Instituto Tecnológico de Costa Rica

Carrera de Ingeniería Mecatrónica

Optimización del manejo de energía de los sistemas de bombeo de acueductos por parte de la empresa RQL Ingeniería.

Informe de Proyecto de Graduación para optar por el título de Ingeniero en Mecatrónicacon el grado académico de Licenciatura

Aharon Xavier Moya Chavarría

Cartago, noviembre de 2023

Agradecimientos

Siendo el presente trabajo la culminación de mis estudios académicos para optar por el grado de Licenciado en Ingeniería en Mecatrónica, quiero agradecer a la institución por la alta calidad de sus docentes, cuya experiencia y conocimiento fueron fundamentales para mi formación como profesional. Quiero agradecer a mi familia, por ser las personas que siempre me apoyaron tanto emocional como económicamente para poder llevar a cabo mis estudios. Por último, quiero dar gracias a la empresa RQL Ingeniería por darme la oportunidad de realizar el presente proyecto de graduación, de esta manera pudiendo mostrar el conocimiento que he adquirido es estos cinco años de estudio, y adquiriendo más en áreas que antes eran desconocidas por mi persona.

Aharon Xavier Moya Chavarría

Pérez Zeledón, San José, Costa Rica, 2023

Declaro que el presente Proyecto de Graduación ha sido realizado enteramente por mi persona, utilizando y aplicando literatura referente al tema e introduciendo conocimientos propios.

En los casos en que he utilizado bibliografía, he procedido a indicar las fuentes mediante las respectivas citas bibliográficas.

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Cartago, 07 de Noviembre del 2023

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INSTITUTO TECNOLÓGICO DE COSTA RICA
PROGRAMA DE LICENCIATURA EN INGENIERÍA MECATRÓNICA
PROYECTO FINAL DE GRADUACIÓN ACTA DE APROBACIÓN

El profesor asesor del presente trabajo final de graduación, indica que el documento presentado por el estudiante cumple con las normas establecidas por el programa de Licenciatura en Ingeniería Mecatrónica del Instituto Tecnológico de Costa Rica para ser defendido ante el jurado evaluador, como requisito final para aprobar el curso Proyecto Final de Graduación y optar así por el título de Ingeniero(a) en Mecatrónica, con el grado académico de Licenciatura.

Estudiante: Aharon Xavier Moya Chavarría

Proyecto: Optimización del manejo de energía de los sistemas de bombeo de acueductos por parte de la empresa RQL Ingeniería

Miembros del Jurado

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Cartago, 20 de Noviembre 2023

INSTITUTO TECNOLÓGICO DE COSTA RICA
PROGRAMA DE LICENCIATURA EN INGENIERÍA MECATRÓNICA
PROYECTO FINAL DE GRADUACIÓN ACTA DE APROBACIÓN

Proyecto final de graduación defendido ante el presente jurado evaluador como requisito para optar por el título de Ingeniero(a) en Mecatrónica con el grado académico de Licenciatura, según lo establecido por el programa de Licenciatura en Ingeniería Mecatrónica, del Instituto Tecnológico de Costa Rica.

Estudiante: Aharon Xavier Moya Chavarría

Proyecto: Optimización del manejo de energía de los sistemas de bombeo de acueductos por parte de la empresa RQL Ingeniería

Miembros del Jurado

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Cartago, 20 de Noviembre 2023

Resumen

El presente proyecto final de graduación consiste en el diseño de un sistema que permita a los acueductos el aprovechamiento de la energía solar mediante la implementación de un sistema fotovoltaico, esto con el fin de poder reducir los costos por concepto de cuota eléctrica al momento de utilizar los sistemas de bombeo. Para este fin de dimensiona el sistema basándose en el acueducto de Jacó, tomando en cuenta el entorno y características socioeconómicas presentes. En este proyecto, se parte del desarrollo inicial del sistema de bombeo basándose en las necesidades de la zona, el crecimiento poblacional y la demanda debido a ser una zona turística. La solución diseñada consiste en un sistema de bombeo con la capacidad de operar mediante el uso de energía solar cuando la radiación sea suficiente, y mediante el servicio eléctrico en el tiempo restante. Además, se implementó un sistema de control con el objetivo de detener o activar diversos componentes del sistema de bombeo para poder dar acciones de mantenimiento. Obteniendo mediante las pruebas de validación respectivas que el sistema diseñado cumple con los requerimientos establecidos por el cliente en aspectos tanto energéticos como económicos.

Palabras clave: Bombeo, Control, Eléctrico, Sistema, Solar

Summary

The present final graduation project consists of the design of a system that allows aqueducts to take advantage of solar energy through the implementation of a photovoltaic system, this in order to be able to reduce the costs of the electrical fee when using pumping systems. For this purpose, the system is sized based on the Jacó aqueduct, taking into account the environment and socioeconomic characteristics presented. In this project, the initial development of the pumping system is based on the needs of the area, population growth and demand due to being a tourist area. The designed solution consists of a pumping system with the capacity to operate through the use of solar energy when the radiation is sufficient, and through electrical service in the remaining time. In addition, a control system was implemented with the objective of stopping or activating various components of the pumping system in order to carry out maintenance actions. Obtaining through the respective validation tests that the designed system meets the requirements established by the client in both energy and economic aspects.

Keywords: Control, Electric, Pump, System, Solar

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CENCE	Centro Nacional de Control y Energía
ICE	Instituto Costarricense de Electricidad
AEE	Asociación Empresarial Eólica
INEC	Instituto Nacional de Estadística y Censos
MIDEPLAN	Ministerio de Planificación Nacional y Política Económica
AyA	Instituto Costarricense de Acueductos y Alcantarillados
ARESEP	Autoridad Reguladora de Servicios Públicos

1. Introducción

1.1. Descripción de la empresa

La empresa RQL Ingeniería S.A. es una compañía costarricense fundada en 2013, una de sus actividades principales consiste en la venta de productos técnicos ferreteros, herramientas eléctricas y manuales, iluminación, paneles solares, etc. Sin embargo, también brindan servicios de ingeniería en distintas áreas tales como instalaciones eléctricas industriales y comerciales, y acueductos [1]; siendo importante para el crecimiento y continua mejora del sector industrial en el cantón de Pérez Zeledón y el resto de la zona sur del país. Por su parte, la empresa se encuentra en Daniel Flores, Pérez Zeledón, San José. Ubicada a 700 metros sur del INA.

1.2. Entorno del proyecto

El uso de sistemas de bombeo en los acueductos de Costa Rica se remonta a hace varios años en diversos sectores. El incremento en la población nacional generó la necesidad del aumento del suministro y distribución del agua potable constante en diferentes regiones del país. Los sistemas de bombeo permiten superar muchos obstáculos topográficos, permitiendo que el suministro de agua logre abastecer comunidades que se encuentran a gran altura y zonas de difícil acceso.

Los avances en la tecnología han permitido una optimización en los procesos de bombeo, actualmente existe una gran variedad de controladores que permiten realizar distintas aplicaciones, un mejor tiempo de respuesta, mayor cantidad de entradas y salidas, entre otros factores que permiten mejorar el rendimiento de estos en para las distintas áreas industriales en las cuales se utilizan.

El aumento en la población y el sector turismo conlleva grandes desafíos en esta área que deben ser analizados con el fin de encontrar soluciones y garantizar un servicio eficiente y de calidad. Uno de los grandes desafíos de los acueductos en las zonas costeras se produce con el aumento de la demanda en los meses desde diciembre hasta abril. Además, entre marzo y mayo se consumió 4,6% más energía respecto a los mismos meses en 2020 [2], lo cual muestra una tendencia a aumentar con el tiempo, lo cual puede afectar por la capacidad de la infraestructura eléctrica. Estas situaciones no solo generan un aumento de demanda del suministro de agua potable, sino del suministro eléctrico que provee energía a los sistemas

de bombeo. A continuación, se muestra la producción de energía por fuente desde el 2013 hasta 2021:

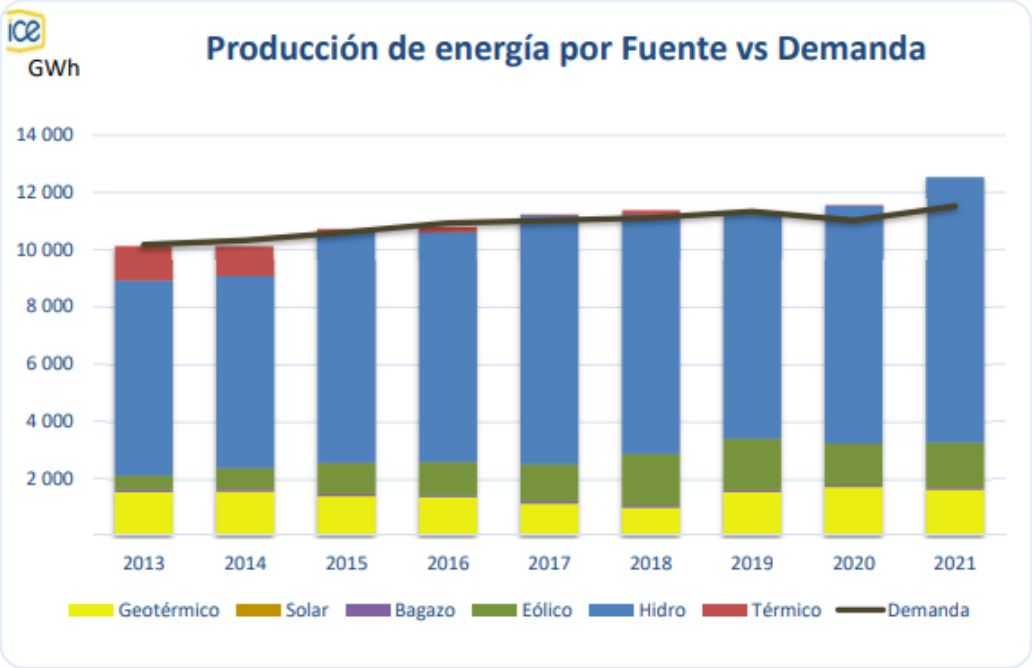


Figura 1.1. Producción de energía por fuente vs demanda desde 2013 hasta 2021 [3].

1.3. Descripción del problema a resolver

De la experiencia laboral de los ingenieros de la empresa en el área de sistemas de bombeo, se conoce que en vacaciones se produce un aumento de la cantidad de personas en las zonas turísticas, lo cual genera un mayor consumo en electricidad por parte de los hoteles, villas o cabinas; produciendo una caída de voltaje de los cables de baja tensión, debido a la poca capacidad de la infraestructura eléctrica. Esta situación, según su severidad, podría producir una disminución en el rendimiento de los sistemas de bombeo, causando que no puedan extraer el agua suficiente para abastecer a todas esas personas.

Según el Banco Central en su informe de Política Monetaria, los ingresos recibidos post pandemia han aumentado respecto a las cifras obtenidas durante la pandemia, pero no han logrado alcanzar el último dato obtenido antes de la pandemia [4]. Se proyecta un aumento de las cifras de turistas en los próximos años, tal como se muestra a continuación:

Figura 1.2. Proyecciones de las cifras de turistas e ingresos por turismo [4].

Como se puede observar en la Figura 1.2, se proyecta un aumento considerable de la cantidad de turistas respecto a los años anteriores, para el 2024 superando la cifra registrada en 2019. Situación la cual podría comprometer la capacidad de la infraestructura eléctrica.

1.4. Síntesis del problema

Existe la necesidad de utilizar una forma de energía alternativa, para lograr bombear una cantidad importante del abastecimiento diario de agua potable en las horas donde hay una caída de la tensión del servicio eléctrico. Para esto, se realizará un sistema que pueda utilizar alguna energía alternativa en el horario y condiciones donde se pueda aprovechar, y se utilizará el servicio eléctrico cuando la alternativa no sea eficiente.

1.5. Objetivos

1.5.1. Objetivo general

Desarrollar un sistema de energía secundario y un sistema de control que permita controlar si la energía a utilizar es la del suministro principal o la del sistema secundario para un sistema de bombeo de un acueducto.

1.5.2. Objetivos específicos

1. Determinar los datos referentes a la forma de operación de sistema, cantidad de litros bombeados y consumo promedio durante el día.
2. Dimensionar las bombas capaces de satisfacer con la demanda de agua.
3. Diseñar un sistema de energía secundario que permita utilizar una energía alternativa para poder reducir el uso del suministro principal de energía.
4. Diseñar un sistema de control que permita cambiar el suministro de energía para aprovechar la energía secundaria cuando la energía principal posee un bajo rendimiento.
5. Formular un plan de mantenimiento para asegurar el funcionamiento correcto del sistema de energía secundario y el sistema de control.
6. Realizar las pruebas de validación respectivas para asegurar el cumplimiento de las especificaciones establecidas.

1.6. Estructura del documento

En el presente proyecto de graduación, se desarrolla una solución mecatrónica ante la problemática descrita referente al desarrollo de un sistema de bombeo que utiliza una forma de alimentación alternativa para contrarrestar la deficiencia energética debido a diversos factores generados por el aumento de la demanda de energía. En el siguiente trabajo divide en los siguientes capítulos: introducción, índice, marco teórico, metodología, propuesta de diseño, resultados y análisis, conclusiones. A continuación, se detalla el contenido de los capítulos:

- En el capítulo 2, se desarrollan los distintos conceptos necesarios para el desarrollo de la solución y el entendimiento de esta.
- En el capítulo 3, se describe el proceso realizado para el diseño del sistema. Para el desarrollo de la solución se utiliza la metodología Ulrich-Eppinger, la cual consiste en distintas etapas a seguir para el desarrollo de productos. Cabe mencionar que este proyecto llega hasta la etapa de pruebas de concepto, sin alcanzar una implementación.
- En el capítulo 4, después de haber filtrado los conceptos generados, se procede a filtrarlos según los criterios considerados más importantes, para posteriormente seleccionar el concepto ganador.
- En el capítulo 5, al concepto ganador le deben realizar las pruebas correspondientes para lograr determinar si la solución diseñada cumple con los requerimientos del cliente previamente establecidos.
- En el capítulo 6, se incluyen las conclusiones obtenidas al culminar el desarrollo del proyecto, abarcando los resultados obtenidos en las pruebas de validación, las dificultades que se presentaron durante la elaboración de la solución, las recomendaciones o aspectos a considerar para futuras mejoras, y el análisis económico respectivo.

2. Marco Teórico

En el presente capítulo se presentan diversos conceptos referentes a dispositivos y elementos importantes a tomar en consideración para el desarrollo del proyecto, incluyendo elementos físicos a incluir en cada subsistema, hasta consideraciones ingenieriles para el uso de algunos de estos dispositivos. Las secciones de este capítulo son las siguientes: inversores, paneles solares, centros de carga, sistemas de protección y PLC.

2.1. Inversores

Un inversor consiste en un dispositivo capaz de transformar la corriente directa a corriente alterna, el principal objetivo de un inversor es la conversión de un voltaje de entrada en corriente directa a un voltaje salida en corriente alterna según las especificaciones de voltaje y frecuencia del usuario [5].

2.1.1. Tipos de inversores

A continuación, se muestra la clasificación para los inversores:

Inversor monofásico: En estos dispositivos, la corriente se transporta mediante una línea. Por lo tanto, estos normalmente poseen una potencia menor. Sin embargo, son menos costosos al requerir menos componentes [6].

Inversor trifásico: En este tipo de inversores, la corriente se transporta mediante tres líneas. Estos dispositivos se utilizan cuando se requieren potencias generalmente superiores a 5kW [6].

Módulo inversor: Estos dispositivos son utilizados para cada uno de los módulos de un sistema fotovoltaico, siendo una solución costosa. Sin embargo, ofrece ventajas como mayor control de cada módulo [6].

Inversor de cadena: Estos son utilizados para sistemas fotovoltaicos cuyos módulos están conectados en serie. Pueden alimentar la potencia en una o tres fases, y producen tanto potencia activa como reactiva [6].

Inversor central: Son utilizados en grandes sistemas fotovoltaicos comerciales. Pueden conmutar más de 12 cuerdas [6].

Inversor híbrido: Combina un inversor fotovoltaico con un inversor de batería, consiguiendo más seguridad en el suministro de energía [6].

Inversor de batería: Generalmente se instalan en sistemas acoplados de CA para poder cargar baterías [6].

2.2. Paneles solares

La energía solar fotovoltaica consiste en una fuente de energía renovable, esta se puede utilizar en la generación de electricidad mediante el uso de paneles solares fotovoltaicos, estos se utilizan para convertir la radiación solar en energía eléctrica, y de ahí se utilizan a múltiples aplicaciones domésticas e industriales. Los paneles solares son los dispositivos que permiten captar la energía solar y convertirla a energía eléctrica mediante el uso de celdas fotovoltaicas. Cabe mencionar que solo cerca del 30% de la energía captada es retenida en cada celda, el otro 70% de la energía es reflejada [7]. Generalmente, estos son orientados al sur con una inclinación de 35 grados para obtener un mayor rendimiento [6]. Según su construcción, los paneles solares pueden ser clasificados en monocristalinos y policristalinos.

2.2.1. Celdas fotovoltaicas

Las celdas fotovoltaicas consisten en dispositivos creados mediante metales sensibles a la luz que desprenden electrones cuando los rayos de luz inciden en ellos, de esta manera se genera la energía eléctrica [7]. Estos están formados por celdas hechas a base de silicio con ciertos aditivos químicos, obteniendo de cada una de las celdas una generación de 2 a 4 A y un voltaje de 0.4 a 0.48 V.

2.2.2. Paneles Monocristalinos

Los paneles monocristalinos están compuestos por celdas de un solo cristal de silicio, lo cual lo hace más eficiente a los paneles policristalinos debido a características como su estructura uniforme y una mejor movilidad de los electrones. Además, tiene una mayor vida útil y posee una mayor resistencia a la sombra y al viento. Estos se utilizan en mayor medida en climas fríos debido a que poseen una mejor absorción de energía y soportan menos el sobrecalentamiento [8]. La eficiencia de cada panel depende en gran medida del fabricante; sin embargo, la eficiencia de los paneles monocristalinos posee un valor entre 15 y 22% [9].

2.2.3. Paneles Policristalinos

Los paneles policristalinos están formados por celdas conformados por varios cristales, lo cual genera una menor eficiencia que en los paneles monocristalinos. Además, posee una menor vida útil, resistencia al viento y la sombra. Sin embargo, posee un menor coste que los paneles monocristalinos y son más utilizados en climas cálidos debido a que soportan más el sobrecalentamiento [8]. La eficiencia de los paneles policristalino posee valores entre 13 y 17% [9].

2.2.4. Inclinación de las placas solares

Al instalar los paneles solares requeridos en un sistema fotovoltaico, se deben tomar en cuenta diversos factores respecto a la zona donde se desea situar el sistema y variables del entorno. Para el cálculo de dicho ángulo, existen diversos métodos matemáticos para obtener el resultado basándose en factores como tipos de radiación, inclinación de la Tierra, factores de conversión de radiación, etc. Estos modelos son los siguientes: Duffie y Beckham, Liu y Jordan, Temps y Coulson, y Klucher. Sin embargo, en ingeniería existen ciertas aproximaciones que permiten un cálculo sencillo de dichos ángulos según la época del año [10]. A continuación, se muestra el cálculo para el ángulo de inclinación para los países que tienen cuatro estaciones:

$$\theta = Latitud\ x\ 0.9 - 23.5\ (Verano) \quad (2.1)$$

$$\theta = Latitud\ x\ 0.9 + 28\ (Invierno) \quad (2.2)$$

$$\theta = Latitud - 2.5\ (Otoño\ y\ primavera) \quad (2.3)$$

Y para los lugares donde solo existen dos estaciones:

$$\theta = Latitud - 15\ (Verano) \quad (2.4)$$

$$\theta = Latitud + 15\ (Invierno) \quad (2.5)$$

Cabe mencionar ciertas consideraciones de diseño al momento de tomar en cuenta el cálculo del ángulo de inclinación. Primeramente, no es recomendable tener un ángulo menor a 15 grados, esto debido a que esto impediría la correcta evacuación del agua sobre las placas, por lo que generaría acumulación de suciedad y daños por retención de agua. Además, a una inclinación mayor a 30 grados se deben tomar en cuenta el efecto del viento en las zonas donde este pueda provocar daños mecánicos en el sistema fotovoltaico [11].

2.3. Energía Eólica

La energía eólica es la energía obtenida del viendo. Consiste en la energía cinética producida por el efecto de las corrientes de aire, para después transformarla a electricidad mediante el uso de un generador. Es un tipo de energía renovables, que no contamina y reemplaza la energía producida mediante los combustibles fósiles. Los mayores productores a nivel mundial son Estados Unidos, China, India y España. Según indica la Asociación Empresarial Eólica, en España cerca del 22.2% de los hogares son abastecidos con este tipo de energía [12].

2.3.1. Funcionamiento

La energía eólica se obtiene del movimiento giratorio de un aerogenerador eléctrico, este es movido mediante una turbina que es accionada por el viento. El aerogenerador está conformador por una torre, un sistema de orientación localizado en el final de la torre, un armario de acoplamiento a la red eléctrica, la armazón de los componentes mecánicos del molino, un eje y rotor del aerogenerador, un freno, un multiplicador, el generador, y un sistema de regulación de energía [13]. A continuación, se describen los conceptos más relevantes:

- Sistema de orientación: También conocido como góndola, este se ubica en la parte superior de la torre, y contiene la mayor parte de elementos esenciales del aerogenerador. Su función es asegurar que el rotor del aerogenerador esté alineado con la dirección del viento para optimizar la obtención de energía eólica.
- Armario de acoplamiento a la red eléctrica: Se encarga de conectar el aerogenerador a la red eléctrica para poder transmitir la energía generada. Incluye los respectivos sistemas de control y conversión de energía.
- Armazón de los componentes mecánicos: Consiste en una estructura que se encarga de proteger los componentes mecánicos internos del aerogenerador.
- Eje y rotor del aerogenerador: El eje es una estructura que conecta el rotor al generador. El rotor, está compuesto por las palas del aerogenerador que captan el viento y transmiten la energía.
- Freno: El freno es el componente utilizado para detener el movimiento de las aspas en caso de emergencia o de requerir realizar acciones de mantenimiento.

- Multiplicador: El multiplicador es un conjunto de engranajes que aumenta la velocidad de rotación del rotor para que el generador pueda producir electricidad a la velocidad óptima.
- Regulación de energía: Supervisa y regula la cantidad de energía que es generada y transferida a la red eléctrica. Mantiene una producción constante y evita daños debido a condiciones climáticas variantes.

2.4. Energía Hidroeléctrica

La energía hidroeléctrica es la que se genera al transformar la energía potencial existente entre dos cuerpos de agua y convertirla en energía eléctrica. Esto se genera mediante el aprovechamiento de la diferencia de altura entre las dos masas de agua. Para este fin se utilizan infraestructuras con capacidad de extraer el máximo potencial de este recurso [14].

2.4.1. Funcionamiento

Las centrales hidroeléctricas tienen como objetivo convertir la diferencia de energía potencial en determinada masa de agua en energía eléctrica. Para este objetivo, dicha central cuenta con distintos elementos cuyas funciones permite un funcionamiento óptimo y continuo. A continuación, se muestran los elementos involucrados en el funcionamiento de una central hidroeléctrica:

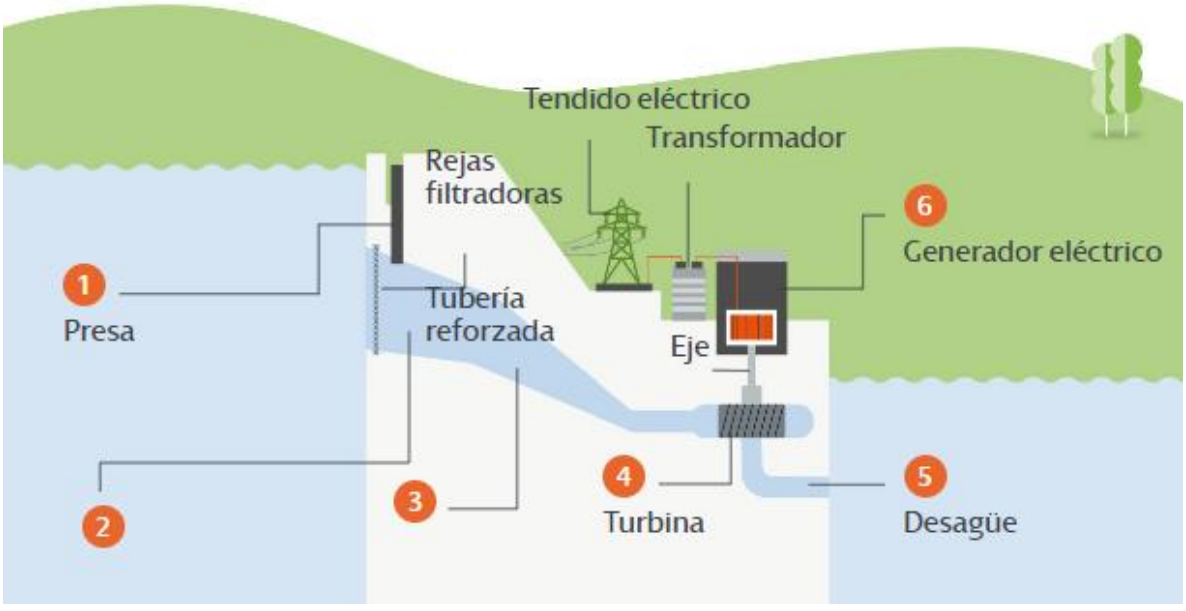


Figura 2.1. Elementos de una central hidroeléctrica [14]

En la Figura 2.1, se observan los distintos elementos involucrados en el funcionamiento de una central hidroeléctrica. A continuación, se describen los principales elementos:

- Tubería reforzada: Esta tubería posee una sección de mayor para obtener el agua del primer cuerpo de agua, reduciendo el diámetro del tubo al acercarse a la turbina para aumentar la presión. Por lo tanto, dicho tubo es capaz de soportar la alta presión generada [14].
- Rejas filtradoras: Son estructuras utilizadas en los sistemas de tratamientos de agua para eliminar partículas grandes y sólidos suspendidos del flujo de agua.
- Turbina: Las turbinas son dispositivos rotativos capaces de convertir la energía de un fluido en energía mecánica, este funcionamiento surge mediante el movimiento de unas aspas mediante la fuerza del agua.

2.5. Energía Combustión Interna

La energía de combustión interna es la producida mediante un motor de combustión interna, generando energía mecánica que seguidamente puede ser utilizada mediante un generador para obtener energía eléctrica [15]. Un motor de combustión interna consiste en un tipo de motor térmico que obtiene la energía mediante el proceso de ignición del combustible, este proceso transforma la energía química del combustible en energía mecánica. Existen distintos tipos de fluidos utilizados en dicho funcionamiento, los principales utilizados en transporte son: gasolina, diésel, GLP o GNC.

2.6. Bombas centrífugas

Las bombas centrífugas son un tipo de bomba hidráulica que transforma la energía mecánica en energía cinética a un fluido. Estas bombas aumentan la velocidad del fluido para que se desplacen grandes distancias [16]. Debido a sus características, consisten en las bombas hidráulicas más utilizadas en la industria para sistemas de bombeo. A continuación, se muestran diversas ventajas de las bombas centrífugas:

- No tienen órganos articulados.
- Posee un acoplamiento sencillo (generalmente motor tipo JP)
- Peso ligero y tamaño reducido
- Mantenimiento reducido

- Coste ajustado

A continuación, se muestra una bomba centrífuga:

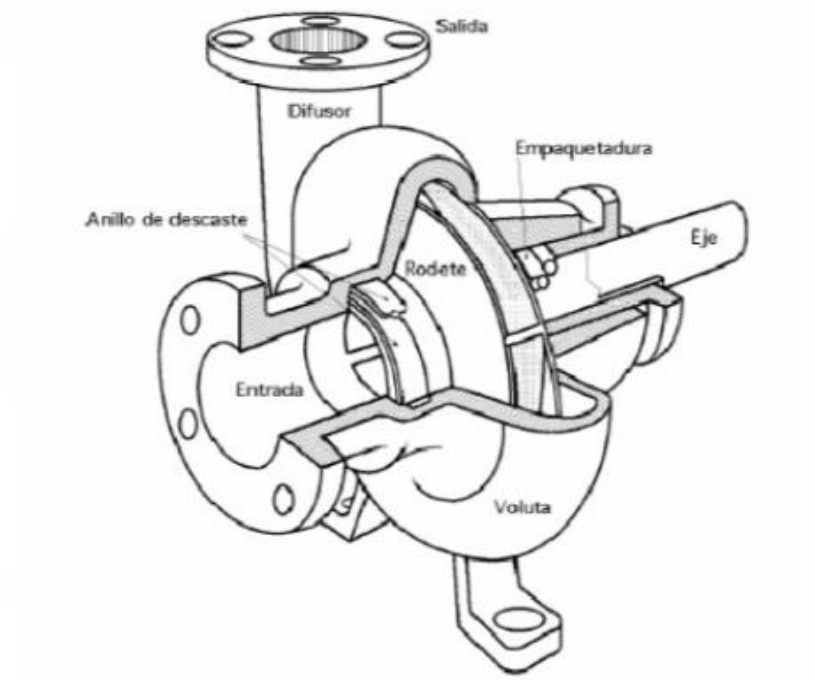


Figura 2.2. Bomba centrífuga [16]

La bomba centrífuga debe ser acoplada a un motor capaz de hacer girar el eje que acciona el impulsor, el cual va a permitir el desplazamiento de la cantidad de agua deseada.

2.7. Centros de Carga

Los centros de carga consisten en dispositivos utilizados para proteger y separar los circuitos que alimentan las instalaciones eléctricas [17]. Su estructura se basa en un tablero metálico que almacena una determinada cantidad de pastillas termomagnéticas, las cuales son alimentadas mediante barras de cobre ubicadas en el interior del centro de carga. Estos equipos son utilizados en instalaciones de tipo doméstico, comercial, industrial, etc. El centro de carga es alimentado por medio de un interruptor principal capaz de cortar todo el suministro de energía en caso de ser necesario. Las pastillas electromagnéticas son utilizadas para alimentar circuitos en específico, tales como iluminación, tomacorrientes, etc. A continuación, se muestra un ejemplo de centro de carga:

Figura 2.3. Tablero de centro de carga [18]

En la Figura 2.3, se logra apreciar cada una de las pastillas termomagnéticas, las cuales se utilizan en cada uno de los circuitos separados. Además, existen dos tipos según número de fases: monofásicos y trifásicos.

2.8. Sistemas de protección

2.8.1. Supresor de picos

Consiste en un dispositivo que desvía la energía de eventos transitorios, reduciendo en parte la sobretensión y enviándola a tierra, con el fin de que la energía en exceso no dañe los dispositivos conectados a la corriente o afecte su funcionamiento. Las sobrecargas se pueden producir por factores ambientales, como las tormentas eléctricas, y por fallas en el servicio eléctrico, por lo tanto, estos dispositivos indispensables en actividades industriales [19].

2.8.2. Pastillas termomagnéticas

Las pastillas termomagnéticas, interruptores termomagnéticos o breakers son elementos utilizados en la seguridad de las instalaciones eléctricas [20]. Estos combinan los efectos del magnetismo y el calor para generar el desacople al existir un cortocircuito. A continuación, se muestra un diagrama de interruptor electromagnético:

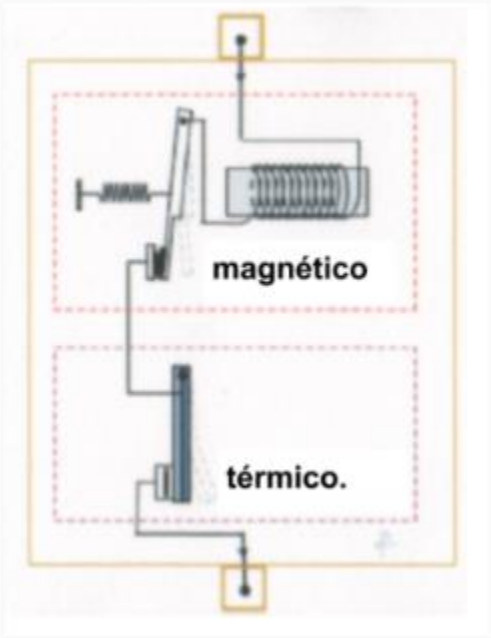


Figura 2.4. Diagrama de interruptor electromagnético [20]

En la Figura 2.4, se muestra como dentro del circuito se tienen dos elementos en serie que se disparan cuando suceda alguna de las dos condiciones (sobrecarga o sobrecalentamiento). Estos se caracterizan según su amperaje máximo (Amperios) y curvas de corte (B, C, D, MA y Z).

Curvas de corte

Curva B: Utilizados en protección de conductores. Actúan por efecto térmico entre 1.1 y 1.4 veces la intensidad nominal y magnético entre 3 y 5 veces la intensidad nominal [20].

Curva C: Utilizados en instalaciones domésticas. Actúan por efecto térmico entre 1.13 y 1.44 veces la intensidad nominal y magnético entre 5 y 10 veces la intensidad nominal [20].

Curva D: Utilizados en actividades industriales donde existen picos de corriente o arranques con corriente elevada. Actúan por efecto térmico entre 1.1 y 1.4 veces la intensidad nominal y por efecto magnético entre 10 y 14 veces la intensidad nominal [20].

Curva MA: No poseen protección térmica. Por efecto magnético actúa con corriente mayores a 12 veces la intensidad nominal [20].

Curva Z: Utilizados en receptores electrónicos. Actúan por efecto térmico entre 1.1 y 1.4 veces la intensidad nominal y por efecto magnético entre 2.4 y 3.6 veces la intensidad nominal [20].

2.9. PLC

Un Controlador Lógico Programable (PLC) consiste en un equipo utilizado en industrias que buscan la automatización de sus procesos. Estos dispositivos consisten en una computadora industrial que permite que las máquinas realicen las funciones asociadas a los sistemas que la componen [21].

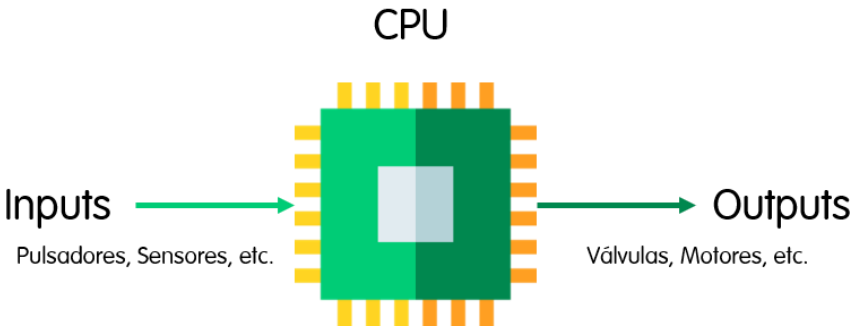


Figura 2.5. Funcionamiento general de un PLC [22]

Esto se realiza mediante un control adecuado de las entradas y salidas, para aplicar la lógica deseada se utiliza un lenguaje de programación compatibles, esto mediante una interfaz que facilita la comunicación con el usuario, y permitiendo un proceso continuo [21].

2.9.1. Funcionamiento

La funcionabilidad de los PLC se basa en procesos periódicos y sucesivos [21]. Entre los procesos principales de su funcionamiento se encuentran los siguientes:

- Autodiagnóstico: El dispositivo revisa los circuitos, en caso de que exista algún inconveniente, se advierte mediante el uso de una señal.
- Lectura de entradas y grabación: Cada uno de los valores de entrada es evaluado y estos son grabados en memoria.
- Lectura y realización del programa: Se utilizan los valores grabados para realizar el programa instruido por el usuario.
- Registro y actualización de salidas: Después de correr el programa, los valores obtenidos se colocan en las salidas.

2.9.2. Tipos de PLC

Existen dos tipos de PLC utilizados a nivel industrial, compacto y modular:

- Compacto: Un PLC compacto consiste en una sola unidad que no requiere de módulos adicionales de entradas, salidas o fuentes de alimentación [22]. A continuación, se muestra un ejemplo de PLC compacto:

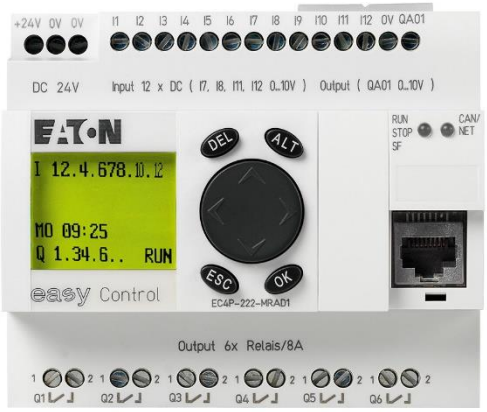


Figura 2.6. PLC Eaton easyControl EC4P [23]

En la Figura 2.6 se puede observar un modelo compacto de la marca Eaton, este posee canales analógicos y digitales, una pantalla integrada, y es muy utilizado en procesos automatizados de bajo costo [23].

- Modular: Este PLC está compuesto por un conjunto de elementos separados: CPU, fuente de alimentación, módulo de entradas y módulo de salidas [22]. A continuación, se muestra un ejemplo de PLC modular:

Figura 2.7. PLC Siemens S7-1200 [24]

En la Figura 2.7, se muestra el modelo S7-1200 de la empresa Siemens, este consiste en un PLC modular utilizado en múltiples actividades automáticas de amplia escala. Aunque este posea una cantidad determinada de entradas y salidas, los módulos de entradas y salidas permiten aumentar esta cantidad en gran medida, permitiendo automatizar procesos de mayor complejidad [24].

2.10. Transformadores

Los transformadores son dispositivos con dos devanados de corriente alterna arrollados sobre un núcleo magnético. El devanado por donde ingresa la energía al transformador se denomina primario y el devanado por donde sale energía se denomina secundario [25]. El funcionamiento de los transformadores se debe a la Ley de Faraday:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P} \quad (2.6)$$

Donde N_S es el número de vueltas del devanado secundario, N_P es el número de vueltas del devanado primario, V_S es el voltaje del devanado secundario y V_P es el voltaje del devanado primario. Esta ley parte de la conservación de la energía, donde la corriente del devanado primario genera un flujo magnético que se transmite por el material del núcleo, y al pasar por el devanado secundario induce un voltaje en el otro devanado [26].

2.10.1. Tipos de transformadores

Los transformadores se pueden separar en distintas categorías según su estructura y funcionamiento. En el mercado, se encuentran los siguientes tipos: en aceite mineral, pedestal, secos y en aceite vegetal.

En aceite mineral: Los transformadores en aceite mineral tienen su circuito magnético y devanados sumergidos en aceite mineral. Dicho aceite proviene de semillas agrícolas y no contiene petroquímicos, siloxanos y halógenos.

Ventajas:

- Alta temperatura de ignición
- Alta conductividad térmica
- Temperatura estable

Desventaja:

- Debe disponer de un colector, incrementa el coste.

- Riesgo de fuego.
- Requiere controles de aceite.

En aceite vegetal: Los transformadores en aceite vegetal tienen su circuito magnético y devanados sumergidos en aceite vegetal. Dicho aceite debe ser de baja viscosidad, tener rigidez dieléctrica, y bajo punto de fusión.

Ventajas:

- Instalación en el exterior si se desea.
- Mayor control sobre el funcionamiento.
- Menor nivel de ruido.
- Menor contaminación ambiental

Desventaja:

- Alto costo en comparación con el aceite mineral
- Inestabilidad en la transferencia de calor
- Requiere controles de aceite.

Pedestal: Estos transformadores se colocan en un armario, dando protección contra algunas condiciones climáticas y peligros exteriores. Son muy utilizados en la industria y en aplicaciones a menor escala.

Ventajas:

- Mayor seguridad
- Mantenimiento menor por contaminación
- Mayor protección de elementos eléctricos
- Desconexión más rápida

Desventaja:

- Contaminación acústica
- Mayor tiempo de instalación
- Tiempo de corte de energía mayor

Secos: Estos transformadores no utilizan aceite u otros líquidos dieléctricos para enfriamiento, en su lugar utiliza materiales como resina epoxi o cerámica para disipación de calor y aislamiento de las bobinas.

Ventajas:

- Menor riesgo de incendio

- No posee materiales inflamables
- Menor mantenimiento
- Menor contaminación ambiental

Desventaja:

- Costo inicial mayor
- Menor capacidad de sobrecarga
- Gran tamaño y peso

3. Marco metodológico

3.1. Reconocimiento y definición del problema

Para desarrollar el proyecto es fundamental reconocer el problema al cual nos enfrentamos, con el fin de planear una adecuada estrategia para la solución correspondiente. Por lo tanto, en este trabajo se comenzó por identificar los objetivos o alcances que se desean en el sistema de bombeo. Es decir, cuánto porcentaje del agua requerida se desea que sea bombeado con energía renovable, qué indicadores son importantes de tomar en consideración para lograr el objetivo, el presupuesto de la institución, etc.

El proceso de definición del problema se realizó mediante reuniones con el asesor de la empresa, esto debido a la experiencia de la empresa en trabajos relacionados a sistemas de bombeo en acueductos en la zona sur del país. De esta manera, se analizaron posibles soluciones y se identificó la oportunidad de realizar un proyecto que englobara varios de los conocimientos del área mecatrónica.

Se conversó con el asesor el funcionamiento del sistema de bombeo de un acueducto, los factores que pueden ser determinantes y formas de abarcar el problema. De esta manera, se procede a definir la problemática existente.

Es importante destacar que el desarrollo del presente proyecto, se enfoca únicamente en el diseño del sistema de bombeo, se suponen condiciones óptimas relacionadas al espacio disponible y suministro de agua del acueducto. Además, la implementación de un sistema de energía secundario, tiene el fin de satisfacer la demanda energética un porcentaje del tiempo operado. Por lo tanto, no requiere tener un excedente de energía, en ese caso no se toma en cuenta el uso de algún sistema de almacenamiento para la energía generada.

3.2. Establecimiento de requerimientos

En las reuniones con el asesor empresarial se abarcaron diversos temas respecto al desarrollo del proyecto, tales como alcances del proyecto y factores a tomar en cuenta. Finalmente, se obtuvieron los siguientes requerimientos:

- Recuperar la inversión en un plazo menor a los 15 años.
- La energía utilizada para bombear el agua debe ser al menos un 50% energía solar en condiciones óptimas.
- La solución diseñada debe ser escalable.

- En caso de requerir mantenimiento el sistema solar, el sistema de bombeo utiliza la energía del servicio eléctrico.

3.3. Obtención y análisis de la información

Antes de proceder a realizar la selección de los componentes necesarios para diseñar el sistema de bombeo, se deben conocer algunos valores importantes tales como: población de la zona, pronóstico del aumento de pobladores de la zona y demanda de agua por parte de los pobladores, estos datos permiten poder dimensionar la capacidad requerida por parte de los elementos del sistema.

3.3.1. Población de la zona

Uno de los sectores más afectados a lo largo de la historia por el desarrollo de la actividad turística ha sido Jacó, abastecido por la ASADA de Herradura. Según los datos obtenidos del Instituto Nacional de Estadística y Censos, la población total de Jacó es 18144 [27].

3.3.2. Pronóstico de aumento de pobladores de la zona

Según un estudio realizado por el Ministerio de Planificación y Política Económica, al analizar varios indicadores tales como esperanza de vida, esperanza de vida al nacer, tasa de natalidad y tasa de mortalidad. Se puede realizar una proyección de la población de Costa Rica, estaría aumentando a 5.9 millones de personas para el 2040 [28].
Se conoce que todos los distritos no van a tener exactamente el mismo crecimiento. Sin embargo, se puede realizar una aproximación calculando la futura población de cada cantón proporcionalmente al aumento poblacional total.

$$Población_{Jacó\ 2040} = \frac{Población_{CR\ 2040} * Población_{Jacó\ 2021}}{Población_{CR2021}} \quad (3.1)$$

Conociendo que la población de Costa Rica, según el último censo registrado en 2021, es de 5.154 millones de personas [27], se estima que la población de Jacó para el 2040 sea de 20770 personas.

3.3.3. Demanda de agua

Según los datos del Instituto Costarricense de Acueductos y Alcantarillados (AyA), el consumo de agua promedio de una persona en Costa Rica es de 180 litros diarios [29].

De esta manera, se puede estimar que, si se mantiene el consumo de agua diario por persona, para el 2040 el consumo total en Jacó será de 3 738 636 litros diarios.

3.4. Establecimiento de requerimientos

A partir de las conversaciones con el asesor, técnicos e ingenieros de la empresa RQL, se ha determinado una serie de requerimientos que el sistema de bombeo debe satisfaces. Además, estos requerimientos establecen una base para la determinación de los parámetros para el diseño del equipo y determinar cuáles se requieren mejorar. En la Tabla 4.1 se establecen las especificaciones del sistema:

Tabla 3.1

Requerimientos del sistema a diseñar

No.	Requerimiento	Valor	Unidades
1	Capacidad bombeada diariamente	>3 738 636	litros
2	El controlador permite agregar módulos de entradas y salidas	Verdadero	Binario
3	Tiempo para recuperar la inversión	<15	años
4	Porcentaje de agua bombeada mediante el sistema de energía secundario	>50	%
5	Cumplir con la normativa para la implementación de sistemas fotovoltaicos en Costa Rica	Verdadero	Binario
6	Paneles totales	<70	Número

3.5. Descomposición funcional del problema

Antes de analizar posibles soluciones a la problemática, se debe realizar una descomposición del sistema general en subsistemas para poder buscar soluciones a cada uno individualmente, y de esta manera reducir la complejidad del proceso de solución. A continuación, se muestra la descomposición funcional del problema:

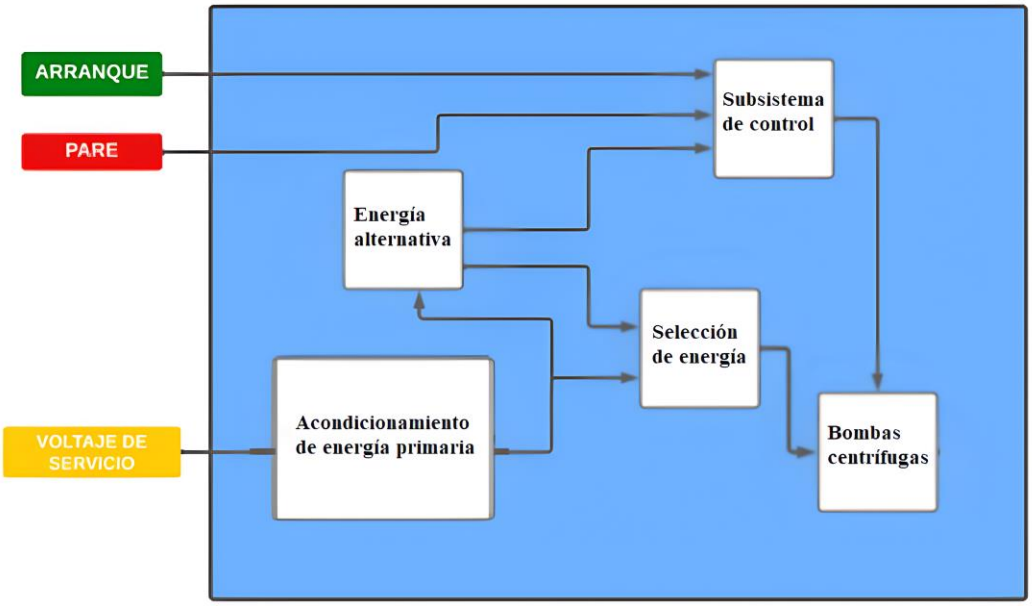


Figura 3.1. Descomposición funcional del problema [Elaboración propia]

De la Figura 3.1, se observa que se descompone la problemática en cinco subsistemas: CCM, selección de energía, subsistema de control, subsistema de energía secundario y subsistema de energía primaria.

3.6. Evaluación de alternativas y síntesis de la solución

Seguidamente, se procede a realizar la selección de los dispositivos requeridos en los subsistemas mencionados anteriormente, esto según las métricas establecidas que se consideren primordiales para la selección adecuada de cada elemento. Para este fin, se utilizaron los filtros de selección de conceptos según la metodología Ulrich-Eppinger [30], donde inicialmente se utiliza un cantidato de referencia al cual se le asignan las calificaciones medias, y se procede a comparar los otros candidatos. Para el primer filtro, se utiliza el 0 para referirse al valor neutro, si otro candidato es mejor en ese criterio se le asigna un "+", y si es peor se le asigna un "- ". Finalmente se suman la cantidad de "+", 0 y "- ", donde cada "+" equivale a un uno y un "–"equivale a un menos uno. Seguidamente, se procede a descartar el cantidato con peor calificación. Para el segundo filtro, a cada uno de los criterios se le asigna un peso según la importancia de este, para este filtro se le va a asignar un valor entre 1 y 5 a cada cantidato para cada criterio. Al candidato referencia se le asigna el valor de 3 para cada

criterio. Los valores asignados se multiplican por el peso del respectivo criterio, y los valores obtenidos se suman para obtener la calificación final.

3.6.1. Selección de bombas hidráulicas

Para la selección de las bombas hidráulicas, se tomó en cuenta la cantidad de litros consumidos diariamente calculados para la zona de Jacó, donde se estimó una cantidad total de 3 738 636 litros diarios. Esto debido a que uno de los factores a tomar en cuenta en la selección de bombas es los litros por minuto. De esta manera, para la selección se consideraron los siguientes factores: caudal máximo, potencia para bombear 600 GPM y precio. Para este propósito, se utilizaron bombas hidráulicas de la marca Franklin Electric debido a la experiencia de la empresa en la implementación de estas, y la diversidad de modelos en distintas aplicaciones tanto industriales como domésticas. Investigando los modelos que se encuentran en el mercado, se encontraron cuatro modelos cuyas características los hacen posibles candidatos a tomar en cuenta para el diseño. A continuación, se muestra el primer filtro aplicado para la selección de los candidatos más apropiados:

Tabla 3.2

Primer filtro de selección de bombas centrífugas

	Conceptos			
Criterios de selección	**A** **15BD3**	**B** **7XS439**	**C** **40HC4X310**	**D** **A346NM-20D2P3**
Caudal máximo	0	0	0	+
Potencia para bombear 600 GPM	0	+	-	0
Precio	0	0	-	-
Suma +	0	1	0	1
Suma 0	3	2	1	1
Suma -	0	0	2	1
Evaluación Neta	0	1	-1	0
Posición	2	1	4	3
¿Continuar?	Sí	Sí	No	Sí

Al haber aplicado el filtro anterior, se descarta el candidato C, de este modo se procede a aplicar un filtro adicional, tomando en cuenta un peso para cada criterio, con el fin de obtener el candidato final.

Tabla 3.3

Segundo filtro de selección de bombas centrífugas

	Conceptos						
		A 15BD3 (Referencia)		**B 7XS439**		**D A346NM-20D2P3**	
Criterios de selección	**Peso (%)**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**
Caudal máximo	25	3	0.75	3	0.75	4	1
Potencia para bombear 600 GPM	50	3	1.5	5	2.5	3	1.5
Precio	25	3	0.75	3	0.75	2	0.5
Total			3		4		3
Posición		2		1		3	
¿Continuar?		No		Desarrollar		No	

Es importante nombrar que el criterio más importante y de mayor peso es la potencia para bombear 600 l/min, debido a que, a mayor potencia requerida, aumenta la complejidad del subsistema de energía secundario, ya que debe satisfacer una mayor demanda de energía.

3.6.2. Selección de la fuente de energía

En este subsistema se requiere un dispositivo capaz de utilizar la fuente de energía alternativa, y cuando haya un problema con esta red, utilizar la energía del servicio eléctrico. Para este fin, se propusieron tres candidatos:

- Candidato 1: Se utiliza un sistema de alimentación ininterrumpida (UPS), mediante el uso de baterías que se encuentran cargadas mediante el sistema de energía primario, entonces cuando el subsistema de energía alternativa no puede satisfacer la demanda de energía, se va a utilizar la energía almacenada en las baterías.
- Candidato 2: Se utilizan dos contactores que van a permitir el acople y desacople de cada subsistema de energía, esto mediante una señal proveniente de un controlador.
- Candidato 3: Se utiliza un interruptor de transferencia automático (ATS), este permite la conexión de dos fuentes de energía y operar en dos modos: manual y automático. En modo automático cuando la primera fuente de energía no satisface la demanda, se cambia a la segunda fuente [25].

Para la selección se tomaron en cuenta los siguientes criterios: complejidad, costo, tiempo de conmutación y capacidad energética. Cabe mencionar que el criterio de complejidad hace referencia a la cantidad de elementos involucrados y conocimiento técnico requerido para implementarse. A continuación, se aplica el primer filtro para elegir a los candidatos que más se ajusten a los criterios:

Tabla 3.4

Primer filtro de selección de subsistema de selección de energía

	Conceptos		
Criterios de selección	**Candidato 1 (Referencia)**	**Candidato 2**	**Candidato 3**
Complejidad	0	-	+
Costo	0	-	0
Tiempo de conmutación	0	0	0
Capacidad energética	0	+	+

Suma +	0	1	2
Suma 0	4	1	2
Suma -	0	2	0
Evaluación Neta	0	-1	2
Posición	2	3	1
¿Continuar?	Sí	No	Sí

Seguidamente, se aplica el filtro final para obtener el candidato óptimo para incorporar en la solución:

Tabla 3.5

Segundo filtro de selección de subsistema de selección de energía

		Conceptos			
		Candidato 1 (Referencia)		**Candidato 3**	
Criterios de selección	**Peso (%)**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**
Complejidad	25	3	0.75	5	1.25
Costo	20	3	0.6	4	0.8
Tiempo de conmutación	20	3	0.6	3	0.6
Capacidad energética	35	3	1.05	4	1.4
Total			3		4.05
Posición		2		1	
¿Continuar?		No		Desarrollar	

Por lo tanto, se decide utilizar un interruptor de transferencia automático para la selección de la fuente de energía a utilizar en las bombas centrífugas.

3.6.3. Selección de subsistema de energía alternativa

Para el subsistema de energía alternativa se consideraron varios conceptos capaces de brindar energía suficiente para permitir el funcionamiento de las bombas centrífugas, los candidatos propuestos son los siguientes: energía hidroeléctrica, energía solar, energía eólica y generador de combustión interna. Para la selección se tomaron en cuenta los siguientes criterios: energía producida, costo, complejidad y escalabilidad. A continuación, se aplica el primer filtro de selección para descartar los candidatos menos indicados acorde con los criterios utilizados:

Tabla 3.6

Primer filtro de selección de subsistema de energía alternativa

	Conceptos			
Criterios de selección	**Energía hidroeléctrica (Referencia)**	**Energía solar**	**Energía eólica**	**Generador de combustión interna**
Energía producida	0	0	-	-
Costo	0	0	-	0
Complejidad	0	+	-	0
Escalabilidad	0	+	+	+
Suma +	0	2	1	1
Suma 0	4	0	0	2
Suma -	0	0	2	1
Evaluación Neta	0	2	-1	0
Posición	2	3	1	
¿Continuar?	Sí	Sí	No	Sí

Se descarta la opción de la energía eólica principalmente por la alta complejidad de su implementación al analizar la zona geográfica, y los costos involucrados en la inversión inicial. A continuación, se aplica el segundo filtro para obtener el candidato final:

Tabla 3.7

Segundo filtro de selección de subsistema de energía alternativa

		Conceptos					
		Energía hidroeléctrica (Referencia)		**Energía solar**		**Generador de combustión interna**	
Criterios de selección	**Peso (%)**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**
Energía producida	25	3	0.75	4	1	4	1
Costo	25	3	0.75	4	1	2	0.5
Complejidad	20	3	0.6	3	0.6	2	0.4
Escalabilidad	30	3	0.9	5	1.5	3	0.9
Total			3		4.1		2.8
Posición		2		1		3	
¿Continuar?		No		Desarrollar		No	

Por lo tanto, se elige diseñar un sistema fotovoltaico para brindar energía, para esta decisión también se tomó en cuenta la disponibilidad de la empresa, la experiencia en el desarrollo de este tipo de sistemas, y el entorno en que se va a desarrollar el proyecto.

3.6.4. Selección de subsistema de acondicionamiento de energía primaria

Para este subsistema se requiere de un transformador que sea capaz de convertir el voltaje de 13.8kV a 480V que es el requerido por las bombas. Para esto, se consultaron los tipos de transformadores que se encuentran disponibles en el mercado obteniendo los siguientes candidatos: secos, en aceite mineral, en aceite vegetal y pedestal [32]. Los criterios a tomar en cuenta en la selección son los siguientes: vida útil, riesgo de incendio, mantenimiento y el espacio. A continuación, se aplica el primer filtro para seleccionar los candidatos más cercanos a las características deseadas:

Tabla 3.8

Primer filtro de selección de subsistema de acondicionamiento de energía primaria

	Conceptos			
Criterios de selección	**Secos (Referencia)**	**Aceite mineral**	**Aceite vegetal**	**Pedestal**
Vida útil	0	0	0	-
Riesgo de incendio	0	0	-	-
Mantenimiento	0	-	0	-
Espacio	0	0	0	-
Suma +	0	0	0	0
Suma 0	4	3	3	0
Suma -	0	1	1	4
Evaluación Neta	0	-1	-1	-4
Posición	1	2	3	
¿Continuar?	Sí	Sí	Sí	No

De esta manera, se procede a aplicar el segundo filtro para poder obtener el candidato final para el transformador a implementar:

Tabla 3.9

Segundo filtro de selección de subsistema de acondicionamiento de energía primaria

		Conceptos					
		Secos (Referencia)		**Aceite mineral**		**Aceite vegetal**	
Criterios de selección	**Peso (%)**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**
Vida útil	20	3	0.6	4	0.8	3	0.6
Riesgo de incendio	25	3	0.75	2	0.5	2	0.5
Mantenimiento	30	3	0.9	2	0.6	2	0.6
Espacio	25	3	0.75	3	0.75	3	0.75
Total			3		2.65		2.45
Posición		1		2		3	
¿Continuar?		Desarrollar		No		No	

Por lo tanto, se decide implementar el uso de un transformador seco para convertir el voltaje de 13.8kV a 480V.

3.6.5. Selección de subsistema de control

Para este subsistema se consideraron los controladores que se encuentran disponibles en el mercado, haciendo énfasis en los utilizados en la empresa para diversos proyectos, ya que se obtiene una mayor información debido a la experiencia. Los candidatos a elegir son los siguientes: Siemens LOGO!, Siemens S7-1200, Siemens S7-1500 y Siemens S7-300. Los criterios a tomar en cuenta para seleccionar el candidato final son el costo, escalabilidad, rendimiento y vida útil. A continuación, se muestra el primer filtro aplicado:

Tabla 3.10

Primer filtro de selección de subsistema de control

	Conceptos			
Criterios de selección	**LOGO! (Referencia)**	**S7-1200**	**S7-1500**	**S7-300**
Costo	0	0	-	-
Escalabilidad	0	+	+	+
Rendimiento	0	+	+	+
Vida útil	0	0	+	+
Suma +	0	2	3	3
Suma 0	4	2	0	0
Suma -	0	0	1	1
Evaluación Neta	0	2	2	2
Posición	4	1	2	3
¿Continuar?	No	Sí	Sí	Sí

Habiendo descartado el PLC Siemens LOGO!, se procede a realizar el filtro final para obtener el candidato final a elegir.

Tabla 3.11

Segundo filtro de selección de subsistema de control

		Conceptos					
		S7-1200 (Referencia)		**S7-1500**		**S7-300**	
Criterios de selección	**Peso (%)**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**	**Calificación**	**Evaluación**
Costo	35	3	1.05	2	0.7	1	0.35

Escalabilidad	25	3	0.75	3	0.75	4	1
Rendimiento	20	3	0.6	3	0.6	4	0.8
Vida útil	20	3	0.6	4	0.8	4	0.8
Total			3		2.85		2.95
Posición		1		3		2	
¿Continuar?		Desarrollar		No		No	

De esta manera, se decide utilizar el PLC Siemens S7-1200 para poder implementar el control del sistema de bombeo.

3.7. Desarrollo de la solución

Al elegir el mejor candidato según los criterios establecidos, se procede a realizar el diseño, diagramas y planos requeridos en la parte de potencia, control y automatización. Además, se realiza la programación de la lógica que se desea implementar, en el software correspondiente al controlador seleccionado en la etapa anterior.

3.8. Evaluación de la solución

En esta etapa se realizan las pruebas requeridas o estudios que validen que la solución cumple con los requerimientos establecidos. En el caso de la energía solar, existen estudios sobre la radiación de la zona, de esta manera se puede conocer el aprovechamiento de la energía por parte de los paneles solares. Sin embargo, hay otros dispositivos que se puede conocer sus capacidades debido a que el manual del fabricante especifica su capacidad de funcionamiento, de esta manera se puede determinar si puede solucionar la problemática. Para conocer el tiempo para recuperar la inversión, se va a realizar un análisis económico tomando en cuenta el uso de únicamente el servicio eléctrico y la otra opción es el modelo hibrido diseñado, se analizan los costes involucrados, el costo de la energía en cada caso, y obtener cuándo se recupera la inversión. Para analizar la producción del subsistema de energía alternativa, existen diversos programas y páginas web que permiten la simulación de distintos sistemas tomando en cuenta ciertas condiciones.

4. Descripción de la de la solución

Para la solución de la problemática planteada, se propone el diseño presentado en este capítulo. Se ha analizado y diseñado una propuesta de desarrollo de un sistema de bombeo para un acueducto que sea capaz de utilizar la energía de un sistema secundario, que pueda abastecer agua potable a la población de la zona durante al menos los próximos 20 años, que sea escalable para futuras mejoras en el sistema, y que pueda cambiar al sistema de energía principal cuando el sistema secundario no pueda generar la energía necesaria para el funcionamiento.

Para el desarrollo de la propuesta se ha considerado información bibliográfica de distintas fuentes referentes a sistemas de bombeo y fotovoltaicos. Además, se contó con la experiencia de funcionarios de la empresa RQL respecto a su experiencia en el diseño y desarrollo de sistema de gran similitud. Siguiendo la metodología planteada anteriormente, a partir de la información obtenida de las reuniones con el asesor empresarial, del procesamiento de información, la determinación de las necesidades y establecimiento de requerimientos; se elaboró una descomposición funcional del sistema para poder llevar a cabo el diseño de una forma estructurada y apropiada. Para la elaboración de la descomposición funcional se identificó los subsistemas cuyas funciones varían según sea un circuito de potencia o control. De esta manera, se obtuvieron los subsistemas presentados a continuación:

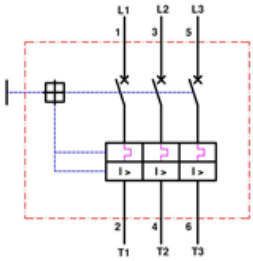
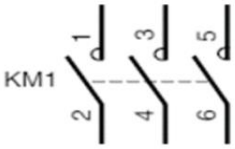
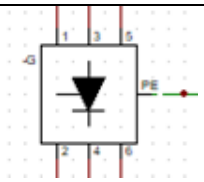
- Subsistema de energía alternativa: Abarca el conjunto de paneles solares, inversor, y circuito de acondicionamiento de una señal de control.
- Subsistema de acondicionamiento de energía primario: Consiste en la fuente de energía proveniente del servicio eléctrico, incluye un transformador para obtener el voltaje requerido por el sistema.
- Subsistema de control: Este subsistema incluye el controlador requerido para procesar las señales provenientes del subsistema de energía secundario, y de unas botoneras que proveen una función de parada y continuar el proceso.
- Bombas hidráulicas: Incluye todas las bombas hidráulicas requeridas para bombear el agua necesaria para satisfacer a la población. Además, incluye los contactores que permiten el acople y desacople de cada uno de los sistemas de energía.

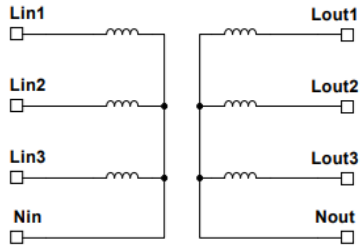
4.1. Simbología utilizada

Para la elaboración de los diagramas, planos y otras representaciones de los circuitos en el sistema de bombeo, se requiere definir la simbología a utilizar para tener un claro entendimiento de las conexiones requeridas. A continuación, se muestra la simbología utilizada:

Tabla 4.1

Simbología eléctrica utilizada en los diagramas y planos

Nombre del elemento	Símbolo
Disyuntor	
Contactor	
Arrancador suave	
Interruptor de transferencia automático	
Panel solar	
Inversor trifásico (salida en estrella)	

Transformador trifásico (estrella-estrella)	

4.2. Bombas hidráulicas

4.2.1. Bombas hidráulicas

Para la elección de las bombas, se tomó en cuenta la demanda de agua potable estimada por día por los próximos 17 años. Uno de los fabricantes más destacados en el sector de bombas centrífugas es Franklin Electric, esta compañía posee una gran variedad de bombas para propósitos domésticos e industriales. Una serie muy utilizada para el sector industrial es la serie XS, esta posee una gran cantidad de modelos con distintas capacidades y características que se adaptan a distintas necesidades. Sin embargo, algunos modelos cuyo caudal otorgado hacen que sean de interés para esta aplicación son los siguientes:

SERIE	SUCC/DESC	HP	DIÁMETRO IMPULSOR PULGADAS	FLUJO (CAUDAL)									MODELO
				LPM	755	945	1135	1325	1515	1705	1895	2270	2460	
				GPM	200	250	300	350	400	450	500	600	650	
					CARGA EN METROS									
9	4" X 3"	7.5	7.62	-	19	19	18	18	17	16	16	12	-	7XS439
		10	8.38	-	24	24	23	22	21	21	20	17	16	10XS439
		15	9	-	27	27	26	26	25	25	24	22	20	15XS439

Figura 4.1. Datos de bombas centrífugas Franklin Electric Serie XS

Como se observa en la Figura 4.1, el modelo 7XS439 puede entregar un caudal de 600 GPM a 7.5 HP (la hoja de datos se puede ver en el Anexo A). Al realizar la conversión a l/m se obtiene un caudal de 2270 l/min. De esta manera, se puede calcular la cantidad de litros diarios producidos.

$$Litros\ diarios = LPM * 60 * h * n_{bombas} \quad (4.1)$$

Asumiendo el uso de cuatro bombas y ocho horas de trabajo, se puede producir un total de 6 537 600 litros diarios. Por lo tanto, puede cumplir con la cuota de diaria de 3 738 636 litros en un tiempo menor a 6.86 horas teóricamente, donde una gran parte se puede obtener mediante la alimentación del sistema de bombeo por parte del sistema de alimentación

secundario. Además, se debe tomar en cuenta las condiciones medioambientales y que hay otros aspectos que pueden afectar el flujo de agua obtenido por el sistema de bombeo.

Otro aspecto a tomar en consideración es la potencia de las bombas, para entregar el caudal mencionado anteriormente, el sistema requiere de 30HP por parte de las cuatro bombas. Este dato debe ser tomado en consideración en el diseño del sistema de energía secundario, ya que los elementos a utilizar deben ser capaces de satisfacer la demanda de energía. Es importante mencionar que la bomba centrífuga no puede funcionar por sí sola, esta requiere del acople a un motor que permita girar el impulsor de la bomba. En el caso de la bomba 7XS439, requiere del acople a un motor JP estándar 1800rpm. Para este propósito se utiliza un motor TEFC PEWWE7.5-18-213JP de 7.5HP ya que la velocidad de este es de 1800rpm (la hoja de datos se puede ver en el Anexo B), y acoplarse a la bomba centrífuga para trabajar correctamente. Sin embargo, se debe incorporar el uso de un acondicionador de voltaje para poder obtener el voltaje de 460Vac requerido para los motores. Para este fin se utiliza el regulador de voltaje AMCR G3 23000, debido a que este permite entre los posibles voltajes de entrada los 480Vac que se obtienen de las fuentes de la alimentación con un ±15% de desviación, lo cual contempla las posibles fluctuaciones del voltaje de entrada, generando en la salida el voltaje requerido con una desviación de ±2% (la hoja de datos se puede ver en el Anexo C). Los sistemas de energía se dimensionaron para 480Vac debido a la amplia cantidad de dispositivos presentes en el mercado.

4.2.2. Elementos del centro de control de motores

En esta sección se colocan los contactores, arrancador, dispositivos de protección y el controlador que permita al sistema tener el funcionamiento según la lógica deseada. Para esta aplicación se decidió utilizar los arrancadores serie SIRIUS de la marca Siemens modelo 3RW4024-1BB05 (la hoja de datos se puede ver en el Anexo D), esto debido a que, al analizar las características de cada modelo, este en específico se coincide con los datos requeridos para el desarrollo del sistema.

$$P[W] = 745.75 * P[HP] \quad (4.2)$$

De la ecuación 4.2, se puede obtener que la potencia de cada bomba es de 5593W, dato a tomar en cuenta para la selección de los elementos del subsistema.

El modelo 3RW4024-1BB05, consiste en un arrancador suave de nivel industrial que permite operar con voltajes de hasta 600V y corriente máxima de 12.5A. Además, permite trabajar con bombas de hasta 7.5kW de potencia. Se debió contar con dispositivos de protección para prevenir daños en el sistema ante una sobrecarga, esto mediante el uso de un disyuntor que permita evitar un mal funcionamiento y poder cortar la corriente cuando se requiera. Primeramente, se requirió calcular la corriente en cada una de las bombas:

$$I = \frac{P[W]}{V_{AC} * \sqrt{3} * F.P} \quad (4.3)$$

Donde P es la potencia del motor, V_{AC} es el voltaje en corriente alterna, y F.P es el factor de potencia, para un motor estándar se supone que su valor es 0.8. De esta manera, se obtiene que el valor de la corriente es de 8.6A. Tomando en cuenta los datos de corriente y voltaje para cada motor, se procede a escoger el disyuntor Siemens 5SY43107CC de tres fases, ya que este permite una corriente máxima de 10A, y trabajar a un voltaje de 460V [36], esto con el objetivo de proteger los dispositivos involucrados (la hoja de datos se puede ver en el Anexo E).

Seguidamente, se procedió a escoger los contactores que permitan un funcionamiento correcto ante las condiciones que se presentan en el proyecto. Para este fin, se utilizaron los contactores Siemens modelo 5SV3352-6, debido a que permite operar con voltajes de hasta 500V, y un valor de corriente máxima de 25A (la hoja de datos se puede ver en el Anexo F). De esta manera, se procede a diseñar el diagrama de fuerza para el centro de control de motores:

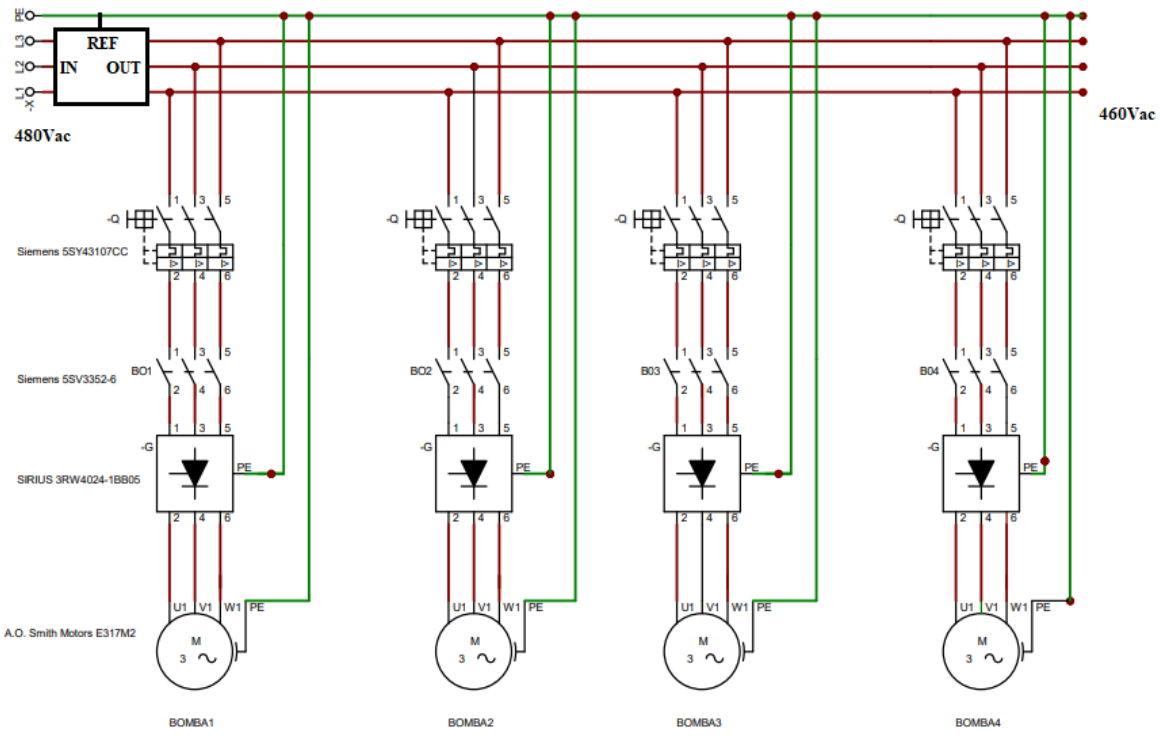


Figura 4.2. Diagrama de fuerza del CCM

En el diagrama de la Figura 4.2, se representa únicamente el funcionamiento de los elementos involucrados en el arranque, pare y seguridad del motor. Se asume que las líneas L1, L2 y L3 provienen de la fuente de energía correcta, ya que la solución a este subproblema se describe en una sección posterior. Los planos se observan con mayor detalle en el Anexo G.

4.3. Subsistema de selección de fuente de energía

En este apartado se describe la solución a cómo el sistema decide que fuente de energía va a implementar en el sistema de bombeo. Para esta funcionalidad, se definen los elementos a utilizar y su conexión. Para este propósito se cuenta con un interruptor de transferencia automática (ATS), el cual va a permitir cambiar entre las dos fuentes de energía como se muestra a continuación:

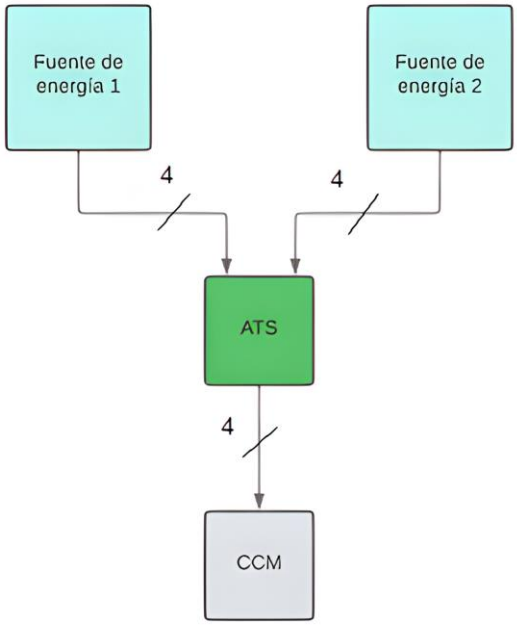


Figura 4.3. Diagrama del subsistema de selección de fuente de energía

El interruptor de transferencia automática va a permitir administrar las dos fuentes de energía A (Sistema Fotovoltaico) y B (Fuente de energía primaria), mientras la fuente A puede suministrar energía correctamente, esta es la fuente a utilizar. Sin embargo, si existe una caída de la tensión de la fuente A, el dispositivo va a cambiar a la fuente B. Además, el dispositivo cuenta con un modo manual el cual puede ser utilizado en caso de querer darle mantenimiento a algún sistema de energía.

Para seleccionar este dispositivo se debe tomar en cuenta la corriente total y la potencia por parte de las cuatro bombas, que para este caso serían de 34.4A y 22372W respectivamente. Al analizar las opciones que se encuentran en el mercado, se decidió utilizar un ATS ATS21/2000/3N3 de la marca McPhersons (la hoja de datos se puede ver en el Anexo H), esto debido a que permite operar a un voltaje de hasta 600V y una corriente máxima de hasta 1200A. Esta corriente es gran medida superior a la corriente total de nuestro diseño, debido a que en el mercado los ATS que poseen una menor corriente máxima, están diseñados para operar a menores voltajes, por lo tanto, no cumplen con nuestros requerimientos de diseño. Este dispositivo posee la particularidad que la empresa fabricante permite variar el umbral al cual se alterna entre la fuente A y B.

A continuación, se muestra el diagrama de conexión y de configuración del ATS:

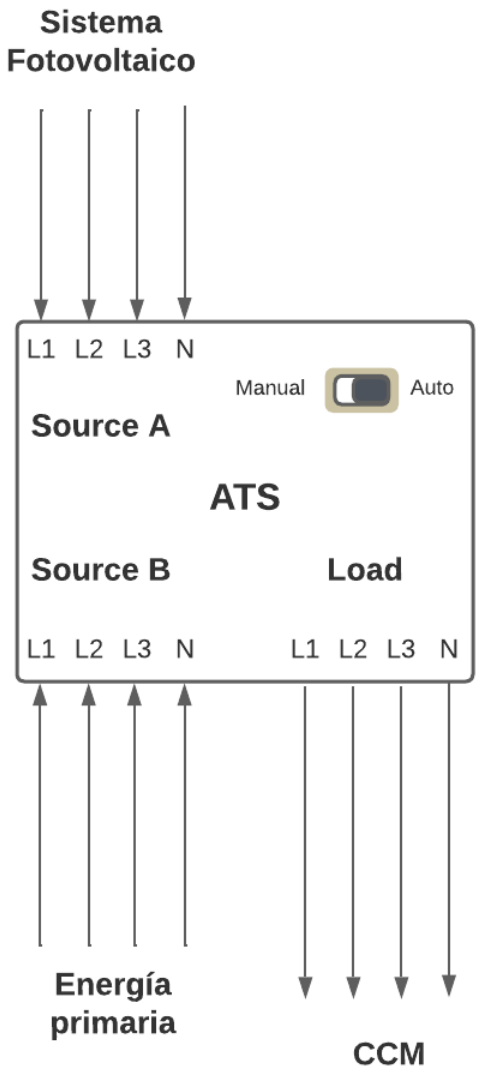


Figura 4.4. Diagrama de conexión y configuración del ATS

Como se muestra en la Figura 4.4, la salida denominada ‘Load’ es la que va a estar internamente conectada a la fuente correcta, por lo tanto, está salida es la entrada de energía denominada ‘L1, L2, L3, PE’ en la sección anterior.

4.4. Subsistema de energía alternativa

Para poder solucionar este subproblema, se procedió a diseñar un sistema fotovoltaico capaz de brindar 22372W de potencia. Para este propósito, se investigaron diversos paneles solares

a nivel industrial con el fin de seleccionar los paneles capaces de satisfacer la demanda de energía. Finalmente, se opta por utiliza paneles solares de la marca Tensite debido a que su potencia es de 500W y su tensión máxima es de 38.35V (la hoja de datos se puede ver en el Anexo I). Sin embargo, su corriente máxima en salida es de 13.04A, por esta razón, se decide utilizar un conjunto de paneles solares para cada bomba, de esta manera poder entregar la corriente necesaria.

La zona de Jacó se encuentra a una latitud de 9.6 grados norte aproximadamente, al utilizar las ecuaciones 2.4 y 2.5 se obtiene que los grados de inclinación para verano e invierno son de -5.4 y 24.6 grados respectivamente. Sin embargo, tomando en cuenta las consideraciones de diseño para inclinación de paneles solares este valor negativo se transformaría en 15 grados, debido a que no se puede contemplar un valor negativo, y se debe considerar la correcta evacuación del agua sobre cada panel. Por lo tanto, los valores de inclinación son 15 grados para el verano y 24.6 grados para el invierno, estos medidos hacia el sur respecto a la horizontal.

Se debe incorporar un inversor trifásico capaz de obtener una salida de 480Vac línea-línea, y cumplir con los requerimientos del sistema. De esta manera, se utiliza un inversor trifásico de la marca Solis SG series (la hoja de datos se puede ver en el Anexo J), esto debido a que permite una potencia en la salida de 40kW, y una corriente de 48.1A [33]. Sin embargo, la tensión nominal en la entrada es de 600V, por lo tanto, se requiere calcular la cantidad de paneles solares a utilizar para cada bomba, esto se realiza al conectar los paneles solares en serie hasta obtener el valor más cercano a 600V, siempre que se cumpla con la potencia requerida.

$$n_{paneles} = \frac{600V}{38.35V} = 15.65 \quad (4.4)$$

Se conoce que cada bomba centrífuga requiere de 5593.125W. Por lo tanto, al utilizar 16 paneles se cumpliría con la demanda de energía para cada bomba. Además, se contó con el uso de un contactor capaz de permitir la operación a 480V L-L y corrientes de 34.4A, ya que esta es la corriente total de las cuatro bombas. Para este fin se utilizó el contactor 3RT1054-2AR36 de Siemens (la hoja de datos se puede ver en el Anexo K), ya que este cumple con los requerimientos del sistema [34]. Además, de la hoja de datos del ATS, se conoce que su

corriente máxima es de 120A, y la corriente máxima del contactor utilizado es de 160A. Por esta razón, se agrega un disyuntor SIEBQD335 de la marca Siemens (la hoja de datos se puede ver en el Anexo L), debido a que permite operar con un voltaje de 480V, y una corriente máxima de 35A [35], lo cual va a permitir el funcionamiento y protección del sistema. Además, para cada rama de paneles solares, se agrega un disyuntor de un polo DZ47Z-63/C16/1P de la empresa Taixi Electric (la hoja de datos se puede ver en el Anexo M), ya que permite una corriente máxima de 16A, operar a un voltaje de hasta 1000V [36], y poder dar mantenimiento a una rama específica del circuito fotovoltaico. A continuación, se muestra el circuito diseñado:

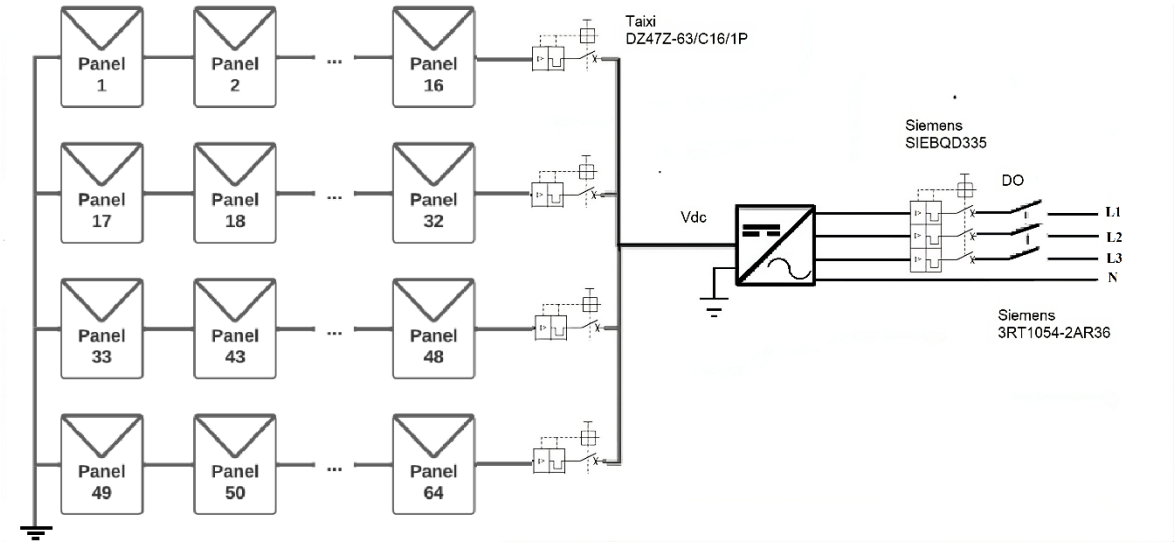


Figura 4.5. Diagrama del sistema fotovoltaico

Los planos se observan con mayor detalle en el Anexo N.

4.5. Subsistema de acondicionamiento de la energía primaria

El sistema de bombeo requiere del uso de la energía brindada por el servicio eléctrico, debido a que el sistema fotovoltaico no es capaz de proveer la energía requerida en todo momento, esto debido a la variación en las condiciones climáticas, mantenimiento del sistema diseñados, etc. De esta manera, se debe utilizar un transformador capaz de transformar la tensión de 13.8kV a 480V. Esto se puede realizar mediante la implementación de un transformador modelo TRI100017529842000 de la marca Schneider Electric (la hoja de datos se puede ver en el Anexo O), este cumple con los requerimientos mencionado

anteriormente. Además, es trifásico y permite una potencia en la salida de hasta 1000kVA [37]. Al igual que en el subsistema de energía alternativa, a la salida de este subsistema se agrega un contactor 3RT1054-2AR36 de Siemens (la hoja de datos se puede ver en el Anexo K), con el objetivo de poder interrumpir el paso de corriente en caso de algún problema existente o de requerir realizar labores de mantenimiento y el disyuntor SIEBQD335 de Siemens para proteger el circuito (la hoja de datos se puede ver en el Anexo L).

A continuación, se muestra un diagrama del sistema de alimentación primaria:

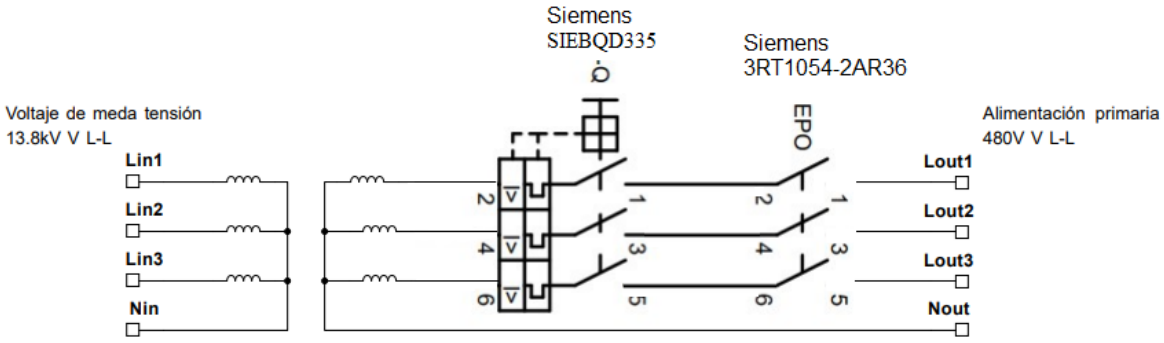


Figura 4.6. Transformador 13.8kV/480V

Según la norma técnica "Prestación del Servicio de Distribución y Comercialización" NRTC-002-2016, el voltaje de media tensión de 13.8kV consiste en un sistema trifásico con conexión estrella de cuatro hilos [38]. Los planos se pueden observar con mayor detalle en el Anexo P.

4.6. Subsistema de control

De la sección de selección de subsistema de control, se eligió el controlador a utilizar para la aplicación, este es el Siemens S7-1200 (la hoja de datos se puede ver en el Anexo Q). Es importante destacar que este sistema no solo se compone del controlador, también contiene las botoneras requeridas para acciones tales como: detener una bomba específica, detener el sistema, y reanudar las acciones. Antes de proceder a implementar la lógica deseada en el controlador, es necesario establecer cuáles son las entrada y salidas del sistema:

Tabla 4.2

Entradas y salidas del Siemens S7-1200

Símbolo	I/O	Descripción
Start	I0.0	Señal de entrada que activa todas las bombas y fuentes
BION1	I0.1	Señal de entrada para activar la bomba 1
BION2	I0.2	Señal de entrada para activar la bomba 2
BION3	I0.3	Señal de entrada para activar la bomba 3
BION4	I0.4	Señal de entrada para activar la bomba 4
BIOFF1	I0.5	Señal de entrada para desactivar la bomba 1
BIOFF2	I0.6	Señal de entrada para desactivar la bomba 2
BIOFF3	I0.7	Señal de entrada para desactivar la bomba 3
BIOFF4	I1.0	Señal de entrada para desactivar la bomba 4
Pare	I1.1	Señal de entrada de pare de emergencia
DION	I1.2	Señal de entrada para acoplar el subsistema de energía alternativa
DIOFF	I1.3	Señal de entrada para desacoplar el subsistema de energía alternativa
EPION	I1.4	Señal de entrada para acoplar el subsistema de energía principal
EPIOFF	I1.5	Señal de entrada para desacoplar el subsistema de energía principal
BO1	Q0.0	Activa/desactiva la bomba 1 y rama de paneles solares 1
BO2	Q0.1	Activa/desactiva la bomba 2 y rama de paneles solares 2
BO3	Q0.2	Activa/desactiva la bomba 3 y rama de paneles solares 3
BO4	Q0.3	Activa/desactiva la bomba 4 y rama de paneles solares 4
DO	Q0.4	Acopla/desacopla el subsistema de energía alternativa
EPO	Q0.5	Acopla/desacopla el subsistema de energía principal

Como se puede observar en la Tabla 4.2, el PLC requiere de al menos catorce entradas y seis salidas. Por lo tanto, se utiliza el S7-1200 CPU1215C debido a que incorpora catorce entradas y diez salidas [39].

Seguidamente, se procede a desarrollar la lógica deseada en el PLC, para esto se utiliza el software TIA PORTAL V17 de Siemens. En este programa se implementa una lógica

mediante el lenguaje Ladder, con el cual se puede obtener el comportamiento deseado. A continuación, se muestra la lógica implementada para las bombas:

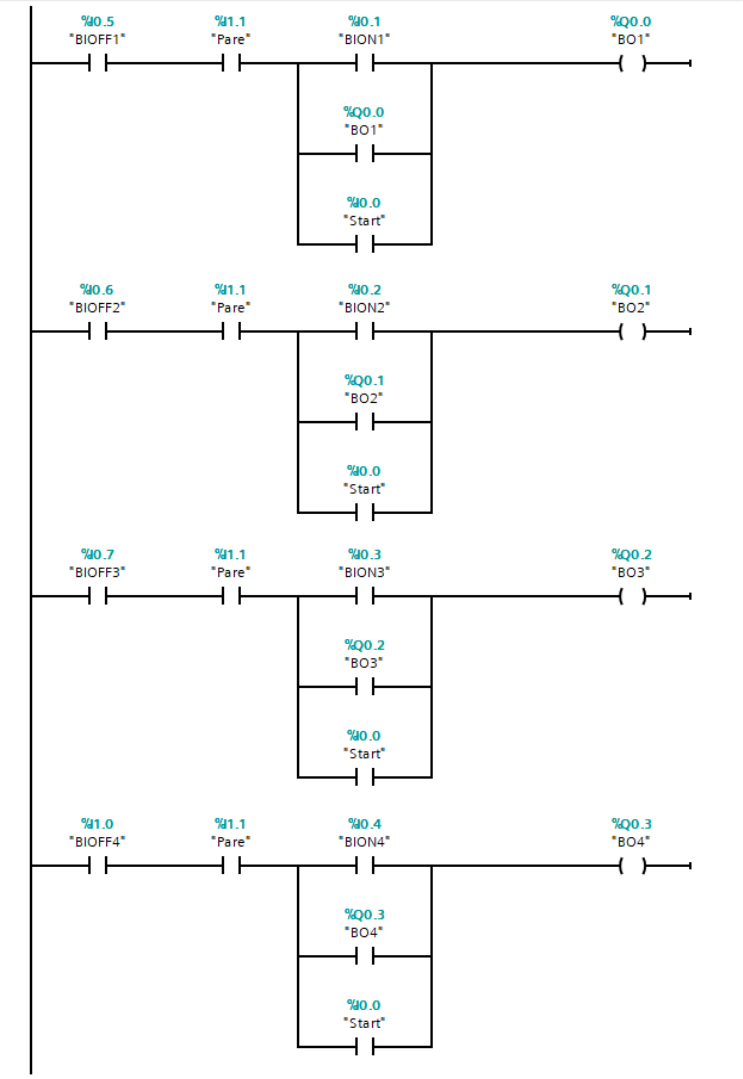


Figura 4.7. Diagrama Ladder para el control de las bombas centrifugas

Como se puede observar en la Figura 4.7, cada bomba posee un botón que activa y otro que desactiva individualmente el funcionamiento de cada bomba. Sin embargo, también se observa un botón general de parada y otro para encendido de todas las bombas. Las fuentes de energía poseen la misma lógica implementada en las bombas:

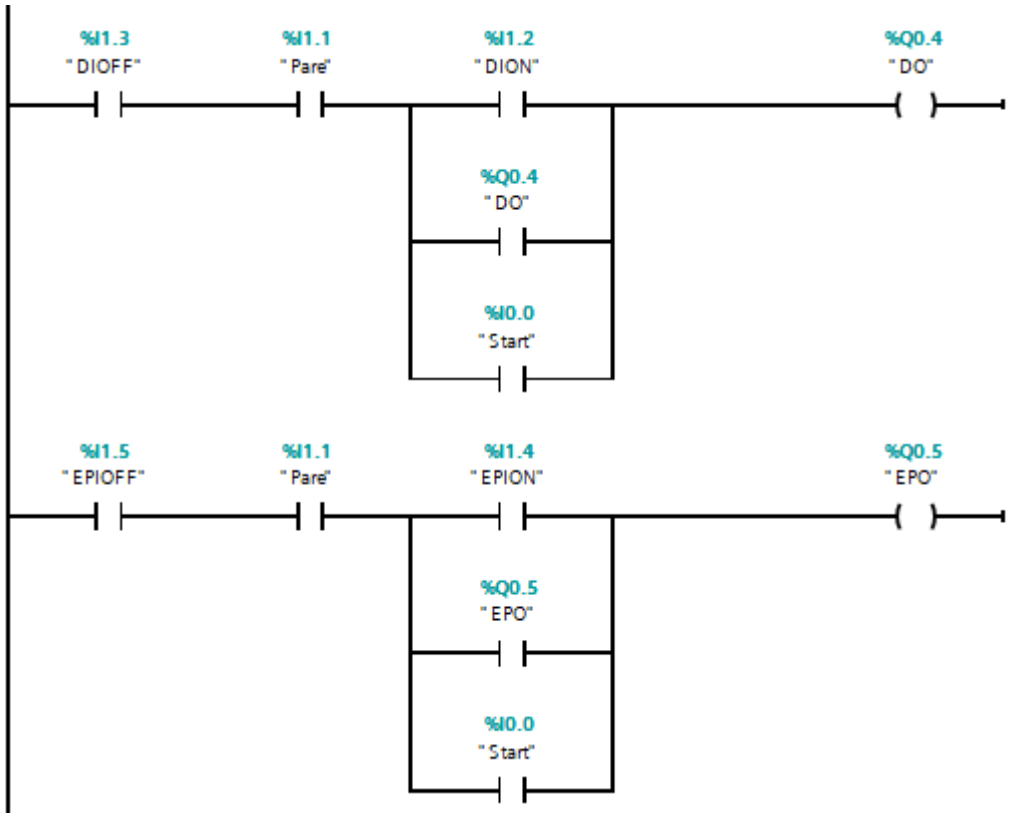


Figura 4.8. Diagrama Ladder para cada una de las fuentes de alimentación

En las figuras 4.7 y 4.8, se observa la lógica contenida dentro del PLC. Sin embargo, también se debe explicar de dónde provienen dichas señales de entrada. Primeramente, se requiere una alimentación de 24V en corriente continua para el PLC y las botoneras [39]. Para esto se decide utilizar una fuente de alimentación conmutada de 24V S-600-24 (la hoja de datos se puede ver en el Anexo R), ya que requiere de una alimentación de 110/220 Vac, y posee protección interna contra sobrecarga y sobre calentamiento [40]. A continuación, se requiere seleccionar las botoneras a utilizar para el panel de control, para este propósito se utilizan unas botoneras NEMA Square D (la hoja de datos se puede ver en el Anexo S), esto debido a que cada una contienen un botón de arranque y uno de pare, permite un voltaje de hasta 600V y corriente de hasta 5A [41]. A continuación, se muestra el diagrama de conexión de las entradas del PLC:

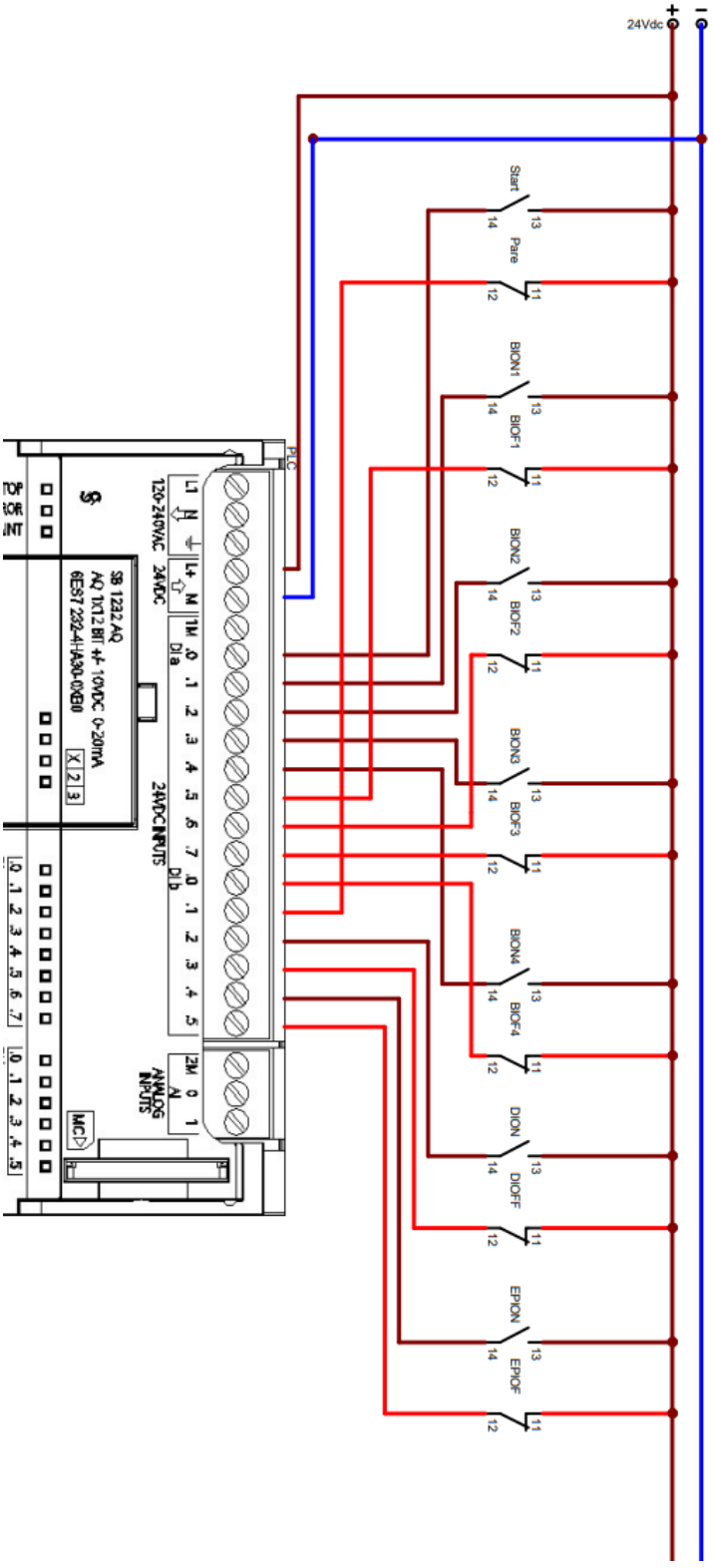


Figura 4.9. Entradas del PLC

Seguidamente, se muestran las salidas del PLC:

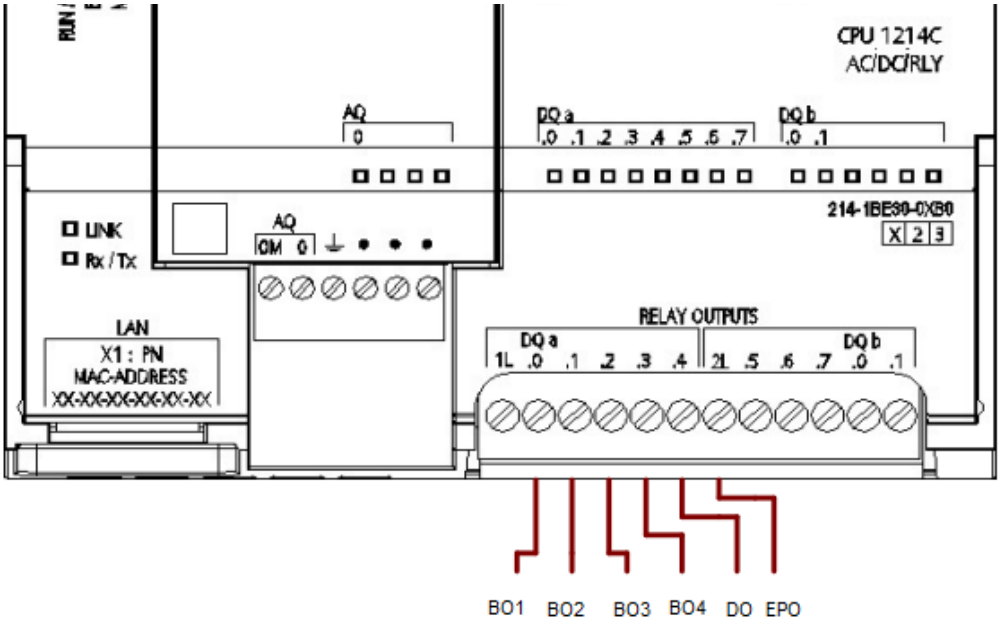


Figura 4.10. Salidas del PLC

Los planos se observan con mayor detalle en el Anexo T. Cada una de las salidas BO1, BO2, BO3, BO4, DO y EPO se pueden observar en los respectivos diagramas donde estas señales actúan.

