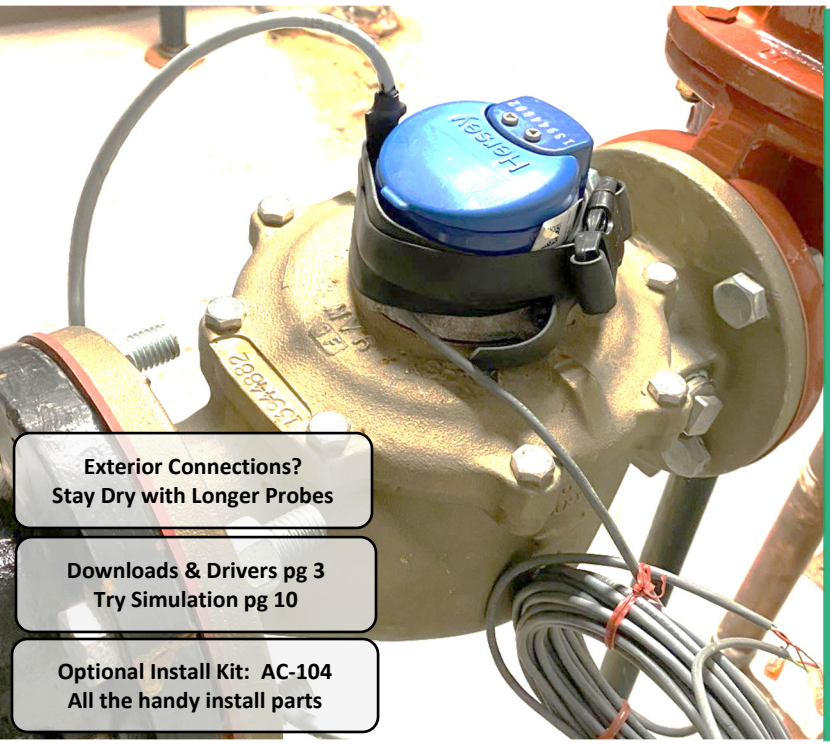
VATA VERKS
water and gas intelligence for buildings

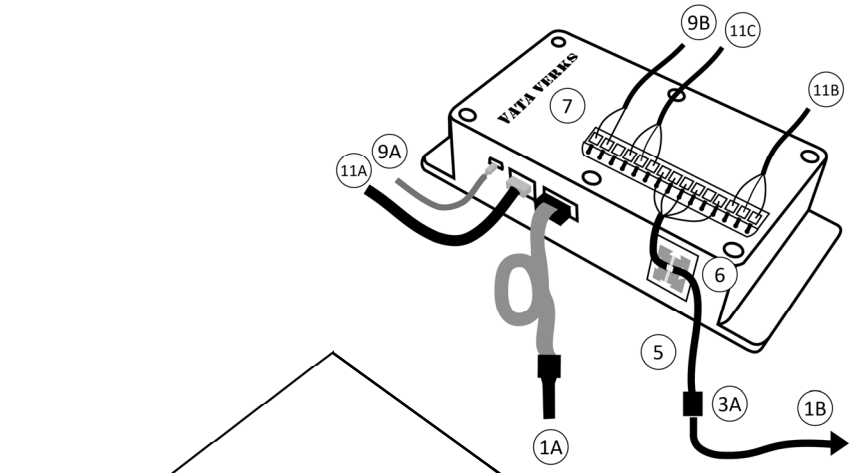
Non-Invasive, Whole-Building
Water Data Acquisition
VV – 100 – XX – W

