

**DESCRIPTION:**

- This unit is used to activate solenoids, and read digital sensors (meters) and analog sensors from a distance using a 2-wire cable. According to the model, the Agrónic Monocable module (**MAM**) can connect up to:
  - **MAM1-20:**
    - 1 latch solenoid of 2 wires
    - 2 digital inputs / meters
  - **MAM2-00:**
    - 2 latch solenoids of 2 wires (or 1 of 3 wires)
  - **MAM3-20:**
    - 3 latch solenoids of 2 wires (or 1 of 3 wires)
    - 2 digital inputs / meters
  - **MAM3-30:**
    - 3 latch solenoids of 2 wires
    - 3 digital inputs / meters
  - **MAM2-22:**
    - 2 latch solenoids of 2 wires (or 1 of 3 wires)
    - 2 digital inputs / meters
    - 2 analog inputs 4-20 mA
  - **MAM1-20R:**
    - 1 relay output (24 V.)
    - 2 digital inputs / meters
- The capsule inside the case allows the module to be temporarily immersed in water.
- The connection between the MAM and the Agrónic is done through a linking unit, the Agrónic Monocable Link (**EAM**). A 2-wire cable from the EAM connects all the MAM's. This cable not only communicates the MAM but it also provides them with electrical power.
- Up to 120 MAM modules can be connected to a single EAM.
- The distance between the EAM and the last MAM on the line can surpass 10 km. (under certain conditions).
- Configuration and consultation using a Modules Reader with screen and keyboard.
- Has a connector with cap to connect the Modules Reader.
- Security: Batteries in the EAM last several hours in the event of a general power cut. With greater capacity batteries, the unit can last several days.
- Protection against overloads.
- Keep in mind that encapsulated MAM's can be integrated into the Agrónic Monocable system along with non-encapsulated MAM's (MAM2-41, MAM5-71, MAM8-101).



## TECHNICAL CHARACTERISTICS:

### Power supply

Power source	24 Vdc through the Monocable bus, -20% +25%	
Energy consumption:		
At rest:	2 mW	(MAM1-20R , with the relay activated: 25 mW)
While communicating:	4 W	

### Outputs

Number	1 to 3 latch solenoids 1 relay output at 24 Volts ac/dc
Latch type	6 Vdc, 9 Vdc, 12 Vdc or 16 Vdc Trigger time: 80 ms Capacitor charge: 3300 $\mu$ F

### Inputs

Digital	Number	From 0 to 3
	Type	Free power contact
Analog	Number	2 (10 bits)
	Type	Analog 4 – 20 mA

### Atmosphere

Temperature	-10 °C to 70 °C
Humidity	100% - IP67
Height	2000 m
Pollution	Grade II

### Weight and size

Weight	0.45 Kg
Height	100 mm
Width	130 mm
Depth	55 mm

## DECLARATION OF CONFORMITY

It follows the 89/336/CEE guidelines for the Electromagnetic Compatibility and the 73/23/CEE guidelines of Low tension for the fulfillment of the product security. The fulfillment of the following specifications was demonstrated as indicated in the Official Diary of the European Communities:



Emissions EN 50081-1:94	EN 55022:1994 Type B	Radiated and conducted emissions.
Immunity EN 50082-1:97	EN 61000-4-2 (95)	Immunity to electrostatic discharges.
	EN 61000-4-3 (96)	Immunity to the electromagnetic field of radioelectric frequency.
	EN 61000-4-4 (95)	Immunity to fast transitional in gusts.
	EN 61000-4-5 (95)	Immunity to crash waves.
	EN 61000-4-6 (96)	Current injection.
	EN 61000-4-11 (94)	Variations to the power supply.
Low tension guidelines:	EN 61010-1	Security requirements of measurement electric units, control and use in laboratory.



