# TRABAJO DE FIN DE GRADO

## Planificación, Gestión y Desarrollo como Smart City para La Laguna

**Titulación:** Grado en Ingeniería Electrónica Industrial y Automática

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# CAPITULO 0. ASPECTOS GENERALES

# 0.1 Resumen

A lo largo de esta memoria encontraremos un trabajo dedicado a la mejora de La Laguna desde el punto de vista de las Smart Cities. Este proyecto surge de la relación establecida con la empresa **Técnicas Competitivas S.A.** durante la realización de las prácticas externas.

Comenzaremos con un capítulo en el que se explicará que es una Smart City y se desarrollará el emplazamiento y sus características y su estado actual en este ámbito. Por último en este capítulo se detallará un apartado de términos característicos y definiciones, necesarios para la lectura de este trabajo.

En el siguiente capítulo entraremos en el diseño propuesto, basado en tres apartados principales, la red de área metropolitana donde se describe la red que soportará todos los sistemas de este proyecto, las comunicaciones por línea eléctrica cuya misión es llevar conexión a la red a los lugares de difícil acceso para la fibra óptica y la red de sensores. En los dos últimos apartados de este capítulo se explicarán los sistemas que controlan y contienen los tres apartados anteriores.

A continuación nos encontraremos con un capítulo de presupuesto, detallado por componente y dispositivo, el capítulo de las conclusiones obtenidas a lo largo del desarrollo de este trabajo, la bibliografía y los anexos.

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Throughout the length of this statement we will find a project dedicated on the improvement of La Laguna from the point of view of the Smart Cities. This project issue from the relationship stablished with Técnicas Competitivas S.A. during the development of my internship.

We will begin with a chapter where we will explain what a Smart City is and we will expand on the placement, its characteristics and the actual condition on this topic. At the end of this chapter we will find a part of terms and definitions used in the project.

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On the next chapter we get into the suggested design, based in three main parts, the metropolitan area network where we will describe the network that will hold all the systems of this project, power line communications which mission is to give access to the network at points where fiber-optic is out of reach and sensors network. At the last two parts of this chapter we will find out who control the previous parts and where are they located.

Next, we will find the budget chapter, specified by component and gadget, a chapter of the conclusions obtained during the development of the project, the bibliography and the attached documentation.

## 0.2 Nomenclatura y Abreviaturas

- AP: Acces Point (Punto de acceso inalámbrico).
- B-PLC: Broadband PowerLine Communications (Comunicación de banda ancha por línea eléctrica).
- $CO_2$: Dióxido de Carbono.
- CPD: Centro de Procesamiento de Datos.
- EEM: Enterprise Energy Management.
- FO: Fibra Óptica.
- I/O: Inputs/Outputs (Entradas y salidas).
- IP: Internet Protocol (Protocolo de Internet).
- LED: Light-Emitting Diode (Diodo emisor de luz).
- MAN: Metropolitan Area Network (Red de área metropolitana).
- Msnm: Metros sobre el nivel del mar.
- NTCS: National Television System Committee (Comité Nacional de Sistema de Televisión.
- NVR: Network Video Recording (Sistema de grabación de video en red).
- PAL: Phase Alternating Line (Línea de fase alternada).
- PC: Personal Computer (Ordenador de uso personal).
- PLC: Programmable Logic Controller (Controlador Lógico Programable).
- REBT: Reglamento Electrotécnico de Baja Tensión.
- RECI: Red Española de Ciudades Inteligentes.
- RGPD: Reglamento General de Protección de Datos.
- RSU: Residuo Sólido Urbano.
- SCADA: Supervisory Control And Data Acquisition (Supervisión, Control y Adquisición de Datos).
- TCP: Transmission Control Protocol (Protocolo de transmisión de datos).
- TIC: Tecnologías de la Información y la Comunicación.
- VMS: Video Management System (Sistema de control de video).
- VRM: Video Recording Manager (Controlador de grabación de video).
- VSS: Virtual Switching System (Sistema virtual de switch).
- WiSM: Wireless Service Module (Módulo de servicio inalámbrico).
- WSN: Wireless Sensor Network (Red inalámbrica de sensores).

# CAPITULO 1. INTRODUCCIÓN

## 1.1 Objetivos

La finalidad de este trabajo no difiere demasiado de los objetivos de una Smart City propiamente dicha, es decir, que la ciudad en cuestión mejore en sostenibilidad, tanto económica como social y medioambiental, sea más eficiente y pueda aportarle a sus ciudadanos una calidad de vida más elevada.

Para conseguir los objetivos propuestos, en este trabajo se propone un modelo de evolución para San Cristóbal de La Laguna que consiga que en el futuro próximo la ciudad pueda convertirse en una Smart City de alto nivel. Dicho modelo de evolución se centrará en las TIC para conseguir que se llegue a los cambios necesarios de una manera más sencilla y rápida.

Como objetivos paralelos, este trabajo está elaborado para la superación de la asignatura Trabajo de Fin de Grado y para la adquisición de conocimientos relacionados con este ámbito durante el transcurso de la misma.

Además, también se pretende obtener conocimientos dentro del ámbito de la redacción de proyectos y del uso de normativas y leyes relacionadas con los temas tratados, que ayudarán en un futuro a la realización de trabajos similares.

## 1.2 Situación y Emplazamiento

Este trabajo se centra en el municipio de San Cristóbal de La Laguna, municipio perteneciente a la provincia de Santa Cruz de Tenerife, en la isla de Tenerife —Canarias, España—. Su centro urbano más relevante, y capital del municipio, se ubica en la ciudad de La Laguna, situada a 545 msnm (metros sobre el nivel del mar). Posee una población de 152.843 habitantes, lo que convierte a La Laguna en la segunda ciudad más poblada de Tenerife y tercera del archipiélago canario.

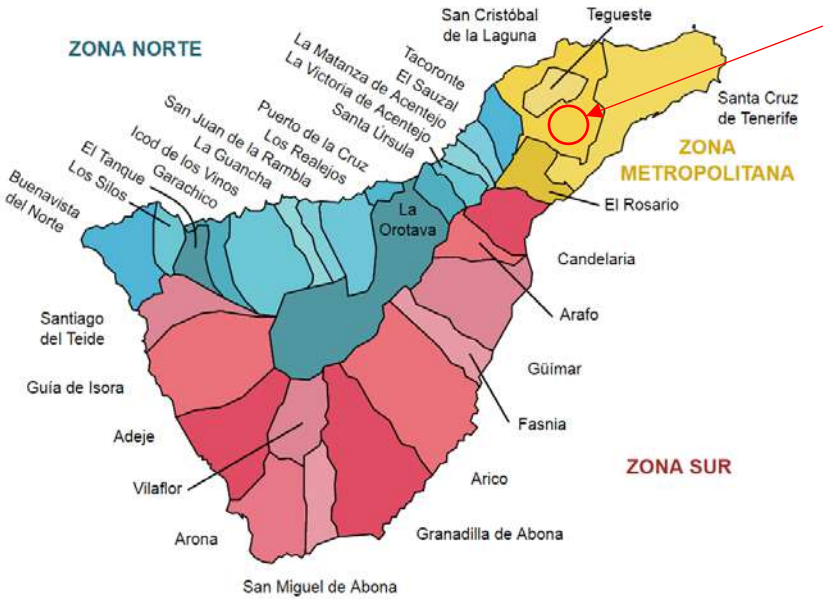


*Figura 1.1 – Isla de Tenerife*

La ciudad fue declarada Patrimonio de la Humanidad por la Unesco en 1999 por ser ejemplo único de ciudad colonial no amurallada. Como organismos a destacar que se encuentran en el municipio tenemos, el Consejo Consultivo de Canarias, el Instituto de Astrofísica de Canarias, la Diócesis de Tenerife, el Aeropuerto de Tenerife Norte y el Hospital Universitario de Canarias. Además, también tiene sede en la ciudad la primera universidad fundada en Canarias, y el primer y más antiguo instituto en activo del archipiélago, motivo por el cual La Laguna históricamente fue considerada como el centro intelectual de Canarias. Fue sede de la Capitanía General de Canarias (1656-1723) y hasta 1833 fue la capital de facto del archipiélago canario.

El término municipal de La Laguna está situado al noreste de la isla de Tenerife, en el valle de Aguere, entre el macizo de Anaga y el Monte de La Esperanza. Limita con los municipios de Santa Cruz de Tenerife, El Rosario y Tacoronte, rodeando completamente al municipio de Tegueste (ver *Figura 1.1*).

Debido a su extensión en el municipio podemos encontrarnos con paisajes de muy diferentes características, aportándole así diversidad.

*Figura 1.2 – Emplazamiento*

En esta memoria nos centraremos en el caso particular de San Cristóbal de La Laguna como capital municipal, también conocida como casco o simplemente La Laguna (*ver Figura 1.2*).

## 1.3 Antecedentes

### 1.3.1. ¿Qué es una Smart City?

Debido a la cantidad de revoluciones tecnológicas que ocurren actualmente, el concepto Smart City es un término caracterizado por estar en constante cambio. Dicho concepto siempre trata de enfocar todas las innovaciones en la mejora de la calidad de vida de los ciudadanos. Es por eso que dicho término debe estar definido por la gran variedad de agentes tecnológicos y empresariales existentes.

Las características principales de las Smart City son el uso de las TIC (**Tecnologías de la Información y la Comunicación**) para la mejora de la vida de sus ciudadanos, no solo a nivel personal, sino también ecológico y con eficiencia. Una ciudad inteligente es, por propia definición, una ciudad sostenible.

Algunas definiciones propuestas hasta el momento son:

*-Unión Europea-*

"Una Smart City tiene tres áreas prioritarias de actuación: energía, transporte y TIC (Tecnologías de la Información y la Comunicación). El objetivo de la aplicación de tecnología a estas áreas, es la mejora de la eficiencia, así como la reducción del consumo energético y de la emisión de gases de efecto invernadero."

*-Gartner-* (Empresa estadounidense centrada en el estudio de las TIC)

"Una Smart City es un área urbana, donde cooperan entidades públicas y privadas para lograr resultados sostenibles a través del análisis de información contextual en tiempo real compartida entre los diferentes sistemas expertos"

Como podemos observar, un nexo común entre todas las definiciones siempre es el uso de las TIC con el objetivo de crear un desarrollo tanto económico, como social y ambiental sostenible, además de mejorar la calidad de vida de sus habitantes. A pesar de esto, no hay un acuerdo con las características mínimas que ha de cumplir una ciudad para ser considerada Smart. Es por ello que para la realización de este trabajo utilizaremos como definición central la

propuesta por la empresa *Movistar España*, que representa de manera directa y concisa que es una Smart City:

*- Movistar España –*

***"Una Smart City es la ciudad que emplea las TIC para lograr que sus infraestructuras críticas, así como sus servicios públicos, sean más interactivos y eficientes".***

### 1.3.2. Smart Cities alrededor del mundo

El término Smart City es, en la actualidad, un término ampliamente extendido y con gran interés para el estudio. Aun así, como comentamos anteriormente, no hay una serie de requisitos mínimos que se deban cumplir para ser considerado Smart. Es por eso que en la mayor parte de los estudios que nos encontramos las ciudades no se clasifican en inteligentes o no inteligentes, sino en cuanto de inteligente es una ciudad con respecto al resto de ciudades.

Para poder poner algunos ejemplos de esto, encontramos imprescindible el uso de un **estudio** patrocinado por la empresa **Nokia**, en el que se realiza un ranking con las ciudades más relevantes de cada continente.

Tenemos ejemplos de Smart City en Nueva York, que ha enfocado su plan de desarrollo en el ámbito Smart City a convertirse en la ciudad más sostenible, comprometiéndose a reducir las emisiones de $CO_2$ en un 80% en los próximos años. A pesar de estar centrada en ese punto, Nueva York también ha realizado una gran inversión en transporte (sensores para la monitorización del tráfico) y Smart Grids (también conocidas como redes de distribución eléctricas inteligentes), entre otros.

Por otro lado, nos encontramos con San Francisco, centrada al igual que Nueva York, en la sostenibilidad de la ciudad, pero que también ha invertido en una plataforma de Open Data, consistente en proporcionar a los ciudadanos toda la información de los proyectos y gastos que realiza el ayuntamiento, además de proporcionar un fácil acceso a trámites de manera online, así como una gran inversión en un sistema que ayuda a la ciudad a saber cómo se está desarrollando dentro del ámbito de las Smart Cities.

La cantidad de ejemplos es enorme, pero no es necesario que nos vayamos demasiado lejos para encontrarnos con verdaderas Ciudades Inteligentes. En España tenemos el principal caso, y ejemplo a seguir a lo largo de este proyecto, de Rivas-Vaciamadrid, además de El Hierro, considerado Smart Island, concepto introducido en España específicamente para Las Islas Canarias y Las Baleares. Además, recientemente, muchos ayuntamientos a lo largo de toda la geografía española han presentado sus propios proyectos de Smart City para la 2ª convocatoria organizada por red.es, encontrándonos con ciudades como Maspalomas, Alicante o Santander entre otras.

### 1.3.3. Rivas-Vaciamadrid (Ciudad modelo)

Dado que el sistema diseñado para La Laguna estará basado principalmente en la estructura de Rivas-Vaciamadrid como Smart City, vemos necesario realizar una descripción del estado y los sistemas de la ciudad ejemplo. Gran parte de la información que vamos a exponer a continuación se puede obtener desde la propia web del Ayuntamiento de la ciudad, aunque también utilizaremos información proporcionada por **Técnicas Competitivas S.A.**

Por un lado, y como se plantea en esta memoria, Rivas-Vaciamadrid ha desarrollado una red MAN (**Metropolitan Area Network**) para toda la ciudad, de manera que se puedan interconectar todos los elementos necesarios. Esto facilita en gran medida la creación y el mantenimiento de un sistema de estas dimensiones.

El ayuntamiento de Rivas-Vaciamadrid se ha centrado principalmente en la eficiencia energética, aunque también se ha invertido en la creación de una plataforma Open Data para los ciudadanos. Todos los edificios municipales y dependientes del ayuntamiento tienen instalados sensores que miden los consumos, tanto de agua como eléctricos y de gas, de manera que se pueda ajustar dicho consumo para un mejor rendimiento o reconocer averías y fallos en el funcionamiento más rápidamente. Además de estos controladores de consumo, toda la luminaria dependiente del Ayuntamiento está controlada remotamente.

Por otro lado se han instalado radares de control semafórico, para penalizar a los conductores que se salten los semáforos en rojo y así mejorar la seguridad vial, además de una mejora del sistema de alumbrado vial. En el ámbito de la seguridad se han instalado sistemas de

control de acceso en los colegios y demás dependencias municipales para mejorarla en dichos edificios.

Por último para el control de todos los elementos incluidos en esta red se diseñó y construyó una sala de control, con un software predeterminado y diseñado específicamente para este propósito a mano de la empresa **ADÍCORA**, unificando así todos los sistemas y facilitando el control de la red y de los elementos conectados a ella.

### 1.3.4. San Cristóbal de La Laguna como Ciudad Inteligente

En los últimos años La Laguna ha demostrado su capacidad para desarrollarse y convertirse en un centro con gran auge económico. Los principales factores que han permitido esto son: Reordenación de la trama urbana con la peatonalización parcial del centro histórico, la puesta en valor del patrimonio arquitectónico y cultural, y la mejora de los accesos y vías urbanas e interurbanas.

Debido a este desarrollo el Ayuntamiento ha considerado necesario plantear una estrategia que mejor la atracción de la Ciudad. Es por eso que el enfoque Smart City es el adecuado, permitiendo a la Ciudad decidir su futuro a través de acciones programadas y del aprovechamiento de las condiciones de partida de la ciudad. Este es el reto y la misión que ha asumido La Laguna para proyectarse en el tiempo.

La Estrategia se concreta en un Plan Director que establece una ordenación jerárquica de ejes y acciones concretas, cada una de las cuales cuenta con objetivos, indicadores y una estimación presupuestaria y financiera. La estructura de los ejes estratégicos está en línea con las determinaciones de la Red Española de Ciudades Inteligentes (RECI, cuya adhesión ha sido recientemente aprobada) y del Comité Técnico de AENOR, de modo que puedan establecerse mediciones y comparativas estandarizadas. Asimismo, el Plan cuenta con estructuras de gestión, coordinación y evaluación, que integran a las áreas municipales y a los agentes sociales locales.

El plan aborda los siguientes ejes:

1. Innovación social

2. Energía y Agua
3. Medio Ambiente, Infraestructuras y Habitabilidad
4. Movilidad urbana
5. Gobierno y Economía
6. Patrimonio y Turismo

A continuación, enumeramos algunos de los proyectos que ya han sido estudiados y aprobados, o que están llevándose a cabo en la actualidad, en la ciudad y que poseen relevancia para este proyecto:

1. Smart Environment: En primer lugar, tenemos el **"Pacto de los Alcaldes"** (movimiento europeo de compromiso para mejorar la eficiencia energética), su objetivo principal es reducir las emisiones de $CO_2$ para el año 2020 en un 21% respecto al año base (2008). Por otro lado, también han impulsado un sistema de Gestión Energética en Tiempo Real de Centros Educativos Usando Redes de Sensores Inalámbricos.

2. Smart Mobility: Bajo el nombre **"Movilidad Inteligente"**, se pretende crear un sistema que publique información de las reservas de estacionamiento en vías y parkings, con objetivo de reducir los desplazamientos y contribuir a la reducción del consumo energético.

3. Smart People: Bajo este punto se presenta un **"Sistema Integral de comunicaciones de Seguridad, Emergencias y Protección Civil"** con el objetivo de integrar todas las comunicaciones en el centro de control de Seguridad y protección civil, además de la puesta en marcha de un sistema de seguimiento de incidentes que permita aplicar la respuesta adecuada a cada situación.

#### 1.3.4.1. Estado de las TIC en La Laguna

Es necesario para este trabajo indicar también el estado de las TIC en el casco de San Cristóbal de La Laguna, así como de otros sistemas relevantes para las propuestas que se van a realizar. Para la obtención precisa de estos datos se concertó una cita con la **Jefa de gabinete**

del **Ayuntamiento de La Laguna** el día 3 de Agosto de 2017, además de posterior comunicación mediante correo electrónico. En esta cita se trató el tema de las TIC en la laguna y como se está abordando actualmente.

Por un lado, con respecto a las TIC, la red de fibra óptica está completamente desplegada en el casco (trabajo realizado por **Movistar España**), pero no poseen ningún tipo de punto de acceso Wi-Fi, ni gratuito ni de pago, en el exterior de las dependencias municipales. Además, los edificios a cargo del Ayuntamiento están conectados a una Intranet común a modo de base de datos, pero no poseen su propia red física. Podemos encontrar en el apartado 2.1 el diseño de la red física que necesitaría el municipio para abordar estos problemas.

Otro aspecto que tocaremos en el diseño es el de los sistemas de seguridad. En las dependencias públicas suele no haber seguridad, y en las que sí hay, podemos observar que no es una seguridad centralizada. Tampoco encontramos sistema de control de accesos en ninguna de las dependencias municipales del casco. Por otro lado, en los colegios que se encuentran dentro de la zona que estamos tratando, el ayuntamiento solo se encarga del exterior de los edificios, ya que el interior pertenece a la consejería de educación. En el apartado 2.1.2 podemos encontrar un sistema de seguridad que solucione esta situación.

Por último, los sistemas de alumbrado del municipio no disponen de algún tipo de regulación diferente al de apagado y encendido a las horas predeterminadas y usan tecnología de sodio, y el sistema de recogida de residuos, subcontratado a una empresa privada, no dispone de ningún sistema de feedback o de optimización de rutas de recogido. Con la comunicación B-PLC y la red de sensores de los apartados 2.2 y 2.3 respectivamente, abordamos estos problemas y proponemos una solución adaptada.

## 1.4 Terminología y Definiciones

A continuación, se describirán los términos que serán utilizados a lo largo del proyecto:

### 1.4.1. HUB

Dispositivo que permite la centralización del cableado de una red para su posterior ampliación, actuando así de núcleo o nodo central. Comúnmente son sustituidos por switchs que pueden cumplir la misma función.

### 1.4.2. Open Data

Filosofía que consiste en la divulgación libre de determinados tipos de datos sin ningún tipo de restricciones ni derechos de autor. En los Ayuntamientos de muchas ciudades, tanto españolas como extranjeras, consiste en permitirle a los ciudadanos acceder a todos los datos que necesiten de manera online y gratuita, y la facilidad de hacer trámites de cualquier tipo telemáticamente.

### 1.4.3. Redes B-PLC (Broadband PowerLine Communication)

La tecnología B-PLC es un método de comunicación que utiliza el cableado eléctrico para transportar de manera simultánea tanto datos como electricidad. En la actualidad es un método de comunicación ampliamente utilizado, principalmente cogiendo fuerza en el desarrollo de Smart Cities debido a sus grandes ventajas con respecto al cableado tradicional.

### 1.4.4. Sistema de Control de Accesos

Un sistema de Sistema de Control de Accesos responde a varias necesidades que provienen de sus características y de su exclusividad, entre las que cabe destacar las siguientes:

- Impedir la entrada de personas o vehículos no autorizados dentro de las dependencias municipales en general y, en particular, a las instalaciones de importancia especial. Tanto para empleados habituales como para visitas, proveedores, contratas, etc.
- Asegurar la identificación del personal que acceda a las instalaciones.
- Asegurar un cuadro de situación en tiempo real en cuanto a los eventos que se produzcan en los recintos, es decir, conocer en todo momento el estado en el que se encuentra cada instalación.
- Permitir un mando completo de los subsistemas, centralizado desde el edificio de la Policía Local.
- Control central de todas las entradas/salidas de los sistemas de seguridad y comunicaciones, ya sea durante operación normal, como durante situaciones de emergencia.

El control de accesos se realiza generalmente por medio de lectores y tarjetas de proximidad. Estos estarán directamente conectados a la red MAN del Ayuntamiento de San Cristóbal de La Laguna, asignándoles una dirección IP.

- Los sistemas de control y supervisión captan y, en algunos casos, operan automáticamente, de acuerdo a una metodología expresa.
- Cada subsistema actúa, en lo posible, mediante un funcionamiento independiente del resto, de manera que las averías ocasionadas en alguno de los elementos no repercutan en el resto de la instalación.

### 1.4.5. Sistemas KNX

KNX es un estándar abierto utilizado en la actualidad para el control de viviendas y edificios a nivel mundial. Su objetivo es transferir los datos de control de todos los dispositivos del sistema al centro de control eliminando los problemas que presentan los dispositivos aislados, consiguiendo que todos los componentes se comuniquen a través de un lenguaje común.

### 1.4.6. Sistema SCADA

SCADA, cuyas siglas en español significan “Supervisión, Control y Adquisición de Datos” es un concepto para la creación de software para ordenadores que permita controlar y supervisar procesos industriales a distancia, siendo nuestro caso una ciudad. Será el encargado de proporcionar el control en tiempo real de cada uno de los procesos presentes en el sistema en su conjunto, recibiendo los datos por parte de los sensores instalados.

### 1.4.7. Sistema de Videovigilancia

Un sistema de videovigilancia consiste en una serie de cámaras conectadas por red a un sistema de grabación, que permitirá conocer el estado de las instalaciones que se estén tratando, tanto en tiempo real como para su posterior estudio, así como mejorar la seguridad de las mismas.

Las condiciones y requisitos de un sistema de este calibre son las siguientes:

- Alto rendimiento de vídeo (resolución, fluidez de PAL/NTSC (**Phase Alternating Line/National Television System Committee**))
- Sistema integrado con centralización de configuración y gestión
- Gestión de telecontrol
- Gestión de almacenamiento de vídeo
- Gestión de alarmas y eventos
- Aplicaciones de análisis de contenido de la imagen

A Partir del RGPD (**Reglamento General de Protección de Datos**), específicamente de la **instrucción 1/2006**, referida a sistemas de videovigilancia, obtenemos los mínimos (requisitos y normas) que debe cumplir un sistema de videovigilancia cuando afecta a datos de carácter personal:

- La instalación de cámaras o videocámaras sólo es admisible cuando la finalidad de vigilancia no pueda obtenerse mediante otros medios que, sin exigir esfuerzos desproporcionados, resulten menos intrusivos para la intimidad de las personas y para su derecho a la protección de datos de carácter personal.
- Las cámaras y videocámaras instaladas en espacios privados no podrán obtener imágenes de espacios públicos, salvo que resulte imprescindible para la finalidad de

vigilancia que se pretende, o resulte imposible evitarlo por razón de la ubicación de las cámaras.

- Las imágenes sólo serán tratadas cuando sean adecuadas, pertinentes y no excesivas en relación al ámbito y las finalidades determinadas, legítimas y explícitas. En caso de crearse un fichero de imágenes (no solo usar el vídeo a tiempo real), este habrá de inscribirse en el Registro General y los interesados habrán de contar con impresos en los que se detalle la información sobre el fichero y su finalidad, el destinatario de los datos, la posibilidad de ejercicio de los derechos por parte del interesado, y la identificación del responsable del fichero.
- Las imágenes no podrán permanecer almacenadas más de un mes desde la fecha de su captura.
- En cumplimiento del derecho de la información, los responsables que cuenten con sistemas de videovigilancia deberán colocar en las zonas videovigiladas, al menos, un distintivo informativo ubicado en lugar suficientemente visible, tanto en espacios abiertos como cerrados.

Los elementos que componen un sistema de este tipo son:

- Cámaras

Las cámaras instaladas en el sistema deberán cubrir los siguientes requisitos:

- Captura de video y audio.
- Conexión inalámbrica o por cable y direccionamiento IP (**Internet Protocol**).
- Resolución adaptable.
- PoE (**Power over Ethernet**).
- Zoom: Óptico y Digital.
- Conector I/O (**Entradas y Salidas**): permite la conexión de elementos externos a la cámara como alarmas, detectores de movimiento, etc...

- NVR (**Grabador de vídeo en red**) y VRM (**Video Recording Manager**)

Elemento que permite grabar y/o visualizar la imagen procedente de una o múltiples cámaras, tanto localmente (dentro de una red de área local) como remotamente (a través de internet).

- VMS (**Video Management System**)

Elemento que permite visualizar la imagen procedente de una o múltiples cámaras, tanto localmente (dentro de un área local o metropolitana), como remotamente (a través de internet). Este elemento es únicamente de software, implementado en el hardware presente en la sala de control, con su propio servidor. Además, también permite la configuración remota de las cámaras. Presenta las siguientes características:

- Opción de alarma e integración con otros sistemas o plataformas.
- Opción Video-wall.
- Reproducción en vivo o exportación de grabaciones.
- Análisis forense de las imágenes.
- Búsqueda científica.
- Se integra con NVR y VRM.

- Plataforma de gestión del sistema de Videovigilancia

Consiste en un software que permite el análisis automático de las imágenes, en función de parámetros previamente definidos por el usuario. Gracias a esto se pueden configurar las cámaras para que solo graben ante determinados eventos o situaciones, optimizando así el uso de energía y mejorando la seguridad. Además, como hemos comentado, es totalmente gestionable de manera remota por IP.

### 1.4.8. Switch

Dispositivo de interconexión utilizado para conectar equipos a una red determinada a través de cable Ethernet.

### 1.4.9. Tecnología LED para el Alumbrado Público

El apartado 2.2.1 de esta memoria propone un cambio en el alumbrado público para pasar de la tecnología actual a la tecnología LED (**Light Emitting Diode**), ya que no solo es más eficiente, sino que además permite una regulación que las tecnologías anteriores no soportan.

Algunas de las ventajas que presentan los LEDs son:

- Cambio del tono de iluminación, siendo este más agradable para el ojo humano, mejorando la percepción del mismo.
- Reducción de la contaminación lumínica.
- Regulación escalable dependiendo de las necesidades del momento.

En segundo lugar, proponemos la telegestión del alumbrado y el uso de la tecnología "PowerLine Communications", envío de señales por medio del tendido eléctrico, para la telegestión de los diferentes servicios municipales en ciudades. La propuesta se fundamenta en un sistema de regulación automática que permitirá telegestionar la instalación y tener el control punto a punto del alumbrado, que unido a detectores de presencia y luminosidad, ayudarán a conseguir un gran ahorro de energía. Además, la tecnología utilizada convierte el cable eléctrico del alumbrado en un canal de comunicación digital de banda ancha, que sirve como infraestructura para el envío de datos a gran velocidad. Si a la instalación de alumbrado inteligente, se le añaden elementos capaces de comunicarse a través del estándar TCP/IP, pasamos de un sistema de telegestión de alumbrado a un sistema de telegestión de servicios municipales integrado.

### 1.4.10. Topología de red en Estrella Extendida

La topología en estrella consiste en un nodo central desde el que se irradian todos los enlaces hacia los demás nodos, transmitiendo de esta manera los datos. Por el nodo central, generalmente ocupado por un HUB, pasa toda la información que circula por la red. La topología en estrella extendida no es más que una variación de la anterior, diferenciándose en que cada nodo que se conecta con el nodo central también es centro de otra estrella a su vez. En este caso el nodo central está ocupado por un HUB o un switch y los nodos secundarios por HUBS.

La principal ventaja de esta topología es que permite limitar la cantidad de dispositivos conectados al nodo central, reduciendo el cableado y manteniendo la información local.

*Figura 2.3 – Topología en Estrella Extendida*

### 1.4.11. Video-wall

Consiste en una configuración especial de monitores, televisiones o proyectores colocados conjuntamente de manera que conformen una única pantalla. También se puede considerar video-wall a la división de una pantalla de grandes dimensiones mostrando en cada división una imagen diferente.

# CAPITULO 2. DISEÑO PROPUESTO

La propuesta de mejora como Smart City para la ciudad de San Cristóbal de La Laguna tendrá como objetivo los siguientes puntos: el uso eficiente de las infraestructuras, la mejora de la seguridad y la centralización de las comunicaciones. Con esta finalidad se propone la implantación de una Red TIC Multiservicio a la que se conectarán todos los elementos planteados.

La Red TIC propuesta estará conformada por tres elementos principales: 1. Red de área metropolitana (**MAN**) (ver **apartado 2.1**), 2. Comunicaciones de banda ancha por líneas eléctricas (**B-PLC**) (ver **apartado 2.2**) y 3. Red inalámbrica de sensores (**WSN**) (ver **apartado 2.3**). Estos tres apartados estarán conectados entre sí en modo cascada, siendo la red MAN la principal, conectada a ella tendremos la red B-PLC y por último la WSN, dependientes consecutivamente.

Todo lo comentado anteriormente estará implementado en un sistema SCADA encargado de gestionar las posibles incidencias que pudieran ocurrir en cada uno de sus apartados. Este sistema SCADA estará integrado en una Sala de Control dispuesta en la sede de la Policía Local de San Cristóbal de La Laguna (ver **apartados 2.4 y 2.5**).

El tipo de estructura de red a elegir y las tecnologías a utilizar se han escogido gracias a información recibida por parte de la empresa **Técnicas Competitivas S.A.**

## 2.1. Diseño de la Red Metropolitana (MAN)

Comenzamos el apartado del diseño desarrollando la parte más importante de este proyecto, la Red MAN. Todos los elementos de la red estarán conectados a la misma de una manera o de otra, permitiendo así su fácil control y gestión. Basada en tecnología Ethernet y con enlaces de fibra óptica se usará para conectar las dependencias públicas del municipio. Para evitar posibles sobrecostos se utilizará la red de fibra óptica actualmente desplegada en el municipio. Conectado directamente a la red MAN tendremos:

a. Puntos de Acceso Wi-Fi interiores (ver **apartado 2.1.1**).
b. Sistemas de Seguridad Electrónica internos (ver **apartado 2.1.2**)

La arquitectura de la red estará basada en el modelo "Enterprise campus" de Cisco, utilizando una **topología de estrella extendida** (ver *Figura 2.1*). Se ha elegido implementar este modelo ya que está expresamente pensado para situaciones en las que los equipos que se conectarán a la red (capa 2 y capa 3, o capas de alta velocidad) se encuentran fuera del CPD (**Centro de Procesamiento de Datos**) y situaciones en las que la red se extiende en una única localización geográfica. Dicho modelo consta de tres capas: capa núcleo, capa de distribución y capa de acceso, cada una con un objetivo diferente:

- Capa núcleo: es la parte más simple, pero a su vez la parte más importante de la red, es la encargada de mantener todos los elementos de la red unidos, además de darle acceso de red a nuestra arquitectura. Debido a su importancia, la capa núcleo debe operar en todo momento, sin pausas, por lo que debe tener la suficiente fiabilidad, además de contar con redundancia de los equipos, para en caso de fallo, tener un soporte.
- Capa de distribución: Será la encargada de conectar a la red principal (capa núcleo) las diferentes subredes LAN proporcionándoles así acceso a la misma.
- Capa de acceso: Encargada de conectar los equipos y demás elementos de las subredes.

La capa núcleo estará formada por dos Cisco Switch Processors Catalyst 6500, implementándole un módulo de tecnología Virtual Switching System 1400 (**VSS**) que permite su

agrupación como un único Switch virtual, aportándonos la redundancia que necesitábamos, sin la necesidad de tener el doble de conexiones para cada uno de los switchs. Cada equipo estará alojado en un emplazamiento diferente, cerciorándonos de que no fallen los dos simultáneamente por problemas eléctricos del edificio. Las localizaciones serán el edificio de la Policía Local de San Cristóbal de La Laguna y el edificio del Ayuntamiento del propio municipio.

La capa de distribución estará formada por dos switchs Cisco 4500, una vez más cumpliendo así con la redundancia. Y finalmente, la capa de acceso estará formada por switchs Cisco Catalyst 2960. El número de los mismos dependerá de la ubicación y el uso que vayamos a darle.

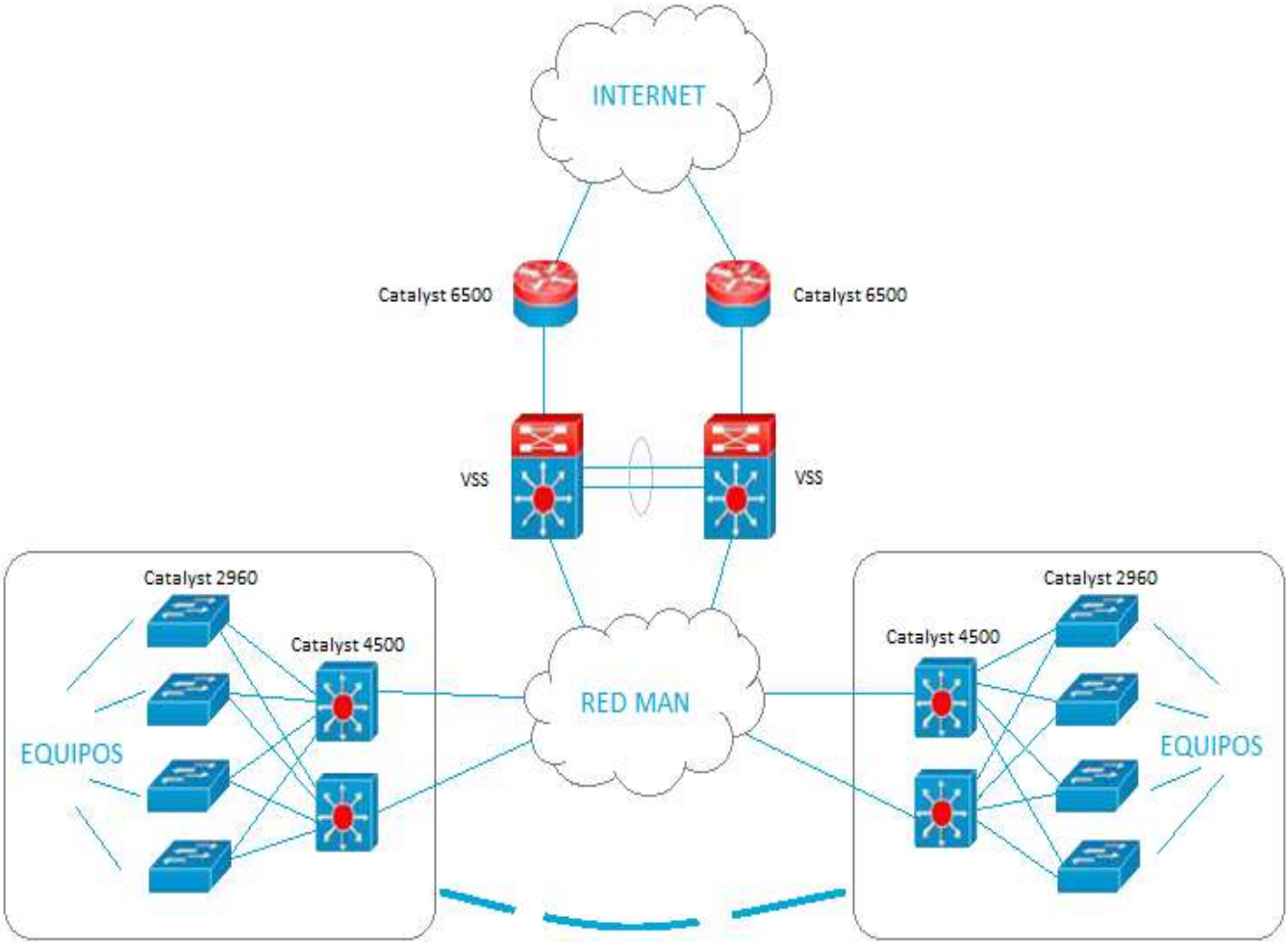


*Figura 2.1 -– Estructura de la Red MAN*

Para controlar los puntos de acceso Wi-Fi, se utilizarán tarjetas WiSM (**Wireless Service Module**) de la misma serie, conectadas a las tarjetas VSS 1400. Cada una de estas tarjetas puede controlar hasta 300 puntos de acceso y 10000 clientes por módulo. Para alojar todas estas tarjetas de red utilizaremos el chasis Cisco Catalyst 6509-E (ver *Figura 2.2*)

*Figura 2.2 – Sistema de gestión de red MAN compuesto por: Chasis Catalyst 6509-E y las tarjetas de red mencionadas*

En el **Anexo 6.1** podremos encontrar el dimensionamiento IP de cada uno de los elementos de la Red.

### 2.1.1. Puntos de Acceso Wi-Fi Interiores (APs)

Como comentamos anteriormente, los puntos de acceso Wi-Fi estarán administrados desde las tarjetas VSS 1400. En este caso solo administrarán los APs internos (dentro de los edificios municipales) ya que los externos estarán conectados a la red mediante B-PLC para

facilitar su instalación y reducir el coste del cableado. Para cumplir con los requisitos mínimos de este tipo de conexiones se propone utilizar APs de la marca Huawei, específicamente el modelo AP6150DN.

*Figura 3.3 – Huawei AP6150DN, punto de acceso Wi-Fi utilizado en el interior de los edificios municipales*

Para realizar una estimación del número de APs necesarios por emplazamiento tenemos que fijarnos en el alcance de nuestros dispositivos y el tamaño de los lugares en los que queremos instalar dichas conexiones de red inalámbrica.

El alcance aproximado es de unos 50 metros, por lo que, teniendo en cuenta la superficie de las plantas de los edificios municipales, solo necesitaremos uno por planta, habiendo un máximo de dos para los edificios con mayor superficie.

### 2.1.2. Sistema de Seguridad Electrónica

Con este sistema se propone implantar una única plataforma de seguridad que integre los diferentes elementos necesarios para gestionar la seguridad tanto en edificios municipales como en otras zonas de San Cristóbal de La Laguna. En este apartado sólo describiremos la parte que incluye el interior de los edificios, ya que la videovigilancia exterior estará conectada a la red mediante B-PLC. Dicho sistema de seguridad electrónica interior estará compuesto de:

- Sistema de videovigilancia IP.
- Sistema de Control de Accesos.

Todos estos sistemas serán controlados desde la Sala de Control, definida más adelante en su propia sección.

#### 2.1.2.1. Sistema de Videovigilancia IP

Con este sistema se pretende aumentar la seguridad de los edificios municipales para evitar posibles intrusiones, robos, o demás actos delictivos que pudieran producirse en los mismos.

Se ha decidido instalar cámaras en las dependencias municipales, así como las instalaciones culturales y deportivas que se encuentren bajo el mantenimiento del Ayuntamiento de La Laguna. Para las instalaciones no dependientes del Ayuntamiento, así como los juzgados, los institutos, centros de salud, etc… Se plantea la posibilidad de un convenio con la consejería en cuestión para llevar a cabo la gestión de la seguridad desde el mismo punto. Al no saber con precisión la superficie de cada uno de los edificios municipales se hará una estimación para un caso particular que será fácilmente escalable a cualquier superficie o edificio que se presentara.

Dimensionamiento

Para la colocación y el dimensionamiento del número de cámaras utilizaremos el método que utilizan las empresas de seguridad, basado en “Puntos Calientes”. Dicho método centra sus esfuerzos en utilizar el mínimo de cámaras, pero a su vez mantener todos los puntos de alta importancia, conocidos como “Puntos Calientes”, perfectamente vigilados. Dentro de esta definición se consideran “Puntos Calientes” los siguientes casos:

- Cajas Registradoras.
- Entradas/Salidas.
- Elementos que contengan información importante para la entidad o empresa asegurada.
- Objetos o recursos importantes para el funcionamiento del lugar.
- Zonas de tránsito o pasillos

A continuación mostraremos una representación de uno de los edificios del Ayuntamiento de La Laguna, y sobre el realizaremos la instalación de las cámaras que servirá como modelo para el resto de edificios (ver *Figura 2.4*).

