Agrónic Monocable Manual
MAM 5-72 y 8-102 Encapsulated

CODE 06630036 (MAM 5-72) | 06630037 (MAM 8-102)

Agrónic Monocable Module (MAM) for activating solenoids and
reading meters and sensors remotely using a two-wire cable

Depending on the model, it offers the following connections:

- MAM 5-72
  - 5 2-wire latch solenoids (or 2 3-wire ones)
  - 7 digital inputs (5 can be meters)
  - 2 analog 4-20 mA inputs

- MAM 8-102
  - 8 2-wire latch solenoids (or 4 3-wire ones)
  - 10 digital inputs (8 can be meters)
  - 2 analog 4-20 mA inputs

The encapsulation inside the box allows the module to be temporarily immersed in water.

The connection between the MAM and the Agrónic is made through the Agrónic Monocable Link (EAM). From the EAM, there is a two-wire cable to which all the MAMs are connected. This cable allows both power and communication to be transmitted to the MAMs.

Up to 120 MAM modules can be connected to a single EAM link.

The distance between the EAM and the last MAM on the line can exceed 10 km (always relative to conditions).

Configuration and consultation through the Module Reader using the screen and the keyboard.

Double security:
- There is an optional battery (supercapacitor) in each MAM with a duration of more than 48 hours in case of power failure or the Monocable is cut.
- Batteries in the EAM last for several hours in case of power failure. With batteries of greater capacity, it can remain working for several days.

Surge protection.

Technical characteristics

Power		
Power source	24 Vdc through the Monocable's own bus, -20% +25%	
Energy consumption	Idle	14 mW
	Communicating	4 W

Outputs	
Number	5 to 8 latch solenoids
Type	6 Vdc, 9 Vdc, 12 Vdc, or 16 Vdc Breakdown times: 80 ms Charging of capacitor: 3300 µF

Inputs		
Digital	Number	7 to 10
	Type	potential-free contact
Analog	Number	2 (12 bits)
	Type	analog 4 - 20 mA

Environment	
Temperature	-10°C to +70°C
Moisture	100% - IP67
Altitude	2000 m
Pollution	Grade II

Weight and dimensions (approx.)	
Height	132.8 mm
Width	178 mm
Depth	70.5 mm
Weight (approx.)	0.95 Kg

| Declaration of conformity		
Complies with Directive 2014/53/EU for Electromagnetic Compatibility and the Directive of Low Voltage 2014/35/EU for Product Safety Compliance		CE
Emissions EN 50081-1:94	EN 55022:1994 Class B	Radiated and conducted emissions.
Immunity EN 50082-1:97	EN 61000-4-2 (95)	Electrostatic discharge immunity.
	EN 61000-4-3 (96)	Radio frequency electromagnetic field immunity.
	EN 61000-4-4 (95)	Fast transient/burst immunity.
	EN 61000-4-5 (95)	Shock wave immunity.
	EN 61000-4-6 (96)	Current injection
	EN 61000-4-11 (94)	Variations in the power supply.
Low voltage directive	EN 61010-1	Safety requirements on electrical equipment for measurement, control, and laboratory use.

This symbol indicates that electrical and electronic devices should 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 recycling and proper treatment of electrical and electronic equipment in accordance with national legislation.

Installation

The box can be installed into a wall or held in a tube with a maximum diameter of 45 millimetres.

There is also an optional set of mounting clips to install the module on a DIN rail (06140329).
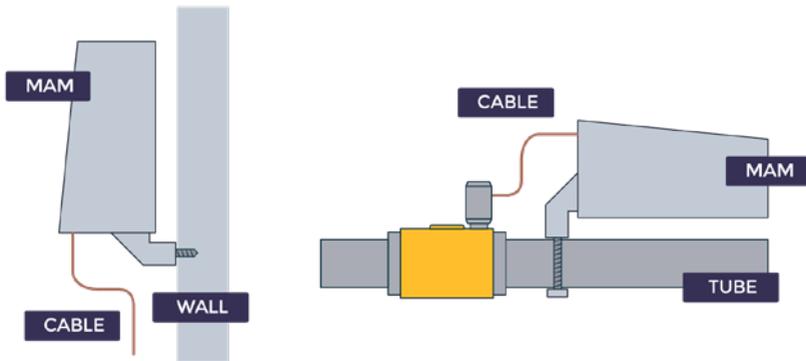