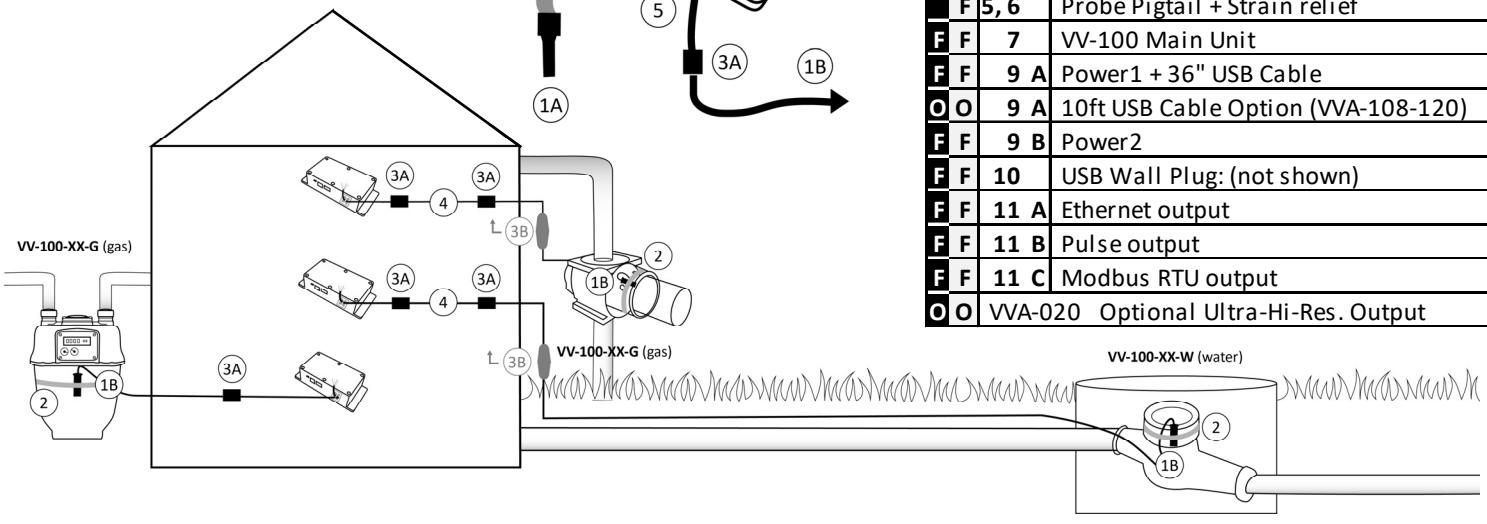
Instructions for WATER METERS



Installing with a Laptop On-Site

Supplementary Information





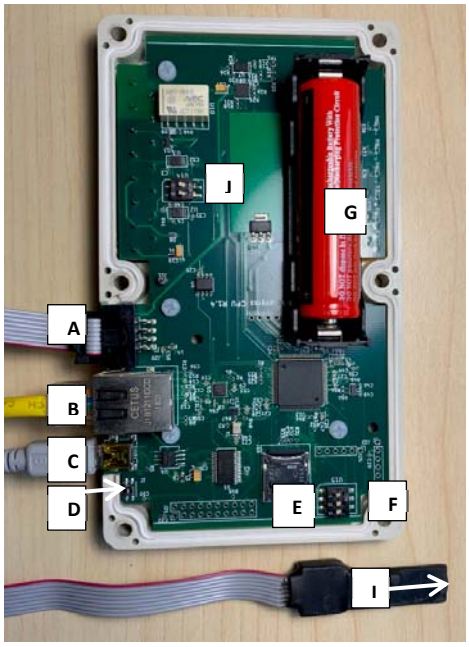
Models : (F)eatures, (O)ptions

VV – 100 – 00 – W			
	VV – 100 – 02/07/15 – W		
F		1 A	Ribbon Probe Water: 18" Indoor ONLY
	F	1 B	Remote Probe Water: 2M, 7M, 15M length
F	F	2	Meter Strap
	F	3 A	Probe Coupler Indoor (1) (VVA-113)
	O	3 B	Probe Coupler Outdoor (VVA-114)
	O	4	Probe Extension (user supplied CAT6)
	F	5, 6	Probe Pigtail + Strain relief
F	F	7	VV-100 Main Unit
F	F	9 A	Power1 + 36" USB Cable
O	O	9 A	10ft USB Cable Option (VVA-108-120)
F	F	9 B	Power2
F	F	10	USB Wall Plug: (not shown)
F	F	11 A	Ethernet output
F	F	11 B	Pulse output
F	F	11 C	Modbus RTU output
O	O	VVA-020	Optional Ultra-Hi-Res. Output

OUTDOOR/WET METER LOCATIONS APPROVED WHEN INSTALLED WITH REMOTE SENSOR PROBE
Confirm Meter Compatibility Before Invasive Site Work. See Instructions or Contact Vata Verks
NOT FOR USE IN HAZARDOUS OR EXPLOSIVE ENVIRONMENTS

HARDWARE LAYOUT / SPECIFICATIONS

BOARD COMPONENTS



COMPONENTS

A. Ribbon Probe Connection

B. Ethernet connection

C. Mini-USB connection (configuration /power)

D. Reset Button: Paperclip accessible

LEDs blink off when actuated.

