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

Get Optional Install Kit: AC-104
All the handy install parts

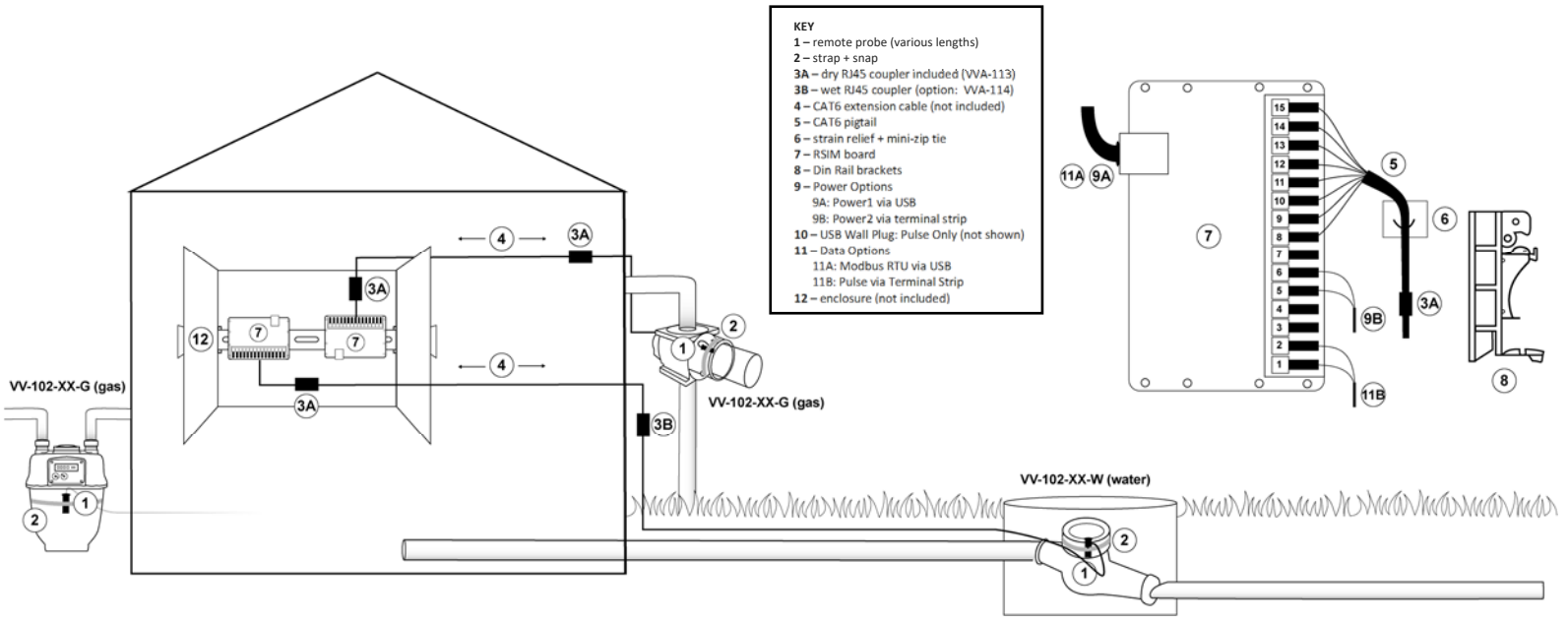
Downloads & Drivers pg 3
Try Simulation pg 5

