DREAM 2
RTU RF G5
USER MANUAL & INSTALLATION GUIDE

Version: Document 1.2 RF G5 Master 2.3 RTU RF ECO 3.1 SNIFFER V1.11 Dream 2 4.106

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RF G5 MCP – General features

The G5 radio RTU system of TALGIL offers a perfect solution for controlling distributed irrigation systems, when using cable is impossible or undesirable. The system utilizes low transmission energy and therefore no licensing is required. Under good conditions, the distance between two units in the communication chain can reach a distance of 3km, but the full coverage of the system is much bigger since the G5 RTUs can serve also as ROUTERs for other RTUs with up to 11 levels of repetition. The G5 radio RTUs are energized by standard Alkaline batteries and those serving as ROUTERS are energized by solar cells with rechargeable batteries. For energy saving purposes the outputs activated by the system are pulse latching, therefore they are suitable for use where no electric energy exists. The bidirectional communication between the RTUs and the control unit enables not only activating remote outputs, but also reading remote inputs both digital and analog. To assure information integrity, each communication gets a confirmation signal and failure is followed by retries. The G5 radio RTU has a modular structure with a maximum capacity of 8 outputs and 4 digital/analog inputs. A G5 radio RTU system channel may handle up to 999 RTUs.

- General Information about RTU
- Multi repetition
- Self-healing
- Auto frequency select
- Retries

General features

The point to point distance of 3km can be multiplied up to 11 times by using the RTUs as routers for others.

- Bidirectional communication.
- Powered by battery or solar energy.
- Up to 999 RTUs per channel.
- Automatic selection of the suitable frequency out of 16 optional channels.
- Automatic selection of most suitable routing option.
- License exempt.
- Asynchronous communication
- I/O test mode
- Automatic shutdown of outputs on communication loss and automatic recovery when communication regained.
- Visual and sound signaling of statuses by LED and buzzer
- Reporting RTU low battery
- Configurable wakeup signals.
- Existence of diagnostic RF sniffer tool.

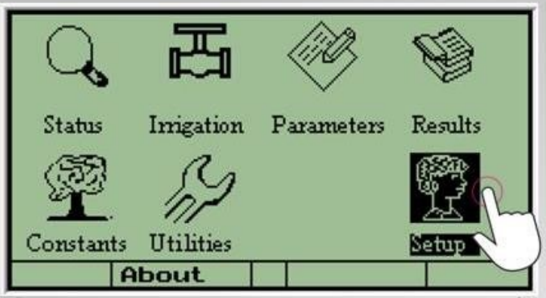
G5 RTU RF ECO

- No. of outputs – 1 or 2 (2 wired latching)
- No. of digital inputs – 1 or 2
- No. of analog inputs – 2 (4-20mA or 0-5V)

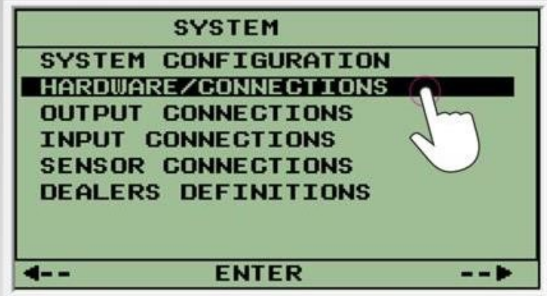
G5 RTU RF Modular

- No. of outputs – 2, 4, 6, 82 (2 wired latching)
- No. of digital inputs – 4 or 8 2

RF G5 – Hardware Definitions on Dream 2.

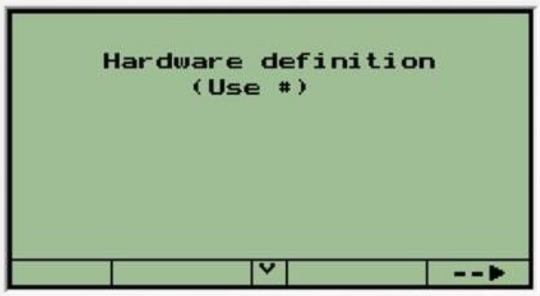


Screenshot 1- Select the SETUP submenu.

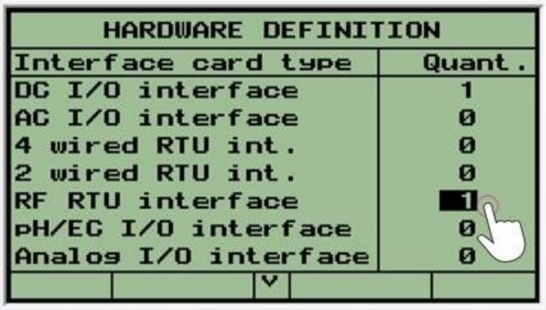


Screenshot 2- Select HARDWARE/CONNECTIONS.

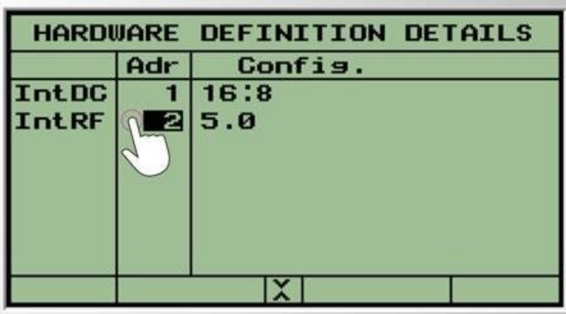
Screenshot 3- Enter the "247" password.



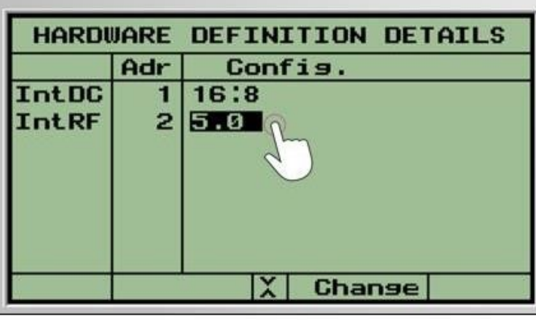
Screenshot 4- Click the Page Down button



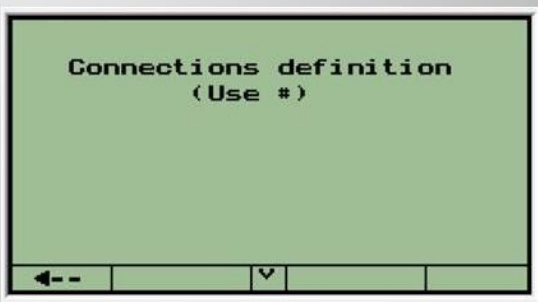
Screenshot 5-Add one RF RTU Interface, then press the Page down button.



Screenshot 6- Select available address for the Interface RF. Make sure to set the highest address for the Interface RF.



Screenshot 7- The number on the right side of the Int. RF address is not relevant. Leave it as 5. To exit, Press P. Down and F4 buttons.



Screenshot 8- In order to set the Outputs and Inputs connection definition, press the Page Down button.

Image 1 – Hardware Definitions on Dream 2.

Hardware Definitions on Dream 2

In order to add the RF G5 to the Dream Hardware Definitions, go to the **Setup** (Screenshot 1 on Image 1), then select the **Hardware/Connection** option (Screenshot 2)**.** For changing the **Hardware Definitions,** press **Enter** and insert the "**247"** password (Screenshot 3)**.** At the **Hardware Definition** screen press **Page Down** button (Screenshot 4).