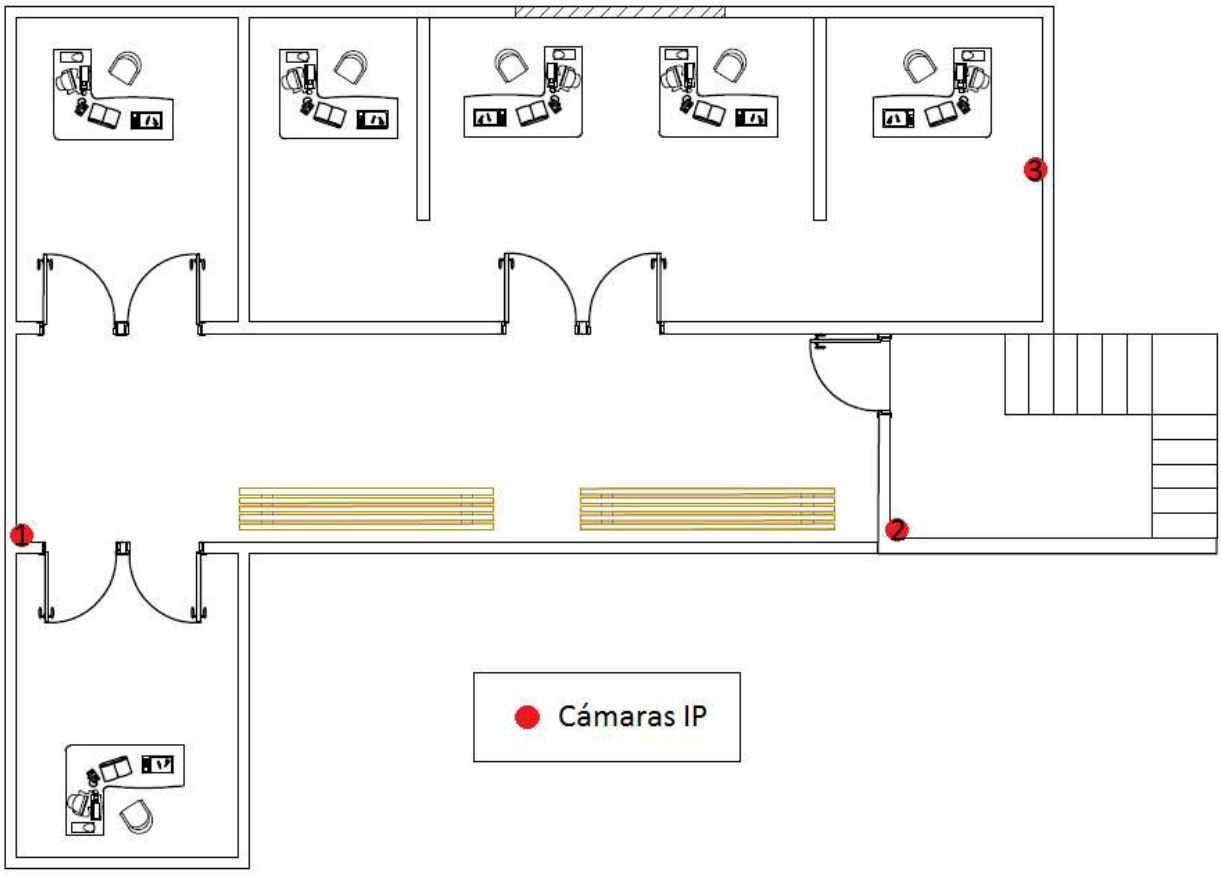


*Figura 2.4 – Plano Ubicación Cámaras IP*

Como vemos, en este caso solo será necesario instalar tres cámaras, ya que con ellas controlamos todos los puntos calientes posibles en este edificio, que son, entrada principal (cámara 2), pasillo (cámara 1) y ventanas de fácil acceso (cámara 3). Las cristaleras no se tienen en cuenta como punto caliente ya que es necesario romperlas para poder acceder al interior del edificio.

Esquema de funcionamiento

En el apartado 1.4.6 de esta memoria describimos los elementos que componen el sistema de videovigilancia. En este apartado mostraremos las conexiones pertinentes y su utilidad, así como el desarrollo de un esquema que incluya todos los elementos nombrados (ver *Figura 2.5*).

La arquitectura de nuestro sistema de seguridad comienza por las cámaras, las cuales estarán conectadas a la red (MAN) mediante switchs, siguiendo este modelo en todas las instalaciones, independientemente del número de instalaciones que queramos realizar. Posteriormente, desde la red podremos acceder a esas cámaras, desde el propio edificio con un PC con el software VMS, visualizarlas en una pantalla a través de un decoder y desde la propia Sala de Control. Dentro de la Sala de Control tendremos instalado por un lado el Grabador de Video en Red (NVR), al que le conectaremos el administrador de grabaciones y el almacenamiento en red, y por otro lado los diferentes sistemas de seguridad que queramos implementar, siendo en nuestro caso un Video-wall (a través de un decoder especializado y un controlador) y un PC con el software VMS central.

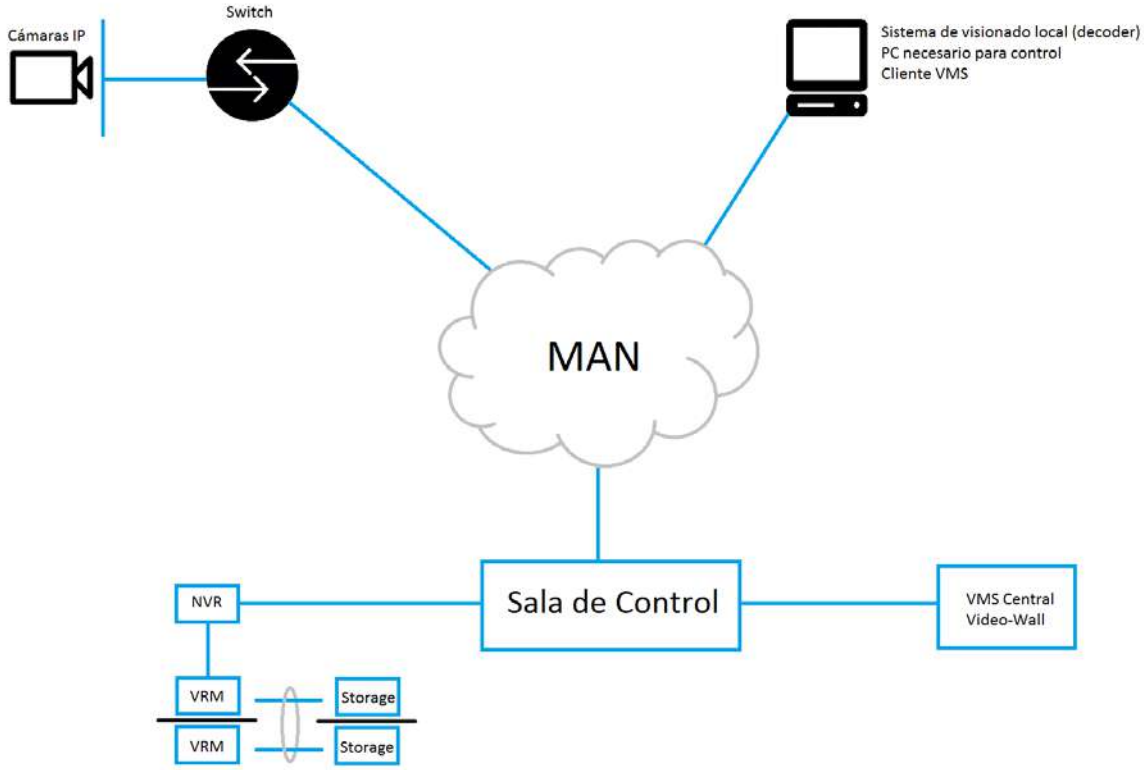


*Figura 2.5 – Esquema funcionamiento Videovigilancia*

Elección de los dispositivos

Para este apartado me he fijado en empresas del sector de la seguridad en Canarias para saber cuáles son los equipos con mayor fiabilidad o mejor relación calidad-precio. A través de una entrevista con un técnico especializado en seguridad de una empresa del sector he podido formular una propuesta para este proyecto.

Se propone la marca Hikvision al ser una de las marcas más utilizadas en este ámbito y el hecho de haber ya instalaciones de seguridad con sus equipos por todas las islas. Además nos ofrece todos los elementos necesarios para nuestra instalación, incluido el software VMS, tanto para Android como para Windows, permitiendo una amplia variedad de opciones.

Para las cámaras se propone el modelo **DS-2CD4024F-(A)** (ver *Figura 2.6*) que cumple con todos los requisitos que pedimos en este tipo de instalaciones, enumerados en el **apartado 1.4.6** anteriormente. Una característica que poseen estos dispositivos digna de mencionar es la incorporación de conectores PoE, que permitirán la reducción de cables a la hora de instalarlas.

*Figura 2.6 – Cámara IP de video-vigilancia en el interior de los edificios*

Para los switchs a los que conectaremos las cámaras y el resto de equipos del sistema se propone el **DS-3E1310P-E** (o **DS-3E0326P-E** en el caso de instalaciones con mayor número de cámaras o la propia sala de Control) (ver *Figura 2.7*). Ambos modelos son compatibles con la tecnología PoE mencionada anteriormente.

*Figura 2.7 – Modelos de switchs encargados de conectar las cámaras IP a la red*

Para el sistema de NVR proponemos el modelo **DS-9664NI-I8** (ver *Figura 2.8*). En este caso gracias a este dispositivo estamos reduciendo el coste total de la instalación, ya que es NVR y VRM al mismo tiempo, desde el podremos administrar las cámaras de todas las instalaciones para realizar la grabación. Acepta hasta 64 cámaras al mismo tiempo, número que no supera la estimación actual de cámaras necesarias para la zona centro de San Cristóbal de La Laguna.

*Figura 2.8 – Grabadora de video en red*

Aunque el dispositivo de NVR elegido posee un sistema de almacenamiento, la capacidad que puede almacenar no es suficiente, por lo que será necesario adquirir un sistema de almacenamiento en red. El **DS-A82024D** (ver *Figura 2.9*) cumple con los requisitos, ya que puede albergar hasta 24 discos duros de hasta 6 TB y grabar hasta 256 canales en modo IP. Para elegir este modelo se ha tenido en cuenta el tamaño de las grabaciones que se van a realizar. Suponiendo que se conecten las 64 cámaras que permite el NVR, 1 hora de video a un bit rate de 2048K (que nos permitirá una visualización correcta de las imágenes) ocupa aproximadamente 1 GB, de manera que:

$$1\ GB/hora * 64\ cámaras * 24\ horas * 30\ días = 45\ TB$$

*Figura 2.9 – sistema de almacenamiento en red*

Esta es la estimación de datos que tendrán que guardarse a lo largo de un mes de grabaciones. Se cuenta un mes ya que, como se expuso anteriormente, por ley las imágenes solo pueden estar almacenadas ese tiempo para su posterior eliminación si no se deben investigar por ningún motivo.

Todos los dispositivos hasta ahora nombrados estarán alojados en un rack en la Sala de Control.

Por último debemos destacar el software con el que se gestionará todo el sistema. Es de la propia marca de los dispositivos, iVMS 4200. Nos permitirá la visualización en tiempo real de todas las cámaras así como la visualización y edición de los videos ya grabados. Además tiene la ventaja de que es totalmente gratuito, por lo que evitamos sobrecostes innecesarios.

#### 2.1.2.2. Subsistema de Control de Accesos

La solución propuesta se basa en la instalación de un sistema centralizado que gestionará todas las unidades de campo que controlan las unidades lectoras de cada acceso, localizado en la Sala de Control que estará presente en las dependencias de la Policía Local.

El sistema consistirá en lectores de tarjetas identificativas proporcionadas tanto a los trabajadores como a los visitantes puntuales de dichas dependencias. Por lo tanto, en cada emplazamiento necesitaremos un controlador de acceso, que estará conectado a la red MAN y a su vez a la base de datos que se encontrará en la Sala de Control y lectores de tarjeta en las entradas de los edificios, así como en los lugares importantes que necesiten doble seguridad. Además habrá que cambiar las cerraduras de las puertas de entrada/salida para permitir su apertura con la simple lectura de las tarjetas a través de un relé.

Para la elección de los equipos necesarios ya mencionados se elegirán productos de la misma empresa de seguridad, Hikvision, para facilitar la integración de los elementos dentro del sistema de seguridad. Al no precisar una gran capacidad en este sistema se elegirán los productos más básicos ofrecidos por la empresa, ya que cumplirán de sobra con los requisitos necesarios.

*Figura 2.10 – Controladora de accesos*

Para el controlador de acceso se propone el **DS-K2601** con capacidad de hasta 100000 tarjetas vinculadas al mismo y hasta 8 lectores de tarjeta. Para el lector de tarjetas se ha elegido el **DS-K1102** (ver *Figuras 2.10 y 2.11*). Normalmente serán necesarios 1 o 2 de este dispositivo por cada edificio, para acceder a las zonas más importantes.

*Figura 2.11 – Lector de tarjetas*

Además este sistema permitirá la adición de un sistema de alarmas anti-intrusión, fácilmente integrable con los dispositivos elegidos, si se viera necesaria su instalación.

## 2.2. Comunicaciones B-PLC

Las comunicaciones por B-PLC son esenciales para la conexión de varios elementos principales de nuestra red TIC multiservicio. Se ha decidido elegir este sistema debido a las siguientes ventajas:

- Monitorización en todo momento del estado del sistema.
- Eficiencia energética gracias a los sensores de detección de presencia que permitirán regular la intensidad lumínica.
- Sobre la red PLC se podrá instalar el control del alumbrado además de otros elementos como cámaras, antenas Wi-Fi etc… que beneficiarán al incremento de la calidad de vida de la zona.
- Al utilizar el tendido eléctrico el coste de esta instalación es extremadamente reducido ya que no es necesario realizar ningún tipo de obra nueva.
- Aumenta la seguridad ante robos de cableado, ya que dicho sistema posee un sistema de alarmas en tiempo real ante la desconexión de uno de los nodos.
- Permite la gestión centralizada de todos los sistemas conectados, pudiéndose integrar dentro del sistema SCADA que plantearemos más adelante.
- Aunque principalmente está pensado para uso urbano se puede ampliar para cualquier tipo de aplicaciones.

A continuación mostraremos una simulación del sistema B-PLC en su totalidad (ver *Figura 2.12*). En el esquema siguiente podemos observar el funcionamiento del conjunto del sistema. En los cuadros eléctricos se instalará un switch que proporcionara conexión a la red tanto al alumbrado público, a través de un adaptador B-PLC, como a otras posibles necesidades que haya en esa zona. De esta manera a través del tendido eléctrico estaremos aportando la conexión necesaria para mantener cámaras IP, puntos de acceso, sensores, etc…

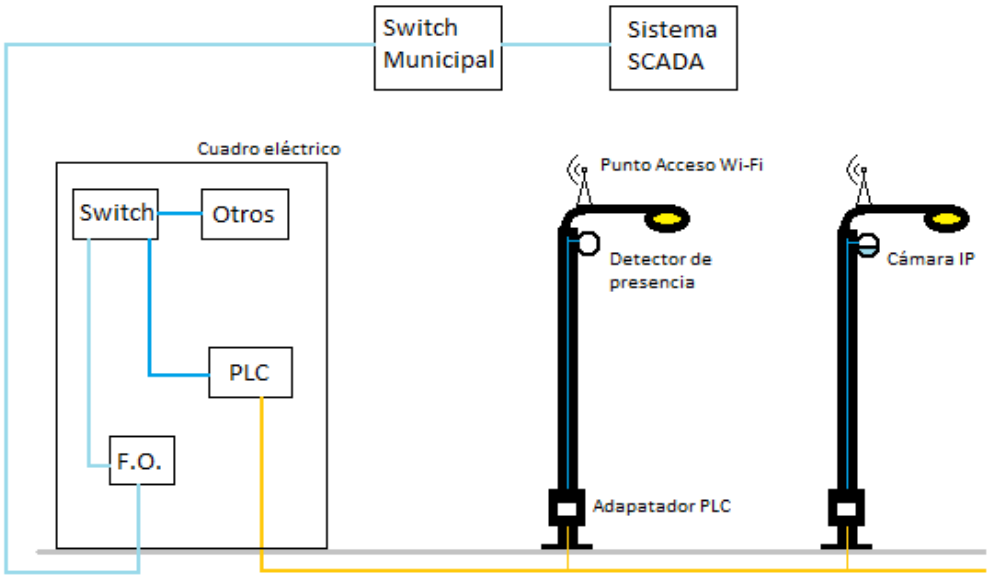


*Figura 2.12 – Estructura de comunicaciones B-PLC*

### 2.2.1. Sistema de gestión de alumbrado

El objetivo de este sistema es mejorar la eficiencia energética del alumbrado, además de mejorar la visibilidad durante la noche al utilizar colores más agradables para la vista. Este sistema permite un control punto a punto del alumbrado y se le añadirán elementos capaces de comunicarse a través del estándar TCP/IP para así poder controlar otros parámetros.

El conjunto del sistema tendrá la siguiente estructura:

- **Luminarias LED:** Para conseguir el máximo rendimiento del sistema se instalarán luminarias eficientes de tecnología LED con fuente de alimentación regulable. El motivo de la elección de esta tecnología es su gran eficiencia con respecto a las de sodio, no solo en consumo sino en uniformidad y dirección del haz de luz, además de proporcionar mayor nitidez y calidad a la hora de identificar colores o elementos, aumentando de esta manera la seguridad dentro de la ciudad.

- **Módulo de Cabecera B-PLC (PLC):** Instalado dentro del cuadro eléctrico, su función será procesar todas las señales que llegan de los equipos y sensores presentes en la instalación, distribuyéndolas directamente al Centro de Control, que proporcionará la respuesta adecuada en cada caso.
- **Nodo inteligente de telegestión:** Localizado conjuntamente con el adaptador PLC, es un dispositivo electrónico presente en cada uno de los puntos del alumbrado público encargado de comunicarse con el módulo de cabecera mediante B-PLC. A su vez dicho nodo posee conexiones I/O que permiten el uso de elementos auxiliares, principalmente sensores. Además, dispone de conexión Ethernet de salida para la conexión de cualquier tipo de elemento mediante IP, por ejemplo, cámara localizadas en el exterior de dependencias públicas o zonas de uso público (parques entre otros…).
- **Dispositivos de detección:** dispositivos electrónicos (sensores) que determinan la presencia de vehículos o personas en la zona, para la adecuación del flujo lumínico. Se plantea la posibilidad, dependiendo de la situación, del uso de más sensores que permitan la medición de otras variables, ya sea temperatura, humedad, etc…

Elección de los equipos a utilizar

Como hemos comentado anteriormente, el ejemplo a seguir para este proyecto es la ciudad Rivas-Vaciamadrid, por lo que en este apartado utilizaremos el mismo software y equipos que se utilizan en dicho modelo. Estos dispositivos serán proporcionados por la empresa **Leycolan**.

Para las luminarias utilizaremos los modelos **ISABA** o **SULKA** (ver *Figura 2.13*) dependiendo de si es para uso en vías peatonales o carreteras respectivamente.

*Figura 3.13 – Luminarias LED que sustituirán al alumbrado público actual*

Se podrán utilizar los mismos postes de alumbrado, con la única necesidad de cambiar la cabecera de cada uno de ellos dependiendo del caso. Para la instalación del resto de elementos se atornillarán al propio poste.

Para el módulo de cabecera la empresa oferta dos modelos, el Estándar y el **Avanzado** (ver *Figura 2.14)*. Para nuestro caso elegiremos el módulo Avanzado para instalarlo en los cuadros eléctricos (ver *Figura 2.15*), ya que nos permite medir la corriente para poder observar más fácilmente la presencia de fallos y nos da la opción de incluir entradas y/o salidas digitales

*Figura 2.14 – Módulo de cabecera B-PLC*

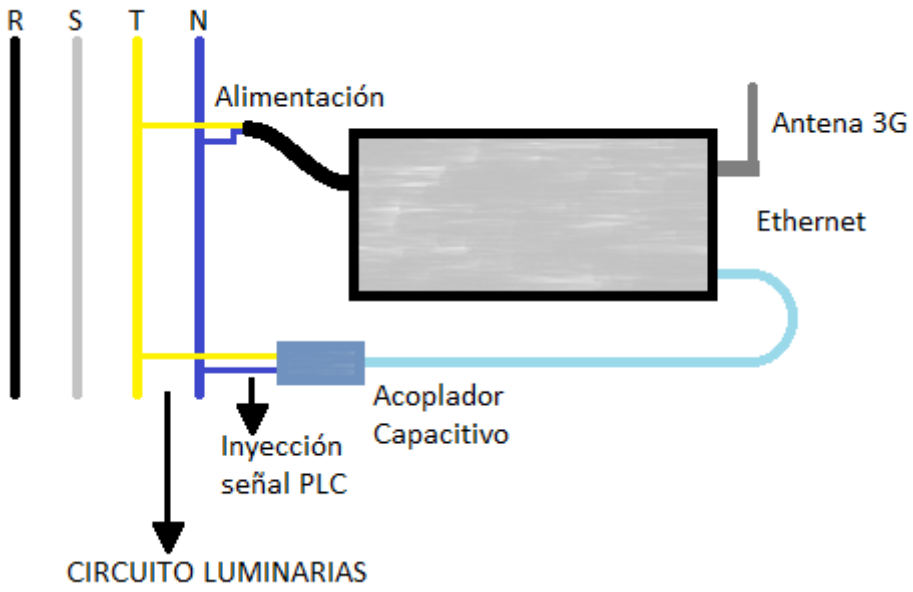


*Figura 2.15 – Esquema de conexión del módulo de cabecera con el alumbrado público y la red presente en los cuadros eléctricos*

En el caso del nodo la empresa oferta dos modelos al igual que en el elemento anterior. Para nuestra instalación elegiremos el modelo **INT** (ver *Figura 2.16*), ya que es el que permite la conexión de sensores, cámaras IP y APs. Además también permite realizar lecturas de consumo, tensión, potencia, etc…, lo que nos puede permitir comprobar si nuestro sistema está funcionando correctamente.

*Figura 2.16 – Nodo de telegestión del alumbrado LED*

Además la empresa también proporciona un nodo con conexión inalámbrica con prácticamente las mismas funcionalidades que el ya mencionado. Nos puede servir para zonas en las que no sea posible la instalación física de los nodos en los postes de alumbrado.

*Figura 2.17 – Detector de presencia por microondas*

Por último para el caso de los sensores, los sensores que afectan a la gestión del alumbrado que vayan instalados en el alumbrado son los sensores de presencia, para la regulación de la intensidad lumínica arrojada por la luminaria. De entre las posibilidades se ha elegido el uso de un radar basado en microondas (ver *Figura 2.17*) para la detección de personas

o vehículos, ya que es el más sencillo y el que puede cumplir más eficientemente con la tarea en cuestión. Tiene un alcance de hasta 25 metros, por lo que la diferente altura del alumbrado de San Cristóbal de La Laguna no será un problema.

### 2.2.2. Sistema de Videovigilancia (exterior)

Para este sistema utilizaremos cámaras de la misma marca antes mencionada, **Leycolan**. Aunque el sistema permite el uso de cámaras de otros fabricantes se ha considerado oportuno tomar esta decisión para facilitar el conexionado entre los dispositivos.

Se ha decidido instalar cámaras en los lugares públicos más transitados como parques, complejos deportivos, etc… El método de colocación de las cámaras es el mismo que para la videovigilancia interior, con la diferencia de que en este caso los puntos calientes cambian, siendo únicamente entradas, salidas y zonas de alta concurrencia. Dichas cámaras se instalarán en los propios postes del alumbrado ya que la gran cantidad de los mismos nos permite orientar la cámara en la dirección que queramos.

Se ha elegido el **Tipo I** de cámara IP (ver *Anexo 2 y Figura 2.17*). Como indica el propio fabricante, aunque están pensadas para ser integradas en el software **SmartLUIX**, existe la posibilidad de utilizarlas en otros programas. Esto es beneficioso ya que podemos seguir utilizando estos modelos sin tener que rechazar el tener todo el sistema de cámaras unificado en el software iVSM 4200 de **Hikvision**.

*Figura 2.17 – Cámara IP de videovigilancia en exterior*

### 2.2.3. Puntos de acceso Wi-Fi exteriores (APs)

Este elemento es de vital importancia para el apartado siguiente (ver **Apartado 2.3**), ya que proporcionará conexión a la red a todos los elementos que no tengan la posibilidad de estar cableados, ni mediante cable Ethernet ni mediante B-PLC, principalmente sensores. Además proporcionará conexión Wi-Fi pública y gratuita a los ciudadanos (nunca superando los 256K de bajada por motivos legales), en toda la extensión de la zona en la que estamos trabajando.

Las razones ya expuestas nos hacen buscar dispositivos que nos aseguren gran fiabilidad, y aunque podríamos optar por la opción de continuar utilizando la marca **Leycolan**, preferimos regresar a la utilización de APs **Huawei**, ampliamente utilizados para estos fines en muchas Smart Cities alrededor del mundo.

Utilizaremos el modelo **AP8030DN** (ver *Figura 2.18*), optimizado para exteriores, de tamaño reducido y fácil instalación. Ofrece generalmente las mismas características que los APs interiores que hemos utilizado anteriormente. Debido a ello colocaremos uno cada 3 farolas, o cada 2, dependiendo de la distancia de separación entre las mismas. También para la facilidad de la instalación, los APs de Huawei utilizan la tecnología PoE para la alimentación, por lo que reduciremos la cantidad de cables necesarios.

***Figura 2.18 – Puntos de Acceso Wi-Fi exteriores, para conexión pública de los ciudadanos y conexión de la WSN***

Al estar conectados a la red MAN podrán ser igualmente gestionados desde la Sala de Control.

## 2.3. Red Inalámbrica de Sensores

Para la mejora de la eficiencia ecológica de la ciudad se propone la integración de una red de sensores inalámbricos conectados a la red MAN a través de los servicios Wi-Fi prestados por los APs exteriores.

Nos centraremos en la eficiencia energética de los edificios y la recogida de R.S.U. por lo que para su fácil descripción la dividiremos en dos apartados:

- Sistema de Gestión de Residuos (RSU).
- Sistema de Monitorización de Eficiencia.

### 2.3.1. Sistema de Gestión de Residuos (RSU)

El objetivo de este apartado es mejorar el sistema actual de recogida de basuras de San Cristóbal de La Laguna. Actualmente los camiones realizan sus rutas de recogida preestablecidas pasando por todos los cubos, lo que aumenta el tiempo del trayecto, junto con las horas de trabajo y el consumo de gasolina del camión. En este proyecto se propone la instalación de sensores en el interior de los cubos que nos permitan saber el nivel de llenado de los mismos, de manera que se pueda decidir antes del inicio de cada ruta si el cubo en cuestión necesita ser vaciado, pudiendo optimizar la ruta de recogida.

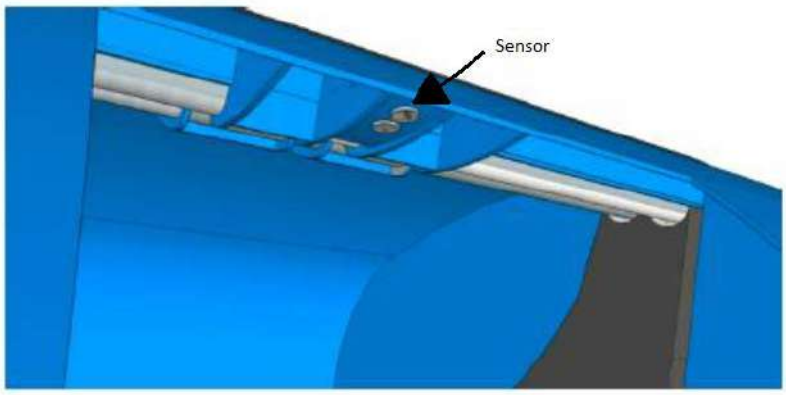


*Figura 2.19 – Instalación sensor de llenado en Contenedores de RSU*

Como podemos observar en la *Figura 2.19*, el sensor iría en el centro del cubo, en la parte superior de la tapa. El sistema consiste en un sensor de ultrasonidos que medirá la distancia hasta los residuos, de manera que cuando llegue a un nivel determinado, de un aviso de necesidad de recogida.

Para la integración de este elemento hay varias empresas que ofertan el mismo tipo de soluciones, tales como **Quamtra** o **Libelium**, en ambos casos los sensores que ofertan se pueden conectar mediante Wi-Fi a nuestra red MAN y enviar los datos hasta nuestra Sala de Control, para su posterior análisis.

### 2.3.2. Sistema de Monitorización de Eficiencia energética de los Edificios Municipales

Con este elemento se pretende mejorar la eficiencia energética de todos los edificios dependientes del Ayuntamiento que se encuentren dentro del casco de San Cristóbal de La Laguna. Consistirá en la instalación de dispositivos que nos permitan conocer el consumo eléctrico de los edificios, para así poder almacenar y estudiar los datos.

A través de la conexión inalámbrica que poseen con la red MAN enviarán los datos en tiempo real, pudiendo además detectar posibles averías o fallos de funcionamiento más fácilmente.

Además, en determinados puntos de la ciudad se instalarán sensores de temperatura y humedad, así como en el interior de las dependencias municipales, para controlar las constantes climáticas de esta zona del municipio, haciendo registros de dicha información y mantener los niveles dentro de lo adecuado en interior.

## 2.4. Sistema SCADA de Gestión y Control de la Smart City

El objetivo de esta sección es optimizar los sistemas de control y gestión remotos, aprovechando la infraestructura de Red Multiservicio previamente descrita presente en las dependencias municipales de La Laguna.

Objetivos de control

Los diferentes elementos y sistemas a controlar son:

- Iluminación en el interior de edificios públicos. Se instalarán sensores de movimiento para reducir el consumo eléctrico y mantener siempre los niveles de iluminación por encima del mínimo establecido por la REBT. Todos estos elementos serán siempre entradas digitales del autómata de la instalación.
- Climatización de edificios municipales. Con los valores mínimos de:
    - Temperatura. Como mínimo, por despacho y varios, según las dimensiones de las zonas comunes.
    - Humedad. El nivel de humedad en los lugares de trabajo viene regulado en el Real Decreto 486/1997, de 14 de abril o posteriores, por el que se establecen las disposiciones mínimas de seguridad y salud en los lugares de trabajo, Anexo III.
- Consumos eléctricos, tensión e intensidad, factor de potencia eléctrica.
- Gestión del Sistema de Alumbrado Público.
- Grupos electrógenos.
- Posible integración con sistema de acceso.
- Gestión de Recogida de R.S.U.

Componentes del Sistema SCADA

1. Autómata programable con conexión Ethernet protocolo TCP/IP. Encargado de llevar a cabo toda la lógica de control de las instalaciones (toma de decisiones respecto a estímulos recibidos). El autómata en cuestión será el Simatic S7-1200 (ver *Figura 2.20*),

de la marca Siemens, ya que cumple con todos los requisitos necesarios para este sistema.

*Figura 2.20 – PLC (Controlador Lógico Programable) que se utilizara para el sistema SCADA*

2. Islas de I/O situadas en los diferentes puntos en los que sea necesario con conexión Ethernet protocolo TCP/IP. Encargadas de recibir los estímulos recogidos por los sensores y enviarlos a la red MAN para su posterior respuesta.
3. Sistemas KNX TCP/IP.
4. Terminal de operación, PC en nuestro caso.
5. Posibilidad de ampliación con componentes externos al sistema planteado originalmente.

Funcionamiento

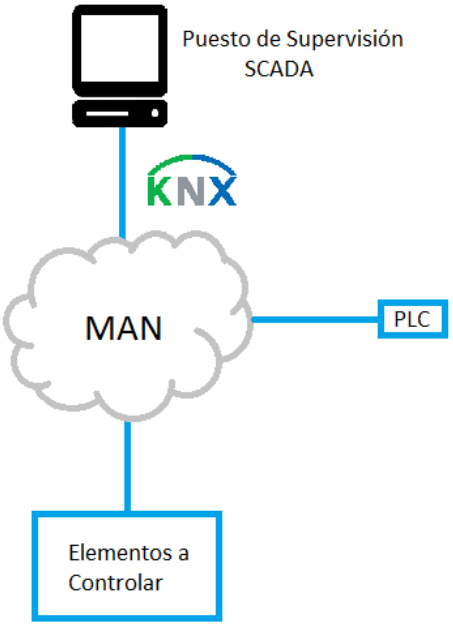


*Figura 2.21 – Esquema sistema SCADA*

Se creará un programa, en el lenguaje de KOP, que tenga en cuenta todas las entradas posibles del sistema y que actúe de manera consecuente según el caso. Principalmente se deberá actuar en el alumbrado público, cambiando niveles de intensidad o apagando el alumbrado según el caso, en la iluminación, apagando las luminarias en ausencia de personal en los edificios y por último en la climatización, encendiendo los equipos de aire acondicionado o deshumidificadores cuando los niveles estén por fuera de los valores establecidos por la normativa vigente.

Los datos obtenidos se volcarán en los PCs de la Sala de Control dedicados al Sistema SCADA, donde podrán ser almacenados y analizados mediante el software PowerLogic ION EEM, de la empresa Schneider Electric.

Este sistema nos permite saber también que zonas del casco de San Cristóbal de La Laguna son más transitadas, y poder invertir más en su mejora o en la mejora de otras zonas para diversificar el uso del mobiliario urbano.

## 2.5. Sala de Control

La Sala de Control es el lugar donde estarán ubicados todos los equipos necesarios para llevar a cabo el control óptimo de los sistemas que se propone instalar en esta memoria. Se propone que se aloje en la sede de la Policía Local de San Cristóbal de La Laguna, siguiendo los modelos conocidos. Si no tuvieran una sala que cumpliera con las características necesarias se adaptaría una ya existente o cercana al propio centro. A continuación se propone un ejemplo de cómo tendría que ser la Sala de Control y la disposición de los equipos en ella:

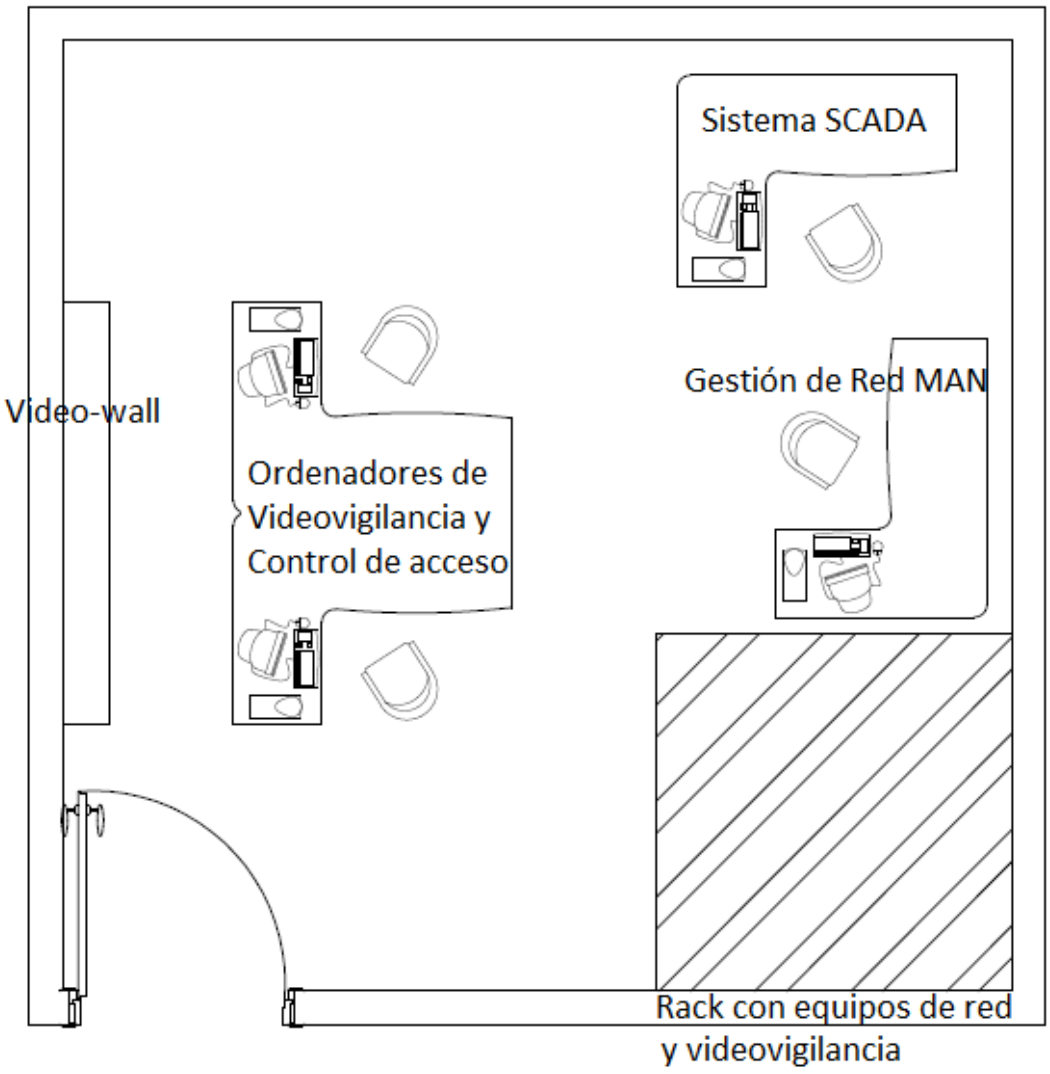


*Figura 2.22 – Plano situación sala de Control*

Serán necesarios cuatro ordenadores con la potencia suficiente como para administrar estos sistemas. Por lo tanto deben tener como mínimo Intel i5 de última generación y 16 de GB de memoria RAM. Para el video-wall, sistema de visualización simultanea de imágenes de seguridad, será necesario una pantalla de grandes dimensiones, mínimo 48 pulgadas, y de resolución 4K (ver *Figura 2.23*) para la correcta visualización de las imágenes de videovigilancia. Además será necesaria la inclusión de un sistema de control de video-wall, para lo que se propone uno de la marca **Hikvision**, modelo **DS-C10S** (ver *Figura 2.23*).

*Figura 2.23 – controladora de video-wall y televisor en el que se mostrará*

Por último para la instalación de todos los equipos de red y videovigilancia (grabadores y controladores) será necesario la instalación de dos rack de 19” de dimensiones 600 x 600 (mm) (ver *Figura 2.24*), para tener separado el sistema de videovigilancia y los equipos de la Red MAN. Un Rack igual al de Red, con los mismos equipos, será instalado también en el Ayuntamiento de San Cristóbal de La Laguna.

*Figura 2.24 – Rack para equipos de red y videovigilancia*

Calculo de potencia media necesaria para la instalación

Debido a esta nueva instalación en la sede de la Policía Local, es posible que sea necesario cambiar la instalación eléctrica del edificio para soportar esta nueva carga. Es por eso que haremos un cálculo de la potencia necesaria para llevar a cabo esta instalación y que así se pueda realizar una nueva instalación eléctrica con estos datos.

| Equipo | Potencia (W) |
|---|---|
| Gestión de red (Catalyst 6509-E) | 6.000 |
| 2 - Switch (DS-3E0326P-E) | 880 |
| Grabador de Video en Red (DS-9664NI-I8) | 30 |
| Almacenamiento de vídeo (DS-A82024D) | 380 |
| Autómata programable (Simatic S7-1200) | 12 |
| Controlador Video-wall (DS-C10S) | 450 |
| Televisor 48” | 150 |
| 4 - Ordenadores | 1.600 |
| **TOTAL** | **9.502** |

Será necesario realizar una comprobación para conocer el estado actual de la instalación eléctrica del edificio y su capacidad máxima.

# CAPITULO 3. PRESUPUESTO ESTIMADO

Al ser un sistema tan amplio, y del que no conocemos todos los edificios y lugares en los que habría que instalarlo, se va a hacer el presupuesto para dos casos, la sala de control (y los equipos duplicados que se alojaran en el ayuntamiento, necesarios para el correcto funcionamiento de la red) y un segundo caso del coste de los elementos que habría que alojar en la instalación de un edificio municipal cualquiera (utilizamos ejemplo del **apartado 2.1.2.1**).

## 3.1. Presupuesto de Sala de Control

| DISPOSITIVO | PRECIO (€) |
|---|---|
| Controlador de Video-wall (DS-C10S) | 20.000 |
| Televisor 48” | 400 |
| 2 – Rack | 540 |
| 4 - Ordenadores | 3.600 |
| Autómata programable (Simatic S7-1200) | 1.000 |
| Lector tarjetas (DS-K1102) | 100 |
| Control de acceso (DS-K2601) | 8.500 |
| Almacenamiento de vídeo (DS-A82024D) | 13.500 |
| Grabador de Video en Red (DS-9664NI-IB) | 3.960 |
| 2 - Switch (DS-3E0326P) | 820 |
| 2 - CISCO CATALYST 6509-E | 164.400 |
| 2 - Módulo de control de puntos de acceso Wi-Fi y licencias (WiSM 6500) | 51.000 |
| 2 - CISCO CATALYST 4500 | 27.000 |
| **TOTAL** | **305.140 €** |

## 3.2. Presupuesto Edificio Ejemplo

| DISPOSITIVO | PRECIO (€) |
|---|---|
| Punto de Acceso Wi-Fi (AP6150DN) | 933 |
| Switch (DS-3E1310P-E) | 120 |
| 3 – Cámara IP (DS-2CD4024F) | 990 |
| Lector de tarjetas (DS-K1102) | 100 |
| Control de Acceso (DS-K2601) | 8.500 |
| **TOTAL** | **10.643** |

## 3.3. Presupuesto Instalación y Diseño

Para la realización de un proyecto de esta magnitud la empresa **Técnicas Competitivas S.A.** me ha informado de que suelen añadir al presupuesto total unos **15.000 €** en relación a los costes intrínsecos del diseño y aproximadamente unos **20.000 €** con respecto a las instalación de los componentes.

# CAPITULO 4. CONCLUSIONES

A lo largo de este proyecto hemos hecho un estudio sobre las Smart Cities y la relevancia de las mismas. Hemos analizado el emplazamiento del proyecto y su situación actual con respecto al tema tratado. Posteriormente se ha propuesto un diseño que abordaría los puntos principales que debe enfocar una Smart City. Todo esto ya ha sido expuesto en el resumen inicial.

La realización de este trabajo abarca un rango de conocimientos bastante amplio. Es por eso que la ayuda de la empresa **Técnicas Competitivas S.A.** ha sido crucial para llevarlo a cabo.

Hemos propuesto muchos sistemas diferentes pero la cantidad de opciones que se podrían haber implementado para La Laguna es mucho mayor. Por ejemplo, un sistema de parking inteligente habría ayudado a solventar varios problemas que podemos observar en el centro de La Laguna.

En la actualidad el concepto Smart City es cada vez más utilizado y ya son bastantes municipios del archipiélago canario los que se están sumando a esta iniciativa, es por eso que consideramos que la implementación de los sistemas propuestos resultaría beneficiosa para la ciudad.

Por último, como conclusión final, el escalado de este proyecto, no tan solo al resto de edificios de la ciudad, sino también al resto del municipio, e incluso a otros municipios sería una ampliación del trabajo realizado.

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Throughout this project we have made a study about Smart Cities and its relevance. We have analysed the location of the project and its actual situation about the topic. After that, we have suggested a design that would address the main points that a Smart City should focus on. All of this have been previously explained in the abstract.

The development of this project cover a wide range of knowledge. That is the reason why the help of **Técnicas Competitivas S.A.** has been crucial for it.

We have suggested very different systems, but the amount of options we had was much bigger. For example, a Smart Parking system could have helped to solve many problems we can see on the city centre.

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Actually, the concept Smart City is used more often and many townships of the Canary Islands archipelago are adding to this initiative. That is why we consider that the implementation of the suggested systems would be beneficial for the city.

At last, as a final conclusion, the expansion of this project, not only for the rest of the buildings nearby, for the township and other of them too, would be an extension of this project.

# CAPITULO 5. BIBLIOGRAFÍA

# Fuentes:

Gran parte de las fuentes utilizadas para el desarrollo de este proyecto han sido aportadas mediante proyectos y documentación técnica perteneciente a la empresa **Técnicas Competitivas S.A.**, además de entrevistas con la jefa de gabinete del Ayuntamiento de San Cristóbal de La Laguna y un técnico especialista en seguridad.

