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AF7000 SCM

07/2019, Edition 5

User Manual

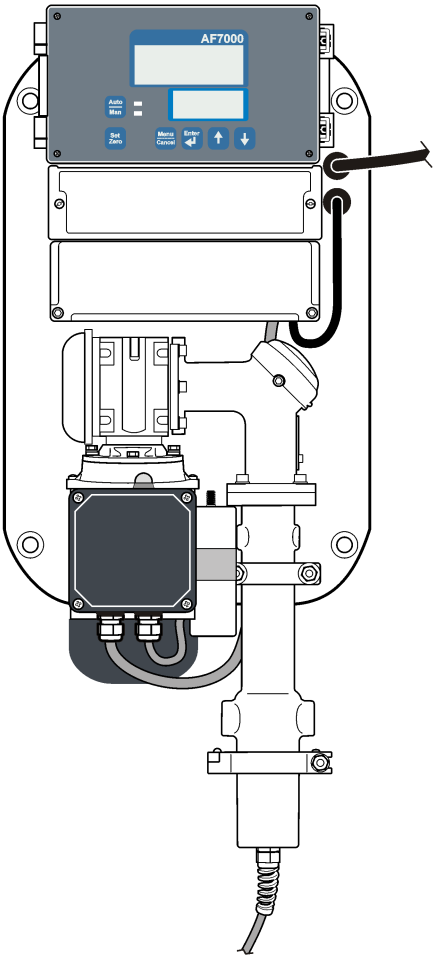


Table of Contents

Specifications

Specifications are subject to change without notice.

General specifications

Specification	Details
Dimensions (W x H x D)	320 x 750 x 250 mm (12.6 x 29.5 x 10 in.)
Sample contact components	Stainless Steel, UHMW, Epoxy
Weight	21.5 kg (47.4 lb) standard option
Pollution degree	2
Installation category	II
Protection class	I
Power requirement options	230 VAC, 50 Hz at 1.6 A ; 115 VAC, 50 Hz at 3.2 A
	120 VAC 60 Hz at 3.2 A
Operating temperature	0 to 50 °C (32 to 122 °F)
Maximum relative humidity	95% for temperatures up to 50 °C (122 °F)
Storage temperature	–20 to 70 °C (–4 to 158 °F) 95% relative humidity, non-condensing
Speed of response	1 second to 1 minute, adjustable average
Sample flow rate	> 1 L/min, 2–4 L/min recommended
Sample temperature	7 to 35 °C (45 to 95 °F)
Plumbing connection	½-in. BSP
Communications	RS485 electrically isolated; data rate: 1200 to 9600 baud
Outputs (optional)	4–20 mA card: Two 4–20 mA outputs; maximum load 500 Ω, electrically isolated
	Alarm relay card: Two relays; SPST, NO and NC terminals, maximum 16 VAC (35 VDC), 5 A (resistive loads only)
Digital inputs (optional)	Two dual digital; optically isolated; switch input or 5 to 24 V input
Certifications	CE, cETLus (UL and CSA 61010-1 safety standards)
Warranty	1 year

Automatic flush specifications

Specification	Details
Water connection	½-in. BSP
Water pressure	10 bar (145 psi) maximum; 1–5 bar (14.5–72.5 psi) recommended
Auto flush options	Interval: 1 minute to 48 hours
	Duration: 1 second to 4 minutes
	Reading hold: 0 seconds to 4 minutes

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to

make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates that the marked item can be hot and should not be touched without care.
	This symbol indicates the need for protective eye wear.

	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates that a risk of fire is present.
	This symbol identifies the presence of a strong corrosive or other hazardous substance and a risk of chemical harm. Only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates the presence of a biohazard.
	This symbol indicates that the marked item requires a protective earth connection. If the instrument is not supplied with a ground plug on a cord, make the protective earth connection to the protective conductor terminal.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

Certification

⚠ CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Product overview

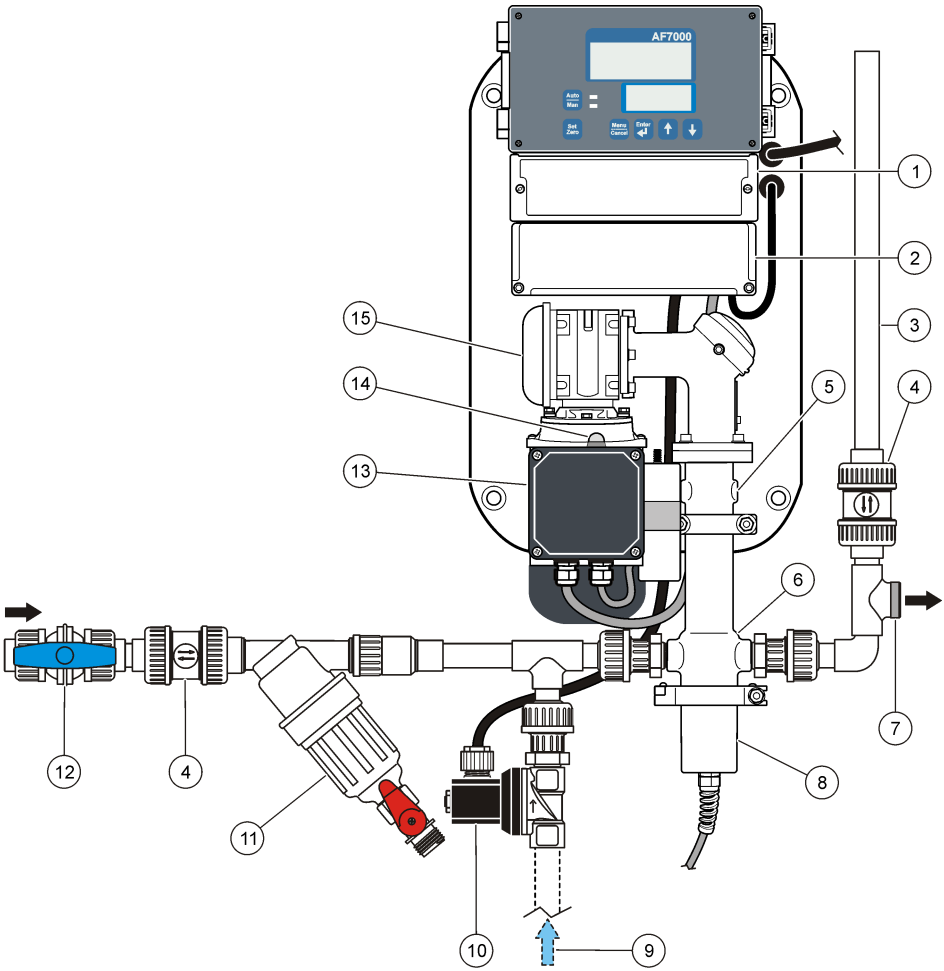
⚠ DANGER	
	Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.

⚠ CAUTION	
	Fire hazard. This product is not designed for use with flammable liquids.

This instrument measures an electrical current (streaming current) from suspended particles in the sample as the sample flows through the instrument. This current is typically used to monitor the amount of coagulant that is added to water treatment systems. Good coagulation occurs when the surface charges on the particles are neutralized by the coagulant. An optional PID controller card can automatically adjust the coagulant dose to keep the dosage at the optimum level.

Applications include drinking water, wastewater and industrial waters (e.g. pulp and paper). The instrument can also be used to monitor changes in the source water. A typical setup is shown in Figure 1.

Figure 1 Instrument overview



1 Wiring access cover	**6** Sample chamber	**11** Grit filter
2 Cable access cover	**7** Sample outlet	**12** Manual isolation valve for inlet
3 Head height indicator pipe	**8** Sensor	**13** Motor
4 Directional valve	**9** Clean water in (for optional flush)	**14** Reset switch for motor
5 Overflow port (2x)	**10** Optional flush valve	**15** Gearbox

Theory of operation

The sensor consists of a piston and a close-ended chamber. A narrow gap of 200–500 µm wide is present between the piston and the walls of the chamber. The piston goes up and down at a constant frequency, typically 4–5 strokes per second. The motion of the piston pushes sample water in and out of the chamber through the narrow gap. The walls of the capillaries in the chamber through which the sample flows are quickly covered in a layer of colloidal particles. The sensor takes on the surface charge characteristics of these particles.

