ES-761

Net Energy Flow Computer for Saturated Steam Energy & Condensate Return Energy

- Computes New Energy
    Flowmeter And Temperature Or Pressure On Saturated Steam Input
    Temperature On Condensate Return Output

- Use Any Flow Meter Type- Menu Selectable

- Isolated Pulse, Analog, And Relay Outputs

- Built In Data-Logger Accessible From Standard RS232

- Optional RS485 Modbus RTU Communication Port

- Internal Communication Card Option
    Supports: BACnet IP, BACnet MS/TP, Metasys N2, Modbus TCP, AB Ethernet IP, AB DF1, LonWorks*

- Windows Setup Software

- Easily Configurable Through Keypad

- Remote Metering Supported

- Enhanced Features Include Stacked DP Transmitters, Peak Demand

- Offers Full Line Of Other Flow Computations Supported As Standard

- DDE Server & HMI Software Available

- Remote Metering by Wireless or Modem

Description of Enhanced Capabilities

Many of today's flow meters offer multiple outputs which are assignable to flow and temperature. The ES761ST2 offers enhanced functionality to permit these multiple outputs to be used with added flexibility. This flexibility is utilized in common applications such as when computing the net energy of saturated steam energy in minus condensate return energy out. Flow and Temperature can be measured at the multi-variable flow meter. A separate temperature measurement can be made in the condensate. The ES761 then computes the mass flow of steam as well as the input energy of steam from the available input sensors on steam, will also compute, the energy in the condensate return, and will compute the net energy. Refer to diagram which follows.

Addition Capabilities

1. Increased uses for compensation input 2
2. Increase variety of new flow meter types including verabar, accelebar, and mass flow meters.
3. Increased variety of selections on:
    Display Scroll List
    Print List
    Current Outputs
    Relay Outputs
    RS232 Interface
    RS485 Interface

The ES761 preserves the core functionality offered by the Supertrol-2 family including the ES749 which can be summarized as follows:
The ES761ST2 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.

* LonWorks protocol requires a different module assembly from the other available protocols. LonWorks is not field selectable.

The versatility of the Flow Computer permits a wide measure of applications 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 the volume flow, corrected volume flow, mass flow, heat 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 logging, or transaction printing, or for connection to a modem for remote meter reading.

A PC Compatible software program is available which permits the user to rapidly redefine the instrument configuration.

NX-19
Advanced Natural Gas calculations where the user requires compensation for compressibility effects. Compensation for these compressibility effects are required at medium to high pressure and are a function of the gas specific gravity, % CO_2, % Nitrogen, as well as temperature and pressure. The compressibility algorithm used is that for NX-19.

Stacked differential pressure transmitter
This feature permits the use of a low range and high range DP transmitter on a single primary element to improve flow transducer and measurement accuracy.

Peak demand
This feature permits the determination of an hourly averaged flow rate. Demand last hour, peak demand and time/date stamping for applications involving premium billing.

Data logging
This feature provides data storage information in 64k of battery backed RAM. Items to be logged, conditions to initiate the log and a variety of utilities to clear and access the data via the RS-232 port are provided.

EZ Setup
The unit has a special EZ setup feature where the user is guided through a minimum number of steps to rapidly configure the instrument for the intended use. The EZ setup prepares a series of questions based on flow equation, fluid, and flowmeter type desired in the application.

1.2 Specifications:

Environmental
Operating Temperature: 0 to +50°C (std)
Storage Temperature: -40 to +85°C
Humidity : 0-95% Non-condensing

Approvals: CE Approved Light Industrial

Display
Type: 2 lines of 20 characters
Types: Backlit LCD, OLED and VFD options, 0.2" characters
User selectable label descriptors and units of measure

Keypad
Keypad Type: Membrane Keypad, 16 Raised Keys
Keypad Rating: Sealed to NEMA 4X / IP65

Enclosure
Enclosure Options: Panel, Wall, Explosion Proof
Size: See Case Dimensions

NX-19 Compressibility Calculations

Temperature	-40 to 240 F
Pressure	0 to 5000 psi
Specific Gravity	0.554 to 1.0
Mole % CO_2	0 to 15%
Mole % Nitrogen	0 to 15%

Power Input
The factory equipped power options are 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 Option:
    85 to 276 Vrms, 50/60 Hz
    Fuse: Time Delay Fuse, 250V, 500mA
DC Power Option:
    24 VDC (16 to 48 VDC)
    Fuse: Time Delay Fuse, 250V, 1.5A

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

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
    Basic Measurement Resolution: 16 bit
    Update Rate: 2 updates/sec minimum
    Automatic Fault detection
    Calibration: Operator assisted learn mode. Learns Zero and Full Scale of each range
    Optional: Stacked DP transmitter 0-20 mA or 4-20 mA
Pulse Inputs:
    Number of Flow Inputs: one
    Input Impedance: 10 kΩ nominal
    Trigger Level: (menu selectable)
    Minimum Count Speed: 0.25 Hz
    Maximum Count Speed: Selectable: 0 to 40 kHz

Temperature, Pressure, Density Inputs
The compensation inputs usage are menu selectable for temperature, temperature 2, pressure, density, steam trap monitor or not used.

