

INSTALLATION AND USER MANUAL



RADET-86

RADON DETECTOR FOR INDUSTRIAL INSTALLATIONS
AND FAMILY HOMES



DURAN[®]
electrónica



FS82426

CONTENTS

1. INTRODUCTION	3
2. OPENING, CONNECTION, AND CLOSING INSTRUCTIONS	5
3. SW1- MODE 1 ROUTING, READING CADENCE and PAIRING	6
4. START AND OPERATING MODES.	7
5. FACTORY DEFAULT SETTINGS.	8
6. LED SEQUENCES	8
7. AUTOMATIC ACTIVATION DEACTIVATION PROTOCOL OF THE INTERNAL RELAY	9
8. RELAY STATUS SELECTION	9
9. RELAY SAFETY PROTOCOL IN STOP MODE	9
10. EVENTS MEMORY OVER MODBUS RTU	10
11. FACTORY RESET ON MODE	10
12. WIFI PAIRING.	11
13. FIRMWARE UPDATE, 2 Modes	11
14. FIRMWARE UPDATE OVER MODBUS	12
15. TECHNICAL CHARACTERISTICS	12
16. COMPATIBLE PROTOCOLS	13
17. COMMUNICATION THROUGH MODBUS RTU PROTOCOL	13
18. CONNECTING TO RADET-86 VIA THE WEB	14
19. ELEMENT IDENTIFIER AND WIRING	18
20. WARRANTY	19

1. INTRODUCTION

Radon is an odorless, colorless, gas that is naturally-generated, principally through radioactive decay of the uranium present in soils and rocks, although occasionally it can also be present in construction materials (concrete, brick and natural stone) and in water from wells, emitting Alpha particles and decaying into Polonium and Lead.

The main pathways of entry of this gas into buildings is through cracks, joins, drains, downspouts, cavities around pipes, cables, or simply through the porosity of the different materials used in the construction.

The highest concentrations are detected in basements, cellars, garages and especially the deeper an enclosure is with respect to ground level.

Its measurement unit in Europe is the Becquerel, (Bq/m³) and in America is Picocuries (pCi/l)

Prolonged exposure to this gas increases the risk of suffering certain types of cancer, especially lung cancer, genetic defects, or blood alterations.

The WHO has included it on the list of group 1 carcinogens.

Safety guide **GS 11-02 of the CSN** (Spanish Nuclear Safety Council) recommends a reference level of **300 Bq/m³ as an annual average**. Also, pending transposition of European Directive **2013/59/Euratom**, member states are invited to adopt this same reference value for workplaces and households.

The WHO recommends a reference **maximum level of prolonged exposure as 100 Bq/m³** to minimise the risks to health.

Controlling exposure to radon in the workplace is a recent requirement in Spain, with exposure regulated through Royal Decree **RD. 1029/2022**.

This is not the permitted limit but rather a reference level that it is advisable not to exceed, bearing in mind that it is harmful for health based on the duration of exposure.

Radon has a half-life of 3 to 4 days and the best solution for making it disappear once detected is to adequately ventilate the enclosure, by opening windows and doors or by using mechanical extraction systems.

The following link provides a map of radon potential in Spain.

<https://www.csn.es/mapa-del-potencial-de-radon-en-espana>

DURAN ELECTRÓNICA has developed RADET-86 which, using a pulse ionization chamber and a microprocessor with adequate algorithms, is designed to detect Alfa particles generated by Radon gas and to show the concentrations present in the atmosphere. It also comes with a memory that continuously stores the concentrations obtained by date and time for up to one year, for subsequent dumping and study.

RADET-86 is a detector that can operate automatically in two modes:

Model: Compatible with DURGAS control panels, addressable, capable of measuring concentrations of this gas and carrying out the relevant operations locally and from the control panel, it can activate up to 3 operating outputs with up to 3 different levels, and is compatible with other gas-measuring detectors in the same loop.

Mode2: Autonomous, with a volt-free relay output for activation of an extractor at a preset safety level.








In Mode2, the system can communicate using the standard protocol Modbus RTU, Wifi or Bluetooth.



ATTENTION:

For adequate operation, please rigorously follow these instructions and recommendations.

RADET-86 is supplied with a support it is compulsory to use for adequate functioning, which separates it 15 cm from the wall. Avoid installing it near windows, in draughts, places with high moisture levels, near the ground, or in positions other than those shown in this document.