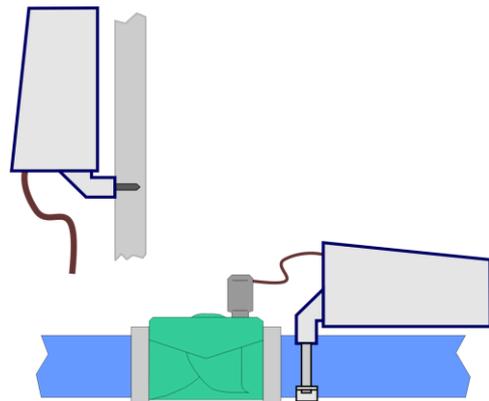
This symbol indicates that the electrical and electronic equipment should not be disposed of as general household waste at its end-of-life. Instead, the product should be handed over to the applicable collection point for the recycling of electrical and electronic equipment for proper treatment, recovery and recycling in accordance with your national legislation.

## INSTALLING AN ENCAPSULATED MAM:

The box can be fastened to a wall or attached to a pipe with a maximum diameter of 45 millimeters.

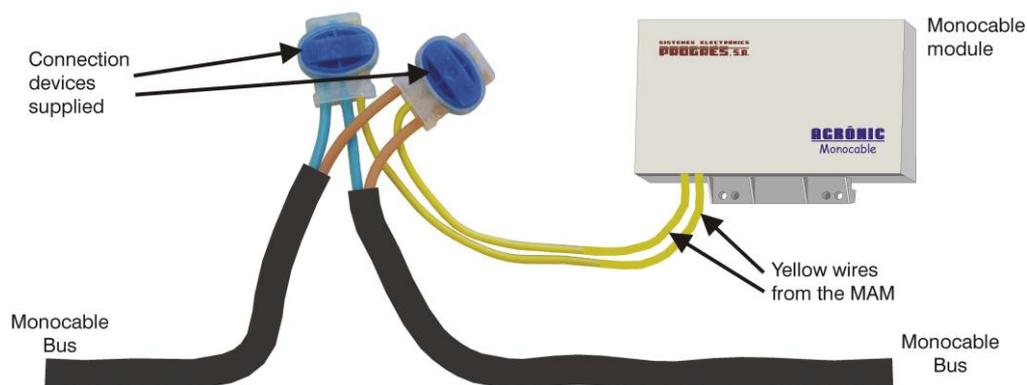
The cable outputs are 45 cm in length and are 0.5 mm thick. **Connections** using electrovalves, Monocable line or meters must be **soldered** and done using connection devices that ensure the union is **watertight**.

The connection devices which can be used include the series of Scotchlok de 3M ([www.3m.com](http://www.3m.com)), the series of *ES Caps* from *TYCO Electronics* ([www.tycoelectronics.com](http://www.tycoelectronics.com)), or the *splicing and resin derivation kits* from *Cellpack* ([www.cellpackiberica.com](http://www.cellpackiberica.com)).



The unit comes with two watertight connection devices so the installer can properly connect the MAM to the Monocable bus. The **connection** with these elements must be made **without stripping the wires** of the cable.

Insert the three wires without removing the copper wire sheathing and then press them tightly together with some flat pliers to lock them into position.



### OPERATION:

The Agrónic Monocable system operates with a linking unit, the Agrónic Monocable Link (EAM), which communicates to the Agrónic using a RS485 bus or RS232 serial port and the *ModBus* communication protocol. The EAM supplies the 24 Vdc which powers the entire Monocable system and distributes it through a 2-wire cable which in turn connects all the Agrónic Monocable Modules (MAM). All the valves, meters, sensors, etc. are connected to the MAM.

Up to 120 MAM's can be connected to a single EAM (depending on the total length and type of cable used). Each MAM is identified by a number and can be placed in any order along the line. This identification can be changed at any time using the Modules Reader.

The MAM's are organized into groups of 10 (from 1 to 10, from 11 to 20, etc.). Every 6.6 seconds the output status is sent to a group and each MAM in this group sends the status of their inputs, totals, sensors, etc. The fewer groups on a line, the faster the communication is between each MAM. In the worst possible case, with 120 MAM connected on a line, it will take 80 seconds to connect to all the MAM's.

**MAM with priority:** if it is necessary that one MAM in particular needs to act very rapidly, either in the solenoid activity or sending the sensor or digital input readings, it can be configured as an "MAM with priority". This module will connect to the EAM every 6.6 seconds. To do this the MAM occupies one communication space for each group, which in turn means the MAM's that occupy its place in each group cannot connect to the line. Example: if MAM 1 has priority, it cannot connect to the line, and nor can 11, 21, 31 ... or 111.

