

# Ag-S Manual

## Silver Ion Water Treatment System



**M395**  
**November 17, 2021**





Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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# Table of Contents

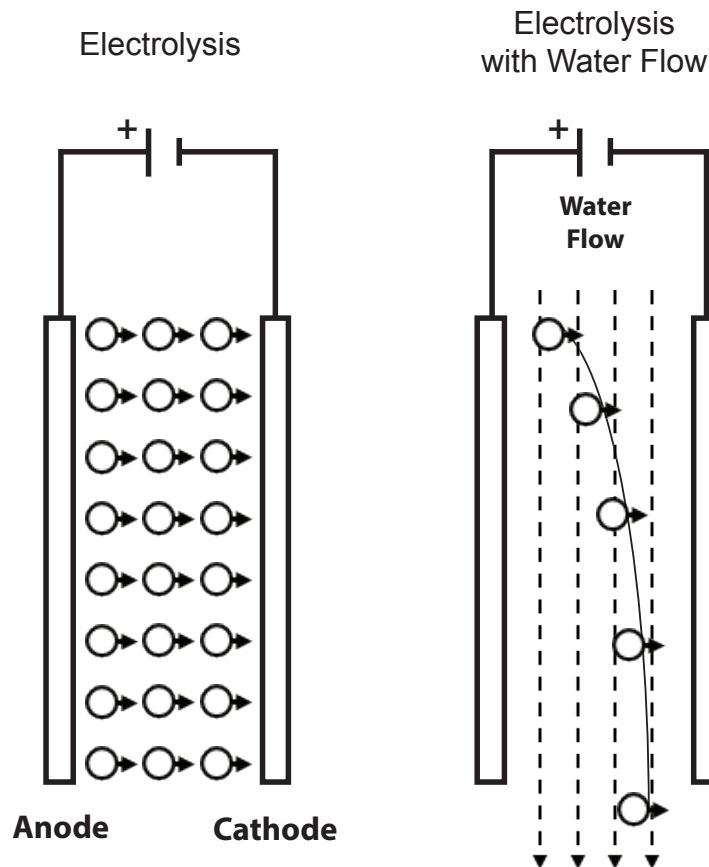
<b>1.0</b>	<b>Introduction.....</b>	<b>1</b>
1.1	General .....	3
<b>2.0</b>	<b>Technical Specification .....</b>	<b>4</b>
<b>3.0</b>	<b>Treatment of Water .....</b>	<b>5</b>
3.1	Standard Installation – Tank Recirculate Mode .....	5
3.2	Direct Flow Mode .....	6
3.3	Options.....	6
<b>4.0</b>	<b>Installation.....</b>	<b>7</b>
4.1	Mounting .....	7
4.2	Piping Connections .....	7
4.3	Electrical Connections.....	8
4.4	Typical connections.....	9
<b>5.0</b>	<b>Operation.....</b>	<b>9</b>
5.1	Start Up – One time setup.....	9
5.1.1	Tank Recirculate Mode.....	10
5.1.2	Direct Flow Mode .....	10
5.1.3	Final Setup .....	11
5.2	Operating the Menu System .....	11
5.3	Operating Modes.....	12
5.4	The Menu Structure .....	13
5.4.1	Water System Tank Size Entry.....	16
5.4.2	Watermaker Flow Rate Entry (Optional – when using a watermaker) .....	16
5.4.3	Setting Final Silver Dosage Level .....	17
5.4.4	Set Volume for Flowmeter pulse (Optional – when using flowmeter)..	17
5.4.5	Flush water through system – when solenoid valve installed .....	17
5.4.6	Setup Relays (Optional – when using outputs).....	18
5.4.7	Select Direct Flow Mode .....	18
5.4.8	Setup Input for Direct Flow.....	18
5.5	Error List.....	19
5.6	Replacement of the Electrode.....	21
5.7	Maintenance.....	22
5.8	Flash Pattern for Power LED .....	22
5.9	Operation Status .....	22
<b>6.0</b>	<b>Trouble Shooting .....</b>	<b>23</b>
6.1	Resetting the Ag-S .....	25
<b>7.0</b>	<b>Spare Parts List .....</b>	<b>27</b>
<b>8.0</b>	<b>Flow Diagrams .....</b>	<b>28</b>
<b>9.0</b>	<b>Mechanical Drawings .....</b>	<b>30</b>
<b>10.0</b>	<b>Electrical Drawings.....</b>	<b>31</b>
<b>11.0</b>	<b>Additional Items.....</b>	<b>32</b>

## 1.0 Introduction

There are many ways to treat water to make it suitable for drinking or to reduce biological growth within a water system. In this manual we will explain how our Ag-S Silver Ion system works. The JOWA Ag-S is a long term system used for storage tanks where the water is kept for a period of time. After a 4 hour contact time the silver ions kill bacteria and prevent re-growth.



The JOWA Ag-S is a well-known product in the shipping world. Since its introduction in 1970 several thousand ships have installed it. The process by which the bacteria and algae are killed is called oligodynamical sterilization. The silver ions are released by electrolysis from two silver plates within a special electrode unit when a controlled current (DC) is driven through them.



The JOWA Ag-S electrode unit consists of two high purity (99.99%) silver plates. The water passes through the center of the electrode and between the two silver plates. The released silver ions, following the current direction between the plates, are forced by the water to flow out of the electrode chamber and into the piping system. By changing the current direction once every ten minutes the silver ions will be released evenly from both plates over a period of time. The periodic change of current also keeps the plates clean, eliminating otherwise necessary regular cleaning.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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Treating drinking water using silver is a very old method and has been used frequently in many parts of the world since ancient times. Before introduction of penicillin, silver was used in many medical products and has proven to be effective. Today silver is used in thousands of products to prevent biological growth.

The JOWA Ag-S can have the concentration of silver ions set for any value between 0.025 mg/l (25 ppb) and 0.10 mg/l (100 ppb). The most common settings are either 0.04 mg/l (40 ppb) or 0.10 mg/l (100 ppb) silver. This setting is user controlled and depends on the ruling administration.

The electronics automatically adjusts the silver output dependent upon volume of water selected, the flow rate of the watermaker, or automatically when an optional flowmeter is used. An alarm is activated when the electrode is consumed or any other system problem is detected. An optional audible/visible alarm can also be fitted in the main control room to indicate any malfunction of the unit (e.g. low flow of water, electrode consumed).

The user should measure the silver ions concentration annually. Samples should be taken from the outlet of the storage tank(s) and at the extremity of the system.

Care must be exercised over the collection and storage of the samples, and it is strongly recommended that the advice of a competent laboratory is sought and followed. Normally such a laboratory will supply full instruction and sterilized bottles.

The ruling administration should be advised of any low concentrations.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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## 1.1 General

To obtain all the advantages from operating a JOWA Ag-S, ensure that all users have adequate education of the equipment, that the installation is correct and that the Ag-S is maintained and operated in accordance with the instructions in this manual. The correct function of the equipment cannot be guaranteed if the user fails to follow these instructions.

Before installation and start-up, read this manual carefully.

Supplier and manufacturer: **JOWA USA, Inc.**  
59 Porter Road  
Littleton, MA 01460  
USA  
Phone: +001 978-486-9800  
Fax: +001 978-486-0170  
Email: [info@jowa-usa.com](mailto:info@jowa-usa.com)  
[www.jowa-usa.com](http://www.jowa-usa.com)

JOWA USA, Inc. is part of the JOWA companies with the head office located at:

JOWA AB  
Tulebo 865  
S-428 34 Kållered , Göteborg  
Sweden  
Phone: +46-31 726 54 00  
Fax: +46-31 795 45 40  
Email: [sales@jowa.se](mailto:sales@jowa.se)  
[www.jowa.com](http://www.jowa.com)

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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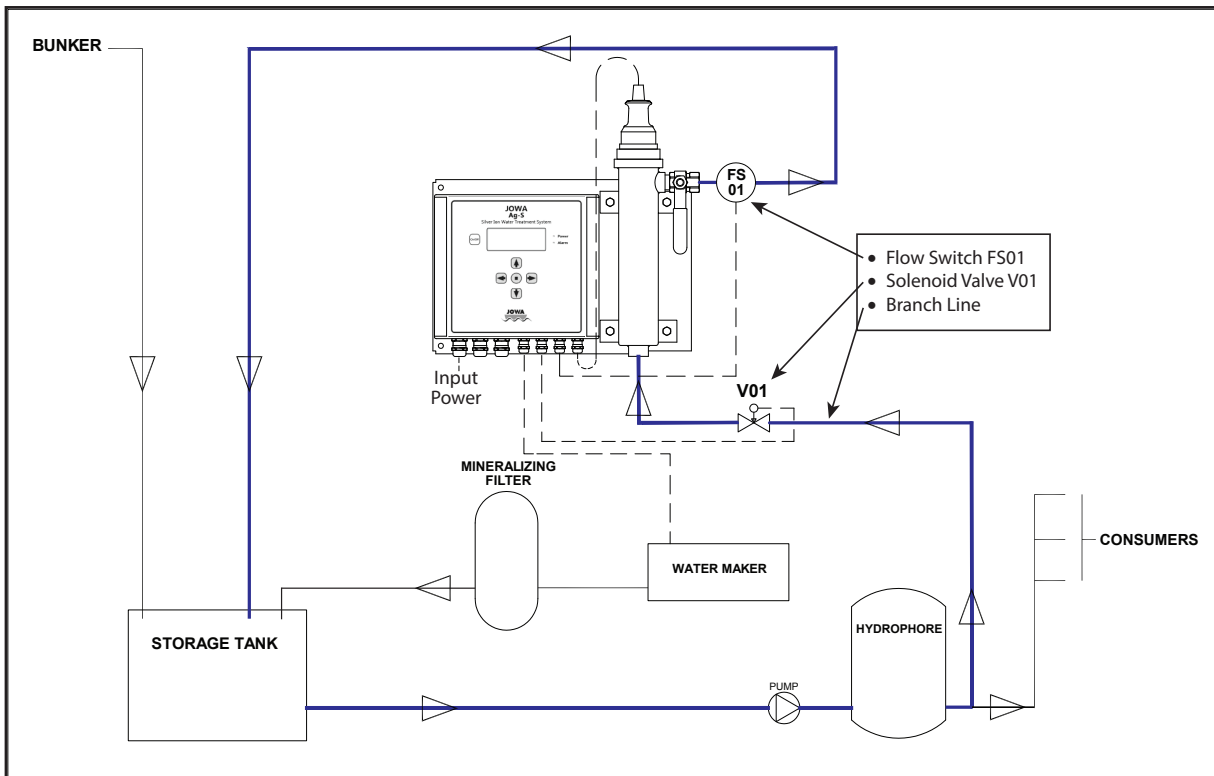
## 2.0 Technical Specification

