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<td>A quick overview for batchers.</td>
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<tr>
<td>MINIBATCHER</td>
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<td>Low cost, miniature batch controller with pulse input.</td>
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<td>SUPERtrol II LE</td>
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<td>Batch controller indicator for pulse inputs.</td>
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<td>Batch controller indicator with pulse or analog inputs.</td>
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</tr>
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<td>FLOWtrol</td>
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<td>Batch controller with two DPDT relay outputs</td>
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<td>MASSbatch</td>
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<td>A quick overview for flow computers.</td>
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<tr>
<td>SUPERtrol-I</td>
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<td>Batch controller, Rate/Total indicator with pulse or analog inputs.</td>
</tr>
<tr>
<td>SUPERtrol-II</td>
<td>75</td>
<td>Multifunction flow computer, compensates steam, gases and liquid for temperature &amp; pressure to yield Volumetric, Mass &amp; Heat Flow.</td>
</tr>
<tr>
<td>MS-748</td>
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<td>Rugged, Field Mount, Multi-Function Flow Computer.</td>
</tr>
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<td>ES-747</td>
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<td>Flow Computer for Liquid and Gas Applications.</td>
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<tr>
<td>DPFC</td>
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</tr>
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### Communication Solutions

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<td>KEPServer (KEPS-KEP1-32)</td>
<td>93</td>
<td>SUPERtrol series 32 bit device driver for KEPware's DDE Server.</td>
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<tr>
<td>TROLlink</td>
<td>94</td>
<td>Remote metering and data collection software.</td>
</tr>
<tr>
<td>IEPS 1000</td>
<td>96</td>
<td>Intelligent Ethernet Port Server - Single Port.</td>
</tr>
<tr>
<td>IEPS 3000</td>
<td>97</td>
<td>Intelligent Ethernet Port Server - Up to 4 Ports.</td>
</tr>
<tr>
<td>MPP-2400</td>
<td>99</td>
<td>Port Powered Modem, 2400 Baud Rate.</td>
</tr>
<tr>
<td>MPP-2400N</td>
<td>101</td>
<td>Port Powered Modem, 2400 Baud Rate in NEMA4 enclosure.</td>
</tr>
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<td>TWP</td>
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<td>Industrial Two Way Pager Wireless Data Transceiver.</td>
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</thead>
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<td>A quick overview for factory automation.</td>
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<td>Infilink-HMI</td>
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<td>Industrial Automation Software.</td>
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<td>KEPServerEX</td>
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<td>OPC/DDE Server Software.</td>
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<tbody>
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<td>FLOWtrol</td>
<td>108</td>
<td>Batch Controller with DPDT relays.</td>
</tr>
<tr>
<td>KEPtrol F/C</td>
<td>108</td>
<td>Net rate &amp; total display, ideal for net flow of boiler or diesel fuel.</td>
</tr>
<tr>
<td>MASSBATCH</td>
<td>109</td>
<td>Batch controller with Temperature or Density Compensation.</td>
</tr>
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</table>

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<td>Explosion proof housing for standard 'trol products.</td>
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<td>XHV</td>
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<td>Explosion proof housing for viewing displays (Supertrols, MRT, INT69, etc) in hazardous areas.</td>
</tr>
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<td>NEMATROL</td>
<td>113</td>
<td>Wall mountable NEMA 4X Enclosures.</td>
</tr>
<tr>
<td>LCN4X</td>
<td>114</td>
<td>Low Cost NEMA 4X Wall mountable Enclosures.</td>
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<td>E200</td>
<td>115</td>
<td>Outdoor Enclosure for 1/32 DIN units.</td>
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<td>P1000</td>
<td>116</td>
<td>Table top / hand held serial printer.</td>
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<tr>
<td>P295</td>
<td>117</td>
<td>Miniature Slip Printer.</td>
</tr>
<tr>
<td>115 Series</td>
<td>118</td>
<td>5, 12 and 24 VDC power supplies with 115 or 230 VAC input.</td>
</tr>
<tr>
<td>AMP-1</td>
<td>118</td>
<td>Preamplifier and signal conditioner for magnetic pickups.</td>
</tr>
<tr>
<td>SPARE PARTS</td>
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<td>Various retrofit boards, IC chips, fuses and spare parts.</td>
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</table>
KEP Company Overview

Introduction
Kessler Ellis Products has manufacturing facilities located in Eatontown, New Jersey. KEP has been supplying display and instrumentation products since it was founded in 1960. In the early 80's, KEP broadened its product line to include flow measurement instrumentation. As the market for instrumentation continued to evolve, product offerings grew to include industrial automation, communication server software, communications accessories, and Industrial PC’s.

People
KEP team members have consistently shown an obsessive concern about our customers for the last 40 years. We work hard to offer you solutions that solve your problems and service your needs. We take that extra step to ensure complete customer satisfaction.

Flow Measurement Community
KEP seeks to service the flow measurement community by providing versatile, economical instrumentation and “know how” to our users. Our goal is to enable you to select a suitable instrument from our offerings for use with a flowmeter selected from any supplier of your choice from the broad range of flowmeter types and suppliers on the market today.

Flowmeter Compatibility
There are a large number of flowmeter types in the market which are compatible with our line of instruments. These include: Coriolis, magnetic, nozzle, open-channel, orifice, pitot/annubar, positive displacement, rotometers, thermal mass, turbine, venturi, and vortex. Our flow instruments also operate with many proprietary flowmeter types.

Applications Assistance
KEP has a large number of applications engineers to assist you in selecting the most appropriate instrument for your application. Our application engineers can provide the detailed “know how” necessary to setup each instrument and to assist in the electrical interconnection between the flowmeter and the instrument.

Special Configurations
In addition to the standard products listed in this catalog, KEP offers in house engineering capabilities to customize the products and enclosures to meet the special needs of customers. Please contact us with you requirements.

Selection Guides
The pages which follow include two selection guides. The first is a preliminary selection guide to help you select several instruments that appear suitable for use with your flowmeter type and perform the intended instrument functions. The second selection guide contains a feature grid to help you make your final selection.

If you are unfamiliar with some aspect of the equipment selection or utilization, please review the tutorials that appear at the start of each section. These include answers to the most frequently asked questions we encounter while assisting customers.

Web Site
Visit our web site (www.kep.com) for the latest datasheets, user manuals, setup software, application notes and other vital information.

http://www.kep.com
# Product vs. Flow Meter Compatibility Table

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<tr>
<th>Flow Meter Type</th>
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<th>Flow Batch Controllers</th>
<th>Flow Computers</th>
<th>Level and Special Instruments</th>
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</thead>
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<tr>
<td>Coriolis</td>
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<td>1</td>
<td>1, 2</td>
<td>1, 2</td>
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<tr>
<td>Differential Producers:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venturi</td>
<td>*</td>
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<tr>
<td>V-Cone</td>
<td>*</td>
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<tr>
<td>Flow Nozzle</td>
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<tr>
<td>Wedge</td>
<td></td>
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<tr>
<td>Elbow</td>
<td></td>
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<tr>
<td>Orifice</td>
<td></td>
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<tr>
<td>Pitot / Annubar</td>
<td></td>
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<tr>
<td>Magnetic</td>
<td>2</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2</td>
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<tr>
<td>Positive Displacement</td>
<td>2</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Propeller (turbo)</td>
<td>2</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Roto Meter (Variable Area)</td>
<td></td>
<td>2, 4</td>
<td>*</td>
<td>2, 4</td>
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<tr>
<td>Target</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Turbine (paddle wheel &amp; Insertion)</td>
<td>2</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Thermal</td>
<td>*</td>
<td>*</td>
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<td>Ultrasonic</td>
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<tr>
<td>Vortex</td>
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<td>*</td>
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<tr>
<td>Open Channel Weirs &amp; Flumes</td>
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<td>2, 4</td>
<td>2, 4</td>
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<tr>
<td>ILVA / GilFlo</td>
<td></td>
<td></td>
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<td>*</td>
</tr>
</tbody>
</table>

**NOTES:**
* Recommended
1. Recommended for flow sensors equipped with pulse out converter
2. Recommended for flow sensors equipped with analog out converter
3. KEP unit must be equipped with optional Square Root Extraction feature
4. Multi point linearization option required
## Product vs. Feature Table

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<tr>
<th>Features</th>
<th>Flow Indicators Rate &amp; Totalizers</th>
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<td>Square</td>
<td>BAT R/T</td>
<td>RAT &amp; D/T</td>
<td>INTELLECT-69</td>
</tr>
<tr>
<td>AC Powered</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>DC Powered</td>
<td>●</td>
<td>●</td>
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<td>●</td>
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<tr>
<td>Loop Powered</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td>Battery Powered</td>
<td>●</td>
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<td>●</td>
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<tr>
<td>DC Power Output</td>
<td>●</td>
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<td>●</td>
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<tr>
<td>LED Display</td>
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<tr>
<td>LCD Display</td>
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<tr>
<td>2 x 20 Char. Backlit LCD Display</td>
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<td>●</td>
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<tr>
<td>2 x 20 Char. VFD Display</td>
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<tr>
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<tr>
<td>Accumulative Total (grand total)</td>
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<td>12</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Net Total Display (A-B, A+B)</td>
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<td>●</td>
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<tr>
<td>Net Rate Display (A-B, A+B)</td>
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<td>Two Pulse Inputs, Separate Scaling</td>
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<td>Pulse Inputs</td>
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<td>Magnetic Pickup Inputs</td>
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<td>Quadrature Inputs</td>
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<td>Analog Inputs</td>
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<tr>
<td>Quadrature Inputs</td>
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<td>Square Root Extraction</td>
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<td>Multi Point Linearization</td>
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<tr>
<td>Stacked DP Inputs</td>
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<td>Batching Capability</td>
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<td>Remote Start &amp; Stop Inputs</td>
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<td>Alarm Outputs</td>
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<td>Pulse Outputs</td>
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<td>RS-232 Serial Communication</td>
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<td>RS-422 Serial Communication</td>
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<td>RS-485 Serial Communication</td>
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<td>Temperature Compensation</td>
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<td>Heat (BTU) Equations</td>
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<td>Volume Equations</td>
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<td>Corrected Volume Equations</td>
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<td>Gas Equations</td>
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</tr>
<tr>
<td>NEMA4 (water tight) Enclosure</td>
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<td>NEMA7 (explosion proof) Enclosure</td>
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<td>MPP-2400 Modem</td>
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<td>TWP Two Way Pager</td>
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</tbody>
</table>

**NOTE:** Refer to datasheets for compatibilities of other models not listed.
Signal Conditioners and Converters Tutorial

Signal conditioners, signal converters, transmitters and amplifiers are devices which represent the majority of the basic instrumentation requirements for transducers. They are provided with flow, temperature, pressure, as well as many other transducer sensor types.

In some cases the signal conditioner/converter is provided by the sensor manufacturer so the user will have his desired output signal.

However, in other cases, there is a need for an external signal conditioner/converter to provide the desired output signal or to provide it at a more attractive price.

Signal conditioners and converters are ancillary devices intended to amplify, filter, condition, scale, and convert the low level “raw” signals produced by many transducers and convert it into the desired, industry standard high level signal before transmitting it across a potentially noisy environment. In some cases, a secondary function is providing signal isolation.

Generally, the output signals from the sensor may be in the form of either a pulse or analog current / voltage that is proportional to the span of the signal being measured. Open collector transistors are common as pulse output signals. The most common analog signal is a 4-20mA.

In many flowmeter types the frequency of the raw input signal carries the flow information. The frequency is related to flow rate. Each pulse or cycle is related to a small equivalent quantity of flow. The quantity represented by each pulse varies with each individual meter and must be scaled to obtain engineering units.

The input signal to a pulse signal conditioner may be a contact closure, a magnetic pickup, or a low level pulse. Some conditioner/converters scale the pulse signal such that each pulse represents a engineering quantity of flow (for example 1 pulse per gallon). Some converters convert the variable frequency signal into a current proportional to flow rate.

In nearly all cases the signal conditioner/converter is intended to be powered by a DC supply voltage normally available in most instruments with 24 VDC being the most common.

Enclosures are available for outdoor weatherproof and also hazardous locations.

Signal Conditioner/Converters are applied in most PLC and PC based control systems to adapt the raw process transducer signals into the standardized levels provides on I/O Cards.

Only the most common signal conditioner/converters applicable for flow metering are shown in the data sheets to follow.

**Typical Application:**

![Diagram](https://via.placeholder.com/150)
**SC-FI Series**

**Features:**
- Magnetic Pickup or Contact Closure Input
- Optically Isolated Input
- 10 kHz Maximum Input Frequency
- Standard, 2-Wire, 4-20 mA Output
- Two Year Warranty
- Loop Powered
- Various Mounting Styles
- LED Indicator

**Description:**
The SC-FI is a two wire frequency to analog converter that converts a pulse rate input into a 4-20 mA output signal proportional to frequency or rate.

The input pulse rate is amplified and filtered by the input signal conditioning circuitry. Two forms of input signal conditioning are provided, one for magnetic pickups or contact closure inputs and the other is an isolated pulse input (depending on order code).

The amplified frequency signal is then converted to an analog signal using a precision frequency to analog converter.

The output stage derives it’s power from the output current loop. The output stage converts the analog input signal into the desired output range. Multi-turn potentiometers provide for the necessary trimming of span and zero.

**Specifications:**

**Operating Temperature**
32°F (0°C) to 158°F (70°C)

**High Level Pulse Input**
- Type: Opto-Isolated
- Input Impedance: 3.3 kΩ
- Logic 1: 4-30 VDC
- Logic 0: 0-1 VDC
- Frequency Range: 0-10 kHz
- Fault Protection: Reverse Polarity Protection
- Isolation Voltage: 500 V
- Fast Transient Immunity: 500 V
- Maximum Rise Time: No Limit
- Maximum Fall Time: No Limit

**Magnetic Pickup Input**
- Differential Input
- Input Impedance: 10 kΩ
- Frequency Response: 0-3500 Hz
- Trigger Sensitivity: 30 mV p-p
- Over Voltage Protection: ±30 VDC

**Contact Closure Input**
- Sensor Compatibility: Requires an isolated, contact closure
- Maximum Contact Voltage: 5 V
- Maximum Contact Current: 0.12 mA
- Nominal Pullup Resistance: 47 Kohm to 5 Vdc
- Frequency Range: 0-100 Hz

**Frequency to Current Conversion**
Range Selection: DIP Switch Selectable

**Available Ranges:**
- **Standard**
  - 150 Hz, 300 Hz, 600 Hz, 1200 Hz, 2500 Hz, 5000 Hz, 10,000 Hz
- Factory Default: 1000 Hz

**Contact Closure Option**
- 30 Hz, 60 Hz, 120 Hz, 240 Hz, 480 Hz, 960 Hz, 1920 Hz
- Factory Default: 100 Hz

**Analog Output**
- Accuracy: ±0.1% Span (@ 20°C)
- Output Type: Two Wire, Loop Powered
- Range: 4-20 mA
- Compliance Voltage: 10 to 40 VDC
- Loop Burden: <10 VDC
- Trim Controls: Voltage & Span, non-interacting
  - Span (20 mA) Trim Range: 50% to 100% of full scale
- Linearity: <±0.1% Span
- Output Voltage Effect: <±0.002% Span/Volt
- Temperature Effect: <200 PPM/C
- Reverse Polarity Protected
- Noise Content: <0.2% Span
- Response Time: 0.1 second (1 sec. jumper selectable)
- Overcurrent Limiting: 35 mA
- Output Loop Indicator: LED illuminates when output loop is powered by proper polarity and blinks proportionally to the input frequency.

**Mounting Styles**
- DIN Rail Mount: Plastic enclosure with a snap fastener for fitting to DIN 46 277 and DIN EN 50 022 assembly rails.
- NEMA 4X: 4.92” x 4.92” NEMA 4X Enclosure for wall mounting.
- Explosion Proof: Aluminum enclosure for:
  - Class I, Division 1, Groups B, C & D
  - Class II, Division I, Groups E, F & G.

**Listing:** CE Compliant
**Terminal Designations**

**Standard Termination**
1• Magnetic pickup
2• Magnetic pickup
3• Shield (common)
4• Opto-isolator In +
5• Opto-isolator In –
6• Shield (common)
7• Output +
8• Output –
9• Do Not Use

**SCFI-X-L (low count speed) Termination**
1• Do Not Use
2• Contact Input
3• Shield (common)
4• Opto-isolator In +
5• Opto-isolator In –
6• Shield (common)
7• Output +
8• Output –
9• Do Not Use

**Simplified Block Diagram**

**Typical Application**

**Magnetic Pickup Input**

**Typical Application**

**Contact Closure Input**

**Ordering Information**

**Example**  SC-FI D ET

<table>
<thead>
<tr>
<th>Series</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FI= Frequency to Current</td>
<td></td>
</tr>
<tr>
<td>Mounting:</td>
<td></td>
</tr>
<tr>
<td>B= Nema 4X</td>
<td></td>
</tr>
<tr>
<td>C= Explosion Proof</td>
<td></td>
</tr>
<tr>
<td>D= DIN Rail</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ET= Extended Temp: -4° to 185°F (-20° to 85° C)</td>
<td></td>
</tr>
<tr>
<td>L = Low Count Speed for Contact Closure Inputs</td>
<td></td>
</tr>
<tr>
<td>T = Third 3/4&quot; conduit entry for Explosion Proof Housing</td>
<td></td>
</tr>
<tr>
<td>H2 = 0.875&quot; Hole for NEMA4 mounting style</td>
<td></td>
</tr>
<tr>
<td>HF2 = 0.5&quot; Female NPT Hub fitting</td>
<td></td>
</tr>
<tr>
<td>H3 = 1.125&quot; Hole for NEMA4 mounting style</td>
<td></td>
</tr>
<tr>
<td>HF3 = 0.75&quot; Female NPT Hub fitting</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Accessories:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>(add to end of part number)</td>
<td></td>
</tr>
<tr>
<td>DR-4= 4&quot; DIN Rail</td>
<td></td>
</tr>
</tbody>
</table>
SC-II SERIES

**Features**
- 4-20 mA Input (10-50 mA optional)
- 2-Wire, 4-20 mA Output (10-50 mA optional)
- Two Year Warranty
- Loop Powered
- Input & Output LED Indicators
- Various Mounting Styles

**Description:**
The SC-II loop powered isolator is a signal conditioner whose function is to provide a retransmitted, galvanically isolated 4-20 mA output signal in response to isolated 4-20 analog input.

The loop powered isolator may be applied in a similar manner as a conventional two wire transmitter.

The SC-II appears to the input loop as a series shunt resistor. A small sense resistor is used to measure the input current. The input loop derives it’s power from the input current loop.

This input current signal is then scaled and converted to a 0 to 10,000 Hz frequency signal by a Current to Frequency Converter. This frequency signal is then transmitted across an opto-isolator to the output stage.

The output stage derives it’s power from the output current loop. The output stage converts the 0-10000 Hz frequency signal into a current flowing in the output loop equal to that flowing in the input current loop.

The 10-50 mA range options are provided to enable the unit to perform range conversions as well as signal isolation.

**Specifications:**

**Analog Input**
- Available Ranges: 4-20 mA (10-50 mA optional)
- Input Type: Two Wire, Loop Powered
- Equivalent Input Impedance: 525 Ω on 4-20 mA range
- 210 Ω on 10-50 mA range
- Operational Range: 3.5-33 mA
- Over Current Protection: 2.5 times rated span
- Reverse Polarity Protection
- Isolation Voltage: 500 V
- Input Loop Indicator: LED illuminates when loop is powered by proper polarity

**Analog Output**
- Accuracy: ± 0.10% Span
- Output Type: Two Wire, Loop Powered
- Range: 4-20 mA (10 - 50 mA optional)
- Compliance Voltage: 10 to 40 VDC
- Loop Burden: < 10 VDC
- Trim Controls: Zero & Span
- Linearity: < ±0.10% Span
- Output Voltage Effect: < ± 0.002% Span/Volt
- Temperature Effect: < 200 PPM/°C
- Reverse Polarity Protected
- Noise Content: < 0.2% Span
- Overcurrent Limiting: 35 mA
- Output Loop Indicator: LED illuminates when output loop is powered by proper polarity

**Mounting Styles**
- DIN Rail Mount: Plastic enclosure with a snap fastener for fitting to DIN 46 277 and DIN EN 50 022 assembly rails.
- NEMA 4: 4.92” x 4.92” NEMA 4 Enclosure for wall mounting.
- Explosion Proof: Aluminum enclosure for: Class I, Division 1, Groups B, C & D
  Class II, Division I, Groups E, F & G.

**Listing:** CE Compliant
### Flow Instruments

**SIGNAL CONDITIONERS**

**Simplified Block Diagram**

![Block Diagram](attachment:diagram.png)

**Typical Wiring Hookup**

- **4-20 mA Input Device**
- **4-20 mA Output Device**
- **4-20 mA Output Loop**
- **4-20 mA Input Loop**
- **I/F**
- **4-20 V**

**Ordering Information**

- **Example SC-II D ET**
- **Series II= Current to Current**
- **Mounting:**
  - B = Nema 4X
  - C = Explosion Proof
  - D = DIN Rail
- **Options:**
  - ET = Extended Temp: -4°F to 185°F (-20°C to 85°C)
  - T = Third 3/4" conduit entry for Explosion Proof Housing
  - H2 = 0.875" Hole for NEMA4 mounting style
  - HF2 = 0.5" Female NPT Hub fitting
  - H3 = 1.125" Hole for NEMA4 mounting style
  - HF3 = 0.75" Female NPT Hub fitting
- **Accessories:** (add to end of part number)
  - DR-4 = 4" DIN Rail

**Dimensions**

- **DIN Rail Mount**
  - 4.92 (125)
  - 2.95 (75)
  - 1.40 (35.5)
  - 0.89 (22.5)

- **NEMA4X**
  - To access terminals, remove cover and 4 panel screws.

- **Explosion Proof Enclosure**
  - All Dimension in inches (mm)
  - Optional 3rd Conduit Entry

**Accessories:**

- **DR-4= 4" DIN Rail**

---

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**SC-IF SERIES**

**Features**

- 4-20 mA Input (10-50 mA optional)
- 0 to 10 kHz Pulse Output
- Two Year Warranty
- Loop Powered
- Input & Output LED Indicators
- Various Mounting Styles

**Description:**
The SC-IF loop powered signal conditioner whose function is to provide a 0 - 10kHz frequency output signal in response to a 4-20mA analog input.

The SC-IF appears to the input loop as a series shunt resistor. A small sense resistor is used to measure the input current. The input loop derives its power from the input current loop.

This input current signal is then scaled and converted to a 0 to 10,000 Hz frequency signal by a Current to Frequency Converter. This frequency signal is then transmitted across an opto-isolator to the output stage.

The 10-50 mA range option is provided to enable the unit to perform range conversions as well as signal isolation.

**Specifications:**

**Analog Input**
- Available Ranges: 4-20 mA (10-50 mA optional)
- Input Type: Two Wire, Loop Powered
- Equivalent Input Impedance: 525 Ω on 4-20 mA range, 210 Ω on 10-50 mA range
- Operational Range: 3.5-33 mA
- Over Current Protection: 2.5 times rated span
- Reverse Polarity Protection
- Isolation Voltage: 500 V
- Input Loop Indicator: LED illuminates when loop is powered by proper polarity

**Pulse Output Option**
- Output Type: Open Collector Transistor
- Low Cutoff: 1% of full scale
- Range: 0 to 10,000 Hz
- Duty Cycle: 50/50 Duty Cycle (nominal)
- Maximum Off Voltage: 30 VDC
- Minimum On Current: 10 mA
- Maximum On Voltage: 1 VDC
- Temperature Effect: Less than 200 ppm/degree C
- Reverse Polarity Protection

**Mounting Styles**
- DIN Rail Mount: Plastic enclosure with a snap fastener for fitting to DIN 46 277 and DIN EN 50 022 assembly rails.
- NEMA 4: 4.92” x 4.92” NEMA 4 Enclosure for wall mounting.
- Explosion Proof: Aluminum enclosure for:
  - Class I, Division 1, Groups B, C & D
  - Class II, Division I, Groups E, F & G.

**Listing:** CE Compliant

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F-16 • Flow Instruments • Page 11
**Simplified Block Diagram**

```
+ 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9
4-20mA Input Loop

I/F

E 7 + 24 VDC

1 4-20mA Output Device

2 4-20 mA Output Device

8 Open Collector

9 Common

Pulse Input Device
```

**Ordering Information**

**Example**

```
SC-IF D ET
```

**Series**

IF = Current to Frequency

**Mounting:**

B = Nema 4X
C = Explosion Proof
D = DIN Rail

**Options:**

ET = Extended Temp: -4°F to 185°F (-20°C to 85°C)
T = Third 3/4" conduit entry for Explosion Proof Housing
H2 = 0.875" hole for NEMA4 mounting style
HF2 = 0.5" Female NPT Hub fitting
H3 = 1.125" hole for NEMA4 mounting style
HF3 = 0.75" Female NPT Hub fitting

**Accessories:** (add to end of part number)
DR-4 = 4" DIN Rail
SC-FF Series

**Features:**
- Pulse Scaler with Isolation
- Pulse, Contact Closure or Magnetic Pickup Inputs
- Two Year Warranty
- Various Mounting Styles
- Output LED Indicator

**Description:**
The model SC-FF is a signal conditioner which permits the user to condition and scale the input pulses from a pulse producing sensor into a high level output where each pulse represents an engineering unit of measure.

Several pulse input types are supported including magnetic pickup, contact closure, and an isolated pulse input.

The pulse scaling permits a user to apply a scaling multiplier with a value of .0001 to .9999 with additional multipliers of 1, .1, .01, .001 and .0001. Pulse scaling is accomplished by rotary encoded and dip switch selections.

The pulse output is available in isolated, non-isolated and relay versions. User selections include output pulse duration and internal pullup resistors. The user may select his pulse output configuration by means of a dip switch.

The unit is powered to 8 - 35 VDC. Reverse polarity protection is provided. Power and Pulse input/output indicators are provided.

The unit is available in enclosures intended for either DIN rail, NEMA4X or Explosion Proof.

**Specifications:**

**Pulse Input:**
- Isolated Pulse:
  - Logic 1 (high): 3 - 30 VDC
  - Logic 0 (low): 0-0.4 VDC
  - Input Frequency Range: 0-10000 Hz
  - Input Impedance: 3.3 kΩ
  - Reverse Polarity Protection
  - Isolation Voltage: 500 V
- Contact Closure:
  - Switch Debounce: 40 CPS maximum count rate
  - 10000 ohm internal pullup to 5 VDC
- Magnetic Pickup:
  - Sensitivity: 30 mV p-p
  - Bandwidth: 0-3500 Hz
  - Over Voltage Protection to 30 VDC
  - 10 Kohm input resistance

**Pulse Output:**
- Pulse Duration: 50 uSec, 500 uSec 50 mSec (Switch selectable)
- Open Collector Pulse:
  - Maximum Voltage: 48 VDC
  - Maximum Current: 100 mA @ .7V max
  - Max. Output Speed: 10 kHz
  - Reverse Polarity Protection
  - Overcurrent Protection
  - Jumper selectable for 5 V and 24 V pulse output
- Isolated Pulse:
  - Maximum Voltage: 30 VDC
  - Maximum Current: 10 mA
  - Max. Output Speed: 1 kHz
  - Isolation Voltage: 500 VDC
  - Reverse Polarity Protected
- Output Relay (optional):
  - Contact Rating: 0.5 amps 240 VAC
  - Output Form: Form A (SPST)
  - Max. Output Speed: 10 Khz

**Power Input:**
- Input Voltage Range: 8.5 to 35 VDC
- Supply Current: 25 mA (nominal)
- Reverse Polarity Protection
- Transient Protection

**Pulse Scaling:**
- Scaler: 0.0001 to .9999
- Multiplier: X1, X0.1, X0.01, X0.001, X0.0001

**Mounting Styles**
- DIN Rail Mount: Plastic enclosure with a snap fastener for fitting to DIN 46 277 and DIN EN 50 022 assembly rails.
- NEMA 4X: 4.92” x 4.92” NEMA 4X Enclosure for wall mounting.
- Explosion Proof: Aluminum enclosure for:
  - Class I, Division 1, Groups B, C & D
  - Class II, Division I, Groups E, F & G.

**Listing:** CE Compliant
**Ordering Information**

**Example**

| SC-FF | 1 | B | ET |

**Series**

- FF = Frequency to Frequency

**Output Type**

- 1 = Open Collector & Isolated Pulse (STD)
- 2 = Open Collector & Relay Output

**Mounting**

- B = Nema 4X
- C = Explosion Proof
- D = DIN Rail

**Options**

- ET = Extended Temp: -4°F to 185°F (-20°C to 85°C)
- T = Third 3/4" conduit entry for Explosion Proof Housing
- H2 = 0.875" Hole for NEMA4 mounting style
- HFF = 0.5" Female NPT Hub fitting
- H3 = 1.125" Hole for NEMA4 mounting style
- HFF3 = 0.75" Female NPT Hub fitting

**Accessories**

- (add to end of part number)
- DR-4 = 4" DIN Rail

**Dimensions**

- **DIN Rail Mount**

  - Width: 3.88 (98.5)
  - Height: 2.95 (75)

- **NEMA4X**

  - Width: 4.21 (107)
  - Height: 4.92 (125)

  - To access terminals, remove cover and 4 panel screws.

- **Explosion Proof Enclosure**

  - Width: 5.9 - 7.7 (150 - 196)
  - Height: 4.75 - 5 (121 - 127)

  - All Dimension in inches (mm)

**Simplified Block Diagram**

- mV Input
- 3-30V Input
- DC Power Input
- Opto-isolator In (+)
- Opto-isolator In (-)
- (+) DC Power Input
- Contact Closure Input
- Contact Closure
- LED Indicator
- Isolated Pulse Out (+) / Relay Output
- Isolated Pulse Out (-) / Relay Output
- Duration Select
- DC Input
- Pule Output (+) / Common
- Pule Output (-) / Common
- Pulse Rate Divider
- Divider Select
- Pulse Rate Multiplier
- Thumwheel Switch
- Monostable
- Pulse Duration
- Optional holes of hub fitting
- Optional 3rd Conduit Entry

**Necessary Parts**

- Flowmeter
- Flowmeter with Magnetic Pickup

**Typical Application**

- Raw Signal
- Raw Signal
- SC-FF
- Mag Pickup Input
- Isolated Pulse Out (+) / Relay Output
- Isolated Pulse Out (-) / Relay Output
- Pulse Output (+)
- Pulse Output (-)
- Magnetic pickup
- Magnetic pickup
- Contact Closure Input
AMP-1-N

Features

• NAMUR Compatible Sensitivity.
• 100 mA Current Sinking Output.
• 11 to 26 VDC Power Supply Range.
• Easy Mount Metal Housing.
• Screw Terminal Hookup.

Description

The KEP AMP-1-N powers and conditions the low level signals from NAMUR pickups, sensing gear teeth movement or flow, and provides a high level pulse output suitable to drive any KEP ratemeter, counter or controller.

Specifications

Environmental

Operating temperature: 32° to 140° F (0° to 60° C)
Storage temperature: -40° to +85° C
Humidity: 0 - 95% non-condensing

Power Input

Power requirement: 11-26VDC; 30mA maximum
Sensor Supply: 8VDC ± 1 VDC

Input Characteristics

Input impedance: 1000 ohm nominal
Input frequency: 0 - 10kHz
Input current: High: > 3mA
Low: < 1 mA

Output Characteristics

Output Type: Open collector with internal 2700 ohm pull-up resistor to supply voltage.
Max. sink current: 100mA sink to 1V or less

Approvals:

CE approved; Light Industrial
Fast transient: 500V (capacitive clamp)
EMI: No effects at 3V/m
ESD: 8kV (case grounded)

Application

Turbine Meter with NAMUR Pickup
Totalizer

T otalizer
Process, Level, Temperature Monitors Tutorial

What is a Process Indicator? This is a general purpose instrument that is intended to condition the electrical signal generated by a process sensor and scale the resulting information into a display in the units of measure desired by the end user. Additional, functionality such as alarms, analog output, and serial communications may also be provided. See the figure below for a typical system configuration.

What capabilities should I look for to assure compatibility with my type of sensor? Indicators are available to work with most process sensor types and most common electrical signals produced by these sensors. Some are termed “universal” and operate with many sensor types. Begin by selecting an instrument(s) that will work with the signal provided by the type of sensor you are considering. In some cases an amplifier or signal conditioner may be necessary. Next, decide on whether linearization or other forms of compensation will be required within the Indicator and on how the calibration will be represented within the instrument. Also determine if the Process Indicator can provide the power required for the sensor (if needed).

What are some basic areas of concern? Most customers begin selecting an indicator by looking for an instrument that will display the type of information that they prefer. It must work with the available power and must be available in a package that can be mounted in the desired location.

What is an analog output and why is it used? Process information is usually sent from one system to another as a 4-20mA. Some instruments permit the user to select what item of information is to be sent on the analog output. The corresponding span is user programmable. Additional features may include programmable damping.

What is an alarm output and why is it used? Relays are often used as controls to activate alarms. An alarm will usually include a provision for setting the alarm point. Additional features may include a programmable delay before the alarm will activate, programmable alarm duration, and/or a programmable alarm hysteresis.

What are remote inputs and how are they used? Often there is a need to connect a remote switch near the operator for such purposes as remote alarm reset, or remote print. Some process indicators offer a variety of capabilities as remote inputs.

What is serial communications and why is it used? Serial communications is used to transmit information between two computers, or between a computer and a printer. There are several commonly used standard hardware interfaces. These include RS-232, RS-422, and RS-485. There are also a variety of communication protocols, or message formats, which are used. Some of these protocols are unique to an equipment manufacturer while others are industry standards. See also “Communication Solutions” section.

What are other areas of concern? Many areas where process indicators are installed are out of doors or are in hazardous areas. Special purpose enclosures are available for many instruments subject to these harsh conditions.

Typical Applications

**Process Indicator Application**

- Temperature Transmitter
- 4-20 mA Output
- Alarm A
- Alarm B
- INT69-PM2
- 4-20 mA Out to Strip Chart Recorder
- RS232 to Computer

**Level Monitor Application**

- Ultrasonic Level Sensor
- Temperature Transmitter
531 Series

Temperature Display for Pt100 and Ni100 RTD's

Features
• Compact and Low-Cost Temperature Display
• Temperature Display in °C or °F
• MIN/MAX Value Retention
• EEPROM Data Backup on Power Failure
• Galvanic Isolation with Reverse Polarity Protection
• Screw Terminal Connectors: pitch 5 mm
• Display Hold Input

Specifications:
Supply voltage: 10-30 V DC, galvanically isolated with reverse polarity protection
Current draw: max. 40 mA
Display: 5-digit display, red LED's; height 8 mm
Measuring rate: 5 measurements/second
Display refresh: 1-2 times per second
Data backup: EEPROM
Housing: housing for control panel 48 x 24 mm acc. to DIN 43 700; RAL 7021, dark grey
Ambient temp.: –20 to +65 °C
EMC: according to EC EMC directive 89/36/EEC
Interference emissions: EN 50081-2/EN 55 011 Class B
Interference resistance: EN 6100-6-2
Protection: NEMA4 / IP65 (front)
Weight: app. 50 g
Circuit type: 2-wire, 3-wire and 4-wire connection technique, programmable
Input: Pt100 or Ni100 RTD with sensor breakage monitoring

Wiring:

Power Supply
1 2 3 4 5 6 7

2-Wire RTD
1 2 3 4 5 6 7

3-Wire RTD
1 2 3 4 5 6 7

4-Wire RTD
1 2 3 4 5 6 7

3 • Latch input
2 • 0 V DC (GND)
1 • 10 to 30 V DC

Panel Cutout: 0.876" x 1.78" (22.3 x 45.2mm)
or 0.99" x 1.97" (25 x 50mm) with adaptor provided

Order #: 531 = Temperature Display with RTD Input
Accessories:
E200 - Outdoor Enclosure (see Accessories section)
Temperature Display for J, K and N Thermocouples

**Features**
- Compact and Low-Cost Temperature Display
- Temperature Display in °C or °F
- MIN/MAX Value Retention
- EEPROM Data Backup on Power Failure
- Galvanic Isolation with Reverse Polarity Protection
- Screw Terminal Connectors: pitch 5 mm
- Display Hold Input
- 5 Measurements/second

**Specifications:**
- Supply voltage: 10-30 V DC, galvanically isolated with reverse polarity protection
- Current draw: max. 40 mA
- Display: 5-digit display, red 7-segment LED’s; height 8 mm
- Measuring rate: 5 measurements/second
- Display refresh: 1-2 times per second
- Data backup: EEPROM
- Housing: housing for control panel 48 x 24 mm acc. to DIN 43 700; RAL 7021, dark grey
- Ambient temp.: –20 to +65 °C
- EMC: according to EC EMC directive 89/36/EEC
- Interference emissions: EN 50081-2/EN 55 011 Class B
- Interference resistance: EN 61000-6-2
- Protection: NEMA4 / IP65 (front)
- Weight: app. 50 g
- Input: Thermocouple Sensor
  - J (Fe-CuNi): –210.0 °C to +1200.0 °C
  - K (Ni-CrNi): –200.0 °C ... +1372.0 °C
  - N (NiCrSi-NiSi): –200.0 °C ... +1300.0 °C
- Control inputs: High: 4-30 V DC, Low: 0-2 V DC
- Supply current: 1 mA
- Supply line: 2-wire: max 20 Ω, programmable 3-wire, 4-wire: max 20 Ω, no balancing required
- Resolution: 0.1°C (0.1°F) or 1°C (1°F)
- Linearity error: < 0.4 % for entire measuring range at an ambient temperature of 20 °C
- Cold junction error: ±1.0 °C typ. ±3.0 °C
- Temp. drift: 0.1 K/K Ambient

**Wiring:**
- **Power Supply**
  - 1: 10 to 30 V DC
  - 2: 0 V DC (GND)
  - 3: Latch input
- **2-Wire RTD**
  - 1: 10 to 30 V DC
  - 2: 0 V DC (GND)
  - 3: Latch input

**Order #:**
- 532 = Temperature Display with thermocouple Input

**Accessories:**
- E200 - Outdoor Enclosure (see Accessories section)

---

Panel Cutout: 0.876” x 1.78” (22.3 x 45.2mm)
or 0.99” x 1.97” (25 x 50mm) with adaptor provided
**TP-550 Series**

**Features**
- Very bright LED display, height 14mm
- DIN housing, 96 x 48 mm
- Programmable operating curve for standard signals, thermocouples, resistance thermometers, etc.
- Programmable operating curve, even non-linear, allowing the use of economical sensors
- Two relay outputs with two preset limit values

**Additional features:**
- DIN housing 96 x 48 mm
- Character height: 14 mm
- Resolution 14 bits
- Simple menu-driven programming, and operation with 4 keys
- Electrical connections by means of plug-in screw terminals
- Voltage supply: 10-30 VDC or 90-260 VAC
- IP 65/NEMA4 (front)
- Auxiliary power supply output for transducer or sensor
  10..30 VDC: 10 VDC ± 2%, 30 mA
  90..260 VAC: 24 VDC ± 15%, 50 mA and 10 VDC ± 2%, 30 mA
- Hum eliminator (50/60 Hz user selectable)
- Serial interface allows reading of the measured values and set-up programming.

**TP54 Specifications:**
Process controller for thermocouples, resistance thermometers and sensors with mV range; two preset limit values
- Display range: -19.999..99.999
- Input ranges:
  0..400 Ω, 0.4000 Ω
  0..100 mV, -100..+100 mV

**Thermocouples**
- Programmable input operating curve with up to 24 reference points
- 2 programmable limit values (TP551; unit without presets, has only 2 buttons)
- Outputs: Two (2) SPDT relays (250 VAC / 3A)
- Programmable hysteresis (on, off, on/off)
- SET key to reset the outputs
- Inputs: thermocouple, millivolt, resistance thermometer with measurement on 2, 3 or 4 wires, RESET to reset the outputs, KEY terminal to lock the front keys.

