VATA VERKS
water and gas intelligence for buildings

Non-Invasive Whole Building Data Acquisition
Water / **D**iaphragm Gas / **R**otary & Turbine Gas
VV – 302 – XX – W/D/R

**Instructions for
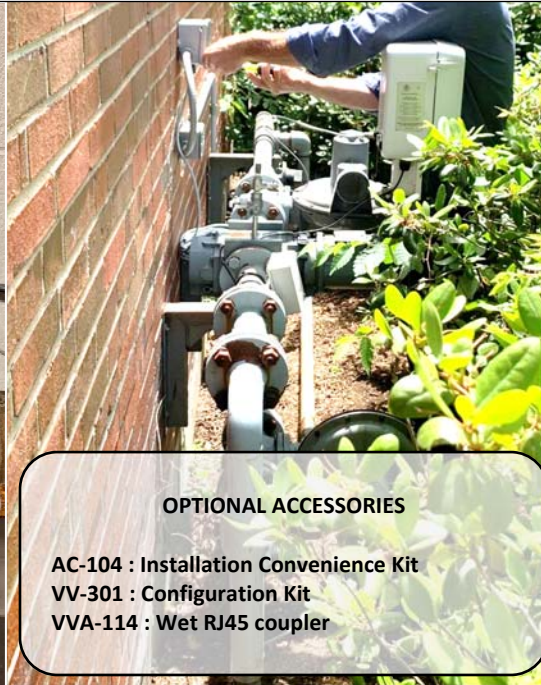Wireless - Ready
WATER & GAS METERS**

Extreme Kit

*The Wireless Flow Sensor
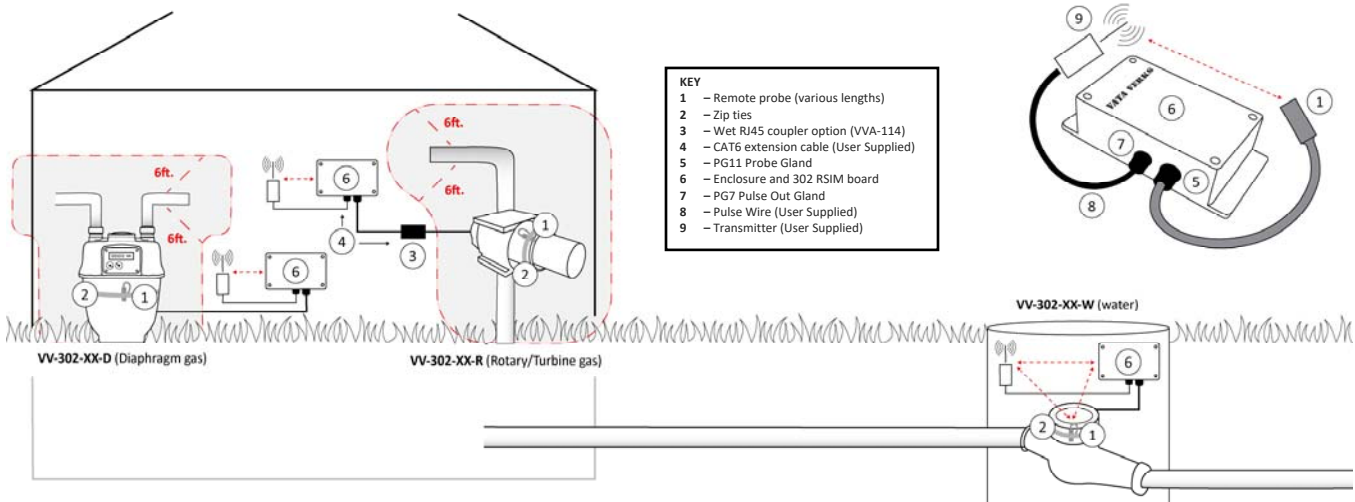that can go almost anywhere*

OPTIONAL ACCESSORIES

AC-104 : Installation Convenience Kit
VV-301 : Configuration Kit
VVA-114 : Wet RJ45 coupler

KEY
1 – Remote probe (various lengths)
2 – Zip ties
3 – Wet RJ45 coupler option (VVA-114)
4 – CAT6 extension cable (User Supplied)
5 – PG11 Probe Gland
6 – Enclosure and 302 RSIM board
7 – PG7 Pulse Out Gland
8 – Pulse Wire (User Supplied)
9 – Transmitter (User Supplied)

