

**PONTIFICIA UNIVERSIDAD CATÓLICA DEL PERÚ**  
**FACULTAD DE CIENCIAS E INGENIERÍA**



**PONTIFICIA**  
**UNIVERSIDAD**  
**CATÓLICA**  
DEL PERÚ

**AUTOMATIZACIÓN DE PRUEBAS DE CILINDROS  
TELESCÓPICOS DE LEVANTE DE TOLVAS EN CAMIONES  
MINEROS**

**ANEXOS**

**Tesis para optar por el título de Ingeniero Mecatrónico,  
que presenta el bachiller:**

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**ASESOR: Dipl. Ing. Benjamín Barriga Gamarra**

**Lima, setiembre de 2017**

# Anexos

## Lista de Anexos

**Anexo 1:** ISO 10100 Hydraulic fluid power cylinders acceptance tests (\*)

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**Anexo 4:** Circuito hidráulico del sistema de levante

**Anexo 5:** Factor de sujeción de cilindros hidráulicos

**Anexo 6:** Manuales y fichas técnicas de componentes seleccionados

- Manual PLC **SIMATIC S7-1200 CPU 1212C**
- Válvula direccional **RE 23178- WE**: especificaciones técnicas
- Válvula de presión proporcional **DBEBE10Z**: especificaciones técnicas
- Transductor de presión **HM20-1X**: especificaciones técnicas
- Transductor de flujo **OM006**: especificaciones técnicas
- Cilindro hidráulico doble efecto: **DIN 24 333**
- Válvula de conexión **DS162C**
- Transductor de desplazamiento **MPS-L-5000-R**
- Parada de emergencia: **XB7ES542P**
- Relé de estado sólido: **EL100D10-05**
- Fuente de Alimentación: **HRP-200-24**
- Interruptor Diferencial: **SICA**
- Banco de Desarme de Cilindros: **MSD-D-20 Assy**

**Anexo 7:** Entradas y salidas del sistema, variables del sistema

**Anexo 8:** Estructura de funciones y Diagramas de flujo (\*\*)

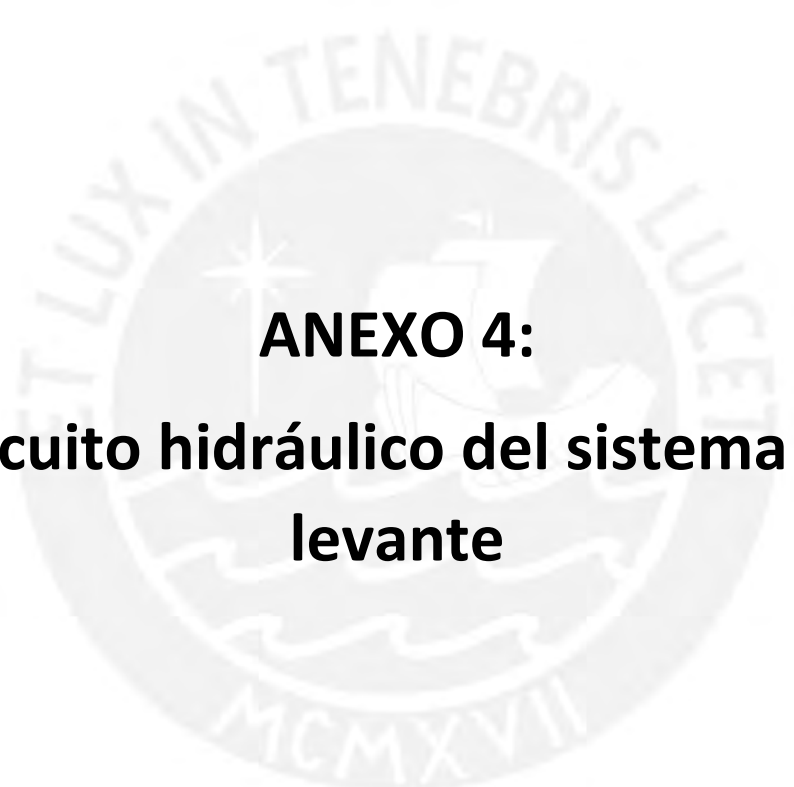
**Anexo 9:** Programación del controlador

**Anexo 10:** Cotizaciones

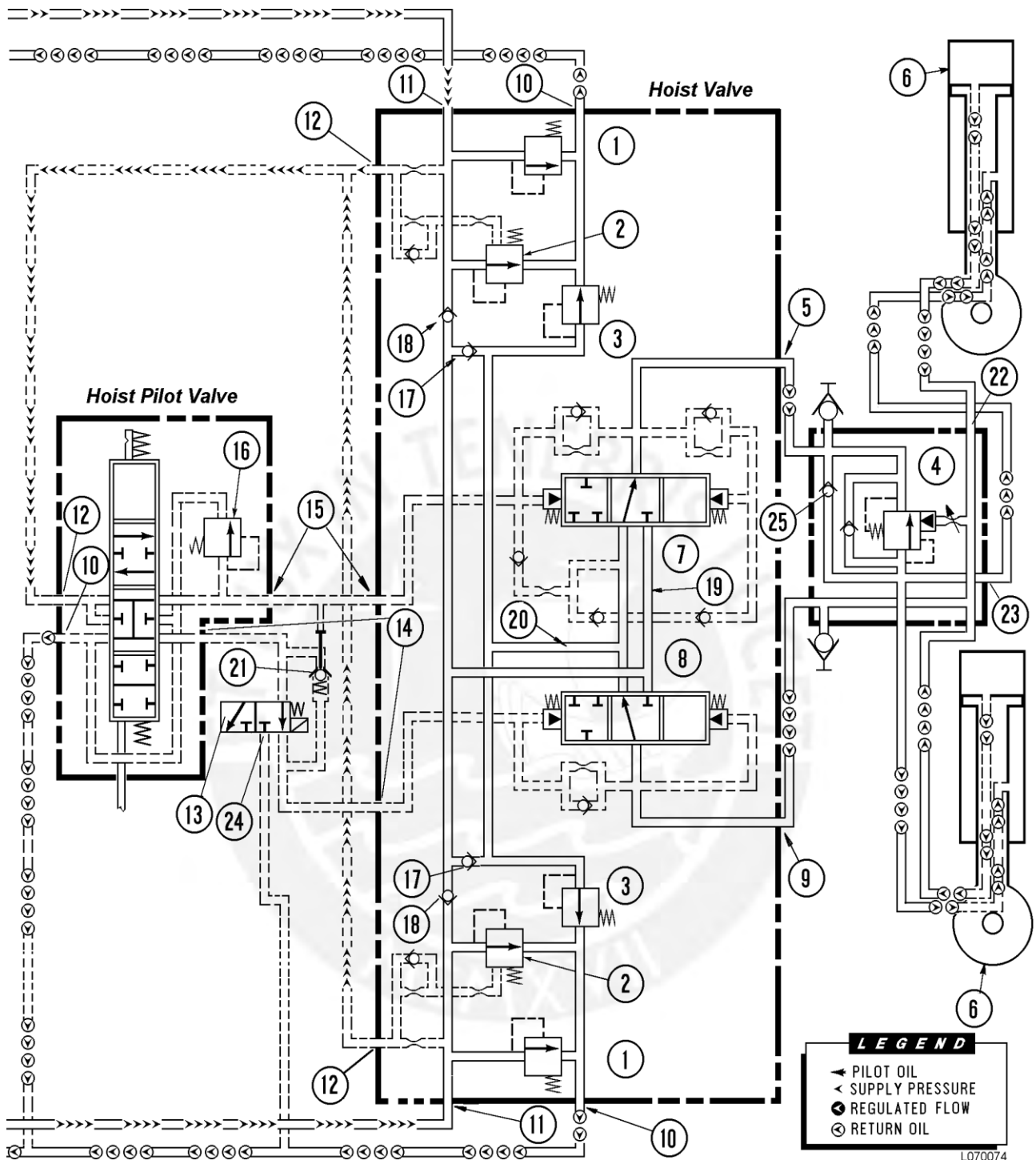
**Anexo 11:** Planos de circuitos hidráulico y eléctricos (\*\*)

(\*) Los anexos 1, 2 y 3 no forman parte del presente documento al no contar con los derechos de publicación. Estos títulos pertenecen a normas de estándar internacional y pueden ser obtenidos en sus sendas organizaciones.

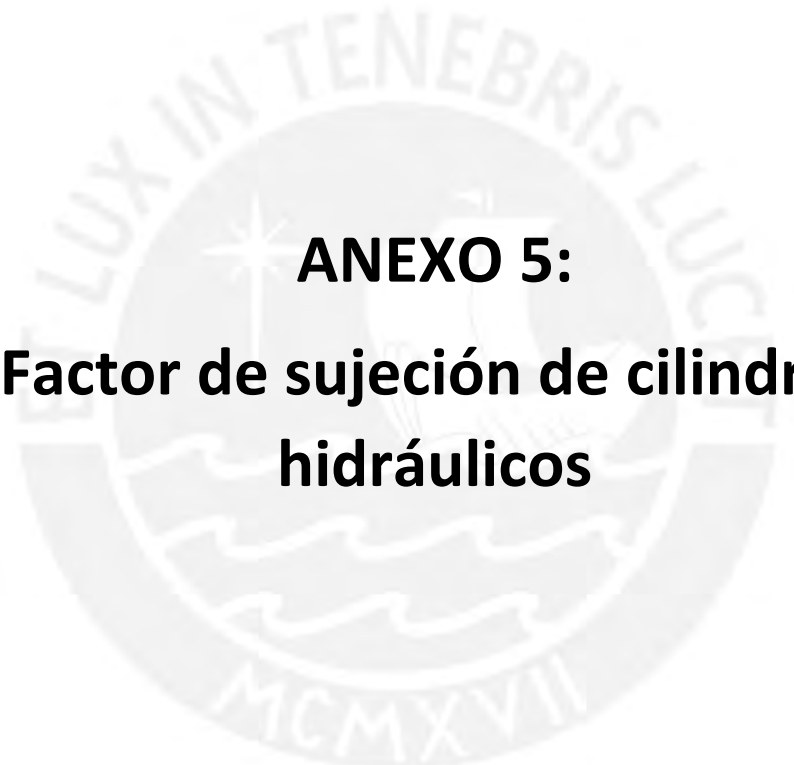
(\*\*) Los anexos 8 y 11 se encuentran en el documento de planos.



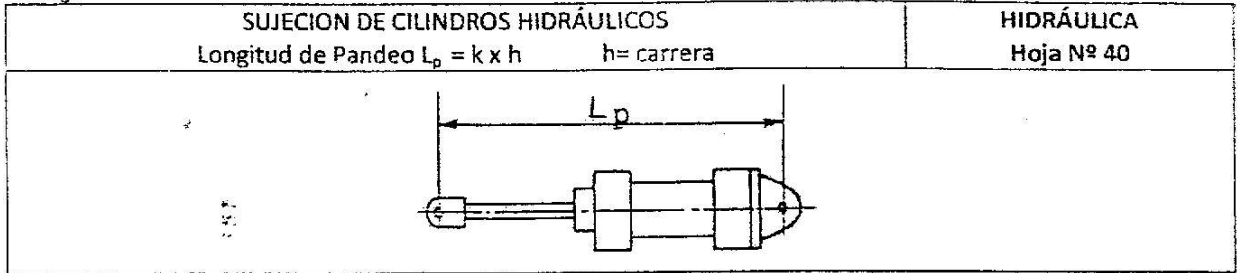
**ANEXO 4:**  
**Circuito hidráulico del sistema de  
levante**



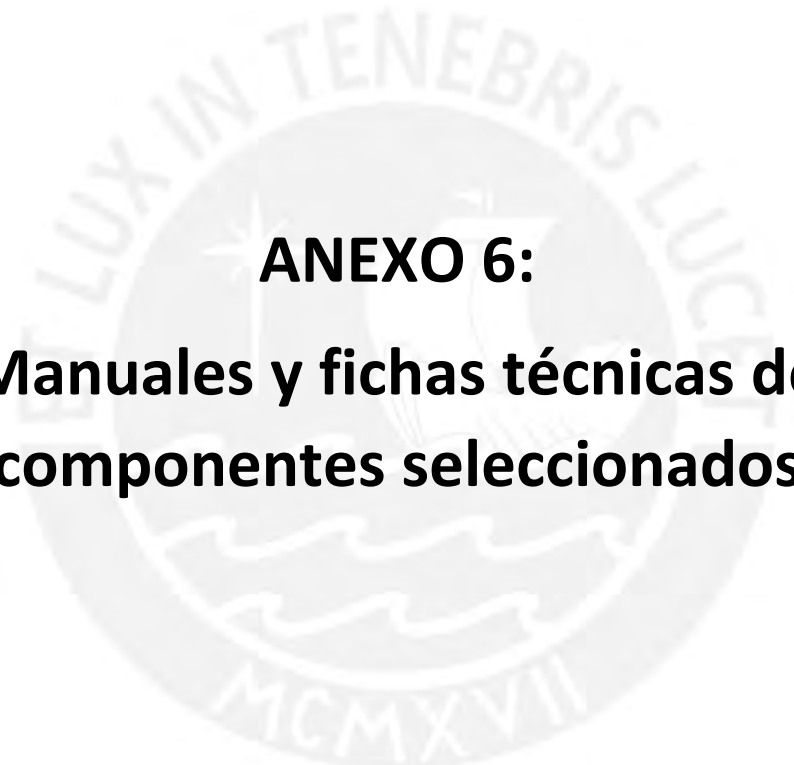




**ANEXO 5:**  
**Factor de sujeción de cilindros  
hidráulicos**



Forma de sujeción	Vástago guiado	Vástago no guiado	Factor k de longitud de carrera, para vástago	
			Guiado	No guiado
Sujeción básica			1,0	2,0
Apoyado en patitas			1,0	2,0
Pivotado atrás			2,0	4,0
Brida atrás			1,33	4,0
Brida adelante			1	2
Pivotado adelante			1,0	2
Pivotado en medio			1,5	3



**ANEXO 6:**  
**Manuales y fichas técnicas de  
componentes seleccionados**

# SIEMENS

## SIMATIC

### S7 Controlador programable S7-1200

Manual de sistema

Prólogo

Sinopsis del producto

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Montaje

2

Principios básicos del PLC

3

Configuración de  
dispositivos

4

Principios básicos de  
programación

5

Instrucciones de  
programación

6

PROFINET

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Comunicación punto a punto  
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Herramientas online y  
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Datos técnicos

A

Calcular la corriente  
necesaria

B

Referencias

C

11/2009  
A5E02486683-02

## Sinopsis del producto

### 1.1 Introducción al PLC S7-1200

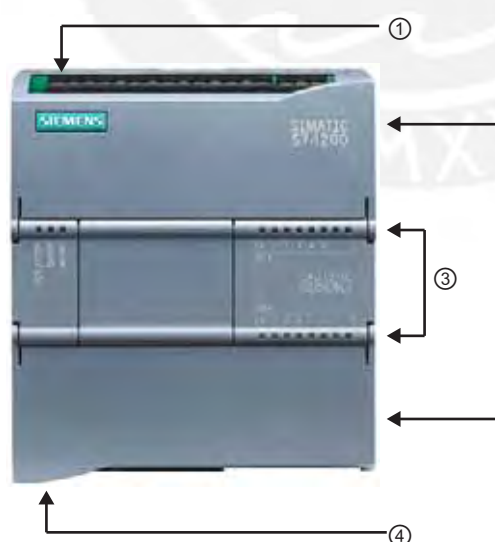
El controlador lógico programable (PLC) S7-1200 ofrece la flexibilidad y capacidad de controlar una gran variedad de dispositivos para las distintas tareas de automatización. Gracias a su diseño compacto, configuración flexible y amplio juego de instrucciones, el S7-1200 es idóneo para controlar una gran variedad de aplicaciones.

La CPU incorpora un microprocesador, una fuente de alimentación integrada, así como circuitos de entrada y salida en una carcasa compacta, conformando así un potente PLC. Una vez cargado el programa en la CPU, ésta contiene la lógica necesaria para vigilar y controlar los dispositivos de la aplicación. La CPU vigila las entradas y cambia el estado de las salidas según la lógica del programa de usuario, que puede incluir lógica booleana, instrucciones de conteo y temporización, funciones matemáticas complejas, así como comunicación con otros dispositivos inteligentes.

Numerosas funciones de seguridad protegen el acceso tanto a la CPU como al programa de control:

- Toda CPU ofrece protección por contraseña que permite configurar el acceso a sus funciones.
- Es posible utilizar la "protección de know-how" para ocultar el código de un bloque específico. Encontrará más detalles en el capítulo "Principios básicos de programación" (Página 99).

La CPU incorpora un puerto PROFINET para la comunicación en una red PROFINET. Los módulos de comunicación están disponibles para la comunicación en redes RS485 o RS232.



- ① Conector de corriente
- ② Conectores extraíbles para el cableado de usuario (detrás de las tapas)
- ② Ranura para Memory Card (debajo de la tapa superior)
- ③ LEDs de estado para las E/S integradas
- ④ Conector PROFINET (en el lado inferior de la CPU)

Los diferentes modelos de CPUs ofrecen una gran variedad de funciones y prestaciones que permiten crear soluciones efectivas destinadas a numerosas aplicaciones. Para más información sobre una CPU en particular, consulte los datos técnicos (Página 319).

Sinopsis del producto

1.1 Introducción al PLC S7-1200

Función	CPU 1211C	CPU 1212C	CPU 1214C
Dimensiones físicas (mm)	90 x 100 x 75		110 x 100 x 75
Memoria de usuario			
<ul style="list-style-type: none"> <li>• Memoria de trabajo</li> <li>• Memoria de carga</li> <li>• Memoria remanente</li> </ul>	<ul style="list-style-type: none"> <li>• 25 KB</li> <li>• 1 MB</li> <li>• 2 KB</li> </ul>		<ul style="list-style-type: none"> <li>• 50 KB</li> <li>• 2 MB</li> <li>• 2 KB</li> </ul>
E/S integradas locales			
<ul style="list-style-type: none"> <li>• Digitales</li> <li>• Analógicas</li> </ul>	<ul style="list-style-type: none"> <li>• 6 entradas/4 salidas</li> <li>• 2 entradas</li> </ul>	<ul style="list-style-type: none"> <li>• 8 entradas/6 salidas</li> <li>• 2 entradas</li> </ul>	<ul style="list-style-type: none"> <li>• 14 entradas/10 salidas</li> <li>• 2 entradas</li> </ul>
Tamaño de la memoria imagen de proceso	1024 bytes para entradas (I) y 1024 bytes para salidas (Q)		
Área de marcas (M)	4096 bytes		8192 bytes
Ampliación con módulos de señales	Ninguna	2	8
Signal Board	1		
Módulos de comunicación	3 (ampliación en el lado izquierdo)		
Contadores rápidos			
<ul style="list-style-type: none"> <li>• Fase simple</li> <li>• Fase en cuadratura</li> </ul>	<ul style="list-style-type: none"> <li>• 3</li> <li>• 3 a 100 kHz</li> <li>• 3 a 80 kHz</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 3 a 100 kHz 1 a 30 kHz</li> <li>• 3 a 80 kHz 1 a 20 kHz</li> </ul>	<ul style="list-style-type: none"> <li>• 6</li> <li>• 3 a 100 kHz 3 a 30 kHz</li> <li>• 3 a 80 kHz 3 a 20 kHz</li> </ul>
Salidas de impulsos	2		
Memory Card	SIMATIC Memory Card (opcional)		
Tiempo de respaldo del reloj de tiempo real	Típico: 10 días / Mínimo: 6 días a 40 °C		
PROFINET	1 puerto de comunicación Ethernet		
Velocidad de ejecución de funciones matemáticas con números reales	18 µs/instrucción		
Velocidad de ejecución booleana	0,1 µs/instrucción		

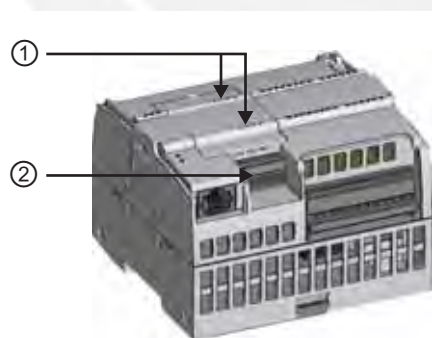
La gama S7-1200 ofrece una gran variedad de módulos de señales y Signal Boards que permiten ampliar las prestaciones de la CPU. También es posible instalar módulos de comunicación adicionales para soportar otros protocolos de comunicación. Para más información sobre un módulo en particular, consulte los datos técnicos (Página 319).

Módulo		Sólo entradas	Sólo salidas	Entradas y salidas
Módulo de señales (SM)	Digital	8 entradas DC	8 salidas DC 8 salidas de relé	8 entradas DC/8 salidas DC 8 entradas DC/8 salidas de relé
		16 entradas DC	16 salidas DC 16 salidas de relé	16 entradas DC/16 salidas DC 16 entradas DC/16 salidas de relé
	Analógico	4 entradas analógicas 8 entradas analógicas	2 salidas analógicas 4 salidas analógicas	4 entradas analógicas/2 salidas analógicas
Signal Board (SB)	Digital	-	-	2 entradas DC/2 salidas DC
	Analógico	-	1 salida analógica	-
Módulo de comunicación (CM)				
<ul style="list-style-type: none"> <li>• RS485</li> <li>• RS232</li> </ul>				

## 1.2 Signal Boards

Una Signal Board (SB) permite agregar E/S a la CPU. Es posible agregar una SB con E/S digitales o analógicas. Una SB se conecta en el frente de la CPU.

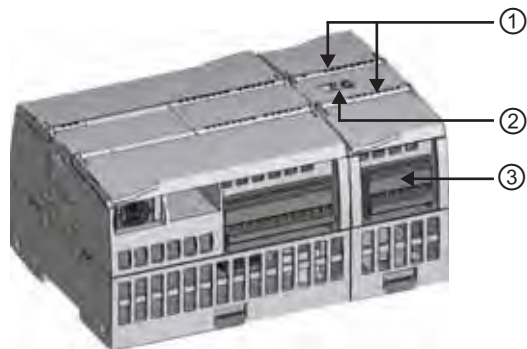
- SB con 4 E/S digitales (2 entradas DC y 2 salidas DC)
- SB con 1 entrada analógica



- ① LEDs de estado en la SB
- ② Conector extraíble para el cableado de usuario

### 1.3 Módulos de señales

Los módulos de señales se pueden utilizar para agregar funciones a la CPU. Los módulos de señales se conectan a la derecha de la CPU.



- ① LEDs de estado para las E/S del módulo de señales
- ② Conector de bus
- ③ Conector extraíble para el cableado de usuario

### 1.4 Módulos de comunicación

La gama S7-1200 provee módulos de comunicación (CMs) que ofrecen funciones adicionales para el sistema. Hay dos módulos de comunicación, a saber: RS232 y RS485.

- La CPU soporta como máximo 3 módulos de comunicación
- Todo CM se conecta en lado izquierdo de la CPU (o en lado izquierdo de otro CM)



- ① LEDs de estado del módulo de comunicación
- ② Conector de comunicación



## 1.5 STEP 7 Basic

El software STEP 7 Basic ofrece un entorno amigable que permite desarrollar, editar y observar la lógica del programa necesaria para controlar la aplicación, incluyendo herramientas para gestionar y configurar todos los dispositivos del proyecto, tales como PLCs y dispositivos HMI. STEP 7 Basic ofrece dos lenguajes de programación (KOP y FUP) que permiten desarrollar el programa de control de la aplicación de forma fácil y eficiente. Asimismo, incluye las herramientas para crear y configurar los dispositivos HMI en el proyecto.

Para poder encontrar la información necesaria, STEP 7 Basic ofrece un completo sistema de ayuda en pantalla.

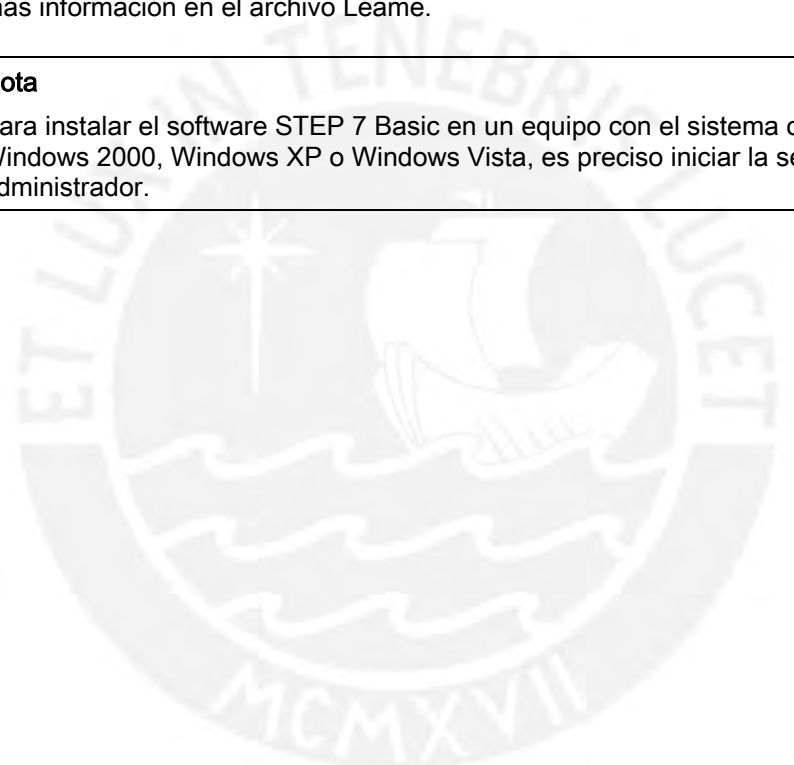
Para instalar STEP 7 Basic, inserte el CD en la unidad de CDROM del equipo. El asistente de instalación arranca automáticamente y le guía por el proceso de instalación. Encontrará más información en el archivo Léame.

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### **Nota**

Para instalar el software STEP 7 Basic en un equipo con el sistema operativo Windows 2000, Windows XP o Windows Vista, es preciso iniciar la sesión con derechos de administrador.

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## 1.6 Visualizadores

Puesto que la visualización se está convirtiendo cada vez más en un componente estándar de la mayoría de las máquinas, los Basic Panels SIMATIC HMI ofrecen dispositivos con pantalla táctil para tareas básicas de control y supervisión. Todos los paneles tienen el tipo de protección IP65 y certificación CE, UL, cULus y NEMA 4x.



KTP 400 Basic PN

- Mono (STN, escala de grises)
- Pantalla táctil de 4 pulgadas con 4 teclas táctiles
- Vertical u horizontal
- Tamaño: 3.8"
- Resolución: 320 x 240
- 128 variables
- 50 pantallas de proceso
- 200 alarmas
- 25 curvas
- 32 KB memoria de recetas
- 5 recetas, 20 registros, 20 entradas



KTP 600 Basic PN

- Color (TFT, 256 colores) o monocromo (STN, escala de grises)
- Pantalla táctil de 6 pulgadas con 6 teclas táctiles
- Vertical u horizontal
- Tamaño: 5.7"
- Resolución: 320 x 240
- 128 variables
- 50 pantallas de proceso
- 200 alarmas
- 25 curvas
- 32 KB memoria de recetas
- 5 recetas, 20 registros, 20 entradas



KTP1000 Basic PN

- Color (TFT, 256 colores)
- Pantalla táctil de 10 pulgadas con 8 teclas táctiles
- Tamaño: 10.4"
- Resolución: 640 x 480
- 256 variables
- 50 pantallas de proceso
- 200 alarmas
- 25 curvas
- 32 KB memoria de recetas
- 5 recetas, 20 registros, 20 entradas



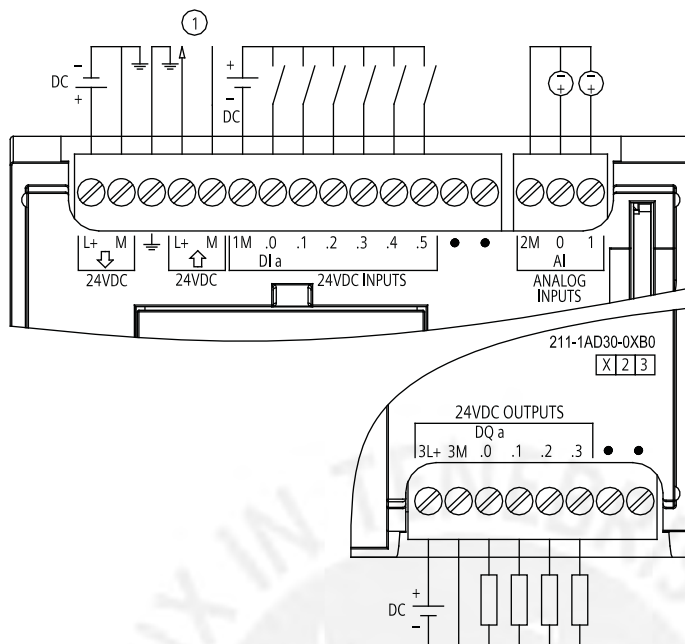
TP1500 Basic PN

- Color (TFT, 256 colores)
- Pantalla táctil de 15 pulgadas
- Tamaño: 15.1"
- Resolución: 1024 x 768
- 256 variables
- 50 pantallas de proceso
- 200 alarmas
- 25 curvas
- 32 KB memoria de recetas (memoria flash integrada)
- 5 recetas, 20 registros, 20 entradas

## A.2 CPUs

### A.2.1 Datos técnicos de la CPU 1211C

Datos técnicos			
Modelo	CPU 1211C AC/DC/relé	CPU 1211C DC/DC/relé	CPU 1211C DC/DC/DC
Referencia (MLFB)	6ES7 211-1BD30-0XB0	6ES7 211-1HD30-0XB0	6ES7 211-1AD30-0XB0
<b>General</b>			
Dimensiones A x A x P (mm)	90 x 100 x 75		
Peso	420 gramos	380 gramos	370 gramos
Disipación de potencia	10 W	8 W	
Intensidad disponible (bus CM)	750 mA máx. (5 V DC)		
Intensidad disponible (24 V DC)	300 mA máx. (alimentación de sensores)		
Consumo de corriente de las entradas digitales (24 V DC)	4 mA/entrada utilizada		
<b>Características de la CPU</b>			
Memoria de usuario	25 KB de memoria de trabajo / 1 MB de memoria de carga / 2 KB de memoria remanente		
E/S digitales integradas	6 entradas/4 salidas		
E/S analógicas integradas	2 entradas		
Tamaño de la memoria imagen de proceso	1024 bytes de entradas (I)/1024 bytes de salidas (Q)		
Área de marcas (M)	4096 bytes		
Ampliación con módulos de señales	Ninguna		
Ampliación con Signal Boards	1 SB máx.		
Ampliación con módulos de comunicación	3 CMs máx.		
Contadores rápidos	3 en total Fase simple: 3 a 100 kHz Fase en cuadratura: 3 a 80 kHz		
Salidas de impulsos	2		
Entradas de captura de impulsos	6		
Alarmas de retardo/cíclicas	4 en total con resolución de 1 ms		
Alarmas de flanco	6 ascendentes y 6 descendentes (10 y 10 con Signal Board opcional)		
Memory Card	SIMATIC Memory Card (opcional)		
Precisión del reloj en tiempo real	+/- 60 segundos/mes		
Tiempo de respaldo del reloj en tiempo real	10 días típ./6 días mín. a 40°C (condensador de alto rendimiento sin mantenimiento)		
<b>Rendimiento</b>			
Velocidad de ejecución booleana	0,1 µs/instrucción		
Velocidad de ejecución de transferencia de palabras	12 µs/instrucción		



① Alimentación de sensores 24 V DC

Figura A-3 CPU 1211C DC/DC/DC (6ES7 211-1AD30-0XB0)

### A.2.2 Datos técnicos de la CPU 1212C

Datos técnicos			
Modelo	CPU 1212C AC/DC/relé	CPU 1212C DC/DC/relé	CPU 1212C DC/DC/DC
Referencia	6ES7 212-1BD30-0XB0	6ES7 212-1HD30-0XB0	6ES7 212-1AD30-0XB0
<b>General</b>			
Dimensiones A x A x P (mm)	90 x 100 x 75		
Peso	425 gramos	385 gramos	370 gramos
Disipación de potencia	11 W	9 W	
Intensidad disponible (SM y bus CM)	1000 mA máx. (5 V DC)		
Intensidad disponible (24 V DC)	300 mA máx. (alimentación de sensores)		
Consumo de corriente de las entradas digitales (24 V DC)	4 mA/entrada utilizada		
<b>Características de la CPU</b>			
Memoria de usuario	25 KB de memoria de trabajo / 1 MB de memoria de carga / 2 KB de memoria remanente		
E/S digitales integradas	8 entradas/6 salidas		
E/S analógicas integradas	2 entradas		
Tamaño de la memoria imagen de proceso	1024 bytes de entradas (I)/1024 bytes de salidas (Q)		
Área de marcas (M)	4096 bytes		
Ampliación con módulos de señales	2 SMs máx.		

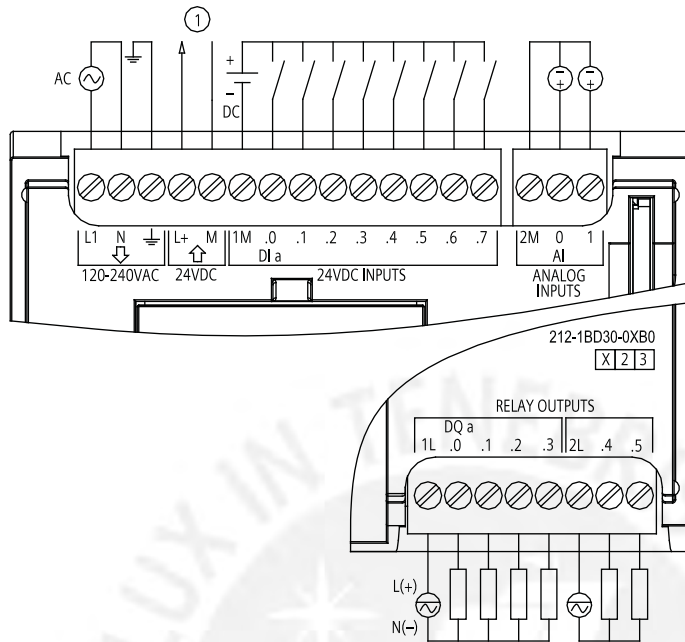
<b>Datos técnicos</b>			
<b>Modelo</b>	<b>CPU 1212C AC/DC/relé</b>	<b>CPU 1212C DC/DC/relé</b>	<b>CPU 1212C DC/DC/DC</b>
Ampliación con Signal Boards	1 SB máx.		
Ampliación con módulos de comunicación	3 CMs máx.		
Contadores rápidos	4 en total Fase simple: 3 a 100 kHz y 1 a 30 kHz de frecuencia de reloj Fase en cuadratura: 3 a 80 kHz y 1 a 20 kHz de frecuencia de reloj		
Salidas de impulsos	2		
Entradas de captura de impulsos	8		
Alarmas de retardo/cíclicas	4 en total con resolución de 1 ms		
Alarmas de flanco	8 ascendentes y 8 descendentes (12 y 12 con Signal Board opcional)		
Memory Card	SIMATIC Memory Card (opcional)		
Precisión del reloj en tiempo real	+/- 60 segundos/mes		
Tiempo de respaldo del reloj en tiempo real	10 días típ./6 días mín. a 40°C (condensador de alto rendimiento sin mantenimiento)		
<b>Rendimiento</b>			
Velocidad de ejecución booleana	0,1 µs/instrucción		
Velocidad de ejecución de transferencia de palabras	12 µs/instrucción		
Velocidad de ejecución de funciones matemáticas con números reales	18 µs/instrucción		
<b>Comunicación</b>			
Número de puertos	1		
Tipo	Ethernet		
Conexiones	<ul style="list-style-type: none"> <li>• 3 para HMI</li> <li>• 1 para la programadora</li> <li>• 8 para instrucciones Ethernet en el programa de usuario</li> <li>• 3 para CPU a CPU</li> </ul>		
Transferencia de datos	10/100 Mb/s		
Aislamiento (señal externa a lógica del PLC)	Aislado por transformador, 1500 V DC		
Tipo de cable	CAT5e apantallado		
<b>Fuente de alimentación</b>			
Rango de tensión	85 a 264 V AC	20,4 a 28,8 V DC	
Frecuencia de línea	47 a 63 Hz	--	
Intensidad de entrada CPU sólo a carga máx.	80 mA a 120 V AC 40 mA a 240 V AC	400 mA a 24 V DC	
CPU con todos los accesorios de ampliación a carga máx.	240 mA a 120 V AC 120 mA a 240 V AC	1200 mA a 24 V DC	
Corriente de irrupción (máx.)	20 A a 264 V AC	12 A a 28,8 V DC	
Aislamiento (potencia de entrada a lógica)	1500 V AC	Sin aislamiento	
Corriente de fuga a tierra, línea AC a tierra funcional	0,5 mA máx.	-	

<b>Datos técnicos</b>			
<b>Modelo</b>	<b>CPU 1212C AC/DC/relé</b>	<b>CPU 1212C DC/DC/relé</b>	<b>CPU 1212C DC/DC/DC</b>
Tiempo de mantenimiento (pérdida de potencia)	20 ms a 120 V AC 80 ms a 240 V AC	10 ms a 24 V DC	
Fusible interno, no reemplazable por el usuario	3 A, 250 V, de acción lenta		
<b>Alimentación de sensores</b>			
Rango de tensión	20,4 a 28,8 V DC	L+ menos 4 V DC mín.	
Intensidad de salida nominal (máx.)	300 mA (protegido contra cortocircuito)		
Ruido de rizado máx. (<10 MHz)	< 1 V de pico a pico	Igual a la línea de entrada	
Aislamiento (lógica de la CPU a alimentación de sensores)	Sin aislamiento		
<b>Entradas digitales</b>			
Número de entradas	8		
Tipo	Sumidero/fuente (tipo 1 IEC sumidero)		
Tensión nominal	24 V DC a 4 mA, nominal		
Tensión continua admisible	30 V DC, máx.		
Sobretensión transitoria	35 V DC durante 0,5 seg.		
Señal 1 lógica (mín.)	15 V DC a 2,5 mA		
Señal 0 lógica (máx.)	5 V DC a 1 mA		
Aislamiento (campo a lógica)	500 V AC durante 1 minuto		
Grupos de aislamiento	1		
Tiempos de filtro	0,2, 0,4, 0,8, 1,6, 3,2, 6,4 y 12,8 ms (seleccionable en grupos de 4)		
Frecuencias de entrada de reloj HSC (máx.) (señal 1 lógica = 15 a 26 V DC)	Fase simple: 100 KHz (la.0 a la.5) y 30 KHz (la.6 a la.7) Fase en cuadratura: 80 KHz (la.0 a la.5) y 20 KHz (la.6 a la.7)		
Número de entradas ON simultáneamente	8		
Longitud de cable (metros)	500 apantallado, 300 no apantallado, 50 apantallado para entradas HSC		
<b>Entradas analógicas</b>			
Número de entradas	2		
Tipo	Tensión (asimétrica)		
Rango	0 a 10 V		
Rango total (palabra de datos)	0 a 27648 (consulte Representación de entradas analógicas para tensión (Página 346) )		
Rango de sobreimpulso (palabra de datos)	27.649 a 32.511 (consulte Representación de entradas analógicas para tensión (Página 346) )		
Desbordamiento (palabra de datos)	32.512 a 32767 (consulte Representación de entradas analógicas para tensión (Página 346) )		
Resolución	10 bits		
Tensión de resistencia al choque máxima	35 V DC		
Aislamiento	Ninguno, débil, medio o fuerte (consulte los tiempos de respuesta de paso en Tiempos de respuesta de las entradas analógicas (Página 346))		

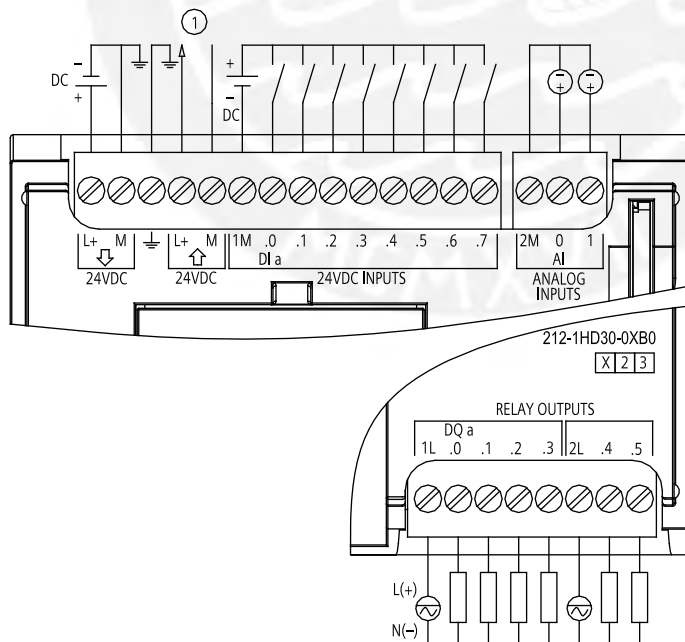


Datos técnicos			
Modelo	CPU 1212C AC/DC/relé	CPU 1212C DC/DC/relé	CPU 1212C DC/DC/DC
Rechazo de interferencias	10, 50 ó 60 Hz (consulte las frecuencias de muestreo en Tiempos de respuesta de las entradas analógicas (Página 346))		
Impedancia	≥100 KΩ		
Aislamiento (campo a lógica)	Ninguno		
Precisión (25°C / 0 a 55°C)	3,0% / 3,5% de rango máximo		
Rechazo en modo común	40 dB, DC a 60 Hz		
Rango de señales operativo	La tensión de señal más la tensión en modo común debe ser menor que +12 V y mayor que -12 V		
Longitud de cable (metros)	10 trenzado y apantallado		
<b>Salidas digitales</b>			
Número de salidas	6		
Tipo	Relé, contacto seco		Estado sólido - MOSFET
Rango de tensión	5 a 30 V DC ó 5 a 250 V AC		20,4 a 28,8 V DC
Señal 1 lógica a intensidad máx.	--		20 V DC mín.
Señal 0 lógica con carga de 10 KΩ	--		0,1 V DC máx.
Intensidad (máx.)	2,0 A		0,5 A
Carga de lámparas	30 W DC/200 W AC		5 W
Resistencia en estado ON	Máx. 0,2 Ω (si son nuevas)		0,6 Ω máx.
Corriente de fuga por salida	--		10 μA máx.
Sobrecorriente momentánea	7 A si están cerrados los contactos		8 A durante máx. 100 ms
Protección contra sobrecargas	No		
Aislamiento (campo a lógica)	1500 V AC durante 1 minuto (bobina a contacto) Ninguno (bobina a lógica)		500 V AC durante 1 minuto
Resistencia de aislamiento	100 MΩ mín. si son nuevas		--
Aislamiento entre contactos abiertos	750 V AC durante 1 minuto		--
Grupos de aislamiento	2		1
Tensión de bloqueo inductiva	--		L+ menos 48 V DC, disipación de 1 W
Retardo de conmutación (Qa.0 a Qa.3)	10 ms máx.		1,0 μs máx., OFF a ON 3,0 μs máx., ON a OFF
Retardo de conmutación (Qa.4 a Qa.5)	10 ms máx.		50 μs máx., OFF a ON 200 μs máx., ON a OFF
Frecuencia de tren de impulsos (Qa.0 y Qa.2)	No recomendado		100 KHz máx., 2 Hz mín.
Vida útil mecánica (sin carga)	10.000.000 ciclos abiertos/cerrados		--
Vida útil de los contactos bajo carga nominal	100.000 ciclos abiertos/cerrados		--
Reacción al cambiar de RUN a STOP	Último valor o valor sustitutivo (valor predeterminado: 0)		
Número de salidas ON simultáneamente	6		
Longitud de cable (metros)	500 apantallado, 150 no apantallado		

Diagramas de cableado

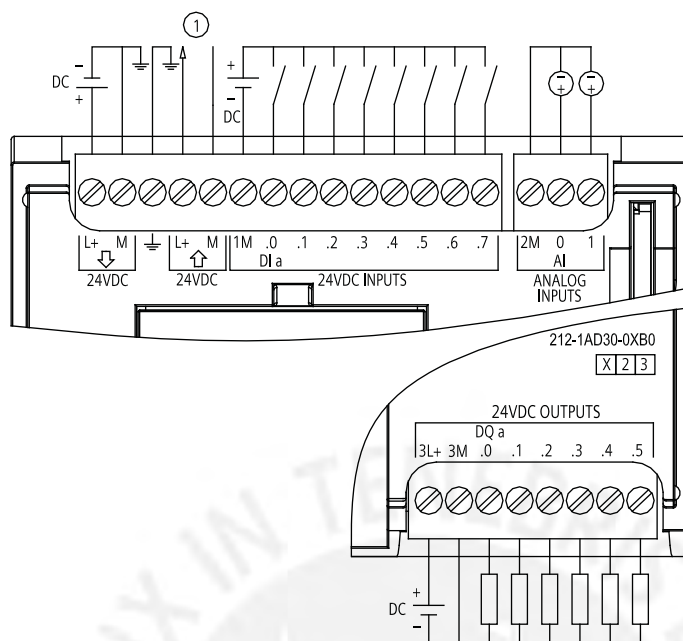


① Alimentación de sensores 24 V DC  
Figura A-4 CPU 1212C AC/DC relé (6ES7 212-1BD30-0XB0)



① Alimentación de sensores 24 V DC  
Figura A-5 CPU 1212C DC/DC/relé (6ES7 212-1HD30-0XB0)





① Alimentación de sensores 24 V DC

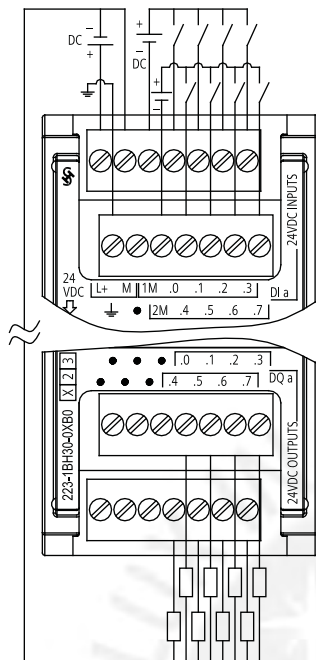
Figura A-6 CPU 1212C DC/DC/DC (6ES7 212-1AD30-0XB0)

### A.2.3 Datos técnicos de la CPU 1214C

Datos técnicos			
Modelo	CPU 1214C AC/DC/relé	CPU 1214C DC/DC/relé	CPU 1214C DC/DC/DC
Referencia	6ES7 214-1BE30-0XB0	6ES7 214-1HE30-0XB0	6ES7 214-1AE30-0XB0
<b>General</b>			
Dimensiones A x A x P (mm)	110 x 100 x 75		
Peso	475 gramos	435 gramos	415 gramos
Disipación de potencia	14 W	12 W	
Intensidad disponible (SM y bus CM)	1600 mA máx. (5 V DC)		
Intensidad disponible (24 V DC)	400 mA máx. (alimentación de sensores)		
Consumo de corriente de las entradas digitales (24 V DC)	4 mA/entrada utilizada		
<b>Características de la CPU</b>			
Memoria de usuario	50 KB de memoria de trabajo / 2 MB de memoria de carga / 2 KB de memoria remanente		
E/S digitales integradas	14 entradas/10 salidas		
E/S analógicas integradas	2 entradas		
Tamaño de la memoria imagen de proceso	1024 bytes de entradas (I)/1024 bytes de salidas (Q)		
Área de marcas (M)	8192 bytes		
Ampliación con módulos de señales	8 SMs máx.		

