

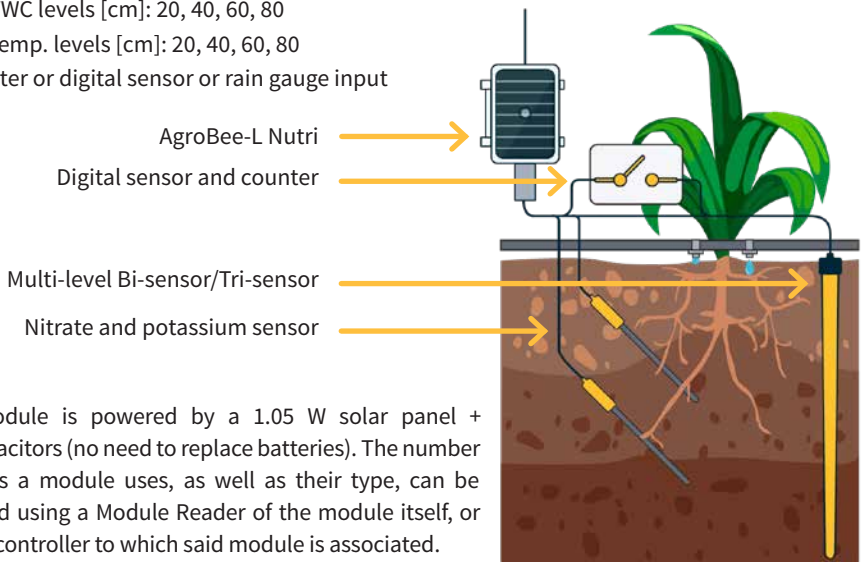
AgroBee-L Manual

AgroBee-L Nutri System

Very low consumption radio modules and integrated parts of the AgroBee-L system for reading 2 Nutrisens sensors; 1 soil water content sensor (VWC: Volumetric Water Content) and temperature up to 4 levels AquaCheck or Drill & Drop type through SDI-12 communication bus; and 1 digital sensor or counter.

The AgroBee-L Nutri model offers the following:

- 4 analog inputs for reading 2 NutriSens sensors (NO₃⁻, K⁺)
- 1 digital input with SDI-12 communication bus for managing 1 multilevel sensor to choose between different options of the following type:
 - AquaCheck: 4 VWC levels and 4 temperature levels (the 4 highest)
 - VWC levels [cm]: 20, 40, 60, 80
 - Temp. levels [cm]: 20, 40, 60, 80
 - Sentek Drill&Drop: 4 VWC levels and 4 temperature levels
 - VWC levels [cm]: 20, 40, 60, 80
 - Temp. levels [cm]: 20, 40, 60, 80
- 1 counter or digital sensor or rain gauge input



This module is powered by a 1.05 W solar panel + supercapacitors (no need to replace batteries). The number of sensors a module uses, as well as their type, can be configured using a Module Reader of the module itself, or from the controller to which said module is associated.

The module itself supplies each sensor with the necessary supply voltage according to the type of sensor configured. Likewise, the read timing of the sensors can be chosen from 3 different values: 5, 10, or 20 minutes, with the default value being 5 minutes.

Technical characteristics

Power supply		
Power supply:	Nutri: Solar: 5V / 1,05W → 3,3V	Panel plus high capacity supercapacitors
Energy consumption: Nutri	Average consumption: 0,90 mW	

Outputs		Inputs	
Number	3	Maximum distance between sensor and AgroBee-L: 50m	
Type	12 Vcc (Sensor power supply) Maximum current: 50 mA	Number	1
		Type	For potential-free contacts
		Number	4
		Type	Analog (16 bits)
		Number	1
		Type	Bus SDI-12

Environment		Box dimensions Nutri	
Temperature	-10 °C to +60 °C	Height	150 mm
Moisture	< 95 %	Width	100 mm
Altitude	2000 m	Depth	70 mm
Pollution	Grade II	Weight (approx.)	0,4 Kg

Declaration of conformity

This system conforms with the regulations and other regulatory documents in the following list:



Electrical safety	Low voltage directive 2014/35/EU	UNE-EN 62368-1:2014+AC:2015+AC1:2015+AC2:2015+AC:2017-03+A11:2017 Audio and video equipment, information and communication technology. Part1: Security requirements.
EMC	Directive 2014/53/EU	<p>ETSI EN 301 489-1 Ver. 2.1.1.1 – <i>ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU.</i></p> <p>ETSI EN 301 489-3 Ver. 2.1.1.1 – <i>ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU.</i></p>



