RAPHAEL

Ultraf PRO

INSTALLATION & OPERATION USER GUIDE

Rev C | Doc P/N: IOM_ULT210404_ULTRAF_EN

HOME

1. SAFETY

This chapter reviews general and specific safety instructions for installing and operating Ultraf, and includes the following sections:

- General Safety Instructions
- Handling Safety Instructions
- Battery Safety Instructions

1.1 General Safety Instructions

- Do not install, operate or maintain Ultraf without reading, understanding and following the factory supplied instructions.
- Read the instructions in this section carefully before beginning installation and save them for future reference.
- Follow all instructions marked on the product.
- Pay attention to all caution notes in this manual.
- Implement handling and lifting instructions to avoid damage.
- Use Ultraf only as specified in this manual. Do not deviate from the instructions and information provided.
- **Do not perform welding while Ultraf is connected to the pipe.**

WARNING: Connect Ultraf output according to the following limitations:

- **Pulse output –** Maximum Current: 100 mA, Maximum voltage: 18 VDC
- **Analog output –** 12-18 VDC
- **Solenoid Output –** LATCH 12-18 VDC, 4,700uF capacitor

IMPORTANT! GROUNDING:

- In order to reduce the risk of the product being damaged by high voltage changes/lightning strikes and noises from the environment, Ultraf is supplied with a green/yellow grounding cable that is permanently connected and marked with a sticker:

- **We strongly recommend connecting the grounding cable to a grounding pole by a certified electrician.**

1.2 Handling Safety Instructions

- If Ultraf does not operate normally, refer to the service instructions or contact qualified Raphael personnel.
- Personnel involved in installation, operation or maintenance of Ultraf must be trained in the safety methods relevant to the tasks assigned. Personnel must be familiar with safety messages and understand the appropriate response procedures for emergencies or other non-standard situations.
- Keep Ultraf in proper operational condition. Ultraf must be serviced by a trained technician on a routine basis. Unauthorized modifications to the meter might impair the function and/or safety and reduce the lifespan of the meter.
- **Lifting Components –** use caution when lifting components during installation. Only authorized personnel using the proper lifting equipment are permitted to lift components.
- Wear appropriate personal protective equipment (PPE).

1.3 Battery Safety Instructions

- Lithium batteries are a high energy power source and might become a potential hazard if handled improperly.
- Raphael Valves is not responsible for any battery failures due to user mishandling.
- Lithium batteries are non-corrosive. However, extreme heat (contact with open flame or system shorting) causes the battery to rupture, leading to severe injury and damaged equipment.
- Do not transport or operate batteries at temperatures beyond their specified range.
- Do not crush, break, or disassemble the battery.
- Do not short circuit, recharge, overcharge, or connect the battery with reversed polarity.
- Do not weld or solder onto the battery compartment or within close proximity of the battery.
- Do not submerge the battery in water or apply any fluids on the battery.
- If the battery is depleted or damaged, consult Raphael for replacement.
- Only an authorized Raphael dealer may replace the battery pack.
- Adhere to all local laws and regulations for disposal or recycling of lithium batteries.

2. INSTALLATION & OPERATION

This chapter reviews the tasks associated with installing and operating Ultraf, and includes:

- Introduction
- Package Contents
- Installation
- Setup and Configuration
- Operation
- Maintenance

2.1 Introduction

Ultraf is an ultrasonic hydrometer valve for water metering and hydraulic control.

2.1.1 Ultraf Configuration

Ultraf can be modified to a large variety of hydraulic applications such as On/Off, pressure reducing, pressure sustaining, flow control, etc.

Ultraf control output can be modified according to the required control application. Ultraf functionality changes according to installed control output thus, the installation and operation instructions varies according to the installed control output.

This guide provides instructions for all the optional control configurations. Make sure to follow the instructions relevant to your Ultraf control configuration.

Ultraf can be mounted with a wide range of Raphael hydraulic valve applications. The hydraulic valve displayed in this guide is for demonstration only.

TIP: Ultraf is delivered already configured according to the configuration ordered. This configuration can be changed at a later stage.

Ultraf is delivered in one of the following control configurations:

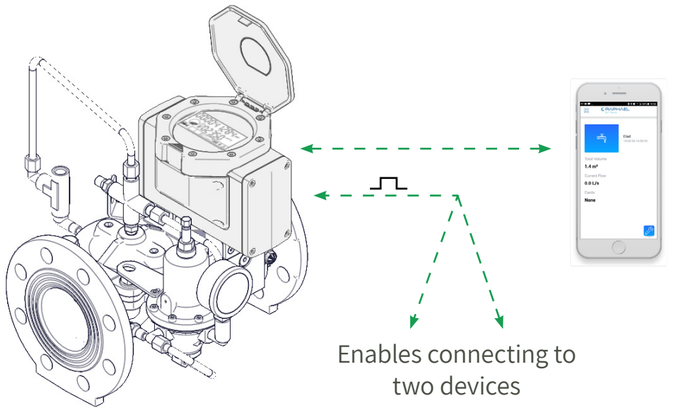
Ultraf with Pulse Output

Ultraf reads the water flow and the readings are monitored on the Ultraf local control panel (see Local Monitoring on page 44) or via a dedicated mobile device application (see Setup and Configuration on page 28).

Ultraf transmits the flow rate via its pulse output to an external reading device (e.g. irrigation controller).

The external reading device is connected using a wire output pulse that provides a pulse when a predefined water volume passes through the meter (see Pulse Output on page 18).

The reading and pulse output are configured via Raphael mobile device application (see Pulse Output Control on page 34).



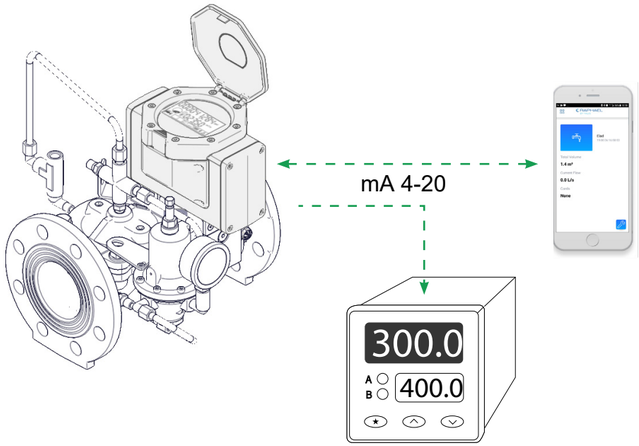
Ultraf with Analog Output

Ultraf reads the water flow. The readings are monitored on the Ultraf local control panel (see Local Monitoring on page 44) or via a dedicated mobile device application (see Setup and Configuration on page 28).

Ultraf transmits the flow rate via its analog 4-20mA output to an external monitoring device such as a 4-20mA input counter or an analog input controller device (see Analog Output on page 21).

The output analog current is related to the flow rate.

The reading is configured via Raphael mobile device application (see Analog Output Control on page 36).

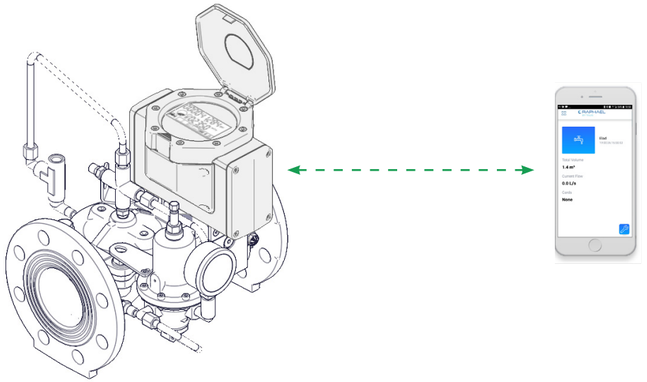


Ultraf for Pressure Management

Ultraf reads the water flow and the readings are monitored on the Ultraf local control panel (see Local Monitoring on page 44) or via a dedicated mobile device application (see Setup and Configuration on page 28).

Ultraf controls a two-stage downstream pressure set based on flow demand and time of day. Ultraf controls the outlet pressure based on predefined programming (see Pressure Management Control on page 38).

In this configuration, Ultraf includes a solenoid valve output (see Solenoid Valve Output on page 26).

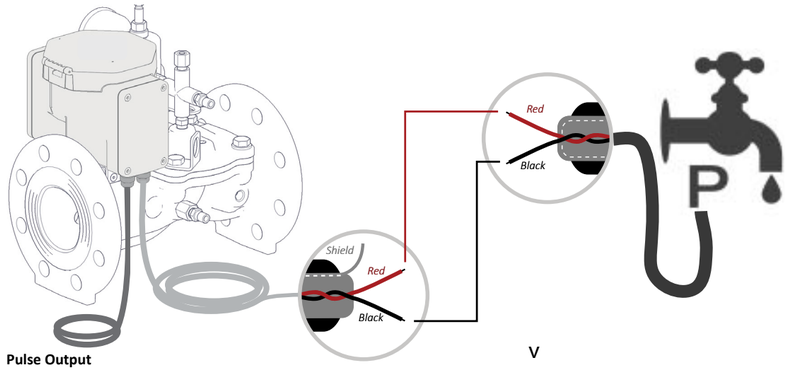


Ultraf for Irrigation Control

Ultraf reads the water flow and the readings are monitored on the Ultraf local control panel (see Local Monitoring on page 44) or via a dedicated mobile device application (see Setup and Configuration on page 28).

Ultraf controls the amount of water for weekly or cyclic irrigation programs (see Irrigation App on page 47).

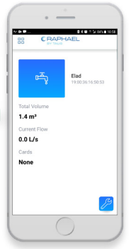
In this configuration, Ultraf includes a solenoid valve output (see Solenoid Valve Output on page 26) and an option for a pulse output (defined in the mobile application).



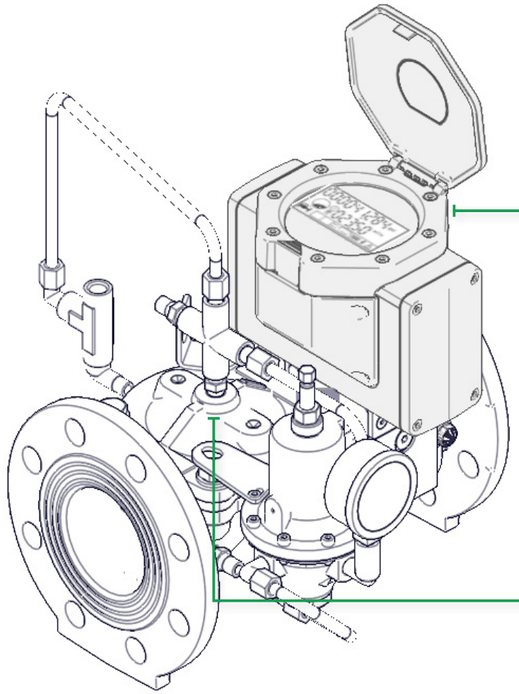
2.1.2 System Overview

Ultraf system consists of the following components:

Mobile device – enables monitoring and configuring Ultraf using a dedicated mobile application (see Mobile Application Installation on page 43).



NOTE: The mobile device is not provided by Raphael Valves.

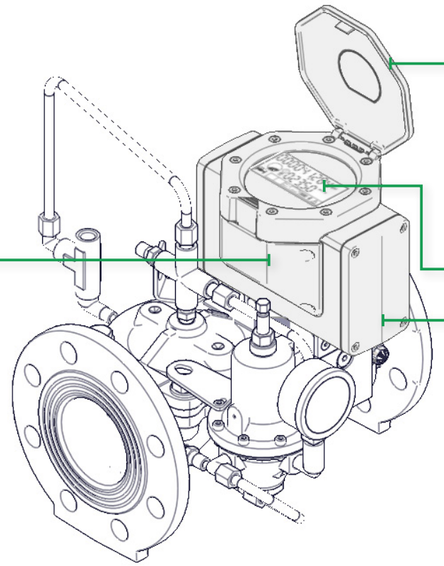


Meter and controller unit – Integrated in the produced, measures the flow and performs optional controls (see Ultraf Main Components on page 5).

Valve – Ultraf is compatible with a wide range of hydraulic valve applications. The appearance of the valves differs according to the model ordered.

2.1.3 Ultraf Main Components

The main components of Ultraf meter and controller unit are:



Main battery enclosure – contains a 3.6V D type lithium battery that powers the Ultraf (see Main Lithium Battery Replacement on page 45).

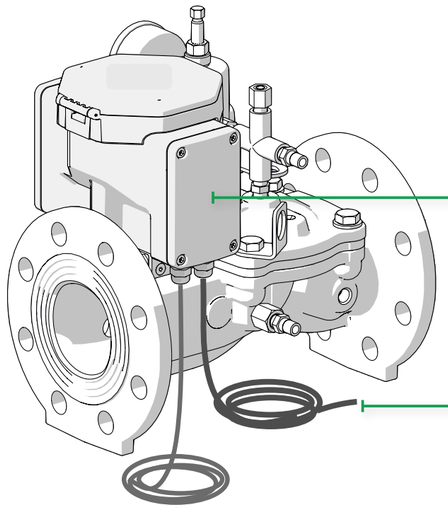
Panel cover – protects the digital panel.

Local display – a digital panel which displays the Ultraf readings and statuses (see Local Monitoring on page 44).

Secondary battery enclosure cell – If pulse card will be installed, battery card will be placed in this cell (on the card, 4 lithium 3.5AA non-replaceable batteries that powers the pulse) (see Secondary Battery Replacement on page 46).

If Modbus card will be installed, the cell will be without any card (see Modbus Connection Card on page 24)

NOTE: The numbers of output cables depends upon the configuration. Basic configuration does not require output cables.



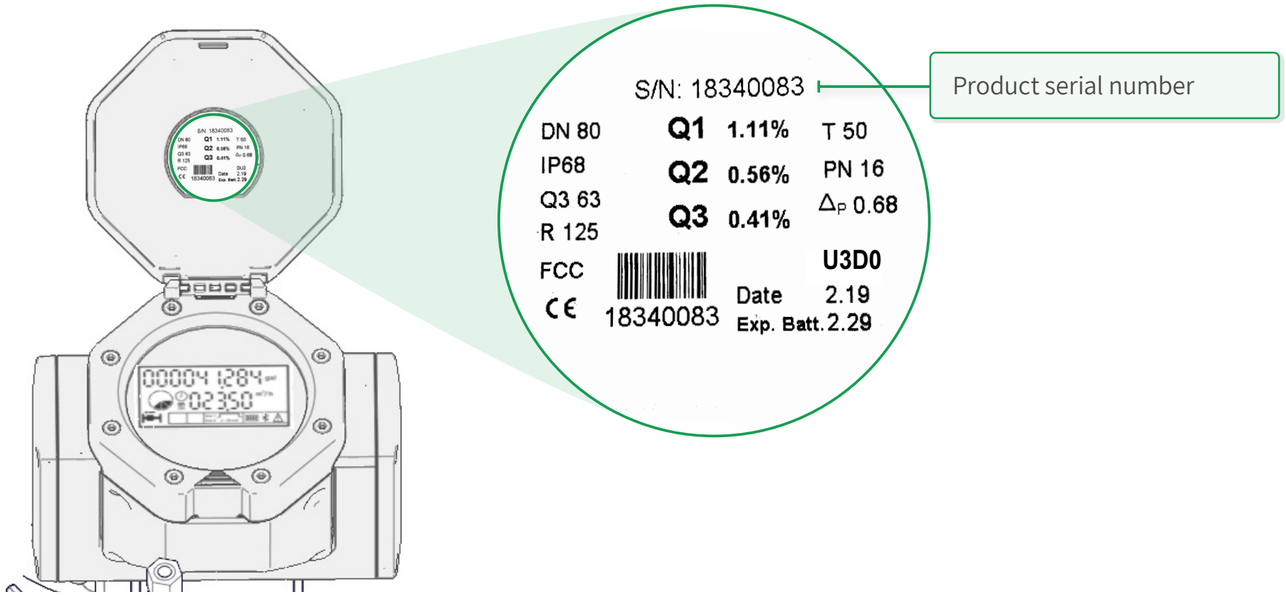
Extension card enclosure – contains optional extension cards according to the Ultraf configuration.

Solenoid valve output – appear in irrigation controller and pressure controller applications.

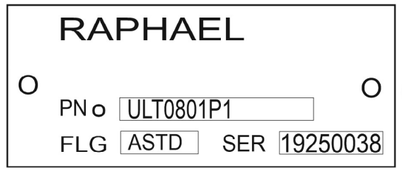
Output cable – connects the Ultraf output to an external device.

Product Serial Number and Data

The serial number is the Ultraf default identification on the mobile device application. This serial number is used to identify the device.



Product serial number



A license label is located on the Ultraf body. The license label includes the following information:

- Catalog number
- Unit serial number
- Unit connection type

2.2 Package Contents

Ultraf is delivered in a cardboard transport box with styrofoam padding and includes the following components:

- 1 Ultraf configured with the selected output card (no card is optional) including batteries, 1 or 2 meters of shielded 2mm cables; set to metric units.
- 1 Ultraf Installation and Operation Manual.

2.3 Installation

This chapter reviews the tasks associated with installing and wiring Ultraf and includes:

- Mechanical Installation
- Wiring Instructions

2.3.1 Mechanical Installation

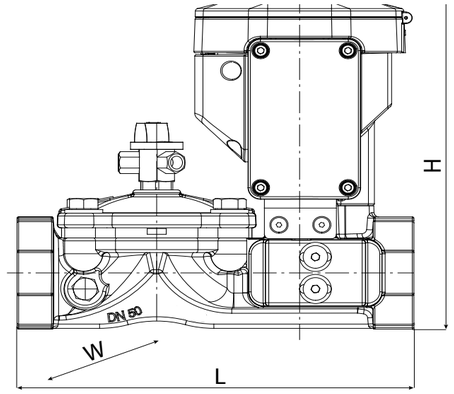
This section describes the tasks associated with Ultraf mechanical installation.

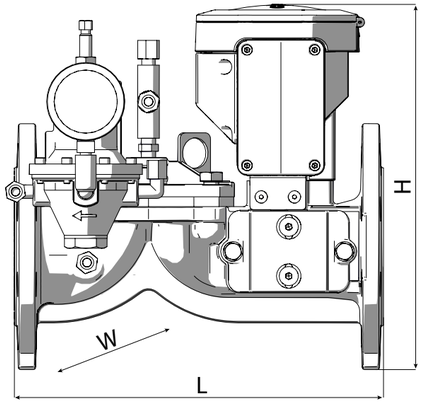
Dimensions

When preparing the pipe line for Ultraf installation, consider the following measurements according to the Ultraf model ordered:

DN [mm]	40	50	80	100	150	200
DN [inch]	1½	2	3	4	6	8
Length L [mm]	250	250	300	350	500	600
Height H [mm]	212	228	300	327	392	425
Width W [mm]	190	190	223	240	310	350
Weight [kg]	9.5	10	13.5	21	43	67
End Connections	TH		F F			

NOTE: Height and Width of the unit changes according to the hydraulic application.





General Installation Instructions

This section provides recommended guidelines for installing Ultraf on a pipeline.

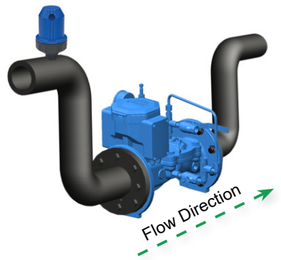
NOTE: Install Ultraf upright in a horizontal mount or flowing upwards in a vertical mount. Make sure water flow is from the metering unit past the valve and out. Avoid air in the water.

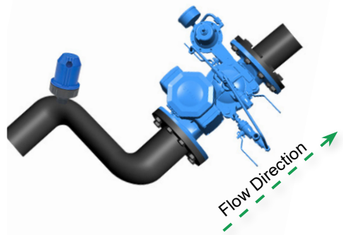
- In case welding is required, do not perform welding while Ultraf is connected to the pipe.
- It is recommended to install isolation valves upstream and downstream Ultraf to enable easy service if necessary.
- Make sure that the end connections are parallel and aligned with one another.
- When using standard tail piece, use rubber gaskets only (not fiberglass). After adding the gaskets, the gap between the end connection and Ultraf should not exceed 1 mm. Unscrew the end connection in order to maintain the recommended distance. Do not use force to close the gap.
- Start tightening the end connections by hand. Final tightening is performed according to pipe size specifications.

CAUTION:

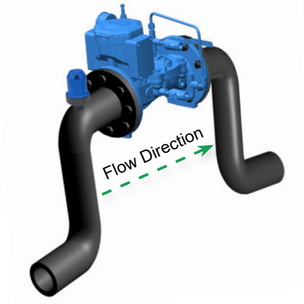
- In case welding is required, do not perform welding while Ultraf is connected to the pipe.
- Make sure ultraf is mounted with correct water flow direction.

Recommended Installation





Optional Installation



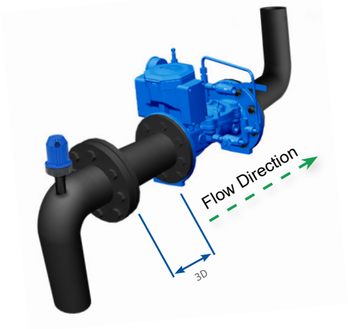
Installing Ultraf in the optional installation location is permitted only if this location is not the highest point in the system, and a properly sized air relief valve is mounted.
Do not install Ultraf in this location if this is the highest point in the system to prevent the pipeline and/or Ultraf from having air flow in the water.