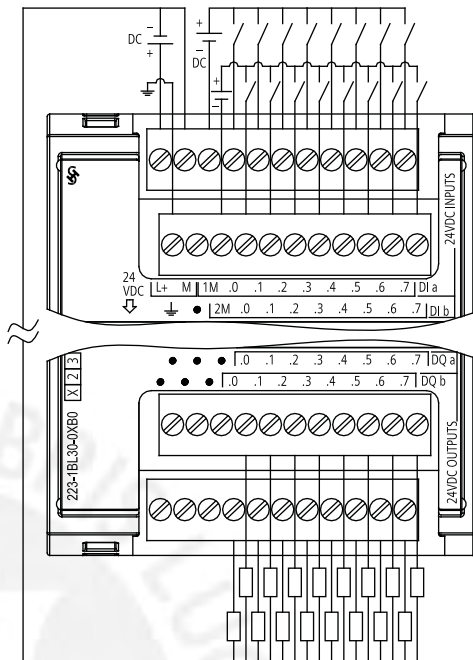
A.4 Módulos de señales analógicas (SMs)

SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC



6ES7 223-1BH30-0XB0

SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC



6ES7 223-1BL30-0XB0

A.4 Módulos de señales analógicas (SMs)

A.4.1 Datos técnicos de los módulos de señales analógicas SM 1231, SM 1232, SM 1234

Datos técnicos			
Modelo	SM 1231 AI 4x13bit	SM 1231 AI 8x13bit	SM 1234 AI 4x13bit AQ 2x14bit
Referencia	6ES7 231-4HD30-0XB0	6ES7 231-4HF30-0XB0	6ES7 234-4HE30-0XB0
<b>General</b>			
Dimensiones A x A x P (mm)	45 x 100 x 75	45 x 100 x 75	45 x 100 x 75
Peso	180 gramos	180 gramos	220 gramos
Disipación de potencia	1,5 W	1,5 W	2,0 W
Consumo de corriente (bus SM)	80 mA	90 mA	80 mA
Consumo de corriente (24 V DC)	45 mA	45 mA	60 mA (sin carga)
<b>Entradas analógicas</b>			
Número de entradas	4	8	4
Tipo	Tensión o intensidad (diferencial): Seleccionable en grupos de 2		
Rango	±10 V, ±5 V, ±2,5 V ó 0 a 20 mA		

Datos técnicos			
Modelo	SM 1231 AI 4x13bit	SM 1231 AI 8x13bit	SM 1234 AI 4x13bit AQ 2x14bit
Rango total (palabra de datos)	-27.648 a 27.648		
Rango de sobreimpulso/subimpulso (palabra de datos)	Tensión: 32.511 a 27.649 / -27.649 a -32.512 Intensidad: 32.511 a 27.649 / 0 a -4864 (Consulte Representación de entradas analógicas para tensión, representación de entradas analógicas para intensidad (Página 346))		
Rebase por exceso/defecto (palabra de datos)	Tensión: 32.767 a 32.512 / -32.513 a -32.768 Intensidad: 32.767 a 32.512 / -4865 a -32.768 (Consulte Representación de entradas analógicas para tensión, representación de entradas analógicas para intensidad (Página 346))		
Resolución	12 bits + bit de signo		
Tensión/intensidad de resistencia al choque máxima	±35 V / ±40 mA		
Alisamiento	Ninguno, débil, medio o fuerte (consulte los tiempos de respuesta de paso en Tiempos de respuesta de las entradas analógicas (Página 346))		
Rechazo de interferencias	400, 60, 50 ó 10 Hz (consulte las frecuencias de muestreo en Tiempos de respuesta de las entradas analógicas (Página 346))		
Impedancia	≥ 9 MΩ (tensión) / 250 Ω (intensidad)		
Aislamiento (campo a lógica)	Ninguno		
Precisión (25°C / 0 a 55°C)	±0,1% / ±0,2% de rango máximo		
Tiempo de conversión analógica/digital	625 μs (rechazo de 400 Hz)		
Rechazo en modo común	40 dB, DC a 60 Hz		
Rango de señales operativo	La tensión de señal más la tensión en modo común debe ser menor que +12 V y mayor que -12 V		
Longitud de cable (metros)	100 metros, trenzado y apantallado		
Diagnóstico			
Rebase por exceso/defecto	Sí <sup>1</sup>	Sí <sup>1</sup>	Sí <sup>1</sup>
Cortocircuito a tierra (sólo en modo de tensión)	No aplicable	No aplicable	Sí en las salidas
Rotura de hilo (sólo en modo de intensidad)	No aplicable	No aplicable	Sí en las salidas
24 V DC, baja tensión	Sí	Sí	Sí

<sup>1</sup> Si se aplica una tensión superior a +30 V DC o inferior a -15 V DC a la entrada, el valor resultante se desconocerá y es posible que no se active el rebase por exceso o por defecto correspondiente.

Datos técnicos			
Modelo	SM 1232 AQ 2x14bit	SM 1232 AQ 4x14bit	SM 1234 AI 4x13bit AQ 2x14bit
Referencia	6ES7 232-4HB30-0XB0	6ES7 232-4HD30-0XB0	6ES7 234-4HE30-0XB0
General			
Dimensiones A x A x P (mm)	45 x 100 x 75	45 x 100 x 75	45 x 100 x 75
Peso	180 gramos	180 gramos	220 gramos
Disipación de potencia	1,5 W	1,5 W	2,0 W

Datos técnicos			
Modelo	SM 1232 AQ 2x14bit	SM 1232 AQ 4x14bit	SM 1234 AI 4x13bit AQ 2x14bit
Consumo de corriente (bus SM)	80 mA	80 mA	80 mA
Consumo de corriente (24 V DC)	45 mA (sin carga)	45 mA (sin carga)	60 mA (sin carga)
<b>Salidas analógicas</b>			
Número de salidas	2	4	2
Tipo	Tensión o intensidad		
Rango	±10 V ó 0 a 20 mA		
Resolución	Tensión: 14 bits; intensidad: 13 bits		
Rango total (palabra de datos)	Tensión: -27.648 a 27.648; intensidad: 0 a 27.648 (Consulte Representación de entradas analógicas para tensión y representación de entradas analógicas para intensidad) (Página 346)		
Precisión (25°C / 0 a 55°C)	±0,3% / ±0,6% de rango máximo		
Tiempo de estabilización (95% del nuevo valor)	Tensión: 300 μS (R), 750 μS (1 uF); intensidad: 600 μS (1 mH), 2 ms (10 mH)		
Impedancia de carga	Tensión: ≥ 1000 Ω; intensidad: ≤ 600 Ω		
Reacción al cambiar de RUN a STOP	Último valor o valor sustitutivo (valor predeterminado: 0)		
Aislamiento (campo a lógica)	Ninguna		
Longitud de cable (metros)	100 metros, trenzado y apantallado		
<b>Diagnóstico</b>			
Rebase por exceso/defecto	Sí	Sí	Sí <sup>1</sup>
Cortocircuito a tierra (sólo en modo de tensión)	Sí	Sí	Sí en las salidas
Rotura de hilo (sólo en modo de intensidad)	Sí	Sí	Sí en las salidas
24 V DC, baja tensión	Sí	Sí	Sí

<sup>1</sup> Si se aplica una tensión superior a +30 V DC o inferior a -15 V DC a la entrada, el valor resultante se desconocerá y es posible que no se active el rebase por exceso o por defecto correspondiente.

### Tiempos de respuesta de las entradas analógicas

Respuesta de paso de los módulos analógicos SM (en ms)				
0V a 10V medido a 95%				
Selección de alisamiento	Frecuencia de rechazo			
	400 Hz	60 Hz	50 Hz	10 Hz
Ninguno	4	18	22	100
Débil	9	52	63	320
Medio	32	203	241	1200
Fuerte	61	400	483	2410
<b>Frecuencia de muestreo</b>				
• 4 canales	• 0.625	• 4.17	• 5	• 25
• 8 canales	• 1.25	• 4.17	• 5	• 25

Respuesta de paso de entradas analógicas de la CPU (en ms)			
0V a 10V medido a 95%			
Selección de alisamiento	Frecuencia de rechazo		
	60 Hz	50 Hz	10 Hz
Ninguno	63	65	130
Débil	84	93	340
Medio	221	258	1210
Fuerte	424	499	2410
Frecuencia de muestreo	4.17	5	25

### Representación de entradas analógicas para tensión

Sistema	Rango de medida de tensión							
	Decimal	Hexadecimal	±10 V	±5 V	±2,5 V	0 a 10 V		
32767	7FFF	11,851 V	5,926 V	2,963 V	Rebase por exceso	11,851V	Rebase por exceso	
32512	7F00							
32511	7EFF	11,759 V	5,879 V	2,940 V	Rango de sobreimpulso	11,759 V	Rango de sobreimpulso	
27649	6C01							
27648	6C00	10 V	5 V	2,5 V	Rango nominal	10 V	Rango nominal	
20736	5100	7,5 V	3,75 V	1,875 V		7,5 V		
1	1	361,7 µV	180,8 µV	90,4 µV		361,7 µV		
0	0	0 V	0 V	0 V		0 V		
-1	FFFF				Rango de subimpulso	Los valores negativos no se soportan		
-20736	AF00	-7,5 V	-3,75 V	-1,875 V				
-27648	9400	-10 V	-5 V	-2,5 V				
-27649	93FF							
-32512	8100	-11,759 V	-5,879 V	-2,940 V	Rebase por defecto			
-32513	80FF							
-32768	8000	-11,851 V	-5,926 V	-2,963 V				

### Representación de entradas analógicas para intensidad

Sistema	Rango de medida de intensidad		
	Decimal	Hexadecimal	0 mA a 20 mA
32767	7FFF	23,70 mA	Rebase por exceso
32512	7F00		
32511	7EFF	23,52 mA	Rango de sobreimpulso
27649	6C01		
27648	6C00	20 mA	Rango nominal
20736	5100	15 mA	
1	1	723,4 nA	

Sistema		Rango de medida de intensidad	
Decimal	Hexadecimal	0 mA a 20 mA	
0	0	0 mA	
-1	FFFF		Rango de subimpulso
-4864	ED00	-3,52 mA	
-4865	ECFF		Rebase por defecto
-32768	8000		

### Representación de salidas analógicas para tensión

Sistema		Rango de salida de tensión	
Decimal	Hexadecimal	$\pm 10$ V	
32767	7FFF	V. nota 1	Rebase por exceso
32512	7F00	V. nota 1	
32511	7EFF	11,76 V	Rango de sobreimpulso
27649	6C01		
27648	6C00	10 V	Rango nominal
20736	5100	7,5 V	
1	1	361,7 $\mu$ V	
0	0	0 V	
-1	FFFF	-361,7 $\mu$ V	
-20736	AF00	-7,5 V	
-27648	9400	-10 V	
-27649	93FF		Rango de subimpulso
-32512	8100	-11,76 V	
-32513	80FF	V. nota 1	Rebase por defecto
-32768	8000	V. nota 1	

<sup>1</sup> . En una condición de rebase por exceso o por defecto, la reacción de las salidas analógicas corresponderá a las propiedades ajustadas en la configuración de dispositivos para el módulo de señales analógico. En el parámetro "Reacción a STOP de la CPU", seleccione: "Aplicar valor sustitutivo" o "Mantener último valor".

### Representación de salidas analógicas para intensidad

Sistema		Rango de salida de intensidad	
Decimal	Hexadecimal	$\pm 20$ mA	
32767	7FFF	V. nota 1	Rebase por exceso
32512	7F00	V. nota 1	
32511	7EFF	23,52 mA	Rango de sobreimpulso
27649	6C01		
27648	6C00	20 mA	Rango nominal
20736	5100	15 mA	
1	1	723,4 nA	

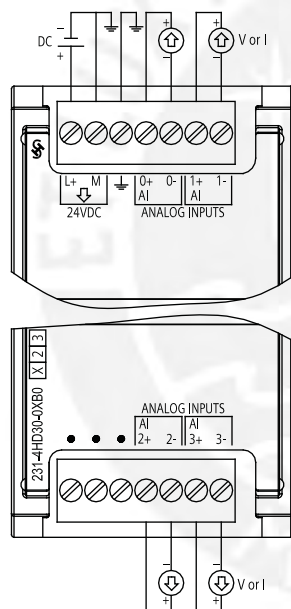


Sistema		Rango de salida de intensidad	
Decimal	Hexadecimal	$\pm 20$ mA	
0	0	0 mA	
-1	FFFF		Rango de subimpulso
-32512	8100		
-32513	80FF	V. nota 1	Rebase por defecto
-32768	8000	V. nota 1	

1. En una condición de rebase por exceso o por defecto, la reacción de las salidas analógicas corresponderá a las propiedades ajustadas en la configuración de dispositivos para el módulo de señales analógico. En el parámetro "Reacción a STOP de la CPU", seleccione: "Aplicar valor sustitutivo" o "Mantener último valor".

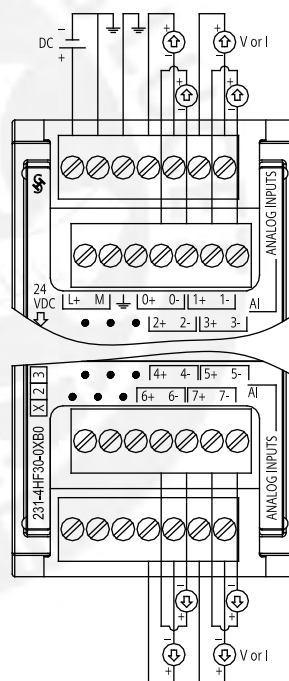
### Diagramas de cableado

SM 1231 AI 4 x 13 bit



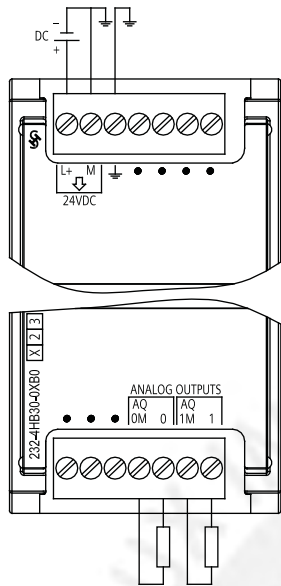
6ES7 231-4HD30-0XB0

SM 1231 AI 8 x 13 bit



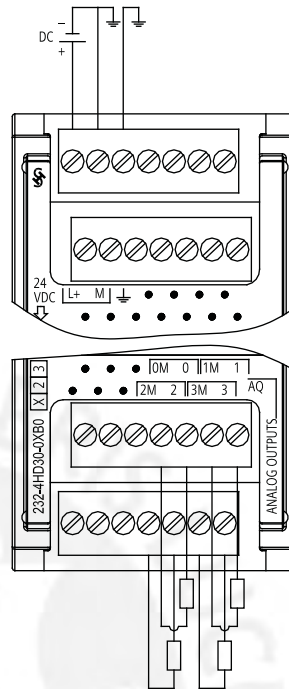
6ES7 231-4HF30-0XB0

SM 1232 AQ 2 x 14 bit



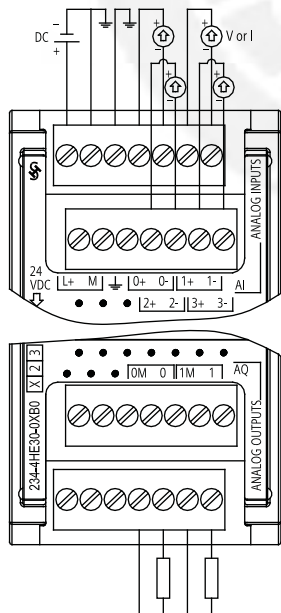
6ES7 232-4HB30-0XB0

SM 1232 AQ 4 x 14 bit



6ES7 232-4HD30-0XB0

SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit



6ES7 234-4HE30-0XB0



## Calcular la corriente necesaria

La CPU incorpora una fuente de alimentación interna capaz de abastecer la CPU, los módulos de ampliación y otros consumidores de 24 V DC.

Hay tres tipos de módulos de ampliación, a saber:

- Los módulos de señales (SM) se montan a la derecha de la CPU. Toda CPU permite conectar un número máximo posible de módulos de señales, sin considerar la corriente disponible.
  - La CPU 1214 permite conectar 8 módulos de señales
  - La CPU 1212 permite conectar 2 módulos de señales
  - La CPU 1211 no permite conectar módulos de señales
- Los módulos de comunicación (CM) se montan a la izquierda de la CPU. Se permiten como máximo 3 módulos de comunicación para cualquier CPU, sin considerar la corriente disponible.
- Las Signal Boards (SB) se montan en el lado superior de la CPU. Se permite como máximo 1 Signal Board para cualquier CPU.

Utilice la información siguiente como guía para determinar cuánta energía (o corriente) puede suministrar la CPU a la configuración.

Toda CPU suministra alimentación tanto de 5 V DC como de 24 V DC:

- La CPU suministra 5 V DC a los módulos de ampliación cuando son conectados. Si el consumo de 5 V DC de los módulos de ampliación excede la corriente que ofrece la CPU, habrá que desconectar tantos módulos de ampliación como sea necesario para no excederla.
- Toda CPU incorpora una fuente de alimentación de sensores de 24 V DC que puede suministrar 24 V DC a las entradas locales, o bien a las bobinas de relé de los módulos de ampliación. Si el consumo de 24 V DC excede la corriente disponible de la CPU, es posible agregar una fuente de alimentación externa de 24 V DC para suministrar 24 V DC a los módulos de ampliación. La alimentación de 24 V DC debe conectarse manualmente a las entradas o bobinas de relé.

### ADVERTENCIA

Si se conecta una fuente de alimentación externa de 24 V DC en paralelo con la fuente de alimentación DC de sensores, podría surgir un conflicto entre ambas fuentes, ya que cada una intenta establecer su propio nivel de tensión de salida.

Este conflicto puede reducir la vida útil u ocasionar la avería inmediata de una o ambas fuentes de alimentación y, en consecuencia, el funcionamiento imprevisible del sistema PLC. El funcionamiento imprevisible puede producir la muerte, lesiones corporales graves y/o daños materiales.

La fuente de alimentación DC de sensores de la CPU y cualquier fuente de alimentación externa deben alimentar diferentes puntos. Se permite una conexión común de los cables neutros.

Algunos puertos de entrada de alimentación de 24 V del sistema PLC están interconectados y tienen un circuito lógico común que conecta varios bornes M. La fuente de alimentación de 24V de la CPU, la entrada de alimentación de las bobinas de relé de un SM, o bien una fuente de alimentación analógica sin aislamiento galvánico son ejemplos de circuitos interconectados si no tienen aislamiento galvánico según las hojas de datos técnicos. Todos los bornes M sin aislamiento galvánico deben conectarse al mismo potencial de referencia externo.

 **ADVERTENCIA**

Si los bornes M sin aislamiento galvánico se conectan a diferentes potenciales de referencia, circularán corrientes indeseadas que podrían averiar o causar reacciones inesperadas en el PLC y los equipos conectados.

Las averías o reacciones inesperadas podrían producir la muerte, lesiones corporales graves y/o daños materiales.

Asegúrese que todos los bornes M sin aislamiento galvánico de un sistema PLC están conectados al mismo potencial de referencia.

Para más información sobre la corriente disponible de las distintas CPUs y el consumo de corriente de los módulos de señales, consulte los datos técnicos (Página 319).

---

**Nota**

Si se excede la corriente disponible de la CPU, es posible que no se pueda conectar el número máximo de módulos soportado.

---

## B.2 Ejemplo de cálculo del consumo de corriente

El ejemplo siguiente muestra el cálculo del consumo de corriente de un PLC que incluye una CPU 1214C AC/DC/relé, 3 módulos de señales SM 1223 de 8 entradas DC y 8 salidas de relé, así como un módulo de señales SM 1221 de 8 entradas DC. Este ejemplo incluye 46 entradas y 34 salidas en total.

### Nota

La CPU ya ha asignado la corriente necesaria para accionar las bobinas de relé internas. Por tanto, no es necesario incluir el consumo de corriente de las bobinas de relé internas en el cálculo.

La CPU de este ejemplo suministra suficiente corriente de 5 V DC a los SMs, pero la alimentación de sensores no suministra suficiente corriente de 24 V DC a todas las entradas y bobinas de relé de ampliación. Las E/S requieren 448 mA, pero la CPU sólo puede suministrar 400 mA. Para esta configuración se necesita una fuente de alimentación adicional de 48 mA (como mínimo) a 24 V DC para operar todas las entradas y salidas de 24 V DC.

Corriente disponible de la CPU	5 V DC	24 V DC
CPU 1214C AC/DC/relé	1600 mA	400 mA
<i>Menos</i>		
Consumo del sistema	5 V DC	24 V DC
CPU 1214C, 14 entradas	-	14 * 4 mA = 56 mA
3 SM 1223, 5 V de corriente	3 * 145 mA = 435 mA	-
1 SM 1221, 5 V de corriente	1 * 105 mA = 105 mA	-
3 SM 1223, 8 entradas c/u	-	3 * 8 * 4 mA = 96 mA
3 SM 1223, 8 salidas de relé c/u	-	3 * 8 * 11 mA = 264 mA
1 SM 1221, 8 entradas	-	8 * 4 mA = 32 mA
<b>Consumo total</b>	540 mA	448 mA
<i>Igual a</i>		
Balance de corriente	5 V DC	24 V DC
Balance total de corriente	1060 mA	(48 mA)

### B.3 Calcular el consumo de corriente

Utilice la tabla siguiente para determinar cuánta energía (o corriente) puede suministrar la CPU S7-1200 a la configuración en cuestión. En los datos técnicos (Página 319) encontrará información sobre la corriente disponible de la CPU y el consumo de los módulos de señales.

Corriente disponible de la CPU	5 V DC	24 V DC
<i>Menos</i>		
Consumo del sistema	5 V DC	24 V DC
Consumo total		
<i>Igual a</i>		
Balance de corriente	5 V DC	24 V DC
Balance total de corriente		

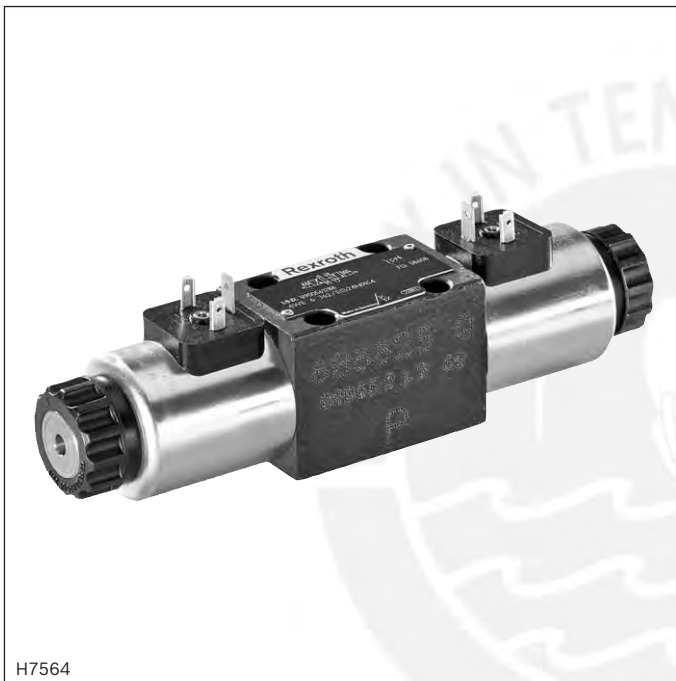
Directional spool valves, direct operated,  
with solenoid actuation

Type WE

**RE 23178**

Edition: 2013-06

Replaces: 04.09



H7564

- ▶ Size 6
- ▶ Component series 6X
- ▶ Maximum operating pressure 350 bar [5076 psi]
- ▶ Maximum flow: 80 l/min [21 US gpm] – DC  
60 l/min [15.8 US gpm] – AC

**Features**

- ▶ 4/3, 4/2 or 3/2 directional design
- ▶ High-power solenoid
- ▶ Porting pattern according to DIN 24340 form A
- ▶ Porting pattern according to ISO 4401-03-02-0-05 and NFPA T3.5.1 R2-2002 D03
- ▶ Wet-pin DC or AC solenoids with detachable coil
- ▶ Solenoid coil can be rotated by 90°
- ▶ The coil can be changed without having to open the pressure-tight chamber
- ▶ Electrical connection as individual or central connection
- ▶ Manual override, optional
- ▶ Spool position monitoring, optional

**Contents**

Features	1
Ordering code	2 ... 4
Mating connectors	4
Symbols	5
Function, section	6
Technical data	7, 8
Characteristic curves	9
Performance limits	10 ... 12
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Circuit breakers	19
More information	19

## Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
	<b>WE</b>	<b>6</b>		<b>6X</b>	<b>/</b>		<b>E</b>				<b>/</b>				<b>*</b>

01	3 main ports	<b>3</b>
	4 main ports	<b>4</b>
02	Directional valve	<b>WE</b>
03	Size 6	<b>6</b>
04	Symbols e.g. C, E, EA, EB, etc; for the possible version, see page 5	
05	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	<b>6X</b>
06	<b>With</b> spring return	<b>no code</b>
	<b>Without</b> spring return	<b>O</b>
	<b>Without</b> spring return with detent	<b>OF</b>
07	High-power wet-pin solenoid with detachable coil	<b>E</b>
08	Direct voltage 24 V	<b>G24</b>
	AC voltage 230 V 50/60 Hz	<b>W230</b>
	AC voltage 120 V or 110 V 50/60 Hz	<b>W110</b> <b>W + voltage</b>
	Direct voltage 205 V	<b>G205</b>
	DC solenoid with rectifier for AC voltage (not frequency-related; only available with plug-in connection with cover, see page 17)	<b>W110R</b>
	Connection to AC voltage mains via control with rectifier (see table below and page 4) <sup>1)</sup> For further ordering codes for other voltages and frequencies, see page 8	
09	<b>Without</b> manual override	<b>no code</b>
	<b>With</b> concealed manual override (standard)	<b>N9</b> <sup>2)</sup>
	<b>With</b> manual override	<b>N</b> <sup>2)</sup>
	<b>With</b> lockable manual override "mushroom button" (small)	<b>N4</b> <sup>2)</sup>
	<b>With</b> lockable manual override "mushroom button" (big)	<b>N5</b> <sup>2; 3)</sup>
	<b>With</b> manual override "mushroom button" (big), not lockable	<b>N6</b> <sup>2)</sup>
	<b>With</b> lockable manual override "nut"	<b>N7</b> <sup>2)</sup>

## Electrical connection

10	<b>Individual connection</b>	
	<b>Without</b> mating connector, with connector according to DIN EN 175301-803	<b>K4</b> <sup>4)</sup>
	<b>Without</b> mating connector, with connector AMP Junior-Timer	<b>C4</b> <sup>4)</sup>
	<b>Without</b> mating connector, with connector DT 04-2PA (Deutsch plug)	<b>K40</b> <sup>4; 7)</sup>
	<b>Without</b> mating connector, 4-pole with connector M12x1 according to IEC 60947-5-2, integrated interference protection circuit and status LED	<b>K72L</b> <sup>5)</sup>
	<b>Without</b> mating connector, 4-pole with connector M12x1 according to IEC 60947-5-2, integrated interference protection circuit and status LED (no connection pin 1 to pin 2)	<b>K73L</b> <sup>5)</sup>
	<b>Central connection</b>	
	Cable entry at the cover, with indicator light	<b>DL</b>
	Central plug-in connection at the cover, with indicator light (without mating connector); connector according to DIN EN 175201-804	<b>DK6L</b> <sup>6)</sup>
	For further electrical connections, see data sheet 08010	

AC voltage mains (admissible voltage tolerance ±10%)	Nominal voltage of the DC solenoid in case of operation with alternating voltage	Ordering code
110 V - 50/60 Hz	96 V	<b>G96</b>
230 V - 50/60 Hz	205 V	<b>G205</b>

## Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
	WE	6		6X	/		E				/				*

### Spool position monitoring

11	<b>Without</b> position switch	no code
	<b>- Inductive position switch type QM</b>	
	Monitored spool position "a"	QMAG24
	Monitored spool position "b"	QMBG24
	Monitored rest position	QM0G24
	<b>- Inductive position switch type QR</b>	
	Monitored rest position	QR0G24S
	Monitored spool position "a" and "b"	QRABG24E
	<b>- Inductive position switch type QL</b>	
	Monitored spool position "a"	QLAG24
	Monitored spool position "b"	QLBG24
	<b>- Inductive proximity sensor type QS</b>	
	Monitored spool position "a"	QSAG24W
	Monitored spool position "b"	QSBG24W
	Monitored spool position "0"	QS0G24W
	Monitored spool position "0" and "a"	QS0AG24W
	Monitored spool position "0" and "b"	QS0BG24W
	Monitored spool position "a" and "b"	QSABG24W
	For more information, see data sheet 24830	

12	<b>Without</b> throttle insert	no code
	<b>With</b> throttle insert see table:	
	Port	Throttle Ø in mm [inch]
		0.8 [0.031]      1.0 [0.039]      1.2 [0.047]
	P	= B08      = B10      = B12
	A	= H08      = H10      = H12
	B	= R08      = R10      = R12
	A and B	= N08      = N10      = N12
	T	= X08      = X10      = X12
	Use with flows which exceed the performance limit of the valve (see page 6).	

### Clamping length

13	42 mm [1.65 inch] (standard)	no code
	22 mm [0.87 inch]	Z

### Seal material

14	NBR seals	no code
	FKM seals	V
	Attention: Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

15	<b>Without</b> locating hole	no code
	<b>With</b> locating hole	/60 <sup>B)</sup>
	<b>With</b> locating hole and locking pin ISO 8752-3x8-St	/62

16	Further details in the plain text	
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Explanation of the footnotes see page 4.

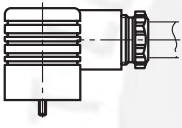
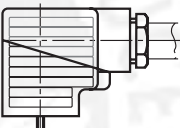
Preferred types and standard units are contained in the EPS (standard price list).



## Ordering code

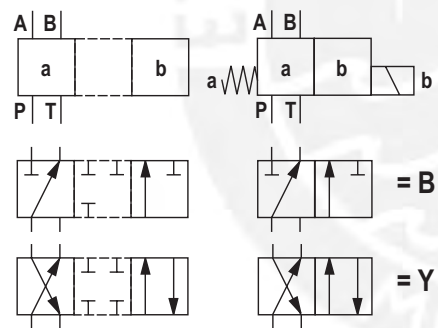
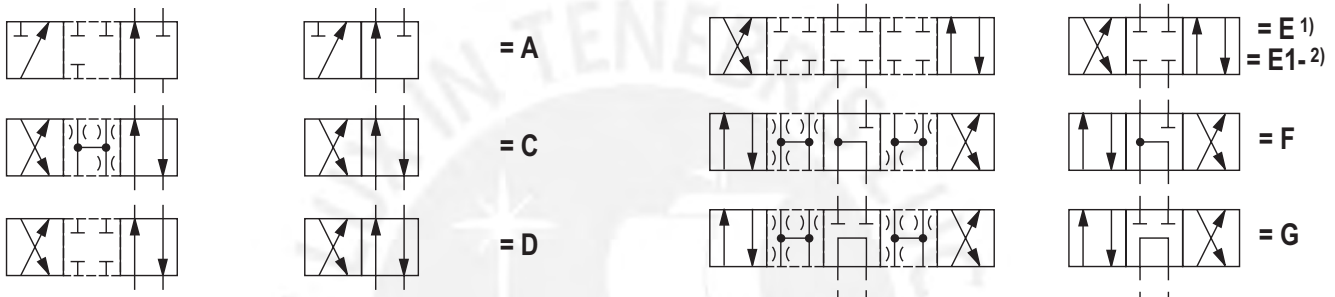
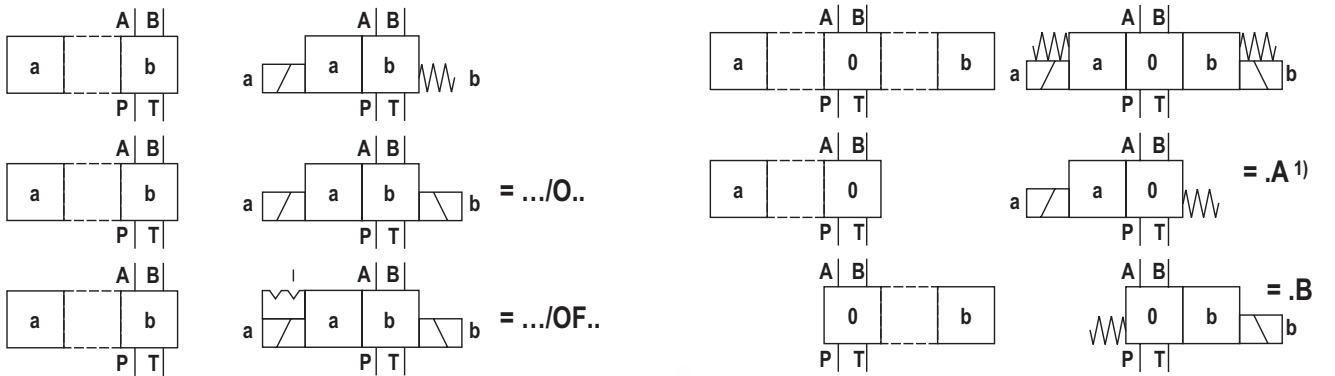
- 1) Only for version "individual connection"
- 2) The manual override cannot be allocated a safety function. The manual override units may only be used up to a tank pressure of 50 bar.
- 3) With tank pressures above 50 bar, it cannot be guaranteed that the valve remains in the position switched by the manual override "N5".
- 4) Mating connectors, separate order, see below and data sheet 08006
- 5) Only version "G24", see data sheet 08010
- 6) Mating connector, separate order, material no. **R900005538**
- 7) Only possible in connection with the symbols G, J, D and E as well a reduced performance limit.
- 8) Locking pin ISO 8752-3x8-St, material no. **R900005694** (separate order)

## Mating connectors according to DIN EN 175301-803

For details and more mating connectors, see data sheet 08006							
Port	Valve side	Color	Material number				
			Without circuitry	With indicator light 12 ... 240 V	With indicator light and rectifier 12 ... 240 V	With rectifier 12 ... 240 V	With indicator light and Zener diode suppression circuit 24 V
M16 x 1.5	a	Gray	<b>R901017010</b>	-	-	-	-
	b	Black	<b>R901017011</b>	-	-	-	-
	a/b	Black	-	<b>R901017022</b>	<b>R901017029</b>	<b>R901017025</b>	<b>R901017026</b>
1/2" NPT (Pg 16)	a	Red/brown	<b>R900004823</b>	-	-	-	-
	b	Black	<b>R900011039</b>	-	-	-	-
	a/b	Black	-	<b>R900057453</b>	<b>R900057455</b>	<b>R900842566</b>	-

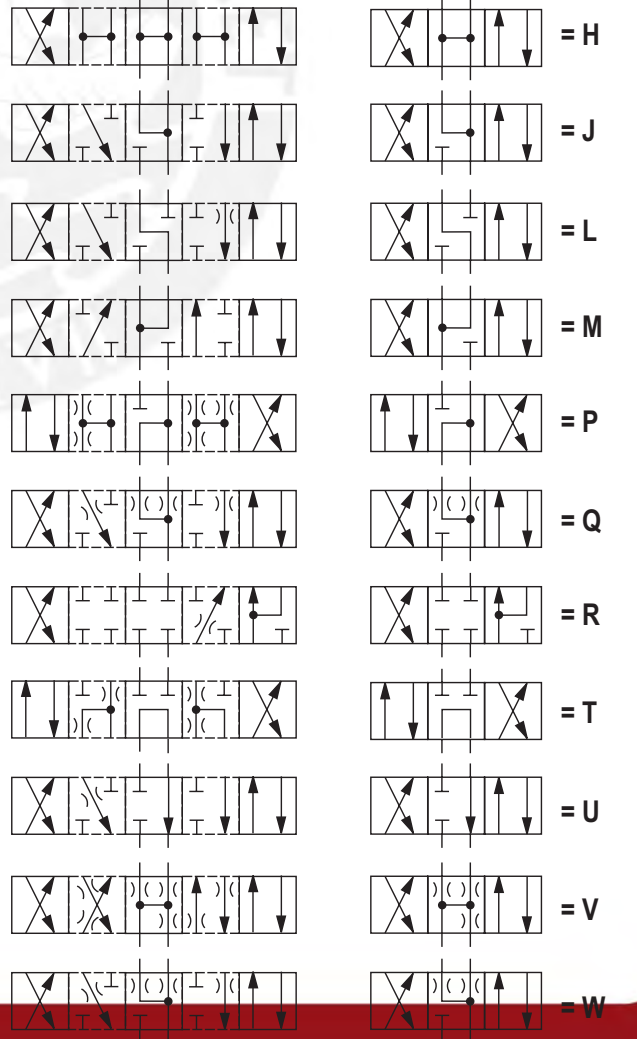


### Symbols



- 1) **Example:**  
Symbol E with spool position "a", ordering code ..EA..
- 2) Symbol E1-: P – A/B pre-opening,  
**Caution in conjunction with differential cylinders due to pressure intensification!**

**Notices!**  
Representation according to DIN ISO 1219-1.  
Hydraulic interim positions are shown by dashes.



## Function, section

Directional valves of type WE are solenoid operated directional spool valves. They control the start, stop and direction of a flow.

The directional valves basically consist of the housing (1), one or two electronic solenoids (2), the control spool (3), and one or two return springs (4).

In the de-energized condition, the control spool (3) is held in the central position or in the initial position by the return springs (4) (except for impulse spools). The control spool (3) is actuated by wet-pin electronic solenoids (2).

**To ensure proper functioning, care must be taken that the pressure chamber of the electronic solenoid is filled with oil.**

The force of the electronic solenoid (2) acts via the plunger (5) on the control spool (3) and pushes the latter from its rest position to the required end position. This enables the necessary direction of flow from P to A and B to T or P to B and A to T.

When the electronic solenoid (2) is de-energized, the return spring (4) pushes the control spool (3) back to its rest position.

An optional manual override (6) allows the control spool (3) to be moved without solenoid energization.

**Without spring return "O"** (only possible with symbols A, C and D)

This version is a directional valve with 2 spool positions and 2 electronic solenoids **without** detent. The valve without spring return at the control spool (3) has no defined basic position in the de-energized condition.

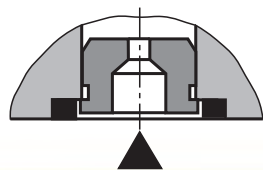
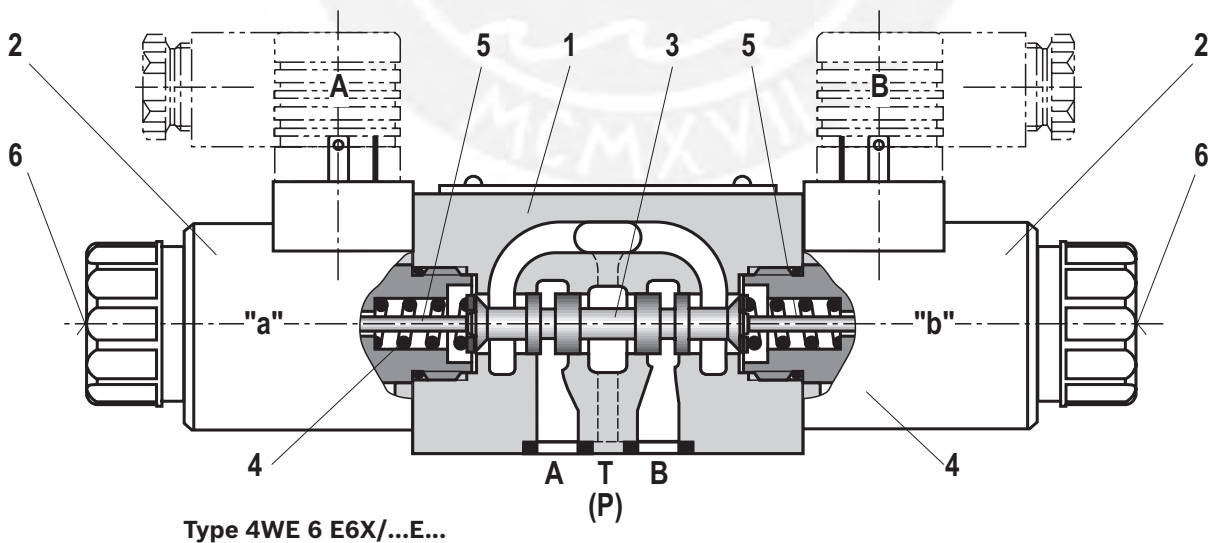
**Without spring return with "OF" detent** (only possible with symbols A, C and D)

This version is a directional valve with 2 spool positions and 2 electronic solenoids **with** detent. The detents are used to fix the control spool (3) in the relevant spool position. During operation, continuous application of current to the electronic solenoid can thus be omitted which contributes to energy-efficient operation.

### Notices!

Pressure peaks in the tank line to two or several valves can result in unintended control spool movements in the case of valves with detent! We therefore recommend that separate return lines be provided or a check valve installed in the tank line.

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.



### Throttle insert

The use of the throttle insert is required when, due to prevailing operating conditions, flows occur during the switching processes which exceed the performance limit of the valve.

