



Computerized Control Systems

The Science of Solutions



EC-pH 3050

Agriculture Control

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EC-pH 3050

An interactive calculator/transmitter for EC and pH accurate measurement.

EC-pH 3050 is a set consisting of a calculator/transmitter, a sampling cup for 2 probes, an EC+ temperature probe and a pH ion selective probe. The **EC-pH 3050** is a one of **Galcon** range of products for high performance irrigation, which is combined in all irrigation integrated machines (Fertimix, Fertigal, Fertijet). Yet, it is also a stand-alone unit which may be purchased for any related purpose.

The calculator/ transmitter unit includes a 16 characters LCD and 4 operation buttons. The buttons are used to perform periodic soft calibration (Sensors calibration through software). The LCD constantly displays the read values of the EC and the pH.

EC-pH 3050 calculates the value obtained from the EC probe, and corrected by a temperature sensor contained in the specific probe. temperature compensated probe). A special program generates a linear result of the EC output.

1. Specifications

1.1) Dimensions and weight:

W1 = 167mm

W2 = 147mm

H1 = 242mm

H2 = 222mm

H3 = 52mm

Weight = 860gr

1.2) Operating Temperature:

Maximum: 50°C

Minimum: 5°C

1.3) Inlet Power:

24V AC 50/60Hz $\pm 25\%$ 5W.



2. Measuring characteristics

2.1) EC

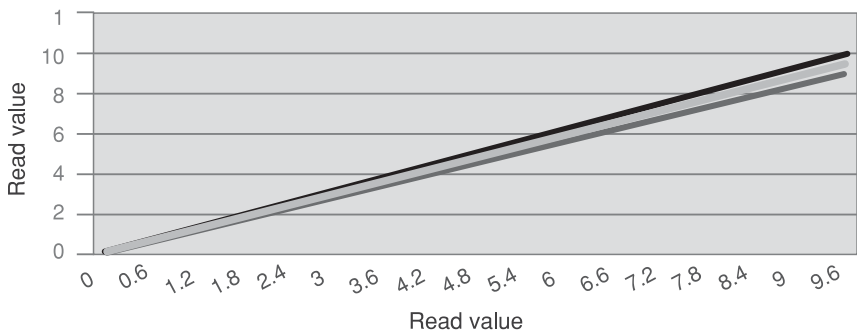
The electrical conductivity of water depends on the whole spectrum of the dissolved minerals in the water, and on the water temperature. Since our main interest is the nutrients concentration, a temperature sensor is included in the EC sensor to eliminate the temperature factor. The values of both conductivity and the termistor are converted to digital data and reach as input to the unit's CPU, which calculates them to a curve. The accuracy of the calculation depends on the CPU's resolution. EC-pH3050 utilized by 16 bit CPU which producing accurate reading even for values which are far from the calibration point.

Electrical conductivity slop

Real EC value —

Calibration EC 1.4 —

Calibration EC 5 —



The offset of the EC slope is always 0 (Zero). The EC sensor should indicate zero when it is wiped and held out in the open air. The second calibration point (gain) will be either EC 1.4 or EC 5 - whichever is closer to the final measured water. The appropriate buffer should be obtained (see ordering info. Below).

2.2) PH

The pH of a solution indicates how acidic or basic (alkaline) it is. The formal mathematical definition of pH is the negative logarithm of hydrogen ion activity. In most cases, hydrogen ion activity can be approximated by the hydrogen ion concentration, and the formula becomes $\text{pH} = -\log_{10} [\text{H}^+]$. On the pH scale, which varies from 0-14, a very acidic solution has a low pH value, a very basic solution has a high pH value, and a neutral solution has a pH of approximately 7.12

A pH measurement loop is essentially a battery where the positive terminal is the measuring electrode and the negative terminal is the reference electrode. The measuring electrode, which is sensitive to the hydrogen ion, develops a potential (voltage) directly related to the hydrogen ion concentration of the solution. The reference electrode provides a stable potential against which the measuring electrode can be compared. When immersed in the solution, the reference electrode potential does not change with the changing hydrogen ion concentration. A solution in the reference electrode also makes contact with the sample solution and the measuring electrode through a junction, completing the circuit.

