# 895/896M Frequency Output Math Modules

## Application Example

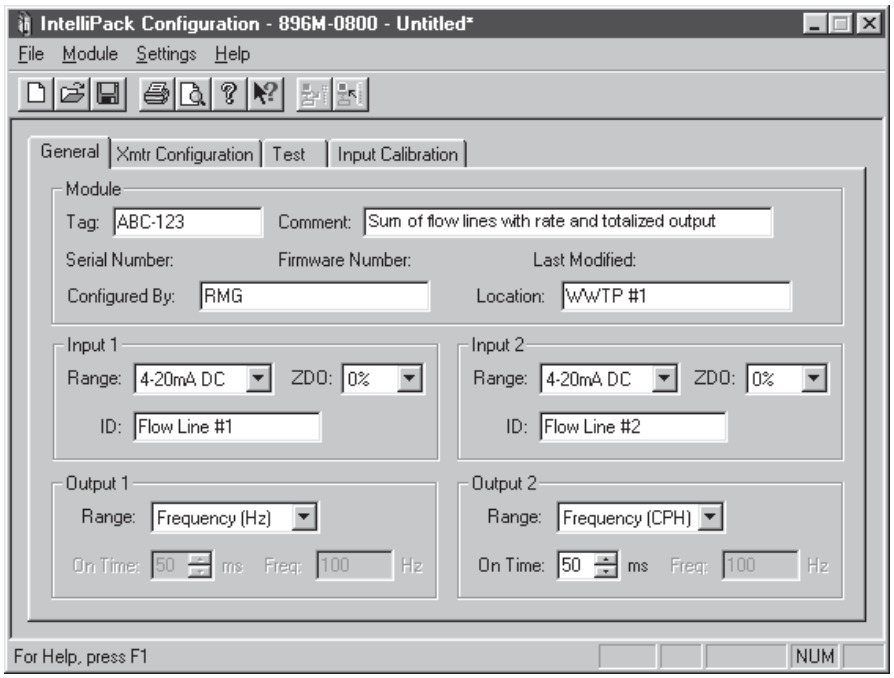
Both models are designed for integrator/totalizer applications. The 896M is ideal for demand metering applications. With one high speed pulse output and one low speed output to a pulse counter, you can measure the sum, flow, rate, and total volume.

### Configuration Procedures

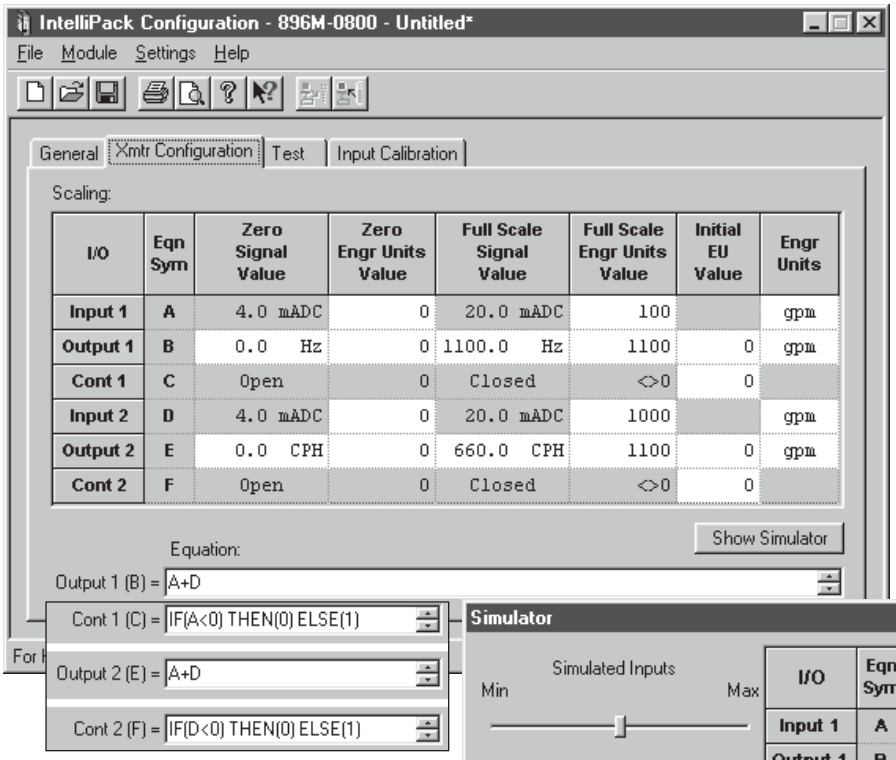
1) Enter optional tag identifiers and application information.

