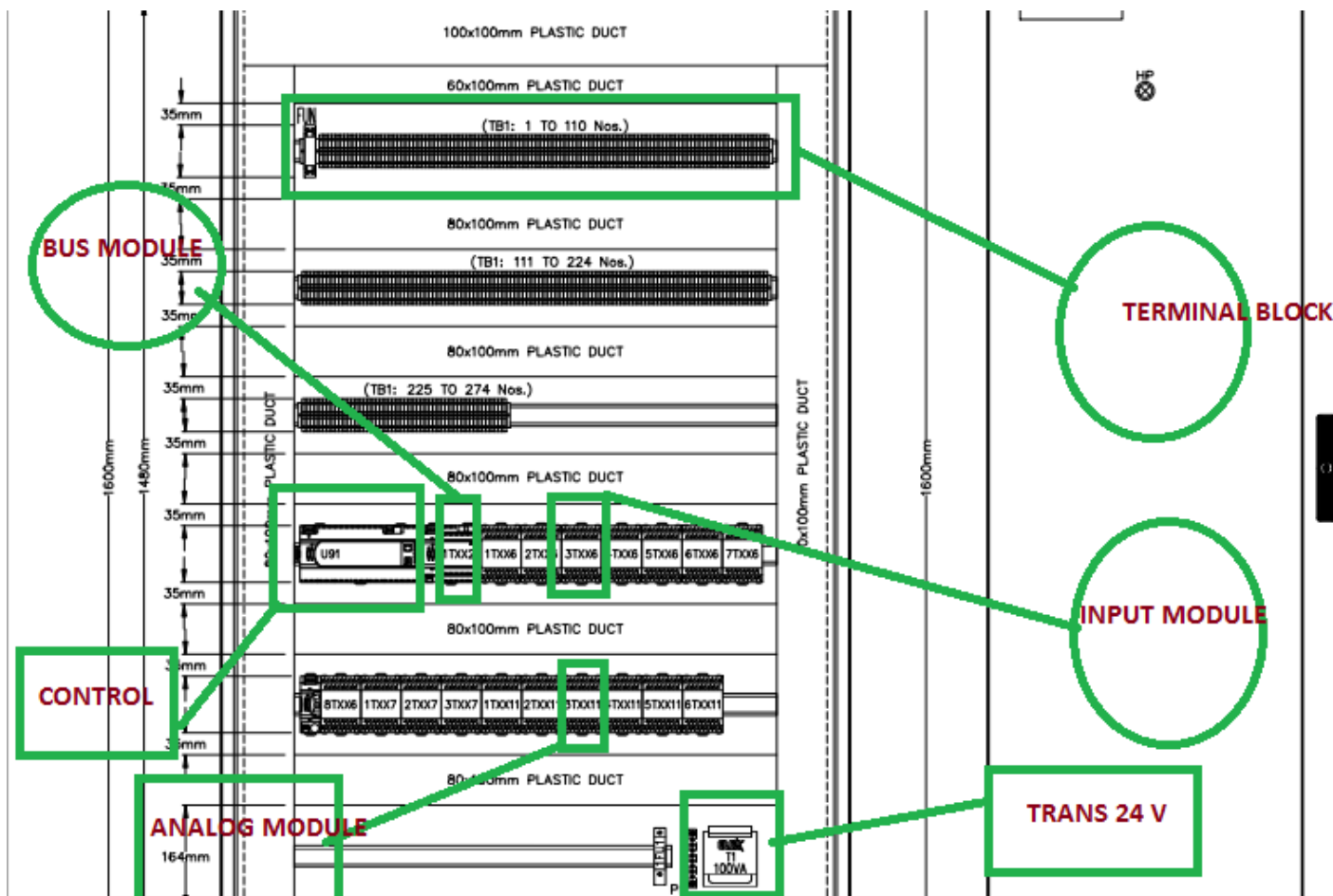
3- DDC PANELS IN MAIN ROOF

RF



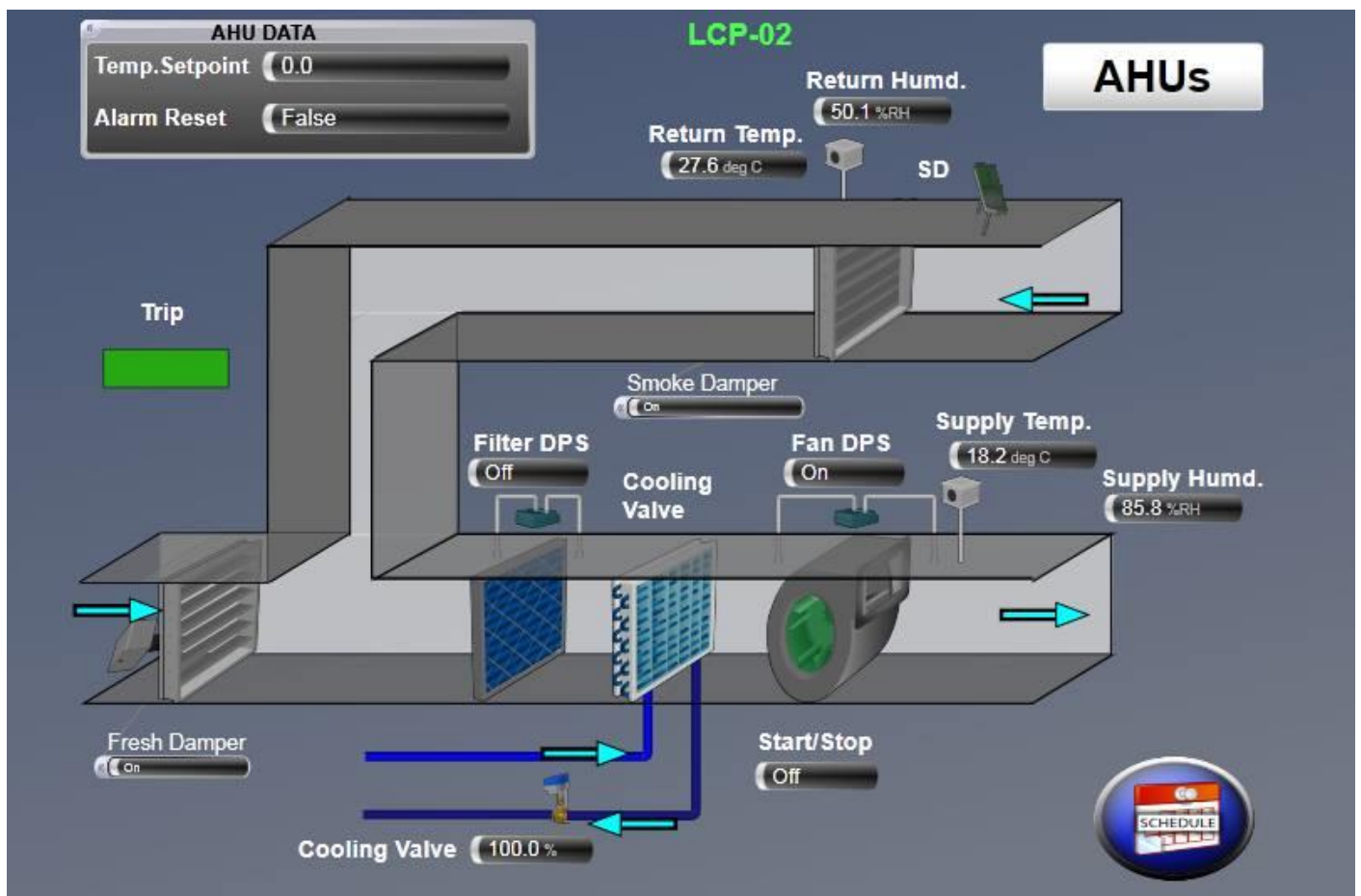