E. SD Card

F. Jumper switch (U15)

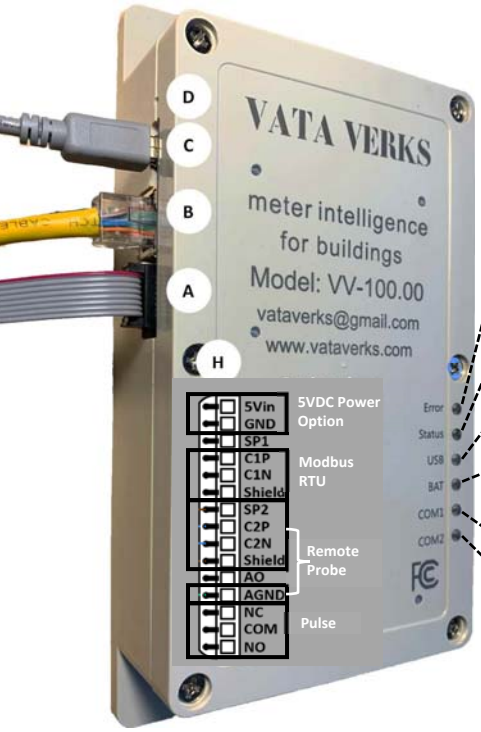
G. 3.7V Lithium Backup battery

H. 15 Position terminal block

I. Sensor chip location (Ribbon Probe Shown)

J. Remote Sensor switches (U14)

UNIT COMPONENTS



LED Key

Slow = 1.0 second blink
Fast = 0.3 second blink

Error (yellow):
- Off: running a command (ex: tracking)
- Slow: unit in idle state. Waiting for command
- Fast: unit is reading amplitude.
- Solid: hard fault including low bus voltage

Status
- Fast: calibrating phase of tracking
- Solid: tracking phase of tracking

USB
- Off: USB port inactive or faulted (PC error)
- Slow / Fast: USB transmitting & receiving

Bat
- Off: battery is fully charged
- Fast: bus voltage too low to support operation
- On: battery charging or no battery present

Com1 (Reserved)

Com2 (Remote Probe: Tracking / Amplitude mode)
- Solid: communicating with Probe
- Slow: failing to Communicate (check wiring)
- Off: not in Tracking or Amplitude mode

VV-100 SPECIFICATIONS

Water Version: **VV-100-XX-W**
Water Meter Compatibility
All positive displacement, piston compound, multi-jet, single jet
Incompatible: Solid state / Ultra-sonic / Sensus Omni: see VV-200 series

Gas Version: **VV-100-XX-G**
Gas Meter Compatibility
All diaphragm, rotary, turbine.
Incompatible: Ultra-sonic

Data Protocols
- Modbus-TCP via Ethernet
- Modbus-RTU via Term. Block
- Telnet via Ethernet
- MQTT via Ethernet
- Pulse via Term. Block
- HTTP Publish via Ethernet
- Data Log via Onboard

Resolution (in meter revolutions)
- 1 rev Standard
- 1/100th rev Optional

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

Control and Management
- Local: via USB cable
- Remote: via Telnet / Web

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

Main Unit and Ribbon Probe
- Indoor / Dry
- Length: 1.5 ft ribbon cable

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

Power Consumption
- 300mA Max

Power Options
- 5V via USB to wall adaptor
- +5VDC 1Amp via Term. Block
- Available 12 - 24V via converter

Backup Battery: Recharg 3.7V Li-ion
- Backup life vs probe length
  12hr@2 ft, 6hr@100 ft, 1hr@200 ft

Certifications
Complies with Part 15 of FCC Rules

I. SOFTWARE PREP AND HARDWARE ASSEMBLY

0. Partially Charge Battery (Optional)

Open top. Confirm battery is secure in place.
Use USB cable & wall plug adapter to wall charge unit for at least 10 min.

1. Download Terminal Emulator & FTDI Driver

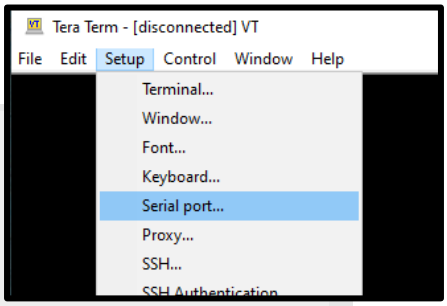
For **Windows OS: Tera Term** (PuTTY and other emulators may be used)