Incorrect Installation

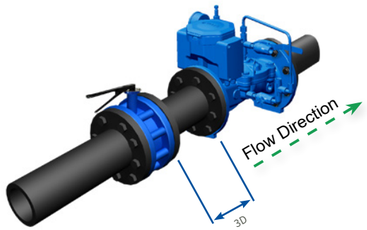
Do not install Ultraf vertically or at an angle that could cause water to flow downwards.

Recommended Installation Examples

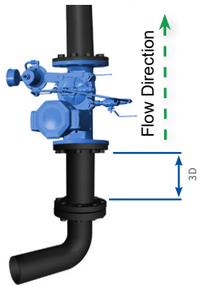
The following examples provide recommendations for Ultraf optimal performance.



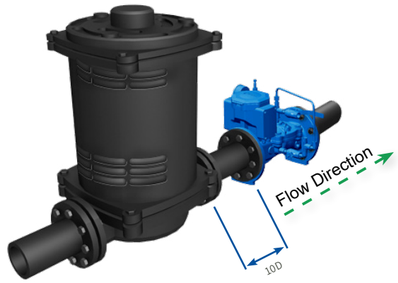
A minimum of three pipe diameters after elbows (90°).



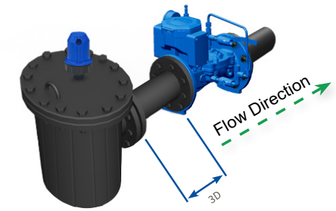
A minimum of three pipe diameters after an isolating valve.



A minimum three pipe diameters after elbows (90°) in vertical installations.



A minimum of ten pipe diameters after pumps.



A minimum of three pipe diameters after strainers.

2.3.2 Wiring Instructions

Ultraf is delivered with one of the following control output options. Each control output requires different wiring. The following sections provide wiring instructions for each control output:

- Pulse Output
- Analog Output (4-20 mA)
- Solenoid Valve Output (Irrigation Controller, Day/Night Controller, Dynamic Controller)
- Modbus Card Output

TIP: Ultraf is delivered already configured according to the configuration ordered. This configuration can be changed at a later stage.

Pulse Output

Ultraf Pulse Output sends a signal each time a pre-determined amount of water passes. The meter units and the amount (volume) are configured through the Raphael Ultraf mobile application (see Pulse Output Control on page 34).

Pulse output is ideal when flow indication is delivered to:

- Irrigation controller
- Flow controller
- Water flow logging
- For external AMI/AMR system

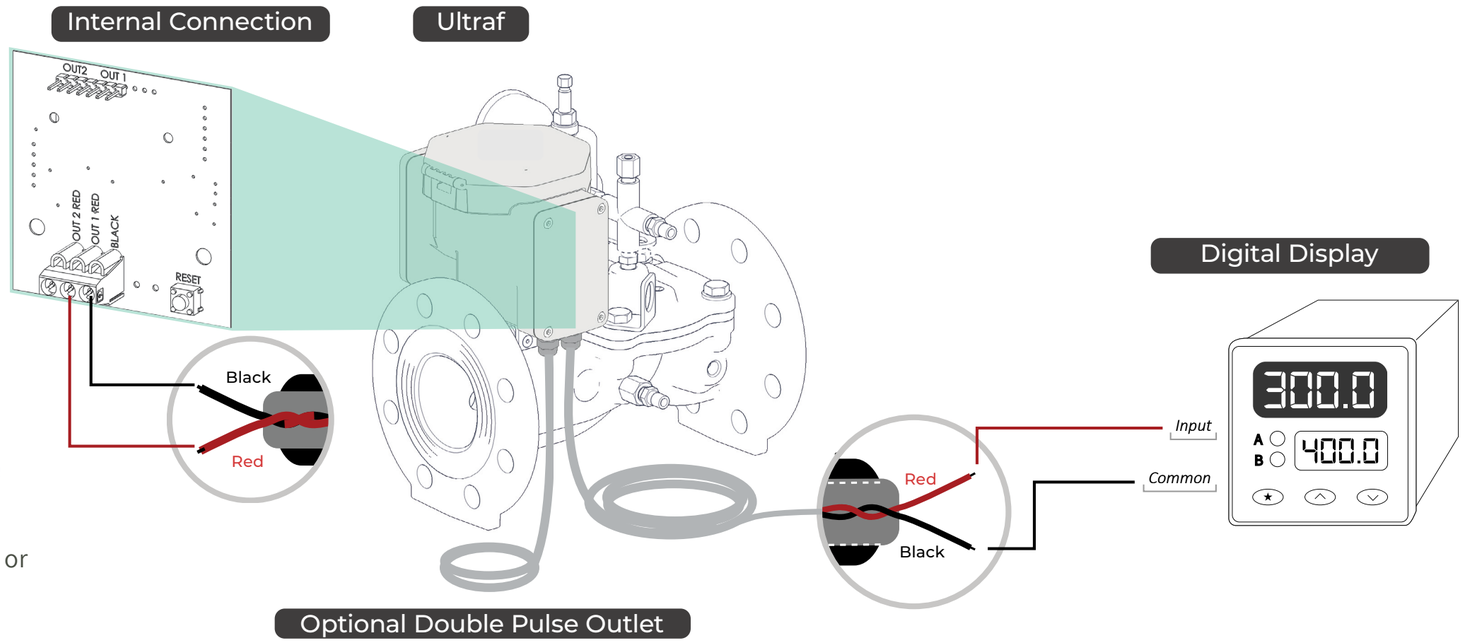
Output Specifications

- **Dual pulse**
- **Pulse type –** “Open Collector” N CH. Mosfet
- **Maximum Current –** 100 mA
- **Maximum voltage –** 18VDC
- **Pulse width –** 1.5 seconds (+/- 0.1) (as default, for more options (see Output Resolution - Metric Units on page 20))
- **Pulse Resolution –** according customer setup (each 10l, 100l, 1m^3/h or 10m^3/h)

Wiring Instructions

1. Connect the Ultraf **red** wire to **input** terminal on the reading device.
2. Connect the Ultraf **black** wire to the **common** terminal on the reading device.

Typical Wiring Diagram

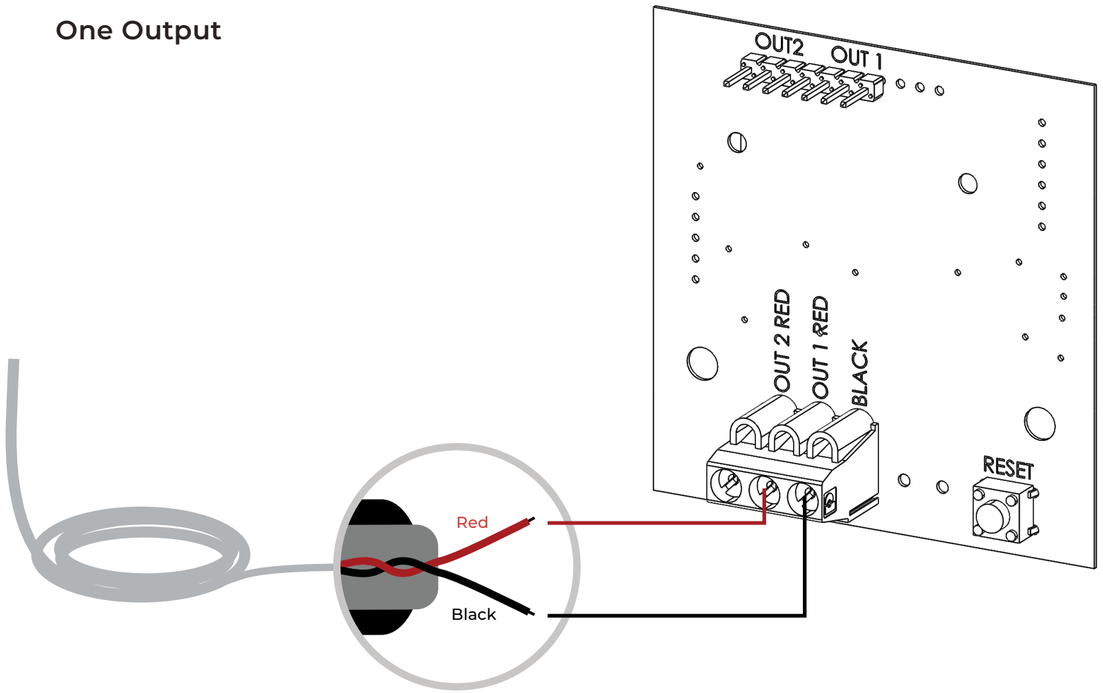


The cables can be connected to the internal card using one of the following two options:

One Port Connection:

- Cable 1 - red wire to OUT-1 and black wire to Common.

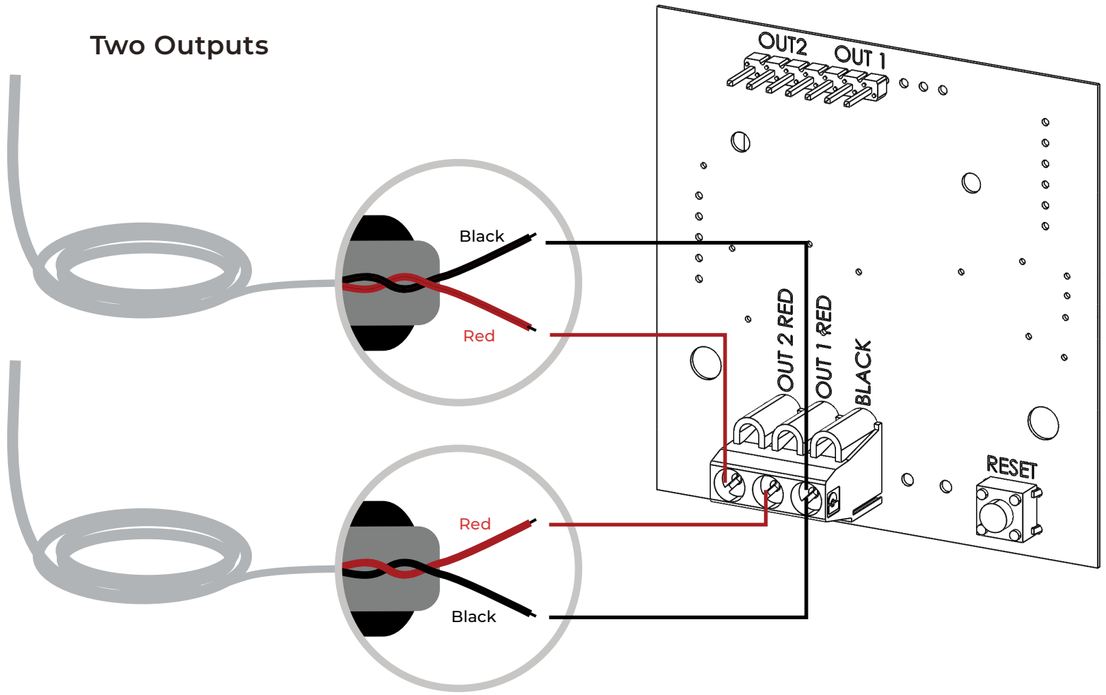
One Output



Two Connection Ports:

- Cable 1 - red wire to OUT-1 and black wire to Common.
- Cable 2 - red wire to OUT-2 and black wire to Common.

Two Outputs



Output Resolution - Metric Units

Diameter					
1.5”	0.001m³	0.01m³	0.1m³	1m³	
2”	0.001m³	0.01m³	0.1m³	1m³	
3”	0.001m³	0.01m³	0.1m³	1m³	
4”	0.001m³	0.01m³	0.1m³	1m³	10m³
6”	0.01m³	0.1m³	1m³	10m³	100m³
8”	0.01m³	0.1m³	1m³	10m³	100m³

Output Resolution - Imperial Units

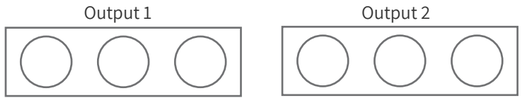
Diameter						
1.5”	1gal	10gal	1ft3	100gal	1Kgal	
2”	1gal	10gal	1ft3	100gal	1Kgal	
3”	1gal	10gal	1ft3	100gal	1Kgal	
4”	1gal	10gal	1ft3	100gal	1Kgal	
6”	1gal	10gal	100gal	1Kgal	1kft3	1AI
8”	1gal	10gal	100gal	1Kgal	1kft3	1AI

NOTE: In order to change the pulse resolution, see Pulse Output Control on page 34.

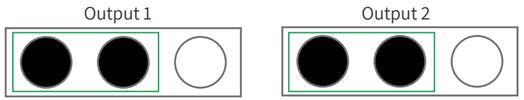
Pulse Width Setup

Each card is supplied with 2 jumpers (P/N M7686-46) and should be set up according to the pulse width, as follows:

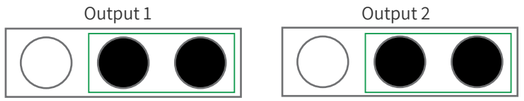
- **1.5 sec. (default) –** no jumpers needed



- **1 sec. –**

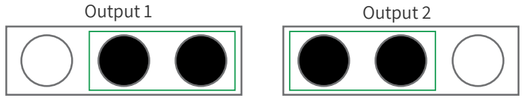


- **0.05 sec. –**



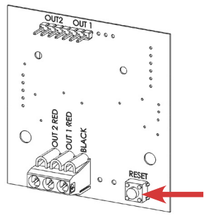
Each pulse output can be used for a different pulse width. For example:

Output 1 – 0.05 sec.
Output 2 – 1 sec.



IMPORTANT: After changing the setup of the pulse width, **push the RESET button on the card.**

If a Modbus card is installed, the pulse width is programmed by the manufacturer and cannot be changed.



Analog Output

Ultraf analog output provides a linear analog signal in a predefined flow spectrum.

Analog output is ideal when flow indication is delivered to a reading device with analog input.

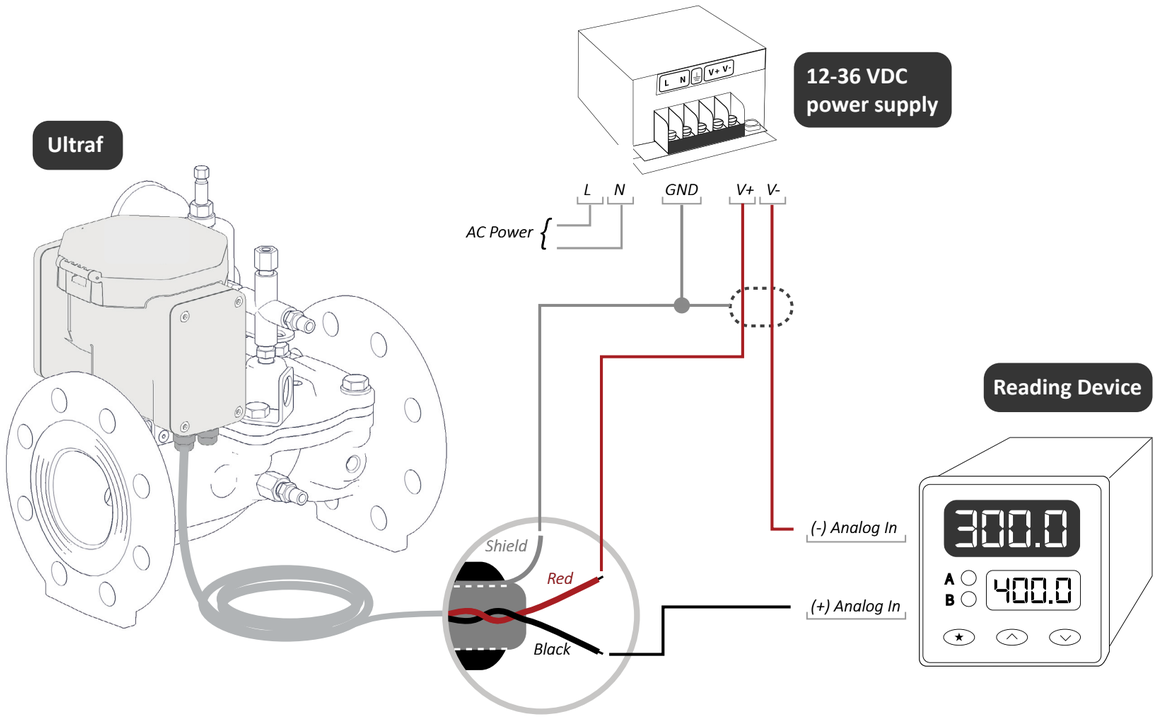
Output Specifications

4-20 mA current, requires external 12-36 VDC power supply.

Wiring Instructions

1. Connect the Ultraf **red** wire to the (+) terminal on the 12-36 VDC power supply.
2. Connect the (-) terminal on the 12-36 VDC power supply to the **(-) Analog Input** terminal on the reading device.
3. Connect the Ultraf **black** wire to the **(+) Analog Input** terminal on the reading device.
4. Connect the Ultraf **shield** wire to the **GND** terminal.

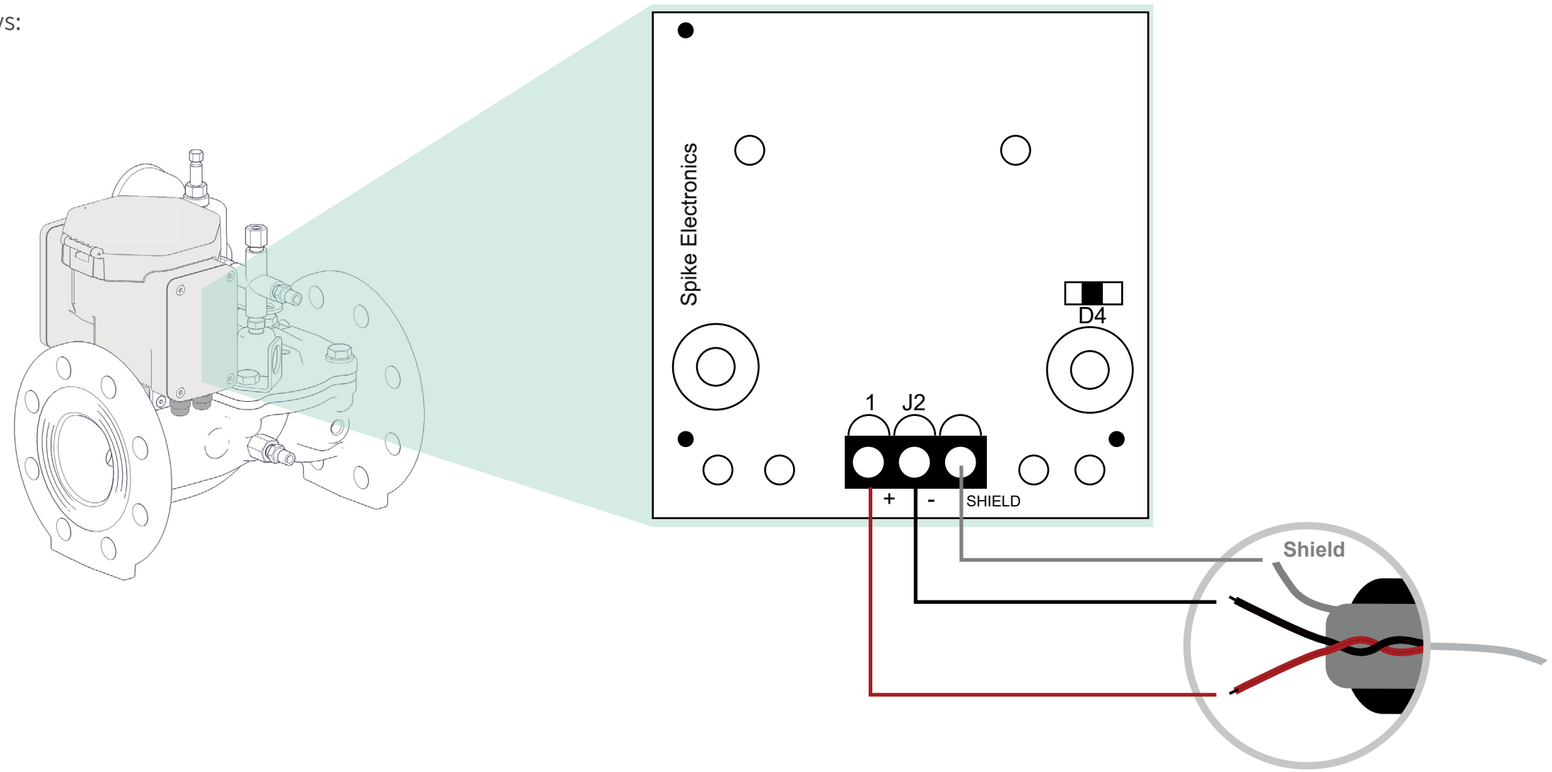
Typical wiring diagram



Analog Card

The connection to the Analog Card is made in the following ways:

- Red wire connects to J1
- Black wire connects to J2
- A ground wire (shield) connects to the SHIELD port

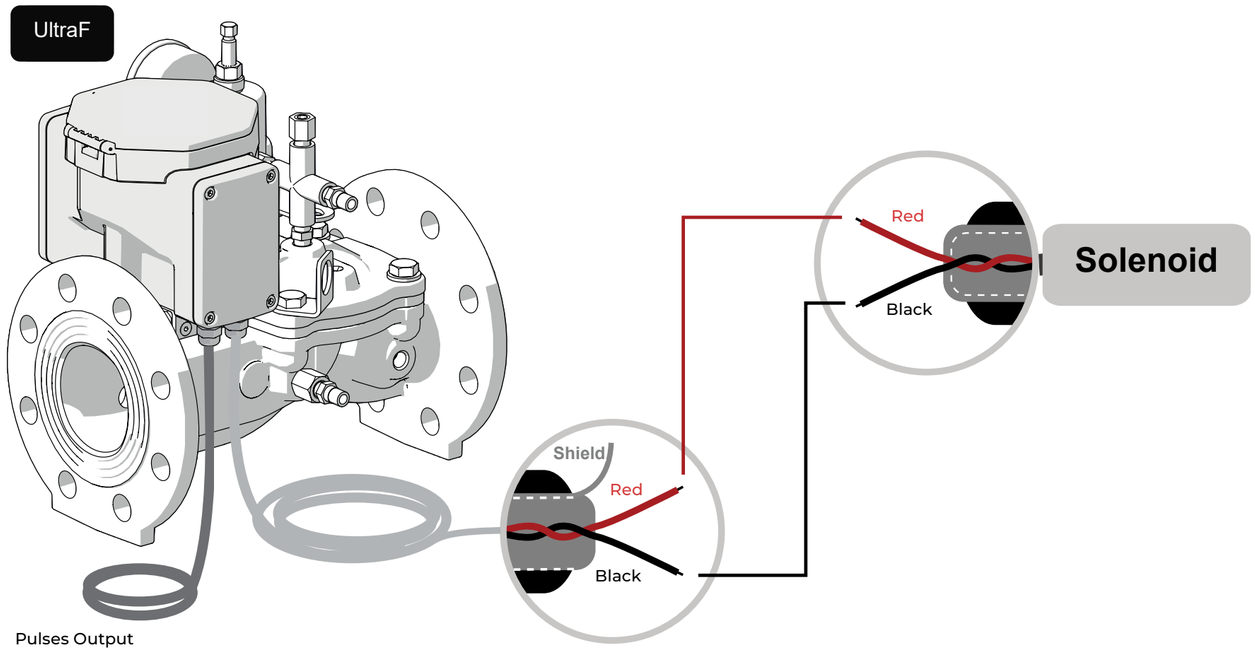


Solenoid Outlet

This port actuates a solenoid body and is used for pressure control applications. In this configuration, Ultraf comes with an additional pulse output (see Pulse Output on page 18).