-  Avoid installing it near magnetic fields, electrical or electronic devices, Such as ionizers, photocopiers, routers, aircon units, electrical panels, etc.
-  Do not open or handle the sensor when live, you could suffer an electric shock.
-  The recommended height of the installation is approximately 1.50/1.70 metres above floor level, on walls, or pillars.
-  Do not install on vibrating or unstable surfaces. If it senses vibrations, the detector will stop measuring automatically during 30s, and will initialize again once the vibrations disappear.
-  Avoid installing the equipment in draughty zones. Always aim to position it in the most unfavourable area.
-  The advisable average time to correctly evaluate the average concentration in an enclosure must not be less than 90 days.
-  In winter, low pressures and rainy days favour radon exhalation.

Because soil is moist on rainy days, its porosity will decline and this could reduce radon emission to the surface, but it will favour emanations in interiors, high atmospheric pressures and very low temperatures impede radon emanation on the surface.



For the system to maintain the enclosure below optimal safety levels for radon, the installation of at least one extractor is required, depending on the m² of the surface, or to proceed somehow to ventilate the enclosure.

2. OPENING, CONNECTION, AND CLOSING INSTRUCTIONS

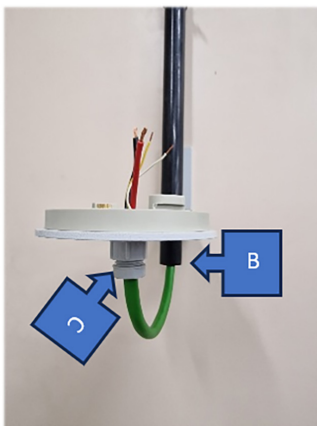


1. Using a 3mm Allen key, loosen the locking screw **(A)** which allows the detector to be opened by turning it anticlockwise.

It does not have to be loosened all the way.



2. To open it, use your hand to turn the detector's body anticlockwise.



3. Fasten the support to the wall using the wallplugs and screws provided, pass the \varnothing 20mm tube (if the wiring is from the surface) through hole **(B)**, and then the connection wire (hose), through the compression gland, but do not yet tighten the nut **(C)**, wait until point 9.


4. Connect the supply positive and negative plus the communication cables A-B (RS485) if the detector is connected to a **DURGAS** control panel or integration system, otherwise leave them unconnected, **pay special attention to the wiring Page 18**

5. Connect the operating output cables to terminals C-NO (dry contact) to activate an extractor when the programmed levels are exceeded, **pay special attention to the wiring Page 18.**

6. Route (assign a number) to the detector using **SW1 Page 6**, if it is connected to a **DURGAS** control panel. If it will operate in autonomous mode (**mode 2**), this will not be necessary.

7. Also configure the reading cadence to 10 minutes or 1h **Page 6**, (the factory reading cadence is pre-set to 10 minutes).

3. SW1- MODE 1 ROUTING, READING CADENCE and PAIRING

Modbus Detector No.	Durgas Detector No.	S-1	S-2	S-3	S-4	S-5	S-6
00	01	On	On	On	On		
01	02	Off	On	On	On		
02	03	On	Off	On	On		
03	04	Off	Off	On	On		
04	05	On	On	Off	On		
05	06	Off	On	Off	On		
06	07	On	Off	Off	On		
07	08	Off	Off	Off	On		
08	09	On	On	On	Off		
09	10	Off	On	On	Off		
10	11	On	Off	On	Off		
11	12	Off	Off	On	Off		
12	13	On	On	Off	Off		
13	14	Off	On	Off	Off		
14	15	On	Off	Off	Off		
15	16	Off	Off	Off	Off		
	Reading cadence	10min.				On	
		1h.				Off	
	 Factory reset and pairing	Read Page 10/11					On 30/5s

Configuration S1-2-3-4, connected to Durgas control panels, not necessary in autonomous mode, mode 2.

Configuration S1-2-3-4, when the Modbus option is used (starts as device 00)



8. To close it, position the body on the support with the LED (C) and specs label facing the front. Turn slightly to the left until it slots into the base. Finally turn clockwise until it reaches a stop.



9. To conclude, tighten the locking screw (A) using a 3mm Allen key and the nut of the compression gland (C) by turning them clockwise.