VV-302-XX-D (Diaphragm gas)
VV-302-XX-R (Rotary/Turbine gas)
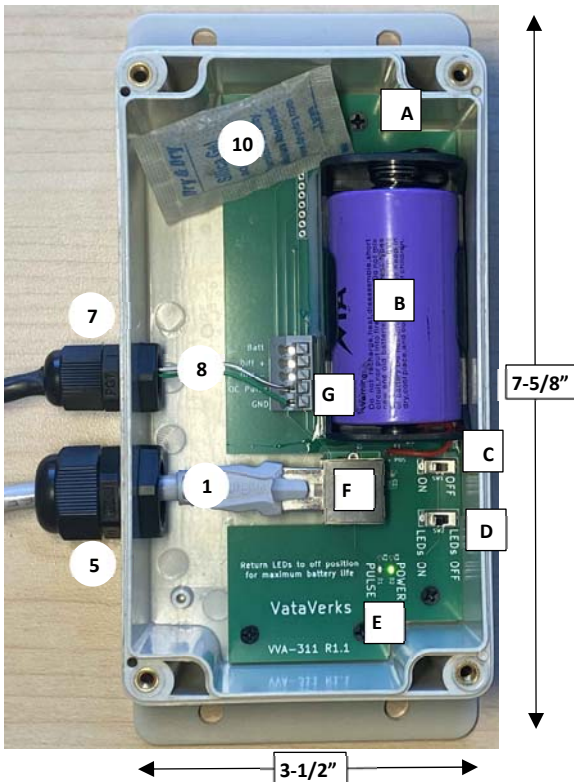VV-302-XX-W (water)

IMPORTANT WARNINGS
NOT FOR USE IN HAZARDOUS OR EXPLOSIVE ENVIRONMENTS

- <u>**Contains Non-Rechargeable Lithium-Metal Battery.**</u> See battery manufacturer website for handling warnings, or contact info@vataverks.com.
- Locate enclosure at least 2M / 6 ft away from combustible gas distribution pipes / equipment / storage.
- **CONFIRM METER COMPATIBILITY** before invasive site work. See Meter Guide pg: 5, pre-test On-site, or contact Vata Verks.
- **DO NOT INSERT** this device's RJ45 connectors into any ethernet device (ex: your laptop). Permanent damage may result.
- VataVerks reserves right to alter offerings and specifications at any time without notice and is not responsible for errors that may appear in this document.
- Sensors are used to acquire Water / Gas utility meter flow data. Vata Verks assumes no liability for their use beyond cost of repair or replacement within warranty period. See Warranty for full details.

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**Instructions for
Wireless - Ready
WATER & GAS METERS**

HARDWARE LAYOUT / SPECIFICATIONS

Components

1 Remote Probe (PG11 gland attached)
2 Zip Ties (2)
3 Wet RJ45 coupler   (purchased sep)
4 CAT6 extension   (user supplied)
5 PG11 Probe Gland
6 Enclosure
7 PG7 Pulse Out Gland
8 Pulse Wire   (user or Radio supplied)
o   Jacketed 2-conductor 3.0 – 6.5mm cable
9 Radio Transmitter   (user supplied)
10 Desiccant

Board Components

A 302 RSIM Board
B Non-Rechargeable Li-Metal
     D-size Battery: 17A-hr
C Switch: Power ON / OFF
D Switch: LED Indicators
E LED Indicators
F RJ45 Probe Port
G Pulse Output Terminal
     Terminal 4: Pulse Output
     Terminal 5: GND Ground

LED Key (if LED switch ON)

Power
     Solid: ON
Pulse
     OFF: No flow or not tracking
     Blink: Tracking / Pulse output

Accessories

AC-104: Installation Convenience Kit
AC-301: Configuration Kit
VVA-114: RJ45 Wet Coupler

7-5/8"

3-1/2"

VV-302 SPECIFICATIONS

Water Version: **VV-302-XX-W**
   Compatible: 95% of utility meters
   Most positive displacement, piston compound, multi-jet, single jet
   Incompatible: Ultra-sonic / solid state
   For Sensus Omni: Use VV-200 series
Gas Versions: **VV-302-XX-D / R**
   Compatible: 99% of utility meters
   Most **D**iaphragm, **R**otary & Turbine
   Incompatible: Ultra-sonic
_____

Configuration
VV-302 is pre-configured pulse output sensor kit for wireless or un-powered locations. Pulse K-factor and Pulse width can be User configured. See pg 4.
Data Protocols
- Pulse output

Radio Compatibility
Pulse Counting Radio not included.
- Dragino CPL01
- Monnit
- Others

