

APPENDIX D
WARRANTY INFORMATION
O&M MANUAL

WARRANTY MANAGEMENT PLAN
WATER SYSTEM REHABILITATION CONSTRUCTION AT
CAMP STANLEY STORAGE ACTIVITY – BOERNE, TX

1. The purpose of this plan is to provide information concerning execution of “Warranty of Construction” for AFCEE task order FA 8903-04-D-8675-0022 and CSSA Purchase Order W45PVN-08-P-0033, Water System Rehabilitation Construction.
2. In accordance with FAR Clause 52.246-21, Warranty of Construction; the warranty performance period will be for twelve (12) months, starting 15 September 2008 and expiring 14 September 2009 for items installed under contract FA8903-04-D-8675-0022. For the North Pasture segment that will supply the future supply well, the 12 month warranty will start on 2 October 2008, and will expire on 1 October 2009 (purchase order W45PVN-08-P-0033).
3. In accordance with the agreement for the acceptance of the water distribution system, the facility has been provided warranty coverage directly with the Installation Contractors: Alamo City Constructors (ACC), Ramos and Associates, Inc. (RAI), and System Controls and Instrumentation (SCI). RAI was responsible for more than 98 percent of the water system rehabilitation. ACC replaced less than 500 feet of waterline in the vicinity of Building 96 in coordination with a roadway construction and re-paving project conducted under a separate task order. SCI installed the flowmeter and chlorine analyzer instrumentation. *Attachment 1* illustrates the locations of responsibility for each Installation Contractor.
4. ACC is responsible for a total of 445 feet of 10-inch waterline that is south and east of Building 96. 260 feet of 10-inch waterline is an east-west alignment south of Building 96, extending from the existing fire hydrant to west to the 90-degree turn southeast of Building 96. The remaining 185 feet is 10-inch waterline with a north-south alignment from the previous 90-degree elbow to northward to the gate valve. The warranty includes the installation of one new fire hydrant.
5. RAI is responsible for the remaining rehabilitated water distribution system (~25,300 feet) that was installed under this contract. The warranty also covers the waterline appurtenances such as fire hydrants and valves
6. SCI is responsible for the flow meters (2) and chlorine analyzers (2).
7. Camp Stanley is to contact Parsons directly for any confirmed warranty service required under the subject time period. In turn, Parsons will contact the appropriate Installation Contractor(s), depending on the area of service. In the event the Installation Contractor(s) do not correct the warranty condition or make a coordinated plan to correct the situation, then CSSA shall contact Parsons for additional follow-up. The following conditions apply to this warranty:
 - a) The Installation Contractor(s) warrants the goods to be free from defects in material and workmanship at all times when operated and maintained in accordance with Manufacturer’s written instructions.
 - b) Contractor’s sole responsibility and Buyer’s exclusive remedy arising out of or relating to the Goods or Services or any breach of these warranties is limited

*WARRANTY MANAGEMENT PLAN
WATER SYSTEM REHABILITATION CONSTRUCTION AT
CAMP STANLEY STORAGE ACTIVITY – BOERNE, TX*

**Attachment 1
Locations of Responsibility Index Map**

- to replacement of any failed items under normal operation.
- c) This warranty will not apply to any items, component system, sub-system, or other piece of the distribution system that has been altered, modified, or otherwise changed by CSSA or others without the express written consent of the Installation Contractor.
 - d) Installation Contractor(s) will provide 48-hour telephone response to warranty queries.
 - e) Installation Contractor(s) shall provide 72-hour response to critical (system out of service) items on proviso of Goods availability.
 - f) The Installation Contractor(s) will respond within 5 days for routine service, on proviso of Goods availability. Routine service is defined as non-time sensitive issues.
 - g) Installation Contractor(s) will provide replacement parts compliant with manufacturer's design.
 - h) The Installation Contractor(s) will be responsible for tracking, reporting, and closing each warranty call under this plan.
8. CSSA shall establish a process to report any potential warranty calls. That process shall include a review process of all potential calls to confirm that an actual warranty condition exists. Prior to placing a warranty call, CSSA shall confirm the situation making the system inoperable is not attributable to operator error, normal wear and tear, or other condition not directly contributable to an actual warranty occurrence. Failure to confirm an actual warranty call exists, subjects CSSA to all charges directly contributable to the erroneous warranty call.
9. For the first year of warranty coverage, the Parsons Contracting Officer will manage any warranty issue. In the event that CSSA is unable to contact the Parsons Contracting Officer, **Attachment 2** contains a list of Parsons officials who can accept and execute *Warranty of Construction* calls. After the first year of warranty period expires, the Government shall contact the respective subcontractor directly for any further warranty service.
10. **Warranty Call-out Procedures** – The warranty process should originate by contacting Mr. Sidney Dukes of Parsons, or Mr. Brian Vanderglas of Parsons (alternate). In the event of an emergency (after hours and weekends), the Installation Contractors have provided contact procedures for warranty calls. The government authorized representative may contact the responsible Contractors directly in the event of an emergency. All calls to the Contractors under this warranty must be documented and reported to Parsons within two (2) business days.



Attachment 1
Warranty Key Map
Camp Stanley Storage Activity

Attachment 2 Pont of Contact Information

Parsons Warranty Administrator:

Primary: Mr. Sidney Dukes
Office: 210-805-2284
Mobile: 210-867-7229
Email: sidney.dukes@parsons.com

Alternate Mr. Brian Vanderglas
Office: 512-719-6059
Mobile: 512-799-9082
Email: brian.vanderglas@parsons.com

Installation Contractors:

**During ‘normal’ working hours contact the following service office:
(08:00 – 17:00 hrs Monday – Friday)**

Ramos and Associates: 210-628-4277
Alamo City Constructors: 210-226-3100
SCI: 210-661-9901

‘Out of Hours’ procedure for reporting issues:

Ramos and Associates: 210-628-4277 (answering service)
Alamo City Constructors: 210-226-3100 (answering service)
SCI (John Crumley): 210-422-3055

Your call will go directly through to a call centre, were you will need to supply the following information;

- *Name of Company*
- *Name of Caller*
- *Callers Telephone number*
- *Nature of fault/call*

The ‘on call’ engineer will then be contacted by the call centre, and you will receive a call back from the ‘on call’ engineer within 60 minutes of you leaving that initial message.



RAMOS & ASSOCIATES, INC.

OPERATION & MAINTENANCE MANUAL

PROJECT: Camp Stanley Storage Activity - Water
Rehabilitation – FA890304D86750022

JOB LOCATION: 25800 Ralph Fair Road
Boerne, Texas 78015-4800

CONTRACTOR: Parsons Infrastructure & Technology Group,
Inc.

DATE: April 3, 2008

Camp Stanley Storage Activity
Water Rehabilitation – FA890304D86750022
25800 Ralph Fair Road
Boerne, Texas 78015-4800

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Endress & Hauser – Electromagnetic Flow Measuring System



RAMOS & ASSOCIATES, INC.

SBE/MBE CERTIFIED CONTRACTOR
SPECIALIZING IN UNDERGROUND UTILITIES

12025 STATE HIGHWAY 16 SOUTH • SAN ANTONIO, TEXAS 78224 • PH (210) 628-4277 • FX (210) 628-4199

DATE: November 25, 2008

SUBCONTRACTOR: Ramos & Associates, Inc.

CONTRACTOR: Parsons (Subcontract 745006.30002-00)

PROJECT: Camp Stanley Storage Activity- Water Improvements
25800 Ralph Fair Road
Boerne, Texas 78015-4800

DATE OF FINAL ACCEPTANCE: September 15, 2008

WORK DESCRIPTION: Material and workmanship for installation of onsite domestic water distribution system

One (1) year general guarantee:

All materials furnished and labor provided by the undersigned are in accordance with the contract, plans specifications and additions, should any defects develop during the contract general guarantee period as hereinafter defined, due to defects in materials or improper workmanship on the part of the undersigned. This does not extend to defects of damage caused by forces or actions beyond the control of the undersigned, such as acts of civil disorder, acts of war, acts of god or failure to maintain the items under warranty.

The general guarantee shall be for a period of one (1) year from the final acceptance date.

Dated this 25th day of November 2008

UNDERSIGNED: RAMOS & ASSOCIATES, INC.

BY: 
GEORGE ZAPATA

TITLE: PROJECT MANAGER / ESTIMATOR

ADDRESS: 12025 ST. HIGHWAY 16 SOUTH
P.O. BOX 240038
SAN ANTONIO, TX 78224



RAMOS & ASSOCIATES, INC.

SBE/MBE CERTIFIED CONTRACTOR
SPECIALIZING IN UNDERGROUND UTILITIES

12025 STATE HIGHWAY 16 SOUTH • SAN ANTONIO, TEXAS 78224 • PH (210) 628-4277 • FX (210) 628-4199

DATE: November 25, 2008

SUBCONTRACTOR: Ramos & Associates, Inc.

CONTRACTOR: Parsons (Subcontract 746488.30000-00)

PROJECT: Camp Stanley Storage Activity- Water Improvements
25800 Ralph Fair Road
Boerne, Texas 78015-4800

DATE OF FINAL ACCEPTANCE: October 2, 2008

WORK DESCRIPTION: Material and workmanship for installation of onsite domestic water distribution system

One (1) year general guarantee:

All materials furnished and labor provided by the undersigned are in accordance with the contract, plans specifications and additions, should any defects develop during the contract general guarantee period as hereinafter defined, due to defects in materials or improper workmanship on the part of the undersigned. This does not extend to defects of damage caused by forces or actions beyond the control of the undersigned, such as acts of civil disorder, acts of war, acts of god or failure to maintain the items under warranty.

The general guarantee shall be for a period of one (1) year from the final acceptance date.

Dated this 25th day of November 2008

UNDERSIGNED: RAMOS & ASSOCIATES, INC.

BY:


GEORGE ZAPATA

TITLE: PROJECT MANAGER / ESTIMATOR

ADDRESS: 12025 ST. HIGHWAY 16 SOUTH
P.O. BOX 240038
SAN ANTONIO, TX 78224

Utility Contractor and Vendor Contact Information

Utility Contractor	Vendor
	
<p>Ramos & Associates, Inc. 12025 State Highway 16 South San Antonio, TX 78224 Contractor License No. PM13135</p> <p>Office: 210-628-4277 Fax: 210-628-4199</p> <p>Contact Name: George Zapata E-mail: georgezrai@aol.com</p>	<p>Ferguson Waterworks 4427 Factory Hill Drive San Antonio, TX 78219</p> <p>Office: 210-333-2410 Fax: 210-333-2589</p> <p>Contact Name: Jimmy Farias E-mail: jimmy.farias@ferguson.com</p>

Mueller Co.

Operating Instructions for

MUELLER® SUPER CENTURION® FIRE HYDRANT

Mueller Co.

MAIN OFFICE and PLANT

500 West Eldorado Street

Decatur, Illinois 62522

www.muellercompany.com

! WARNING

Before removing any bolts(s) holding the hydrant together, shut off gate valve to isolate hydrant from main water source. Loosen (do not remove) one nozzle cap two turns and check for water under pressure inside hydrant - bleed off any pressure, then remove nozzle cap completely. Open hydrant main valve completely. A continuous flow of water, no matter how slight, indicates hydrant is not properly isolated from the main water supply, and that problem must be corrected before any hydrant disassembly can proceed. Disassembly of hydrant with pressurized water acting against the main valve could result in unexpected ejection of hydrant parts, debris or high-pressure water stream, which could cause serious bodily injury.

MUELLER® SUPER CENTURION® FIRE HYDRANT

Inspection and Maintenance

Beginning with the 1997 date codes, there are two styles of Super Centurion Fire Hydrants:

- 1) the Super Centurion 250™ Hydrant and
- 2) the Super Centurion 200™ Hydrant.

This manual applies to all Mueller Super Centurion Fire Hydrants with date codes 1997 or later. However, the 250 psig rated 3-way Hydrant, which has O-ring Seals at the Bonnet and Ground Line Flanges, is shown in all illustrations and O-rings are referred to in the instructions. When working on a 2-way or 1-way Hydrant, which is rated at 200 psig, the foregoing references to O-rings should be understood to mean the flat gaskets that are standard with 2-way and 1-way Hydrants.

NOTE: HYDRANTS MADE PRIOR TO 1997 WILL CONTINUE TO USE FLAT GASKETS WHEN REPLACING THESE GASKETS AT THE BONNET AND SAFETY FLANGES.

All Hydrants produced in 1997 and after have a stainless steel Safety Coupling, Reversible Main Valve (patent pending) and two Shoe Bolts used to retain the Drain Ring Housing.

The 1997 style stainless steel Safety Coupling is compatible with the Hydrants made prior to 1997.

Non-reversible Main Valves for pre-1997 Hydrants are available. To retrofit such a Hydrant with the 1997 style Reversible Main Valve, both the Main Valve and the Lower Valve Plate must be changed to the 1997 style part.

For Hydrants made prior to 1997, see the operating instructions for the Centurion® Fire Hydrant (Form 10492).

Inspection

To ensure their readiness for instantaneous use, it is recommended that Fire Hydrants be inspected and tested at six-month intervals.

Inspect visually for damaged or missing parts.

Loosen one Nozzle Cap slightly and tighten the others. Open Hydrant fully. Tighten loose Nozzle Cap when water starts to flow. Remove Oil Filler Plug to check oil level. If oil level is low, fill as shown on page 3. Check all flange connections for leaks. Turn Operating Nut to fully CLOSED position.

If water or oil overflowed from Oil Filler Hole, remove Bonnet and replace O-rings in both the Bonnet and the Hold Down Nut. Inspect and clean Stem, and replace it if corroded or pitted. Check oil level. Replace Bonnet and test for leaks.

Use A-367 Brass Sleeve when removing or replacing Bonnet or Hydrant Barrel to protect stem O-rings.

Remove one Nozzle Cap, stand on the side of Hydrant opposite the cap removed, open Hydrant fully, and flush Barrel and Hydrant Lateral. Turn Operating Nut to fully CLOSED position.

Remove all Nozzle Caps. Clean and lubricate threads.

Examine inside of Barrel to make certain Drain Valves have completely drained water from Barrel. If water fails to drain from Barrel, it may be caused by one or more of the following conditions:

1. Water Table in ground is higher than drains.
2. When Hydrant was installed, coarse gravel was not placed around Drains, in locations where ground has a make up such that it will not absorb water.
3. Drains are stopped by some foreign material.
4. Failure to leave Cap off of Hydrant to allow air to enter so Barrel will drain.

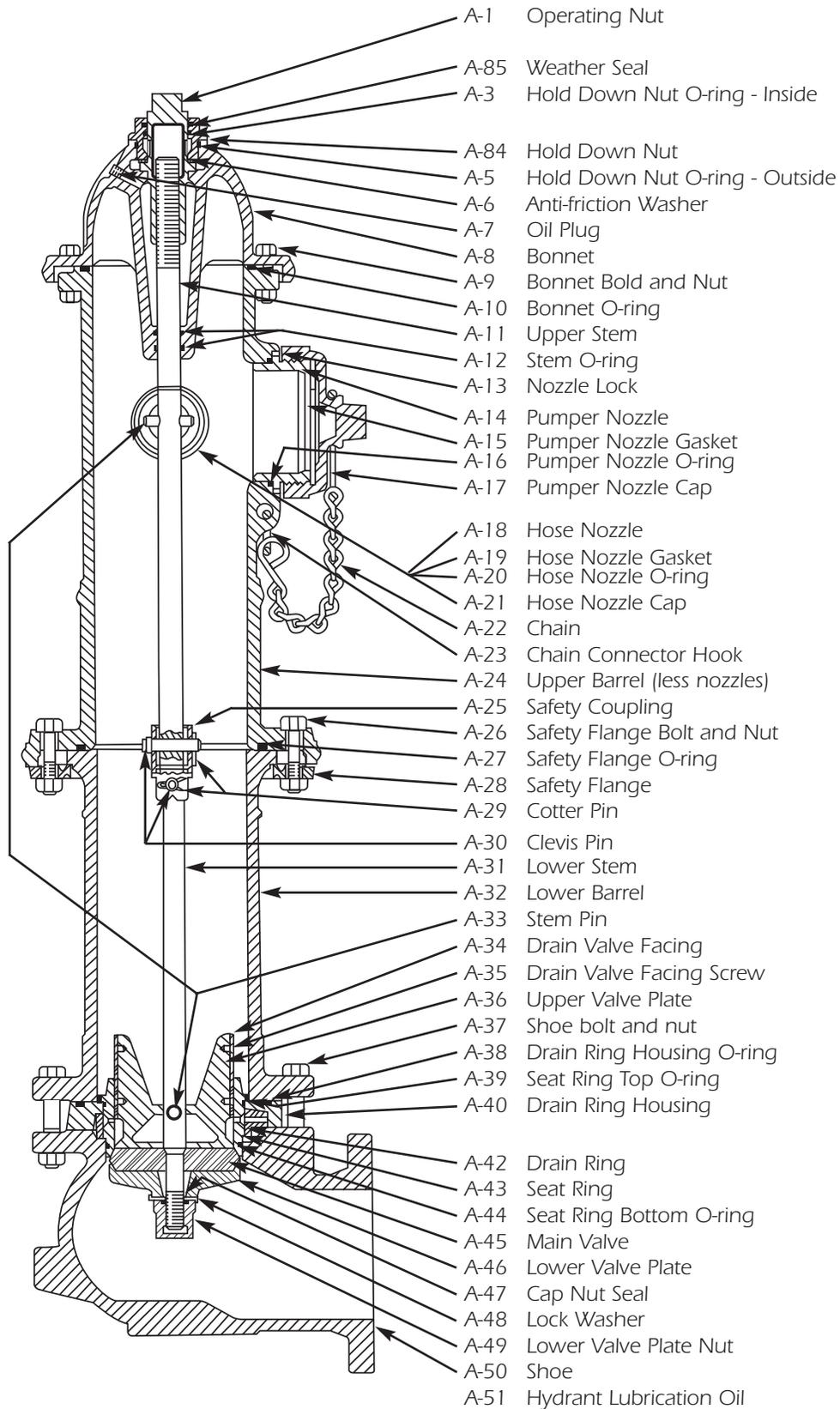
The foregoing procedure introduces full line pressure to Drain Valves. It provides the best method for cleaning Drain Valves using water pressure.

IMPORTANT - Initial installation of Hydrant MUST BE MADE PROPERLY so Safety Flange will function properly. Hydrant should be blocked at ground line and around Shoe using concrete or similar substance to prevent ground from giving way when Hydrant is struck.

For additional information on Hydrant anchorage, blocking, and drainage, see AWWA Standard C600 and Manual M17.

MUELLER® SUPER CENTURION® FIRE HYDRANT

Parts



MUELLER® SUPER CENTURION® FIRE HYDRANT

Filling Oil Reservoir

CAUTION: Always fill the oil reservoir with the bonnet installed, the hydrant in its normal upright position, and the main valve fully closed. If the hydrant is filled with lubricant under any other circumstances, excess lubricate can overflow the Bonnet and create a pressure lock. This could result in damage to the seals or Bonnet or prevent proper hydrant operation.



1. Remove Oil Filler Plug and check oil level. Oil should be level with Oil Filler Plug Hole.



2. If oil is low, use a small funnel to add MUELLER Hydrant Lubricant



3. When oil is level with Oil Filler Plug Hole, replace Oil Filler Plug.

MUELLER® SUPER CENTURION® FIRE HYDRANT

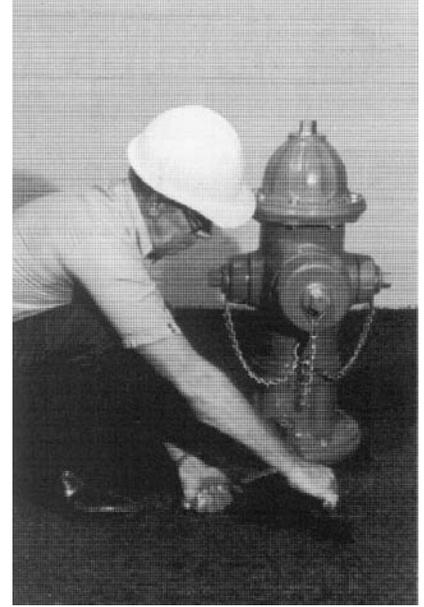
Facing of Hose Nozzles



1. Loosen Nuts on Safety Flange Bolts.



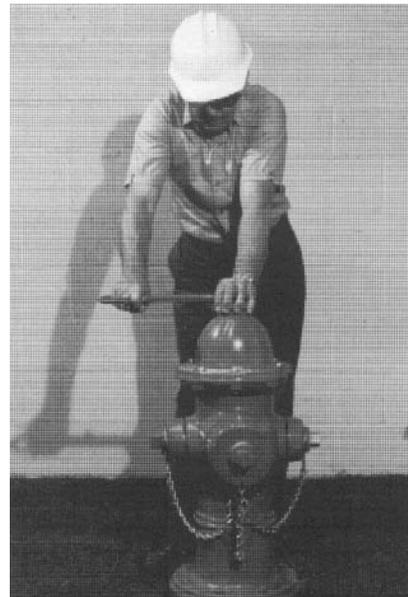
3. Rotate Upper Barrel section as desired.



5. Tighten Safety Flange Bolts.



2. Turn Operating Nut slightly in the opening direction to relieve compression between Barrel sections.

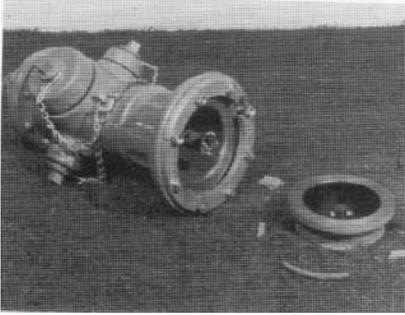


4. Tighten Operating Nut, turning in closing direction.

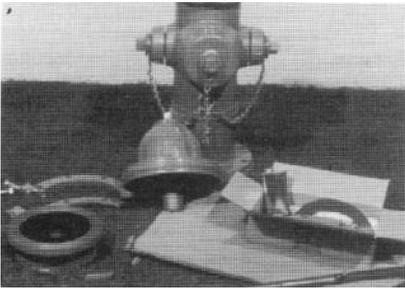
6. Turn Operating Nut in closing direction to make sure Main Valve is closed tightly, then turn in opening direction approximately 1/4 turn to relieve tension on operating mechanism.

MUELLER® SUPER CENTURION® FIRE HYDRANT

Replacing Safety Stem Flange and Safety Stem Coupling



1. Mueller Hydrant with Upper Barrel knocked over by truck. Note broken pieces of Safety Flange lying on ground.

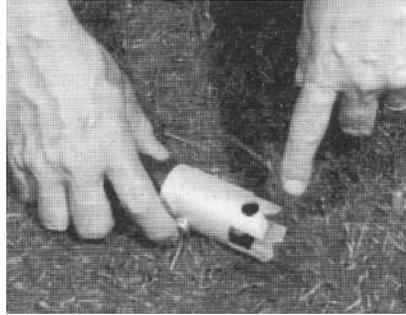


2. Remove stainless steel Cotter Pin from stainless steel Clevis Pin. Remove Clevis Pin and Safety Coupling from Upper Stem. Unbolt and remove broken Safety Flange from Upper Barrel. Remove Hold Down Nut, Anti-Friction Washer, and Operating Nut from Bonnet. Lubricate Brass Sleeve and slide over threaded Stem end to prevent O-ring damage. Unbolt Bonnet from Upper Barrel. Slide Upper Stem out of Bonnet and remove Brass Sleeve.



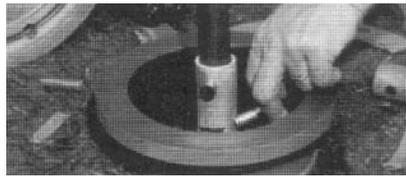
3. Remove stainless steel Cotter Pin from stainless steel Clevis Pin in Lower Stem (throw away the old Clevis Pin and Cotter Pin).

CAUTION: ALWAYS FILL THE OIL RESERVOIR WITH THE BONNET INSTALLED, THE HYDRANT IN ITS NORMAL UPRIGHT POSITION, AND THE MAIN VALVE FULLY CLOSED. IF THE HYDRANT IS FILLED WITH LUBRICANT UNDER ANY OTHER CIRCUMSTANCES, EXCESS LUBRICANT CAN OVERFILL THE BONNET AND CREATE A PRESSURE LOCK. THIS COULD RESULT IN DAMAGE TO THE SEALS OR BONNET, OR PREVENT PROPER HYDRANT OPERATION.



4. Assemble new Safety Stem Coupling to Upper Stem with new stainless steel Clevis Pin and new stainless steel Cotter Pin. Safety Stem Coupling should be installed with notches towards the Lower Stem.

NOTE: "THIS END UP" STAMPED ON COUPLING.



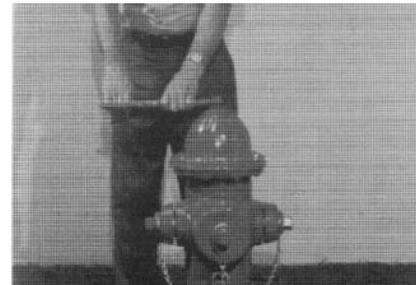
5. Assemble Upper Stem and new Safety Stem Coupling onto Lower Stem and retain it with the new stainless steel Clevis Pin and new stainless steel Cotter Pin furnished with Safety Stem Coupling.



6. Install O-ring** in groove in Ground Line Flange of Upper Barrel and place Upper Barrel carefully in position on Lower Barrel. Be sure that Upper Barrel is concentric with Lower Barrel. Bolt the two halves of Safety Flange into place (with bevel on outer edge downward) and with Safety Flange snugly fitting around Lower Barrel.



7. Check Bonnet O-ring** for proper position and condition. Attach Brass Sleeve to Upper Stem and lubricate outside to protect O-ring Seals from thread damage. Place Bonnet onto Upper Barrel and assemble Bonnet Bolts only hand-tight. Remove Brass Sleeve. Reassemble Operating Nut, Anti-Friction Washer, and Hold Down Nut*. Be sure O-ring Seals are in good condition at thread shoulder on outside of Hold Down Nut and on in side where contact is made with Operating Nut. Remove Oil Filler Plug in side of Bonnet. Pour MUELLER Hydrant Lubricant into Oil Reservoir until it is level with the Oil Filler Hole. Replace Oil Filler Plug.



8. Tighten Bonnet Bolts. Unscrew one Hose Nozzle Cap slightly to bleed air. Open Hydrant fully. Tighten the Hose Nozzle Cap when water starts flowing and check all flange connections for leaks. Turn Operating Nut to fully closed position and remove Hose Nozzle Cap to allow Barrel to drain. Replace Hose Nozzle Cap.

9. Turn Operating Nut in closing direction to make sure Main Valve is closed tightly, then turn in opening direction approximately 1/4 turn to relieve tension on operating mechanism.

*TIGHTEN HOLD DOWN NUT TO 200-300 FT-LBS OF TORQUE. IF TORQUE WRENCH IS NOT AVAILABLE, USE A 3 LB HAMMER TO STRIKE THE END OF THE A-311 WRENCH FIRMLY TWO TIMES TO ASSURE THE NUT IS PROPERLY TIGHTENED.

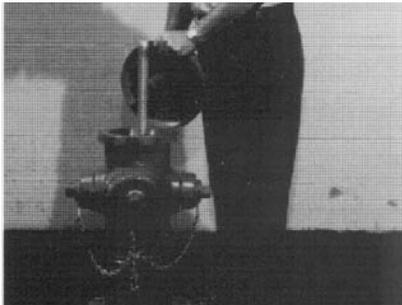
**TO DETERMINE CORRECT O-RINGS FOR BONNET AND GROUND LINE FLANGES, WHICH ARE SIMILAR IN APPEARANCE: SMALLER DIAMETER O-RING IS USED AT BONNET FLANGE; LARGER AT GROUND LINE FLANGE.

MUELLER® SUPER CENTURION® FIRE HYDRANT

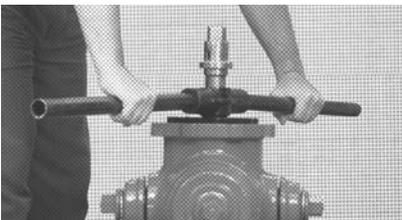
Removing Main Valve From Bonnet Flange

! WARNING

Before removing any bolt(s) holding the hydrant together, shut off gate valve to isolate hydrant from main water source. Loosen (do not remove) one nozzle cap two turns and check for water under pressure inside hydrant – bleed off any pressure, then remove nozzle cap completely. Open hydrant main valve completely. A continuous flow of water, no matter how slight, indicates hydrant is not properly isolated from the main water supply, and that problem must be corrected before any hydrant disassembly can proceed. Disassembly of hydrant with pressurized water acting against the main valve could result in unexpected ejection of hydrant parts, debris or high-pressure water stream, which could cause serious bodily injury.



1. Remove Hold Down Nut, Operating Nut, and Anti-Friction Washer from Bonnet. Lubricate Brass Sleeve and slide over threaded stem to prevent O-ring damage. Unbolt and remove Bonnet. Remove Brass Sleeve.



2. Slide slotted end of Wrench over top of Stem and engage the slot with Pin in Upper Stem. Thread Operating Nut onto stem and tighten against wrench to hold it securely. Lower support arm onto top flange of the Upper Barrel and tighten Thumb Screw to hold the Main Valve in the closed position. Shut off water at the Gate Valve. Remove Main Valve Assembly by turning Seat Wrench counter-clockwise.



3. Lift out Wrench, Lower Stem, Main Valve Assembly and Seat Ring from Hydrant Barrel as a unit.

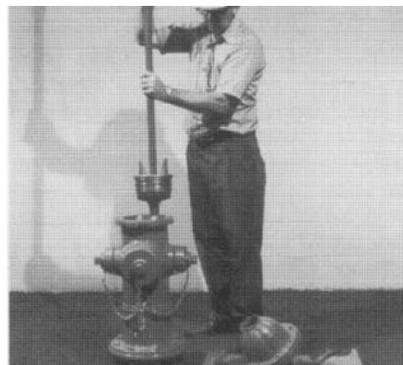
CAUTION: ALWAYS FILL THE OIL RESERVOIR WITH THE BONNET INSTALLED, THE HYDRANT IN ITS NORMAL UPRIGHT POSITION, AND THE MAIN VALVE FULLY CLOSED. IF THE HYDRANT IS FILLED WITH LUBRICANT UNDER ANY OTHER CIRCUMSTANCES, EXCESS LUBRICANT CAN OVERFILL THE BONNET AND CREATE A PRESSURE LOCK. THIS COULD RESULT IN DAMAGE TO THE SEALS OR BONNET, OR PREVENT PROPER HYDRANT OPERATION.



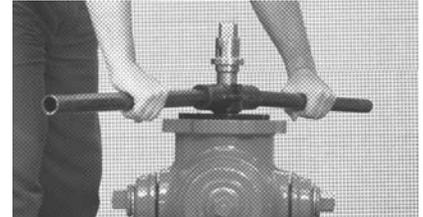
4. Straighten stainless steel Lock Washer, unscrew Cap Nut and remove Washer, Stem Seal, Lower Valve Plate, Main Valve and Seat Ring. Clean, inspect and replace any damaged parts. (Main Valve can be reversed to provide new seal.) Replace Drain Ring Facings. Inspect and lubricate Top and Bottom Seat Ring O-rings (replace if necessary). Lubricate all threaded surfaces and reassemble.



5. With Cap Nut tightened to 100 ft-lbs on 5 1/4" Hydrant or 75 ft-lbs on 4 1/2" Hydrant, bend edges of stainless steel Lock Washer over one flat on the Lower Valve Plate and one flat on the Cap Nut.



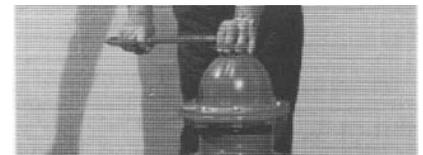
6. Lower Main Valve, turn Seat Wrench clockwise, and carefully thread Main Valve and Seat Ring into the base of the Hydrant hand-tight. Raise the Main Valve leaving about 1/2" of play between the Main Valve and Seat. Lower Support Arm and tighten Thumb Screw.



7. Turn Seat Wrench clockwise to tighten Main Valve to 350 ft-lbs. Turn on water at the Gate Valve and remove Seat Wrench by removing operating nut.



8. Check Bonnet O-ring for proper position and condition. Attach Brass Sleeve to Upper Stem and lubricate outside to protect O-ring Seals from thread damage. Place Bonnet onto Upper Barrel and assemble Bonnet Bolts only hand-tight. Remove Brass Sleeve. Reassemble Operating Nut, Anti-Friction Washer, and Hold Down Nut*. Be sure O-ring Seals are in good condition at thread shoulder on outside of Hold Down Nut and on inside where contact is made with Operating Nut. Remove Oil Filler Plug in side of Bonnet. Pour MUELLER Hydrant Lubricant into Oil Reservoir until it is level with the Oil Filler Hole. Replace Oil Filler Plug.



9. Tighten Bonnet Bolts. Unscrew one Hose Nozzle Cap slightly to bleed air. Open hydrant fully. Tighten the Hose Nozzle Cap when water starts flowing and check all flange connections for leaks. Turn Operating Nut to fully closed position and remove Hose Nozzle Cap to allow Barrel to drain. Replace Nozzle Cap.

10. Turn Operating Nut in closing direction to make sure Main Valve is closed tightly, then turn in opening direction approximately 1/4 turn to relieve tension on operating mechanism.

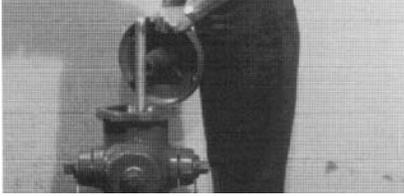
*TIGHTEN HOLD DOWN NUT TO 200-300 FT-LBS OF TORQUE. IF TORQUE WRENCH IS NOT AVAILABLE, USE A 3 LB HAMMER TO STRIKE THE END OF THE A-311 WRENCH FIRMLY TWO TIMES TO ASSURE THE NUT IS PROPERLY TIGHTENED.

MUELLER® SUPER CENTURION® FIRE HYDRANT

Remove Main Valve from Lower Barrel Flange

! WARNING

Before removing any bolt(s) holding the hydrant together, shut off gate valve to isolate hydrant from main water source. Loosen (do not remove) one nozzle cap two turns and check for water under pressure inside hydrant – bleed off any pressure, then remove nozzle cap completely. Open hydrant main valve completely. A continuous flow of water, no matter how slight, indicates hydrant is not properly isolated from the main water supply, and that problem must be corrected before any hydrant disassembly can proceed. Disassembly of hydrant with pressurized water acting against the main valve could result in unexpected ejection of hydrant parts, debris or high-pressure water stream, which could cause serious bodily injury.



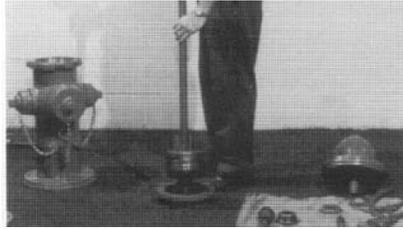
1. Remove Hold Down Nut, Anti-Friction Washer, and Operating Nut from Bonnet. Lubricate Brass Sleeve and slide over threaded stem end to prevent O-ring damage. Unbolt and remove Bonnet. Remove Safety Flange Bolts and Safety Flange. Remove Upper Barrel. Remove Upper Stem and Stem Coupling from Lower Stem. Slide slotted end of Wrench over Lower Stem. Align holes in Wrench and Stem and attach Wrench to Stem with Clevis Pin. Lower Support Arm onto the Flange of Lower Barrel and tighten Thumb Screw (to hold Main Valve in closed position). Shut off water at Gate Valve.



2. Remove Main Valve Assembly by turning Wrench counter-clockwise and lift out Wrench, Lower Stem, Main Valve Assembly and Seat Ring from Hydrant Barrel as a unit.



3. Straighten stainless steel Lock Washer, unscrew Cap Nut and remove Washer, Stem Seal, Lower Valve Plate, Main Valve and Seat Ring. Clean, inspect and replace any damaged parts. (Main Valve can be reversed to provide new seal.) Replace Drain Valve Facings. Inspect and lubricate Top and Bottom Seat Ring O-rings (replace if necessary). Lubricate all threaded surfaces and reassemble. With Cap Nut tightened to 100 ft-lbs on 5 1/4" Hydrant, or 75 ft-lbs on 4 1/2" Hydrant, bend edges on stainless steel Lock Washer over one flat on the Lower Valve Plate and one flat on the Cap Nut.



4. Lower Main Valve Assembly and carefully thread Seat Ring into the base of the Hydrant hand-tight. Raise the Main Valve leaving about 1/2" of play between the Main Valve and Seat. Lower Support Arm onto Flange of Lower Barrel and tighten Thumb Screw.



