

Fertimix User's manual

Eldar-Shany is thanking you for choosing our *Fertimix* irrigation and fertigation machine. For more than 20 years we do not spare efforts to develop and provide with the best software and hardware solutions for friendly and accurate control of intensive agriculture. We, in Eldar-Shany, have the confidence that using our product by following the instructions of this manual will bring you many years of satisfying results and prosperity with the regarding project.

This manual book will guide you through installation, First operation of the machine, Regular operation and maintenance.

Note: Fertimix is provided with Galileo controller, and operated by Eldar greenhouse irrigation software. Apart of few concerned paragraphs – Installing and operating the Galileo controller is fully explained in the *Galileo setup manual book*, and the operation of the Greenhouse irrigation software is fully explained in the *Greenhouse irrigation manual book*. You will be directed to those books in the right points. If you use the Galileo PC center you will find all the regarding information in the *Galileo PC center manual book*.

The chapters of this book:

1. Pre-Installation infrastructure recommendations – provided as a separate document prior to the Fertimix shipment.
2. General description (major parts)
3. Place and connect.
4. Description of the mixing procedure.
5. First time operation.
6. Maintenance.
7. Appendix A – layouts.
8. Appendix B – Parts list and ordering information.
9. Appendix C – troubleshooting.

Fertimix majour parts

1. Water inlet, Water meter.
2. Fill valve.
3. Mixing tank.
4. Mixer pump.
5. Main irrigation valve.
6. Manual by-pass.
7. Water outlet.
8. Float valve
9. Venturi fertilizer injectors
10. EC-pH unit
11. EC-pH smpling cup and Electrodes
12. Tank level sensor
13. Electrical control box.

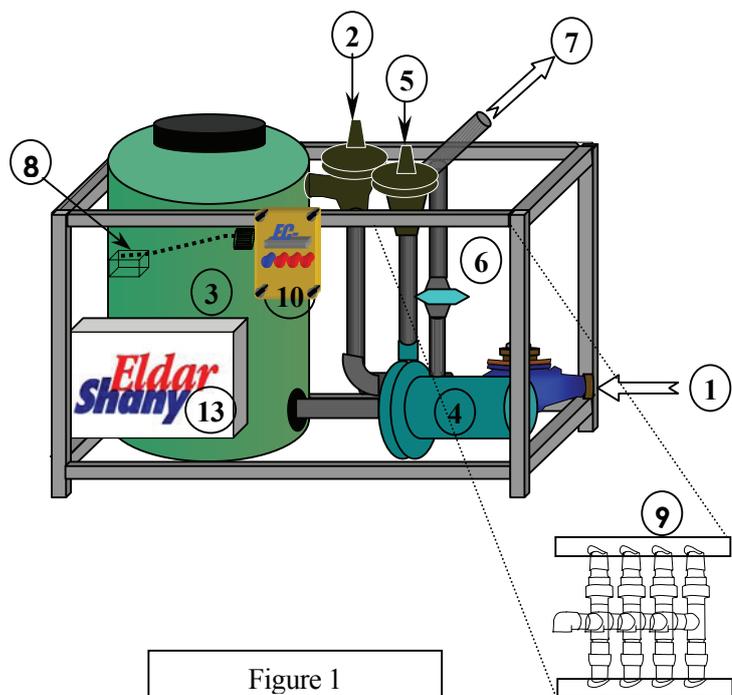


Figure 1

Principle of operation:

The irrigation water is filled into a pressure-less tank together with all the required dissolved fertilizers. A booster pump is pumping the water from the tank to the irrigation plot and to serve a set of fertilizer injectors that based on Venturi principle. ES basic concept requires emptying of the mixer tank at the end of each irrigation session, in order to avoid wrong applying of water-fertilizer solution.

Note that all the following described behavior is software-dependend and may be changed by the controller's manufacturer.

Verbal description:

Stage 1: The unit receives a command to start irrigation. The tank stat at this point should be empty.