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# CAPITULO 6. ANEXOS

## 6.1 Direccionamiento IP

Se reservarán IPs de sobra para cada equipo para garantizar la posibilidad de ampliación del sistema en el futuro:

| Sub-red Máscara 255.255.0.0 | Dispositivos Máscara 255.255.255.0 | Servicio |
|---|---|---|
| 172.16.1.x | 1-254 | Vídeo |
| 172.16.2.x | 1-254 | |
| 172.16.3.x | 1-254 | |
| 172.16.10.x | 1-254 | Wi-Fi |
| 172.16.11.x | 1-254 | |
| 172.16.12.x | 1-254 | |
| 172.16.13.x | 1-254 | |
| 172.16.14.x | 1-254 | |
| 172.16.20.x | 1-254 | Sensores |
| 172.16.21.x | 1-254 | |
| 172.16.22.x | 1-254 | |
| 172.16.23.x | 1-254 | |
| 172.16.24.x | 1-254 | |
| 172.16.25.x | 1-254 | |
| 172.16.30.x | 1-254 | Seguridad |
| 172.16.31.x | 1-254 | |
| 172.16.32.x | 1-254 | |
| 172.16.33.x | 1-254 | |
| 172.16.40.x | 1-254 | Autómatas |

# HOJAS DE DATOS

# Cisco Catalyst 2960-L Series Switches

## Product Overview

Cisco Catalyst® 2960-L Series Switches are fixed-configuration, Gigabit Ethernet switches that provide entry-level enterprise-class Layer 2 access for branch offices, conventional workspaces, and out-of-wiring closet applications. Designed for operational simplicity to lower total cost of ownership, they enable secure, and energy-efficient business operations with a range of Cisco IOS® Software features.

## Product Highlights

Cisco Catalyst 2960-L switches feature:

- 8, 16, 24, or 48 Gigabit Ethernet ports with line-rate forwarding
- 2 or 4 Gigabit Small Form-Factor Pluggable (SFP) uplinks
- Power over Ethernet Plus (PoE+) support with up to 370W of power budget
- Perpetual PoE provides uninterrupted power to connected devices even when the switch is booting
- Fanless operation and operational temperature up to 45°C for deployment outside the wiring closet
- Higher mean time between failure (MTBF) because they have no moving mechanical parts
- Less than 11.5-inch depth fit in use cases with space limitation
- Reduced power consumption and advanced energy management features
- RJ45 and USB console access for simplified operations
- Intuitive web UI for easy deployment and management
- Over-the-air configuration and management via Bluetooth interface
- Cisco IOS® Software features
- Enhanced limited lifetime warranty (E-LLW) offering next-business-day hardware replacement

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## Switch Models and Configurations

Cisco Catalyst 2960-L switches include a single fixed power supply. Table 1 shows configuration information.

**Table 1.** Cisco Catalyst 2960-L Configurations

| Product ID | 10/100/1000 Ethernet Ports | Uplink Interfaces | Available PoE Power | Fanless | Dimensions (H x D x W) | Weight |
|---|---|---|---|---|---|---|
| **WS-C2960L-8TS-LL** | 8 | 2 SFP | – | Y | 1.73 x 8.45 x 10.56 in. (4.4 x 21.5 x 26.8 cm) | 4.45 lb (2.02 kg) |
| **WS-C2960L-8PS-LL** | 8 | 2 SFP | 67W | Y | 1.73 x 9.45 x 10.56 in. (4.4 x 24 x 26.8 cm) | 5.64 lb (2.56 kg) |
| **WS-C2960L-16TS-LL** | 16 | 2 SFP | – | Y | 1.73 x 8.45 x 10.56 in. (4.4 x 21.5 x 26.8 cm) | 4.53 lb (2.06 kg) |
| **WS-C2960L-16PS-LL** | 16 | 2 SFP | 120W | Y | 1.73 x 9.45 x 10.56 in. (4.4 x 24 x 26.8 cm) | 5.73 lb (2.6 kg) |
| **WS-C2960L-24TS-LL** | 24 | 4 SFP | – | Y | 1.73 x 9.45 x 17.5 in. (4.4 x 24 x 44.5 cm) | 6.61 lb (3.0 kg) |
| **WS-C2960L-24PS-LL** | 24 | 4 SFP | 195W | Y | 1.73 x 10.45 x 17.5 in. (4.4 x 26.5 x 44.5 cm) | 7.63 lb (3.46 kg) |
| **WS-C2960L-48TS-LL** | 48 | 4 SFP | – | Y | 1.73 x 9.45 x 17.5 in. (4.4 x 24 x 44.5 cm) | 7.21 lb (3.27 kg) |
| **WS-C2960L-48PS-LL** | 48 | 4 SFP | 370W | N | 1.73 x 11.5 x 17.5 in. (4.4 x 29.2 x 44.5 cm) | 10.25 lb (4.65 kg) |

## Features and Benefits

All Cisco Catalyst 2960-L Series Switches feature a LAN Lite Cisco IOS Software image, providing basic functionality for small-scale deployments.

For more information about the features included in the LAN Lite feature sets, refer to the Cisco Feature Navigator: http://tools.cisco.com/ITDIT/CFN/jsp/index.jsp.

## Network Security

The Cisco Catalyst 2960-L Series Switches provide a range of security features to limit access to the network and mitigate threats, including:

- **Comprehensive 802.1x** features to control access to the network, including flexible authentication, 802.1x monitor mode, and RADIUS change of authorization.
- **Multidomain Authentication** allows an IP phone and a PC to authenticate on the same switch port while placing them on appropriate voice and data VLANs.
- **Access Control Lists (ACLs)** for IPv6 and IPv4 for security and QoS ACEs:
  - **Port-based ACLs** for Layer 2 interfaces allow security policies to be applied on individual switch ports.
- **Secure Shell (SSH) Protocol, Kerberos, and Simple Network Management Protocol Version 3 (SNMPv3)** provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSH Protocol, Kerberos, and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions.
- **Switched Port Analyzer (SPAN),** with bidirectional data support, allows Cisco Intrusion Detection System (IDS) to take action when an intruder is detected.
- **TACACS+ and RADIUS authentication** facilitates centralized control of the switch and restricts unauthorized users from altering the configuration.
- **MAC address notification** allows administrators to be notified about users added to or removed from the network.
- **Multilevel security on console access** prevents unauthorized users from altering the switch configuration.

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- **Bridge Protocol Data Unit (BPDU) guard** shuts down spanning-tree port fast–enabled interfaces when BPDUs are received to avoid accidental topology loops.
- **Spanning-tree Root Guard (STRG)** prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.
- **IGMP filtering** provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.
- **Dynamic VLAN assignment** is supported through implementation of VLAN membership policy server client capability to provide flexibility in assigning ports to VLANs. Dynamic VLAN facilitates the fast assignment of IP addresses.

## Redundancy and Resiliency

Cisco Catalyst 2960-L Series Switches offer a number of redundancy and resiliency features to prevent outages and help ensure that the network remains available:

- **IEEE 802.1s/w Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)** provide rapid spanning-tree convergence independent of spanning-tree timers and also offer the benefits of Layer 2 load balancing and distributed processing.
- **Per-VLAN Rapid Spanning Tree (PVRST+)** allows rapid spanning-tree reconvergence on a per-VLAN spanning-tree basis, without requiring the implementation of spanning-tree instances.
- **Switch-port autorecovery (error disable)** automatically attempts to reactivate a link that is disabled because of a network error.

## Enhanced Quality of Service

The Cisco Catalyst 2960-L Series Switches offers intelligent traffic management that keeps everything flowing smoothly. Flexible mechanisms for marking, classification, and scheduling deliver superior performance for data, voice, and video traffic, all at wire speed. Primary QoS features include:

- Up to **four egress queues** and two thresholds per port supporting bandwidth control, shaping, and priority queuing so that the high priority packets are serviced ahead of other traffic.
- **Weighted Round Robin** (WRR) scheduling and **Weighted Tail Drop** (WTD) congestion avoidance.
- **802.1p class of service** (CoS) classification, with marking and reclassification on a per-packet basis by source and destination IP address, MAC address, or Layer 4 TCP/UDP port number.

## Intelligent Power over Ethernet Plus

Cisco Catalyst 2960-L Series Switches support both IEEE 802.3af Power over Ethernet (PoE) and IEEE 802.3at PoE+ (up to 30W per port) to deliver lower total cost of ownership for deployments that incorporate Cisco IP Phones, Cisco Aironet® wireless access points, or other standards-compliant PoE/PoE+ end devices. PoE removes the need to supply wall power to PoE-enabled devices and eliminates the cost of adding electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments.

The Cisco Catalyst 2960-L Series PoE power allocation is dynamic, and power mapping scales up to a maximum of 370W PoE+ power. Intelligent power management allows flexible power allocation across all ports. With Perpetual POE, the POE power is maintained during a switch reload. This is important for critical endpoints such as medical devices and IOT endpoints such as POE-powered lights so that there is no disruption during switch reboot.

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## Cisco Catalyst SmartOperations

Cisco Catalyst SmartOperations is a comprehensive set of capabilities that simplify LAN planning, deployment, monitoring, and troubleshooting. Deploying SmartOperations tools reduces the time and effort required to operate the network and lowers TCO.

- **Cisco AutoConfig** services determine the level of network access provided to an endpoint based on the type of the endpoint device. This feature also permits hard binding between the end device and the interface.
- **Cisco Smart Install** services enable minimal-touch deployment by providing automated Cisco IOS Software image installation and configuration when new switches are connected to the network. This enables network administrators to remotely manage Cisco IOS Software image installs and upgrades.
- **Cisco Auto SmartPorts** services enable automatic configuration of switch ports as devices connect to the switch with settings optimized for the device type resulting in zero-touch port-policy provisioning.
- **Cisco Smart Troubleshooting** is an extensive array of diagnostic commands and system health checks in the switch, including Smart Call Home. The Cisco Generic Online Diagnostics (GOLD) and Cisco online diagnostics on switches in live networks help predict and detect failures more quickly.
- **PnP (Plug and Play)** with Cisco APIC – EM (Application Policy Infrastructure Controller Enterprise Module) support for simple, secure, unified, and integrated new branch or campus device deployments or for provisioning updates to an existing network.

For more information about Cisco Catalyst SmartOperations, visit cisco.com/go/SmartOperations.

## Operational Simplicity Features

- **Cisco AutoSecure provides** a single-line command-line interface (CLI) to enable baseline security features (Port Security, DHCP snooping, Dynamic ARP Inspection (DAI)). This feature simplifies security configurations with a single touch.
- **Dynamic Host Configuration Protocol (DHCP)** autoconfiguration of multiple switches through a boot server eases switch deployment.
- **Autonegotiation** on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth.
- **Dynamic Trunking Protocol (DTP)** facilitates dynamic trunk configuration across all switch ports.
- **Port Aggregation Protocol (PAgP)** automates the creation of Cisco Fast EtherChannel groups or Gigabit EtherChannel groups to link to another switch, router, or server.
- **Link Aggregation Control Protocol (LACP)** allows the creation of Ethernet channeling with devices that conform to IEEE 802.3ad. This feature is similar to Cisco EtherChannel technology and Port Aggregation Protocol (PAgP).
- **Automatic media-dependent interface crossover (MDIX)** automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed.
- **Unidirectional Link Detection Protocol (UDLD)** and aggressive UDLD allow unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
- **Local Proxy Address Resolution Protocol (ARP)** works in conjunction with private VLAN edge to minimize broadcasts and maximize available bandwidth.
- **VLAN1 minimization** allows VLAN1 to be disabled on any individual VLAN trunk.

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- **Internet Group Management Protocol (IGMP)** snooping for IPv4 and IPv6 MLD v1 and v2 snooping provide fast client joins and leaves of multicast streams and limit bandwidth-intensive video traffic to only the requestors.
- **Per-port broadcast, multicast, and unicast storm control** prevents faulty end stations from degrading overall system performance.
- **Voice VLAN** simplifies telephony installations by keeping voice traffic on a separate VLAN for easier administration and troubleshooting.
- **Cisco VLAN Trunking Protocol (VTP)** supports dynamic VLANs and dynamic trunk configuration across all switches.
- For enhanced traffic management, monitoring, and analysis, the embedded **remote monitoring (RMON)** software agent supports four RMON groups (history, statistics, alarms, and events).
- **Layer 2 trace route** eases troubleshooting by identifying the physical path that a packet takes from source to destination.
- **Trivial File Transfer Protocol (TFTP)** reduces the cost of administering software upgrades by downloading from a centralized location.
- **Network Timing Protocol (NTP)** provides an accurate and consistent timestamp to all intranet switches.

## Power Management

The 2960-L switches offer a range of industry-leading features for effective energy efficiency and energy management.

- **IEEE 802.3az Energy Efficient Ethernet (EEE)** enables ports to dynamically sense idle periods between traffic bursts and quickly switch the interfaces into a low- power idle mode, reducing power consumption.
- **Cisco EnergyWise**® policies can be used to control the power consumed by PoE-powered endpoints, desktop and data-center IT equipment, and a wide range of building infrastructure. Cisco EnergyWise technology is included on all Cisco Catalyst 2960-L Series Switches. For more information about Cisco EnergyWise technology, visit cisco.com/go/energywise.

## Network Management

The Cisco Catalyst 2960-L Series Switches offer a superior CLI for detailed configuration and administration. 2960-L Series Switches are also supported in the full range of Cisco network management solutions.

- **Cisco Prime**® **Infrastructure** provides comprehensive network lifecycle management, including an extensive library of easy-to-use features to automate the initial and day-to-day management of your Cisco network. Cisco Prime technology integrates hardware and software platform expertise and operational experience into a powerful set of workflow-driven configuration, monitoring, troubleshooting, reporting, and administrative tools.
- **Cisco Network Plug and Play** provides a simple, secure, unified, and integrated offering for enterprise network customers to ease new branch or campus device rollouts or for provisioning updates to an existing network with a near zero-touch deployment experience.
- **Web UI** on the 2960-L allows for easy and quick installation, configuration management, and monitoring of the switch.

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## Switch Management

2960-L can now be configured and managed over the air with Bluetooth. The switch supports an external Bluetooth dongle that plugs into the USB port on the switch and allows Bluetooth based RF connection with an external Laptops and Tablets.

Laptop/Tablets can now access the switch CLI using a telnet/ssh client over bluetooth. The GUI can be accessed over bluetooth with a browser.

## Product Specifications

Product specifications (Table 2) apply to both PoE and non-PoE models.

**Table 2.** Specifications

| | 8 Port | 16 Port | 24 Port | 48 Port |
|---|---|---|---|---|
| **Console Ports** | | | | |
| **RJ45 Ethernet** | 1 | 1 | 1 | 1 |
| **USB mini-B** | 1 | 1 | 1 | 1 |
| **USB-A port for storage and Bluetooth console** | 1 | 1 | 1 | 1 |
| **Memory and Processor** | | | | |
| **CPU** | ARMv7 800 MHz | ARMv7 800 MHz | ARMv7 800 MHz | ARMv7 800 MHz |
| **DRAM** | 512 MB | 512 MB | 512 MB | 512 MB |
| **Flash memory** | 256 MB | 256 MB | 256 MB | 256 MB |
| **Performance** | | | | |
| **Forwarding bandwidth** | 10 Gbps | 18 Gbps | 28 Gbps | 52 Gbps |
| **Switching bandwidth** | 20 Gbps | 36 Gbps | 56 Gbps | 104 Gbps |
| **Forwarding rate (64-byte L3 packets)** | 14.88 Mpps | 26.78 Mpps | 41.67 Mpps | 77.38 Mpps |
| **Unicast MAC addresses** | 8K | 8K | 8K | 8K |
| **Maximum active VLANs** | 64 | 64 | 64 | 64 |
| **VLAN IDs available** | 4094 | 4094 | 4094 | 4094 |
| **Maximum STP instances** | 64 | 64 | 64 | 64 |
| **Maximum SPAN sessions** | 1 | 1 | 1 | 1 |
| **MTU-L3 packet** | 9198 bytes | 9198 bytes | 9198 bytes | 9198 bytes |
| **Jumbo Ethernet frame** | 10,240 bytes | 10,240 bytes | 10,240 bytes | 10,240 bytes |
| **MTBF in hours (Data)** | 2,448,133 | 2,416,689 | 2,412,947 | 1,370,769 |
| **MTBF in hours (PoE)** | 315,044 | 313,496 | 909,838 | 437,970 |
| **Environment** | | | | |
| **Operating temperature** | | | | |
| **Up to 5,000 ft** | 23ºF to 113ºF (–5ºC to 45ºC) | 23ºF to 113ºF (–5ºC to 45ºC) | 23ºF to 113ºF (–5ºC to 45ºC) | 23ºF to 113ºF (–5ºC to 45ºC) |
| | WS-C2960L-16PS-LL has maximum operating temperature of 40°C (up to 5,000 ft) and 35°C (up to 10,000 ft) | | | |
| **Up to 10,000 ft** | 23ºF to 104ºF (–5ºC to 40ºC) | 23ºF to 104ºF (–5ºC to 40ºC) | 23ºF to 104ºF (–5ºC to 40ºC) | 23ºF to 104ºF (–5ºC to 40ºC) |
| **Operating altitude** | 10,000 ft (3000m) | 10,000 ft (3000m) | 10,000 ft (3000m) | 10,000 ft (3000m) |
| **Operating relative humidity** | 5% to 90% at 40ºC | 5% to 90% at 40ºC | 5% to 90% at 40ºC | 5% to 90% at 40ºC |

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| | 8 Port | | 16 Port | | 24 Port | | 48 Port | |
|---|---|---|---|---|---|---|---|---|
| **Storage temperature** | –13º to 158ºF (–25º to 70ºC) | | –13º to 158ºF (–25º to 70ºC) | | –13º to 158ºF (–25º to 70ºC) | | –13º to 158ºF (–25º to 70ºC) | |
| **Storage altitude** | 15,000 ft (4500m) | | 15,000 ft (4500m) | | 15,000 ft (4500m) | | 15,000 ft (4500m) | |
| **Storage relative humidity** | 5% to 95% at 65ºC | | 5% to 95% at 65ºC | | 5% to 95% at 65ºC | | 5% to 95% at 65ºC | |
| **Storage altitude** | **Note:** Minimum ambient temperature for cold start is 0°C (32°F) | | | | | | | |
| **Electrical** | **Data** | **PoE** | **Data** | **PoE** | **Data** | **PoE** | **Data** | **PoE** |
| **Voltage (autoranging)** | 110 to 220V AC in | 110 to 220V AC in | 110 to 220V AC in | 110 to 220V AC in | 110 to 220V AC in | 110 to 220V AC in | 110 to 220V AC in | 110 to 220V AC in |
| **Frequency** | 50 to 60 Hz | 50 to 60 Hz | 50 to 60 Hz | 50 to 60 Hz | 50 to 60 Hz | 50 to 60 Hz | 50 to 60 Hz | 50 to 60 Hz |
| **Current** | 0.13A to 0.22A | 0.22A to 0.27A | 0.16A to 0.26A | 0.24A to 0.28A | 0.20A to 0.33A | 0.21A to 0.26A | 0.29A to 0.48A | 0.37A to 0.64A |
| **Power rating (maximum consumption)** | 0.04 kVA | 0.11 kVA | 0.05 kVA | 0.19 kVA | 0.06 kVA | 0.24 kVA | 0.09 kVA | 0.48 kVA |
| **Power consumption (watts)** | | | | | | | | |
| 0% traffic | 13.0 | 19.9 | 14.9 | 21.9 | 19.4 | 25.9 | 29.7 | 68.4 |
| 10% traffic | 14.8 | 22.0 | 19.3 | 27.1 | 26.5 | 32.9 | 41.1 | 81.6 |
| 100% traffic | 14.9 | 22.0 | 19.3 | 27.1 | 26.5 | 32.9 | 41.1 | 81.9 |
| Weighted average | 14.2 | 21.3 | 17.8 | 25.4 | 24.1 | 30.6 | 37.3 | 77.3 |
| | **Note:** The wattage rating on the power supply does not represent actual power draw. It indicates the maximum power draw possible by the power supply. This rating can be used for facility capacity planning. For PoE switches, cooling requirements are smaller than total power draw because a significant portion of the load is dissipated in the endpoints. | | | | | | | |
| **Acoustic Noise (48 Port PoE only)** | | | | | | | | |
| **Sound Pressure** | LpA (Typical) | | | | | | 35dB | |
| | LpAD (Maximum) | | | | | | 39dB | |
| **Sound Power** | LwA (Typical) | | | | | | 4.8B | |
| | LwAD (Maximum) | | | | | | 5.2B | |
| | **Note:** Bystander positions operating mode at 25°C ambient. | | | | | | | |
| **Safety and Compliance** | | | | | | | | |
| **Safety** | UL 60950-1 Second Edition, CAN/CSA-C22.2 No. 60950-1 Second Edition, EN 60950-1 Second Edition, IEC 60950-1 Second Edition, AS/NZS 60950-1 | | | | | | | |
| **EMC: emissions** | 47CFR Part 15 (CFR 47) Class A, AS/NZS CISPR22 Class A, CISPR22 Class A, EN55022 Class A, ICES003 Class A, VCCI Class A, EN61000-3-2, EN61000-3-3, KN22 Class A, CNS13438 Class A | | | | | | | |
| **EMC: immunity** | EN55024, CISPR24, EN300386, KN24 | | | | | | | |
| **Environmental** | Reduction of Hazardous Substances (RoHS) including Directive 2011/65/EU | | | | | | | |
| **Telco** | Common Language Equipment Identifier (CLEI) code | | | | | | | |
| **U.S. government certifications** | USGv6 and IPv6 Ready Logo | | | | | | | |
| **Connectors and Interfaces** | | | | | | | | |
| **Ethernet interfaces** | 10BASE-T ports: RJ-45 connectors, 2-pair Category 3, 4, or 5 unshielded twisted-pair (UTP) cabling | | | | | | | |
| | 100BASE-TX ports: RJ-45 connectors, 2-pair Category 5 UTP cabling | | | | | | | |
| | 1000BASE-T ports: RJ-45 connectors, 4-pair Category 5 UTP cabling | | | | | | | |
| | 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Category 5 UTP cabling | | | | | | | |
| **SFP and SFP+ interfaces** | For information about supported SFP/SFP+ modules, refer to the Transceiver Compatibility matrix tables at cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html | | | | | | | |
| **Indicator LEDs** | Per-port status: link integrity, disabled, activity, speed, and full duplex | | | | | | | |
| | System status: system, PoE, and link speed | | | | | | | |
| **Console cables** | CAB-CONSOLE-RJ45 Console cable 6 ft. with RJ-45 | | | | | | | |
| | CAB-CONSOLE-USB Console cable 6 ft. with USB Type A and mini-B connectors | | | | | | | |

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| | 8 Port | 16 Port | 24 Port | 48 Port |
|---|---|---|---|---|
| **Power** | Use the supplied AC power cord to connect the AC power connector to an AC power outlet | | | |
| **Management** | | | | |
| | BRIDGE-MIB<br>CISCO-CABLE-DIAG-MIB<br>CISCO-CDP-MIB<br>CISCO-CLUSTER-MIB<br>CISCO-CONFIG-COPY-MIB<br>CISCO-CONFIG-MAN-MIB<br>CISCO-DHCP-SNOOPING-MIB<br>CISCO-ENTITY-VENDORTYPE-OID-MIB<br>CISCO-ENVMON-MIB<br>CISCO-ERR-DISABLE-MIB<br>CISCO-FLASH-MIB<br>CISCO-FTP-CLIENT-MIB<br>CISCO-IGMP-FILTER-MIB<br>CISCO-IMAGE-MIB<br>CISCO-IP-STAT-MIB<br>CISCO-LAG-MIB<br>CISCO-MAC-NOTIFICATION-MIB<br>CISCO-MEMORY-POOL-MIB<br>CISCO-PAGP-MIB<br>CISCO-POE-EXTENSIONS-MIB | CISCO-PORT-QOS-MIB<br>CISCO-PORT-SECURITY-MIB<br>CISCO-PORT-STORM-CONTROL-MIB<br>CISCO-PRODUCTS-MIB<br>CISCO-PROCESS-MIB<br>CISCO-RTTMON-MIB<br>CISCO-SMI-MIB<br>CISCO-STP-EXTENSIONS-MIB<br>CISCO-SYSLOG-MIB<br>CISCO-TC-MIB<br>CICSO-TCP-MIB<br>CISCO-UDLDP-MIB<br>CISCO-VLAN-IFTABLE<br>CISCO-VLAN-MEMBERSHIP-MIB<br>CISCO-VTP-MIB<br>ENTITY-MIB<br>ETHERLIKE-MIB<br>IEEE8021-PAE-MIB<br>IEEE8023-LAG-MIB | IF-MIB<br>INET-ADDRESS-MIB<br>OLD-CISCO-CHASSIS-MIB<br>OLD-CISCO-FLASH-MIB<br>OLD-CISCO-INTERFACES-MIB<br>OLD-CISCO-IP-MIB<br>OLD-CISCO-SYS-MIB<br>OLD-CISCO-TCP-MIB<br>OLD-CISCO-TS-MIB<br>RFC1213-MIB<br>RMON-MIB<br>RMON2-MIB<br>SNMP-FRAMEWORK-MIB<br>SNMP-MPD-MIB<br>SNMP-NOTIFICATION-MIB<br>SNMP-TARGET-MIB<br>SNMPv2-MIB<br>TCP-MIB<br>UDP-MIB | |
| | For an updated list of supported MIBs, refer to the MIB Locator at cisco.com/go/mibs. | | | |
| **Standards** | | | | |
| | IEEE 802.1D Spanning Tree Protocol<br>IEEE 802.1p CoS Prioritization<br>IEEE 802.1Q VLAN<br>IEEE 802.1s<br>IEEE 802.1w<br>IEEE 802.1X<br>IEEE 802.1ab (LLDP)<br>BlueTooth Ver 4.0 | IEEE 802.3ad<br>IEEE 802.3af and IEEE 802.3at<br>IEEE 802.3ah (100BASE-X single/multimode fiber only)<br>IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports<br>IEEE 802.3 10BASE-T<br>IEEE 802.3u 100BASE-TX | IEEE 802.3ab 1000BASE-T<br>IEEE 802.3z 1000BASE-X<br>RMON I and II standards<br>SNMP v1, v2c, and v3<br>IEEE 802.3az<br>IEEE 802.3ae 10Gigabit Ethernet<br>IEEE 802.1ax | |
| **RFC Compliance** | | | | |
| | RFC 768 - UDP<br>RFC 783 - TFTP<br>RFC 791 - IP<br>RFC 792 - ICMP<br>RFC 793 - TCP<br>RFC 826 - ARP<br>RFC 854 - Telnet<br>RFC 951 - Bootstrap Protocol (BOOTP)<br>RFC 959 - FTP<br>RFC 1112 - IP Multicast and IGMP<br>RFC 1157 - SNMP v1<br>RFC 1166 - IP Addresses | RFC 1256 - Internet Control Message Protocol (ICMP) Router Discovery<br>RFC 1305 - NTP<br>RFC 1492 - TACACS+<br>RFC 1493 - Bridge MIB<br>RFC 1542 - BOOTP extensions<br>RFC 1901 - SNMP v2C<br>RFC 1902-1907 - SNMP v2<br>RFC 1981 - Maximum Transmission Unit (MTU) Path Discovery IPv6<br>FRC 2068 - HTTP<br>RFC 2131 - DHCP<br>RFC 2138 - RADIUS<br>RFC 2233 - IF MIB v3 | RFC 2373 - IPv6 Aggregatable Addrs<br>RFC 2460 - IPv6<br>RFC 2461 - IPv6 Neighbor Discovery<br>RFC 2462 - IPv6 Autoconfiguration<br>RFC 2463 - ICMP IPv6<br>RFC 2474 - Differentiated Services (DiffServ) Precedence<br>RFC 2597 - Assured Forwarding<br>RFC 2598 - Expedited Forwarding<br>RFC 2571 - SNMP Management<br>RFC 3046 - DHCP Relay Agent Information Option<br>RFC 3376 - IGMP v3<br>RFC 3580 - 802.1X RADIUS | |

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## Ordering Information

### Cisco Enhanced Limited Lifetime Hardware Warranty

Cisco Catalyst 2960-L Series Switches come with an enhanced limited lifetime warranty (E-LLW). The E-LLW provides the same terms as the Cisco standard limited lifetime warranty but adds next-business-day delivery of replacement hardware, where available, and 90 days of 8 x 5 Cisco Technical Assistance Center (TAC) support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy. For more information about warranty terms, visit http://www.cisco.com/go/warranty and see Table 3.

**Table 3.** Warranty Terms

| Cisco Enhanced Limited Lifetime Hardware Warranty | |
|---|---|
| **Device covered** | Applies to all Cisco Catalyst 2960-L Series Switches. |
| **Warranty duration** | As long as the original end user continues to own or use the product. |
| **End-of-life policy** | In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance. |
| **Hardware replacement** | Cisco or its service center will use commercially reasonable efforts to ship a Cisco Catalyst 2960-L replacement part for next business day delivery, where available. Otherwise, a replacement will be shipped within 10 working days after the receipt of the RMA request. Actual delivery times might vary depending on customer location. |
| **Effective date** | Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco). |
| **TAC support** | Cisco will provide during customer's local business hours, 8 hours per day, 5 days per week basic configuration, diagnosis, and troubleshooting of device-level problems for up to 90 days from the date of shipment of the originally purchased Cisco Catalyst 2960-L product. This support does not include solution or network-level support beyond the specific device under consideration. |
| **Cisco.com access** | Warranty allows guest access only to Cisco.com. |

## Software Policy

Customers with Cisco Catalyst LAN Lite software feature sets are provided with maintenance updates and bug fixes designed to maintain the compliance of the software with published specifications, release notes, and industry standards compliance as long as the original end user continues to own or use the product or up to 1 year from the end-of-sale date for this product, whichever occurs earlier.

This policy supersedes any previous warranty or software statement and is subject to change without notice.

## Technical Support and Services

Table 4 describes available technical services.

**Table 4.** Technical Services Available for Cisco Catalyst 2960-L Series Switches

| Technical Services |
|---|
| **Cisco Smart Net Total Care™ Service**<br>• Around-the-clock, global access to the Cisco TAC<br>• Unrestricted access to the extensive Cisco.com knowledge base and tools<br>• Next-business-day, 8x5x4, 24x7x4, or 24x7x2 advance hardware replacement and onsite parts replacement and installation available[1]<br>• Ongoing operating system software updates within the licensed feature set[2]<br>• Proactive diagnostics and real-time alerts on Smart Call Home–enabled devices |

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| Technical Services |
| --- |
| **Cisco Smart Foundation Service**<br>• Next-business-day advance hardware replacement as available<br>• Access to SMB TAC during business hours (access levels vary by region)<br>• Access to Cisco.com SMB knowledge base<br>• Online technical resources through Smart Foundation Portal<br>• Operating system software bug fixes and patches |
| **Cisco Smart Care Service**<br>• Network-level coverage for the needs of small and medium-sized businesses<br>• Proactive health checks and periodic assessments of Cisco network foundation, voice, and security technologies<br>• Technical support for eligible Cisco hardware and software through Smart Net Total Care portal<br>• Cisco operating system and application software updates and upgrades[2]<br>• Next-business-day advance hardware replacement as available, 24x7x4 option available[1] |
| **Cisco SP Base Service**<br>• Around-the-clock, global access to the Cisco TAC<br>• Registered access to Cisco.com<br>• Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement; return to factory option available[1]<br>• Ongoing operating system software updates[2] |
| **Cisco Focused Technical Support Services**<br>Three levels of premium, high-touch services are available:<br>• Cisco High-Touch Operations Management Service<br>• Cisco High-Touch Technical Support Service<br>• Cisco High-Touch Engineering Service<br>Valid Cisco Smart Net Total Care or SP Base contracts are required on all network equipment. |

[1] Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment is initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with next-business-day (NBD) delivery. Where NBD is not available, same day shipping is provided. Restrictions apply; for details, review the appropriate service descriptions.

[2] Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

## Accessories

Table 5 describes accessories.

**Table 5.** Cisco Catalyst 2960-L Accessories

| Part Numbers | Description | Compatibility |
| --- | --- | --- |
| **CAB-CONSOLE-RJ45** | Console Cable 6 Feet with RJ45 | All models |
| **CAB-CONSOLE-USB** | Console Cable 6 Feet with USB Type A and mini-B Connectors | All models |
| **PWR-CLP** | Power Cable Restraining Clip | All models |
| **CMPCT-MGNT-TRAY** | Magnetic Mounting Tray for 3560-CX, 2960-CX, and 2960-L Compact Switches | 8-port and 16-port models only |
| **CMPCT-CBLE-GRD** | Cable Guard for 3560-CX, 2960-CX, and 2960-L Compact Switches | 8-port and 16-port models only |
| **CMPCT-DIN-MNT** | DIN Rail Mount for 3560-CX, 2960-CX, and 2960-L Compact Switches | 8-port and 16-port models only |

## Contact Cisco

For more information about Cisco products, contact:

- Phone: +1 800 553-NETS (6387)
- Worldwide Product Support
- Company website: cisco.com

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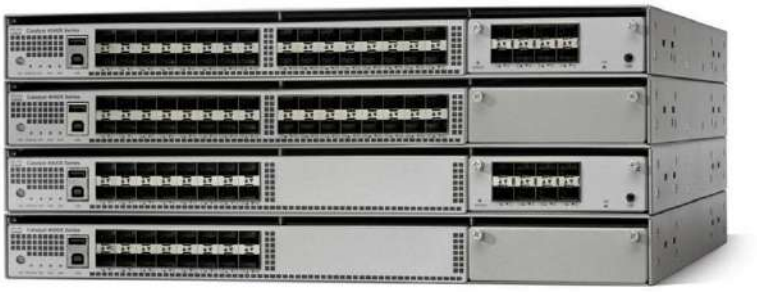
# Cisco Catalyst 4500-X Series Fixed 10 Gigabit Ethernet Aggregation Switch

## Product Overview

Cisco® Catalyst® 4500-X Series Switch (Figure 1) is a fixed aggregation switch that delivers best-in-class scalability, simplified network virtualization, and integrated network services for space-constrained environments in campus networks. It meets business growth objectives with unprecedented scalability, simplifies network virtualization with support for one-to-many (Cisco Easy Virtual Networks [EVN]) and many-to-one (Virtual Switching System [VSS]) virtual networks, and enables emerging applications by integrating many network services.

The Cisco Catalyst 4500-X Series offers key innovations, including:

- **Platform Scalability:** Delivers up-to 800 Gbps of switching capacity, capable of scaling up to 1.6-Tbps capacity with the VSS technology. Future-proof investment with modular uplink and auto-detect 10 Gigabit Ethernet and 1 Gigabit Ethernet ports.
- **High Availability:** Delivers the network availability demanded by business-critical enterprise applications through comprehensive high-availability capabilities, including VSS and EVN. Furthermore, innovative features such as redundant hot swappable fans and power supplies with AC to DC, and DC to AC failover remove single point of failure in network.
- **Application Monitoring:** Enhanced application monitoring through Flexible Netflow and eight ports of line rate bidirectional Switched Port Analyzer (SPAN)/Remote Switched Port Analyzer (RSPAN). In addition Cisco IOS® XE Software provides the ability to host third-party applications.
- **Security:** Support for Cisco TrustSec™ technology as well as robust control plane policing (CoPP) to address denial of service attacks.
- **Simplified Operations:** Support for Smart Install Director, providing a single point of management enabling zero-touch deployment for new switches and stacks in campus and branch networks.



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## Cisco Catalyst 4500-X Series Switch Family

Cisco Catalyst 4500-X Series provides scalable, fixed-campus aggregation solutions in space-constrained environments. The solution provides flexibility to build desired port density through two versions of base switches along with optional network module, providing line-rate 10GE capability. Both the 32-port and 16-port versions can be configured with optional network modules and offer similar features. The Small Form-Factor Pluggable Plus (SFP+) interface supports both 10 Gigabit Ethernet and 1 Gigabit Ethernet ports, allowing customers to use their investment in 1 Gigabit Ethernet SFP and upgrade to 10 Gigabit Ethernet when business demands change, without having to do a comprehensive upgrade of the existing deployment. The uplink module is hot swappable.

Following are key offering from this product family:

- 32 x 10 Gigabit Ethernet Port switch with optional module slot (Figure 1)
- 16 x 10 Gigabit Ethernet Port switch with optional module slot (Figure 2)
- 8 x 10 Gigabit Ethernet Port uplink module (Figure 3)

**Figure 1.** 32 x 10 Gigabit Ethernet Port Switch with Optional Uplink Module Slot

**Figure 2.** 16 x 10 Gigabit Ethernet Port Switch with Optional Uplink Module Slot

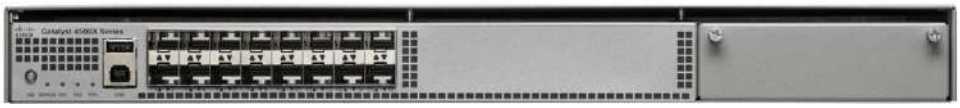

**Figure 3.** 8 x 10 Gigabit Ethernet Port Uplink Module

In addition, both 32 port and 16 port versions are available with front-to-back and back-to-front airflow. The front-to-back airflow switch comes with matching burgundy color fan and power supply handle to indicate warm side. Similarly, back-to-front airflow switch fan and power supply handles are color-coded in blue to indicate cool side. Figure 5 and Figure 6 show rear view of the switch with front-to-back and back-to-back airflow respectively.

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**Figure 4.** Front-to-Back Airflow Rear View

**Figure 5.** Back-to-Front Airflow Rear View

Cisco Catalyst 4500-X switch provides redundant hot swappable fans and power supplies (Figure 7) for highest resiliency with no single point of failure.

**Figure 6.** Redundant Fan and Power Supply

## Cisco Catalyst 4500-X Switch Series Feature Highlights

Cisco Catalyst 4500-X Series Switch provides nonblocking 10 Gigabit Ethernet per port bandwidth and Cisco IOS Flexible NetFlow for optimized application visibility. In addition to this, the enterprise-class Cisco Catalyst 4500-X offers the following:

- **Performance and scalability**
  - 800-Gbps switching capacity with up to 250 Mpps of throughput
  - External USB and SD card support for flexible storage options
  - 10/100/1000 RJ-45 console and management port
  - IPv6 support in hardware, providing wired-network-rate forwarding for IPv6 networks and support for dual stack with innovative resource utilization
  - Dynamic hardware forwarding-table allocations for ease of IPv4-to-IPv6 migration
  - Scalable routing (IPv4, IPv6, and multicast) tables, Layer 2 tables, and ACL and quality of service (QoS) entries to make use of eight queues per port and comprehensive security policies per port

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- **Infrastructure services**
  - Cisco IOS XE Software, the modular open application platform for virtualized borderless services
  - Maximum resiliency with redundant components, Nonstop Forwarding/Stateful Switchover (NSF/SSO), and In-Service Software Upgrade (ISSU) support in a VSS enabled system
  - Network virtualization through Multi-VRF technology for Layer 3 segmentation
  - Automation through Embedded Event Manager (EEM), Cisco Smart Call Home, AutoQoS, and Auto SmartPorts for fast provisioning, diagnosis, and reporting
- **Cisco Borderless Networks services**
  - Optimized application performance through deep visibility with Flexible NetFlow supporting rich Layer 2/3/4 information (MAC, VLAN, TCP flags) and synthetic traffic monitoring with IP service-level agreement (SLA)
  - Medianet capabilities to simplify video quality of service, monitoring, and security. In addition, multicast features such as Protocol Independent Multicast (PIM) and Source-Specific Multicast (SSM) provide enterprise customers with the additional scalability to support multimedia applications
- **Investment protection and reduced TCO**

  Cisco Catalyst 4500-X Series eliminates the need for standalone solutions by integrating many network services. Customers can lower the total cost of ownership while streamlining management and accelerating deployment time. Integrated network services available on Cisco Catalyst 4500-X Series include:
  - Application visibility and control (Flexible NetFlow, Cisco IOS Embedded Event Manager)
  - Security with Cisco TrustSec[1]
  - Troubleshooting video or any User Datagram Protocol-based flows (Mediatrace)
  - Video network readiness assessment (built-in traffic simulator with IP SLA Video Operation)
  - Ability to run third-party applications (Wireshark)

Table 1 highlights the performance and scalability enhancements of the Cisco Catalyst 4500-X Series Switches.

**Table 1.** Cisco Catalyst 4500-X Switch Series Performance and Scalability Features

| Product Number | Description |
|---|---|
| **System** | |
| **Base System** | Front to Back Airflow:<br>• 32x10 GE SFP+/SFP - WS-C4500X-32SFP+<br>• 16x10 GE SFP+/SFP - WS-C4500X-16SFP+<br>Back to Front Airflow:<br>• 32x10 GE SFP+/SFP - WS-C4500X-F-32SFP+<br>• 16x10 GE SFP+/SFP - WS-C4500X-F-16SFP+ |
| **Expansion Module (Optional)** | 8x10 GE SFP+/SFP - C4KX-NM-8SFP+ |
| **Management Port** | 10/100/1000 Base-T |
| **USB Port** | Type A (storage and boot) up-to 4 GB |
| **Dual Power Supply** | Yes |
| **Field Replaceable Fans** | Yes (5 fans) |
| **Fan Redundancy** | No performance impact with single fan failure |
| **Scalability** | |
| **System Throughput** | Up to 800 Gbps |
| **IPv4 Routing in Hardware** | Up to 250 Mpps |

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| Product Number | Description |
|---|---|
| **IPv6 Routing in Hardware** | Up to 125 Mpps |
| **L2 Bridging in Hardware** | Up to 250 Mpps |
| **Media Access Control (MAC) Entries** | 55K |
| **Forwarding Entries** | 32x10 GE Port Base SKU: IPv4: 256K, IPv6: 128K<br>16x10 GE Port Base SKU: IPv4: 64K, IPv6: 32K |
| **Flexible Netflow Entries** | 128K |
| **Switched Port Analyzer (SPAN), Remote Switched Port Analyzer (RSPAN)** | 8 line rate bidirectional sessions (ingress and egress) |
| **Total VLANs** | 4094 |
| **Total Switched Virtual Interfaces (SVIs)** | 4094 |
| **IGMP groups** | 32K |
| **Multicast routes** | 32x10 GE Port Base SKU: IPv4: 32K, IPv6: 32K<br>16x10 GE Port Base SKU: IPv4: 24K, IPv6: 12K |
| **Dynamic Host Configuration Protocol (DHCP) Snooping Entries** | 12K (DHCP snooping bindings) |
| **ARP Entries** | 47K |
| **Spanning Tree Protocol Instances** | 10K |
| **Jumbo Frame Support for Bridged and Routed Packets** | Up to 9216 bytes |
| **High Availability and Resiliency** | |
| **High Availability Solution** | Virtual Switching System (VSS) |
| **Number of stackable switches in VSS** | Up to 2 |
| **VSS Throughput** | Up to 1.6 Tbps |
| **Virtual Switch Link** | 1GE or 10GE |
| **Max number of Virtual Switch Links** | 8 |
| **In-Service Software Upgrade** | Across the switches |
| **Nonstop Forwarding with Stateful Switchover** | Across the switches |
| **CPU and Memory** | |
| **Onboard Memory (SRAM DDR-II)** | 4 GB |
| **Port Buffers** | 32-MB Shared Memory |
| **CPU** | Dual Core 1.5 GHz |
| **NVRAM** | 2 GB |
| **Optional External Memory (SD Card)** | 2 GB |
| **QoS Features** | |
| **Port Queues** | 8 Queues/Port |
| **CPU Queues** | 64 |
| **QoS Entries** | 128K (64K ingress and 64K in egress) Shared with ACL |
| **Aggregate Rate-Limiting** | Ingress port or VLAN and egress VLAN or Layer 3 port |
| **Rate-Limiting Level Types** | Committed Information Rate (CIR), Peak Information Rate (PIR) |
| **Aggregate Traffic Rate-Limiting Policers (1K=1024)** | 16K |

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| Product Number | Description |
|---|---|
| **Flow-Based Rate-Limiting Method; Number of Rates** | Supported using flow-records in the classification criteria and policing action |
| **Qos Policy Enforcement** | Per Port or Per Vlan or Per Port, Per VLAN Granularity |
| **Class of Service (CoS)** | Yes |
| **Differentiated Services Code Point (DSCP)** | Yes |
| **Security Features** | |
| **Port Security** | Yes |
| **IEEE 802.1x and 802.1x Extensions** | Yes |
| **VLAN, Router, and Port ACLs** | Yes |
| **Security ACL Entries (1K=1024)** | 128K (64K ingress and 64K in egress) Shared with QoS |
| **Unicast Reverse Path Forwarding (uRPF) Check in Hardware** | Yes |
| **CPU Rate Limiters (DoS Protection) Includes Control Plane Policing** | Yes |
| **Private VLANs** | Yes |
| **Micro Flow Policer** | Yes. Supported using flow records in the class-map |
| **CPU HW Rate Limiters by Packet Per Second (pps) and Bit Rate Policers (bps)** | Supported in hardware control-plane policing (CoPP) |
| **Control Plane Policing (CoPP) for Multicast** | Yes |
| **ACL Labels** | Yes |
| **Port ACL** | Yes |
| **Traffic Storm Control (formally known as Broadcast/Multicast Suppression)** | Yes |
| **Virtualization Features** | |
| **VRF-Lite Scalability** | 64 |
| **Easy Virtual Network (EVN) Scalability** | 32 |
| **Simplified Operations** | |
| **Smart Install** | Smart Install Director[2] |

[2] Smart Install Director support in VSS mode will be available in a future software release.