5. Tighten Main Valve to 350 ft-lbs. Turn on water at the Gate Valve and remove Wrench from Stem by removing Clevis Pin.

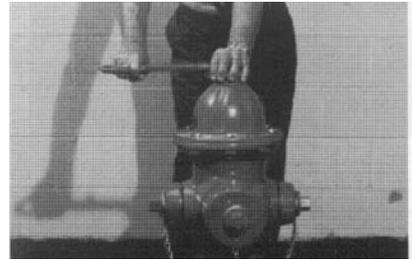


6. Reassemble Upper Stem to Lower Stem. Place Upper Barrel in place and reassemble Safety Flange.**

CAUTION: Always fill the oil reservoir with the bonnet installed, the hydrant in its normal upright position, and the main valve fully closed. If the hydrant is filled with lubricant under any other circumstances, excess lubricant can overflow the bonnet and create a pressure lock. This could result in damage to the seals or bonnet, or prevent proper hydrant operation.



7. Check Bonnet O-ring** for proper position and condition. Attach the Brass Sleeve to Upper Stem and lubricate outside to protect O-ring Seals from thread damage. Place Bonnet onto Upper Barrel and assemble Bonnet Bolts only hand-tight. Remove Brass Sleeve. Reassemble Operating Nut, Anti-Friction Washer, and Hold Down Nut*. Be sure O-ring Seals are in good condition at thread shoulder on outside of Hold Down Nut and on inside where contact is made with Operating Nut. Remove Oil Filler Plug in side of Bonnet. Pour MUELLER Hydrant Lubricant into Oil Reservoir until it is level with Oil Filler Plug Hole. Replace Oil Filler Plug.



8. Tighten Bonnet Bolts. Unscrew one Hose Nozzle Cap slightly to bleed air. Open Hydrant fully. Tighten the Hose Nozzle Cap when water starts flowing and check all flange connections for leaks. Turn Operating Nut to fully closed position and remove Hose Nozzle Cap to allow Barrel to drain. Replace Nozzle Cap.

9. Turn Operating Nut in closing direction to make sure Main Valve is closed tightly, then turn in opening direction approximately 1/4 turn to relieve tension on operating mechanism.

*TIGHTEN HOLD DOWN NUT TO 200-300 FT-LBS OF TORQUE. IF TORQUE WRENCH IS NOT AVAILABLE, USE A 3 LB HAMMER TO STRIKE THE END OF THE A-311 WRENCH FIRMLY TWO TIMES TO ASSURE THE NUT IS PROPERLY TIGHTENED.

**TO DETERMINE CORRECT O-RINGS FOR BONNET AND GROUND LINE FLANGES, WHICH ARE SIMILAR IN APPEARANCE: SMALLER DIAMETER O-RING IS USED AT BONNET FLANGE; LARGER AT GROUND LINE FLANGE.

MUELLER® SUPER CENTURION® FIRE HYDRANT

To Replace Nozzles



1. Remove Nozzle Cap.



2. Remove stainless steel Nozzle Lock by driving it out with a pointed tool and hammer.



3. Place Nozzle Wrench, A-316, on Nozzle with Wrench Forks facing toward Hydrant Barrel and locked onto Nozzle Drive Lugs. Replace Nozzle Cap and tighten until Cap rests loosely against backside of Wrench.



4. Remove Nozzle. The Nozzle Wrench may be struck with a heavy brass hammer or additional leverage may be obtained by placing a length of 2" schedule 40 steel pipe over the handle of the Nozzle Wrench.



5. Thread new Nozzle into Upper Barrel, attach A-316 Nozzle Wrench as described in Step 3, and tighten Nozzle to approximately 600 ft-lbs torque (100 lbs. pull on a 6' lever).



6. Remove Nozzle Cap and A-316 Nozzle Wrench. Place the Nozzle Lock (Part 143137), lengthwise in the slot formed by either of the Nozzle Drive Lugs and the Barrel Bore. Drive the Nozzle Lock in place by striking the Nozzle Lock Installation Tool (Part 143132) several times with a heavy brass hammer.

NOTE: Wear safety glasses when using a striking tool. The Nozzle Lock does not have to be completely seated into the slot, but it should be well engaged along the entire length of the Nozzle Drive Lug and Barrel Bore.



7. Replace and tighten Nozzle Cap.

MUELLER® SUPER CENTURION® FIRE HYDRANT

Changing Shoe



1. Tighten Operating Nut to be sure Main Valve is in the fully closed position.



4. Lubricate new Shoe and Bottom Seat Ring O-ring.



7. Replace Shoe Bolt Nuts. Tighten to approximately 1800 in-lbs.



2. Remove all 6 Shoe Bolt Nuts.



5. Position Shoe to slip in place.



3. Slip off Hydrant Shoe.



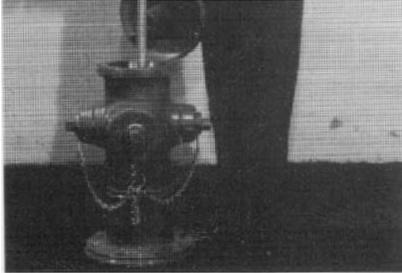
6. Slip new Shoe in place being careful not to damage Bottom Seat Ring O-ring.

MUELLER® SUPER CENTURION® FIRE HYDRANT

Inserting Extension Section

! WARNING

Before removing any bolt(s) holding the hydrant together, shut off gate valve to isolate hydrant from main water source. Loosen (do not remove) one nozzle cap two turns and check for water under pressure inside hydrant – bleed off any pressure, then remove nozzle cap completely. Open hydrant main valve completely. A continuous flow of water, no matter how slight, indicates hydrant is not properly isolated from the main water supply, and that problem must be corrected before any hydrant disassembly can proceed. Disassembly of hydrant with pressurized water acting against the main valve could result in unexpected ejection of hydrant parts, debris or high-pressure water stream, which could cause serious bodily injury.



1. Remove Hold Down Nut, Anti-Friction Washer and Operating Nut from Bonnet. Lubricate outside of Brass Sleeve and slide over threaded stem end to prevent O-ring damage. Unbolt Bonnet from Upper Barrel and remove. Remove Brass Sleeve.



2. Unbolt Safety Flange. Remove Upper Barrel. Remove Upper Stem and Safety Stem Coupling by removing the lower stainless steel Cotter Pin and stainless steel Clevis Pin.

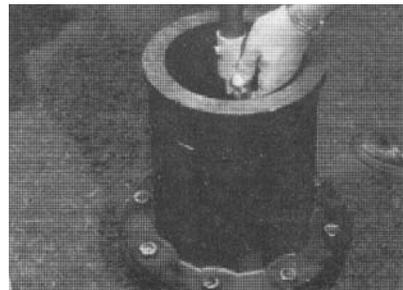


3. Place Extension Stem and Extension Coupling on Lower Stem and retain it with stainless steel Clevis Pin and stainless steel Cotter Pin.

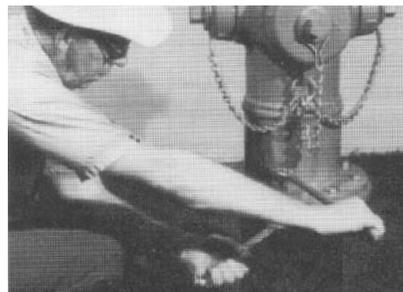
CAUTION: Always fill the oil reservoir with the bonnet installed, the hydrant in its normal upright position, and the main valve fully closed. If the hydrant is filled with lubricant under any other circumstances, excess lubricant can overflow the bonnet and create a pressure lock. This could result in damage to the seals or bonnet, or prevent proper hydrant operation.



4. Attach Extension Barrel to Lower Barrel with solid Flange halves (without groove) and Bolts, being sure Flange Gasket is in place.



5. Assemble Upper Stem and Safety Stem Coupling on to Extension Stem and retain it with stainless steel Clevis Pin and stainless steel Cotter Pin. **MAKE SURE SAFETY STEM COUPLING IS INSTALLED WITH NOTCHES TOWARDS THE LOWER STEM. WORDS "THIS END UP" TOWARDS THE UPPER STEM.**

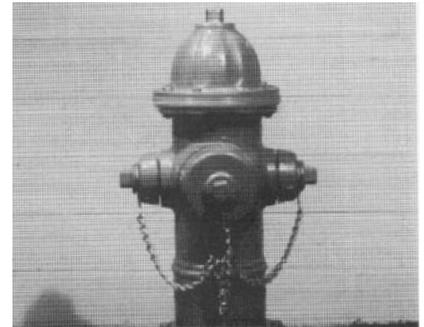


6. Attach Upper Barrel with Safety Flange Halves (with bevel on outer edge downward) and Bolts; being sure Safety Flange O-ring** is in groove in Upper Barrel.

*TIGHTEN HOLD DOWN NUT TO 200-300 FT-LBS OF TORQUE. IF TORQUE WRENCH IS NOT AVAILABLE, USE A 3 LB HAMMER TO STRIKE THE END OF THE A-311 WRENCH FIRMLY TWO TIMES TO ASSURE THE NUT IS PROPERLY TIGHTENED.



7. Check Bonnet O-ring** for proper position and condition. Attach Brass Sleeve to Upper Stem and lubricate outside to protect O-ring Seals from thread damage. Place Bonnet onto Upper Barrel and assemble Bonnet Bolts only hand-tight. Remove Brass Sleeve. Reassemble Operating Nut, Anti-Friction Washer, and Hold Down Nut*. Be sure O-ring Seals are in good condition at thread shoulder on outside of Hold Down Nut and on inside where contact is made with Operating Nut. Remove Oil Filler Plug in side of Bonnet. Pour MUELLER Hydrant Lubricant into Oil Reservoir until it is level with Oil Filler Plug Hole. Replace Oil Filler Plug.



8. Tighten Bonnet Bolts. Unscrew one Hose Nozzle Cap slightly to bleed air. Open Hydrant fully. Tighten Hose Nozzle Cap when water starts flowing and check all flange connections for leaks. Turn Operating Nut to fully closed position and remove Hose Nozzle Cap to allow Barrel to drain. Replace Hose Nozzle Cap.

9. Turn Operating Nut in closing direction to make sure Main Valve is closed tightly, then turn in opening direction approximately 1/4 turn to relieve tension on operating mechanism.

**TO DETERMINE CORRECT O-RINGS FOR BONNET AND GROUND LINE FLANGES, WHICH ARE SIMILAR IN APPEARANCE: SMALLER DIAMETER O-RING IS USED AT BONNET FLANGE; LARGER AT GROUND LINE FLANGE.

Mueller Co.

MUELLER® SUPER CENTURION® FIRE HYDRANT PARTS

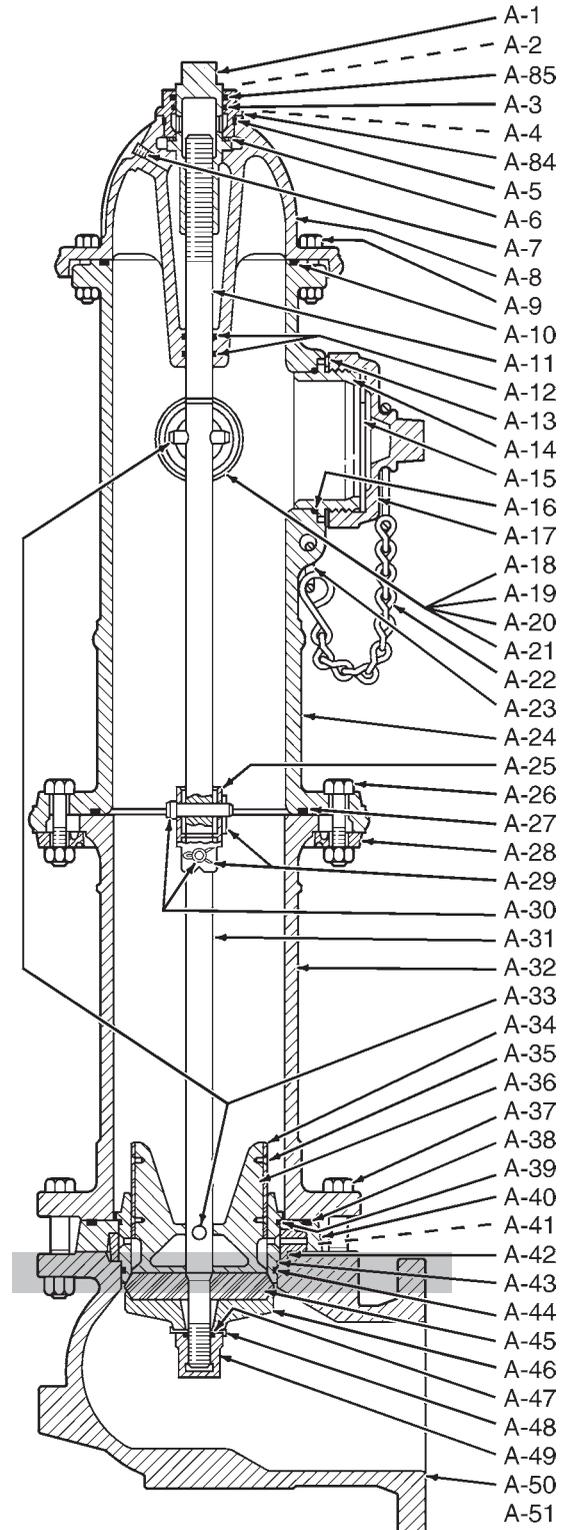


9.9

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MUELLER Super Centurion Fire Hydrant Parts

Cat. part #	Description	Material	Material standard
A-1	Operating nut	Bronze	ASTM B584
A-2	Weather cap (not shown; used only on pre-1988 models)	Cast iron	ASTM A126 CL.B
A-3	Hold down nut O-ring	Rubber	ASTM D2000 BUNA N
A-4	Hold down nut (not shown; used only on pre-1988 models)	Bronze	ASTM B584
A-5	Bonnet O-ring	Rubber	ASTM D2000 BUNA N
A-6	Anti-friction washer	Celcon	
A-7	Oil plug	Brass	ASTM B16
A-8	Bonnet	Cast iron	ASTM A126 CL.B
A-9	Bonnet bolt and nut	Steel	ASTM A307 Plated
A-10	Bonnet O-ring (1997 and newer 3-way models; all pre-1997 models and 1-way and 2-way models have flat gasket)	Rubber	ASTM D2000 BUNA N
A-11	Upper stem	Steel	ASTM A576 GR.B
A-12	Stem O-ring	Rubber	ASTM D2000 BUNA N
A-13	Nozzle lock	Stainless steel	ASTM A276
A-14	Pumper nozzle	Bronze	ASTM B584
A-15	Pumper nozzle gasket	Rubber	ASTM D2000 Neoprene
A-16	Pumper nozzle O-ring	Rubber	ASTM D2000 BUNA N
A-17	Pumper nozzle cap	Cast iron	ASTM A126 CL.B
A-18	Hose nozzle	Bronze	ASTM B584
A-19	Hose nozzle gasket	Rubber	ASTM D2000 Neoprene
A-20	Hose nozzle O-ring	Rubber	ASTM D2000 BUNA N
A-21	Hose nozzle cap	Cast iron	ASTM A126 CL.B
A-22	Cap chain	Steel	Plated
A-23	Chain ring	Steel	Plated
A-24	Upper barrel less nozzles	Cast iron	ASTM A126 CL.B
A-25	Safety coupling	Stainless steel	ASTM A890
A-26	Safety flange bolt and nut	Steel	ASTM A307 Plated
A-27	Safety flange O-ring (1997 and newer models; pre-1997 models have flat gasket)	Rubber	ASTM D2000 BUNA N
A-28	Safety flange	Cast iron	ASTM A126 CL.B
A-29	Cotter pin	Stainless steel	ASTM A276
A-30	Clevis pin	Stainless steel	ASTM A276
A-31	Lower stem	Steel	ASTM A576 GR.B
A-32	Lower barrel	Cast iron	ASTM A126 CL.B
A-33	Stem pin	Stainless steel	ASTM A276
A-34	Drain valve facing	Plastic	
A-35	Drain valve screw	Stainless steel	ASTM A276
A-36	Upper valve plate (includes A-34 and A-35)	Bronze	ASTM B584
A-37	Shoe bolt and nut	Steel	ASTM A307 Plated
A-38	Drain ring housing O-ring (1997 and newer models; pre-1997 models have square gasket)	Rubber	ASTM D2000 BUNA N
A-39	Seat ring top O-ring	Rubber	ASTM D2000 BUNA N
A-40	Drain ring housing	Cast iron	ASTM A126 CL.B
A-41	Drain ring housing bolt and nut (not shown; used only on pre-1997 model hydrants)	Steel	ASTM A307 Plated
A-42	Drain ring	Bronze	ASTM B584
A-43	Seat ring	Bronze	ASTM B584
A-44	Seat ring bottom O-ring	Rubber	ASTM D2000 BUNA N
A-45*	Reversible main valve (1997 and newer models only; pre-1997 models use non-reversible main valve and lower valve plate - not shown)	Rubber	ASTM D2000
A-46	Lower valve plate (1997 and newer models for reversible main valve; pre-1997 models have non-reversible main valve - not shown)	Cast iron	ASTM A126 CL.B
A-47	Cap nut seal	Rubber	ASTM D2000
A-48	Lock washer	Stainless steel	ASTM A276
A-49	Lower valve plate nut	Cast iron	ASTM A126 CL.B
A-50	Shoe**	Cast iron	ASTM A126 CL. B
A-84	Hold down nut	Bronze	ASTM B584
A-85	Weather seal	Rubber	ASTM D2000
A-51	10.5 oz. hydrant lubricating oil (not shown)		



* Pre-1997 models may be upgraded to use the reversible main valve by also replacing the lower valve plate with the 1997 model.

** 6" MJ shoe is Ductile Iron, ASTM A536 Grade 65-45-12.

LIMITED WARRANTY

Mueller Co. warrants its products to be free of defects in workmanship and material under normal use and service and when used for the purposes and under the conditions for which they are intended.

Obligation under this Warranty is limited, at Company's option; to adjustment, repair or replacement of the defective product. Purchaser must immediately notify Mueller Co. in writing of the claimed defect. Company shall have the right to inspect said product and Purchaser shall, if requested, return the defective product to Mueller Co., with transportation prepaid. Purchaser shall assume all responsibility and expense for removal, reinstallation, and freight charges in connection with the foregoing remedy. Mueller Co. shall not be liable for indirect, special, incidental or consequential damage or penalties and does not assume any liability of Purchaser to others, or to others, for injury to persons or property.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED.

GATE VALVES USER INSTALLATION MANUAL

This booklet is designed to assist you, the installer of gate valves, by assuring that you have received a working valve, that the valve is stored and handled properly, and that after installation it will work satisfactorily. The AWWA C500 Water Works Gate Valve Standard requires working pressure and test pressure ratings be established for valves up to 12" at 200 psig water working pressure – 400 psig test pressure; for 14" valves and larger at 150 psig water working pressure – 300 psig test pressure. (Mueller® Resilient Wedge Valves are rated at 250 psig working pressure, 500 psig test pressure.) Every valve must be hydrostatically tested at the manufacturer's plant before shipment.

Following these simple instructions will make your job easier:

(A) INSPECTION ON DELIVERY

- When you first get the valve, check it for possible damage in shipment, conformance to specifications, opening direction, shortages, etc.
- Carefully unload all valves - do not drop valve - or lift valve using gearing, bypass or other appendage as a hook.
- Valve should be opened and then closed to make sure it works properly. Also check opening direction against the order instruction.
- Any problems should be reported immediately to the Trucker and noted on bill of lading, and signed by the driver on your copy.

(B) STORAGE

- Valves should be stored in a partially open position.
- When possible, keep valves out of the weather.
- In cold climates the inside of the valve must be kept drained of any water to prevent freezing.
- When stored outside, valve stem should be in a vertical position.
- Whenever possible, valves should be covered with a water-proof covering.
- Protect all parts of the valve at all times.
- Protect rubber seat of resilient wedge valves from ozone and hydrocarbons (solvents, paints and oils, etc.).

(C) INSPECTION BEFORE INSTALLATION

- Check to see the valve end-joints are clean.
- The valve is not damaged.
- Open and close valve - make sure it works properly.
- Keep valve closed when placing in trench.
- Inspect casting for damage.
(Repair Finish Kit 280087 is available for use on both resilient wedge and double-disc gate valves.)

(D) INSTALLATION

- Handle valve carefully.
- Prepare pipe ends in accordance with pipe manufacturers' instructions.
- Install valve as/per appropriate instructions for the specified joint (flanged, mechanical joint, slip-on, etc.)
- Water main should be properly supported to avoid line stress on valve.
- In buried applications, make sure that the valve box does not transmit traffic loads or other stress to the valve.
- Do not use valves to force a pipeline into position.
- Do not deflect any valve/pipe joint.

(E) TESTING

- Do not backfill valves before hydrostatic system test. Leave the valves exposed while the pipeline is being pressurized. Check to see that all valve joints and pressure containing bolting, including bonnet bolts, are tight.
- AWWA C-500 states that double-disc gate valves have an allowable leakage rate. This allowable leakage must be taken into consideration when hydrostatically testing the system. (This does not apply to resilient wedge valves.)
- Valves can be tested (**but not operated**) at two times the rated pressure of the valve.
- After testing, steps should be taken to relieve any trapped pressure in body of valves.

GENERAL NOTES

These reference materials are available and should be helpful in the installation and testing of Gate Valve products.

- AWWA C-500 (Gate Valves – 3" thru 48")
- AWWA C-509 (Resilient Seated Gate Valves 3" thru 12" Nominal Pipe Size)
- AWWA C-600 Installation of Ductile Iron Water Mains and Main Appurtenances.
- All installation, operation and maintenance instructions issued by the manufacturer of the pipe and the valves.
- Valve user guide as published by MSS.
- AWWA Recommendation for Installation, Operation and Maintenance of Gate Valves.
- NFPA-24 – Outside Pipeline Protection Equipment U/L.
- AWWA C-515 Reduced Wall Gate Valves.

These industry practices have been listed to help you make a safe and acceptable installation of a gate valve.

GATE VALVE USER INSTALLATION MANUAL FOR MUELLER® RESILIENT WEDGE AND DOUBLE-DISC GATE VALVES



MAIN OFFICE – Decatur, IL (217) 423-4471
CANADA – Mueller Canada, Inc., Milton, Ontario (905) 878-0541

MUELLER CO. • CHATTANOOGA, TN

Rev. 2-06 Shaded area indicates change.

- Catalog number—
 - A-2360-20** Mechanical joint ends (with accessories unassembled)
 - A-2360-23** Mechanical joint ends (less accessories)
 - A-2360-25** Mechanical joint ends (with transition gaskets accessories unassembled)
- Sizes – 2", 3", 4", 6", 8", 10", 12"
- Meets or exceeds all applicable requirements of ANSI/AWWA C509 Standard, UL Listed, FM Approved, and certified to ANSI/NSF 61.
- Standard mechanical joint ends comply with ANSI/AWWA C111
- Iron body with nominal 10 mils MUELLER® Pro-Gard™ Fusion Epoxy Coated interior and exterior surfaces
- Epoxy coating meets or exceeds all applicable requirements of ANSI/AWWA C550 Standard and is certified to ANSI/NSF 61
- Iron wedge, symmetrical & fully encapsulated with molded rubber; no exposed iron
- Non-rising stem (NRS)
- Triple O-ring seal stuffing box (2 upper & 1 lower O-rings), **with fourth O-ring serving as dirt seal††**
- 2" square wrench nut (optional handwheel available)—open left or open right
- 250 psig (1723 kPa) maximum working pressure, 500 psig (3447 kPa) static test pressure
- 3"-12" sizes – UL Listed, FM Approved: 200 psig (1379 kPa)



A-2360-20 M.J. accessories shipped unassembled

††Dirt seal on 4"-12" valves

Options

See page 10.40 for more information on Resilient Wedge Gate Valve options

- Position indicators
- Stainless steel fasteners: Type 316
- ASTM B98-C66100/H02 stem
- Handwheel

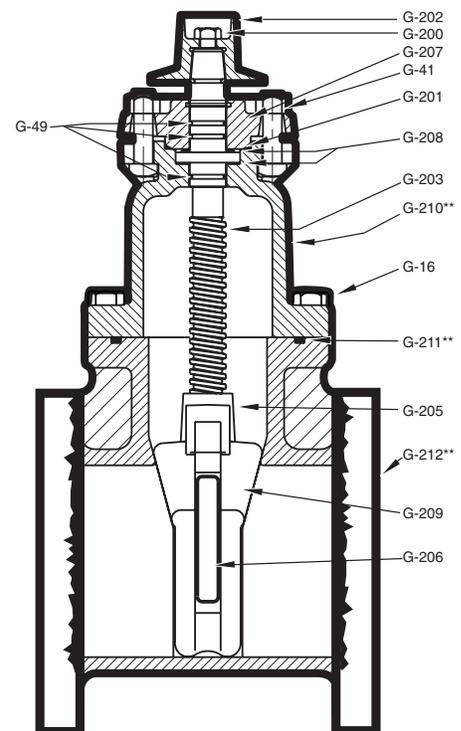
Resilient wedge gate valve parts

Catalog Part No.	Description	Material	Material standard
G-16	Bonnet Bolts & Nuts	Stainless Steel	Type 304
G-41	Stuffing Box Bolts & Nuts	Stainless Steel	Type 304
G-49	Stem O-rings (3)	Rubber	
G-200	Wrench Nut Cap Screw	Stainless Steel	Type 304
G-201	Stuffing Box Seal	Rubber	
G-202	Wrench Nut	Cast Iron	ASTM A126 CL.B
G-203	Stem	Bronze	ASTM B138
G-204	Hand Wheel (not shown)	Cast Iron	ASTM A126 CL.B
G-205	Stem Nut	Bronze	ASTM B62
G-206	Guide Cap Bearings	Celcon	
G-207	Stuffing Box with dirt seal††	Cast iron Rubber	ASTM A126 CL.B --
G-208	Anti-friction Washers (2)	Celcon	
G-209	Wedge, Rubber Encapsulation	Cast Iron* SBR	ASTM A126 CL.B --
G-210**	Bonnet	Cast Iron	ASTM A126 CL.B
G-211**	Bonnet O-ring	Nitrile	
G-212**	Body	Cast Iron	ASTM A126 CL.B

* Fully encapsulated in molded rubber with no iron exposed

** Previous to 1999 these parts on 4"-12" valves were designed with a gasket instead of an O-ring and with additional bolt holes (2"-3" sizes retain neoprene gasket design affecting these parts). Confirm the type of seal when ordering a replacement gasket or O-ring.

††Dirt seal on 4"-12" valves

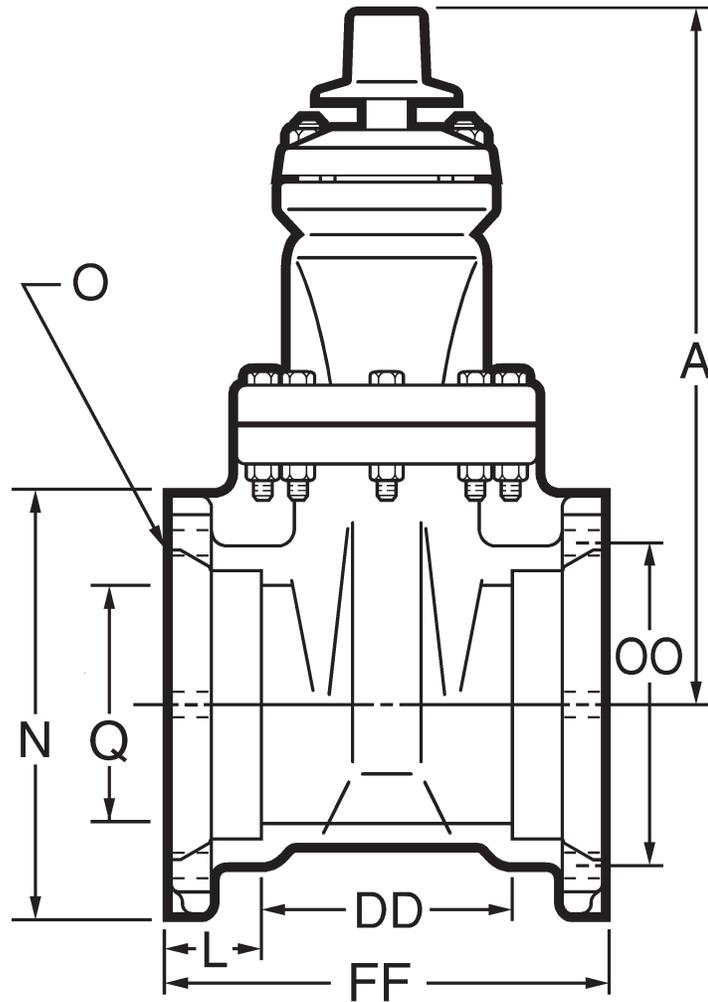


SEE PAGE 10.43 FOR ORDERING INSTRUCTIONS

2"-12" A-2360 RESILIENT WEDGE GATE VALVE - M.J. x M.J.

Mueller Co. 10.15

Rev. 2-06



Dimensions

Dimension*	Nominal size						
	2"	3"	4"	6"	8"	10"	12"
A	9.88	12.38	14.19	18.00	21.50	25.50	28.62
FF	8.50	9.00	10.00	11.50	12.50	14.75	14.88
L	2.50	2.50	2.50	2.50	2.50	2.50	2.50
N	4.62	7.50	9.12	11.12	13.37	15.62	17.88
O (number and size of holes)	4--.88	4--.88	4--.88	6--.88	6--.88	8--.88	8--.88
DD	3.50	4.00	5.00	6.50	7.50	9.75	9.88
Q (bore)	2.30	3.30	4.30	6.30	8.30	10.30	12.30
OO (bolt circle diameter)	5.00	6.19	7.50	9.50	11.75	14.00	16.25
Turns to open	8	11	14	20.5	26.5	33	38.5
Weight*	40	83	120	186	280	405	540

*All dimensions are in inches. All weights include accessories are in pounds and are approximate.

P-2360-20 (with M.J. Accessories+)

P-2360-23 (less M.J. Accessories)

MECHANICAL JOINT ENDS
Indicator Post Style Stuffing box
O-ring Seals
2" Square Operating Nut

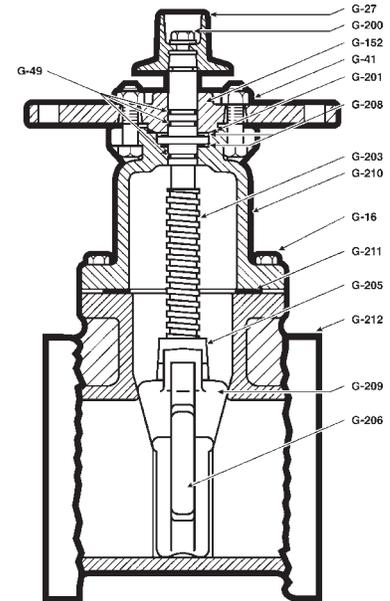
- 4", 6", 8", 10" AND 12" SIZES
- MEETS OR EXCEEDS ALL APPLICABLE REQUIREMENTS OF UL 262 AND FM 1120/1130 SPECIFICATIONS AND COMPLIES WITH NSF-61
- IRON BODY WITH MUELLER® PRO-GARD™ FUSION EPOXY COATED INTERIOR & EXTERIOR SURFACES
- NON-RISING BRONZE STEM

- RUBBER ENCAPSULATED IRON WEDGE
- 200 PSIG (1379 KPA) MAXIMUM WORKING PRESSURE, 400 PSIG (2758 KPA) STATIC TEST
- TRIPLE O-RING SEAL STUFFING BOX (2 UPPER & 1 LOWER O-RINGS)
- EPOXY COATING MEETS OR EXCEEDS ANSI/AWWA C550 AND COMPLIES WITH NSF-61



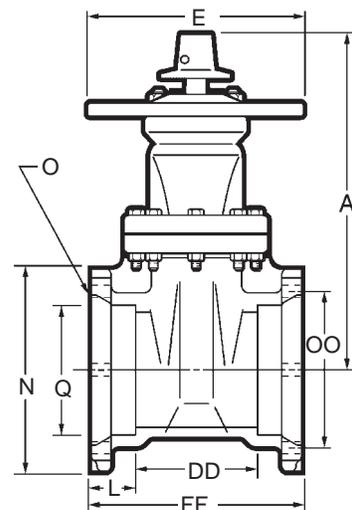
PARTS LIST

Catalog Part No.	Description	Material	Material Standard
G-16	Bonnet Bolts & Nuts	Carbon Steel	ASTM A307 Grade B, Zinc Plated
G-27	Wrench Nut	Cast Iron	ASTM A126 CL.B
G-41	Stuffing Box Bolts & Nuts	Carbon Steel	ASTM A307 Grade B, Zinc Plated
G-49	Stem O-rings (3)	Rubber	ASTM D2000
G-152	Stuffing Box	Cast Iron	ASTM A126 CL.B
G-200	Wrench Nut Cap Screw	Carbon Steel	ASTM A307 Grade B, Zinc Plated
G-201	Stuffing Box Seal	Rubber	ASTM D2000
G-203	Stem	Bronze	ASTM B138
G-205	Stem Nut	Bronze	ASTM B62
G-206	Guide Cap Bearings	Thermal Plastic	
G-208	Anti-friction Washers (2)	Thermal Plastic	
G-209	Wedge, Rubber Encapsulated	Cast Iron*	ASTM A126 CL.B
G-210	Bonnet	Cast Iron	ASTM A126 CL.B
G-211	Bonnet Gasket	Rubber	ASTM D2000
G-212	Body	Cast Iron	ASTM A126 CL.B



DIMENSIONS

Dimension	Size				
	4"	6"	8"	10"	12"
A	14.19"	18.00"	21.50"	25.50"	28.62"
FF	10.00"	11.50"	12.50"	14.75"	14.88"
E	12.00"	12.00"	12.00"	12.00"	12.00"
Q (Bore)	4.30"	6.30"	8.30"	10.30"	12.30"
OO	7.50"	9.50"	11.75"	14.00"	16.25"
N	9.12"	11.12"	13.37"	15.62"	17.88"
L	2.50"	2.50"	2.50"	2.50"	2.50"
DD	5.00"	6.50"	7.50"	9.75"	9.88"
O (number and size of bolts)	4--7/8"	6--7/8"	6--7/8"	8--7/8"	8--7/8"
Turns to open	14	20.5	26.5	33	38.5
Weight (lbs.)**	120	186	280	405	540



+MJ accessories are included and palletized separately from valves.

* Fully encapsulated in molded rubber with no iron exposed.

** All weights are in pounds and are approximate.

LIMITED WARRANTY

Mueller Co. warrants its products to be free of defects in workmanship and material under normal use and service and when used for the purposes and under the conditions for which they are intended.

Obligation under this Warranty is limited, at Company's option; to adjustment, repair or replacement of the defective product. Purchaser must immediately notify Mueller Co. in writing of the claimed defect. Company shall have the right to inspect said product and Purchaser shall, if requested, return the defective product to Mueller Co., with transportation prepaid. Purchaser shall assume all responsibility and expense for removal, reinstallation, and freight charges in connection with the foregoing remedy. Mueller Co. shall not be liable for indirect, special, incidental or consequential damage or penalties and does not assume any liability of Purchaser to others, or to others, for injury to persons or property.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED.

GATE VALVES USER INSTALLATION MANUAL

This booklet is designed to assist you, the installer of gate valves, by assuring that you have received a working valve, that the valve is stored and handled properly, and that after installation it will work satisfactorily. The AWWA C500 Water Works Gate Valve Standard requires working pressure and test pressure ratings be established for valves up to 12" at 200 psig water working pressure – 400 psig test pressure; for 14" valves and larger at 150 psig water working pressure – 300 psig test pressure. (Mueller® Resilient Wedge Valves are rated at 250 psig working pressure, 500 psig test pressure.) Every valve must be hydrostatically tested at the manufacturer's plant before shipment.

Following these simple instructions will make your job easier:

(A) INSPECTION ON DELIVERY

- When you first get the valve, check it for possible damage in shipment, conformance to specifications, opening direction, shortages, etc.
- Carefully unload all valves - do not drop valve - or lift valve using gearing, bypass or other appendage as a hook.
- Valve should be opened and then closed to make sure it works properly. Also check opening direction against the order instruction.
- Any problems should be reported immediately to the Trucker and noted on bill of lading, and signed by the driver on your copy.

(B) STORAGE

- Valves should be stored in a partially open position.
- When possible, keep valves out of the weather.
- In cold climates the inside of the valve must be kept drained of any water to prevent freezing.
- When stored outside, valve stem should be in a vertical position.
- Whenever possible, valves should be covered with a water-proof covering.
- Protect all parts of the valve at all times.
- Protect rubber seat of resilient wedge valves from ozone and hydrocarbons (solvents, paints and oils, etc.).

(C) INSPECTION BEFORE INSTALLATION

- Check to see the valve end-joints are clean.
- The valve is not damaged.
- Open and close valve - make sure it works properly.
- Keep valve closed when placing in trench.
- Inspect casting for damage.
(Repair Finish Kit 280087 is available for use on both resilient wedge and double-disc gate valves.)