Type	Value
Capacity (Maximum)	15.0 m <sup>3</sup> /h (3,962 gal/h)
Silver Dosage	0.025 to 0.10 mg/L; (25 to 100 PPB)
Current Range for Electrode	0-200 mA
Electrode Specification	99.99% Pure Silver; 280g
200g Ag usable at 0.04mg/L	5000 m <sup>3</sup> (1,320,860 gallons)
200g Ag usable at 0.10mg/L	2000 m <sup>3</sup> (528,344 gallons)
Voltage, Input for system	90 – 250 VAC 48/65Hz
Power Consumption	< 15 W
Display	20 Characters by 4 Lines LCD with backlight
Relays (Outputs)	3 – Dry Contacts; NC/C/NO that can be set for Power; Alarm or Pump On 5 A max 250 VAC
Inputs	4 User Configurable Switch Inputs; Flowmeters, Remote Start (Water On) Ratings: V <sub>oc</sub> = 4.6 VDC; I <sub>sc</sub> = 2 mA
Dimensions Unit	See Mechanical Drawings: Section 9
Chamber Test Pressure	9 bar (130 psi)
Dimension inlet	DN15 BSPP Female G½” (Optional NPT)
Dimension outlet	DN10 BSPP Female G¾” (Optional NPT)
Empty Weight	8.0 kg (17.6 lbs)
Chamber Material	AISI 316L
Flowmeter (optional)	Pulse Type, L/pulse adjustable within Ag-S
Operating Temperature	5 - 60°C (41 - 140°F)
Ingress Protection for Enclosure	IP64 EN 60529
Color (Control Cabinet)	RAL 7040 (Silver)
Water Conductivity	65µS/cm to 1000µS/cm

## 3.0 Treatment of Water

### 3.1 Standard Installation – Tank Recirculate Mode

Read this section in conjunction with the full size drawing in Section 8, flow diagram.



**Fig 3.1**

Standard Installation for the Ag-S system is on a vessel with a water supply system that incorporates bunkered water and water from production plants (either reverse osmosis or evaporation plants).

The Ag-S is installed after the pressure vessel (hydrophore tank) in a branch line from the main water supply line. Pressure for the Ag-S is provided by the hydrophore pump.

The Ag-S unit doses silver into the branch line. This branch line is then directed back to the ship's storage tank where the silver ions can treat the entire ship's fresh water supply. See figure 3.1

*The silver concentration in this branch line from the Ag-S to the storage tank is very high. When this water comes in contact with the "newly made" or bunkered water in the storage tank the concentration will be correct.*

The silver must be allowed a minimum 4 hours contact time with the water in the fresh water storage tank to have full effect.



Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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The valve V01 is controlled by the Ag-S and will open when the unit is actively producing Silver Ions. The water will then go through the silver chamber; in at the bottom and out at the top. The flow switch FS01 will tell the system if there is water flow going through the chamber.

The Ag-S can be controlled by a remote signal. A signal from a watermaker can start the unit and the Ag-S can send a signal to the watermaker to stop if the Ag-S unit stops. This can happen with certain error conditions.

The system can operate in a Volume mode where the User enters a known quantity of water when bunkering water from shore or a known amount of water has been produced.

### 3.2 Direct Flow Mode

If a storage tank is not available to support the recirculate mode the unit can be setup in the Direct Flow mode and dose the Silver Ions into the stream only when water is produced or flowing in the main line. In this mode the unit has a reduced flow and PPB range. See Fig 5.1.2 A 4 hour contact time is still required for the Silver Ions to be effective. Note: Flow meters are not usable in this mode and it is for a fixed flow only.

### 3.3 Options

A flowmeter can be installed in the water production plant line. The Ag-S will determine the correct dose of silver based on the flow signal from the meter. A second flowmeter can also be installed if you want to monitor both bunker and production water lines. **NOTE! An optional flowmeter (PN 92000-00023 or other pulse output flowmeter) is required if the unit is to be run in this mode.**

As an extra protection a shut off valve V02 can be installed on the main pipe to stop the water flow from the watermaker or the bunker line. This is can be done to avoid any non-treated water from being produced or bunkered. In the case of using this valve with a watermaker there should also be a stop signal connected from the Ag-S to the watermaker.

The standard Ag-S is designed to be hard wired to an electrical supply. An external power switch can be install by the user or if desired an optional switch can be mounted to the left side of the enclosure.

The system can be modified for non-standard installations. JOWA will give you support when you have special installation requirements.

## 4.0 Installation

### 4.1 Mounting

The JOWA Ag-S consists of a standard cabinet with all the electronics, an electrode chamber made with high grade electro-polished stainless steel, shut off valve, flow setting valve with flow indicator, flow switch, and two ball valves to isolate the chamber.

Additional parts (optional):

Shut off valve for bunker line

Shut off valve for production line (watermaker)

Flowmeter for production line and/or bunker line (PN 92000-00023)

All parts are mounted on a common polished stainless steel plate ready to be installed on a bulkhead. (Flow switch FS01, Flow regulator and the valve V01 are supplied loose. Attach as shown below and per mechanical drawing in Section 9.) To save space the unit can be removed from the plate and individual items mounted.

To gain access to the inside of the enclosure remove the two screw covers on either side of the unit. A flat head screw driver can be used to help pry these off (perpendicular to the display face). Four Phillips screws will then be visible that allow the cover to open. The cover swings open with a simple left side hinge.



### 4.2 Piping Connections

The connections are female DN15 BSP for the input (bottom) and DN10 BSP for the outlet (top right). An optional conversion kit (PN 2117200) is available that converts this to NPT male fittings for connection to NPT piping.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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### 4.3 Electrical Connections

The Ag-S is designed to be connected to 100 - 240 VAC, 50/60 Hz.

#### Terminals (Left to Right at bottom of PCB)

##### Label

100 – 240 VAC ~	Power Supply input
100 – 240 VAC ~	Power Supply input
100 – 240 ⏏	Power Supply ground
Relay 1 NC	Normally Closed terminal; typically Activate Pump when Ag-S is on
Relay 1 COM	Common terminal; typically Activate Pump when Ag-S is on
Relay 1 NO	Normally Open terminal; typically Activate Pump when Ag-S is on
Relay 2 NC	Normally Closed terminal; typically Alarm relay
Relay 2 COM	Common terminal; typically Alarm relay
Relay 2 NO	Normally Open terminal; typically Alarm relay
Relay 3 NC	Normally Closed terminal; typically Power relay
Relay 3 COM	Common terminal; typically Power relay
Relay 3 NO	Normally Open terminal; typically Power relay
24 V + Valve	Positive terminal for the flow valve for the chamber
24 V - Valve	Negative terminal for the flow valve for the chamber
Chamber Flow In +	Positive terminal input for the flow switch for the chamber
Chamber Flow In -	Negative terminal input for the flow switch for the chamber
In 1 +	Positive terminal input typically for optional flowmeter #1
In 1 -	Negative terminal input typically for optional flowmeter #1
In 2 +	Positive terminal input typically for optional flowmeter #2
In 2 -	Negative terminal input typically for optional flowmeter #2
In 3 +	Positive terminal input typically for the watermaker run signal
In 3 -	Negative terminal input typically for the watermaker run signal
In 4 +	Positive terminal input typically not used
In 4 -	Negative terminal input typically not used
24V CAN Bus	+24VDC for Supplying power to items on the CAN Bus
GND CAN Bus	Ground for Supplying power to items on the CAN Bus
L CAN Bus	CAN Bus Signal CANL
H CAN Bus	CAN Bus Signal CANH

#### Terminals (Center Right of the PCB)

##### Label

Ag1	Connection for one side of the Silver electrode (prewired)
Ag2	Connection for other side of the Silver electrode (prewired) (Polarity is not important with this connection)

#### Jumper (Lower Right of the PCB)

##### Label

J1 On	CAN Bus Terminator – On when single unit only
J1 Off	CAN Bus Terminator – Off when multiple units connected

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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## 4.4 Typical connections

(see flow diagram Section 8 and electrical Section 10)

1. Power input on **100-240 VAC** terminals
2. Solenoid valve V01 on **24 V Valve +** and **-** ; Brown +, Blue -, Green not used
3. External alarm to **Relay 2 NO** and **Comm** (Optional)
4. Electrode to **Ag1** and **Ag2** (Prewired)
5. Flow switch to **Chamber Flow In +** and **-** ; Brown +, Blue -
6. Flowmeter to **In 1 +** and **-** (Optional)
7. Fixed flow to tank signal from watermaker **In 3 +** and **-** (Optional)
8. CAN Bus Terminator Jumper set to On (Center and Top pins connected)

The Relays and Inputs are universal and can be set up for any combination of the available settings.