The Fill valve opens.

The system expects to receive emitted pulses from the water meter.

Stage 2: The water level in the tank reaches to the **pump start** set point (usually 10-30% of the tank capacity).

The booster pump starts.

Fertigation program starts (including EC and pH control).

Stage 3: The water level in the tank reaches to the **main valve open** set point (usually 60-80% of the tank capacity).

The main valve opens.

The float valve keeps the filling flow in correlation with the irrigation flow.

Stage 4: The required water amount has passed through the water meter.

The fill valve closes.

No more water pulses expected.

The emptying timer is set – The tank level suppose to initialize within a reasonable given time.

The main irrigation valve remains open.

The booster pump remains ON.

The fertigation program stops.

Stage 5: The water level in the tank reaches to the **stop pump** set point (0 is recommended)

The booster pump stops.

The main valve closes

Tabular description:

Event \ Component	At irrigation program start	Begin of fertigation	Begin of irrigation	All water delivered	End of irrigation
Filling valve	OPENS	OPENED	OPENED	CLOSES	CLOSED
Water meter	Emit pulses	Emit pulses	Emit pulses	Idle	Idle
Tank level	Low (0)	Reaches to 'pump stat' set point (10-30%)	Reaches to 'Min valve open' set point (60-80%)	Variates from 40 to 90%	Reduced to 'level to stop pump' set point (0).
Booster pump	OFF	STARTS	ON	ON	STOPS
Fertigation program	OFF	STARTS	ON	STOPS	OFF
Main valve	CLOSED	CLOSED	OPENS	OPEN	CLOSES

Continuous mode - Principle of operation:

For applications with unique type of crop, where the cycle time is uptight, there is a mode of operation that enables constant irrigation on programs change. 2 conditions are essential to operate this mode:

- The water quantity must be either Minutes or Seconds in both ending and starting programs.
- Both ending and starting programs must use the same fertigation program.

There is no need in any other definition. The system counts time from Main valve opening and swap to the next valve without emptying the tank or stopping the pump when the time is done.

Detailed description of the components

1. The water meter

The water-meter is rated according to the Fertimix nominal size and its expected flow rate. However, the pulse size may be requested other than the standard one, according to the application optimization.

Model:	1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
W. meter type	Arad multijet 1" Qn5		Arad multijet 2" Qn15		Bermad WT 3"		Bermad WT 3"	
Standard pulse size	1 liter	1 gallon	10 liter	1 gallon	10 liter	10 gallon	100 liter	10 gallon

See more technical details in appendix A.

2. The fill valve

The fill valve assembly is including 4 components:

- A globe type hydraulic valve.
- Solenoid valve.
- Diamond valve + orifice tee.

8. A float valve (Item 8)

This unique hydraulic circle enables a smooth balance of the filling flow against the taken flow.

The position of the fill valve is in a high point for good accessibility in case that maintenance is needed.

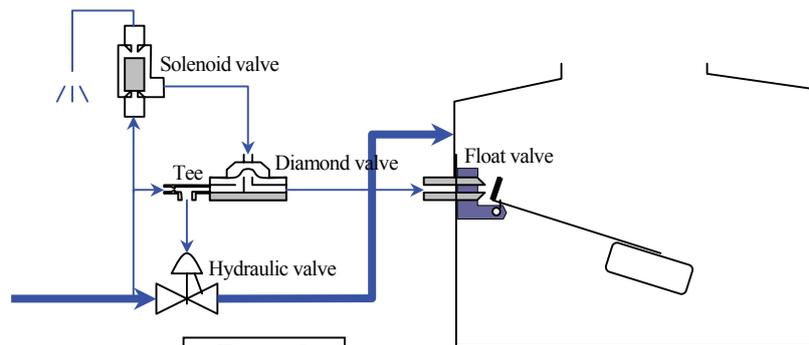


Figure 2

Types of valves:

Model:	1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
Valve - Bermad	205-00-01-G-BP-2W-M		205-00-02-A-BP-2W-M		R05-03-00-A-I-BP-M		405-00-03-G-I-BP-M	
Solenoid valve	S200-3W-24-AC-50-NO							

3. The mixing tank

A polyethylene tank sized according to the Fertimix model.