**Dimensions**

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Example: TP554.010</th>
<th>Series:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>00</td>
</tr>
</tbody>
</table>

TP551.012 = No Presets/Relays
TP554.010 = 2 Presets/Relays

**Operating Voltage:**
- 0 = 90 to 260 VAC
- 3 = 10 to 30 VDC

**Options:**
- 00 = without interface
- 05 = RS232
- 06 = RS422
- 07 = RS485

Dimensions are in inches (mm)
### Electrical Connections

- **TB1**
  1. Measuring input 1 (Sense)
  2. Measuring input 2 (– Ref)
  3. Sensor (+Ref)
  4. Current output for 0 .. 4000 Ω (+ Sense)
  5. Current output for 0 .. 400 Ω (+ Sense)
  6. Keys locking
  7. Reference ground
  8. Reset
  9. GND for DC Output (Pins 10 & 11)
  10. +10 VDC Out (30 mA)
  11. +24 VDC Out (50 mA) (AC units only)

- **TB2**
  1. Relay 2 Com. (Opto-Emitter)
  2. Relay 2 N.O.
  3. Relay 2 N.C. (Opto-Collector)
  4. Relay 1 Com. (Opto-Emitter)
  5. Relay 2 N.O.
  6. Relay 2 N.C. (Opto-Collector)
  7. A.C. In (10-30 VDC)
  8. A.C. In (Ground; 0 VDC)

- **TB3**
  1. RS232
  2. RS485
  3. RS422
  4. GND

### Thermocouples

- **TB1**
  - Negative leg of thermocouple
  - Positive leg of thermocouple

**NOTE:** For accurate readings, use only leads of same type thermocouple wire without junctions to dissimilar metals.

### Resistance measurements

#### 2 wire measurement (measuring resistance 0 .. 400/4000 Ω)

**NOTE:** Not recommended for long runs.

- Measuring input 1 (Sense) • 1
- Measuring input 2 (– Ref) • 2
- Sensor (+Ref) • 3
- Current out for 0 .. 4000 Ω/Pt 1000 (+ Sense) • 4
- Current out for 0 .. 400 Ω/Pt 100 (+ Sense) • 5
- Keys locking • 6
- Reference ground
- Reset • 8
- +10 VDC Out (30 mA) • 10
- +24 VDC Out (50 mA) (AC units only) • 11

#### 3 wire measurement (measuring resistance 0 .. 400/4000 Ω)

**NOTE:** Jumper 1 & 2 at meter, wires 3 & 4 must go to sensor

- Measuring input 1 (Sense) • 1
- Measuring input 2 (– Ref) • 2
- Sensor (+Ref) • 3
- Current out for 0 .. 4000 Ω/Pt 1000 (+ Sense) • 4
- Current out for 0 .. 400 Ω/Pt 100 (+ Sense) • 5
- Keys locking • 6
- Reference ground
- Reset • 8
- GND for DC Output (Pins 10 & 11) • 9
- +10 VDC Out (30 mA) • 10
- +24 VDC Out (50 mA) (AC units only) • 11

#### 4 wire measurement (measuring resistance 0 .. 400/4000 Ω)

**NOTE:** All 4 wires must go to sensor

- Measuring input 1 (Sense) • 1
- Measuring input 2 (– Ref) • 2
- Sensor (+Ref) • 3
- Current out for 0 .. 4000 Ω/Pt 1000 (+ Sense) • 4
- Current out for 0 .. 400 Ω/Pt 100 (+ Sense) • 5
- Keys locking • 6
- Reference ground
- Reset • 8
- GND for DC Output (Pins 10 & 11) • 9
- +10 VDC Out (30 mA) • 10
- +24 VDC Out (50 mA) (AC units only) • 11

### Voltage measurement (0 to 100mV or -100 to +100mV)

- **TB1**
  - +/- Measuring input
  - Reference ground

**NOTE:** For accurate readings, use only leads of same type thermocouple wire without junctions to dissimilar metals.
Flow Instruments

PROCESS & LEVEL

MONITORS

Features

- Analog Input 0-20 mA, 4-20 mA
  0-5V, 0-10V or 1-5V
- Display Rate, Pressure, Level, Temperature, Watts, etc., Peak & Valley
- Calibration, High and Low Values (-9999 to 49999) Fully Programmable Through Keypad
- NEMA 4X / IP65 Front
- +24V Output for Peripherals
- 16 Bit A/D Resolution
- 2 Form C SPDT Relays (optional)
- 2 Levels of Operator Password Lockout

Application:
Any process monitoring application where two set points and scaling are needed.

Description:
Featuring 4½ digits of bright, 7-segment LED displays, the Intellect-69PM2 is a process monitor which accepts analog signal inputs. The unit can be field programmed to accept 0-20mA, 4-20mA, 0-5V, 0-10V or 1-5V signals. Two assignable set points are standard for high/low alarm outputs. The high and low scaling settings (-9999 to 49999) are programmable from the front panel. By pressing the "view" button, the unit will display: process reading, peak or valley. Press the lock button once to freeze the display, press it again to resume normal operation. Press the lock button 4 times quickly to enter lock code for panel lockout. RS-232, RS-422 and 4-20mA analog out are available options for interfacing to a host computer or strip chart recorder.

Specifications:

Display:
4½ digit, .55” high, 7 segment, red orange, LED.

Input Power:
110, 220 VAC ± 15% or 12 to 24VDC.
Current: 300 max. mA DC or 10.0 VA (10W) at rated AC voltage.

Output Power:
(AC powered units only) + 24VDC @ 50mA regulated ±5%. (100 mA available on request)

Temperature:
Operating: +32°F (0°C) to +130°F (+54°C).
Storage: -40°F (-40°C) to +200°F (93°C).
Memory: EEPROM stores data for ten years if power is lost.

Reset:
Front Panel: resets displayed value and control outputs.

Control Outputs:
Standard: Open collector sinks 250mA from 30VDC when active.
Optional: 2 each Form C SPDT 5 Amp @ 120/240 VAC or 28 VDC.

Input:
Linear 0-20mA, 4-20mA, 0-5V, 0-10V or 1-5V selectable from the front panel.

Calibration:
The unit does all of the calibrations internally. There are no potentiometers to adjust and the unit never needs to be removed from the case or panel.

Set Points:
Two control set points are provided. The unit comes standard with two open collector control outputs. Two 5 Amp, Form C relays are optional. The outputs have a programmable alarm range from -9999 to 49999 with hysteresis.

Process Display:
Updates 4 times per second, Accurate to 4.5 digits.

Programming:
Decimal points, Scaling from -9999 to 49999, set points, input type and security lock code are all programmable from the front panel.

Housing:
Standard 1/8 DIN, high impact ABS plastic case (NEMA 4X/IP65 front panel).

Shipping Weight:
2 lbs.

Overvoltage Protection:
50 V

Over-current Protection:
50 mA

Temperature Stability:
Will not drift more than 10 parts per million per °C from 0°C to 54°C

Accuracy:
.1% (5 V inputs .16%)

Listing:
CE Compliant, CSA (File No. LR91109), NRTL/C pending
**Typical Hookups:**

2-Wire 4-20mA Transmitter

![2-Wire 4-20mA Transmitter Diagram](image)

3-Wire 0-10V Transmitter

![3-Wire 0-10V Transmitter Diagram](image)

2-Wire 4-20mA Transmitter with Analog Output

![2-Wire 4-20mA Transmitter with Analog Output Diagram](image)

Relay Output

![Relay Output Diagram](image)

Wiring:

- 1: Reset In
- 2: Analog Out (Sink)
- 3: Signal (GRD - DC)
- 4: + In (Current)
- 5: + V (In - Voltage)
- 6: +24V Out
- 7: +24V Out
- 8: +110/220 VAC
- 9: +110/220 VAC
- 10: +110/220 VAC
- 11: +110/220 VAC
- 12: +110/220 VAC
- 13: Common
- 14: N.C.
- 15: N.O.
- 16: Common
- 17: N.C.
- 18: N.O.

**DIMENSIONS:**

4.44 (112.7)

3.62 (92)

2.63 (66.8)

1.77 (45)

**Ordering Information**

**EXAMPLE:** INT69PM2 A 1 A

**Series**

INT69PM2 = Process Monitor

**Operating Voltage**

- A = 110 VAC ± 15% or 12 to 24 VDC
- B = 220 VAC ± 15% or 12 to 24 VDC

**Control outputs**

- 1 = 2 - Open Collector Outputs
- 2 = 2 - 5 Amp Form C Relays

**Options** (multiple options available)

- A = Analog Output (4-20mA)
- C1 = RS232 Communications
- C2 = RS422 Communications
- CSA: CSA Approved Unit

**Accessories**

- Separate non keyboard panel order #34235
- Separate keyboard panel - order #34234
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285
- XHV Explosion Proof Housing (see Accessories)
- NEMA-1/8DIN NEMA 4 wall mount enclosure (see Accessories)
Squirt-R

Features

- Linear or Square Root Extraction of Input
- 3 1/2 or 4 1/2 Digit Display (Selectable)
- Calibration, High and Low Values Fully Programmable Through Keypad
- NEMA 4X / IP65 Front
- No Dipswitches or Pots to Adjust
- 16 Bit A/D Resolution
- Password Protection of Menu

Description:
Featuring up to 4 1/2 digits of display, the Squirt-R is a loop powered indicator capable of accepting either linear or square root 4-20 mA inputs. Numeric password protection prevents unauthorized access to the menu. The easy-to-read menu prompts make the Squirt-R so easy to program that you will feel comfortable programming it without the use of a manual.

Specifications:

Power:
Loop powered 4-20 mA
Internal Battery (Setup memory storage only):
3 V 250 mA-H Lithium (2 yr. Standby life)

Display:
Display: (selectable decimal)
3.5 or 4.5 Digits (selectable), 0.35" High, Display updates once every two seconds.
Rate Descriptors: /SEC, /MIN, /HR or "blank"
Units Descriptors: GAL, LIT, FT3, M3, "blank"
Low Battery Error Detection: "BAT" descriptor & flashing display
Under/Over range Indication: Display flashes when out of range

Environmental:
OPERATING TEMPERATURE
-4°F (-20°C) to + 158°F (70°C)
Extended Temp: -22°F (-30°C) to + 158°F (70°C)

HUMIDITY
0 - 90% Noncondensing

Listing: CE Compliant

Accuracy: (Indication @ 20°C)
0.1% Full Scale Resolution

Temperature Drift:
- 50 ppm/°C Typical
- 200 ppm/°C Worst Case

Lockout:
Password: Unauthorized menu changes can be prevented by entering a user selectable password (5 digit number).
Jumper: An internal jumper shunt is provided for a "sealed" menu lockout. Install the jumper to enable the lock.

Inputs:
Signal Input:
Full Scale Range: 4 to 20 mA DC
Loop Voltage Drop: 6 Volts Maximum
Reverse Polarity Protected
Over Current Protection to 60 mA
16 Bit resolution; 1 sample every 2 seconds
Low Cutoff supplied to inhibit indications at low flow rates.

Calibration & Operation:
Input Scaling: Via front keypad
Calibration: Via front keypad
Decimal Point: Via front keypad
Keypad: 4 tactile feedback keys

Mounting Styles:
0- Circuit Board - OEM option (consult factory)
1- Panel Mount - NEMA 4X Clear Front
2- Wall Mount - NEMA 4X Enclosure (unit mounted behind clear cover)
3- Explosion Proof - Class I, Division I, Groups B, C & D
Class II, Division I, Groups E, F & G
4- Wall Mount - NEMA 4X with keypad mounted outside opaque cover
### Typical Wiring: (2-Wire Transmitter)

- **Do Not Use**: 6, 5, 4, 3
- **Input**: + (1) 2
- **Input - (-) 1**

**Jump momentarily to initialize unit prior to calibration. Use only after battery replacement. Loop power must be applied when initializing.**

---

### Ordering Information

**Example:**  
SQUIRTR 3 ET

- **SQUIRTR**: Loop powered; Rate Only
- **Mounting**:  
  - 0 = OEM
  - 1 = Panel Mount
  - 2 = NEMA 4X Box (Squirt behind clear cover)
  - 3 = Explosion Proof Housing
  - 5 = NEMA 4X Box (Squirt outside opaque cover)
- **Options**:  
  - ET = Extended Temp.: -22°F to 158°F (-30°C to 70°C)
  - H2 = 0.5" Female NPT Hub fitting for mounting styles 2 and 5
  - H3 = 1.125" Hole for mounting styles 2 and 5
  - HF2 = 0.75" Female NPT Hub fitting for mounting styles 2 and 5

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**Flowmeters**

- **Data Acquisition or DC Power Supply**: 24V Typ.
LEVELtrol II

Multi-Function Level Indicator, Controller and Batcher

Features

• Level and Tank Volume/Mass Indicator
• Batching by Level
• Level Control, Tank Volume, Corrected Volume and Mass Calculations
• Menu Selectable Hardware & Software Features
• Two Line LCD or VFD Display
• Isolated Outputs Standard
• RS-232 Port Standard, RS-485 Optional
• Windows™ Setup Software
• DIN Enclosure with Two Piece Connectors
• DDE Server & HMI Software Available
• NEW! - Attractive Wall Mount Enclosure

Description:
The LEVELtrol II Flow Computer satisfies the instrument requirements for a variety of level sensor types in liquid applications. Multiple tank geometries, fluid equations and instrument functions are available in a single unit with many advanced features.

The alphanumeric display shows measured and calculated parameters in easy to understand format. Single key direct access to measurements and display scrolling are supported.

The versatility of the LEVELtrol II permits a wide measure of versatility within the instrument package. The various hardware inputs and outputs can be “soft” assigned to meet a variety of common application needs. The user “soft selects” the usage of each input/output while configuring the instrument. Consider the following illustrative examples.

The isolated analog output can be chosen to follow level, tank volume, corrected tank volume, tank mass, temperature, or density by means of a menu selection. Most hardware features are assignable by this method.

The user can assign the standard RS-232 Serial Port for data logging, transaction printing, or for connection to a modem for remote meter reading.

Specifications:

Environmental

Operating Temperature: 0°C to +50°C
Storage Temperature: -40°C to +85°C
Humidity: 0-95% Non-condensing
Materials: UL approved

Listing: UL/C-UL Listed (File No. E192404), CE Compliant

Display

Type: 2 lines of 20 characters
Types: Backlit LCD and VFD ordering options
Character Size: 0.3" nominal
User programmable label descriptors and units of measure

Keypad

Keypad Type: Membrane Keypad
Number of keys: 16

Enclosure

Style: See Ordering Code for Available Mounting Options
Size: See Dimensions
Depth behind panel: 6.5" including mating connector

Power Input

The factory equipped power option is internally fused. An internal line to line filter capacitor and MOV are provided for added transient suppression.

110 VAC Power Option: 85 to 127 Vrms, 50/60 Hz
220 VAC Power Option: 170 to 276 Vrms, 50/60 Hz
DC Power Option:
  12 VDC (10 to 14 VDC)
  24 VDC (14 to 28 VDC)
Power Consumption
  AC Power: 11.0 V/A (11W)
  DC Power: 300 mA max.

Level Inputs:

Analog Input:

Accuracy: 0.01% FS at 20°C
Ranges
  Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
  Current: 4-20 mA, 0-20 mA

Basic Measurement Resolution: 16 bit
Update Rate: 4 updates/sec
Automatic Fault detection: Signal over/under-range, Current Loop Broken
Calibration: Software Calibration (no trimmers) and Auto-zero Continuously
Extended calibration: Learns Zero and Full Scale of each range using special test mode.

Sensor Types Supported:

Differential Pressure, Ultrasonic, Many Others

Tank Geometries:

Horizontal, vertical, spherical and 32 point strapping table

Auxiliary / Compensation Input

The auxiliary/compensation input is menu selectable for temperature, density or not used. This input is used for the compensated input when performing compensated tank volume and mass calculations. It can also be used as a general purpose input for display and alarming.

Available Input Ranges

Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
Current: 4-20 mA, 0-20 mA
Resistance: 100 Ohms DIN RTD
Control Inputs
Switch inputs are menu selectable for Start, Stop, Reset, Lock, Alarm Acknowledge, Print or Not Used.

Relay Outputs
The relay outputs are menu assignable to Level, Tank Volume, Temperature, Density, Batch Control or Malfunction.
Number of relays: 2 (4 optional)
Contact Ratings: 5 amp, 240 VAC or 30 VDC

Isolated Analog Output
The analog output is menu assignable to correspond to the Level, Tank Volume/Mass, Temperature or Density.
Type: Isolated 4-20 mA Current Sourcing

Excitation Voltage (AC powered units only)
24 VDC @ 100 mA (fault protected)

Isolated Pulse output
The isolated pulse output is menu assignable to generate pulse outputs when tank fills, empties or both.
Pulse Output Form: Isolated Photomos Relay
Maximum On Current: 25 mA
Maximum Off Voltage: 30 VDC
Pulse Duration: 10 msec or 100 msec

Serial Communication
The serial port can be used for printing, datalogging, modem connection and communication with a computer. Windows setup software is included for easy programming using a PC.
RS-232:
Device ID: 01-99
Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
Parity: None, Odd, Even
Handshaking: None, Software, Hardware
Print Setup: Configurable print list and formatting
RS-485: (coming soon)
Device ID: 01-247
Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
Parity: None, Odd, Even
Protocol: Modbus RTU (Half Duplex)

Real Time Clock
LEVELtrol II is equipped with a battery backed real time clock with display of time and date.
Format:
12 or 24 hour time display
Day, Month, Year date display

Fig. 1: Standard Dimensions

Fig. 2: Wall Mount ("W" mounting option) Dimensions

Terminal Designations:

Ordering Information
Example LT2 L 1 B 0 P
Series:
LT2 = LEVELtrol II
Display Type:
L= LCD
V= VFD
Input Type:
1= 110 VAC
2= 220 VAC
3= 12 VDC (10 to 14 VDC)
4= 24 VDC (14 to 28 VDC)
Relays:
A= 2 SPDT Relays
B= 4 SPDT Relays
Network Card:
0= None (STD)
2= RS485/Modbus (available soon) (optional 2nd COM port)
Mounting:
P= Panel Mount ......................................................... (see Fig. 1)
N= NEMA 4 Wall Mount .............................................. (see NEMAtrolST4X)
W= NEMA 12/13 Wall Mount w/ Clear Cover .......... (see Fig.2)
E= Explosion Proof (No Button Access) ................. (see XHVD 7/4)
X= Explosion Proof (with Button Access) ......... (see XTROL 7/4)
Options
ET= Extended Temperatue
-4°F to 131°F (-20°C to 55°C)
IM = Internal Modem
M = Modem Power Option
Accessories:
KEPS-KEP1-32 = KEP RS232 for SUPERtrol 1, SUPERtrol 1LE, SUPERtrol 2 and LEVELtrol 2 • 32 Bit DDE Server
Modem Available, see MPP-2400N (requires M option)
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Remote metering and data collection software available, see TROLlink
Field Indicators Tutorial

Field indicators are signal conditioner/converter devices with a display. Field indicators are intended for mounting on or near the flow sensor. They perform many of the same roles of signal conditioner/converters plus that of providing a convenient local display.

Many “smart” Field Indicators provide additional, advanced functionality such as sensor linearization.

Field Indicators are ancillary display devices also intended to amplify, filter, condition, scale, and convert the low level “raw” signals produced by many transducers and convert it into the desired, industry standard high level signal before transmitting it across a potentially noisy environment. Display indication is also provided. In some cases, a secondary function is providing signal isolation.

Generally, the output signals may be in the form of either a pulse and/or analog current/voltage that is proportional to the span of the signal being measured. Open collector transistors are common as pulse output signals. The most common analog signal is a 4-20mA current signal.

In many flowmeter types the frequency of the raw input signal carries the flow information. The frequency is related to flow rate. Each pulse or cycle is related to a small equivalent quantity of flow. The quantity represented by each pulse varies with each individual meter and must be scaled to obtain engineering units.

The input signal to a pulse signal conditioner may be a contact closure, a magnetic pickup, or a low level pulse. Some conditioner/converters scale the pulse signal such that each pulse represents a engineering quantity of flow, for example 1 pulse per gallon). Some converters convert the variable frequency signal into a current proportional to flow rate.

In many cases, the field indicator is intended to be powered either by an internal battery, or by the 4-20mA output current loop, or by a DC supply voltage normally available in most instruments with 24 VDC being the most common.

Enclosures are available for outdoor weatherproof and also hazardous locations. Most have provisions for mounting on the flowmeter and/or near the flowmeter.

Field Rate/Total Indicators are applied in most PLC and PC based control systems to adapt the process signals into the standardized levels provides on I/O Cards while at the same time providing a display of information in the field.

Typical Application
**SQUIRT**

**Features**
- Linear or Square Root Extraction of Input
- 3 1/2 or 4 1/2 Digit Rate Display (Selectable)
- 8 Digit Totalizer Display
- Calibration, High and Low Values Fully Programmable Through Keypad
- No Dipswitches or Pots to Adjust
- 16 Bit A/D Resolution
- Isolated Scaled Pulse Output
- Password Protection of Menu and Totalizer

**Description:**
Featuring up to 4 1/2 digits of rate and 8 digits of total, the Squirt is a loop powered indicator capable of accepting either linear or square root 4-20 mA inputs. An isolated scaled pulse output is available for hook up to a remote totalizer. Numeric password protection prevents unauthorized access to menu. The easy-to-read menu prompts make the Squirt so easy to program that you will feel comfortable programming it without the use of a manual.

**Specifications:**

**Power:**
- Loop powered 4-20 mA
- Internal Battery (Setup & totalizer memory storage only): 3 V 250 mA-H Lithium (2 yr. Standby life)

**Display:**
- Rate Display: (selectable decimal)
  - 3.5 or 4.5 Digits (selectable), 0.35" High, Display updates once every two seconds.
  - Rate Descriptors: /SEC, /MIN, /HR or "blank"
- Totalizer Display: (selectable decimal)
  - 8 Digits (99999999), 0.2" High
  - Totalizer Descriptors: GAL, LI, FT3, M3, "blank"
- Low Battery Error Detection: "BAT" descriptor
- Under/Over range Indication: Flashing display

**Environmental:**
- OPERATING TEMPERATURE
  - -4°F (-20°C) to + 158°F (70°C)
  - Extended Temp: -22°F (-30°C) to + 158°F (70°C)
- HUMIDITY
  - 0 - 90% Noncondensing
- Accuracy: (Rate @ 20°C)
  - 0.1% Full Scale Resolution, ±1 count
- Temperature Drift:
  - 50 ppm/°C Typical
  - 200 ppm/°C Worst Case
- Listing: CE Compliant

**Inputs:**
- Signal Input:
  - Full Scale Range: 4 to 20 mA DC
  - Loop Voltage Drop: 6 Volts Maximum
  - Reverse Polarity Protected
  - Over Current Protection to 60 mA
  - 16 Bit resolution; 1 sample every 2 seconds
  - Low Cutoff supplied to inhibit indications at low flow rates.
- Reset Input: (contact closure)
  - Internal Pullup Resistor: 100 kΩ to +3 VDC
  - High (logic 1): Open or 3-30 VDC
  - Low (logic 0): Less Than .5 VDC
  - Minimum On : 25 msec

**Pulse Output:**
- The pulse output advances with the least significant digit of the totalizer.
- Type: Opto-isolated open collector transistor.
  - Max. voltage (off state): 30 VDC
  - Current (on state): 5 mA @ .9 V drop, .1mA @ .7 drop
  - Pulse Duration: 15 msec
  - Pulse Output Rate: 25 CPS max.
  - Pulse output divider: User selectable, ÷1, ÷10, ÷100 or off

**Calibration & Operation:**
- Input Scaling: Via front keypad
- Calibration: Via front keypad
- Decimal Point: Via front keypad
- Reset Input: Via front keypad or remote dry contact closure
- Keypad: 4 tactile feedback keys

**Mounting:**
- 0- Circuit Board - OEM option (consult factory)
- 1- Wall Mount - NEMA 4X Clear Front
- 2- Wall Mount - NEMA 4X Enclosure with Squirt mounted behind clear cover
- 3- Explosion Proof - Class I, Division I, Groups B, C & D
  - Class II, Division I, Groups E, F & G
- 5- Wall Mount - NEMA 4X with Squirt mounted outside opaque cover
Wiring:

2-Wire Transmitter

Rear View

- Pulse Output + 6
- Pulse Output - 5
- Remote Reset 4
- Remote Reset 3
- Input + (+I) 2
- Input - (-I) 1

Remote Totalizer

DC Power Supply 24V Typ.

Flowmeter (4-20mA Transmitter)

Install jumper to enable front panel lockout.

Jump momentarily to initialize unit prior to calibration. Use only after battery replacement. Loop power must be applied when initializing.

4-Wire Transmitter

Rear View

- Pulse Output + 6
- Pulse Output - 5
- Remote Reset 4
- Remote Reset 3
- Input + (+I) 2
- Input - (-I) 1

Remote Totalizer

4-20mA Loop

To Power Supply

Flowmeter (4-20mA Transmitter)

Install jumper to enable front panel lockout.

Jump momentarily to initialize unit prior to calibration. Use only after battery replacement. Loop power must be applied when initializing.
**Flow Instruments**

**FIELD INDICATORS**

**Squirt-0**

- 3.0120 DIAMETER
- .900 (22.8)
- .992 (25.2)

Mounting holes: .125 Drill (2 places)

- .438 Nylon Spacer Supplied

**Squirt-2**

- #8 Screw Mounting holes molded directly under cover screws. Max. screw head .29" (Typ. 4 places)

To access terminals, unscrew cover and loosen 4 panel screws. Terminals are on bottom side of PC board.

**Squirt-3**

To access terminals, unscrew cover and loosen 2 panel screws. Terminals are on bottom side of PC board.

**Squirt-5**

- #8 Screw Mounting holes molded directly under cover screws. Max. screw head .29" (Typ. 4 places)

To access terminals, remove cover. Terminals are on bottom side of PC board.

**Ordering Information**

**Example:** SQUIRT 3 ET

**SQUIRT**

Loop powered; Rate & Total

**Mounting:**

- 0 = OEM
- 1 = Panel Mount
- 2 = NEMA 4X Box (Squirt behind clear cover)
- 3 = Explosion Proof Housing
- 5 = NEMA 4X Box (Squirt outside opaque cover)

**Options:**

- ET = Extended Temp.: -22°F to 158°F (-30°C to 70°C)
- R = External Magnetic Reset for NEMA4X & Explosion Proof Enclosures
- RX = NEMA7 Explosion Proof Reset Switch for Explosion Proof Enclosure with 3/4" straight thread side entry
- H2 = 0.875" Hole for mounting styles 2 and 5
- HF2 = 0.5" Female NPT Hub fitting for mounting styles 2 and 5
- H3 = 1.125" Hole for mounting styles 2 and 5
- HF3 = 0.75" Female NPT Hub fitting for mounting styles 2 and 5
Features

- Accepts Inputs From: Magnetic Pickups, Contact Closures, DC Pulses (Optically Isolated) from Pulse Producing Flowmeters
- Displays Rate & Total Simultaneously 5 Digit Rate Display, 8 Digit Totalizer Display
- 4-20mA Analog Output Option (8 updates/sec)
- Powered From Internal Battery, External DC Supply or 4-20 mA Output Loop
- 20 Point Linearization (optional);
  10 Point Linearization with Data Logger option
- Isolated Scaled Pulse Output
- Nonvolatile Flash Memory of Setup Data
- RS232 Serial Communications (optional)

Description

Featuring 5 digits of rate and 8 digits of total, the BAT R/T Millennium edition (BATRT-M) is a battery or loop powered indicator capable of accepting magnetic pickup, DC pulse and switch closure inputs from pulse producing flowmeters. The unit can be ordered with an optional 4-20mA output. The BATRT-M uses the 4-20mA loop to provide power when this output is used.

Specifications

Power:
BATTERY POWERED
- Supplied with 1 or 2 C size Lithium battery pack.
EXTERNAL POWER INPUT
- Voltage: 8.5 to 30 VDC
- Current: Less than 5 mA
- Supplied with 1 C size lithium battery
- Protection: Reverse Polarity Protection on DC Power Input
LOOP POWERED
- Voltage: 8.5 to 30 VDC
- Supplied with 1 or 2 C size lithium battery(ies)
- Protection: Reverse Polarity Protection on Current Loop
- Loop Burden: 8.5V maximum

BATTERY LIFE EXPECTANCY:

Expected Years of Operation for BATRT-M of various powering options at equipment duty cycles

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RUN TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Idle</td>
</tr>
<tr>
<td>BATRT-M-A</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATRT-M-A-4</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATRT-M-B/C</td>
<td>10 yrs</td>
</tr>
</tbody>
</table>

standby-operation

BATRT-M-B/C - Indefinite operation when externally powered
External or loop power

NOTE: Battery shelf life is rated at 10 years by manufacturer.
Life expectancy based on rated battery capacity at 20°C
The above table is shown with pulse output inactive. Use of pulse output shortens battery life.
Example: A pulse output of 0.06 sec. duration, once per second, would derate the battery life by 20%.

* A large delay setting and internal math operations may delay the update rate.

DISPLAY:
Rate Display: (selectable decimal)
5 Digits (99999), 0.35" High, Display updates once per second with battery power, 8X per second with DC or Loop power
Rate Descriptors: /SEC, /MIN, /HR
/MIN, /HR, /DAY with "D" option
Select any Rate Display Damping
Totalizer Display: (selectable decimal)
8 Digits (99999999), 0.2" High
Totalizer Descriptors: GAL, LIT, FT3, M3, "blank"
GAL, BBL, MCF, M3, "blank" with "D" option
Warning Displays: Low battery warning

PULSE OUTPUT:
The pulse output advances with the least significant digit of the totalizer or decimal multiples thereof (see Pulse scale divider).
Type: Isolated photomos relay
Max. voltage (off state): 30 VDC
Current (on state): 100mA
Pulse Duration: Selectable 0.5, 0.25, 0.125, 0.0625 seconds
Pulse Scale divider (Pulscale): User selectable, ÷1, ÷10, ÷100 or OFF
NOTE: Select OFF for max. battery life.

ACCURACY:
0.01% Reading, ±1 count
Temperature Drift: 50 ppm/°C Worst Case

ENVIRONMENTAL:
OPERATING TEMPERATURE
-4°F (-20°C) to + 158°F (70°C)
Extended Temp: -22°F (-30°C) to + 158°F (70°C)
HUMIDITY
0 - 90% Noncondensing

• RS485 Modbus Communications and Data Logger (optional)
• Setup Software Available for Easy Programming and Monitoring Using a PC
• Extended Battery Life
• Direct Meter Mounting Kit (optional)
MOUNTING STYLES:
0: Circuit Board - OEM option (consult factory)
1: Panel Mount - NEMA 4X Front
2: Wall Mount - NEMA 4X Enclosure
   (keypad mounted behind clear cover)
3: Explosion Proof - Class I, Division I, Groups B, C & D
   (keypad mounted on cover)
4: Wall Mount - NEMA 4X Enclosure
5: Wall Mount - NEMA 4X Enclosure
   (keypad mounted on cover)
6: Double Ended Explosion Proof - Class I, Division I, Groups B, C & D
   (keypad mounted behind clear cover)

NOTE: Meter mounting kits available for styles 2, 3 and 5

INPUTS:
MAGNETIC PICKUP INPUT
Frequency Range: 0 to 3500 Hz
Trigger Sensitivity: 30 mV p-p (10 mV p-p on special order)
Over Voltage Protected: ± 30 VDC

OPTO-ISOLATED DC PULSE INPUT
High (logic 1): 4-30 VDC
Low (logic 0): Less Than 1 VDC
Minimum Current: .5 mA
Hysteresis: 0.4 VDC
Frequency Range: 0 to 5 kHz
Min. Pulse Width: 0.1 msec

CONTACT CLOSURE INPUT (contact closure to common)
Internal Pullup Resistor: 100 KΩ to +3.6 VDC
High (logic 1): Open or 4-30 VDC
Low (logic 0): Less Than .5 VDC
Internal Switch Debounce Filter: 0 to 40 Hz

NOTE: Sustained contact closure will shorten battery life.

RESET INPUT (contact closure to common)
Internal Pullup Resistor: 100 KΩ to +3.6 VDC
High (logic 1): Open or 4-30 VDC
Low (logic 0): Less Than .5 VDC
Minimum On: 25 msec

NOTE: Sustained contact closure will shorten battery life.

K-FACTOR
Range: 0.001 to 99999999
Decimal Point Locations: XXXX.XXXX to XXXXXXXXX

20 Point Linearization Option (10 Point with Data Logger option)
This feature allows the user to enter 20 different frequencies with 20
different corresponding K-Factors to linearize non linear signals.

ANALOG OUTPUT OPTION:
Type: 4-20 mA follows rate display, Two wire hookup
Accuracy: 0.025% Full Scale at 20°C
Temperature Drift:
50 ppm/°C Typical
Reverse Polarity Protected
Update Rate: 8 times/second

NOTE: The BATRT-M uses the 4-20 mA loop power as its primary
power source when this option is used. The battery is still
required for standby battery operation.

COMMUNICATIONS OPTION (S1):
RS232 SERIAL SETUP SOFTWARE OPTION:
This option enables you to access a variety of process parameters
through serial communications. PC compatible communications soft-
ware is included with this option. With this software and a BAT R/T-M
Serial Adapter Cable (BSAC1) you will be able to setup the BAT R/T-
M through your PC.

RS-485 MODBUS and DATA LOGGER OPTION (S2):
The optional RS-485 card utilizes Modbus RTU protocol to access a
variety of process parameters. The Data Logger stores the totalizer
to flash memory once every 24 hours at the time you set.

DATA STORAGE:
Setup Information: Stored in flash memory
Totalizer: Stored in battery backed RAM but can be saved to flash
memory by operator for recall after battery change out.

Typical Wiring:

CONTACT INPUT / PULSE OUTPUT / BATTERY POWERED
(Power option A or B)

MAG INPUT / 4-20 mA LOOP POWERED
(Power option C or AC)

MAG INPUT / BATPACK POWERED
(Power option A or B)

MAG INPUT / DC POWERED
(Power option A or B)
**Ordering Information**

**EXAMPLE:** BATRTM 3 A 4 ET

**Series:**
- BATRTM

**Mounting:**
- 0 = OEM
- 1 = Panel Mount
- 2 = NEMA 4X Box (Bat R/T behind clear cover)
- 3 = Explosion Proof Housing
- 5 = NEMA 4X Box (Bat R/T outside opaque cover)
- 6 = Double Ended Explosion Proof Housing (consult factory)

**Power Supply:**
- A = Battery (2 supplied)
- B = External Power Supply (8.5 to 30 VDC)
- C = Loop Powered with 4-20 mA Output
- AC = Loop Powered with 4-20 mA Output and 2 Batteries

**Options** (Multiple Options Available)
- S1 = Serial Setup Software
- S2 = RS485/Modbus/Data Logger - Isolated
- 4 = 20 Point Linearization (10 point with S2 option)
- D = Rate per Day, Hour or Minute
- ET = Extended Temp.: -22°F to 158°F (-30°C to 70°C)
- CE** = CE Compliant
- CSA** = CSA Listed Explosion Proof (planned)
- IS** = UL Listed IS (planned)
- TRX = NEMA7 Explosion Proof Reset Switch
- RN = External Magnetic Reset
- T = Third Conduit Entry in Ex-Proof Housing
- H2 = 0.875" Hole for mounting styles 2 and 5
- HF2 = 0.5" Female NPT Hub fitting for mounting styles 2 and 5
- H3 = 1.125" Hole for mounting styles 2 and 5
- HF3 = 0.75" Female NPT Hub fitting for mounting styles 2 and 5

**Accessories:**
- BATPACK = External Batt. Pack with 2 C Size Batteries & 12" leads
- BATC = Single Battery: Tadiran P/N TL2200/S 3.6V 7200mAh or equal
- 115-24 = 115 VAC to 24 VDC power supply
- BSAC1 = RS232 Serial Adapter Cable
- * Contact factory for latest information
**Features**
- Magnetic Pickup Input, Contact Closure Input, DC Pulse Input (Optically Isolated)
- Displays Rate & Total Simultaneously
- 5 Digit Rate Display, 8 Digit Totalizer Display
- 4-20mA Analog Output (optional)
- Powered From Internal Battery, External DC Supply or 4-20 mA Output Loop
- 20 Point Linearization (optional); 10 Point Linearization with Data Logger option
- Isolated High/Low Flow Rate Alarm Output
- Nonvolatile Flash Memory of Setup Data
- Extended Battery Life

**Description**
Featuring 5 digits of rate and 8 digits of total, the BAT RAT Millenium (BATRAT-M) is a battery powered indicator with flow rate alarm output. It is capable of accepting magnetic pickup, DC pulse and switch closure inputs from pulse producing flowmeters. The unit can be ordered with an optional 4-20mA output. The BAT RAT uses the 4-20mA loop to provide power when this output is used.

**Specifications**

**Power:**
- BATTERY POWERED
  - Supplied with 2 C size Lithium battery pack.
  - EXTERNAL POWER INPUT
    - Voltage: 8.5 to 30 VDC
    - Current: Less than 5 mA
    - Supplied with 1 C size lithium battery for standby operation
    - Protection: Reverse Polarity Protection on DC Power Input

**LOOP POWERED**
- Voltage: 8.5 to 30 VDC
- Supplied with 1 C size lithium battery for standby operation
- Protection: Reverse Polarity Protection on Current Loop
- Loop Burden: 8.5V maximum

**BATTERY LIFE EXPECTANCY:**
Expected Years of Operation for BATRAT-M of various powering options at equipment duty cycles

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RUN TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Idle</td>
</tr>
<tr>
<td>BATRAT-M-A</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATRAT-M-A-4</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATRAT-M-B/C</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATRAT-M-B/C</td>
<td>Indefinite operation when externally powered</td>
</tr>
</tbody>
</table>

**NOTE:** Battery shelf life is rated at 10 years by manufacturer
Life expectancy based on rated battery capacity at 20°C
The above table is shown with pulse output inactive. Use of pulse output shortens battery life.
Example: A pulse output of 0.06 sec. duration, once per second, would derate the battery life by 20%.

**Display:**
- Rate Display: (selectable decimal)
  - 5 Digits (99999), 0.35” High, Display updates once per second with battery power, 8X per second with DC or Loop power
- Rate Descriptors: /SEC, /MIN, /HR
  - /MIN, /HR, /DAY with "D" option
- Min. Input Frequency: 0.01 Hz to 10 Hz (selectable delay of 0.1 to 99.9 seconds)"
- Selectable Rate Display Damping
- Totalizer Display: (selectable decimal)
  - 8 Digits (99999999), 0.2” High
  - Totalizer Descriptors: GAL, LT, FT3, M3, "blank"
  - GAL, BBL, MCF, M3, "blank" with "D" option
- Warning Displays: Low battery warning

**Alarm Output:**
Combination High-Low flow rate alarm output activates when flow rate is less than low set point or greater than high set point.
Type: Opto-isolated photomos relay
Max. voltage (off state): 100 VDC
Current (on state): 100 mA

**Mounting Styles:**
- 0- Circuit Board - OEM option (consult factory)
- 1- Panel Mount - NEMA 4X Front
- 2- Wall Mount - NEMA 4X Enclosure with BAT RAT mounted behind clear cover
- 3- Explosion Proof - Class I, Division I, Groups B, C & D
  - Class II, Division I, Groups E, F & G
- 5- Wall Mount - NEMA 4X with keypad mounted outside opaque cover
Environmental:
OPERATING TEMPERATURE
-4°F (-20°C) to +158°F (70°C)
Extended Temp: -22°F (-30°C) to + 158°F (70°C)
HUMIDITY
0 - 90% Noncondensing

ACCURACY:
0.01% Reading, ±1 count
Temperature Drift: 50 ppm/°C Worst Case

ENVIRONMENTAL:
OPERATING TEMPERATURE
-4°F (-20°C) to +158°F (70°C)
Extended Temp: -22°F (-30°C) to + 158°F (70°C)
HUMIDITY
0 - 90% Noncondensing

MOUNTING STYLES:
0 - Circuit Board- OEM option (consult factory)
1- Panel Mount - NEMA 4X Front
2- Wall Mount - NEMA 4X Enclosure
3- Explosion Proof - Class I, Division I, Groups B, C & D
5- Wall Mount - NEMA 4X Enclosure
6- Double Ended Explosion Proof - Class I, Division I, Groups B, C & D

NOTE: Meter mounting kits available for styles 2, 3 and 5

INPUTS:
MAGNETIC PICKUP INPUT
Frequency Range: 0 to 3500 Hz
Trigger Sensitivity: 30 mV p-p (10 mV p-p on special order)
Over Voltage Protected: ± 30 VDC

OPTO-ISOLATED DC PULSE INPUT
High (logic 1): 4-30 VDC
Low (logic 0): Less Than 1 VDC
Minimum Current: .5 mA
Hysteresis: 0.4 VDC
Frequency Range: 0 to 5 kHz
Min. Pulse Width: 0.1 msec

CONTACT CLOSURE INPUT (contact closure to common)
Internal Pullup Resistor: 100 KΩ to +3.6 VDC
High (logic 1): Open or 4-30 VDC
Low (logic 0): Less Than .5 VDC
Minimum On : 25 msec

NOTE: Sustained contact closure will shorten battery life.

K-FACTOR
Range: 0.001 to 99999999
Decimal Point Locations: XXXX.XXXX to XXXXXXXX

RESET INPUT (contact closure to common)
Internal Pullup Resistor: 100 KΩ to +3.6 VDC
High (logic 1): Open or 4-30 VDC
Low (logic 0): Less Than .5 VDC
Minimum On : 25 msec

NOTE: Sustained contact closure will shorten battery life.

K-FACTOR
Range: 0.001 to 99999999
Decimal Point Locations: XXXX.XXXX to XXXXXXXX

20 Point Linearization Option (10 Point with Data Logger option)
This feature allows the user to enter 20 different frequencies with 20 different corresponding K-Factors to linearize non linear signals.

ANALOG OUTPUT OPTION:
Type: 4-20 mA follows rate display, Two wire hookup
Accuracy: 0.025% Full Scale at 20°C
Temperature Drift:
50 ppm/°C Typical
Reverse Polarity Protected
Update Rate: 8 times/second

NOTE: The BATRT-M uses the 4-20 mA loop power as its primary power source when this option is used. The battery is still required for standby battery operation.

COMMUNICATIONS OPTION (S1):
RS232 SERIAL SETUP SOFTWARE OPTION:
This option enables you to access a variety of process parameters through serial communications. PC compatible communications software is included with this option. With this software and a BATRT-M Serial Adapter Cable (BSAC1) you will be able to setup the BATRT-M through your PC.

RS-485 MODBUS and DATA LOGGER OPTION (S2):
The optional RS-485 card utilizes Modbus RTU protocol to access a variety of process parameters. The Data Logger stores the totalizer to flash memory once every 24 hours at the time you set.