### Relay Options

- |           |  |
|-----------|--|
| a. Unused | Select when the relay is not used  |
| b. Pump   | When a pump is used for water flow through the Ag-S chamber (the bypass is not connected to a pressurized line). |
| c. Alarm  | If an Alarm condition is active the Relay will close   |
| d. Power  | When the Ag-S is ready to operate the Relay will close   |

### Input Options

- |                       |   |
|-----------------------|---|
| a. Unused             | Select when the input is not used   |
| b. Fixed flow to tank | A watermaker or other signal is used to signal water flowing into the storage tank (Tank recirculate mode only) |
| c. Flowmeter pulses   | A flowmeter is connected in the line to the storage tank  |
| d. Direct Flow        | Flow input without a storage tank to indicate flow (Direct flow mode only)                                      |

## 5.0 Operation.

### 5.1 Start Up – One time setup

- Open inlet and outlet valves. Check for leaks.
- Check that the green (LED) lamp “Power” is illuminated or flashing.
- Determine if you will operate the system in Tank recirculate mode with water flowing into a storage tank or in Direct flow mode when water is not recirculated from the storage tank. Skip to section 5.1.2 if operating in Direct flow mode.

### 5.1.1 Tank Recirculate Mode

See section 3.1 on when to use Tank Recirculate Mode. On the first start up the system must be setup with the following items:

1. The **Tank recirculate** mode must be selected. See *Setup Menu section 5.4.1*
2. Enter the capacity of the fresh water tank. This determines some internal settings to optimize the silver electrode life. See *Setup Menu section 5.4.1*
3. Enter the flow rate from the watermaker (if equipped)  
**It is important that this set value is the actual flow from the watermaker. For safe operation the flow should be checked regularly.** See *Setup Menu section 5.4.2*
4. Enter the desired final silver dosage level; 0.025 mg/l (25 ppb) – 0.1 mg/l (100 ppb), typically it will be either 0.04 mg/l (40 ppb) or 0.1 mg/l (100 ppb) and this depends on the ruling administration. See *Setup Menu section 5.4.3*
5. Optional - Enter the volume of water for each pulse when using a flowmeter. See *Setup Menu section 5.4.4*

### 5.1.2 Direct Flow Mode

See section 3.2 on when to use Direct Flow Mode. (Skip this section if using Tank recirculate mode)

On the first start up the system must be setup with the following items:

1. The **Direct Flow** mode must be selected. See *Setup Menu section 5.4.7*
2. Set the desired silver dosage level. See *Setup Menu section 5.4.3*
3. The input for fixed flow must be setup along with flow rate entered. See *Setup Menu section 5.4.8*

The chart below shows the flows that are acceptable for the Ag-S in this mode.

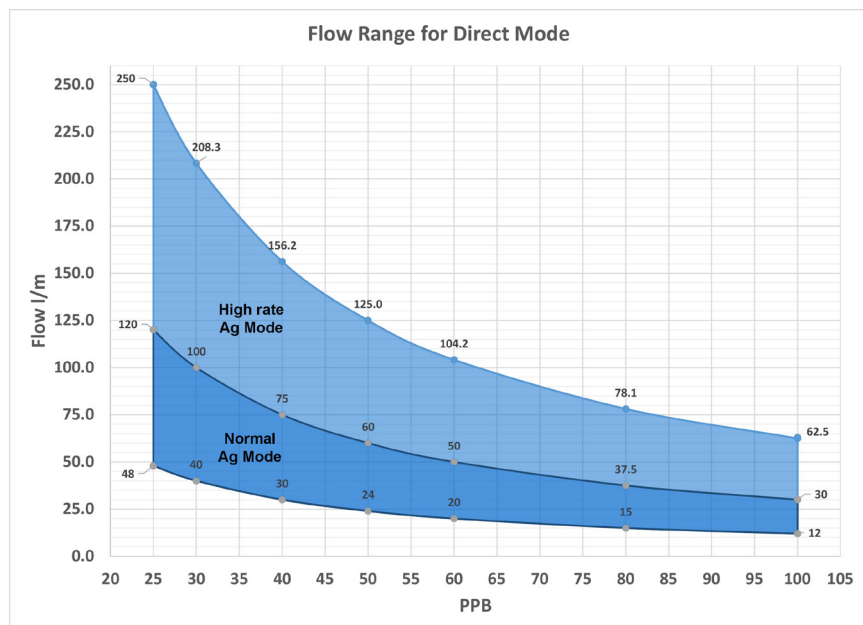


Fig 5.1.2

### 5.1.3 Final Setup

1. Adjust the flow through the chamber to approximately 3 to 4 l/min. by adjusting the flow setting valve. The bottom of the float should be between the 3 and 4 l/min. line. See Setup Menu section 5.4.5 to run water through the system without producing silver ions.
2. Set up Relays if you want to have an external alarm, use a pump to move water through the Ag-S or control another solenoid with the power-on option. See Setup Menu section 5.4.6



## 5.2 Operating the Menu System

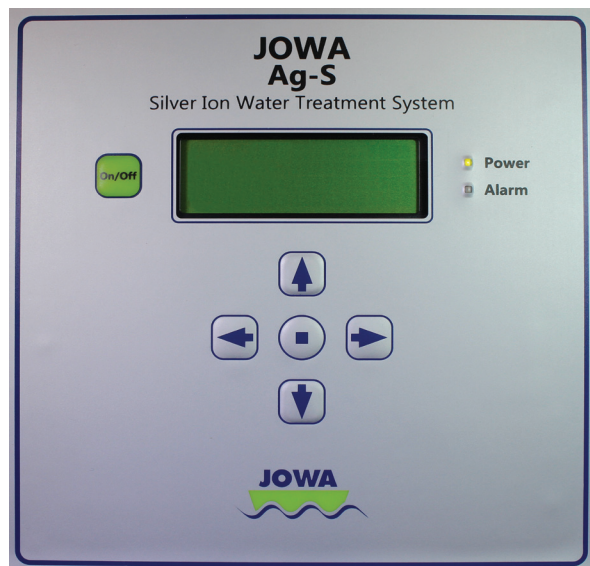
When power is first applied to the unit the application program of the Ag-S is started. It will search for any optional systems (such as remote Ag-S units) that are connected. If only one unit is found it will immediately go to the Main Menu. If you have additional equipment connected to the system then it will prompt you to connect to a particular unit. Pick the serial number of the unit you want to control or display. The serial number is located under the left side screw cover. See section 4.1 for instructions on how to remove the side screw covers.

On the display, the main menu will be shown. This menu consists of a number of screens that allow you to adjust and/or set all the system parameters such as; silver consumption, Relays, Inputs and perform Diagnostics if the system is not operating properly. See Section 5.4 for the complete menu structure.

You navigate in the menu system by pressing the buttons:



The On/Off button turns the display backlight on or off and returns the display to either the main menu or if treating water, to the untreated water status or to the flow status in Direct flow mode. The Ag-S still operates when the display is turned off. The production of Silver Ions is indicated when the Power LED is on steady and not flashing.





Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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### 5.3 Operating Modes

(Under the **Setup** menu **Tank recirculate** or **Direct Flow** must be first selected)

**Volume Mode** – You enter the amount of water to be treated. (Tank recirculate Mode)

1. Select **Operate** and press Enter
2. Select **Untreated water** and press Enter
3. Select **Add** and press Enter
4. Select the units you want to use; **Liters**, **Gallons**, **Cubic meters** and press Enter
5. Using the Left and Right arrows go to the position you want to change and press the Up arrow to increase the value or the Down arrow to decrease the value.
6. When you have input the amount of water that was added press Enter.
7. The display will then show the amount of untreated water and will count down to zero which will indicate that the full amount of water has been treated to the set silver dosage amount.
8. If you want to change the amount of water to be treated press the Left button and it will bring you back to the screen to Add, Show or Reset.
9. You can **Add** more untreated water and this will add the new amount to the existing amount. (See line 3 above)
10. You can **Show** the amount left to be treated
11. You can **Reset** the amount back to zero. You will be asked to confirm that you want to stop water treatment. Either **Cancel** or **Confirm**

**Auto Mode** – When connected to either a flowmeter or the watermaker run signal with water recirculating to a tank. (Tank recirculate Mode)

1. When connected to a flowmeter the proper dosage will be determined by the number of pulses that are received. Setup of the flowmeter input is required. See Setup Menu section 5.4.4
2. When connected to a watermaker and using the run signal a Fixed flow to tank input must be setup. See Setup Menu section 5.4.2

**Direct Flow Mode** – The Silver Ions are dosed into the stream only when water is produced or flowing in the main line. The water flowing signal automatically starts the production of silver ions (See Section 5.4.8 for setting up input).

1. Select **Operate** from the main menu and then **Direct Flow** and the display will show the set flow rate (liters/minute) and Ag PPB concentration when water is flowing. Pressing the On/Off button once if the display is not active or pressing it twice if you are anywhere in the menu system and it will also show the set flow rate and Ag PPB if water is flowing.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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## 5.4 The Menu Structure

In the menu system there are multiple screens to setup, operate, and if needed, diagnose the equipment.

The general way to move within the menu structure is as follows:

The up and down arrows move among the possible choices. You will notice that the actual choice that is currently selected will become a solid triangle. See the example below.