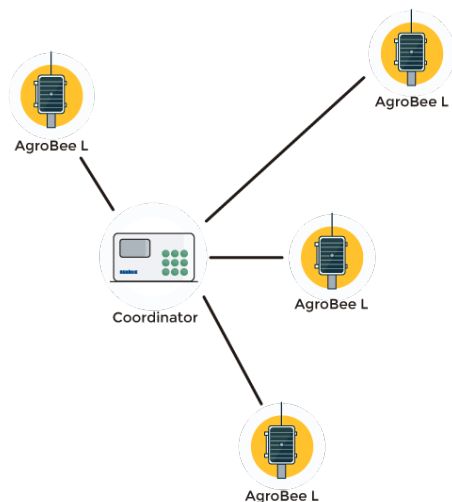
This symbol indicates that electrical and electronic controller must not be disposed of along with household waste at the end of its useful life. The product must be taken to the corresponding collection point for the recycling and proper treatment of electrical and electronic controller in accordance with national legislation.

AgroBee-L System Operation

The AgroBee-L radio modules are used for the activation of valves and other irrigation elements, as well as the reading of sensors and meters. It is very low consumption and follows the LoRa radio modulation, which operates in the 868MHz, 433 MHz and 915 MHz, free bands, obtaining radio coverage of up to 2500 m between two points (depending on the orography).

Currently, they can be incorporated into the Agrónic 2500, Agrónic 4500, Agrónic 5500 and Agrónic Bit Con fertirrigation controllers.

The AgroBee-L system consists of a coordinator device (located in the Agrónic 2500, Agrónic 4500, Agrónic 5500 or Agrónic Bit Con controllers) and by field elements with different functions, depending on the model in question. This system does not include the use of repeater elements, so all modules must connect directly with their coordinator. The field modules manage their consumption by activating the communication in the precise time of the exchange; the rest of the time, they are asleep or attending to irrigation control.



Its low consumption allows it to operate with a solar panel integrated into the module and supercapacitors or battery (depending on the model). The solar panel stores the energy in the supercapacitors/battery, offering a long operational life. It is only necessary to replace batteries in models that include batteries instead of supercapacitors.

The maximum number of modules that an Agrónic controller can manage is 20 units in standard mode, which can be configured as modules of any of the available types. There is also a priority mode, which makes it possible for the modules to communicate more often: in this case, the number of modules (10) is halved.

To use AgroBee-L modules, it is necessary to assign their outputs to the sectors or generals of the controller in question, and their inputs to the digital, analog, or counters sensors.


The AgroBee-L system has the following features, among others:

- Operation in 868 MHz, 433 MHz and 915 MHz free bands.
- Availability of 13 communication channels plus 18 transmission modes, which allow for the operation of more than one network in the same area working on the same channel.
- Availability of network code, which allows for filtering the information of several networks configured with the same parameters.
- Self-adjustable communication rate according to the chosen transmission mode and the timing mode:
 - Timing in standard mode (60 –200”). Up to 20 modules.
 - Timing in priority mode (30 –100”). Up to 10 modules.
- Distances of up to 2500 metres between any module and its coordinator (depending on the orography).
- Manual actions, consultations, and configuration of the network number, channel, transmission mode, and communication timing (standard/priority):
 - In-situ: Through the Module Reader
 - From a distance: Through the Agrónic
- Battery/charge level reading and solar panel (if any).
- Reading SNR level (signal-to-noise ratio) reception in the module and coordinator (in [%]).
- Reading the status of the last 16 communications and remaining time indicator until the next communication.

Installation

For the supply of radio controller, it is essential to have a coverage study. This study verifies the viability of the system according to the profile of the terrain, the location of the points to be controlled, and the distance between them. The study is delivered along with the controller offer.

SISTEMAS ELECTRONICOS PROGRES, S.A.
ESTUDIO DE COBERTURA RADIO

 **VIABLE** El resultado del estudio es: **2017 - 001** Número de estudio: **05/12/2017** Fecha de creación


Referencia: **FINCA RIO GRANDE**
Instalador: **AGUAS DEL NORTE**

AgroBee 868 MHz
Indicaciones para su correcta instalación:

Altura
Categoría: altura mínima de cable subterráneo 10 m
Distancia: altura mínima 4.0m - cable subterráneo 10 m
Estado: dependiente altura mínima de cable

Viabilidad
Categoría: viable directa entre a terreno

Distribución directa entre antenas
Coordenadas: latitud del coordinador: 4.161046, longitud: -74.641470
Coordenadas Módulo: 868 EXTENSO 28°50'42.17" N - 4°19'44.14" O