Calibration: Operator assisted learn mode
Accuracy: 0.02% FS
Thermal Drift: Less than 100 ppm/C
Basic Measurement Resolution: 16 bit
Update Rate: 2 updates/sec minimum
Automatic Fault detection:

Available Input Ranges
    (Temperature / Pressure / Density / Trap Monitor)
    Current: 4-20 mA, 0-20 mA
    Resistance: 100 Ohms DIN RTD, 3 Wire

100 Ohm DIN RTD (DIN 43-760, BS 1904):
    Three Wire Lead Compensation
    Internal RTD linearization learns ice point resistance
    Temperature Resolution: 0.1°C, Accuracy ± 0.5°C

Datalogger
Type: Battery Backed RAM
Size: 64k
Initiate: Key, Interval or Time of Day
Items Included: Selectable List
Data Format: Printer or CSV Access via RS-232 command

Stored Information (ROM)
Steam Tables (saturated & superheated), General Fluid Properties, Properties of Water, Properties of Air, Natural Gas

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

RS-232 Communication
Uses: Printing, Setup, Modem, Datalogging
Baud Rates: 300, 1200, 2400, 9600
Parity: None, Odd, Even
Device ID: 0 to 99
Protocol: Proprietary, Contact factory for more information
Chassis Connector Style: DB 9 Female connector

RS-485 Communication (optional)
  Uses: Network Communications
  Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200
  Parity: None, Odd, Even
  Device ID: 1 to 247
  Protocol: ModBus RTU

Excitation Voltage
  24 VDC @ 100 mA overcurrent protected

Relay Outputs
  The relay outputs usage is menu assignable to (Individually for each relay) Hi/Lo Flow Rate Alarm, Hi/Lo Temperature Alarm, Hi/Lo Pressure Alarm, Pulse Output (pulse options), Wet Steam or General purpose warning (security).
  (Peak demand and demand last hour optional)

  Number of relays: 2 (3 optional)
  Contact Style: Form C contacts (Form A with 3 relay option)
  Contact Ratings: 240 V, 1 amp

Analog Outputs
  The analog output usage is menu assignable to correspond to the Heat Rate, Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Density, or Pressure.
  (Peak demand and demand last hour optional)

  Number of Outputs: 2
  Type: Isolated Current Sourcing (shared common)
  Isolated I/P/C: 500 V
  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
Calibration: Operator assisted Learn Mode
Averaging: User entry of DSP Averaging constant to cause an smooth control action

Isolated Pulse output
  The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total, Heat Total or Mass Total.
  Isolation I/O/P: 500 V
  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

Real Time Clock
  The Flow Computer is equipped with a battery backed real time clock with display of time and date.
  Format:
        24 hour format for time
        Day, Month, Year format for date
        Daylight Savings Time (optional)


Saturated Steam Delta Heat
Measurements:
Measures actual volume flow and pressure of the saturated steam in the supply piping as well as the temperature of the condensate in the downstream piping of a heat exchanger.

Calculations:
· Calculates density, mass flow as well as the delta heat between the saturated steam (supply) and condensation (return) using physical characteristic tables of steam and water stored in the flow computer.
· With square law device measurement the actual volume is calculated from the differential pressure, taking into account temperature and pressure compensation.
· The saturated steam properties in the supply line is calculated from the pressure (or temperature) measured there.

Steam Delta Heat Illustration
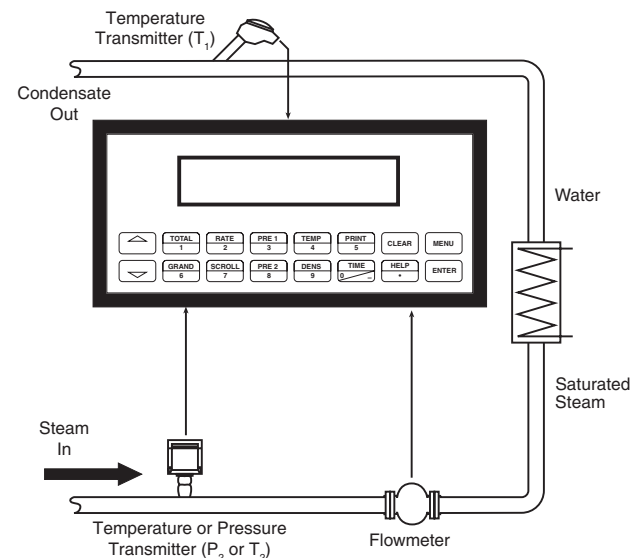
Calculations