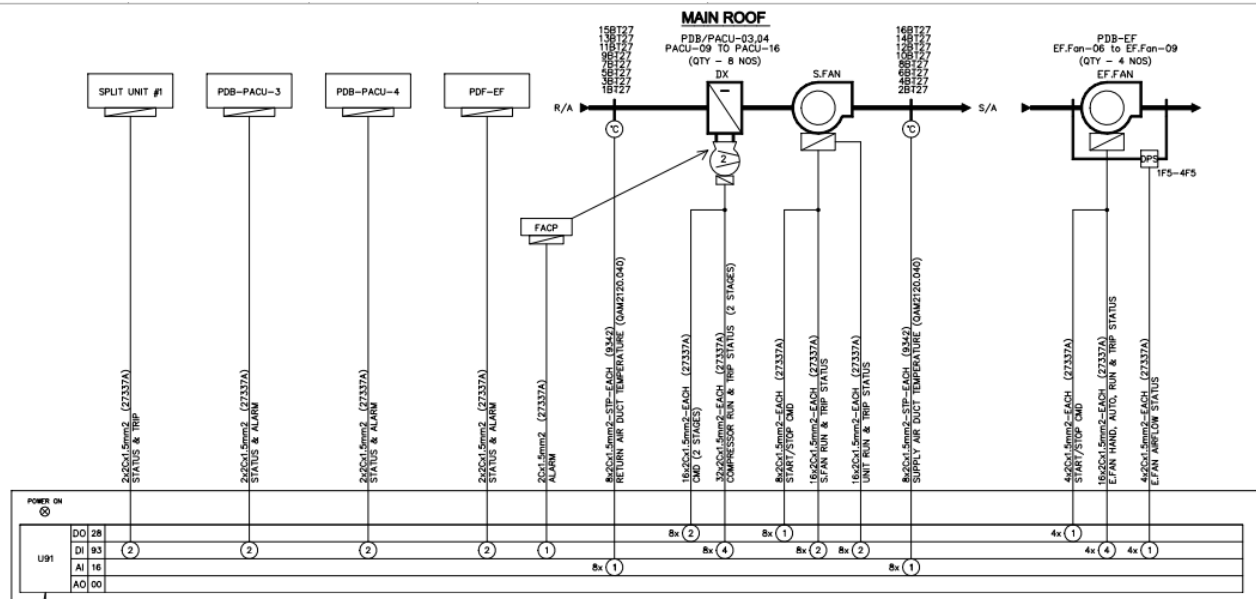
DDC-3 FOR AHU & PACKAGE UNIT





