Installation Manual
for technical personnel only

HI 8001 and HI 8002

Agricare-Fertigation
Controller

HANNA
instruments

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments product.

Please read this instruction manual carefully before using this instrument.

This manual will provide you with the necessary information for correct use of this instrument, as well as a precise idea of its versatility. If you need additional technical information, do not hesitate to email us at tech@hannainst.com or view our worldwide contact list at www.hannainst.com.

TABLE OF CONTENTS

Hanna Instruments reserves the right to modify the design, construction or appearance of its products without advance notice.

1 CONTROLLER HARDWARE PRESENTATION

1.1 ELECTRICAL SPECIFICATIONS

Power Inputs	Power supply	220/110Va.c. 50/60Hz	GND, 220Vac, 220Vac
	Auxiliary power supply	24Vac	IN24Vac
Digital Inputs	16 digital inputs	Contact to GND pin	TEMP Break
			cond.stop
			irrig.count
			dif.pres.1,2
			fert.level1,2,3,4
			acid level
			mixing level
			ext.tank1,2,3,4,5
Serial Input	RS232 DB9 male	1200,2400,4800,-9600bps	RS232
Digital Outputs	Relay 34 outputs	10A	main pump
			agitators
			sect.1-8,sect.9-32
	Solid State Relay 7 outputs	10A	filter1,2
			pH
			fert1,2,3,4
	Alarm 1 output	10A	nc,no,gnd alarm

Analog Inputs	Current type 7 inputs	4-20mA	ph1,2 sensor
			ec1,2 sensorec
			ec in
			unused1,2
	Voltage type 1 input	0-2V	solar radiation
Power supply output	Transmitters supply output	12V dc	+/-Vs

1.2 INPUTS-OUTPUTS DESCRIPTION

1.2.1 Analog Inputs

The main board of HI 8001 and HI 8002 controllers have on the right side eight inputs dedicated for the standard analog signals: seven of the 4-20mA type and one of the 0-2V type.

The transmitters have to be connected between the pH, the conductivity sensors and the controller. They can be supplied from the controller outputs (Vs 12VDC) if the consumption doesn't exceed 250mA. These inputs use the transmitters that have source current output type.

The Hanna transmitter code that can be used is HI98143-20 (one EC and one pH channel). When the user has other Hanna transmitter types it can modify them to the HI98143-20. For modifications contact the closer Hanna Instruments representative.

1.2.2 Digital Inputs

On the main board, near the analog inputs, the controller has 16 digital inputs with optical separation. They are available only when the IN24Vac input is supplied with 24Vdc (min. 150mA). The sensors have to be of switch type and connected to the COM IN pins, near the last digital input.

When between a digital input and the COM IN pin a switch ON is connected , that input is considered as inactive. Otherwise, when the switch is open or the 24Vac supply is not present that digital input is active. When the power supply is not present this solution detects and generates the alarm conditions.

The digital inputs assigned to the sensors of the external tank are used to generate a start condition for the programs (if this setting has been done). In this case the program is started when the switch is ON (closed).

1.2.3 RS232 input

The RS232 communication is available through the RS232 input placed in the left corner on the connection panel. This port allows the PC application (Agricare) to transfer the data for the remote control of HI 8001/2. The serial cable is Hanna serial cable type.
To allow our users access to the latest version of Hanna Instruments PC compatible software, we made the products available for download at http://software.hannainst.com. Select the product code and click Download Now. After download is complete, use the setup.exe file to install the software.

1.2.4 Accumulator input

This input is not accessible outside the controller. In case of power failure the controller uses a backup source (9V and 100mAh Nickel Cadmium accumulator) that can supply the controller for about 2h (at 40mA consumption, in Power Safe Mode). The controller consumption in the power safe mode depends on the digital input number connected to the COM IN pin.

1.2.5 Power inputs

The controller works when the 220V(110V)-dc power supply is connected to the 220Vac input and an auxiliary 24Vdc(min.150mA) voltage is connected to the IN24Vac input. This source doesn't supply internally the digital outputs and should be separated from the external 24Vac power supply used for the valves. The PE pin from the power supply input must be connected to the ground protection line (see in the appendix).