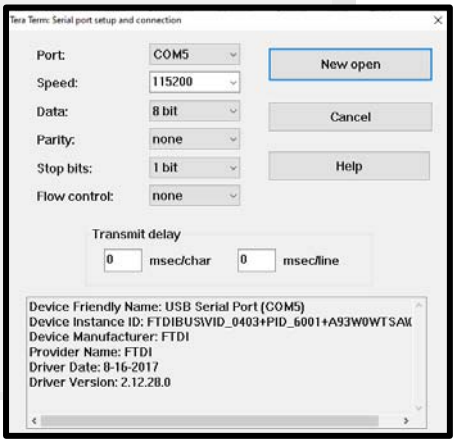
1. Go to: https://download.cnet.com/
2. Enter: "**Tera Term**" in the **Download** search bar.
3. **Download** and **Install** with default settings
4. Go to: https://ftdichip.com/
5. Navigate to **Drivers** then **VCP** and Download Driver
   If Windows: Download "**Setup Executable**" under Comments.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

2. Assemble Unit and Connect Laptop

1. Connect **Ribbon** OR **Remote** Probe to Unit. Not both. **(See right)**
2. Connect to laptop with the mini-USB cable. LEDs blink.
3. **DO NOT** connect Ethernet port to laptop or Remote Probe.

3. Configure "Tera Term"





PROBE MUST BE CONNECTED FIRST

1. Open **Tera Term**.
2. Click **Setup** for dropdown
3. Choose **Serial Port…**
4. **Configure** as shown **right**
5. At **Port*** Choose the Com#.
6. Click **New Open**
7. Click Black Screen. **ENTER**
   - I. **Username: admin ENTER**
   - II. **Password: admin ENTER**

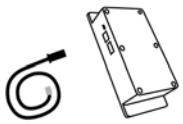
   NOTE: If **Password** appears first, hit **ENTER**
8. **M> ENTER** for Command Directory
9. **T ENTER** for Tracking Directory

(try Desk-Top Simulation pg 10 to become familiar)

***If Port prompt is "grey", and unit is connected to laptop via serial port as directed above, your laptop's FTDI Driver may be missing /incorrect. Recheck above.**
***Your Tera Term configuration can be saved. At **Setup** dropdown: click "**Save Setup**"*

To Connect Ribbon Probe

VV-100-00-G
Plug Ribbon Cable Probe into Main



To Connect Remote Probe

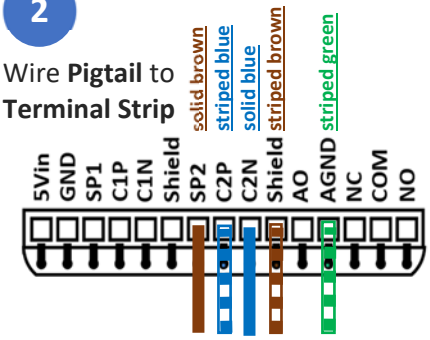
VV-100-0X-G
Wire Remote Probe Cat6 cable to terminal strip

1

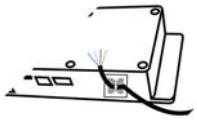
Remove screws + cover
Find Switch **U14**
Switch **1** to **"ON"**
(confirm battery is secure)

2

Wire **Pigtail** to **Terminal Strip**



3



Affix **Strain Relief** to side.
Zip tie **Pigtail** to **Strain Relief**

4

Connect 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.

INSTALLING WITH A LAPTOP

II. Tracking (Counting Meter Revolutions)

PRO TIP

- **When Meter is distant from Main Unit's final location, consider a temporary set-up at Meter with laptop** to locate Probe, and discover Meter K-factor.

Tracking Meter Revolutions

1. **Water <u>should</u> flow this step***

2. Strap the sensor to the meter. See pg 11 for location.
Compound Meters: Take special note pg 11

3. ### To Calibrate or Re-Calibrate

At **<u>Tracking Menu</u> type** :

x	ENTER	Wait for "Function complete" Keeps calibration & rev. count
r	ENTER	Deletes calibration & rev. count
t	ENTER	Calibrates and starts tracking *If Flow=0, unit will Auto-Calibrate and Track whenever flow starts.