Model:	1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
Tank capacity	100 liter	200 liter	280 liter	500 liter				

4. The Mixer pump

A centrifugal or multi-stage pump, applied with the fully required protection and the automatic operation set, as required by the application and local safety codes.

Model:	1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
Pump type	Calpeda NM 25/20A		Calpeda NM 40/16A		Calpeda NM 50/20B		Grundfos CR-64-2	
Pump Voltage	~3/380V	~3/460V	~3/380V	~3/460V	~3/380V	~3/460V	~3/380V	~3/460V
Pump size Kw/HP	3 Kw	4 HP	4 Kw	5.5 HP	9.2 Kw	12 HP	7.5 Kw	10 HP
Thermo-Magnetic Protection	Allan-Bradley 140-MN-0630		Allan-Bradley 140-MN-1600		Allan-Bradley 140-MN-2500		Allan-Bradley 140-MN-2500	
Contactora	Allan-Bradley 100-M09NKD31		Allan-Bradley 100-C09KO1		Allan-Bradley 100-C23K01		Allan-Bradley 100-C23K01	

5. Main irrigation valve

Model:	1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
Valve - Bermad	205-00-01-G-BP-2W-M		205-00-02-A-BP-2W-M		R05-03-00-A-I-BP-M		405-00-03-G-I-BP-M	

6. Manual By-pass

The manual by-pass is a PVC ball/butterfly valve that needs to be opened only in case of total controller failure. Opening the by-pass valve is practically disabling the entire machine functionality. When the by-pass valve is opened – the main valve (5) must be manually closed to avoid water back-leak to the tank and out.

7. Water outlet (Fertimix's downstream)

Where the irrigation system should be connected. Notice that no check valve or secondary filtration is provided with the Fertimix.

Model:	1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
Outlet connection	Tread 1" BSP	Tread 1" MNPT	Tread 2" BSP	Flange 2" ANSI	Flange 75mm BS	Flange 3" ANSI	100 liter	10 gallon

9. Venturi Fertilizer injectors

See appendix B below.

10-11. EC-pH monitor and probes

See associated EC-pH manual.

12. Tank level sensor

The standard sensor is an ES product. The electronic unit is placed in the electrical box (13) and senses the water level by an air tube. The air tube is positioned vertically in the tank and opened in its bottom. As the level rises it creates air pressure in the tube which translated to an analog value. Empty tank should transmit 4 mA, while a full tank should transmit 20 mA.

Note that this sensor is not designed for a precise long-term reading of constant non-zero level. The captured air tends to loose and the result is false reading. The basic assumption is that the tank is emptying at least once an hour. If [continues mode](#) is applied – it is recommended to set a short quantity irrigation once an hour to initiate the pressure in the tube.

The level sensor definition is always from 0 to 100. It is hence referring to percentage of the tank capacity. Since we use different sizes of tanks to the different models, A new sensor is always provided non-calibrated, and must be locally calibrated.

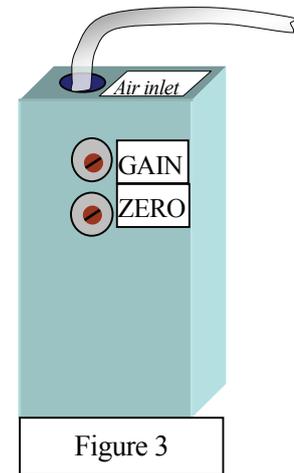


Figure 3

Calibration of the level sensor:

- Step a: Plug the new level sensor.
 - i. Ensure that the water level in the tank is below the tube's lower end.
- Step b: View the sensor current value in the controller at address <62 row 11>
- Step c: Use 2mm screwdrivers to adjust the ZERO screw to display 0.
- Step d: Fill the tank up to its overflow point.
 - i. Set the fill valve solenoid lever to manual open.
 - ii. Open the tank's cover and wait for the water to reach to the point where it stops filling due to the float valve.
 - iii. Press the float valve's arm down and let the water continue filling until the water reaches the overflow outlet.
- Step e: Use 2mm screwdrivers to adjust the GAIN screw to display 100.