### INPUTS AND OUTPUTS:

#### DIGITAL INPUTS:

There are up to 2 digital inputs, **D3** and **D4**, which can function as a digital input or as a meter. When a meter is connected to a digital input, it has the ability to count up to 5 pulses per second.

The common return for the **CD** inputs will be connected with the **Purple** wire

The D3 input will be connected to the **Grey** wire, the D4 to the **Brown** wire, and the D5 to the **White**.

The contacts on the unit that connect to a digital input must be free potential contacts.

#### ANALOG INPUTS:

The MAM has two analog inputs **A1 (White)** and **A2 (Pink)** for reading sensors that emit a 4 – 20 mA signal. The input also has a 200  $\Omega$  resistor which can read voltages of 800 mV for the 4 mA and 4000 mV for the 20 mA.

The sensors are powered at 12 Vdc provided by the MAM. The sensor only receives power for the time that has been configured, as for the rest of the time it has no power to it. The time between readings is configured on site, and can differ according to the function of the MAM and the sensors. The sensor power is connected to the **Green** wire for the positive of 12 V, and the common or 0 V will be the **Violet** (digital and analog common).

## LATCH SOLENOIDS:

MAM can operate with two or three wires latch solenoids using:

- *2-wire latch solenoids*: the common return of all the solenoids is connected to **CR, Black** wire, the other solenoid wire is connected to the wires marked as **R1 to R3**.
- *3-wire latch solenoids*: with this type, the encapsulated MAM can activate just one solenoid. Solenoid connection is **CR** (common return) to the **Black** wire, **R1** (start action) to **Red** wire, and **R2** (stop action) to **Blue** wire. The MAM3-30 model cannot have a 3-wire latch solenoid

The trigger voltage in the solenoid is programmable, and can be of 6, 9, 12 or 16 V.

Keep in mind that many latch solenoids with 3 wires can function perfectly well with 2 wires, if it were necessary to use them.

## OUTPUT RELAY:

The MAM1-20R model has an output for the “PhotoMOS” relay to activate devices powered at 24 volts of alternating or direct current. The maximum current is 1 Ampere and the voltage limit is 40 volts.

The internal relay output corresponds to R1 and R2, **Red** and **Blue** respectively.

Keep in mind in the study and execution of the Monocable line that a module with an activated relay consumes the same power as 12 normal modules.

## CONNECTIONS OF ENCAPSULATED AGRÓNIC MONOCABLE MODULE:



The wires connection is done by the following code of colors:

Function	MODEL						
	MAM1-20	MAM2-00	MAM3-20	MAM3-30	MAM2-22	MAM1-20R	
Monocable1	Yellow 1						
Monocable2	Yellow 2						
Output R1	Red	Red	Red	Red	Red	Red	
Output R2		Blue	Blue	Blue	Blue	Blue	
Output R3			Green	Green			
Common CR	Black	Black	Black	Black	Black	Black	
Digital D3	Grey		Grey	Grey	Grey	Grey	
Digital D4	Brown		Brown	Brown	Brown	Brown	
Digital D5				White			
Common CD	Violet		Violet	Violet	Violet	Violet	
Analog A1					White		
Analog A2					Pink		
Power V+					Green		
Common CA/CD					(Violet)		