The electrode's output ranges from -417mV (pH 14) to +417 mV (pH 0) and the calculation must include consideration of the water temperature. The quality of the measurement depends, to a great extent, on the stability of the referenced electrode. EC-pH3050 provides a galvanic isolation to reduce influence caused by the power source, but still requires a solution for the water. The grounding electrode in the sampling cell must, therefore, be connected to a proper ground connection with an impedance which shall not exceed 1 ohm. In some cases where the electrical potential in the water is high, grounding through the sampling cup may be found insufficient, and additional grounding of the water is recommended.

3. Inputs

3.1) EC

	Standard	High Pressure
Body:	CPVC 12 mm	CPVC
tread 1":		
EC range:	0-10.0 mS	0-10.0 mS
Cell constant:	K=1.0 ±5%	K=1.0
±5%:		
Temperature range:	0-80°C	0-80°C
Temperature compansation:	10K internal termister	10K
internal termister:		
Maximum pressure:	7 bar.	7 bar.
Response time:	1 sec.	1 sec.
Calculator side connector:	6 pins round	6 pins round
round:		

3.2) PH

	Standard	High Pressure
Principal	ION selective ±414mV	ION selective ±414mV
Valid '0' value	pH 7	pH 7
Body	Epoxy 12 mm	CPVC tread
pH range:	0-14	0-14
Temperature range	0-60°C	0-80°C
Maximum pressure:	3 bar.	7 bar.
Response time	3 sec. To 98%	3 sec. To 98%
Calculator side connector	BNC	BNC

4. Output:

4.1) EC

- 4-20mA (4mA = 0 mS, 20mA = 10 mS) Max load 200
 - Digital input via RS485 channel by Galileo protocol.
 - Local display
- Accuracy: 0.05 to 0.1 mS; including galvanic isolation.

4.2) pH

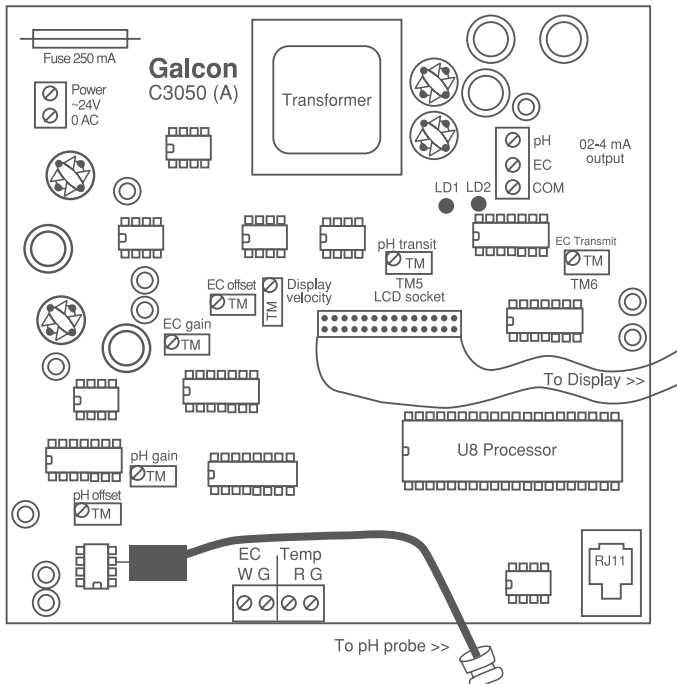
- 4-20mA (5.6mA = 1 pH, 20mA = 14 pH) Max load 200
 - Digital input via RS485 channel by Galileo protocol.
 - Local display
- Accuracy: 0.05