Typical Accuracy (12 month)
- Water >95%   Gas >95%

Installation Limits
- -40C to 60C
- Not for hazardous locations
  Sensor Probe
- Outdoor, immersion, burial
- 2M, 7M, 15M long burial CAT6, AWG 23, RJ45, Pin out T568B Extendable to 15M / 50 ft. Contact Vata Verks if longer required
  Enclosure (7-5/8 x 3-1/2 x 2-1/2 H)
- Indoor / Outdoor
- Enclosure + battery to be 2M / 6ft from gas distribution equipment. (see Warning pg 1)

Pulse Specification
- Pulse K-factor: 1.0 (see probe label)
- Width= 10 – 100 msec (default=50)
- Pulses>Max rate: pulsed when slow
- Transistor Collector (dry contact)
- Wire: Jacketed 2 wire 3.0 - 6.5mm (Ex: Alpha Wire Xtra-Guard 5261C)

Battery Power
- 5-7 year battery life Non-rechargeable, D-Cell 17A-hr Lithium-Metal

Certifications
Complies with Part 15 of FCC Rules

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**Instructions for
Wireless - Ready
WATER & GAS METERS**

HARDWARE ASSEMBLY / INSTALLATION / COMMISSIONING

▶ 1. Prep

1.	Inspect Desiccant bag.
	• If beads are Clear or Orange, continue to step 2.
	• If beads are Dark Green: Remove from Zip bag and bake at 200F for 1.0 hr.
	• Re-Seal in Zip lock bag
2.	Choose Pulse Volume Discovery Method. Pg 4 and pg 8

▶ 2. Assemble / Install: See pg 1 and pg 2 diagrams

NOTE: Confirm Meter Compatibility before invasive site work.

1.	Run Probe + extension from Meter to your Counter / Radio
	• Probe extendable to **15M / 50 ft** with CAT6 cable
	Contact Vata Verks if longer probe required
	• **PRO TIP**: If removing /re-crimping probe RJ45 connector, Pin-out is Ethernet T568B
2.	Zip Tie Probe to Meter **see pg 6**
	• Zip tie cable for strain relief.
	• **PRO TIP**: Zip Ties are reusable. Flat head Jeweler screwdriver to open latch. (**see right**)
3.	Mount Enclosure.
	• **LOCATE Enclosure at least 2M / 6ft from any GAS distribution / storage.**
4.	Open Top.
5.	Connect Probe + extension to board.
	• With included PG11 Gland. 2-piece compression fitting outboard, 1 hex nut inboard.
	• Do Not Over Torque.
6.	Connect Pulse Wire to board terminals (see pg 5 Radio integration)
	• Jacketed 2 conductor 3.0 - 6.5mm wire. (Ex: Alpha Wire Xtra-Guard 5261C)
	• **PRO TIP**: Pulse wire included with radio may be suitable.
	• With included PG7 Gland. 2-piece compression fitting outboard, 1 hex nut inboard.
	• Do Not Over Torque.
	• Maximize distance between Radio & Probe. See Radio Mft instructions.
7.	Switch Power 'ON' (no LED indicator)
	• If probe is moved, re-secure probe. Then cycle Power OFF / ON.
8.	Switch LEDs 'ON' (indicates Power and Pulse)
9.	**OPTION**: See Flow Simulation pg 4
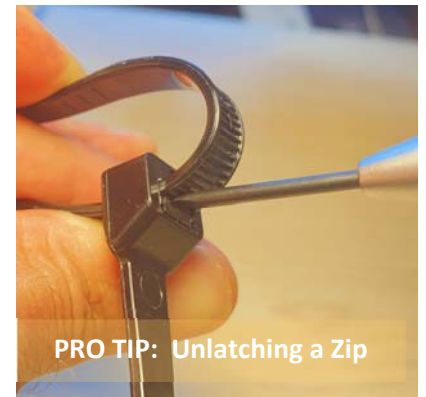
PRO TIP: Unlatching a Zip

▶ 3. Commission

1	Choose Pulse Volume calculation method.
	• Follow instructions pg 8.
2	**Flow Water or Gas Safely, as instructed by appliance manufacturer.**
	• Observe Pulse LED Flashes
	• Indicates successful Tracking.
3	Confirm successful transmission by your radio
4	**REQUIRED: Switch LEDs OFF. (to conserve battery)**
5	**IMPORTANT: Turn off Water or Gas Flow**
6	Place Desiccant in enclosure.
7	Fasten Top onto enclosure
	INSTALLATION COMPLETE