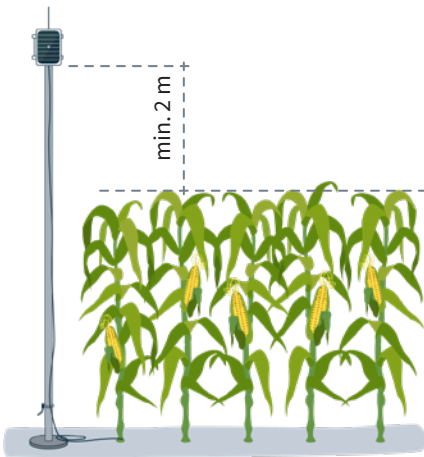
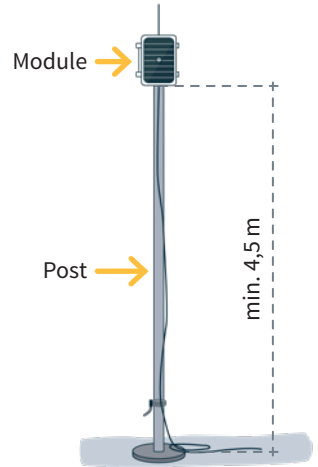
 **Distribución**
Instalación

INSTALLATION OF MODULES

The AgroBee-L modules have the antenna integrated into the module, so they are installed on top of a post.

For good radio communication, it is very important to place the modules in areas free of vegetation, walls, and metal structures.

The minimum recommended height to place the module is 4.5 metres from the ground. If there are tall crops (corn, trees, ...) this minimum height of the module must be increased by 2 metres above the height of the crop. In all cases, it must always have direct visibility with the controller's antenna that sends the information (coordinator located in Agrónic). The 7 metres of cable supplied already include these assembly recommendations.



To increase the coverage, and if necessary, the best system is made by raising the module as high as the length of the cable allows.

The modules with solar panels must be placed orienting the panel to the South (Northern hemisphere) or North (Southern hemisphere) to obtain the best solar coverage.

To keep it watertight, it is necessary to always leave the lid closed.

The modules can be fixed on a 35 to 45mm post by means of the support and flange, incorporated (Endless stainless steel clamp, measure 32-50mm DIN3017) in such a way that the cable output passes through the inside of the post.

It is recommended to install it on folding or extendible posts for easy access to the module.



Flange

Folding posts

Inputs and Outputs

DIGITAL INPUTS

There is 1 digital input in an AgroBee-L Nutri module, which can function either as a digital input or a counter/rain gauge input. When the input is connected to a counter, the minimum time between pulses must be 0.1 seconds and an anti-bounce filter may be enabled in order to avoid accumulating undesired pulses. Maximum allowed distance between AgroBee-L module and a digital sensor or meter is 50m.

DIGITAL INPUT SDI-12 BUS

This model has 1 digital SDI-12-type input for reading soil water content sensors, which must all be of the same type, among: “AquaCheck-8” (only soil water content and temperature), “Drill&Drop by Sentek” (only soil water content and temperature). Regardless of the number of sensor levels, only the following will be taken into account:

- Soil water content: Levels 20cm, 40cm, 60cm, 80cm
- Temperature: Levels 20cm, 40cm, 60cm, 80cm

These levels will correspond to:

- AquaCheck (20cm between sensors): The 4 upper levels
- Drill&Drop (10cm between sensors): Levels 2, 4, 6, 8 starting from the top

As detailed in the following table, the multi-sensor SDI-12 will be connected in the following way:

- Common Power Sensors: 0V
- SDI-12 sensor power supply: +V1
- SDI-12 sensor input: ED2-SDI12

ANALOG INPUTS

This model has up to 4 analog inputs for reading and managing a maximum of 2 Nutrisens sensors that it can manage: Remember that 2 analog inputs are needed for each Nutrisens, since it provides both Nitrate and Potassium values.

As detailed in the following table, the connections will be made in the following way:














- | | |
|--|--|
| • Nutrisens sensor #1: | • Nutrisens sensor #2: |
| – Nitrate (NO ₃ ⁻) Output: A1 Input | – Nitrate (NO ₃ ⁻) Output: A3 input |
| – Potassium (K ⁺) Output A2 input | – Potassium (K ⁺) Output A4 input |
| – Power supply Output +V2 | – Power supply Output +V4 |

CONNECTION

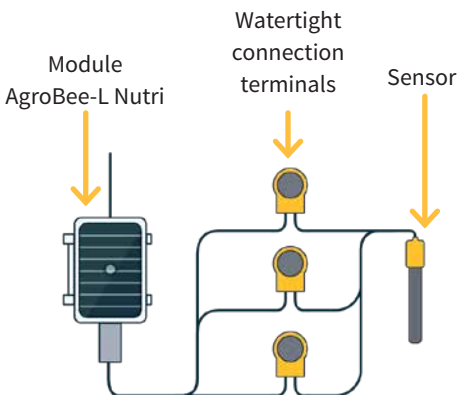
Said module is provided with a cable tube that allows different connections to be made more easily without the need to access the interior of the module:

- Nutri - 13-wire tube

The cables of the different tubes will be identified by colours and numbers. Connect them according to the following table and according to their functionality.

