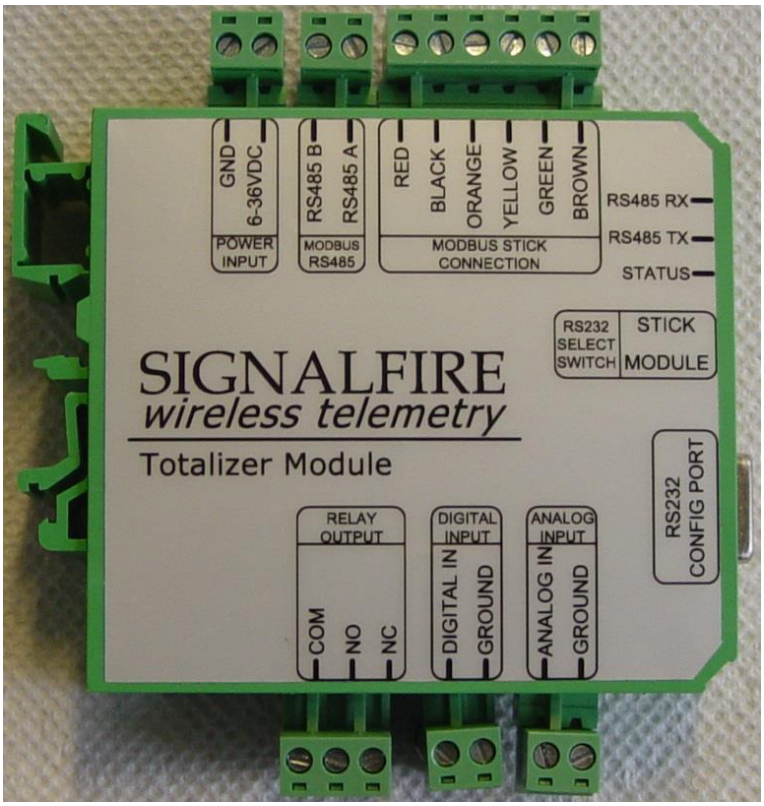
SignalFire Totalizer Manual



The SignalFire Totalizer Module is designed to be an interface module to an analog output on a flow meter. The analog output from the flow meter (4-20 mA or 1-5 V) is integrated over a contract period (configurable 24 hours) and archived. Some of the features are:

Analog input scales to flow velocity (ft/sec)
Pipe diameter configuration
1 second integration period
32 days of history available via Modbus interface
Very low power consumption (few milliamps)
Wide range DC power input – 6 to 36VDC
DIN Rail Mount with pluggable screw terminal blocks
Status LEDs
Future capability for unlimited history, digital input totalizing, and relay output
Real Time Clock (RTC) – Better than 3 minutes drift/year over temperature range
RTC – Battery backed up (10 year life min) – battery not used when powered
Configured using SignalFire's ToolKit

Totalizer Module Connections

The Totalizer module provides screw terminals for the following connections:

- Power – 2 position screw terminal connector (6-36 VDC)
- Modbus – 2 position screw terminal connection to a Modbus master unit (A,B)
- SignalFire Wireless Node – 6 position connection for SF Modbus Stick or Sentinel
- Analog Input – 2 position connection for analog input (4-20mA standard)
- DB9 Plug – Configuration and debug port (SignalFire ToolKit interface)

Status LEDs

The Totalizer module has a green status LED which blinks indicating the module is running. In addition there are RS485 TX/RX LED's to indicate RS485 messages to/from the Modbus port.

Operation

The module will convert the analog input into a flow rate using setup parameters:

Scaling 4 to 20mA = X to Y velocity (V) (ft/sec)
Pipe Diameter Z inches

Calculated Volume Flow (CVF) = $(V * \pi Z^2)/(4*144)$ (ft^3/sec)

Each one second (integration period), the system will calculate the Average Volume (AV) during the one second time period:

$AV\ (ft^3) = CVF\ (ft^3/sec) * 1\ sec$

It will add this to the total volume so far in the 24 hour period. At the end of the 24 hour period, the totalized value will be stored in the history memory (non-volatile). The last 32 days are stored.

Additionally, the current totalized (so far in the contract time) value will be backed up (in case of a loss of power or reboot) every 10 seconds so minimal flow data will be lost.