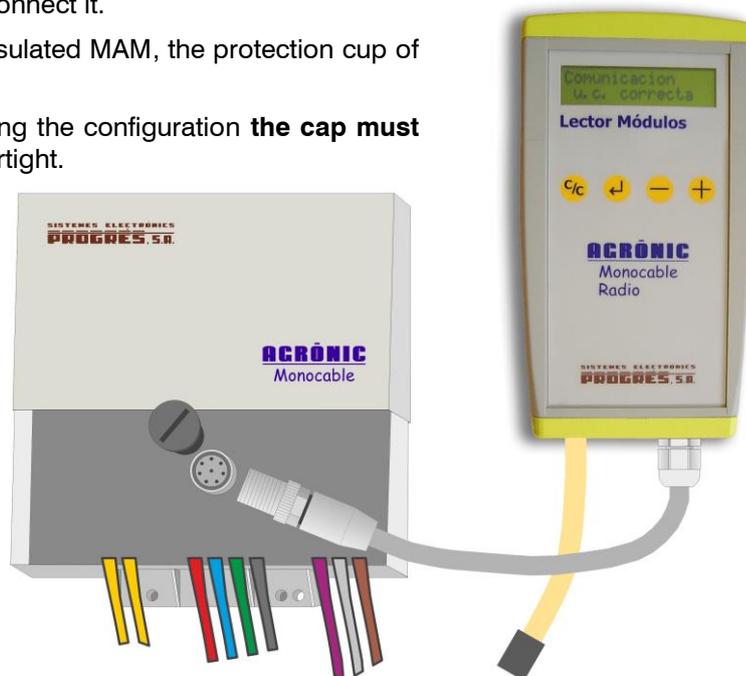
## CONFIGURATION:

The configuration on the MAM is made using the Modules Reader, consisting of a screen and four keys. It is not necessary to disconnect the MAM in order to connect it.

To connect the Modules Reader to the encapsulated MAM, the protection cup of the central connector must be taken out.

It is recommended that when finished adjusting the configuration **the cap must be properly closed** to ensure the unit is kept watertight.

After connection the Modules Reader, press a key for the screen to display the consultation. To then reach the configuration screen, press the  key and enter the menu. Change between the menu options with the keys  and . Use the  key to enter the selected menu option.



Options in the menu:

- **Consultation**
- **Configuration**
- **Manual**

### Consultation:

- Product name and program version.
- Status of solenoids 1 to 3.
- Status of digital inputs 3 to 5, which correspond to meters 1, 2 and 3.
- Totals stored in the MAM and EAM sending protocol. 2 screens.
- Analog sensor reading (in millivolts). Does not appear on MAM3-30.
- Status of MAM communications:
  - o Syncr: no . Not synchronizing with the EAM, there is no communication.
  - o Syncr: yes. Synchronized with the EAM, the communication is okay.
  - o Vdc: no. No voltage from the Monocable line.
- Last communication received from EAM:
  - o okay. Last communication received correctly.
  - o error timeout. Nothing received in last connection.
  - o error checksum. Last communication received with erroneous data.
  - o error group. Last communication received is from other MAM group.
  - o error config. Error occurred due to communication configuration.
  - o change group. The total number of groups has changed.
- Status of the last eight communications: 0 marks all the communications which were erroneous and 1 marks those which were correct. The number appearing to the right of the screen indicates the phase-out time between the EAM and MAM.
- Next reception: time between two receptions, time remaining before the next one, and time remaining before the next synchronization.
- Latch voltage: shows the voltage applied to the latch solenoid in the last activation or deactivation that took place. The voltage level is shown in millivolts.

### Configuration:

- *MAM number*: a value from 1 to 120 is used to distinguish the 120 possible modules which can be connected to an EAM.
- *3W valve*: a “no” response indicates that 2-wire latch solenoid will be used; with “yes”, 3-wire latch solenoid is used. Does not appear on MAM3-30.
- *T. Latch*: the voltage to activate the latch solenoid. May be 16V, 12V, 9V or 6V.

- *T. sensor*: indicates, in minutes, the sensor reading frequency. Setting it to 0 means no reading will take place. The maximum time between readings is 200 minutes. Does not appear on MAM3-30.
- *T. sen 1 2*: this is the time needed to power sensors so the reading will be done correctly. The unit of time is 0.01 seconds. The power supply is 12 V. Setting it to 0 means the sensor does not make a reading. The maximum time that the sensors can be powered is  $40 \times 0.01 = 0.4$  seconds. Does not appear on MAM3-30.
- *Delay m.*: This is the minimum time needed to activate the meter pulse for it to increase the total. A pulse at a lesser time will not increase the total. The time is indicated in seconds and a decimal. The default value is 1.0".
- *Close R1*: setting at "1" indicates that the solenoid connected to R1 will close in the event of a power cut in the Monocable line.
- *Priority*: setting to "yes" means the MAM will have a rapid response time; setting it to "no" means the MAM will respond in its turn according to the number of groups per line.