1.2.6 Power output

This output has 12Vdc and is dedicated to supply the transmitters. Two HI98143-20 transmitters can be supplied from this output (2-pH channels and 2-EC channels). If another source is used to supply the transmitters, than a short circuit has to be between the –Vs (12V) pin and the ground of the external source. When the user connects the EC-in sensor, the third transmitter should be supplied from this output.

1.2.7 SSR outputs

Each SSR (solid state relay) output supports a 10A current and is dedicated to command the pH, fertilizer and filter valves. The valves connected here must be AC supplied.

1.2.8 Relay outputs

The other digital outputs are of relay type and also support 10A. For this output type only the NO and COMMON terminals are accessible on the connector . Twenty-four of these outputs are on the extension board and can be optional. The remaining outputs are on the main board. For the extension board, all the COM relay terminals are placed together (inside the controller) at the COM OUT3 output.
An active output means a short-circuit between that output pin and the COM OUT 1(3) pin from the same group.

1.2.9 Alarm output

The ALARM relay can command a 10A load and all terminals are available on the connection panel (NC, NO and COM ALARM).

2 CONTROLLER INSTALLATION

2.1 INSTALLATION TYPES

The hardware architecture can be simplified (pH and EC sensor number, external tank number, and fertilizer tank number). The controller is produced in four versions (8,16,24 and 32 sectors). The architecture should be clarified before starting the installation. It depends on:
- pH sensor number
- EC sensor number
- fertilizer tank number
- filter number
- external tank number
- differential presostate number
- sectors number
- agitator number
- other problems that can be generated by external devices (power supply voltage, valve features, irrigation counter features, pump features, alarm device features, transmitter's features and level sensor's features).

When these external device parameters are not identical with those in the Inputs Outputs Description, the installation could require modifications on the external devices (transmitters, level sensors etc.) and/or supplementary components (relays, auxiliary supplies).
The most important things that have to be checked are:
· The main power supply voltage should be the same with the controller voltage.
· The external transformer parameters should be as in chapter 1.2
· The transmitters should be as in chapter 1.2 .
· The devices connected to the digital inputs should be as in chapter 1.2

2.2 CONNECTIONS & WIRING

2.2.1 Main power supply connection

The main power should be connected to the J1 connector on the main board as in the next figure.

The main power connections
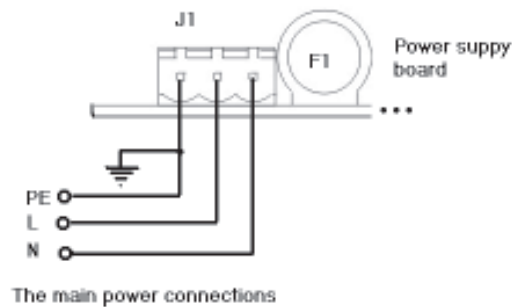
2.2.2 Auxiliary 24Vac supply connections

A separate 24Vdc (150mA) source should be used for this supply. It supplies the digital inputs. The transformer that is used for the valves could provide the voltage for these inputs, but it needs a separate winding. The IN 24Vac input can be connected to the same transformer but in this case, here connections with COM IN pins have to be avoided.

IN24Vdc connections
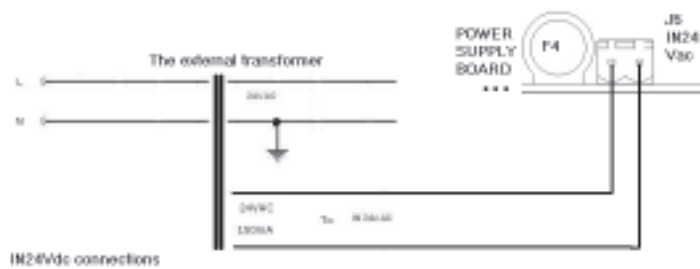
2.2.3 Digital input connections

The digital inputs have to be connected as in the next figure. All these inputs are mechanical contacts form switches or relay contacts. When one of the digital inputs is not used (fert. level, acid level, dif. pres., irrig. counter) it should be connected to the COM IN pin. The unused external tank's level inputs have to remain unconnected.