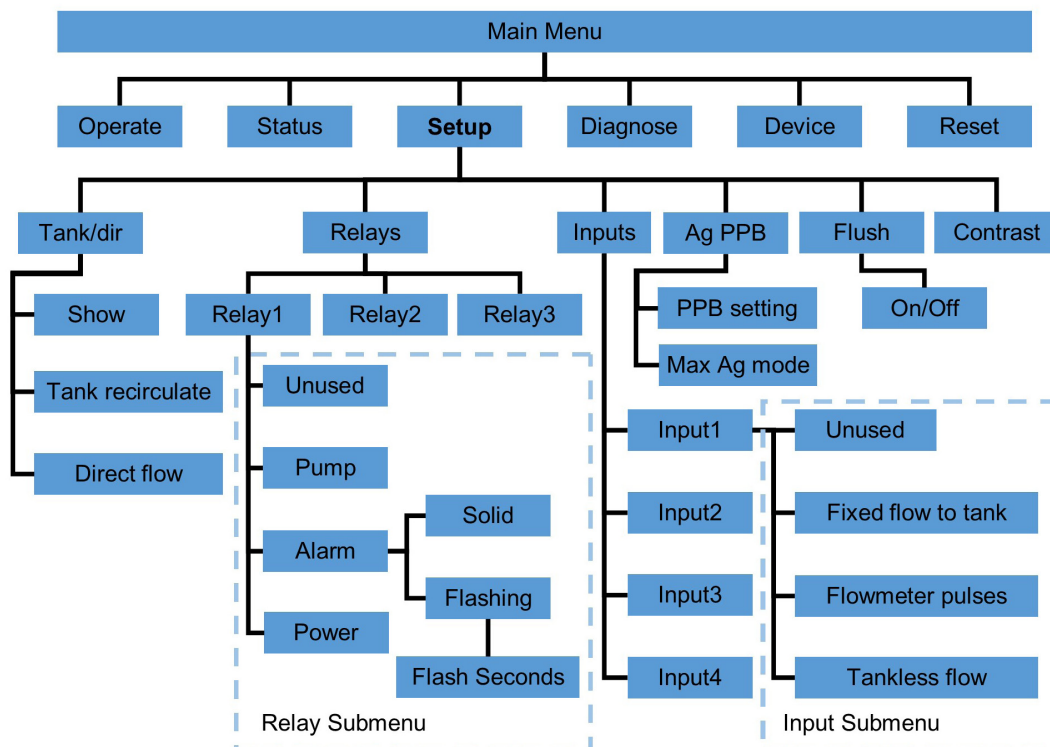
- > This is a possible choice that is not selected
- ▶ This is the possible choice that is selected

When the desired menu item has been chosen, then pressing the center button will select that item and the sub menu items will then be available.

When you have a solid left triangle in the upper left corner ( ◀ ) pressing the left arrow will bring you back to the previous menu.

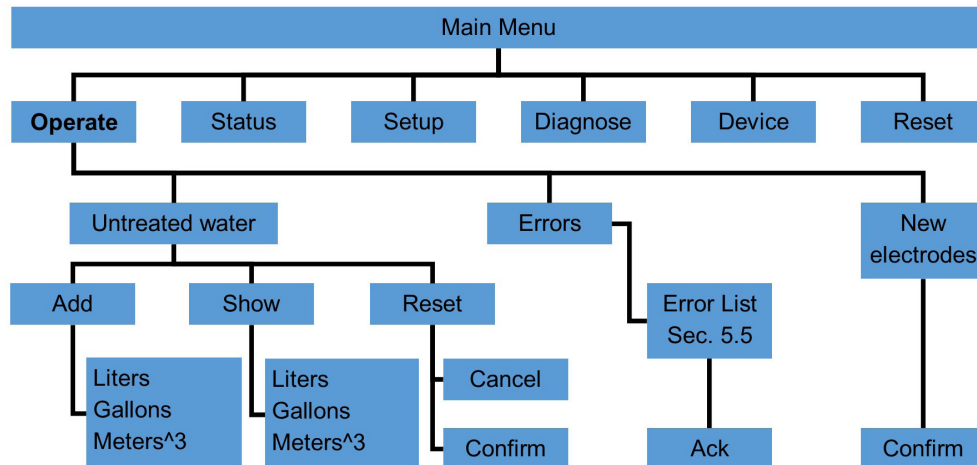
In the figures below you can see the menu structure.

### Setup Menu

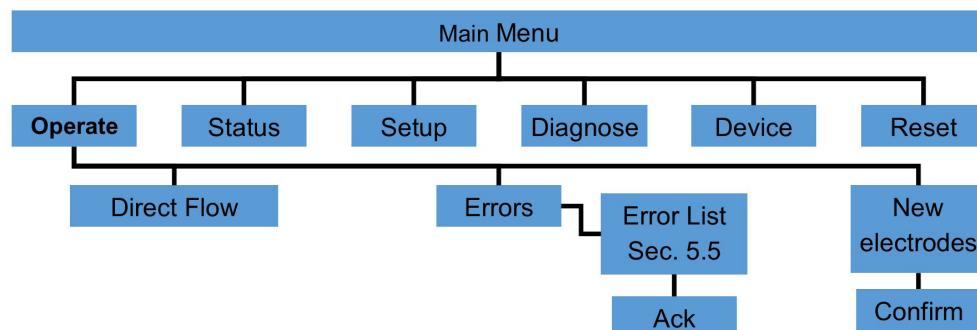




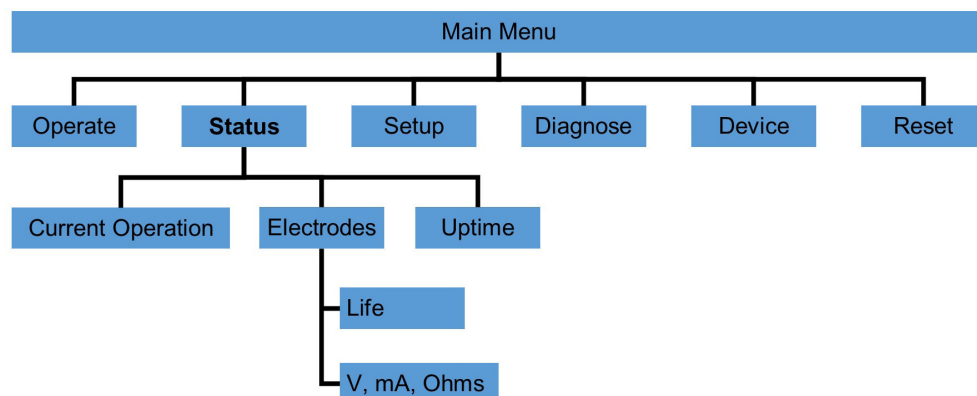
### Operate Menu - Tank Recirculate Mode



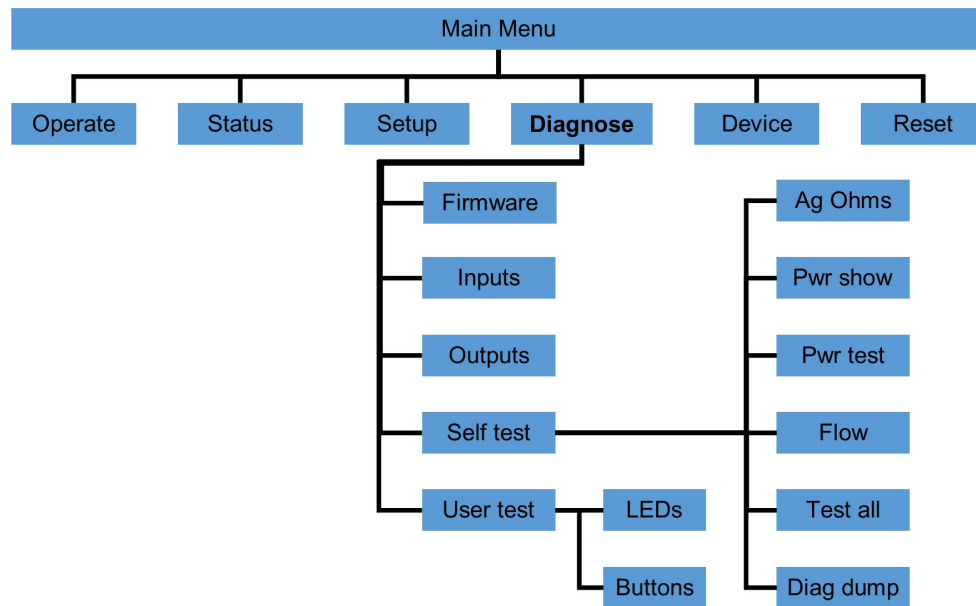
### Operate Menu - Direct Flow Mode



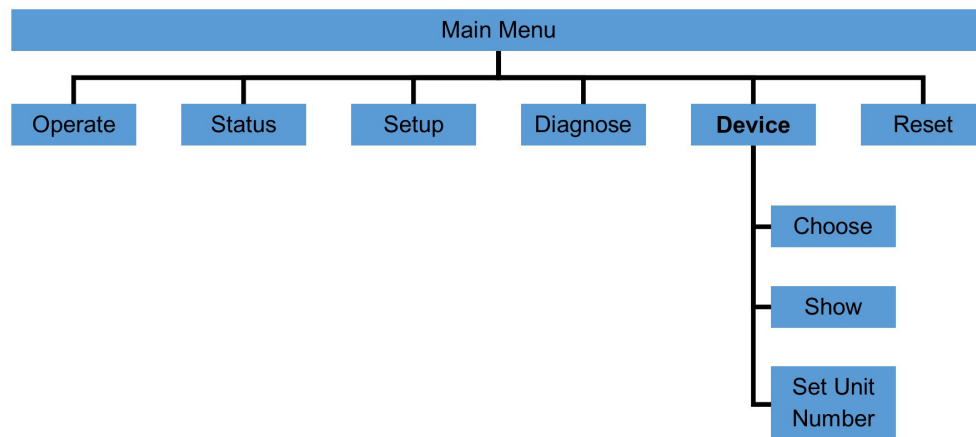
### Status Menu



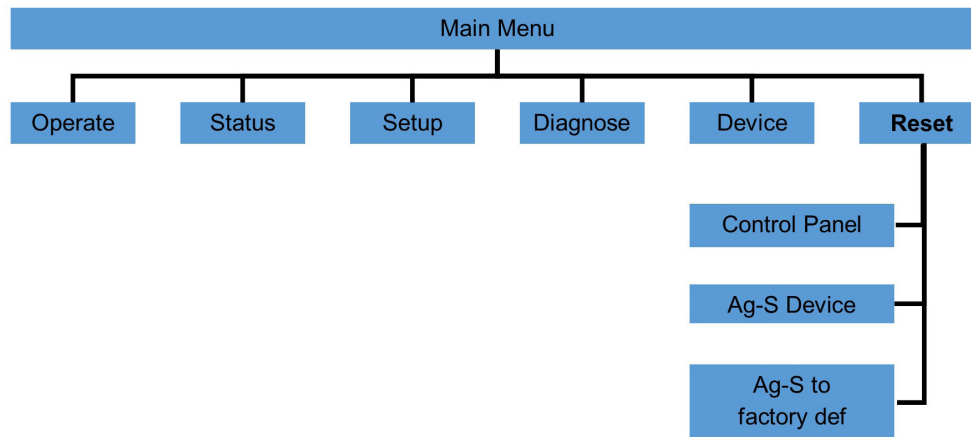
## Diagnose Menu



## Device Menu



## Reset Menu



### 5.4.1 Water System Tank Size Entry

(Tank recirculate Mode) Default setting is 15m<sup>3</sup>

1. Under the **Setup** section of the main menu you need to enter the maximum capacity of your fresh water tank.
2. Select **Tank/Dir** and press Enter
3. Select **Tank recirculate** and press Enter
4. Select **Set** and then Select the units of measure
5. Enter the maximum capacity of the fresh water tank. A value between 3m<sup>3</sup> (793 gal.) and 15m<sup>3</sup> (3,962 gal.) is acceptable. If you have a smaller or larger tank just enter the lowest or highest acceptable value. In Normal mode tank sizes up to 7.2 m<sup>3</sup> (1,902 gal.) will be treated to 25ppb in 1 hour. In High rate mode tank sizes up to 15m<sup>3</sup> (3,962 gal.) will be treated to 25ppb in 1 hour. See section 5.4.3 for setting final silver dosage level for more details.