DATA STORAGE:
Setup Information: Stored in flash memory
Totalizer: Stored in battery backed RAM but can be saved to flash memory by operator for recall after battery change out.
**FIELD INDICATORS**

**BATRAT-M-0**

- Mounting Hole 0.125 (3) dia.
- Battery 0.15 (3.8)
- 0.30 max. (7.6)

**BATRAT-M-1**

- Outside Dotted Line Shows Outside Panel Dimension (4.00" Diameter)
- 3.582" Dia. Bolt Circle 120° Holes to be 120° Apart
- 3.062" (77.77) Dia. Cutout

**BATRAT-M-2**

- #8 Screw Mounting holes molded directly under cover screws. Max. screw head .29" (Typ. 4 places)
- 4.92(125)
- 4.33 (110)

**BATRAT-M-3**

To access terminals, unscrew cover and loosen 2 panel screws. Terminals are on bottom side of PC board.

**BATRAT-M-5**

- #8 Screw Mounting holes molded directly under cover screws. Max. screw head .29" (Typ. 4 places)

---

**Ordering Information**

**EXAMPLE:** BATRATM 3 A 4 ET

<table>
<thead>
<tr>
<th>Series</th>
<th>Mounting</th>
<th>Power Supply</th>
<th>Options</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OEM</td>
<td></td>
<td></td>
<td>BATPACK=</td>
</tr>
<tr>
<td>1</td>
<td>Panel Mount</td>
<td></td>
<td></td>
<td>Single Batt. Pack with 2 C Size Batteries &amp; 12&quot; leads</td>
</tr>
<tr>
<td>2</td>
<td>NEMA 4X Box (BATRATM behind clear cover)</td>
<td></td>
<td></td>
<td>BATC=</td>
</tr>
<tr>
<td>3</td>
<td>Explosion Proof Housing</td>
<td></td>
<td></td>
<td>Tadiran P/N TL2200/S 3.6V 7200mAh or equal</td>
</tr>
<tr>
<td>5</td>
<td>NEMA 4X Box (BATRATM outside opaque cover)</td>
<td></td>
<td></td>
<td>B15=</td>
</tr>
<tr>
<td>6</td>
<td>Double Ended Explosion Proof Housing (consult factory)</td>
<td></td>
<td></td>
<td>RS232 Serial Adapter Cable</td>
</tr>
</tbody>
</table>

- A  = Battery (2 supplied)
- B  = External Power Supply (8.5 to 30 VDC)
- C  = Loop Powered with 4-20 mA Output
- AC = Loop Powered with 4-20 mA Output and 2 Batteries

**Options** (Multiple Options Available)

- S1 = Serial Setup Software
- S2 = RS485/Modbus/Data Logger - Isolated
- 4 = 20 Point Linearization (10 point with S2 option)
- D = Rate per Day, Hour or Minute
- ET = Extended Temp: -22°F to 158°F (-30°C to 70°C)
- CE** = CE Compliant
- CSA** = CSA Listed Explosion Proof (planned)
- IS** = UL Listed IS (planned)
- TRX = NEMA7 Explosion Proof Reset Switch
- RN = External Magnetic Reset
- T = Third Conduit Entry in Ex-Proof Housing
- H2 = 0.875" Hole for mounting styles 2 and 5
- HF2 = 0.5" Female NPT Hub fitting for mounting styles 2 and 5
- H3 = 1.125" Hole for mounting styles 2 and 5
- HF3 = 0.75" Female NPT Hub fitting for mounting styles 2 and 5

**Accessories:**

- BATPACK= External Batt. Pack with 2 C Size Batteries & 12" leads
- BATC= Single Battery: Tadiran P/N TL2200/S 3.6V 7200mAh or equal
- 115-24 = 115 VAC to 24 VDC power supply
- BSAC1= RS232 Serial Adapter Cable

* External battery pack supplied with models BATRTM0A & BATRTM1A
** Contact factory for latest information
**Flow Instruments**

**FIELD INDICATORS**

**Description**

Featuring 5 digits of resettable total and 8 digits of grand total, the BAT D/T Millennium (BATDTM) is a battery powered indicator capable of accepting magnetic pickup, DC pulse and switch closure inputs from pulse producing flowmeters.

**Specifications**

**POWER:**

- **BATTERY POWERED**
  - Supplied with 2 C size Lithium battery pack.
- **EXTERNAL POWER INPUT**
  - Voltage: 8.5 to 30 VDC
  - Current: Less than 5 mA
- **LOOP POWERED**
  - Voltage: 8.5 to 30 VDC
  - Supplied with 1 or 2 C size lithium battery(ies) for standby operation

**LOOP POWERED**

- **Protection:** Reverse Polarity Protection on DC Power Input
- **Protection:** Reverse Polarity Protection on Current Loop
- **Loop Burden:** 8.5V maximum

**BATTERY LIFE EXPECTANCY:**

Expected Years of Operation for BATRT-M of various powering options at equipment duty cycles

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RUN TIME</th>
<th>24hrs/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATDT-M-A</td>
<td>10 yrs</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATDT-M-A-4</td>
<td>10 yrs</td>
<td>10 yrs</td>
</tr>
<tr>
<td>BATDT-M-B/C</td>
<td>10 yrs</td>
<td>10 yrs</td>
</tr>
</tbody>
</table>

**NOTE:**

Battery shelf life is rated at 10 years by manufacturer. Life expectancy based on rated battery capacity at 20°C. The above table is shown with pulse output inactive. Use of pulse output shortens battery life. Example: A pulse output of 0.06 sec. duration, once per second, would derate the battery life by 20%.

**DISPLAY:**

- **Resettable Total Display**
  - 5 Digits (99999), 0.35” High, Display updates once every two seconds
- **Grand Totalizer Display:** (selectable decimal)
  - 8 Digits (99999999), 0.2” High
  - Totalizer Descriptors: GAL, LIT, FT3, M3, "blank"

**PULSE OUTPUT:**

- The pulse output advances with the least significant digit of the totalizer or decimal multiples thereof (see Pulse scale divider).
- **Type:** Isolated photomos relay
- **Max. voltage (off state):** 30 VDC
- **Current (on state):** 100mA
- **Pulse Duration:** Selectable 0.5, 0.25, 0.125, 0.0625 seconds
- **Pulse Scale divider (Pulscale):** User selectable, ÷1, ÷10, ÷100 or OFF

**ACCUACY:**

- 0.01% Reading, ±1 count
- Temperature Drift: 50 ppm/°C Worst Case

**ENVIRONMENTAL:**

- **OPERATING TEMPERATURE**
  - -4°F (-20°C) to + 158°F (70°C)
- **Extended Temp:** -22°F (-30°C) to + 158°F (70°C)
- **HUMIDITY**
  - 0 - 90% Noncondensing

**MOUNTING STYLES:**

- **0 - Circuit Board**
  - OEM option (consult factory)
- **1 - Panel Mount -**
  - NEMA 4X Front
  - NEMA 4X Enclosure (keypad mounted behind clear cover)
- **3 - Explosion Proof -**
  - Class I, Division I, Groups B, C & D
  - Class II, Division I, Groups E, F & G
  - Class II, Division I, Groups E, F & G
  - Contact factory for details
- **5 - Wall Mount -**
  - NEMA 4X Enclosure (keypad mounted on cover)
- **6 - Double Ended Explosion Proof -**
  - Contact factory for details

**NOTE:** Meter mounting kits available for styles 2, 3 and 5
INPUTS:
MAGNETIC PICKUP INPUT
Frequency Range: 0 to 3500 Hz
Trigger Sensitivity: 30 mV p-p (10 mV p-p on special order)
Over Voltage Protected: ± 30 VDC
OPTO-ISOLATED DC PULSE INPUT
High (logic 1): 4-30 VDC
Low (logic 0): Less Than 1 VDC
Minimum Current: .5 mA
Hysteresis: 0.4 VDC
Frequency Range: 0 to 5 kHz
Min. Pulse Width: 0.1 msec
CONTACT CLOSURE INPUT (contact closure to common)
Internal Pullup Resistor: 100 KΩ to +3.6 VDC
High (logic 1): Open or 4-30 VDC
Low (logic 0): Less Than .5 VDC
Internal Switch Debounce Filter: 0 to 40 Hz
NOTE: Sustained contact closure will shorten battery life.
RESET INPUT (contact closure to common)
Internal Pullup Resistor: 100 KΩ to +3.6 VDC
High (logic 1): Open or 4-30 VDC
Low (logic 0): Less Than .5 VDC
Minimum On: 25 msec
NOTE: Sustained contact closure will shorten battery life.
K-FACTOR
Range: 0.001 to 99999999
Decimal Point Locations: XXXX.XXXX to XXXXXXXX
20 Point Linearization Option (10 Point with Data Logger option)
This feature allows the user to enter 20 different frequencies with 20 different corresponding K-Factors to linearize non linear signals.
ANALOG OUTPUT OPTION:
Type: 4-20 mA follows rate display, Two wire hookup
Accuracy: 0.025% Full Scale at 20°C
Temperature Drift: 50 ppm/°C Typical
Reverse Polarity Protected
Update Rate: 8 times/second
NOTE: The BATRT-M uses the 4-20 mA loop power as its primary power source when this option is used. The battery is still required for standby battery operation.
COMMUNICATIONS OPTION (S1):
RS232 SERIAL SETUP SOFTWARE OPTION:
This option enables you to access a variety of process parameters through serial communications. PC compatible communications software is included with this option. With this software and a BATDTM Serial Adapter Cable (BSAC1) you will be able to setup the BATDTM through your PC.
RS-485 MODBUS and DATA LOGGER OPTION (S2):
The optional RS-485 card utilizes Modbus RTU protocol to access a variety of process parameters. The Data Logger stores the totalizer to flash memory once every 24 hours at the time you set.
DATA STORAGE:
Setup Information: Stored in flash memory
Totalizer: Stored in battery backed RAM but can be saved to flash memory by operator for recall after battery change out.

Typical Wiring:

CONTACT INPUT / PULSE OUTPUT / BATTERY POWERED
(Power option A or B)

MAG INPUT / 4-20 mA LOOP POWERED
(Power option C or AC)

MAG INPUT / BATPACK POWERED
(Power option A or B)
**Ordering Information**

**EXAMPLE:** BATDTM 3 A 4 ET

<table>
<thead>
<tr>
<th>Series</th>
<th>Mounting</th>
<th>Power Supply</th>
<th>Options (Multiple Options Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATDM</td>
<td></td>
<td></td>
<td>S1 = Serial Setup Software</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S2 = RS485/Modbus/Data Logger - Isolated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 = 20 Point Linearization (10 point with S2 option)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D = Rate per Day, Hour or Minute</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ET = Extended Temp.: -22°F to 158°F (-30°C to 70°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CE** = CE Compliant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CSA** = CSA Listed Explosion Proof (planned)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IS** = UL Listed IS (planned)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TRX = NEMA7 Explosion Proof Reset Switch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RN = External Magnetic Reset</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T = Third Conduit Entry in Ex-Proof Housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>H2 = 0.875&quot; Hole for mounting styles 2 and 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>H3 = 1.125&quot; Hole for mounting styles 2 and 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HF3 = 0.75&quot; Female NPT Hub fitting for mounting styles 2 and 5</td>
</tr>
</tbody>
</table>

**Accessories:**

- **BATPACK=** External Batt Pack with 2 C Size Batteries & 12" leads
- **BATO =** Single Battery: Tadiran P/N TL2200/S 3.6V 7200mAh or equal
- **115-24 =** 115 VAC to 24 VDC power supply
- **BSAC1 =** RS232 Serial Adapter Cable

* Contact factory for latest information
**Ratemeter / Totalizer Tutorial**

**What is a Rate/Totalizer Indicator?** This is a general purpose instrument which conditions the electrical signal generated by the flowmeter and scales the resulting flow information into a flow rate and flow total display in the units of measure desired by the end user. Additional functionality such as alarms, analog output, pulse output, and serial communications may also be provided. Also see the section on flow computers. See the figure below for a typical system configuration.

**What capabilities should I look for to ensure compatibility with my type of flowmeter?** Rate/Totalizers are available to work with most flowmeter types and most common electrical signals produced by flowmeters. Begin by selecting an instrument(s) that will accept the signal provided by the flowmeter. In some cases an amplifier or signal conditioner may be necessary. Next decide whether linearization will be required within the Rate/Totalizer and how the calibration will be represented within the instrument. Also determine if the Rate/Totalizer can provide the correct power required to operate the flow sensor (if needed).

**What are basic areas of concern?** Most customers begin a selection by looking for the instrument that has the type of information display they prefer, that will work with the available power, and is available in a package which can be mounted in the desired location.

**What is an analog output and why is it used?** Flow rate information is usually sent from one system to another as a 4-20mA signal. Some instruments permit the user to select what item of information is to be sent on the analog output. The corresponding span is user programmable. Additional features include programmable damping and user selectable ranges.

**What is a pulse output and why is it used?** Flow total information is usually sent from one system to another as a pulse which represents a quantity of flow. The remote system may sum these pulses to compute the flow total. Attributes of a pulse output include provisions for user scaling of the amount of flow each pulse represents, and the width of the pulse. Specifications will usually list the electrical drive ratings for the pulse output.

**What is an alarm output and why is it used?** Relays are often used as controls to activate alarms. A alarm will usually include a provision for setting the alarm point. Additional features may include a programmable delay before the alarm will activate, a programmable alarm duration, and/or a programmable alarm hysteresis.

**What are remote inputs and how are they used?** Often there is a need to connect a remote switch near the operator for such purposes as remote reset, or remote print. Many Rate/Totalizers offer a variety of capabilities as remote inputs.

**What is serial communications and why is it used?** Serial communications is used to transmit information between two computers, or between a computer and a printer. There are several commonly used standard hardware interfaces. These include RS-232, RS-422, and RS-485. There are also a variety of communication protocols, or message formats, which are used. Some of these are unique to the equipment manufacturer, others are industry standards. See also the section on communication solutions.

**What is temperature compensation?** In some cases the temperature may also be used to estimate the fluid density from stored fluid properties. Many customers prefer to correct their flow readings to the equivalent mass or corrected volume at a desired reference temperature.

**What are other areas of concern?** Many areas where rate/totalizer indicators are installed are out of doors or are located in hazardous areas. Special purpose enclosures are available for many instruments to ensure that the equipment will be protected in these environments. A NEMA-4 rating is weather proof. A NEMA-7 rating is explosion proof.

**Typical Ratemeter/Totalizer Application**

![Typical Ratemeter/Totalizer Application Diagram](image-url)
130K

Battery Powered Totalizer with LCD Display

Features
- Low price and high efficiency
- Large (8 mm) 8-digit LCD display,
- Optional backlighting
- NEMA4/IP65 Front Panel
- Screw terminals, RM 5 mm
- Lifetime of the battery approximately 8 years
- Locking of the reset key
- All versions for positive or negative counting edge

Specifications
Power supply: non-replaceable lithium battery (lifetime approximately 8 years at 20°C)
Backlighting: external electrical source 24 V DC +/-20 %, 50 mA
Display: LCD, 8 decades, 8 mm high characters
Display range: –9999999 to 99999999, with overflow display
Reset: manual and electrical

Inputs:
A. Standard DC Input (max. 30 V DC)
   - Slow counting input: max. 30 Hz NPN
   - Fast counting input: max. 12 kHz (PNP), 7 kHz (NPN)
   - Switching level:
     NPN: Low: 0 to 0.7 V, High: 3 to 30 V DC
     PNP: Low: 0 to 0.7 V, High: 4 to 30 V DC

D. Reset Input
   - Minimum pulse time:
     DC: 50 ms, high voltage: 16 ms
   - Contact input DC:
     NPN: Low: 0 to 0.7 V, High: 3 to 30 V DC

E. Electrical reset key locking
   - Contact input:
     Open Collector NPN (switching at 0 V)
   - Switching level:
     NPN: Low: 0 to 0.7 V, High: 3 to 5 V DC

Interference emissions:
EN 55011 Class B, EN 61000-6-2 EN 61010 Section 1 (only AC versions)

Housing: dark grey RAL 7021

Operating temperature:
–10 to +55 °C

Ambient temperature:
–10 to +60 °C

Storage temperature:
–20 to +70 °C

Protection: NEMA4/Ip65 front

Weight: approximately 50 g

Debounce filter function for counting with mechanical contacts.

Dimensions

Order Table

<table>
<thead>
<tr>
<th>Type</th>
<th>Input type</th>
<th>Counting inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>130K.012.8x0</td>
<td>1)</td>
<td>INP A</td>
</tr>
<tr>
<td>130K.012.8x2</td>
<td>1)</td>
<td>INP B</td>
</tr>
</tbody>
</table>

X: 5 = no backlight
X: 6 = with backlight

1): one-channel, adding or subtracting counting

Accessories:
N7 - Explosion proof housing (see accessories section)
E200 - Outdoor Enclosure (see accessories section)
525K, 529K & 530K
Rate and Total Indicators with Pulse or Analog Inputs

Features

• 6 digit, LED display with very high luminosity 0.315" (8mm) digit height
• DIN housing, 1.88"x.944" (48x24mm)
• Two button programming
• Connection with screw terminal
• IP65 NEMA 4X (front)
• DC Powered

525K
Totalizer and Ratemeter

- Display range 0..999999 with leading zero blanking
- Overflow condition will be indicated by 1 Hz flashing of rate value and leading zeros of totalizer
- Count frequency up to 10kHz
- Indicates rate / sec or min (1/Tau)
- SET-key resets the counter to zero (can be disabled in the setup)
- key to switch rate / total display
- 1 count input
- 1 reset input
- Separate multiplying factors totalizer / ratemeter (0.00001...99.9999)
- Operating mode: Rate meter: 1/Tau (average value at higher frequencies)

Order #: 525K.2

Accessories:
E200 - Outdoor Enclosure (see Accessories section)

529K & 530K
Analog Displays

- Display range -19999.0..99999 with leading zero blanking
- Resolution 14 bit
- 5 digit rate display: 6 digit total display (530K)
- 4 different resolutions (0..20mA; 4..20mA; 0..10V or 2..10V)
- Scaling factor for displayed value
- Automatic storage of maximum and minimum value (can be disabled in setup)
- Input to activate storing of displayed value

Listing: UL listed (file#: E128604)

Order #:
529K.2 = Rate Display Only
530K.2 = Rate and Total Display

Accessories:
E200 - Outdoor Enclosure (see Accessories section)

Electrical characteristics:

- Supply Voltage: 10 to 30 VDC (50 mA)
- Data retention: EEPROM (1 million cycles or 10 years)
- Noise immunity acc. to EN 50081-2; EN55011 class B; EN 50082-2
- Ambient temperature: 14°F to 122°F (-10°C to +50°C)
- Input sensitivity: Low: 0 to 1 VDC High: 4 to 30 VDC (525K)
- Input resistance: 10 k ohm (525K)
- Polarity of inputs: programmable for all inputs in common
- Optocoupler: Max 30VDC, 10 mA, 1V drop @ 10 mA

Panel Cutout: 0.876" x 1.78" (22.3 x 45.2mm)
or 0.99" x 1.97" (25 x 50mm) with adaptor provided
INTELLECT-69

Ratemeter / Totalizer
From Analog Inputs

Features
• High/Low Scaling From Front Panel
• 2 Set Points Assignable To Rate or Total
• Display Rate, Integrated Total and Peak & Valley
• 0-5V, 0-10V, 1-5V, 4-20mA or 0-20mA
  Analog Input
• NEMA 4X/IP 65 Front Panel
• +24V Output Power For Peripherals
• RS422/232 Serial Communications (optional)
• 4-20mA Output (optional)
• Square Root Extraction (optional)
• Rate Per Day Feature (optional)

Description:
Featuring 6 digits of bright, 7-segment LED displays, the Intellect-69 is an integrating totalizer/ratemeter which accepts analog signal inputs. The unit can be field programmed to accept 4-20mA, 0-20mA, 0-5V, 0-10V or 1-5V signals. An optional Square Law input is available for inputs that require square root extraction. A 4-20mA output option is available to control strip recorders or to transmit linear signal other peripherals. Two assignable set points are standard. The high and low scaling settings are programmable from the front panel. By pressing the “view” button, the unit will display: integrated total, rate, peak or valley. Press the “lock” key once to freeze the display. RS422 or RS232 serial communications are available options for data communication with a host computer.

Specifications:
Display: 6 digit, .55” high, 7 segment, red orange, LED.
Input Power: 110, 220 VAC ± 15% or 12 to 24VDC.
Current: max. 300mA DC or 10.0VA (10W) at rated AC voltage.
Output Power: (AC powered units only) + 24VDC @ 50mA regulated ±5% (100 mA available on request)
Temperature: Operating: +41°F (5°C) to +130°F (+54°C).
Storage: -40°F (-40°C) to +200°F (93°C).
Humidity: 0-90% Noncondensing
Memory: EEPROM stores data for ten years if power is lost.
Reset: Front Panel: resets displayed values and control outputs.
Remote: 4-30VDC positive edge, resets totalizer and control outputs.
Input: Standard: Linear 4-20mA, 0-20mA, 0-5V, 0-10V or 1-5V
selectable from the front panel.
Optional: Square Law 4-20mA, 0-20mA, 0-5V, 0-10V or 1-5V is available for inputs that require square root extraction.
Input Impedance: Current: 100Ω; Voltage: 115KΩ
Overvoltage Protection: 50 V
Overcurrent Protection: 50 mA
Resolution: 14.5 Bits

Listing: CE Compliant, CSA Listed (File No. LR91109), NRTL/C pending
Calibration: The unit does all of the calibrations internally. There are no potentiometers to adjust and the unit never needs to be removed from the case.
Control Outputs:
Standard: Open collector sinks 250mA from 30VDC when active.
Optional: 2 each Form C SPDT 5 Amp @ 120/240 VAC or 28 VDC.
Set Points: The two control set points can be set at any number from 0 to 59999. The set point outputs can be assigned to rate or total. The unit comes standard with two open collector control outputs. Two 5 Amp, Form C relays are optional. The outputs are programmable from .01 to 599.99 sec or latched until reset when assigned to the total and a hysteresis (alarm range) when assigned to the rate.
Rate Display: Updates 2 times per second. Accurate to 4.5 digits. Set “low” greater than “high” for inverted display (LINEAR ONLY). A user programmable low cutoff inhibits indications at low flow rates.
Totalizer: Integrates from the rate reading and accumulates up to 6 digits of total count. A totalizer divider allows the total to be divided by 1, 10, 100 or 1000. This feature is especially useful for users who deal with high total volumes.
Analog Output: The unit can be ordered with an optional 4-20mA output which is proportional to the instantaneous rate. (The normalizing averaging factor does not affect the analog output) The high and low settings are programmable from the front panel. Set “low” greater than “high” for inverted output. A sinking driver generates a corresponding linear current through the external devices. The output updates with each update of the rate. Accuracy is ±.25% FS worst case. Compliance voltage must be 3 to 30 VDC non inductive. (The unit can provide the DC source as long as the drop across the devices being driven does not exceed 21V).
**Programming:** Decimal points, Scaling from 0 to 59999 units per selected time base, set points, input type, security lock code, and assigning outputs are all programmable from the front panel.

**Housing:** Standard 1/8 DIN, high impact ABS plastic case (NEMA 4X/IP65 front panel).

**Shipping Weight:** 2 lbs.

**Accuracy:**

<table>
<thead>
<tr>
<th>RANGE</th>
<th>% FS ERROR (worst case)</th>
<th>% FS ERROR (typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 mA</td>
<td>0.1%</td>
<td>0.05%</td>
</tr>
<tr>
<td>4-20 mA</td>
<td>0.1%</td>
<td>0.05%</td>
</tr>
<tr>
<td>0-10 VDC</td>
<td>0.2%</td>
<td>0.1%</td>
</tr>
<tr>
<td>0-5 VDC</td>
<td>.25%</td>
<td>.15%</td>
</tr>
<tr>
<td>1-5 VDC</td>
<td>.25%</td>
<td>.15%</td>
</tr>
</tbody>
</table>

Square Law: (above 5% of bottom range) 0.1%

(5V inputs .4%) Worst case over complete range: 2%

**Temperature Stability:** Will not drift more than 20 parts per million per °C from 5°C to 54°C

**Dimensions:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>4.44</td>
</tr>
<tr>
<td>Height</td>
<td>3.62</td>
</tr>
<tr>
<td>Depth</td>
<td>2.63</td>
</tr>
</tbody>
</table>

**WIRING:**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reset In</td>
</tr>
<tr>
<td>2</td>
<td>Analog Out (Sink)</td>
</tr>
<tr>
<td>3</td>
<td>Signal GND (DC)</td>
</tr>
<tr>
<td>4</td>
<td>Current</td>
</tr>
<tr>
<td>5</td>
<td>Voltage</td>
</tr>
<tr>
<td>6</td>
<td>Not Used</td>
</tr>
<tr>
<td>7</td>
<td>-24V Out</td>
</tr>
<tr>
<td>8</td>
<td>Preset B Collector</td>
</tr>
<tr>
<td>9</td>
<td>Preset A Collector</td>
</tr>
<tr>
<td>10</td>
<td>+DC In</td>
</tr>
<tr>
<td>11</td>
<td>110/220 VAC</td>
</tr>
<tr>
<td>12</td>
<td>110/220 VAC</td>
</tr>
<tr>
<td>13</td>
<td>+24V Out</td>
</tr>
<tr>
<td>14</td>
<td>Relay A</td>
</tr>
<tr>
<td>15</td>
<td>N.C.</td>
</tr>
<tr>
<td>16</td>
<td>N.O.</td>
</tr>
<tr>
<td>17</td>
<td>Relay B</td>
</tr>
<tr>
<td>18</td>
<td>N.C.</td>
</tr>
</tbody>
</table>

**Ordering Information**

Example: INT69RT A L 1 A C1

- **Series:**
  - INT69RT= Ratemeter / Totalizer
  - INT69R= Ratemeter Only
  - INT69T= Totalizer Only

- **Operating Voltage:**
  - A= 110 VAC ±15% or 12 to 24 VDC
  - B= 220 VAC ±15% or 12 to 24 VDC

- **Inputs:**
  - L= Linear (standard)
  - S= Square Law (optional)

- **Control outputs:**
  - 1= 2 - Open Collector Outputs (standard)
  - 2= 2 - 5 Amp Form C Relays (optional)

- **Options (Multiple Options Available):**
  - A= Analog Output (4-20 mA)
  - D= Rate per Day, Hour or Minute
  - C1= RS 232 communications
  - C2= RS 422 communications

- **Accessories:**
  - Separate non keyboard panel order #34235
  - Separate keyboard panel - order #34234
  - NEMA 4X wall mount enclosure available, see NEMA-1/8DIN
  - XHV 7/4 Explosion Proof Housing available, see XHV7/4
  - Serial printer available, see P1000, P295
  - Ethernet Port Server available, see IEP5
  - RS-422/485 to RS-232 Communication Adaptor available, see CA285
MRT (MINITROL)

Features

- Separate Scaling Factors For A & B Inputs
- Display Rate & Total
- Pulse Input - 10 kHz Max.
- RS422/RS232 Serial Communication (optional)
- Modbus RTU RS422/RS485/RS232 (optional)
- NEMA 4X / IP65 Front Panel
- Separate Add/Subtract Simultaneous Inputs
- Quadrature and Up/Down Direction Control Inputs (optional)
- 30mV Magnetic Pickup Inputs (optional)

Application:
Any rate, total or blending application where 2 preset alarms and scaling are required.

Description:
The MINITROL is a 6 digit totalizer / ratemeter with two level, 5 digit preset alarm control of total or rate. Inputs A & B have separate scaling K-factors. The totalizer can be programmed for “A” subtract “B”, “A” add “B” or A & B as separate totalizers, with display and control of the “net” total and rate of “A”. The MINITROL is also available in 4 other versions. MC2: a two preset totalizer with scaling, MR2: a high/low alarm ratemeter with scaling; The “MC”: a totalizing counter only, and the “MR”: a ratemeter display only. If only one input is required, the unit will display the total and rate from that one channel. The MINITROL can accept up to 10,000 pulses per second. It has a 5 digit floating decimal scale factor allowing total readout in true engineering units and rate per second, minute or hour.

Input “A” simultaneously drives a ratemeter which can be programmed to display the basic frequency (rate per second) or factored to show rate per minute or rate per hour. Simply push the “VIEW” button to see either total or rate without losing a count. Two separate 5 A relay contacts can be set to operate at either rate or total presets in a latch or auto-recycle mode with output timing from 0.1 to 99.9 seconds.

Two control outputs can be assigned to either the totalizer or ratemeter and can automatically recycle at the batch or stay latched until reset.

Up to 99 units can communicate to a host computer on a single RS232 or RS422 loop.

When two inputs are received (A & B), the unit can either add or subtract the two inputs or display the two inputs as separate totalizers.

4-20mA or 0-20mA Analog Output (optional)

 CSA Listed

Specifications:
- Display: 6 digit, 0.55” High LED
- Input Power:
  - 110 VAC ± 15% or 12 to 15 VDC
  - 220 VAC ± 15% or 12 to 15 VDC
  - 24VAC ± 15% or 12 to 15 VDC
- Current: 250 mA DC max. or 6.5 VA AC
- Output Power: (AC powered units only)
  - +12 VDC @ 50 mA, unregulated -10 + 50%
- Temperature:
  - Operating: +32°F (0°C) to +130°F (+54°C)
  - Storage: -40 F (-40°C) to +200°F (93°C)
- Humidity: 0-90% Noncondensing
- Memory: EEPROM stores data for 10 years if power is lost.
- Inputs:
  - 3: High Impedance DC pulse input 4-30 VDC (high), Open or 0-1 VDC (low), 10 KΩ imp. 10 kHz max. speed. Accepts simultaneous inputs.
  - 3M: Mag. Input, Input A only, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max. (Input B, 4-30V)
  - 3MB: Mag. Input, Inputs A & B, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max.
  - 5: 4-30 V Count pulses on Input A, 4-30 V Direction Control input (level) on Input B.
  - 5M: 30 mV Count pulses on Input A (50 V max. P/P) 4-30 V Direction Control input (level) on Input B.
  - 9: Quadrature, accepts 4-30 V pulses with 90° phase shift for direction detection.
  - 9MB: Quadrature, accepts 30 mV (50 V max. P/P) pulses with 90° phase shift for direction detection.

Low Cost, Pulse Input Totalizer/Ratemeter
Approvals: CSA File# LR91109-7, CE Compliant
Reset:
Front Panel:
  Resets displayed value and control output
Remote:
  4-30 VDC negative edge resets Totalizer "A" and control output
Control Outputs:
Relays:
  2 each N.O. Relay; 5 Amps 120/240 VAC or 28 VDC.
  (N.C. relay contacts and NPN transistor output available with solder jumpers. Transistor output is internally pulled up to 10 VDC through relay coil, sinks from 10 VDC to .5 V @ 100 mA)
Analog Output:
  An optional 4-20mA (0-20mA) output is available for the Minitrol series. The output can be programmed to track rate or total. This feature is available by adding suffix A to the part number. Connections are via a 2 terminal pluggable screw connector.
  Programming is accomplished by using the front panel in conjunction with rear dip switches.
  Accuracy: ±.25% FS worst case.
  Compliance Voltage: 3 to 30 VDC non inductive.
Scaling Factor (K-Factor): In the standard unit, a user programmable K-Factor is used to convert the input pulses to engineering units. The 5 digit K-Factor dividers, with decimal keyed into any position, allow easy direct entry of any K-Factor from 0.0001 to 99999. Separate factors may be entered for the 2 separate input channels.
Presets: Two control outputs are provided. To set relay values, press "menu" button until “Relay” appears on the display, the A and B outputs can be assigned to the ratemeter (high/low), one preset for rate and one for total, or two presets on the A and B totalizers. A 5 digit value can be entered for both presets and the decimal point location is the same as the counter. The outputs can be set to energize from 0.1 to 99.9 seconds or latch (0.0). If a value other than 0.0 is entered, the totalizers will auto reset at the preset. In the A-B or A+B versions, the relays will be assigned to either net total or A rate.
Lockout: Unauthorized front panel changes can be prevented by entering a user selected 5 digit code in the “LOC” mode. The front panel can be completely locked out or the presets can remain accessible.
Ratemeter: Accuracy: 0.01% FS (±1 display digit).
  The rate display updates once per second. The rate meter can be programmed to accept almost any number of pulses per unit of measurement, sample from 2 to 24 seconds maximum, and auto-range up to 5 digits of significant information. In the “RPS” mode, the ratemeter displays in units per second, and in the “scale” mode, units per hour or per minute. The unit will display the rate of the A Input only.
Totalizer: The two 6-digit totalizers can count at 10 kHz max. Each can have a 5-digit dividing scale factor. The totalizer advances on the positive edge of each pulse. Count up or down modes available, as are quadrature inputs from encoders for position or flow measurement. The unit can be programmed to view the net value of “A+B” or “A-B”, or A and B as separate totalizers.
RS232/RS422 with KEP Protocol:
If the serial interface option is supplied, multiple units can be linked together. (The terminal addressing the unit must be capable of driving all loads in the loop.) Unit status and new set points can be communicated by serial communication. Mode changes, however, must always be made on the front panel.
Data is received and transmitted over standard EIA RS232 or RS422 levels. Unit number, baud rate and parity are entered in the “Program Setting” set up mode and remain in memory even if power is off.
RS232/RS422/RS485 with Modbus RTU Protocol:
The serial port can be used for serial printing or also for data acquisition. The unit can assign addresses up to 247 units (The terminal addressing the unit must be capable of driving all loads in the loop.) The unit can communicate with a master device through a Modbus-RTU protocol. The data given for each parameter is in IEEE float format comprising of 2 words. The unit can be connected in a network.
  Device ID: 01-247
  Baud Rates: 300, 600, 1200, 2400, 4800, 9600
  Parity: None, Odd, Even
  Protocol: Modbus RTU (Half Duplex)
**Mounting:**

```
3.925 (99.7) 4.437 (112.7) 2.625 (66.68)
```

**Termination:**

- 1 - COMMON
- 2 - N.O.(N.C./NPN)
- 3 - COMMON
- 4 - N.O.(N.C./NPN)
- 5 - A INPUT
- 6 - B INPUT
- 7 - 12VDC OUT/+DC IN
- 8 - -DC (GROUND)
- 9 - RESET INPUT
- 10 - NOT USED
- 11 - A.C. INPUT
- 12 - A.C. INPUT

**Example:**

```
MRT = 6 digits, ratemeter/totalizer with presets and scaling.
MC2 = 6 digits, totalizer only with presets and scaling.
MR2 = 5 digits, rate only with presets and scaling.
```

**Operating Voltage:**

- A = 110 VAC ± 15% or 12 to 15 VDC
- B = 220 VAC ± 15% or 12 to 15 VDC
- C = 24 VAC ± 15% or 12 to 15 VDC

**Count Inputs:**

- 3 = Standard, 4-30 VDC simultaneous inputs.
- 3M = Mag. Input, Input A only, 30mV input (Input B, 4-30V)
- 5 = 4-30 V pulses on Input A, 4-30 V Direction Control input on Input B.
- 5M = 30 mV pulses on Input A, 4-30 V Direction Control input on Input B
- 9 = Quadrature, accepts 4-30 V pulses
- 9MB = Quadrature, accepts 30 mV pulses (A & B)

**Options:**

- 1 = RS232 Communications
- 2 = RS422 Communications
- 3 = Modbus RTU RS232
- 4 = Modbus RTU RS422/RS485
- A = Analog Output (4-20/0-20 mA)

**NOTE:** RS232/RS422/RS485 & Analog Output options can not be combined

**Accessories:**

- Separate non keyboard panel order #34235
- Separate keyboard panel - order #34234
- NEMA4 wall mount enclosure available, see NEMAtrol
- Explosion proof enclosure available, see XHV
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285
- Modbus DDE/OPC Server available, see KEPserver
**Minitrol-S**

**Features**
- Separate Scaling Factors For Rate & Total
- Display Rate & Total
- 30mV Magnetic Pickup Inputs (optional)
- Count Inhibit Input for Meter Proving
- Security Lockout
- RS422/RS232 Serial Communication (optional)
- NEMA 4X/IP65 Front Panel
- 4-20mA or 0-20mA Analog Output (optional)
- CSA Listed

**Description:**
The totalizer and ratemeter display each have their own 5 digit dividing scale factor. The two 5 AMP preset relay outputs can be programmed by the user to apply to the “A” total counter or the “A” ratemeter. The user can view the rate, total, and grand total. The B relay can be used to create a scaled pulse output. Magnetic pickup input, analog output and RS232 communication options are available.

**Specifications:**
- **Display:** 6 digit, 0.55” High LED
- **Input Power:**
  - 110 VAC ± 15% or 12 to 15 VDC
  - 220 VAC ± 15% or 12 to 15 VDC
  - 24 VAC ± 15% or 12 to 15 VDC
- **Current:** 250 mA DC max. or 6.5 VA (6.5W) AC
- **Output Power:** (AC powered units only)
  - +12 VDC @ 50 mA, unregulated -10 % + 50%
- **Temperature:**
  - Operating: +32 °F (0 °C) to +130 °F (+54 °C)
  - Storage: -40 °F (-40 °C) to +200 °F (93 °C)
- **Memory:** EEPROM stores data for 10 years if power is lost.
- **Inputs:**
  - 3: High Impedance DC pulse input 4-30 VDC (high), Open or 0-1 VDC (low), 10 KΩ imp. 10 kHz max. speed.
  - 3M: Mag. Input, Rate/total input only, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max. (Inhibit input, 4-30V)
  - **Note:** The Mag. input has filtering as follows: 30mV trigger level up to 300Hz, 0.25 V trigger level at 5KHz
- **Reset:**
  - Front Panel: Resets displayed total value and control output.
  - Remote: 4-30 VDC negative edge resets the A total and relay control output.
  - **Note:** The remote reset does not reset the grand total.
- **Listing:** CSA (File No. LR91109), CE Compliant, NRTL/C pending
- **K Factor/Scaling:**
  - The K-Factors are used to convert the input pulses to engineering units. The 5 digit K-Factor dividers, with decimal keyed into any position, allow easy direct entry of any K-Factor from 0.0001 to 99999. Separate factors may be entered for rate and total permitting rate display to be in a different unit of measure than the total.

**Control Outputs:**
- **Relays:** 2 each N.O. Relay; 5 Amps, 120/240 VAC or 28 VDC. (N.C. relay contacts and NPN transistor output available via solder jumpers.
- **Analog Output:** An optional 4-20mA (0-20mA) output is available for the Minitrol series. The output can be programmed to track rate or total. This feature is available by adding suffix A to the part number. Connections are via a 2 terminal pluggable screw connector. Programming is accomplished by using the front panel in conjunction with rear dip switches.
  - **Accuracy:** ± 0.25% FS
  - **Compliance Voltage:** 3 to 30 VDC non inductive.

**RS232/RS422**
If the serial interface option is supplied, multiple units can be linked together. (The terminal addressing the unit must be capable of driving all loads in the loop.) Unit status and new set points can be communicated by serial communication. Mode changes, however, must always be made on the front panel.
- **Data received and transmitted over standard EIA RS232 or RS422 levels. Unit number, baud rate and parity are entered in the “Program Setting” setup mode and remain in memory even if power is off.

**RS232/RS422/RS485 with Modbus RTU Protocol:**
The serial port can be used for serial printing or also for data acquisition. The unit can assign addresses up to 247 units. (The terminal addressing the unit must be capable of driving all loads in the loop.) The unit can communicate with a master device through a Modbus-RTU protocol. The data given for each parameter is in IEEE float format comprising of 2 words. The unit can be connected in a network.
  - **Device ID:** 01-247
  - **Baud Rates:** 300, 600, 1200, 2400, 4800, 9600
  - **Parity:** None, Odd, Even
  - **Protocol:** Modbus RTU (Half Duplex)

**Presets:**
Two control outputs are provided. To set relay A or B’s functionality, press “menu” button until “Relay” appears on the display, the A and B outputs can be assigned to the rate alarm (high/low), or for total/grand total. A 5 digit value can be entered for both presets A and B. The decimal point location is the same as the counter. The outputs can be set to energize from 0.1 to 99.9 seconds or latch (0.0). If a value other than 0.0 is entered, the corresponding totalizer will auto reset at the preset. This may be used to create a relay scaled pulse output.
LOCKOUT:
Unauthorized front panel changes can be prevented by entering a user selected 5 digit code, in the “LOC” mode. The front panel can be completely locked out or the presets can remain accessible.

RATEMETER
Accurate to 4 1/2 digits (±1 display digit). The rate meter can be programmed to:
- accept almost any number of pulses per unit of measurement
- determine rate for slow pulsing signals (up to 24 sec).
- auto-range up to 5 digits of significant information.
The display can be programmed to read in units per Second (Sec), Minute (min), Hour (hour), or Day (day).

TOTALIZER:
The two 6-digit totalizers can count at 10kHz speed. They share a 5-digit dividing scale factor. The totalizer advances on the positive edge of each pulse.