(D) INSTALLATION

- Handle valve carefully.
- Prepare pipe ends in accordance with pipe manufacturers' instructions.
- Install valve as/per appropriate instructions for the specified joint (flanged, mechanical joint, slip-on, etc.)
- Water main should be properly supported to avoid line stress on valve.
- In buried applications, make sure that the valve box does not transmit traffic loads or other stress to the valve.
- Do not use valves to force a pipeline into position.
- Do not deflect any valve/pipe joint.

(E) TESTING

- Do not backfill valves before hydrostatic system test. Leave the valves exposed while the pipeline is being pressurized. Check to see that all valve joints and pressure containing bolting, including bonnet bolts, are tight.
- AWWA C-500 states that double-disc gate valves have an allowable leakage rate. This allowable leakage must be taken into consideration when hydrostatically testing the system. (This does not apply to resilient wedge valves.)
- Valves can be tested (**but not operated**) at two times the rated pressure of the valve.
- After testing, steps should be taken to relieve any trapped pressure in body of valves.

GENERAL NOTES

These reference materials are available and should be helpful in the installation and testing of Gate Valve products.

- AWWA C-500 (Gate Valves – 3" thru 48")
- AWWA C-509 (Resilient Seated Gate Valves 3" thru 12" Nominal Pipe Size)
- AWWA C-600 Installation of Ductile Iron Water Mains and Main Appurtenances.
- All installation, operation and maintenance instructions issued by the manufacturer of the pipe and the valves.
- Valve user guide as published by MSS.
- AWWA Recommendation for Installation, Operation and Maintenance of Gate Valves.
- NFPA-24 – Outside Pipeline Protection Equipment U/L.
- AWWA C-515 Reduced Wall Gate Valves.

These industry practices have been listed to help you make a safe and acceptable installation of a gate valve.

GATE VALVE USER INSTALLATION MANUAL FOR MUELLER® RESILIENT WEDGE AND DOUBLE-DISC GATE VALVES



MAIN OFFICE – Decatur, IL (217) 423-4471
CANADA – Mueller Canada, Inc., Milton, Ontario (905) 878-0541

MUELLER CO. • CHATTANOOGA, TN

Rev. 2-06 Shaded area indicates change.

- Catalog number—
 - A-2360-20** Mechanical joint ends (with accessories unassembled)
 - A-2360-23** Mechanical joint ends (less accessories)
 - A-2360-25** Mechanical joint ends (with transition gaskets accessories unassembled)
- Sizes – 2", 3", 4", 6", 8", 10", 12"
- Meets or exceeds all applicable requirements of ANSI/AWWA C509 Standard, UL Listed, FM Approved, and certified to ANSI/NSF 61.
- Standard mechanical joint ends comply with ANSI/AWWA C111
- Iron body with nominal 10 mils MUELLER® Pro-Gard™ Fusion Epoxy Coated interior and exterior surfaces
- Epoxy coating meets or exceeds all applicable requirements of ANSI/AWWA C550 Standard and is certified to ANSI/NSF 61
- Iron wedge, symmetrical & fully encapsulated with molded rubber; no exposed iron
- Non-rising stem (NRS)
- Triple O-ring seal stuffing box (2 upper & 1 lower O-rings), **with fourth O-ring serving as dirt seal††**
- 2" square wrench nut (optional handwheel available)—open left or open right
- 250 psig (1723 kPa) maximum working pressure, 500 psig (3447 kPa) static test pressure
- 3"-12" sizes – UL Listed, FM Approved: 200 psig (1379 kPa)



A-2360-20 M.J. accessories shipped unassembled

††Dirt seal on 4"-12" valves

Options

See page 10.40 for more information on Resilient Wedge Gate Valve options

- Position indicators
- Stainless steel fasteners: Type 316
- ASTM B98-C66100/H02 stem
- Handwheel

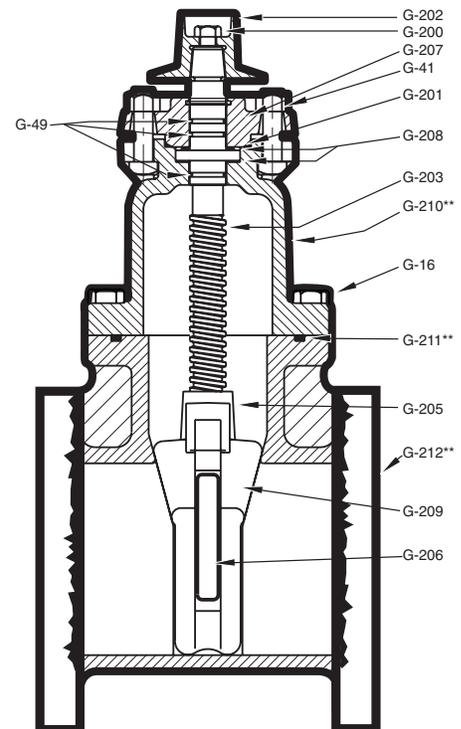
Resilient wedge gate valve parts

Catalog Part No.	Description	Material	Material standard
G-16	Bonnet Bolts & Nuts	Stainless Steel	Type 304
G-41	Stuffing Box Bolts & Nuts	Stainless Steel	Type 304
G-49	Stem O-rings (3)	Rubber	
G-200	Wrench Nut Cap Screw	Stainless Steel	Type 304
G-201	Stuffing Box Seal	Rubber	
G-202	Wrench Nut	Cast Iron	ASTM A126 CL.B
G-203	Stem	Bronze	ASTM B138
G-204	Hand Wheel (not shown)	Cast Iron	ASTM A126 CL.B
G-205	Stem Nut	Bronze	ASTM B62
G-206	Guide Cap Bearings	Celcon	
G-207	Stuffing Box with dirt seal††	Cast iron Rubber	ASTM A126 CL.B --
G-208	Anti-friction Washers (2)	Celcon	
G-209	Wedge, Rubber Encapsulation	Cast Iron* SBR	ASTM A126 CL.B --
G-210**	Bonnet	Cast Iron	ASTM A126 CL.B
G-211**	Bonnet O-ring	Nitrile	
G-212**	Body	Cast Iron	ASTM A126 CL.B

* Fully encapsulated in molded rubber with no iron exposed

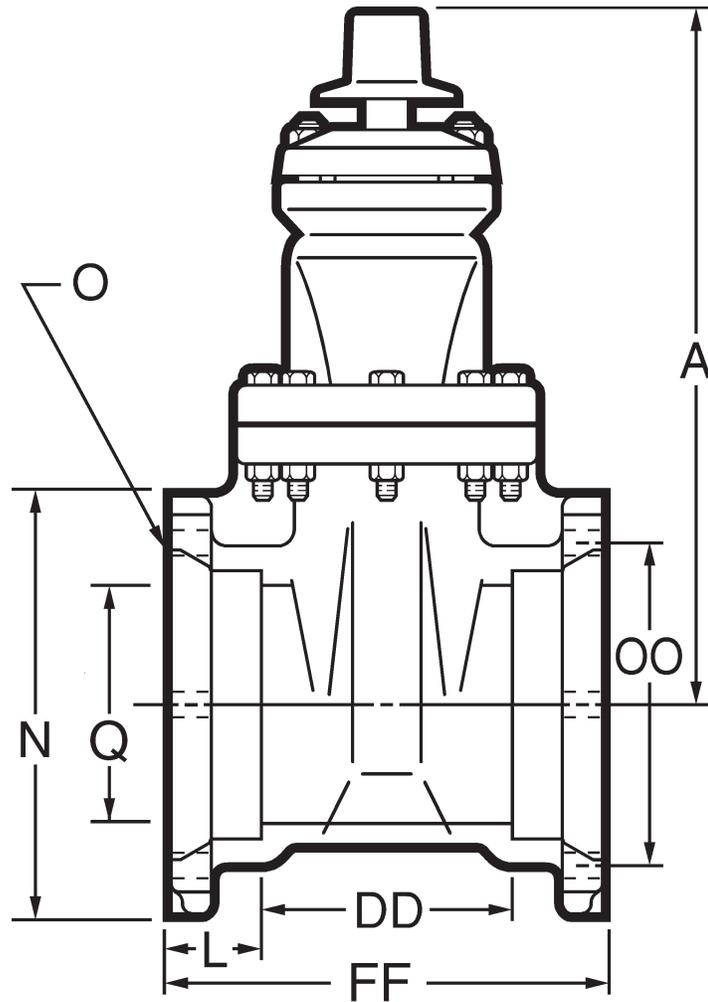
** Previous to 1999 these parts on 4"-12" valves were designed with a gasket instead of an O-ring and with additional bolt holes (2"-3" sizes retain neoprene gasket design affecting these parts). Confirm the type of seal when ordering a replacement gasket or O-ring.

††Dirt seal on 4"-12" valves



SEE PAGE 10.43 FOR ORDERING INSTRUCTIONS

2"-12" A-2360 RESILIENT WEDGE GATE VALVE - M.J. x M.J.



Dimensions

Dimension*	Nominal size						
	2"	3"	4"	6"	8"	10"	12"
A	9.88	12.38	14.19	18.00	21.50	25.50	28.62
FF	8.50	9.00	10.00	11.50	12.50	14.75	14.88
L	2.50	2.50	2.50	2.50	2.50	2.50	2.50
N	4.62	7.50	9.12	11.12	13.37	15.62	17.88
O (number and size of holes)	4--.88	4--.88	4--.88	6--.88	6--.88	8--.88	8--.88
DD	3.50	4.00	5.00	6.50	7.50	9.75	9.88
Q (bore)	2.30	3.30	4.30	6.30	8.30	10.30	12.30
OO (bolt circle diameter)	5.00	6.19	7.50	9.50	11.75	14.00	16.25
Turns to open	8	11	14	20.5	26.5	33	38.5
Weight*	40	83	120	186	280	405	540

*All dimensions are in inches. All weights include accessories are in pounds and are approximate.

P-2360-20 (with M.J. Accessories+)

P-2360-23 (less M.J. Accessories)

MECHANICAL JOINT ENDS
Indicator Post Style Stuffing box
O-ring Seals
2" Square Operating Nut

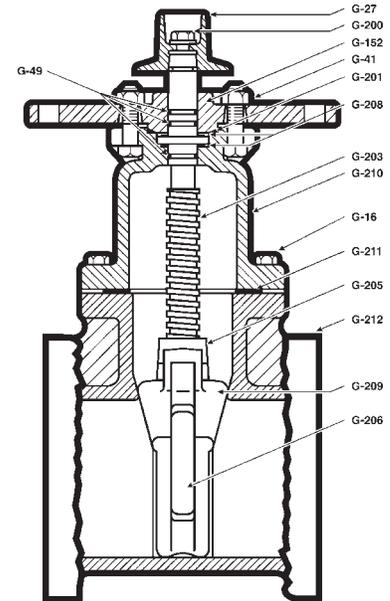
- 4", 6", 8", 10" AND 12" SIZES
- MEETS OR EXCEEDS ALL APPLICABLE REQUIREMENTS OF UL 262 AND FM 1120/1130 SPECIFICATIONS AND COMPLIES WITH NSF-61
- IRON BODY WITH MUELLER® PRO-GARD™ FUSION EPOXY COATED INTERIOR & EXTERIOR SURFACES
- NON-RISING BRONZE STEM

- RUBBER ENCAPSULATED IRON WEDGE
- 200 PSIG (1379 KPA) MAXIMUM WORKING PRESSURE, 400 PSIG (2758 KPA) STATIC TEST
- TRIPLE O-RING SEAL STUFFING BOX (2 UPPER & 1 LOWER O-RINGS)
- EPOXY COATING MEETS OR EXCEEDS ANSI/AWWA C550 AND COMPLIES WITH NSF-61



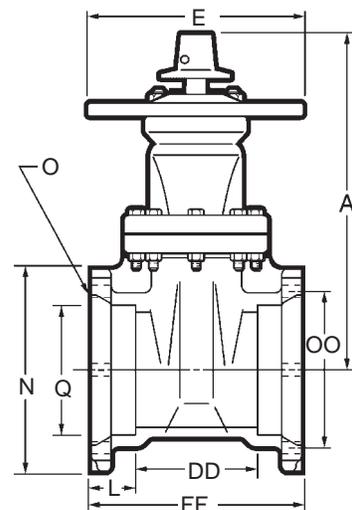
PARTS LIST

Catalog Part No.	Description	Material	Material Standard
G-16	Bonnet Bolts & Nuts	Carbon Steel	ASTM A307 Grade B, Zinc Plated
G-27	Wrench Nut	Cast Iron	ASTM A126 CL.B
G-41	Stuffing Box Bolts & Nuts	Carbon Steel	ASTM A307 Grade B, Zinc Plated
G-49	Stem O-rings (3)	Rubber	ASTM D2000
G-152	Stuffing Box	Cast Iron	ASTM A126 CL.B
G-200	Wrench Nut Cap Screw	Carbon Steel	ASTM A307 Grade B, Zinc Plated
G-201	Stuffing Box Seal	Rubber	ASTM D2000
G-203	Stem	Bronze	ASTM B138
G-205	Stem Nut	Bronze	ASTM B62
G-206	Guide Cap Bearings	Thermal Plastic	
G-208	Anti-friction Washers (2)	Thermal Plastic	
G-209	Wedge, Rubber Encapsulated	Cast Iron*	ASTM A126 CL.B
G-210	Bonnet	Cast Iron	ASTM A126 CL.B
G-211	Bonnet Gasket	Rubber	ASTM D2000
G-212	Body	Cast Iron	ASTM A126 CL.B



DIMENSIONS

Dimension	Size				
	4"	6"	8"	10"	12"
A	14.19"	18.00"	21.50"	25.50"	28.62"
FF	10.00"	11.50"	12.50"	14.75"	14.88"
E	12.00"	12.00"	12.00"	12.00"	12.00"
Q (Bore)	4.30"	6.30"	8.30"	10.30"	12.30"
OO	7.50"	9.50"	11.75"	14.00"	16.25"
N	9.12"	11.12"	13.37"	15.62"	17.88"
L	2.50"	2.50"	2.50"	2.50"	2.50"
DD	5.00"	6.50"	7.50"	9.75"	9.88"
O (number and size of bolts)	4--7/8"	6--7/8"	6--7/8"	8--7/8"	8--7/8"
Turns to open	14	20.5	26.5	33	38.5
Weight (lbs.)**	120	186	280	405	540



+MJ accessories are included and palletized separately from valves.

* Fully encapsulated in molded rubber with no iron exposed.

** All weights are in pounds and are approximate.



Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services



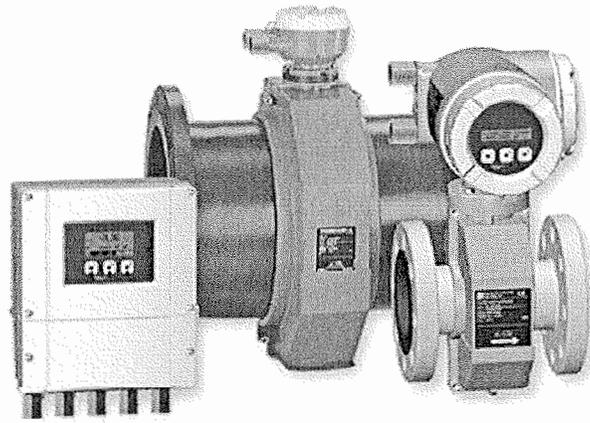
Solutions

Technical Information

Proline Promag 50W, 53W

Electromagnetic Flow Measuring System

Flow measurement in water or wastewater applications



Application

Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of $\geq 5 \mu\text{S}/\text{cm}$:

- Drinking water
- Wastewater
- Wastewater sludge
- Flow measurement up to 700 Mgal/day (110,000 m³/h)
- Fluid temperature up to +176°F (+80°C)
- Process pressures up to 580 psi (40 bar)
- Fitting lengths to DVGW/ISO

Application-specific lining materials:

- Polyurethane and hard rubber

Approvals for hazardous area:

- ATEX, FM, CSA

Lined measuring pipes with materials approved for drinking water:

- KTW, WRAS, NSF, ACS, etc. (for Polyurethane liners as well)

Connection to process control system:

- HART®, Profibus® DP/PA, FOUNDATION Fieldbus™, MODBUS® RS485

Your benefits

Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform **Proline transmitter concept** comprises:

- Modular device and operating concept resulting in a higher degree of efficiency
- Software options for electrode cleaning
- Uniform operating concept

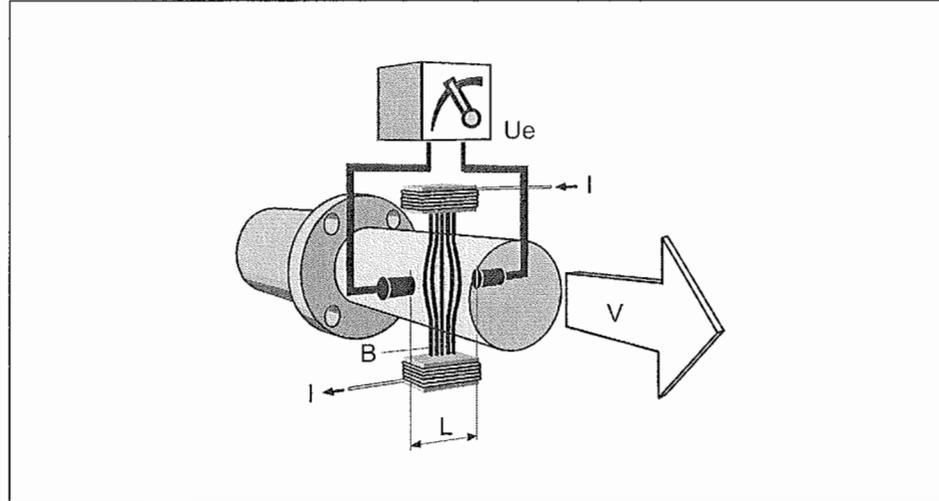
The tried-and-tested **Promag sensors** offer:

- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

Function and system design

Measuring principle

Faraday's law of induction states that a voltage is induced in a conductor moving in a magnetic field. In electromagnetic measuring, the flowing medium corresponds to the moving conductor. The induced voltage is proportional to the flow velocity and is detected by two measuring electrodes and transmitted to the amplifier. Flow volume is computed on the basis of the pipe's diameter. The constant magnetic field is generated by a switched direct current of alternating polarity.



$$U_e = B \cdot L \cdot v$$

$$Q = A \cdot v$$

U_e = induced voltage
 B = magnetic induction (magnetic field)
 L = electrode gap
 v = flow velocity
 Q = volume flow
 A = pipe cross-section
 I = current strength

Measuring system

The measuring system consists of a transmitter and a sensor. Two versions are available:

- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

Transmitter:

Promag 50/53 transmitters incorporate a high impedance amplifier of 1×10^{12} ohms or greater.

- Promag 50 (user interface with push buttons for operation, two-line display)
- Promag 53 ("Touch Control" without opening the housing, four-line display)

Sensor:

- 1" to 78" (DN 25 to 2000)

Input

Measured variable	Flow rate (proportional to induced voltage)
Measuring range	Typically $v = 0.033$ to 33 ft/s (0.01 to 10 m/s) with the specified measuring accuracy
Operable flow range	Over $1000 : 1$
Input signal	<p>Status input (auxiliary input): $U = 3$ to 30 V DC, $R_i = 5$ kΩ, galvanically isolated. Configurable for: totalizer(s) reset, measured value suppression, error-message reset.</p> <p>Status input (auxiliary input) with PROFIBUS DP and MODBUS RS485: $U = 3$ to 30 V DC, $R_i = 3$ kΩ, galvanically isolated Switching level: 3 to 30 V DC, independent of polarity Configurable for: totalizer(s) reset, measured value suppression, error-message reset, batching start/stop (optional), batch totalizer reset (optional)</p> <p>Current input (for Promag 53 only): Active/passive selectable, galvanically isolated, full scale value selectable, resolution: 3 μA, temperature coefficient: typ. 0.005% o.r./$^{\circ}$C (o.r. = of reading) active: 4 to 20 mA, $R_i \leq 150$ Ω, $U_{out} = 24$ V DC, short-circuit-proof passive: $0/4$ to 20 mA, $R_i \leq 150$ Ω, $U_{max} = 30$ V DC</p>

Output

Output signal	<p>Promag 50</p> <p>Current output: active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s), full scale value selectable, temperature coefficient: typ. 0.003% o.r./$^{\circ}$F (0.005% o.r./$^{\circ}$C), resolution: 0.5 μA (o.r. = of reading)</p> <ul style="list-style-type: none"> ■ active: $0/4$ to 20 mA, $R_L < 700$ Ω (HART: $R_L \geq 250$ Ω) ■ passive: 4 to 20 mA, operating voltage V_S 18 to 30 V DC, $R_i \leq 150$ Ω <p>Pulse/frequency output: passive, open collector, 30 V DC, 250 mA, galvanically isolated.</p> <ul style="list-style-type: none"> ■ Frequency output: full scale frequency 2 to 1000 Hz ($f_{max} = 1250$ Hz), on/off ratio $1:1$, pulse width max. 10 s. ■ Pulse output: pulse value and pulse polarity selectable, max. pulse width configurable (0.5 to 2000 ms) <p>PROFIBUS DP interface:</p> <ul style="list-style-type: none"> ■ Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated ■ Profile version 3.0 ■ Data transmission rate: 9.6 kBaud to 12 MBaud ■ Automatic data transmission rate recognition ■ Function blocks: 1 x analog input, 3 x totalizer ■ Output data: volume flow, totalizer ■ Input data: positive zero return (ON/OFF), totalizer control, value for local display ■ Cyclic data transmission compatible with previous model "Promag 33" ■ Bus address adjustable via miniature switches or local display (optional) at the measuring device
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~~PROFIBUS PA interface:~~

- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profile version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 1 x analog input, 1 x totalizer
- Output data: volume flow, totalizer
- Input data: positive zero return (ON/OFF), control totalizer, value for local display
- Cyclic data transmission compatible with previous model "Promag 33"
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

Promag 53

Current output:

active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s), full scale value selectable, temperature coefficient: typically 0.003% o.r./°F (0.005% o.r./°C), resolution: 0.5 μ A (o.r. = of reading)

- active: 0/4 to 20 mA, $R_L < 700 \Omega$ (HART: $R_L \geq 250 \Omega$)
- passive: 4 to 20 mA, operating voltage V_S 18 to 30 V DC, $R_i \leq 150 \Omega$

Pulse/frequency output:

active/passive selectable, galvanically isolated (Ex i version: only passive)

- active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100 \Omega$
- passive: open collector, 30 V DC, 250 mA

- Frequency output: full scale frequency 2 to 10000 Hz ($f_{max} = 12500$ Hz), intrinsically safe: 2 to 5000 Hz; on/off ratio 1:1; pulse width max. 10 s.
- Pulse output: pulse value and pulse polarity adjustable, pulse width configurable (0.05 to 2000 ms)

PROFIBUS DP interface:

- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- Profile version 3.0
- Data transmission rate: 9.6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Function blocks: 2 x analog input, 3 x totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model "Promag 33"
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Available output combination → Page 7 ff.

PROFIBUS PA interface:

- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profile version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 2 x analog input, 3 x totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model "Promag 33"
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

MODBUS interface:

- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- MODBUS device type: Slave
- Address range: 1 to 247
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Supported MODBUS function codes: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Transmission mode: RTU oder ASCII
- Supported baudrate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Response time:
 - Direct data access = typically 25 to 50 ms
 - Auto-scan buffer (data range) = typically 3 to 5 ms
- Available output combination → Page 7 ff.

FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- ITK version 4.01
- Current consumption: 12 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Bus connection with integrated reverse polarity protection
- Function blocks: 5 x analog input, 1 x discrete output, 1 x PID
- Output data: volume flow, calculated mass flow, temperature, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), reset totalizer
- Link Master (LM) functionality is supported

Signal on alarm

- Current output → failure response selectable (e.g. in accord. with NAMUR Recom. NE 43)
- Pulse/frequency output → failure response selectable
- Status output (Promag 50) → non-conductive by fault or power supply failure
- Relay output (Promag 53) → de-energized by fault or power supply failure

Load

See "Output signal"

Switching output

Status output (Promag 50, Promag 53):
 Open collector, max. 30 V DC / 250 mA, galvanically isolated.
 Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.

Relay outputs (Promag 53):
 Normally closed (NC or break) or normally open (NO or make) contacts available
 (default: relay 1 = NO, relay 2 = NC),
 max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated.
 Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values, batching contacts.

Low flow cutoff

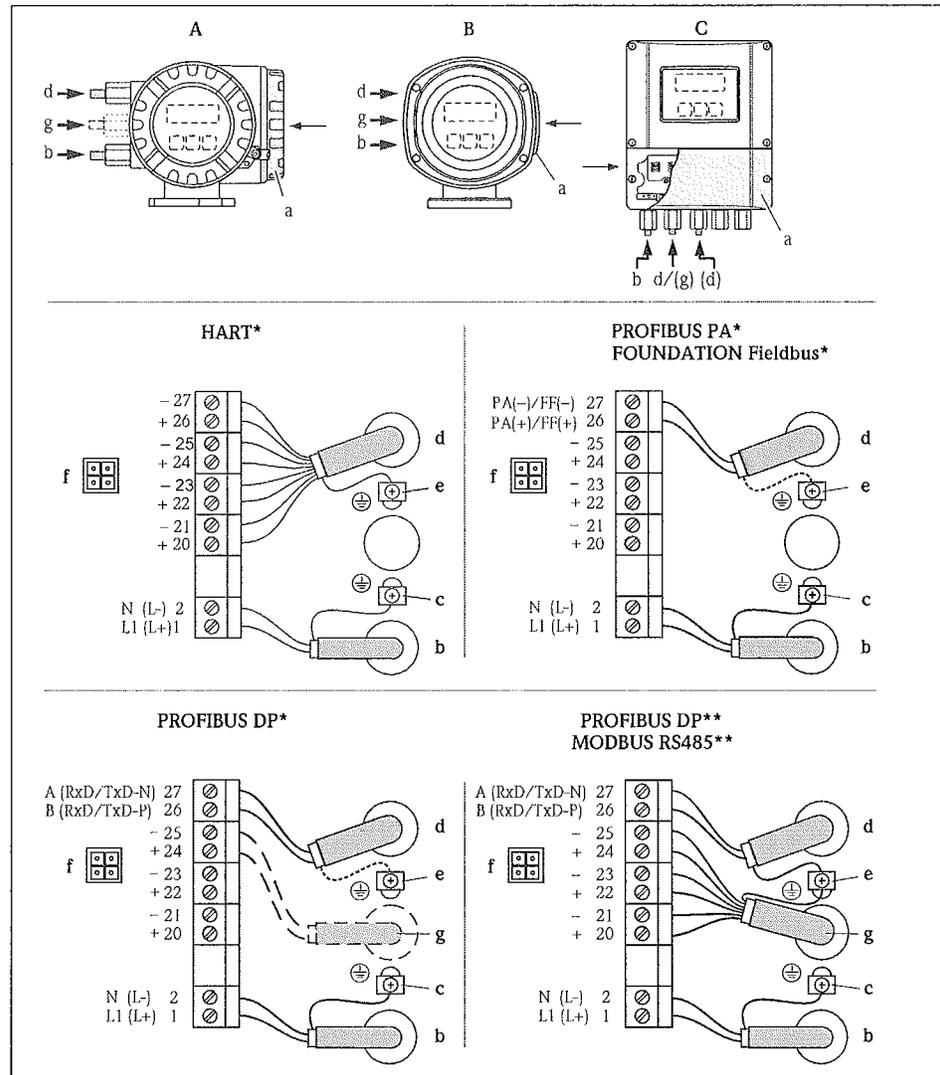
Switch points for low flow cutoff are selectable

Galvanic isolation

All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

Power supply

Electrical connection Measuring unit



Cable cross section max. 16 AWG (2.5 mm²)

- A View A (field housing)
- B View B (stainless steel field housing)
- C View C (wall-mount housing)

- *) non changeable communication board
- **) changeable communication board
- a Cover of the connection compartment
- b Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L- for DC
- c Ground terminal for protective conductor
- d Signal cable: see Terminal assignment → Page 7 ff.
Fieldbus cable:
Terminal No. 26: DP (A) / PA (+) / FF (+) / MODBUS RS485 (A) / (PA, FF: with reverse polarity protection)
Terminal No. 27: DP (B) / PA (-) / FF (-) / MODBUS RS485 (B) / (PA, FF: with reverse polarity protection)
- e Ground terminal for signal-cable shield / Fieldbus cable / RS485 line
- f Service connector for connecting service interface FXA 193 (Fieldcheck, Tof Tool - Fieldtool Package)
- g Signal cable: see Terminal assignment → Page 7 ff.
Cable for external termination (only for PROFIBUS DP with fixed assignment communication board):
Terminal No. 24: +5 V
Terminal No. 25: GND

Terminal assignment, Promag 50

Order variant	Terminal No. (inputs / outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
50***_*****W	-	-	-	Current output HART
50***_*****A	-	-	Frequency output	Current output HART
50***_*****D	Status input	Status output	Frequency output	Current output HART
50***_*****H	-	-	-	PROFIBUS PA
50***_*****J	-	-	+5 V (external termination)	PROFIBUS DP
50***_*****S	-	-	Frequency output IS, passive	Current output Ex i active, HART
50***_*****T	-	-	Frequency output IS, passive	Current output Ex i passive, HART
Ground connection, power supply → Page 6				

Terminal assignment, Promag 53

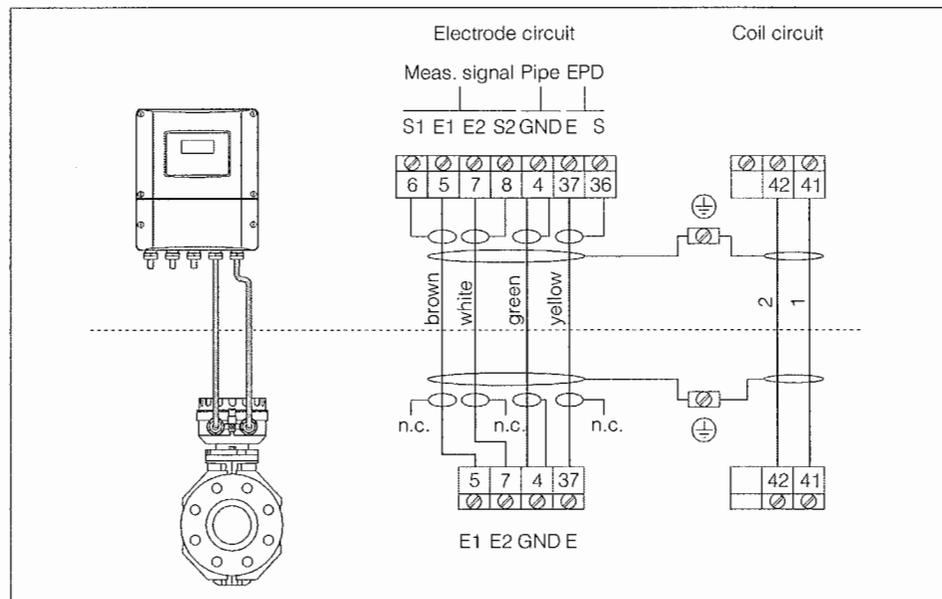
The inputs and outputs on the communication board can be either permanently assigned or variable, depending on the version ordered (see table). Replacements for modules which are defective or which have to be replaced can be ordered as accessories.

Order variant	Terminal No. (inputs / outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
Fixed communication boards (fixed assignment)				
53***_*****A	-	-	Frequency output	Current output HART
53***_*****B	Relay output 2	Relay output 1	Frequency output	Current output HART
53***_*****F	-	-	-	PROFIBUS PA IS
53***_*****G	-	-	-	FOUNDATION Fieldbus, IS
53***_*****H	-	-	-	PROFIBUS PA
53***_*****J	-	-	-	PROFIBUS DP
53***_*****K	-	-	-	FOUNDATION Fieldbus
53***_*****Q	-	-	Status input	MODBUS RS485
53***_*****S	-	-	Frequency output IS	Current output IS active, HART
53***_*****T	-	-	Frequency output IS	Current output IS passive, HART
Flexible communication boards				
53***_*****C	Relay output 2	Relay output 1	Frequency output	Current output HART
53***_*****D	Status input	Relay output	Frequency output	Current output HART
53***_*****L	Status input	Relay output 2	Relay output 1	Current output HART

Order variant	Terminal No. (inputs / outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
53***_*****M	Status input	Frequency output	Frequency output	Current output HART
53***_*****N	Current output	Frequency output	Status input	MODBUS RS485
53***_*****P	Current output	Frequency output	Status input	PROFIBUS DP
53***_*****V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
53***_*****2	Relay output	Current output	Frequency output	Current output HART
53***_*****4	Current input	Relay output	Frequency output	Current output HART
53***_*****7	Relay output 2	Relay output 1	Status input	MODBUS RS485

Ground connection, power supply → Page 6

Electrical connection remote version



n.c. = isolated cable shields, not connected

F06-SxFlxxxx-04-zxxxx-en-001

Cable entry

Power-supply and signal cables (inputs/outputs):

- Cable entry M20 x 1.5 (8 to 12 mm)
- Sensor cable entry for armoured cables M20 x 1.5 (9.5 to 16 mm)
- Threads for cable entries 1/2" NPT, G 1/2"

Connecting cable for remote version:

- Cable entry M20 x 1.5 (8 to 12 mm)
- Sensor cable entry for armoured cables M20 x 1.5 (9.5 to 16 mm)
- Threads for cable entries 1/2" NPT, G 1/2"

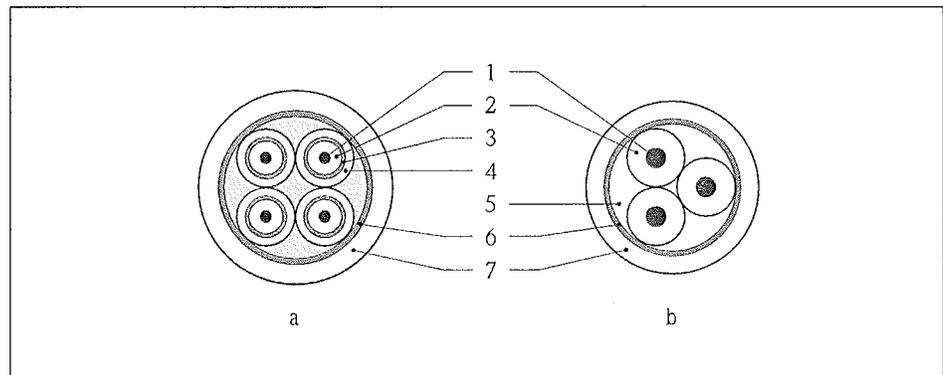
**Cable specifications
remote version**

Coil cable:

- 2 x 18 AWG (0.75 mm²) PVC cable with common, braided copper shield (Ø approx. 0.28" / 7 mm)
- Conductor resistance: ≤ 37 Ω/km
- Capacitance: core/core, shield grounded: ≤ 120 pF/m
- Permanent operating temperature: -5 to +180°F (-20 to +80°C)
- Cable cross-section: max. 16 AWG (2.5 mm²)

Signal cable:

- 3 x 20 AWG (0.38 mm²) PVC cable with common, braided copper shield (Ø approx. 0.28" / 7 mm) and individually shielded cores.
- With Empty Pipe Detection (EPD): 4 x 20 AWG (0.38 mm²) PVC cable with common, braided copper shield (Ø approx. 0.28" / 7 mm) and individually shielded cores.
- Conductor resistance: ≤ 50 Ω/km
- Capacitance: core/shield: ≤ 420 pF/m
- Permanent operating temperature: -5 to +180°F (-20 to +80°C)
- Cable cross-section: max. 16 AWG (2.5 mm²)



a = signal cable, b = coil current cable (cross-section: max. 16 AWG / 2.5 mm²)
 1 = core, 2 = core insulation, 3 = core shield, 4 = core jacket, 5 = core strengthening,
 6 = cable shield, 7 = outer jacket

A0003194

Optionally, Endress+Hauser also supplies reinforced connecting cables with an additional, metal strengthening braid. We recommend such cables for the following cases:

- Cables laid underground
- Danger of rodent attack
- Device used with ingress protection NEMA 6P (IP 68)

Operation in zones of severe electrical interference:

The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR Recommendation NE 21.

Caution!

Grounding is by means of the ground terminals provided for that purpose inside the connection housing. Keep the stripped and twisted lengths of cable shield to the terminals as short as possible.

