1 YEAR WARRANTY

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User's Guide

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FTB-1500 SERIES
Turbine Flow Meters

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Description and Principle of Operation

Turbine Flow Meter

FTB-1500 Series turbine flow meters are designed with wear resistant internal components to provide trouble-free operation and a long service life. Fluid entering the flow meter is first conditioned by the inlet flow straightener which reduces turbulence in the fluid. The moving fluid causes the rotor to spin at a speed that is proportional to its flow rate. As the blades on the rotor pass through the magnetic field of the pickup, an electronic pulse is generated. This pulse train signal can then be used to monitor the fluids actual flow rate or the total amount of fluid that has passed through the flow meter.

The number of electronic pulses generated by the meter, per unit volume, is known as its K-Factor. Each flow meter is calibrated to find its unique K-Factor, which is supplied with the flow meter when purchased.

All-in-One Pickup Sensor

The FTB-1500 Series comes with an all-in-one sensor that easily mounts on the flow meter and has 3 different output types available. We have equipped the sensor with a Bluetooth feature, which allows users to use a mobile app to setup the sensor and view real time outputs with their smart devices. The sensor comes equipped with an integrated linearizer for voltage and current outputs. This sensor is RoHS-compliant and utilizes surface mount components and a more up-to-date circuit design.

Turbine Specifications

Operation Limitations

Corrosion

The internal parts are constructed from stainless steels and tungsten carbide with a nickel binder. Ensure that your fluid is compatible with these materials. Incompatible fluids could deteriorate the internal parts, causing inaccurate readings. Consult the manufacturer of the fluid regarding its chemical compatibility with these materials.

Pulsation

Severe fluid pulsation will have a negative effect on the flow meters accuracy and may shorten the life of the flow meter.

Vibration

Severe vibration may decrease the life of the flow meter.

Filter/Strainer

A filter or strainer is recommended to be installed upstream of the flow meter (consult factory for recommended filtration). Particles entering the flow meter may cause pitting of the internal components, reducing its service life. Build up of particles on rotating parts can adversely affect the performance of the flow meter.

New Model Number	Strainer Mesh
FTB-1501 & FTB-1511	140 X 140
FTB-1502 & FTB-1512	140 X 140
FTB-1503 & FTB-1513	140 X 140
FTB-1504 & FTB-1514	50 X 50
FTB-1505 & FTB-1515	50 X 50
FTB-1506 & FTB-1516	50 X 50
FTB-1507 & FTB-1517	50 X 50
FTB-1508 & FTB-1518	50 X 50

Installation

Preparation

Before installation, the flow meter should be checked for foreign material and to ensure that the rotor spins freely. All upstream fluid lines should also be cleared of any debris.

WARNING: Make sure that fluid flow has been shut off and all pressure in the lines has been released prior to installing the flow meter into an existing system.

Preferred Flow Direction

The flow meter must be installed with the flow direction arrow pointing in the direction of fluid flow. The flow direction arrow can be found on the side of the flow meter. The flow meter is designed to work in any orientation, but the preferred orientation is to have the meter installed in horizontal piping.

Filtration

The fluid to be measured is recommended to be filtered. The best location for the filter/strainer would be upstream of the flow meter, after any other system components, while maintaining straight piping requirements.

Location

The preferred plumbing setup is one containing a bypass line (Figure 1). This allows meter inspection and repair without interrupting flow, as well as the ability to cycle the fluid through the system filter before diverting to the flow meter. If a bypass line is not used, it is important that all flow control valves be located downstream of the flow meter.

For optimum flow meter performance a minimum length of upstream and downstream piping is required. It is recommended that a minimum length equal to 10 pipe diameters of straight pipe be installed directly on the upstream side of the flow meter and 5 pipe diameters on the downstream side of the flow meter. This helps to eliminate turbulence in the fluid. Having shorter pipe lengths, other system components and elbows to close to the flow meter may adversely affect the accuracy and repeatability of the flow meter. Piping should be the same size as the meter bore or port size.