2) Select input ranges and zero dropout values from pull-down lists and identify the device.

3) Select output ranges from the pull-down menu and set the duty cycle (on-time).




*IntelliPack Configuration Software makes it very easy to set up your input and output ranges and other operational parameters.*




| I/O | Eqn Sym | Zero Signal Value | Zero Engr Units Value | Full Scale Signal Value | Full Scale Engr Units Value | Initial EU Value | Engr Units |
|---|---|---|---|---|---|---|---|
| Input 1 | A | 4.0 mADC | 0 | 20.0 mADC | 100 | | gpm |
| Output 1 | B | 0.0 Hz | 0 | 1100.0 Hz | 1100 | 0 | gpm |
| Cont 1 | C | Open | 0 | Closed | <>0 | 0 | |
| Input 2 | D | 4.0 mADC | 0 | 20.0 mADC | 1000 | | gpm |
| Output 2 | E | 0.0 CPH | 0 | 660.0 CPH | 1100 | 0 | gpm |
| Cont 2 | F | Open | 0 | Closed | <>0 | 0 | |

*The IntelliPack math module's configuration property sheet simplifies the entry of equations.*

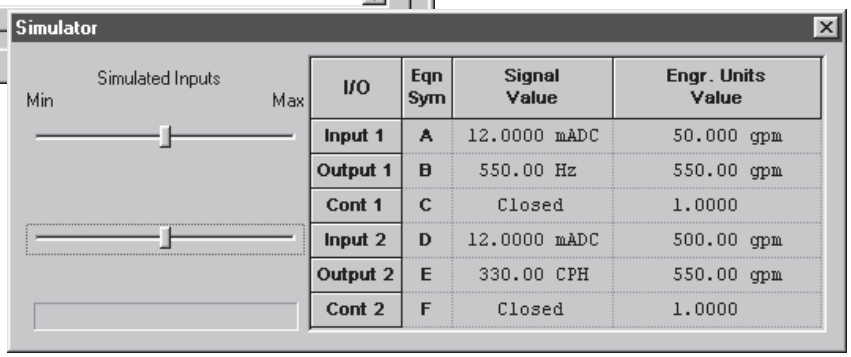
4) Enter the scaling parameters in engineering units for input variables A and D.

5) Enter the frequency scaling parameters for outputs B and E.

6) Enter the initial start-up conditions for outputs B, C, E, and F in engineering units.

7) Enter up to four 50-character equations in the scroll-down fields to define each output.

8) Use the I/O equation simulator (shown below) to verify the expected results for various field conditions.




| I/O | Eqn Sym | Signal Value | Engr. Units Value |
|---|---|---|---|
| Input 1 | A | 12.0000 mADC | 50.000 gpm |
| Output 1 | B | 550.00 Hz | 550.00 gpm |
| Cont 1 | C | Closed | 1.0000 |
| Input 2 | D | 12.0000 mADC | 500.00 gpm |
| Output 2 | E | 330.00 CPH | 550.00 gpm |
| Cont 2 | F | Closed | 1.0000 |

*The pop-up simulator sheet helps you test equations in software with slider bars to simulate input conditions.*

# Real Time Monitoring

## 895/896M Frequency Output Math Modules

### Models

895M-0800: Single I/O channel
896M-0800: Dual I/O channels

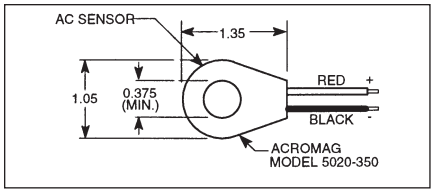
### Input Ranges

0 to 1mA, 0 to 20mA, or 4 to 20mA DC
0 to 5V or 0 to 10V DC
0 to 20A AC (with AC current sensor)