LIST OF MATERIALS

TAGNAME	CATALOG NUMBER	CATALOG DESCRIPTION	RATING1	RATING2	RATING3	MANUFACTURER
1FU1	0058 08 + 4A FUSE..	1P (FUSE CARRIER + 4A FUSE (10x38mm) dM	4A			LEGRAND
1TX02	TXS1.12F10	POWER SUPPLY MODULE	24VAC	24VDC	1.2A	Siemens
1TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
1TX07	TXM1.8U	UNIVERSAL MODULE	21...26V	1.7W		Siemens
1TX011	TXM1.6R	RELAY MODULE	22...26V	1.7W		Siemens
1TX013	TXS1.EF10	BUS CONNECTION MODULE	24VDC	24VDC	1.2A	Siemens
1TX015	TXA1.K24	ADDRESS KEYS 1-24 + RESET				Siemens
2TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
2TX07	TXM1.8U	UNIVERSAL MODULE	21...26V	1.7W		Siemens
2TX011	TXM1.6R	RELAY MODULE	22...26V	1.7W		Siemens
3TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
3TX07	TXM1.8U	UNIVERSAL MODULE	21...26V	1.7W		Siemens
3TX011	TXM1.6R	RELAY MODULE	22...26V	1.7W		Siemens
4TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
4TX011	TXM1.6R	RELAY MODULE	22...26V	1.7W		Siemens
5TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
5TX011	TXM1.6R	RELAY MODULE	22...26V	1.7W		Siemens
6TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
6TX011	TXM1.6R	RELAY MODULE	22...26V	1.7W		Siemens
7TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
8TX06	TXM1.16D	DIGITAL INPUT MODULE	22...26V	1.4W		Siemens
DDC-RF-2	047-SBY161030 + 047-MPX1610	H=1600 x W=1000 x D=300mm. + MOUNTING PLATE	IP65			ALFANAR
FUN	0058 18 + 1A FUSE	1P+N (FUSE CARRIER + 1A FUSE (10x38mm) dM	1A			LEGRAND
HP	PLM1.2L24	SINGLE LED INDICATOR	GREEN	24AC/DC	50/60HZ	Glovenzana-Italy (PLight)
T1	TMSH 110 S24 (ITALY)	TRANSFORMER	100VA	230VAC	24VAC	ELCA TRANSFORMER
TB1:1-274	ONKA-1019/MRK2.5mm2	MRK SCREWED TYPE RAIL TERMINAL BLOCK-GREY	2.5mm2			ONKA-TURKEY
U91	PXC100.D	AUTOMATION STATION - MODULAR SERIES	24VAC			Siemens



ده مثال للجرافيك الخاص بنظام ال BMS الخاص بشركة (AdvanSys) يوضح الأجهزة اللي بتركب على
- Air handling unit -AHU
وبيوضح ايضاً البيانات اللي الخاصة بتشغيل ال AHU

الأجهزة الموجودة فى الصورة هي :

١- DPS : differential pressure sensor

وعن طريقة بنقدر نعرف ان كانت المروحة شغالة ولا لا كمان بنقدر نعرف حالة الفلتر نظيف ولا متسخ

٢- Temperature and humidity sensor:

وده بتركبه على دكت ال return air duct لمعرفة درجة حرارة الهواء الراجع وبالتالي بناءا عليه بنقدر نتحكم أوتوماتيكيا فى كمية المياه
المثلجة الداخلة لل water coil عن طريق ال three way valve عن طريق فتحة بنسبة % كما هو موضح فى الصورة
وأيضا يتم تركيبه على ال supply duct حسب الحاجة

٤- smoke detector

بيتركب على ال return air duct عشان لو فى دخان راجع مع الهواء بيخلى المروحة تفصل مباشرة ويقفل ال supply air damper
و return air damper و ممكن كمان يرسل اشارة لمروحة سحب الدخان انها تشتغل ويعطى اشارة لل smoke damper يفتح ولكن الأولوية
هنا فى الجزئية دى بيبكون لنظام ال fire alarm system حيث يتم التحكم فى تشغيل مروحة ال smoke عن طريق relay module
هنلاقى كمان موضح فى الصورة انى اقدر اشغل المروحة on/off كمان اقدر اعرف حالة ال dampers مفتوح او مغلقة status

CABLE RECOMMENDED FOR BMS SYSTEM

Cable Type	Signal type	Used for	Manufacture	Part Number	Max Distance
					Meters
2Cx1.5mm2	DI	Alarm,Trip,Status From Field side to DDC Panel	Belden	27337A	250
2Cx1.5mm2	DO	Start/Stop Cmd From Field side to DDC Panel	Belden	27337A	250
2Cx1.5mm2 - STP	AI	Sensors From Field side to DDC Panel	Belden	9342	250
2Cx1.5mm2 - STP	AO	Electric Heater Control Via SCR From Field side to DDC Panel	Belden	9342	250
2x2Cx22AWG - UTP	BACNet/Lon	Controller Loop From DDC to DDC Panel and DDC to Router Panel	Belden	3107A	900
CAT5e / CAT6e UTP	Communication	From PXG3.L to Workstation	Belden	7923A	100
y(st)y 2x2x0.8mm	KNX	VAV to VAV	Belden	YE00820	1000

Wira Cable Recomond for BMS	Belden Catalog no	Description
2x1C 16 AWG	27337A	For Command Status & Alarm
1 Pair 16 AWG STP	8719	For Immerssion Temperature Sensor& Duct Temperature Sensor
2 Pair 16 AWG STP	1069A	Pressure Sensor For Liquid
2 Pair 16 AWG STP	1055A	Differential Sensor for Air
3 Pair 16 AWG STP	1037A	Temperature&Humidity sensor for Duct
2x1C 16 AWG	27337A	Differentia Switch for Fan and Filter
5 C 14 AWG	27339A	Motorized Damper Actuator
5 C 14 AWG Unshielded	27083A	32MM,40MM,50MM 2 Way Motorized Valve And Actutor
3 C 16 AWG STP	1037A	Flow Meter For Chilled Water
1 Pair 22 AWG STP	3106A	Bacnet Actuator for VAV
4Pair 24 AWG STP	1583ENH	Room Thermostat for BACent Actuator
2Pair 24 AWG STP	1588A	VAV Controller to VAV Router
2X2CX22AWG STP	3107A	DDC to DDC
Cat 5 e	7923A	DDC to DGP Router
2Pair 24 AWG Cat 5 e	CAT 5e	Router to Work Statoin