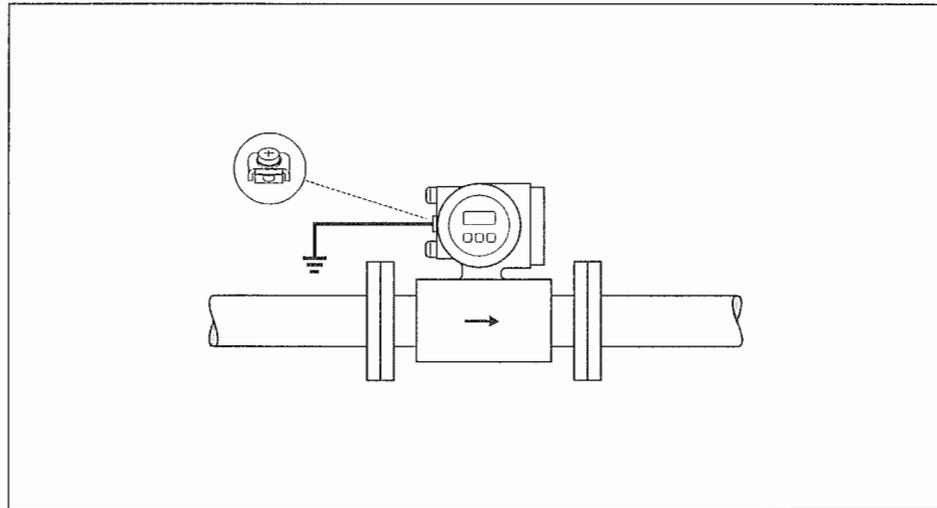
Supply voltage	85 to 260 V AC, 45 to 65 Hz 20 to 55 V AC, 45 to 65 Hz 16 to 62 V DC PROFIBUS PA and FOUNDATION Fieldbus Non-hazardous: 9 to 32 V DC Intrinsically safe: 9 to 24 V DC Explosion proof: 9 to 32 V DC
Power consumption	AC: <15 VA (including sensor) DC: <15 W (including sensor) Switch-on current: ■ max. 13.5 A (< 50 ms) at 24 V DC ■ max. 3 A (< 5 ms) at 260 V AC
Power supply failure	Lasting min. 1 power cycle: ■ EEPROM or T-DAT (Promag 53 only) retain the measuring system data in the event of a power supply failure ■ S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point etc.)

Potential equalisation**Standard case**

Perfect measurement is only ensured when the medium and the sensor have the same electrical potential. Most Promag sensors have a standard installed reference electrode which guarantees the required connection. This usually means that additional potential matching measures are unnecessary.

Note!

For installation in metal pipes, it is advisable to connect the ground terminal of the transmitter housing to the piping. Also, observe company-internal grounding guidelines.

**Caution!**

For sensors without reference electrodes or without metal process terminals, carry out potential matching as per the instructions for special cases described below. These special measures are particularly important when standard grounding practice cannot be ensured or extremely strong matching currents are expected.

A0004375

Metal, ungrounded piping

In order to prevent outside influences on measurement, it is advisable to use ground cables to connect each sensor flange to its corresponding pipe flange and ground the flanges. Connect the transmitter or sensor connection housing, as applicable, to ground potential means of the ground terminal provided for the purpose.

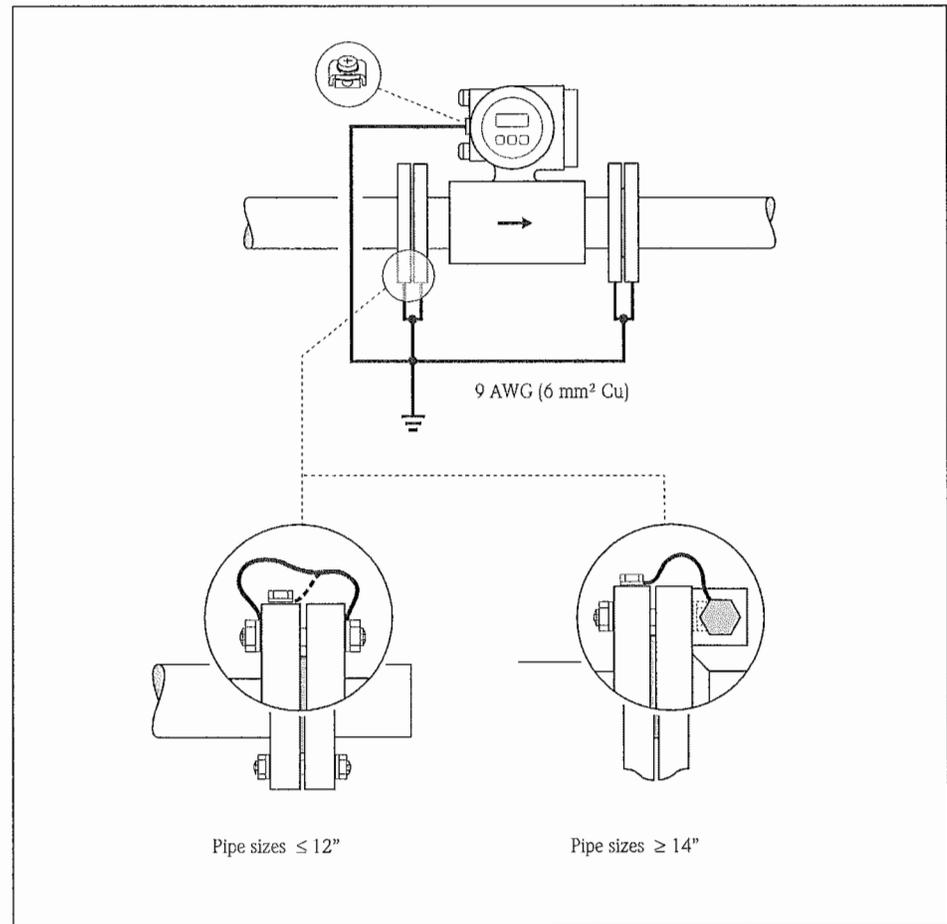
Caution!

Also, observe company-internal grounding guidelines.

Note!

The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.

- Pipe dia. $\leq 12"$ (DN 300): The ground cable is in direct connection with the conductive flange coating and is secured by the flange screws.
- Pipe dia. $\geq 14"$ (DN 350): The ground cable connects directly to the metal transport bracket.



A0004376

Plastic pipes and isolating lined pipes

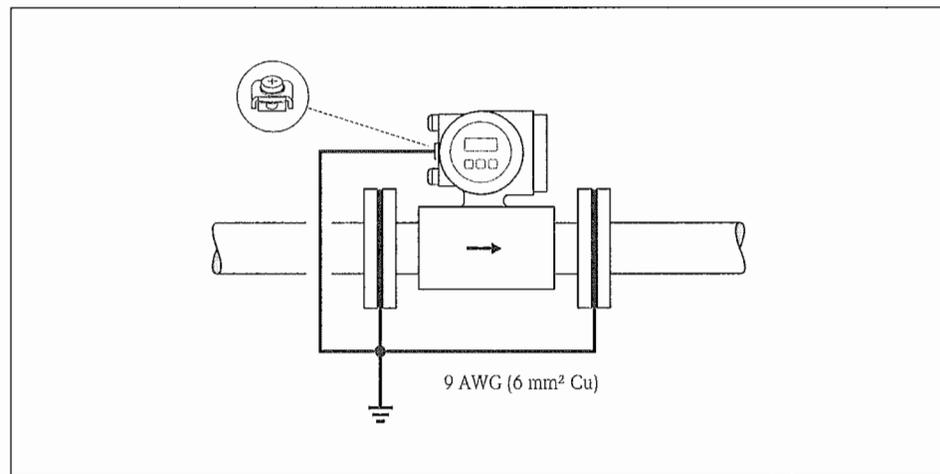
Normally, potential is matched using the reference electrodes in the measuring tube. However, in exceptional cases it is possible that, due to the grounding plan of a system, large matching currents flow over the reference electrodes. This can lead to destruction of the sensor, e.g. through electrochemical decomposition of the electrodes. In such cases, e.g. for fibre-glass or PVC piping, it is recommended that you use additional ground disks for potential matching.

When using ground disks, note the following points:

- Ground disks 1/2" to 12" (DN 15 to 300) can be ordered separately from Endress+Hauser as an accessory.
- Ground disks (incl. seals) increase the installation length. You can find the dimensions of ground disks on Page 30.

Caution!

- Risk of damage from electrochemical corrosion. Note the electrochemical insulation rating, if the ground disks and measuring electrodes are made of different materials.
- Also, observe company-internal grounding guidelines.

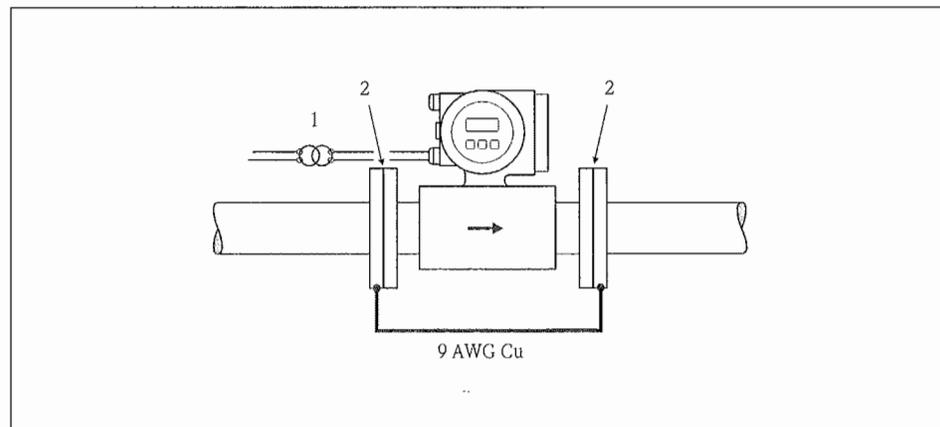


A0004377

Pipes with cathodic protection

In such cases, install the measuring instrument without potential in the piping:

- When installing the measuring device, make sure that there is an electrical connection between the two piping runs (copper wire, 9 AWG / 6 mm²).
- Make sure that the installation materials do not establish a conductive connection to the measuring device and that the installation materials withstand the tightening torques applied when the threaded fasteners are tightened.
- Also comply with the regulations applicable to potential-free installation.



A0004378

1 = isolating transformer, 2 = electrically insulated

Performance characteristics

Reference operating conditions

To DIN EN 29104 and VDI/VDE 2641:

- Medium temperature: $+28^{\circ}\text{C} \pm 2\text{ K}$
- Ambient temperature: $+22^{\circ}\text{C} \pm 2\text{ K}$
- Warm-up period: 30 minutes

Installation:

- Inlet run $> 10 \times \text{Dia}$
- Outlet run $> 5 \times \text{Dia}$
- Sensor and transmitter grounded.
- Sensor centered relative to the pipe.

Maximum measured error

Promag 50:

Pulse output: $\pm 0.5\%$ o.r. $\pm 1\text{ mm/s}$ (o.r. = of reading)

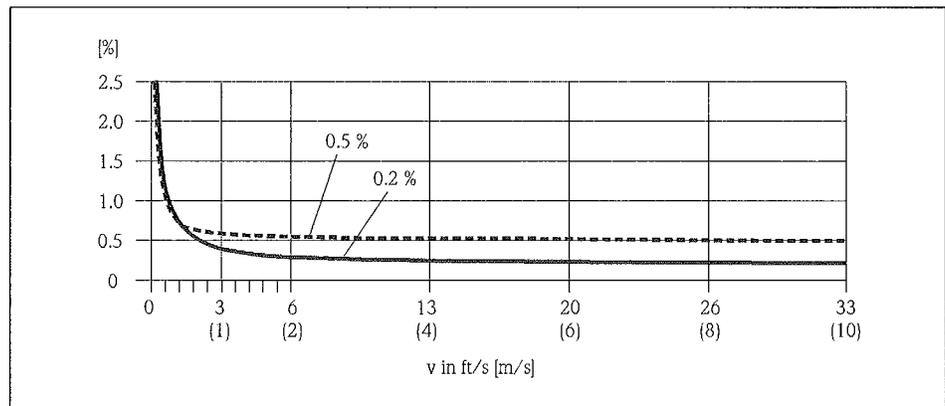
Current output: plus typically $\pm 5\ \mu\text{A}$

Promag 53:

Pulse output: $\pm 0.2\%$ o.r. $\pm 2\text{ mm/s}$ (o.r. = of reading)

Current output: plus typically $\pm 5\ \mu\text{A}$

Supply voltage fluctuations have no effect within the specified range.



Max. measured error in % of reading

F06-5xxxxxxx-05-xx-xx-xx-000

Repeatability

max. $\pm 0.1\%$ o.r. $\pm 0.5\text{ mm/s}$ (o.r. = of reading)

Operating conditions

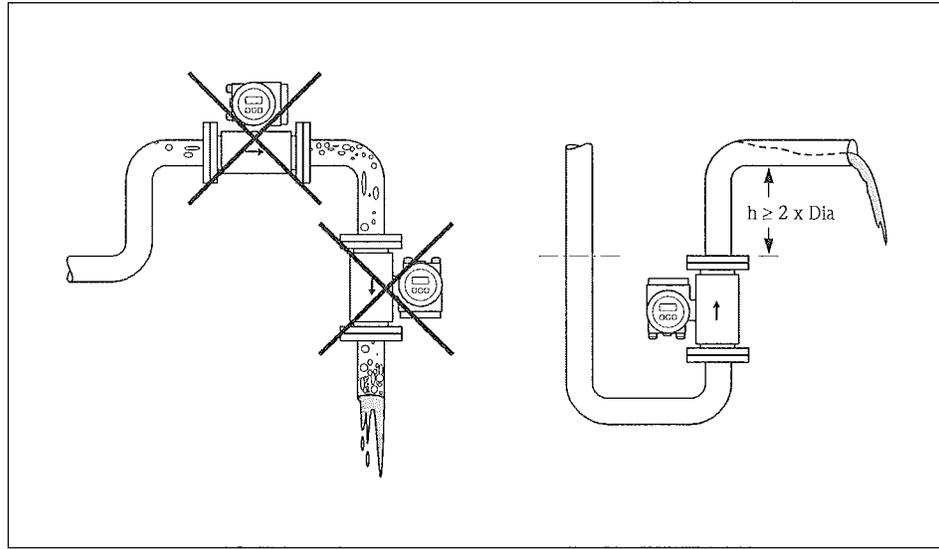
Installation conditions

Installation instructions

Mounting location

Correct measuring is possible only if the pipe is full. Avoid the following locations:

- Highest point of a pipeline. Risk of air accumulating
- Directly upstream of a free pipe outlet in a vertical pipe.

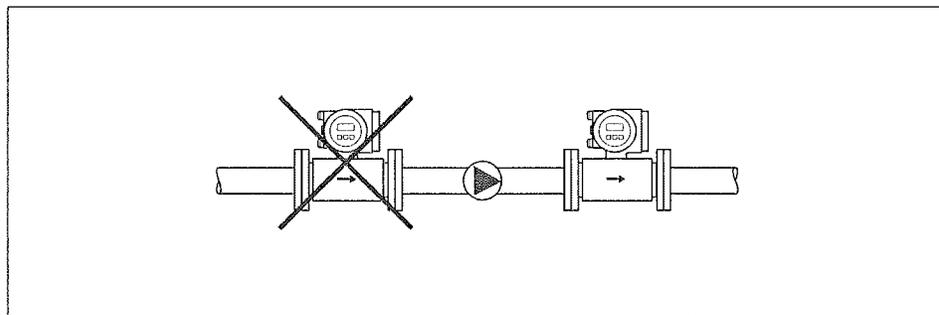


F06-5xxxxxxx-11-00-00-xx-000

Installation of pumps

Do not install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the lining's resistance to partial vacuum can be found on Page 20.

It might be necessary to install pulse dampers in systems incorporating reciprocating, diaphragm or peristaltic pumps. Information on the measuring system's resistance to vibration and shock can be found on Page 20.



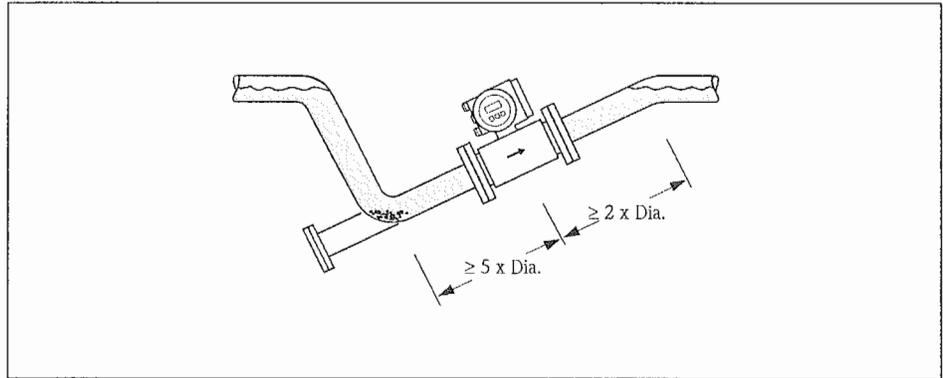
F06-5xxxxxxx-11-00-00-xx-001

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration. The Empty Pipe Detection (EPD) function offers additional protection by detecting empty or partially filled pipes.

Caution!

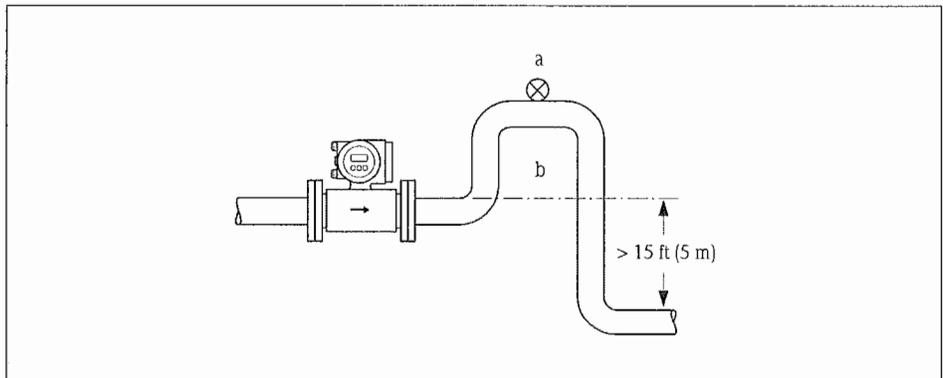
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



F06-5xxxxxxx-11-00-00-xx-002

Vertical pipes

Install a siphon (b) or a vent valve (a) downstream of the sensor in vertical pipes longer than 15 ft (5 meters). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. These measures also prevent the system losing prime, which could cause air inclusions. Information on the lining's resistance to partial vacuum can be found on Page 20.



F06-5xxxxxxx-11-00-00-xx-003

a = vent valve, b = siphon

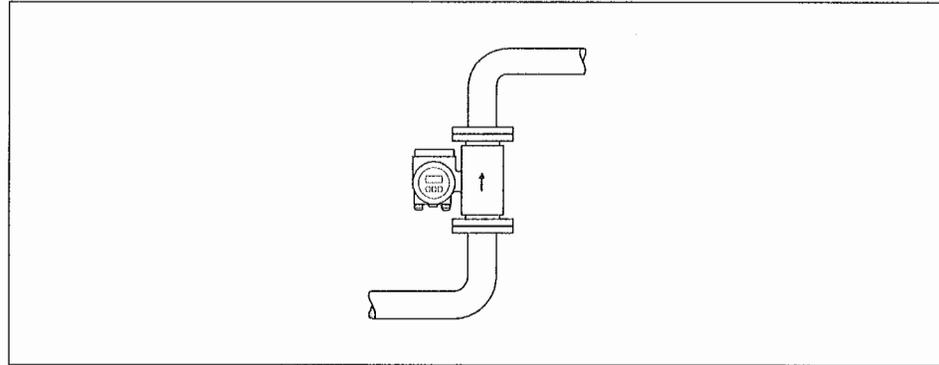
Orientation

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. Promag, nevertheless, supplies a range of options and accessories for correct measuring of problematic mediums:

- Electrode Cleaning Circuitry (ECC) to remove electrically conductive deposits in the measuring tube, e.g. in accretive mediums.
- Empty Pipe Detection (EPD) for recognition of partially filled measuring tubes, or for degassing mediums or for applications with fluctuating process pressure.
- Exchangeable measuring electrodes for abrasive mediums.

Vertical orientation:

This orientation is ideal for self-emptying piping systems and for use in conjunction with Empty Pipe Detection.



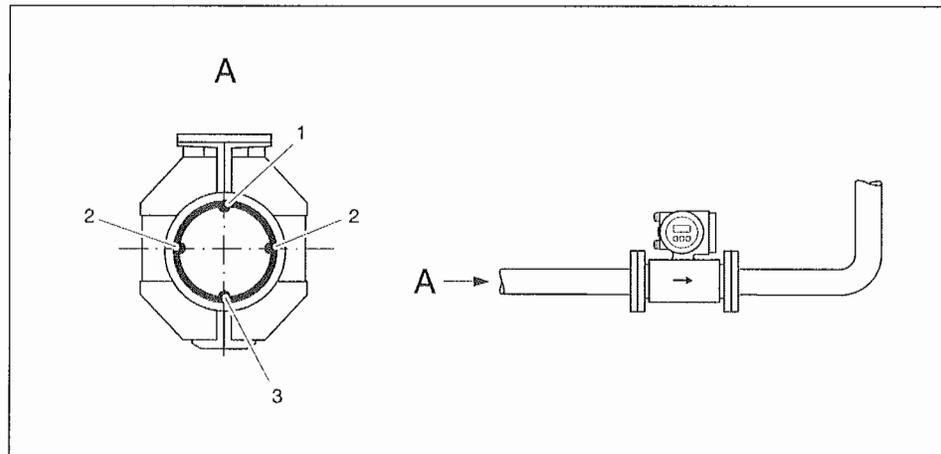
F06-5xxxxxx-11-00-00-xx-004

Horizontal orientation:

The measuring electrode-plane should be horizontal. This prevents brief insulation of the two electrodes by entrained air bubbles.

Caution!

Empty Pipe Detection functions correctly only when the measuring device is installed horizontally and the transmitter housing is facing upward. Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled or empty.



F06-5xxxxxx-11-00-xx-xx-000

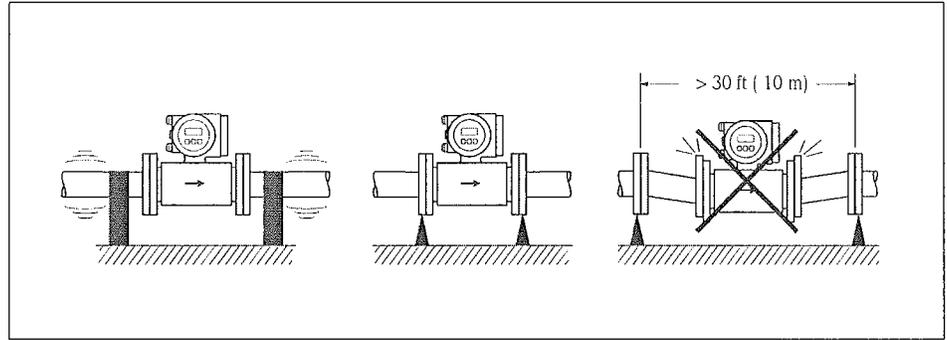
- 1 = EPD electrode (Empty Pipe Detection)
 2 = Measuring electrodes (signal detection)
 3 = Reference electrode (potential equalization)

Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!

It is advisable to install sensor and transmitter separately if vibration is excessively severe. Information on resistance to vibration and shock can be found on page 20.



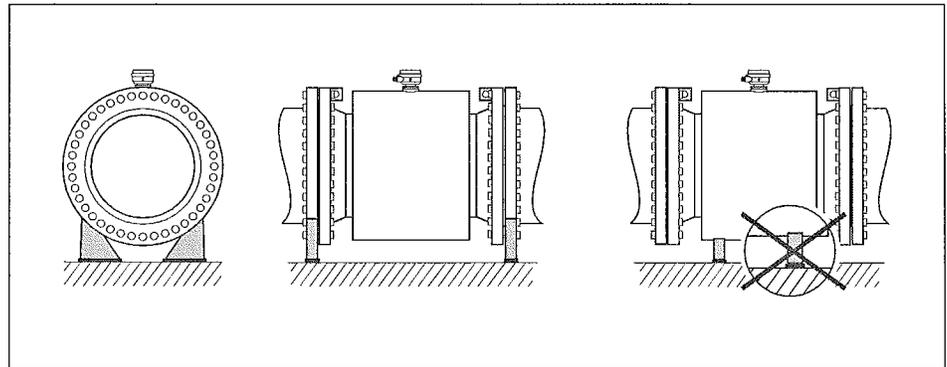
F06-5xxxxxx-11-00-00-xx-006

Foundations, supports

If the nominal diameter is $\geq 14''$ (DN 350), mount the transmitter on a foundation of adequate load-bearing strength.

Caution!

Do not allow the casing to take the weight of the sensor. This would buckle the casing and damage the internal magnetic coils.

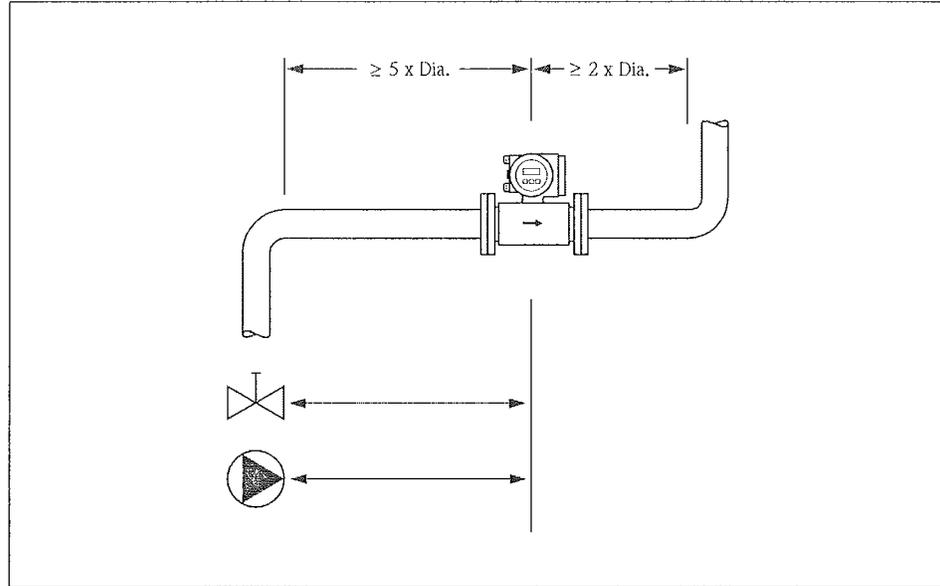


F06-5xxxxxx-11-05-xx-xx-000

Inlet and outlet runs

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc. Compliance with the following requirements for the inlet and outlet runs is necessary in order to ensure measuring accuracy:

- Inlet run $\geq 5 \times \text{Dia}$
- Outlet run $\geq 2 \times \text{Dia}$

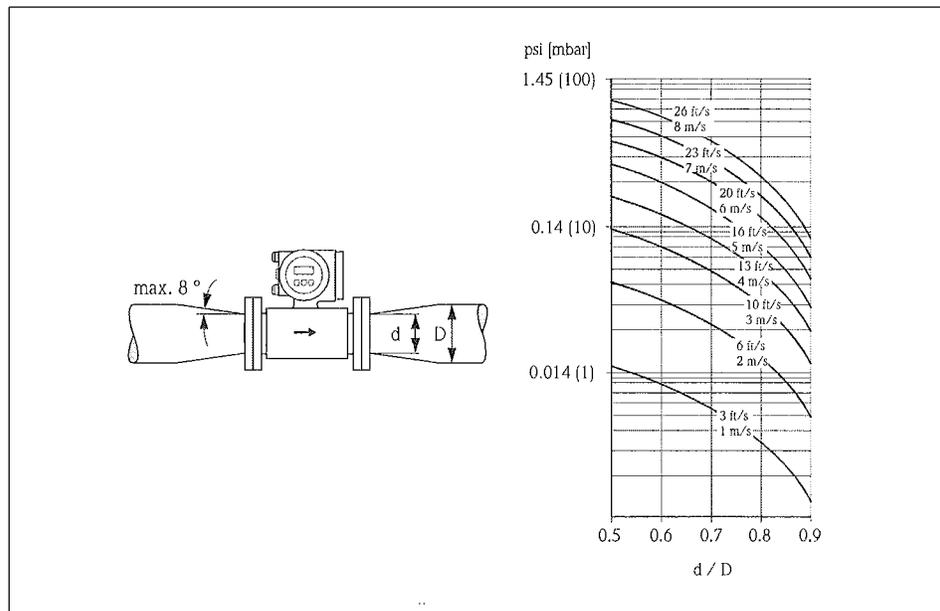


F06-5xxxxxxx-11-00-00-xx-005

Adapters

Suitable adapters to DIN EN 545 (reducers and expanders) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders. The nomogram applies only to fluids of viscosity similar to water.

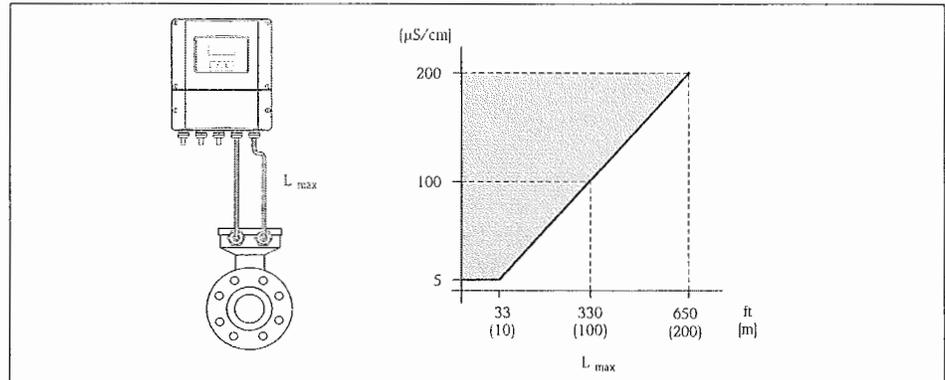
1. Calculate the ratio of the diameters d/D .
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.



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Length of connecting cable

Permissible cable length L_{max} depends on the conductivity of the medium. A minimum conductivity of $20 \mu\text{S}/\text{cm}$ is required for measuring demineralized water.



Gray shaded area = permissible range for medium conductivity
 L_{max} = length of connecting cable in feet [m]
 Medium conductivity in [$\mu\text{S}/\text{cm}$]

F06-5xxxxxxx-05-xx-xx-xx-006

In order to ensure measuring accuracy, moreover, comply with the following instructions when installing the remote version:

- Secure the cable run or route the cable in a conduit. Movement of the cable can falsify the measuring signal, particularly if the conductivity of the medium is low.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between sensor and transmitter, if necessary.

Environment

Ambient temperature

Transmitter:

- Standard: -5 to $+140^\circ\text{F}$ (-20 to $+60^\circ\text{C}$)
- Optional: -40 to $+140^\circ\text{F}$ (-40 to $+60^\circ\text{C}$)

Note!

At ambient temperatures below -5°F (-20°C) the readability of the display may be impaired.

Sensor:

- Flange material carbon steel: 14 to 140°F (-10 to $+60^\circ\text{C}$)
- Flange material stainless steel: -40 to $+140^\circ\text{F}$ (-40 to $+60^\circ\text{C}$)

Caution!

It is not allowed to use the device beyond the min. and max. lining specified temperature values (→ "Medium temperature range").

Note the following points:

- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- If both fluid and ambient temperatures are high, install the transmitter at a remote location from the sensor (→ "Medium temperature range").

Note!

HE or Harsh Environment Protection for sensor:

Provides enhanced moisture ingress protection for humid ambient environments. Apply in applications with severe temperature cycling and humid environments. Refer to ordering information, page 37.

Storage temperature

- The storage temperature corresponds to the ambient temperature range of the transmitter and sensor (see "Ambient temperature").
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Choose a storage location where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.
- Do not remove the protective plates or caps on the process connections until you are ready to install the device.

Degree of protection ■ Standard: NEMA 4X (IP 67) for transmitter and sensor
 ■ Optional: NEMA 6P (IP 68) for sensor in remote version

Shock and vibration resistance Acceleration up to 2 g by analogy with IEC 60068-2-6.

Electromagnetic compatibility (EMC) To EN 61326/A1 and NAMUR recommendation NE 21.

Process conditions

Medium temperature range The permissible medium temperature depends on the measuring-tube lining:
 ■ 32 to 180°F (0 to +80°C) for hard rubber (2-1/2" to 78" / DN 65 to 2000)
 ■ -5 to +125°F (-20 to +50°C) for polyurethane (1" to 40" / DN 25 to 1000)

Conductivity Minimum conductivity:
 ≥ 5 μS/cm for liquids generally
 ≥ 20 μS/cm for demineralized water

Note that in the case of the remote version, the minimum conductivity is also influenced by the length of the connecting cable → see "Length of connecting cable"

Medium pressure range (nominal pressure) EN 1092-1 (DIN 2501):
 PN 6 (DN 1200 to 2000)
 PN 10 (DN 200 to 2000)
 PN 16 (DN 65 to 2000)
 PN 25 (DN 200 to 1000)
 PN 40 (DN 25 to 150)

ANSI B16.5:
 Class 150 (1 to 24")
 Class 300 (1 to 6")

AWWA:
 Class D (28 to 78")

JIS B2238:
 10K (DN 50 to 300)
 20K (DN 25 to 300)

AS 2129:
 Table E (DN 80, 100, 150 to 400, 500, 600)

AS 4087:
 Cl. 14 (DN 80, 100, 150 to 400, 500, 600)

Pressure tightness (liner)

Nominal diameter		Measuring tube lining	Resistance to partial vacuum of measuring tube lining						
			Limit values for abs. pressure [psia] at various fluid temperatures						
[mm]	[inch]		75°F (25°C)	120°F (50°C)	175°F (80°C)	212°F (100°C)	265°F (130°C)	300°F (150°C)	355°F (180°C)
25 to 1000	1 to 40"	Polyurethane	0	0	-	-	-	-	-
65 to 2000	3 to 78"	Hard rubber	0	0	0	-	-	-	-

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is 6 to 10 ft/s (2 to 3 m/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the medium:

- $v < 6$ ft/s (2 m/s): for abrasive mediums such as potter's clay, lime milk, ore slurry, etc.
- $v > 6$ ft/s (2 m/s): for accretive mediums such as wastewater sludge, etc.