Nutri			
Wire colour	ID	Function (3 sensors + digital input)	
	White	A1	Analog input NUTRISENS NO3- sensor # 1
	Brown	0V	Common Power Sensors
	Green	A2	Analog input NUTRISENS K+ sensor #1
	Yellow	V2	NUTRISENS sensor #1 power supply
	Grey	A3	Analog input NUTRISENS NO3- sensor # 2
	Pink	0V	Common Power Sensors
	Blue	A4	Analog input NUTRISENS K+ sensor #2
	Red	V4	NUTRISENS sensor #2 power supply
	Black	0V	Common power sensors SDI-12
	Purple	ED2-SDI12	SDI-12 sensor input
	Grey-pink	V1	SDI-12 sensor power supply
	Red-blue	ED1	Digital Input 1
	White-green	CD	Common inputs

Consult the sensor manual for information about its installation.



To ensure the seal of the module's cable connections, it is recommended to use watertight terminals. The connection through these terminals must be made without stripping the cable's wires.

The 3M Scotchlok series (www.3m.com), ES Caps from TYCO Electronics (www.tycoelectronics.com), or Cellpack resin splicing and junction kits (www.cellpackiberica.com) can be used as connecting elements.






Settings

For any AgroBee-L module to enter the correct operating mode, you must have an Agrónic controller (Agrónic 2500, Agrónic 4500, Agrónic 5500 and Agrónic Bit Con) with the AgroBee-L option installed, which includes the internal coordinator and an antenna with 10 metres of cable. This can be verified by doing the following in the controller:

Consult → Communication → AgroBee-L → Status: Correct



In the same way, a module must be configured to communicate with the Agrónic with which you want to associate it. To do this (if the module is not already configured at the factory) you must use the Module Reader (or Agronic Radio Reader, LAR) consisting of a screen and four keys, that is connected to the AgroBee-L module through the only connector visible on the inside.

Press the  key to enter the main menu. Use the  and  keys to change the options within the menu. Use the  key to enter the selected menu option. Use the  key to return to the previous hierarchy's menu.

NOTE

Once the AgroBee-L module is linked with an Agrónic, all the consultations and parameters are accessible through the Agrónic.

CONTROLLER QUERY OF AN AGROBEE-L MODULE

General query menu of the module, where the following parameters are displayed:

- Module and serial number:
 - Module: It refers to the module number (1 to 20) according to the established communication parameters. There can only be one same module number for each Agrónic.
 - Serial number: Information regarding the controller. It comes from the factory.
- Battery voltage and solar panel:
 - Vbat: Battery voltage:
 - Panel+Supercapacitors: Maximum value: 3.4V; Minimum value: 2.2V
 - Panel+Battery: Maximum value: 4.2V; Minimum value 3.4V
 - Vsol: Voltage of the solar panel

These same data can be viewed in the Agrónic by accessing “Consult - Communications - AgroBee,” as you will see in the next section.

CONSULT COMMUNICATIONS IN AN AGROBEE-L MODULE

Communication consultation menu of the module, where the following parameters are displayed:

- Transceiver: Type of emitter installed in the module. It tells you if the module works at 868MHz/433MHz or 915MHz
 - RN2483 (868MHz/433MHz)
 - RN2903 (915MHz)
- Band and transmission mode:
 - Band: 868MHz, 433MHz, 915MHz
 - Transmission Mode: 1 to 18 (mode 5 will be set by default)
- Consult parameters of the communication type:
 - Channel: 1 to 13
 - Network code: It is usually the associated Agrónic serial number
 - BW: Bandwidth of the radio modulation (125KHz, 250KHz, 500KHz). It is set according to the transmission mode chosen in the communication parameters.
 - Radio modulation factor: SF7, SF8,..., SF12. It is set according to the transmission mode chosen in the communication parameters.
 - Communication status:
 - Status message:
 - Correct Communication
 - Network error
 - Communication error
 - Model error
 - Does not communicate
 - Signal-Noise ratio of the last received message: Reliable communication if >40%.
 - Time until next radio emission: time in [s]
 - Status of the last 16 communications (the previous communications appear on the right side of the screen):
 - 1: It indicates that the emission has been made and the correct information received in the last communication
 - 0: Indicates that the radio emission has been made, but the correct data has not been received or no data has been received

Part of this information is available through the Agrónic by accessing “Consultation | Communications | AgroBee”, where you can also see the query regarding the controller and the parameters of the communication.