CABLE TYPE	USED FOR	BELDEN PART#	B3 PART#	MAX DIST SUPPORT
				In Mts
2CX 16 AWG	DO	5200UE	C1008	150 M
3CX 16 AWG		5201UE	C1010	150 M
4CX 16 AWG		5202UE	C1012	150 M
5CX 16 AWG		5203UE		150 M
6CX 16 AWG		5204UE	C1253	150 M
7CX 16 AWG		5205UE		150 M
8CX 16 AWG		5206UE	C1255	150 M
2CX 16 AWG	DI	5200UE	C1008	250 M
3CX 16 AWG		5201UE	C1010	250 M
4CX 16 AWG		5202UE	C1012	250 M
5CX 16 AWG		5203UE		250 M
6CX 16 AWG		5204UE	C1253	250 M
7CX 16 AWG		5205UE		250 M
8CX 16 AWG		5206UE	C1255	250 M
2CX 16 AWG STP	AI & AO	5200FE	C1007	150 M
3CX 16 AWG STP		5201FE	C1009	150 M
4CX 16 AWG STP		5202FE	C1011	150 M
6CX 16 AWG STP			C1252	150 M
8CX 16 AWG STP			C1254	150 M
ModBus Loop	Modbus	3107A / 3106A		LESS THAN 1000M
Mbus Loop	Mbus	3107A Or 3106A		LESS THAN 1000M
BACnet MS/TP Loop	BACnet MS/TP	9925 Or 9842		LESS THAN 1000M
BACnet/LON Loop	BACnet LON	8471		LESS THAN 1000M
KNX Loop	KNX	YE00819		LESS THAN 1000M

BOQ for Some Project

Document: III BILLS OF QUANTITIES		TYPE OF WORK:					
Building: 03. ADMINISTRATION BUILDING EXTENSION		12. MECHANICAL					
		12.6 AIR CONDITIONING					
		12.6.3 AUTOMATIC CONTROL					
CHAPTER		REFERENCES					AMOUNT
ITEM	DESCRIPTION	SPEC	DRAWING	Q'TY	UNIT	RATE	SR
A	Two way on/off control valve, DN-15mm	15-23.56	AC-101 TO AC-117, AC-211, AC-212	15	No		
Rate in words:							
B	Two way on/off control valve, DN-20mm	15-23.56	AC-101 TO AC-117, AC-211, AC-212	1	No		
Rate in words:							
C	Two way on/off control valve, DN-25mm	15-23.56	AC-101 TO AC-117, AC-211, AC-212	1	No		
Rate in words:							
D	Two way on/off control valve, DN-32mm	15-23.56	AC-101 TO AC-117, AC-211, AC-212	1	No		
Rate in words:							
E	Two way modulating control valve, DN-40mm	15-23.43	AC-101 TO AC-117, AC-211, AC-212	3	No		
Rate in words:							
F	Two way modulating control valve, DN-65mm	15-23.43	AC-101 TO AC-117, AC-211, AC-212	5	No		
Rate in words:							
G	Two way modulating control valve, DN-80mm	15-23.43	AC-101 TO AC-117, AC-211, AC-212	1	No		
Rate in words:							

H	Two way modulating control valve, DN-100mm	18,23,43	AC-101 TO AC-117, AC-211, AC-212	1 No					
Rate in words:									
I	Three way modulating control valve, DN-65mm	18,23,54	AC-101 TO AC-117, AC-211, AC-212	1 No					
Rate in words:									
J	On off control damper motor with spring return (freecooling)	18,23,39	AC-211, AC-212	6 No					
Rate in words:									
K	Continuous control damper motor with spring return	18,23,39	AC-211, AC-212	6 No					
Rate in words:									
L	Electronic duct temperature and humidity sensor (AHU-1 to AHU-6)	18,23,40	AC-211, AC-212	24 No					
Rate in words:									
M	Electronic out door air temperature sensor	18,23,46	AC-211, AC-212	1 No					
Rate in words:									
TO COLLECTION									

Document: ■■■ BILLS OF QUANTITIES
 Building: 03. ADMINISTRATION BUILDING EXTENSION

TYPE OF WORK:
 12. MECHANICAL
 12.6 AIR CONDITIONING
 12.6.3 AUTOMATIC CONTROL

CHAPTER ITEM	DESCRIPTION	REFERENCES		Q'TY	UNIT	RATE	AMOUNT SR
		SPEC	DRAWING				
N	Servomotor (AHU)	15.23.47	AC-211, AC-212	18	No		
				Rate in words:			
O	Variable speed drive unit (VSD drive) for AHU motors	15.25.J	AC-211, AC-212	13	No		
				Rate in words:			
P	Variable speed drive unit (VSD drive) for Pumps	15.25.J	AC-211, AC-212	2	No		
				Rate in words:			
Q	Electronic differential pressure sensor (AHU)	15.23.48	AC-211, AC-212	10	No		
				Rate in words:			
R	Differential pressure switch (for filter status AHU)	15.24.6.J	AC-211, AC-212	14	No		
				Rate in words:			
S	Air flow switch (for AHU flow control)	15.24.6.J	AC-211, AC-212	13	No		
				Rate in words:			
T	Temperature transmitter-duct insertion	15.24.6.J	AC-211, AC-212	35	No		
				Rate in words:			
U	Pressure transmitter (CHW pipe)	15.24.6.J	AC-211, AC-212	3	No		
				Rate in words:			