## Technical data

(for applications outside these parameters, please consult us!)

general			
Weight	- Valve with one solenoid	kg [lbs]	1.45 [3.2]
	- Valve with two solenoids	kg [lbs]	1.95 [4.3]
Installation position			Any
Ambient temperature range		°C [°F]	-30 ... +50 [-22 ... +122] (NBR seals) -20 ... +50 [-4 ... +122] (FKM seals)
MTTF <sub>d</sub> values according to EN ISO 13849		Years	150 (for further details see data sheet 08012)

hydraulic			
Maximum operating pressure	- Ports A, B, P	bar [psi]	350 [5076]
	- Port T	bar [psi]	210 [3050] (DC); 160 [2320] (AC) With symbols A and B, port T must be used as leakage oil connection.
Maximum flow		l/min [USgpm]	80 [21] (DC); 60 [15.8] (AC)
Flow cross-section (spool position 0)	- Symbol Q	mm <sup>2</sup>	Approx. 6% of nominal cross-section
	- Symbol W	mm <sup>2</sup>	Approx. 3% of nominal cross-section
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C [°F]	-30 ... +80 [-22 ... +176] (NBR seals) -15 ... +80 [-4 ... +176] (FKM seals)
Viscosity range		mm <sup>2</sup> /s [cSt]	2.8 ... 500 [35 ... 2320]
Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 <sup>1)</sup>

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524
Bio-degradable	- insoluble in water	HETG	VDMA 24568
		HEES	
	- soluble in water	HEPG	VDMA 24568
Flame-resistant	- water-free	HFDU, HFDR	ISO 12922
	- containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	ISO 12922



### Important information on hydraulic fluids!

- ▶ For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- ▶ The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

### ▶ Flame-resistant – containing water:

- Maximum pressure difference per control edge 50 bar
- Pressure pre-loading at the tank port >20% of the pressure differential, otherwise increased cavitation
- Life cycle as compared to operation with mineral oil HL, HLP 50 to 100%

- ▶ **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-soluble, zinc may accumulate in the fluid (per pole tube 700 mg zinc).

<sup>1)</sup> The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components. For maintenance requirements of the hydraulic fluid and contamination limit values, see data sheet 07300. For the selection of the filters, see [www.boschrexroth.com/filter](http://www.boschrexroth.com/filter).

**Technical data**

(for applications outside these parameters, please consult us!)

<b>electric</b>			
Voltage type		Direct voltage	Alternating voltage 50/60 Hz
Available voltages <sup>2)</sup> (For ordering codes for AC voltage solenoids, see below)	V	12, 24, 96, 205	110, 230
Voltage tolerance (nominal voltage)	%	±10	
Power consumption	W	30	–
Holding power	VA	–	50
Switch-on power	VA	–	220
Duty cycle	%	100	
Switching time according to ISO 6403 <sup>3)</sup>	– ON	ms	25 ... 45
	– OFF	ms	10 ... 25
Maximum switching frequency	1/h	15000	7200
Maximum surface temperature of the coil <sup>4)</sup>	°C [°F]	120 [248]	180 [356]
Protection class according to DIN EN 60529	– With connector "K4", "K72L", "K73L"	IP 65 (with mating connector mounted and locked)	
	– With connector "C4"	IP 66A (with mating connector mounted and locked)	
	– With connector "K40"	IP 69K (with mating connector mounted and locked)	

<sup>2)</sup> Special voltages available upon request

<sup>3)</sup> The switching times were determined at a hydraulic fluid temperature of 40 °C [104 °F] and a viscosity of 46 cSt. Deviating hydraulic fluid temperatures can result in different switching times! Switching times change depending on operating time and application conditions.

<sup>4)</sup> Due to the temperatures occurring at the surfaces of the solenoid coils, the standards ISO13732-1 and ISO 4413 need to be adhered to!

The specified surface temperature in AC solenoids is valid for the faultless operation. In case of error (e.g. blocking of the control spool), the surface temperature may rise to above 180 °C [356 °F]. Thus, the system must be checked for possible dangers considering the flash point (see page 7).

As fuse protection, circuit breakers (see table on page 19) must be used, unless the creation of an ignitable atmosphere can be excluded in a different way. Thus, the surface temperature can – in case of error – be limited to maximally 220 °C [428 °F]. The tripping current must lie within a time interval of 0.6 s with 8 to 10 times the nominal power supply. (tripping characteristics "K").

The necessary non-tripping current of the fuse must not fall below the value  $I_1$  (see table on page 19). The maximum tripping current of the fuse must not exceed the value  $I_2$  (see table on page 19).

The temperature dependence of the tripping behavior of the circuit breakers has to be considered according to the manufacturer's specifications.

**Notices!**

- ▶ The actuation of the manual override is only possible up to a tank pressure of approx. 50 bar [725 psi]. Avoid damage to the bore of the manual override! (Special tool for the operation, separate order, material no. **R900024943**). When the manual override is blocked, actuation of the opposite solenoid must be ruled out!
- ▶ The simultaneous actuation of 2 solenoids of one valve must be ruled out!

**Notice!**

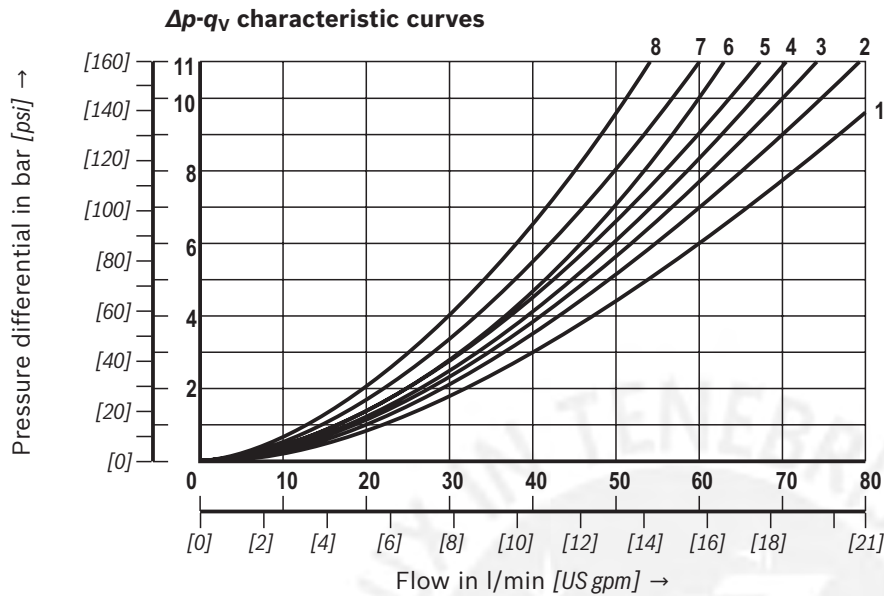
**AC solenoids** can be used for 2 or 3 mains; e.g. solenoid type **W110** for:  
110 V, 50 Hz; 110 V, 60 Hz; 120 V, 60 Hz

Ordering code	Mains
<b>W110</b>	110 V, 50 Hz
	110 V, 60 Hz
	120 V, 60 Hz
<b>W230</b>	230 V, 50 Hz
	230 V, 60 Hz

**When establishing the electrical connection, the protective earthing conductor (PE  $\perp$ ) has to be connected correctly.**

## Characteristic curves

(measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$  [ $104 \pm 9 \text{ }^\circ\text{F}$ ])



Symbol	Direction of flow			
	P - A	P - B	A - T	B - T
A; B	5	5	-	-
C	3	3	5	3
D; Y	6	6	5	5
E	5	5	3	3
F	3	5	3	3
T	8	8	4	4
H	2	1	2	2
J; Q	3	3	2	3
L	5	5	1	4
M	2	1	5	5
P	5	3	3	3
R	6	6	1	-
V	3	2	3	3
W	3	3	2	2
U	5	5	4	1
G	7	7	4	4

- 7 Symbol "R" in spool position B - A
- 8 Symbol "G" and "T" in central position P - T
- 9 Symbol "H" in central position P - T

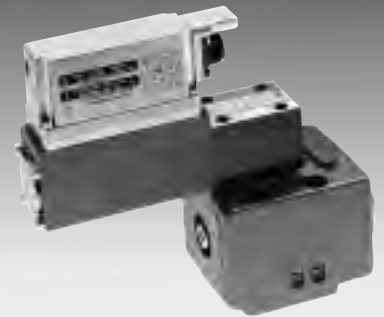
# Proportional pressure relief valve, pilot operated, with on-board elec- tronics (OBE) and position feedback

RE 29163/07.05

1/12

## Type DBEBE10Z

Nominal size 10  
Unit series 1X  
Maximum working pressure A, B, X 315 bar, Y 2 bar  
Maximum flow rate  $Q_{nom}$  120 l/min



## List of Contents

Contents	Page
Features	1
Ordering data	2
Preferred types, symbol	2
Function, sectional diagram	3
Technical data	4 to 6
On-board trigger electronics	7 and 8
Characteristic curves	9
Unit dimensions	10

## Features

- Pilot operated valves with position feedback and on-board electronics for limiting system pressure (pilot oil internal only)
- Adjustable through the position of the armature against the compression spring
- With position control, minimal hysteresis < 1 %, rapid response times, see Technical Data
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )
- For subplate attachment, mounting hole configuration to ISO 5781-AG-06-2-A  
Subplates as per catalog sheet RE 45055 (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics  
Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  - $U_B = 24 V_{nom}$  DC
  - Electrical connection 6P+PE
  - Signal actuation
    - Standard 0...+10 V (A1)
    - Version 4...20 mA (F1)
  - Valve curve calibrated at the factory

## Ordering data

DBEB	E	10	Z	-1X/	XY	G24	K31	A1	M	*
------	---	----	---	------	----	-----	-----	----	---	---

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics = E

Nominal size = 10

Mounting hole configuration to ISO 5781-AG-06-2-A = Z

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = 1X

**Max. pressure stage**

up to 180 bar = 180

up to 315 bar = 315

Relief port X

Pilot oil port Y = XY

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

**Interface for trigger electronics\***

A1 = Setpoint input 0...+10 V

K31 = **Electrical connection without** plug-in connector, with unit plug to DIN 43563-AM6  
Order plug-in connector separately

G24 = Voltage supply of trigger electronics  
24 V DC

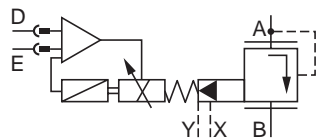
\* Variant "F1" (4...20 mA version) available on request

## Preferred types

Type...A1 (0... +10 V)	Material Number
DBEBE10Z-1X/180XYG24K31A1M	0 811 402 115
DBEBE10Z-1X/315XYG24K31A1M	0 811 402 116

## Symbol

For on-board electronics






## Function, sectional diagram

### General

Type DBEBE10Z proportional pressure relief valves are pilot operated and are used to limit system pressure.

They are actuated by means of a position-controlled proportional solenoid with on-board electronics.

The valve body contains a logic element (poppet valve) of the "normally closed" type. This is pilot operated and is in conical seat design.

 EN 61000-6-2: 2002-08  
EN 61000-6-3: 2002-08

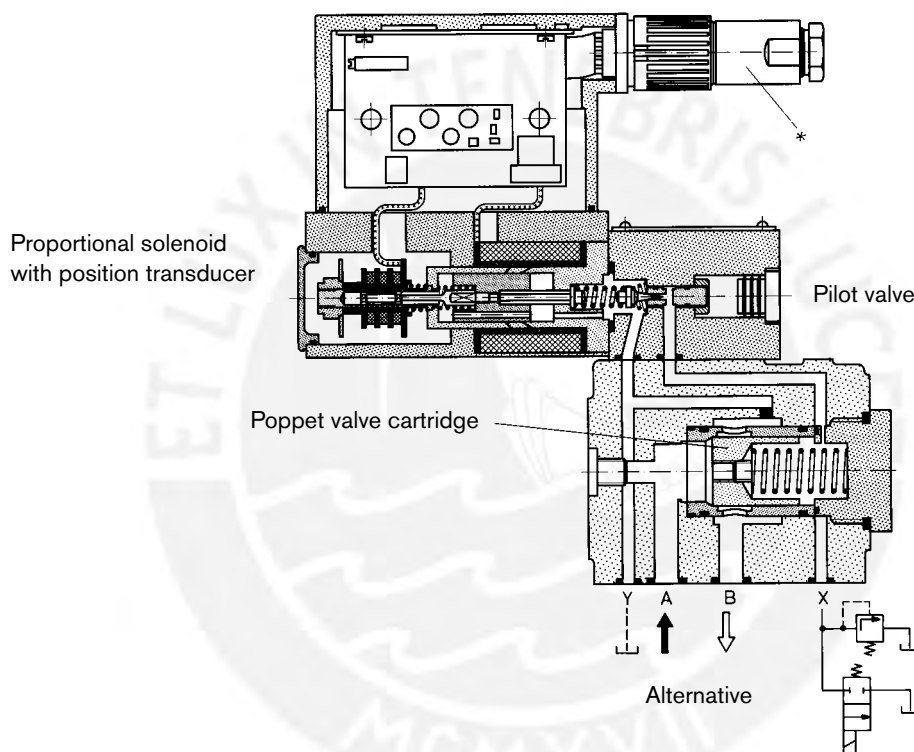
### Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.



The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure. The pilot stage is supplied with pilot oil at a flow rate of <math><0.8 \text{ l/min}</math> through a bore. The " $p_{\text{max}}$ " pressure stage is determined by the cone and seating bore configuration.

### Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current ( $I_{\text{max}}$ ) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



### Accessories

Type		Material Number
(4 x)  ISO 4762-M10x80-10.9	Cheese-head bolts	2 910 151 309
* 	Plug-in connectors 6P+PE, see also RE 08008	KS
		KS
		MS
		MS
		KS 90°
		1 834 482 022
		1 834 482 026
		1 834 482 023
		1 834 482 024
		1 834 484 252

### Testing and service equipment

Test box type VT-PE-TB3, see RE 30065

Measuring adapter 6P+PE type VT-PA-2, see RE 30068


## Technical data

General		
Construction	Pilot stage	Poppet valve
	Main stage	Pressure relief valve
	Valve cartridge	Poppet valve, normally closed, with pilot oil bore
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG10 (ISO 5781-AG-06-2-A)
Mounting position		Optional
Ambient temperature range	°C	-20...+50
Weight	kg	7.8
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

### Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$ )

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation	
Viscosity range,	recommended mm <sup>2</sup> /s	20...100	
	max. permitted mm <sup>2</sup> /s	10...800	
Pressure fluid temperature range	°C	-20...+70	
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 <sup>1)</sup>	
Direction of flow		See symbol	
Max. set pressure (at $Q_{min} = 1\text{ l/min}$ )	bar	180	315
Minimum pressure (at $Q_{min} = 1\text{ l/min}$ )	bar	6	8
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	< 190	< 325
Max. working pressure	bar	Port A, B: 315	
		Port Y: ≤ 2 external pilot oil drain	
		Port X: 315 relief port	
Internal pilot oil flow	l/min	≤ 0.8	
Max. flow	l/min	120 for $Q_{max}$ , see Characteristic Curves	

### Static/Dynamic

Hysteresis	%	≤ 1
Manufacturing tolerance for $p_{max}$	%	≤ ±5, see Characteristic Curves
Response time 100% signal change	ms	≈ 80 dependent on dead volume or system volume
Thermal drift		< 1% at $\Delta T = 40\text{ °C}$
Conformity		 EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

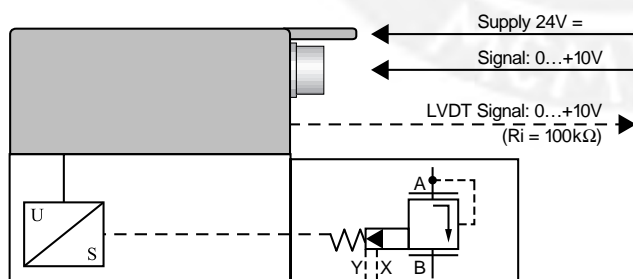
<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

## Technical data

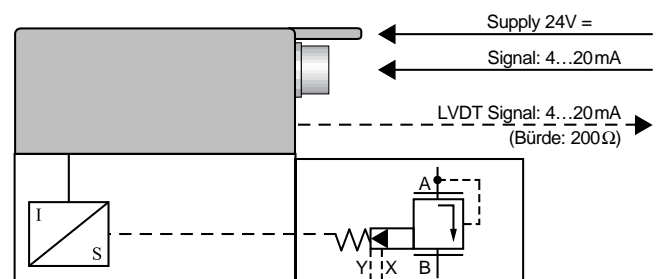
<b>Electrical, trigger electronics integrated in valve</b>		
Cyclic duration factor	%	100%
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage		24 V DC <sub>nom</sub>
Terminal A:		Min. 21 V DC/max. 40 V DC
Terminal B: 0 V		Ripple max. 2 V DC
Power consumption		Solenoid $\square$ 45 mm = 40 VA max.
External fuse		2.5 A <sub>F</sub>
Input, "standard" version	A1	Differential amplifier, $R_i = 100 \text{ k}\Omega$
Terminal D: $U_E$		0...+10 V
Terminal E:		0 V
Input, "mA signal" version	F1*	Burden, $R_{sh} = 200 \Omega$
Terminal D: $I_{D-E}$		4...20 mA
Terminal E: $I_{D-E}$		Current loop $I_{D-E}$ feedback
Max. voltage to differential inputs over 0 V		$D \rightarrow B$ } max. 18 V DC $E \rightarrow B$ }
Test signal, "standard" version	A1	LVDT
Terminal F: $U_{\text{Test}}$		0...+10 V
Terminal C:		Reference 0 V
Test signal, "mA signal" version	F1*	LVDT signal 4...20 mA at external load 200...500 $\Omega$ max.
Terminal F: $I_{F-C}$		4...20 mA output
Terminal C: $I_{F-C}$		Current loop $I_{F-C}$ feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm <sup>2</sup> up to 40 m 7 x 1 mm <sup>2</sup>
Calibration		Calibrated at the factory, see valve curve

\* Variant "F1" (4...20 mA version) available on request

### Version A1: Standard

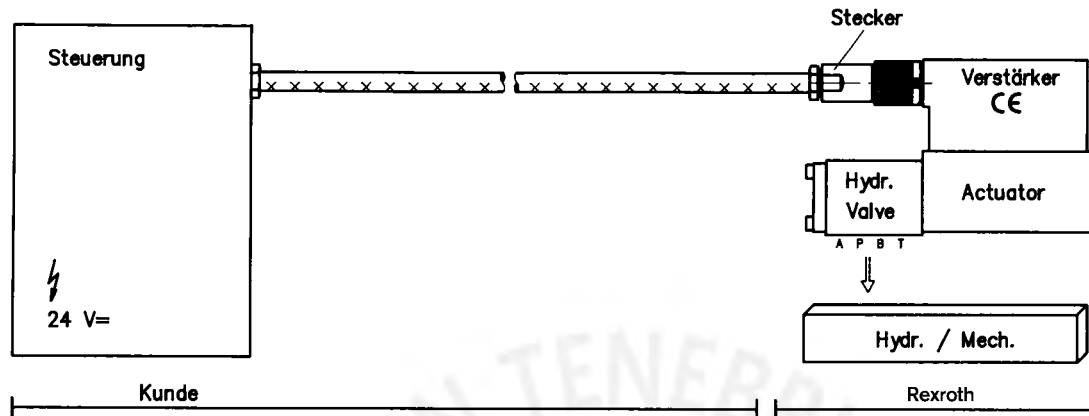


### \* Version F1: mA signal



## Connection

For electrical data, see page 5 and  
Operating Instructions 1 819 929 083



### Technical notes for the cable

- Version:**
- Multi-wire cable
  - Extra-finely stranded wire to VDE 0295, Class 6
  - Safety earth conductor, green/yellow
  - Cu braided shield
- Type:**
- e.g. Ölflex-FD 855 CP (from Lappkabel company)
- No. of wires:**
- Determined by type of valve, plug type and signal assignment
- Cable Ø:**
- 0.75 mm<sup>2</sup> up to 20 m long
  - 1.0 mm<sup>2</sup> up to 40 m long
- Outside Ø:**
- 9.4...11.8 mm – Pg11
  - 12.7...13.5 mm – Pg16

### Important

Power supply 24 V DC nom., if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally. In addition, with the "mA signal" version:

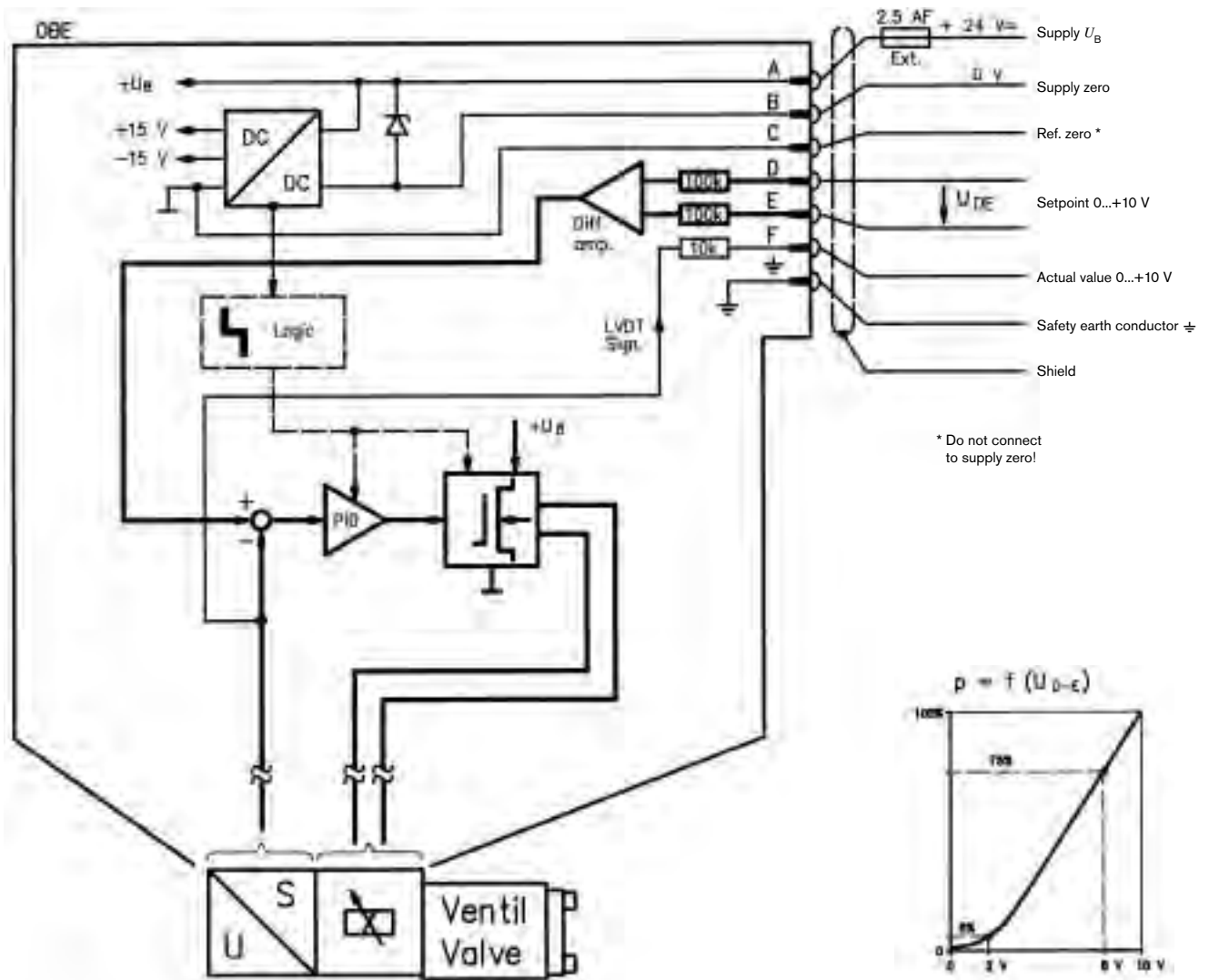
$I_{D-E} \geq 3 \text{ mA}$  – valve is active  
 $I_{D-E} \leq 2 \text{ mA}$  – valve is deactivated.

Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions! (See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.

### On-board trigger electronics

#### Circuit diagram/pin assignment

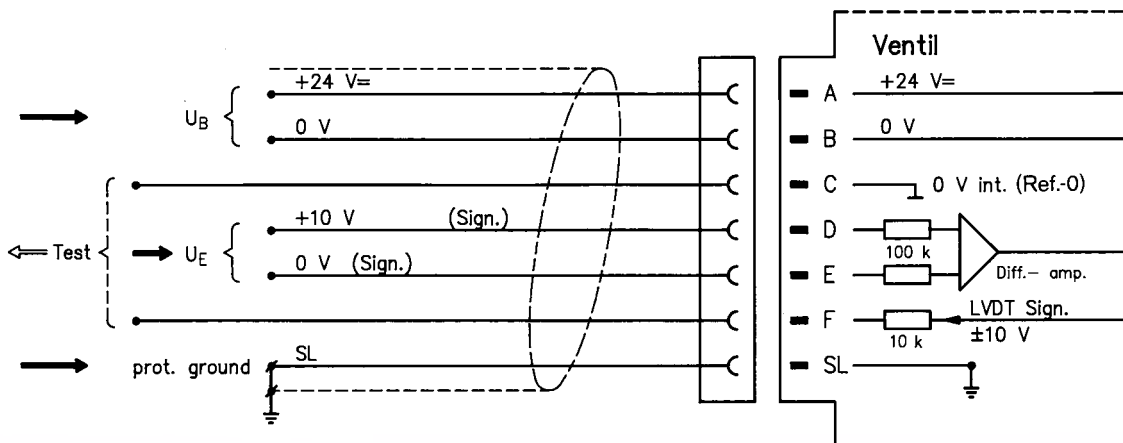
Version A1:  $U_{D-E}$  0...+10 V



#### Pin assignment

Version A1:  $U_{D-E}$  0...+10 V

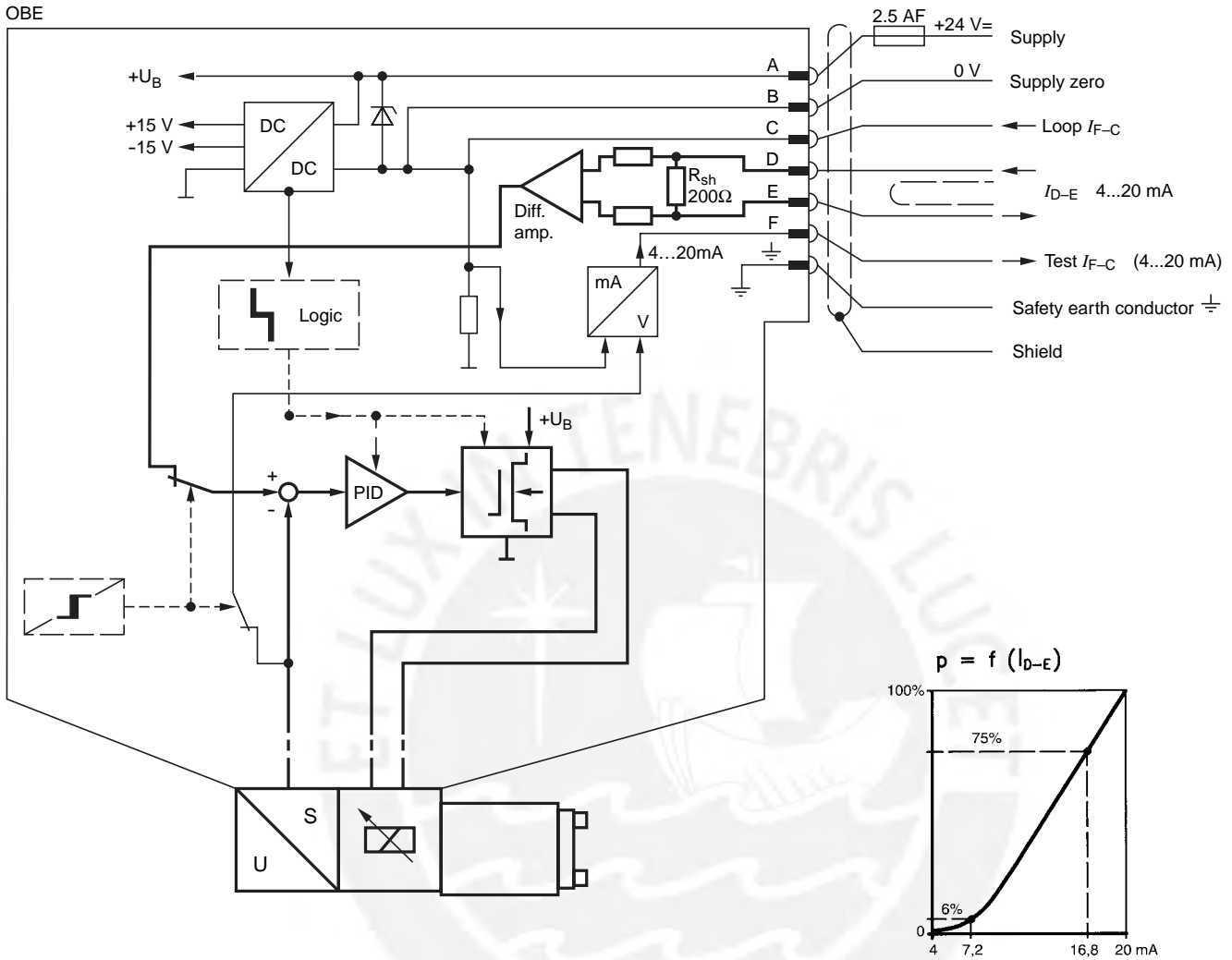
( $R_i = 100 \text{ k}\Omega$ )



### On-board trigger electronics

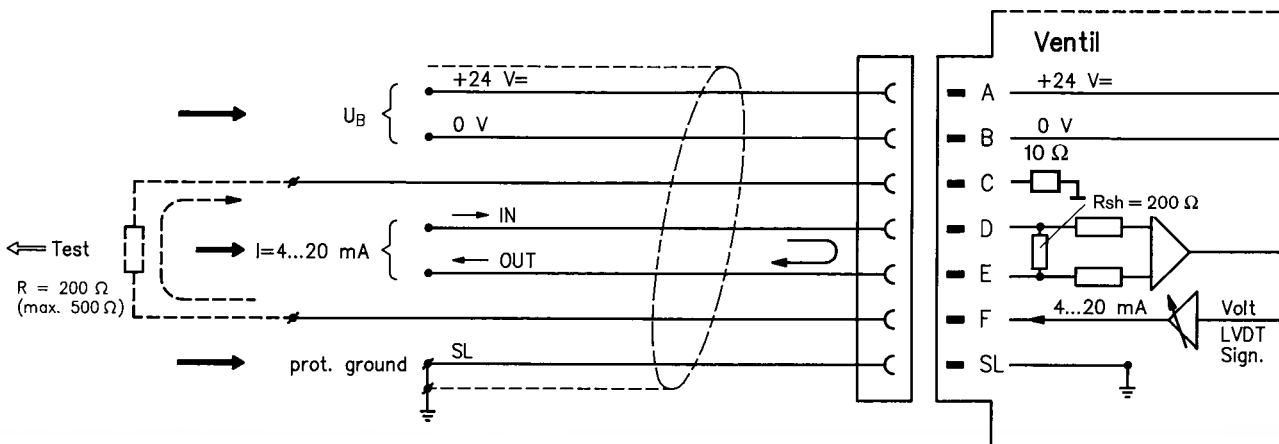
#### Circuit diagram/pin assignment

Version F1:  $I_{D-E}$  4...20 mA



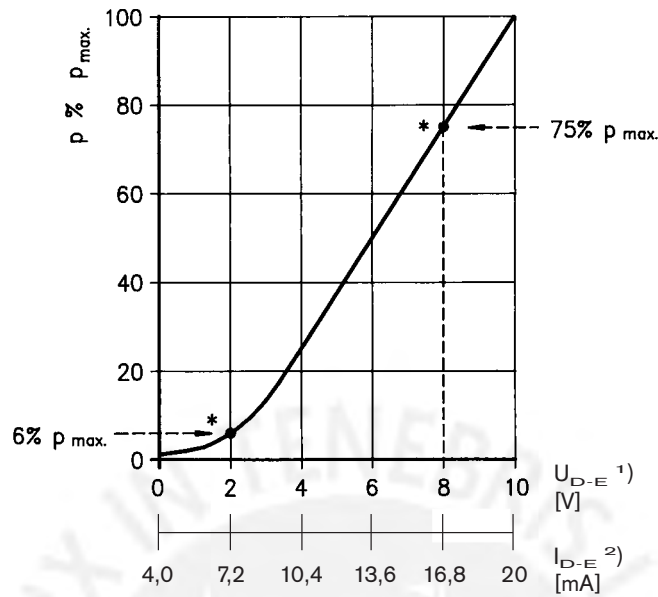
#### Pin assignment 6P+PE

Version F1:  $I_{D-E}$  4...20 mA  
 ( $R_{sh} = 200 \text{ k}\Omega$ )



### Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$ )

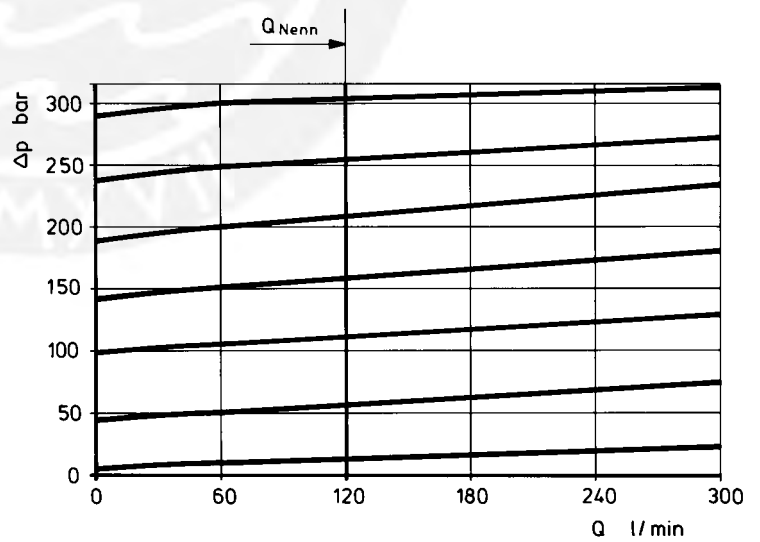
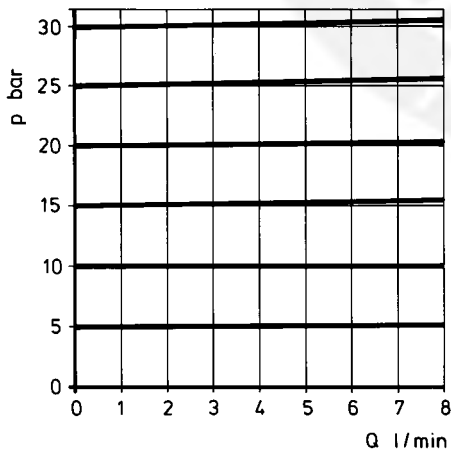
Pressure in port A as a function of the setpoint



- \* Factory setting at  $Q = 1 \text{ l/min}$   
 $\pm 5\%$  manufacturing tolerance
- 1) Version:  $U_{D-E} = 0 \dots +10 \text{ V}$
- 2) Version:  $I_{D-E} = 4 \dots 20 \text{ mA}$

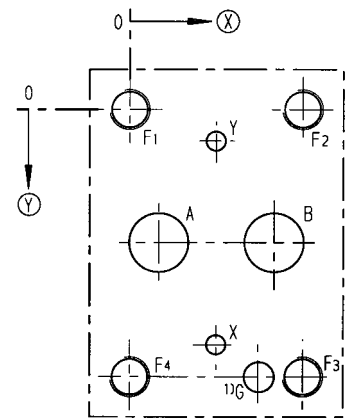
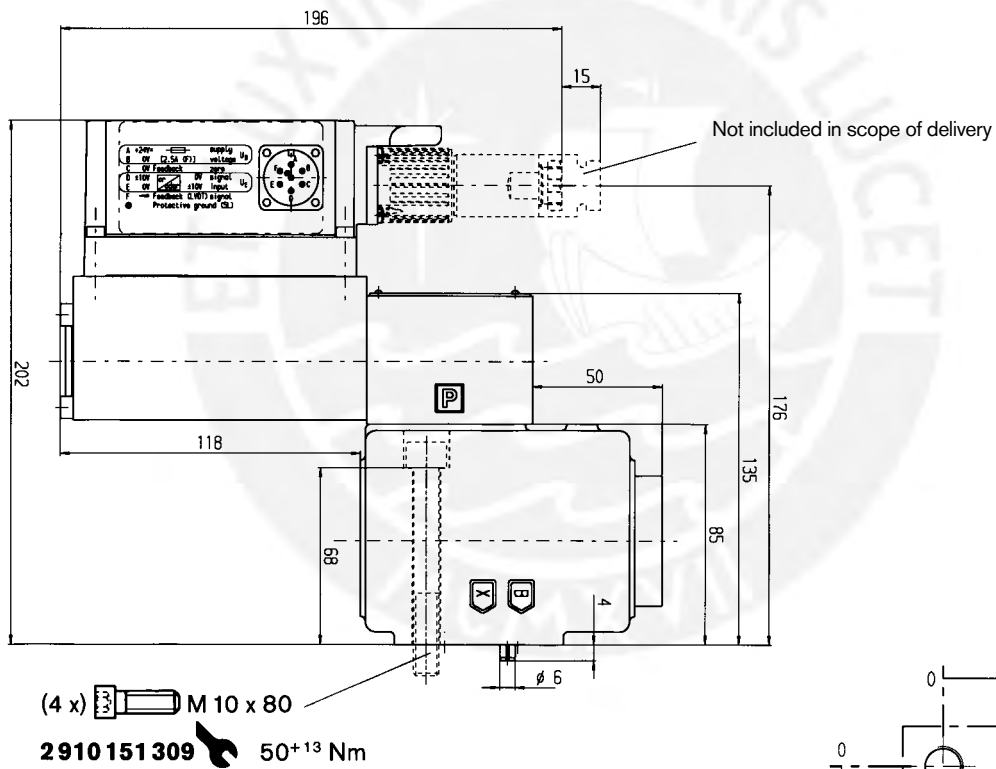
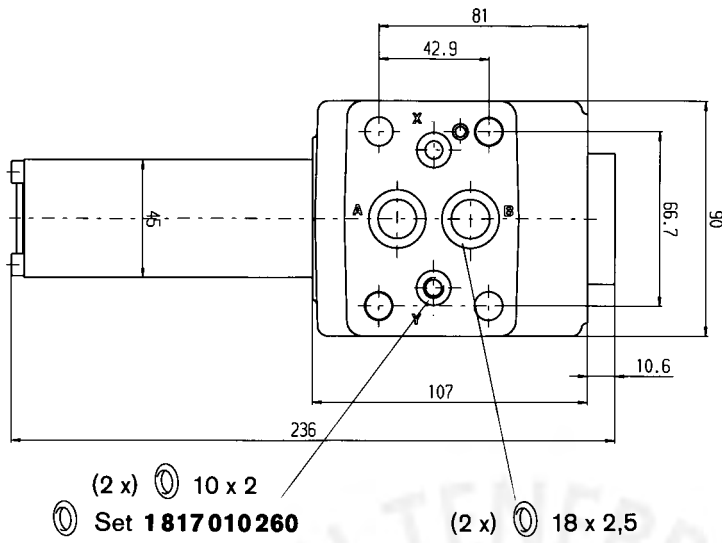
Pressure in port A as a function of the main stage nominal flow rate

$$p = f(Q)$$





Unit dimensions (nominal dimensions in mm)

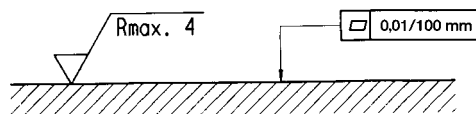


Mounting hole configuration: NG10 (ISO 5781-AG-06-2-A)

For subplates see catalog sheet RE 45055

Required surface quality of mating component

- 1) Deviates from standard
- 2) Thread depth:  
 Ferrous metal 1.5 x Ø\*  
 Non-ferrous 2 x Ø
- \* NG10 min.10.5 mm



	A	B	X	Y	G	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>
⊗	7.2	35.8	21.4	21.4	31.8	0	42.9	42.9	0
⊙	33.35	33.35	58.7	7,9	66.7	0	0	66.7	66.7
⊘	14.7	14.7	24.8	24,8	27.5	M10 <sup>2)</sup>	M10 <sup>2)</sup>	M10 <sup>2)</sup>	M10 <sup>2)</sup>

# Pressure transducer for hydraulic applications

**RE 30270/01.12**  
Replaces: 09.11

1/4

## Type HM 20

Component series 1X  
CE, UL

H7879

## Table of contents

Contents	Page
Features	1
Ordering code	2
Technical data	3
Electrical connection	4
Unit dimensions	4

## Features

- Measuring pressures in hydraulic systems
- Conversion of the measured pressure into a standardized electric analog signal
- Sensor with thick-film measuring cell
- Components that are in contact with the media are of stainless steel
- Operational reliability due to high bursting pressure, reverse polarity, overvoltage and short-circuit protection
- Compact design
- Very good temperature behavior
- Accuracy class 0.5
- 4-pin M12 connector at the housing
- Hydraulic port G1/4A
- Protection class IP65/IP67
- UL approval for the US and Canadian market

### Ordering code

HM 20 -1X/ - -K35

Pressure transducer

Component series 10 to 19  
(10 to 19: Identical technical data and pinout)

= 1X

**K35** = Connector, 4-pin, M12x1

**C** = Current output 4 to 20 mA

**H** = Voltage output 0.1 to 10 V

#### Pressure measuring ranges

up to 100 bar = 100  
up to 250 bar = 250  
up to 400 bar = 400

### Replacement seal ring

Denomination	Material no.
Seal ring NBR	R900012467

Cable sets or mating connectors are not included in the scope of delivery; please order separately

### Accessories: Cable sets and mating connectors

Technical data	
<b>general</b>	
Current carrying capacity	4 A
Temperature range	-25 ... 85 °C
Protection class	IP 67 according to EN 60529
<b>Cable sets, shielded</b>	
Cable diameter	5.9 mm
Jacket material	PUR-OB
Line cross-section	4 x 0.34 mm <sup>2</sup>
<b>Mating connectors</b>	
Cable diameter	4 to 6 mm
Line cross-section	4 x 0.75 mm <sup>2</sup>
Type of connection	Screw connection
Connection diagram cable set	Socket contacts, viewed to socket side

Unit dimensions (in mm)	Denomination	Material no.
	4PM12 (L = 2 m)	R900773031
	4PM12 (L = 5 m)	R900779498
	4PM12 (L = 2 m)	R900779504
	4PM12 (L = 5 m)	R900779503
	4PE11508	R900773042
	4PE11509	R900779509

## Technical data

### Input variables

Operating voltage	$U_S$	16 to 36 VDC		
Residual ripple	$U_{PP}$	2.5 V (40 to 400 Hz)		
Current consumption	$I_{max}$	6 mA (with voltage output)		
Measurement range	$p_N$ [bar]	100	250	400
Overload protection	$p_{max}$ [bar]	200	500	800
Bursting pressure	$p$ [bar]	800	1000	1600

### Output variables

Output signal and admissible load $R_A$	$I_{Sig}$	4 to 20 mA, two-wire, $R_A = (U_S - 8.5 \text{ V}) / 0.02 \text{ A}$ with $R_A$ in $\Omega$ and $U_S$ in V		
	$U_{Sig}$	0.1 to 10 V, three-wire, $R_A > 20 \text{ k}\Omega$		
	Resolution	11 bit		
Accuracy		< 0,5 % Related to the complete measurement range, including non-linearity, hysteresis, zero point and end value deviation (corresponds to the measuring deviation according to IEC 61298-2)		
Temperature coefficient (TK) in the nominal temperature range for zero point and range		< 0.1 % / 10 K <sup>1)</sup>		
Hysteresis		< 0.15 % <sup>1)</sup>		
Non-repeatability		< 0.10 % <sup>1)</sup>		
Setting time (10 to 90 %)	$t$	< 1 ms		
Long-term drift (1 year) with reference conditions		< 0.1 % <sup>1)</sup>		

### Environmental conditions

Nominal temperature range	$\vartheta$	-20 ... +80 °C
Limit temperature range	$\vartheta$	-40 ... +85 °C
Storage temperature range	$\vartheta$	-40 ... +100 °C
Hydraulic fluid temperature range	$\vartheta$	-40 ... +90 °C

### Further characteristics

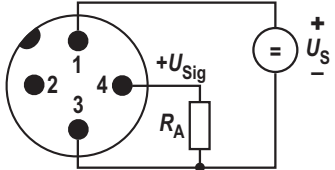
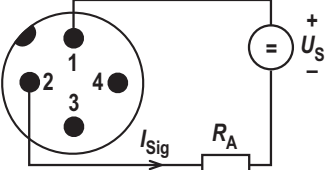
Pressure port		G1/4 male thread (pressure channel with throttle $\varnothing$ 0.6 mm), seal ring according to DIN 3869
Materials:		
– Measuring cell, hydraulic port, housing		CrNi steel 1.4404
– Throttle		CrNi steel 1.4305
– Seal		NBR
Hydraulic fluids		HL, HLP, HFC, other media upon request
Tightening torque	$M_A$	20 to 25 Nm
Electrical connection		4-pin M12 connector at the housing <sup>2)</sup>
Protection class according to EN 60529		IP65/IP67 with mating connector correctly mounted and locked
Weight	$m$	0.07 kg
Service life		40 million load cycles or 40000 h
Shock resistance, mechanical		15 g according to IEC 60068-2-27
Vibration resistance in case of resonance		10 g according to IEC 60068-2-6
Electromagnetic compatibility (EMC)		DIN EN 61326-2-3

<sup>1)</sup> Related to the complete measurement range

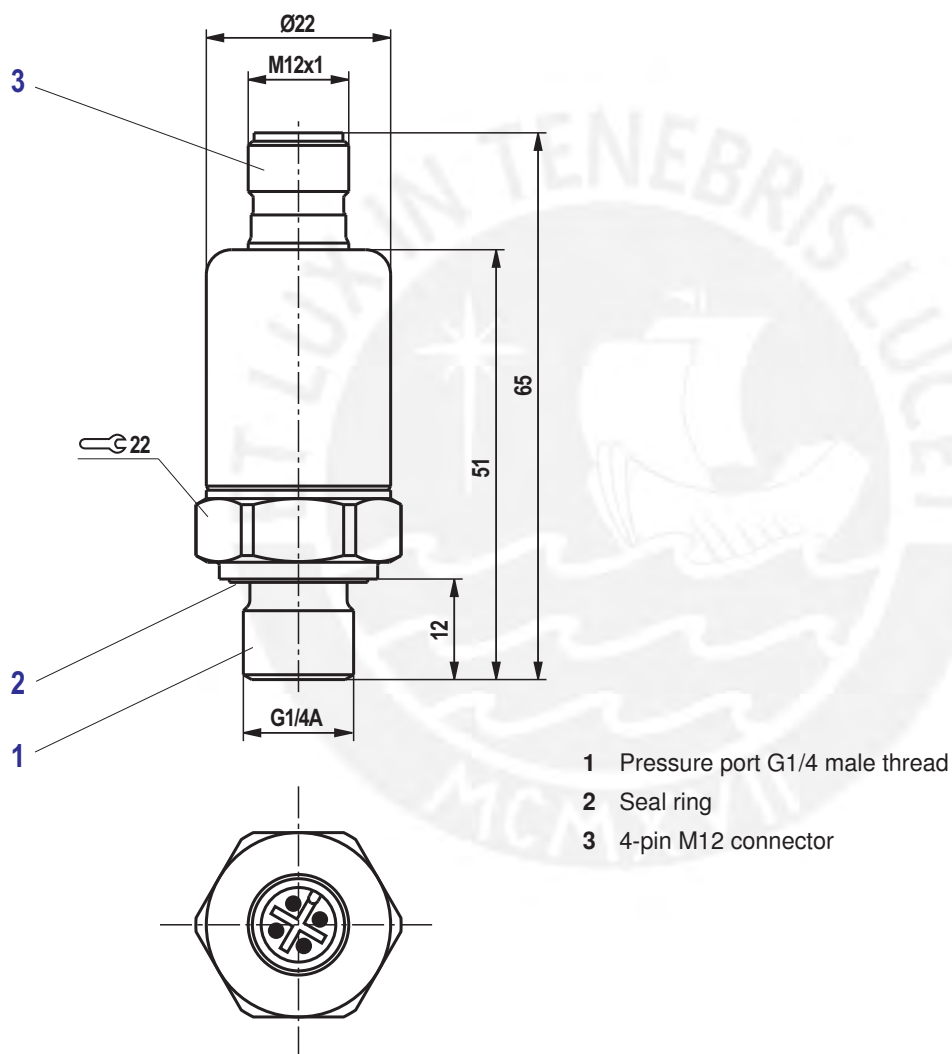
<sup>2)</sup> Recommendation:  
Use of shielded connection cable, see cable set on page 2

## Electrical connection

### 4-pin M12 connector, view to connection side

Voltage		Current (two-wire system)	
	Values for $U_S$ , $R_A$ and $U_{Sig}$ see page 3		Values for $U_S$ , $R_A$ and $I_{Sig}$ see page 3

### Unit dimensions (dimensions in mm)



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# FLAMEC®

# Flowmeter Catalog

version eight

**PARTNERSHIP  
IN MOTION™**



**GREAT PLAINS INDUSTRIES**





# OM SERIES OVAL GEAR METERS

OM Series Oval Gear Meters are designed for low flow and high accuracy. OM Series Meters are great for viscous fluids. Units are available with pulse output from either a Reed Switch or Hall Effect Sensor. Electronics choices for the OM Series Meters are covered in the Electronic Choices Section.