*It takes **5** - 10 seconds to track on Water Meters displaying revolution count every 5 seconds.*

4. Strap or Zip Tie sensor in place. (permanently)
Zip tie Probe cable to adjacent pipe as strain relief.

If sensor moves, **Re-Calibrate**. (see above)

If discovering K-factor on-site. Start Now pg 5. Otherwise:
****** Stop Water Flow ******
See pg 7 to Configure Communications

Having Trouble Tracking? Refer to:
<u>Signal Strength</u> or <u>Troubleshooting: pg 10</u>

Data Displayed with Successful Tracking

SLOW METERS	FAST METERS
TRACK:x	TRACK:x
Function complete	Function complete
TRACK:r	TRACK:r
TRACK:t	TRACK:t
Track	Track
Start Tracking	Start Tracking
TRACK:	TRACK:
P1	P1
P2	P2
P3	P3
P4	P4
P5	P5
Signal Measured: 1850	Signal Measured: 4538
Z Dominate	Z Dominate
Rev=2.00 rev	Rev=7.00 rev
<u>Rev=8.22 rev</u>	Rev=23.00 rev
Rev=13.90 rev	Rev=44.00 rev
Rev=19.49 rev	Rev=66.00 rev
Rev=24.41 rev	<u>Rev=87.53 rev</u>
Rev=30.07 rev	Rev=108.19 rev
Rev=35.64 rev	

Calibrating

Tracking

Transition to Ultra Hi-Res Output
If unit equipped with this option

To Start or Stop the Display feed

3	ENTER	to stop reporting to the screen
2	ENTER	to re-start reporting to the screen

INSTALLING WITH A LAPTOP

III. K-Factor (Meter Volume)

PRO TIP

Increasing Tracking display rate from 5 seconds to 1 second can increase accuracy of your K-factor data.
In Tracking Menu:

+	ENTER	expands Menu
b(space)1.0	ENTER	sets display rate to 1/sec.

return to 5 second rate when finished

If K-Factor < 1.0

The VV-100 **requires** a K-factor of 1.0 or greater.
If K-factor is <1.0: Multiply both sides by 10.

Example: If a meter K-factor is: 0.33 Revs / ft3
Convert K-factor to: 3.3 Revs / 10 ft3.

OPTION 1: K-Factor Calculated using the Meter

K-Factor = **(Revolutions** from **the Vata Verks Display**) / (**Flow Volume** from **the Meter Register**).

Water must be flowing for this step.

1 **START K-Factor Measurement**

Simultaneously record Rev. count from **Vata Verks Display** AND take a photo of **Meter Display**.
For improved accuracy **START** when flow momentarily stops.

Vata Verks Display

Rev=56.00 rev
Rev=58.00 rev
Rev=61.00 rev
Rev=64.00 rev
Rev=67.00 rev
Rev=70.00 rev
Rev=73.00 rev
Rev=76.00 rev

64.00 rev

Meter Display

322,687.084 ft³

4 is estimated

2 ***Note: More revolutions = higher accuracy of K-Factor (preferably >400 revolutions).**

STOP K-Factor Measurement

Simultaneously record Rev. count from **Vata Verks Display** AND take a photo of **Meter Display**.
For improved accuracy **STOP** when flow momentarily stops.

Vata Verks Display

Rev=323.00 rev
Rev=326.00 rev
Rev=329.00 rev
Rev=332.00 rev
Rev=336.00 rev
Rev=341.00 rev
Rev=345.00 rev

336.00 rev

Meter Display

322,687.710 ft³

0 is estimated

******Water Flow Can Be Turned OFF******

INSTALLING WITH A LAPTOP

III. K-Factor (Meter Volume)

OPTION 1: K-Factor Calculated on the Meter: Continued

1 Flow Volume from the Meter Register

322,687.710 ft³ - 322,687.084 ft³ = 0.626 ft³

2 Revolutions from Vata Verks Display

336.00 rev - 64.00 rev = 272.00 rev

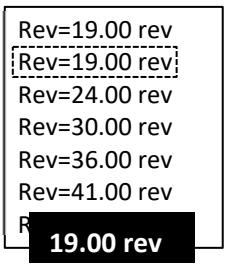
3

Revolutions	/	Flow Volume	=	K-Factor
272.00 rev	/	0.626 ft³	=	434.505 rev/ft³

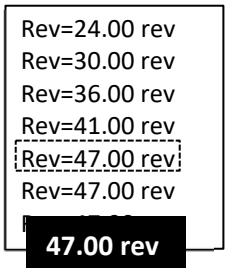
OPTION 2: K-Factor Calculated using Measured Volume (for small controlled buildings)

*All building flow must be zero, except for this test. Some human measurement error is to be expected.