## Continued Innovations Through Infrastructure Services

### Modular Open Application Platform, Cisco IOS XE Software

Cisco IOS XE Software is the open service platform software operating system for the Cisco Catalyst 4500-X Series. Cisco continues to evolve Cisco IOS Software to support next-generation switching hardware and provide increased architectural flexibility to deliver Cisco Borderless Networks services. Cisco IOS XE Software provides the following customer benefits:

- Cisco IOS XE Software provides an enhanced operating system that can take advantage of the multicore CPU architecture of the Cisco Catalyst 4500-X system.
- Cisco IOS XE enables single software image, without the need to download a separate software image per license feature set.

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- Cisco IOS XE Software provides customer investment protection in the existing Cisco IOS Software by keeping a consistent feature set and operational look and feel. This supports a transparent migration experience.
- Cisco IOS XE Software supports service virtualization capability that allows the Cisco Catalyst 4500-X to host third-party applications in parallel with Cisco IOS Software. The hosted application communicates with Cisco IOS Software to use its rich feature sets. This benefit keeps Cisco IOS Software simple and robust while allowing the customer to quickly adopt new technologies using proven code. Cisco IOS XE Software enables Cisco Catalyst 4500-X to be an open service platform and is a primary anchor for future Cisco Borderless Networks innovations.

### Simplified Operations Through Automation

As campus switching has grown to support increasing enterprise demands, so has the need to deploy and manage new and evolving technologies. Simplified operations are critical in meeting these challenges and achieving increased operational efficiency through proactive management and reduction in unplanned network downtime. The Cisco Catalyst 4500-X offers the following rich set of capabilities for simplified operations:

- Auto Install and AutoQoS for fast deployment
- Smart Install Director support for plug-and-play configuration and image-management
- Flexible NetFlow and IP SLA for enhanced visibility
- EEM integration with NetFlow and third-party applications
- Smart Call Home, Generic Online Diagnostic (GOLD), and Digital Optical Monitoring (DOM) for simplified operations
- Cisco EnergyWise for simplified and effective power management
- ISSU, SSO, and NSF for simplified change management and high availability for VSS enabled deployment
- Configuration rollback for improved configuration management

### Best-in-Class Resiliency

The Cisco Catalyst 4500-X Series is designed for excellent nonstop communications with non-interrupted hardware switching. With Cisco IOS XE Software, customers continue to reap the benefits of this best-in-class resiliency in various ways.

In addition to redundant power supplies and fans, the Cisco Catalyst 4500-X is Virtual Switching System (VSS).

Any two Cisco Catalyst 4500-X Series Switches can be pooled together into a VSS. The two switches are connected with 10 Gigabit Ethernet links called Virtual Switch Links (VSLs). Once a VSS is created, it acts as a single virtual Cisco Catalyst switch delivering the following benefits:

**Operational Manageability**

- Two Cisco Catalyst 4500-X Series Switches share a single point of management, single gateway IP address, and single routing instance.
- Eliminates the dependence on First Hop Redundancy Protocols (FHRP) and Spanning Tree Protocol.

**Scales to 1.6 Tbps**

- Scales system bandwidth capacity to 1.6 Tbps by activating all available bandwidth across redundant Cisco Catalyst 4500-X Series Switches.
- Provides up to 80 ports of 10 Gigabit Ethernet per system.

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## Enhanced Application Visibility with Flexible NetFlow

Cisco IOS Flexible NetFlow is the next generation in flow monitoring technology, allowing optimization of the network infrastructure resources, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Cisco Catalyst 4500-X Series provides 128K Flexible NetFlow entries. Based on a custom-built ASIC, Cisco Catalyst 4500-X Series delivers unprecedented flexibility and comprehensive flow visibility extending from Layer 2 (MAC, VLAN) to Layer 4 (TCP, UDP flags, and so on).

The flow data collected by Flexible NetFlow can be exported to an external collector for analysis and reporting or tracked by EEM. The Cisco Catalyst 4500-X Series enables powerful on-box and customizable event correlation and policy actions with EEM. This allows the switches to trigger customized event alarms or policy actions when the predefined condition is met. With no external appliance required, customers are able to use existing infrastructure to perform traffic monitoring, making traffic analysis economical even on large IP networks.

Additional details on Cisco Flexible NetFlow are available at: http://www.cisco.com/go/fnf.

## Features at a Glance

- **Cisco IOS XE Software IP Base:** Includes all Layer 2 features and some basic Layer 3 features.
- **Cisco IOS XE Software Enterprise Services:** Upgradable with a Software Activation License (SAL); supports full Layer 3 protocols and advanced features such as complete routing scalability, Border Gateway Protocol (BGP), Virtual Routing and Forwarding, Policy-Based Routing, and so on.

These features can be enabled using the software-licensing mechanism. For details about software licensing, see “Licensing” section later in this document or visit http://www.cisco.com/go/sa.

## Industry Standards

- Ethernet: IEEE 802.3
- 10 Gigabit Ethernet: IEEE 802.3ae
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1w Rapid Reconfiguration of Spanning Tree
- IEEE 802.1s Multiple VLAN Instances of Spanning Tree
- IEEE 802.3ad LACP
- IEEE 802.1p CoS Prioritization
- IEEE 802.1Q VLAN
- IEEE 802.1X User Authentication
- IEEE 802.1x-Rev
- RMON I and II standards
- USGv6 and IPv6 Gold Logo certified

## Supported Pluggables

For details about the different optical modules and the minimum Cisco IOS Software release required for each of the supported optical modules, visit: http://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html.

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**Note:** SFP-10G-ZR modules are not supported on ports 1 to 32 (or 1 to 16) in the back-to-front airflow configuration. They are supported on the uplink module ports instead. In the back-to-front airflow configuration, limit usage of ZR optics to the uplink module only.

## Software Requirements

The Cisco Catalyst 4500-X Series is supported in Cisco IOS Software with minimum Cisco IOS XE Software Release 3.3.0SG. For VSS capability, minimum software requirement is Cisco IOS XE Software Release 3.4.0SG.

## Environmental Conditions

Table 2 lists environmental conditions for Cisco Catalyst 4500-X Series.

**Table 2.** Environmental Conditions for the Cisco Catalyst 4500-X Series

| Parameter | Performance Range |
|---|---|
| **Operating Temperature** | 0°C to 40°C (RH to 90%) |
| **Storage Temperature** | -40°C to 70°C (RH 93%) |
| **Operating Altitude** | 60m below sea level to 3000m above sea level |
| **Relative Humidity** | Nonoperating Humidity: 95% RH |
| **Acoustic Noise Measured per ISO 7779 and Declared per ISO 9296 Bystander Positions Operating to an Ambient Temperature of 25°C** | Industrial Product: 65 dBA maximum |
| **RoHS** | Reduction of Hazardous Substances (ROHS) 5 |

## Power Information

Table 3 lists power information for Cisco Catalyst 4500-X Series.

**Table 3.** Power Supply Information for Cisco Catalyst 4500-X Series

| Power Supply Feature | Support in the 4500-X Series |
|---|---|
| **AC Power Max Rating** | 750W |
| **System Power Consumption** | 330W nominal/400W max |
| **Input-Voltage Range and Frequency** | AC 100 to 240 VAC 50-60 Hz/DC -72 VDC to -40 VDC |
| **DC Power Max Rating** | 750W |
| **AC to DC failover and vice versa** | Yes |
| **Total Output BTU (Note: 1000 BTU/hr = 293W)** | 1122 BTU/hr (330 W) nominal/1365 BTU/hr (400 W) max |
| **Input Current** | AC 11A @ 110VAC, 6 A @ 200VAC/DC 25A Max |
| **Output Ratings** | 12V @ 62A & 3.3V @ 3A |
| **Output Holdup Time** | AC = 16 ms; DC = 4 ms @ maximum load |
| **Power-Supply Input Receptacles** | AC IEC 60320 C15/DC Custom detachable screw terminal (supplied) |
| **Power Cord Rating** | AC 15A/DC 25A |

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## MTBF Information

Table 4 lists mean-time-between-failures (MTBF) information for Cisco Catalyst 4500-X Series.

**Table 4.** MTBF Information for Cisco Catalyst 4500-X Series

| Product Number | Description |
|---|---|
| **WS-C4500X-16SFP+** | 209,330 |
| **WS-C4500X-24X-ES** | 209,330 |
| **WS-C4500X-32SFP+** | 199,720 |
| **WS-C4500X-40X-ES** | 199,720 |
| **C4KX-NM-8SFP+** | 2,286,500 |
| **WS-C4500X-F-16SFP+** | 209,330 |
| **WS-C4500X-F-32SFP+** | 199,720 |
| **C4KX-FAN-F** | L10 Life 60,000 at 40C[1] |
| **C4KX-FAN-R** | L10 Life 60,000 at 40C |
| **C4KX-PWR-750AC-F** | 1,045,265 |
| **C4KX-PWR-750AC-R** | 1,045,265 |
| **C4KX-PWR-750DC-F** | 443,423 |
| **C4KX-PWR-750DC-R** | 443,423 |

[1] Since fan is an electro-mechanical device it doesn't follow electronics failure mode. L10 life means the time 10% of total PS population will fail at a particular temperature.

## Regulatory Standards Compliance

Table 5 shows regulatory standards compliance information, and Table 6 provides ordering information.

**Table 5.** Cisco Catalyst 4500-X Regulatory Standards Compliance

| Standard | Specification |
|---|---|
| **Regulatory Compliance** | CE marking |
| **EMI and EMC Compliance** | 47CFR Part 15 (CFR 47) Class A<br>AS/NZS CISPR22 Class A<br>CISPR22 Class A<br>EN55022 Class A<br>ICES003 Class A<br>VCCI Class A<br>EN61000-3-2<br>EN61000-3-3<br>KN22 Class A<br>CNS13438 Class A<br>EN55024<br>CISPR24<br>EN300386<br>KN24 |
| **Safety Certifications** | UL 60950-1 Second Edition<br>CAN/CSA-C22.2 No. 60950-1 Second Edition<br>EN 60950-1 Second Edition<br>IEC 60950-1 Second Edition<br>AS/NZS 60950-1 |
| **Industry EMC, Safety, and Environmental Standards** | GR-63-Core Network Equipment Building Systems (NEBS) Level 3<br>GR-1089-Core Level 3 |

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**Table 6.** Ordering Information

| Product Number | Description |
|---|---|
| **Base Switch PIDs** | |
| **WS-C4500X-16SFP+** | Catalyst 4500-X 16 Port 10GE IP Base, Front-to-Back Cooling, No P/S |
| **WS-C4500X-24X-IPB** | Catalyst 4500-X 24 Port 10GE IP Base, Front-to-Back Cooling, No P/S |
| **WS-C4500X-24X-ES** | Catalyst 4500-X 24 Port 10GE Enterprise Services, Front-to-Back Cooling, No P/S |
| **WS-C4500X-32SFP+** | Catalyst 4500-X 32 Port 10GE IP Base, Front-to-Back Cooling, No P/S |
| **WS-C4500X-40X-ES** | Catalyst 4500-X 40 Port 10GE Enterprise Services, Front-to-Back Cooling, No P/S |
| **C4KX-NM-8SFP+** | Catalyst 4500-X 8 Port 10GE Network Module |
| **WS-C4500X-F-16SFP+** | Catalyst 4500-X 16 Port 10GE IP Base, Back-to-Front Cooling, No P/S |
| **WS-C4500X-F-32SFP+** | Catalyst 4500-X 32 Port 10GE IP Base, Back-to-Front Cooling, No P/S |
| **FRU and OIR FANs** | |
| **C4KX-FAN-F** | Catalyst 4500-X Back-to-Front Cooling Fan |
| **C4KX-FAN-R** | Catalyst 4500-X Front-to-Back Cooling Fan |
| **Power Supply** | |
| **C4KX-PWR-750AC-F** | Catalyst 4500-X 750W AC Back-to-Front Cooling Power Supply |
| **C4KX-PWR-750AC-R** | Catalyst 4500-X 750W AC Front-to-Back Cooling Power Supply |
| **C4KX-PWR-750DC-F** | Catalyst 4500-X 750W DC Back-to-Front Cooling Power Supply |
| **C4KX-PWR-750DC-R** | Catalyst 4500-X 750W DC Front-to-Back Cooling Power Supply |
| **Accessories** | |
| **CAB-CON-C4K-RJ45** | Console Cable 6ft with RJ-45-to-RJ-45 |
| **SD-X45-2GB-E** | Cisco Catalyst 4500 2-GB SD card |
| **USB-X45-4GB-E** | Cisco Catalyst 4500 4-GB USB device |
| **Software** | |
| **S45XU-33-1511SG** | Cisco IOS Software XE Release 3.3.0 SG non-crypto universal image for Cisco Catalyst 4500-X 32-port and 40-port models |
| **S45XUK9-33-1511SG** | Cisco IOS Software XE Release 3.3.0 SG crypto universal image for Cisco Catalyst 4500-X 32-port and 40-port models |
| **S45XU-331-1511SG** | Cisco IOS Software XE Release 3.3.1 SG non-crypto universal image for Cisco Catalyst 4500-X 16-port and 24-port models |
| **S45XUK9-331-1511SG** | Cisco IOS Software XE Release 3.3.1 SG crypto universal image for Cisco Catalyst 4500-X 16-port and 24-port models |
| **S45XU-34-1512SG** | Cisco IOS Software XE Release 3.4.0 SG non-crypto universal image for all Cisco Catalyst 4500-X models |
| **S45XUK9-34-1512SG** | Cisco IOS Software XE Release 3.4.0 SG crypto universal image for all Cisco Catalyst 4500-X models |
| **C4500X-LIC=** | Base product ID for software upgrade licenses on Catalyst 4500-X (paper delivery) |
| **C4500X-IPB** | Catalyst 4500-X IP BASE software license (paper delivery) |
| **C4500X-16P-IP-ES** | Catalyst 4500-X IP BASE to Enterprise Services upgrade license (paper delivery) for 16-port and 24-port models |
| **C4500X-IP-ES** | Catalyst 4500-X IP BASE to Enterprise Services upgrade license (paper delivery) for 32-port and 40-port models |
| **L-C4500X-LIC=** | Catalyst 4500-X Base product ID for software upgrade licenses (electronic delivery) |
| **L-C4500X-IPB** | Catalyst 4500-X IP BASE software license (electronic delivery) |
| **L-C4500X-16P-IP-ES** | Catalyst 4500-X IP BASE to Enterprise Services upgrade license (electronic delivery) for 16-port and 24-port models |
| **L-C4500X-IP-ES** | Catalyst 4500-X IP BASE to Enterprise Services upgrade license (electronic delivery) for 32-port and 40-port models |

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## Licensing

### Software Activation Licensing

The Cisco Catalyst 4500-X Series enables software activation licensing. Each Cisco Catalyst 4500-X Series ships with a universal image containing all feature sets, IP Base and Enterprise Services. The level of functionality is determined by the license applied.

The software activation licensing enables customers to:

- Speed deployment and roll out new Cisco software activation feature sets across global networks
- Centrally and more accurately manage and track software and license compliance
- Easily conduct software compliance audits to meet regulations without affecting network operations

Additional benefits of Cisco activation licensing include:

- Operational simplicity
  - Simplified upgrades and license transfers save time and improve productivity. You can add new capabilities simply by using a license file.
  - You can easily track software assets, licenses, and feature set status.
  - A single software image improves service delivery.
- Ease of ordering:
  - “Try and buy” lets you use a temporary license to try and evaluate new Cisco IOS Software functionality before purchasing.
  - Pay-as-you-grow software key enables new features incrementally without service calls.

For more information about Cisco software licensing, visit: http://www.cisco.com/go/sa.

## Cisco ONE Software

Cisco ONE Software for Access Switching is available for the Cisco Catalyst 4500-X Series Switches.

Cisco ONE Software is a new way for customers to purchase and use our infrastructure software. It offers a simplified consumption model, centered on common customer scenarios in the data center, WANs, and LANs.

Cisco ONE Software and services provide customers with four primary benefits:

- Software suites that address typical customer use scenarios at an attractive price
- Investment protection of their software purchase through software services-enabled license portability
- Access to ongoing innovation and new technology with Cisco Software Support Service (SWSS)
- Flexible licensing models to smoothly distribute customer's software spend over time

For ordering information for Cisco ONE Software for the Cisco Catalyst 4500-X Series Switches, go to http://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html.

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## Cisco Limited Lifetime Hardware Warranty

The Cisco limited lifetime hardware warranty (LLW) includes 10-day advance hardware replacement for as long as the original end user owns the product. Table 7 describes the Cisco limited lifetime hardware warranty.

The formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

For additional information on warranty terms, visit: http://www.cisco.com/go/warranty.

**Table 7.** Cisco Limited Lifetime Hardware Warranty

| Warranty Terms | Description[1] |
|---|---|
| **Warranty Duration** | As long as the original end user continues to own or use the product. |
| **EoL Policy** | In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance. |
| **Hardware Replacement** | Cisco or its service center will use commercially reasonable efforts to ship a replacement part within 10 business days after receipt of the RMA request and confirmation that a replacement part is the appropriate response. Actual delivery times may vary depending on customer location. |
| **Effective Date** | Hardware warranty commences from the date of shipment to the customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco). |
| **Cisco Technical Assistance Center (TAC) Support** | None. |
| **Cisco.com Access** | Warranty allows guest access only to Cisco.com. |

[1] Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

Adding a Cisco Technical Services contract to your device coverage provides benefits not available through the warranty, including access to the Cisco Technical Assistance Center (TAC), a variety of hardware replacement options to meet critical business needs, updates for licensed Cisco IOS Software, and registered access to the extensive Cisco.com knowledge base and support tools. Choose from a flexible suite of support services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. Table 8 describes the benefits and features of Cisco Technical Services. For more information about Cisco Technical Services, visit: http://www.cisco.com/go/ts.

**Table 8.** Cisco Technical Services for Cisco Catalyst 4500-X Series Switches

| Technical Services |
|---|
| **Cisco SMARTnet™ Service**<br>• Around-the-clock, global access to the Cisco TAC<br>• Unrestricted access to the extensive Cisco.com resources, communities, and tools<br>• Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement[2] and onsite parts replacement and installation available<br>• Ongoing operating system software updates within the licensed feature set[1]<br>• Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices |
| **Cisco Smart Foundation Service**<br>• Next-business day advance hardware replacement as available<br>• Business hours access to small and medium-sized business (SMB) TAC (access levels vary by region)<br>• Access to Cisco.com SMB knowledge base<br>• Online technical resources through Cisco Smart Foundation Portal<br>• Operating system software bug fixes and patches |

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| Technical Services |
| --- |
| **Cisco Focused Technical Support Services**<br>Three levels of premium, high-touch services are available:<br>• Cisco High-Touch Operations Management Service<br>• Cisco High-Touch Technical Support Service<br>• Cisco High-Touch Engineering Service<br>Valid Cisco SMARTnet Service or service provider base contracts on all network equipment are required. |

**Footnotes:**

[1] Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

[2] Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with next business day (NBD) delivery. Where NBD is not available, same day ship is provided. Restrictions apply; please review the appropriate service descriptions for details.

## Cisco and Partner Services

Enable the innovative, secure, intelligent edge in Cisco Borderless Network Architecture using personalized services from Cisco and our partners. Through a discovery process that begins with understanding your business objectives, we help you integrate the next-generation Cisco Catalyst 4500-X Series Switches into your architecture and incorporate network services onto that platform. Sharing knowledge and leading practices, we support your success every step of the way as you deploy, absorb, manage, and scale new technology.

For additional information about Cisco services, visit: http://www.cisco.com/go/services.

## Cisco Capital

### Financing to Help You Achieve Your Objectives

Cisco Capital can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

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# Cisco Catalyst 6500-E Series Chassis

## Product Overview

Cisco introduces the Cisco® Catalyst® 6500 Enhanced Series Chassis (6500-E Series) delivering up to 2 terabits per second of system bandwidth capacity and 80 Gbps of per-slot bandwidth. In a system configured for VSS, this translates to a system capacity of 4 Tbps. The Cisco® Catalyst® 6500 Enhanced Series Chassis will be capable of delivering up to 180 Gbps of per-slot bandwidth with a system capacity of up to 4 terabits per second. A system configured for VSS will be capable of delivering up to 8 Tbps of system bandwidth.

The Cisco Catalyst 6500-E Series Switch offers the broadest range of interface modules with industry-leading performance and advanced feature integration. The Cisco Catalyst 6500-E Series Switch also offers high port densities and comes in 3-, 4-, 6-, 9, 9-Vertical, and 13-slot versions that make it ideal for a range of deployment scenarios.

The Cisco Catalyst 6500-E Series Chassis provides superior investment protection by supporting multiple generations of products in the same chassis, lowering the total cost of ownership. The Cisco Catalyst 6500-E Series Chassis (Figure 1) supports all the Cisco Catalyst 6500 Supervisor Engines up to and including the Cisco Catalyst 6500 Series Supervisor Engine 2T, and associated LAN, WAN, and services modules.

**Figure 1.** Cisco Catalyst 6500-E Series Chassis

## Applications

The versatile Cisco Catalyst 6500-E Series Chassis is ideal for addressing high-performance, high- port-density Fast Ethernet, Gigabit Ethernet, and 10 and 40 Gigabit Ethernet applications in all parts of the network. This series is ideally suited for enterprise core and aggregation environments. The Cisco Catalyst 6500-E Series chassis offers industry-leading 10/100/1000 Gigabit Ethernet, 10 Gigabit Ethernet and 40 Gigabit Ethernet port densities while providing high levels of network resilience.

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## Features and Benefits

Table 1 lists the Cisco Catalyst 6500-E Series Chassis features and benefits.

**Table 1.** Features and benefits

| Feature | Benefit |
|---|---|
| **Scalability** | |
| **3, 4, 6, 9, 9-V and 13-slot modular chassis** | Allows flexibility and room for future growth |
| **Delivers up to 2 terabits per second of system bandwidth capacity and 80 Gbps per-slot for all slots. A system configured for VSS has a system capacity of 4 terabits per second.**<br>**Capable of delivering up to 4 terabits per second of system bandwidth and 180Gbps of per-slot bandwidth. A system configured for VSS will be capable of delivering up to 8 Tbps of system capacity.** | Scales the system capacity for future needs |
| **High interface capacity** | Scales to high-density 40 Gigabit Ethernet, 10 Gigabit Ethernet and Gigabit Ethernet configurations |
| **Increased resiliency** | |
| **Standby fabric hot sync** | Decreases the supervisor engine switchover time of Supervisor Engine 720 and Supervisor Engine 2T based systems to between 50 and 200 ms, depending on the modules being used |
| **Redundant control channel** | Increases resiliency to protect against backplane control channel failures |
| **Redundant supervisor engine option** | Increases availability with redundant supervisor engine options |
| **Redundant power supply option** | Supports redundant power supplies for increased availability |
| **Fan tray** | Supports hot-swappable fan tray<br>The 6509-V-E provides for redundant, hot-swappable fan trays |
| **Environmental** | |
| **Side-to-side airflow (except Cisco Catalyst 6509-V-E)** | Allows ease of access to ports and cables<br>6509-V-E has front-to-back air flow to support hot aisle or cold aisle designs |
| **AC and DC power supply** | Supports both AC and DC power supply options, including AC and DC mixing |
| **Network Equipment Building Standards Layer 3 (NEBS L3) compliant** | Supports NEBS L3 compliance for deployment in demanding environments |

## Product Specifications

Table 2 lists the Cisco Catalyst 6500-E Series Product Specifications.

**Table 2.** Product Specifications

| | 6503-E | 6504-E | 6506-E | 6509-E | 6509-V-E | 6513-E |
|---|---|---|---|---|---|---|
| **Number of Slots** | 3 | 4 | 6 | 9 | 9 | 13 |
| **Supervisor Compatibility** | Cisco Catalyst 6500 Series Supervisor Engine 32<br>Cisco Catalyst 6500 Series Supervisor Engine 720-3B<br>Cisco Catalyst 6500 Series Supervisor Engine 720-3BXL<br>Cisco Catalyst 6500 Series Supervisor Engine 720-10G-3C<br>Cisco Catalyst 6500 Series Supervisor Engine 720-10G-3CXL<br>Cisco Catalyst 6500 Series Supervisor Engine 2T | | | | | |
| **Power Supply Compatibility**<br>* Indicates EoS Power Supply | AC: 1400W, 950W*<br>DC: 950W* | AC: 2700W<br>DC: 2700W | AC: 2500W*, 3000W, 4000W, 6000W, 8700W<br>DC: 2500W, 4000W, 6000W | AC: 2500W*, 3000W, 4000W, 6000W, 8700W<br>DC: 2500W, 4000W, 6000W | AC: 2500W*, 3000W, 4000W, 6000W, 8700W<br>DC: 2500W, 4000W, 6000W | AC: 3000W, 4000W, 6000W, 8700W<br>DC: 2500W, 4000W, 6000W |
| **Module Compatibility** | All modules based on the software release in the system | | | | | |

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| | 6503-E | 6504-E | 6506-E | 6509-E | 6509-V-E | 6513-E |
|---|---|---|---|---|---|---|
| **Software Compatibility** (Minimum Software Version) | | | | | | |
| **With Supervisor Engine 32** | • 12.2(18)SXF | • 12.2(18)SXF | • 12.2(18)SXF | • 12.2(18)SXF | • 12.2(18)SXF10 | • 12.2(33)SXI1<br>• 12.2(33)SXH2<br>• 12.2(18)SXF14 |
| **With Supervisor Engine 720** | • 12.2(14)SX | • 12.2(18)SXE | • 12.2(14)SX | • 12.2(14)SX | • 12.2(18)SXF10 | • 12.2(33)SXI1<br>• 12.2(33)SXH2<br>• 12.2(18)SXF14 |
| **With Supervisor Engine 720-10 GE** | • 12.2(33)SXH | • 12.2(33)SXH | • 12.2(33)SXH | • 12.2(33)SXH | • 12.2(33)SXH | • 12.2(33)SXI1<br>• 12.2(33)SXH2 |
| **With Supervisor Engine 2T-10 GE** | • 15.0(1)SY | • 15.0(1)SY | • 15.0(1)SY | • 15.0(1)SY | • 15.0(1)SY | • 15.0(1)SY |
| **Reliability and Availability**<br>Calculated Mean Time Between Failure (MTBF) | 860,868 | 677,643 | 441,418 | 348,935 | 330,888 | 311,778 |
| **MIBS** | Check the corresponding supervisor engine data sheet | | | | | |
| **Network Management** | Check the corresponding supervisor engine data sheet | | | | | |
| **Physical Dimensions** | | | | | | |
| **Inches** | 7 x 17.37 x 21.75 | 8.75 x 17.5 x 21.75 | 19.2 x 17.5 x 18 | 24.5 x 17.5 x 18.2 | 36.65 x 17.2 x 20.7 | 32.7 x 17.3 x 18.1 |
| **Centimeters** | 17.8 x 44.1 x 55.2 | 22.2 x 44.45 x 55.25 | 48.8 x 44.5 x 46.0 | 62.2 x 44.5 x 46.0 | 93.3 x 43.1 x 53.3 | 83.0 x 43.9 x 46 |
| **Rack Units (RU)** | 4 | 5 | 11 | 14 | 21 | 19 |
| **Weight** | | | | | | |
| **Chassis Only (lbs)** | 33 | 40 | 50 | 60 | 121 | 102 |
| **Fully Configured (lbs)** | 85.4 | 97 | 159 | 190 | 270 | 280 |
| **Input Voltage** | 100 to 240 VAC<br>-48 to -60 VDC | | | | | |
| **Safety** | UL 60950 Second Edition<br>CAN/CSA-C22.2 No. 60950 Second Edition<br>EN 60950 Second Edition<br>IEC 60950 Second Edition<br>AS/NZS 60950 | | | | | |
| **EMC** | FCC Part 15 (CFR 47) Class A<br>VCCI Class A<br>EN55022 Class A<br>CISPR 22 Class A<br>CE marking<br>AS/NZS 3548 Class A<br>ETS300 386<br>EN55024<br>EN61000-6-1<br>EN50082-1 | | | | | |
| **NEBS/ETSI** | GR-1089-Core NEBS Level 3<br>ETS 300 019 Storage Class 1.1<br>ETS 300 019 Transportation Class 2.3<br>ETS 300 019 Stationary Use Class 3.1 | | | | | |

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| | 6503-E | 6504-E | 6506-E | 6509-E | 6509-V-E | 6513-E |
|---|---|---|---|---|---|---|
| **ATIS Pb free and Energy Efficiency** | ATIS-0600020.2010 Pb Free circuit packs<br>ATIS-0600015-2009 General Energy Efficiency Requirements (TEER)<br>ATIS-0600015.03-2009 Switch and Router Energy Efficiency<br>ATIS-0600015.01-2009 Server Energy Efficiency<br>VZ.TPR.9205 Verizon Energy Efficiency Requirements for Telecommunication Equipment (TEEER) | | | | | |
| **Operating Environment** | | | | | | |
| **Operating Temperature** | 32℉ to 104℉ (0 to 40℃) | | | | | |
| **Storage Temperature** | -4 to 149℉ (-20 to 65℃) | | | | | |
| **Thermal Transition** | 0.5℃ per minute (hot to cold)<br>0. 33℃ per minute (cold to hot) | | | | | |
| **Relative Humidity** | Ambient (noncondensing) operating: 5% to 90%<br>Ambient (noncondensing) nonoperating and storage: 5% to 95% | | | | | |
| **Operating Altitude** | Certified for operation: 0 to 6500 ft (0 to 2000 m)<br>Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m) | | | | | |

## Ordering Information

Table 3 lists the ordering information for the Cisco Catalyst 6500-E Series Chassis. To place an order, visit the Cisco ordering homepage.

**Table 3.** Ordering Information

| Product Name | Part Number |
|---|---|
| **Cisco Catalyst 6503 Enhanced Chassis** | WS-C6503-E |
| **Cisco Catalyst 6503 Enhanced Chassis Spare** | WS-C6503-E= |
| **Cisco Catalyst 6503 Enhanced Chassis Fan Tray Spare** | WS-C6503-E-FAN= |
| **Cisco Catalyst 6504 Enhanced Chassis** | WS-C6504-E |
| **Cisco Catalyst 6504 Enhanced Chassis Spare** | WS-C6504-E= |
| **Cisco Catalyst 6504 Enhanced Chassis Fan Tray Spare** | WS-C6504-E-FAN= |
| **Cisco Catalyst 6506 Enhanced Chassis** | WS-C6506-E |
| **Cisco Catalyst 6506 Enhanced Chassis Spare** | WS-C6506-E= |
| **Cisco Catalyst 6506 Enhanced Chassis Fan Tray Spare** | WS-C6506-E-FAN= |
| **Cisco Catalyst 6509 Enhanced Chassis** | WS-C6509-E |
| **Cisco Catalyst 6509 Enhanced Chassis Spare** | WS-C6509-E= |
| **Cisco Catalyst 6509 Enhanced Chassis Fan Tray Spare** | WS-C6509-E-FAN= |
| **Cisco Catalyst 6509 Vertical Enhanced Chassis** | WS-C6509-V-E |
| **Cisco Catalyst 6509 Vertical Enhanced Chassis Spare** | WS-C6509-V-E= |
| **Cisco Catalyst 6509 Vertical Enhanced Chassis Fan Tray Spare** | WS-C6509-V-E-FAN= |
| **Cisco Catalyst 6513 Enhanced Chassis** | WS-C6513-E |
| **Cisco Catalyst 6513 Enhanced Chassis Spare** | WS-C6513-E= |
| **Cisco Catalyst 6513 Enhanced Chassis Fan Tray Spare** | WS-C6513-E-FAN= |
| **Cisco Catalyst 6500 1400 W AC Power Supply** | PWR-1400-AC= |
| **Cisco Catalyst 6500 2700W AC Power Supply** | PWR-2700-AC/4= |
| **Cisco Catalyst 6500 3000W AC Power Supply** | WS-CAC-3000W= |
| **Cisco Catalyst 6500 6000W AC Power Supply** | WS-CAC-6000W= |
| **Cisco Catalyst 6500 8700W Enhanced AC Power Supply** | WS-CAC-8700W-E= |
| **Cisco Catalyst 6500 4000W AC Power Supply for US** | WS-CAC-4000W-US= |

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| Product Name | Part Number |
|---|---|
| **Cisco Catalyst 6500 4000W AC Power Supply for International** | WS-CAC-4000W-INT= |
| **Cisco Catalyst 6500 2500W DC Power Supply** | WS-CDC-2500W= |
| **Cisco Catalyst 6500 2700W DC Power Supply** | PWR-2700-DC/4= |
| **Cisco Catalyst 6500 4000W DC Power Supply** | PWR-4000-DC= |
| **Cisco Catalyst 6500 6000W DC Power Supply** | PWR-6000-DC= |

## For More Information

For more information about the Cisco Catalyst 6500-E Series chassis, visit: http://www.cisco.com/en/US/partner/products/hw/switches/ps708.


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# VIDEO IP

Plataforma de gestión de cámaras IP integradas dentro de la red PLC. La cámara irá conectada a un nodo PLC mediante conector RJ45. Aplicación dentro del concepto de Smart City donde se aprovecha la red de comunicación creada, para desarrollar otros servicios además del control de la iluminación. La aplicación Smartluix permite visualizar en tiempo real imágenes de las cámaras siendo posible emplear cualquier otro programa de vigilancia y control.

## MODELOS DISPONIBLES

| | |
|---|---|
| Cámara IP DOBLE FIJA – Tipo I: | Sensor doble 8,8 Megapíxeles, hasta 30fps. |
| Cámara IP FIJA – Tipo II: | Sensor 1,3 Megapíxeles, hasta 30fps. |
| Cámara IP FIJA – Tipo III: | Sensor 1 M/HDTV 720P, hasta 30fps. |
| Cámara IP DOMO- Tipo IV: | Sensor 1 M/HDTV 720P, hasta 30fps. |

GRABADORES-NVR

Video grabación: NVR (Network video recorder): 500 Gb y 50 cámaras.
Video grabación: NVR (Network video recorder): 2 Tb Gb y 8 cámaras.

## CARACTERÍSTICAS ELÉCTRICAS Y MECÁNICAS

| | |
|---|---|
| Potencia Consumida: | Inferior a 15W |
| Alimentación: | 100-240 Vac |
| Conexión con Nodo: | RJ45 |
| Dimensiones: | En función del modelo. |

LEYCOLAN
ILUMINACIÓN Y CONTROL

# DETECTOR RADAR

Sensor de microondas para detección de vehículos y personas a larga distancia. Diseñado para conectarse a un NODO PLC, incluye complejos algoritmos para discriminar elementos no deseados y mejorar el nivel de aciertos. Sus parámetros de ajuste y control pueden ser configurados de forma remota.

## MODELOS DISPONIBLES

GRAN ANGULAR

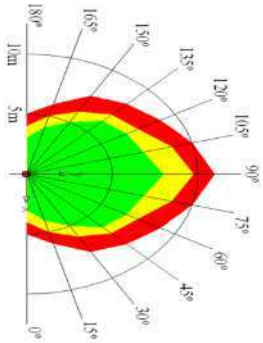
| | |
|---|---|
| Apertura horizontal : | 72° |
| Alcance típico: | 11 metros |
| Alcance máximo: | 25 metros |
| Velocidad detección vehículos: | Hasta 80Km/hora |

GRAN ALCANCE

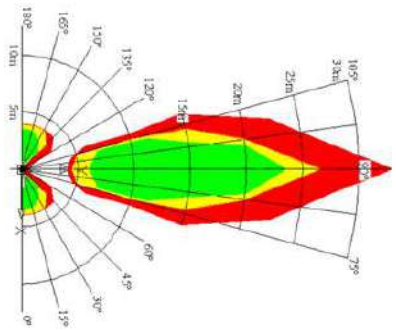
| | |
|---|---|
| Apertura horizontal : | 36° |
| Alcance típico: | 36metros |
| Alcance máximo: | 80 metros |
| Velocidad detección vehículos: | Hasta 80Km/hora |

## CARACTERÍSTICAS ELÉCTRICAS Y MECÁNICAS

| | |
|---|---|
| Potencia Consumida: | Inferior a 0,3 W |
| Alimentación: | 12Vdc |
| Salida: | Señal analógica 5v |
| Frecuencia radar: | 10.525 Ghz |
| Dimensiones: | 140x140x114mm |




GRAN ANGULAR




GRAN ALCANCE

ÁREA TÍPICA DETECCIÓN PARA PEATONES

IP 65

GARANTÍA 3 AÑOS

LEYCOLAN
ILUMINACIÓN Y CONTROL

# NODO DE CONTROL PLC

Dispositivo diseñado para monitorizar y controlar un punto de luz a través de comunicación Power Line. Incluye relé de corte, salida 1-10v para control de potencia de las luminarias, medición de consumos y entradas analógicas y conexión RJ45 para aplicaciones IP según modelo.

## MODELOS DISPONIBLES

ESTÁNDAR (STD)

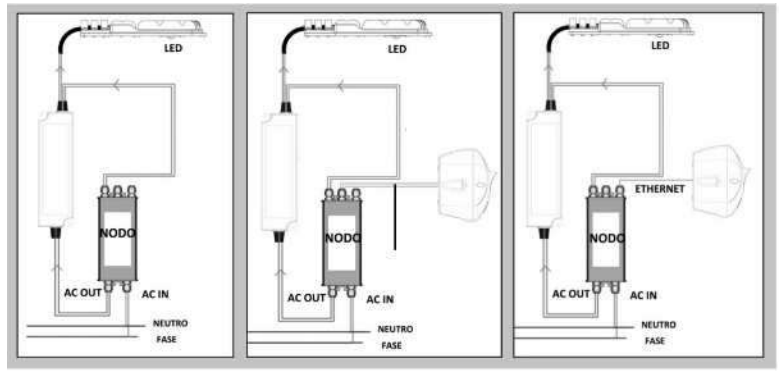
- Salida Dimmer (Regulación) 0-10Vdc.
- Lectura de consumos de la carga, tensión, corriente, Potencia.
- Clase I

INTELIGENTE (INT)

- Entrada analógica 0-5V para conexión de sensores de luminosidad, presencia, etc.
- Salida alimentación auxiliar 12Vdc.
- Conector Ethernet/RJ45 para conexión de dispositivos IP: Video, Audio, WIFI...
- Lectura de consumos de la carga, tensión, corriente, Potencia.
- Clase II

## CARACTERÍSTICAS ELÉCTRICAS Y MECÁNICAS

| | |
|---|---|
| Potencia Consumida: | Inferior a 4W |
| Alimentación | |
| Entrada : | 100-277Vac. 50/60Hz. |
| Salida | 100-277Vac. 50-60Hz. I max =4A. |
| Pmax | 400w(Carga máxima a la salida) |
| Dimensiones: | 130x80x40mm (STD) |
| | 185x73x33.5mm (INT) |




Clase I | IP 67

Clase II | IP 65

GARANTÍA 3 AÑOS

LEYCOLAN
ILUMINACIÓN Y CONTROL

# CABECERA DE CONTROL - PLC

Módulo de cabecera para control de las instalaciones por tecnología PLC en Banda Ancha. Su función es gestionar todos los elementos que se conectan a la red eléctrica a través de su correspondiente NODO. Incluye el software de control inteligente de iluminación y hace de pasarela de cualquier elemento IP conectado al NODO, permitiendo una transmisión en banda ancha. Instalación «PLUG AND PLAY»

## MODELOS DISPONIBLES

BÁSICO

- Procesador tipo ARM.
- Pasarela PLC-IP mediante acoplador capacitivo que inyecta la señal en la Red Eléctrica. Total de 200 Mbps.
- Comunicación externa mediante HSPA/UMTS o Ethernet.
- Programa de control embebido Smartluix.

AVANZADO

- Incluye medición de corriente.
- I/O digitales

## CARACTERÍSTICAS ELÉCTRICAS Y MECÁNICAS

| | |
|---|---|
| Carcasa: | Extrusión de aluminio. |
| Color: | Negro. |
| Potencia Consumida: | 15w |
| Alimentación: | 100-277Vac. 50/60Hz. |
| Dimensiones: | 316x105x30mm |

**Software de control de instalaciones incluido:**

- Iluminación.
- Energía.
- Video.