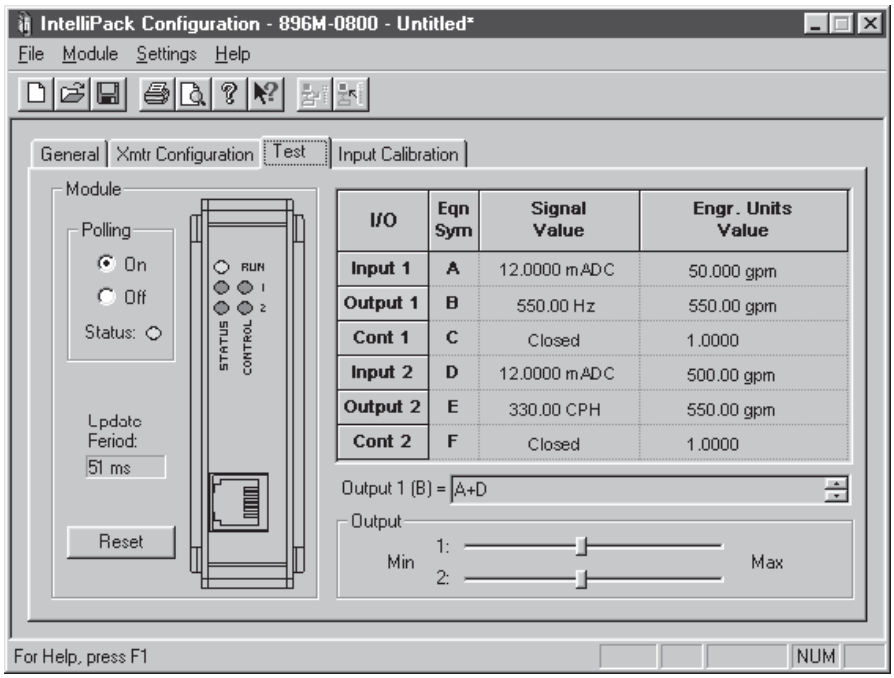
### Output Ranges

0 to 36,000 pulse counts per hour,
0 to 10KHz Open-drain MOSFETs (60V DC @ 1A),
Solid-state relays (60V DC @ 500mA)

High-voltage open-drain outputs interface to a variety of discrete level devices and to TTL level systems with the use of internal 5V pull-ups.




AC Current Sensor Model 5020-350 (ordered separately)




*The test property sheet continuously displays polled information and input/output signal values for easy troubleshooting and diagnostic checkout.*

## Arithmetic Functions

| Function | Equation |
|---|---|
| Addition | A + D |
| Subtraction | A - D |
| Multiplication | 4*A - 6*D |
| Division | (A/4 + D/2) / 8 |
| Square Root | SQRT (A + D) |
| Absolute Value | ABS (A - D) |
| Exponential | EXP (2*A) = $e^{2A}$ |
| Power | POWER (A, D) = $A^{D}$ |
| Natural Log | LN (A + D) |
| Log Base 10 | LOG10 (A/D) |
| SIN, COS, TAN, ASIN, ACOS, ATAN | SIN (A - D) ACOS (A*D) |
| Minimum | MIN (A/2, 3*D) |
| Maximum | MAX ((A - D)/4, A + D) |

## Conditional

| Function | Equation |
|---|---|
| If, Then, Else, And, Or | IF (A > D) THEN (2*B) |
| >, <, <>, =, >=, <= | IF (OR (A = D, D <= 4*A) THEN (E/2) |

## Track & Hold Function

Discrete inputs on the math module accept logic level signals from PLCs and other devices to hold the associated output constant at the last known value. This function is helpful in determining conditions at the time of a critical event.