Delta Heat Flow

Net Heat Flow = Volume flow • density $(P_2$ or $T_2)$ • $[E_D$ $(P_2$ or $T_2)- E_W$ $(T_1)]$

E_D =   Specific enthalpy of steam implied by either T_2 or P_2
E_w =   Specific enthalpy of water implied by T_1

Note: Assumes a closed system.

Terminal Designations

Terminal	Designation
1	DC OUTPUT
2	PULSE IN — FLOW IN: Vin (+), lin (+)
3	- - - - - - - - -
4	COMMON
5	RTD EXCIT (+) — TEMPERATURE IN: lin (+)
6	RTD SENS (+)
7	RTD SENS (-)
8	DC OUTPUT
9	RTD EXCIT (+) — PRESSURE (TEMP 2) IN: lin (+)
10	RTD SENS (+)
11	RTD SENS (-)
12	PULSE OUTPUT (+)
13	PULSE OUTPUT (-)
14	ANALOG OUTPUT 1 (+)
15	ANALOG OUTPUT 2 (+)
16	ANALOG OUTPUT COMMON (-)
17	NO
18	COM RLY1
19	NC
20	NC
21	COM RLY2
22	NO
23	AC LINE — POWER IN: DC (+)
24	AC LINE — POWER IN: DC (-)

Internal Multi-protocol Communication Card Option

FEATURES
- Internal communication card eliminates the need for external protocol converters.
- Supports: BACnet IP, BACnet MS/TP, Metasys N2, Modbus TCP, AB Ethernet IP, AB DF1, LonWorks*
- Easy to configure via the Web Interface.
- Dedicated internal LonWorks is also available
- Dedicated internal RS485 Modbus RTU is also available

DESCRIPTION
The multi-protocol communication card is an internal, high performance, Building Management System communication solution for the ST2 flow computer family. The card provides an instant interface, enabling the KEP flow computers to communicate with multiple BMS protocols, including:
- BACnet MS/TP
- BACnet IP
- Modbus TCP
- Metasys N2
- AB DF1
- AB EtherNet/IP
- LonWorks*

CONFIGURATION
Use a web browser to locate the internal web page and configure the settings. The detailed settings vary with the different communication protocols. Only one communication port/protocol can be used. A web browser is also used to configure the site specific settings for each instrument
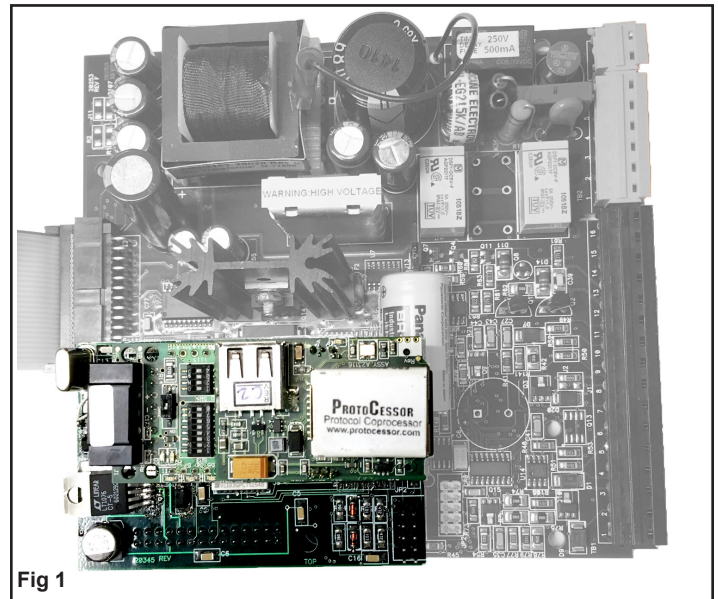