Exterior Connections?
Stay Dry: Longer Probes

Setup

Configuring On-Site or Off-Site

Supplement



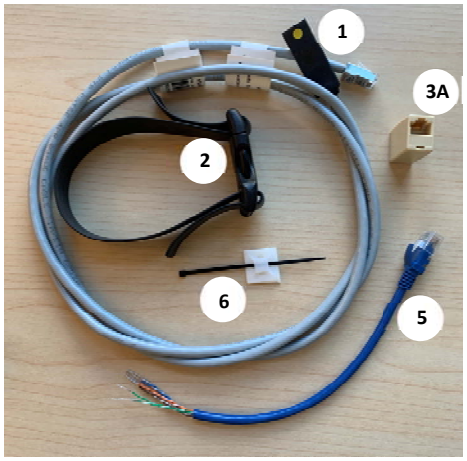
*****IMPORTANT WARNINGS*****

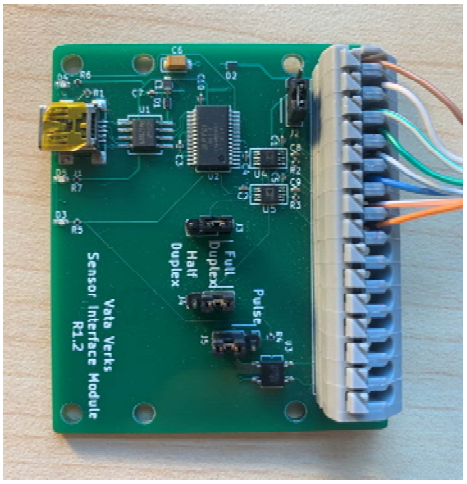
CONFIRM METER COMPATIBILITY before invasive site work. See Meter Guide pg: 9, pre-test On-site, or contact Vata Verks.

DO NOT INSERT this device's RJ45 connectors into any ethernet device (ex: your laptop). Permanent damage may result.

NOT FOR USE IN HAZARDOUS OR EXPLOSIVE ENVIRONMENTS

HARDWARE LAYOUT / SPECIFICATIONS



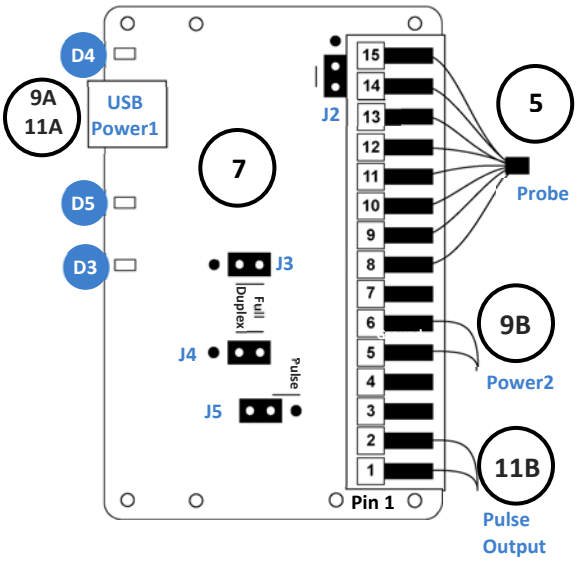


Probe Components

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

Board Components

7 RSIM Board
8 Din Rail Brackets (see pg 8)
9 Power Options
9A Power1: 5V via Mini-USB
9B Power2: Terminal Strip
Terminal 5: Ground
Terminal 6: +5VDC
10 USB Wall Power Plug (not shown)
11 Data Options
11A RTU via Mini-USB
11B Pulse via Terminal Strip
(see Pulse Specification right)
12 Enclosure (not included)



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

VV-102 SPECIFICATIONS

Water Version: **VV-102-XX-W**
Compatible with 95% of meters
All positive displacement, piston compound, multi-jet, single jet
Incompatible: Ultra-sonic / Sensus Omni: see VV-200 series
Gas Version: **VV-102-XX-G**
Compatible with 98% of meters
All diaphragm, rotary, turbine.
Incompatible: Ultra-sonic

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

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

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

Board
- Indoor or in User enclosure

Remote Probe
- Outdoor, immersion, burial
- Max extended: 200 ft CAT6

Board Mounting Options
- On included Din Rail brackets
- On Raspberry Pi
- Direct fasten to enclosure

Pulse Specification
- 1 to 10,000 meter revolutions
- 10 – 100 m-sec width
- Solid State Relay: DC or AC ok No Polarity.
- Max Voltage: 24V DC / 17V RMS AC
- Max Current: 1A DC / 0.5A AC RMS
- Isolation Voltage: 1kV RMS
- Device is a CPC 1020N

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

Power Consumption
- 45mA Max

Power Options
- Power1: 5V via USB adaptor
- Power2: 5V DC via Term. Block
- Power1/2 may be in parallel
- Available 12 - 24V via converter