The detector is now ready to be powered.

The system will be set in the corresponding mode depending on the type of connection made, see LED sequences Page 8.



Appearance of the final assembly.

4. START AND OPERATING MODES:

Operating modes 1 and 2 will be selected automatically according to the following protocol:

Mode 1: Connected to a DURGAS control panel, when powered a communication protocol will initialize, if after $\pm 2s$. no external communication is received, the detector will automatically switch operating mode.

Mode 2: Autonomous, in this case the internal relay will activate **whenever $\geq 150 \text{ Bq/m}^3$** is exceeded and as of that moment the detector **will take a reading every 10 min.**

In this mode, MODBUS RTU standard communication is also available.

If the detector is automatically configured in **mode 1** it means it is connected to a **DURGAS** control panel through its own RS485 protocol, or in Modbus RTU mode. In the first case, the control panel will carry out the operations according to the programmed level. The detector's internal relay will activate independently when **$\geq 150 \text{ Bq/m}^3$ are exceeded, and will take a Radon reading every 10 min.**

In this mode, to reduce power consumption, communication via Bluetooth and Wifi is disabled.
















5. FACTORY DEFAULT SETTINGS:


Radon Reading Cadence.	10 min.
Internal relay status.	Automatic mode.
Communication speed by Radio.	4800 bauds.
Waiting time to receive Control Panel or Modbus RTU communication data to switch to mode 2 autonomous.	±4s.

 Approximate distances according to the selected radio communication speed.

115200 bauds-20m 4800 bauds-150m 1200 bauds-300m (approximately)


6. LED SEQUENCES:

LED SEQUENCES	MEANING
	Detector initializing (± 4 min chamber stabilisation).
	System idle operation OK, relay in AUTOMATIC mode.
	Relay OFF, manually disconnected. 
	Relay ON, manually connected.
	Relay activated manually with warning Radon level ≥ 100 Bq/m ³ . (A)
	General hardware failure or communication error. (B)
	Warning-Radon Level ≥ 100 Bq/m ³ . (C)
	Alarm Radon Level ≥ 150 Bq/m ³ , relay ON. (D)
	Vibrations detection. (E)
	Factory reset, white LED pulse when completed 
	Communications pulse, not in any status. A-B-C-D and E
	WiFi pairing mode.
	Updating Software.


 Modes A-B-C-D and E are priority. No other optical indications will appear if any of these is active.




7. AUTOMATIC ACTIVATION DEACTIVATION PROTOCOL OF THE INTERNAL RELAY:

 When a concentration is detected equal to or higher than the safety level of 150Bq/m³, the relay will activate. As of that moment, irrespective of the programmed reading cadence, 10 min or 1 hour, the system will check the detected concentration every 10 min, deactivating the relay once the concentration is below the safety level, 150Bq/m³, to avoid unnecessary power consumption.

8. RELAY STATUS SELECTION:

 From Modbus RTU mode or the web gateway generated by the detector, it is possible to control the relay statuses in **ON**, continuously activated, even if the conditions of the Radon level detection logic are not met, **AUTOMATIC**, its activation will entirely depend on the logic according to the Radon levels or **STOP**, always deactivated.

9. RELAY SAFETY PROTOCOL IN STOP MODE:

 From the Modbus mode or from the web page generated by the detector, if the internal relay is manually disconnected, an automatic reconnection safety protocol will be established with the following logic:

If a level is detected of equal to or more than 150 Bq/m³ during more than one hour, the relay will activate automatically, switching to STOP mode again if a lower level is detected.

This behaviour is only applicable to the internal relay the RADET-86 incorporates.

Similarly, the relay will not be able to switch to STOP mode manually if a level is detected of >150Bq/m³, and the relay is activated.

10. EVENTS MEMORY OVER MODBUS RTU:

RADET-86 has an internal memory of up to 8,000 positions, where it stores any event or operation plus all data related to detected Radon levels, to subsequently be able to monitor its behaviour.

TYPES OF EVENTS:

Device connection. **(compatible with Durgas)**

Device disconnection. **(compatible with Durgas)**

Sensor error. **(compatible with Durgas)**

Hardware and/or Communications error. **(compatible with Durgas)**

Vibrations detection. **(compatible with Durgas)**

Warning Level ≥ 100 Bq/m³.