As the piston and chamber surfaces are covered with a layer of charged particles, the water that flows rapidly up and down through the narrow gap results in the displacement of the counter-ions. The streaming current signal is measured by electrodes in and around the gap and is proportional to the water velocity. Therefore, the streaming current signal alternates in time with the movement of the piston. This signal is typically between 0.05 µA to 5µA depending on the particular conditions.

The measurement of a streaming current in a closed chamber has several advantages over a measurement done directly in a flowing stream. A closed-end measurement is electrically isolated and removes problems caused by large potentials in the process stream from other sources. The signal alternates at the frequency of the piston which lets the signal be separated from external noise and offset caused by electrode drift and dissymmetry.

Installation

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Installation guidelines

This instrument is rated for an altitude of 2000 m (6562 ft) maximum. Use of this instrument at an altitude higher than 2000 m can slightly increase the potential for the electrical insulation to break down, which can result in an electric shock hazard. The manufacturer recommends that users with concerns contact technical support.

- For best results, the pH of the sample must be reasonably constant or controlled before coagulation.
- Install the instrument as near to the sample mixer as possible. The sample measurement must occur within 30 seconds after the coagulant is fully mixed with the sample at all expected flow rates.
- Install the instrument as near to the point of chemical addition (coagulant and pH adjustment) as possible and make sure that the sample is well-mixed when measured. Typically, this means that the instrument is installed in a location where the sample will reach the instrument within 30 seconds of chemical addition at all expected flow rates.
- Installation of the instrument indoors is recommended. Install the instrument in a relatively dust-free location away from direct sunlight.
- If the instrument is installed in an outdoor environment, put the instrument in an enclosure that supplies protection from precipitation and direct sunlight. The enclosure must also supply good ventilation and temperature control.
- Make sure that there is sufficient drainage for any sample that flows through the overflow ports.
- Make sure that sufficient airflow is supplied around the motor so that the motor does not become too hot.
- Make sure that the sample flow is more than 1 L/minute. A flow rate of 2–4 L/min is recommended. A sample flow more than 4 L/min will cause water to leak from the weep hole in the piston shaft.
- If the sample water contains sand or fibrous material, install an inlet filter (Y-strainer). A 40-mesh strainer is sufficient for most applications.

Mechanical installation

Attach the instrument to a wall

⚠ WARNING

Personal injury hazard. Instruments or components are heavy. Use assistance to install or move.

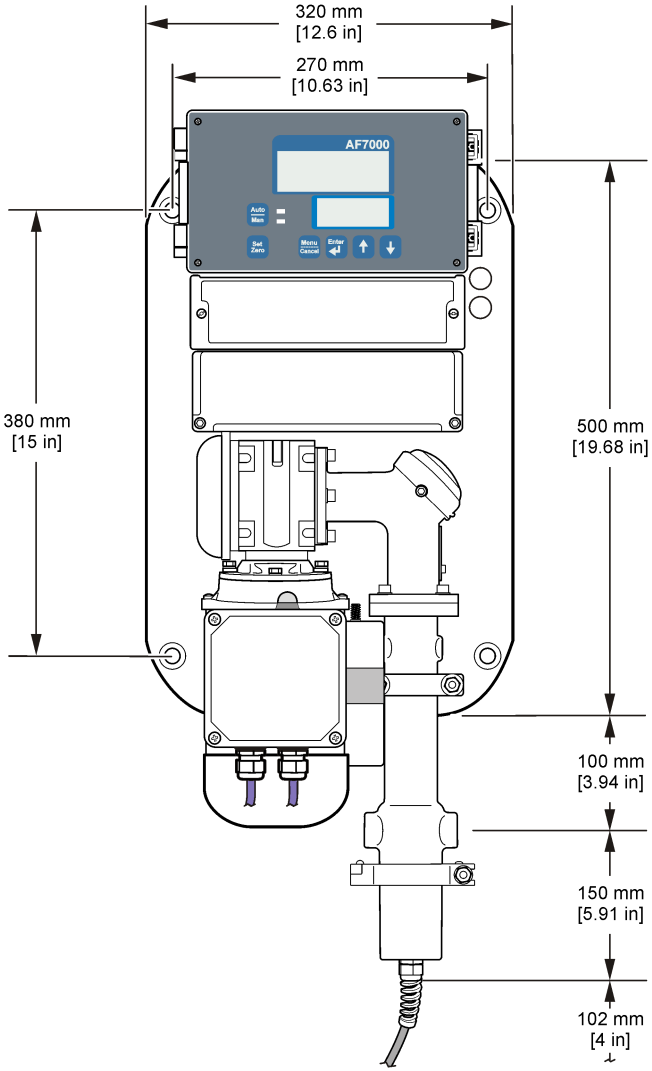
Attach the instrument vertically to a wall or structure that is able to hold at least 86 kg (190 lb) of downward force. Make sure that there is sufficient airflow around the motor.

User-supplied hardware:

- Four bolts, 10 × 40 mm (7/16 × 1.5 in.)

Figure 2 shows the installation dimensions.

Figure 2 Installation dimensions



Plumb the instrument

NOTICE

Supply ½-in. NPT plumbing for both the sample inlet and the sample outlet. Outlet fittings smaller in diameter than ½-in. NPT can cause unwanted back pressure into the instrument and result in instrument damage.

Plumb the sample to the instrument as shown in Figure 1 on page 7. Plumbing guidelines:

- Install a manual flow isolation valve at the inlet.
- Keep the sample flow within the specified flow rate of 2–4 L/min.
- Use PTFE tape on the pipe threads.
- The inlet piping and outlet piping must be ½-in. NPT.
- Use ½-in. NPT fittings for the inlet piping.
- Use ½-in. or larger NPT fittings for the outlet piping.
- If the water connections are user-supplied, install an elbow after the sensor to keep a 25–133 mm (1–5.25 in.) head of water above the sensor (in the head height indicator pipe). Refer to Figure 1 on page 7.
- If the automatic flush mechanism is used, plumb a clean water supply at 1–5 bar (14.5 to 72.5 psi), 10 bar (145 psi) maximum.

Note: *The direction of sample flow can be in either direction through the sensor.*

Electrical installation

Wiring safety information

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

⚠ DANGER

Electrocution hazard. Always remove power to the instrument before making electrical connections.

⚠ DANGER

Electrocution hazard. If this equipment is used outdoors or in potentially wet locations, a Ground Fault Circuit Interrupt (GFCI/GFI) device must be used for connecting the equipment to its main power source.

Electrostatic discharge (ESD) considerations

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

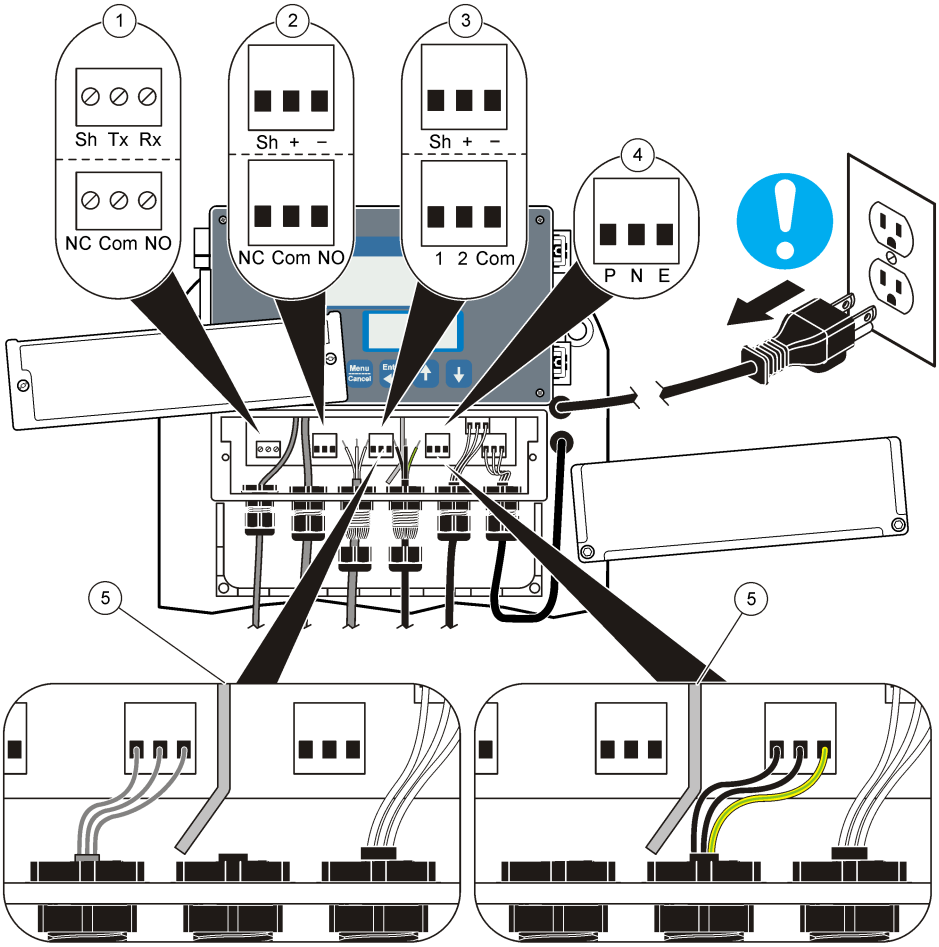
Refer to the steps in this procedure to prevent ESD damage to the instrument:

- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.
- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

Wiring overview

Figure 3 shows all of the possible connections for optional devices and communications.

Figure 3 Optional connections



1 Modbus (RS485) card or alarm relay card (optional)	**4** Autoflush card (optional)
2 4–20 mA PID controller card or alarm relay card (optional)	**5** High voltage barrier
3 4–20 mA Process Output controller card or digital input card (optional)	

Connect to devices

⚠ WARNING

Electrical shock hazard. Externally connected equipment must have an applicable country safety standard assessment.

⚠WARNING

Fire hazard. Relay loads must be resistive. Always limit current to the relays with an external fuse or breaker. Obey the relay ratings in the Specifications section.

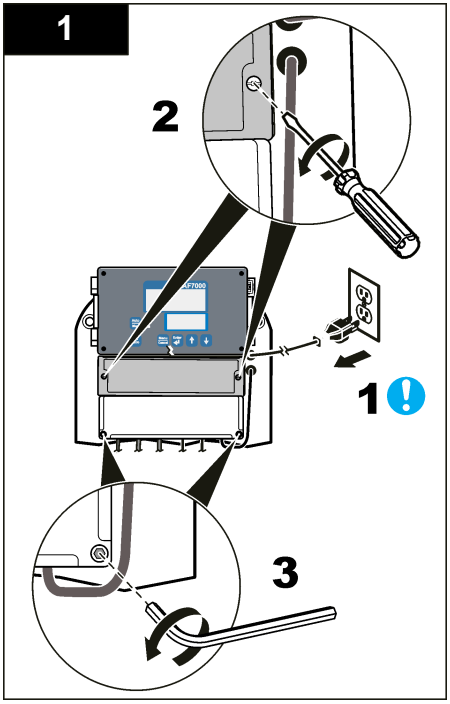
Refer to the illustrated steps in this section to connect the instrument to external devices or to a communications network. For connection to the wire terminals, refer to Table 1 and Table 2.

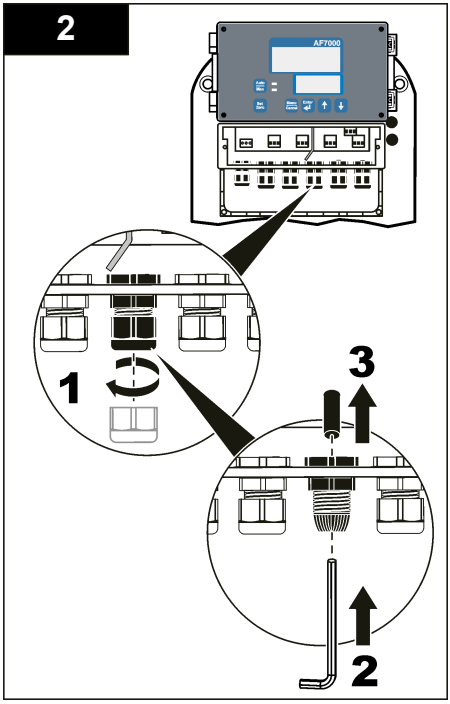
Table 1 Optional device wiring

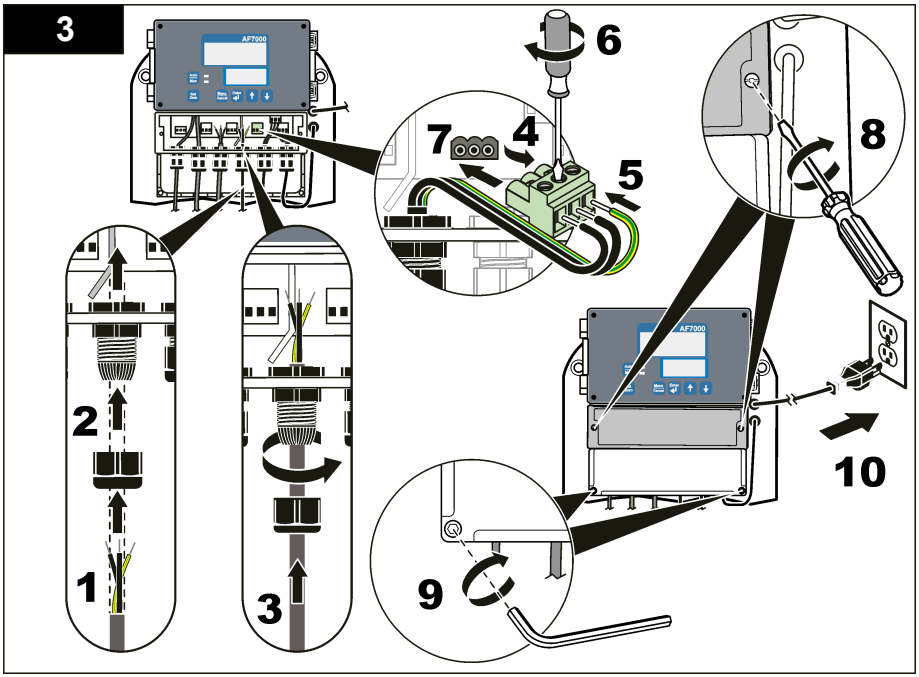
Option	Pin name (description)	Pin name (description)	Pin name (description)
4–20 mA	Sh (shield with ground)	+ (positive)	– (neutral)
Modbus (RS485)	Sh (shield without ground)	Tx (transmit)	Rx (receive)
Alarm relays	NC (normally closed)	Com (common)	NO (normally open)
External PID controller	Sh (shield)	+ (positive)	– (negative)
Digital input	1 (input 1)	2 (input 2)	Com (common)

Table 2 Autoflush card wiring

Pin	Description	Wire color
P	Phase	Black—1
N	Neutral	Black—2
E	Protective earth ground	Green/yellow



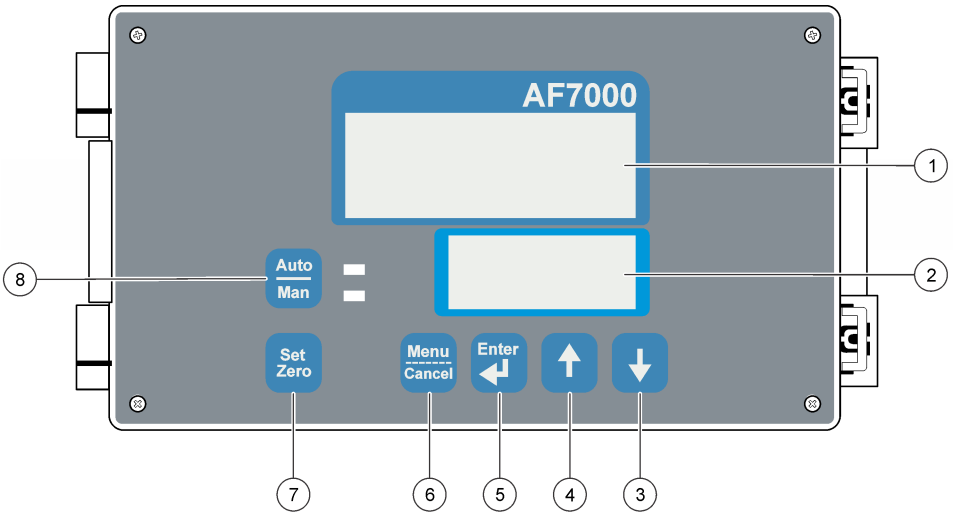




User interface

Figure 4 shows the instrument keypad and display. Table 3 gives the display and keypad descriptions.