- **Solenoid type –** 12-18VDC, Latch
- **C –** 4,700 uF
- **Pulse Width –** 100msec

Wiring Diagram

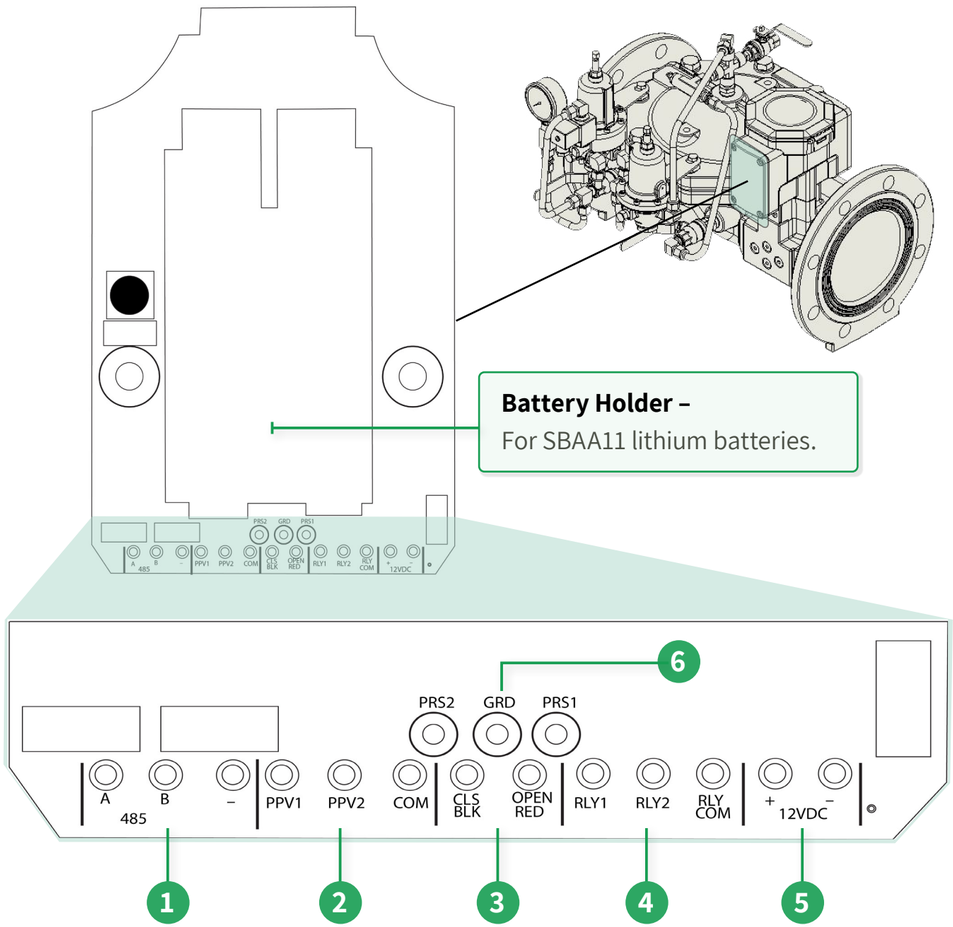


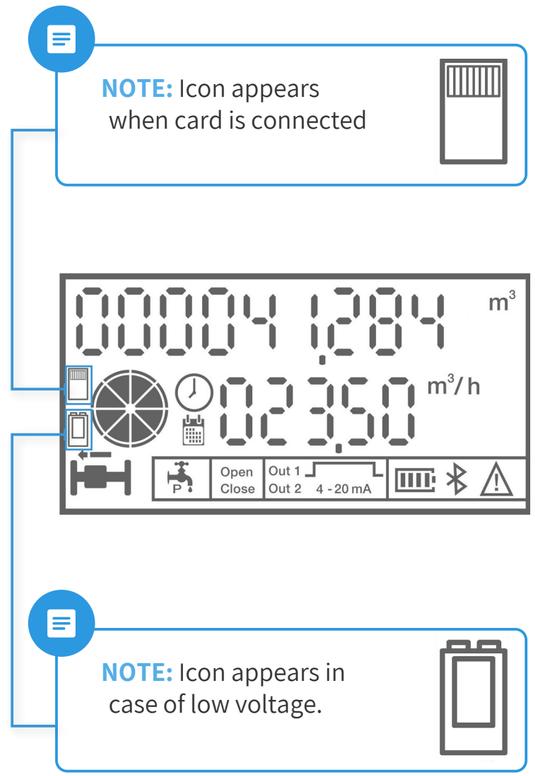
Modbus Connection Card

A Modbus Protocol Card is used for communication. This type of connection allows the user to take all the information from the Ultraf (flow, consumption, etc.) and transfer the information to the unit using the Modbus protocol. In this configuration, Ultraf comes with an additional pulse output (see Pulse Output on page 18). A Modbus type card can come in several configurations.

The General Configuration of the card and the connections to it are described in the following table:

Area	Cable	Description
1	RS485	Three-wire cable connection for Modbus communication.
2	PPV1 PPV2 COM	Connecting a digital port/two digital ports. COM connection is for grounding
3	CLS BLK OPEN RED	Connecting an electric actuator in the marked polarity
4	RLY1 RLY 2 RLY COM	RLY - connecting electric actuator to loop 1 2RLY - Loop 2 electric actuator connection COM RLY - negative pole connection to electric actuator (Connection of two electric actuators in case the ultraf is used as a flow controller)
5	12VDC	Connecting an external 12 volt direct power source (not used while connecting the card to the ultra-fast)
6	PRS2 GRD PRS1	Connecting one or two pressure sensors 1PRS - first sensor 2PRS Second pressure sensor (in the case of Ultref as a pressure control system)





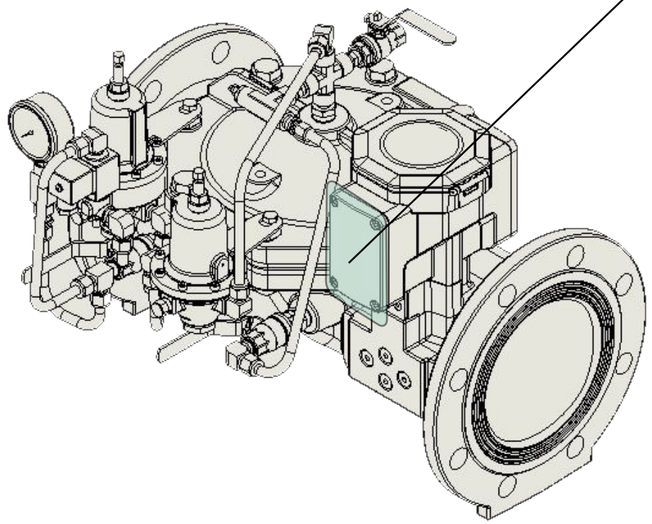
2.4 Modbus Card Connection for Pressure Control

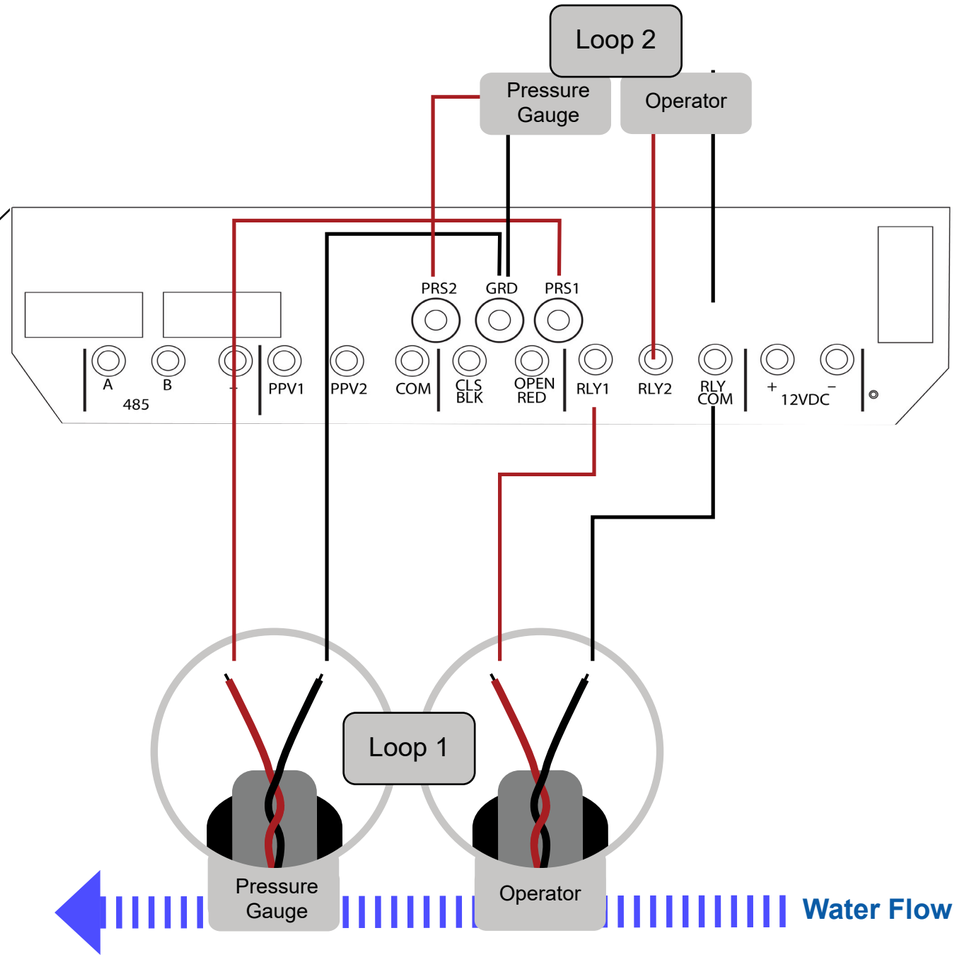
The Modbus card will be used by the electronic card of the ultra-highway that activates two loops through two operators so that each operator has a loop relevant to him. Each loop represents a different pressure level

General: the card has the option to be used as an activation card for two pressure loops only when the Ultraf has the appropriate software installed for this activation.

Wiring Diagram

How to connect the card as described below.





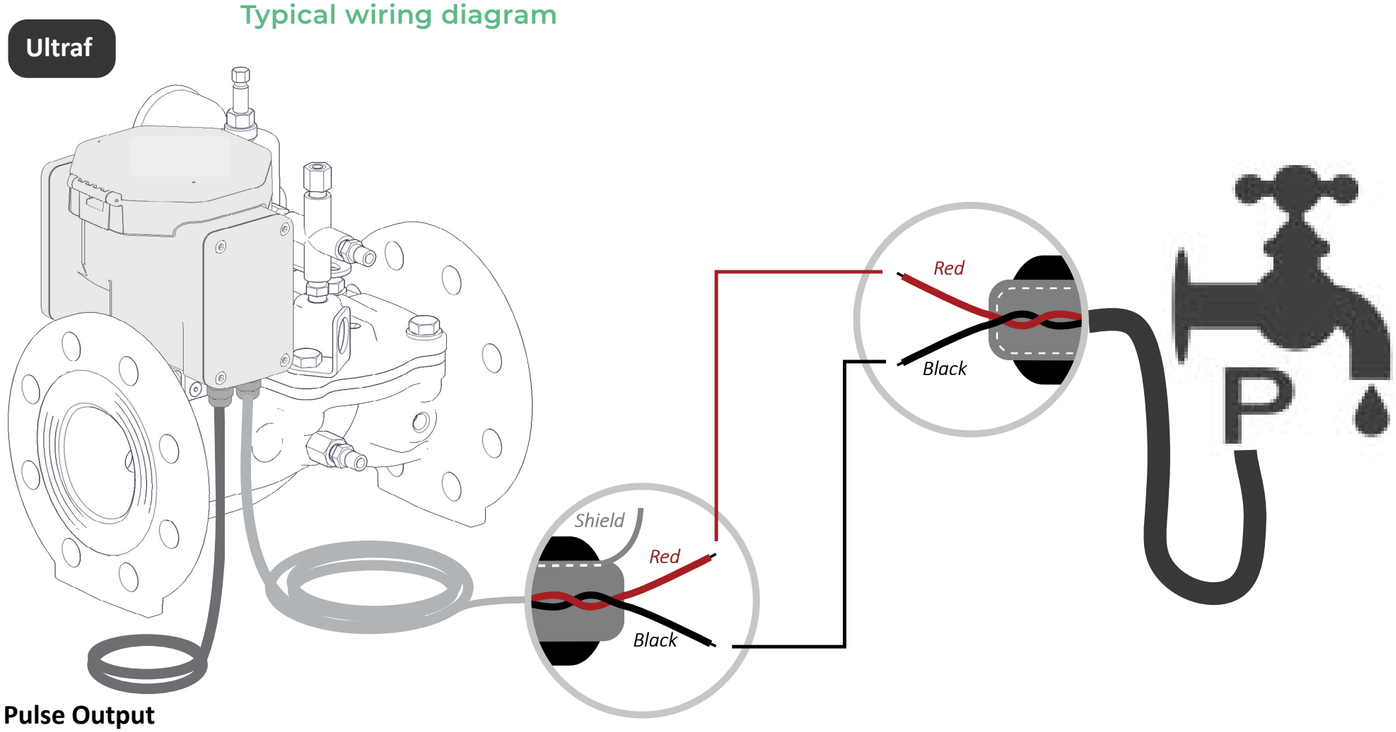
Solenoid Valve Output

This output type operates a solenoid valve and is used for pressure management applications. In this configuration Ultraf is delivered with an additional pulse output (see Pulse Output on page 18).

Output Specifications

- **Solenoid type –** 12-18 VDC, latch
- **C: 4,700 uF**
- **Pulse width –** 100 msec

Typical wiring diagram

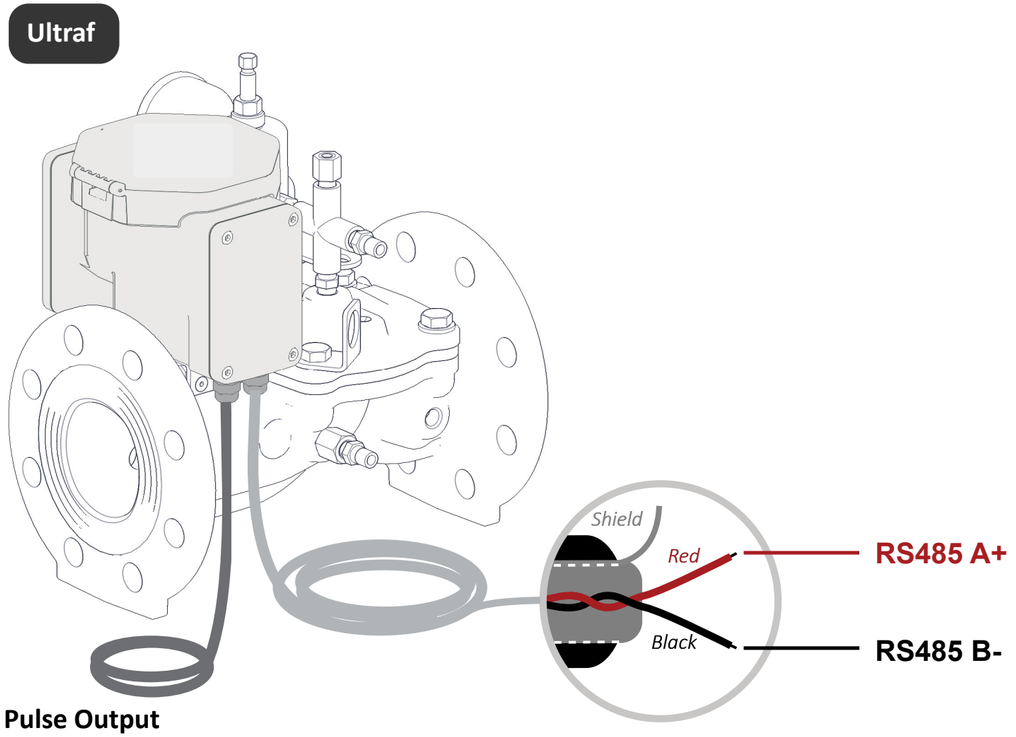


Pulse Output

Modbus Card Output

Modbus card is used for communication according to Modbus protocol. This type of connection allows the user to take all the information from Ultraf (continuous flow, consumption, etc.) and transfer the information to the unit using the Modbus protocol. In this configuration Ultraf is delivered with an additional pulse output (see Pulse Output on page 18).

Typical Wiring Diagram



2.5 Setup and Configuration

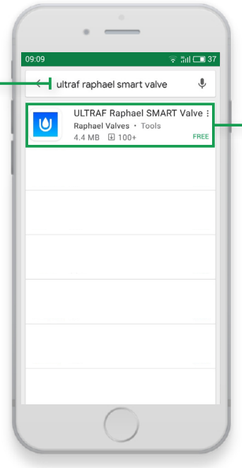
This chapter reviews the tasks associated with monitoring and configuring Ultraf using a mobile device running the Ultraf application and includes:

- Mobile Application Installation
- Ultraf Configuration

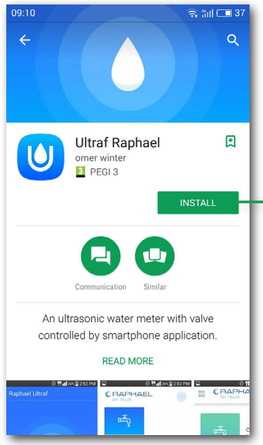
2.5.1 Mobile Application Installation

To install Raphael Ultraf on a mobile device:

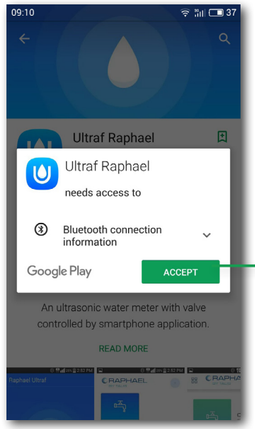
1. Search for **ULTRAF Raphael SMART Valve** in the Google Play store or the App Store on Apple mobile devices.



2. Tap the Raphael Ultraf application.



3. Tap the **Install** button.



4. Tap the **Accept** buttonto allow the application to activate Bluetooth.

Ulraf app requires permission to access the mobile device Bluetooth.

2.5.2 Ultraf Configuration

This section describes the Ultraf configuration process using Ultraf mobile application and includes:

- Connecting to Ultraf
- Pulse Output Control
- Analog Output Control
- Pressure Management Control

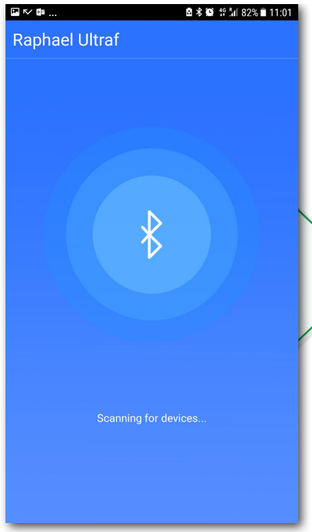
Connecting to Ultraf

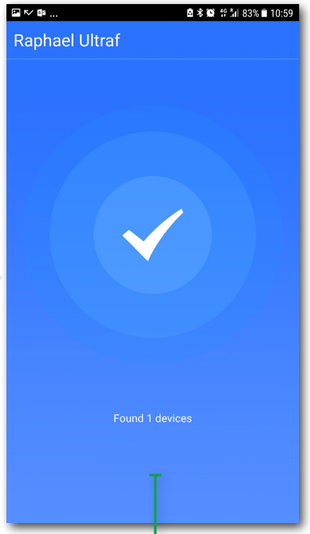
To connect a mobile device to Ultraf: The detected Ultraf devices are displayed.