**Manual:**

In this menu option, the solenoids can be activated manually. We cannot exit this menu option if one of the solenoids is being manually activated.

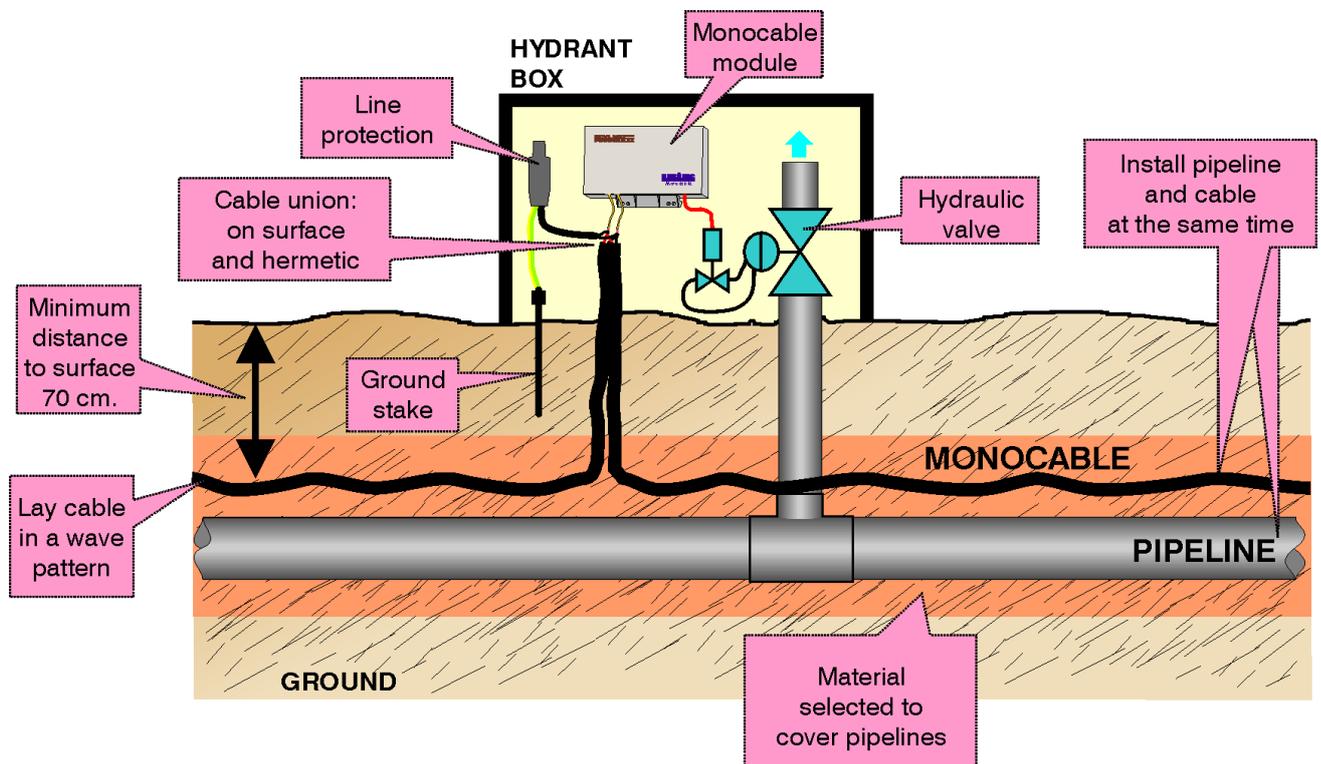
**PRACTICAL TIPS:**

- The maximum No. of MAM's that can connect to an EAM is 120, although this number may be lower, according to the section of 2-wire cable used and the total line distance.
- For long distances it is better for MAM in the same group not to be connected consecutively along the line.
- When the voltage at the end of the line is less than 20 Vdc, it is better not to name all the MAM's in one group. For example, set the MAM's as 1, 4, 8, 11, 14, 18, and do not set 2, 3, 5, etc. In this way we can make sure the voltage on the line remains uniform.
- **The EAM and non encapsulated MAM's must be installed in a place which are protected against sunlight and rain.**
- Encapsulated MAM's are protected against inclement weather, but if they are kept from direct sunlight, the resistance of the box will be maintained over time.
- In the EAM with SAI model, the batteries must be **disconnected** every time the system remains without power for a period of time, to avoid deterioration of these batteries.
- All of the system's MAM units will be configured to prevent the R1 output from closing when the system is without power. This parameter can be individually modified if required by the installation (module with general output/hydrant and gravity irrigation installations).
- A system with a total cable length of less than 500 meters and fewer than 8 modules can present a malfunction of communications with the modules. Contact PROGRÉS to make the necessary adjustments.

