VATA VERKS
water and gas intelligence for buildings

Non-Invasive Whole Building
Water/Gas Data Acquisition
VV – 102 – XX – G
VV – 102 – XX – W

Instructions for
WATER & GAS METERS

EXPRESS KIT

Downloads & Drivers pg 3
Try Simulation pg 5

OPTIONAL ACCESSORIES

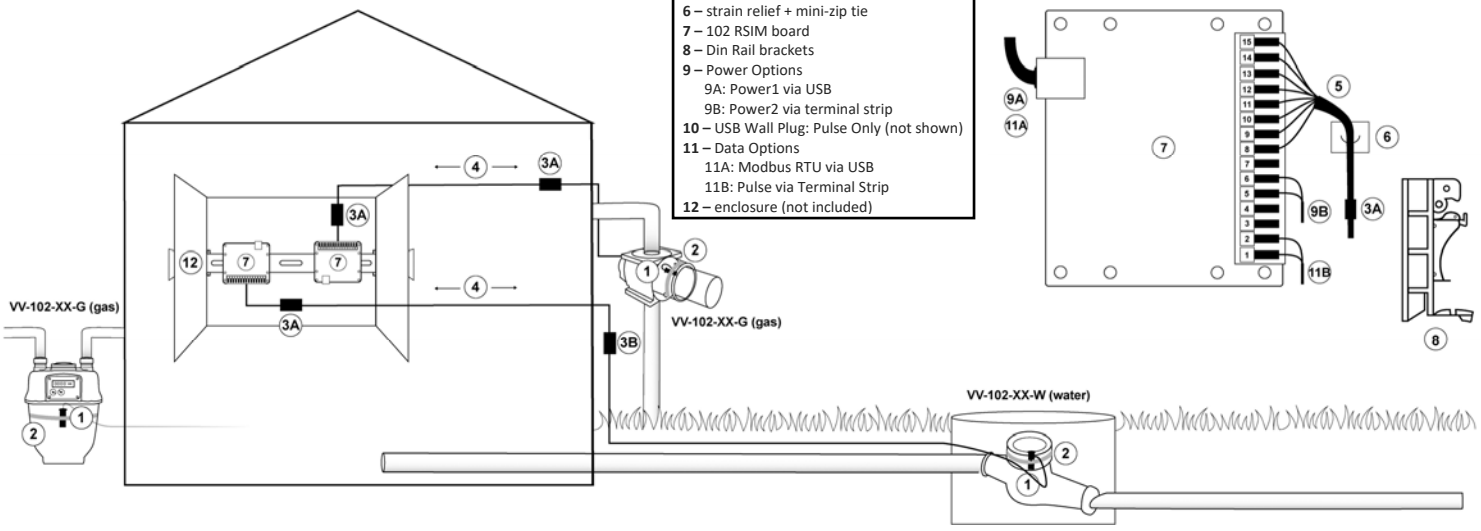
AC-104 : Installation Convenience Kit
AC-107 : Battery backup (with 110v adaptor)
AC-108 : 12v/24v converter to 5v USB
VVA-114 : Wet RJ45 coupler

Setup

Configuring On-Site or Off-Site

Supplement

KEY
1 – remote probe (2M, 7M or 15M lengths)
2 – Zip Tie (UV resistant)
3A – dry RJ45 coupler included (VVA-113)
3B – wet RJ45 coupler (option: VVA-114)
4 – CAT6 extension cable (not included)
5 – CAT6 pigtail
6 – strain relief + mini-zip tie
7 – 102 RSIM board
8 – Din Rail brackets
9 – Power Options
9A: Power1 via USB
9B: Power2 via terminal strip
10 – USB Wall Plug: Pulse Only (not shown)
11 – Data Options
11A: Modbus RTU via USB
11B: Pulse via Terminal Strip
12 – enclosure (not included)