Trouble Shooting: Tracking
- **No Pulse LED Flashes, not tracking?**
  - Are LEDs ON?
  - Is there flow through meter?
  - Check probe Extension / Coupler.
    1) Wave probe in air. See pg 5
    2) Connect probe directly to board without extension.
  - Is Mag. field too weak.
    - Refer **to pg 6 and** shift probe to a stronger location on meter.
  - Is Meter compatible? see pg 2.
    - Send Meter photo to info@vataverks.com
  - Is VV-302 Version correct for meter? (Water / Diaphragm / Rotary & Turb)
  - Is Probe correct model for VV-302. (Grey probe OK. Black probe not OK)
  - Radio interference with Probe function. Extend radio from probe.
- **Pulse LED Flashes, but No Pulse?**
  - Check Pulse output wiring.
  - Is Pulse width too short for Pulse Counter? Contact Vata Verks

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Instructions for
Wireless - Ready
WATER & GAS METERS

SUPPLEMENT: Familarize with Sensor, Pulse Volume / Pulse Setting

▶ 1. Optional: Fast Familiarize

Simulate Tracking at your Desk

1. Quick Start: Follow Steps 4, 5, & 7 of pg 3 Assembly / Install section
2. **Switch ON both Power & LED**
3. Roll Probe back and forth

4. Pulse LED will flash at Pulse K-factor rate
5. Cycle Power to reset for each use.
6. When Done, switch OFF LEDs

Option: Wire / test the Pulse Counter, connect to the Terminals as shown pg 2.

Output Explained
- Tracking an identical path through Earth's magnetic field, is similar to tracking the magnetic field of flow through a meter.

Tracking at your Meter

1. Strap Probe to the meter as shown pg 6
2. Switch Power OFF / ON clearing the Calibration before each use.
3. Run water or gas safely following manufacturer instructions
4. Observe LED flashes
5. **Shut OFF Water / Gas flow**
6. **Switch OFF LEDs**

▶ 2. Required: Pulse Volume

Calculating Pulse Volume

The VV-302 Pulses at a programmed meter revolution count, the Pulse K-factor (revs/pulse).   Each Pulse represents a Volume.
The Pulse Volume will be used to convert received Pulses into Water / Gas flow data.
Choose a Pulse Vol. Method. pg 8

Pulse Volume can also be calculated from a meter's K-factor if known
(k-factor = meter size in revolutions/unit vol)
Pulse K-factor = Pulse Volume
   K-factor

Is Your K-Factor Already Known?

Many meter models are known.
Email to: info@vataverks.com
- Photo of Meter data / face plate
- Photo of Probe Serial #.

One K-factor per serial #.
Same day requests are not recommended.

PRO TIP: K-factors and Pulse Volumes, can vary for specific installations.
Measuring k-factor or Pulse Volume for the specific meter is **Highly Recommended** and **REQUIRED** for highest accuracy.

Choose your method

Review and choose the best Pulse Volume Discovery Method for your project. See pg 8
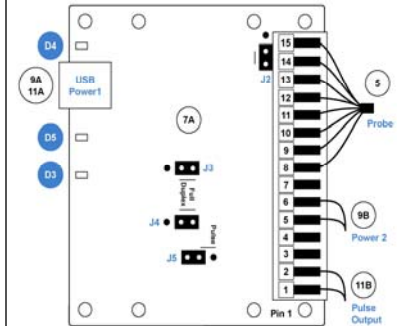
Need help converting K-factors, Pulse K-factors and Pulse Volumes?

Contact info@vataverks.com

▶ 3. Optional: Pulse Settings

Changing Pulse Settings

The VV-302 is Factory Configured.
For Pulse K-factor see probe label.
For Pulse Width: default 50 msec.
To change settings use either:
**Accessory Kit: VV-301**
Sensor Kit: VV-102

To change Pulse K-factor & Width
1. Position Jumpers J2, J3, J4, J5 as shown in diagram above.
2. Download VV-102 Instruction at http://vataverks.com/support
3. Follow instructions pg 3 to:
-Download Emulator & Driver
4. Follow instructions pg 3 to:
-Assemble and Connect Laptop
5. Follow instructions pg 3 to:
Open / Configure Tera Term
*__Set Baud=115,200__ (not 38,400)
6. Move Jumper J2 to end of terminal strip. A Menu Opens. Then move Jumper J2 back.
7. Adjust K-factor or Pulse Width
8. Display Configuration. Confirm
9. Record changes on Probe label, and project files.