Make sure location by GPS is enabled on the device.

Locate the Ultraf icon and tap it to open the Ultraf application.

The application automatically searches for Ultraf devices using Bluetooth.

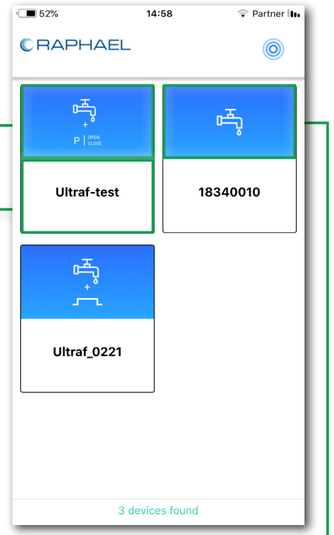




Once the application detects an Ultraf device, a confirmation checkmark appears.

Each device icon displays the following information:

1. **Extension card used** – when applicable
2. **Name of the device** – the default name is the Ultraf serial number (see Product Serial Number and Data on page 12). The default name can be changed to a descriptive name in the Settings screen.



To connect, tap the relevant Ultraf device icon

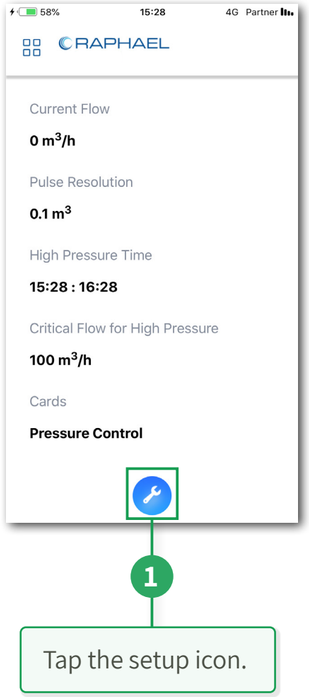
NOTE: The mobile device must be within Bluetooth proximity to the valve and with a clear line of sight.

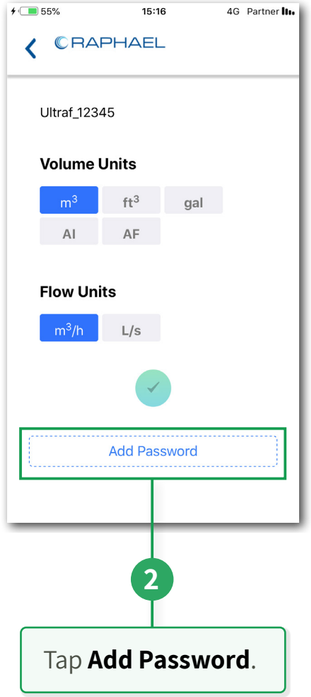
NOTE: For Android devices, activate the location feature through the Settings of the device.

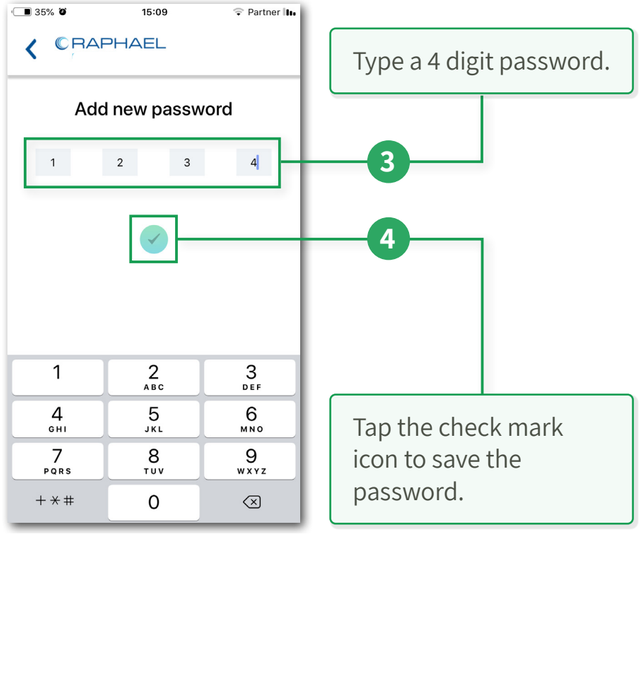
Configuring a Password and Settings

To create a new password:

IMPORTANT: Adding a password is optional but not a must.

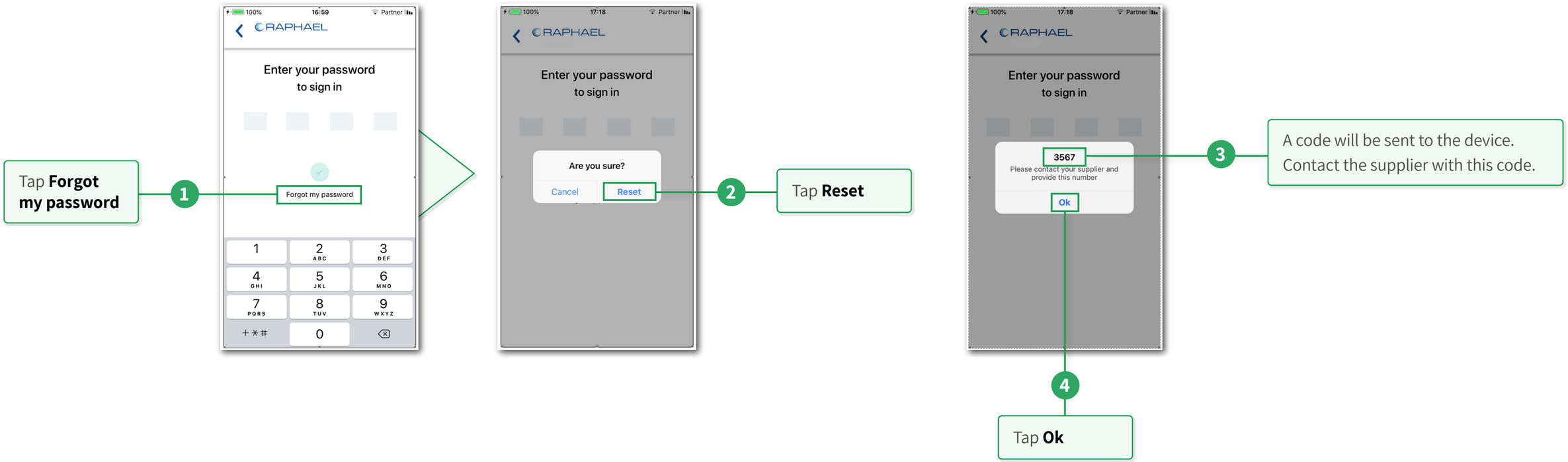






Resetting a Forgotten Password

To reset a password:



The following sections describe the tasks associated with various control configurations of Ultraf.

Read the section related to the type of output installed on your Ultraf:

- Pulse Output Control on page 34
- Analog Output Control on page 36
- Pressure Management Control on page 38

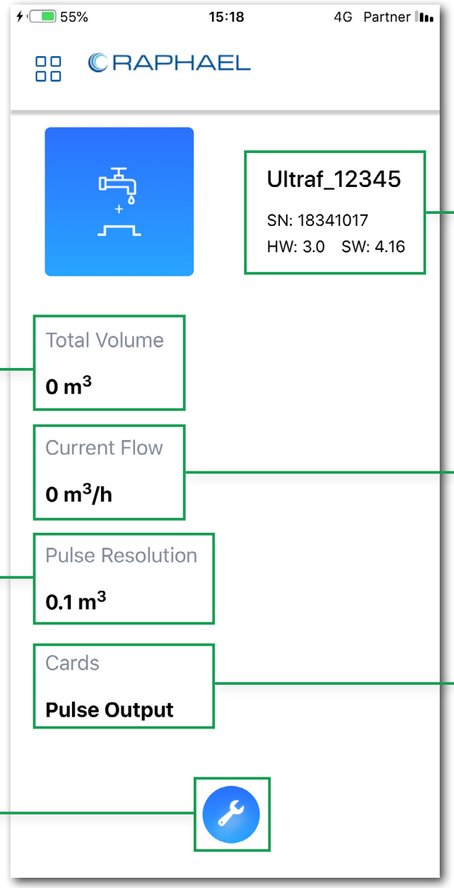
Pulse Output Control

This section describes the tasks associated with configuration of Ultraf when a Pulse Output extension card is used.

NOTE: See section Pulse Width Setup for pulse width setup instructions.

Monitoring Screen

The following information regarding Ultraf connections is displayed:



Total Volume – displays the total amount of water that passed through Ultraf since the installation date, measured in volume units as selected in the Settings Screen.

Pulse Resolution – displays the pulse volume selected in the Settings Screen.

To access the **Settings** screen, tap the setup icon. The Setting screen appears.

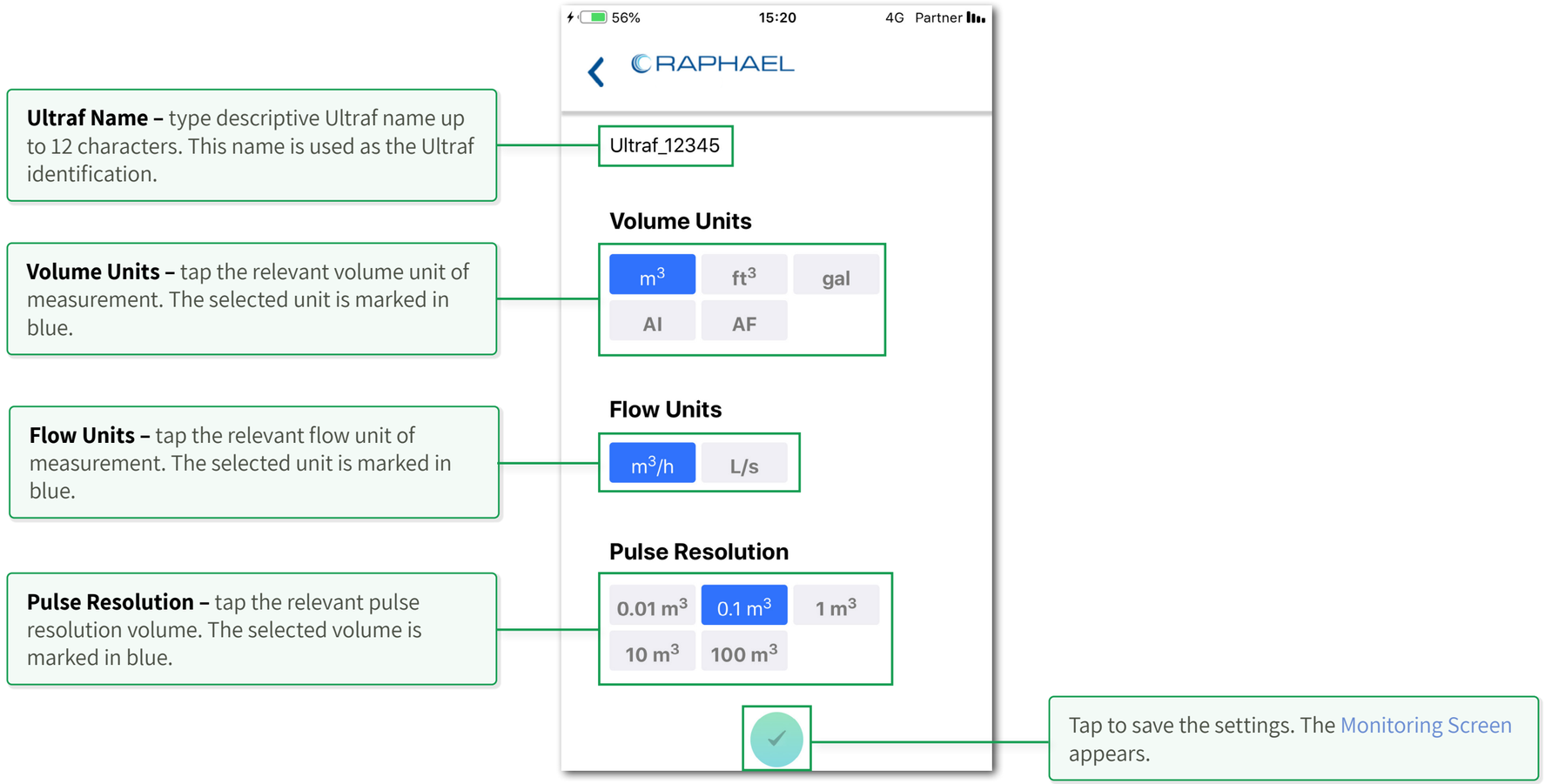
Ultraf Name – the default Ultraf name is the serial number of the device. This number appears on the internal side of the control panel cover (see Product Serial Number and Data on page 12).

Current Flow – displays the current water flow measured in flow units as selected in the Settings Screen.

Cards – displays the extension card currently used.

Settings Screen

Configure the following via the Settings screen:

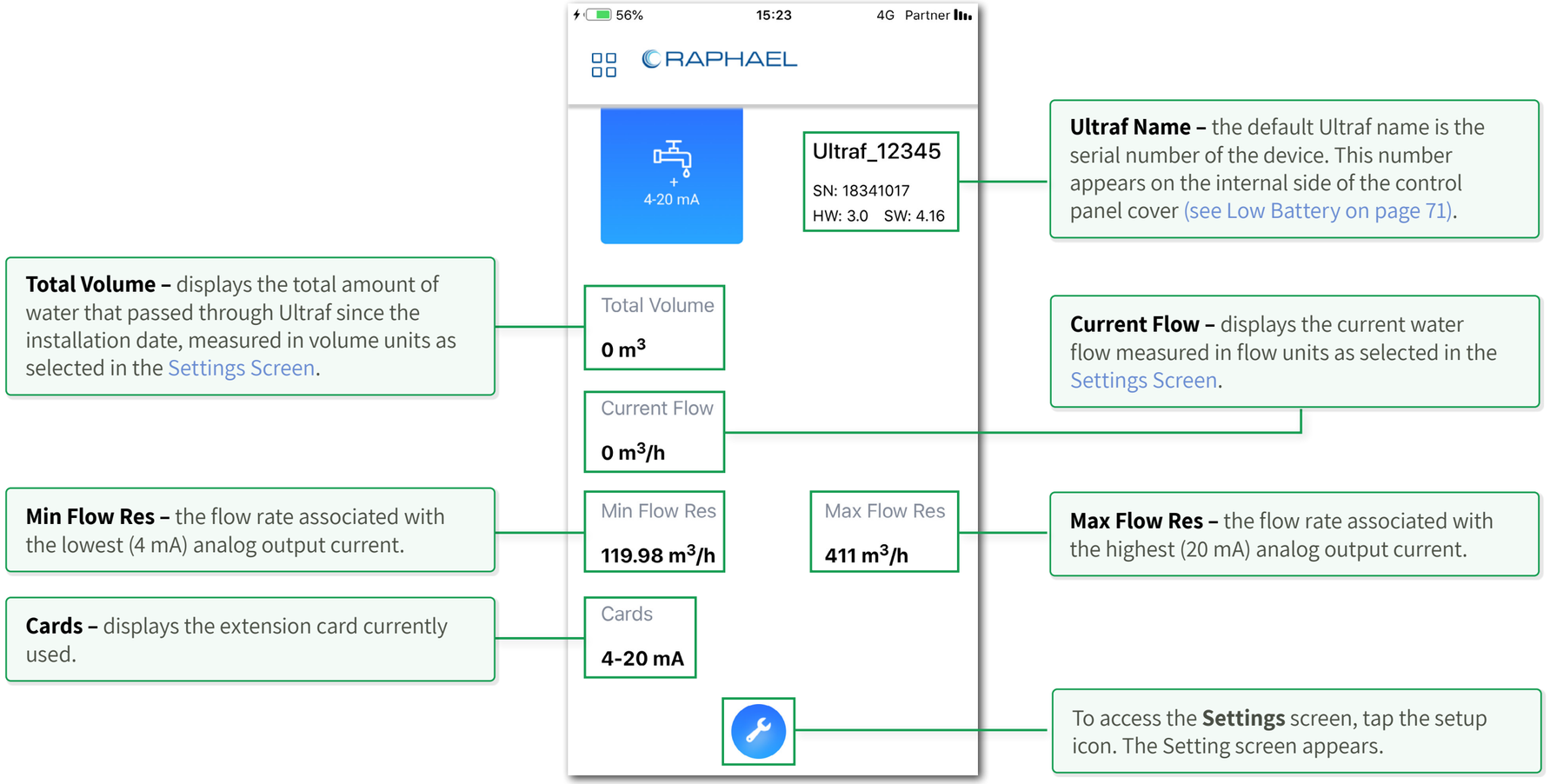


Analog Output Control

This section describes the tasks associated with configuration of Ultraf, when an Analog Output extension card is used.

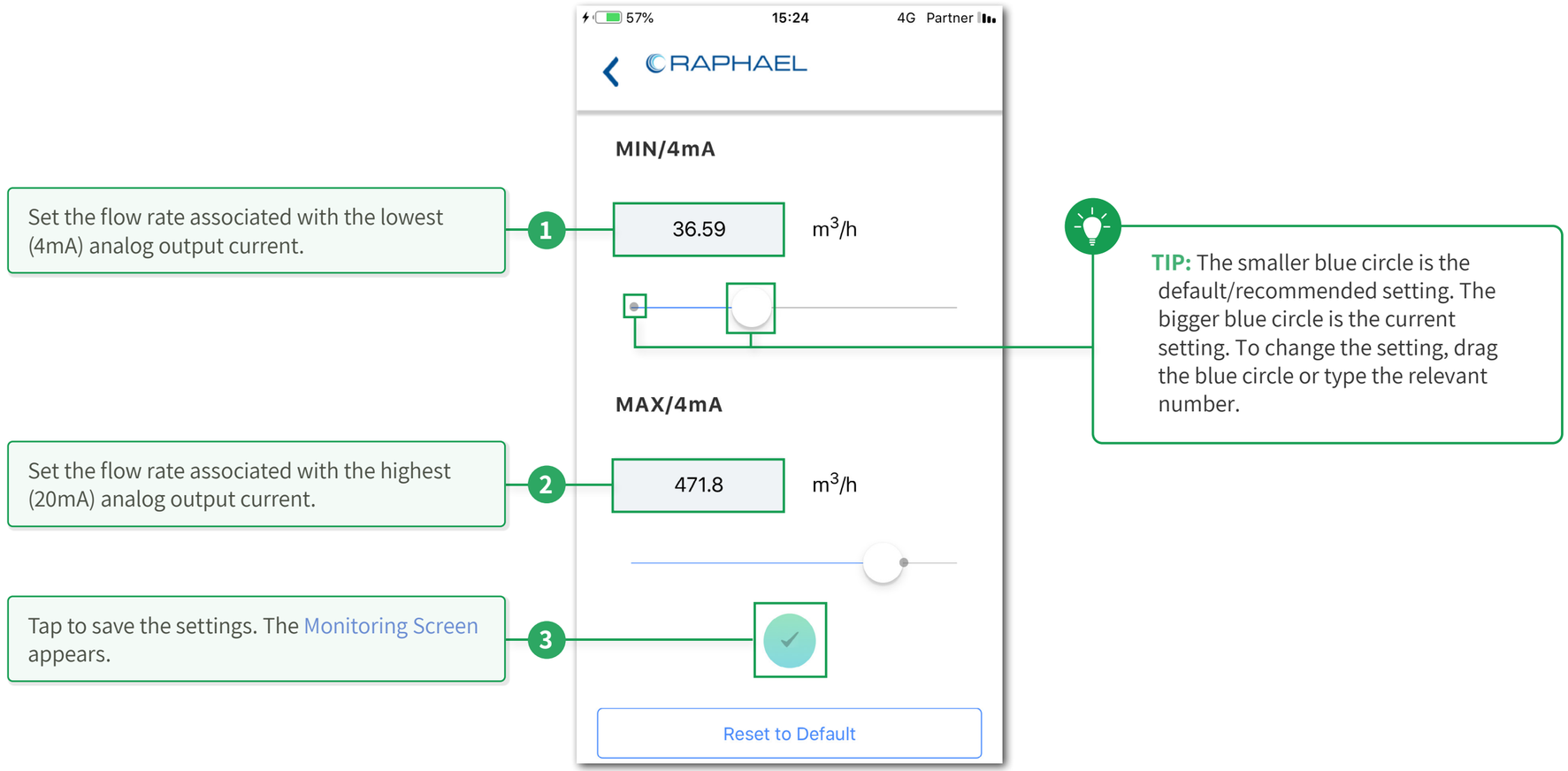
Monitoring Screen

The following information regarding Ultraf connections is displayed:



Settings Screen

Configure the following via the Settings screen:

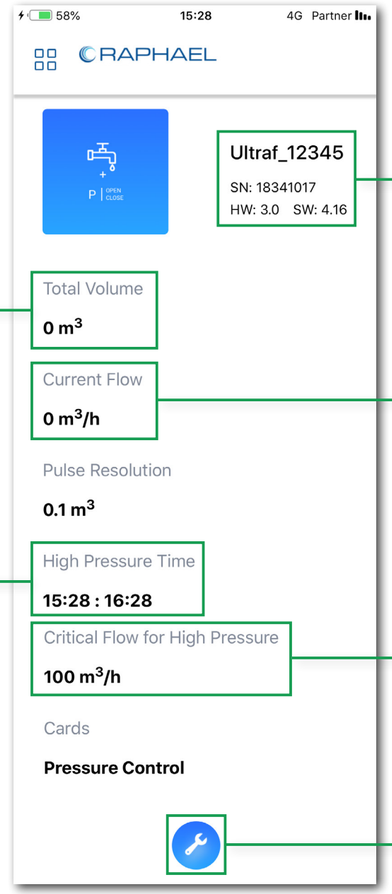


Pressure Management Control

This section describes the tasks associated with configuration of Ultraf when a Pressure Management extension card is used.