Clase II | IP 54 | CE

GARANTÍA 3 AÑOS

LEYCOLAN
ILUMINACIÓN Y CONTROL

Luminaria clásica modelo ISABA construida en chapa de acero pintado, que presenta una línea de diseño clásico con un grado de protección IP23 en la envolvente e IP66 en el bloque óptico. Basado en componentes de primeras marcas mundiales, muy estandarizados, intercambiables y disponibles en el mercado para facilitar y garantizar su mantenimiento en el tiempo.

## MODELOS DISPONIBLES

| | | | | |
|---|---|---|---|---|
| Potencia Total (W): | 25w | 45w | 60w | 90w |
| Flujo Neto (lm)*: | 2.520lm | 3.913lm | 5.250 lm | 6.853 lm |
| Vida Útil (L80/B10)> | 100.000 h | 100.000 h | 80.000 h | 40.000 h |
| Vida Útil (L70/B10)> | 100.000 h | 100.000h | 100.000h | 70.000h |

(*) Valores medios obtenidos en ensayos con óptica de Silicona. En función de la óptica empleada, el LED y otros parámetros pueden oscilar +/- 7%

## ÓPTICAS:

| | | | | |
|---|---|---|---|---|
| Simétricas: | SIM 0 | SIM 1 | | |
| Asimétricas: | ASIM0 | ASIM1 | ASIM2 | ASIM3 |

## LED: COB BRIDGELUX-CITIZEN-SEOUL. Version SMD Opcional.

| | | |
|---|---|---|
| Temperatura de color: | 4000 K . | Opcional 3000K y 5000K. |
| IRC- Ra: | >80. | Opcional >90 |

## DRIVER: MEAN WELL- INVERTRONICS

Fuente regulable 1-10V de serie.
DALI - Opcional
Curva de regulación programable - Opcional

## TELEGESTIÓN:

Telegestión Punto a Punto por PLC Banda Ancha. Smart City.
Telegestión Punto a Punto por RF Integrado en Banda Ancha.

## MATERIALES Y ACABADOS

| | |
|---|---|
| Envolvente y difusores: | Chapa de acero pintado y metacrilato. Fundición de Aluminio, bajo pedido |
| Disipador y porta equipos: | Aluminio anodizado. |
| Óptica: | Silicona, PMMA, Borosilicato. |
| Colores: | Negro. Otros colores: consultar |

## OPCIONALES:

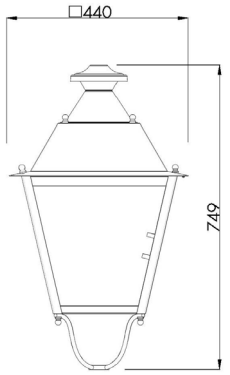
Protector sobretensiones 10 KV- 10 KA.

Clase II | IP 23 | CE | 1-10V

GARANTÍA 5 AÑOS

COB de LED

Opción LED SMD




LEYCOLAN
ILUMINACIÓN Y CONTROL

# SULKA

Luminaria vial modelo SULKA construida en aluminio, que presenta una línea de diseño actual con un grado de protección IP65. Basado en componentes de primeras marcas mundiales, muy estandarizados, intercambiables y disponibles en el mercado para facilitar y garantizar su mantenimiento en el tiempo.

## MODELOS DISPONIBLES

| | | | | | | |
|---|---|---|---|---|---|---|
| Potencia Total (W): | 25w (1) | 45w (1,2) | 60w (2) | 90w (2) | 120w (3) | 180w (3) |
| Flujo Neto (lm)*: | 3.600lm | 5.590lm | 7.500 lm | 9.790 lm | 14.500 lm | 19.800 lm |
| Vida Útil (L80/B10)> | 100.000h | 100.000h | 80.000h | 40.000h | 80.000h | 40.000h |
| Vida Útil (L70/B10)> | 100.000h | 100.000h | 100.000h | 70.000h | 100.000h | 70.000h |

(*) Valores medios obtenidos en ensayos con óptica de Silicona. En función de la óptica empleada, el LED y otros parámetros pueden oscilar +/- 7%.
(1) Disponible en versión MINI. (2) Disponible en versión MIDI. (3) Disponible en versión MAXI

## ÓPTICAS:

| | | | | |
|---|---|---|---|---|
| Simétricas: | SIM 0 | SIM 1 | | |
| Asimétricas: | ASIM0 | ASIM1 | ASIM2 | ASIM3 |

## LED: COB BRIDGELUX-CITIZEN-SEOUL

| | | |
|---|---|---|
| Temperatura de color: | 4000 K . | Opcional 3000K y 5000K. |
| IRC- Ra: | >80. | Opcional >90 |

## DRIVER: MEAN WELL - INVERTRONICS

Fuente regulable 1-10V de serie.
DALI - Opcional
Curva de regulación programable - Opcional

## TELEGESTIÓN:

Telegestión Punto a Punto por PLC Banda Ancha. Smart City.
Telegestión Punto a Punto por RF Integrado en Banda Ancha.

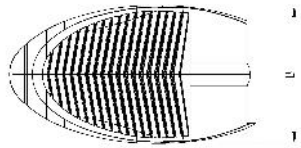
## MATERIALES Y ACABADOS

| | |
|---|---|
| Envolvente: | Aluminio. |
| Óptica: | Silicona, PMMA. |
| Colores: | Gris. Otros colores: consultar |

## OPCIONALES:

Protector sobretensiones 10 KV- 10 KA.

COB de LED



DIMENSIONES (mm)

| | A | B | C |
|---|---|---|---|
| Mini | 470 | 240 | 95 |
| Midi | 650 | 300 | 130 |
| Maxi | 870 | 375 | 120 |

Clase II | IP 65 | CE | 1-10V

GARANTÍA 5 AÑOS

LEYCOLAN
ILUMINACIÓN Y CONTROL

# DS-9600NI-I8 Series NVR

## Available Models

DS-9632NI-I8, DS-9664NI-I8;

## Key Features

**Professional and Reliable**

- Dual-OS design to ensure high reliability of system running
- ANR technology to enhance the storage reliability when the network is disconnected
- HDD hot swap with RAID0, RAID1, RAID5 and RAID10 storage scheme configurable

**HD Input**

- H.265/H.264+/H.264/MPEG4 video formats
- Connectable to the third-party network cameras
- Up to 64 IP cameras can be connected
- Recording at up to 12 MP resolution
- Supports live view, storage, and playback of the connected camera at up to 12 MP resolution

**HD Output**

- HDMI1/VGA1 and HDMI2/VGA2 outputs provided
- HDMI1 Video output at up to 4K (3840 × 2160) resolution

**HD Storage**

- Up to 8 SATA interfaces and 1 eSATA interface connectable for recording and backup
- Storage space effectively saved by 50% to 70% with the use of H.264+ decoding format

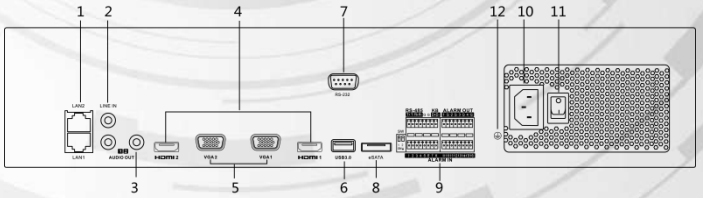
**HD Transmission**

- 2 self-adaptive 10M/100M/1000M network interfaces, and two working modes are configurable: multi-address and network fault tolerance

**Various Applications**

- Centralized management of IP cameras, including configuration, information import/export, real-time information display, two-way audio, upgrade, etc.
- Connectable to smart IP cameras from Hikvision and the recording, playing back, and backing up of VCA alarms can be realized
- VCA detection alarm is supported
- Instant playback for assigned channel during multi-channel display mode
- Smart search for the selected area in the video; and smart playback to improve the playback efficiency
- Supports HDD quota and group modes; different capacity can be assigned to different channels

## Physical Interfaces




| Index | Description |
|---|---|
| 1 | LAN1/LAN2 Interface, 2 RJ-45 10 /100 /1000 Mbps self-adaptive Ethernet interfaces provided. |
| 2 | LINE IN, RCA connector for audio input. |
| 3 | AUDIO OUT, RCA connector for audio output. |
| 4 | HDMI1/HDMI2, HDMI video output connector. |
| 5 | VGA1/VGA2, DB9 connector for VGA output. Display local video output and menu. |
| 6 | USB 3.0 Interface |
| 7 | RS-232 Interface |
| 8 | eSATA Interface |
| 9 | Controller Port, Alarm In/Alarm Out |
| 10 | 100 to 240 VAC power supply |
| 11 | Power Switch |
| 12 | GND |

# DS-9600NI-I8 Series NVR

## Specifications

| Model | | DS-9632NI-I8 | DS-9664NI-I8 |
|---|---|---|---|
| Video/Audio input | IP video input | 32-ch | 64-ch |
| | | Up to 12 MP resolution | |
| | Two-way audio | 1-ch, RCA (2.0 Vp-p, 1kΩ) | |
| Network | Incoming bandwidth | 320 Mbps,<br>or 200 Mbps (when RAID is enabled) | 320 Mbps,<br>or 200 Mbps (when RAID is enabled) |
| | Outgoing bandwidth | 256 Mbps, or 200 Mbps (when RAID is enabled) | |
| | Remote connection | 128 | |
| Video/Audio output | Recording resolution | 12 MP/8 MP/6 MP/5 MP/4 MP/3 MP/1080p/UXGA/720p/VGA/4CIF/DCIF/2CIF/CIF/QCIF | |
| | VGA1 /HDMI1 output resolution | HDMI1: 4K (3840 × 2160)/60Hz,<br>4K (3840 × 2160)/30Hz, 2K (2560 × 1440)/60Hz, 1920 × 1080p/60Hz, 1600 × 1200/60Hz, 1280 × 1024/60Hz, 1280 × 720/60Hz, 1024 × 768/60Hz | |
| | | VGA1: 2K (2560 × 1440)/60Hz, 1920 × 1080p/60Hz, 1600 × 1200/60Hz, 1280 × 1024/60Hz, 1280 × 720/60Hz, 1024 × 768/60Hz | |
| | VGA2 /HDMI2 output resolution | 1920 × 1080p/60Hz, 1280 × 1024/60Hz, 1280 × 720/60Hz, 1024 × 768/60Hz | |
| | Audio output | 2-ch, RCA (2.0Vp-p, 1 KΩ) | |
| Decoding | Decoding format | H.265/H.264/MPEG4 | |
| | Live view / Playback resolution | 12 MP/8 MP/6 MP/5 MP/4 MP/3 MP/1080p/UXGA/720p/VGA/4CIF/DCIF/2CIF/CIF/QCIF | |
| | Synchronous playback | 16-ch | |
| | Capability | 4-ch @4K, or 16-ch @ 1080p | |
| Hard disk | SATA | 8 SATA interfaces for 8HDDs | |
| | eSATA | 1 eSATA interface | |
| | Capacity | Up to 6TB capacity for each HDD | |
| Disk array | Array type | RAID0, RAID1, RAID5, RAID10 | |
| | Number of arrays | 4 | |
| External interface | Network interface | 2, RJ-45 10/100/1000 Mbps self-adaptive Ethernet interface | |
| | Serial interface | RS-232; RS-485; Keyboard | |
| | USB interface | Front panel: 2 × USB 2.0; Rear panel: 1 × USB 3.0 | |
| | Alarm in/out | 16/4 | |
| General | Power supply | 100 to 240 VAC, 50 to 60 Hz | |
| | Max. Power | 200 W | |
| | Consumption (without hard disk) | ≤30 W | |
| | Working temperature | -10 to +55°C (14 to 131°F) | |
| | Working humidity | 10 to 90 % | |
| | Chassis | 19-inch rack-mounted 2U chassis | |
| | Dimensions(W × D × H) | 445 × 470 ×90 mm (17.5"× 18.5" × 3.5") | |
| | Weight(without hard disk) | ≤ 10 Kg (22 lb) | |

# DS-A82024D

## Network Storage Device

## Overview

DS-A82024D is highly reliable controller framework storage product from Hikvision. Designed with highly reliable redundancy, no single point failure, it protects user data security in a perfect way. With SAN/NAS application integration, it provides high cost-effective video surveillance storage solution. The DS-A82024D applies to large and medium sized projects that demand high data security such as Safe City, Banking Network, etc.

## Order Models

DS-A82024D

## Features

- **Highly Reliable System Design**

  Developed with modularization no-cable design, double-controller framework, it supports caching real-time mirroring and BBU power-off permanent protection to improve system reliability.

- **High-performance & Easy-extensible Hardware Platform**
  - High-performance Platform

    64-bits multi-core processor,

    Extensible high-speed memory;

    SBB2.0 framework;

    PCI-E2.0 bus and high-speed IO channel transmission.
  - Extensible Port

    Configured with multi-gigabit network interface, it supports SAS cascade extension and can be added with quintillion Ethernet port and 8Gb FC port to meet various application requirements.
- **Massive Storage Space**

  Designed with high density chassis, 4U chassis with 24 HDs and it supports cascade extension. Single system supports at most 96 HDs.
- **Disk Detection, Repair and RAID Optimization**
  - **Disk Detection and Repair**

    It provides dryrun technique before the use as to prevent errors before the use;

    It provides scanning test technique during the use as to alarm in time;

    It provides repair technique and resurgence technique after the use as to improve disk service efficiency.
  - **RAID**

    It supports RAID 0,1,3,5,6,10,50 Raid Modes and overall and part hot standby as data security multi-protection.

    It supports RAID instant set-and-use and supports logical volume dynamic online extension.
- **Advanced Data Protection**
  - **System Information Real-time Backup**

    It performs synchronous real-time backup with system key information in case that error of part of the hardware leads to the application being unrecoverable.
  - **Data Tamper-proofing**

    It provides data synchronization function between devices without any needed server.
  - **Clone Technique**

    When the RAID is not available, the data can be restored with clone technique as long as the HD is physically readable.
- **Low Power Design**
  - **CPU Smart Frequency Adjustment**

    CPU dynamically adjusts the operating frequency according to load to lower the system consumption.
  - **Fan Smart Speed Adjustment**

    It provides smart elaborate speed adjustment strategy to effectively improve the dissipation and lower the noise.
  - **HDD Smart Hibernation**

    It sets part or all no read-write HDD in hibernation mode according to the load condition to reduce energy dissipation and extend the lifespan of the HDD.
- **Friendly Operation & Maintenance Interface**

  It provides one key configuration function so that users can accomplish the system configuration fast.

  It provides friendly graphic interface, users can get operating status information of device in time (Key parts, storage resource, environment control information, etc.)

  Provided with sufficient alarm management mode, it supports alarm modes such as indicator, SMS and E-mail to improve the device maintenance efficiency.

  It supports jointing with NMS by SNMP to support multi-device centralized management.

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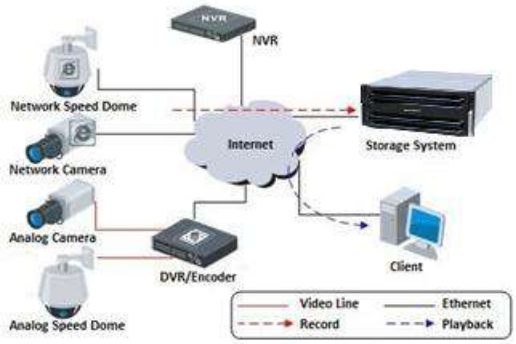
## Typical Applications




## Performance Index

| Mode / Resolution | IPSAN | CVR |
|---|---|---|
| D1 (2Mbps) Record + Playback | 256-ch | 448-ch |

## Specifications

| Type | | DS-A82024D |
|---|---|---|
| Video input & output | Record & Playback | IPSAN：256-ch (2Mbps)　CVR:448-ch (2Mbps) |
| Controller | Processor | Double Controller (64 BIT Multi-core Processor) |
| | Memory | 4GB per Controller (Can be extended to 8G) |
| Storage | Disk Amount | 24, It Supports at most 96 Disks |
| | Disk Interface | SAS/1TB、2TB、3TB、4TB（SSD is optional） |
| | Hot Plug Disk | Supports |
| | RAID Level | RAID0、1、3、5、6、10、50、JBOD、Hot-Spare |
| Memory Management | Disk Management | Disk Detection Alert & Repair |
| | Logical Volume Management | NAS Volume, iSCSI Volume,Record Volume |
| | Data Protection | WORM Tamer-proofing, System Information Real-time Backup, Volume Clone |
| Device Management | Management Mode | GUI based on Web, Serial Port CLI, Supports multidevice centralized management. |
| | Alarm Mode | Voice, Light, email, SMS, Page |
| | Log Download | U Disk Automatic Download, Login Webpage to Save Locally |
| Network Management | Network Protocol | iSCSI、NFS、CIFS、FTP、HTTP、AFP、FCP |
| External Interface | Data Interface | 4kilomega Ethernet Port per Controller, Can Be Extended to 4*GE or 2*10GE or Extend 4*8G FC Interface |
| | Management Interface | 1 kilomega Ethernet Port per Controller |
| | SAS Extension Interface | Supported |
| | COM Interface | UPS 2 USB Interfaces per Controller, 1 for HyperTerminal, 1 for Circumscribed Mobile Alarm |
| | USB Interface | 2 USB Interfaces per Controller |
| Others | Power Interface | Redundant Power Source (1+1) |
| | Consumption (with HDD or DVD-R/W) | Working Consumption: ≤ 380W<br>Rating Power Consumption: ≤1050W |
| | Environment Temperature | Working:5 ℃~40 ℃　Storing: -20 ℃~70 ℃ |
| | Environment Humidity | Working: 20%~80%RH (No Freezing, No Condensation)<br>Storing:5%~90%RH (No Freezing, No Condensation) |
| | Chassis | 19 Inch 4U Standard Chassis |
| | Size | 447mm (Width) × 172mm (Height) × 550mm (Depth) |
| | Weight (without HDD or DVD-R/W) | ≤32Kg |

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# DS-C10S SERIES VIDEO WALL CONTROLLER

## Features and Functions

- A signal source can be displayed on the M × N (M ≥ 1, N ≥ 1) display units
- FPGA-based hardware design with high bandwidth for accessing and processing the high-definition signal
- 10 kinds of signal sources are supported, including VGA, DVI, HDMI, BNC, SDI, YPbPr, Ultra HD, HDBaseT, HDTVI, DP and IP camera input
- Live view in the roaming window and signal source list
- Fluent video output
- Window spanning for up to 16ch@8.0 MP
- An enhanced network decoding board supports H.264 and H.265 compression standard and can display network signal of 2-ch@8.0 MP, 2-ch@6.0 MP, 2-ch@5.0 MP, 8-ch@1080p, 16-ch@720p and 32-ch@D1 and local video files
- Supports 1/4/9/16 split screen layout
- Up to 6 image layers can be displayed on one screen, including one virtual LED image layer and a background layer
- Adjustable LED font size, background color and moving type
- Up to 16384 × 8192 for background layer's resolution
- Users are able to manage the signal source and video wall via client software
- Provides DVI dual link signal collection card whose input resolution is up to 4088×4088/15 Hz
- A build-in matrix for opening a signal source on several windows at the same time
- Supports HD/3G SDI synchronous output
- Supports cross-window video roaming
- Supports SADP searching active devices
- Resets the administrator password
- Supports adjusting the output to match the virtual output
- The client software is able to manage 16 devices and 4 video walls
- Supports HDTVI signal and reverse PTZ control
- Remote control via ipad client software and IE browser
- Supports preview list for signal sources
- Intelligent fan to automatically adjust the fan speed according to the temperature

# Specifications

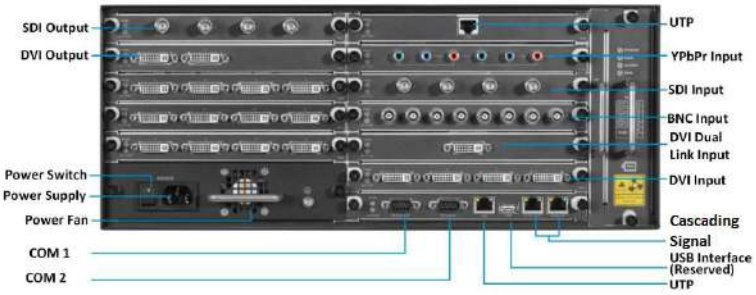
| C10S Series | | | | |
|---|---|---|---|---|
| **Module** | | **DS-C10S-S11/E** | **DS-C10S-S22/E** | **DS-C10S-S41/E** |
| Hardware | Slot No. | 11 (6 × Input, 5 × Output) | 22 (12 × input, 10 × output) | 41 (23 × input & 18 × output) |
| Motherboard (DS-C10S-MSU) | Network | 1; 10M/100M/1000M self-adaptive Ethernet interface | | |
| | USB | 1 × USB 2.0 (Reserved) | | |
| | RS-232 | 2 | | |
| Network Decoding Board (DS-C10S-SI) | Decoding Performance | 2-ch@5 MP; 4-ch@1080p; 8-ch@720p; 16-ch@D1 | | |
| Enhanced Network Decoding Board (DS-C10S-SI/UH) | Decoding Performance | 2-ch@8 MP (low frame rate), 2-ch @6 MP (full frame rate), 2-ch @5 MP (full frame rate), 8-ch @1080p, 16-ch @720p, or 32-ch @D1, supporting H.265 | | |
| BNC Input Board (DS-C10S-BI/8) | Input | 8 × BNC interface; PAL/NTSC self-adaptive | | |
| VGA Input Board (DS-C10S-VI/2E, DS-C10S-VI/4E) | Input | 4/2 × VGA interface | | |
| | RGB Resolution | HD15 interface (DVI-HD15 adaptor is needed.)<br>Resolution: 720p@60 Hz, 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1280 × 1024@60 Hz, 1280 × 1024@75 Hz, 1366 x 768@60 Hz, 1400 x 1050@60 Hz, 1080p@60 Hz, UXGA@60 Hz, 1920 × 1200@60 Hz | | |
| DVI Input Board (DS-C10S-DI/2E, DS-C10S-DI/4E) | Input | 4/2 × DVI interface | | |
| | DVI Resolution | 720p@50 Hz, 720p@60 Hz, 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1280 × 1024@60 Hz, 1280 × 1024@75 Hz, 1366 x 768@60 Hz, 1400 x 1050@60 Hz, 1080p@50 Hz, 1080p@60 Hz, UXGA@60 Hz, 1920 × 1200@60 Hz | | |
| DVI Dual Link Input Board (DS-C10S-HDI/1) | Digital Signal Input Resolution | 2048 × 1536@30 Hz, 2560 × 1440@30 Hz, 2560 × 1600@30 Hz, 2560 × 2048@30 Hz, 2800 × 2100@30 Hz, 3072 × 2304@30 Hz, 840 × 2160@30 Hz, 4088 × 4088@15 Hz | | |
| HDMI Input Board (DS-C10S-HI/4, DS-C10S-HI/2, DS-C10S-HI/E) | Input | 4/2 × HDMI interface | | |
| | DVI resolution | DS-C10S-HI/4, DS-C10S-HI/2: 720p@50 Hz, 720p@60 Hz, 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1280 × 1024@60 Hz, 1280 × 1024@75 Hz, 1366 x 768@60 Hz, 1400 x 1050@60 Hz, 1080p@50 Hz, 1080p@60 Hz, UXGA@60 Hz, 1920 × 1200@60 Hz.<br>DS-C10S-HI/E: 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1280 × 720@50 Hz, 1280 × 720@60 Hz, 1280 × 1024@60 Hz, 1280 × 1024@75 Hz, 1366 × 768@60 Hz, 1400 × 1050@60 Hz, 1600 × 1200@60 Hz, 1920 × 1080@50 Hz, 1920 × 1080@60 Hz, 1920 × 1200@60 Hz, 3840 × 2160@30 Hz (3840 × 2160@30 Hz is only supported by No. 1 and 3 interfaces.) | | |
| SDI Input Board (DS-C10S-SDI/4) | Input | 4 × SDI interface | | |
| | SDI Digital Signal Input Resolution | 720p@25 Hz, 720p@30 Hz, 720p@50 Hz, 720p@60 Hz, 1080p@25 Hz, 1080p@30 Hz, 1080i@50 Hz, 1080i@60 Hz | | |
| YPbPr Input Board (DS-C10S-YI/2) | Input | 2 × RCA interface | | |
| | Resolution | 480i@60 Hz, 480p@60 Hz, 576i@50 Hz, 576p@50 Hz, 720p@50 Hz, 720p@60 Hz, 1080i@50 Hz, 1080i@60 Hz | | |

| | | | | |
|---|---|---|---|---|
| HD TVI Input Board (DS-C10S-TVI/4) | Input | 4 × HD TVI interface | | |
| | Resolution | 1280 × 720@25 Hz, 1280 × 720@30 Hz, 1280 × 720@50 Hz, 1280 × 720@60 Hz, 1920 × 1080@25 Hz, 1920 × 1080@30 Hz | | |
| DP Input Board (DS-C10S-DPI/4) | Input | 4 × DP interface | | |
| | Resolution | 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1280 × 720@50 Hz, 1280 × 720@60 Hz, 1280 × 1024@60 Hz, 1280 × 1024@75 Hz, 1366 × 768@60 Hz, 1400 × 1050@60 Hz, 1600 × 1200@60 Hz, 1920 × 1080@50 Hz, 1920 × 1080@60 Hz, 1920 × 1200@60 Hz, 3840 × 2160@30 Hz (3840 × 2160@30 Hz is only supported by No. 1 and 3 interfaces.) | | |
| HDBasetT Input Board (DS-C10S-HDBI/4) | Input | 4 × HDBaseT interface | | |
| | Resolution | 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1280 × 720@50 Hz, 1280 × 720@60 Hz, 1280 × 1024@60 Hz, 1280 × 1024@75 Hz, 1366 × 768@60 Hz, 1400 × 1050@60 Hz, 1600 × 1200@60 Hz, 1920 × 1080@50 Hz, 1920 × 1080@60 Hz, 1920 × 1200@60 Hz, 3840 × 2160@30 Hz (3840 × 2160@30Hz is only supported by No. 1 and 3 interfaces.) | | |
| VGA Output Board (DS-C10S-VO/4E, DS-C10S-VO/2E) | Output | 4/2 × VGA interface | | |
| | RGB Resolution | HD15 interface (DVI-HD15 adaptor is needed.) Resolution: 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1360 × 768@60 Hz, 1080p@60 Hz, 1400×1050@60 Hz, 1920×1200@60 Hz, 720P@60 Hz | | |
| DVI Output Board (DS-C10S-DO/4E, DS-C10S-DO/2E) | Output | 4/2 × DVI interface | | |
| | DVI Resolution | 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1360 × 768@60 Hz, 1080p@60 Hz, 1400 × 1050@60 Hz, 1920 × 1200@60 Hz, 720p@60 Hz | | |
| HDMI Output Board (DS-C10S-HO/4E, DS-C10S-HO/2E) | Output | 4/2 × HDMI interface | | |
| | HDMI Resolution | 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1360 × 768@60 Hz, 1400 × 1050@60 Hz, 1920 × 1200@60 Hz, 720p@60 Hz, 1080p@60 Hz | | |
| SDI Output Board (DS-C10S-SDO/4) | Output | 4 × SDI interface | | |
| | SDI Resolution | 720p@50 Hz, 720p@60 Hz, 1080p@50 Hz, 1080p@60 Hz | | |
| HDBaseT Output Board (DS-C10S-HDBO/4) | Output | 4 × RJ45 interface | | |
| | HDBaseT Resolution | 1024 × 768@60 Hz, 1024 × 768@75 Hz, 1360 × 768@60 Hz, 1080p@60 Hz, 1400 × 1050@60 Hz, 1920 × 1200@60 Hz, 720p@60 Hz | | |
| Others | Power Supply | 100 to 240 VAC, 50/60Hz | | |
| | | A build-in power supply | Build-in redundant power supply | |
| | Consumption | ≤ 250 W (full-loaded) | ≤ 450 W (full-loaded) | ≤ 1000 W (full-loaded) |
| | Working Temperature | +0° C to +50° C (+32° F to +122° F) | | |
| | Working Humidity | 10 to 90% (Non-condensing) | | |
| | Chassis | Standard 4U chassis | Standard 8U chassis | Standard 13U chassis |

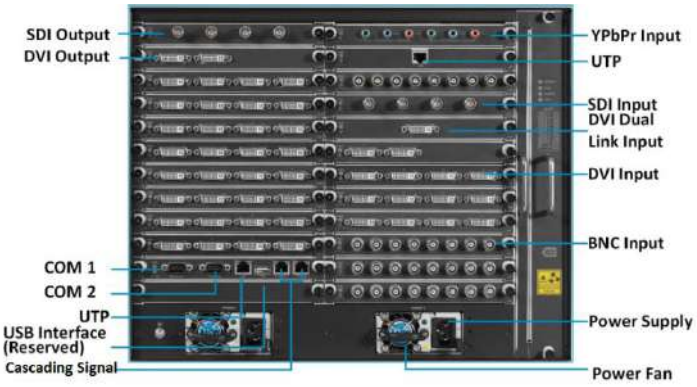
| | | | | |
|---|---|---|---|---|
| | Dimension (D×H×W) | 352 × 177 × 442.4 mm (13.9 × 7 × 17.4 inch) | 352 × 354 × 442.4 mm (13.9 × 13.9 × 17.4 inch) | 417 × 576.6 × 442.4mm (16.4 × 27.7 × 17.4 inch) |
| | Weight | ≤ 20 kg (full-loaded) | ≤ 35 kg (full-loaded) | ≤ 50 kg (full-loaded) |

# Physical Interfaces

## 4U Chasis

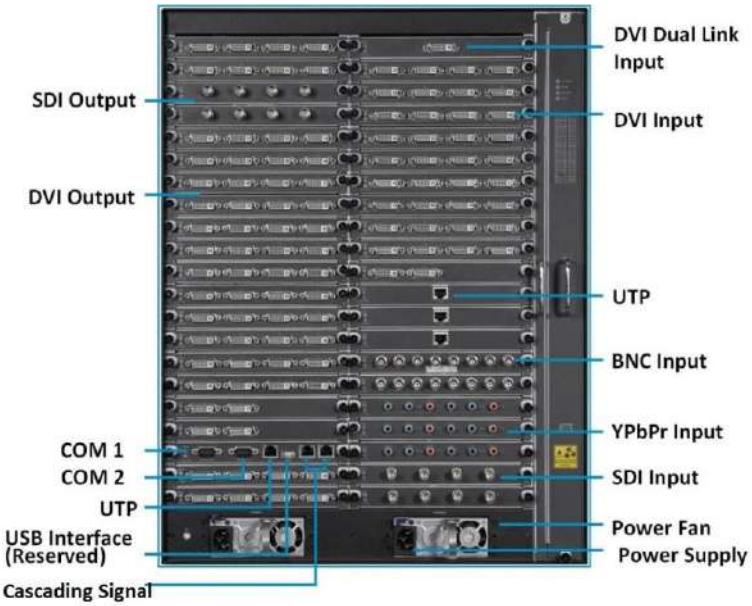



## 8U Chassis



# Physical Interfaces

## 13U Chasis




## Available Models

DS-C10S-S11/E, DS-C10S-S22/E, DS-C10S-S41/E

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# DS-K2600 Series

## Network Access Controller

DS-K2600 series access controller is designed with latest structure with TCP/IP and RS485 communication interface. The communication data is encrypted to improve the security of system. The controller also supports offline operation and is designed with tamper-proof switch.

## MODELS

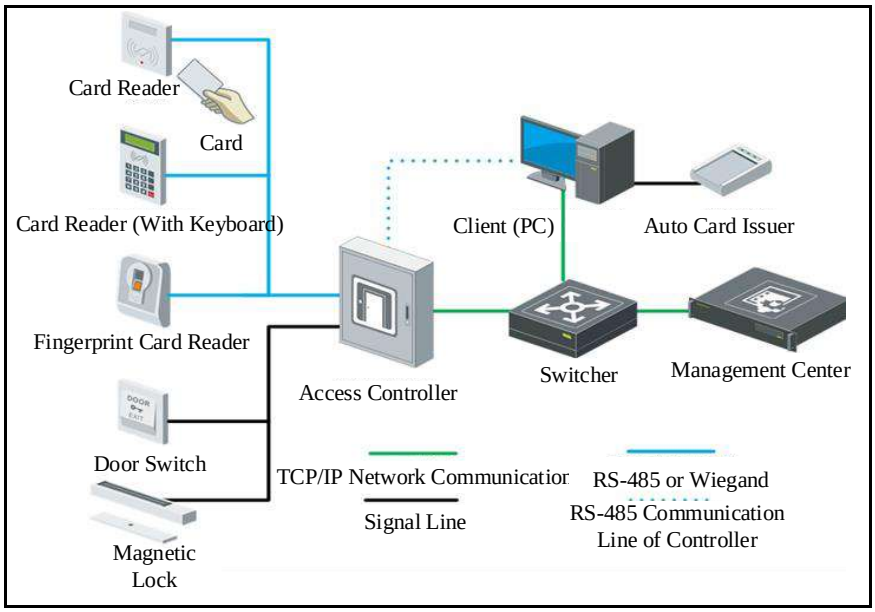
DS-K2601 Single-door Access Controller
DS-K2602 Double-door Access Controller
DS-K2604 Four-door Access Controller

## MAIN FEATURES

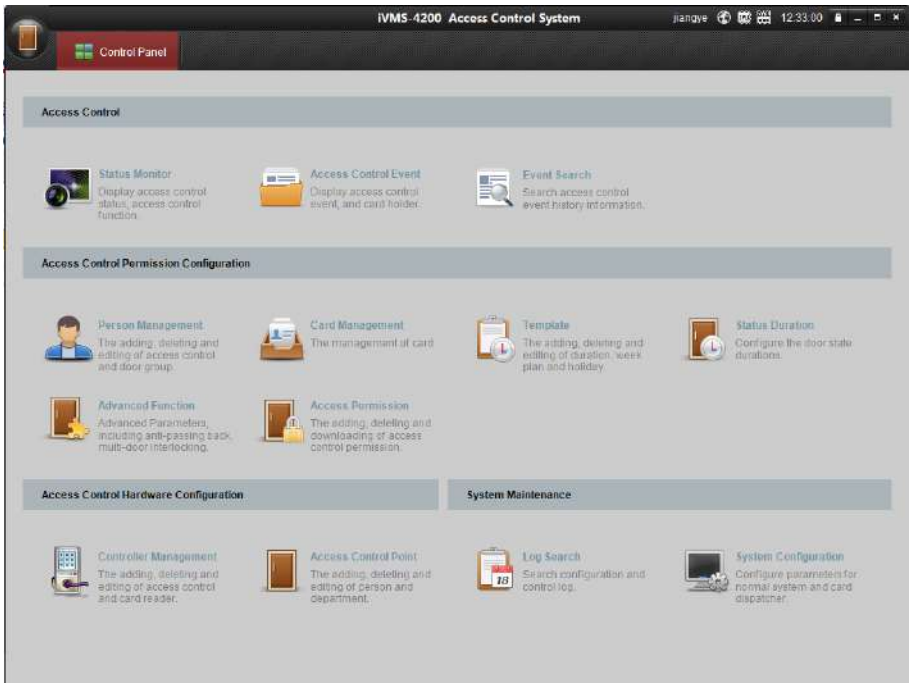
- 32-bit high-speed processor;
- TCP/IP network communication, with self-adaptive network interface. The communication data is encrypted to ensure information security;
- The recognition and storage of card number with maximum 20 digits;
- Massive storage with 100,000 (can be expended to 200,000) cards information and 300,000 (can be expended to 600,000) access control events;
- Supports multi-door interlocking function (DS-K2602, and DS-K2604), anti-passback function, multi-card function, first card function, super card and super password function.
- Online upgrade function and online remote control of the doors;
- Supports alarm event upload (including tamper-proof alarm, unsecured door alarm, forced entry alarm, delayed door alarm, duress card and code alarm, blacklist alarm and alarm for invalid card swiping attempts alarm);
- Short circuit attempts alarm and open circuit attempts alarm;
- Supports zone alarm input;
- Supports RS485 interface and Wiegand interface for accessing card reader. Wiegand interface supports W26/W34 and is seamlessly compatible with third-party card reader with Wiegand interface;
- Supports various card types such as normal/ disabled/ blacklist/ patrol/ guest/ duress/

super card, etc.;
- Various indicators to show different device status;
- Supports time synchronization via NTP, manual or automatic method;
- Supports standby battery;
- Watchdog for device running status detection;
- Data can be permanently saved when the access controller is powered off.

## TYPICAL APPLICATOIN




Topological Graph




Client Software Interface

## SPECIFICATION

| Model | DS-K2601 | DS-K2602 | DS-K2604 |
|---|---|---|---|
| **Working Voltage** | DC 12V/1A | DC 12V/1A | DC 12V/1A |
| **Power Dissipation (with Load)** | ≤50W | ≤100W | ≤100W |
| **Processor** | 32-bit | 32-bit | 32-bit |
| **Capacity** | 16M | 16M | 16M |
| **Uplink Communication Interface** | TCP/IP Network Interface and RS-485 Interface | TCP/IP Network Interface and RS-485 Interface | TCP/IP Network Interface and RS-485 Interface |
| **Downlink Communication Interface** | RS-485 and Wiegand (w26/w34) | RS-485 and Wiegand (w26/w34) | RS-485 and Wiegand (w26/w34) |
| **Storage** | cards information: 100,000 (200,000 expandable)<br>access control events : 300,000 (600,000 expandable) | cards information: 100,000 (200,000 expandable)<br>access control events : 300,000 (600,000 expandable) | cards information: 100,000 (200,000 expandable)<br>access control events: 300,000 (600,000 expandable) |
| **LED Indicator** | Power Supply Status, Communication Status, Working Status | Power Supply Status, Communication Status, Working Status | Power Supply Status, Communication Status, Working Status |
| **Built-in Clock** | Yes | Yes | Yes |
| **Accessible Card Reader** | 2 Card Readers (RS485 Interface) and<br>2 Card Readers (Wiegand Interface) Connectable | 4 Card Readers (RS485 Interface) and<br>4 Card Readers (Wiegand Interface) Connectable | 8 Card Readers (RS485 Interface) and<br>4 Card Readers (Wiegand Interface) Connectable |
| **Input Interface** | Alarm Input×4,<br>Door Magnetic×1,<br>Door Switch×1,<br>Case Input×2,<br>Tamper-proof×1 | Alarm Input×4,<br>Door Magnetic×2,<br>Door Switch×2,<br>Case Input×4,<br>Tamper-proof×1 | Alarm Input×4,<br>Door Magnetic×4,<br>Door Switch×4,<br>Case Input×8,<br>Tamper-proof ×1 |
| **Output Interface** | Door Switch Relay×1,<br>Alarm Relay×1 | Door Switch Relay×2,<br>Alarm Relay×2 | Door Switch Relay×4,<br>Alarm Relay×4 |
| **Working Temperature** | -20°C to +65°C<br>(-4°F to +149°F) | -20°C to +65°C<br>(-4°F to +149°F) | -20°C to +65°C<br>(-4°F to +149°F) |

| Model | DS-K2601 | DS-K2602 | DS-K2604 |
|---|---|---|---|
| **Working Humidity** | 10% to 90%<br>(Non-Condensing) | 10% to 90%<br>(Non-Condensing) | 10% to 90%<br>(Non-Condensing) |
| **Dimensions (L×W×H)** | 370x345x90mm<br>(14.6x13.6x3.5") | 370x345x90mm<br>(14.6x13.6x3.5") | 370×345×90mm<br>(14.6×13.6×3.5") |
| **Certification** | CE, FCC | CE, FCC | CE, FCC |

# DS-K1102E/EK

## Card Reader

## AVAILABLE MODELS

| | |
|---|---|
| DS-K1102E | EM card reader |
| DS-K1102 EK | EM card reader (with a keypad) |

## MAIN FEATURES

- PC+ABS material shell with PMMA panel design and alloy decoration;
- Equipped with the 32-bit high-speed processor;
- Built-in audible beeper;
- Display the reader status with LED indicator;
- DIP switch;
- RS485 and Wiegand (W26/ W34) protocol;
- Tamper-proof alarm;
- Online upgrade function (under the 485 communication mode). Card reader can degrade to pre-upgrade status in case of upgrading failed;
- Watchdog design for repairing itself in case that exception occurs, to ensure the long service life of the reader;
- Dust-proof and water-proof design;
- Read EM card and obtain the card No.;

## SPECIFICATIONS

| Model | DS-K1102E/EK |
|---|---|
| Power Supply | 12V DC |
| Working Current | ≤500mA |
| Processor | 32-bit |
| Reading Frequency | 125KHz |
| Reading Range | 50 to 60mm (1.18 to 1.96") |
| ID Settings | Setting by the DIP Switch on the Main Board |
| Audio Alert | Beeper |
| Power Consumption | ≤6W |
| Keypad | No Keypad (DS-K1102E)<br>Keypad with 12 Keys (0 to 9, *, #) (DS-K1102EK) |
| Certifications | FCC, CE |
| LED Indicator | Power Indicator; Status LED Indicator |
| Working Temperature | -40°C to +70°C (-40°F to +158°F) |
| Working Humidity | 10% to 90% (Non Condensing) |
| Protection Level | IP 64 |
| Dimensions | 121×86.5×14mm (4.76×3.41×0.55") |
| Weight | ⩽ 0.14Kg |
| Installing Method | Applied for 86 & 120 Gang Box |

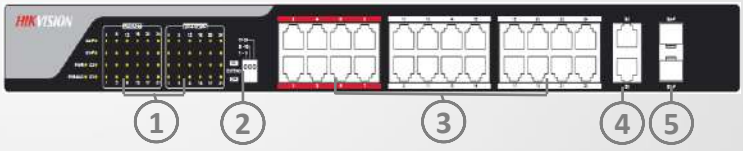
# DS-3E0326P-E
# 24-ports 100Mbps Unmanaged PoE Switch

## Overview

DS-3E0326P-E is an 24 10/100Mbps ports unmanaged switch that requires no configuration and provides 24 PoE (Power over Ethernet) ports. It can automatically detect and supply power with all IEEE 802.3af/at compliant Powered Devices (PDs). In this situation, the electrical power is transmitted along with data in one single cable allowing you to expand your network to where there are no power lines or outlets, where you wish to fix devices such as IP Cameras or IP Phones, etc.