Alarm Level ≥ 150 Bq/m³. **(compatible with Durgas, or the level programmed in the control panel)**

Factory Reset.

Relay ON, manually activated.

Relay OFF, manually deactivated.



When the system is not powered, it will stop storing read data in the memory, but its internal clock will continue to function leaving a record of the time during which it did not have any voltage. Once it is powered again, the device will start to store data as normal.

11. FACTORY RESET ON MODE:

To reset the equipment and restore it to the factory settings, place **switch 6** of **(SW1)** in the **On** position during **30s** and then leave it in the **Off** position, at this point the equipment will display the following sequence for **20s**, at the end of this time the equipment will be left with the factory settings.



When a factory reset is performed, all data stored in the events memory will be definitively deleted.

12. WIFI PAIRING:

Switch S6 of SW1 (Page 9) from OFF to ON and to OFF again, in under 5s.

Next, LED sequence  will begin until the pairing occurs, the maximum pairing time will be 90s after this time it will be necessary to start the sequence again.

13. FIRMWARE UPDATE, 2 Modes:

Mode 1: The update must be done “manually” (when there is no APP). To do this:

Open the equipment and lift and lower switch number 6 of SW1 in a 2-second pulse Up-2-s-Down.

When it enters this mode, the LED will start with  the sequence

Use a computer to find Wifi network: DRN#RADET86#XXXXXXXXXX **(this is generated by RADET-86)**

Connect to it, **no password is required.**

Mode 2: From the Web page generated by **RADET-86**



When we click the **“Browse”** button, it will ask us for the update file: Search for file **DRN#RADET86#VXXX.bin** on your computer, (this file will be previously downloaded from the web page, [https://www.duranelectronica.com/ en PRODUCTOS-DETECCIÓN DE GASES-DETECTOR DE RADON-RADET-86- DESCARGAS](https://www.duranelectronica.com/en PRODUCTOS-DETECCIÓN DE GASES-DETECTOR DE RADON-RADET-86- DESCARGAS)). Once downloaded, select it and then press **“Update”**. Wait a few seconds and if correctly updated **“OK”** will appear, then the equipment will be updated retaining the configuration values, otherwise **“Fail”** will appear.

(The LED sequence that indicates the update mode is the same irrespective of the selected mode).

14. FIRMWARE UPDATE OVER MODBUS:

Connect by RS485/MODBUS to Sensor **RADET-86**

In position **WORD14**, enter value **255**

Follow the procedure described in the previous section Page 11, **UPDATE FIRMWARE** from the moment the LED begins with the sequence



15. TECHNICAL CHARACTERISTICS:

Operating technology.	Pulse ionization chamber + Microprocessor
Supply voltage.	9-24V DC.
Approximate maximum consumption	± 150mA in autonomous mode, relay ON 12V DC
Types of communication.	RS485 own protocol, connection to DURGAS control panels, autonomous mode MODBUS RTU/ Wifi/Bluetooth.
Measurement range / Precision.	14-3700 Bq/m ³ ± 10 Bq/m ³ . (Bq= Becquerel).
Chamber stabilization optimum precision measurement stabilization time.	Approx. 1 h./4min
Default data storage and Radon reading cadence.	Every 10min in Mode 1 and 2, programmable, 10min/1h.
Factory levels modes 1-2	Optical warning at 100 Bq/m ³ >150 Bq/m ³ activates local relay +Optical warning.
Programmable levels in DURGAS control panel.	Up to 3, in steps of 20Bq/m ³ up to 3,000 Bq/m ³ .
Default factory programmed levels mode 1 in Durgas control panel.	≥100 Vent1- ≥200 Vent2- ≥350 Alarm Bq/m ³ . (Selecting Portuguese standards)
Local data storage.	Data logger of up to 8,000 positions.
Events memory and data request.	Over Modbus RTU.
Operating range	10-50°C / Hr < 80% without condensation.
External LED status indicator.	RGB. (See LED codes Page 6)
Recommended installation height:	Minimum 1.50 m maximum 1.70 m from the ground.
Operating output	Volt-free contact relay C-NO 3A 230V AC.
Operating output mode 1 . Connected to a DURGAS control panel	1 local relay C-NO + 3 relays C-NO-NC. Of independent levels programmable in Durgas control panel.
*Approximate coverage reference.	50/75 m ²
**Cable type and input, model .	Shielded 4-wire hose 2 of 1.5 + 2 of 0.8 mm ² braided pair / by compression gland PG9.
Weight and dimensions.	± 400g with support, cylinder Ø of 90X110mm.