13. Electrical control box

- 1) The Fertimix Electrical control box contain the following components:
- 2) Connection bar.
- 3) Motor Thermo-Magnetic protection.
- 4) Contactor
- 5) Transformer (mains ~1) to ~24V / 200 VA for local consumers and for the controller.
- 6) One or two 3R-W cards (3 Triacs) for fertilizer valves and the contactor's operation.
- 7) Analog level sensor assembly.
- 8) Auto-OFF-Manual switch for the Fertimix pump.

Fertimix User's Manual



- 9) A 6A protective switch for the ~1 mains.
- 10) See appendix D for detailed layout

Technical specifications.

Infrastructure requirements: ('A' modules are for USA, Mexico and all other 60 Hz network countries)

Subject		Model:		1" E	1" A	2" E	2" A	3" E	3" A	3" HFE	3" HFA
Rated flow	Maximum	6.5 m ² /h 30 GPM		20 m ² /h 90 GPM		35 m ² /h 150 GPM		55 m ² /h 250 GPH			
	Minimum	0.15 m ² /h 0.7 GPM		1 m ² /h 4.5 GPM		5 m ² /h 22 GPM		15 m ² /h 66 GPH			
Electrical supply	Controller mains voltage	~1 220V 50Hz	~1 120V 60Hz	~1 220V 50Hz	~1 120V 60Hz	~1 220V 50Hz	~1 120V 60Hz	~1 220V 50Hz	~1 120V 60Hz		
	Controller mains current	6A									
	Water pump mains voltage	~3 380V	~3 460V	~3 380V	~3 460V	~3 380V	~3 460V	~3 380V	~3 460V		
	Water pump mains ampere	16A	10A	20A	16A	25A	20A	36A	25A		
Water supply	Minimum inlet pressure	30 m (40 PSI)		35 m (50 PSI)		40 m (60 PSI)					
	Maximum inlet pressure	40 m (60 PSI)		50 m (70 PSI)		55 m (80 PSI)					
	Water quality	Max. Solid size 50 micron (0.05 mm)									
	Downstream pressure	40 m (60 PSI)		45 m (70 PSI)		50 m (75 PSI)					
	Own tank capacity	100 liter		200 liter		580 liter		500 liter			

Place and connect.

- Step 1: Read and follow all the directives in **ES** Pre-Installation guide.
- Step 2: Unpack the Fertimix and check all enclosed assemblies according to the packing list.
- Step 3: Place the Fertimix in its position.
- Step 4: Connect inlet and outlet pipes, and all the fertilizer hoses to their store-tanks. **Important!** – No weigh can be applied on the Fertimix outlet.
- Step 5: Call connection of both ~3 and ~1 mains by local qualified electrician. Press the protection green switch ON, and check the pump's motor rotation direction using the 'Manual' switch.
- Step 6: Call connection of the controller by ES qualified technician and do all necessary definitions according to the directives of 'Galileo Setup' manual, The diagrams in appendix D and the specific directives of the 'Greenhouse irrigation' manual.
- Step 7: Check the water supply pressure consistency and its valid operation by the controller's main pump output when sets to 'Automat'.
- Step 8: Place the EC and pH probes in the sampling cup and perform probes calibration according to the instructions in the EC-pH 3050 user's guide.
- Step 9: Assemble the float valve (The float is removed to avoid shake damage in delivery).
- Step 10: Check all solenoid levers to Automat position.

Your Fertimix is now ready for first operation.