Backup Battery not included
- Can be provided via Power2

Certifications
Complies with Part 15 of FCC Rules

SOFTWARE PREP AND HARDWARE ASSEMBLY

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**

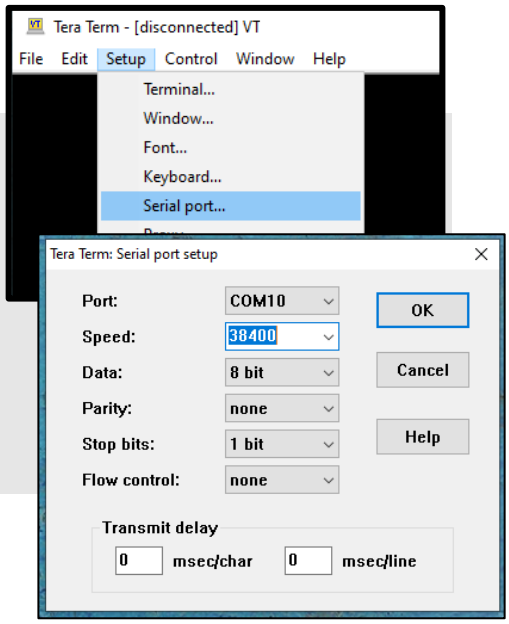
2. Assemble Unit and Connect Laptop

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.**

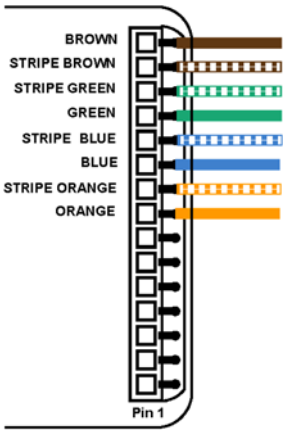
****Sensor and Terminal Emulator MUST be set to same Baud rate.**

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

To Connect to Remote Probe

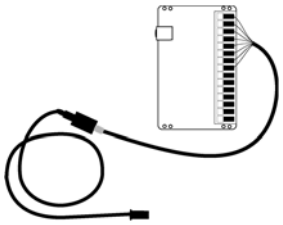
1

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



2

Connect Remote Probe to
Pigtail using supplied Coupler



If extending the Probe's Cat6 cable:
Probe End-to-Main Unit Max Length = 200 ft
Requires additional Coupler.

OPENING CONSOLE

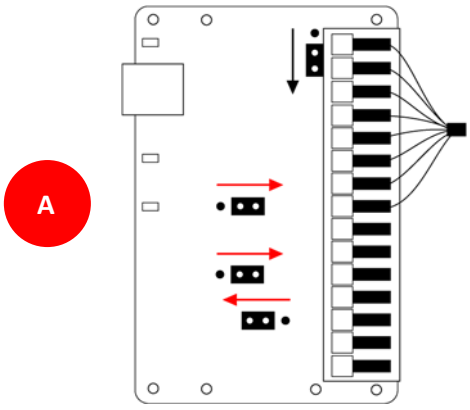
Probe MUST be Connected to Board

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

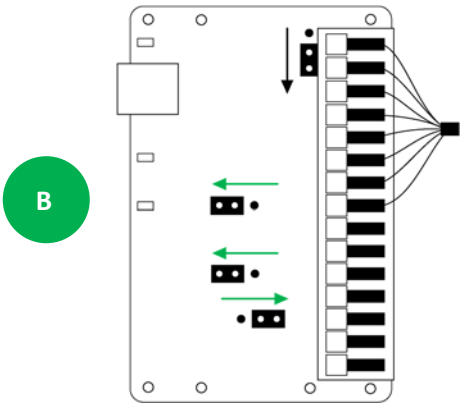
Not Open? Possibly in Pulse Mode.

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

	Commands:	
	t	Display amplitude and tracking status
Mode Settings	m x	Set Mode (ex: m m) m m for Modbus (default) m p for Pulse 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)
Modbus Settings 38,400 = default If Baud is changed Emulator Baud MUST change	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
Boost	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. Possible disconnect
- 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

NAVIGATING FROM CONSOLE MODE

1. Optional: Familiarize

SIMULATE FLOW AT DESK

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.
- Use K-factor to convert to total vol.

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

Know the K-factor OR the Method of discovery before Completing configuration

The Sensor counts Meter Revolutions (Revs)
K-factor converts Revs to Volume.
Meter K-factor = Revs / Unit Vol.
(ex: 750 revs/ ft^3).