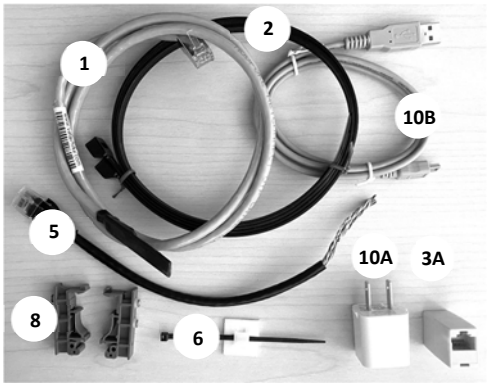


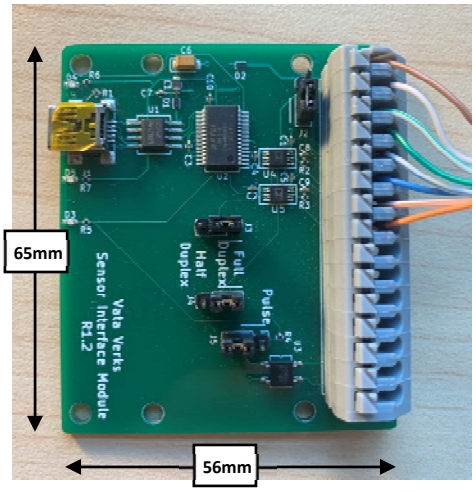
IMPORTANT WARNINGS

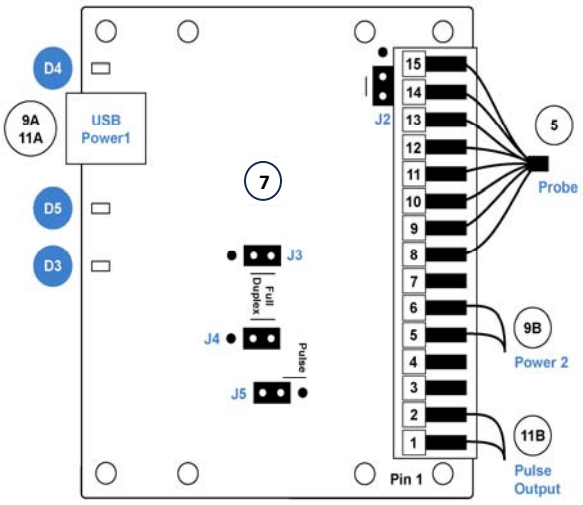
NOT FOR USE IN HAZARDOUS OR EXPLOSIVE ENVIRONMENTS

- **Conform 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.
- Vata Verks 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.

HARDWARE LAYOUT / SPECIFICATIONS







Probe Components

1 Remote Probe (various lengths)
2 Zip Ties
3A (1) dry RJ45 Coupler
4 CAT6 Ext + 2nd Coupler (not included)
5 CAT6 Pigtail
6 Strain Relief + mini-Zip Tie

Board Components

7 102 RSIM Board
8 Din Rail Brackets (see pg 8)
9 Power Options
  9A Power1: USB Terminal
    110v via USB wall plug
    5v via Mini-USB
  9B Power2: Terminal Strip
    Terminal 5: Ground
    Terminal 6: +5v DC
10A USB Wall Power Plug
10B USB power / programming cord
11 Data Options
  11A RTU via Mini-USB
  11B Pulse via Terminal Strip
    (see Pulse Specification right)

LED Key

D3: Pulse Mode
  Blink = Pulse indicator
  Solid = Exited Pulse Mode
    (OR probe disconnected)
D4: RTU Mode
  Blink = RTU transmission
D5: Power
  Solid = Power

Jumper Key

J2 Admin Use Only / spare jumper
J3, **J4** Console
J5 Pulse

Accessories

AC-108: 12v or 24v converter to 5v USB
AC-104: Install Convenience Kit
AC-107: 110v power supply + Battery back up
VVA-114: RJ45 Wet Coupler

VV-102 SPECIFICATIONS

Water Version: **VV-102-XX-W**
Compatible 95% of utility meters
All positive displacement, piston compound, multi-jet, single jet
Incompatible: Ultra-sonic.
For Sensus Omni: Use VV-200 series

Gas Version: **VV-102-XX-G**
Compatible >99% of utility meters
All diaphragm, rotary, turbine.
Incompatible: Ultra-sonic

Data Protocols
- Pulse via Term. Block
- Modbus-RTU via USB full duplex

Typical Accuracy (12 month)
- Water >99% Gas >97%

Installation Limits
- -20C to 40C
- 10% - 95% RH non-condensing
- Not for hazardous locations

Sensor Probe
- Outdoor, immersion, burial
- 2M, 7M, 15M long burial CAT6, AWG 23, RJ45, Pin out T568B
- Extendable to 60M / 200 ft.

102 RSIM Board (65mm x 56mm)
- Indoor or in User enclosure
- Mounts on Din Rails
- Mounts on Raspberry Pi
- Direct fasten to enclosure

Pulse Specification
- Solid State Optically Isolated Relay: DC or AC ok. No Polarity.
- Width= 10 – 100 msec (default=50)
- Max Voltage: 24v DC / 17V RMS AC
- Max Current: 1A DC / 0.5A AC RMS
- Isolation Voltage: 1kV RMS
- Device is a CPC 1020N
- Pulses>Max rate: pulsed when slow
- Pulse Wire: 16 - 24 gauge (not incl)

Modbus RTU Specification
- Resister Terminated
- Full Duplex Output via USB Port

Power Consumption: <45mA Max

Standard Power
- 110v, USB@5v, 5v
- USB & 5v may be powered in parallel.

Optional Power
- 12v/24v AC-108
- 100v + Battery Backup AC-107

Certifications
Complies with Part 15 of FCC Rules

SOFTWARE PREP AND HARDWARE ASSEMBLY

Pro- Tip: All VV-102 units shipped after 11/2023 will be pre-configured in Pulse-mode, Pulse k-factor 1.0, Pulse width 50 msec. If the Jumpers are moved to Position B (pg 4) the sensor unit could be directly installed

1. Download Terminal Emulator & FTDI Driver

For **Windows OS: Tera Term** (PuTTY and other emulators may be used)

1. Go to: https://download.cnet.com/
2. Enter: "**Tera Term**" in the **Download** search bar.
3. **Download** and **Install** "**Tera Term**" with default settings
4. Go to: https://ftdichip.com/
5. Navigate to **Drivers** then **VCP** and Download Driver
   If Windows: Download "**Setup Executable**" under Comments.
6. **Reboot Laptop**