Monitoring Screen

The following information regarding Ultraf connections is displayed:



Total Volume – displays the total amount of water that passed through Ultraf since the installation date, measured in volume units as selected in the Settings Screen.

High Pressure Time – displays the daily schedule when Ultraf switches to high outlet pressure. During the rest of the day, Ultraf uses low outlet pressure.

NOTE: When using Flow Value Mode, the value selected for pressure changeover is displayed on Monitoring Screen.

Ultraf Name – the default Ultraf name is the serial number of the device. This number appears on the internal side of the control panel cover (see Product Serial Number and Data on page 12).

Current Flow – displays the current water flow measured in flow units as selected in the Settings Screen.

Critical Flow for High Pressure – displays the flow pressure set point, which, when exceeded, results in Ultraf maintaining high pressure regardless of the time of day.

To access the Settings screen, tap the setup icon. The Setting screen appears.

Settings Screen

There are two modes for pressure management:

- Day Night Mode – setting a daily schedule and a flow pressure set point for Ultraf to switch to high outlet pressure.
- Flow Value Mode – setting flow value for pressure changeover Day Night Mode.

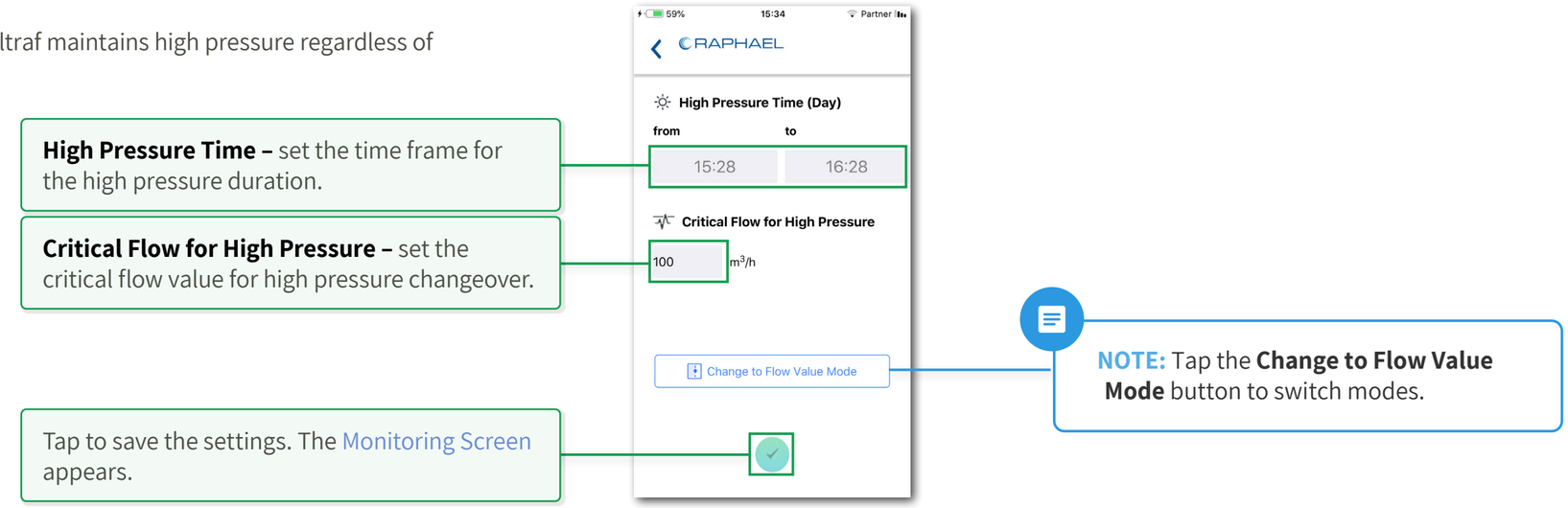
Day Night Mode

In this mode, Ultraf maintains high pressure within a time frame. During the rest of the day, Ultraf maintains low pressure.

When the water flow exceeds the critical flow set point, Ultraf maintains high pressure regardless of the time of day.

The configuration of Day Night Mode includes:

.

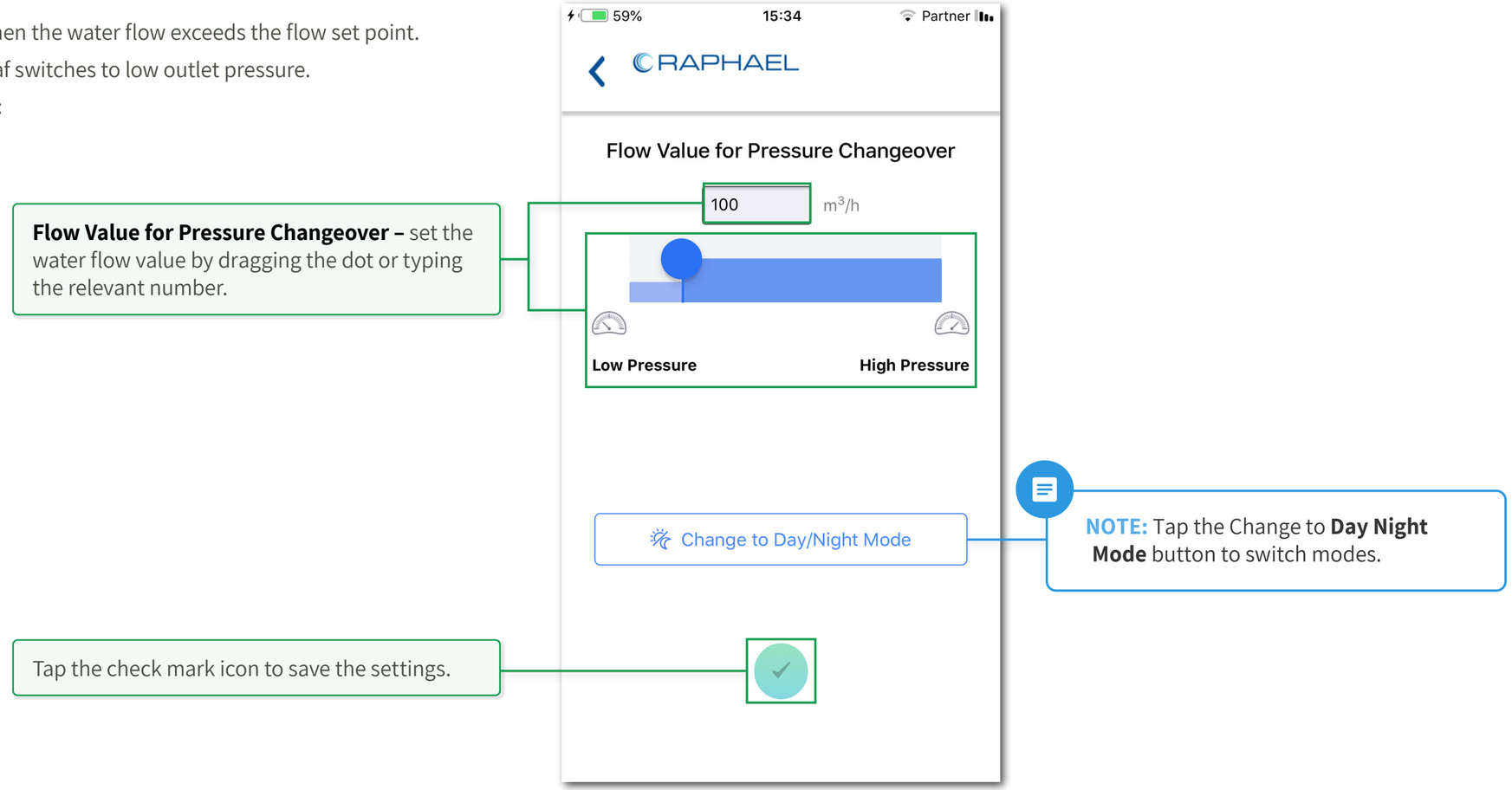


Flow Value Mode

In this mode, Ultraf maintains high pressure when the water flow exceeds the flow set point.

When water flow falls below the set point, Ultraf switches to low outlet pressure.

The configuration of Flow Value Mode includes:



2.6 Operation

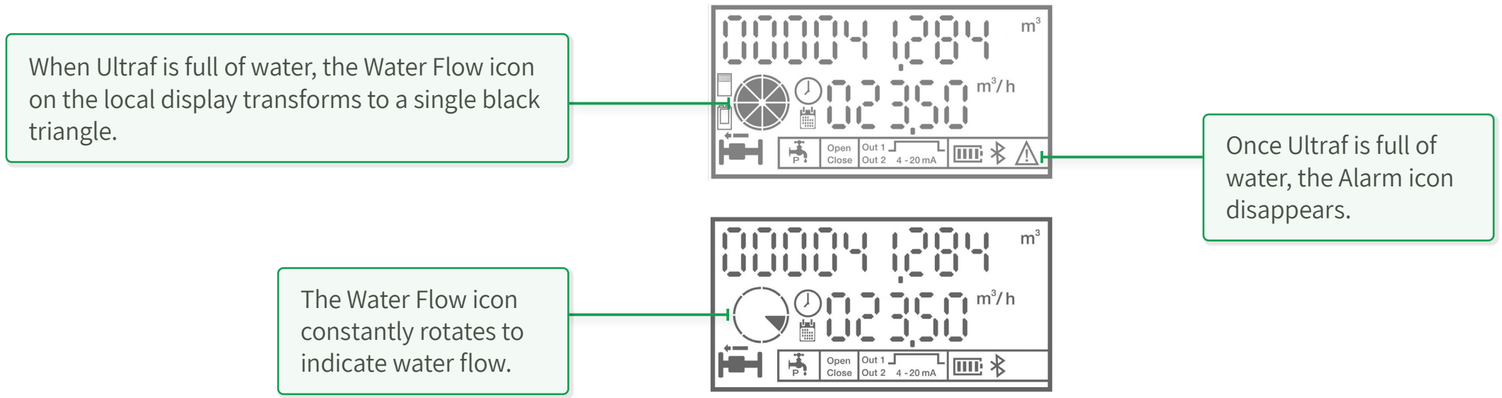
This chapter reviews the tasks associated with the operation of Ultraf and includes:

- First Operation
- Remote Monitoring
- Local Monitoring

2.6.1 First Operation

When operating Ultraf for the first time, make sure of the following:

- Before installing Ultraf, flush the pipeline to remove scale, dirt and other particles that might affect valve performance.
- Check for leaks, tighten bolts and fittings if necessary.



Ultraf status can be monitored by the following:

- Remote Monitoring
- Local Monitoring

2.6.2 Remote Monitoring

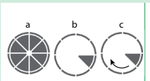
Remote monitoring of Ultraf operation is done via the Raphael Ultraf application on an Android/IOS mobile device.

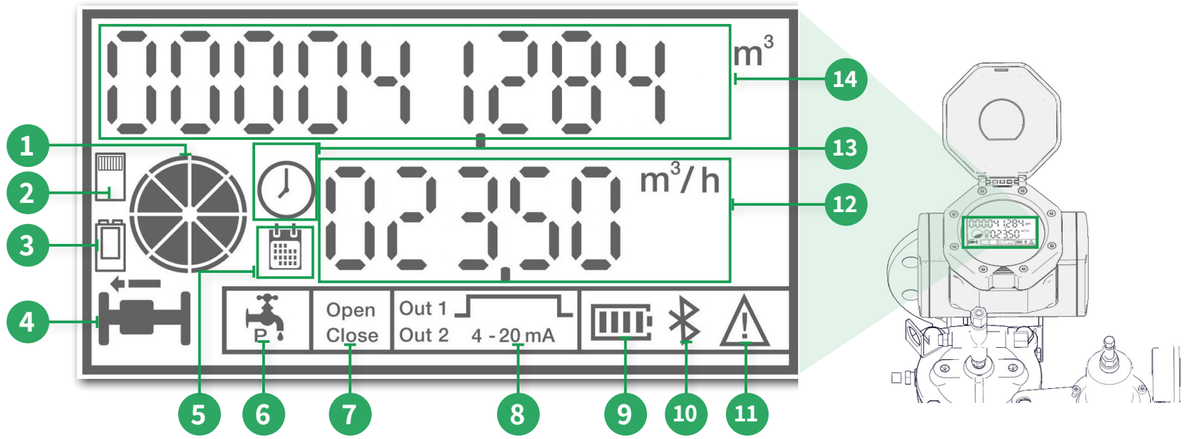
For more information refer to the following sections:

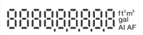
- Mobile Application Installation
- Ultraf Configuration

2.6.3 Local Monitoring

The table below describes the information provided by Ultraf local display.

	Icon	Description	Notes
1		**Water Flow** – when Ultraf fills up with water, this icon transforms from **(a)** to **(b)**. This icon constantly rotates **(c)** to indicate that water is flowing through Ultraf.	When this icon alternates between **(a)** and **(b)**, see Air in the water on page 66.
2		Mod-bus card indicator	
3		Low battery	
4		**Flow Direction** – displays the direction of water flow.	Ultraf does not measure back flow.
5		**Calendar –** indicates that irrigation controller is configured. When blinking indicates that an irrigation program is delayed.	
6		**Latch Solenoid** – displayed when a pressure management card is configured.	
	P	**Pressure Management** – indicates that a pressure management control is set	Older models will display the Latch solenoid icon (see line 4)
7	Open Close	**Solenoid Position** – when a latch solenoid is connected, this icon displays the position of the solenoid (**Open** or **Close**).	
8	Out 1	**Output 1** – indicates that a pulse output card is configured. When a pulse is released, this icon appears for one second.	
	Out 2 4 - 20 mA	**Output 2 –** indicates that an analog output card is configured.	
9		**Main Battery Status** – displays the main lithium battery status.	When this icon displays one line or starts flashing, see Low Battery on page 71. For battery replacement, see Main Lithium Battery Replacement on page 45.



	Icon	Description	Notes
10		**Bluetooth Connection** – displayed when bluetooth is connected.	
11		**Alarm** – displayed when air is detected in the water, the main battery is low, Bluetooth malfunction, or when water is flowing backwards.	See Troubleshooting on page 65.
12		**Flow Rate** – displays the current water flow rate.	Measured in flow units, as selected in the mobile application (see Ultraf Configuration on page 29).
14		**Clock** – indicates that Ultraf internal clock is synced with the local time zone (upon initial application communication).	
		**Totalizer** – displays the total amount of water that passed through Ultraf since the installation date.	Measured in volume units, as selected in the mobile application (see Ultraf Configuration on page 29).

2.7 Maintenance

2.7.1 Preventive Maintenance

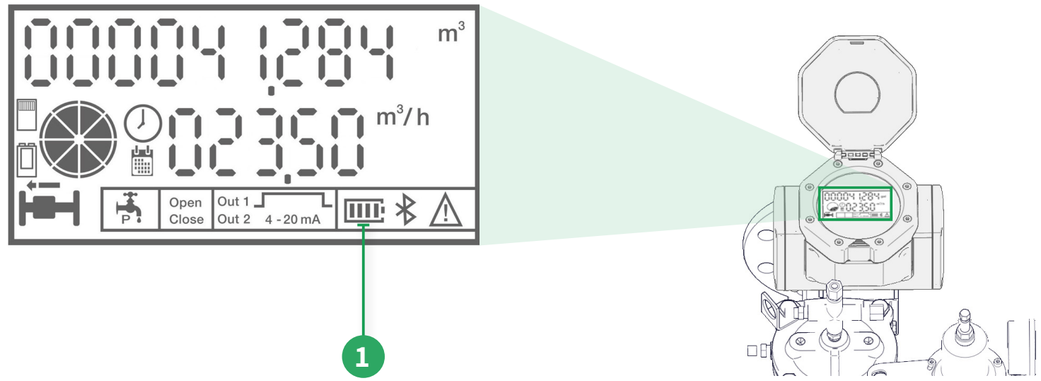
Winterizing

In potentially freezing climates, Ultraf should be properly drained from standing water to avoid damage from expansion. Alternatively, freeze protection means can be used if operating in a sub freezing environment.

2.7.2 Main Lithium Battery Replacement

When the Main Battery Status icon (1) on the local display drops to a single line, there are about 6 months of operation left before the battery discharges completely.

An authorized Raphael dealer must be contacted to perform a field service replacement operation. All registered data will be saved to the unit as usual (for more details (see 4.8 Battery Replacement on page 73).



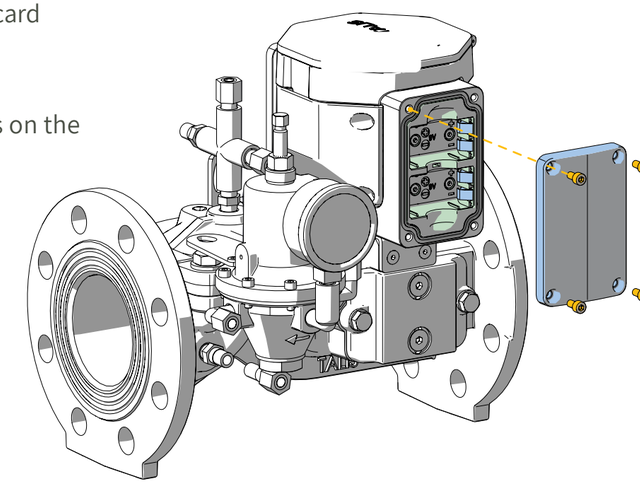
NOTE: Replacement of the lithium battery may only be done by an authorized team on behalf of Raphael only. Opening the seal of the battery violates the product warrenty and might cause measuring interruptions.

2.7.3 Secondary Battery Replacement

NOTE: This section is only relevant for Ultraf models that use an alkaline battery as a secondary battery.

Ultraf requires the following batteries per control configuration:

- **Pulse Output –** replaceable lithium battery card
- **Analog Output –** none
- **Solenoid Output –** two replaceable batteries on the external Modbus card (CAT. EXT MB CARD)



NOTE: Verify correct polarity of the battery. Pay attention to the markings on the battery body and inside the Ultraf compartment.

To replace the battery:

9V Alkaline battery:

1. Unscrew the screws of the battery compartment using a 4mm Allen wrench.
2. Remove the cover of the battery compartment.
3. Unscrew two screws that close the card to the body using a 4mm Allen wrench and place a new card in place.
4. Connect the cable to the card.
5. Refasten the screws.

Battery card:

1. Unscrew the four cover screws using a 5mm Allen wrench.
2. Unscrew the two card screws using a 3mm Allen wrench.
3. Disconnect the cable from the unit.
4. Replace the battery Card with a new card.
5. Close the card by fastening the two card screws using a 3mm Allen wrench.
6. Make sure the rubber gasket sits inside the recess perfectly.
7. Close the battery cover by fastening the four cover screws using a 5mm Allen wrench.

3. IRRIGATION APP

This chapter reviews the tasks associated with programming and using the Ultraf irrigation application, and includes the following sections:

- Introduction
- Getting Started
- Irrigation Programming
- Irrigation Monitoring and Operation

3.1 Introduction

This chapter reviews the tasks associated with programming and using the Ultraf irrigation application.

TIP: For complete information about installing and operating Ultraf, see Ultraf Installation and Operation Manual.

3.1.1 Typical Workflow

The following diagram shows the basic steps of using the Ultraf irrigation app.

3.1.2 Terminology

- **Weekly irrigation program –** Ultraf irrigates during specified days and start times.
- **Cyclic irrigation program –** Ultraf irrigates every repeating number of days/hours.
- **Irrigation cycle –** irrigation period defined by a quantity of water, using a weekly or cyclic irrigation program.
- **Pulse resolution –** specifies the volumetric quantity selected to emit a pulse output.
- **Burst flow –** optional setup that will stop the irrigation cycle in progress when there is an unexpected change in the flow of water through Ultraf.

3.2 Getting Started

Prerequisite

Before operating Ultraf irrigation controller, make sure the following were completed:

1. Ultraf was mechanically installed and wired.
2. Ultraf application was installed on a mobile device.
3. Ultraf application connected successfully with Ultraf.

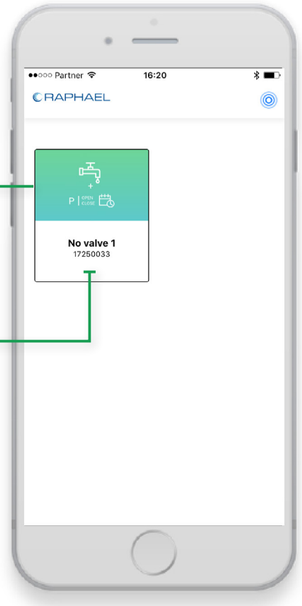
Starting the App Main Screen

When started, the application displays all connected Ultraf devices.

The device icon displays the following information:

Extension Card Used – Tap to open main screen (see Initial Main Screen).