TYPICAL SENSOR HOOKUP:

### High Level Pulse

- RELAYS A B
- COMMON 1 COMMON 2 N.O. (N.C./NPN) 3 COMMON 4 N.O. (N.C./NPN) 5 A INPUT 6 INHIBIT TOTAL INPUT 7 12 V OUTPUT/+ DC INPUT 8 - DC (GROUND) 9 RESET INPUT 10 NOT USED 11 AC INPUT 12 AC INPUT
- OUTPUT POWER GROUND

* PULLUP RESISTOR REQUIRED FOR OPEN COLLECTOR OUTPUTS
4.7kΩ TYPICAL

### Low Level Pulse (Mag Pickup)

- RELAYS A B
- COMMON 1 COMMON 2 N.O. (N.C./NPN) 3 COMMON 4 N.O. (N.C./NPN) 5 A INPUT 6 INHIBIT TOTAL INPUT 7 12 V OUTPUT/+ DC INPUT 8 - DC (GROUND) 9 RESET INPUT 10 NOT USED 11 AC INPUT 12 AC INPUT
- SIGNAL GROUND

### Ordering Information

Example: MRTS A 3 1

<table>
<thead>
<tr>
<th>Series</th>
<th>Operating Voltage</th>
<th>Count Inputs</th>
<th>Options</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRTS</td>
<td></td>
<td></td>
<td>1= RS232 Communications</td>
<td>Separate non keyboard panel order #34235</td>
</tr>
<tr>
<td></td>
<td>A= 110 VAC ± 15% or 12 to 15 VDC</td>
<td>3 = Standard, 4-30 VDC simultaneous inputs.</td>
<td>2= RS422 Communications</td>
<td>Separate keyboard panel - order #34234</td>
</tr>
<tr>
<td></td>
<td>B= 220 VAC ± 15% or 12 to 15 VDC</td>
<td>3M = Mag, Input, rate/total input only, 30mV input (Inhibit input, 4-30V)</td>
<td>3= Modbus RTU RS232</td>
<td>NEMA4 wall mount enclosure available, see NEMAtrol</td>
</tr>
<tr>
<td></td>
<td>C= 24 VAC ± 15% or 12 to 15 VDC</td>
<td></td>
<td>4= Modbus RTU RS422/RS485</td>
<td>Explosion proof enclosure available, see XHV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A= Analog Output (4-20/0-20 mA)</td>
<td>Serial printer available, see P1000, P295</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NOTE: RS232/RS422/RS485 &amp; Analog Output options can not be combined</td>
<td>Ethernet Port Server available, see IEPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RS-422/485 to RS-232 Communication Adaptor available, see CA285</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Modbus DDE/OPC Server available, see KEPserver</td>
</tr>
</tbody>
</table>
MINITROL-PW

Features:
- Display Rate & Total
  Flowrate Display = Input Frequency + Offset B
  Factor A
- 30mV Magnetic Pickup Inputs (optional)
- RS422/RS232 Serial Communication (optional)
- NEMA 4X / IP65 Front Panel
- 4-20mA or 0-20mA Analog Output (optional)

DESCRIPTION:
The MINITROL-PW is a single input counter/ratemeter intended for use with low flow paddle or pelton wheel turbine flowmeters. Two scale factors are used to describe the flowmeter calibration characteristics. The two 5 AMP preset relay outputs can be programmed by the user to apply to the "A" total counter or the "A" ratemeter. The user can view the rate, total and grand total.

SPECIFICATIONS:
Electrical Specifications: See MINItrol-S
Dimensions: See MINItrol-S

K FACTOR/SCALING:
The K-Factor is used to convert the input pulses to engineering units. The two 5 digit scale factors, with decimal keyed into any position, allow easy direct entry of any scaling factor from 0.0001 to 99999. Factor A is used to enter the linearized K-Factor and Factor B is used to enter the offset frequency.

LOW FLOW CUTOFF:
A low flow cutoff is provided to inhibit operation in low flow out of range regions.

RATEMETER:
Accurate to 4 1/2 digits (±1 display digit). The rate meter can be programmed to accept almost any number of pulses per unit of measurement and auto-range up to 5 digits of significant information. The display can be programmed to read in units per Second (sec), Minute (min), Hour (hour), or Day (day).

COUNTER:
The two 6-digit totalizers can count at 10kHz speed. They share a 5-digit dividing scale factor. The totalizer performs as follows:

If Freq. In > Cutoff
Total increment = Freq Offset • Δ Time + Pulses In
K Factor A  K Factor A
Rate = (Freqin + Freq offset) • Time base
K Factor A

Time base: Sec =1, Min = 60, Hour = 3600, Day = 86400

If Freq. In < Cutoff
Total Increment = 0
Rate = 0

Total B (grand total) increments with Total A.

THEORY OF OPERATION:
Low flow, Pelton Wheel turbine flowmeters have a transfer characteristic which can be best be represented by the following equation for frequencies above the minimum usable flowrate for the device:

\[ \text{frequency} = \left( \frac{K_{\text{linearized}} \cdot \text{GPM}}{60} \right) - \text{Offset Frequency} \]

Where: \( K_{\text{linearized}} \) and offset frequency are scaling constants determined during flow sensor calibration.

This transfer characteristic applies within the meter manufacturers published range. Below some minimum flow meter output frequency, the flow rate should be considered as 0 and the totalization inhibited. This is called the "cutoff" frequency.

Ordering Information:

Example: MRTPW A 3 1
Series:
MRTPW = 6 digit counter / 5 digit ratemeter
with presets and scaling.

Operating Voltage:
A= 110 VAC ± 15% or 12 to 15 VDC
B= 220 VAC ± 15% or 12 to 15 VDC
C= 24 VAC ± 15% or 12 to 15 VDC

Count Inputs:
3 = Standard, 4-30 VDC simultaneous inputs.
3M = Mag. Input, rate/total input only, 30mV input
(Inhibit input, 4-30V)

Options
1= RS232 Communications
2= RS422 Communications
A= Analog Output (4-20/0-20 mA)

NOTE: RS232/RS422 & Analog Output options can not be combined

Accessories
Separate non keyboard panel order #34235
Separate keyboard panel - order #34234
NEMA4 wall mount enclosure available, see NEMAtrol
Explosion proof enclosure available, see XHV
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
DRT (Dual rate/totalizer)

Features
- Displays A,B,&C Rate & A,B,&C Total
- Separate Scaling Factors For A & B Inputs
- “C” Displays A+B, A÷B, & A÷A+B
- RS422/RS232 Serial Communication
- Modbus RTU RS422/RS485/RS232
- Pulse Input - 10 kHz Max.
- Security Lockout
- NEMA 4X / IP65 Front Panel
- 30mV Magnetic Pickup Inputs

DESCRIPTION:
The DRT (Dual Rate Totalizer) is a dual 5 digit Ratemeter 6 digit Totalizer in a 1/8 DIN package. User selects 1 of 6 displays to show A, B or C rate and A, B or C total. Inputs A and B have separate scaling to read in engineering units.
A 4-20mA (0-20mA) output of the C rate or total is optional. The user can press the VIEW button to see 6 separate items total A, total B, total C, rate A, rate B, rate C. Negative values are displayed with a negative symbol (-). For the C value, the user can choose from the following combination of A&B inputs: TOTAL; with a choice of A+B or A-B; RATIO with choice of A÷B(x100) to show percent of A to B quantity or A÷[A+B(x100)] to show percent of A to total quantity.

Two independent presets are standard. User selects whether output A is activated by total or rate value of input A or selected C. Output B can be activated by total or rate value of input B or selected C. Outputs activated by A or B total can be set to latch or autorecycle with an adjustable output duration from 0.1 to 99.9 sec. For rate, ratio, or C total outputs pull in when value is equal or above the preset and drop out when value is below the preset minus the selected 0 or 999 hysteresis.

SPECIFICATIONS:
DISPLAY:
6 digit, 0.55” High LED

INPUT POWER:
110 VAC ± 15% or 12 to 15 VDC
220 VAC ± 15% or 12 to 15 VDC
24VAC ± 15% or 12 to 15 VDC

CURRENT:
250 mA DC max. or 6.5 VA (6.5W) AC

OUTPUT POWER: (AC powered units only)
+12 VDC @ 50 mA, unregulated -10 + 50%

TEMPERATURE:
Operating: +32°F (0°C) to +130°F (+54°C)
Storage: -40°F (-40°C) to +20°F (93°C)

HUMIDITY: 0-90% Noncondensing

MEMORY:
EEPROM stores data for 10 years if power is lost.

INPUTS:
3: High Impedance DC pulse input 4-20 VDC (high), Open or 0-1 VDC (low), 10 KΩ imp. 10 kHz max. speed. Accepts simultaneous inputs.
3M: Mag. Input, Input A only, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max. (Input B, 4-30V)
3MB: Mag. Input, Inputs A & B, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max.

RESET:
Front Panel: Resets displayed value and control output
Remote: 4-30 VDC negative edge resets all counters, “A” counter or “B” counter (user selectable).

K FACTOR/SCALING
The DRT has two separate K-Factors that are used to convert the input pulses to engineering units. The 5 digit K-Factor dividers, with decimal keyed into any position, allow easy direct entry of any K-Factor from 0.0001 to 99999. Separate factors may be entered for the 2 separate input channels.

CONTROL OUTPUTS:
Relays:
2 each N.O. Relay; 5 Amps 120/240 VAC or 28 VDC.
(N.C. relay contacts and NPN transistor output available with solder jumpers. Transistor output is internally pulled up to 10 VDC through relay coil, sinks from 10 VDC to .5 V @ 100 mA)

Analog Output:
An optional 4-20mA (0-20mA) output is available for the DRT. The output can be programmed to track rate or total of the C display. This feature is available by adding suffix A to the part number. Connections are via a 2 terminal pluggable screw connector. Programming is accomplished by using the front panel in conjunction with rear dip switches.

Accuracy: 50µA worst case,
Compliance Voltage: 3 to 30 VDC non inductive.

Approvals: CSA File# LR91109-7, CE Compliant
PRESETS
Two control outputs are provided. To set relay values, press “menu” button until “Relay” appears on the display, the A and B outputs can be assigned to the A, B or C displays. A 5 digit value can be entered for both presets and the decimal point location is the same as the counter. The outputs can be set to energize from 0.1 to 99.9 seconds or latch (0.0). If a value other than 0.0 is entered, the counters will auto reset at the preset (for A&B counters).

LOCKOUT
Unauthorized front panel changes can be prevented by entering a user selected 5 digit code. The front panel can be completely locked out or the presets can remain accessible.

RATEMETER
Accurate to 4 1/2 digits (±1 display digit). The ratemeter uses 1/tau with 8 digit math, can sample from 2 to 24 seconds maximum, and auto-range up to 5 digits of significant information. In the “RPS” mode, the ratemeter displays in units per second, and in the “scale” mode, units per hour or per minute. The unit will display the rate of the A&B inputs.

TOTALIZER
The two 5-digit totalizers can count at 10Khz speed. Each has a separate 5-digit dividing scale factor. The totalizers advance on the positive edge of each pulse. Besides being able to step through the total and rate values of A & B inputs, the user can see a selected combination of total and rate of A+B, A-B, (A*B)/100 (percent of A to B), A/(A+B)*100 (percent of A to total). The unit can be programmed to view the Total/Rate value of “A+B” & “A-B”, or “A+B” & “A/(A+B)”.

RS232/RS422 with KEP Protocol:
If the serial interface option is supplied, multiple units can be linked together. (The terminal addressing the unit must be capable of driving all loads in the loop.) Unit status and new set points can be communicated by serial communication. Mode changes, however, must always be made on the front panel.

Data is received and transmitted over standard EIA RS232 or RS422 levels. Unit number, baud rate and parity are entered in the “Program Setting” set up mode and remain in memory even if power is off.

RS232/RS424/RS485 with Modbus RTU Protocol:
The serial port can be used for serial printing or also for data acquisition. The unit can address up to 247 units (The terminal addressing the unit must be capable of driving all loads in the loop.) The unit can communicate with a master device through a Modbus-RTU protocol. The data given for each parameter is in IEEE float format comprising of 2 words. The unit can be connected in a network.

Device ID: 01-247
Baud Rates: 300, 600, 1200, 2400, 4800, 9600
Parity: None, Odd, Even
Protocol: Modbus RTU (Half Duplex)

Ordering Information
Example: DRT A 3 1
Series: ________
DRT = 6 digit counter / 5 digit ratemeter with presets and scaling.

Operating Voltage:
A= 110 VAC ± 15% or 12 to 15 VDC
B= 220 VAC ± 15% or 12 to 15 VDC
C= 24 VAC ± 15% or 12 to 15 VDC

Count Inputs:
3 = Standard, 4-30 VDC simultaneous inputs.
3M = Mag. Input, Input A only, 30mV input (Input B, 4-30V)
3MB = Mag. Input, Inputs A & B, 30mV input

Options: (Multiple Options Not Available)
A= Analog Output (4-20/0-20 mA)
1= RS232 Communications
2= RS422 Communications
3= Modbus RTU RS232
4= Modbus RTU RS424/RS485

NOTE: RS232/RS424/RS485 & Analog Output options can not be combined

Accessories
Separate non keyboard panel order #34235
Separate keyboard panel - order #34234
NEMA4 wall mount enclosure available, see NEMAtrol
Explosion proof enclosure available, see XHV
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Modbus DDE/OPC Server available, see KEPserver
SUPERtrol-I LE

Features

• EZ Setup Feature Speeds Instrument Setup
• Setup Diskette
• Advanced Batching Features, Including Quick Batching Sequence
• Menu Selectable Hardware Features
• Two Line LCD or VFD Display
• NEW! - 0-20mA or 4-20mA Analog Output
• NEW! - Attractive Wall Mount Enclosure
• Isolated Pulse Output Standard
• RS-232 Port Standard, RS-485 Optional
• Advanced Printing Capabilities
• Data Logging & Modem Remote Metering Support
• DIN Enclosure with Two Piece Connectors
• DDE Server & HMI Software Available

Description:
The SUPERtrol-I LE Flow Computer satisfies the instrument requirements for a variety of pulse producing flowmeter types in liquid applications. The alphanumeric display shows measured and calculated parameters in easy to understand format. Single key direct access to measurements and display scrolling is supported. An EZ Setup feature rapidly guides the user through the basic setup. The SUPERtrol-I LE can be programmed for rate/total indication or batching. The various pulse inputs and outputs can be "soft" assigned to meet a variety of common application needs. The user "soft selects" the usage of each feature while configuring the instrument. A 0-20mA or 4-20mA analog output is standard. The user can assign the standard RS-232 Serial Port for data logging, transaction printing, or for connection to a modem for remote meter reading. An optional RS-485 serial port using Modbus RTU protocol is available.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs. The system setup can also be printed.

Specifications:

Environmental
Operating Temperature: 0°C to +50°C
Storage Temperature: -40°C to +85°C
Humidity: 0-95% Non-condensing
Materials: UL approved
Listing: UL/C-UL Listed (File No. E192404), CE Compliant

Display
Type: 2 lines of 20 characters
Types: Backlit LCD and VFD ordering options
Character Size: 0.3" nominal
User programmable label descriptors and units of measure

Keypad
Keypad Type: Membrane Keypad
Keypad Rating: Sealed to Nema 4
Number of keys: 16

Power Input
Type: DIN
Materials: Plastic, UL94V-0, Flame retardant
Bezel: Textured per matt finish

Flow Inputs:
Pulse Inputs:
Number of Flow Inputs: one (single or quadrature)
Input Impedance: 10 KΩ nominal
Pullup Resistance: 10 KΩ to 5 VDC (menu selectable)
Pull Down Resistance: 10 KΩ to common
Trigger Level: (menu selectable)
High Level Input
Logic On: 3 to 30 VDC
Logic Off: 0 to 1 VDC
Low Level Input (mag pickup)
Sensitivity: 10 mV or 100 mV
Minimum Count Speed: User selectable (as low as 1 pulse/99 seconds)
Maximum Count Speed: Selectable: 40 Hz, 300 Hz or 20kHz
Overvoltage Protection: 50 VDC
Linearization: Average K or 16 Point linearization with separate forward and reverse tables

Control Inputs
Number of Inputs: 3
Switch Inputs are menu selectable for Start, Stop, Reset, Lock, Inhibit, Alarm Acknowledge, Print or Not Used.
Control Input Specifications
Input Scan Rate: 10 scans per second
Logic 1: 4 - 30 VDC
Logic 0: 0 - 0.8 VDC
Input Impedance: 100 KΩ
Control Activation:
Positive Edge or Pos. Level based on product definition for switch usage.

Excitation Voltage
Menu Selectable: 5, 12 or 24 VDC @ 100 mA (fault protected)

Data Logging
The data logger captures print list information to internal storage for approximately 1000 transactions. This information can be used for later uploading or printing. Storage format is selectable for Comma-Carriage Return or Printer formats.

Batching Features
Quick batching sequence, single or dual stage batching, slow fill, auto-batch restart and batch overrun compensation.
Serial Communication
The serial port can be used for printing, datalogging, modem connection and communication with a computer.

RS-232:
- Device ID: 01-99
- Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
- Parity: None, Odd, Even
- Handshaking: None, Software, Hardware
- Print Setup: Configurable print list and formatting.
- Print Out: Custom form length, print headers, print list.
- Print Initialization: Print on end of batch, key depression, interval, time of day or remote request.

RS-485: (optional 2nd COM port)
- Device ID: 01-247
- Baud Rates: 1200, 2400, 4800, 9600, 19200
- Parity: None, Odd, Even
- Protocol: Modbus RTU (Half Duplex)

Relay Outputs
The relay outputs are menu assignable to (Individually for each relay) Low Rate Alarm, Hi Rate Alarm, Prewarn Alarm, Preset Alarm or General purpose warning (security).
- Number of relays: 2 (4 optional)
- Contact Style: Form C contacts
- Contact Ratings: 5 amp, 240 VAC or 30 VDC

Isolated Pulse output
The isolated pulse output is assigned to Uncompensated Volume Total.
- Pulse Output Form: Photomos Relay
- Maximum Off Voltage: 30 VDC
- Saturation Voltage: 1.0 VDC
- Pulse Duration: 10 mSec or 100 mSec (user selectable)
- Pulse output buffer: 256
- Fault Protection
- Reverse polarity: Shunt Diode

Terminal Designations

Fig. 1: Standard Dimensions

Fig. 2: Wall Mount ("W" mounting option) Dimensions

Ordering Information

Example: ST1LE L 1 A 0 P ET

Series:
- ST1LE = SUPERtrol-I LE

Display Type:
- L = LCD
- V = VFD

Input Type:
- 1 = 110 VAC
- 2 = 220 VAC
- 3 = 12 VDC (10 to 14 VDC)
- 4 = 24 VDC (14 to 28 VDC)

Relays:
- A = 2 SPDT Relays
- B = 4 SPDT Relays

Network Card:
- 0 = None (STD)
- 2 = RS485/Modbus (optional 2nd COM port)

Mounting:
- P = Panel Mount ................................................... (see Fig. 1)
- N = NEMA 4 Wall Mount ................................. (see NEMAtrolST4X)
- W = NEMA 12/13 Wall Mount w/ Clear Cover ...... (see Fig.2)
- E = Explosion Proof (No Button Access) ....... (see XHVD 7/4)
- X = Explosion Proof (with Button Access) ... (see XTROL 7/4)

Options:
- TB = RS485 Terminal Block for Panel Mount Enclosure
- ET = Extended Temperature ........................ (consult factory)
- -4°F to 131°F (-20°C to 55°C)
- IM = Internal Modem
- M = Modem Power Option

Accessories:
- KEPS-KEP1-32 = KEP RS232 for SUPERtrol 1, SUPERtrol 1LE, SUPERtrol 2 and LEVELtrol 2 • 32 Bit DDE Server
- Modem Available, see MPP-2400 and MPP-2400N (requires M option)
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285
- Remote metering and data collection software available, see TROLink
**KEPTROL R/T**

**Features**
- Pulse or Analog Input Ordering Options
- Display Total, Rate or Grand Total
- Two Alarm Outputs, User Selectable for Total, Rate or Grand Total
- Pulse Input to 20 kHz Count Frequency
- K-Factor Programmable to 8 Places
- Password Protection
- Two Way RS232/422/ Communications Option
- NEMA 4X/IP 65 Front Panel
- Scalable Analog Output of Rate or Total (optional)
- 16 Point Linearization Option

**Description:**
Featuring 8 digits of bright, .55", alphanumeric display, the pulse input version of the KEPTrol R/T can accept up to 20,000 pulses per second. The analog input version accepts inputs, such as 4 to 20mA or 1 to 5V. The standard KEPTrol R/T has two separate, 8 digit, floating decimal, “K” factors to convert the inputs to meaningful total and rate data. An optional 16 point K-factor can linearize flow from meter outputs. The user, with the push of a button, can toggle back and forth to view the total, the rate of flow and the grand total count. Two control outputs can be assigned independently by the user to activate at preset limit of total, rate or grand total for .1 to 9.9 seconds or until reset.

A scaled pulse output is also provided by an open collector driver. Since the output frequency is user selectable at 10, 200, 2K or 20K Hz, the unit can transmit the total data to remote electromechanical or electronic totalizers as well as computers, programmable controllers or other monitor equipment.

An optional analog output allows the user to select low and high settings to control strip chart recorders or other peripherals. Up to 15 units can be connected to optional RS232 or RS422 communications port to set control points or access data.

**Specifications:**
- **Display:** 8 Digit, .55" High, 15 Segment, Red Orange, LED.
- **Input Power** (Internally Fused)
  - A: 110 VAC ±15% or 12 to 27 VDC
  - B: 220 VAC ±15% or 12 to 27 VDC
- **Current:** Maximum 250mA DC or 3.2VA (3.2W) at rated AC voltage.
- **Output Power:** (On AC powered units only)
  - +12 VDC at 100mA. Separate Isolated 12 VDC at 100mA to allow +12 VDC or +24 VDC regulated ±5% worst case.
  - DC Outputs are supplied with resettable fuses.
- **Memory:** EEPROM stores all program and total data for minimum of 10 years if power is lost.

**Pulse Inputs:**
3A: Standard, High impedance pulse input. Open or 0 to 1 VDC (low), 3 to 30 VDC (high), 10K Ohm impedance, 20 kHz max. input speed (min. on/off 25 μsec.).
3B: Same as 3A but has 4.7K Ohm input pull up resistors to +5 VDC on input for pulsing with contact to ground or NPN open collector transistor.

**Analog Inputs:**
The current loop or voltage input is converted to a highly linear 0 to 10 kHz frequency. This frequency can then be scaled by the 8 digit K-Factors to total or display rate in separate engineering units.

**Accuracy over full temperature range:**
- Zero error: +0.175% full scale max.
- Overall error: +0.5% full scale max.
- 5A/7A: 4-20mA, 250 Ohm impedance
- 5B/7B: 0-20mA, 250 Ohm impedance
- 5C/7C: 1-5 VDC, 15K Ohm impedance
- 6A: 4-20 mA, Square Law, 250 Ohm impedance

**Memory:**
EEPROM stores all program and total data for minimum of 10 years if power is lost.

**Reset:**
Front push button: “Clear” resets displayed number and control output. Remote: 3 to 30 VDC positive edge resets the totalizer and control output. Impedance: 10K to ground Minimum pulse: 5 msec.

**Temperature:**
- Operating: +32°F (0°C) to +130°F (+54°C).
- Storage: -40°F (-40°C) to +200°F (+93°C).

**ET**:
- Extended Temperature -40°F to 158°F (-40°C to 70°C)

**Humidity:**
- 0-90% Noncondensing

**Listing:**
- CE Compliant

**Totalizer:**
Each of the total and grand total counters have 8 digits. In the set-up mode choose “RO” (reset to zero) for adding operation or “SP” (set to preset) for subtracting operation. While viewing the total, the display can be made to flash the grand total by pressing “ENT”. Activating “OLR” while the grand total is flashing, resets the grand total counter.
**Ratemeter**: Accurate to 51/2 digits (±1 display digit). The rate meter can be programmed to accept almost any number of pulses per unit of measurement for pulse rate as low as one pulse every 24 seconds, and autorange up to 6 digits of significant information. The rate meter with a “K” factor of 1 displays the rate of pulses per second. Simply dial in the proper “K” factor to display in minutes, hours or other units of measurement. Press the “C” button while the unit is displaying the total to display the rate as indicated by “R” displayed on the left side of the display.

**Password Lockout**: Two stage lockout is available for allowing change of presets only or total lockout of front panel parameter changes. Unauthorized front panel changes can be prevented by entering a user selected four digit password code.

**Factored Output**: The KEPtrol R/T gives one pulse out for each factored total count. Open collector sinks 30 VDC maximum to 1 volt maximum at 100mA maximum. Output speed is user-selectable (see table below). An internal buffer holds up to 10,000 pulses for output at the selected frequency before “DATALOSS” flashes, indicating output pulses were lost. If factored rate exceeds 7 digits “RFF…” flashes. This alarm indicates that the maximum displayed rate has been exceeded.

<table>
<thead>
<tr>
<th>Speed (HZ)</th>
<th>10</th>
<th>200</th>
<th>2000</th>
<th>20000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. on/off (msec)</td>
<td>47.5</td>
<td>2.0</td>
<td>0.2</td>
<td>0.013</td>
</tr>
</tbody>
</table>

**Control Outputs**: (Each of two outputs)
1. NPN Transistor Version: (Optional)
   Open collector sinks max. 250mA from 30 VDC when active.
2. SPDT Relay Version:
   10A 120/240VAC or 28 VDC (Standard).

**Analog Output**: Digital input or analog input (except Square Law) versions can be ordered with an analog output of the rate or total reading. User keys in the low and high settings at set-up.

**Current Outputs**: A sinking driver generates a corresponding linear current through the external devices, updating with each update of the rate display. Accuracy is ±5% worst case. Compliance voltage must be 3 to 24 VDC, non inductive. (The KEPtrol R/T can provide the DC source as long as the drop across all devices being driven does not exceed 21 V).

**Voltage Outputs**: When the voltage output option is ordered, a controlled voltage output is located at terminal 3 and referenced to pin 12 (ground). Accuracy is ±1% @ 20°C (max. drift .01%/°C).

**Preset Alarms**: Two control alarms are provided on the KEPtrol R/T. The preset numbers can be made to flash without interrupting the control function by pressing “A” (Preset A) or “B” (Preset B). Press “ENT” to return to rate or total display. Change the preset by clearing the flashing preset number and keying in a new setpoint number before pressing the “ENT” button. (Count pulses may be lost if the preset is changed while pulses are coming in.) In the “Relay Set-Up” the user selects either or both preset outputs to be activated by the total, grand total or rate. If selected for total or grand total the outputs can be set to activate at the preset total for 0.1 to 9.9 seconds or latch (0.0 second) until reset. If selected for rate control, the rate will be compared with the preset at each display update and the output activated if the rate is equal to or greater than the preset. The output drops out again only if the rate drops below the preset. If the rate goes out of scale the display will show all “F” and the output will remain in the state prior to going out of scale.

**K-Factor**: In the standard unit a fixed K-Factor is used to convert the input pulses or frequency generated internally by the analog input to engineering units. The 8 digit K-Factor divider, with decimal keyed into any position, allow easy direct entry of any K-Factor greater than 0.0001 to 99999999. Separate K-Factors may be entered for the total and rate section. Thus, you may totalize in gallons and display rate in liters per hour. The maximum factored count speed is 20,000 Hz. The maximum factored rate is 7 digits.

16 POINT LINEARIZATION variable K-factor option makes flow systems more accurate and often extends their usable range by allowing users to dial in different K-factors for different flow rates. It works with either pulse input or standard analog current loop or voltage input. It is recommended for flow meters whose K-factors change with different rates of flow. From 3 to 16 points of frequency (0 to 10,000 Hz) and K-factors (.0001 to 999.999) are dialed in at set up. The unit uses 8 digit floating math to interpolate between settings. Rate per second, per minute or per hour programmability eliminates the need to calculate separate K-factors for total and rate.

**Outcard**: RS232 or RS422 serial two way communication options are available. Several units can be linked together and addressed separately to transmit unit status or accept new set points in the standard ASCII format. Baud rates of 300, 600,1200, 2400, 4800 as well as choice of odd, even, space or mark parity can be selected by keypad control.
**Dimensions:**

- **3.31 (84)**
- **8.17 (207.5)**
- **7.375 (187.3) (NOM.)**
- **0.53 (13.5)**
- **2.48 (63) (NOM.)**
- **6.0 (152.4) (NOM.)**
**RTP**

**Two Separate Ratemeters, Totalizers With Two Line LCD Display**

**Features**
- Two pulse and three control inputs
- Displays: A Rate, A Total, B Rate, B Total, A+B Rate, A+B Total, A-B Rate, A-B Total, Grand Total
- Separate Scaling Factors For A & B Inputs
- Two relay outputs with LED Indication
- RS232/ RS485 port for serial communication and printing
- Security lockout
- 4-20 mA output (optional)

**DESCRIPTION:**
The RTP is a presettable Ratemeter and Totalizer from two pulse inputs. It can show rate and total at the same time on the 2 X 16 backlit LCD display. Both inputs can have up to 16 point linearizing k factors. The unit can be connected in a network for Data Acquisition.

**SPECIFICATIONS:**

<table>
<thead>
<tr>
<th>INPUT POWER:</th>
<th>AC: 85 to 265 VAC; 6.5 VA</th>
<th>DC: +/− 24 VDC; 250 mA max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>THRESHOLD:</td>
<td>High: 4-24 VDC; Low: &lt; 1Vdc or open</td>
<td></td>
</tr>
<tr>
<td>INPUT A:</td>
<td>Count Input, 5 kHz max.</td>
<td></td>
</tr>
<tr>
<td>INPUT B:</td>
<td>Count Input, 5 kHz max.</td>
<td></td>
</tr>
<tr>
<td>INPUT C:</td>
<td>Control Input</td>
<td></td>
</tr>
<tr>
<td>INPUT D:</td>
<td>Control Input</td>
<td></td>
</tr>
<tr>
<td>INPUT E:</td>
<td>Control Input (Not Used with RS485)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** AC powered units have isolated inputs. DC units share -DC with input common.

- **OUTPUT POWER:** +20VDC @50 mA (unreg), +/- 15%
- **DISPLAY:** 2 lines of 16 characters, backlit LCD (character size: 2.95mm x 5.55mm)
- **BEZEL:** NEMA 4/IP65 rated membrane keypad
- **INDICATORS:** Two LED’s to indicate control output status. (Red = Output A, Green = Output B)
- **MEMORY:** NVRAM retains data on power failure
- **TEMPERATURE:** Operating: 0 to 50 degrees C Storage: -40 to 90 degrees C
- **HUMIDITY:** 10% to 90% (Non condensing)
- **SIZE:** Bezel: 103mm X 55mm; Depth: 97 mm
- **PANEL CUTOUT:** 92 mm X 45 mm (1/8 DIN size cutout)
- **IMMUNITY TO ESF:** Level 3 per IEC1000-4-2
- **IMMUNITY TO TRANSIENTS:** Level 3 per IEC1000-4-4
- **RADIATED SUSCEPTIBILITY:** Level 3 per IEC1000-4-3
- **EMISSIONS:** EN55011 CISPR A
- **PULSE INPUTS:** The RTP can accept two pulse inputs (A&B). It computes rate and total of A, B, A+B and A-B. For both inputs the user can define up to 16 points of “k” factors. This allows linearization of the displayed rate, which is useful in improving the accuracy of the flowmeter.

The rate is computed within 300 ms per input. To stabilize the rate display, the user can select normalizing factor, which allows weighted average to be shown. Moreover, for rate displays, a time delay of up to 25 seconds can also be selected.

**CONTROL INPUTS**
The RTP has three Control Inputs, i.e. Input C, Input D and Input E (Only C & D with RS485 option). Each input can be configured to start/stop each counter or reset each counter and Control Output. These inputs can also perform different control actions like printing on serial port, lock unit and freeze display.

**RESET OPTIONS**
The entire unit, i.e. all counters and control outputs, or Counter A, Counter B, Counter A+B, Counter A-B, Control O/P A and Control O/P B can be individually programmed to be reset on pressing the front panel RST key and also by a positive edge signal to any of the Control I/Ps C, D and E.

**SERIAL COMMUNICATION**
The serial strobed port can be used for serial printing of Total or Rate data with descriptors. The unit can also communicate with a master device through a Modbus-RTU protocol. The data given for each parameter is in IEEE float format comprising of 2 words. The unit can be connected in a network. Order Option 1 is RS-232 level format; Order Option 2 is RS-422/485 level format.

**Features**
- Two pulse and three control inputs
- Displays: A Rate, A Total, B Rate, B Total, A+B Rate, A+B Total, A-B Rate, A-B Total, Grand Total
- Separate Scaling Factors For A & B Inputs
- Two relay outputs with LED Indication
- RS232/ RS485 port for serial communication and printing
- Security lockout
- 4-20 mA output (optional)
CONTROL OUTPUTS
RELAY: 2 N.O. relays of 5 A and 250 V

ANALOG OUTPUT:
Type: 4-20 mA output.
Accuracy: ±50µA worst case.
This Analog O/P can be programmed to track any parameter. Reverse tracking O/P is also available.

PRESETS: The unit supports five counters, i.e. Counter A, Counter B, Counter A+B, Counter A-B and Grand Total. The counters can either be reset to zero or disabled. Relays can be activated by any of the Total or Rate values. If a Total preset activates the relay, the user can select an output duration of 0.1 to 99.9 seconds with instant auto reset to "0". A 0.0.0 duration keeps the relay activated until externally reset. If both presets are assigned to same counter, with Relay A duration set to 0.0.0 and Preset A lower than Preset B, Relay A pulls in at Preset B and drops out when Preset B (having a duration other than 0.0.0) pulls in. Counter recycles immediately, and Relay B stays activated for the selected duration.

If activated by rate, the relay pulls in at High Preset or above and remains on until rate falls below Low Preset.

LOCKOUT: The unit program and presets can be protected with a lock code to prevent unauthorized front panel changes. This code can be assigned with a maximum of 4 digits and is user selectable. It can be entered through front panel LOCK key or by configuring any of the Control I/ P channel as "Lock unit". Alternate entry of the lock code or pulses to that I/P will lock or unlock the unit.

Communication Port Terminal Designations:

<table>
<thead>
<tr>
<th>Communication Port Terminal Designations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485 Port: (DB9 Female)</td>
</tr>
<tr>
<td>1 • Transmit B (-)</td>
</tr>
<tr>
<td>2 • Receive B (-)</td>
</tr>
<tr>
<td>3 • N.C.</td>
</tr>
<tr>
<td>4 • N.C.</td>
</tr>
<tr>
<td>5 • Ground</td>
</tr>
<tr>
<td>6 • N.C.</td>
</tr>
<tr>
<td>7 • N.C.</td>
</tr>
<tr>
<td>8 • Receive A (+)</td>
</tr>
<tr>
<td>9 • Transmit A (+)</td>
</tr>
<tr>
<td>RS-232 Port: (DB9 Female)</td>
</tr>
<tr>
<td>1 • N.C.</td>
</tr>
<tr>
<td>2 • Transmit</td>
</tr>
<tr>
<td>3 • Receive</td>
</tr>
<tr>
<td>4 • N.C.</td>
</tr>
<tr>
<td>5 • Ground</td>
</tr>
<tr>
<td>6 • Strobe</td>
</tr>
<tr>
<td>7 • N.C.</td>
</tr>
<tr>
<td>8 • N.C.</td>
</tr>
</tbody>
</table>

Keypad Functions

<table>
<thead>
<tr>
<th>KEY</th>
<th>Run Mode</th>
<th>Program Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROG</td>
<td>Enter The Programming Mode</td>
<td>Toggles between menus</td>
</tr>
<tr>
<td>VIEW</td>
<td>VIEW key scrolls through the selected viewing parameters</td>
<td>Left key shifts digits in number entry/characters in message mode</td>
</tr>
<tr>
<td>PRE A</td>
<td>PRE A key allows Preset A to be changed if unit is not locked</td>
<td>Up key increments digits/characters</td>
</tr>
<tr>
<td>CLR</td>
<td>CLR key clears the numeric field</td>
<td></td>
</tr>
<tr>
<td>ENT</td>
<td>ENT key saves changes and steps to next menu</td>
<td></td>
</tr>
<tr>
<td>LOCK</td>
<td>Lock Key allows the entry of a lock code to lock/unlock the unit</td>
<td>Unit comes out of programming at any level</td>
</tr>
<tr>
<td>RST</td>
<td>RST Key resets counters (with/without confirmation)</td>
<td></td>
</tr>
</tbody>
</table>
**Flow Totalizer, Ratemeter and Batcher for Vehicle & Skid Mounting**

**MS-716**

**Features**
- NEW! - Vehicle Mount Enclosure; Rugged Aluminum Construction
- Provisions for Sealing
- "EZ Setup" Guided Setup for First Time Users
- Rate/Total and Batching Functions
- Menu Selectable Hardware & Software Features
- Universal Viscosity Curve (UVC) and API Eq.
- Advanced Batching Features: Overrun Compensation, Autobatch Start, Print End of Batch, Slow Fill, 2 Stage Batching
- Isolated Outputs Standard
- RS-232 Port Standard, RS-485 Optional
- Advanced Printing Capabilities
- Windows™ Setup Software
- On Board Data Logging
- DDE Server & HMI Software Available
- Enhanced Modem Features for Remote Metering
- Quick Batching Sequence with Automatic Ticket Printing

**Description:**
The MS-716 is a special version of the SUPERtrol-1 Flow Computer which is supplied in a vehicle mount enclosure. The MS-716 satisfies the instrument requirements for a variety of flowmeter types in liquid applications. Multiple flow equations and instrument functions are available in a single unit with many advanced features.

The alphanumeric display shows measured and calculated parameters in easy to understand format. Single key direct access to measurements and display scrolling is supported.

The versatility of the MS-716 permits a wide measure of versatility within the instrument package. The various hardware inputs and outputs can be “soft” assigned to meet a variety of common application needs. The user “soft selects” the usage of each input/output while configuring the instrument.

The isolated analog output can be chosen to follow volume flow, corrected volume flow, mass flow, temperature, or density by means of a menu selection. Most hardware features are assignable by this method.

The user can assign the standard RS-232 Serial Port for data logging, transaction printing, or for connection to a modem for remote meter reading.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs and printing system setup.
Specifications:
Flow Meters and Computations
   Meter Types: All linear and square law meters supported including: Coriolis, vortex, turbine, magnetic, PD, target, orifice, venturi, v-cone and many others
   Linearization: Square root, 16 point table or UVC table
   Computations: Volume, Corrected Volume & Mass
   Fluid Computations: Temperature, Density, Viscosity and API 2540 for petroleum.
Environmental
   Operating Temperature: -4°F to +131°F (-20°C to +55°C)
   Storage Temperature: -40°C to +85°C
   Humidity: 0-95% Non-condensing
   Materials: U.L. approved
Listing: UL/ULC Listed (File No. E192404), CE Compliant
Display
   Type: 2 lines of 20 characters
   Types: Backlit LCD
   Character Size: 0.3" nominal
   User programmable label descriptors and units of measure
Keypad
   Keypad Type: Membrane Keypad with 16 keys
Enclosure
   Size: See Dimensions
   Seal: NEMA4X
   Materials: Aluminum
Real Time Clock
   The MS-716 is equipped with a battery backed real time clock with display of time and date.
   Format:
      12 or 24 hour time display
      Day, Month, Year date display
Power Input
   The factory equipped power option is internally fused. An internal line to line filter capacitor and MOV are provided for added transient suppression.
   110 VAC Power: 85 to 127 Vrms, 50/60 Hz
   220 VAC Power: 170 to 276 Vrms, 50/60 Hz
   DC Power:
      12 VDC (10 to 14 VDC)
      24 VDC (14 to 28 VDC)
   Power Consumption:
      AC: 11.0 VA (11W)
      DC: 300 mA max.
Flow Inputs:
Analog Input:
   Accuracy: 0.01% FS at 20°C
   Ranges
      Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
      Current: 4-20 mA, 0-20 mA
   Basic Measurement Resolution: 16 bit
   Update Rate: 4 updates/sec
   Automatic Fault detection: Signal over/under-range, Current Loop Broken
   Calibration: Software Calibration (no trimmers) and Auto-zero Continuously
   Extended calibration: Learns Zero and Full Scale of each range using special test mode.
   Fault Protection:
      Reverse Polarity: No ill effects
      Over-Voltage Limit: 50 VDC Over voltage protection
      Over-Current Protection: Internally current limited protected to 24VDC
Pulse Inputs:
   Number of Flow Inputs: one with or without quadrature
   Input Impedance: 10 KΩ nominal
   Pullup Resistance: 10 KΩ to 5 VDC (menu selectable)
   Pull Down Resistance: 10 KΩ to common
   Trigger Level: (menu selectable)
      High Level Input
         Logic On: 3 to 30 VDC
         Logic Off: 0 to 1 VDC
      Low Level Input (mag pickup)
         Sensitivity: 10 mV or 100 mV
   Minimum Count Speed: Menu selectable
   Maximum Count Speed:
      Menu Selectable: 40Hz, 3000Hz or 20 kHz
   Overvoltage Protection: 50 VDC
**Auxiliary / Compensation Input**

The auxiliary/compensation input is menu selectable for temperature, density or not used. This input is used for the compensated input when performing compensated flow calculations and using volumetric flowmeters. It can also be used as a general purpose input for display and alarming.

- **Operation:** Ratiometric
- **Accuracy:** 0.01% FS at 20°C
- **Basic Measurement Resolution:** 16 bit
- **Update Rate:** 1 update/sec minimum
- **Automatic Fault detection:**
  - Signal Over-range/under-range
  - Current Loop Broken
  - RTD short
  - RTD open
  - Fault mode to user defined default settings
- **Fault Protection:**
  - Reverse Polarity: No ill effects
  - Over-Voltage Limit (Voltage Input): 50 VDC
- **Available Input Ranges**
  - Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
  - Current: 4-20 mA, 0-20 mA
  - Resistance: 100 Ohms DIN RTD

  100 Ohm DIN RTD
  (DIN 43-760, BS 1904):
  - Three Wire Lead Compensation
  - Internal RTD linearization learns ice point resistance
  - 1 mA Excitation current with reverse polarity protection
  - Temperature Resolution: 0.01°C

**Control Inputs**

Switch Inputs are menu selectable for Start, Stop, Reset, Lock, Inhibit, Alarm Acknowledge, Print or Not Used.

- **Control Input Specifications**
  - Input Scan Rate: 10 scans per second
  - Logic 1: 4 - 30 VDC
  - Logic 0: 0 - 0.8 VDC
  - Input Impedance: 100 KΩ
  - Control Activation:
    - Positive Edge or Pos. Level based on product definition for switch usage.