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Radio Integration

Integration with
Dragino Pulse Counting
LoRa-Wan Radio Model: CPL01

1. Preparation: Network Connection
   a. Requires a LoRa-Wan system provider account:
      (ex: Things Network Senet, Helium.
   b. If within range of a LoRa-wan Gateway, go to Step 2.
   c. Install a LoRa-wan Gateway (example: Laird RG191)
2. Connect Probe to the VV-302
3. Open the Dragino enclosure.
4. **NOTE**: Use Gland connecting pulse cable to VV-302.
5. Connect Dragino PB14 terminal wire to VV-302 Pulse terminal. (This wire comes connected from Dragino)
6. Move Dragino Wire from outer terminal to one terminal inboard (**see picture**)
   Connect this wire to VV-302 GND term (**see picture**)
7. Move Dragino Yellow Jumper to the 2 pin JP2.
   Radio turns on.
8. Turn VV-302 Power ON.
9. Follow LoRa-wan Provider, and Dragino instructions to connect to Network. Gateway mft instructions if deploying.
10. Once connected, enter Dragino credentials.
NOTE: Extend Pulse cable so Radio is max distance from probe
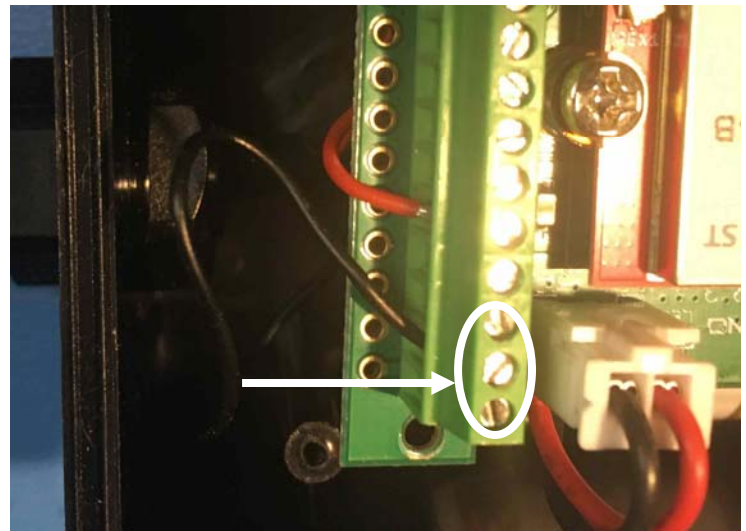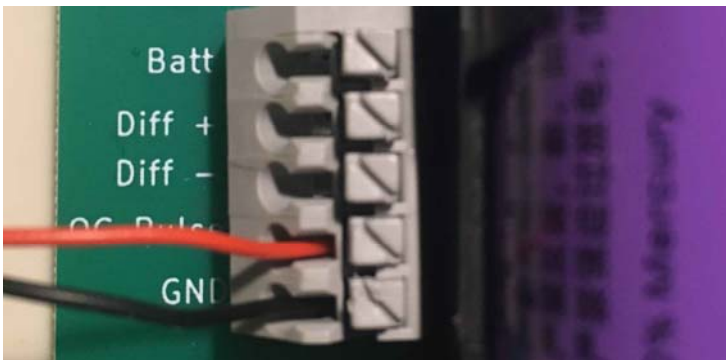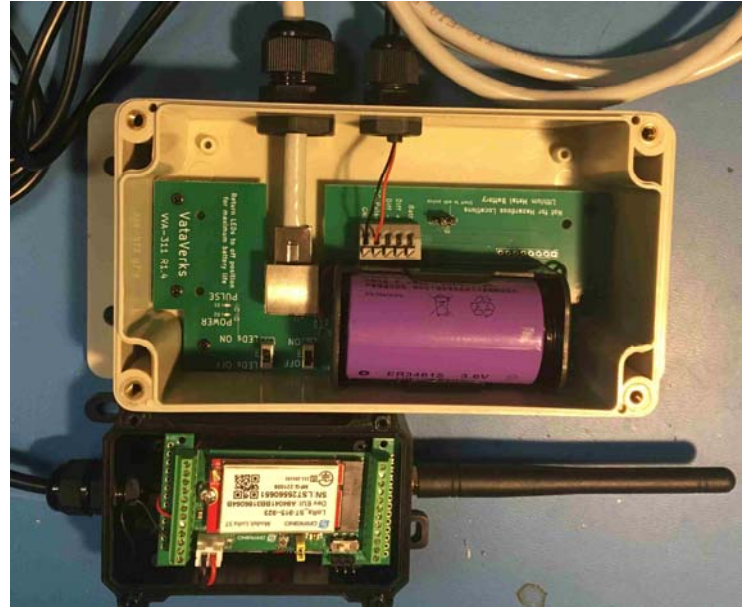
Integration with
Monnit Pulse Counting Radio