K-FACTOR ALREADY KNOWN?

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

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

K-FACTOR NOT KNOWN?

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

b. If Laptop is NOT on-Site:
Unit is Pre-configured.
Choose the best K-factor Discovery Method for your project. pg 11

Choose Method

BEFORE Configuring

3. Complete Configuration

For Pulse: **pg 6**

For Modbus RTU: **pg 7**

Trouble Shooting: Tracking on Meter
- Not Tracking
  - Mag. field strength, "amp" must be >360. Shift Probe to increase "amp".
  - Confirm "Boost" is enabled
- ****OVERFLOW**** Alert in Console Mode
  - Mag. Field strength, "amp" must be <16,000. Shift Probe to weaker "amp"
  - Or Disable Boost. Then Reset

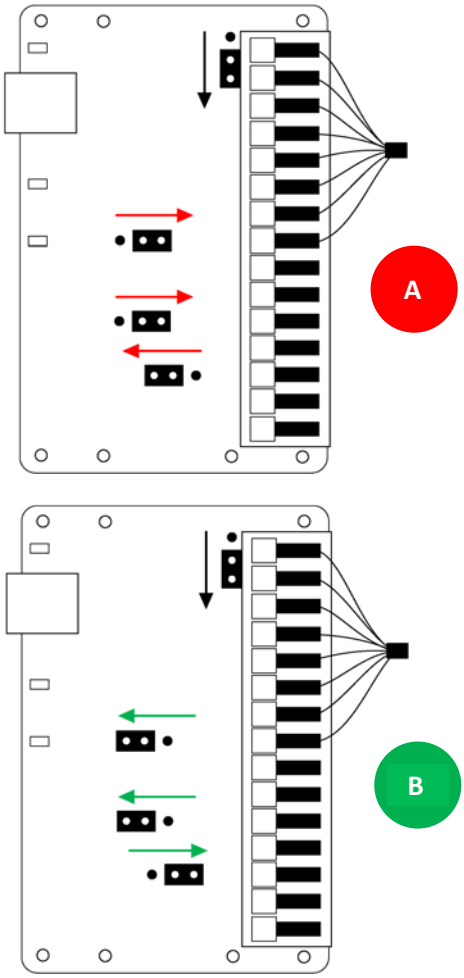
CONFIGURING PULSE

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

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

If Meter K-factor is Known
Calculate Pulse K-factor for chosen Pulse Volume
If Meter K-factor is Unknown, and Sensor is being Pre-Configured
Choose whole # Pulse K-factor (ex: **10.00** or **100.00 Revs / Pulse**)

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



To EXIT Pulse OR Pulse Test Modes to Console Mode:

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

NOTE: "Boost" reverts to Enabled upon Exiting Pulse

Optional Pulse Test Mode: Test Pulse Wiring, Width & Counting with 1 Pulse per sec.

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

Troubleshooting: Pulse

- **Will not accept Pulse K-factor**
  - Min Pulse K-factor = 1.
    If <1, increase Pulse k-factor AND Pulse Vol. (ex. Change 0.23 rev/ft3 to 2.3 rev/10 ft3)
  - Max Pulse K-factor = 10,000. Reduce Pulse Vol, to reduce k-factor
- **Pulses are Not Counted**
  - Check Pulse output wiring.
  - Pulse Width too short for Pulse Counter. Increase Pulse Width.
  - Pulse k-factor too small, on meter too fast. Not likely a problem if Pulse K-factor is 10 or more

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.
Have questions? Contact Vata Verks.

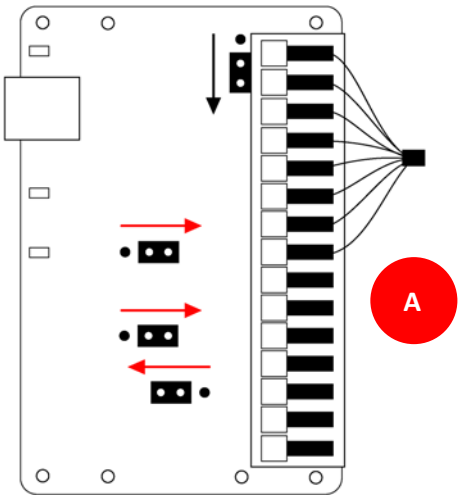
▶ Configuring for Modbus RTU from CONSOLE (see pg 4)