Fig 1

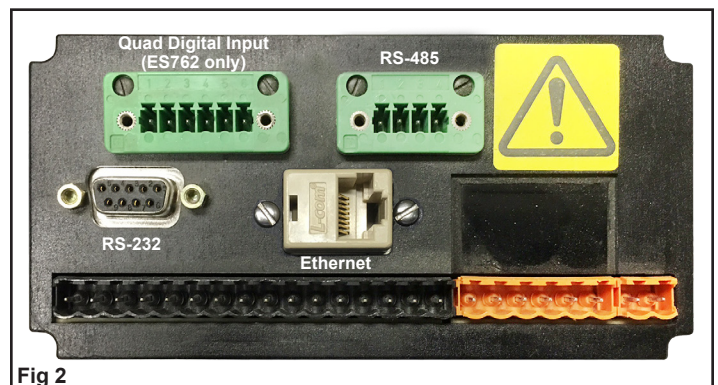*Top view of multi-protocol card installed on ES749 mother board*

Fig 2

Rear view of ES749 case.
Communication ports are available for RS-485 and Ethernet

The Web Interface makes it easy to configure.

Configuration Parameters

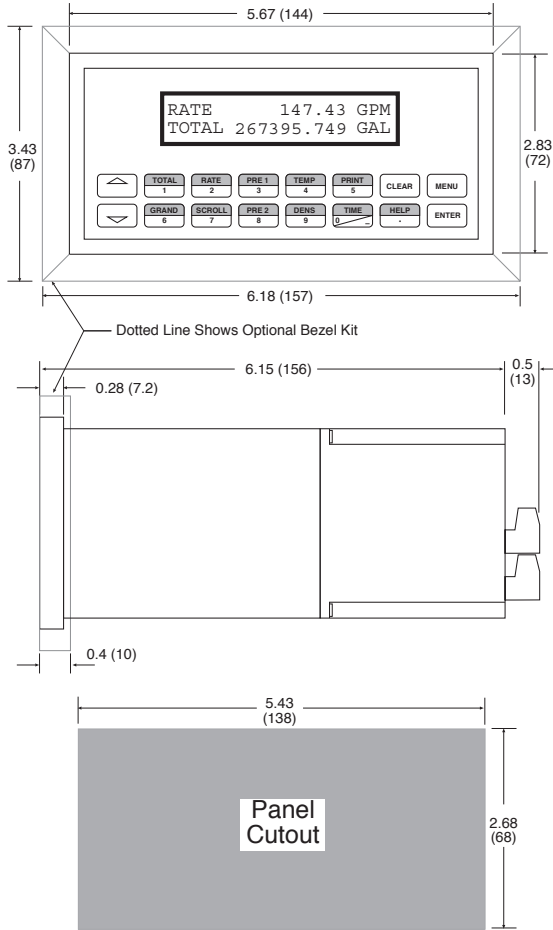| Parameter Name	Parameter Description	Value	
protocol_select	**Protocol Selector** Set to 1 for BACnet IP Set to 2 for BACnet MSTP Set to 3 for Metasys N2 Set to 4 for Modbus TCP Set to 5 for EtherNet/IP Set to 6 for DF1	1	Submit
node_offset	**BACnet Node Offset** This is used to set the BACnet device instance. The device instance will be sum of the Modbus device address and the node offset. *(0 - 4194303)*	50000	Submit
bac_ip_port	**BACnet IP Port** This sets the BACnet IP port of the Gateway. The default is 47808. *(1 - 65535)*	47808	Submit
bac_cov_option	**BACnet COV** This enables or disables COVs for the BACnet connection. Use COV_Enable to enable. Use COV_Disable to disable. *(COV_Enable/COV_Disable)*	COV_Disable	Submit
bac_bbmd_option	**BACnet BBMD** This enables BBMD on the BACnet IP connection. Use BBMD to enable. Use - to disable. The bdt.ini files also needs to be downloaded. *(BBMD/-)*	-	Submit

Active profiles

Nr	Node ID	Current profile	Parameters	
1	1	BAC_IP_SUPERtrol_II		Remove

Add

Sample screen shot of web interface configuration

Dimensions

5.67 (144)

3.43 (87)

2.83 (72)

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RATE       147.43 GPM
TOTAL 267395.749 GAL
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| △ | TOTAL 1 | RATE 2 | PRE 1 3 | TEMP 4 | PRINT 5 | CLEAR | MENU |
| ▽ | GRAND 6 | SCROLL 7 | PRE 2 8 | DENS 9 | TIME 0 | HELP . | ENTER |

6.18 (157)

Dotted Line Shows Optional Bezel Kit

6.15 (156)   0.5 (13)

0.28 (7.2)

0.4 (10)

5.43 (138)

Panel Cutout

2.68 (68)

Dimensions are in inches (mm)

Wall Mount (option W)

9.4 (238)

4.13 (105)

7.3 (184)

2.34 (59.5)

Security Tag Provisions

8.4 (213.4)

2.33 (59)