V	Temperature transmitter-chilled water Pipe	15.24.6.J	AC-211, AC-212	19	No		
				Rate in words:			
W	PLC-AHU (DDC type control unit for AHU)	15.23.87	AC-211, AC-212	7	No		
				Rate in words:			
X	PLC-FC	15.23.76	AC-211, AC-212	15	No		
				Rate in words:			
Y	PLC-VV (DDC type control unit for VV units)	15.23.84.A	AC-211, AC-212	229	No		
				Rate in words:			
Z	Room thermostat with set point adjustment VV unit control	15.23.84.F	AC-001 TO AC-017, AC-211, AC-212	226	No		
				Rate in words:			
TO COLLECTION							

Document: ■■■ BILLS OF QUANTITIES			TYPE OF WORK:				
Building: 03. ADMINISTRATION BUILDING EXTENSION			12. MECHANICAL				
			12.6 AIR CONDITIONING				
			12.6.3 AUTOMATIC CONTROL				
CHAPTER			REFERENCES				AMOUNT
ITEM	DESCRIPTION	SPEC	DRAWING	QTY	UNIT	RATE	SR
AA	Continuous control damper motor for VV unit	15.23.84.C	AC-211, AC-212	286	No		
Rate in words:							
AB	Velocity/Differential pressure sensor for VV unit control	15.23.84.D	AC-211, AC-212	286	No		
Rate in words:							
AC	PLC (DDC type control unit for cooling water pipe incoming to building)	15.23.84.A	AC-211, AC-212	1	No		
Rate in words:							
AD	PLC (DDC type control unit for fan unit)	15.23.87	AC-211, AC-212	4	No		
Rate in words:							
AE	PLC (DDC type control unit for pumps and heat exchanger)	15.23.84.A	AC-211, AC-212	1	No		
Rate in words:							
AF	Integration with existing central control & monitoring system of Campus	15.23.86	AC-211, AC-212	1	No		
Rate in words:							
AG	Operator work station- BMC panels, monitor, printer, network switches all inclusive	15.23.89	AC-211, AC-212	1	No		
Rate in words:							

AH	LON bus cable interconnecting VV units with zone controller	15.23.05-B	AC-211, AC-212	1431 m			
				Rate in words:			
AI	21 mm ND PVC conduit (LON bus network)	16.12.2	AC-211, AC-212	1431 m			
				Rate in words:			
AJ	Cable for interconnecting DCP, DDC controllers and zone controllers	15.23.05-B	AC-211, AC-212	314 m			
				Rate in words:			
AK	21 mm ND PVC conduit (interconnection of DCP panels/DDC panels & zone controllers)	16.12.2	AC-211, AC-212	314 m			
				Rate in words:			
AL	Cable from building to central control system located in plants & network area	15.23.05-C	AC-211, AC-212	56 m			
				Rate in words:			
AM	21 mm ND PVC conduit (Cable from building to central control system)	16.12.2	AC-211, AC-212	56 m			
				Rate in words:			
TO COLLECTION							

Document: III BILLS OF QUANTITIES
Building: 03. ADMINISTRATION BUILDING EXTENSION

TYPE OF WORK:
12. MECHANICAL
12.6 AIR CONDITIONING
12.6.3 AUTOMATIC CONTROL

CHAPTER ITEM	DESCRIPTION	SPEC	REFERENCES DRAWING	Q'TY	UNIT	RATE	AMOUNT SR
AN	Junction boxes (for Lon bus network)	16.12.4.C	AC-211, AC-212	229	No		
				Rate in words:			
AO	Junction boxes (for interconnection of ddc panels)	16.12.4.C	AC-211, AC-212	28	No		
				Rate in words:			
AP							
				Rate in words:			
AQ							
				Rate in words:			
AR							
				Rate in words:			
AS							
				Rate in words:			
AT							