Connection

Cable outlets are 45 cm long and 0.5 mm thick. **The connections with the solenoid valves,** Monocable line, or meters **must be welded and made with connection elements that ensure a watertight connection.**

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

The controller is provided with two watertight connection elements for the installer to properly connect the MAM with the Monocable bus. **The connection with these elements must be done without stripping the cable wires.**

Insert the three cables into each element without removing the sheath from the copper wires, then press firmly with flat-nose pliers to lock them in place.
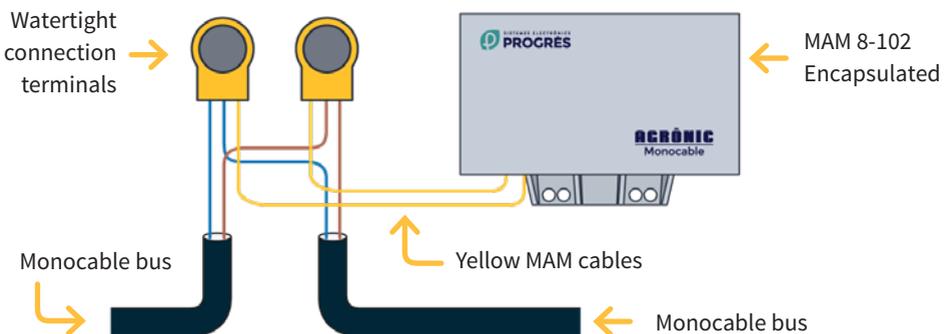
Operation

The Agrónic Monocable system works with an Agrónic Monocable Link (EAM) that communicates with the Agrónic through an RS-485 bus or RS-232 serial port and with ModBus communication protocol. The EAM supplies 24 Vdc, which powers the entire Monocable system and is distributed via a two-wire cable to which all the Agrónic Monocable Modules (MAM) are connected. Valves, meters, sensors, etc. are connected to the MAMs.

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

The MAMs are organized in groups of 10 (from 1 to 10, from 11 to 20, etc.). Every 6.6 seconds, the status of the outputs is sent to a group and each of the MAMs in that group sends their status for inputs, totals, sensors, etc. The fewer groups there are on a line, the faster the communication with each of the MAMs will be. In the worst case, with 120 MAMs connected on the line, it will take 80 seconds to communicate with all the MAMs.

MAM priority if an MAM must act very quickly, both for activating solenoids and sending readings from sensors or digital inputs, it can be configured as *"MAM priority"*. This module communicates with the EAM every 6.6 seconds. To do this, the MAM occupies a communication space in each group, so, the MAMs that occupy their place in each group cannot be connected to the line. Example: if MAM 1 has priority, neither line 11, 21, or 31, ..., nor 111 can connect to the line.

Inputs and outputs

DIGITAL INPUTS

There are up to 10 digital inputs, D1 to D10, which can function as digital inputs. Inputs D3 to D10 can also function as a meter. When a meter is connected to a digital input, it can count up to 5 pulses per second.

The common of the CD inputs will be connected to the violet cable. The D1 input connects to red, D2 to green, D3 to gray, D4 to brown, D5 to yellow, D6 to blue, D7 to dark blue, D8 to black, D9 to green/yellow, and D10 to orange.

The contacts of the element that are connected to a digital input must be free of voltage.

ANALOG INPUTS

The MAM has two analog inputs--A1 (white) and A2 (pink)--for reading sensors that provide a 4-20 mA signal. The input has a resistance of 200 Ω, so the voltages will be read as 800 mV for the 4 mA ones and 4000 mV for the 20 mA ones.