0.385 (9.8)

0.472 (12)

0.59 (14)

5.7 (145)

0.625"ø   0.75"ø   5 places

0.75 (19)

1.06 (27) 1.10 (28) 1.10 (28) 1.10 (28) 1.10 (28)

0.75" Conduit Knockouts (5 places)

1.10 (28) 1.10 (28) 1.10 (28) 1.10 (28)   0.63 (16)

7.8 (198)
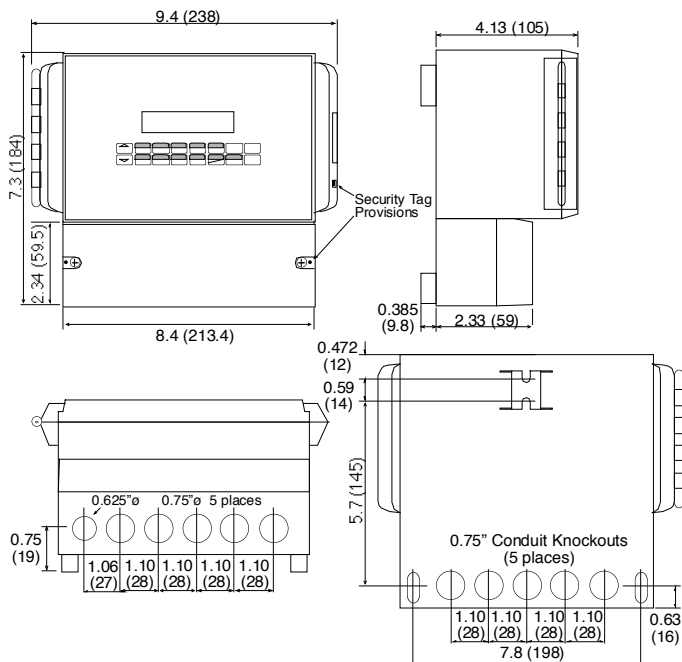
ES761

Example   ES761   L   1   0   P   TB

Series:
   ES761ST2 = ST2Flow Computer Special

Display Type:
   L= LCD
   O= OLED
   V= VFD

Input Type:
   1= 85 to 276 VAC
   3= 24 VDC

Network Card:
   0= None
   1= RS485/Modbus
   3= COM CARD with Multi-Protocol
       Specify protocol (example: **3 BAC/IP**)
       BAC/IP = BACnet IP
       BACMS/TP = BACnet MS/TP
       MOD/IP = Modbus TCP/IP
       METASYS/N2 = Metasys N2
       ABDF1 = AB DF1
       ABETH/IP = AB EtherNet/IP
   4= COM CARD with LonWorks Protocol
       Specify protocol (example: **4 LONWORKS**)
   Factory configuration of network card settings

Mounting:
   P= Panel Mount
   N= NEMA 4 Wall Mount (see MS811)
   W= NEMA 12/13 Wall Mount w/ Clear Cover
   E= Explosion Proof (No Button Access)

Options:
   9 = 3 Relay Super Chip
       (Includes: Peak Demand, AGA NX-19 calculation for natural gas,
       Stacked DP option, Datalogger option, Stack Emissions Controller
       option,Manifold Flowmeter Controller option)
   10 = 2 Relay Super Chip
       (Includes: Peak Demand, AGA NX-19 calculation for natural gas,
       Stacked DP option, Datalogger option, Stack Emissions Controller
       option,Manifold Flowmeter Controller option)
   13 = Superchip; 2 relay, Positive heat only
   14 = Superchip; 3 relay, Positive heat only
   22 = Superchip; 2 relay, For use with 4 terminal
       multi-variable vortex meters
   26 = Superchip; 3 relay, For use with 4 terminal
       multi-variable vortex meters
   TM = Trap monitor RS485 network card
   IM = Internal Modem
   IM-56K = 56K Internal Secure Modem
   M = Modem Power Option
   ET= Extended Temperature LCD Display
   TB= RS485 Terminal Block for Panel Mount Enclosure

Accessories:
ST2 SETUP PRO - Advanced setup software for ST2 family
OPC/DDE Server for RS232 Port available, see KWP-UCOND0-PRD
OPC/DDE Server for Modbus Suite available, see KWP-MDBUS0-PRD
Modem Available, see MPP-56KN, MPP-2400 and MPP-2400N
Serial printer available, see P20, P220, P295, PMi190, PMt2200
Ethernet Port Server available, see IEPS
RS-422/485 to RS-232 Communication Adaptor available, see CA285
RS232 Extender Cable: P/N=13220-<length in inches>
Remote metering and data collection software available, see TROLlink

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