1	2	3	4
No flow. Record rev. count	**Fill a measured container**	**Stop flow when full** Record rev. count	**Calculate K-Factor** Repeat to confirm result



½ gallon



47.00 - 19.00
= 28.00 rev

28.00 / 0.5
= 56.00 rev/gallon

OPTION 3: K-Factor Calculated Using the Utility Bill. (No meter read or laptop required)

Install Sensor. Use your archived sensor data with 1 fully Sensor Tracked Utility Bill period.

1. Revolutions = (Rev. Count LAST day* of utility bill) – (Rev. Count 1st day* of bill)
2. Flow Volume (ft³) = Flow Volume from the monthly bill
3. Revolutions / Flow Volume (ft³) = K-Factor (revs/ ft³)

2 consecutive "Actual" Meter Reads required. No Estimated reads.
2nd Utility Bill must START after the date of installation.
***Time of Billing Period START / STOP is unknown. Use 12:00 Noon when choosing Vata Verks Sensor data.**
Adding subsequent months will improve accuracy.
Requires 32 – 60 days

INSTALLING WITH A LAPTOP

III. K-Factor (Meter Volume)

How to Use the K-Factor

FOR MODBUS, MQTT, HTPP
To Transmit Volume

1) Enter K-factor in Tracking Menu
2) NOTE: If K-factor <1.0, See top pg 5.

Or Transmit Revolutions

3) Apply K-factor to your Revolution data in the Cloud

FOR PULSE
To Pulse per Standard Volume (ex: 1 pulse / 10 ft^3)

1) Use K-factor to calculate Pulse K-factor. Enter in Pulse Menu

Or Pre-program Pulse K-Factor (ex: 10 revs / pulse)

2) Use K-factor to calculate resulting Volume per Pulse.

SAVE Often: 'S' ENTER

IV. Configure Communications

TO COMPLETE THIS INSTALLATION

With K-Factor Known and Sensor Probe Strapped in Place

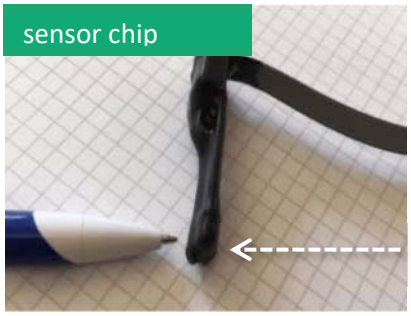
- To Configure Communication for:
  MQTT, Modbus-TCP, Modbus-RTU, Pulse, HTTP Publish, Data Logging, Telnet:
  See **"Data Transmission Instructions" found at https://vataverks.com/support/**
- If Communication is configured and data received, transfer to permanent power
  - Transfer USB Cord with Wall Adaptor to wall outlet
  - OR Optional 5VDC to terminal Strip (pg 2)

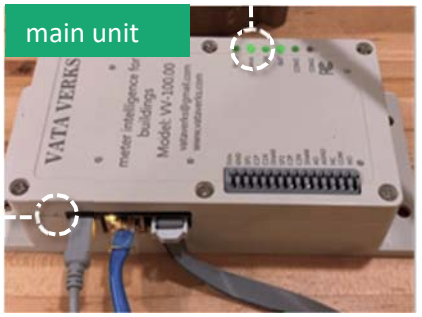
SUPPLEMENTARY INFORMATION

Supplementary Information -

INSTALLING WITHOUT A LAPTOP

PRO TIP: **Installing Units without a laptop On-Site**
Use Simulation pg 10 to familiarize before sending to field.
PRO TIP: Installing Units with Remote Probe
Temporarily set up at Meter to confirm tracking.
A laptop is suggested for larger meters.





Setting up the Main Unit

1. Unit **MUST** be Assembled and Configured Off-Site (see pg 3)
   See Instructions: Configuring Data Transmission at:
   https://vataverks.com/support/
2. Strap Probe to meter. Refer to **Sensor Placement Maps** (pg 11).
3. Connect Power: USB wall adaptor OR 5VDC to terminal strip.
   LEDs will be ON.
4. **Water MUST flow through Meter THIS STEP.**
   Gently depress **Reset** with paperclip. LEDs will blink off. (pg 2)
   With **Reset**, Unit will auto-Calibrate then track with flow
   (If Flow=0, unit will Auto-Calibrate and Track when flow starts)
5. **COM2** LED solid if Remote Probe is Communicating.
   Status LED blinks if Calibrating. Solid if Tracking Flow
   ****** Water Flow Can be Turned OFF ******
6. Zip Tie Probe Cable to pipe as strain relief. Permanently
7. Finish: Affix Main Unit in a dry location.
8. If MQTT, Modbus, HTTP: Connect Ethernet cable to Gateway
9. If Pulse: Wire twisted pair from terminal strip to Pulse counter
10. If unit Sensor Probe was unplugged, or unit lost power:
    Reset the device. Repeat steps 4, 5, 6.
11. Confirm data is being received.
12. Discover K-Factor (see below)

Failure to Calibrate?