Max. load impedance: 500 ohm

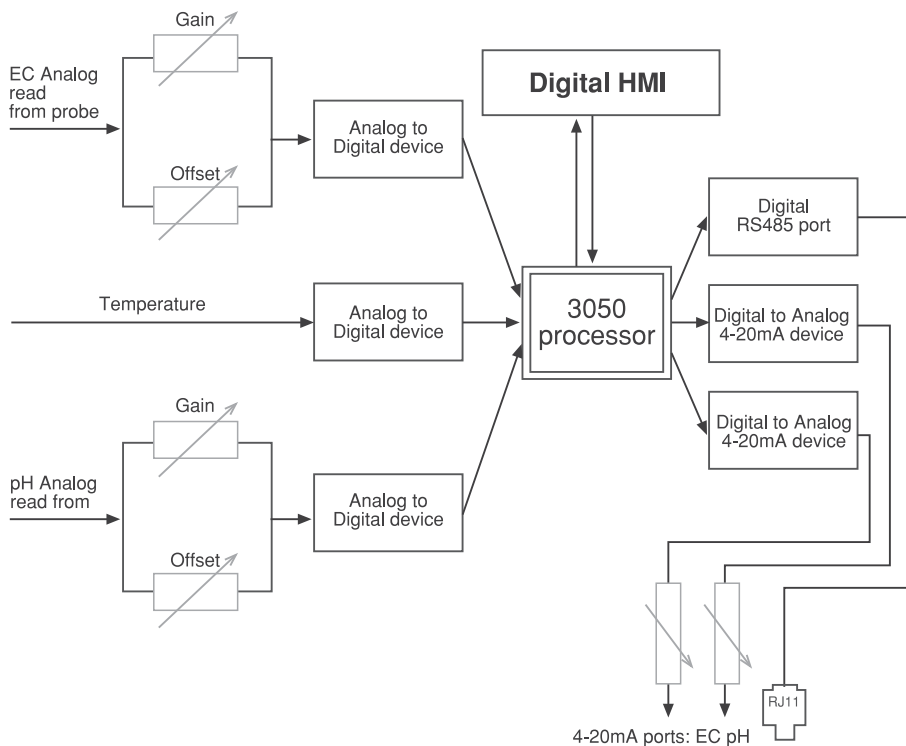
Data: RS485 special Galileo protocol - connect via RJ11 socket, since card #12 is an Analog card.

5. Card general view:

5.1)



5.1) Block diagram



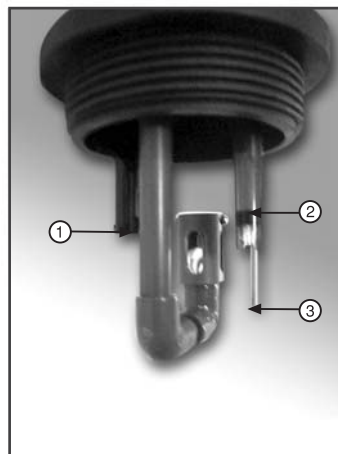
6. Installation:

When supplied as part of Fertimix, Fertigal, Fertijet:

When EC-pH3050 is supplied as part of one of Galcon's Integrated irrigation machines, all you have to do is provide an appropriate grounding for the machine's electrical control board.

6.1) When supplied as a stand alone unit:

- (1) Mount the EC-pH3050 unit in a dry shaded place.
- (2) Connect the power supply from 24V AC isolating transformer, minimum capacity 25VA.