So, for example:

- 4-20mA = 0-100 ft/sec
- Pipe Diameter = 6 inches

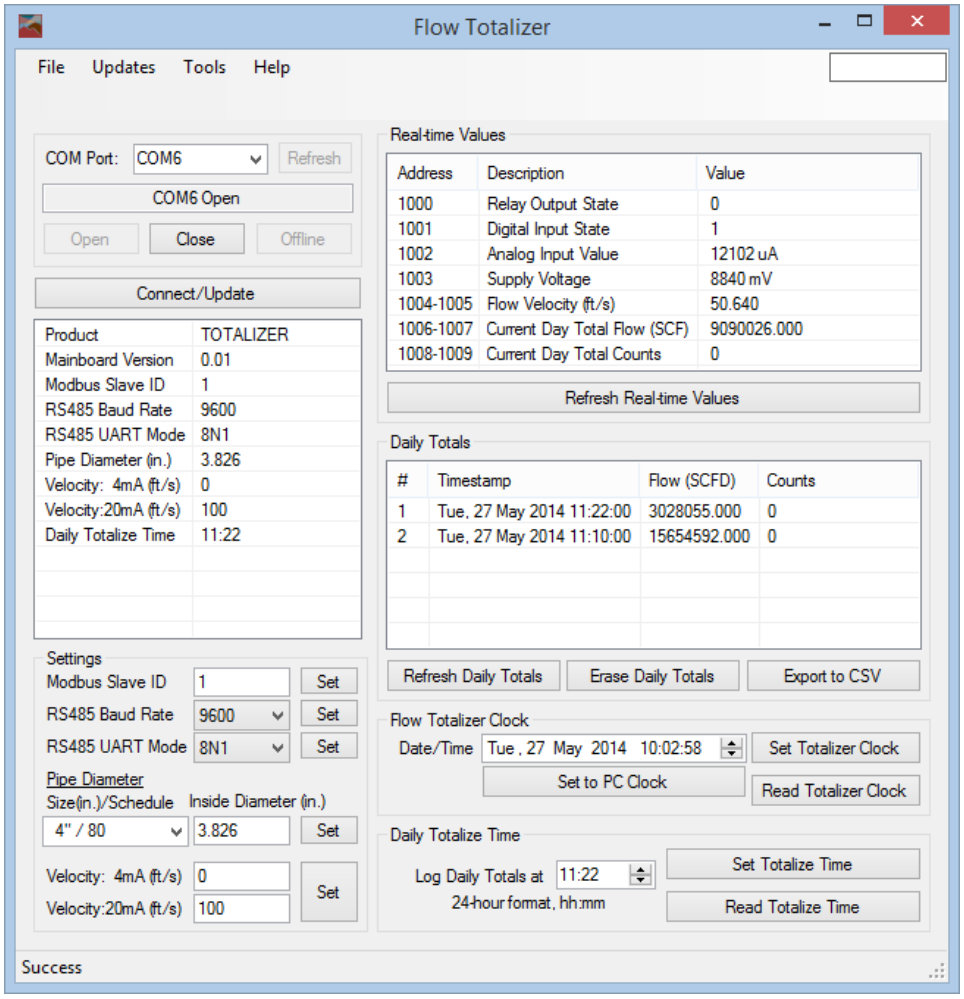
Let's say the analog input is steady at 10mA. This equates to a flow velocity of 37.5 ft/sec.

- $CVF = (37.5 * \pi * 6^2) / (4*144) = 7.363\ ft^3/sec$

Over a 24 hour period, this would equate to a total volume of 636,173 ft^3.

Configuration

The Totalizer module must be configured prior to correct operation. The SignalFire ToolKit is used to configure the module. Connect a PC to the DB9 port of the module and run the ToolKit (note – the slide switch next to the DB9 port must be in the "module" position in order to configure the module).



The following items need to be set:

- Modbus Slave ID – must be unique within the network (also baud rate and mode)
- Pipe Diameter – Pull down selection for common sizes plus a custom size
- Analog Scaling – Analog input (4-20mA) equates to a range of flow rates. In the example above 4-20mA = 0-100 ft/sec.
- Clock – The clock will be set at the factory, but it should be updated in the field as it is likely that the time zones will not be the same. You can sync it with your PC clock or enter a particular time.
- Contract Time – Set the time for the daily total to be archived. The totalizer will save the 24 hour period at this time and reset to zero for the next period.

Configuration via Modbus

In addition to configuring the module settings using the ToolKit, the settings can be viewed and changed remotely via Modbus. See the register map for details.