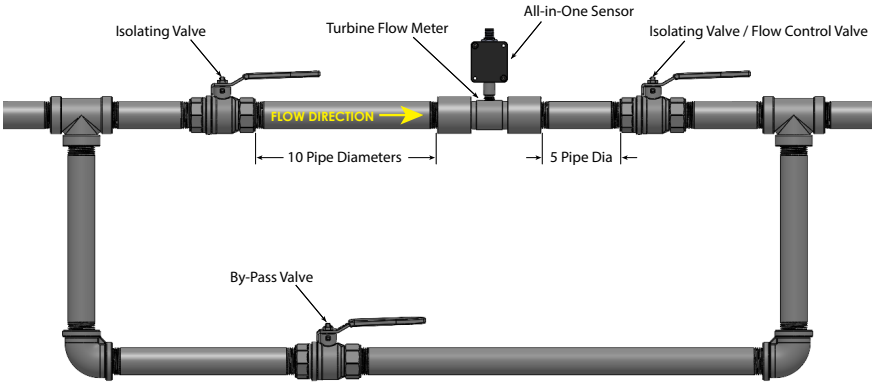

Figure 1: Preferred plumbing setup including by-pass line

Do not locate the flow meter or the connection cable close to electric motors, transformers, sparking devices, high voltage lines or place connecting cable in a conduit with wire supplying power for such devices. These devices can induce false signals in the flow meter coil or cable, causing the meter to read inaccurately.

Pickup Sensor Location

Locate the pickup and wiring away from A/C motors, actuators, heaters, relays, etc. Use only shielded cable and if possible, a dedicated power supply for the electronics. If sharing power with other devices in the system, be aware that power-draw spikes from other equipment could cause a surge into the sensor, which in turn can cause sensor to give erroneous pulses. Ensure clean power supplies that utilize a true earth ground. Install Intrinsic Safety Barriers if the circuit is intended to be intrinsically safe.

Operation

Start-Up Procedure

The following procedures should be observed when installing the flow meter and running it for the first time after installation.

1. After meter installation, close the isolation valves and open the bypass valve. Flow liquid through the system for a sufficient time to eliminate any air or gas in the flow line.

WARNING: Air and gas, running at a high velocity, can damage the internal components of the flow meter.

2. Slowly open the upstream isolating valve to fill the flow meter with liquid.
3. Open the downstream isolating valve to start fluid flow through the flow meter, permitting the flow meter to start to operate, then close the bypass valve completely.
4. If the downstream valve is used as a flow control valve, adjust the valve to provide the required flow rate through the flow meter.

WARNING: Never hit a flow meter, empty of fluid, with full fluid flow. This fluid shock or hammering effect on the internals of the flow meter can permanently damage the internal components.

If any problems with the flow meter arise, consult the Trouble Shooting Guide (Appendix A). If you cannot resolve the problems using this guide, please consult the factor for assistance.

Maintenance

Repair Kits and Flow Meter Maintenance

Repair kits are available if needed. Contact factory for ordering information.

Trouble-Shooting Guide

Problem/Issue	Possible Cause	Possible Fix
The flow meter is indicating a flow rate which is higher than the actual flow rate.	1. Meter cavitation. 2. Buildup of particles/debris on the rotor support. 3. Air or gas in the fluid. 4. Upstream piping at inlet of flow meter is smaller than recommended.	1. Increase back pressure to the flow meter. 2. Clean rotor support & check filter 3. Purge air/gas from system or add a gas eliminator upstream of flow meter. 4. Change piping to recommended size.
The flow meter is indicating a flow rate which is lower than the actual flow rate.	1. Buildup of particles/debris on the rotor. 2. Excessive wear on support bushing. 3. Fluid viscosity higher than calibration fluid viscosity. 4. Fluid flow is leaking through to bypass piping section.	1. Clean rotor & meter & check filter 2. Replace rotor. 3. Recalibrate flow meter with systems fluid or a similar viscosity fluid 4. Check bypass valves are closed. Replace if necessary.
Erratic system indication from remote monitor. Flow meter itself seems to work fine.	1. Ground loop in shielding.	1. Ground shield one place only. 2. Look for internal electronic instrument ground. 3. Isolate cables from electrical noise.