All specifications are measured at a temperature of 20°C and RH of 20-60%

- i** * Coverage data is approximate as it can be affected by several factors: types of materials used in the construction of the enclosure, structure of the enclosure, humidity, temperature, installation location, draughts, etc.,
In the event of using the internal relay output in mode1, the hose must be 6-wire:
2 supply, 2 communications and 2 for operations.

**Supply cable sections and maximum distances vary depending on the quality of cable used, number of detectors on the line and sensor distribution across the total cable length.

16. COMPATIBLE PROTOCOLS:

RS485 of Duran Electrónica, compatible with DURGAS control panels.

Modbus RTU RS485/TCP

Hive-MQTT

17. COMMUNICATION THROUGH MODBUS RTU PROTOCOL:

Registers Status System:

WORD 0:	STATUSES
0	HARDWARE ERROR
1	SENSOR NOT DETECTED
2	SENSOR ERROR
3	SENSOR INITIALIZING
4	SYSTEM INITIALIZED, LEVEL OK
5	WARNING LEVEL
6	CRITICAL LEVEL, SATURATION
7	LOADING CODE
8	FACTORY RESET

- WORD 1:** Start % (0-100 progressive system start percentage).
- WORD 2:** Configuration, 1 protocol change from modbus to normal.
- WORD 3:** Time remaining for next reading in seconds.
- WORD 4:** Communication status 0 - 1 Ok.
- WORD 5:** Free
- WORD 6:** Vibration detected 0 – 1 detected
- WORD 10:** Event selection
- WORD 11:** Response to the event request (no decimals)
- WORD 12:** Data request
- WORD 13:** Response to the data request (no decimals)
- WORD 14:** Value 255, (Firmware update)
- WORD 50:** Sensor value, according to period 10min, 60min (no decimals).
- 0x0E76** -Detector error.
- 0x0E75** -Saturation, (detector scale bottom exceeded).
- 0x0000** – Detector not found, (No ready) coinciding with the booting (start).
- WORD 100:** XXXX (becquerels measured according to reading cadence 10min – 60min).
- WORD 150:** Current status of relay 1 relay ON- 0 relay Off.
- WORD 200:** Relay status selection: 0 Auto- 1 Always On- 2 Always Off.

18. CONNECTING TO RADET-86 VIA THE WEB

From a browser, enter the equipment's IP address: It could be

1-If the equipment is already connected to WIFI, the one provided by the WIFI network.

2-If the equipment has never connected to WIFI, find among nearby WIFI networks one called **DRN#RADET86#xxxxxxxxxxxx**. Each detector generates a different ID. Connect to it, [no password is required](#).

i If the one generated by **RADET-86** does not appear, stand one to two metres from it.

From a browser enter in the address bar: <http://192.168.4.1>

It will ask for a username and password: [admin / DURAN123](#)

Next, the following page generated by the detector will appear:



The screenshot shows a web browser window with the URL 194.100.100.188. The page header includes the DURAN ELECTRONICA logo and the text RADET86. Below the header is a dark blue bar with the text "SENSOR DE RADON RADET86". Underneath, it says "Ubicacion: LAB-CALIBRACION".

The main content area has three tabs: "ESTADO", "Red", and "Parametros". The "ESTADO" tab is active, displaying the following information:

Valor Actual	
Hora Sistema	13/06/2024 9:32.17
Nombre	DRN#RADET86#A842E38695F8
Ip Actual	194.100.100.188
Version	0.0.10-(Reinicios:0)
Nivel	74 Bq/m3
Nivel Maximo	86 Bq/m3
Nivel Minimo	37 Bq/m3
Estado Rele	Rele Apagado
Modo Rele	Rele Automatico
Cadencia Lectura	10m

At the bottom of the "ESTADO" tab, there are several buttons: "Exportar eventos a Csv", "Exportar Historico a Csv", "Ver eventos", "Ver Historicos", "Borrar eventos", "Borrar Historicos", and "Borrar Reinicios".

On this web, you will be able to consult the individual status of each detector in real time.