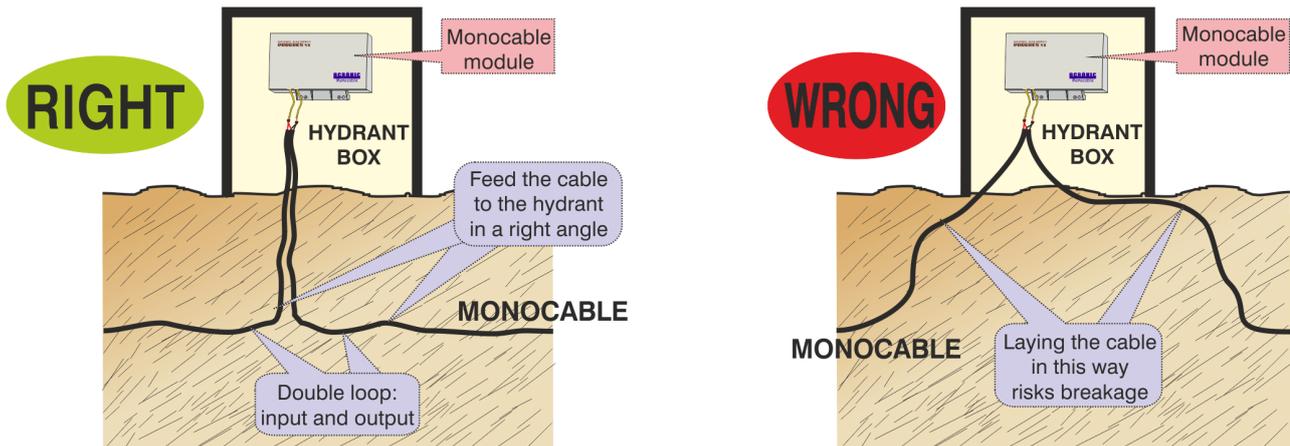
**RECOMMENDATIONS FOR INSTALLING THE MONOCABLE BUS:**

- **Unit distribution:**
  - a) Have a map or sketch with the location of the modules to make them easier to install and start up, taking into consideration the configuration Sistemas Electrònics Progrés S.A. has provided regarding the distance between the Agrònic and the modules.
  - b) Have strategically placed line protections on branch ends, forks, and sections over 500 meters, with their corresponding grounding connection.
- **Choosing the cable:**
  - a) 2-wire section cable between  $1.5 \text{ mm}^2$  and  $2.5 \text{ mm}^2$ , according to the distance and number of modules to install.
  - b) **Reticulated polyethylene (RV-K)** insulation should be used between wires to ensure a low mutual capacity. Insulation voltage of 500V.
  - c) Cable of lower mutual capacity possible. To ensure 10 km distances, we should choose cable of less than 60 nanofarads/kilometer (nF/km) and never more than 80 nF/km. If this is not given on the cable specifications, request them from the manufacturer.
  - d) For installations with breakage risks due to improper handling or ground settling, flex cable (RVFK) is recommended.