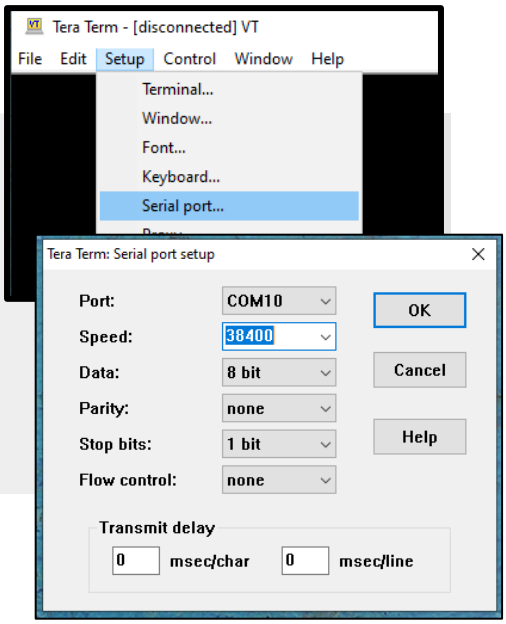
2. Assemble Unit and Connect Laptop

1. Connect **Remote** Probe to Board. **(See right)**
2. Connect to laptop with the mini-USB cable. D5 LED Solid "On"

3. Configure "Tera Term"

PROBE MUST BE CONNECTED TO BOARD

1. Open **Tera Term**.
2. Click **Setup** for dropdown
3. Choose **Serial Port…**
4. **Configure** as shown **right**
5. **Port*** Choose the Com#.
6. **Speed**** Choose Baud Rate **(default = 38,400)**
7. Click **New Open**



Troubleshooting: Opening Emulator

***If Port prompt is "grey", and unit is connected to laptop as directed above, the laptop's FTDI Driver may be missing. Recheck above.**

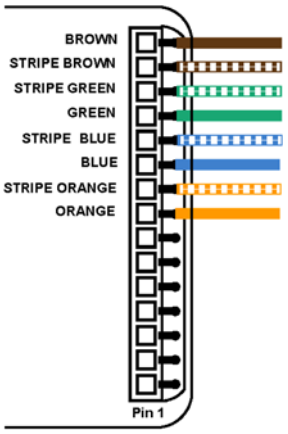
****Sensor and Terminal Emulator MUST be set to same Baud rate.**

*Your Tera Term configuration can be saved. At **Setup** dropdown: click "**Save Setup**"*

To Connect to Remote Probe

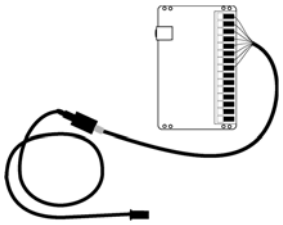
1

Wire **CAT6 Pigtail** to **Terminal Strip**
Depress / Insert / Release



2

Connect Remote Probe to
Pigtail using supplied Coupler



IMPORTANT
If extending the Probe's CAT6 cable:
Probe End-to-Main Unit **Max Length = 200 ft**
Requires additional Coupler.

OPENING CONSOLE

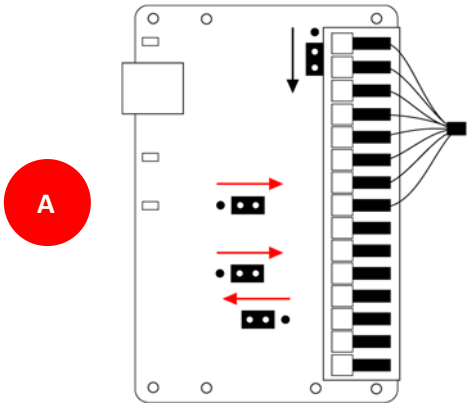
Probe MUST be Connected to Board

Opening Console from Console Mode
Jumpers in Position A

1. **Open Emulator pg 3**
2. TYPE: **shift '6', shift '6', shift '6**; *(shift '6', 3X)*
   Console Opens on Screen

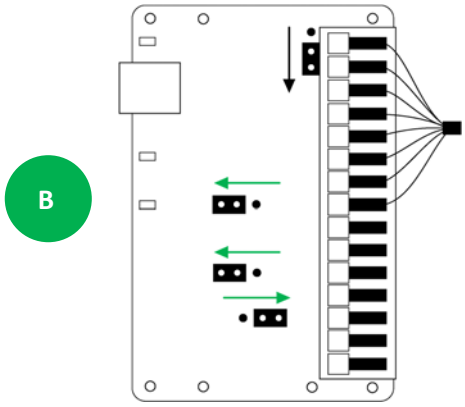
Not Open? Possibly in Pulse Mode.

1. Move Jumpers: **Position B**
2. Follow Instructions **RIGHT**



Opening Console from Pulse Mode:
Jumpers in Position B

1. **Open Emulator pg 3**
2. TYPE: **shift '6', shift '6', shift '6**; *(shift '6', 3X)*
   D3 LED Lights **SOLID**
3. Move Jumpers: **Position A**
   Now in **Console Mode**.
4. Follow Instructions to **LEFT**



Console

Modbus Screen

	t	Display amplitude and tracking status
Mode Settings	m x	Set Mode (ex: m m)
		m m for Modbus
		m p for Pulse (default)
		m t for Pulse Test
RTU Settings	a xxx	Set Modbus address: 1-255 (ex: a 170)
	b x	Set Modbus baud rate (ex: b 5)
		Valid Entries:
		1=2400
		2=4800
		3=9600
		4=19200
		5=38400 (default)
		6=57600
		7=115200
	h	Set boost signal (default)
	w	Clear boost signal
	c	Display Configuration
	s	Display Status
	f	Restore Factory Defaults
	R	Reset
	x	Exit

m(space)p ENTER opens Pulse Screen

Pulse Screen

	t	Display amplitude and tracking status
	m x	Set Mode (ex: m m)
		m m for Modbus
		m p for Pulse (default)
		m t for Pulse Test
Pulse Settings	k xxx.xxx	Set Pulse k factor (ex: k 58.95)
	d xxx	Set Pulse width, 10 to 100 msec (ex: d 100)
	h	Set boost signal (default) (enable)
	w	Clear boost signal (disable)
	c	Display Configuration
	s	Display Status
	f	Restore Factory Defaults
	R	Reset (or power cycle)
	x	Exit

Troubleshooting: Opening Console

- If in Console Mode: Inspect wiring. Possibly disconnected.
- If in Pulse Mode and D3 LED Solid in **Pos B**, but will not open in **Pos A.** Probe wiring IS disconnected. Inspect. Replace Coupler. Until D3 is Off.
- If Baud Rate of Sensor and Emulator do not match.
  - Jumpers to **Position A**. Tera Term to 38,400
  - Power Cycle, **then** Shift '6' 3X, within **10 sec.** Console Mode opens
- If using a non-North American keyboard. Shift 6 3X, may not work.
  - Instead Type: NNN Wherever Shift 6 3X is called for.