Figure 4 Display and keypad overview



1 Top display	**4** UP arrow key	**7** Set Zero key
2 Bottom display	**5** Enter key	**8** Auto/Manual key
3 DOWN arrow key	**6** Menu/Cancel key	

Table 3 Display and keypad descriptions

Item	Name	Description
(1)	Top display	Raw streaming current value (the same value shown in the bottom display) until the zero point has been set. When the zero point is set, the display shows the deviation from the raw streaming current value. • 0 = Optimal amount of coagulant if the user has set the zero point based on the zeta potential or the jar test • – XX = The streaming current value is less than the optimum value. Coagulant may need to be added if the user has set the zero point based on the zeta potential or the jar test. • + XX = The streaming current value is more than the optimum value. The coagulant feed may need to be stopped or reduced if the user has set the zero point based on the zeta potential or the jar test.
(2)	Bottom display	Raw streaming current value ***Note:*** *"PXX"(e.g., P66) shows when the instrument has a PID controller that is set to manual mode. Push* ***Auto/Manual*** *to show the raw streaming current value.* *"PXX" identifies the percentage at which the PID controller is operating. For example, if the instrument output signal (4–20 mA) is 4 mA, "P00" shows. If the instrument output signal is 12 mA, "P50" shows. The percentage shown depends on the user settings.*
(3)	DOWN arrow key	Select a menu or option, set or change a value To adjust the zero point, push and hold an arrow key for 2 seconds, then push the applicable arrow key. • DOWN arrow = increase the zero point • UP arrow = decrease the zero point ***Note:*** *When the optional 4–20 mA PID controller card is installed, the controller must be in manual mode to adjust the zero point. Push* ***Auto/Manual*** *to go to manual mode.*
(4)	UP arrow key	
(5)	Enter key	Select a menu item or accept an entry

Table 3 Display and keypad descriptions (continued)

Item	Name	Description
(6)	Menu/Cancel key	Show the menu options or exit the menu options. Push the **DOWN** arrow to scroll through the menu options.
(7)	Set Zero key	Set the zero point. The top display changes to "0". To set the zero point, push and hold **Set Zero** for 3 seconds. Set the zero point when the optimum coagulant dose is added and the reading is stable. ***Note:*** *Set the zero point again whenever there is a significant change in source water. Significant changes include seasonal changes such as lake turnover, after a storm or other high turbidity event. It is important to keep the variation from the zero point very small so that the instrument can make fine adjustments.*
(8)	Auto/Manual key	When the optional 4–20 mA PID controller card is installed, push **Auto/Manual** to switch between automatic and manual controller mode.

Startup

Connect the instrument to power

⚠ CAUTION

Burn hazard. The motor surface gets hot. Do not touch.

Plug the power cord into an electrical outlet. The instrument starts automatically.

Validate the installation

1. Set the zero point. Refer to Set the zero point on page 20.
2. Increase the coagulant dose by 10%. Make sure that the top and bottom values on the display increase. Wait 5–10 minutes for the full-scale change to complete.

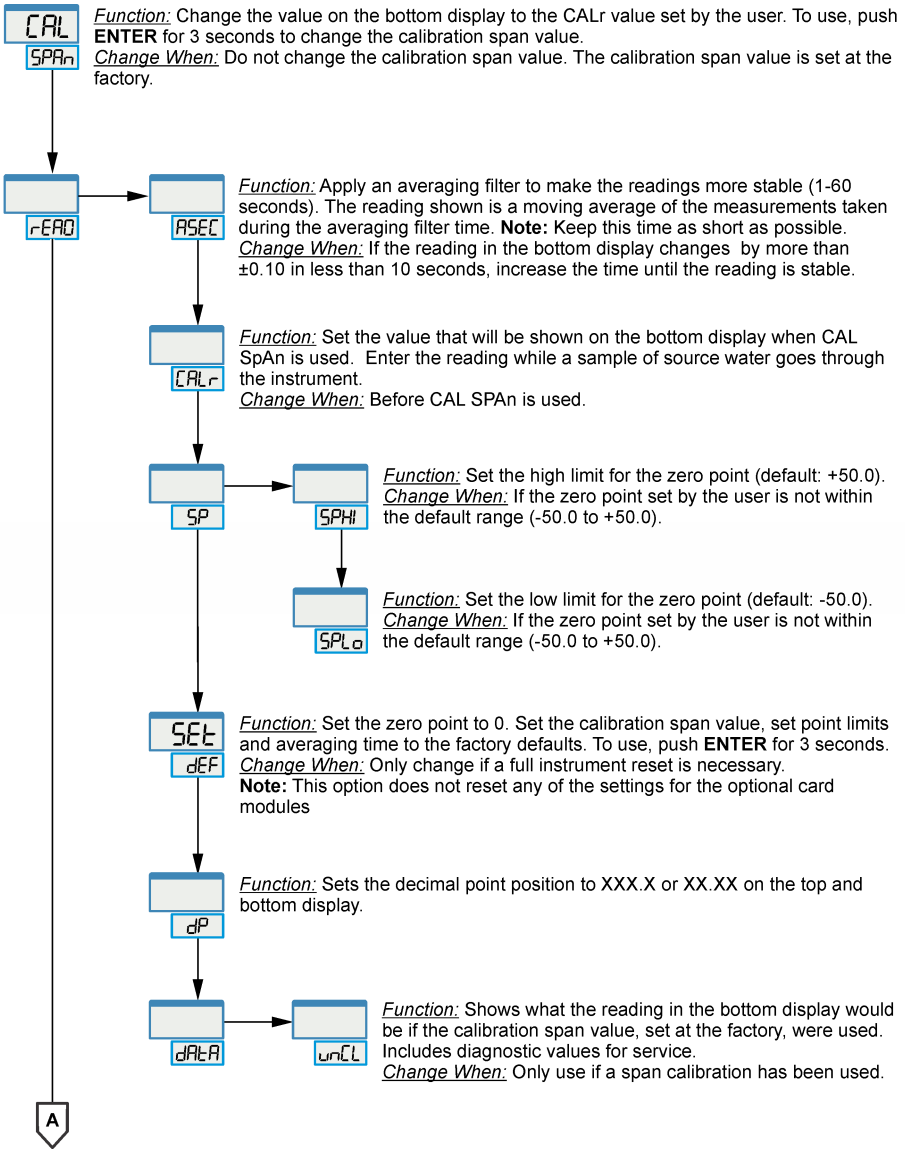
   Note: *The instrument shows an approximate half-scale change in 20–40 seconds. A full-scale change occurs in 5–10 minutes.*
3. Decrease the coagulant dose by 10% of the optimal dose. Make sure that the top and bottom values on the display decrease. Wait 5–10 minutes for the full-scale change to complete.
4. Set the coagulant dose back to the optimal dose. Wait 5–10 minutes for the full-scale change to complete.