Name of Device – the default name is the serial number of the Ultraf unit. The default name can be changed to a descriptive name in later stage (see Measurement Units Setup).



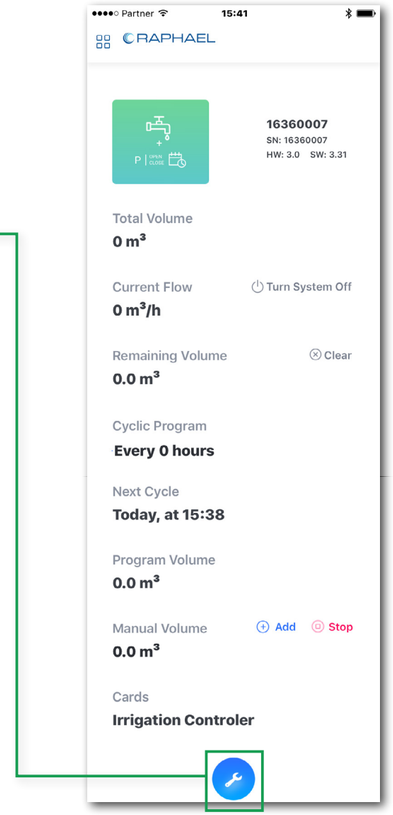
Initial Main Screen

The following default screen is displayed before any irrigation program is defined.

Scroll to the bottom of the screen and tap the **Settings** button to start irrigation programming (see Irrigation Programming).

TIP: After defining irrigation program, one of the following screens is displayed when starting the app main screen:

- Weekly Program screen (see Weekly Irrigation Program Monitoring on page 58).
- Cyclic Program screen (see Cyclic Irrigation Program Monitoring on page 61).



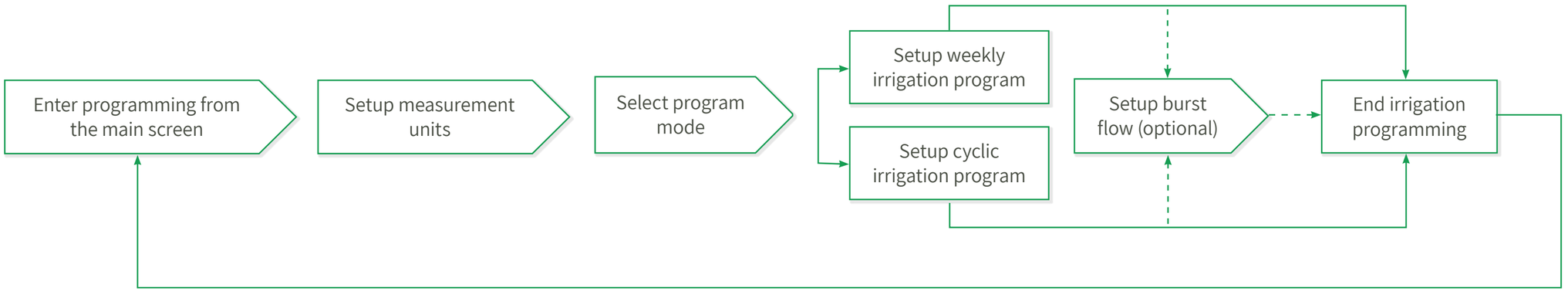
3.3 Irrigation Programming

This chapter describes the tasks associated with programming the two irrigation modes in Ultraf.

Irrigation programming is enabled after Starting the App Main Screen on page 50.

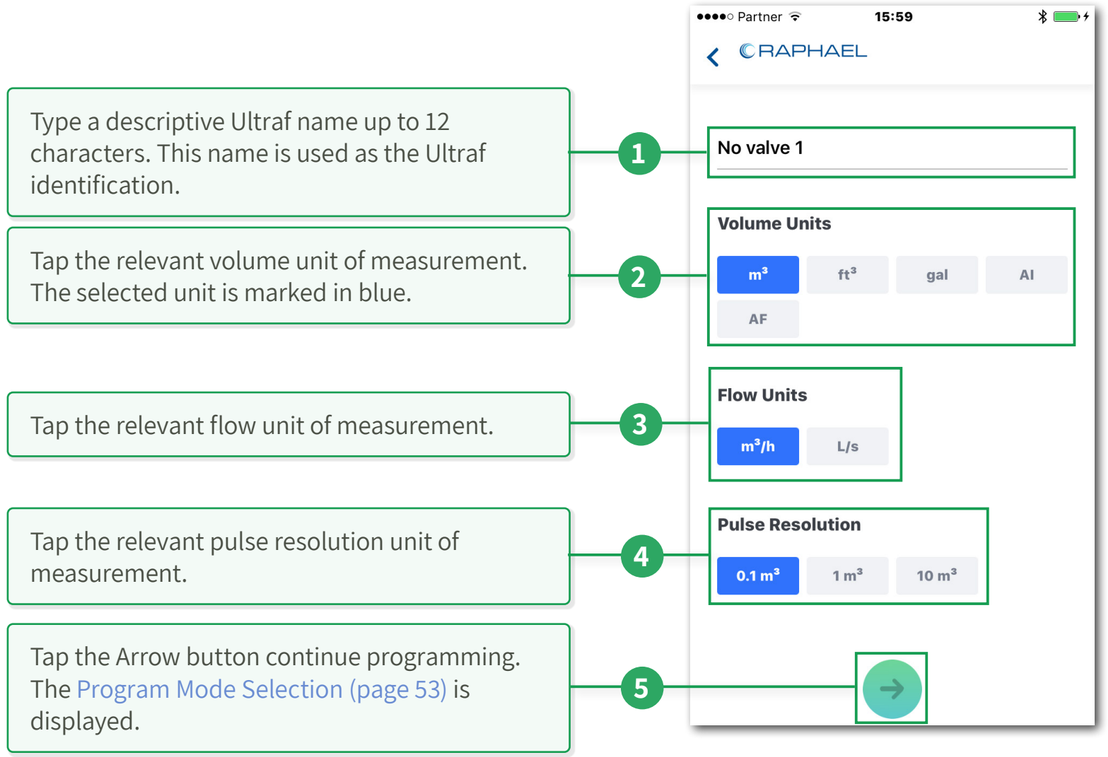
3.3.1 Programming Workflow

Perform the following steps to treat the water and prepare it for use:



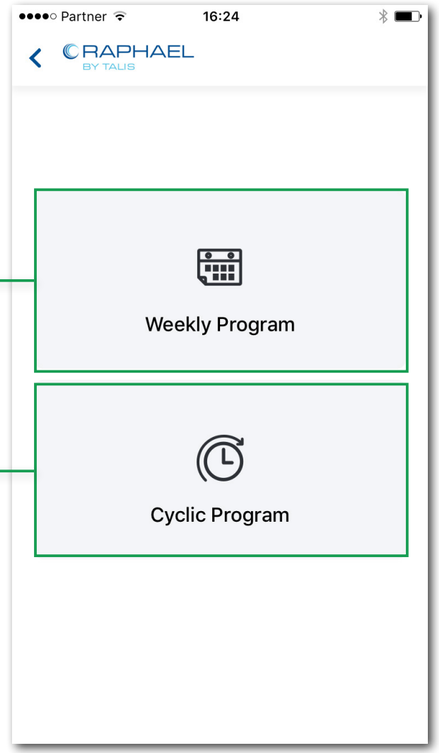
3.3.2 Measurement Units Setup

The first screen in the programming process enables defining the Ultraf units of measurement using the following steps:



3.3.3 Program Mode Selection

Select one of the irrigation program modes:



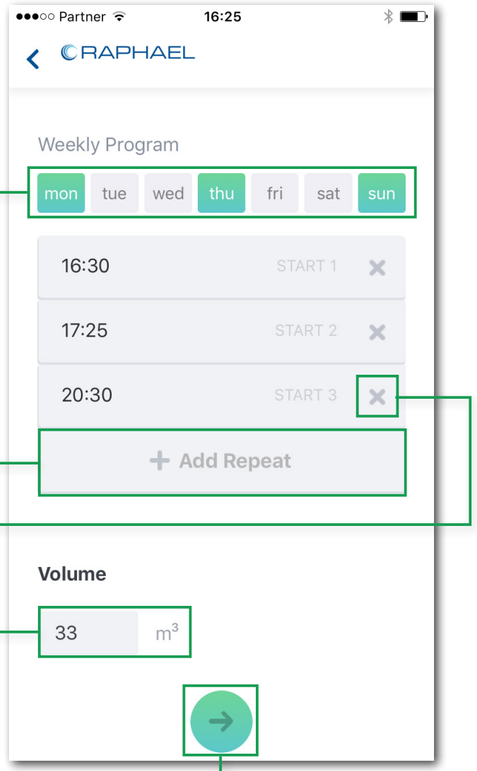
Weekly Program – Ultraf irrigates during specified days and start times (see Weekly Program Setup on page 53).

Cyclic Program – Ultraf irrigates every repeating number of days or hours (see Cyclic Program Setup on page 54).

3.3.4 Weekly Program Setup

This section describes the tasks associated with configuration of Ultraf when the weekly irrigation program is selected (for more information see Weekly Irrigation Program Monitoring on page 58).

Configure the weekly program as follows:



1. Tap the days the irrigation system will turn on. The selected days are marked.
2. Tap to set the times when the irrigation cycle will start during each of the selected irrigation days.

TIP: Tap X to remove irrigation cycle time.

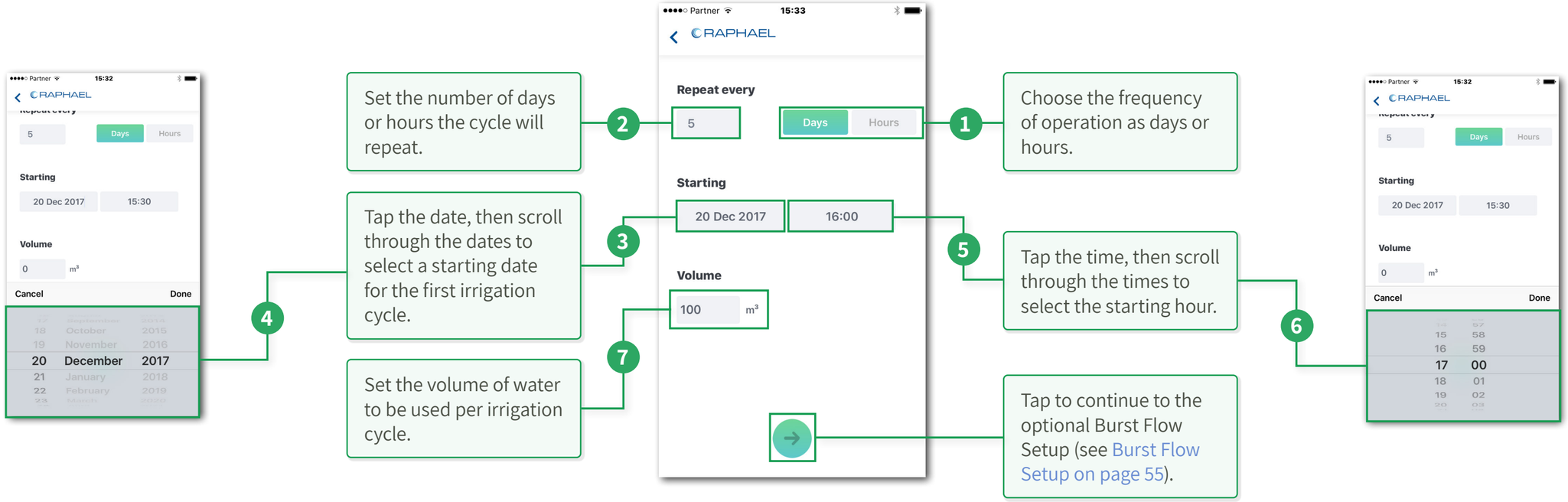
3. Set the volume of water to be used per irrigation cycle.

Tap to continue to the Burst Flow Setup (see page 55).

3.3.5 Cyclic Program Setup

This section describes the tasks associated with configuration of Ultraf when the cyclic irrigation program is selected (for more information see Cyclic Irrigation Program Monitoring on page 61).

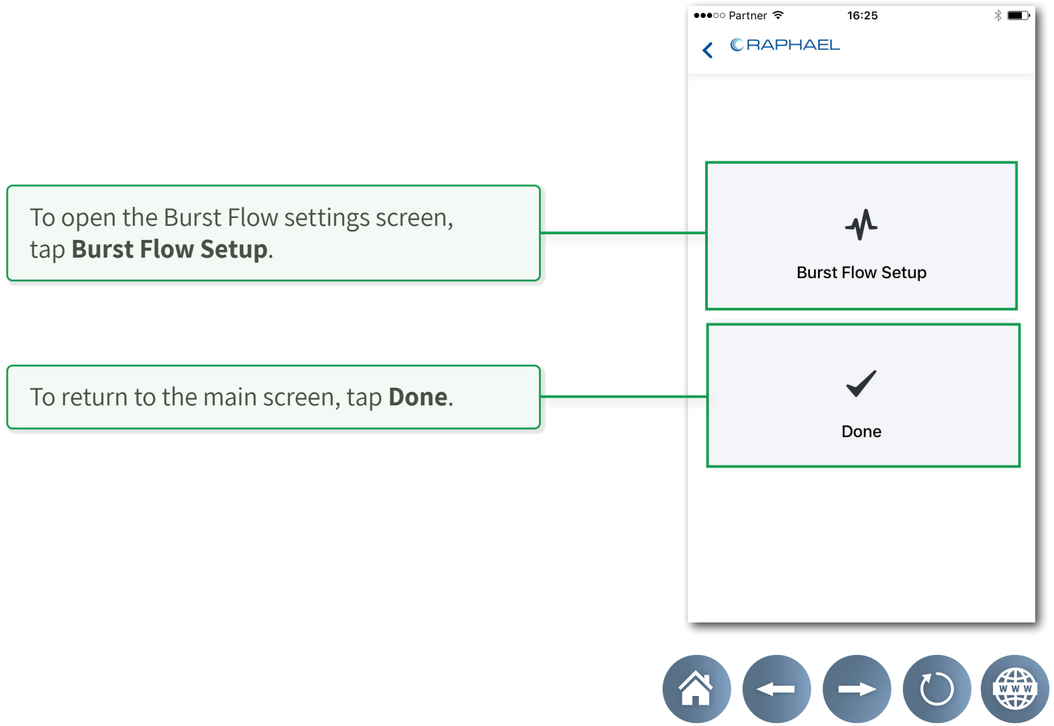
Configure the cyclic program as follows:



3.3.6 Burst Flow Setup

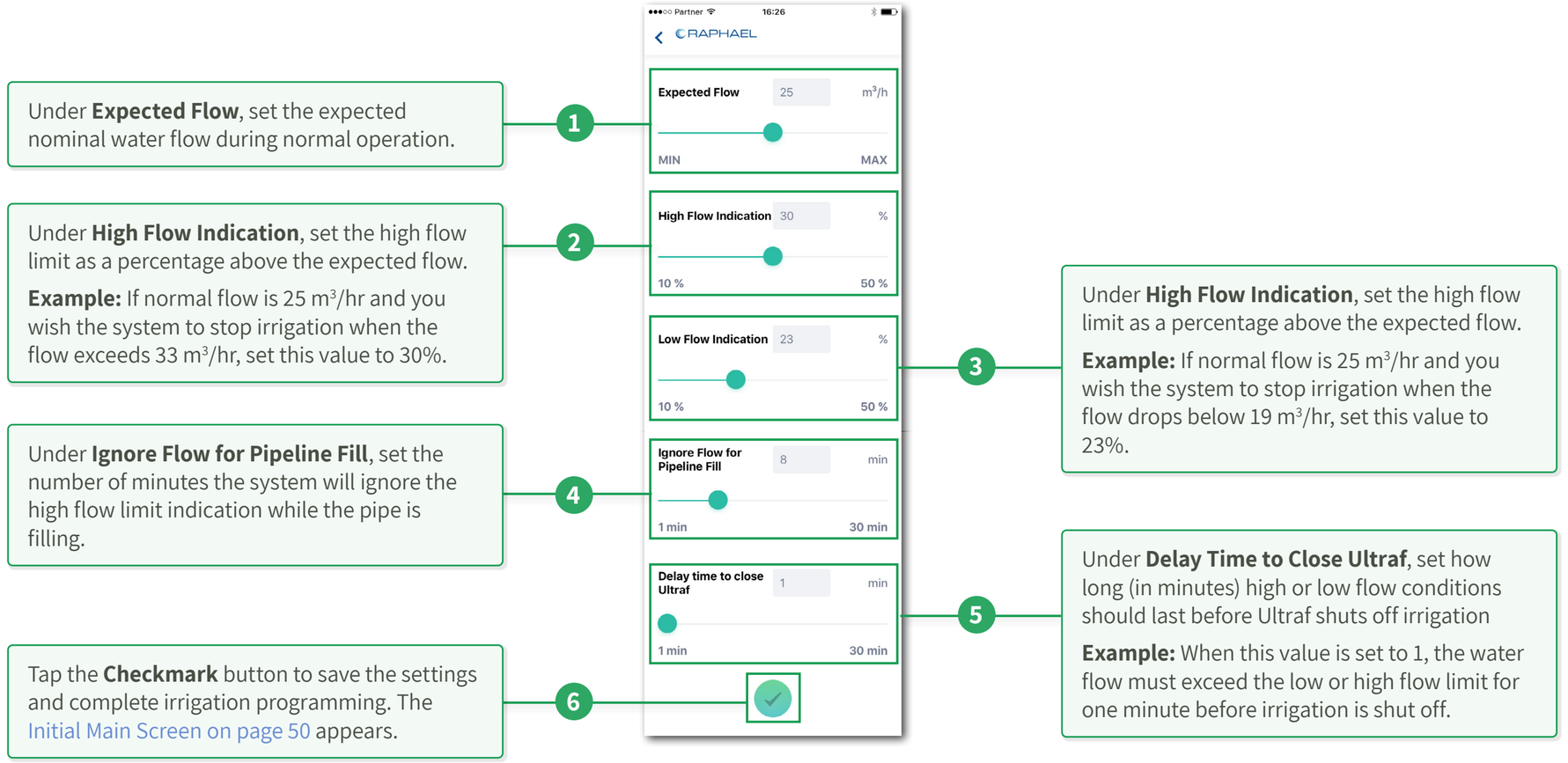
NOTE: Setting up Burst Flow is optional.

This screen is displayed after completing configuration of either weekly or cyclic irrigation program and enables selecting one of the following options:



Burst Flow Settings Screen

To define conditions for irrigation shut off due to a problem with the water flow, perform the following steps:



3.4 Irrigation Monitoring and Operation

This chapter reviews the tasks associated with monitoring and operating Ultraf irrigation controller.

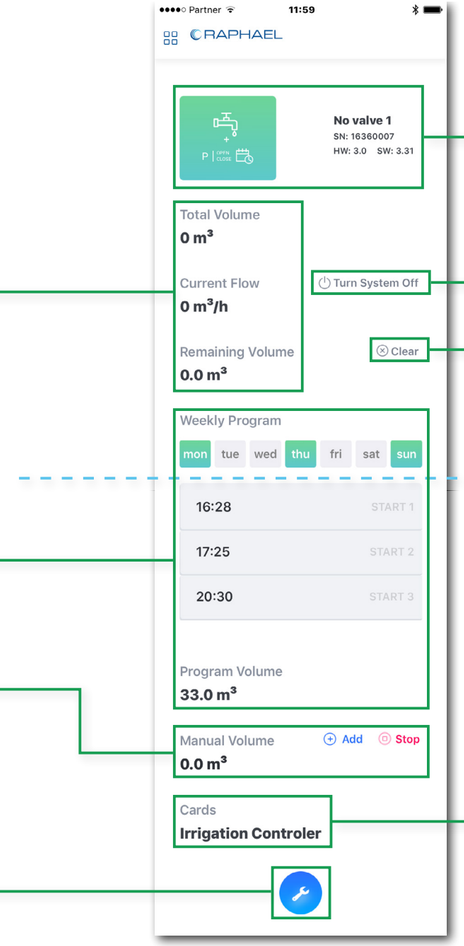
This chapter includes:

- Weekly Irrigation Program Monitoring
- Cyclic Irrigation Program Monitoring
- Adding Irrigation Manually
- Turning Irrigation Off

3.4.1 Weekly Irrigation Program Monitoring

The following screen is displayed when a weekly irrigation cycle is used. For initial configuration see Weekly Program Setup (page 53).

This screen includes the following types of information (described in detail later):



Current Irrigation Cycle Information – see page 59

Weekly Program Information – see page 60

Manual Volume – initiates a one-time manual addition of water volume (see Adding Irrigation Manually on page 63).

Settings Button (8) – opens the irrigation programming screen (see Irrigation Programming on page 51).

Ultraf Information – the following information is displayed:

- Ultraf assigned name (up to 12 characters)
- Ultraf serial number
- Controller hardware version (HW) and software version (SW)

Turn System Off – stops all irrigation activity until a designated date and time (see Stopping Irrigation Program on page 64).

Clear – terminates the active irrigation cycle that is in progress (see Terminating Irrigation Cycle on page 64). This does not affect future cycles.

Cards – specifies that Ultraf is fitted with an irrigation controller card.