Trouble-Shooting Guide

Problem/Issue	Possible Cause	Possible Fix
Flow meter is indicating fluid flow when system is shut off.	1. Mechanical system vibration. 2. Fluid leak somewhere in the system. 3. Electrical RF/EMI noise.	1. Try to isolate the flow meter from the source of vibration 2. Repair or replace leaking component or piping. 3. Improve grounding of signal cable. 4. Locate & remove noise source.
Flow meter is indicating no flow when fluid is known to be flowing.	1. Damaged internal components due to fluid shock on initial startup. 2. Excessive buildup of particles/debris on shaft and/or support bushing. 3. Actual fluid flow rate is below the stated range of the meter. 4. Faulty sensor/pickup, wiring or monitor.	1. Rebuild the flow meter with a new repair kit. 2. Clean the flow meter & check the filter. 3. Increase flow rate to be within the flow meters stated range. 4. Verify sensor is seated all the way down. 5. Replace pickup or have it repaired by factory 6. Verify unit is properly wired 7. Replace monitor or have it repaired by factory.
Indicated flow rate at lower flow rates is erratic, but fine at higher flow rates.	1. Actual fluid flow rate is below the stated range of the meter. 2. Buildup of particles/ debris on internal components.	1. Increase flow rate to be within the flow meters stated range 2. Clean the flow meters internal components & check the filter.

All-In-One Sensor

Technical Specifications

Supply Voltage Range
12-24VDC ±10%
Max current draw 40-100mA
(model-specific, contact factory)

Analog Output Options
4-20mA & 0-10V - Default
0-5V, 1-5V & 2-10V - Available
through PC Toolkit or mobile app

Standard Max Output
+2.5% of max scaling (20.5mA/5.125V
/10.25V)

Error Indication
+10% of max scaling (22mA/5.5V/11V)

Analog Output Resolution
16 bit

Analog Output Update Time
100mSec minimum

Ambient Temperature
-40°F to 185°F (-40°C to 85°C)

Pulse/Frequency Output:
Push/Pull output - default
Sinking or Sourcing optional.
Easy setup through PC Toolkit.

Bluetooth® Option
Easy setup, scaling, and adjusting.

**Contains Transmitter Module FCC ID: 12208A-01*

Materials of Construction

- Housing: Anodized Aluminum
- Pickup: 303 Stainless Steel body with Zytel cap
- Seal: Chloroprene Rubber (CR)

Dimensional Drawing

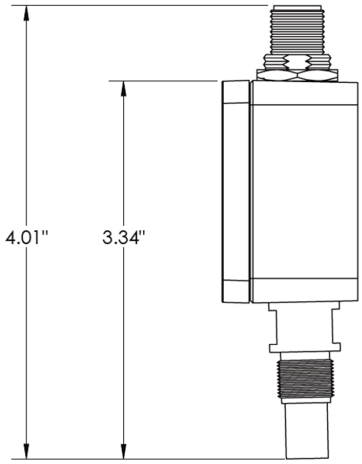

Figure 4: M14 thread-in style sensor

Industry Standard M12-A Connectors

5 PIN

PULSE OUTPUT

1: 12-24VDC
2: GROUND
3: FREQ OUT 1
4: FREQ OUT 2
5: N/C

ANALOG + PULSE

1: 12-24VDC
2: GROUND
3: mA OUT
4: V OUT
5: FREQ OUT 1

8 PIN

ANALOG + PULSE + MODBUS

1: 12-24VDC
2: GROUND
3: FREQ OUT 1
4: FREQ OUT 2
5: mA OUT
6: V OUT
7: MODBUS +
8: MODBUS -

Figure 5: Cable Pin-outs

Signal Outputs

Frequency

Each model of sensor comes equipped with a frequency output. Single pulse versions need to be specified as Sinking or Sourcing when ordered. For all others, frequency out can be set to 3 different output types; Push-Pull, Sinking, and Sourcing. Push-pull is the default setting, and all other options can be set using the Bluetooth app or computer toolkit.

Analog

Current Output - The sensor offers a sourced 4-20 mA output that can be scaled via the Bluetooth app or computer toolkit. Current output is referenced to supply ground.

Voltage Output - The sensor offers 4 types of Voltage outputs; 0-5, 1-5, 0-10, 2-10 Volts. Default output is 0-10V and can be changed via the Bluetooth app and computer toolkit. Voltage output is referenced to supply ground

Input Source

For versions with dual pick-ups, the sensor offers 5 different choices on the frequency output lines; Signal 1, Signal 2, Signal 1+2, Direction, and Limits.