## 1) Select Your OM Meter

OM Meters come in a variety of sizes and materials.



**Pulse Meter**



**Mechanical Meter**



## 2) Select Your Sensor

**Reed Switch**

**Hall Effect**  
Requires Dedicated Power Source

**Combo**  
**Reed Switch / Hall Effect**  
(Standard)

**Quadrature Pulse**  
Bi-directional Flow



## 3) Select Your Electronics Choice

For further details and selections see the Electronics Section.



**RT12**



**EB10**



**RT40**



**E018 / E110**



**F018**



**GA**

4-20 mA Output Without Display  
(Remote)



**GG**

Display With Pulse Output  
(Remote)



**GX**

Display 4-20 mA Output  
(Remote)



**Pulse Output**



## 4) Need a Strainer



Oval Gear Meters work best with clean fluid, free of debris. GPI carries Y Strainers to fit all models of Oval Gear Meters. These strainers range from 1/4 in. to 2 in. models. All sizes are 316 Stainless Steel and come complete with blow-off and plug. See page 79 for strainer specifications.

### SIZE

<b>OM004</b>	= 1/8 in.	( 4mm )	0.13-9.5 GPH	0.5-36 L/hr
<b>OM006</b>	= 1/4 in.	( 6mm )	0.5-27 GPH	2-100 L/hr
<b>OM008</b>	= 3/8 in.	( 8mm )	4-145 GPH	15-550 L/hr
<b>OM008</b>	= 1/4 in. high pressure	( 6 mm )	4-145 GPH	15-550 L/hr
<b>OM015</b>	= 1/2 in.	( 15mm )	0.26-10.6 GPM	1-40 L/min
<b>OM025</b>	= 1 in.	( 25mm )	2.6-40 GPM	10-150 L/min
<b>OM040</b>	= 1-1/2 in.	( 40mm )	4-66 GPM	15-250 L/min
<b>OM050</b>	= 2 in.	( 50mm )	8-120 GPM	30-450 L/min
<b>OM080</b>	= 3 in.	( 80mm )	10-200 GPM	35-750 L/min
<b>OM080E</b>	= 3 in.	( 80mm )	13-260 GPM	50-1000 L/min
<b>OM100</b>	= 4 in.	( 100mm )	20-400 GPM	75-1500 L/min

### BODY MATERIAL

- A** = Aluminum
- E** = Extended flow aluminum version
- P** = PPS ( 73 PSI / 5 Bar)
- M** = Intermediate pressure aluminum meter ( 2000 PSI [138 Bar] max.) (OM025 only)
- S** = 316L Stainless Steel
- N** = Intermediate press. 316L SS meters (OM004N-025N = 1450 PSI [100 bar] , OM040N-050N = 725 PSI [50 bar])
- H** = High Pressure 316SS (OM004H-040H = 5800 PSI [400 bar] max. OM050H = 4350 PSI [300 bar])

### ROTOR MATERIAL

- 0** = PPS - PTFE filled (Polyphenylene Sulfide)
- 1** = Keishi cutting of PPS rotors (for high viscosity liquids)
- 5** = Stainless steel (standard on OM004 & OM006, optional on other sizes)
- 7** = Keishi cutting of stainless steel rotors (for high viscosity liquids)

### BEARING TYPE

- 0** = No Bearing - PPS rotor option only
- 1** = Carbon Ceramic (standard with stainless steel rotors)

### O-RING MATERIAL

- 1** = FKM (Viton™) (**standard for Alum.**) -5° F minimum (-15° C)
- 2** = EPR (Ethylene Propylene Rubber) - for ketones only
- 3** = PTFE encapsulated FKM (Viton™) - (**standard for SS**)
- 4** = Buna-N (Nitrile), -40° F minimum (-40° C)

### MAXIMUM TEMPERATURE LIMIT

- 2** = 250° F (120° C) max. (reduced to 80° C when fitted with integral instruments)
- 3** = 300° F (150° C) max. (Hall Effect output only, not available with HP meters)
- 5** = 250° F (120° C) max. (includes integral cooling fin)
- 8** = 176° F (80° C) max. (applies to Mech. Reg., OM025P & OM008 with PPS rotors)

**FLAMEC**<sup>®</sup>  
Continued on next page.

gpimeters.net / 49

## PROCESS CONNECTIONS

- 1 = BSPP ( G ) female threaded
- 2 = NPT female threaded
- 3 = Sanitary Fittings (Sanitary Fittings are 1/2" larger than the meter size)
- 4 = ANSI-150 RF flanged
- 5 = ANSI-300 RF flanged
- 6 = PN16 DIN flanged

## CABLE ENTRIES

- 0 = 3-6mm cable gland or no cable entry [Exclusive to B2 & B3 options (OM004 to OM008 and mechanical display models only)]
- 1 = M20 x 1.5 mm
- 2 = 1/2" NPT (OM004-OM008) 1/2" NPT Adaptor used for other sizes

## INTEGRAL OPTIONS

- \_\_\_ = Combination Reed Switch and Hall Effect Sensor
- G5 = [GG 500] Rate / Total Display with pulse out and optional Ex. Power [Local Display w/ Pulse (60°C)]
- G6 = [GX 500] Rate / Total Display w/ 4-20mA out [Local Display w/ 4-20mA (60°C)]
- G7 = [GA 500] Loop powered 4-20mA analog output [Local 4-20mA (60°C)]
- RS = Reed Switch only - to suit Intrinsically safe installations
- E1 = Explosionproof Exd IIB T4/T6 (aluminum & stainless meters) [IECEX & ATEX approved] [120° C]
- E2 = Explosionproof Exd I/IIB T4/T6 (stainless meters only) [IECEX & ATEX mines approved] [120° C]
- QP = Quadrature pulse (2 NPN phased outputs) [not available with high press models]
- Q1 = Explosionproof Exd (with quadrature pulse, but not available with high pressure meter) [IECEX & ATEX approved]
- HR = High resolution Hall effect output (Hall Effect only) [OM004:11200ppL], [OM006:4200ppL]
- H1 = Explosionproof - Exd with HR Hi-res. Hall option [IECEX & ATEX approved]
- PF = Pulsating flow option (Hall effect output only) [for injected combustion engines]
- P1 = Explosionproof - Exd with PF pulsating flow option [IECEX & ATEX approved]
- B2 = BT11 totaliser with pulse output [with scaleable pulse output]
- B3 = Intrinsically safe BT11 with pulse output [IECEX & ATEX approved]
- R0 = RT12 rate totaliser with all outputs (Alloy housing) [scaled pulse, alarms, 4-20mA]
- R2 = RT12 rate totaliser with all outputs (GRN housing) [scaled pulse, alarms, 4-20mA]
- R3 = Intrinsically safe RT12 with all outputs (GRN housing) [IECEX & ATEX approved]
- R4 = RT40 rate totaliser with backlit large digit LCD [scaleable pulse output, backlight]
- E0 = EB10 batch controller [2 stage DC batcher & totaliser]
- M3 = 4-digit Mechanical Totalizer - litres [Resolution depends on size]
- M4 = 4-digit Mechanical Totalizer - gallon [Resolution depends on size]  
[Consult Factory for Availability with High Pressure Meters]

### OM004 (1/8"), OM006 (1/4") and OM008 (3/8") Oval Gear Meters



The OM Small Capacity Oval Gear Meters have an increased flow range and offers the ability to handle a wide range of fluid viscosities with exceptional levels of repeatability.

#### OM Electronic Choices:

Options include electronic LCD totalisers, flowrate totalisers and batch controllers (4-20mA, scaled pulse, alarms and batch control)

- G5 LCD 6-digit reset, cumulative totalizer and flow rate, pulse output
- G6 LCD 6-digit reset, cumulative totalizer and flow rate analog (4-20mA) and pulse outputs
- G7 Blind analog (4-20mA) output
- BT11 LCD 5-digit reset, 8-digit cumulative totalizer, pulse output
- RT12 LCD 6-digit reset, cumulative totalizer and flow rate, analog and pulse outputs
- RT40 LCD 6-digit reset, cumulative totalizer and flow rate. Backlit Display, pulse output
- EB LCD 6-digit 2 stage batcher and cumulative totaliser (Available for remote mounting and with I.S. approvals - RT12 and BT11 only)

*Meter Number Reference for this Section.*

**ACCURACY: ±1.0% OF READING**

#### Select Your Body Material:

Aluminum or Stainless Steel

#### Features and Benefits:

- ✓ High accuracy and repeatability, direct volumetric reading.
- ✓ No requirement for flow conditioning (straight pipe runs).
- ✓ Stainless Steel rotors (Optional PPS Rotor for OM008 meter).
- ✓ Measures high and low viscosity liquids
- ✓ Quadrature pulse output option and bi-directional flow
- ✓ Blind 4-20mA output option
- ✓ Optional Exd I/IIB approval (ATEX, IECEx)
- ✓ PF option available for metering pulsating flows
- ✓ Only two moving parts

#### SPECIFICATIONS

Model Prefix:	OM004 (1/8")	OM006 (1/4")	OM008 (3/8")
Nominal size (inches):	1/8" (4mm)	1/4" (6mm)	3/8" (8mm)
*Flow range - (GPH):	(0.13-9.5)	(0.5-27)	(4-145)
- (LPH):	(0.5 - 36)	(2 - 100)	(15 - 550)
**Accuracy @ 3cp:	± 1% of reading (accuracy is ± 0.2% of reading with optional RT12 with non-linearity correction)		
Repeatability:	Typically ± 0.03% of reading		
Temperature range:	-4° F - +250° F (-20° C - +120° C), refer factory for lower temperature		
Maximum pressure:	<b>PSI (bar) Threaded Meter</b>		
Aluminium meters:	220 (15)		
316 stainless steel:	495 (34)		
Intermediate press. SS meter:	1450 (100)		
High pressure models:	5800 (400)		

**Electrical** - for pulse meters (see below for optional outputs)

Output pulse resolution:	Pulses / gallon (Pulses / litre) - nominal		
Reed switch:	10600 (2800)	3975 (1050)	1345 (355)
Hall effect:	10600 (2800)	3975 (1050)	2690 (710)
QP-Quadrature Hall option:	10600 (2800)	3975 (1050)	2690 (710)
PF-Pulsating Flow (Hall Effect):	10600 (2800)	3975 (1050)	675 (178)
HR-High resolution Hall effect:	42400 (11200)	15900 (4200)	N/A
Reed switch output:	30Vdc x 200mA max. [maximum thermal shock 18° F (10° C) / minute]		
Hall effect output (NPN):	3 wire open collector, 5-24Vdc max., 20mA max.		
Optional outputs:	4-20mA, scaled pulse, quadrature pulse, flow alarms or two stage batch control		

#### Physical

Protection class:	IP66/67 (NEMA4X), optional Exd I / IIB T4/T6, integral ancillaries can be supplied I.S. (intrinsically safe)
Overall dimensions:	Refer Below
Recommended filtration:	200 mesh (75 microns)

\* Maximum flow is to be reduced as viscosity increases, see flow de-rating guide. Max. recommended pressure drop is 100Kpa. (14.5 psi)

\*\*QP and PF Options are not available with High Pressure Meters



### Display With 4-20 mA Output



**GX500**  
Remote Mount



**GX510**  
Local Mount

The GX500 is a remote mount 4-20 mA Output Transmitter with display.

Choose the GX510 when a local mount is needed on the G2 series.

Choose the G6 when a local mount is needed on the OM series.

Choose the 6 when a local mount is needed on the G series.

### GX500/GX510 – SPECIFICATIONS

<b>Accuracy:</b>	± 0.1% of reading
<b>Output Options:</b>	
<b>Primary Output:</b>	Loop (4-20 mA or 0-20 mA)
<b>Minimum:</b>	1.5 mA
<b>Maximum:</b>	25 mA
<b>Auxiliary Outputs 0-5 V:</b>	Single Ended
<b>Minimum:</b>	0.1 V
<b>Maximum:</b>	4.9 V
<b>Pulse-Out:</b>	
<b>Max. "OFF" Voltage:</b>	60 V
<b>Max. "ON" Current:</b>	200 mA
<b>Max. "ON" Voltage Drop:</b>	< 0.5 V @ 200 mA
<b>Electrical:</b>	
<b>Strain Relief:</b>	Hubble PG7
<b>Strain Relief Thread:</b>	Female 1/2-20 UNF-2B
<b>Cable:</b>	<i>Remote:</i> Belden 9363 (500 Series only) <i>Local:</i> No cable provided
<b>Cable Length:</b>	20 ft. (6 m) provided (500 Series only)
<b>Power Supply:</b>	2-wire, loop powered
<b>Voltage Supply (Min.):</b>	8.5 VDC
<b>Voltage Supply (Max.):</b>	35 VDC
<b>Input Options:</b>	Hall Effect, Reed Switch, Open Collector or Low Level Sine Wave
<b>Remote Mounting:</b>	Pipe or wall
<b>Operating Temperature:</b>	+32° F to +140° F (0° C to +60° C)
<b>Frequency Input:</b>	
<b>Low Level Coil (LLC):</b>	0.25 - 1000 Hz
<b>High Level Low Freq.:</b>	0.25 - 150 Hz
<b>High Level High Freq.:</b>	0.25 - 1000 Hz
<b>Optically Isolated HLLF:</b>	w/2500 V optical isolation
<b>Optically Isolated HLHF:</b>	w/2500 V optical isolation
<b>Enclosure Rating:</b>	NEMA 4X / IP55
<b>Shipping Weight:</b>	<i>Remote:</i> 2.0 lbs. (.90 kg) <i>Local:</i> 1.1 lbs. (.5 kg)
<b>Calibratable:</b>	K-factor Entry

### ACCURACY: ±0.1% READING

#### Features and Benefits:

- ✓ Provides communication with process control equipment.
- ✓ Works with G Series, G2 Turbine Meters, OM and DP Meters.
- ✓ 2 Totals (Batch = Resettable, Cumulative = Non-Resettable); Rate of Flow. Factory calibrated in gallons and litres. Field calibratable. Allows user calibration. Includes non-volatile totals.
- ✓ Now available with Lockout feature.
- ✓ Microprocessor-based electronics have extremely low power requirements.
- ✓ Easy to set 4-20 mA endpoints under actual flow conditions.
- ✓ A signal conditioner with industry standard current loop output.
- ✓ Easily mounted on pipe or wall.

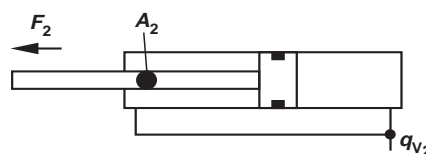
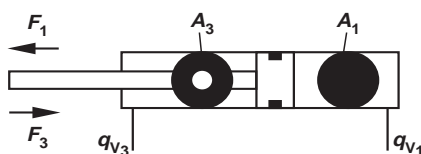
<b>MANNESMANN REXROTH</b>	Hydrozylinder	Hydraulic Cylinder	Vérin Hydraulique	<b>RD/E/F 17 334/12.96</b>  Ersetzt: 01.96
	<b>CDH2 / CGH2</b>			
	250 bar (25 MPa)			



H/A 4652/95

- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li>• Normen:</li> <li>DIN 24 333</li> <li>ISO 6022</li> <li>CETOP RP 73 H</li> <li>VW 39 D 921</li> <li>• 6 Befestigungsarten</li> <li>• Kolben-Ø:</li> <li>50 bis 500 mm</li> <li>• Kolbenstangen-Ø:</li> <li>32 bis 360 mm</li> <li>• Hublängen bis 6 m</li> <li>• Selbsteinstellende Endlagendämpfung</li> </ul> | <ul style="list-style-type: none"> <li>• Standards:</li> <li>DIN 24 333</li> <li>ISO 6022</li> <li>CETOP RP 73 H</li> <li>VW 39 D 921</li> <li>• 6 mounting types</li> <li>• Piston Ø:</li> <li>50 to 500 mm</li> <li>• Piston rod Ø:</li> <li>32 to 360 mm</li> <li>• Stroke up to 6 m</li> <li>• Self-regulating end position cushioning</li> </ul> | <ul style="list-style-type: none"> <li>• Normes:</li> <li>DIN 24 333</li> <li>ISO 6022</li> <li>CETOP RP 73 H</li> <li>VW 39 D 921</li> <li>• 6 modes de fixation</li> <li>• Ø de piston:</li> <li>50 à 500 mm</li> <li>• Ø de tige:</li> <li>32 à 360 mm</li> <li>• Course jusqu'à 6 m</li> <li>• Amortissement de fin de course auto-régulateur</li> </ul> |
|---|---|--|

Flächen, Kräfte, Volumenstrom			Area, force, flow			Sections, forces, débit					
Kolben	Kolbenstange	Flächenverhältnis	Kolben	Flächen Stange	Ring.	Kraft bei 250 bar <sup>1)</sup>			Volumenstrom bei 0,1 m/s <sup>2)</sup>		
Piston	Piston rod	Area ratio	Piston	Areas Rod	Annulus	Druck	Diff.	Zug	Aus	Diff.	Ein
Piston	Tige	Rapport de sections	Piston	Sections Tige	Annulaire	Force at 250 bar <sup>1)</sup>			Flow at 0.1 m/s <sup>2)</sup>		
AL	MM	$\varphi$	$A_1$	$A_2$	$A_3$	$F_1$	$F_2$	$F_3$	$q_{V1}$	$q_{V2}$	$q_{V3}$
Ø mm	Ø mm	$A_1/A_3$	cm <sup>2</sup>	cm <sup>2</sup>	cm <sup>2</sup>	kN	kN	kN	l/min	l/min	l/min
50	32 36	1,69 2,08	19,63	8,04 10,18	11,59 9,45	49,10	20,12 25,45	28,98 23,65	11,8	4,8 6,1	7,0 5,7
63	40 45	1,67 2,04	31,17	12,56 15,90	18,61 15,27	77,90	31,38 39,75	46,52 38,15	18,7	7,5 9,5	11,2 9,2
80	50 56	1,66 1,96	50,26	19,63 24,63	30,63 25,63	125,65	49,07 61,55	76,58 64,10	30,2	11,8 14,8	18,4 15,4
100	63 70	1,66 1,96	78,54	31,16 38,48	47,38 40,06	196,35	77,93 96,20	118,42 100,15	47,1	18,7 23,1	28,4 24,0
125	80 90	1,69 2,08	122,72	50,24 63,62	72,48 59,10	306,75	125,62 159,05	181,13 147,70	73,6	30,14 38,2	43,46 35,4
140	90 100	1,70 2,04	153,94	63,62 78,54	90,32 75,40	384,75	159,05 196,35	225,70 188,40	92,4	38,2 47,1	54,2 45,3
160	100 110	1,64 1,90	201,06	78,54 95,06	122,50 106,00	502,50	196,35 237,65	306,15 264,85	120,6	47,1 57,0	73,5 63,6
180	110 125	1,60 1,93	254,47	95,06 122,72	159,43 131,75	636,17	237,65 306,80	398,52 329,37	152,7	57,0 73,6	95,7 79,1
200	125 140	1,64 1,96	314,16	122,72 153,96	191,44 160,20	785,25	306,80 384,90	478,45 400,35	188,5	73,6 92,4	114,9 96,1
250	160 180	1,69 2,08	499,8	201,0 254,4	289,8 236,4	1227,2	502,7 636,2	724,5 590,0	294,5	120,7 152,7	173,8 141,8
320	200 220	1,64 1,90	804,2	314,1 380,1	490,1 424,2	2010,6	785,4 950,3	1225,2 1060,3	482,5	188,5 228,1	294,0 254,4
400	250 280	1,64 1,96	1256,6	490,8 615,7	765,8 640,9	3141,6	1227,2 1539,4	1914,4 1602,2	754,0	294,6 369,5	459,4 384,5
500	320 360	1,69 2,08	1963,4	804,2 1017,8	1159,2 945,6	4908,7	2010,6 2544,7	2898,1 2364,0	1178,0	482,5 610,8	695,5 567,2

**Bemerkungen**

- 1) Theoretische Kraft (ohne Berücksichtigung des Wirkungsgrades)
- 2) Hubgeschwindigkeit

**Note**

- 1) Theoretical force (efficiency not taken into account)
- 2) Stroke velocity

**Remarques**

- 1) Force théorique (le rendement n'est pas pris en considération)
- 2) Vitesse de la tige



Masse Zylinder		Cylinder weight					Masse du vérin				
Kolben	Kolbenstange	CD-Zylinder bei 0 mm Hublänge				pro 100 mm Hublänge	CG-Zylinder bei 0 mm Hublänge			pro 100 mm Hublänge	
Piston	Piston rod	CD cylinder at 0 mm stroke				per 100 mm stroke	CG cylinder at 0 mm stroke			per 100 mm stroke	
Piston	Tige	Vérin CD à 0 mm de course				par 100 mm de course	Vérin CG à 0 mm de course			par 100 mm de course	
AL Ø	MM Ø	MP3; MP5 kg	MF3; MF4 kg	MT4 kg	MS2 kg	kg	MF3 kg	MT4 kg	MS2 kg	kg	
50	32	12	14	13	13	1,3	16	16	16	1,9	
	36	12	14	13	14	1,5	16	16	16	2,3	
63	40	20	21	21	21	2,3	25	25	25	3,3	
	45	20	21	21	21	2,6	25	25	25	3,8	
80	50	32	35	34	35	3,2	41	40	41	4,7	
	56	32	35	34	36	3,6	41	40	42	5,5	
100	63	51	54	54	55	5,2	63	63	64	7,6	
	70	51	55	54	56	5,7	64	64	65	8,8	
125	80	95	96	99	98	8,2	113	115	114	12,1	
	90	96	97	100	99	9,2	115	117	116	14,2	
140	90	131	132	136	137	10,7	155	158	159	15,7	
	100	132	133	137	138	11,9	156	160	161	18,1	
160	100	185	184	197	206	12,6	217	231	239	18,8	
	110	186	186	199	207	13,9	220	233	242	21,4	
180	110	255	253	264	274	14,7	294	305	314	22,1	
	125	258	256	267	277	16,8	300	311	320	26,5	
200	125	349	332	350	363	19,0	359	377	389	28,6	
	140	352	335	353	366	21,5	365	383	396	33,5	
250	160	1)	1)	1)	1)	1)	1)	1)	1)	1)	
	180										
320	200	1)	1)	1)	1)	1)	1)	1)	1)	1)	
	220										
400	250	1)	1)	1)	1)	1)	1)	1)	1)	1)	
	280										
500	320	1)	1)	1)	1)	1)	1)	1)	1)	1)	
	360										

1) = Auf Anfrage

1) = On enquiry

1) = Sur demande

Toleranzen nach ISO 8135		Tolerances to ISO 8135					Tolérances selon ISO 8135		
Einbaumaße	WC	XC <sup>1)</sup>	XO <sup>1)</sup>	XS <sup>2)</sup>	XV <sup>1)</sup>	ZP <sup>1)</sup>	Hubtoleranzen		
Installation dimensions							Stroke tolerances		
Encombrement							Tolérances de course		
Befestigungsart							MF3	MP3	MP5
Mounting type									
Type de fixation									
Hublänge / stroke / course	Toleranzen /			tolerances /			tolérances		
0 - 499	± 2	± 1,5	± 1,5	± 2	± 2	± 1,5	+ 3		
500 - 1249	± 2,8	± 2	± 2	± 2,8	± 2,8	± 2	+ 4		
1250 - 3149	± 4	± 3	± 3	± 4	± 4	± 3	+ 6		
3150 - 8000	± 8	± 5	± 5	± 8	± 8	± 5	+ 10		
1) Inklusive Hublänge		1) Stroke length included				1) Course incluse			
2) Nicht genormt		2) Not standardized				2) Non normalisé			



**Contents**

**Solenoid Valves**

**CV** Check Valves

**SH** Shuttle Valves

**LM** Load/Motor Controls

**FC** Flow Controls

**PC** Pressure Controls

**LE** Logic Elements

**DC** Directional Controls

**MV** Manual Valves

**SV** Solenoid Valves

**PV** Proportional Valves

**CE** Coils & Electronics

**BC** Bodies & Cavities

**TD** Technical Data

SERIES	CAVITY	DESCRIPTION	FLOW LPM/GPM	PRESSURE BAR/PSI	PAGE NO.
--------	--------	-------------	--------------	------------------	----------

**HIGH FLOW VALVE FAMILY**

*See individual catalog pages for exact specifications.*

<b>2 WAY SPOOL TYPE</b>					
	GS02 22*	2X / C09-2 .. 2 Position, 2 Way, N.C. Spool	19/5	350/5000	SV7-SV8
	GS02 27*	2X / C09-2 .. 2 Position, 2 Way, N.O. Spool	19/5	350/5000	SV9-SV10

*\*These valves fit the C09-2 Parker cavity.*

<b>4 WAY, 2 POSITION SPOOL TYPE</b>					
	GS02 42	C08-4 ..... 2 Position, 4 Way	19/5	350/5000	SV11-SV12

<b>2 WAY POPPET TYPE</b>					
	☆ DSL081	C08-2 ..... 2 Position, 2 Way, N.C. or N.O.	30/8	250/3600	SV13-SV14
	☆ DSH081	C08-2 ..... 2 Position, 2 Way, N.C. or N.O.	30/8	350/5000	SV15-SV16
	☆ DSL101	C10-2 ..... 2 Position, 2 Way, N.C. or N.O.	60/15	250/3600	SV17-SV18
	☆ DSH101	C10-2 ..... 2 Position, 2 Way, N.C. or N.O.	60/15	350/5000	SV19-SV20
	DSH121	C12-2 ..... 2 Position, 2 Way, N.C. or N.O.	90/24	350/5000	SV21-SV22
	DS161	C16-2 ..... 2 Position, 2 Way, N.C. or N.O.	150/40	210/3000	SV23-SV24
	☆ DSH161*	C16-2 ..... 2 Position, 2 Way, N.C. or N.O.	150/40	350/5000	SV25-SV26
	DS201	C20-2 ..... 2 Position, 2 Way, N.C. or N.O.	260/70	210/3000	SV27-SV28
	☆ DSL201*	C20-2 ..... 2 Position, 2 Way, N.C. or N.O.	260/70	250/3600	SV29-SV30

*\*The DSH161 and DSL201 will be available January 1, 2011*

	GH02 01	C08-2 ..... 2 Position, 2 Way, N.C., with Flow Adj.	11/3	285/4000	SV31-SV32
	GS02 72/73	C08-2 ..... Bi-Directional Poppet, N.C.	1.7/45	210/3000	SV33-SV34
	GS02 80*/81	C08-2 ..... Bi-Directional Poppet, N.C.	58/15	350/5000	SV35-SV36
	GS04 80*/81	2R ..... Bi-Directional Poppet, N.C.	76/20	350/5000	SV37-SV38
	GS06 80*/81	C16-2 ..... Bi-Directional Poppet, N.C.	285/75	350/5000	SV39-SV40
	GS02 77/78	C08-2 ..... Bi-Directional Poppet, N.O.	1.7/45	210/3000	SV41-SV42
	GS02 85*/86	C08-2 ..... Bi-Directional Poppet, N.O.	58/15	350/5000	SV43-SV44
	GS04 85*/86	2R ..... Bi-Directional Poppet, N.O.	76/20	350/5000	SV45-SV46
	GS06 85*/86	C16-2 ..... Bi-Directional Poppet, N.O.	285/75	350/5000	SV47-SV48

*\*210/3000 psi rating*

☆ Denotes New Winner's Circle Product Line.



	SERIES	CAVITY	DESCRIPTION	FLOW LPM/GPM	PRESSURE BAR/PSI	PAGE NO.
<b>2 WAY SPOOL TYPE</b>						
	☆ DSL082	C08-2	2 Position, 2 Way	15/4	250/3600	SV49-SV50
	☆ DSH082	C08-2	2 Position, 2 Way	15/4	350/5000	SV51-SV52
	☆ DSL102	C10-2	2 Position, 2 Way	30/8	250/3600	SV53-SV54
	☆ DSH102	C10-2	2 Position, 2 Way	30/8	350/5000	SV55-SV56
	DS162	C16-2	2 Position, 2 Way	75/20	210/3000	SV57-SV58
<b>3 WAY SPOOL TYPE</b>						
	☆ DSL083	C08-3	2 Position, 3 Way	15/4	250/3600	SV59-SV61
	☆ DSH083	C08-3	2 Position, 3 Way	15/4	350/5000	SV62-SV64
	☆ DSL103	C10-3	2 Position, 3 Way	30/8	250/3600	SV65-SV67
	☆ DSH103	C10-3	2 Position, 3 Way	30/8	350/5000	SV68-SV70
	DS163	C16-3	2 Position, 3 Way	57/15	210/3000	SV71-SV72
<b>4 WAY, 2 POSITION SPOOL TYPE</b>						
	☆ DSL084	C08-4	2 Position, 4 Way	15/4	250/3600	SV73-SV74
	☆ DSH084	C08-4	2 Position, 4 Way	15/4	350/5000	SV75-SV76
	☆ DSL104	C10-4	2 Position, 4 Way	30/8	250/3600	SV77-SV78
	☆ DSH104	C10-4	2 Position, 4 Way	30/8	350/5000	SV79-SV80
	DSH164	C16-4	2 Position, 4 Way	113/30	350/5000	SV81-SV82
<b>4 WAY, 3 POSITION SPOOL TYPE</b>						
	GS02 51	C08-4	3 Position, 4 Way	17/4.5	350/5000	SV83-SV84
	GS02 53	C08-4	3 Position, 4 Way	15/4	350/5000	SV85-SV86
	GS02 57	C08-4	3 Position, 4 Way	13/3.5	350/5000	SV87-SV88
	GS02 59	C08-4	3 Position, 4 Way	13/3.5	350/5000	SV89-SV90
	☆ DSL105	C10-4	3 Position, 4 Way	19/5	250/3600	SV91-SV92
	GS04 52D	C10-4	3 Position, 4 Way	20/8	350/5000	SV93-SV94
	GS04 54D	C10-4	3 Position, 4 Way	38/10	350/5000	SV95-SV96
	GS04 57D	C10-4	3 Position, 4 Way	42/11	350/5000	SV97-SV98
	GS04 59D	C10-4	3 Position, 4 Way	42/11	350/5000	SV99-SV100
	DSH125 52	C12-4L	3 Position, 4 Way	57/15	350/5000	SV101-SV102
	DSH125 54	C12-4L	3 Position, 4 Way	57/15	350/5000	SV103-SV104
	DSH125 57	C12-4L	3 Position, 4 Way	57/15	350/5000	SV105-SV106
	DSH125 59	C12-4L	3 Position, 4 Way	57/15	350/5000	SV107-SV108

- CV**  
Check Valves
- SH**  
Shuttle Valves
- LM**  
Load/Motor Controls
- FC**  
Flow Controls
- PC**  
Pressure Controls
- LE**  
Logic Elements
- DC**  
Directional Controls
- MV**  
Manual Valves
- SV**  
Solenoid Valves
- PV**  
Proportional Valves
- CE**  
Coils & Electronics
- BC**  
Bodies & Cavities
- TD**  
Technical Data

☆ Denotes New Winner's Circle Product Line.



CV

Check Valves

SH

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SV

Solenoid Valves

PV

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TD

Technical Data

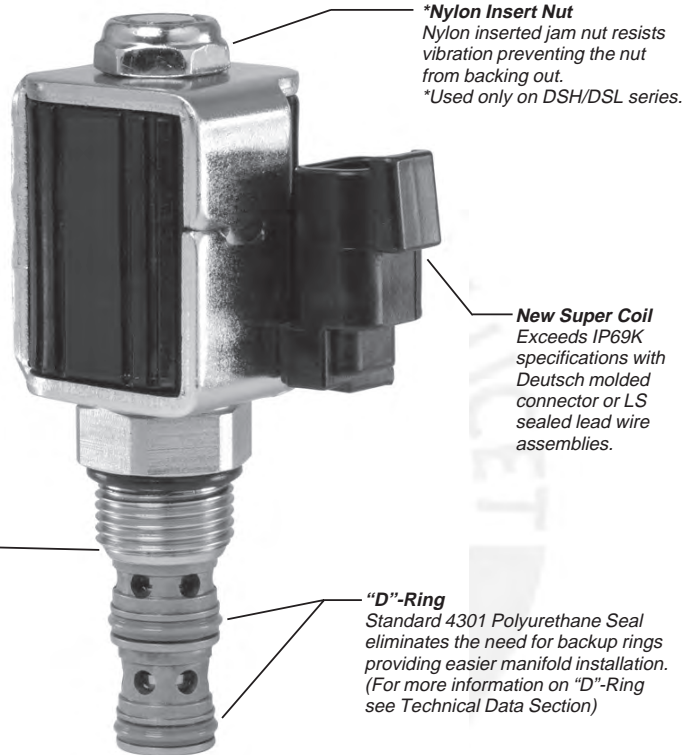
**INTRODUCTION**

This technical tips section is designed to help familiarize you with the Parker line of Solenoid Valves. In this section we highlight new products to this catalog as well as some design features of our solenoid valves. In addition we present common options available to help you in selecting products for your application. Finally, we give a brief synopsis of the operation and applications of the various products offered in this section. Some tips in applying and selecting our products are provided throughout this guide.

**NEW PRODUCTS**

There are several new additions and product improvements to our Solenoid Valve product line.

*Here are just some of the design features and advantages to the product line.*



**\*Nylon Insert Nut**  
Nylon inserted jam nut resists vibration preventing the nut from backing out.  
*\*Used only on DSH/DSL series.*

**New Super Coil**  
Exceeds IP69K specifications with Deutsch molded connector or LS sealed lead wire assemblies.

**Crimp Design**  
Fold over crimp provides secure holding and eliminates the need for adhesive.

**"D"-Ring**  
Standard 4301 Polyurethane Seal eliminates the need for backup rings providing easier manifold installation. (For more information on "D"-Ring see Technical Data Section)

**New Parker SUPER COIL Now Available!**

**\*Exceeds IP69k Specifications**

After exhaustive testing, the new Super Coil has clearly distanced itself from the competition. This coil was subjected to the rigors of this environmental standard and the results were excellent. This coil stands up to most rugged of environmental conditions including weather, dust, and extreme temperature variations.

**\*Water Dunk Test Qualified**

The Super Coil was taken to task in a repeated water dunk thermal cycle test program with alternate exposure to high and low temperature, only to perform with outstanding results.

**\*Endurance Tested**

The goal of this test was to cycle the coil to high temperature extremes in order to validate the coils ability to perform in extreme temperature environments.

**\*Water Spray and Chemical Solvent Compatibility**

The Super Coil was subjected to numerous chemical solvents in a rigorous test which established the fact that these coils can withstand harsh and unusual environments. Also, the coils were subjected to a high pressure water spray test. Once again, the Super Coil passed this test.

*\*Deutsch molded connector or LS option is highly recommended.*

**NOTE: LS coil option will be available January 1, 2011.**



**COMMON OPTIONS**

As you will see, Parker offers a variety of solenoid valve products. As such, some of the options mentioned below may not be available on all valves. Consult the model coding and dimensions for each valve for more specifics. Here are some of the common options available.

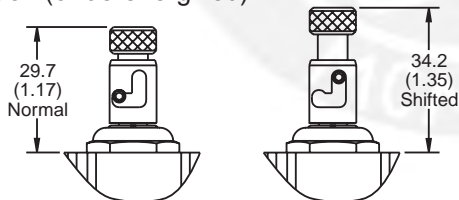
**Seals:** The Winner's Circle products feature a standard Polyurethane "D"-Ring. The "D"-Ring eliminates the need for backup rings. For more information on the "D"-Ring see the Technical Data section of the catalog. The majority of the products are available in Nitrile or Fluorocarbon Seals. You should always match the seal compatibility to the temperature and fluid being used in your application.

**Coils:** Coils can be ordered as part of the full assembly or separately. Various terminations and voltages are available. For detailed information on the coil options consult the coil section of the catalog. The ordering information for each valve will direct you to the proper coil.

**Manual Overrides:** Many of our solenoid valves are also offered with a manual override. The override allows the user to shift the valve when coil force is not available. They provide a means of shifting the solenoid valve due to a loss of power or a coil failure. Overrides are intended for infrequent usage and are not designed to be used as a primary method of valve actuation.

The most common override option for the 2 Position valves is the push & twist style shown below. With a normally closed valve or a pull style tube, the valve is in normal operation (or de-energized)

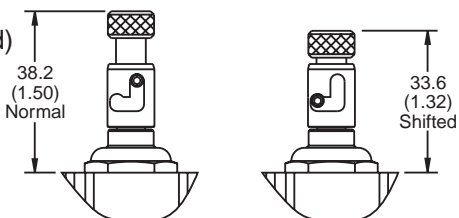
when the pin is seated in the slotted groove at the lowest position. To shift the valve manually, the operator pushes down on the knob



**Normally Closed Pull Type Tube**

and twists it counterclockwise. When the pressure is removed from the knob, an internal spring pushes the pin up the slotted groove to the upper position of the override. With a normally open valve, or push style tube, the actuation is reversed. The valve is in the normal position (or de-energized)

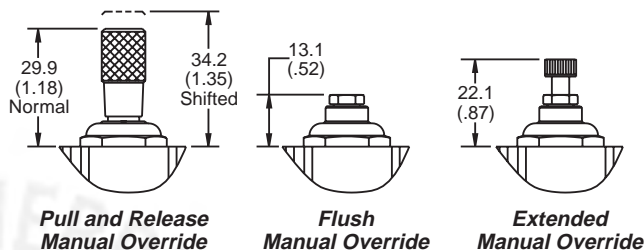
when the pin is in the upper position of the override. To shift the valve manually, the operator pushes



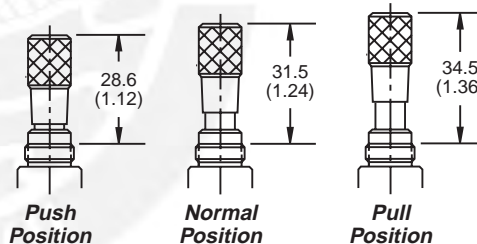
**Normally Open Push Type Tube**

down on the knob and twists is clockwise. Once the pin is seated in the slotted groove, the operator can remove pressure and the valve will stay actuated.

In addition to the push and twist style override, normally closed (pull style tube) 2 position valves can be ordered with a pull and release override. Normally open (push style) 2 position valves are available with flush style and extended style overrides. These overrides are not detented. Each style is shown below.



3 Position valves are offered with a Push / Pull style override. This override is not detented. Springs hold the spool of the valve in the center position of the valve. When the knob is pulled, the spool is moved upward simulating the action of the upper coil. When the override is pushed, the spool moves downward simulating the action of the lower coil. When no pressure is applied to the knob, it centers the spool.



**Screens:** 2 way valves can be ordered with a small mesh screen (60 x 60 mesh) placed over the cage of the cartridge valve. This screen is intended for cursory protection of the internal components of the solenoid valve. It should not be used as the primary method of filtration. The mesh catches small pieces of debris that could impede spool or poppet movement. Note that a screen will trap debris from both directions. Thus, any debris coming from the nose of the cartridge would be trapped inside the valve. As such, we recommend that screens be implemented in only applications where hydraulic fluid passes through the cartridge from the side of the cage to the nose. It should also be noted that the pressure drop through the cartridge will be increased slightly due to the small restriction of the mesh. As the screen fills with debris, pressure drop will continue to rise.



**CV**  
Check Valves

**SH**  
Shuttle Valves

**LM**  
Load/Motor Controls

**FC**  
Flow Controls

**PC**  
Pressure Controls

**LE**  
Logic Elements

**DC**  
Directional Controls

**MV**  
Manual Valves

**SV**  
Solenoid Valves

**PV**  
Proportional Valves

**CE**  
Coils & Electronics

**BC**  
Bodies & Cavities

**TD**  
Technical Data

CV

Check Valves

SH

Shuttle Valves

LM

Load/Motor Controls

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MV

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BC

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TD

Technical Data

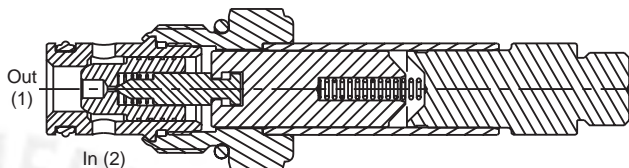
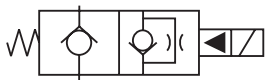
PRODUCT TYPES / APPLICATIONS

Two Way Poppet Valves

Two way poppet valves are pilot operated, low leakage solenoid actuated valves. Two way poppet valves control the flow of a two way function by blocking flow in one direction (similar to a check valve). They are generally selected due to their low leakage and ability to meet higher flow requirements. Poppet valves are often used on single operation actuators or in unloading functions. They are available in normally closed and normally open types. In addition, free reverse flow and fast response versions are available.