4.7. Plan de mantenimiento preventivo

Se realiza un cronograma con las acciones de mantenimiento preventivas requeridas para cada máquina, esto con el fin de aumentar la funcionabilidad y durabilidad de cada uno de los subsistemas. Esto se planifica asumiendo un inicio de las operaciones en el año 2024, dicho cronograma puede ser modificado para ser utilizado en años posteriores, según sea la experiencia de los operadores y técnicos en el área. A continuación, se muestran las actividades de mantenimiento planteadas para el sistema de bombeo:

Tabla 4.3

Acciones de mantenimiento preventivo del sistema de bombeo

SUBSISTEMA	MAQUINA	ACTIVIDAD	FRECUENCIA	SEMANA INICIAL
Acondicionamiento de energía principal	Transformador	Inspección de acumulación de polvo o corrosión	Mensual	10
Acondicionamiento de energía principal	Transformador	Pruebas de aislamiento	Anual	49
Acondicionamiento de energía principal	Transformador	Verificación de temperatura	Diario	1
Energía alternativa	Paneles Solares	Limpieza de superficie	Semestral	26
Energía alternativa	Paneles Solares	Revisar conexiones eléctricas	Anual	49
Energía alternativa	Paneles Solares	Comprobar el voltaje de salida	Semestral	26
Energía alternativa	Inversor	Verificar la energía producida	Mensual	1
Energía alternativa	Inversor	Revisar conexiones eléctricas	Anual	49
Selección de energía	ATS	Comprobar conmutación	Semanal	1
Selección de energía	ATS	Inspección de acumulación de polvo o corrosión	Mensual	10
Selección de energía	ATS	Verificar las conexiones eléctricas	Anual	49
Control	PLC	Actualizar programación de respaldo	Mensual	1
Control	PLC	Verificar conexiones	Semestral	26
Control	PLC	Verificar temperatura y humedad del entorno	Diario	1
Bombas centrífugas	Motores	Limpieza	Trimestral	28
Bombas centrífugas	Motores	Monitoreo de temperatura	Diario	1
Bombas centrífugas	Motores	Pruebas de resistencia	Anual	49
Bombas centrífugas	Bombas	Verificación de alineación	Semestral	26
Bombas centrífugas	Bombas	Limpieza	Trimestral	28
Bombas centrífugas	Bombas	Inspección Visual	Semanal	1

Las acciones planteadas en la tabla 4.3, se obtuvieron de la información obtenida respecto a cada uno de los dispositivos consultados para cada uno de los subsistemas. Además, se consulta otras fuentes referentes al mantenimiento de equipos y sistemas [51]. Seguidamente, se propone las semanas donde se aplicarían las acciones de mantenimiento. A continuación, se muestra el cronograma de actividades de mantenimiento preventivo propuesto para el año 2024, para el primer cuatrimestre del año:

Tabla 4.4

Cronograma de mantenimiento preventivo para el primer cuatrimestre del 2024

	Enero				Febrero					Marzo				Abril				
ACTIVIDAD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Inspección de acumulación de polvo o corrosión										x	x	x	x	x	x	x	x	x
Pruebas de aislamiento																		
Verificación de temperatura	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limpieza de superficie																		
Revisar conexiones eléctricas																		
Comprobar el voltaje de salida																		
Verificar la energía producida	x				x					x				x				
Revisar conexiones eléctricas																		
Comprobar conmutación	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Inspección de acumulación de polvo o corrosión										x	x	x	x	x	x	x	x	x
Verificar las conexiones eléctricas																		
Actualizar programación de respaldo	x				x					x				x				
Verificar conexiones																		
Verificar temperatura y humedad del entorno	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limpieza																		
Monitoreo de temperatura	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pruebas de resistencia																		
Verificación de alineación																		
Limpieza																		
Inspección Visual	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Para el segundo cuatrimestre:

Tabla 4.5

Cronograma de mantenimiento preventivo para el segundo cuatrimestre del 2024

	Mayo				Junio					Julio				Agosto				
ACTIVIDAD	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Inspección de acumulación de polvo o corrosión	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pruebas de aislamiento																		
Verificación de temperatura	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limpieza de superficie								x										
Revisar conexiones eléctricas																		

Comprobar el voltaje de salida								x										
Verificar la energía producida	x				x					x				x				
Revisar conexiones eléctricas																		
Comprobar conmutación	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Inspección de acumulación de polvo o corrosión	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Verificar las conexiones eléctricas																		
Actualizar programación de respaldo	x				x					x				x				
Verificar conexiones								x										
Verificar temperatura y humedad del entorno	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limpieza										x								
Monitoreo de temperatura	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pruebas de resistencia																		
Verificación de alineación								x										
Limpieza										x								
Inspección Visual	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Para el tercer cuatrimestre:

Tabla 4.6

Cronograma de mantenimiento preventivo para el tercer cuatrimestre del 2024

	Septiembre				Octubre				Noviembre				Diciembre					
ACTIVIDAD	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Inspección de acumulación de polvo o corrosión	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pruebas de aislamiento															x			
Verificación de temperatura	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limpieza de superficie																		x
Revisar conexiones eléctricas															x			
Comprobar el voltaje de salida																		x
Verificar la energía producida			x				x				x				x			
Revisar conexiones eléctricas															x			
Comprobar conmutación	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Inspección de acumulación de polvo o corrosión	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Verificar las conexiones eléctricas															x			

Actualizar programación de respaldo			x				x				x				x			
Verificar conexiones																		x
Verificar temperatura y humedad del entorno	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Limpieza							x											
Monitoreo de temperatura	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pruebas de resistencia															x			
Verificación de alineación															x			
Limpieza							x											
Inspección Visual	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

5. Validación de la solución

Para la validación de la solución diseñada, se cuenta con el uso de distintos programas gratuitos para la simulación de sistemas fotovoltaicos, estas aplicaciones toman en cuenta los datos climáticos de la zona, datos referentes al servicio eléctrico, etc. Además, se contó con el uso de Multisim, el cual consiste en un software de modelado de circuitos, el cual permite la simulación de algunos de los circuitos diseñados ante ciertas condiciones.

5.1. Costo de la solución

En este apartado se muestra el coste de cada uno de los elementos involucrados en la solución y la potencia consumida por cada dispositivo. Esto debido a que esta información es requerida para las simulaciones posteriores. A continuación, se muestra el coste y la potencia consumida por cada uno de los elementos.

Tabla 5.1

Costes y consumo de cada elemento involucrado

Elementos	Cantidad	Coste Total ($)	Consumo Total (W)
Taixi Dz47z-63/c17/1P	4	400	60
Siemens SIEBQD335	2	399.8	60
Siemens 3RT1054-2AR36	2	1763.14	50
Solis SG series	1	5708.93	150
Franklin Electric 3RW4024-1BB05 + TEFC PEWWE7.5-18-213JP	4	30398.99	22372
Siemens 5SY43107CC	4	285.56	120
Siemens 5SV3352-6	4	390	120
Siemens 3RW4024-1BB05	4	3539.8	250
ATS McPhersons	1	9778	45
Schneider Electric TRI100017529842000	1	1200	500
S7-1200 CPU1215C	1	730	20
Solis SG series	64	7898.88	---
Diseño del Sistema	---	3500	---

Implementación del Sistema	---	75000	---
Total		140993.1	23747

5.2. Simulación mediante PVWatts

El software PVWatts consiste en una calculadora de la producción de sistemas solares por parte de National Renewable Energy Laboratory. En este programa se deben ingresar ciertos parámetros tales como: Ubicación, Potencia del sistema, Tipo de módulo, Pérdidas, Inclinación, etc. Seguidamente, el programa calcula la producción del sistema por cada mes según los datos climáticos de la zona.

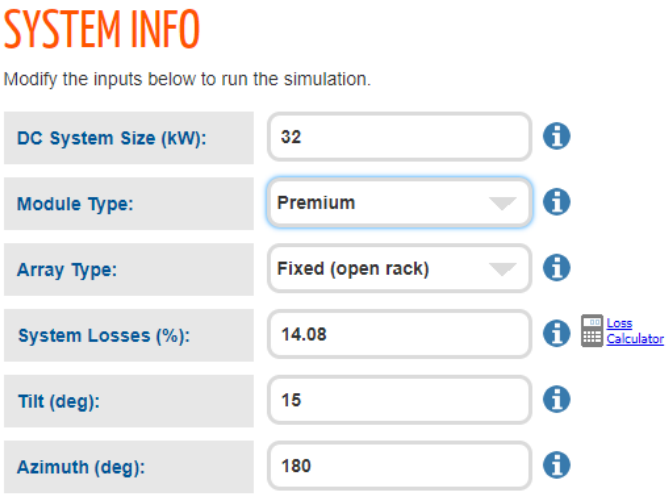
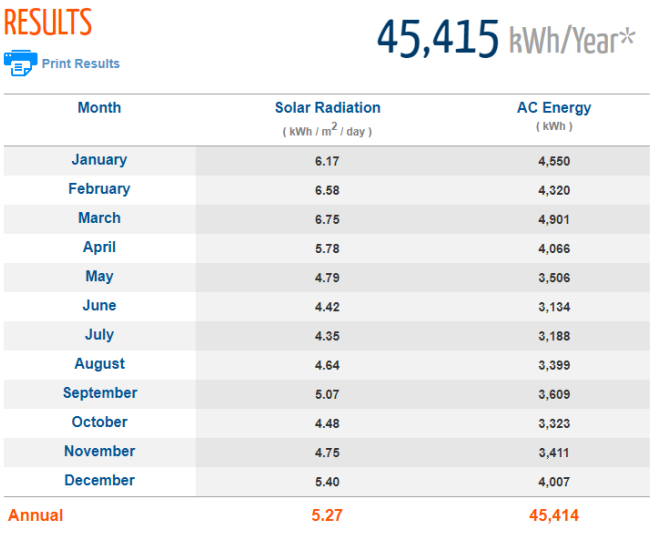


Figura 5.1. Parámetros establecidos en PVWatts



Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)
January	6.17	4,550
February	6.58	4,320
March	6.75	4,901
April	5.78	4,066
May	4.79	3,506
June	4.42	3,134
July	4.35	3,188
August	4.64	3,399
September	5.07	3,609
October	4.48	3,323
November	4.75	3,411
December	5.40	4,007
Annual	5.27	45,414

Figura 5.2. Resultados obtenidos de PVWatts

De la Figura 5.2, se observa que el sistema fotovoltaico produciría 45414 kWh al año tomando en cuenta la radiación en la zona de Jacó. Para calcular el porcentaje de energía utilizada que corresponde a dicho subsistema, primero se debe obtener la energía consumida por las bombas anualmente.

$$P_{Bombas\ Anual} = P_{Bomba} n_{Bombas} h * días \quad (5.1)$$

Se conoce que el sistema consume 23.747kW, y el trabajo del sistema es de 6.89 horas para obtener el caudal esperado. Por lo tanto, la energía consumida anualmente sería 59720.15 kWh. Por lo tanto, se procede a calcular el porcentaje de energía utilizada mediante el subsistema de energía alternativo.

$$\%_{Energía\ Alternativa} = \frac{P_{Producida\ E.Alternativa}}{P_{Bombas\ Anual}} \quad (5.2)$$

De la ecuación 5.2, se obtiene que el porcentaje de energía utilizada mediante el subsistema de energía alternativa sería del 76.04%, este resultado se obtiene asumiendo que el horario de trabajo de las bombas centrífugas coincide con el horario donde hay más aprovechamiento de la energía solar.

5.3. Simulación en Solar Power Calculator

Para obtener el tiempo que tomaría recuperar la inversión, se utiliza el software Solar Power Calculator. Para realizar los cálculos se requieren los siguientes parámetros: Potencia del sistema fotovoltaico, inclinación, consumo energético anual del sistema, coste energético por kWh e incremento anual en el coste. La potencia del sistema fotovoltaico corresponde a 32kW, la inclinación de los paneles es de 15 grados, el consumo energético anual se obtuvo en la sección anterior, el coste energético por kWh se obtuvo de la Aresep [52], siendo de 123.03 colones el kWh para actividades industriales, el incremento anual es un factor difícil de obtener mediante una fuente confiable, esto debido a que el costo de la electricidad depende de muchos factores socioeconómicos; sin embargo, se optó por valor del 5%, esto debido a que es un porcentaje que está por debajo de los incrementos registrados por la Aresep.

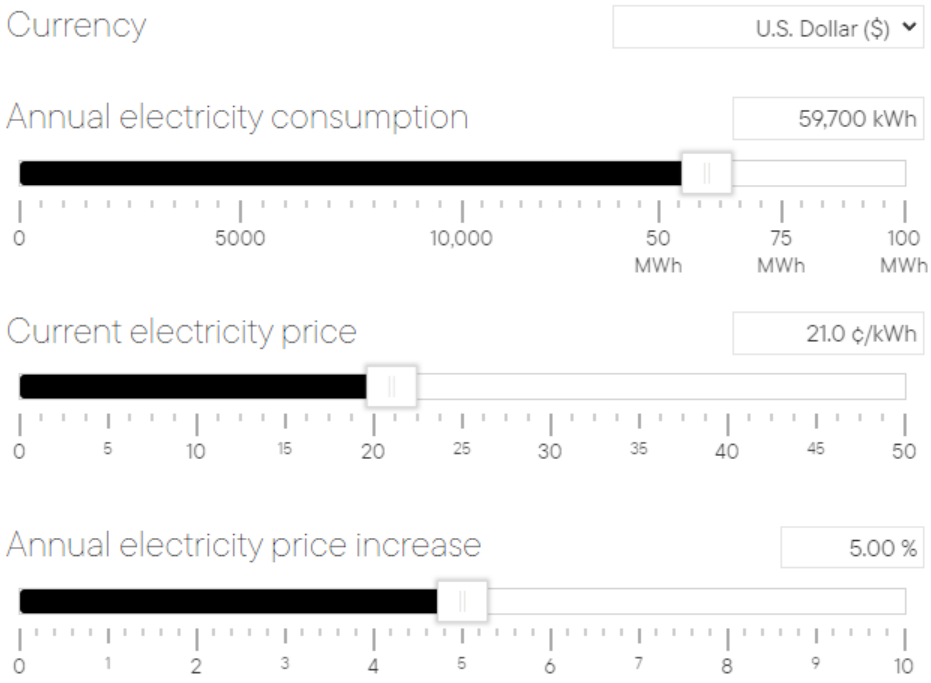


Figura 5.3. Parámetros establecidos en Solar Power Calculator

Actualmente, los costos adicionales que involucra el uso de paneles solares son por interconexión a la red eléctrica. Sin embargo, en el análisis solo se toma en cuenta el ahorro generado para recuperar la inversión, por lo tanto, se asume un costo de energía solar de cero colones. Mediante el uso del programa, se obtiene la siguiente gráfica:

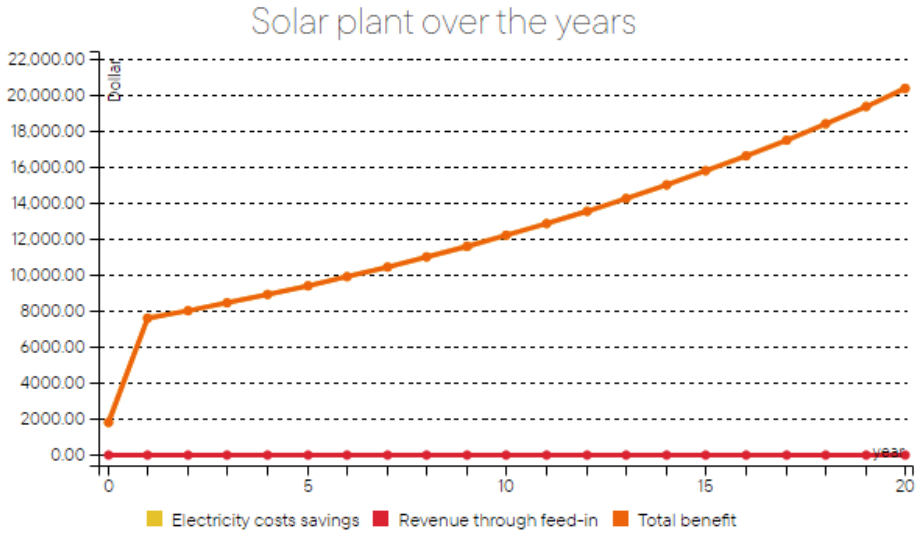


Figura 5.4. Beneficio total del uso del sistema solar diseñado

De la Figura 5.4, se observa el ahorro del sistema diseñado por cada año en los próximos 20 años. A continuación, se muestra el ahorro por año de los próximos siete años:

Tabla 5.2

Ahorro del sistema solar en los próximos quince años

Año	Ahorro (dólares)
2024	7516.81
2025	7930.14
2026	8364.14
2027	8819.84
2028	9298.31
2029	9800.73
2030	10328.25
2031	10738.27
2032	11206.47
2033	11674.68
2034	12142.88
2035	12611.08
2036	13079.28
2037	13547.49
2038	14015.69
Total	161074.07

Si se suman dichos valores hasta obtener un monto superior a la inversión inicial, se obtiene que dentro de quince años se logra recuperar la inversión inicial de 140993.1 dólares.

5.3. Cumplimiento de la Ley que Autoriza la Generación Eléctrica Autónoma o Paralela

En la Ley que Autoriza la Generación Eléctrica Autónoma o Paralela, se describen el conjunto de reglas y sanciones que pueden recibir las distintas entidades que realicen operación de generación eléctrica mediante distintas fuentes de energía [53]. Sin embargo,

para nuestro propósito se analizaron los puntos de mayor relevancia tomando en cuenta que la generación presentada en este proyecto no requiere de combustibles fósiles u otro material que requiera de una mayor regulación ambiental. A continuación, se presentan dichas regulaciones:

- Certificación de Impacto Ambiental: El interesado deberá aportar al Servicio Nacional de Electricidad una certificación sobre la aprobación de un estudio del impacto ambiental, elaborado por un profesional del ramo.
- Impacto en la flora y fauna: Para dicho sistema, no se requiere desalojar ninguna especie de su hábitat natural, ni se genera ningún residuo que represente un riesgo para la integridad física de ninguna especie de la zona, ya sea flora o fauna.
- Señalamiento en caso de requerir deforestación: En caso de requerir deforestación, se debe contar con señalamiento de áreas. Para el caso del presente proyecto, se planea maximizar el uso de las zonas libres que permitan la instalación de los paneles sin requerir deforestación.

5.4. Simulación de los motores

En esta sección, se presenta el proceso realizado para validar que el sistema sea capaz de bombear la cantidad de litros establecida en los requerimientos. Sin embargo, se debe tomar en cuenta una serie de limitantes que se tienen por el entorno en que se está desarrollando en el proyecto y los alcances del mismo.

Primeramente, se toma en cuenta que el alcance del presente proyecto culmina en la etapa de diseño. Por lo tanto, la empresa no dispone de presupuesto para la implementación de este u obtener los elementos y dispositivos necesarios. De esta manera, no se dispone de las bombas centrífugas seleccionadas para realizar las pruebas respectivas y conocer su comportamiento en condiciones reales.

Además, el caudal generado por cada bomba depende de la transmisión de la potencia entre el motor y la bomba. Sin embargo, de la hoja de datos de la bomba no se obtiene ningún valor referente a la inercia del impulsor o pérdidas por transmisión. Sin embargo, de la hoja de datos del motor se conoce la eficiencia nominal, de los disyuntores y de los contactores se conoce la potencia máxima disipada.

A continuación, se procede realizar una simulación capaz de obtener la potencia de los motores tomando en cuenta los factores mencionados anteriormente, para este fin se optó por utilizar el software Proteus. Este programa permite agregar motores trifásicos con distintos parámetros como resistencia del rotor, resistencia del estator, inductancia del rotor e inductancia del estator. Dichos parámetros se variaron hasta conseguir una configuración donde el motor tuviera una velocidad de giro cercana a 1800rpm y una corriente de 8.6A. A continuación, se muestra la configuración utilizada:

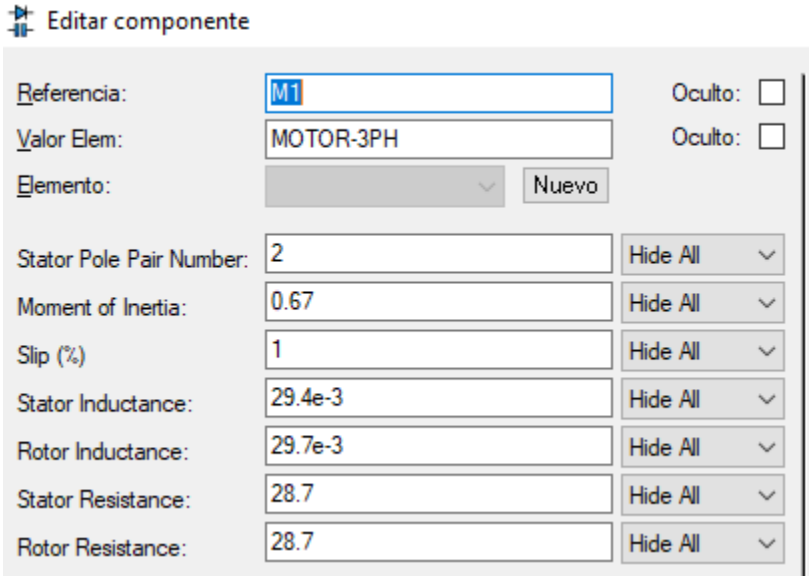


Figura 5.5. Parámetros utilizados en el motor trifásico

Seguidamente, se muestra el motor simulado sin pérdidas asociadas a otros elementos:

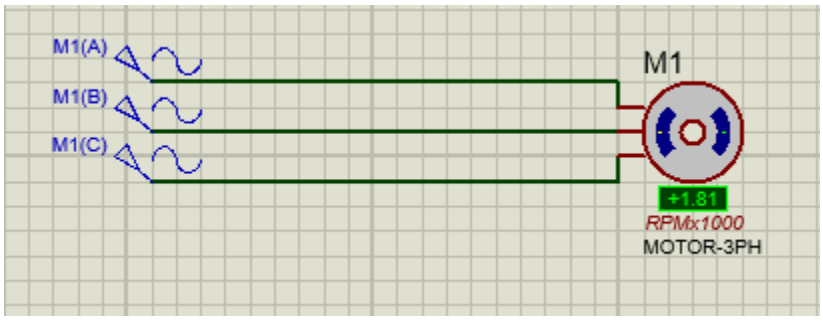


Figura 5.6. Motor girando sin resistencia

De las hojas de datos de los contactores y disyuntores se conoce que la potencia máxima disipada por los contactores por polo es de 2.4W y en el disyuntor es de 1.1W. Por lo tanto, partiendo de la corriente calculada previamente de 8.6A (ec. 4.6), se calcula la resistencia de cada polo mediante la siguiente fórmula:

$$R = \frac{P}{I^2} \quad (5.1)$$

Obteniendo una resistencia para el contactor de 0.03245 Ω y para el disyuntor de 0.01487 Ω. Por lo tanto, se procede a simular el comportamiento del motor tomando en cuenta dichos factores.

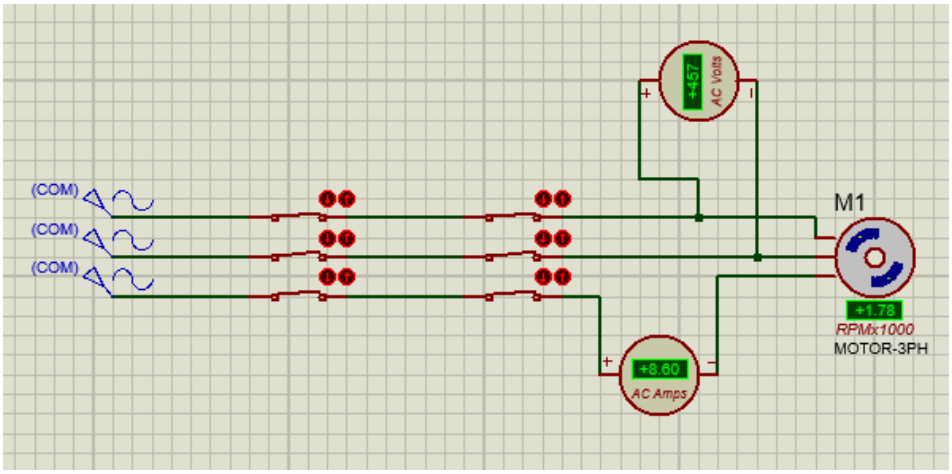


Figura 5.7. Motor girando con pérdidas en contactor y disyuntor

Además, se conoce que la eficiencia nominal del motor es 95%, de esta manera se procede agregar una resistencia que represente esa pérdida adicional en el motor, y de esta forma conocer finalmente cuánta potencia puede ser aprovechada por este. De la Figura 5.7, se conoce que el voltaje L-L en el motor es de 457V y la corriente es de 8.6A, de esta manera se calcula una resistencia para reducir dicho voltaje un 5%. El voltaje que se obtiene es 22.85V en la resistencia y al dividirlo entre 8.6A se obtiene una resistencia de 2.67 Ω. A continuación, se muestra la simulación respectiva:

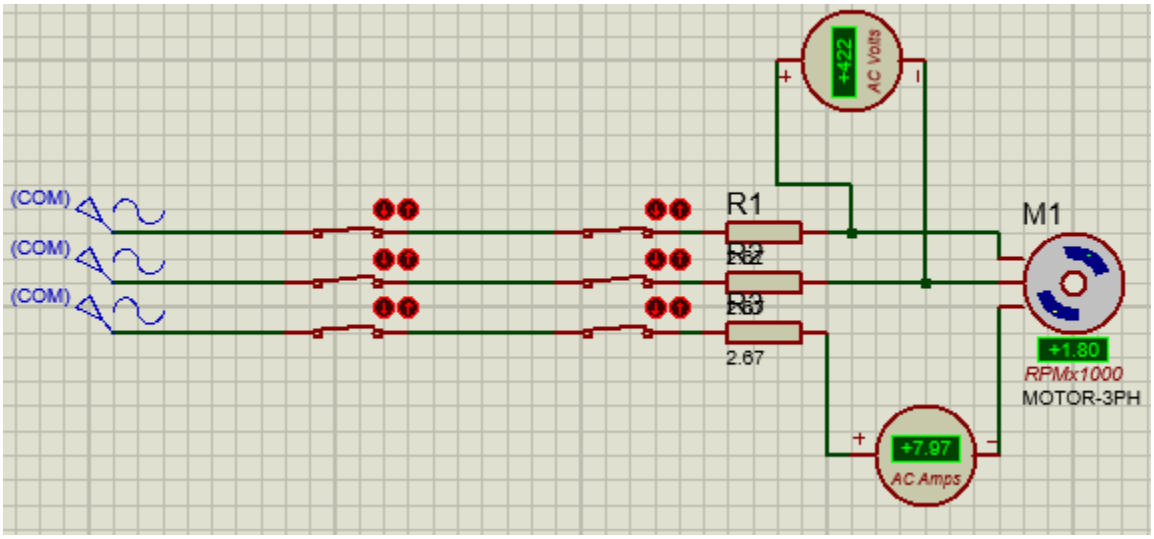


Figura 5.8. Motor girando con pérdidas en contactor, disyuntor y pérdidas asociadas a la eficiencia del motor

De la Figura 5.8, se observa que la corriente disminuye respecto a la simulación de la Figura 5.7. Sin embargo, al calcular la caída de tensión en la resistencia se obtiene que es de 27.28V que corresponde al 5.9% del voltaje obtenido en la Figura 5.7. Por lo tanto, se toma en cuenta una eficiencia inferior a la establecida por el fabricante.

Al calcular la potencia en el motor mediante la ecuación 4.3, se obtiene que dicha potencia corresponde a 4604.72W, y al convertir a HP mediante la ecuación 4.2, se obtiene como resultado 6.17HP.

Seguidamente, se procede generar las curvas de caudal vs carga mediante los datos obtenidos de las bombas [47]. Además, se extrapola los valores para una potencia de 6.17HP.

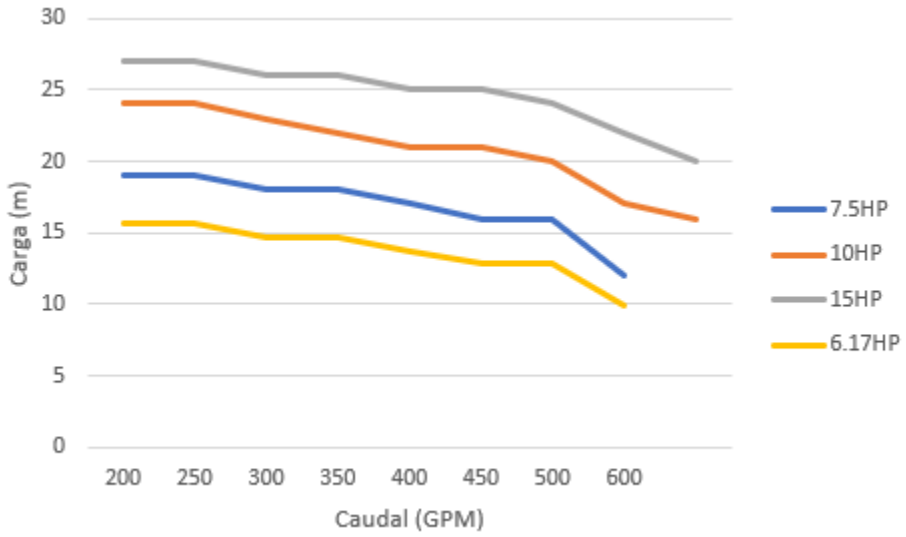


Figura 5.9. Curvas de Carga en metros vs Caudal en GPM para las bombas [Elaboración propia]

Inicialmente se había calculado el tiempo de bombeo mediante el caudal para una carga de doce metros. Por lo tanto, se obtiene que el caudal de la bomba a 6.17HP para la misma carga es de 528GPM que al convertirlos corresponden a 1998.7 LPM.

Al calcular el tiempo requerido para obtener 3 738 636 litros en un día, se obtiene que se requieren 7.79h de trabajo. De la hoja de datos de los paneles solares, se analiza a qué valores de radiación estos logran operar efectivamente.

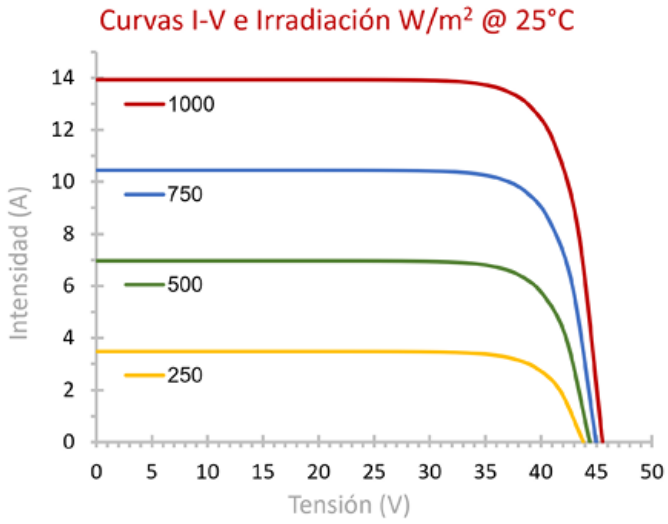


Figura 5.10. Curvas de I-V e irradiación de los paneles solares a 25 grados centígrados (véase Anexo I)

De la Figura 5.10, se observa que los paneles solares a 750W/m^2 pueden generar una corriente superior a 8.6A, la cual es la requerida por para cada bomba. Por lo tanto, se procede a analizar las horas donde la radiación solar sea superior a 750W/m^2.

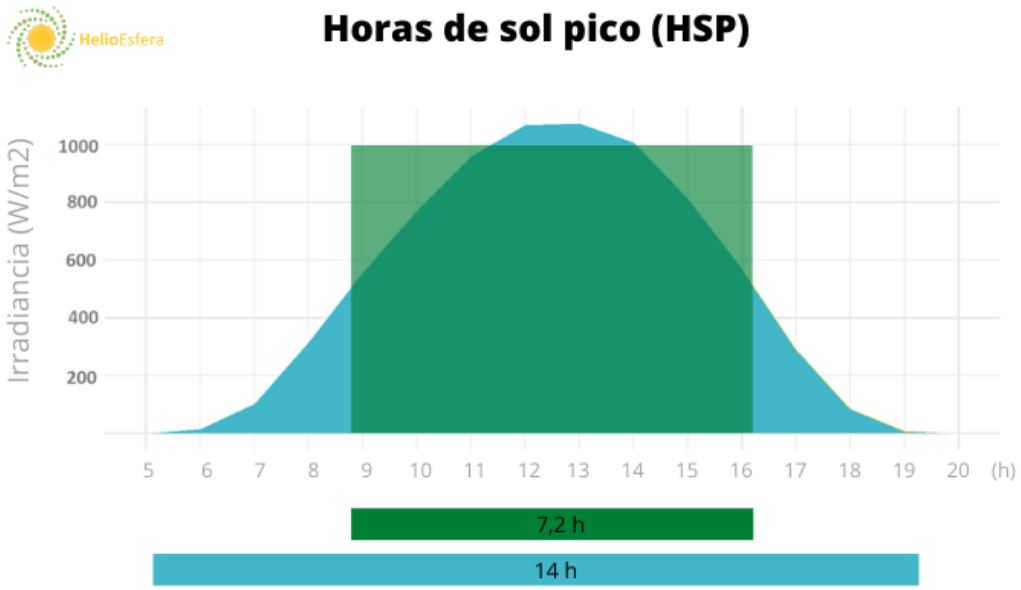


Figura 5.11. Curvas de irradiación diaria [54]

De la Figura 5.11, se observa diariamente se tiene una radiación de al menos 750W/m^2 en cerca de 6 horas. Por lo tanto, al calcular el porcentaje de tiempo que el sistema estaría alimentado por energía solar, se obtiene como resultado un 77.9% de tiempo, cumpliendo con los requerimientos establecidos de producir 3 738 636 litros en un solo día, y utilizar al menos un 50% de la energía solar para el funcionamiento.

Cabe mencionar que, aunque se obtuvo un valor distinto dadas ciertas condiciones obtenidas de las hojas de datos, para tener un conocimiento mayor del comportamiento de las bombas y el caudal producido, se requeriría obtener un modelo real para poder realizar pruebas de funcionamiento y de esta forma poder obtener valores más cercanos a los que se obtendrían en un entorno de producción.

5.5. Cumplimiento del dimensionamiento del sistema diseñado

Límite de 70 paneles solares: Para el diseño del sistema propuesto se contó con el uso de 64 paneles, lo cual está por debajo del límite establecido de 70 paneles, esto con el fin de reducir costos adicionales referentes a los elementos requeridos que conllevaría aumentar la complejidad del subsistema de energía alternativa.

Aumentar I/O del controlador: El controlador Siemens S7-1200 tiene la capacidad de aumentar el número de entradas y salidas mediante el uso de módulos I/O [24], lo cual permite a futuro poder agregar más señales provenientes de más botoneras para controlar más elementos incluidos en un sistema de mayor complejidad.

5.4. Análisis Económico

En esta sección, se presenta el análisis económico respectivo para determinar si la implementación de la solución diseñada tiene la capacidad de retribuir económicamente los costes iniciales por concepto de precio de dispositivos, diseño de la solución y su implementación.

5.4.1. Costes iniciales

Los costes involucrados en la inversión inicial fueron calculados en la sección denominada Costo de la Solución. En la Tabla 5.2, se observa los costos asociados a cada uno de los dispositivos utilizados en la solución, el monto que se le brindaría al estudiante por realizar el diseño del proyecto, y el costo de la implementación del proyecto por parte de la empresa. Dichos costos corresponden a los siguientes montos:

- Dispositivos: 62493.1 dólares.
- Diseño del sistema: 3500 dólares.
- Implementación del sistema: 75000 dólares.

Se puede observar que el mayor costo asociado es la mano de obra humana correspondiente a un 55.6% de la inversión total. Sin embargo, este puede variar dependiendo de diversas situaciones que puedan ocurrir durante la instalación del sistema tales como:

- Agotamiento de algún dispositivo y tener que comprar otro similar.
- Atrasos por transporte.
- Dispositivos adicionales que se decidan colocar por diversas circunstancias.

Además, se debe tomar en cuenta que el pago de dichos montos a la empresa y mano de obra se pagarían en colones, por dicha razón se deben tomar que la tasa de cambio puede variar entre la fecha de presentación del documento y la fecha de inicio de la implementación.

5.4.2. Estimación de las ganancias esperadas

La estimación de las ganancias esperadas al implementar el subsistema de energía alternativa, se obtuvo en la sección denominada Simulación en Solar Power Calculator. En esta sección, se utilizar el software mencionado anteriormente, el cual permite determinar el ahorro que se obtendría anualmente al utilizar paneles solares en lugar del servicio eléctrico mediante el ingreso de diversos parámetros tales como consumo del sistema, costo de la energía eléctrica, incremento anual del costo de la energía eléctrica, inclinación de los paneles, zona geográfica, etc. En la Tabla 5.2, se muestra el ahorro del sistema por año para los próximos 15 años, se observa que para cada año el ahorro aumenta debido al aumento anual del costo de la energía eléctrica, y las condiciones actuales para utilizar paneles solares en Costa Rica, donde las políticas actuales promueven el uso de sistemas fotovoltaicos al cobrar únicamente por concepto de interconexión [38]. Por lo tanto, cabe mencionar que el presente análisis se realiza basándose en las condiciones actuales; sin embargo, es importante tomar en cuenta que la normativa que regula el uso de la energía renovable puede cambiar a través de los años.

5.4.3. Recuperación de la inversión

De la Tabla 5.2, se observa que para el año 2037 se recuperaría la inversión inicial debido a que el ahorro total desde la fecha hasta dicho año sería de 147058.41 dólares, y el sistema continuaría generado un ahorro por concepto de costo de energía en las condiciones utilizadas para el análisis. Es necesario el uso de algún indicador con el objetivo de evaluar la rentabilidad del sistema diseñado. El indicador ROI o Retorno sobre la Inversión, es una métrica utilizada para conocer cuánto gana una empresa a través de sus inversiones. A continuación, se muestra la respectiva fórmula:

$$ROI = \frac{Ingresos}{Inversión} \quad (5.2)$$

Se procede a aplicar el indicador ROI de retorno de la inversión por año para conocer el porcentaje de recuperación para cada año:

Tabla 5.3

Indicador ROI según el ahorro generado cada año

Año	Ahorro anual ($)	Ahorro acumulado ($)	ROI (%)
2024	7516.81	7516.81	5.33133182
2025	7930.14	15446.95	10.9558198
2026	8364.14	23811.09	16.8881243
2027	8819.84	32630.93	23.1436361
2028	9298.31	41929.24	29.7385049
2029	9800.73	51729.97	36.6897174
2030	10328.25	62058.22	44.0150759
2031	10738.27	72796.49	51.6312429
2032	11206.47	84002.96	59.579483
2033	11674.68	95677.64	67.8598031
2034	12142.88	107820.52	76.4721962
2035	12611.08	120431.6	85.4166622
2036	13079.28	133510.88	94.6932013
2037	13547.49	147058.37	104.30182
2038	14015.69	161074.06	114.242513

De la Tabla 5.3, se observar que efectivamente para el año 2037 se recuperaría la inversión inicial, esto debido a que el indicador ROI supera el 100%, de esta manera se comenzarían a percibir ingresos por encima del monto de la inversión inicial.

6. Conclusiones y Recomendaciones

Se obtuvieron los datos de la zona referentes a aspectos demográficos e históricos, los cuales permitieron realizar un mejor análisis y planteamiento en la solución desarrollada. El sistema de bombeo diseñado incluye bombas centrífugas que tienen la capacidad de poder abastecer la demanda de agua de la zona de Jacó en los próximos años, tomando en cuenta el aumento poblacional obtenido, y la actividad turística.

Además, el sistema de control diseñado, posee las botoneras requeridas para poder permitir el arranque y pare de cada motor JP individualmente y en conjunto, y el acople y desacople de cada fuente de energía, esto permitiendo poder realizar acciones de mantenimiento en cada uno de los subsistemas que lo requiera. El sistema de energía alternativo diseñado permite el aprovechamiento un bombeo eficiente al utilizar 76.04% de la energía mediante este sistema. Además, del análisis económico realizado, se obtiene una recuperación de la inversión inicial en un tiempo menor a 15 años.

Las acciones de mantenimiento preventivo presentadas corresponden únicamente a las acciones básicas que requiere el sistema, dicho cronograma de mantenimiento está sujeto a cambios en caso de requerir acciones especiales para el correcto funcionamiento de cada uno de los subsistemas.

Para la prueba de validación del requerimiento de consumo de agua mensual, se realizó una simulación basada en el comportamiento del motor tomando en cuenta la eficiencia nominal de este, y las pérdidas en los contactores y disyuntores; obteniendo que el motor tendría una potencia de 6.17HP, y al analizar mediante la información de la bomba, la curva trazada a esa potencia de trabajo, se obtiene que el sistema le tomaría 7.79h bombear la misma cantidad de litros, pero al analizar las horas de irradiación, se considera que las horas de trabajo se encuentran en un rango donde se continua aprovechando la energía solar.

El diseño de sistemas de bombeo y fotovoltaico conlleva un amplio rango de conocimientos y la implementación de diversos dispositivos a tomar en cuenta en aspectos de protección. Por lo tanto, se recomienda realizar un mayor análisis de los posibles riesgos existentes en los circuitos eléctricos. Además, en los datos recolectados de la zona a implementar el sistema de bombeo, existen diversos datos que se deben tomar en cuenta para hacer un análisis más exhaustivo, tales como: condiciones climáticas adversas, tendencia de crecimiento demográfico en la zona, y posibles cambios en la actividad turística.

7. Bibliografía

[1] RQL Ingeniería S.A., “Quienes Somos: RQL Ingeniería S.A.”, (s.f.). [Online]. Disponible en: https://www.rqlingenieria.com/nosotros/. Accesado: [Jul.27, 2023]

[2] J. F. Lara Salas " Consumo eléctrico se levanta impulsado por exportaciones y turismo en Costa Rica", El Economista, 9 de Junio del 2021. [En Linea]. Disponible en: https://www.eleconomista.net/actualidad/Consumo-electrico-se-levanta-impulsado-por-exportaciones-y-turismo-en-Costa-Rica--20210609-0015.html. [Acceso: 13, Junio, 2023]

[3] CENCE, "Informe Anual de la Operación del Sistema Eléctrico Nacional", Instituto Costarricense de Electricidad, 2021. [En línea]. Disponible en: https://apps.grupoice.com/CenceWeb/documentos/3/3008/16/Informe%20%20Anual%20CENCE%202021.pdf. [Acceso: 13, junio, 2023].

[4] P. Leitón. " Sector turismo en Costa Rica tardará hasta 2024 para recuperar cantidad de visitantes e ingresos", El Economista, 4 de Febrero del 2022. [En Linea]. Disponible en: https://www.eleconomista.net/actualidad/Sector-turismo-en-Costa-Rica-tardara-hasta-2024-para-recuperar-cantidad-de-visitantes-e-ingresos-20220204-0022.html. [Acceso: 15, Junio, 2023]

[5] Newline, “Inversores de Voltaje Eléctricos”, (s.f.). [Online]. Disponible en: https://corpnewline.com/inversores.htm. Accesado: [Ago.01, 2023]

[6] TRITEC, “Inversores para sistemas fotovoltaicos (PV) de mayoristas especializados”, (s.f.). [Online]. Disponible en: https://www.tritec-energy.com/es/inversor//. Accesado: [Ago.09, 2023]

[7] G. Arencibia, “La importancia del uso de paneles solares en la generación de energía eléctrica REDVET”, Revista Electrónica de Veterinaria, vol. 17, no. 9, pp. 1-4, 2016.

[8] AutoSolar, “Diferencias entre silicio monocristalino y multicristalino o policristalino”, (s.f.). [Online]. Disponible en: https://autosolar.es/aspectos-tecnicos/diferencias-entre-silicio-monocristalino-y-multicristalino-o-policristalino. Accesado: [Ago.01, 2023]

[9] DamiaSolar, “Comparativa entre paneles solares monocristalinos frente a paneles solares policristalinos”, 2023. [Online]. Disponible en: https://www.damiasolar.com/actualidad/blog/articulos-sobre-la-energia-solar-y-sus-

componentes/comparativa-entre-paneles-solares-monocristalinos-frente-a-paneles-solares-policristalinos#:~:text=Los%20paneles%20monocristalinos%20tienen%20un,eficiencia%20con%20temperaturas%20m%C3%A1s%20elevadas.. Accesado: [Ago.01, 2023]

[10] AutoSolar, "Inclinación Placas Solares", 2023. [Online]. Disponible en: https://autosolar.es/aspectos-tecnicos/inclinacion-placas-solares. Accesado: [Sep.25, 2023]

[11] Smart Spain, "La inclinación de placas solares en España: latitud y más", 2023. [Online]. Disponible en: https://smartspain.es/inclinacion-placas-solares/. Accesado: [Sep.25, 2023]

[12] AEE, "Las Cifras de la Eólica en España". [Online]. Disponible en: https://aeeolica.org/. Accesado: [Oct.08, 2023]

[13] Aipes, "¿Cuáles son las 5 partes principales de los aerogeneradores?". [Online]. Disponible en: https://www.airpes.com/es/partes-aerogenerador/#:~:text=Los%20componentes%20principales%20son%20los,de%20cada%20uno%20de%20ellos. Accesado: [Oct.08, 2023]

[14] Iberdrola, "La energía hidráulica, clave para un futuro más verde". [Online]. Disponible en: https://www.iberdrola.com/conocenos/nuestra-actividad/energia-hidroelectrica. Accesado: [Oct.08, 2023]

[15] Renting Finders, "Combustión Interna". [Online]. Disponible en: https://rentingfinders.com/glosario/combustion-interna/#:~:text=Un%20motor%20de%20combusti%C3%B3n%20interna,permite%20el%20movimiento%20del%20veh%C3%ADculo. Accesado: [Oct.08, 2023]

[16] Seguas, "Bombas centrífugas y su uso en instalaciones hidráulicas". [Online]. Disponible en: https://www.seguas.com/bombas-centrifugas-instalaciones-hidraulicas/. Accesado: [Oct.08, 2023]

[17] Siemens, "Centro de carga", 2019. [Online]. Available: https://new.siemens.com/mx/es/productos/energia/baja-tension.html. [Accesado: Ago. 03, 2023].

[18] Electro Persa, "Centros de carga", (s.f). [Online]. Disponible en: https://www.electro-persa.com/centros-de-carga. Accesado: [Ago.03, 2023]

[19] Novex, "Supresor de picos de voltaje", (s.f.). [Online]. Disponible en: https://novex.cr/producto/151698/Supresor-de-picos-de-voltaje.html. Accesado: [Ago.09,

2023]

[20] EMAC, "¿Cómo funcionan los interruptores termomagnéticos?", (2021). [Online]. Disponible en: https://emacstores.com/como-funcionan-los-interruptores-termomagneticos/. Accesado: [Ago.03, 2023]

[21] GLS Industrias, "¿Qué es un PLC y cómo funciona?", (2021). [Online]. Disponible en: https://industriasgsl.com/blogs/automatizacion/que-es-un-plc-y-como-funciona#:~:text=El%20PLC%20(Control%20L%C3%B3gico%20Programable,de%20distintas%20formas%20y%20maneras. Accesado: [Ago.10, 2023]

[22] Opertek, "¿Qué es un PLC?", (2019). [Online]. Disponible en: https://www.opertek.com/blog/que-es-un-plc/#:~:text=Existen%20dos%20formatos%20de%20PLC,un%20grupo%20de%20elementos%20separados. Accesado: [Ago.10, 2023]

[23] Eaton, "Controlador Lógico Programable Compacto EC4P", (2023). [Online]. Disponible en: https://www.eaton.com/es/es-es/catalog/industrial-control--drives--automation---sensors/ec4p-compact-plc.html. Accesado: [Ago.10, 2023]

[24] Siemens, "SIMATIC S7-1200", (2023). [Online]. Disponible en: https://www.siemens.com/mx/es/productos/automatizacion/systems/industrial/plc/s7-1200.html. Accesado: [Ago.10, 2023]

[25] M. Rodríguez. "Transformadores", Dpto. de Ing. Eléctrica y Energética., Universidad de Cantabria. Santander, 2015.

[26] Georgia State University, "Transformer". [Online]. Disponible en: http://hyperphysics.phy-astr.gsu.edu/hbasees/magnetic/transf.html#:~:text=Transformador,de%20corriente%20alterna%20(AC). Accesado: [Oct.02, 2023]

[27] Instituto Nacional de Estadística y Censos, "Estimación de Población y Vivienda 2022", 2022. [Online]. Available: https://admin.inec.cr/sites/default/files/2023-07/rePoblacResultadosGenerales_Estimacion_poblacion_vivienda_2022.pdf. [Accesado: Ago. 18, 2023].

[28] MIDEPLAN, "Costa Rica: Prospectiva en cambio demográfico al 2045", 2015. [Online]. Disponible en:

https://archivo.cepal.org/pdfs/GuiaProspectiva/CostaRicaProspectiva2045.pdf [Accesado: Sep. 10, 2023].

[29] Instituto Costarricense de Acueductos y Alcantarillados, “Consumo de agua en una vivienda”, 2010. [Online]. Available: https://www.aya.go.cr/centroDocumetacion/catalogoGeneral/Estimación%20de%20consumo%20de%20agua%20potable%20en%20una%20casa.pdf. [Accesado: Ago. 23, 2023].

[30] Karl Ulrich and Steven Eppinger, Diseño Y Desarrollo De Productos. (5th ed.) México: McGraw Hill Education, 2013.

[32] Promelsa, “Catálogo de transformadores”. (02/12/2020). [En línea]. Disponible en: https://www.promelsa.com.pe/media/PDF/catalogos/catalogotransformadores.pdf

[33] EcoPotencia, “Inversor Solis 40kW 5G Trifasico 480V”. (2023-09-15). [En línea]. Disponible en: https://ecopotencia.com.mx/?product=inversor-solis-40kw-5g-trifasico-480v

[34] Siemens, “3RT1054-2AR36”. (19/9/2023). [En línea]. Disponible en: https://mall.industry.siemens.com/mall/es/es/Catalog/DatasheetDownload?downloadUrl=teddatasheet%2F%3Fformat%3DPDF%26caller%3DMall%26mlfbs%3D3RT1054-2AR36%26language%3Des

[35] SMC Electric, “Siemens SpeedFax™ BQD335 Molded Case Circuit Breaker, 277/480 VAC, 35 A, 14 kA Interrupt, 3 Poles, Thermal Magnetic Trip”. (19/9/2023). [En línea]. Disponible en: https://www.smcelectric.com/products/siemens-siebqd335/

[36] MSolar, “DZ47Z-63 Series of DC”. (19/9/2023). [En línea]. Disponible en: https://cdn.shopify.com/s/files/1/0437/1264/3235/files/FICHA_TECNICA_INTERRUPTOR_TERMOMAGNETICO_CORRIENTE_DIRECTA_16AMPS_1000V_2_POLOS_POWERFULL_LUX.pdf?v=1614815853

[37] Schneider Electric, “Trihal 1000KVA 60Hz 13.8KV/480V Dyn-11 2400msnm”. (2023-09-15). [En línea]. Disponible en: https://www.se.com/mx/es/product/TRI100017529842000/trihal-1000kva-60hz-13-8kv-480v-dyn11-2400msnm/

[38] Autoridad Reguladora de Servicios Públicos, “Norma Técnica: Prestación del Servicio de Distribución y Comercialización (AR-NTSDC)”. (08/01/2002). [En línea]. Disponible en: https://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?par

am1=NRTC&nValor1=1&nValor2=66065&nValor3=77514&strTipM=TC#:~:text=Media%20Tensi%C3%B3n%20(abreviatura%3A%20MT)%3A,1%20kV%20y%2034.5%20kV.

[39] Siemens, “S7 Controlador programable S7-1200 Manual de sistema”. (19/9/2023). [En línea]. Disponible en: https://cache.industry.siemens.com/dl/files/622/91696622/att_42774/v1/s71200_system_manual_es-ES_es-ES.pdf

[40] MicroJPM, “S-600-24 Switch Power Supply 24VDC @ 25A”. (19/9/2023). [En línea]. Disponible en: https://www.microjpm.com/products/ad63435/

[41] Inyepartes Industriales, “Botonera NEMA Square D”. (19/9/2023). [En línea]. Disponible en: https://www.inyepartes.com/botonera-nema/#ficha

[42] PAMA ROMA, “Automatic Sheeter mod. CA/280-400,” [Online]. Italia: PAMA PARSI MACCHINE S.R.L, 2016 Disponible en: http://www.pamaroma.com/automatic-sheeter-pasta-machine.htm.

[43] Siemens, “LOGO!-¡Ya se anda por las nubes!”, (2023). [Online]. Disponible en: https://www.siemens.com/es/es/productos/automatizacion/sistemas/simatic/controladores-simatic/logo.html. Accesado: [Ago.10, 2023]

[44] Siemens, “Innovative switching and control”, (2016). [Online]. Available: https://assets.new.siemens.com/siemens/assets/api/uuid:709ff6ce-71f3-44da-a941-cef01e9381c2/logo8-in-detail-en-2-of-4.pdf. [Accesado: Ago. 11, 2023].

[45] Instituto Nacional de Estadística y Censos, “Censo 2011”, 2016. [Online]. Available: https://inec.cr/estadisticas-fuentes/censos/censo-2011. [Accesado: Ago. 18, 2023].

[46] Amazon, “Interruptor de transferencia automática de aislamiento” (2022-03-07). [En línea]. Disponible en: https://www.amazon.com/-/es/Interruptor-transferencia-autom%C3%A1tica-Aislamiento-aislamiento/dp/B084FTHJF1

[47] Franklin Electric, “Bombas centrífugas serie XS”. (2023-09-15). [En línea]. Disponible en: https://franklinagua.com/productos/ii-superficie/bombas-centr%C3%ADfugas/serie-xs.aspx#OrderInfotab2

[48] Siemens, “Arrancadores suaves SIRIUS 3RW”. (2023-09-15). [En línea]. Disponible en: https://mall.industry.siemens.com/mall/es/WW/Catalog/Products/10024029

[49] IESA, “INTERRUPTOR TERMOMAGNETICO P/RIEL/DIN 3P 10A 480V 5SY43107CC SIEMENS”. (19/9/2023). [En línea]. Disponible en:

https://www.iesacr.com/shop/5177cc10a-interruptor-termomagnetico-p-riel-din-3p-10a-480v-5sy43107cc-siemens-8864?product=product.template%288864%2C%29#attr=2666

[50] A. Cruz "Determinación del ángulo óptimo de inclinación de paneles solares en el municipio de Moa", Tesis de diplomado, Dpto. de Ing. Eléctrica., ISMMM., Moa, 2018.

[51] Santiago García, Organización Y Gestión Integral De Mantenimiento. (1st ed.) Madrid: Díaz de Santo, 2003.

[52] ARESEP, “Tarifas Vigentes Electricidad”. (2023-10-17). [En línea]. Disponible en: https://aresep.go.cr/electricidad/tarifas/

[53] ARESEP, "Ley No. 7200, Ley General de Electricidad". (2023-10-22). [En línea]. Disponible en: https://aresep.go.cr/wp-content/uploads/2015/02/Ley-Generacion-Electrica-Autonoma-o-Paralela.pdf

[54] HelioEsfera, "Horas de sol pico ¿qué es y para qué sirve?
". (2023-11-07). [En línea]. Disponible en: https://www.helioesfera.com/horas-de-sol-pico-que-es-y-para-que-sirve/

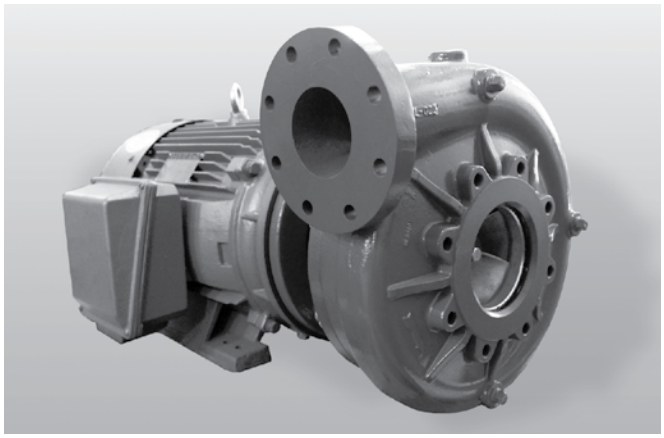
8. Anexos

8.1. Anexo A

Se adjunta la hoja de datos de las bombas centrífugas Franklin Electric serie XS

Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor



FPS XS series

Características:

- Área de empaquetadura para fácil acceso*
- Prensaestopa de 2 piezas en inoxidable*
- Se ajustan a los motores estándar JP
- Impulsor balanceado hidráulicamente
- Separador de flujo de la voluta en modelos de alta capacidad
- Impulsor estándar inoxidable para la mayoría de los modelos
- Facilidad de mantenimiento que incluye perforaciones para desplazamiento y soportes para elevación
- La succión, descarga y soporte de montaje son los estándar en la industria para fácil renovación

* Únicamente para los modelos con sello de empaquetadura.

Explicación del Número de Modelo

Ejemplo: 15XS4313-CCMLBD

15 = 15 HP (sólo CC)
XS = Serie Centrífuga
4 = Tamaño de Succión
3 = Tamaño de Descarga
13 = Diám. Nominal del Impulsor
CC = Acoplamiento Directo a Motor
M = Sello del Eje:
P = Empaquetadura
M = Sello Mecánico

LBD = Diámetro del Impulsor (Alpha)

A=0	F=5	L=10
B=1	G=6	M=11
C=2	H=7	N=12
D=3	J=8	P=13
E=4	K=9	Q=14

Información para Pedidos

Diámetro Nominal del Impulsor, 13" - (CC) Acoplamiento Directo a Motor c/Motor Eléctrico										
Modelo de Bomba	Tam. de Succión/Desc.	HP	RPM	Carcasa del Motor	Recorte del Impulsor	Tipo de Motor	Sello del Eje	Descripción del Modelo	Número de Pedido	Peso
XS-3x25-13	3" x 2.5"	10	1750	215JP	9-3/8	APG	Empaquetadura	10XS32513-CCPKDJ	70032513100	390
		10	1750	215JP	9-7/8	APG	Empaquetadura	10XS32513-CCPKJJ	70032513102	390
		15	1750	254JP	11-3/8	APG	Empaquetadura	15XS32513-CCPMDJ	70032513110	483
		15	1750	254JP	11-7/8	APG	Empaquetadura	15XS32513-CCPMJJ	70032513112	483
		20	1750	256JP	12-3/4	APG	Empaquetadura	20XS32513-CCPNHF	70032513120	533
		20	1750	256JP	13-1/16	APG	Empaquetadura	20XS32513-CCPPAG	70032513122	533
		10	1750	215JP	9-3/8	APG	Sello Mecánico	10XS32513-CCMKDJ	71032513101	390
		10	1750	215JP	9-7/8	APG	Sello Mecánico	10XS32513-CCMKJJ	71032513103	390
		15	1750	254JP	11-3/8	APG	Sello Mecánico	15XS32513-CCMMDJ	71032513111	483
		15	1750	254JP	11-7/8	APG	Sello Mecánico	15XS32513-CCMMJJ	71032513113	483
		20	1750	256JP	12-3/4	APG	Sello Mecánico	20XS32513-CCMNHF	71032513121	533
		20	1750	256JP	13-1/16	APG	Sello Mecánico	20XS32513-CCMPAG	71032513123	533

NOTAS: Habrá un cargo adicional en el recorte del impulsor cuando no se trate de una medida estándar.
Consulte la lista de precios para verificar cargos adicionales.

Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor

Información para Pedidos

Diámetro Nominal del Impulsor, 13" - (CC) Acoplamiento Directo a Motor c/Motor Eléctrico										
Modelo de Bomba	Tam. de Succión/Desc.	HP	RPM	Carcasa del Motor	Recorte del Impulsor	Tipo de Motor	Sello del Eje	Descripción del Modelo	No. Pedido	Peso
XS-4x3-13	4" x 3"	7.5	1750	213JP	8	APG	Empaquetadura	7XS4313-CCPJAA	70040313102	402
		10	1750	215JP	9-1/8	APG	Empaquetadura	10XS4313-CCPKBD	70040313100	415
		15	1750	254JP	10-3/4	APG	Empaquetadura	15XS4313-CCPLHF	70040313110	508
		20	1750	256JP	11-3/4	APG	Empaquetadura	20XS4313-CCPMHF	70040313120	558
		25	1750	284JP	12-5/16	APG	Empaquetadura	25XS4313-CCPNBD	70040313130	585
		30	1750	286JP	12-3/4	APG	Empaquetadura	30XS4313-CCPNHF	70040313140	597
		40	1750	324JP	13-1/6	APG	Empaquetadura	40XS4313-CCPPAG	70040313150	730
		7.5	1750	213JP	8	APG	Sello Mecánico	7XS4313-CCMJAA	71040313103	402
		10	1750	215JP	9-1/8	APG	Sello Mecánico	10XS4313-CCMKBD	71040313101	415
		15	1750	254JP	10-3/4	APG	Sello Mecánico	15XS4313-CCMLHF	71040313111	508
		20	1750	256JP	11-3/4	APG	Sello Mecánico	20XS4313-CCMMHF	71040313121	558
		25	1750	284JP	12-5/16	APG	Sello Mecánico	25XS4313-CCMNDB	71040313131	585
		30	1750	286JP	12-3/4	APG	Sello Mecánico	30XS4313-CCMNHF	71040313141	597
		40	1750	324JP	13-1/6	APG	Sello Mecánico	40XS4313-CCMPAG	71040313151	730
XS-6x4-13	6" x 4"	20	1750	256JP	9-3/8	APG	Empaquetadura	20XS6413-CCPKDJ	70060413100	573
		25	1750	284JP	10-1/4	APG	Empaquetadura	25XS6413-CCPLCF	70060413110	600
		30	1750	286JP	10-7/8	APG	Empaquetadura	30XS6413-CCPLJJ	70060413120	612
		30	1750	286JP	11-3/8	APG	Empaquetadura	30XS6413-CCPMDJ	70060413122	612
		40	1750	324JP	12-1/4	APG	Empaquetadura	40XS6413-CCPNCF	70060413130	745
		50	1750	326JP	12-7/8	APG	Empaquetadura	50XS6413-CCPNJJ	70060413140	878
		20	1750	256JP	9-3/8	APG	Sello Mecánico	20XS6413-CCMKDJ	71060413101	573
		25	1750	284JP	10-1/4	APG	Sello Mecánico	25XS6413-CCMLCF	71060413111	600
		30	1750	286JP	10-7/8	APG	Sello Mecánico	30XS6413-CCMLJJ	71060413121	612
		30	1750	286JP	11-3/8	APG	Sello Mecánico	30XS6413-CCMMDJ	71060413123	612
		40	1750	324JP	12-1/4	APG	Sello Mecánico	40XS6413-CCMNCF	71060413131	745
		50	1750	326JP	12-7/8	APG	Sello Mecánico	50XS6413-CCMNJJ	71060413141	878
XS-8x6-13	8" x 6"	25	1750	284JP	9-1/2	APG	Empaquetadura	25XS8613-CCPKFA	70080613150	685
		30	1750	286JP	10	APG	Empaquetadura	30XS8613-CCPLAA	70080613100	697
		40	1750	324JP	10-7/8	APG	Empaquetadura	40XS8613-CCPLJJ	70080613110	830
		40	1750	324JP	11-1/8	APG	Empaquetadura	40XS8613-CCPMBD	70080613112	830
		50	1750	326JP	11-5/8	APG	Empaquetadura	50XS8613-CCPMGD	70080613120	963
		60	1750	364TCZ	11-7/8	APG	Empaquetadura	60XS8613-CCPMJJ	70080613130	1109
		60	1750	364TCZ	12-5/16	APG	Empaquetadura	60XS8613-CCPNBD	70080613132	1109
		75	1750	365TCZ	12-1/2	APG	Empaquetadura	75XS8613-CCPNFA	70080613140	1183
		75	1750	365TCZ	13	APG	Empaquetadura	75XS8613-CCMPAA	70080613142	1183
		25	1750	284JP	9-1/2	APG	Sello Mecánico	25XS8613-CCMKFA	71080613151	685
		30	1750	286JP	10	APG	Sello Mecánico	30XS8613-CCMLAA	71080613101	697
		40	1750	324JP	10-7/8	APG	Sello Mecánico	40XS8613-CCMLJJ	71080613111	830
		40	1750	324JP	11-1/8	APG	Sello Mecánico	40XS8613-CCMMBD	71080613113	830
		50	1750	326JP	11-5/8	APG	Sello Mecánico	50XS8613-CCMMGD	71080613121	963
		60	1750	364TCZ	11-7/8	APG	Sello Mecánico	60XS8613-CCMMJJ	71080613131	1109
		60	1750	364TCZ	12-5/16	APG	Sello Mecánico	60XS8613-CCMNDB	71080613133	1109
		75	1750	365TCZ	12-1/2	APG	Sello Mecánico	75XS8613-CCMNFA	71080613141	1183
		75	1750	365TCZ	13	APG	Sello Mecánico	75XS8613-CCMPAA	71080613143	1183
XS-10x8-13	10" x 8"	60	1750	364TCZ	9-13/16	APG	Empaquetadura	60XS10813-CCPKJB	70100813100	1294
		75	1750	365TCZ	10-7/8	APG	Empaquetadura	75XS10813-CCPLJJ	70100813110	1368
		75	1750	365TCZ	11-1/4	APG	Empaquetadura	75XS10813-CCPLCF	70100813112	1368
		100	1750	404TCZ	11-15/16	APG	Empaquetadura	100XS10813-CCPMKE	70100813120	1565
		100	1750	404TCZ	12-3/8	APG	Empaquetadura	100XS10813-CCPNDJ	70100813122	1565
		125	1750	444TCZ	12-3/4	APG	Empaquetadura	125XS10813-CCPNHF	70100813130	1888
		150	1750	445TCZ	13	APG	Empaquetadura	150XS10813-CCPPAA	70100813140	1981
		60	1750	364TCZ	9-13/16	APG	Sello Mecánico	60XS10813-CCMKJB	71100813101	1294
		75	1750	365TCZ	10-7/8	APG	Sello Mecánico	75XS10813-CCMLJJ	71100813111	1368
		75	1750	365TCZ	11-1/4	APG	Sello Mecánico	75XS10813-CCMLCF	71100813113	1368
		100	1750	404TCZ	11-15/16	APG	Sello Mecánico	100XS10813-CCMMKE	71100813121	1565
		100	1750	404TCZ	12-3/8	APG	Sello Mecánico	100XS10813-CCMNDJ	71100813123	1565
		125	1750	444TCZ	12-3/4	APG	Sello Mecánico	125XS10813-CCMNHF	71100813131	1888
		150	1750	445TCZ	13	APG	Sello Mecánico	150XS10813-CCMPAA	71100813141	1981

NOTAS: Habrá un cargo adicional en el recorte del impulsor cuando no se trate de una medida estándar.
Consulte la lista de precios para verificar cargos adicionales.

Franklin Electric
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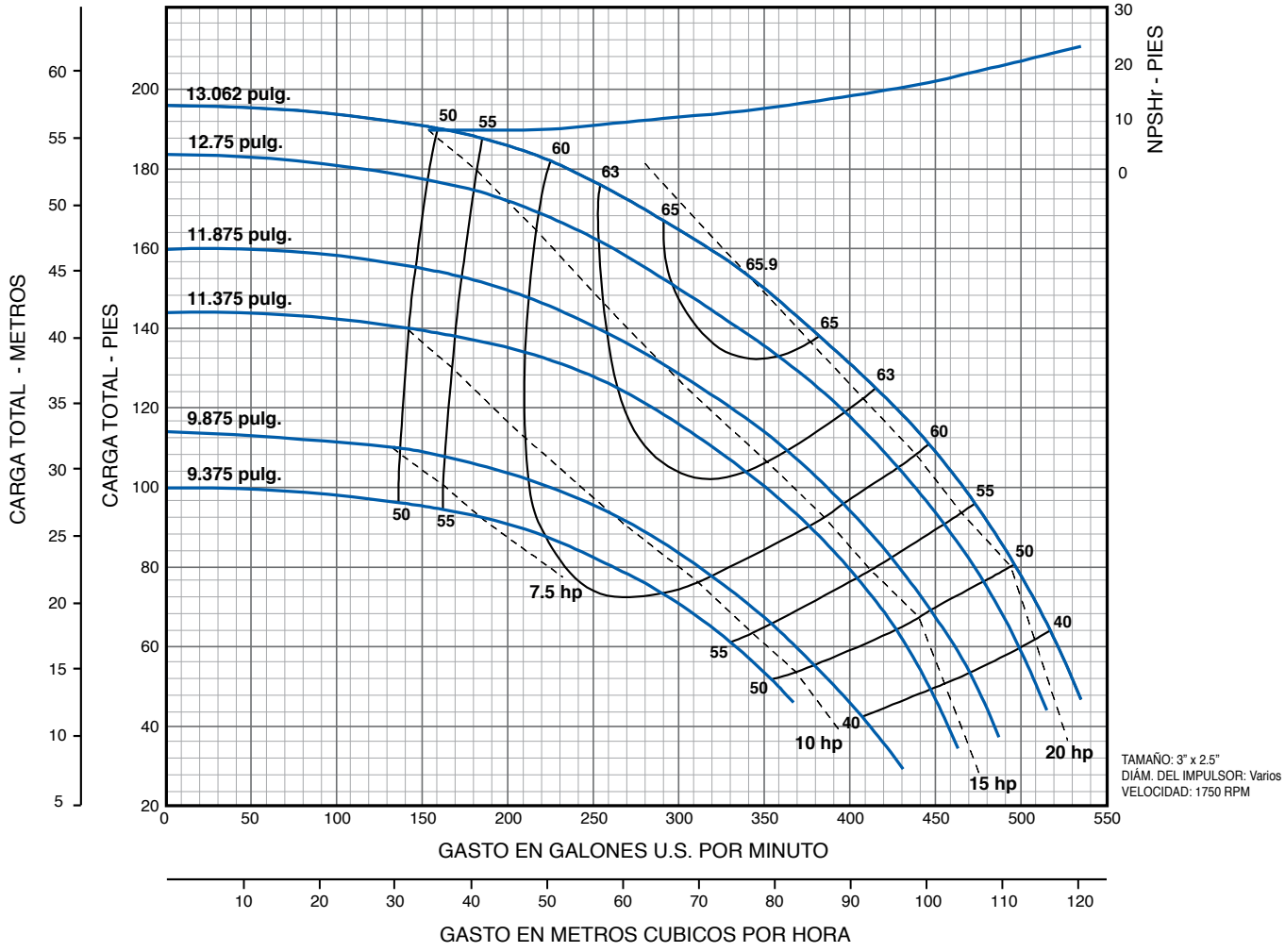
www.franklin-electric.com

Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor

Modelo XS-3x25-13

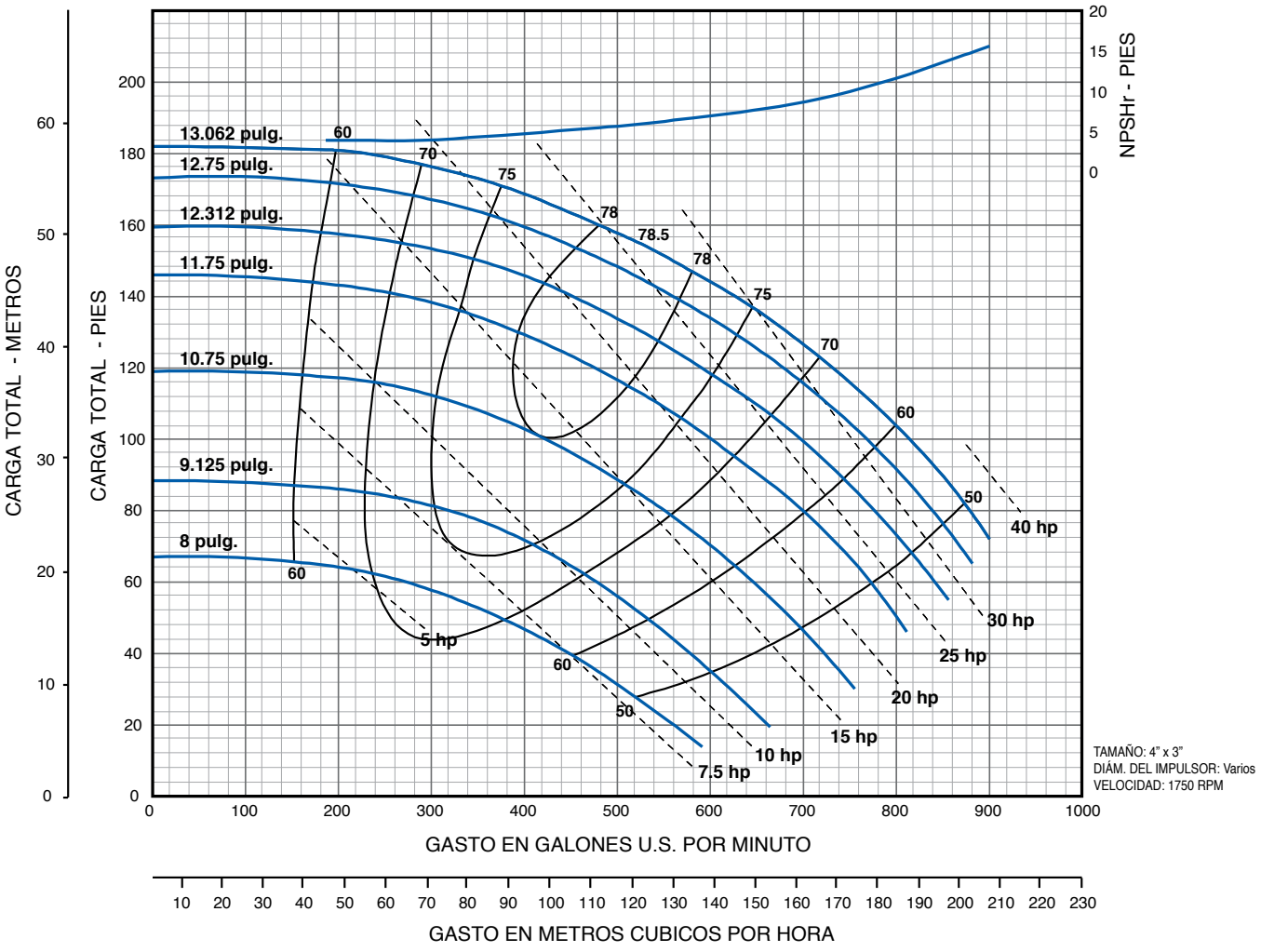


FPS XS series

Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor

Modelo XS-4x3-13



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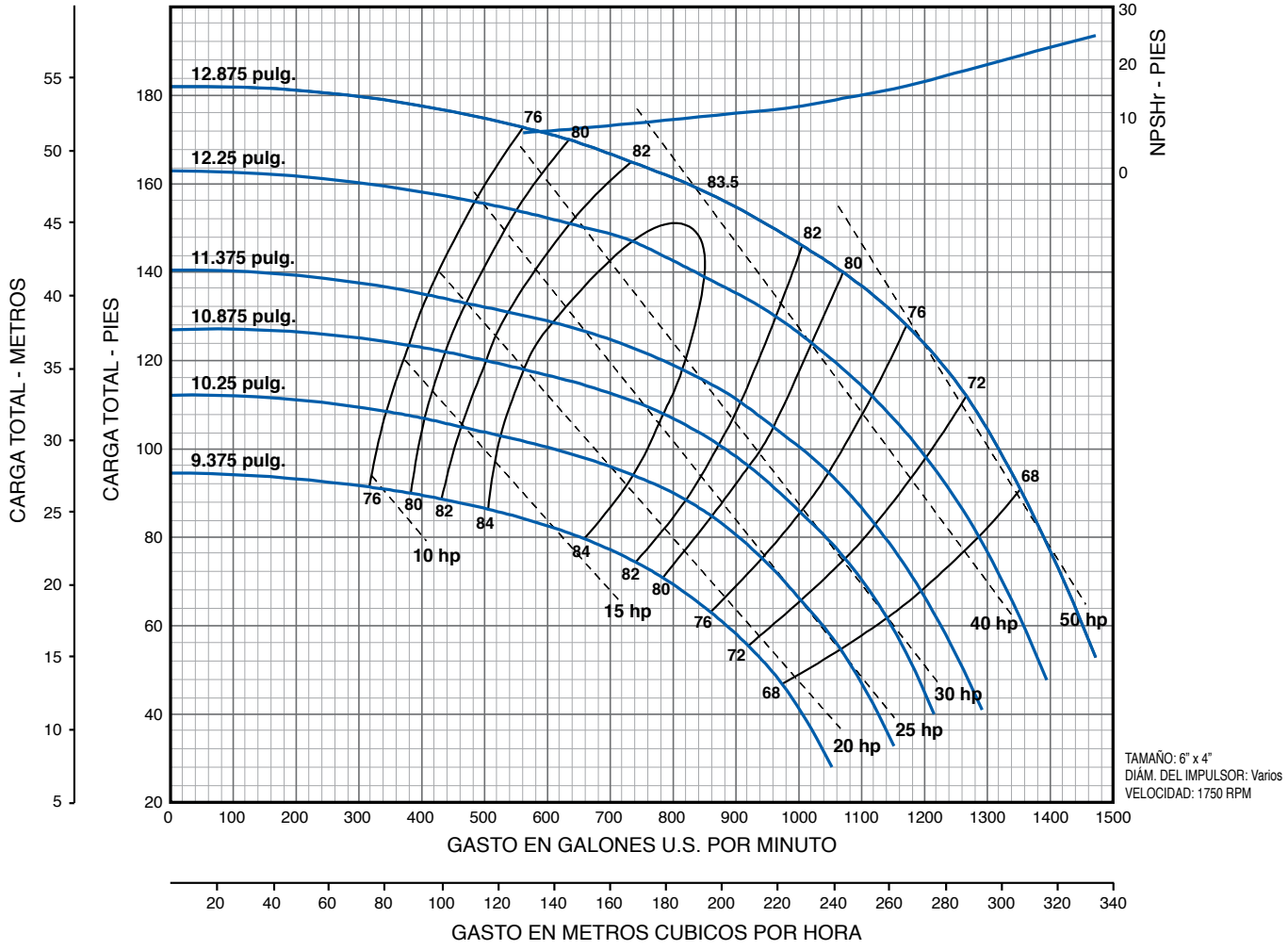
Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor

PAGINA: CP-810
FECHA: Sept. 1, 2008

Modelo XS-6x4-13



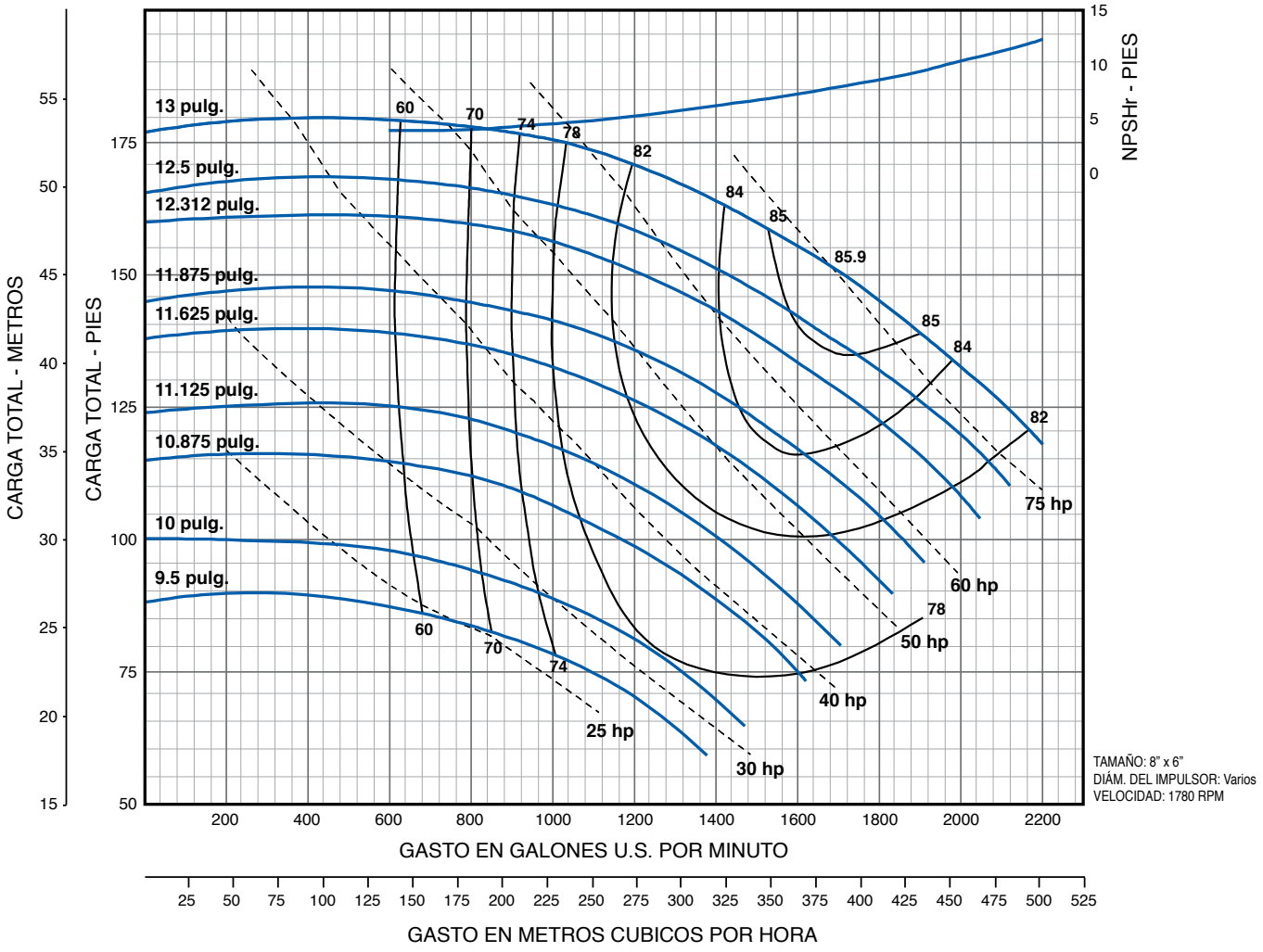
TAMAÑO: 6" x 4"
DIÁM. DEL IMPULSOR: Varios
VELOCIDAD: 1750 RPM

FPS XS series

Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor

Modelo XS-8x6-13



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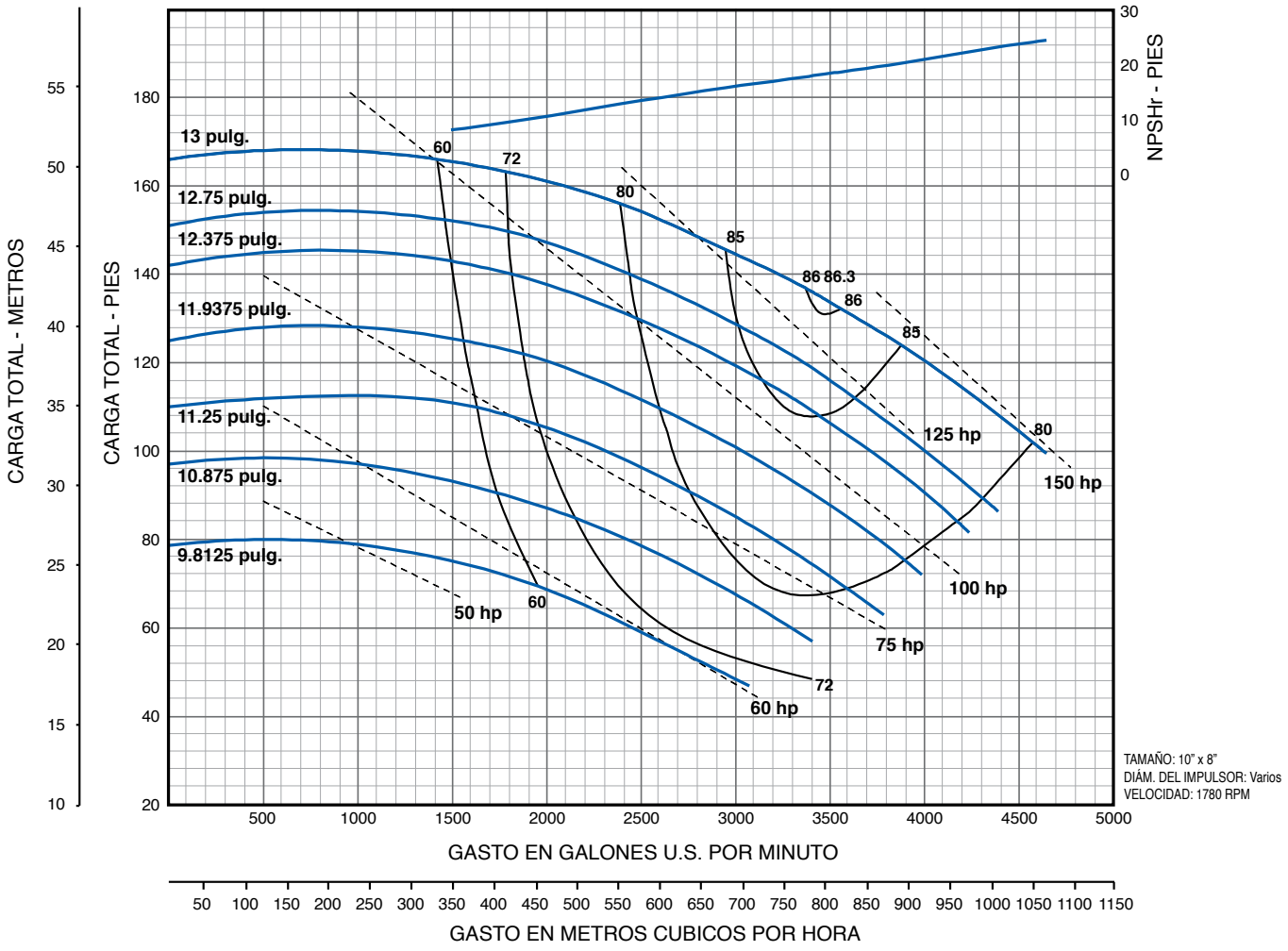
Serie XS

Bombas Centrífugas Estándar - Acoplamiento Directo a Motor

Modelo XS-10x8-13



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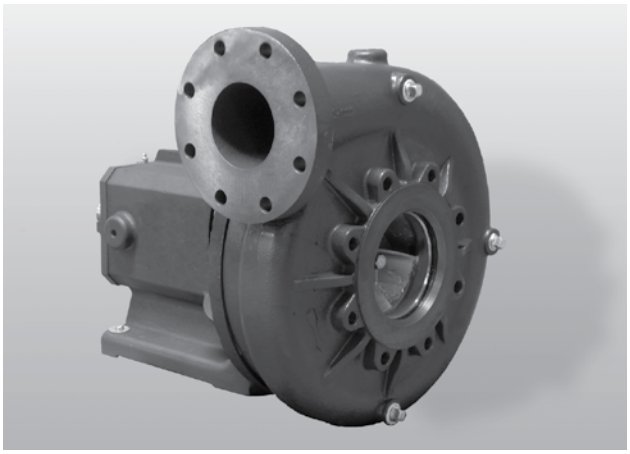
Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

PAGINA: CP-820
FECHA: Sept. 1, 2008



FPS XS series

Características de la Serie XS-9:

- Caja de rodamientos de alta resistencia
- Eje robusto Stressproof® de 2-3/8″
- Eje del impulsor de doble cuñero de 1-1/4″
- Diseño compacto para ahorro de espacio
- Área de empaquetadura de fácil acceso*
- La succión, descarga y soporte de montaje son los estándar en la industria para fácil renovación
- Otras opciones de aplicación:
  - Volutas NPT y Victaulic
  - Disponible para rotación en ambos sentidos

Características de la Serie XS-13:

- Caja de rodamientos robusta fácil de instalar
- Eje robusto Stressproof® de 2-1/2″
- Impulsores de doble cuñero de 1-1/4″ y 1-5/8″
- Área de empaquetadura de fácil acceso con 2 piezas de prensaestopa inoxidable*
- Facilidad de mantenimiento que incluye perforaciones para desplazamiento y soportes para elevación
- Impulsores balanceados hidráulicamente
- Separador de flujo de la voluta para modelos de alta capacidad
- Impulsor estándar inoxidable para la mayoría de los modelos

* Únicamente para modelos con sello de empaquetadura.

Explicación del Número de Modelo

Ejemplo: XS439-BFNP-CW

XS = Serie Centrífuga
4 = Tamaño de Succión
3 = Tamaño de Descarga
9 = Diám. Nominal del Impulsor
BF = Caja de Rodamientos
N = Conexión:
N=NPT
V=Victaulic
F=Brida
P = Sello del Eje:
P=Empaquetadura
M=Sello Mecánico
CW = Rotación:
CW=A la derecha
CCW=A la izquierda

Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

Información para Pedidos

Diámetro Nominal del Impulsor, 9"- (CR) Caja de Rodamientos									
Modelo de Bomba	Tam. de Succión/ Desc.	Rotación	Diseño de Voluta	Sello del Eje	Ajuste	Material del Impulsor	Descripción del Modelo	No. Pedido	Peso
XS-4x3-9	4" x 3"	CW	NPT	Empaquetadura	Estándar	Hierro Fundido	XS439-BFNP-CW	64040309100	135
		CCW	NPT	Empaquetadura	Estándar	Hierro Fundido	XS439-BFNP-CCW	64040309200	135
		CW	Victaulic	Empaquetadura	Estándar	Hierro Fundido	XS439-BFVP-CW	64040309101	135
		CCW	Victaulic	Empaquetadura	Estándar	Hierro Fundido	XS439-BFVP-CCW	64040309201	135
		CW	NPT	Sello Mecánico	Estándar	Hierro Fundido	XS439-BFNM-CW	65040309100	135
		CCW	NPT	Sello Mecánico	Estándar	Hierro Fundido	XS439-BFNM-CCW	65040309200	135
		CW	Victaulic	Sello Mecánico	Estándar	Hierro Fundido	XS439-BFVM-CW	65040309101	135
		CCW	Victaulic	Sello Mecánico	Estándar	Hierro Fundido	XS439-BFVM-CCW	65040309201	135
XS-8x6-9	8" x 6"	CW	Brida	Empaquetadura	Estándar	Hierro Fundido	XS869-BFP	64080609102	235
		CW	Brida	Sello Mecánico	Estándar	Hierro Fundido	XS869-BFM	65080609102	235

Diámetro Nominal del Impulsor, 13"- (CR) Caja de Rodamientos									
Modelo de Bomba	Tam. de Succión/ Desc.	Rotación	Diseño de Voluta	Sello del Eje	Ajuste	Material del Impulsor	Descripción del Modelo	No. Pedido	Peso
XS-3x25-13	3" x 2.5"	CW	Brida	Empaquetadura	Estándar	Bronce	XS32513-BFP-CW	64030213102	261
		CW	Brida	Sello Mecánico	Estándar	Bronce	XS32513-BFM-CW	65030213102	261
XS-4x3-13	4" x 3"	CW	Brida	Empaquetadura	Estándar	Bronce	XS4313-BFP-CW	64040313102	277
		CW	Brida	Sello Mecánico	Estándar	Bronce	XS4313-BFM-CW	65040313102	277
XS-6x4-13	6" x 4"	CW	Brida	Empaquetadura	Estándar	Acero Inoxidable	XS6413-BFP-CW	64060413102	294
		CW	Brida	Sello Mecánico	Estándar	Acero Inoxidable	XS6413-BFM-CW	65060413102	294
XS-8x6-13	8" x 6"	CW	Brida	Empaquetadura	Estándar	Acero Inoxidable	XS8613-BFP-CW	64080613102	390
		CW	Brida	Sello Mecánico	Estándar	Acero Inoxidable	XS8613-BFM-CW	65080613102	390
XS-10x8-13	10" x 8"	CW	Brida	Empaquetadura	Estándar	Acero Inoxidable	XS10813-BFP-CW	64100813102	575
		CW	Brida	Sello Mecánico	Estándar	Acero Inoxidable	XS10813-BFM-CW	65100813102	575

NOTAS: Habrá un cargo adicional en el recorte del impulsor cuando no se trate de una medida estándar.
Consulte la lista de precios para verificar cargos adicionales.