Operation

For your convenience we bring here some of the relevant paragraphs from the 'Greenhouse irrigation' manual. The below setting is exclusive to the Galileo Greenhouse 2.04, and is subject for further changes.

Irrigation Setup:

Text in controller <i>Text in PC</i>	Description	Code	Recommended value
(Irrigation) system active? <i>System active?</i>	Activates or inactivates the entire system. Initiates the irrigation memory block in the RAM.	5211 #1	Yes
(Irrigation) system number. <i>System number for messages and data coll.</i>	The system number must be unique for all Galileo systems that are connected to the same PC, including climate, poultry and open field modules.	5211 #2	11-19 or 51-59
Info Cycle mnt <i>Sensors data coll. Cycle min.</i>	In case of engaging sensors to the irrigation system – set the time between each sensor recording in the PC file.	5211 #9	30
System type * <i>System type</i>	Set to 'Mixer'.	5211 #3	Mixer
Max. prog. number <i>Irrigation programs No.</i>	The number of the highest actual implemented irrigation program. In the controller you will not be able to access any higher program number than the one set here. In a PC, you can access and program them, but they will never operate.	5211 #4	50-100
Water counter exist <i>Water counter exist</i>	The system is capable of working without a hydrometer. In such a case, only pre-set flow rates for valves will be used for fertilizer calculation (besides EC off course) and irrigation ending.	5211 #5	Exist
Wtr. Pls. Size ltr <i>Water counter pulse size – liter</i>	The amount of water measured each time a pulse is received from the hydrometer.	5211 #6	See device
Irig. EC gen. Sen. No. <i>EC-1 gen. Sensor No. for irrigation control</i>	Set the EC sensor from General Sensors Registration table as the sensor for irrigation control. All compounded irrigation machines are preset with general sensor No. 1	5211 #7	1
Irig. pH gen. Sen. No. <i>pH-1 gen. Sensor No. for irrigation control</i>	Set the pH sensor from General Sensors Registration table as the sensor for irrigation control. All compounded irrigation machines are preset with general sensor No. 2	5211 #8	2

Mixer Setup:

Text in controller <i>Text in PC</i>	Description	Code	Recommended value
Tank volume Ltr. <i>Mixer tank volume Ltr.</i>	Fill the accurate volume of the mixers tank, or verify the factory setting. This feature is for future use.	5214 #1	100-1000
Max emptying – sec <i>Emptying tank max. time (to detect failure) – sec</i>	The time it takes to empty the tank at the end of irrigation of the smallest plot. A safety parameter to protect the pump in case of level sensor failure.	5214 #2	
Restart fill sec. <i>Delay to restart tank filling – sec. (after full tank indication)</i>	Fault recovery cycle: If the mixer tank remained full between irrigation sessions, the controller will not receive pulses from the water meter as expected. After 5 seconds the controller tries to empty the tank to the previous valve and resume to the new program.	5214 #3	5
Level sensor type * <i>Level meter type</i>	On early mixers that were produced up to 1997, the level indicator was defined by 2 discrete inputs instead of an analog sensor. Set to "Switch" if you use this type of mixer, or leave default "Analog" if you have the usual one.	5214 #4	Analog