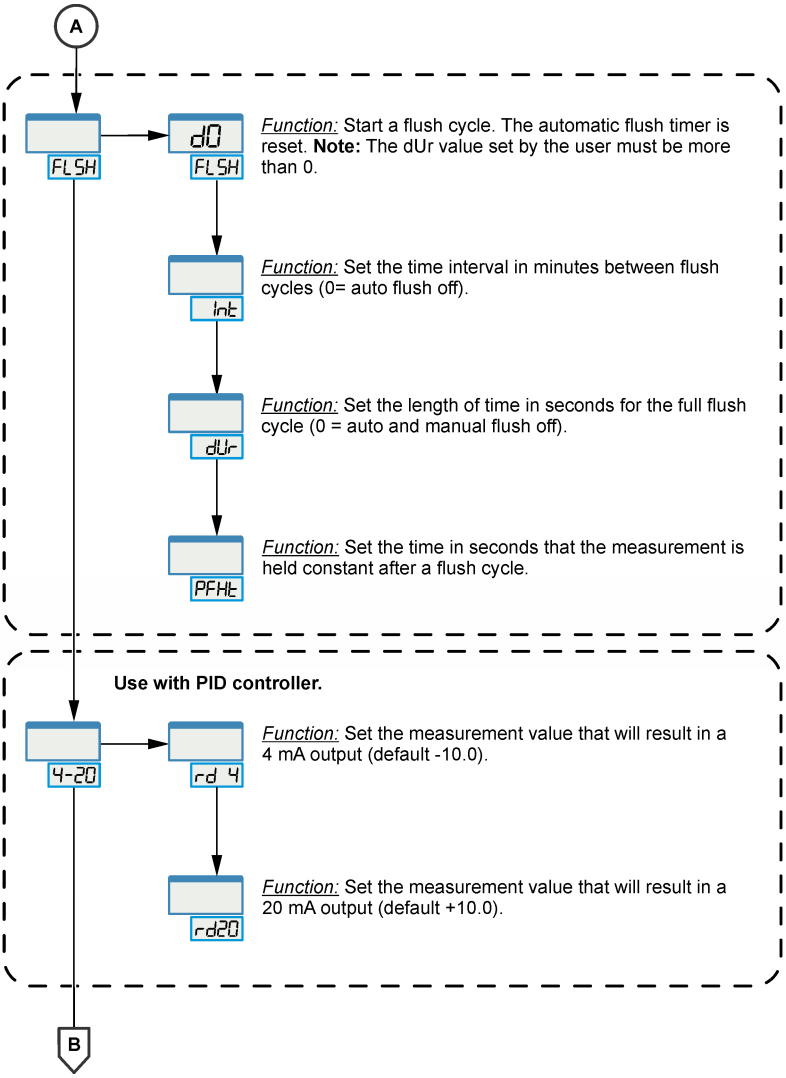
Configuration

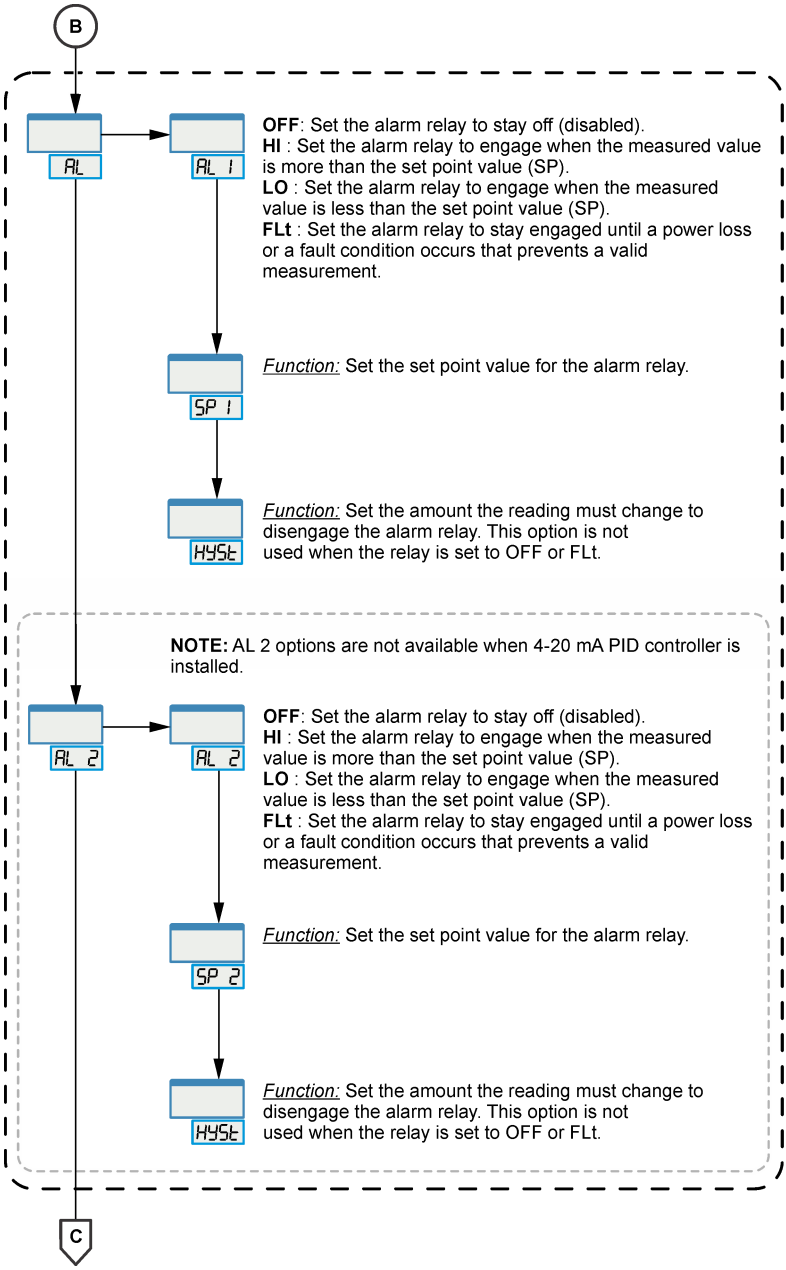
Push **Menu/Cancel**, then push the **DOWN** arrow to scroll through the menu options. Push **Enter** to select a menu option. Refer to Figure 5.

To go back one menu level, push **Menu/Cancel**. To exit the menus, push **Menu/Cancel** until the reading shows.