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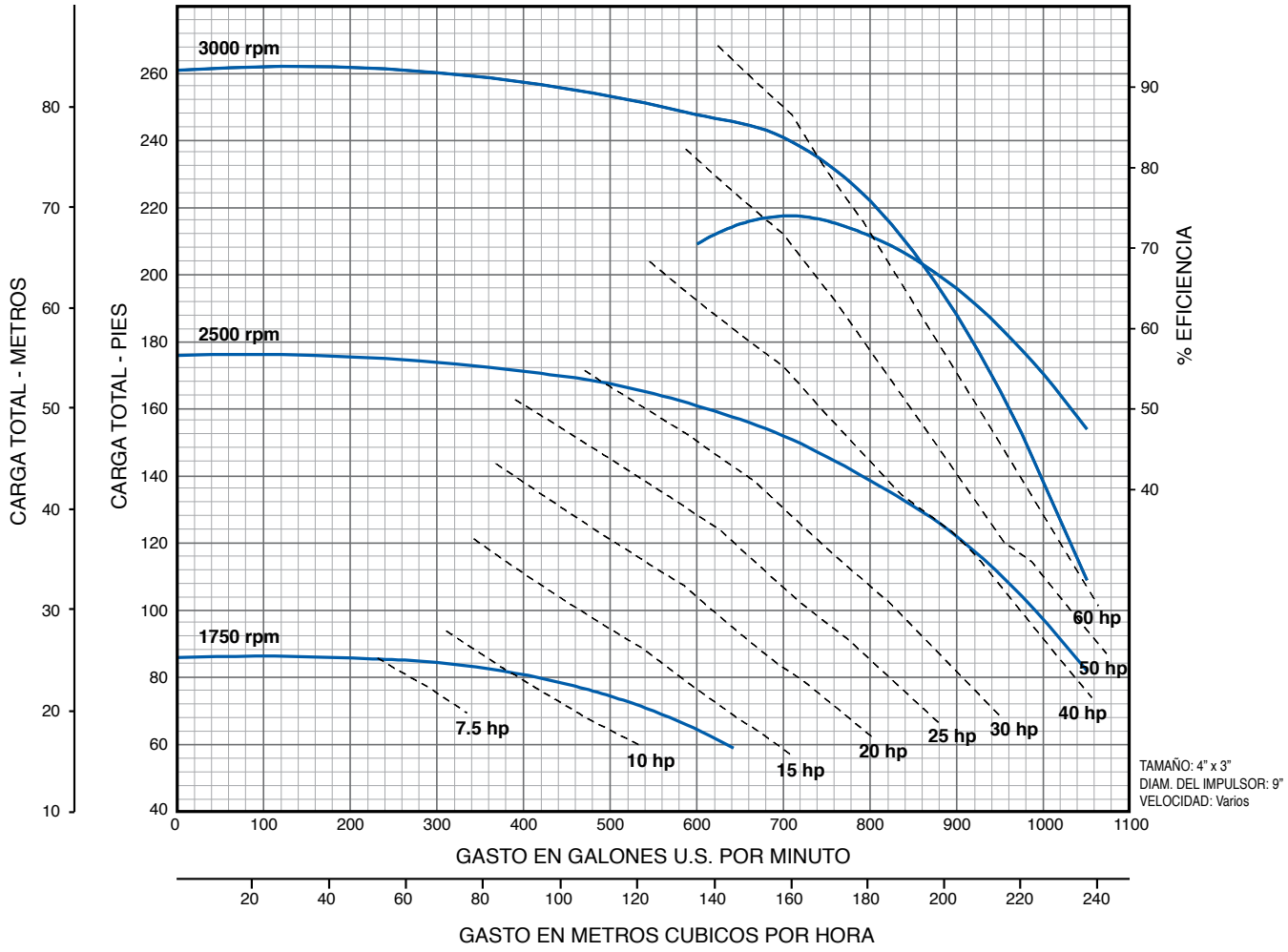
Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

PAGINA: CP-825
FECHA: Sept. 1, 2008

Modelo XS-4x3-9

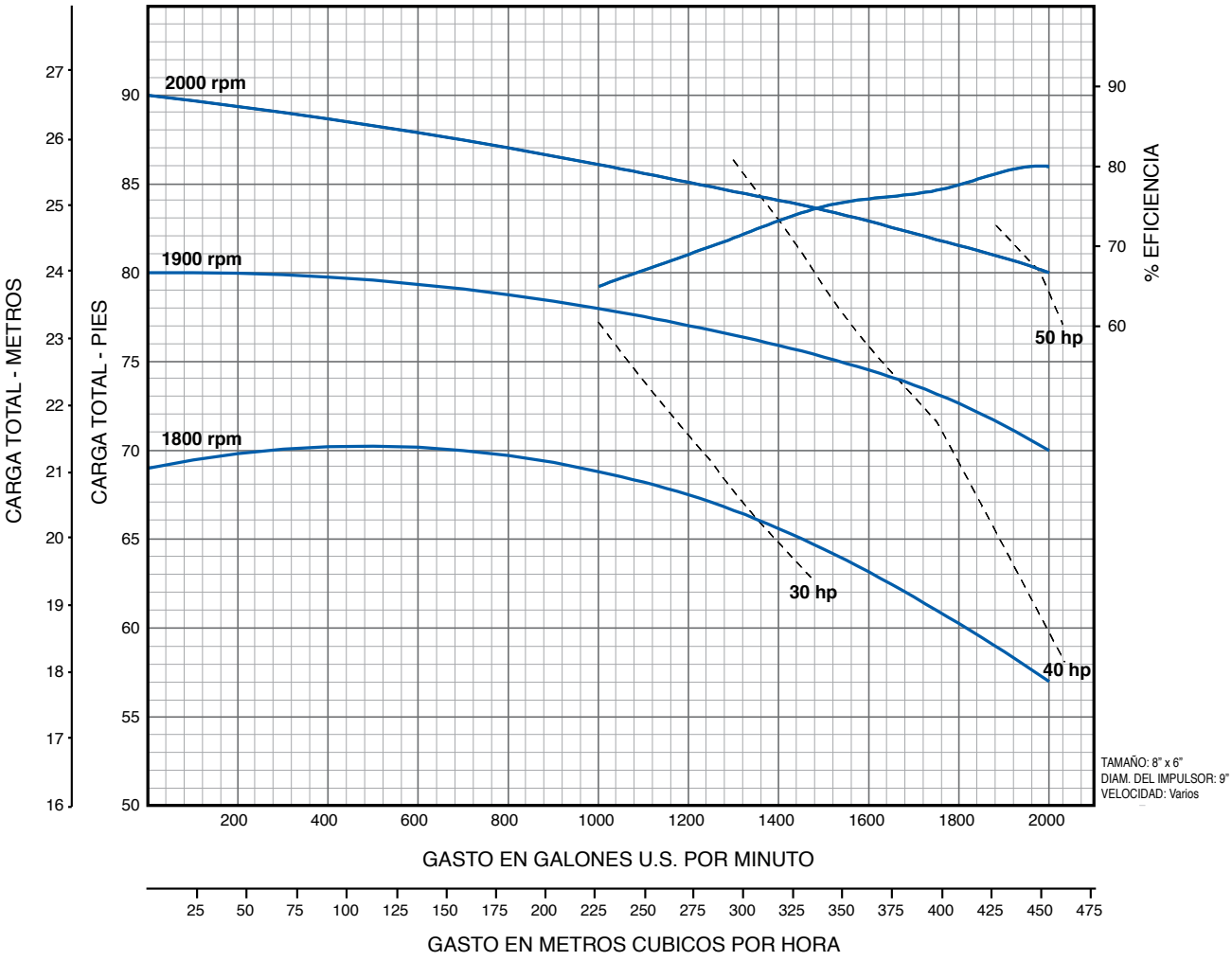


FPS XS series

Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

Modelo XS-8x6-9



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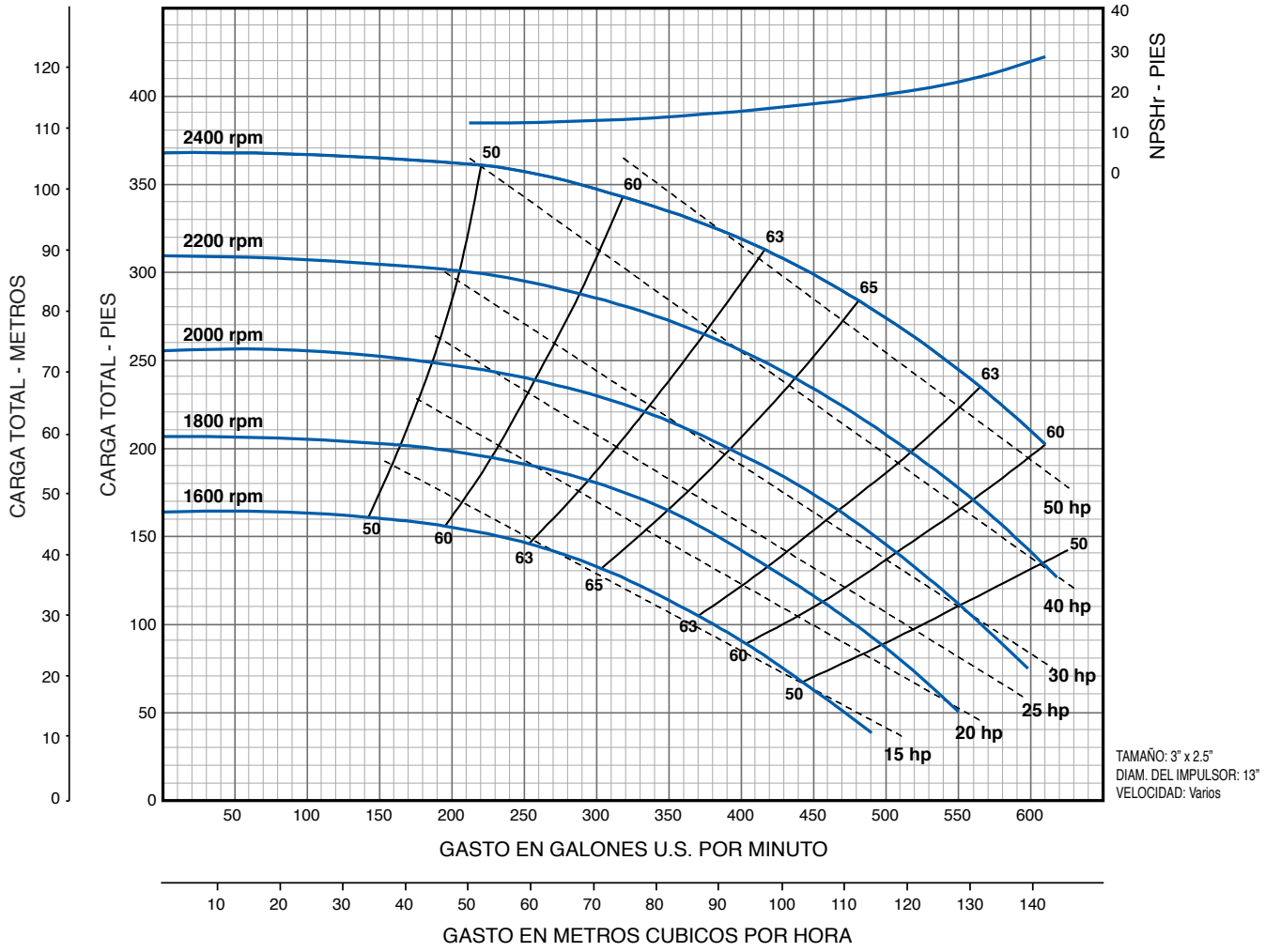
Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

PAGINA: CP-830
FECHA: Sept. 1, 2008

Modelo XS-3x25-13



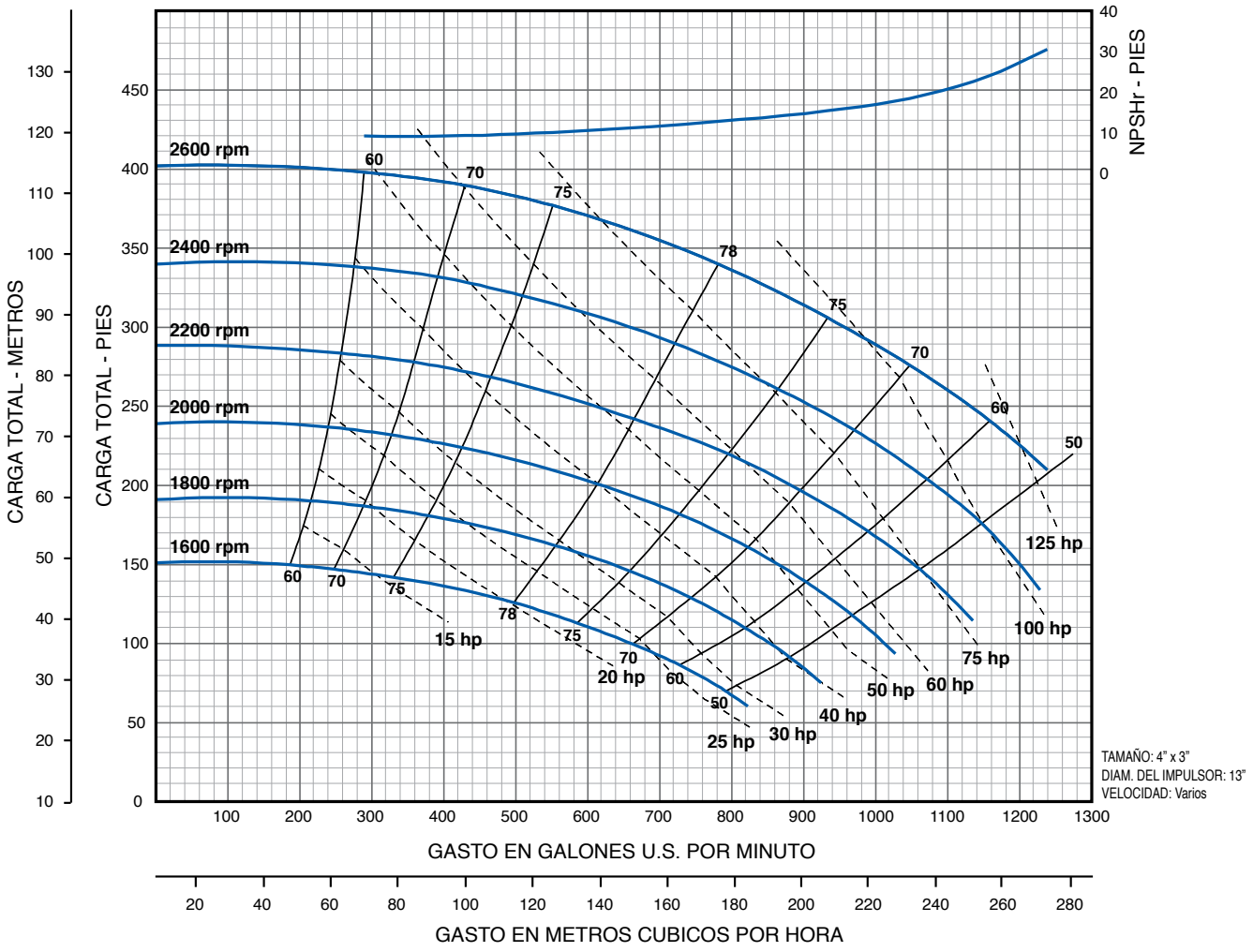
TAMAÑO: 3" x 2.5"
DIAM. DEL IMPULSOR: 13"
VELOCIDAD: Varios

FPS XS series

Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

Modelo XS-4x3-13



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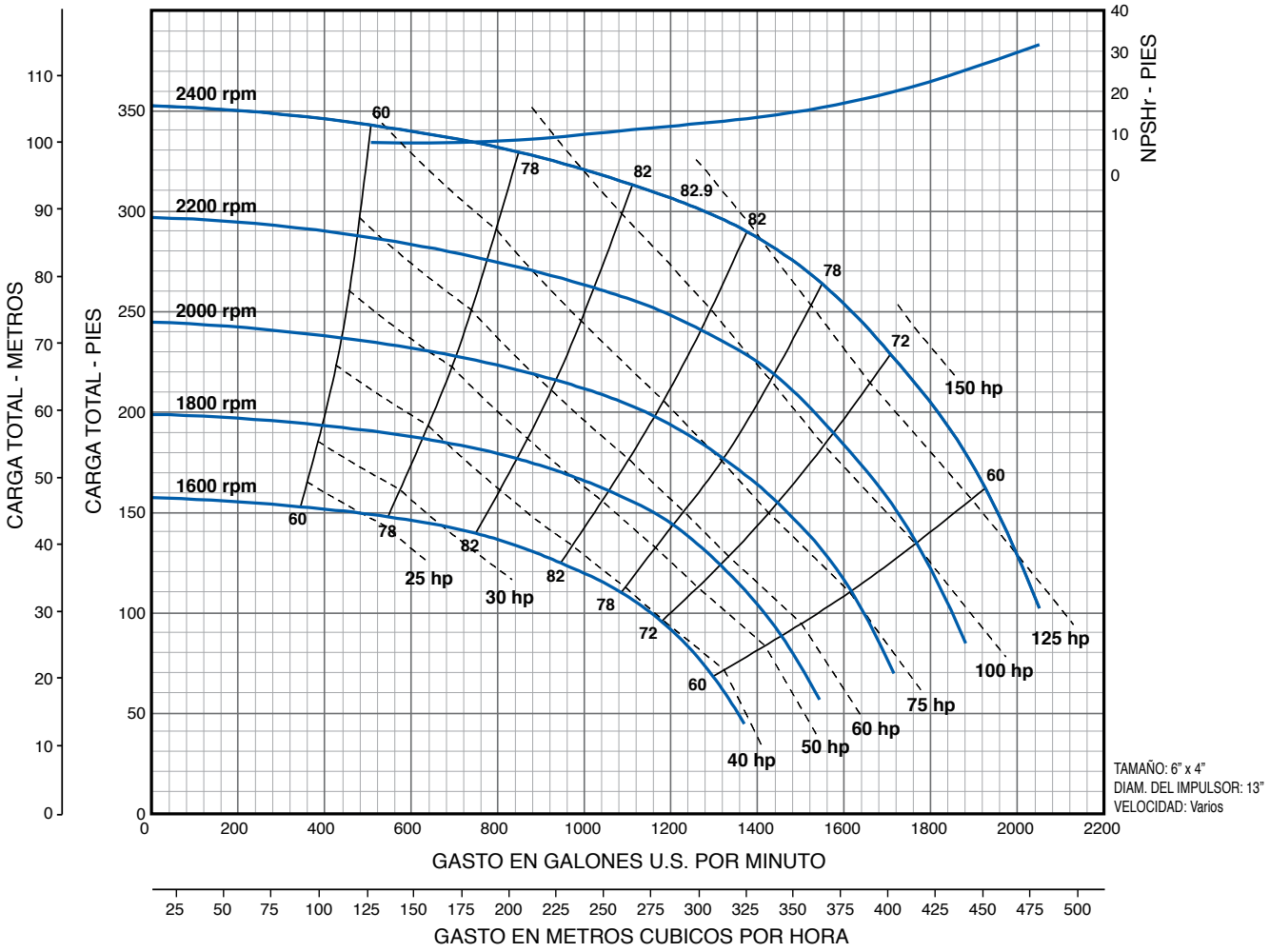
Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

FECHA: CP-835
FECHA: Sept. 1, 2008

Modelo XS-6x4-13



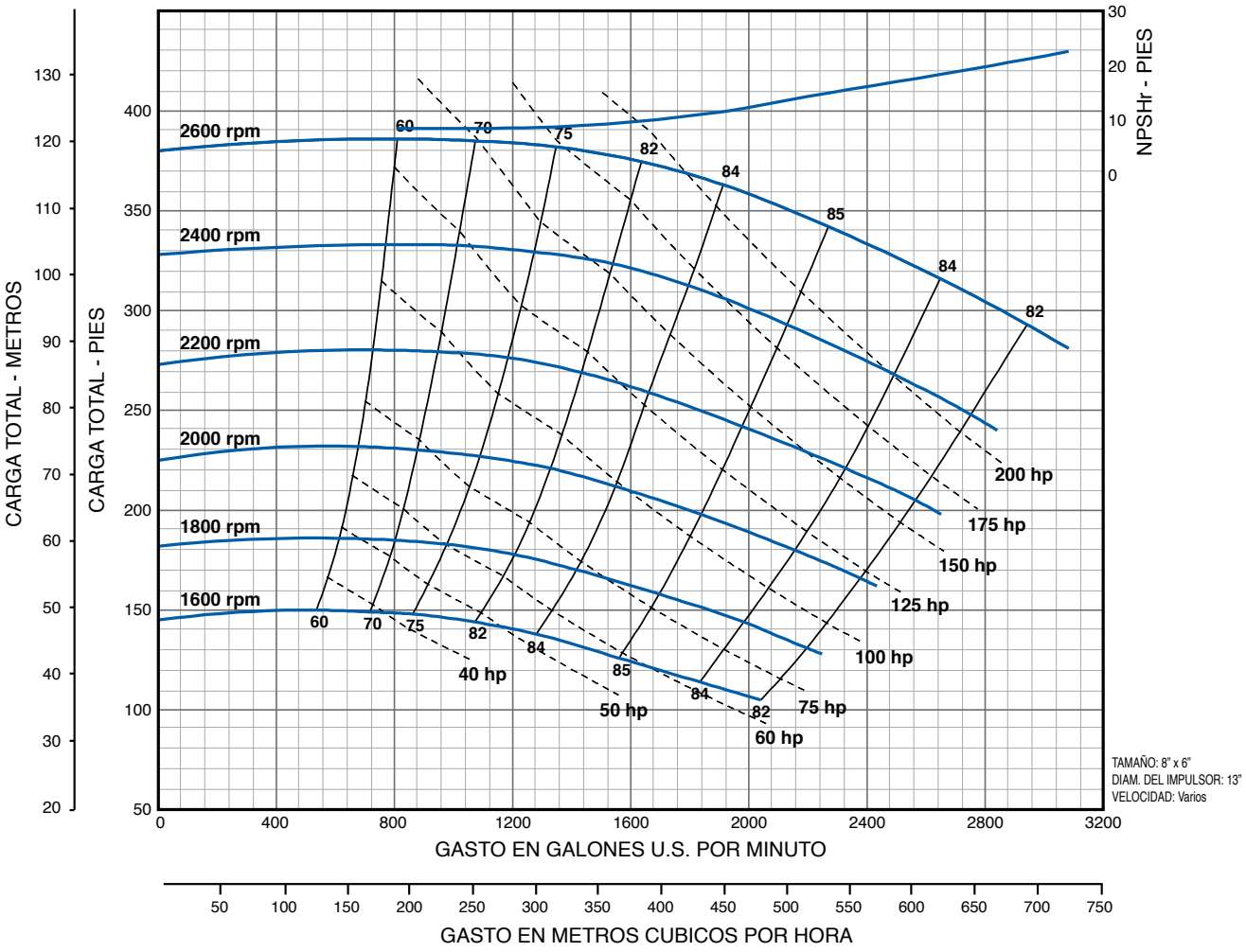
TAMAÑO: 6" x 4"
DIAM. DEL IMPULSOR: 13"
VELOCIDAD: Varios

FPS XS series

Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

Modelo XS-8x6-13



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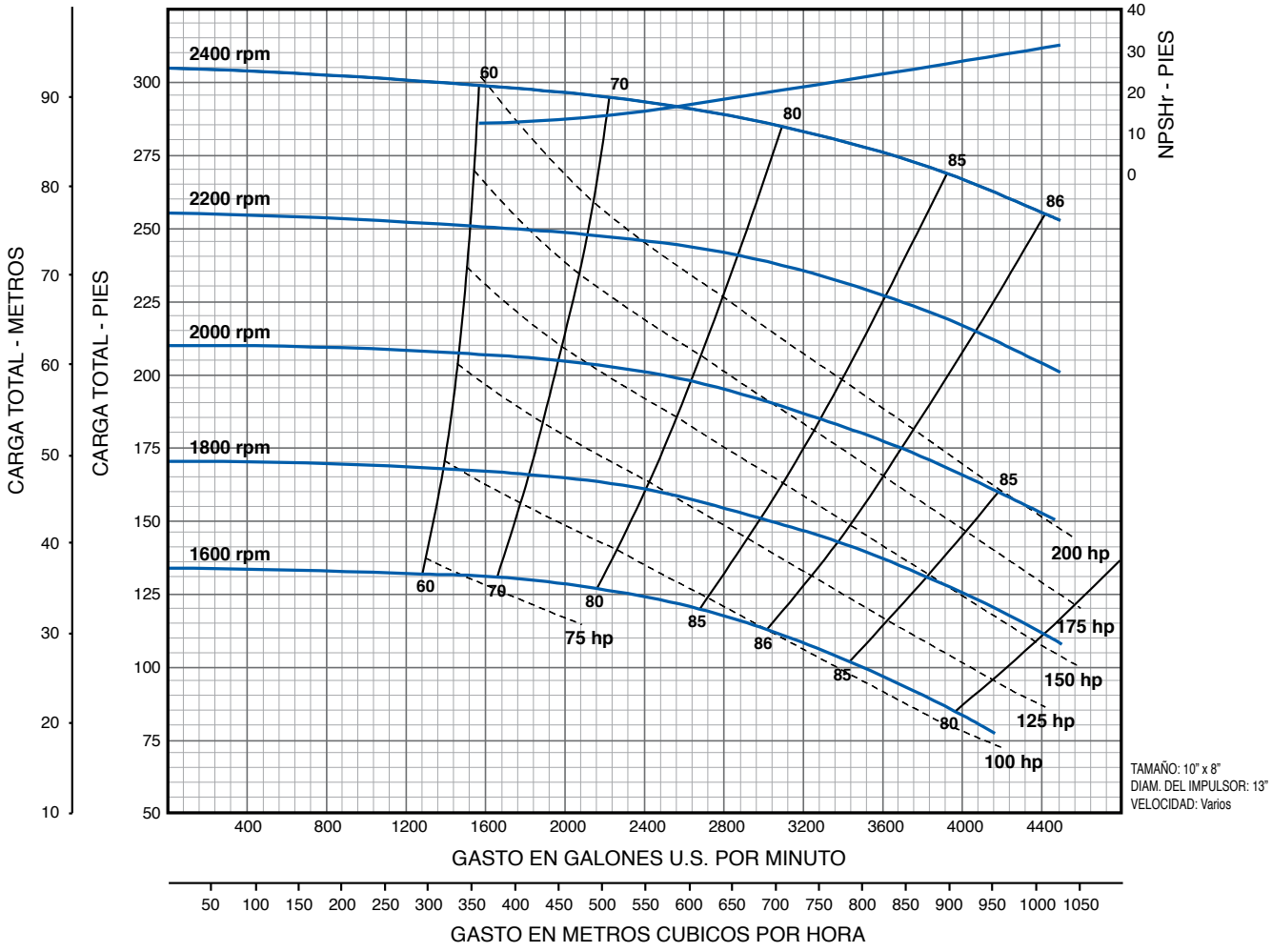
Serie XS

Bombas Centrífugas Estándar - Caja de Rodamientos

PAGINA: CP-840
FECHA: Sept. 1, 2008

Modelo XS-10x8-13



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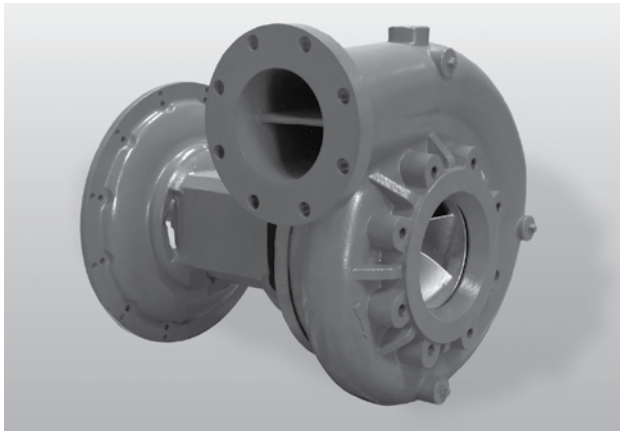
Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

PAGINA: CP-845
FECHA: Sept. 1, 2008



Explicación del Número de Modelo

Ejemplo: XS439-SA45NP

XS = Serie Centrífuga
4 = Tamaño de Succión
3 = Tamaño de Descarga
9 = Diám. Nominal del Impulsor
SA = Montaje con Drive SAE
45 = Tamaño de la carcasa SAE
45=4/5
23=2/3
N = Conexión
N=NPT
V=Victaulic
F=Brida
P = Sello del Eje:
P=Empaquetadura
M=Sello Mecánico

FPS XS series

Características de la Serie XS-9:

- Caja de rodamientos de alta resistencia
- Campanas de embrague SAE convertibles de doble perforación
- Eje robusto Stressproof® de 2-3/8″
- Impulsor de doble cuñero de 1-1/4″
- Eje de entrada de 1-1/2″ estriado con 10 dientes para fácil instalación
- Diseño compacto para ahorro de espacio
- Área de empaquetadura de fácil acceso*
- La succión, descarga y soporte de montaje son los estándar en la industria para fácil renovación
- Otras opciones de aplicación:
  - Volutas NPT y Victaulic
  - Disponible para rotación en ambas direcciones

Características de la Serie XS-13:

- Caja de rodamientos robusta fácil de instalar
- Eje robusto Stressproof® de 2-1/2″
- Impulsores de doble cuñero de 1-1/4″ y 1-5/8″
- Área de empaquetadura de fácil acceso con 2 piezas de prensaestopa inoxidable*
- Facilidad de mantenimiento que incluye perforaciones para desplazamiento y soportes para elevación
- Impulsores balanceados hidráulicamente
- Separador de flujo de la voluta para modelos de alta capacidad
- Impulsor estándar inoxidable para la mayoría de los modelos

* Únicamente para los modelos con sello de empaquetadura.

Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

Información para Pedidos

Diámetro Nominal del Impulsor, 9"- (SA) Montaje con Drive SAE									
Modelo de Bomba	Tam. de Succión/ Desc.	Rotación	Diseño de Voluta	Sello del Eje	Ajuste	Material del Impulsor	Descripción del Modelo	No. Pedido	Peso
XS-4x3-9	4" x 3"	CW	NPT	Empaquetadura	4/5	Hierro Fundido	XS439-SA45NP	66040309145	150
		CW	Victaulic	Empaquetadura	4/5	Hierro Fundido	XS439-SA45VP	66040309245	150
		CW	NPT	Empaquetadura	2/3	Hierro Fundido	XS439-SA23NP	66040309123	150
		CW	Victaulic	Empaquetadura	2/3	Hierro Fundido	XS439-SA23VP	66040309223	150
		CW	NPT	Sello Mecánico	4/5	Hierro Fundido	XS439-SA45NM	67040309145	150
		CW	Victaulic	Sello Mecánico	4/5	Hierro Fundido	XS439-SA45VM	67040309245	150
		CW	NPT	Sello Mecánico	2/3	Hierro Fundido	XS439-SA23NM	67040309123	150
		CW	Victaulic	Sello Mecánico	2/3	Hierro Fundido	XS439-SA23VM	67040309223	150
XS-8x6-9	8" x 6"	CW	Brida	Empaquetadura	4/5	Hierro Fundido	XS869-SA45P	66080609345	250
		CW	Brida	Empaquetadura	2/3	Hierro Fundido	XS869-SA23P	66080609323	250
		CW	Brida	Sello Mecánico	4/5	Hierro Fundido	XS869-SA45M	67080609345	250
		CW	Brida	Sello Mecánico	2/3	Hierro Fundido	XS869-SA23M	67080609323	250

Diámetro Nominal del Impulsor, 13"- (SA) Montaje con Drive SAE									
Modelo de Bomba	Tam. de Succión/ Desc.	Rotación	Diseño de Voluta	Sello del Eje	Ajuste	Material del Impulsor	Descripción del Modelo	No. Pedido	Peso
XS-3x25-13	3" x 2.5"	CW	Brida	Empaquetadura	4/5	Bronce	XS32513-SA45P	66032513345	345
		CW	Brida	Empaquetadura	2/3	Bronce	XS32513-SA23P	66032513323	355
		CW	Brida	Sello Mecánico	4/5	Bronce	XS32513-SA45M	67032513345	345
		CW	Brida	Sello Mecánico	2/3	Bronce	XS32513-SA23M	67032513323	355
XS-4x3-13	4" x 3"	CW	Brida	Empaquetadura	4/5	Bronce	XS4313-SA45P	66040313345	360
		CW	Brida	Empaquetadura	2/3	Bronce	XS4313-SA23P	66040313323	370
		CW	Brida	Sello Mecánico	4/5	Bronce	XS4313-SA45M	67040313345	360
		CW	Brida	Sello Mecánico	2/3	Bronce	XS4313-SA23M	67040313323	370
XS-6x4-13	6" x 4"	CW	Brida	Empaquetadura	4/5	Acero Inoxidable	XS6413-SA45P	66060413345	370
		CW	Brida	Empaquetadura	2/3	Acero Inoxidable	XS6413-SA23P	66060413323	380
		CW	Brida	Sello Mecánico	4/5	Acero Inoxidable	XS6413-SA45M	67060413345	370
		CW	Brida	Sello Mecánico	2/3	Acero Inoxidable	XS6413-SA23M	67060413323	380
XS-8x6-13	8" x 6"	CW	Brida	Empaquetadura	4/5	Acero Inoxidable	XS8613-SA45P	66080613345	450
		CW	Brida	Empaquetadura	2/3	Acero Inoxidable	XS8613-SA23P	66080613323	460
		CW	Brida	Sello Mecánico	4/5	Acero Inoxidable	XS8613-SA45M	67080613345	450
		CW	Brida	Sello Mecánico	2/3	Acero Inoxidable	XS8613-SA23M	67080613323	460
XS-10x8-13	10" x 8"	CW	Brida	Empaquetadura	4/5	Acero Inoxidable	XS10813-SA45P	66100813345	635
		CW	Brida	Empaquetadura	2/3	Acero Inoxidable	XS10813-SA23P	66100813323	645
		CW	Brida	Sello Mecánico	4/5	Acero Inoxidable	XS10813-SA45M	67100813345	635
		CW	Brida	Sello Mecánico	2/3	Acero Inoxidable	XS10813-SA23M	67100813323	645

NOTAS: Habrá un cargo adicional en el recorte del impulsor cuando no se trate de una medida estándar.
Consulte la lista de precios para verificar cargos adicionales.

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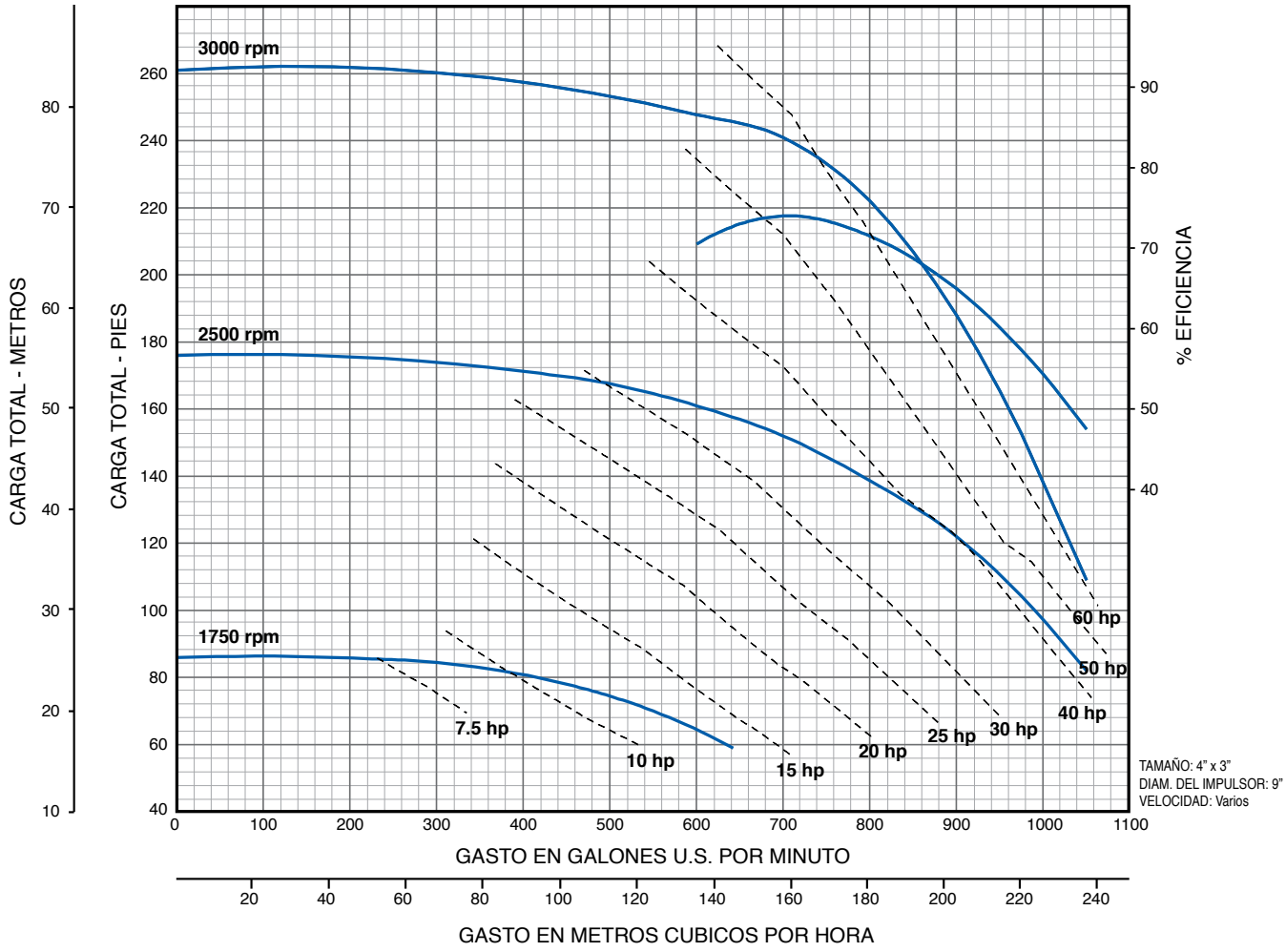
Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

Modelo XS-4x3-9

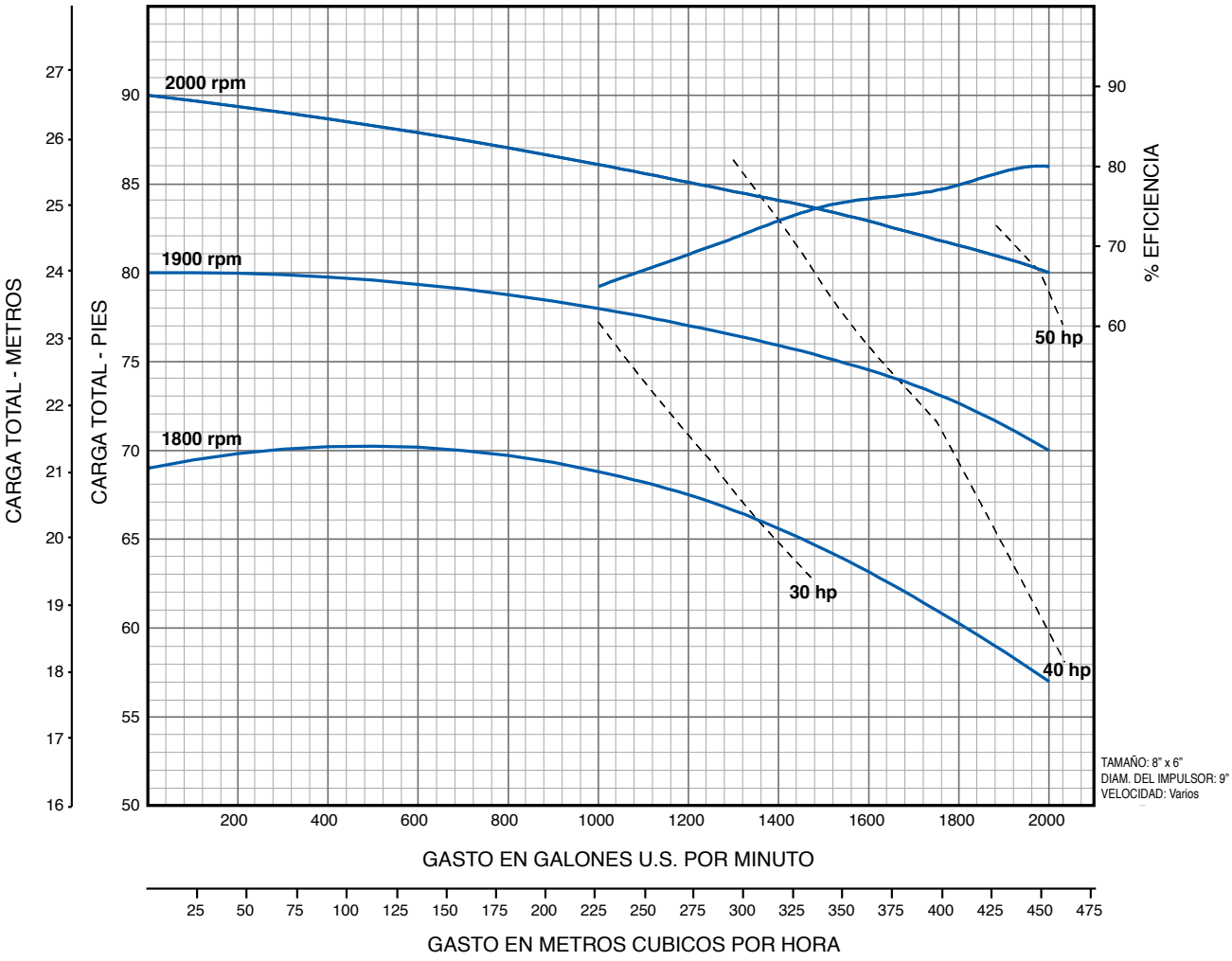


FPS XS series

Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

Modelo XS-8x6-9



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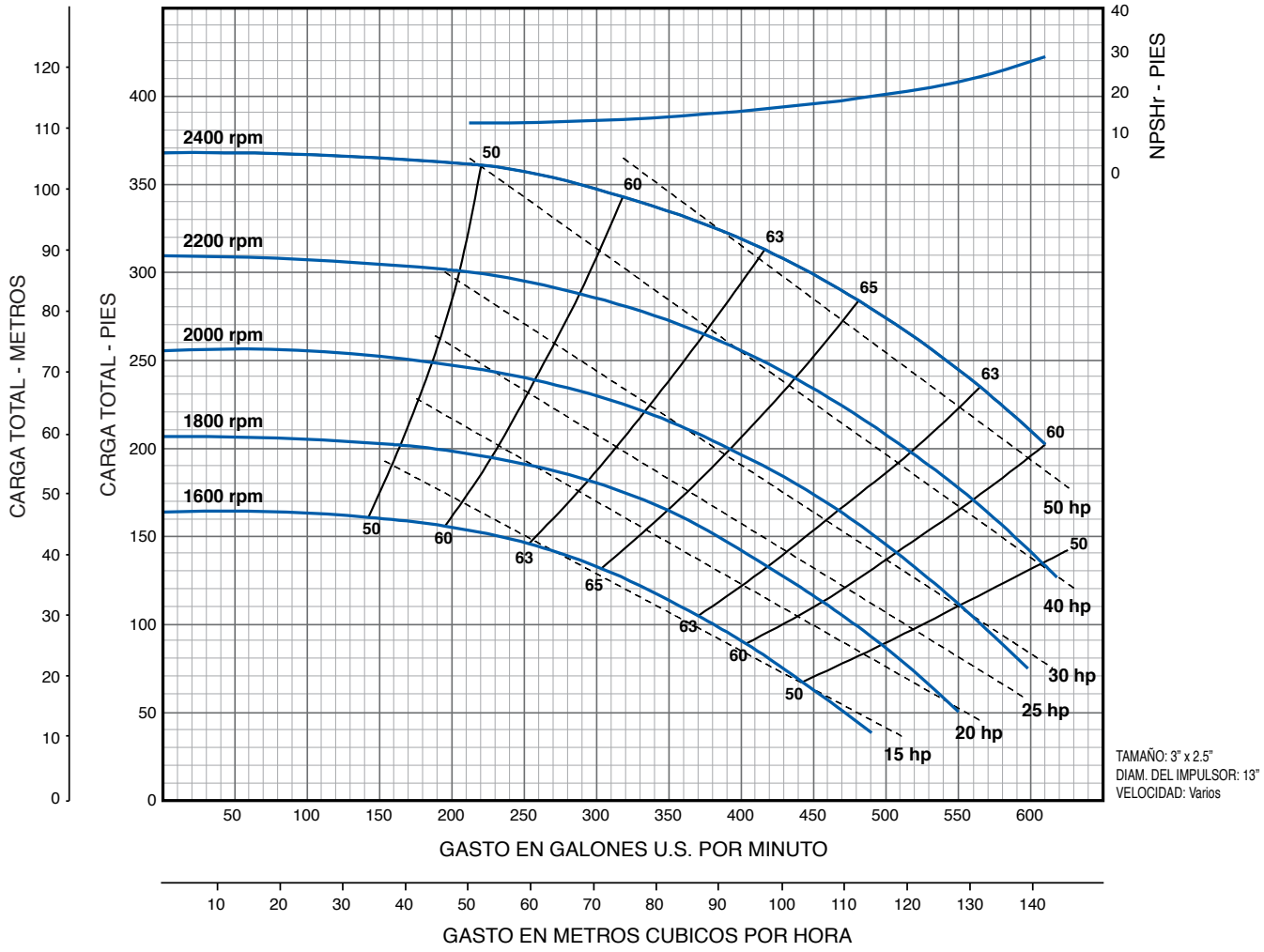
Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

PAGINA: CP-855
FECHA: Sept. 1, 2008

Modelo XS-3x25-13



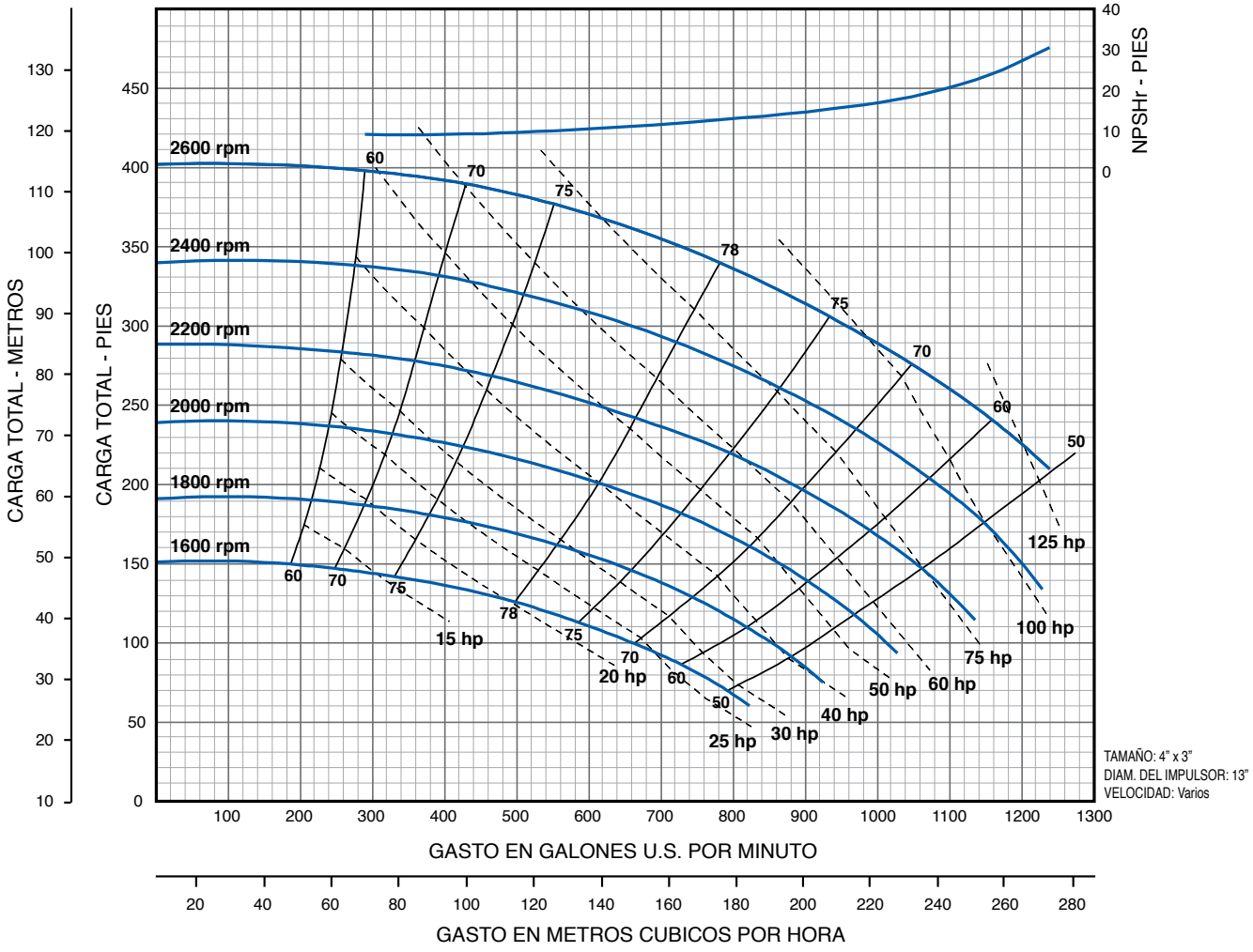
TAMAÑO: 3" x 2.5"
DIAM. DEL IMPULSOR: 13"
VELOCIDAD: Varios

FPS XS series

Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

Modelo XS-4x3-13



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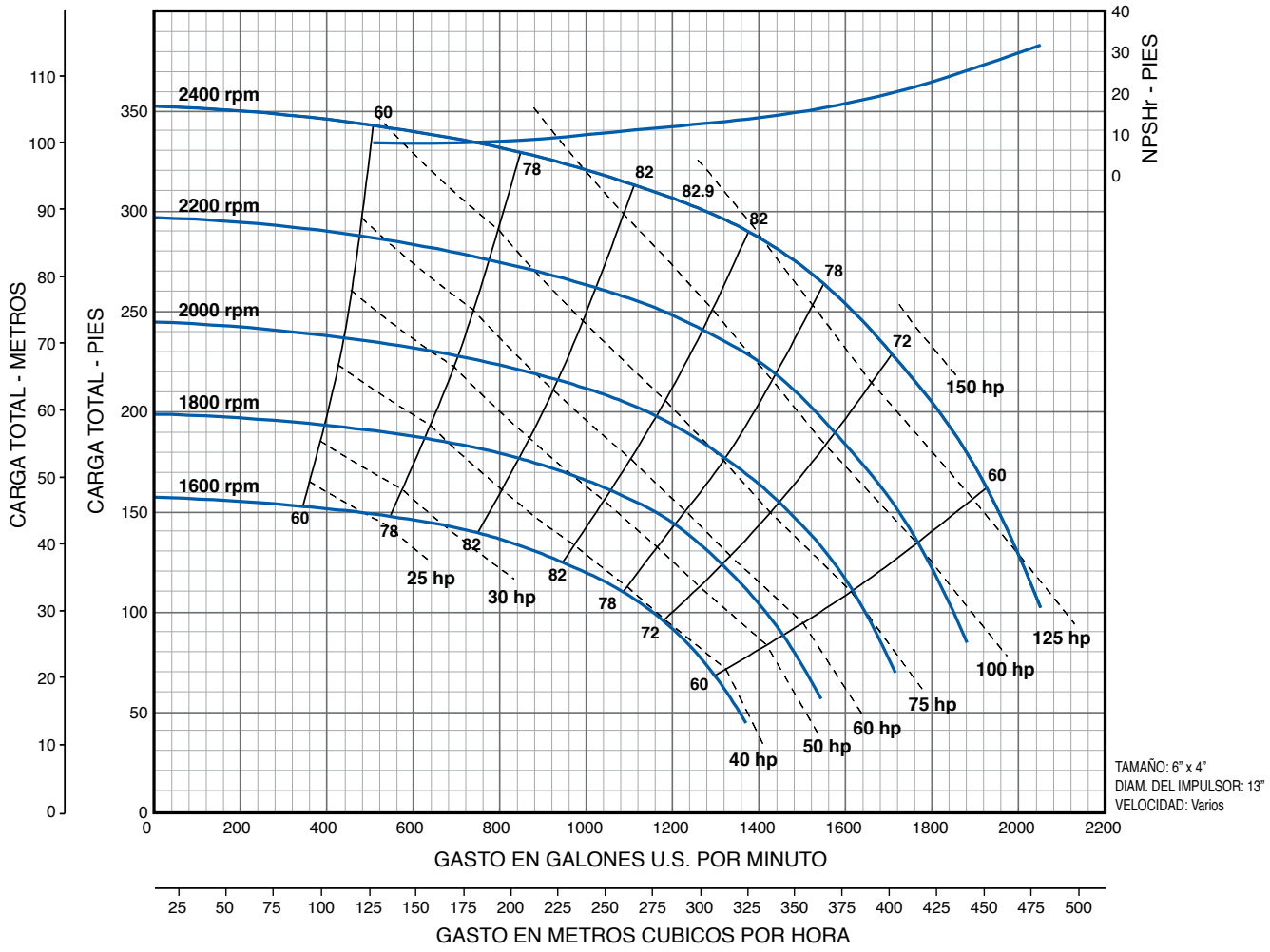
Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

PAGINA: CP-860
FECHA: Sept. 1, 2008

Modelo XS-6x4-13

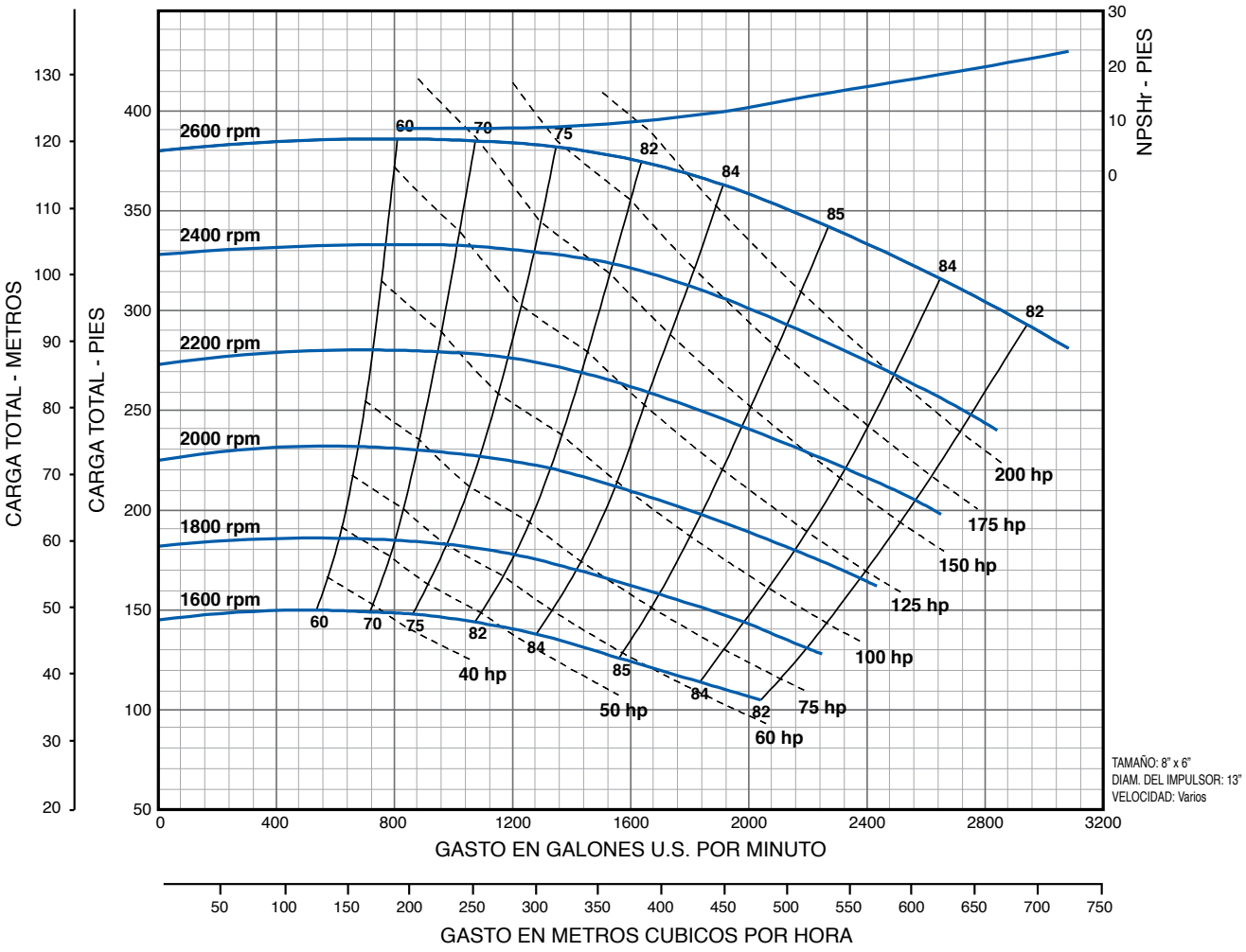


FPS XS series

Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

Modelo XS-8x6-13



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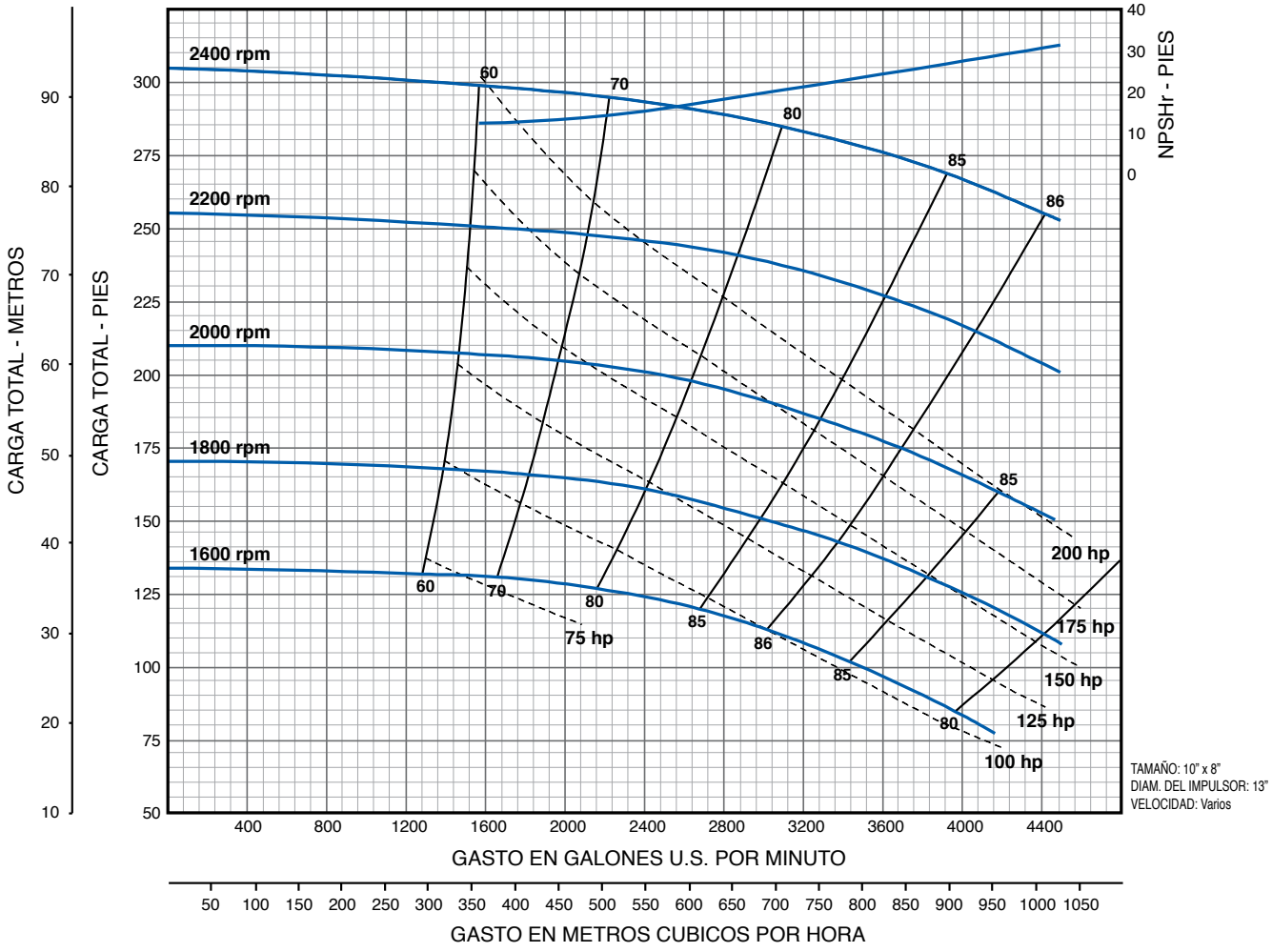
Serie XS

Bombas Centrífugas Estándar - Montaje con Drive SAE

PAGINA: CP-865
FECHA: Sept. 1, 2008

Modelo XS-10x8-13



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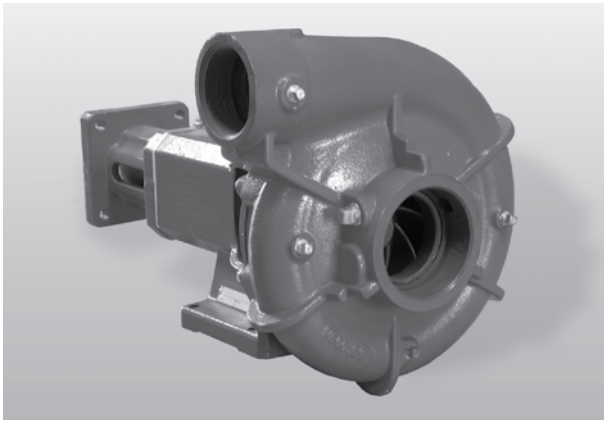
Serie XS

Bombas Centrífugas Estándar - Dispositivo para Motor Hidráulico

PAGINA: CP-870
FECHA: Sept. 1, 2008



FPS XS series

Características:

- Caja de rodamientos de alta resistencia
- Eje robusto Stressproof® de 2-3/8″
- Impulsor de doble cuñero de 1-1/4″
- Diseño compacto para ahorro de espacio
- Área de empaquetadura de fácil acceso*
- La succión, descarga y soporte de montaje son los estándar en la industria para fácil renovación
- Otras opciones de aplicación:
  - Volutas NPT y Victaulic
  - Disponible para rotación en ambos sentidos
- Disponible para acoplamiento “B”(eje de 7/8″) y “C”(eje de 1-1/4″)

* Únicamente para los modelos con sello de empaquetadura.

Explicación del Número de Modelo

Ejemplo: XS869-HBFP-CW

XS = Serie Centrífuga
8 = Tamaño de Succión
6 = Tamaño de Descarga
9 = Diám. Nominal del Impulsor
HB = Hidráulico
F = Conexión
N=NPT
V=Victaulic
F=Brida
P= Sello del Eje:
P=Empaquetadura
M=Sello Mecánico
CW= Rotación:
CW=A la derecha

Serie XS

Bombas Centrífugas Estándar - Dispositivo para Motor Hidráulico

Información para Pedidos

Diámetro Nominal del Impulsor, 9"- (HB) Hidráulico									
Modelo de Bomba	Tam. de Succión/ Desc.	Rotación	Diseño de Voluta	Sello del Eje	Ajuste	Material del Impulsor	Descripción del Modelo	No. Pedido	Peso
XS-4x3-9	4" x 3"	CW	NPT	Empaquetadura	B	Hierro Fundido	XS439-HBNP-CW	68040309100	145
		CCW	NPT	Empaquetadura	B	Hierro Fundido	XS439-HBNP-CCW	68040309200	145
		CW	Victaulic	Empaquetadura	B	Hierro Fundido	XS439-HBVP-CW	68040309101	145
		CCW	Victaulic	Empaquetadura	B	Hierro Fundido	XS439-HBVP-CCW	68040309201	145
		CW	NPT	Sello Mecánico	B	Hierro Fundido	XS439-HBNM-CW	69040309100	145
		CCW	NPT	Sello Mecánico	B	Hierro Fundido	XS439-HBNM-CCW	69040309200	145
		CW	Victaulic	Sello Mecánico	B	Hierro Fundido	XS439-HBVM-CW	69040309101	145
		CCW	Victaulic	Sello Mecánico	B	Hierro Fundido	XS439-HBVM-CCW	69040309201	145
		CW	NPT	Empaquetadura	C	Hierro Fundido	XS439-HCNP-CW	68040309300	145
		CCW	NPT	Empaquetadura	C	Hierro Fundido	XS439-HCNP-CCW	68040309400	145
		CW	Victaulic	Empaquetadura	C	Hierro Fundido	XS439-HCVP-CW	68040309301	145
		CCW	Victaulic	Empaquetadura	C	Hierro Fundido	XS439-HCVP-CCW	68040309401	145
		CW	NPT	Sello Mecánico	C	Hierro Fundido	XS439-HCNM-CW	69040309300	145
		CCW	NPT	Sello Mecánico	C	Hierro Fundido	XS439-HCNM-CCW	69040309400	145
		CW	Victaulic	Sello Mecánico	C	Hierro Fundido	XS439-HCVM-CW	69040309301	145
		CCW	Victaulic	Sello Mecánico	C	Hierro Fundido	XS439-HCVM-CCW	69040309401	145
XS-8x6-9	8" x 6"	CW	Brida	Empaquetadura	B	Hierro Fundido	XS869-SA45P	68080609102	245
		CW	Brida	Sello Mecánico	B	Hierro Fundido	XS869-SA23P	69080609102	245
		CW	Brida	Empaquetadura	C	Hierro Fundido	XS869-SA45M	68080609302	245
		CW	Brida	Sello Mecánico	C	Hierro Fundido	XS869-SA23M	69080609302	245

NOTAS: Habrá un cargo adicional en el recorte del impulsor cuando no se trate de una medida estándar.
Consulte la lista de precios para verificar cargos adicionales.

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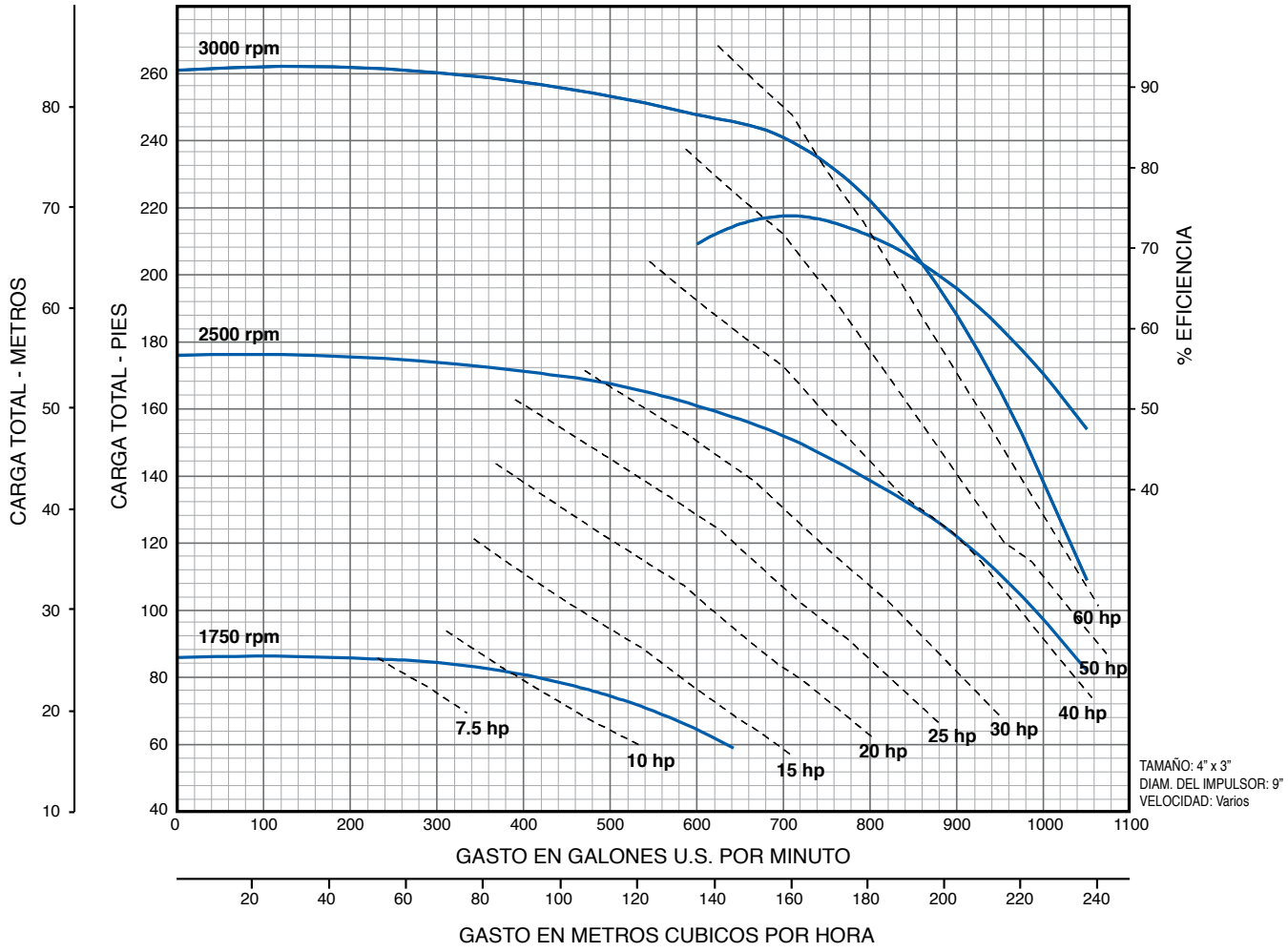
Serie XS

Bombas Centrífugas Estándar - Dispositivo para Motor Hidráulico

PAGINA: CP-875
FECHA: Sept. 1, 2008

Modelo XS-4x3-9

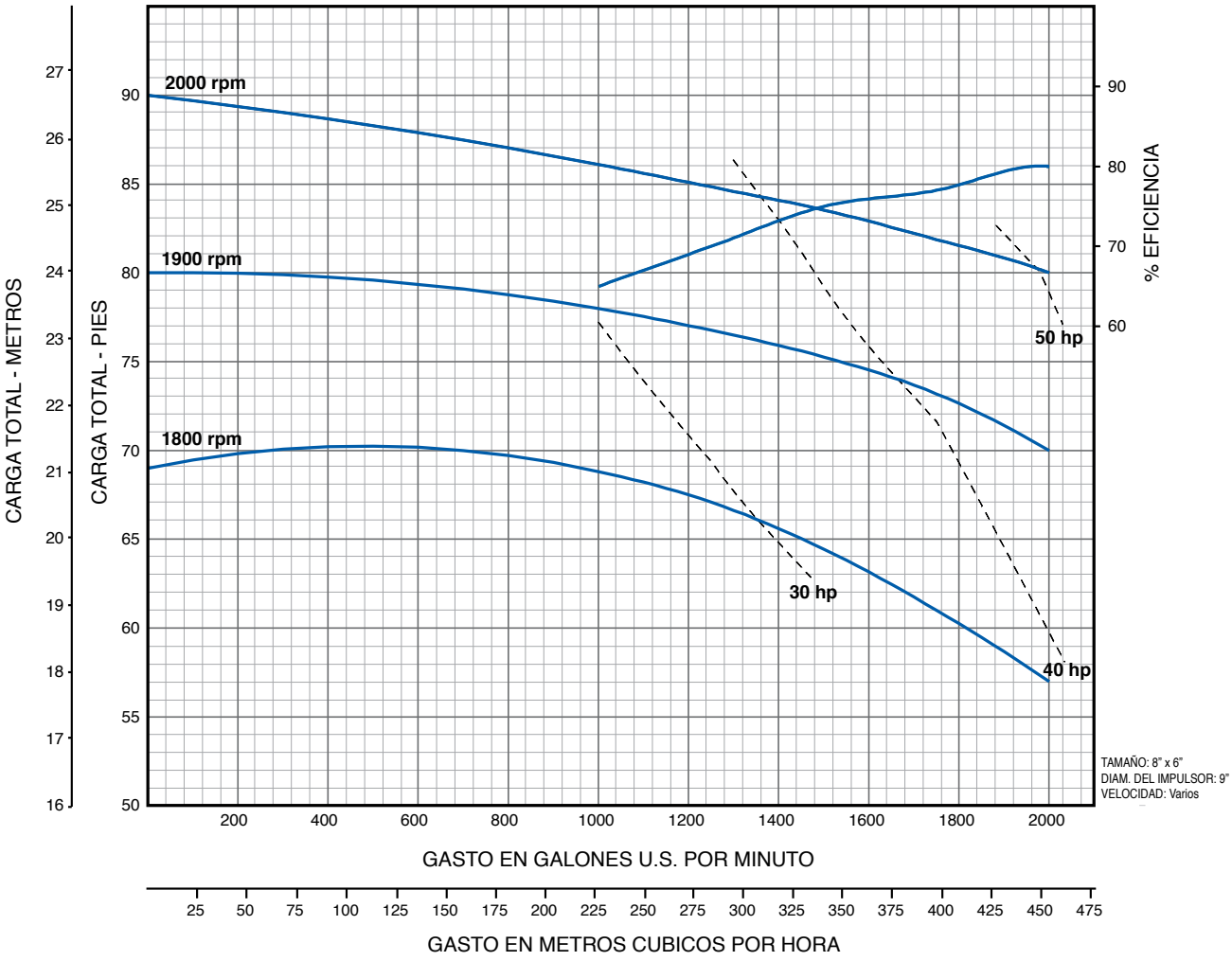


FPS XS series

Serie XS

Bombas Centrífugas Estándar - Dispositivo para Motor Hidráulico

Modelo XS-8x6-9



Franklin Electric
400 E. Spring St., Bluffton, IN 46714
Tel: 260.824.2900 Fax: 260.824.2909
www.franklin-electric.com

8.2. Anexo B

Se adjunta la hoja de datos del motor TEFC PEWWE7.5-18-213JP

WORLDWIDE
ELECTRIC CORPORATION

Electric
Motors

(800) 808-2131
worldwideelectric.com

Electric Motors
Stock Products Catalog

2023-2024

WorldWide Electric's complete line of motors, including Fractional HP, Stainless, Jet Pump, Farm Duty, Premium Efficient, Explosion Proof, Rock Crusher, Oil Well Pump, Hyundai Lines and More

WORLDWIDE
ELECTRIC CORPORATION

WorldWide Electric Motors

Proven, reliable designs

WorldWide Electric's flagship line of electric motors includes our Fractional HP, Stainless Steel, Jet Pump, Permanent Magnet DC, Farm Duty, Premium Efficient, Explosion Proof, Advanced Design Rock Crusher, Oil Well Pump, Closed Coupled Pump, IEC Aluminum Frame and Vertical Hollow Shaft motors. We also offer Hyundai Electric Crown Triton™ Premium Efficiency, IEEE-841, and Severe Duty Large Frame Motors.

WorldWide Electric has been in the motor business for more than two decades, providing reliable and affordable electric motors, motor controls, and gear reducers. We continue to meet the needs of the most unique applications and strive to have the best customer service in the industry.

A Note About Pricing

Dear Valued Customer,

All domestic and international electric motor manufacturers are currently grappling with uncertain pricing and availability of raw materials, labor, and transportation. As a result of the unpredictability of the global supply chain, the prices printed in this catalog are subject to change.

To obtain the most up-to-date and accurate pricing, please contact your WorldWide Electric Sales Representative or sign into your online account at worldwideelectric.com.

- Contact information for your Sales Representative is available at worldwideelectric.com/support
- Your Sales Representative can assist you with creating an online account on worldwideelectric.com where you will be able to view current pricing and inventory information.

Thank you very much for your patience as we continue to navigate the ongoing effects of the Coronavirus pandemic on global markets. We truly appreciate your business, and we look forward to continuing to serve you with exceptional customer support.

Best Regards,
Patrick Toms, Executive Vice President and General Manager
WorldWide Electric Corporation

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General Purpose Motors

TEFC Enclosure ▪ C-Face with Removable Base ▪ Single-Phase ▪ 115/230 Volt

Product Specifications

- 1/3 - 2 HP
- 3600 and 1800 RPM
- 115/230 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP43 Protection
- 1.15 SF
- Class F Insulation
- C-Face with Removable Base
- Capacitor Start / Induction Run (1/3 - 1 HP)
- Capacitor Start / Capacitor Run (1.5 - 2 HP) for Reduced Amperage and High Torque
- Vacuum Pressure Impregnation (VPI) System
- Anti-Rust Film Applied to Rotor
- Improved Shaft Seal on Drive-End Protects Drive-End Bearing from Moisture and Contaminants

Suitable for Use with Stearns Coupler Brakes
Found on Page 5

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1/3	3600	115/230	56C	NT13-36-56CB	$363.18	2.7	59.5	21	
	1800	115/230	56C	NT13-18-56CB	$373.21	2.6	63.0	22	
1/2	3600	115/230	56C	NT12-36-56CB	$383.34	3.3	63.0	23	
	1800	115/230	56C	NT12-18-56CB	$393.21	3.6	64.5	25	
3/4	3600	115/230	56C	NT34-36-56CB	$394.15	4.6	66.5	27	
	1800	115/230	56C	NT34-18-56CB	$427.98	5.0	67.0	29	
1	3600	115/230	56C	NT1-36-56CB	$431.24	5.8	69.5	30	
	1800	115/230	56C	NT1-18-56CB	$477.50	6.5	70.0	36	
1.5	3600	115/230	56C	NT1.5-36-56CB	$539.07	6.5	77.0	31	
	1800	115/230	56C	NT1.5-18-56CB	$603.03	7.3	77.0	37	
2	3600	115/230	56C	NT2-36-56CB	$594.18	8.5	79.5	37	
	1800	115/230	56C	NT2-18-56CB	$733.70	9.8	79.0	44	

General Purpose Motors

TEFC Enclosure ▪ Rigid Base and C-Face ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- Rigid Base: 1/2 - 2 HP; 1800 RPM
- C-Face: 1/3 - 3 HP; 3600 and 1800 RPM
- 230/460 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP43 Protection
- 1.15 SF
- Class F Insulation
- Premium Efficiency (1-3 HP)
- Vacuum Pressure Impregnation (VPI) System
- Anti-Rust Film Applied to Rotor
- Improved Shaft Seal on Drive-End Protects Drive-End Bearing from Moisture and Contaminants
- Inverter Rated, 4:1 CT / 10:1 VT
- Suitable for 50 Hz at 1.0 SF (Derate in HP)

Suitable for Use with Stearns Coupler Brakes Found on Page 5

NEMA® Premium

Only the NATE models meet the NEMA Premium Efficiency specifications.

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
Rigid Base									
1/2	1800	230/460	56	NAT12-18-56	$352.01	0.95	70.0	19	
3/4	1800	230/460	56	NAT34-18-56	$376.65	1.3	73.0	22	
1	1800	230/460	56	NATE1-18-56	$466.58	1.61	85.5	35	P
1.5	1800	230/460	56	NATE1.5-18-56	$550.87	2.26	86.5	43	P
2	1800	230/460	56	NATE2-18-56	$656.41	2.96	86.5	49	P
C-Face ▪ Removable Base									
1/3	3600	230/460	56C	NAT13-36-56CB	$312.75	0.65	60.0	18	
	1800	230/460	56C	NAT13-18-56CB	$340.49	0.72	67.0	18	
1/2	3600	230/460	56C	NAT12-36-56CB	$326.43	0.85	67.5	19	
	1800	230/460	56C	NAT12-18-56CB	$361.60	0.95	70.0	19	
3/4	3600	230/460	56C	NAT34-36-56CB	$339.99	1.2	71.5	21	
	1800	230/460	56C	NAT34-18-56CB	$392.10	1.3	73.0	22	
1	3600	230/460	56C	NATE1-36-56CB	$475.04	1.5	77.0	23	P
	1800	230/460	56C	NATE1-18-56CB	$514.70	1.61	85.5	35	P
1.5	3600	230/460	56C	NATE1.5-36-56CB	$537.90	1.98	84.0	31	P
	1800	230/460	56C	NATE1.5-18-56CB	$652.37	2.26	86.5	43	P
2	3600	230/460	56C	NATE2-36-56CB	$594.46	2.61	85.5	34	P
	1800	230/460	56C	NATE2-18-56CB	$727.14	2.96	86.5	59	P
3	3600	230/460	56C	NATE3-36-56CB	$687.65	3.69	86.5	52	P
C-Face ▪ Round Body									
1/3	1800	230/460	56C	NAT13-18-56CRD	$340.49	0.72	67.0	18	
1/2	1800	230/460	56C	NAT12-18-56CRD	$361.60	0.95	70.0	19	
3/4	1800	230/460	56C	NAT34-18-56CRD	$392.10	1.3	73.0	22	
1	3600	230/460	56C	NATE1-36-56CRD	$475.04	1.5	77.0	23	P
	1800	230/460	56C	NATE1-18-56CRD	$514.70	1.61	85.5	35	P
1.5	3600	230/460	56C	NATE1.5-36-56CRD	$537.90	1.98	84.0	31	P
	1800	230/460	56C	NATE1.5-18-56CRD	$652.37	2.26	86.5	43	P
2	3600	230/460	56C	NATE2-36-56CRD	$594.46	2.61	85.5	34	P
	1800	230/460	56C	NATE2-18-56CRD	$727.14	2.96	86.5	59	P
3	3600	230/460	56C	NATE3-36-56CRD	$687.65	3.69	86.5	52	P

P NATE models are premium efficiency

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Stearns Double C-Face Coupler Brakes
For Drive-End of Motor

Product Specifications

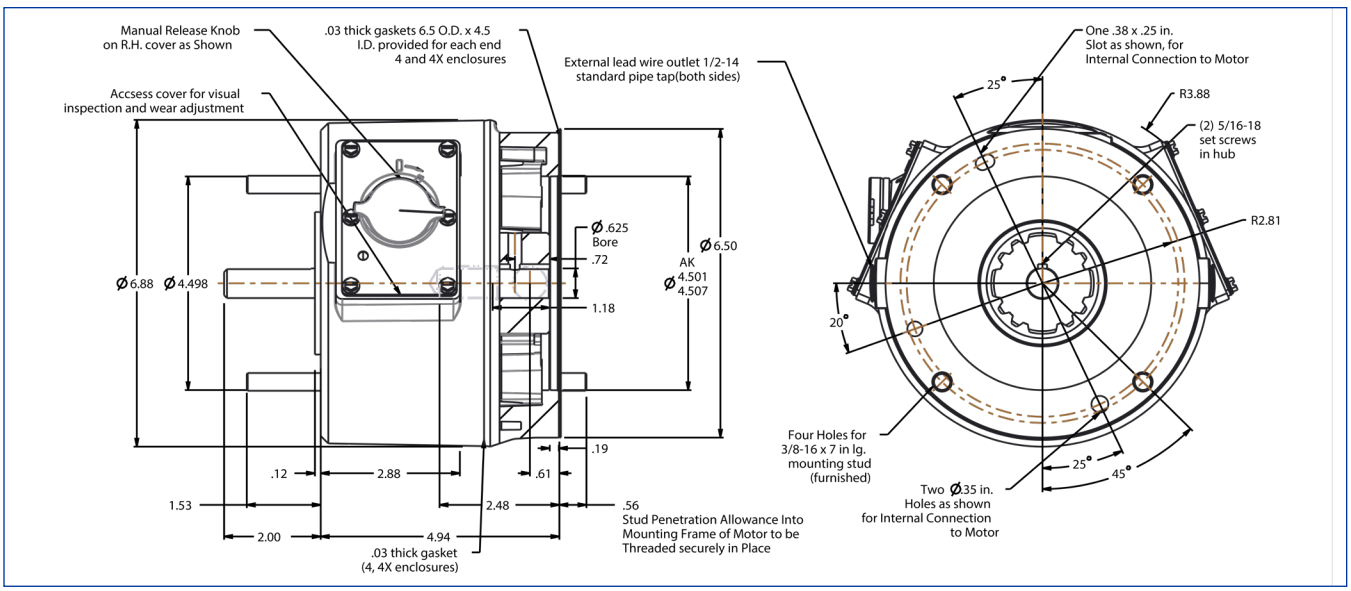
- NEMA C-Frame: 56C
- Torque lb-ft : 1.5, 3, 6, 10
- IP54 Protection
- Coil Voltage: 115/230 (VAC 60Hz), 230/460 (VAC 60Hz)
- Manual Release Knob
- CSA Certified File LR6254
- RoHS3 Compliant
- Self-Adjusting
- AC Operated Coil
- Solenoid Actuated Brake (SAB)
- Designed for industrial applications that fit between a standard C-Face motor and quill input C-Flange

Suitable for Use with our Full-Line of Fractional HP Motors:

- General Purpose Motors: Page 3-4
- Stainless Steel Motors: Page 9-10
- Permanent Magnet DC Motors: Page 11
- Fractional Farm Duty Motors: Page 13

Single-Phase Input	Brand	Description	Voltage	List Price
230/460 Volt				
S-105670205 QF	Stearns	1.5 lb-ft, 56C, IP54	230/460	$1,313.66
S-105671205 QF	Stearns	3 lb-ft, 56C, IP54	230/460	$1,239.33
S-105672205 QF	Stearns	6 lb-ft, 56C, IP54	230/460	$1,365.69
S-105673205 QF	Stearns	10 lb-ft, 56C, IP54	230/460	$1,555.20
115/230 Volt				
S-105670205 PF	Stearns	1.5 lb-ft, 56C, IP54	115/230	$1,200.34
S-105671205 PF	Stearns	3 lb-ft, 56C, IP54	115/230	$1,239.33
S-105672205 PF	Stearns	6 lb-ft, 56C, IP54	115/230	$1,352.69
S-105673205 PF	Stearns	10 lb-ft, 56C, IP54	115/230	$1,570.08

Dimensions



Jet Pump Motors

ODP Enclosure ▪ C-Face with Removable Base and Round Body

Product Specifications

- 3600 RPM
- Open Drip Proof (ODP) Enclosure
- IP23 Protection
- Class F Insulation
- C-Face with Removable Base (CB / JB) and C-Face Round Body Footless (CRD / JRD)
- 56J - Threaded Shaft, ODE Shaft Supplied with Slot for Installation
- 56C - Keyed Shaft
- 304 Stainless Steel Shaft End
- Vacuum Pressure Impregnation (VPI) System
- Anti-Rust Film Applied to Rotor
- Drive-End Shaft Slinger
- Double Shielded Ball Bearings

Single-Phase

- 1/3 - 3 HP
- 115/230 Volt, Usable at 208 Volt
- Capacitor Start / Capacitor Run
- Automatic Thermal Overload Protection
- Terminal Board with Spade Connectors
- Premium Efficiency in Accordance with NEMA Table 12-20

Three-Phase

- 1/3 - 5 HP
- 230/460 Volt, Usable at 208 Volt (Preconfigured for 460 Volt from Factory)
- Stud Terminals for Use with Ring or Fork Terminals
- Supplied with Terminal Plug in Terminal Box for Switching from 230 to 460 Volt and Vice-Versa
- Premium Efficiency in Accordance with NEMA Table 12-20 and 12-21

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Service Factor
Single-Phase ▪ 115/230 Volt ▪ C-Face Removable Base									
1/3	3600	115/230	56C	OJ13-36-56CB	$404.64	1.584	70.5	23.8	1.75
	3600	115/230	56J	OJ13-36-56JB	$404.64	1.6	70.5	23.8	1.75
1/2	3600	115/230	56C	OJ12-36-56CB	$434.59	2.4	72.4	25	1.6
	3600	115/230	56J	OJ12-36-56JB	$434.59	2.4	72.4	25	1.6
3/4	3600	115/230	56C	OJ34-36-56CB	$456.66	3.2	76.2	26.6	1.5
	3600	115/230	56J	OJ34-36-56JB	$456.66	3.2	76.2	26.6	1.5
1	3600	115/230	56C	OJ1-36-56CB	$494.06	4.1	80.4	30.2	1.4
	3600	115/230	56J	OJ1-36-56JB	$494.06	4.1	80.4	30.2	1.4
1.5	3600	115/230	56C	OJ1.5-36-56CB	$554.51	6.7	81.5	33.1	1.3
	3600	115/230	56J	OJ1.5-36-56JB	$554.51	6.7	81.5	33.1	1.3
2	3600	115/230	56C	OJ2-36-56CB	$607.07	8.1	82.9	37.8	1.2
	3600	115/230	56J	OJ2-36-56JB	$607.07	8.1	82.9	37.8	1.2
3	3600	115/230	56C	OJ3-36-56CB	$708.48	11.4	84.1	46.8	1.15
	3600	115/230	56J	OJ3-36-56JB	$708.48	11.4	84.1	46.8	1.15
Single-Phase ▪ 115/230 Volt ▪ C-Face ▪ Round Body (Footless)									
1/3	3600	115/230	56C	OJ13-36-56CRD	$385.37	1.6	70.5	21.6	1.75
	3600	115/230	56J	OJ13-36-56JRD	$385.37	1.6	70.5	21.6	1.75
1/2	3600	115/230	56C	OJ12-36-56CRD	$413.89	2.4	72.4	22.8	1.6
	3600	115/230	56J	OJ12-36-56JRD	$413.89	2.4	72.4	22.8	1.6
3/4	3600	115/230	56C	OJ34-36-56CRD	$434.92	3.2	76.2	24.4	1.5
	3600	115/230	56J	OJ34-36-56JRD	$434.92	3.2	76.2	24.4	1.5
1	3600	115/230	56C	OJ1-36-56CRD	$470.51	4.1	80.4	28	1.4
	3600	115/230	56J	OJ1-36-56JRD	$470.51	4.1	80.4	28	1.4
1.5	3600	115/230	56C	OJ1.5-36-56CRD	$528.11	6.7	81.5	30.9	1.3
	3600	115/230	56J	OJ1.5-36-56JRD	$528.11	6.7	81.5	30.9	1.3
2	3600	115/230	56C	OJ2-36-56CRD	$578.16	8.1	82.9	35.6	1.2
	3600	115/230	56J	OJ2-36-56JRD	$578.16	8.1	82.9	35.6	1.2
3	3600	115/230	56C	OJ3-36-56CRD	$674.80	11.4	84.1	44.6	1.15
	3600	115/230	56J	OJ3-36-56JRD	$674.80	11.4	84.1	44.6	1.15

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Service Factor
Three-Phase ▪ 230/460 Volt ▪ C-Face Removable Base									
1/3	3600	230/460	56C	ODPJ13-36-56CB	$396.65	0.6	69.5	20.5	1.75
	3600	230/460	56J	ODPJ13-36-56JB	$396.65	0.6	69.5	20.5	1.75
1/2	3600	230/460	56C	ODPJ12-36-56CB	$438.92	0.9	73.4	21.6	1.6
	3600	230/460	56J	ODPJ12-36-56JB	$438.92	0.9	73.4	21.6	1.6
3/4	3600	230/460	56C	ODPJ34-36-56CB	$479.87	1.0	76.8	23.6	1.5
	3600	230/460	56J	ODPJ34-36-56JB	$479.87	1.0	76.8	23.6	1.5
1	3600	230/460	56C	ODPJ1-36-56CB	$505.66	1.4	77.0	27.5	1.4
	3600	230/460	56J	ODPJ1-36-56JB	$505.66	1.4	77.0	27.5	1.4
1.5	3600	230/460	56C	ODPJ1.5-36-56CB	$582.32	2.0	84.0	30.5	1.3
	3600	230/460	56J	ODPJ1.5-36-56JB	$582.32	2.0	84.0	30.5	1.3
2	3600	230/460	56C	ODPJ2-36-56CB	$607.29	2.5	85.5	34.2	1.2
	3600	230/460	56J	ODPJ2-36-56JB	$607.29	2.5	85.5	34.2	1.2
3	3600	230/460	56C	ODPJ3-36-56CB	$679.51	3.7	85.5	40.1	1.15
	3600	230/460	56J	ODPJ3-36-56JB	$679.51	3.7	85.5	40.1	1.15
5	3600	230/460	56C	ODPJ5-36-56CB	$784.48	5.8	86.5	51.7	1.15
	3600	230/460	56J	ODPJ5-36-56JB	$784.48	5.8	86.5	51.7	1.15
Three-Phase ▪ 230/460 Volt ▪ C-Face ▪ Round Body (Footless)									
1/3	3600	230/460	56C	ODPJ13-36-56CRD	$377.81	0.6	69.5	18.3	1.75
	3600	230/460	56J	ODPJ13-36-56JRD	$377.81	0.6	69.5	18.3	1.75
1/2	3600	230/460	56C	ODPJ12-36-56CRD	$418.00	0.9	73.4	19.4	1.6
	3600	230/460	56J	ODPJ12-36-56JRD	$418.00	0.9	73.4	19.4	1.6
3/4	3600	230/460	56C	ODPJ34-36-56CRD	$456.99	1.0	76.8	21.4	1.5
	3600	230/460	56J	ODPJ34-36-56JRD	$456.99	1.0	76.8	21.4	1.5
1	3600	230/460	56C	ODPJ1-36-56CRD	$510.48	1.4	77.0	25.3	1.4
	3600	230/460	56J	ODPJ1-36-56JRD	$510.48	1.4	77.0	25.3	1.4
1.5	3600	230/460	56C	ODPJ1.5-36-56CRD	$554.56	2.0	84.0	28.3	1.3
	3600	230/460	56J	ODPJ1.5-36-56JRD	$554.56	2.0	84.0	28.3	1.3
2	3600	230/460	56C	ODPJ2-36-56CRD	$578.38	2.5	85.5	32	1.2
	3600	230/460	56J	ODPJ2-36-56JRD	$578.38	2.5	85.5	32	1.2
3	3600	230/460	56C	ODPJ3-36-56CRD	$647.15	3.7	85.5	37.9	1.15
	3600	230/460	56J	ODPJ3-36-56JRD	$647.15	3.7	85.5	37.9	1.15
5	3600	230/460	56C	ODPJ5-36-56CRD	$747.08	5.8	86.5	49.5	1.15
	3600	230/460	56J	ODPJ5-36-56JRD	$747.08	5.8	86.5	49.5	1.15

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Jet Pump Motors

TEFC Enclosure ▪ C-Face with Removable Base

Product Specifications

- 1/3 - 3 HP
- 3600 RPM
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP43 Protection
- 1.15 SF
- Class F Insulation
- C-Face with Removable Base
- 56J - Threaded Shaft
- 56C - Keyed Shaft
- Vacuum Pressure Impregnation (VPI) System
- Anti-Rust Film Applied to Rotor
- Improved Shaft Seal on Drive-End Protects Drive-End Bearing from Moisture and Contaminants
- Inverter rated, 4:1 CT / 10:1 VT

Single-Phase

- 115/230 Volt
- Capacitor Start / Induction Run (1/3 - 1 HP)
- Capacitor Start / Capacitor Run (1.5 - 2 HP) for Reduced Amperage and High Torque

Three-Phase

- 230/460 Volt
- Premium Efficiency (1-3 HP)
- Suitable for 50 Hz at 1.0 SF (Derate in HP)

NEMA Premium

**Only the NATJE models meet the NEMA Premium Efficiency specifications.*

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
Single-Phase ▪ 115/230 Volt									
1/3	3600	115/230	56C	NTJ13-36-56CB	$346.89	2.5	58.0	20	
	3600	115/230	56J	NTJ13-36-56JB	$355.13	2.5	58.0	20	
1/2	3600	115/230	56C	NTJ12-36-56CB	$361.99	3.3	61.0	21	
	3600	115/230	56J	NTJ12-36-56JB	$370.17	3.3	61.0	21	
3/4	3600	115/230	56C	NTJ34-36-56CB	$393.02	4.5	64.0	26	
	3600	115/230	56J	NTJ34-36-56JB	$401.13	4.5	64.0	26	
1	3600	115/230	56C	NTJ1-36-56CB	$416.44	5.7	69.0	29	
	3600	115/230	56J	NTJ1-36-56JB	$424.64	5.7	69.0	29	
1.5	3600	115/230	56C	NTJ1.5-36-56CB	$503.90	6.5	72.0	31	
	3600	115/230	56J	NTJ1.5-36-56JB	$512.02	6.5	72.0	31	
2	3600	115/230	56C	NTJ2-36-56CB	$546.23	8.6	75.0	37	
	3600	115/230	56J	NTJ2-36-56JB	$554.37	8.6	75.0	37	
Three-Phase ▪ 230/460 Volt									
1/3	3600	230/460	56C	NATJ13-36-56CB	$307.60	0.65	57.0	18	
	3600	230/460	56J	NATJ13-36-56JB	$316.71	0.65	57.0	18	
1/2	3600	230/460	56C	NATJ12-36-56CB	$317.99	0.85	62.0	19	
	3600	230/460	56J	NATJ12-36-56JB	$327.01	0.85	62.0	19	
3/4	3600	230/460	56C	NATJ34-36-56CB	$349.15	1.2	67.0	22	
	3600	230/460	56J	NATJ34-36-56JB	$358.17	1.2	67.0	22	
1	3600	230/460	56C	NATJE1-36-56CB	$380.01	1.5	77.0	23	P
	3600	230/460	56J	NATJE1-36-56JB	$389.04	1.5	77.0	23	P
1.5	3600	230/460	56C	NATJE1.5-36-56CB	$482.08	1.98	84.0	31	P
	3600	230/460	56J	NATJE1.5-36-56JB	$491.17	1.98	84.0	31	P
2	3600	230/460	56C	NATJE2-36-56CB	$505.02	2.61	85.5	34	P
	3600	230/460	56J	NATJE2-36-56JB	$514.03	2.61	85.5	34	P
3	3600	230/460	56J	NATJE3-36-56JB	$655.29	3.69	86.5	39	P

P NATJE models are premium efficiency

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

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Stainless Steel / Washdown Duty Motors

TENV Enclosure ▪ C-Face with Feet and Round Body ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1/3 - 3/4 HP
- 1800 RPM
- 230/460 Volt
- Totally Enclosed Non-Ventilated (TENV) Enclosure
- IP56 Protection
- 1.15 SF
- Class F Insulation
- C-Face with Feet and Round Body (Footless)
- 304 Stainless Steel Frame, End Bracket and Junction Box
- Stainless Steel Shaft
- Anti-Rust Film Applied to Rotor
- Double Lip Seals with an Additional Shaft Slinger on the Drive-End
- O-Ring Installed on Endbells to Prevent Moisture Intrusion
- Stainless Steel Cord Connector Included

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
C-Face with Feet									
1/3	1800	230/460	56C	WSSNV13-18-56CB	$524.01	0.7	82.5	28	
1/2	1800	230/460	56C	WSSNV12-18-56CB	$546.15	0.8	82.5	31	
3/4	1800	230/460	56C	WSSNV34-18-56CB	$582.71	1.2	82.5	33	
Round Body									
1/3	1800	230/460	56C	WSSNV13-18-56CRD	$497.81	0.7	82.5	28	
1/2	1800	230/460	56C	WSSNV12-18-56CRD	$518.84	0.8	82.5	31	
3/4	1800	230/460	56C	WSSNV34-18-56CRD	$553.57	1.2	82.5	33	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Stainless Steel / Washdown Duty Motors

TEFC Enclosure ▪ C-Face with Feet and Round Body ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1/3 - 2 HP
- 3600 and 1800 RPM
- 230/460 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP56 Protection
- 1.15 SF
- Class F Insulation
- Premium Efficiency (1-2 HP)
- C-Face with Feet and Round Body (Footless)
- 304 Stainless Steel Frame, End Bracket and Junction Box
- Stainless Steel Shaft
- Anti-Rust Film Applied to Rotor
- Double Lip Seals on Both Ends of the Motor with an Additional Shaft Slinger on the Drive-End
- O-Ring Installed on Endbells to Prevent Moisture Intrusion
- Stainless Steel Cord Connector Included

NEMA® Premium

*Only the NAWSSE models meet the NEMA Premium Efficiency specifications.