Option 1	Reposition Probe: try again. Repeat Steps 4 through 12
Option 2	A Telnet connected colleague can help identify the strongest magnetic field location (pg 10)

Options to Discover K-Factor without a Laptop

A. **Using Monthly Bills** **(pg 6)**
B. **Real-time tracking data received in office (pg 5) with Simultaneous meter reads in the field.**
C. **Archived tracking data synchronized (pg 5) with time stamped photos of meter register**

Supplementary Information - **COMMAND MENU REFERENCE**

****MAIN MENU****

M - Main Menu
T - Tracking menu — ***SEE BELOW***
C - Communication menu — *(to configure for Modbus, MQTT, HTTP Publish)*
N - Network menu — *(to configure for Modbus, MQTT, Telnet)*
P - Pulse Output menu — *(to configure for Pulse)*
Z - Device maintenance menu — ***SEE BELOW***
g - Logout
x - Exit current function
S - Save configuration — ***SAVE OFTEN***
Some configuration parameters require a reset to take effect
M – Return to Main Menu

See Instructions: **Configuring Data Transmission**

T ENTER

****TRACKING MENU****

a - Signal Strength (requires flow) — *measure magnetic field strength*
t - Start tracking (requires flow)
x - Stop Tracking or Signal Strength
r - Reset tracker to 0, deletes calibration
k - Enter meter K factor rev/unit volume (k xxx.xxx) — *for entering k factor. Will not accept k-factor <1.0. see pg 5.*
v - Set Units (gal, ft3, m3, rev) (v gal) — *K-factor can be any unit of volume. This takes note of the choice.*
2 - Start reporting data to screen
3 - Stop reporting data to screen
+ - Show Advanced Functions — *So many other features*
S - Save configuration — ***SAVE OFTEN***
Some configuration parameters require a reset to take effect
M – Return to Main Menu

Z ENTER

****MAINTENANCE MENU****

a - Start Tracking on powerup — *default is enabled.*
c - Display current configuration – all — *useful information*
v - Display Version Information — *useful information: Serial Number and firmware build*
b - Display device info and battery status — *displays programmed time*
R - Reset Board — ***soft Reset: saves tracking+count. (hard button Reset does not)***
f - Restore factory defaults — *(Note: Push button Reset deletes Calibration and Tracking)*
r - Reload last saved configuration
p - Save path file
m - Record signal strength (SEE INSTR)
w - Enable/Disable Web Server — *Default is enabled*
u - Set device username and password
t - Set Time of day 24Hr format (t yyyy:mm:ddThh:mm:ss) — *programming time*
k - Unlock features — admin Use
S - Save configuration — ***SAVE OFTEN***
Some configuration parameters require a reset to take effect
M – Return to Main Menu

Supplementary Information - **TROUBLESHOOTING / SIMULATION**

Trouble / Causes / Corrections

1. **Attempting to Track**
   Displays: "Start Tracking"
   Does not display: P1, P2 etc showing calibration.
   a. No flow through meter?
   b. Sensor not strapped to meter?
   c. Magnetic Field too weak: (see Right)
   d. Meter incompatible.
2. **Attempting to Track**
   Displays: "Start Tracking"
   Display repeats over and over P1, P2, P3, P4, P5
   a. Flow happening, but magnetic field too weak.
   b. Find Stronger Field (see Right)
3. **Attempting to Track**
   Does not display "Start Tracking"
   a. Repeat the steps x, r, t (see pg 4)
   b. Wait for "Function Complete" after "x", before "r"
4. **Will not track. Though Magnetic Field is strong.**
   a. Go to Z Menu, and Reset "R" the device.
5. **"Sensor Stall" warning**
   a. Check that Sensor is correctly wired.
   b. Reset the device
6. **"Remote Sensor Not Found" warning or COM2 LED blinking**
   a. Check that Sensor is correctly wired
   b. Go to Z Menu, and Reset "R" the device.
7. **LED's are OFF, though Power is ON**
   a. Unscrew top, Find Switch U15, Confirm all OFF.
   b. Reset the Unit with Push Button
8. **K-Factor Entered on Tracking Menu**
   Displays: **Invalid Data Entry**
   a. K-factor <1.0 is not accepted by VV-100
   b. Use 10X. Ex: 0.3 rev/ft3 = 3.3 rev / 10 ft3
   c. Enter 3.3, and take note of 10 ft3.
9. **Forgot Password or Username**
   a. **Contact Vata Verks for instructions**