## Features

- IEEE 802.3at and IEEE 802.3af Power over Ethernet (PoE) compliant
- 24x10/100Mbps Auto-MDIX PoE ports
- Provides up to 30 watts per PoE port
- PoE power budget 370W
- 4 KV surge protection for PoE ports
- IEEE 802.3x flow control support
- Plug-and-play installation
- 8.8 Gbps switching fabric
- 2.75 Mbits RAM Data Buffer
- 4K MAC address entries
- Sturdy metal enclosure




| NO. | Description |
|---|---|
| 1 | LEDs |
| 2 | Extend mode |
| 3 | PoE port |
| 4 | Uplink ports |
| 5 | SFP ports |

# DS-3E0326P-E
# 24-ports 100Mbps Unmanaged PoE Switch

## Specifications

| | |
|---|---|
| **Model** | DS-3E0326P-E |
| **Ports** | |
| Network Ports | 26 |
| PoE Port | 24, 10/100Mbps RJ45 ports |
| Uplink Port | 2, 1000M Combo Port |
| **Standard** | |
| Network Protocol | IEEE802.3,802.3u,802.3x, 802.3af, 802.3at |
| **Performance** | |
| Switching Capacity | 8.8Gbps |
| Max. Forwarding Rate | 6.55Mpps |
| High Priority Ports | Ports 1-8 |
| Forwarding Mode | Store-and-forward |
| MAC Address Table | 4k |
| Flow Control | IEEE802.3x full duplex |
| **Power Over Ethernet** | |
| PoE Standard | IEEE802.3af, IEEE802.3at |
| PoE Power Budget | 370W |
| Working Mode | Extend On:250m,10M,CAT 5e |
| | Extend Off:100m |
| **General** | |
| Power Supply | 100-240V AC, 50/60Hz |
| Power Consumption | ≤440W |
| Surge Protection | 4KV |
| Working Temperature | Temperature: 0℃-40℃ |
| Working Humidity | Humidity: 10%-90% , non-condensing |
| Storage Temperature | Temperature: -40℃-70℃ |
| Storage Humidity | Humidity: 5%-90% , non-condensing |
| Weight | 4.29kg |
| Dimension | 440mm*285mm*43mm |
| Accessories | |
| SFP modules (Optional) | HK-1.25G-20-1550: 1000M SFP module, TX1550nm/RX1310nm, LC, single-mode single-fiber, 20km<br>HK-155M-20-1550: 100M SFP module, TX1550nm/RX1310nm, LC, single-mode single-fiber, 20km |

# Web-managed PoE Switch

## Introduction

The DS-3E series PoE switch supports 8/16/24 100M PoE electrical ports and can be powered by the network cable directly. 802.3af (15.4W) and 802.3at (30W) standards can be self-adaptive. The PoE maximum output power is 120/230/370W. The switch can transmit power and data for the powered devices such as AP, IP camera, VoIP (Voice over Internet Protocol), etc. simultaneously via normal CAT5 twisted pair.

The switch supports network EXTEND mode. If the EXTEND mode is enabled, the maximum data transmission and power supply distance of the corresponding port can be extended to 250 meters via CAT5e twisted pair or above. The 8-core power supply technology helps to reduce the power circuit loss effectively. The data monitor and control for the important ports can guarantee the data or video transmission of key area first. The web managed switch supports intelligent management such as VLAN, link aggregation, QoS, loop guard via STP, SNMP, etc. to reduce the project construction difficulty and time, save the project cost at the greatest extent and protect customer's investment.

The all-metal design of the complete machine guarantees the firm structure, convenient usage and good reliability. The switch can be used in surveillance scenes such as parks, public security, buildings, etc..

## Features and Functions

- 802.3af/at PoE standard;
- 8-core power supply technology, reducing the power circuit loss;
- Data monitor and control for the important ports;
- EXTEND mode available to extend the network cable transmission distance to 250 meters;
- Buffer optimization to guarantee the video data transmission;
- VLAN configurable;
- Port trunk;
- STP, multicast and port mirroring;
- QoS;
- SNMP
- WEB management;
- Store-and-forward switching;
- IEEE802.3, IEEE802.3u and IEEE802.3x network standards available;
- MTBF (Mean Time Between Failure) ≥ 100,000 hours;
- All-metal enclosed construction;
- Table-mounted and rack-mouted design for convenient installation.

## Available Models

| Model | Description |
|---|---|
| DS-3E1310P-E | Web-managed PoE switch with 8 100M PoE electrical ports and 2 1000M COMBO ports |
| DS-3E1318P-E | Web-managed PoE switch with 16 100M PoE electrical ports and 2 1000M COMBO ports |
| DS-3E1326P-E | Web-managed PoE switch with 24 100M PoE electrical ports and 2 1000M COMBO ports |

# Panel

DS-3E1310P-E

DS-3E1318P-E

DS-3E1326P-E

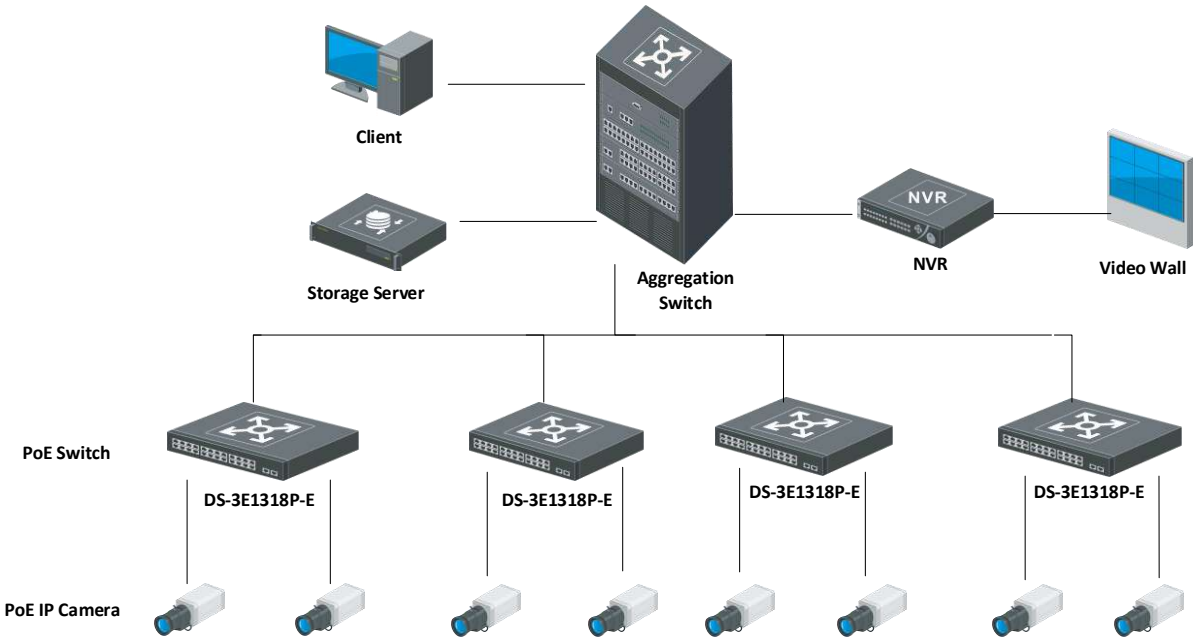
## Hardware Specifications for Web-managed Models

| Model | | DS-3E1310P-E | DS-3E1318P-E | DS-3E1326P-E |
|---|---|---|---|---|
| Port | 10/100M RJ45 | 8 | 16 | 24 |
| | 10/100/1000M RJ45 | 2 | | |
| | 1000M SFP | 2 (multiplex) | | |
| | Port of high priority | Port 1 to 8 | | |
| Performance | Store-and-forward | Support | | |
| | MAC address table | 4K | | |
| | MAC address learning | Automatic learning/Aging | | |
| | Backplane bandwidth | 5.4 Gbps | 7.2 Gbps | 8.8 Gbps |
| PoE | PoE standard | IEEE 802.3af, IEEE802.3at | | |
| | PoE cable core | Supports 8-core power supply and simultaneous power supply via the 1236 and 4578 line order. | | |
| | PoE port | Port 1 to 8 | Port 1 to 16 | Port 1 to 24 |
| | Port max. power | 30W | | |
| | Switch max. power | 123W | 230W | 370W |
| Lighting Protection Grade | For port | 4 KV | | |
| | For power supply | 6 KV | | |
| Power Supply | | 100 to 240 VAC, 50/60Hz | | |
| Operating Environment | Working environment | Temperature: 0 ºC to +40 ºC (+32 ºF to +104 ºF)<br>Humidity: 10% to 90% (Relative humidity, without condensation) | | |
| | Storage environment | Temperature: -40 ºC to +70 ºC (-40 ºF to +158 ºF)<br>Humidity: 5% to 90% (Relative humidity, without condensation) | | |
| Data Transfer Rate | | Ethernet: 10 Mbps (half-duplex)/20 Mbps (full-duplex)<br>Fast Ethernet: 100 Mbps (half-duplex)/200 Mbps (full-duplex)<br>Gigabit Ethernet: 2000 Mbps (full-duplex) | | |
| Network Media | | Ethernet: UTP/STP of CAT3 or above<br>Fast Ethernet: UTP/STP of CAT5 or above<br>Gigabit Ethernet: Recommended UTP/STP of CAT5e or CAT6<br>1000 Base-SX: MMF (Multi-Mode Fiber)<br>1000 Base-LX: MMF (Multi-Mode Fiber) or SMF (Single Mode Fiber) | | |
| Network Standard | | IEEE 802.3, IEEE 802.3u, IEEE802.3ab, IEEE 802.3af, IEEE802.3at, IEEE 802.3x, IEEE802.3z | | |

# Software Specifications for Web-managed Models

| Item | Specifications |
|---|---|
| **Port** | When the EXTEND mode is enabled, the maximum data transmission (for 10 Mbps full/half duplex communication only) and power supply distance can be extended to 250 meters via CAT5e twisted pair or above. |
| **PoE** | IEEE 802.3at/IEEE 802.3af<br>Enable/Disable PoE<br>PoE over-temperature protection<br>Display power supply status and output power of the PoE port<br>Dynamic power supply of the PoE port. Power supply priority (Port 1 > Port 2 > … > Port 16… > Port 24) |
| **Security Feature** | MAC address binding |
| **VLAN** | One-key enable VLAN<br>Port VLAN (Max. 18/26 groups can be configured)<br>IEEE 802.1Q VLAN (Max. 31 groups can be configured) |
| **Port Trunk** | 3 groups:<br>Port 1, 2, 3 and 4<br>Port 5, 6, 7 and 8<br>Port G1/G1-F and G2/G2-F |
| **STP (Spanning Tree)** | IEEE 802.1d Spanning Tree Protocol<br>IEEE 802.1w RSTP (Rapid Spanning Tree Protocol) |
| **Multicast** | IGMP Snooping and IGMP v1/v2 |
| **Mirroring** | N: 1 port mirroring |
| **QoS** | FIFO (First-in First-out)<br>SP (Strict Priority)<br>WP (Weighted Priority) |
| **MAC Address Management** | MAC address aging and static MAC address configuration |
| **Loading and Upgrade** | HTTP upgrade<br>Import/Export configuration file |
| **Management and Maintenance** | SNMP v1/v2<br>WEB management |

# Networking Application

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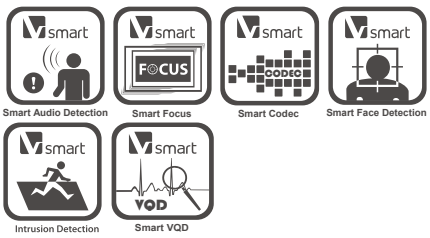
# DS-2CD4024F-(A)(P)(W)

## 2MP Full HD Box Camera

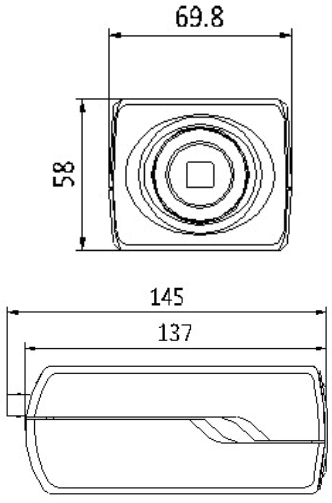



smart IPC

### Key features

- Up to 1920 x 1080 high resolution
- Full HD1080p video
- Smart Codec
- DWDR, 3D DNR
- Triple streams
- On-board storage, up to 128GB
- Smart Focus: ABF (-A)
- Smart Facial Detection
- Smart Audio Detection
- Intrusion Detection
- Two way audio, built-in Mic
- Defog
- P-Iris optional (-P)
- People Counting
- Support Wifi (-W)

### Dimension (unit: mm)




### Available Models

DS-2CD4024F, DS-2CD4024F-A, DS-2CD4024F-W, DS-2CD4024F-P, DS-2CD4024F-AW, DS-2CD4024F-AP, DS-2CD4024F-PW, DS-2CD4024F-APW

* -A: Auto Back Focus
* -P: P-Iris
* -W: Support Wifi

| | |
|---|---|
| **Camera** | |
| Image sensor | 1/2.8" progressive scan CMOS |
| Min. illumination | Color: 0.01 lux@F1.2, AGC on<br>B/W: 0.001 lux@F1.2, AGC on |
| Shutter time | 1s ~ 1/100,000s |
| Slow shutter | Yes |
| Lens mount | C/CS mount |
| Auto iris | DC drive (-P: P-Iris) |
| Day & night | ICR (Auto/Schedule/Alarm Trigger) |
| Digital noise reduction | 3D DNR |
| Wide dynamic range | DWDR |
| Smart Focus | Auto Back Focus *only for -A model |
| **Compression standard** | |
| Video compression | H.264+/H.264/MPEG4/MJPEG |
| H.264 codec profile | Baseline profile / main profile / high profile |
| Video bit rate | 32 Kbps ~ 16 Mbps |
| Audio compression | G.711/G.722.1/G.726/MP2L2 |
| Audio bit rate | 64Kbps(G.711) / 16Kbps(G.722.1) / 16Kbps(G.726) / 32-128Kbps(MP2L2) |
| **Image** | |
| Max. resolution | 1920 x 1080 |
| Frame rate | 50 Hz: 25fps (1920 x 1080), 25fps (1280 x 960), 25fps (1280 x 720)<br>60 Hz: 30fps (1920 x 1080), 30fps (1280 x 960), 30fps (1280 x 720) |
| 3rd stream | Independent setting, up to:<br>50Hz: 25fps (1920 x 1080), 60Hz: 30fps (1920 x 1080) |
| Image settings | Rotate mode, saturation, brightness, contrast, grayscale adjustable through client software or web browser |
| BLC | Yes, zone configurable |
| Picture overlay | 128 x 128, BMP 24bit, zone configurable |
| HLC | Yes |
| Defog | Yes |
| EIS | Yes |
| ROI | Support |
| **Network** | |
| Network storage | NAS (Support NFS, SMB/CIFS) |
| Alarm trigger | Intrusion detection, motion detection, face detection, tampering alarm, defocus, network disconnect, IP address conflict, storage exception, line crossing detection |
| Protocols | TCP/IP, ICMP, HTTP, HTTPS, FTP, DHCP, DNS, DDNS, RTP, RTSP, RTCP, PPPoE, NTP, UPnP, SMTP, SNMP, IGMP, 802.1X, QoS, IPv6, Bonjour |
| Security | User authentication, watermark, IP address filtering, anonymous access |
| System compatibility | ONVIF, PSIA, CGI, ISAPI |
| **Interface** | |
| Audio input | 1-ch 3.5mm audio interface, Mic in/Line in |
| Audio output | 1-ch 3.5mm audio interface |
| Communication interface | 1 RJ45 10M / 100M ethernet port, 1 RS-485 interface, 1 RS-232 interface |
| Alarm I/O | 1/1 |
| Video output | 1 Vp-p composite output (75 Ω / BNC) |
| On-board storage | Built-in micro SD/SDHC/SDXC card slot, up to 128GB |
| Reset | Yes |
| **General** | |
| Operating conditions | -30°C ~ 60°C (-22°F ~ 140°F), humidity 95% or less (non-condensing) |
| Power supply | 24VAC± 10%, 12 VDC ± 10%, PoE (802.3af) |
| Power consumption | Max. 6W (max. 9W with ICR on)<br>-W: max. 7W (max. 10W with ICR on) |
| Dimensions | 69.8 × 58 × 145 mm (2.68" x 2.56" x 5.70") |
| Weight | 830g (1.83 lbs) |

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## Overview

- The clever compact solution
- With 10 integral input/outputs
- Expandable by:
  - 1 signal board (SB)
  - max. 3 communication modules (CM)

## Design

The compact CPU 1211C has:

- 3 device versions with different power supply and control voltages.
- Integrated power supply either as wide-range AC or DC power supply (85 to 264 V AC or 24 V DC)
- Integrated 24 V encoder/load current supply:
  For direct connection of sensors and encoders. With 300 mA output current also for use as load power supply.
- 6 integrated digital inputs 24 V DC (current sinking/current sourcing (IEC type 1 current sinking)).
- 4 integrated digital outputs, either 24 V DC or relay.
- 2 integrated analog inputs 0 to 10 V.
- 2 pulse outputs (PTO) with a frequency of up to 100 kHz.
- Pulse-width modulated outputs (PWM) with a frequency of up to 100 kHz.
- Integrated Ethernet interface (TCP/IP native, ISO-on-TCP)
- 3 fast counters (100 kHz), with parameterizable enable and reset inputs, can be used simultaneously as up and down counters with separate inputs or for connecting incremental encoders.
- Expansion by additional communication interfaces, e.g. RS485 or RS232
- Expansion by analog or digital signals directly on the CPU via signal board (with retention of CPU mounting dimensions)
- Optional memory expansion (SIMATIC Memory Card)
- PID controller with auto-tuning functionality
- Integral real-time clock
- Interrupt inputs:
  For extremely fast response to rising or falling edges of process signals.
- Removable terminals on all modules
- Simulator (optional):
  For simulating the integrated inputs and for testing the user program.

**Device versions**

| Version | Supply voltage | Input voltage DI | Output voltage DO | Output current |
|---|---|---|---|---|
| • DC/DC/DC | 24 V DC | 24 V DC | 24 V DC | 0.5 A, transistor |
| • DC/DC/relay | 24 V DC | 24 V DC | 5 … 30 V DC /<br>5 … 250 V AC | 2 A;<br>30 W DC /<br>200 W AC |
| • AC/DC/relay | 85 … 264 V AC | 24 V DC | 5 … 30 V DC /<br>5 … 250 V AC | 2 A;<br>30 W DC /<br>200 W AC |

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## CPU 1211C



### Function

- Comprehensive instruction set:
  A wide range of operations facilitate programming:
  - basic operations such as binary logic operations, result allocation, save, count, create times, load, transfer, compare, shift, rotate, create complement, call subprogram (with local variables)
  - integral communication commands (e.g. USS protocol, Modbus RTU, S7 communication "T-Send/T-Receive" or Freeport)
  - user-friendly functions such as pulse-width modulation, pulse sequence function, arithmetic functions, floating point arithmetic, PID closed-loop control, jump functions, loop functions and code conversions
  - mathematical functions, e.g. SIN, COS, TAN, LN, EXP
- Counting:
  User-friendly counting functions in conjunction with the integrated counters and special commands for high-speed counters open up new application areas for the user
- Interrupt processing:
  - edge-triggered interrupts (activated by rising or falling edges of process signals on interrupt inputs) support a rapid response to process events
  - time-triggered interrupts
  - counter interrupts can be triggered when a setpoint is reached or when the direction of counting changes
  - communication interrupts allow the rapid and easy exchange of information with peripheral devices such as printers or bar code readers
- Password protection
- Test and diagnostics functions:
  Easy-to-use functions support testing and diagnostics, e.g. online/offline diagnostics
- "Forcing" of inputs and outputs during testing and diagnostics:
  Inputs and outputs can be set independently of cycle and thus permanently, for example, to test the user program
- Motion Control in accordance with PLCopen for simple movements
- Library functionality

### Programming

The STEP 7 Basic programming package permits complete programming of all S7-1200 controllers and the associated I/O.

### Technical specifications

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| **Product version** | | | |
| Associated programming package | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 |
| **Supply voltages** | | | |
| Rated value | | | |
| • 24 V DC | | Yes | Yes |
| • 120 V AC | Yes | | |
| • 230 V AC | Yes | | |
| • Lower limit of permissible range (DC) | | 20.4 V | 20.4 V |
| • Upper limit of permissible range (DC) | | 28.8 V | 28.8 V |
| • Lower limit of permissible range (AC) | 85 V | | |
| • Upper limit of permissible range (AC) | 264 V | | |
| • Lower limit of permissible frequency range | 47 Hz | | |
| • Upper limit of permissible frequency range | 63 Hz | | |
| Load voltage L+ | | | |
| • Rated value (DC) | | 24 V | 24 V |
| • Lower limit of permissible range (DC) | | 20.4 V | 20.4 V |
| • Upper limit of permissible range (DC) | | 28.8 V | 28.8 V |

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## Technical specifications (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| **Current consumption** | | | |
| Current consumption (rated value) | 60 mA at 120 V AC<br>30 mA at 240 V AC | 300 mA; typically | 300 mA; typically |
| Current consumption, max. | 180 mA at 120 V AC<br>90 mA at 240 V AC | 0.9 A; 24 V DC | 0.9 A; 24 V DC |
| Max. starting current | 20 A; at 264 V | 12 A; at 28.8 V | 12 A; at 28.8 V |
| Current output at backplane bus (5 V DC), max. | 750 mA; max. 5 V DC for SM and CM | 750 mA; max. 5 V DC for SM and CM | 750 mA; max. 5 V DC for SM and CM |
| **Current consumption/power loss** | | | |
| Power loss, typ. | 10 W | 8 W | 8 W |
| **Memory** | | | |
| Usable memory for application data | 25 KB | 25 KB | 25 KB |
| Work memory | | | |
| • Integrated | 25 KB | 25 KB | 25 KB |
| • Expandable | No | No | No |
| Load memory | | | |
| • Integrated | 1 MB; load memory expandable using SIEMENS Memory Card | 1 MB; load memory expandable using SIEMENS Memory Card | 1 MB; load memory expandable using SIEMENS Memory Card |
| • Expandable, max. | 24 MB; with SIEMENS Memory Card | 24 MB; with SIEMENS Memory Card | 24 MB; with SIEMENS Memory Card |
| Buffering | | | |
| • Available | Yes; complete project maintenance-free in the integral EEPROM | Yes; complete project maintenance-free in the integral EEPROM | Yes; complete project maintenance-free in the integral EEPROM |
| • without battery | Yes | Yes | Yes |
| **CPU/execution times** | | | |
| For bit operations, min. | 0.1 µs; per operation | 0.1 µs; per operation | 0.1 µs; per operation |
| For word operations, min. | 12 µs; per operation | 12 µs; per operation | 12 µs; per operation |
| For floating-point arithmetic, min. | 18 µs; per operation | 18 µs; per operation | 18 µs; per operation |
| **Data areas and their retentivity** | | | |
| Total retentive data area (including timers, counters, bit memories), max. | 2048 byte | 2048 byte | 2048 byte |
| **Address range** | | | |
| I/O address range | | | |
| • Total I/O address range | 1024 byte for inputs/<br>1024 byte for outputs | 1024 byte for inputs/<br>1024 byte for outputs | 1024 byte for inputs/<br>1024 byte for outputs |
| • Inputs | 1024 byte | 1024 byte | 1024 byte |
| • Outputs | 1024 byte | 1024 byte | 1024 byte |
| Digital channels | | | |
| • Integrated channels (DI) | 6 | 6 | 6 |
| • Integrated channels (DO) | 4 | 4 | 4 |
| Analog channels | | | |
| • Integrated channels (AI) | 2 | 2 | 2 |

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## Technical specifications (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| **Hardware configuration** | | | |
| Number of modules per system, max. | 3 communication modules, 1 signal board | 3 communication modules, 1 signal board | 3 communication modules, 1 signal board |
| **Time** | | | |
| Clock | | | |
| • Hardware clock (real-time clock) | Yes | Yes | Yes |
| • Buffered period | 240 h; typically | 240 h; typically | 240 h; typically |
| • Deviation per day, max. | 60 s/month at 25 °C | 60 s/month at 25 °C | 60 s/month at 25 °C |
| **Test and startup functions** | | | |
| Status/control | | | |
| • Status/modify variable | Yes | Yes | Yes |
| • Tags | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters |
| Forcing | | | |
| • Forcing | Yes | Yes | Yes |
| **Communications functions** | | | |
| S7 communication | | | |
| • Supported | Yes | Yes | Yes |
| • As server | Yes | Yes | Yes |
| • As client | Yes | Yes | Yes |
| Open IE communication | | | |
| • TCP/IP | Yes | Yes | Yes |
| • ISO-on-TCP (RFC1006) | Yes | Yes | Yes |
| Number of connections | | | |
| • Total | 16 | 16; dynamic | 16 |
| **1st interface** | | | |
| Type of interface | PROFINET | PROFINET | PROFINET |
| Physics | Ethernet | Ethernet | Ethernet |
| Isolated | Yes | Yes | Yes |
| Automatic determination of transfer rate | Yes | Yes | Yes |
| Autonegotiation | Yes | Yes | Yes |
| Autocrossover | Yes | Yes | Yes |
| **CPU/programming** | | | |
| Configuring software | | | |
| • STEP 7 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 |
| Programming language | | | |
| • LAD | Yes | Yes | Yes |
| • FBD | Yes | Yes | Yes |
| • STL | | | |
| Cycle time monitoring | | | |
| • Configurable | Yes | Yes | Yes |

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**Technical specifications** (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| **Digital inputs** | | | |
| Number of digital inputs | 6; integrated | 6; integrated | 6; integrated |
| • Inputs which can be used for technological functions | 3; HSC (high-speed counting) | 3; HSC (high-speed counting) | 3; HSC (high-speed counting) |
| Current sourcing/sinking | Yes | Yes | Yes |
| Concurrently controllable inputs | | | |
| • All mounting positions | | | |
| - concurrently controllable inputs, up to 40 °C | 6 | 6 | 6 |
| Input voltage | | | |
| • Rated value, DC | 24 V | 24 V | 24 V |
| • for "0" signal | 5 V DC at 1 mA | 5 V DC at 1 mA | 5 V DC at 1 mA |
| • for "1" signal | 15 V DC at 2.5 mA | 15 V DC at 2.5 mA | 15 V DC at 2.5 mA |
| Input current | | | |
| • for "1" signal, typ. | 1 mA | 1 mA | 1 mA |
| Input delay (at rated value of input voltage) | | | |
| • for standard inputs | | | |
| - programmable | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 |
| - for "0" to "1", min. | 0.2 ms | 0.2 ms | 0.2 ms |
| - for "0" to "1", max. | 12.8 ms | 12.8 ms | 12.8 ms |
| • for alarm inputs | | | |
| - programmable | Yes | Yes | Yes |
| • for counter/technological functions | | | |
| - programmable | Single-phase: 3 at 100 KHz Differential: 3 at 80 KHz | Single-phase: 3 at 100 KHz Differential: 3 at 80 KHz | Single-phase: 3 at 100 KHz Differential: 3 at 80 KHz |
| Cable length | | | |
| • Max. cable length, shielded | 500 m; 50 m for technological functions | 500 m; 50 m for technological functions | 500 m; 50 m for technological functions |
| • Max. cable length, unshielded | 300 m; for technological functions: No | 300 m; for technological functions: No | 300 m; for technological functions: No |
| **Digital outputs** | | | |
| Number of digital outputs | 4; relays | 4 | 4; relays |
| • of those as fast outputs | | 2; 100 kHz pulse train output | |
| Short-circuit protection | No; to be provided externally | No; to be provided externally | No; to be provided externally |
| Voltage induced on current interruption limited to | | L+ (-48 V) | |
| Switching capacity of outputs | | | |
| • with ohmic load, max. | 2 A | 0.5 A | 2 A |
| • with lamp load, max. | 30 W DC; 200 W AC | 5 W | 30 W DC; 200 W AC |
| Output voltage | | | |
| • for "0" signal (DC), max. | | 0.1 V; with 10 kOhm load | |
| • for "1" signal, min. | | 20 V | |
| Output current | | | |
| • for "1" signal, rated value | | 0.5 A | |
| • for "0" signal, residual current, max. | | 0.1 mA | |

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**Technical specifications** (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| Output delay with ohmic load | | | |
| • "0" to "1", max. | 10 ms; max. | 1 µs; max. | 10 ms; max. |
| • "1" to "0", max. | 10 ms; max. | 5 µs; max. | 10 ms; max. |
| Wiring 2 outputs in parallel | | | |
| • for performance increase | No | | No |
| Switching frequency | | | |
| • of pulse outputs, with ohmic load, max. | 1 Hz | 100 kHz | 1 Hz |
| Cable length | | | |
| • Max. cable length, shielded | 500 m | 500 m | 500 m |
| • Max. cable length, unshielded | 150 m | 150 m | 150 m |
| **Relay outputs** | | | |
| Number of relay outputs | 4 | | 4 |
| Number of operating cycles | Mechanically 10 million, with rated load voltage 100000 | | Mechanically 10 million, with rated load voltage 100000 |
| **Analog inputs** | | | |
| Number of analog inputs | 2 | 2 | 2 |
| Number of analog inputs with voltage/current measurement | 2 | | 2 |
| Max. cable length, shielded | 10 m; twisted and shielded | 10 m; twisted and shielded | 10 m; twisted and shielded |
| Input ranges | | | |
| • Voltage | Yes | Yes | Yes |
| Input ranges (rated values), voltages | | | |
| • 0 … +10 V | Yes | Yes | Yes |
| • Input resistance (0 … 10 V) | ≥100 kOhm | ≥100 kOhm | ≥100 kOhm |
| **Analog value generation** | | | |
| Integration and conversion time/resolution per channel | | | |
| • Resolution with overrange (bits including sign), max. | 10 bit | 10 bit | 10 bit |
| • Integration time can be parameterized | Yes | Yes | Yes |
| • Conversion time (per channel) | 625 µs | 625 µs | 625 µs |
| **Analog value generation (in isochronous mode)** | | | |
| Cable length | | | |
| • Max. cable length, shielded | 10 m; twisted | 10 m; twisted | 10 m; twisted |
| **Encoder supply** | | | |
| 24 V encoder supply | | | |
| • 24 V | Permissible range: 20.4 … 28.8 V | Permissible range: 20.4 … 28.8 V | Permissible range: 20.4 … 28.8 V |
| **Encoders** | | | |
| Connectable encoders | | | |
| • 2-wire BEROs | Yes | Yes | Yes |

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## Technical specifications (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| **Integrated functions** | | | |
| Number of counters | 3 | 3 | 3 |
| Max. counter frequency | 100 kHz | 100 kHz | 100 kHz |
| Frequency meters | Yes | Yes | Yes |
| Controlled positioning | Yes | Yes | Yes |
| PID controllers | Yes | Yes | Yes |
| Number of alarm inputs | 4 | 4 | 4 |
| Number of pulse outputs | | 2 | |
| Limit frequency (pulse) | | 100 kHz | |
| **Operator control and monitoring** | | | |
| Display | | | |
| • Integrated | No | No | No |
| **Galvanic isolation** | | | |
| Galvanic isolation of digital inputs | | | |
| • Galvanic isolation of digital inputs | 500 V AC for 1 minute | 500 V AC for 1 minute | 500 V AC for 1 minute |
| • Between the channels, in groups of | 1 | 1 | 1 |
| Isolation of digital outputs | | | |
| • Isolation of digital outputs | Yes; relays | Yes | Relays |
| • Between the channels | No | No | No |
| • Between the channels, in groups of | 1 | 1 | 1 |
| **Permissible potential difference** | | | |
| Between different circuits | 500 V DC between 24 V DC and 5 V DC | 500 V DC between 24 V DC and 5 V DC | 500 V DC between 24 V DC and 5 V DC |
| **EMC** | | | |
| Immunity to static discharge | | | |
| • Immunity to static discharge in accordance with IEC 61000-4-2 | Yes | Yes | Yes |
| - test voltage with air discharge | 8 kV | 8 kV | 8 kV |
| - test voltage with contact discharge | 6 kV | 6 kV | 6 kV |
| Immunity to conducted interference | | | |
| • On the supply lines in accordance with IEC 61000-4-4 | Yes | Yes | Yes |
| • Immunity on supply lines in accordance with IEC 61000-4-4 | Yes | Yes | Yes |
| Immunity to surge voltages | | | |
| • On the supply lines in accordance with IEC 61000-4-5 | Yes | Yes | Yes |
| Immunity to conducted interference, induced by high-frequency fields | | | |
| • Immunity to high-frequency irradiation in accordance with IEC 61000-4-6 | Yes | Yes | Yes |
| Emission of radio interference in accordance with EN 55 011 | | | |
| • Emission of radio interference in accordance with EN 55 011 (limit class A) | Yes; Group 1 | Yes; Group 1 | Yes; Group 1 |

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**Technical specifications** (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| **Climatic and mechanical conditions for storage and transport** | | | |
| Climatic conditions for storage and transport | | | |
| • Free fall | | | |
| - max. height of fall (in packaging) | 0.3 m; five times, in transport packaging | 0.3 m; five times, in transport packaging | 0.3 m; five times, in transport packaging |
| • Temperature | | | |
| - permissible temperature range | -40 °C ... +70 °C | -40 °C ... +70 °C | -40 °C ... +70 °C |
| • Relative humidity | | | |
| - permissible range (without condensation) at 25 °C | 95% | 95% | 95% |
| **Mechanical and climatic conditions in operation** | | | |
| Climatic conditions in operation | | | |
| • Temperature | | | |
| - permissible temperature range | 0 °C ... 55 °C horizontal mounting; 0 °C ... 45 °C vertical mounting | 0 °C ... 55 °C horizontal mounting; 0 °C ... 45 °C vertical mounting | 0 °C ... 55 °C horizontal mounting; 0 °C ... 45 °C vertical mounting |
| - permissible temperature change | 5 °C ... 55 °C, 3 °C/minute | 5 °C ... 55 °C, 3 °C/minute | 5 °C ... 55 °C, 3 °C/minute |
| • Atmospheric pressure acc. to IEC 60068-2-13 | | | |
| - permissible atmospheric pressure | 1080 ... 795 hPa | 1080 ... 795 hPa | 1080 ... 795 hPa |
| - permissible operating altitude | -1000 m … 2000 m | -1000 m … 2000 m | -1000 m … 2000 m |
| • Concentration of pollutants | | | |
| - $SO_2$ at RH < 60% without condensation | $S0_2$: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% without condensation | $S0_2$: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% without condensation | $S0_2$: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% without condensation |
| **Environmental requirements** | | | |
| Operating temperature | | | |
| • Min. | 0 °C | 0 °C | 0 °C |
| • Max. | 55 °C | 55 °C | 55 °C |
| • Vertical installation, min. | 0 °C | 0 °C | 0 °C |
| • Vertical installation, max. | 45 °C | 45 °C | 45 °C |
| • Horizontal installation, min. | 0 °C | 0 °C | 0 °C |
| • Horizontal installation, max. | 55 °C | 55 °C | 55 °C |
| Storage/transport temperature | | | |
| • Min. | -40 °C | -40 °C | -40 °C |
| • Max. | +70 °C | +70 °C | +70 °C |
| Atmospheric pressure | | | |
| • Operation, min. | 795 hPa | 795 hPa | 795 hPa |
| • Operation, max. | 1080 hPa | 1080 hPa | 1080 hPa |
| • Storage/transport, min. | 660 hPa | 660 hPa | 660 hPa |
| • Storage/transport, max. | 1080 hPa | 1080 hPa | 1080 hPa |
| Relative humidity | | | |
| • Operation, max. | 95%; no condensation | 95%; no condensation | 95%; no condensation |
| Vibrations | | | |
| • Vibrations | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) |
| • In operation, tested according to IEC 60068-2-6 | Yes | Yes | Yes |

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## Technical specifications (continued)

| | 6ES7 211-1BD30-0XB0 | 6ES7 211-1AD30-0XB0 | 6ES7 211-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1211C AC/DC/relay** | **CPU 1211C DC/DC/DC** | **CPU 1211C DC/DC/relay** |
| Shock test | | | |
| • Tested in accordance with IEC 60068-2-27 | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes |
| **Degree of protection** | | | |
| IP20 | Yes | Yes | Yes |
| **Standards, approvals, certificates** | | | |
| CE mark | Yes | Yes | Yes |
| C-TICK | Yes | Yes | Yes |
| cULus | Yes | Yes | Yes |
| FM approval | Yes | Yes | Yes |
| **Dimensions and weight** | | | |
| Dimensions and weight | | | |
| • Width | 90 mm | 90 mm | 90 mm |
| • Height | 100 mm | 100 mm | 100 mm |
| • Depth | 75 mm | 75 mm | 75 mm |
| Weight | | | |
| • Approx. weight | 420 g | 370 g | 380 g |

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## CPU 1211C



### Ordering data

| | | Order No. |
|---|---|---|
| **CPU 1211C** | | |
| **Compact CPU, AC/DC/relay**; integral program/data memory 25 KB, load memory 1 MB; wide-range power supply 85 ... 264 V AC; Boolean execution times 0.1 µs per operation; 6 digital inputs, 4 digital outputs (relays), 2 analog inputs; expandable by up to 3 communication modules and 1 signal board; digital inputs can be used as HSC at 100 kHz | C | **6ES7 211-1BD30-0XB0** |
| **Compact CPU, DC/DC/DC**; integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 µs per operation; 6 digital inputs, 4 digital outputs (relays), 2 analog inputs; expandable by up to 3 communication modules and 1 signal board; digital inputs can be used as HSC at 100 kHz, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) with 100 kHz | C | **6ES7 211-1AD30-0XB0** |
| **Compact CPU, DC/DC/relay**; integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 µs per operation; 6 digital inputs, 4 digital outputs, 2 analog inputs; expandable by up to 3 communication modules and 1 signal board; digital inputs can be used as HSC at 100 kHz | C | **6ES7 211-1HD30-0XB0** |

C: Subject to export regulations: AL: N and ECCN: EAR99H

| | | Order No. |
|---|---|---|
| **SB 1223 signal board** | C | **6ES7 223-0BD30-0XB0** |
| 2 inputs, 24 V DC, IEC type 1 current sinking; two 24 V DC transistor outputs, 0.5 A, 5 W; can be used as HSC at up to 30 kHz | | |
| **SB 1232 signal board** | C | **6ES7 232-4HA30-0XB0** |
| 1 analog output, ±10 V with 12 bit or 0 … 20 mA with 11 bit | | |
| **Simulator (optional)** | C | **6ES7 274-1XF30-0XA0** |
| 8 input switches, for CPU 1211C / CPU 1212C | | |
| **SIMATIC Memory Card (optional)** | | |
| 2 MB | C | **6ES7 954 -8LB00-0AA0** |
| 24 MB | C | **6ES7 954 -8LF00-0AA0** |
| **S7-1200 automation system, System Manual** | | |
| for SIMATIC S7-1200 and STEP 7 Basic | | |
| German | | **6ES7 298-8FA30-8AH0** |
| English | | **6ES7 298-8FA30-8BH0** |
| **STEP 7 Basic engineering software** | | |
| *Target system:* SIMATIC S7-1200 controllers and the associated I/O. The WinCC Basic which is included permits configuration of the SIMATIC Basic Panels *Requirement:* MS Windows XP SP3 / MS Windows Vista SP1 *Type of delivery:* German, English, with online documentation | | |
| Single license | D | **6ES7 822-0AA00-0YA0** |
| STEP 7 Basic Software Update Service, 1 year | D | **6ES7 822-0AA00-0YL0** |

D: Subject to export regulations: AL: N and ECCN: EAR99S

### More information

***Brochures***

Information material for downloading can be found in the Internet:

http://www.siemens.com/simatic/printmaterial

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## Overview

- The superior compact solution
- With 14 integral input/outputs
- Expandable by:
  - 1 signal board (SB)
  - 2 signal modules (SM)
  - max. 3 communication modules (CM)

## Design

The compact CPU 1212C has:

- 3 device versions with different power supply and control voltages
- Integrated power supply either as wide-range AC or DC power supply (85 to 264 V AC or 24 V DC)
- Integrated 24 V encoder/load current supply:
  For direct connection of sensors and encoders. With 300 mA output current also for use as load power supply
- 8 integrated digital inputs 24 V DC (current sinking/current sourcing (IEC type 1 current sinking))
- 6 integrated digital outputs, either 24 V DC or relay
- 2 integrated analog inputs 0 to 10 V
- 2 pulse outputs (PTO) with a frequency of up to 100 kHz
- Pulse-width modulated outputs (PWM) with a frequency of up to 100 kHz
- Integrated Ethernet interface (TCP/IP native, ISO-on-TCP)
- 4 fast counters (3 with max. 100 kHz; 1 with max. 30 kHz), with parameterizable enable and reset inputs, can be used simultaneously as up and down counters with 2 separate inputs or for connecting incremental encoders
- Expansion by additional communication interfaces, e.g. RS485 or RS232
- Expansion by analog or digital signals directly on the CPU via signal board (with retention of CPU mounting dimensions)
- Expansion by a wide range of analog and digital input and output signals via signal modules
- Optional memory expansion (SIMATIC Memory Card)
- PID controller with auto-tuning functionality
- Integral real-time clock
- Interrupt inputs:
  For extremely fast response to rising or falling edges of process signals
- Removable terminals on all modules
- Simulator (optional):
  For simulating the integrated inputs and for testing the user program

**Device versions**

| Version | Supply voltage | Input voltage DI | Output voltage DO | Output current |
|---|---|---|---|---|
| • DC/DC/DC | 24 V DC | 24 V DC | 24 V DC | 0.5 A, transistor |
| • DC/DC/relay | 24 V DC | 24 V DC | 5 … 30 V DC /<br>5 … 250 V AC | 2 A;<br>30 W DC / 200 W AC |
| • AC/DC/relay | 85 … 264 V AC | 24 V DC | 5 … 30 V DC /<br>5 … 250 V AC | 2 A;<br>30 W DC / 200 W AC |

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## CPU 1212C



### Function

- Comprehensive instruction set:
  A wide range of operations facilitate programming:
  - basic operations such as binary logic operations, result allocation, save, count, create times, load, transfer, compare, shift, rotate, create complement, call subprogram (with local variables)
  - integral communication commands (e.g. USS protocol, Modbus RTU, S7 communication "T-Send/T-Receive" or Freeport)
  - user-friendly functions such as pulse-width modulation, pulse sequence function, arithmetic functions, floating point arithmetic, PID closed-loop control, jump functions, loop functions and code conversions
  - mathematical functions, e.g. SIN, COS, TAN, LN, EXP
- Counting:
  User-friendly counting functions in conjunction with the integrated counters and special commands for high-speed counters open up new application areas for the user
- Interrupt processing:
  - edge-triggered interrupts (activated by rising or falling edges of process signals on interrupt inputs) support a rapid response to process events.
  - time-triggered interrupts.
  - counter interrupts can be triggered when a setpoint is reached or when the direction of counting changes.
  - communication interrupts allow the rapid and easy exchange of information with peripheral devices such as printers or bar code readers
- Password protection
- Test and diagnostics functions:
  Easy-to-use functions support testing and diagnostics, e.g. online/offline diagnostics
- "Forcing" of inputs and outputs during testing and diagnostics:
  Inputs and outputs can be set independently of cycle and thus permanently, for example, to test the user program
- Motion Control in accordance with PLCopen for simple movements
- Library functionality

### Programming

The STEP 7 Basic programming package permits complete programming of all S7-1200 controllers and the associated I/O.