Identifying name of the Wifi generated by the detector - Assigned IP - Firmware Version - Radon level in Bq/m³-Maximum and Minimum Levels in last 24 hours-Relay status-Selected relay mode and reading cadence, 10min-1h.

It is also possible to select - Export events and Histories to CSV format assigning them a name- See generated events-See generated registers-Delete events, Delete generated registers and Delete resets, *this last case indicates the number of times that the detector has been automatically or manually rebooted.*



(The reading cadence can only be selected with the detector open by S5 of SW1)



Parameters: Set time and date, Assign detector location, change operating mode, autonomous or connected to a **DURGAS** control panel, select different relay states AUTO-ON-OFF, factory reset and firmware update. When you change any of the options confirm with Apply, [to update the equipment's firmware consult page 11 and follow the instructions.](#)



Example of some events.

Event format: The order and quantity generated, date and time, event and event type (each event is assigned an identification number), to be able to select a required number when we need to generate histories with the exports in CSV format.



Orden	Hora	Datos
[1/ 113]	12/06/2024 14:48.50	33 Bq/m3
[2/ 113]	12/06/2024 14:50.58	47 Bq/m3
[3/ 113]	12/06/2024 14:51.48	47 Bq/m3
[4/ 113]	12/06/2024 15:00.00	47 Bq/m3
[5/ 113]	12/06/2024 15:10.00	47 Bq/m3
[6/ 113]	12/06/2024 15:20.00	49 Bq/m3
[7/ 113]	12/06/2024 15:30.00	50 Bq/m3
[8/ 113]	12/06/2024 15:40.00	50 Bq/m3
[9/ 113]	12/06/2024 15:50.00	50 Bq/m3
[10/ 113]	12/06/2024 16:00.00	53 Bq/m3
[11/ 113]	12/06/2024 16:10.00	59 Bq/m3
[12/ 113]	12/06/2024 16:20.00	63 Bq/m3
[13/ 113]	12/06/2024 16:30.00	65 Bq/m3

Examples of histories.

History format: The order and quantity generated, date and time, and measurements of Bq/m³.



ESTADO: Red

Parametros red

WiFi SSID: DURAN-2.4

Password: *****

DST (MQTT):

PORT(MQTT): 8888

Apply

Network: The corresponding parameters in each case.

WiFi SSID: Name of the network to which the equipment connected.

Password: Its password.