Motherboard

Digital input connections:

Normal state   Alarm state
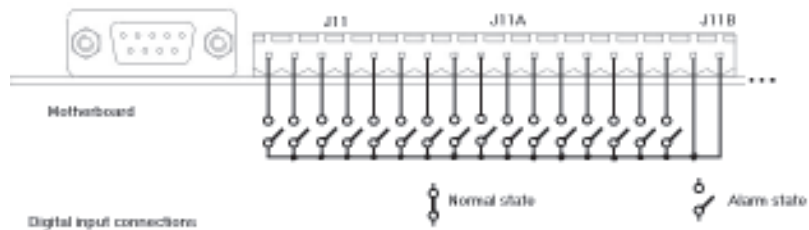
2.2.4 Analog input connections

The pH, EC and solar radiation sensors have be connected to the analog inputs through the transmitters, that have 4-20mA (source current type) outputs and 0-2V (solar radiation). The Hanna transmitters that can be used are HI98143-22 (1 pH, 1 EC). The user can or can not use the second pH, EC sensors or the pH input sensor. The number os EC, pH sensors is configured within panel S55 - SENSOR CONFIG.

The EC-in sensor can be replaced from installation without modifications. Thus, the "EC-in " input will stay unconnected.

The transmitters will be supplied from the +/-Vs outputs. The maximum consumption supported by the controller is around 250mA (12V). This means that two Hanna transmitters can be supplied from the same output (2 pH channels and 2 EC channels) and one transmitter for the EC-in sensor.

The following type of sensors can be connected to the transmitters:

HI 1001 Plastic in-line pH electrode

HI 3001 4-ring conductivity probe

Analog input connections
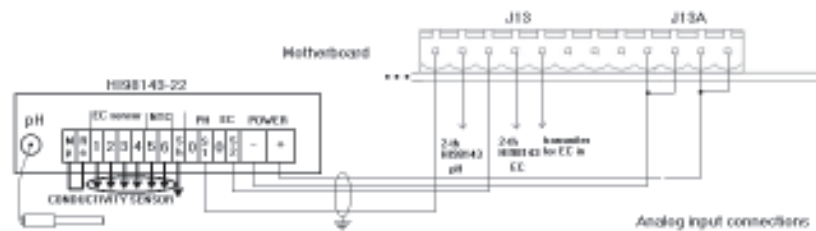
2.2.5 Valve connections

The valves have to be connected as in the following figure. Each group of 8 valves has a common pin placed near the valve's output called COM OUT 1, 2, 3. The valves are not supplied from the controller.

In this case the external transformer should support the consumption for all loads connected to 24Vdc. The sector outputs from the main board, together with the agitators and the main pump output have a common fuse, F3. The valves numbered from 9 to 32 have the F1 common fuse on the extension board.
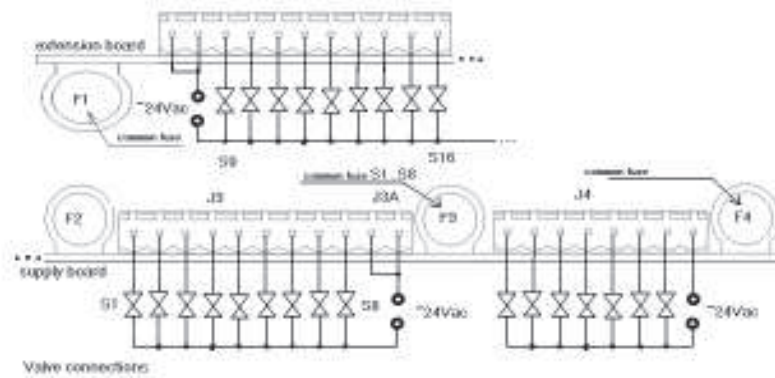
Filter schematic
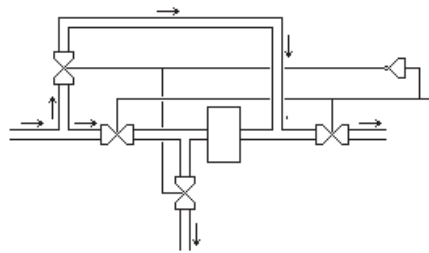
The HI 8001 (2) controller has the programs to clean the filters. This operation is done by the four valves that are commanded alternatively two by two like in the schematic. The controller provides a mechanical contact that is switched ON/OFF periodically and it can be used in the installation to control the external relay (see in the appendix).