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
C-Face with Feet									
1/3	1800	230/460	56C	WSS13-18-56CB	$492.57	0.7	82.5	28	
1/2	3600	230/460	56C	WSS12-36-56CB	$507.94	0.9	77.0	29	
	1800	230/460	56C	NAWSS12-18-56C	$935.63	0.8	82.5	31	
3/4	3600	230/460	56C	WSS34-36-56CB	$526.05	1.2	73.0	33	
	1800	230/460	56C	NAWSS34-18-56C	$962.58	1.2	82.5	33	
1	1800	230/460	56C	NAWSSE1-18-56C	$1,137.62	1.56	85.5	44	P
1.5	1800	230/460	56C	NAWSSE1.5-18-56C	$1,259.73	2.27	86.5	58	P
2	1800	230/460	56C	NAWSSE2-18-56C	$1,310.06	2.97	86.5	64	P
Round Body									
1/3	1800	230/460	56C	WSS13-18-56CRD	$467.95	0.7	82.5	28	
1/2	1800	230/460	56C	WSS12-18-56CRD	$487.71	0.8	82.5	31	
3/4	1800	230/460	56C	WSS34-18-56CRD	$520.36	1.2	82.5	33	
1	1800	230/460	56C	NAWSSE1-18-56CRD	$1,186.27	1.56	85.5	44	P
1.5	1800	230/460	56C	NAWSSE1.5-18-56CRD	$1,316.95	2.27	86.5	58	P
2	1800	230/460	56C	NAWSSE2-18-56CRD	$1,370.74	2.97	86.5	64	P

P NAWSSE models are premium efficiency

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

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Permanent Magnet DC Motors

TENV / TEFC Enclosure ▪ C-Face with Removable Base ▪ 90, 180, 12 and 24 Volt

Product Specifications

- 1/4 - 2 HP
- 1800 RPM
- 90, 180, 12 and 24 Volt
- Totally Enclosed Non-Ventilated (TENV) Enclosure (1/4 - 1/2 HP)
- Totally Enclosed Fan Cooled (TEFC) Enclosure (3/4 - 2 HP)
- IP54 Protection
- 1.0 SF
- Class F Insulation
- C-Face with Removable Base
- 20:1 Speed Range at Constant Torque
- High Starting Torque
- 12 Volt and 24 Volt Models Used in Applications Where Low Voltage DC Power is Supplied by Batteries or Generators

Suitable for Use with Stearns Coupler Brakes Found on Page 5

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
90 Volt and 180 Volt									
1/4	1800	90	56C	WPMDC14-18-90V-56CB	$393.20	2.9	80.0	17	X
1/3	1800	90	56C	WPMDC13-18-90V-56CB	$420.33	3.5	82.0	19	X
	1800	180	56C	WPMDC13-18-180V-56CB	$415.81	1.8	82.0	19	X
1/2	1800	90	56C	WPMDC12-18-90V-56CB	$537.83	5.2	82.0	22	X
	1800	180	56C	WPMDC12-18-180V-56CB	$533.38	2.6	82.0	22	X
3/4	1800	90	56C	WPMDC34-18-90V-56CB	$611.10	7.8	82.0	28	X
	1800	180	56C	WPMDC34-18-180V-56CB	$605.64	3.9	82.0	28	X
1	1800	90	56C	WPMDC1-18-90V-56CB	$683.37	10.4	82.0	32	X
	1800	180	56C	WPMDC1-18-180V-56CB	$678.00	5.2	82.0	32	X
1.5	1800	90	56C	WPMDC1.5-18-90V-56CB	$738.45	15.4	83.0	38	X
	1800	180	56C	WPMDC1.5-18-180V-56CB	$732.14	7.7	83.0	38	X
	1800	180	145TC	WPMDC1.5-18-180V-145TCB	$1,095.55	7.7	80.0	47	X
2	1800	180	56C	WPMDC2-18-180V-56CB	$1,171.45	9.8	85.0	65	X
	1800	180	145TC	WPMDC2-18-180V-145TCB	$1,534.87	9.8	80.0	65	X
12 Volt and 24 Volt									
1/3	1800	12	56C	WPMDC13-18-12V-56CB	$501.72	26.4	78.0	19	
	1800	24	56C	WPMDC13-18-24V-56CB	$497.22	13.2	78.0	19	
1/2	1800	12	56C	WPMDC12-18-12V-56CB	$592.13	40.0	78.0	22	
	1800	24	56C	WPMDC12-18-24V-56CB	$588.46	20.0	78.0	22	
3/4	1800	12	56C	WPMDC34-18-12V-56CB	$670.71	61.2	75.0	28	
	1800	24	56C	WPMDC34-18-24V-56CB	$667.04	30.6	75.0	28	
1	3600	12	56C	WPMDC1-36-12V-56CB	$740.31	82.2	75.0	26	
	1800	12	56C	WPMDC1-18-12V-56CB	$746.64	82.2	75.0	33	
	1800	24	56C	WPMDC1-18-24V-56CB	$742.98	41.1	75.0	33	
1.5	1800	24	56C	WPMDC1.5-18-24V-56CB	$824.39	62.5	76.0	39	

X Extra set of brushes and brush springs included

Permanent Magnet DC Motors
Variable Speed DC Controls

Product Specifications

- Dual Voltage - 120/240 VAC, 50/60 Hz
- Adjustable Horsepower Settings
- Barrier Terminal Strip
- Packaged Bridge Supply (Fullwave)
- 1% Speed Regulation with Armature Voltage Feedback; ± 1/2% with Tach Feedback
- Adjustable Minimum Speed (0-30% of max.)
- Adjustable Maximum Speed (66-110% of base)
- Adjustable IR Compensation
- Adjustable Linear Acceleration (0.5-8 sec.)
- Adjustable Current Limit to 15 Amps
- Line Voltage Compensation
- 5K Ohm Speed Potentiometer with Leads, Knob and Dial Included
- Power On / Off Switch
- 50:1 Speed Range
- Overload Capacity: 150% for One Minute
- Transient Voltage Protection
- Voltage Following Mode or DC Tachometer Follower by Supplying Underground Analog Input Signal (0-12 VDC)
- DC Tachometer Feedback (6 V at Base Speed)
- Inhibit Circuit - Permits Start and Stop Without Breaking AC Lines
- Remote Start/Stop via Pot Circuit or Inhibit Circuit
- Shunt Field Supply Provided (1 Amp Max.; 100 V for 120 VAC; 200 V for 240 VAC Input)
- AC Line Fuse
- Rated NEMA 4/12 with Threaded Conduit Holes

Single-Phase Input	Output	HP Range	Model Number	List Price
Non-Reversing (ON / OFF)				
120 VAC	0-90 VDC	1/8 - 1.0	WDCCONT	$585.29
240 VAC	0-180 VDC	1/4 - 2.0	WDCCONT	$585.29
Reversing (FORWARD / OFF / REVERSE)				
120 VAC	0-90 VDC	1/8 - 1.0	WDCCONTREV	$888.44
240 VAC	0-180 VDC	1/4 - 2.0	WDCCONTREV	$888.44

Fractional Farm Duty Motors

TEFC Enclosure ▪ Rigid Base ▪ Single-Phase ▪ 115/230 Volt

Product Specifications

- 1/3-2 HP
- 1800 RPM
- 115/230 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP54 Protection
- High Torque
- 1.15 SF
- Class F Insulation
- Rigid Base
- 56H Frame Motors Have Double Punched Feet
- Vacuum Pressure Impregnation (VPI) System
- Anti-Rust Film Applied to Rotor
- Capacitor Start / Induction Run (1/3-1 HP)
- Capacitor Start / Capacitor Run (1.5-2 HP) for Reduced Amperage and High Torque
- With Manual Overload
- Improved Shaft Seal on Drive-End Protects Drive-End Bearing from Moisture and Contaminants

Suitable for Use with Stearns Coupler Brakes Found on Page 5

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
Rigid Base									
1/3	1800	115/230	56	FM13-18-56	$412.25	5.2	63.0	22	
1/2	1800	115/230	56	FM12-18-56	$424.38	7.2	64.5	25	
3/4	1800	115/230	56	FM34-18-56	$496.69	10.0	67.0	29	
1	1800	115/230	56	FM1-18-56	$518.66	13.0	70.0	36	
1.5	1800	115/230	56H	FM1.5-18-56H	$615.37	14.5	77.0	37	H
2	1800	115/230	56HZ	FM2-18-56HZ	$742.83	19.6	79.0	45	H Z
C-Face									
1/3	1800	115/230	56C	FM13-18-56C	$472.96	5.2	63.0	22	
1/2	1800	115/230	56C	FM12-18-56C	$485.82	7.2	64.5	25	
3/4	1800	115/230	56C	FM34-18-56C	$568.24	10.0	67.0	29	
1	1800	115/230	56C	FM1-18-56C	$592.59	13.0	70.0	36	
1.5	1800	115/230	56HC	FM1.5-18-56HC	$701.59	14.5	77.0	37	H
2	1800	115/230	56HZC	FM2-18-56HZC	$845.16	19.6	79.0	45	H Z

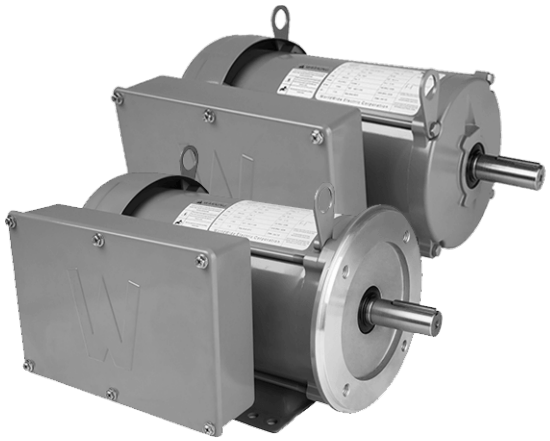
H Suitable for mounting in either 56, 143T or 145T mounting dimensions
Z Motor has 7/8" diameter shaft

Integral Farm Duty Motors

TEFC Enclosure ▪ Rigid Base and C-Face ▪ Single-Phase ▪ 230 Volt

Product Specifications

- 2-10 HP
- 1800 RPM
- 230 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.15 SF
- Class F Insulation
- Rigid Base and C-Face with Feet
- Dual-Drilled Feet
- With Manual Overload
- Capacitor Start / Capacitor Run for Reduced Amperage and High Torque
- Shaft Seals on Both Ends of the Motor
- Cast Aluminum Endbells



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
Rigid Base									
2	1800	230	145T	FD2-18-145T	$679.90	7.8	85.6	54	
	1800	230	182T	FD2-18-182T	$754.04	8.5	84.0	54	
3	1800	230	184T	FD3-18-184T	$897.24	12.5	84.4	76	
5	1800	230	184T	FD5-18-184T	$1,057.97	20.2	86.4	101	
7.5	1800	230	215T	FD7.5-18-215T	$1,628.74	28.7	86.6	134	
	1800	230	215TZ	FD7.5-18-215TZ	$1,628.74	28.7	86.6	134	Z
10	1800	230	215T	FD10-18-215T	$1,898.38	38.8	87.5	149	
C-Face									
2	1800	230	145TC	FD2-18-182TC	$853.00	8.5	84.0	54	
3	1800	230	184TC	FD3-18-184TC	$934.63	12.5	84.4	76	
5	1800	230	184TC	FD5-18-184TC	$1,102.06	20.2	86.4	101	
7.5	1800	230	215TC	FD7.5-18-215TC	$1,696.60	28.7	86.6	134	
10	1800	230	215TC	FD10-18-215TC	$1,977.47	38.8	87.5	149	

FD Motor C-Flange Kits

Frame Size	Model Number	List Price
145T	FD140TC	$130.14
182T / 184T	FD180TC	$168.44
215T	FD210TC	$232.59

Z Motor has 1-1/8” diameter shaft

Premium Efficient Stainless Steel Motors

TEFC Enclosure ▪ C-Face ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1/3-20 HP, 3600 and 1800 RPM
- 1/2-5 HP, 1200 RPM
- 230/460 Volt, 60 Hz
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP69K Protection
- BISSC and BEAG Certified
- 1.15 SF
- Class F Insulation with Class B Temperature Rise
- C-Face with Feet and Round Body (Footless)
- NEMA Premium Efficiency
- Suitable for 50 Hz , 190/380V, 1.15 SF (Derate in HP)
- NEMA Design B
- Continuous Duty
- 304 Stainless Steel Frame, End Bracket, Junction Box, and Hardware
- Stainless Steel Shaft and Key
- F1 Mounting Configuration
- Lip Seal on DE and ODE
- Round Welded Junction Box with Epoxy Potted Leads
- Double Sealed Bearings
- Inverter Duty – 10:1 Constant Torque (CT) / 20:1 Variable Torque (VT)
- CSA Class 1 Division 2 Groups A, B, C, D – Temperature Code T2B
- Ambient -20°C to +40°C, Altitude up to 3300 Feet Above Sea Level (FASL)
- Bi-directional Rotation
- In Accordance with NEMA, CSA, UL, and CE

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
C-Face with Feet									
1/3	3600	230/460	56C	SSPE13-36-56C	$865.43	0.55	72.0	26	
	1800	230/460	56C	SSPE13-18-56C	$898.37	0.6	74.0	28	
1/2	3600	230/460	56C	SSPE12-36-56C	$893.80	0.75	74.0	29	
	1800	230/460	56C	SSPE12-18-56C	$918.23	0.8	78.5	30	
	1200	230/460	56C	SSPE12-12-56C	$1,046.62	0.9	75.5	30	
3/4	3600	230/460	56C	SSPE34-36-56C	$1,028.60	1.1	77.0	33	
	1800	230/460	56C	SSPE34-18-56C	$993.12	1.2	81.5	33	
	1200	230/460	56C	SSPE34-12-56C	$1,133.82	1.85	81.5	35	
	1200	230/460	143TC	SSPE34-12-143TC	$1,191.75	1.85	81.5	35	
1	3600	230/460	56C	SSPE1-36-56C	$1,135.00	1.4	77.0	35	
	3600	230/460	143TC	SSPE1-36-143TC	$1,183.55	1.4	80.0	39	
	1800	230/460	56C	SSPE1-18-56C	$1,135.00	1.45	85.5	36	
	1800	230/460	143TC	SSPE1-18-143TC	$1,170.46	1.45	85.5	36	
	1200	230/460	145TC	SSPE1-12-145TC	$1,342.61	2.0	82.5	42	
1.5	3600	230/460	56C	SSPE1.5-36-56C	$1,241.39	2.0	84.0	39	
	3600	230/460	143TC	SSPE1.5-36-143TC	$1,276.87	2.0	84.0	39	
	1800	230/460	56C	SSPE1.5-18-56C	$1,276.87	2.0	86.5	42	
	1800	230/460	145TC	SSPE1.5-18-145TC	$1,312.33	2.0	86.5	42	
	1200	230/460	182TC	SSPE1.5-12-182TC	$2,279.87	2.45	87.5	82	
2	3600	230/460	56C	SSPE2-36-56C	$1,347.80	2.4	85.5	46	
	3600	230/460	145TC	SSPE2-36-145TC	$1,390.37	2.4	85.5	46	
	1800	230/460	56C	SSPE2-18-56C	$1,383.28	3.0	86.5	51	
	1800	230/460	145TC	SSPE2-18-145TC	$1,418.74	3.0	86.5	51	
	1200	230/460	184TC	SSPE2-12-184TC	$2,483.83	3.05	88.5	98	
3	3600	230/460	145TC	SSPE3-36-145TC	$2,283.23	3.6	86.5	60	
	3600	230/460	182TC	SSPE3-36-182TC	$2,763.00	4.05	86.5	81	
	1800	230/460	145TC	SSPE3-18-145TC	$2,543.51	4.1	89.5	65	
	1800	230/460	182TC	SSPE3-18-182TC	$2,796.70	4.0	89.5	81	
	1200	230/460	213TC	SSPE3-12-213TC	$3,887.27	4.6	89.5	170	
5	3600	230/460	184TC	SSPE5-36-184TC	$3,032.57	6.1	88.5	95	
	1800	230/460	184TC	SSPE5-18-184TC	$3,133.65	6.25	89.5	100	
	1200	230/460	215TC	SSPE5-12-215TC	$4,574.24	7.0	89.5	200	

Premium Efficient Stainless Steel Motors (Continued)

TEFC Enclosure ▪ C-Face ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
7.5	3600	230/460	213TC	SSPE7.5-36-213TC	$4,582.55	9.5	89.5	155	
	1800	230/460	213TC	SSPE7.5-18-213TC	$4,447.76	9.3	91.7	180	
10	3600	230/460	215TC	SSPE10-36-215TC	$4,852.09	12.2	90.2	170	
	1800	230/460	215TC	SSPE10-18-215TC	$4,852.09	12.2	91.7	210	
15	3600	230/460	254TC	SSPE15-36-254TC	$10,553.58	18.5	91.0	363	
	1800	230/460	254TC	SSPE15-18-254TC	$10,553.58	18.5	92.4	370	
20	3600	230/460	256TC	SSPE20-36-256TC	$11,513.02	23.0	91.0	422	
	1800	230/460	256TC	SSPE20-18-256TC	$11,491.83	24.5	93.0	436	
C-Face Round Body (Footless)									
1/3	3600	230/460	56CRD	SSPE13-36-56CRD	$829.97	0.55	74.0	25	
	1800	230/460	56CRD	SSPE13-18-56CRD	$858.68	0.6	82.5	27	
1/2	3600	230/460	56CRD	SSPE12-36-56CRD	$858.34	0.75	77.0	28	
	1800	230/460	56CRD	SSPE12-18-56CRD	$882.55	0.8	82.5	29	
	1200	230/460	56CRD	SSPE12-12-56CRD	$972.17	0.9	80.0	29	
3/4	3600	230/460	56CRD	SSPE34-36-56CRD	$993.12	1.1	80.0	32	
	1800	230/460	56CRD	SSPE34-18-56CRD	$950.57	1.2	82.5	32	
	1200	230/460	56CRD	SSPE34-12-56CRD	$1,090.27	1.85	81.5	34	
	1200	230/460	143TCRD	SSPE34-12-143TCRD	$1,149.18	1.85	81.5	34	
1	3600	230/460	56CRD	SSPE1-36-56CRD	$1,099.53	1.4	80.0	34	
	3600	230/460	143TCRD	SSPE1-36-143TCRD	$1,147.65	1.4	80.0	39	
	1800	230/460	56CRD	SSPE1-18-56CRD	$1,092.43	1.45	85.5	35	
	1800	230/460	143TCRD	SSPE1-18-143TCRD	$1,127.90	1.45	85.5	35	
	1200	230/460	145TCRD	SSPE1-12-145TCRD	$1,296.37	2.0	82.5	41	
1.5	3600	230/460	56CRD	SSPE1.5-36-56CRD	$1,205.95	2.0	84.0	38	
	3600	230/460	143TCRD	SSPE1.5-36-143TCRD	$1,241.39	2.0	86.5	38	
	1800	230/460	56CRD	SSPE1.5-18-56CRD	$1,234.31	2.0	86.5	41	
	1800	230/460	145TCRD	SSPE1.5-18-145TCRD	$1,262.69	2.0	86.5	41	
	1200	230/460	182TCRD	SSPE1.5-12-182TCRD	$2,189.52	2.45	87.5	81	
2	3600	230/460	56CRD	SSPE2-36-56CRD	$1,305.24	2.4	85.5	45	
	3600	230/460	145TCRD	SSPE2-36-145TCRD	$1,347.80	2.4	85.5	45	
	1800	230/460	56CRD	SSPE2-18-56CRD	$1,340.72	3.0	86.5	50	
	1800	230/460	145TCRD	SSPE2-18-145TCRD	$1,376.18	3.0	86.5	50	
	1200	230/460	184TCRD	SSPE2-12-184TCRD	$2,393.49	3.05	88.5	97	
3	3600	230/460	145TCRD	SSPE3-36-145TCRD	$1,970.18	3.6	86.5	60	
	3600	230/460	182TCRD	SSPE3-36-182TCRD	$2,661.91	4.05	86.5	80	
	1800	230/460	145TCRD	SSPE3-18-145TCRD	$2,207.73	4.1	89.5	65	
	1800	230/460	182TCRD	SSPE3-18-182TCRD	$2,695.61	4.0	89.5	80	
	1200	230/460	213TCRD	SSPE3-12-213TCRD	$3,749.76	4.6	89.5	169	
5	3600	230/460	184TCRD	SSPE5-36-184TCRD	$2,931.48	6.1	88.5	94	
	1800	230/460	184TCRD	SSPE5-18-184TCRD	$3,032.57	6.25	89.5	99	
	1200	230/460	215TCRD	SSPE5-12-215TCRD	$4,442.26	7.0	89.5	199	
7.5	3600	230/460	213TCRD	SSPE7.5-36-213TCRD	$4,447.76	9.5	89.5	154	
	1800	230/460	213TCRD	SSPE7.5-18-213TCRD	$4,447.76	9.3	91.7	179	
10	3600	230/460	215TCRD	SSPE10-36-215TCRD	$4,717.32	12.2	90.2	169	
	1800	230/460	215TCRD	SSPE10-18-215TCRD	$4,717.32	12.2	91.7	209	
15	3600	230/460	254TCRD	SSPE15-36-254TCRD	$10,073.87	18.5	91.0	361	
	1800	230/460	254TCRD	SSPE15-18-254TCRD	$10,073.87	18.5	92.4	368	
20	3600	230/460	256TCRD	SSPE20-36-256TCRD	$11,033.31	23.0	91.0	420	
	1800	230/460	256TCRD	SSPE20-18-256TCRD	$11,033.31	24.5	93.0	434	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Stainless Steel Motors

TENV Enclosure ▪ C-Face ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1/3-3 HP, 3600 and 1800 RPM
- 230/460 Volt, 60 Hz
- Totally Enclosed Non-Ventillated (TENV) Enclosure
- IP69K Protection
- BISSC and BEAG Certified
- 1.15 SF
- Class F Insulation with Class B Temperature Rise
- C-Face with Feet and Round Body (Footless)
- NEMA Premium Efficiency at 60 Hz, IE3 Premium Efficiency at 50 Hz
- Suitable for 50 Hz, 190/380V, 1.15 SF (Derate in HP)
- NEMA Design B
- Continuous Duty
- 304 Stainless Steel Frame, End Bracket, Junction Box, and Hardware
- Stainless Steel Shaft and Key
- F1 Mounting Configuration
- Lip Seal on DE and ODE
- Round Welded Junction Box with Epoxy Potted Leads
- Double Sealed Bearings
- Inverter Duty – 10:1 Constant Torque (CT) / 20:1 Variable Torque (VT)
- CSA Class 1 Division 2 Groups A, B, C, D – Temperature Code T2B
- Ambient -20°C to +40°C, Altitude up to 3300 Feet Above Sea Level (FASL)
- Bi-directional Rotation
- In Accordance with NEMA, CSA, UL, and CE

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
C-Face with Feet									
1/3	3600	230/460	56C	SSPENV13-36-56C	$864.73	0.55	72.0	26	
	1800	230/460	56C	SSPENV13-18-56C	$898.07	0.7	74.0	28	
1/2	3600	230/460	56C	SSPENV12-36-56C	$893.59	0.75	74.0	29	
	1800	230/460	56C	SSPENV12-18-56C	$918.14	0.8	78.5	30	
3/4	3600	230/460	56C	SSPENV34-36-56C	$1,029.70	1.1	77.0	33	
	1800	230/460	56C	SSPENV34-18-56C	$993.95	1.2	81.5	33	
1	3600	230/460	56C	SSPENV1-36-56C	$1,244.86	1.4	80.0	39	
	3600	230/460	143TC	SSPENV1-36-143TC	$1,280.59	1.4	80.0	39	
	1800	230/460	56C	SSPENV1-18-56C	$1,280.80	1.55	85.5	42	
	1800	230/460	143TC	SSPENV1-18-143TC	$1,316.69	1.55	85.5	42	
1.5	3600	230/460	56C	SSPENV1.5-36-56C	$1,365.70	1.85	84.0	46	
	3600	230/460	143TC	SSPENV1.5-36-143TC	$1,408.72	1.85	84.0	46	
	1800	230/460	56C	SSPENV1.5-18-56C	$1,401.78	2.2	86.5	51	
	1800	230/460	145TC	SSPENV1.5-18-145TC	$1,437.87	2.2	86.5	51	
2	3600	230/460	56C	SSPENV2-36-56C	$2,151.24	2.5	85.5	60	
	3600	230/460	145TC	SSPENV2-36-145TC	$2,179.01	2.5	85.5	60	
	1800	230/460	56C	SSPENV2-18-56C	$2,401.08	2.7	86.5	65	
	1800	230/460	145TC	SSPENV2-18-145TC	$2,428.83	2.7	86.5	65	
3	3600	230/460	182TC	SSPENV3-36-182TC	$3,244.91	3.60	86.5	95	
	1800	230/460	182TC	SSPENV3-18-182TC	$3,353.30	3.8	89.5	99	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Stainless Steel Motors (Continued)

TENV Enclosure ▪ C-Face ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
C-Face Round Body (Footless)									
1/3	3600	230/460	56CRD	SSPENV13-36-56CRD	$830.36	0.55	72.0	26	
	1800	230/460	56CRD	SSPENV13-18-56CRD	$863.70	0.7	74.0	28	
1/2	3600	230/460	56CRD	SSPENV12-36-56CRD	$859.24	0.75	74.0	29	
	1800	230/460	56CRD	SSPENV12-18-56CRD	$883.76	0.8	78.5	30	
3/4	3600	230/460	56CRD	SSPENV34-36-56CRD	$995.33	1.1	77.0	33	
	1800	230/460	56CRD	SSPENV34-18-56CRD	$959.60	1.2	81.5	33	
1	3600	230/460	56CRD	SSPENV1-36-56CRD	$1,210.48	1.4	80.0	39	
	3600	230/460	143TCRD	SSPENV1-36-143TCRD	$1,246.23	1.4	80.0	39	
	1800	230/460	56CRD	SSPENV1-18-56CRD	$1,246.43	1.55	85.5	42	
	1800	230/460	143TCRD	SSPENV1-18-143TCRD	$1,282.31	1.55	85.5	42	
1.5	3600	230/460	56CRD	SSPENV1.5-36-56CRD	$1,331.00	1.9	84.0	46	
	3600	230/460	143TCRD	SSPENV1.5-36-143TCRD	$1,374.03	1.9	84.0	46	
	1800	230/460	56CRD	SSPENV1.5-18-56CRD	$1,367.09	2.2	86.5	51	
	1800	230/460	145TCRD	SSPENV1.5-18-145TCRD	$1,403.17	2.2	86.5	51	
2	3600	230/460	56CRD	SSPENV2-36-56CRD	$2,070.75	2.5	85.5	60	
	3600	230/460	145TCRD	SSPENV2-36-145TCRD	$2,105.45	2.5	85.5	60	
	1800	230/460	56CRD	SSPENV2-18-56CRD	$2,331.68	2.7	86.5	65	
	1800	230/460	145TCRD	SSPENV2-18-145TCRD	$2,359.43	2.7	86.5	65	
3	3600	230/460	182TCRD	SSPENV3-36-182TCRD	$3,140.82	3.6	86.5	95	
	1800	230/460	182TCRD	SSPENV3-18-182TCRD	$3,249.21	3.8	89.5	99	

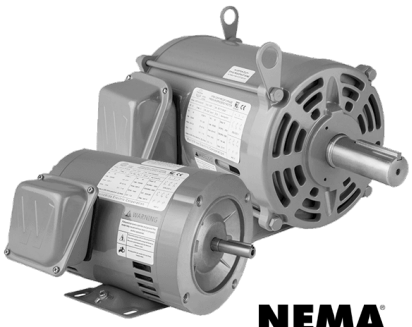
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Open Drip (ODP) Proof Motors

ODP Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1/2-200 HP
- 3600, 1800, 1200 RPM
- 230/460 Volt, 60 Hz
- 190/380 Volt, 50 Hz
- Open Drip Proof (ODP) Enclosure
  - Rolled Steel Frame (56-324/6T)
  - Cast Iron Frame (364/5-444/5T)
- IP23 Protection
- 1.15 SF (1.0 SF at 50 Hz)
- Class F Insulation
- NEMA Premium Efficiency
- Rigid Base (Exception: 56 Frame has C-Face with Removable Base)
- Class B Temperature Rise
- Inverter Duty, 10:1 CT / 20:1 VT (1.0 SF)
- Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31
- Pre-Drilled and Tapped Drive Endbells on 143T Frame and Up to Accept Inpro® Current Diverter Rings and WWE Grounding Rings; No Machining Required, Simple and Easy Installation
- 254T and larger are suitable for F1 to F2 conversion
- Exclusive Double Vacuum Pressure Impregnation (VPI) Insulation System
- Double Drilled Feet to Accommodate Mounting Flexibility (143T-445T)



NEMA Premium

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1/2	3600	230/460	56C	ODP12-36-56CB	$393.00	0.73	73.4	22	1
	1800	230/460	56C	ODP12-18-56CB	$425.25	0.95	78.2	27	1
3/4	3600	230/460	56C	ODP34-36-56CB	$418.37	0.98	76.8	27	1
	1800	230/460	56C	ODP34-18-56CB	$451.45	1.1	81.1	27	1
1	3600	230/460	143T	ODP1-36-143T	$525.75	1.35	77.0	29	
	1800	230/460	143T	ODP1-18-143T	$464.99	1.4	85.5	34	
	1800	230/460	143T	ODP1-18-143T-F2	$464.99	1.4	85.5	34	F2
	1800	230/460	143T	ODP1-18-143T-GR	$647.37	1.4	85.5	34	GR
	1200	230/460	145T	ODP1-12-145T	$598.97	1.7	82.5	41	
1.5	3600	230/460	143T	ODP1.5-36-143T	$614.73	1.9	84.0	32	
	1800	230/460	145T	ODP1.5-18-145T	$578.48	2.1	86.5	35	
	1800	230/460	145T	ODP1.5-18-145T-F2	$578.48	2.1	86.5	35	F2
	1800	230/460	145T	ODP1.5-18-145T-GR	$760.85	2.1	86.5	35	GR
	1200	230/460	182T	ODP1.5-12-182T	$752.56	2.6	86.5	65	
2	3600	230/460	145T	ODP2-36-145T	$692.65	2.5	85.5	35	
	1800	230/460	145T	ODP2-18-145T	$613.57	2.7	86.5	39	
	1800	230/460	145T	ODP2-18-145T-F2	$613.57	2.7	86.5	39	F2
	1800	230/460	145T	ODP2-18-145T-GR	$795.94	2.7	86.5	39	GR
	1200	230/460	184T	ODP2-12-184T	$927.31	3.5	87.5	76	
3	3600	230/460	145T	ODP3-36-145T	$740.85	3.7	85.5	40	
	1800	230/460	182T	ODP3-18-182T	$738.78	3.9	89.5	69	
	1800	230/460	182T	ODP3-18-182T-F2	$738.78	3.9	89.5	69	F2
	1800	230/460	182T	ODP3-18-182T-GR	$957.63	3.9	89.5	69	GR
	1200	230/460	213T	ODP3-12-213T	$1,529.90	4.3	88.5	120	
5	3600	230/460	182T	ODP5-36-182T	$852.23	5.9	86.5	79	
	1800	230/460	184T	ODP5-18-184T	$881.71	6.2	89.5	92	
	1800	230/460	184T	ODP5-18-184T-F2	$881.71	6.2	89.5	92	F2
	1800	230/460	184T	ODP5-18-184T-GR	$1,100.56	6.2	89.5	92	GR
	1200	230/460	215T	ODP5-12-215T	$1,727.39	6.5	89.5	145	
7.5	3600	230/460	184T	ODP7.5-36-184T	$1,204.13	8.68	88.5	79	
	1800	230/460	213T	ODP7.5-18-213T	$1,197.78	9.8	91.0	141	
	1800	230/460	213T	ODP7.5-18-213T-F2	$1,197.78	9.8	91.0	141	F2
	1800	230/460	213T	ODP7.5-18-213T-GR	$1,455.62	9.8	91.0	141	GR
	1200	230/460	254T	ODP7.5-12-254T	$2,146.43	9.7	90.2	185	FC
10	3600	230/460	213T	ODP10-36-213T	$1,395.95	11.8	89.5	151	
	1800	230/460	215T	ODP10-18-215T	$1,429.47	12.2	91.7	156	
	1800	230/460	215T	ODP10-18-215T-F2	$1,429.47	12.2	91.7	156	F2
	1800	230/460	215T	ODP10-18-215T-GR	$1,687.31	12.2	91.7	156	GR
	1200	230/460	256T	ODP10-12-256T	$2,454.71	13.1	91.7	240	
15	3600	230/460	215T	ODP15-36-215T	$1,822.10	17.1	90.2	142	
	1800	230/460	254T	ODP15-18-254T	$1,955.76	17.4	93.0	215	FC
	1800	230/460	254T	ODP15-18-254T-GR	$2,252.60	17.4	93.0	215	FC GR
	1200	230/460	284T	ODP15-12-284T	$3,315.38	18.3	91.7	331	FC

1 56C-face removable base
F2 Factory F2 mount
FC F1/F2 convertible
GR Factory installed grounding rings (WWE brand)

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

WORLDWIDE ELECTRIC CORPORATION

Open Drip Proof (ODP) Motors (Continued)

ODP Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
20	3600	230/460	254T	ODP20-36-254T	$2,312.88	22.1	91.0	247	FC
	1800	230/460	256T	ODP20-18-256T	$2,396.72	23.3	93.0	261	FC
	1800	230/460	256T	ODP20-18-256T-GR	$2,693.54	23.3	93.0	261	FC GR
	1200	230/460	286T	ODP20-12-286T	$3,905.67	25.5	92.4	330	FC
25	3600	230/460	256T	ODP25-36-256T	$2,815.32	27.0	91.7	270	FC
	1800	230/460	284T	ODP25-18-284T	$2,915.66	30.0	93.6	300	FC
	1800	230/460	284T	ODP25-18-284T-GR	$3,272.85	30.0	93.6	300	FC GR
	1200	230/460	324T	ODP25-12-324T	$4,955.78	30.8	93.0	440	FC
30	3600	230/460	284TS	ODP30-36-284TS	$3,362.81	33.2	91.7	329	FC
	1800	230/460	286T	ODP30-18-286T	$3,324.88	35.1	94.1	330	FC
	1800	230/460	286T	ODP30-18-286T-GR	$3,682.08	35.1	94.1	330	FC GR
	1200	230/460	326T	ODP30-12-326T	$5,205.21	37.0	93.6	470	FC
40	3600	230/460	286TS	ODP40-36-286TS	$4,288.65	45.4	92.4	340	FC
	1800	230/460	324T	ODP40-18-324T	$4,344.95	47.9	94.1	440	FC
	1800	230/460	324T	ODP40-18-324T-GR	$4,749.96	47.9	94.1	440	FC GR
	1200	230/460	364T	ODP40-12-364T	$6,200.91	46.7	94.1	706	FC
50	3600	230/460	324TS	ODP50-36-324TS	$5,186.42	56.1	93.0	418	FC
	1800	230/460	326T	ODP50-18-326T	$5,011.00	59.3	94.5	470	FC
	1800	230/460	326T	ODP50-18-326T-GR	$5,415.99	59.3	94.5	470	FC GR
	1200	230/460	365T	ODP50-12-365T	$7,056.58	57.6	94.1	744	FC
60	3600	230/460	326TS	ODP60-36-326TS	$6,037.66	67.8	93.6	455	FC
	1800	230/460	364T	ODP60-18-364T	$6,144.21	71.1	95.1	706	FC
	1800	230/460	364TS	ODP60-18-364TS	$6,144.21	71.1	95.1	706	FC
75	3600	230/460	364TS	ODP75-36-364TS	$6,717.15	83.3	93.6	706	FC
	1800	230/460	365T	ODP75-18-365T	$7,162.65	86.3	95.0	744	FC
	1800	230/460	365TS	ODP75-18-365TS	$7,162.65	86.3	95.0	744	FC
100	3600	230/460	365TS	ODP100-36-365TS	$7,933.31	110.6	93.6	816	FC
	1800	230/460	404T	ODP100-18-404T	$9,335.36	115.3	95.4	1034	FC
	1800	230/460	404TS	ODP100-18-404TS	$9,335.36	115.3	95.4	1034	FC
125	3600	230/460	404TS	ODP125-36-404TS	$11,256.89	128.8	94.1	1089	FC
	1800	230/460	405T	ODP125-18-405T	$11,615.35	136.2	95.4	1085	FC
	1800	230/460	405TS	ODP125-18-405TS	$11,615.35	136.2	95.4	1085	FC
150	3600	230/460	405TS	ODP150-36-405TS	$12,851.11	160.5	94.1	1165	FC
	1800	230/460	444T	ODP150-18-444T	$13,505.96	165.4	95.8	1504	FC
	1800	230/460	444TS	ODP150-18-444TS	$13,505.96	165.4	95.8	1504	FC
200	3600	230/460	444TS	ODP200-36-444TS	$16,723.37	219.4	95.0	1654	FC
	1800	230/460	445T	ODP200-18-445T	$16,470.09	224.4	95.8	1733	FC

Inpro® Current Diverter Rings

For use on WorldWide Electric Motors

Model Number	Frame Size	List Price
CDR-180T	182T / 184T	$429.66
CDR-210T	213T / 215T	$531.96
CDR-250T/280TS	254T / 256T / 284TS / 286TS	$624.05
CDR-280T/320TS/360TS	284T / 286T / 324TS / 326TS / 364TS / 365TS	$716.12
CDR-320T/400TS	324T / 326T / 404TS	$818.42
CDR-360T/440TS	364T / 365T	$910.49
CDR-400T	404T	$1,104.86

WorldWide Electric Grounding Rings

Model Number	Frame Size	List Price
GR-140	143/145T	$139.61
GR-180	182/184T	$176.09
GR-210	213/215T	$203.75
GR-250/280TS	254/256T/284/286T	$240.22
GR-280/320TS/360TS	284/286T/324/326TS/364/365TS	$276.70
GR-320/400TS	324/326T/404/405TS	$320.72
GR-360/440TS	364/365T/444/445TS	$383.61

ODP Motor C-Flange Kits

Model Number	Frame Size	List Price
ODP56C	56	$34.78
ODP140TC	143T / 145T	$87.84
ODP180TC	182T / 184T	$94.59
ODP210TC	213T / 215T	$214.25
ODP250TC	254T / 256T	$236.51
ODP280TC	284T / 286T	$286.62
ODP320TC	324T / 326T	$349.21
ODP360TC	364T/365T	$484.01
ODP400TC	404T/405T	$665.35
ODP440TC	444T/445T	$844.00

1 56C-face removable base
F2 Factory F2 mount
FC F1/F2 convertible
GR Factory installed grounding rings (WWE brand)

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Open Drip (ODP) Proof Motors

ODP Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-200 HP
- 3600, 1800 RPM
- 230/460 Volt, 60 Hz
- 190/380 Volt, 50 Hz
- Open Drip Proof (ODP) Enclosure
  - Rolled Steel Frame (143/5-324/6TC)
  - Cast Iron Frame (364/5-444/5TC)
- IP23 Protection
- 1.15 SF (1.0 SF at 50 Hz)
- Class F Insulation
- NEMA Premium Efficiency
- C-Face with Feet
- Class B Temperature Rise
- Inverter Duty, 10:1 CT / 20:1 VT (1.0 SF)
- Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31
- Pre-Drilled and Tapped Drive Endbells on 143TC Frame and Up to Accept Inpro® Current Diverter Rings and WWE Grounding Rings; No Machining Required, Simple and Easy Installation
- 254TC and larger are suitable for F1 to F2 conversion
- Exclusive Double Vacuum Pressure Impregnation (VPI) Insulation System
- Double Drilled Feet to Accommodate Mounting Flexibility

NEMA Premium

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	3600	230/460	143TC	ODP1-36-143TC	$561.00	1.35	77.0	29	
	1800	230/460	143TC	ODP1-18-143TC	$496.00	1.4	85.5	34	
1.5	3600	230/460	143TC	ODP1.5-36-143TC	$655.00	1.9	84.0	32	
	1800	230/460	145TC	ODP1.5-18-145TC	$616.00	2.1	86.5	35	
2	3600	230/460	145TC	ODP2-36-145TC	$738.00	2.5	85.5	35	
	1800	230/460	145TC	ODP2-18-145TC	$639.00	2.7	86.5	39	
3	3600	230/460	145TC	ODP3-36-145TC	$790.00	3.7	85.5	40	
	1800	230/460	182TC	ODP3-18-182TC	$787.00	3.9	89.5	69	
5	3600	230/460	182TC	ODP5-36-182TC	$908.00	5.9	86.5	79	
	1800	230/460	184TC	ODP5-18-184TC	$940.00	6.2	89.5	92	
7.5	3600	230/460	184TC	ODP7.5-36-184TC	$1,283.00	8.68	88.5	79	
	1800	230/460	213TC	ODP7.5-18-213TC	$1,277.00	9.8	91.0	141	
10	3600	230/460	213TC	ODP10-36-213TC	$1,488.00	11.8	89.5	151	
	1800	230/460	215TC	ODP10-18-215TC	$1,523.00	12.2	91.7	156	
15	3600	230/460	215TC	ODP15-36-215TC	$1,942.00	17.1	90.2	142	
	1800	230/460	254TC	ODP15-18-254TC	$2,084.00	17.4	93.0	215	FC
20	3600	230/460	254TC	ODP20-36-254TC	$2,465.00	22.1	91.0	247	FC
	1800	230/460	256TC	ODP20-18-256TC	$2,554.00	23.3	93.0	261	FC
25	3600	230/460	256TC	ODP25-36-256TC	$3,001.00	27.0	91.7	270	FC
	1800	230/460	284TC	ODP25-18-284TC	$3,107.00	30.0	93.6	300	FC
30	3600	230/460	284TSC	ODP30-36-284TSC	$3,584.00	33.2	91.7	329	FC
	1800	230/460	286TC	ODP30-18-286TC	$3,543.00	35.1	94.1	330	FC
40	3600	230/460	286TSC	ODP40-36-286TSC	$4,571.00	45.4	92.4	340	FC
	1800	230/460	324TC	ODP40-18-324TC	$4,631.00	47.9	94.1	440	FC
50	3600	230/460	324TSC	ODP50-36-324TSC	$5,528.00	56.1	93.0	418	FC
	1800	230/460	326TC	ODP50-18-326TC	$5,341.00	59.3	94.5	470	FC
60	3600	230/460	326TSC	ODP60-36-326TSC	$6,129.00	67.8	93.6	455	FC
	1800	230/460	364TC	ODP60-18-364TC	$6,237.00	71.1	95.1	706	FC
75	3600	230/460	364TSC	ODP75-36-364TSC	$6,809.00	83.3	93.6	706	FC
	1800	230/460	365TC	ODP75-18-365TC	$7,260.00	86.3	95.0	744	FC
100	3600	230/460	365TSC	ODP100-36-365TSC	$8,041.00	110.6	93.6	816	FC
	1800	230/460	404TC	ODP100-18-404TC	$9,462.00	115.3	95.4	1034	FC
125	3600	230/460	404TSC	ODP125-36-404TSC	$11,390.00	128.8	94.1	1089	FC
	1800	230/460	405TC	ODP125-18-405TC	$11,770.00	136.2	95.4	1085	FC
150	3600	230/460	405TSC	ODP150-36-405TSC	$13,299.00	160.5	94.1	1165	FC
	1800	230/460	444TC	ODP150-18-444TC	$16,095.00	165.4	95.8	1504	FC
200	3600	230/460	444TSC	ODP200-36-444TSC	$17,307.00	219.4	95.0	1654	FC
	1800	230/460	445TC	ODP200-18-445TC	$18,506.00	224.4	95.8	1733	FC

FC F1/F2 convertible

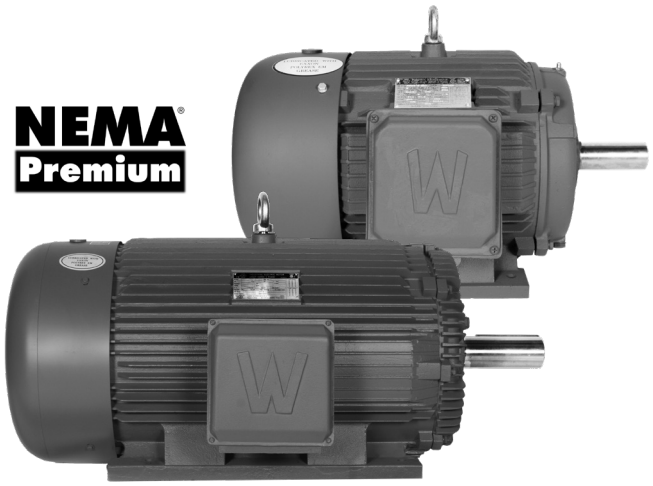
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Severe Duty Motors

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 1-500 HP
- 3600, 1800, 1200 and 900 RPM
- 230/460 Volt, 60 Hz
- 460 Volt, 60 Hz (449T-586/7 Frame)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.25 SF (1-200 HP)
- 1.15 SF (250-500 HP)
- Class F Insulation
- Rigid Base
- Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT at 1.0 SF (1-400 HP)
- Inverter Ready, 3:1 CT / 6:1 VT at 1.0 SF (450-500 HP)
- Class 1, Division 2, Groups A, B, C, D (1-400 HP)
- Suitable for 50 Hz, 200/400V with 1.0 SF (1-200 HP)
- Suitable for 50 Hz, 400V with 1.0 SF (250-400 HP)



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143T	PEWWE1-18-143T	$478.88	1.5	85.5	41	FC
	1200	230/460	145T	PEWWE1-12-145T	$666.17	1.7	82.5	53	DD FC
1.5	3600	230/460	143T	PEWWE1.5-36-143T	$650.35	2.0	84.0	46	FC
	1800	230/460	145T	PEWWE1.5-18-145T	$590.97	2.2	86.5	56	DD FC
	1200	230/460	182T	PEWWE1.5-12-182T	$761.09	2.4	87.5	92	FC
2	3600	230/460	145T	PEWWE2-36-145T	$707.11	2.6	85.5	51	DD FC
	1800	230/460	145T	PEWWE2-18-145T	$626.14	2.9	86.5	59	DD FC
	1200	230/460	184T	PEWWE2-12-184T	$999.64	3.0	88.5	100	DD FC
3	3600	230/460	182T	PEWWE3-36-182T	$853.88	3.8	86.5	57	FC
	1800	230/460	182T	PEWWE3-18-182T	$881.60	4.0	89.5	86	FC
	1200	230/460	213T	PEWWE3-12-213T	$1,345.77	4.4	89.5	166	FC
	900	230/460	215T	PEWWE3-9-215T	$2,018.09	4.8	85.5	154	DD FC
5	3600	230/460	184T	PEWWE5-36-184T	$1,056.44	6.0	88.5	96	DD
	1800	230/460	184T	PEWWE5-18-184T	$1,033.03	6.3	89.9	104	DD
	1200	230/460	215T	PEWWE5-12-215T	$1,669.10	7.0	89.5	179	DD FC
	900	230/460	254T	PEWWE5-9-254T	$3,121.37	7.3	86.5	219	FC
7.5	3600	230/460	213T	PEWWE7.5-36-213T	$1,595.22	8.8	89.5	105	FC
	1800	230/460	213T	PEWWE7.5-18-213T	$1,365.88	9.1	91.7	172	FC
	1200	230/460	254T	PEWWE7.5-12-254T	$2,193.47	9.4	91.0	247	FC
	900	230/460	256T	PEWWE7.5-9-256T	$3,459.84	10.8	86.5	249	DD FC
10	3600	230/460	215T	PEWWE10-36-215T	$1,655.91	11.7	90.2	180	DD FC
	1800	230/460	215T	PEWWE10-18-215T	$1,654.66	12.0	91.7	193	DD FC
	1200	230/460	256T	PEWWE10-12-256T	$2,752.75	12.5	91.0	258	DD FC
	900	230/460	284T	PEWWE10-9-284T	$4,394.72	13.8	89.5	347	FC
15	3600	230/460	254T	PEWWE15-36-254T	$2,682.39	17.3	91.0	190	FC
	1800	230/460	254T	PEWWE15-18-254T	$2,378.12	18.1	92.4	265	FC
	1200	230/460	284T	PEWWE15-12-284T	$3,456.57	18.7	91.7	366	FC
	900	230/460	286T	PEWWE15-9-286T	$5,114.34	20.4	89.5	390	DD FC
20	3600	230/460	256T	PEWWE20-36-256T	$3,269.51	23.1	91.0	297	DD FC
	1800	230/460	256T	PEWWE20-18-256T	$2,732.43	23.7	93.0	304	DD FC
	1200	230/460	286T	PEWWE20-12-286T	$4,311.26	24.6	91.7	419	DD FC
	900	230/460	324T	PEWWE20-9-324T	$6,076.75	26.3	90.2	501	FC
25	3600	230/460	284TS	PEWWE25-36-284TS	$4,035.14	29.0	91.7	358	FC
	1800	230/460	284T	PEWWE25-18-284T	$3,564.24	29.1	93.6	385	FC
	1800	230/460	284TS	PEWWE25-18-284TS	$3,564.24	29.1	93.6	385	FC
	1200	230/460	324T	PEWWE25-12-324T	$4,903.34	32.7	93.0	522	FC
	900	230/460	326T	PEWWE25-9-326T	$6,854.25	32.9	90.2	552	DD FC

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Severe Duty Motors (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
	3600	230/460	286T	PEWWE30-36-286T	$4,127.88	34.4	91.7	394	DD FC
	3600	230/460	286TS	PEWWE30-36-286TS	$4,127.88	34.4	91.7	394	DD FC
30	1800	230/460	286T	PEWWE30-18-286T	$4,037.63	34.5	93.6	430	DD FC
	1200	230/460	326T	PEWWE30-12-326T	$5,756.09	38.7	93.0	562	DD FC
	900	230/460	364T	PEWWE30-9-364T	$10,368.94	40.8	91.7	731	FC
	3600	230/460	324TS	PEWWE40-36-324TS	$5,316.09	46.1	92.4	485	FC
40	1800	230/460	324T	PEWWE40-18-324T	$5,131.19	46.3	94.1	531	FC
	1200	230/460	364T	PEWWE40-12-364T	$7,153.71	49.1	94.1	780	FC
	900	230/460	365T	PEWWE40-9-365T	$11,454.77	54.5	91.7	796	DD FC
	3600	230/460	326TS	PEWWE50-36-326TS	$6,679.20	56.6	93.0	534	DD FC
50	1800	230/460	326T	PEWWE50-18-326T	$5,831.02	57.6	94.5	578	DD FC
	1200	230/460	365T	PEWWE50-12-365T	$9,380.36	60.7	94.1	844	DD
	900	230/460	404T	PEWWE50-9-404T	$16,582.65	66.7	92.4	968	R FC
	3600	230/460	364TS	PEWWE60-36-364TS	$9,159.35	70.6	93.6	743	
60	1800	230/460	364T	PEWWE60-18-364T	$7,702.51	72.0	95.0	769	
	1200	230/460	404T	PEWWE60-12-404T	$10,371.19	70.8	94.5	1012	R FC
	900	230/460	405T	PEWWE60-9-405T	$19,321.97	80.0	92.4	1058	R DD FC
	3600	230/460	365TS	PEWWE75-36-365TS	$10,968.34	88.3	93.6	787	DD
	3600	230/460	365TS	PEWWE75-36-365TS-IB	$15,252.22	88.3	93.6	787	IB DD
75	1800	230/460	365T	PEWWE75-18-365T	$9,277.68	88.7	95.4	858	DD
	1200	230/460	405T	PEWWE75-12-405T	$10,869.61	87.4	94.5	1129	R DD FC
	900	230/460	444T	PEWWE75-9-444T	$22,205.07	101	93.6	1325	R FC
	3600	230/460	405TS	PEWWE100-36-405TS	$13,205.70	111	94.1	1054	DD
	3600	230/460	405TS	PEWWE100-36-405TS-IB	$17,208.22	111	94.1	1054	DD
	1800	230/460	405T	PEWWE100-18-405T	$10,999.62	113	95.4	1131	R DD
	1800	230/460	405T	PEWWE100-18-405TBB	$10,999.62	113	95.4	1131	BB DD
100	1800	230/460	405T	PEWWE100-18-405TBB-IB	$11,819.77	113	95.4	1131	BB IB DD
	1800	230/460	405TS	PEWWE100-18-405TSBB	$10,999.62	113	95.4	1131	BB DD
	1200	230/460	444T	PEWWE100-12-444T	$15,729.72	120	95.0	1477	R FC
	1200	230/460	444T	PEWWE100-12-444T-IB	$17,307.01	120	95.0	1477	IB R DD FC
	900	230/460	445T	PEWWE100-9-445T	$25,502.52	135	93.6	1546	R DD FC
	3600	230/460	444TS	PEWWE125-36-444TS	$17,250.56	137	95.0	1338	FC
	3600	230/460	444TS	PEWWE125-36-444TS-IB	$21,102.05	137	95.0	1338	IB FC
	1800	230/460	444T	PEWWE125-18-444T	$14,764.32	146	95.4	1429	R FC
125	1800	230/460	444T	PEWWE125-18-444TBB	$14,764.32	146	95.4	1429	BB FC
	1800	230/460	444T	PEWWE125-18-444TBB-IB	$17,815.52	146	95.4	1429	BB IB FC
	1200	230/460	445T	PEWWE125-12-445T	$18,327.48	145	95.0	1632	R DD FC
	900	230/460	445/7T	PEWWE125-9-445/7T	$26,449.87	168	94.1	1782	R DD FC
	3600	230/460	445TS	PEWWE150-36-445TS	$19,850.19	164	95.0	1517	DD FC
	3600	230/460	445TS	PEWWE150-36-445TS-IB	$23,660.73	164	95.0	1517	IB DD FC
	1800	230/460	445T	PEWWE150-18-445T	$16,213.19	172	95.8	1625	R DD FC
150	1800	230/460	445T	PEWWE150-18-445T-IB	$19,571.97	172	95.8	1625	IB R DD FC
	1800	230/460	445T	PEWWE150-18-445TBB	$16,213.19	172	95.8	1625	BB DD FC
	1200	230/460	445/7T	PEWWE150-12-445/7T	$23,410.56	179	95.8	2013	R DD FC
	1200	230/460	445/7T	PEWWE150-12-445/7T-IB	$27,623.24	179	95.8	2013	IB R DD FC
	900	230/460	449T	PEWWE150-9-449T	$28,957.93	194	94.1	2486	R D[12] FC
	3600	230/460	445/7TS	PEWWE200-36-445/7TS	$26,829.74	216	96.2	1797	DD FC
	3600	230/460	445/7TS	PEWWE200-36-445/7TS-IB	$28,765.12	216	96.2	1797	IB DD FC
200	1800	230/460	445/7T	PEWWE200-18-445/7T	$21,547.79	226	96.2	2033	R DD FC
	1800	230/460	445/7T	PEWWE200-18-445/7T-IB	$24,960.48	226	96.2	2033	IB R DD FC
	1800	230/460	445/7T	PEWWE200-18-445/7TBB	$21,547.79	226	96.2	2033	BB DD FC
	1800	230/460	445/7T	PEWWE200-18-445/7TBB-IB	$25,257.25	226	96.2	2033	BB IB DD FC

BB Ball bearing on drive-end for direct coupled applications
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive-end for belted applications
DD Double drilled feet
D[6] Double drilled feet with 6 holes
D[12] Double drilled feet with 12 holes
FC F1/F2 convertible

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Severe Duty Motors (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
200	1200	460	449T	PEWWE200-12-449T	$27,699.88	236	95.8	2664	R D12 FC
	1200	460	449T	PEWWE200-12-449T-IB	$31,180.73	236	95.8	2664	IB R D12 FC
	1200	460	449T	PEWWE200-12-449TBB	$27,699.88	236	95.8	2664	BB D12 FC
	1200	460	505Z	PEWWE200-12-505Z	$38,646.24	225	95.8	2470	R D6
	1200	460	505UZ	PEWWE200-12-505UZ	$38,646.24	225	95.8	2470	R D6
	900	230/460	449T	PEWWE200-9-449T	$46,853.25	254	94.5	2971	R D12 FC
250	3600	460	449TS	PEWWE250-36-449TS	$29,193.43	269	95.8	2200	D12 FC
	3600	460	449TS	PEWWE250-36-449TS-IB	$31,128.81	269	95.8	2200	IB D12 FC
	1800	460	449T	PEWWE250-18-449T	$30,506.18	280	96.2	2508	R D12 FC
	1800	460	449T	PEWWE250-18-449T-IB	$33,732.12	280	96.2	2508	IB R D12 FC
	1800	460	449T	PEWWE250-18-449TBB	$30,506.18	280	96.2	2508	BB D12 FC
	1800	460	449T	PEWWE250-18-449TBB-IB	$33,732.12	280	96.2	2508	BB IB D12 FC
	1800	460	449TS	PEWWE250-18-449TSBB	$30,506.18	280	96.2	2508	BB D12 FC
	1800	460	505Z	PEWWE250-18-505Z	$31,368.31	280	96.2	2360	R D6
	1800	460	505UZ	PEWWE250-18-505UZ	$31,368.31	280	96.2	2360	R D6
	1800	460	505UZ	PEWWE250-18-505UZ-IB	$34,133.28	280	96.2	2360	IB R D6
	1200	460	449T	PEWWE250-12-449T	$33,395.40	298	95.8	2750	R D12 FC
	1200	460	449T	PEWWE250-12-449T-IB	$36,621.34	298	95.8	2750	IB R D12 FC
	1200	460	449T	PEWWE250-12-449TBB	$33,395.40	298	95.8	2750	BB D12 FC
	1200	460	586/7	PEWWE250-12-586/7	$46,869.52	287	95.8	3737	R D12 FC
	1200	460	586/7	PEWWE250-12-586/7-IB	$51,938.85	287	95.8	3737	IB R D12 FC
	1200	460	586/7UZ	PEWWE250-12-586/7UZ	$46,869.52	287	95.8	3737	R D12 FC
	900	460	586/7	PEWWE250-9-586/7	$49,750.52	312	95.0	4030	R D12 FC
300	1800	460	449T	PEWWE300-18-449T	$34,171.63	336	96.2	2728	R D12 FC
	1800	460	449T	PEWWE300-18-449T-IB	$37,397.50	336	96.2	2728	IB R D12 FC
	1800	460	449T	PEWWE300-18-449TBB	$34,171.63	336	96.2	2728	BB D12 FC
	1800	460	449T	PEWWE300-18-449TBB-IB	$37,397.50	336	96.2	2728	BB IB D12 FC
	1800	460	449TS	PEWWE300-18-449TSBB	$34,171.63	336	96.2	2728	BB D12 FC
	1800	460	586/7	PEWWE300-18-586/7	$50,422.60	324	96.2	3873	R D12 FC
	1800	460	586/7	PEWWE300-18-586/7-IB	$55,491.85	324	96.2	3873	IB R D12 FC
	1800	460	586/7	PEWWE300-18-586/7BB	$50,422.60	324	96.2	3873	BB D12 FC
	1800	460	586/7UZ	PEWWE300-18-586/7UZ	$50,422.60	324	96.2	3873	R D12 FC
	1200	460	449T	PEWWE300-12-449T	$37,192.12	353	95.8	2977	R D12 FC
	1200	460	449T	PEWWE300-12-449T-IB	$40,418.00	353	95.8	2977	IB R D12 FC
	1200	460	449T	PEWWE300-12-449TBB	$37,192.12	353	95.8	2977	BB D12 FC
	1200	460	449T	PEWWE300-12-449TBB-IB	$40,418.00	353	95.8	2977	BB IB D12 FC
	1200	460	586/7	PEWWE300-12-586/7	$53,446.88	341	95.8	4136	R D12 FC
	1200	460	586/7	PEWWE300-12-586/7-IB	$58,516.13	341	95.8	4136	IB R D12 FC
	1200	460	586/7	PEWWE300-12-586/7BB	$53,446.88	341	95.8	4136	BB D12 FC
	1200	460	586/7UZ	PEWWE300-12-586/7UZ	$53,446.88	341	95.8	4136	R D12 FC
	1200	460	586/7UZ	PEWWE300-12-586/7UZ-IB	$58,516.13	341	95.8	4136	IB R D12 FC
	900	460	586/7	PEWWE300-9-586/7	$54,888.03	374	95.0	4440	R D12 FC
	900	460	586/7UZ	PEWWE300-9-586/7UZ	$54,888.03	374	95.0	4440	R D12 FC
350	1800	460	449T	PEWWE350-18-449T-IB	$42,574.13	392	96.2	2870	IB R D12 FC
	1800	460	449T	PEWWE350-18-449TBB-IB	$42,574.13	392	96.2	2870	IB D12 FC
	1800	460	586/7	PEWWE350-18-586/7	$53,640.95	374	96.2	4070	R D12 FC
	1800	460	586/7	PEWWE350-18-586/7-IB	$58,710.28	374	96.2	4070	IB R D12 FC
	1800	460	586/7UZ	PEWWE350-18-586/7UZ-IB	$58,710.28	374	96.2	4070	IB R D12 FC
	1200	460	449T	PEWWE350-12-449T	$45,209.48	407	95.8	2930	R D12 FC
	1200	460	449T	PEWWE350-12-449T-IB	$48,435.06	407	95.8	2930	IB R D12 FC
	1200	460	586/7	PEWWE350-12-586/7	$56,373.30	398	95.8	4145	R D12 FC
	1200	460	586/7	PEWWE350-12-586/7-IB	$61,442.49	398	95.8	4145	IB R D12 FC
	1200	460	586/7UZ	PEWWE350-12-586/7UZ	$56,373.30	398	95.8	4145	R D12 FC

BB Ball bearing on drive-end for direct coupled applications
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive-end for belted applications
DD Double drilled feet
D6 Double drilled feet with 6 holes
D12 Double drilled feet with 12 holes
FC F1/F2 convertible

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Severe Duty Motors (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
400	1800	460	586/7	PEWWE400-18-586/7	$56,006.54	428.0	96.2	4374	R D^{12} FC
	1800	460	586/7	PEWWE400-18-586/7-IB	$61,075.80	428.0	96.2	4374	IB R D^{12} FC
	1800	460	586/7	PEWWE400-18-586/7BB	$56,006.54	428.0	96.2	4374	BB D^{12} FC
	1800	460	586/7	PEWWE400-18-586/7BB-IB	$61,075.80	428.0	96.2	4374	BB IB D^{12} FC
	1800	460	586/7UZ	PEWWE400-18-586/7UZ	$56,006.54	428.0	96.2	4374	R D^{12} FC
	1800	460	586/7UZ	PEWWE400-18-586/7UZ-IB	$61,075.80	428.0	96.2	4374	IB R D^{12} FC
	1200	460	586/7	PEWWE400-12-586/7	$58,515.27	449.0	95.8	4707	R D^{12} FC
	1200	460	586/7	PEWWE400-12-586/7-IB	$63,584.31	449.0	95.8	4707	IB R D^{12} FC
	1200	460	586/7	PEWWE400-12-586/7BB	$58,515.27	449.0	95.8	4707	BB D^{12} FC
	1200	460	586/7	PEWWE400-12-586/7BB-IB	$63,584.31	449.0	95.8	4707	BB IB D^{12} FC
	1200	460	586/7UZ	PEWWE400-12-586/7UZ	$58,515.27	449.0	95.8	4707	R D^{12} FC
	1200	460	586/7UZ	PEWWE400-12-586/7UZ-IB	$63,584.31	449.0	95.8	4707	IB R D^{12} FC
450	1800	460	586/7	PEWWE450-18-586/7	$58,542.81	481.0	96.2	4500	R D^{12}
	1800	460	586/7	PEWWE450-18-586/7-IB	$62,229.02	481.0	96.2	4500	IB R D^{12}
	1200	460	586/7	PEWWE450-12-586/7-IB	$65,518.98	506.0	95.8	4850	IB R SF D^{12}
500	1800	460	586/7	PEWWE500-18-586/7-IB	$66,876.00	535	96.2	4630	IB R D^{12}
	1800	460	586/7	PEWWE500-18-586/7BB	$61,806.89	535	96.2	4630	BB D^{12}
	1800	460	586/7	PEWWE500-18-586/7BB-IB	$66,876.00	535	96.2	4630	BB IB D^{12}
	1800	460	586/7UZ	PEWWE500-18-586/7UZ	$61,806.89	535	96.2	4630	R D^{12}
	1200	460	586/7	PEWWE500-12-586/7	$62,384.39	562	95.8	4740	R SF D^{12}
	1200	460	586/7	PEWWE500-12-586/7-IB	$67,453.43	562	95.8	4740	IB R SF D^{12}
	1200	460	586/7UZ	PEWWE500-12-586/7UZ	$62,384.39	562	95.8	4740	R SF D^{12}
	1200	460	586/7UZ	PEWWE500-12-586/7UZ-IB	$67,453.43	562	95.8	4740	IB R SF D^{12}
600	1800	460	586/7	WWE600-18-586/7	$66,570.86	661	95.0	4630	R SF D^{12}
	1800	460	586/7	WWE600-18-586/7BB	$66,570.86	661	95.0	4630	BB SF D^{12}

PEWWE Motor C-Flange and D-Flange Kits

Frame Size	C-Flange Kits		D-Flange Kits	
	Model Number	List Price	Model Number	List Price
143T / 145T	PEW140TC (≤ 2016)	$46.07	PEW140TD (≤ 2016)	$46.07
	PEW140TCN (≥ 2017)	$46.07	PEW140TDN (≥ 2017)	$46.07
182T / 184T	PEW180TC (≤ 2016)	$64.02	PEW180TD (≤ 2016)	$64.02
	PEW180TCN (≥ 2017)	$64.02	PEW180TDN (≥ 2017)	$64.02
213T / 215T	PEW210TC	$89.60	PEW210TD	$89.60
254T / 256T	PEW250TC (≤ 2016)	$153.64	PEW250TD (≤ 2016)	$153.64
	PEW250TCN (≥ 2017)	$153.64	PEW250TDN (≥ 2017)	$153.64
284T / 286T	PEW280TC	$192.09	PEW280TD	$192.09
324T / 326T	PEW320TC	$268.92	PEW320TD	$268.92
364T / 365T	PEW360TC (≤ 2016)	$384.12	PEW360TD (≤ 2016)	$384.12
	PEW360TCN (≥ 2017)	$384.12	PEW360TDN (≥ 2017)	$384.12
404T / 405T (2 Pole)	PEW400TC-2	$570.22	PEW400TD-2	$570.22
404T / 405T (4/6 Pole)	PEW400TC	$570.22	PEW400TD	$570.22
444T / 445T (2 Pole)	PEW444/5TC-2	$603.76	PEW444/5TD-2	$603.76
444T / 445T (4/6 Pole)	PEW444/5TC	$603.76	PEW444/5TD	$603.76
447T (2 Pole)	PEW447TC-2	$603.76	PEW447TD-2	$603.76
447T (4/6 Pole)	PEW447TC	$603.76	PEW447TD	$603.76
449T	PEW449TC	$852.38	PEW449TC	$852.38
586/7	PEW580TC	$1,509.44	PEW580TD	$1,509.44

BB Ball bearing on drive-end for direct coupled applications
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive-end for belted applications
DD Double drilled feet
D^{6} Double drilled feet with 6 holes
D^{12} Double drilled feet with 12 holes
FC F1/F2 convertible
SF 1.0 SF

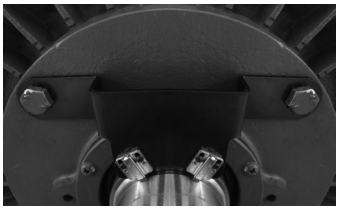
Helwig Carbon® The Bearing Protector™

- For use on WorldWide Electric Severe Duty Motors *
- Divert current from motor shaft
- Provides lowest resistant path to ground
- Easy to install - Simply remove top two bearing cap bolts
- Includes integral bracket for easy mounting

Frame Size	Model Number	List Price
364T / 365T	SGK-PEWWE-364/5T	$1,739.14
404T / 405T	SGK-PEWWE-404/5T/TS	$1,739.14
444T / 445T	SGK-PEWWE-444/5T	$1,739.14
445/7TS	SGK-PEWWE-445/7TS	$1,739.14
445/7T	SGK-PEWWE-445/7T	$1,739.14
449T **	SGK-PEWWE-449T **	$1,739.14
586/7 / 586/7UZ	SGK-PEWWE-586/7T-UZ	$1,739.14

* Installation of this product will result in loss of Class I Division 2 Classification from motor - please contact WorldWide for new motor nameplate at a cost of $25 net.

** Not suitable for use with PEWWE350-18-449T or PEWWE350-12-449T.



When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

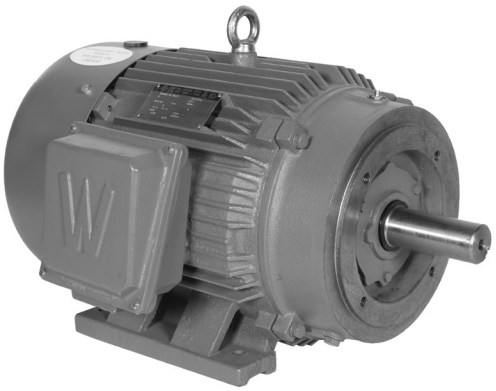
Premium Efficient Severe Duty Motors

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 1-300 HP
- 3600, 1800 and 1200 RPM
- 230/460 Volt, 60 Hz
- 460 Volt, 60 Hz (449TC Frame)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.25 SF (1-200 HP)
- 1.15 SF (250-300 HP)
- Class F Insulation
- C-Face with Feet
- Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT at 1.0 SF
- Class 1, Division 2, Groups A, B, C, D
- Suitable for 50 Hz, 200/400V with 1.0 SF (1-200 HP)
- Suitable for 50 Hz, 400V with 1.0 SF (250-300 HP)

NEMA Premium



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143TC	PEWWE1-18-143TC	$498.84	1.6	86.3	49	FC
	1200	230/460	145TC	PEWWE1-12-145TC	$693.91	1.6	82.5	51	DD FC
1.5	3600	230/460	143TC	PEWWE1.5-36-143TC	$677.46	2.0	85.5	48	FC
	1800	230/460	145TC	PEWWE1.5-18-145TC	$615.60	2.3	87.3	55	DD FC
2	3600	230/460	145TC	PEWWE2-36-145TC	$736.59	2.7	86.6	56	DD FC
	1800	230/460	145TC	PEWWE2-18-145TC	$652.23	3.0	87.3	58	DD FC
3	3600	230/460	145TC	PEWWE3-36-145TC	$889.47	3.8	87.4	57	DD FC
	3600	230/460	182TC	PEWWE3-36-182TC	$889.47	3.9	88.0	79	FC
	1800	230/460	182TC	PEWWE3-18-182TC	$918.33	4.0	90.3	98	FC
	1200	230/460	213TC	PEWWE3-12-213TC	$1,401.86	4.2	89.5	165	FC
5	3600	230/460	184TC	PEWWE5-36-184TC	$1,100.45	6.3	89.0	95	DD
	1800	230/460	184TC	PEWWE5-18-184TC	$1,076.07	6.7	90.3	115	DD
	1200	230/460	215TC	PEWWE5-12-215TC	$1,738.63	6.9	89.5	171	DD FC
7.5	3600	230/460	184TC	PEWWE7.5-36-184TC	$1,661.68	8.8	90.8	105	DD
	3600	230/460	213TC	PEWWE7.5-36-213TC	$1,661.68	9.2	89.7	176	FC
	1800	230/460	213TC	PEWWE7.5-18-213TC	$1,422.80	9.3	91.8	158	FC
	1200	230/460	254TC	PEWWE7.5-12-254TC	$2,284.88	10.4	91.1	251	FC
10	3600	230/460	215TC	PEWWE10-36-215TC	$1,724.92	12.2	90.3	180	DD FC
	1800	230/460	215TC	PEWWE10-18-215TC	$1,723.61	12.5	91.8	175	DD FC
	1200	230/460	256TC	PEWWE10-12-256TC	$2,867.46	13.9	91.0	251	DD FC
15	3600	230/460	215TC	PEWWE15-36-215TC	$2,794.16	17.3	91.8	190	DD FC
	3600	230/460	254TC	PEWWE15-36-254TC	$2,794.16	18.2	91.2	276	FC
	1800	230/460	254TC	PEWWE15-18-254TC	$2,477.22	17.1	92.5	294	FC
	1200	230/460	284TC	PEWWE15-12-284TC	$3,600.60	20.2	91.7	419	FC
20	3600	230/460	256TC	PEWWE20-36-256TC	$3,405.76	24.2	91.2	298	DD FC
	1800	230/460	256TC	PEWWE20-18-256TC	$2,846.29	24.0	93.8	436	DD FC
	1200	230/460	286TC	PEWWE20-12-286TC	$4,490.91	26.2	91.7	449	DD FC

DD Double drilled feet
D[6] Double drilled feet with 6 holes
D[12] Double drilled feet with 12 holes
FC F1/F2 convertible

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Premium Efficient Severe Duty Motors (Continued)

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 and 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
25	3600	230/460	256TC	PEWWE25-36-256TC	$4,203.28	28.7	92.1	309	FC
	3600	230/460	256TSC	PEWWE25-36-256TSC	$4,203.28	28.7	92.1	309	FC
	3600	230/460	284TC	PEWWE25-36-284TC	$4,203.28	29.3	91.7	358	FC
	3600	230/460	284TCS	PEWWE25-36-284TSC	$4,203.28	29.4	91.9	350	FC
	1800	230/460	284TC	PEWWE25-18-284TC	$3,712.74	29.8	93.6	406	FC
	1200	230/460	324TC	PEWWE25-12-324TC	$5,107.65	32.3	93.0	629	FC
30	3600	230/460	286TC	PEWWE30-36-286TC	$4,299.87	34.8	91.7	394	DD FC
	3600	230/460	286TCS	PEWWE30-36-286TSC	$4,299.87	35.2	91.9	384	DD FC
	1800	230/460	286TC	PEWWE30-18-286TC	$4,205.87	35.7	93.7	448	DD FC
	1200	230/460	326TC	PEWWE30-12-326TC	$5,995.92	38.8	93.0	660	DD FC
40	3600	230/460	324TC	PEWWE40-36-324TC	$5,537.57	46.1	92.4	485	FC
	3600	230/460	324TSC	PEWWE40-36-324TSC	$5,537.57	46.6	92.7	560	FC
	1800	230/460	324TC	PEWWE40-18-324TC	$5,344.98	47.4	94.4	684	FC
	1200	230/460	364TC	PEWWE40-12-364TC	$7,451.79	49.8	94.1	933	FC
50	3600	230/460	326TC	PEWWE50-36-326TC	$6,957.50	56.6	93.0	534	DD FC
	3600	230/460	326TSC	PEWWE50-36-326TSC	$6,957.50	57.2	93.2	598	DD FC
	1800	230/460	326TC	PEWWE50-18-326TC	$6,074.00	60.4	94.5	580	DD FC
	1200	230/460	365TC	PEWWE50-12-365TC	$9,771.21	62.3	94.1	968	DD
60	3600	230/460	364TSC	PEWWE60-36-364TSC	$9,540.99	68.3	93.6	710	
	1800	230/460	364TC	PEWWE60-18-364TC	$8,023.44	68.8	95.1	805	
	1200	230/460	404TC	PEWWE60-12-404TC	$10,803.32	72.6	94.5	1020	FC
75	3600	230/460	365TCS	PEWWE75-36-365TSC	$11,322.53	85.3	93.6	849	DD
	1800	230/460	365TC	PEWWE75-18-365TC	$9,664.27	83.8	95.4	891	DD
	1200	230/460	405TC	PEWWE75-12-405TC	$11,322.53	90.7	94.5	1180	DD FC
100	3600	230/460	405TSC	PEWWE100-36-405TSC	$13,755.93	111	94.2	1007	DD
	1800	230/460	405TC	PEWWE100-18-405TC	$11,457.96	114	95.4	1198	DD
	1800	230/460	405TSC	PEWWE100-18-405TSC	$11,457.96	114	95.4	1198	DD
125	3600	230/460	444TSC	PEWWE125-36-444TSC	$17,969.32	137	95.0	1366	FC
	1800	230/460	444TC	PEWWE125-18-444TC	$15,379.52	143	95.4	1609	FC
150	3600	230/460	445TSC	PEWWE150-36-445TSC	$20,677.25	165	95.0	1496	DD FC
	1800	230/460	445TC	PEWWE150-18-445TC	$16,888.74	171	95.8	2062	DD FC
200	1800	230/460	445/7TC	PEWWE200-18-445/7TC	$22,445.62	227	96.3	2124	DD FC
	1200	460	449TC	PEWWE200-12-449TC	$28,854.03	232	95.8	2678	DD[12] FC
250	1800	460	449TC	PEWWE250-18-449TC	$31,777.26	283	96.2	2498	DD[12] FC
300	1800	460	449TC	PEWWE300-18-449TC	$35,595.45	336.0	96.2	2728	DD[12] FC

DD Double drilled feet
D[6] Double drilled feet with 6 holes
D[12] Double drilled feet with 12 holes
FC F1/F2 convertible

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Explosion Proof Motors

TEXP Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 1-300 HP
- 3600, 1800 and 1200 RPM
- 230/460 Volt (1-100 HP)
- 460 Volt (125-300 HP)
- Totally Enclosed Fan Cooled Explosion Proof (TEXP) Enclosure
- IP55 Protection
- 1.15 SF
- Class F Insulation
- Rigid Base
- Premium Efficiency (1-200 HP)
- High Efficiency (250-300 HP)
- Inverter Duty, 5:1 CT / 10:1 VT (1-200 HP only)
- Normally Closed Winding Thermostats Provided
- UL Listed Class 1, Div. 1, Groups C and D; Class 2, Div. 1, Groups F and G; T3C; Inverter Duty (1-200 HP), 40°C amb. temp. as standard
  - 143T-215T: Class 1, Div. 1, Groups C and D; T3C; Inverter Duty (1-200 HP); 55°C amb. temp.
  - 254T-449T: Class 1, Div. 1, Groups C and D; T2C; Inverter Duty (1-200 HP); 55°C amb. temp.

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143T	IXPEWWE1-18-143T	$985.40	1.4	85.5	62	
	1200	230/460	145T	IXPEWWE1-12-145T	$1,080.56	1.7	82.5	79	
1.5	3600	230/460	143T	IXPEWWE1.5-36-143T	$1,001.82	1.9	84.0	73	
	1800	230/460	145T	IXPEWWE1.5-18-145T	$1,053.21	2.0	86.5	88	
	1200	230/460	182T	IXPEWWE1.5-12-182T	$1,208.52	2.1	87.5	115	
2	3600	230/460	145T	IXPEWWE2-36-145T	$1,022.60	2.5	85.5	75	
	1800	230/460	145T	IXPEWWE2-18-145T	$1,088.21	2.6	86.5	88	
	1200	230/460	184T	IXPEWWE2-12-184T	$1,361.81	2.8	88.5	130	
3	3600	230/460	182T	IXPEWWE3-36-182T	$1,303.67	3.5	86.5	115	
	1800	230/460	182T	IXPEWWE3-18-182T	$1,419.60	3.8	89.5	130	
	1200	230/460	213T	IXPEWWE3-12-213T	$1,959.88	4.0	89.5	238	
5	3600	230/460	184T	IXPEWWE5-36-184T	$1,475.88	6.0	88.5	128	
	1800	230/460	184T	IXPEWWE5-18-184T	$1,434.72	7.0	89.5	183	
	1200	230/460	215T	IXPEWWE5-12-215T	$2,076.90	7.5	89.5	295	
7.5	3600	230/460	213T	IXPEWWE7.5-36-213T	$1,935.70	8.3	89.5	253	
	1800	230/460	213T	IXPEWWE7.5-18-213T	$2,074.72	8.9	91.7	254	
	1200	230/460	254T	IXPEWWE7.5-12-254T	$2,715.60	12.5	91.0	386	
10	3600	230/460	215T	IXPEWWE10-36-215T	$2,030.95	11.5	90.2	262	
	1800	230/460	215T	IXPEWWE10-18-215T	$2,184.08	12.2	91.7	262	
	1200	230/460	256T	IXPEWWE10-12-256T	$3,171.67	12.5	91.0	384	
15	3600	230/460	254T	IXPEWWE15-36-254T	$2,610.62	16.5	91.0	401	
	1800	230/460	254T	IXPEWWE15-18-254T	$2,901.53	17.5	92.4	403	
	1200	230/460	284T	IXPEWWE15-12-284T	$4,427.22	22.8	91.7	476	
20	3600	230/460	256T	IXPEWWE20-36-256T	$3,371.81	22.8	91.0	434	
	1800	230/460	256T	IXPEWWE20-18-256T	$3,289.79	23.0	93.0	428	
	1200	230/460	286T	IXPEWWE20-12-286T	$4,860.31	23.5	91.7	520	
25	3600	230/460	284TS	IXPEWWE25-36-284TS	$4,580.33	27.5	91.7	506	
	1800	230/460	284T	IXPEWWE25-18-284T	$4,250.04	27.5	93.6	558	
	1200	230/460	324T	IXPEWWE25-12-324T	$5,878.53	29.0	93.0	657	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Explosion Proof Motors (Continued)

TEXP Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
	3600	230/460	286TS	IXPEWWE30-36-286TS	$4,661.27	32.5	91.7	528	
30	1800	230/460	286T	IXPEWWE30-18-286T	$4,698.45	32.5	93.6	580	
	1200	230/460	326T	IXPEWWE30-12-326T	$6,776.44	34.5	93.0	739	
	3600	230/460	324TS	IXPEWWE40-36-324TS	$6,106.01	44.5	92.4	710	
40	1800	230/460	324T	IXPEWWE40-18-324T	$5,884.00	44.5	94.1	734	
	1200	230/460	364T	IXPEWWE40-12-364T	$11,566.76	46.0	94.1	911	
	3600	230/460	326TS	IXPEWWE50-36-326TS	$7,198.60	54.0	93.0	743	
50	1800	230/460	326T	IXPEWWE50-18-326T	$7,158.13	55.0	94.5	763	
	1200	230/460	365T	IXPEWWE50-12-365T	$11,589.73	56.5	94.1	899	
	3600	230/460	364TS	IXPEWWE60-36-364TS	$10,923.68	65.5	93.6	860	
60	1800	230/460	364T	IXPEWWE60-18-364T	$11,439.90	66.5	95.0	891	
	1200	230/460	404T	IXPEWWE60-12-404T	$14,432.20	69.0	94.5	1188	
	3600	230/460	365TS	IXPEWWE75-36-365TS	$12,342.18	84.5	93.6	946	
75	1800	230/460	365T	IXPEWWE75-18-365T	$12,167.19	86.5	95.4	957	
	1200	230/460	405T	IXPEWWE75-12-405T	$15,132.16	84.0	94.5	1349	
	3600	230/460	405TS	IXPEWWE100-36-405TS	$14,369.62	109	94.1	1393	
100	1800	230/460	405T	IXPEWWE100-18-405TBB	$15,703.88	110	95.4	1426	BB
	1200	230/460	444/5T	IXPEWWE100-12-444/5T	$23,249.61	117	95.0	1642	
	1200	230/460	444/5T	IXPEWWE100-12-444/5TBB	$23,249.61	117	95.0	1642	BB
	3600	460	444/5TS	IXPEWWE125-36-444/5TS	$23,074.96	130	95.0	1638	
125	1800	460	444/5T	IXPEWWE125-18-444/5TBB	$22,065.69	133	95.4	1640	BB
	1200	460	444/5T	IXPEWWE125-12-444/5TBB	$23,807.86	135	95.0	1779	BB
	3600	460	444/5TS	IXPEWWE150-36-444/5TS	$23,567.99	160	95.0	1830	
150	1800	460	444/5T	IXPEWWE150-18-444/5TBB	$23,829.97	163	95.8	1898	BB
	1200	460	447/9T	IXPEWWE150-12-447/9TBB	$35,783.10	166	95.8	2174	BB
	3600	460	444/5TS	IXPEWWE200-36-447/9TS	$32,550.79	214	95.4	2370	
200	1800	460	447/9T	IXPEWWE200-18-447/9TBB	$32,386.07	217	96.2	2348	BB
	1200	460	447/9T	IXPEWWE200-12-447/9TBB	$37,157.16	228	95.8	2368	BB
250	1800	460	447/9T	IXPEWWE250-18-447/9TBB	$36,331.39	275	95.2	2560	BB

BB Ball bearing on drive-end for direct coupled applications

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Explosion Proof Motors

TEXP Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 2-300 HP
- 3600, 1800 and 1200 RPM
- 230/460 Volt (2-100 HP)
- 460 Volt (125-300 HP)
- Totally Enclosed Fan Cooled Explosion Proof (TEXP) Enclosure
- IP55 Protection
- 1.15 SF
- Class F Insulation
- C-Face with Feet
- Premium Efficiency (2-200 HP)
- High Efficiency (250-300 HP)
- Inverter Duty, 5:1 CT / 10:1 VT (2-200 HP only)
- Normally Closed Winding Thermostats Provided
- UL Listed Class 1, Div. 1, Groups C and D; Class 2, Div. 1, Groups F and G; T3C; Inverter Duty (2-200 HP), 40°C amb. temp. as standard
  - 143T-215T: Class 1, Div. 1, Groups C and D; T3C; Inverter Duty (2-200 HP); 55°C amb. temp.
  - 254T-449T: Class 1, Div. 1, Groups C and D; T2C; Inverter Duty (2-200 HP); 55°C amb. temp.

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
2	1800	230/460	145TC	IXPEWWE2-18-145TC	$1,255.55	2.6	86.5	88	
3	1800	230/460	182TC	IXPEWWE3-18-182TC	$1,501.63	3.8	89.5	130	
	1200	230/460	213TC	IXPEWWE3-12-213TC	$2,043.00	4.0	89.5	238	
5	1800	230/460	184TC	IXPEWWE5-18-184TC	$1,628.76	7.0	89.5	183	
7.5	3600	230/460	213TC	IXPEWWE7.5-36-213TC	$2,025.07	8.3	89.5	253	
	1800	230/460	213TC	IXPEWWE7.5-18-213TC	$2,274.86	8.9	91.7	254	
10	3600	230/460	215TC	IXPEWWE10-36-215TC	$2,120.33	11.5	90.2	262	
	1800	230/460	215TC	IXPEWWE10-18-215TC	$2,120.33	12.2	91.7	262	
	1200	230/460	256TC	IXPEWWE10-12-256TC	$3,488.84	12.5	91.0	384	
15	3600	230/460	254TC	IXPEWWE15-36-254TC	$2,723.26	16.5	91.0	401	
	1800	230/460	254TC	IXPEWWE15-18-254TC	$3,254.79	17.5	92.4	403	
	1200	230/460	284TC	IXPEWWE15-12-284TC	$4,869.93	22.8	91.7	476	
20	3600	230/460	256TC	IXPEWWE20-36-256TC	$3,709.00	22.8	91.0	434	
	1800	230/460	256TC	IXPEWWE20-18-256TC	$3,402.44	23.0	93.0	428	
25	3600	230/460	284TSC	IXPEWWE25-36-284TSC	$5,038.36	27.5	91.7	506	
	1800	230/460	284TC	IXPEWWE25-18-284TC	$4,661.27	27.5	93.6	558	
30	3600	230/460	286TSC	IXPEWWE30-36-286TSC	$5,127.39	32.5	91.7	528	
	1800	230/460	286TC	IXPEWWE30-18-286TC	$5,168.30	32.5	93.6	580	
40	3600	230/460	324TSC	IXPEWWE40-36-324TSC	$6,716.62	44.5	92.4	710	
	1800	230/460	324TC	IXPEWWE40-18-324TC	$6,472.40	44.5	94.1	734	
50	1800	230/460	326TC	IXPEWWE50-18-326TC	$7,873.95	55.0	94.5	763	
60	3600	230/460	364TSC	IXPEWWE60-36-364TSC	$12,016.04	65.5	93.6	860	
	1800	230/460	364TC	IXPEWWE60-18-364TC	$12,583.88	66.5	95.0	891	
75	1800	230/460	365TC	IXPEWWE75-18-365TC	$13,992.27	86.5	94.5	957	
100	3600	230/460	405TSC	IXPEWWE100-36-405TSC	$16,525.06	109	94.1	1393	
	1800	230/460	405TC	IXPEWWE100-18-405TC	$17,274.26	110	95.4	1426	
125	1800	460	444/5TC	IXPEWWE125-18-444/5TC	$24,272.25	133	95.4	1640	
150	1800	460	444/5TC	IXPEWWE150-18-444/5TC	$26,212.97	163	95.8	1898	
200	1800	460	445/7/9TC	IXPEWWE200-18-445/7/9TC	$35,624.68	217	96.2	2348	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Advanced Design Rock Crusher Motors

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

NEMA Premium

- 250-500 HP
- 1800 and 1200 RPM
- 230/460 Volt (100-200 HP)
- 460 Volt (250-600 HP)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.15 SF
- Class F Insulation
- Rigid Base
- 4140 High Tensile Strength Steel Shaft
- Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT at 1.0 SF (200-400 HP)
- Inverter Ready, 3:1 CT / 6:1 VT at 1.0 SF (450-500 HP)
- Please Consult WorldWide Electric for 50 Hz Operation

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
200	1800	230/460	445/7T	PEWWE200-18-445/7T	$21,547.79	226	96.2	2033	R DD FC
	1800	230/460	445/7T	PEWWE200-18-445/7T-IB	$24,960.48	226	96.2	2033	IB R DD FC
	1200	460	449T	PEWWE200-12-449T	$27,699.88	236	95.8	2664	R D12 FC
	1200	460	449T	PEWWE200-12-449T-IB	$31,180.73	236	95.8	2664	IB R D12 FC
	1200	460	505Z	PEWWE200-12-505Z	$38,646.24	225	95.8	2470	R D6
	1200	460	505UZ	PEWWE200-12-505UZ	$38,646.24	225	95.8	2470	R D6
250	1800	460	449T	PEWWE250-18-449T	$30,506.18	280	96.2	2508	R D12 FC
	1800	460	449T	PEWWE250-18-449T-IB	$33,732.12	280	96.2	2508	IB R D12 FC
	1800	460	505Z	PEWWE250-18-505Z	$31,368.31	280	96.2	2360	R D6
	1800	460	505UZ	PEWWE250-18-505UZ	$31,368.31	280	96.2	2360	R D6
	1800	460	505UZ	PEWWE250-18-505UZ-IB	$34,133.28	280	96.2	2360	IB R D6
	1200	460	449T	PEWWE250-12-449T	$33,395.40	298	95.8	2750	R D12 FC
	1200	460	449T	PEWWE250-12-449T-IB	$36,621.34	298	95.8	2750	IB R D12 FC
	1200	460	586/7	PEWWE250-12-586/7	$46,869.52	287	95.8	3737	R D12 FC
	1200	460	586/7	PEWWE250-12-586/7-IB	$51,938.85	287	95.8	3737	IB R D12 FC
	1200	460	586/7UZ	PEWWE250-12-586/7UZ	$46,869.52	287	95.8	3737	R D12 FC
300	1800	460	449T	PEWWE300-18-449T	$34,171.63	336	96.2	2728	R D12 FC
	1800	460	449T	PEWWE300-18-449T-IB	$37,397.50	336	96.2	2728	IB R D12 FC
	1800	460	586/7	PEWWE300-18-586/7	$50,422.60	324	96.2	3873	R D12 FC
	1800	460	586/7	PEWWE300-18-586/7-IB	$55,491.85	324	96.2	3873	IB R D12 FC
	1800	460	586/7UZ	PEWWE300-18-586/7UZ	$50,422.60	324	96.2	3873	R D12 FC
	1200	460	449T	PEWWE300-12-449T	$37,192.12	353	95.8	2977	R D12 FC
	1200	460	449T	PEWWE300-12-449T-IB	$40,418.00	353	95.8	2977	IB R D12 FC
	1200	460	586/7	PEWWE300-12-586/7	$53,446.88	341	95.8	4136	R D12 FC
	1200	460	586/7	PEWWE300-12-586/7-IB	$58,516.13	341	95.8	4136	IB R D12 FC
	1200	460	586/7UZ	PEWWE300-12-586/7UZ	$53,446.88	341	95.8	4136	R D12 FC
	1200	460	586/7UZ	PEWWE300-12-586/7UZ-IB	$58,516.13	341	95.8	4136	IB R D12 FC
350	1800	460	449T	PEWWE350-18-449T-IB	$42,574.13	392	96.2	2870	IB R D12 FC
	1800	460	586/7	PEWWE350-18-586/7	$53,640.95	374	96.2	4070	R D12 FC
	1800	460	586/7	PEWWE350-18-586/7-IB	$58,710.28	374	96.2	4070	IB R D12 FC
	1800	460	586/7UZ	PEWWE350-18-586/7UZ-IB	$58,710.28	374	96.2	4070	IB R D12 FC
	1200	460	449T	PEWWE350-12-449T	$45,209.48	407	95.8	2930	R D12 FC
	1200	460	449T	PEWWE350-12-449T-IB	$48,435.06	407	95.8	2930	IB R D12 FC
	1200	460	586/7	PEWWE350-12-586/7	$56,373.30	398	95.8	4145	R D12 FC
	1200	460	586/7	PEWWE350-12-586/7-IB	$61,442.49	398	95.8	4145	IB R D12 FC
	1200	460	586/7UZ	PEWWE350-12-586/7UZ	$56,373.30	398	95.8	4145	R D12 FC
400	1800	460	586/7	PEWWE400-18-586/7	$56,006.54	428.0	96.2	4374	R D12 FC
	1800	460	586/7	PEWWE400-18-586/7-IB	$61,075.80	428.0	96.2	4374	IB R D12 FC
	1800	460	586/7UZ	PEWWE400-18-586/7UZ	$56,006.54	428.0	96.2	4374	R D12 FC
	1800	460	586/7UZ	PEWWE400-18-586/7UZ-IB	$61,075.80	428.0	96.2	4374	IB R D12 FC
	1200	460	586/7	PEWWE400-12-586/7	$58,515.27	449.0	95.8	4707	R D12 FC
	1200	460	586/7	PEWWE400-12-586/7-IB	$63,584.31	449.0	95.8	4707	IB R D12 FC
	1200	460	586/7UZ	PEWWE400-12-586/7UZ	$58,515.27	449.0	95.8	4707	R D12 FC
	1200	460	586/7UZ	PEWWE400-12-586/7UZ-IB	$63,584.31	449.0	95.8	4707	IB R D12 FC
450	1800	460	586/7	PEWWE450-18-586/7	$58,542.81	481.0	96.2	4500	R D12
	1800	460	586/7	PEWWE450-18-586/7-IB	$62,229.02	481.0	96.2	4500	IB R D12
	1200	460	586/7	PEWWE450-12-586/7-IB	$65,518.98	506.0	95.8	4850	IB R SF D12
500	1800	460	586/7	PEWWE500-18-586/7-IB	$66,876.00	535	96.2	4630	IB R D12
	1800	460	586/7UZ	PEWWE500-18-586/7UZ	$61,806.89	535	96.2	4630	R D12
	1200	460	586/7	PEWWE500-12-586/7	$62,384.39	562	95.8	4740	R SF D12
	1200	460	586/7	PEWWE500-12-586/7-IB	$67,453.43	562	95.8	4740	IB R SF D12
	1200	460	586/7UZ	PEWWE500-12-586/7UZ	$62,384.39	562	95.8	4740	R SF D12
	1200	460	586/7UZ	PEWWE500-12-586/7UZ-IB	$67,453.43	562	95.8	4740	IB R SF D12

BB Ball bearing on drive-end for direct coupled applications
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive-end for belted applications
DD Double drilled feet
D6 Double drilled feet with 6 holes
D12 Double drilled feet with 12 holes
FC F1/F2 convertible
SF 1.0 SF

Oil Well Pump Motors

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460/796 Volt

Product Specifications

- 3-150 HP
- 1200 and 900 RPM
- 230/460/796 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.15 SF
- Class F Insulation
- Rigid Base
- Inverter Duty, 10:1 CT / 20:1 VT
- 3000 Volt Spike Resistant, Inverter Duty Wire
- Motors Meet NEMA MG-1, Part 31
- Three Winding Thermostats Provided (One Per Phase)
- NEMA Design D - High Slip 5-8%
- Cast Iron Construction/Steel Fan Cover
- F2 Mount
- Suitable for 50 Hz with 1.0 SF

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
3	1200	230/460/796	213T	OW3-12-213T	$1,283.52	4.0	84.9	143	
	900	230/460/796	215T	OW3-9-215T	$1,634.37	4.9	84.0	153	
5	1200	230/460/796	215T	OW5-12-215T	$1,519.95	7.5	87.5	158	
	900	230/460/796	254T	OW5-9-254T	$2,611.33	7.9	85.6	248	
7.5	1200	230/460/796	254T	OW7.5-12-254T	$1,902.84	10.7	85.0	251	
	900	230/460/796	256T	OW7.5-9-256T	$2,757.43	12.4	87.4	272	
10	1200	230/460/796	256T	OW10-12-256T	$2,589.57	13.9	86.5	286	
	900	230/460/796	284T	OW10-9-284T	$3,752.65	16.7	87.0	410	
15	1200	230/460/796	284T	OW15-12-284T	$3,253.87	19.5	87.7	409	
	900	230/460/796	286T	OW15-9-286T	$4,209.17	22.1	88.0	321	
20	1200	230/460/796	286T	OW20-12-286T	$3,995.55	25.5	89.9	451	
	900	230/460/796	324T	OW20-9-324T	$5,067.45	26.3	89.1	631	
25	1200	230/460/796	324T	OW25-12-324T	$4,672.13	34.6	90.3	550	
	900	230/460/796	326T	OW25-9-326T	$5,514.84	34.0	89.4	689	
30	1200	230/460/796	326T	OW30-12-326T	$5,537.28	35.4	91.7	622	
	900	230/460/796	364T	OW30-9-364T	$6,811.39	39.2	91.1	801	
40	1200	230/460/796	365T	OW40-12-365T	$7,486.25	47.9	87.4	714	
	900	230/460/796	404T	OW40-9-404T	$8,071.39	53.6	90.5	989	R
50	1200	230/460/796	404T	OW50-12-404T	$8,399.20	57.8	91.3	957	R
	900	230/460/796	405T	OW50-9-405T	$10,993.16	64.2	91.5	1107	R
60	1200	230/460/796	405T	OW60-12-405T	$8,925.45	78.0	82.4	1058	R
	900	230/460/796	444T	OW60-9-444T	$12,070.58	80.7	93.3	1257	R
75	1200	230/460/796	444T	OW75-12-444T	$12,910.30	88.2	93.5	1185	R
	900	230/460/796	445T	OW75-9-445T	$16,361.92	94.0	93.9	1385	R
100	1200	230/460/796	445T	OW100-12-445T	$14,596.60	118	92.2	1370	R
	900	230/460/796	447T	OW100-9-447T	$18,891.09	130	94.9	2033	R
125	1200	230/460/796	447T	OW125-12-447T	$15,961.52	138	93.5	1766	R
150	1200	230/460/796	449T	OW150-12-449T	$18,311.28	174	94.5	2064	R

R Roller bearing on drive-end for belted applications

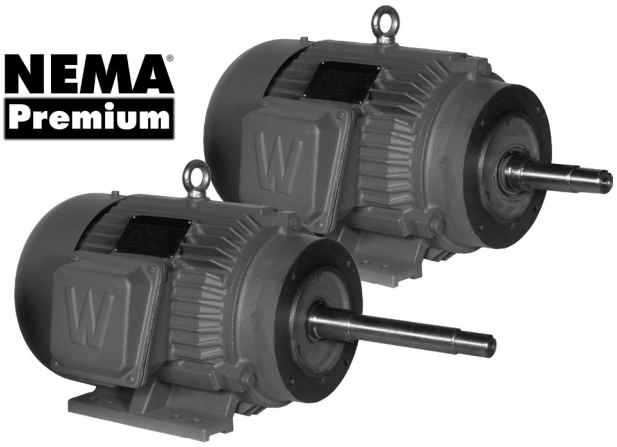
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Close Coupled Pump Motors

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-50 HP
- 3600 and 1800 RPM
- 230/460 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.15 SF
- Class F Insulation
- C-Face with Feet
- Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT (1.0 SF)
- Spike Resistant Wire, per NEMA MG-1, Part 31
- Class 1, Division 2, Groups A, B, C, D
- Suitable for 50 Hz, 200/400V with 1.0 SF



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143JM	PEWWE1-18-143JM	$554.02	1.5	85.5	41	
	1800	230/460	143JP	PEWWE1-18-143JP	$554.02	1.5	85.5	41	
1.5	3600	230/460	143JM	PEWWE1.5-36-143JM	$601.91	2.0	84.0	46	
	3600	230/460	143JP	PEWWE1.5-36-143JP	$601.91	2.0	84.0	46	
	1800	230/460	145JM	PEWWE1.5-18-145JM	$621.00	2.2	86.5	56	
	1800	230/460	145JP	PEWWE1.5-18-145JP	$621.00	2.2	86.5	56	
2	3600	230/460	145JM	PEWWE2-36-145JM	$647.68	2.6	85.5	51	
	3600	230/460	145JP	PEWWE2-36-145JP	$647.68	2.6	85.5	51	
	1800	230/460	145JM	PEWWE2-18-145JM	$645.73	2.9	86.5	59	
	1800	230/460	145JP	PEWWE2-18-145JP	$645.73	2.9	86.5	59	
3	3600	230/460	145JM	PEWWE3-36-145JM	$845.57	3.8	86.5	57	
	3600	230/460	145JP	PEWWE3-36-145JP	$845.57	3.8	86.5	57	
	3600	230/460	182JM	PEWWE3-36-182JM	$845.57	3.8	86.5	81	
	3600	230/460	182JP	PEWWE3-36-182JP	$845.57	3.8	86.5	81	
	1800	230/460	182JM	PEWWE3-18-182JM	$1,045.63	4.0	89.5	86	
	1800	230/460	182JP	PEWWE3-18-182JP	$1,045.63	4.0	89.5	86	
5	3600	230/460	184JM	PEWWE5-36-184JM	$986.86	6.0	88.5	96	
	3600	230/460	184JP	PEWWE5-36-184JP	$986.86	6.0	88.5	96	
	1800	230/460	184JM	PEWWE5-18-184JM	$1,116.81	6.3	89.5	104	
	1800	230/460	184JP	PEWWE5-18-184JP	$1,116.81	6.3	89.5	104	
7.5	3600	230/460	184JM	PEWWE7.5-36-184JM	$1,703.52	8.8	89.5	105	
	3600	230/460	184JP	PEWWE7.5-36-184JP	$1,703.52	8.8	89.5	105	
	3600	230/460	213JM	PEWWE7.5-36-213JM	$1,703.52	9.0	89.5	160	
	3600	230/460	213JP	PEWWE7.5-36-213JP	$1,703.52	9.0	89.5	160	
	1800	230/460	213JM	PEWWE7.5-18-213JM	$1,652.31	9.1	91.7	172	
	1800	230/460	213JP	PEWWE7.5-18-213JP	$1,652.31	9.1	91.7	172	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Close Coupled Pump Motors (Continued)