CONSULT COMMUNICATIONS

AgroBee-L 868

Status: Correct

Timing: 60”

Channel: 01 TX Mode: 05

Network code: 00001

CONSULT COMMUNICATIONS

M01 (ns. 236) V1.00

Status: Correct (40”)

Level: 80% / 82%

Vbat: 04.0 V Vsol: 05.8 V

1111111111111111

CONSULT THE AGROBEE-L MODULE DIGITAL AND ANALOG INPUTS

Menu to check the status of digital inputs, counters, and Nutri inputs. The information shown on the different screens is as follows:

- Check digital inputs: For each of the digital inputs available to the module in question, its status is shown either as '0' (open contact) or '1' (closed contact).
- See accumulated counter sensors: The total number of pulses detected will be displayed for each digital input configured as a counter sensor. If this entry is not configured as a counter, the text 'N-A' (Not-Activated) will appear.
- See instant flow rate (time between pulses): The time in [ms] between the last 2 pulses detected will be displayed for each digital input that is configured as a counter sensor. If this entry is not configured as a counter, the text 'N-A' (Not-Activated) will appear.
- Consult analog sensors: For each of the available analog inputs, the value read is displayed and expressed in [%] according to the type of input in question. If the analog input in question is not configured, the text 'N-A' (Not-Activated) will appear.
- Check the supply voltage of the analog sensors: The value of the supply voltage sent to the active analog sensors is displayed in [mV].

From the Agrónic, press the '1' key in the module's consultation screen on the Agrónic to view the analog/digital inputs.

Nomenclature used in these queries (Below is an example of the screen you can see):

- **EA** Analog input values in mV:
 - Nutrisens sensor input: Value in mV (direct value, or concentration estimate, depending on the chosen format). The number next to EA indicates the sensor number. The second number indicates whether it is Nitrate (1) or Potassium (2)
 - SDI-12 sensor input: Value, in 4-20mA format, of the relevant VWC and temperature values. AI3 to AI6 for VWC values. AI7 to AI10 for temperature values
- **ED** status of digital inputs. With a '1' indicating that the contact is closed and a '0,' that it is open.
- **Vsen** value of the voltage in mV supplied to the sensors.

```

AgroBee-L 02 NUTRI
EA1-1: 963 EA2-1: 963
EA1-2: 963 EA2-2: 963

Vsen: 12125
ED: 1
    
```

```

AgroBee-L 02 NUTRI
EA3: 963 EA7: 963
EA4: 963 EA8: 963
EA5: 963 EA9: 963
EA6: 963 EA10: 963
    
```







The following table shows the relationship between the sensor number and the corresponding parameter:

<i>Sensors (analog inputs)</i>					
Nº	Description	Units	Nº	Description	Units
01	Nitrate sensor 1	mV or meq/L	07	Water content in soil at 60 cm	%
02	Potassium sensor 1	mV or meq/L	08	Water content in soil at 80 cm	%
03	Nitrate sensor 2	mV or meq/L	09	Soil temperature at 20 cm	°C
04	Potassium sensor 2	mV or meq/L	10	Soil temperature at 40 cm	°C
05	Water content in soil at 20 cm	%	11	Soil temperature at 60 cm	°C
06	Water content in soil at 40 cm	%	12	Soil temperature at 80 cm	°C

COMMUNICATION PARAMETERS OF AN AGROBEE-L MODULE

The following parameters are in the Communication Parameters menu of the Module Reader, which allow you to establish the communication of a certain AgroBee-L module with a controller:

- **Module** Module number in the network. It is used to distinguish all modules that may be associated with an Agrónic. The module number cannot be repeated in the same Agrónic:
 - 1 to 20 (timing in normal mode)
 - 1 to 10 (timing in priority mode)
- **Band** Frequency Band:
 - 868MHz or 915MHz (default value, depending on the model)
 - 433MHz (only available in models that also support 868MHz band)
- **Channel** Frequency channel number:
 - 1 to 13 (independent from the band used)
- **TX Mode** Transmission method. Set the radio's transmission and reception parameters.
 - 1 to 18 (mode 5 set by default):
 - Mode 1: The shortest coverage length permitting the lowest lag time
 - Mode 18: The greatest coverage length, but with the most lag time
- **Timing** 2 timing modes:
 - Normal mode (recommended): It is automatically set according to the chosen transmission mode, but always includes the communication of up to 20 modules. Value between 60" and 200".
 - Priority mode: It is automatically set according to the chosen transmission mode and includes the communication of up to 10 modules. Value between 30" and 100".
- **Network code** It differentiates the information from several controllers with the same communication parameters (band, channel, and transmission mode). The Agrónic serial number is assigned by default.

To modify any of the sub-menu's fields, press . The screen will display that you are in edit mode. Use the  and  keys to set the desired value. Confirm with  or dismiss with . Press  to exit the menu and access the previous hierarchy's menu, which will change the parameters and let them take effect.