- (3) Mount the measuring cup in a shaded place. The distance from the EC-pH3050 unit is limited to the length of the probes cables. A Standard probe is supplied with a 50 cm cable, but a longer cable, up to 3 m, is available upon a special order. Connect the EC probe to the 7 pin socket, and the pH probe to the BNC mail connection in the EC-pH3050 unit.
- (4) Insert the EC probe in one of the designated bores and tighten the clamp. Remove the Silicon shield from the pH probe. Attention: If you are not applying water to the sampling cell immediately – return the shield over the probe, until it is used. Do not spill the contents of the cup. Insert the pH probe in one of the designated bores and tighten the clamp.
- (5) Connect the grounding electrode to a grounding point using a 2.5mm flexible wire.
- (6) Connect the Water inlet to the measuring point. Provide a flow of 300-1000 L/h. Ascertain that the pressure in the probes shall not exceed the specified pressure of the probe. Connect a drainage hose to the sampling cup's outlet.
- (7) Connect the two 4-20 mA outputs to the reading device. Follow the reading device manufacturer's instructions for sensors connection.

6.2) Handling electric or electromagnetic noises:

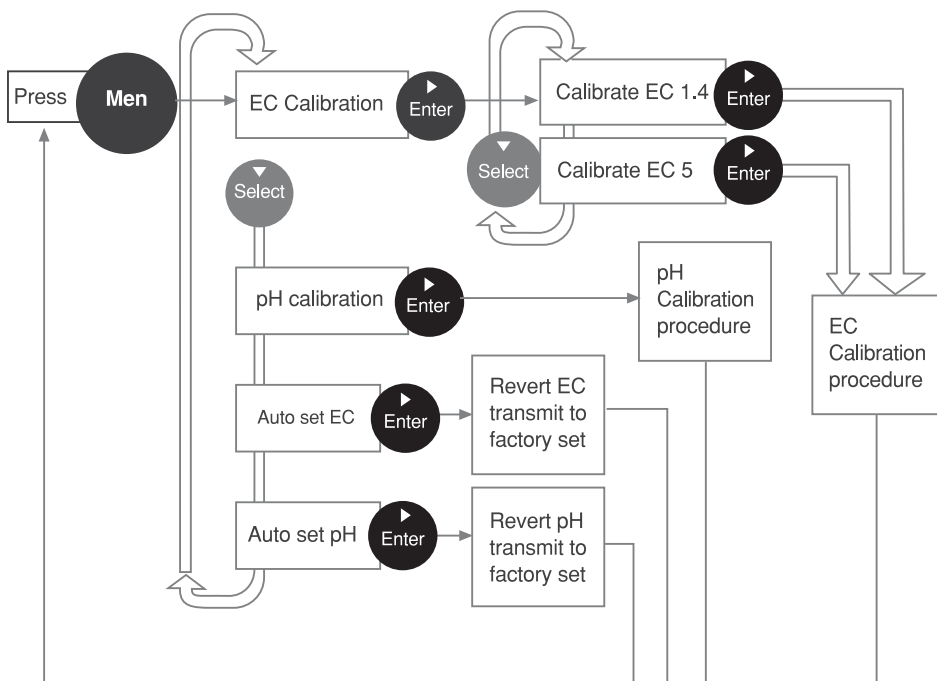
Prior to attempting neutralization of the noises, locate their origin. Since the noise origin may vary from place to place (different frequency, intensity, direction, distance etc.), the remedies in every particular case may be different. Some recommendations are given below.

- (1) Make a new grounding connection to the grounding connection point in the sampling chamber.
- (2) Connect the grounding to one of the measurement unit's 24 VAC power supply points.
- (3) Connect an RFI filter before the 24 VAC power supply connection point.
- (4) Do not connect more than one grounding point to the above mentioned measurement unit.

7. Operation:

Once initiated, EC-pH 3050 displays the values of both sensors fluently. The menu of the EC-pH 3050 is accessed only when calibration required.

EC-pH 3050 Menu map:



7.1) Calibration and troubleshooting instructions EC measurement

(1) How often is it necessary to calibrate the EC?

The minimum recommended period between calibrations is 2 weeks. However, in applications where the EC value is critical, or where high calcium rates occur, we recommend to perform calibration once a week.

(2) Soft calibration

In the soft calibration process, the electric value obtained from the electrodes is tuned to the real value obtained from the buffers by the unit's processor which calculates the correction according to its fixate.