Modbus Register Map

The register map is large and is shown in the Appendix. However, there are several obvious registers that you will need to read to get relevant information. Here they are:

Register Address	Register Number	Description	Function Codes
1003	41004	Supply Voltage (mV)	03, 04
1004	41005	Flow Velocity (ft/sec) (Float, High Word)	03, 04
1005	41006	Flow Velocity (ft/sec) (Float, Low Word)	03, 04
1006	41007	Current Day Flow Total (Float, SCF, High Word)	03, 04
1007	41008	Current Day Flow Total (Float, SCF, Low Word)	03, 04
2000	42001	Day 1: Flow Total (Float, SCFD, High Word)	03, 04
2001	42002	Day 1: Flow Total (Float, SCFD, Low Word)	03, 04

Note that the Flow Velocity, Current Flow, and Flow Totals are floating point numbers and require a read of two registers.

Appendix – Complete Register Map

Register Address	Register Number	Description	Function Codes
Coils (0xxxx)			
Read/Write			
101	00102	Relay Coil	01, 05
Write-only			
111	00112	Counter Reset Coil	05,
Discretes (1xxxx)			
Read-only			
1001	11002	DI State	02,
Holding Registers (4xxxx)			
Write-only			
121	40122	Relay Pulse (0=Off, 1-255 = Pulse Time (sec))	06,
Read-only, Real-time values			
1000	41001	Relay Coil State	03, 04
1001	41002	DI State	03, 04
1002	41003	ADC Value (uA or mV)	03, 04
1003	41004	Supply Voltage (mV)	03, 04
1004	41005	Flow Velocity (ft/sec) (Float, High Word)	03, 04
1005	41006	Flow Velocity (ft/sec) (Float, Low Word)	03, 04
1006	41007	Current Day Flow Total (Float, SCF, High Word)	03, 04
1007	41008	Current Day Flow Total (Float, SCF, Low Word)	03, 04
1008	41009	Current Day Counter Total (Unsigned long, High Word)	03, 04
1009	41010	Current Day Counter Total (Unsigned long, Low Word)	03, 04
Read/Write			
1010	41011	Modbus Slave ID (1 - 240)	03, 04, 06, 16
1011	41012	RS485 Baud Rate (1200,2400,4800,9600,19200,38400,57600)	03, 04, 06, 16
1012	41013	RS485 UART Mode (see manual for values, 0x00 = 8N1)	03, 04, 06, 16
1013	41014	Current Month (1 - 12)	03, 04, 06, 16
1014	41015	Current Day (1 - 31)	03, 04, 06, 16
1015	41016	Current Year (0 - 99, 0 = 2000)	03, 04, 06, 16
1016	41017	Current Day of Week (0 - 6, 0 = Sunday)	03, 04, 06, 16

1017	41018	Current Hour (0 - 23)	03, 04, 06, 16
1018	41019	Current Minute (0 - 59)	03, 04, 06, 16
1019	41020	Current Second (0 - 59)	03, 04, 06, 16
1020	41021	Totalizer Start of Day, Hour (0 - 23)	03, 04, 06, 16
1021	41022	Totalizer Start of Day, Minute (0 - 59)	03, 04, 06, 16
1022	41023	Pipe Diameter (inches, Float, High Word)	03, 04, 06, 16
1023	41024	Pipe Diameter (inches, Float, Low Word)	03, 04, 06, 16
1024	41025	Flow Velocity Min. (ft/sec, Float, High Word)	03, 04, 06, 16
1025	41026	Flow Velocity Min. (ft/sec, Float, Low Word)	03, 04, 06, 16
1026	41027	Flow Velocity Max. (ft/sec, Float, High Word)	03, 04, 06, 16
1027	41028	Flow Velocity Max. (ft/sec, Float, Low Word)	03, 04, 06, 16
Read-only, Historical values			
2000	42001	Day 1: Flow Total (Float, SCFD, High Word)	03, 04
2001	42002	Day 1: Flow Total (Float, SCFD, Low Word)	03, 04
2002	42003	Day 2: Flow Total	03, 04
2003	42004	Day 2: Flow Total	03, 04
2004	42005	Day 3: Flow Total	03, 04
2005	42006	Day 3: Flow Total	03, 04
2006	42007	Day 4: Flow Total	03, 04
2007	42008	Day 4: Flow Total	03, 04
2008	42009	Day 5: Flow Total	03, 04
2009	42010	Day 5: Flow Total	03, 04
2010	42011	Day 6: Flow Total	03, 04
2011	42012	Day 6: Flow Total	03, 04
2012	42013	Day 7: Flow Total	03, 04
2013	42014	Day 7: Flow Total	03, 04
2014	42015	Day 8: Flow Total	03, 04
2015	42016	Day 8: Flow Total	03, 04
2016	42017	Day 9: Flow Total	03, 04
2017	42018	Day 9: Flow Total	03, 04
2018	42019	Day 10: Flow Total	03, 04
2019	42020	Day 10: Flow Total	03, 04
2020	42021	Day 11: Flow Total	03, 04