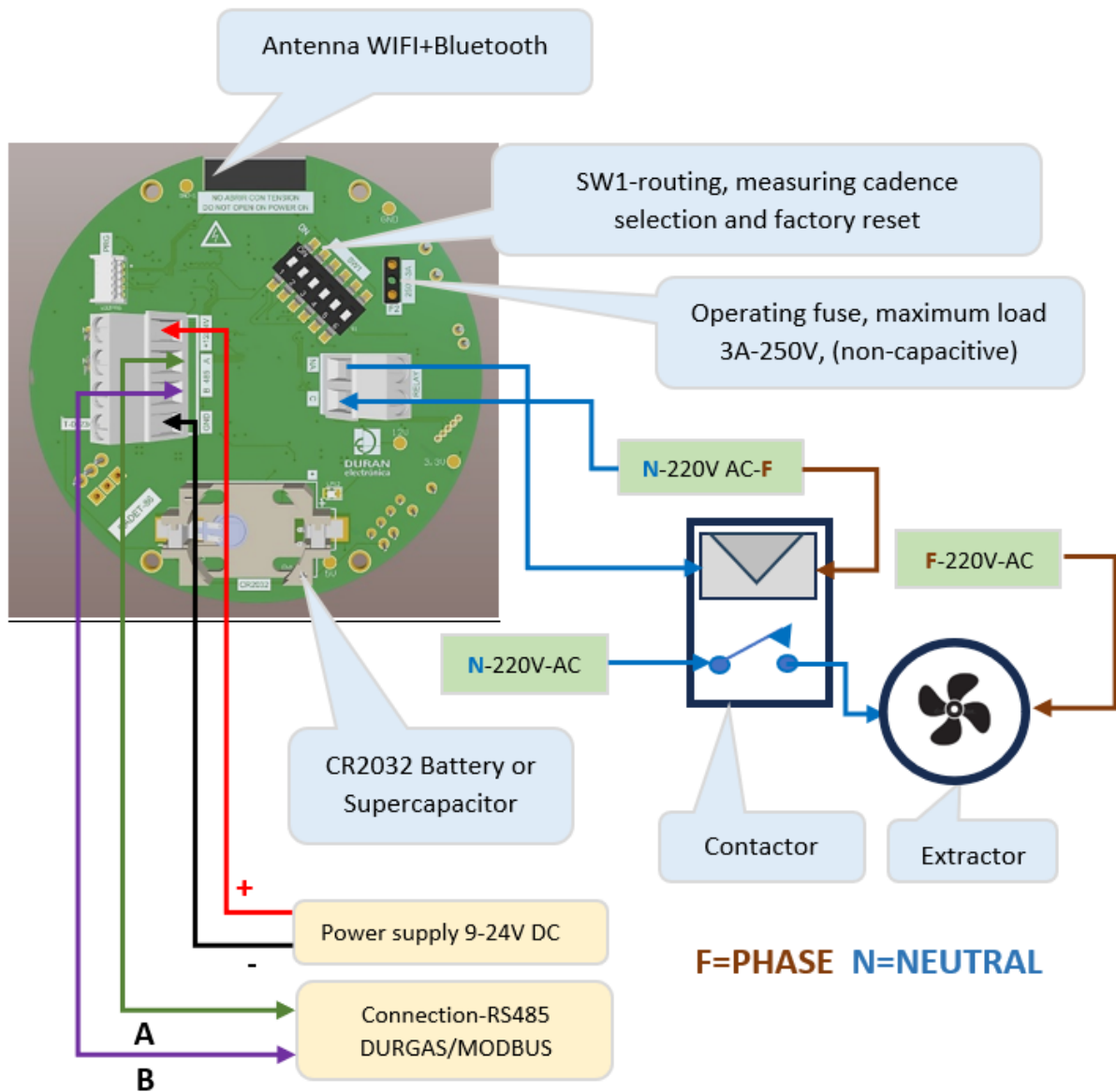
Auth token: Authentication

DST (MQTT): IP address, to send data to MQTT

ORT (MQTT): Assigned port

When we confirm with Apply we will establish the values that will be left configured in the equipment forever.

19. ELEMENT IDENTIFIER AND WIRING:



 IF YOU DO NOT HAVE BASIC KNOWLEDGE OF ELECTRICITY, ASK A PROFESSIONAL TO CARRY OUT THE INSTALLATION.

 THE INTERNAL RELAY CONTACTS ARE VOLT-FREE, C-NO.

 IF THE SELECTED EXTRACTOR EXCEEDS THE CAPACITIES OF THE INTERNAL OPERATING OUTPUT (3A-250V), USE A CONTACTOR TO ACTIVATE IT.

 THE PHASE CABLE CAN ALSO BE FOUND IN GREY or BLACK.

20. WARRANTY:

RADET-86 is guaranteed against any manufacturing defect for 1 year from the equipment's date of purchase . If you detect any fault in this period, inform your supplier or installer.

The warranty covers the complete repair of equipment that the Technical Service of DURAN ELECTRÓNICA consider to be defective, to reinstate it for normal use. This warranty will be valid provided the equipment has been installed by a competent person and following this manual's instructions. A negligent use or installation will exempt DURAN ELECTRÓNICA from liability for any damage caused to property and/or people and compliance with the terms of this warranty. In the event of undue handling, or failure to observe the conditions, characteristics and observations described in this manual, DURAN ELECTRÓNICA WILL NOT BE LIABLE FOR DAMAGE THAT COULD ARISE THROUGH INCORRECT USE OF THIS PRODUCT.

The warranty does not cover: installations, periodic inspections and maintenance, damage caused by undue handling, inappropriate use, negligence, overloading, inadequate powering or abandonment of the equipment, voltage shorts, defective installations and all other external causes, repairs or fixes made by personnel not authorised by DURAN ELECTRÓNICA or the transport costs of the equipment.

DURAN ELECTRÓNICA reserves the right to make improvements or modify the equipment without prior warning.



DURAN[®]
electrónica

C/ Tomás Bretón, 50
28045 MADRID - SPAIN
T. (+34) 915 289 375
duran@duranelectronica.com
www.duranelectronica.com



FS82426