Fertimix User's Manual

Level sens. Flt. * <i>Level meter in fail condition</i>	If the level sensor is out of order – it is still possible to operate the mixer by notifying the program that the sensor (or input) is faulty. In this case, the mixer will operate by timing and by float valve, and give you the necessary time to repair the fault.	5214 #5	No prob. (OK)
Level gen. Sns. No. <i>Analog meter – general sensor No.</i>	Pick the level sensor from the General Sensors table. The factory setting for this sensor is 12. The scale will always be from 0 (empty) to 100 (full), which represent the level in percents, regardless the tank's size. For sensor settings, refer to the Hardware Manual.	5214 #6	12
Stop W. pump below <i>Value to stop mixer pump - below</i>	The value used for stopping the mixer pump at the end of irrigation	5214 #7	5
Stop W. fill abv. <i>Value to stop filling valve – above</i>	Shuts the filling valve to avoid tank overflow during irrigation. Normally, the float valve should be set to stop the filling before the level reaches the shut value. The float valve is supposed to balance the filling gradually according to the irrigation consumption. Setting a shut value that is lower then the float close level will cause an unbalanced system.	5214 #8	90
Open main water abv. <i>Value to open main valve – above</i>	If the main valve closes during irrigation due to a low water level (the flow is higher then the water supply capability), the main valve will not open before the level reach this value.	5214 #9	70
Close main water blw. <i>Value to close main valve - below</i>	During irrigation only, the main valve closes if the tank level drops below this value to enable proper fertilizer mixing and avoid cavitation. This situation should be avoided. It indicates a faulty application design: the irrigation flow is higher then the supply ability.	5214 #10	40

Fertilizer Injectors Adjustment

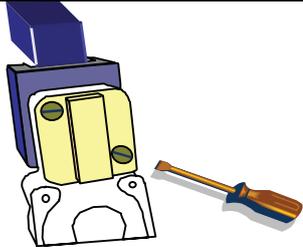
Every fertilizer injector must be flow- adjusted to some extent. To adjust, use one of three methods as listed below:

Fixed cone-jets of 20, 40, 60 and 80 liter/hour (5, 10, 15 and 20 GPM).

Flow- control valve.

Flow indicator with control valve.

Follow the instructions in the table below as applicable to the method selected for each injector:

Step	Cone-jet	Adjustable valve	Flow indicator
1	Calculate optimal pump flow to inject during 40-70% of the irrigation time, taking into consideration the specific mainline flow, fertilizer concentration and final quantity of nutrient required. Consult ftp://ftp.eldarshany.com/pub/literature/Fert_Calc.xls ("Fert Calc" sheet) as required.		
2	Fit jet in housing	Remove bottom cover of fertilizer solenoid valve by unscrewing the 2 flat bolts.	
3		Immerse the far end of the flexible pipe in a measurable bucket of water. Start the irrigation program.	Immerse the far end of the flexible pipe in a bucket of water. Start the irrigation program.
4	Operate a normal irrigation with no fertigation program. Use a valve with no crop or a kind of list sensitive crop.		
5		Press the solenoid's plunger up with your finger for exactly 30 seconds.	Press the solenoid's plunger up with your finger and set the required flow on the scale.
6		Measure the amount of water pumped out of the bucket. Calculate the flow by multiplying the quantity of the missing water by 120.	Fit the plunger protector back in place and secure with bolts.
7		Adjust the valve slightly. Repeat steps 4-5 until the required flow is obtained. Fit the plunger protector back in place and secure with bolts.	
8	Update the "Fertilizer pump flow" parameter in the controller: code <5216 #3> in CL_IR 2.04 or code <452 #3>		

Fertigation automation setup

In most cases it is found that the program's default values are suitable to all Fertimix models.

Measure delay at irrigation start – sec. **at code 5241 #1** **to 20**

Change fertigation delay – sec. **at code 5241 #2** **to 8**

If EC or pH values doesn't balance you may try to extend the 'Change fertigation delay' a few seconds more. Problems of EC/pH balancing are more likely to occur due to a large contradiction between the required fertilizer quantity and the required EC (in EC injectors) or pH (in pH injectors) levels. Secondly likely are problems of electrical interference on the EC-pH unit, and only third would be the 'Change fertigation delay' parameter. Contact your local ES authorized technician for further assistance.

PC users

To appropriately operate Fertimix from the Galileo PC center, you must enter the system by clicking the “Ometz” button. If you click any of the two others – the operation of your system will not be effected, but you won’t be able to see all the specific mixer’s visualization properties.

Ometz is the former name of this product.