### 5.4.2 Watermaker Flow Rate Entry (Optional – when using a watermaker)

(Tank recirculate Mode)

1. Under the **Setup** section of the main menu you need to enter the output flow rate of the watermaker.
2. Select **Inputs** and press Enter
3. Select **In 3** and press Enter (typically In 3 or other input if watermaker signal wired to alternate terminal)
4. Select **Fixed flow to tank** and press Enter
5. Select **Set** or if entering this input after a value has already been entered a **Show** option will be available to just show the current value.
6. Select the units of measure and press Enter

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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7. Input the flow rate from the watermaker and press enter
8. Select the watermaker Polarity; **Closed=On** is normal and then press enter


#### 5.4.3 Setting Final Silver Dosage Level

1. Under the **Setup** section of the main menu you need to enter the desired silver ion dosage level.
2. Select **Setup** and press Enter
3. Select **Ag PPB** and press Enter
4. Select **PPB setting** and press Enter
5. Input the target PPB concentration and press Enter (100ppb, 0.1mg/l is the maximum and 25ppb, 0.025mg/l is the minimum). Typically 40ppb or 100ppb is selected and depends on the ruling administration.
6. Option: In the **Ag PPB** menu you can select **Max Ag mode** and then **High rate** if the quantity of water to be treated is greater than 120l/min (31.7 gal/min) and the desire is to treat to greater than 50ppb in less than 2 hours. This mode will consume slightly more silver and might require electrode cleaning on a regular basis.

#### 5.4.4 Set Volume for Flowmeter pulse (Optional – when using flowmeter) (Tank recirculate Mode)

1. Under the **Setup** section of the main menu you need to enter the volume of water for each pulse of the flowmeter.
2. Select **Inputs** and press Enter
3. Select **In 1** and press Enter (typically In 1, or other input if flowmeter signal wired to alternate terminal)
4. Select **Flowmeter pulses** and press Enter
5. Select **Set** or if entering this input with the same input choice a **Show** option will be available to just show the current value.
6. Select the units of measure and press Enter
7. Input the Volume per pulse from the flowmeter and press enter
8. Select the flowmeter Polarity; **Closed=On** is normal and press enter

#### 5.4.5 Flush water through system – when solenoid valve installed

1. In the **Setup** section of the main menu select **Flush** and press Enter.
2. The heading will indicate the current status of solenoid valve; Flushing Off when the valve is closed and Flushing On when the valve is open. If a relay has been setup for Pump it will also close.
3. Press **Enter** to toggle between the two states. The screen will give you the status of Inputs 1 – 4 and the flow switch. A “ – ” indicates not active and a “  ” active. Confirm that all the air has flushed out of the system and then proceed to the next step.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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4. Adjust the flow regulator to 3L/min and confirm that the flow switch opens and closes with the change in the flushing state. If the regulator is confirmed to be at 3L/min and the status does not change, then the flow switch will need to be adjusted. See Section 11 on how to adjust the flow switch.
5. During the Flush operation no Silver Ions will be produced. The system will time out and return to the former state after 5 minutes or when exiting this menu.

#### 5.4.6 Setup Relays (Optional – when using outputs)

1. Under the **Setup** section of the main menu you choose the relay that will be used for the output.
2. Select **Relays** and press Enter
3. Select the relay you want to setup; **Rel1**, **Rel2**, **Rel3** and press Enter
4. Select the desired function for the relay; **Unused**, **Pump**, **Alarm**, **Power** and press Enter
  - Pump – Activates the relay when the Ag-S is treating water with Silver. Used most commonly to turn on a pump if the Ag-S is not connected to a pressurized tank. Typically Relay 1.
  - Alarm – Activates the relay during an alarm condition. The relay remains active until the alarm is acknowledged. See the next step for additional settings. Typically Relay 2 steady.
  - Power – Activates the relay when power is connected to the Ag-S. Typically Relay 3.
5. If Pump or Power are selected then the menu will return to the previous screen. If Alarm is selected then you need to select **Solid** or **Flashing**. If Flashing is selected then the number of times per second the relay will be closed will also need to be selected. Acknowledging the alarm deactivates the relay.

#### 5.4.7 Select Direct Flow Mode

1. Under the **Setup** section of the main menu select **Tank/Dir** and press Enter
2. Select **Direct flow** and press Enter
3. **Confirm** the selection by pressing Enter

#### 5.4.8 Setup Input for Direct Flow

1. Under the **Setup** section of the main menu you choose the input that will be used for the flow signal.
2. Select **Inputs** and press Enter
3. Choose the input you want to setup and press enter. Typically this will be In 1.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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4. Select **Direct Flow** (Tankless flow) and press Enter
5. If a value was previously entered then set a **Show** and **Set** option will be available to just show the current value. Choose **Set** to enter a new value.
6. Select the units you want to enter for the flow and press Enter
7. Use the arrows to select and adjust the value to the known flow rate and press Enter.
8. Select the flow signal Polarity; **Closed=On** is normal and then press enter

## 5.5 Error List

When running the Ag-S a number of errors can occur. The possible errors are listed below. To view this list select **Operate** under the main menu and then **Errors**

- |                         |              |  |
|-------------------------|--------------|--|
| 0                       | No flow      | Flow has not been detected in the Chamber *                  |
| 1                       | Ag shorted   | Resistance measured between the electrodes is below limits * |
| 2                       | Ag open      | Resistance measured between the electrodes is above limits * |
| 3                       | Ag 20% life  | Electrode has been consumed 80% - time to reorder            |
| 4                       | Ag 15% life  | Electrode has been consumed 85% - time to reorder            |
| 5                       | Ag 10% life  | Electrode has been consumed 90% - get ready to replace it    |
| 6                       | Ag 5% life   | Electrode has been consumed 95% - replace it                 |
| 7                       | Ag depleted  | Electrode has been consumed *                                |
| 8                       | Ag comm err  | Communication between system processors stopped              |
| 9                       | Flow not off | Flow detected when flow should be off                        |
| Errors 10 – 15 Not used |              |  |

\* **This indicates that the error will cause the unit to halt operation until the error is corrected. Errors 0, 1, 2 & 7**

When an error is detected the red Alarm LED on the front panel will illuminate. If a relay has been configured to be activated on alarm then the relay will activate. To see the cause of the alarm press the On/Off button on the front panel and the display will show the Error page and the active alarm. If the display was already on then the screen will change to the Errors page. Flow errors that are no longer active will self acknowledge after 2 minutes. Ag shorted or Ag open errors that are no longer active will self acknowledge after 5 minutes.

**Summary:** The error status column will show a **+** when an error is active and a **–** when the error is not active. An **N** indicates that the alarm has not been acknowledged and this will change to an **A** once acknowledged. If only one error is active then the selector will automatically go to that error. If multiple errors are active you can use the up and down arrows to select each error.

**Press Enter to acknowledge an Alarm.**

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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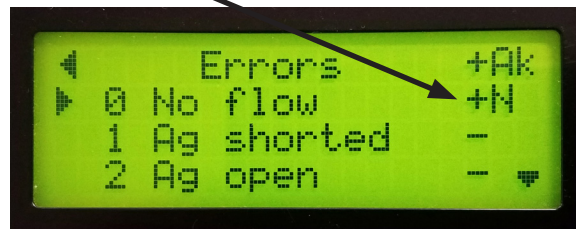
Below are examples of the different conditions for the Errors page.

The status column will show a **-** when that item is not an active error.



Error Screen without any active errors

The status symbol will change to a **+** when the error is active. An **N** will also be shown when the alarm has not been acknowledged.



Error Screen with an active error without Acknowledgement.

The status symbol will remain a **+** as long as the error is active. After the alarm has been acknowledged the **N** will change to an **A**.



Error Screen with an active error that has been acknowledged.



The status symbol will change to a – when the error is not active, however, the **N** indicates that the alarm condition was not acknowledged. This allows you to determine the error and alarm even if the error is no longer active.



Error Screen with an error no longer active that has not been acknowledged

## 5.6 Replacement of the Electrode

When the red (LED) “Alarm” is illuminated and the alarm message number 7 is shown ‘Ag depleted’ the silver electrode must be replaced. The electrode will give you warnings at 80%, 85%, 90% and 95% depleted. These errors can be acknowledged and the system will continue to operate. This gives you sufficient time to order a replacement electrode. Once the “Ag depleted” error message is shown the unit will stop operating.

1. Replace the electrode by removing the black plug by pulling up. Care must be taken to pull on the body of the plug and not the wire.
2. Shut off the ball valves before and after the chamber. (As shown)
3. Remove the electrode by unthreading it from the chamber.
4. Check that the chamber is clean and free from foreign objects and if necessary clean the chamber.
5. Place the new electrode inside the chamber making sure that the provided O-ring is properly seated.
6. Thread the new electrode into the chamber and reconnect the plug.
7. The unit must be told that the electrode was replaced so that it can track usage. Under the **Main Menu / Operate / New electrode** menu you can confirm that a new electrode has been installed. A warning is shown to make sure that you do not select this by mistake.





Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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Scroll down and then **Confirm** or **Cancel**. Press the Left Arrow to Cancel and press Enter to Confirm.

8. Once this is completed the unit will again operate and you can treat additional water.
9. Check for leaks upon operating after electrode replacement and periodically to assure that water does not leak out of the chamber.

The Ag-S is now ready for operation.

## 5.7 Maintenance

Very little maintenance is required as high quality materials are used. The electrode chamber as well as the common base plate are made of polished stainless steel and need no maintenance.

The JOWA Ag-S uses 99.99% pure silver in both of the electrodes and also shifts the current direction once every ten minutes so there is no oxidation or growth on the surface of the electrodes, and so no regular cleaning is required.

## 5.8 Flash Pattern for Power LED

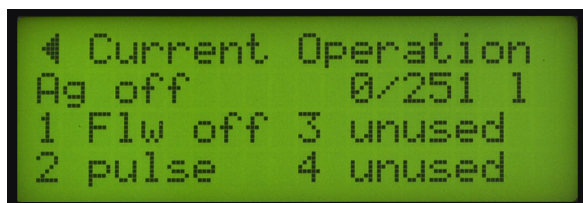
The power LED will either be steady or flashing when power is supplied to the Ag-S.

Flashing On	On once every 2 seconds indicates that the Ag-S has power and ready to produce silver ions.
Steady On	Indicates that the Ag-S is producing silver ions.

## 5.9 Operation Status

The Current Operating status can be viewed by pressing the center **Enter** button when the display is off or by selecting **Main Menu / Status / Current Operation**. The display will show the configured inputs along with any progress of untreated water being added. Based on the tank size and desired PPB level selected at initial setup the start threshold will be shown with the amount of water being added above it. The first screen shot below shows Input 1 setup as Fixed Flow and the flow is off; Input 2 for pulses from a flow meter and 3 & 4 are unused. No water to be treated, 0, and 251 liters needed to start the unit so that it runs for the minimum 2 minutes. As the inputs change the status will indicate the change and the water added will increase until treatment starts. The second screen shot shows that 30 liters were added. Once sufficient water has been added to start treatment the **Ag off** will turn to **Ag on** and the amount of untreated water will count down until all the water has been treated.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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Current Operation Screen with  
no water to be treated



Current Operation Screen with 30 liters of  
water to be treated and more water needed  
to reach the 251 liter minimum to run for 2  
minutes

## 6.0 Trouble Shooting

Section 5.5 lists the possible errors that the system will detect. Below is a chart that can be helpful if the error description does not indicate the issue directly. See section 5.5 for additional details on how to handle errors.

Under the **Main menu** a **Diagnose menu** contains a **Self test** section that will automatically run internal tests to help determine causes of problems. A **Test all** choice will check all internal power supplies, flow control and electrode resistance.

Problem	Cause	Correction
Green Power (LED) not illuminated or flashing	No power to the Ag-S. A fuse is defective	Check the power Replace fuses
Red Alarm (LED) is illuminated or flashing  Error 0 is shown  If display is blank press the On/Off button to show the error screen	Flow has not been detected in the Chamber  Flow switch out of adjustment  Defective flow switch	Check the water flow in the chamber. Flow regulator should be set for 3 l/min.  Check the adjustment. (see Section 11, PN 9801010)  Replace flow switch if defective

Continued on next page

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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Problem	Cause	Correction
<p>Red Alarm (LED) is illuminated or flashing</p> <p>Error 1 is shown</p> <p>If display is blank press the On/Off button to show the error screen</p>	<p>Contamination between the electrode plates</p> <p>Electrodes were damaged</p> <p>Wires to electrodes shorted</p>	<p>Run Flush under the Setup menu at higher than normal flow rate</p> <p>Check the electrodes in the chamber and remove debris</p> <p>Replace electrode in the chamber.</p> <p>Replace wires to electrode</p>
<p>Red Alarm (LED) is illuminated or flashing</p> <p>Error 2 is shown</p> <p>If display is blank press the On/Off button to show the error screen</p>	<p>The silver electrode is used up.</p> <p>The conductivity of the water is too low.</p> <p>Wires to the electrode are not connected.</p>	<p>Replace silver electrode.</p> <p>Use a filter to add minerals to the water.</p> <p>Properly connect the wires to the electrode</p>
<p>The Ag-S cannot be started remotely (Tank recirculate mode)</p>	<p>There is no signal from watermaker.</p> <p>The signal is not connected to the correct terminal</p> <p>The input terminal was not configured as Fixed flow to tank</p>	<p>Check signal from watermaker. LED by input terminal will indicate the status or on the display by selecting <a href="#">Diagnose, Inputs</a></p> <p>Check connection to terminal</p> <p>Check SETUP / INPUTS to see if Fixed flow to tank is set for terminal</p>
<p>The Ag-S cannot be started remotely (Direct flow mode)</p>	<p>There is no signal from watermaker.</p> <p>The signal is not connected to the correct terminal</p> <p>Input terminal was not configured as Direct flow</p>	<p>Check signal from watermaker. LED by input terminal will indicate the status or on the display by selecting <a href="#">Diagnose, Inputs</a></p> <p>Check connection to terminal</p> <p>Check SETUP / INPUTS to see if Direct flow is set for terminal</p>

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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Problem	Cause	Correction
Ag-S is not recognizing the pulses from flow transmitter.	There are no pulses coming from flow transmitter  The input terminal was not set to Flowmeter  Volume per pulse was not set properly in the setup	Check pulses from transmitter (Menu <a href="#">Diagnose, Inputs</a> – Input should count from 1 to 9 then A to F)  See Section 5.4.4 for setting up flowmeter input
Red Alarm (LED) is illuminated or flashing  Error 8 shown	The multiple processors that make up the system are not communicating properly	Turn power off to the system and restart.  An option to a power cycle is to press the reset button located on the main PCB located below the left power supply and labeled reset on the board
Red Alarm (LED) is illuminated or flashing  Error 9 shown	The flow switch input detects flow when flow not expected	Check the flow setting of the flow switch; see error 0 above for actions
Water is going into the tank, however, the Ag-S is not indicating silver ions are being produced. (Tank recirculate mode)	Not enough water has entered the tank to run the unit for a minimum of 2 minutes	Wait until more water has entered the tank  If a quicker response is desired then adjust the tank size, see Section 5.4.1

## 6.1 Resetting the Ag-S

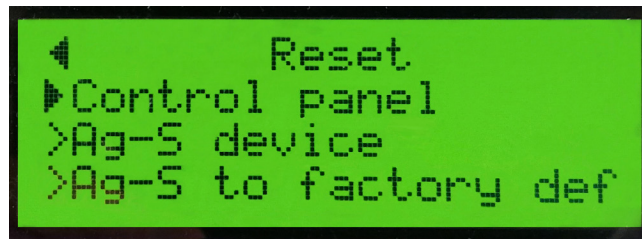
In the rare case that the Ag-S needs to be reset it has three options:

**Control panel** – This choice would be used if a remote display is used and that display is not working correctly. It restarts only the display board that is connected directly to the panel being operated. No setup data is lost during this reset.

**Ag-S device** – This choice will reset the main board and will reset the display board that is directly connected to it. If no remote display is used this will be the panel that is being operated. No setup data is lost during this reset.

Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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**Ag-S to factory def** – This is a reset of all the settings within the device to the factory default. All user settings will be erased and must be reentered. A second warning screen is displayed if this option is selected to confirm that you want to reset to factory defaults. After selecting this you will need to go back to section 5.4.1 and enter all the setup parameters.



Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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## 7.0 Spare Parts List

Part Number	Description
30002-24209	Silver electrode*
32152-00016	Flow regulator, DN15 2-8 l/min
33026-00002	Connection plug, female
19001-15156	Ball Valve, DN15 female/female
9801010	Flow switch, DN10, G $\frac{3}{8}$ " 2 l/min
9801007	Solenoid Valve, G $\frac{1}{2}$ ", 24VDC
9400105	Ball Valve, DN10 male/male
2165804	Main Board, PCB Assembly
2165821	Display Board, PCB Assembly
2165801	Membrane Switch
9170302	Fuse, Cartridge, 250V, 1.5A Slow Blow