**Excitation Voltage**

Menu Selectable: 5, 12 or 24 VDC @ 100 mA (fault protected)

**NOTE:** DC powered units have limited excitation voltage

**Relay Outputs**

The relay outputs are menu assignable to (Individually for each relay) Low Rate Alarm, Hi Rate Alarm, Prewarn Alarm, Preset Alarm or General purpose warning (security), low temperature/high temperature.

- **Number of relays:** 2 (4 optional)
- **Contact Style:** Form C contacts
- **Contact Ratings:** 5 amp, 240 VAC or 30 VDC

**Serial Communication**

The serial port can be used for printing, datalogging, modem connection and communication with a computer.

- **RS-232:**
  - Device ID: 01-99
  - Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
  - Parity: None, Odd, Even
  - Handshaking: None, Software, Hardware
  - Print Setup: Configurable print list and formatting.
  - Print Out: Custom form length, print headers, print list.
  - Print Initialization: Print on end of batch, key depression, interval, time of day or remote request.

- **RS-485:** (optional 2nd COM port)
  - Device ID: 01-247
  - Baud Rates: 1200, 2400, 4800, 9600, 19200
  - Parity: None, Odd, Even
  - Protocol: Modbus RTU (Half Duplex)

**Data Logging**

The data logger captures print list information to internal storage for approximately 1000 transactions. This information can be used for later uploading or printing.

**Isolated Analog Output**

The analog output is menu assignable to correspond to the Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Density, Volume Total, Corrected Volume Total or Mass Total.

- **Type:** Isolated Current Sourcing
- **Available Ranges:** 4-20 mA, 0-20 mA
- **Resolution:** 12 bit
- **Accuracy:** 0.05% FS at 20°C
- **Update Rate:** 1 update/sec minimum
- **Maximum Load:** 1000 ohms (at nominal line voltage)
- **Temperature Drift:** Less than 200 ppm/C
- **Compliance Effect:** Less than .05% Span
- **60 Hz rejection:** 40 dB minimum
- **Calibration:** Operator assisted Learn Mode
- **Averaging:** User entry of damping constant to cause a smooth control action

**NOTE:** DC powered units are not isolated

**Isolated Pulse output**

The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total or Mass Total.

- **Pulse Output Form:** Photomos Relay
- **Maximum On Current:** 25 mA
- **Maximum Off Voltage:** 30 VDC
- **Saturation Voltage:** 1.0 VDC
- **Maximum Off Current:** 0.1 mA
- **Pulse Duration:** 10 mSec or 100 mSec (user selectable)
- **Pulse output buffer:** 256
- **Fault Protection**
  - Reverse polarity: Shunt Diode
Vehicle Mount Dimensions

Terminal Designations

Optional Mounting Bracket (MB)

Ordering Information

Example MS716 L 1 A 0 V ETMB

Series: MS716 = ST1 Special

Display Type: L = LCD

Input Type:
1 = 110 VAC
2 = 220 VAC
3 = 12 VDC (10 to 14 VDC)
4 = 24 VDC (14 to 28 VDC)

Relays:
A = 2 SPDT Relays
B = 4 SPDT Relays

Network Card:
0 = None (STD)
2 = RS485/Modbus

Mounting:
V = Vehical Mount, Skid Mount, Field Mount

Options:
ET = Extended Temperature
-4°F to 131°F (-20°C to 55°C)
UL = UL Class 1 Division 2
MB = Aluminum Mounting Brackets (2) (Recommended)
IM = IM-2400 Internal Modem
M = Modern Power Option
TB = RS485 Terminal Block
for Panel Mount Enclosure

Accessories:
KEPS-KEP1-32
KEP RS232 for SUPERtrol 1, SUPERtrol 1LE,
SUPERtrol 2 and LEVELtrol 2 • 32 Bit OPC/DDE Server
KEPS-MBS32
Supports RS485 for ST1, ST1LE, ST2,
LT2, MRT, DRT & MB2 (Modbus RTU)
Modern Available, see MPP-2400 and MPP-2400N
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Remote metering and data collection software available, see TROLlink
Batching Tutorial

What is a Flow Batch Controller? A special purpose instrument which is intended to be used in conjunction with a flow sensor and a control valve to dispense a desired amount of a fluid into a container, tank, or vehicle. In some cases the temperature may also be used to estimate the fluid density from stored fluid properties.

How does a Batcher Work? The basic batcher is illustrated in the figures below. The operator begins by entering the desired amount of fluid to be dispensed into a batch quantity setpoint on the instrument. The Start button is pushed. The valve opens and the vessel begins filling. The flow sensor sends the flow signal to the batcher. The batcher compares the total amount delivered and shuts the valve when the desired amount has been dispensed.

What is batch overrun and how do I prevent it? Batch over run is the term given for the amount of fluid dispensed which is greater than the setpoint which was entered. Batch overrun results from the delay in the valve closing. Two techniques are used to minimize batch overrun. See Batch Overrun Compensation and Two Stage Batching.

Batch Overrun Compensation- This technique uses a feature in some batchers which “learn” the amount of batch overrun and then seek to turn the batch off “early” by the average amount of the batch overrun. This feature may be enabled or disabled in some models.

Two Stage Batching- This technique for reducing Batch Overrun uses two valves, one slow fill and one fast fill, to reduce the flow rate just before the batch ends to reduce the amount of overrun. The user can enter the prewarn value for the slow fill at the end of the batch.

Slow Fill- This is a technique used in conjunction two stage batching where a vessel is initially filled at a slow rate to prevent splashing before the fast fill begins. The user can enter the amount of fluid to be filled during the slow fill.

Count Mode- In general, a batcher may be configured to either count from 0 up to the batch quantity or to count down from the batch quantity to 0.

Maximum Batch Preset- This is a safety feature which places a limit on the maximum batch size the operator may enter. It is intended to eliminate large operator entry errors.

Batch Auto Restart- This is a capability which may be used in some applications where the same size container will be filled repeatedly. A programmable time is allowed for the removal of the previously filled container and the repositioning of the new empty container between batches.

Flow Time Out or Security- This is a safety feature which automatically stops a batch when a loss of flow signal is encountered for longer than a user programmed time while a batch is in progress. It is intended to prevent a spill in the event of a failed flow sensor.

Drain Time- This is a feature in some batchers which delays the print of batch record for a user programmable time to permit draining of a fluid into the receiving vessel.

Printing Capability- Many batchers support the generation of a transaction printout. Usually a RS-232 port is provided which may be connected to a printer. A transaction print may be generated manually by pressing a PRINT key, or automatically. The format of the printout and the information which it contains are usually selectable by the user.

Print on End of Batch- This is a capability to automatically create a print out when a batch has been completed by sending out a report on a RS-232 port to a local printer.

Overrun Alarm Detection- This is a safety feature which generates an alarm if the batch quantity has exceeded the desired batch size by more than the allowed limit. It is intended as a safety measure to notify the user of a malfunctioning valve which has failed to close on command.

Remote Start/Stop/Clear Capability- Many batchers have provisions for wiring remote switches or contact closure such that a remote operator or system can control the starting and stopping of a batcher.

Typical Batcher Application

<table>
<thead>
<tr>
<th>Pulse Output</th>
<th>Slow Fill Solenoid Valve</th>
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<tbody>
<tr>
<td>Flowmeter with DC pulse output</td>
<td>Main Solenoid Valve</td>
</tr>
<tr>
<td>Preset Output</td>
<td>Flowrate</td>
</tr>
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</table>

Two Stage vs. Single Stage Batching Illustration

Two Stage Batch Cycle

<table>
<thead>
<tr>
<th>Flowrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Batch</td>
</tr>
<tr>
<td>Fast Fill</td>
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<tr>
<td>Slow Fill</td>
</tr>
<tr>
<td>End Batch</td>
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<tr>
<td>Time</td>
</tr>
</tbody>
</table>

Single Stage Batch Cycle

<table>
<thead>
<tr>
<th>Flowrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Batch</td>
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<td>Fast Fill</td>
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<tr>
<td>End Batch</td>
</tr>
<tr>
<td>Time</td>
</tr>
</tbody>
</table>
**MB2 (MINI-Batcher)**

**Low Cost, Pulse Input Batch Controller**

**Features**

- 5 Digit Scaling Factor
- Display Rate, Batch Size and (Number of Batches or Grand Total)
- Second B Relay Programmable for Output at Prewarn or selected Batch/Grand Total
- Pulse Input - 10 kHz Max.
- Security Lockout
- RS422/RS232 Serial Communication Option
- Modbus RTU RS422/RS485/RS232
- NEMA 4X / IP65 Front Panel

**Application:**
This miniature batcher is ideal for all batching applications. The display will show Batch Amount, Rate and Batch/Grand Total at the push of a button. The Start and Stop buttons make batching simple.

**Description:**
The MINI-Batcher is a 6 digit totalizer and 4.5 digit ratemeter with two relay outputs. One output is dedicated to the batch amount (Preset A), the other can be activated for Prewarn or Batch/Grand Total. The unit can count up to the preset (reset to 0) or down from the preset (set to preset). Start, Stop and Reset functions can be activated from the front panel or remote inputs. An analog output (assignable for Rate or Batch Amount) is available for data logging. Several units can communicate to a host computer on a single RS232 or RS422 loop.

**Specifications:**
- Display: 6 digit, 0.55" High LED
- Input Power:
  - 110 VAC ± 15% or 12 to 15 VDC
  - 220 VAC ± 15% or 12 to 15 VDC
  - 24 VAC ± 15% or 12 to 15 VDC
- Current:
  - 250 mA DC max. or 6.5 VA (6.5W) AC
- Output Power: (AC powered units only)
  - +12 VDC @ 50 mA, unregulated -10 + 50%
- Temperature:
  - Operating: +32°F (0°C) to +130°F (+54°C)
  - Storage: -40°F (-40°C) to +200°F (93°C)
- Humidity: 0-90% Noncondensing
- Memory: EEPROM stores data for 10 years if power is lost.
- Listing: CSA (File No. LR91109), CE Compliant, NRTL/C pending

**Inputs:**
- 3: High Impedance DC pulse input 4-30 VDC (high), Open or 0-1 VDC (low), 10 kΩ impedance, 10 kHz max. speed.
- 3M: Mag. Input, accepts 30mV input (50 V max.) signals 10 KΩ impedance, 5 kHz max.

**Stop / Reset:**
- Front Panel:
  - STOP/RST button stops batch if batch is running, Resets displayed value and control output if batch is stopped.
- Remote:
  - 4-30 VDC, positive edge: stops batch if batch is running, Resets batch amount if batch is stopped.

**NOTE:** Hold either front or remote reset active to inhibit any start inputs.

**Scaling Factor (K-Factor):** A user programmable K-Factor is used to convert the input pulses to engineering units. The 5 digit K-Factor divider, with decimal keyed into any position, allows easy direct entry of any K-Factor from 0.0001 to 99999.

**Presets:** Two control outputs are provided. A 5 digit value can be entered for both presets. The decimal point location is the same as the counter (No decimal in Batch Total counter).

**PRESET A:**
- The preset A output is dedicated to the batch amount. When START is activated, Relay A will energize and remain on until the batch is complete or the batch is stopped.

**PRESET B:**
- The preset B output can be programmed to activate as a Prewarn (for two stage batch control) or activate on Batch Total (number of batches) or Grand Total (selectable). When set for PREWARN, Relay B will energize when START is activated and drop out at Prewarn number before preset. When set for Batch Total (number of batches) or Grand Total, Relay B will activate when the batch total or grand total counts up to preset B amount. The output ON time can be set for a duration (0.01 to 99.99 sec.) or latched (0.00 setting). If a value other than 0.00 is set for the duration, the batch total (number of batches) or grand total will auto-reset at preset B.
Control Outputs:
Relays:
2 each N.O. Relay; 5 Amps 120/240 VAC or 28 VDC. (N.C. relay contacts and NPN transistor output available with solder jumpers.

Analog Output:
An optional 4-20mA (0-20mA) output is available for the Mini-Batch series. The output can be programmed to track rate or batch amount. Connections are via a 2 terminal pluggable screw connector. Programming is accomplished by using the front panel in conjunction with rear dip switches. Accuracy: ±25% FS worst case. Compliance Voltage: 3 to 30 VDC non inductive.

Lockout: Unauthorized front panel changes can be prevented by entering a user selected 5 digit code. The front panel can be completely locked out (except Start & Stop) or the preset can remain accessible.

Ratemeter: Accuracy: 0.01% FS (±1 display digit). The rate display updates once per second. The rate meter can be programmed to sample from 2 to 24 seconds maximum, and auto-range up to 5 digits of significant information. The ratemeter displays in units per second, minute or hour.

Batch or Grand Totalizer: In addition to viewing the batch amount, a second counter can be viewed. This counter is programmable to count either the number of batches (Batch Total) or the grand total count (Grand Total).

RS232/RS422 with KEP Protocol:
If the serial interface option is supplied, up to 99 units can be linked together. (The terminal addressing the unit must be capable of driving all loads in the loop.) Unit status and new set points can be communicated by serial communication. Mode changes, however, must always be made on the front panel. Data is received and transmitted over standard EIA RS232 or RS422 levels. Unit number, baud rate and parity are entered in the “Program Setting” set up mode and remain in memory even if power is off.

RS232/RS422/RS485 with Modbus RTU Protocol:
The serial port can be used for serial printing or also for data acquisition. The unit can address up to 247 units (The terminal addressing the unit must be capable of driving all loads in the loop.) The unit can communicate with a master device through a Modbus-RTU protocol. The data given for each parameter is in IEEE float format comprising of 2 words. The unit can be connected in a network.

Dimensions:

Wiring:

Ordering Information:

Example: MB2 A 3 1
Series: MB2 = MiniBatcher
Operating Voltage: A = 110 VAC ± 15% or 12 to 15 VDC
B = 220 VAC ± 15% or 12 to 15 VDC
C = 24 VAC ± 15% or 12 to 15 VDC
Count Inputs: 3 = Standard, 4-30 VDC pulse inputs.
3M = Mag. Input, 30mV input

Options
1 = RS232 Communications
2 = RS422 Communications
3 = Modbus RTU RS232
4 = Modbus RTU RS422/RS485
A = Analog Output (4-20mA/0-20 mA)

NOTE: RS232/RS422/RS485 & Analog Output options can not be combined

Accessories
Separate keyboard panel - order #34569
NEMA4 wall mount enclosure available, see NEMAnet
Explosion proof enclosure available, see XHV
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Modbus DDE/OPC Server available, see KEPserver
Features

- "EZ Setup" Guided Setup for First Time Users
- Rate/Total and Batching Functions
- Menu Selectable Hardware & Software Features
- Environmental Compliance Monitoring and Report Generation
- Universal Viscosity Curve (UVC) and API Eq.
- Advanced Batching Features: Overrun Compensation, Autobatch Start, Print End of Batch, Slow Fill, 2 Stage Batching
- Isolated Outputs Standard
- RS-232 Port Standard, RS-485 Optional
- Advanced Printing Capabilities
- Windows™ Setup Software
- DIN Enclosure with Two Piece Connectors
- On Board Data Logging
- DDE Server & HMI Software Available
- Enhanced Modern Features for Remote Metering
- NEW! - Attractive Wall Mount Enclosure

Description:
The SUPERtrol-I Flow Computer satisfies the instrument requirements for a variety of flowmeter types in liquid applications. Multiple flow equations and instrument functions are available in a single unit with many advanced features.

The alphanumeric display shows measured and calculated parameters in easy to understand format. Single key direct access to measurements and display scrolling is supported.

The versatility of the SUPERtrol-I permits a wide measure of versatility within the instrument package. The various hardware inputs and outputs can be “soft” assigned to meet a variety of common application needs. The user “soft selects” the usage of each input/output while configuring the instrument.

The isolated analog output can be chosen to follow volume flow, corrected volume flow, mass flow, temperature, or density by means of a menu selection. Most hardware features are assignable by this method.

The user can assign the standard RS-232 Serial Port for data logging, transaction printing, or for connection to a modem for remote meter reading.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs and printing system setup.

Specifications:

Flow Meters and Computations
- Meter Types: All linear and square law meters supported including: vortex, turbine, magnetic, PD, target, orifice, venturi, v-cone and many others
- Linearization: Square root, 16 point table or UVC table
- Computations: Volume, Corrected Volume & Mass
- Fluid Computations: Temperature, Density, Viscosity and API 2540 for petroleum.

Environmental
- Operating Temperature: 0°C to +50°C
- Storage Temperature: -40°C to +85°C
- Humidity: 0-95% Non-condensing
- Materials: U.L. approved

Display
- Type: 2 lines of 20 characters
- Types: Backlit LCD and VFD ordering options
- Character Size: 0.3” nominal
- User programmable label descriptors and units of measure

Keypad
- Keypad Type: Membrane Keypad with 16 keys

Enclosure
- Size: See Dimensions
- Depth behind panel: 6.5” including mating connector
- Type: DIN
- Materials: Plastic, UL94V-0, Flame retardant
- Bezel: Textured per matt finish

Real Time Clock
- The SUPERtrol-I is equipped with a battery backed real time clock with display of time and date.
- Format: 12 or 24 hour time display
- Day, Month, Year date display

Power Input
- The factory equipped power option is internally fused. An internal line to line filter capacitor and MOV are provided for added transient suppression.
- 110 VAC Power: 85 to 127 Vrms, 50/60 Hz
- 220 VAC Power: 170 to 276 Vrms, 50/60 Hz
- DC Power: 12 VDC (10 to 14 VDC)
- 24 VDC (14 to 28 VDC)

Power Consumption:
- AC: 11.0 VA (11W)
- DC: 300 mA max.
Flow Inputs:

Analog Input:
- Accuracy: 0.01% FS at 20° C
- Ranges
  - Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
  - Current: 4-20 mA, 0-20 mA
- Basic Measurement Resolution: 16 bit
- Update Rate: 4 updates/sec
- Automatic Fault detection: Signal over/under-range, Current Loop Broken
- Calibration: Software Calibration (no trimmers) and Auto-zero Continuously
- Extended calibration: Learns Zero and Full Scale of each range using special test mode.
- Fault Protection:
  - Reverse Polarity: No ill effects
  - Over-Voltage Limit: 50 VDC Over voltage protection
  - Over-Current Protection: Internally current limited protected to 24VDC

Pulse Inputs:
- Number of Flow Inputs: one with or without quadrature or pulse security checking
- Input Impedance: 10 KΩ nominal
- Pullup Resistance: 10 KΩ to 5 VDC (menu selectable)
- Pull Down Resistance: 10 KΩ to common
- Trigger Level: (menu selectable)
  - High Level Input
    - Logic On: 3 to 30 VDC
    - Logic Off: 0 to 1 VDC
  - Low Level Input (mag pickup)
    - Sensitivity: 10 mV or 100 mV
- Minimum Count Speed: Menu selectable
- Maximum Count Speed: Menu Selectable: 40Hz, 3000Hz or 20 kHz
- Overvoltage Protection: 50 VDC

Auxiliary / Compensation Input
The auxiliary/compensation input is menu selectable for temperature, density or not used. This input is used for the compensated input when performing compensated flow calculations. It can also be used as a general purpose input for display and alarming.

- Operation: Ratiometric
- Accuracy: 0.01% FS at 20° C
- Basic Measurement Resolution: 16 bit
- Update Rate: 1 update/sec minimum
- Automatic Fault detection:
  - Signal Over-range/under-range
  - Current Loop Broken
  - RTD short
  - RTD open
- Fault mode to user defined default settings
- Fault Protection:
  - Reverse Polarity: No ill effects
  - Over-Voltage Limit (Voltage Input): 50 VDC
- Available Input Ranges
  - Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
  - Current: 4-20 mA, 0-20 mA
  - Resistance: 100 Ohms DIN RTD
- 100 Ohm DIN RTD (DIN 43-760, BS 1904):
  - Three Wire Lead Compensation
  - Internal RTD linearization learns ice point resistance
  - 1 mA Excitation current with reverse polarity protection
  - Temperature Resolution: 0.01 C

Control Inputs
Switch Inputs are menu selectable for Start, Stop, Reset, Lock, Inhibit, Alarm Acknowledge, Print or Not Used.
- Number of Control Inputs: 3
- Control Input Specifications
  - Input Scan Rate: 10 scans per second
  - Logic 1: 4 - 30 VDC
  - Logic 0: 0 - 0.8 VDC
  - Input Impedance: 100 KΩ

Excitation Voltage
Menu Selectable: 5, 12 or 24 VDC @ 100 mA (fault protected)

Relay Outputs
The relay outputs are menu assignable to (Individually for each relay) Low Rate Alarm, Hi Rate Alarm, Prewarn Alarm, Preset Alarm or General purpose warning (security), low temperature/high temperature.
- Number of relays: 2 (4 optional)
- Contact Style: Form C contacts
- Contact Ratings: 5 amp, 240 VAC or 30 VDC

Serial Communication
The serial port can be used for printing, datalogging, modem connection and communication with a computer.
- RS-232:
  - Device ID: 01-99
  - Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
  - Parity: None, Odd, Even
  - Handshaking: None, Software, Hardware
  - RS-485: (optional 2nd COM port)
    - Device ID: 01-247
    - Baud Rates: 2400, 4800, 9600, 19200
    - Parity: None, Odd, Even
    - Protocol: Modbus RTU (Half Duplex)

Data Logging
The data logger captures print list information to internal storage for approximately 1000 transactions. This information can be used for later uploading or printing. Storage format is selectable for Comma-Carriage Return or Printer formats.
- RS-232: 300, 600, 1200, 2400, 4800, 9600, 19200
- Parity: None, Odd, Even
- Handshaking: None, Software, Hardware
- Print Setup: Configurable print list and formatting.
- Print Out: Custom form length, print headers, print list items.
- Print Initialization: Print on end of batch, key depression, interval, time of day, control input or serial request.
- RS-485: (optional 2nd COM port)
  - Device ID: 01-247
  - Baud Rates: 2400, 4800, 9600, 19200
  - Parity: None, Odd, Even
  - Protocol: Modbus RTU (Half Duplex)

Isolated Analog Output
The analog output is menu assignable to correspond to the Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Density, Volume Total, Corrected Volume Total or Mass Total.
- Type: Isolated Current Sourcing
- Available Ranges: 4-20 mA, 0-20 mA
- Resolution: 12 bit
- Accuracy: 0.05% FS at 20° C
- Update Rate: 1 update/sec minimum
- Temperature Drift: Less than 200 ppm/C
- Maximum Load: 1000 ohms (at nominal line voltage)
- Compliance Effect: Less than .05% Span
- 60 Hz rejection: 40 dB minimum
- Calibration: Operator assisted Learn Mode
- Averaging: User entry of damping constant to cause a smooth control action.
**Isolated Pulse output**

The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total or Mass Total

Pulse Output Form: Photomos Relay

- Maximum On Current: 25 mA
- Maximum Off Voltage: 30 V DC
- Saturation Voltage: 1.0 V DC
- Maximum Off Current: 0.1 mA
- Pulse Duration: 10 mSec or 100 mSec (user selectable)
- Pulse output buffer: 256

Fault Protection

- Reverse polarity: Shunt Diode

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**Terminal Designations**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>DOGPUT</td>
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<tr>
<td>3/4</td>
<td>DOGPUT</td>
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<td>5/6</td>
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<td>7</td>
<td>RTD</td>
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<td>RTD</td>
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</tbody>
</table>

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**Ordering Information**

**Example ST1 L 1 A 0 P TB**

**Series:**

- ST1= Supertrol 1

**Display Type:**

- L= LCD
- V= VFD

**Input Type:**

- 1= 110 VAC
- 2= 220 VAC
- 3= 12 VDC (10 to 14 VDC)
- 4= 24 VDC (14 to 28 VDC)

**Relays:**

- A= 2 SPDT Relays
- B= 4 SPDT Relays

**Network Card:**

- 0= None (STD)
- 2= RS485/Modbus (optional 2nd COM port)

**Mounting:**

- P= Panel Mount
- N= NEMA 4 Wall Mount
- W= NEMA 12/13 Wall Mount w/ Clear Cover
- E= Explosion Proof (No Button Access)
- X= Explosion Proof (with Button Access)

**Options:**

- TB= RS485 Terminal Block for Panel Mount Enclosure
- ET= Extended Temperatures
- IM = Internal Modem
- M = Modem Power Option

**Accessories:**

- KEPS-KEP1-32
  - KEP RS232 for SUPERtrol 1, SUPERtrol 1LE, SUPERtrol 2 and LEVELtrol 2 • 32 Bit OPC/DDE Server
- KEPS-MBS32
  - Supports RS485 for ST1, ST1LE, ST2, LT2, MRT, DRT & MB2 (Modbus RTU)
- Modem Available, see MPP-2400 and MPP-2400N (requires M option)
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285
- Remote metering and data collection software available, see TROLlink
Features

- Start/Stop Buttons & Remote Inputs
- Separate 8 Digit K-Factors For Rate & Total
- Accepts Pulse or Analog Inputs
- Displays Rate, Total and Grand Total
- Security Lockout with Missing Pulse Detection
- Scaled Pulse Output
- Two Way Pulse Output
- Two Way RS232/422 Communications Option

Description:

Featuring 8 digits of bright, .55 inch, alphanumeric display, the BATCHtrol II can accept up to 20,000 pulses per second of digital count. The analog input versions accept inputs, such as 4 to 20 mA or 1 to 5 V. The standard unit has two separate, 8 digit, floating decimal, "K" factors to convert the inputs to meaningful total and rate data. An optional 16 point K-factor can linearize flow from non-linear meter outputs. The user, with the push of a button, can toggle back and forth to view the total of the batch, the rate of flow or the grand total of flow.

The BATCHtrol II may be thought of as two separate counters and a ratermeter. The "batching" counter counts to warn and preset numbers entered by the user and enables separate control outputs. The "totalizing" counter gives a cumulative reading or grand total. Finally, the ratermeter counts the number of pulses per second and, with its scaling feature, can provide gallons per minute or any other rate measurement without the totalizer losing counts. At any time, the user may view the total, the grand total or the rate while never interrupting the counting process.

Setup is done through the front panel and the menu driven software in the unit. Start-Stop control can be activated via the front panel buttons or remote inputs. The unit operates from either 110 VAC/12 to 27 VDC, or optional 220 VAC/12 to 27 VDC. If AC power is used, two built-in regulated 12 VDC @ 100 mA power supplies are offered. They can be connected to provide +12 VDC and -12VDC or +24 VDC to drive external devices. CMOS Logic is used to provide high noise immunity and low power consumption with EEPROM to hold data a minimum of 10 years if power is lost.

Up to 15 addresses can be defined for the optional RS232 or RS422 communications port and units multi-dropped. The serial port can be used to set control points or access data.

Specifications:

**DISPLAY:**
8 Digit, .55” High, 15 Segment, Red Orange, LED.

**INPUT POWER:** (Internally Fused)
A: 110 VAC ±15% or 12 to 27 VDC
B: 220 VAC ±15% or 12 to 27 VDC

**CURRENT:**
Maximum 280 mA DC or 5.3 VA (5.3W) at rated AC voltage.

**OUTPUT POWER:** (On AC powered units only):
+12 VDC at 100mA. Separate Isolated 12 VDC at 100mA to allow +12 VDC or +24 VDC regulated ±5% worst case. DC Outputs are supplied with resettable fuses.

**ANALOG INPUTS:**
5A/7A: 4-20 mA, 250 Ohm impedance
5B/7B: 0-20mA, 250 Ohm impedance
5C/7C: 1-5 VDC, 15K Ohm impedance
5D/7D: 0-5 VDC, 15K Ohm impedance
5E/7E: 0-10 VDC, 15K Ohm impedance
6A: 4-20 mA, Square Law, 250 Ohm impedance

**MEMORY:**
EEPROM stores all program and total data for minimum of 10 years if power is lost.

**PULSE INPUTS:**
3A: Standard, High impedance pulse input. Low: Open 0 to 1 VDC
High: 3 to 30 VDC, 10K Ohm impedance
3B: Same as 3A but has 4.7K Ohm input pull up resistors to +5 VDC on input for pulsing with contact to ground or NPN open collector transistor.

**RESET:**
Front push button: “CLR” resets displayed number and control output.

**REMOTE START & STOP/RESET INPUTS:**
A 4 to 30VDC positive pulse will activate these inputs. Pin 10 is the START input and when activated, the unit will "start." Pin 5 is the STOP/RESET input. When activated, the unit will "stop" (if unit is started and the batch is not complete). When the unit is stopped or the batch is complete, activating this input will reset the total. If pin 5 is held high (4 to 30VDC), the display will flash “STOPPED” and any start inputs will be inhibited. Stop always over-rides Start input.

**NOTE:** The remote START input will not work with the type 7 input option (analog in & analog out) boards. All other features will work as described above.

These new features have not yet been added to the 16 point linearization BATCHtrol II version 12.0.
FACTORED OUTPUT:
The BATCHtrol II gives one pulse out for each increment in total. The open collector sinks 30 VDC maximum to 1 volt maximum at 100mA maximum. Output speed is user selectable (see table below). An internal buffer holds up to 10,000 pulses for output at the selected frequency before “DATALOST” flashes, indicating pulses are lost. If factored rate exceeds 7 digits “RFF…” flashes. These alarms indicated that speed has been exceeded.

<table>
<thead>
<tr>
<th>Speed(HZ)</th>
<th>10</th>
<th>200</th>
<th>2000</th>
<th>20000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. on/off (msec)</td>
<td>47.5</td>
<td>2.0</td>
<td>0.2</td>
<td>0.013</td>
</tr>
</tbody>
</table>

CONTROL OUTPUTS:
(Each of two outputs)
1. NPN Transistor Version: (Optional)
The open collector sinks max. 250mA from 30 VDC when active. (When relay is used, 10 VDC is provided at transistor outputs through relay coil. If greater than 2mA is used, relay will remain energized. Applying greater than 10 VDC may destroy unit. Transistor will sink 100mA in “ON” state).
2. SPDT Relay Version: 10A 120/240 VAC or 28 VDC (Standard).

ANALOG OUTPUT:
Digital input or analog input (except Square Law) versions can be ordered with an analog output of the rate or total reading. Digital input or analog input (except Square Law) versions can be ordered with an analog output of the rate or total reading.

Voltage Outputs:
- 10A 120/240 VAC or 28 VDC (Standard).
- Voltage output is located at terminal 3 and referenced to pin 12 (ground). Accuracy is ±.5% FS worst case. Compliance voltage must be 3 to 24 VDC, non inductive. (The BATCHtrol II can provide the DC source as long as the drop across all devices being driven does not exceed 21 V).

Voltage Output:
When the voltage out option is ordered, a controlled voltage output is located at terminal 3 and referenced to pin 12 (ground). Accuracy is ±.5% at 20°C (max. drift .01%/°C).

SECURITY:
The BATCHtrol II has a missing pulse detector. The user selects the amount of time (1 to 99 sec.) that the unit will “wait” for input pulses. If the unit doesn’t receive pulses within the selected time, the unit displays “SECURITY” and both relays drop out. (00 Disables the security feature; Entering the lockout code returns the unit to the run mode)

PRESETS:
The user may enter two numbers to set up the batch totalizer, Preset and Prewarn. The Prewarn is a number set a certain amount before the preset number. For instance, you may want one hundred gallons in a particular batch. You may also want a valve to close and slow down flow 25 gallons before the end. Your preset is 100, your prewarn is 25. When the start is activated, the relays energize simultaneously to start flow. When the totalizer reaches 75, the prewarn relay drops out. When the totalizer reaches 100 the preset relay drops out. The preset values can be viewed or changed via the menu (when stopped).

K-FACTOR:
In the standard unit a fixed K-Factor is used to convert the input pulses or frequency generated internally by the analog input to engineering units. The 8 digit K-Factor dividers, with decimal keyed into any position, allow easy direct entry of any K-Factor greater than 0.0001 to 99999999. Separate K-Factors may be entered for the total and rate section. Thus, you may batch and total in gallons and display rate in liters per hour.

16 POINT LINEARIZATION:
This variable K-factor option makes flow systems more accurate and often extends their usable range by allowing users to dial in different K-factors for different flow rates. It works with either pulse input or standard analog current loop or voltage input. It is recommended for flow meters whose K-factors change with different rates of flow. From 3 to 16 points of frequency from 0 to 10,000 Hz. and K-factors greater than .0001 to 999,999 are dialed in at set up. The 16 point linearization option uses 8 digit floating math to interpolate between settings. Rate per second, per minute or per hour programmability eliminates the need to calculate separate K-factors for total and rate.

TOTALIZER:
Each of the total and grand total counters have 8 digits. In the setup mode choose “R0” (reset to zero) for adding operation or “SP” (set to preset) for subtracting operation. While viewing the total the display can be made to flash the grand total by pressing “ENT”. Activating “CLR” while the grand total is flashing, resets the grand totalizer.

RATEMETER:
Accurate to 51/2 digits (+1 display digit). The rate meter can be programmed to accept almost any number of pulses per unit of measurement, sample from 2 to 24 seconds maximum, and autorange up to 6 digits of significant information. The rate meter with a “K” factor of 1 displays the rate of pulses per second. Simply dial in the proper “K” factor to display the rate of pulses per second. Compliance voltage must be ±0.5% FS worst case. ±0.5% FS worst case.

LOCKOUT:
Unauthorized front panel changes can be prevented by entering a user selected four digit code.

OUTCARD:
RS232 or RS422 serial two way communication options are available. Up to 15 units can be linked together and addressed separately to transmit unit status or accept new set points in the standard ASCII format. Baud rates of 300, 600, 1200, 2400 4800 or 9600 as well as choice of odd, even, space or mark parity can be selected by keypad control.

Termination:
| 1 | NOT USED |
| 2 | SCALED OUTPUT (OPEN COLLECTOR) |
| 3 | ANALOG OUTPUT (SINK) |
| 4 | INPUT (PULSE/ANALOG) |
| 5 | STOP / RESET INPUT |
| 6 | NOT USED |
| 7 | NOT USED |
| 8 | NOT USED |
| 9 | NOT USED |
| 10 | START INPUT |
| 11 | NO CONNECTION |
| 12 | GROUND (-DC) |
| 13 | 12 VOLTS OUT |
| 14 | + DC POWER IN (12 to 27 VDC) |
| 15 | ISOLATED -12 VOLTS OUT |
| 16 | ISOLATED +12 VOLTS OUT |
| 17 | AC INPUT |
| 18 | AC INPUT |
| 19 | PREWARN TRANSISTOR |
| 20 | PRESET TRANSISTOR |
| Kessler-Ellis Products • 800-631-2165 | F-16 • Flow Instruments • Page 71 |
**Typical Hookup:**

<table>
<thead>
<tr>
<th>Analog Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Powered 4-20 mA</td>
</tr>
</tbody>
</table>

**Pulse Input**

<table>
<thead>
<tr>
<th>12V Powered Flowmeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4-20mA Transmitter)</td>
</tr>
</tbody>
</table>

**Dimensions:**

- **Flowmeter** (4-20mA Transmitter)
  - 110 VAC 60/50 Hz
  - 10 V AC 60/50 Hz
  - +24V
- **Flowmeter** (DC Pulse Output)
  - 110 VAC 60/50 Hz

---

**Ordering Information**

**Example BT28**

<table>
<thead>
<tr>
<th>Series</th>
<th>A</th>
<th>3A</th>
<th>2</th>
<th>A</th>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batchrol II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operating Voltage:**

- A: 110 VAC ±15% or 12 to 27 VDC
- B: 220 VAC ±15% or 12 to 27 VDC

**Control Inputs:**

- 3A: STD Pulse 3-30 VDC 20 kHz Max.
- 3B: As 3A, with 4.7 KΩ pull up resistors

<table>
<thead>
<tr>
<th>5A</th>
<th>4-20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>5B</td>
<td>0-20 mA</td>
</tr>
<tr>
<td>5C</td>
<td>1-5 VDC</td>
</tr>
<tr>
<td>5D</td>
<td>0-5 VDC</td>
</tr>
<tr>
<td>5E</td>
<td>0-10 VDC</td>
</tr>
</tbody>
</table>

**Control Outputs:**

- 1: Open Collector
- 2: SPDT Relay 10A (standard)

<table>
<thead>
<tr>
<th>Input Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: 0-40 CPS (Inputs 3A, 3B)</td>
</tr>
<tr>
<td>C: 0-400 CPS (Inputs 3A, 3B)</td>
</tr>
<tr>
<td>E: 0-20K CPS (Inputs 3A, 3B)</td>
</tr>
</tbody>
</table>

- * Dip switch selectable, all units can be field modified easily.

**Options:** (Multiple Options Available)

- 1: RS232 Serial Interface
- 2: RS422 Serial Interface
- 3: 4-20 mA Output (Input 3A or 3B only)
- 3X: 0-20 mA Output (Input 3A or 3B only)
- 3Y: 0-5VDC Output (Input 3A or 3B only)
- 3Z: 0-10VDC Output (Input 3A or 3B only)
- 4: 16 Point Linearization Opt.

**Accessories:**

- FLEXCOVER #36120
- XTROL7/4- Explosion proof housing
- NEMA 4X wall mount enclosure available, see NEMATROL
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285

---

**For Other Outputs:**

- Add X for 0-20mA out
- Add Y for 0-5V out
- Add Z for 0-10V out

**Accessories:**

- FLEXCOVER #36120
- XTROL7/4- Explosion proof housing
- NEMA 4X wall mount enclosure available, see NEMATROL
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285
Flow Computer Tutorial

**What is a flow computer?** A special purpose device which computes a corrected flow based on information derived from raw input signals and stored sensor and fluid properties information.

**What are the typical applications requiring a flow computer?** Computation of Heat Flow, Mass Flow, Corrected Volume Flow typically require a flow computer. In addition, many flow sensors require linearization to improve accuracy. The flow computer is also used for data logging, communication, remote metering, alarming and control functions. In many cases a flow computer may replace some of the functionality of a small PLC in your application.

**What are typical uses of flow computers?** The figures and equations below illustrate a number of the common applications for flow computers.

**Where do the equations come from which are solved by the flow computer?** All flow measurement sensors have basic mathematical expressions which describe how they relate the measured input signal to a flow measurement. Often there are a number of such expressions for each flowmeter type which range from the simple to those which include additional second order effects. In addition, there are basic equations from thermodynamics and industry standard equations which are utilized in liquid, gas, steam, and heat.

**How can you enhance the accuracy of flow meters?** A flow computer often offers a variety of performance enhancement functions. These range from simple square root functions, to more elaborate linearization tables applicable to that flowmeter type. In addition, the flow computer can correct for changes in physical dimensions of the flowmeter with temperature and for the effects of changes in fluid properties of the material being measured in some cases.

**How are fluid properties determined?** Fluid properties are stored within the flow computer. Properties are then computed as a function of measured fluid temperature and/or pressure. Density and viscosity are among the most commonly computed fluid properties.

**What types of flowmeters typically use flow computers?** The most common types used in conjunction with flow computers are turbine, vortex, positive displacement, orifice and similar types, magnetic flowmeters, and a variety of special flowmeter types. Flow computers are often used with other types when the application calls for local information display, data communications, control, alarm, and data logging functions.

**What other factors should be considered?** Flexibility in use of flow computation and use of inputs and outputs, signal input resolution and accuracy, isolation, 24VDC to power transmitters, networking, communications software and accessories, printing, data logging and remote metering support. Approvals may also be required. Instrument setup software is also of value. Application support from the manufacturer is also important.

### Applications & Equations

#### Steam Mass & Steam Heat

**Illustration**

**Calculations**

**Mass Flow**

Mass Flow = volume flow \cdot\text{ density (T, p)}

**Heat Flow**

Heat Flow = Volume flow \cdot\text{ density (T, p)} \cdot\text{ Sp. Enthalpy of steam (T, p)}

#### Steam Net Heat

**Illustration**

**Calculations**

**Net Heat Flow**

Net Heat Flow = Volume flow \cdot\text{ density (T, p)} \cdot\left[ E_0 (T, p) - E_w (T_{SIP}) \right]

- $E_0$ = Specific enthalpy of steam
- $E_w$ = Specific enthalpy of water
- $T_{SIP}$ = Calculated condensation temperature (= saturated steam temperature for supply pressure)
**Calculations**

**Delta Heat Flow**

Net Heat Flow = Volume flow • density (p) • \[E_D (p) – E_w (T)\]

\[E_D = \text{Specific enthalpy of steam}\]
\[E_w = \text{Specific enthalpy of water}\]

**Steam Delta Heat Illustration**

**Gas**

Corrected Volume Flow

**Combustion Heat Flow**

Combustion Energy = \[C \cdot p_{\text{ref}} \cdot Q \cdot P/P_{\text{ref}} \cdot T_{\text{ref}}/T \cdot Z_{\text{ref}}/Z\]

**Mass Flow**

Mass Flow = Actual Volume Flow • \[p_{\text{ref}} \cdot P/P_{\text{ref}} \cdot T_{\text{ref}}/T \cdot Z_{\text{ref}}/Z\]

\[p_{\text{ref}} = \text{Reference density}\]
\[T_{\text{ref}} = \text{Reference temperature}\]
\[P_{\text{ref}} = \text{Reference pressure}\]
\[Z_{\text{ref}} = \text{Reference Z-factor}\]
\[C = \text{Specific combustion heat}\]
\[Q = \text{Volume flow}\]

**Liquid**

Corrected Volume Flow

**Combustion Heat Flow**

Combustion Energy = \[C \cdot Q \cdot P/P_{\text{ref}} \cdot T_{\text{ref}}/T \cdot Z_{\text{ref}}/Z\]

**Mass Flow**

Mass Flow = Volume flow • \([1 - \alpha \cdot (T-T_{\text{ref}})]^2\) • ref. density

\[\alpha = \text{Thermal expansion coefficient} \times 10^{-6}\]
\[C = \text{Specific combustion heat}\]

**Liquid Delta Heat Illustration**

**Calculations**

**Corrected Volume Flow**

Corrected Volume Flow = Volume flow • \([1 - \alpha \cdot (T-T_{\text{ref}})]^2\) • ref. density

**Water**

Heat = Volume Flow • \[\rho(T_1) \cdot [h(T_2) – h(T_1)]\]

**Other heat carrying liquids**

Heat = \[C \cdot Q \cdot P/P_{\text{ref}} \cdot (T_{\text{ref}}/T)_2 \cdot (T_2 - T_1)\]

\[\rho(T_1) = \text{Density of water at temperature } T_1\]
\[h(T_1) = \text{Specific enthalpy of water at temperature } T_1\]
\[h(T_2) = \text{Specific enthalpy of water at temperature } T_2\]
\[\rho_{\text{ref}} = \text{Reference density}\]
\[T_{\text{ref}} = \text{Reference temperature}\]
Description:
The SUPERtrol II Flow Computer satisfies the instrument requirements for a variety of flowmeter types in liquid, gas, steam and heat applications. Multiple flow equations are available in a single instrument with many advanced features.