2021	42022	Day 11: Flow Total	03, 04
2022	42023	Day 12: Flow Total	03, 04
2023	42024	Day 12: Flow Total	03, 04
2024	42025	Day 13: Flow Total	03, 04
2025	42026	Day 13: Flow Total	03, 04
2026	42027	Day 14: Flow Total	03, 04
2027	42028	Day 14: Flow Total	03, 04
2028	42029	Day 15: Flow Total	03, 04
2029	42030	Day 15: Flow Total	03, 04
2030	42031	Day 16: Flow Total	03, 04
2031	42032	Day 16: Flow Total	03, 04
2032	42033	Day 17: Flow Total	03, 04
2033	42034	Day 17: Flow Total	03, 04
2034	42035	Day 18: Flow Total	03, 04
2035	42036	Day 18: Flow Total	03, 04
2036	42037	Day 19: Flow Total	03, 04
2037	42038	Day 19: Flow Total	03, 04
2038	42039	Day 20: Flow Total	03, 04
2039	42040	Day 20: Flow Total	03, 04
2040	42041	Day 21: Flow Total	03, 04
2041	42042	Day 21: Flow Total	03, 04
2042	42043	Day 22: Flow Total	03, 04
2043	42044	Day 22: Flow Total	03, 04
2044	42045	Day 23: Flow Total	03, 04
2045	42046	Day 23: Flow Total	03, 04
2046	42047	Day 24: Flow Total	03, 04
2047	42048	Day 24: Flow Total	03, 04
2048	42049	Day 25: Flow Total	03, 04
2049	42050	Day 25: Flow Total	03, 04
2050	42051	Day 26: Flow Total	03, 04
2051	42052	Day 26: Flow Total	03, 04
2052	42053	Day 27: Flow Total	03, 04
2053	42054	Day 27: Flow Total	03, 04
2054	42055	Day 28: Flow Total	03, 04
2055	42056	Day 28: Flow Total	03, 04
2056	42057	Day 29: Flow Total	03, 04
2057	42058	Day 29: Flow Total	03, 04
2058	42059	Day 30: Flow Total	03, 04
2059	42060	Day 30: Flow Total	03, 04
2060	42061	Day 31: Flow Total	03, 04
2061	42062	Day 31: Flow Total	03, 04

2062	42063	Day 32: Flow Total	03, 04
2063	42064	Day 32: Flow Total	03, 04
2100	42101	Day 1: Counter Total (Unsigned long, High Word)	03, 04
2101	42102	Day 1: Counter Total (Unsigned long, Low Word)	03, 04
2102	42103	Day 2: Counter Total	03, 04
2103	42104	Day 2: Counter Total	03, 04
2104	42105	Day 3: Counter Total	03, 04
2105	42106	Day 3: Counter Total	03, 04
2106	42107	Day 4: Counter Total	03, 04
2107	42108	Day 4: Counter Total	03, 04
2108	42109	Day 5: Counter Total	03, 04
2109	42110	Day 5: Counter Total	03, 04
2110	42111	Day 6: Counter Total	03, 04
2111	42112	Day 6: Counter Total	03, 04
2112	42113	Day 7: Counter Total	03, 04
2113	42114	Day 7: Counter Total	03, 04
2114	42115	Day 8: Counter Total	03, 04
2115	42116	Day 8: Counter Total	03, 04
2116	42117	Day 9: Counter Total	03, 04
2117	42118	Day 9: Counter Total	03, 04
2118	42119	Day 10: Counter Total	03, 04
2119	42120	Day 10: Counter Total	03, 04
2120	42121	Day 11: Counter Total	03, 04
2121	42122	Day 11: Counter Total	03, 04
2122	42123	Day 12: Counter Total	03, 04
2123	42124	Day 12: Counter Total	03, 04
2124	42125	Day 13: Counter Total	03, 04
2125	42126	Day 13: Counter Total	03, 04
2126	42127	Day 14: Counter Total	03, 04
2127	42128	Day 14: Counter Total	03, 04
2128	42129	Day 15: Counter Total	03, 04
2129	42130	Day 15: Counter Total	03, 04
2130	42131	Day 16: Counter Total	03, 04
2131	42132	Day 16: Counter Total	03, 04
2132	42133	Day 17: Counter Total	03, 04
2133	42134	Day 17: Counter Total	03, 04
2134	42135	Day 18: Counter Total	03, 04
2135	42136	Day 18: Counter Total	03, 04
2136	42137	Day 19: Counter Total	03, 04
2137	42138	Day 19: Counter Total	03, 04
2138	42139	Day 20: Counter Total	03, 04