Normally Closed Poppet

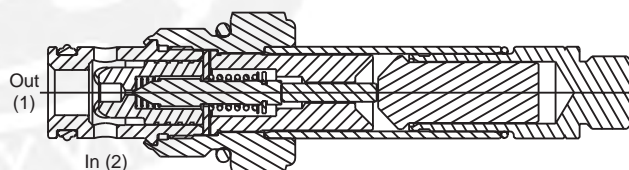
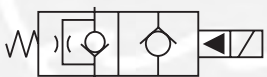
Normally closed two way poppet valves act as a check valve when de-energized, blocking flow from one direction and allowing restricted free flow in the reverse condition. When energized, the poppet lifts allowing free flow from the side to the nose of the cartridge. Should the application require free flow in both directions, the free reverse flow option should be chosen.



**OPERATION** - The valve pilot is held on its seat by spring force, blocking pilot flow. This allows pressure at the inlet (port 2) to hold the poppet on its seat, thus, preventing flow through the valve (2-1). If the nose of the cartridge (port 1) is pressurized, the pressure will overcome the spring force, pushing the poppet off of its seat, allowing free flow through the cartridge (1-2). When the coil is energized, the valve pilot is pulled off of its seat. This vents the pressure inside the poppet to port 1, creating a pressure imbalance across the main poppet. This differential lifts the poppet allowing flow from the side to nose (2-1). Since poppet valves are piloted operated, a minimum amount of pressure differential (25-50 psi) and flow between ports 2 and 1 must be present to overcome the spring and lift the poppet.

Normally Open Poppet

Normally open two way poppet valves, when de-energized, allow free flow from the side (port 2) of the cartridge to the nose (port 1). Flow in the reverse direction is restricted. Should free flow be required in both directions, the free reverse flow option should be specified. Once the coil is energized the normally open poppet valve acts as a check valve, blocking flow from one direction and allowing restricted free flow in the reverse condition.

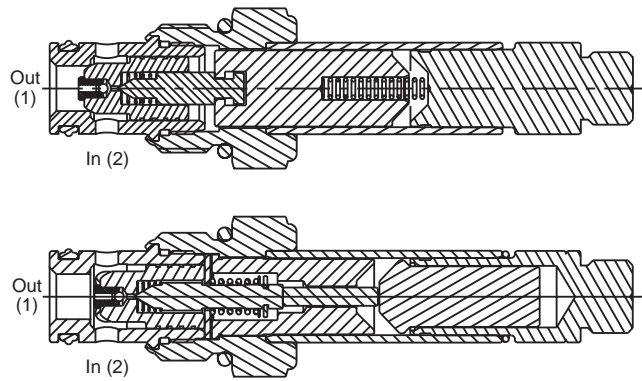
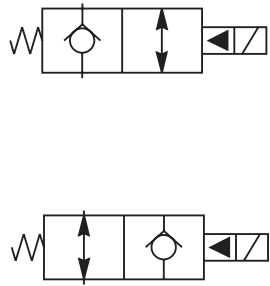


**OPERATION** - The valve pilot is held off its seat by spring force. Pilot flow is vented to port 1, creating a pressure imbalance that moves the main poppet. This differential lifts the poppet allowing flow from the side to nose (2-1). Since poppet valves are piloted operated, a minimum amount of pressure differential (25-50 psi) between ports 2 and 1 must be present to overcome the spring and lift the poppet. When the coil is energized, the coil force overcomes the spring force to drive the valve pilot and main poppet into their seats, thus blocking flow from port 2-1. If the nose of the cartridge (port 1) is pressurized, the pressure will overcome the spring force and solenoid force, pushing the poppet off of its seat, allowing restricted flow through the cartridge (1-2).



**Free Reverse Flow**

The free reverse flow versions are available on both the normally closed and normally open poppet valves. As mentioned above, the operation is the same as the standard poppet valve except flow through the reverse direction is not restricted. The free reverse flow option is only needed if the application requires flow to pass through the cartridge valve from the nose to side (port 1 to port 2).



**Fast Response**

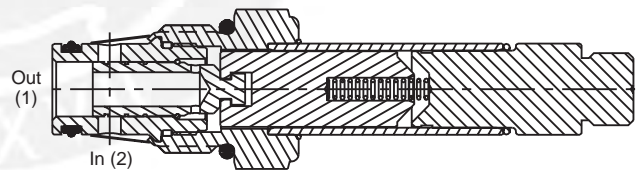
Since poppet valves are pilot operated valves, a few milliseconds are needed to move the pilot and allow the poppet to lift. Should a faster response time be required on normally closed poppet valves, this option can be chosen. The fast response is accomplished by reducing the movement of the pilot. Thus, the flow capacity of the poppet valve is also decreased.

**Two Way Spool Valves**

Two way spool valves are direct acting, fast responding solenoid actuated valves. Like the poppet valves described earlier, they block the flow of a two way function. Unlike two way poppet valves, spool valves block flow from both the side port and the nose port. They do not have the check like function of the poppet valve, thus they are either open or closed. Spool valves are direct operated, so they respond more quickly to coil voltage than poppet valves. Spool valves operate via a sliding spool, thus, some leakage will be present due to the required spool clearance. Spool valves block flow in both directions, but the preferred flow path is still from the side of the cartridge to the nose due to the flow forces acting on the spool. Two way spool valves are available in normally open and normally closed types.

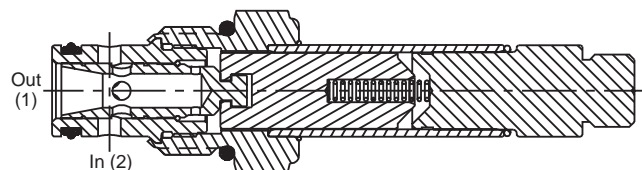
**Normally Closed Spool**

When de-energized, the spool is positioned by the spring force to cover both the side (2) and nose (1) ports of the valve. Thus, no flow is allowed from either direction. Once the coil is energized, the spool shifts exposing a flow path between the two ports. Flow can then be passed through the valve from either direction.



**Normally Open Spool**

When de-energized, the spool is positioned by the spring force so that a flow path between the side (2) and nose (1) ports is exposed, allowing flow through the valve from either direction. Once the coil is energized, the spool shifts to cover both the side (2) and nose (1) ports of the valve. Thus, no flow is allowed from either direction.

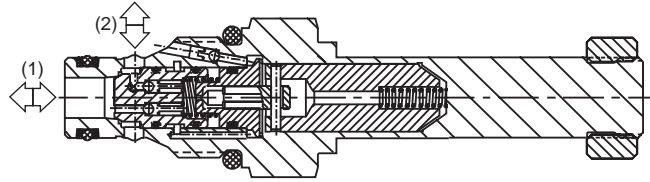
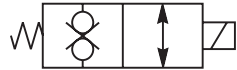


- CV**  
Check Valves
- SH**  
Shuttle Valves
- LM**  
Load/Motor Controls
- FC**  
Flow Controls
- PC**  
Pressure Controls
- LE**  
Logic Elements
- DC**  
Directional Controls
- MV**  
Manual Valves
- SV**  
Solenoid Valves
- PV**  
Proportional Valves
- CE**  
Coils & Electronics
- BC**  
Bodies & Cavities
- TD**  
Technical Data

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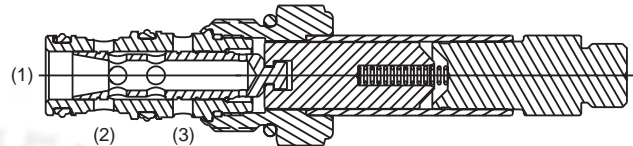
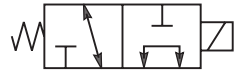
**Bi-Directional Poppet Valve**

Bi-directional poppet valves combine the dual blocking function of spool valves with the lower leakage capabilities of poppet valves. These valves also have a limited flow capacity compared to standard poppet or spool valves.



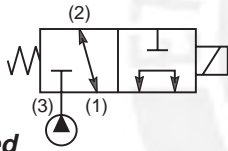
**Two Position, Three Way Spool Valve**

Three way spool solenoid valves provide directional control of flow. Each three way valve has a special internal spool which connects two of the three valve ports. When actuated, the spool connects a different combination of valve ports. These valves are often used for raise and lower functions of a single acting cylinder, control of a uni-directional motor, or as a circuit selector.



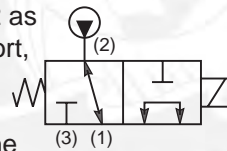
**OPERATION** - In the de-energized mode, the spool is positioned by spring force. When energized, the coil force directly shifts the spool against the spring, thus changing the flow through the valve. Each spool type can be used as a normally open, normally closed, or selector valve. To explain this we will review the DSL103A which is pictured here. When the valve is de-energized, ports 1 and 2 are open to one another. When energized, ports 1 and 3 are connected.

Thus, if we use port 3 as our pressure port, we have a



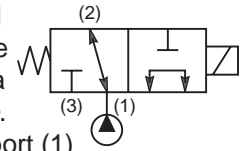
**normally closed valve.** The pressure port (3) is blocked, while the actuator port (1) is drained to tank (2).

If we use port 2 as our pressure port, we have a



**normally open valve.** The pressure port (2) is connected to the actuator port (1), and the tank port (3) is blocked.

If we use port 1 as our pressure port, we have a

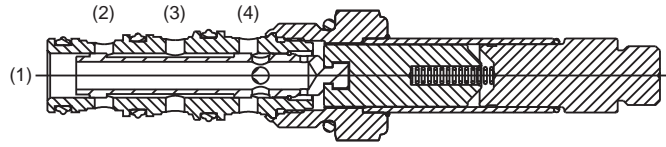


**selector valve.** The pressure port (1) is either connected to port (2) or port (3). Thus, it is "selecting" which port will get the system pressure and flow.

Note that in all three examples, we were using the same valve. The flow forces acting on the spool change depending on which port is pressurized. Thus, if you will be shifting the three way valve under full flow and pressure, it is important to review the shift limit characteristics for the flow paths you have chosen to be sure the coil has enough force to shift the spool. Various spools are available in this catalog to maximize the flow and pressure capacities for the desired flow function.

**Two Position,  
Four Way Spool Valve**

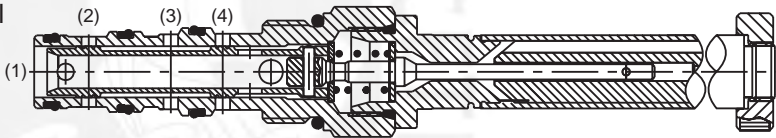
Four way spool solenoid valves provide directional control of flow. Each four way valve has a special internal spool which connects some combination of the four valve ports together. When actuated, the spool connects a different combination of valve ports. These valves are often used for the raise / lower function of a double acting cylinder, or as a forward / reverse function of bi-directional motors.



**OPERATION** - In the de-energized mode, the spool is positioned by spring force. When energized, the coil force directly shifts the spool against the spring, thus changing the flow through the valve. Each spool type is customized to provide the flow combination desired. The flow forces acting on the spool change depending on which port is pressurized. Thus, if you will be shifting the four way valve under full flow and pressure, it is important to review the shift limit characteristics for the flow paths you have chosen to ensure the coil has enough force to shift the spool. Various spools are shown in this catalog to maximize the flow and pressure capacities for the desired flow function.

**Three Position,  
Four Way Spool Valve**

Three position, four way spool solenoid valves provide directional control of flow. Each four way valve has a special internal spool which connects some combination of the four ports together. When one coil is actuated, the spool connects a different combination of valve ports. When the other coil is actuated a third combination of valve ports are connected. These valves are often used for the raise / lower function of a double acting cylinder, or as a forward / reverse function of bi-directional motors. The center position can be used to stop the actuator in mid-stroke, or dump the pump flow.



**OPERATION** - In the de-energized mode, the spool is positioned by spring force. When energized, the coil force directly shifts the against the spring, thus changing the flow through the valve. Each spool type is customized to provide the flow combination desired. The flow forces acting on the spool change depending on which port is pressurized. Thus, if you will be shifting the four way valve under full flow and pressure, it is important to review the shift limit characteristics for the flow paths you chosen to ensure the coil has enough force to shift the spool. Various spools are shown in this catalog to maximize the flow and pressure capacities for the desired flow function.

<b>CV</b>
Check Valves
<b>SH</b>
Shuttle Valves
<b>LM</b>
Load/Motor Controls
<b>FC</b>
Flow Controls
<b>PC</b>
Pressure Controls
<b>LE</b>
Logic Elements
<b>DC</b>
Directional Controls
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<b>SV</b>
Solenoid Valves
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Proportional Valves
<b>CE</b>
Coils & Electronics
<b>BC</b>
Bodies & Cavities
<b>TD</b>
Technical Data

**Technical Information**

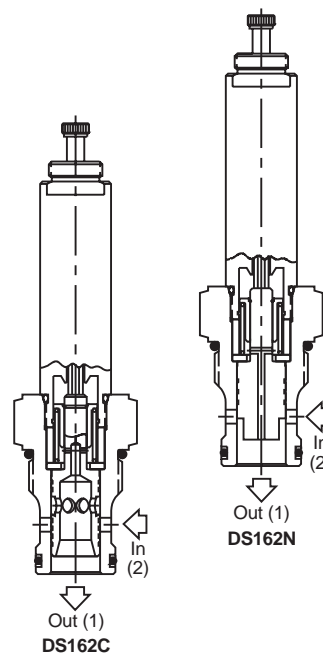
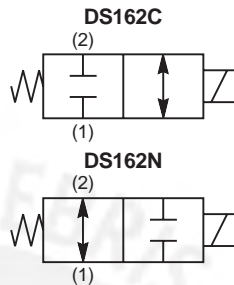
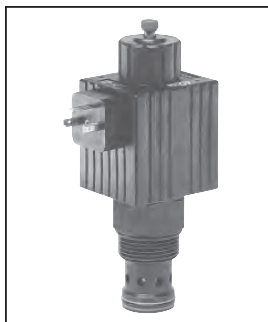
- CV** Check Valves
- SH** Shuttle Valves
- LM** Load/Motor Controls
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- PV** Proportional Valves
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- BC** Bodies & Cavities
- TD** Technical Data

**General Description**

2-Way Spool Valves. For additional information see Technical Tips on pages SV1-SV6.

**Features**

- Low hysteresis
- One-piece encapsulated coil with minimal amperage draw
- Variety of coil terminations and voltages
- Manual override standard (push and release)
- All external parts zinc plated

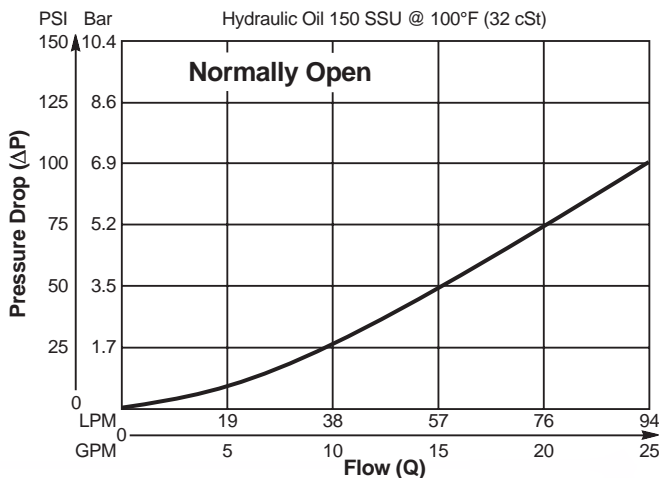
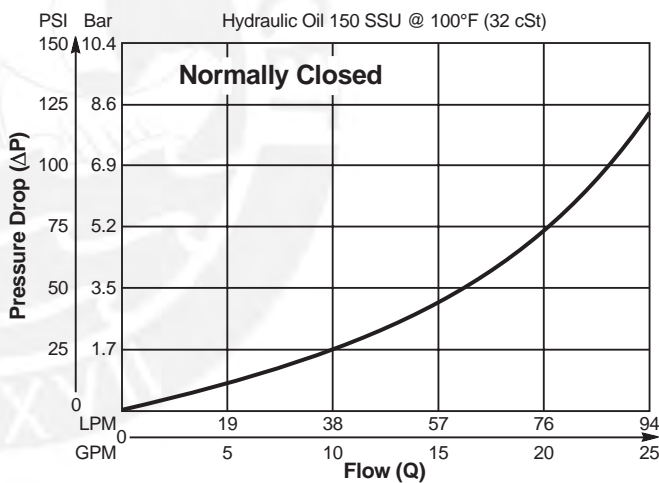


**Specifications**

<b>Rated Flow</b>	75 LPM (20 GPM)
<b>Maximum Inlet Pressure</b>	210 Bar (3000 PSI)
<b>Leakage at 150 SSU (32 cSt)</b>	240 cc/min. (15 in <sup>3</sup> /min.)
<b>Minimum Operating Voltage</b>	85% of rated voltage at 20°C (72°F).
<b>Response Time</b>	<b>C</b> - 90 ms <b>N</b> - 100 ms
<b>Cartridge Material</b>	All parts steel. All operating parts hardened steel.
<b>Operating Temp. Range/Seals</b>	-40°C to +93.3°C (Nitrile) (-40°F to +200°F) -31.7°C to +121.1°C (Fluorocarbon) (-25°F to +250°F)
<b>Fluid Compatibility/Viscosity</b>	Mineral-based or synthetic with lubricating properties at viscosities of 45 to 2000 SSU (6 to 420 cSt)
<b>Filtration</b>	ISO Code 16/13, SAE Class 4 or better
<b>Approx. Weight</b>	.59 kg (1.3 lbs.)
<b>Cavity</b>	C16-2 (See BC Section for more details)
<b>Form Tool</b>	Rougher None Finisher NFT16-2F

**Performance Curves**

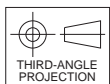
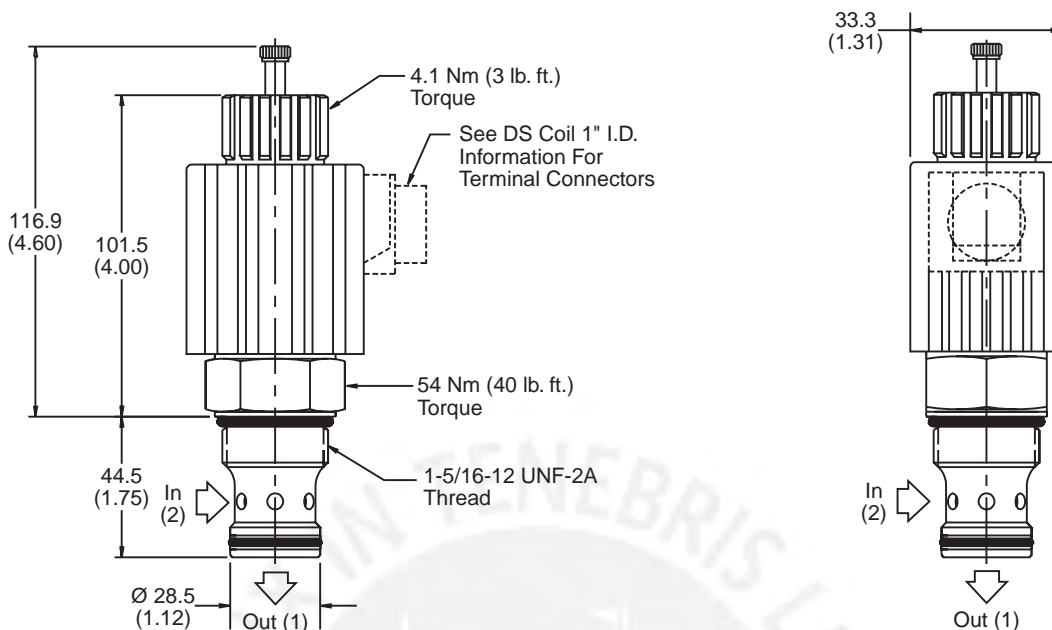
Pressure Drop vs. Flow (Through cartridge only)



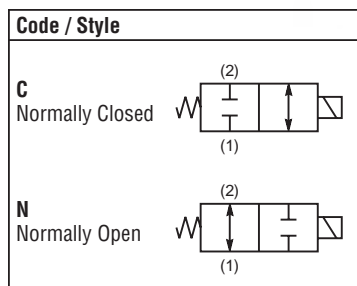
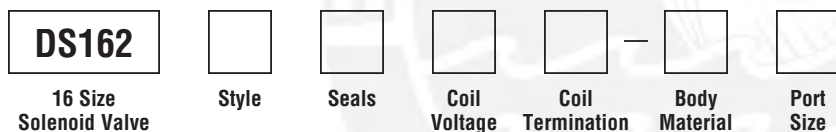


Technical Information

Dimensions Millimeters (Inches)



Ordering Information



Code	Seals / Kit No.
Omit	Nitrile / (SK16-2)
V	Fluorocarbon / (SK16-2V)

Code	Coil Voltage
Omit	Without Coil
D012	12 VDC
D024	24 VDC
A120	120/110 VAC, 60/50 Hz

Code	Coil Termination
Omit	Without Coil
C	Conduit (AC Only)
D	DIN Plug Face
P	Dual Spade (DC Only)
S	Dual Screw (DC Only)
W	Dual Lead (DC Only)

See DS coil 1" I.D.

Code	Body Material
Omit	Steel
A	Aluminum

Code	Port Size	Body Part No.
Omit	Cartridge Only	
12T	SAE-12	(B16-2-*12T)
16T	SAE-16	(B16-2-*16T)
12B	3/4" BSPG	(B16-2-*12B)
16B	1" BSPG	(B16-2-16B)†

\* Add "A" for aluminum, omit for steel.  
† Steel body only.

- CV Check Valves
- SH Shuttle Valves
- LM Load/Motor Controls
- FC Flow Controls
- PC Pressure Controls
- LE Logic Elements
- DC Directional Controls
- MV Manual Valves
- SV Solenoid Valves
- PV Proportional Valves
- CE Coils & Electronics
- BC Bodies & Cavities
- TD Technical Data



# 米朗拉绳位移传感器全系列

LINEAR WIRE POTENTIOMETER/ENCODER SERIES



拉绳位移传感器系列产品专业供应商

**SHENZHEN MIRAN TECHNOLOGY CO., LTD.**

SUPPLIER OF LINEAR WIRE POTENTIOMETERS/ENCODERS

- PRECISION MEASUREMENT 高精度
- HIGH STABILITY 高稳定性
- LONG SERVICE LIFE 长使用寿命
- MULTI-SPECIFICATIONS 规格齐全





## 安装注意事项

1. 利用底部 4 个固定螺丝孔, 依现场及机器安装空间设施需要, 直接安装或另加保护或其他机械使用.
2. 不锈钢索安装时, 须注意水平角度, 亦即尽量使钢索由出线口至移动部位之机构, 于工作时水平滑动, 保持最小角度 (容许偏差 $\pm 3^{\circ}$ ) 以确保量测精度及钢索之寿命.
3. 钢索本体是不锈钢加涂氟层, 请勿让其受外力的割伤、烧损、撞击等不当之事发生: 过量的粉尘、积屑或是足以破坏钢索的物品贮留于内部的滑轮或出线口将造成钢索破损, 导致运转不顺的故障.
4. 未安装于工作台或固定坐前, 请勿用手或是其它产品将钢索拉出并让其瞬间自行弹回. 此举将造成钢索断裂, 伤害本体结构及人身安全.
5. MPS-S 和 MPS-M 系列产品的往复运动的瞬间加速绝对不可超过 1 米 / 秒; MPS-L 和 MPS-L-P 系列产品的往复运动的瞬间加速绝对不可超过 0.5 米 / 秒; 此举将造成钢索断裂, 恕本公司不承担此范围以外的责任.
6. 若使用于非直线运动的机构, 请加装适当的滑轮运转.
7. 若使用于环境恶劣或特殊场合, 请自行加装保护机构或与本公司工程部、经销商洽谈、否则造成产品损坏, 本公司不予以负责.

## FOR INSTALLATION

- 1.To install stainless steel wire ,the angle of wire should be got proper and minimal,the allow tolerance is at $\pm 3^{\circ}$ .
- 2.To make sure that the hook of the stainless steel wire does not exceed the measurement range ,otherwise ,the wire will be to break off or you will get inferior accuracy.
- 3.The wire is stainless steel with fluorin coating.You will get inferior accuracy if the wire is damaged or stretched excessively.
- 4.You can move the linear sensor instead of the wire.
- 5.If your application is not linear motion,please set the pulley to smooth the rotation.
- 6.If the products work under serious environments,such as oil,water ,heavy dust,iron chipping or shavings or any powder can cause to hurt the wire,please make more protective cover or other equipment.
- 7.The acceleration for MPS-S-P and MPS-M-P series is under 1m/sec.max;the acceleration for MPS-L-P and MPS series is under 0.5m/sec.max.

# 选型指引 ordering instruction

MPS--L--500--R

□ □ □ Add information: 附加信息



Output mode 输出信号模式: R:resistance output 电阻输出型  
 V1:voltage output within 0-5VDC 电压输出型 0-5VDC  
 V2:Voltage output within 0-10VDC 电压输出型 0-10VDC  
 MA: current output with 4-20mA 电流输出型 4-20mA  
 P:incremental pulse phase output AB phase or ABZ phase,增量型方波输出 AB 相或 ABZ 相

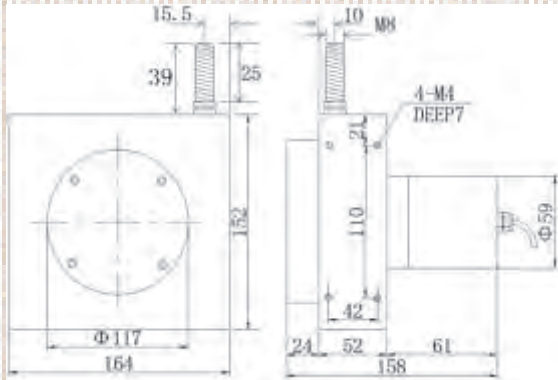
Effective measurement range 有效量测行程

Installation model 安装机座型号

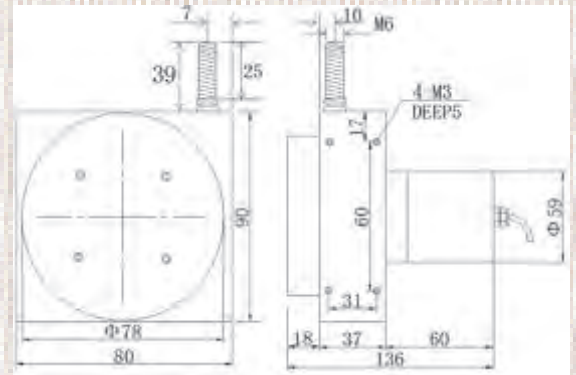
MPS:Linear wire potentiometer/encoder Mark 米朗拉绳尺标志

Installation model 安装机座型号:

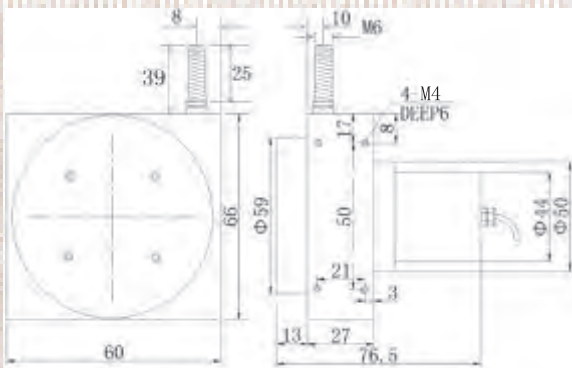
L:



M:



S:

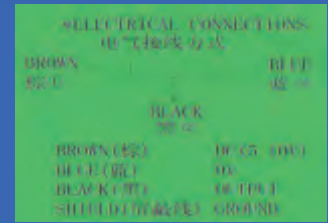


# 拉绳式位移传感器系列.....



公司经营电阻式系列直线位移传感器(电子尺)、磁致伸缩系列直线位移传感器(磁感应电子尺)、磁致伸缩系列液位测量系统(液位计测控系统)、角度位移传感器系列产品、V/A 转换模块、显示控制器系列产品、集中润滑给油器系列产品、小型齿轮减速马达、调速器系列产品、拉绳位移传感器(拉绳式电子尺)系列产品.....

MPS-L-R 系列产品



## ◀ LINEAR WIRE POTENTIOMETER ▶

- PRECISION ELECTRIC RESISTANCE SIGNAL OUTPUT
- SUITABLE FOR SHORT TO MEDIUM MEASUREMENT RANGE

ELECTRICAL SPEC.	
Effective Stroke(mm)量测行程	(4000mm~20000mm)之间量程任意可选
Output Signal Mode 输出信号模式	Resistance(Potentiometer)
Linearity 线性度	±0.25%FS(standard class);±0.10%FS(precision class)
Repeatability 重复性	±0.02%FS
Resolution 解析	Essentially infinite 本质无穷
Measurement Wire 线径规格	Diameter 1mmSUS304 with fluorin-coated
Sensor 传感器	Wire-winding and hybrid potentiometer 绕线混合电位器
Starting force 拉力	≅ 2200g
Max.Measuring Wire Velocity( go and back )最大往复速度	600mm/sec
Weight 重量	≤3500g,
MECHANICAL SPEC.	
Input Resistance 输入电阻值	5Kohm±10%FS(standard class),±5%FS(precision class)
Power Rating(watts)额定功率	2Wat70℃
Recommended Input Voltage 输入电压	30VDCmax.,best voltage at5/10Vdc
ENVIRONMENTAL SPEC.	
Operating Temp.工作温度	0℃~+70℃
Storage Temperature 储存温度	-20℃~+80℃
Vibration 震动	10Hz to 2000Hz
Protection 保护等级	IP65(for pot .housing only)

### ORDERING INFORMATION 订货须知

MPS-L- Measuring Range  
量测行程  
(4000mm~20000mm)  
之间量程任意可选 — Signal Mode  
信号模式  
\*R:Resistance 5k ohm — Life  
寿命及线性度  
Blank:1×10<sup>6</sup>cycles linearity0.25%FS  
\*F: 5×10<sup>6</sup>cycles linearity0.10%FS

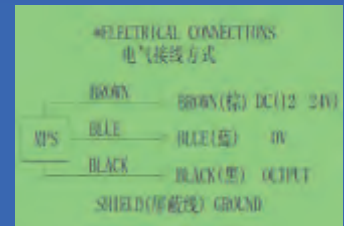


## 拉绳式位移传感器系列.....



公司经营电阻式系列直线位移传感器(电子尺)、磁致伸缩系列直线位移传感器(磁感应电子尺)、磁致伸缩系列液位测量系统(液位计测控系统)、角度位移传感器、V/A 转换模块、显示控制器系列产品、集中润滑给油器系列产品、小型齿轮减速马达、调速器系列产品、拉绳位移传感器(拉绳式电子尺)系列产品.....

MPS-L-V 系列产品



### ◀ LINEAR WIRE POTENTIOMETER ▶

- PRECISION ELECTRIC 0-5V AND 0-10V SIGNAL OUTPUT
- SUITABLE FOR LONG MEASUREMENT RANGE

ELECTRICAL SPEC.	
Effective Stroke(mm)量测行程	(4000mm~20000mm)之间量程任意可选
Output Signal Mode 输出信号模式	0~5Vdc or 0~10Vdc
Linearity 线性度	±0.3%FS(standard class);±0.15%FS(precision class)
Repeatability 重复性	±0.05%FS
Resolution 解析	Essentially infinite 本质无穷
Measurement Wire 线径规格	Diameter 1mmSUS304 with fluorin-coated
Sensor 传感器	Wire-winding and hybrid potentiometer 绕线混合电位器
Starting force 拉力	≤2200g
Max.Measuring Wire Velocity( go and back)最大往复速度	600mm/sec
Weight 重量	≤3500g

MECHANICAL SPEC.	
Power supply 供应电压	10~24Vdc for 0-5V volt output,12-24Vdc for 0-10volt output
Power Current 供应电流	10mA max
Zero and Span Adjustment 零度和满度调节	Please see detailed product instruction booklet 请见详细产品说明书

ENVIRONMENTAL SPEC.	
Operating Temp.工作温度	0°C ~+70 °C
Storage Temperature 储存温度	-20 °C ~+80 °C
Vibration 震动	10Hz to 2000Hz
Protection 保护等级	IP65(for pot. housing only)

#### ORDERING INFORMATION 订货须知

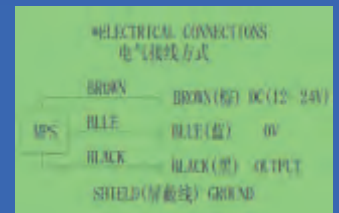
MPS-L-	<b>Measuring Range</b> 量测行程 (4000mm~20000mm) 之间量程任意可选	<b>Signal Mode</b> 信号模式 *V1:0-5Vdc *V2:0-10Vdc	<b>Life</b> 寿命及线性度 Blank:1×10 <sup>6</sup> cycles linearity0.3%FS *F: 5×10 <sup>6</sup> cycles linearity0.15%FS
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## 拉绳式位移传感器系列.....



公司经营电阻式系列直线位移传感器(电子尺)、磁致伸缩系列直线位移传感器(磁感应电子尺)、磁致伸缩系列液位测量系统(液位计测控系统)、角度位移传感器、V/A 转换模块、显示控制器系列产品、集中润滑给油器系列产品、小型齿轮减速马达、调速器系列产品、拉绳位移传感器(拉绳式电子尺)系列产品.....

MPS-L-MA 系列产品



### ◀ LINEAR WIRE POTENTIOMETER ▶

- PRECISION ANALOG CURRENT 4-20mA SINGAL OUTPUT
- SUITABLE FOR SHORT TO MEDIUM MEASURMENT RANGE

#### ELECTRICAL SPEC.

Effective Stroke(mm) 量测行程	(4000mm~20000mm)之间量程任意可选
Output Signal Mode 输出信号模式	4-20mA (3wires)、(2wires)
Linearity 线性度	±0.3%FS(standard class);±0.15%FS(precision class)
Repeatability 重复性	±0.05%FS
Resolution 解析	Essentially infinite 本质无穷
Measurement Wire 线径规格	Diameter 1mm SUS304 with fluorin-coated
Sensor 传感器	Wire-winding and hybrid potentiometer 绕线混合电位器
Starting force 拉力	≦ 2200g
Max.Measuring Wire Velocity(go and back)最大往复速度	600mm/sec
Weight 重量	≦ 3500g

#### MECHANICAL SPEC.

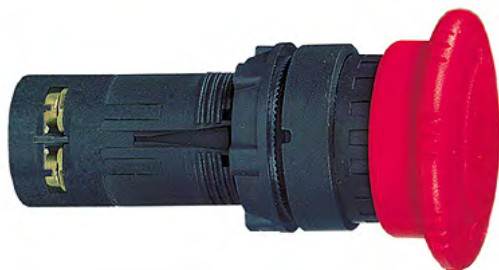
Power supply 供应电压	12-24V dc(3wires);15-36Vdc(2wires)
Input current 供应电流	25mA max
Loop Resistance(load)回路电阻(负载)	(loop supply voltage-10)/0.02max
Zero and span adjustment	Please see detailed product instruction booklet 请见详细产品说明书

#### ENVIRONMENTAL SPEC.

Operating Temp.工作温度	0°C ~ +70°C
Storage Temperature 储存温度	-20°C ~ +80°C
Vibration 震动	10Hz to 2000Hz
Protection 保护等级	IP65(for pot. housing only)

#### ORDERING INFORMATION 订货须知

MPS-L-	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Measuring Range 量测行程</div> (4000mm~20000mm) 之间量程任意可选	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Signal Mode 信号模式</div> MA:4-20mA	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Life 寿命及线性度</div> Blank:1×10 <sup>6</sup> cycles linearity0.3%FS *F: 5×10 <sup>6</sup> cycles linearity0.15%FS
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## Main

Range of product	Harmony XB7
Product or component type	Emergency switching off monolithic pushbutton
Device short name	XB7
Mounting diameter	22 mm
Sale per indivisible quantity	10
Shape of signaling unit head	Round
Type of operator	Mechanical latching
Reset	Turn to release
Operator profile	Mushroom Ø 40 mm red unmarked
Contacts type and composition	1 NC
Connections - terminals	Faston connectors 6.35 x 0.8 mm EN/IEC 60947-1 Forked type tag connectors 6.5 mm EN/IEC 60947-1 Screw clamp terminals 1 x 0.22...2 x 2.5 mm <sup>2</sup> without cable end EN/IEC 60947-1 Screw clamp terminals ≤ 2 x 1.5 mm <sup>2</sup> with cable end EN/IEC 60947-1

## Complementary

Product weight	0,032 kg
Device mounting	Fixing hole 22,5 mm 22.3 +0.4/0 EN/IEC 60947-1
Fixing center	≥ 30 x 40 mm support panel metal 1...6 mm ≥ 30 x 40 mm support panel plastic 2...6 mm
Fixing mode	Fixing nut beneath head 1.2 N.m 0.8...2 N.m
Contacts operation	Slow-break
Contacts usage	Standard
Positive opening	With EN/IEC 60947-5-1 appendix K
Mechanical durability	10000 cycles
Tightening torque	0,8...1,2 N.m EN 60947-1
Shape of screw head	Cross pozidriv No 1 Cross Philips no 1 Cross JIS No 1 Slotted flat Ø 4 mm Slotted flat Ø 5.5 mm
Short circuit protection	4 A cartridge fuse gG EN/IEC 60947-5-1
[Ui] rated insulation voltage	250 V 3 EN/IEC 60947-1
[Uimp] rated impulse withstand voltage	6 kV EN/IEC 60947-1
[Ie] rated operational current	0,1 A 250 V DC-13 R300 EN/IEC 60947-5-1 0,3 A 240 V AC-14 D300 EN/IEC 60947-5-1 0,6 A 120 V AC-14 D300 EN/IEC 60947-5-1 0,22 A 125 V DC-13 R300 EN/IEC 60947-5-1
Electrical reliability IEC 60947-5-4	$\Lambda < 10\exp(-6)$ 17 V 5 mA IEC 60947-5-4



## Environment

Protective treatment	TH
Ambient air temperature for storage	-40...70 °C
Ambient air temperature for operation	-25...70 °C
Class of protection against electric shock	Class II IEC 60536
IP degree of protection	IP20 rear face IEC 60529 IP54 front face IEC 60529
NEMA degree of protection	NEMA 12
Standards	CSA C22-2 No 14 EN/IEC 60947-1 EN/IEC 60947-5-1 EN/IEC 60947-5-5 IEC 60364-5-53 UL 508
Vibration resistance	5 gn 2...500 Hz IEC 60068-2-6
Shock resistance	10 gn 11 ms half sine wave acceleration IEC 60068-2-27
RoHS EUR conformity date	0730
RoHS EUR status	Compliant



## EL Series



- Ratings of 5A and 10A @ 3-100 VDC
- UL Recognized, CE and RoHS Compliant
- 5, 12 and 24VDC control
- Mosfet Output

### PRODUCT SELECTION

Control Voltage	5A	10A
4-8 VDC	EL100D5-05	EL100D10-05
10-14 VDC	EL100D5-12	EL100D10-12
21-27 VDC	EL100D5-24	EL100D10-24

### OUTPUT SPECIFICATIONS (1)(3)

Description	5A	10A
Operating Voltage Range [VDC]	3-100	3-100
Maximum Load Current [Adc] (2)	5	10
Minimum Load Current [mAdc]	150	150
Maximum Surge Current Non-Repetitive (10ms) [A]	80	100
Maximum Off-State Leakage Current @ Rated Voltage [ $\mu$ Adc]	100	100
Maximum On-State Resistance @ Rated Current (Rds-on)	0.04 Ohm	0.01 Ohm
Maximum On-State Voltage Drop @ Rated Current	0.2V	0.1V

### INPUT SPECIFICATIONS (1)

Description	EL100Dxx-05	EL100Dxx-12	EL100Dxx-24
Control Voltage Range	4-8 VDC	10-14 VDC	21-27 VDC
Minimum Turn-On Voltage	4.0 VDC	10 VDC	21 VDC
Minimum Turn-Off Voltage	0.5 VDC	1.0 VDC	2 VDC
Typical Input Current @ nominal turn-on voltage	13.3 mA	11.7 mA	11.5 mA
Nominal Input Impedance [Ohms]	300	940	2K
Maximum Turn-On Time [msec]	1	1	1
Maximum Turn-Off Time [ $\mu$ sec]	300	300	300

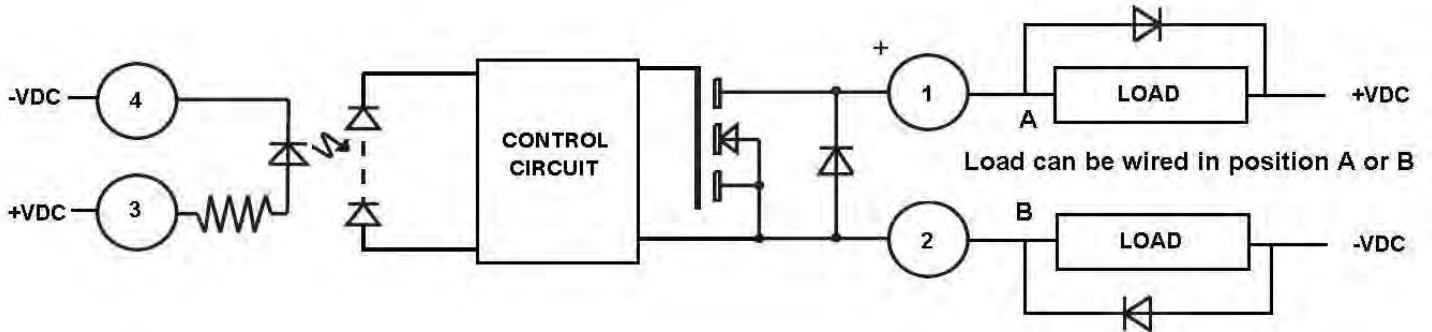
### GENERAL SPECIFICATIONS

Description	Parameters
Dielectric Strength, Input to Output	2500 Vrms
Dielectric Strength, Output to Baseplate	2500 Vrms
Ambient Operating Temperature Range	-30 to 80 °C
Ambient Storage Temperature Range	-30 to 125 °C
Weight (typical)	0.5 oz (14.4g)
Terminals	3/16" input, 1/4" output QC

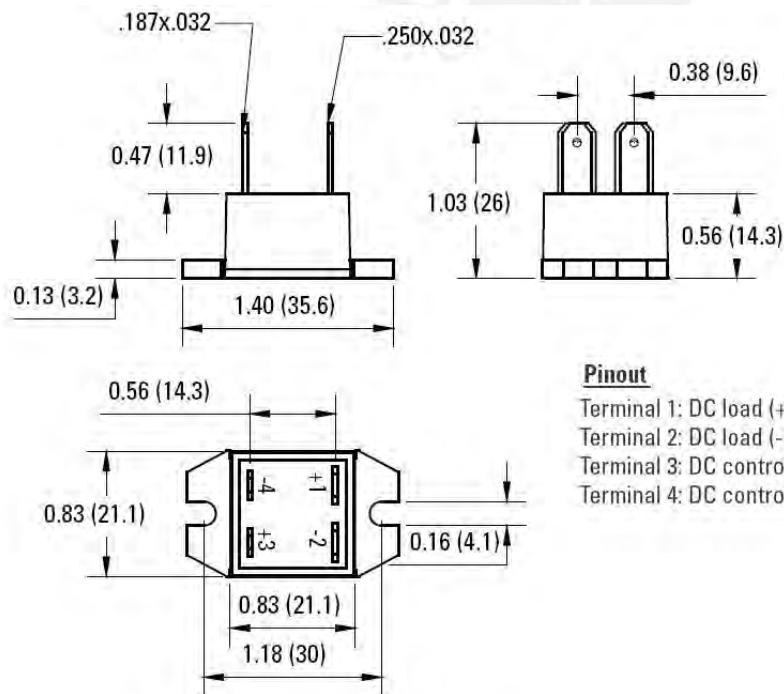
### GENERAL NOTES

- 1) All parameters at 25°C unless otherwise specified.
- 2) When mounted to the proper size heat sink (see derating curves)
- 3) Inductive loads should be diode suppressed to prevent damage to the relay.