The **RF G5** does not include an interface card. The **RF Master G5** card has been used as **Master** and **Interface** between the **Dream 2** to the **RTUs** in the field.
Add one **RF RTU Interface** and press the **Page Down** button (Screenshot 5).
Select an available address for the **Interface RF** (Screenshot 6).

The **Interface RF** address number must be the highest of all the Interfaces addresses which connected to the **Dream 2**. The reason is, that the **Interface RF** holds the next ten addresses after his address.

On the right side of the **Interface RF Address** there is the **Polling rate** number. The **Polling rate** is not relevant on **RF G5**. You can leave it as 5 (Default) as described in screenshot 7. In order to exit from **Hardware Definition** screen, press the **Page down** and **F4** button. The **Connections Definition** screen will appear (Screenshot 8).

Define the **Outputs and Inputs connection** which connected to **RTUs RF** in the field. The **Interface address** should be the **RF G5** address.

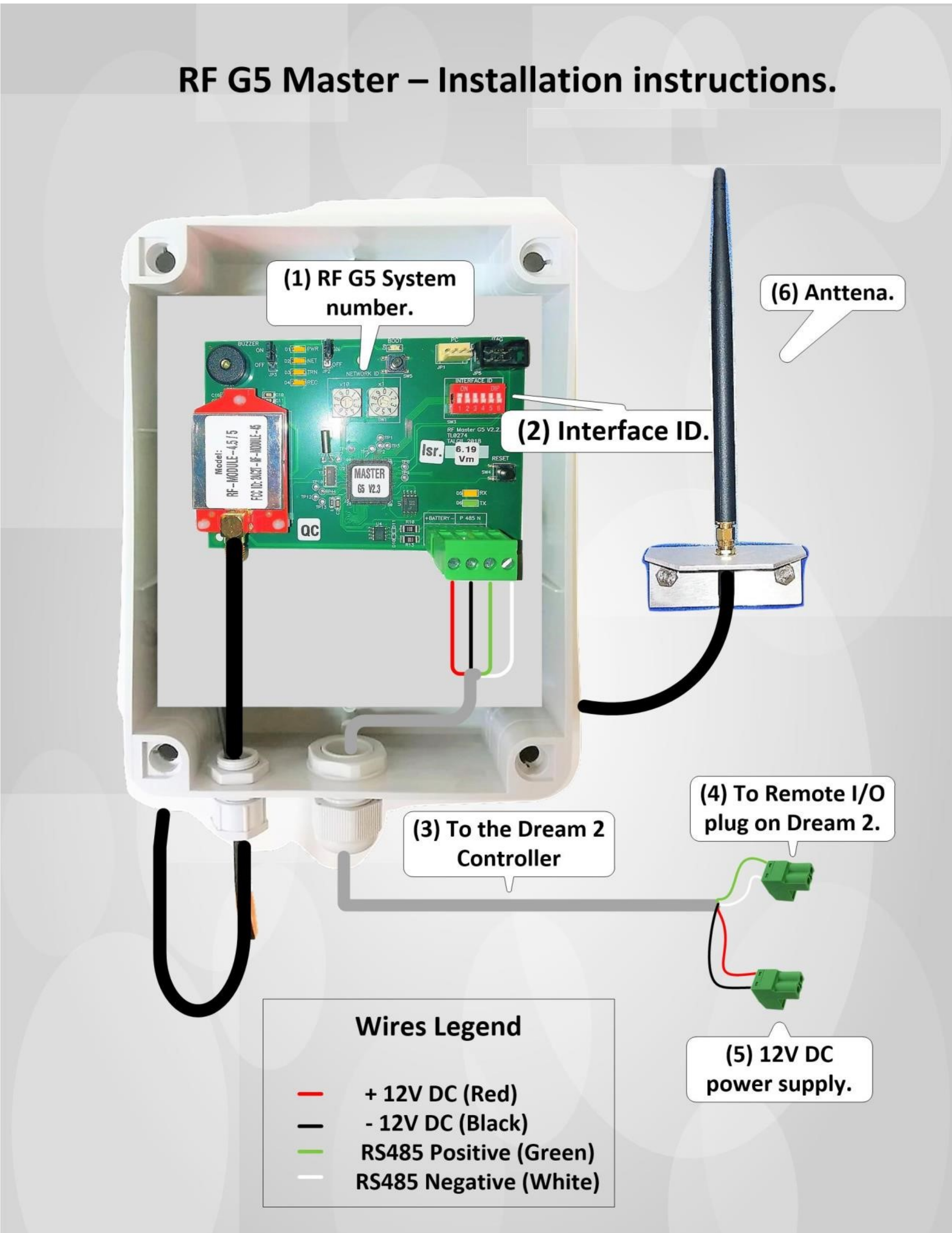


Image 2 – Installation of RF G5 Master and wiring to the Dream 2 controller.

Image 2- Installation of RF

Installing the RF G5 Master

1. Setting the **RF G5 SYSTEM NUMBER** - Every **RF G5** system must use a unique **SYSTEM NUMBER**. Make sure that in your vicinity there are no **RF G5** systems using your **RF G5 SYSTEM NUMBER**. In order to set the **RF G5 SYSTEM NUMBER,** use the **SYSTEM NUMBER** rotary switches (Pointer 1).
2. Setting the **RF G5 INTERFACE ID**- The **RF G5 INTERFACE ID** can be defined on

   Interface ID dip switch (Pointer 2). The **Interface ID** of the **RF G5 system** Must have the highest address among the other addresses of the rest of the Interfaces.
3. In order to improve the **RF** reception, install the **RF G5 MASTER Antenna** in a high place. The top of the **RF G5 MASTER Antenna** must be installed on a pipe made of non-metallic material.
4. It is recommended to install the **RF G5 MASTER Antenna** in a place which the **RF G5 MASTER Antenna** will have a **Line of sight** with the **RTU's** that communicating directly with the **RF G5 MASTER.**
5. Connect the **RS485** two wires which coming from the **RF G5 MASTER** (Pointer 3) to the **Dream 2 Remote I/O** plug (Pointer 4).
6. Connect the **+12V** and -**12V** DC wires which coming from the **RF G5 MASTER** to the Dream **12V DC** plug or to external **12V DC** power supply (Pointer 5).

7. The **RF G5 MASTER** will select automatically the RF frequency. It examines the frequencies and chooses the first best available frequency that will find. If a foreign external transmitter will use the frequency which has been used by the **RF G5 System**, the **RF G5 System** will skip to another available frequency.

RTU RF G5 ECO – Installation instructions.