For an AgroBee-L module to establish communication with a certain Agrónic, you must set, through the reader, the parameters that have just been described, according to those established in the Agrónic in question. In the Agrónic, you can modify these parameters in 'Parameters | Installer | Communications | AgroBee | Coordinator':

AgroBee-L
Channel: 01
Network code: 00001
Timing: standard
Band: 868MHz
TX Mode: 05

INPUT/OUTPUT PARAMETERS OF AN AGROBEE-L MODULE

In the Input-Output Parameters menu of the Module Reader, you can set the parameters of the AgroBee-L module's different inputs and outputs, available through the following sub-menu:

- **Digital Inputs** Configuration of digital sensors or counters.
 - Configuration of functions of each of the available digital inputs:
 - Digital input
 - Counter
 - Anti-bounce filter: (default 300 ms) only applicable when digital input is setup as counter. A filter time between 0.0” and 10.0” can be fixed, and it represents the minimum time that a contact must be closed to count a new pulse. Same time is considered for all the inputs of the module. This filter time can only be setup by using the Module Reader (it cannot be setup from the programmer to which this module is linked).
- **Sensors** Configuration of analog sensors:
 - S1-N: Active / Not Active (Nutrisens #1)
 - S2-N: Active / Not Active (Nutrisens #2)
 - S3-S: Active / Not Active (SDI-12)
 - Sensor type: AquaCheck-8, Drill&Drop H-T
 - Type of soil: Only applies to AquaCheck. The different soil possibilities are shown in the following table:

Table on the selection of terrain according to sensor







Sensor	Mineral terrain	Mulch terrain	Clay terrain	Mud/loam: terrain	Loam terrain	Clay/loam terrain
AquaCheck-4/-8	x	x	x	x	x	x

- Reading rate: 5min (default), 10min, 20min
- Format: Refers to how the Nutrisens sensor values are delivered.
 - Direct: Value in mV in the -1300mV a +1200mV range
 - Estimate: Estimated value of the concentration according to the following expression:

$$\text{Concentration [meq/L]} = 10 \left(\frac{\text{Value_direct} - \text{Coefficient \#1}}{\text{Coefficient\#2}} \right)$$

You must introduce the coefficients of the equations in order to correctly display these values (see next point).

- N1-C1: Coefficient #1 for the Nitrate concentration estimate of Nutrisens sensor #1
- N1-C2: Coefficient #2 for the Nitrate concentration estimate of Nutrisens sensor #1
- K1-C1: Coefficient #1 for the Potassium concentration estimate of Nutrisens sensor #1
- K1-C2: Coefficient #2 for the Potassium concentration estimate of Nutrisens sensor #1
- N2-C1: Coefficient #1 for the Nitrate concentration estimate of Nutrisens sensor #2
- N2-C2: Coefficient #2 for the Nitrate concentration estimate of Nutrisens sensor #2
- K2-C1: Coefficient #1 for the Potassium concentration estimate of Nutrisens sensor #2
- K2-C2: Coefficient #2 for the Potassium concentration estimate of Nutrisens sensor #2

To modify a field of any of the parameters, press . The screen indicates that you are in edit mode. Use the  and  keys to set the desired value. Confirm with  or dismiss with . Press  to exit the menu and access the previous hierarchy's menu, which will change the parameters and let them take effect.

IMPORTANT

The detailed input/output parameters can also be entered in the Agrónic. In this case, the module will receive the parameters upon communicating with it. If not, and these parameters have been changed through the Module Reader in the same module, the Agrónic will receive and update said parameters.

To modify these parameters from the Agrónic, you must access "Parameters - Installer - Communications - AgroBee - Module." Specify the module number in the Agrónic network in question, after which you will see the following screens to modify the detailed parameters (see the Agrónic manual in question for more details).

AgroBee-L 01
Timing: 05'
S1-N: yes S2-N: no S3-S: yes

Sensor: AquaCheck-8
Terrain: Mineral

Format: Direct

N1-C1: +/-0000.00
N1-C2: +/-0000.00
K1-C1: +/-0000.00
K1-C2: +/-0000.00

N2-C1: +/-0000.00
N2-C2: +/-0000.00
K2-C1: +/-0000.00
K2-C2: +/-0000.00

ANALOG NUTRI SENSOR FORMAT

Regarding the values of the Nutrisens sensors, it is not necessary to apply any format into the controller, since the value sent to them by the AgroBee-L module does not undergo any changes.