## WIRING DIAGRAM



## MECHANICAL SPECIFICATIONS



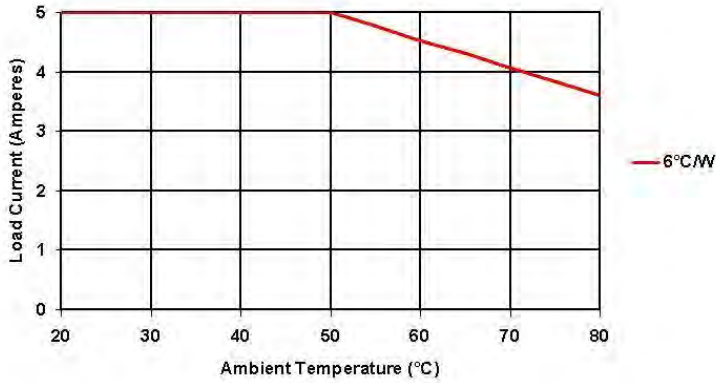
### Pinout

- Terminal 1: DC load (+)
- Terminal 2: DC load (-)
- Terminal 3: DC control (+)
- Terminal 4: DC control (-)

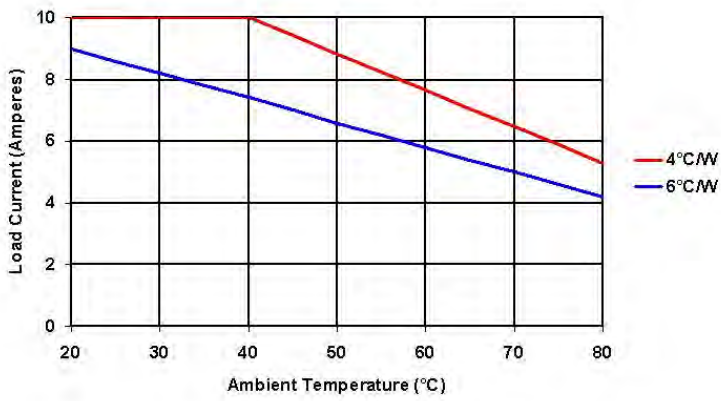
All dimensions are in inches (millimeters)

## THERMAL DERATE INFORMATION

DERATING CURVE: EL 5 AMP



DERATING CURVE: EL 10 AMP




## AGENCY APPROVALS

Designed in accordance with the requirements of IEC 62314



Rev. 120811



 <b>DANGER / PELIGRO / DANGER /GEFAHR / PERICOLO / PERIGO</b>					
<p><b>HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.</b></p> <ul style="list-style-type: none"> <li>• Disconnect all power before installing or working with this equipment.</li> <li>• Verify all connections and replace all covers before turning on power.</li> </ul> <p><b>Failure to follow these instructions will result in death or serious injury.</b></p>	<p><b>RIESGO DE DESCARGA ELECTRICA O EXPLOSION.</b></p> <ul style="list-style-type: none"> <li>• Desconectar todos los suministros de energia a este equipo antes de trabajar con este equipo.</li> <li>• Verificar todas las conexiones y colocar todas las tapas antes de energizar el equipo.</li> </ul> <p><b>El incumplimiento de estas instrucciones puede provocar la muerte o lesiones serias.</b></p>	<p><b>RISQUE DE DESCARGE ELECTRIQUE OU EXPLOSION</b></p> <ul style="list-style-type: none"> <li>• Eteindre toutes les sources d'énergie de cet appareil avant de travailler dessus de cet appareil</li> <li>• Vérifier tous connections, et remettre tous couverts en place avant de mettre sous</li> </ul> <p><b>De non-suivi de ces instructions provoquera la mort ou des lésions sérieuses sérieuses.</b></p>	<p><b>GEFAHR EINES ELEKTRISCHE N SCHLAGES ODER EINER EXPLOSION.</b></p> <ul style="list-style-type: none"> <li>• Stellen Sie jeglichen Strom ab, der dieses Gerät versorgt, bevor Sie an dem Gerät Arbeiten durchführen</li> <li>• Vor der Inbetriebnahme alle Anschlüsse überprüfen und alle Gehäuseteile montieren.</li> </ul> <p><b>Unterlassung dieser Anweisungen können zum Tode oder zu schweren Verletzungen führen.</b></p>	<p><b>RISCHIO DI SCOSSA ELETTRICA O DELL'ESPLOSIONE.</b></p> <ul style="list-style-type: none"> <li>• Spenga tutta l'alimentazione e che fornisce questa apparecchiatura prima del lavorare a questa apparecchiatura</li> <li>• Verificare tutti i collegamenti e sostituire tutte le coperture prima della rotazione sull'alimentazione</li> </ul> <p><b>L'omissione di seguire queste istruzioni provocherà la morte o di lesioni serie</b></p>	<p><b>RISCO DE DESCARGA ELÉTRICA OU EXPLOÇÃO</b></p> <ul style="list-style-type: none"> <li>• Desconectar o equipamento de toda a energia antes de instalar ou trabalhar com este equipamento</li> <li>• Verificar todas as conexões e recolocar todas as tampas antes de religar o equipamento</li> </ul> <p><b>O não cumprimento destas instruções pode levar à morte ou lesões sérias.</b></p>

 <b>WARNING / AVERTISSEMENT / WARNUNG /ADVERTENCIA / AVVERTENZA / AVISO</b>		
<p><b>RISK OF MATERIAL DAMAGE AND HOT ENCLOSURE</b></p> <ul style="list-style-type: none"> <li>• The product's side panels may be hot, allow the product to cool before touching.</li> <li>• Follow proper mounting instructions including torque values.</li> <li>• Do not allow liquids or foreign objects to enter this product.</li> </ul> <p><b>Failure to follow these instructions can result in serious injury, or equipment damage.</b></p>	<p><b>RISQUE DE DOMMAGE MATERIEL ET DE SURCHAUFFE DU BOITIER</b></p> <ul style="list-style-type: none"> <li>• Les panneaux latéraux du produit peuvent être chauds. Laisser le produit refroidir avant de le toucher.</li> <li>• Respecter les consignes de montage, et notamment les couples de serrage.</li> <li>• Ne pas laisser pénétrer de liquide ni de corps étrangers à l'intérieur du produit.</li> </ul> <p><b>Le non-respect de cette directive peut entraîner, des lésions corporelles graves ou des dommages matériels.</b></p>	<p><b>GEFAHR VON MATERIALSCHÄDEN UND GEHÄUSEERHITZUNG</b></p> <ul style="list-style-type: none"> <li>• Die Seitenwände können heiß sein. Lassen Sie das Produkt abkühlen, bevor Sie es berühren.</li> <li>• Beachten Sie die Montageanweisungen.</li> <li>• Führen Sie keine Flüssigkeiten oder Fremdkörper in das Produkt ein.</li> </ul> <p><b>Die Nichtbeachtung dieser Anweisung kann Körperverletzung oder Materialschäden zur Folge haben.</b></p>
<p><b>RIESGO DE DAÑOS MATERIALES Y DE SOBRECIENTAMIENTO DE LA UNIDAD</b></p> <ul style="list-style-type: none"> <li>• Los paneles laterales del producto pueden estar calientes. Esperar que el producto se enfríe antes de tocarlo.</li> <li>• Respetar las instrucciones de montaje, y en particular los pares de apretado.</li> <li>• No dejar que penetren líquidos o cuerpos extraños en el producto.</li> </ul> <p><b>Si no se respetan estas precauciones pueden producirse graves lesiones, daños materiales.</b></p>	<p><b>RISCHIO DI DANNI MATERIALI E D'INVOLUCRO CALDO</b></p> <ul style="list-style-type: none"> <li>• I pannelli laterali dell'apparecchio possono scottare; lasciar quindi raffreddare il prodotto prima di toccarlo.</li> <li>• Seguire le istruzioni di montaggio corrette.</li> <li>• Non far entrare liquidi o oggetti estranei in questo apparecchio.</li> </ul> <p><b>La mancata osservanza di questa precauzione può causare gravi rischi per l'incolumità personale o danni alle apparecchiature.</b></p>	<p><b>RISCO DE DANO MATERIAL E DE AQUECIMENTO</b></p> <ul style="list-style-type: none"> <li>• Os painéis laterais do produto podem estar quentes; dê tempo ao produto para arrefecer antes de lhe tocar.</li> <li>• Siga devidamente as instruções de montagem.</li> <li>• Não permita a entrada de líquidos e de objectos estranhos no produto.</li> </ul> <p><b>A não observância destas precauções pode provocar a morte, ferimentos graves ou danos materiais.</b></p>

**ANNEX - ENVIROMENTAL INFORMATION**

The environmental information disclosed in this annex including the EIP Pollution logo are in compliance with People's Republic of China Electronic Industry Standard SJ/T11364 – 2006, Marking for Control of Pollution Caused by Electronic Information Products.

Part Name	Toxic or hazardous Substance and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr (VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Semiconductor die	X	0	0	0	0	0
Solder	X	0	0	0	0	0

此附件所标示的包括电子信息产品污染图标的环保信息符合中华人民共和国电子行业标准 **SJ/T11364 - 2006**, 电子信息产品污染控制标识要求



部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
半导体芯片	X	0	0	0	0	0
焊接点	X	0	0	0	0	0







## 200W Single Output with PFC Function

## HRP-200 series



### ■ Features :

- Universal AC input / Full range
- Built-in active PFC function, PF>0.95
- High efficiency up to 89%
- Withstand 300VAC surge input for 5 seconds
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Cooling by free air convection
- Built-in constant current limiting circuit
- 1U low profile 38mm
- Built-in remote sense function
- 5 years warranty



### SPECIFICATION

MODEL	HRP-200-3.3	HRP-200-5	HRP-200-7.5	HRP-200-12	HRP-200-15	HRP-200-24	HRP-200-36	HRP-200-48		
OUTPUT	DC VOLTAGE	3.3V	5V	7.5V	12V	15V	24V	36V	48V	
	RATED CURRENT	40A	35A	26.7A	16.7A	13.4A	8.4A	5.7A	4.3A	
	CURRENT RANGE	0 ~ 40A	0 ~ 35A	0 ~ 26.7A	0 ~ 16.7A	0 ~ 13.4A	0 ~ 8.4A	0 ~ 5.7A	0 ~ 4.3A	
	RATED POWER	132W	175W	200.3W	200.4W	201W	201.6W	205.2W	206.4W	
	RIPPLE & NOISE (max.) Note.2	80mVp-p	90mVp-p	100mVp-p	120mVp-p	150mVp-p	150mVp-p	250mVp-p	250mVp-p	
	VOLTAGE ADJ. RANGE	2.8 ~ 3.8V	4.3 ~ 5.8V	6.8 ~ 9V	10.2 ~ 13.8V	13.5 ~ 18V	21.6 ~ 28.8V	28.8 ~ 39.6V	40.8 ~ 55.2V	
	VOLTAGE TOLERANCE Note.3	±2.0%	±2.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	
	LINE REGULATION	±0.5%	±0.5%	±0.5%	±0.3%	±0.3%	±0.2%	±0.2%	±0.2%	
	LOAD REGULATION	±1.5%	±1.0%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	
	SETUP, RISE TIME	1000ms, 50ms/230VAC      2500ms, 50ms/115VAC at full load								
HOLD UP TIME (Typ.)	16ms/230VAC      16ms/115VAC at full load									
INPUT	VOLTAGE RANGE Note.5	85 ~ 264VAC      120 ~ 370VDC								
	FREQUENCY RANGE	47 ~ 63Hz								
	POWER FACTOR (Typ.)	PF>0.95/230VAC		PF>0.99/115VAC at full load						
	EFFICIENCY (Typ.)	80%	84%	86%	88%	88%	88%	89%	89%	
	AC CURRENT (Typ.)	2.1A/115VAC      1.1A/230VAC								
	INRUSH CURRENT (Typ.)	35A/115VAC      70A/230VAC								
	LEAKAGE CURRENT	<1.2mA / 240VAC								
PROTECTION	OVERLOAD	105 ~ 135% rated output power Protection type : Constant current limiting, recovers automatically after fault condition is removed								
	OVER VOLTAGE	3.96 ~ 4.62V	6 ~ 7V	9.4 ~ 10.9V	14.4 ~ 16.8V	18.8 ~ 21.8V	30 ~ 34.8V	41.4 ~ 48.6V	57.6 ~ 67.2V	
		Protection type : Shut down o/p voltage, re-power on to recover								
	OVER TEMPERATURE	Shut down o/p voltage, recovers automatically after temperature goes down								
ENVIRONMENT	WORKING TEMP.	-40 ~ +70°C (Refer to "Derating Curve")								
	WORKING HUMIDITY	20 ~ 90% RH non-condensing								
	STORAGE TEMP., HUMIDITY	-40 ~ +85°C, 10 ~ 95% RH								
	TEMP. COEFFICIENT	±0.03%/°C (0 ~ 50°C)								
	VIBRATION	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes								
SAFETY & EMC (Note 4)	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 approved								
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC    I/P-FG:2KVAC    O/P-FG:0.5KVAC								
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms / 500VDC / 25°C / 70% RH								
	EMC EMISSION	Compliance to EN55022 (CISPR22) Class B, EN61000-3-2,-3								
	EMC IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11, EN55024, heavy industry level, criteria A								
OTHERS	MTBF	209.4K hrs min.    MIL-HDBK-217F (25°C)								
	DIMENSION	199*98*38mm (L*W*H)								
	PACKING	0.77Kg; 18pcs/14.9Kg/0.9CUFT								
NOTE	<ol style="list-style-type: none"> <li>1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature.</li> <li>2. Ripple &amp; noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uF &amp; 47uF parallel capacitor.</li> <li>3. Tolerance : includes set up tolerance, line regulation and load regulation.</li> <li>4. The power supply is considered a component which will be installed into a final equipment. All the EMC tests are been executed by mounting the unit on a 360mm*360mm metal plate with 1mm of thickness. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies." (as available on <a href="http://www.meanwell.com">http://www.meanwell.com</a>)</li> <li>5. Derating may be needed under low input voltages. Please check the derating curve for more details.</li> </ol>									

**Mechanical Specification**

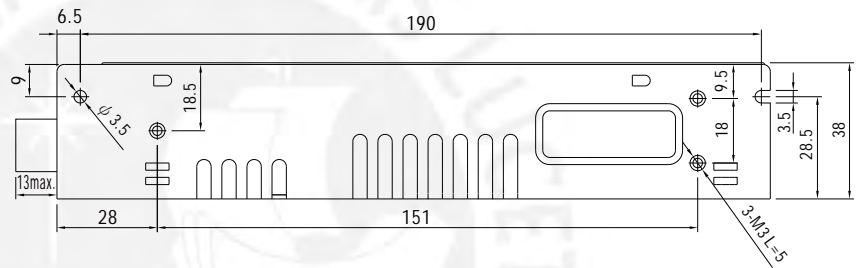
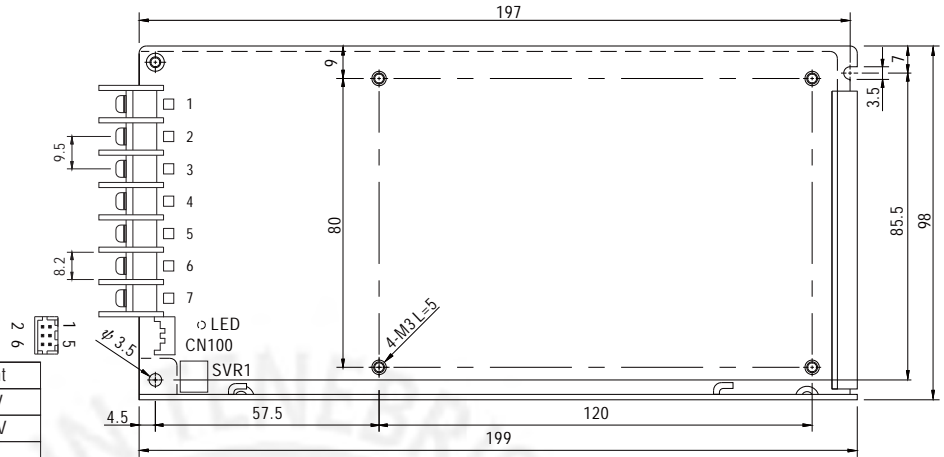
Case No.902E Unit:mm

**Terminal Pin No. Assignment**

Pin No.	Assignment	Pin No.	Assignment
1	AC/L	4,5	DC OUTPUT -V
2	AC/N	6,7	DC OUTPUT +V
3	FG $\oplus$		

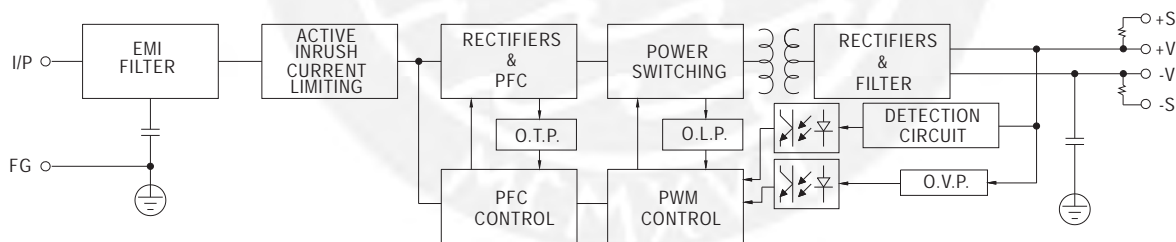
**Connector Pin No. Assignment (CN100) :**  
HRS DF11-6DP-2DS or equivalent

Pin No.	Assignment	Mating Housing	Terminal
1	NC	HRS DF11-6DS or equivalent	HRS DF11-**-SC or equivalent
2	NC		
3	NC		
4	NC		
5	+S		
6	-S		



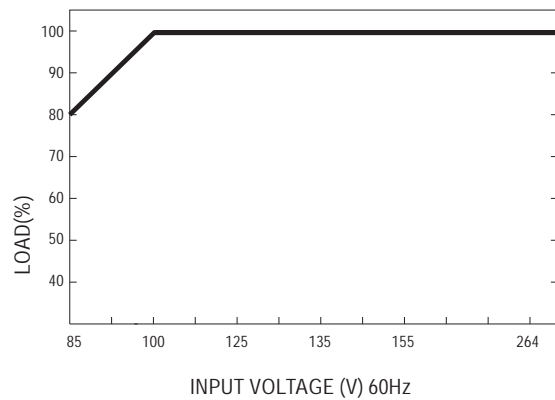
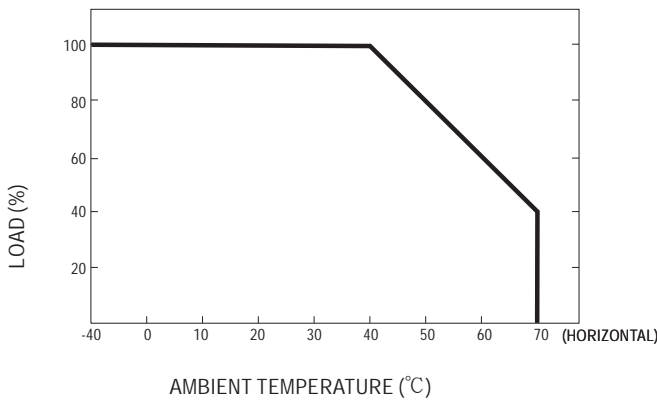
**Block Diagram**

fosc :70KHz



**Derating Curve**

**Output Derating VS Input Voltage**



# Mouser Electronics

Authorized Distributor

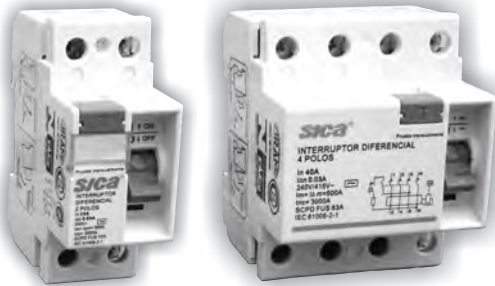
Click to View Pricing, Inventory, Delivery & Lifecycle Information:

## Mean Well:

[HRP-200-12](#) [HRP-200-15](#) [HRP-200-24](#) [HRP-200-3.3](#) [HRP-200-36](#) [HRP-200-48](#) [HRP-200-5](#) [HRP-200-7.5](#)



# Interruptor Diferencial



Soluciones Eléctricas  
**SICA**<sup>®</sup>  
Electrotecnia de vanguardia

## GENERALIDADES:

El interruptor diferencial es un dispositivo de protección contra fugas de corriente eléctrica. Permite proteger la vida de las personas ante choques eléctricos causados por:

- Desperfectos en electrodomésticos o equipos eléctricos.
- Contactos accidentales de elementos bajo tensión.

Certificado bajo norma IEC 61008-2-1.

Esta fabricado con materiales de última tecnología que le confieren la seguridad de funcionamiento que necesita.

## FUNCIONAMIENTO:

El interruptor diferencial se comanda manualmente por medio de la palanca que posee en su frente, quedando a la vista cuando se lo instala en el tablero.

Por medio de esta palanca se puede conectar o desconectar la alimentación de energía al circuito eléctrico a voluntad.

Esta palanca tiene dos posiciones que permiten saber en qué estado se encuentran los contactos del interruptor.

Las posiciones son:

- Palanca en posición hacia arriba: "I" ; "ON"  
*Interruptor cerrado, indicador de color rojo, circuito energizado.*

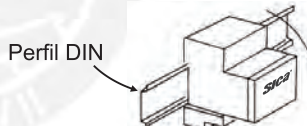
- Palanca en posición hacia abajo: "O" ; "OFF"  
*Interruptor abierto, indicador de color verde, circuito desenergizado.*

El interruptor diferencial actúa desenergizando al circuito ante la fuga de corriente a tierra, producida por algún equipo defectuoso o por un contacto accidental de las personas con algún elemento de la instalación eléctrica que pueda poner en riesgo vidas humanas, abriendo el circuito en forma instantánea. Una vez que ha sido subsanado el problema que causó la apertura de los contactos del interruptor es necesario reponer el mecanismo del mismo. Para hacerlo, hay que llevar la palanca desde la posición de abierto (abajo), hacia la posición de cerrado (hacia arriba), quedando el circuito energizado.

## INSTALACIÓN:

El interruptor diferencial se instala muy fácilmente.

El sistema de montaje es sobre perfil DIN, en las cajas de la línea *Prestige* o *Sicabox*, o en cualquier otra que ofrezca el perfil DIN como forma de fijación, y que asegure de igual modo la adecuada protección de los contactos.



1) Instalar el interruptor sobre el riel haciendo una ligera presión.

2) Seccionar previamente la alimentación desde algún dispositivo anterior (interruptor de cabecera) para trabajar en forma segura y sin riesgos de electrocución.

3) Conectar los cables de entrada de energía a los bornes superiores del diferencial. (1 - N / 1 - 3 - 5 - N)

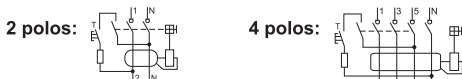
4) Colocar la palanca del diferencial en posición "OFF".

5) Conectar los cables de carga a los bornes inferiores del diferencial. (2 - N / 2 - 4 - 6 - N)

6) Finalmente restablecer la alimentación de energía y colocar la palanca del diferencial en posición "ON" para que el circuito quede en funcionamiento.

**NOTA:** Si bien la conexión superior o inferior de los conductores de entrada no altera el funcionamiento del Interruptor diferencial, aconsejamos la conexión superior por motivos de uso y costumbre.

## DIAGRAMA DE CONEXIÓN:



Verificar el correcto ajuste de los tornillos, de lo contrario se pueden producir recalentamientos perjudiciales.

Es aconsejable volver a ajustar los tornillos luego de transcurrido un mes de su instalación para prevenir presuntos desajustes.

Cuando se instale un interruptor tetrapolar en una red trifásica sin neutro se debe efectuar un puente en los bornes de entrada 3 y N a los efectos de garantizar el funcionamiento del botón de prueba.

## VERIFICACIÓN DE FUNCIONAMIENTO:

Una vez instalado el interruptor diferencial en el tablero se puede verificar el funcionamiento del mismo presionando el botón de prueba "T" que se encuentra ubicado sobre el frente del diferencial.

Este botón de prueba reproduce sobre el diferencial, exactamente el mismo efecto que genera una fuga a tierra por desperfecto o contacto accidental. Por lo tanto, por medio de él, se está probando la sensibilidad del interruptor frente a corrientes de fuga como las que se producirían cuando un ser humano se pone en contacto con un circuito bajo tensión.

Este pulsador debe ser presionado en forma periódica para probar si el interruptor se encuentra en condiciones de operar en presencia de una fuga de cualquier índole. Una vez que el interruptor ha abierto, será necesario reponerlo y cerrarlo de forma manual. Se recomienda realizar esta verificación de funcionamiento 1 vez al mes.

Es importante destacar que el correcto funcionamiento del interruptor diferencial se obtendrá si la instalación eléctrica posee una adecuada puesta a tierra de acuerdo a lo especificado por la Reglamentación de Instalaciones eléctricas para inmuebles de la AEA u organismo regulador del lugar.

## ADVERTENCIA:

El interruptor diferencial actúa solo en caso de fuga de corriente. Para proteger la instalación contra cortocircuitos y sobrecargas de tensión debe utilizarse fusibles o Interruptores Termomagnéticos SICALimit.

## CARACTERÍSTICAS TÉCNICAS:

### 2 Polos:

Tensión nominal: 240 Vca  
Corriente nominal: 16 A, 25 A, 40 A, 63 A y 80 A.  
Corriente diferencial: 10 mA ó 30 mA  
 $I_{m} = I_{\Delta m} = 500A - 630A - 800A$   
 $I_{nc} = 3000A$   
SCPD= Fus 63A gG - Fus 80A gG  
Tamaño: 2 módulos DIN

### 4 Polos:

Tensión nominal: 240/415 Vca  
Corriente nominal: 25 A, 40 A, 63 A y 80 A.  
Corriente diferencial: 30 mA ó 300 mA  
 $I_{m} = I_{\Delta m} = 500A - 630A - 800A$   
 $I_{nc} = 3000A$   
SCPD= Fus 63A gG - Fus 80A gG  
Tamaño: 4 módulos DIN

## CONSEJOS ÚTILES:

-La instalación del interruptor diferencial requiere un mínimo de conocimientos relacionados con instalaciones eléctricas y trabajos con tensión. Consulte a electricistas para instalarlo o derive el trabajo de instalación a ellos.

-Realice la prueba de verificación de funcionamiento periódicamente para cerciorarse del buen funcionamiento del interruptor.

-Utilice los tomacorrientes con conexión de puesta a tierra para la conexión de equipos eléctricos. No utilice fichas o adaptadores que anulen esta conexión.

-Si tiene dudas sobre el funcionamiento del interruptor recurra a su fabricante. No experimente ni haga ensayos por su cuenta.

-Si tiene dudas sobre si su instalación eléctrica está en condiciones para instalar un interruptor diferencial, recurra a personal idóneo para que la revise y determine su correcta instalación.

## ADVERTENCIAS:

-Este producto ha sido diseñado y desarrollado para prestar servicio de acuerdo con lo especificado anteriormente. Cualquier otra aplicación que no se encuadre dentro de lo explicado corre por cuenta del usuario.

INDUSTRIAS SICA S.A.I.C. se reserva el derecho de modificar la información anterior sin previo aviso.

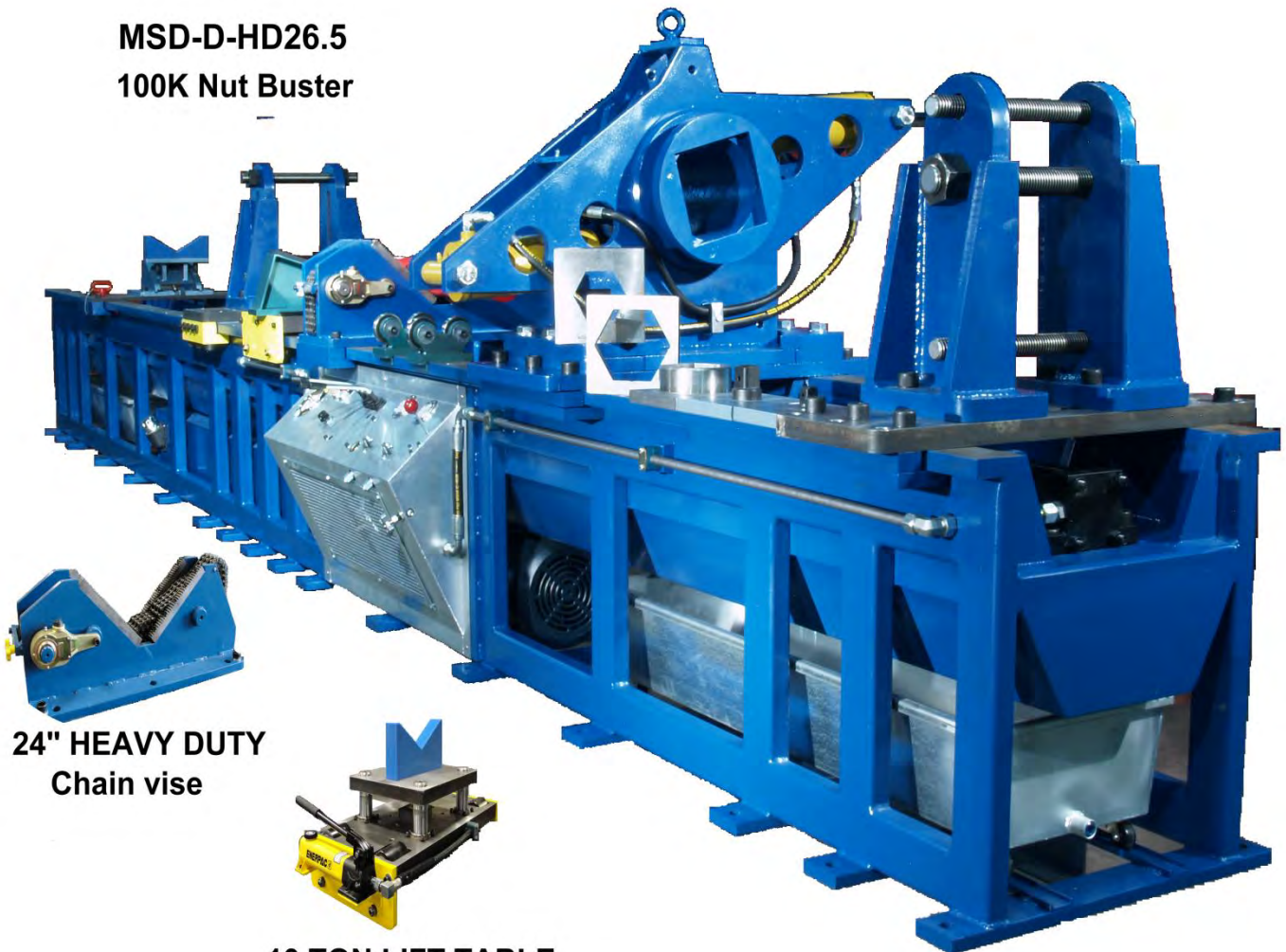
Importa y distribuye: **INDUSTRIAS SICA S.A.I.C.**  
Av. 25 DE MAYO 1200 - (B1824NMY) - Lanús Oeste  
PROV. de Buenos Aires - ARGENTINA  
[www.sicaelec.com](http://www.sicaelec.com)

Teléfono de Atención  
al Cliente: **4357-5034**



# HEAVY DUTY & STANDARD CYLINDER REPAIR MACHINE. OPERATIONS MANUAL

**MSD-D-HD26.5  
100K Nut Buster**



**24" HEAVY DUTY  
Chain vise**

**10 TON LIFT TABLE**

*MSD-D-HD 26.5 HEAVY DUTY*

## ***Machine Spec Sheet.***

Model Number	D-15	D-20	D-25	D-30	HD-26.5	HD-38.5	HD-45
Machine Length	15 feet	20 feet	25 feet	30 feet	26.5 feet	38.5 feet	45 feet
Machine Floor Space	30" x 180"	30" x 240"	30" x 300"	30" x 360"	30" x 318"	30" x 462"	30" x 540"
Max Cylinder Length	96"	150"	210"	270"	228"	372"	450"
Max Cylinder Diameter	12"	12"	12"	12"	24"	24"	24"
Hydraulic Power units	15 HP 18 GPM	15HP 18 GPM	15HP 18 GPM	15HP 18 GPM	30HP 30 GPM	30HP 30 GPM	30HP 30 GPM
Pressure Booster	yes	yes	yes	yes	yes	yes	yes
Hydraulic Reservoirs	A	A,B	A & B	A, B,C	A,B,C,	A,B,C,D	A,B,C,D
Maximum Nut Buster Size	50K	50K	50K	50K	100K	100K	100K
Cylinder Pull a Part	yes	yes	yes	yes			
Automatic Pull a Part					yes	yes	yes
Chain Vise Capacity	8"	8"	8"	8"	24" & 30"	24" & 30"	24" & 30"

### **Hydraulic Reservoirs:**

A= 40 gallons  
 B= 114 gallons  
 C= 214 gallons  
 D= 250 gallons

### **Nut Busters:**

Nut Runner force= 2,100 pounds  
 Nut runners, 30,40,50,70,100K Nut Buster.

### **Nut Buster Tooling:**

4.5" Square Impact Socket Driver.  
 AT. Nut Tool 3" to 9" capacity.  
 SAE Hex Plates  
 Metric Hex Plates.  
 Arc Tool.

### **Hydraulic Power Units.**

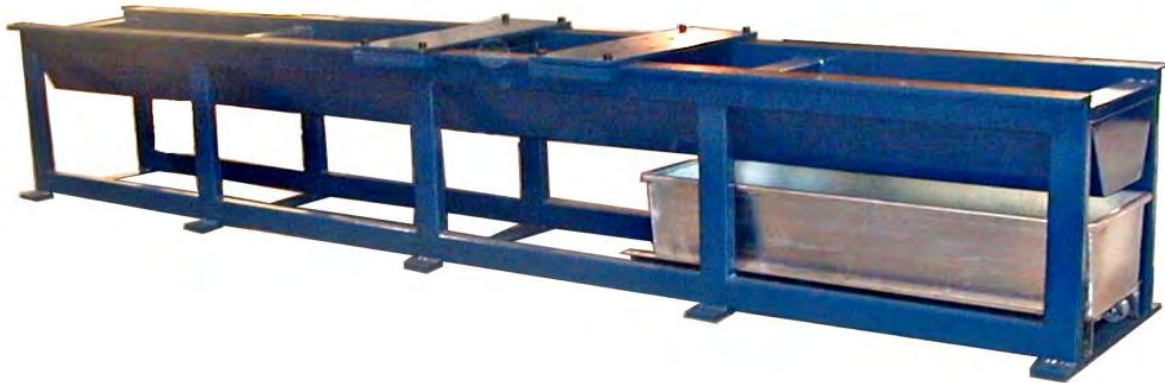
15 HP with 18 GPM Gear pump. Rated for 3000 PSI, Remote pressure control.  
 30 HP motor with 30 GPM piston pump. Rated for 3500 PSI, Remote pressure control.  
 Air operated pressure booster to 5000 PSI.

### **Hydraulic Control Valves.**

Two spool valve for Nut Buster control and cylinder test.  
 Two spool valve and selector valve, for Nut Buster control and  
 Cylinder pull a part and cylinder test.  
 Electric control valves with Pendant control.

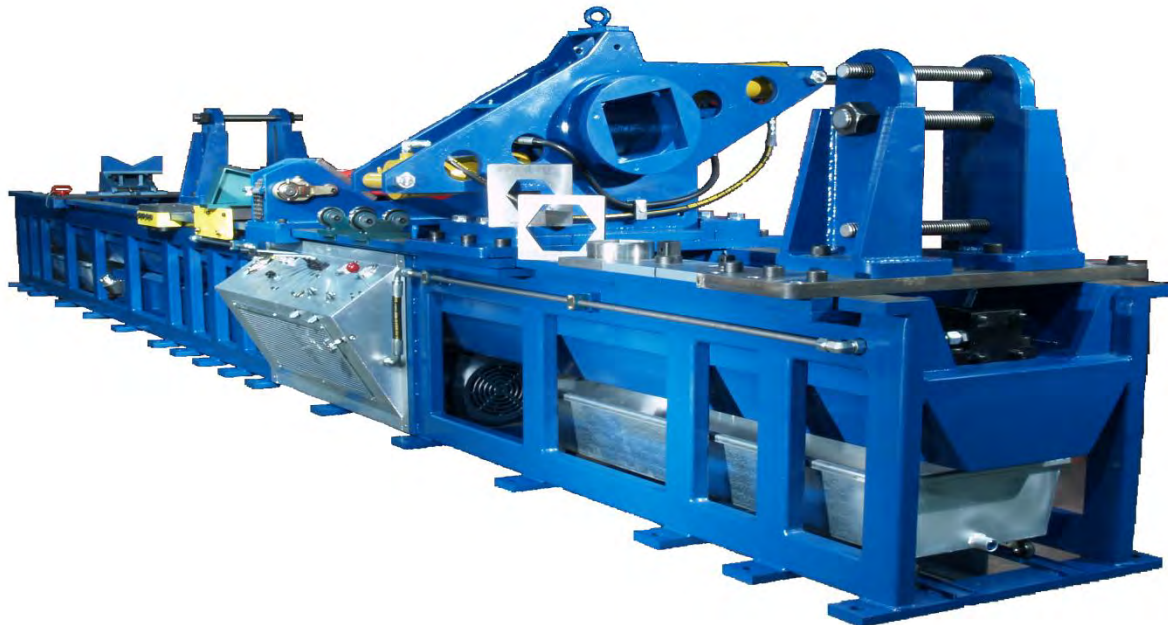
***Standard Duty  
Disassembly Fixture***

Standard Disassembly Machine.  
Rated for 1000 Pounds per foot.  
Available in 15,20,25,30 foot lengths  
Maximum Nut Buster size is 50K  
Available 18 GPM Power unit to 3000 PSI  
Pressure Booster to 5000 PSI  
Reservoirs 40, 100, Gallons



***Heavy Duty  
Disassembly Fixture***

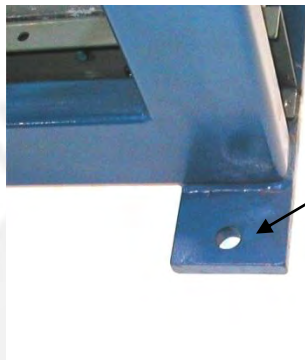
Heavy Duty Disassembly Machine  
Rated for 2000 Pounds Per foot.  
Available in 26.5, 38.5 & 45 foot  
Maximum Nut Buster size 100K  
Available with 30 GPM Power Unit to 3500 PSI  
Pressure Booster to 5000 PSI  
Reservoirs: up to 250 Gallons





## ***Disassembly fixture installation.***

The table is designed to be bolted to the floor. The table legs are drilled for a 1 1/8" diameter to allow the installer to drill a 3/4" diameter hole right thru the leg mounting hole. We have designed the frame to provide maximum rigidity, but cannot be responsible for damages to the frame if the machine is operated without attaching it to the floor. We suggest using US Anchor Co or any equivalent anchor system. Drill and install 3/4"-10 x 7.0 inch long mounting bolts.



3/4" DIAMETER  
MOUNTING HOLES  
ON EACH LEGG



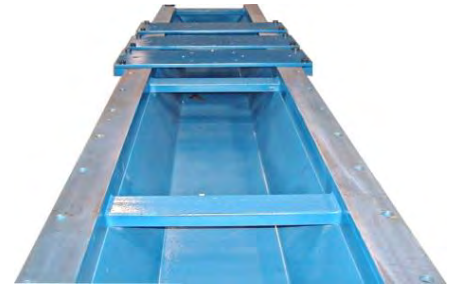
Pull Anchor 3/4"- 10 x 7" long.



Anchor Bolts in position.

## *The Disassembly fixture features*

1. The full-length 10ga. Collector pan in the frame helps keep your shop clean and promotes safety by eliminating spillage while disassembling components. Keeping the pan clean and free of tools will increase efficiency and safety.
2. A 10ga. Roll out Drain pan, supported on a section of roller conveyor, rolls out for easy disposal of waste oil. This tank is also used to capture oil from an overhung cylinder head during disassembly. The **pan should be rolled back after use** thus eliminating a safety hazard and maintaining a clean and dry working area. This pan must be manually drained when it fills. We suggest an inexpensive centrifugal pump to pump the fluid to a waste container. The pan can also be rolled out of the frame and manually emptied



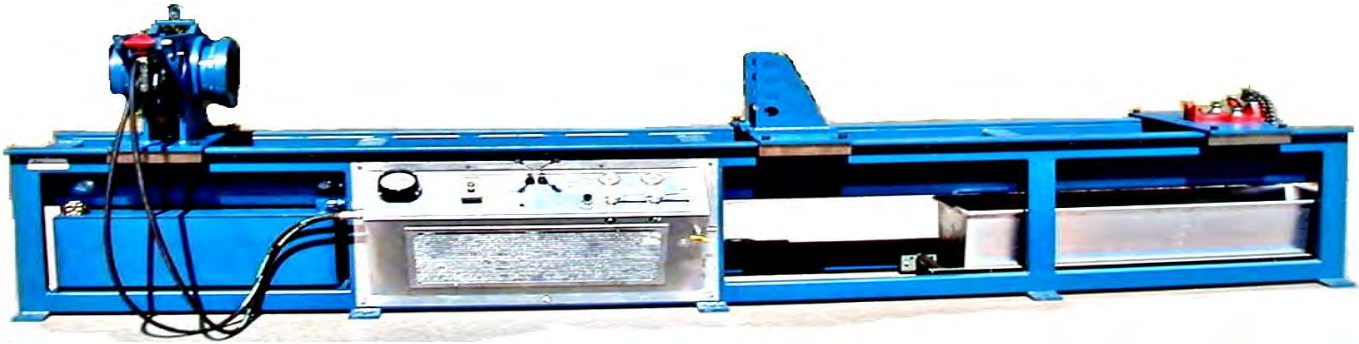
3. The fixture is supplied with two (2) 32" x 12" x 3/4" sliding support plates (Slide Plates). These plates are predrilled for the following; "Ridgid" and "Reed" chain vises, brace tooling, vise elevator, hold down tooling and a disassembly (pull-apart) cylinder. Plates can be slid along the full length of the fixture. They can be secured at any place by tightening the four attached Allen head cap screws, or locked in place with a bolt placed through the predrilled holes in the frame and slide plate for maximum strength. **It is strongly recommended that the slide plates are secured with the Allen bolts at all times except when the cylinders are being pulled apart or nuts run off.** See the section on Slide Plates for operating instructions.





## *Integrated Power Unit*

### MSD-PU



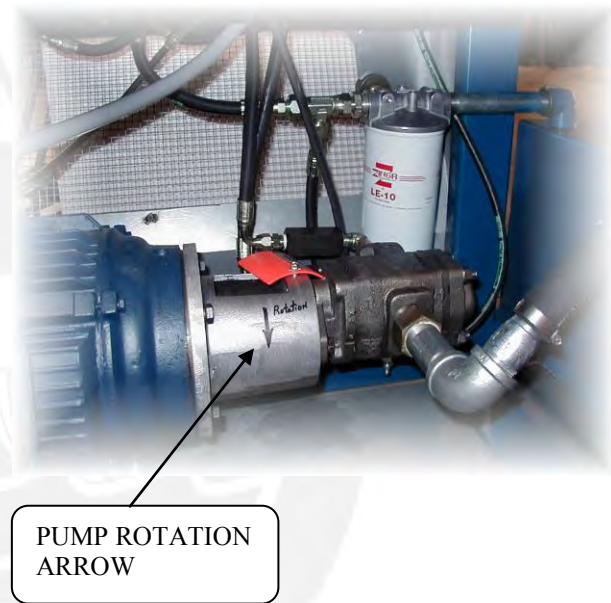
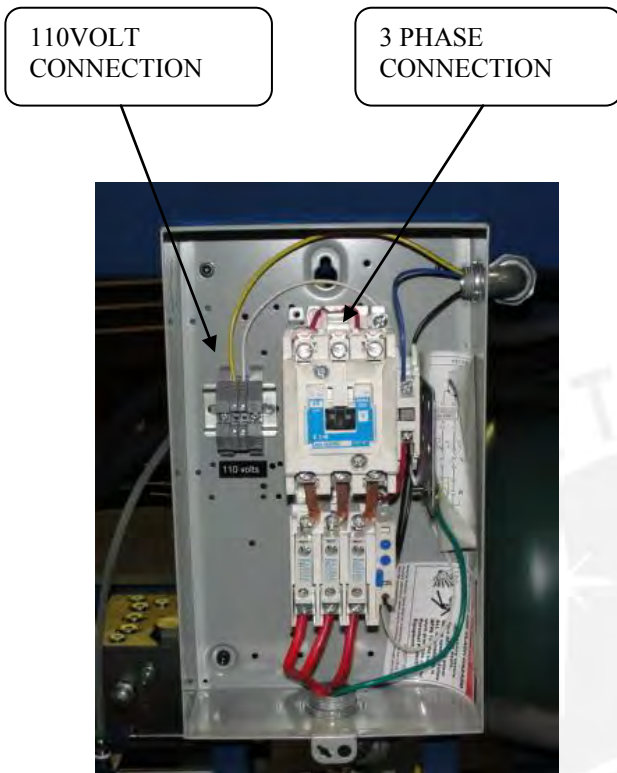
The standard MS&D disassembly table has the option of a built in power unit. The power unit consists of a 40 gal. Reservoir, 15hp. 3 phase motor and starter, a 2 stage gear pump that will develop 18 gpm and 3000psi. This power unit can be used to power the “Nut Buster” and pressure test cylinders being repaired. Phase converters are available for single phase operation.