1. Compatible with both regular and industrial versions of Monnit pulse counting radios.
2. Monnit Settings: Default.

NOTE: Extend Pulse cable so Radio is max distance from probe

Other Radios
Wondering about other Pulse Counting Radios?   Ask at:
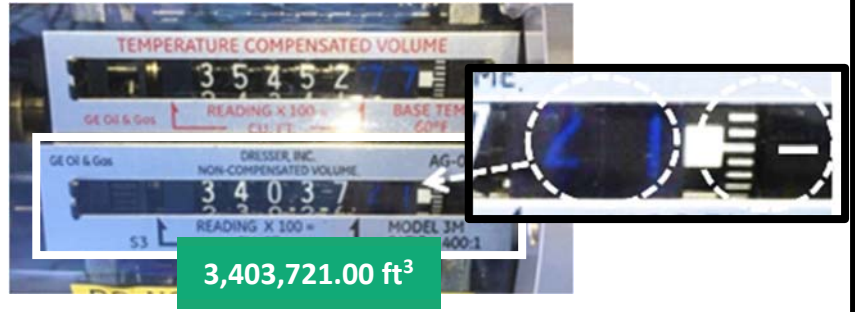info@vataverks.com

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**Instructions for
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WATER & GAS METERS**

METER GUIDE

Rotary or Turbine Gas Meters

Rotary:
Between Chamber
and Register

Dresser D800 / D1000
Rotary Meter

Turbine
Sensus / Equimeter
Auto Adjust Mach II

Turbine
Honeywell / Elster
GT/GTS/GTX

Place chip top of register
attachment flange
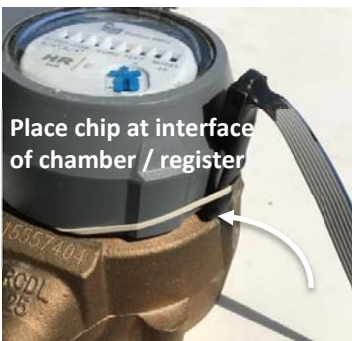
How to Read a Rotary Meter

- Use the "Non-Compensated Volume" reading.
- Dresser: Use a light to see 10's and 1's. (see below).
- Snap photo of the register and read from the photo.
- Dresser: Each "hash" mark on right side = 0.2 ft^3.
  - Rollover (X.00 ft^3) = main hash aligns with fixed hash.
  - Estimate to the 2nd decimal place. (ex: 3,403,721.36 ft^3)

3,403,721.00 ft^3

When Compensated & Non-Compensated output is greatly different the utility may be using a high pressure feed.

Confirm K-factor with the Monthly Bill

Need some help? Send Meter photos to info@vataverks.com

Water Meters

Place chip at interface
of chamber / register

Place chip at interface
of chamber / register

Compound Meters
Requires (2) Units

Probes must be at the
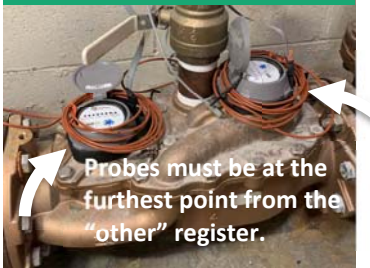furthest point from the
"other" register.

METER READING

1. **Take meter readings from a photo**
2. Read digits / dial. Estimate last digit between "hash" marks
3. Check Meter units (ex: Gal or Cubic Feet)
4. Avoid register voids and rollovers.

Diaphragm Gas Meters:
Place Probe Vertically + Horizontally Centered Front OR Back

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**Instructions for
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WATER & GAS METERS**

PULSE VOLUME DISCOVERY METHOD "D2"

For all Meters with Resolution < 1 ft^3

(If resolution = 100 ft^3 this method may be unsuitable)

Temporary Install at Meter

1. Strap Probe to meter. See Meter Guide pg 6.
2. Connect to Pulse Counter
3. **Start flow (Water or Gas) to Track so Pulse LED flashes**

Data Collection
4. **START** Test at <u>Instant</u> of Pulse Flash / Pulse SIMULTANEOUSLY:
   a. **Meter1**: take **Photo1** of Meter (as below)
   b. **Pulse1**: Record Pulse Counter Count.