Flow characteristics (SI units)						
Nominal diameter		Recommended flow rate Min./max. full scale value (v ~ 0.3 or 10 m/s)	Factory settings			
[mm]	[inch]		Full scale value (v ~ 2.5 m/s)	Pulse weighting (~ 2 pulse/s)	Creepage (v ~ 0.04 m/s)	
25	1"	9...300 dm ³ /min	75 dm ³ /min	0.50 dm ³	1 dm ³ /min	
32	1 1/4"	15...500 dm ³ /min	125 dm ³ /min	1.00 dm ³	2 dm ³ /min	
40	1 1/2"	25...700 dm ³ /min	200 dm ³ /min	1.50 dm ³	3 dm ³ /min	
50	2"	35...1100 dm ³ /min	300 dm ³ /min	2.50 dm ³	5 dm ³ /min	
65	2 1/2"	60...2000 dm ³ /min	500 dm ³ /min	5.00 dm ³	8 dm ³ /min	
80	3"	90...3000 dm ³ /min	750 dm ³ /min	5.00 dm ³	12 dm ³ /min	
100	4"	145...4700 dm ³ /min	1200 dm ³ /min	10.00 dm ³	20 dm ³ /min	
125	5"	220...7500 dm ³ /min	1850 dm ³ /min	15.00 dm ³	30 dm ³ /min	
150	6"	20...600 m ³ /h	150 m ³ /h	0.025 m ³	2.5 m ³ /h	
200	8"	35...1100 m ³ /h	300 m ³ /h	0.05 m ³	5.0 m ³ /h	
250	10"	55...1700 m ³ /h	500 m ³ /h	0.05 m ³	7.5 m ³ /h	
300	12"	80...2400 m ³ /h	750 m ³ /h	0.10 m ³	10 m ³ /h	
350	14"	110...3300 m ³ /h	1000 m ³ /h	0.10 m ³	15 m ³ /h	
400	16"	140...4200 m ³ /h	1200 m ³ /h	0.15 m ³	20 m ³ /h	
450	18"	180...5400 m ³ /h	1500 m ³ /h	0.25 m ³	25 m ³ /h	
500	20"	220...6600 m ³ /h	2000 m ³ /h	0.25 m ³	30 m ³ /h	
600	24"	310...9600 m ³ /h	2500 m ³ /h	0.30 m ³	40 m ³ /h	
700	28"	420...13500 m ³ /h	3500 m ³ /h	0.50 m ³	50 m ³ /h	
–	30"	480...15000 m ³ /h	4000 m ³ /h	0.50 m ³	60 m ³ /h	
800	32"	550...18000 m ³ /h	4500 m ³ /h	0.75 m ³	75 m ³ /h	
900	36"	690...22500 m ³ /h	6000 m ³ /h	0.75 m ³	100 m ³ /h	
1000	40"	850...28000 m ³ /h	7000 m ³ /h	1.00 m ³	125 m ³ /h	
–	42"	950...30000 m ³ /h	8000 m ³ /h	1.00 m ³	125 m ³ /h	
1200	48"	1250...40000 m ³ /h	10000 m ³ /h	1.50 m ³	150 m ³ /h	
–	54"	1550...50000 m ³ /h	13000 m ³ /h	1.50 m ³	200 m ³ /h	
1400	–	1700...55000 m ³ /h	14000 m ³ /h	2.00 m ³	225 m ³ /h	
–	60"	1950...60000 m ³ /h	16000 m ³ /h	2.00 m ³	250 m ³ /h	
1600	–	2200...70000 m ³ /h	18000 m ³ /h	2.50 m ³	300 m ³ /h	
–	66"	2500...80000 m ³ /h	20500 m ³ /h	2.50 m ³	325 m ³ /h	
1800	72"	2800...90000 m ³ /h	23000 m ³ /h	3.00 m ³	350 m ³ /h	
–	78"	3300...100000 m ³ /h	28500 m ³ /h	3.50 m ³	450 m ³ /h	
2000	–	3400...110000 m ³ /h	28500 m ³ /h	3.50 m ³	450 m ³ /h	

Flow characteristics (US units)						
Nominal diameter		Recommended flow rate Min./max. full scale value (v ~ 1.0 or 33 ft/s)	Factory settings			
[inch]	[mm]		Full scale value (v ~ 8 ft/s)	Pulse weighting (~ 2 pulse/s)	Creepage (v ~ 0.1 ft/s)	
1"	25	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min	
1 1/4"	32	4 to 130 gal/min	30 gal/min	0.20 gal	0.50 gal/min	
1 1/2"	40	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min	
2"	50	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min	
2 1/2"	65	16 to 500 gal/min	130 gal/min	1 gal	2.0 gal/min	
3"	80	24 to 800 gal/min	200 gal/min	2 gal	2.5 gal/min	
4"	100	40 to 1250 gal/min	300 gal/min	2 gal	4.0 gal/min	
5"	125	60 to 1950 gal/min	450 gal/min	5 gal	7.0 gal/min	
6"	150	90 to 2650 gal/min	600 gal/min	5 gal	12 gal/min	
8"	200	155 to 4850 gal/min	1200 gal/min	10 gal	15 gal/min	
10"	250	250 to 7500 gal/min	1500 gal/min	15 gal	30 gal/min	
12"	300	350 to 10,600 gal/min	2400 gal/min	25 gal	45 gal/min	
14"	350	500 to 15,000 gal/min	3600 gal/min	30 gal	60 gal/min	
16"	400	600 to 19,000 gal/min	4800 gal/min	50 gal	60 gal/min	
18"	450	800 to 24,000 gal/min	6000 gal/min	50 gal	90 gal/min	
20"	500	1000 to 30,000 gal/min	7500 gal/min	75 gal	120 gal/min	
24"	600	1400 to 44,000 gal/min	10500 gal/min	100 gal	180 gal/min	
28"	700	1900 to 60,000 gal/min	13500 gal/min	125 gal	210 gal/min	
30"	–	2150 to 67,000 gal/min	16500 gal/min	150 gal	270 gal/min	
32"	800	2450 to 80,000 gal/min	19500 gal/min	200 gal	300 gal/min	
36"	900	3100 to 100,000 gal/min	24000 gal/min	225 gal	360 gal/min	
40"	1000	3800 to 125,000 gal/min	30000 gal/min	250 gal	480 gal/min	
42"	–	4200 to 135,000 gal/min	33000 gal/min	250 gal	600 gal/min	
48"	1200	5500 to 175,000 gal/min	42000 gal/min	400 gal	600 gal/min	
54"	–	9 to 300 Mgal/d	75 Mgal/d	0.0005 Mgal	1.3 Mgal/d	
–	1400	10 to 340 Mgal/d	85 Mgal/d	0.0005 Mgal	1.3 Mgal/d	
60"	–	12 to 380 Mgal/d	95 Mgal/d	0.0005 Mgal	1.3 Mgal/d	
–	1600	13 to 450 Mgal/d	110 Mgal/d	0.0008 Mgal	1.7 Mgal/d	
66"	–	14 to 500 Mgal/d	120 Mgal/d	0.0008 Mgal	2.2 Mgal/d	
72"	1800	16 to 570 Mgal/d	140 Mgal/d	0.0008 Mgal	2.6 Mgal/d	
78"	–	18 to 650 Mgal/d	175 Mgal/d	0.001 Mgal	3.0 Mgal/d	
–	2000	20 to 700 Mgal/d	175 Mgal/d	0.001 Mgal	3.0 Mgal/d	

Pressure loss

- No pressure loss if the sensor is installed in a pipe of the same nominal diameter.
- Pressure losses for configurations incorporating adapters to DIN EN 545 → Page 18

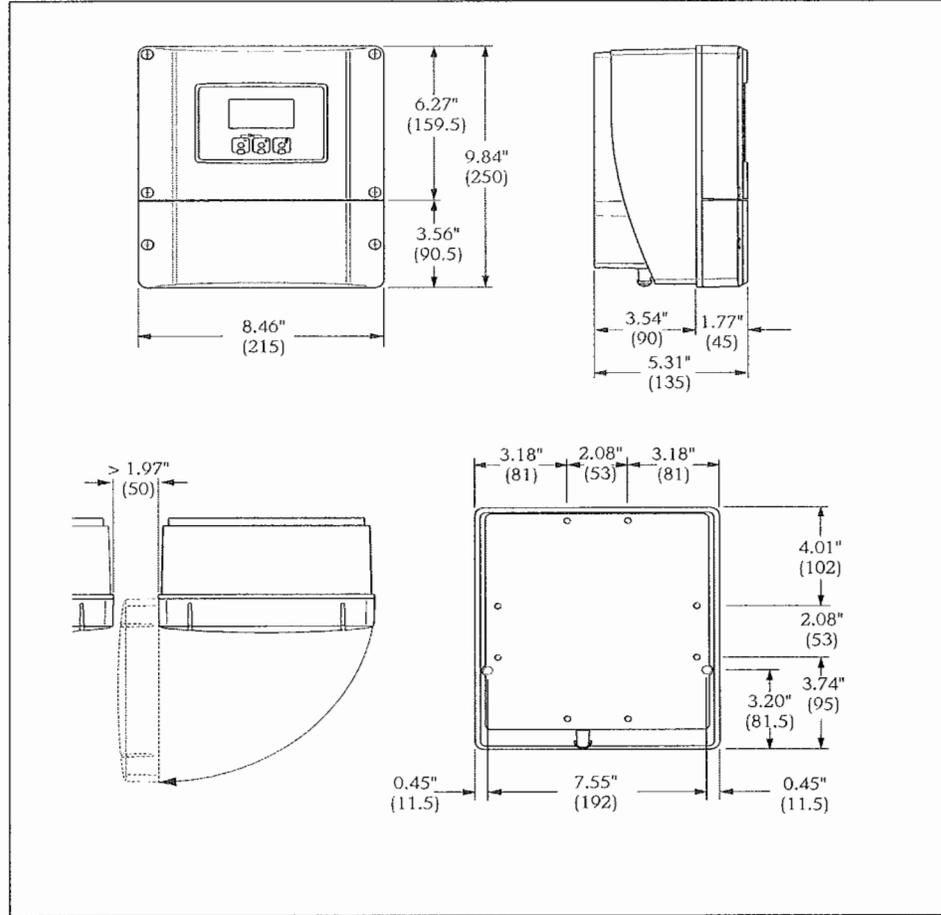
Measuring-tube specifications

Nominal Diameter		Pressure rating						Inside diameter of measuring tube	
[mm]	[inch]	EN (DIN) [bar]	AS 2129	AS 4087	ANSI [lbs]	AWWA	JIS	Hard rubber	Polyurethane
25	1"	PN 40	-	-	Cl 150	-	20K	-	0.94"
32	-	PN 40	-	-	-	-	20K	-	1.26"
40	1 1/2"	PN 40	-	-	Cl 150	-	20K	-	1.50"
50	2"	PN 40	-	-	Cl 150	-	10K	-	1.97"
65	-	PN 16	-	-	-	-	10K	2.60"	2.60"
80	3"	PN 16	Table E	Cl.14	Cl 150	-	10K	3.11"	3.11"
100	4"	PN 16	Table E	Cl.14	Cl 150	-	10K	4.02"	4.02"
125	-	PN 16	-	-	-	-	10K	5.0"	5.0"
150	6"	PN 16	Table E	Cl.14	Cl 150	-	10K	6.14"	6.14"
200	8"	PN 10	Table E	Cl.14	Cl 150	-	10K	8.03"	8.03"
250	10"	PN 10	Table E	Cl.14	Cl 150	-	10K	10.2"	10.2"
300	12"	PN 10	Table E	Cl.14	Cl 150	-	10K	12.2"	12.2"
350	14"	PN 10	Table E	Cl.14	Cl 150	-	-	13.5"	13.5"
400	16"	PN 10	Table E	Cl.14	Cl 150	-	-	15.4"	15.4"
450	18"	PN 10	-	-	Cl 150	-	-	17.2"	17.2"
500	20"	PN 10	Table E	Cl.14	Cl 150	-	-	19.4"	19.4"
600	24"	PN 10	Table E	Cl.14	Cl 150	-	-	23.4"	23.4"
700	28"	PN 10	-	-	-	Class D	-	27.2"	27.2"
-	30"	-	-	-	-	Class D	-	29.2"	29.2"
800	32"	PN 10	-	-	-	Class D	-	31.3"	31.3"
900	36"	PN 10	-	-	-	Class D	-	35.1"	35.1"
1000	40"	PN 10	-	-	-	Class D	-	39.1"	39.1"
-	42"	-	-	-	-	Class D	-	41.1"	41.1"
1200	48"	PN 6	-	-	-	Class D	-	47.1"	47.1"
-	54"	-	-	-	-	Class D	-	52.7"	52.7"
1400	-	PN 6	-	-	-	-	-	55.2"	55.2"
-	60"	-	-	-	-	Class D	-	58.7"	58.7"
1600	-	PN 6	-	-	-	-	-	63"	63"
-	66"	-	-	-	-	Class D	-	64.5"	64.5"
1800	72"	PN 6	-	-	-	Class D	-	70.3"	70.3"
2000	78"	PN 6	-	-	-	Class D	-	78.3"	78.3"

Mechanical construction

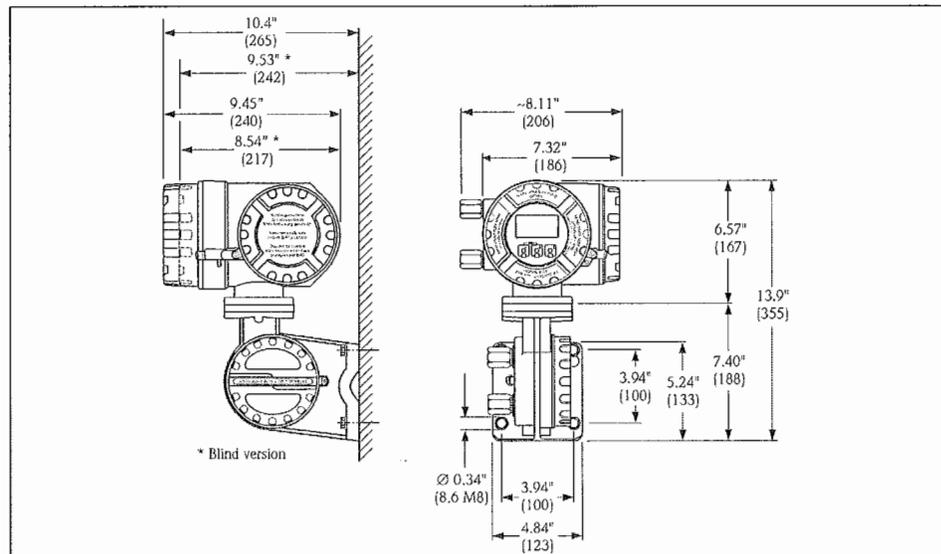
Design / dimensions

Dimensions: Wall-mount housing (non hazardous area and II3G / zone 2)



A0001150

Dimensions: Remote field housing (II2GD / zone 1)

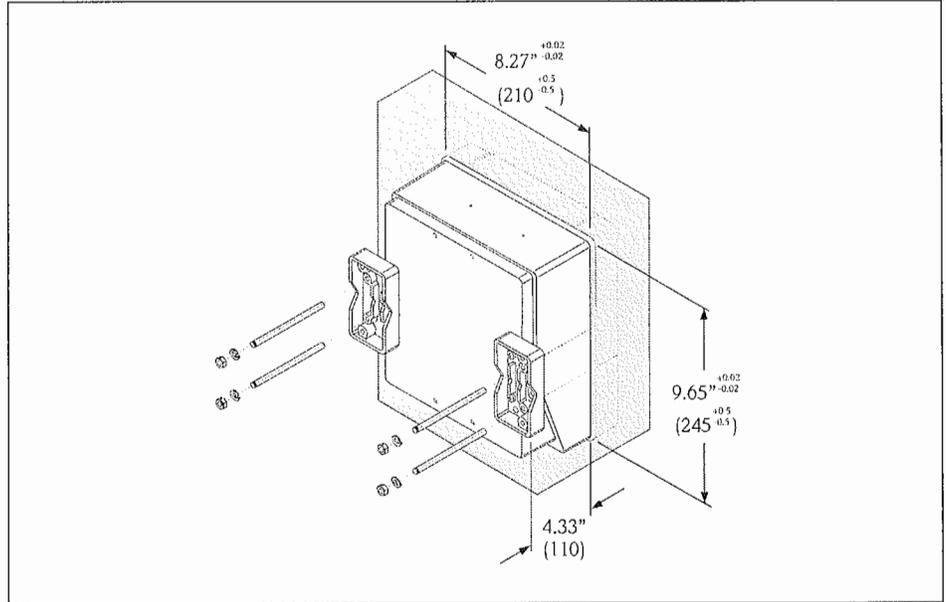


A0002128

There is a separate mounting kit for the wall-mounted housing. It can be ordered from Endress+Hauser as an accessory. The following installation variants are possible:

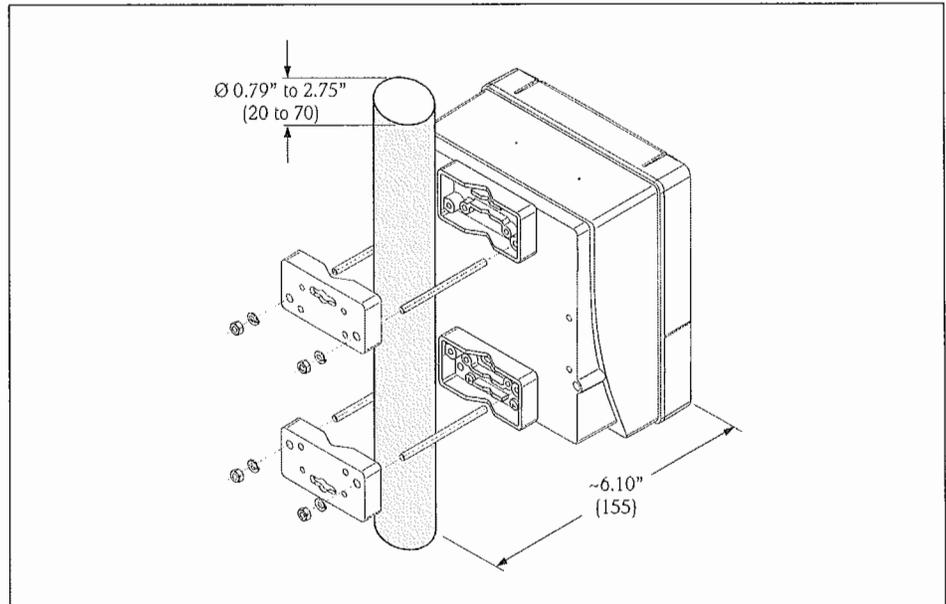
- Panel-mounted installation
- Pipe mounting

Panel-mounted installation



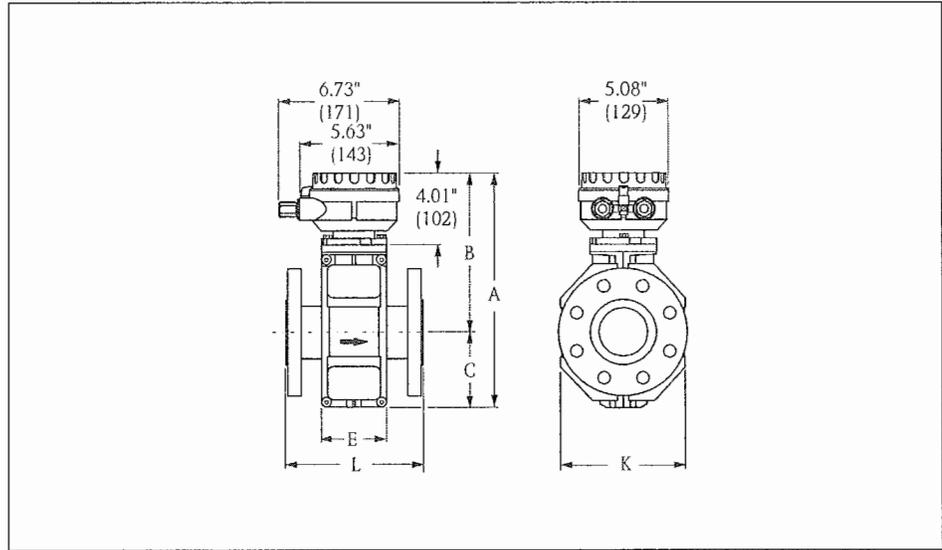
A0001131

Pipe mounting



A0001132

Remote version ≤ 12" (DN ≤ 300)

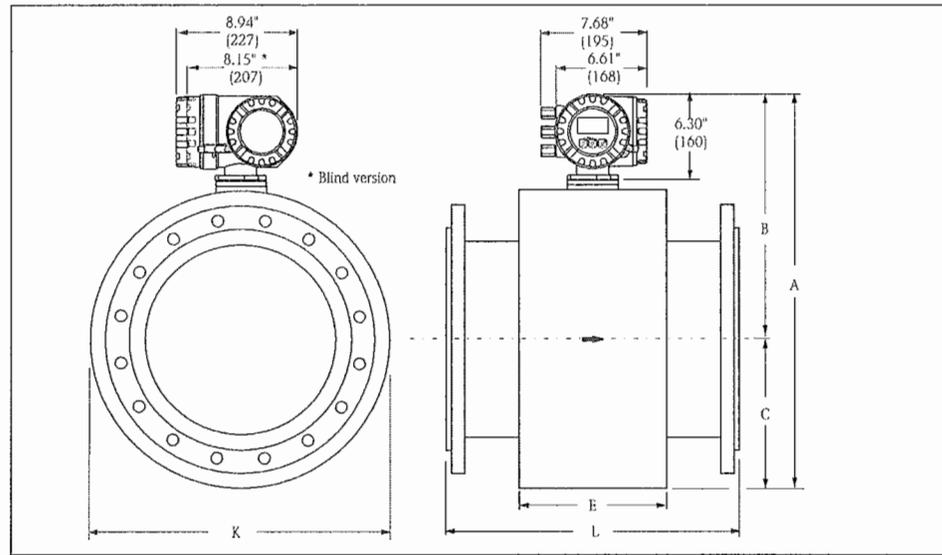


A0003219

DN		L	A	B	C	K	E
EN (DIN) / JIS / AS* [mm]	ANSI [inch]	inches [mm]					
25	1"	7.87 (200)	11.2 (286)	7.95 (202)	3.31 (84)	4.72 (120)	3.7 (94)
32	-	7.87 (200)	11.2 (286)	7.95 (202)	3.31 (84)	4.72 (120)	3.7 (94)
40	1 1/2"	7.87 (200)	11.2 (286)	7.95 (202)	3.31 (84)	4.72 (120)	3.7 (94)
50	2"	7.87 (200)	11.2 (286)	7.95 (202)	3.31 (84)	4.72 (120)	3.7 (94)
65	-	7.87 (200)	13.2 (336)	8.94 (227)	4.29 (109)	7.08 (180)	3.7 (94)
80	3"	7.87 (200)	13.2 (336)	8.94 (227)	4.29 (109)	7.08 (180)	3.7 (94)
100	4"	9.84 (250)	13.2 (336)	8.94 (227)	4.29 (109)	7.08 (180)	3.7 (94)
125	-	9.84 (250)	16.4 (417)	10.5 (267)	5.90 (150)	10.2 (260)	5.51 (140)
150	6"	11.8 (300)	16.4 (417)	10.5 (267)	5.90 (150)	10.2 (260)	5.51 (140)
200	8"	13.8 (350)	18.6 (472)	11.5 (292)	7.08 (180)	12.7 (324)	6.14 (156)
250	10"	17.7 (450)	20.5 (522)	12.5 (317)	8.07 (205)	15.7 (400)	6.14 (156)
300	12"	19.7 (500)	22.5 (572)	13.5 (342)	9.05 (230)	18.1 (460)	6.53 (166)

The fitting length (L) is always the same, regardless of the pressure rating.
 * Only DN 80, 100 and 150 to 300 are available if flanges according to AS are used.

Compact version ≥ 14" (DN 350)

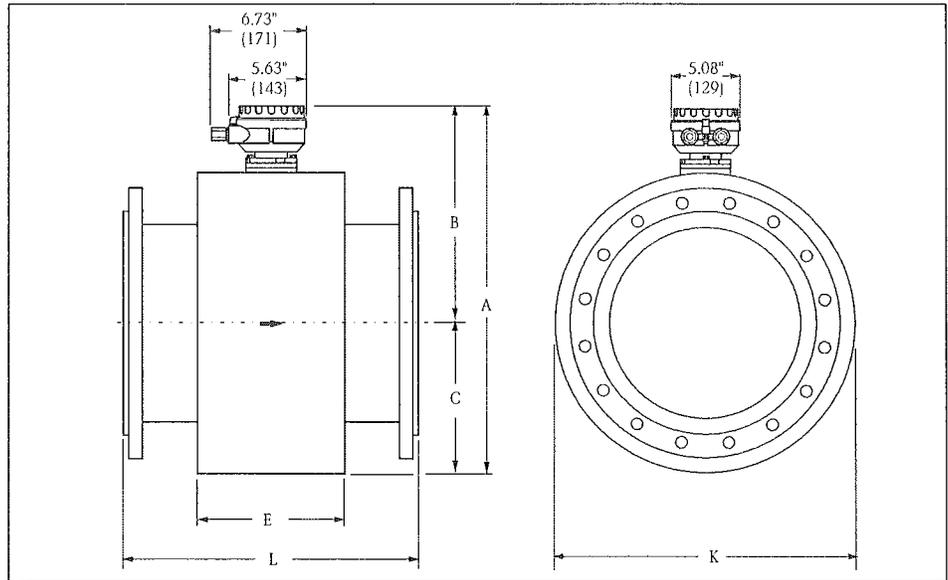


F06-xxFxxxx-06-05-xx-xx-000

DN		L	A	B	C	K	E
EN (DIN) / AS ¹⁾ [mm]	ANSI / AWWA ²⁾ [inch]	inches [mm]	inches [mm]	inches [mm]	inches [mm]	inches [mm]	inches [mm]
350	14"	21.6 (550)	29.1 (738.5)	17.9 (456.5)	11.1 (282.0)	22.2 (564)	10.9 (276)
400	16"	23.6 (600)	31.1 (790.5)	18.9 (482.5)	12.1 (308.0)	24.2 (616)	10.9 (276)
450	18"	25.6 (650)	33.1 (840.5)	19.9 (507.5)	13.1 (333.0)	26.2 (666)	11.5 (292)
500	20"	25.6 (650)	35.1 (891.5)	20.9 (533.0)	14.1 (358.5)	28.2 (717)	11.5 (292)
600	24"	30.7 (780)	39.2 (995.5)	23.0 (585.0)	16.2 (410.5)	32.3 (821)	15.8 (402)
700	28"	35.8 (910)	47.2 (1198.5)	27.0 (686.5)	20.1 (512.0)	40.3 (1024)	23.2 (589)
750	30"	38.4 (975)	47.2 (1198.5)	27.0 (686.5)	20.1 (512.0)	40.3 (1024)	24.6 (626)
800	32"	40.9 (1040)	48.9 (1241.5)	27.9 (708.0)	21.0 (533.5)	42.0 (1067)	25.5 (647)
900	36"	46.0 (1170)	54.9 (1394.5)	30.9 (784.5)	24.0 (610.0)	48.0 (1220)	30.9 (785)
1000	40"	51.2 (1300)	60.9 (1546.5)	33.9 (860.5)	27.0 (686.0)	54.0 (1372)	33.9 (862)
1050	42"	53.7 (1365)	62.9 (1598.5)	34.9 (886.5)	28.0 (712.0)	56.0 (1424)	35.9 (912)
1200	48"	61.4 (1560)	71.7 (1796.5)	38.8 (985.5)	31.9 (811.0)	63.8 (1622)	39.0 (992)
1350	54"	69.1 (1755)	78.7 (1998.5)	42.8 (1086.5)	35.9 (912.0)	71.8 (1824)	42.3 (1252)
1400	-	1820	2148.5	1161.5	987.0	1974	1252
1500	60"	76.8 (1950)	86.5 (2196.5)	46.7 (1185.5)	39.8 (1011)	79.6 (2022)	54.8 (1392)
1600	-	2080	2286.5	1230.5	1056	2112	1482
1650	66"	84.4 (2145)	92.9 (2360.5)	49.9 (1267.5)	43.0 (1093)	86.0 (2186)	58.3 (1482)
1800	72"	92.1 (2340)	100.4 (2550.5)	53.6 (1362.5)	46.8 (1188.0)	93.5 (2376)	64.2 (1632)
2000	78"	102.3 (2600)	104.3 (2650.5)	55.6 (1412.5)	48.7 (1238.0)	97.5 (2476)	68.2 (1732)

The fitting length (L) is always the same, regardless of the pressure rating.
¹⁾ Only DN 350, 400, 500 and 600 are available if flanges according to AS are used.
²⁾ Nominal size < 28" only to ANSI, Nominal size > 24" only to AWWA.

Remote version $\geq 14''$ (DN 350)



A0903220

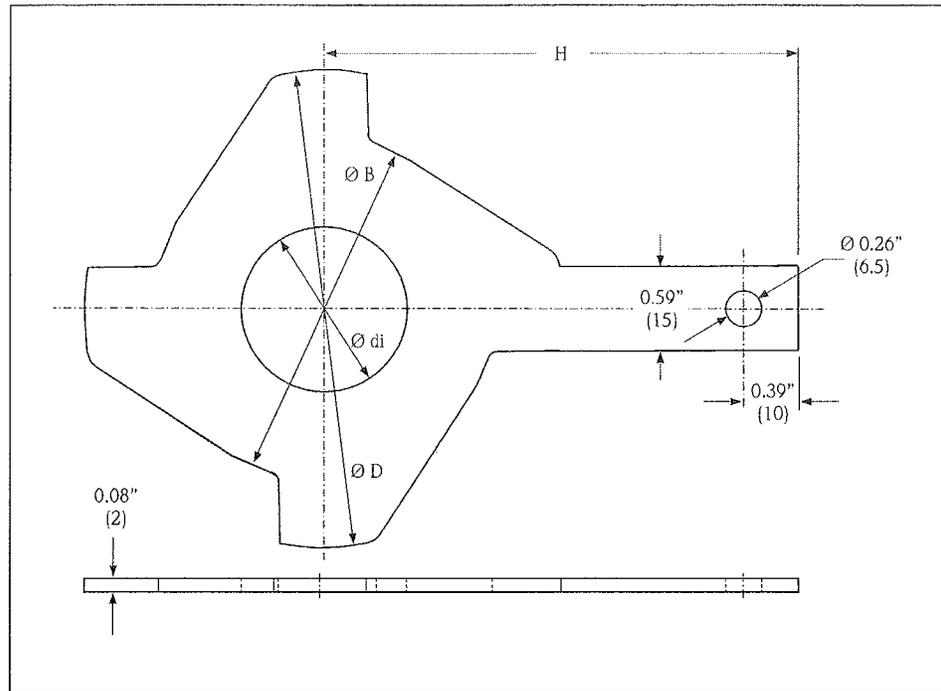
DN		L	A	B	C	K	E
EN (DIN) / AS ¹⁾ [mm]	ANSI / AWWA ²⁾ [inch]	inches [mm]	inches [mm]	inches [mm]	inches [mm]	inches [mm]	inches [mm]
350	14"	21.6 (550)	26.9 (683.5)	15.8 (401.5)	11.1 (282.0)	22.2 (564)	10.9 (276)
400	16"	23.6 (600)	29.0 (735.5)	16.8 (427.5)	12.1 (308.0)	24.2 (616)	10.9 (276)
450	18"	25.6 (650)	30.9 (785.5)	17.8 (452.5)	13.1 (333.0)	26.2 (666)	11.5 (292)
500	20"	25.6 (650)	32.9 (836.5)	18.8 (478.0)	14.1 (358.5)	28.2 (717)	11.5 (292)
600	24"	30.7 (780)	37.0 (940.5)	20.9 (530.0)	16.2 (410.5)	32.3 (821)	15.8 (402)
700	28"	35.8 (910)	45.0 (1143.5)	24.9 (631.5)	20.1 (512.0)	40.3 (1024)	23.2 (589)
750	30"	38.4 (975)	45.0 (1143.5)	24.9 (631.5)	20.1 (512.0)	40.3 (1024)	24.6 (626)
800	32"	40.9 (1040)	46.7 (1186.5)	25.7 (653.0)	21.0 (533.5)	42.0 (1067)	25.5 (647)
900	36"	46.0 (1170)	52.7 (1339.5)	28.7 (729.5)	24.0 (610.0)	48.0 (1220)	30.9 (785)
1000	40"	51.2 (1300)	58.7 (1491.5)	31.7 (805.5)	27.0 (686.0)	54.0 (1372)	33.9 (862)
1050	42"	53.7 (1365)	60.7 (1543.5)	32.7 (831.5)	28.0 (712.0)	56.0 (1424)	35.9 (912)
1200	48"	61.4 (1560)	68.5 (1741.5)	36.6 (930.5)	31.9 (811.0)	63.8 (1622)	39.0 (992)
1350	54"	69.1 (1755)	76.5 (1943.5)	40.6 (1031.5)	35.9 (912.0)	71.8 (1824)	42.3 (1252)
1400	-	1820	2093.5	1106.5	987.0	1974	1252
1500	60"	76.8 (1950)	84.3 (2141.5)	44.5 (1130.5)	39.8 (1011)	79.6 (2022)	54.8 (1392)
1600	-	2080	2231.5	1175.5	1056	2112	1482
1650	66"	84.4 (2145)	90.8 (2305.5)	47.7 (1212.5)	43.0 (1093)	86.0 (2186)	58.3 (1482)
1800	72"	92.1 (2340)	98.2 (2495.5)	51.5 (1307.5)	46.8 (1188.0)	93.5 (2376)	64.2 (1632)
2000	78"	102.3 (2600)	102.2 (2595.5)	53.4 (1357.5)	48.7 (1238.0)	97.5 (2476)	68.2 (1732)

The fitting length (L) is always the same, regardless of the pressure rating.

¹⁾ Only DN 350, 400, 500 and 600 are available if flanges according to AS are used.

²⁾ DN < 700 only to ANSI, DN > 600 only to AWWA.

Ground disk 1" to 12" (DN 25 to 300)



A0003221

DN ¹⁾		di	B	D	H
EN (DIN) / JIS / AS ⁴⁾	ANSI [inch]	inches [mm]	inches [mm]	inches [mm]	inches [mm]
25	1"	1.02 (26)	2.44 (62)	3.05 (77.5)	3.44 (87.5)
32	-	35	80	87.5	94.5
40	1 1/2"	1.61 (41)	3.23 (82)	3.98 (101)	4.06 (103)
50	2"	2.05 (52)	3.98 (101)	4.55 (115.5)	4.25 (108)
65	-	68	121	131.5	118
80	3"	3.15 (80)	5.16 (131)	6.08 (154.5)	5.31 (135)
100	4"	4.09 (104)	6.14 (156)	7.34 (186.5)	6.02 (153)
125	-	130	187	206.5	160
150	6"	6.22 (158)	8.54 (217)	10.1 (256)	7.24 (184)
200	8"	8.11 (206)	10.5 (267)	11.3 (288)	8.07 (205)
250	10"	10.2 (260)	12.9 (328)	14.1 (359)	9.45 (240)
300 ²⁾	12" ²⁾	12.3 (312)	14.8 (375)	16.3 (413)	10.7 (273)
300 ³⁾	12" ³⁾	12.2 (310)	14.8 (375)	15.9 (404)	10.6 (268)

¹⁾ Ground disks can, with the exception of 12" (DN 300), can be used for all supplied flange standards / pressure ratings.

²⁾ PN 10/16, Cl. 150

³⁾ PN 25, JIS 10K/20K

⁴⁾ DN 32, 40, 65 and 125 are not available if flanges according to AS are used.

Weight

Weight data in kg (ANSI and AWWA in lbs)									
Nominal diameter		Compact version			Remote version (without cable)				
		EN (DIN) / AS*	JIS	ANSI/AWWA	EN (DIN) / AS*	Sensor		ANSI/AWWA	Wall housing
[mm]	[inch]					JIS			
25	1"	7.3	7.3	16 lbs	5.3	5.3	12 lbs	13 lbs	
32	1 1/4"	8.0	7.3	-	6.0	5.3	-	13 lbs	
40	1 1/2"	9.4	8.3	20 lbs	7.4	6.3	16 lbs	13 lbs	
50	2"	10.6	9.3	23 lbs	8.6	7.3	19 lbs	13 lbs	
65	2 1/2"	12.0	11.1	-	10.0	9.1	-	13 lbs	
80	3"	14.0	12.5	31 lbs	12.0	10.5	24 lbs	13 lbs	
100	4"	16.0	14.7	35 lbs	14.0	12.7	31 lbs	13 lbs	
125	5"	21.5	21.0	-	19.5	19.0	-	13 lbs	
150	6"	25.5	24.5	56 lbs	23.5	22.5	52 lbs	13 lbs	
200	8"	45	41.9	99 lbs	43	39.9	95 lbs	13 lbs	
250	10"	65	69.4	165 lbs	63	67.4	161 lbs	13 lbs	
300	12"	70	72.3	242 lbs	68	70.3	238 lbs	13 lbs	
350	14"	115		386 lbs	113		381 lbs	13 lbs	
400	16"	135		452 lbs	133		448 lbs	13 lbs	
450	18"	175		562 lbs	173		558 lbs	13 lbs	
500	20"	175		628 lbs	173		624 lbs	13 lbs	
600	24"	235		893 lbs	233		888 lbs	13 lbs	
700	28"	355		882 lbs	353		877 lbs	13 lbs	
-	30"	-		1014 lbs	-		1010 lbs	13 lbs	
800	32"	435		1212 lbs	433		1208 lbs	13 lbs	
900	36"	575		1764 lbs	573		1759 lbs	13 lbs	
1000	40"	700		1984 lbs	698		1980 lbs	13 lbs	
-	42"	-		2425 lbs	-		2421 lbs	13 lbs	
1200	48"	850		3086 lbs	848		3082 lbs	13 lbs	
-	54"	-		4850 lbs	-		4846 lbs	13 lbs	
1400	-	1300		-	1298		-	13 lbs	
-	60"	-		5952 lbs	-		5948 lbs	13 lbs	
1600	-	1700		-	1698		-	13 lbs	
-	66"	-		8157 lbs	-		8153 lbs	13 lbs	
1800	72"	2200		9039 lbs	2198		9035 lbs	13 lbs	
-	78"	-		10,141 lbs	-		10,137 lbs	13 lbs	
2000	-	2800		-	2798		-	13 lbs	

Transmitter Promag (compact version): 3.4 kg
 (Weight data valid for standard pressure ratings and without packaging material)
 * Only DN 80, 100, 150...400, 500 and 600 are available if flanges according to AS are used.