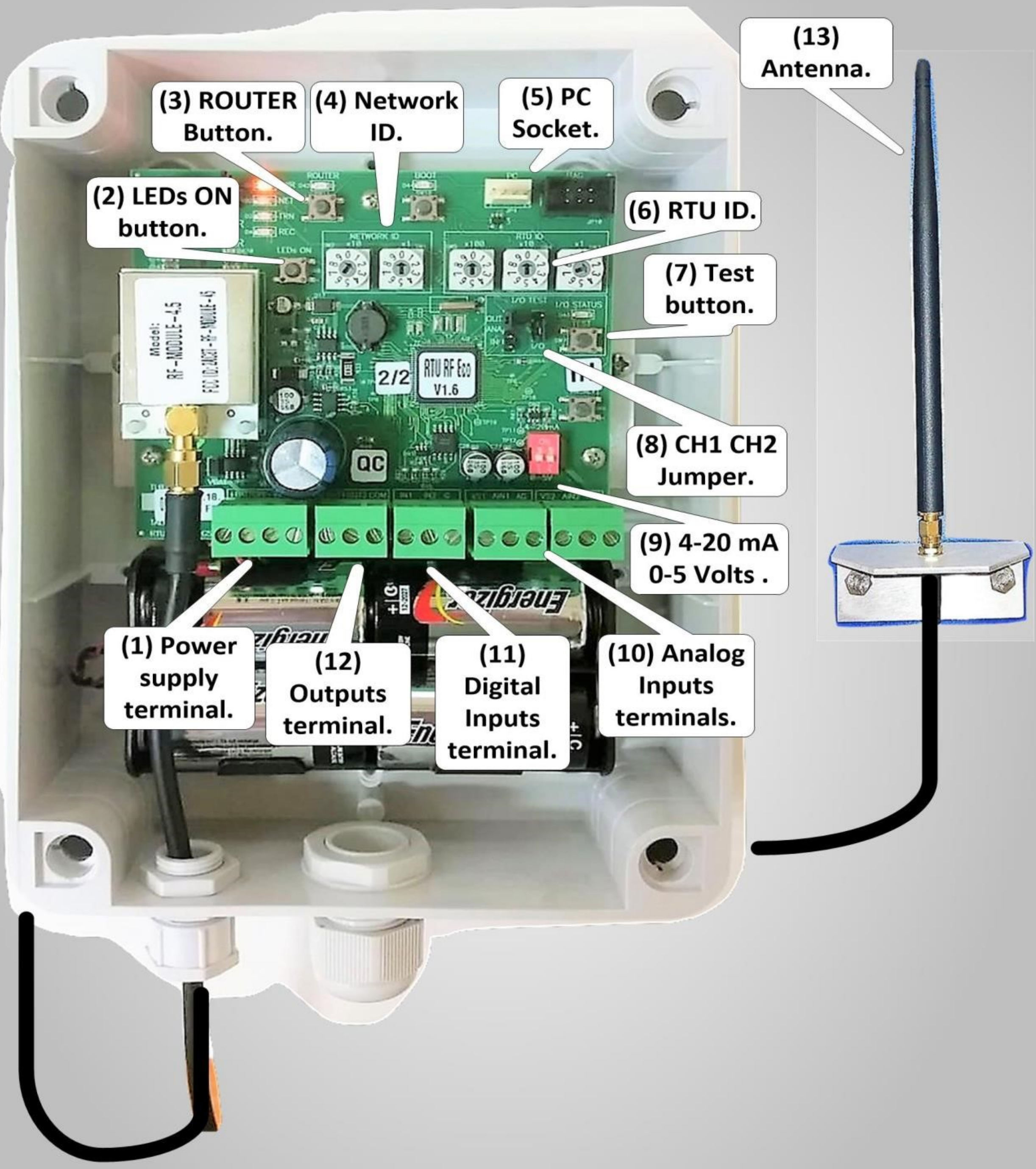


Image 3 – Installation of RTU RF G5 ECO

Installing the RTU RF G5 ECO

1. Connect the power supply to the **Power supply terminal** (Image 4 Pointer 1). The power supply for End unit can be 6V DC (four batteries 1.5 Volts size C) or 12V DC. If the RTU has been defined as **ROUTER** or it is reading **Analog inputs,** the power supply voltage must be **12 V DC** (Solar panel and rechargeable battery or 12V DC power supply and rechargeable battery).

2. LEDs ON Button (2) turn on the **POWER, NETWORK, RECEIVE, and TRANSMIT** LEDs. **POWER LED** turns on when there is power supply. **NETWORK** LED turns on when the RTU is connected to the **G5 SYSTEM, RECEIVE and TRANSMIT** blinks during receiving or transmitting data.

3. In order to change the RTU mode to a **ROUTER** , press the **LEDS ON** button
(2) then press the **ROUTER** button (3)**.** The **ROUTER LED** will turn On.

4. Set the **NETWORK ID (SYSTEM NUMBER)** of the **RF G5** system. In order to set the **RF G5 NETWORK ID,** use the **NETWORK ID** rotary switches (4).

5. Connect an **RF Programmer** to the **PC** socket (5) to program the RTU. Use the **WORKBENCH ECO** software.

6. Set the **RTU ID** (RTU address). In order to set the **RF G5 RTU ID,** use the **RTU ID** rotary switches (6).

7. For your convenience, there is a **Test outputs** button (7) which enables manually outputs and inputs test.

8. In order to test any output, set the **CH1 CH2 Jumper** (8) to your preferred output then press and hold the **Test** button until you will hear one long beep, then, every short click will open or close the output.

9. If you have analog inputs, set the appropriate analog sensor type. In order to set the analog sensor type**,** use the **4-20 mA** or **0-5V** dip switches (9).

10. Connect **ANALOG SENSORS** to the **ANALOG INPUTS TERMINAL** (10)**.**

11. If you have digital inputs (Dry contact Water meter, Fert meter, Pressure sensor, DP sensor) connect the **Digital Input** to the **Digital Inputs terminal**
(11).

12. Connect the solenoids (Or other output device l-ike Latch realy or Pump switching device) to the **Outputs terminal** (12).

13. In order to improve the **RF** reception, install the **RF G5 RTU Antenna** (13) in a high place. The top of the **RF G5 RTU Antenna** must be installed on a pipe made of non-metallic material. In addition, the **RF G5 RTU Antenna** should have a **Line of sight** with the **RF G5 Master** or with a **ROUTER.**

RTU RF G5 Modular – Installation instructions.