- e) In areas with high levels of electromagnetic interference or installations with two or more parallel cables, shielded cable (RVMK) is recommended.
- f) Using flex or shielded cable means having greater mutual capacity, which will reduce reach capacity.
- **Cable specification to be used with Monocable System**
    - **RV-K:** Type of cable used worldwide in electrical installations.
      - **R:** Inner cables cover: XLPE or PEX (Cross-linked polyethylene)
      - **V:** External cover: PVC (Polyvinyl chloride)
      - **K:** Flexibility
        - Class 5: Flexible
        - Class 1-2: Rigid
    - **RVMK:** Same cable specified above but with a crown of wires below external cover acting as a protection against rats, rabbits ...
      - **R:** Inner cables cover: XLPE or PEX (Cross-linked polyethylene)
      - **V:** External cover: PVC (Polyvinyl chloride)
      - **M:** With crown of wires below external cover.
      - **K:** Flexibility
        - Class 5: Flexible
        - Class 1-2: Rigid
    - **RVFK:** Same cable specified above but with a double steel spring below external cover acting as a protection against rats, rabbits ...
      - **R:** Inner cables cover: XLPE or PEX (Cross-linked polyethylene)
      - **V:** External cover: PVC (Polyvinyl chloride)
      - **F:** With a double steel spring below external cover.
      - **K:** Flexibility
        - Class 5: Flexible
        - Class 1-2: Rigid
  - **Cable laying:**
    - a) Do not connect any wires from the Monocable bus to the ground.
    - b) Install the cable in the same trench as the pipelines and at the same depth to prevent breakage from agricultural machinery or rodents, not to mention the corresponding costs. Coil the length of cable without stretching it, which may cause breakage if the terrain settles.
    - c) Avoid scrapes or slight cuts in the cable as it can cause variations in the cable magnitude (capacities, inductances, resistances, etc.) which directly affect communication signals. As a cable covering material, use the same soil bed where the pipelines have been laid.



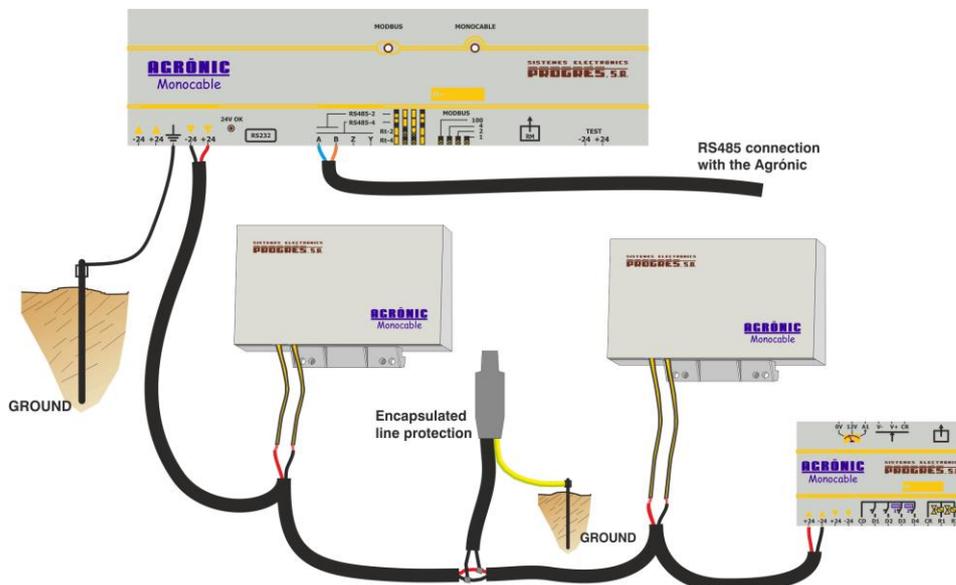
- d) Respect the safety distances in the cable when connecting the modules to prevent machinery from breaking it.



- e) The union of the roller end with the next one is always done at the surface. If not, the union must be completely watertight using thermo-retracting terminals with sealant or resin unions.

• **Connecting and verifying the installation:**

- Begin the connections along the line protections and the EAM at the top, with its ground line, to safeguard the installation against electric shocks at all time.
- Leave a sufficiently loose wire coil where the connection modules will be installed, avoid buried unions and always respecting the depth level of the buried cable.
- Make continuity and ground insulation tests for each branch or splice points.



**ATTENTION:**

- ✓ It is very important to close correctly the protection cup of the configuration connector to keep the device watertight.
- ✓ Prevent as much as possible any sunlight from falling directly on encapsulated MAM's. Put always the protection external cover.

**Sistemas Electrònics Progrés, S.A.**

Polígon Industrial, C/ de la Coma, 2  
 25243 El Palau d'Anglesola | Lleida | España  
 Tel. 973 32 04 29 | info@progres.es  
 www.progres.es