Current Irrigation Cycle Information

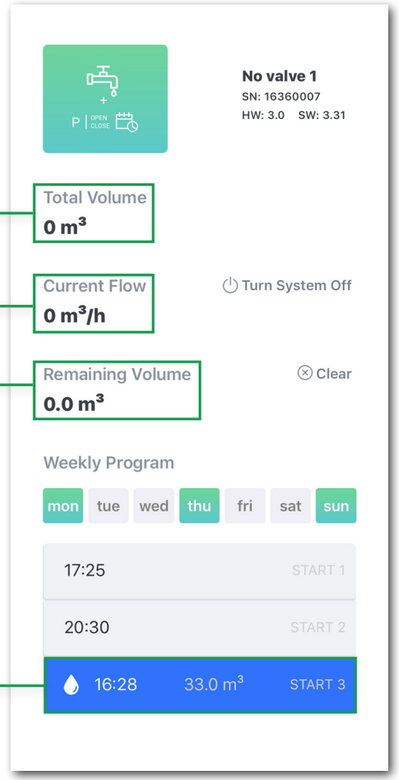
TIP: When irrigation is on, the active irrigation cycle is highlighted.

Total Volume – displays the total amount of water already irrigated.

Current Flow – displays the current water flow rate.

Remaining Volume – displays the amount of water that is left to irrigate during the current irrigation cycle.

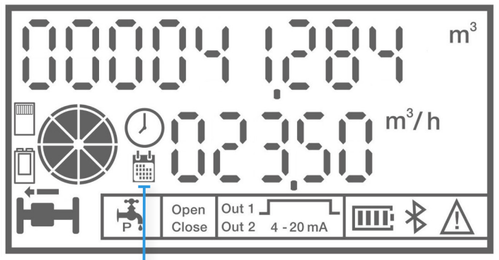
Current Cycle –the active irrigation cycle is highlighted when watering.



NOTE: If an irrigation cycle is still running at the time the next cycle in line is scheduled to start, it will continue running. Once that cycle ends, the next cycle will commence. At midnight, any scheduled cycles waiting to start will be cleared.

To indicate that an overlap of cycles is occuring, the calendar icon on the Ultraf display blinks steadily.

For more information, see Ultraf Installation and Operation Manual.

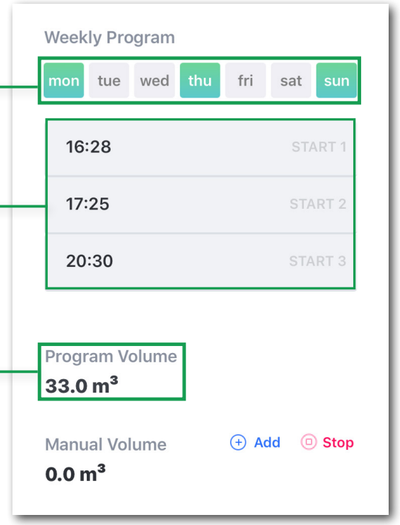


Weekly Program Information

Programmed Days – the programmed irrigation days of the week are highlighted.

Programmed Times – the daily irrigation cycle starting times are listed.

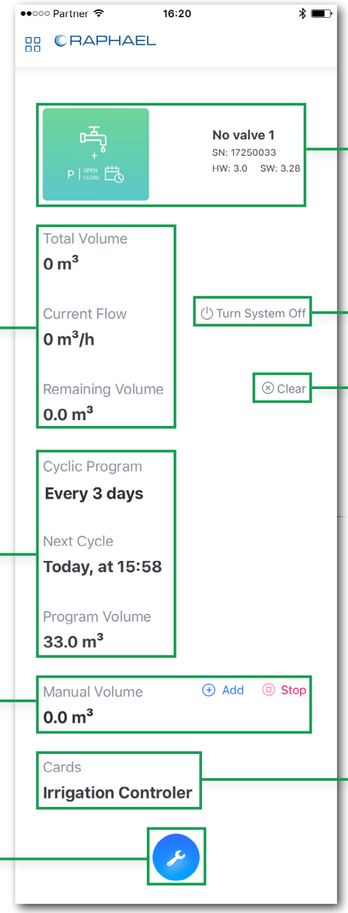
Program Volume – the volume of water per each irrigation cycle is displayed.



3.4.2 Cyclic Irrigation Program Monitoring

The following screen is displayed when a cyclic irrigation program is used. For initial configuration see Weekly Program Setup (page 53)

This screen includes the following types of information (described in details later):



Current Irrigation Cycle Information – see page 59

Cyclic Program Information – see page 62

Manual Volume – initiates a one-time manual addition of water volume (see Adding Irrigation Manually on page 63).

Settings Button – opens the irrigation programming screen (see Irrigation Programming on page 51).

Ultraf Information – the following information is displayed:

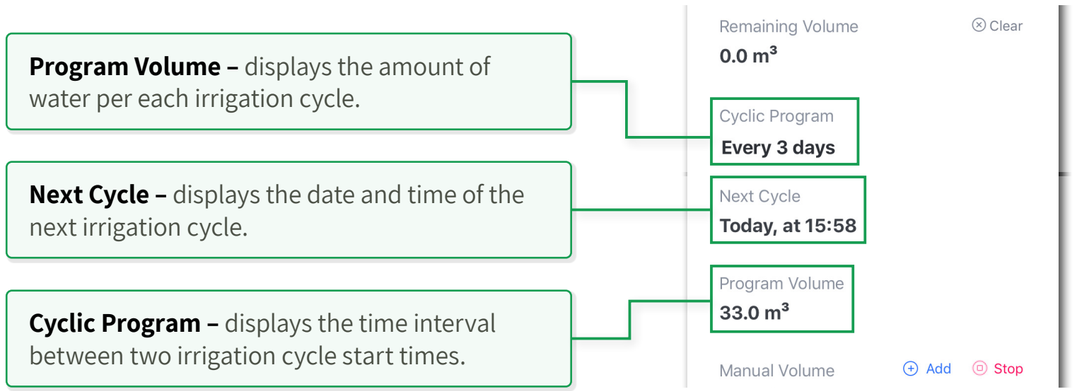
- Ultraf assigned name (up to 12 characters)
- Ultraf serial number
- Controller hardware version (HW) and software version (SW)

Turn System Off – stops all irrigation activity until a designated date and time (see Stopping Irrigation Program on page 64).

Clear – terminates the active irrigation cycle that is in progress (see Terminating Irrigation Cycle on page 64). This does not affect future cycles.

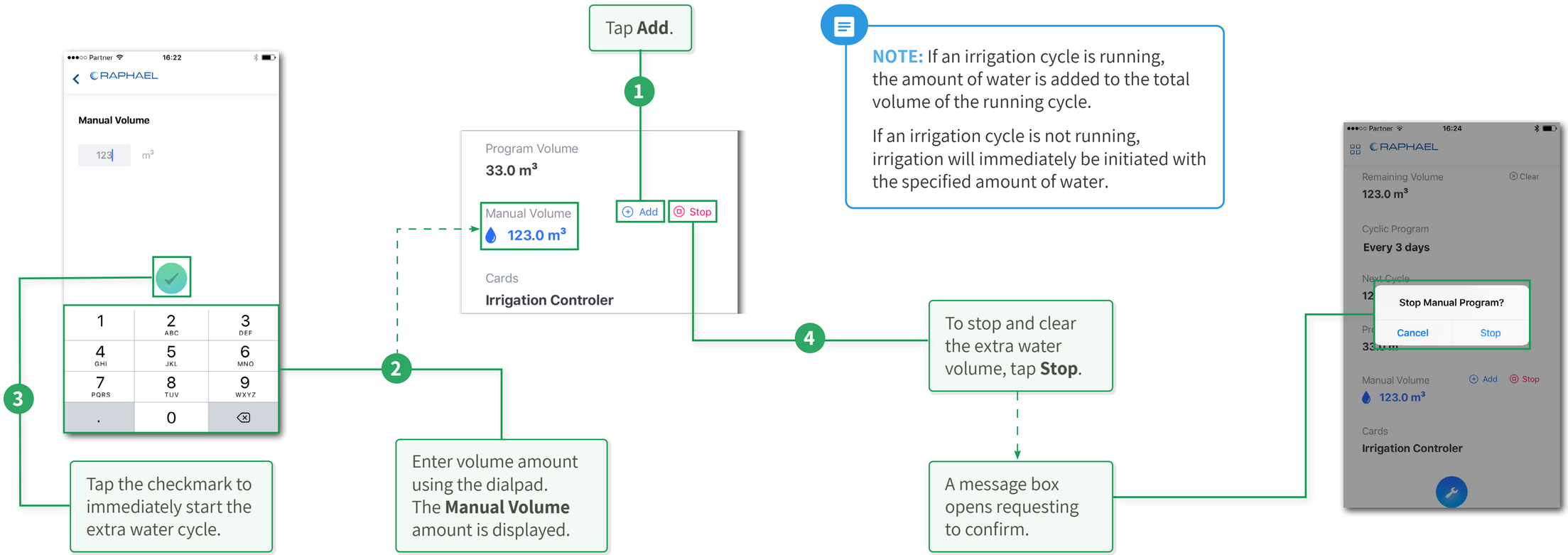
Cards – specifies that Ultraf is fitted with an irrigation controller card.

Cyclic Program Information



3.4.3 Adding Irrigation Manually

To initiate a one-time manual addition of water volume:

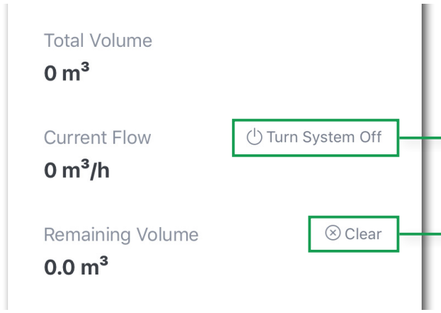


3.4.4 Turning Irrigation Off

This section reviews the options to pause the irrigation program until a given date.

TIP: This option is available on the main screen. See Weekly Program Setup and Cyclic Irrigation Program Monitoring on page 61.

Terminating Irrigation Cycle



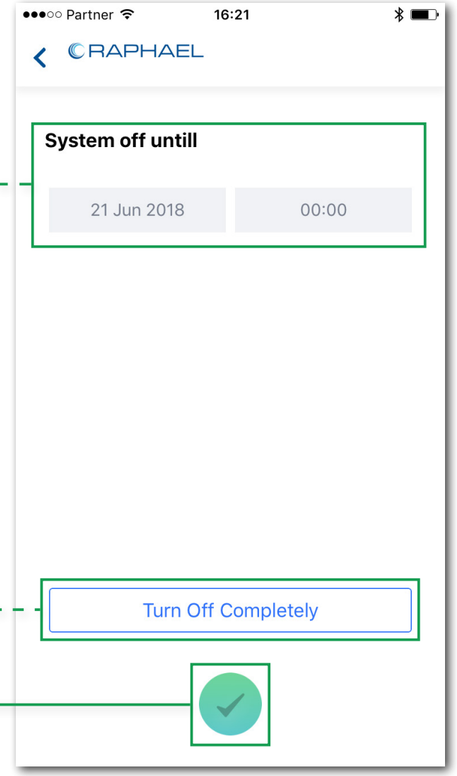
To clear remaining volume of water and terminate the current irrigation cycle, tap **Clear**

TIP: This option terminates the current irrigation cycle only.

Stopping Irrigation Program

To stop the irrigation program, tap **Turn System Off**. A screen appears with the following options:

- Turn off irrigation system until a designated date and time.
- Turn off irrigation system completely.



Tap the Checkmark button (5) to save the settings and confirm stopping the irrigation program.

4. TROUBLESHOOTING

This chapter reviews problems that might occur during Ultraf operation and instructions for corrective actions, and includes the following sections:

- Air in the water
- No Pulse Output
- No Analog Output
- No Solenoid Valve Output
- Damaged Cable or Extension Card Corrosion
- Low Battery
- Damaged O-Ring
- Battery Replacement
- MODBUS Battery Replacement
- Top Cover Plastic Replacement
- Battery Card Replacement
- Pulse Card Replacement

4.1 Air in the water

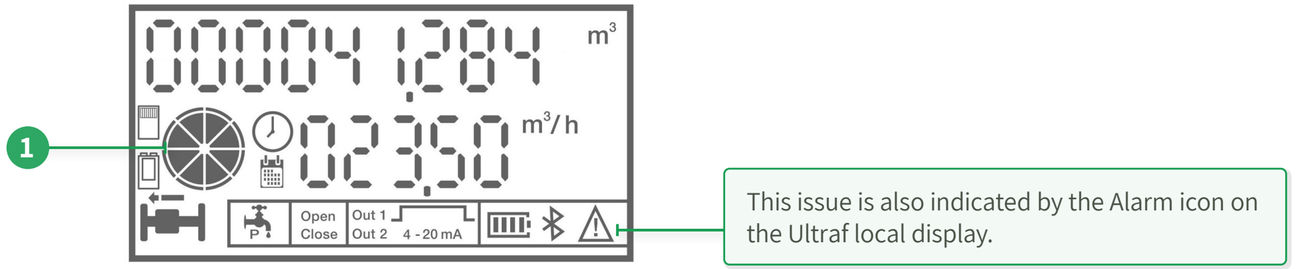
4.1.1 Problem Description

Air in the flowing water is indicated when the Water Level icon (1) stops rotating and the all icon looks “full”, that shows that there is air in the water and the water meter cannot operate.

4.1.2 Corrective Actions

Install air vents sized and positioned properly.

NOTE: Occasional air bubbles do not affect Ultraf reading and are indicated by the Water Level icon (1) altering between Full and Empty.



This issue is also indicated by the Alarm icon on the Ultraf local display.

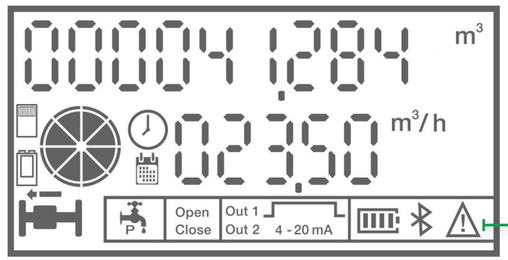
4.2 No Pulse Output

4.2.1 Problem Description

Pulse is not received by the reading device connected to the Ultraf pulse output (see Pulse Output on page 18).

4.2.2 Corrective Actions

- Verify that water is flowing through Ultraf in the proper direction and all measuring units are set to need.
- Verify that all internal terminals are clean and free of corrosion.
- Verify indication of pulse emission on the local display (see Local Monitoring on page 44). When a pulse is emitted, the pulse sign on the Ultraf display will appear for one second duration.
- Verify that wire connections to irrigation controller are properly secured.
- Verify that voltage and polarity are within specifications.
- Verify that the pulse is recognized by the reading device.
- Verify that the batteries are in proper working order.



This issue is indicated by the Alarm icon on the Ultraf local display.

4.3 No Analog Output

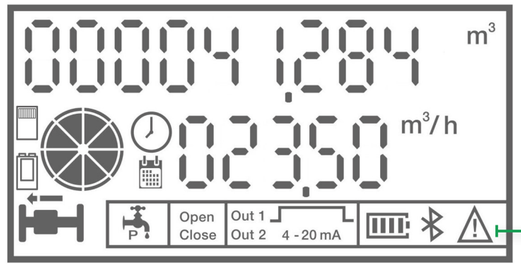
4.3.1 Problem Description

Analog signal is not received by the reading device connected to the Ultraf analog output (see Analog Output on page 21).

4.3.2 Corrective Actions

Verify the following:

- Water is flowing through Ultraf in the proper direction and all measuring units are set to need.
- The settings of 4-20 mA in proportion to the flow rate are set properly via the Raphael mobile application.
- Wire connections to reading device are properly secured.
- Voltage and polarity are within specifications.
- The current is recognized by the reading device.



This issue is indicated by the Alarm icon on the Ultraf local display.

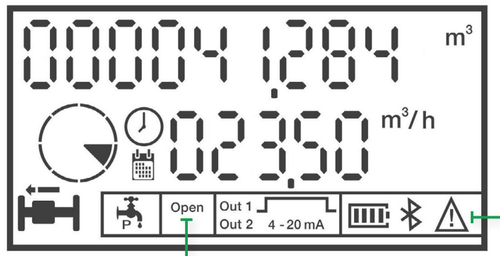
4.4 No Solenoid Valve Output

4.4.1 Problem Description

Latch solenoid connected to the Ultraf output is not activated.

4.4.2 Corrective Actions

- Verify that water is flowing through Ultraf in the proper direction and all measuring units are set to need.
- Initiate solenoid valve activation by changing the settings according to pressure management mode (see Pressure Management Control on page 38):
  - **Day Night Mode –** set the high pressure time to the current time
  - **Flow Value Mode –** set the flow value to lower than the current flow rate
- Verify that all internal terminals are clean and free of corrosion.



This issue is also indicated by the Alarm icon on the Ultraf local display.

When the Solenoid Position icon on the local display shows **Open**, the latching solenoid makes a sound while shifting. If it does not:

- Check the integrity of the solenoid and replace if needed.
- Verify that wire connections are properly secured.
- Verify that solenoid voltage and polarity are within specifications.

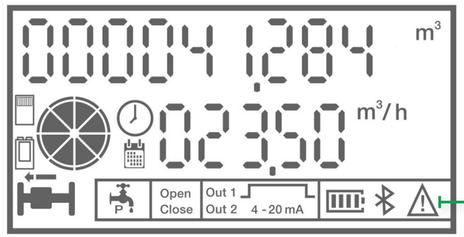
4.5 Damaged Cable or Extension Card Corrosion

4.5.1 Problem Description

Cables that are torn or damaged, and/or extension cards that are corroded.

4.5.2 Corrective Actions

Replace the damaged equipment. Proper cables and cards are available through Raphael authorized dealers.



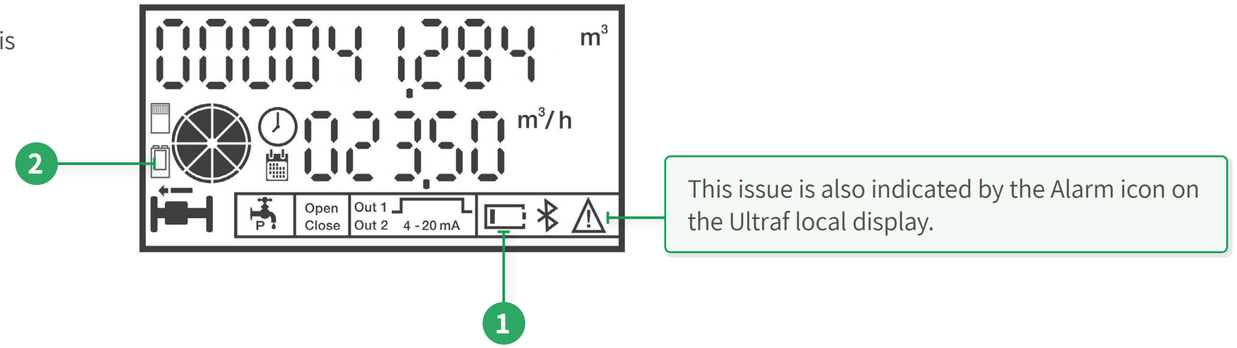
This issue is indicated by the Alarm icon on the Ultraf local display.

4.6 Low Battery

4.6.1 Problem Description

The Main Battery Status icon (1) on the local display drops to a single line and starts flashing. In this case, there is about one month of operation left before the battery discharges completely and no data is recorded.

See Battery Replacement on page 73.



4.6.2 Corrective Actions

Contact an authorized Raphael dealer to perform a field service replacement operation. All calibration data and recorded data will be preserved.

4.6.3 Problem Description

In case of a low battery on the Modbus card, the battery status indicator on the Modbus card will light up (2). In this case, there are several days left until the card works properly (pulse generation or solenoid activation), then the card is disabled and it will not be possible to command the solenoid or the pulse generation.

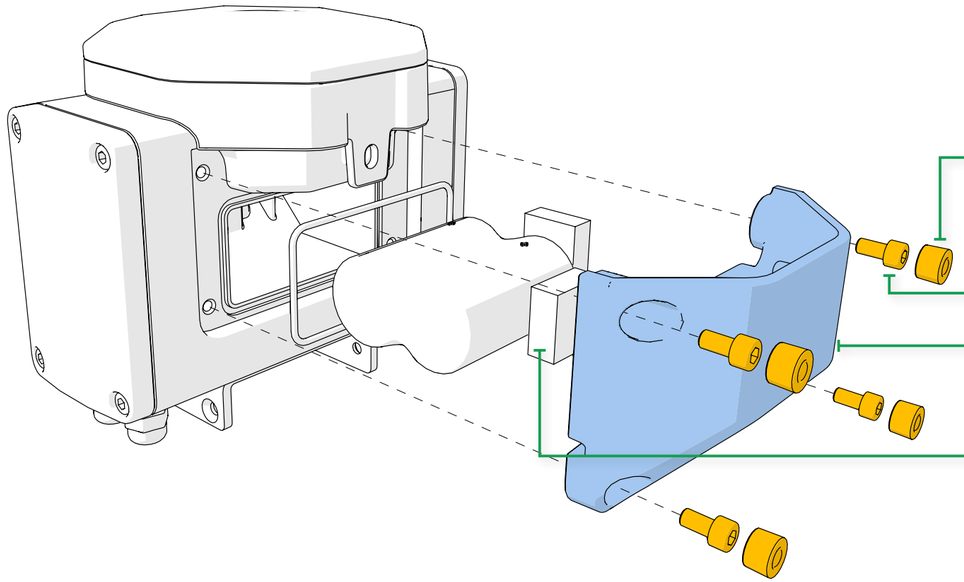
4.6.4 Corrective Actions

Contact an authorized Rafael Industries agent from Raphael Valves to get replacement batteries and instructions for replacing them in the field

4.7 Damaged O-Ring

This section describes the procedures required to replace a damaged O-ring.