The alphanumeric display offers measured parameters in easy to understand format. Manual access to measurements and display scrolling is supported.

The versatility of the Flow Computer permits a wide measure of versatility within the instrument package. The various hardware inputs and outputs can be "soft" assigned to meet a variety of common application needs. The user "soft selects" the usage of each input/output while configuring the instrument. Consider the following illustrative examples.

The isolated analog output can be chosen to follow the volume flow, corrected volume flow, mass flow, temperature, pressure, or density by means of a menu selection. Most hardware features are assign able by this method.

The user can assign the standard RS-232 Serial Port for external data logging, transaction printing, or for connection to a modem for remote meter reading.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs. The system setup can also be printed.

Specifications:
Environmental
Operating Temperature: 0 to +50 C
Storage Temperature: -40 to +85 C
Humidity : 0-95% Non-condensing
Materials: UL, CSA, VDE approved
Display
Type: 2 lines of 20 characters
Types: Backlit LCD and VFD ordering options
Character Size: 0.3" nominal
User selectable label descriptors and units of measure

Flow Meter Types:
Linear: Vortex, Turbine, Positive Displacement, Magnetic, GilFlo and others
Square Law: Orifice, Venturi, Nozzle, V-Cone, Wedge, Averaging Pitot, Target and others
Multi-Point Linearization: May be used with all flowmeter types. Including: 16 point, UVC and dynamic compensation.

Flow Inputs:
Analog Input:
Accuracy: 0.02% FS at 20° C
Ranges
Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
Current: 4-20 mA, 0-20 mA, 4-20 mA stacked, 0-20 mA stacked
Basic Measurement Resolution: 16 bit
Update Rate: 4 updates/sec
Automatic Fault detection: Signal over/under-range, Current Loop Broken
Calibration: Operator assisted learn mode
Extended calibration: Learns Zero and Full Scale of each range
Fault Protection:
Fast Transient: 500 V Protection (capacitive clamp)
Reverse Polarity: No ill effects
Over-Voltage Limit: 50 VDC Over voltage protection
Over-Current Protection: Internally current limited protected to 24VDC
Pulse Inputs:
- Number of Flow Inputs: one
- Input Impedance: 10 kΩ nominal
- Trigger Level: (menu selectable)
  - High Level Input
    - Logic On: 2.5 to 30 VDC
    - Logic Off: 0 to 2 VDC
  - Low Level Input (mag pickup)
    - Selectable sensitivity: 10 mV and 100 mV
- Minimum Count Speed: 0.25 Hz (to maintain rate display)
- Maximum Count Speed: Selectable: 0 to 50 kHz
- Overvoltage Protection: 50 VDC

Temperature, Pressure, Density Inputs
The compensation inputs usage are menu selectable for temperature, pressure, density or not used.

Calibration: Operator assisted learn mode
Operation: Ratiometric
Accuracy: 0.02% FS at 20°C
Basic Measurement Resolution: 16 bit
Update Rate: 2 updates/sec minimum
Automatic Fault detection:
  - Signal Over-range/under-range
  - Current Loop Broken
  - RTD short
  - RTD open
  - Reverse Polarity: No ill effects
  - Over-Current Limit
    - (current input) Internally limited to protect input to 24 VDC

Available Input Ranges
- Current: 4-20 mA, 0-20 mA
- Resistance: 100 Ohms DIN RTD

100 Ohm DIN RTD (DIN 43-760, BS 1904):
- Three Wire Lead Compensation
- Internal RTD linearization learns ice point resistance
- 1 mA Excitation current with reverse polarity protection
- Temperature Resolution: 0.1°C

Stored Information (ROM)
Steam Tables (saturated & superheated),
Fluid Properties: Water, Air, Natural Gas, A Variety of User Entered Industrial Fluids or Generic

User Entered Stored Information (EEPROM / Nonvolatile RAM)
Transmitter Ranges, Signal Types
Fluid Properties
  - (reference density, expansion factor, specific heat, viscosity, isentropic exponent, combustion heating value, Z factor)
Units Selections (English/Metric)
Language Translations (optional)

Excitation Voltage
24 VDC @ 100 mA (fault protected with self resetting fuse)

Relay Outputs
The relay outputs usage is menu assignable to (Individually for each relay) Hi/Lo Rate Alarm, Hi/Lo Temperature Alarm, Hi/Lo Pressure Alarm, Pulse Output (pulse options), Wet Steam or General purpose warning (security).
- Number of relays: 2 (3 optional)
- Contact Style: Form C contacts
- Contact Ratings: 240 V, 5 amp

Analog Outputs
The analog outputs are menu assignable to correspond to the Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Heat Rate, Temperature, Density, or Pressure.

- Number of Outputs: 2
- Type: Isolated Current Sourcing (shared common)
- Available Ranges: 0-20 mA, 4-20 mA (menu selectable)
- Resolution: 16 bit
- Accuracy: 0.05% FS at 20°C
- Update Rate: 5 updates/sec
- Temperature Drift: Less than 200 ppm/C
- Maximum Load: 1000 ohms
- Compliance Effect: Less than .05% Span
- 60 Hz rejection: 40 dB minimum
- EMI: No effect at 3 V/M

Calibration: Operator assisted Learn Mode
Averaging: User entry of DSP Averaging constant to cause a smooth control action

Listing:
CE Compliant, UL/C-UL Pending

Serial Communication
The serial port can be used for printing, datalogging, modem connection, two way paging and communication with a computer.

RS-232:
- Device ID: 01-99
- Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
- Parity: None, Odd, Even
- Handshaking: None, Software, Hardware
- Print Setup: Configurable print list and formatting

RS-485: (optional 2nd COM port)
- Device ID: 01-247
- Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
- Parity: None, Odd, Even
- Protocol: Modbus RTU (Half Duplex)

Data Logging
The data logger captures print list information to internal storage for approximately 5000 transactions. This information can be used for later uploading or printing. Storage format is selectable for Comma-Carriage Return or Printer formats.

Isolated Pulse output
The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total, Heat Total or Mass Total.

- Pulse Output Form (menu selectable): Open Collector NPN or 24 VDC voltage pulse
- Nominal On Voltage: 24 VDC
- Maximum Sink Current: 25 mA
- Maximum Source Current: 25 mA
- Maximum Off Voltage: 30 VDC
- Saturation Voltage: 0.4 VDC
- Pulse Duration: User selectable
- Pulse output buffer: 8 bit
- Fault Protection
  - Reverse polarity:
  - Shunt Diodes
  - Over-current Protected
  - Over-voltage Protected

Real Time Clock
The Flow Computer is equipped with a pseudo nonvolatile real time clock with display of time and date.
- Format:
  - 24 hour format for time
  - Day, Month, Year for date
**Terminal Designations**

<table>
<thead>
<tr>
<th>Terminal Layout</th>
<th>Rear View</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rear View</strong></td>
<td></td>
</tr>
<tr>
<td>RS-232</td>
<td>RS-485</td>
</tr>
<tr>
<td>RS-485</td>
<td>(optional)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ordering Information**

**Example ST2**

<table>
<thead>
<tr>
<th>ST2</th>
<th>L</th>
<th>1</th>
<th>0</th>
<th>P</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Series:**

ST2 = Flow Computer

**Display Type:**

L = LCD
V = VFD

**Input Power:**

1 = 85 to 276 VAC
3 = 24 VDC (16 to 48 VDC)

**Network Card:**

0 = None
1 = RS485/Modbus (optional 2nd COM port)

**Mounting:**

P = Panel Mount ......................................................... (see Fig. 1)
W = NEMA 12/13 Wall Mount w/ Clear Cover ............. (see Fig. 2)
E = Explosion Proof (No Button Access) ............. (see XHVD 7/4)
X = Explosion Proof (with Button Access) ........ (see XTROL 7/4)

**Options:**

1 = Peak Demand
2 = AGA NX-19 calculation for natural gas
3 = Three Relays
4 = Stacked DP option
5 = Datalogger option (consult factory)
6 = Stack Emissions Controller option
7 = Manifold Flowmeter Controller option
9 = 3 Relay Super Chip (options 1, 2, 4, 6, 7)
10 = 2 Relay Super Chip (options 1, 2, 4, 6, 7)
13 = Superchip; 2 relay, Positive heat only
14 = Superchip; 3 relay, Positive heat only
ET = Extended Temperatures; -4°F to 131°F (-20°C to 55°C)
IM = Internal Modem
M = Modern Modem Option
TB = RS485 Terminal Block for Panel Mount Enclosure
TU = Translation Utility Disk

**Accessories:**

KEPS-KEP1-32 = KEP RS232 DDE server for SUPERtrol.
KEPS-MBS32 = Modbus RTU OPC/DDE server
SUPERtrol 2 and LEVELtrol 2 • 32 Bit DDE Server
Modem Available, see MPP-2400 and MPP-2400N (requires M option)
Two Way Pager Available, see MPP-TWP (requires M option)
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Remote metering and data collection software available, see TROLink
**MS-748**

- "EZ Setup" - Guided Setup for First Time Users
- Liquid, Gas, Steam and Heat Flow Equations
- Utility Metering
- Menu Selectable Hardware & Software Features
- Internal Data Logging Option
- Isolated Pulse and Analog Outputs Standard
- RS-232 Port Standard, RS-485 Optional Windows™ Setup Software
- NX19 Gas Equations, Stacked DP Transmitters
- DDE Server & HMI Software Available
- Remote Metering by Wireless or Modem and TROLlink Remote Metering Software Available
- NEW! - Attractive, Rugged, Field Mount Enclosure

**Description:**
The MS-748 Flow Computer satisfies the instrument requirements for a variety of flowmeter types in liquid, gas, steam and heat applications. Multiple flow equations are available in a single instrument with many advanced features. The unit is provided in a rugged enclosure.

The alphanumeric display offers measured parameters in easy to understand format. Manual access to measurements and display scrolling is supported.

The versatility of the Flow Computer permits a wide measure of versatility within the instrument package. The various hardware inputs and outputs can be "soft" assigned to meet a variety of common application needs. The user "soft selects" the usage of each input/output while configuring the instrument. Consider the following illustrative examples.

The isolated analog output can be chosen to follow the volume flow, corrected volume flow, mass flow, temperature, pressure, or density by means of a menu selection. Most hardware features are assignable by this method.

The user can assign the standard RS-232 Serial Port for external data logging, transaction printing, or for connection to a modem or two way pager transceiver for remote meter reading.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs. The system setup can also be printed.

**Specifications:**

**Environmental**
- Operating Temperature: -20 to 55°C
- Storage Temperature: -40 to +85°C
- Humidity: 0-95% Non-condensing
- Materials: UL, CSA, VDE approved

**Display**
- Type: 2 lines of 20 characters
- Types: Backlit LCD and VFD ordering options
- Character Size: 0.3" nominal
- User selectable label descriptors and units of measure

**Keypad**
- Type: Membrane Keypad
- Rating: Sealed to Nema 4
- Number of keys: 16

**Enclosure**
- Size: See Dimensions
- Materials: Aluminum, UL94V-0 Keypad
- Enclosure Rating: NEMA 4X
- Provisions for sealing unit
Power Input
The factory equipped power option is internally fused. An internal line to line filter capacitor is provided for added transient suppression. MOV protection for surge transient is also supported.
Universal AC Power: 85 to 276 Vrms, 50/60 Hz
DC Power Option: 24 VDC (16 to 48 VDC)
Power Consumption
AC Power: 6.5 V/A (6.5W)
DC Power: 300 mA max.

Flow Meter Types:
Linear: Vortex, Turbine, Positive Displacement, Magnetic, GilFlo and others
Square Law: Orifice, Venturi, Nozzle, V-Cone, Wedge, Averaging Pitot, Target and others
Multi-Point Linearization: May be used with all flowmeter types. Including: 16 point, UVC and dynamic compensation.

Flow Inputs:
Analog Input:
Accuracy: 0.01% FS at 20°C
Ranges
Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
Current: 4-20 mA, 0-20 mA, 4-20 mA stacked, 0-20 mA stacked
Basic Measurement Resolution: 16 bit
Update Rate: 4 updates/sec
Automatic Fault detection: Signal over/under-range, Current Loop Broken
Calibration: Operator assisted learn mode
Extended calibration: Learns Zero and Full Scale of each range
Fault Protection:
Fast Transient: 500 V Protection (capacitive clamp)
Reverse Polarity: No ill effects
Over-Voltage Limit: 50 VDC Over voltage protection
Over-Current Protection: Internally current limited protected to 24VDC

Pulse Inputs:
Number of Flow Inputs: one
Input Impedance: 10 kΩ nominal
Trigger Level: (menu selectable)
High Level Input
Logic On: 2.5 to 30 VDC
Logic Off: 0 to 2 VDC
Low Level Input (mag pickup)
Selectable sensitivity: 10 mV and 100 mV
Minimum Count Speed: 0.25 Hz (to maintain rate display)
Maximum Count Speed: Selectable: 0 to 50 kHz
Overvoltage Protection: 50 VDC

Temperature, Pressure, Density Inputs
The compensation inputs usage are menu selectable for temperature, temperature 2, pressure, density or not used.
Calibration: Operator assisted learn mode
Operation: Ratiometric
Accuracy: 0.02% FS at 20°C
Basic Measurement Resolution: 16 bit
Update Rate: 2 updates/sec minimum
Automatic Fault detection:
Signal Over-range/under-range
Current Loop Broken
RTD short
RTD open
Reverse Polarity: No ill effects
Over-Current Limit
(current input) Internally limited to protect input to 24 VDC

Available Input Ranges
Current: 4-20 mA, 0-20 mA
Resistance: 100 Ohms DIN RTD

100 Ohm DIN RTD (DIN 43-760, BS 1904):
Three Wire Lead Compensation
Internal RTD linearization learns ice point resistance
1 mA Excitation current with reverse polarity protection
Temperature Resolution: 0.1°C

Stored Information (ROM)
Steam Tables (saturated & superheated), Fluid Properties: Water, Air, Natural Gas and Other Common Fluids or Generic

User Entered Stored Information (EEPROM / Nonvolatile RAM)
Transmitter Ranges, Signal Types Fluid Properties
(reference density, expansion factor, specific heat, viscosity, isentropic exponent, combustion heating value, Z factor)
Units Selections (English/Metric)
Language Translations (optional)

Excitation Voltage
24 VDC @ 100 mA (fault protected with self resetting fuse)
Relay Outputs
The relay outputs usage is menu assignable to (individually for each relay) Hi/Lo Rate Alarm, Hi/Lo Temperature Alarm, Hi/Lo Pressure Alarm, Pulse Output (pulse options), Wet Steam or General purpose warning (security).

Number of relays: 2 (3 optional)
Contact Style: Form C contacts
Contact Ratings: 240 V, 5 amp

Analog Outputs
The analog outputs are menu assignable to correspond to the Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Heat Rate, Temperature, Density, or Pressure.

Number of Outputs: 2
Type: Isolated Current Sourcing (shared common)
Available Ranges: 0-20 mA, 4-20 mA (menu selectable)
Resolution: 16 bit
Accuracy: 0.05% FS at 20 Degrees C
Update Rate: 5 updates/sec
Temperature Drift: Less than 200 ppm/C
Maximum Load: 1000 ohms
Compliance Effect: Less than .05% Span
60 Hz rejection: 40 dB minimum
EMI: No effect at 3 V/M
Calibration: Operator assisted Learn Mode
Averaging: User entry of DSP Averaging constant to cause a smooth control action

Listing: CE Compliant, UL/CSA Pending

Data Logging
The data logger captures print list information to internal storage for approximately 5000 transactions. This information can be used for later uploading or printing. Storage format is selectable for Comma-Carriage Return or Printer formats.

Isolated Pulse output
The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total, Heat Total or Mass Total.

Pulse Output Form (menu selectable): Open Collector NPN or 24 VDC voltage pulse
Nominal On Voltage: 24 VDC
Maximum Sink Current: 25 mA
Maximum Source Current: 25 mA
Maximum Off Voltage: 30 VDC
Saturation Voltage: 0.4 VDC
Pulse Duration: User selectable
Pulse output buffer: 8 bit
Fault Protection
Reverse polarity:
Shunt Diodes
Over-current Protected
Over-voltage Protected

Real Time Clock
The Flow Computer is equipped with a pseudo nonvolatile real time clock with display of time and date.
Format:
24 hour format for time
Day, Month, Year for date
Dimensions

Terminal Designations

NOTE: All dimensions are in inches (mm)

Terminal Designations

Ordering Information

Example MS-748 L 1 0 V MB

Series: MS-748 = Flow Computer

Display Type:
L = LCD
V = VFD

Input Power:
1 = 85 to 276 VAC
3 = 24 VDC (16 to 48 VDC)

Network Card:
0 = None
1 = RS485/Modbus (optional 2nd COM port)

Mounting:
V = Field, Skid, Vehicle Mount

Options:
1 = Peak Demand
2 = AGA NX-19 calculation for natural gas
3 = Three Relays
4 = Stacked DP option
5 = Datalogger option (consult factory)
6 = Stack Emissions Controller option
7 = Manifold Flowmeter Controller option
9 = 3 Relay Super Chip (options 1, 2, 4, 6, 7)
10 = 2 Relay Super Chip (options 1, 2, 4, 6, 7)
13 = Superchip; 2 relay, Positive heat only
14 = Superchip; 3 relay, Positive heat only
ET = Extended Temperature; -4°F to 131°F (-20°C to 55°C)
IM = Internal Modem
M = Modem Power Option
TB = RS485 Terminal Block for Panel Mount Enclosure
TU = Translation Utility Disk

Accessories:
KEPS-KEP1-32 = KEP RS232 DDE server for SUPERtrol.
KEPS-MBS32 = Modbus RTU OPC/DDE server
SUPERtrol 2 and LEVELtrol 2 • 32 Bit DDE Server
Modern Available, see MPP-2400 and MPP-2400N (requires M option)
Two Way Pager Available, see MPP-TWP (requires M option)
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Remote metering and data collection software available, see TROLink
**Flow Computer for Liquid and Gas Applications**

**ES-747**

**Features**
- Supports Pulse Producing Flowmeters
- Rate/Total and Batching Functions
- Universal Viscosity Curve (UVC) and Strouhal/Roshko Advanced Linearization Methods
- Gas & Liquid Flow Equations (Volume, Mass, Corrected Volume)
- API 2540, AGA-7 Equations
- 10 Selectable Fluid Tables
- Advanced Batching Features: Overrun Compensation, Print End of Batch
- Menu Selectable Hardware & Software Features
- Data Logging
- Two Line LCD or VFD Display

**Description:**
The ES-747 Flow Computer satisfies the instrument requirements for pulse producing flowmeters in liquid and gas applications. Multiple flow equations and instrument functions are available in a single unit with many advanced features.

The alphanumeric display shows measured and calculated parameters in easy to understand format. Single key direct access to measurements and display scrolling is supported.

The versatility of the ES-747 permits a wide measure of versatility within the instrument package. The various hardware inputs and outputs can be “soft” assigned to meet a variety of common application needs. The user “soft selects” the usage of each input/output while configuring the instrument.

The isolated analog output can be chosen to follow volume flow, corrected volume flow, mass flow, temperature, pressure or density by means of a menu selection. Most hardware features are assignable by this method.

The user can assign the standard RS-232 Serial Port for data recording, transaction printing, or for connection to a computer.

Front panel selection of fluid type is supported.

Linearization options include UVC, Strouhal/Roshko and 40 point linearization tables.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs and printing system setup.

**Specifications:**

**Flow Meters and Computations**
- Meter Types: Supports pulse producing meters including: vortex, single rotor turbine, magnetic, PD flowmeter
- Linearization: 40 point table, UVC table or Strouhal/Roshko
- Computations: Volume, Corrected Volume & Mass
- Fluid Computations: Density, Viscosity

**Environmental**
- Operating Temperature: 0°C to +50°C
- Storage Temperature: -40°C to +85°C
- Humidity: 0-95% Non-condensing
- Materials: U.L. approved

**Approvals:**
- CE Compliant, UL/CUL Listed

**Display**
- Type: 2 lines of 20 characters, Blue VFD or Backlit LCD
- Character Size: 0.3” nominal
- User programmable label descriptors and units of measure

**Keypad**
- Keypad Type: Membrane Keypad with 16 keys
- Keypad Rating: Sealed to Nema 4

**Enclosure**
- Size: See Dimensions
- Depth behind panel: 6.5” including mating connector
- Type: DIN
- Materials: Plastic, UL94V-0, Flame retardant
- Bezel: Textured per matt finish

**Fluid Types**
- General Purpose, Water, Skydraul 500B, 50/50 Ethylene, Air, Propane, MIL-C-7024D, MIL-O-5606, MIL-23699, JETA-1, Diesel, Methanol
Real Time Clock
The ES-747 is equipped with a battery backed real time clock with display of time and date.
Format:
  12 or 24 hour time display
  Day, Month, Year date display

Excitation Voltage
Menu Selectable: 5, 12 or 24 VDC @ 100 mA (fault protected with self resetting fuse)

Relay Outputs
The relay outputs are menu assignable to (Individually for each relay) Low Rate Alarm, Hi Rate Alarm, Prewarn Alarm, Preset Alarm, Temperature, Pressure, Density or General purpose warning (security).
Number of relays: 2 (4 optional)
Contact Style: Form C contacts
Contact Ratings: 5 amp, 240 VAC or 30 VDC
Capabilities: Alarm Delay, Setpoint, Hysteresis, Duration

Power Input
The factory equipped power option is internally fused. An internal line to line filter capacitor and MOV are provided for added transient suppression.

110 VAC Power: 85 to 127 Vrms, 50/60 Hz
220 VAC Power: 170 to 276 Vrms, 50/60 Hz
DC Power:
  12 VDC (10 to 14 VDC)
  24 VDC (14 to 28 VDC)
Power Consumption:
  AC: 11.0 VA (11W)
  DC: 300 mA max.

Flow Inputs:
Pulse Inputs:
Number of Flow Inputs: one input available for single pickup or with dual pickups or quadrature
Input Impedance: 10 KΩ nominal
Pullup Resistance: 10 KΩ to 5 VDC (menu selectable)
Pull Down Resistance: 10 KΩ to common
Trigger Level: (menu selectable)
  High Level Input
    Logic On: 3 to 30 VDC
    Logic Off: 0 to 1 VDC
  Low Level Input (mag pickup)
    Sensitivity:
      10 mV or 100 mV
Minimum Count Speed:
  Menu selectable: 1-99 seconds
Maximum Count Speed:
  Menu Selectable: 40Hz, 3000Hz or 20 kHz
Overvoltage Protection: 50 VDC

Control Inputs
Switch Inputs are menu selectable for Start, Stop, Reset, Lock, Inhibit, Alarm Acknowledge, Print or Not Used.
Control Input Specifications
Number of Control Inputs: 3
Input Scan Rate: 10 scans per second
Logic 1: 4 - 30 VDC
Logic 0: 0 - 0.8 VDC
Input Impedance: 100 KΩ
Control Activation:
  Positive Edge or Pos. Level based on product definition for switch usage.

Auxiliary / Compensation Inputs
The auxiliary/compensation inputs are menu selectable for temperature, pressure, density or not used. These inputs are used for the compensated inputs when performing compensated flow calculations. They can also be used as a general purpose input for display and alarming.
Number of inputs: 2
Operation: Ratiometric
Accuracy: 0.02% FS at 20° C
Basic Measurement Resolution:
  16 bit
Update Rate: 1 update/sec minimum
Automatic Fault detection:
  Signal Over-range/under-range
  Current Loop Broken
  RTD short
  RTD open
  Fault mode to user defined default settings
Fault Protection:
  Reverse Polarity: No ill effects
  Over-Voltage Limit (Voltage Input): 50 VDC
Available Input Ranges
  Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
  Current: 4-20 mA, 0-20 mA
  Resistance: 100 Ohms DIN RTD
  Proprietary Thermistor
100 Ohm DIN RTD (liquid equations only)
(DIN 43-760, BS 1904):
  Three Wire Lead Compensation
Internal RTD linearization learns ice point resistance
  1 mA Excitation current with reverse polarity protection
Temperature Resolution: 0.1°C
**Isolated Analog Output**

The analog output is menu assignable to correspond to the Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Pressure, Density, Volume Total, Corrected Volume Total or Mass Total.

- **Type:** Isolated Current Sourcing
- **Available Ranges:** 4-20 mA, 0-20 mA
- **Resolution:** 12 bit
- **Accuracy:** 0.05% FS at 20°C
- **Update Rate:** 1 update/sec minimum
- **Temperature Drift:** Less than 200 ppm/C
- **Maximum Load:** 1000 ohms (at nominal line voltage)
- **Compliance Effect:** Less than .05% Span
- **60 Hz rejection:** 40 dB minimum
- **Calibration:** Operator assisted Learn Mode
- **Averaging:** User entry of damping constant to cause a smooth control action

**Isolated Pulse output**

The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total or Mass Total.

- **Pulse Output Form:** Photo MOS Relay
- **Maximum On Current:** 100 mA
- **Maximum Off Voltage:** 30 VDC
- **Saturation Voltage:** 1.0 VDC
- **Maximum Off Current:** 0.1 mA
- **Pulse Duration:** 10 mSec or 100 mSec (user selectable)
- **Pulse output buffer:** 256

**Fault Protection**
- Reverse polarity: Shunt Diode

**Serial Communication**

The serial port can be used for printing, data recording, and/or communication with a computer.

- **RS-232:**
  - **Device ID:** 01-99
  - **Baud Rates:** 300, 600, 1200, 2400, 4800, 9600, 19200
  - **Parity:** None, Odd, Even
  - **Handshaking:** None, Software, Hardware
  - **Print Setup:** Configurable print list and formatting

- **RS-485:** (optional 2nd COM port)
  - **Device ID:** 01-247
  - **Baud Rates:** 2400, 4800, 9600, 19200
  - **Parity:** None, Odd, Even
  - **Protocol:** Modbus RTU (Half Duplex)

**Setup Diskette Capabilities**

Capabilities include: View Live Results Configure unit, Upload and Download to unit, Load and Save to file, Print Setup,

**Data Logging Capabilities**

Capabilities:
- Permits unit to automatically gather data during use.
- **Data Log List:** User selectable: includes process variables, totalizers, set points, time and date
- **Data Log Event Trigger:** selectable: includes interval, time of day, front key, external contact, end of batch
- **Data Log Format:** selectable: Printer format, Database CSV format
- **Data Transmission:** Selectable: Output may be transmitted immediately or held in data log for later polling
- **Remote RequestCapabilities include:** Send data log, clear data log

**External Modem Support Capabilities:**

- **Compatibility:** Hayes Compatible
- **Polling Capabilities:** Answers incoming calls, responds to requests for information of action
- **Call Out Capabilities:** Can initiate call on user selectable event condition, or upon error
- **Error Handling:** Supports multiple retry, automatic disconnect upon loss of line or remote inactivity
Fig. 1: Standard Dimensions

Fig. 2: Wall Mount ("W" mounting option) Dimensions

Terminal Designations

Terminal Layout

Ordering Information

Example: ES747 L 1 A 0 P

Series:
ES747 = ES-747

Display Type:
L = LCD
V = VFD

Input Type:
1 = 110 VAC
2 = 220 VAC
3 = 12 VDC (10 to 14 VDC)
4 = 24 VDC (14 to 28 VDC)

Relays:
A = 2 SPDT Relays
B = 4 SPDT Relays

Network Card:
0 = None (STD)
2 = RS485/Modbus (optional 2nd COM port)

Mounting:
P = Panel Mount (see Fig. 1)
N = NEMA 4 Wall Mount (see NEMAtrolST4X)
W = NEMA 12/13 Wall Mount w/ Clear Cover (see Fig. 2)
E = Explosion Proof (No Button Access) (see XHVD 7/4)
X = Explosion Proof (with Button Access) (see XTROL 7/4)

Options:
TB = RS485 Terminal Block for Panel Mount Enclosure
ET = Extended Temptature
-4°F to 131°F (-20°C to 55°C)
IM = Internal Modem
M = Modern Power Option

Accessories:
KEPS-KEP1-32
KEP RS232 for SUPERtrol 1, SUPERtrol 1LE, SUPERtrol 2 and LEVELtrol 2 • 32 Bit OPC/DDE Server
KEPS-MBS32
Supports RS485 for ST1, ST1LE, ST2, LT2, MRT, DRT & MB2 (Modbus RTU)
Modem Available, see MPP-2400 and MPP-2400N (requires M option)
Serial printer available, see P1000, P295
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
Remote metering and data collection software available, see TROLINK
Mass Flow Computer

Features

• Compensates Steam, Gases and Liquids for Temperature and Pressure to Yield Corrected Volume, Mass and Heat Flow.
• Two Line by 20 Character Super Twist Back-Lit LCD Display
• Square Root Extraction of DP Inputs
• 16 Point Linearization
• Displays Compensated Rate and Total Flow
• Takes a Direct 100 Ω Platinum RTD (4 wire)
• Flow Rate, Temperature and Pressure Alarms
• 4-20 mA and Pulse Outputs Based on Compensated Flow
• Non-volatile Memory
• 24 Volt Excitation Provided
• Front Panel NEMA 4X/IP 65 Rated

Description:
The KEP MASStrol is a microprocessor based instrument designed to measure compensated flow in an industrial environment. Three analog inputs for temperature, pressure and flow are provided to measure the parameters needed to calculate the actual compensated mass, volume or heat flow.

Special signal conditioning circuitry is included to allow direct connection of platinum resistance temperature detectors (RTD’S). A high speed digital input is provided to interface with pulse output type flowmeters. As an alternative, voltage inputs or current loops can be used for the above.

All instrument interface is with a 32 point screw terminal strip on the rear of the instrument.

Flow Computer Application

§ Pressure transducer sends 0-5V or 4-20mA signal to Flow Computer.
§ 100Ω, 4 wire, RTD direct hookup to Flow Computer.
§ Turbine flowmeter sends digital signal to Flow Computer.
§ Flow Computer calculates flow and generates output signals.
§ 5 V pulse out to remote totalizer in supervisory area.
§ 4-20 mA out to strip chart recorder tracks trends.
§ RS232 out to printer for data logging.
§ Alarm relays activate bell and/or light as needed.
General Specifications:

OVERALL ACCURACY: .25%

ENVIRONMENTAL:
Operating Temperature: 32° to 122° F (0° to 50° C)
Storage Temperature: -10 to 160°F (-23 to 71°C)
Humidity: 0 to 90% Noncondensing

Case: ABS Plastic
Listing: CE Compliant

POWER: (Internally Fused)
Nominal Line Voltage: 110, 110, 220 or 240 VAC (50/60 Hz)
24VDC ±20% or 12VDC ±20%/±10%
Power Consumption: 10 Watts max

Input Specifications:
The following applies to all inputs. Inputs are referenced to signal ground. All ground terminals are connected internally. NOTE: All inputs are single-ended with one leg grounded. The exception is the RTD input which is differential but is referenced to ground.

CURRENT INPUTS:
Input Impedance: 100Ω
Maximum sustained input voltage: 5 VDC (Fault Condition)
Resolution: ±0.024% FS

VOLTAGE INPUTS:
Input Impedance: 115 kΩ
Range: 0-5V, 0-10V
Resolution: ±0.024% FS

TEMPERATURE INPUTS:
Compatible RTD type: 100Ω Platinum
(α = .00385; DIN 43-760 Calibration)
Lead Wire Compensation: 4 Wire
Configuration: 2, 3 or 4 wire (4 wire cable required)
Excitation Current: 2mA typical
Max Fault Current: 15mA
Max Volt on sense inputs: 50 VDC
Rejection of 50 or 60Hz signal: 40dB minimum (Automatically based on line frequency)
Raw Accuracy: ± 5°C

DIGITAL FLOW INPUT:
Range: 3-30 VDC Pulse
Max Input Frequency: 40kHz max
Min pulse width: 10μsec (with 40kHz filter)
Thresholds: OFF is less than 2.0V; ON is greater than 2.5V
Min Fault Current: 4.0 mA sink: 1.0 Volts max
No load: 4.5 Volts min
Max Slew Rate: 27 Volts/μsec
Max Fault Current: 15mA
Sustained Fault Voltage for no permanent damage: 7 Volts

DATA DISPLAY AND KEYPAD:
Internal 2 line by 20 character dot matrix, Backlit LCD display.
Sealed, 16 key panel featuring numeric keys
0-9, plus the following keys:
A Advance through menus
B Back up through menus
C Cancel current menu selection
D Decimal point key
ENT ............ General purpose enter or recall data key
CLR ............. Data clear key

OPERATION:
Through the 16 button, NEMA 4X/IP 65, front keypad, the operator enters all parameters necessary to configure the mass flow computer. One MAssStrol will handle all of your mass flow requirements.

The type of flow equations desired (steam tables, ideal gas law or liquids) must be selected first. For steam flow and heat measurement, the 1967 ASME steam tables for both saturated and superheated steam are stored in memory. For gases, the ideal gas law is used. For liquids and heat calculations, factors are entered through the front keypad.

Additionally, the following hardware parameters must be entered to configure the MAssStrol input signal types (from the flow, temperature and pressure transmitters) along with their corresponding ranges or K factors; alarm set points may be entered; the output range for the 4-20 mA signal and the pulse output scaling factor. The operator can select, in any order, up to 16 parameters to display on the read out.

If it is so desired, the operator then can lockout the unit from changes by entering a five digit lockout code.

Optional RS232 serial communications for ease of programming and timely printouts of flow results and/or parameters is available. If RS232 two way communications and the keypad are being used simultaneously, the serial port takes precedence.

SOFTWARE ACCESSORIES:

K1 Diskette:
A diskette program is available to assist in the computation of the K1 term. The K1 factor is used in Orifice/Pitot/Annubar calculations. The K1 factor is the calibration factor for the meter run. It is part of the Variables menu for flow input values (analog).

MASSCON Diskette:
The MASSCON diskette program facilitates the configuration and calibration of the flow computer. The program runs on PC compatibles and communicates through the RS232 port.
**TERMINAL BLOCK DESIGNATIONS:**

<table>
<thead>
<tr>
<th>PIN</th>
<th>RTD</th>
<th>VOLTAGE IN</th>
<th>CURRENT IN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RTD EXCITATION +</td>
<td>------------</td>
<td>-----------</td>
<td>CHANNEL 1</td>
</tr>
<tr>
<td>2</td>
<td>RTD SENSE +</td>
<td>------------</td>
<td>-----------</td>
<td>TEMPERATURE</td>
</tr>
<tr>
<td>3</td>
<td>RTD SENSE -</td>
<td>------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>RTD EXCITATION -</td>
<td>V IN - (COM)</td>
<td>I IN +</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>COMMON (SHIELD)</td>
<td>V IN - (COM)</td>
<td>I IN - (COM)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>V IN +</td>
<td>------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RTD EXCITATION +</td>
<td>------------</td>
<td>-----------</td>
<td>CHANNEL 2</td>
</tr>
<tr>
<td>8</td>
<td>RTD SENSE +</td>
<td>------------</td>
<td>-----------</td>
<td>PRESSURE or AUX. TEMP.</td>
</tr>
<tr>
<td>9</td>
<td>RTD SENSE -</td>
<td>------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>RTD EXCITATION -</td>
<td>V IN - (COM)</td>
<td>I IN +</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>COMMON (SHIELD)</td>
<td>V IN - (COM)</td>
<td>I IN - (COM)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>V IN +</td>
<td>------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>COMMON (SHIELD)</td>
<td>V IN - (COM)</td>
<td>I IN +</td>
<td>CHANNEL 3</td>
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<td>14</td>
<td>V IN +</td>
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<td>-----------</td>
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<tr>
<td>15</td>
<td>V IN +</td>
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<td>18</td>
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<tr>
<td>21</td>
<td>COMMON (SHIELD)</td>
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<tr>
<td>22</td>
<td>N.O.</td>
<td></td>
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<td>ALARM</td>
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<tr>
<td>23</td>
<td>N.C.</td>
<td></td>
<td></td>
<td>RELAY</td>
</tr>
<tr>
<td>24</td>
<td>COMMON</td>
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<td></td>
</tr>
<tr>
<td>25</td>
<td>N.O.</td>
<td></td>
<td></td>
<td>FLOW</td>
</tr>
<tr>
<td>26</td>
<td>N.C.</td>
<td></td>
<td></td>
<td>ALARM</td>
</tr>
<tr>
<td>27</td>
<td>COMMON</td>
<td></td>
<td></td>
<td>RELAY</td>
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<td>115/230 VAC 50/60Hz</td>
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<td>POWER (AC)</td>
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<tr>
<td>29</td>
<td>115/230 VAC 50/60Hz</td>
<td></td>
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<tr>
<td>30</td>
<td>+24 VOLTS</td>
<td>24VDC OUT (AC POWERED UNITS ONLY)</td>
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<td>31</td>
<td>24 VOLTS RETURN</td>
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<td>32</td>
<td>CHASSIS COMMON</td>
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</tr>
</tbody>
</table>

**TYPICAL HOOKUP:**

- RTD: 100Ω, 2 Wire RTD
- Open Collector: Pulsing Type Input
- 0-5 Volt Pressure Transducer
- 4-20mA Analog Flow Transducer
- Strip Chart Recorder
- 115 or 230 VAC 60/50Hz

**Ordering Information**

**Example:** MFC A 1 BL

**Series:** MFC

**Operating Voltage:**
A: 115 VAC ±15% at 50/60Hz
B: 230 VAC ±15% at 50/60Hz
C: 24 VDC ±20%
D: 12 VDC -10, +20%

**Options:**
1: RS-232 Serial Interface

**Display:**
BL: Backlit Display (standard)

**Accessories:**
- FLEXCOVER #36120
- NEMA 4x wall mount enclosure available, see NEMATROL
- Explosion Proof housing available, see XTRTOL7/4
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- Remote metering and data collection software available, see TROLlink

**Dimensions:**

- Panel Cutout: 8.17 x 6.0 (207.5 x 152.4) (NOM.)
- Dimensions: 3.31 x 2.48 (64 x 63) (NOM.)
Features

- Compensates Steam, Gases and Liquids for Temperature and Pressure to Yield Corrected Volume, Mass and Heat Flow.
- Two Line by 20 Character Super Twist Back-Lit LCD Display
- Accepts Single or Dual Differential Pressure (DP) Inputs
- Square Root Extraction of DP Inputs
- 16 Point Linearization
- Displays Compensated Rate and Total Flow
- Takes a Direct 100 Ω Platinum RTD (4 wire)
- Flow Rate, Temperature and Pressure Alarm
- 4-20 mA and Pulse Outputs Based on Compensated Flow
- 24 Volt Excitation Provided
- Front Panel NEMA 4X/IP 65 Rated

Description

The KEP DPFC is a microprocessor based instrument designed to measure compensated flow in an industrial environment. Four analog inputs for temperature, pressure and dual differential pressure are provided to measure the parameters needed to calculate the actual compensated volume, mass or heat flow.

Special signal conditioning circuitry is included to allow direct connection of platinum resistance temperature detectors (RTD'S). Voltage inputs or current loops can be used for the above.

All instrument interface is with a 32 point screw terminal strip on the rear of the instrument.

DP Flow Computer Application

- Pressure transducer sends 0-5V or 4-20 mA signal to Flow Computer.
- 100Ω, 4 wire, RTD direct hookup to Flow Computer.
- DP transmitters send signals to Flow Computer.
- Flow Computer calculates flow and generates output signals.
- 5 V pulse out to remote totalizer in supervisory area.
- 4-20 mA out to strip chart recorder tracks trends.
- RS232 out to printer for data logging.
- Alarm relays activate bell and/or light as needed.
General Specifications
OVERALL ACCURACY: ± 0.25%

ENVIRONMENTAL:
Operating Temperature: 32 to 122 °F (0 to 50 °C)
Storage Temperature: -10 to 160 °F (-23 to 71 °C)
Humidity: 0 to 90% Noncondensing
Front Bezel: NEMA 4X/IP 65
Case: ABS Plastic
Listing: CE Compliant

POWER: (Internally Fused)
115 / 230 VAC ±15% (Switch Selectable)
or 24VDC ±20% or 12 VDC +20%/-10%
Frequency: 50/60Hz.
Power Consumption: 10 Watts max

Input Specifications:
The following applies to all inputs. Inputs are referenced to signal ground. All ground terminals are connected internally. NOTE: All inputs are single-ended with one leg grounded. The exception is the RTD input which is differential but is referenced to ground.