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**	to confirm 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**



To EXIT Modbus RTU Mode to Console Mode:

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

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

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 Read the 2 together to confirm no roll over between reads.
3	R	Rev. Count high word	
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

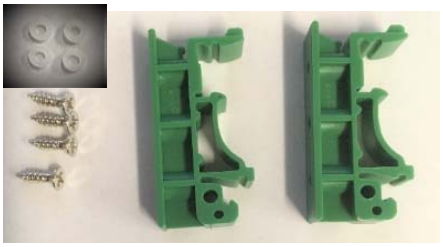
Final Installation

NOTE: Confirm Meter Compatibility before invasive site work.
NOTE: The Sensor must be Pre-configured, OR Configured during Final Installation.

1. Run Cable from Meter to Enclosure (200 ft max) **(see diagram pg 1)**
   If probe voltage drops <3000mV, shorten cable or increase wire gauge
   s ENTER to confirm probe voltage
2. Strap Probe to Meter, cable to pipe. Refer to Meter Guide **pg 9**
3. At Enclosure: Mount Sensor Board with Pigtail
   - **a.** on Din Rails (brackets shown right)
     Or on Raspberry Pi, OR to enclosure wall
   - **b.** Zip tie Pigtail cable to Adhesive Strain relief
4. Make Connections **(pg 2)**
   - **a.** Probe to pigtail with RJ45 Coupler
   - **b.** Pulse: Connect to power. Power1 or Power2 (see pg 2)
   - **c.** Pulse: Wire terminals 1+2 to your Pulse Counter
   - **d.** RTU: Connect USB cable to network and Power.

   Note: Power1 / 2 may be wired in parallel for both Pulse or RTU
5. **Flow Water or Gas.**
6. Confirm Pulse or RTU Communications
7. **Shut OFF Water or Gas flow**
8. **Document Installation**
   - Record: Meter Model, K-factor, Pulse K-factor, Probe Serial No (on cable label), Installation Photo
   - Keep for your records AND send to: **info@vataverks.com**

   Installation Complete

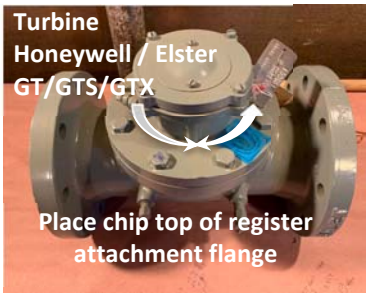


Troubleshooting: Installation

- Exterior Meter with exterior RJ45 Connections
  - Use IP68 waterproof Couplers
  - 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
- Not Tracking Flow
  - Signal too weak. Shift Probe. Amplitude **>360 R**equired to track
  - Confirm "Boost" is enabled
- Meter is incompatible **(see compatibility pg 2)**

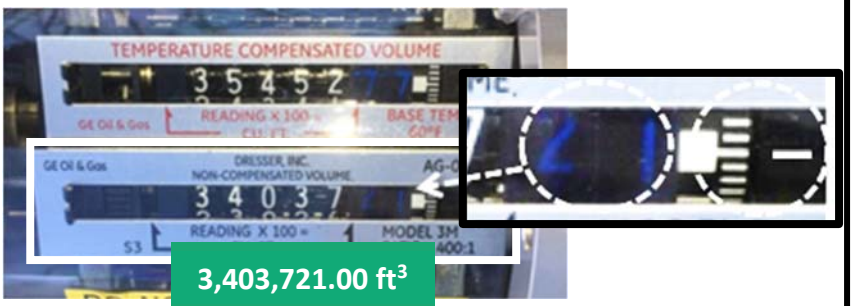
METER GUIDE

Rotary or Turbine Gas Meters



How to Read a Rotary Meter

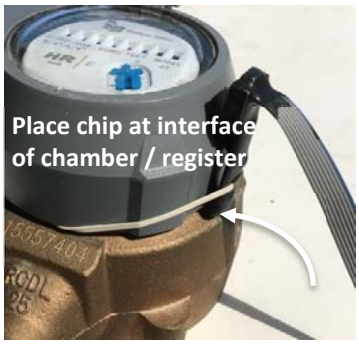
- Use the "Non-Compensated Volume" reading.
- Dresser: Use a light to see 10's and 1's. (see below).
- Snap photo of the register and read from the photo.
- Dresser: Each "hash" mark on right side = 0.2 ft^3.
  - Rollover (X.00 ft^3) = main hash aligns with fixed hash.
  - Estimate to the 2nd decimal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