Unlike hard calibration, which modifies the electric values by tuning the potentiometers, soft calibration is performed through the unit's interface (buttons) only. Similar to any other calibration, the slope fixation uses 2 points: Offset - the "base" point, and Gain - the "target" point. The advantages of soft calibration are:

- It provides higher precision.
- It is easier to perform - you do not need any tools.
- It stores the original setting - after you replace a probe or perform an Acid treatment, you just perform "Autoset" and then calibration.
- Indication of calibration failure if the probe is faulty.
- Any calibration is based on the previous calibration. Consequently, a wide deviation range occurs, over a prolonged time.

(3) Calibration and troubleshooting instructions EC measurement

Step 1: Press the **MENU** button and wait for the Service prompt to appear.

Step 2: Press the **SELECT** button several times until the CALIB(rate) EC prompt is displayed and then press **ENTER**.

Step 3: Choose between EC 1.4. and EC, according to your water value and the buffers you have. Use the **SELECT** button to select and **ENTER** to choose.

Step 4: In response to the To EC ## prompt, immerse the probe in the appropriate buffer and press **ENTER**. You will be asked to wait for a few seconds, while the unit performs the value correction. The Gain point is now set and the prompt To EC 00 will be displayed. Hold the EC probe out in the open air and wipe it gently with a napkin or some tissue, then press **ENTER**. The unit will now try to correct the Offset point.

According to the product definition, the soft calibration is allowed to correct:

For EC 1.4 - a deviation of 0.7 mS.

For EC 5.0 - a deviation of 1.0 mS.

Any higher deviations shall invoke the prompt EC CALIBRATION FAIL. In this case, refer to the maintenance instructions below.

Step 5: If the calibration process is completed successfully, the display shall revert to its normal view.

(4) AUTOSSET EC (EC factory set)

The Autoset procedure initializes all the previous corrections and sets the calibration according to the factory setup.

Perform Autoset when:

- You replace an EC electrode with a new one.
- Before you perform an Acid treatment.

Step 1: Press the **MENU** button and wait for the Service prompt to appear..

Step 2: Press the **SELECT** several times until AUTOSet EC prompt is displayed and then press **ENTER**. The message OK is displayed for a while and then the display reverts back to the ordinary. Attention: Remember to perform soft calibration immediately after Autoset is completed. The real value of the probe will rarely be 100% compatible with the Autoset.

(5) Card normalcy check:

If your attempt to perform calibration fails, act according to the following procedure to locate the source of the problem and determine if the fault is in the probe or the card:

- Disconnect the probe from the main unit; the displayed value of the EC after an Autoset should be 0.0.
- Check the voltage of the power supply while the unit is ON. The AC voltage must range from 18V to 28V.
In the first case - in the event of failure - replace the card.
In the second case - in the event of failure - check the power source. If proven normal - replace the card.

(6) Incompatibility between the value displayed on the LCD and the 4-20mA output.

An active LD1 LED indicates regular transmission of the 4-20mA output. The value of the 4-20mA output is adjusted in accordance with the value displayed on the LCD, as part of the production process. In the event that the value of the reading device is incompatible with the value displayed by the LCD, act as follows:

- Verify that the range definition in the reading device is compatible with the sensor's range. Namely, 0-100 or 0-1000 (depending on the required resolution).
- Use an Ampermeter to check on a linear loop that the transmitted value does indeed deviate from the expected value. For example, EC 1.4 should transmit 6.24mA. EC 5 should transmit exactly 12.0mA.
- In case that a significant deviation is found, which cannot be corrected in the reading device, we recommend to replace the card. But if a spare card is not available, you can carefully tune the potentiometer TM6 until the required value is obtained.

7.2) Calibration and troubleshooting instructions pH measurement

General remark:

The pH probe life expectancy is 18 - 30 months. You can distinguish between an old probe to a new one by noticing its content. The contents in a new probe is thick (gel state), whereas the contents of an old probe is thin (liquid state). When a probe nears its end, we recommend to have a replacement probe ready, within easy access.