The sensors will be powered at 12 Vdc, provided by the MAM. The sensor will only be powered while it is configured; for the rest of the time, it will remain without a power supply. The time between readings is configured on-site through the Module Reader and may be different depending on the MAM or the sensors. **The sensor's power supply is connected to green for the 12V positive wire, and the common wire, or 0V, will be violet (digital and analog common).**

LATCH SOLENOIDS

The MAM allows you to work with two- or three-wire latch solenoids:

- 2-wire latch solenoids: connect the common wire of all solenoids to CR, the black wire, and connect the other solenoid wire to wires marked as R1 through R8

- 3-wire latch solenoids: This type uses half the number of solenoids acting on the MAM. Connect the solenoids to the common in CR, the black cable, and the start and stop wires at the following terminals:

| 3-wire latch solenoids		
Solenoid 1	R1 cable start	R2 cable stop
Solenoid 2	R3 cable start	R4 cable stop
Solenoid 3	R5 cable start	R6 cable stop
Solenoid 4	R7 cable start	R8 cable stop

The breakdown voltage of the solenoids is programmable and can be either 6, 9, 12, or 16 V.

Keep in mind that many 3-wire latch solenoids can work perfectly with 2 wires if necessary.

Connect the cables using the following color code:

	Wire color	ID	Operation	MAM 5-72	MAM 8-102
Agrónic Monocable module connection					
	Yellow		Monocable 1 (Data and Vdc, no polarity)	x	x
	Yellow		Monocable 2 (Data and Vdc, no polarity)	x	x
	Red	R1	Output 1	x	x
	Blue	R2	Output 2	x	x
	Green	R3	Output 3	x	x
	Gray	R4	Output 4	x	x
	Brown	R5	Output 5	x	x
	Violet	R6	Output 6		x
	White	R7	Output 7		x
	Pink	R8	Output 8		x
	Black	CR	Common Outputs	x	x
	Red	D1	Digital 1	x	x
	Green	D2	Digital 2	x	x
	Gray	D3	Digital 3	x	x
	Brown	D4	Digital 4	x	x
	Yellow	D5	Digital 5	x	x
	Blue	D6	Digital 6	x	x
	Dark Blue	D7	Digital 7	x	x
	Black	D8	Digital 8		x
	Ground Green/Yellow	D9	Digital 9		x
	Orange	D10	Digital 10		x
	Violet	CD/CA	Common Inputs	x	x
	White	A1	Analog Sensor 1 Input	x	x
	Pink	A2	Analog Sensor 2 Input	x	x
	Green	+VA	Sensor power supply	x	x

Configuration
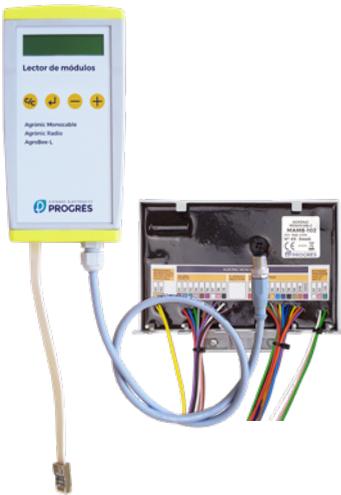
You can configure the MAM with the Module Reader, consisting of a screen and four keys. It is not necessary to deactivate the MAM before connecting it.

To connect the Module Reader to the encapsulated MAM, unscrew the protection cap from the central connector.

To ensure watertightness, **you must properly close the protection plug on the central connector** after configuring the device.

After connecting the Module Reader, press a key to display the consultation. To go to the configuration, press the C/C key and enter the menu. Use the − and + keys to change the selected option within the menu. Enter the selected menu option with the ↵ key.

You can see the following options within the main menu:

- Consultation
- Configuration
- Manual

CONSULTATION MENU

- Product name and program version
- Status of solenoids 1 to 8
- Status of digital inputs 1 and 2
- Status of digital inputs 3 to 10, which correspond to meters 1 to 8.
- Totals stored in the MAM and sending protocol in the EAM. 8 screens.
- Instantaneous flow (time between meter pulses, in seconds). 4 screens.
- Analog sensor reading (in millivolts).
- Status of MAM communications:
  - Synch: no: It is not synchronized with the EAM, there is no communication.
  - Synch: yes: It is synchronized with the EAM, the communication is correct.
  - Vdc: no: There is no power supply from the Monocable line.
- Last communication received from the EAM:
  - Correct: Last successful communication received.
  - Timeout error: Nothing was received in the last communication.