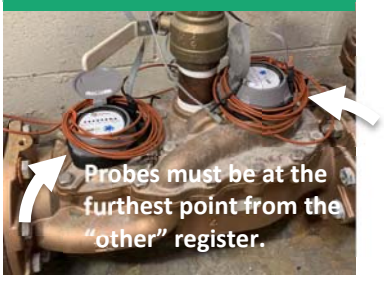
Water Meters



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. **M1**: 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. **M2**: take **Photo2** of Meter (as above)

SHUT OFF WATER OR GAS FLOW

K-Factor Calculation

4. **Read the Meters in photos M1, M2**

5. **k-factor =** **total Revs** = rev2 – rev1 (from Sensor)
   total Vol M2 – M1 (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 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 **AND**
   b. **M1**: take Photo A of Meter ½ ft³ Dial

0.67 revs
(7 is est)

21.00 revs

0.84 revs
(4 is est)

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

3. **STOP Test at the Instant of Roll Over.**
   SIMULTANEOUSLY:
   a. **rev2**: Record Rev count **AND**
   b. **M2**: 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 revs of ½ ft³ dial
   Total Vol = 11.255 ft³

5. **k-factor =** **total Revs** = rev2 – rev1 (from Sensor)
   total Vol M2 – M1 (from Meter)
6. Complete configuration **pg 6 or 7.**

K FACTOR 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)			
METHODS	**A**	**B**	**C**	**D**	**E**	**F**
		PREFERRED			***PREFERRED***	***GOOD***
Revs from:	**Laptop**	**Laptop**	**Pulse Flashes**	**Pulse Flashes**	**Customer Database**	**Customer Database**
Flow from:	**Measured Container**	**Meter Photo**	**Measured Container***	**Meter Video / 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 Need 110V at faucet	Pulse ONLY Need 110V at meter Meter Resolution <1 ft3	Requires 2 people If meters res = 100 ft^3 See*	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 >93% 2 mon >96%
Poss. Error	Secondary flows Few revolutions	Meter reading	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