### Technical specifications

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| **Product version** | | | |
| Associated programming package | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 |
| **Supply voltages** | | | |
| Rated value | | | |
| • 24 V DC | | Yes | Yes |
| • 120 V AC | Yes | | |
| • 230 V AC | Yes | | |
| • Lower limit of permissible range (DC) | | 20.4 V | 20.4 V |
| • Upper limit of permissible range (DC) | | 28.8 V | 28.8 V |
| • Lower limit of permissible range (AC) | 85 V | | |
| • Upper limit of permissible range (AC) | 264 V | | |
| • Lower limit of permissible frequency range | 47 Hz | | |
| • Upper limit of permissible frequency range | 63 Hz | | |
| Load voltage L+ | | | |
| • Rated value (DC) | 24 V | 24 V | 24 V |
| • Lower limit of permissible range (DC) | 5 V | 20.4 V | 5 V |
| • Upper limit of permissible range (DC) | 250 V | 28.8 V | 250 V |

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## Technical specifications (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| **Current consumption** | | | |
| Current consumption (rated value) | 80 mA at 120 V AC<br>40 mA at 240 V AC | | 175 mA; typically |
| Current consumption, max. | 240 mA at 120 V AC<br>120 mA at 240 V AC | 1.2 A; 24 V DC | 1.2 A; 24 V DC |
| Max. starting current | 20 A; at 264 V | 12 A; 28.8 V DC | 12 A; at 28.8 V |
| Current output at backplane bus (5 V DC), max. | 1000 mA; max. 5 V DC for SM and CM | 1000 mA; max. 5 V DC for SM and CM | 1000 mA; max. 5 V DC for SM and CM |
| **Current consumption/power loss** | | | |
| Power loss, typ. | 11 W | 9 W | 9 W |
| **Memory** | | | |
| Usable memory for application data | 25 KB | 25 KB | 25 KB |
| Work memory | | | |
| • Integrated | 25 KB | 25 KB | 25 KB |
| • Expandable | No | No | No |
| Load memory | | | |
| • Integrated | 1 MB; load memory expandable using SIEMENS Memory Card | 1 MB; load memory expandable using SIEMENS Memory Card | 1 MB; load memory expandable using SIEMENS Memory Card |
| • Expandable, max. | 24 MB; with SIEMENS Memory Card | 24 MB; with SIEMENS Memory Card | 24 MB; with SIEMENS Memory Card |
| Buffering | | | |
| • Available | Yes; complete project maintenance-free in the integral EEPROM | Yes; complete project maintenance-free in the integral EEPROM | Yes; complete project maintenance-free in the integral EEPROM |
| • Without battery | Yes | Yes | Yes |
| **CPU/execution times** | | | |
| for bit operations, min. | 0.1 µs; per operation | 0.1 µs; per operation | 0.1 µs; per operation |
| for word operations, min. | 12 µs; per operation | 12 µs; per operation | 12 µs; per operation |
| for floating-point arithmetic, min. | 18 µs; per operation | 18 µs; per operation | 18 µs; per operation |
| **Data areas and their retentivity** | | | |
| Total retentive data area (including timers, counters, bit memories), max. | 2048 byte | 2048 byte | 2048 byte |
| **Address range** | | | |
| I/O address range | | | |
| • Total I/O address range | 1024 byte for inputs/<br>1024 byte for outputs | 1024 byte for inputs/<br>1024 byte for outputs | 1024 byte for inputs/<br>1024 byte for outputs |
| • Inputs | 1024 byte | 1024 byte | 1024 byte |
| • Outputs | 1024 byte | 1024 byte | 1024 byte |
| Digital channels | | | |
| • Integrated channels (DI) | 8 | 8 | 8 |
| • Integrated channels (DO) | 6 | 6 | 6 |
| Analog channels | | | |
| • Integrated channels (AI) | 2 | 2 | 2 |

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**Technical specifications** (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| **Hardware configuration** | | | |
| Number of modules per system, max. | 3 communication modules, 1 signal board, 2 signal modules | 3 communication modules, 1 signal board, 2 signal modules | 3 communication modules, 1 signal board, 2 signal modules |
| **Time** | | | |
| Clock | | | |
| • Hardware clock (real-time clock) | Yes | Yes | Yes |
| • Buffered period | 240 h; typically | 240 h; typically | 240 h; typically |
| • Deviation per day, max. | 60 s/month at 25 °C | 60 s/month at 25 °C | 60 s/month at 25 °C |
| **Test and startup functions** | | | |
| Status/control | | | |
| • Status/modify variable | Yes | Yes | Yes |
| • Tags | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters |
| Forcing | | | |
| • Forcing | Yes | Yes | Yes |
| **Communications functions** | | | |
| S7 communication | | | |
| • Supported | Yes | Yes | Yes |
| • As server | Yes | Yes | Yes |
| • As client | Yes | Yes | Yes |
| Open IE communication | | | |
| • TCP/IP | Yes | Yes | Yes |
| • ISO-on-TCP (RFC1006) | Yes | Yes | Yes |
| Number of connections | | | |
| • Total | 16; dynamic | 16; dynamic | 16; dynamic |
| **1st interface** | | | |
| Type of interface | PROFINET | PROFINET | PROFINET |
| Physics | Ethernet | Ethernet | Ethernet |
| Isolated | Yes | Yes | Yes |
| Automatic determination of transfer rate | Yes | Yes | Yes |
| Autonegotiation | Yes | Yes | Yes |
| Autocrossover | Yes | Yes | Yes |
| **CPU/programming** | | | |
| Configuring software | | | |
| • STEP 7 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 |
| Programming language | | | |
| • LAD | Yes | Yes | Yes |
| • FBD | Yes | Yes | Yes |
| Cycle time monitoring | | | |
| • Configurable | Yes | Yes | Yes |

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**Technical specifications** (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| **Digital inputs** | | | |
| Number of digital inputs | 8; integrated | 8; integrated | 8; integrated |
| • Inputs which can be used for technological functions | 4; HSC (high-speed counting) | 4; HSC (high-speed counting) | 4; HSC (high-speed counting) |
| Current sourcing/sinking | Yes | Yes | Yes |
| Concurrently controllable inputs | | | |
| • All mounting positions | | | |
| - concurrently controllable inputs, up to 40 °C | 8 | 8 | 8 |
| Input voltage | | | |
| • Rated value, DC | 24 V | 24 V | 24 V |
| • for "0" signal | 5 V DC at 1 mA | 5 V DC at 1 mA | 5 V DC at 1 mA |
| • for "1" signal | 15 V DC at 2.5 mA | 15 V DC at 2.5 mA | 15 V DC at 2.5 mA |
| Input current | | | |
| • for "1" signal, typ. | 1 mA | 1 mA | 1 mA |
| Input delay (at rated value of input voltage) | | | |
| • for standard inputs | | | |
| - programmable | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 |
| - for "0" to "1", min. | 0.2 ms | 0.2 ms | 0.2 ms |
| - for "0" to "1", max. | 12.8 ms | 12.8 ms | 12.8 ms |
| • For alarm inputs | | | |
| - programmable | Yes | Yes | Yes |
| • For counter/technological functions | | | |
| - programmable | Single-phase: 3 at 100 kHz, 1 at 30 kHz<br>Differential: 3 at 80 kHz, 1 at 30 kHz | Single-phase: 3 at 100 kHz, 1 at 30 kHz<br>Differential: 3 at 80 kHz, 1 at 30 kHz | Single-phase: 3 at 100 kHz, 1 at 30 kHz<br>Differential: 3 at 80 kHz, 1 at 30 kHz |
| Cable length | | | |
| • Max. cable length, shielded | 500 m;<br>50 m for technological functions | 500 m;<br>50 m for technological functions | 500 m;<br>50 m for technological functions |
| • Max. cable length, unshielded | 300 m;<br>for technological functions: No | 300 m;<br>for technological functions: No | 300 m;<br>for technological functions: No |
| **Digital outputs** | | | |
| Number of digital outputs | 6; relays | 6; relays | 6; relays |
| • of those as fast outputs | | 2; 100 kHz pulse train output | |
| Short-circuit protection | No; to be provided externally | No; to be provided externally | No; to be provided externally |
| Voltage induced on current interruption limited to | | L+ (-48 V) | |
| Switching capacity of outputs | | | |
| • with ohmic load, max. | 2 A | 0.5 A | 2 A |
| • with lamp load, max. | 30 W DC; 200 W AC | 5 W | 30 W DC; 200 W AC |
| Output voltage | | | |
| • for "0" signal (DC), max. | | 0.1 V; with 10 kOhm load | |
| • for "1" signal, min. | | 20 V | |
| Output current | | | |
| • for "1" signal, rated value | | 0.5 A | |
| • for "0" signal, residual current, max. | | 0.1 mA | |

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**Technical specifications** (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| Output delay with ohmic load | | | |
| • "0" to "1", max. | 10 ms; max. | 1 µs | 10 ms; max. |
| • "1" to "0", max. | 10 ms; max. | 5 µs | 10 ms; max. |
| Switching frequency | | | |
| • of pulse outputs, with ohmic load, max. | 1 Hz | 100 kHz | 1 Hz |
| Cable length | | | |
| • Max. cable length, shielded | 500 m | 500 m | 500 m |
| • Max. cable length, unshielded | 150 m | 150 m | 150 m |
| **Relay outputs** | | | |
| Number of relay outputs | 6 | | 6 |
| Number of operating cycles | Mechanically 10 million, with rated load voltage 100000 | | Mechanically 10 million, with rated load voltage 100000 |
| **Analog inputs** | | | |
| Number of analog inputs | 2 | 2 | 2 |
| Max. cable length, shielded | 10 m; twisted and shielded | 10 m; twisted and shielded | 10 m; twisted and shielded |
| Input ranges | | | |
| • Voltage | Yes | Yes | Yes |
| Input ranges (rated values), voltages | | | |
| • 0 … +10 V | Yes | Yes | Yes |
| • Input resistance (0 … 10 V) | ≥100 kOhm | ≥100 kOhm | ≥100 kOhm |
| **Analog value generation** | | | |
| Integration and conversion time/ resolution per channel | | | |
| • Resolution with overrange ( bits including sign), max. | 10 bit | 10 bit | 10 bit |
| • Integration time can be parameter-ized | Yes | Yes | Yes |
| • Conversion time (per channel) | 625 µs | 625 µs | 625 µs |
| **Analog value generation (in isochronous mode)** | | | |
| Cable length | | | |
| • Max. cable length, shielded | 10 m; twisted | 10 m; twisted | 10 m; twisted |
| **Encoder supply** | | | |
| 24 V encoder supply | | | |
| • 24 V | Permissible range: 20.4 … 28.8 V | Permissible range: 20.4 … 28.8 V | Permissible range: 20.4 … 28.8 V |
| **Encoders** | | | |
| Connectable encoders | | | |
| • 2-wire BEROs | Yes | Yes | Yes |

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**Technical specifications** (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| **Integrated functions** | | | |
| Number of counters | 4 | 4 | 4 |
| Max. counter frequency | 100 | 100 | 100 |
| Frequency meters | Yes | Yes | Yes |
| Controlled positioning | Yes | Yes | Yes |
| PID controllers | Yes | Yes | Yes |
| Number of alarm inputs | 4 | 4 | 4 |
| Number of pulse outputs | | 2 | |
| Limit frequency (pulse) | | 100 kHz | |
| **Operator control and monitoring** | | | |
| Display | | | |
| • Integrated | No | No | No |
| **Galvanic isolation** | | | |
| Galvanic isolation of digital inputs | | | |
| • Galvanic isolation of digital inputs | 500 V AC for 1 minute | 500 V AC for 1 minute | 500 V AC for 1 minute |
| • Between the channels, in groups of | 1 | 1 | 1 |
| Isolation of digital outputs | | | |
| • Isolation of digital outputs | Yes; relays | Yes | Relays |
| • Between the channels | No | No | No |
| • Between the channels, in groups of | 2 | 2 | 1 |
| **Permissible potential difference** | | | |
| Between different circuits | 500 V DC between 24 V DC and 5 V DC | 500 V DC between 24 V DC and 5 V DC | 500 V DC between 24 V DC and 5 V DC |
| **EMC** | | | |
| Immunity to static discharge | | | |
| • Immunity to static discharge in accordance with IEC 61000-4-2 | Yes | Yes | Yes |
| - test voltage with air discharge | 8 kV | 8 kV | 8 kV |
| - test voltage with contact discharge | 6 kV | 6 kV | 6 kV |
| Immunity to conducted interference | | | |
| • on the supply lines in accordance with IEC 61000-4-4 | Yes | Yes | Yes |
| • Immunity on supply lines in accordance with IEC 61000-4-4 | Yes | Yes | Yes |
| Immunity to surge voltages | | | |
| • on the supply lines in accordance with IEC 61000-4-5 | Yes | Yes | Yes |
| Immunity to conducted interference, induced by high-frequency fields | | | |
| • Immunity to high-frequency irradiation in accordance with IEC 61000-4-6 | Yes | Yes | Yes |
| Emission of radio interference in accordance with EN 55 011 | | | |
| • Emission of radio interference in accordance with EN 55 011 (limit class A) | Yes; Group 1 | Yes; Group 1 | Yes; Group 1 |

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**Technical specifications** (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| **Climatic and mechanical conditions for storage and transport** | | | |
| Climatic conditions for storage and transport | | | |
| • Free fall | | | |
| - max. height of fall (in packaging) | 0.3 m; five times, in transport packaging | 0.3 m; five times, in transport packaging | 0.3 m; five times, in transport packaging |
| • Temperature | | | |
| - permissible temperature range | -40 °C ... +70 °C | -40 °C ... +70 °C | -40 °C ... +70 °C |
| • Relative humidity | | | |
| - permissible range (without condensation) at 25 °C | 95% | 95% | 95% |
| **Mechanical and climatic conditions in operation** | | | |
| Climatic conditions in operation | | | |
| • Temperature | | | |
| - permissible temperature range | 0 °C ... 55 °C horizontal mounting; 0 °C ... 45 °C vertical mounting | 0 °C ... 55 °C horizontal mounting; 0 °C ... 45 °C vertical mounting | 0 °C ... 55 °C horizontal mounting; 0 °C ... 45 °C vertical mounting |
| - permissible temperature change | 5 °C ... 55 °C, 3 °C/minute | 5 °C ... 55 °C, 3 °C/minute | 5 °C ... 55 °C, 3 °C/minute |
| • Atmospheric pressure acc. to IEC 60068-2-13 | | | |
| - permissible atmospheric pressure | 1080 ... 795 hPa | 1080 ... 795 hPa | 1080 ... 795 hPa |
| - permissible operating altitude | -1000 m … 2000 m | -1000 m … 2000 m | -1000 m … 2000 m |
| • Concentration of pollutants | | | |
| - $SO_2$ at RH < 60% without condensation | $S0_2$: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% without condensation | $S0_2$: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% without condensation | $S0_2$: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% without condensation |
| **Environmental requirements** | | | |
| Operating temperature | | | |
| • Min. | 0 °C | 0 °C | 0 °C |
| • Max. | 55 °C | 55 °C | 55 °C |
| • Vertical installation, min. | 0 °C | 0 °C | 0 °C |
| • Vertical installation, max. | 45 °C | 45 °C | 45 °C |
| • Horizontal installation, min. | 0 °C | 0 °C | 0 °C |
| • Horizontal installation, max. | 55 °C | 55 °C | 55 °C |
| Storage/transport temperature | | | |
| • Min. | -40 °C | -40 °C | -40 °C |
| • Max. | +70 °C | +70 °C | +70 °C |
| Atmospheric pressure | | | |
| • Operation, min. | 795 hPa | 795 hPa | 795 hPa |
| • Operation, max. | 1080 hPa | 1080 hPa | 1080 hPa |
| • Storage/transport, min. | 660 hPa | 660 hPa | 660 hPa |
| • Storage/transport, max. | 1080 hPa | 1080 hPa | 1080 hPa |
| Relative humidity | | | |
| • Operation, max. | 95%; no condensation | 95%; no condensation | 95%; no condensation |
| Vibrations | | | |
| • Vibrations | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) |
| • in operation, tested according to IEC 60068-2-6 | Yes | Yes | Yes |

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## Technical specifications (continued)

| | 6ES7 212-1BD30-0XB0 | 6ES7 212-1AD30-0XB0 | 6ES7 212-1HD30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1212C AC/DC/relay** | **CPU 1212C DC/DC/DC** | **CPU 1212C DC/DC/relay** |
| Shock test | | | |
| • Tested in accordance with IEC 60068-2-27 | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes |
| **Degree of protection** | | | |
| IP20 | Yes | Yes | Yes |
| **Standards, approvals, certificates** | | | |
| CE mark | Yes | Yes | Yes |
| C-TICK | Yes | Yes | Yes |
| cULus | Yes | Yes | Yes |
| FM approval | Yes | Yes | Yes |
| **Dimensions and weight** | | | |
| Dimensions and weight | | | |
| • Width | 90 mm | 90 mm | 90 mm |
| • Height | 100 mm | 100 mm | 100 mm |
| • Depth | 75 mm | 75 mm | 75 mm |
| Weight | | | |
| • Approx. weight | 425 g | 370 g | 385 g |

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## CPU 1212C



### Ordering data

| | | Order No. |
|---|---|---|
| **CPU 1212C** | | |
| **Compact CPU, AC/DC/relay**; integral program/data memory 25 KB, load memory 1 MB; wide-range power supply 85 ... 264 V AC; Boolean execution times 0.1 µs per operation; 8 digital inputs, 6 digital outputs (relays), 2 analog inputs; expandable by up to 3 communication modules, 2 signal modules and 1 signal board; digital inputs can be used as HSC at 100 kHz | C | **6ES7 212-1BD30-0XB0** |
| **Compact CPU, DC/DC/DC**; integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 µs per operation; 8 digital inputs, 6 digital outputs (relays), 2 analog inputs; expandable by up to 3 communication modules, 2 signal modules and 1 signal board; digital inputs can be used as HSC at 100 kHz, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) with 100 kHz | C | **6ES7 212-1AD30-0XB0** |
| **Compact CPU, DC/DC/relay**; integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 µs per operation; 8 digital inputs, 6 digital outputs, 2 analog inputs; expandable by up to 3 communication modules, 2 signal modules and 1 signal board; digital inputs can be used as HSC at 100 kHz | C | **6ES7 212-1HD30-0XB0** |

| | | Order No. |
|---|---|---|
| **SB 1223 signal board**<br>2 inputs, 24 V DC, IEC type 1 current sinking; two 24 V DC transistor outputs, 0.5 A, 5 W; can be used as HSC at up to 30 kHz | C | **6ES7 223-0BD30-0XB0** |
| **SB 1232 signal board**<br>1 analog output, ±10 V with 12 bit or 0 … 20 mA with 11 bit | C | **6ES7 232-4HA30-0XB0** |
| **Simulator (optional)**<br>8 input switches, for CPU 1211C / CPU 1212C | C | **6ES7 274-1XF30-0XA0** |
| **SIMATIC Memory Card (optional)** | | |
| 2 MB | C | **6ES7 954 -8LB00-0AA0** |
| 24 MB | C | **6ES7 954 -8LF00-0AA0** |
| **Starter box CPU 1212C AC/DC/relay**<br>Complete offer SIMATIC S7-1200, starter box, comprising: CPU 1212C AC/DC/relay, simulator, STEP 7 BASIC CD, manual CD, info material, in Systainer | E | **6ES7 212-1BD30-4YB0** |
| **S7-1200 automation system, System Manual**<br>for SIMATIC S7-1200 and STEP 7 Basic | | |
| German | | **6ES7 298-8FA30-8AH0** |
| English | | **6ES7 298-8FA30-8BH0** |
| **STEP 7 Basic engineering software**<br>*Target system:*<br>SIMATIC S7-1200 controllers and the associated I/O. The WinCC Basic which is included permits configuration of the SIMATIC Basic Panels<br>*Requirement:*<br>MS Windows XP SP3 / MS Windows Vista SP1<br>*Type of delivery:*<br>German, English, with online documentation | | |
| Single license | D | **6ES7 822-0AA00-0YA0** |
| STEP 7 Basic Software Update Service, 1 year | D | **6ES7 822-0AA00-0YL0** |

C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: EAR99S
E: Subject to export regulations: AL: N and ECCN: EAR99T

### More information

***Brochures***

Information material for downloading can be found in the Internet:

http://www.siemens.com/simatic/printmaterial

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## Overview

- The compact high-performance CPU
- With 24 integral input/outputs
- Expandable by:
  - 1 signal board (SB)
  - 8 signal modules (SM)
  - max. 3 communication modules (CM)

## Design

The compact CPU 1214C has:

- 3 device versions with different power supply and control voltages
- Integrated power supply either as wide-range AC or DC power supply (85 to 264 V AC or 24 V DC)
- Integrated 24 V encoder/load current supply:
  For direct connection of sensors and encoders. With 400 mA, the output current can also be used as load power supply
- 14 integrated digital inputs 24 V DC (current sinking/current sourcing (IEC type 1 current sinking))
- 10 integrated digital outputs, either 24 V DC or relay
- 2 integrated analog inputs 0 to 10 V
- 2 pulse outputs (PTO) with a frequency of up to 100 kHz
- Pulse-width modulated outputs (PWM) with a frequency of up to 100 kHz
- Integrated Ethernet interface (TCP/IP native, ISO-on-TCP)
- 6 fast counters (3 with max. 100 kHz; 3 with max. 30 kHz), with parameterizable enable and reset inputs, can be used simultaneously as up and down counters with 2 separate inputs or for connecting incremental encoders
- Expansion by additional communication interfaces, e.g. RS485 or RS232
- Expansion by analog or digital signals directly on the CPU via signal board (with retention of CPU mounting dimensions)
- Expansion by a wide range of analog and digital input and output signals via signal modules
- Optional memory expansion (SIMATIC Memory Card)
- PID controller with auto-tuning functionality
- Integral real-time clock
- Interrupt inputs:
  For extremely fast response to rising or falling edges of process signals
- Removable terminals on all modules
- Simulator (optional):
  For simulating the integrated inputs and for testing the user program

**Device versions**

| Version | Supply voltage | Input voltage DI | Output voltage DO | Output current |
|---|---|---|---|---|
| • DC/DC/DC | 24 V DC | 24 V DC | 24 V DC | 0,5 A, Transistor |
| • DC/DC/relay | 24 V DC | 24 V DC | 5 … 30 V DC /<br>5 … 250 V AC | 2 A;<br>30 Watt DC /<br>200 Watt AC |
| • AC/DC/relay | 85 … 264 V AC | 24 V DC | 5 … 30 V DC /<br>5 … 250 V AC | 2 A;<br>30 Watt DC /<br>200 Watt AC |

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## CPU 1214C



### Function

- Comprehensive instruction set:
  A wide range of operations facilitate programming:
  - basic operations such as binary logic operations, result allocation, save, count, create times, load, transfer, compare, shift, rotate, create complement, call subprogram (with local variables)
  - integral communication commands (e.g. USS protocol, Modbus RTU, S7 communication "T-Send/T-Receive" or Freeport)
  - user-friendly functions such as pulse-width modulation, pulse sequence function, arithmetic functions, floating point arithmetic, PID closed-loop control, jump functions, loop functions and code conversions
  - mathematical functions, e.g. SIN, COS, TAN, LN, EXP
- Counting:
  User-friendly counting functions in conjunction with the integrated counters and special commands for high-speed counters open up new application areas for the user
- Interrupt processing:
  - edge-triggered interrupts (activated by rising or falling edges of process signals on interrupt inputs) support a rapid response to process events
  - time-triggered interrupts
  - counter interrupts can be triggered when a setpoint is reached or when the direction of counting changes
  - communication interrupts allow the rapid and easy exchange of information with peripheral devices such as printers or bar code readers
- Password protection
- Test and diagnostics functions:
  Easy-to-use functions support testing and diagnostics, e.g. online/offline diagnostics
- "Forcing" of inputs and outputs during testing and diagnostics:
  Inputs and outputs can be set independently of cycle and thus permanently, for example, to test the user program
- Motion Control in accordance with PLCopen for simple movements
- Library functionality

### Programming

The STEP 7 Basic programming package permits complete programming of all S7-1200 controllers and the associated I/O.

### Technical specifications

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| **Product version** | | | |
| Associated programming package | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 |
| **Supply voltages** | | | |
| Rated value | | | |
| • 24 V DC | | Yes | Yes |
| • 120 V AC | Yes | | |
| • 230 V AC | Yes | | |
| • Lower limit of permissible range (DC) | | 20.4 V | 20.4 V |
| • Upper limit of permissible range (DC) | | 28.8 V | 28.8 V |
| • Lower limit of permissible range (AC) | 85 V | | |
| • Upper limit of permissible range (AC) | 264 V | | |
| • Lower limit of permissible frequency range | 47 Hz | | |
| • Upper limit of permissible frequency range | 63 Hz | | |
| Load voltage L+ | | | |
| • Rated value (DC) | 24 V | 24 V | 24 V |
| • Lower limit of permissible range (DC) | 5 V | 20.4 V | 5 V |
| • Upper limit of permissible range (DC) | 250 V | 28.8 V | 250 V |

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## Technical specifications (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| **Current consumption** | | | |
| Current consumption (rated value) | 100 mA at 120 V AC<br>50 mA at 240 V AC | | 500 mA; typically |
| Current consumption, max. | 300 mA at 120 V AC<br>150 mA at 240 V AC | 1,5 A; 24 V DC | 1,2 A; 24 V DC |
| Max. starting current | 20 A; at 264 V | 12 A; at 28,8 V | 12 A; at 28,8 V |
| Current output at backplane bus (5 V DC), max. | 1600 mA;<br>max. 5 V DC for SM and CM | 1600 mA;<br>max. 5 V DC for SM and CM | 1600 mA;<br>max. 5 V DC for SM and CM |
| **Current consumption/power loss** | | | |
| Power loss, typ. | 14 W | 12 W | 12 W |
| **Memory** | | | |
| Usable memory for application data | 50 kbyte | 50 kbyte | 50 kbyte |
| Work memory | | | |
| • Integrated | 50 kbyte | 50 kbyte | 50 kbyte |
| • Expandable | No | No | No |
| Load memory | | | |
| • Integrated | 2 Mbyte; load memory expandable using SIEMENS Memory Card | 2 Mbyte; load memory expandable using SIEMENS Memory Card | 2 Mbyte; load memory expandable using SIEMENS Memory Card |
| • Expandable, max. | 24 Mbyte;<br>with SIEMENS Memory Card | 24 Mbyte;<br>with SIEMENS Memory Card | 24 Mbyte;<br>with SIEMENS Memory Card |
| Buffering | | | |
| • Available | Yes; complete project maintenance-free in the integral EEPROM | Yes; complete project maintenance-free in the integral EEPROM | Yes; complete project maintenance-free in the integral EEPROM |
| • Without battery | Yes | Yes | Yes |
| **CPU/execution times** | | | |
| for bit operations, min. | 0.1 µs; per operation | 0.1 µs; per operation | 0.1 µs; per operation |
| for word operations, min. | 12 µs; per operation | 12 µs; per operation | 12 µs; per operation |
| for floating-point arithmetic, min. | 18 µs; per operation | 18 µs; per operation | 18 µs; per operation |
| **Data areas and their retentivity** | | | |
| Total retentive data area (including timers, counters, bit memories), max. | 2048 byte | 2048 byte | 2048 byte |
| **Address range** | | | |
| I/O address range | | | |
| • Total I/O address range | 1024 byte for inputs/<br>1024 byte for outputs | 1024 byte for inputs/<br>1024 byte for outputs | 1024 byte for inputs/<br>1024 byte for outputs |
| • Inputs | 1024 byte | 1024 byte | 1024 byte |
| • Outputs | 1024 byte | 1024 byte | 1024 byte |
| Digital channels | | | |
| • Integrated channels (DI) | 14 | 14 | 14 |
| • Integrated channels (DO) | 10 | 10 | 10 |
| Analog channels | | | |
| • Integrated channels (AI) | 2 | 2 | 2 |

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**Technical specifications** (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| **Hardware configuration** | | | |
| Number of modules per system, max. | 3 communication modules, 1 signal board, 8 signal modules | 3 communication modules, 1 signal board, 8 signal modules | 3 communication modules, 1 signal board, 8 signal modules |
| **Time** | | | |
| Clock | | | |
| • Hardware clock (real-time clock) | Yes | Yes | Yes |
| • Buffered period | 240 h; typically | 240 h; typically | 240 h; typically |
| • Deviation per day, max. | 60 s/month at 25°C | 60 s/month at 25°C | 60 s/month at 25°C |
| **Test and startup functions** | | | |
| Status/control | | | |
| • Status/modify variable | Yes | Yes | Yes |
| • Tags | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters | Inputs/outputs, bit memories, DBs, distributed inputs/outputs, timers, counters |
| Forcing | | | |
| • Forcing | Yes | Yes | Yes |
| **Communications functions** | | | |
| S7 communication | | | |
| • Supported | Yes | Yes | Yes |
| • As server | Yes | Yes | Yes |
| • As client | Yes | Yes | Yes |
| Open IE communication | | | |
| • TCP/IP | Yes | Yes | Yes |
| - data length, max. | | | |
| • ISO-on-TCP (RFC1006) | Yes | Yes | Yes |
| Number of connections | | | |
| • Total | 16; dynamic | 16; dynamic | 16; dynamic |
| **1st interface** | | | |
| Type of interface | PROFINET | PROFINET | PROFINET |
| Physics | Ethernet | Ethernet | Ethernet |
| Isolated | Yes | Yes | Yes |
| Automatic determination of transfer rate | Yes | Yes | Yes |
| Autonegotiation | Yes | Yes | Yes |
| Autocrossover | Yes | Yes | Yes |
| **CPU/programming** | | | |
| Configuring software | | | |
| • STEP 7 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 | STEP 7 Basic V 10.5 |
| Programming language | | | |
| • KOP | Yes | Yes | Yes |
| • FUP | Yes | Yes | Yes |
| Cycle time monitoring | | | |
| • Configurable | Yes | Yes | Yes |

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## Technical specifications (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| **Digital inputs** | | | |
| Number of digital inputs | 14; integrated | 14; integrated | 14; integrated |
| • Inputs which can be used for technological functions | 6; HSC (high-speed counting) | 6; HSC (high-speed counting) | 6; HSC (high-speed counting) |
| Current sourcing/sinking | Yes | Yes | Yes |
| Concurrently controllable inputs | | | |
| • All mounting positions | | | |
| - concurrently controllable inputs, up to 40 °C | 14 | 14 | 14 |
| Input voltage | | | |
| • Rated value, DC | 24 V | 24 V | 24 V |
| • for "0" signal | 5 V DC at 1 mA | 5 V DC at 1 mA | 5 V DC at 1 mA |
| • for "1" signal | 15 V DC at 2.5 mA | 15 V DC at 2.5 mA | 15 V DC at 2.5 mA |
| Input current | | | |
| • for "1" signal, typ. | 1 mA | 1 mA | 1 mA |
| Input delay (at rated value of input voltage) | | | |
| • for standard inputs | | | |
| - programmable | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 | 0.2, 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 ms, selectable in groups of 4 |
| - for "0" to "1", min. | 0.2 ms | 0.2 ms | 0.2 ms |
| - for "0" to "1", max. | 12.8 ms | 12.8 ms | 12.8 ms |
| • for alarm inputs | | | |
| - programmable | Yes | Yes | Yes |
| • for counter/technological functions | | | |
| - programmable | Single-phase:<br>3 at 100 kHz, 3 at 30 kHz<br>Differential:<br>3 at 80 kHz, 3 at 30 kHz | Single-phase:<br>3 at 100 kHz, 3 at 30 kHz<br>Differential:<br>3 at 80 kHz, 3 at 30 kHz | Single-phase:<br>3 at 100 kHz, 3 at 30 kHz<br>Differential:<br>3 at 80 kHz, 3 at 30 kHz |
| Cable length | | | |
| • Max. cable length, shielded | 500 m;<br>50 m for technological functions | 500 m;<br>50 m for technological functions | 500 m;<br>50 m for technological functions |
| • Max. cable length, unshielded | 300 m;<br>for technological functions: No | 300 m;<br>for technological functions: No | 300 m;<br>for technological functions: No |
| **Digital outputs** | | | |
| Number of digital outputs | 10; relays | 10; relays | 10; relays |
| • of those as fast outputs | | 2; 100 KHz pulse train output | |
| Short-circuit protection | No; to be provided externally | No; to be provided externally | No; to be provided externally |
| Voltage induced on current interruption limited to | | L+ (-48 V) | |
| Switching capacity of outputs | | | |
| • with ohmic load, max. | 2 A | 0.5 A | 2 A |
| • with lamp load, max. | 30 W DC; 200 W AC | 5 W | 30 W DC; 200 W AC |
| Output voltage | | | |
| • for "1" signal, min. | | 20 V | |
| Output current | | | |
| • for "1" signal, rated value | | 0.5 A | |
| • for "0" signal, residual current, max. | | 0.1 mA | |

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**Technical specifications** (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| Output delay with ohmic load | | | |
| • "0" to "1", max. | 10 ms; max. | 1 µs | 10 ms; max. |
| • "1" to "0", max. | 10 ms; max. | 5 µs | 10 ms; max. |
| Switching frequency | | | |
| • of pulse outputs, with ohmic load, max. | 1 Hz | 100 kHz | 1 Hz |
| Cable length | | | |
| • Max. cable length, shielded | 500 m | 500 m | 500 m |
| • Max. cable length, unshielded | 150 m | 150 m | 150 m |
| **Relay outputs** | | | |
| Number of relay outputs | 10 | | 10 |
| Number of operating cycles | Mechanically 10 million, with rated load voltage 100000 | | Mechanically 10 million, with rated load voltage 100000 |
| **Analog inputs** | | | |
| Number of analog inputs | 2 | 2 | 2 |
| Max. cable length, shielded | 10 m; twisted and shielded | 10 m; twisted and shielded | 10 m; twisted and shielded |
| Input ranges | | | |
| • Voltage | Yes | Yes | Yes |
| Input ranges (rated values), voltages | | | |
| • 0 … +10 V | Yes | Yes | Yes |
| • Input resistance (0 … 10 V) | ≥100 kOhm | ≥100 kOhm | ≥100 kOhm |
| **Analog value generation** | | | |
| Integration and conversion time/resolution per channel | | | |
| • Resolution with overrange (bits including sign), max. | 10 bit | 10 bit | 10 bit |
| • Integration time can be parameterized | Yes | Yes | Yes |
| • Conversion time (per channel) | 625 µs | 625 µs | 625 µs |
| **Analog value generation (in isochronous mode)** | | | |
| Cable length | | | |
| • Max. cable length, shielded | 10 m; twisted | 10 m; twisted | 10 m; twisted |
| **Encoder supply** | | | |
| 24 V encoder supply | | | |
| • 24 V | Permissible range: 20.4 … 28.8 V | Permissible range: 20.4 … 28.8 V | Permissible range: 20.4 … 28.8 V |
| **Encoders** | | | |
| Connectable encoders | | | |
| • 2-wire BEROs | Yes | Yes | Yes |

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## Technical specifications (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| **Integrated functions** | | | |
| Number of counters | 6 | 6 | 6 |
| Max. counter frequency | 100 kHz | 100 kHz | 100 kHz |
| Frequency meters | Yes | Yes | Yes |
| Controlled positioning | Yes | Yes | Yes |
| PID controllers | Yes | Yes | Yes |
| Number of alarm inputs | 4 | 4 | 4 |
| Number of pulse outputs | | 2 | |
| Limit frequency (pulse) | | 100 kHz | |
| **Operator control and monitoring** | | | |
| Display | | | |
| • Integrated | No | No | No |
| **Galvanic isolation** | | | |
| Galvanic isolation of digital inputs | | | |
| • Galvanic isolation of digital inputs | 500 V AC for 1 minute | 500 V AC for 1 minute | 500 V AC for 1 minute |
| • Between the channels, in groups of | 1 | 1 | 1 |
| Isolation of digital outputs | | | |
| • Isolation of digital outputs | Relays | Yes | Relays |
| • Between the channels | No | No | No |
| • Between the channels, in groups of | 2 | 2 | 1 |
| **Permissible potential difference** | | | |
| Between different circuits | 500 V DC between 24 V DC and 5 V DC | 500 V DC between 24 V DC and 5 V DC | 500 V DC between 24 V DC and 5 V DC |
| **EMC** | | | |
| Immunity to static discharge | | | |
| • Immunity to static discharge in accordance with IEC 61000-4-2 | Yes | Yes | Yes |
| - test voltage with air discharge | 8 kV | 8 kV | 8 kV |
| - test voltage with contact discharge | 6 kV | 6 kV | 6 kV |
| Immunity to conducted interference | | | |
| • on the supply lines in accordance with IEC 61000-4-4 | Yes | Yes | Yes |
| • Immunity on supply lines in accordance with IEC 61000-4-4 | Yes | Yes | Yes |
| Immunity to surge voltages | | | |
| • on the supply lines in accordance with IEC 61000-4-5 | Yes | Yes | Yes |
| Immunity to conducted interference, induced by high-frequency fields | | | |
| • Immunity to high-frequency irradiation in accordance with IEC 61000-4-6 | Yes | Yes | Yes |
| Emission of radio interference in accordance with EN 55 011 | | | |
| • Emission of radio interference in accordance with EN 55 011 (limit class A) | Yes; Group 1 | Yes; Group 1 | Yes; Group 1 |

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## Technical specifications (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| **Climatic and mechanical conditions for storage and transport** | | | |
| Climatic conditions for storage and transport | | | |
| • Free fall | | | |
| - max. height of fall (in packaging) | 0.3 m; five times, in transport packaging | 0.3 m; five times, in transport packaging | 0.3 m; five times, in transport packaging |
| • Temperature | | | |
| - permissible temperature range | -40° C ... +70° C | -40° C ... +70° C | -40° C ... +70° C |
| • Relative humidity | | | |
| - permissible range (without condensation) at 25 °C | 95% | 95% | 95% |
| **Mechanical and climatic conditions in operation** | | | |
| Climatic conditions in operation | | | |
| • Temperature | | | |
| - permissible temperature range | 0° C ... 55° C horizontal mounting; 0° C .. 45° C vertical mounting | 0° C ... 55° C horizontal mounting; 0° C .. 45° C vertical mounting | 0° C ... 55° C horizontal mounting; 0° C .. 45° C vertical mounting |
| - permissible temperature change | 5° C ... 55°, 3 °C/min | 5° C ... 55°, 3 °C/min | 5° C ... 55°, 3 °C/min |
| • Atmospheric pressure acc. to IEC 60068-2-13 | | | |
| - permissible atmospheric pressure | 1080 ... 795 hPa | 1080 ... 795 hPa | 1080 ... 795 hPa |
| - permissible operating altitude | -1000 m … 2000 m | -1000 m … 2000 m | -1000 m … 2000 m |
| • Concentration of pollutants | | | |
| - $SO_2$ at RH < 60% without condensation | $S0_2$: < 0.5 ppm; $H_2S$: < 0.1 ppm; RH < 60% without condensation | $S0_2$: < 0.5 ppm; $H_2S$: < 0.1 ppm; RH < 60% without condensation | $S0_2$: < 0.5 ppm; $H_2S$: < 0.1 ppm; RH < 60% without condensation |
| **Environmental requirements** | | | |
| Operating temperature | | | |
| • Min. | 0 °C | 0 °C | 0 °C |
| • Max. | 55 °C | 55 °C | 55 °C |
| • Vertical installation, min. | 0 °C | 0 °C | 0 °C |
| • Vertical installation, max. | 45 °C | 45 °C | 45 °C |
| • Horizontal installation, min. | 0 °C | 0 °C | 0 °C |
| • Horizontal installation, max. | 55 °C | 55 °C | 55 °C |
| Storage/transport temperature | | | |
| • Min. | -40 °C | -40 °C | -40 °C |
| • Max. | 70 °C | +70 °C | 70 °C |
| Atmospheric pressure | | | |
| • Operation, min. | 795 hPa | 795 hPa | 795 hPa |
| • Operation, max. | 1080 hPa | 1080 hPa | 1080 hPa |
| • Storage/transport, min. | 660 hPa | 660 hPa | 660 hPa |
| • Storage/transport, max. | 1080 hPa | 1080 hPa | 1080 hPa |
| Relative humidity | | | |
| • Operation, max. | 95 %; no condensation | 95 %; no condensation | 95 %; no condensation |
| Vibrations | | | |
| • Vibrations | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) | 2 g (mounting in switchboard), 1 g (mounted on DIN rail) |
| • In operation, tested according to IEC 60068-2-6 | Yes | Yes | Yes |

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## Technical specifications (continued)

| | 6ES7 214-1BE30-0XB0 | 6ES7 214-1AE30-0XB0 | 6ES7 214-1HE30-0XB0 |
|---|---|---|---|
| **Product name** | **CPU 1214C AC/DC/relay** | **CPU 1214C DC/DC/DC** | **CPU 1214C DC/DC/relay** |
| Shock test | | | |
| • Tested in accordance with IEC 60068-2-27 | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes | Yes; magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes |
| **Degree of protection** | | | |
| IP20 | Yes | Yes | Yes |
| **Standards, approvals, certificates** | | | |
| CE mark | Yes | Yes | Yes |
| C-TICK | Yes | Yes | Yes |
| cULus | Yes | Yes | Yes |
| FM approval | Yes | Yes | Yes |
| **Dimensions and weight** | | | |
| Dimensions and weight | | | |
| • Width | 110 mm | 110 mm | 110 mm |
| • Height | 100 mm | 100 mm | 100 mm |
| • Depth | 75 mm | 75 mm | 75 mm |
| Weight | | | |
| • Approx. weight | 455 g | 415 g | 435 g |

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## CPU 1214C



### Ordering data

| | | Order No. |
|---|---|---|
| **CPU 1214C** | | |
| **Compact CPU, AC/DC/relay**; integral program/data memory 50 KB, load memory 2 MB; wide-range power supply 85 ... 264 V AC; Boolean execution times 0.1 µs per operation; 14 digital inputs, 10 digital outputs (relays), 2 analog inputs; expandable by up to 3 communication modules, 8 signal modules and 1 signal board; digital inputs can be used as HSC at 100 kHz | C | **6ES7 214-1BE30-0XB0** |
| **Compact CPU, DC/DC/DC**; integral program/data memory 50 KB, load memory 2 MB; power supply 24 V DC; Boolean execution times 0.1 µs per operation; 14 digital inputs, 10 digital outputs (relays), 2 analog inputs; expandable by up to 3 communication modules, 8 signal modules and 1 signal board; digital inputs can be used as HSC at 100 kHz, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) with 100 kHz | C | **6ES7 214-1AE30-0XB0** |
| **Compact CPU, DC/DC/relay**; integral program/data memory 50 KB, load memory 2 MB; power supply 24 V DC; Boolean execution times 0.1 µs per operation; 14 digital inputs, 10 digital outputs, 2 analog inputs; expandable by up to 3 communication modules, 8 signal modules and 1 signal board; digital inputs can be used as HSC at 100 kHz | C | **6ES7 214-1HE30-0XB0** |
| **SB 1223 signal board**<br>2 inputs, 24 V DC, IEC type 1 current sinking; two 24 V DC transistor outputs, 0.5 A, 5 W; can be used as HSC at up to 30 kHz | C | **6ES7 223-0BD30-0XB0** |
| **SB 1232 signal board**<br>1 analog output, ±10 V with 12 bit or 0 … 20 mA with 11 bit | C | **6ES7 232-4HA30-0XB0** |
| **Simulator (optional)**<br>14 input switches, for CPU 1214C | C | **6ES7 274-1XH30-0XA0** |
| **SIMATIC Memory Card (optional)** | | |
| 2 MB | C | **6ES7 954-8LB00-0AA0** |
| 24 MB | C | **6ES7 954-8LF00-0AA0** |
| **S7-1200 automation system, System Manual**<br>for SIMATIC S7-1200 and STEP 7 Basic | | |
| German | | **6ES7 298-8FA30-8AH0** |
| English | | **6ES7 298-8FA30-8BH0** |
| **STEP 7 Basic engineering software**<br>*Target system:*<br>SIMATIC S7-1200 controllers and the associated I/O. The WinCC Basic which is included permits configuration of the SIMATIC Basic Panels<br>*Requirement:*<br>MS Windows XP SP3 / MS Windows Vista SP1<br>*Type of delivery:*<br>German, English, with online documentation | | |
| Single license | D | **6ES7 822-0AA00-0YA0** |
| STEP 7 Basic Software Update Service, 1 year | D | **6ES7 822-0AA00-0YL0** |

C: Subject to export regulations: AL: N and ECCN: EAR99H

D: Subject to export regulations: AL: N and ECCN: EAR99S

### More information

***Brochures***

Information material for downloading can be found in the Internet:

http://www.siemens.com/simatic/printmaterial

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# CSM 1277 unmanaged



## Overview

- For connecting a SIMATIC S7-1200 to an Industrial Ethernet network with a line, tree or star topology
- Up to three further nodes can be connected
- Simple, space-saving mounting on the SIMATIC S7-1200 mounting rail
- Low-cost solution for implementing small, local Ethernet networks
- Rugged, industry-standard node connections with RJ45 connectors
- Simple and fast status display via LEDs on the device
- Integral autocrossover function permits use of uncrossed connecting cables

## Benefits

get Designed for Industry

- Reduction in assembly costs and mounting space compared to use of external network components
- Multiplication of Ethernet interfaces on a SIMATIC S7-1200 for additional connection of programming devices, operator controls, and further Ethernet nodes
- Lowest-cost solution for implementing small, local Ethernet networks with a SIMATIC S7-1200

## Application

The CSM 1277 is an Industrial Ethernet switch of compact and modular design for use in the SIMATIC S7-1200. The CSM 1277 can be used to multiply the Ethernet interface of the SIMATIC S7-1200 in order to allow simultaneous communication with operator panels, programming devices, other controllers, or the office world.