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
10	3600	230/460	215JM	PEWWE10-36-215JM	$1,805.02	11.7	90.2	180	
	3600	230/460	215JP	PEWWE10-36-215JP	$1,805.02	11.7	90.2	180	
	1800	230/460	215JM	PEWWE10-18-215JM	$1,808.78	12.0	91.7	193	
	1800	230/460	215JP	PEWWE10-18-215JP	$1,808.78	12.0	91.7	193	
15	3600	230/460	215JM	PEWWE15-36-215JM	$2,641.14	17.3	91.0	190	
	3600	230/460	215JP	PEWWE15-36-215JP	$2,641.14	17.3	91.0	190	
	3600	230/460	254JM	PEWWE15-36-254JM	$2,641.14	17.5	91.0	261	
	3600	230/460	254JP	PEWWE15-36-254JP	$2,641.14	17.5	91.0	261	
	1800	230/460	254JM	PEWWE15-18-254JM	$2,588.07	18.1	92.4	265	
	1800	230/460	254JP	PEWWE15-18-254JP	$2,588.07	18.1	92.4	265	
20	3600	230/460	256JM	PEWWE20-36-256JM	$2,850.56	23.1	91.0	297	
	3600	230/460	256JP	PEWWE20-36-256JP	$2,850.56	23.1	91.0	297	
	1800	230/460	256JM	PEWWE20-18-256JM	$2,923.58	23.7	93.0	304	
	1800	230/460	256JP	PEWWE20-18-256JP	$2,923.58	23.7	93.0	304	
25	3600	230/460	256JM	PEWWE25-36-256JM	$3,426.10	28.7	91.7	309	
	3600	230/460	256JP	PEWWE25-36-256JP	$3,426.10	28.7	91.7	309	
	3600	230/460	284JM	PEWWE25-36-284JM	$3,426.10	29.0	91.7	358	
	3600	230/460	284JP	PEWWE25-36-284JP	$3,426.10	29.0	91.7	358	
	1800	230/460	284JM	PEWWE25-18-284JM	$3,635.67	29.1	93.6	385	
	1800	230/460	284JP	PEWWE25-18-284JP	$3,635.67	29.1	93.6	385	
30	3600	230/460	286JM	PEWWE30-36-286JM	$3,637.57	34.4	91.7	394	
	3600	230/460	286JP	PEWWE30-36-286JP	$3,637.57	34.4	91.7	394	
	1800	230/460	286JM	PEWWE30-18-286JM	$3,911.75	34.5	93.6	430	
	1800	230/460	286JP	PEWWE30-18-286JP	$3,911.75	34.5	93.6	430	
40	3600	230/460	286JM	PEWWE40-36-286JM	$4,916.37	45.5	92.4	419	
	3600	230/460	286JP	PEWWE40-36-286JP	$4,916.37	45.5	92.4	419	
	3600	230/460	324JM	PEWWE40-36-324JM	$4,916.37	46.1	92.4	485	
	3600	230/460	324JP	PEWWE40-36-324JP	$4,916.37	46.1	92.4	485	
	1800	230/460	324JM	PEWWE40-18-324JM	$4,916.37	46.3	94.1	531	
	1800	230/460	324JP	PEWWE40-18-324JP	$4,916.37	46.3	94.1	531	
50	3600	230/460	326JM	PEWWE50-36-326JM	$5,784.26	56.6	93.0	534	
	3600	230/460	326JP	PEWWE50-36-326JP	$5,784.26	56.6	93.0	534	
	1800	230/460	326JM	PEWWE50-18-326JM	$5,837.59	57.6	94.5	578	
	1800	230/460	326JP	PEWWE50-18-326JP	$5,837.59	57.6	94.5	578	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Close Coupled Pump Motors

ODP Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-50 HP
- 3600 and 1800 RPM
- 230/460 Volt
- Open Drip Proof (ODP) Enclosure
- Rolled Steel Frame
- IP23 Protection
- 1.15 SF
- Class F Insulation
- C-Face with Feet
- Premium Efficiency
- Inverter Duty, 10:1 VT
- Spike Resistant Wire, per NEMA MG-1, Part 31
- Suitable for 50 Hz with 1.0 SF

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143JM	OCCP1-18-143JM	$523.36	1.3	85.5	33.1	
	1800	230/460	143JP	OCCP1-18-143JP	$523.36	1.3	85.5	33.1	
1.5	3600	230/460	143JM	OCCP1.5-36-143JM	$541.72	1.9	84.0	34	
	3600	230/460	143JP	OCCP1.5-36-143JP	$541.72	1.9	84.0	34	
	1800	230/460	145JM	OCCP1.5-18-145JM	$562.20	2.1	86.5	34.2	
	1800	230/460	145JP	OCCP1.5-18-145JP	$562.20	2.1	86.5	34.2	
2	3600	230/460	145JM	OCCP2-36-145JM	$588.23	2.5	85.5	35	
	3600	230/460	145JP	OCCP2-36-145JP	$588.23	2.5	85.5	35	
	1800	230/460	145JM	OCCP2-18-145JM	$596.62	2.7	86.5	38.6	
	1800	230/460	145JP	OCCP2-18-145JP	$596.62	2.7	86.5	38.6	
3	3600	230/460	145JM	OCCP3-36-145JM	$728.43	3.6	85.5	42	
	3600	230/460	145JP	OCCP3-36-145JP	$728.43	3.6	85.5	42	
	1800	230/460	182JM	OCCP3-18-182JM	$757.50	3.8	89.5	68.3	
	1800	230/460	182JP	OCCP3-18-182JP	$757.50	3.8	89.5	68.3	
5	3600	230/460	182JM	OCCP5-36-182JM	$863.39	5.9	86.5	66	
	3600	230/460	182JP	OCCP5-36-182JP	$863.39	5.9	86.5	66	
	1800	230/460	184JM	OCCP5-18-184JM	$861.60	6.2	89.5	96.8	
	1800	230/460	184JP	OCCP5-18-184JP	$861.60	6.2	89.5	96.8	
7.5	3600	230/460	184JM	OCCP7.5-36-184JM	$1,345.50	8.6	88.5	99	
	3600	230/460	184JP	OCCP7.5-36-184JP	$1,345.50	8.6	88.5	99	
	1800	230/460	213JM	OCCP7.5-18-213JM	$1,362.28	9.4	91.0	140.2	
	1800	230/460	213JP	OCCP7.5-18-213JP	$1,362.28	9.4	91.0	140.2	
10	3600	230/460	213JM	OCCP10-36-213JM	$1,560.63	11.8	89.5	143	
	3600	230/460	213JP	OCCP10-36-213JP	$1,560.63	11.8	89.5	143	
	1800	230/460	215JM	OCCP10-18-215JM	$1,475.11	12.2	91.7	160.6	
	1800	230/460	215JP	OCCP10-18-215JP	$1,475.11	12.2	91.7	160.6	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Close Coupled Pump Motors (Continued)

ODP Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
15	3600	230/460	215JM	OCCP15-36-215JM	$1,996.59	16.9	90.2	144	
	3600	230/460	215JP	OCCP15-36-215JP	$1,996.59	16.9	90.2	144	
	1800	230/460	254JM	OCCP15-18-254JM	$2,216.90	17.1	93.0	214.9	
	1800	230/460	254JP	OCCP15-18-254JP	$2,216.90	17.1	93.0	214.9	
20	3600	230/460	254JM	OCCP20-36-254JM	$2,339.67	22.1	91.0	247	
	3600	230/460	254JP	OCCP20-36-254JP	$2,339.67	22.1	91.0	247	
	1800	230/460	256JM	OCCP20-18-256JM	$2,474.31	22.5	93.0	260.1	
	1800	230/460	256JP	OCCP20-18-256JP	$2,474.31	22.5	93.0	260.1	
25	3600	230/460	256JM	OCCP25-36-256JM	$3,009.52	27.0	91.7	270	
	3600	230/460	256JP	OCCP25-36-256JP	$3,009.52	27.0	91.7	270	
	1800	230/460	284JM	OCCP25-18-284JM	$3,211.59	30.0	93.6	305	
	1800	230/460	284JP	OCCP25-18-284JP	$3,211.59	30.0	93.6	305	
30	3600	230/460	284JM	OCCP30-36-284JM	$3,191.59	33.2	92.5	330	
	3600	230/460	284JP	OCCP30-36-284JP	$3,191.59	33.2	92.5	330	
	1800	230/460	286JM	OCCP30-18-286JM	$3,563.86	35.9	94.1	335	
	1800	230/460	286JP	OCCP30-18-286JP	$3,563.86	35.9	94.1	335	
40	3600	230/460	286JM	OCCP40-36-286JM	$4,206.65	45.4	92.4	340	
	3600	230/460	286JP	OCCP40-36-286JP	$4,206.65	45.4	92.4	340	
	1800	230/460	324JM	OCCP40-18-324JM	$4,591.56	47.9	94.1	445	
	1800	230/460	324JP	OCCP40-18-324JP	$4,591.56	47.9	94.1	445	
50	3600	230/460	324JM	OCCP50-36-324JM	$4,795.82	56.1	93.0	407	
	3600	230/460	324JP	OCCP50-36-324JP	$4,795.82	56.1	93.0	407	
	1800	230/460	326JM	OCCP50-18-326JM	$4,873.77	58.8	94.5	475	
	1800	230/460	326JP	OCCP50-18-326JP	$4,873.77	58.8	94.5	475	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

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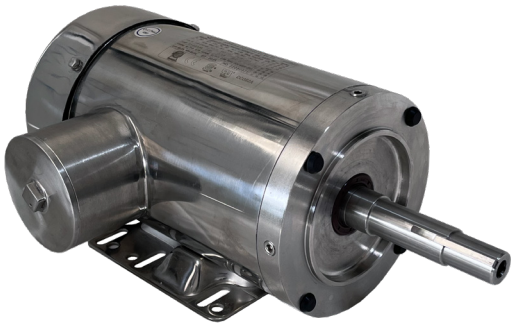
Close Coupled Pump Motors - Stainless Steel

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-20 HP, 3600 and 1800 RPM
- 230/460 Volt, 60 Hz
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP69K Protection
- BISSC and BEAG Certified
- 1.15 SF
- Class F Insulation with Class B Temperature Rise
- C-Face with Feet
- NEMA Premium Efficiency
- NEMA Design B
- Continuous Duty
- 304 Stainless Steel Frame, End Bracket, Junction Box, and Hardware
- Stainless Steel JM Shaft and Key
- F1 Mounting Configuration
- Lip Seal on DE and ODE
- Round Welded Junction Box with Epoxy Potted Leads
- Double Sealed Bearings
- Inverter Duty – 10:1 Constant Torque (CT) / 20:1 Variable Torque (VT)
- CSA Class 1 Division 2 Groups A, B, C, D – Temperature Code T2B
- Ambient -20°C to +40°C, Altitude up to 3300 Feet Above Sea Level (FASL)
- Bi-directional Rotation
- In Accordance with NEMA, CSA, UL, and CE



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	3600	230/460	143JM	SSPE1-36-143JM	$1,604.67	1.4	77.0	35	
	1800	230/460	143JM	SSPE1-18-143JM	$1,604.67	1.45	85.5	36	
1.5	3600	230/460	143JM	SSPE1.5-36-143JM	$1,736.48	2.0	84.0	39	
	1800	230/460	145JM	SSPE1.5-18-145JM	$1,775.33	2.0	86.5	42	
2	3600	230/460	145JM	SSPE2-36-145JM	$1,860.68	2.4	85.5	46	
	1800	230/460	145JM	SSPE2-18-145JM	$1,891.80	3.0	86.5	51	
3	3600	230/460	182JM	SSPE3-36-182JM	$3,658.01	4.05	86.5	81	
	1800	230/460	182JM	SSPE3-18-182JM	$3,695.62	4.0	89.5	81	
5	3600	230/460	184JM	SSPE5-36-184JM	$3,958.73	6.1	88.5	95	
	1800	230/460	184JM	SSPE5-18-184JM	$4,071.48	6.25	89.5	100	
7.5	3600	230/460	213JM	SSPE7.5-36-213JM	$5,924.88	9.5	89.5	155	
	1800	230/460	213JM	SSPE7.5-18-213JM	$5,924.88	9.3	91.7	180	
10	3600	230/460	215JM	SSPE10-36-215JM	$6,225.60	12.2	90.2	170	
	1800	230/460	215JM	SSPE10-18-215JM	$6,225.60	12.2	91.7	210	
15	3600	230/460	254JM	SSPE15-36-254JM	$12,091.66	18.5	91.0	363	
	1800	230/460	254JM	SSPE15-18-254JM	$12,091.66	18.5	92.4	370	
20	3600	230/460	256JM	SSPE20-36-256JM	$13,077.08	23.0	91.0	422	
	1800	230/460	256JM	SSPE20-18-256JM	$13,055.29	24.5	93.0	436	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Vertical Hollow Shaft Motors

WPI Enclosure ▪ Vertical P Base ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 10 - 500 HP
- 1800 RPM
- 230/460 Volt (10 - 100 HP)
- 460 Volt Only Motors (50 - 500 HP) are Suitable for Part Winding Start (PWS)
- Weather Protected (WPI) Enclosure with Rodent Screens
- IP23 Protection
- 1.15 SF
- Class F Insulation
- Vertical P Base
- Premium Efficiency
- Inverter Duty, 10:1 Variable Torque
- Spike Resistant Wiring per NEMA MG-1 Part 31
- 120 Volt Space Heaters
- Double Thrust Bearing Design (100-500 HP) for Deeper Well Applications
- Winding RTDs (125-500 HP)
- Gray Epoxy Paint for Cooler Surface Temperature
- Standard Coupling Size Included

NEMA Premium

HP	RPM	Voltage	Frame	Base Size	Model Number	List Price	Down Thrust	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Included Coupling
10	1800	230/460	215TP	10	WPEVHS10-18-215TP-10	$3,181.95	2500	12.2	91.7	366	MC210-1
15	1800	230/460	254TP	10	WPEVHS15-18-254TP-10	$3,970.83	3200	17.3	93.0	514	MC250-1
20	1800	230/460	256TP	10	WPEVHS20-18-256TP-10	$4,521.78	3200	23.5	93.0	527	MC250-1
25	1800	230/460	284TP	12	WPEVHS25-18-284TP-12	$5,423.38	3200	28.8	93.6	571	MC280-1
30	1800	230/460	286TP	12	WPEVHS30-18-286TP-12	$5,729.45	3200	34.1	94.1	591	MC280-1
40	1800	230/460	324TP	16.5	WPEVHS40-18-324TP-16.5	$7,147.21	5500	46.0	94.1	761	MC320-1.25-.25
50	1800	230/460	326TP	16.5	WPEVHS50-18-326TP-16.5	$7,739.92	5500	56.4	94.5	825	MC320-1.25-.25
	1800	460	326TP	16.5	WPEVHS50-18-460-326TP-16.5	$7,739.92	5500	56.4	94.5	825	MC320-1.25-.25
60	1800	230/460	364TP	16.5	WPEVHS60-18-364TP-16.5	$8,827.93	5600	68.3	95.0	983	MC360-1.25-.25
	1800	460	364TP	16.5	WPEVHS60-18-460-364TP-16.5	$8,827.93	5600	68.3	95.0	983	MC360-1.25-.25
75	1800	230/460	365TP	16.5	WPEVHS75-18-365TP-16.5	$10,939.95	5600	85.0	95.0	1034	MC360-1.25-.25
	1800	460	365TP	16.5	WPEVHS75-18-460-365TP-16.5	$10,939.95	5600	85.0	95.0	1034	MC360-1.25-.25
100	1800	230/460	404TP	16.5	WPEVHS100-18-404TP-16.5	$13,708.68	6700	112	95.4	1455	MC400-1.5
	1800	460	404TP	16.5	WPEVHS100-18-460-404TP-DB-16.5	$15,090.26	13400	112	95.4	1455	MC400-1.5
125	1800	460	405TP	16.5	WPEVHS125-18-460-405TP-16.5	$14,832.87	6700	139	95.4	1505	MC400-1.5
	1800	460	405TP	16.5	WPEVHS125-18-460-405TP-DB-16.5	$16,214.44	13400	139	95.4	1505	MC400-1.5
150	1800	460	444TP	16.5	WPEVHS150-18-460-444TP-DB-16.5	$19,443.70	14400	165	95.8	1984	MC440-1.6875
200	1800	460	445TP	16.5	WPEVHS200-18-460-445TP-DB-16.5	$27,052.83	14400	221	95.8	2099	MC440-1.6875
	1800	460	445TP	20	WPEVHS200-18-460-445TP-DB-20	$27,052.83	14400	221	95.8	2099	MC440-1.6875
250	1800	460	445TP	20	WPEVHS250-18-460-445TP-DB-20	$28,690.42	14400	276	95.8	2206	MC440-1.6875
300	1800	460	5006P	20	WPEVHS300-18-460-5006P-DB-20	$47,210.30	24000	328	95.8	3609	MC5006/8P-1.6875
350	1800	460	5006P	20	WPEVHS350-18-460-5006P-DB-20	$50,785.56	24000	379	95.8	3774	MC5006/8P-1.6875
	1800	460	5006P	24.5	WPEVHS350-18-460-5006P-DB-24.5	$50,785.56	24000	379	95.8	3774	MC5006/8P-1.6875
400	1800	460	5008P	20	WPEVHS400-18-460-5008P-DB-20	$58,682.40	24000	437	95.8	4149	MC5006/8P-1.9375
	1800	460	5008P	24.5	WPEVHS400-18-460-5008P-DB-24.5	$58,682.40	24000	437	95.8	4149	MC5006/8P-1.9375
450	1800	460	5008P	20	WPEVHS450-18-460-5008P-DB-20	$63,133.56	24000	489	96.2	4266	MC5006/8P-2.1875
	1800	460	5008P	24.5	WPEVHS450-18-460-5008P-DB-24.5	$63,133.56	24000	489	96.2	4266	MC5006/8P-2.1875
500	1800	460	5008P	20	WPEVHS500-18-460-5008P-DB-20	$67,326.00	24000	544	96.2	4449	MC5006/8P-2.1875
	1800	460	5008P	24.5	WPEVHS500-18-460-5008P-DB-24.5	$67,326.00	24000	544	96.2	4449	MC5006/8P-2.1875

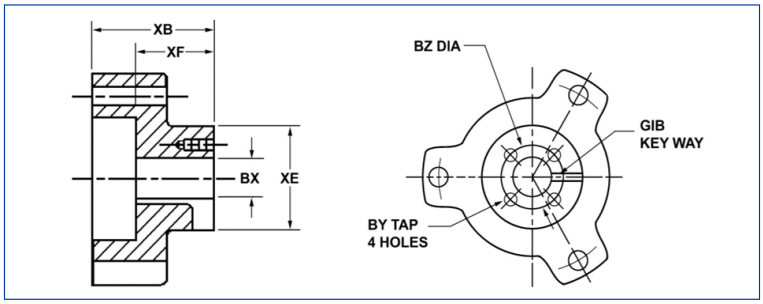
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Vertical Hollow Shaft Motors (Continued)
WPEVHS Bases

Motor Model Number	Base Model Number	Base Size	List Price
WPEVHS10-18-215TP-10	**PEBASE210TP-10 ***	10	$730.43
WPEVHS15-18-254TP-10	**PEBASE250TP-10N *** PEBASE250TP-12N PEBASE250TP-16.5N	10 12 16.5	$879.32
WPEVHS20-18-256TP-10	**PEBASE250TP-10N *** PEBASE250TP-12N PEBASE250TP-16.5N	10 12 16.5	$879.32
WPEVHS25-18-284TP-12	PEBASE280TP-10N **PEBASE280TP-12N *** PEBASE280TP-16.5N	10 12 16.5	$879.32
WPEVHS30-18-286TP-12	PEBASE280TP-10N **PEBASE280TP-12N *** PEBASE280TP-16.5N	10 12 16.5	$879.32
WPEVHS40-18-324TP-16.5	PEBASE320TP-12N **PEBASE320TP-16.5N ***	12 16.5	$1,259.14
WPEVHS50-18-326TP-16.5 WPEVHS50-18-460-326TP-16.5	PEBASE320TP-12N **PEBASE320TP-16.5N ***	12 16.5	$1,259.14
WPEVHS60-18-364TP-16.5 WPEVHS60-18-460-364TP-16.5	PEBASE360TP-12N **PEBASE360TP-16.5N ***	12 16.5	$1,542.98
WPEVHS75-18-365TP-16.5 WPEVHS75-18-460-365TP-16.5	PEBASE360TP-12N **PEBASE360TP-16.5N ***	12 16.5	$1,542.98
WPEVHS100-18-404TP-16.5 WPEVHS100-18-460-404TP-DB-16.5	**PEBASE400TP-16.5N *** PEBASE400TP-20N	16.5 20	$1,786.45
WPEVHS125-18-460-405TP-16.5 WPEVHS125-18-460-405TP-DB-16.5	**PEBASE400TP-16.5N *** PEBASE400TP-20N	16.5 20	$1,786.45
WPEVHS150-18-460-444TP-DB-16.5	**PEBASE444TP/445TP-16.5 *** PEBASE444TP/445TP-20	16.5 20	$2,354.10
WPEVHS200-18-460-445TP-DB-16.5	**PEBASE444TP/445TP-16.5 *** PEBASE444TP/445TP-20	16.5 20	$2,354.10
WPEVHS200-18-460-445TP-DB-20	PEBASE444TP/445TP-16.5 **PEBASE444TP/445TP-20 ***	16.5 20	$2,354.10
WPEVHS250-18-460-445TP-DB-20	PEBASE444TP/445TP-16.5 **PEBASE444TP/445TP-20 ***	16.5 20	$2,354.10
WPEVHS300-18-460-5006P-DB-20	**PEBASE5006P-20 *** PEBASE5006P-24.5	20 24.5	$2,693.25
WPEVHS350-18-460-5006P-DB-20	**PEBASE5006P-20 *** PEBASE5006P-24.5	20 24.5	$2,693.25
WPEVHS350-18-460-5006P-DB-24.5	PEBASE5006P-20 **PEBASE5006P-24.5 ***	20 24.5	$2,693.25
WPEVHS400-18-460-5008P-DB-20	**PEBASE5008P-20 *** PEBASE5008P-24.5	20 24.5	$2,693.25
WPEVHS400-18-460-5008P-DB-24.5	PEBASE5008P-20 **PEBASE5008P-24.5 ***	20 24.5	$2,693.25
WPEVHS450-18-460-5008P-DB-20	**PEBASE5008P-20 *** PEBASE5008P-24.5	20 24.5	$2,693.25
WPEVHS450-18-460-5008P-DB-24.5	PEBASE5008P-20 **PEBASE5008P-24.5 ***	20 24.5	$2,693.25
WPEVHS500-18-460-5008P-DB-20	**PEBASE5008P-20 *** PEBASE5008P-24.5	20 24.5	$2,693.25
WPEVHS500-18-460-5008P-DB-24.5	PEBASE5008P-20 **PEBASE5008P-24.5 ***	20 24.5	$2,693.25

* Standard base size included with each motor

Vertical Hollow Shaft Motors (Continued)
WPEVHS Couplings



Motor Model Number	Coupling Model Number	BX	BY	BZ	XB	XE	XF	SQ (EW)	List Price
WPEVHS10-18-215TP-10	MC210-.75	3/4	10-32	1-3/8	1-3/4	2	1-1/8	3/16	$151.66
	MC210-.875	7/8	10-32	1-3/8	1-3/4	2	1-1/8	3/16	
	MC210-1 *	1	10-32	1-3/8	1-3/4	2	1-1/8	1/4	
WPEVHS15-18-254TP-10 WPEVHS20-18-256TP-10	MC250-.75	3/4	10-32	1-3/8	2-9/16	2-1/4	1-5/8	3/16	$180.87
	MC250-.875	7/8	10-32	1-3/8	2-9/16	2-1/4	1-5/8	3/16	
	MC250-1 *	1	10-32	1-3/8	2-9/16	2-1/4	1-5/8	1/4	
	MC250-1.1875	1-3/16	1/4-20	1-3/4	2-9/16	2-1/4	1-5/8	1/4	
	MC250-1.25	1-1/4	1/4-20	1-3/4	2-9/16	2-1/4	1-5/8	1/4	
	MC250-1.25-.375	1-1/4	1/4-20	1-3/4	2-9/16	2-1/4	1-5/8	3/8	
WPEVHS25-18-284TP-12 WPEVHS30-18-286TP-12	MC280-.75	3/4	10-32	1-3/8	2-9/16	2-1/4	1-5/8	3/16	$180.87
	MC280-.875	7/8	10-32	1-3/8	2-9/16	2-1/4	1-5/8	3/16	
	MC280-1 *	1	10-32	1-3/8	2-9/16	2-1/4	1-5/8	1/4	
	MC280-1.1875	1-3/16	1/4-20	1-3/4	2-9/16	2-1/4	1-5/8	1/4	
	MC280-1.25-.25	1-1/4	1/4-20	1-3/4	2-9/16	2-1/4	1-5/8	1/4	
	MC280-1.25-.375	1-1/4	1/4-20	1-3/4	2-9/16	2-1/4	1-5/8	3/8	
WPEVHS40-18-324TP-16.5 WPEVHS50-18-326TP-16.5 WPEVHS50-18-460-326TP-16.5	MC320-1	1	10-32	1-3/8	2-15/16	2-7/8	1-15/16	1/4	$210.09
	MC320-1.1875	1-3/16	1/4-20	1-3/4	2-15/16	2-7/8	1-15/16	1/4	
	MC320-1.25-.375	1-1/4	1/4-20	1-3/4	2-15/16	2-7/8	1-15/16	3/8	
	MC320-1.25-.25 *	1-1/4	1/4-20	1-3/4	2-15/16	2-7/8	1-15/16	1/4	
	MC320-1.4375	1-7/16	1/4-20	2-1/8	2-15/16	2-7/8	1-15/16	3/8	
	MC320-1.5	1-1/2	1/4-20	2-1/8	2-15/16	2-7/8	1-15/16	3/8	
WPEVHS60-18-364TP-16.5 WPEVHS60-18-460-364TP-16.5 WPEVHS75-18-365TP-16.5 WPEVHS75-18-460-365TP-16.5	MC360-1	1	10-32	1-3/8	2-15/16	2-7/8	1-15/16	1/4	$240.69
	MC360-1.1875	1-3/16	1/4-20	1-3/4	2-15/16	2-7/8	1-15/16	1/4	
	MC360-1.25-25 *	1-1/4	1/4-20	1-3/4	2-15/16	2-7/8	1-15/16	1/4	
	MC360-1.25-.375	1-1/4	1/4-20	1-3/4	2-15/16	2-7/8	1-15/16	3/8	
	MC360-1.4375	1-7/16	1/4-20	2-1/8	2-15/16	2-7/8	1-15/16	3/8	
	MC360-1.5	1-1/2	1/4-20	2-1/8	2-15/16	2-7/8	1-15/16	3/8	
WPEVHS100-18-404TP-16.5 WPEVHS100-18-460-404TP-DB-16.5 WPEVHS125-18-460-405TP-16.5 WPEVHS125-18-460-405TP-DB-16.5	MC400-1.1875	1-3/16	1/4-20	1-3/4	3-13/32	3-1/8	2-13/32	1/4	$360.34
	MC400-1.25-.25	1-1/4	1/4-20	1-3/4	3-13/32	3-1/8	2-13/32	1/4	
	MC400-1.25-.375	1-1/4	1/4-20	1-3/4	3-13/32	3-1/8	2-13/32	3/8	
	MC400-1.4375	1-7/16	1/4-20	2-1/8	3-13/32	3-1/8	2-13/32	3/8	
	MC400-1.5 *	1-1/2	1/4-20	2-1/8	3-13/32	3-1/8	2-13/32	3/8	
	MC400-1.5625	1-9/16	1/4-20	2-1/2	3-13/32	3-1/8	2-13/32	3/8	
	MC400-1.6875	1-11/16	1/4-20	2-1/2	3-13/32	3-1/8	2-13/32	3/8	
	MC400-1.8125	1-13/16	1/4-20	2-1/2	3-13/32	3-1/8	2-13/32	3/8	
WPEVHS150-18-460-444TP-DB-16.5 WPEVHS200-18-460-445TP-DB-16.5 WPEVHS200-18-460-445TP-DB-20 WPEVHS250-18-460-445TP-DB-20	MC440-1.4375	1-7/16	1/4-20	2-1/8	4.2	3-11/16	2.95	3/8	$510.60
	MC440-1.5	1-1/2	1/4-20	2-1/8	4.2	3-11/16	2.95	3/8	
	MC440-1.6875 *	1-11/16	1/4-20	2-1/2	4.2	3-11/16	2.95	3/8	
	MC440-1.75	1-3/4	1/4-20	2-1/2	4.2	3-11/16	2.95	3/8	
	MC440-1.9375	1-15/16	1/4-20	2-1/2	4.2	3-11/16	2.95	1/2	
	MC440-2.1875	2-3/16	3/8-16	2-1/4	4.2	3-11/16	2.95	1/2	
WPEVHS300-18-460-5006P-DB-20 WPEVHS350-18-460-5006P-DB-20 WPEVHS350-18-460-5006P-DB-24.5	MC5006/8P-1.5	1-1/2	1/4-20	2-1/2	4.37	4-3/4	3.07	3/8	$886.27
	MC5006/8P-1.6875 *	1-11/16	1/4-20	2-1/2	4.37	4-3/4	3.07	3/8	
	MC5006/8P-1.75	1-3/4	1/4-20	2-1/2	4.37	4-3/4	3.07	3/8	
	MC5006/8P-1.8125	1-13/16	1/4-20	2-1/2	4.37	4-3/4	3.07	3/8	
WPEVHS400-18-460-5008P-DB-20 WPEVHS400-18-460-5008P-DB-24.5	**MC5006/8P-1.9375 ***	1-15/16	1/4-20	2-1/2	4.37	4-3/4	3.07	1/2	$886.27
	MC5006/8P-2.001	2	3/8-16	3-1/4	4.37	4-3/4	3.07	1/4	
	MC5006/8P-2.251	2-1/4	3/8-16	3-1/4	4.37	4-3/4	3.07	1/2	
	MC5006/8P-2.5	2-1/2	3/8-16	3-1/4	4.37	4-3/4	3.07	5/8	
WPEVHS450-18-460-5008P-DB-20 WPEVHS450-18-460-5008P-DB-24.5 WPEVHS500-18-460-5008P-DB-20 WPEVHS500-18-460-5008P-DB-24.5	**MC5006/8P-2.1875 ***	2-3/16	3/8-16	3-1/4	4.37	4-3/4	3.07	1/2	$886.27
	MC5006/8P-2.001	2	3/8-16	3-1/4	4.37	4-3/4	3.07	1/4	
	MC5006/8P-2.251	2-1/4	3/8-16	3-1/4	4.37	4-3/4	3.07	1/2	
	MC5006/8P-2.5	2-1/2	3/8-16	3-1/4	4.37	4-3/4	3.07	5/8	

* Standard coupling size included with each motor

Louis Allis LAM Series Motors - IEEE 45 Marine-Duty

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 1-500 HP
- 3600, 1800, 1200 and 900 RPM
- 60 Hz, 230/460V (1-200 HP)
- 60 Hz, 460V (250-500 HP)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.25 SF (1-200 HP)
- 1.15 SF (250-500 HP)
- Class F insulation
- Rigid Base
- NEMA Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT (1.0 SF)
- Class 1 Division 2 Groups A,B,C,D in Accordance with NEC
- UR, CE, IEEE 45, CC306B
- Double Vacuum Pressure Impregnation (VPI) Treatment
- Heavy Gauge Rolled Steel Fan Cover
- All Frames Double Punched
- Metal Clad V-Ring on DE, Oil Seal on ODE

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	3600	230/460	143T	LAM1-36-143T	$474.00	1.3	77.0	---	
	1800	230/460	143T	LAM1-18-143T	$509.46	1.4	85.5	54	
	1200	230/460	145T	LAM1-12-145T	$708.68	1.7	82.5	57	
1.5	3600	230/460	143T	LAM1.5-36-143T	$691.88	1.9	84.0	51	
	1800	230/460	145T	LAM1.5-18-145T	$628.69	2.1	86.5	55	
	1200	230/460	182T	LAM1.5-12-182T	$809.69	2.4	87.5	89	
2	3600	230/460	145T	LAM2-36-145T	$752.25	2.5	85.5	55	
	1800	230/460	145T	LAM2-18-145T	$666.11	2.7	86.5	58	
	1200	230/460	184T	LAM2-12-184T	$1,063.44	3.4	88.5	100	
3	3600	230/460	145T	LAM3-36-145T	$908.38	3.8	86.5	62	
	3600	230/460	182T	LAM3-36-182T	$908.38	3.7	86.5	87	
	1800	230/460	182T	LAM3-18-182T	$937.88	3.8	89.5	95	
	1200	230/460	213T	LAM3-12-213T	$1,431.69	4.1	89.5	145	
	900	230/460	215T	LAM3-9-215T	$2,139.18	4.3	85.5	---	
5	3600	230/460	184T	LAM5-36-184T	$1,123.87	5.9	88.5	104	
	1800	230/460	184T	LAM5-18-184T	$1,098.97	6.2	89.5	113	
	1200	230/460	215T	LAM5-12-215T	$1,775.63	6.7	89.5	196	
	900	230/460	254T	LAM5-9-254T	$3,308.65	8.1	86.5	---	
7.5	3600	230/460	213T	LAM7.5-36-213T	$1,697.03	8.6	89.5	180	
	1800	230/460	213T	LAM7.5-18-213T	$1,453.06	8.9	91.7	147	
	1200	230/460	254T	LAM7.5-12-254T	$2,333.49	9.7	91.0	273	
	900	230/460	256T	LAM7.5-9-256T	$3,667.43	11.6	86.5	---	
10	3600	230/460	215T	LAM10-36-215T	$1,761.62	11.6	90.2	192	
	1800	230/460	215T	LAM10-18-215T	$1,760.28	11.6	91.7	198	
	1200	230/460	256T	LAM10-12-256T	$2,928.46	13.0	91.0	311	
	900	230/460	284T	LAM10-9-284T	$4,658.40	14.3	89.5	---	
15	3600	230/460	254T	LAM15-36-254T	$2,853.61	16.6	91.0	291	
	1800	230/460	254T	LAM15-18-254T	$2,529.91	17.3	92.4	304	
	1200	230/460	284T	LAM15-12-284T	$3,677.19	18.4	91.7	449	
	900	230/460	286T	LAM15-9-286T	$5,421.20	22.4	89.5	---	
20	3600	230/460	256T	LAM20-36-256T	$3,478.21	22.3	91.0	320	
	1800	230/460	256T	LAM20-18-256T	$2,906.84	23.2	93.0	332	
	1200	230/460	286T	LAM20-12-286T	$4,586.46	26.3	91.7	486	
	900	230/460	324T	LAM20-9-324T	$6,441.36	32.6	90.2	---	
25	3600	230/460	284TS	LAM25-36-284TS	$4,292.69	28.0	91.7	430	
	1800	230/460	284T	LAM25-18-284T	$3,791.73	29.8	93.6	420	
	1800	230/460	284TS	LAM25-18-284TS	$3,791.73	29.8	93.6	420	
	1200	230/460	324T	LAM25-12-324T	$5,216.32	30.2	93.0	649	
	900	230/460	326T	LAM25-9-326T	$7,265.51	33.1	90.2	---	
30	3600	230/460	286TS	LAM30-36-286TS	$4,391.37	33.2	91.7	434	
	1800	230/460	286T	LAM30-18-286T	$4,295.36	35.7	93.6	449	
	1800	230/460	286TS	LAM30-18-286TS	$4,295.36	35.7	93.6	449	
	1200	230/460	326T	LAM30-12-326T	$6,123.50	34.6	93.0	688	
	900	230/460	364T	LAM30-9-364T	$10,991.08	40.2	91.7	---	

Louis Allis offers common modifications on LAM Series motors.
See LAM Modifications on Page 47.

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Louis Allis LAM Series Motors - IEEE 45 Marine-Duty (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
	3600	230/460	324TS	LAM40-36-324TS	$5,655.41	46.4	92.4	552	
	1800	230/460	324T	LAM40-18-324T	$5,458.70	47.6	94.1	596	
40	1800	230/460	324TS	LAM40-18-324TS	$5,458.70	47.6	94.1	596	
	1200	230/460	364T	LAM40-12-364T	$7,610.32	46.2	94.1	825	
	900	230/460	365T	LAM40-9-365T	$12,142.06	52.8	91.7	---	
	3600	230/460	326TS	LAM50-36-326TS	$7,105.52	55.3	93.0	572	
	1800	230/460	326T	LAM50-18-326T	$6,203.21	58.2	94.5	633	
50	1800	230/460	326TS	LAM50-18-326TS	$6,203.21	58.2	94.5	633	
	1200	230/460	365T	LAM50-12-365T	$9,979.11	58.3	94.1	1038	
	900	230/460	404T	LAM50-9-404T	$17,577.61	60.5	92.4	---	R
	3600	230/460	364TS	LAM60-36-364TS	$9,743.98	65.7	93.6	790	
	1800	230/460	364T	LAM60-18-364T	$8,194.15	69.4	95.0	824	
60	1800	230/460	364TS	LAM60-18-364TS	$8,194.15	69.4	95.0	824	
	1200	230/460	404T	LAM60-12-404T	$11,033.17	70.6	94.5	1126	R
	900	230/460	405T	LAM60-9-405T	$20,481.29	77.6	92.4	---	R
	3600	230/460	365TS	LAM75-36-365TS	$11,668.44	80.8	93.6	949	
	1800	230/460	365T	LAM75-18-365T	$9,475.10	85.8	95.4	946	
75	1800	230/460	365TS	LAM75-18-365TS	$9,475.10	85.8	95.4	946	
	1200	230/460	405T	LAM75-12-405T	$11,563.43	83.7	94.5	1212	R
	900	230/460	444T	LAM75-9-444T	$23,537.37	94.0	93.6	---	R
	3600	230/460	405TS	LAM100-36-405TS	$14,048.61	109	94.1	1122	
	1800	230/460	405T	LAM100-18-405T	$11,701.71	114.9	95.4	1151	R
100	1800	230/460	405T	LAM100-18-405TBB	$11,701.71	114.9	95.4	1151	BB
	1800	230/460	405TS	LAM100-18-405TS	$11,701.71	114.9	95.4	1151	
	1200	230/460	444T	LAM100-12-444T	$16,366.40	115	95.0	1353	R
	900	230/460	445T	LAM100-9-445T	$27,032.67	131.0	93.6	---	R
	3600	230/460	444TS	LAM125-36-444TS	$18,351.66	129	95.0	1371	
	1800	230/460	444T	LAM125-18-444T	$16,254.97	136.6	95.4	1298	R
	1800	230/460	444T	LAM125-18-444TBB	$16,254.97	136.6	95.4	1298	BB
125	1800	230/460	444TS	LAM125-18-444TS	$16,254.97	136.6	95.4	1298	
	1200	230/460	445T	LAM125-12-445T	$19,497.31	141	95.0	1488	R
	900	230/460	445/7T	LAM125-9-445/7T	$28,036.86	152.3	94.1	---	R
	900	230/460	445/7T	LAM125-9-445/7TBB	$28,036.86	152.3	94.1	---	BB
	3600	230/460	445TS	LAM150-36-445TS	$21,117.21	161	95.0	1455	
	1800	230/460	445T	LAM150-18-445T	$17,248.06	163.7	95.8	1410	R
150	1800	230/460	445T	LAM150-18-445TBB	$17,248.06	163.7	95.8	1410	BB
	1800	230/460	445TS	LAM150-18-445TS	$17,248.06	163.7	95.8	1410	
	1200	230/460	447T	LAM150-12-447T	$24,904.85	170	95.8	1975	R
	900	460	449T	LAM150-9-449T	$30,695.41	189.8	94.1	---	R
	3600	230/460	447TS	LAM200-36-447TS	$28,542.28	217	95.4	1907	
	1800	230/460	445/7T	LAM200-18-445/7T	$22,923.18	221.1	96.2	2203	R
200	1800	230/460	445/7T	LAM200-18-445/7TBB	$22,923.18	221.1	96.2	2203	BB
	1800	230/460	445/7TS	LAM200-18-445/7TS	$22,923.18	221.1	96.2	2203	
	1200	460	449T	LAM200-12-449T	$29,467.95	231	95.8	2552	R
	900	460	449T	LAM200-9-449T	$49,664.45	256.0	94.5	---	R
	3600	460	449TS	LAM250-36-449TS	$31,657.92	276	95.8	2368	
	1800	460	449T	LAM250-18-449T	$31,285.43	271	96.2	2530	R
	1800	460	449T	LAM250-18-449TBB	$31,285.43	271	96.2	2530	BB
250	1200	460	449T	LAM250-12-449T	$37,076.68	279.1	95.8	2552	R
	1200	460	449T	LAM250-12-449T-IB	$38,819.00	279.1	95.8	2646	IB R
	1200	460	586/7	LAM250-12-586/7	$54,198.00	279.1	95.8	2552	R
	900	460	L449T	LAM250-9-L449T	$50,145.58	315.5	95.0	---	R
	900	460	586/7	LAM250-9-586/7	$52,735.56	298.6	95.0	---	R

BB Ball bearing on drive-end for direct coupled applications
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive-end for belted applications

Louis Allis offers common modifications on LAM Series motors.
See LAM Modifications on Page 47.

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Louis Allis LAM Series Motors - IEEE 45 Marine-Duty (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
300	3600	460	449TS	LAM300-36-449TS	$34,030.74	332.3	95.8	2645	
	3600	460	449TS	LAM300-36-449TS-IB	$42,676.00	332.3	95.8	2645	IB
	1800	460	449T	LAM300-18-449T	$39,725.98	313.1	96.2	2785	R
	1800	460	449T	LAM300-18-449T-IB	$39,725.98	313.1	96.2	2785	IB R
	1800	460	449T	LAM300-18-449TBB	$39,725.98	313.1	96.2	2785	BB
	1800	460	449T	LAM300-18-449TBB-IB	$39,725.98	313.1	96.2	2785	BB IB
	1800	460	586/7	LAM300-18-586/7	$52,747.75	338.2	96.2	---	R
	1200	460	449T	LAM300-12-449T	$42,235.39	336.8	95.8	2765	R
	1200	460	449T	LAM300-12-449T-IB	$50,874.00	336.8	95.8	2765	IB R
	1200	460	586/7	LAM300-12-586/7	$55,401.42	333.5	95.8	---	R
	900	460	L449T	LAM300-9-L449T	$55,140.12	372.2	95.0	---	R
	900	460	586/7	LAM300-9-586/7	$58,181.31	370.3	95.0	---	R
350	3600	460	449TS	LAM350-36-449TS	$35,476.37	382.8	95.8	2870	
	3600	460	449TS	LAM350-36-449TS-IB	$44,124.00	382.8	95.8	2870	IB
	1800	460	L449T	LAM350-18-L449T	$39,636.19	382.4	96.2	---	R
	1800	460	L449T	LAM350-18-L449TBB	$39,636.19	382.4	96.2	---	BB
	1800	460	L449T	LAM350-18-L449T-IB	$45,111.76	382.4	96.2	---	IB R
	1800	460	L449T	LAM350-18-L449TBB-IB	$45,111.76	382.4	96.2	---	BB IB
	1800	460	586/7	LAM350-18-586/7	$56,034.51	376.0	96.2	3886	R
	1800	460	586/7UZ	LAM350-18-586/7UZ	$56,034.51	376.0	96.2	3886	R
	1200	460	L449T	LAM350-12-L449T	$48,712.79	410.6	95.8	4031	R
	1200	460	L449T	LAM350-12-L449T-F2	$48,712.79	410.6	95.8	4031	F2 R
	1200	460	L449T	LAM350-12-L449T-IB	$54,764.73	410.6	95.8	4031	IB R
	1200	460	L449T	LAM350-12-L449T-IB-F2	$54,764.73	410.6	95.8	4031	IB R F2
	1200	460	586/7	LAM350-12-586/7	$57,915.43	374.0	95.8	4031	R
400	3600	460	L449TS	LAM400-36-L449TS	$47,278.75	421.3	95.8	---	
	3600	460	L449TS	LAM400-36-L449TS-IB	$52,898.41	421.3	95.8	---	IB
	3600	460	586/7	LAM400-36-586/7	$58,094.80	425.3	95.9	3986	
	1800	460	L449T	LAM400-18-L449T	$45,999.97	433.8	96.2	3444	R
	1800	460	L449T	LAM400-18-L449TBB	$45,999.97	433.8	96.2	3444	BB
	1800	460	L449T	LAM400-18-L449T-IB	$52,051.91	433.8	96.2	3444	IB R
	1800	460	L449T	LAM400-18-L449TBB-IB	$52,051.91	433.8	96.2	3444	BB IB
	1800	460	586/7	LAM400-18-586/7	$58,757.98	444.6	96.2	4127	R
	1800	460	586/7UZ	LAM400-18-586/7UZ	$58,757.98	444.6	96.2	4127	R
	1200	460	L449T	LAM400-12-L449T	$52,894.25	461.5	95.8	3999	R
	1200	460	L449T	LAM400-12-L449T-F2	$52,894.25	461.5	95.8	3999	F2 R
	1200	460	L449T	LAM400-12-L449T-IB	$58,946.19	461.5	95.8	3999	IB R
	1200	460	L449T	LAM400-12-L449T-IB-F2	$58,946.19	461.5	95.8	3999	IB F2 R
	1200	460	586/7	LAM400-12-586/7	$61,139.38	445.0	95.8	---	R
450	3600	460	L449TS	LAM450-36-L449TS	$52,292.73	473.7	95.8	---	
	3600	460	L449TS	LAM450-36-L449TS-IB	$58,344.67	473.7	95.8	---	IB
	3600	460	586/7	LAM450-36-586/7	$58,094.80	479.5	95.8	---	
	1800	460	L449T	LAM450-18-L449T	$49,730.30	487.9	96.2	---	R
	1800	460	L449T	LAM450-18-L449TBB	$49,730.30	487.9	96.2	---	BB
	1800	460	L449T	LAM450-18-L449T-IB	$56,995.17	487.9	96.2	---	IB R
	1800	460	L449T	LAM450-18-L449TBB-IB	$56,995.17	487.9	96.2	---	BB IB
	1800	460	586/7	LAM450-18-586/7	$62,384.75	500.0	96.2	---	R
	1200	460	586/7	LAM450-12-586/7	$64,247.01	509.5	95.8	---	R
500	1800	460	L449T	LAM500-18-L449T	$53,001.35	539.4	96.2	---	R
	1800	460	L449T	LAM500-18-L449TBB	$53,001.35	539.4	96.2	---	BB
	1800	460	L449T	LAM500-18-L449T-IB	$59,053.29	539.4	96.2	---	IB R
	1800	460	586/7	LAM500-18-586/7	$65,945.38	536.1	96.2	4647	R
	1800	460	586/7	LAM500-18-586/7BB	$65,945.38	536.1	96.2	4647	BB
	1200	460	586/7	LAM500-12-586/7	$67,040.36	564.1	95.8	---	R
	1200	460	586/7UZ	LAM500-12-586/7UZ	$67,040.36	564.1	95.8	---	R

BB Ball bearing on drive-end for direct coupled applications
F2 Factory F2 mount
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive-end for belted applications

Louis Allis offers common modifications on LAM Series motors.
See LAM Modifications on Page 47.

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Louis Allis LAM Series Motors - IEEE 45 Marine-Duty
TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

Product Specification

- 1-200 HP
- 3600, 1800, 1200 RPM
- 60 Hz, 230/460V
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.25 SF
- Class F insulation
- C-Face with Feet
- NEMA Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT (1.0 SF)
- Class 1 Division 2 Groups A,B,C,D in Accordance with NEC UR, CE, IEEE 45, CC306B
- Double Vacuum Pressure Impregnation (VPI) Treatment
- Heavy Gauge Rolled Steel Fan Cover
- All Frames Double Punched
- Metal Clad V-Ring on DE, Oil Seal on ODE

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	3600	230/460	143TC	LAM1-36-143TC	$480.00	1.3	77.0	---	
	1800	230/460	143TC	LAM1-18-143TC	$530.69	1.4	85.5	54	
	1200	230/460	145TC	LAM1-12-145TC	$738.22	1.7	82.5	57	
1.5	3600	230/460	143TC	LAM1.5-36-143TC	$720.70	1.9	84.0	51	
	1800	230/460	145TC	LAM1.5-18-145TC	$654.90	2.1	86.5	55	
	1200	230/460	182TC	LAM1.5-12-182TC	$843.41	2.4	87.5	89	
2	3600	230/460	145TC	LAM2-36-145TC	$783.60	2.5	85.5	55	
	1800	230/460	145TC	LAM2-18-145TC	$693.86	2.7	86.5	58	
	1200	230/460	184TC	LAM2-12-184TC	$1,079.00	3.4	88.5	100	
3	3600	230/460	145TC	LAM3-36-145TC	$946.25	3.7	86.5	87	
	3600	230/460	182TC	LAM3-36-182TC	$946.25	3.8	89.5	95	
	1800	230/460	182TC	LAM3-18-182TC	$976.95	4.1	89.5	145	
	1200	230/460	213TC	LAM3-12-213TC	$1,453.00	4.1	89.5	169	
5	3600	230/460	184TC	LAM5-36-184TC	$1,170.70	5.9	88.5	104	
	1800	230/460	184TC	LAM5-18-184TC	$1,144.76	6.2	89.5	113	
	1200	230/460	215TC	LAM5-12-215TC	$1,849.63	6.7	89.5	196	
7.5	3600	230/460	213TC	LAM7.5-36-213TC	$1,767.75	8.6	89.5	180	
	1800	230/460	213TC	LAM7.5-18-213TC	$1,513.62	8.9	91.7	147	
	1200	230/460	254TC	LAM7.5-12-254TC	$2,430.72	9.7	91.0	273	
10	3600	230/460	215TC	LAM10-36-215TC	$1,835.02	11.6	90.2	192	
	1800	230/460	215TC	LAM10-18-215TC	$1,833.64	11.6	91.7	198	
	1200	230/460	256TC	LAM10-12-256TC	$3,050.47	13.0	91.0	311	
15	3600	230/460	254TC	LAM15-36-254TC	$2,972.51	16.6	91.0	291	
	1800	230/460	254TC	LAM15-18-254TC	$2,635.34	17.3	92.4	304	
	1200	230/460	284TC	LAM15-12-284TC	$3,830.41	18.4	91.7	449	
20	3600	230/460	256TC	LAM20-36-256TC	$3,623.13	22.3	91.0	320	
	1800	230/460	256TC	LAM20-18-256TC	$3,027.95	23.2	93.0	332	
	1200	230/460	286TC	LAM20-12-286TC	$4,777.54	26.3	91.7	486	
25	3600	230/460	284TSC	LAM25-36-284TSC	$4,471.56	28.0	91.7	430	
	1800	230/460	284TC	LAM25-18-284TC	$3,949.71	29.8	93.6	420	
	1800	230/460	284TSC	LAM25-18-284TSC	$3,949.71	29.8	93.6	420	
	1200	230/460	324TC	LAM25-12-324TC	$5,433.68	30.2	93.0	649	

Louis Allis offers common modifications on LAM Series motors.
See LAM Modifications on Page 47.

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

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Louis Allis LAM Series Motors - IEEE 45 Marine-Duty (Continued)

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
30	3600	230/460	286TSC	LAM30-36-286TSC	$4,574.34	33.2	91.7	434	
	1800	230/460	286TC	LAM30-18-286TC	$4,474.32	35.7	93.6	449	
	1800	230/460	286TSC	LAM30-18-286TSC	$4,474.32	35.7	93.6	449	
	1200	230/460	326TC	LAM30-12-326TC	$6,378.63	34.6	93.0	688	
40	3600	230/460	324TSC	LAM40-36-324TSC	$5,891.05	46.4	92.4	552	
	1800	230/460	324TC	LAM40-18-324TC	$5,686.15	47.6	94.1	596	
	1800	230/460	324TSC	LAM40-18-324TSC	$5,686.15	47.6	94.1	596	
	1200	230/460	364TC	LAM40-12-364TC	$7,927.42	46.2	94.1	825	
50	3600	230/460	326TSC	LAM50-36-326TSC	$7,401.61	55.3	93.0	572	
	1800	230/460	326TC	LAM50-18-326TC	$6,461.69	58.2	94.5	633	
	1800	230/460	326TSC	LAM50-18-326TSC	$6,461.69	58.2	94.5	633	
	1200	230/460	365TC	LAM50-12-365TC	$10,394.90	58.3	94.1	1038	
60	3600	230/460	364TSC	LAM60-36-364TSC	$10,149.98	65.7	93.6	790	
	1800	230/460	364TC	LAM60-18-364TC	$8,535.57	69.4	95.0	824	
	1800	230/460	364TSC	LAM60-18-364TSC	$8,535.57	69.4	95.0	824	
	1200	230/460	404TC	LAM60-12-404TC	$11,492.89	70.6	94.5	1126	
75	3600	230/460	365TSC	LAM75-36-365TSC	$12,154.63	80.8	93.6	949	
	1800	230/460	365TC	LAM75-18-365TC	$9,869.91	85.8	95.4	946	
	1800	230/460	365TSC	LAM75-18-365TSC	$9,869.91	85.8	95.4	946	
	1200	230/460	405TC	LAM75-12-405TC	$12,045.22	83.7	94.5	1212	
100	3600	230/460	405TSC	LAM100-36-405TSC	$14,633.98	109	94.1	1122	
	1800	230/460	405TC	LAM100-18-405TC	$12,189.30	114.9	95.4	1151	
	1800	230/460	405TSC	LAM100-18-405TSC	$12,189.30	114.9	95.4	1151	
	1200	230/460	444TC	LAM100-12-444TC	$17,048.34	115	95.0	1353	
125	3600	230/460	444TSC	LAM125-36-444TSC	$19,116.29	129	95.0	1371	
	1800	230/460	444TC	LAM125-18-444TC	$16,361.17	136.6	95.4	1298	
	1800	230/460	444TSC	LAM125-18-444TSC	$16,361.17	136.6	95.4	1298	
	1200	230/460	445TC	LAM125-12-445TC	$20,309.71	141	95.0	1488	
150	3600	230/460	445TSC	LAM150-36-445TSC	$21,997.09	161	95.0	1455	
	1800	230/460	445TC	LAM150-18-445TC	$17,966.73	163.7	95.8	1410	
	1800	230/460	445TSC	LAM150-18-445TSC	$17,966.73	163.7	95.8	1410	
	1200	230/460	447TC	LAM150-12-447TC	$25,942.54	170	95.8	1975	
200	3600	230/460	447TSC	LAM200-36-447TSC	$29,731.54	217	95.4	1907	
	1800	230/460	445/7TC	LAM200-18-445/7TC	$23,878.30	221.1	96.2	2203	
	1800	230/460	445/7TSC	LAM200-18-445/7TSC	$23,878.30	221.1	96.2	2203	
	1200	460	449TC	LAM200-12-449TC	$30,695.78	231	95.8	2552	

LAM Motor C-Flange Kits

Frame Size	Model Number *	List Price
143T / 145T	LAM140TC	$62.90
182T / 184T	LAM180TC	$113.75
213T / 215T	LAM210TC	$136.27
254T / 256T	LAM250TC	$282.14
284T / 286T	LAM280TC	$303.80
324T / 326T	LAM320TC	$353.65
	LAM320TC-L	$353.65
364T / 365T	LAM360TC	$462.50
	LAM360TC-L	$462.50

Frame Size	Model Number *	List Price
404T / 405T	LAM400TC	$700.55
	LAM400TC-L	$700.55
444T / 445T	LAM444/5TC	$865.66
	LAM444/5TC-A	$865.66
445T / 447T	LAM445/7TC	$1,029.43
447T / 449T	LAM447/9TC-L	$1,029.43
	LAM447/9TC-S	$1,029.43

* Please consult WWE for correct Model Number

Louis Allis offers common modifications on LAM Series motors.
See LAM Modifications on Page 47.

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

Louis Allis LAM Series Motors - IEEE 45 Marine-Duty
TEFC Enclosure ▪ C-Face Round Body ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-250 HP
- 1800 RPM
- 60 Hz, 230/460V (1-200 HP)
- 60 Hz, 460V (250 HP)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.25 SF (1-200 HP)
- 1.15 SF (250 HP)
- Class F insulation
- C-Face Round Body
- NEMA Premium Efficiency
- Inverter Duty, 10:1 CT / 20:1 VT (1.0 SF)
- Class 1 Division 2 Groups A,B,C,D in Accordance with NEC UR, CE, IEEE 45, CC306B
- Double Vacuum Pressure Impregnation (VPI) Treatment
- Heavy Gauge Rolled Steel Fan Cover
- Metal Clad V-Ring on DE, Oil Seal on ODE

NEMA Premium

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143TCRD	LAM1-18-143TCRD	$586.65	1.4	85.5	54	
1.5	1800	230/460	145TCRD	LAM1.5-18-145TCRD	$674.82	2.1	86.5	55	
2	1800	230/460	145TCRD	LAM2-18-145TCRD	$724.13	2.7	86.5	58	
3	1800	230/460	182TCRD	LAM3-18-182TCRD	$1,032.75	4.1	89.5	145	
5	1800	230/460	184TCRD	LAM5-18-184TCRD	$1,205.25	6.2	89.5	113	
7.5	1800	230/460	213TCRD	LAM7.5-18-213TCRD	$1,609.63	8.9	91.7	147	
10	1800	230/460	215TCRD	LAM10-18-215TCRD	$1,917.90	11.6	91.7	198	
15	3600	230/460	254TCRD	LAM15-36-254TCRD	$3,098.00	16.6	91.0	301	
	1800	230/460	254TCRD	LAM15-18-254TCRD	$2,716.96	17.3	92.4	304	
20	1800	230/460	256TCRD	LAM20-18-256TCRD	$3,148.18	23.2	93.0	332	
25	1800	230/460	284TCRD	LAM25-18-284TCRD	$4,131.24	29.8	93.6	420	
30	1800	230/460	286TCRD	LAM30-18-286TCRD	$4,656.31	35.7	93.6	449	
40	1800	230/460	324TCRD	LAM40-18-324TCRD	$5,774.82	47.6	94.1	596	
50	1800	230/460	326TCRD	LAM50-18-326TCRD	$6,693.54	58.2	94.5	633	
60	1800	230/460	364TCRD	LAM60-18-364TCRD	$8,837.83	67.7	95.0	824	
75	1800	230/460	365TCRD	LAM75-18-365TCRD	$10,278.52	85.7	95.4	946	
100	1800	230/460	405TCRD	LAM100-18-405TCRD	$12,789.68	113	95.4	1151	
125	1800	230/460	444TCRD	LAM125-18-444TCRD	$16,915.82	136	95.4	1298	
150	1800	230/460	445TCRD	LAM150-18-445TCRD	$18,684.59	164	95.8	1410	
200	1800	230/460	447TCRD	LAM200-18-447TCRD	$24,653.10	221	96.2	2203	
250	1800	460	449TCRD	LAM250-18-449TCRD	$33,119.00	270.2	96.2	2530	

Louis Allis offers common modifications on LAM Series motors.
See LAM Modifications on Page 47.

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

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LAM Modification Program
LAM IEEE 45 Marine-Duty Motor Modification Services

Modification Services

- The common modifications listed below are available on LAM IEEE 45 Marine-Duty Motors.
- Modifications are completed by expert craftsmen at Louis Allis' ISO 9001:2015 certified facility in Warrior, Alabama.

Modification Description	Suffix	143T 145T	182T 184T	213T 215T	254T 256T	284T 286T	324T 326T	364T 365T	404T 405T	444T 445T	447T 449T	586/7
C-Flange Install/Remove	C	$621	$621	$621	$875	$875	$875	$1,242	$1,242	$1,580	$1,580	$1,806
D-Flange Install/Remove	D	$621	$621	$621	$875	$875	$875	$1,242	$1,242	$1,580	$1,580	$1,806
F2 Conversion	F2	$706	$706	$706	$931	$931	$931	$1,242	$1,242	$1,919	$1,919	$2,117
Fungus Protection	FP	$706	$706	$706	$931	$931	$931	$1,242	$1,242	$1,919	$1,919	$2,117
Roller Bearing To Ball Bearing	BB	$1,694	$1,694	$1,694	$1,694	$1,694	$1,694	$1,694	$2,117	$2,399	$2,822	$4,234
Ball Bearing To Roller Bearing	RB	$2,088	$2,258	$2,428	$2,597	$2,766	$2,936	$3,105	$3,387	$4,234	$5,419	$7,056
Insulated ODE Bearing	IO	$3,105	$3,528	$3,810	$4,234	$4,799	$5,222	$5,362	$5,362	$5,927	$7,056	$7,762
Convert TEFC to TEAO/TENV	TE	$791	$791	$791	$791	$791	$791	$791	$1,298	$1,298	$1,298	$1,298
Add Drip Cover (TEFC)	DC	$610	$610	$610	$791	$791	$791	$791	$1,062	$1,062	$1,062	$1,062
Install Dynapar HS35 Encoder	EN	$3,189	$3,189	$3,189	$3,189	$3,189	$3,189	$3,189	$4,347	$4,347	$4,347	$4,347
Install Aegis Grounding Rings*	AGR	$582	$610	$632	$729	$774	$846	$891	$1,338	$1,620	$1,620	$1,931
TS Short Shaft Turn-Down	TS	$1,045	$1,045	$1,045	$1,045	$1,045	$1,045	$1,298	$1,298	$1,552	$1,552	$1,552
Machine Custom New Shaft (Single Extension)	NS	$2,428	$2,428	$2,428	$2,428	$4,065	$4,065	$8,581	$8,581	$12,870	$12,870	$20,547
Machine Double Extension Shaft**	DS	$2,682	$2,682	$2,682	$2,682	$4,600	$4,600	$9,370	$9,370	$13,378	$13,378	$21,055
Install Seal in DE (Brand is a Protec Seal)	SDE	$1,045	$1,045	$1,045	$1,045	$1,045	$1,580	$1,580	$1,580	$1,834	$1,834	$1,834
Increase Ingress Protection (TEFC IP65)	IP	$2,371	$2,371	$2,371	$2,653	$2,653	$2,653	$2,653	$3,162	$3,162	$3,162	$3,725
Mill Feet for IEEE841 Flatness	FF	$508	$508	$508	$508	$762	$762	$762	$1,525	$1,525	$1,525	$1,778
Provisions for Jack Bolts/ Dowel Pins	JB	NA	NA	NA	$762	$762	$762	$762	$1,525	$1,525	$1,525	$1,525
Zinc-Epoxy Marine Duty Paint	ZEP	$1,016	$1,016	$1,016	$1,016	$1,016	$1,016	$1,016	$1,525	$1,525	$1,525	$1,637
Epoxy Chemical Duty Paint	ECP	$960	$960	$960	$960	$960	$960	$960	$1,468	$1,468	$1,468	$1,580
Install (2) 100 Ohm Bearing RTDs	BR	NA	NA	NA	$960	$960	$960	$1,084	$1,084	$2,371	$2,371	$2,371
Install (3) 100 Ohm Winding RTDs	WR	NA	NA	NA	$1,214	$1,214	$1,214	$1,343	$1,343	$1,525	$1,525	$1,525
Install (1) 120V Heater	SH	NA	NA	NA	$791	$791	$791	$948	$948	$1,129	$1,129	$1,129
Install (1) 240V Heater	SH1	NA	NA	NA	$791	$791	$791	$948	$948	$1,129	$1,129	$1,129
Install (1) Winding Thermostat (NC)	T1	NA	NA	NA	$1,214	$1,214	$1,214	$1,343	$1,343	$1,525	$1,525	$1,525
Install Auxiliary Terminal Box	ATB	NA	NA	NA	$2,117	$2,117	$2,117	$2,117	$2,653	$2,653	$2,653	$3,162
Custom Lead Length	CL	$1,298	$1,298	$1,298	$1,694	$1,694	$1,694	$1,694	$1,976	$1,976	$1,976	$1,976
Replace Terminal Box with Lead Support Gasket	TBG	$537	$537	$537	$537	$537	$537	$537	$819	$819	$819	$819

Modification prices do not include the price of the motor.

** Shaft grounding ring installed on drive end shaft, not suitable for Class I or Class II, Division I or Division II locations.*

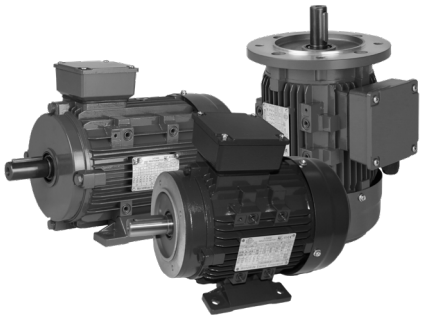
*** Assumes no change to NDE Bearing Size*

IEC Aluminum Frame Motors

TEFC Enclosure ▪ Multi-Mount ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1/4-25 HP
- 3600 and 1800 RPM
- 230/460 Volt, 60 Hz
- 190/380 Volt, 50 Hz
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.15 SF (1.0 SF at 50 Hz)
- IEC60034-1
- CE Certified
- IE3 Efficiency at 50 Hz Operation
- Aluminum Frame
- Multi-Mounting Frame Design
  F3 Configuration from Stock
- Oil Seal on DE and ODE
- Vacuum Pressure Impregnation (VPI) System
- RAL 6007 Finish Color



HP	kW	RPM	Voltage*	Frame	Model Number	List Price	-FF Flange Attached	-C Flange Attached	FL Amps (A)	FL Eff. (%)	Approx. Wt. (kg.)	Notes
1/4	0.19	3600	230/460	63	IEC14-36-63	$394.81	$432.00	$432.00	0.42	65.6	4.5	
		1800	230/460	63	IEC14-18-63	$407.56	$446.00	$446.00	0.55	69.5	5	
1/3	0.25	3600	230/460	63	IEC13-36-63	$420.30	$460.00	$460.00	0.61	69.5	4.5	
		1800	230/460	63	IEC13-18-63	$443.94	$486.00	$486.00	0.77	73.4	5.75	
1/2	0.37	3600	230/460	71	IEC12-36-71	$462.83	$506.00	$506.00	0.80	73.4	6.5	
		1800	230/460	71	IEC12-18-71	$481.70	$527.00	$527.00	0.99	78.2	7.7	
3/4	0.56	3600	230/460	80	IEC34-36-80	$510.02	$558.00	$558.00	1.10	76.8	8.9	
		1800	230/460	80	IEC34-18-80	$534.17	$584.00	$584.00	1.23	81.1	10.3	
1	0.75	3600	230/460	80	IEC1-36-80	$554.88	$607.00	$607.00	1.50	77.0	9.6	
		1800	230/460	80	IEC1-18-80	$566.76	$620.00	$620.00	1.58	83.5	12	
1.5	1.1	3600	230/460	80	IEC1.5-36-80	$598.40	$661.00	$661.00	1.97	84.0	11.7	
		1800	230/460	90S	IEC1.5-18-90	$577.49	$646.00	$646.00	2.11	86.5	15.7	
2	1.5	3600	230/460	90S	IEC2-36-90	$572.21	$640.00	$640.00	2.64	85.5	15.4	
		1800	230/460	90L	IEC2-18-90	$607.37	$680.00	$680.00	3.11	86.5	17.3	
3	2.2	3600	230/460	90L	IEC3-36-90	$650.11	$727.00	$727.00	3.91	86.5	17.5	
		1800	230/460	100L	IEC3-18-100	$781.92	$875.00	$875.00	3.98	89.5	23.8	
4	3.0	3600	230/460	100L	IEC4-36-100	$859.88	$962.00	$962.00	4.90	88.5	25	
		1800	230/460	100L	IEC4-18-100	$863.00	$965.00	$965.00	5.64	89.5	26.4	
5.5	3.7	3600	230/460	112M	IEC5.5-36-112	$1,049.85	$1,174.00	$1,174.00	6.43	88.5	31	
		1800	230/460	112M	IEC5.5-18-112	$1,067.03	$1,193.00	$1,193.00	6.73	88.6	35.5	
7.5	5.6	3600	230/460	132S	IEC7.5-36-132	$1,467.08	$1,641.00	$1,641.00	8.77	89.5	41.7	
		1800	230/460	132S	IEC7.5-18-132	$1,490.50	$1,667.00	$1,667.00	9.37	91.7	45.5	
10	7.5	3600	230/460	132S	IEC10-36-132	$1,608.17	$1,798.00	$1,798.00	12.08	90.2	46.2	
		1800	230/460	132M	IEC10-18-132	$1,648.67	$1,844.00	$1,844.00	13.10	91.7	56.5	
15	11.2	3600	230/460	160M	IEC15-36-160	$2,531.72	$2,831.00	---	16.62	91.0	85	
		1800	230/460	160M	IEC15-18-160	$2,687.17	$3,005.00	---	17.29	92.4	88.5	
20	15.0	3600	230/460	160M	IEC20-36-160	$2,822.10	$3,155.00	---	22.09	91.0	98	
		1800	230/460	160L	IEC20-18-160	$2,998.72	$3,353.00	---	24.08	93.0	105.5	
25	18.6	3600	230/460	160L	IEC25-36-160	$2,969.61	$3,320.00	---	27.91	91.7	109.5	

IEC Motor FF-Flanges

Model Number	Frame Size	List Price
IEC63-FF	63	$35.27
IEC71-FF	71	$46.32
IEC80-FF	80	$72.19
IEC90-FF	90	$76.43
IEC100-FF	100	$104.11
IEC112-FF	112	$126.40
IEC132-FF	132	$166.70
IEC160-FF	160	$249.04

IEC Motor C-Flanges

Model Number	Frame Size	List Price
IEC63-C	63	$26.47
IEC71-C	71	$29.82
IEC80-C	80	$39.20
IEC90-C	90	$40.93
IEC100-C	100	$54.56
IEC112-C	112	$69.99
IEC132-C	132	$107.53

HYUNDAI Crown Triton™ Series Motors - G2 Series

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-50 HP
- 3600, 1800 and 1200 RPM
- 230/460 volt, 60 Hz
- 190/380 volt, 50 Hz
- Totally enclosed fan cooled (TEFC) enclosure
- IP55 Protection
- 1.15 SF (1.0 SF for 50Hz applications)
- Class F insulation with Class B temperature rise
- Rigid base
- Premium efficiency
- Inverter Duty per NEMA MG1 Part 31 10:1 CT / 20:1 VT
- Class I, Division 2, Groups A, B, C, D
- Double drilled feet to accommodate mounting flexibility (143T-184T, 324T-326T)
- Cast iron frame with solid feet for reduced vibration
- Rigid cast aluminum conduit box
- Shaft slingers
- NEMA Design B
- IEEE-45 Marine Duty rated
- ABS Type approval
- F2 field convertible

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143T	HEE1-18-143T	$490.53	1.4	85.5	55	
	1200	230/460	145T	HEE1-12-145T	$596.27	1.6	82.5	55	
2	3600	230/460	145T	HEE2-36-145T	$576.40	2.6	85.5	55	
	1800	230/460	145T	HEE2-18-145T	$668.03	2.7	86.5	55	
	1200	230/460	184T	HEE2-12-184T	$785.84	3.0	88.5	105	
3	3600	230/460	182T	HEE3-36-182T	$739.06	3.8	86.5	105	
	1800	230/460	182T	HEE3-18-182T	$729.77	3.9	89.5	105	
	1200	230/460	213T	HEE3-12-213T	$1,123.47	4.5	89.5	150	
5	3600	230/460	184T	HEE5-36-184T	$866.94	6.1	88.5	105	
	1800	230/460	184T	HEE5-18-184T	$829.19	6.5	89.5	105	
	1200	230/460	215T	HEE5-12-215T	$1,316.76	7.4	89.5	175	
7.5	3600	230/460	213T	HEE7.5-36-213T	$1,161.69	9.0	89.5	150	
	1800	230/460	213T	HEE7.5-18-213T	$1,116.03	9.8	91.7	150	
	1200	230/460	254T	HEE7.5-12-254T	$2,120.58	10.3	91.0	240	
10	3600	230/460	215T	HEE10-36-215T	$1,319.86	12.0	90.2	175	
	1800	230/460	215T	HEE10-18-215T	$1,345.32	12.8	91.7	175	
	1200	230/460	256T	HEE10-12-256T	$2,511.20	13.8	91.0	290	
15	3600	230/460	254T	HEE15-36-254T	$2,300.51	17.0	91.0	240	
	1800	230/460	254T	HEE15-18-254T	$2,148.25	18.3	92.4	240	
	1200	230/460	284T	HEE15-12-284T	$3,491.45	19.8	91.7	360	
20	3600	230/460	256T	HEE20-36-256T	$2,536.16	23.2	91.0	290	
	1800	230/460	256T	HEE20-18-256T	$2,514.42	24.8	93.0	290	
	1200	230/460	286T	HEE20-12-286T	$4,331.51	26.7	91.7	410	
25	3600	230/460	284TS	HEE25-36-284TS	$3,781.77	28.5	91.7	360	
	1800	230/460	284T	HEE25-18-284T	$3,040.08	30.3	93.6	360	
	1200	230/460	324T	HEE25-12-324T	$5,137.21	31.2	93.0	550	
30	3600	230/460	286TS	HEE30-36-286TS	$3,869.69	33.8	91.7	410	
	1800	230/460	286T	HEE30-18-286T	$3,576.67	36.0	93.6	410	
	1200	230/460	326T	HEE30-12-326T	$5,801.88	37.1	93.0	550	
40	3600	230/460	324TS	HEE40-36-324TS	$4,951.58	45.5	92.4	550	
	1800	230/460	324T	HEE40-18-324T	$4,779.97	48.8	94.1	550	
50	3600	230/460	326TS	HEE50-36-326TS	$5,863.92	55.8	93.0	550	
	1800	230/460	326T	HEE50-18-326T	$6,056.46	59.9	94.5	550	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - G2 Series

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-50 HP
- 3600, 1800 and 1200 RPM
- 230/460 volt, 60 Hz
- 190/380 volt, 50 Hz
- Totally enclosed fan cooled (TEFC) enclosure
- IP55 Protection
- 1.15 SF (1.0 SF for 50Hz applications)
- Class F insulation with Class B temperature rise
- C-Face with Feet
- Premium efficiency
- Inverter Duty per NEMA MG1 Part 31 10:1 CT / 20:1 VT
- Class I, Division 2, Groups A, B, C, D
- Double drilled feet to accommodate mounting flexibility (143T-184T, 324T-326T)
- Cast iron frame with solid feet for reduced vibration
- Rigid cast aluminum conduit box
- Shaft slingers
- NEMA Design B
- IEEE-45 Marine Duty rated
- ABS Type approval
- F2 field convertible

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143TC	HEE1-18-143TC	$510.60	1.4	85.5	55	
	1200	230/460	145TC	HEE1-12-145TC	$620.83	1.6	82.5	55	
2	3600	230/460	145TC	HEE2-36-145TC	$600.82	2.6	85.5	55	
	1800	230/460	145TC	HEE2-18-145TC	$695.90	2.7	86.5	55	
3	3600	230/460	182TC	HEE3-36-182TC	$770.25	3.8	86.5	105	
	1800	230/460	182TC	HEE3-18-182TC	$759.92	3.9	89.5	105	
5	3600	230/460	184TC	HEE5-36-184TC	$902.70	6.1	88.5	105	
	1800	230/460	184TC	HEE5-18-184TC	$863.78	6.5	89.5	105	
	1200	230/460	215TC	HEE5-12-215TC	$1,371.31	7.4	89.5	175	
7.5	3600	230/460	213TC	HEE7.5-36-213TC	$1,210.63	9.0	89.5	150	
	1800	230/460	213TC	HEE7.5-18-213TC	$1,162.77	9.8	91.7	150	
	1200	230/460	254TC	HEE7.5-12-254TC	$2,208.99	10.3	91.0	240	
10	3600	230/460	215TC	HEE10-36-215TC	$1,374.53	12.0	90.2	175	
	1800	230/460	215TC	HEE10-18-215TC	$1,400.95	12.8	91.7	175	
	1200	230/460	256TC	HEE10-12-256TC	$2,615.98	13.8	91.0	290	
15	3600	230/460	254TC	HEE15-36-254TC	$2,395.81	17.0	91.0	240	
	1800	230/460	254TC	HEE15-18-254TC	$2,237.84	18.3	92.4	240	
	1200	230/460	284TC	HEE15-12-284TC	$3,637.52	19.8	91.7	360	
20	3600	230/460	256TC	HEE20-36-256TC	$2,642.01	23.2	91.0	290	
	1800	230/460	256TC	HEE20-18-256TC	$2,619.19	24.8	93.0	290	
	1200	230/460	286TC	HEE20-12-286TC	$4,512.61	26.7	91.7	410	
25	3600	230/460	284TSC	HEE25-36-284TSC	$3,261.47	28.5	91.7	360	
	1800	230/460	284TC	HEE25-18-284TC	$3,166.85	30.3	93.6	360	
	1200	230/460	324TC	HEE25-12-324TC	$5,351.04	31.2	93.0	550	
30	3600	230/460	286TSC	HEE30-36-286TSC	$4,027.71	33.8	91.7	410	
	1800	230/460	286TC	HEE30-18-286TC	$3,726.28	36.0	93.6	410	
	1200	230/460	326TC	HEE30-12-326TC	$6,044.02	37.1	93.0	550	
40	3600	230/460	324TSC	HEE40-36-324TSC	$5,160.04	45.5	92.4	550	
	1800	230/460	324TC	HEE40-18-324TC	$4,978.98	48.8	94.1	550	
50	3600	230/460	326TSC	HEE50-36-326TSC	$6,108.56	55.8	93.0	550	
	1800	230/460	326TC	HEE50-18-326TC	$6,308.57	59.9	94.5	550	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - G2 Series

TEFC Enclosure ▪ C-Face Round Body ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-50 HP
- 1800 RPM
- 230/460 volt, 60 Hz
- 190/380 volt, 50 Hz
- Totally enclosed fan cooled (TEFC) enclosure
- IP55 Protection
- 1.15 SF (1.0 SF for 50Hz applications)
- Class F insulation with Class B temperature rise
- C-Face Round Body
- Premium efficiency
- Inverter Duty per NEMA MG1 Part 31
  10:1 CT / 20:1 VT
- Class I, Division 2, Groups A, B, C, D
- Cast iron frame
- Rigid cast aluminum conduit box
- Shaft slingers
- NEMA Design B
- IEEE-45 Marine Duty rated
- ABS Type approval

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143TC	HEE1-18-143TCRD	$510.60	1.4	85.5	55	
1.5	1800	230/460	145TC	HEE1.5-18-145TCRD	$561.67	1.6	82.5	55	
2	1800	230/460	145TC	HEE2-18-145TCRD	$695.90	2.7	86.5	55	
3	1800	230/460	182TC	HEE3-18-182TCRD	$759.92	3.9	89.5	105	
5	1800	230/460	184TC	HEE5-18-184TCRD	$863.78	6.5	89.5	105	
7.5	1800	230/460	213TC	HEE7.5-18-213TCRD	$1,162.77	9.8	91.7	150	
10	1800	230/460	215TC	HEE10-18-215TCRD	$1,400.95	12.8	91.7	175	
15	1800	230/460	254TC	HEE15-18-254TCRD	$2,237.84	18.3	92.4	240	
20	1800	230/460	256TC	HEE20-18-256TCRD	$2,619.19	24.8	93.0	290	
25	1800	230/460	284TC	HEE25-18-284TCRD	$3,166.85	30.3	93.6	360	
30	1800	230/460	286TC	HEE30-18-286TCRD	$3,726.28	36.0	93.6	410	
40	1800	230/460	324TC	HEE40-18-324TCRD	$4,978.98	48.8	94.1	550	
50	1800	230/460	326TC	HEE50-18-326TCRD	$6,308.57	59.9	94.5	550	

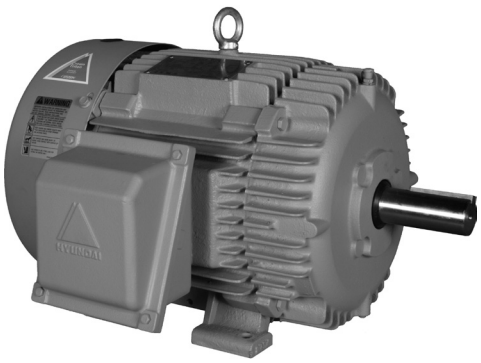
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - Severe Duty

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 1-250 HP
- 3600, 1800 and 1200 RPM
- 230/460 Volt (1-125 HP)
- 460 Volt (150-600 HP)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- Dual Rated SF
  1.15 for 40°C / 1.0 for 65°C
- Class F Insulation
  with Class N Varnish
- Rigid Base
- Premium Efficiency
- NEMA Design B
- Inverter Ready, 10:1 CT / 20:1 VT
- Inverter Shield Insulation and Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31 for Exceptional Corona and Transient Protection
- Cast Iron Frame and Conduit Box
- Suitable for Part Winding Start on Low Voltage (1-125 HP)
- Suitable for Wye-Delta Start (15-250 HP)
- Double Drilled Feet to Accommodate Mounting Flexibility (324T-445T)
- F2 Field Convertible (HHI Models Only)
- Suitable for 50 Hz Operation with 1.0 SF
- Class 1, Division 2, Groups A, B, C, D
- All Motors Carry ABS Type Approval



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
60	3600	230/460	364T	HHI60-36-364T	$10,430.72	65.6	94.1	780	
	3600	230/460	364TS	HHI60-36-364TS	$8,635.10	65.6	94.1	780	
	1800	230/460	364T	HHI60-18-364T	$8,901.82	69.9	95.0	780	
	1800	230/460	364TS	HHI60-18-364TS	$8,901.82	69.9	95.0	780	
	1200	230/460	404T	HHI60-12-404T	$11,709.18	71.2	94.5	1120	R
75	3600	230/460	365T	HHI75-36-365T	$12,098.64	79.8	94.5	820	
	3600	230/460	365TS	HHI75-36-365TS	$10,016.25	79.8	94.5	820	
	1800	230/460	365T	HHI75-18-365T	$10,341.82	85.1	95.4	820	
	1800	230/460	365TS	HHI75-18-365TS	$10,341.82	85.1	95.4	820	
	1200	230/460	405T	HHI75-12-405T	$14,120.93	87.0	94.5	1220	R
	1200	230/460	405T	HHI75-12-405T-F2	$14,120.93	87.0	94.5	1220	F2 R
100	3600	230/460	405TS	HHI100-36-405TS	$13,437.24	110.1	94.5	1110	
	1800	230/460	405T	HHI100-18-405T	$13,598.76	114.1	95.4	1110	R
	1800	230/460	405T	HHI100-18-405TBB	$13,598.76	114.1	95.4	1110	BB
	1800	230/460	405TS	HHI100-18-405TSBB	$13,598.76	114.1	95.4	1110	BB
	1800	230/460	405T	HHI100-18-405T-F2	$13,598.76	114.1	95.4	1110	F2 R
	1200	230/460	444T	HHI100-12-444T	$16,972.16	116.6	95.0	1530	R
125	3600	230/460	444TS	HHI125-36-444TS	$18,486.05	139.5	95.0	1610	
	1800	230/460	444T	HHI125-18-444T	$17,569.46	142.0	95.4	1530	R
	1800	230/460	444T	HHI125-18-444TBB	$17,569.46	142.0	95.4	1530	BB
	1800	230/460	444TS	HHI125-18-444TSBB	$17,569.46	142.0	95.4	1530	BB
	1200	230/460	445T	HHI125-12-445T	$20,007.47	147.7	95.0	1700	R
150	3600	460	445TS	HHI150-36-445TS	$20,986.68	161.5	95.0	1770	
	1800	460	445T	HHI150-18-445T	$20,314.25	163.8	95.8	1700	R
	1800	460	445T	HHI150-18-445TBB	$20,314.25	163.8	95.8	1700	BB
	1800	460	445TS	HHI150-18-445TSBB	$20,314.25	163.8	95.8	1700	BB
	1800	460	445T	HHI150-18-445T-F2	$20,314.25	163.8	95.8	1700	F2 R
	1200	460	447T	HHI150-12-447T	$23,339.55	169.5	95.8	1860	R
	1200	460	447T	HHI150-12-447T-IB	$25,817.62	169.5	95.8	1860	IB R
	1200	460	447TS	HHI150-12-447TSBB	$23,339.55	169.5	95.8	1860	BB

BB Ball bearing on drive-end for direct coupled applications
F2 Factory F2 mount
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive end for belted applications

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - Severe Duty (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 230/460 and 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
200	3600	460	447TS	HHI200-36-447TS	$26,116.89	219.3	95.4	1900	
	1800	460	447T	HHI200-18-447T	$23,519.85	222.4	96.2	1860	R
	1800	460	447T	HHI200-18-447T-IB	$28,046.52	222.4	96.2	1860	IB R
	1800	460	447T	HHI200-18-447TBB	$23,519.85	222.4	96.2	1860	BB
	1800	460	447T	HHI200-18-447TBB-IB	$28,046.52	222.4	96.2	1860	BB IB
	1800	460	447TS	HHI200-18-447TSBB	$23,519.85	222.4	96.2	1860	BB
	1200	460	449T	HHI200-12-449T	$28,041.51	231.2	95.8	2430	R
	1200	460	449T	HHI200-12-449T-IB	$32,787.31	231.2	95.8	2430	IB R
	1200	460	449TS	HHI200-12-449TSBB	$28,041.51	231.2	95.8	2430	BB
	1200	460	449T	HHI200-12-449T-F2	$28,041.51	231.2	95.8	2430	F2 R
250	3600	460	449TS	HHI250-36-449TS	$35,202.77	276.6	95.8	2430	
	1800	460	449T	HHI250-18-449T	$30,284.18	281.7	96.2	2430	R
	1800	460	449T	HHI250-18-449TBB	$30,284.18	281.7	96.2	2430	BB
	1800	460	449TS	HHI250-18-449TSBB	$30,284.18	281.7	96.2	2430	BB

HHI Motor C-Flange Kits

Frame Size	Model Number	List Price
143T / 145T	H140TC	$340.66
182T / 184T	H180TC	$371.68
213T / 215T	H210TC	$465.35
254T / 256T	H250TC	$1,032.72
284T / 286T	H280TC	$1,092.98
324T / 326T	H320TC	$1,341.15
364T / 365T (2 Pole)	H3602PTC	$1,940.87
364T / 365T (4/6 Pole)	H360TC	$1,664.95
404T / 405T (2 Pole)	H4002PTC	$1,586.12
404T / 405T (4/6 Pole)	H400TC	$2,641.20
444T / 445T (2 Pole)	H4402PTC	$2,947.28
444T / 445T (4/6 Pole)	H440TC	$1,940.87
447T (2 Pole)	H4402PTC	$2,947.28
447T (4/6 Pole)	H447TC	$1,940.87
449T (2 Pole)	H4402PTC	$2,947.28
449T (4/6 Pole)	H449TC	$1,940.87

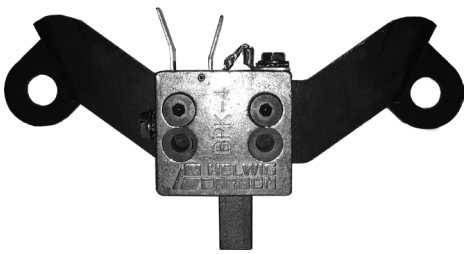
HHI Motor D-Flange Kits

Frame Size	Model Number	List Price
143T / 145T	---	---
182T / 184T	---	---
213T / 215T	---	---
254T / 256T	H250TD	$1,126.98
284T / 286T	H280TD	$1,205.73
324T / 326T	H320TD	$1,458.09
364T / 365T (2 Pole)	H3602PTD	$1,743.77
364T / 365T (4/6 Pole)	H360TD	$1,834.22
404T / 405T (2 Pole)	H4002PTD	$2,138.00
404T / 405T (4/6 Pole)	H400TD	$2,138.00
444T / 445T (2 Pole)	H4402PTD	$3,241.77
444T / 445T (4/6 Pole)	H445TD	$2,907.85
447T (2 Pole)	H4402PTD	$3,241.77
447T (4/6 Pole)	H449TD	$2,907.85
449T (2 Pole)	H4402PTD	$3,241.77
449T (4/6 Pole)	H449TD	$2,907.85

Helwig Carbon® The Bearing Protector™

- For use on Hyundai Crown Triton™ Series Motors
- Divert current from motor shaft
- Provides lowest resistant path to ground
- Easy to install - Simply remove top two bearing cap bolts
- Includes integral bracket for easy mounting

Frame Size	Model Number	List Price
364T / 365T / 444/5TS / 445/7TS / 449TS	SGK-HHI-364/5T-440TS	$1,739.14
404 / 405T	SGK-HHI-404/5T	$1,739.14
444T / 445T / 447T / 449T	SGK-HHI-440T	$1,739.14



* Installation of this product will result in loss of Class I Division 2 Classification from motor - please contact WWE for new motor nameplate at a cost of $25 net.

BB Ball bearing on drive-end for direct coupled applications
F2 Factory F2 mount
IB Insulated opposite drive-end bearing installed
R Roller bearing on drive end for belted applications

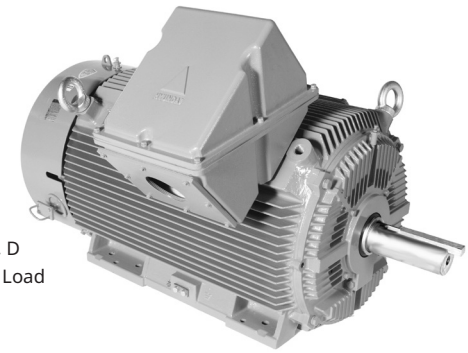
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - Severe Duty Large Frame

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 460 Volt

Product Specifications

- 250-800 HP
- 3600, 1800 and 1200 RPM
- Single Voltage, 460 Volt
- Dual Frequency Rated 50/60 Hz Nameplate
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- 1.15 SF, 40°C Ambient
- Class F Insulation with Class N Varnish
- Class B Temperature Rise
- Rigid Base
- Premium Efficiency
- Cast Iron Frame and Conduit Box
- Heavy Gauge Rolled Steel Fan Cover
- Ground Lug in Terminal Box
- Cast Iron Inner Bearing Caps
- Double Drilled Feet
- Bi-Directional for 1800 and 1200 RPM Ratings
- Uni-Directional (CCW) for 3600 RPM Ratings, Each Motor Shipped with Extra Fan for Directional Change
- CSA Certified for Class 1, Division 2, Groups A, B, C, D
- Inverter Duty, 10:1 VT at Full Load / 20:1 VT at 50% Load 4:1 CT at Full Load / 10:1 CT for 1 Hour Cycle
- Inverter Shield Insulation and Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31 for Exceptional Corona and Transient Protection



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
250	1200	460	L449T	HSDE250-12-L449T	$39,018.20	296.3	95.8	2890	R
	1200	460	L449T	HSDE250-12-L449T-IB	$42,748.47	296.3	95.8	2890	IB R
300	3600	460	L449TS	HSDE300-36-L449TS-IB	$52,696.77	327.5	95.8	2890	IB
	1800	460	L449T	HSDE300-18-L449TBB-IB	$42,405.36	333.6	96.2	2890	BB IB
	1200	460	L449T	HSDE300-12-L449T-IB	$45,727.42	353.9	95.8	3090	IB R
350	3600	460	L449TS	HSDE350-36-L449TS-IBSH	$53,114.36	378.5	95.8	3090	IB SH
	3600	460	L449TS	HSDE350-36-L449TS-IBBRSRSHSP	$64,674.30	378.5	95.8	3090	IB BR SR SH SP
	1800	460	L449T	HSDE350-18-L449T	$44,866.87	385.5	96.2	3090	R
	1800	460	L449T	HSDE350-18-L449TBB-IB	$50,529.56	385.5	96.2	3090	BB IB
	1200	460	5008	HSDE350-12-5008-IB	$68,314.41	405.5	95.8	3880	IB R
400	3600	460	L449TS	HSDE400-36-L449TS	$61,505.00	436.7	95.8	3770	
	3600	460	L449TS	HSDE400-36-L449TS-IBSH	$61,505.00	436.7	95.8	3770	IB SH
	1800	460	L449T	HSDE400-18-L449TBB-IB	$59,598.71	444.8	96.2	3570	BB IB
450	3600	460	5009S	HSDE450-36-5009S-IBBRSRSHSP	$80,877.62	487.7	95.8	3860	IB BR SR SH SP
	1800	460	5009	HSDE450-18-5009BB-IB	$70,371.76	491.1	96.2	3970	BB IB
	1800	460	5009	HSDE450-18-5009BB-IBSH	$71,358.48	491.1	96.2	3970	BB IB SH
	1200	460	5011	HSDE450-12-5011-IB	$84,436.33	522.5	95.8	4850	IB R
500	3600	460	5010S	HSDE500-36-5010S	$73,468.40	545.9	95.8	4740	W
	3600	460	5010S	HSDE500-36-5010S-IBH	$75,771.20	545.9	95.8	4740	IB W
	3600	460	5010S	HSDE500-36-5010S-IBBRSRSHSP	$85,587.09	545.9	95.8	4740	IB BR SR SH SP
	1800	460	5010	HSDE500-18-5010	$70,653.01	549.7	96.2	4760	R
	1800	460	5010	HSDE500-18-5010BB-IB	$74,994.84	549.7	96.2	4760	BB IB W
600	3600	460	5812	HSDE600-36-5812-IB	$83,095.62	657.8	95.4	6340	IB
700	3600	460	5812	HSDE700-36-5812-IBBRSRSHSP	$88,760.15	768.4	95.8	6730	IB BR SR SH SP
800	3600	460	5812	HSDE800-36-5812-2IBBRSRSHSPVP	$103,110.49	883.2	95.8	6730	2IB BR SR SH SP VP

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- For use on Hyundai Crown Triton™ Series Motors
- Divert current from motor shaft
- Provides lowest resistant path to ground
- Easy to install - Simply remove top two bearing cap bolts
- Includes integral bracket for easy mounting

Frame Size	Model Number	List Price
L449T	SGK-HSD-L449T	$1,739.14
L449TS	SGK-HSD-L449TS	$1,739.14
5008 / 5009 / 5010 / 5011	SGK-HSD-5000T	$1,739.14
5008S / 5009S / 5010S / 5011S	SGK-HSD-5000TS	$1,739.14

BB	Ball bearing on drive-end for direct coupled applications
IB	Insulated opposite drive-end bearing installed
R	Roller bearing on drive-end for belted applications
SH	Space heater installed (120 Volt)
W	Winding RTDs provided (two per phase)
2IB	Insulated bearings on drive-end and opposite drive-end
BR	Bearing RTDs, 1 per bearing
SR	Winding RTDs, 2 per phase
SP	Special paint color
VP	Vibration provisions

* Installation of this product will result in loss of Class I Division 2 Classification from motor - please contact WWE for new motor nameplate at a cost of $25 net.