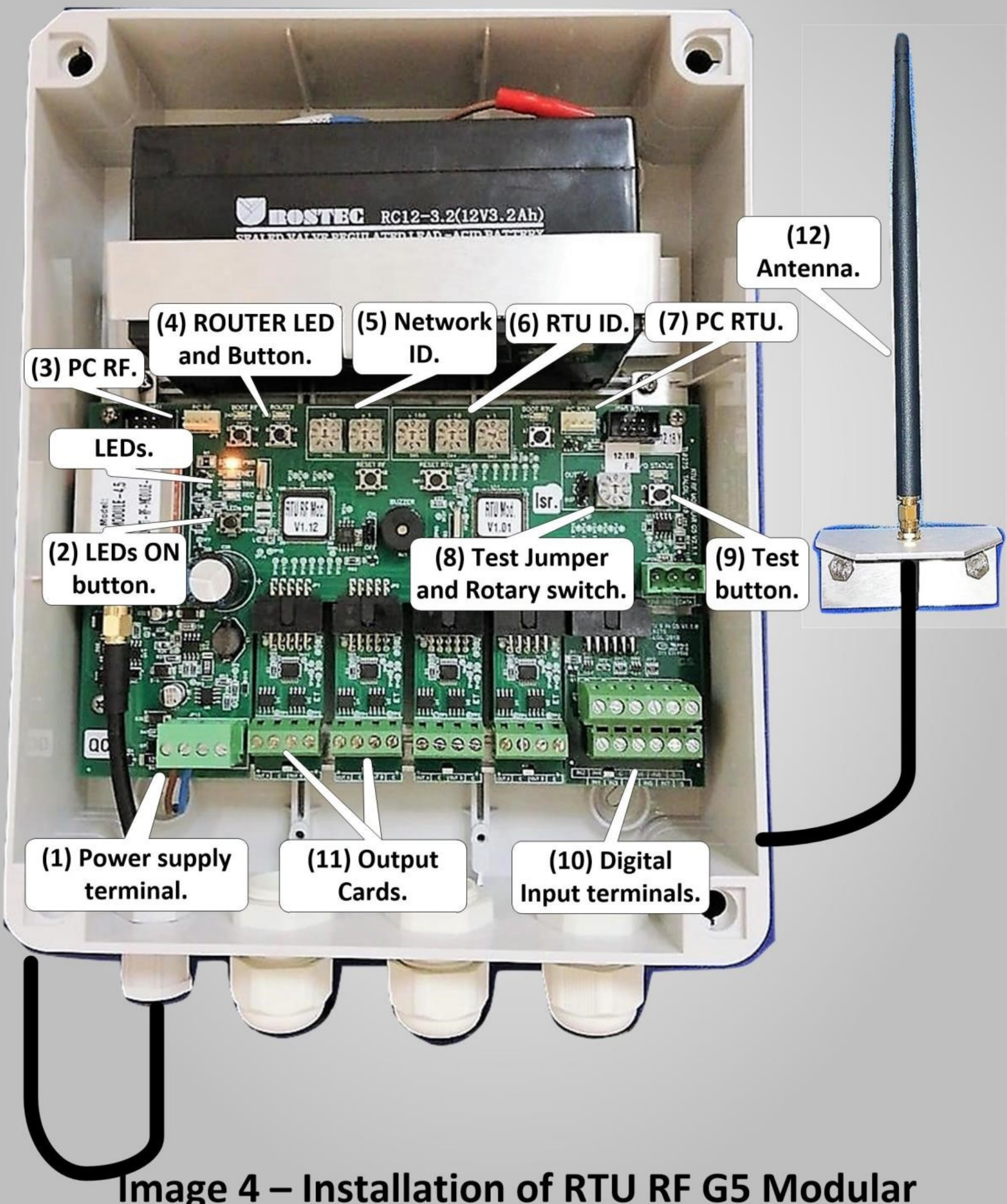


Image 4 – Installation of RTU RF G5 Modular

Installing the RTU RF G5 MODULAR

1. Connect the power supply to the **Power supply Terminal** (Image 4 Pointer 1). The power supply for End unit can be 6V DC (four batteries 1.5 Volts size D) or 12V DC. If the RTU has been defined as **ROUTER** or it is reading **Analog inputs,** the power supply voltage must be **12 V DC** (Solar panel and rechargeable battery or 12V DC power supply and rechargeable battery).

2. LEDs ON Button (2) turn on the **POWER, NETWORK, RECEIVE, and TRANSMIT** LEDs. **POWER LED** turns on when there is power supply. **NETWORK** LED turns on when the RTU is connected to the **G5 SYSTEM, RECEIVE and TRANSMIT** blinks during receiving or transmitting data.

3. In order to edit or set the RF parameters, connect an **RF PROGRAMMER** device to **PC RF** connector (3).

4. In order to change the RTU mode to a **ROUTER** , press the **LEDS ON** button then press the **ROUTER** button (3)**.** The **ROUTER LED** will turn On.

5. Set the **NETWORK ID (SYSTEM NUMBER)** of the **RF G5** system. In order to set the **RF G5 NETWORK ID,** use the **NETWORK ID** rotary switches (5).

6. Set the **RTU ID** (RTU address). In order to set the **RF G5 RTU ID,** use the **RTU ID** rotary switches (6).

7. Connect an **RF Programmer** to the **PC RTU** connector (7) to program the RTU. Use the **WORKBENCH MODULAR** software.

8. For your convenience, there are **TEST JUMPER** and **TEST ROTARY SWITCH** (8) which enables selection of desired output or inputs test.

9. **Test outputs** button (9) enables manually outputs and inputs test.
 In order to test any output, set the **TEST JUMPER** and **TEST ROTARY SWITCH** to your preferred output then press and hold the **Test** button until you will hear one long beep, then, every short click will open or close the output.

10. If you have digital inputs (Dry contact Water meter, Fert meter, Pressure sensor, DP sensor) connect the **Digital Inputs** to the **Digital Input terminals** (10).

11. Connect the solenoids (Or other output device like Latch realy or Pump switching device) to the **Outputs terminal** (12).

12. In order to improve the **RF** reception, install the **RF G5 RTU Antenna** (12) in a high place. The top of the **RF G5 RTU Antenna** must be installed on a pipe made of non-metallic material. . In addition, the **RF G5 RTU Antenna** should have a **Line of sight** with the **RF G5 Master** or with a **ROUTER.**

RTU RF ECO G5 – Special modes

RTU RF G5 has 4 different modes. The modes are **Working mode, Programming mode, Test I/O mode,** and **Boot mode**. Read on for detailed descriptions.

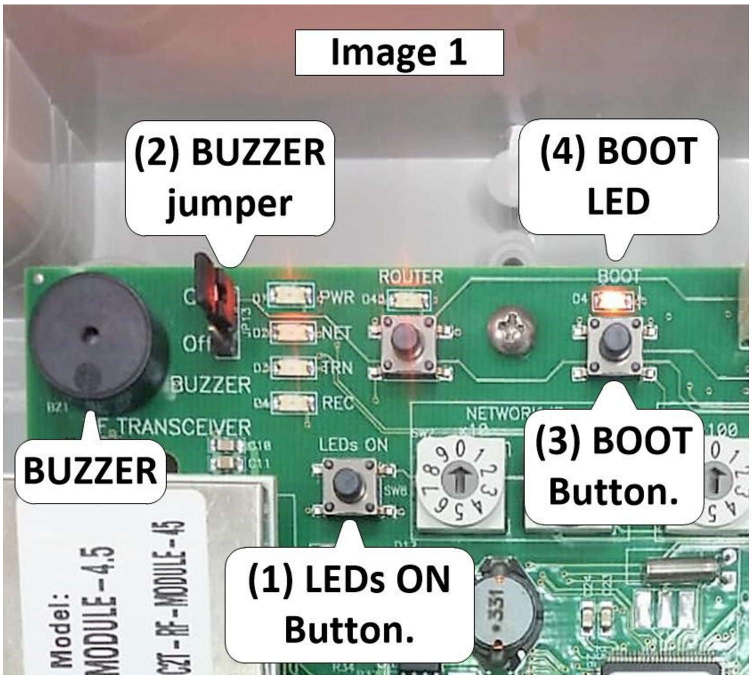
Working mode

The **RTU RF Eco G5** enters to **Working mode** after finding the Master unit and joining to the system. During **Working mode** the RTU making a sound every 10 seconds (default **Wake up** time) which describes the communication status. One beep means good communication. Two beep means communication error.

Programming mode

In order to write or read the RTU RF Eco G5 **settings, change the RTU mode to** Programming mode**. To enter to** Programming mode**, press the LEDs ON button (Pointer 1 image 1) for one second.** Enable the sound. Set the **BUZZER** jumper (Pointer 2) to **ON**.

In **Programming mode**, the **POWER**, **NET, TRN,** and **REC** LEDs are active. To exit from **Programming mode**, press the **LEDs ON** button for one second. If there is no activity, the **RTU RF Eco G5** exits from **Programming mode** automatically after 2 minutes.