If Gas: Use **"Non-Compensated"** output

Photo1	Photo2
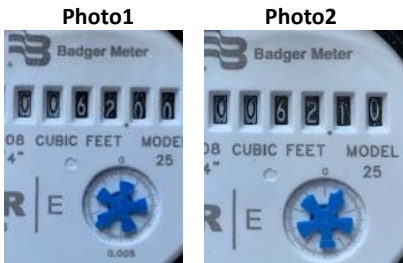
62.00 ft^3	62.10 ft^3

5. **During Test PERIOD**
   a. **Run Water or Gas.**
      >400 Revs preferred. More is better.

6. **STOP** Test at <u>Instant</u> of Pulse Flash / Pulse SIMULTANEOUSLY:
   a. **Meter2**:   take **Photo2** of Meter (as above)
   b. **Pulse2**: Record Pulse Counter Count.

SHUT OFF WATER OR GAS FLOW

Pulse Volume Calculation
7. **Read the Meters in Photo1 and 2**

8. Pulse Volume =   <u>Total Flow</u> =   **Meter2 – Meter1**   (Meter)
               Total Pulses   **Count2 – Count1**   (Sensor)

For Diaphragm Gas Meters

Diaphragm Gas Meters lack 10 ft^3 & 1 ft^3 register resolution. Therefore the ½ ft^3 dial must be used.

Temporary Install at Meter

1. Strap Probe to meter. See Meter Guide pg 6.
2. Connect to Pulse Counter
3. **Start Gas flow to Tracking so Pulse LED flashes**

Data Collection
While Gas Continues to flow:

4. **START Test at <u>Instant</u> of Pulse Flash / Pulse SIMULTANEOUSLY:**
   a. **M1**: take **Photo A** of Meter ½ ft^3 Dial
   b. **Pulse1**: Record Pulse Counter Count.
      If counting Pulses by eye, do not include the START Pulse.
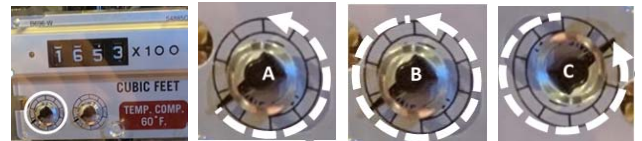
0.67	21.00	0.84
(7 is est)		(4 is est)

5. **During Test PERIOD**
   <u>Carefully Count</u> full rotations of the ½ ft^3 dial. Watch closely.
   ~10 rotations acceptable, 20 preferred. Example = 21.

6. **STOP Test at <u>Instant</u> of Pulse Flash / Pulse SIMULTANEOUSLY:**
   a. **M2**:   take **Photo C** of Meter ½ ft^3 Dial
   b. **Pulse2**: Record Pulse Counter Count

SHUT OFF GAS FLOW

Pulse Volume Calculation
7. **Totalize Flow from Photos**
   Ex: **Total = 0.67 + 21.0 + 0.84 = 22.51 rotations of ½ ft^3 dial**
           Total Flow = 11.255 ft^3

8. Pulse Volume = <u>Total Flow</u> =   **<u>Total Flow</u>**
              Total Pulses   **Pulse 2 – Pulse1**   (Counter)

VV-302 Pulse Volume Discovery Methods: Choose One

	Pre-Configured Sensors On OR Off-Site Pulse Volume Calculation				
	PRO TIP: During Peak flows, a Pulse-rate over what can be transmitted in 1 second are "banked" and transmitted when flow slows. Because of this, Pulse Volume cannot be accurately discovered if Meter is past Peak pulse at moment of **START** or **STOP**. If unit is pulsing at 10X per second do not **START** until it slows. If Started, do not **STOP** until it slows. The Unit can be re-configured to accomodate continuous Peak Pulse rates.				
METHODS	**C**	**D1**	**D2**	**E**	**F**
		DIFFICULT	*PREFERRED*	*PREFERRED*	*GOOD*
Revs from:	**Pulse Flashes** (or pulse counter)	**Pulse Flashes** (or pulse counter)	**Pulse Counter**	Customer Database	Customer Database
Flow from:	**Measured Container***	**Meter Photo (or video)**	**Meter Photo**	**Meter Photo**	**Utility Bill**
Situational Limits	Water ONLY Small or Controlled Buildings No Compound water meters	Meter Resolution <1 ft3	Meter Resolution <1 ft3 Pulse width of 50msec or longer	For Water and Gas NOTE: If gas meter res. = 100 ft3 START/STOP at 100.00 ft3 rollover	No Compound water meters Test month + Prior month MUST be Actual meter reads. No Est. reads.
Flow Limits	Test faucet ONLY. All other = 0	All Flows OK	All Flows OK	All Flows OK	All Flows OK
Accuracy	>95%.	>95%	>95%	>95%	1 month >95% 2 mon >97%
Poss. Error	Pulse Flash mis-count Secondary flows	Pulse Flash mis-count	Pulse Flash mis-count	Meter reading	Time of Bill Start/Stop Low seasonal usage
On-site Effort	Low	Medium	Medium	Low	Zero
Total Time	15 Minutes	15 Minutes	15 - 30 Minutes	Hours or days or weeks	32 - 63 days after install