Signal 1 – Outputs frequency from pick-up 1 (leads signal 2 by 90° phase shift)

Signal 2 – Outputs frequency from pick-up 2 (trails signal 1 by 90° phase shift)

Signal 1+2 – Outputs 2x the frequency. Users using this output must multiply the k-factor by 2

Direction – Outputs a high or low signal based on the flow direction. In forward direction, sensor will output a high signal equal to the supply voltage. In reverse flow direction, sensor will output a low signal.

Limits – Outputs a high or low signal based off the selected limit source, Total or Rate.

Test Mode

The sensor comes equipped with a push button that allows the sensor to output a set frequency on the signal output lines. There are 3 modes of operation, indicated by the green LED on the board. (D2 for frequency boards and D4 for analog and Modbus)

Mode 1 – Standard operating mode indicated with 1 green LED that blinks every 3 seconds

Mode 2 – Outputs 10 Hz frequency. For dual sensor versions, it outputs on both signal outs with signal 1 leading signal 2 by a 90 degree phase shift.

Mode 3 – Outputs 50 Hz frequency. For dual sensor versions, it outputs on both signal outs with signal 2 leading signal 1 by a 90 degree phase shift.

Bluetooth Application

Sensor App Overview

For the Modbus and Analog versions of this product a Bluetooth app for Android devices (Android 10 or newer operating systems) is available that allows scaling of the analog output wirelessly. The application can be found on the OMEGA website or on the Google Play store.

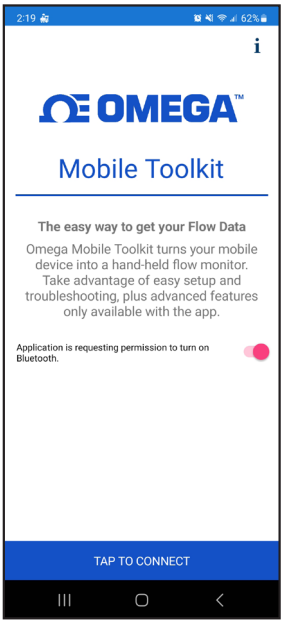

Figure 6: Main Menu

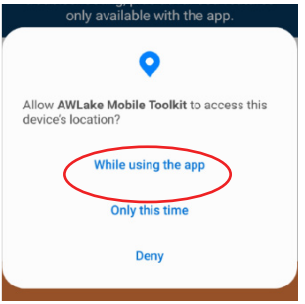

Figure 7: Location Permission

Allow device location for the app, or devices will not appear in search list.

Getting Started

Download and open the application. It will ask to turn on Bluetooth, if not already on. Press the button at the bottom to scan for devices (Figure 6). The default name of the device will be the same as the serial number on the outside of the device. Tap on the name to connect. Once connected the device name will appear at the top of the display with flow rate, Voltage output, and Current output. (Figure 8)

Menu Navigation

Press the three lines in the top right corner to access the setup menu (Figure 9)

System Settings: Adjust K-factor, Filter, Flow Units, Flow Time Base, Max Flow Rate, Max Flow Units, Max Time Base, and Bluetooth name

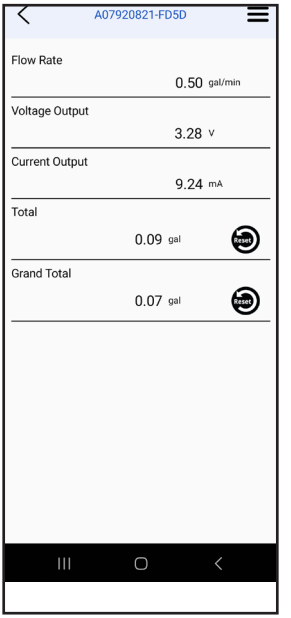

Figure 8: Device Menu

Output Settings: Where outputs can be forced to certain values or output type can be selected (Voltage type only)

Output Calibration: Calibrate analog outputs (consult factory)

Linearizer Table: Allows user to select custom K-factors for different points in the flow range

Diagnostics: Shows raw input frequency

About Bluetooth Device: Displays device type, Bluetooth name, firmware version, and serial number