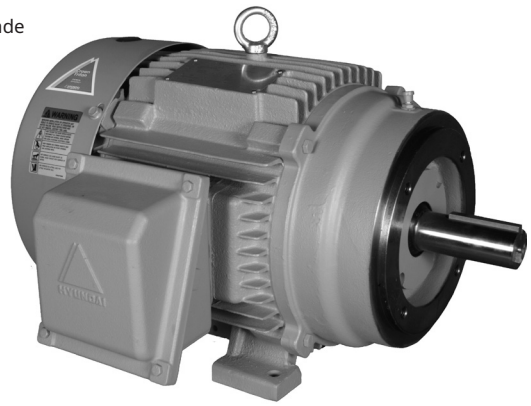
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - Severe Duty

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 230/460 and 460 Volt

Product Specifications

- 60-200 HP
- 3600, 1800 and 1200 RPM
- 230/460 Volt (60-125 HP)
- 460 Volt (150-200 HP)
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- Dual Rated SF
  1.15 for 40°C / 1.0 for 65°C
- Class F Insulation
  with Class N Varnish
- C-Face with Feet
- Premium Efficiency
- NEMA Design B
- Inverter Ready, 10:1 CT / 20:1 VT
- Inverter Shield Insulation and Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31 for Exceptional Corona and Transient Protection (364TC and up)
- Cast Iron Frame and Conduit Box
- Suitable for Part Winding Start on Low Voltage (60-125 HP)
- Suitable for Wye-Delta Start (60-200 HP)
- Double Drilled Feet to Accommodate Mounting Flexibility (364TC-445TC)
- F2 Field Convertible
- Suitable for 50 Hz Operation with 1.0 SF
- Class 1, Division 2, Groups A, B, C, D
- All Motors Carry ABS Type Approval



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
60	1800	230/460	364TC	HHI60-18-364TC	$9,272.46	69.9	95.0	780	
	1200	230/460	404TC	HHI60-12-404TC	$12,197.56	71.2	94.5	1120	
75	1800	230/460	365TC	HHI75-18-365TC	$10,772.58	85.1	95.4	820	
	1800	230/460	365TSC	HHI75-18-365TSC	$10,772.58	85.1	95.4	820	
	1200	230/460	405TC	HHI75-12-405TC	$14,709.46	87.0	94.5	1220	
100	3600	230/460	405TSC	HHI100-36-405TSC	$13,996.96	110.1	94.5	1110	
	1800	230/460	405TC	HHI100-18-405TC	$14,166.00	114.1	95.4	1110	
	1800	230/460	405TC	HHI100-18-405TC-F2	$14,166.00	114.1	95.4	1110	F2
	1800	230/460	405TSC	HHI100-18-405TSC	$14,166.00	114.1	95.4	1110	
	1200	230/460	444TC	HHI100-12-444TC	$17,679.64	116.6	95.0	1530	
125	1800	230/460	444TC	HHI125-18-444TC	$18,301.98	142.0	95.4	1530	
	1800	230/460	444TSC	HHI125-18-444TSC	$18,301.98	142.0	95.4	1530	
	1200	230/460	445TC	HHI125-12-445TC	$20,841.42	147.7	95.0	1700	
150	1800	460	445TC	HHI150-18-445TC	$21,160.74	163.8	95.8	1700	
	1800	460	445TC	HHI150-18-445TC-F2	$21,160.74	163.8	95.8	1700	F2
	1800	460	445TSC	HHI150-18-445TSC	$21,160.74	163.8	95.8	1700	
	1200	460	447TC	HHI150-12-447TC	$24,312.50	169.5	95.8	1860	
200	1800	460	447TC	HHI200-18-447TC	$24,500.31	222.4	96.2	1860	
	1800	460	447TSC	HHI200-18-447TSC	$24,500.31	222.4	96.2	1860	
	1200	460	449TC	HHI200-12-449TC	$29,209.80	231.2	95.8	2430	

F2 Factory F2 mount

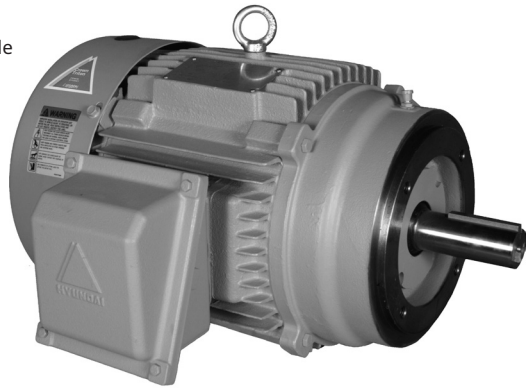
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - Severe Duty

TEFC Enclosure ▪ C-Face Round Body (Footless) ▪ Three-Phase ▪ 230/460 Volt

Product Specifications

- 1-200 HP
- 1800 RPM
- 230/460 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 Protection
- Dual Rated SF
  1.15 for 40°C / 1.0 for 65°C
- Class F Insulation
  with Class N Varnish
- C-Face Round Body (Footless)
- Premium Efficiency
- NEMA Design B
- Inverter Ready, 10:1 CT / 20:1 VT
- Inverter Shield Insulation and Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31 for Exceptional Corona and Transient Protection (254TC and up)
- Cast Iron Frame and Conduit Box
- Suitable for Part Winding Start on Low Voltage (1-125 HP)
- Suitable for Wye-Delta Start (15-200 HP)
- Suitable for 50 Hz Operation with 1.0 SF
- Class 1, Division 2, Groups A, B, C, D
- All Motors Carry ABS Type Approval



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	230/460	143TC	HHI1-18-143TCRD	$573.50	1.6	85.5	53	
1.5	1800	230/460	145TC	HHI1.5-18-145TCRD	$631.09	2.2	86.5	55	
2	1800	230/460	145TC	HHI2-18-145TCRD	$781.36	3.0	86.5	55	
3	1800	230/460	182TC	HHI3-18-182TCRD	$852.73	3.9	89.5	90	
5	1800	230/460	184TC	HHI5-18-184TCRD	$969.19	6.5	89.5	105	
7.5	1800	230/460	213TC	HHI7.5-18-213TCRD	$1,308.53	9.5	91.7	150	
10	1800	230/460	215TC	HHI10-18-215TCRD	$1,576.49	12.8	91.7	165	
15	1800	230/460	254TC	HHI15-18-254TCRD	$2,376.65	18.3	92.4	260	
20	1800	230/460	256TC	HHI20-18-256TCRD	$2,786.11	24.8	93.0	300	
25	1800	230/460	284TC	HHI25-18-284TCRD	$3,378.39	30.3	93.6	380	
30	1800	230/460	286TC	HHI30-18-286TCRD	$3,774.10	36.0	93.6	410	
40	1800	230/460	324TC	HHI40-18-324TCRD	$5,043.81	48.8	94.1	626	
50	1800	230/460	326TC	HHI50-18-326TCRD	$6,392.41	59.9	94.5	620	
60	1800	230/460	364TC	HHI60-18-364TCRD	$9,272.46	69.9	95.0	780	
75	1800	230/460	365TC	HHI75-18-365TCRD	$10,772.58	85.1	95.4	820	
100	1800	230/460	405TC	HHI100-18-405TCRD	$14,166.00	114.1	95.4	1110	
125	1800	230/460	444TC	HHI125-18-444TCRD	$18,301.98	142.0	95.4	1530	
150	1800	230/460	445TC	HHI150-18-445TCRD	$21,160.74	163.8	95.8	1700	
200	1800	230/460	447TC	HHI200-18-447TCRD	$24,500.31	222.4	96.2	1860	

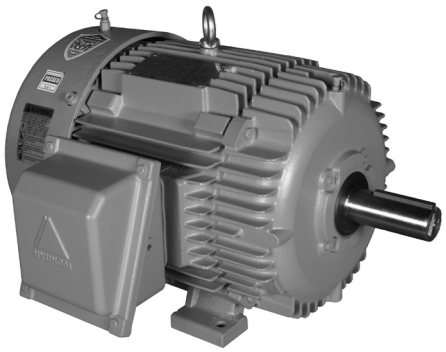
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - IEEE-841

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 460 Volt

Product Specifications

- 1-250 HP
- 3600, 1800 and 1200 RPM
- Single Voltage, 460 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 rating with ABS Type approval
- Suitable for IP56 without ABS approval
- Dual Rated SF 1.15 for 40°C / 1.0 for 65°C
- Class F Insulation with Class N Varnish
- Rigid Base
- Full Compliance with IEEE-841 Standard
- Premium Efficiency
- Class B Temperature Rise
- NEMA Design B
- Parker Hannifin ProTech IP66 Labyrinth Seals on Both Drive-End and Opposite Drive-End Bearings
- Inverter Duty, 10:1 CT / 20:1 VT
- Inverter Shield Insulation and Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31 for Exceptional Corona and Transient Protection
- IEEE-841 Motor Test Report Supplied with Each Motor
- Suitable for 50 Hz Operation with 1.0 SF
- Class 1, Division 2, Groups A, B, C, D
- All Motors Carry ABS Type Approval



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	460	143T	IEEE1-18-143T	$1,108.17	1.6	85.5	53	
	1200	460	145T	IEEE1-12-145T	$1,321.07	1.8	82.5	55	
1.5	3600	460	143T	IEEE1.5-36-143T	$1,214.62	2.0	84.0	53	
	1800	460	145T	IEEE1.5-18-145T	$1,184.56	2.2	86.5	55	
	1200	460	182T	IEEE1.5-12-182T	$1,440.01	2.3	87.5	90	
2	3600	460	145T	IEEE2-36-145T	$1,272.21	2.6	85.5	55	
	1800	460	145T	IEEE2-18-145T	$1,279.73	3.0	86.5	55	
	1200	460	184T	IEEE2-12-184T	$1,690.44	3.0	88.5	105	
3	3600	460	182T	IEEE3-36-182T	$1,571.49	3.8	86.5	90	
	1800	460	182T	IEEE3-18-182T	$1,567.75	3.9	89.5	90	
	1200	460	213T	IEEE3-12-213T	$2,162.52	4.5	89.5	150	
5	3600	460	184T	IEEE5-36-184T	$1,759.32	6.1	88.5	105	
	1800	460	184T	IEEE5-18-184T	$1,781.87	6.5	89.5	105	
	1200	460	215T	IEEE5-12-215T	$2,479.33	7.4	89.5	165	
7.5	3600	460	213T	IEEE7.5-36-213T	$2,177.55	9.0	89.5	150	
	1800	460	213T	IEEE7.5-18-213T	$2,193.83	9.5	91.7	150	
	1200	460	254T	IEEE7.5-12-254T	$3,507.38	10.3	91.0	260	
10	3600	460	215T	IEEE10-36-215T	$2,384.15	12.0	90.2	165	
	1800	460	215T	IEEE10-18-215T	$2,421.72	12.8	91.7	165	
	1200	460	256T	IEEE10-12-256T	$4,013.25	13.8	91.0	300	
15	3600	460	254T	IEEE15-36-254T	$3,556.21	16.9	91.7	260	
	1800	460	254T	IEEE15-18-254T	$3,293.25	18.3	92.4	260	
	1200	460	284T	IEEE15-12-284T	$5,053.83	19.8	91.7	380	
20	3600	460	256T	IEEE20-36-256T	$3,959.42	23.1	91.7	300	
	1800	460	256T	IEEE20-18-256T	$3,849.22	24.8	93.0	300	
	1200	460	286T	IEEE20-12-286T	$5,353.10	26.7	91.7	390	
25	3600	460	284TS	IEEE25-36-284TS	$4,417.70	28.5	91.7	380	
	1800	460	284T	IEEE25-18-284T	$4,561.72	30.3	93.6	380	
	1200	460	324T	IEEE25-12-324T	$6,199.58	31.2	93.0	550	
30	3600	460	286TS	IEEE30-36-286TS	$4,668.15	33.8	91.7	410	
	1800	460	286T	IEEE30-18-286T	$5,121.45	36.0	93.6	410	
	1200	460	326T	IEEE30-12-326T	$7,223.88	37.1	93.0	560	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - IEEE-841 (Continued)

TEFC Enclosure ▪ Rigid Base ▪ Three-Phase ▪ 460 Volt

HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
	3600	460	324TS	IEEE40-36-324TS	$6,587.76	45.5	92.4	530	
40	1800	460	324T	IEEE40-18-324T	$6,434.99	48.8	94.1	550	
	1200	460	364T	IEEE40-12-364T	$12,127.44	48.8	94.1	780	
	3600	460	326TS	IEEE50-36-326TS	$7,425.47	55.8	93.0	540	
50	1800	460	326T	IEEE50-18-326T	$7,550.69	59.9	94.5	560	
	1200	460	365T	IEEE50-12-365T	$13,149.23	60.2	94.1	840	
	3600	460	364TS	IEEE60-36-364TS	$11,095.64	65.6	94.1	780	
60	1800	460	364T	IEEE60-18-364T	$12,584.49	69.9	95.0	780	
	1200	460	404T	IEEE60-12-404T	$15,627.30	71.2	94.5	1120	R
	3600	460	365TS	IEEE75-36-365TS	$12,675.91	79.8	94.5	820	
75	1800	460	365T	IEEE75-18-365T	$12,995.22	85.1	95.4	820	
	1200	460	405T	IEEE75-12-405T	$17,096.14	87.0	94.5	1220	R
	3600	460	405TS	IEEE100-36-405TS	$15,896.54	110.1	94.5	1110	
100	1800	460	405T	IEEE100-18-405T	$19,368.85	114.1	95.4	1110	R
	1800	460	405T	IEEE100-18-405TBB	$19,368.85	114.1	95.4	1110	BB
	1200	460	444T	IEEE100-12-444T	$21,247.14	116.6	95.0	1530	R
	3600	460	444TS	IEEE125-36-444TS	$24,172.25	139.5	95.0	1610	
125	1800	460	444T	IEEE125-18-444T	$23,523.62	142.0	95.4	1530	R
	1800	460	444T	IEEE125-18-444TBB	$23,523.62	142.0	95.4	1530	BB
	1200	460	445T	IEEE125-12-445T	$24,655.59	147.7	95.0	1700	R
	3600	460	445TS	IEEE150-36-445TS	$26,577.69	161.5	95.0	1770	
150	1800	460	445T	IEEE150-18-445T	$26,627.79	163.8	95.8	1770	R
	1800	460	445T	IEEE150-18-445TBB	$26,627.79	163.8	95.8	1770	BB
	1200	460	447T	IEEE150-12-447T	$28,747.74	169.5	95.8	1860	R
	3600	460	447TS	IEEE200-36-447TS	$34,764.50	219.3	95.4	1900	
200	1800	460	447T	IEEE200-18-447T	$30,023.73	222.4	96.2	1860	R
	1800	460	447T	IEEE200-18-447TBB	$30,023.73	222.4	96.2	1860	BB
	1200	460	449T	IEEE200-12-449T	$34,159.70	231.2	95.8	2430	R
	3600	460	449TS	IEEE250-36-449TS	$41,218.29	276.6	95.8	2430	
250	1800	460	449T	IEEE250-18-449T	$37,127.39	281.7	96.2	2430	R
	1800	460	449T	IEEE250-18-449TBB	$37,127.39	281.7	96.2	2430	BB

IEEE Motor C-Flange Kits

Frame Size	Model Number	List Price
143T / 145T	IH140TC	$173.91
182T / 184T	IH180TC	$218.43
213T / 215T	IH210TC	$301.91
254T / 256T	IH250TC	$669.22
284T / 286T	IH280TC	$800.00
324T / 326T	IH320TC	$1,036.54
364T / 365T	IH360TC	$1,463.67
364TS / 365TS	IH3602PTC	$1,463.67
404T / 405T	IH400TC	$1,732.19
404TS / 405TS	IH4002PTC	$1,732.19
444T / 445T / 447T / 449T	IH440TC	$2,369.42
444TS / 445TS / 447TS / 449TS	IH4402PTC	$2,369.42

BB Ball bearing on drive-end for direct coupled applications
R Roller bearing on drive end for belted applications

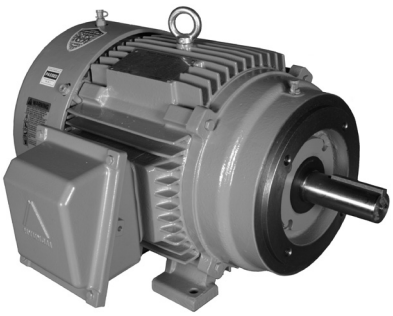
When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

HYUNDAI Crown Triton™ Series Motors - IEEE-841

TEFC Enclosure ▪ C-Face with Feet ▪ Three-Phase ▪ 460 Volt

Product Specifications

- 1-100 HP
- 3600 and 1800 RPM
- Single Voltage, 460 Volt
- Totally Enclosed Fan Cooled (TEFC) Enclosure
- IP55 rating with ABS Type approval
- Suitable for IP56 without ABS approval
- Dual Rated SF
  1.15 for 40°C / 1.0 for 65°C
- Class F Insulation with Class N Varnish
- C-Face with Feet
- Full Compliance with IEEE-841 Standard
- Premium Efficiency
- Class B Temperature Rise
- NEMA Design B
- Parker Hannifin ProTech IP66 Labyrinth Seals on Both Drive-End and Opposite Drive-End Bearings
- Inverter Duty, 10:1 CT / 20:1 VT
- Inverter Shield Insulation and Inverter Grade Magnet Wire Meets or Exceeds NEMA MG-1 Part 31 for Exceptional Corona and Transient Protection
- IEEE-841 Motor Test Report Supplied with Each Motor
- Suitable for 50 Hz Operation with 1.0 SF
- Class 1, Division 2, Groups A, B, C, D
- All Motors Carry ABS Type Approval



HP	RPM	Voltage	Frame	Model Number	List Price	FL Amps (A)	FL Eff. (%)	Approx. Wt. (lbs.)	Notes
1	1800	460	143TC	IEEE1-18-143TC	$1,154.52	1.6	85.5	53	
1.5	3600	460	143TC	IEEE1.5-36-143TC	$1,264.72	2.0	84.0	53	
	1800	460	145TC	IEEE1.5-18-145TC	$1,233.40	2.2	86.5	55	
2	3600	460	145TC	IEEE2-36-145TC	$1,324.82	2.6	85.5	55	
	1800	460	145TC	IEEE2-18-145TC	$1,333.58	3.0	86.5	55	
3	3600	460	182TC	IEEE3-36-182TC	$1,636.61	3.8	86.5	90	
	1800	460	182TC	IEEE3-18-182TC	$1,632.84	3.9	89.5	90	
5	3600	460	184TC	IEEE5-36-184TC	$1,833.21	6.1	88.5	105	
	1800	460	184TC	IEEE5-18-184TC	$1,855.74	6.5	89.5	105	
	1200	460	215TC	IEEE5-12-215TC	$2,583.26	7.4	89.5	165	
7.5	3600	460	213TC	IEEE7.5-36-213TC	$2,267.70	9.0	89.5	150	
	1800	460	213TC	IEEE7.5-18-213TC	$2,285.24	9.5	91.7	150	
	1200	460	254TC	IEEE7.5-12-254TC	$3,653.88	10.3	91.0	260	
10	3600	460	215TC	IEEE10-36-215TC	$2,483.08	12.0	90.2	165	
	1800	460	215TC	IEEE10-18-215TC	$2,523.15	12.8	91.7	165	
	1200	460	256TC	IEEE10-12-256TC	$4,181.05	13.8	91.0	300	
15	3600	460	254TC	IEEE15-36-254TC	$3,703.97	16.9	91.7	260	
	1800	460	254TC	IEEE15-18-254TC	$3,430.98	18.3	92.4	260	
	1200	460	284TC	IEEE15-12-284TC	$5,264.20	19.8	91.7	380	
20	3600	460	256TC	IEEE20-36-256TC	$4,124.71	23.1	91.7	300	
	1800	460	256TC	IEEE20-18-256TC	$4,009.50	24.8	93.0	300	
	1200	460	286TC	IEEE20-12-286TC	$5,576.00	26.7	91.7	390	
25	3600	460	284TSC	IEEE25-36-284TSC	$4,601.80	28.5	91.7	380	
	1800	460	284TC	IEEE25-18-284TC	$4,752.05	30.3	93.6	380	
30	3600	460	286TSC	IEEE30-36-286TSC	$4,862.23	33.8	91.7	410	
	1800	460	286TC	IEEE30-18-286TC	$5,334.32	36.0	93.6	410	
40	3600	460	324TSC	IEEE40-36-324TSC	$6,861.99	45.5	92.4	550	
	1800	460	324TC	IEEE40-18-324TC	$6,702.96	48.8	94.1	550	
50	3600	460	326TSC	IEEE50-36-326TSC	$7,734.76	55.8	93.0	560	
	1800	460	326TC	IEEE50-18-326TC	$7,864.99	59.9	94.5	560	
60	1800	460	364TC	IEEE60-18-364TC	$13,109.16	69.9	95.0	780	
75	1800	460	365TC	IEEE75-18-365TC	$13,536.15	85.1	95.4	820	
100	1800	460	405TC	IEEE100-18-405TC	$20,176.52	114.1	95.4	1110	

When using any motor with a variable frequency drive, take precautions to eliminate or reduce shaft currents in order to prolong bearing life.

WORLDWIDE Motor Slide Bases

Product Specifications

- Bases are Provided with Washers
- Bases are Painted with an Oven-Baked Primer for Better Contact of Customer's Paint
- All "D" Bolts (Motor Mounting Bolts) are Grade 5 and Welded into Position to Prevent Spinning and "Dropping" from Slots
- All "D" Bolts are Fixed to the Exact Foot Pattern of the Motor to Aid in Easier Motor Installation
- Exact Drop-In Replacement for all Major Make Slide Bases
- Single Adjusting Screws for Frames 56-145T
- Double Adjusting Screws for Frames 182T-505T

Frame	Model Number	List Price	Approx. Wt. (lbs.)
56	W56	$25.71	3
143T	W143T	$49.52	6
145T	W145T	$49.52	7
182T	W182T	$67.35	10
184T	W184T	$67.35	10
213T	W213T	$100.19	15
215T	W215T	$100.19	17
254T	W254T	$136.48	19
256T	W256T	$136.48	20
284T	W284T	$153.47	24
286T	W286T	$153.47	25
324T	W324T	$223.30	35
326T	W326T	$223.30	36
364T	W364T	$310.80	49
365T	W365T	$310.80	50
404T	W404T	$380.73	66
405T	W405T	$380.73	68
444T	W444T	$430.16	74
445T	W445T	$430.16	76
447T	W447T	$569.00	102
449T	W449T	$569.00	105
505T	W505T	$884.00	137

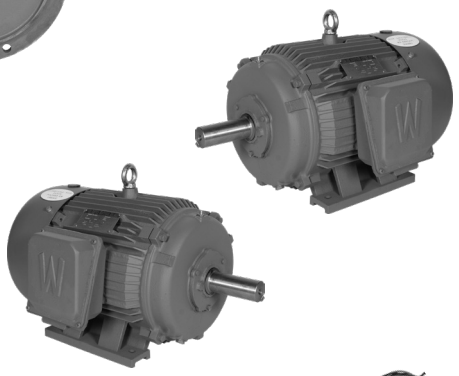
"INSTA-MOD" Modification Program

The "INSTA-MOD" Modification Program is the quickest way to get custom-built motors!

C-Flange / D-Flange Adaptation
Installation of C-Flange or D-Flange.

F1 / F2 Mount Conversion
Convert from F1 mount to F2 mount or convert from F2 mount to F1 mount.

Turn Down T to TS Short Shaft
Convert from "T" to "TS" shaft dimensions.



Space Heaters (120 or 240 Volt)
Space heaters are installed in the motor to prevent moisture or condensation from building up on the motor windings or bearings.

Winding Thermistors
Thermistors are provided and placed in the stator windings and as critical temperature is reached, the resistance of the thermistors changes radically, causing operation of the control relay.

Bearing / Winding RTDs
Resistance Temperature Detectors are installed in the windings or at the bearing journals to measure the internal temperature rise of the components to assist in preventing thermal damage to the motor windings or bearings.

Bearing Change
Change roller bearing to ball bearing or ball bearing to roller bearing.

Insulated ODE Bearing
Opposite drive-end bearing is insulated to prevent circulating current damage to the bearing.

Current Diverter Ring
Provided and installed to protect your motor bearings and coupled equipment from damaging electrical currents.

IEEE / Washdown - White Epoxy Paint
Suitable for use in USDA inspected facilities.
Conforms to AWWA D102 Outside Coating Systems: #4 (OCS-4), #5 (OCS-5) and #6 (OCS-6)

Fungus Protection / Tropicalization
Protection of windings, electrical and mechanical parts of motor from tropical environments.

Please call for additional modifications and explosion proof modifications not seen above.

Warranty Policy

Warranty Length

The warranty length for WorldWide Electric Motors is as follows:

WorldWide Fractional HP Motors

General Purpose Motors	Two (2) years from date of sale (invoice)
Jet Pump Motors	Two (2) years from date of sale (invoice)
Stainless Steel / Washdown Duty Motors	Three (3) years from date of sale (invoice)
Permanent Magnet DC Motors	One (1) year from date of sale (invoice)

WorldWide Farm Duty Motors

Two (2) years from date of sale (invoice)

WorldWide Premium Efficient Stainless Steel Motors

Two (2) years from date of sale (invoice)

WorldWide Open Drip Proof (ODP) Motors

Three (3) years from date of sale (invoice)

WorldWide Premium Efficiency Motors (PEWWE)

1-200 HP	3600 and 1800 RPM	Three (3) years from date of sale (invoice)
1-150 HP	1200 RPM	Three (3) years from date of sale (invoice)
3-300 HP	900 RPM	Two (2) years from date of sale (invoice)
200 HP	1200 RPM	Two (2) years from date of sale (invoice)
250-500 HP	3600, 1800 and 1200 RPM	Two (2) years from date of sale (invoice)

WorldWide Explosion Proof Motors

Two (2) years from date of sale (invoice)

WorldWide Advanced Design Rock Crusher Motors

Two (2) years from date of sale (invoice)

WorldWide Oil Well Pump Motors

Two (2) years from date of sale (invoice)

WorldWide Close Coupled Pump Motors

Two (2) years from date of sale (invoice)

WorldWide Vertical Hollow Shaft Motors

Two (2) years from date of sale (invoice)

LAM IEEE 45 Marine-Duty Motors

Three (3) years from date of sale (invoice)

WorldWide IEC Aluminum Frame Motors

Two (2) years from date of sale (invoice)

HYUNDAI G2 Motors (HEE Series)

Three (3) years from date of sale (invoice)

HYUNDAI Severe Duty Motors

Three (3) years from date of sale (invoice)

HYUNDAI Severe Duty Large Frame Motors

Three (3) years from date of sale (invoice)

HYUNDAI IEEE 841 Motors

Five (5) years from date of sale (invoice)

WorldWide Motor Slide Bases

Three (3) years from date of sale (invoice)

Warranty Policy

Warranty Procedure

ALL MOTORS WITH THE EXCEPTION OF IEEE-841, EXPLOSION PROOF AND VERTICAL HOLLOW SHAFT MOTORS:

1. Motors up to and including 286T are covered by our nameplate only policy. If the motor has failed due to a manufacturer's defect within the warranty period, the customer must complete the NAMEPLATE WARRANTY CREDIT REQUEST FORM, attach the nameplate to the completed form and mail to WorldWide Electric for credit (photo of nameplate required for stainless steel / washdown duty motors). **Please note, the Nameplate Warranty Credit Request Form should be mailed via certified mail.** WorldWide Electric shall not be liable for any labor or operating costs connected with the replacement of the motor. The purchaser shall be responsible for any transportation charges connected with the replacement of the motor. This warranty is offered one time per end user, per application. If there are additional failures, please follow our normal warranty policy.
2. Motors 324T and above must be inspected by an authorized EASA service center or other approved motor shop for determination of cause of failure. Authorized EASA service centers are available inside and outside of the United States. Visit the EASA website at www.easa.com to find the nearest authorized service center. These shops may also be able to assist with non-warranty service.
3. The service center must provide a written estimate for inspection and a purchase order must be issued by WorldWide Electric prior to the motor inspection.
4. After completion of the motor inspection, the service center must complete the WARRANTY REPAIR REPORT, attach detailed photographs of the failure and e-mail to WorldWide Electric for review.
5. If the failure is determined to be from a defect in material or workmanship when operated under normal conditions and in accordance with nameplate characteristic limits, WorldWide Electric shall either repair or replace the motor, at the company's discretion. WorldWide Electric shall not be liable for any labor or operating costs connected with the repair / replacement of the motor.
6. Should WorldWide Electric choose to repair the motor, the service center must provide a written estimate for repair and a purchase order must be issued by WorldWide Electric prior to the repair being performed.
7. Should WorldWide Electric choose to replace the motor, the purchaser shall be responsible for any transportation charges connected with the replacement of the motor.
8. All warranties, regardless of frame size / motor size will be subject to WorldWide Electric's final approval.

ALL IEEE-841, EXPLOSION PROOF AND VERTICAL HOLLOW SHAFT MOTORS:

1. Motors must be inspected by a UL certified / authorized EASA service center for determination of cause of failure. Authorized EASA service centers are available inside and outside of the United States. Visit the EASA website at www.easa.com to find the nearest authorized service center. These shops may also be able to assist with non-warranty service.
2. The service center must provide a written estimate for inspection and a purchase order must be issued by WorldWide Electric prior to the motor inspection.
3. After completion of the motor inspection, the service center must complete the WARRANTY REPAIR REPORT, attach detailed photographs of the failure and e-mail to WorldWide Electric for review.
4. If the failure is determined to be from a defect in material or workmanship when operated under normal conditions and in accordance with nameplate characteristic limits, WorldWide Electric shall either repair or replace the motor, at the company's discretion. WorldWide Electric shall not be liable for any labor or operating costs connected with the repair / replacement of the motor.
5. Should WorldWide Electric choose to repair the motor, the service center must provide a written estimate for repair and a purchase order must be issued by WorldWide Electric prior to the repair being performed.
6. Should WorldWide Electric choose to replace the motor, the purchaser shall be responsible for any transportation charges connected with the replacement of the motor.
7. All warranties, regardless of frame size / motor size will be subject to WorldWide Electric's final approval.

Return Policy

1. All WorldWide Electric products (electric motors, motor controls and gearing products) that are purchased as normal stock items may be returned, with freight to be paid, back to the closest WorldWide Electric warehouse by the customer.
2. Any returned products must be new, undamaged and in original cartons/packaging. Final credit will not be issued until WorldWide Electric has verified the products/shipping cartons as such.
3. All RGA requests must be made within 90 days of original purchase.
4. If the returned products were ordered incorrectly by the customer, 20% will be levied as a restocking charge which carries a minimum $75 charge.
5. If the customer places an order equal to or greater than the goods being returned, then the restocking charge will be 10% (minimum $75 charge).
6. If the product being returned was originally shipped to the customer prepaid and allowed, the original freight charge will be deducted from the return credit.
7. If the returned products are not in original condition (as well as the packaging), there will be additional fees applied to repair and/or replace those parts/products.

Freight Terms / Programs / Services

Freight Terms

Freight terms are as follows on all orders shipped from any of our warehouses.
All products can be assorted from all three divisions; motors, controls and gearing.

$5,000 +	Truck - Prepaid and Allowed
$1,000 - $4,999	Truck - 10% of Invoice - Prepaid and Add
$0 - $999	Truck - $100 Minimum - Prepaid and Add

FedEx / UPS may be utilized for shipments under 100 lbs. and billed on a prepaid and add basis (excluding cast iron motors and gear reducer products). Customers may always choose to have their shipment sent freight collect.

Special Freight Prepaid Programs

56-Frame Motors	25 + Pieces Assorted - Prepaid and Allowed
Slide Bases	25 + Pieces Assorted - Prepaid and Allowed

Orders may be picked up from any of our warehouses as a will call. We would prefer a one-hour advance notification for orders to be picked up. However, allowances will be made for special rush and urgent situations. Freight terms are as follows on all orders shipped from any of our warehouses.

Additional Freight Services

Delivery Appointment	$ 65.00
Liftgate Delivery	$200.00
Residential Delivery	$125.00
Expedited Delivery	Please Call for Quote

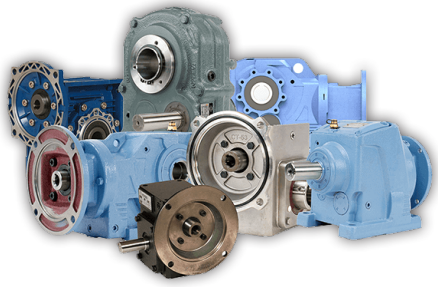
WORLDWIDE
ELECTRIC CORPORATION

Designed for demanding applications at affordable and competitive prices.

Industrial Products
Proven Quality

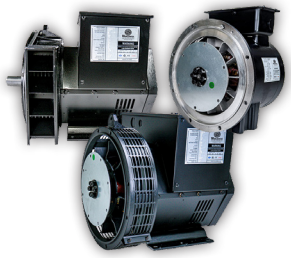
Motor Controls

- Variable Frequency Drives
- Soft Starters
- Across the Line Starters
- Remote Operating Modules
- Pre-configured/Customizable Cabinets and Panels
- Pilot Devices, Safety Switches, Contactors & Relays



Gear Reducers

- Helical Bevel Gear Reducers
- Helical Inline Gear Reducers
- Parallel Shaft Helical Gear Reducers
- Shaft Mount Reducers
- Worm Gear Reducers
- Accessories and Kits



Generators

- Single Bearing
- Double Bearing
- Pancake

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LOUIS ALLIS
Custom Specialty Motors

GLEASON-AVERY
Fractional and Sub-fractional Gear Motors

GEORATOR
Frequency Convertors

2023-2024
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Rochester, NY 14623

‡While most products are in stock in one of our distribution centers, certain conditions may lead to temporary stock shortages.

8.3. Anexo C

Se adjunta la hoja de datos del regulador de voltaje AMCR G3 23000

Industronic
Energía Evolutiva

AMCR G3 23000

Acondicionador de Voltaje
Trifásico, 300 ~ 500 kVA

10
Años de
Garantía

Características

- Regulación de voltaje ± 2%
- Rango de voltaje de entrada ± 15%
- Capacidad de sobrecarga hasta 400% en arranques intermitentes
- Protección inteligente contra sobrecarga (SOP)
- Supresor de picos de voltaje incluido
- Corte automático
- Eficiencia del 99% promedio
- Historial de eventos
- Tiempo de corrección inmediato (8 milisegundos)
- Monitoreo vía ethernet en tiempo real
- Bypass de mantenimiento incluido
- Display con indicador para ajuste de voltaje en sitio y operación del sistema
- Calibración de voltaje vía remota
- Protección contra caída de fases
- Control electrónico, estado sólido
- Voltaje nominal de 100 hasta 600 volts (línea a línea)
- Monitor de calidad de energía que mide en dos puntos eléctricos (entrada y salida)

Problemas que resuelve

- Alto voltaje momentáneo
- Bajo voltaje momentáneo
- Alto voltaje sostenido
- Bajo voltaje sostenido
- Ruido eléctrico
- Picos de voltaje

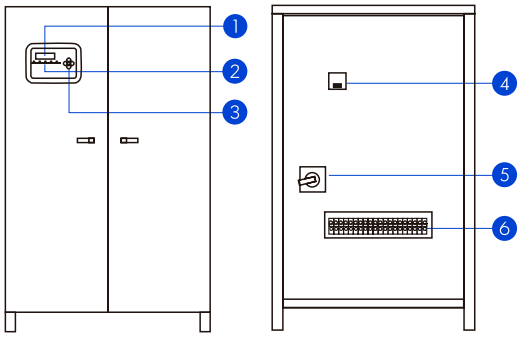
Aplicaciones

- Equipo de cómputo
- Equipo médico y laboratorio
- Equipo audiovisual
- Equipo de telecomunicaciones
- Impresoras y plotters
- Sistemas de iluminación
- Robótica
- Líneas automatizadas de ensamble
- Maquinaria y herramienta de control numérico

Opciones complementarias

- Pantalla tactil de 7"
- Medición de corriente
- Emparalelamiento por capacidad
- Transformador para compatibilidad entre estándares eléctricos

Especificaciones técnicas AMCR G3 2300



1. Display indicador
2. LEDs indicadores
3. Botones navegación
4. Interruptor de alimentación breaker
5. Bypass de mantenimiento
6. Block de conexiones de entrada y salida

Modelo AMCR G3	23300	23400	23500
Entrada			
Capacidad (kVA / kW)	300 / 300	400 / 400	500 / 500
Voltaje entrada (V)	110 / 190, 115 / 200, 120 / 208, 127 / 220 o 254 / 440, 266 / 460, 277 / 480		
Protección contra sobrecarga	Interruptor termomagnético en la entrada		
Rango	± 15%		
Frecuencia de operación	60 Hz ± 10%, no altera la frecuencia*		
Distorsión armónica	Menor a 2 % THD		
Factor de potencia	No lo altera, refleja el de la carga		
Salida			
Voltaje salida (V)	110 / 190, 115 / 200, 120 / 208, 127 / 220 o 254 / 440, 266 / 460, 277 / 480		
Rango de regulacion de voltaje	± 2% (típico)		
Impedancia de la fuente	Menor al 2%		
Protección altos o bajos voltajes sostenidos	Contactor o relevador a la salida, de corte automático (según modelo)		
Tiempo de corrección	Inmediato, (8.3 milisegundos, ½ ciclo)		
Restablecimiento	Automático (programable en fábrica)		
Tiempo de restablecimiento	3 segundos tiempo estándar **		
Físicas			
Uso recomendado	Industrial, para uso fijo e interior		
Transformadores	Alambre magneto de cobre electrolítico y lámina de acero al silicio		
Enfriamiento y ventilación	Por convección natural		
Gabinete	Lámina de acero galvanizada en base tubular de acero		
Acabado y pintura	Fondo primario y recubrimiento de esmalte epóxico horneado o secado al aire según modelo		
Altitud máxima de operación (m s.n.m.)	3,000		
Temperatura de operación (°C)	0 ~ 40		
Humedad relativa	0 ~ 95% sin condensación		
Dimensiones, alto x ancho x fondo (mm)	1575 x 1570 x 802	2360 x 2290 x 1330	
Peso (kg)	892	1052	1672
Tecnología			
Protección de ruidos de alta frecuencia	Filtro PI		
Tecnología de control	Microcontrolador		
Monitoreo (estado operativo)	Display / red ethernet		
Parámetros de medición	Voltaje, corriente, potencia, frecuencia, factor de potencia, etc.		
Electrónica de conmutación	TRIACs o SCRs según modelo		
Eléctricas			
Regulación	Línea-línea y línea-neutro		
Supresor de picos de voltaje	Varistores a la salida		
Eficiencia	98% mínima		
Capacidad de sobrecarga	Hasta 400% en arranques intermitentes		

* Tolerancia disponibles bajo evaluación del departamento de Ingeniería ** Configurable en fábrica a solicitud
Las especificaciones están sujetas a cambios y modificaciones sin previo aviso, debido a el compromiso de mejora continua de confiabilidad, diseño y funcionalidad de nuestros productos

8.4. Anexo D

Se adjunta la hoja de datos del arrancador Siemens SIRIUS 3RW4024-1BB05

SIEMENS

Hoja de datos 3RW4024-1BB05

arrancador suave SIRIUS S0 12,5 A, 7,5 kW/500 V, 40 °C AC 400-600 V, AC/DC 24 V bornes de tornillo

Datos técnicos generales		
nombre comercial del producto		SIRIUS
equipamiento del producto		
● sistema de contactos de puenteo integrado		Sí
● tiristores		Sí
función del producto		
● autoprotección electrónica del aparato		Sí
● protección de sobrecarga del motor		Sí
● evaluación de protección de motor por termistor		No
● reset externo		Sí
● limitación de corriente ajustable		Sí
● conexión en triángulo interior (raíz de 3)		No
componente del producto salida para freno de motor		No
tensión de aislamiento valor asignado	V	600
grado de contaminación		3, según IEC 60947-4-2
designaciones de referencia según EN 61346-2		Q
designaciones de referencia según DIN 40719, ampliado según IEC 204-2 según IEC 750		G
Electrónica de potencia		
designación del producto		Arrancador suave
intensidad de empleo		
● con 40 °C valor asignado	A	12,5
● con 50 °C valor asignado	A	11
● con 60 °C valor asignado	A	10
potencia mecánica entregada para motor trifásico		
● con 400 V		
— en conexión estándar con 40 °C valor asignado	kW	5,5
● con 500 V		
— en conexión estándar con 40 °C valor asignado	kW	7,5
frecuencia de empleo valor asignado	Hz	50 ... 60
tolerancia negativa relativa de la frecuencia de empleo	%	-10
tolerancia positiva relativa de la frecuencia de empleo	%	10
tensión de empleo en conexión estándar valor asignado	V	400 ... 600
tolerancia negativa relativa de la tensión de empleo en conexión estándar	%	-15
tolerancia positiva relativa de la tensión de empleo en conexión estándar	%	10
carga mínima [%]	%	20
corriente nominal ajustable del motor para protección contra sobrecarga del motor valor nominal mínimo	A	5
tensión de empleo permanente [% de le] con 40 °C	%	115

pérdidas [W] con corriente de empleo con 40 °C durante el funcionamiento típico	W	2
Circuito de control/ Control por entrada		
tipo de corriente de la tensión de alimentación de mando		AC/DC
frecuencia de la tensión de alimentación de mando 1 valor asignado	Hz	50
frecuencia de la tensión de alimentación de mando 2 valor asignado	Hz	60
tolerancia negativa relativa de la frecuencia de la tensión de alimentación de mando	%	-10
tolerancia positiva relativa de la frecuencia de la tensión de alimentación de mando	%	10
tensión de alimentación del circuito de mando 1 con AC		
● con 50 Hz valor asignado	V	24
● con 60 Hz valor asignado	V	24
tolerancia negativa relativa de la tensión de alimentación de mando con AC con 50 Hz	%	-15
tolerancia positiva relativa de la tensión de alimentación de mando con AC con 50 Hz	%	10
tolerancia negativa relativa de la tensión de alimentación de mando con AC con 60 Hz	%	-15
tolerancia positiva relativa de la tensión de alimentación de mando con AC con 60 Hz	%	10
tensión de alimentación del circuito de mando 1 con DC valor asignado	V	24
tolerancia negativa relativa de la tensión de alimentación de mando con DC	%	-20
tolerancia positiva relativa de la tensión de alimentación de mando con DC	%	20
tipo de display para señal de error		rojo
Datos mecánicos		
tamaño de la unidad electrónica de control de motor		S0
anchura	mm	45
altura	mm	125
profundidad	mm	155
tipo de fijación		fijación por tornillo y abroche
posición de montaje		con ventilador adicional: con nivel de montaje vertical girable +/- 90°, con nivel de montaje vertical inclinable +/- 22,5° hacia adelante/atrás sin ventilador adicional: con nivel de montaje vertical girable +/-10°, con nivel de montaje vertical inclinable +/- 10° hacia adelante/atrás
distancia que debe respetarse para montaje en serie		
● hacia arriba	mm	60
● hacia un lado	mm	15
● hacia abajo	mm	40
longitud del cable máx.	m	300
número de polos para circuito principal		3
Conexiones/ Bornes		
tipo de conexión eléctrica		
● para circuito principal		conexión por tornillo
● para circuito auxiliar y circuito de mando		conexión por tornillo
número de contactos NC para contactos auxiliares		0
número de contactos NA para contactos auxiliares		2
número de contactos conmutados para contactos auxiliares		1
tipo de secciones de conductor conectables para contactos principales del borne de marco utilizando el punto de embornadodelantero		
● monofilar		2x (1 ... 2,5 mm²), 2x (2,5 ... 6 mm²), máx. 1x 10 mm²
● alma flexible con preparación de los extremos de cable		2x (1 ... 2,5 mm²), 2x (2,5 ... 6 mm²)
tipo de secciones de conductor conectables con cables AWG para contactos principales del borne de marco		
● utilizando el punto de embornadodelantero		1x 8, 2x (16 ... 10)
tipo de secciones de conductor conectables para contactos auxiliares		
● monofilar		2x (0,5 ... 2,5 mm²)
● alma flexible con preparación de los extremos de cable		2x (0,5 ... 1,5 mm²)

tipo de secciones de conductor conectables con cables AWG		
● para contactos auxiliares		2x (20 ... 14)
● para contactos auxiliares alma flexible con preparación de los extremos de cable		2x (20 ... 16)
Condiciones ambiente		
altitud de instalación con altura sobre el nivel del mar	m	5 000
categoría medioambiental		
● durante el transporte según IEC 60721		2K2, 2C1, 2S1, 2M2 (altura de caída máx. 0,3 m)
● durante el almacenamiento según IEC 60721		1K6 (condensación ocasional), 1C2 (sin niebla salina), 1S2 (no puede entrar arena en los aparatos), 1M4
● durante el funcionamiento según IEC 60721		3K6 (sin formación de hielo, sin condensación), 3C3 (sin niebla salina), 3S2 (no puede entrar arena en los aparatos), 3M6
temperatura ambiente		
● durante el funcionamiento	°C	-25 ... +60
● durante el almacenamiento	°C	-40 ... +80
temperatura de reducción de potencia (derating)	°C	40
grado de protección IP frontal según IEC 60529		IP20
protección contra contactos directos frontal según IEC 60529		a prueba de contacto directo con los dedos en caso de contacto vertical por la parte frontal

Certificados/ Homologaciones

General Product Approval				EMC	For use in hazard-ous locations
CSA	Confirmation	UL	EAC	RCM	ATEX

Declaration of Conformity		Test Certificates		Marine / Shipping	
EG-Konf.	UKCA	Type Test Certific-ates/Test Report	Special Test Certific-ate	LRS	PRS

Marine / Shipping	other	Railway
DNV-GL	Confirmation	Confirmation

Valores nominales UL/CSA		
potencia mecánica entregada [hp] para motor trifásico		
● **con 460/480 V**		
— en conexión estándar con 50 °C valor asignado	hp	7,5
● **con 575/600 V**		
— en conexión estándar con 50 °C valor asignado	hp	10
capacidad de carga de los contactos auxiliares según UL		B300 / R300

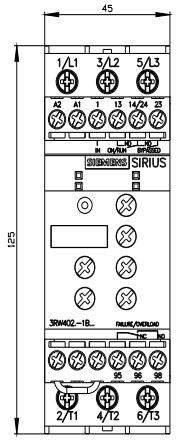
Más información

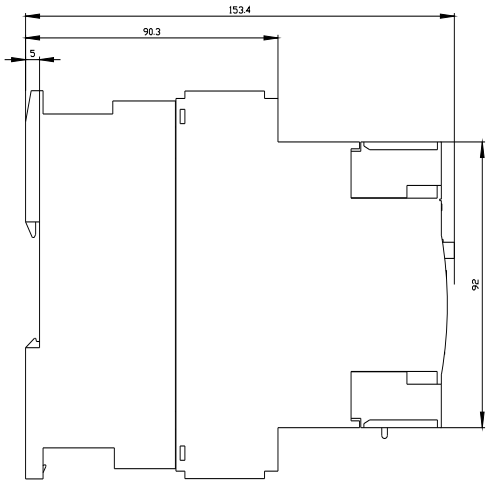
Siemens ha decidido abandonar el mercado ruso (ver aquí).
https://press.siemens.com/global/en/pressrelease/siemens-wind-down-russian-business
Siemens está trabajando en la renovación de los actuales certificados EAC.
Póngase en contacto con su oficina local de Siemens en relación con el estado de validez de la certificación EAC si tiene intención de importar o suministrar estos productos a un mercado relevante para EAC (salvo Rusia o Bielorrusia).
Simulation Tool for Soft Starters (STS)
https://support.industry.siemens.com/cs/ww/en/view/101494917
Información sobre el embalaje
https://support.industry.siemens.com/cs/ww/es/view/109813875
Information- and Downloadcenter (Catálogos, Folletos,…)
https://www.siemens.com/ic10
Industry Mall (sistema de pedido online)
https://mall.industry.siemens.com/mall/es/es/Catalog/product?mlfb=3RW4024-1BB05
Generador CAx online

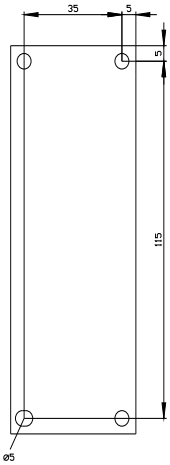
http://support.automation.siemens.com/WW/CAXorder/default.aspx?lang=en&mlfb=3RW4024-1BB05

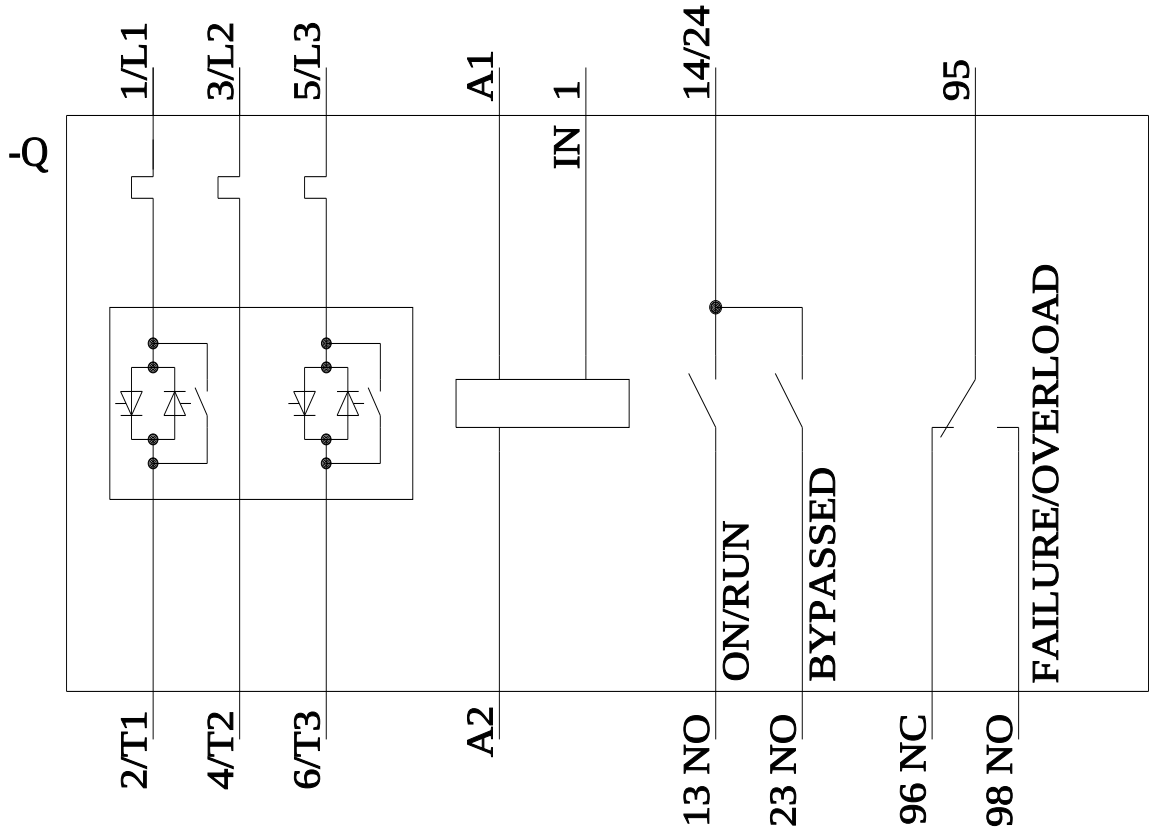
Service&Support (Manuales, certificados, características, FAQ,...)
https://support.industry.siemens.com/cs/ww/es/ps/3RW4024-1BB05

Base de datos de imágenes (fotos de producto, dibujos acotados 2D, modelos 3D, esquemas de conexiones, macros EPLAN, ...)
http://www.automation.siemens.com/bilddb/cax_de.aspx?mlfb=3RW4024-1BB05&lang=en









Última modificación: 24/8/2023

8.5. Anexo E

Se adjunta la hoja de datos del disyuntor Siemens 5SY43107CC

SIEMENS

Data sheet 5SY4310-7CC

Miniature circuit breaker 400 V 10kA, 3-pole, C, 10 A

Model	
product brand name	SENTRON
product designation	Miniature circuit breaker
General technical data	
number of poles	3
design of pole	3P
tripping characteristic class	C
mechanical service life (operating cycles) typical	10 000
overvoltage category	III
degree of pollution	3
Voltage	
type of voltage of the operating voltage	AC
insulation voltage (Ui)	
● with multi-phase operation at AC rated value	440 V
Supply voltage	
supply voltage	
● at AC rated value	400 V
● at DC rated value	60 V
value range of the supply voltage frequency	50/60 Hz
operating voltage at DC rated value maximum	72 V
supply voltage frequency rated value	50/60 Hz
Protection class	
protection class IP	IP20, with connected conductors
Switching capacity	
switching capacity current	
● according to EN 60898 rated value	10 kA
energy limitation class	3
Dissipation	
power loss [W] for rated value of the current at AC in hot operating state per pole	1.1 W
suitability for operation	Mechanical engineering / industry
Product details	
product component	
● combined terminal top	Yes
● combined terminal bottom	Yes
● neutral conductor switching	No
product feature	
● properties for main switches in accordance with EN 60204-1	Yes
● halogen-free	Yes

● sealable	Yes
● silicon-free	Yes
product extension installable supplementary devices	Yes
Connections	
connectable conductor cross-section solid	
● minimum	0.75 mm²
● maximum	35 mm²
connectable conductor cross-section stranded	
● minimum	0.75 mm²
● maximum	35 mm²
connectable conductor cross-section finely stranded with core end processing	
● minimum	0.75 mm²
● maximum	25 mm²
tightening torque [lbf·in] with screw-type terminals	
● minimum	22 lbf·in
● maximum	31 lbf·in
tightening torque with screw-type terminals	
● minimum	2.5 N·m
● maximum	3.5 N·m
position of power supply cord	Any
Mechanical Design	
height	90 mm
width	54 mm
depth	76 mm
installation depth	70 mm
number of modular width units	3
fastening method	Quick assembly system
mounting position	any
net weight	420 g
Environmental conditions	
influence of the surrounding temperature	max. 95% to 55°C, max. 55% to 70°C, max. 35% to 75°C
standard	IEC / EN 60898-1
ambient temperature during operation	
● minimum	-25 °C
● maximum	55 °C
ambient temperature during storage	
● minimum	-40 °C
● maximum	75 °C
number of test cycles for environmental testing according to IEC 60068-2-30	28

General Product Approval					Declaration of Conformity
CCC	Confirmation	IMQ	Miscellaneous	EAC	UKCA

Declaration of Conformity	other		Railway	Environment
CE EG-Konf.	Confirmation	Miscellaneous	Confirmation	Environmental Confirmations

Further information

Siemens has decided to exit the Russian market (see here).
https://press.siemens.com/global/en/pressrelease/siemens-wind-down-russian-business
Siemens is working on the renewal of the current EAC certificates.
Please contact your local Siemens office on the status of validity of the EAC certification if you intend to import or offer to supply these products to an

EAC relevant market (other than the sanctioned EAEU member states Russia or Belarus).

Information on the packaging
https://support.industry.siemens.com/cs/ww/en/view/109813875

Information- and Downloadcenter (Catalogs, Brochures,…)
http://www.siemens.com/lowvoltage/catalogs

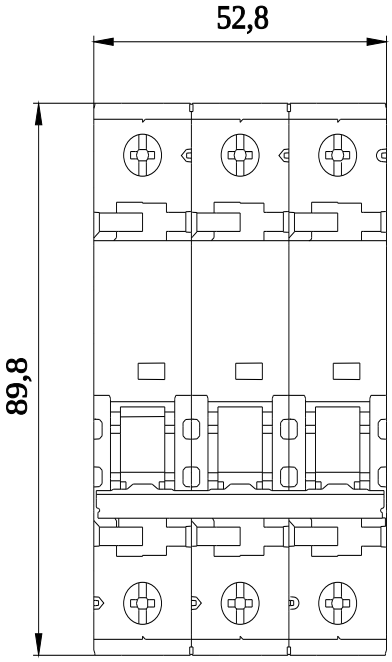
Industry Mall (Online ordering system)
https://mall.industry.siemens.com/mall/en/en/Catalog/product?mlfb=5SY4310-7CC

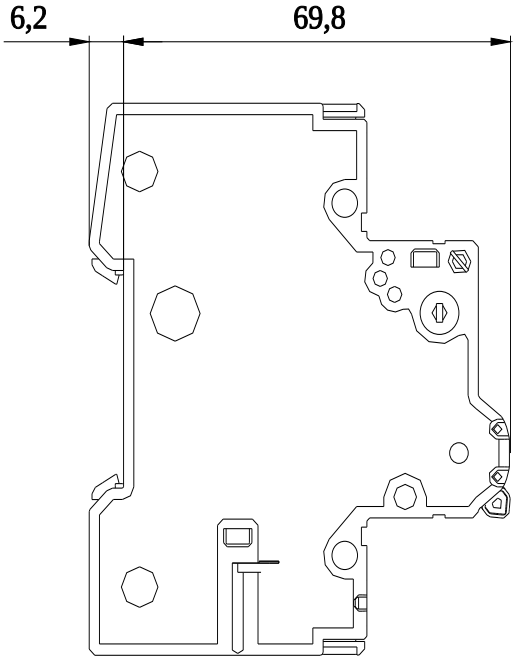
Service&Support (Manuals, Certificates, Characteristics, FAQs,...)
https://support.industry.siemens.com/cs/ww/en/ps/5SY4310-7CC

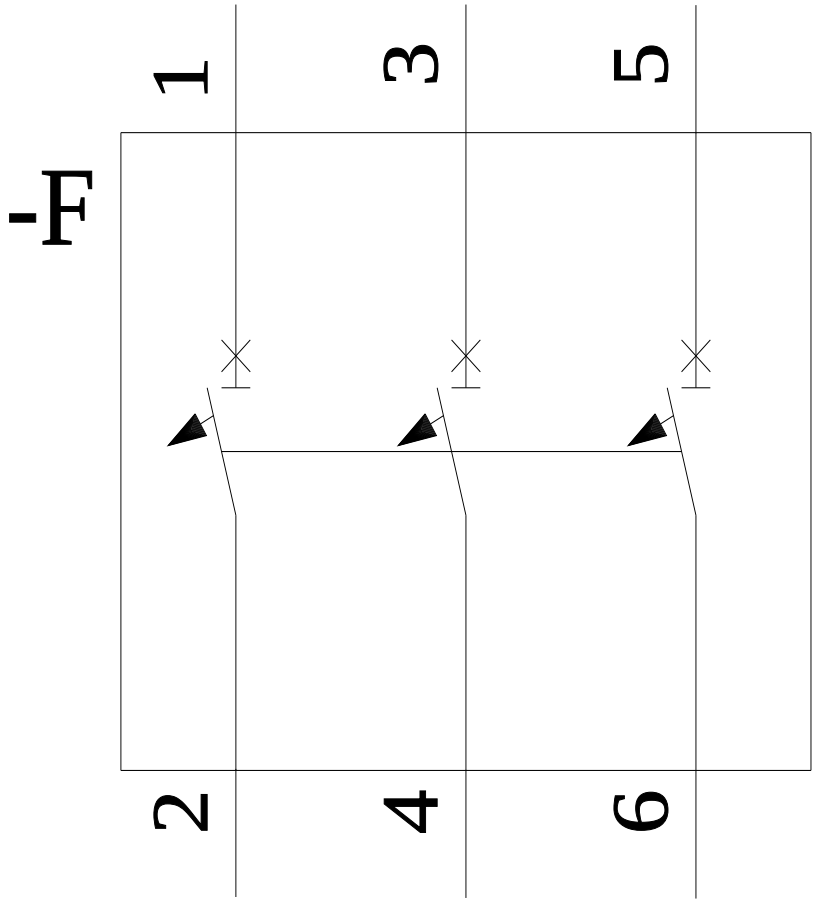
Image database (product images, 2D dimension drawings, 3D models, device circuit diagrams, ...)
http://www.automation.siemens.com/bilddb/cax_en.aspx?mlfb=5SY4310-7CC

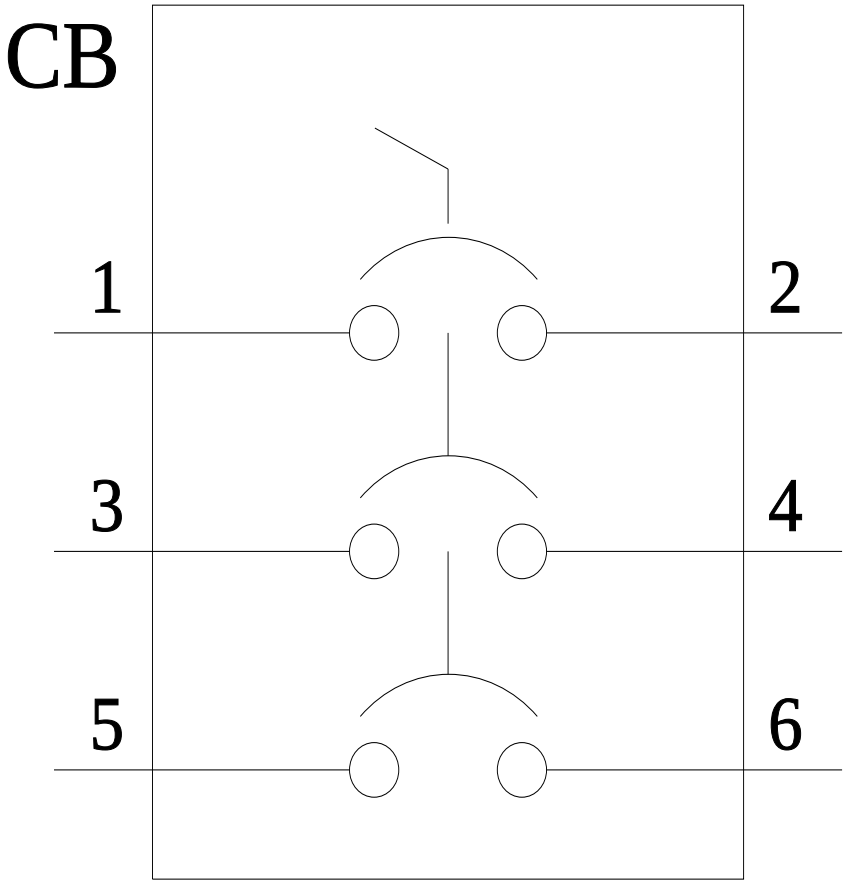
CAx-Online-Generator
http://www.siemens.com/cax

Tender specifications
http://www.siemens.com/specifications









last modified: 9/21/2023

8.6. Anexo F

Se adjunta la hoja de datos del contactor Siemens 5SV3352-6

SIEMENS

Data sheet 5SV3352-6

Residual current operated circuit breaker, 4-pole, type A, In: 25 A, 30 mA, Un AC: 500 V

Model	
product brand name	SENTRON
product designation	RCCB
design of the product	Instantaneous
product type designation	5SV3
General technical data	
number of poles	4
size of installation devices according to DIN 43880	1
mechanical service life (operating cycles) typical	10 000
short-circuit current of series fuse maximum permissible	63 A
short-circuit current rating	10 kA
switching function short-term delayed	No
overvoltage category	III
Supply voltage	
supply voltage for testing equipment minimum	195 V
value range of the supply voltage frequency	50 Hz
value range of the operating frequency	50 Hz
value range of the supply voltage at AC	500 V
Protection class	
protection class IP	IP20, if the distribution board is installed, with connected conductors
Switching capacity	
switching capacity current	
● according to IEC 61008-1 rated value	0.8 kA
Dissipation	
power loss [W]	
● for rated value of the current at AC in hot operating state per pole	0.8 W
● maximum	2.4 W
Product details	
product feature silicon-free	Yes
product extension installable supplementary devices	Yes
Connections	
connectable conductor cross-section solid	
● minimum	0.75 mm²
● maximum	35 mm²
connectable conductor cross-section stranded	
● minimum	0.75 mm²
● maximum	35 mm²
tightening torque with screw-type terminals	
● minimum	2.5 N·m

• maximum	3 N·m
position of power supply cord	top or bottom

Mechanical Design	
height	90 mm
width	72 mm
depth	70 mm
installation depth	70 mm
number of modular width units	4
fastening method	DIN rail (REG)
mounting position	any
grid spacing	60 mm

Environmental conditions	
ambient temperature during operation	
• minimum	-25 °C
• maximum	45 °C
ambient temperature during storage minimum	-40 °C
number of test cycles for environmental testing according to IEC 60068-2-30	28

General Product Approval | **Declaration of Conformity**

Confirmation | Miscellaneous

Test Certificates | **other** | | **Railway** | | **Dangerous Good**

Miscellaneous | Miscellaneous | Confirmation | Vibration and Shock | Confirmation | Transport Information

Environment

Environmental Con-firmations

Further information

Siemens has decided to exit the Russian market (see here).
https://press.siemens.com/global/en/pressrelease/siemens-wind-down-russian-business
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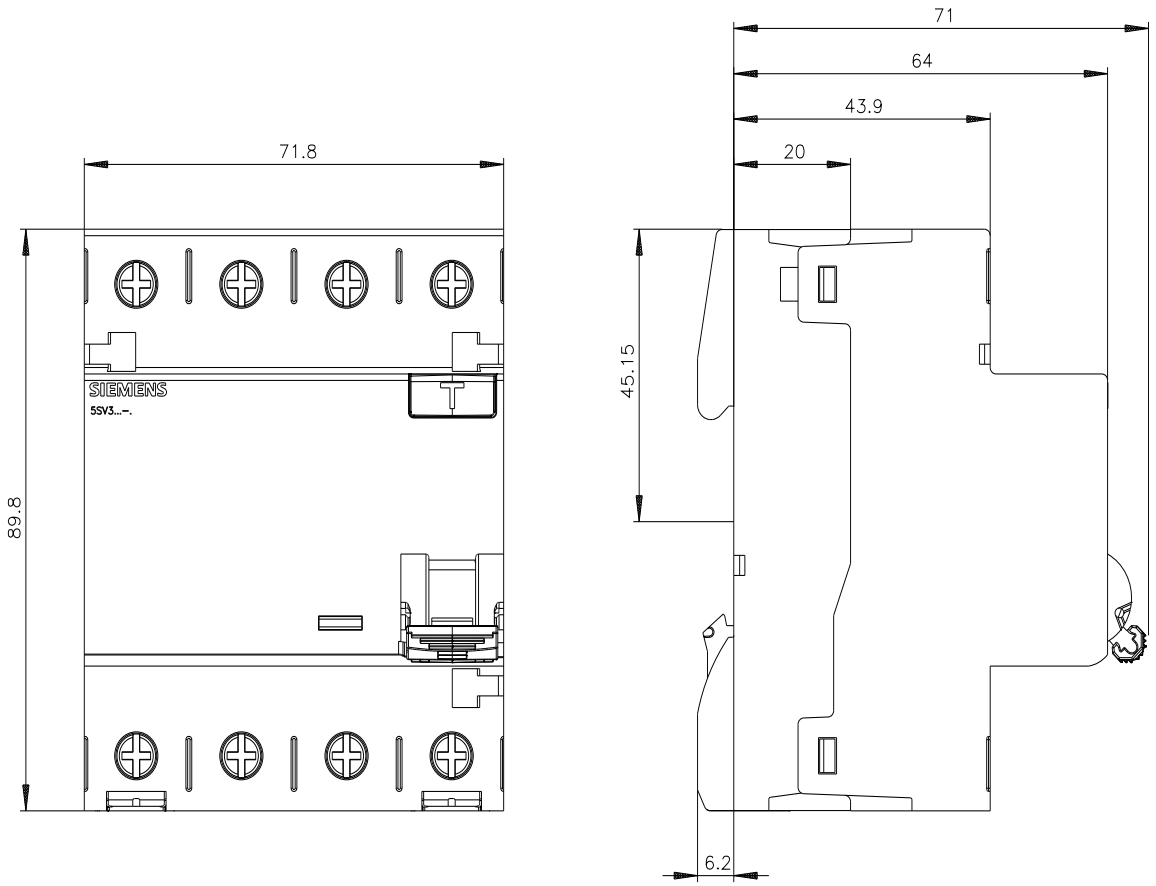
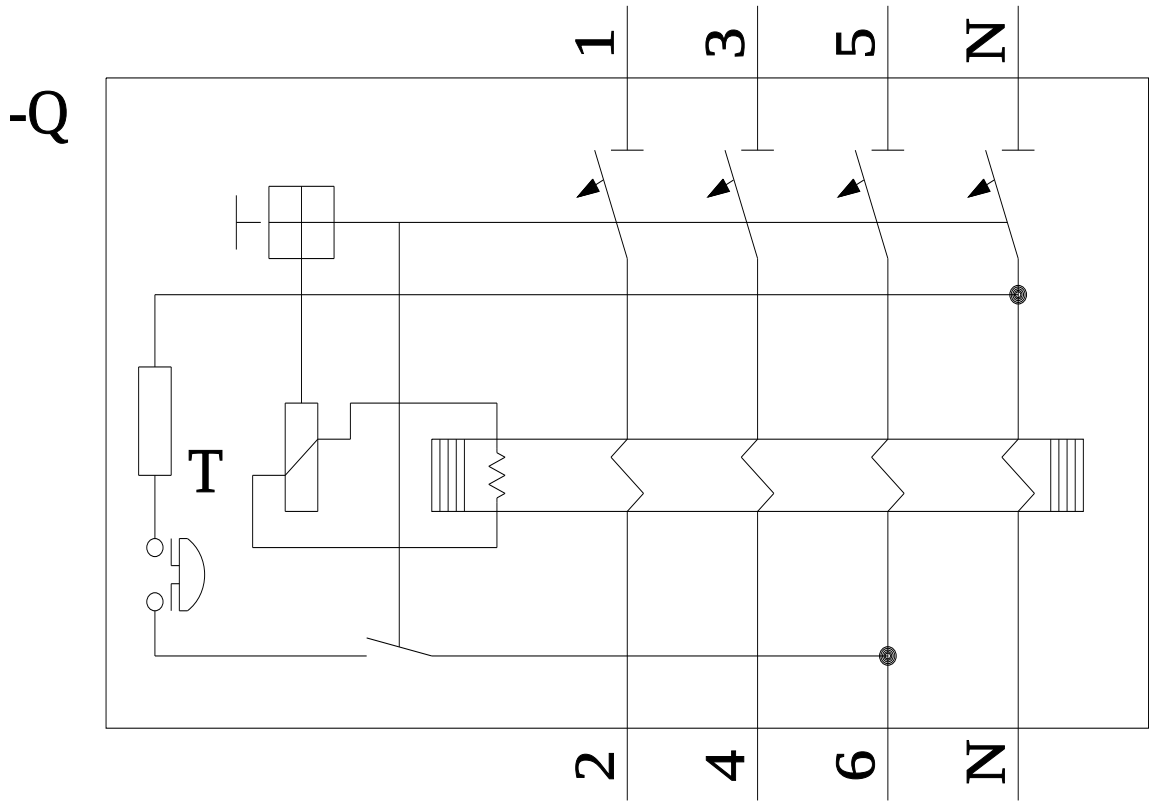
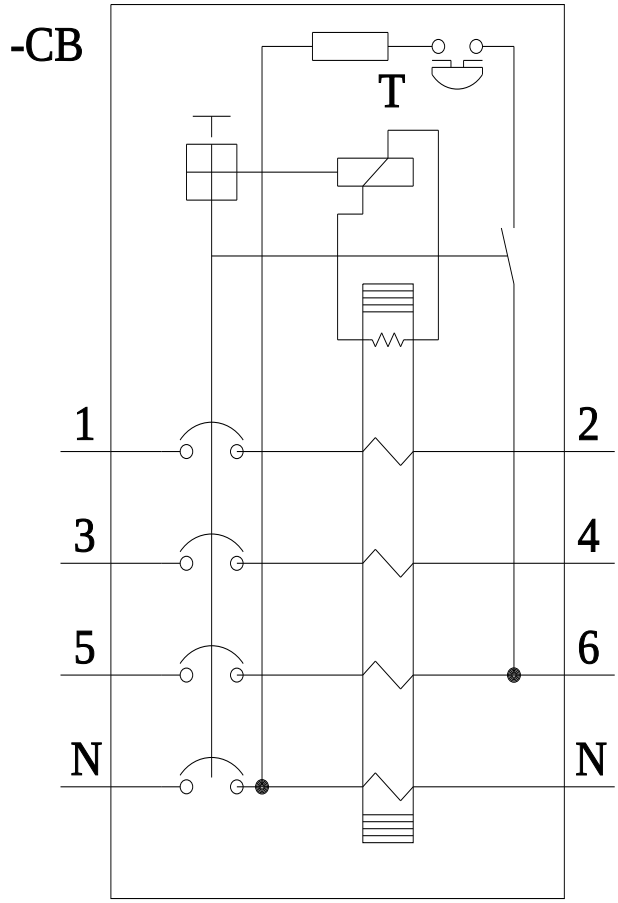
Information on the packaging
https://support.industry.siemens.com/cs/ww/en/view/109813875
Information- and Downloadcenter (Catalogs, Brochures,…)
http://www.siemens.com/lowvoltage/catalogs
Industry Mall (Online ordering system)
https://mall.industry.siemens.com/mall/en/en/Catalog/product?mlfb=5SV3352-6
Service&Support (Manuals, Certificates, Characteristics, FAQs,...)
https://support.industry.siemens.com/cs/ww/en/ps/5SV3352-6
Image database (product images, 2D dimension drawings, 3D models, device circuit diagrams, ...)
http://www.automation.siemens.com/bilddb/cax_en.aspx?mlfb=5SV3352-6
CAx-Online-Generator
http://www.siemens.com/cax
Tender specifications
http://www.siemens.com/specifications



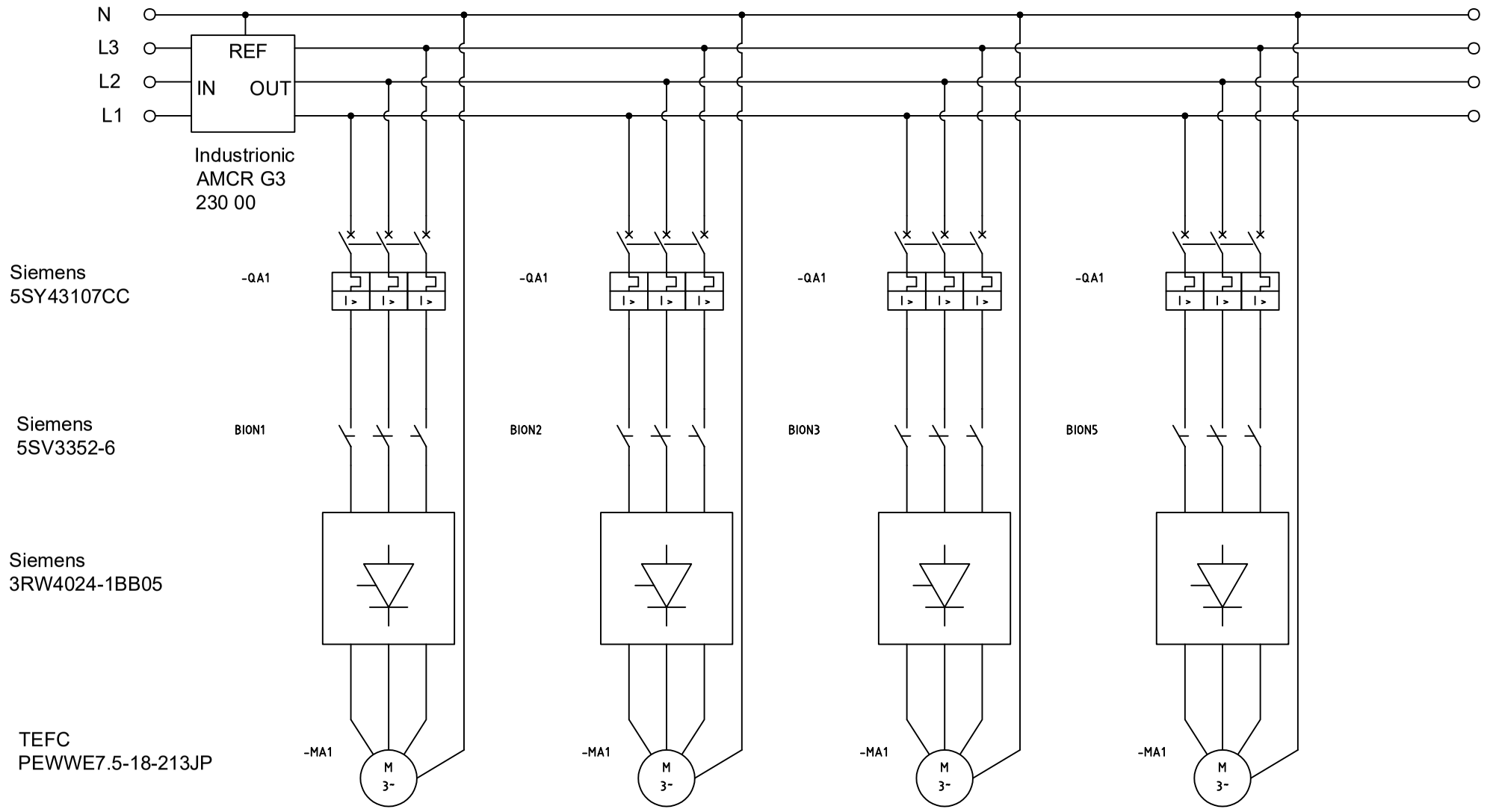




last modified: 8/15/2023

8.7. Anexo G

Se adjunta el plano del circuito de fuerza de los motores encargados de transmitir potencia a las bombas centrífugas



TEC | INSTITUTO TECNOLÓGICO DE COSTA RICA AREA ACADEMICA DE INGENIERIA MECATRONICA	ESCALA:	ACOTACIÓN: mm	
	DISEÑO: A.MOYA	21/9/2023	
	DIBUJO: A.MOYA	21/9/2023	
	SUPERVISO: C.SALAZAR		
PARTE: CIRCUITO DE FUERZA DE LAS BOMBAS CENTRIFUGAS	SISTEMA	LÁMINA	
PROYECTO: SISTEMA DE BOMBEO PARA ACUEDUCTO		1 / 1	

8.8. Anexo H

Se adjunta la hoja de datos del ATS21/2000/3N3

ATS21/2000/3N3

MCCS Type Automatic Transfer Switch

Rated Current 2000A Voltage 100~600VAC

Features

- Trouble-free Modular Design
- Easy Service & Maintenance
- ATS-22*PLC Controller with Voltage, Phase Monitoring, 168HR Exerciser & Protections
- PTM-100M* Voltage Transformer Module-Change Voltages Easily Via Plug-In Connector
- BTS*-Transfer Switch Built With High Short Circuit Breaking Capacity & OCPD**MCCBs
- The Modules interconnected by Harness using High Voltage rated Plugs
- Complies with IEC 60947-6 Requirements***

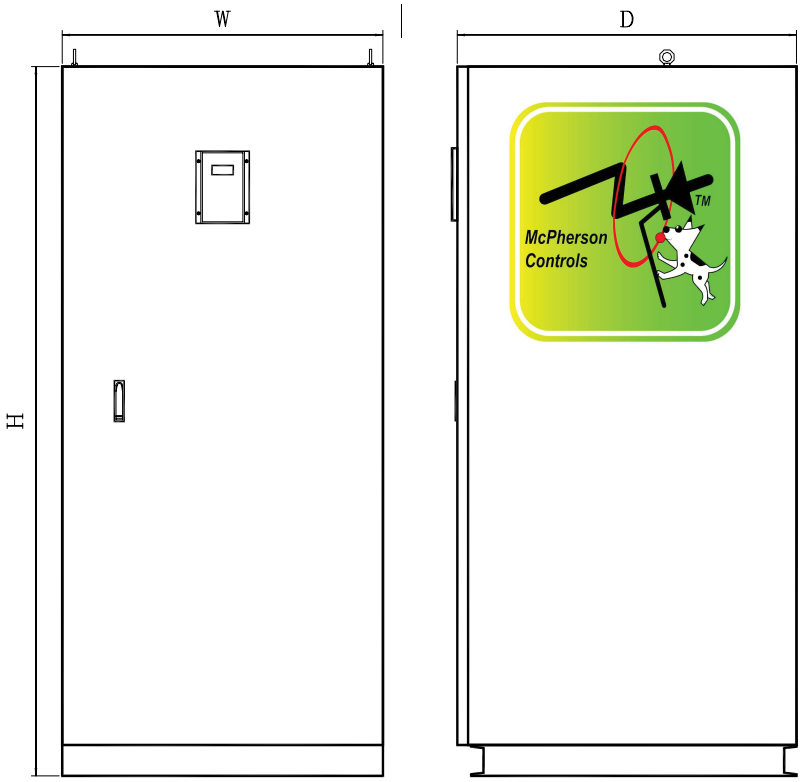
* Pictured: ATS with enclosure, ATS-22, PTM-100M & BTS Switch, for more details, please check brochures & manuals

ATS Rated Operating Current & AC Rated Breaking Capacity

ATS Type	Pole	Rated Current (A) Ambient Temperature 40	AC Rated Breaking Capacity Sym r.m.s(KA) IEC 60947-2 Icu/Ics					
			240V	380V	415V	440V	500V	690V
2000	3 P							

*For special high breaking capacity requirements, please contact us.

Mechanical Specifications



UNIT: mm

Enclosure P/N.	CA-N1800
H	1800
W	820
D	640
Thickness	2.0
Fixed Type	Floor
MCCS Capacity	3P 500~2000 A
Wire Portal Dimensions	OB*
Outdoor Enclosures	Please contact us if rain-proof (for outdoor use) enclosure is needed.

Note: T & B stands for "2 portals on both Top & Bottom"

**** OCPD**：
Over Current Protection Device

***** IEC60947-6 Class CB**：
ATS provided with over current releases and the main contacts of which are capable of making and are intended for breaking short circuit currents.

***** IEC60947-6 Utilization Category AC-33A**：
1. Frequent Operations
2. Motor loads or mixed loads including motors, resistive loads and up to 30% incandescent lamp

8.9. Anexo I

Se adjunta la hoja de datos del panel solar Tensite EM500-PH

EM500-PH

- 132 Células MBB 72S 2P
- Tecnología Half Cell Mono PERC
- Mayor potencia de salida
- Diseño ligero
- Rendimiento con poca luz
- Mayor eficiencia de conversión del módulo

GARANTÍA

- + Tolerancia positiva de vatios
- 12 Años de garantía del producto
- 25 Años de garantía de potencia lineal

Tensite
info@tensite-energy.com
www.tensite-energy.com

Patrocinador oficial de

Tensite

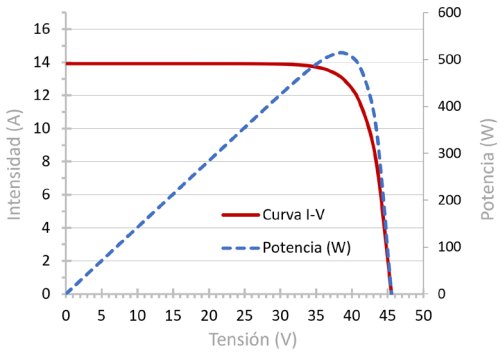
EM500-PH

Datos Eléctricos STC — EM500-PH

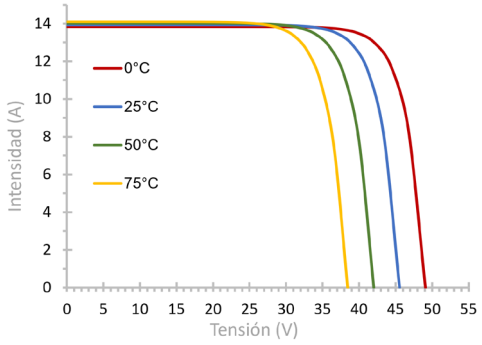
Tipo de módulo	500M Half cell Mono PERC
Máxima potencia (Wp)	500 Wp
Corriente de potencia máxima (I_{mp})	13,04 A
Voltaje de potencia máxima (V_{mp})	38,35 V
Corriente de cortocircuito (I_{sc})	13,93 A
Voltaje de circuito abierto (V_{oc})	45,55 V
Eficiencia del módulo	21%
Fusible de serie máxima	25 A
Número de Diodos	3
Tolerancia positiva de potencia	0+3%
Condiciones de prueba estándar	1.000 W/m², 25 °C, AM 1.5
Voltaje máximo del sistema DC	1.500 V
Coeficiente de temperatura I_{sc}	0,048% / °C
Coeficiente de temperatura V_{oc}	-0,270% / °C
Coeficiente de temperatura P_{mp}	-0,350% / °C
Rango temperatura funcionamiento	-40°C / +85°C
Temperatura operación célula (TONC)	45°C ±2
Capacidad carga frontal del módulo	5.400 Pa IEC61215 (nieve)
Capacidad carga trasera del módulo	2.400 Pa IEC61215 (viento)

*Condiciones Estandar de Medida STC: Irradiación 1.000 W/m2, espectro AM1.5, célula a 25°C.

Curva I-V y Potencia W @ STC



Curvas I-V y Temperaturas °C @ 1000 W/m²

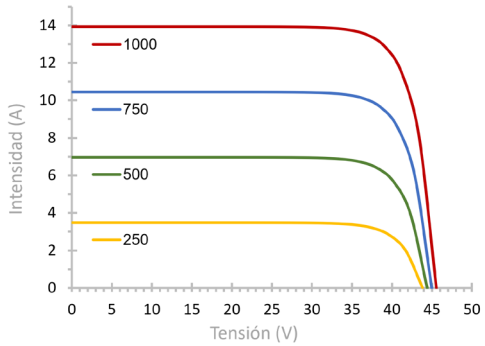


Valores en condiciones TONC**

Potencia máxima TONC (P_{max})	378 W
Voltaje de potencia máxima ($V_{mp\ TONC}$)	36,24 V
Corriente de potencia máxima ($I_{mp\ TONC}$)	10,43 A
Voltaje de circuito abierto ($V_{oc\ TONC}$)	42,82 V
Corriente de cortocircuito ($I_{sc\ TONC}$)	11,07 A

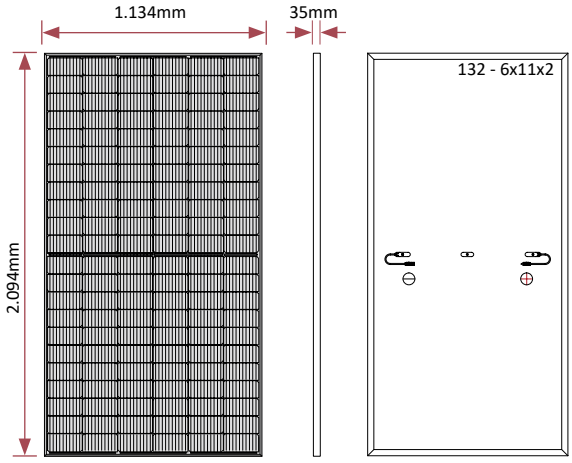
**Condiciones TONC: Irradiación de 800 W/m2, AM1.5, temperatura ambiente 20 °C y viento de 1 m/s.

Curvas I-V e Irradiación W/m² @ 25°C



Características mecánicas

Cubierta frontal (material/espesor)	Vidrio templado / 3.2mm
Peso del módulo	25,0 kg
Dimensiones del módulo (L / W / H)	2.094 x 1.134 x 35mm
Lámina de protección posterior	TPT en blanco
Células (cantidad/material)	132 (6x11x2) / Silicio mono
Marco (material/color)	Aluminio anodizado / Plata
Grado protección caja de conexiones	≥ IP68
Cables y conectores	4mm², long. 1.400mm
Clasificación de calidad	Clase A
Clase de protección eléctrica	Clase II
Clase de seguridad contra incendios	Clase C



Tensite
info@tensite-energy.com
www.tensite-energy.com

Patrocinador oficial de

8.10. Anexo J

Se adjunta la hoja de datos del inversor solar Solis-80K-5G-US

Solis-80K-5G-US

Inversores Solis 5G trifásicos

360 grados

Características:

- Más del 99% de eficiencia máxima
- Cumplimiento con UL 1741, IEEE1547
- Rango de voltaje ultra amplio, voltaje de arranque ultra bajo
- Diseño de 9 MPPT con algoritmo preciso
- Interrupción de circuito de falla de arco integrado (AFCI)
- THDi <3% baja distorsión armónica
- Antirresonancia, compatible con más de 6 MW en paralelo en un transformador
- Solución perfecta de monitoreo de sitios comerciales
- Ventilador redundante inteligente
- Monitoreo inteligente de cadenas, diagnóstico de curva inteligente I-V
- Diseño sin fusibles para evitar riesgos de incendio
- Módulo de protección contra rayos AC y DC incorporado, descargador de sobretensiones tipo I opcional
- Tecnología de supresión de fuga de corriente
- Modo de trabajo voltio-vatio integrado
- Alarma de retroceso de entrada CC
- Función anti-PID opcional
- Interruptores de CC integrados, interruptor de CA opcional

Modelo:

Solis-80K-5G-US

Tabla de datos

Modelo	Solis-80K-5G-US
Entrada (CC)	
Voltaje máxima de entrada	1000V
Voltaje de nominal	600V
Voltaje de arranque	195V
Rango de voltaje MPPT	180-1000V
Corriente máxima de entrada	9*26A
Corriente máxima de cortocircuito	9*40A
Número de MPPT/Número máxima de cadenas de entrada	9/18
Salida (CA)	
Potencia nominal de salida	80kW
Potencia máxima de salida aparente	80kVA
Potencia máxima de salida	80kW
Voltaje nominal de la red	3/PE, 480V
Frecuencia nominal de la red	60Hz
Corriente nominal de salida de red	166.6A
Corriente máxima de salida	96.2A
Factor de potencia	>0.99 (0.8 que lleva a 0.8 de retraso)
THDi	<3%
Eficiencia	
Eficiencia máxima	98.7%
Eficiencia EU	98.3%
Protección	
Protección contra polaridad inversa DC	Sí
Monitoreo de fallos a tierra	Sí
Detección Anti-isla	Sí
Monitoreo de cadenas	Sí
Escaneo de curvas I/V	Sí
Función anti-PID	Opcional
AFCI integrado (Protección de circuito de falla de arco CC)	Sí
Señal PLC Sunspec para apagado rápido	Opcional
Interruptor de CC integrado	Sí
Interruptor de CA integrado	Opcional
Datos generales	
Dimensiones (longitud*ancho*altura)	1050*567*314.5 mm (con interruptor de CA)
Peso	82kg
Topología	Sin Transformador
Consumo propio	<2W (noche)
Rango de temperatura de funcionamiento	-25 ~ +60°C
Humedad relativa	0-100%
Nivel de protección	NEMA 4X
Enfriamiento	Ventilador redundante inteligente
Altitud máxima de funcionamiento	4000m
Conformidad	UL 1741, UL 1741SA, UL 1998, UL 1699B, IEEE 1547, FCC Part 15 (Class A & B), CAN/CSA C22.2 107.1-1, Rule 21 Phase I, I&III
Características	
Conexión de CC	Conector MC4
Conexión de CA	Terminal OT (máxima 185 mm^2)
Pantalla	LCD, 2×20 Z
Comunicación	RS485, Opcional: Wi-Fi, GPRS, Ethernet, PLC

8.11. Anexo K

Se adjunta la hoja de datos del contactor Siemens 3RT1054-2AR36

SIEMENS

Hoja de datos 3RT1054-2AR36

contactor de potencia, AC-3e/AC-3 115 A, 55 kW / 400 V, AC (50-60 Hz)/DC Uc: 440-480 V tripolar, contactos auxiliares 2 NA + 2 NC accionamiento: convencional circuito ppal.: barra circuito de control y auxiliar: borne de resorte

nombre comercial del producto	SIRIUS
designación del producto	Contactor de potencia
denominación del tipo de producto	3RT1
Datos técnicos generales	
tamaño del contactor	S6
ampliación del producto	
● módulo de función para comunicación	No
● interruptor auxiliar	Sí
pérdidas [W] con valor asignado de la intensidad	
● con AC en estado operativo caliente	21 W
● con AC en estado operativo caliente por polo	7 W
● sin componente de corriente de carga típico	5,2 W
tensión de aislamiento	
● del circuito principal con grado de contaminación 3 valor asignado	1 000 V
● del circuito auxiliar con grado de contaminación 3 valor asignado	500 V
resistencia a tensión de choque	
● del circuito principal valor asignado	8 kV
● del circuito auxiliar valor asignado	6 kV
tensión máxima admitida para separación de protección entre bobina y contactos principales según EN 60947-1	690 V
resistencia a choques con choque rectangular	
● con AC	8,5g / 5 ms, 4,2g / 10 ms
● con DC	8,5g / 5 ms, 4,2g / 10 ms
resistencia a choques con choque sinusoidal	
● con AC	13,4g / 5 ms, 6,5g / 10 ms
● con DC	13,4g / 5 ms, 6,5g / 10 ms
vida útil mecánica (ciclos de maniobra)	
● del contactor típico	10 000 000
● del contactor con bloque de contactos auxiliares montado para equipo electrónico típico	5 000 000
● del contactor con bloque de contactos auxiliares montado típico	10 000 000
designaciones de referencia según IEC 81346-2:2009	Q
Directiva RoHS (fecha)	05/01/2012
Condiciones ambiente	
altitud de instalación con altura sobre el nivel del mar máx.	2 000 m
temperatura ambiente	
● durante el funcionamiento	-25 ... +60 °C
● durante el almacenamiento	-55 ... +80 °C
humedad relativa del aire mín.	10 %

humedad relativa del aire con 55 °C según IEC 60068-2-30 máx.	95 %
Circuito de corriente principal	
número de polos para circuito principal	3
número de contactos NA para contactos principales	3
tensión de empleo	
● con AC-3 valor asignado máx.	1 000 V
● con AC-3e valor asignado máx.	1 000 V
intensidad de empleo	
● con AC-1 con 400 V con temperatura ambiente de 40 °C valor asignado	160 A
● con AC-1	
— hasta 690 V con temperatura ambiente de 40 °C valor asignado	160 A
— hasta 690 V con temperatura ambiente de 60 °C valor asignado	140 A
— hasta 1000 V con temperatura ambiente de 40 °C valor asignado	80 A
— hasta 1000 V con temperatura ambiente de 60 °C valor asignado	80 A
● con AC-3	
— con 400 V valor asignado	115 A
— con 500 V valor asignado	115 A
— con 690 V valor asignado	115 A
— con 1000 V valor asignado	53 A
● con AC-3e	
— con 400 V valor asignado	115 A
— con 500 V valor asignado	115 A
— con 690 V valor asignado	115 A
— con 1000 V valor asignado	53 A
● con AC-4 con 400 V valor asignado	97 A
● con AC-5a hasta 690 V valor asignado	140 A
● con AC-5b hasta 400 V valor asignado	95 A
● con AC-6a	
— hasta 230 V con valor de pico de intensidad n=20 valor asignado	115 A
— hasta 400 V con valor de pico de intensidad n=20 valor asignado	115 A
— hasta 500 V con valor de pico de intensidad n=20 valor asignado	115 A
— hasta 690 V con valor de pico de intensidad n=20 valor asignado	115 A
— hasta 1000 V con valor de pico de intensidad n=20 valor asignado	53 A
● con AC-6a	
— hasta 230 V con valor de pico de intensidad n=30 valor asignado	98 A
— hasta 400 V con valor de pico de intensidad n=30 valor asignado	98 A
— hasta 500 V con valor de pico de intensidad n=30 valor asignado	98 A
— hasta 690 V con valor de pico de intensidad n=30 valor asignado	98 A
— hasta 1000 V con valor de pico de intensidad n=30 valor asignado	53 A
sección mínima en circuito principal con valor asignado máximo AC-1	70 mm²
intensidad de empleo para aprox. 200000 ciclos de maniobras con AC-4	
● con 400 V valor asignado	54 A
● con 690 V valor asignado	48 A
intensidad de empleo	
● con 1 vía de circulación de corriente con DC-1	
— con 24 V valor asignado	160 A
— con 60 V valor asignado	160 A
— con 110 V valor asignado	18 A

— con 220 V valor asignado	3,4 A
— con 440 V valor asignado	0,8 A
— con 600 V valor asignado	0,5 A
● con 2 vías de corriente en serie con DC-1	
— con 24 V valor asignado	160 A
— con 60 V valor asignado	160 A
— con 110 V valor asignado	160 A
— con 220 V valor asignado	20 A
— con 440 V valor asignado	3,2 A
— con 600 V valor asignado	1,6 A
● con 3 vías de corriente en serie con DC-1	
— con 24 V valor asignado	160 A
— con 60 V valor asignado	160 A
— con 110 V valor asignado	160 A
— con 220 V valor asignado	160 A
— con 440 V valor asignado	11,5 A
— con 600 V valor asignado	4 A
● con 1 vía de circulación de corriente con DC-3 con DC-5	
— con 24 V valor asignado	160 A
— con 60 V valor asignado	7,5 A
— con 220 V valor asignado	0,6 A
— con 440 V valor asignado	0,17 A
— con 600 V valor asignado	0,12 A
● con 2 vías de corriente en serie con DC-3 con DC-5	
— con 24 V valor asignado	160 A
— con 60 V valor asignado	160 A
— con 110 V valor asignado	160 A
— con 220 V valor asignado	2,5 A
— con 440 V valor asignado	0,65 A
— con 600 V valor asignado	0,37 A
● con 3 vías de corriente en serie con DC-3 con DC-5	
— con 24 V valor asignado	160 A
— con 60 V valor asignado	160 A
— con 110 V valor asignado	160 A
— con 220 V valor asignado	160 A
— con 440 V valor asignado	1,4 A
— con 600 V valor asignado	0,75 A
potencia de empleo	
● con AC-3	
— con 230 V valor asignado	37 kW
— con 400 V valor asignado	55 kW
— con 500 V valor asignado	75 kW
— con 690 V valor asignado	110 kW
— con 1000 V valor asignado	75 kW
● con AC-3e	
— con 230 V valor asignado	37 kW
— con 400 V valor asignado	55 kW
— con 500 V valor asignado	75 kW
— con 690 V valor asignado	110 kW
— con 1000 V valor asignado	75 kW
potencia de empleo para aprox. 200000 ciclos de maniobras con AC-4	
● con 400 V valor asignado	29 kW
● con 690 V valor asignado	48 kW
potencia aparente de empleo con AC-6a	
● hasta 230 V con valor de pico de intensidad n=20 valor asignado	40 000 kVA
● hasta 400 V con valor de pico de intensidad n=20 valor asignado	80 000 VA
● hasta 500 V con valor de pico de intensidad n=20 valor asignado	100 000 VA

● hasta 690 V con valor de pico de intensidad n=20 valor asignado	130 000 VA
● hasta 1000 V con valor de pico de intensidad n=20 valor asignado	90 000 VA
potencia aparente de empleo con AC-6a	
● hasta 230 V con valor de pico de intensidad n=30 valor asignado	30 000 VA
● hasta 400 V con valor de pico de intensidad n=30 valor asignado	60 000 VA
● hasta 500 V con valor de pico de intensidad n=30 valor asignado	80 000 VA
● hasta 690 V con valor de pico de intensidad n=30 valor asignado	110 000 VA
● hasta 1000 V con valor de pico de intensidad n=30 valor asignado	90 000 VA
corriente de corta duración admisible con estado operativo frío hasta 40 °C	
● limitada a 1 s con corte de corriente máx.	2 565 A; Utilizar sección mínima de acuerdo con el valor asignado AC-1
● limitada a 5 s con corte de corriente máx.	1 654 A; Utilizar sección mínima de acuerdo con el valor asignado AC-1
● limitada a 10 s con corte de corriente máx.	1 170 A; Utilizar sección mínima de acuerdo con el valor asignado AC-1
● limitada a 30 s con corte de corriente máx.	729 A; Utilizar sección mínima de acuerdo con el valor asignado AC-1
● limitada a 60 s con corte de corriente máx.	572 A; Utilizar sección mínima de acuerdo con el valor asignado AC-1
frecuencia de maniobra en vacío	
● con AC	2 000 1/h
● con DC	2 000 1/h
frecuencia de maniobra	
● con AC-1 máx.	800 1/h
● con AC-2 máx.	400 1/h
● con AC-3 máx.	1 000 1/h
● con AC-3e máx.	1 000 1/h
● con AC-4 máx.	130 1/h
Circuito de control/ Control por entrada	
tipo de corriente de la tensión de alimentación de mando	AC/DC
tensión de alimentación del circuito de mando con AC	
● con 50 Hz valor asignado	440 ... 480 V
● con 60 Hz valor asignado	440 ... 480 V
tensión de alimentación del circuito de mando con DC	
● valor asignado	440 ... 480 V
factor de rango de trabajo tensión de alimentación de mando valor asignado de la bobina con DC	
● valor inicial	0,8
● valor final	1,1
factor de rango de trabajo tensión de alimentación de mando valor asignado de la bobina con AC	
● con 50 Hz	0,8 ... 1,1
● con 60 Hz	0,8 ... 1,1
tipo de limitador de sobretensión	con varistor
potencia inicial aparente	
● con valor asignado mínimo de la tensión de alimentación de mando con AC	
— con 50 Hz	250 VA
— con 60 Hz	250 VA
● con valor asignado máximo de la tensión de alimentación de mando con AC	
— con 60 Hz	300 VA
— con 50 Hz	300 VA
potencia inicial aparente de la bobina con AC	
● con 50 Hz	300 VA
● con 60 Hz	300 VA
cos phi inductivo a la potencia de atracción de la bobina	
● con 50 Hz	0,9
● con 60 Hz	0,9
potencia de retención aparente	
● con valor asignado mínimo de la tensión de alimentación de mando con DC	4,3 VA

● con valor asignado máximo de la tensión de alimentación de mando con DC	5,2 VA
potencia de retención aparente	
● con valor asignado mínimo de la tensión de alimentación de mando con AC	
— con 50 Hz	4,8 VA
— con 60 Hz	4,8 VA
● con valor asignado máximo de la tensión de alimentación de mando con AC	
— con 50 Hz	5,8 VA
— con 60 Hz	5,8 VA
cos phi inductivo con potencia de retención de la bobina	
● con 50 Hz	0,8
● con 60 Hz	0,8
potencia inicial de la bobina con DC	360 W
potencia de retención de la bobina con DC	5,2 W
retardo de cierre	
● con AC	20 ... 95 ms
● con DC	20 ... 95 ms
retardo de apertura	
● con AC	40 ... 60 ms
● con DC	40 ... 60 ms
duración de arco	10 ... 15 ms
tipo de control del accionamiento de maniobra	Standard A1 - A2
Circuito de corriente secundario	
número de contactos NC para contactos auxiliares conmutación instantánea	2
número de contactos NA para contactos auxiliares conmutación instantánea	2
intensidad de empleo con AC-12 máx.	10 A
intensidad de empleo con AC-15	
● con 230 V valor asignado	6 A
● con 400 V valor asignado	3 A
● con 500 V valor asignado	2 A
● con 690 V valor asignado	1 A
intensidad de empleo con DC-12	
● con 24 V valor asignado	10 A
● con 48 V valor asignado	6 A
● con 60 V valor asignado	6 A
● con 110 V valor asignado	3 A
● con 125 V valor asignado	2 A
● con 220 V valor asignado	1 A
● con 600 V valor asignado	0,15 A
intensidad de empleo con DC-13	
● con 24 V valor asignado	10 A
● con 48 V valor asignado	2 A
● con 60 V valor asignado	2 A
● con 110 V valor asignado	1 A
● con 125 V valor asignado	0,9 A
● con 220 V valor asignado	0,3 A
● con 600 V valor asignado	0,1 A
confiabilidad de contacto de los contactos auxiliares	una conexión errónea por 100 millones (17 V, 1 mA)
Valores nominales UL/CSA	
corriente a plena carga (FLA) para motor trifásico	
● con 480 V valor asignado	124 A
● con 600 V valor asignado	125 A
potencia mecánica entregada [hp]	
● por motor monofásico	
— con 230 V valor asignado	25 hp
● para motor trifásico	
— con 200/208 V valor asignado	40 hp
— con 220/230 V valor asignado	50 hp

— con 460/480 V valor asignado	100 hp
— con 575/600 V valor asignado	125 hp
capacidad de carga de los contactos auxiliares según UL	A600 / Q600
Protección contra cortocircuitos	
tipo de cartucho fusible	
● para protección contra cortocircuitos del circuito principal	
— con tipo de coordinación 1 necesario	gG: 355 A (690 V, 100 kA)
— con tipo de coordinación 2 necesario	gG: 250 A (690 V, 100 kA), aM: 200 A (690 V, 50 kA), BS88: 250 A (415 V, 50 kA)
● para protección contra cortocircuitos del bloque de contactos auxiliares necesario	gG: 10 A (500 V, 1 kA)
Instalación/ fijación/ dimensiones	
posición de montaje	con nivel de montaje vertical girable +/-90°, con nivel de montaje vertical +/-22.5° hacia adelante, posición de montaje de pie
tipo de fijación	fijación por tornillo
● montaje en serie	Sí
altura	172 mm
anchura	120 mm
profundidad	170 mm
distancia que debe respetarse	
● para montaje en serie	
— hacia adelante	20 mm
— hacia arriba	10 mm
— hacia abajo	10 mm
— hacia un lado	0 mm
● a piezas puestas a tierra	
— hacia adelante	20 mm
— hacia arriba	10 mm
— hacia un lado	10 mm
— hacia abajo	10 mm
● a piezas bajo tensión	
— hacia adelante	20 mm
— hacia arriba	10 mm
— hacia abajo	10 mm
— hacia un lado	10 mm
Conexiones/ Bornes	
tipo de conexión eléctrica	
● para circuito principal	Barra de conexión
● para circuito auxiliar y circuito de mando	conexión por resorte
● en contactor para contactos auxiliares	Bornes de resorte
● de la bobina	Bornes de resorte
anchura de las barras de conexión	17 mm
espesor de las barras de conexión	3 mm
diámetro del taladro	9 mm
número de taladros	1
sección de conductor conectable para contactos principales	
● multifilar	25 ... 120 mm²
sección de conductor conectable para contactos auxiliares	
● monofilar o multifilar	0,25 ... 2,5 mm²
● alma flexible con preparación de los extremos de cable	0,25 ... 1,5 mm²
● alma flexible sin preparación de extremos de cable	0,25 ... 2,5 mm²
tipo de secciones de conductor conectables	
● para contactos auxiliares	
— monofilar	2x (0,25 ... 2,5 mm²)
— monofilar o multifilar	2x (0,25 ... 2,5 mm²)
— alma flexible con preparación de los extremos de cable	2x (0,25 ... 1,5 mm²)
— alma flexible sin preparación de extremos de cable	2x (0,25 ... 2,5 mm²)
● con cables AWG para contactos auxiliares	2x (24 ... 14)
calibre AWG como sección de conductor conectable codificada	

● para contactos auxiliares	24 ... 14

Seguridad

función del producto	
● contacto espejo según IEC 60947-4-1	Sí
● apertura positiva según IEC 60947-5-1	No
aptitud para uso desconexión de seguridad	Sí
valor B10 con alta tasa de demanda según SN 31920	1 000 000
valor T1 para intervalo entre pruebas o vida útil según IEC 61508	20 a
grado de protección IP frontal según IEC 60529	IP00; IP20 con borne tipo marco/tapa
protección contra contactos directos frontal según IEC 60529	a prueba de contacto directo con los dedos en caso de contacto vertical por la parte frontal con borne tipo marco/tapa

Certificados/ Homologaciones

General Product Approval

CSA CCC Confirmation UL KC EAC

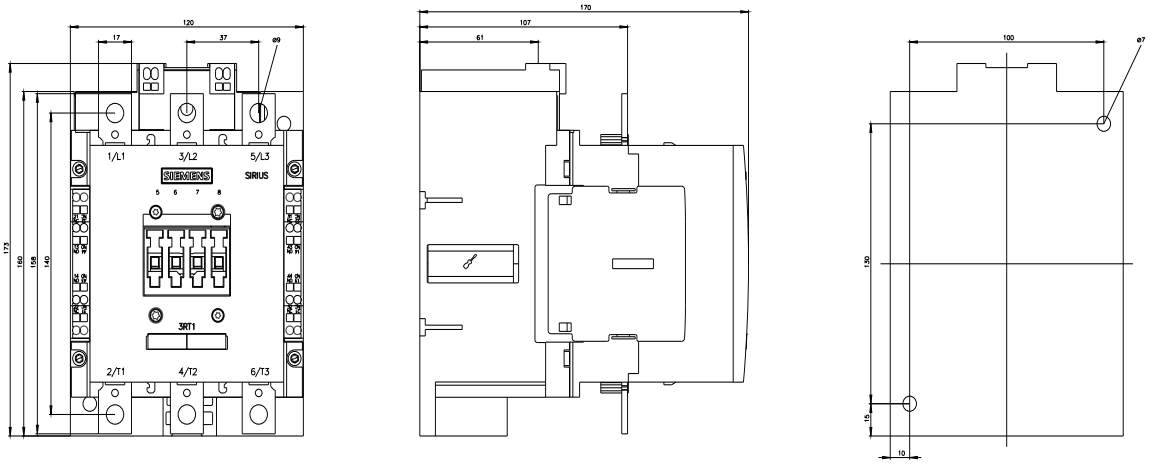
EMC	Functional Safety/Safety of Machinery	Declaration of Conformity		Test Certificates	
RCM	Type Examination Certificate	UKCA	CE EG-Konf.	Special Test Certificate	Type Test Certificates/Test Report

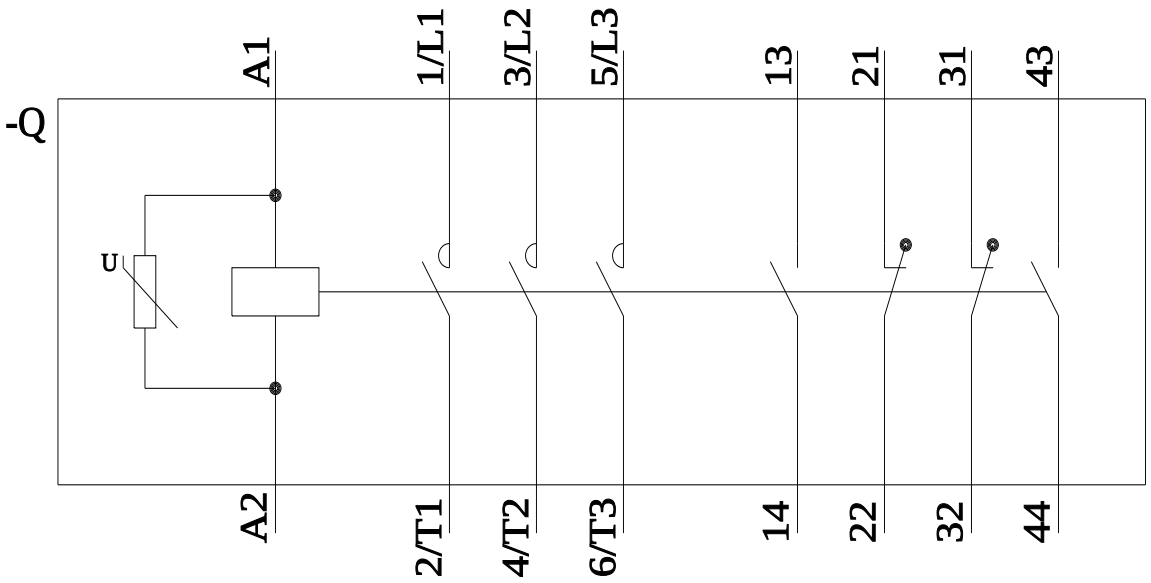
Marine / Shipping					other
ABS	LRS	PRS	RMRS	DNV·GL	Miscellaneous

other			Railway	
Confirmation	Confirmation	Miscellaneous	Vibration and Shock	Special Test Certificate

Más información

Siemens ha decidido abandonar el mercado ruso (ver aquí).
https://press.siemens.com/global/en/pressrelease/siemens-wind-down-russian-business
Siemens está trabajando en la renovación de los actuales certificados EAC.
Póngase en contacto con su oficina local de Siemens en relación con el estado de validez de la certificación EAC si tiene intención de importar o suministrar estos productos a un mercado relevante para EAC (salvo Rusia o Bielorrusia).
Información sobre el embalaje
https://support.industry.siemens.com/cs/ww/es/view/109813875
Information- and Downloadcenter (Catálogos, Folletos,…)
https://www.siemens.com/ic10
Industry Mall (sistema de pedido online)
https://mall.industry.siemens.com/mall/es/es/Catalog/product?mlfb=3RT1054-2AR36
Generador CAx online
http://support.automation.siemens.com/WW/CAXorder/default.aspx?lang=en&mlfb=3RT1054-2AR36
Service&Support (Manuales, certificados, características, FAQ,…)
https://support.industry.siemens.com/cs/ww/es/ps/3RT1054-2AR36
Base de datos de imágenes (fotos de producto, dibujos acotados 2D, modelos 3D, esquemas de conexiones, macros EPLAN, …)
http://www.automation.siemens.com/bilddb/cax_de.aspx?mlfb=3RT1054-2AR36&lang=en
Curva característica: Comportamiento en disparo, I²t, Corriente de corte limitada
https://support.industry.siemens.com/cs/ww/en/ps/3RT1054-2AR36/char
Otras características (p. ej. vida útil eléctrica, frecuencia de maniobras)
http://www.automation.siemens.com/bilddb/index.aspx?view=Search&mlfb=3RT1054-2AR36&objecttype=14&gridview=view1





Última modificación: 5/10/2023

8.12. Anexo L

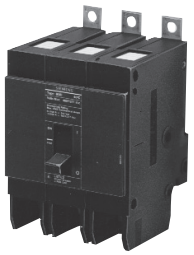
Se adjunta la hoja de datos del disyuntor Siemens SIEBWD335

BQD④

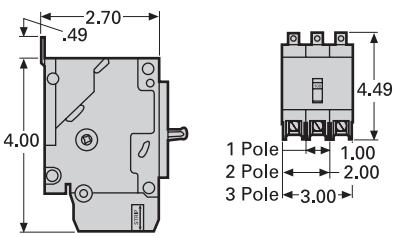
Continuous Current Rating @ 40°C	1-Pole 277V AC–125V DC Catalog Number	2-Pole③ 480Y/277V AC–125/250V DC Catalog Number	3-Pole③ 480Y/277V AC Catalog Number
15	BQD115①②	BQD215⑤	BQD315⑤
20	BQD120①②	BQD220⑤	BQD320⑤
25	BQD125②	BQD225⑤	BQD325⑤
30	BQD130②	BQD230⑤	BQD330⑤
35	BQD135②	BQD235⑤	BQD335⑤
40	BQD140②	BQD240⑤	BQD340⑤
45	BQD145②■	BQD245⑤	BQD345⑤
50	BQD150②	BQD250⑤	BQD350⑤
60	BQD160	BQD260	BQD360
70	BQD170■	BQD270	BQD370
80	BQD180■	BQD280	BQD380
90	BQD190■	BQD290	BQD390
100	BQD1100■	BQD2100	BQD3100

BQD6 CSA Certified

Continuous Current Rating @ 40°C	1-Pole 347V AC Catalog Number	2-Pole③ 600/347V AC Catalog Number	3-Pole③ 600/347V AC Catalog Number
15	BQD6115①	BQD6215	BQD6315
20	BQD6120①	BQD6220	BQD6320
25	BQD6125■	BQD6225■	BQD6325■
30	BQD6130	BQD6230	BQD6330
35	BQD6135■	BQD6235■	BQD6335■
40	BQD6140■	BQD6240■	BQD6340
45	BQD6145■	BQD6245■	BQD6345■
50	BQD6150■	BQD6250■	BQD6350
60	BQD6160■	BQD6260■	BQD6360
70	BQD6170■	BQD6270■	BQD6370



BQD, BQD6



BQD, BQD6

Shipping Weights

Number of Poles	Number per Carton	Shipping Weight (lbs.) (ea.)
1	1/12/48	.6
2	1/6/24	1.2
3	1/4/16	2.0

Lugs For 60/75°C Wire

BQD – Load End Only	
15–40	#14–#6 AWG Cu #12–#6 AWG Al
45–100	#8–#1 AWG Cu #6–#1/0 AWG Al

Interrupting Ratings

Breaker Type	Number of Poles	RMS Symmetrical Amperes (KA)							
		Volts AC						Volts DC	
		120	240	277	480/277	347	600/347	125	125/250
BQD (UL)	1	65	—	14	—	—	—	14	—
	2	—	65	—	14	—	—	—	14
	3	—	65	—	14	—	—	—	—
BQD6 (CSA)	1	65	—	—	—	10	—	14	—
	2	—	65	—	—	—	10	—	14
	3	—	65	—	—	—	10	—	—

For inches / millimeters conversion, see Application Data section.