Materials

Transmitter housing:

- Compact housing: powder coated die-cast aluminium
- Wall-mounted housing: powder coated die-cast aluminium

Sensor housing:

- 1" to 12" (DN 25 to 300): powder-coated die-cast aluminium
- 14" to 78" (DN 350 to 2000): painted steel (Amerlock 400)

Measuring tube:

- < 14" (DN < 350): stainless steel 1.4301 or 1.4306/304L; non-stainless flange material with Al/Zn protective coating
- > 12" (DN > 300): stainless steel 1.4301/304; non-stainless flange material with Amerlock 400 paint

Flange:

- EN 1092-1 (DIN 2501): 316L SS / 1.4571; RSt37-2 (S235JRG2) / C22 / FE 410W B with flanges made of carbon steel: < 14" (DN < 350) with Al/Zn protective coating; > 12" (DN > 300) with Amerlock 400 paint
- ANSI: A105, 316L SS with flanges made of carbon steel: < 14" (DN < 350) with Al/Zn protective coating; > 12" (DN > 300) with Amerlock 400 paint
- AWWA: 1.0425 (with Amerlock 400 paint)
- JIS: RSt37-2 (S235JRG2) / H II / 1.0425 / 316L SS with flanges made of carbon steel: < 14" (DN < 350) with Al/Zn protective coating; > 12" (DN > 300) with Amerlock 400 paint
- AS 2129: (DN 150, 200, 250, 300, 600) A105 or RSt37-2 (S235JRG2) (DN 80, 100, 350, 400, 500) A105 or St44-2 (S275JR) (with flanges made of carbon steel: DN < 350 with Al/Zn protective coating; DN > 300 with Amerlock 400 paint)
- AS 4087: A105 or St44-2 (S275JR) (with flanges made of carbon steel: DN < 350 with Al/Zn protective coating; DN > 300 with Amerlock 400 paint)

Ground disks: 1.4435/316L SS or Alloy C-22

Electrodes: 1.4435/316L SS or Alloy C-22, tantalum

Seals: Seals to DIN EN 1514-1

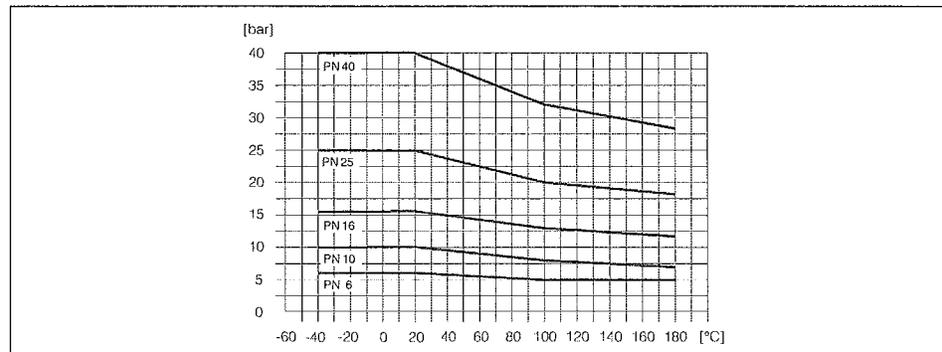
Material load diagrams

Caution!

The following diagrams contain material load curves (reference curves) for various process connections relating to the fluid temperature. But the maximal permissible fluid temperature always depends on the lining material of the sensor and/or of the sealing material (Page 20).

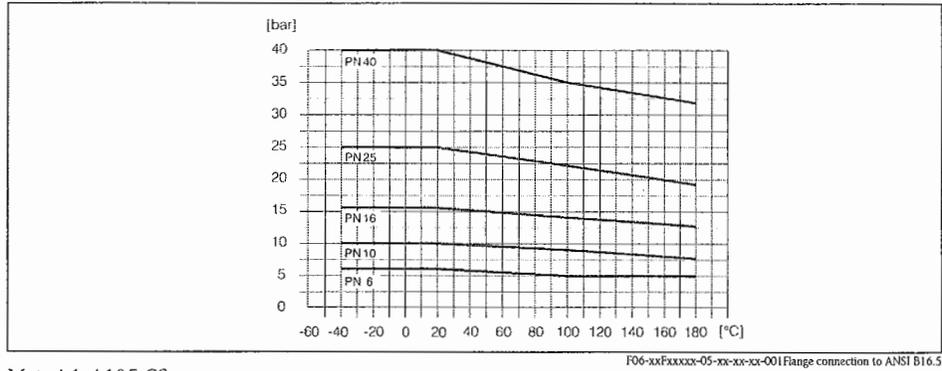
Flange connection to EN 1092-1 (DIN 2501)

Material: RSt37-2 (S235JRG2) / C22 / FE 410W B

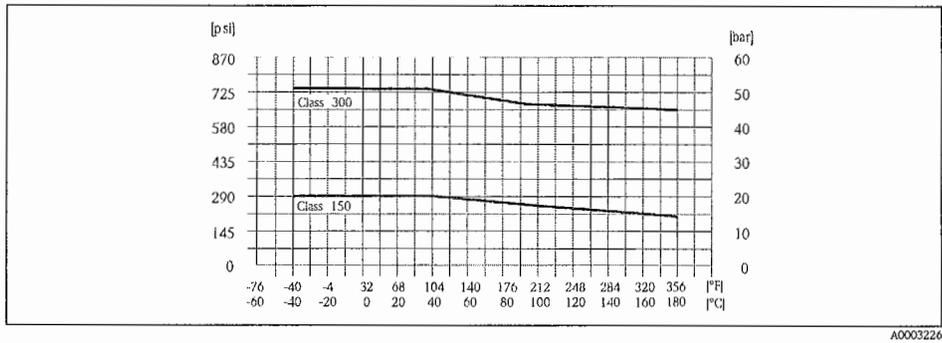


F06-xxFxxxx-05-xx-xx-xx-000

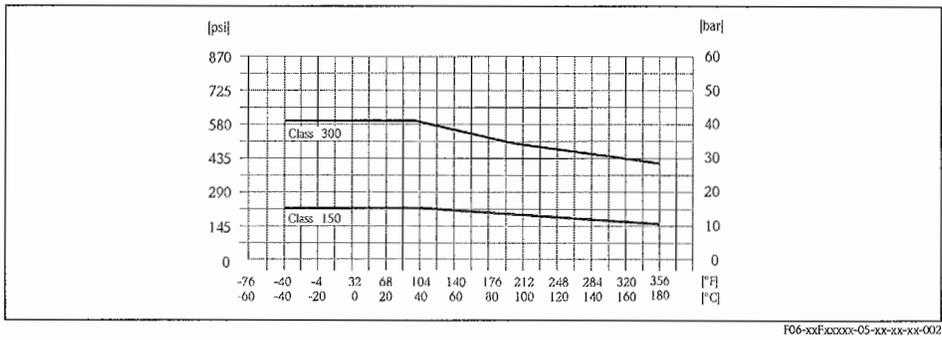
Flange connection to EN 1092-1 (DIN 2501)
 Material: 316L SS/ 1.4571



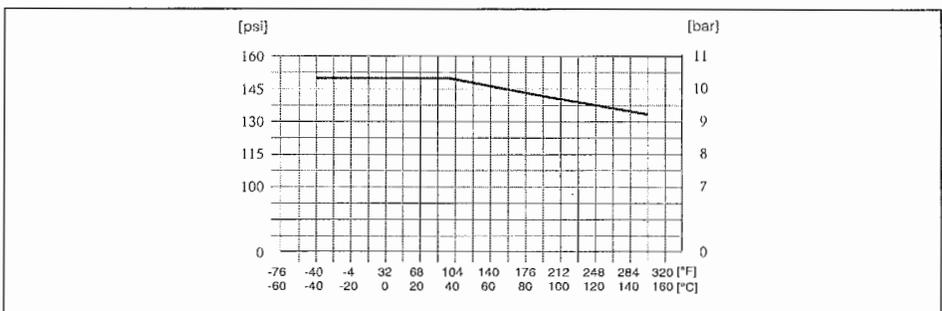
Material: A105 CS



Flange connection to ANSI B16.5
 Material: 316L SS

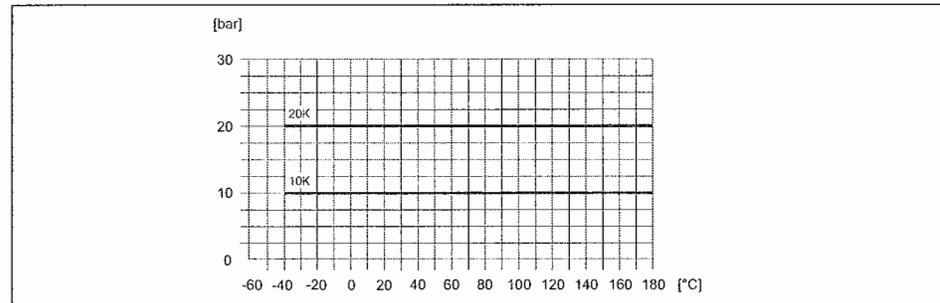


Flange connection to AWWA C 207, Class D
 Material: 1.0425



Flange connection to JIS B2238

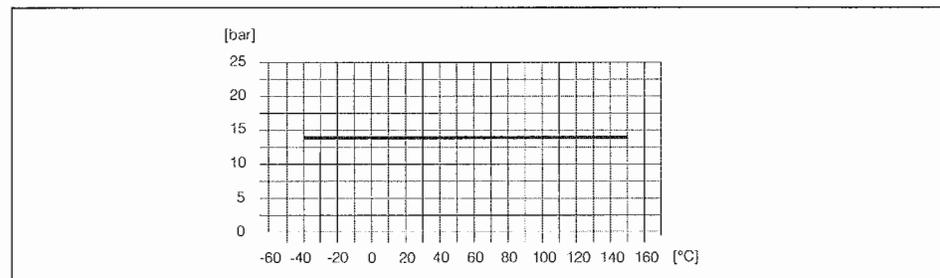
Material: RSt37-2 (S235JRG2) / H II / 1.0425



A0003228

Flange connection to AS2129 Table E or AS4087 Cl. 14

Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



F06-xxFxxxx-05-xx-xx-xx-010

Fitted electrodes

Measuring, reference and EPD electrodes:

- Standard with: 1.4435/316L SS, Alloy C-22, tantalum
- Optional: exchangeable measuring electrodes made of 1.4435/316L SS, 14" to 78" (DN 350 to 2000)

Process connection

Flange connection:

- EN 1092-1 (DIN 2501), < DN 350 Form A, > DN 300 Form B (dimensions acc. to DIN 2501; DN 65 PN 16 and DN 600 PN 16 exclusively to EN 10921)
- ANSI B16.5
- AWWA C 207, Class D
- JIS B2238
- AS2129 Table E
- AS4087 Cl. 14

Surface roughness

■ Electrodes:

- 1.4435/316L SS, Alloy C-22, Tantalum: 12 µin to 10 µin (0.3 to 0.5 µm)

(all data relate to parts in contact with the medium)

Human interface

Display elements

- Liquid-crystal display: backlit, two lines (Promag 50) or four lines (Promag 53) with 16 characters per line
- Custom configurations for presenting different measured-value and status variables
- Totalizer:
 - Promag 50: 2 totalizers (7-digit plus 7-digit overflow with sign and units)
 - Promag 53: 3 totalizers (7-digit plus 7-digit overflow with sign and units)

Operating elements	<p>Unified operation concept for both types of transmitter:</p> <p>Promag 50:</p> <ul style="list-style-type: none"> ■ Local operation with three push buttons (-, +, E) ■ Quick Setup menus for straightforward commissioning <p>Promag 53:</p> <ul style="list-style-type: none"> ■ Local operation with three optical keys (-, +, E) ■ Application-specific Quick Setup menus for straightforward commissioning
Language group	<p>Language groups available for operation in different countries:</p> <p>Promag 50, Promag 53:</p> <ul style="list-style-type: none"> ■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese ■ Eastern Europe and Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech ■ South and east Asia (SEA): English, Japanese, Indonesian <p>Promag 53:</p> <ul style="list-style-type: none"> ■ China (CIN): English, Chinese <p>You can change the language group via the operating program "ToF Tool - Fieldtool Package."</p>
Remote operation	<p>Promag 50: Remote control via HART, PROFIBUS DP/PA Promag 53: Remote control via HART, PROFIBUS DP/PA, MODBUS RS485, FOUNDATION Fieldbus</p>

Certificates and approvals

Ex approvals	<p>Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your Endress+Hauser Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.</p>
CE mark	<p>The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.</p>
C-Tick mark	<p>The measuring system is in conformity with the EMC requirements of the Australian Communications Authority (ACA).</p>
Pressure Equipment Directive	<p>Flow meters with a nominal diameter smaller or equal 1" (DN 25) are covered by Art. 3(3) of the European directive 97/23/EG (Pressure Equipment Directive) and are designed according to sound engineer practice. For larger nominal diameter, optional approvals according to Cat. III are available when required (depends on fluid and process pressure).</p>
PROFIBUS DP/PA certification	<p>The flow device has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organisation). The device thus meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified to PROFIBUS PA, profile version 3.0 (device certification number: on request) ■ The device can also be operated with certified devices of other manufacturers (interoperability)
FOUNDATION Fieldbus certification	<p>The flow device has successfully passed all the test procedures carried out and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified to FOUNDATION Fieldbus Specification ■ The device meets all the specifications of the FOUNDATION Fieldbus H1. ■ Interoperability Test Kit (ITK), revision status 4.0 (device certification number: on request) ■ The device can also be operated with certified devices of other manufacturers ■ Physical Layer Conformance Test of the Fieldbus Foundation

MODBUS certification	The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the "MODBUS/TCP Conformance Test Laboratory" of the University of Michigan.
Other standards, guidelines	<p>EN 60529: Degrees of protection by housing (IP code)</p> <p>EN 61010: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.</p> <p>EN 61326/A1 (IEC 6326): Electromagnetic compatibility (EMC requirements)</p> <p>NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.</p> <p>NAMUR NE 43: Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.</p> <p>NAMUR NE 53: Software of field devices and signal-processing devices with digital electronics. Accessories</p>

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. The Endress+Hauser service organization can provide detailed information on request.

Supplementary documentation

- Flow Measurement (FA005D/06/en)
- Operating Instructions Promag 50 (BA046D/06/en, BA049D/06/en)
- Operating Instructions Promag 50 PROFIBUS PA (BA055D/06/en, BA056D/06/en)
- Operating Instructions Promag 53 (BA047D/06/en, BA048D/06/en)
- Operating Instructions Promag 53 PROFIBUS DP/PA (BA053D/06/en, BA054D/06/en)
- Operating Instructions Promag 53 FOUNDATION Fieldbus (BA051D/06/en, BA052D/06/en)
- Operating Instructions Promag 53 MODBUS (BA117D/06/en und BA118D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, etc.

Registered trademarks

HART®

Registered trademark of HART Communication Foundation, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organisation, Karlsruhe, Germany

FOUNDATION™ Fieldbus

Registered trademark of the Fieldbus FOUNDATION, Austin, USA

MODBUS®

Registered trademark of the MODBUS Organisation

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, ToF Tool - Fieldtool® Package, Fieldcheck®, Applicator®

Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

Ordering information

NOTE: Endress+Hauser reserves the right to change or modify product, specifications, and ordering information at any time without notice. Please consult Endress+Hauser or your local representative for the most recent information.

Promag 50W, 1" to 24" sizes

Promag 50 W 0 1 2 3 4 5 6 7 8 9 10 11 12

Nominal Diameter

- 0 25 1"
- 40 1-1/2"
- 50 2"
- 80 3"
- 1H 4"
- 1F 6"
- 2H 8"
- 2F 10"
- 3H 12"
- 3F 14"
- 4H 16"
- 4F 18"
- 5H 20"
- 6H 24"

1 Liner

- H Hard rubber (not available for 1", 1-1/2" or 2" sensors)
- U Polyurethane

2 Process connection

- L Class 150 ANSI B16.5 CS steel A105 flanges
- M Class 300 ANSI B16.5 CS steel A105 flanges (not for 8" and larger)
- R Class 150 ANSI B16.5 316L SS flanges
- S Class 300 ANSI B16.5 316L SS flanges (not for 8" and larger)

3 Electrodes / material

- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22

4 Calibration

- A 3-point calibration, 0.5%
- B 3-point calibration, 0.2%
- D SCS/A2LA 3-point 0.5% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- E SCS/A2LA 3-point 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)

5 Certificates

- 1 Standard, no certificate
- 2 3.1B material certificate for pipe and flanges
- 3 2.3 pressure test certificate (1.5 x PN, 3 minutes) for sensors up to 12" only
- 4 3.1B material and 2.3 pressure test certificate for sensors up to 12" only

6 Approvals

- A For use in non-hazardous areas
- N FM explosion proof Class I, Div. 1 / CSA Class I, Div. 1 (only for aluminum field housing, compact version, not for 14" and larger sensors)
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

7 Housing

- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- N NEMA 6P sensor, aluminum field housing, non-hazardous
- P NEMA 4X (IP 67) compact aluminum housing, HE (harsh environment), compact and remote sensor sizes up to 12" only *
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)

8 Cable for remote

- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)

9 Cable entries

- B 1/2" NPT
- L 1/2" NPT fieldbus connector (only for approval A and R)

10 Power supply / display

- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- X Sensor only (without transmitter, only available up to 8")

11 Software

- A Standard software
- X Sensor only (up to 8" only)

12 Outputs / Inputs

- A Current HART, frequency
- D Current HART, frequency, status output, status input
- H PROFIBUS-PA (approvals A and R only)
- J PROFIBUS-DP (approvals A and R only)
- S Current HART, frequency; active I.S. (not for approvals A and R)
- T Current HART, frequency; passive I.S. (not for approvals A and R)
- W Current HART
- X Sensor only

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

Promag 50W, 28" to 78" sizes

Promag 50 W

0	1	2	3	4	5	6	7	8	9	10	11	12

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Nominal Diameter

- 0 7H 28"
- 7F 30", AWWA
- 8H 32"
- 9H 36"
- TO 40"
- VO 42", AWWA
- T2 48"
- V3 54", AWWA
- V5 60", AWWA
- V6 66", AWWA
- T8 72"
- V9 78", AWWA

1 Liner

- H Hard rubber
- U Polyurethane (not available for 42" up to 78")

2 Process connection

- P Class D AWWA carbon steel A105 flanges

3 Electrodes / material

- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22

4 Calibration

- A 3-point calibration, 0.5%
- B 3-point calibration, 0.2%
- D SCS/A2LA 3-point 0.5% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- E SCS/A2LA 3-point 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)

5 Certificates

- 1 Standard, no certificate
- 2 3.1B material certificate for pipe and flanges

6 Approvals

- A For use in non-hazardous areas
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

7 Housing

- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)

8 Cable for remote

- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)

9 Cable entries

- B 1/2" NPT
- L 1/2" NPT fieldbus connector (only for approval A and R)

10 Power supply / display

- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- X Sensor only (without transmitter, only available up to 8")

11 Software

- A Standard software

12 Outputs / Inputs

- A Current HART, frequency
- D Current HART, frequency, status output, status input
- H PROFIBUS-PA (approvals A and R only)
- J PROFIBUS-DP (approvals A and R only)
- S Current HART, frequency; active I.S. (not for approvals A and R)
- T Current HART, frequency; passive I.S. (not for approvals A and R)
- W Current HART
- X Sensor only

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

Promag 53W, 1" to 24" sizes

Promag 53 W 0 1 2 3 4 5 6 7 8 9 10 11 12
 1 F - H L 0 B 1 R C 2 B A A Q

Nominal Diameter

- 0 25 1"
- 40 1-1/2"
- 50 2"
- 80 3"
- 1H 4"
- 1F 6"
- 2H 8"
- 2F 10"
- 3H 12"
- 3F 14"
- 4H 16"
- 4F 18"
- 5H 20"
- 6H 24"

1 Liner

- H Hard rubber (not available for 1", 1-1/2" or 2" sensors)
- U Polyurethane

2 Process connection

- L Class 150 ANSI B16.5 CS steel A105 flanges
- M Class 300 ANSI B16.5 CS steel A105 flanges (not for 8" and larger)
- R Class 150 ANSI B16.5 316L SS flanges
- S Class 300 ANSI B16.5 316L SS flanges (not for 8" and larger)

3 Electrodes / material

- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22

4 Calibration

- B 3-point calibration, 0.2%
- E SCS/A2LA 3-point, 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)

5 Certificates

- I Standard, no certificate
- 2 3.1B material certificate for pipe and flanges
- 3 2.3 pressure test certificate (1.5 x PN, 3 minutes) for sensors up to 12" only
- 4 3.1B material and 2.3 pressure test certificate for sensors up to 12" only

6 Approvals

- A For use in non-hazardous areas
- N FM explosion proof Class I, Div. 1 / CSA Class I, Div. 1 (only for aluminum field housing, compact version, not for 14" and larger sensors)
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

7 Housing

- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- N NEMA 6P sensor, aluminum field housing, non-hazardous
- P NEMA 4X (IP 67) compact aluminum housing, HE (harsh environment), compact and remote sensor sizes up to 12" only *
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

8 Cable for remote

- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)

9 Cable entries

- B 1/2" NPT
- L 1/2" NPT fieldbus connector (only for approval A and R)

10 Power supply / display

- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- X Sensor only (without transmitter, only available up to 8")

11 Software

- A Standard software
- C ECC electrode cleaning circuit (only for approvals A and R)

12 Outputs / Inputs

- Fixed communication boards
 - A Current HART, frequency
 - B Current HART, frequency, 2 relays
 - F PROFIBUS-PA, IS
 - G Foundation Fieldbus, IS
 - H PROFIBUS-PA
 - J PROFIBUS-DP
 - K Foundation Fieldbus
 - Q Modbus RS485, status input
 - S Current HART, frequency; active I.S
 - T Current HART, frequency; passive I.S
- Flexible communication boards
 - C Current HART, frequency, 2 relays, flexible module
 - D Current HART, frequency, relay, and status input, flexible module
 - L Current HART, 2 relays and status input/output
 - M Current HART, 2 frequency output, status input
 - N Modbus RS 485, current and frequency output, status input
 - P PROFIBUS-DP, current and frequency output, status input
 - V PROFIBUS-DP, two relay outputs, status input
 - 2 Current HART, relay, current, frequency outputs
 - 4 Current HART, relay, frequency outputs, current input
 - 7 Modbus RS485, two relay outputs, status input
 - X Sensor only

Promag 53W, 1" to 24" sizes

Promag 53 W 0 1 2 3 4 5 6 7 8 9 10 11 12
2F - H L 0 B 1 R C 2 B A A Q

- Nominal Diameter
 - 0 25 1"
 - 40 1-1/2"
 - 50 2"
 - 80 3"
 - 1H 4"
 - 1F 6"
 - 2H 8"
 - 2F 10"
 - 3H 12"
 - 3F 14"
 - 4H 16"
 - 4F 18"
 - 5H 20"
 - 6H 24"
- 1 Liner
 - H Hard rubber (not available for 1", 1-1/2" or 2" sensors)
 - U Polyurethane
- 2 Process connection
 - L Class 150 ANSI B16.5 CS steel A105 flanges
 - M Class 300 ANSI B16.5 CS steel A105 flanges (not for 8" and larger)
 - R Class 150 ANSI B16.5 316L SS flanges
 - S Class 300 ANSI B16.5 316L SS flanges (not for 8" and larger)
- 3 Electrodes / material
 - 0 Measuring, reference and EPD electrodes / 316L SS
 - 1 Measuring, reference and EPD electrodes / Alloy C22
 - 2 Measuring, reference and EPD electrodes / tantalum
 - 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
 - G Measuring, reference and EPD electrodes, bullet nose / 316L SS
 - H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22
- 4 Calibration
 - B 3-point calibration, 0.2%
 - E SCS/A2LA 3-point, 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- 5 Certificates
 - 1 Standard, no certificate
 - 2 3.1B material certificate for pipe and flanges
 - 3 2.3 pressure test certificate (1.5 x PN, 3 minutes) for sensors up to 12" only
 - 4 3.1B material and 2.3 pressure test certificate for sensors up to 12" only
- 6 Approvals
 - A For use in non-hazardous areas
 - N FM explosion proof Class I, Div. 1 / CSA Class I, Div. 1 (only for aluminum field housing, compact version, not for 14" and larger sensors)
 - R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2
- 7 Housing
 - A NEMA 4X (IP 67) compact aluminum housing
 - C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
 - G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
 - K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
 - N NEMA 6P sensor, aluminum field housing, non-hazardous
 - P NEMA 4X (IP 67) compact aluminum housing, HE (harsh environment), compact and remote sensor sizes up to 12" only *
 - S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
 - 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
 - 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
 - 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)

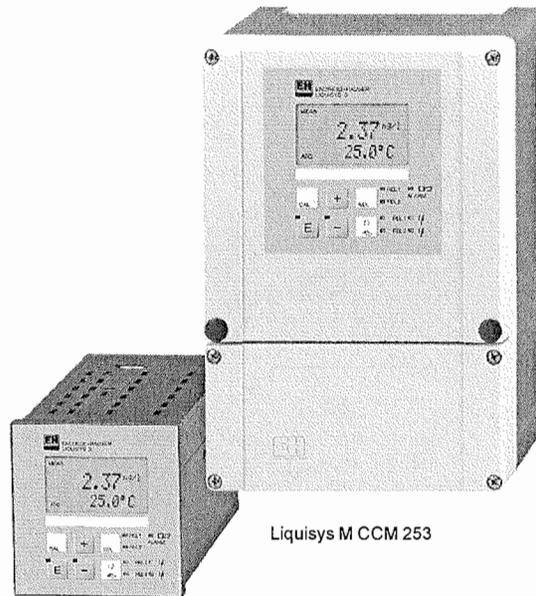
- 8 Cable for remote
 - 0 Without cable
 - 1 15 foot coil and signal cable
 - 2 30 foot coil and signal cable
 - 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
 - 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)
- 9 Cable entries
 - B 1/2" NPT
 - L 1/2" NPT fieldbus connector (only for approval A and R)
- 10 Power supply / display
 - 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
 - 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
 - A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
 - B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
 - X Sensor only (without transmitter, only available up to 8")
- 11 Software
 - A Standard software
 - C ECC electrode cleaning circuit (only for approvals A and R)
- 12 Outputs / Inputs
 - Fixed communication boards
 - A Current HART, frequency
 - B Current HART, frequency, 2 relays
 - F PROFIBUS-PA, IS
 - G Foundation Fieldbus, IS
 - H PROFIBUS-PA
 - J PROFIBUS-DP
 - K Foundation Fieldbus
 - Q Modbus RS485, status input
 - S Current HART, frequency; active I.S
 - T Current HART, frequency; passive I.S
 - Flexible communication boards
 - C Current HART, frequency, 2 relays, flexible module
 - D Current HART, frequency, relay, and status input, flexible module
 - L Current HART, 2 relays and status input/output
 - M Current HART, 2 frequency output, status input
 - N Modbus RS 485, current and frequency output, status input
 - P PROFIBUS-DP, current and frequency output, status input
 - V PROFIBUS-DP, two relay outputs, status input
 - 2 Current HART, relay, current, frequency outputs
 - 4 Current HART, relay, frequency outputs, current input
 - 7 Modbus RS485, two relay outputs, status input
 - X Sensor only

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

Chlorine / Chlorine Dioxide Measurement

liquisys M CCM 223 / 253

Analyzer for free chlorine and
chlorine dioxide



Liquisys M CCM 253

Liquisys M CCM 223

Due to the modularity of its design, the Liquisys M CCM 223 / 253 Analyzer can be adapted to a wide range of customer needs. The basic version, which provides simple measuring and alarm signalling functions, can be equipped with additional software and hardware modules to meet specific applications. Expansion modules can be retrofitted as required.

Areas of application

- Drinking water
- Water treatment
- Cooling water
- Gas scrubbers
- Reverse osmosis
- Food processing
- Swimming pool water

Benefits at a glance

- Chlorine analyzer in a NEMA 4X field enclosure or panel-mounted housing
- Universal application
 - Switchable between chlorine and chlorine dioxide measurement
 - pH compensation for free chlorine
- Simple handling
 - Logical menu structure with plain text in 6 languages makes equipment configuration easy
 - Large two-line display indicates measured value and temperature or pH/ORP simultaneously
- Reliable operation
 - Overvoltage (lightning) protection according to EN 61000-4-5
 - Direct access for manual contact control
 - Automatic controller shutdown if lower flow rate limit violated or total failure in sample current

The basic unit can be extended with:

- 2 or 4 contacts for use as:
 - Limit contacts (for temperature also)
 - P(ID) controller for chlorine and pH
 - Timer for simple rinse process
 - "Complete cleaning" with Chemoclean
- "Plus package":
 - Manual pH compensation for Cl_2
 - Any current output configuration via table
 - Automatic cleaning start in case of alarm or upper limit violation
 - Live check of sensor
 - Process monitoring
- Optional pH or ORP measurement
 - Automatic pH compensation for Cl_2
- HART® or PROFIBUS-PA and DP
- 2nd current output for temperature, pH or ORP
- Current input for controller shutdown on lower flow rate limit violation or total failure in main flow or for feed-forward control

Endress + Hauser

The Power of Know How



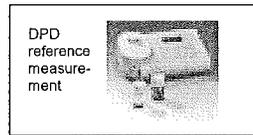
Details

Liquisys M CCM 223 / 253 offers the right solution for all applications in drinking water and process water treatment.

Features of the **basic version (EK)**:

Measuring the concentration of free chlorine or chlorine dioxide in standard or trace amount range.

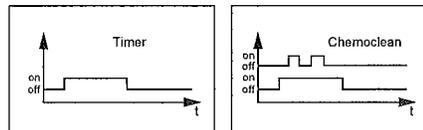
The sensor is selected from the menu. The **temperature** is displayed but the reading can also be hidden.



The CCS 140 / 141 sensors for free chlorine and the CCS 240 / 241 sensors for chlorine dioxide are zero-current-free and therefore require only **single-point calibration**. This is performed by entering the DPD reference value, determined with a separate DPD kit.

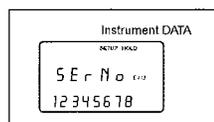
		2.4 / 22 mA
E 057	yes	no
E 080	no	yes
---	yes	no

Different alarms are required depending on the application and operator. Therefore, the Liquisys M CCM 223 / 253 permits the independent **configuration of the alarm contact and the error current** for each individual error. Unnecessary or undesirable alarms can be suppressed in this way.



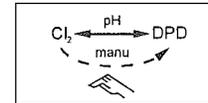
Up to four contacts can be used as limit contacts (also for temperature), to implement a P(ID) controller and for cleaning functions.

Direct **manual operation of the contacts** (bypassing the menu) provides quick access to limit, control or cleaning contacts. If necessary, this helps to correct deviations very quickly.

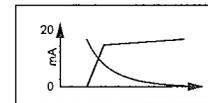


The **serial numbers** of the instrument and the modules and the order code can be called up on the display.

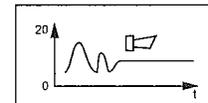
The **ES version** provides **additional functions**:



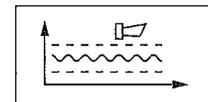
Measuring free chlorine with the amperometric sensor is pH-dependent, but not the DPD measurement used for calibration. **Manual pH compensation** is used in media with stable pH values. Changes in pH should be < 0.1 pH.



The **current output** is freely configurable by means of a table in order to display large measuring ranges and still achieve high resolution in certain ranges. This permits **bilinear** or **quasilogarithmic** curves, etc.

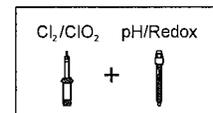


The **live check** issues an alarm when the sensor signal fails to change over a defined period of time. This may be caused by blocking, passivation, separation from the process, etc.

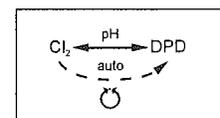


The **Process Check System** uses adjustable time intervals to monitor whether the measured value is above or below the nominal value over an excessively long period of time.

Additional functions of the EP version:



The EP version provides additional measurement of pH value or ORP. This expansion stage also allows control of the pH value in the process. The pH or ORP value can be displayed simultaneously.



Automatic pH compensation allows the instrument to be used in a process with changing pH values.

Basic versions, "plus package" and full version

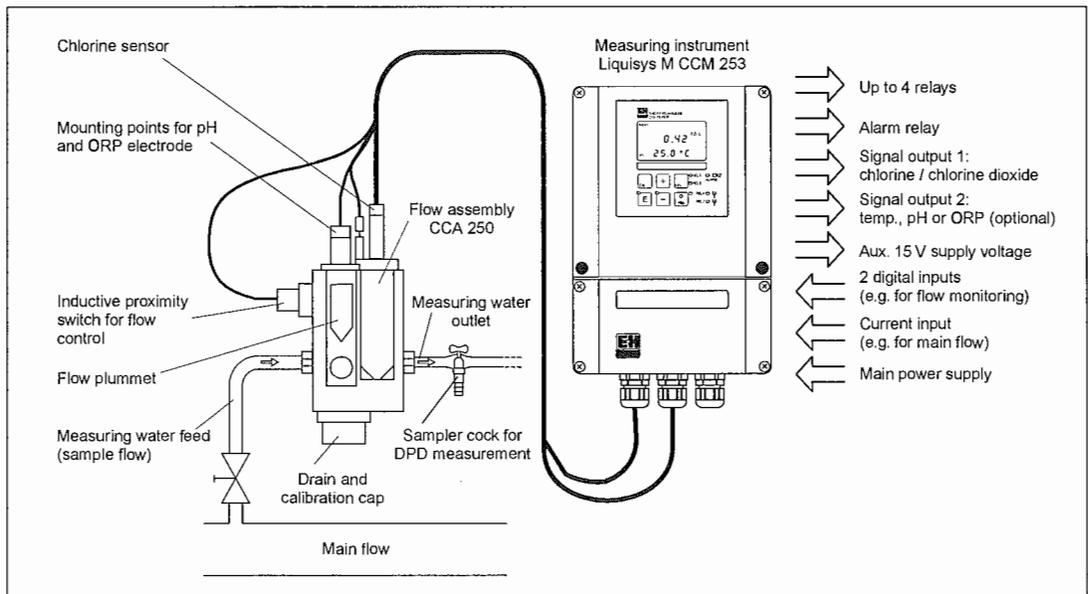
+ \$300 + \$800

	Basic Version (EK version)	With plus package (ES version)	Full expansion (EP version)
Measuring and alarm signalling	MEASUREMENT		
	CALIBRATION Read instrument DATA Linear CURRENT OUTPUT CURRENT OUTPUT simulation 1 programmable ALARM CONTACT (contact and error current)	Manual pH compensation for free chlorine PROCESS CHECK SYSTEM for monitoring LIVE CHECK of sensor CURRENT OUTPUT programmable (table)	Optional pH value or ORP measurement Automatic pH compensation for free chlorine PROCESS CHECK SYSTEM and LIVE CHECK for pH or ORP
	<i>Additional features</i>	<i>Additional features</i>	<i>Additional features</i>
Cleaning	2 CHANGEOVER CONTACTS for - Measuring parameter limit - Temperature limit - PID controller - Timer for cleaning	Automatic cleaning start on alarm or upper limit violation	- pH or ORP limit - pH value control
	<i>Additional features</i>	<i>Additional features</i>	
Controlling	2 more CHANGEOVER CONTACTS (total of 4) for - Measuring parameter limit - Temperature limit - PID controller - Three-step controller - Chemoclean cleaning (water and cleaning agent)	External or automatic cleaning start on alarm upper limit violation	
	<i>Additional features</i>		
Controlling Process	1 current input for - Flow monitoring in main flow - Feed forward control on chemical dosing		

Measuring and control system

- A full measuring system comprises:
- The Liquisys M CCM 223 or CCM 253 chlorine/chlorine dioxide measuring transmitter
 - A CCS 140 / 141 for Cl₂ or CCS 240 / 241 membrane-covered sensor for ClO₂ or an open sensor/ assembly system 963
 - Flow assembly CCA 250

- Options:
- pH or ORP electrode (e.g. CPS 11 or CPS 12)
 - Proximity switch INS for monitoring flow
 - CPK9 sensor cable for pH electrode



Complete measuring system with Liquisys M CCM 253

Measuring Principles

Forms of chlorine and the related measuring principles

Free active chlorine

This is the form of chlorine that disinfects most effectively, hypochlorous acid HOCl. Its proportion depends on the pH value. At pH values < pH 6, only HOCl exists. As the pH increases, HOCl dissociates into hypochlorite ions OCl⁻ and hydrogen ions H⁺. Only OCl⁻ is left at approximately 9.5 pH, i.e. the disinfectant effect is accordingly low.

The amperometric measurement with membrane-covered cells ("Clark cells" like the CCS x4x) measures the free active chlorine. This is the desired measured value for determining that portion of chlorine which has a disinfecting effect, and for chlorination control since it is the effective portion of the chlorine (the HOCl) that is measured. However, correct measurement is only possible when the pH value is held constant with an accuracy of ± 0.1 pH. If the measurement takes place with pH > 6.5 pH and DPD is used for calibration, pH compensation is mandatory.

Bound chlorine (chloramines)

Compounds of chlorine and nitrogen compounds (NH₂, NH₃, NH₄⁺). Bound chlorine is no longer active and has no disinfectant effects.

Bound chlorine is not measured; its share can be determined numerically by subtracting free active chlorine from total chlorine.

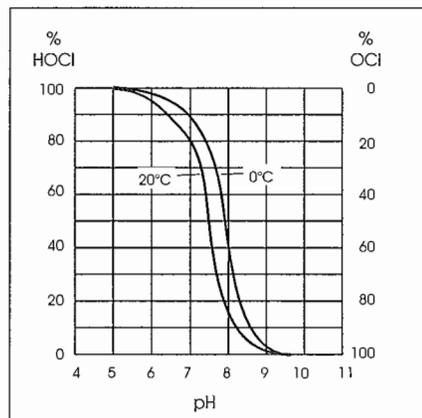
Total free chlorine

Forms of chlorine that have a disinfecting effect. These are: elemental chlorine Cl₂, hypochlorous acid HOCl, hypochlorite ions OCl⁻ and combinations thereof.