2.2.6 Main pump connections

The controller cannot command the pump directly. Thus, the digital output generates the command for the external pump relay.

2.2.7 Agitator's connections

The same situation is true for the agitators. They can be supplied with three-phase power.
The relays that connect the power to the agitators are controlled simultaneous by the AGITATOR'S signal.

2.2.8 Alarm device connections

A special connector is used for the alarm device command. The alarm device connections depend on the device type. Outside the controller all contacts (NO, NC, COM OUT AL) are accessible.

2.3 CONTROLLER START-UP

After all the connections have been made according to the controller type and specifications, you should follow the next steps:
- Disconnect the main supply from the controller (J1 connector)
- Close the K1 switch; verify if there are short-circuits (the fuse F1 blow up)
- verify the analog inputs (sensors, connections, transmitters)
- Turns OFF the Stop switch and supply the controller (connect J1)
- After initialization the Controller State should be in the STOP state
- Go in the S50 (OUTLETS MANUAL CTRL) panel
- For each output device connected to the controller you can verify the correct functioning step by step. Set and clear the desired output according to the table from APPENDIX 2 (**Instruction Manual**).
- Calibrate the controller. See section 6.1 Sensor Calibration Procedure (**Instruction Manual**), panel S54. This procedure should be done for each analog input that is used in installation.
- Make the program settings
- Connect the 24Vac supply (Close the K1 switch)
- Check if the installation works
- When it works, you can set the PID control. See section 6.2 PID Calibration Procedure (**Instruction Manual**).

2.4 TESTING FOLLOWING INSTALLATION

The HI 8001 (2) controller has many facilities that allow the user to configure it according to his/here purposes. To demonstrate the controller functionality you can run a lot of program setting types, depending on the imagination. In this section we present below a controller programming sample that try to highlight the main features.

Make the following settings:

Program 1

    Irrig ctrl mode (S53): Sets time mode
    Active Timetable (S31): sets a valid range for the current day
    Set priority (S33): sets 1 priority sect/group 4
    Start conditions (S34): sets Time condition Y
    Set start time (S35): sets three start hours ex: xx: 00, xx: 03, xx: 06
    Set program repeats (S36): sets 0
    Pre/post Irrig. (S37): sets 5s
    Set sectors (S38): sets 4s for valves 1, 5, 9, 13, 17, 21, 25, 29

Program 2

    Active Timetable (S31): sets a valid range for the current day
    Set priority (S33): sets 3 priority; sect/group 4
    Start conditions (S34): sets External tank 02
    Set program repeats (S36): sets 0
    Pre/post Irrig. (S37): sets 1s
    Set sectors (S38): sets 10s for valves 1, 2, 9, 10, 16, 17, 24, 25
    Set fertilizers (S39): 20%, 40%, 60%, and 80%
    PH control (S40): sets Ref = 7.0; -0.6 ; $+0.6$; threshold 2
    Cond control (S41): sets Ref = 7.0; -0.6; $+0.6$

Program 3

    Irrig ctrl mode (S53): Sets time mode
    Active Timetable (S31): sets a valid range for the current day
    Set priority (S33): sets 1 priority
    Start conditions (S34): sets External tank 03
    Set start time (S35): sets three start hours ex: xx: 00, xx: 03, xx: 06
    Set program repeats (S36): sets 3
    Pre/post Irrig. (S37): sets 1s
    Set sectors (S38): sets 5s for valves 1, 2, 3, 9, 10, 11, 16, 17, 18, 24, 25, 26
    Set fertilizers (S39): 20%, 40%, 60%, and 80%
    PH control (S40): sets Ref = 7.0; -0.6 ; $+0.6$; threshold 2
    Cond control (S41): sets Ref = 7.0; -0.6; $+0.6$