2139	42140	Day 20: Counter Total	03, 04
2140	42141	Day 21: Counter Total	03, 04
2141	42142	Day 21: Counter Total	03, 04
2142	42143	Day 22: Counter Total	03, 04
2143	42144	Day 22: Counter Total	03, 04
2144	42145	Day 23: Counter Total	03, 04
2145	42146	Day 23: Counter Total	03, 04
2146	42147	Day 24: Counter Total	03, 04
2147	42148	Day 24: Counter Total	03, 04
2148	42149	Day 25: Counter Total	03, 04
2149	42150	Day 25: Counter Total	03, 04
2150	42151	Day 26: Counter Total	03, 04
2151	42152	Day 26: Counter Total	03, 04
2152	42153	Day 27: Counter Total	03, 04
2153	42154	Day 27: Counter Total	03, 04
2154	42155	Day 28: Counter Total	03, 04
2155	42156	Day 28: Counter Total	03, 04
2156	42157	Day 29: Counter Total	03, 04
2157	42158	Day 29: Counter Total	03, 04
2158	42159	Day 30: Counter Total	03, 04
2159	42160	Day 30: Counter Total	03, 04
2160	42161	Day 31: Counter Total	03, 04
2161	42162	Day 31: Counter Total	03, 04
2162	42163	Day 32: Counter Total	03, 04
2163	42164	Day 32: Counter Total	03, 04
2200	42201	Day 1: Month (1 - 12)	03, 04
2201	42202	Day 1: Date (1 - 31)	03, 04
2202	42203	Day 2: Month	03, 04
2203	42204	Day 2: Date	03, 04
2204	42205	Day 3: Month	03, 04
2205	42206	Day 3: Date	03, 04
2206	42207	Day 4: Month	03, 04
2207	42208	Day 4: Date	03, 04
2208	42209	Day 5: Month	03, 04
2209	42210	Day 5: Date	03, 04
2210	42211	Day 6: Month	03, 04
2211	42212	Day 6: Date	03, 04
2212	42213	Day 7: Month	03, 04
2213	42214	Day 7: Date	03, 04
2214	42215	Day 8: Month	03, 04
2215	42216	Day 8: Date	03, 04

2216	42217	Day 9: Month	03, 04
2217	42218	Day 9: Date	03, 04
2218	42219	Day 10: Month	03, 04
2219	42220	Day 10: Date	03, 04
2220	42221	Day 11: Month	03, 04
2221	42222	Day 11: Date	03, 04
2222	42223	Day 12: Month	03, 04
2223	42224	Day 12: Date	03, 04
2224	42225	Day 13: Month	03, 04
2225	42226	Day 13: Date	03, 04
2226	42227	Day 14: Month	03, 04
2227	42228	Day 14: Date	03, 04
2228	42229	Day 15: Month	03, 04
2229	42230	Day 15: Date	03, 04
2230	42231	Day 16: Month	03, 04
2231	42232	Day 16: Date	03, 04
2232	42233	Day 17: Month	03, 04
2233	42234	Day 17: Date	03, 04
2234	42235	Day 18: Month	03, 04
2235	42236	Day 18: Date	03, 04
2236	42237	Day 19: Month	03, 04
2237	42238	Day 19: Date	03, 04
2238	42239	Day 20: Month	03, 04
2239	42240	Day 20: Date	03, 04
2240	42241	Day 21: Month	03, 04
2241	42242	Day 21: Date	03, 04
2242	42243	Day 22: Month	03, 04
2243	42244	Day 22: Date	03, 04
2244	42245	Day 23: Month	03, 04
2245	42246	Day 23: Date	03, 04
2246	42247	Day 24: Month	03, 04
2247	42248	Day 24: Date	03, 04
2248	42249	Day 25: Month	03, 04
2249	42250	Day 25: Date	03, 04
2250	42251	Day 26: Month	03, 04
2251	42252	Day 26: Date	03, 04
2252	42253	Day 27: Month	03, 04
2253	42254	Day 27: Date	03, 04
2254	42255	Day 28: Month	03, 04
2255	42256	Day 28: Date	03, 04
2256	42257	Day 29: Month	03, 04

2257	42258	Day 29: Date	03, 04
2258	42259	Day 30: Month	03, 04
2259	42260	Day 30: Date	03, 04
2260	42261	Day 31: Month	03, 04
2261	42262	Day 31: Date	03, 04
2262	42263	Day 32: Month	03, 04
2263	42264	Day 32: Date	03, 04