Example

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
1		Roof Floor							
2		Control Panel #1							
3		Electrical Panels							
4		PDB 7.5 (Status, Alarm)	1		2				
5		AHU (VAV Type) #10							
6	QBM81-10	Differential Pressure Switch for Sand Filter	1		1				Siemens
7	QFM2120	Outside Air temperature/Humidity in F/A Duct	1			2			Siemens
8	QAM2120.040	Duct Temperature Sensor	1			1			Siemens
9	QFM2120	Temperature/Humidity Sensor for Duct	1			2			Siemens
10	QBM81-10	Differential Pressure Switch for Filters	2		2				Siemens
11	QAE2120.010	Immersion Temperature Sensor	2			2			Siemens
12		2-Way Valve for Cooling Coil	1			1	1		
13		Heater (Command, Status)	1	7	7				
14	GBB161.1E	Motorized Damper Actuator F/A (Command, Status)	1			1	1		Siemens
15	GBB161.1E	Motorized Damper Actuator R/A (Command, Status)	1			1	1		Siemens
16	GBB161.1E	Motorized Damper Actuator E/A (Command, Status)	1			1	1		Siemens
17		Supply Fan (Command, Auto, Status, Trip)		1	3				
18	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
19		Supply Fan (Speed Command)	1				1		
20		Return Fan (Command, Status, Trip)		1	2				
21	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
22		Return Fan (Speed Command)	1				1		
23	QBM66.203	Supply Pressure Sensor	1			1			Siemens
24		Fire Alarm Status (Volfree contact)	1		1				
25	PXC100.D	Modular Controller with I/O Modules	1						Siemens
26	Control Panel	DGP	1						Siemens
27		Total Points		9	20	12	6		
28		Extra Points		11	24	15	8	58	
29									
30		Control Panel #2							
31		AHU (VAV Type) #11							
32	QFM2120	Outside Air temperature/Humidity in F/A Duct	1			2			Siemens
33	QAM2120.040	Duct Temperature Sensor	1			1			Siemens
34	QFM2120	Temperature/Humidity Sensor for Duct	1			2			Siemens
35	QBM81-10	Differential Pressure Switch for Filters	2		2				Siemens
36	QAE2120.010	Immersion Temperature Sensor	2			2			Siemens
37		2-Way Valve for Cooling Coil	1			1	1		
38		Heater (Command, Status)	1	4	4				
39	GBB161.1E	Motorized Damper Actuator F/A (Command, Status)	1			1	1		Siemens
40	GBB161.1E	Motorized Damper Actuator R/A (Command, Status)	1			1	1		Siemens
41	GBB161.1E	Motorized Damper Actuator E/A (Command, Status)	1			1	1		Siemens

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
42		Supply Fan (Command, Auto, Status, Trip)		1	3				
43	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
44		Supply Fan (Speed Command)	1				1		
45		Return Fan (Command, Status, Trip)		1	2				
46	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
47		Return Fan (Speed Command)	1				1		
48	QBM86.203	Supply Pressure Sensor	1			1			Siemens
49		Fire Alarm Status (Volfree contact)	1		1				
50	PXC100.D	Modular Controller with I/O Modules	1						Siemens
51	Control Panel	DGP	1						Siemens
52		Total Points		8	14	12	8		
53		Extra Points		8	17	15	8	48	
54									
55		Control Panel #3							
56		Electrical Panels							
57		PDB 8.6 (Status, Alarm)	1		2				
58		AHU (VAV Type) #12							
59	QBM81-10	Differential Pressure Switch for Sand Filter	1		1				Siemens
60	QFM2120	Outside Air temperature/Humidity in F/A Duct	1			2			Siemens
61	QAM2120.040	Duct Temperature Sensor	1			1			Siemens
62	QFM2120	Temperature/Humidity Sensor for Duct	1			2			Siemens
63	QBM81-10	Differential Pressure Switch for Filters	2		2				Siemens
64	QAE2120.010	Immersion Temperature Sensor	2			2			Siemens
65		2-Way Valve for Cooling Coil	1			1	1		
66		Heater (Command, Status)	1	3	3				
67	GBB161.1E	Motorized Damper Actuator F/A (Command, Status)	1			1	1		Siemens
68	GBB161.1E	Motorized Damper Actuator R/A (Command, Status)	1			1	1		Siemens
69	GBB161.1E	Motorized Damper Actuator E/A (Command, Status)	1			1	1		Siemens
70		Supply Fan (Command, Auto, Status, Trip)		1	3				
71	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
72		Supply Fan (Speed Command)	1				1		
73		Return Fan (Command, Status, Trip)		1	2				
74	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
75		Return Fan (Speed Command)	1				1		
76	QBM86.203	Supply Pressure Sensor	1			1			Siemens
77		Fire Alarm Status (Volfree contact)	1		1				
78	PXC100.D	Modular Controller with I/O Modules	1						Siemens
79	Control Panel	DGP	1						Siemens
80		Total Points		5	16	12	8		
81		Extra Points		8	20	15	8	49	

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
83		Control Panel # 4							
84		AHU (VAV Type) #13							
85	QFM2120	Outside Air temperature/Humidity in F/A Duct	1			2			Siemens
86	QAM2120.040	Duct Temperature Sensor	1			1			Siemens
87	QFM2120	Temperature/Humidity Sensor for Duct	1			2			Siemens
88	QBM81-10	Differential Pressure Switch for Filters	2		2				Siemens
89	QAE2120.010	Immersion Temperature Sensor	2			2			Siemens
90		2-Way Valve for Cooling Coil	1			1	1		
91		Heater (Command, Status)	1	5	5				
92	GBB161.1E	Motorized Damper Actuator F/A (Command, Status)	1			1	1		Siemens
93	GBB161.1E	Motorized Damper Actuator R/A (Command, Status)	1			1	1		Siemens
94	GBB161.1E	Motorized Damper Actuator E/A (Command, Status)	1			1	1		Siemens
95		Supply Fan (Command, Auto, Status, Trip)		1	3				
96	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
97		Supply Fan (Speed Command)	1				1		
98		Return Fan (Command, Status, Trip)		1	2				
99	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
100		Return Fan (Speed Command)	1				1		
101	QBM86.203	Supply Pressure Sensor	1			1			Siemens
102		Fire Alarm Status (Volfree contact)	1		1				
103	PXC100.D	Modular Controller with I/O Modules	1						Siemens
104	Control Panel	DGP	1						Siemens
105		Total Points		7	15	12	6		
106		Extra Points		9	18	15	8	50	
107									
108		Control Panel #5							
109		Electrical Panels							
110		PDB 9.6 (Status, Alarm)	1		2				
111		AHU (VAV Type) #14							
112	QBM81-10	Differential Pressure Switch for Sand Filter	1		1				Siemens
113	QFM2120	Outside Air temperature/Humidity in F/A Duct	1			2			Siemens
114	QAM2120.040	Duct Temperature Sensor	1			1			Siemens
115	QFM2120	Temperature/Humidity Sensor for Duct	1			2			Siemens
116	QBM81-10	Differential Pressure Switch for Filters	2		2				Siemens
117	QAE2120.010	Immersion Temperature Sensor	2			2			Siemens
118		2-Way Valve for Cooling Coil	1			1	1		
119		Heater (Command, Status)	1	6	6				
120	GBB161.1E	Motorized Damper Actuator F/A (Command, Status)	1			1	1		Siemens
121	GBB161.1E	Motorized Damper Actuator R/A (Command, Status)	1			1	1		Siemens
122	GBB161.1E	Motorized Damper Actuator E/A (Command, Status)	1			1	1		Siemens