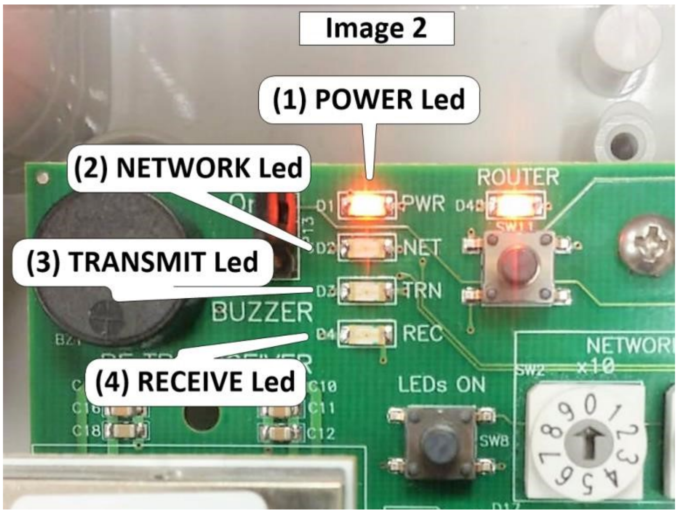
Sound and LEDs behavior during the Programming mode

POWER Led: When the power supply voltage is normal, the **POWER** led (Image 2 pointer 1) turns on and blinks every second. When **Low Battery** voltage has been detected (Less than 11 volts for rechargeable battery or 4.8 volts for Batteries), the **POWER** led turns off and blinks every second. When **Dead Battery** voltage has been detected (Less than 10.6 volts), the **POWER** led turns off. During dead battery detection, the **Buzzer** sounds several short beeps every 10 seconds.

NETWORK Led: When the **RTU RF Eco G5** finds a **Master** and join to the RF network, the **NETWORK** Led (Pointer 2) turns on. During the communication with the Master, the **RTU RF Eco G5** Buzzer sounds short beep every 10 seconds (default wake up time). When there is communication error, the **NETWORK** led turns off and the **RTU RF Eco G5** Buzzer sounds 2 short beeps.

TRANSMIT Led: When the **RTU RF Eco G5** transmits information about digital or analog inputs state, the **TRANSMIT** Led (Pointer 3) turns on for a short time. The **RECEIVE** led (Pointer 4) also will turn on for a short time because the **Master** will send an acknowledge information to the **RTU**. Acknowledge means confirmation for getting the data.

RECEIVE Led: When the **MASTER** transmits information about the outputs state, the **RECEIVE** Led on **RTU RF Eco G5** turns on for a short time. The **TRANSMIT** led also will turn on for a short time because the **RTU RF Eco G5** will send an acknowledge information to the **MASTER**.
Acknowledge means confirmation for getting the data.



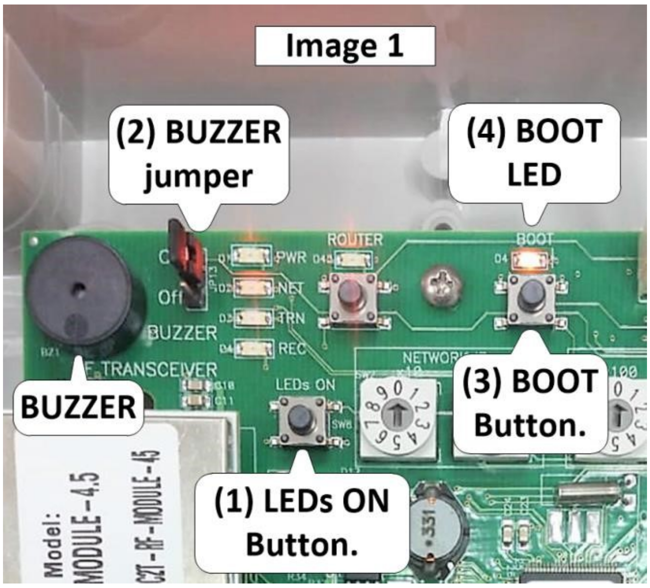
TEST I/O Mode

There are a local Input and Output **Test mode**. To test Input or Output number 1, connect the **I/O TEST** jumper to the bottom two pins (Upper pin is free). Press the **TEST button** for one second then press again to open output number 1. After every click on the **TEST button**, output number 1 will change his state. Every change on Input 1 state will be accompanied by sound. One beep for close contact. Two beeps for open contact. On **TEST mode**, the **I/O Status** led turns on. In order to test Input or Output number 2, connect the **I/O TEST** jumper to the upper two pins (Bottom pin is free). To exit **TEST mode**, press the **TEST button**. If there is no activity, the **RTU RF Eco G5** exits **from Test mode** automatically after 2 minutes.

Loading mode (Boot loader)

In order to upgrade the **RTU RF Eco G5** firmware version, change the unit mode to **Loading mode**. Press and hold the **BOOT** button (Pointer 3 image 1) then press the **RESET** button for a short time then leave the **RESET**. After one second, leave the **BOOT** button.

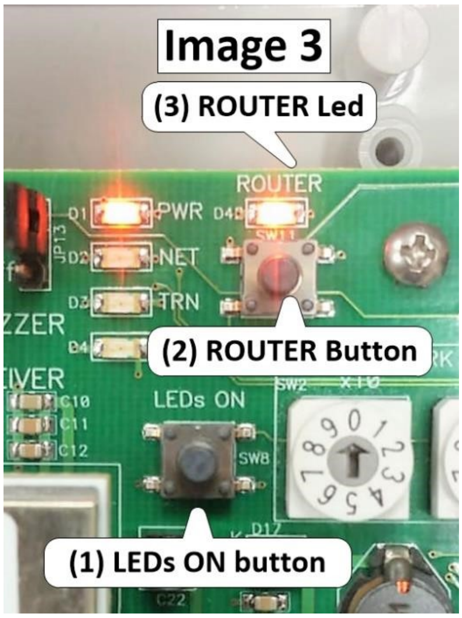
In **LOADING MODE**, the **BOOT** led (Pointer 4) turns on and the **BUZZER** sounds a long beep**.** If there is no activity (No serial communication) the unit stays in **Loading mode** for 30 seconds. After 30 seconds it returns to working mode.



ROUTER Mode

When RTU **RF Eco G5** has been defined to work as RTU, the **ROUTER led** turns off. In order to change the **RTU RF Eco G5** mode to a **ROUTER mode**, press the **LEDs ON** button (Image 3 pointer 1) then press the **ROUTER button** (pointer 2). In **ROUTER mode** the **ROUTER led** turns on (Pointer 3).

Pay attention that the **ROUTER** unit power consumption is higher than regular RTU therefore, a **ROUTER** unit should be equipped with Solar panel and rechargeable battery.