For the sensors provided through the SDI-12 bus, a certain format must be applied. The possibility of selecting one or another type of terrain is determined by the sensor manufacturer itself. Being able to make this selection allows the SDI-12 module to perform one process or another with the sensor readers, just like the manufacturer itself recommends:

- **AquaCheck-8** This sensor delivers a value between 0 and 100, which represents the WVC (Volumetric Water Content). In order to obtain the desired WVC value, the relevant equation must be applied according to the type of terrain, which is already done internally by the AgroBee-L module:

i.Mineral:

$$\text{WVC}[\%] = -7.4347 + 0.5564 * (\text{SF-reading})$$

ii.Sand:

$$\text{WVC}[\%] = -8.6463 + 0.5219 * (\text{SF-reading})$$

iii.Clay:

$$\text{WVC}[\%] = -5.9575 + 0.6193 * (\text{SF-reading})$$

iv.Mud-Loam:

$$\text{WVC}[\%] = -2.7900 + 0.4392 * (\text{SF-reading})$$

v.Loam:

$$\text{WVC}[\%] = +4.8372 + 0.4851 * (\text{SF-reading})$$

vi.Clay-Loam:

$$\text{WVC}[\%] = -8.4439 + 0.5650 * (\text{SF-reading})$$

,where the “SF-reading” is the value that the sensor directly delivers.

Regardless of whether or not AquaCheck-8 has been selected, the first 4 WVC values (those of the 4 upper sensors) and the first 4 temperature values will be delivered.

The obtained temperature [°C] and WVC [%] values are converted by the module itself to the standard 4-20 mA (800-4000 mV) format, so, in the controller in question, you have to select the ideal data format according to the type of sensor and type of terrain selected. In the case of the Agrónic, the controller itself already selects the most suitable format when registering a sensor corresponding to an SDI-12 module. It is the user’s responsibility to change the data that characterize this format. In the case of a AquaCheck-8 sensor connected to the SDI-12 module:

Parameter	AquaCheck format sensor		
	Default value		
	Value 1	Value 2	Value 3
	WVC [%]	CE [mS/cm]	Temperature [°C]
No. of integers	3	-	2
No. of decimals	1	-	1
Sign	no	-	Yes
Units	%	-	°C
Calibration Point 1			
Actual Value	800 mV	-	800 mV
Logical value	000,0 %	-	-40,0 °C
Calibration Point 2			
Actual Value	4000 mV	-	4000 mV
Logical value	100,0 %	-	+50,0 °C



- **Sentek Drill&Drop Moisture-Temperature** This sensor delivers the VWC (Volumetric Water Content), the volumetric ion content (VIC, only for TriScan) and temperature. In the case of AgroBee-L NUTRI, **only the values of levels 2, 4, 6, 8 (VWC and Temperature) will be taken into account, starting from the top.**

The temperature values obtained [°C], VIC[] and VWC [%] are converted, by the module itself, to the standard 4-20 mA (800-4000 mV) format, so you must select the suitable data format in the controller in question according to the type of sensor selected. In the case of the Agrónic, the controller itself already selects the most suitable format when registering a sensor corresponding to an SDI-12 module. It is the user's responsibility to change the data that characterize this format. In the case of the Drill&Drop sensor connected to the SDI-12 module.

Drill&Drop format sensor			
Parameter	Default value		
	Value 1	Value 2	Value 3
	VWC [%]	VIC [] ⁽¹⁾	Temperature [°C]
No. of integers	3	5	2
No. of decimals	1	0	1
Sign	no	No	Yes
Units	%	-	°C
Calibration Point 1			
Actual Value	800 mV	800 mV	800 mV
Logical value	000,0 %	0	-20,0 °C
Calibration Point 2			
Actual Value	4000 mV	4000 mV	4000 mV
Logical value	100,0 %	10000	+60,0 °C

(1): VIC (Volumetric Ion Content): Only available in the TriScan model. Does not apply to the AgroBee-L NUTRI



- **EnviroPro** This sensor provides the soil water content index (VWC), Electrical Conductivity (EC) and temperature. In the case of the AgroBee-L NUTRI **only the values of levels 2, 4, 6, 8, 10, 12 (VWC) and levels 2, 4 (Temperature) starting from the top will be taken into account.**

The values obtained for temperature [°C], CE[dS/m] and VWC [%] are converted, by the module itself, to the standard format 4-20 mA (800-4000 mV), so that in the controller in question, the most suitable data format must be selected according to the type of sensor selected. In the case of the Agrónic, the programmer himself already selects the most appropriate format when registering a sensor corresponding to a NUTRI module. It is the responsibility of the user to change the data that characterizes said format. For the case of an EnviroPro sensor connected to the NUTRI module.

EnviroPro format sensor			
Parameter	Default value		
	Value 1	Value 2	Value 3
	VWC [%]	CE [1] ⁽¹⁾	Temperature [°C]
No. of integers	2	1	2
No. of decimals	1	2	1
Sign	No	No	Yes
Units	%	dS/m	°C
Calibration Point 1			
Actual Value	800 mV	800 mV	800 mV
Logical Value	000,0 %	0,00 dS/m	-20,0 °C
Calibration Point 2			
Actual Value	4000 mV	4000 mV	4000 mV
Logical Value	50,0 %	6,00 dS/m	+60,0 °C



(1): VIC (Volumetric Ion Content): Only available on the TriScan model. Not applicable on the AgroBee-L NUTRI.