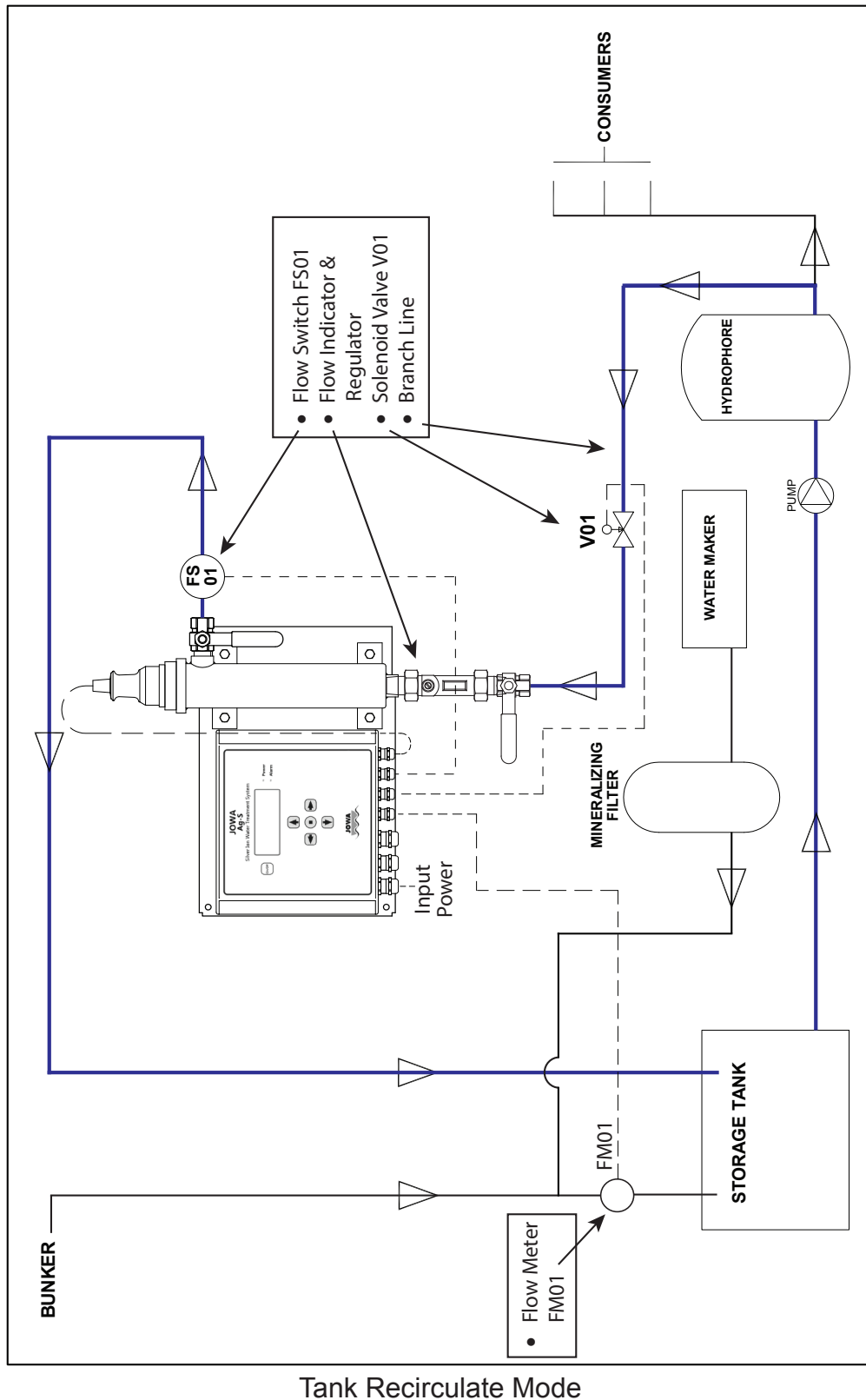
### Optional Parts

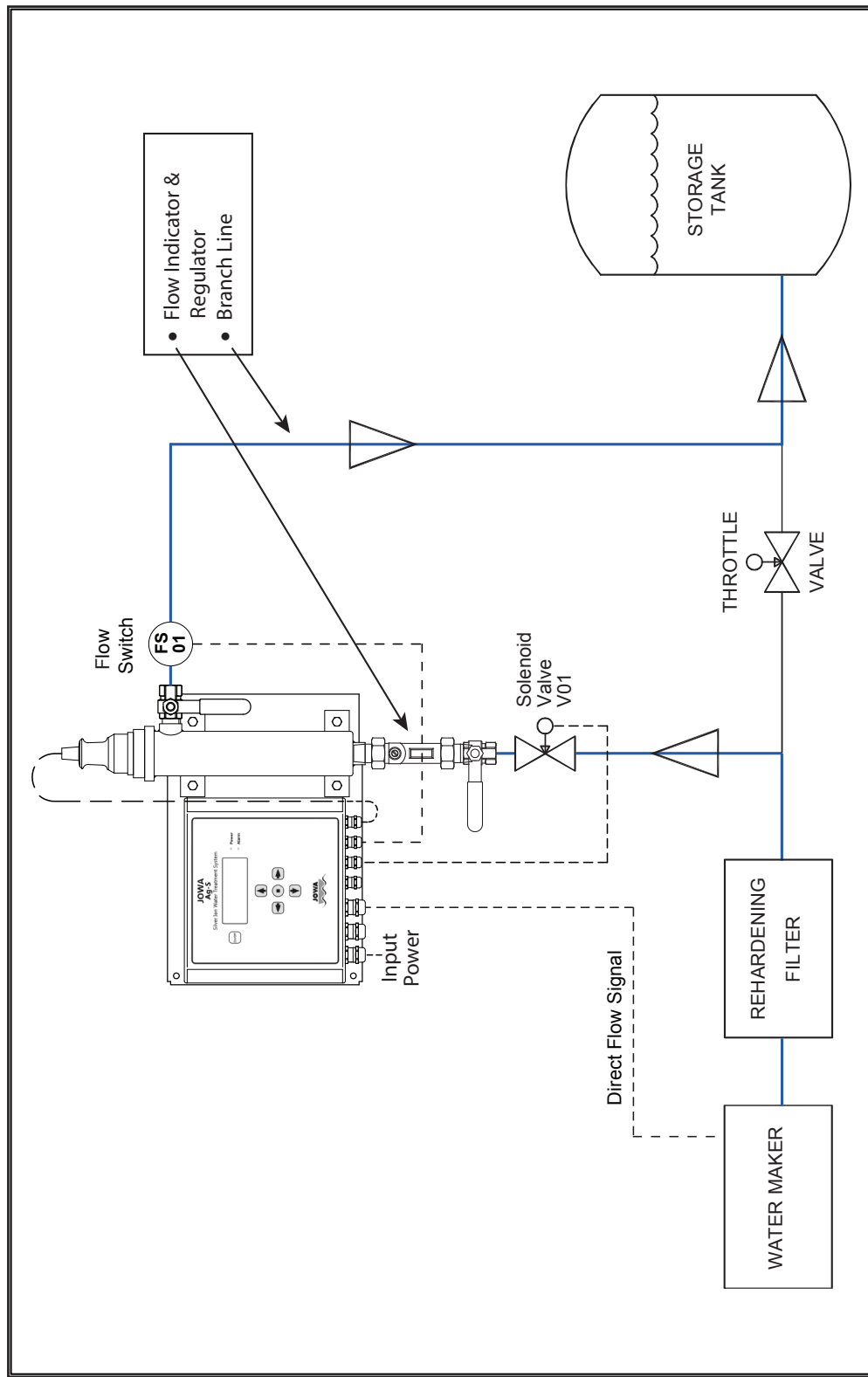
92000-00023	Flowmeter, G1" union connection, 10 L/Pulse (min. 120l/m, max. 12m <sup>3</sup> /h)
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\*Silver electrode is the only recommended spare part for 2 years operation

Contact your local JOWA office for Spare Parts or go to [www.jowa.com](http://www.jowa.com) for more information.