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
124	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
125		Supply Fan (Speed Command)	1				1		
126		Return Fan (Command, Status, Trip)		1	2				
127	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
128		Return Fan (Speed Command)	1				1		
129	QBM66.203	Supply Pressure Sensor	1			1			Siemens
130		Fire Alarm Status (Volfree contact)	1		1				
131	PXC100.D	Modular Controller with I/O Modules	1						Siemens
132	Control Panel	DGP	1						Siemens
133		Total Points		8	19	12	6		
134		Extra Points		10	23	15	8	56	
135									
136		Control Panel #6							
137		Electrical Panels							
138		PDB 6.6 (Status, Alarm)	1		2				
139		AHU (VAV Type) #15							
140	QBM81-10	Differential Pressure Switch for Sand Filter	1		1				Siemens
141	QFM2120	Outside Air temperature/Humidity in F/A Duct	1			2			Siemens
142	QAM2120.040	Duct Temperature Sensor	1			1			Siemens
143	QFM2120	Temperature/Humidity Sensor for Duct	1			2			Siemens
144	QBM81-10	Differential Pressure Switch for Filters	2		2				Siemens
145	QAE2120.010	Immersion Temperature Sensor	2			2			Siemens
146		2-Way Valve for Cooling Coil	1			1	1		
147		Heater (Command, Status)	1	4	4				
148	GBB161.1E	Motorized Damper Actuator F/A (Command, Status)	1			1	1		Siemens
149	GBB161.1E	Motorized Damper Actuator R/A (Command, Status)	1			1	1		Siemens
150	GBB161.1E	Motorized Damper Actuator E/A (Command, Status)	1			1	1		Siemens
151		Supply Fan (Command, Auto, Status, Trip)		1	3				
152	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
153		Supply Fan (Speed Command)	1				1		
154		Return Fan (Command, Status, Trip)		1	2				
155	QBM81-3	Differential Pressure Switch for Fan	1		1				Siemens
156		Return Fan (Speed Command)	1				1		
157	QBM66.203	Supply Pressure Sensor	1			1			Siemens
158		Fire Alarm Status (Volfree contact)	1		1				
159	PXC100.D	Modular Controller with I/O Modules	1						Siemens
160	Control Panel	DGP	1						Siemens
161		Total Points		6	17	12	6		
162		Extra Points		8	21	15	8	52	
163									
164		Control Panel #7							

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
165		Exhaust Fans 5.5, 5.9, 5.10, 5.13, 5.16, 5.22, 5.23, 5.32, 5.36							
166		Exhaust Fan (Comand, Status, Trip)	9	9	18				
167	QBM81-3	Differential Pressure Switch for Fan	9		9				Siemens
168		Elevator # 4.2, 4.5, 5, 6							
169		Elevator (Status, Alarm)	4		8				
170		Electrical Panels							
171		PDB 8.9 (Status, Alarm)	1		2				
172		PDB 5.5 (Status, Alarm)	1		2				
173		PDB/LDB 7.4 (Status, Alarm)	1		2				
174		Lighting control (Command, Alarm)	1	1	1				
175		PDB/LDB 9.4 (Status, Alarm)	1		2				
176		Lighting control (Command, Alarm)	1	1	1				
177		Split Unit # 12							
178		Split Unit (Command, Status)	1	1	1				
179	PXC100.D	Modular Controller with I/O Modules	1						Siemens
180	Control Panel	DGP	1						Siemens
181		Total Points		12	46	0	0		
182		Extra Points		15	56	0	0	71	
183									
184		Control Panel #8							
185		Exhaust Fans 5.3, 5.4, 11.1, 11.2, 12, 14, 15, 31							
186		Exhaust Fan (Comand, Status, Trip)	8	8	16				
187	QBM81-3	Differential Pressure Switch for Fan	8		8				Siemens
188		Elevator # 7, 5.1, 5.2							
189		Elevator (Status, Alarm)	3		6				
190		Electrical Panels							
191		PDB 6.5 (Status, Alarm)	1		2				
192		PDB 8.8 (Status, Alarm)	1		2				
193		PDB/LDB 8.4 (Status, Alarm)	1		2				
194		Lighting control (Command, Alarm)	1	1	1				
195		PDB/LDB 6.4 (Status, Alarm)	1		2				
196		Lighting control (Command, Alarm)	1	1	1				
197		Split Unit # 13, 14							
198		Split Unit (Command, Status)	2	2	2				
199	PXC100.D	Modular Controller with I/O Modules	1						Siemens
200	Control Panel	DGP	1						Siemens
201		Total Points		12	42	0	0		
202		Extra Points		15	51	0	0	66	
203									