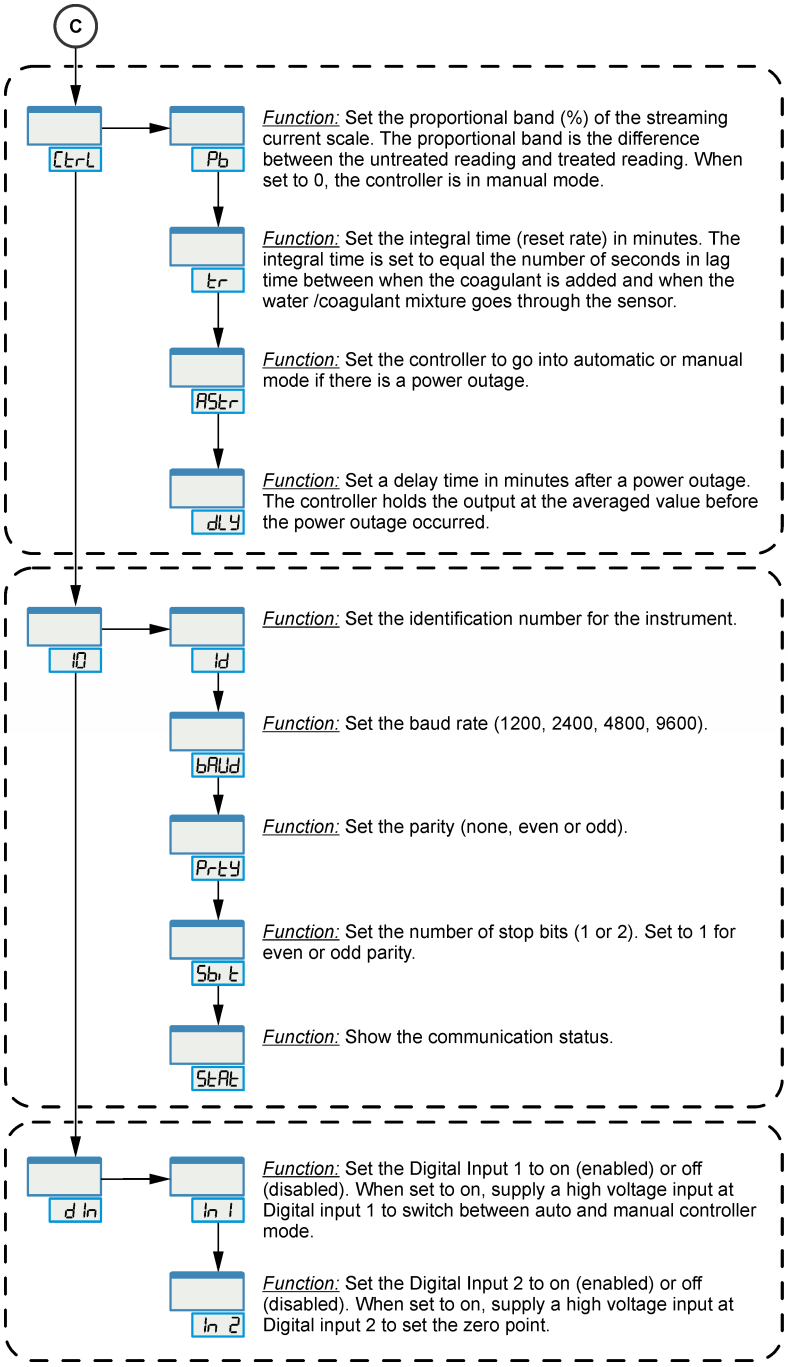
Figure 5 Menu options




A
FLSH
dO
FLSH
Function: Start a flush cycle. The automatic flush timer is reset. Note: The dUr value set by the user must be more than 0.
Int
Function: Set the time interval in minutes between flush cycles (0= auto flush off).
dUr
Function: Set the length of time in seconds for the full flush cycle (0 = auto and manual flush off).
PFHt
Function: Set the time in seconds that the measurement is held constant after a flush cycle.
Only shows when Auto Flush card is installed
Use with PID controller.
4-20
rd 4
Function: Set the measurement value that will result in a 4 mA output (default -10.0).
rd20
Function: Set the measurement value that will result in a 20 mA output (default +10.0).
Only shows when 4-20 mA PID card is installed
B



Only shows when Relay card is installed


C
CtrL
Pb
Function: Set the proportional band (%) of the streaming current scale. The proportional band is the difference between the untreated reading and treated reading. When set to 0, the controller is in manual mode.
tr
Function: Set the integral time (reset rate) in minutes. The integral time is set to equal the number of seconds in lag time between when the coagulant is added and when the water /coagulant mixture goes through the sensor.
ASTr
Function: Set the controller to go into automatic or manual mode if there is a power outage.
dLY
Function: Set a delay time in minutes after a power outage. The controller holds the output at the averaged value before the power outage occurred.
Only shows when 4-20 mA PID card is installed
IO
Id
Function: Set the identification number for the instrument.
bAUd
Function: Set the baud rate (1200, 2400, 4800, 9600).
PrtY
Function: Set the parity (none, even or odd).
Sb, t
Function: Set the number of stop bits (1 or 2). Set to 1 for even or odd parity.
StAt
Function: Show the communication status.
Only shows when RS485 card is installed
d In
In 1
Function: Set the Digital Input 1 to on (enabled) or off (disabled). When set to on, supply a high voltage input at Digital input 1 to switch between auto and manual controller mode.
In 2
Function: Set the Digital Input 2 to on (enabled) or off (disabled). When set to on, supply a high voltage input at Digital input 2 to set the zero point.
Only shows when the Digital Input card is installed

Operation

Set the zero point

Pre-requisite: Complete a jar test, or take a zeta potential measurement, to find the optimum coagulant dose. The optimum dose gives the best floc formation and lowest turbidity without excess coagulant. Set the coagulant pump speed to supply the optimum dose and examine the coagulation. If necessary, increase or decrease the coagulant pump speed until the optimum dose is supplied.

Push the **Set Zero** key to set the top display to 0 when the optimum sample-coagulant mixture goes through the instrument. If the display later shows a positive or negative number, the coagulant dosage is above or below the optimum setting.

1. Set the optimum coagulant dose in the system.
2. Wait for the dosage change to get to the instrument and a full-scale change to complete through the instrument (approximately 5–10 minutes).
3. When the reading is stable, push and hold **Set Zero** for three seconds. The top display shows 0.

Adjust the zero point

The zero point can be changed to increase or decrease the coagulant dosage. Increase the zero point setting to decrease the coagulant dose. Decrease the zero point setting to increase the coagulant dose.

1. Put the controller in manual mode.
2. Push and hold the **Up** or **Down** key for two seconds.
3. Push the **Up** or **Down** key to increase or decrease the zero point setting (top display).
4. Put the controller in automatic mode. The coagulant dose changes until the zero point setting shows 0.

Set the controller dosage manually

The optional PID controller automatically adjusts the coagulant dosage in response to changes in the streaming current. In facilities with a high flow rate and small mixer, the controller adjustment time is too slow for the short coagulant retention time. In this situation, adjust the controller dosage manually.

Note: *The minimum flow rate is also important. If the controller is adjusted when the flow rate is high, cycling and instability can occur when the flow rate is low.*

1. Record the initial streaming current value.
2. Increase or decrease the controller dose output by 20%.
3. Record the wait time before the streaming current value changes (about 20 seconds).
4. Monitor the streaming current value until the value is stable (5 to 10 minutes).
5. Record the final streaming current value.
6. Set the controller dose to the original value.
7. Record the wait time, initial and final values to confirm the previous results.
8. If the wait time is less than 30 seconds, adjust the proportional band (e.g., the 4–20 mA span) and the time response (averaging).

   a. Find the proportional band (PB) value:

      PB = 400 × (final reading – initial reading) / (final dose value – initial dose value).
      Note: *The dose value is a % of maximum and assumes that the 4–20 mA span is set to the default values (–10.0 to +10.0).*
   b. Go to CAL SPAn>CtrL>Pb.
   c. Enter the proportional band value from step a.
   d. Go to CtrL>tr and enter 1.2 minutes for the time response (Tr).

With these settings, the controller typically recovers from major disturbances in 5 to 15 minutes. Treatment facilities that have a mixer retention time greater than 3 minutes or a response wait time greater than 30 seconds may need to increase the PB.

Start a flush cycle (optional)

Typically, the auto flush feature is not necessary. At installation, the manufacturer recommends that the instrument is operated without the auto flush feature for a period of time to see if the feature is necessary. If the grit filter (Y-strainer) at the inlet becomes clogged, the measurements on the display no longer change when the coagulant dose changes or the sensor becomes contaminated, the auto flush feature can be used.

Use the optional flush valve to flush the sample chamber with clean water at user-specified intervals. The user can also start a flush cycle manually. To set up an automatic flush cycle or to start a manual flush, refer to Configuration on page 16.

Note: *The manufacturer recommends that outputs to SCADA are held during the flush cycle and until the instrument readings are stable again.*

Calibrate the span value (optional)

The instrument can show a user-specified value for the source water so that the range of streaming current values is easy to read.

Note: *Correct operation occurs with the factory span settings. A user span calibration is not recommended.*

1. Go to CAL SPAn>rEAd>CALr and enter a value for the source water.
2. Pour a sample of source water (without coagulant) into the inlet.

   Note: *If the system has been in operation, close the inlet valve and flush the sample chamber with about 5 liters of source water.*
3. Monitor the reading until the value is stable (up to 10 minutes).

   Note: *It may be necessary to plumb the source water directly to the instrument for stable operation.*
4. Push **Menu/Cancel**. The display shows CAL SPAn.
5. Push and hold the **Enter** key for 3 seconds. The display shows the specified value.

Maintenance

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Maintenance schedule

Table 4 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 4 Maintenance schedule

Task	14 days	1 month	6 months	1 year	5 years
Examine and clean the sensor. Refer to Clean the sensor on page 22.	X[1] (without auto-flush)	X[1] (with grit filter and auto-flush)			
Examine the replaceable parts for wear. Refer to Examine the replaceable parts on page 24.			X		

[1] Do this task also after each high-turbidity event.

Table 4 Maintenance schedule (continued)

Task	14 days	1 month	6 months	1 year	5 years
Replace the piston.[2]				X	
Replace the cam rod to piston linkage.[2]				X	
Replace the linear bearings.[2]					X
Replace the sensor.[2]					X

Clean spills

⚠ CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

1. Obey all facility safety protocols for spill control.
2. Discard the waste according to applicable regulations.

Clean the instrument

Clean the exterior of the instrument with a moist cloth and a mild soap solution and then wipe the instrument dry as necessary.

Clean the sensor

NOTICE

Do not use abrasive cleaners. Always use gloves to handle the piston or the sensor. Oil from hands will increase the stabilization time.