NAVIGATING FROM CONSOLE MODE

▶ 1. Optional: Familiarize

SIMULATE FLOW TRACKING

The Earth's magnetic field can be used to simulate meter tracking

From Console (pg 4)

1. **t** **ENTER** to display tracking.
2. Roll Probe back and forth **(as below)**

amp = 1705, rev = 1
amp = 1673, rev = 2

Output Explained

amp = 1705 = Magnetic strength.
- >360 required to track

rev = 12 = Totalized Meter Revolutions.
- The Meter K-factor would be used to convert revolutions to total volume.

TRACK FLOW ON METER

From Console (pg 4)

1. Strap Probe to the meter **pg 9**
2. **t** **ENTER** to display tracking
   >360 amp required. >500 preferred
3. Run water or gas (safely follow manufacturer instructions)
   amp=1705, rev=1
   amp=1673, rev=2
4. **Shut OFF Water / Gas flow**

▶2. Required: Find K-Factor / Pulse Vol

DISCOVER YOUR PULSE VOLUME

The VV-102 is pre-configured to Pulse at each 1.0 meter revolution. (and easily reconfigured)
Each Pulse = a Pulse Volume.
The Pulse Volume is used to convert received Pulses into flow data.
Choose a Pulse Vol. Discovery Method. pg 11

Pulse Volume can also be calculated from a meter's K-factor (meter size in revs/unit vol)
Pulse K-factor = Revs per Pulse = Pulse Volume
Meter K-factor Revs per Unit Vol

K-FACTOR ALREADY KNOWN

Many meter k-factors are already 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 can vary on individual meters. Measuring k-factor for the specific meter is **Highly Recommended** and **REQUIRED** for highest accuracy.

MEASURING K-FACTOR

If Laptop is on Site: K-factor Discovery Method 'B' pg 10 is the most common method.

If Unit is Pre-configured, no laptop on site.
Choose a Pulse Volume Discovery Method. pg 11

Choose a Method BEFORE Configuring

▶ 3. Complete Config.

For Pulse: pg 6

For Modbus: pg 7

Trouble Shooting: Tracking on Meter
See Trouble Shooting pg 8

CONFIGURING PULSE

Configuring for Pulse from CONSOLE (pg 4)
Jumpers Position 'A'

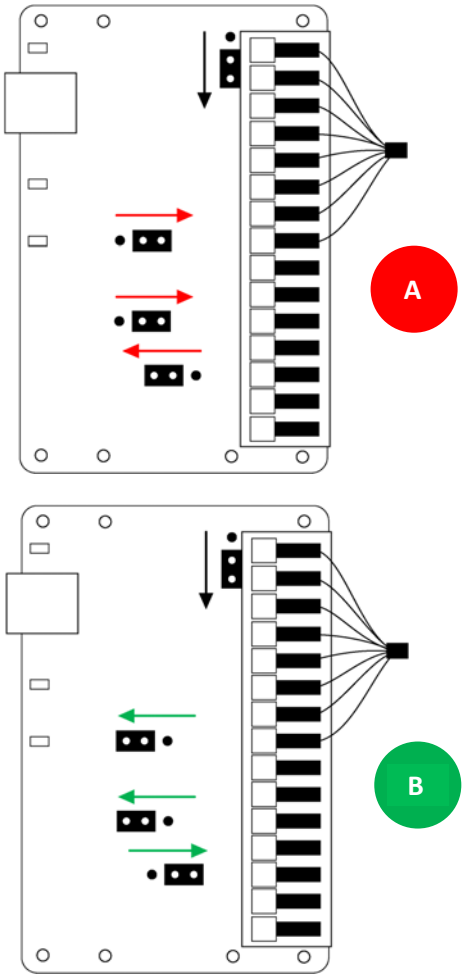
1.	**m**(space)**p**	**ENTER**	Opens Pulse Console
2.	**k**(space)**XXX.XX**	**ENTER**	Pulse K-factor = Revolutions per Pulse

PULSE K-FACTOR OPTIONS

A) Generic Pulse k-factor, ex: 1.0 or 10.0 Revs / Pulse is easiest to Pre-Configure and Deploy. Volume per Pulse is calculated in the back end.

B) Volumetric Pulse k-factor: Each Pulse represents a unit volume (ex: 1 ft3). Use Meter K-factor to calculate the revolutions required for that volume. ex: if 426.45 revs = 1 ft3, enter k 426.45 into Console. Then 1 pulse = 1 ft3. Usually requires more time for on-site configuration.