- Checksum error: The last communication was received with erroneous data.
- Group error: The last communication received is for another MAM group.
- Config. error: An error occurred while configuring communications.
- Group change: The total number of groups on the line has been changed.
- Status of the last eight communications: erroneous communications are marked with a 0 and those that were correct, with a 1. The number on the right of the screen indicates the lag time between the EAM and the MAM.
- Next reception: time between two receptions, time remaining for the next reception, and time for the next synchronization.
- Latch Voltage: Shows the voltage applied to the latch solenoid on the last activation or deactivation. The voltage level is displayed in millivolts.

CONFIGURATION MENU

- MAM number: is a value from 1 to 120 that is used to distinguish the 120 possible modules that can be connected to an EAM.
- 3H valve: if you are going to work with 2-wire latch solenoids, answer "no". If you are going to work with 3-wire latch solenoids, answer "yes".
- Latch V.: latch breakdown voltage. It can be 16V, 12V, 9V, or 6V.
- Sensor T.: indicates the reading frequency of the sensors in minutes. If it is set to 0, they will not be read. The maximum time between readings is 200 minutes.
- Sen. T. 1 2: the time that the sensors need to be powered up for a proper reading. The unit of time is 0.01 seconds. The power supply is 12 V. If you enter 0, the sensor is not read. The maximum time that the sensors can be powered is 40 x 0.01 = 0.4 seconds.
- Delay c.: the minimum time that the meter's pulse needs to be active for the total to increase. A pulse less than this time does not increase the total. The time is indicated in seconds and a decimal. By default, it is 1.0".
- Close R1: a "1" indicates that the solenoid connected to R1 will close if the Monocable line is cut.
- Priority: if you enter "yes", the MAM will have a fast response time. With "no", the MAM responds in turn according to the number of groups on the line. Only MAMs from 1 to 10 can be set to priority. If MAM 1 has priority, neither 11, 21, nor 31, ..., nor 111 can connect to the line. The same goes with the other numbers.

MANUAL MENU

This menu option allows the manual activation of solenoids. You will not be able to exit this menu option if there is a manually activated solenoid.

Practical tips

The maximum No. of MAM that can be connected to an EAM is 120, although this number may be lower depending on the section of the two-wire cable used and the total distance of the line.

If the distance is long, it is better that the MAMs of the same group not be connected consecutively on the line.

If the voltage at the end of the line is less than 22 Vdc, it is better not to number all the MAMs in a group. For example, configure the MAMs as 1, 4, 8, 11, 14, 18, not entering 2, 3, 5, etc. This is how you can make sure the line's voltage remains more uniform.

Encapsulated MAMs are designed to be used outdoors, but if they are not in direct sunlight, the resistance of the box will be better over time.

In the EAM model with UPS, the batteries must be disconnected every time the system functions without being connected to a power supply for a long period of time to avoid the deterioration of these batteries.

All the MAMs in the system will be configured so that their R1 output does not close if they run out of power. This parameter can be modified individually if the installation requires it (module with general/hydrant output and in gravity irrigation installations).

A system with a total cable length of less than 500 metres and fewer than 8 modules may malfunction when communicating with the modules. Contact Progrés to make the necessary adjustments.

Recommendations for installing the Monocable Bus

CONTROLLER DISTRIBUTION

- Have a plan or sketch with the location of the modules to facilitate their installation and start-up, taking into account the configuration that Progrés has estimated in relation to the distances between the Agrónic and the modules.

- Have strategically distributed line protections, at the ends of branch, bifurcations, and in sections of more than 500 metres, with their corresponding grounding connection.

CABLE CHOICE

- Two-wire cable with a section between 1.5mm2 and 2.5mm2, depending on the distance installed and the number of modules.