Factory Reset: Defaults all user settings back to factory settings

Disconnect: Used to disconnect from device

Exit: Closes application

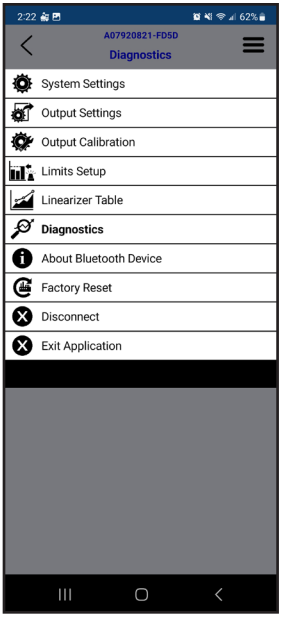

Figure 9: Setup Menu

System Settings

This menu allows users to scale the sensor to output correct analog signal and display correct flow rate in the desired units and time base. It will also allow for filtering of the output. (Figure 10)

After any option is changed press SET for it to take effect. Use back button on phone to return to main screen.

K-Factor: The flow meter scaling factor in pulses/gal (found on calibration sheet)

Digital Filter: Smooth out erratic input frequency. Only effects analog signals. There are four options to choose from:

- **Off:** No filtering
- **Low:** Most filtered, low sensitivity. (Corner frequency ¼ Hz)
- **Medium:** Medium sensitivity. (Corner frequency 1 HZ)
- **High:** Least filtered, high sensitivity. (Corner frequency 10 Hz)

Flow Units: Real time flow rate units

Flow Time Base: Real time flow time base unit

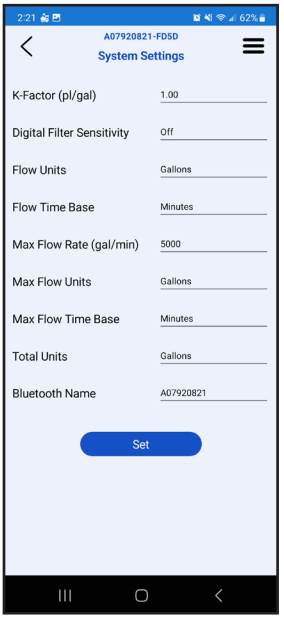

Figure 10: System Settings

Max Flow Rate: The flow rate at which the analog output should be at its max.

Max Flow Units: Selects what unit to scale flow in.

**Flow units will affect Max Flow Rate. Verify both after changing flow units.*

Max Flow Time Base: Can be set to Sec, Min, Hours, and Days.

**Time base will affect the Max Flow Rate. Verify max flow rate is correct after changing time base.*

Bluetooth Name: The name that will appear when searching for the device. Connection will be lost after changing the Bluetooth name and will require reconnection. Name is limited to 19 characters. Some characters on the phone are invalid to use. Examples: $, %, ^ symbols

Output Settings

Forced Outputs

This menu will provide the option to force one or both outputs to a certain value. Along with this ability, Voltage output type will also be selectable. (Figure 5)

To activate, Move the slider to the right. Enter in desired forced output and press **Set** to store information.

**Note: Forced output will not output a value when only being powered by USB. Information will not be stored until SET is pressed and forced value will revert back to previous value or state if output value is outside of the range.*

Forced output limitations: When forcing an output, it must be in between the analog out specifications and will go to the third decimal place.

Ex. 4-20mA output Forced output: 6.25mA
0-10V output Forced output: 7.5V

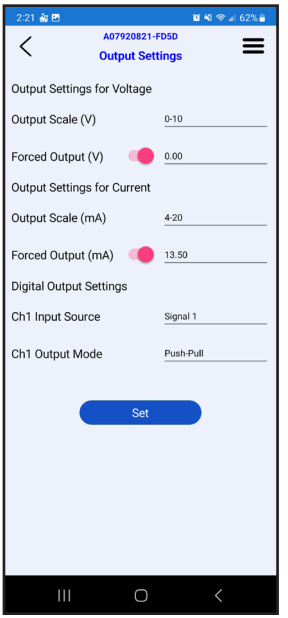

Figure 11: Output Settings

Digital Output Settings

Input Source - User can choose between 5 digital input sources depending on sensor version. Input sources include: Signal 1, Signal 2, Signal 1+2, Direction, and Limit. See page 16 for further descriptions.