Several factors may affect the pH probe's lifetime:

The probe's quality - purchase probes from a reliable source only.

The water contents - in the case of abnormal water contents, select an appropriate probe.

Pressure and temperature - ensure that the pressure in the sampling cell never exceeds the probe's specifications.

Maintenance Quality - Perform all the required maintenance activities according to the instructions.

Electromagnetic Disturbances - Provide grounding, not higher than 1 to the sampling cup and to the irrigation water.

(1) The calibration process:

Step 1: Remove the pH probe from its place in the sampling cell and clean it by directing a stream of water towards its membrane. Do not wipe or dry the membrane.

Step 2: Press the **MENU** button and wait for the Service prompt to appear.

Step 3: Press the **SELECT** button several times until the CALIB (rate) pH prompt is displayed and then press **ENTER**.

Step 4: In response to the To pH 7.0 Enter prompt, shake the probe to avoid mixing the buffer and immerse it in the pH 7.0 (yellow) buffer. Wait 5 seconds. Press **ENTER**. You will be asked to wait for a few seconds, while the unit performs the value correction. The Gain point is now set

Step 5: In response to the prompt To pH 4.0 Enter, shake the probe to avoid mixing the buffer and immerse it in the pH 4.0 (red) buffer. Wait 5 seconds Press **ENTER**. You will be asked to wait for a few seconds, while the unit performs the value correction. The Offset point is now set
According to the product definition, the soft calibration is allowed to correct a deviation of 1 pH unit. Therefore, correction to pH 7.0 can be made if the read value ranges between 6.0 to 8.0. Exceeding this range shall invoke the prompt LIQUID IS POOR.

In this case, refer to the maintenance instructions below.

Each calibration is based on the previous one, thus in the long run, a wide deviation range may occur.

Step 6: If the calibration process is completed successfully, the display shall revert to its normal view.

(2) AUTOSET pH

The Autaset procedure initializes all the previous corrections and sets the calibration according to the factory setup.

Perform Autaset when:

- You replace a pH electrode with a new one.
- Before you perform an Acid treatment.

Step 1: Press the **MENU** button and wait for the Service prompt to appear.

Step 2: Press the **SELECT** several times until AUTOSET pH prompt is displayed and then press **ENTER**. The message OK is displayed for a while and then the display reverts back to the ordinary.

Attention: Remember to perform soft calibration immediately after Autoset is completed. The real value of the probe will rarely be 100% compatible with the Autoset.

(3) Card normalcy check:

If your attempt to perform calibration fails, act according to the following procedure to locate the source of the problem and determine if the fault is in the probe or the card:

- (a) Unplug the probe's BNC connector from the main unit and short between its poles on the card side. The displayed pH value after an Autoset should be 7.0.
- (b) Check the voltage of the power supply while the unit is ON. The AC voltage must range from 18V to 28V.
In the first case - in the event of failure - replace the card.
In the second case - in the event of failure - check the power source.
If proven normal - replace the card.

(4) Incompatibility between the value displayed on the LCD and the 4-20mA output.

An active LD2 LED indicates regular transmission of the 4-20mA output. The value of the 4-20mA output is adjusted in accordance with the value displayed on the LCD, as part of the production process. In the event that the value of the reading device is incompatible with the value displayed by the LCD, act as follows:

- (1) Verify that the range definition in the receiving device fits the sensor's range. Namely, 0-140 or 0-1400 (depending on the required resolution).
- (2) Use an Ampermeter to check on a linear loop that the transmitted value does indeed deviate from the expected value. For example, pH 7.0 should transmit 12mA. pH 4.0 should transmit exactly 8.57mA.
- (3) In case that a significant deviation is found, which cannot be corrected in the reading device, we recommend to replace the card. But if a spare card is not available, you can carefully tune the potentiometer TM5 until the required value is obtained.