- Insulation between wires must be made of cross-linked polyethylene (RV-K) to guarantee low mutual capacitance. Insulation voltage of 500 V.
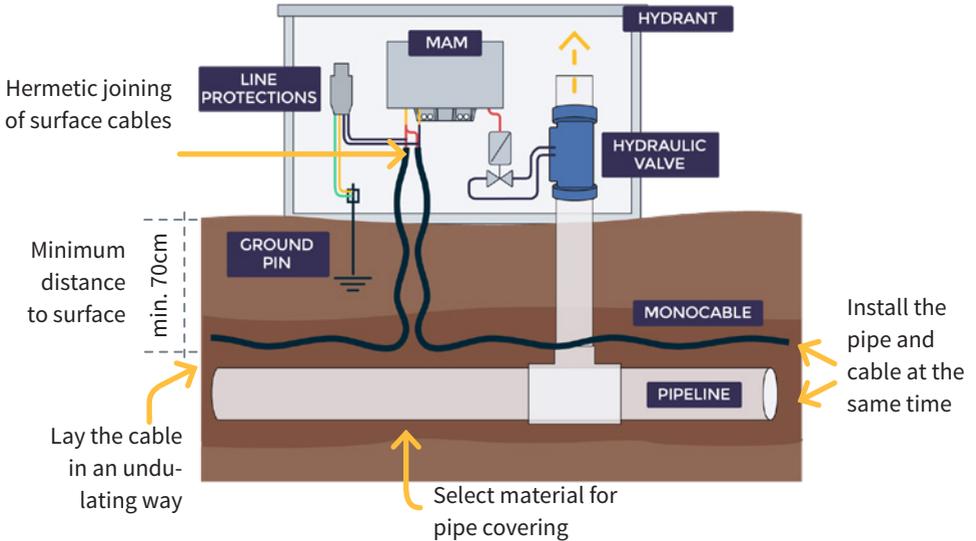
- Cable with the lowest possible mutual capacitance. To guarantee distances of 10 km, choose a cable less than 60 nanofarads/kilometre (nF/km) and never greater than 80nF/km. If not listed in the cable specifications, ask the manufacturer.

- If there are installations at risk of breaking due to bad handling or how it sits on the terrain, it is recommended to use strapped cables (RVFK).

- In cases of high levels of electromagnetic noise or installation of two or more parallel cables, it is recommended to use shielded cables (RVMK).

- Keep in mind that the use of strapped or shielded cable has a greater mutual capacitance that will reduce its ranged benefits.

SPECIFICATIONS OF THE CABLE TO BE USED IN THE MONOCABLE SYSTEM
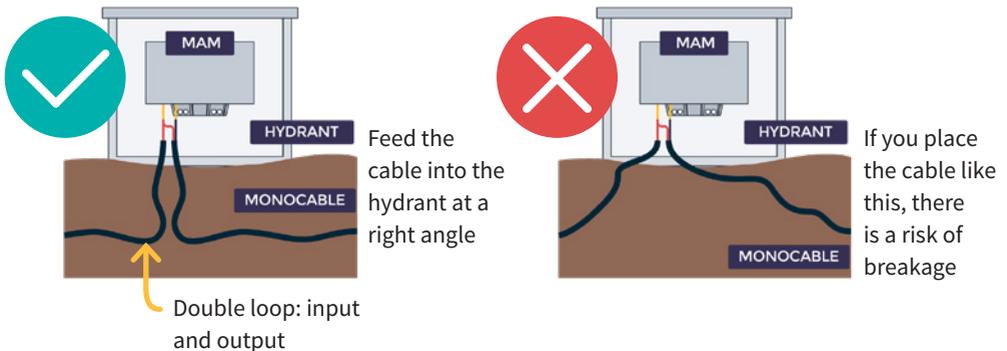
- RV-K: Type of cable used in most electrical installations.
  - R: Internal cable covering: XLPE or PEX (Cross-linked Polyethylene)
  - V: Outer covering: PVC (Polyvinyl chloride)
  - K: Flexibility
    - Class 5: Flexible
    - Class 1-2: Rigid
- RVMK: A cable like the previous one, but equipped with a wire armature under the outer covering acting as protection against rodents or mechanical damage.
  - R: Internal cable covering: XLPE or PEX (Cross-linked Polyethylene)
  - V: Outer covering: PVC (Polyvinyl chloride)
  - M: With a wire armature under the outer covering
  - K: Flexibility
    - Class 5: Flexible
    - Class 1-2: Rigid
- RVFK: A cable like the previous one, but equipped with a double steel strap armature under the outer covering acting as protection against rodents or mechanical damage.
  - R: Internal cable covering: XLPE or PEX (Cross-linked Polyethylene)
  - V: Outer covering: PVC (Polyvinyl chloride)
  - F: With a double steel strap armature under the outer covering.
  - K: Flexibility
    - Class 5: Flexible
    - Class 1-2: Rigid