Output Mode – User has the option to select the output type of the signal. The 3 options include: Push-Pull, Sinking (NPN), and sourcing (PNP).

Output Calibration

WARNING: Modifying these outputs could result in inaccurate analog signals.

This menu is provided to adjust the sensor analog output to correspond correctly with the analog output of the input device.

** This menu is intended for use with slight output differences between the sensor output and customer input device. These values are factory calibrated before shipping to match meters that are calibrated annually.*

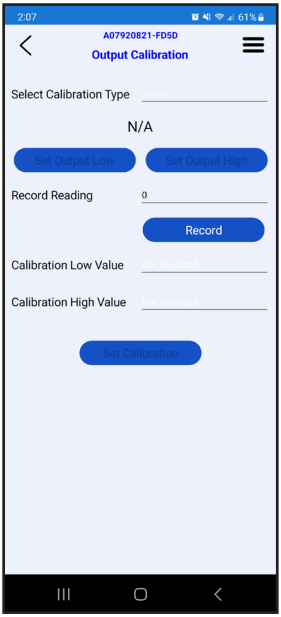

Figure 12: Output Calibration

Select Calibration Type: From this menu both mA and Voltage outputs may be calibrated. (Figure 6)

1. Select which output type to be calibrated; mA or Voltage
2. Press **Set Output Low**, then enter in the value on user's device into Record Reading
   a. Ex. If sensor is being calibrated to a multimeter, enter in reading from multimeter to Record Reading
3. Press **Record** button
4. Now press **Set Output High** to calibrate the high end of the output
5. Enter in High reading from input device to Record Reading
6. Press **Record** button
7. Verify both Calibration high and low values are correct and press **Set Calibration**
8. Use back button on phone to navigate to the main menu

***WARNING: Do not do 2 calibrations in a row. After calibration is finished, exit the app and restart the device.**

Limits

The limit screen is used to set the parameters that trigger the outputs. To use this function, set the Input Source on the Output Settings menu to Limit. The limit has 4 types of triggers: Rate, Total, Grand Total, and Cycle Output.

Rate – Output will go high when flow rate is within the given parameters and low when it goes outside. Select a threshold/ target rate, then select the percentage the flow rate that is allowed to drift from that threshold. Example: a 10% bound on a threshold of 20 gpm would give a rate range of 18-22 gpm.

Total – Output will go high when Total goes above the threshold value.

Grand Total – Output will go high when Grand Total goes above threshold value.

Cycle Output – Output will change state between high and low every time the threshold total is reached. To achieve one pulse per desired output, divide that value by 2. For example, to get 1 pulse per gallon set threshold to 0.5 gallons.

Cycle Output limited to 5Hz or 300 pulses per minute

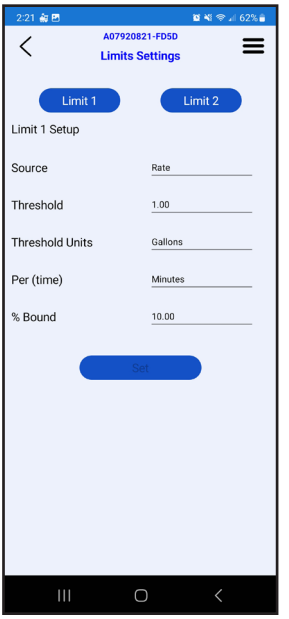

Figure 13: Limits

Linearizer

The linearizer function is designed to correct for devices that will vary in a nonlinear way as a device changes in flow/frequency. It can take nonlinear input and change it to a more linear analog output. (Figure 14)

Ex. Looking at a meter that has a range of 0.5-2 GPM. If at 0.5 GPM (=100HZ) it has a K-factor of 1800, at 1.5 GPM (=200Hz) it has a K-factor of 1850, and at 2.0 GPM (=300Hz) it has a K-factor of 1900. Using a linearizer would ensure the most accurate results over the full range of flow.