## 8.0 Flow Diagrams





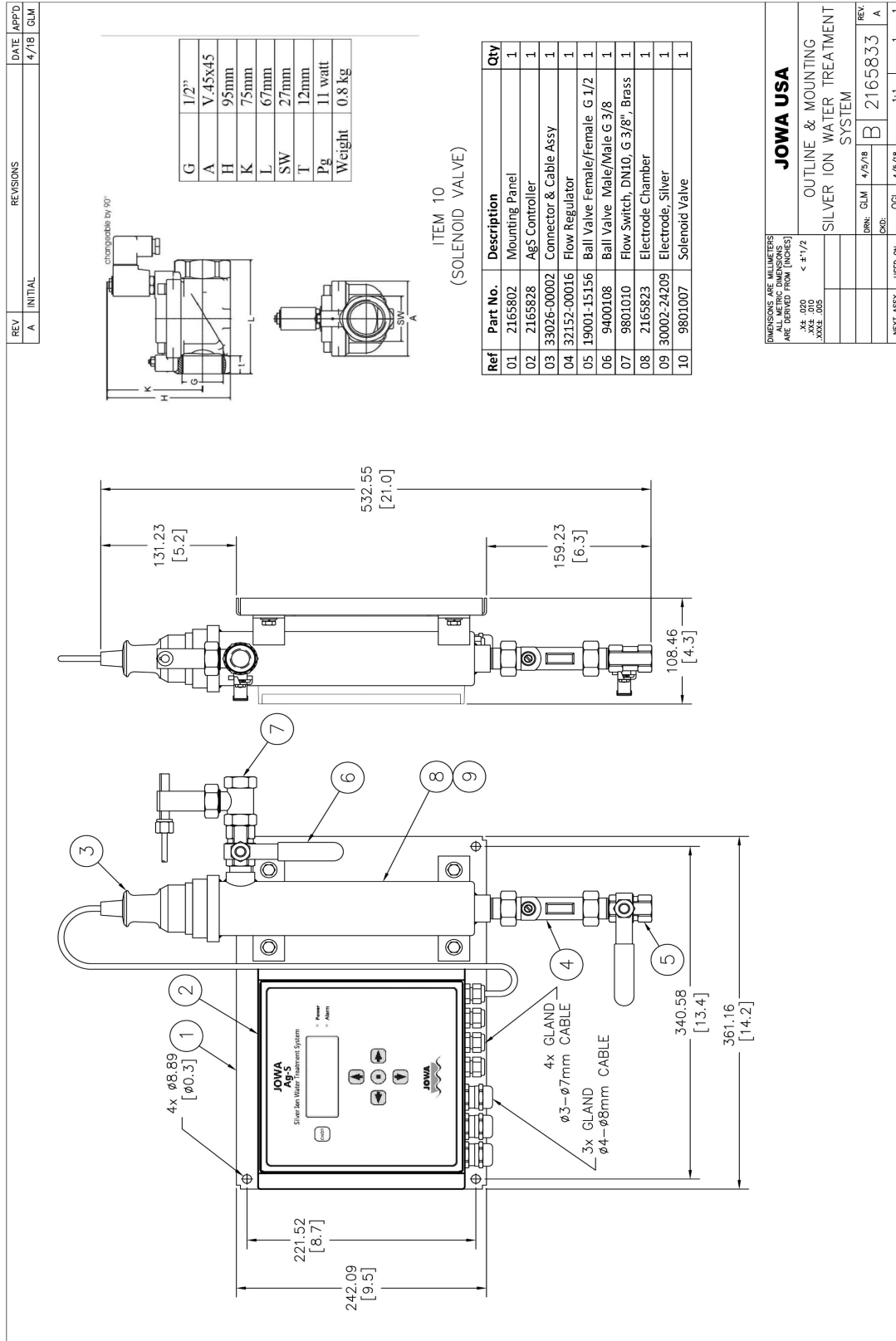
Direct Flow Mode



Date: 2021-11-17  
Manual: M395  
Rev: H4

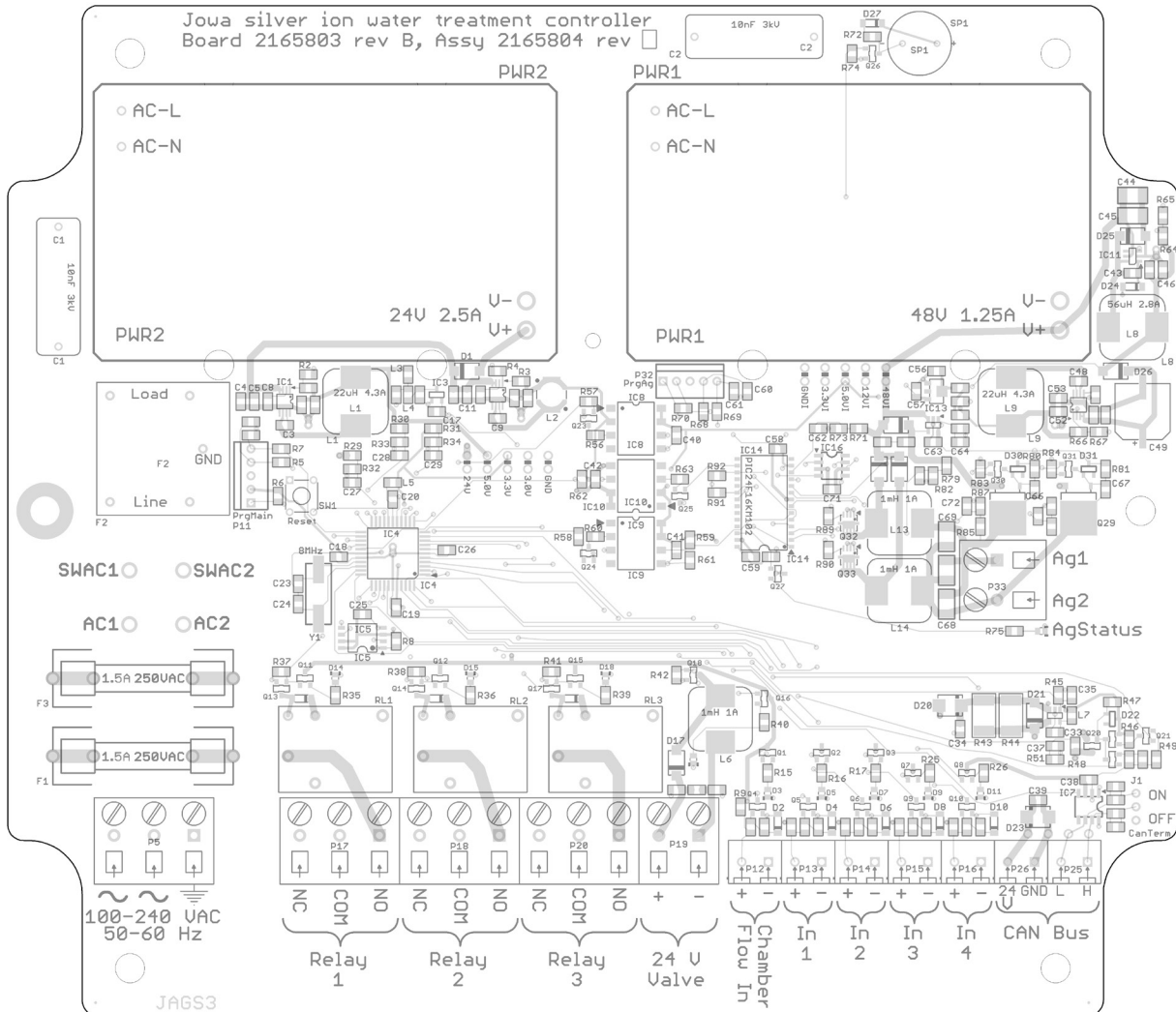
# JOWA Ag-S Silver Ion Water Treatment System Standard

## 9.0 Mechanical Drawings

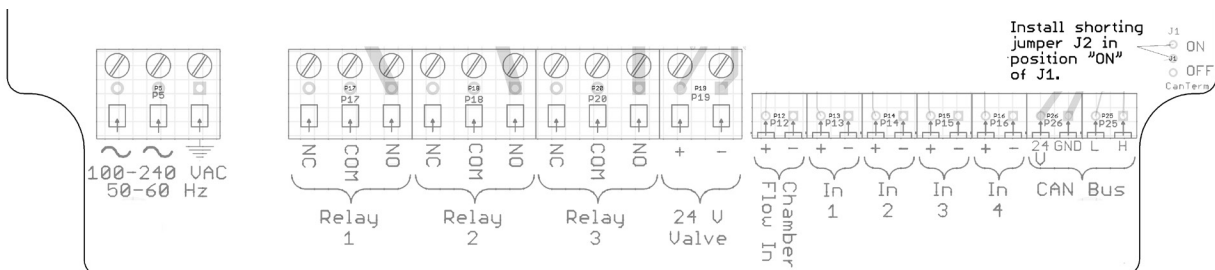


## 10.0 Electrical Drawings

Below is the PCB layout for the main board.



The area most important for the user is the terminal connections at the bottom of the board. Section 4.3 gives a description of each of the connections.



Date: 2021-11-17 Manual: M395 Rev: H4	JOWA Ag-S Silver Ion Water Treatment System Standard
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## 11.0 Additional Items

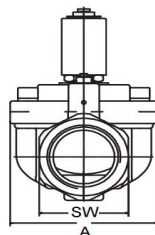
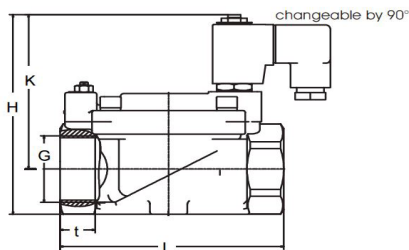
### Shut off Solenoid Valve; PN 9801007

#### Standard type

Valve normally closed - NC. When energized, the pressure decomposes on the secondary side of the diaphragm via the pilot hole. The pressure differential lifts the piston from the seat. The stated minimum pressure is always necessary as pressure differential for accurate operation.



Type of control:	Pilot operated	Metallic internals:	Brass and stainless steel(AISI430F)
Construction:	Diaphragm design	Sealing:	NBR
Connection:	G1/2, DIN ISO228	Installation:	Actuator in any position, preferable upright
Pressure:	0.3 - 20 bar	Supply voltage:	DC:24
Medium:	neutral, gaseous and liquid	Voltage tolerance:	+10%/-10%
Viscosity:	22mm²/s	Power-consumption:	6.8 Watt
Medium temp.:	-10 up to +80°C	Protection class:	IP65 according to DIN 40050
Ambient temp.:	+35°C	Duty factor:	100% ED-VDE0580
Body material:	Brass	Cable connection:	DIN 43650 - plug



G	1/2"
A	V.45x45
H	95mm
K	75mm
L	67mm
SW	27mm
T	12mm
Pg	11 watt
Weight	0.8 kg

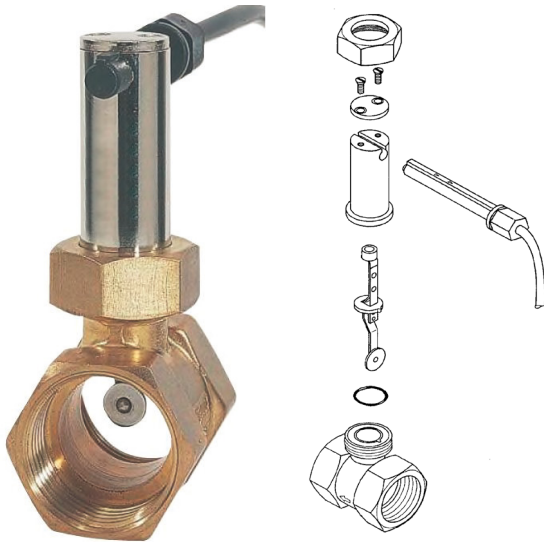
Date: 2021-11-17  
Manual: M395  
Rev: H4

JOWA Ag-S  
Silver Ion Water Treatment System  
Standard

## Flow Switch Model; PN 9801010

### Description

Depending on the flow velocity, the baffle plate is deflected and it moves the balance arm and the permanent magnet into the operating range of the reed contact that is mounted outside the process fluid.



The leaf spring, which also serves as a support for the balance arm, forces the baffle plate back to its rest position when there is no flow. The baffle plate flow monitors are supplied completely assembled.

### Switching point setting

To set the switching point loosen the locking washer at the top of the casing and move the contact unit. Moving the contact unit in the direction of flow will activate the switch at lower flow rates.

The front edge of the locking washer serves as the adjustment mark.

Note: Use the Flush feature under the Setup menu to control the solenoid valve to turn the flow on and off. This screen will also show you the status of the flow switch.

Make sure that the flow input is on during flow and off without flow.

### Technical Details

Rising flow rate: 2.0 l/min.  $\pm 15\%$   
Nominal size: DN10  
Connection: G  $\frac{3}{8}$ "  
Medium temperature: 100°C maximum  
Ambient temperature: 70°C maximum  
Max. pressure: 25 bar  
Protection type: IP65  
Preferred mounting: Upright  
Inlet/outlet: 5 x DN (Both)

### Electrical Details

Max. current: 1.5 A  
Max. voltage: 230VAC/DC  
Max. rating: 80 W, 90 VA  
Cable: PVC (1.5m)

### Materials

Case: Brass  
Baffle Plate: St. Steel  
Leaf Spring: St. Steel  
Balance arm: St. Steel  
Sleeve: Brass  
Seal: NBR