3.	**c**	**ENTER**	Displays Pulse Configuration. Confirm.
4.	**R**	**ENTER**	Activates Configuration. Enters Pulse Mode
5.	**Jumpers to Position 'B'**		
	Optional **Pulse Simulation** (see bottom right this page)		
6.	Complete Final Installation **pg 8**		



To EXIT Pulse Mode (OR Pulse Test) back to Console Mode:

1.	Set Terminal Emulator to default 38,400 if changed		
2.	Type: **Shift '6' 3X**		D3 LED lights Solid. Exits Pulse Mode
3.	**Jumpers to Position 'A'**		
4.	Type: **Shift '6' 3X**		Console opens
5.	**m**(space)**p**	**ENTER**	Opens Pulse Console

NOTE: "Boost" reverts to Enabled upon Exiting Pulse

Optional Pulse Test Mode:
Auto outputs 1 Pulse / second to test Pulse Wiring and Pulse Counting.

1.	**m**(space)**t**	**ENTER**	Set for Pulse Test Mode
2.	**R**	**ENTER**	to Activate changes
3.	**Jumpers to Position 'B'**		
4.	**To start Pulses: Shake probe back and forth 5 times.**		

Troubleshooting:

- **Difficulty exiting to Console mode**
  - Follow both sets of instructions top of pg 3.
- **Will not accept Pulse K-factor when entered.**
  - Pulse K-factor Minimum = 1.0 Maximum = 30,000
    If <1.0, increase Pulse k-factor AND Pulse Vol. (ex. Change 0.23 rev/1 ft3 to 2.3 rev/10 ft3)

SIMULATE PULSE OUTPUT

- Configure Pulse as instructed **(left)**
- Roll sensor back and forth
- D3 LED will blink with every Pulse.
- If **Pulse k-factor = 1.0**
  Unit will pulse every cycle

CONFIGURING MODBUS RTU

The VV-102 is Resister Terminated and features Full Duplex Modbus RTU via the USB Port.
The VV-102 is shipped from factory in Pulse Mode. Follow pg 3 Instructions "Opening Console from Pulse Mode"

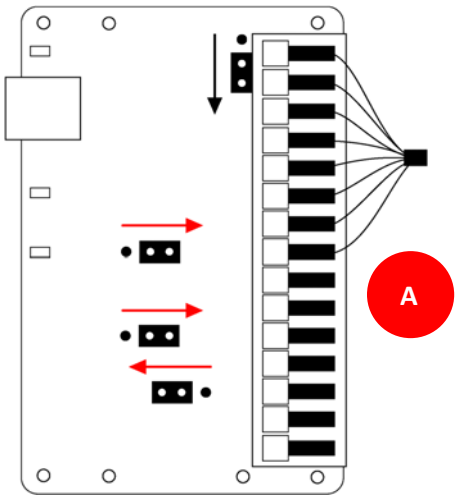
▶ Configuring for Modbus RTU from CONSOLE (see pg 4)

Jumpers Position 'A'

1.	**m(space)m**	**ENTER**	for Modbus RTU Mode
2.	Modbus address	(default 170)	Change if required
3.	Modbus baud Rate	(default 38,400)	Change if required
4.	**c**	**ENTER**	Displays Modbus Configuration
5.	**R**	**ENTER**	to Reset or Power-Cycle Activates Configuration

NOTE: After Reset, if Baud changed, Emulator Baud MUST change

6. Complete Final Installation **Pg 8**



1. To EXIT Modbus RTU Mode to Console Mode:

Type: **shift '6' 3X** Console Opens

NOTE: Baud of Emulator & Sensor must match. See Troubleshooting pg 4.

MODBUS RTU CONSOLE

t Display amplitude and tracking status
m x Set Mode (ex: m m)
m m for Modbus
m p for Pulse (default)
m t for Pulse Test
a xxx Set Modbus address: 1-255 (ex: a 170)
b x Set Modbus baud rate (ex: b 5)
Valid Entries:
1=2400
2=4800
3=9600
4=19200
5=38400 (default)
6=57600
7=115200
h Set boost signal (default)
w Clear boost signal
c Display Configuration
s Display Status
f Restore Factory Defaults
R Reset
x Exit

CONFIGURING MODBUS RTU MASTER

The RTU Sensor defaults are as follows:
1. Baud rate: 38,400
2. 8 bit data, No Parity, 1 stop bit.
3. Modbus Address 170

The RTU Sensor supports the following function codes:
03: Read Registers
06: Write Single Register
16: Write Multiple Registers

The following data registers are available

Offset	Read / Write	Description	
0	R	Software Version	The version of the running software
1	R	Address	The current Modbus Address
2	R	Rev. Count low word	32 bit value of the current revolution count
3	R	Rev. Count high word	Read the 2 together to confirm no roll over between reads.
4	R/W	RTU Sensor Command	01: Reset the revolution counter 02: Issue a software reset to the Modbus RTU Sensor
5	R	Signal Level	A positive value proportional to the signal strength. Requires >1 revolution of utility meter to be a value other than 0.
6	R	State	Can either be Acquiring a signal or Counting revolutions. 01=Acquisition 02=Tracking
7	R	Sensor Bus voltage in mV	Normal operating voltage is 3300mV (+/-100mV) A voltage < 2600mV is unacceptable. Investigate the problem. Lower values can be excessive cable losses (long runs) or low 5VDC supply voltage (USB power).
8	R	Sensor Temp. in degrees C	Note: not highly accurate. Considered a relative measurement. A temp. approaching 0, is a cause for water freeze alarm. Accuracy is not guaranteed.