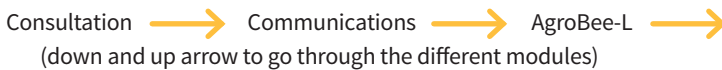
VARIOUS PARAMETERS OF AN AGROBEE-L MODULE

In the Various Parameters menu of the Module Reader, you can select the language among Spanish, Catalan, English, French, Italian, and Portuguese.

From this menu, you can also completely erase the module's data, restoring it to factory settings, maintaining the serial number and the model.

Battery levels and radio signal/quality

You have already seen how to consult the different parameters of an AgroBee-L module through the Module Reader. In the Agronic to which the AgroBee-L module is associated, it also shows the battery information and radio link performance of said module.



The information provided is:

- Module number, serial number, and firmware version
- Signal level received by the Agronic and the module. It is displayed in % and indicates the level of the signal-to-noise ratio.
- Advisable/recommended value > 40%
- Vbat: Battery level in mV:
 - Module with panel + supercapacitors: VBat max = 3.4 V; VBat min = 2.2 V.
- VSol: Voltage level delivered by the solar panel.

Estimated battery life

Battery life is approximate since there are several factors that can affect consumption. Frequent reading of digital sensors (when counters are configured) shortens the duration. Likewise, if a priority mode rate is set, the battery life will decrease.

Conversely, for the Nutri model, if a higher sensor reading rate is selected, the battery life will increase.

Battery life with standard communication rate mode 5: 60 seconds

Type	Nutri
Panel + Supercapacitors ⁽¹⁾	< 3 days

1): The duration of the battery with its maximum charge and without recharging. This case can occur when the solar panel does not recharge the battery (with clouds or fog).

Battery replacement you do not need to replace any battery in any case, since the power supply of the modules is based on a system of supercapacitors.

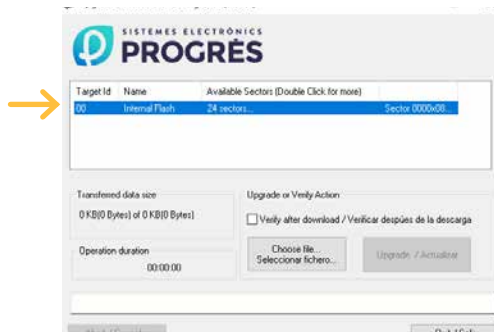
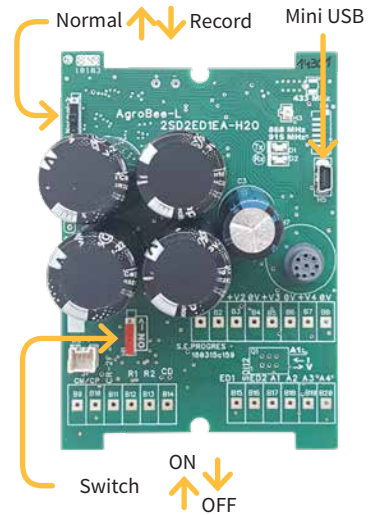
TURNING OFF THE CONTROLLER

If a module does not find the Agronic with which it communicates, said module will follow its own course, and will send data every certain time, according to the established timing. However, in order to avoid possible collisions and/or interferences, the module will slightly offset the pre-established communication time. The consumption of an AgroBee-L module is practically unchanged due to the fact that it is not connected to any Agronic.

Updating the AgroBee-L module software

Whenever there is a new software version for an AgroBee-L module, the user can update it. To do this, you must perform the following steps:

- Have a computer with an Internet connection and a USB to miniUSB cable.
- Download the program “AgronicUpg” + “drivers” + update file (dfu) by typing this address bit.ly/actualizaragronic into the computer’s browser.
- Select and download the AgroBee-L folder.
- Go to the module and turn it off using the switch.
- Place the other switch inside the module in the recording position (by default, it is in the ‘Normal’ position).
- Connect the USB to the computer and the miniUSB to the module.
- Start up the module using the ON/OFF switch.
- On the computer, run the program “AgronicUpg”. If you do not see the “Internal Flash” line on the screen as seen in the image, you must install the drivers. If you already have the drivers installed, skip to the next step.
- To install the drivers, go to the files you have downloaded and select the folder that corresponds to your Windows version. Run the file “dpinst_” and follow the steps. If you use Windows XP, call Progrés to help you with the installation.
- Press the “Choose file” button and select the file “xxx.dfu”. Once loaded, press the “Update” button and wait for the process to finish.
- Once the process is finished, the module is updated.
- To finish, turn off the module, disconnect the miniUSB cable, and place the second switch in the ‘Normal’ position.
- Finally, the module can be started up again.



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