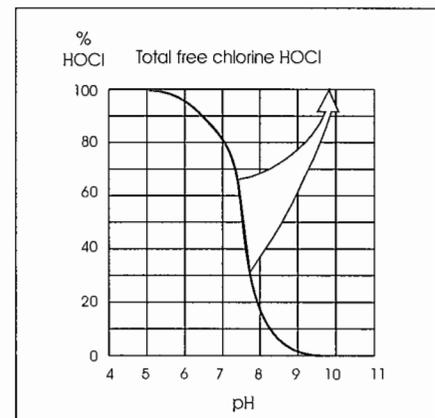
At pH values < pH 6, only HOCl exists, i.e. the measurement is identical to the free active chlorine measurement in this range. This corresponds to the DPD measurement with tablet A since the sample is buffered to pH 6.3 for the DPD measurement. At pH values > pH 6, the HOCl portion decreases and the share of OCl⁻ increases. Non-pH-compensated amperometric measurement indicates a smaller value than DPD measurement. In the case of amperometric measurement with pH compensation ("pH-compensated" mode of the Liquisys S), the measuring signal is therefore evaluated along with the pH value, i.e. the display always corresponds to the DPD check measurement independent of the current pH value. Both compensation and the current pH value must be taken into account to determine the disinfectant effect.

Total chlorine

This is the sum of total free chlorine and bound chlorine. The total chlorine portion is determined by DPD measurement using tablet C or tablets A + B.



Dissociation of HOCl (free active chlorine) in water into OCl⁻ and H⁺ depending on pH values. At pH values < 5, only HOCl exists, at pH values > 9.5, only the relatively ineffective OCl⁻ exists. Dissociation depends on temperature.



Thanks to pH compensation, the HOCl concentration is always shown referred to pH 5. The display value corresponds to the total free chlorine value.

Chlorine Calibration

Calibration of a chlorine system using a DPD reference value

DPD is the abbreviation for N, N-diethyl-p-phenyldiamine sulphate. DPD is a chemical substance in tablet form that reacts to chlorine by turning red, with the tint of red increasing with increasing chlorine concentrations.

If the chemical DPD is used for analytical purposes, this is termed "DPD measurement".

- In the case of simple instruments, the DPD solution is visually compared to a color disk or wedge. This method is called "colorimetric analysis"
- Photometers measure the extinction of a light beam of a defined wavelength (510 nm) by sample. User-friendly colorimeters display the measured value directly.

DPD is the method prescribed by DIN 38408, part 4 for chlorine measurement in water and wastewater. A DPD calibration kit is available from Endress+Hauser.

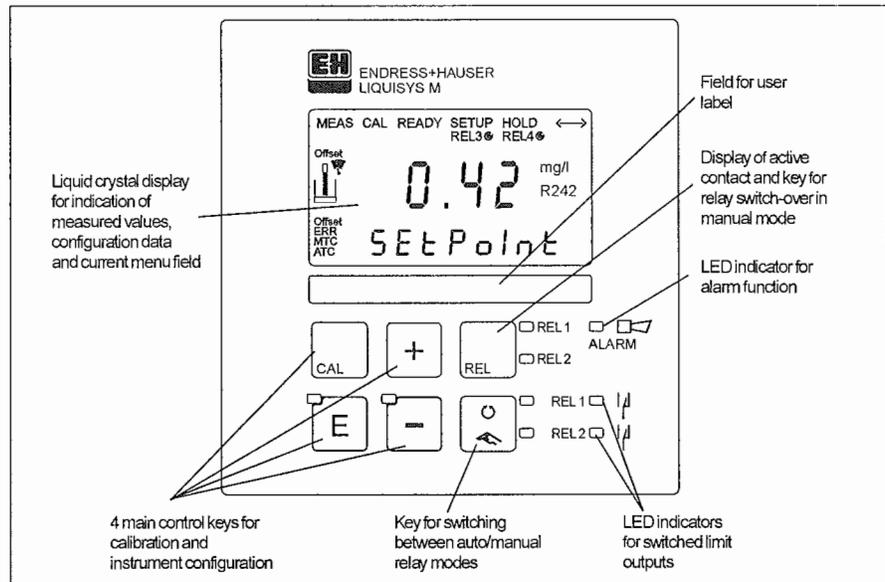
The following substances can be measured with the DPD method:

- Free active chlorine; DPD tablet "A" is used for this purpose.
- Total chlorine; after tablet "A", tablet "B" is used for this measurement. The same measurement can be performed in one step by using tablet "C."
- Chlorine dioxide; 3-step method. Any chlorine present is bound with glycine.
- Ozone; tablet "C": Measurement with chlorine color disk: multiply by 0.676.

Special characteristics of DPD measurement

- The measuring solution is buffered to pH 6.3. Therefore, the DPD measurement is independent of the actual pH value of the water. Thus, the result of the measurement does not provide information on the disinfecting effect but merely indicates the theoretical chlorine content at pH 6.3 (refer to Forms of Chlorine, previous page).
- The accuracy of the DPD measurement is approximately ± 0.03 ppm.
- The lower detection limit is approximately 0.1 to 0.05 ppm.
- To determine the intrinsic error and additives that may affect the measurement, a complete DPD check measurement with chlorine-free water must be performed.
- The DPD method is unsuitable for continuous monitoring. Amperometric measuring cells with electronic measuring instruments, e.g. Liquisys CCM 223 / 253 and CCS x4x, are used for this purpose.

Operation



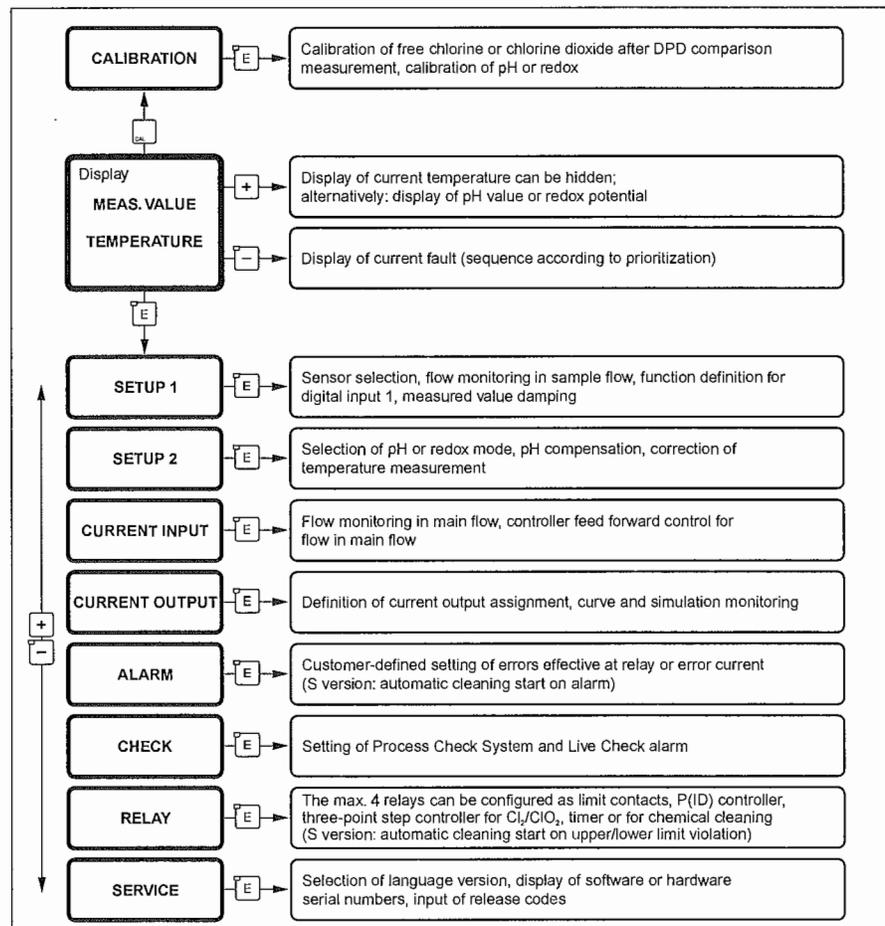
User interface: display and keys

Everything at a glance

The display simultaneously shows the current measured value and the temperature, i.e. the essential process data at a glance. Brief informational texts in the configuration menu provide assistance with parameter configuration.

Intelligent and simple

All instrument control functions are arranged in a logical menu structure. Following access code entry, the individual parameters can be easily selected and modified as needed.



Overview of Liquisys M CCM 223 / 253 menu. This covers all the options that can be installed (see page 2, Details).

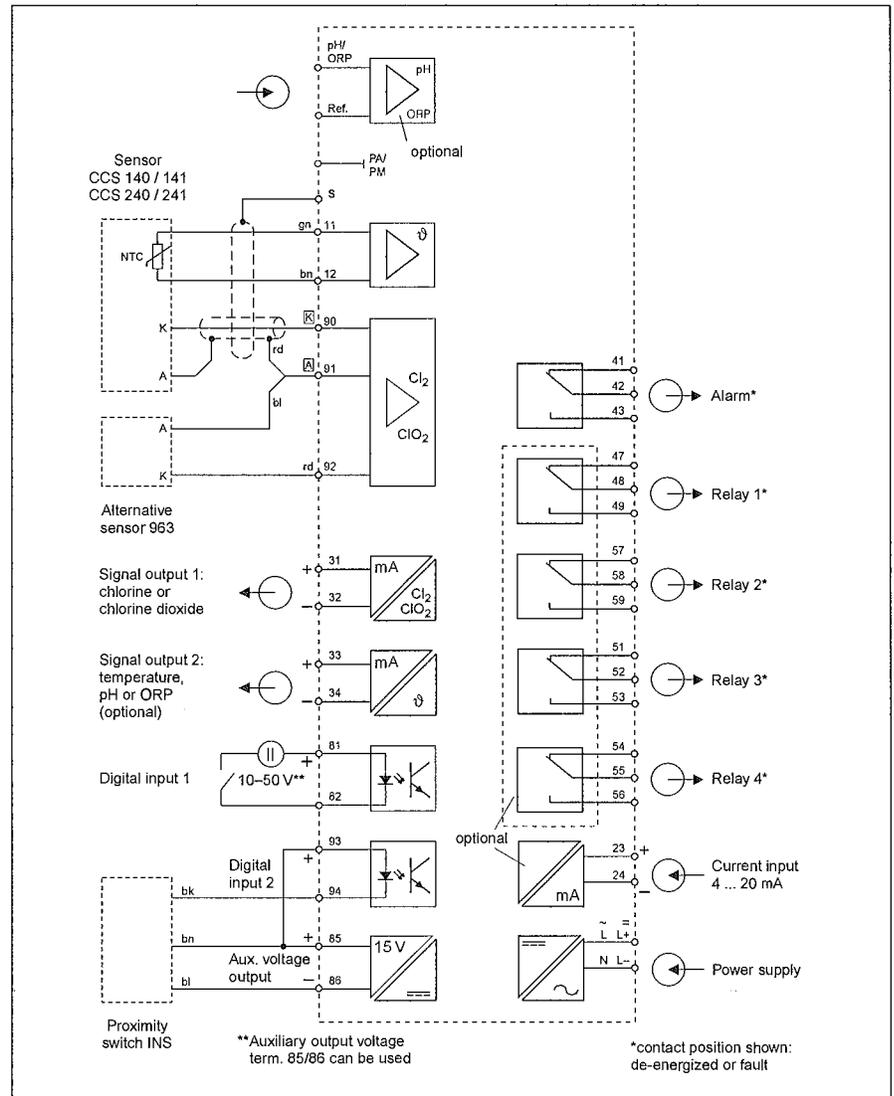
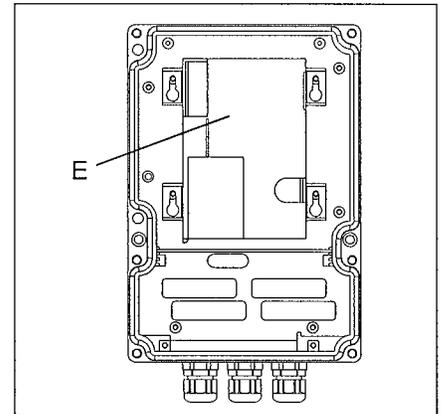
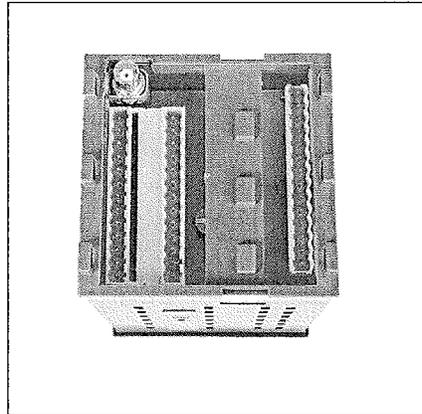
Electrical connection

All connections to the panel-mounted CCM 223 are made on terminal strips on the rear of the unit. The CCM 253 is wired to terminals in the separate wiring compartment.

All the wiring except for the pH input can remain in place if the instrument needs repair because repairs are limited to assembly replacement. Disassembling the instrument and rewiring are not necessary.

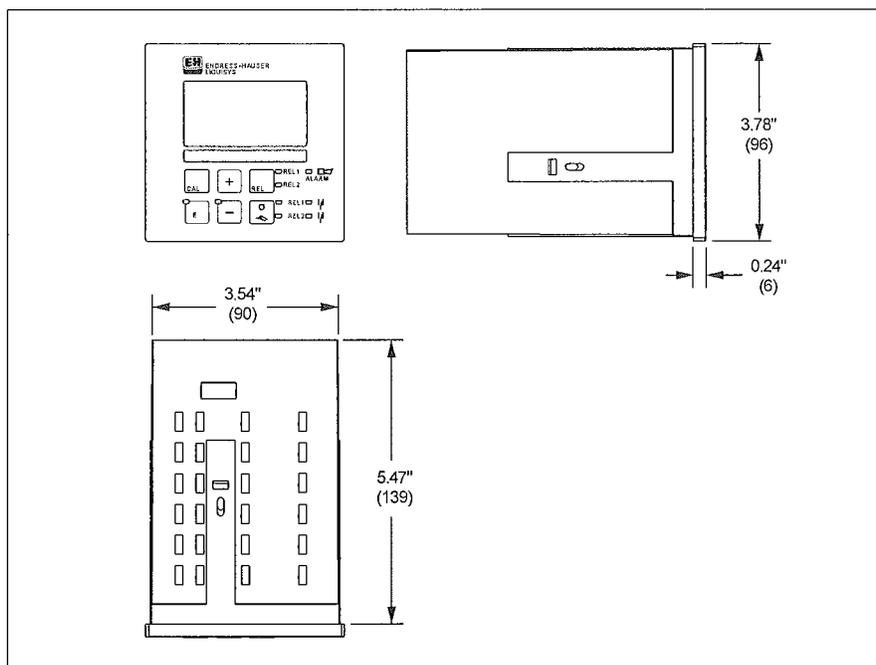
left:
Liquisys M CCM 223, terminals on the rear of the instrument; pH connection on BNC connector

right:
Liquisys M CCM 253, rear of instrument with replaceable electronics box (E); pH connection on terminal

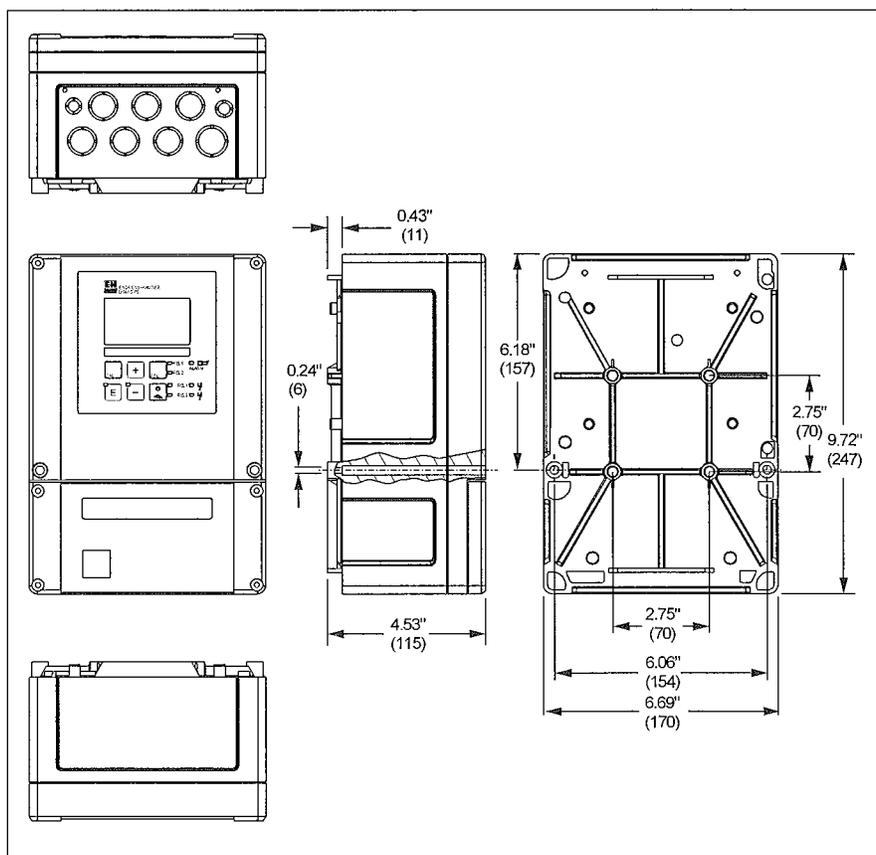


Electrical connection of the Liquisys M CCM 223 / 253

Dimensions



Liquisys M CCM 223
Dimensions are in inches
(mm)

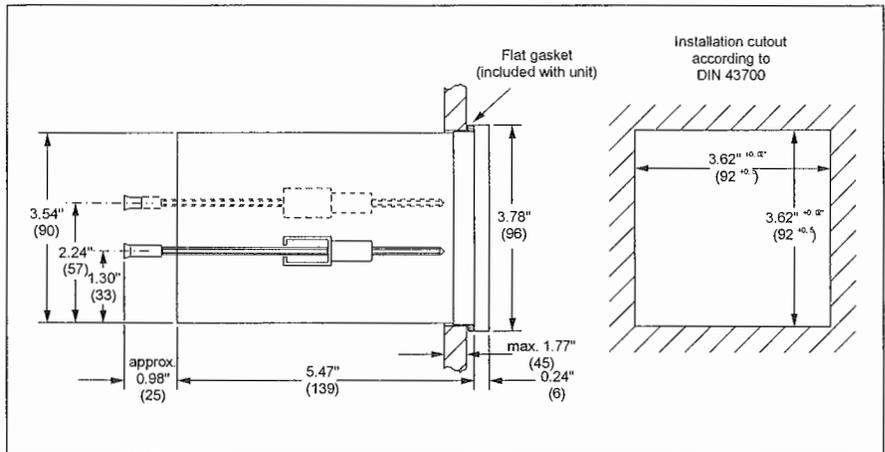


Liquisys M CCM 253
Dimensions are in inches
(mm)

Liquisys M CCM 223 Mounting

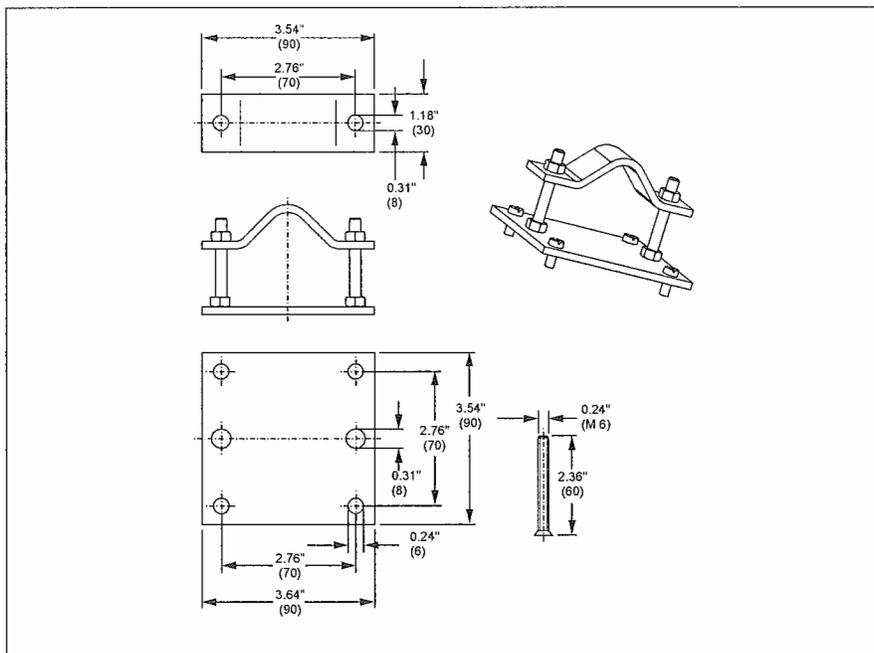
The panel mounted version is mounted using the supplied tensioning screws. The required overall mounting depth is approximately 6.5 inches (165 mm).

Installation of the panel mounted housing

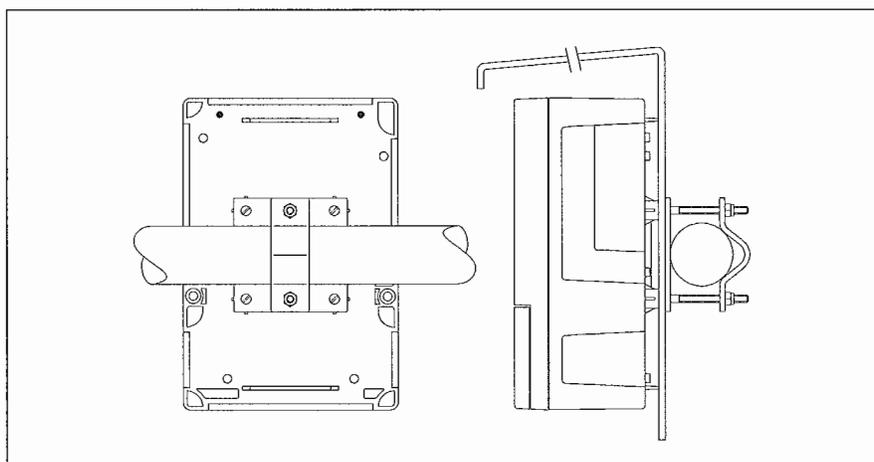


Liquisys M CCM 253 Mounting

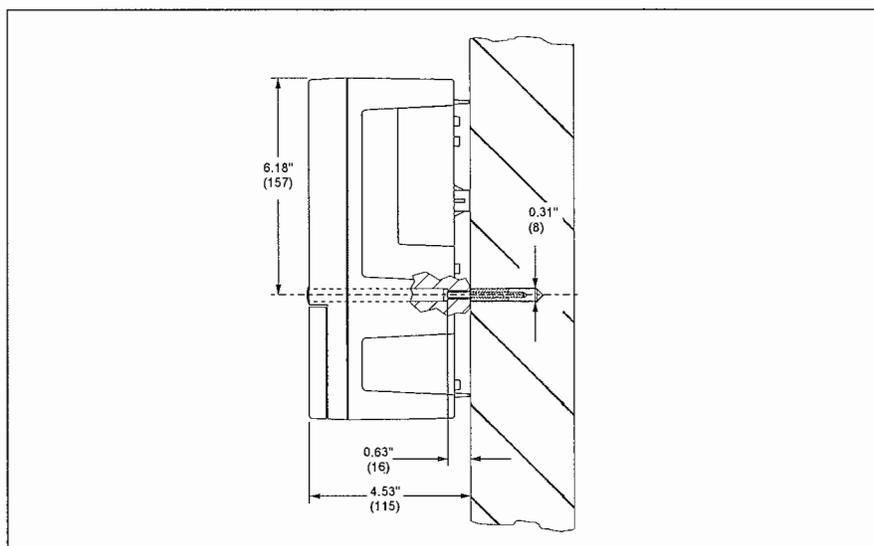
Post mounting kit for installing field housing on round pipes (horizontal or vertical, max. dia., 2.36"), refer to Accessories.



Mounting on round pipes (right with
CYY 101 protective cover)



Wall mounting:
Screws, 0.24" (6mm) dia.
Anchors, 0.31" (8 mm) dia.



Technical data

General specifications

Manufacturer	Endress+Hauser
Product designation	Liquisys M CCM 223 / CCM 253
Measured variables	Free chlorine or chlorine dioxide, temperature, pH or ORP (optional)

Input

Cl₂ / ClO₂ measurement

Display and measuring range	0 to 5 mg/l or 0 to 20 mg/l (1 mg/l = 1 ppm)
Application measuring range	0.05 to 20 mg/l for CCS 140 / 240 sensors 0.01 to 5 mg/l for CCS 141 / 241 sensors 0.05 to 5 mg/l for 963 sensor (1 mg/l = 1 ppm)
Temperature compensation range	35° to 110°F (2° to 45°C)
pH compensation range	Free chlorine, 4 to 9 pH
Reference point for nominal slope	76°F (25°C) / pH 7.2

Cl₂ / ClO₂ signal input

Sensors CCS 140 / 141 / 240 / 241	0 to 5000 nA
Sensor 963	-100 to 500 µA

Temperature measurement

Temperature sensor	CCS 140/141, 240/241: NTC, 10 kΩ at 76°F (25°C)
Display range	32°F to 122°F (0° to 50°C)

pH and ORP measurement

pH measuring range	3.5 to 9.5 pH
ORP measuring range	0 to 1500 mV
Zero point adjustment	± 100 mV
Slope adjustment	38 to 65 mV/pH

Digital inputs 1 and 2

Voltage	10 to 50 V
Current drain	10 mA maximum

Current input

Current range	4 to 20 mA, galvanically isolated
---------------	-----------------------------------

Output

Signal outputs Cl₂ / ClO₂ or temperature / pH / ORP (optional)

Current range	0/4 to 20 mA, galvanically isolated, error current 2.4 / 22 mA
Load	500 Ω maximum
Maximum resolution	700 digits/mA
Transfer range Cl ₂ / ClO ₂	0 to 20 mg/l for CCS 140 / 240 sensors 0 to 5 mg/l for CCS 141 / 241 / 963 sensors
Temperature transfer range	32°F to 122°F (0° to 50°C)
pH transfer range	4 to 9 pH
ORP transfer range	0 to 1500 mV
Isolation voltage	Maximum 350 V _{rms} / 500 VDC
Overvoltage protection	According to EN 61000-4-5: 1995

Auxillary voltage output

Output voltage	15 V ± 0.6 V
Output current	Maximum 10 mA

Technical data (con't.)

Output (con't.)

Contact outputs (floating changeover contacts)

Switching current	With resistive load ($\cos \varphi = 1$), maximum 2 A
Switching current	With inductive load ($\cos \varphi = 0.4$), maximum 2 A
Switching voltage	Maximum 250 VAC, 30 VDC
Switching power	With resistive load ($\cos \varphi = 1$), maximum 1250 VA AC 150 W DC
Switching power	With inductive load ($\cos \varphi = 0.4$), maximum 500 VA AC 90 W DC

Limit contactor

Pickup / dropout relay	0 to 7200 seconds
------------------------	-------------------

Controller

Function (adjustable)	Pulse length / pulse frequency controller, three-point step controller for $\text{Cl}_2 / \text{ClO}_2$
Controller response	P, PI, PD, PID
Controller gain K_p	0.01 to 20.00
Integral action time T_n	0.0 to 9999 minutes
Derivative action time T_v	00 to 999.9 minutes
Pulse length controller period	0.5 to 999.9 seconds
Pulse frequency controller frequency	60 to 180 min^{-1}
Motor run time	Three-point step controller, 10 to 999 seconds
Neutral zone	Three-point step controller, 0 to 40%

Alarm

Function (selectable)	Steady / fleeting contact
Alarm threshold adjustment range	$\text{Cl}_2 / \text{ClO}_2 / \text{pH} / \text{ORP} / \text{temp.}$; total measuring range
Alarm delay	0 to 2000 min (s)
Monitoring time limit violation	Lower and upper limit, 0 to 2000 min

Accuracy

$\text{Cl}_2 / \text{ClO}_2$ measurement with membrane-covered sensors

Measured value resolution	CCS 140 / 240 / 963, 0.01 mg/l CCS 141 / 241, 0.001 mg/l
Measurement deviation *	Display (pH, T = constant), max. 0.5% of measured value ± 4 digits
Measurement deviation *	$\text{Cl}_2 / \text{ClO}_2$ signal output, max. 0.75% of current output range
Repeatability	Max. 0.2% of measuring range

Deviation for $\text{Cl}_2 / \text{ClO}_2$ measurement with open sensor 963

Measurement deviation *	Display (pH, T = constant), max. 1% of measuring range ± 4 digits
-------------------------	---

Temperature measurement

Measured value resolution	0.1°C
Measurement deviation *	Display, $\pm 0.3\text{K}$
Measurement deviation *	Temperature signal output, max. 1.25% of current range output

pH and ORP measurement

pH measured value resolution	pH 0.01
ORP measured value resolution	1 mV
Measurement deviation *	pH display, 0.03 pH
Measurement deviation *	ORP display, 3 mV
Measurement deviation *	pH signal output, max. 1.25% of current output range
Measurement deviation *	ORP signal output, max. 1.25% of current output range

* According to IEC 60746-1, at nominal operating conditions.

Technical data (con't.)

Ambient conditions

Ambient temperature	Nominal operating conditions, 14° to 130°F (-10° to 55°C)
Ambient temperature	Limit operating conditions, -4° to 140°F (-20° to 60°C)
Storage and transport temperature	-13° to 150°F (-25° to 65°C)
Relative humidity	10 to 95%, non-condensing, nominal operating conditions
Protection class	Panel mount, front, NEMA 3S Field housing, NEMA 4X
Electromagnetic compatibility	Interference emission and immunity according to EN 61326-1: 1997

Physical data

Dimensions	Refer to page 8
Weight	Panel mount, maximum 2 lb (0.7 kg); field housing, maximum 5 lb (2.3 kg)
Display	LCD display, two lines, five and nine digit with status indicators

Materials

Housing	Panel mount, polycarbonate; field housing, ABS PC Fr
Front membrane	Polyester, UV-resistant

Power supply

Supply voltage	100 / 115 / 230 VAC +10% / -15%, 48 to 62 Hz; 24 VAC / VDC, +20% / -15%
Power consumption	Maximum 7.5 VA
Fuse protection	Fine-wire fuse, medium blow, 250 V / 3.15 A

Accessories

Mounting accessories

Type	Features	Order code
Weather protection cover CYY 101	For mounting on field housing, for outdoor operations Dimensions (H x W x D) 12.6" x 11.8" x 10.6" (320 x 300 x 270 mm). 304 SS	101-A
Universal upright post CYY 102	Square pipe for mounting field housing Dimensions (H x W x D) 58.9" x 2.36" x 2.36" (1495 x 60 x 60 mm), 304 SS	CYY 102-A
Post mounting kit	Kit for mounting field housing to horizontal or vertical pipes (2.36" max. dia.), 304 SS	50086842

Flow Holder

Type	Features	Applications
CCA 250	Flow holder for bypass installation, suitable for mounting a sensor CCS 140 / 141 for free chlorine or CCS 240 / 241 for chlorine dioxide and a pH and ORP electrode; with flow setting and optical monitoring, optionally monitoring by proximity switch.	drinking water swimming pool water process water

Sensors

Type	Features	Applications
CCS 140	Membrane-covered amperometric sensor for free chlorine in measuring range of 0.05 to 20 mg/l	drinking water
CCS 141	Membrane-covered amperometric trace sensor for free chlorine in measuring range of 0.01 to 5 mg/l	swimming pool water
CCS 240	Membrane-covered amperometric sensor for chlorine dioxide in measuring range of 0.05 to 20 mg/l	processing water
CCS 241	Membrane-covered amperometric trace sensor for chlorine dioxide in measuring range of 0.01 to 5 mg/l	

Cable extension

Type	Features	Order code
VBM	Junction box for extending measuring cable connection between sensor cable and measuring transmitter, NEMA 4X protection, 10 terminals, two 1/2" FNPT conduit entries	51500177
CMK	Special measuring cable for sensors CCS 140 / 141 and CCS 240 / 241 for cable extension between measuring transmitter and VBM junction box (order length in meters)	50005374
CYK 71	Extension cable for pH electrodes (order length in feet)	

Accessories (con't.)

DPD calibration kit

CMM 181-1 Photometer CCM 181
Microprocessor-controlled photometer for chlorine or chlorine dioxide determination according to DPD method. For calibration and checking of measuring systems with measuring cells CCS 140 / 141 or CCS 240 / 241. Battery-powered. Including tablet supply.

Replacement tablets

		Order No.
DPD tablet No. 1, for free chlorine or chlorine dioxide	100 pcs.	50035461
DPD tablet No. 3, for total chlorine	100 pcs.	50035462
DPD glycine tablets, bottle of tablets	250 pcs.	50069378

Ordering information

Chlorine / chlorine dioxide measuring transmitter Liquisys M CCM 223 / 253

CCM 223 -

1	2	3	4
---	---	---	---

- 1 Version
 - EK Measurement of free chlorine / chlorine dioxide
 - ES Measurement of free chlorine / chlorine dioxide with plus functions
 - EP Measurement of chlorine / chlorine dioxide with extended functions
- 2 Power supply
 - 0 230 VAC
 - 1 115 VAC
 - 2 230 VAC, CSA general purpose
 - 3 115 VAC, CSA general purpose
 - 5 100 VAC
 - 7 24 VAC/VDC, CSA general purpose
 - 8 24 VAC/VDC
- 3 Measurement output
 - 0 Chlorine or chlorine dioxide
 - 1 Chlorine or chlorine dioxide and temperature, alternatively pH or ORP (EP version)
 - 3 PROFIBUS-PA
 - 4 PROFIBUS-DP
 - 5 Chlorine or chlorine dioxide with HART®
 - 6 Chlorine or chlorine dioxide with HART® and temperature, alternatively pH or ORP (EP version)
- 4 Contacts
 - 05 No additional contacts
 - 10 2 contacts (limits / PID / timer)
 - 15 4 contacts (limits / PID / timer / chemoclean / three-step controller for Cl₂ / ClO₂)
 - 16 4 contacts (limits / PID / timer / three-step controller for Cl₂ / ClO₂)
 - 20 2 relays and current input (limit / PID / timer)
 - 25 4 relays with cleaning, current input (limit / PID / ChemoClean / three-step controller for Cl₂ / ClO₂)
 - 26 4 relays with timer, current input (limit / PID / timer / three-step controller for Cl₂ / ClO₂)

CCM 253 -

E	K	1	1	0	5
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- 1 Version
 - EK Measurement of free chlorine / chlorine dioxide
 - ES Measurement of free chlorine / chlorine dioxide with plus functions
 - EP Measurement of chlorine / chlorine dioxide with extended functions
- 2 Power supply
 - 0 230 VAC
 - 1 115 VAC
 - 2 230 VAC, CSA general purpose
 - 3 115 VAC, CSA general purpose
 - 5 100 VAC
 - 7 24 VAC/VDC, CSA general purpose
 - 8 24 VAC/VDC
- 3 Measurement output
 - 0 Chlorine or chlorine dioxide
 - 1 Chlorine or chlorine dioxide and temperature, alternatively pH or ORP (EP version)
 - 3 PROFIBUS-PA
 - 4 PROFIBUS-DP
 - 5 Chlorine or chlorine dioxide with HART®
 - 6 Chlorine or chlorine dioxide with HART® and temperature, alternatively pH or ORP (EP version)
- 4 Contacts
 - 05 No additional contacts
 - 10 2 contacts (limits / PID / timer)
 - 15 4 contacts (limits / PID / timer / chemoclean / three-step controller for Cl₂ / ClO₂)
 - 16 4 contacts (limits / PID / timer / three-step controller for Cl₂ / ClO₂)
 - 20 2 relays and current input (limit / PID / timer)
 - 25 4 relays with cleaning, current input (limit / PID / ChemoClean / three-step controller for Cl₂ / ClO₂)
 - 26 4 relays with timer, current input (limit / PID / timer / three-step controller for Cl₂ / ClO₂)

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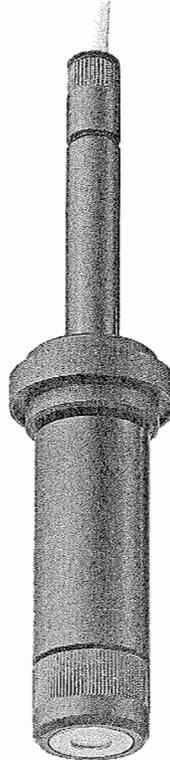
United States	Canada	Mexico
Endress+Hauser, Inc. 2350 Endress Place Greenwood, IN 46143 Phone: (317) 535-7138 888-ENDRESS FAX: (317) 535-8498 ..	Endress+Hauser Canada Ltd. 1440 Graham's Lane Unit 1, Burlington ON, L7S 1W3 Phone: (905) 681-9292 800-668-3199 FAX: (905) 681-9444	Endress+Hauser Paseo del Pedregal No. 610 Col. Jardines del Pedregal 01900, Mexico D.F. Mexico Phone: (525) 568-2405 FAX: (525) 568-7459 ..