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
205		Control Panel #9							
206		Electrical Panels							
207		IDF 8DB (Status, Alarm)	1		2				
208		PDB/LDB 6.3 (Status, Alarm) Normal, Emergency, UPS	1		6				
209		Lighting control (Command, Alarm)	3	3	3				
210		PDB/LDB 8.3 (Status, Alarm) Normal, Emergency, UPS	1		6				
211		Lighting control (Command, Alarm)	3	3	3				
212	PXC52	Compact Controller	1						Siemens
213	Control Panel	DGP	1						Siemens
214		Total Points		6	20	0	0		
215		Extra Points		8	24	0	0	32	
216									
217		Control Panel #10							
218		Fire Alarm							
219		FACP (Status, Alarm)	1		2				
220		Floor Fire Alarm			1				
221		Split Unit # 2, 10							
222		Split Unit (Command, Status)	2	2	2				
223		Electrical Panels							
224		IDF 9DB (Status, Alarm)	1		2				
225		PDB/LDB 5.4 (Status, Alarm) Normal, Emergency, UPS	1		6				
226		Lighting control (Command, Alarm)	3	3	3				
227		PDB/LDB 7.3 (Status, Alarm) Normal, Emergency, UPS	1		6				
228		Lighting control (Command, Alarm)	3	3	3				
229		PDB/LDB 9.3 (Status, Alarm) Normal, Emergency, UPS	1		6				
230		Lighting control (Command, Alarm)	3	3	3				
231	PXC100.D	Modular Controller with I/O Modules	1						Siemens
232	Control Panel	DGP	1						Siemens
233		Total Points		11	34	0	0		
234		Extra Points		14	41	0	0	55	
235									
236		1st Floor							
237		Control Panel #11							
238		Split Unit# 6.2							
239		Split Unit (Command, Status)	1	1	1				
240		Electrical Panels							
241		IDF 4DB (Status, Alarm)	1		2				
242		PDB/LDB 6.2 (Status, Alarm) Normal, Emergency, UPS	1		6				
243		Lighting control (Command, Alarm)	3	3	3				
244		PDB/LDB 8.2 (Status, Alarm) Normal, Emergency, UPS	1		6				
245		Lighting control (Command, Alarm)	3	3	3				

No.	Part No.	Description	Qty	DO	DI	UI	AO	Total Points	Responsible for Supply
369		VAV Control							
370	550-430 (Application 2580)	BACnet Actuator (Command, Position)	445					1780	Siemens
371		Built-in Pressure Sensor for Air Flow (Min- Max)	445						
372	540-680CB	Room Temperature + Set Point	435						Siemens
373	Loytec	Router BACnet MS/TP to BACnet/IP	6						Siemens
374	PXC00-E.D	Controller for Enhanced Features	6						Siemens
375	SEM62.1	Control Transformer (220 to 24ac)	445						Siemens
376									
377		Building Management System							
378	PXG80-N	BACnet Router with Panel	2						Siemens
379	RXZ02.1	Bus Terminator	4						Siemens
380	Fiber Optic Switch	Optical Fiber Switch	3						Siemens
381	PXM20 + PXA-C1	Operator Terminal	1						Siemens
382	CMM.04	Design Insight Software Units	880						Siemens
383									

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The following are a list of abbreviations used throughout these design guidelines and are also abbreviations used by the University of British Columbia relating to Building Management Systems.

ACC - UBC Auxiliary Control and Alarm Centre
ANSI - American National Standards Institute
ASC - Application Specific Controller
ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM - American Society for Testing Materials
AWG - American Wire Gauge
BMS - Building Management and Control System
BACnet - Building Automation and Controls Network - ANSI/ASHRAE Standard 135-2001

CBMS - Campus Building Management System
CCF - BMS Central Computer Facility
CCP - Communications Control Panel
CPU - Central Processing Unit
DCP - Distributed Control Panel
DDC - Direct Digital Control
FAS - Fire Detection, Alarm and Communication System
FTS - Field Termination Schedule
H/O/A - Hand/Off/Auto Motor Control Switch/Circuit
HVAC - Heating, Ventilating and Air Conditioning
IEEE - Institute of Electrical and Electronics Engineers
I/O - Input/Output
JCI - Johnson Controls, Inc.
LAN - Local Area Network
LCD - Liquid Crystal Display
LED - Light Emitting Diode
LON - Local Operating Network
LonTalk - The open control networking protocol developed by Echelon Corporation
LONWORKS - Echelon's family of hardware and software products

MACC-	BMS Master Alarm and Control Centre
NDS -	Network Data Server
NEC -	National Electrical Code
NEMA -	National Electrical Manufacturers Association
OIW -	Operator Interface Workstation
PC -	Personal Computer
POT -	Portable Operator Workstation
PIM -	Process Interface Module
RAM -	Random Access Memory
RFI -	Radio Frequency Interference
RH -	Relative Humidity
ROW -	Remote Operator Workstation
RTD -	Resistance Temperature Device
SCU -	System 600 Standalone Control Unit DCP
SVGA -	Super Video Graphics Adapter
UBC -	University of British Columbia
cUL -	Underwriters Laboratory Canada
UPS -	Uninterruptible Power Supply Unit
VDU -	Video Display Unit