K-Factor Discovery Methods: Instructions

Off - Site Prep	**Unit Set-up pg 3**	**Unit Set-up pg 3** **See full example Pg 10**	**Unit Set-up pg 3** **Pre-configure for Pulse pg 6** Pulse K-factor 10-100. Width 100	**Unit Set-up pg 3** **Pre-configure for Pulse pg 6** Pulse Width: 100	**Unit Set-up pg 3** **Pre-configure (Pulse/RTU) pg 6 or 7**	**Unit Set-up pg 3** **Pre-configure pg 6 or 7**
On - Site Prep	**Temporary Install for K-factor** Probe on Meter connected to Control Board+Laptop at Faucet (board protected in plastic bag) -at Console Mode pg 4 -for probe locations: pg 9	**Temporary Install for K-factor** Probe on Meter connected to Control Board + Laptop at Meter (board protected in plastic bag) -at Console Mode pg 4 -for probe locations: pg 9	**Temporary Install for K-factor** Probe on Meter connected to Control Board at Faucet (board protected in plastic bag) -Wall power to Interface board -for probe locations: pg 9	**Temporary Install for K-factor** Probe on Meter connected to Control Board at Meter (board protected in plastic bag) -Wall power to Interface board -for probe locations: pg 9	**Permanent Install. Pg 8** Probe on Meter connected to Control Board Permanently Installed, tracking, communicating to database. **Confirm data reception**	**Permanent Install. Pg 8** Probe on Meter connected to Control Board Permanently Installed, tracking, communicating to database. **Confirm data reception**
On - Site Data Collection	**t ENTER**: to display tracking -run flow until unit tracks -stop flow. **AT START: Confirm All flows=0** -Record Rev1 count from laptop -Fill Container to measure line. (larger container the better) **AT STOP: Confirm All flows=0** -Record Rev2 count from laptop Repeat to confirm results.	***if Diaphragm Gas Meter**: pg 10* **t ENTER**: to display tracking -run flow until unit tracks **AT START: Simultaneously** -Record Rev1 from laptop -Take Photo of Meter register More flow = more accuracy >400 revs better **AT STOP: Simultaneously** -Record Rev2 from laptop -Take Photo of Meter register **-Stop flow.**	-run flow until unit tracks **D3 LED flash @ Pulse K-factor rate** **-Stop Flow. Confirm meter flow=0** -Start Flow down Drain. **START:** at D3 LED **Flash0**, instantly divert to container -Do Not Overflow. -Count D3 Flashes. **(Do not count 1st Flash0)** **STOP:** at D3 LED Flash, instantly divert flow to Drain. -if Container Overflow: Do over **-Stop flow. Confirm meter flow=0** -Measure volume in container	***If Diaphragm Gas Meter**: pg 10* -run flow until unit tracks **D3 LED flash @ Pulse K-factor rate** **Video: capture D3 LED flashes & Meter advance in same frame.** **START Video, START Flow** Continue flow, and video as D3 LED Flashes. More flow=more accuracy, but the video must be reviewed. **STOP Flow, STOP Video**	Tracking indicated by LED Flash. **2 people required: 1 see LED flash and tell other take Meter photo** **START*: Photo1 Meter at instant:** - of D3 LED **Flash** if PULSE - of D4 LED **Flash** if RTU Maximize flow: hours, days, wks **STOP*: Photo2 Meter at instant:** - of D3 LED **Flash** if PULSE - of D4 LED **Flash** if RTU	**No On-Site Data Collection**
Calculation & Final Install	**ON-SITE CALCULATIONS** Total Revs = Rev2 - Rev1 K-factor=Tot Revs/Container Vol (convert to std units ex: ft^3) **If Pulse: Calc. Pulse K-factor for preferred Pulse Vol.** **Configure (Pulse / RTU) pg 6 or 7** **Permanent Install. Pg 8**	**ON-SITE CALCULATIONS** Read Meters from Photo1 & 2 Total Flow = Meter2 - Meter1 Total Revs = Rev2 - Rev1 K-factor = Tot Revs / Tot Flow **If Pulse: Calc. Pulse K-factor for preferred Pulse Vol.** See Example Pg 10 **Configure (Pulse / RTU) pg 6 or 7** **Permanent Install. Pg 8**	**Permanent Install. Pg 8** **OFF-SITE CALCULATIONS** Tot Revs=Pulse K-fctr x Flashes K-factor=Tot Revs/Container Vol (convert to std units ex: ft^3) **Pulse K-factor is pre-set.** **Calculate Vol per Pulse** ***Larger Pulse Volumes may require large or multiple containers.**	**Permanent Install. Pg 8** **OFF-SITE CALCULATIONS** Review Video. -Read Meter1 at first D3 Flash0 -Read Meter2 at last D3 Flash -Count D3 Flashes Meter1 to 2. **(Do not count 1st Flash0)** Total Flow = Meter2 - Meter1 Tot Revs=Pulse K-fctr X Flashes K-factor = Tot Revs / Tot Flow **Pulse K-factor is pre-set.** **Calculate Vol per Pulse**	**OFF-SITE CALCULATIONS** Use Photo1 & 2 time stamps to find corresponding data in database. (convert data to meter revs) Read Meters from Photos1 & 2 Total Flow = Meter2 - Meter1 Total Revs = Rev2 - Rev1 K-factor=Tot Revs / Tot Flow **If Pulse:** **Pulse K-factor is pre-set.** **Calculate Vol per Pulse** ***If Meter resolution = 100 ft^3, then START/STOP at a 100.00 ft^3 meter Rollover**	**OFF-SITE CALCULATIONS** Review Utility Bills Test month and Prior month MUST be "Actual" reads. No Est. reads. From database: Identify data which corresponds with: -noon 1st day of bill: Rev1 -noon last day of bill: Rev2 (convert data to meter revs) Total Revs = Rev2 - Rev1 Total Flow = Utility Bill volume (convert to std units ex: ft^3) K-factor = Tot Revs / Tot Flow **If Pulse:** **Pulse K-factor is pre-set.** **Calculate Vol per Pulse**