- Do not connect any wire of the Monocable bus to the grounding connection.
- Install the cable in the same ditch and at the same depth as the pipe to avoid cable breaks from agricultural machinery and rodents, in addition to the corresponding cost savings, snaking the cable without stretching it to avoid breakage due to it settling into the ground.

Hermetic joining of surface cables

Minimum distance to surface

min. 70cm

Lay the cable in an undulating way

Install the pipe and cable at the same time

Select material for pipe covering

- Avoid abrasions or partial cable cuts as they may cause variations in the cable's magnitudes (capacitances, inductances, resistances, etc.) that directly affect the communication signals. Use the same soil bed where the pipe is placed as the material to cover the cable.
- Respect the cable's safety distances at the module connections to avoid breakage due to machinery.

Feed the cable into the hydrant at a right angle

Double loop: input and output

If you place the cable like this, there is a risk of breakage

- Create a joint at one end of the roller with the next one on the surface, whenever possible; If not, you must ensure the total watertightness of the connection by using heat-shrinkable terminals with sealant or with resin joints.

- Begin by connecting the line protections and the EAM, with its grounding connection, thus ensuring protection against electric sparks from the start.
- Leave a amply loose loop where the modules will be installed and connected, avoiding burying the joints and always respecting the cable's burial depths.
- Perform continuity and insulation tests with the grounding connection for each branch or junction point.
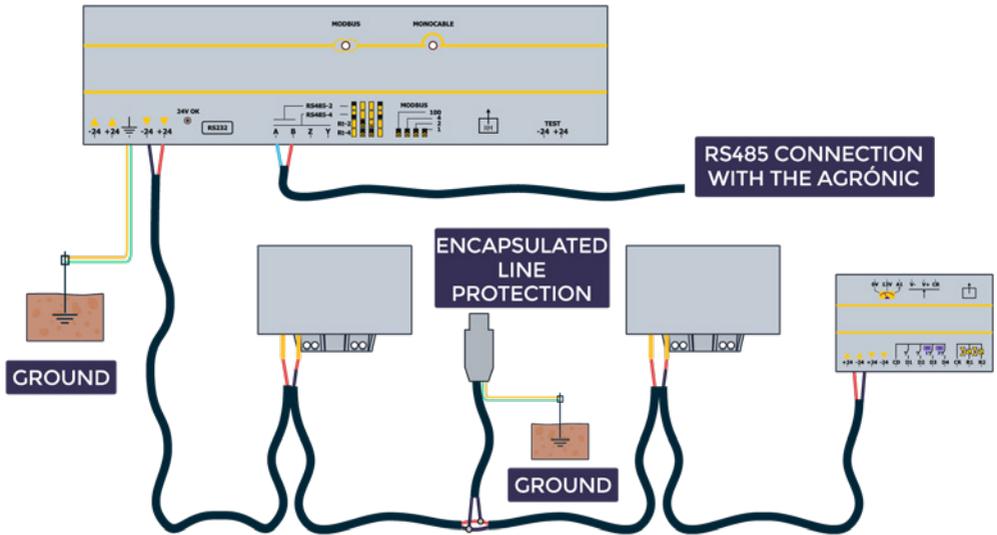
ATTENTION

It is very important to properly close the configuration connector's protection cap to ensure that the controller is watertight.
Avoid, as much as possible, direct sunlight hitting the encapsulated MAMs. Always put on the external protection cap.