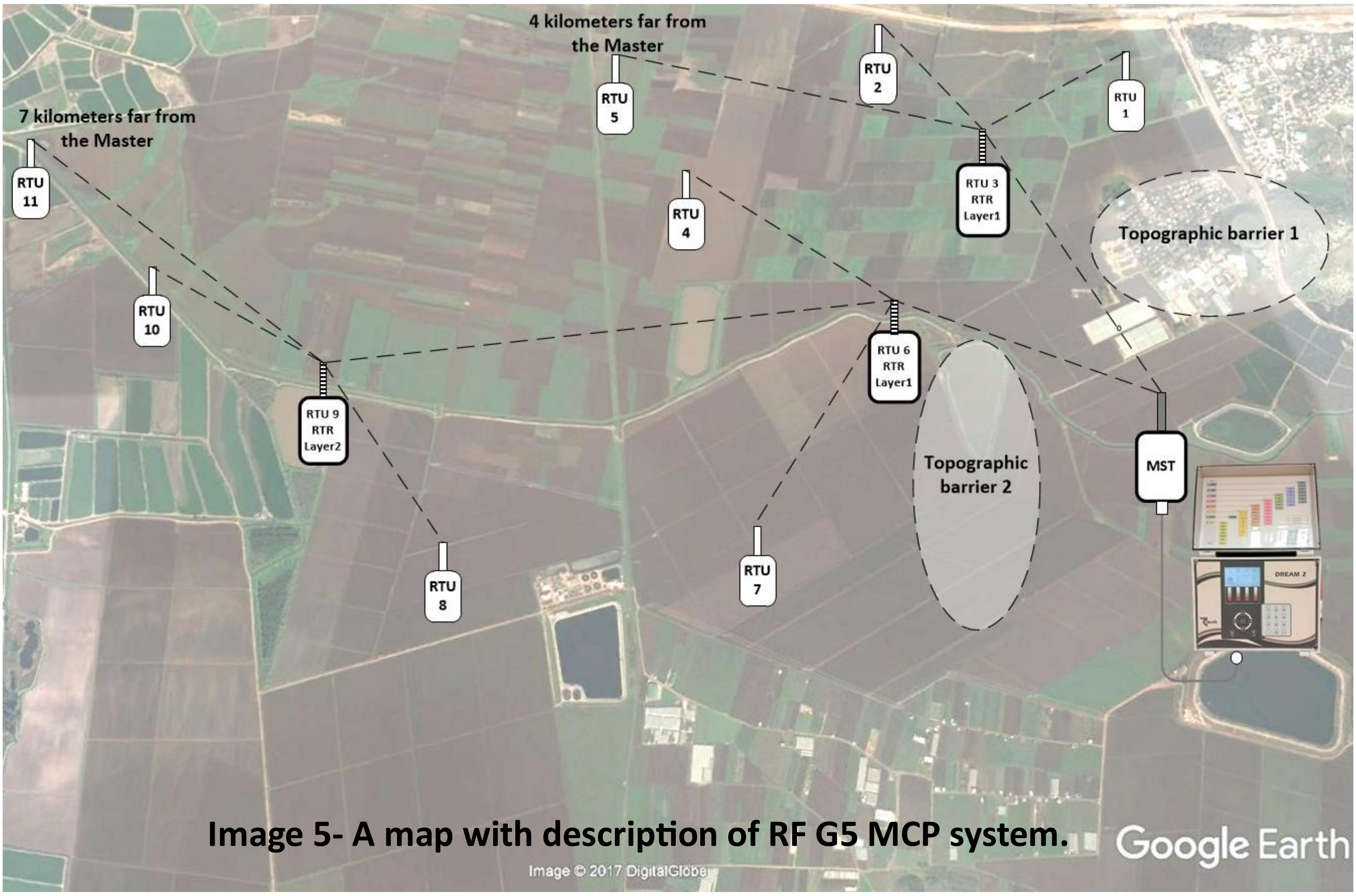


Image 5- A map with description of RF G5 MCP system.

Introduction to RF G5 MCP SYSTEM

The **MCP** (wirelesses Multilayer Communication Protocol) used to convey information between the Master unit and RF RTUs. The RF G5 system units used for operation of irrigation heads which installed away from the Dream 2 controller. The advantage of the RF G5 on the previous RF generations is the ability to add to the RF system up to 11 layers. It means that the user can define a repeater to repeater 11 times. In this way, the RF system can handle irrigation heads which are more than 20 km far away from the Dream 2. Another advantage, the RF G5 system use an asynchronous communication protocol. In other words, the RF G5 system transmits information when there is a change in outputs or inputs state. In this way, the RF system saves energy and does not send unnecessary information to the air. In order to make a good RF communication between the **Master unit** to the End units, three preconditions (FDL) must be met:

1. **Free frequency**-the frequency which has been used by the RF system must be free and clear.
2. **Distance**- the Distance between the **RF Master** to the **Routers** or **End units** which communicate directly with the **RF Master**, must be not more than 3 kilometers.
3. **Line of sight**- there must be **Line of sight** between the **RF Master** to the **Routers** or **End units** which communicate directly with the **RF Master**.

The RF G5 system select automatically the first free available frequency. But, if the distance between the **Master** to the **End unit** is more than 2.5 kilometers or there is no line of sight between the **Master** to the **End unit,** the user can program any RTU and set it to work as a **Router.** A **Router** can use as an **End unit** and can help to other **RTUs** in his vicinity and **improve** the communication Between the **Master** to **End unit**. The system defines the links between the

End units and **Routers** and finds the best **Router** in the vicinity of problematic **End unit.**

Image 5 describes an example of **RF G5 MCP** system. **RTU** number **1** cannot communicate directly with the Master because of a **topographic barrier** (There is no line of sight). In addition, RTU number 2 is away from the Dream 2 controller (More than 3 kilometers). Therefore, the installer defined a **Router** (RTU number 3) in the middle between the **Master** and **RTUs 1** and **2**.

There is no need to define the **layer** or the number of **RTUs** to serve or a special arrangement of addresses (Like previous **RF** generations). It is defined automatically. The same about **RTUs 4** and **7** which use **RTU** number **6** as a **Router**. **RTU** number **9** is a **ROUTER** on **layer 2**. **RTUs 8, 10** and **11** helped by **ROUTER** RTU 9 to communicate with the G5 center because of the high distance between the **Master** to them.

The TreeView (Sniffer) software

Since the **RF** transmission is invisible, Talgil computing and control ltd developed a troubleshooting tool which helps to identify, examine and see what is happening in the air. This tool called **Sniffer**. The **Sniffer** listens to the **RF** communication and writes the results on the **MCP Sniffer** software. The user can read and examine the results by reading the log files. The **Sniffer** and the **RF G5 Master** have the same hardware but different firmware. The **Sniffer** communication protocol is **RS485** therefore**,** in order to connect the Sniffer to the PC, connect an **INTERFACE PC RS485 USB** device to the **PC**. Open the **TreeView** software and press the **START CONNECTION** button. **TreeView** software will display on TOPOLOGY window the discovered RF units and their interactions.