4.7.1 For O-RING Replacement



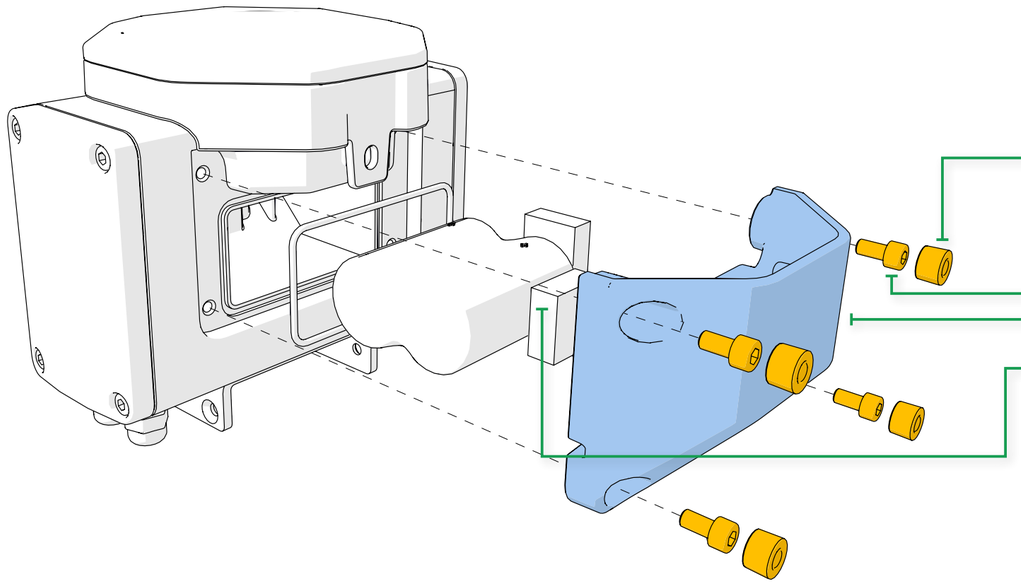
To replace the O-ring:

1. Remove the four plastic caps using a sharp tool or a screw.
2. Unscrew the four screws using a 5mm Allen wrench.
3. Remove the battery compartment cover.
4. Remove the foam spacers.
5. Replace the O-ring.
6. Position the cover in place. Make sure not to close the cover on the O-ring or the battery wire.
7. Fasten the four screws using a 5mm Allen wrench.
8. Push the four plastic caps in place.

NOTE: Opening the main battery cover for any maintenance purposes requires preliminary training from Raphael's staff. Opening the battery cover without such training voids the product warranty.

Description	P/N
TFC Plomba	45721
M5X10 DIN912	BRM05&10-5-N
TFC Li-Battery Supporting Foam	45734
TFC Li-Battery Pack	45718
TFC Li-Battery Cover Seal	45719
TFC Li-Battery Cover Seal	45719

4.8 Battery Replacement



To replace the battery:

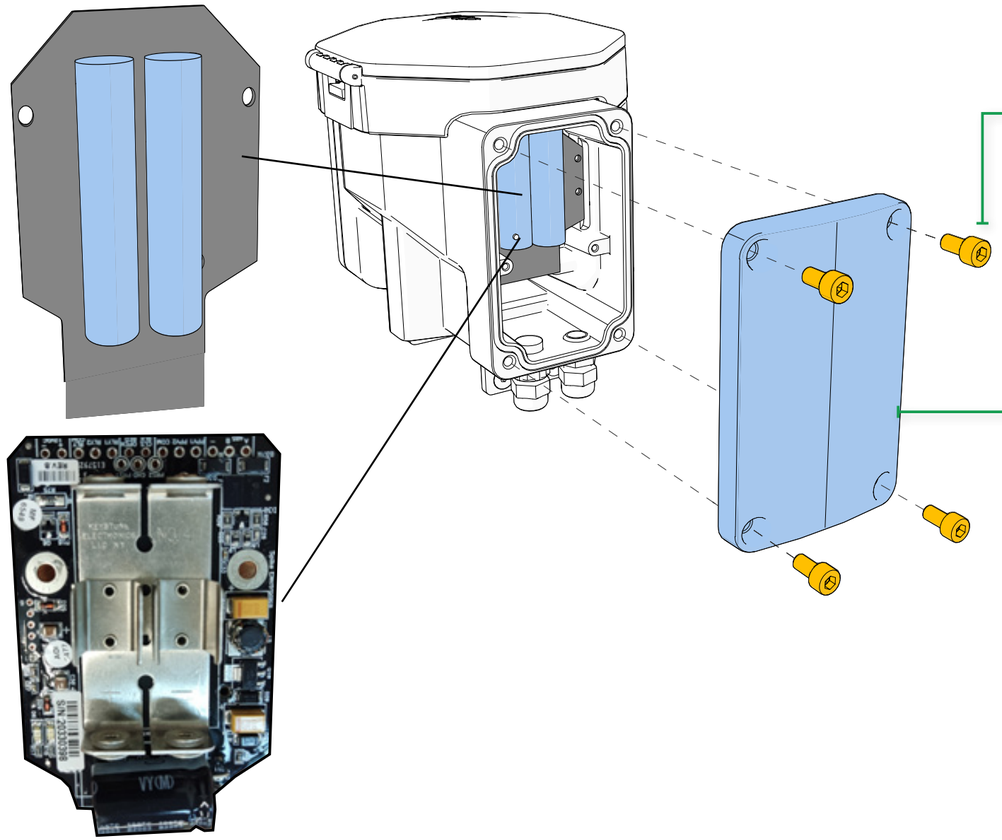
1. Remove the four plastic caps using a sharp tool or a screw.
2. Unscrew the four screws using a 5mm Allen wrench.
3. Remove the battery compartment cover.
4. Remove the foam spacers.
5. Disconnect the battery and replace with a new one.
6. Verify that the O-ring and the battery wire are in place.
7. Position the foam spacers in the same place they were before.
8. Position the cover in place. Make sure not to close the cover on the O-ring or the battery wire.
9. Fasten the four screws using a 5mm Allen wrench.
10. Push the four plastic caps in place.

NOTE: Opening the main battery cover for any maintenance purposes requires preliminary training from Raphael's staff. Opening the battery cover without such training voids the product warranty.

Description	P/N
TFC Plomba	45721
M5X10 DIN912	BRM05&10-5-N
TFC Li-Battery Supporting Foam	45734
TFC Li-Battery Pack	45718
TFC Li-Battery Cover Seal	45719

4.9 MODBUS Battery Replacement

This section describes the procedures required to replace MODBUS battery replacement.



To replace MODBUS Battery:

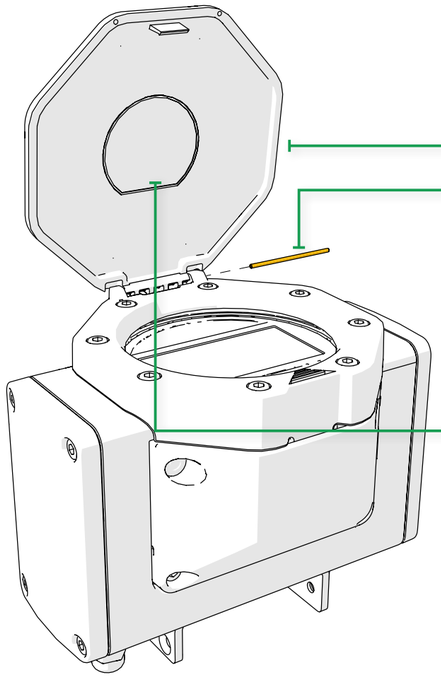
1. Loosen the four cover screws with a 5 mm Allen key.
2. Replace both batteries in the card.
3. Close the battery cover by tightening the four cover screws using a 5mm Allen key.

4.10 Top Cover Plastic Replacement

This section describes the procedure required to replace the top cover.

4.10.1 Top Lid Cover Replacement

NOTE: Opening the main battery cover for any maintenance purposes requires preliminary training from Raphael's staff. Opening the battery cover without such training voids the product warranty.



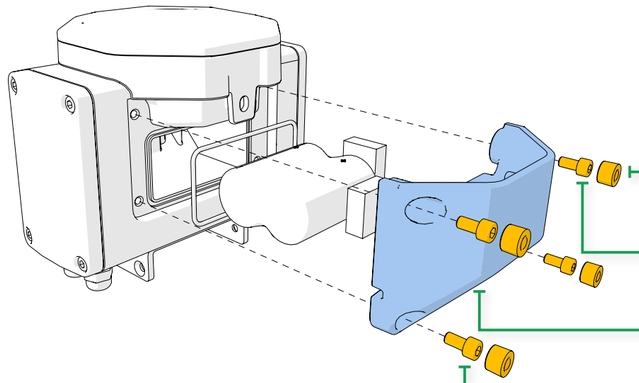
To replace the top lid cover:

1. Open the broken lid.
2. Remove the pin using a sharp tool and a hammer.
3. Replace the lid with the new one.
4. Push the pin back into place using the same tools. Verify that the pin is in place (end to end).
5. Remove the serial number label from the old lid and replace it on the new lid in the same position.

Description	P/N
TFC Display Door	45714
TFC Display Door Axis	45713

4.10.2 Top Ring Replacement

NOTE: Opening the main battery cover for any maintenance purposes requires preliminary training from Raphael's staff. Opening the battery cover without such training voids the product warranty.

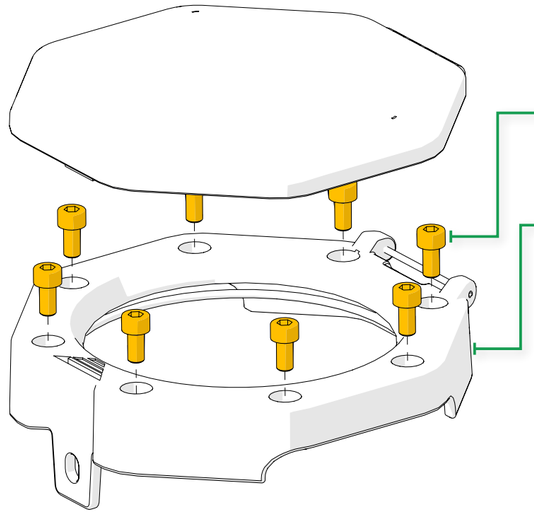


Stage 1: opening the Battery Cover:

Note: Without opening the battery cover you cannot open the top ring.

1. Remove the four plastic caps using a sharp tool or a screw.
2. Unscrew the four screws using a 5mm Allen wrench.
3. Remove the battery compartment cover.

Do not take out the battery!



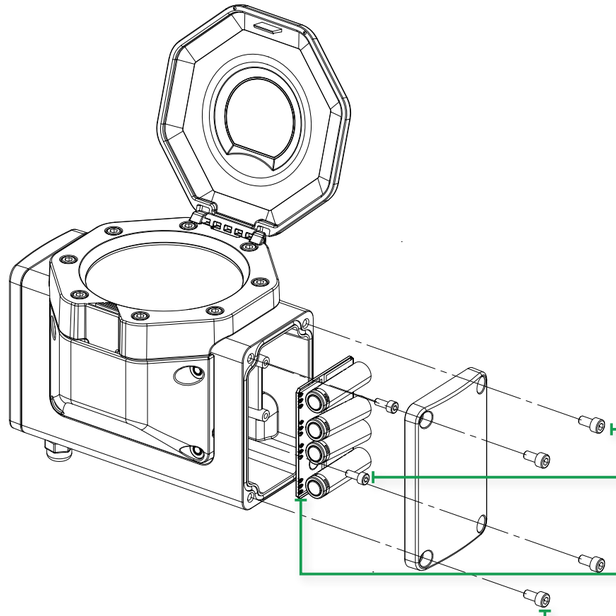
Stage 2: removing the top cover and replacing the ring

1. Remove the pin using a sharp tool and a hammer and remove the lid.
2. Unscrew the eight screws from the top of the plastic cover using a 5mm Allen wrench.
3. Remove and replace the broken ring.
4. Fasten the 8 screws using a 5mm Allen wrench.
5. Push the pin back into place using the same tools. Verify that the pin is in place (end to end).
6. Fasten the four screws using a 5mm Allen wrench.
7. Push the four plastic caps in place.

Description	P/N
TFC Display Windows Support	45711

4.11 Battery Card Replacement

This section describes the procedure required to replace the battery card.

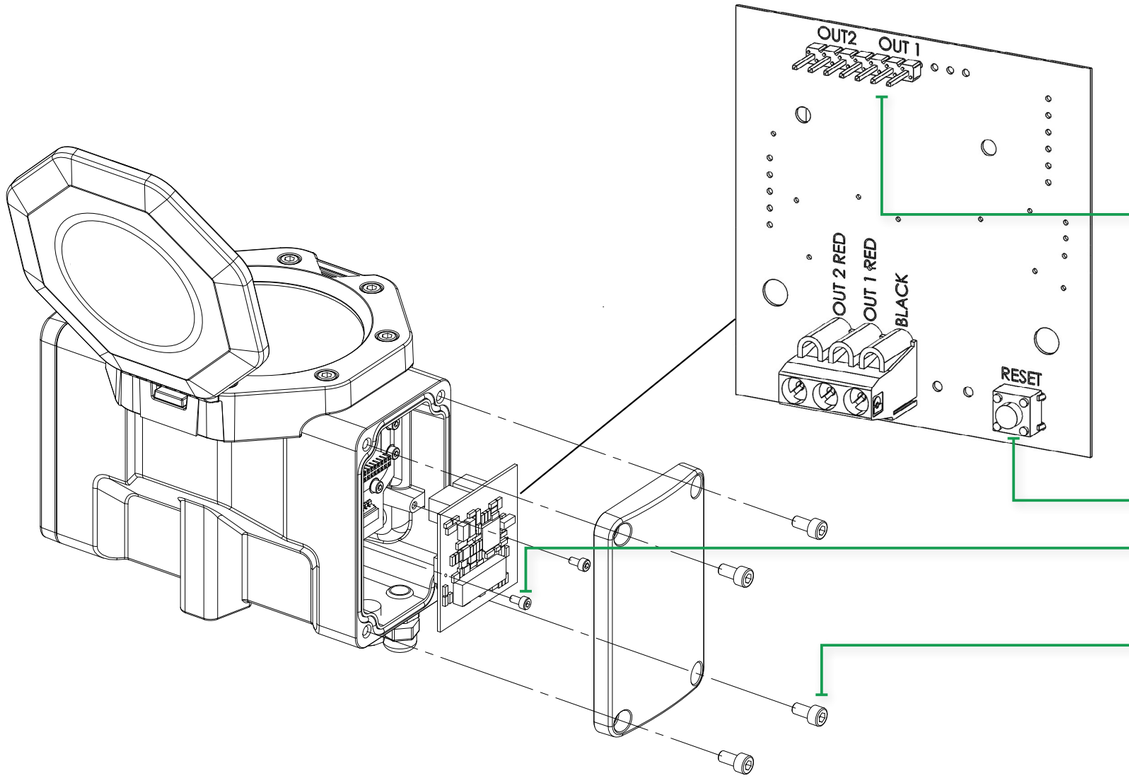


To replace the battery card:

1. Unscrew the four cover screws using a 5mm Allen wrench.
2. Unscrew the two card screws using a 3mm Allen wrench.
3. Disconnect the cable from the unit.
4. Replace the battery Card with a new card.
5. Close the card by fastening the two card screws using a 3mm Allen wrench.
6. Make sure the rubber gasket sits inside the recess perfectly.
7. Close the battery cover by fastening the four cover screws using a 5mm Allen wrench.

4.12 Pulse Card Replacement

This section describes the procedure required to replace the pulse card.



To replace the pulse card:

1. Unscrew the four cover screws using a 5mm Allen wrench.
2. Remove the jumpers.
3. Disconnect the wires that are connected to the card.
4. Unscrew the two card screws using a 3mm Allen wrench.
5. Replace the Pulse Card with a new card.
6. Reconnect the wire.
7. Place the jumpers in the same place.
8. Press the Reset button on the card.
9. Close the card by fastening the two card screws using a 3mm Allen wrench.
10. Make sure the rubber gasket sits inside the recess perfectly.
11. Close the battery cover by fastening the four cover screws using a 5mm Allen wrench.

5. SPECIFICATIONS

This chapter includes the following sections:

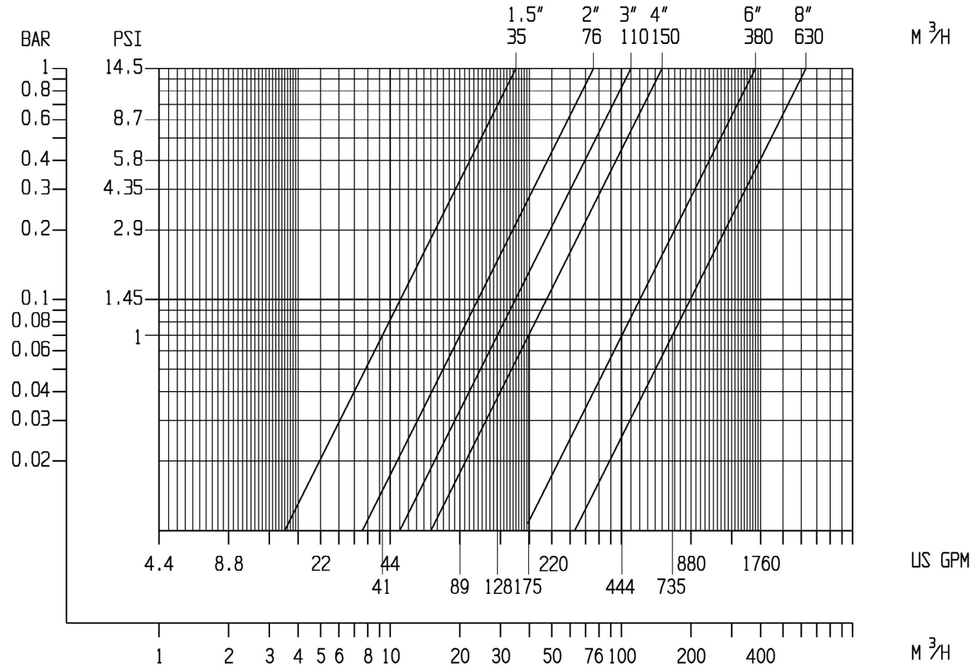
5.1 Specifications

- Ultraf is powered by a battery that lasts up to 10 years without maintenance.
- Accuracy according to ISO 4064-2014 standard.
- Multi-measurement worldwide system (gallons, m^3, ft^3, AI, AF).
- Bluetooth® communication with Raphael smartphone application for measuring unit preference selection and controller settings.
- Separate volume pulse output and external card for 4-20mA continues volume output.
- 16 bar pressure rating.
- Available from 40mm to 200mm.
- IP68 Water intrusion resistance according to the Environmental Protection Standard.
- Water temperature 0.1^0C to 50^0C.
- Operation temperature -25^0C to $+55^0$C.

5.2 Ultraf Measurements

DN [mm]	40	50	80	100	150	200
DN [inch]	1½	2	3	4	6	8
Length L [mm]	250	250	300	350	500	600
Height H [mm]	212	228	300	327	392	425
Width W [mm]	190	190	223	240	310	350
Weight [kg]	9.5	10	13.5	21	43	67
End connections	TH		F F			

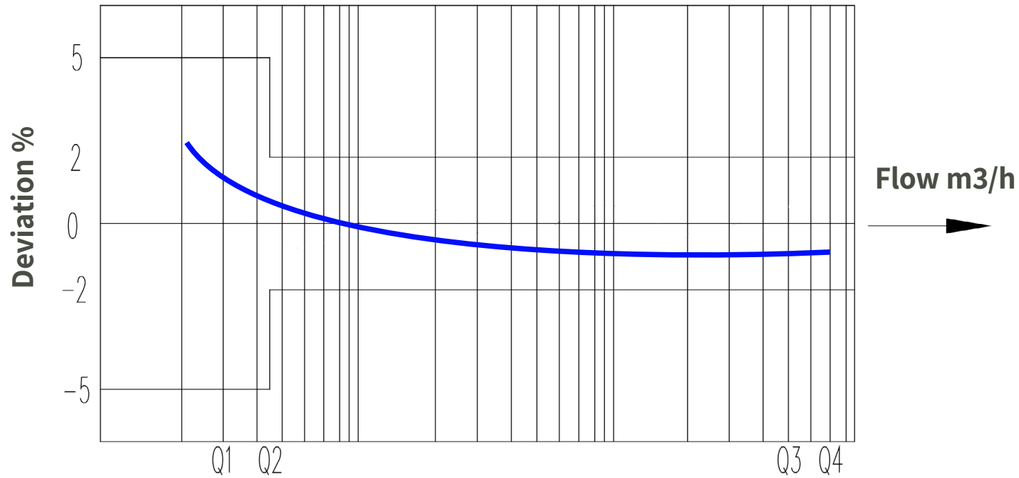
5.3 Headloss Curve



5.4 Accuracy Curve

DN [mm]	40	50	80	100	150	200
DN [inch]	1½	2	3	4	6	8
Q1	0.2	0.32	0.504	0.8	2	3.2
Q2	0.51	0.51	0.806	1.28	3.2	5.12
Q3	25	40	63	100	250	400
Q4	31.25	50	78.75	125	312.5	500
R = Q3/Q1	125	125	125	125	125	125

According to ISO 4064-2014



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