8. Maintenance:

The system's pH electrodes require periodic maintenance of cleaning and calibration. The duration between one periodic cleaning and calibration to the next depends on process conditions and the user's accuracy and stability expectations. Over time, electrical properties of the measuring and reference electrode change. Calibration in known-value pH solutions, called buffers, will correct some of these changes. Cleaning the measuring sensor and reference junction will also help. However, just as batteries have a limited life, a pH electrode's lifetime is also finite. Even in the "friendliest" environments, pH electrodes have to be replaced eventually.

Here we meet one of the greatest advantages of the EC-pH 3050: as long as the calibration does not require deviation of more than 0.7 of a unit you will not need a screwdriver. The replacement can be preformed by the unit's program.

Action	Period	Detailed description
Primary cleansing of EC electrode	Every calibration	Slightly wipe with napkin or gentle fiber
Primary cleansing of pH electrode	Every calibration	A direct stream of water on the membrane.
Cleansing of the sampling cell	Monthly	Immerse the cup in Sodium dioxide 3-5% for 3-5 minutes or wash with hot water and detergent.
Chemical treatment for EC electrode	6 month or when soft calibration fail.	1) Oil remains will be removed by hot water (70°) and detergent. 2) Immerse the probe in Sodium dioxide 2-3% for 2 minutes. Wash with fresh water. Perform Autoset, and then regular calibration.
Chemical treatment for pH probe		

9. Upgrading from EC-pH 2050 to EC-pH 3050

When upgrading an existing EC-pH 2050 unit with 3050 card, carefully perform the following actions: You will need an extra double BNC adapter (Female – Female) for the pH probe connection.

You have to change the order of the wires between the temperature and the conductivity sensors which come out of the EC probe.

You may have to adjust the velocity of the LCD by modifying the trimmer R41 EC-pH card replacement shall be performed by authorized technician only.

10. Digital transition to Galileo controller via RS485 channel.

EC-pH3050 is capable of transmitting the values to Galileo controllers via RS485 protocol. The unit is identified by the controller as an analog card, The EC sensor is the first sensor of the card, and the pH sensor is the second. The connection is via an RJ11 cable from the RJ11 socket on the card to the "Channel 3" socket in Galileo 2000.

Details: Galileo 2000:

- 1) Connect the cable as described above.
- 2) Define card #9 as 16Analog (code 72)
- 3) Sensors definition as below attributes the sensors numbers, according to the number of other Analog cards which are defined in that controller:
 - (a) In case that there are no other Analog cards, The EC will be sensor #1 and the pH #2.
 - (b) In case that there is one Analog card, The EC will be sensor #17 and the pH #18.
 - (c) In case that there are 2 Analog cards, The EC will be sensor #33 and the pH #34.

11. Ordering Information:

	Item/Kit	Catalog #	Picture
1	EC-pH 3050 unit	AMEC0B01	
2	Sampling cup	AF0510	
3	EC probe 3 bar	AMEE0L01	
4	EC probe 7 bar (3/4" tread)	AMEE0H01	
5	pH probe 3 bar	AMEP0L01	
6	pH probe 6 bar (3/4" tread)	AMEP0H01	
7	Complete EC-pH 3050 3 bar kit including items 1,2,3,5	AMEC2B01	
8	Calibration buffer pH 7 - 100ml	AMBL0P01	
9	Calibration buffer pH 4 - 100ml	AMBL0P02	
10	Calibration buffer EC 1.42 - 100ml	AMBL0E01	
11	Calibration buffers kit include items 9,10,11	AMBL0A01	
12	EC-pH 3050 card only	AMC0606	
13	EC-pH 2050 card only (Obsolete)	AMC0626	
14	LCD + 4 keys	AC0607	

12. Calibrations logbook:

Date	Performed by:	Comments

13. Probes Treatment logbook:

Date	Performed by:	Comments





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