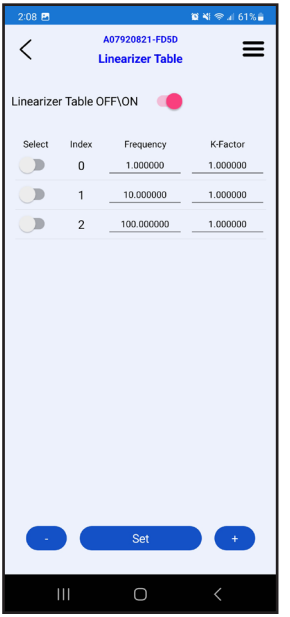

Figure 14: Linearizer Table

Turn On Linearizer: Press the slider to turn the linearizer On and Off. The Slider will turn pink to indicate it is On. Press the **Set** button for selection to take place.

Changing Values: To change values in the table, press on the desired data point that needs changing. Enter in new values and press the **Set** button to save the changes.

Entering New Values: To enter in values to the linearizer, press the **(+)** button. This will bring up the option to type in a desired frequency and corresponding K-factor. After values are entered, press **Add**, this should input the values into the table. Continue to the next row and repeat the process for each additional value needed. There are 10 rows available, but it is not required to fill them all. When desired amount of points are entered, press **Set** to save the changes.

Deleting Values: To Remove a value, press the slider next to the row that needs to be delete. The slider will turn Pink to indicate the row is selected. When all desired rows are selected, press the **(-)** button to remove them. Press **Set** to save the changes.

Short-circuit sink/source internal Current limit:

1. Low Side Driver (Sinking/NPN): MAX 450uA
2. High Side Driver (Sourcing/PNP): MAX -450uA

Leakage current: Max +/- 100uA

Saturation voltage:

1. Low Side Driver (Sinking/NPN)
    a. 1.6V at Iout = 100mA
    b. 2.2V at Iout = 200mA
2. High Side Driver (Sourcing/PNP)
    a. -1.6V at Iout = -100mA
    b. -2.2V at Iout = -200mA

Sensor Modbus Registers

RS485 Settings

- 1 Start Bit
- 8 data Bit
- No Parity Bit
- 1 Stop Bit
- 9600 Baud Rate

Example of Use

Below is a screenshot of the Modbus registers in Modbus Poll. 32-bit float registers are being read in Big-Endian. Integers (Int) are set up as Signed values. And the total resets are set up as single write coils.

Name	Register Start Address	Register Count	Value type	Value Units/ Description
Input Registers (read-only register addresses, read function byte 0x04)				
Raw Frequency Input	5000	2	32 Bit Float	(Hz)
Flow Rate (Users units)	5002	2	32 Bit Float	User Selected
Total (Users Units)	5004	2	32 Bit Float	User Selected
Grand Total (Users units)	5006	2	32 Bit Float	User Selected
Write Coils (Write coil addresses, read function byte 0x05 or 0x0ff00) Single Coil functions only				
Reset Total	1000	1	Bool	0 - False - Normal Mode 1- True - Reset (0x0ff00)
Reset Grand Total and Total	1001	1	Bool	0 - False - Normal Mode 1- True - Reset (0x0ff00)

Name	Register Start Address	Register Count	Value type	Value Units/ Description
Holding Registers (read-write register addresses, read function byte 0x03, write function byte 0x06 for single or 0x10 for multiple registers)				
K-Factor	3000	2	32 Bit Float	
Max Flowrate	3002	2	32 Bit Float	
Flow Rate Time Base	4000	1	Int	0 - Seconds 1 - Minutes 2 - Hours 3 - Days
Flow Rate Volume Unit	4001	1	Int	0 - Pulses 1 - Ounces 2 - Gallons 3 - Barrels (Oil) 4 - Cubic Centimeters 5 - Cubic Meters 6 - Milliliters 7 - Liters
Max Flow Time Base	4002	1	Int	0 - Seconds 1 - Minutes 2 - Hours 3 - Days
Max Flow Volume Unit	4003	1	Int	0 - Pulses 1 - Ounces 2 - Gallons 3 - Barrels (Oil) 4 - Cubic Centimeters 5 - Cubic Meters 6 - Milliliters 7 - Liters
Total Volume Units	4004	1	Int	0 - Pulses 1 - Ounces 2 - Gallons 3 - Barrels (Oil) 4 - Cubic Centimeters 5 - Cubic Meters 6 - Milliliters 7 - Liters

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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