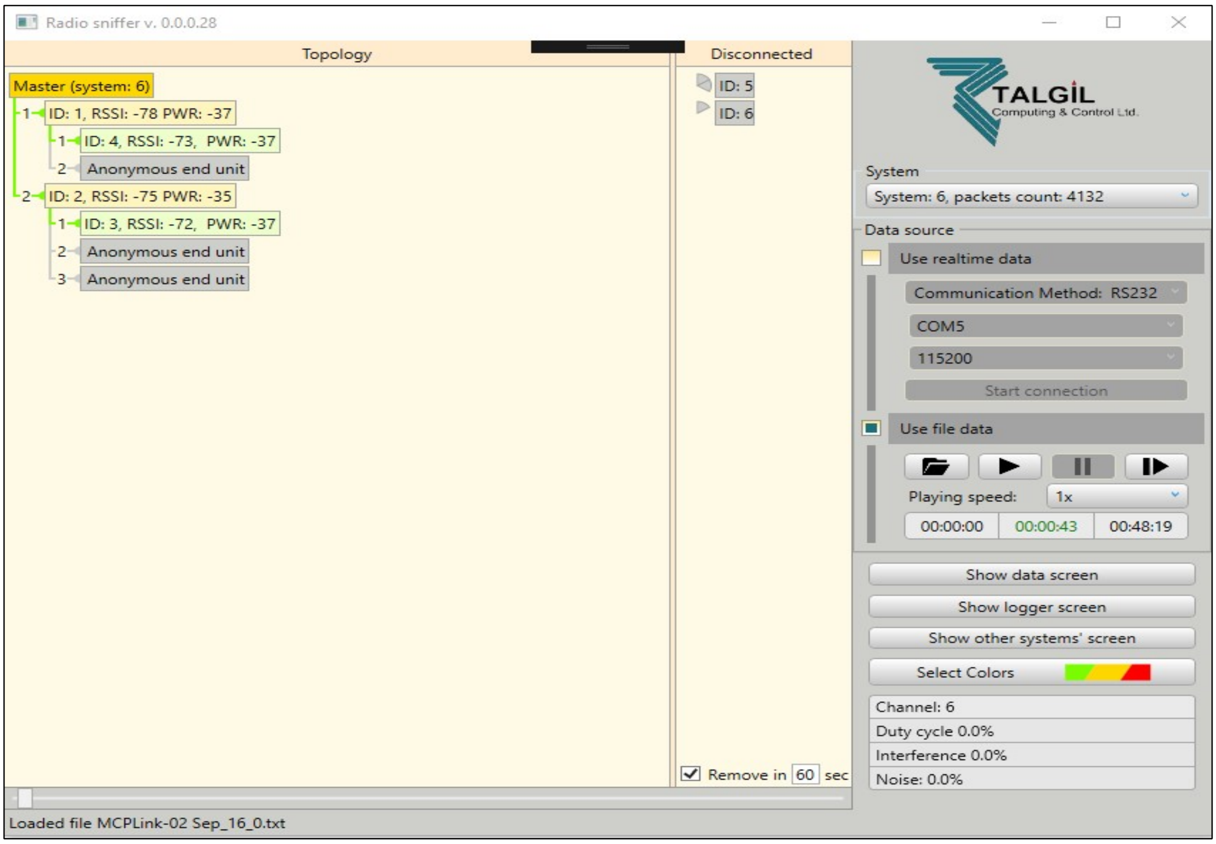
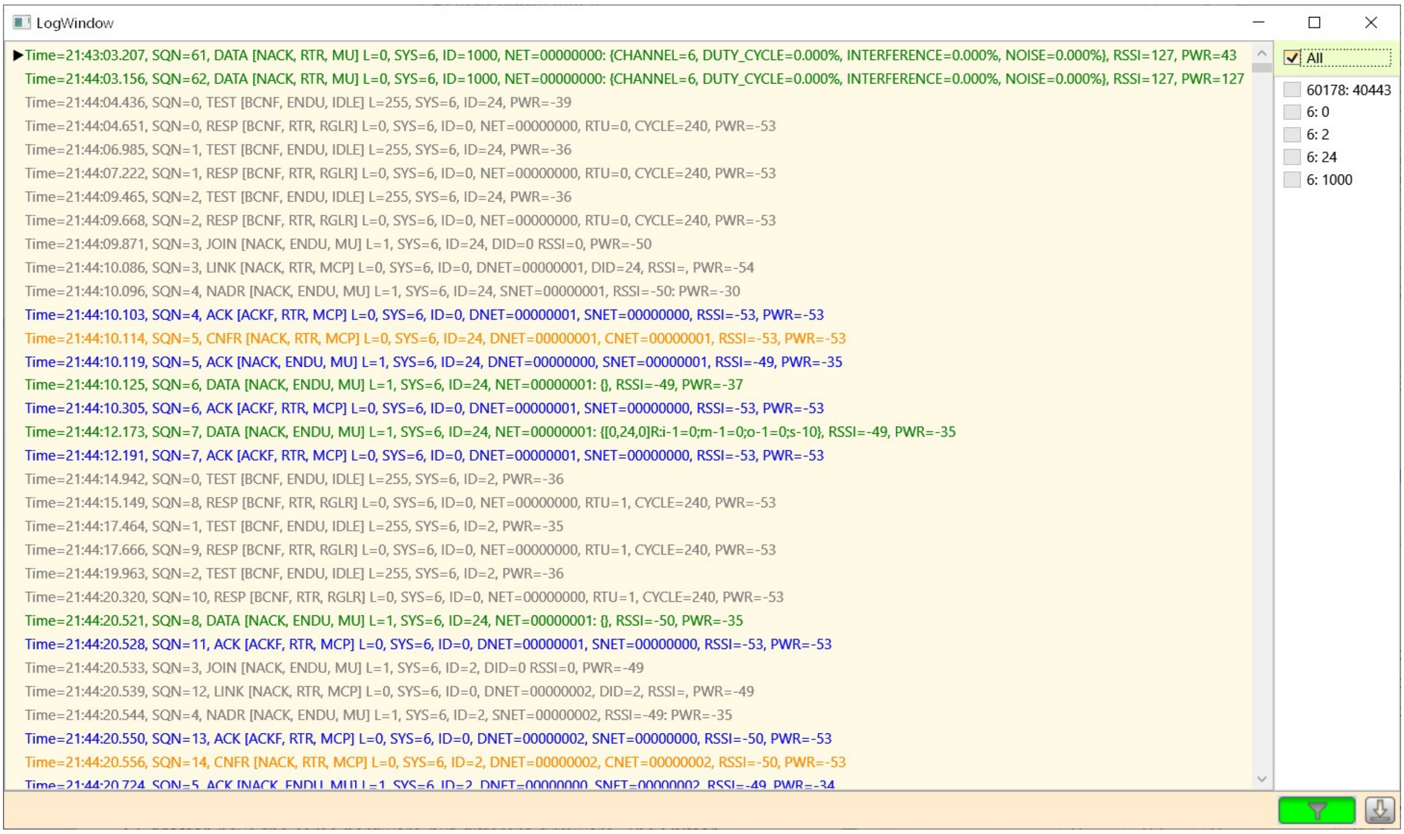


Figure 6- Treeveiw software

SHOW DATA and **SHOW LOG** displays the communication between the end units to the Master unit. The RF unit, Layer, ID, Network address, and transmitted data of any Rf unit will appear DATA/LOG window.