### CONTROL PANEL



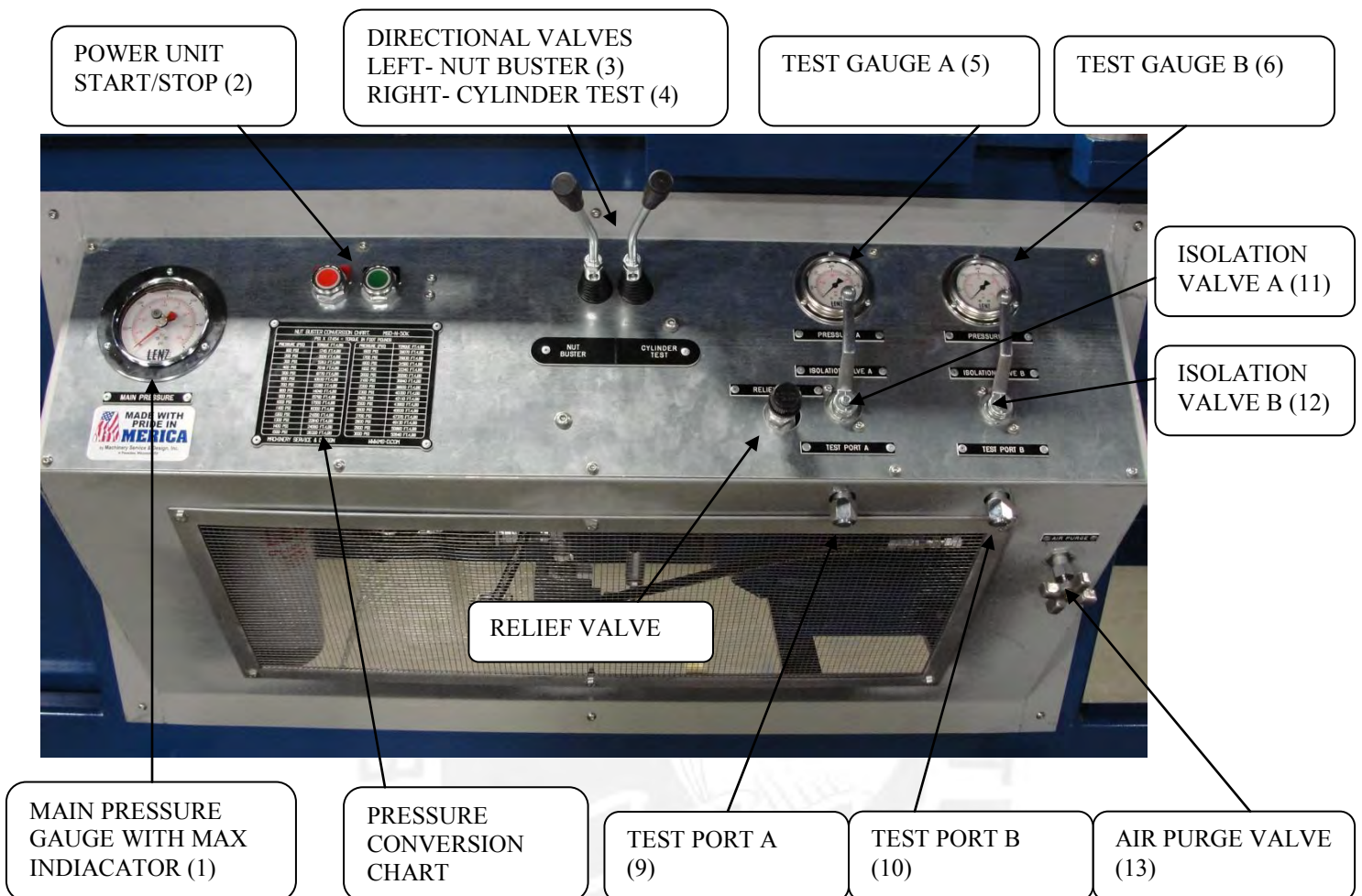
The control panel contains a main pressure gauge (calibrated in ft/lbs of torque), a two-spool control valve, two pressure gauges, adjustable relief valve and isolation valves to check leakage across pistons. High torque nuts can be removed and re-torque with the “Nut Buster” and a “Brace Tool”.

## *Electrical Connections*



1. Each MS&D power unit has been pre-tested and will be wired 220V or 440V, 3 phase according to your instructions. Special units will have different wiring instructions.
2. The three phase main power leads are connected to terminals labeled L1, L2, and L3, at the top of the electrical starter.
3. A 110V power supply is needed for the control circuit of the starter. Connect as shown.
4. Motor rotation is shown on the pump-motor coupler; you should remove the orange cover to check rotation. Rotation is changed by reversing two of the input leads connected to L1, L2, or L3.

## Test Console Description



### *Procedures and Guidelines for Integrated Power Unit*

1. The standard power unit is designed with 15 GPM flow and a maximum pressure of 3000 psi. It has an adjustable relief valve (8) mounted on the control panel to allow the operator to set the pressure to the components at the correct value. Pressure should always be set at the lowest value to get the job done. The relief valve should always be turned down before starting the unit. A pressure gage is mounted on the control panel to show the pressure in the system.
2. The pump is a two-stage gear pump with unloading valve circuit. The pump will deliver 15 GPM at low pressures, and will deliver 4 GPM at pressures above 1000 psi. This is an automatic function within the pump and should not be changed or adjusted. The higher flow is desired to quickly fill up larger cylinders for testing, while the lower flow at high pressures will minimize the power draw and component sizes.
3. The control panel has two handles for the integral directional control valve (3 and 4). The control valve is used to operate the Nut Buster, Pull Apart cylinder and cylinder testing. The hoses can be used from either side of the control valve to operate any of the components. The specific operating instructions are detailed in the individual sections, i.e. testing, Nut Buster etc.
4. The control panel also has two rotating levers to operate the isolation valves (11 and 12). The isolation valves are used to test cylinders, and their operation is described in the section on Cylinder Testing.

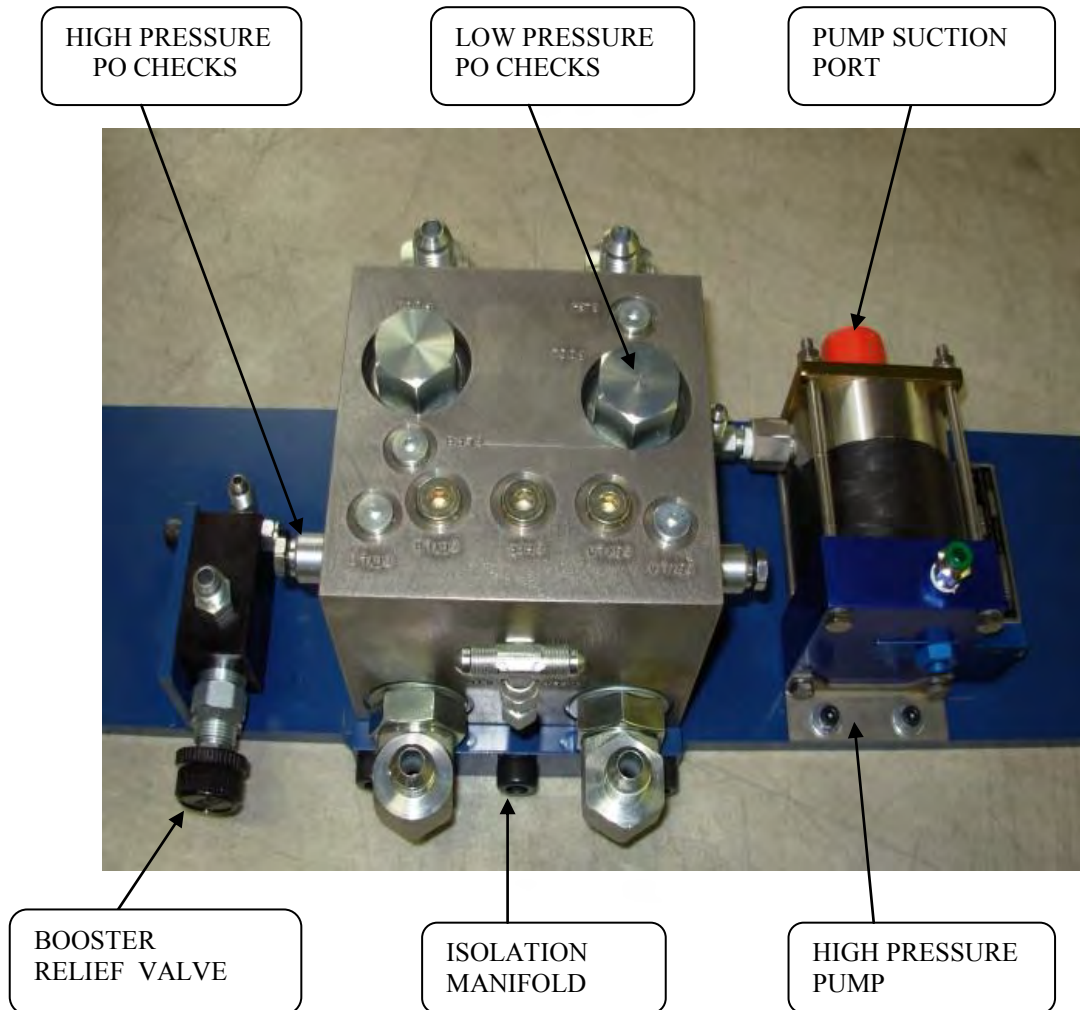


Mounted next to the isolation valves are the cylinder pressure gages (5 and 6), which show the pressure in the line connected to each isolation valve. **Note, due to the location of the isolation valve, under certain circumstances you might build up higher pressures in the cylinder lines than the main relief valve is set for.** Adjust the relief valve to maintain safe pressures in all parts of the system. **Check the two cylinder port gages to be sure that the pressure in the cylinder is not higher than the main system pressure.**

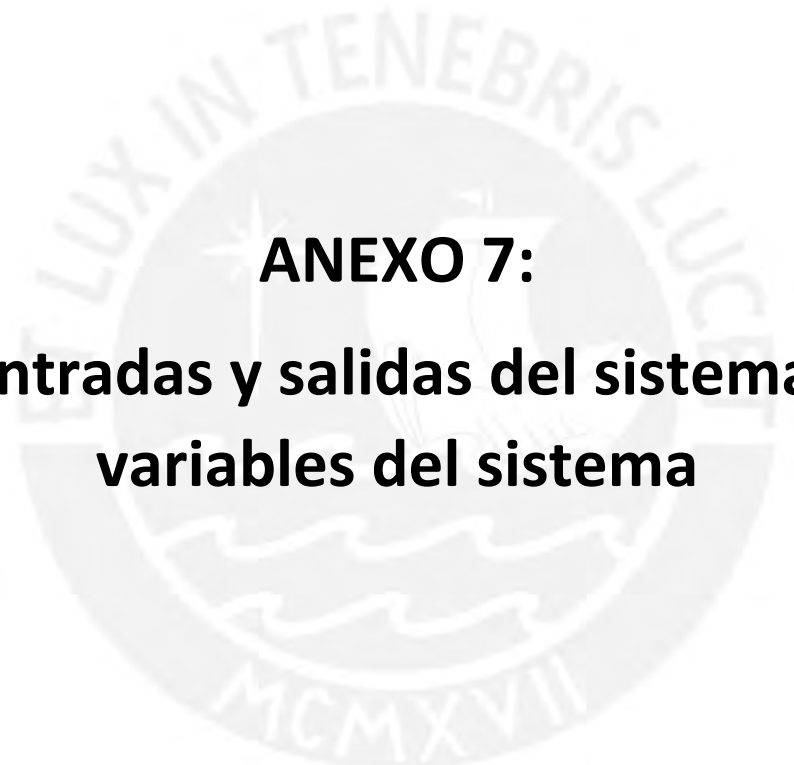
5. A Start stop button (2) on the control panel will be used to turn the unit on and off.
6. **Before starting the unit be sure that the relief valve is backed off.** It is safest to start the power unit under little or no load. By reducing the setting on the relief valve each time, you will minimize the wear and tear on the system and reduce the possibility of excessive system pressure building up. Unexpectedly high-pressure surges from start up could lead to component failure and PSO (pressure squirting out). While the components are selected to handle the pressure in the system, wear, fatigue and improper maintenance can reduce the strength and safety factor of the components. For this reason **we strongly recommend that the relief valve always be turned down when starting the power unit.**
7. A return line filter for the integral power unit is mounted within the disassemble table. Proper maintenance for the filter will assure a long service life for all components. See the bill of materials for your machine to determine the type of filter, elements and recommended replacement intervals.
8. Since each customer will have different facility needs, we do not supply the hoses and fittings for the external connections to the Nut Buster, Pull Apart cylinder, or cylinder testing. The appropriate length hoses should be selected for your application. **All hoses and fittings must be rated for at least 4000 PSI.** We recommend that you use valved quick disconnects for the connections on the hoses to minimize leakage and contamination. We can supply any type, lengths and sizes of hoses and fittings you specify.
9. A purging system is installed on standard power units to help force out oil from the cylinder after testing is completed. An air valve is used to introduce compressed air into the cylinder, which will extend and retract the cylinder and force out the oil from testing. Compressed air can force oil to spray a long distance, so you must shut off the compressed air valve and cycle the directional control valve several times before removing any fittings or hoses. Purging details are included in the test procedures.
10. The torque values for the “Nut Buster” are different for each size “Nut Buster”. An appropriate conversion table for pressure to torque is included for each “Nut Buster”. A conversion table and formula is also located on the front panel. For information on how to use the specific tools and options please check in the sections listed for each unit. Remember; check to be sure that the reference material you select is for the correct unit and options.

## ***Pressure Booster Description.***

Machinery Service & Design offers an Air Operated Pressure booster system to boost static test pressure to 5000 psi. The pressure booster system consists of a High Pressure Air Operated hydraulic pump, isolation manifold and boost pressure relief valve. The booster system is built on a mounting plate and is housed inside the machine frame. The system is installed so that the operator has access to the booster relief valve.







**ANEXO 7:**  
**Entradas y salidas del sistema,**  
**variables del sistema**

## PUERTOS DE ENTRADA Y SALIDA

		Tipo	Descripción	Etiqueta	
Entradas	PC/HMI	Digital	Modelo del cilindro 730	M2.0	
			Modelo del cilindro 830	M2.1	
	Sensores	Analógica	Digital	Parada de emergencia	I0.0
			Analógica	Transductor de presión del cilindro de prueba	IW0
				Transductor de presión del actuador	IW1
				Transductor de caudal del cilindro de prueba	IW2
		Transductor de desplazamiento del cilindro de prueba	IW3		
Salidas	Actuadores	Digital	Bobina de salida on/off cilindro de prueba	Q0.0	
			Bobina de ingreso on/off cilindro de prueba	Q0.1	
			Bobina de ingreso on/off del actuador	Q0.2	
			Bobina de salida on/off del actuador	Q0.3	
			Bobina de conexión del transmisor de caudal	Q0.4	
			Analógica	Valvula limitadora de presión proporcional del cilindro de prueba	AW0
		Valvula limitadora de presión proporcional del actuador		AW1	
		Válvula de conexión proporcional del actuador		AW2	
		Adicional	HMI	Ethernet	Puerto Ethernet

## VARIABLES DEL SISTEMA

	DESCRIPCIÓN	TIPO	ETIQUETA
VARIABLES DEL SISTEMA	EXTENDER ACTUADOR PARA MONTAJE	Bool	M0.0
	INICIO DE PRUEBA	Bool	M0.1
	FIN DE CARRERA: CILINDRO DE PRUEBA TOTALMENTE EXTENDIDO	Bool	M0.2
	FIN DE CARRERA: CILINDRO DE PRUEBA TOTALMENTE CONTRAÍDO	Bool	M0.3
	ACTUADOR AVANZANDO	Bool	M0.4
	ACTUADOR RETROCEDIENDO	Bool	M0.5
	CILINDRO AVANZANDO	Bool	M0.6
	CILINDRO RETROCEDIENDO	Bool	M0.7
	PRESIÓN DE PRUEBA ALCANZADA	Bool	M1.0
	CICLO DE DESPLAZAMIENTO TERMINADO	Bool	M1.1
	SENTIDO DE DESPLAZAMIENTO	Bool	M1.2
	SISTEMA EN REPOSO	Bool	M1.5
	CONFIRMAR INICIAR CICLO DE PRUEBA	Bool	M21.0
	TIEMPO DE PRUEBA	Time	MD1
	LONGITUD DEL CILINDRO EXTENDIDO	Real	MD2
	LONGITUD DEL CILINDRO CONTRAÍDO	Real	MD3
	DATO PRESIÓN MÁXIMA DE OPERACIÓN CILINDRO DE PRUEBA	Real	MD4
	DATO PRESIÓN MÁXIMA DE OPERACIÓN ACTUADOR	Real	MD5
	DATO PRESIÓN DE PRUEBA PARA FUGAS EXTERNAS	Real	MD6
	DATO DE CARGA DEL CILINDRO	Real	MD7
	DATO DE FUGA INTERNA	Real	MD8
	DATO DE FUGA EXTERNA	Real	MD9
	FUERZA DEL ACTUADOR	Real	MD10
	FUGAS INTERNAS	Real	MD11
	FUGAS EXTERNAS	Real	MD12
	PRUEBA TERMINADA	Real	M21.4
	PRESIÓN EN CILINDRO REAL	Real	MD14
	PRESIÓN EN ACTUADOR REAL	Real	MD15
	LONGITUD DEL CILINDRO REAL	Real	MD16
	CAUDAL DE RETORNO REAL	Real	MD17
	PRESIÓN EN VÁLVULA LIMITADORA CILINDRO DE PRUEBA	Real	MD22
	PRESIÓN EN VÁLVULA LIMITADORA ACTUADOR	Real	MD26
	PRESIÓN EN VÁLVULA DE CONEXIÓN ACTUADOR	Real	MD30
	PRESIÓN FINAL DE PRUEBA FE	Real	MD34



**ANEXO 9:**  
**Programación del controlador**

## Main

### Main Propiedades

#### General

<b>Nombre</b>	Main	<b>Número</b>	1	<b>Tipo</b>	OB.ProgramCycle	<b>Idioma</b>	KOP
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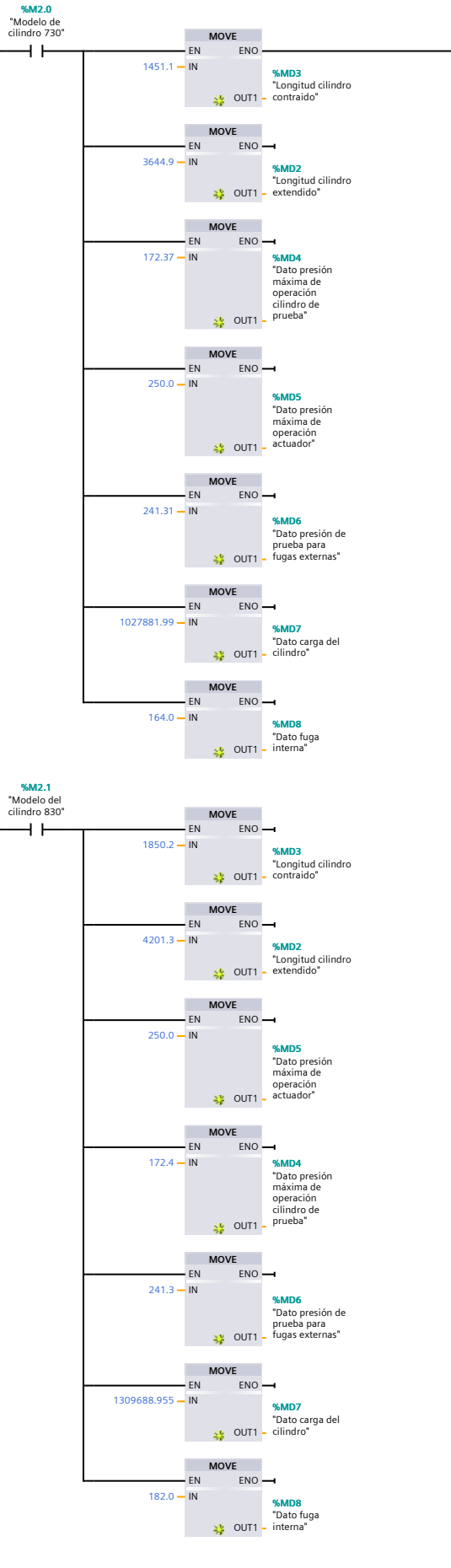
#### Información

<b>Título</b>	"Main Program Sweep (Cycle)"	<b>Autor</b>		<b>Comentario</b>		<b>Familia</b>	
<b>Versión</b>	0.1	<b>ID personalizada</b>					

Nombre	Tipo de datos	Offset	Comentario
▼ Temp			
FIN DE PRUEBA FI	Bool		

### Segmento 1:

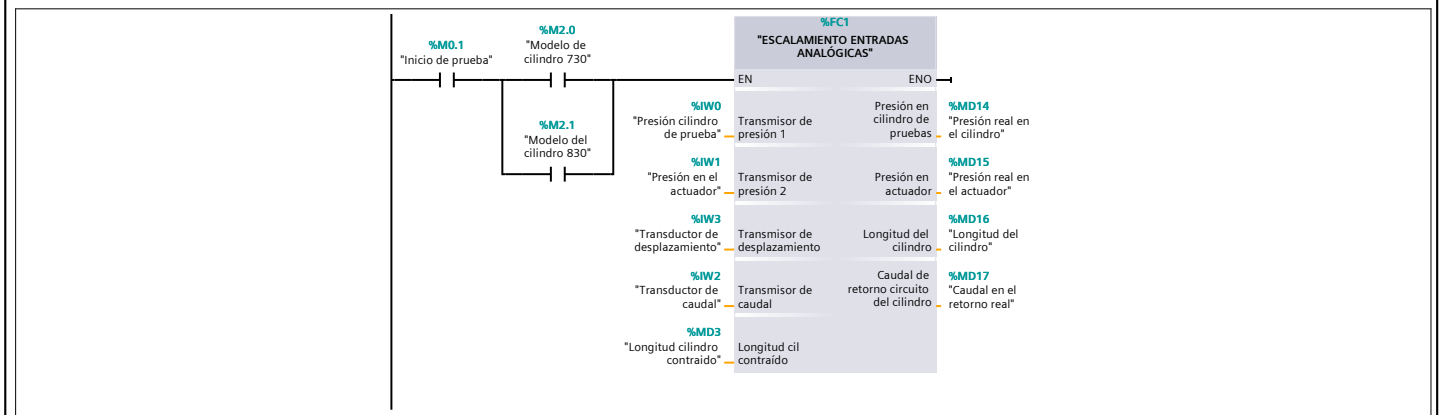




Símbolo	Dirección	Tipo	Comentario
"Modelo de cilindro 730"	%M2.0	Bool	
"Modelo del cilindro 830"	%M2.1	Bool	
1451.1	1451.1	LReal	
"Longitud cilindro contraido"	%MD3	Real	

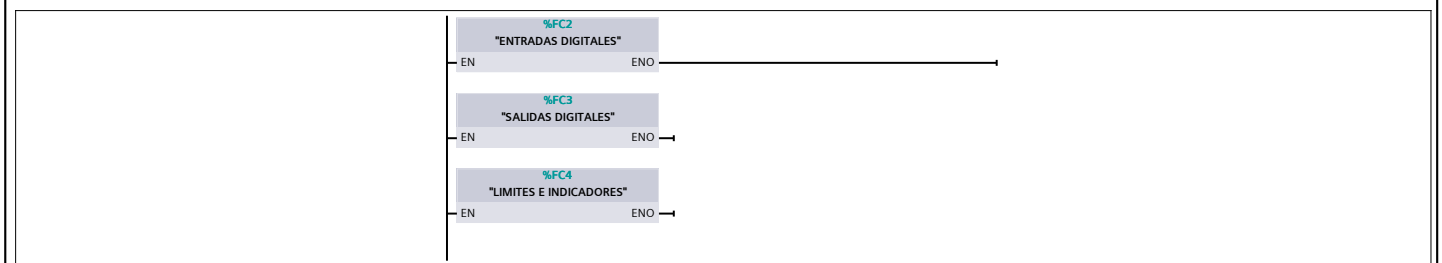
Símbolo	Dirección	Tipo	Comentario
3644.9	3644.9	LReal	
"Longitud cilindro extendido"	%MD2	Real	
172.37	172.37	LReal	
"Dato presión máxima de operación cilindro de prueba"	%MD4	Real	
250.0	250.0	LReal	
"Dato presión máxima de operación actuador"	%MD5	Real	
241.31	241.31	LReal	
"Dato presión de prueba para fugas externas"	%MD6	Real	
1027881.99	1027881.99	LReal	
"Dato carga del cilindro"	%MD7	Real	
164.0	164.0	LReal	
"Dato fuga interna"	%MD8	Real	
1850.2	1850.2	LReal	
4201.3	4201.3	LReal	
172.4	172.4	LReal	
241.3	241.3	LReal	
1309688.955	1309688.955	LReal	
182.0	182.0	LReal	

**Segmento 2:**



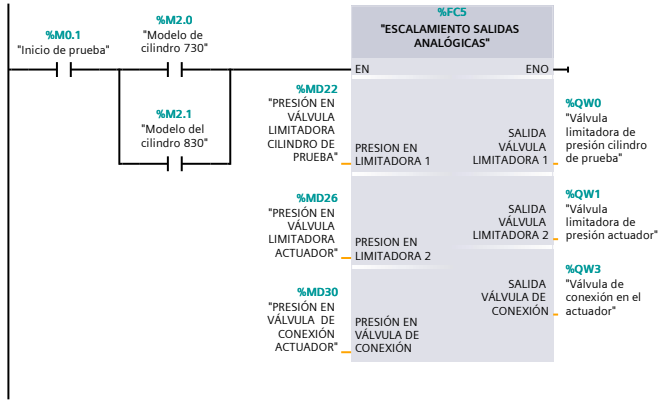
Símbolo	Dirección	Tipo	Comentario
"Modelo de cilindro 730"	%M2.0	Bool	
"Modelo del cilindro 830"	%M2.1	Bool	
"Longitud cilindro contraído"	%MD3	Real	
"ESCALAMIENTO ENTRADAS ANALÓGICAS"	%FC1	Block_FC	
"Presión cilindro de prueba"	%IW0	Int	
"Presión en el actuador"	%IW1	Int	
"Transductor de desplazamiento"	%IW3	Int	
"Inicio de prueba"	%M0.1	Bool	
"Transductor de caudal"	%IW2	Int	
"Presión real en el cilindro"	%MD14	Real	
"Presión real en el actuador"	%MD15	Real	
"Longitud del cilindro"	%MD16	Real	
"Caudal en el retorno real"	%MD17	Real	

**Segmento 3:**



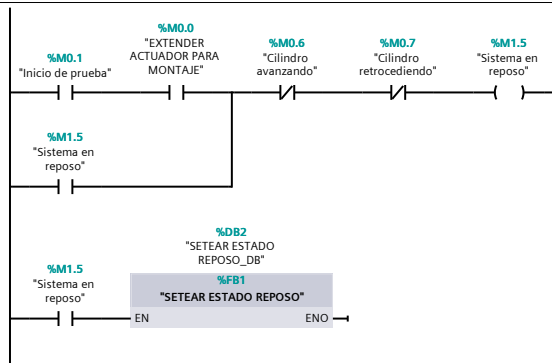
Símbolo	Dirección	Tipo	Comentario
"ENTRADAS DIGITALES"	%FC2	Block_FC	
"SALIDAS DIGITALES"	%FC3	Block_FC	
"LIMITES E INDICADORES"	%FC4	Block_FC	

**Segmento 4:**



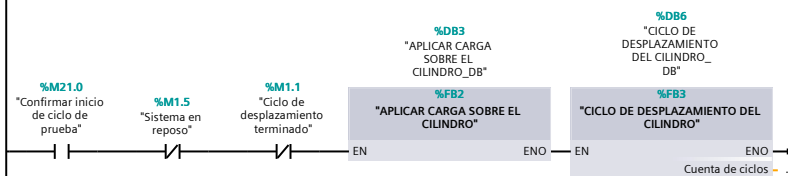
Símbolo	Dirección	Tipo	Comentario
"Modelo de cilindro 730"	%M2.0	Bool	
"Modelo del cilindro 830"	%M2.1	Bool	
"Inicio de prueba"	%M0.1	Bool	
"ESCALAMIENTO SALIDAS ANALÓGICAS"	%FC5	Block_FC	
"PRESIÓN EN VÁLVULA LIMITADORA CILINDRO DE PRUEBA"	%MD22	Real	
"PRESIÓN EN VÁLVULA LIMITADORA ACTUADOR"	%MD26	Real	
"PRESIÓN EN VÁLVULA DE CONEXIÓN ACTUADOR"	%MD30	Real	
"Válvula limitadora de presión cilindro de prueba"	%QW0	Int	
"Válvula limitadora de presión actuador"	%QW1	Int	
"Válvula de conexión en el actuador"	%QW3	Int	

Segmento 5:



Símbolo	Dirección	Tipo	Comentario
"Inicio de prueba"	%M0.1	Bool	
"Cilindro avanzando"	%M0.6	Bool	
"Cilindro retrocediendo"	%M0.7	Bool	
"EXTENDER ACTUADOR PARA MONTAJE"	%M0.0	Bool	
"Sistema en reposo"	%M1.5	Bool	
"SETEAR ESTADO REPOSO"	%FB1	Block_FB	
"SETEAR ESTADO REPOSO_DB"	%DB2	Block_FB	

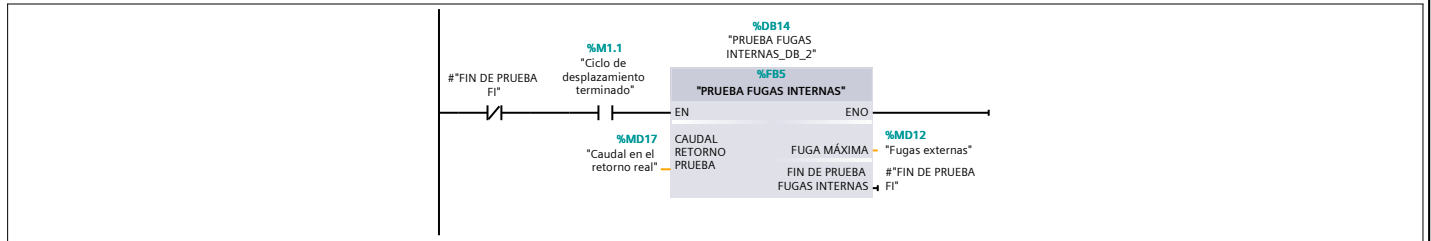
Segmento 6:



Símbolo	Dirección	Tipo	Comentario
"Sistema en reposo"	%M1.5	Bool	
"Confirmar inicio de ciclo de prueba"	%M21.0	Bool	
"APLICAR CARGA SOBRE EL CILINDRO"	%FB2	Block_FB	
"APLICAR CARGA SOBRE EL CILINDRO_DB"	%DB3	Block_FB	

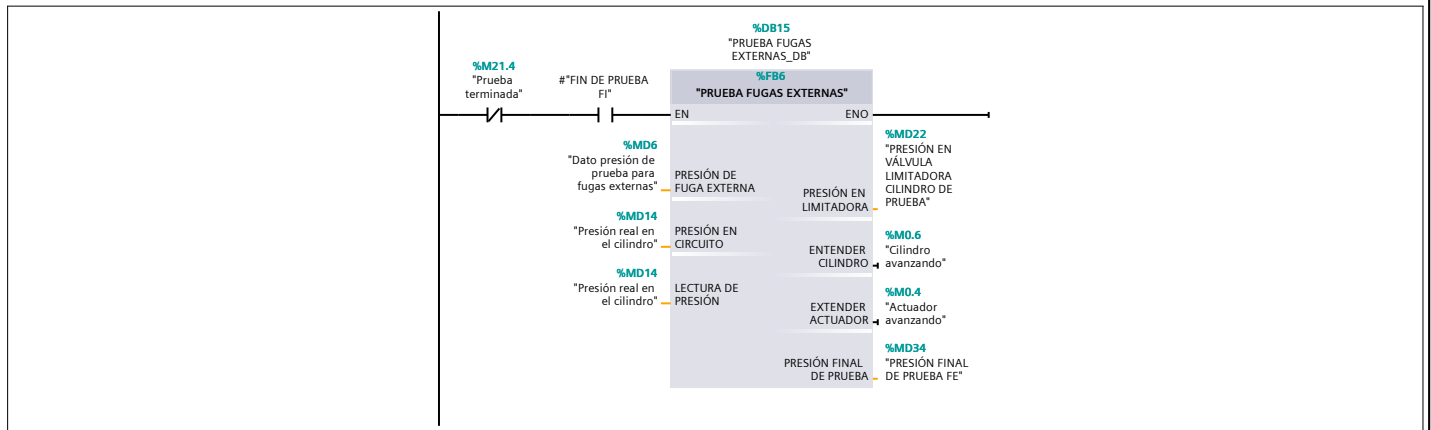
Símbolo	Dirección	Tipo	Comentario
"CICLO DE DESPLAZAMIENTO DEL CILINDRO"	%FB3	Block_FB	
"CICLO DE DESPLAZAMIENTO DEL CILINDRO_DB"	%DB6	Block_FB	
"Ciclo de desplazamiento terminado"	%M1.1	Bool	

**Segmento 7:**



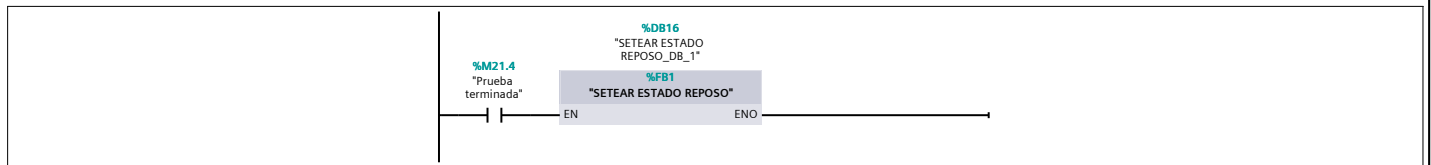
Símbolo	Dirección	Tipo	Comentario
"Caudal en el retorno real"	%MD17	Real	
"Ciclo de desplazamiento terminado"	%M1.1	Bool	
"PRUEBA FUGAS INTERNAS"	%FB5	Block_FB	
"PRUEBA FUGAS INTERNAS_DB_2"	%DB14	Block_FB	
"Fugas externas"	%MD12	Real	
"#FIN DE PRUEBA FI"		Bool	

**Segmento 8:**



Símbolo	Dirección	Tipo	Comentario
"Dato presión de prueba para fugas externas"	%MD6	Real	
"Presión real en el cilindro"	%MD14	Real	
"PRESIÓN EN VÁLVULA LIMITADORA CILINDRO DE PRUEBA"	%MD22	Real	
"Cilindro avanzando"	%M0.6	Bool	
"#FIN DE PRUEBA FI"		Bool	
"PRUEBA FUGAS EXTERNAS"	%FB6	Block_FB	
"PRUEBA FUGAS EXTERNAS_DB"	%DB15	Block_FB	
"Actuador avanzando"	%M0.4	Bool	
"PRESIÓN FINAL DE PRUEBA FE"	%MD34	Real	
"Prueba terminada"	%M21.4	Bool	

**Segmento 9:**



Símbolo	Dirección	Tipo	Comentario
"SETEAR ESTADO REPOSO"	%FB1	Block_FB	
"Prueba terminada"	%M21.4	Bool	
"SETEAR ESTADO REPOSO_DB_1"	%DB16	Block_FB	

## ESCALAMIENTO ENTRADAS ANALÓGICAS

### ESCALAMIENTO ENTRADAS ANALÓGICAS Propiedades

#### General

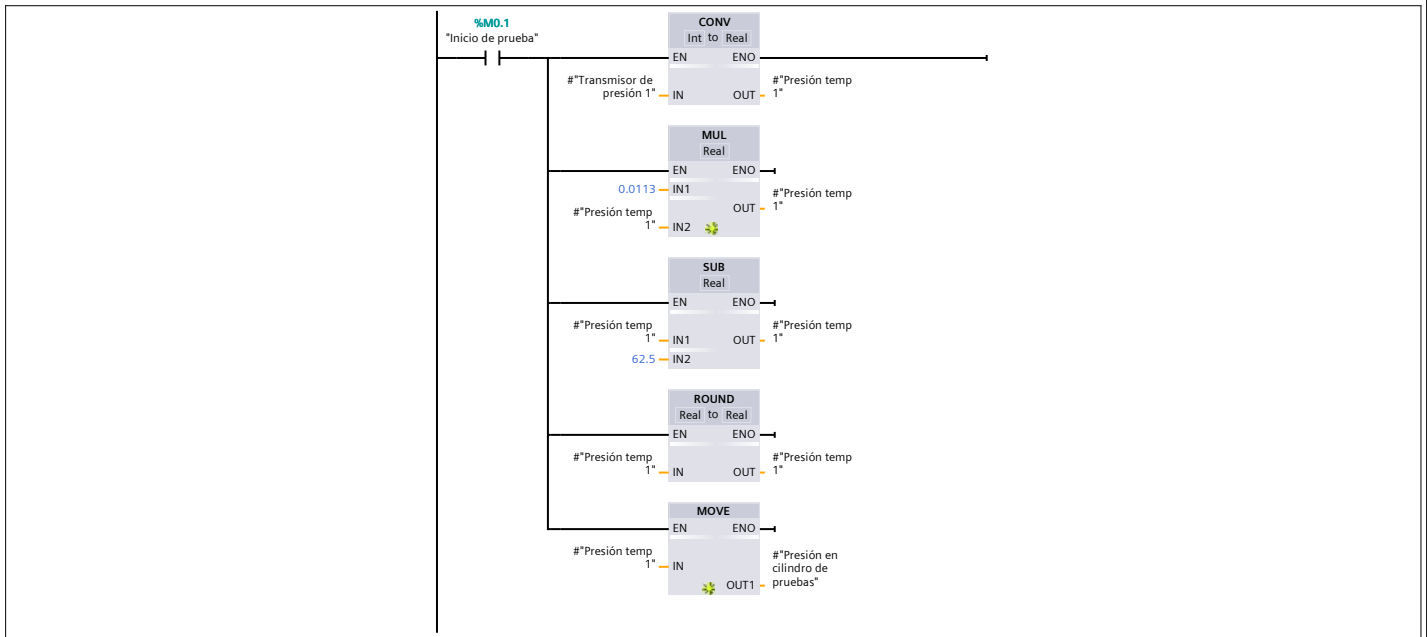
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#### Información

<b>Título</b>		<b>Autor</b>		<b>Comentario</b>		<b>Familia</b>	
<b>Versión</b>	0.1	<b>ID personalizada</b>					

Nombre	Tipo de datos	Offset	Comentario
▼ Input			
Transmisor de presión 1	Int		
Transmisor de presión 2	Int		
Transmisor de desplazamiento	Int		
Transmisor de caudal	Int		
Longitud cil contraído	Real		
▼ Output			
Presión en cilindro de pruebas	Real		
Presión en actuador	Real		
Longitud del cilindro	Real		
Caudal de retorno circuito del cilindro	Real		
InOut			
▼ Temp			
Presión temp 1	Real		
Presión temp 2	Real		
Posición temp	Real		
Caudal temp	Real		
▼ Return			
Ret_Val	Void		

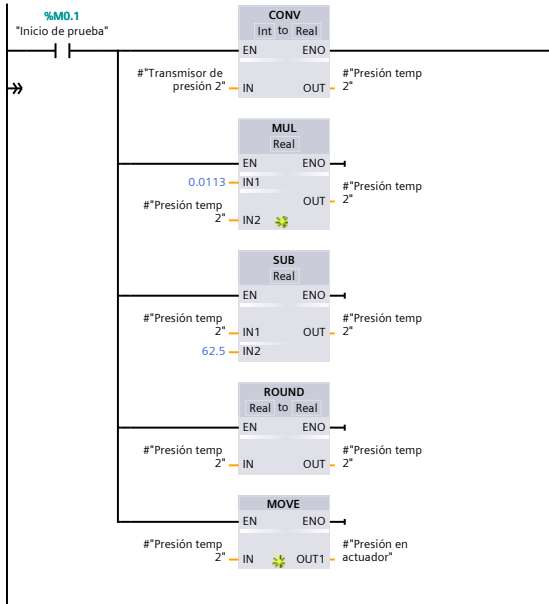
#### Segmento 1:



Símbolo	Dirección	Tipo	Comentario
"Inicio de prueba"	%M0.1	Bool	
"#Transmisor de presión 1"		Int	
"#Presión temp 1"		Real	
0.0113	0.0113	LReal	
62.5	62.5	LReal	
"#Presión en cilindro de pruebas"		Real	

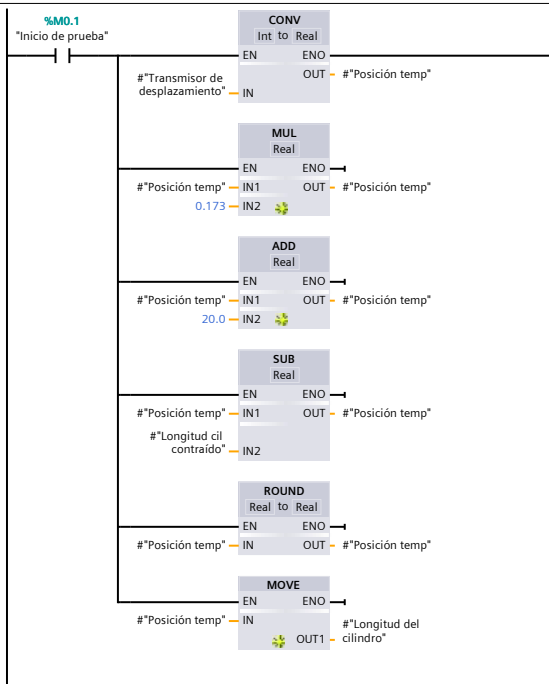
#### Segmento 2:





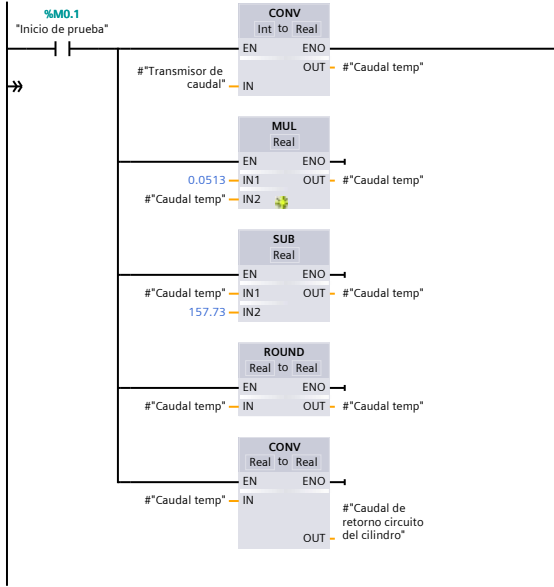
Símbolo	Dirección	Tipo	Comentario
"Inicio de prueba"	%M0.1	Bool	
0.0113	0.0113	LReal	
62.5	62.5	LReal	
"#Transmisor de presión 2"		Int	
"#Presión temp 2"		Real	
"#Presión en actuador"		Real	

Segmento 3:



Símbolo	Dirección	Tipo	Comentario
"Inicio de prueba"	%M0.1	Bool	
"#Transmisor de desplazamiento"		Int	
"#Posición temp"		Real	
0.173	0.173	LReal	
20.0	20.0	LReal	
"#Longitud cil contraído"		Real	
"#Longitud del cilindro"		Real	

Segmento 4:



Símbolo	Dirección	Tipo	Comentario
"Inicio de prueba"	%M0.1	Bool	
"#Transmisor de caudal"		Int	
"#Caudal temp"		Real	
0.0513	0.0513	LReal	
157.73	157.73	LReal	
"#Caudal de retorno circuito del cilindro"		Real	