Pre-requisites:

1. Put the controller in manual mode.
2. Disconnect power to the instrument.

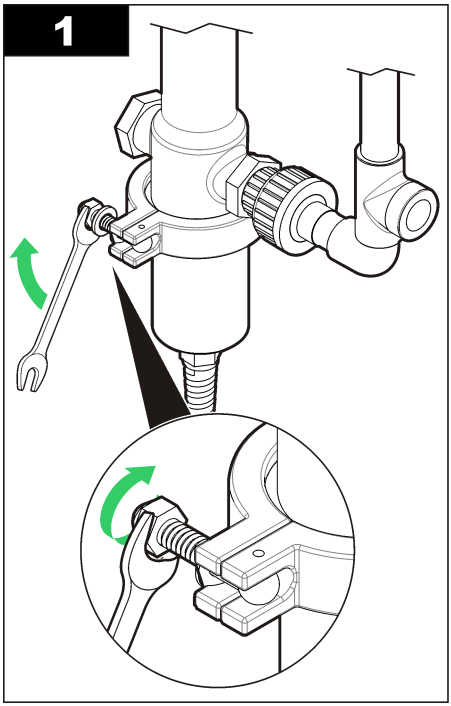
Required items:

- Soft toothbrush or soft cloth
- Clean sample water

Procedure:

The frequency and cleaning method changes with conditions in the process water. The streaming current is very sensitive to the surface condition of the piston. After the sensor is cleaned, the stabilization time can be up to 30 minutes. Refer to the illustrated steps to clean the sensor.

[2] Refer to the instructions that are supplied with the replacement part. Refer to Replacement parts on page 28.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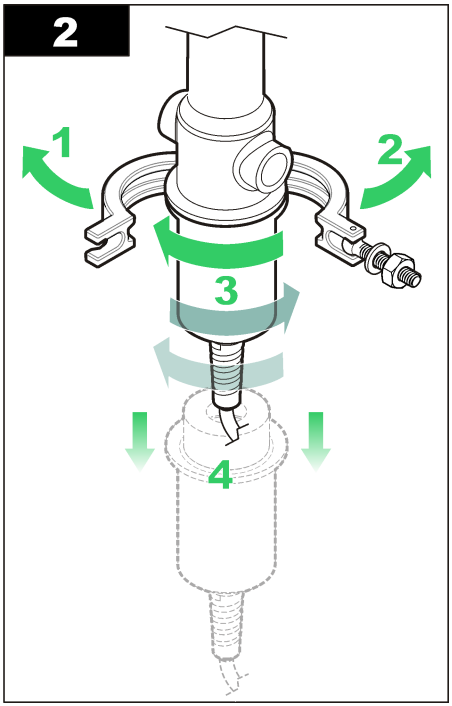
2
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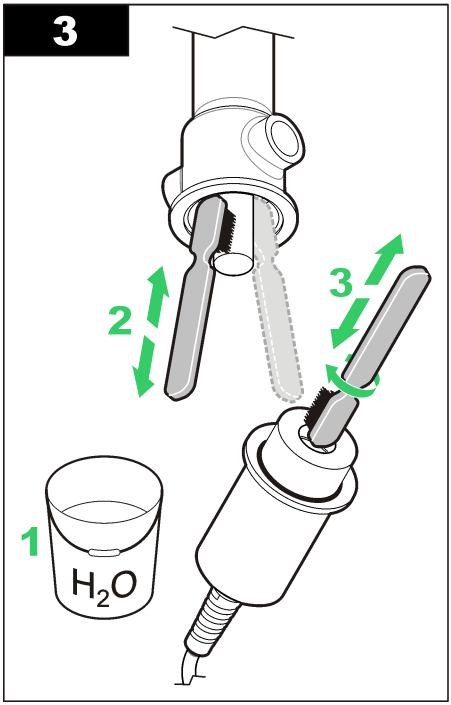
3
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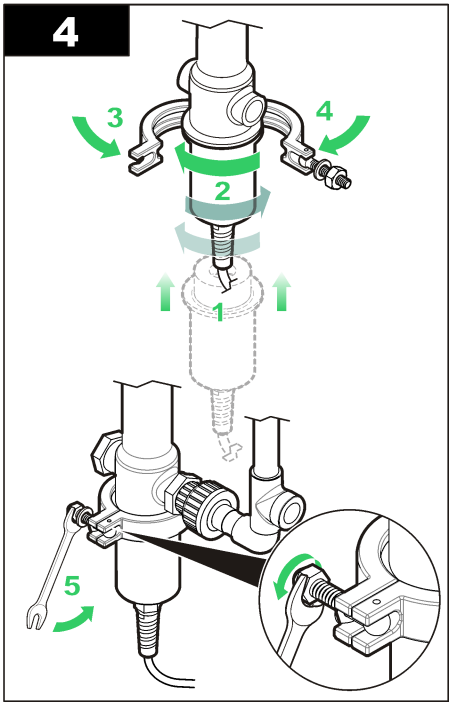
H2O


4
3
4
2
1
5

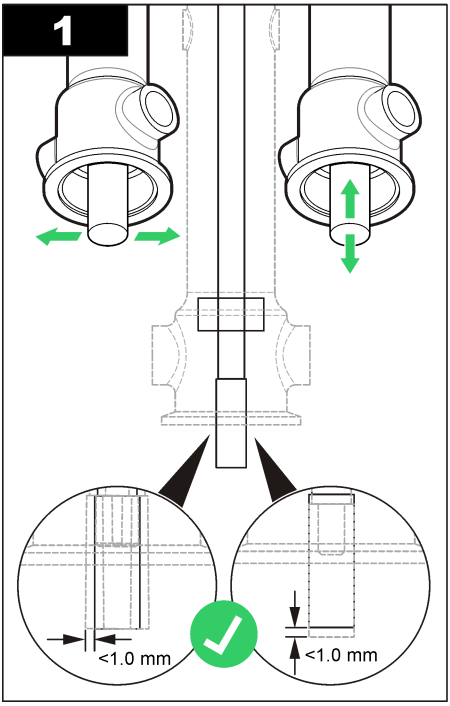
Post-requisites:

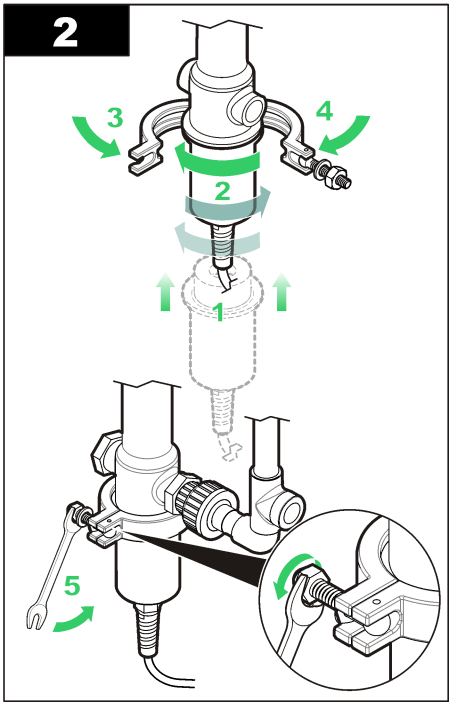
1. Apply power to the instrument.
2. Let the reading become stable.
3. Set the zero point.

Examine the replaceable parts

Worn parts can cause poor sensitivity and frequent drifts in the zero point. To examine the parts, refer to Clean the sensor on page 22 and the illustrated steps that follow. Look for signs of wear:

- Piston—deep scratches or scores.
- Cam rod to piston linkage—too much movement when the piston is pushed up and down.
- Linear bearings—too much movement when the piston is pushed side to side.
- Sensor—deep scratches or scores.





Replace the fuses

⚠ DANGER

Fire hazard. Use the same type and current rating to replace fuses.

The instrument has fuses in two locations. Figure 6 shows the location of the 5 A fuses. Figure 7 shows the location of the 8 A fuses.