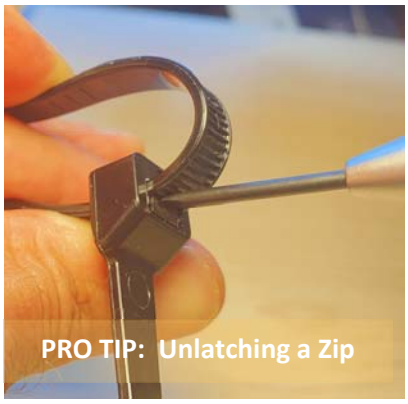
INSTALLATION

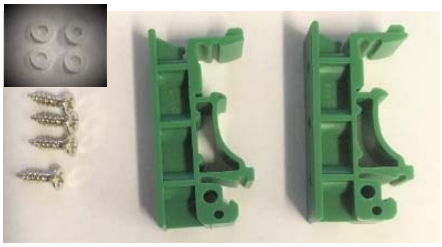
Installation of Configured Units

NOTE: The Sensor must be Pre-configured, OR Configured during Final Installation.

1. Run Probe Cable + CAT6 extension from Meter to Enclosure (see pg 1)
   - Probe + Probe Extension: **NOT to exceed 60M / 200 ft.**
   - **PRO TIP**: If removing /re-crimping probe RJ45 connector: Pin out T568B
2. Zip tie Probe to Meter, cable to pipe. Refer to Meter Guide **pg 9**
   - **PRO TIP**: Re-use Zip Ties. Flat head Jeweler screwdriver to open latch.
3. Inside your Enclosure: Mount Sensor Board with Pigtail. Choose:
   - on Din Rails **(see brackets right)**
   - on Raspberry Pi
   - on enclosure wall with screws or Velcro tape
4. Zip tie Pigtail to enclosure with Adhesive Strain relief
5. Make Final Connections **(pg 2)**
   - Connect Probe to pigtail with included Coupler
   - If Pulse: Connect to Power and Pulse Counter.
   - If RTU: Connect USB cable to network and Power.
     Note: Power1 / Power2 may be wired in parallel for both Pulse or RTU

IMPORTANT: If probe moves, power cycle **AFTER** re-securing probe


PRO TIP: Unlatching a Zip




Din Rail Brackets

Commissioning

1. **Flow Water or Gas safely (as instructed by appliance manufacturer)**
   - Confirm successful Pulse or RTU Communications
   - **PRO TIP:** If flow is impossible, pg 6 Simulation can create Pulse / RTU data. After confirming data transmission, strap probe to meter, and power cycle.
2. **Shut OFF Water or Gas flow**
3. Pulse Volume / **Meter k-factor**.
   Review discovery options pg 11, if not already chosen.
4. **Document the Installation**
   - Record: Meter Model, K-factor, Pulse K-factor, Probe Serial No, Installation Photo, location. Email to: info@vataverks.com

Installation Complete

Troubleshooting: Installation

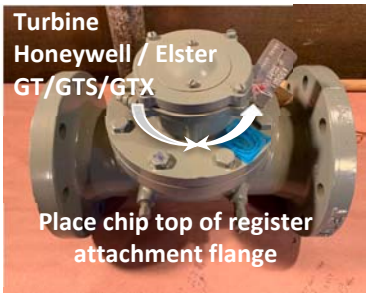
- Exterior Meter with exterior RJ45 Connections
  - Use IP68 waterproof Couplers.
  - OR use longer Probes to make interior Connections.
- Pulses are not Counted.
  - Check Pulse output wiring.
  - Pulses too short for Counter. Increase Pulse width.
- ****OVERFLOW**** Alert in Console Mode = Over Strong Magnetic field
  - Shift Probe to weaker location
  - OR Disable Boost. Then Reset

Troubleshooting: Installation

- Not Tracking Flow
  - Magnetic Signal too weak. Shift Probe. Amplitude **>360 R**equired to track.
  - Confirm "Boost" is enabled.
  - Meter is incompatible **(see compatibility pg 2)**
  - Are you using a too long probe cable run or using non-CAT6 probe cable?
    - s Enter for Status
    - If probe voltage is <3000mV, shorten cable or increase wire gauge.

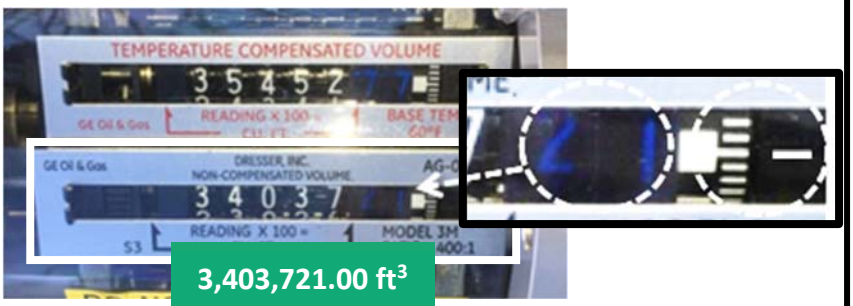
METER GUIDE

Rotary or Turbine Gas Meters



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)

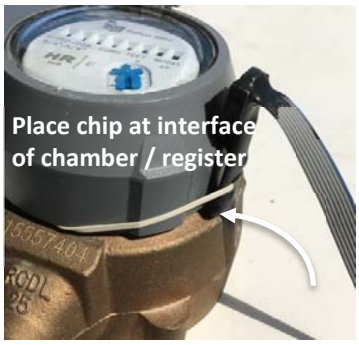


When Compensated & Non-Compensated output is greatly different the utility may be using a high pressure feed.