## 895/896M Performance Specs

### General

**Analog to Digital Converter (ADC)**
16-bit Σ–Δ A/D converter.

**Input Accuracy**
Better than ±0.05% of input span.

**Input Zero Dropout Threshold**
0 to 10% of input span, user-defined.

**Ambient Temperature Effect**
Better than ±0.005% of input span per °C or ±1µV, whichever is greater.

**Noise Rejection**
Normal Mode: Better than 40dB @ 60Hz.
Common Mode: Better than 100dB @ 60Hz.

**Input Overvoltage Protection**
Bipolar Transient Voltage Suppressors (TVS).

**Input Scaling**
Input signal endpoints are scaled using IntelliPack Configuration Software.

**Response Time (for input step change)**
70mS typical to 98% of final output value.

### DC Current Inputs

**DC Current Input Ranges**
0 to 1mA, 0 to 20mA, 4 to 20mA DC.

**DC Current Input Impedance**
49.9 ohms.

### DC Voltage Inputs

**DC Voltage Input Ranges**
0 to 5V, 0 to 10V DC.

**DC Voltage Input impedance**
Greater than 500K ohms.

### Frequency Output

**Output Type**
Open -drain MOSFETs, 60V DC @ 1A DC.
On resistance: 0.2 ohms.

**Frequency Range**
0 to 10KHz (100% scalable) or
0 to 36,000 counts per hour (CPH).

**Output Scaling**
Output signal endpoints are scaled using IntelliPack Configuration Software. Output frequency is limited from a minimum span of 0-10Hz to a maximum span of 0-10KHz or from 0-10CPH to 0-36000 CPH.

**Output Pullups**
470 ohms to 5V via pullup terminals.
60V DC with external pullup resistor.

**Output Duty Cycle**
User-defined on-time from 0 to 100% of frequency range.

### Relay Control Outputs

**Solid-State Relay**
Form A normally-open switch.
Maximum current: 500mA DC.
Maximum off-state voltage: 60V DC.
Maximum on-state resistance: 0.7 ohms.

### Environmental

**Ambient Temperature**
Operating: -25 to 70°C (-13 to 158°F).
Storage: -40 to 85°C (-40 to 185°F).

**Relative Humidity**
5 to 95%.

**Power Requirements**
10 to 36V DC. 55mA @ 24V.

**Isolation (optical)**
4-way (input/output/relays/power).
Input circuits share a common.
1500V AC peak or 250V AC (354V DC) continuous.

**Radiated Field Immunity (RFI)**
EN61000-4-3, EN50082-1.

**Electromagnetic Field Immunity (EMI)**
Less than ±0.25% of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

**Electrical Fast Transient (EFT)**
EN61000-4-4, EN50082-1.

**Surge Withstanding Capability (SWC)**
EN61000-4-5, EN50082-1.

**Electrostatic Discharge (ESD)**
EN61000-4-2, EN50082-1.

**Radiated Emissions**
EN50081-1 for Class B equipment.

**Approvals**
CE, UL listed (USA, Canada).
UL3121 - general product safety.

### Configuration

**Software Configuration**
Units are fully programmable via the Windows XP/Vista/7 IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

**LED Indicators**
LEDs indicate power, status, and relay.

### Physical

**Enclosure**
Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

**Connectors (Removable Terminal Blocks)**
Wire Range: AWG #14-24.

**Printed Circuit Boards**
Military grade FR-4 epoxy glass circuit board.

**Dimensions**
1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

**Shipping Weight**
1 pound (0.45 Kg) packed.

## Ordering Information

IMPORTANT: All IntelliPack units require initial software configuration (order 800C-SIP). See Note 1 below.

**895M-0800**
Single channel math module with one frequency output and one control/relay output.

**896M-0800**
Dual channel math module with two frequency outputs and two control/relay outputs.

**5020-350**
AC current sensor. Required for AC inputs..
See Page 205 for more information.

**800C-SIP**
Software Interface Package.
Only one kit is required for all IntelliPack models.
See diagram on Page 83 for included parts.

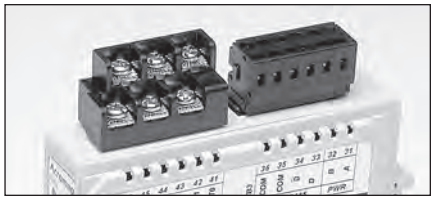
**5034-225**
USB-to-RS232 adapter. See page 121 for more info.