Program 4

Irrig ctrl mode (S53): Sets time mode

Active Timetable (S31): sets a valid range for the current day

Set priority (S33): sets 1 priority

Start conditions (S34): sets External tank 04

Set program repeats (S36): sets 0

Pre/post Irrig. (S37): sets 1s

Set sectors (S38): sets 4s for valves 1, 2, 3, 4, 9, 10, 11, 12, 16, 17, 18, 19, 24, 25, 26, 27

Set fertilizers (S39): 20%, 40%, 60%, and 80%

PH control (S40): sets Ref = 7.0; −0.6 ; +0.6; threshold 2

Cond control (S41): sets Ref = 7.0; -0.6; +0.6

Filter control (S46):

After finishing these settings, the following things can be demonstrated:

· Program 1 started *by time*.

Allows verifying the: start times, set valves and irrigation time.

· Program 2 started *by external tank* 02.

Allows verifying the: start condition, set valves and irrigation time.

· Program 3 *with repetitions*.

Allows verifying the: start condition (ext. tank 03), set valves, irrigation time and repetitions.

· Program 4 *liked by another program*.

Allows verifying the: start condition (ext. tank 04), set valves and the irrigation time.

Sets the Start conditions (S34): link 2.

Starts the program 2 (ext. tank 02)

Allows verifying the: link with program 2.

· *Manual started*.

Goes in S47 and starts manually program 2.

· The program *priorities*

Starts program 3 (ext. tank 03) and immediately starts program 2 (ext. tank 02). Program 2 has a high priority and should be activated (program 3 goes in suspend state). After that, program 2 is finished and program 3 is reactivated.

· The *alarms*

Generates a low level in the mixing tank (simulator).

The ALARM led will blink and this setting is available on panel C25.

Modify the pH 1 sensor value. When the value is out of the set range, a new alarm is generated (C25). Modify the pH2 sensor value to obtain a difference between pH1 and pH2 bigger that

the set value. A new alarm type should appear (C25).

· The *logging*

Go to panel C28 and consult the log for the current day. You should be able to see the alarms presented above.

· The "POWER FAILURE " event

Disconnects the power supply or the auxiliary 24Vdc voltage. The controller stops the active programs and displays the "POWER FAILURE" message. After reconnecting, the controller starts from the anterior state.

CERTIFICATION

All Hanna Instruments conform to the **CE European Directives.**
Disposal of Electrical & Electronic Equipment. The product should not be treated as household waste.
Instead hand it over to the appropriate collection point for the recycling of electrical and electronic equipment which will conserve natural resources.
Disposal of waste batteries. This product contains batteries, do not dispose of them with other household waste. Hand them over to the appropriate collection point for recycling. Ensuring proper product and battery disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, the place of purchase or go to www.hannainst.com.
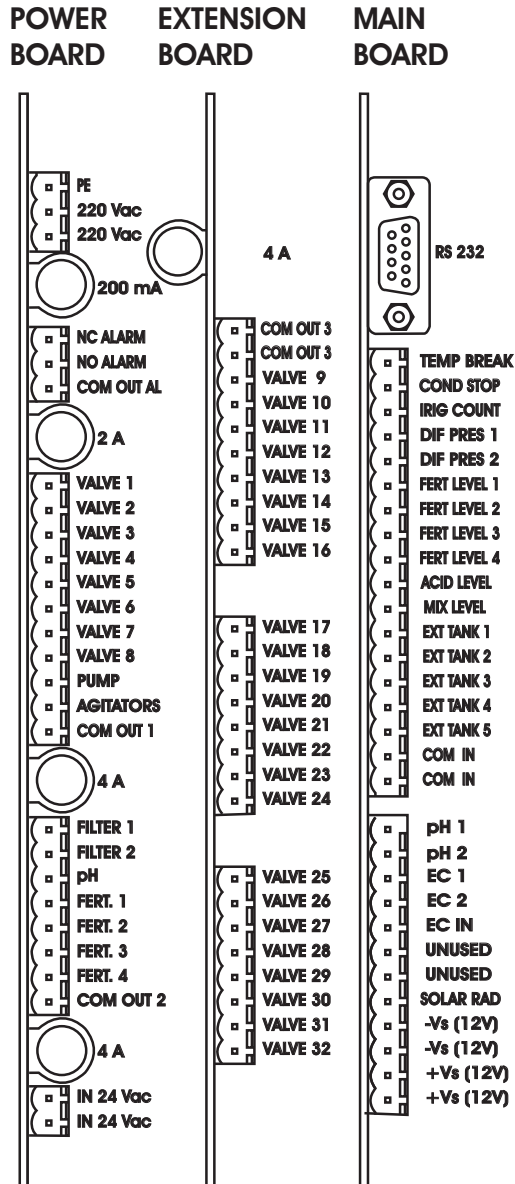
RECOMMENDATIONS FOR USERS