Confirm K-factor with the Monthly Bill

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

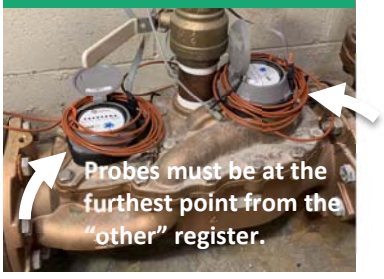
Water Meters



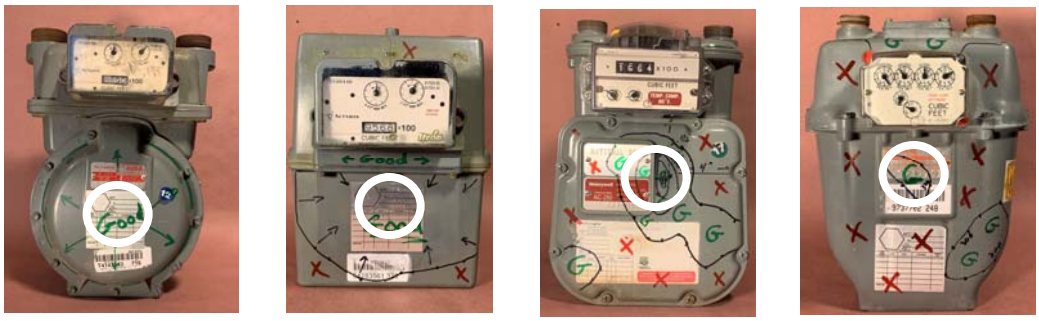
METER READING

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.

Compound Meters
Requires (2) Units



Diaphragm Gas Meters:
Place Probe Vertically + Horizontally Centered <u>Front OR Back</u>



K FACTOR DISCOVERY METHOD "B"

For all Meters with Resolution < 1 ft³

(If resolution = 100 ft³ this method may be unsuitable)

Temporary Install at Meter

From Console Mode pg 4

NOTE: Keep Board Safe in Plastic Bag

1. Strap Probe to meter. See Meter Guide **pg 9**
2. **t ENTER** to Display Tracking Status
3. **Start flow (Water or Gas) to Track**
   amp = 7785, rev = 2 **TRACKING (2 Revs)**
   amp = 7619, rev = 9

Data Collection

1. **To START Test**
   Simultaneously:
   a. **rev1**: Record Rev count (ex: 12 revs) **AND**
   b. take **Photo1** of Meter (as below)

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

Photo1

62.00 ft³

Photo2

62.10 ft³

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

3. **To STOP Test**
   Simultaneously:
   a. **rev2**: Record Rev count (ex: 85 revs) **AND**
   b. take **Photo2** of Meter (as above)

SHUT OFF WATER OR GAS FLOW

Optionally, shut off flow after Step 2

K-Factor Calculation

4. **Read the Meters in photos**

5. **k-factor =** **total Revs** = rev2 – rev1 (from Sensor)
   total Vol Photo2 – Photo1 (from Meter)

6. Complete configuration **pg 6 or 7.**

For Diaphragm Gas Meters

Diaphragm Gas Meters lack 10 ft³ & 1 ft³ register resolution. Therefore the ½ ft³ dial must be used.

Temporary Install at Meter

From Console Mode pg 4

NOTE: Keep Board Safe in Plastic Bag

1. Strap Probe to meter. See Meter Guide **pg 9**
2. **t ENTER** to Display Tracking Status
3. **Start Gas flow to Track**
   amp = 7785, rev = 2 **TRACKING** (ex: 2 Revs)
   amp = 7619, rev = 3

Data Collection

**While Gas Continues to flow:*

1. **START** Test at **Instant of** Sensor **Rev Roll Over.**
   amp = 7785, rev = 7
   amp = 7619, rev = 7 ⬅ **AT ROLL OVER: START TEST**
   amp = 7621, rev = 8
   SIMULTANEOUSLY:
   a. **rev1**: Record Rev count from Vata Verks sensor **AND**
   b. take Photo A of Meter ½ ft³ Dial

0.67
(7 is est)

21.00

0.84
(4 is est)

2. **During Test PERIOD**
   Carefully Count full rotations of the ½ ft³ dial. Watch closely.
   ~20 rotations is acceptable. **(21 illustrated in Photo B)**

3. **STOP Test at the Instant of Roll Over.**
   SIMULTANEOUSLY:
   a. **rev2**: Record Rev count from Vata Verks sensor **AND**
   b. take Photo C of Meter ½ ft³ Dial

SHUT OFF GAS FLOW

K-Factor Calculation

4. **Totalize flow volume from Photos**
   Ex: **Total =** 0.67 + 21.0 + 0.84 = 22.51 rotations of ½ ft³ dial
   Total Vol = 11.255 ft³

5. **k-factor =** **total Revs** = rev2 – rev1 (from Sensor)
   total Vol 11.25 (from Meter)