CURRENT INPUTS:
Input Impedance: 100Ω
Range: 0-20mA, 4-20mA
Maximum sustained input voltage: 5 VDC (Fault Condition)
Resolution: ± 0.024% FS

VOLTAGE INPUTS:
Input Impedance: 115 kΩ
Range: 0-5V, 0-10V
Resolution: ± 0.024% FS

TEMPERATURE INPUTS:
Compatible RTD type: 100Ω Platinum
(α = .00385; DIN 43-760 Calibration)
Lead Wire Compensation: 4 Wire
Configuration: 2, 3 or 4 wire (4 wire cable required)
Excitation Current: 2mA typical
Max Fault Current: 15mA
Max Volt on sense inputs: 50 VDC
Rejection of 50 or 60Hz signal: 40dB minimum (Automatically based on line frequency)
Raw Accuracy: ± .5°C

Output Specifications:

ANALOG OUTPUTS:
Range: 4-20mA DC, sink only.
Compliance Voltage Range: 3 - 24 VDC
Load Type: Non Inductive
Accuracy: ± .5% FS
Update Rate: 1Hz

PULSE OUTPUT:
This output is intended to drive a counter with a minimum input impedance of 1000Ω. It is compatible with TTL and 5V CMOS logic inputs.
Output High Voltage
No load: 4.5 Volts min
4.0 mA source: 4.0 Volts min
Output Low Voltage
No Load: 0.2 Volts max
4.0 mA sink: 1.0 Volts max
Output waveform: Symmetric square wave above 1Hz 100msec pulse below 1Hz
Frequency Range: 0 to 50kHz
Max Slew Rate: 27 Volts/µsec
Sustained Fault Voltage for no permanent damage: 7 Volts

RELAY OUTPUTS:
One relay is a flow alarm output and a second is for other alarm conditions. Each has the following electrical specifications:
Type: Dry Contact, Form C
Contact Rating: 10A @ 115/230VAC/28VDC

Auxiliary Power Output: (AC Powered units only)
Voltage: 24VDC regulated and filtered
Isolation: 230VAC max
The 24VDC output is supplied with a self resetting fuse.
Current: 0 to 100mA
Protection: Short Circuit Proof

RS232 Communications:
Connector: 25 Pin Sub-D
Input Impedance: 3000Ω to 7000Ω
Compliance Voltage:
Output: -25 to -5 (Mark);
5 to 25 (Space); Volts
Input: -25 to -3 (Mark);
3 to 25 (Space); Volts
Protection: Short circuit proof.
Protocol: 8 bits, 1 Stop bit
Parity: None (Not monitored)
Available Baud Rates: 300, 1200, or 9600

Data Display and Keypad:
Internal 2 line by 20 character dot matrix LCD display. Sealed, 16 key panel featuring numeric keys
0-9, plus the following keys:
A Advance through menus
B Back up through menus
C Cancel current menu selection
D Decimal point key
ENT ............. General purpose enter or recall data key
CLR ............. Data clear key

Operation:
Through the 16 button, NEMA 4X/IP 65, front keypad, the operator enters all parameters necessary to configure the DPFC. No additional input cards or dip switch settings are needed.
The operator selects the type of compensation desired for the medium (steam, ideal gas or liquid). For steam flow and heat measurement the 1967 ASME steam tables for saturated and superheated steam are stored in memory. For gases and liquids, the necessary factors are entered in by the operator.
Additionally, the following hardware parameters must be entered to configure the DPFC input signal types (from the temperature, pressure and differential pressure transmitters) along with their corresponding ranges or factors and alarm set points. Also the 4-20mA output, pulse output and optional serial port can be set up. If desired, the operator can lockout the unit from changes by entering a five digit lockout code.
The optional RS232 serial communications allows for timely printouts of flow results and/or parameters as well as parameter down load and up load for easy computer programming.

Software Accessories:

K1 Diskette:
A diskette program is available to assist in the computation of the K1 term. The K1 factor is used in Orifice/Pitot/Annubar calculations. The K1 factor is the calibration factor for the meter run. It is part of the Variables menu for flow input values (analog).

Masscon Diskette:
The MASSCON diskette program facilitates the configuration and calibration of the flow computer. The program runs on PC compatibles and communicates through the RS232 port.
### Terminal Block Designations:

<table>
<thead>
<tr>
<th>PIN</th>
<th>RTD Voltage</th>
<th>Current Function</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RTD Excitation +</td>
<td>V IN - (COM)</td>
<td>CHANNEL 1</td>
</tr>
<tr>
<td>2</td>
<td>RTD Sense +</td>
<td>V IN +</td>
<td>TEMPERATURE</td>
</tr>
<tr>
<td>3</td>
<td>RTD Sense -</td>
<td>V IN +</td>
<td>CHANNEL 2</td>
</tr>
<tr>
<td>4</td>
<td>RTD Excitation -</td>
<td>V IN +</td>
<td>PRESSURE or AUX. TEMP.</td>
</tr>
<tr>
<td>5</td>
<td>Common (Shield)</td>
<td>V IN - (COM)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>V IN +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RTD Excitation +</td>
<td>V IN +</td>
<td>FLOW (LOW)</td>
</tr>
<tr>
<td>8</td>
<td>RTD Sense +</td>
<td>V IN +</td>
<td>ALARM</td>
</tr>
<tr>
<td>9</td>
<td>RTD Sense -</td>
<td>V IN +</td>
<td>RELAY</td>
</tr>
<tr>
<td>10</td>
<td>RTD Excitation -</td>
<td>V IN +</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Common (Shield)</td>
<td>V IN - (COM)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>V IN +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Common (Shield)</td>
<td>V IN - (GND)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>V IN +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Common (Shield)</td>
<td>V IN - (GND)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Common (Shield)</td>
<td>V IN - (GND)</td>
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<td>17</td>
<td>Common (Shield)</td>
<td>V IN - (GND)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Common (Shield)</td>
<td>V IN - (GND)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Analog Output (Sink)</td>
<td>V IN +</td>
<td>ANALOG OUT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Pulse Output</td>
</tr>
<tr>
<td>21</td>
<td>Common (Shield)</td>
</tr>
<tr>
<td>22</td>
<td>N.O.</td>
</tr>
<tr>
<td>23</td>
<td>N.C.</td>
</tr>
<tr>
<td>24</td>
<td>Common</td>
</tr>
<tr>
<td>25</td>
<td>N.O.</td>
</tr>
<tr>
<td>26</td>
<td>N.C.</td>
</tr>
<tr>
<td>27</td>
<td>Common</td>
</tr>
<tr>
<td>28</td>
<td>115/230 VAC 50/60Hz</td>
</tr>
<tr>
<td>29</td>
<td>115/230 VAC 50/60Hz</td>
</tr>
<tr>
<td>30</td>
<td>+24 Volts</td>
</tr>
<tr>
<td>31</td>
<td>24 Volts Return (AC Powered Units Only)</td>
</tr>
<tr>
<td>32</td>
<td>Chassis Common</td>
</tr>
</tbody>
</table>

### TYPICAL HOOKUP:

- **Input Channel 1 (Temperature):**
  - 1. RTD+ - 4. RTD - /1+
  - 5. Vcom/ Icom
  - 6. V+
  - 7. RTD+
  - 8. Sense RTD+
  - 9. Sense RTD-
  - 10. RTD - /2+
  - 11. Vcom/ Icom
  - 12. V+
  - 13. V+
  - 14. Vcom/ Icom
  - 15. V+
  - 16. Vcom/ Icom
  - 17. V+
  - 18. Vcom/ Icom
  - 19. Sink Analog
  - 20. 4-20 mA Pressure Transducer
  - 21. 4-20 mA Pressure Transducer Low Range
  - 22. 4-20 mA Pressure Transducer High Range

- **Output 4-20 mA:**
  - 23. -115/230 VAC 50/60Hz
  - 24. -115/230 VAC 50/60Hz
  - 25. -115/230 VAC 50/60Hz
  - 26. -115/230 VAC 50/60Hz
  - 27. 115 or 230 VAC 60/50 Hz
  - 28. 115 or 230 VAC 60/50 Hz
  - 29. 115 or 230 VAC 60/50 Hz
  - 30. 115 or 230 VAC 60/50 Hz
  - 31. 115 or 230 VAC 60/50 Hz
  - 32. Common (Chassis)

### Ordering Information

**Example:**

- **Series:** DPFC
- **Operating Voltage:**
  - A: 115 VAC ±15% at 50/60Hz
  - B: 230 VAC ±15% at 50/60Hz
  - C: 24 VDC ±20%
  - D: 12 VDC -10, +20%

**Options:**

- 1: RS-232 Serial Interface

**Accessories:**

- FLEXCOVER #36120
- NEMA 4X wall mount enclosure available, see NEMATROL
- Explosion Proof housing available, see XTROL7/4
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- Remote metering and data collection software available, see TROLLink

### Dimensions:

- Panel Cutout: 2.50 -0, +0.02 (63.5 -0, +0.5)
- Panel Height: 8.17 (207.5)
- Panel Width: 7.375 (187.3)
- Panel Depth: 3.31 (84)
- Dimensions: 2.48 (63) (NOM.)
Communications Solutions Tutorial

In recent years there has been a virtual explosion of new technologies and methods which greatly simplify the exchange of information between systems. This virtual explosion in new technologies complement many of the traditional direct wiring approaches of interconnecting instruments around a plant, complex, city, or region.

KEP seeks to assist our customers in “getting connected” by using the serial communication ports provided on many of our models such that they may be used for communications with computers, for modems, for printing, for datalogging, and in wire-line and wireless communications.

KEP offers a variety of compatible hardware and software system building blocks which many users find helpful in interconnecting their instruments to their computer over their preferred communication channel.

How can I get a printed report? Many instruments may be supplied with a standard or optional RS-232 serial port which may be connected to a printer with a RS-232 serial interface. Printers are purchased separately as an accessory.

What information can I get on my printed report? The printing capabilities of instruments vary widely. Instruments with more advanced printing capabilities permit the user to decide on the form length, include a custom print header, time and date, sequential print number, and all the desired information. Some models include a more limited print list. Basic models support only the printing of a single number.

How can I initiate the report to print? Depending on the model being used there may be one or more ways to initiate a print. These include: Remote Print Switch, Local Print Key, End of Batch, Interval, and Time of Day.

How can I get information into my PC? There are several issues involved with getting information into a PC from an instrument. The first is the decision for the communication channel to be used. The second is the data gathering software (server). The final is the selection of the software that will display or store the information for the operator (client software).

What is a Server or DDE Server? A server is a communication utility program that you purchase which enables you to easily communicate with an instrument or PLC. Most programs offer a wizard which guides you through naming and selecting the communication channel with its com port and setting, the instruments which will be on that cable and the various measurements (tags) being made by each instrument. Other programs will latter reference instrument name and tag.

How can I get information into my spreadsheet? One of the simplest ways involves using a “DDE or OPC Server” which has been configured to constantly gather information from your instrument to make it available for other programs to access. (See using a dde server.) The information is accessed in the desired cell of your spread sheet by entering the following: “=KEPDDE\UNIT_NAME!DATA_ITEM_NAME”. One of the nice aspects of this approach is there is no need to write a program in many applications. A DDE server and the above command is all you need.

I want to write my own program. How do I go about it? You will need to consider using an off the shelf server or writing your own custom program in the language of your choice. Each instrument with serial communications has a special user manual which describes the format of a request for information and a list of the information. These will act as an aid while you are writing and debugging your program.

What is an HMI Software? HMI software is a software toolbox that enables a user to create custom screens for displaying information and controlling his plant. Capabilities include: controls and displays on touch screen, graphics symbols or object libraries, real time trending, data logging, and alarming. The software toolbox also includes a powerful programming or scripting language.

What do I need to get information into my Human Machine Interface Software? DDE and OPC Servers are routinely used. Alternately, custom scripting may be used in some cases.

What are the some of the common communications possibilities on the market? The choice of communications solutions available on the market is quite large. These include direct connect, wireless, fiber optic, LAN’s and those which utilize RS-232, RS-422 and RS-485. There are a range of related communication settings which include baud rate, parity, start and stop bits which further clarify the interface.

What is RS-232 and how far can I send it? RS-232 is an industry standard for electrical signal levels. It is commonly used with many serial devices where the information will be send over distances not to exceed 50-200’. RS-232 ports are provided on all personal computers with a connector style known as mini-D or D-Sub.

What is RS-485 and how far can I send these signals? RS-485 is an industry standard for electrical signal levels. It is commonly used with many serial devices where the information will be send over distances not to exceed 4000’. Information is carried of 3 wires including a ground reference. RS-485 to RS-232 adapters are required to provide connections to the RS-232 ports on all personal computers.

What is a protocol? A protocol is an agreed upon method for exchanging information. It is used to decide on the method of formatting information that will be carried along a communication cable. An example would be the MODBUS-RTU protocol used on many instruments. However, there are a vast number on the market place.

What is remote metering? This may be described as any approach that is used to access information from a remote instrument to a centralized PC by connecting to and then polling an instrument for information. Telephone (modem) and wireless systems are commonly used.

What is Wireless Communications? Wireless if a term that includes a variety of technologies which do not require the sender and receiver of the system be directly connected by a wire cable. Instead a wireless transceiver is used. In common usage it may be divided into subclassifications. Common ones include wireless telephone, wireless one and two way personal messaging or paging, and radio telemetry.

What is the cost of a wireless solution? The costs of initial equipment, and installation cost vary. There is usually a monthly service charge associated with each transceiver that is based on the amount of air time, or amount of information to be transferred. There are often reduced charges for off peak hour usage.
**KEPServer**  
**SUPERtrol Series 32 Bit Device Driver for KEPware's KEPServer**

**Description**  
KEPware’s 32 bit KEP SUPERtrol device driver works in conjunction with KEPware’s DDE Server (KEPServer) to exchange data between DDE clients and Kessler-Ellis Products SUPERtrol devices. Block reads are optimized automatically. Block polling rates are defined by scanning blocks at the rate of the fastest tag scan rate in the block.

**Part Number:**  
KEPS-KEP1-32: KEP RS232 for SUPERtrol 1, SUPERtrol 1LE, SUPERtrol 2 and LEVELtrol 2 • 32 Bit DDE Server, Now with Modem Support  
KEPS-MBS32: SUPERtrol & LEVELtrol Series with RS-485 & MODBUS RTU Support

**Supported Devices**  
- Multidrop Supported
- SUPERtrol ILE, SUPERtrol I, SUPERtrol II, LEVELTROL II, MS716, MS748, ES747

**Supported Data**  
KEPware’s 32 bit KEP SUPERtrol device driver supports: Process Variables, Totalizers, Error Status, and Action Routines may be read or activated.

**Process Variables:** Heat, Mass, Corrected Volume, Volume, Temperature, Pressure, Density and similar items as well as Raw Input & Output signals.

**Totalizers:** Resetttable & non-resettable total of: Heat, Mass, Corrected Volume and Volume

**Action Routines:** Initiate Print, Clear Totalizer, Clear Alarms, Start Batch, Stop Batch and many others

**Data Types:** Boolean - bit, Word - unsigned 16 bit, Short - signed 16 bit, Long - signed 32 bit, DWord - unsigned 32 bit, Float - floating point 32 bit, Double - floating point 64 bit, String - null terminated ASCII

**Driver System Requirements**  
- Windows 95 and Windows NT 3.51 or better with 16MB RAM minimum.

**Network Configuration Options**

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Multiple KEPServers can share data with other networked PC’s and with local Clients. DDE compliant applications can send data from the KEPServer.
TROLlink

Features

- Retrieve data from KEP flow computers using direct wire, internet or modem connection.
- Collects data from the following Kessler-Ellis Products flow computer instruments: SUPERtrol I, SUPERtrol II, ES-747, LEVELtrol II, MASStrol, DPFC
- Runs on: Windows 95® and higher; Windows NT® 4.0 and higher
- Works with most Hayes compatible modems for remote data collection.
- Handles a mix of instruments, they don’t have to be the same type.
- Select the data items to acquire by simple check boxes for each instrument.
- Can automatically collect data from 1 to 100’s of instruments.
- Automatic data collection by Time and Date.
- Automatic Telephone busy retries.
- Collected data can go to screen, text file, Excel spreadsheets and is available to DDE aware applications.
- Each instrument can have data directed to separate or common named files.
- Can write log files showing data collection session details and connection failures due to busy or no answers.
- Collects data from items that are displayable on instrument displays.
- Collects data from SUPERtrol and LEVELtrol II dataloggers.
- Automatic Peak Demand reset capability possible when using meter reading routes.
- Each instrument can be assigned a route number to write special messages during data collection to data file.

Description

TROLlink is remote metering software for collecting data, via direct wire or modem, from KEP’s SUPERtrol, LEVELtrol II, MASStrol, and DPFC flow computer families.

This practical data collection system lets the operator retrieve data from one or hundreds of instruments, of varying types, in manual or automatic mode. Adding a modem and PC provides an easy-to-use and cost-effective remote monitoring system for utility, continuous process, and batching operations.

TROLlink’s simple user interface prompts the operator to select the data items to be acquired, specify automatic data collection by time and date, direct data to screen, text, or EXCEL files, and define a route number for each instrument, if required.

TROLlink runs on Windows 95 and higher, and Windows NT 4.0 and higher, and works with most Hayes compatible modems.
EASY TO SETUP!

Setup is simple using check boxes and “fill in the blank” formats.

EASY TO USE!

Within moments after setup you will be up and running and collecting your vital data. The data may be viewed on screen or saved as text or Excel™ Spreadsheet files.
IEPS 1000

**Features**
- LAN-Attached Serial Port Expansion
- Optional Ethernet Hub
- Remote Monitoring
- IP Routing for Multi-Site Networks
- Software for Virtual Com Port Included
- Permits Gateway Connection from Instrument's RS-232 to PC's Ethernet LAN

**Description:**
The IEPS1000 gives users the ability to connect KEP products with Ethernet networks. The SUPERtrol II (ST2) unit can be connected to the RS-232 port on the IEPS1000. The port server allows customers to use their existing plant 10 base T ethernet rather than running separate cables to the ST2's. This will permit users to have Infilink-HMI software, Server software or Flow Computer setup application running on a PC with an ethernet port. Their software at the PC end creates a virtual RS-232 COM Port for these programs.

Port Server Software Included to:
- Assign IP Address
- Set Communication Parameters
- Create Virtual Com Port

The IEPS1000 Series of Networked Peripheral Servers provide LAN-attached serial port expansion and remote monitoring. The IEPS1000 is targeted to users who need to manage, control, and share access with one to two peripheral devices over the LAN or Internet using standard protocols. The IEPS1000 uses industry standard TCP/IP, and telnet protocols to ensure open-systems connectivity and flexibility for your demanding applications. The IEPS1000 is bundled with NativeCOM port redirection software, web browser interface, and remote diagnostics. NativeCOM simplifies installation and support, and makes any LAN-attached serial port (whether local or remote) appear as local to your Windows application.

**Ordering Information**
IEPS1101 1-port, RS-232 Interface

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th><strong>Serial Interface</strong></th>
<th>DB9 Connector; supports all TTY signals (RxD, TxD, RTS, CTS, DCD, DTR, DSR, RI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Requirements</strong></td>
<td>External 110/220V; Worldwide; Over current protection</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>w 3.25&quot; x l 4.37&quot; x h 1.5&quot;</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Operating temp 0˚ to 60˚ C</td>
</tr>
<tr>
<td><strong>Humidity range</strong></td>
<td>5% to 95% non condensing</td>
</tr>
<tr>
<td><strong>LAN Interface</strong></td>
<td>RJ45 (10 Base-T), 10Mbit, Ethernet 802.3; TCP protocol</td>
</tr>
<tr>
<td><strong>Host Communications</strong></td>
<td>10 Base-T, 10Mbit, Ethernet 802.3</td>
</tr>
<tr>
<td><strong>Protocols Supported</strong></td>
<td>Raw TCP, NativeCOM port redirector, Telnet, Rtelnet, LPD</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>Password protected configuration</td>
</tr>
<tr>
<td><strong>Management and Diagnostics</strong></td>
<td>Web-based interface, Remote/local diagnostics (to pin level)</td>
</tr>
<tr>
<td><strong>Compatible Instruments</strong></td>
<td>SUPERtrol 1LE, 1, 2, LEVELtrol II, INT69, MINItrol and others.</td>
</tr>
<tr>
<td><strong>Compatible Software</strong></td>
<td>SUPERtrol Family Setup Diskette, KEPServer, TROLlink, Infilink-HMI</td>
</tr>
</tbody>
</table>
IEPS 3000

Features
• LAN-Attached Serial Port Expansion
• Optional Ethernet Hub
• Remote Monitoring
• IP Routing for Multi-Site Networks
• Software for Virtual Com Port Included
• Permits Gateway Connection from Instrument’s RS-232 to PC’s Ethernet LAN

Description:
The IEPS3000 gives users the ability to connect KEP products with Ethernet networks. Up to six SUPERtrol II (ST2) units can be connected to each of the RS-232 ports on the IEPS3000. The port server allows customers to use their existing plant 10 base T ethernet rather than running separate cables to the ST2’s. This will permit users to have TROLink, Infilink-HMI software, Server software or Flow Computer setup application running on a PC with an ethernet port. Their software at the PC end creates a virtual RS-232 COM Port for these programs.

Since the IEPS3000 works using an IP address and uses TCP/IP Protocol, it also has Internet address capabilities.

Port Server Software Included to:
• Assign IP Address
• Set Communication Parameters
• Create Virtual Com Port

The IEPS3000 is characterized by high reliability, superior software functionality, expanded hardware interfaces and simplified remote installation. The IEPS3000 is designed for users who need to manage, control, program and share access with one to four devices over the LAN or Internet using standard protocols.

IEPS3000 Hardware Specifications
• Motorola MC68EN360 QUICC 25 MHz or 33 MHz microprocessor with internal RISC processor.
• 1M byte in-circuit boot flash and program memory.
• 4 M byte nonparity DRAM.
• 10 Mbps Ethernet connection over 10BASET physical lines.
• 1 10BASET Ethernet HUB ports
• Two or Four asynchronous serial ports with modem control and surge suppression. Asynchronous port data rates of 50 bps to 115.2 Kbps over EIA-232 electrical interface. Uses DB-9 physical interface. Supports RS-232, RS-422, and RS-485.
• External 110 or 240 VAC power supply.
• Initialization self-test.
• Hardware exerciser.
• Status LEDs for each port.

Environmental Specifications
Operating temperature range: 0 to 50°C
Storage temperature range: -10 to 70°C
Humidity range: 10% to 90% noncondensing

Product Dimensions
The IEPS3000 model measures: 8 inches x 4.75 inches x 1.25 inches (203 mm x 121 mm x 32 mm)

Ethernet cabling specifications
This section describes guidelines for using 10BASET twisted-pair cabling:
• Recommended cable is 22 to 26 AWG category 3 or category 5 unshielded solid copper twisted pair (standard telephone wire), at least Level 2 (two twists per foot).
• Maximum distance of a segment—from concentrator to node—is 100 meters (328 feet).
• Maximum of two devices to a cable segment.
• Ethernet network interface cards (NICs) are available with built-in 10BASET transceivers and a 15-pin AUI port.
• Devices with standard AUI ports may be attached by using a twisted-pair transceiver (MAU).

Compatible Instruments:
• SUPERtrol 1LE, 1, 2, LEVELtrol II, INT69, MINItrol and others.

Compatible Software:
• SUPERtrol Family Setup Diskette,
  KEPserver, TROLink, Infilink-HMI

Ordering Information
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEPS3182</td>
<td>2-port</td>
</tr>
<tr>
<td>IEPS3282</td>
<td>2 port with optional HUB port</td>
</tr>
<tr>
<td>IEPS3184</td>
<td>4-port</td>
</tr>
<tr>
<td>IEPS3284</td>
<td>4 port with optional HUB port</td>
</tr>
</tbody>
</table>
CA-285

RS-422/485 to RS-232 Interface Converter

Features
- User Selectable RS-422 or RS-485
- RS-485 User Selectable 2 or 4-Wire Operation
- Intelligent Control of RS-485 Transmitter and Receiver
- Td and Rd LED
- DTE/DCE Compatible
- Data Rates up to 64k BPS
- Connects to Standard PC Compatible 25 Pin RS-232 Port

DESCRIPTION:
The CA-285 is a unique interface converter that can be configured by the user to convert either RS-422 or RS-485 to RS-232. When operating in RS-485 mode, the CA-285 has an “intelligent” mode which provides control of the RS-485 line.

When configured to operate as an RS-232 to RS-422 interface converter, the CA-285 converts full duplex data, Td and Rd, between RS-232 and RS-422.

As an RS-232 to RS-485 converter, the unit can be configured for either 2 or 4-wire operation. In either mode, the CA-285 allows control of the transmitter so that multi-dropped operation can be accommodated. The CA-285 can be configured to control its data flow in one of two ways. The first is via the use of RTS, pin 4, of the RS-232 port. In this case, the RS-485 transmitter will turn ON when RTS is turned on. When RTS is OFF, the CA-285 is in the receive mode. In the 4-wire mode, the receiver is always on. The second method of controlling the RS-485 transmitter is to turn it ON when Td data is applied to the RS-232 port. (recommended with KEPServer)

The receiver also operates differently depending on whether the mode is 2 or 4-wire. In the 2-wire mode, when no data is received by the RS-232 receiver, the RS-485 receiver is switched ON. When data is detected for transmission, the receiver is switched OFF. In the 4-wire mode, the RS-485 receiver is constantly ON while the transmitter is switched as required.

The CA-285 is equipped with a five position dip switch that is used to select the following:

- RS-422 mode: 4-wire
- RS-485 mode: 2-wire
- RS-485 mode: 4-wire
- RS-485 mode: controlled by RTS
- RS-485 mode: controlled by data
- 220 ohm terminator: in or out

The CA-285 is also equipped with a DTE/DCE switch to allow reversing pins 2 and 3 on the RS-232 interface. Td and Rd LED indicators help verify operation.

SPECIFICATIONS:

Interface:
- RS-232, conforms to CCITT V.24; pins 2 and 3 (transmit/receive data) switch selectable, pin 4 (RTS) tied to pin 5 (CTS), pins 6 (DSR), 8 (DCD) and pin 20 (DTR) are connected together; RS-422 or RS-485, selectable
- RS-422, 4-position terminal block
- RS-485, 5-position terminal block

Connectors:
- RS-232, DB-25 male, RS-422/485, 5-position terminal block
- RS-422/485, 5-position terminal block

Indicators:
- 2 LEDs, Td and Rd

Switches:
- DTE/DCE switch selectable for reversing Td and Rd; 5-position dip switch set RS-422/485 operation and termination

Data Rate:
- 0 to 64k bps

MTBF:
- 596,000 hours

Power:
- 115 VAC at 60 Hz (Wall plug power adapter with 6’ cable provided)

Size:
- 0.875"H x 2"W x 3.5" D

Operating Temp.:
- 32 to 122°F (0 to 50°C)

Humidity:
- 5 to 95% RH (non-condensing)

Ordering Information

EXAMPLE
CA285
Series
CA-285 RS-422/485 to RS-232 Communication Adaptor
### MPP-2400

**Features**
- Operates on All Telephone Lines
- External DC Power Required
- 2400 BPS Operation
- Automatic Fallback
- Compatible with All Communications Software Including: TROLLink Remote Metering Software
- Compatible with SUPERtrol 1LE, 1 & 2, LEVELtrol II Families
- Automatic Answer
- Tone & Pulse Dialing
- Compact Size

**Description:**

The MPP-2400 Modem is ultra-compact and easy to install. The Modem operates at speeds up to 2400 bps. If you are connected to a slower speed modem on the other end of the line, the MPP-2400 automatically “falls back” to match the speed of the slower modem so your data transmission is not interrupted.

The MPP-2400 also features automatic answer, so it can operate unattended.

It will operate over rotary or push-button lines since it works in tone or pulse dialing modes.

The Modem is very small and simple to install. It offers a standard DB25 female connector for your RS-232 port connection and an RJ-11 jack for your telephone cabling.

The MPP-2400 complies fully with the Hayes Standard AT Command Set and the ITU V.22 bis and V.22 standards, as well as Bell 103 and Bell 212A protocols. The MPP2400 can be powered by ST1LE, ST1, ST2 and LT2 units equipped with modem power option (option “M”).

Alternately, an external DC power supply is available upon request. Call factory for details.

---

**Specifications:**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Full- or Half-Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards</td>
<td>ITU V.22, V.22 bis, Bell 103/212A</td>
</tr>
<tr>
<td>Interface</td>
<td>RS-232/V.24</td>
</tr>
<tr>
<td>Baud Rate</td>
<td>2400, 1200, 300 bps</td>
</tr>
<tr>
<td>Command Set</td>
<td>AT compatible</td>
</tr>
<tr>
<td>Dialing</td>
<td>Tone and Pulse</td>
</tr>
<tr>
<td>Transmit Level</td>
<td>-12 dBm</td>
</tr>
<tr>
<td>Receive Sensitivity</td>
<td>-70 dBm</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>-43 dBm</td>
</tr>
<tr>
<td>Operating Temp.</td>
<td>32 to 104 °F (0 to 40 °C)</td>
</tr>
<tr>
<td>Storage Temp.</td>
<td>-40 to 212 °F (-40 to 100 °C)</td>
</tr>
<tr>
<td>Humidity</td>
<td>10 to 95% (non-condensing)</td>
</tr>
<tr>
<td>Connectors</td>
<td>(1) DB25 female, (1) RJ-11 female</td>
</tr>
<tr>
<td>Power</td>
<td>6.5 to 15 VDC (75mA)</td>
</tr>
<tr>
<td>Pin 20 (+); Pin 7 (–)</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>0.9&quot;H x 2.3&quot;W x 3.4&quot; D</td>
</tr>
<tr>
<td>Weight</td>
<td>0.18 lb. (0.08 kg)</td>
</tr>
</tbody>
</table>

---

**Ordering Information**

**EXAMPLE MPP2400**

**Series**

| MPP-2400 Low Power Modem |

**Accessories**

Interconnecting Cables and Power Pack Available on Request
**MS-722 MPP-2400N**

**Wall Mount External Modem**

**Features**
- Operates on All Telephone Lines
- RS-232 Powered from SUPERtrol-II
- 2400 BPS Operation
- Automatic Fallback
- Compatible with All Communications Software Including: TROLlink Remote Metering Software
- Compatible with SUPERtrol 1LE, 1 & 2, LEVELtrol II Families
- Automatic Answer
- Tone & Pulse Dialing
- Wall Mount Enclosure with Locking and Sealing Provisions
- FCC Approved

**Description:**
The MS722MPP-2400N Modem is compact and easy to install. It needs no batteries or AC power because it’s designed to run on the DC power provided from the SUPERtrol (with modem power option “M”) interface to which it attaches.

The Modem operates at speeds up to 2400 bps. If you are connected to a slower speed modem on the other end of the line, the MPP-2400 automatically “falls back” to match the speed of the slower modem so your data transmission is not interrupted.

The MS722MPP-2400 also features automatic answer, so it can operate unattended.

It will operate over rotary or push-button lines since it works in tone or pulse dialing modes.

The Modem is very small and simple to install. It offers an RJ-45 connector for your RS-232 port connection and an RJ-11 jack for your telephone cabling. An extra RJ-11 jack is provided to permit the connection of a portable telephone.

The MS722MPP-2400 complies fully with the Hayes Standard AT Command Set and the ITU V.22 bis and V.22 standards, as well as Bell 103 and Bell 212A protocols.

**SPECIFICATIONS:**
- **Operation:** Full- or Half-Duplex
- **Standards:** ITU V.22, V.22 bis, Bell 103/212A
- **Interface:** RS-232/V.24
- **Baud Rate:** 2400, 1200, 300 bps
- **Command Set:** AT compatible
- **Dialing:** Tone and Pulse
- **Transmit Level:** -12 dBm
- **Receive Sensitivity:** -70 dBm
- **Dropout Level:** -43 dBm
- **Operating Temp.:** 32 to 104 °F (0 to 40 °C)
- **Storage Temp.:** -40 to 212 °F (-40 to 100 °C)
- **Humidity:** 10 to 95% (non-condensing)
- **Connectors:** (1) RJ-45, (2) RJ-11 female
- **Power:** 7-12VDC (RS-232 pins 8 & 9, 75mA)
- **Size:** 8.97” H x 7.86” W x 5.38” D
- **Weight:** 1 lb.

**Ordering Information**
**EXAMPLE** MS722MPP2400N
**Series**
MS722MPP-2400N Wall Mount, External Modem
**MPP-2400N**

**Wall Mount External Modem**

**Features**
- Operates on All Telephone Lines
- RS-232 Powered from KEP Instruments
- 2400 BPS Operation
- Automatic Fallback
- Compatible with All Communications Software Including: TROLlink Remote Metering Software
- Compatible with SUPERtrol 1LE, 1 & 2, LEVELtrol II Families
- Automatic Answer
- Tone & Pulse Dialing
- Compact Wall Mount Enclosure
- FCC Approved

**Description:**

The MPP-2400N Modem is ultra-compact and easy to install. It needs no batteries or AC power because it’s designed to run on the DC power provided from the SUPERtrol interface to which it attaches.

The Modem operates at speeds up to 2400 bps. If you are connected to a slower speed modem on the other end of the line, the MPP-2400N automatically “falls back” to match the speed of the slower modem so your data transmission is not interrupted.

The MPP-2400N also features automatic answer, so it can operate unattended.

It will operate over rotary or push-button lines since it works in tone or pulse dialing modes.

The Modem is very small and simple to install. It offers a standard DB-9 male connector for your RS-232 port connection and an RJ-11 jack for your telephone cabling.

The MPP-2400N complies fully with the Hayes Standard AT Command Set and the ITU V.22 bis and V.22 standards, as well as Bell 103 and Bell 212A protocols.

**SPECIFICATIONS:**

- **Operation:** Full- or Half-Duplex
- **Standards:** ITU V.22, V.22 bis, Bell 103/212A
- **Interface:** RS-232/V.24
- **Baud Rate:** 2400, 1200, 300 bps
- **Command Set:** AT compatible
- **Dialing:** Tone and Pulse
- **Transmit Level:** -12 dBm
- **Receive Sensitivity:** -70 dBm
- **Dropout Level:** -43 dBm
- **Operating Temp.:** 32 to 104 °F (0 to 40 °C)
- **Storage Temp.:** -40 to 212 °F (-40 to 100 °C)
- **Humidity:** 10 to 95% (non-condensing)
- **Connectors:** (1) DB-9 male, (1) RJ-11 female
- **Power:** 7-12VDC (RS-232 pins 8 & 9, 75mA)
- **Size:** 3.0"H x 5.1"W x 2.4" D
- **Weight:** 0.5 lb.

**Ordering Information**

**EXAMPLE**

<table>
<thead>
<tr>
<th>Series</th>
<th>MPP-2400N</th>
</tr>
</thead>
</table>

**Accessories**

Interconnecting Cables and Power Pack Available on Request
TWP

Features
• Use ST2 and TWP to Automatically Send Meter Readings by Email
• Wireless Communications Over ReFLEX Two Way Paging Network
• Request Information From SUPERtrol II on Demand, by Exception or on a Scheduled Basis
• Low Cost Solution for Moderate Message Lengths
• Up to 500 Bytes of Data per Transmission

APPLICATIONS:
Remote Wireless Metering Applications
Fixed Telemetry
Call Out/Call In capabilities to a host system

DESCRIPTION:
The TWP is a two way wireless data transceiver intended for applications where ReFLEX Two-Way Wireless Messaging will be used in remote metering applications using SUPERtrol II flow computers.

The TWP is intended for fixed telemetry applications requiring moderate message length wireless communications.

TWP can initiate a transmission as well as receive and store a transmission. Messages are loaded/sent and received/read using a RS-232 Port and CLP communication linking protocol commands.

USER WIRING TERMINATIONS:
RS-232 Port Pin Assignment
1 DO NOT USE
2 RECEIVE (IN)
3 TRANSMIT (OUT)
4 DO NOT USE
5 SIGNAL GROUND
6 DO NOT USE
7 BIAS
8 DC POWER –
9 DC POWER +

Ordering Information
EXAMPLE TWP N W 6ST2
Series
TWP = Two Way Pager
Enclosure
N = NEMA4X
Antenna Type
X = None
W = Internally mounted Dipole Whip (std)
R = Internal Radome with 5’ Antenna Cable
Interconnecting Cable
6ST2 = 6 foot ST2 Cable (other lengths available)
Accessories
TWP-AMK = Antenna Mounting Kit for Radome Antenna

SPECIFICATIONS:
Antenna:
Internal Dipole antenna
Optional External Antenna and Antenna Mounting Kit
(acceptable
and customer supplied)
Antenna Connection:
External Female SMA Connector
Transmitter Specifications
Frequency
ReFLEX NBPCS Networks (901-902MHz)
RF Power Output
1.75 – 2.0 Watt
at Antenna Port
Transmit Data Bit Rate
ReFLEX 25 9600
ReFLEX 50 9600
Frequency Stability
1 ppm on transmit
Receiver Specifications
Receive Data Bit Rate
929-942 MHz
6400 bps
Receiver Sensitivity
-115 dBm
Serial Input Connection:
Connector:
DB9-M
Protocol:
RS-232 with power connection
Motorola CLP – Communications Linking Protocol
Power Consumption:
Primary Voltage: 7-12 VDC
Standby/Transmit Power: 6 VDC Sealed Battery
Standby Operation: 50 mA
Receive: 150 mA
Transmit: 1.5 A
Battery: Rechargeable battery provided
Reverse Polarity Protected Overcurrent Protected
EMC filtered
Environmental:
Enclosure Rating: NEMA-4X
Dimensions: 3.5” x 4.75” x 8”
Operating Temperature: 0 to +70C
Storage Temperature: -40 to +85C
Humidity: 0-95% Non Condensing
Approvals: FCC
Mounting Cautions and Hazards:
Mount antenna in a location where people will not come within 12” during use

APPLICATIONS:
Remote Wireless Metering Applications
Fixed Telemetry
Call Out/Call In capabilities to a host system

DESCRIPTION:
The TWP is a two way wireless data transceiver intended for applications where ReFLEX Two-Way Wireless Messaging will be used in remote metering applications using SUPERtrol II flow computers.

The TWP is intended for fixed telemetry applications requiring moderate message length wireless communications.

TWP can initiate a transmission as well as receive and store a transmission. Messages are loaded/sent and received/read using a RS-232 Port and CLP communication linking protocol commands.

USER WIRING TERMINATIONS:
RS-232 Port Pin Assignment
1 DO NOT USE
2 RECEIVE (IN)
3 TRANSMIT (OUT)
4 DO NOT USE
5 SIGNAL GROUND
6 DO NOT USE
7 BIAS
8 DC POWER –
9 DC POWER +
Factory Automation Solutions Tutorial

The selection of factory automation hardware and software is a topic still quite new to many users of conventional flow instrumentation. They are presented with an increased range of possible solutions to their plant-wide automation needs.

Broadly speaking there are three basic approaches to solve instrumentation and control needs. These are networks of instrumentation, or PLC-based designs, or PC-based designs. Each has its own merits based on the size of the plant and the need for local control.

Industrial PC’s are finding their way into more and more monitoring and control applications each year. In most cases the PC is used as an operator station or data gathering station which collects information from a number of instruments or PLC’s.

Many users are trying to grow their own system by looking at their need for information and tackling small portions of their plant one step at a time and slowly adding these to their existing PC network within their plant.

How will information be displayed on my PC? Generally speaking there are two broad mechanisms which are involved in the display of factory information on a PC. One program is gathering and sharing data with the display, or “client” program. The data gathering program is called a “Server/Driver”. “Client” programs include “HMI” or Human Machine Interface programs and common PC Spread Sheet and/or Database report programs. Many are available on the market.

How do I select an Industrial PC? In most cases the hardware selection is done after you have decided on the software, on what you want this to do, and how it will be connected to the rest of the plant. Many experts agree that you should purchase a PC which is compatible with your software and with the best capabilities you can afford. Industrial PC offerings change frequently.

What are some of the selection criteria for Industrial PC’s? Most customers begin by reviewing the processor, memory and hardware requirements for the software they plan on using since this lists the minimum requirements for any PC they might use. Next the desired display type/size, operator input, environmental ratings, and materials of construction are reviewed. The number and type of required field and/or instrument communication channel and the desired network connection is also considered. Supplier quotations are then solicited.

What are the common field or instrument communication channels? There has been a lack of standardization in instruments and PLC’s. There are many on the market and in most plants. As a result it is not uncommon to find that several communication ports are required on your PC. Industrial PC’s are usually provided with 2 or 4 RS-232 serial com ports and an optional LAN connector. Instruments and PLC’s are arranged into groups that share a communication channel hardware and protocol type. Each com port is then associated with a “Server” software that knows how to gather information over that channel and how to share that information with the “client” software which is running on that or remote PC’s. In some cases a “signal adapter or converter” is required to convert the COM Ports RS-232 into the signal type required by that channel. An example might be a RS-485 communication channel with several instruments which uses the MODBUS-RTU protocol would connect to COM PORT1 using a RS-232 to RS-485 adapter.

What are the common office LAN connections used in business? It is important to note that an industrial PC is after all a PC. Your system administrator will add a network card and software in the same manner as other PC’s in your office. Many Industrial PC’s come with an Ethernet connection as standard or as an option.

Typical Application:
**INFINILINK-HMI**

**Features**

- Free Design Mode: Only pay to unlock run-mode copies
- OPC Client Functionality
- E-mail and Web Enabled: Send e-mail and View tag data over the Internet

**Description:**

Infinlink-HMI is a full featured solution at an affordable price. It is ideal for the small PLC user with its easy setup and run time price half that of competitive products. Machine builders and users want the benefits of a Windows based package, but are held back by the premium prices demanded by many vendors. Infinlink-HMI changes all of that with the truly affordable HMI, Infinlink-HMI.