## CICLO DE DESPLAZAMIENTO DEL CILINDRO [FB3]

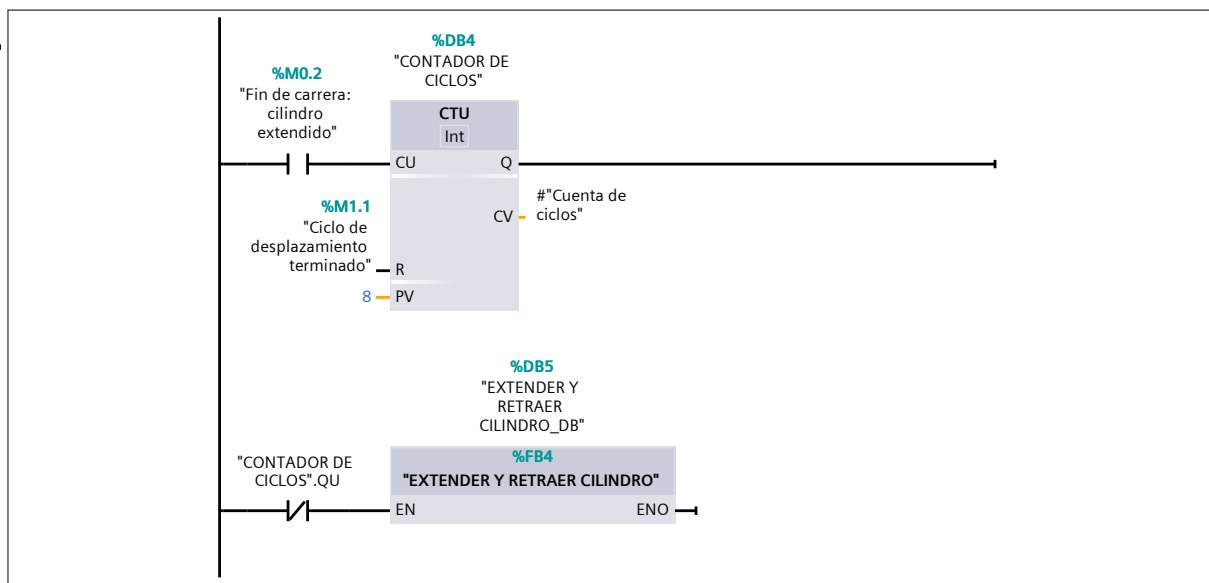
### CICLO DE DESPLAZAMIENTO DEL CILINDRO Propiedades

#### General

Nombre	CICLO DE DESPLAZAMIENTO DEL CILINDRO	Número	3
Tipo	FB	Idioma	KOP
<b>Información</b>			
Título		Autor	
Comentario		Familia	
Versión	0.1	ID personalizada	

Nombre	Tipo de datos	Offset	Valor predet.	Remanencia	Accesible desde HMI	Visible en HMI	Comentario
Input							
▼ Output							
Cuenta de ciclos	Int		0	No remanente	True	True	
InOut							
Static							
Temp							

### Segmento 1:



Símbolo	Dirección	Tipo	Comentario
"CONTADOR DE CI-CLOS"	%DB4	IEC_Counter	
"Fin de carrera: cilindro extendido"	%M0.2	Bool	

Owner	Project name	Tesis1	Date	10/11/2015
Operator	Project Path	C:\Users\HP\Documents\Automation\Tesis1		
Designed By	Location			
Checked By	Description 1st			
Approved By	Description 2nd	Language	es-ES	
	1st View	Version	Sheet 1 - 1	

1

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4

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Símbolo	Dirección	Tipo	Comentario
"Ciclo de desplazamiento terminado"	%M1.1	Bool	
8	8	Int	
"#Cuenta de ciclos"		Int	
"CONTADOR DE CICLOS"	%DB4	IEC_Counter	
"CONTADOR DE CICLOS".QU		Bool	
"EXTENDER Y RETRAER CILINDRO"	%FB4	Block_FB	
"EXTENDER Y RETRAER CILINDRO_DB"	%DB5	Block_FB	

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Owner	Project name	Tesis1	Date	10/11/2015
Operator	Project Path C:\Users\HP\Documents\Automation\Tesis1			
Designed By	Location			
Checked By	Description 1st	Language es-ES		
Approved By	Description 2nd	1st View	Version	Sheet 1 - 2

# EXTENDER Y RETRAER CILINDRO

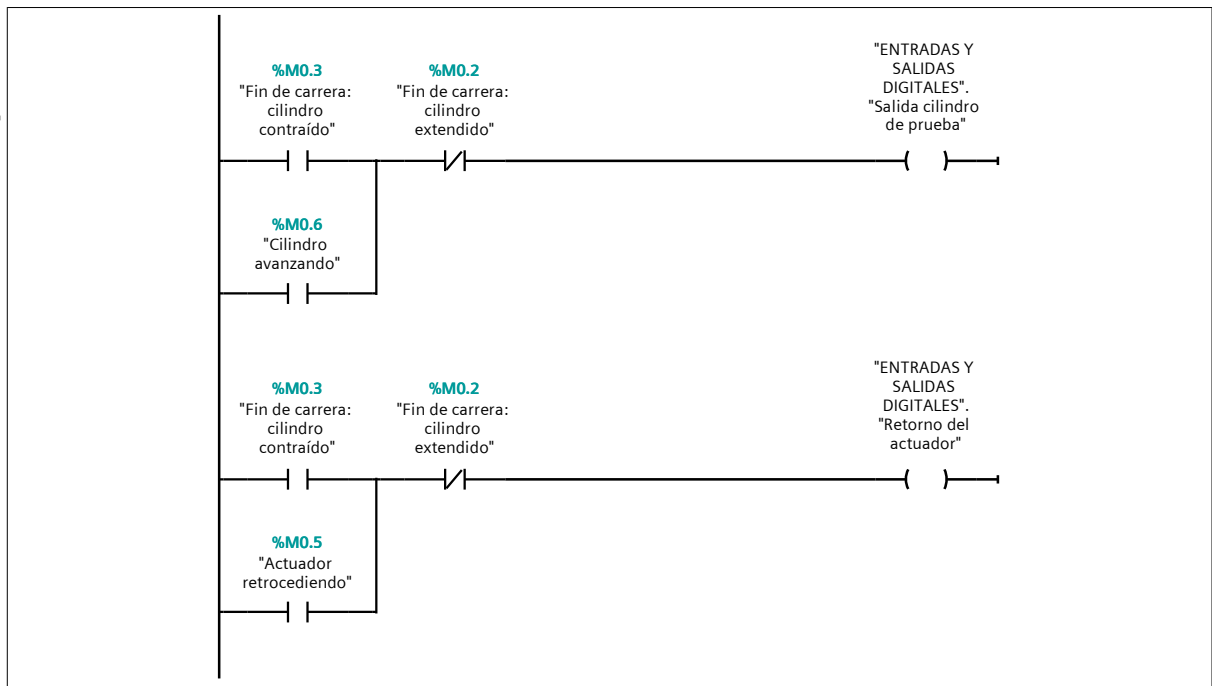
## EXTENDER Y RETRAER CILINDRO Propiedades

### General

Nombre	EXTENDER Y RETRAER CILINDRO	Número	4
Tipo	FB	Idioma	KOP
<b>Información</b>			
Título		Autor	
Comentario		Familia	
Versión	0.1	ID personalizada	

Nombre	Tipo de datos	Offset	Valor predet.	Remanencia	Accesible desde HMI	Visible en HMI	Comentario
Input							
Output							
InOut							
Static							
Temp							

### Segmento 1:



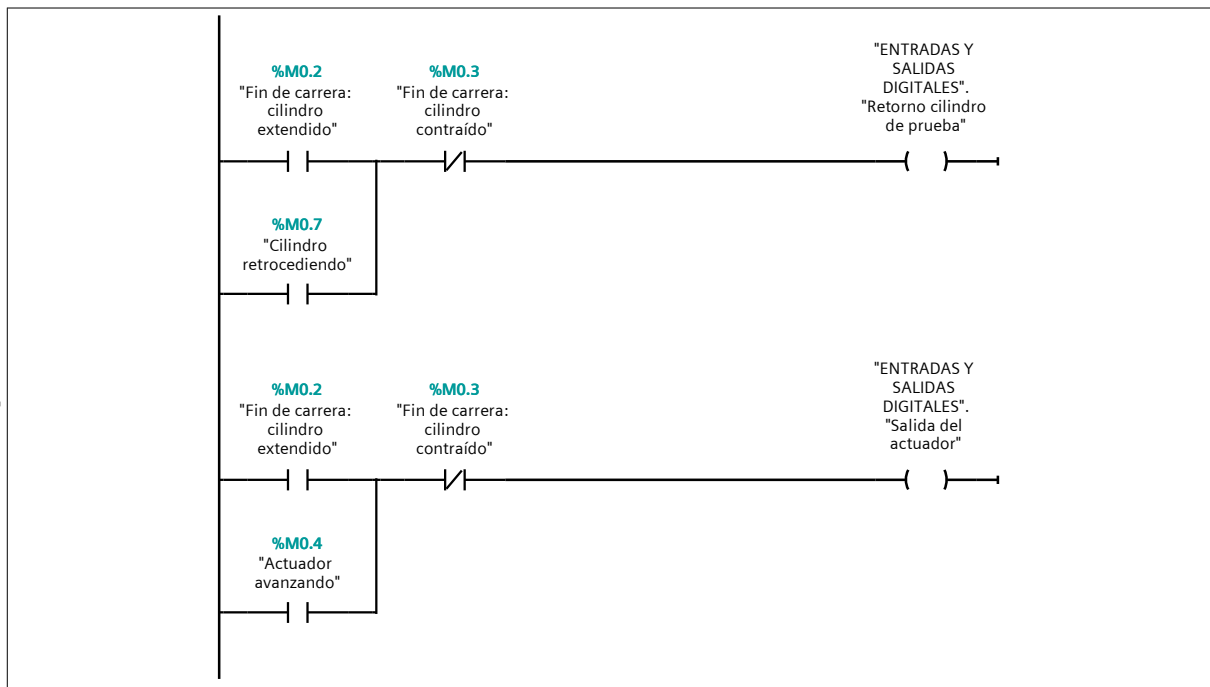
Símbolo	Dirección	Tipo	Comentario
"Fin de carrera: cilindro contraído"	%M0.3	Bool	

Owner	Project name Tesis1	Date 21/06/2016
Operator	Project Path C:\Users\HP\Documents\Automation\Automation ppl\Tesis1	
Designed By	Location	
Checked By	Description 1st	Language es-ES
Approved By	Description 2nd	Version
	1st View	Sheet 1 - 1



Símbolo	Dirección	Tipo	Comentario
"Fin de carrera: cilindro extendido"	%M0.2	Bool	
"ENTRADAS Y SALIDAS DIGITALES"	%DB1	Block_DB	
"ENTRADAS Y SALIDAS DIGITALES"."Salida cilindro de prueba"		Bool	
"Cilindro avanzando"	%M0.6	Bool	
"ENTRADAS Y SALIDAS DIGITALES"."Retorno del actuador"		Bool	
"Actuador retrocediendo"	%M0.5	Bool	

### Segmento 2:



Símbolo	Dirección	Tipo	Comentario
"Fin de carrera: cilindro contraído"	%M0.3	Bool	
"Fin de carrera: cilindro extendido"	%M0.2	Bool	
"ENTRADAS Y SALIDAS DIGITALES"	%DB1	Block_DB	
"ENTRADAS Y SALIDAS DIGITALES"."Retorno cilindro de prueba"		Bool	
"Cilindro retrocediendo"	%M0.7	Bool	

Owner	Project name	Tesis1	Date	21/06/2016
	Project Path	C:\Users\HP\Documents\Automation\Automation ppl\Tesis1		
Operator	Location			
	Description 1st			
Designed By	Description 2nd	Language	es-ES	
	1st View	Version	Sheet 1 - 2	

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Símbolo	Dirección	Tipo	Comentario
"ENTRADAS Y SALIDAS DIGITALES". "Salida del actuador"		Bool	
"Actuador avanzando"	%M0.4	Bool	

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Owner	Project name Tesis1	Date 21/06/2016
Operator	Project Path C:\Users\HP\Documents\Automation\Automation pp\Tesis1	
	Location	
Designed By	Description 1st	
Checked By	Description 2nd	Language es-ES
Approved By	1st View	Version
		Sheet 1 - 3

# PRUEBA FUGAS INTERNAS

## PRUEBA FUGAS INTERNAS Propiedades

### General

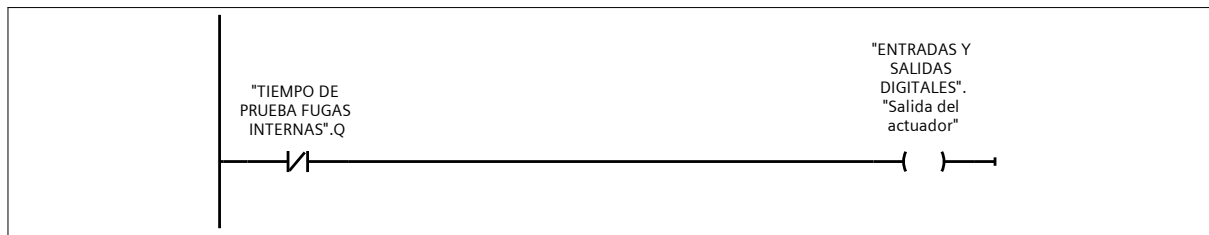
Nombre	PRUEBA FUGAS INTERNAS	Número	5
Tipo	FB	Idioma	KOP

### Información

Título		Autor	
Comentario		Familia	
Versión	0.1	ID personalizada	

Nombre	Tipo de datos	Offset	Valor predet.	Remanencia	Accesible desde HMI	Visible en HMI	Comentario
▼ Input							
CAUDAL RETORNO PRUEBA	Real		0.0	No remanente	True	True	
▼ Output							
FUGA MÁXIMA	Real		0.0	No remanente	True	True	
FIN DE PRUEBA FUGAS INTERNAS	Bool		false	No remanente	True	True	
InOut							
Static							
▼ Temp							
CAUDAL 1	Real				False	False	
CAUDAL 2	Real				False	False	
CONTADOR	Bool				False	False	
ESTADO INICIAL	Bool				False	False	

### Segmento 1:



Símbolo	Dirección	Tipo	Comentario
"ENTRADAS Y SALIDAS DIGITALES"	%DB1	Block_DB	
"ENTRADAS Y SALIDAS DIGITALES". "Salida del actuador"		Bool	
"TIEMPO DE PRUEBA FUGAS INTERNAS"	%DB9	IEC_Timer	

Owner	Project name	Tesis1	Date	10/11/2015
Operator	Project Path	C:\Users\HP\Documents\Automation\Tesis1		
Designed By	Description 1st			
Checked By	Description 2nd	Language	es-ES	
Approved By	1st View	Version	Sheet 1 - 1	

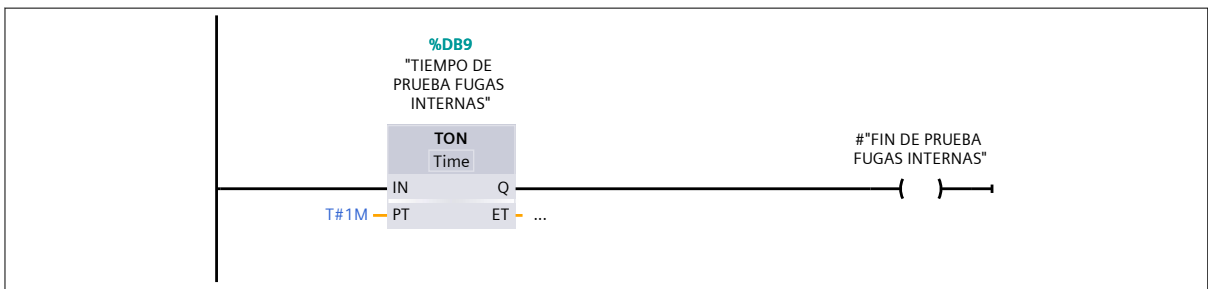
Símbolo	Dirección	Tipo	Comentario
"TIEMPO DE PRUEBA FUGAS INTERNAS".Q		Bool	

### Segmento 2:



Símbolo	Dirección	Tipo	Comentario
"ENTRADAS Y SALIDAS DIGITALES"	%DB1	Block_DB	
"ENTRADAS Y SALIDAS DIGITALES"."Salida cilindro de prueba"		Bool	
"TIEMPO DE PRUEBA FUGAS INTERNAS"	%DB9	IEC_Timer	
"TIEMPO DE PRUEBA FUGAS INTERNAS".Q		Bool	

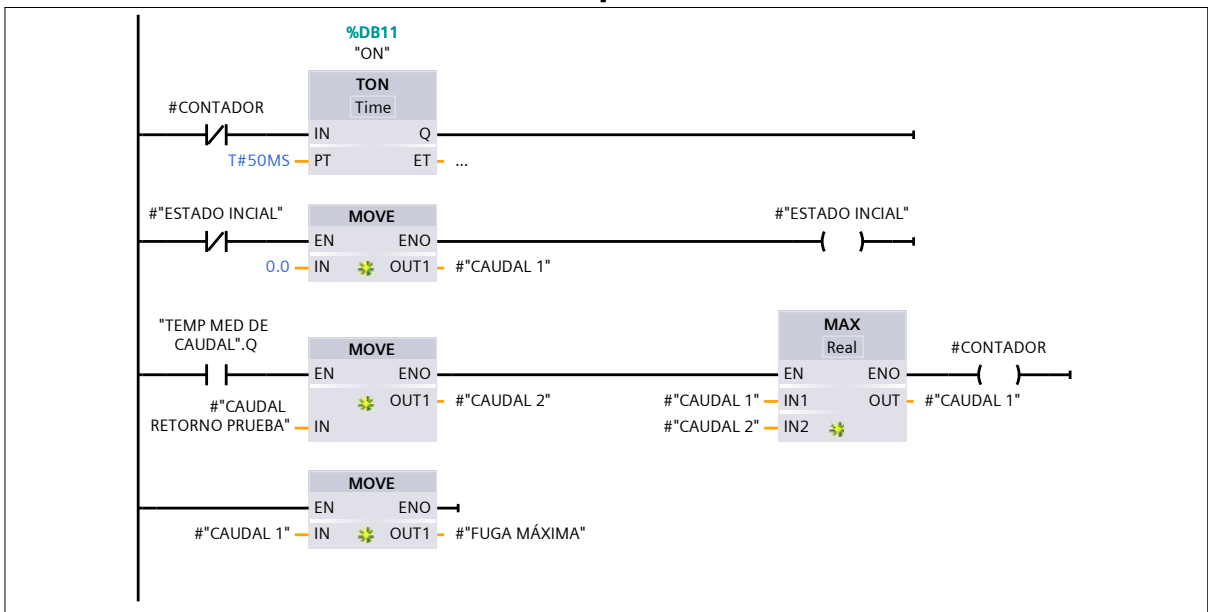
### Segmento 3:



Símbolo	Dirección	Tipo	Comentario
T#1M	T#1M	Time	
"TIEMPO DE PRUEBA FUGAS INTERNAS"	%DB9	IEC_Timer	
"#FIN DE PRUEBA FUGAS INTERNAS"		Bool	

### Segmento 4:

Owner	Project name Tesis1		Date 10/11/2015
	Project Path C:\Users\HP\Documents\Automation\Tesis1		
Operator	Location		
Designed By	Description 1st		
Checked By	Description 2nd	Language es-ES	
Approved By	1st View	Version	Sheet 1 - 2



Símbolo	Dirección	Tipo	Comentario
#"CAUDAL 1"		Real	
0.0	0.0	LReal	
#"CAUDAL RETORNO PRUEBA"		Real	
#"CAUDAL 2"		Real	
"TEMP MED DE CAUDAL"	%DB10	IEC_Timer	
"TEMP MED DE CAUDAL".Q		Bool	
#"ESTADO INICIAL"		Bool	
#CONTADOR		Bool	
T#50MS	T#50MS	Time	
"ON"	%DB11	IEC_Timer	
#"FUGA MÁXIMA"		Real	

Owner	Project name	Tesis1	Date	10/11/2015
	Project Path	C:\Users\HP\Documents\Automation\Tesis1		
Operator	Location			
	Designed By	Description 1st		
Checked By	Description 2nd	Language	es-ES	
Approved By	1st View	Version	Sheet 1 - 3	



## **ANEXO 10: Cotizaciones**



## COTIZACION - COT 00065

Lima, 16 de Febrero del 2015

**Señores:**

**SUDAMERICANA DE FIBRAS S.A**

**Atención:**

Ing. Richard Melchor

**REF:**

De acuerdo a su solicitud, no es grato cotizarle lo siguiente:

ITEM	CODIGO	DESCRIPCION	U.M	CANT.	P.U	V.VENTA	DIAS ENTREGA
1	6AV6647-0AD11-3AX0 G C F	SIMATIC HMI KTP600 BASIC COLOR PN, BASIC PANEL, KEY AND TOUCH OPERATION, 6" TFT DISPLAY, 256 COLORS, PROFINET INTERFACE	UND	1	2,231.55 ✓	2,231.55	2 DIAS
2	6EP1333-2BA20 G C F	SITOP PSU100S 24 V/5 A STABILIZED POWER SUPPLY INPUT: 120/230 V AC OUTPUT: 24 V/5 A DC	UND	1	422.37 ✓	422.37	2 DIAS
3	6ES7157-0AC83-0XA0	SIMATIC DP, CON. DISP. DE CAMPO ACOPLADOR DP/PA FDC157-0 VERSION NO EX 1000MA/31V ACOPL. BUS DE CAMPO ENTRE PROFIBUS DP Y PROFIBUS PA ESCLAVO	UND	1	2,255.17 ✓	2,255.17	INMEDIATO
4	6ES7153-2BA82-0XB0	SIMATIC DP, INTERFACE DP/PA LINK Y ET200M IM153-2 HF PARA RANGO DE TEMP. AMPLIADO PARA MAX. 12 MODULOS S7-300	UND	1	1,243.17	1,243.17	IMPORTACION ENTRE 4 A 5 SEMANAS
5	6ES7214-1HG40-0XB0 G C F	SIMATIC S7-1200, CPU 1214C, COMPACT CPU, DC/DC/RELAY, ONBOARD I/O: 14 DI 24V DC; 10 DO RELAY 2A; 2 AI 0 - 10V DC, POWER SUPPLY: DC 20.4 - 28.8 V DC	UND	1	1,128.60 ✓	1,128.60	IMPORTACION ENTRE 4 A 5 SEMANAS
6	6ED1055-1FB00-0BA1 G C F	LOGO! DM8 230R, EXP. MODULE, PU/I/O: 230V/230V/RELAIS, 2TE, 4 DI/4 DO	UND	2	180.69 ✓	361.38	2 DIAS
7	6ES7223-1PL32-0XB0 G C F	SIMATIC S7-1200, DIGITAL I/O SM 1223, 16DI / 16DO, 16DI DC 24 V, SINK/SOURCE, 16DO, RELAY 2A	UND	1	830.49 ✓	830.49	2 DIAS
8	6ES7331-7NF10-0AB0 G F	SIMATIC S7-300, MOD E ANALOG. SM 331, AISLAM. GALVAN. 8 EA; +/-5/10V, 1-5 V, +/-20MA, 0/4 A 20MA, 16 BITS, SIN COMUN (60V COM.),	UND	1	2,415.65 ✓	2,415.65	IMPORTACION ENTRE 4 A 5 SEMANAS
9	6ED1052-1FB00-0BA6 G C F	LOGO! 230RC, LOGIC MODULE, DISPL. PU/I/O: 115V/230V/RELAY, 8 DI/4 DO, MEM. 200 BLOCKS, EXPANDABLE WITH EXTRA MODULES 230V AC/DC	UND	3	339.15 ✓	1,017.45	2 DIAS
10	6GK1561-2AA00 F	PROCESADOR DE COMUNIC. CP 5612 TARJ. PCI (32 BIT; 3,3/5V; 33/66 MHZ) PARA CONECTAR UN PG O PC CON BUS PCI A PROFIBUS O MPI	UND	1	1,710.55 ✓	1,710.55	IMPORTACION ENTRE 4 A 5 SEMANAS
11	6DR1900-4 F	REGULADOR UNIVERSAL, COMPACTO, MONOLAZO, MODELO SIPART DR 19, CON SISTEMA DE AUTOSINTONIZACION Y GENERACION DE HASTA DOS RAMPAS	UND	2	2,617.94 ✓	5,235.87	IMPORTACION ENTRE 4 A 5 SEMANAS
12	6DR2210-4 F	REGULADOR UNIVERSAL, COMPACTO, PARA 1 O 2 LAZOS DE CONTROL, MODELO SIPART DR 22, CON SISTEMA DE AUTOSINTONIZACION,	UND	1	4,781.49 ✓	4,781.49	IMPORTACION ENTRE 4 A 5 SEMANAS
13	1746-IM16	MODULO DE ENTRADA DISCRETA 220VAC 1746-IM16 ?	UND	2	1,622.90	3,245.80	IMPORTACION ENTRE 4 A 5 SEMANAS

VALOR DE VENTA S/.	26,879.54
I.G.V. 18%	4,838.32
PRECIO DE VENTA S/.	31,717.86

**SON:**

**NOTAS:**

**ITEMS:**

**OBSERVACIONES:**

COND.DE PAGO	
VALIDEZ OFERTA	30 DIAS
LUGAR DE ENTREGA	ALMACENES LIMA
VENDEDOR	ANGELA TRUJILLO
CELULAR	989591121
E-MAIL	atrujillo@dinaut.com

**CTAS. CTES. DE DINAUT**

BANCO DE CREDITO USS: 194-1991369-1-46  
 BANCO DE CREDITO S/.: 194-1996078-0-02  
 BANCO CONTINENTAL USS: 0011-0157-0100001440

# FAMETAL

A VCA GROUP COMPANY

FAMETAL S.A.  
 Sede Central Av. República Panamá 3972 Surquillo, Lima  
 Telfs: 614 7575  
 Sucursal Proel Antonio Bazo 1524 La Victoria, Lima  
 Telfs: 473 7957 / 473 4897 Fax: 4733329  
 E-mail: fametal@fametal.com Web site: www.fametal.com  
 RUC: 20100302005

CTV-COTIZACION  
 CTV-6NS-1509357-01

Fecha:	29-Sep-2015	Serie:	SUDAMERICANA DE FIBRAS S.A.	RUC:	2030791664	Muestra Ref:		Moneda:	PEN
Dirección:	AV. CORONEL NESTOR GAMBERTA 8815 - CALLAO			Vuestra Ref:		T/C:	3.222		

Estimados Señores:  
 De acuerdo a nuestra requerimiento nos es grato presentarles nuestro cotización de los siguientes Productos y/o Servicios:

Item	Código Fam	Marca	Modelo	Descripción	Cantidad	Unidad de medida	Moneda	Precio Unitario Majo	Subtotal	Tiempo de Entrega
01	0006508	SIEMENS	3AV1201-1AA10	GUARDAMOTOR 1.3.1 6A, CLASE 10, 50, BORNES DE TORNILLO	2	UNO	S/.	132.84	265.68	Inmediato - recepción de orden de compra
02	0006508	SIEMENS	3RV1201-1EA10	GUARDAMOTOR 1.8.4A, CLASE 10, 50, BORNES DE TORNILLO	1	UNO	S/.	132.84	132.84	Inmediato - recepción de orden de compra
03	0006503	SIEMENS	3AV1201-4AA10	GUARDAMOTOR 1.1.16A, CLASE 10, 50, BORNES DE TORNILLO	1	UNO	S/.	146.88	146.88	Inmediato - recepción de orden de compra
04	0006015	SIEMENS	3RV1316-3A003-0AA0	GUARDAMOTOR 1.1.16A, CLASE 10, 50, BORNES DE TORNILLO	2	UNO	S/.	695.52	1,391.04	Inmediato - recepción de orden de compra
ACTUAL	0005043	SIEMENS	6EP1334-3BA10	INTERRUPTOR RESERVABLE 3P, 63A, CLASE 10, 50, BORNES DE TORNILLO	1	UNO	S/.	706.86	706.86	Inmediato - recepción de orden de compra
06	0008853	SIEMENS	6ES7311-1EG00-0000	PLUJADOR 32MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	1	UNO	S/.	1,145.88	1,145.88	Inmediato - recepción de orden de compra
07	0007482	SIEMENS	6ES7954-BE02-0AA0	SMALITE S7, MEMORIA CARO PARA S7-300 CPU/SIMATIC 3.1 V PLAIN, 4 MBYTE	1	UNO	S/.	186.84	186.84	5-6 Semanas desde recepción de orden de compra
08	0002893	SIEMENS	6ES7223-1EX2-0X00	SMALITE S7, 1200 E/S DIGITAL SM 3211, 16 DI / 16 DO, 16 DI DC 24 V, SIM/SOURCE, 16 DO, RELÉ 2A	1	UNO	S/.	834.30	834.30	Inmediato - recepción de orden de compra
09	0009621	SIEMENS	3BS160-0AA1	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	5	UNO	S/.	26.46	132.30	Inmediato - recepción de orden de compra
10	0003622	SIEMENS	3BS160-0AA21	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	5	UNO	S/.	26.46	132.30	Inmediato - recepción de orden de compra
11	0003630	SIEMENS	3BS160-0AA30	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	5	UNO	S/.	47.52	237.60	Inmediato - recepción de orden de compra
12	0003632	SIEMENS	3BS160-0AA40	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	5	UNO	S/.	47.52	237.60	Inmediato - recepción de orden de compra
13	0004768	SIEMENS	3BS160-0AA51	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	5	UNO	S/.	1.51	7.55	Inmediato - recepción de orden de compra
14	0004768	SIEMENS	3BS160-0AA61	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	5	UNO	S/.	2.77	13.85	Inmediato - recepción de orden de compra
15	0016274	SIEMENS	3BS160-0AA71	PLUJADOR 22MM, REDONDO, 1HC, METALICO, BORNES DE TORNILLO C/ROTON	3	UNO	S/.	9.77	29.30	Inmediato - recepción de orden de compra

CONDICIONES COMERCIALES (\*) :

Modelo de entrega :	CREDITO 30 DIAS NUEVOS SOLIS	Vigencia:	01-09-2015
Forma de Pago :		Observaciones:	

MONTOS MENORES A 1/5000 SE PROCEDE AL CONTARLO Y EL RECIBO ES EN NUESTROS ALMACENES.  
 LAS O CANTIDADES MENORES A 1/5000 SE ENTREGAN EN EL MOMENTO DE ENTREGA DEL PRODUCTO.  
 LAS O CANTIDADES MENORES A 1/5000 SE ENTREGAN EN EL MOMENTO DE ENTREGA DEL PRODUCTO.  
 LAS O CANTIDADES MENORES A 1/5000 SE ENTREGAN EN EL MOMENTO DE ENTREGA DEL PRODUCTO.

\*Agentes Retención desde el 01-06-2012 de acuerdo a lo dispuesto a la RS 096-2012/SUNAT.  
 \*Agentes de Percepción desde el 01-07-2013 de acuerdo a lo dispuesto a la DS 091-2013/SUNAT.  
 BCP CATEMAN 191-03363282451 CODIGO INTERBANCARIO 0021910003342805156  
 BCP CATEMAN 191-03363282451 CODIGO INTERBANCARIO 0021910003342805156

Subtotal S/.	5,753.30
I.G.V 18% S/.	1,035.59
<b>Total S/.</b>	<b>6,788.89</b>
Total S/.	6,788.89





**GRAMSA DISTRIBUIDORA SAC**  
 OFICINA PRINCIPAL  
 P.J. ASTURIAS NRO. 162 - P. LIBRE - Telefono : 5186600 - TeleFax : 2611615

GC-F-004  
 Version : 01

**R.U.C. 20468095301**  
**COTIZACION Nro. 1500108293**

Señores : GRAMSA DISTRIBUIDORA SAC  
 Atención : RICHARD MELCHOR  
 E-Mail :

RUC : 20468095301  
 Telefono : /  
 Referencia : SUDAMERICANA DE FIBRAS S.A.

Fec. Emision : 29/09/2015  
 Moneda : NUEVOS SOLES

Estimados señores :  
 En atención a su amable solicitud nos es grato ofrecerles lo siguiente:

It	Cantidad	UM	Descripción	Tipo	Marca	Ref Entrega	V.V Unitario	V.Venta S/.
001	2.00	UNI	INT. TERMOMAGNET. S0 1.1-1.6A	3RV1021-1AA10	SIEMENS	STOCK	142.705	285.41
002	1.00	UNI	INT. TERMOMAGNET. S0 2.8-4A	3RV1021-1EA10	SIEMENS	STOCK	142.705	142.70
003	1.00	UNI	INT. TERMOMAGNET. S0 11-16A	3RV1021-4AA10	SIEMENS	STOCK	157.787	157.79
004	2.00	UNI	INT. AUTOMATICO TRIF. 128-160A 65KA/240V 40KA/380V	3VL1716-1DD33-0AA0	SIEMENS	STOCK	747.169	1,494.34
005	1.00	UNI	SITOP PSU200M 10 A FUENTE DE ALIMENT. ESTABILIZADA ENTRADA: AC	6EP1334-3BA10	SIEMENS	2 DIAS	759.351	759.35
CODIGO DE REEMPLAZO DE 6EP1334-3BA00								
006	1.00	UNI	SIMATIC S7-1200. CPU 1214C. CPU COMPACTA. DC/DC/RELES. E/S	6ES7214-1HG40-0XB0	SIEMENS	STOCK	1,230.972	1,230.97
007	1.00	UNI	SIMATIC S7. MEMORY CARD PARA S7-1X00 CPU/SINAMICS. 3.3 V FLASH, 4	6ES7954-8LC02-0AA0	SIEMENS	6-8 SEMANAS	200.715	200.71
008	1.00	UNI	SIMATIC S7-1200. E/S DIGITAL. SM 1223. 16 DI / 16 DO. 16 DI DC 24 V,	6ES7223-1PL32-0XB0	SIEMENS	STOCK	896.255	896.25
009	5.00	UNI	BOTÓN PULSADOR RASANTE VERDE. MARCHA NA	XB4BA31	SCHNEIDER	2 DIAS	35.928	179.64
010	5.00	UNI	BOTÓN PULSADOR RASANTE ROJO. PARADA NC	XB4BA42	SCHNEIDER	STOCK	35.928	179.64
011	5.00	UNI	PILOTO DE SEALIZACIóN ROJO <250 VAC CONEXIóN DIRECTA - 2.4W NO	XB4BV64	SCHNEIDER	2 DIAS	29.736	148.68
012	5.00	UNI	PILOTO DE SEALIZACIóN VERDE <250 VAC CONEXIóN DIRECTA - 2.4W NO	XB4BV63	SCHNEIDER	2 DIAS	29.736	148.68
013	100.00	UNI	BORNE DE 2.5MM2 - PASO 5MM VIKING3	37160	LEGRAND	STOCK	2.415	241.50
014	10.00	UNI	BORNE DE 6MM2 - PASO 8MM VIKING3	37162	LEGRAND	STOCK	3.136	31.36
015	10.00	UNI	CONECTOR HEMBRA M12 4 PINES ACOBADO	XZCP1241L2	SCHNEIDER	2 DIAS	38.520	385.20
016	10.00	UNI	CONECTOR HEMBRA M12 ACOBADO 5M	XZCP1241L5	SCHNEIDER	2 DIAS	50.904	509.04

**Condiciones Comerciales**

Forma de Pago : CONTADO - C/ENTREGA  
 Tiempo de Entrega : EL QUE SE INDICA SALVO PREVIA VENTA  
 Validez de Oferta : 03 dias  
 Lugar de Entrega : EN SUS ALMACENES DE LIMA

Ventas	Cliente
--------	---------

Sub - Total	6,991.26
I.G.V. S/.	1,258.43
<b>Total S/.</b>	<b>8,249.69</b>

EMILIO ALVA  
 Asesor Comercial

Cuentas Bancarias :  
 BCP Cia Cle. Soles 193-1713211-0-61  
 BCP Cia Cle. Dolares 191-1409928-1-05



Soluciones Integrales en Automatización y Control Industrial

COTIZACION – COT 00621

Lima, 28 de Septiembre del 2015

Señores:

SUDAMERICANA DE FIBRAS S.A

Atención:

Sr. Richard Melchor

REF:

De acuerdo a su solicitud, no es grato cotizarle lo siguiente:

ITEM	CODIGO	DESCRIPCION	U.M	CANT.	P.U	V.VENTA	DIAS ENTREGA
1	3RV1021-1AA10	INTERR. AUTOM., 1,1...1,6 A, DISP.SOBR.S.RET.21 A, TAM. S0, PROTECCION DE MOTOR, CLASE 10, CONEXION POR TORNILLO PODER DE CORTE ESTANDAR	UND	2	150.33	300.67	INMEDIATO
2	3RV1021-1EA10	INTERR. AUTOM., 2,8...4 A, DISP.SOBR.S.RET.52 A, TAM. S0, PROTECCION DE MOTOR, CLASE 10, CONEXION POR TORNILLO PODER DE CORTE ESTANDAR	UND	1	150.33	150.33	INMEDIATO
3	3RV1021-4AA10	INTERR. AUTOM., 11...16 A, DISP.SOBR.S.RET.208 A, TAM. S0, PROTECCION DE MOTOR, CLASE 10, CONEXION POR TORNILLO PODER DE CORTE ESTANDAR	UND	1	166.22	166.22	INMEDIATO
4	3VL1716-1DD33-0AA0	In: 160 A, 65kA / 240V - 25kA / 440V, Ir: 125-160 A, li: 1500 A	UND	2	787.11	1,574.22	INMEDIATO
5	6EP1334-3BA10	SITOP PSU200M 10 A FUENTE ALIMENT. ESTABILIZADA ENTRADA: AC 120/230-500 V SALIDA: DC 24 V/10 A	UND	1	727.22	727.22	2 DIAS
6	6ES7214-1HG40-0XB0	SIMATIC S7-1200, CPU 1214C, COMPACT CPU, DC/DC/RELAY, ONBOARD I/O: 14 DI 24V DC; 10 DO RELAY 2A; 2 AI 0 - 10V DC, POWER SUPPLY: DC 20.4 - 28.8 V DC, PROGRAM/DATA MEMORY: 75 KB	UND	1	1,178.89	1,178.89	2 DIAS
7	6ES7954-8LC02-0AA0	SIMATIC S7, MEMORY CARD FOR S7-1X00 CPU/SINAMICS, 3,3 V FLASH, 4 MBYTE	UND	1	192.22	192.22	2 DIAS
8	6ES7223-1PL32-0XB0	SIMATIC S7-1200, DIGITAL I/O SM 1223, 16DI / 16DO, 16DI DC 24 V, SINK/SOURCE, 16DO, RELAY 2A	UND	1	858.33	858.33	2 DIAS

VALOR DE VENTA S/.	5,148.11
I.G.V. 18%	926.66
PRECIO DE VENTA S/.	6,074.77

SON:

NOTAS:  
ITEMS:

OBSERVACIONES:

COND.DE PAGO	FACTURA 30 DIAS
VALIDEZ OFERTA	30 DIAS
LUGAR DE ENTREGA	ALMACENES LIMA
VENDEDOR	ANGELA TRUJILLO
CELULAR	989591121
E-MAIL	atrujillo@dinaut.com

CTAS. CTES. DE DINAUT

BANCO DE CREDITO USS: 194-1991369-1-46  
 BANCO DE CREDITO S/,: 194-1996078-0-02  
 BANCO CONTINENTAL USS: 0011-0157-0100001440

E-mail: mail@dinaut.com

# Quote

Machinery Service & Design LLC  
 W232 N2960 Roundy Circle West #400  
 Pewaukee, WI 53072

Phone: 262.513.8040 Fax: 262.513.8044

DATE	QUOTE #
6/6/2016	5349E

NAME / ADDRESS

Komatsu Mitsui Maquinarias Peru SA  
 Cal. Dean Valdivia  
 148 N 1401 San Isidro  
 Lima Peru.



MS & D PROJECT	CUSTOMER / PROJECT	TERMS	FREIGHT	EST.
3390 - D-20, 50K		50% down, 50% prior to shipping	NO INCLUIDO	LR
ITEM	DESCRIPTION	COST	Qty.	TOTAL
MSD-D-20 Assy	MSD-D-20 is a 20' (6.1m) long cylinder Disassembly machine with collector pan, drain pan and two slide plates.	13,806.00	1	13,806.00
MSD-D-P/U Assy	15hp,(11Kw) 240v / 480v, 3 phase, 60 cycle power unit with test console integrated into Disassembly fixture. Power unit has a 40 gal reservoir, 16 gpm pump with high-low unloading circuit developing 3,500 psi, air purge system, pressure/torque gauge, and a two spool valve for operation of the "Nut Buster"® and test console with isolation valves and gauges.	9,822.00	1	9,822.00
MSD-N-50 NR	"Nut Buster"® built to develop 50,000ft/lbs of torque with a swivel base and hydraulically assisted nut runner built-in. The nut runner section can develop torques to 2,500 ft/lbs when used alone at the standard input of approximately 2,500 PSI.	10,886.00	1	10,886.00
MSD-ABT-40/50 Assy	Heavy duty adjustable brace tool used with our 40K and 50K "Nut Buster"® for capturing the clevis end of shafts where high torques are required. Includes slotted slide plate and "L" brackets. Drawing #1560	1,889.00	1	1,889.00
MSD-SP Assy	Slide plate used on our Disassembly table that is pre drilled for tooling and comes complete with two "L" brackets per plate. Drawing # 1299 "L" Brackets Drawing # 1292 & 1293.	668.00	2	1,336.00
		<b>TOTAL US\$</b>		

This estimate is subject to ACCEPTANCE BY BUYER WITHIN 60 DAYS hereof, otherwise Machinery Service & Design, Inc. at its option may declare it null and void. All Taxes state, local, municipal, and federal are the responsibility of the buyer. All tooling and equipment is warranted for a period of one (1) year from date of purchase on parts and labor.



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3390 - D-20, 50K		50% down, 50% prior to shipping	NO INCLUIDO	LR
ITEM	DESCRIPTION	COST	Qty.	TOTAL
MSD-BT Assy	Brace tooling (fixed) used with our "Nut Buster"® and pull apart cylinder. Drawing #1563	637.00	2	1,274.00
MSD-LP	Lock pins for slide plates-set of 2.	55.00	2	110.00
MSD-SPS	Slide plate spacers-set of 2.	28.00	2	56.00
MSD-CR Assy	Concentric roller set to check rod concentricity. (Set of two) Drawing #1572	846.00	1	846.00
MSD-VRP	"V" Block Roller Plate is used with our Vise Elevator (MSD-VE) or Nylon "V"'s (MSD-V) in conjunction with a pull-apart cylinder (MSD-PAC/PAC HD). The VRP consists of hevy duty steel plate with polyurethane wheels and flanged undercarriage wheels for ease of movement.	2,785.00	2	5,570.00
MSD-ACSN Assy	MSD-ACSN the adjustable cylinder support is used to support large cylinder tubes and shafts that are to large to be secured in a chain vise. They are secured to any of our standard slide plates and are supplied with non-marring "Nylatron" surfaces. (Set of two) Drawing #1558	1,224.00	2	2,448.00
MSD-RIDGID	Ridgid brand 8" chain vise for cylinder hold down.	766.00	1	766.00
		<b>TOTAL US\$</b>		

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MS & D PROJECT	CUSTOMER / PROJECT	TERMS	FREIGHT	EST.
3390 - D-20, 50K		50% down, 50% prior to shipping	NO INCLUIDO	LR
ITEM	DESCRIPTION	COST	Qty.	TOTAL
MSD-ARC Assy	Adjustable tool used to hold cylinder clevis end when rotating cylinder. Drawing #1559	3,625.00	1	3,625.00
MSD-HDSS Assy	Heavy duty face and side spanner tool to be welded to MSD-ETVBT, or MSD-ABT vertical brace tool (not included) and positioned with "Nut Buster"®. Supplied with pin spanners 5/16", 3/8", 7/16", 1/2", 5/8" and 3/4" diameters. Drawing #1667	1,735.00	1	1,735.00
MSD-HPS	Set of 14 piece hex tooling plates for ANSI nuts from 3" to 6".	1,250.00	1	1,250.00
MSD-HPSM	Set of 12 piece hex tooling plates for metric hex nuts from 60mm to 150mm.	1,250.00	1	1,250.00
MSD-DP-1 Assy	Tooling plate with 1" drive for use with 1" drive sockets. Maximum torque capability 1000 Foot pounds. Drawing #1570	210.00	1	210.00
MSD-DP-1.5 Assy	Tooling plate with 1-1/2" drive for use with 1-1/2" drive sockets. Maximum torques capability 1500 Foot pounds. Drawing #1575	354.00	1	354.00
SUBTOTAL OF ITEMS LISTED ABOVE				57,233.00
		<b>TOTAL US\$</b>		

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3390 - D-20, 50K		50% down, 50% prior to shipping	NO INCLUIDO	LR
ITEM	DESCRIPTION	COST	Qty.	TOTAL
	<p>Términos:                      50% de Deposito para Generar su Orden.                      50% de Deposito al Finalizar la Fabricación.                      Tiempo de Fabricación es de 10-12 semanas una vez recibido el deposito.                      El Envio no está Incluido.</p>			
		<b>TOTAL US\$ \$57,233.00</b>		

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