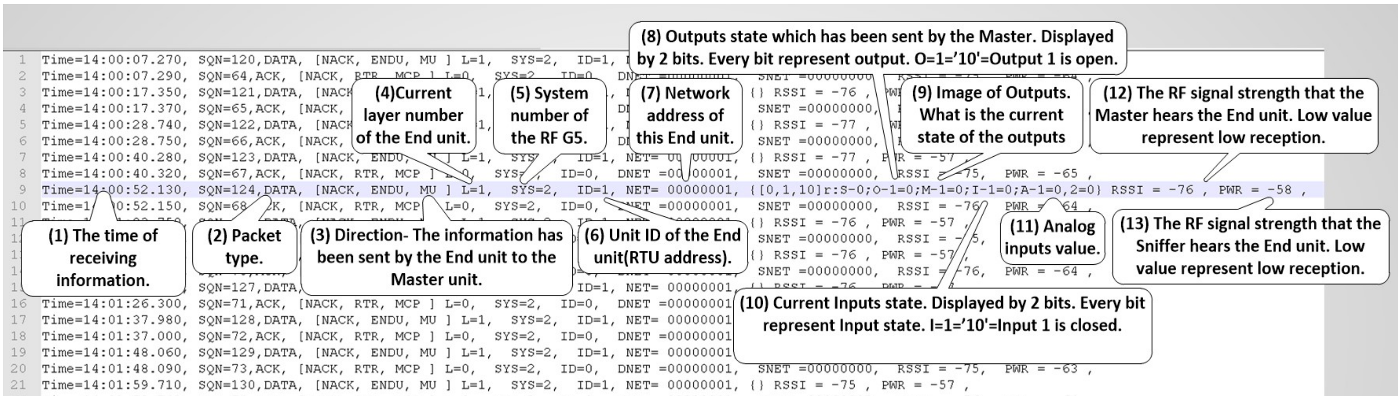


Figure 7 –TreeView (Sniffer) software log file.

Description of the Sniffer results

Figure 7 describes an example of a packet that has been sent by the **End unit** number 1 to the **Master unit**. Here are the terms and their explanations:

1. **Time-**Any packet starts with the time of receiving the information.
2. **Type-**Every packet classified by type. Figure 7 describes a **DATA** type. It means that the **End unit** sends information about Outputs, Digital and Analog Inputs state.
3. **Direction-**Describes the packet direction. The **End unit** sends information to the **Master unit**.
4. **Layer-**Determine the **End unit** layer. Layer 0 represent packets which coming from the **Master unit**. Layer 1 represent **End unit** or **Router** which communicating directly with the **Master unit.** Layer 2 means that there is a **Router** in layer 1 which helps to the **End unit** on layer 2.
5. **System number-** Represent the RF G5 system number.
6. **Unit ID-** Represent the **End** unit address (RTU address).
7. **Network address-** Determines the address that the **MCU** grant to the **End unit.**
8. **Outputs State-** The outputs state which has been sent to the **Master unit**. The value represents a decimal conversion of two bits. The possibilities are:

   0= ‘00’- Two outputs are closed.

   1= ‘10’- Output 1 is open.

   2= ‘01’-Output 2 is open.

   3=‘11’-Outputs 1 and 2 are open.
9. **Image of Outputs**- Represents the current outputs state on the **End unit**. The **Image of Outputs** should be the same as the **Outputs state.**

10. **Inputs State-** The current Inputs state of the **End unit**. The value represents a decimal conversion of two bits. The possibilities are:
    0= ‘00’- the two Inputs are opened.
    1= ‘10’- Input 1 is closed.
    2= ‘01’- Input 2 is closed.
    3=‘11’- the two Inputs are closed.

11. **Analog inputs**- represent the value of the two analog inputs measurements. A-1 =Analog input 1. A-2=Analog input 2.
12. **RSSI-** Received signal strength indication. Determine how the **Master unit** hears the **End unit.**
13. Power- Determine how the **Sniffer** hears the **End unit.**

Revision History

The table below describes the changes which have been made to this document.

Date	Change	Description
9 November 17		Writing the user manual.
15 July 2019		Edit RTU pictures. Add the Treeview software.

Typical RTU Instalation

Vineyard Stand

Aluminium

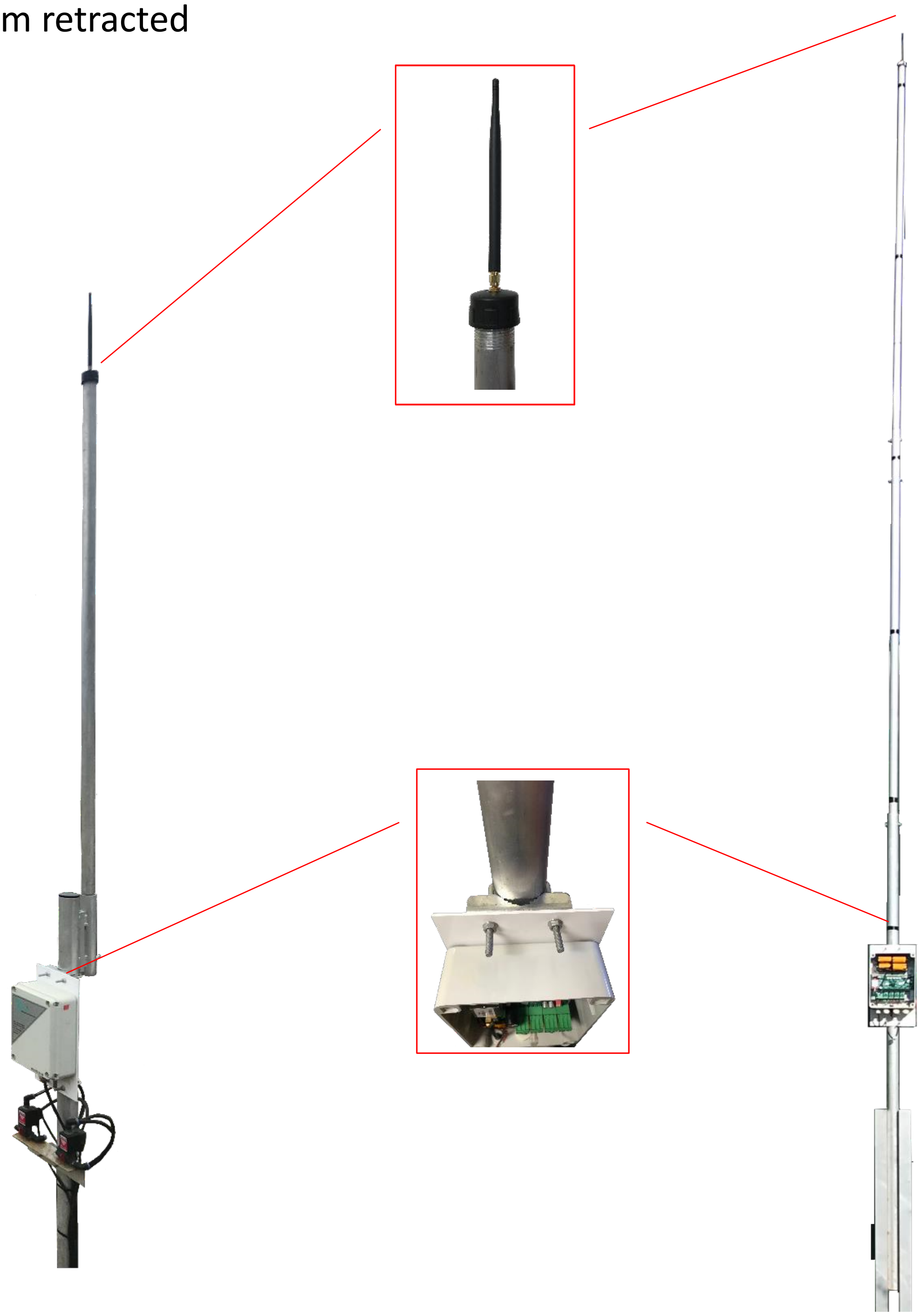
3m extended

1.7m retracted

Orchard Stand

6m Aluminium

Fold Down



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