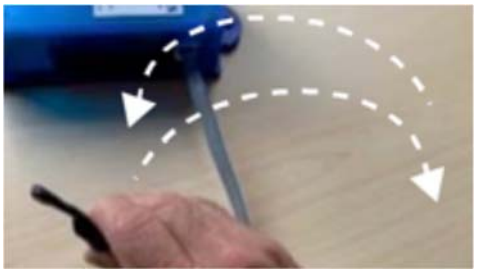
Desk Top Simulation

Sensor function simulated using Earth's magnetic field.

From Tracking Menu:

Simulate Tracking

A) Holding probe in hand
B) x ENTER to stop function
C) r ENTER to delete calibration
D) t ENTER to calibrate / track
E) Roll sensor back and forth (as below)



Measure Magnetic Fields

A) a ENTER to measure field
B) Move sensor or pass objects by probe

Find Meter's Strongest Signal Location

Water Flow Required

At **Tracking Menu**:
a ENTER measures field strength

Seek highest last number in the series.
Hold Probe to meter for multiple readings then move to new location.

If Output is:

A) 9,11,9,**25** no signal or no flow
B) 27,5,34,**175** too low
C) 111,47,267,**382** >275 is good
D) 0,630,0,**2500** >2000 can be too strong*

***If too strong, either:**

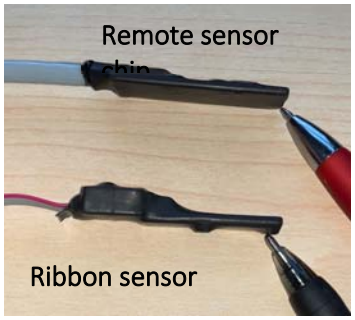
A) **w ENTER** disables Boost
B) Move Probe to weaker location

Found a suitable location?
Repeat Tracking pg 4

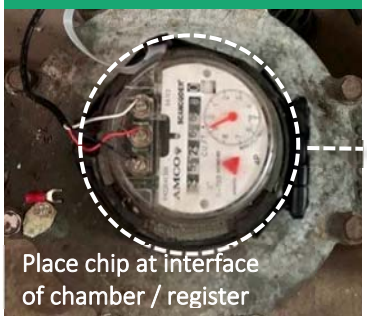
Supplementary Information -

SENSOR PLACEMENT / METER READING

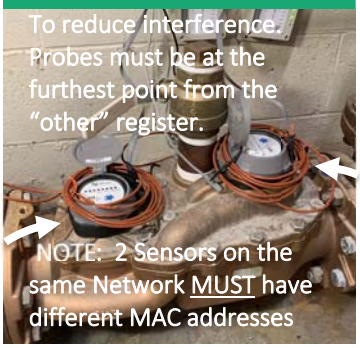
Probe Placement



recommended location



Compound Meters Requires (2) Units

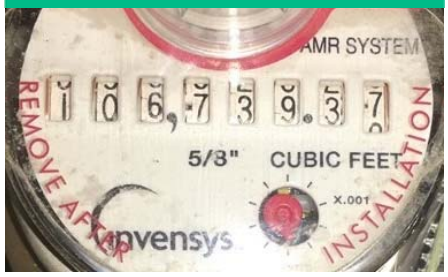


METER READING

1. **Take meter readings from a photo**
2. Read digits and dial and estimate the last digit between "hash" marks
3. Check meter units (ex: Gal or Cubic Feet)
   Check dial volume (ex: 1 ft^3 or 10 ft^3)
4. When choosing between 2 digits take the lowest. (ex. if **7 OR 8** choose **7**)
   (*exception: if between **9/0** choose **9**).
5. Avoid register voids and rollovers.

Need help?
Send a photo to:
info@vataverks.com

106,739.3748 ft^3 ('8' est)



1,647.218 ft^3

Requires light to activate display

70,421.462 ft^3 ('2' est)

1,372,666.48 ft^3 ('8' est)

16,055.825 ft^3 (last '5' est)

755,503.42 ft^3 ('2' est)