VV-302 Pulse Volume Discovery Methods: Instructions

	C	**D1**	**D2**	**E**	**F**
Off - Site Prep	***Bring a measured container. The larger the better.**	None	None	Preferably Know Pulse Counter upload period	None
On - Site Prep	Temporary or Permanent Install -Strap Probe on Meter. See pg 6 -Connect probe to RSIM Board at Faucet -connect Pulse counter if using -Switch ON Power and LED	Temporary or Permanent Install -Strap Probe on Meter. See pg 6 -Connect probe to RSIM Board at Meter -connect Pulse counter if using -Switch ON Power and LED	Temporary or Permanent Install -Strap Probe on Meter. See pg 6 -Connect probe to RSIM Board at Meter -connect Pulse counter if using -Switch ON Power and LED	Permanent Install. Pg 3 Probe on Meter connected to RSIM Board Permanently Installed, tracking, communicating to database. **Confirm backend data reception**	Permanent Install. Pg 3 Probe on Meter connected to RSIM Board Permanently Installed, tracking, communicating to database. **Confirm backend data reception**
On - Site Data Collection	-run low flow, unit track **Pulse LED flashes** -Stop Flow. Confirm meter flow=0 -Start a low Flow down Drain. **START:** at LED Flash **Pulse0**, **Instantly** divert into container -**Do Not Overflow**. -Count Pulses (**Do not count 1st Pulse0**) **STOP:** at LED Flash **Pulse#** **instantly** divert flow to Drain. -if Container Overflow: Do over -**Stop flow.** Confirm meter flow=0 -Switch OFF LED -Repeat Test to Confirm Results	*If Diaphragm Gas Meter* : pg 7 -run low flow, unit tracks **Pulse LED flashes** If Video: Start recording with D5 LED & Meter register in 1 frame. Continue flow More flow=more accuracy. **STOP Flow** **STOP Video** - Switch OFF LED	*If Diaphragm Gas Meter* : pg 7 -run med flow, unit tracks **Pulse LED flashes** **START** at 1st **Pulse0**: **Simultaneously** -Take Photo1 of Meter -Record Pulse Count1 Continue flow. More flow=more accuracy. **STOP at last Pulse#**: **Simultaneously** -Take Photo2 of Meter -Record Pulse Count2 **STOP Flow** - Switch OFF LED	****Take Photos simultaneous with Pulse Counter upload. If not known, take photo every minute for an upload period. (ex:15 photos over 15 min) **START** Take Photo1 of Meter** To minimize error, Maximize flow between START / STOP: hours, days, weeks. **STOP** Take Photo2 of Meter.**	**No On-Site Data Collection**
Calculation & Final Install	Permanent Install. Pg 3 **Total Flow** = Measured Volume **Total Pulses** = Pulse Count Pulse0 to Pulse# (**Do not count 1st Pulse0**) **Volume per Pulse** = **Total Flow / Total Pulses**	Permanent Install. Pg 3 Review Video / Photos -Read Meter1 at first Pulse0 -Read Meter2 at last Pulse# **Total Flow** = Meter2 - Meter1 **Total Pulses** = Pulse Count Pulse0 to Pulse# (**Do not count 1st Pulse0**) **Volume per Pulse** = **Total Flow / Total Pulses**	Permanent Install. Pg 3 Review Photos -Read Meter1 in Photo1 -Read Meter2 in Photo2 **Total Flow** = Meter2 - Meter1 **Total Pulses** = (Count2 - Count1) **Volume per Pulse** = **Total Flow / Total Pulses**	Choose Photos time stamped closest to Pulse Counter Uploads -Read Meter1 in Photo1 -Read Meter2 in Photo2 **Total Flow** = Meter2 - Meter1 Use Photo1 & 2 time stamps to calculate **Total Pulses** received in database during period. **Volume per Pulse** = **Total Flow / Total Pulses**	Review Utility Bills Test month and prior month MUST be "Actual" reads. **Total Flow** = Utility Bill volume (converted to std units ex: ft3) From your database, calculate **Total Pulses** from -noon 1st day to last day of bill **Volume per Pulse** = **Total Flow / Total Pulses**