The System Setup dialog box can be found in the top menu item ‘Settings’ >

‘Irrigation settings’ > ‘System setup’. The special mixer

settings are in ‘Settings’ > ‘Irrigation settings’ >

‘Mixer’.

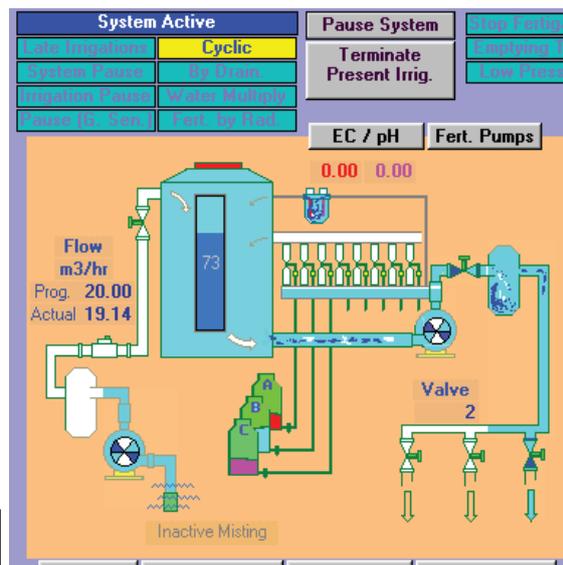
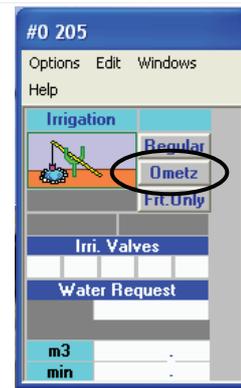


Figure 4

Maintenance.

Component	Action	One month after first operation	Weekly	Monthly	Annually	End of season
Electric connections	Shut of main power switch and tight all screws up	X				
Water filter	Clean		X*			
Fertilizer tanks filters	Clean		X			
Booster pump	Operate with fresh water 5 minutes and bleed all water.					X
Float valve	Replace diaphragm				X	
Level sensor	Fasten air tubes			X		
Fertilizer solenoids (Sirai)	Wash crystallized minerals. Lubricate plunger with silicon oil.			X		
Fertilizer venturi pumps	Adjust flow, clean possible clogged jets.			X		
EC-pH 3050	Perform probes calibration		X			

*In case that you find that weekly cleaning of filters is not sufficient - pre filtering must be improved.

X Shall be performed by qualified electrician.

Winterizing.

Wintertime in frost- ridden areas may prove quite harmful to all irrigation components if not duly prepared. The following steps will guide you in safe winterizing. Follow them strictly.

When to Winterize

The best time to winterize is the morning after the last day of the irrigation season.

Procedure

1. Wash out all corrosive material residues. Fill the fertilizer tanks with fresh water (if you have some fertilizer left for next season, fill a bucket with water and place it instead of the tank), then run the system with a program that will use all the injectors. Ensure that each injector receives at least 20 liters (4 gallons) of water.
2. Close all manual valves and turn all pumps switches Off. Define the Galileo controller "Not active".
3. Dismantle all records and bleed all water residues from the Venturi injectors, electrical valves, check valves and other elements as required.
4. In applications employing main fertilizer NC valves, make sure to dry all the 8mm command hoses, the solenoid valve, and both the upper and lower chambers of each valve.
5. Open the booster pump's draining cap (Figure 5) and leave it opened for 1 hour. In models with a cast iron pumps (all standard models except 3HF) it is advised to tip 100 cc of oil to the block and operate the pump for 3 seconds.
6. Verify bleeding of all pipes.
7. Remove one of the probes from the EC-pH sampling cell and drip in 50cc (2 OZ) of concentrated antifreeze material. Re- fit the probe in place and secure with bolt.
8. Clean the Fertimix of all external residues of corrosive materials. Cover the Fertimix with a sheet. **Do not shut controller's power supply down!** – leaving the Galileo controller powered down for an extended period of time may drain the memory backup lithium battery.