The CSM 1277 and the SIMATIC S7-1200 controller can be used to implement simple automation networks at low cost.

## Design

The CSM 1277 compact switch module offers all advantages of the SIMATIC S7-1200 design:

- Compact design;
  the rugged plastic enclosure contains:
  - 4 x RJ45 sockets for connecting to Industrial Ethernet
  - 3-pole plug-in terminal strip for connection of the external 24 V DC supply on the top
  - LEDs for diagnostics and for status display of the Industrial Ethernet ports
- Simple mounting on the mounting rail of the S7-1200
- Fanless and therefore low-maintenance design
- The module can be replaced without using a programming device

## Function

- Multiplication of Ethernet interfaces of the SIMATIC S7-1200
- Design of a small, local Industrial Ethernet network with three further nodes
- Automatic detection of data transfer rate by means of autosensing and autocrossover functions
- Secure, industry-standard plug-in connections
- LEDs for diagnostics and for status display

### Network topology and configuration

Various network topologies can be implemented using the CSM 1277 compact switch module:

- Connection of SIMATIC S7-1200 in linear topology:
  At least one RJ45 connection of the SIMATIC S7-1200 remains vacant, e.g. for connecting a programming device (PG)
- Connection of SIMATIC S7-1200 to a higher-level network in a tree/star topology:
  At least two RJ45 connections of the SIMATIC S7-1200 remain vacant, e.g. for connecting a programming device/operator panel (PG/OP)
- Design of a small, local network with a SIMATIC S7-1200 and three further Ethernet nodes

### Configuration

The CSM 1277 compact switch module is an unmanaged switch and need not be configured.

### Diagnostics

The following information is displayed on LEDs on the device:

- Power
- Port status
- Data traffic

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## Technical specifications

| | 6GK7 277-1AA00-0AA0 |
|---|---|
| **Product name** | **CSM 1277** |
| Transfer rate 1 | 10 Mbit/s |
| Transfer rate 2 | 100 Mbit/s |
| Number of electrical connections | |
| • for signaling contact | - |
| • for network components or terminals | 4 |
| • for power supply | 1 |
| Electrical connection version | |
| • for signaling contact | - |
| • for network components or terminals | RJ45 socket |
| • for power supply | 3-pole terminal block |
| Power supply | 24 V DC |
| • maximum | 28.2 V |
| • minimum | 19.2 V |

| | 6GK7 277-1AA00-0AA0 |
|---|---|
| **Product name** | **CSM 1277** |
| Input current | 70 mA |
| Effective power loss | 1.1 W |
| • at 24 V DC | 1.6 W |
| • maximum | - |
| Ambient temperature | |
| • during operation | 0 °C ... +60 °C |
| • during storage | -40 °C ... +70 °C |
| • during transport | -40 °C ... +70 °C |
| Maximum relative humidity at 25 °C during operation | 95% |
| Construction type | SIMATIC S7-1200 device design |
| Width | 45 mm |
| Height | 100 mm |
| Depth | 76 mm |
| Net weight | 150 g |
| Type of fixing | S7-1200 mounting rail, wall mounting |
| IP degree of protection | IP20 |

## Ordering data

| | Order No. |
|---|---|
| **CSM 1277 compact switch module**<br>Unmanaged switch for connecting a SIMATIC S7-1200 and up to three further nodes to Industrial Ethernet with 10/100 Mbit/s; 4 x RJ45 ports; external 24 V DC power supply, diagnostics on LEDs, S7-1200 module including electronic manual on CD-ROM | **6GK7 277-1AA00-0AA0** |
| **Accessories** | |
| **IE TP Cord RJ45/RJ45**<br>TP cable 4 x 2 with 2 RJ45 connectors | |
| • 0.5 m | **6XV1 870-3QE50** |
| **IE FC TP Standard Cable GP 2 x 2 (Type A)**<br>4-core, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug; PROFINET-compatible; with UL approval; sold by the meter; max. length 1000 m, minimum order quantity 20 m | **6XV1 840-2AH10** |
| **FC TP Trailing Cable 2 x 2 (Type C)**<br>4-core, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug 180/90 for use as trailing cable; PROFINET-compatible; with UL approval; sold by the meter; max. length 1000 m, minimum order quantity 20 m | **6XV1 840-3AH10** |

| | Order No. |
|---|---|
| **IE FC RJ45 Plug 180**<br>RJ45 plug-in connector for Industrial Ethernet with rugged metal enclosure and integrated insulation displacement contacts for connecting Industrial Ethernet FC installation cables; 180° cable outlet; for network components and CPs/CPUs with Industrial Ethernet interface | |
| • 1 pack = 1 unit | **6GK1 901-1BB10-2AA0** |
| • 1 pack = 10 units | **6GK1 901-1BB10-2AB0** |
| • 1 pack = 50 units | **6GK1 901-1BB10-2AE0** |
| **IE FC stripping tool**<br>Preadjusted stripping tool for fast stripping of the Industrial Ethernet FC cables | **6GK1 901-1GA00** |
| **IE FC Outlet RJ45**<br>For connecting Industrial Ethernet FC cables and TP cords; graduated prices for 10 and 50 units or more | **6GK1 901-1FC00 0AA0** |
| **SIMATIC NET Manual Collection**<br>Electronic manuals on communications systems, protocols, products; on DVD; German/English | **6GK1 975-1AA00-3AA0** |

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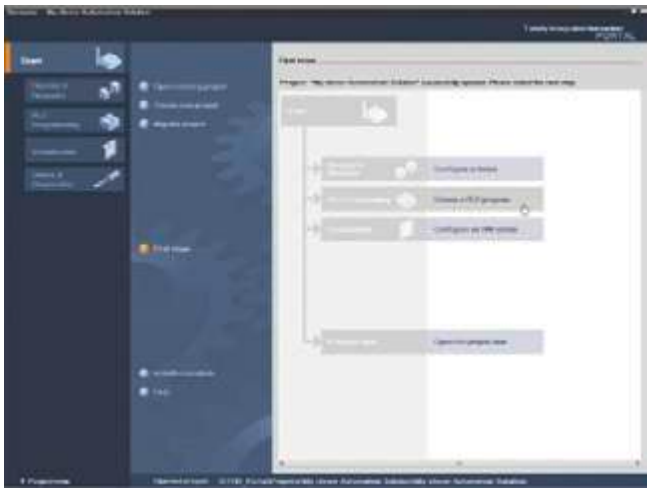
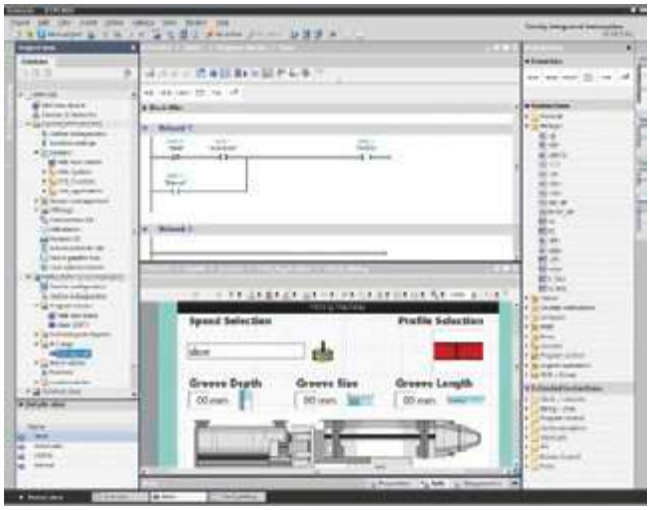
## Overview



STEP 7 Basic, portal view



STEP 7 Basic, project view

The STEP 7 Basic software is the engineering system for programming the SIMATIC S7-1200. The WinCC Basic engineering system included in the package additionally allows configuration of SIMATIC HMI Basic Panels on the S7-1200.

STEP 7 Basic thus provides support in all phases of the automation project:

- Configuring and parameterizing the hardware
- Specifying the communication
- Programming in LAD (Ladder Diagram) and FBD (Function Block Diagram)
- Configuration of the visualization
- Test, commissioning, and service

## Benefits

### *Optimized interaction of controller and HMI engineering*

Efficient solving of complete automation task through:

- Integrated handling of controller programming and HMI configuration in one engineering framework
- Common data management
- Integral WinCC Basic configuration environment; the application can be supplemented seamlessly by SIMATIC HMI Basic Panels.

### *Fast startup using the portal view*

The portal view facilitates navigation:

- It is also possible for beginners to access each task rapidly and specifically.
- In the event of maintenance, fast access to the online views directly in the portal overview; previous downloading of a project is unnecessary.

### *Intuitive user interface*

Use of STEP 7 Basic is extremely intuitive:

- Editors matched to the tasks and sequence
- Use of the latest Windows technologies

## Application

STEP 7 Basic is the engineering system for automation systems with SIMATIC S7-1200. In addition to programming of the controller, it permits configuration of the connected SIMATIC HMI Basic Panels in association with the integral WinCC Basic. It is thus possible to use the full performance of these systems simply and conveniently with just one tool.

STEP 7 Basic can be used for:

- Programming of the SIMATIC S7-1200 controller family: CPU 1211C, CPU 1212C, CPU 1214C
- Configuration of the PROFINET-based SIMATIC HMI Basic Panels:
  KTP400 Basic, KTP600 Basic mono and KTP600 Basic color, KTP1000 Basic, TP1500 Basic;
  KTP400 Basic and KTP600 Basic can also be configured for upright mounting.

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## Function

### *Device & network configuration*

- Clear configuration of network and device functionalities in specialized views of the editor
- Device view
  - photorealistic representation and configuration of the hardware modules
  - clipboard for modules; for simple intermediate storage of respective module parameters
  - catalog; includes all panels, CPUs, and modules with firmware versions
- Network view
  - clear total view of all devices and network components used
  - intelligent drag&drop function for generation of connections

### *Controller programming*

- Powerful editors for programming the S7-1200 in LAD and FBP
  - comprehensive catalog of instructions
  - configurable favorites area for frequently used instructions
  - table-based editor for configuration of block interfaces
  - intellisense for support during selection of tags
  - simple reuse of instructions or networks within a project
- Motion and technology functionalities
  - system support for integrated technology functions such as "Speed-controlled axis" and "Positioning axis"
  - PID controller with self-optimization (autotuning)

### *Visualization*

- Powerful editors for configuration of Basic Panel functionalities
  - operating screens with touch/key operation and trend/vector graphics
  - bit and analog alarms
  - recipe management
- Multi-language (up to 5 languages online)
- Graphics library with off-the-shelf picture objects
- Intelligent drag&drop for efficient configuration of standard functionalities

### *Integration*

- Integrated symbolic programming
- Direct use of control variables in the HMI to avoid multiple inputs
- Common cross-reference list for configuration objects (tags, blocks, etc.) for system-based project analysis or trouble-shooting
- Automatic generation of connections when using the control variables in the HMI
- Global and local libraries for simple repeated use of preconfigured elements
- Intelligent drag&drop for importing and interconnecting data from different editors

### *Online diagnostics*

- Clear representation of module diagnostics information
- Monitoring tables with "Force" and "Control" facilities
- Automatic display of all nodes accessible in the network
- Detailed comparison between online and offline projects

## Technical specifications

| | STEP 7 Basic |
|---|---|
| Licensing form | Single License |
| Software class | A |
| Current version | V10.5 |
| Target system | SIMATIC S7-1200 |
| Operating system | Windows XP Professional SP3 (32 bit)<br>Windows Vista Ultimate SP1 (32 bit)<br>Windows Vista Business SP1 (32 bit)<br>Windows Vista Home Premium SP1 (32 bit) |
| Main memory size in programming device/PC, min. | 1 GB |
| Disk memory requirement in programming device/PC | 2 GB |
| Remark | Includes the IEC programming languages LAD and FBP |

## Ordering data

| | | Order No. |
|---|---|---|
| **STEP 7 Basic V10.5** | | |
| *Target system:*<br>SIMATIC S7-1200,<br>SIMATIC HMI Basic Panels<br>*Requirement:*<br>Windows XP SP3,<br>Vista Ultimate SP1,<br>Vista Business SP1,<br>Home Premium SP1<br>*Type of delivery:*<br>German, English | | |
| STEP 7 Basic V10.5 on DVD | D | **6ES7 822 -0AA00-0YA0** |
| Software Update Service (requires current software version) | D | **6ES7 822 -0AA00-0YL0** |

D: Subject to export regulations: AL: N and ECCN: EAR99S

## More information

### *Brochures*

Information material for downloading can be found in the Internet:

http://www.siemens.com/simatic/printmaterial

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## PM 1207 power supply



### Overview

- Stabilized power supply for SIMATIC S7-1200
- In S7-1200 design
- Input 120/230 V AC, output 24 V DC/2.5 A

### Technical specifications

| | PM 1207 power supply |
|---|---|
| Order No. | 6EP1 332-1SH71 |
| Input voltage, rated value | 120/230 V AC (autoranging) |
| • Range | 85…132 V/176...264 V AC |
| Mains buffering | > 20 ms (at 93/187 V) |
| Line frequency, rated value | 50/60 Hz |
| • Range | 47… 63 Hz |
| Input current, rated value | 1.2/0.67 A |
| • Switch-on current (25 °C) | < 13 A |
| • Recommended miniature circuit-breaker | 16 A characteristic B,<br>10 A characteristic C |
| Output voltage, rated value | 24 V DC |
| • Tolerance | ± 3% |
| • Residual ripple | < 150 mVpp |
| • Adjustment range | No |
| Output current, rated value | 2.5 A |
| Approx. efficiency at rated values | 83% |
| Connectable in parallel | Yes, 2 units |
| Electronic short-circuit protection | Yes, automatic restart |
| Radio suppression level (EN 55022) | Class B |
| Status display | Green LED for "24 V OK" |
| Line harmonic limitation (EN 61000-3-2) | Not applicable |
| Degree of protection (EN 60529) | IP20 |
| Safety class | Class 1 |
| Galvanic isolation | SELV acc. to EN 60950 and EN 50178 |
| Ambient temperature | 0 … +60 °C |
| Transport/storage temperature | -25 … +85 °C |
| Mounting | Standard mounting rail EN 60715 35x7.5/15 |
| Dimensions (W x H x D) in mm | 70 x 100 x 75 |
| Approx. weight | 0.3 kg |
| Certification | CE, cULus |

### Ordering data

| | Order No. |
|---|---|
| **PM 1207 power supply**<br>Input 120/230 V AC,<br>output 24 V DC/2.5 A | **6EP1 332-1SH71** |

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## Overview

- The ideal entry level series of 3.8" to 15" for operating and monitoring simple machines and plants
- Clear process representation thanks to use of pixel-graphics displays
- Intuitive operation using Touch and tactile function keys
- Equipped with all the necessary basic functions such as alarm logging, recipe management, plots, vector graphics, and language switching
- Simple connection to the controller via integral Ethernet interface or separate version with RS485/422

## Benefits

- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimum engineering overhead, reduction in life-cycle costs
  - Can be used even where installation space is restricted thanks to vertical configuring (4" and 6" devices)
  - Short configuring and commissioning times
  - Service-friendly thanks to maintenance-free design and long service life of the backlighting display
- Simple and user-friendly representation of process values thanks to, for example, input/output fields, vector graphics, trend curves, bar charts, text and bitmaps
- Graphics library available with off-the-shelf picture objects
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - You can switch between up to 5 languages online
  - Language-dependent texts and graphics

## Application

The SIMATIC HMI Basic Panels can be used wherever simple machines and plants are controlled and monitored locally - in production, process and building automation alike. They are used in the most diverse sectors and applications.

## Design

The SIMATIC HMI Basic Panels are installation-compatible with the existing touch devices of the product family of Panels and Multi Panels.

- KTP400 Basic mono
  3.8" STN mono
  1 Ethernet interface (TCP/IP)
  Touch screen and 4 tactile function keys
- KTP600 Basic mono
  5.7" STN mono
  1 Ethernet interface (TCP/IP)
  Touch screen and 6 tactile function keys
- KTP600 Basic color
  5.7" TFT with 256 colors
  1 Ethernet interface (TCP/IP) or 1 RS 485/422 interface (separate version)
  Touch screen and 6 tactile function keys
- KTP1000 Basic color
  10.4" TFT with 256 colors
  1 Ethernet interface (TCP/IP) or 1 RS 485/422 interface (separate version)
  Touch screen and 8 tactile function keys
- TP1500 Basic color
  15.1" TFT with 256 colors
  1 Ethernet interface (TCP/IP)
  Touch screen
- No slot for SD/CF/MultiMedia Card, no USB interface

## Function

- Permanent window and template concept for creating screen templates
- Input/output fields
  for displaying and modifying process parameters
- Buttons
  are used for direct triggering of functions and actions. Up to 16 functions can be configured simultaneously on buttons.
- Graphics
  can be used as icons instead of text to "label" function keys or buttons. They can also be used as full-screen background images.
  The configuration tool contains a library with extensive graphics and diverse objects. All editors with an OLE interface can be used as graphics editors, e.g. PaintShop, Designer or CorelDraw, etc.
- Vector graphics
  Simple geometric basic forms (line, circle and rectangle) can be created direct in the configuring tool
- Fixed texts
  for labeling function keys, process images and process values in different font sizes
- Curve functions and bars
  are used for graphical display of dynamic values
- Language switching:
  - 5 online languages, 32 configuration languages including Asian and Cyrillic character sets
  - Language-dependent texts and graphics
- User administration (security) in accordance with the requirements of the different sectors
  - Authentication with user ID and password
  - User-group-specific rights

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## Function (continued)

- Signaling system
  - Discrete alarms
  - Analog messages
  - Freely definable message classes (e.g. status/fault messages) for defining acknowledgment response and displaying message events
  - Message history
- Recipe management
- Help texts
  for process screens, messages and variables
- Arithmetic functions
- Limit value monitoring
  for reliable process control of inputs and outputs
- Indicator light
  for indicating machine and plant statuses
- Task planner for cyclic execution of functions
- Template concept
- Creation of picture templates (picture elements configured in the template appear in every image)
- Simple maintenance and configuration thanks to:
  - Backup/restore of configuration, operating system and firmware on a PC using ProSave
  - Configuration download via MPI/PROFIBUS DP or Ethernet
  - Automatic transfer identification
  - Individual contrast setting and calibration
  - Clean screen
  - No battery required

### *Configuration*

The configuration is implemented using the engineering software SIMATIC WinCC flexible 2008 Compact or WinCC Basic V10.5, which is part of STEP 7 Basic V10.5 (for PROFINET-based devices only).

## Integration

The Basic Panels can be connected to:

- SIMATIC S7 controllers
- Non-Siemens controllers (applies for DP devices)
  - Allen Bradley DF1
  - Modicon Modbus

Note:
Further information can be found under "System interfaces".

## Technical specifications

| | 6AV6 647-0AA11-3AX0 | 6AV6 647-0AB11-3AX0 | 6AV6 647-0AD11-3AX0 | 6AV6 647-0AF11-3AX0 | 6AV6 647-0AG11-3AX0 |
|---|---|---|---|---|---|
| **Product name** | **SIMATIC KTP400 Basic mono PN** | **SIMATIC KTP600 Basic mono PN** | **SIMATIC KTP600 Basic color PN** | **SIMATIC KTP1000 Basic color PN** | **SIMATIC TP1500 Basic color PN** |
| **Supply voltage** | | | | | |
| Supply voltage | 24 V DC | 24 V DC | 24 V DC | 24 V DC | 24 V DC |
| permissible range | +19.2 V to +28.8 V DC | +19.2 V to +28.8 V DC | +19.2 V to +28.8 V DC | +19.2 V to +28.8 V DC | +19.2 V to +28.8 V DC |
| Rated current | 0.07 A | 0.24 A | 0.35 A | 0.6 A | 0.24 A |
| **Memory** | | | | | |
| Type of storage | | | | | |
| Type | Flash / RAM | Flash / RAM | Flash / RAM | Flash / RAM | Flash / RAM |
| Memory usable for project data/Options | 512 KB usable memory for user data | 512 KB usable memory for user data | 512 KB usable memory for user data | 1024 KB usable memory for user data | 1024 KB usable memory for user data |
| **Time** | | | | | |
| Clock | | | | | |
| • Type | Software clock, not battery backed | Software clock, not battery backed | Software clock, not battery backed | Software clock, not battery backed | Software clock, not battery backed |
| **Protocols** | | | | | |
| Protocols (terminal link) | | | | | |
| • Sm@rtAccess | No | No | No | No | No |
| **Configuration** | | | | | |
| Configuration tool | WinCC flexible Compact Version 2008 or higher (to be ordered separately) | WinCC flexible Compact Version 2008 or higher (to be ordered separately) | WinCC flexible Compact Version 2008 or higher (to be ordered separately) | WinCC flexible Compact Version 2008 or higher (to be ordered separately) | WinCC flexible Compact Version 2008 or higher (to be ordered separately) |
| **Display** | | | | | |
| Display type | STN, gray scales | STN, gray scales | TFT, 256 colors | TFT, 256 colors | TFT, 256 colors |
| Size | 3.8" | 5.7" | 5.7" | 10.4" | 15" |
| Resolution (W x H in pixel) | 320 x 240 | 320 x 240 | 320 x 240 | 640 x 480 | 1024 x 768 |
| • MTBF backlighting (at 25 °C) | about 30,000 h | about 50,000 h | about 50,000 h | about 50,000 h | about 50,000 h |

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## Technical specifications (continued)

| | 6AV6 647-0AA11-3AX0 | 6AV6 647-0AB11-3AX0 | 6AV6 647-0AD11-3AX0 | 6AV6 647-0AF11-3AX0 | 6AV6 647-0AG11-3AX0 |
|---|---|---|---|---|---|
| **Product name** | **SIMATIC KTP400 Basic mono PN** | **SIMATIC KTP600 Basic mono PN** | **SIMATIC KTP600 Basic color PN** | **SIMATIC KTP1000 Basic color PN** | **SIMATIC TP1500 Basic color PN** |
| **Operating mode** | | | | | |
| Operating elements | Membrane keyboard | Membrane keyboard | Membrane keyboard | Membrane keyboard | Touchscreen |
| Function keys, programmable | 4 function keys | 6 function keys | 6 function keys | 8 function keys | none |
| Connection for mouse/keyboard/barcode reader | - / - / - | - / - / - | - / - / - | - / - / - | - / - / - |
| • Touchscreen | analog, resistive | analog, resistive | analog, resistive | analog, resistive | analog, resistive |
| • Numeric/alphabetical input | Yes / Yes | Yes / Yes | Yes / Yes | Yes / Yes | Yes / Yes |
| **Ambient conditions** | | | | | |
| Mounting position | vertical | vertical | vertical | vertical | vertical |
| maximum permissible angle of incliniation without external ventilation | +/- 35 ° | +/- 35 ° | +/- 35 ° | +/- 35 ° | +/- 35 ° |
| max. relative humidity (in %) | 90% | 90% | 90% | 90% | 90% |
| Temperature | | | | | |
| • Operation (vertical installation) | 0 °C to +50 °C | 0 °C to +50 °C | 0 °C to +50 °C | 0 °C to +50 °C | 0 °C to +50 °C |
| • Operation (max. tilt angle) | 0 °C to +40 °C | 0 °C to +40 °C | 0 °C to +40 °C | 0 °C to +40 °C | 0 °C to +40 °C |
| • Transport, storage | -20 °C to +60 °C | -20 °C to +60 °C | -20 °C to +60 °C | -20 °C to +60 °C | -20 °C to +60 °C |
| **Degree of protection** | | | | | |
| Front | IP65, NEMA 4, NEMA 4x, NEMA 12 (when installed) | IP65, NEMA 4, NEMA 4x, NEMA 12 (when installed) | IP65, NEMA 4, NEMA 4x, NEMA 12 (when installed) | IP65, NEMA 4x, NEMA 12 (when installed) | IP65, NEMA 4x, NEMA 12 (when installed) |
| Rear | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Certifications & Standards** | | | | | |
| Certifications | CE, UL, cULus, NEMA 4, NEMA 4x, NEMA 12 | CE, UL, cULus, NEMA 4, NEMA 4x, NEMA 12 | CE, UL, cULus, NEMA 4, NEMA 4x, NEMA 12 | CE, UL, cULus, NEMA 4x, NEMA 12 | CE, UL, cULus, NEMA 4x, NEMA 12 |
| **I/O/Options** | | | | | |
| I/O devices | None | None | None | None | None |
| **Type of output** | | | | | |
| LED colors | None | None | None | None | None |
| Acoustics | Sound signal | Sound signal | Sound signal | Sound signal | Sound signal |
| **Interfaces** | | | | | |
| Interfaces | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) |
| PC card slot | No | No | No | No | No |
| CF card slot | No | No | No | No | No |
| Multi Media Card slot | No | No | No | No | No |
| USB | No | No | No | No | No |
| Ethernet | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) | 1 x Ethernet (RJ45) |
| **Operating systems** | | | | | |
| Operating system | | | | LINUX | LINUX |
| **Processor** | | | | | |
| Processor | RISC 32 bit, 75 | RISC 32 bit, 75 MHz | RISC 32 bit, 75 MHz | RISC 32 bit | RISC 32 bit, 200 |
| **Functionality under WinCC flexible** | | | | | |
| Applications/options | None | None | None | None | None |
| Number of Visual Basic scripts | Not possible | Not possible | Not possible | Not possible | Not possible |
| Task planner | Yes | Yes | Yes | Yes | Yes |

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**Technical specifications** (continued)

| | 6AV6 647-0AA11-3AX0 | 6AV6 647-0AB11-3AX0 | 6AV6 647-0AD11-3AX0 | 6AV6 647-0AF11-3AX0 | 6AV6 647-0AG11-3AX0 |
|---|---|---|---|---|---|
| **Product name** | **SIMATIC KTP400 Basic mono PN** | **SIMATIC KTP600 Basic mono PN** | **SIMATIC KTP600 Basic color PN** | **SIMATIC KTP1000 Basic color PN** | **SIMATIC TP1500 Basic color PN** |
| Help system | Yes | Yes | Yes | Yes | Yes |
| Status/control | Not possible | Not possible | Not possible | Not possible | Not possible |
| Message system | | | | | |
| • Number of messages | 200 | 200 | 200 | 200 | 200 |
| • Bit messages | Yes | Yes | Yes | Yes | Yes |
| • Analog messages | Yes | Yes | Yes | Yes | Yes |
| • Message buffer | Message buffer (n x 256 entries), non-retentive | Message buffer (n x 256 entries), non-retentive | Message buffer (n x 256 entries), non-retentive | Message buffer (n x 256 entries), non-retentive | Message buffer (n x 256 entries), non-retentive |
| Recipes | | | | | |
| • Recipes | 5 | 5 | 5 | 5 | 5 |
| • Data records per recipe | 20 | 20 | 20 | 20 | 20 |
| • Entries per data record | 20 | 20 | 20 | 20 | 20 |
| • Recipe memory | 40 kB integrated Flash | 40 kB integrated Flash | 40 kB integrated Flash | 32 kB integrated Flash | 32 kB integrated Flash |
| Number of process images | | | | | |
| • Process images | 50 | 50 | 50 | 50 | 50 |
| • Variables | 128 | 128 | 128 | 256 | 256 |
| • Limit values | Yes | Yes | Yes | Yes | Yes |
| • Multiplexing | Yes | Yes | Yes | Yes | Yes |
| Image elements | | | | | |
| • Graphics object | Bit maps, icons, icon (full-screen), vector graphics | Bit maps, icons, icon (full-screen), vector graphics | Bit maps, icons, icon (full-screen), vector graphics | Bit maps, icons, icon (full-screen), vector graphics | Bit maps, icons, icon (full-screen), vector graphics |
| • dynamic objects | Diagrams | Diagrams | Diagrams | Diagrams | Diagrams |
| Lists | | | | | |
| • Text lists | 150 | 150 | 150 | 150 | 150 |
| • Graphics list | 100 | 100 | 100 | 100 | 100 |
| • Libraries | Yes | Yes | Yes | Yes | Yes |
| Security | | | | | |
| • Number of user groups | 50 | 50 | 50 | 50 | 50 |
| • Passwords exportable | No | No | No | No | No |
| • Number of user rights | 32 | 32 | 32 | 32 | 32 |
| Data medium support | | | | | |
| • PC card | No | No | No | No | No |
| • CF card | No | No | No | No | No |
| • Multi Media Card | No | No | No | No | No |
| Recording | | | | | |
| • Recording/Printing | PROFINET | PROFINET | PROFINET | PROFINET | PROFINET |
| Fonts | | | | | |
| • Keyboard fonts | US American (English) | US American (English) | US American (English) | US American (English) | US American (English) |

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## Technical specifications (continued)

| | 6AV6 647-0AA11-3AX0 | 6AV6 647-0AB11-3AX0 | 6AV6 647-0AD11-3AX0 | 6AV6 647-0AF11-3AX0 | 6AV6 647-0AG11-3AX0 |
|---|---|---|---|---|---|
| **Product name** | **SIMATIC KTP400 Basic mono PN** | **SIMATIC KTP600 Basic mono PN** | **SIMATIC KTP600 Basic color PN** | **SIMATIC KTP1000 Basic color PN** | **SIMATIC TP1500 Basic color PN** |
| Languages | | | | | |
| • Online languages | 5 | 5 | 5 | 5 | 5 |
| • Configuration languages | D, GB, F, I, E, CHN "traditional", CHN "simplified", DK, FIN, GR, J, KP / ROK, NL, N, PL, P, RUS, S, CZ / SK, TR, H | D, GB, F, I, E, CHN "traditional", CHN "simplified", DK, FIN, GR, J, KP / ROK, NL, N, PL, P, RUS, S, CZ / SK, TR, H | D, GB, F, I, E, CHN "traditional", CHN "simplified", DK, FIN, GR, J, KP / ROK, NL, N, PL, P, RUS, S, CZ / SK, TR, H | D, GB, F, I, E, CHN "traditional", CHN "simplified", DK, FIN, GR, J, KP / ROK, NL, N, PL, P, RUS, S, CZ / SK, TR, H | D, GB, F, I, E, CHN "traditional", CHN "simplified", DK, FIN, GR, J, KP / ROK, NL, N, PL, P, RUS, S, CZ / SK, TR, H |
| • Fonts | WinCC flexible Standard, symbol languages | WinCC flexible Standard, symbol languages | WinCC flexible Standard, symbol languages | WinCC flexible Standard, symbol languages | WinCC flexible Standard, symbol languages |
| Transfer (Upload/Download) | | | | | |
| • Transfer of configuration | Ethernet, automatic transfer recognition | Ethernet, automatic transfer recognition | Ethernet, automatic transfer recognition | Ethernet, automatic transfer recognition | Ethernet, automatic transfer recognition |
| Process coupling | | | | | |
| • Connection to controller | S7-200, S7- 300/400, WinAC, PC (TCP/IP) see Catalog ST 80 | S7-200, S7- 300/400, WinAC, PC (TCP/IP) see Catalog ST 80 | S7-200, S7- 300/400, WinAC, PC (TCP/IP) see Catalog ST 80 | S7-200, S7- 300/400, WinAC, PC (TCP/IP) see Catalog ST 80 | S7-200, S7- 300/400, WinAC, PC (TCP/IP) see Catalog ST 80 |
| Expandability/openness | | | | | |
| • Open Platform Program | No | No | No | No | No |
| **Dimensions** | | | | | |
| Front of enclosure (W x H) | 140 mm x 116 mm | 214 mm x 158 mm | 214 mm x 158 mm | 335 mm x 275 mm | 400 mm x 310 mm |
| Mounting cutout/Device depth (W x H/D) in mm | 123 mm x 99 mm / 40 mm device depth | 197 mm x 141 mm / 44 mm device depth | 197 mm x 141 mm / 44 mm device depth | 310 mm x 248 mm / 60 mm device depth | 367 mm x 289 mm / 60 mm device depth |
| **Dimensions and weight** | | | | | |
| Weight | | | | | |
| • Weight | 0.33 kg | 1.1 kg | 1.1 kg | 2.5 kg | 4.2 kg |

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| Ordering data | | Order No. |
|---|---|---|
| **SIMATIC KTP400 Basic mono PN** | E | **6AV6 647-0AA11-3AX0** |
| **Starter kit for SIMATIC KTP400 Basic mono PN** | A | **6AV6 652-7AA01-3AA0** |
| **SIMATIC KTP600 Basic mono PN** | E | **6AV6 647-0AB11-3AX0** |
| **Starter kit for SIMATIC KTP600 Basic mono PN** | A | **6AV6 652-7BA01-3AA0** |
| **SIMATIC KTP600 Basic color PN** | E | **6AV6 647-0AD11-3AX0** |
| **Starter kit for SIMATIC KTP600 Basic color PN** | A | **6AV6 652-7DA01-3AA0** |
| **SIMATIC KTP1000 Basic color PN** | E | **6AV6 647-0AF11-3AX0** |
| **Starter kit for SIMATIC KTP1000 Basic color PN** | A | **6AV6 652-7FA01-3AA0** |
| **SIMATIC TP1500 Basic color PN** | E | **6AV6 647-0AG11-3AX0** |
| Starter kits consist of:<br>• the relevant SIMATIC KTP Basic Panel<br>• SIMATIC WinCC flexible Compact engineering software<br>• SIMATIC HMI Manual Collection (DVD), 5 languages (English, French, German, Italian, Spanish), comprising: all currently available user manuals, manuals and communication manuals for SIMATIC HMI<br>• Ethernet cable on PN devices<br>• MPI cable on DP devices (for download and test purposes only)<br>• Voucher for Software Update Service for 1 year | | |

A: Subject to export regulations: AL: N and ECCN: 5D992
D: Subject to export regulations: AL: N and ECCN: EAR99S

| | Order No. |
|---|---|
| ***Configuration*** | |
| • all devices: with SIMATIC WinCC flexible Compact | See Catalog ST 80 |
| • PROFINET-based devices: with WinCC Basic V10.5 (part of STEP 7 Basic V10.5) | See Catalog ST 80 |
| ***Documentation (to be ordered separately)*** | |
| You can find the manual for the Basic Panels on the Internet at http://support.automation.siemens.com | |
| **User Manual WinCC flexible Compact/Standard/Advanced** | |
| • German | **6AV6 691-1AB01-3AA0** |
| • English | **6AV6 691-1AB01-3AB0** |
| • French | **6AV6 691-1AB01-3AC0** |
| • Italian | **6AV6 691-1AB01-3AD0** |
| • Spanish | **6AV6 691-1AB01-3AE0** |
| **User Manual WinCC flexible Communication** | |
| • German | **6AV6 691-1CA01-3AA0** |
| • English | **6AV6 691-1CA01-3AB0** |
| • French | **6AV6 691-1CA01-3AC0** |
| • Italian | **6AV6 691-1CA01-3AD0** |
| • Spanish | **6AV6 691-1CA01-3AE0** |
| **SIMATIC HMI Manual Collection** D | **6AV6 691-1SA01-0AX0** |
| **Electronic documentation, on DVD**<br>5 languages (English, French, German, Italian and Spanish); contains: all currently available user manuals, manuals and communication manuals for SIMATIC HMI | |
| ***Accessories*** | |
| **Accessories for supplementary ordering** | See Catalog ST 80 |

E: Subject to export regulations: AL: N and ECCN: EAR99T

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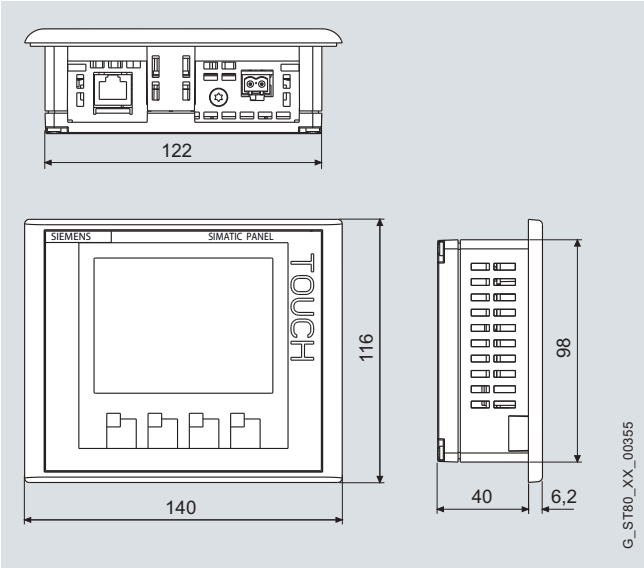
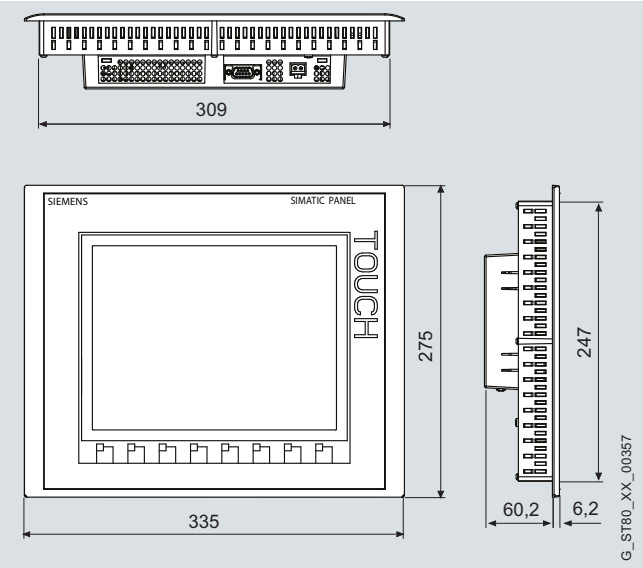
## Dimensional drawings

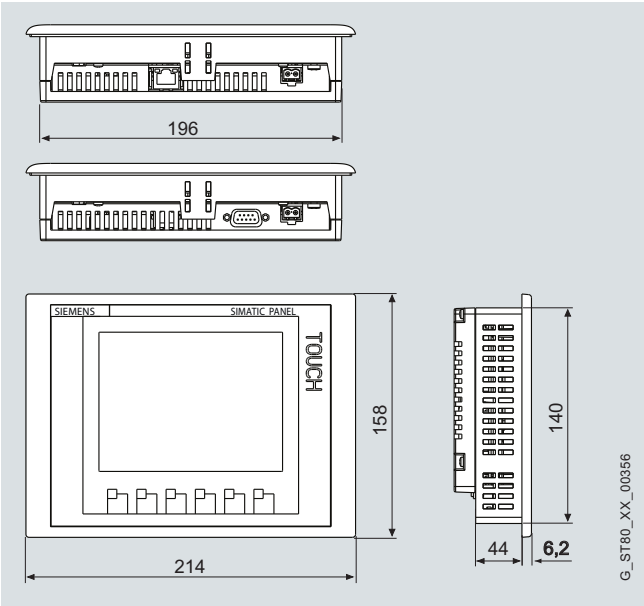
All dimensions in mm.



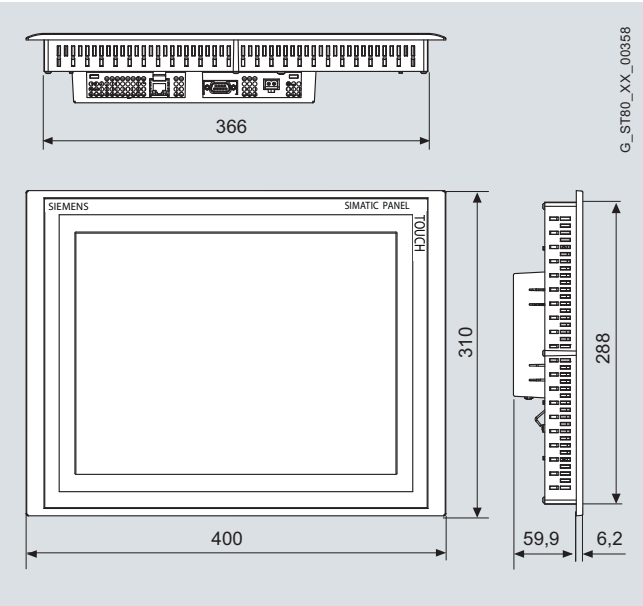

KTP400 Basic




KTP1000 Basic




KTP600 Basic




TP1500 Basic

## More information

Additional information is available in the Internet under:

http://www.siemens.com/panels

Note:

Do you require a specific modification to or supplement for the products described here? Look in the catalog ST 80 under "Customized products". We provide information there about additional and generally available sector products, and about the customer-specific modification and adaptation options.