■ Built to order. Allow 2–3 weeks for delivery.

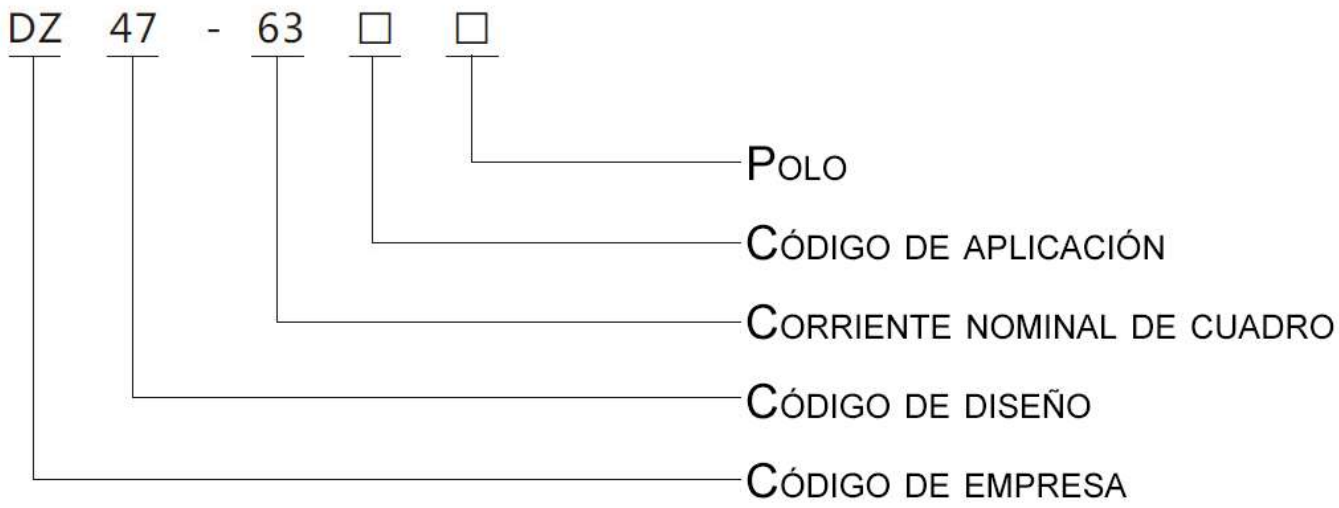
①SWD rated for switching fluorescent lighting.
②HID rated at 277V AC.
③Not suitable for 3-phase delta 480V applications.
④HACR rated.
⑤HID rated at 480Y/277V AC.

For external accessories, please refer to pages 7-95 to 7-100
For internal accessories, please refer to page 7-35

8.13. Anexo M

Se adjunta la hoja de datos del disyuntor Taixi DZ47-63

Modelo y significado



Modelo	Polo	Tipo de disparo	Corriente nominal
DZ47-63	1P	C	63
	1p 2p 3p 4p	B: Tipo B C: Tipo C D: Tipo D	1: 1A 10: 10A 32: 32A 2: 2A 16: 16A 40: 40A 3: 3A 20: 20A 50: 50A 6: 6A 25: 25A 63: 63A

Condiciones de operación y condiciones de instalación normales

3.1 El límite superior de la temperatura ambiente no supera +40 ℃, el límite inferior no es inferior a -5 ° C, y la temperatura media de 24h no supera los +35 ° C.

3.2 La altitud del sitio de instalación no debe exceder 2000m.

3.3 La humedad relativa atmosférica a temperatura ambiente +40 ℃ no es más del 50%, permite tener una humedad relativa más alta a temperaturas más bajas; por ejemplo a + 20 ℃ hasta 90%. Se deben tomar precauciones especiales para la condensación que ocasionalmente puede ocurrir en el producto debido a los cambios de temperatura.

3.4 Grado de contaminación: Grado 2.

3.5 Condiciones de instalación: instalado en un lugar sin impacto significativo, vibración, medio no peligroso (explosivo).

3.6 Instalación: Riel de instalación TH35-7.5.

3.7 Categoría de instalación: Clase II, III.

Los principales parámetros y el rendimiento técnico

Especificaciones principales:

De acuerdo con la corriente nominal: 1A, 3A, 6A, 10A, 16A, 20A, 25A, 32A, 40A, 50A, 63A.

De acuerdo con el POLO: 1P. Unipolar; 2P.Two polo; 3P. Tres polos; 4P. Cuatro polos.

De acuerdo con la forma de liberación instantánea del interruptor: a. Tipo B MCB (3In ~ 6In); segundo. Tipo C MCB (5 In ~ 10 In); do. Tipo D MCB (10In ~ 20In).

Vida mecánica y eléctrica: el interruptor hace y rompe la corriente nominal en la tensión nominal, el factor de potencia es 0.85 ~ 0.9, de acuerdo con la prueba de frecuencia del ciclo de operación por hora 120 veces (> 32 A) o 240 (≤ 32 A) la vida eléctrica es 4000 veces, la vida mecánica es 10,000 veces.

Parámetros técnicos

Capacidad nominal de corte de cortocircuitos

Tipo de disparo	Corriente nominal	Capacidad nominal d
C	1≤In≤40	
C	40 < In≤63	
D	1≤In≤63	

Características de protección de sobre corriente bajo la temperatura ambiente de 30℃~35℃

No.	Tipo de disparo	Corriente nominal In (A)	Corriente de prueba	Fijar tiempo
1	C, D	Todos los valores	1.13In	t≤1h
2	C, D	Todos los valores	1.45In	t < 1h
3	C, D	≤32	2.55In	s < t < 60s
		> 32		1s < t < 120s
4	C	Todos los valores	5In	t≤0.1s
	D		10In	
5	C	Todos los valores	10In	t≤0.1s
	D		20In	

Coeficiente de compensación de temperatura

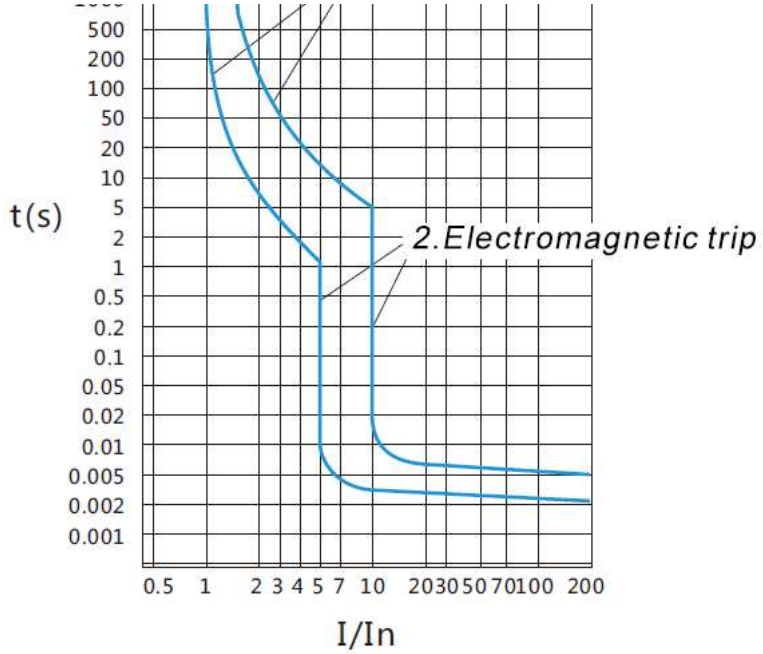
Corriente nominal (A)	El coeficiente de compensación de tempera				
	-10℃	0℃	10℃	20℃	
1~6	1.20	1.14	1.09	1.05	
10~32	1.18	1.12	1.08	1.04	
40~63	1.16	1.12	1.07	1.03	

El factor de corrección de la corriente utilizada por el interruptor automático a diferentes altitudes

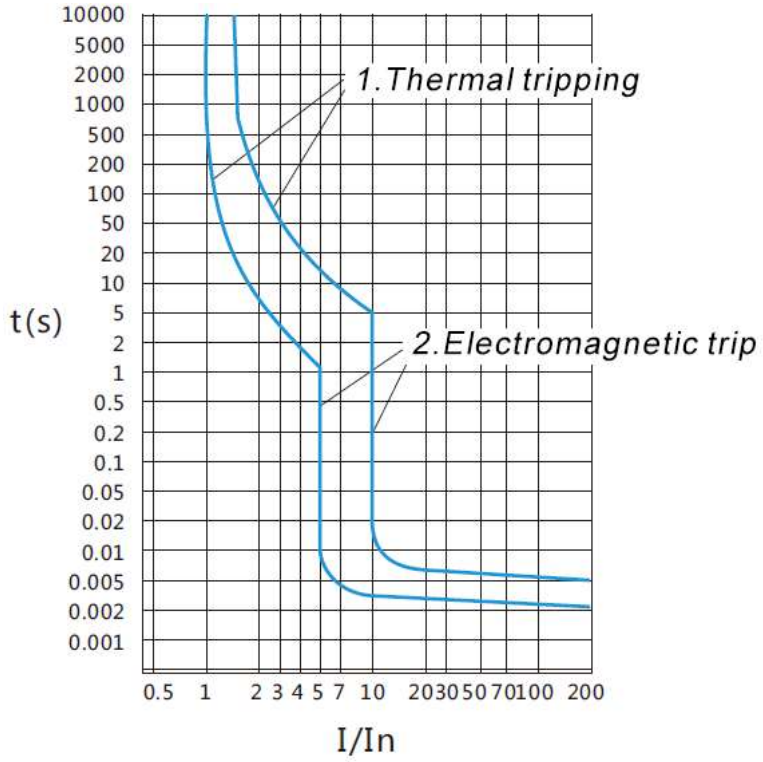
Tipo de disparo	Corriente nominal	≤2000m	2000~3000m	≥3000m	
C, D	1~63A	1	0.9	0.8	La corriente de funcionamiento después de los produc

Curva característica de disparo del interruptor

Curva característica de disparo tipo C



Curva característica de disparo tipo D

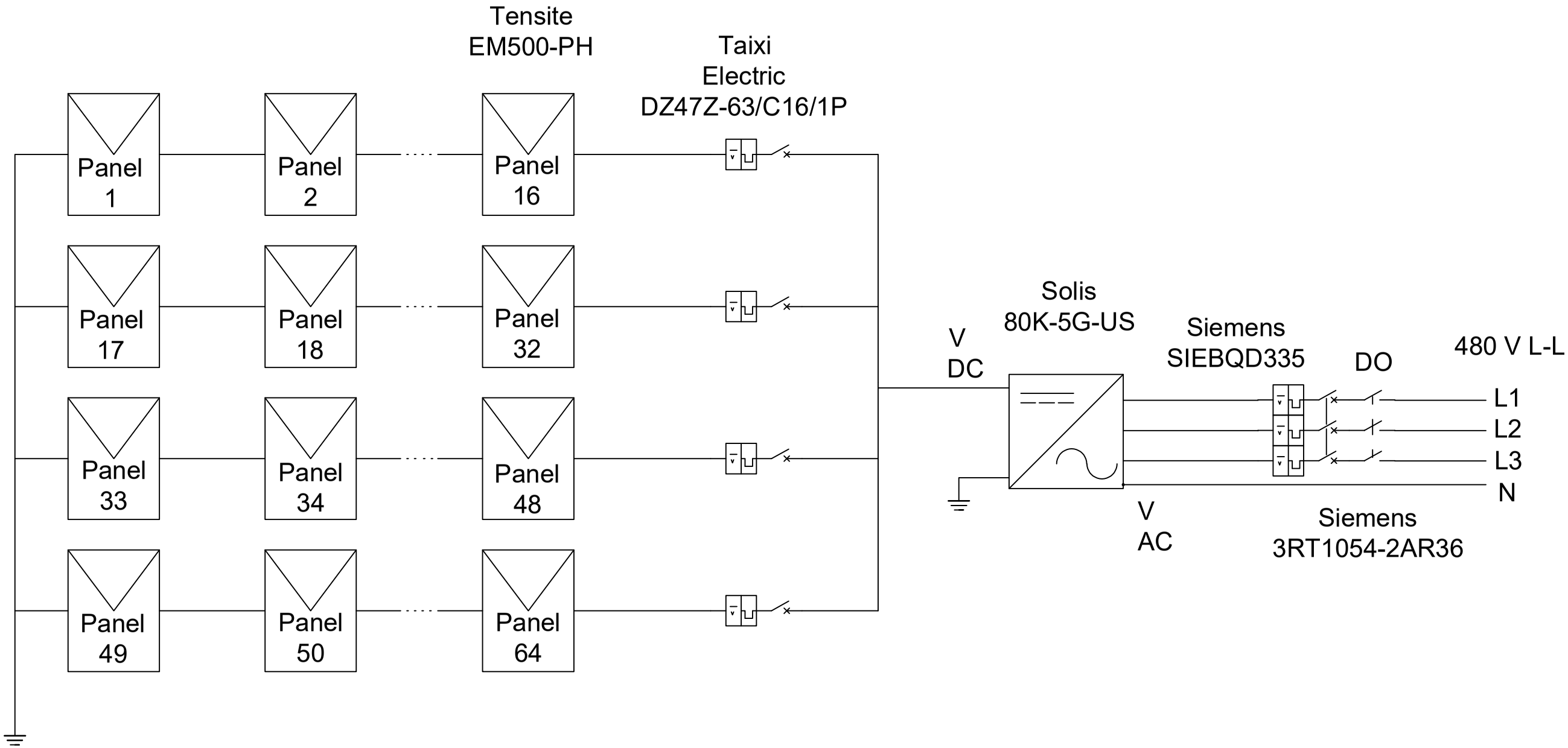


Cableado: 25 mm^2 y menos para la conexión del cable, el método de cableado son tornillos para apretar el cableado, el par es de 2,0 N

Corriente nominal In (A)	Área nominal de la sección
1~6	
10	
16~20	
25	
25	
40~50	
63	

8.14. Anexo N

Se adjunta el plano del subsistema de energía alternativa



TEC | INSTITUTO TECNOLÓGICO DE COSTA RICA AREA ACADEMICA DE INGENIERIA MECATRONICA	ESCALA:	ACOTACIÓN: mm	
	DISEÑO: A.MOYA	21/9/2023	
	DIBUJO: A.MOYA	21/9/2023	
	SUPERVISO: C.SALAZAR		
PARTE: SUBSISTEMA DE ENERGIA ALTERNATIVA	SISTEMA	LÁMINA	
PROYECTO: SISTEMA DE BOMBEO PARA ACUEDUCTO		1 / 1	

8.15. Anexo O

Se adjunta la hoja de datos del transformador TRI100017529842000

Ficha técnica del producto

Especificaciones

Trihal 1000KVA 60Hz 13.8KV/480V Dyn-11 2400msnm

TRI100017529842000

Principal

Product range	Trilliant
Tipo de producto o componente	Transformador
Tipo de transformador	Dry type transformer
Tipo de red	CA
Directivas	2015/2014/548/EC- ecodesign
Tipo de instalación	Interior
Maximum altitude	< 2400 m
Cooling mode	ANAF (air natural air forced)
Winding material	Aluminio
Insulation material	Cast resin HV Pre-impregnated LV
Degree of protection	IP31
Tipo de montaje	Sostenimiento de pie

Opcionales

Phase	3 fases
Rated power	1000 kVA
Rated frequency	60 Hz
Rated primary voltage	13.8 kV
Secondary voltage (at no-load)	Sin carga 480 V
Insulation voltage to industrial frequency (50 Hz 1 mn)	17.5 kV CA primario / tierra 1.1 kV CA seleccionable
Rated insulation level	Circuito primário 95 kV CA Circuito secundário 10 kV CA
Lighting impulse whistand voltage (BIL) , 1.2/50 µs	95 kV
Vector group	Dyn11
HV tappings (off circuit)	+/- 2 x 2.5 %
Short circuit impedance	6 %
No-load losses	2710 W
Load losses at 75°C/120 °C	11000 W 120 °C

Temperature rise of windings	100 K bobinado
Thermal class	F
Sound power level	62 dB 1 m
Consecutivo, seguido, continuo, adosado	Cable Conexión de embarrado
Protective relay	1.0 Ziehl relay
Altura	2070 mm
Anchura	1590 mm
Longitud	2925 mm
Total weight	2455 kg

Ambiente

Temperatura ambiente de funcionamiento	-25…40 °C C4
Temperatura ambiente	-50…40 °C C4
Environmental certification	0…95 % E4
Fire certificate	F1
Normas	IEC 60076-11 2018
Corrosion category	C3M

Unidades emabalaje

Tipo de unidad de paquete 1	PCE
Número de unidades en el paquete 1	1

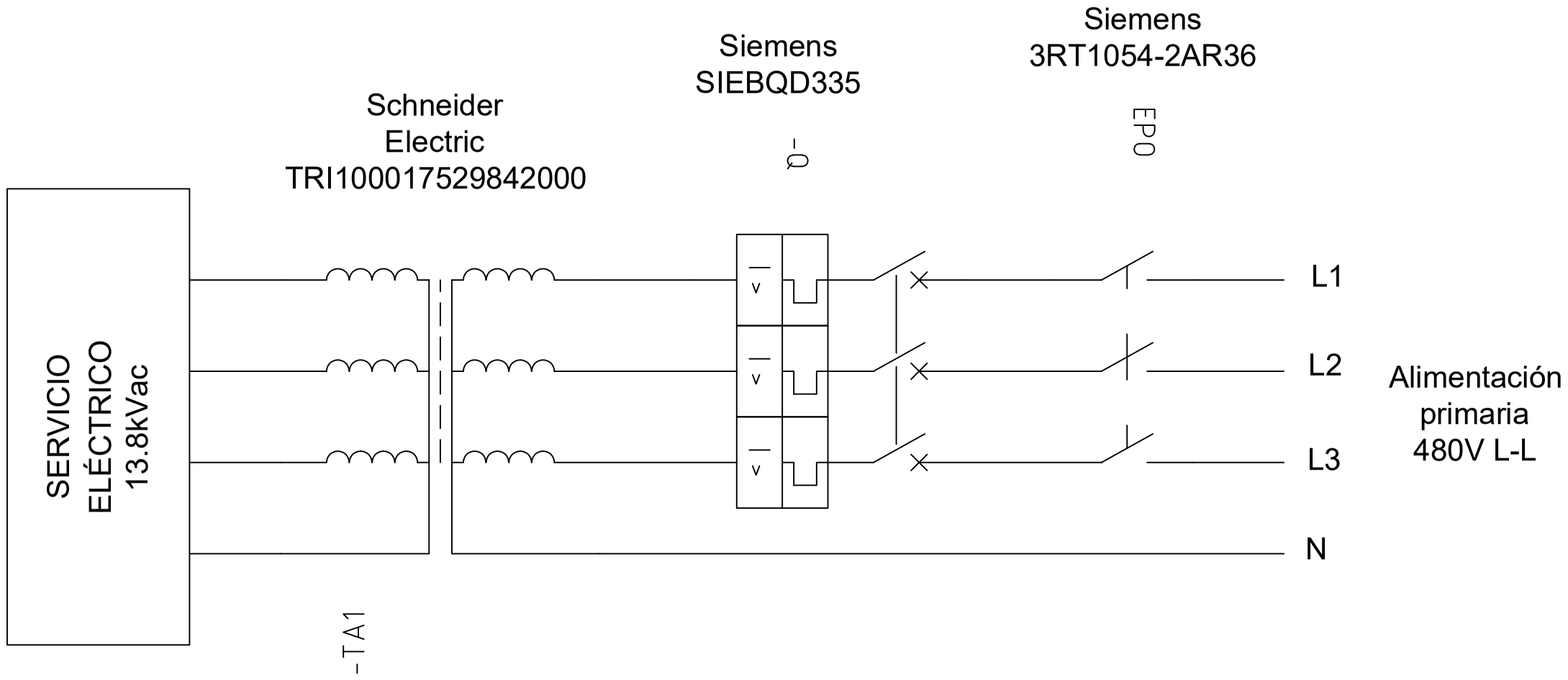
Oferta sostenibilidad

Reglamento REACh	Declaración de REACh
Conforme con REACh sin SVHC	Sí
Directiva RoHS UE	Cumplimiento proactivo (producto fuera del alcance de la normativa RoHS UE) Declaración RoHS UE
Sin mercurio	Sí
Normativa de RoHS China	Declaración RoHS China Producto fuera del ámbito de RoHS China. Declaración informativa de sustancias
Información sobre exenciones de RoHS	Sí

Reemplazo(s) recomendado(s)

8.16. Anexo P

Se adjunta el plano del subsistema de acondicionamiento de energía primaria



TEC | INSTITUTO TECNOLÓGICO DE COSTA RICA AREA ACADEMICA DE INGENIERIA MECATRONICA	ESCALA:	ACOTACIÓN: mm	
	DISEÑO: A.MOYA	21/9/2023	
	DIBUJO: A.MOYA	21/9/2023	
	SUPERVISO: C.SALAZAR		
PARTE: CIRCUITO ACONDICIONAMIENTO DE ENERGÍA PRIMARIA	SISTEMA	LÁMINA	
PROYECTO: SISTEMA DE BOMBEO PARA ACUEDUCTO		1 / 1	

8.17. Anexo Q

Se adjunta la hoja de datos del PLC Siemens S7-1200

SIMATIC S7-1200

4

Brochures

For brochures serving as selection guides for SIMATIC products refer to:

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

S7-1200

Overview

- The new modular miniature controller from the SIMATIC S7 family
- Consisting of:
  - controller with integrated PROFINET interface for communication with programming device, HMI or other SIMATIC controllers
  - powerful, integrated technology functions such as counting, measuring, closed-loop control, and motion control
  - integrated digital and analog inputs/outputs
  - signal boards for direct use in a controller
  - signal modules for expansion of controllers by input/output channels
  - communication modules for expansion of controllers by communications interfaces
  - accessories, e.g. power supply, switch module or SIMATIC Memory Card
- The miniature controller that offers maximum automation at minimum cost
- Extremely simple installation, programming and operation
- Large-scale integration, space-saving, powerful
- Suitable for small to medium-size automation engineering applications
- Can be used both for simple controls and for complex automation tasks
- All CPUs can be used in stand-alone mode, in networks and within distributed structures
- Suitable for applications where programmable controllers would not have been economically viable in the past
- With exceptional real-time performance and powerful communication options

Application

The SIMATIC S7-1200 is the controller for open-loop and closed-loop control tasks in mechanical equipment manufacture and plant construction. It combines maximum automation and minimum cost.

Due to the compact modular design with a high performance at the same time, the SIMATIC S7-1200 is suitable for a wide variety of automation applications. Its range of use extends from the replacement of relays and contactors up to complex automation tasks in networks and within distributed structures.

The S7-1200 also increasingly opens up areas for which special electronics was previously developed for economical reasons.

Application examples include, for example:

- Placement systems
- Conveyor systems
- Elevators and escalators
- Material transportation equipment
- Metalworking machinery
- Packaging machines
- Printing machines
- Textile machines
- Mixing systems
- Freshwater treatment plants
- Wastewater treatment plants
- External displays
- Electricity distribution stations
- Room temperature control
- Heating/cooling system control
- Energy management
- Fire protection systems
- Air conditioning
- Lighting control
- Pump control
- Security/access control systems

Design

The SIMATIC S7-1200 family consists of the following modules:

- 3 compact controllers with graded performances in different versions as wide-range AC or DC controllers
- 2 signal boards (analog and digital) for low-cost modular controller expansion directly on the CPU, with retention of the mounting space
- 13 different digital and analog signal modules
- 2 communication modules (RS232/RS485) for communication via point-to-point connection
- Ethernet switch with 4 ports for implementation of many different network topologies
- PS 1207 stabilized power supply units, line voltage 115/230 V AC, rated voltage 24 V DC

Mechanical features

- Rugged, compact plastic enclosure
- Easily accessible connection and control elements, protected by front flaps
- Removable connection terminals, also for analog or digital expansion modules

Device features

- International standards:
  SIMATIC S7-1200 complies with the standards according to VDE, UL, CSA and FM (Class I, Category 2; Danger zone groups A, B, C and D, T4A). The quality management system used during production is certified according to ISO 9001

Design (continued)

Communication

The SIMATIC S7-1200 is equipped with different communication mechanisms:

- Integral PROFINET interface
- Point-to-point connection via communication modules

PROFINET interface

The integral PROFINET interface permits communication with:

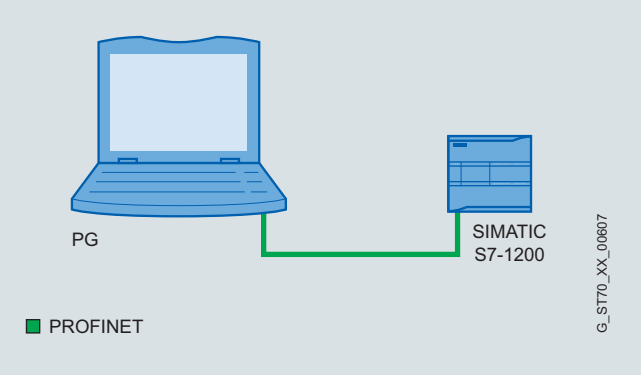
- Programming device
- HMI devices
- Other SIMATIC controllers

The following protocols are supported:

- TCP/IP
- ISO-on-TCP
- S7 communication

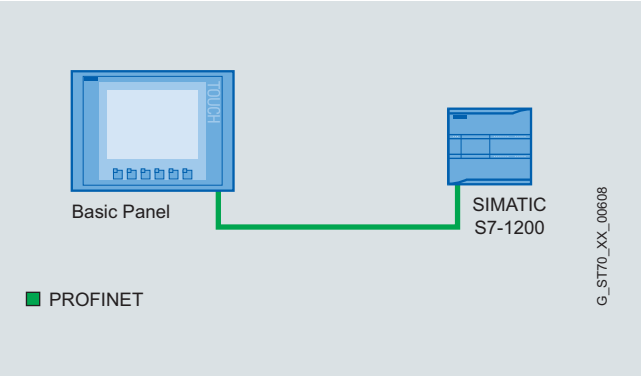
The following can be connected:

Field PG programming device and PCs via standard CAT5 cable.



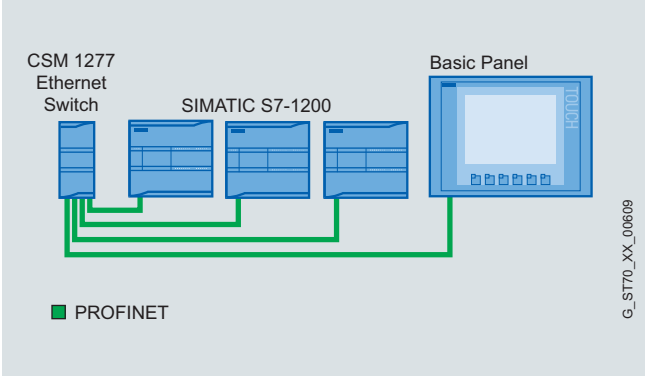
Connection between PG and CPU of SIMATIC S7-1200

- SIMATIC HMI Basic Panels



Connection between Basic Panel and CPU of SIMATIC S7-1200

- Further SIMATIC S7-1200 controllers

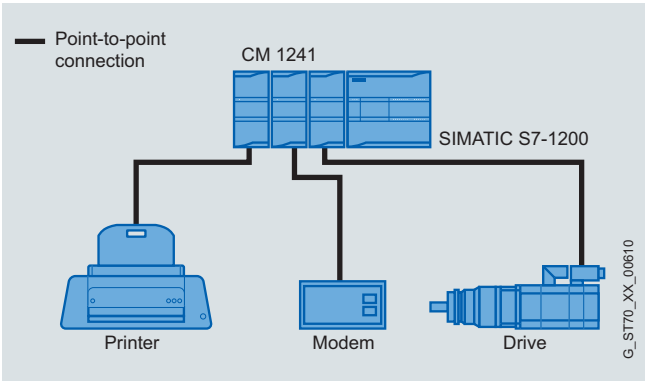


Connection of several devices via CSM 1277 Ethernet switch

Point-to-point interface, freely-programmable interface mode

Communication modules permit communication via point-to-point connections. The RS232 and RS485 physical transmission media are used. Data transmission is carried out in the "Freeport" mode of the CPU. A user-specific, bit-oriented communication protocol is used (e.g. ASCII protocol, USS, or MODBUS).

Any terminal equipment with a serial interface can be connected, e.g. drives, printers, bar code readers, modems, etc.



Point-to-point connection via CM 1241 in programmable interface mode

S7-1200

Function

The S7-1200 is characterized by:

- Extremely simple starter solution:
  Special starter packages and introductions facilitate familiarization.
- Uncomplicated operation:
  Powerful standard commands which are simple to use, together with the user-friendly programming software, reduce the programming overhead to a minimum.
- Exceptional real-time characteristics:
  Special interrupt functions, fast counters, and pulse outputs permit use even with time-critical processes.

The SIMATIC S7-1200 meets national and international standards:

- UL 508
- CSA C22.2 No. 142
- FM Class I, div. 2, group A, B, C, D; T4A Class I, Zone 2, IIC, T4
- VDE 0160
- EN 61131-2
- Requirements of the EMC directive in accordance with EN 50081-1, 50081-2 and 50082-2

Technical specifications

General technical specifications	
Degree of protection	IP20 acc. to IEC 529
Ambient temperature	
• Operation (95% humidity)	
- horizontal installation	0 ... 55 °C
- vertical installation	0 ... 45 °C
• Transportation and storage	-40 ... +70 °C
- with 95% humidity	25 ... 55 °C
Insulation	
• 5/24 V DC circuits	500 V AC test voltage
• 115/230 V AC circuits to ground	1500 V AC test voltage
• 115/230 V AC circuits to 115/230 V AC circuits	1500 V AC test voltage
• 230 V AC circuits to 5/24 V DC circuits	1500 V AC test voltage
• 115 V AC circuits to 5/24 V DC circuits	1500 V AC test voltage
Electromagnetic compatibility	Requirements of the EMC directive
• Noise immunity acc. to EN 50082-2	Test acc. to: IEC 801-2, IEC 801-3, IEC 801-4, EN 50141, EN 50204, IEC 801-5, VDE 0160
• Emitted interference acc. to EN 50081-1 and EN 50081-2	Test according to EN 55011, Class A, Group 1

General technical specifications	
Mechanical strength	
• Vibrations, test acc. to / tested with	IEC 68, Part 2-6: 10 ... 57 Hz; constant amplitude 0.3 mm; 58 ... 150 Hz; constant acceleration 1 g (mounted on DIN rail) or 2 g (mounted in switchboard); mode of vibration: frequency sweeps with a sweep rate of 1 octave/minute; duration of vibration: 10 frequency sweeps per axis in each direction of the three mutually perpendicular axes
• Shocks, test acc. to / tested with	IEC 68, Part 2-27/half-sine: magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes

Environmental conditions	SIPLUS extreme		
Ambient temperature range	-25 to +60/+70 °C[1]		
Relative humidity	100% Dewing, condensation and icing permissible		
Contaminant concentration	EN60721-3-3 3C4 and ISA S71.04 G1, G2, G3, GX[2]		
		Constant load	Limit value[3]
	SO_2	4.8 ppm	17.8 ppm
	H_2S	9.9 ppm	49.7 ppm
	Cl	0.2 ppm	1.0 ppm
	HCl	0.66 ppm	3.3 ppm
	HF	0.12 ppm	2.4 ppm
	NH	49 ppm	247 ppm
	O_3	0.1 ppm	1.0 ppm
	NO_x	5.2 ppm	10.4 ppm
	At RH < 75%, condensation permitted		
Saline fog	Saline fog test (EN 60068-2-52)		
Mechanically active substances	EN60721-3-3 3S4		
• Dust (suspended substance content)	4.0 mg/m^{2}h		
• Dust (precipitation)	40 mg/m^{2}h incl. conductive sand/dust ("Arizona dust")		
Biologically active substances	EN60721-3-3 3B2 Mildew growth, Fungus, excluding fauna		

1) Depends on the product family
2) ISA -S71.04 severity level GX from October 2010
3) 30 min/day

More information

Brochures

Information material for downloading can be found in the Internet:

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

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 / 5 … 250 V AC	2 A; 30 W DC / 200 W AC
• AC/DC/relay	85 … 264 V AC	24 V DC	5 … 30 V DC / 5 … 250 V AC	2 A; 30 W DC / 200 W AC

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-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Product version			
associated programming package	STEP 7 Basic V10.5	STEP 7 Basic V10.5	STEP 7 Basic V10.5
Supply voltages			
Rated value			
• 24 V DC		Yes	Yes
• permissible range, lower limit (DC)		20.4 V	20.4 V
• permissible range, upper limit (DC)		28.8 V	28.8 V
• 120 V AC	Yes		
• 230 V AC	Yes		
• permissible range, lower limit (AC)	85 V		
• permissible range, upper limit (AC)	264 V		
• permissible frequency range, lower limit	47 Hz		
• permissible frequency range, upper limit	63 Hz		
Load voltage L+			
• Rated value (DC)		24 V	24 V
• permissible range, lower limit (DC)		20.4 V	20.4 V
• permissible range, upper limit (DC)		28.8 V	28.8 V
Current consumption			
Current consumption (rated value)	60 mA at 120 V AC 30 mA at 240 V AC	300 mA; Typical	300 mA; Typical
Current consumption, max.	180 mA at 120 V AC 90 mA at 240 V AC	0.9 A; 24 V DC	0.9 A; 24 V DC
Inrush current, max.	20 A; at 264 V	12 A; 28.8 V DC	12 A; 28.8 V DC
Current output to backplane bus (DC 5 V), max.	750 mA; 5 V DC max. for SM and CM	750 mA; 5 V DC max. for SM and CM	750 mA; 5 V DC max. for SM and CM
Power loss			
Power loss, typ.	10 W	8 W	8 W
Memory			
Available project memory/user memory	25 kbyte	25 kbyte	25 kbyte

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Work memory			
• integrated	25 kbyte	25 kbyte	25 kbyte
• expandable	No	No	No
Load memory			
• integrated	1 Mbyte	1 Mbyte	1 Mbyte
• expandable	24 Mbyte; with SIEMENS Memory Card	24 Mbyte; with SIEMENS Memory Card	24 Mbyte; with SIEMENS Memory Card
Backup			
• present	Yes; entire project maintenance-free in the integral EEPROM	Yes; entire project maintenance-free in the integral EEPROM	Yes; entire project maintenance-free in the integral EEPROM
• without battery	Yes	Yes	Yes
CPU/ blocks			
Number of blocks (total)	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory
OB			
• Number, max.	Limited only by RAM for code	Limited only by RAM for code	Limited only by RAM for code
CPU/ processing times			
for bit operations, min.	0.1 µs; / instruction	0.1 µs; / instruction	0.1 µs; / instruction
for word operations, min.	12 µs; / instruction	12 µs; / instruction	12 µs; / instruction
for floating point arithmetic, min.	18 µs; / instruction	18 µs; / instruction	18 µs; / instruction
Data areas and their retentivity			
retentive data area in total (incl. times, counters, flags), max.	2 048 byte	2 048 byte	2 048 byte
Flag			
• Number, max.	4 kbyte; Size of bit memory address area	4 kbyte; Size of bit memory address area	4 kbyte; Size of bit memory address area
Address area			
I/O address area			
• I/O address area, overall	1024 bytes for inputs / 1024 bytes for outputs	1024 bytes for inputs / 1024 bytes for outputs	1024 bytes for inputs / 1024 bytes for outputs
• overall	1 024 byte	1 024 byte	1 024 byte
• Outputs	1 024 byte	1 024 byte	1 024 byte
Process image			
• Inputs, adjustable	1 kbyte	1 kbyte	1 kbyte
• Outputs, adjustable	1 kbyte	1 kbyte	1 kbyte
Digital channels			
• integrated channels (DI)	6	6	6
• integrated channels (DO)	4	4	4
Analog channels			
• Integrated channels (AI)	2	2	2
• Integrated channels (AO)	0	0	0
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

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Time of day			
Clock			
• Hardware clock (real-time clock)	Yes	Yes	Yes
• Backup time	240 h; Typical	240 h; Typical	240 h; Typical
• Deviation per day, max.	60 s/month at 25°C	60 s/month at 25°C	60 s/month at 25°C
Test commissioning functions			
Status/control			
• Status/control variable	Yes	Yes	Yes
• Variables	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters
Forcing			
• Forcing	Yes	Yes	Yes
Communication functions			
S7 communication			
• supported	Yes	Yes	Yes
• as server	Yes	Yes	Yes
Open IE communication			
• TCP/IP	Yes	Yes	Yes
• ISO-on-TCP (RFC1006)	Yes	Yes	Yes
Number of connections			
• overall	15; dynamically	15; dynamically	15; dynamically
1st interface			
Type of interface	PROFINET	PROFINET	PROFINET
Physics	Ethernet	Ethernet	Ethernet
Isolated	Yes	Yes	Yes
automatic detection of transmission speed	Yes	Yes	Yes
Autonegotiation	Yes	Yes	Yes
Autocrossover	Yes	Yes	Yes
CPU/ programming			
Configuration software			
• STEP 7	STEP 7 Basic V10.5	STEP 7 Basic V10.5	STEP 7 Basic V10.5
Programming language			
• LAD	Yes	Yes	Yes
• FBD	Yes	Yes	Yes
Cycle time monitoring			
• can be set	Yes	Yes	Yes
Digital inputs			
Number of digital inputs	6; Integrated	6; Integrated	6; Integrated
• of which, inputs usable for technological functions	3; HSC (High Speed Counting)	3; HSC (High Speed Counting)	3; HSC (High Speed Counting)
m/p-reading	Yes	Yes	Yes
Number of simultaneously controllable inputs			
• All mounting positions - Concurrently controllable inputs, up to 40 °C	6	6	6

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Input voltage			
• Rated value, DC	24 V	24 V	24 V
• for signal "0"	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA
• for signal "1"	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Input current			
• for signal "1", typ.	1 mA	1 mA	1 mA
Input delay (for rated value of input voltage)			
• for standard inputs			
- parameterizable	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in 4 groups	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in 4 groups
- at "0" to "1", min.	0.2 ms	0.2 ms	0.2 ms
- at "0" to "1", max.	12.8 ms	12.8 ms	12.8 ms
• for interrupt inputs			
- parameterizable	Yes	Yes	Yes
• for counter/technological functions			
- parameterizable	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			
• Cable length, shielded, max.	500 m; 50 m for technological functions	500 m; 50 m for technological functions	500 m; 50 m for technological functions
• Cable length unshielded, max.	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; Relay	4	4; Relay
• of which high-speed 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
Limitation of inductive shutdown voltage to		L+ (-48 V)	
Switching capacity of the outputs			
• with resistive load, max.	2 A	0.5 A	2 A
• on lamp load, max.	30 W DC; 200 W AC	5 W	30 W DC; 200 W AC
Output voltage			
• for signal "0" (DC), max.		0.1 V; with 10k ohms load	
• for signal "1", min.		20 V	
Output current			
• for signal "1" rated value		0.5 A	
• for signal "0" residual current, max.		0.1 mA	
Output delay with resistive 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.
Parallel switching of 2 outputs			
• for increased power	No		No
Switching frequency			
• of the pulse outputs, with resistive load, max.	1 Hz	100 kHz	1 Hz
Cable length			
• Cable length, shielded, max.	500 m	500 m	500 m
• Cable length unshielded, max.	150 m	150 m	150 m

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Relay outputs			
Number of relay outputs	4		4
Number of operating cycles	mechanically 10 million, at rated load voltage 100,000		mechanically 10 million, at rated load voltage 100,000
Analog inputs			
Number of analog inputs	2	2	2
Number of analog inputs for voltage/current measurement	2		2
Cable length, shielded, max.	100 m; twisted and shielded	100 m; twisted and shielded	100 m; twisted and shielded
Input ranges			
• Voltage	Yes	Yes	Yes
Input ranges (rated values), voltages			
• 0 to +10 V	Yes	Yes	Yes
• Input resistance (0 to 10 V)	≥100k ohms	≥100k ohms	≥100k ohms
Analog value creation			
Integrations and conversion time/ resolution per channel			
• Resolution with overrange (bit including sign), max.	10 bit	10 bit	10 bit
• Integration time, parameterizable	Yes	Yes	Yes
• Conversion time (per channel)	625 µs	625 µs	625 µs
Formation of analog values (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 to 28.8 V	permissible range: 20.4 to 28.8 V	permissible range: 20.4 to 28.8 V
Encoder			
Connectable encoders			
• 2-wire BEROS	Yes	Yes	Yes
Integrated Functions			
Number of counters	3	3	3
Counter frequency (counter) max.	100 kHz	100 kHz	100 kHz
Frequency meter	Yes	Yes	Yes
controlled positioning	Yes	Yes	Yes
PID controller	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 digital inputs			
• Galvanic isolation 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

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Galvanic isolation digital outputs			
• Galvanic isolation 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			
Interference immunity against discharge of static electricity			
• Interference immunity against discharge of static electricity acc. to 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
Interference immunity to cable-borne interference			
• on the supply lines acc. to IEC 61000-4-4	Yes	Yes	Yes
• Interference immunity on signal lines acc. to IEC 61000-4-4	Yes	Yes	Yes
Immunity to surge voltages			
• on the supply lines acc. to IEC 61000-4-5	Yes	Yes	Yes
Immunity to conducted interference, induced by high-frequency fields			
• Interference immunity against high-frequency radiation acc. to IEC 61000-4-6	Yes	Yes	Yes
Emission of radio interference in accordance with EN 55 011			
• Emission of radio interferences acc. to EN 55 011 (limit class A)	Yes; Group 1	Yes; Group 1	Yes; Group 1
• Emission of radio interference acc. to EN 55 011 (limit class B)	Yes	Yes	Yes
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 shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package
• 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%

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Mechanical and climatic conditions during operation			
Climatic conditions during operation			
• Temperature			
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted 95% rel. humidity, no condensation	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted 95% rel. humidity, no condensation
- permissible temperature change	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 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	-1000m ... 2000m	-1000m ... 2000m	-1000m ... 2000m
• Concentration of pollutants			
- SO_2 at RH < 60% without condensation	< 0.5 ppm	< 0.5 ppm	< 0.5 ppm
- H_2S at RH < 60% without condensation	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm
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
Air pressure			
• Operation, min.	795 hPa	795 hPa	795 hPa
• Operation, max.	1 080 hPa	1 080 hPa	1 080 hPa
• Storage/transport, min.	660 hPa	660 hPa	660 hPa
• Storage/transport, max.	1 080 hPa	1 080 hPa	1 080 hPa
Relative humidity			
• Operation, max.	95 %; no condensation	95 %; no condensation	95 %; no condensation
Vibrations			
• Vibrations	2*g* wall mounting, 1*g* DIN rail	2*g* wall mounting, 1*g* DIN rail	2*g* wall mounting, 1*g* DIN rail
• Operation, checked according to IEC 60068-2-6	Yes	Yes	Yes
Shock test			
• checked according to IEC 60068-2-27	Yes; IEC 68, Part 2-27 half-sine: Strength of the shock 15 g (peak value), duration 11 ms	Yes; IEC 68, Part 2-27 half-sine: Strength of the shock 15 g (peak value), duration 11 ms	Yes; IEC 68, Part 2-27 half-sine: Strength of the shock 15 g (peak value), duration 11 ms
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

Technical specifications (continued)

	6ES7 211-1BD30-0XB0	6ES7 211-1AD30-0XB0	6ES7 211-1HD30-0XB0
Product-type designation	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/DC	CPU 1211C DC/DC/Relay
Dimensions and weight			
Dimensions			
• Width	90 mm	90 mm	90 mm
• Height	100 mm	100 mm	100 mm
• Depth	75 mm	75 mm	75 mm
Weight			
• Weight, approx.	420 g	370 g	380 g

4

Ordering data

		Order No.
CPU 1211C **Compact CPU, AC/DC/relay**; integrated program/data memory 25 kbyte, load memory 1 Mbyte; 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**
CPU 1211C **Compact CPU, DC/DC/DC**; integrated program/data memory 25 kbyte, load memory 1 Mbyte; 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, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) at 100 kHz	C	**6ES7 211-1AD30-0XB0**
CPU 1211C **Compact CPU, DC/DC/relay**; integrated program/data memory 25 kbyte, load memory 1 Mbyte; 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	C	**6ES7 211-1HD30-0XB0**

		Order No.
Accessories		
SB 1221 signal board		
4 inputs, 5 V DC, 200 kHz	C	**6ES7 221-3AD30-0XB0**
4 inputs, 24 V DC, 200 kHz	C	**6ES7 221-3BD30-0XB0**
SB 1222 signal board		
4 outputs, 5 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1AD30-0XB0**
4 outputs, 24 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1BD30-0XB0**
SB 1223 signal board		
2 inputs, 24 V DC, IEC type 1 active high; 2 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**
2 inputs, 5 V DC, 200 kHz 2 outputs 5 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3AD30-0XB0**
2 inputs, 24 V DC, 200 kHz 2 outputs 24 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3BD30-0XB0**
SB 1232 signal board 1 analog output, ±10 V with 12 bits or 0 to 20 mA with 11 bits	C	**6ES7 232-4HA30-0XB0**
Simulator (optional)		
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		**6ES7 954-8LF00-0AA0**
Terminal block (spare part)		
For CPU 1211/1212		
For DI, with 14 screws, tin-plated; 4 units	C	**6ES7 292-1AH30-0XA0**
For DO, with 8 screws, tin-plated; 4 units	C	**6ES7 292-1AP30-0XA0**
For AI, with 3 screws, tin-plated; 4 units	C	**6ES7 292-1BC30-0XA0**

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

CPU 1211C

Ordering data

		Order No.
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**

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

		Order No.
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

More information

Brochures

Information material for downloading can be found in the Internet:

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

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 / 5 … 250 V AC	2 A; 30 W DC / 200 W AC
• AC/DC/relay	85 … 264 V AC	24 V DC	5 … 30 V DC / 5 … 250 V AC	2 A; 30 W DC / 200 W AC

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-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Product version			
associated programming package	STEP 7 Basic V10.5	STEP 7 Basic V10.5	STEP 7 Basic V10.5
Supply voltages			
Rated value			
• 24 V DC		Yes	Yes
• permissible range, lower limit (DC)		20.4 V	20.4 V
• permissible range, upper limit (DC)		28.8 V	28.8 V
• 120 V AC	Yes		
• 230 V AC	Yes		
• permissible range, lower limit (AC)	85 V		
• permissible range, upper limit (AC)	264 V		
• permissible frequency range, lower limit	47 Hz		
• permissible frequency range, upper limit	63 Hz		
Load voltage L+			
• Rated value (DC)	24 V	24 V	24 V
• permissible range, lower limit (DC)	5 V	20.4 V	5 V
• permissible range, upper limit (DC)	250 V	28.8 V	250 V
Current consumption			
Current consumption (rated value)	80 mA at 120 V AC 40 mA at 240 V AC		175 mA; Typical
Current consumption, max.	240 mA at 120 V AC 120 mA at 240 V AC	1.2 A; 24 V DC	1.2 A; 24 V DC
Inrush current, max.	20 A; at 264 V	12 A; 28.8 VDC	12 A; At 28.8 V
Current output to backplane bus (DC 5 V), max.	1 000 mA; 5 V DC max. for SM and CM	1 000 mA; 5 V DC max. for SM and CM	1 000 mA; 5 V DC max. for SM and CM
Power loss			
Power loss, typ.	11 W	9 W	9 W
Memory			
Available project memory/user memory	25 kbyte	25 kbyte	25 kbyte

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Work memory			
• integrated	25 kbyte	25 kbyte	25 kbyte
• expandable	No	No	No
Load memory			
• integrated	1 Mbyte	1 Mbyte	1 Mbyte
• expandable	24 Mbyte; with SIEMENS Memory Card	24 Mbyte; with SIEMENS Memory Card	24 Mbyte; with SIEMENS Memory Card
Backup			
• present	Yes; entire project maintenance-free in the integral EEPROM	Yes; entire project maintenance-free in the integral EEPROM	Yes; entire project maintenance-free in the integral EEPROM
• without battery	Yes	Yes	Yes
CPU/ blocks			
Number of blocks (total)	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory
OB			
• Number, max.	Limited only by RAM for code	Limited only by RAM for code	Limited only by RAM for code
CPU/ processing times			
for bit operations, min.	0.1 µs; / instruction	0.1 µs; / instruction	0.1 µs; / instruction
for word operations, min.	12 µs; / instruction	12 µs; / instruction	12 µs; / instruction
for floating point arithmetic, min.	18 µs; / instruction	18 µs; / instruction	18 µs; / instruction
Data areas and their retentivity			
retentive data area in total (incl. times, counters, flags), max.	2 048 byte	2 048 byte	2 048 byte
Flag			
• Number, max.	4 kbyte; Size of bit memory address area	4 kbyte; Size of bit memory address area	4 kbyte; Size of bit memory address area
Address area			
I/O address area			
• I/O address area, overall	1024 bytes for inputs / 1024 bytes for outputs	1024 bytes for inputs / 1024 bytes for outputs	1024 bytes for inputs / 1024 bytes for outputs
• overall	1 024 byte	1 024 byte	1 024 byte
• Outputs	1 024 byte	1 024 byte	1 024 byte
Process image			
• Inputs, adjustable	1 kbyte	1 kbyte	1 kbyte
• Outputs, adjustable	1 kbyte	1 kbyte	1 kbyte
Digital channels			
• integrated channels (DI)	8	8	8
• integrated channels (DO)	6	6	6
Analog channels			
• Integrated channels (AI)	2	2	2
• Integrated channels (AO)	0	0	0
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

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Time of day			
Clock			
• Hardware clock (real-time clock)	Yes	Yes	Yes
• Backup time	240 h; Typical	240 h; Typical	240 h; Typical
• Deviation per day, max.	60 s/month at 25°C	60 s/month at 25°C	60 s/month at 25°C
Test commissioning functions			
Status/control			
• Status/control variable	Yes	Yes	Yes
• Variables	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters
Forcing			
• Forcing	Yes	Yes	Yes
Communication functions			
S7 communication			
• supported	Yes	Yes	Yes
• as server	Yes	Yes	Yes
Open IE communication			
• TCP/IP	Yes	Yes	Yes
• ISO-on-TCP (RFC1006)	Yes	Yes	Yes
Number of connections			
• overall	15; dynamically	15; dynamically	15; dynamically
1st interface			
Type of interface	PROFINET	PROFINET	PROFINET
Physics	Ethernet	Ethernet	Ethernet
Isolated	Yes	Yes	Yes
automatic detection of transmission speed	Yes	Yes	Yes
Autonegotiation	Yes	Yes	Yes
Autocrossover	Yes	Yes	Yes
CPU/ programming			
Configuration software			
• STEP 7	STEP 7 Basic V10.5	STEP 7 Basic V10.5	STEP 7 Basic V10.5
Programming language			
• LAD	Yes	Yes	Yes
• FBD	Yes	Yes	Yes
Cycle time monitoring			
• can be set	Yes	Yes	Yes
Digital inputs			
Number of digital inputs	8; Integrated	8; Integrated	8; Integrated
• of which, inputs usable for technological functions	4; HSC (High Speed Counting)	4; HSC (High Speed Counting)	4; HSC (High Speed Counting)
m/p-reading	Yes	Yes	Yes
Number of simultaneously controllable inputs			
• All mounting positions - Concurrently controllable inputs, up to 40 °C	8	8	8

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Input voltage			
• Rated value, DC	24 V	24 V	24 V
• for signal "0"	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA
• for signal "1"	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Input current			
• for signal "1", typ.	1 mA	1 mA	1 mA
Input delay (for rated value of input voltage)			
• for standard inputs			
- parameterizable	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four
- at "0" to "1", min.	0.2 ms	0.2 ms	0.2 ms
- at "0" to "1", max.	12.8 ms	12.8 ms	12.8 ms
• for interrupt inputs			
- parameterizable	Yes	Yes	Yes
• for counter/technological functions			
- parameterizable	Single phase : 3 at 100 kHz, 1 at 30 kHz differential: 3 at 80 kHz, 1 at 30 kHz	Single phase : 3 at 100 kHz, 1 at 30 kHz differential: 3 at 80 kHz, 1 at 30 kHz	Single phase : 3 at 100 kHz, 1 at 30 kHz differential: 3 at 80 kHz, 1 at 30 kHz
Cable length			
• Cable length, shielded, max.	500 m; 50 m for technological functions	500 m; 50 m for technological functions	500 m; 50 m for technological functions
• Cable length unshielded, max.	300 m; For technological functions: No	300 m; For technological functions: No	300 m; For technological functions: No
Digital outputs			
Number of digital outputs	6; Relay	6	6; Relay
• of which high-speed 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
Limitation of inductive shutdown voltage to		L+ (-48 V)	
Switching capacity of the outputs			
• with resistive load, max.	2 A	0.5 A	2 A
• on lamp load, max.	30 W DC; 200 W AC	5 W	30 W DC; 200 W AC
Output voltage			
• for signal "0" (DC), max.		0.1 V; with 10k ohms load	
• for signal "1", min.		20 V	
Output current			
• for signal "1" rated value		0.5 A	
• for signal "0" residual current, max.		0.1 mA	
Output delay with resistive 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 the pulse outputs, with resistive load, max.	1 Hz	100 kHz	1 Hz
Cable length			
• Cable length, shielded, max.	500 m	500 m	500 m
• Cable length unshielded, max.	150 m	150 m	150 m

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Relay outputs			
Number of relay outputs	6		6
Number of operating cycles	mechanically 10 million, at rated load voltage 100,000		mechanically 10 million, at rated load voltage 100,000
Analog inputs			
Number of analog inputs	2	2	2
Cable length, shielded, max.	100 m; twisted and shielded	100 m; twisted and shielded	100 m; twisted and shielded
Input ranges			
• Voltage	Yes	Yes	Yes
Input ranges (rated values), voltages			
• 0 to +10 V	Yes	Yes	Yes
• Input resistance (0 to 10 V)	≥100k ohms	≥100k ohms	≥100k ohms
Analog value creation			
Integrations and conversion time/ resolution per channel			
• Resolution with overrange (bit including sign), max.	10 bit	10 bit	10 bit
• Integration time, parameterizable	Yes	Yes	Yes
• Conversion time (per channel)	625 µs	625 µs	625 µs
Formation of analog values (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 to 28.8 V	permissible range: 20.4 to 28.8 V	permissible range: 20.4 to 28.8 V
Encoder			
Connectable encoders			
• 2-wire BEROS	Yes	Yes	Yes
Integrated Functions			
Number of counters	4	4	4
Counter frequency (counter) max.	100 kHz	100 kHz	100 kHz
Frequency meter	Yes	Yes	Yes
controlled positioning	Yes	Yes	Yes
PID controller	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 digital inputs			
• Galvanic isolation 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

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Galvanic isolation digital outputs			
• Galvanic isolation 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			
Interference immunity against discharge of static electricity			
• Interference immunity against discharge of static electricity acc. to 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
Interference immunity to cable-borne interference			
• on the supply lines acc. to IEC 61000-4-4	Yes	Yes	Yes
• Interference immunity on signal lines acc. to IEC 61000-4-4	Yes	Yes	Yes
Immunity to surge voltages			
• on the supply lines acc. to IEC 61000-4-5	Yes	Yes	Yes
Immunity to conducted interference, induced by high-frequency fields			
• Interference immunity against high-frequency radiation acc. to IEC 61000-4-6	Yes	Yes	Yes
Emission of radio interference in accordance with EN 55 011			
• Emission of radio interferences acc. to EN 55 011 (limit class A)	Yes; Group 1	Yes; Group 1	Yes; Group 1
• Emission of radio interference acc. to EN 55 011 (limit class B)	Yes	Yes	Yes
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 shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package
• 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%

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Mechanical and climatic conditions during operation			
Climatic conditions during operation			
• Temperature			
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
- permissible temperature change	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 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	-1000m ... 2000m	-1000m ... 2000m	-1000m ... 2000m
• Concentration of pollutants			
- SO_2 at RH < 60% without condensation	< 0.5 ppm	< 0.5 ppm	< 0.5 ppm
- H_2S at RH < 60% without condensation	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm
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
Air pressure			
• Operation, min.	795 hPa	795 hPa	795 hPa
• Operation, max.	1 080 hPa	1 080 hPa	1 080 hPa
• Storage/transport, min.	660 hPa	660 hPa	660 hPa
• Storage/transport, max.	1 080 hPa	1 080 hPa	1 080 hPa
Relative humidity			
• Operation, max.	95 %; no condensation	95 %; no condensation	95 %; no condensation
Vibrations			
• Vibrations	2*g* panel mount, 1*g* DIN rail mount	2*g* panel mount, 1*g* DIN rail mount	2*g* panel mount, 1*g* DIN rail mount
• Operation, checked according to IEC 60068-2-6	Yes	Yes	Yes
Shock test			
• checked according to IEC 60068-2-27	Yes; 15 G, 11 ms pulse, 6 shocks in each of 3 axes	Yes; 15 G, 11 ms pulse, 6 shocks in each of 3 axes	Yes; 15 G, 11 ms pulse, 6 shocks in each of 3 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

Technical specifications (continued)

	6ES7 212-1BD30-0XB0	6ES7 212-1AD30-0XB0	6ES7 212-1HD30-0XB0
Product-type designation	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/DC	CPU 1212C AC/DC/Relay
Dimensions and weight			
Dimensions			
• Width	90 mm	90 mm	90 mm
• Height	100 mm	100 mm	100 mm
• Depth	75 mm	75 mm	75 mm
Weight			
• Weight, approx.	425 g	370 g	385 g

4

Ordering data

		Order No.
CPU 1212C Compact CPU, AC/DC/relay; integral program/data memory 25 kbyte, load memory 1 Mbyte; 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**
CPU 1212C Compact CPU, DC/DC/DC; integrated program/data memory 25 kbyte, load memory 1 Mbyte; 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, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) at 100 kHz	C	**6ES7 212-1AD30-0XB0**
CPU 1212C Compact CPU, DC/DC/relay; integrated program/data memory 25 kbyte, load memory 1 Mbyte; 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	C	**6ES7 212-1HD30-0XB0**

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

		Order No.
Accessories		
SB 1221 signal board		
4 inputs, 5 V DC, 200 kHz	C	**6ES7 221-3AD30-0XB0**
4 inputs, 24 V DC, 200 kHz	C	**6ES7 221-3BD30-0XB0**
SB 1222 signal board		
4 outputs, 5 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1AD30-0XB0**
4 outputs, 24 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1BD30-0XB0**
SB 1223 signal board		
2 inputs, 24 V DC, IEC type 1 active high; 2 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**
2 inputs, 5 V DC, 200 kHz 2 outputs 5 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3AD30-0XB0**
2 inputs, 24 V DC, 200 kHz 2 outputs 24 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3BD30-0XB0**
SB 1232 signal board	C	**6ES7 232-4HA30-0XB0**
1 analog output, ±10 V with 12 bits or 0 to 20 mA with 11 bits		
Simulator (optional)		see CPU 1211C, page 4/13
SIMATIC Memory Card (optional)		
2 MB	C	**6ES7 954-8LB00-0AA0**
24 MB		**6ES7 954-8LF00-0AA0**
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
Starter box CPU 1212C AC/DC/relay	B	**6ES7 212-1BD30-4YB0**
Complete offer SIMATIC S7-1200, starter box, comprising: CPU 1212C AC/DC/relay, simulator, STEP 7 BASIC CD, manual CD, info material, in Systainer		
Terminal block (spare part)		see CPU 1211C, page 4/13

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

CPU 1212C

Ordering data

		Order No.
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**

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

		Order No.
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

More information

Brochures

Information material for downloading can be found in the Internet:

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

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 / 5 … 250 V AC	2 A; 30 W DC / 200 W AC
• AC/DC/relay	85 … 264 V AC	24 V DC	5 … 30 V DC / 5 … 250 V AC	2 A; 30 W DC / 200 W AC

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-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Product version			
associated programming package	STEP 7 Basic V10.5	STEP 7 Basic V10.5	STEP 7 Basic V10.5
Supply voltages			
Rated value			
• 24 V DC		Yes	Yes
• permissible range, lower limit (DC)		20.4 V	20.4 V
• permissible range, upper limit (DC)		28.8 V	28.8 V
• 120 V AC	Yes		
• 230 V AC	Yes		
• permissible range, lower limit (AC)	85 V		
• permissible range, upper limit (AC)	264 V		
• permissible frequency range, lower limit	47 Hz		
• permissible frequency range, upper limit	63 Hz		
Load voltage L+			
• Rated value (DC)	24 V	24 V	24 V
• permissible range, lower limit (DC)	5 V	20.4 V	5 V
• permissible range, upper limit (DC)	250 V	28.8 V	250 V
Current consumption			
Current consumption (rated value)	100 mA at 120 VAC 50 mA at 240 VAC		500 mA; Typical
Current consumption, max.	300 mA at 120 VAC 150 mA at 240 VAC	1.5 A; 24 VDC	1.2 A; 24 VDC
Inrush current, max.	20 A; at 264 V	12 A; at 28.8 V	12 A; at 28.8 V
Current output to backplane bus (DC 5 V), max.	1 600 mA; 5 V DC max. for SM and CM	1 600 mA; 5 V DC max. for SM and CM	1 600 mA; 5 V DC max. for SM and CM
Power loss			
Power loss, typ.	14 W	12 W	12 W
Memory			
Available project memory/user memory	50 Kibyte	50 Kibyte	50 Kibyte

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Work memory			
• integrated	50 kbyte	50 kbyte	50 kbyte
• expandable	No	No	No
Load memory			
• integrated	2 Mbyte	2 Mbyte	2 Mbyte
• expandable	24 Mbyte; with SIEMENS Memory Card	24 Mbyte; with SIEMENS Memory Card	24 Mbyte; with SIEMENS Memory Card
Backup			
• present	Yes; entire project maintenance-free in the integral EEPROM	Yes; entire project maintenance-free in the integral EEPROM	Yes; entire project maintenance-free in the integral EEPROM
• without battery	Yes	Yes	Yes
CPU/ blocks			
Number of blocks (total)	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory	DBs, FCs, FBs, counters, timers). Up to 65,535 blocks can be addressed. There is no limit, use of the entire work memory
OB			
• Number, max.	Limited only by RAM for code	Limited only by RAM for code	Limited only by RAM for code
CPU/ processing times			
for bit operations, min.	0.1 µs; / instruction	0.1 µs; / instruction	0.1 µs; / instruction
for word operations, min.	12 µs; / instruction	12 µs; / instruction	12 µs; / instruction
for floating point arithmetic, min.	18 µs; / instruction	18 µs; / instruction	18 µs; / instruction
Data areas and their retentivity			
retentive data area in total (incl. times, counters, flags), max.	2 048 byte	2 048 byte	2 048 byte
Flag			
• Number, max.	8 kbyte; Size of bit memory address area	8 kbyte; Size of bit memory address area	8 kbyte; Size of bit memory address area
Address area			
I/O address area			
• I/O address area, overall	1024 bytes for inputs / 1024 bytes for outputs	1024 bytes for inputs / 1024 bytes for outputs	1024 bytes for inputs / 1024 bytes for outputs
• overall	1 024 byte	1 024 byte	1 024 byte
• Outputs	1 024 byte	1 024 byte	1 024 byte
Process image			
• Inputs, adjustable	1 kbyte	1 kbyte	1 kbyte
• Outputs, adjustable	1 kbyte	1 kbyte	1 kbyte
Digital channels			
• integrated channels (DI)	14	14	14
• integrated channels (DO)	10	10	10
Analog channels			
• Integrated channels (AI)	2	2	2
• Integrated channels (AO)	0	0	0
Hardware configuration			
Number of modules per system, max.	3 comm. modules, 1 signal board, 8 signal modules	3 comm. modules, 1 signal board, 8 signal modules	3 comm. modules, 1 signal board, 8 signal modules

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Time of day			
Clock			
• Hardware clock (real-time clock)	Yes	Yes	Yes
• Backup time	240 h; Typical	240 h; Typical	240 h; Typical
• Deviation per day, max.	60 s/month at 25°C	60 s/month at 25°C	60 s/month at 25°C
Test commissioning functions			
Status/control			
• Status/control variable	Yes	Yes	Yes
• Variables	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters	Inputs/outputs, memory bits, DB, distributed I/Os, timers, counters
Forcing			
• Forcing	Yes	Yes	Yes
Communication functions			
S7 communication			
• supported	Yes	Yes	Yes
• as server	Yes	Yes	Yes
Open IE communication			
• TCP/IP	Yes	Yes	Yes
• ISO-on-TCP (RFC1006)	Yes	Yes	Yes
Number of connections			
• overall	15; dynamically	15; dynamically	15; dynamically
1st interface			
Type of interface	PROFINET	PROFINET	PROFINET
Physics	Ethernet	Ethernet	Ethernet
Isolated	Yes	Yes	Yes
automatic detection of transmission speed	Yes	Yes	Yes
Autonegotiation	Yes	Yes	Yes
Autocrossover	Yes	Yes	Yes
CPU/ programming			
Configuration software			
• STEP 7	STEP 7 Basic V10.5	STEP 7 Basic V10.5	STEP 7 Basic V10.5
Programming language			
• LAD	Yes	Yes	Yes
• FBD	Yes	Yes	Yes
Cycle time monitoring			
• can be set	Yes	Yes	Yes
Digital inputs			
Number of digital inputs	14; Integrated	14; Integrated	14; Integrated
• of which, inputs usable for technological functions	6; HSC (High Speed Counting)	6; HSC (High Speed Counting)	6; HSC (High Speed Counting)
m/p-reading	Yes	Yes	Yes
Number of simultaneously controllable inputs			
• Mounting position - Concurrently controllable inputs, up to 40 °C	14	14	14

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Input voltage			
• Rated value, DC	24 V	24 V	24 V
• for signal "0"	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA
• for signal "1"	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Input current			
• for signal "1", typ.	1 mA	1 mA	1 mA
Input delay (for rated value of input voltage)			
• for standard inputs			
- parameterizable	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four
- at "0" to "1", min.	0.2 ms	0.2 ms	0.2 ms
- at "0" to "1", max.	12.8 ms	12.8 ms	12.8 ms
• for interrupt inputs			
- parameterizable	Yes	Yes	Yes
• for counter/technological functions			
- parameterizable	Single phase : 3 at 100 kHz, 3 at 30 kHz differential: 3 at 80 kHz, 3 at 30 kHz	Single phase : 3 at 100 kHz, 3 at 30 kHz differential: 3 at 80 kHz, 3 at 30 kHz	Single phase : 3 at 100 kHz, 3 at 30 kHz differential: 3 at 80 kHz, 3 at 30 kHz
Cable length			
• Cable length, shielded, max.	500 m; 50 m for technological functions	500 m; 50 m for technological functions	500 m; 50 m for technological functions
• Cable length unshielded, max.	300 m; For technological functions: No	300 m; For technological functions: No	300 m; For technological functions: No
Digital outputs			
Number of digital outputs	10; Relay	10	10; Relay
• of which high-speed 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
Limitation of inductive shutdown voltage to		L+ (-48 V)	
Switching capacity of the outputs			
• with resistive load, max.	2 A	0.5 A	2 A
• on lamp load, max.	30 W DC; 200 W AC	5 W	30 W DC; 200 W AC
Output voltage			
• for signal "1", min.		20 V	
Output current			
• for signal "1" rated value		0.5 A	
• for signal "0" residual current, max.		0.1 mA	
Output delay with resistive 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 the pulse outputs, with resistive load, max.	1 Hz	100 kHz	1 Hz
Cable length			
• Cable length, shielded, max.	500 m	500 m	500 m
• Cable length unshielded, max.	150 m	150 m	150 m

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Relay outputs			
Number of relay outputs	10		10
Number of operating cycles	mechanically 10 million, at rated load voltage 100,000		mechanically 10 million, at rated load voltage 100,000
Analog inputs			
Number of analog inputs	2	2	2
Cable length, shielded, max.	100 m; twisted and shielded	100 m; twisted and shielded	100 m; twisted and shielded
Input ranges			
• Voltage	Yes	Yes	Yes
Input ranges (rated values), voltages			
• 0 to +10 V	Yes	Yes	Yes
• Input resistance (0 to 10 V)	≥100 kohms	≥100 kohms	≥100 kohms
Analog value creation			
Integrations and conversion time/ resolution per channel			
• Resolution with overrange (bit including sign), max.	10 bit	10 bit	10 bit
• Integration time, parameterizable	Yes	Yes	Yes
• Conversion time (per channel)	625 µs	625 µs	625 µs
Formation of analog values (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 to 28.8 V	permissible range: 20.4 to 28.8 V	permissible range: 20.4 to 28.8 V
Encoder			
Connectable encoders			
• 2-wire BEROS	Yes	Yes	Yes
Integrated Functions			
Number of counters	6	6	6
Counter frequency (counter) max.	100 kHz	100 kHz	100 kHz
Frequency meter	Yes	Yes	Yes
controlled positioning	Yes	Yes	Yes
PID controller	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 digital inputs			
• Galvanic isolation 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

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Galvanic isolation digital outputs			
• Galvanic isolation 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			
Interference immunity against discharge of static electricity			
• Interference immunity against discharge of static electricity acc. to 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
Interference immunity to cable-borne interference			
• on the supply lines acc. to IEC 61000-4-4	Yes	Yes	Yes
• Interference immunity on signal lines acc. to IEC 61000-4-4	Yes	Yes	Yes
Immunity to surge voltages			
• on the supply lines acc. to IEC 61000-4-5	Yes	Yes	Yes
Immunity to conducted interference, induced by high-frequency fields			
• Interference immunity against high-frequency radiation acc. to IEC 61000-4-6	Yes	Yes	Yes
Emission of radio interference in accordance with EN 55 011			
• Emission of radio interferences acc. to EN 55 011 (limit class A)	Yes; Group 1	Yes; Group 1	Yes; Group 1
• Emission of radio interference acc. to EN 55 011 (limit class B)	Yes	Yes	Yes
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 shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package
• 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%

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Mechanical and climatic conditions during operation			
Climatic conditions during operation			
• Temperature			
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
- permissible temperature change	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 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	-1000m ... 2000m	-1000m ... 2000m	-1000m ... 2000m
• Concentration of pollutants			
- SO_2 at RH < 60% without condensation	< 0.5 ppm	< 0.5 ppm	< 0.5 ppm
- H_2S at RH < 60% without condensation	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm
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
Air pressure			
• Operation, min.	795 hPa	795 hPa	795 hPa
• Operation, max.	1 080 hPa	1 080 hPa	1 080 hPa
• Storage/transport, min.	660 hPa	660 hPa	660 hPa
• Storage/transport, max.	1 080 hPa	1 080 hPa	1 080 hPa
Relative humidity			
• Operation, max.	95 %; no condensation	95 %; no condensation	95 %; no condensation
Vibrations			
• Vibrations	2*g* panel mount, 1*g* DIN rail mount	2*g* panel mount, 1*g* DIN rail mount	2*g* panel mount, 1*g* DIN rail mount
• Operation, checked according to IEC 60068-2-6	Yes	Yes	Yes
Shock test			
• checked according to IEC 60068-2-27	Yes; 15 *g*, 11 ms pulse, 6 shocks in each of 3 axes	Yes; 15 *g*, 11 ms pulse, 6 shocks in each of 3 axes	Yes; 15 *g*, 11 ms pulse, 6 shocks in each of 3 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

Technical specifications (continued)

	6ES7 214-1BE30-0XB0	6ES7 214-1AE30-0XB0	6ES7 214-1HE30-0XB0
Product-type designation	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/DC	CPU 1214C DC/DC/Relay
Dimensions and weight			
Dimensions			
• Width	110 mm	110 mm	110 mm
• Height	100 mm	100 mm	100 mm
• Depth	75 mm	75 mm	75 mm
Weight			
• Weight, approx.	455 g	415 g	435 g

Ordering data

		Order No.
CPU 1214C **Compact CPU, AC/DC/relay**; integral program/data memory 50 kbyte, load memory 2 Mbyte; 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**
CPU 1214C **Compact CPU, DC/DC/DC**; integrated program/data memory 50 kbyte, load memory 2 Mbyte; 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, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) at 100 kHz	C	**6ES7 214-1AE30-0XB0**
CPU 1214C **Compact CPU, DC/DC/relay**; integrated program/data memory 50 kbyte, load memory 2 Mbyte; 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	C	**6ES7 214-1HE30-0XB0**

		Order No.
Accessories		
SB 1221 signal board		
4 inputs, 5 V DC, 200 kHz	C	**6ES7 221-3AD30-0XB0**
4 inputs, 24 V DC, 200 kHz	C	**6ES7 221-3BD30-0XB0**
SB 1222 signal board		
4 outputs, 5 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1AD30-0XB0**
4 outputs, 24 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1BD30-0XB0**
SB 1223 signal board		
2 inputs, 24 V DC, IEC type 1 active high; 2 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**
2 inputs, 5 V DC, 200 kHz 2 outputs 5 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3AD30-0XB0**
2 inputs, 24 V DC, 200 kHz 2 outputs 24 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3BD30-0XB0**
SB 1232 signal board 1 analog output, ±10 V with 12 bits or 0 to 20 mA with 11 bits	C	**6ES7 232-4HA30-0XB0**
Simulator (optional)		
14 input switches, for CPU 1214C	C	**6ES7 274-1XH30-0XA0**
SIMATIC Memory Card (optional)		
2 MB	C	**6ES7 954-8LB00-0AA0**
24 MB		**6ES7 954-8LF00-0AA0**
Extension cable for two-tier configuration for connecting digital/analog signal modules; length 2 m	C	**6ES7 290-6AA30-0XA0**
Terminal block (spare part)		
For CPU 1214		
For DI, with 20 screws, tin-plated; 4 units	C	**6ES7 292-1AV30-0XA0**
For DO, with 12 screws, tin-plated; 4 units	C	**6ES7 292-1AM30-0XA0**
For AI, with 3 screws, tin-plated; 4 units	C	**6ES7 292-1BC30-0XA0**

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

CPU 1214C

Ordering data

		Order No.
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**

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

		Order No.
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview SIPLUS CPU 1211C

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

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

For ordering information see page 4/38.

SIPLUS CPU 1211C			
Order No.	**6AG1 211-1BD30-5XB0** **6AG1 211-1BD30-2XB0**	**6AG1 211-1BD30-5XB0** **6AG1 211-1BD30-2XB0**	**6AG1 211-1HD30-5XB0** **6AG1 211-1HD30-2XB0**
Order No. based on	**6ES7 211-1BD30-0XB0**	**6ES7 211-1AD30-0XB0**	**6ES7 211-1HD30-0XB0**
Ambient temperature range	-25 ... +55 °C/+70 °C; condensation permissible		
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme		
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.		

[1] ISA -S71.04 severity level GX from October 2010

Overview SIPLUS CPU 1212C

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

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

For ordering information see page 4/38.

SIPLUS CPU 1212C			
Order No.	**6AG1 212-1BD30-5XB0** **6AG1 212-1BD30-2XB0**	**6AG1 212-1AD30-5XB0** **6AG1 212-1AD30-2XB0**	**6AG1 212-1HD30-5XB0** **6AG1 212-1HD30-2XB0**
Order No. based on	**6ES7 212-1BD30-0XB0**	**6ES7 212-1AD30-0XB0**	**6ES7 212-1HD30-0XB0**
Ambient temperature range	-25 ... +55 °C/+70 °C; condensation permissible		
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme		
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.		

[1] ISA -S71.04 severity level GX from October 2010

Overview SIPLUS CPU 1214C

- 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)

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

For ordering information see page 4/38.

SIPLUS CPU 1214C			
Order No.	**6AG1 214-1BE30-5XB0** **6AG1 214-1BE30-2XB0**	**6AG1 214-1AE30-5XB0** **6AG1 214-1AE30-2XB0**	**6AG1 214-1HE30-5XB0** **6AG1 214-1HE30-2XB0**
Order No. based on	**6ES7 214-1BE30-0XB0**	**6ES7 212-1AE30-0XB0**	**6ES7 212-1HE30-0XB0**
Ambient temperature range	-25 ... +55 °C/+70 °C; condensation permissible		
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme		
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.		

[1] ISA -S71.04 severity level GX from October 2010

SIPLUS CPU 1211C, CPU 1212C, CPU 1214C

Ordering data		Order No.
SIPLUS CPU 1211C Compact CPU, AC/DC/relay		
(extended temperature range and medial exposure)		
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 ms 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		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 211-1BD30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 211-1BD30-5XB0**
SIPLUS CPU 1211C Compact CPU, DC/DC/DC		
(extended temperature range and medial exposure)		
integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 ms per operation; 6 digital inputs, 4 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, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) with 100 kHz		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 211-1AD30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 211-1AD30-5XB0**
SIPLUS CPU 1211C Compact CPU, DC/DC/relay		
(extended temperature range and medial exposure)		
integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 ms 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		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 211-1HD30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 211-1HD30-5XB0**
SIPLUS CPU 1212C Compact CPU, AC/DC/relay		
(extended temperature range and medial exposure)		
integral program/data memory 25 KB, load memory 1 MB; wide-range power supply 85 ... 264 V AC; Boolean execution times 0.1 ms 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		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 212-1BD30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 212-1BD30-5XB0**

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

Ordering data

		Order No.
SIPLUS CPU 1212C Compact CPU, DC/DC/DC		
(extended temperature range and medial exposure)		
integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 ms 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, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) with 100 kHz		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 212-1AD30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 212-1AD30-5XB0**
SIPLUS CPU 1212C Compact CPU, DC/DC/relay		
(extended temperature range and medial exposure)		
integral program/data memory 25 KB, load memory 1 MB; power supply 24 V DC; Boolean execution times 0.1 ms 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		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 212-1HD30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 212-1HD30-5XB0**
SIPLUS CPU 1214C Compact CPU, AC/DC/relay		
(extended temperature range and medial exposure)		
integral program/data memory 50 KB, load memory 2 MB; wide-range power supply 85 ... 264 V AC; Boolean execution times 0.1 ms 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		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 214-1BE30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 214-1BE30-5XB0**
SIPLUS CPU 1214C Compact CPU, DC/DC/DC		
(extended temperature range and medial exposure)		
integral program/data memory 50 KB, load memory 2 MB; power supply 24 V DC; Boolean execution times 0.1 ms 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, 24 V DC digital outputs can be used as pulse outputs (PTO) or pulse-width modulated outputs (PWM) with 100 kHz		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 214-1AE30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 214-1AE30-5XB0**

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

SIPLUS CPU 1211C, CPU 1212C, CPU 1214C

Ordering data		Order No.
SIPLUS CPU 1214C Compact CPU, DC/DC/relay		
(extended temperature range and medial exposure)		
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 ms 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		
• Ambient temperature -25 ... +70 °C; number of simultaneously controllable inputs and outputs max. 50%; Signal Board cannot be used	C	**6AG1 214-1HE30-2XB0**
• Ambient temperature -25 ... +55 °C; without restrictions; Signal Board can be used	C	**6AG1 214-1HE30-5XB0**

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

	Order No.
Accessories	see S7-1200 CPUs, pages 4/13, 4/23, 4/33

Overview

- Digital inputs as supplement to the integral I/O of the CPUs
- For flexible adaptation of the controller to the relevant task
- For subsequent expansion of the system with additional inputs

Application

Digital input modules allow the connection of the controller to digital signals of the process.

This provides users with the following advantages:

- Optimum adaptation:
  With signal modules which can be mixed as desired, users can adapt their controllers exactly to the relevant task. This avoids superfluous investments. Modules with 8, 16, and 32 input/output channels are available.
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple.

Function

The SM 1221 digital input signal modules convert the level of the external digital signals from the process into the internal signal level of the S7-1200.

Technical specifications

	6ES7 221-1BF30-0XB0	6ES7 221-1BH30-0XB0
Product type designation	SM 1221 DI 8x24 V DC	SM 1221 DI 16x24 V DC
Supply voltages		
Rated value		
• 24 V DC	Yes	Yes
• permissible range, lower limit (DC)	20.4 V	20.4 V
• permissible range, upper limit (DC)	28.8 V	28.8 V
Power supply to the transmitters		
• present	Yes	Yes
Current consumption		
from backplane bus 5 V DC, max.	105 mA	130 mA
Digital inputs		
• from load voltage L+ (without load), max.	4 mA; per channel	4 mA; per channel
Power loss		
Power loss, typ.	1.5 W	2.5 W
Connection method		
required front connector	Yes	Yes
Digital inputs		
Number of digital inputs	8	16
• in groups of	2	4
Number of simultaneously controllable inputs		
• all mounting positions		
- Concurrently controllable inputs, up to 40 °C	8	16

	6ES7 221-1BF30-0XB0	6ES7 221-1BH30-0XB0
Product type designation	SM 1221 DI 8x24 V DC	SM 1221 DI 16x24 V DC
Number of simultaneously controllable inputs		
• horizontal installation		
- up to 40 °C, max.	8	16
- up to 50 °C, max.	8	16
• vertical installation		
- up to 40 °C, max.	8	16
Input characteristic curve acc. to IEC 1131, Type 1	Yes	Yes
Input voltage		
• Rated value, DC	24 V	24 V
• for signal "0"	5 V DC at 1 mA	5 V DC at 1 mA
• for signal "1"	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Input current		
• for signal "0", max. (permissible quiescent current)	1 mA	1 mA
• for signal "1", min.	2.5 mA	2.5 mA
• for signal "1", typ.	4 mA; Typical	4 mA; Typical
Input delay (for rated value of input voltage)		
• for standard inputs		
- parameterizable	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four
• for interrupt inputs		
- parameterizable	Yes	Yes

Technical specifications (continued)

	6ES7 221-1BF30-0XB0	6ES7 221-1BH30-0XB0
Product type designation	SM 1221 DI 8x24 V DC	SM 1221 DI 16x24 V DC
Cable length		
• Cable length, shielded, max.	500 m	500 m
• Cable length unshielded, max.	300 m	300 m
Digital outputs		
Number of digital outputs	0	0
Interrupts/diagnostics/ status information		
Alarms		
• Alarms	Yes	Yes
• Diagnostic alarm	Yes	Yes
Diagnoses		
• Diagnostic functions	Yes	Yes
• Monitoring the supply voltage to the electronics	Yes	Yes
Diagnostics indication LED		
• for status of inputs	Yes	Yes
• for maintenance	Yes	Yes
• Status indicator digital input (green)	Yes	Yes
Galvanic isolation		
Galvanic isolation digital inputs		
• between the channels, in groups of	2	4
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 shipping package	0.3 m; five times, in shipping package
• Temperature		
- permissible temperature range	-40 °C ... +70 °C	-40 °C ... +70 °C
• Air pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 to 660 hPa	1080 to 660 hPa
• Relative humidity		
- permissible range (without condensation) at 25 °C	95%	95%

	6ES7 221-1BF30-0XB0	6ES7 221-1BH30-0XB0
Product type designation	SM 1221 DI 8x24 V DC	SM 1221 DI 16x24 V DC
Mechanical and climatic conditions during operation		
Climatic conditions during operation		
• Temperature		
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
- permissible temperature change	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min
Degree of protection		
IP20	Yes	Yes
Standards, approvals, certificates		
CE mark	Yes	Yes
C-TICK	Yes	Yes
FM approval	Yes	Yes
Mechanics		
Type of housing (front)		
• Plastic	Yes	Yes
Dimensions and weight		
Dimensions		
• Width	45 mm	45 mm
• Height	100 mm	100 mm
• Depth	75 mm	75 mm
Weight		
• Weight, approx.	170 g	210 g

Ordering data		Order No.
SM 1221 digital input signal module		
8 inputs, 24 V DC, isolated, current sourcing/sinking	C	**6ES7 221-1BF30-0XB0**
16 inputs, 24 V DC, isolated, current sourcing/sinking	C	**6ES7 221-1BH30-0XB0**
Accessories		
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
Terminal block (spare part)		
for 8/16-channel digital signal modules		
with 7 screws, zinc-plated; 4 pcs.	C	**6ES7 292-1AG30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

4

SB 1221 digital input module

Overview

- Digital inputs as a supplement to the integral I/O of SIMATIC S7-1200 CPUs
- Can be plugged directly into the CPU

Application

The SB 1221 Signal Board digital input modules enable connection of the controller to digital process signals.

Design

The Signal Boards are plugged straight into the holder on the front of the S7-1200-CPU.

- Mounting:
  Signal Boards are plugged direct into the SIMATIC S7-1200-CPU and linked electrically and mechanically with the CPU in this way.
- The installation dimensions of the CPU remain unchanged.
- On all Signal Boards, replacement is facilitated by removable terminals ("permanent wiring").

Function

The SB 1221 Signal Board digital input/output modules convert the level of the external digital signals from the process to the internal signal level of the S7-1200.

Technical specifications

	6ES7 221-3AD30-0XB0	6ES7 221-3BD30-0XB0
Product type designation	SB 1221 4xDI 5 V DC 200 kHz	SB 1221 4xDI 24 V DC 200 kHz
Supply voltages		
Power supply to the transmitters		
• Supply current, max.	4 mA; per channel	4 mA; per channel
Current consumption		
from backplane bus 5 V DC, typ.	50 mA	50 mA
Power loss		
Power loss, typ.	1 W	1 W
Digital inputs		
Number of digital inputs	4	4
• in groups of	1	1
Number of simultaneously controllable inputs		
• all mounting positions		
- Concurrently controllable inputs, up to 40 °C	4	4
Input characteristic curve acc. to IEC 1131, Type 1	Yes	
Input characteristic curve acc. to IEC 1131, Type 2		Yes
Input voltage		
• Rated value, DC	5 V	24 V
• for signal "0"	0 to 1 V	0 to 5 V
• for signal "1"	2 to 6 V	15 to 30 V
Input current		
• for signal "0", max. (permissible quiescent current)	3 mA	2 mA
• for signal "1", min.	6 mA	5.8 mA
• for signal "1", typ.		14 mA

	6ES7 221-3AD30-0XB0	6ES7 221-3BD30-0XB0
Product type designation	SB 1221 4xDI 5 V DC 200 kHz	SB 1221 4xDI 24 V DC 200 kHz
Input delay (for rated value of input voltage)		
• for standard inputs		
- parameterizable	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four
- at "0" to "1", max.	2 µs	2.5 µs
• for interrupt inputs		
- parameterizable	Yes	Yes
• for counter/technological functions		
- parameterizable	Yes	Yes
Cable length		
• Cable length, shielded, max.	50 m	50 m; Standard input: 500 m, high-speed counters: 50 m
Short-circuit protection	No	
Interrupts/diagnostics/ status information		
Alarms		
• Alarms	Yes	Yes
Diagnoses		
• Diagnostic functions	Yes	Yes
Input delay (for rated value of input voltage)		
Diagnostics indication LED		
• for status of inputs	Yes	Yes

Technical specifications (continued)

	6ES7 221-3AD30-0XB0	6ES7 221-3BD30-0XB0
Product type designation	SB 1221 4xDI 5 V DC 200 kHz	SB 1221 4xDI 24 V DC 200 kHz
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 shipping package	0.3 m; five times, in shipping package
• Temperature		
- permissible temperature range		-40 °C ... +70 °C
• Air pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 ... 660hPa	1080 ... 660hPa
• Relative humidity		
- permissible range (without condensation) at 25 °C	95%	95%
Mechanical and climatic conditions during operation		
Climatic conditions during operation		
• Temperature		
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
Degree of protection		
IP20	Yes	Yes
Mechanics		
Type of housing (front)		
• Plastic	Yes	Yes
Dimensions and weight		
Dimensions		
• Width	38 mm	38 mm
• Height	62 mm	62 mm
• Depth	21 mm	21 mm
Weight		
• Weight, approx.	40 g	40 g

Ordering data

		Order No.
SB 1221 Signal Board digital input modules		
4 inputs, 5 V DC, 200 kHz	C	**6ES7 221-3AD30-0XB0**
4 inputs, 24 V DC, 200 kHz	C	**6ES7 221-3BD30-0XB0**
Accessories		
Terminal block (spare part)		
for Signal Board		
with 6 screws, gold-plated; 4 pcs.	C	**6ES7 292-1BF30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8BH0**
English	B	**6ES7 298-8FA30-8AH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

SM 1222 digital output module

Overview

- Digital outputs as supplement to the integral I/O of the CPUs
- For flexible adaptation of the controller to the relevant task
- For subsequent expansion of the system with additional outputs

Application

Digital output modules permit the output of digital signals from the controller to the process.