**PS5R-D24**
Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

**TBK-B02**
Optional terminal block kit, barrier strip style, 4 pcs.

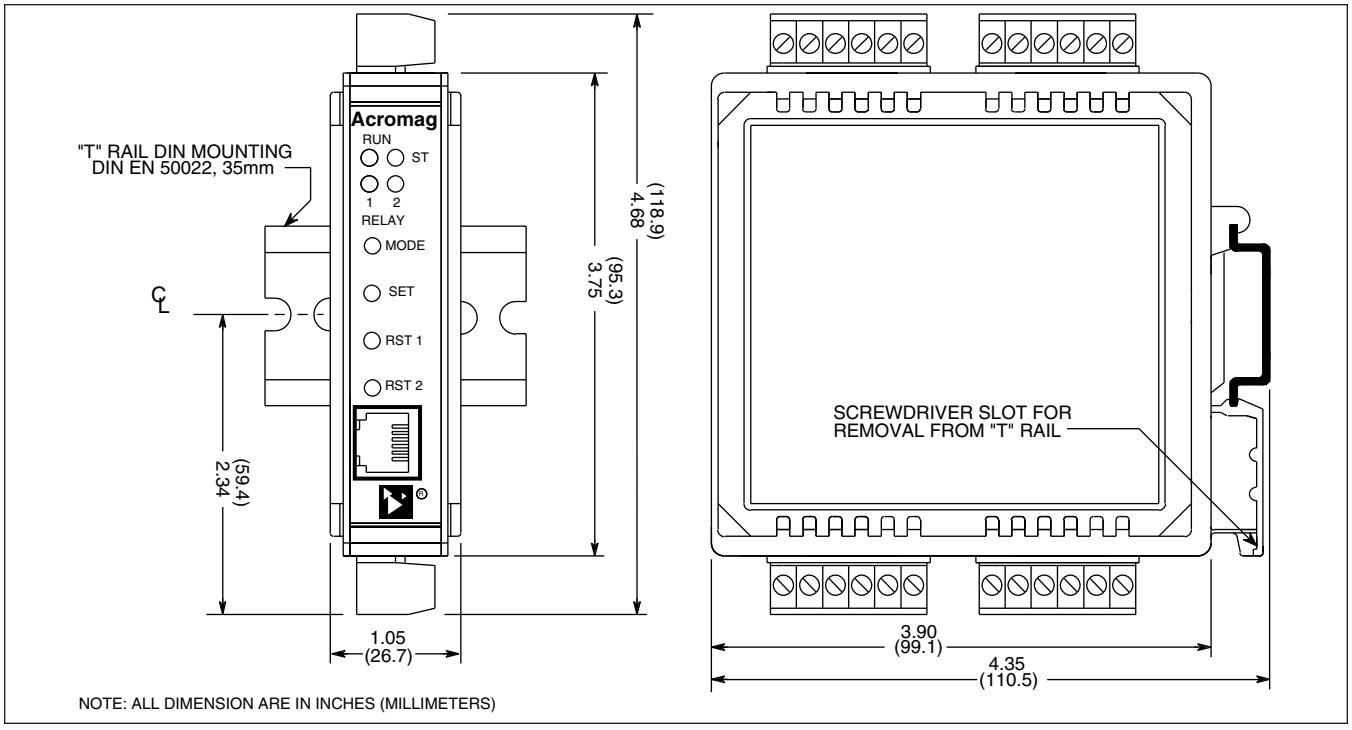
**TBK-S02**
Optional terminal block kit, spring clamp style, 4 pcs.

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 892M-0500-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

## Dimensions


"T" RAIL DIN MOUNTING
DIN EN 50022, 35mm
Acromag
RUN
ST
1 2
RELAY
MODE
SET
RST 1
RST 2
(118.9)
4.68
(95.3)
3.75
(59.4)
2.34
1.05
(26.7)
SCREWDRIVER SLOT FOR
REMOVAL FROM "T" RAIL
3.90
(99.1)
4.35
(110.5)
NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

# Accessories

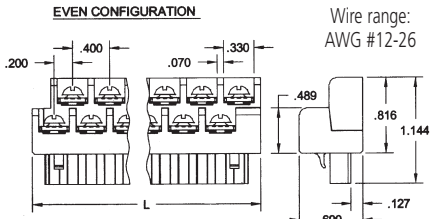
## Terminal Blocks

Barrier strip (left) and spring clamp (right).