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the meter's performance. For yours and the meter's safety do not use or store the meter in hazardous environments.

WARRANTY

HI8001 and **HI8002** are guaranteed for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Electrodes and probes are guaranteed for six months. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered. If service is required, contact your local Hanna Instruments Office. If under warranty, report the model number, date of purchase, serial number and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

3 APPENDIX - ELECTRICAL DIAGRAMS

POWER BOARD   **EXTENSION BOARD**   **MAIN BOARD**

POWER BOARD

- PE
- 220 Vac
- 220 Vac
- 200 mA
- NC ALARM
- NO ALARM
- COM OUT AL
- 2 A
- VALVE 1
- VALVE 2
- VALVE 3
- VALVE 4
- VALVE 5
- VALVE 6
- VALVE 7
- VALVE 8
- PUMP
- AGITATORS
- COM OUT 1
- 4 A
- FILTER 1
- FILTER 2
- pH
- FERT. 1
- FERT. 2
- FERT. 3
- FERT. 4
- COM OUT 2
- 4 A
- IN 24 Vac
- IN 24 Vac

EXTENSION BOARD

- 4 A
- COM OUT 3
- COM OUT 3
- VALVE 9
- VALVE 10
- VALVE 11
- VALVE 12
- VALVE 13
- VALVE 14
- VALVE 15
- VALVE 16
- VALVE 17
- VALVE 18
- VALVE 19
- VALVE 20
- VALVE 21
- VALVE 22
- VALVE 23
- VALVE 24
- VALVE 25
- VALVE 26
- VALVE 27
- VALVE 28
- VALVE 29
- VALVE 30
- VALVE 31
- VALVE 32

MAIN BOARD

- RS 232
- TEMP BREAK
- COND STOP
- IRIG COUNT
- DIF PRES 1
- DIF PRES 2
- FERT LEVEL 1
- FERT LEVEL 2
- FERT LEVEL 3
- FERT LEVEL 4
- ACID LEVEL
- MIX LEVEL
- EXT TANK 1
- EXT TANK 2
- EXT TANK 3
- EXT TANK 4
- EXT TANK 5
- COM IN
- COM IN
- pH 1
- pH 2
- EC 1
- EC 2
- EC IN
- UNUSED
- UNUSED
- SOLAR RAD
- -Vs (12V)
- -Vs (12V)
- +Vs (12V)
- +Vs (12V)

FRONT

DIGITAL OUTPUT

ISTL8001
06/19

ANALOG INPUT CONNECTIONS

SOLAR
RADIATION
SENSOR 0-2V
OUT
+ −

+Usr(12V)
+Usr(12V)
-Usr(12V)
-Usr(12V)
SOLAR RAD
UNUSED
UNUSED
EC IN
EC 2
EC 1
pH 2
pH 1

✱ TRANSMITTER FOR EC IN

HI981143-22

CONDUCTIVITY SENSOR

POWER
EC sensor
NTC
pH
EC
POWER
+ − S2 0 S1 0 Sh 6 5 4 3 2 1 Me Mp
pH

HI981143-22

CONDUCTIVITY SENSOR

POWER
EC sensor
NTC
pH
EC
POWER
+ − S2 0 S1 0 Sh 6 5 4 3 2 1 Me Mp
pH

✱ Connected to the 3 th transmitter
HI981143-22 (S2 output)