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The Power of Know How



Sensors for free chlorine *CCS 140 and CCS 141*

Membrane-covered, amperometric sensors
for installation in the CCA 250 flow holder



Areas of application

Drinking, industrial, and swimming pool water must be disinfected with suitable oxidizing agents such as chlorine or chlorine compounds.

The dosing of the appropriate oxidizing agents must be carefully controlled to suit the application.

Too low a concentration makes the degree of disinfection questionable; too high a concentration can result in corrosion effects, impairment of taste, or skin irritation.

The CCS 140 chlorine sensor is suitable for applications with a measuring range of 0.05 to 20 mg Cl₂/l (1 mg/l = 1 ppm). The CCS 141 chlorine sensor is especially suitable for disinfection of drinking water conditioning or for the detection of chlorine traces in the range of 0.01 to 5 mg Cl₂/l (1 mg/l = 1 ppm).

Benefits at a glance

- Minimum flow rate for installation in the CCA 250 flow holder: 8 gal/hr (30 l/h)
- Measurement almost independent of flow rate in the range above 8 gal/hr (30 l/h)
- No zero point calibration necessary; so the complicated installation of an active carbon filter, as in open chlorine sensors, is unnecessary
- Measured values are not affected by conductivity fluctuation
- The CCS 140 sensor is ready for measurement after a polarization time of approximately 30 to 60 minutes; the CCS 141 sensor requires 45 to 90 minutes
- Ready-made membrane head allows simple membrane change
- Re-calibration intervals are approximately 1 to 4 months under constant operating conditions
- Outlet up to 14 psig (1 bar) back pressure

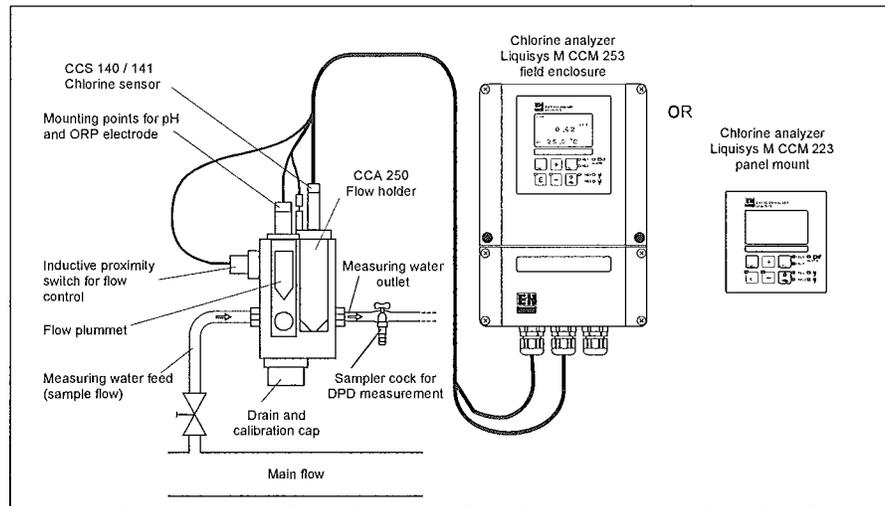
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Measuring system

The membrane-covered amperometric sensors CCS 140 or CCS 141 are designed for mounting in the CCA 250 flow holder. Sensors are connected to the CCM 223 / 253 Chlorine Analyzer.

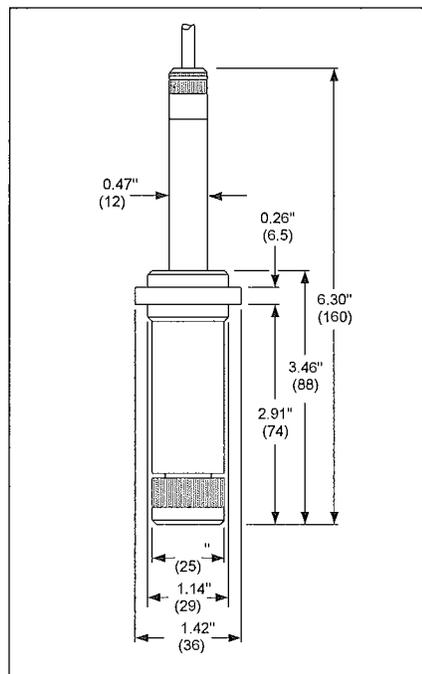


Operating principle

The membrane-covered sensor consists of a cathode serving as the working electrode, and an anode acting as the counter electrode. These electrodes are immersed in an electrolyte. Electrodes and electrolyte are separated from the medium to be measured by a membrane. This membrane prevents the loss of electrolyte and penetration of contaminants which can cause "poisoning." A fixed polarization voltage is applied between the anode and the cathode.

When the sensor is immersed in chlorinated water, chlorine diffuses through the membrane. The chlorine molecules impinging on the cathode (electron surplus) are reduced to chloride ions. At the anode, silver is oxidized to silver chloride. The resulting maximum diffusion current is a direct measure of the concentration of free chlorine (chlorine surplus).

Dimensions



CCS 140 / 141
dimensions are
in inches (mm)

Technical data

Measuring system	Passively operated sensor with gold cathode and silver/silver chloride anode
Shaft material	PVC
Membrane material	PTFE
Membrane cap	Replaceable
Cable connection	15 foot (3 m) 4-wire, double-shielded cable, low noise
Depolarization current	CCS 140, approximately 25 nA per mg Cl ₂ /l (25°C/pH 7.2) CCS 141, approximately 80 nA per mg Cl ₂ /l (25°C/pH 7.2)
Polarization time	CCS 140, first polarization 30 minutes; re-polarization, 10 minutes CCS 141, first polarization 90 minutes; re-polarization, 45 minutes
Measuring range	CCS 140, 0.05 to 20 mg Cl ₂ /l (25°C, pH 7.2) CCS 141, 0.01 to 5 mg Cl ₂ /l (25°C, pH 7.2) Note: mg/l = 1 ppm
Response time	Measurement jump upwards, 90% < 2 min., 99% < 5 min. Measurement jump downwards, 90% < 0.5 min., 99% < 3 min.
Minimum flow rate	For CCA 250 flow holder, 7 gal/h (30 l/h)
Minimum flow velocity	For CCA 250 flow holder, 6 in/s (15 cm/s)
Permissible temperature range	CCS 140, 50° to 113°F (10° to 45°C) CCS 141, 35° to 113°F (2° to 45°C)
pH value range	CCS 140, 4 to 8 pH CCS 141, 4 to 8.2 pH
Maximum back pressure	14 psig (1 bar)
Filling electrolyte lifetime	Typically 12 months average
Temperature sensor	NTC, 10 kΩ at 77°F (25°C)

Subject to modifications.

Ordering information

CCS 140 Chlorine sensor

CCS 140 - ¹
N

- 1 Version
 A Without temperature sensor
 N With NTC temperature sensor

CCS 141 Chlorine sensor

CCS 141 - ¹
□

- 1 Version
 N With NTC temperature sensor

Accessories

- **CCY 14-WP**
2 replacement cartridges ready-made for CCS 140 / 141 / 240 / 241 sensors
Order no. 50005255
- **CCY 14-F**
50 ml electrolyte ready-made for CCS 140 / 141 sensors
Order no. 50005256

Supplementary documentation

Technical information

- | | | |
|--------------------------|--|---------------|
| <input type="checkbox"/> | CCA 250 Flow holder for free chlorine and chlorine dioxide sensors: | TI 062C/24/ae |
| <input type="checkbox"/> | CCM 181 microprocessor photometer for chlorine and chlorine dioxide detection: | TI 121C/24/ae |
| <input type="checkbox"/> | CCM 223 / 253 Liquisys M chlorine analyzer: | TI 214C/24/ae |

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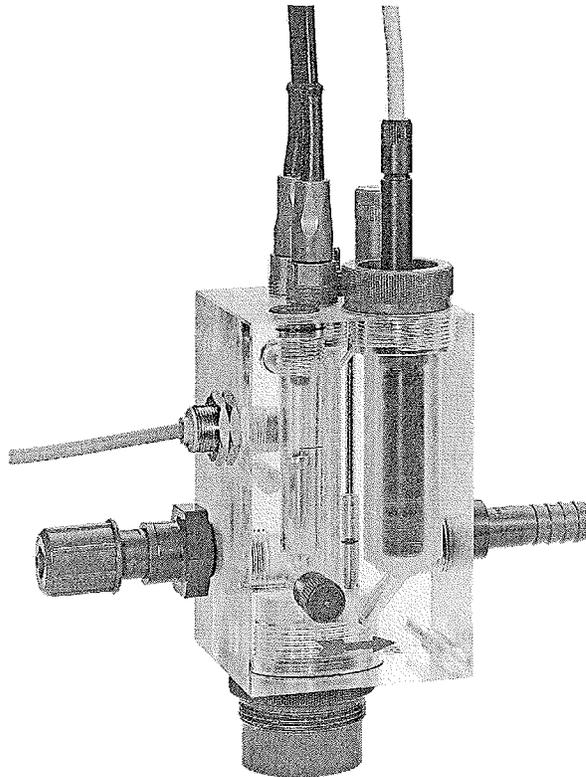
United States	Canada	Mexico
Endress+Hauser, Inc. 2350 Endress Place Greenwood, IN 46143 Phone: (317) 535-7138 888-ENDRESS FAX: (317) 535-8498	Endress+Hauser Canada Ltd. 1440 Graham's Lane Unit 1, Burlington ON, L7S 1W3 Phone: (905) 681-9292 800-668-3199 FAX: (905) 681-9444	Endress+Hauser Paseo del Pedregal No. 610 Col. Jardines del Pedregal 01900, Mexico D.F. Mexico Phone: (525) 568-2405 FAX: (525) 568-7459

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Flow assembly *FlowFit W CCA 250*

Flow assembly for free chlorine and chlorine dioxide



The CCA 250 flow assembly has been specially designed to hold the chlorine sensors CCS 140 or CCS 141 or the chlorine dioxide sensors CCS 240 and CCS 241. Additionally, there are 2 mounting positions for one ORP and pH combination electrode, such as the CPS 11 and CPS 12.

Advantages at a glance

- The plexiglass body contains a needle valve to adjust the flow of the measured water, and a flow meter for optical control of the minimum flow
- When used with the CCM 223 / 253 chlorine analyzer, a flow alarm can be activated, with an inductive proximity switch
- A "flow alarm" is also possible by using a separate proximity switch, type INS-R
- A ground matching pin is built into the holder for pH and ORP measurement
- Calibration of pH and ORP electrodes is possible without electrode removal. The cap screwed onto the holder from below can be used as a calibration cup.

Areas of application

- Swimming pool water
- Industrial water
- Drinking water
- Other process applications

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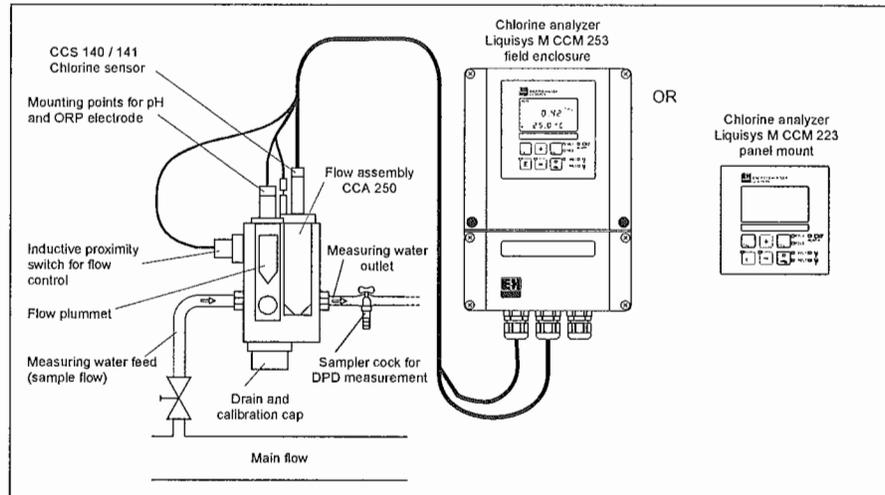


Measuring System

The complete measuring system consists of the CCA 250 holder and:

- CCS 140 / CCS 141 free chlorine sensors or CCS 240 / CCS 241 chlorine dioxide sensors
- CCM 223 / 253 Liquisys M chlorine analyzer

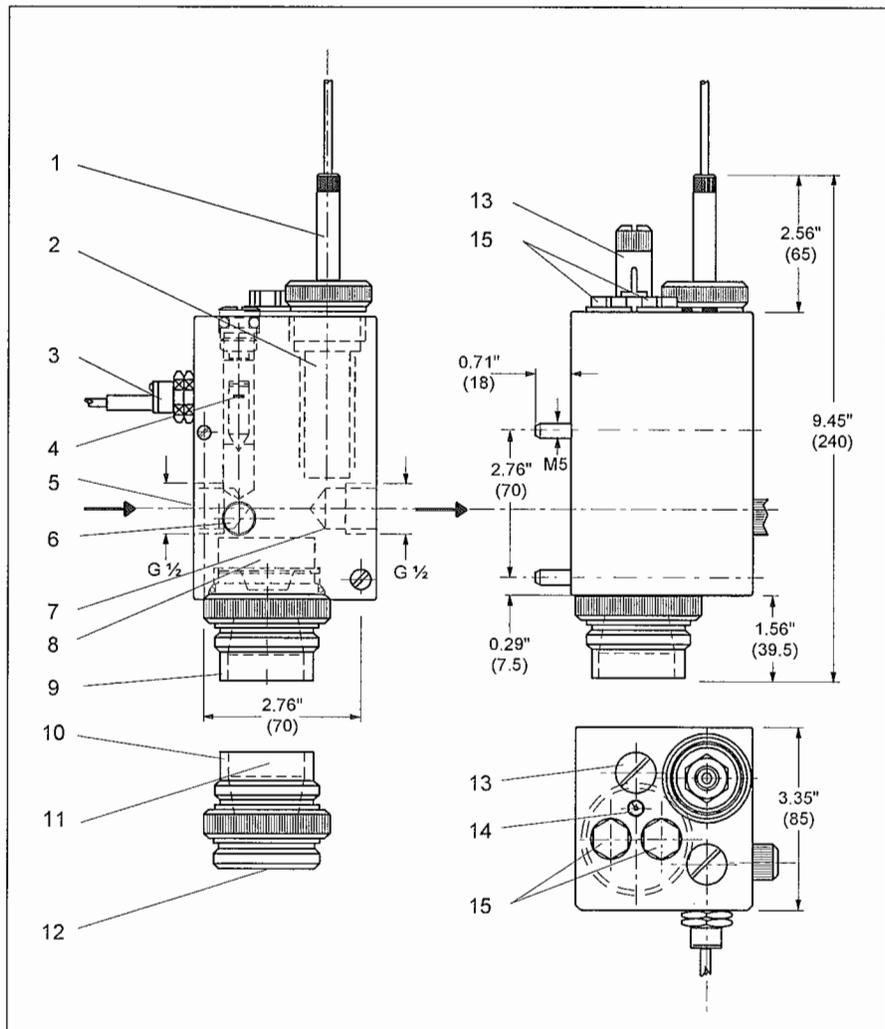
- CCE 1 / CCE 3 compact chlorine system
- pH and ORP electrodes
- RC-link for PM connection



Dimensions

Dimensions of CCA 250 holder in inches (mm)

- 1 Chlorine sensor CCS 140 / 141 or chlorine dioxide sensor CCS 240 / 241
- 2 Measuring chamber for chlorine measuring cell
- 3 Inductive proximity switch for automatic flow control (optional)
- 4 Stainless steel flow meter for optical control of minimum flow 7 gal/hr
- 5 Inlet
- 6 Needle valve for flow rate regulation < 30 gal/hr
- 7 Outlet
- 8 Measuring chamber for pH / ORP electrode
- 9 Closing cap with calibration cup
- 10 Cup (measuring chamber) for cleaning and calibration of pH or ORP electrode
- 11 Cup side
- 12 Closing side
- 13 Venting screw
- 14 Connection potential matching PM
- 15 Mounting position for one pH and one ORP electrode



Technical data

General data

Manufacturer	Endress+Hauser GmbH+Co.
Designation	CCA 250 flow holder

Dimensions

Instrument with electrodes	3.35" x 3.35" x 9.84" (85 x 85 x 250 mm), refer to page 2
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Materials

Measuring cell body	Plexiglass (PMMA), PVC, 316 Ti SS, EPDM
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Process connection

pH / ORP electrode thread	2 x Pg 13.5
Water inlet / outlet	G 1/2 internal thread
Pipe connection	NV 1/2 for change-over from G 1/2 internal thread to bonded adapter coupling for bonding of PVC pipe (OD = 16 mm)
Hose connection	SV 1/2 for change-over from G 1/2 internal thread to hose adapter D 6/12 in inlet and hose adapter d 16 in outlet

Mounting positions

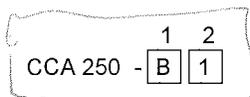
Mounting position	One position for chlorine CCS 140 / 141 or chlorine dioxide CCS 240 / 241 sensor
Mounting positions	Two Pg 13.5 thread positions for 1 pH combination electrode (CPS 11) and 1 ORP combination electrode (CPS 12)
Optional	1 inductive proximity switch

Operating data

Permissible water pressure	Maximum 58 psig (4 bar) without sensors, 14 psig (1 bar) with sensors at 104°F (40°C)
Measured water flow	With adjustable needle valve, 7 to 30 gal/hr (30 to 120 l/h)
Operating temperature	Maximum 113°F (45°C)

Ordering information

CCA 250 flow holder



- 1 Adapter
 - A Without adapter
 - B 2 adapters NV 1/2" for pipe OD 16
 - C 2 adapters for D 6/12
 - D Adapter D 6/12 and D 16
- 2 Version
 - 0 Standard
 - 1 With inductive proximity switch

Supplementary documentation

Technical information:

- CCS 140 / 141 sensors for free chlorine TI 058C/24/ae
- CCS 240 / 241 sensors for chlorine dioxide TI 114C/24/ae
- CCE 1 / CCE 3 compact chlorine system TI 014C/24/ae
- CCM 223 / 253 Liquisys M chlorine analyzer TI 214C/24/ae
- CCM 181 microprocessor photometer for chlorine and chlorine dioxide detection TI 121C/24/ae

Accessories

- INS**
Inductive proximity switch for CCA 250 flow holder for flow monitoring Order No. 50005179
- SV 1/2**
2 adapters D6/12 and D16 for CCA 250 for hose connection Order No. 50003232
- SV 1/2**
2 adapters OD 16 for CCA 250 for hose connection Order No. 50003230
- NV 1/2**
2 adapters OD 16 for CCA 250 for hose connection Order No. 50003228
- Pressure reducer**
With connection G 1/2 and dirt trap, pre-pressure maximum 360 psi (25 bar), back-pressure 20 psi to 174 psi (1.5 to 12 bar) Order No. 50046134
- VBC**
Junction box for CMK sensor cable for cable extension, IP 65 ingress protection Order No. 50005181
- CMK**
Special measuring cable for chlorine sensors CCS 140 / 141 or chlorine dioxide sensors CCS 240 / 241 for cable extension to transmitter (order lengths in feet) Order No. 50005374
- DFS-PAL**
Flow holder for pH / mV electrodes Order No. 50043049
- Adapters**
2 adapters G 1/2 to 1/2" pipe socket to use with option CCA 250-A Order No. 63002219

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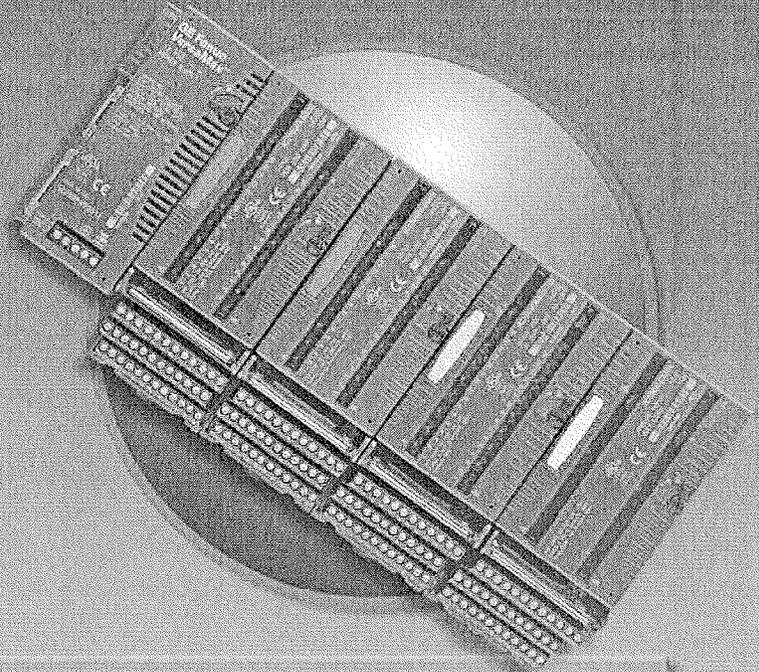


GE Fanuc Automation

VersaMax® I/O and Control

OVERVIEW

Maximum versatility is the guiding principle behind VersaMax® from GE Fanuc. This compact, extremely affordable control solution can be used as a PLC, as I/O, and as distributed control for up to 4096 I/O points. With its modular and scaleable architecture, intuitive features and unparalleled ease of use, VersaMax can save machine builders and end users considerable time and money.



PRODUCT FEATURES

Offering Big PLC Power in a Small Package. VersaMax CPUs supply a number of features usually found only in PLCs with larger footprints, including up to 64k of memory for application programs, floating point math, real-time clock, subroutines, PID control, flash memory, and bumpless program store. The serial ports support serial read/write and Modbus master/slave communications.

An Abundance of Useful I/O Options. GE Fanuc offers a broad range of discrete, analog, mixed, and specialty I/O modules. These modules can be freely combined to create stand-alone I/O stations with up to 256 I/O points and expanded I/O systems with up to 4,096 I/O points.

The Perfect Match for Today's Open Systems. VersaMax gives you the freedom to connect to a wide variety of host controllers, including PLC, DCS and PC-based control systems by way of Genius®, DeviceNet™, Profibus-DP™ and Ethernet bus. VersaMax also fully supports the power and open architecture of GE Fanuc's PC Control solutions.

The Ultimate in Cost-effective Control and I/O. With intuitive diagnostics, hot insertion of modules and quick connect wiring, VersaMax extends uptime, reduces engineering and training needs, and dramatically reduces project life-cycle costs.

A Design that Maximizes Ease of Use. Every aspect of VersaMax has been carefully refined to accommodate the user. Snap-together carriers mean that no tools are required for module installation or extraction. A convenient rotary switch can be used for setting bus addresses, reducing programming time. With VersaMax, you can even address I/O automatically.

ORDERING INFORMATION

Description	Catalog Number		Catalog Number	
Discrete Input Modules ⁽¹⁾	IC200MDL140	Input 120 VAC (1 Group of 8) 8 Points	IC200MDL631	Input 125 VDC Pos/Neg Logic Isolated 8 Points
	IC200MDL141	Input 240 VAC (1 Group of 8) 8 Points	IC200MDL632	Input 125 VDC Pos/Neg Logic Isolated 16 Points
	IC200MDL143	Input 120 VAC Isolated 8 Points	IC200MDL635	Input 48 VDC Pos/Neg Logic (2 Groups of 8) 16 Points
	IC200MDL144	Input 240 VAC Isolated 4 Points	IC200MDL636	Input 48 VDC Pos/Neg Logic (4 Groups of 8) 32 Points
	IC200MDL240	Input 120 VAC (2 Groups of 8) 16 Points	IC200MDL640	Input 24 VDC Pos/Neg Logic (2 Groups of 8) 16 Points
	IC200MDL241	Input 240 VAC (2 Groups of 8) 16 Points	IC200MDL643	Input 5/12 VDC Pos/Neg Logic (2 Groups of 8) 16 Points
	IC200MDL243	Input 120 VAC Isolated 16 Points	IC200MDL644	Input 5/12 VDC Pos/Neg Logic (4 Groups of 8) 32 Points
	IC200MDL244	Input 240 VAC Isolated 8 Points	IC200MDL650	Input 24 VDC Pos/Neg Logic (4 Groups of 8) 32 Points
	Discrete Output Modules ⁽¹⁾	IC200MDL329	Output 120 VAC 0.5 Amp per Point Isolated 8 Points	IC200MDL741
IC200MDL330		Output 120 VAC 0.5 Amp per Point Isolated 16 Points	IC200MDL742	Output 24 VDC Pos Logic 0.5 Amp per Point with ESCP 32 Points
IC200MDL331		Output 120 VAC 2.0 Amp per Point Isolated 8 Points	IC200MDL743	Output 5/12/24 VDC Neg Logic 0.5 Amp per Point 16 Points
IC200MDL730		Output 24 VDC Pos Logic 2.0 Amp per Point with ESCP 8 Points	IC200MDL744	Output 5/12/24 VDC Neg Logic 0.5 Amp per Point 32 Points
IC200MDL740		Output 12/24 VDC Pos Logic 0.5 Amp per Point 16 Points	IC200MDL750	Output 12/24 VDC Pos Logic 0.5 Amp per Point 32 Points
Relay Output Modules ⁽¹⁾	IC200MDL930	Output Relay 2.0 Amp per Point Isolated Form A 8 Points	IC200MDL940	Output Relay 2.0 Amp per Point Isolated Form A 16 Points
Mixed Discrete Modules ⁽¹⁾	IC200MDD840	Mixed 24 VDC Pos Logic Input Grouped 20 Points / Output Relay 2.0 Amp per Point Grouped 12 Points	IC200MDD846	Mixed Output Relay 2.0 Amp per Point Isolated 8 Points / Input 120 VAC Grouped 8 Points
	IC200MDD841	Mixed 24 VDC Pos Logic Input Grouped 20 Points / Output Grouped 12 Points/HSC/PWM/PT	IC200MDD847	Mixed Output Relay 2.0 Amp per Point Isolated 8 Points / Input 240 VAC Grouped 8 Points
	IC200MDD842	Mixed 24 VDC Pos Logic Output 0.5 Amp Grouped with ESCP 16 Points / Input Grouped 16 Points	IC200MDD848	Mixed Output 120 VAC 0.5 Amp per Point Isolated 8 Points / Input 120 VAC Grouped 8 Points
	IC200MDD843	Mixed 24 VDC Pos Logic Input Grouped 10 Points / Output Relay 2.0 Amp per Point Grouped 6 Points	IC200MDD849	Mixed Output Relay 2.0 Amp per Point Isolated 8 Points / Input 120 VAC Isolated 8 Points
	IC200MDD844	Mixed 24 VDC Pos Logic Output 0.5 Amp Grouped 16 Points / Input Grouped 16 Points	IC200MDD850	Mixed Output Relay 2.0 Amp per Point Isolated 8 Points / Input 240 VAC Isolated 4 Points
	IC200MDD845	Mixed Output Relay 2.0 Amp per Point Isolated 8 Points / Input 24 VDC Pos Logic Grouped 16 Points	IC200MDD851	Mixed 12/24VDC Pos Logic Output 0.5 Amp per Point Grouped 16 Points/ Input 5/12VDC Pos/Neg Logic Grouped 16 PT
Analog Input Modules ⁽¹⁾	IC200ALG230	Analog Input 12 Bit Voltage/Current 4 Channels	IC200ALG263 ⁽⁴⁾	Analog Input 15 Bit Voltage 15 Channels
	IC200ALG240	Analog Input 16 Bit Voltage/Current Isolated 8 Channels	IC200ALG264 ⁽⁴⁾	Analog Input 15 Bit Current 15 Channels
	IC200ALG260	Analog Input 12 Bit Voltage/Current 8 Channels	IC200ALG620	Analog Input 16 Bit RTD 4 Channels
	IC200ALG261 ⁽⁴⁾	Analog Input 15 Bit Differential Voltage 8 Channels	IC200ALG630	Analog Input 16 Bit Thermocouple 7 Channels
	IC200ALG262 ⁽⁴⁾	Analog Input 15 Bit Differential Current 8 Channels		
Analog Output Modules ⁽¹⁾	IC200ALG320	Analog Output 12 Bit Current 4 Channels	IC200ALG326 ⁽⁴⁾	Analog Output 13 Bit Current 8 Channels
	IC200ALG321	Analog Output 12 Bit Voltage 0-10 V 4 Channels	IC200ALG327 ⁽⁴⁾	Analog Output 13 Bit Voltage 12 Channels
	IC200ALG322	Analog Output 12 Bit Voltage ±10 V 4 Channels	IC200ALG328 ⁽⁴⁾	Analog Output 13 Bit Current 12 Channels
	IC200ALG325 ⁽⁴⁾	Analog Output 13 Bit Voltage 8 Channels	IC200ALG331	Analog Output 16 Bit Voltage/Current Isolated 4 Channels
Mixed Analog Modules ⁽¹⁾	IC200ALG430	Analog Mixed 12 Bit Current 4 Input / 2 Output Channels	IC200ALG432	Analog Mixed 12 Bit Voltage ±10 V 4 Input / 2 Output Channels
	IC200ALG431	Analog Mixed 12 Bit Voltage 0-10 V 4 Input / 2 Output Channels		
I/O Carriers	IC200CHS001	Barrier Horizontal Style	IC200CHS005	Spring Clamp Horizontal Style
	IC200CHS002	Box Horizontal Style	IC200CHS002	Box Vertical Style
	IC200CHS003 ⁽⁴⁾	Connector Vertical Style	IC200CHS025	Spring Clamp Vertical Style
Network Interface Units	IC200DBI001 ⁽²⁾	Remote I/O DeviceNet Network Interface Unit	IC200GBI001	Remote I/O Genius Network Interface Unit
	IC200EBI001 ⁽²⁾	Remote I/O Ethernet Network Interface Unit	IC200PBI001	Remote I/O Profibus-DP Network Interface Unit
	IC200BEM002	PLC Network Communication Profibus-DP Slave	IC200BEM104	PLC Network Communications AS-I Master
Network Communication Modules ⁽¹⁾	IC200BEM103	PLC Network Communication DeviceNet (Master/Slave)		
Controllers	IC200CPU001	CPU 34 Kbyte Configurable Memory, Two Serial Ports (RS-232 and RS-485)	IC200CPU005	CPU with 64 Kbyte Configurable User Memory, Two Serial Ports (RS-232 and RS-485)
	IC200CPU002	CPU 42 Kbyte Configurable Memory, Two Serial Ports (RS-232 and RS-485)	IC200CPUE05	CPU with 64 Kbyte Configurable User Memory, Two Serial Ports (RS-232 and RS-485), 10 MBIT Ethernet Port
Power Supplies	IC200PWR001	Power Supply 24 VDC Input	IC200PWR102	Power Supply 120/240 VAC Input with Expanded 3.3 VDC
	IC200PWR002	Power Supply 24 VDC Input with Expanded 3.3 VDC	IC200PWR201	Power Supply 12 VDC Input
	IC200PWR101	Power Supply 120/240 VAC Input	IC200PWR202	Power Supply 12 VDC Input with Expanded 3.3 VDC
Accessories	IC200ACC003	EZ Program Store Flash Device for CPUs	IC200ERM001 ⁽⁴⁾	I/O Expansion Receiver Isolated (Up to 750 meters)
	IC200CBL001	CPU Programming Cable (RS-232)	IC200ERM002 ⁽⁴⁾	I/O Expansion Receiver Non-Isolated (Up to 15 meters)
	IC200ETM001 ⁽⁴⁾	I/O Expansion Transmitter for CPU and Network Interface Units	BC846MPH101	Logic Developer PDA software tool with cable adapter.

(1) Requires an I/O carrier for wiring termination.

(2) The DeviceNet network interface unit only supports autoconfiguration of I/O. Remote I/O configuration tool will be supported in the future.

(3) These modules are for use in CPU systems.

(4) Refer to VersaMax Modules, Power Supplies, and Carriers Manual GFK-1504 for cables and Interposing Terminal Blocks.

(5) Includes support for EGD and Modbus Ethernet.

(6) Supported by CPUs, Genius, Profibus and Ethernet only.

ADDITIONAL RESOURCES

For detailed technical specifications and product ordering information, please visit the GE Fanuc e-catalog, on-line at:

www.gefanuc.com



GE Fanuc Automation

GE Fanuc Automation Information Centers

USA and the Americas 1-800-648-2001
or 434-978-5100

Europe and Middle East (352) 727979-1
Asia Pacific 65-566-4918

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Flow Calibration with Adjustment

30123466-1940254

41831792

Purchase order number

US-49348255-11 / Endress+Hauser Flowtec

Order N°/Manufacturer

53W1F-HLOB1RK2BAAQ

Order code

PROMAG 53 W 6"

Transmitter/Sensor

A5065316000

Serial N°

-

Tag N°

FCP-7.1.B

Calibration rig

1400.492 us.gal/min ($\pm 100\%$)

Calibrated full scale

Calibration Interface

Calibrated output

1.0225

Calibration factor

-2

Zero point

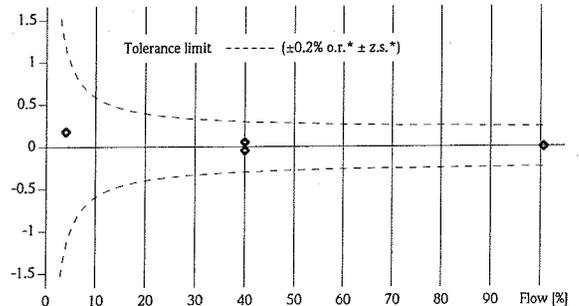
79.8 °F

Water temperature

Flow [%]	Flow [us.gal/min]	Duration [sec]	V target [us.gal]	V meas. [us.gal]	Δ o.r.* [%]
4.0	56.6	80.1	75.517	75.657	0.19
40.1	561.3	60.1	561.895	561.642	-0.05
40.1	561.5	60.1	562.015	562.310	0.05
100.7	1410.3	80.1	1881.93	1881.92	0.00
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

*o.r.: of rate

Measured error % o.r.



*z.s.: Zero stability

For detailed data concerning output specifications of the unit under test, see technical informations (TI), chapter Performance characteristics.
 The calibration is traceable to the N.I.S.T. through standards certified at preset intervals.

Endress+Hauser Flowtec operates ISO/IEC 17025 accredited calibration facilities in Reinach (CH), Cernay (FR), Greenwood (USA) and Aurangabad (IN).

06-11-2008

Date of calibration

Endress+Hauser Flowtec, Division USA
 2330 Endress Place
 Greenwood, IN 46143



William Darnell

Operator

Certified acc. to
 MIL-STD-45662A
 ISO 9001, Reg.-N° 030502.2

Flow Calibration with Adjustment

30123473-1940255

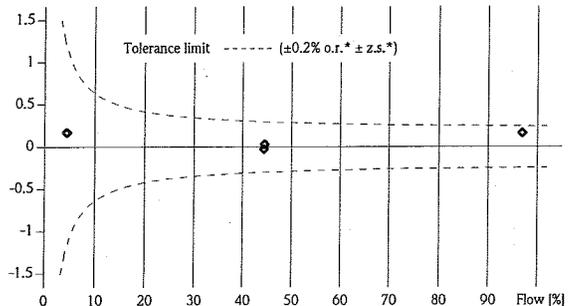
41831792
 Purchase order number
 US-49348255-21 / Endress+Hauser Flowtec
 Order N°/Manufacturer
 53W2F-HLOB1RK2BAAQ
 Order code
 PROMAG 53 W 10"
 Transmitter/Sensor
 A5065416000
 Serial N°
 -
 Tag N°

FCP-7.1.B
 Calibration rig
 3499.751 us.gal/min (\pm 100%)
 Calibrated full scale
 Calibration Interface
 Calibrated output
 1.3271
 Calibration factor
 0
 Zero point
 79.8 °F
 Water temperature

Flow [%]	Flow [us.gal/min]	Duration [sec]	V target [us.gal]	V meas. [us.gal]	Δ o.r.* [%]
4.5	156.8	93.4	244.006	244.433	0.17
44.5	1556.3	70.1	1818.03	1817.56	-0.03
44.6	1559.8	70.1	1822.11	1822.70	0.03
96.9	3392.3	93.4	5281.33	5290.05	0.17
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

*o.r.: of rate

Measured error % o.r.



*z.s.: Zero stability

For detailed data concerning output specifications of the unit under test, see technical informations (TI), chapter Performance characteristics.
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