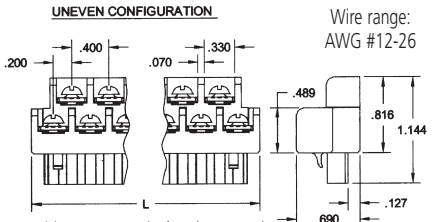
### Ordering Information

See individual I/O modules for compatibility.

#### Barrier Strip Terminal Blocks




6-position: L = 1.47 inches (37.7 mm)



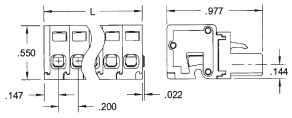

3-position: L = 0.87 inches (22.3 mm)

**TBK-B01**
Terminal block kit, two 6-position pieces

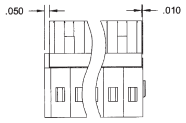
**TBK-B02**
Terminal block kit, four 6-position pieces

**TBK-B03**
Terminal block kit, one 3-position and three 6-position pieces

#### Spring Clamp Terminal Blocks




Wire range:
AWG #12-26




3-position:
L = 0.66 inches (16.9 mm)

6-position:
L = 1.26 inches (32.3 mm)

**TBK-S01**
Terminal block kit, two 6-position pieces

**TBK-S02**
Terminal block kit, four 6-position pieces

**TBK-S03**
Terminal block kit, one 3-position and three 6-position pieces

## Mounting Hardware

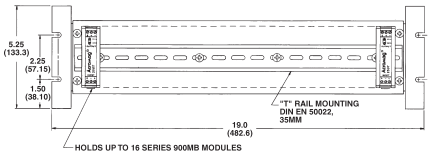
### DIN-Rail Mounting

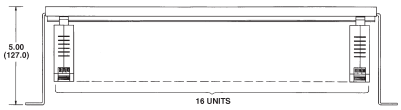
For your convenience, Acromag offers several mounting accessories to simplify your system installation. Our 19" rack-mount kit provides a clean solution for mounting your I/O modules and a power supply. Or you can buy precut DIN rail strips for mounting on any flat surface.

### Ordering Information

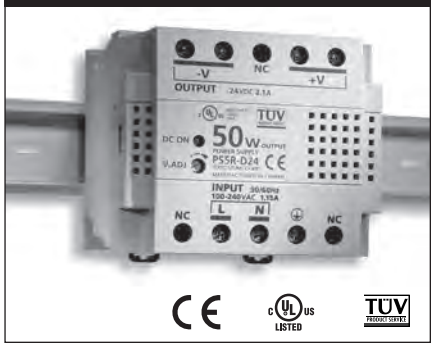
**20RM-16-DIN**
19" rack-mount kit with DIN rail.

**DIN RAIL 3.0**
**DIN RAIL 16.7**
DIN rail strip, Type T, 3 inches (75mm) or 16.7 inches (425mm)




## Power Supplies




### 50W Supply

**Input Power Requirement**
85 to 264V AC or 105 to 370V DC

**Output**
24V DC, 2.1A (50W)

### Ordering Information

**PS5R-D24**
Universal 50W power supply

See Power Supplies on Page 199 for other models and more information.

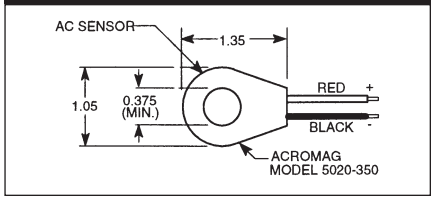
## USB / RS232 Adapter

Length: 3.15 in (8.0 cm)
Height: 0.80 in (2.03 cm)
Width: 1.75 in (4.44 cm)
Weight: 1.6 oz (45.36 g)

### Ordering Information

**5034-225**
USB-to-RS232 adapter

## AC Current Sensor




### Ordering Information

**5020-350**
AC current sensor (See page 205)