**Features Added to the New Version of Infinlink-HMI**

- OPC Client Functionality
- E-mail and Web Enabled: Send e-mail and View tag data over the Internet
- Historical and Alarm Data Logging to MS Access (MDB) Files

**Other Important Features of Infinlink-HMI:**

- Free Design Mode: Only pay to unlock run-mode copies
- Historical Trending, Alarming, Data Logging included in base price
- Email and Web Enabling included in base price
- No yearly “maintenance” or “support” fees
- Built In Scheduler
- OPC, DDE, NetDDE & AdvancedDDE Support

**Email Capable**

Infinlink-HMI can send email messages based on alarm conditions. This can be a regular email message, or it could be sent to a technician’s alphanumeric pager.

**Industrial Automation Software**

- Historical Trending, Alarming, Data Logging included in base price
- Email and Web Enabling included in base price
- No yearly “maintenance” or “support” fees

**Scheduler**

Infinlink-HMI now includes a built in scheduler. Events can take place or tag data can be changed based on time, date, day of week, or holiday. New events can be entered by the operator in Run mode through the calendar interface.

**Infinlink-HMI Communicates Using KEPServerEX**

- One free driver included with Infinlink-HMI purchase.
- OPC and DDE supported.
- Over 100 drivers available.
- Support for various fieldbus networks including Ethernet TCP/IP and DeviceNet.

**Web Enabled**

Use the internet and our Infi viewer utility to view tag data. This is an especially powerful troubleshooting feature when combined with email going to an alphanumeric pager. Infinlink can notify technical personnel of a problem via email, and give them the ability to obtain additional application information over the internet.
Graphic Objects and Editing Features
Infilink-HMI provides a powerful set of graphic primitives and editing features allowing you to easily depict your application’s displays. All of these functions are available from our toolbox. Store your objects in libraries for reuse later or use the 2000+ library objects available with Infilink-HMI to speed your development.

Professional Library Objects
Infilink-HMI includes over 2000 professionally drawn library objects licensed from Reichard Software, famous for their Symbol Factory product. Additionally, our libraries also contain hundreds of pre-animated objects such as buttons, meters, displays, and sliders to a name few. These pre-animated objects can quickly be added to your application using the new Reassign Tags function. Drag and Drop objects out of the library into your application.

Key Editing and Drawing Functions Include:
- Lines
- Polylines
- Polygons
- Rectangles
- Rounded Rectangles
- Ellipses & Circles
- Arcs, Pies, Chords
- Text
- Bitmaps
- Buttons
- Windows Metafile Import
- Alarm Displays
- Alarm Logger
- Trend Displays
- Object Grouping
- Editing of Group Objects
- Align ~ Left, Right, Top, Bottom
- Align Middle ~ Horizontal, Vertical
- Space Equal ~ Horizontal, Middle
- Rotate ~ Clockwise, Counter Clockwise
- Make Equal ~ Width, Height
- Bring to Front
- Send to Back
- Z Depth Level 1-10
- Reshape
- Rotate Shapes
- Flip Horizontal or Vertical

Trend Functions
Infilink-HMI provides built-in Real Time and Historical Trend objects which allow you to quickly add time based views of your process data.

Sample Trending Application

Key Trend Functions Include:
- Multiple Plotting Modes
- Script Control
- Fast Display Speed
- 10 Pens / Trend
- Library Objects for Trend Control
- Comments
- File Functions ~ Read, Write, Text, CSV
- Object Property Access
- Conditional Operators
- Full Set of Math and String Functions
- Automatic Error Checking
- Play Wave Files

Key Script Functions Include:
- Project Script ~ (Before, While, After) Open
- Window Scripts ~ (Before, While, After) Open
- Tag Scripts ~ On Data Change
- Conditionals ~ IF, THEN, ELSE
- Logical Operators ~ AND, OR, NOT

Key Animation Functions Include:
- Visibility ~ Show/Hide
- Change Color
- Blink ~ Fast, Medium, Slow
- Take Action ~ Activate Script
- Rotate Shapes
- Move ~ Horizontal, Vertical
- Stretch ~ Horizontal, Vertical
- Enter Data ~ Boolean, Numeric, String
- Slider ~ Horizontal, Vertical
- Show Value ~ Boolean, Numeric, String

Scripting Language
Infilink-HMI was designed to fit all of your needs with our built in functions. However, we have provided a powerful scripting language allowing you to tailor Infilink-HMI’s operation to meet any application requirement.

Key Script Functions Include:
- Project Script ~ (Before, While, After) Open
- Window Scripts ~ (Before, While, After) Open
- Tag Scripts ~ On Data Change
- Conditionals ~ IF, THEN, ELSE
- Logical Operators ~ AND, OR, NOT

Data Logging
Any Tag in Infilink’s tag database can be configured to log itself to disk. Crucial events can be stored and shared with any application via industry standard database formats.

Key Data Logging Functions Include:
- User Specified Logging Path
- User Controlled Log Enabling
- Log File Change Based On Time
- Improved logging performance
- User Selectable DBASE (DBF) or MS Access (MDB) file formats.
Alarm Management and Display
Infilink-HMI provides a complete alarm management and display system available from any window in your application. Operators can view and acknowledge alarm conditions quickly using the alarm object. The Alarm History Viewer allows logged alarm events to be searched and filtered.

Key Alarm Functions Include:
- Limit Alarms ~ LowLow to HighHigh
- Discrete Alarms
- Selectable Priority Levels
- Custom Alarm Messages
- Selectable Filtering on History Viewer
- Automatic Printing of Alarms
- Logging of event with User ID
- Print Selected Alarm History Data

MS Access (MDB) File Logging
Use your favorite editor or report generation tools such as Excel, Crystal Reports or MS Access, to organize or analyze your data.

OPC Client
OPC (Object Linking and Embedding for Process Control) is now the standard format for industrial communication drivers. We have added OPC Client functionality to Infilink-HMI. Now you can use any of the OPC communication servers on the market with our product. We recommend using the KEPWare Extreme OPC servers, but you can use the OPC server product of your choice. Infilink also supports AdvancedDDE and NetDDE.

Other Features:
Software Based Protection
Infilink-HMI uses a software based keying system which works on any Windows operating system.

Multi-Platform Operation
Infilink-HMI runs with Windows 98SE, Windows 2000 and Windows NT.

Minimum System Requirements
Pentium 133MHz CPU
32 MB of RAM
50 MB of Free Disk Space
Display Resolution of 640x480 Run Mode, 800x600 Design Mode

Free Development System
Buy Only the Runtimes You Need
Infilink-HMI now offers our complete development system for free. When you download the latest version of Infilink-HMI (4.00 or higher) from our website you have a complete development system. There’s no limitation on the tag count. The provided runtime has a one hour expiration time. When used in combination with a demo version of our 32 bit OPC servers, you have a complete HMI system that can be used by every developer in your organization without spending a dime.

Ordering Information
Runtime Packages with the following Real I/O Tag counts are available:
- 128 I/O Tag Runtime Part # KEPRUN-128
  includes 1 KEPServer driver
- 256 I/O Tag Runtime Part # KEPRUN-256
  includes 1 KEPServer driver
- 512 I/O Tag Runtime Part # KEPRUN-512
  includes 1 KEPServer driver
- Unlimited I/O Tag Runtime Part # KEPRUN-0000
  includes 1 KEPServer driver
Note: Internal or Memory tags are not counted as part of your licensed tag count.

Download a fully functional version of Infilink-HMI from our website at: www.kep.com
Description
KEPServerEX is the latest generation of KEPware’s OPC server technology. Building upon the original KEPserver, KEPServerEX has incorporated many of the features requested by KEPware’s customers. In addition to customer driven enhancements, many technological changes have occurred. These features and enhancements have all been made with the goal of providing an OPC server that demonstrates unparalleled compatibility and performance. A few of the enhancements are transparent to the user, but there are a number of new features that are readily apparent and directly available to the user. The following sections will describe the primary features of KEPServerEX.

Application Connectivity
KEPServerEX supports the following client server technologies:
OPC Data Access Version 1.0a & 2.0
DDE Format CF_Text, XL_Table & AdvancedDDE

Device Connectivity
KEPServerEX allows you to use a number of communications drivers concurrently.

Runs as NT Service
KEPServerEX supports running as a service under Windows NT/2000. Service operation is completely user configurable from the Tools|Options menu and can be changed at any time allowing you to move from normal stand alone program operation to NT service mode.

Data Scaling
KEPServerEX now supports direct scaling of device data. Scaling allows raw device data to be converted to engineering units for OPC client applications. KEPServerEX provides a number of unique scaling features that make it easy to implement scaling in your application.

On-Line Full Time
The full time on-line mode of operation allows a KEPServerEX project to be modified while the server continues to supply data to client applications. Almost every parameter can be changed while the server is operating.

User Management
KEPServerEX includes a built-in User Manager that allows complete control over what types of functionality each individual user can access.

Tag Management
KEPServerEX’s new user defined tag management features allow you to create a tag database structure that fits the nature of your application.

Automatic Tag Database Generation
The Automatic Tag Database Generation feature brings OPC technology one step closer to Plug and Play operation. Drivers that support this feature can either read tag information directly from a device or generate tags from stored tag data.

Diagnostics
KEPServerEX’s new diagnostic features provide real-time data on the performance of your communication driver. All read and write operations can be viewed in the diagnostic display window of KEPServerEX or can be tracked directly in your OPC client application by using its built-in diagnostic tags.

Modem Support
KEPServerEX supports the use of modems on all serial communication drivers. Modem control is provided by a set of new modem tags.

OPC Quick Client
KEPServerEX includes an extensive OPC Quick Client application to aid in the development of your OPC applications.

Visual Basic Examples
The simple and complex VB examples included with KEPServerEX are well commented and provide additional pointers for using OPC servers in your VB applications.

System Requirements:

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System: Windows 98</td>
<td>Windows NT 4.0 SP5 or better</td>
</tr>
<tr>
<td>Processor: Pentium 200MHz</td>
<td>Pentium 400MHz</td>
</tr>
<tr>
<td>Ram: 32 MB</td>
<td>64 MB</td>
</tr>
<tr>
<td>Disk Space: 10 MB</td>
<td>10 MB</td>
</tr>
</tbody>
</table>

NOTE: While KEPServerEX will run on Windows 95 and Windows 98 we strongly recommend the use of either Windows NT 4.0 SP5 or Windows 2000 for use in industrial applications.

For More Information call KEPlware, Inc.
KEPlware • 81 Bridge Street • Yarmouth, Maine 04096
Phone: 207-846-5881 • Fax: 207-846-5947 • http://www.OPCSource.com
Features

- Start/Stop Buttons and Remote Inputs
- Programmable K-Factor
- Batch Total and Grand Total
- Two DPDT Relay Outputs for Two Stage Shut Off
- Pulse Input to 20 kHz Count Frequency

Description:
The FLOWtrol is a batch controller intended for use with pulse producing flowmeters. The FLOWtrol offers control outputs consisting of DPDT Relays rather than SPDT Relays. The Flowtrol may be applied in existing applications seeking to expand their batching operations with compatible units.

The FLOWtrol was the fore runner to the BATCHtrol II. However, it lacks the rate display, analog input and Easy Preset capabilities now available in the BATCHtrol II. The BATCHtrol II is recommended for all new applications.

Specifications:
Display: 8 digit, .55" high, 15 segment bright LED.
Input Power:
A) 115 VAC ±15% or 12 to 27 VDC
B) 230 VAC ±15% or 12 to 27 VDC
Current: 280 mA DC max. or 5.3 VA (5.3W) at rated AC voltage.
Output Power: (on AC powered units only)
+12 VDC @ 100 mA and separate isolated 12 VDC @ 100 mA to allow ±12 VDC or +24 VDC, regulated ±5% worst case.
Input: (count/start/stop/reset)
High: 3 to 30 VDC
Low: open or <1 VDC
Impedance: 20 kHz max.
Thresholds: High: 3 to 30 VDC; Low: open or <1 VDC
Debounce filtering: Positive edge triggered, 3 μsec/61 μsec/5 msec selectable
Control Output: (preset and prewarn)
DPDT relay, 5 amp, 115 or 230 VAC
Temperature: 32° to 132°F (0° to 55°C)
Humidity: 0 to 90% (non-condensing)
Memory: EEPROM stores all program and data count for minimum of 10 years if power is lost.
Dimensions: See BATCHtrol II

Example FLO8 A 1

<table>
<thead>
<tr>
<th>Ordering Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example KFC8 A 3A 2 E 1 3</td>
</tr>
<tr>
<td>KEPtrol F/C Measures Net Flow of Boiler Fuel</td>
</tr>
<tr>
<td>Operating Voltage:</td>
</tr>
<tr>
<td>A: 110 VAC ±15% or 12 to 27 VDC</td>
</tr>
<tr>
<td>B: 220 VAC ±15% or 12 to 27 VDC</td>
</tr>
<tr>
<td>Control Inputs:</td>
</tr>
<tr>
<td>*A: 0-40 CPS (Inputs 3A, 3B)</td>
</tr>
<tr>
<td>*C: 0-400 CPS (Inputs 3A, 3B)</td>
</tr>
<tr>
<td>*E: 0-10K CPS (Inputs 3A, 3B)</td>
</tr>
<tr>
<td>* Dip switch selectable, all units can be field modified easily.</td>
</tr>
<tr>
<td>Options: (Multiple Options Available)</td>
</tr>
<tr>
<td>1: RS232 Serial Interface</td>
</tr>
<tr>
<td>2: RS422 Serial Interface</td>
</tr>
<tr>
<td>3: 4-20 mA Output (Input 3A or 3B only)</td>
</tr>
<tr>
<td>3X: 0-20 mA Output (Input 3A or 3B only)</td>
</tr>
<tr>
<td>3Y: 0-5VDC Output (Input 3A or 3B only)</td>
</tr>
<tr>
<td>3Z: 0-10VDC Output (Input 3A or 3B only)</td>
</tr>
<tr>
<td>ET: Extended Temperature -40°F to 158°F (-40° to 70°C)</td>
</tr>
<tr>
<td>ET not available with analog outputs</td>
</tr>
<tr>
<td>CSA: CSA Approved Unit (pending)</td>
</tr>
</tbody>
</table>
MASSbatch

Features
- Display Mass or Corrected Volume, Rate, Grand Total, Temperature or Density
- Accepts 4-30V Inputs or Pulses Directly From Magnetic Pickup Meters (no pre-amp required)
- Takes a Direct 100Ω Platinum RTD or Analog Signal For Compensation Input
- RS232/422 Communications (optional)
- Scalable 4-20mA Output of Rate/Total

Description:
Featuring 8 digits of bright, .55”, alphanumeric display, the MASSbatch can accept up to 10,000 pulses per second and a direct 100Ω platinum RTD or analog input. The MASSbatch has two separate, 8 digit, floating decimal, “K” factors to convert the inputs to meaningful total and rate data. The user, with the push of a button, can toggle back and forth to view the total of the batch, the rate of flow, temperature or density and the grand total. Two control outputs are provided for two-stage valve control.

A scaled pulse output is also provided by an open collector driver. Since the output frequency is user selectable at 10, 200, 2K or 20K Hz, the unit can transmit the count data to remote electromechanical or electronic counters as well as computers, programmable controllers or other monitor equipment.

An optional analog output allows the user to select low and high settings to control strip recorders or other peripherals.

Specifications:
- **DISPLAY:** 8 Digit, .55” High, 15 Segment, Red Orange, LED.
- **INPUT POWER:** (Internally Fused)
  - A: 110 VAC ±15% or 15 to 27 VDC
  - B: 220 VAC ±15% or 15 to 27 VDC
- **CURRENT:** Maximum 350 mA DC or 8.8 VA (8.8W) at rated AC voltage.
- **OUTPUT POWER:** (On AC powered units only):
  - +12 VDC at 100mA. Separate Isolated 12 VDC at 100mA to allow +12 VDC or +24 VDC regulated +5% worst case.
  - The 24VDC Output is supplied with a self resetting fuse.
- **MEMORY:** EEPROM stores all program and total data for minimum of 10 years if power is lost.
- **PULSE INPUT:**
  - 3A: (Standard) 4-30VDC 30 k Ohm impedance to GND, 10 kHz max. input speed (min. on/off 50µsec.).
  - 3C: (Magnetic Pickup) 30mV to 30V P/P min., 2 Hz to 5 kHz Input Speed.
- **ENVIRONMENTAL:**
  - Temperature:
    - Operating: +41°F (5°C) to +130°F (+54°C).
    - Storage: -40°F (-40°C) to +200°F (+93°C).
  - ET: Extended Temperature -40° to 158°F (-40° to 70° C)
  - Humidity: 0-90% Noncondensing
  - Dimensions: See BATCHtrol II
  - Listing: CE Compliant, UL/CSA Pending
- **FACTORED OUTPUT:**
  - The MASSbatch gives one pulse out for each factored count. The open collector sinks 30 VDC maximum to 1 volt maximum at 100mA maximum. Output speed is user selectable (see table below). An internal buffer holds up to 10,000 pulses for output at the selected frequency before “DATALOST” flashes, indicating pulses are lost. If factored rate exceeds 7 digits “RFF…” flashes. These alarms indicated that speed has been exceeded.

**Ordering Information**

**Example:** MB8 A 3A 2 H R 3
**Series:** MASSbatch
**Operating Voltage:**
- A: 110 VAC ±15% or 15 to 27 VDC
- B: 220 VAC ±15% or 15 to 27 VDC
**Count Inputs:**
- 3A: (STD) Pulse 4-30 VDC 10 kHz Max. (jumper selectable)
- 3C: (Mag. Pickup) 30mV 2 Hz to 10 kHz (jumper selectable)
**Control Outputs:**
- 1: Open Collector
- 2: SPDT Relay 10A
**Input Speed:**
- L: (Low Speed) 0-40 Hz
- H: (High Speed) 0-10 kHz
**Options:** (Multiple Options Available)
- R: RTD and 4-20mA input (jumper selectable) ....... Standard
  - 1: RS232 Serial Interface
  - 2: RS422 Serial Interface
  - 3: 4-20 mA Output (jumper selectable)
  - 3Y: 0-5VDC Output (jumper selectable)
  - 3Z: 0-10VDC Output (jumper selectable)
  - 4: 16 Point Linearization
- ET : Extended Temperature:
  - -40° to 158°F (-40° to 70° C)
  - CSA: CSA Approved Unit (pending) ............ (consult factory)

**Accessories:**
- FLEXCOVER #26120
- XTROL7/4- Explosion proof housing, see XTROL 7/4
- NEMA 4X wall mount enclosure available, see NEMATROL
- Serial printer available, see P1000, P295
- Ethernet Port Server available, see IEPS
- RS-422/485 to RS-232 Communication Adaptor available, see CA285
**XTROL 7/4**

**Expansion Proof Housing for 'trol Products**

**Features:**
- Compatible with all Standard Size "trol" and "SUPERtrol" Family of Products
- Meets NEMA 7 & 4 Specs.
- For use in Class 1, Division 1, Groups C & D
- For use in Class 2 & 3, Division 1, Groups E, F & G
- FM, CSA Approved
- Specials Available for Custom Conduit Entries

**Specifications:**
This housing is designed and manufactured in compliance with FM Standards 3600 & 3615 and CSA Standard C22.2 No. 30-M1986 for use in Class I, Division I, Groups C & D and Class II an III, Division I, Groups E, F & G hazardous locations. It is certified by:

ADALET
FM (file# J02A6.AE)
CSA (file # LR36172).

It is made from cast aluminum and sealed to meet NEMA 7 and 4 specifications. This is accomplished by neoprene gaskets retained in machined grooves in the covers and buttons.

The front button actuators have the same easy-to-use keypad layout that has become the trademark of the KEP "trol" and "SUPERtrol" series. 6 blind threaded holes are provided for mounting with 2 each 1/2" NPT openings for wiring.

To install a unit, the 16 front 3/16" allen screws must be removed and the "trol" mounted in the sub panel provided.

If the assembly option is ordered, only the 8 back cap screws need to be removed to complete the wiring to an optional pluggable connector.

Empty weight is 26 lbs.

<table>
<thead>
<tr>
<th>XTROL 7/4*</th>
<th>Example: X</th>
<th>BT2</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series:</strong></td>
<td>XTROL7/4 (housing only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mounting Hardware:</strong></td>
<td>(Includes labels and two piece connector)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT2 = BATCh'trol II</td>
<td>MB = MASSbatch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLO = FLOWtrol</td>
<td>KFC = KEP'trol F/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KP8 = KEP'trol</td>
<td>Controllers sold separately</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KRT = KEP'trol R/T</td>
<td>MFC = Mass Flow Computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DFPC = DPFC</td>
<td>ST1** = SUPERtrol-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST1LE** = SUPERtrol-I LE</td>
<td>ST2** = SUPERtrol-II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT2** = LEVELtrol-II</td>
<td>X = No Mounting Hardware</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Assembly By KEP:**
A = Assembled by KEP
X = No Assembly

**Note:** When placing the order, the unit part number directly following the XTROL part number on the Purchase Order is the one that will be assembled into the XTROL housing.

**See also XHV series enclosure.**

**Assembly:**

If HOUSING ONLY is purchased, all front allen screws and front must be removed. Remove four allen screws so that the 'trol product can be mounted in the internal bracket (gasket not used; top of bracket is the thinner side). Wiring should be done before installing 'trol in the housing unless the MOUNTING HARDWARE with two piece connector is purchased. If the unit is assembled by KEP, only remove the back plate. The pluggable connector can be wired at back.
XHV Series

**Features:**
- Available for 1/8 DIN and DIN 144 x 72 mm Cases
- Meets NEMA 7 & 4 Specs.
- For use in Class 1, Division 1, Groups C & D
- For use in Class 2 & 3, Division 1, Groups E, F & G
- UL, cUL Approved
- Magnetic Reset Switch Available

**Specifications:**
This housing is designed and manufactured in compliance with UL Standard No. 1203 and was investigated to CSA Standard C22.2 No. 30-M1986 by UL for use in Class 1, Division 1, Groups C & D and Class II & III, Division I, Groups E, F & G hazardous locations.

**Certified by:**
ADALET
UL (file# E81696)

The housing is made from cast aluminum and sealed to meet NEMA 7 and 4 specifications.

To install a unit, the cover must be removed and the KEP unit mounted in the sub panel provided.

**Empty weight:**
- XHV = 19 lbs.
- XHVD = 22 lbs.

**Ordering Information**

<table>
<thead>
<tr>
<th>Example: XHV 7/4 A A S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series:</td>
</tr>
<tr>
<td>XHV 7/4 (8.5&quot; high for INT69, MRT, Reporter, etc.)</td>
</tr>
<tr>
<td>XHVD 7/4 (11.5&quot; high for SUPERtrol 1 and 2, LEVELtrol II)</td>
</tr>
<tr>
<td>Mounting Sub Panel:</td>
</tr>
<tr>
<td>A = Panel for (1) 1/8 DIN unit (INT69, MRT, etc.)</td>
</tr>
<tr>
<td>B = Panel for (2) 1/8 DIN units (INT69, MRT, etc.)</td>
</tr>
<tr>
<td>C = Panel for (1) DIN 144 x 72mm unit (ST1, ST2, LT2, Reporter)</td>
</tr>
<tr>
<td>Assembly By KEP:</td>
</tr>
<tr>
<td>A = Assembled by KEP</td>
</tr>
<tr>
<td>X = No Assembly</td>
</tr>
<tr>
<td>Options:</td>
</tr>
<tr>
<td>S1 = 1 Magnetic Reset Switch and Magnet</td>
</tr>
<tr>
<td>S2 = 2 Magnetic Reset Switches and Magnet</td>
</tr>
<tr>
<td>Accessories:</td>
</tr>
<tr>
<td>XHVA-1 = Magnetic Switch</td>
</tr>
<tr>
<td>XHVA-2 = Actuating Magnet</td>
</tr>
</tbody>
</table>

**Note:** When placing the order, the unit part number directly following the XHV part number on the Purchase Order is the one that will be assembled into the XHV housing.
NEMAtrol

Features

• Compatible with all Standard Size "trol", SUPERtrol & 1/8 DIN Products
• Meets NEMA 4X/IP65 Specs.
• Quick-Release Latches
• Light Weight

Application:
Ideal for use in most petrochemical plants, sewage plants, food processing areas, packing plants, electroplating plants, etc.

Construction:
• Molded fiberglass reinforced polyester material has excellent chemical resistance and outstanding physical properties.
• Fiberglass material is easily punched, drilled, filed or sawed.
• Oil-resistant gasket attached with oil-resistant adhesive.
• The enclosures have corrosion-resistant fiberglass hinges and spring-loaded fiberglass latches attached with monel screws.

Dimensions:

### Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>ASTM Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural Strength</td>
<td>17,000 PSI</td>
<td>D-790</td>
</tr>
<tr>
<td>Heat Distortion</td>
<td>400°F</td>
<td>D-648</td>
</tr>
<tr>
<td>Water Absorption (24hrs.)</td>
<td>.5%</td>
<td>D-570</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>6,500 PSI</td>
<td>D-651</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.8</td>
<td>D-792</td>
</tr>
<tr>
<td>Flammability</td>
<td>94-5V</td>
<td>UL94</td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>400 V.P.M</td>
<td>D-149</td>
</tr>
<tr>
<td>Arc Resistance</td>
<td>180 Sec.</td>
<td>D-495</td>
</tr>
</tbody>
</table>

### Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMAtrol4X</td>
<td>(NEMA 4X enclosure for all standard &quot;trol units 7.365&quot; x 2.495&quot; cutout)</td>
</tr>
<tr>
<td>NEMAtrol4x0</td>
<td>(no cutout)</td>
</tr>
<tr>
<td>NEMAtrol4x1</td>
<td>(1 cutout)</td>
</tr>
<tr>
<td>NEMAtrol4x2</td>
<td>(2 cutouts)</td>
</tr>
<tr>
<td>NEMAST4X</td>
<td>(NEMA 4X enclosure for SUPERtrol &amp; LEVELtrol II series)</td>
</tr>
<tr>
<td>NEMAST4x1</td>
<td>(1- 5.43&quot; x 2.68&quot; cutout for SUPERtrol series)</td>
</tr>
<tr>
<td>NEMAST4x2</td>
<td>(2- 5.43&quot; x 2.68&quot; cutout for SUPERtrol series)</td>
</tr>
<tr>
<td>NEMA-1/8DIN</td>
<td>(NEMA 4X enclosure for all 1/8 DIN size units)</td>
</tr>
<tr>
<td>NEMA-1/8DIN4x0</td>
<td>(no cutout)</td>
</tr>
<tr>
<td>NEMA-1/8DIN4x1</td>
<td>(1 cutout)</td>
</tr>
<tr>
<td>NEMA-1/8DIN4x2</td>
<td>(2 cutouts)</td>
</tr>
</tbody>
</table>
FEATURES:

- Made of impact and corrosive resistant VELOX®, RAL 7035
- Molded internal bosses for back panel, component mounting and DIN-rails
- NEMA4X / IP66 Rating
- UL 508 and CSA Type 4, 4X, 3, 3R, 12, 13 Rating
- Temperature resistance: Base and opaque cover to +248°F (120°C) per UL 746B. Polycarbonate cover -40°F (40°C) to +248° (120°C)
- Non-Metallic cover screws
- Continuously poured polyurethane gasket
- Cover and bases meet with tongue and groove design for tight seal

Ordering Information:

Part Number:
- LCN4X 1/8 DIN - for all 1/8th DIN products
- LCN4X 1/16 DIN - for all 1/16th DIN products

Options:
- H2 - 0.875” Hole for Hub fitting
- HF2 - 0.5” Female NPT Hub fitting
- 2H2 - Two 0.875” Holes for Hub fittings
- 2HF2 - Two 0.5” Female NPT Hub fittings
- H3 - Three 0.84” Holes for Hub fittings
E200 Plastic Outdoor Enclosure
The E200 is a Plastic NEMA 3R raintight enclosure with hinged door and latch. It offers provisions for mounting up to four of ANY KEP 1/32 DIN sized units. The E200 also offers five combination 1/2"-3/4" knockouts: In bottom, sides and back for easy wiring and conduit connections. Exterior Size: 6.5" x 10" x 3.75" deep. Interior Size: 4.75" x 7.75" x 3" deep. Dark grey plastic finish.

Compatible with all Standard 1/32 DIN Products Including:
- KAL D Series
- KAL D Time Series
- 130K - 136K Series
- 520K - 530K Series

Dimensions:

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E200-0</td>
<td>E200 Enclosure with no cutout</td>
</tr>
<tr>
<td>E200-1</td>
<td>E200 Enclosure with 1 cutout</td>
</tr>
<tr>
<td>E200-2</td>
<td>E200 Enclosure with 2 cutouts</td>
</tr>
<tr>
<td>E200-3</td>
<td>E200 Enclosure with 3 cutouts</td>
</tr>
<tr>
<td>E200-4</td>
<td>E200 Enclosure with 4 cutouts</td>
</tr>
</tbody>
</table>
Features
- Compact Serial Printer (Dot Matrix) for Field Use
- Uses Standard 2.25" Plain Paper Roll
- 24 or 40 Column Printing
- Standard Epson™ Ribbon
- Internal 2KB Buffer
- RS232 With Selectable Baud Rate
- Will Operate for 2 Hours on Internal Batteries for Hand Held Applications

Applications:
- Logging data from KEP instruments
- Remote messages printing
- Real-time-clock (optional) for time and date stamp
- Plain paper for long lasting record keeping

Description:
The P1000 printer is a top quality, impact dot matrix micro printer. It is small, light weight, and low in cost, but extremely powerful in performance. This model is portable and designed for applications where regular desktop printers are unnecessary and space is limited. The P1000 is ideal for many uses such as logging data from KEP instruments, direct recording measurements from digital hand tools or electronic scales, remote message printing and more. It is an excellent service aid permitting print outs of setup information and helps with troubleshooting problems in the field.

Specifications:
Character Types: 448 defined characters include:
96 standard ASCII characters
Math symbols
Printing symbols
Block graphic characters
32 user defined characters

Print Method: Impact Dot Matrix
Character: Standard characters 5x7 dot matrix
compositions:
Block graphic char. 6x8 dot matrix
User definable char. 6x8 dot matrix

Dimension: 7" x 4" x 3.25"

Baud Rate: Selectable baud rate & parity setting by key combinations (1200,2400,4800,9600)

Print Speed: 40 lines per minute

Control Commands: 35 codes, IBM/EPSON

Input Buffer: 2k bytes (expandable to 4k)

Interface: RS-232C, 25 pin D-SUB, RS connector

Power: 7.5 volt DC input, max. current
750mA with Internal Battery Pack
110V AC/DC to 7.5V DC adapter supplied.

Paper: Plain adding machine type paper roll, internal mounting up to 130' x 2.25" size roll

Ink Ribbon: Porelon ERC 09 or equivalent

Options:
220V AC/DC adapter (spare)
12VDC adapter
Real Time Clock for time and date stamp at command

Ordering Information
EXAMPLE P1000 1 C
Series
P1000 Printer
Operating Voltage
1 = 110V AC adaptor
2 = 230V AC adaptor
3 = 12V DC power cord
Options
C = Real Time Clock
(not required for ST1, ST1 LE, ST2, LT2)

Accessories
P1AR = Ink Ribbon
P1AA230 = 230V Adapter (spare)
P1AA110 = 110V/Adapter (spare)
P1AC25M9MC = 6’, Printer cable for ST1 & ST2
P1AC25M9FC = 6’, Printer cable for MRT & INT69
P1AC25M25MS = 6’, Printer cable for all ‘trols
Other cables available on request

Kessler-Ellis Products • 800-631-2165
## P295

### Features
- Worlds Smallest Slip Printer
- Only 1.6 Kg
- Epson’s ESC/POS Command Set
- Easy-To-Use Touch Panel
- Four Print Directions
- Auto Eject
- Compatible with KEP instruments

### Description:
Just 1.6kg and ultra compact, the P295 is the worlds smallest slip printer. Select from among 4 print sizes and four printing directions. Or, use page mode to tell the printer where to print the page. The P295 is also equipped with a host of user-friendly features, such as an easy-to-operate touch panel and an automatic paper eject function.

The P295 offers printing capabilities of normal, double and quadruple size print in either horizontal or vertical formats. The P295 will print multi-part copies, original and two copies and supports dual cash drawer capability. The P295 is uses a serial interface and meets all world-wide regulatory requirements including UL, CSA and CE mark. The P295 utilizes the PA295 Universal Power Supply Adaptor which is an auto-switching supply. The P295 is Windows and OPOS compliant.

### Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Method</td>
<td>7-pin, serial impact dot matrix</td>
</tr>
<tr>
<td>Print Font</td>
<td>5 x 7/7 x 7</td>
</tr>
<tr>
<td>Column capacity</td>
<td>35 / 42 columns</td>
</tr>
<tr>
<td>Character size (mm)</td>
<td>1.6 (W) x 2.9 (H) / 1.3 (W) x 2.9 (H)</td>
</tr>
<tr>
<td>Character set</td>
<td>95 Alphanumeric, 32 International, 128 x 3 Graphic</td>
</tr>
<tr>
<td>Characters Per Inch</td>
<td>13.5 CPI / 16.2 CPI</td>
</tr>
<tr>
<td>Interface</td>
<td>RS-232C</td>
</tr>
<tr>
<td>Data Buffer</td>
<td>512 bytes</td>
</tr>
<tr>
<td>Print Speed</td>
<td>2.1 LPS</td>
</tr>
<tr>
<td>Paper</td>
<td>80(W) x 69(L) x to 182(W) x 257(L)</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>0.09 to 0.35</td>
</tr>
<tr>
<td>Copy Capability</td>
<td>One original and two copies</td>
</tr>
<tr>
<td>Inked Ribbon</td>
<td>ERC-27 (Purple)</td>
</tr>
<tr>
<td>Power</td>
<td>24 VDC± 10%</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>Approx. 600 mA</td>
</tr>
<tr>
<td>Overall</td>
<td>180(W) x 19.5(D) x 101.5(H) mm</td>
</tr>
<tr>
<td>Dimensions</td>
<td>1.6 kg (Approx)</td>
</tr>
<tr>
<td>Weight</td>
<td>UL / C-UL / TUV</td>
</tr>
<tr>
<td>EMI Standard</td>
<td>VCC # 1, FCC class A, CE marking</td>
</tr>
<tr>
<td>Safety Standards</td>
<td></td>
</tr>
</tbody>
</table>

### How To Order:

**EXAMPLE**

<table>
<thead>
<tr>
<th>P295 Slip Printer</th>
</tr>
</thead>
</table>

### Accessories
- PA295 = Universal AC Power Supply Adaptor
- PA295DC = Power Supply Adaptor for DC Operation
- P2CA25M9ML6 = 6' Serial Cable for SUPERtrol I, SUPERtrol ILE, LEVELtrol II, SUPERtrol II

**115 Series**  
*Cased Power Supply*

**Features:**
- Screw Terminal Connections
- 250 mA of Regulated Power at 5 and 12 VDC
- 115/230 Volt 50/60 Hz Input
- Easily Mounted
- 5, 12 and 24 VDC Models

**Power Supplies:** 115-5, 115-12, 115-24

**Applications:**
A compact supply to power various DC operated peripherals and inputs/output modules on PLC’s, or transmitters in process control.

**Description:**
This module converts 115 VAC to DC. The 115-5 and 115-12 provide 250 mA of regulated DC for all of your 5VDC and 12VDC applications. Model 115-24 is available for all regulated 24VDC at 100mA applications.

**Listing:** CE Compliant

**Sample Hookup to KAL-D R/T**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COMMON</td>
</tr>
<tr>
<td>2</td>
<td>SLOW SPEED INPUT</td>
</tr>
<tr>
<td>3</td>
<td>PERIOD/GATED MODE SELECT</td>
</tr>
<tr>
<td>4</td>
<td>HIGH SPEED INPUT</td>
</tr>
<tr>
<td>5</td>
<td>+10 to +30 VDC SUPPLY</td>
</tr>
</tbody>
</table>

**Ordering Information**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>115-5</td>
<td>115VAC to 5VDC for all 5 Volt applications</td>
</tr>
<tr>
<td>115-12</td>
<td>115VAC to 5VDC for all 12 Volt applications</td>
</tr>
<tr>
<td>115-24</td>
<td>115VAC to 5VDC for all 24 volt applications</td>
</tr>
<tr>
<td>230-24</td>
<td>230VAC to 5VDC for all 24 volt applications</td>
</tr>
</tbody>
</table>

**Options:**
E-Explosion Proof Housing (add E to end of part number)

**Mounting:** (115 & AMP-1 Series)

---

**AMP-1**  
*Preamp & Signal Conditioner for Magnetic Pickups*

**Features:**
- Ultra Low Speed to 15 kHz Operation.
- 20 mV to 50 V Sensitivity.
- 100 mA Current Sinking Output.
- 11 to 26 VDC Power Supply Range.
- Easy Mount Metal Housing.
- Screw Mount Terminal Housing.

**Description:**
The KEP AMP 1 amplifies the low level signals from a magnetic pickup or flow transmitter by a factor of more than a hundred times to drive any ratemeter, counter or controller. The unit uses only 30 mA and operates from 11 to 26 VDC. It has a 2.7K pullup resistor attached to the open collector output and sinks a minimum of 100 mA to less than 1 V from a maximum of 26 VDC. It is mounted in a rugged 2” x 3” metal housing with screw terminals for easy installation. Operating temperature is 32 to 140°F (0 to 60°C).

**Note:** The low voltage line from the magnetic pickup to the AMP-1 should be less than 10 ft. in length, shielded and isolated from relays, solenoids or other sources of electrical noise (let the output line make the long run). If the input is too sensitive, lower the 1.1k input impedance by adding a 220 to 1K ohm resistor across TB1, pins 1 and 2, to increase noise immunity.

A special version, the AMP1-10k, is available with 10 kΩ impedance for use with turbine and paddle wheel flowmeters.

**Listing:** CE Compliant

**Sample Hookup**

**Ordering Information**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMP 1:</td>
<td>Standard unit</td>
</tr>
<tr>
<td>AMP-1-10k:</td>
<td>AMP-1 with 10 kΩ input impedance</td>
</tr>
</tbody>
</table>

**Options:**
E-Explosion Proof Housing (add E to end of part number)
### SPARE PARTS

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 36120</td>
<td>Flex Cover</td>
</tr>
<tr>
<td>KRTBEZEL</td>
<td>Front panel bezel for KEPTrol R/T</td>
</tr>
<tr>
<td>BT2BEZEL</td>
<td>Front panel bezel for BT2</td>
</tr>
<tr>
<td>KEPTROLBEZEL</td>
<td>Front panel bezel for KEPTrol</td>
</tr>
<tr>
<td>MFCBEZEL</td>
<td>Front panel bezel for MASSStrol</td>
</tr>
<tr>
<td>FLOWBEZEL</td>
<td>Front panel bezel for FLOWtrol</td>
</tr>
<tr>
<td>DPFCBEZEL</td>
<td>Front panel bezel for DPFC</td>
</tr>
<tr>
<td>MBBEZEZL</td>
<td>Front panel bezel for MASSbatch</td>
</tr>
<tr>
<td>LVTBEZEL</td>
<td>Front panel bezel for LEVELtrol</td>
</tr>
<tr>
<td>KFCBEZEL</td>
<td>Front panel bezel for KEPTrol F/C</td>
</tr>
<tr>
<td>ST1LELCDFRONT</td>
<td>LCD Front panel assembly for SUPERtrol LED</td>
</tr>
<tr>
<td>ST1LEVFDFRONT</td>
<td>VFD Front panel assembly for SUPERtrol LED</td>
</tr>
<tr>
<td>ST1LCLCDFRONT</td>
<td>LCD Front panel assembly for SUPERtrol I</td>
</tr>
<tr>
<td>ST1LVFDFRONT</td>
<td>VFD Front panel assembly for SUPERtrol I</td>
</tr>
<tr>
<td>ST2LCDFRONT</td>
<td>LCD Front panel assembly for SUPERtrol II</td>
</tr>
<tr>
<td>ST2VFDFRONT</td>
<td>VFD Front panel assembly for SUPERtrol II</td>
</tr>
<tr>
<td>LT2LCDFRONT</td>
<td>LCD Front panel assembly for LEVELtrol II</td>
</tr>
<tr>
<td>LT2VFDFRONT</td>
<td>VFD Front panel assembly for LEVELtrol II</td>
</tr>
<tr>
<td>KPCASE</td>
<td>Case for KEPTrol</td>
</tr>
<tr>
<td>KRTCASE</td>
<td>Case for KEPTrol R/T</td>
</tr>
<tr>
<td>BT2CASE</td>
<td>Case for BT2</td>
</tr>
<tr>
<td>FIOCASE</td>
<td>Case for Flowtrol</td>
</tr>
<tr>
<td>MASSCASE</td>
<td>Case for MASSStrol</td>
</tr>
<tr>
<td>DPFCASE</td>
<td>Case for DPFC</td>
</tr>
<tr>
<td>ST1LREAR</td>
<td>Rear Case for SUPERtrol LED</td>
</tr>
<tr>
<td>ST1REAR</td>
<td>Rear Case for SUPERtrol I</td>
</tr>
<tr>
<td>ST2REAR</td>
<td>Rear Case for SUPERtrol II</td>
</tr>
<tr>
<td>LT2REAR</td>
<td>Rear Case for LEVELtrol II</td>
</tr>
<tr>
<td>Model 34503</td>
<td>Mounting Kit for: ST1 series, ST2 series, LT2 series, INT69 series, BEACON series</td>
</tr>
<tr>
<td>STMOUNT</td>
<td>Mounting Kit for: ST1 series, ST2 series, LT2 series, INT69 series, BEACON series</td>
</tr>
<tr>
<td>TROLCLAMP</td>
<td>Mounting Kit (4 clamps &amp; gasket)</td>
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