This provides users with the following advantages:

- Optimum adaptation:
  With signal modules which can be mixed as desired, users can adapt their controllers exactly to the relevant task. This avoids superfluous investments. Modules with 8, 16, and 32 input/output channels are available.
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple.

Function

The SM 1222 digital output signal modules convert the internal signal level of the SIMATIC S7-1200 into the external signal level required by the process.

Technical specifications

	6ES7 222-1BF30-0XB0	6ES7 222-1BH30-0XB0	6ES7 222-1HF30-0XB0	6ES7 222-1HH30-0XB0
Product type designation	SM1222 DQ 8x24 V DC	SM1222 DQ 16x24 V DC	SM 1222 DQ 8xRelay	SM1222 DQ 16xRelay
Supply voltages				
Rated value				
• permissible range, lower limit (DC)	20.4 V	20.4 V	5 V	5 V
• permissible range, upper limit (DC)	28.8 V	28.8 V	30 V	30 V
Current consumption				
from backplane bus 5 V DC, max.	120 mA	140 mA	120 mA	135 mA
Digital inputs				
• from load voltage L+ (without load), max.			11 mA / relay coil used	11 mA / relay coil used
Power loss				
Power loss, typ.	1.5 W	2.5 W	4.5 W	8.5 W
Connection method				
required front connector	Yes	Yes	Yes	Yes
Digital inputs				
Number of digital inputs	0	0	0	0
Digital outputs				
Number of digital outputs	8	16	8	16
• in groups of	1	1	2	1
Short-circuit protection	No; to be provided externally	No; to be provided externally	No; to be provided externally	No; to be provided externally
Limitation of inductive shutdown voltage to	typ. (L+) -48 V	typ. (L+) -48 V		
Switching capacity of the outputs				
• with resistive load, max.	0.5 A	0.5 A	2 A	2 A
• on lamp load, max.	5 W	5 W	30 W DC; 200 W AC	30 W DC; 200 W AC

Technical specifications (continued)

	6ES7 222-1BF30-0XB0	6ES7 222-1BH30-0XB0	6ES7 222-1HF30-0XB0	6ES7 222-1HH30-0XB0
Product type designation	SM1222 DQ 8x24 V DC	SM1222 DQ 16x24 V DC	SM 1222 DQ 8xRelay	SM1222 DQ 16xRelay
Output voltage				
• Rated value (AC)			5 to 250 V AC	5 to 250 V AC
• Rated value (DC)	24 V	24 V	5 to 30 V DC	5 to 30 V DC
• for signal "0" (DC), max.	0.1 V; with 10 kohms Load	0.1 V; with 10k ohms Load		
• for signal "1", min.	20 V DC	20 V DC		
Output current				
• for signal "1" rated value	0.5 A	0.5 A		
• for signal "1" permissible range, max.			2 A	2 A
• for signal "0" residual current, max.	10 µA	10 µA		
Output delay with resistive load				
• 0 to "1", max.	50 µs	50 µs	10 ms	10 ms
• 1 to "0", max.	200 µs	200 µs	10 ms	10 ms
Aggregate current of outputs (per group)				
• horizontal installation - up to 50 °C, max.	4 A; Current per mass	8 A; Current per common	10 A; Current per common	10 A; Current per common
Cable length				
• Cable length, shielded, max.	500 m	500 m	500 m	500 m
• Cable length unshielded, max.	150 m	150 m	150 m	150 m
Relay outputs				
Number of relay outputs			8	16
Rated input voltage of relay L+ (DC)			24 V	24 V
Number of operating cycles			mechanically 10 million, at rated load voltage 100,000	mechanically 10 million, at rated load voltage 100,000
Switching capacity of contacts				
• with inductive load, max.	0.5 A	0.5 A	2 A	2 A
• on lamp load, max.	5 W	5 W	30 W DC; 200 W AC	30 W DC; 200 W AC
• with resistive load, max.	0.5 A	0.5 A	2 A	2 A
Interrupts/diagnostics/ status information				
Alarms				
• Alarms	Yes	Yes	Yes	Yes
• Diagnostic alarm	Yes	Yes	Yes	Yes
Diagnoses				
• Diagnostic functions	Yes	Yes	Yes	Yes
• Monitoring the supply voltage to the electronics	Yes	Yes	Yes	Yes
Diagnostics indication LED				
• for status of outputs	Yes	Yes	Yes	Yes
• for maintenance	Yes	Yes	Yes	Yes
• Status indicator digital output (green)	Yes	Yes	Yes	Yes
Galvanic isolation				
Galvanic isolation digital outputs				
• between the channels			Relay, dry contact	Relay, dry contact
• between the channels, in groups of	1	1	2	4
• between the channels and the back-plane bus	500 V AC	500 V AC	1500 V AC for 1 minute	1500 V AC for 1 minute
Permissible potential difference				
between different circuits			750 V AC for 1 minute	750 V AC for 1 minute

Technical specifications (continued)

	6ES7 222-1BF30-0XB0	6ES7 222-1BH30-0XB0	6ES7 222-1HF30-0XB0	6ES7 222-1HH30-0XB0
Product type designation	SM1222 DQ 8x24 V DC	SM1222 DQ 16x24 V DC	SM 1222 DQ 8xRelay	SM1222 DQ 16xRelay
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 shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package
• Temperature				
- permissible temperature range	-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C
• Air pressure acc. to IEC 60068-2-13				
- permissible atmospheric pressure	1080 to 660hPa	1080 to 660hPa	1080 to 660hPa	1080 to 660hPa
• Relative humidity				
- permissible range (without condensation) at 25 °C	95%	95%	95%	95%
Mechanical and climatic conditions during operation				
Climatic conditions during operation				
• Temperature				
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
- permissible temperature change	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min
Degree of protection				
IP20	Yes	Yes	Yes	Yes
Standards, approvals, certificates				
CE mark	Yes	Yes	Yes	Yes
C-TICK	Yes	Yes	Yes	Yes
FM approval	Yes	Yes	Yes	Yes
Mechanics				
Type of housing (front)				
• Plastic	Yes	Yes	Yes	Yes
Dimensions and weight				
Dimensions				
• Width	45 mm	45 mm	45 mm	45 mm
• Height	100 mm	100 mm	100 mm	100 mm
• Depth	75 mm	75 mm	75 mm	75 mm
Weight				
• Weight, approx.	180 g	220 g	190 g	260 g

Ordering data

		Order No.
SM 1222 digital output signal module		
8 outputs, 24 V DC; 0.5 A, 5 W, isolated	C	**6ES7 222-1BF30-0XB0**
16 outputs, 24 V DC; 0.5 A, 5 W, isolated	C	**6ES7 222-1BH30-0XB0**
8 relay outputs, 5 ... 30 V DC/ 5 ... 250 V AC, 2 A, 30 W DC/200 W AC	C	**6ES7 222-1HF30-0XB0**
16 relay outputs, 5 ... 30 V DC/ 5 ... 250 V AC, 2 A, 30 W DC/200 W AC	C	**6ES7 222-1HH30-0XB0**
Accessories		
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
Terminal block (spare part)		
for 8/16-channel digital signal modules		
with 7 screws, zinc-plated; 4 pcs.	C	**6ES7 292-1AG30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8BH0**
English	B	**6ES7 298-8FA30-8AH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H

		Order No.
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

More information

Brochures

Information material for downloading can be found in the Internet:

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

SB 1222 digital output module

Overview

- Digital outputs as a supplement to the integral I/O of SIMATIC S7-1200 CPUs
- Can be plugged directly into the CPU

Application

The SB 1222 Signal Board digital output modules enable the digital signals of the controller to be output to the process.

Design

The Signal Boards are plugged straight into the holder on the front of the S7-1200-CPU.

- Mounting:
  Signal Boards are plugged direct into the SIMATIC S7-1200-CPU and linked electrically and mechanically with the CPU in this way.
- The installation dimensions of the CPU remain unchanged.
- On all Signal Boards, replacement is facilitated by removable terminals ("permanent wiring").

Function

The SB 1222 Signal Board digital input/output modules convert the internal signal level of the S7-1200 to the external signal level required for the process.

Technical specifications

	6ES7 222-1AD30-0XB0	6ES7 222-1BD30-0XB0
Product type designation	SB 1222 4xDQ 5 V DC 200 kHz	SB 1222 4xDQ 24 V DC 200 kHz
Supply voltages		
Power supply to the transmitters		
• Supply current, max.	4 mA; per channel	4 mA; per channel
Current consumption		
from backplane bus 5 V DC, typ.	50 mA	50 mA
Power loss		
Power loss, typ.	1 W	1 W
Digital outputs		
Number of digital outputs	4	4
• in groups of	1	1
Short-circuit protection	No	No
Switching capacity of the outputs		
• with resistive load, max.	0.1 A	0.1 A
Output voltage		
• Rated value (DC)	5 V	24 V
• for signal "0" (DC), max.	0.4 V	0.1 V; with 10k ohms load
• for signal "1", min.	L+ (-0.5 V)	20 V
• for signal "1" (DC), max.	6 V	
Output current		
• for signal "1" rated value	0.1 A	0.1 A
• for signal "1" permissible range, max.	0.11 A	
• for signal "0" residual current, max.		10 µA

	6ES7 222-1AD30-0XB0	6ES7 222-1BD30-0XB0
Product type designation	SB 1222 4xDQ 5 V DC 200 kHz	SB 1222 4xDQ 24 V DC 200 kHz
Load resistance range		
• upper limit	5 Ω	10 Ω
Cable length		
• Cable length, shielded, max.	50 m	50 m
Interrupts/diagnostics/ status information		
Alarms		
• Alarms	Yes	Yes
Diagnoses		
• Diagnostic functions	Yes	Yes
Diagnostics indication LED		
• for status of outputs	Yes	Yes
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 shipping package	0.3 m; five times, in shipping package
• Atmospheric pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 bis 660hPa	1080 bis 660hPa
• Relative humidity		
- permissible range (without condensation) at 25 °C	95%	95%

Technical specifications (continued)

	6ES7 222-1AD30-0XB0	6ES7 222-1BD30-0XB0
Product type designation	SB 1222 4xDQ 5 V DC 200 kHz	SB 1222 4xDQ 24 V DC 200 kHz
Mechanical and climatic conditions during operation		
Climatic conditions during operation		
• Temperature		
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
Degree of protection		
IP20	Yes	Yes

	6ES7 222-1AD30-0XB0	6ES7 222-1BD30-0XB0
Product type designation	SB 1222 4xDQ 5 V DC 200 kHz	SB 1222 4xDQ 24 V DC 200 kHz
Mechanics		
Type of housing (front)		
• Plastic	Yes	Yes
Dimensions and weight		
Dimensions		
• Width	38 mm	38 mm
• Height	62 mm	62 mm
• Depth	21 mm	21 mm
Weight		
• Weight, approx.	40 g	40 g

Ordering data

		Order No.
SB 1222 Signal Board digital output modules		
4 outputs, 5 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1AD30-0XB0**
4 outputs, 24 V DC, 0.1 A, 200 kHz	C	**6ES7 222-1BD30-0XB0**
Accessories		
Terminal block (spare part)		
for Signal Board		
with 6 screws, gold-plated; 4 pcs.	C	**6ES7 292-1BF30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8BH0**
English	B	**6ES7 298-8FA30-8AH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H

		Order No.
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

SM 1223 digital input/output module

Overview

- Digital inputs and outputs as supplement to the integral I/O of the CPUs
- For flexible adaptation of the controller to the relevant task
- For subsequent expansion of the system with additional inputs and outputs

Application

Digital input/output modules permit:

- Connection of the controller to digital signals of the process
- Output of digital signals from the controller to the process

This provides users with the following advantages:

- Optimum adaptation:
  With signal modules which can be mixed as desired, users can adapt their controllers exactly to the relevant task. This avoids superfluous investments. Modules with 8, 16, and 32 input/output channels are available.
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple

Function

The SM 1223 digital input/output signal modules convert

- the level of the external digital signals from the process into the internal signal level of the S7-1200 and
- the internal signal level of the S7-1200 into the external signal level required by the process.

Technical specifications

	6ES7 223-1BH30-0XB0	6ES7 223-1BL30-0XB0	6ES7 223-1PH30-0XB0	6ES7 223-1PL30-0XB0
Product type designation	SM 1223 DI 8x24 V DC, DQ 8x24 V DC	SM 1223 DI 16x24 V DC, DQ 16x24 V DC	SM 1223 DI 8x24 V DC, DQ 8xRelay	SM 1223 DI 16x24 V DC, DQ 16xRelay
Supply voltages				
Rated value				
• 24 V DC	Yes	Yes	Yes	Yes
• permissible range, lower limit (DC)	20.4 V	20.4 V	20.4 V	20.4 V
• permissible range, upper limit (DC)	28.8 V	28.8 V	28.8 V	28.8 V
Power supply to the transmitters				
• present	Yes	Yes	Yes	Yes
Current consumption				
from backplane bus 5 V DC, max.	145 mA	185 mA	145 mA	180 mA
Digital inputs				
• from load voltage L+ (without load), max.	4 mA; per channel	4 mA; per channel	4 mA / input 11 mA / relay	4 mA / input 11 mA / relay
Power loss				
Power loss, typ.	2.5 W	4.5 W	5.5 W	10 W
Connection method				
required front connector	Yes	Yes	Yes	Yes
Digital inputs				
Number of digital inputs	8	16	8	16
• in groups of	2	2	2	2
Number of simultaneously controllable inputs				
• all mounting positions				
- Concurrently controllable inputs, up to 40 °C	8	16	8	16

Technical specifications (continued)

	6ES7 223-1BH30-0XB0	6ES7 223-1BL30-0XB0	6ES7 223-1PH30-0XB0	6ES7 223-1PL30-0XB0
Product type designation	SM 1223 DI 8x24 V DC, DQ 8x24 V DC	SM 1223 DI 16x24 V DC, DQ 16x24 V DC	SM 1223 DI 8x24 V DC, DQ 8xRelay	SM 1223 DI 16x24 V DC, DQ 16xRelay
Number of simultaneously controllable inputs				
• horizontal installation				
- up to 40 °C, max.	8	16	8	16
- up to 50 °C, max.	8	16	8	16
• vertical installation				
- up to 40 °C, max.	8	16	8	16
Input characteristic curve acc. to IEC 1131, Type 1	Yes	Yes	Yes	Yes
Input voltage				
• Rated value, DC	24 V	24 V	24 V	24 V
• for signal "0"	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA
• for signal "1"	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Input current				
• for signal "0", max. (permissible quiescent current)	1 mA	1 mA	1 mA	1 mA
• for signal "1", min.	2.5 mA	2.5 mA	2.5 mA	2.5 mA
• for signal "1", typ.	4 mA; Typical	4 mA; Typical	4 mA; Typical	4 mA; Typical
Input delay (for rated value of input voltage)				
• for standard inputs				
- parameterizable	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four
• for interrupt inputs				
- parameterizable	Yes	Yes	Yes	Yes
Cable length				
• Cable length, shielded, max.	500 m	500 m	500 m	500 m
• Cable length unshielded, max.	300 m	300 m	300 m	300 m
Digital outputs				
Number of digital outputs	8	16	8	16
• in groups of	1	1	2	4
Short-circuit protection	No; to be provided externally	No; to be provided externally	No; to be provided externally	No; to be provided externally
Limitation of inductive shutdown voltage to	L+ (-48 V)	L+ (-48 V)		
Switching capacity of the outputs				
• with resistive load, max.	0.5 A	0.5 A	2 A	2 A
• on lamp load, max.	5 W	5 W	30 W DC; 200 W AC	30 W DC; 200 W AC
Output voltage				
• Rated value (AC)			5 to 250 V AC	5 to 250 V AC
• Rated value (DC)	24 V	24 V	5 to 30 V DC	5 to 30 V DC
• for signal "0" (DC), max.	0.1 V; with 10 kohms Load	0.1 V; with 10 kohms Load		
• for signal "1", min.	20 V DC	20 V DC		
Output current				
• for signal "1" permissible range, max.	0.5 A	0.5 A	2 A	2 A
• for signal "0" residual current, max.	10 µA	10 µA		
Output delay with resistive load				
• 0 to "1", max.	50 µs	50 µs	10 ms	10 ms
• 1 to "0", max.	200 µs	200 µs	10 ms	10 ms

Technical specifications (continued)

	6ES7 223-1BH30-0XB0	6ES7 223-1BL30-0XB0	6ES7 223-1PH30-0XB0	6ES7 223-1PL30-0XB0
Product type designation	SM 1223 DI 8x24 V DC, DQ 8x24 V DC	SM 1223 DI 16x24 V DC, DQ 16x24 V DC	SM 1223 DI 8x24 V DC, DQ 8xRelay	SM 1223 DI 16x24 V DC, DQ 16xRelay
Aggregate current of outputs (per group)				
• horizontal installation - up to 50 °C, max.	4 A; Current per mass	8 A; Current per mass	10 A; Current per mass	8 A; Current per mass
Cable length				
• Cable length, shielded, max.	500 m	500 m	500 m	500 m
• Cable length unshielded, max.	150 m	150 m	150 m	150 m
Relay outputs				
Number of relay outputs			8	16
Rated input voltage of relay L+ (DC)			24 V	24 V
Number of operating cycles			mechanically 10 million, at rated load voltage 100 000	mechanically 10 million, at rated load voltage 100 000
Switching capacity of contacts				
• with inductive load, max.	0.5 A	0.5 A	2 A	2 A
• on lamp load, max.	5 W	5 W	30 W DC; 200 W AC	30 W DC; 200 W AC
• with resistive load, max.	0.5 A	0.5 A	2 A	2 A
Interrupts/diagnostics/ status information				
Alarms				
• Alarms	Yes	Yes	Yes	Yes
• Diagnostic alarm	Yes	Yes	Yes	Yes
Diagnoses				
• Diagnostic functions	Yes	Yes	Yes	Yes
• Monitoring the supply voltage to the electronics	Yes	Yes	Yes	Yes
Diagnostics indication LED				
• for status of inputs	Yes	Yes	Yes	Yes
• for status of outputs	Yes	Yes	Yes	Yes
• for maintenance	Yes	Yes	Yes	Yes
• Status indicator digital output (green)	Yes	Yes	Yes	Yes
• Status indicator digital input (green)	Yes	Yes	Yes	Yes
Galvanic isolation				
Galvanic isolation digital inputs				
• between the channels, in groups of	2	2	2	2
Galvanic isolation digital outputs				
• between the channels			Relays	Relays
• between the channels, in groups of	1	1	2	4
• between the channels and the back-plane bus	500 V AC	500 V AC	1500 V AC for 1 minute	1500 V AC for 1 minute
Permissible potential difference				
between different circuits			750 V AC for 1 minute	750 V AC for 1 minute
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 shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package

Technical specifications (continued)

	6ES7 223-1BH30-0XB0	6ES7 223-1BL30-0XB0	6ES7 223-1PH30-0XB0	6ES7 223-1PL30-0XB0
Product type designation	SM 1223 DI 8x24 V DC, DQ 8x24 V DC	SM 1223 DI 16x24 V DC, DQ 16x24 V DC	SM 1223 DI 8x24 V DC, DQ 8xRelay	SM 1223 DI 16x24 V DC, DQ 16xRelay
Climatic conditions for storage and transport				
• Temperature				
- permissible temperature range	-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C
• Atmospheric pressure acc. to IEC 60068-2-13				
- permissible atmospheric pressure	1080 to 660hPa	1080 to 660hPa	1080 to 660hPa	1080 to 660hPa
• Relative humidity				
- permissible range (without condensation) at 25 °C	95%	95%	95%	95%
Mechanical and climatic conditions during operation				
Climatic conditions during operation				
• Temperature				
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
- permissible temperature change	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min	5 °C ... 55 °C, 3 °C/min
Degree of protection				
IP20	Yes	Yes	Yes	Yes
Standards, approvals, certificates				
CE mark	Yes	Yes	Yes	Yes
C-TICK	Yes	Yes	Yes	Yes
FM approval	Yes	Yes	Yes	Yes
Mechanics				
Type of housing (front)				
• Plastic	Yes	Yes	Yes	Yes
Dimensions and weight				
Dimensions				
• Width	45 mm	70 mm	45 mm	70 mm
• Height	100 mm	100 mm	100 mm	100 mm
• Depth	75 mm	75 mm	75 mm	75 mm
Weight				
• Weight, approx.	210 g	310 g	230 g	350 g

SM 1223 digital input/output module

Ordering data

		Order No.
SM 1223 digital input/output signal module		
8 inputs, 24 V DC, IEC type 1 current sinking; 8 24 V DC transistor outputs, 0.5 A, 5 W	C	**6ES7 223-1BH30-0XB0**
16 inputs, 24 V DC, IEC type 1 current sinking; 16 24 V DC transistor outputs, 0.5 A, 5 W	C	**6ES7 223-1BL30-0XB0**
8 inputs, 24 V DC, IEC type 1 current sinking; 8 relay outputs, 5 ... 30 V DC/ 5 ... 250 V AC, 2 A, 30 W DC/200 W AC	C	**6ES7 223-1PH30-0XB0**
16 inputs, 24 V DC, IEC type 1 current sinking; 16 relay outputs, 5 ... 30 V DC/ 5 ... 250 V AC, 2 A, 30 W DC/200 W AC	C	**6ES7 223-1PL30-0XB0**
Accessories		
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
Terminal block (spare part)		
for 8/16-channel digital signal modules		
with 7 screws, zinc-plated; 4 pcs.	C	**6ES7 292-1AG30-0XA0**

		Order No.
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

SB 1223 digital input/output module

Overview

- Digital inputs and outputs as supplement to the integral I/O of the SIMATIC S7-1200 CPUs
- Can be plugged direct into the CPU

Application

The SB 1223 digital input/output signal module permits:

- Connection of the controller to digital signals of the process
- Output of digital signals from the controller to the process.

Design

The signal boards are plugged directly into the receptacle on the front of each S7-1200 CPU.

- Mounting:
  Signal boards are plugged directly into the SIMATIC S7-1200 CPU and are thus electrically and mechanically connected to the CPU
- The CPU mounting dimensions remain unchanged
- All signal boards are easy to replace thanks to removable connecting terminals ("independent wiring")

Function

The SB 1223 digital input/output signal board converts

- the level of the external digital signals from the process into the internal signal level of the S7-1200 and
- the internal signal level of the S7-1200 into the external signal level required by the process

Technical specifications

	6ES7 223-0BD30-0XB0	6ES7 223-3AD30-0XB0	6ES7 223-3BD30-0XB0
Product type designation	SB 1223 DI 2x24 V DC, DQ 2x24 V DC	SB 1223 2xDI / 2xDQ 5 V DC 200kHz	SB 1223 2xDI / 2xDQ 24 V DC 200kHz
Supply voltages			
Rated value			
• permissible range, lower limit (DC)	20.4 V		
• permissible range, upper limit (DC)	30 V		
Power supply to the transmitters			
• Supply current, max.	4 mA; per channel	4 mA; per channel	4 mA; per channel
Current consumption			
from backplane bus 5 V DC, typ.	50 mA	50 mA	50 mA
Power loss			
Power loss, typ.	1 W	1 W	1 W
Digital inputs			
Number of digital inputs	2	2	2
• in groups of	1	1	1
Number of simultaneously controllable inputs			
• all mounting positions - Concurrently controllable inputs, up to 40 °C	2	2	2
Input characteristic curve acc. to IEC 1131, Type 1	Yes	Yes	Yes
Input voltage			
• Rated value, DC	24 V	5 V	24 V
• for signal "0"	0 to 5 V	0 to 1 V	0 to 5 V
• for signal "1"	15 to 30 V	2 to 6 V	15 to 30 V
Input current			
• for signal "0", max. (permissible quiescent current)	1 mA	3 mA	2 mA
• for signal "1", min.		6 mA	5.8 mA
• for signal "1", typ.	0.5 A		14 mA

Technical specifications (continued)

	6ES7 223-0BD30-0XB0	6ES7 223-3AD30-0XB0	6ES7 223-3BD30-0XB0
Product type designation	SB 1223 DI 2x24 V DC, DQ 2x24 V DC	SB 1223 2xDI / 2xDQ 5 V DC 200kHz	SB 1223 2xDI / 2xDQ 24 V DC 200kHz
Input delay (for rated value of input voltage)			
• for standard inputs			
- parameterizable	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four	Yes; 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of four
- at "0" to "1", max.	2 µs	2 µs	2.5 µs
- at "1" to "0", max.	10 µs		
• for interrupt inputs			
- parameterizable	Yes	Yes	Yes
• for counter/technological functions			
- parameterizable	Yes	Yes	Yes
Cable length			
• Cable length, shielded, max.	500 m	50 m	50 m for technological functions
• Cable length unshielded, max.	300 m		
Digital outputs			
Number of digital outputs	2	2	2
• in groups of	1	1	1
Short-circuit protection	No	No	No
Switching capacity of the outputs			
• with resistive load, max.	0.5 A	0.1 A	0.1 A
• on lamp load, max.	5 W		
Output voltage			
• Rated value (DC)	24 V	5 V	24 V
• for signal "0" (DC), max.	0.1 V; with 10k ohms load	0.4 V	0.1 V; with 10 kohms load
• for signal "1", min.	20 V	L+ (-0.5 V)	20 V
• for signal "1" (DC), max.		6 V	
Output current			
• for signal "1" rated value	0.5 A	0.1 A	0.1 A
• for signal "1" permissible range, max.		0.11 A	
• for signal "0" residual current, max.	10 µA		10 µA
Load resistance range			
• upper limit	0.6 Ω	5 Ω	10 Ω
Cable length			
• Cable length, shielded, max.	500 m	50 m	50 m
• Cable length unshielded, max.	150 m		
Interrupts/diagnostics/ status information			
Alarms			
• Alarms	Yes	Yes	Yes
Diagnoses			
• Diagnostic functions	Yes	Yes	Yes
Diagnostics indication LED			
• for status of inputs	Yes	Yes	Yes
• for status of outputs	Yes	Yes	Yes

Technical specifications (continued)

	6ES7 223-0BD30-0XB0	6ES7 223-3AD30-0XB0	6ES7 223-3BD30-0XB0
Product type designation	SB 1223 DI 2x24 V DC, DQ 2x24 V DC	SB 1223 2xDI / 2xDQ 5 V DC 200kHz	SB 1223 2xDI / 2xDQ 24 V DC 200kHz
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 shipping package	0.3 m; five times, in shipping package	0.3 m; five times, in shipping package
• Air pressure acc. to IEC 60068-2-13			
- permissible atmospheric pressure	1080 to 660 hPa	1080 to 660 hPa	1080 to 660 hPa
• Relative humidity			
- permissible range (without condensation) at 25 °C	95%	95%	95%
Mechanical and climatic conditions during operation			
Climatic conditions during operation			
• Temperature			
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
Degree of protection			
IP20	Yes	Yes	Yes
Mechanics			
Type of housing (front)			
• Plastic	Yes	Yes	Yes
Dimensions and weight			
Dimensions			
• Width	38 mm	38 mm	38 mm
• Height	62 mm	62 mm	62 mm
• Depth	21 mm	21 mm	21 mm
Weight			
• Weight, approx.	40 g	40 g	40 g

SB 1223 digital input/output module

Ordering data

		Order No.
SB 1223 digital input/output signal board		
2 inputs, 24 V DC, IEC type 1 current sinking; 2 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**
2 inputs, 5 V DC, 200 kHz 2 outputs 5 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3AD30-0XB0**
2 inputs, 24 V DC, 200 kHz 2 outputs 24 V DC, 0.1 A, 200 kHz	C	**6ES7 223-3BD30-0XB0**
Accessories		
Terminal block (spare part)		
for signal board		
with 6 screws, gold-plated; 4 pcs.	C	**6ES7 292-1BF30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H

		Order No.
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview SIPLUS SM 1221 digital input modules

- Digital inputs as supplement to the integral I/O of the CPUs
- For flexible adaptation of the controller to the relevant task
- For subsequent expansion of the system with additional inputs

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

SIPLUS SM 1221		
Order No.	**6AG1 221-1BF30-2XB0**	**6AG1 221-1BH30-2XB0**
Order No. based on	**6ES7 221-1BF30-0XB0**	**6ES7 221-1BH30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible	
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme	
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.	

[1] ISA -S71.04 severity level GX from October 2010

Overview SIPLUS SM 1222 digital output modules

- Digital outputs as supplement to the integral I/O of the CPUs
- For flexible adaptation of the controller to the relevant task
- For subsequent expansion of the system with additional outputs

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

SIPLUS SM 1222				
Order No.	**6AG1 222-1BF30-2XB0**	**6AG1 222-1BH30-2XB0**	**6AG1 222-1HF30-2XB0**	**6AG1 222-1HH30-2XB0**
Order No. based on	**6ES7 222-1BF30-0XB0**	**6ES7 222-1BH30-0XB0**	**6ES7 222-1HF30-0XB0**	**6ES7 222-1HH30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible			
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme			
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.			

[1] ISA -S71.04 severity level GX from October 2010

Overview SIPLUS SM 1223 digital input/output module

- Digital inputs and outputs as supplement to the integral I/O of the CPUs
- For flexible adaptation of the controller to the relevant task
- For subsequent expansion of the system with additional inputs and outputs

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

SIPLUS SM 1223				
Order No.	**6AG1 223-1BH30-2XB0**	**6AG1 223-1PH30-2XB0**	**6AG1 223-1PL30-2XB0**	**6AG1 223-1BL30-2XB0**
Order No. based on	**6ES7 223-1BH30-0XB0**	**6ES7 223-1PH30-0XB0**	**6ES7 223-1PL30-0XB0**	**6ES7 223-1BL30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible			
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme			
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.			

[1] ISA -S71.04 severity level GX from October 2010

Ordering data

		Order No.
SIPLUS SM 1221 **Digital input module**		
(extended temperature range and medial exposure)		
8 inputs, 24 V DC, isolated, current sourcing/sinking; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 221-1BF30-2XB0**
16 inputs, 24 V DC, isolated, current sourcing/sinking; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 221-1BH30-2XB0**
SIPLUS SM 1222 **Digital output module**		
(extended temperature range and medial exposure)		
8 outputs, 24 V DC; 0.5 A, 5 W, isolated	C	**6AG1 222-1BF30-2XB0**
16 outputs, 24 V DC; 0.5 A, 5 W, isolated	C	**6AG1 222-1BH30-2XB0**
8 relay outputs, 5 ... 30 V DC/5 ... 250 V AC, 2 A, 30 W DC/200 W AC; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 222-1HF30-2XB0**
16 relay outputs, 5 ... 30 V DC/5 ... 250 V AC, 2 A, 30 W DC/200 W AC; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 222-1HH30-2XB0**

		Order No.
SIPLUS SM 1223 **Digital input/output module**		
(extended temperature range and medial exposure)		
8 inputs, 24 V DC, IEC type 1 current sinking; 8 24 V DC transistor outputs, 0.5 A, 5 W from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 223-1BH30-2XB0**
16 inputs, 24 V DC, IEC type 1 current sinking; 16 24 V DC transistor outputs, 0.5 A, 5 W	C	**6AG1 223-1BL30-2XB0**
8 inputs, 24 V DC, IEC type 1 current sinking; 8 relay outputs, 5 ... 30 V DC/5 ... 250 V AC, 2 A, 30 W DC/200 W AC; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 223-1PH30-2XB0**
16 inputs, 24 V DC, IEC type 1 current sinking; 16 relay outputs, 5 ... 30 V DC/5 ... 250 V AC, 2 A, 30 W DC/200 W AC; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 223-1PL30-2XB0**
Accessories		see S7-1200 digital modules, pages 4/45, 4/49, 4/56

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

SIPLUS SB 1223 digital input/output module

Overview

- Digital inputs and outputs as supplement to the integral I/O of the SIMATIC S7-1200 CPUs
- Can be plugged direct into the CPU

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS SB 1223
Order No.	**6AG1 223-0BD30-5XB0**
Order No. based on	**6ES7 223-0BD30-0XB0**
Ambient temperature range	-25 ... +55 °C; condensation permissible
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.

[1] ISA -S71.04 severity level GX from October 2010

Ordering data

		Order No.
Digital input/output module Signal Board SIPLUS SB 1223 (extended temperature range and medial exposure)		
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	**6AG1 223-0BD30-5XB0**
Accessories		see S7-1200 digital modules, page 4/60

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

4

SM 1231 analog input module

Overview

- Analog inputs for SIMATIC S7-1200
- With extremely short conversion times
- For connecting analog sensors without additional amplifiers
- For solving even more complex automation tasks

Application

The SM 1231 analog input signal modules allow the connection of the controller to analog signals of the process.

This provides users with the following advantages:

- Optimal adaptation:
  With analog signal modules, users can optimally adapt their controllers even to more complex tasks.
- Direct connection of sensors:
  Up to 14 bit resolution and different input ranges permit the connection of sensors without additional amplifier.
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple.

Design

The signal modules have the same design features as the basic devices.

- Installation on DIN rails:
  The modules are snapped onto the rail next to the CPU on the right and are electrically and mechanically connected to each other and to the CPU by the integral slide mechanism.
- Direct installation:
  Horizontal or vertical mounting on DIN rail or direct mounting in the cabinet using integral lugs.

Function

The SM 1231 analog input signal modules convert analog signals from the process into digital signals for internal processing by the SIMATIC S7-1200.

Technical specifications

	6ES7 231-4HD30-0XB0	6ES7 231-4HF30-0XB0
Product type designation	SM 1231 AI 4 x13 bit	SM 1231 AI 8 x 13 bit
Supply voltages		
Rated value		
• 24 V DC	Yes	Yes
Current consumption		
Current consumption, typ.	45 mA	45 mA
from backplane bus 5 V DC, typ.	80 mA	90 mA
Power loss		
Power loss, typ.	1.5 W	1.5 W
Connection method		
required front connector	Yes	Yes
Analog inputs		
Number of analog inputs	4; Current or voltage differential inputs	8; Current or voltage differential inputs
permissible input frequency for current input (destruction limit), max.	± 35 V	± 35 V
permissible input current for voltage input (destruction limit), max.	40 mA	40 mA
Cycle time (all channels) max.	625 µs	625 µs
Technical unit for temperature measurement adjustable		
• Voltage	Yes; ±10 V, ±5 V, ±2.5 V	Yes; ±10 V, ±5 V, ±2.5 V
• Current	Yes; 0 to 20 mA	Yes; 0 to 20 mA
• Thermocouple	No	No
• Resistance thermometer	No	No
• Resistance	No	No
Input ranges (rated values), voltages		
• -10 V to +10 V	Yes	Yes
• Input resistance (-10 V to +10 V)	≥9 Mohms	≥9 Mohms
• -2.5 V to +2.5 V	Yes	Yes
• Input resistance (-2.5 V to +2.5 V)	≥9 Mohms	≥9 Mohms
• -5 V to +5 V	Yes	Yes
• Input resistance (-5 V to +5 V)	≥9 Mohms	≥9 Mohms
Input ranges (rated values), currents		
• 0 to 20 mA	Yes	Yes
• Input resistance (0 to 20 mA)	≥ 250 ohms	≥ 250 ohms
Voltage input		
• permissible input voltage for voltage input (destruction limit), max.	35 V	35 V

Technical specifications (continued)

	6ES7 231-4HD30-0XB0	6ES7 231-4HF30-0XB0
Product type designation	SM 1231 AI 4 x13 bit	SM 1231 AI 8 x 13 bit
Current input		
• permissible input current for current input (destruction limit), max.	40 mA	40 mA
Temperature compensation		
• Temperature compensation parameterizable	No	No
Analog outputs		
Number of analog outputs	0	0
Analog value creation		
Integrations and conversion time/ resolution per channel		
• Resolution with overrange (bit including sign), max.	12 bit; + sign	12 bit; + sign
• Integration time, parameterizable	Yes	Yes
• Interference voltage suppression for interference frequency f1 in Hz	40 dB, DC to 60 V for interference frequency 50 / 60 Hz	40 dB, DC to 60 V for interference frequency 50 / 60 Hz
Smoothing of measured values		
• parameterizable	Yes	Yes
• Step: None	Yes	Yes
• Step: Low	Yes	Yes
• Step: Medium	Yes	Yes
• Step: High	Yes	Yes
Errors/accuracies		
Temperature error (relative to input area)	25°C ±0.1% to 55°C ±0.2% total measurement range	25°C ±0.1% to 55°C ±0.2% total measurement range
Basic error limit (operational limit at 25 °C)		
• Voltage, relative to input area	+/- 0,1 %	+/- 0,1 %
• Current, relative to input area	+/- 0,1 %	+/- 0,1 %
Interference voltage suppression for f = n x (fl +/- 1%), fl = interference frequency		
• common mode voltage, max.	12 V	12 V
Interrupts/diagnostics/ status information		
Alarms		
• Alarms	Yes	Yes
• Diagnostic alarm	Yes	Yes
Diagnoses		
• Diagnostic functions	Yes	Yes
• Monitoring the supply voltage to the electronics	Yes	Yes
• Wire break	No	No

	6ES7 231-4HD30-0XB0	6ES7 231-4HF30-0XB0
Product type designation	SM 1231 AI 4 x13 bit	SM 1231 AI 8 x 13 bit
Diagnostics indication LED		
• for status of inputs	Yes	Yes
• for maintenance	Yes	Yes
Galvanic isolation		
Galvanic isolation analog outputs		
• between the channels and the power supply of the electronics	No	No
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 shipping package	0.3 m; five times, in shipping package
• Temperature		
- permissible temperature range	-40 °C ... +70 °C	-40 °C ... +70 °C
• Atmospheric pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 to 660 hPa	1080 to 660 hPa
• Relative humidity		
- permissible range (without condensation) at 25 °C	95%	95%
Mechanical and climatic conditions during operation		
Climatic conditions during operation		
• Temperature		
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
• Air pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 ... 795 hPa	1080 ... 795 hPa
• Concentration of pollutants		
- SO2 at RH < 60% without condensation	< 0.5 ppm	< 0.5 ppm
- H2S at RH < 60% without condensation	< 0.1 ppm	< 0.1 ppm
Degree of protection		
IP20	Yes	Yes
Standards, approvals, certificates		
CE mark	Yes	Yes
C-TICK	Yes	Yes
FM approval	Yes	Yes

SM 1231 analog input module

Technical specifications (continued)

	6ES7 231-4HD30-0XB0	6ES7 231-4HF30-0XB0
Product type designation	SM 1231 AI 4 x13 bit	SM 1231 AI 8 x 13 bit
Mechanics		
Type of housing (front)		
• Plastic	Yes	Yes
Dimensions and weight		
Dimensions		
• Width	45 mm	45 mm
• Height	100 mm	100 mm
• Depth	75 mm	75 mm
Weight		
• Weight, approx.	180 g	180 g

More information

Brochures

Information material for downloading can be found in the Internet:

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

Ordering data

		Order No.
SM 1231 analog input signal module		
4 analog inputs ±10 V, ±5 V, ±2.5 V, or 0 ... 20 mA; 12 bits + sign	C	**6ES7 231-4HD30-0XB0**
8 analog inputs ±10 V, ±5 V, ±2.5 V, or 0 to 20 mA; 12 bits + sign	C	**6ES7 231-4HF30-0XB0**
Accessories		
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
Terminal block (spare part)		
for 8/16-channel analog signal modules		
with 7 screws, gold-plated; 4 pcs.	C	**6ES7 292-1BG30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

Overview

- Analog outputs for SIMATIC S7-1200
- With extremely short conversion times
- For connecting analog actuators without additional amplifiers
- For solving even more complex automation tasks

Application

SM 1232 analog output signal modules permit the use of analog outputs.

This provides users with the following advantages:

- Optimal adaptation:
  With analog signal modules, users can optimally adapt their controllers even to more complex tasks
- Direct connection of actuators:
  Up to 14 bit resolution permit the connection of actuators without an additional amplifier
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple

Design

The signal modules have the same design features as the basic devices.

- Installation on DIN rails:
  The modules are snapped onto the rail next to the CPU on the right and are electrically and mechanically connected to each other and to the CPU by the integral slide mechanism.
- Direct installation:
  Horizontal or vertical mounting on DIN rail or direct mounting in the cabinet using integral lugs.

Function

SM 1232 analog output signal modules convert digital signals of the SIMATIC S7-1200 into signals for controlling the respective process.

Technical specifications

	6ES7 232-4HB30-0XB0	6ES7 232-4HD30-0XB0
Product type designation	SM 1232 AQ 2x14 bit	SM 1232 AQ 4 x 14bit
Supply voltages		
Rated value		
• 24 V DC	Yes	Yes
Current consumption		
Current consumption, typ.	45 mA	45 mA
from backplane bus 5 V DC, typ.	80 mA	80 mA
Power loss		
Power loss, typ.	1.5 W	1.5 W
Connection method		
required front connector	Yes	Yes
Analog inputs		
Number of analog inputs	0	
Analog outputs		
Number of analog outputs	2; Current or voltage	4; Current or voltage
Output ranges, voltage		
• -10 to +10 V	Yes	Yes

	6ES7 232-4HB30-0XB0	6ES7 232-4HD30-0XB0
Product type designation	SM 1232 AQ 2x14 bit	SM 1232 AQ 4 x 14bit
Output ranges, current		
• 0 to 20 mA	Yes	Yes
Load impedance (in rated range of output)		
• with voltage outputs, min.	1 000 Ω	1 000 Ω
• with current outputs, max.	600 Ω	600 Ω
Analog value creation		
Measurement principle	Differential	Differential
Integrations and conversion time/ resolution per channel		
• Resolution (incl. overrange)	Voltage: 14 bits; Current : 13 bits	Voltage: 14 bits; Current : 13 bits
• Integration time, parameterizable	Yes	Yes
• Interference voltage suppression for interference frequency f1 in Hz	40 dB, DC to 60 V for interference frequency 50 / 60 Hz	40 dB, DC to 60 V for interference frequency 50 / 60 Hz

Technical specifications (continued)

	6ES7 232-4HB30-0XB0	6ES7 232-4HD30-0XB0
Product type designation	SM 1232 AQ 2x14 bit	SM 1232 AQ 4 x 14bit
Errors/accuracies		
Temperature error (relative to output area)	25°C ±0.3% to 55°C ±0.6% total measurement range	25°C ±0.3% to 55°C ±0.6% total measurement range
Basic error limit (operational limit at 25 °C)		
• Voltage, relative to output area	+/- 0,3 %	+/- 0,3 %
• Current, relative to output area	+/- 0,3 %	+/- 0,3 %
Interference voltage suppression for f = n x (fl +/- 1%), fl = interference frequency		
• common mode voltage, max.	12 V	12 V
Interrupts/diagnostics/ status information		
Alarms		
• Alarms	Yes	Yes
• Diagnostic alarm	Yes	Yes
Diagnoses		
• Diagnostic functions	Yes	Yes
• Monitoring the supply voltage to the electronics	Yes	Yes
• Wire break	Yes	Yes
• Short circuit	Yes	Yes
Diagnostics indication LED		
• for status of inputs	Yes	Yes
• for maintenance	Yes	Yes
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 shipping package	0.3 m; five times, in shipping package
• Temperature		
- permissible temperature range	-40 °C ... +70 °C	-40 °C ... +70 °C
• Atmospheric pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 to 660hPa	1080 to 660hPa
• Relative humidity		
- permissible range (without condensation) at 25 °C	95%	95%

	6ES7 232-4HB30-0XB0	6ES7 232-4HD30-0XB0
Product type designation	SM 1232 AQ 2x14 bit	SM 1232 AQ 4 x 14bit
Mechanical and climatic conditions during operation		
Climatic conditions during operation		
• Temperature		
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
• Air pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 ... 795 hPa	1080 ... 795 hPa
• Concentration of pollutants		
- SO_2 at RH < 60% without condensation	< 0.5 ppm	< 0.5 ppm
- H_2S at RH < 60% without condensation	< 0.1 ppm	< 0.1 ppm
Degree of protection		
IP20	Yes	Yes
Standards, approvals, certificates		
CE mark	Yes	Yes
C-TICK	Yes	Yes
FM approval	Yes	Yes
Mechanics		
Type of housing (front)		
• Plastic	Yes	Yes
Dimensions and weight		
Dimensions		
• Width	45 mm	45 mm
• Height	100 mm	100 mm
• Depth	75 mm	75 mm
Weight		
• Weight, approx.	180 g	180 g

Ordering data

		Order No.
SM 1232 analog output signal module		
2 analog outputs, ±10 V with 14 bits or 0 ... 20 mA with 13 bits	C	**6ES7 232-4HB30-0XB0**
4 analog outputs, ±10 V with 14 bits or 0 to 20 mA with 13 bits	C	**6ES7 232-4HD30-0XB0**
Accessories		
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

4

SB 1232 analog output module

Overview

- Analog output for the SIMATIC S7-1200
- Can be plugged direct into the CPU

Application

The SB 1232 analog output signal board permits the use of analog outputs.

This provides users with the following advantages:

- Optimal adaptation:
  Signal boards can be used where space is limited or if only a few additional inputs/outputs are required. Each S7-1200 CPU can be modularly expanded by a signal board. This does not increase the mounting space required for the controller.
- Direct connection of sensors and actuators:
  Up to 14 bit resolution and different output ranges permit the connection of actuators without additional amplifier.
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple.

Design

The signal boards are plugged directly into the receptacle on the front of each S7-1200 CPU.

- Mounting:
  Signal boards are plugged directly into the SIMATIC S7-1200 CPU and are thus electrically and mechanically connected to the CPU.
- The CPU mounting dimensions remain unchanged.
- All signal boards are easy to replace thanks to removable connecting terminals ("independent wiring").

Function

The SB 1232 analog output signal board converts digital signals of the S7-1200 into analog signals for the process.

Technical specifications

	6ES7 232-4HA30-0XB0
Product type designation	SB 1232 1 x AO
Supply voltages	
Power supply to the transmitters	
• Supply current, max.	25 mA
Current consumption	
from backplane bus 5 V DC, typ.	15 mA
Power loss	
Power loss, typ.	1.5 W
Analog outputs	
Number of analog outputs	1
Cycle time (all channels) max.	Voltage: 300 µS (R), 750 µS (1 uF) Current: 600 ms (1 mH); 2 ms (10 mH)
Output ranges, voltage	
• -10 to +10 V	Yes
Output ranges, current	
• 0 to 20 mA	Yes

	6ES7 232-4HA30-0XB0
Product type designation	SB 1232 1 x AO
Load impedance (in rated range of output)	
• with voltage outputs, min.	1 000 Ω
• with current outputs, max.	600 Ω
Analog value creation	
Measurement principle	Differential
Integrations and conversion time/ resolution per channel	
• Resolution (incl. overrange)	V / 12 bits, I / 11 bits
Smoothing of measured values	
• parameterizable	Yes
Analog value generation (in isochronous mode)	
Cable length	
• Max. cable length, shielded	10 m; twisted
Errors/accuracies	
Temperature error (relative to output area)	25°C ±0.5% ... 55°C ±1%

Technical specifications (continued)

	6ES7 232-4HA30-0XB0
Product type designation	SB 1232 1 x AO
Interrupts/diagnostics/ status information	
Alarms	
• Alarms	Yes
Diagnoses	
• Diagnostic functions	Yes
Diagnostics indication (LED)	
• for status of outputs	Yes
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 shipping package
• Atmospheric pressure acc. to IEC 60068-2-13	
- permissible atmospheric pressure	1080 to 660hPa
• Relative humidity	
- permissible range (without condensation) at 25 °C	95%
Mechanical and climatic conditions during operation	
Climatic conditions during operation	
• Temperature	
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
Degree of protection	
IP20	Yes
Mechanics	
Type of housing (front)	
• Plastic	Yes
Dimensions and weight	
Dimensions	
• Width	38 mm
• Height	62 mm
• Depth	21 mm
Weight	
• Weight, approx.	40 g

Ordering data

		Order No.
SB 1232 analog output signal board		
1 analog output, ±10 V with 12 bits or 0 ... 20 mA with 11 bits	C	**6ES7 232-4HA30-0XB0**
Accessories		
Terminal block (spare part)		
for signal board		
with 6 screws, gold-plated; 4 pcs.	C	**6ES7 292-1BF30-0XA0**
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

SM 1234 analog input/output module

Overview

- Analog inputs and outputs for the SIMATIC S7-1200
- With extremely short conversion times
- For connecting analog actuators and sensors without additional amplifiers
- For solving even more complex automation tasks

Application

SM 1234 analog input/outputs permit the use of analog inputs/outputs.

This provides users with the following advantages:

- Optimal adaptation:
  With analog and digital expansion modules, users can optimally match their controllers even to more complex tasks
- Direct connection of sensors and actuators:
  Up to 14 bit resolution plus sign and different input/output ranges permit the connection of sensors and actuators without an additional amplifier
- Flexibility:
  If the task is expanded subsequently, the controller can be upgraded. Updating of the user program is extremely simple

Design

The SM 1234 analog input/output signal modules have the same design features as the basic devices.

- Installation on DIN rails:
  The modules are snapped onto the rail next to the CPU on the right and are electrically and mechanically connected to each other and to the CPU by the integral slide mechanism.
- Direct installation:
  Horizontal or vertical mounting on DIN rail or direct mounting in the cabinet using integral lugs.

Function

The SM 1234 analog input/output signal modules

- convert analog signals from the process into digital signals for internal processing by the SIMATIC S7-1200.
- convert digital signals of the SIMATIC S7-1200 into signals for controlling the respective process.

Technical specifications

	6ES7 234-4HE30-0XB0
Product type designation	SM 1234 AI 4 x13 bit AQ 2 x14 bit
Supply voltages	
Rated value	
• 24 V DC	Yes
Current consumption	
Current consumption, typ.	60 mA
from backplane bus 5 V DC, typ.	80 mA
Power loss	
Power loss, typ.	2 W
Connection method	
required front connector	Yes
Analog inputs	
Number of analog inputs	4; Current or voltage differential inputs
permissible input frequency for current input (destruction limit), max.	± 35 V
permissible input current for voltage input (destruction limit), max.	40 mA
Cycle time (all channels) max.	625 µs
Technical unit for temperature measurement adjustable	
• Voltage	Yes; ±10 V, ±5 V, ±2.5 V
• Current	Yes; 0 to 20 mA
• Thermocouple	No
• Resistance thermometer	No
• Resistance	No
Input ranges (rated values), voltages	
• -10 V to +10 V	Yes
• Input resistance (-10 V to +10 V)	≥9 Mohms
• -2.5 V to +2.5 V	Yes
• Input resistance (-2.5 V to +2.5 V)	≥9 Mohms
• -5 V to +5 V	Yes
• Input resistance (-5 V to +5 V)	≥9 Mohms
Input ranges (rated values), currents	
• 0 to 20 mA	Yes
• Input resistance (0 to 20 mA)	≥ 250 ohms
Voltage input	
• permissible input voltage for voltage input (destruction limit), max.	35 V

Technical specifications (continued)

	6ES7 234-4HE30-0XB0
Product type designation	SM 1234 AI 4 x13 bit AQ 2 x14 bit
Current input	
• permissible input current for current input (destruction limit), max.	40 mA
Temperature compensation	
• Temperature compensation parameterizable	No
Analog outputs	
Number of analog outputs	2; Current or voltage
Output ranges, voltage	
• -10 to +10 V	Yes
Output ranges, current	
• 0 to 20 mA	Yes
Load impedance (in rated range of output)	
• with voltage outputs, min.	1 000 Ω
• with current outputs, max.	600 Ω
Analog value creation	
Measurement principle	Differential
Integrations and conversion time/ resolution per channel	
• Resolution (incl. overrange)	Voltage: 14 bits; Current : 13 bits
• Resolution with overrange (bit including sign), max.	12 bit; + sign
• Integration time, parameterizable	Yes
• Interference voltage suppression for interference frequency f1 in Hz	40 dB, DC to 60 V for interference frequency 50 / 60 Hz
Smoothing of measured values	
• parameterizable	Yes
• Step: None	Yes
• Step: Low	Yes
• Step: Medium	Yes
• Step: High	Yes
Errors/accuracies	
Temperature error (relative to input area)	25°C ±0.1% to 55°C ±0.2% total measurement range
Temperature error (relative to output area)	25°C ±0.3% to 55°C ±0.6% total measurement range
Basic error limit (operational limit at 25 °C)	
• Voltage, relative to input area	+/- 0,1 %
• Current, relative to input area	+/- 0,1 %

	6ES7 234-4HE30-0XB0
Product type designation	SM 1234 AI 4 x13 bit AQ 2 x14 bit
Basic error limit (operational limit at 25 °C)	
• Voltage, relative to output area	+/- 0,3 %
• Current, relative to output area	+/- 0,3 %
Interference voltage suppression for f = n x (fl +/- 1%), fl = interference frequency	
• common mode voltage, max.	12 V
Interrupts/diagnostics/ status information	
Alarms	
• Alarms	Yes
• Diagnostic alarm	Yes
Diagnoses	
• Diagnostic functions	Yes
• Monitoring the supply voltage to the electronics	Yes
• Wire break	Yes
• Short circuit	Yes
Diagnostics indication (LED)	
• for status of inputs	Yes
• for status of outputs	Yes
• for maintenance	Yes
Galvanic isolation	
Galvanic isolation analog outputs	
• between the channels and the power supply of the electronics	No
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 shipping package
• Temperature	
- permissible temperature range	-40 °C ... +70 °C
• Atmospheric pressure acc. to IEC 60068-2-13	
- permissible atmospheric pressure	1080 to 660 hPa
• Relative humidity	
- permissible range (without condensation) at 25 °C	95%

SM 1234 analog input/output module

Technical specifications (continued)

	6ES7 234-4HE30-0XB0
Product type designation	SM 1234 AI 4 x13 bit AQ 2 x14 bit
Mechanical and climatic conditions during operation	
Climatic conditions during operation	
• Temperature	
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
• Atmospheric pressure acc. to IEC 60068-2-13	
- permissible atmospheric pressure	1080 ... 795 hPa
• Concentration of pollutants	
- SO_2 at RH < 60% without condensation	< 0.5 ppm
- H_2S at RH < 60% without condensation	< 0.1 ppm
Degree of protection	
IP20	Yes
Standards, approvals, certificates	
CE mark	Yes
C-TICK	Yes
FM approval	Yes
Mechanics	
Type of housing (front)	
• Plastic	Yes
Dimensions and weight	
Dimensions	
• Width	45 mm
• Height	100 mm
• Depth	75 mm
Weight	
• Weight, approx.	220 g

Ordering data

		Order No.
SM 1234 analog input/output signal module		
4 analog inputs, ±10 V, ±5 V, ±2.5 V, or 0 ... 20 mA, 12 bits + sign; 2 analog outputs, ±10 V with 14 bits or 0 ... 20 mA with 13 bits	C	**6ES7 234-4HE30-0XB0**
Accessories		
Extension cable for two-tier configuration	C	**6ES7 290-6AA30-0XA0**
for connecting digital/analog signal modules; length 2 m		
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview

- To measure temperatures easily and with high accuracy
- 7 common thermocouple types can be used
- Also for measurement of analog signals with low level (±80 mV)
- Easy to retrofit in existing systems

Field of application

The SM 1231 thermocouple module is a highly accurate temperature sensor using standard thermocouples. Low-level analog signals in the range of ±80 mV can also be detected. The SM 1231 thermocouple modules can be used with the CPU of the S7-1200 series.

Construction

The SM 1231 thermocouple modules have the same construction features as other modules in the S7-1200 series: Mounting on DIN rails:

- The modules are snapped onto the rails next to the CPU on the right and are connected to each other and to the CPU 12xx by means of the integrated backplane bus.
- Direct installation:
  The module can also be screwed directly to the wall using the pre-drilled holes. This installation method is recommended in cases of high vibration load.
- Thermocouples:
  In each case, 4 thermocouples of types J, K, T, E, R, S and N can be used. They are connected directly to the module without amplifiers.
- Installation site
- Thermocouple modules should be installed in locations with low fluctuations in temperature to ensure the highest measurement and repeat accuracy.

Function

- Different measuring ranges:
  Thermocouples of types J, K, T, E, R, S and N;
  Analog signal recording ±80 mV.
- Testing for open lines.
- Faults caused by contact voltages at the connection between thermocouple and module are prevented; when recording analog signals (±80 mV), the compensation is automatically deactivated.
- Temperature scale:
  The measured temperature can be displayed in °C or °F.

Technical specifications

	6ES7 231-5QD30-0XB0
Product type designation	Thermocouple module SM 1231
Current consumption	
from load voltage L+ (no-load), max.	60 mA
from 5 V DC backplane bus, max.	87 mA
Power loss	
Power loss, typ.	1.8 W
Connection system	
pluggable IO terminals	Yes
Analog inputs	
Number of analog inputs	4
Max. cable length, shielded	100 m; to sensor
Cable loop resistance	100 Ω
Refresh time (all channels)	405 ms
Input ranges (rated values), voltages	
• -80 mV to +80 mV	Yes
Input ranges (rated values), thermocouples	
• Type E	Yes
• Type J	Yes
• Type K	Yes
• Type N	Yes
• Type R	Yes
• Type S	Yes
• Type T	Yes
Input ranges (rated values), resistors	
• permissible input voltage for voltage input (destruction limit), max.	30 V
Formation of analog values	
Measuring principle	Sigma-Delta
Integration and conversion time/ resolution per channel	
• Resolution with overrange (bits including sign), max.	16 bits; temperature 0.1 °C / 0.1 °F
• Noise suppression for interference frequency f1 in Hz	85 dB at 50 / 60 / 400 Hz
Range of conversion values that can be displayed	
• bipolar signals	-27 648 to +27 648
Errors/accuracies	
Cold connection point	+/-1.5 °C
Repeat accuracy in settled state at 25 °C (relative to input range)	+/- 0.05 %
Operational limit over entire temperature range	
• Voltage, related to the output range	+/- 0.1 %

SM 1231 Thermocouple module

Technical specifications (continued)

	6ES7 231-5QD30-0XB0
Product type designation	Thermocouple module SM 1231
Noise suppression for f = n x (fl +/- 1 %), fl = interfering frequency	
• Common-mode voltage, max.	120 V; AC
• Common-mode interference, min.	120 dB; at AC 120 V
Isolation	
Isolation of analog inputs	
• Isolation analog inputs	Yes
Dimensions and weight	
Dimensions	
• Width	71.2 mm
• Height	80 mm
• Depth	62 mm
Weight	

Ordering data

		Order No.
Thermocouple module SM 1231 Inputs +/- 80 mV, resolution 15 bit + sign, thermocouple types J, K, S, T, R, E, N; 4 inputs	C	**6ES7 231-5QD30-0XB0**
Accessories		
S7-1200 automation system, System Manual For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview

- To measure temperatures easily and with high accuracy
- 4 inputs
- The most common resistance temperature detectors can be used
- Easy to retrofit in existing systems

Field of application

The SM 1231 RTD modules permit high-precision temperature recording using standard resistance temperature detectors. They can be used with CPU 1211, 1212 and 1214.

Construction

The SM 1231 RTD modules have the same construction features as other modules in the S7-1200 series:

- Mounting on DIN rails:
  The modules are snapped onto the rails next to the CPU on the right and are connected to each other and to the CPU 12xx by means of the integrated backplane bus.
- Direct installation:
  The module can also be screwed directly to the wall using the pre-drilled holes. This installation method is recommended in cases of high vibration load.
- The most common resistance temperature detectors can be used: Pt 100, Pt 200, Pt 500, Pt 1000, Pt 10000, Ni 100, Ni 120, Ni 1000, Cu 10, FS 150, FS 30, FS 600. The resistance temperature detectors are connected directly to the module without amplifiers, whereby they must all be of the same type. The detectors can be connected with 2, 3 or 4 lines.
- Installation site:
  The RTD module should be installed in locations with low fluctuations in temperature to ensure the highest measurement and repeat accuracy.
- DIP switches:
  The required settings, e.g. selection of the connected resistance detectors, are made using the DIP switches on the module.

Function

- Resistance temperature detectors of types Pt 100, Pt 200, Pt 500, Pt 1000, Pt 10000, Ni 100, Ni 120, Ni 1000, Cu 10, FS 150, FS 30, FS 600.
- Temperature scale:
  The measured temperature can be displayed in °C or °F.

Technical specifications

	6ES7 231-5PD30-0XB0
Product type designation	SM 1231 RTD signal module
Current consumption	
from load voltage L+ (no load), max.	60 mA
from 5 V DC backplane bus, max.	87 mA
Power loss	
Power loss, typ.	1.8 W; sensor: 1 mW
Connection system	
pluggable IO terminals	Yes
Analog inputs	
Number of analog inputs	4
Max. cable length, shielded	100 m; to sensor
Cable loop resistance	20 Ω; max. 2.7 Ω for Cu
Refresh time (all channels)	405 ms; 700 ms for Pt10000
Input ranges (rated values), resistance thermometer	
• Cu 10	Yes
• Ni 10	Yes
• Ni 1000	Yes
• Ni 120	Yes
• Pt 100	Yes
• Pt 1000	Yes
• Pt 10000	Yes
• Pt 200	Yes
• Pt 500	Yes
Input ranges (rated values), resistors	
• 0 to 150 Ω	Yes
• 0 to 300 Ω	Yes
• 0 to 600 Ω	Yes
• permissible input voltage for voltage input (destruction limit), max.	30 V; DC 30 V (sensor), DC 5 V (source)
Formation of analog values	
Measuring principle	Sigma-Delta
Integration and conversion time/resolution per channel	
• Resolution with overrange (bits including sign), max.	16 bits; temperature 0.1 °C / 0.1 °F
• Noise suppression for interference frequency f1 in Hz	85 dB at 50 / 60 / 400 Hz
Range of conversion values that can be displayed	
• bipolar signals	-27 648 to +27 648
Errors/accuracies	
Repeat accuracy in settled state at 25 °C (relative to input range)	+/- 0.05 %

SM 1231 RTD signal module

Technical specifications (continued)

	6ES7 231-5PD30-0XB0
Product type designation	SM 1231 RTD signal module
Operational limit over entire temperature range	
• Voltage, related to the output range	+/- 0.1 %
Noise suppression for f = n x (fl +/- 1 %), fl = interfering frequency	
• Common-mode voltage, max.	0 V
• Common-mode interference, min.	120 dB; at AC 120 V
Isolation	
Isolation of analog inputs	
• Isolation analog inputs	Yes
Dimensions and weight	
Dimensions	
• Width	71.2 mm
• Height	80 mm
• Depth	62 mm
Weight	
• Weight, approx.	210 g

Ordering data

		Order No.
SM 1231 RTD signal module	C	**6ES7 231-5PD30-0XB0**
4 inputs for resistance temperature detectors Pt100/200/500/1000/10000, Ni100/120/1000, Cu10; resistors 150/300/600 ohms, resolution 15 bits + sign		
Accessories		
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

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

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview SIPLUS SM 1231 analog input module

- Analog inputs for SIMATIC S7-1200
- With extremely short conversion times
- For connecting analog sensors without additional amplifiers
- For solving even more complex automation tasks

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS SM 1231
Order No.	**6AG1 231-4HD30-2XB0**
Order No. based on	**6ES7 231-4HD30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.

[1] ISA -S71.04 severity level GX from October 2010

Overview SIPLUS SM 1232 analog output module

- Analog outputs for SIMATIC S7-1200
- With extremely short conversion times
- For connecting analog actuators without additional amplifiers
- For solving even more complex automation tasks

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS SM 1232
Order No.	**6AG1 232-4HB30-2XB0**
Order No. based on	**6ES7 232-4HB30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.

[1] ISA -S71.04 severity level GX from October 2010

SIPLUS SM 1231, SM 1232, SM 1234

Overview SIPLUS SM 1234 analog input/output module

- Analog inputs and outputs for the SIMATIC S7-1200
- With extremely short conversion times
- For connecting analog actuators and sensors without additional amplifiers
- For solving even more complex automation tasks

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS SM 1234
Order No.	**6AG1 234-4HE30-2XB0**
Order No. based on	**6ES7 234-4HE30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.

[1] ISA -S71.04 severity level GX from October 2010

Ordering data

		Order No.
Analog input module Signal Module SIPLUS SM 1231 (extended temperature range and medial exposure)		
4 analog inputs ±10 V, ±5 V, ±2.5 V, or 0 ... 20 mA 12 bit + sign; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 231-4HD30-2XB0**
Analog output module Signal Module SIPLUS SM 1232 (extended temperature range and medial exposure)		
2 analog outputs, ±10 V with 14 bit or 0 ... 20 mA with 13 bit; from +60 °C to +70 °C number of simultaneously controllable inputs and outputs max. 50%	C	**6AG1 232-4HB30-2XB0**
Analog input/output module Signal Module SIPLUS SM 1234 (extended temperature range and medial exposure)		
4 analog inputs, ±10 V, ±5 V, ±2.5 V, or 0 ... 20 mA, 12 bit + sign; 2 analog outputs, ±10 V with 14 bit or 0 ... 20 mA with 13 bit	C	**6AG1 234-4HE30-2XB0**
Accessories		see S7-1200 analog modules, pages 4/66, 4/69, 4/74

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

SIPLUS SB 1232 analog output module

Overview

- Analog output for the SIMATIC S7-1200
- Can be plugged direct into the CPU

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS SB 1232
Order No.	**6AG1 232-4HA30-5XB0**
Order No. based on	**6ES7 232-4HA30-0XB0**
Ambient temperature range	-25 ... +55 °C; condensation permissible
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.

[1] ISA -S71.04 severity level GX from October 2010

Ordering data

		Order No.
Analog output module Signal Board SIPLUS SB 1232 (extended temperature range and medial exposure)		
1 analog output, ±10 V with 12 bit or 0 ... 20 mA with 11 bit	C	**6AG1 232-4HA30-5XB0**
Accessories		see S7-1200 analog modules, page 4/71

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

4

SIM 1274 simulator

Overview

- Simulator module for program testing during commissioning and ongoing operation
- Simulation of 8 or 14 inputs

Application

The SM 1274 simulator modules for SIMATIC S7-1200 provide users with the opportunity for testing user programs during commissioning and ongoing operation.

Design

The input simulators are mounted on the terminal block instead of the digital inputs.

The front of the module contains:

- Input status selector switch
- Connecting brackets for secure connection with the terminal block

Function

Program execution can be specifically influenced by setting the inputs.
The CPU reads the set input signal statuses, and processes them in the user program. The subsequent response of the controller allows conclusions to be drawn concerning program execution.

Technical specifications

	6ES7 274-1XH30-0XA0	6ES7 274-1XF30-0XA0
Product type designation	SIM 1274 14 Ch DI Simulator	SIM 1274 8 Ch DI Simulator
Supply voltages		
Rated value		
• 24 V DC	Yes	Yes
Degree of protection		
IP20	Yes	Yes

Ordering data

		Order No.
Digital input simulator SIM 1274 simulator module (optional)		
with 14 input switches, for CPU 1214C	C	**6ES7 274-1XH30-0XA0**
with 8 input switches, for CPU 1211C, CPU 1212C	C	**6ES7 274-1XF30-0XA0**
Accessories		
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview

- For quick, high-performance serial data exchange via point-to-point connection
- Implemented protocols: ASCII, USS drive protocol, Modbus RTU
- Additional protocols can also be loaded
- Simple parameterization with STEP 7 Basic

Application

The CM 1241 communication modules are used for quick, high-performance serial data exchange via point-to-point connection.

Point-to-point connection is possible to, e.g.:

- SIMATIC S7 automation systems and the systems of many other manufacturers
- Printers
- Robot controls
- Modems
- Scanners
- Bar code readers, etc.

Design

The CM 1241 communication modules have the same design features as the basic devices.

- Installation on DIN rails:
  The modules are snapped onto the rail next to the CPU on the right and are electrically and mechanically connected to each other and to the CPU by the integral slide mechanism.
- Direct installation:
  Horizontal or vertical mounting on DIN rail or direct mounting in the cabinet using integral lugs.

The communication modules are equipped with the following:

- Status LEDs for indicating “Send”, “Receive” and “Error”
- Communication interfaces:
  Available for the RS232 and RS485 physical transmission media

Function

The following standard protocols are available on the CM 1241 communication modules:

- ASCII:
  For interfacing to third-party systems with simple transmission protocols, e.g. protocols with start and end characters or with block check characters. The interface handshake signals can be called and controlled via the user program.
- MODBUS:
  For communication according to the MODBUS protocol with RTU format:
  - MODBUS master:
    Master-slave interfacing with SIMATIC S7 as master.
  - MODBUS slave:
    Master-slave interfacing with SIMATIC S7 as slave; message frame traffic from slave to slave not possible.
- USS drive protocol:
  Instructions for connection of USS protocol drives are especially supported. In this case, drives exchange data over RS485. It is then possible to control these drives, and to read and write parameters.

Further drivers for downloading are also available.

Parameterization

Parameterization of the CM 1241 communication module is particularly user-friendly and simple with STEP 7 Basic:

- The user assigns the module characteristics via a parameterization environment integrated in STEP 7 Basic, e.g.:
  - the implemented protocol drivers that are used.
  - the driver-specific characteristics that are used.

Technical specifications

	6ES7 241-1CH30-0XB0	6ES7 241-1AH30-0XB0
Product type designation	CM 1241 RS485	CM 1241 RS232
Supply voltages		
Rated value		
• 24 V DC	Yes	Yes
• permissible range, lower limit (DC)	20.4 V	20.4 V
• permissible range, upper limit (DC)	28.8 V	28.8 V
Current consumption		
Current consumption, max.	220 mA; from L5+; logic	220 mA; from L5+; logic
Power loss		
Power loss, typ.	1.1 W	1.1 W
Interfaces		
Number of interfaces	1	1
Interface physics, RS 232C (V.24)		Yes
Interface physics, RS 422/RS 485 (X.27)	Yes	
Point-to-point		
Cable length, max.	1 000 m	10 m

CM 1241 communication module

Technical specifications (continued)

	6ES7 241-1CH30-0XB0	6ES7 241-1AH30-0XB0
Product type designation	CM 1241 RS485	CM 1241 RS232
Integrated protocol driver		
• ASCII	Yes; available as library function	
• USS	Yes; available as library function	
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 shipping package	0.3 m; five times, in shipping package
• Temperature		
- permissible temperature range	-40 °C ... +70 °C	-40 °C ... +70 °C
• Air pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 to 660hPa	1080 to 660hPa
• Relative humidity		
- permissible range (without condensation) at 25 °C	95%	95%
Mechanical and climatic conditions during operation		
Climatic conditions during operation		
• Temperature		
- permissible temperature range	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted	0 °C ... 55 °C when horizontally mounted 0 °C ... 45 °C when vertically mounted
- permissible temperature change	5 °C ... 55 °C, 3 °C/ min	5 °C ... 55 °C, 3 °C/ min
• Air pressure acc. to IEC 60068-2-13		
- permissible atmospheric pressure	1080 ... 795 hPa	1080 ... 795 hPa
Software		
Runtime software		
• Target system		
- S7-1200	Yes	Yes
Dimensions and weight		
Dimensions		
• Width	30 mm	30 mm
• Height	100 mm	100 mm
• Depth	75 mm	75 mm
Weight		
• Weight, approx.	150 g	150 g

Ordering data

		Order No.
CM 1241 communication module		
Communication module for point-to-point connection, with one RS485 interface	C	**6ES7 241-1CH30-0XB0**
Communication module for point-to-point connection, with one RS232 interface	C	**6ES7 241-1AH30-0XB0**
Accessories		
S7-1200 automation system, System Manual		
For SIMATIC S7-1200 and STEP 7 Basic		
German	B	**6ES7 298-8FA30-8AH0**
English	B	**6ES7 298-8FA30-8BH0**
French	B	**6ES7 298-8FA30-8CH0**
Spanish	B	**6ES7 298-8FA30-8DH0**
Italian	B	**6ES7 298-8FA30-8EH0**
Chinese	B	**6ES7 298-8FA30-8KH0**
S7-1200 automation system, Easy Book		
Brief instructions		
German	B	**6ES7 298-8FA30-8AQ0**
English	B	**6ES7 298-8FA30-8BQ0**
French	B	**6ES7 298-8FA30-8CQ0**
Spanish	B	**6ES7 298-8FA30-8DQ0**
Italian	B	**6ES7 298-8FA30-8EQ0**
Chinese	B	**6ES7 298-8FA30-8KQ0**
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**
Trial License STEP 7 Basic; on DVD, 14-day trial	D	**6ES7 822-0AA00-0YA7**

B: Subject to export regulations: AL: N and ECCN: EAR99T
C: Subject to export regulations: AL: N and ECCN: EAR99H
D: Subject to export regulations: AL: N and ECCN: 5D992

More information

Brochures

Information material for downloading can be found in the Internet:

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

Overview

- Unmanaged switch for connecting a SIMATIC S7-1200 to an Industrial Ethernet network with a line, tree or star topology
- Multiplication of Ethernet interfaces on a SIMATIC S7-1200 for additional connection of up to three programming devices, operator controls, and further Ethernet nodes
- Simple, space-saving mounting on the SIMATIC S7-1200 mounting rail
- Low-cost solution for implementing small, local Ethernet networks
- Connection without any problems using RJ45 standard 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
- Fast commissioning, as no configuration is necessary
- Flexible expansion of the network by simply inserting the CSM

Application

The CSM 1277 is an Industrial Ethernet switch of compact design for use in the SIMATIC S7-1200. The CSM 1277 can be used to multiply the Ethernet interface of the SIMATIC S7-1200 for 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 auto-sensing and autocrossover functions
- LEDs for diagnostics and for status display

Network topology and network 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

CSM 1277 unmanaged

Technical specifications

	6GK7 277-1AA00-0AA0
Product type designation	**CSM 1277**
Data transmission rate	
Transmission rate 1	10 Mbit/s
Transmission rate 2	100 Mbit/s
Interfaces	
Maximum number of electrical/ optical connections for network components or terminal equipment	4
Number of electrical connections	
• For network components or terminal equipment	4
• For power supply	1
Design of electrical connection	
• For network components or terminal equipment	RJ45 port
• For power supply	3-pin terminal block
Supply voltage, current consumption, power loss	
Type of power supply	DC
Supply voltage, external	24 V
• Minimum	19.2 V
• Maximum	28.8 V
Current consumption, maximum	0.07 A
Product component: fusing of power supply input	Yes
Type of fusing of power supply input	0.5 A / 60 V
Effective power loss at 24 V with DC	1.6 W
Permitted ambient conditions	
Ambient temperature	
• During operating phase	0 … 60 °C
• During storage	-40 … +70 °C
• During transport	-40 … +70 °C
Relative humidity at 25 °C without condensation during operating phase, maximum	95 %
IP degree of protection	IP 20

	6GK7 277-1AA00-0AA0
Product type designation	**CSM 1277**
Design, dimensions and weights	
Type of construction	SIMATIC S7-1200 device design
Width	45 mm
Height	100 mm
Depth	75 mm
Net weight	0.15 kg
Type of mounting	
• 35 mm DIN rail mounting	Yes
• Wall mounting	No
• S7-300 rail mounting	No
Product properties, functions, components General	
Product function: switch-managed	No
Standards, specifications, approvals	
Standard	
• For EMC from FM	FM3611: Class 1, Division 2, Group A, B, C, D / T.., CL.1, Zone 2, GP. IIC, T.. Ta
• For Ex zone	EN 600079-15:2005, EN 600079-0:2006, II 3 G Ex nA II T4, KEMA 08 ATEX 0003 X
• For CSA and UL safety	UL 508, CSA C22.2 No. 142
• For emitted interference	EN 61000-6-4
• For noise immunity	EN 61000-6-2
Certificate of suitability	EN 61000-6-2, EN 61000-6-4
• CE mark	Yes
• C-Tick	Yes

Ordering data

	Order No.
CSM 1277 compact switch module 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 TP cable 4 x 2 with 2 RJ45 connectors	
• 0.5 m	**6XV1 870-3QE50**
• 1 m	**6XV1 870-3QH10**
• 2 m	**6XV1 870-3QH20**
• 6 m	**6XV1 870-3QH60**
• 10 m	**6XV1 870-3QN10**
IE FC TP Standard Cable GP 2 x 2 (Type A) 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**
IE FC stripping tool Preadjusted stripping tool for fast stripping of the Industrial Ethernet FC cables	**6GK1 901-1GA00**
IE FC Outlet RJ45 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 Electronic manuals on communications systems, protocols, products; on DVD; German/English	**6GK1 975-1AA00-3AA0**

More information

To assist in selecting the right Industrial Ethernet switches as well as configuration of modular variants, the Switch Selection Tool is available as a free download at:

http://support.automation.siemens.com/WW/view/en/39134641

SIPLUS CM 1241 communication module

Overview

- For quick, high-performance serial data exchange via point-to-point connection
- Implemented protocols: ASCII, USS drive protocol, Modbus RTU
- Additional protocols can also be loaded
- Simple parameterization with STEP 7 Basic

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS CM 1241	
Order No.	**6AG1 241-1CH30-2XB0**	**6AG1 241-1AH30-2XB0**
Order No. based on	**6ES7 241-1CH30-0XB0**	**6ES7 241-1AH30-0XB0**
Ambient temperature range	-25 ... +70 °C; condensation permissible	
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme	
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.	

[1] ISA -S71.04 severity level GX from October 2010

Ordering data

		Order No.
SIPLUS CM 1241 communication module		
(extended temperature range and medial exposure)		
Communication module for point-to-point connection, with one RS485 interface	C	**6AG1 241-1CH30-2XB0**
Communication module for point-to-point connection, with one RS232 interface	C	**6AG1 241-1AH30-2XB0**
Accessories		see CM 1241 communication module, page 4/84

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

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, 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 Input 120/230 V AC, output 24 V DC/2.5 A	**6EP1 332-1SH71**

SIPLUS 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

For further technical documentation on SIPLUS, see:
http://www.siemens.com/siplus-extreme/techdoku

	SIPLUS PM 1207
Order No.	**6AG1 332-1SH71-7AA0**
Order No. based on	**6EP1 332-1SH71**
Ambient temperature range	-25 ... +70 °C; condensation permissible
Ambient conditions	Resistant in accordance with EN60721 to chemically (-3C4), mechanically (-3S4) and biologically (-3B2) active substances and compliant with ISA S71.04 G1, G2, G3, GX[1]. For further information, refer to Environmental conditions of SIPLUS extreme (on pg. 4/4) or go to www.siemens.com/siplus-extreme
Technical data	The technical data of the standard product apply with the exception of the environmental conditions.

[1] ISA -S71.04 severity level GX from October 2010

Ordering data

	Order No.
SIPLUS PM 1207 power supply (extended temperature range and medial exposure) Input 120/230 V AC, output 24 V DC/2.5 A; Derating from +55°C ... +70 °C to 1.5 A output current	**6AG1 332-1SH71-7AA0**

Overview

- The ideal entry level series of 3.8" to 15" for operating and monitoring compact 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 compact 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

- 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

Basic Panels

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
- Scheduler for global function execution in case of global events
- Template concept for creation of screen templates (screen elements configured in the template appear in every screen)
- 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 (except KTP600)
  - clean screen
  - no battery required

Configuration

Configuration is implemented with the engineering software SIMATIC WinCC flexible 2008 Compact or with WinCC Basic V10.5, which is a component of STEP 7 Basic V10.5 (only PROFINET-based device versions).

Integration

The Basic Panels can be connected to:

- SIMATIC S7 controllers
- Non-Siemens controllers (applies for DP devices)
  - Allen Bradley DF1
  - Modicon Modbus RTU
  - Mitsubishi FX[1)]
  - Omron Hostlink/Multilink[1)]
- Non-Siemens controllers (non-Siemens drivers for PN devices)
  - Modicon Modbus TCP/IP[1)]

[1)] WinCC flexible 2008 SP2 and higher

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 type designation	KTP400 Basic mono PN	KTP600 Basic mono PN	KTP600 Basic color PN	KTP1000 Basic color PN	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	Flash / RAM	Flash / RAM	Flash / RAM	Flash / RAM	Flash / RAM
Usable memory for user data	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 of day					
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 SP1 or higher or WinCC Basic V10.5 (to be ordered separately)	WinCC flexible Compact Version 2008 SP1 or higher or WinCC Basic V10.5 (to be ordered separately)	WinCC flexible Compact Version 2008 SP1 or higher or WinCC Basic V10.5 (to be ordered separately)	WinCC flexible Compact Version 2008 SP1 or higher or WinCC Basic V10.5 (to be ordered separately)	WinCC flexible Compact Version 2008 SP1 or higher or WinCC Basic V10.5 (to be ordered separately)

Technical specifications (continued)

	6AV6 647-0AA11-3AX0	6AV6 647-0AB11-3AX0	6AV6 647-0AD11-3AX0	6AV6 647-0AF11-3AX0	6AV6 647-0AG11-3AX0
Product type designation	KTP400 Basic mono PN	KTP600 Basic mono PN	KTP600 Basic color PN	KTP1000 Basic color PN	TP1500 Basic color PN
Display					
Display type	STN, gray scales	STN, gray scales	TFT, 256 colors	TFT, 256 colors	TFT, 256 colors
Size	3.8" (76.8 mm x 57.6 mm)	5.7" (115.2 mm x 86.4 mm)	5.7" (115.2 mm x 86.4 mm)	10.4" (211.2 mm x 158.4 mm)	15" (304.1 mm x 228.1 mm)
Resolution (WxH in pixel)	320 x 240	320 x 240	320 x 240	640 x 480	1024 x 768
Backlighting					
• MTBF backlighting (at 25 °C)	Approx. 30000 hours	about 50,000 hours	about 50,000 hours	about 50,000 hours	about 50,000 hours
Operating mode					
Control elements	Membrane keyboard	Membrane keyboard	Membrane keyboard	Membrane keyboard	Touch screen
Function keys, programmable	4 function keys	6 function keys	6 function keys	8 function keys	None
Connection for mouse/ keyboard/barcode reader	- / - / -	- / - / -	- / - / -	- / - / -	- / - / -
Touch operation					
• Touch screen	analog, resistive	analog, resistive	analog, resistive	analog, resistive	analog, resistive
• Numeric/alphabetical input	Yes (on-screen keyboard) / Yes (on-screen keyboard)	Yes (on-screen keyboard) / Yes (on-screen keyboard)	Yes (on-screen keyboard) / Yes (on-screen keyboard)	Yes (on-screen keyboard) / Yes (on-screen keyboard)	Yes (on-screen keyboard) / Yes (on-screen keyboard)
Ambient conditions					
Mounting position	vertical	vertical	vertical	vertical	vertical
maximum permissible angle of inclination 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 4, NEMA 4x, NEMA 12 (when installed)	IP65, NEMA 4, 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 4, NEMA 4x, NEMA 12	CE, UL, cULus, NEMA 4, NEMA 4x, NEMA 12
I/O					
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)

Technical specifications (continued)

	6AV6 647-0AA11-3AX0	6AV6 647-0AB11-3AX0	6AV6 647-0AD11-3AX0	6AV6 647-0AF11-3AX0	6AV6 647-0AG11-3AX0
Product type designation	KTP400 Basic mono PN	KTP600 Basic mono PN	KTP600 Basic color PN	KTP1000 Basic color PN	TP1500 Basic color PN
Processor					
Processor	RISC 32 bit, 75 MHz	RISC 32 bit, 75 MHz	RISC 32 bit, 75 MHz	RISC 32-bit, 200 MHz	RISC 32-bit, 200 MHz
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
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	Ring buffer (n x 256 entries), non-retentive[1)]	Ring buffer (n x 256 entries), non-retentive[1)]	Ring buffer (n x 256 entries), non-retentive[1)]	Ring buffer (n x 256 entries), non-retentive[1)]	Ring buffer (n x 256 entries), non-retentive[1)]
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	40 KB integrated Flash	40 KB integrated Flash
Number of process images					
• Process images	50	50	50	50	50
• Variables	250[1)2)]	500[1)2)]	500[1)2)]	500[1)2)]	500[1)2)]
• Limit values	Yes	Yes	Yes	Yes	Yes
• Multiplexing	Yes	Yes	Yes	Yes	Yes
Image elements					
• Text objects	500 text elements	500 text elements	500 text elements	500 text elements	500 text 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 carrier 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

1) WinCC flexible 2008 SP2 and higher
2) WinCC Basic V10.5 SP2 and higher (component of STEP 7 Basic V10.5 SP2)

Technical specifications (continued)

	6AV6 647-0AA11-3AX0	6AV6 647-0AB11-3AX0	6AV6 647-0AD11-3AX0	6AV6 647-0AF11-3AX0	6AV6 647-0AG11-3AX0
Product type designation	KTP400 Basic mono PN	KTP600 Basic mono PN	KTP600 Basic color PN	KTP1000 Basic color PN	TP1500 Basic color PN
Fonts					
• Keyboard fonts	US American (English)	US American (English)	US American (English)	US American (English)	US American (English)
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
• Character sets	Tahoma, WinCC flexible Standard, symbol languages	Tahoma, WinCC flexible Standard, symbol languages	Tahoma, WinCC flexible Standard, symbol languages	Tahoma, WinCC flexible Standard, symbol languages	Tahoma, 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, S7-1200[2], S7- 300/400, Modicon (Modbus TCP/IP)[1], see catalog ST 80, chapter "System interfaces"	S7-200, S7-1200[2], S7- 300/400, Modicon (Modbus TCP/IP)[1], see catalog ST 80, chapter "System interfaces"	S7-200, S7-1200[2], S7- 300/400, Modicon (Modbus TCP/IP)[1], see catalog ST 80, chapter "System interfaces"	S7-200, S7-1200[2], S7- 300/400, Modicon (Modbus TCP/IP)[1], see catalog ST 80, chapter "System interfaces"	S7-200, S7-1200[2], S7- 300/400, Modicon (Modbus TCP/IP)[1], see catalog ST 80, chapter "System interfaces"
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
Weight					
Weight					
• Weight	0.32 kg	1.07 kg	1.07 kg	2.65 kg	4.2 kg

1) WinCC flexible 2008 SP2 and higher
2) WinCC Basic V10.5 SP2 and higher (component of STEP 7 Basic V10.5 SP2)

4

Ordering data		Order No.
SIMATIC KTP400 Basic mono PN	B	**6AV6 647-0AA11-3AX0**
Starter kit for SIMATIC KTP400 Basic mono PN	D	**6AV6 652-7AA01-3AA0**
SIMATIC KTP600 Basic mono PN	B	**6AV6 647-0AB11-3AX0**
Starter kit for SIMATIC KTP600 Basic mono PN	D	**6AV6 652-7BA01-3AA0**
SIMATIC KTP600 Basic color PN	B	**6AV6 647-0AD11-3AX0**
Starter kit for SIMATIC KTP600 Basic color PN	D	**6AV6 652-7DA01-3AA0**
SIMATIC KTP1000 Basic color PN	B	**6AV6 647-0AF11-3AX0**
Starter kit for SIMATIC KTP1000 Basic color PN	D	**6AV6 652-7FA01-3AA0**
SIMATIC TP1500 Basic color PN	B	**6AV6 647-0AG11-3AX0**
Starter kits consist of: • the relevant SIMATIC KTP Basic Panel • SIMATIC WinCC flexible Compact engineering software • 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 • Ethernet cable on PN devices		
Starter kit SIMATIC S7-1200 + KTP400 Basic consisting of: • SIMATIC HMI KTP400 Basic mono PN • SIMATIC S7-1200 CPU 1212C AC/DC/Rly • SIMATIC S7-1200 Simulator Module SIM 1274 • SIMATIC STEP 7 BASIC CD • SIMATIC S7-1200 HMI Manual Collection CD • Ethernet CAT5 cable, 2 m	D	**6AV6 651-7AA01-3AA0**
Starter kit SIMATIC S7-1200 + KTP600 Basic consisting of: • SIMATIC HMI KTP600 Basic color PN • SIMATIC S7-1200 CPU 1212C AC/DC/Rly • SIMATIC S7-1200 Simulator Module SIM 1274 • SIMATIC STEP 7 BASIC CD • SIMATIC S7-1200 HMI Manual Collection CD • Ethernet CAT5 cable, 2 m	D	**6AV6 651-7DA01-3AA0**

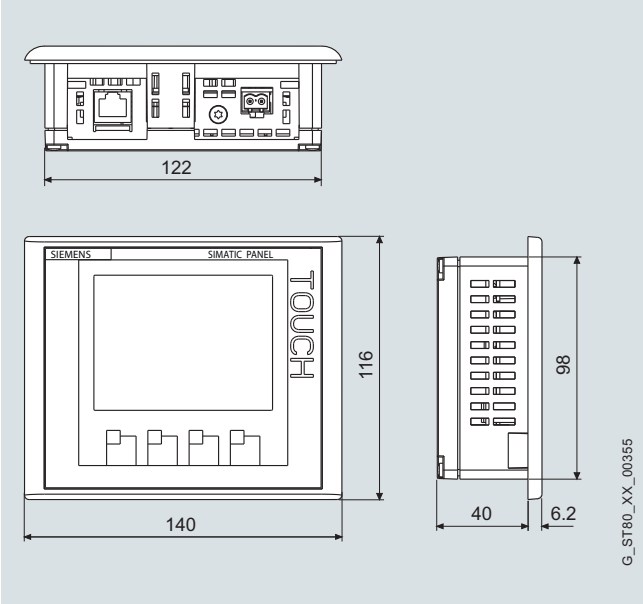
A: Subject to export regulations: AL: N and ECCN: EAR99S
B: Subject to export regulations: AL: N and ECCN: EAR99T

	Order No.
Configuration	
• All device versions: with SIMATIC WinCC flexible Compact	see catalog ST 80
• PROFINET-based device versions: with WinCC Basic V10.5 (component of STEP 7 Basic V10.5)	see STEP 7 Basic, page 7/2
Documentation (to be ordered separately)	
You can find the manual for the Basic Panels on the Internet at http://support.automation.siemens.com	
WinCC flexible Compact/ Standard/Advanced User Manual	
• 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 A	**6AV6 691-1SA01-0AX0**
Electronic documentation, on DVD 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, HMI software

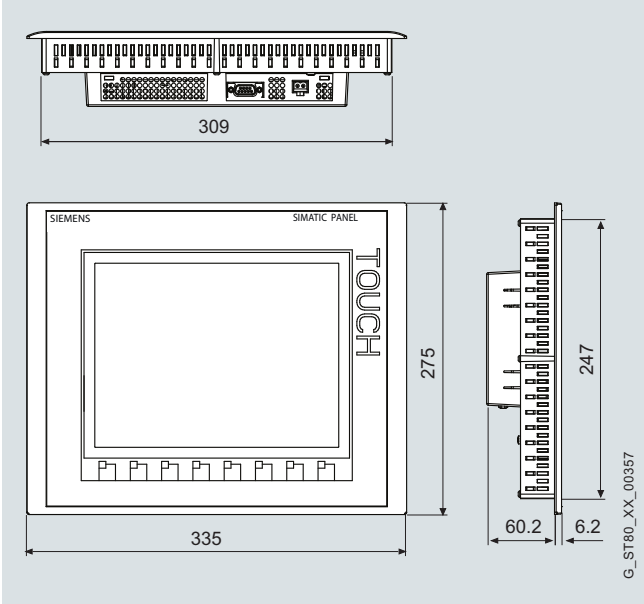
D: Subject to export regulations: AL: N and ECCN: 5D992

Dimensional drawings

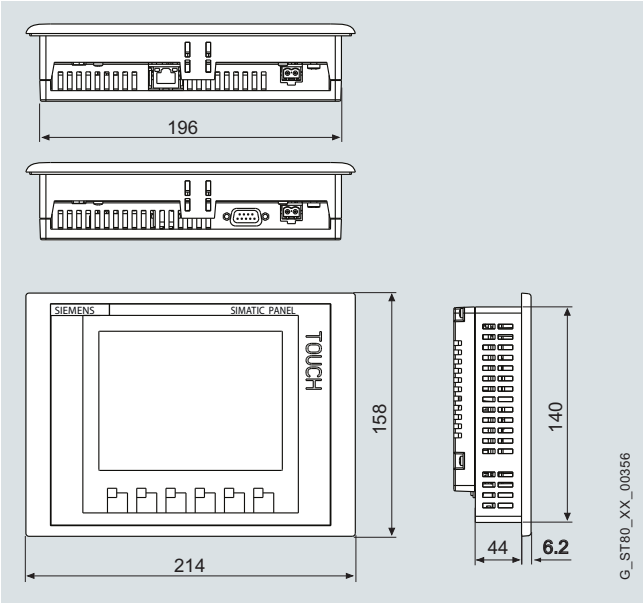
All dimensions in mm.



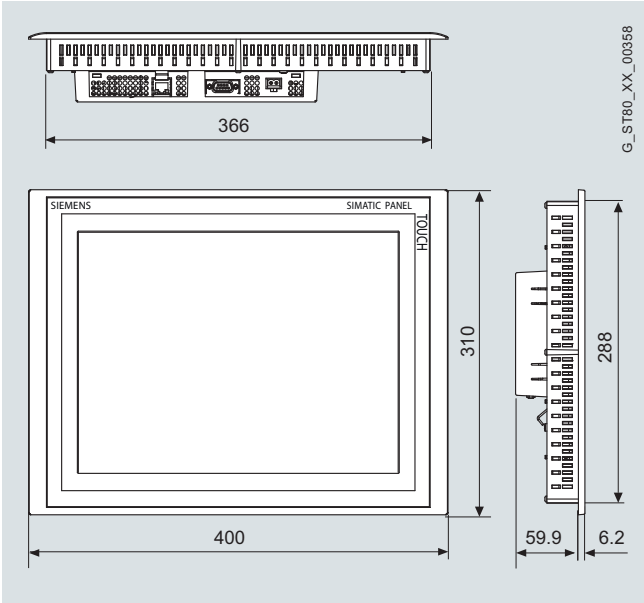
KTP400 Basic



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.

Software

Overview

- Software for the SIMATIC S7-1200
- Functions for 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

The following is available:

- STEP 7 Basic

Additional informationen see page 7/2.

8.18. Anexo R

Se adjunta la hoja de datos de la fuente conmutadora 24V S-600-24

Switching Power Supply 250W S-250-24

Output 24Vdc 10.5A

Fully enclosed switching power supply for industrial applications around the world regardless of voltage and frequency of the power line.

Highly reliable power output with short circuit, overload, overvoltage and overheat protection. Output capacitors are rated at 105℃. Features factory installed EMI filter.

Electrical Specifications:

DC output voltage	24Vdc.
Output voltage tolerance	1%
Output adj. voltage range	±10%.
Output Voltage Adjustment Range	21.6V - 26.4V
Rated output current	10.5A.
Output current range	0-10.5A.
Ripple and Noise	180mVp-p.
Line Regulation	±0.5%.
Load Regulation	±0.5%.
Rated Output Power	250W
Efficiency	84%
AC Input Voltage Range	88-132Vac 176-264Vac
AC Line Frequency	47-63Hz
AC Current (typical)	5.0A/115V 2.5A/230V
AC Inrush Current	18A/115V 36A/230V
Leakage Current	<3.5mA/240Vac
Overload Protection	105-145%
Overvoltage Protection	115-150%
Overheating Protection	automatic fan
Setup, rise, hold-up time	1,20,10ms
Isolation Resistance	500Vdc/100MΩ
Withstand Voltage	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC
Working Temp	-10℃ - +60℃
Working Humidity	20% - 90% RH
Overal Dimension	215x115x50mm
Weight	1.10kG
Safety Standard	UL1950, TUVEN60950
EMC Standard	EN55022 CLASSB EN61000-4, 2,3,4 EN60555-2,3

Manufactured by:
YOEQING SUNWOR ELECTRIC CO., LTD.

Other Features:

- AC Input Range selectable by switch.
- Forced air cooling by DC fan.
- Built-in cooling fan on-off control:
  Fan OFF <= 55 to 60℃
  Fan ON >= 80 to 85℃.
- Overload Protection type:
  Output cutout.
  Recovers automatically after fault condition removed
- Overvoltage Protection type:
  Pulsing Hiccup mode.
  Recovers automatically after fault condition removed
- 100% Full Load Burn-in Test.

Installation Issues:

- Always connect ground to the Ground terminal. This way the case will be safe to touch.
- Provide adequate air circulation for cooling.
- There are two or more terminals labeled "+" and "-" provided for convenience. All terminals labeled with the same symbol are internally connected.

POWER CORD INNER CONDUCTOR COLORS

Standard power cords in the USA:
BLACK = HOT
WHITE = NEUTRAL
GREEN = GROUND

International power cords:
BROWN = HOT
BLUE = NEUTRAL
GREEN/YELLOW STRIPE = GROUND

POWER SUPPLY

NOTICE: SOME MODELS FEATURE AC SELECTION SWITCH LOCATED ON LONGER SIDE OF THE CASE. PLEASE MOVE THE SWITCH TO CORRECT POSITION MATCHING YOUR AC LINE.
FOR 100 TO 130VAC LINE MOVE THE SWITCH TO **115V**.
FOR 200 TO 240VAC LINE MOVE THE SWITCH TO **230V**.

AC side connection:
L – Live (Hot) - BLACK conductor (USA) or BROWN conductor (International)
N – Neutral - WHITE conductor (USA) or BLUE conductor (International)
GND (or FG or Earth or GND symbol) – Ground - GREEN conductor (USA) or GREEN/YELLOW conductor (International)

DC side connection:
+V – positive DC voltage
- V (or COM) – negative DC voltage or COMMON (0V) for asymmetrical or single polarity output

8.19. Anexo S

Se adjunta la hoja de datos de las botoneras NEMA Square D

Product data sheet
Characteristics

9001BW240
Push Button Control Station, 2 momentary push buttons, START STOP, 600 VAC, 5 A, NEMA 4

Green Premium

Product availability: Stock - Normally stocked in distribution facility

Main

Range of product	Harmony 9001B
Product or component type	Complete control station
Device short name	9001BW

Complementary

Control station composition	2 push-buttons START-STOP
Contacts type and composition	1 NO + 1 NC
Connections - terminals	Screw clamp terminal
[Ie] rated operational current	5 A 600 V
Device mounting	Surface
Type of installation	Indoor/outdoor

Environment

NEMA degree of protection	NEMA 4
Product certifications	CE CSA LR25490 class 3211 03 UL listed file E42259 CCN NKCR
Environmental characteristic	Dust and damp proof

Ordering and shipping details

Category	21421 - 9001 B (NOT BW70 - BW80)
Discount Schedule	CS1
GTIN	00785901458753
Package weight(Lbs)	1.08 kg (2.39 lb(US))
Returnability	Yes
Country of origin	MX

Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: This product can expose you to chemicals including: Nickel compounds and Di-isodecyl phthalate (DIDP) which is known to the State of California to cause Carcinogen and Reproductive harm. For more information go to www.p65warnings.ca.gov
REACh Regulation	REACh Declaration
REACh free of SVHC	Yes
EU RoHS Directive	Pro-active compliance (Product out of EU RoHS legal scope) EU RoHS Declaration

Toxic heavy metal free	Yes
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS Declaration
Environmental Disclosure	Product Environmental Profile
Circularity Profile	End Of Life Information

Contractual warranty

Warranty	18 months