Figure 6 Fuse location, 5 A

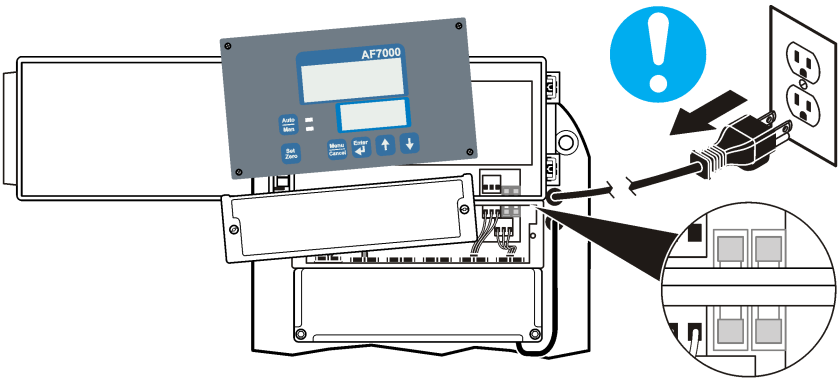
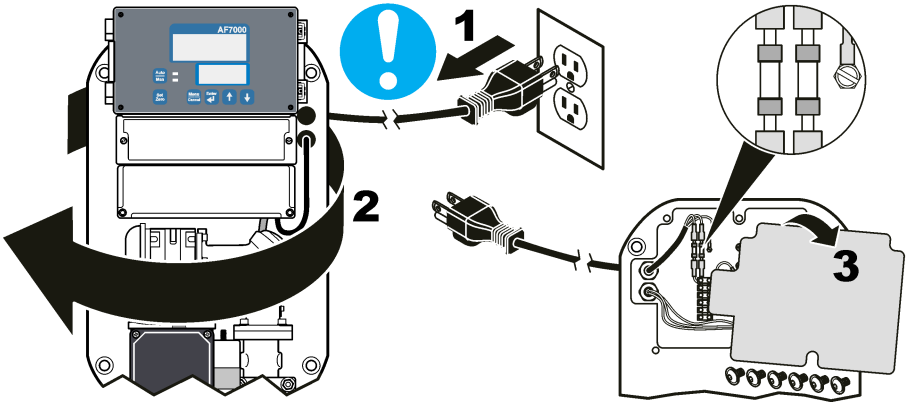


Figure 7 Fuse location, 8 A



Troubleshooting

Problem	Possible cause	Solution
The bottom display shows P XX (e.g., P 66).	The instrument has a PID controller and the controller is in manual mode. The controller goes to manual mode each time power is applied.	Push the **Auto/Manual** key to go to auto mode. The bottom display will show the streaming current value.
The measurement value shows a drift (small continuous changes).	The source water conditions change gradually.	Do a series of jar tests to look for dosage changes.
		Examine the source water pH for changes.
	The piston and sensor are dirty.	Refer to Clean the sensor on page 22.
	The piston or sensor has wear damage.	Examine the piston and sensor for damage. Replace the piston or sensor as needed.
	The electronics show a drift over time.	Set the zero point again.
The measurement is not stable and shows large variation.	The span calibration is not accurate.	Set the calibration span value to the factory defaults. Refer to Configuration on page 16.
		Calibrate the span to a large negative value.
The measurement is stable but does not respond to coagulant dose changes.	The sample line is blocked.	Monitor the sample flow rate. If necessary, clean the grit filter.
	The piston and sensor are dirty.	Refer to Clean the sensor on page 22.
	The sample has coagulant saturation caused by high dosage.	Make sure that the coagulant dosage is less than two times the optimal result from jar tests.
		Measure the pH. An over-dose situation can occur in water with low alkalinity.
The measurement is reversed. For example, the measurement decreases with an increase in the coagulant dose.	The span calibration is reversed.	Set the calibration span value to the factory defaults. Refer to Configuration on page 16.
	The water chemistry is not correct.	Make sure that the treatment facility operates with the correct coagulation requirements. When the jar tests show a minimum residual turbidity, the coagulant dosage is probably correct for streaming current measurements.
When the dosage is automatically adjusted, the measurement shows a continuous cycle. For example, the dosage increases, then decreases, etc.	The coagulant retention time is short and the controller adjustment is too slow.	Put all control loops and flow control valves into manual mode to stop the cycle. Refer to Set the controller dosage manually on page 20.

Problem	Possible cause	Solution
The measurement shows small, rapid changes (noise).	The coagulant is not mixed sufficiently.	Stop the sample flow. If the measurement becomes stable, move the sample line farther away from the mixer. Make sure that the dose pump operates correctly.
	Electrical interference is present.	Stop the sample flow. If the measurement does not become stable, increase the signal averaging time or look for a poor electrical ground connection on the instrument or on nearby motors or heaters.
The drain hole has a water leak.	The water head level is above the drain hole level.	Decrease the inlet or outlet pressure.
The surface temperature of the motor is very hot, greater than 105 °C (221 °F).	The air circulation is not sufficient to remove the heat from the motor.	Supply additional airflow for the motor.
The display is blank and the motor will not start.	There is no power to the instrument.	Supply power to the instrument.

Error messages

Error	Description	Solution
Stop	The motor has stopped.	For instruments with a motor isolation switch, make sure that the switch is on.
	The rotation sensor has failed.	Contact technical support.
Err2	The electronics have a non-volatile memory error. The instrument cannot store changes to settings while this error is present.	Cycle power to the instrument. Make sure that the calibration span value and zero point settings have not been reset to default.
Err3	The speed of the motor changes continuously.	Make sure that the supply voltage is stable.
	A rotation sensor fault is present.	Contact technical support.
Err4	An electronics fault is present.	Contact technical support.

Appendix

Send readings to a SCADA system

Readings from a process analyzer analog output can be sent to a SCADA system.

1. Identify the process analyzer analog output configuration.
   a. Identify the type of analog signal:
      - Voltage or current (e.g., 0–20 mA, 4–20 mA or 0–10 V)
      - Option to select between (selector switch) or to configure card
      - Loop power signal or source power signal
   b. Identify the analog output range used and set the analog output to match the SCADA readout. For example, pH can read between pH 1 to 14. To read between 4 and 10, set 4 as the low and 10 as the high. For the AF7000, set the range and use SCU as the units for streaming current.
2. Identify the type and options for the PLC analog input cards used for the process analyzer interface.
   - Voltage or current (e.g., 0–20 mA, 4–20 mA or 0–10 V): option to select between (selector switch) or configure card

- Loop power signal or source power signal: option to select between external or internal (PLC) power.
- Identify if the selected analog input card is an isolated or non-isolated type (e.g., common DC COM power).
  Note: *If the analyzer has source 4–20 mA analog output and the user supplies an isolated externally powered analog input with 4–20 mA signal option, the user can make a direct connection between the analyzer analog output card and the PLC analog input card.*

Suggested preventative measure—Use a signal isolator between the process analyzer and the PLC analog input card for the reasons that follow:

- It is possible to connect different types of signals to a PLC (e.g., current or voltage, and loop or source).
- System reliability is increased. For example, failure of the analyzer analog output module, electrical shock and/or lightning strike will not cause a PLC analog input card failure and a PLC/process crash and vice versa.
- Troubleshooting is easier. It is possible to "source"/imitate the signal from the analyzer to examine the PLC and confirm the signal from the analyzer is correct.

3. If the readings between the analyzer and SCADA are not the same:

a. Refer to the analyzer documentation for instructions on how to set the high and low values for the recorder output.

b. If the SCADA programming cannot be accessed, send 4 mA for the low output signal and 20 mA for the high output signal and read the results. The SCADA reading will be the high value and low value for your recorder outputs. The high value and low value should be the same as the values set for your recorder output. If the recorder output is not 4–20 mA, identify the high value and low value and use the instructions in this section to identify the recorder range.

c. Make sure that the range set for the recorder output is the same as the range set for the SCADA input.

d. Put a meter in the recorder loop and measure the current or voltage. For example, with a 4–20 mA signal and a range of 0–10, the reading should be 4 mA at 0, 20 mA at 10 and 12 mA at 5. If the reading is different, the readings will not be the same.

Note: *If the readings are negative, examine the connections. The leads of the meter may be reversed.*

Replacement parts

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Item no.
4–20 mA PID controller output card	LZY764
Alarm relay card	LZY763
Cam rod to piston linkage, replacement kit	LZY755
Grit filter, replacement	25091000
Linear bearings and washers, replacement kit	LZY758
Modbus (RS485) card	25061020
Piston, replacement kit	LZY757
Streaming current sensor, replacement kit	LZY756
Tool kit, parts replacement	LZY759
Water connections kit. Includes weir, grit filter and automatic flush valve	LZY765
Water connections kit. Includes weir and grit filter (no automatic flush valve)	LZY766

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