6. Complete configuration **pg 6 or 7.**

VV-102 K-factor / Pulse Volume Discovery Methods: Choose One

	On-Site Configuration On-Site K-factor Calculation (laptop on-site)		Off-Site Configuration Off-Site K-factor Calculation (no laptop on-site)			
			*METHOD C & D2 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 D3 LED is pulsing at 10X per sec, do not **START** until it slows. If Started, do not **STOP** until it slows.			
METHODS	**A**	**B**	**C***	**D2***	**E**	**F**
		PREFERRED		***PREFERRED***	***PREFERRED***	***GOOD***
Revs from:	**Laptop**	**Laptop**	**Pulse Flashes** Pulse Counter	**Pulse Counter** Pulse Counter	**Customer Database**	**Customer Database**
Flow from:	**Measured Container**	**Meter Photo**	**Measured Container****	**Meter Photo**	**Meter Photo**	**Utility Bill**
Situational Limits	Water ONLY Small or Controlled Buildings No Compound water meters	Meter Resolution <1 ft3	Water & Pulse ONLY Small or Controlled Buildings No Compound water meters Electric power at faucet If Pulse K-factor 1.0: Low flows only	Pulse ONLY Electric power at meter Meter Resolution <1 ft3	For Water and Gas. NOTE: If gas meter resolution = 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	Test faucet ONLY. All other = 0	All Flows OK	All Flows OK	All Flows OK
Accuracy	>95%.	>99%	>95%.	Video: >99%, Eye: ~95%	>99%	1 month >97% 2 mon >98%
Poss. Error	Secondary flows Few revolutions	Meter reading	Pulse Flash mis-count Secondary flows	Flash mis-count	Meter reading	Time of Bill Start/Stop Low seasonal usage
On-site Effort	Low	Medium	Low	Medium	Low	Zero
Total Time	15 minutes	15 minutes	15 Minutes	15 Minutes	Hours or days or weeks	32 - 63 days after install

VV-102 K-factor / Pulse Volume Discovery Methods: Instructions

Off - Site Prep	**Unit Set-up pg 3**	***If Diaphragm Gas Meter: pg 10*** **Unit Set-up pg 3** **See full example Pg 10**	**Unit Set-up pg 3** **Pre-configure for Pulse pg 6** Pulse K-factor 1.0 or 10.0	***If Diaphragm Gas Meter: pg 10*** **Unit Set-up pg 3** **Pre-configure for Pulse pg 6** Pulse K-factor 10.0	**Unit Set-up pg 3** **Pre-configure pg 6 or 7** **Know Pulse Counter upload period**	**Unit Set-up pg 3** **Pre-configure pg 6 or 7**
On - Site Prep	**Temporary Install for K-factor** Probe on Meter pg 9 connected to RSIM Board+Laptop at Faucet (board protected in plastic bag) -at Console Mode pg 4 **t ENTER**: to display tracking	**Temporary Install for K-factor** Probe on Meter pg 9 connected to RSIM Board+Laptop at Faucet (board protected in plastic bag) -at Console Mode pg 4 **t ENTER**: to display tracking	**Temporary Install** Probe on Meter pg 9 connected to RSIM Board at Faucet (board protected in plastic bag) -connect RSIM board to power -connect Pulse counter if using	**Temporary Install** Probe on Meter pg 9 connected toRSIM Board at Meter (board protected in plastic bag) -connect RSIM board to power -connect Pulse counter if using	**Permanent Install. Pg 8** Probe on Meter connected to 102 RSIM Board Permanently Installed, tracking, communicating to database. **Confirm data reception**	**Permanent Install. Pg 8** Probe on Meter connected to 102 RSIM Board Permanently Installed, tracking, communicating to database. **Confirm data reception**
On - Site Data Collection	-run low flow, unit tracks **D3 LED flashes** -Stop Flow at flash. -Confirm meter flow=0 -Record Rev1 count from laptop **START** -Fill Container to measure line. (larger = better) **STOP** -Confirm meter flows=0 -Record Rev2 count from laptop Repeat to confirm results.	-run flow until unit tracks **D3 LED flashes** **AT START: Simultaneously** -Record Rev1 from laptop -Take Photo1 of Meter More flow = more accuracy **AT STOP: Simultaneously** -Record Rev2 from laptop -Take Photo2 of Meter -Stop flow.	-run low flow, unit tracks **D3 LED flashes** -Stop Flow at flash -Confirm meter flow=0 -Start Flow down Drain. **START:** at D3 LED Flash **Pulse0**, **instantly** divert to container -**Do Not Overflow**. -Count D3 Pulses **(Do not count 1st Pulse0)** **STOP:** at D3 LED Flash Pulse# **instantly** divert flow to Drain. -if Container Overflow: Do over -Stop flow. -Confirm meter flow=0 -Repeat to Confirm Results	-run med flow, unit tracks **D3 LED flashes** **START** at 1st D3 LED **Pulse0**: **Simultaneously** -Take Photo1 of Meter -Record Pulse Count1 Continue flow. More flow=more accuracy. **STOP** at last D3 LED **Pulse#: Simultaneously** -Take Photo2 of Meter -Record Pulse Count2 Stop Flow	**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 8** **Total Flow** = Measured Volume **Total Revs** = Rev2 - Rev1 **K-factor =** **Total Revs / Total Flow** **Configure (Pulse / RTU) pg 6 or 7**	**Permanent Install. Pg 8** Read Meters from Photo1 & 2 **Total Flow** = Photo2 - Photo1 **Total Revs** = Rev2 - Rev1 **K-factor =** **Total Revs / Total Flow** **Configure (Pulse / RTU) pg 6 or 7**	**Permanent Install. Pg 8** **Total Flow** = Measured Volume **Total Pulses** = Pulse Count Pulse0 to last Pulse# **(Do not count 1st Pulse0)** **Volume per Pulse =** **Total Flow / Total Pulses** **Larger Pulse Volumes may require large or multiple containers.	**Permanent Install. Pg 8** Read Meters from Photo1 & 2 **Total Flow** = Meter2 - Meter1 **Total Pulses** = (Count2 - Count1) **Volume per Pulse =** **Total Flow / Total Pulses**	Choose Photos time stamped closest to a Pulse Counter Upload Read Meters from Photo1 & 2 **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 noon last day of bill **Volume per Pulse =** **Total Flow / Total Pulses**