PROFESSIONAL CONSULTATION REPORT

Study to Upgrade the Energy Management System

State University College at New Paltz

Project No. S4448

prepared for

State University College at New Paltz

prepared by

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May 18, 2009

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Study to Upgrade Energy Management System
State University Collage at New Paltz
New Paltz, NY

PROJECT INTENT:

The College has requested this study to provide modifications and upgrades to the Campus Energy Management System to provide campus wide metering of building energy use. Only the campus Academic buildings will be included. Provisions would be made to provide the necessary direct digital control (DDC) system "backbone" in the Dormitory buildings as part of this project. Work within the dormitory buildings themselves would be provided as part of future DASNY funded projects. All metering equipment will be integrated with the existing Carrier and Siemens DDC systems. The systems will be capable of expansion for future sub-metering of additional devices (i.e. air handling units, electrical panels, etc.) within each building. In addition, several system improvements have been identified that would increase energy efficiency in several buildings. Per request of the College, a portion of this report

EXECUTIVE SUMMARY:

This report serves to outline the most effective means of providing upgrades to the Campus Energy Management system necessary to provide utility metering at each of the Academic Buildings and future metering at Dormitory Buildings. Recommendations include upgrades to control systems in each building and installation of metering devices for electrical power, heating systems, domestic hot water systems and natural gas. These upgrades would also provide the necessary Energy Management System infrastructure throughout the facility to allow for future sub-metering of additional equipment within each building and control of lighting systems. Several energy conservation options in various buildings have also been recommended. The estimated cost for the recommended scope of work is $1,183,000.

PROJECT HISTORY:

Twenty-three of the twenty-four Campus Academic buildings have existing Direct Digital Control (DDC) systems. Refer to the Campus map in the Appendix of this report. The majority of these buildings have systems manufactured, installed and maintained by Carrier Corporation. Only five buildings have been provided with systems by Siemens Building Technologies. The Campus would like to maintain only these two manufacturers throughout the facility. Both companies have been contacted by the facility in the past to review expansion of the existing DDC systems to accommodate Energy Monitoring. It is the intent of this project to implement necessary control system upgrades along with installation of various metering devices to allow the existing DDC systems in each building to monitor building energy use. Although the facility is amenable to either manufacturer's system within each building, it is desired to totalize energy use and provide reporting at a single primary operator's workstation in the Service building.

The College has previously implemented several energy saving measures in various buildings including demand control ventilation and heat recovery. As part of the analysis of building systems for energy monitoring purposes, the College has requested that any additional potential energy saving strategies be noted in this report. The Haggerty Data Center and Coykendall Science building laboratories were two areas specifically noted by the Campus as potential candidates for energy efficiency improvements.

ORIENTATION MEETING / FIELD SURVEY:

On March 2, 2009, an Orientation Meeting was held at SUNY New Paltz to discuss the scope of work for this project. The following persons were present:

David Layton, P.E.	Sage Engineering Associates, LLP
Demetrios Koniaris, P.E.	OGS Design & Construction
Brian Pine	SUNY New Paltz Director of Facilities Operations and Maintenance
Gary Buckman	SUNY New Paltz Asst. Director of Facilities Operations and Maint.

The minutes from this orientation meeting are included in the Appendix of this report. Following this meeting, several field surveys of all Academic buildings were conducted on April 7, April 14, and April 16, 2009 by various Sage Engineering personnel including David Layton, John Edwards, Mark Akin and George Campbell.

The probability of asbestos containing insulation is noted based on visual inspection. However, all areas of work should be tested for hazardous materials prior to performing any removals.

FINDINGS:

Haggerty Administration

Year Built: 1972

Description: 9 floors, basement and penthouse, concrete construction

Use: Administrative Staff Offices

Gross Area: 70,778 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. 4 inch HTHW lines enter the building in the basement mechanical room. 2 inch HTHW lines branch off the main within the mechanical room and feed the heat exchanger providing building heat. The 4 inch main continues through the building basement to serve the adjacent Student Union building. There is approximately 3 to 4 feet of straight length of pipe to accommodate a HTHW flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Cooling is provided by the chiller located in the basement of the Student Union Building.
   c. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the penthouse, but not in the basement mechanical room. Control wiring would need to be run to the nearest DDC panel on the first floor.

2) Domestic Water Heating
   a. Domestic water is provided be a single electric 36kW tank type storage heater in the penthouse.

3) Electrical Service Power Metering
   a. The building 480/277V electrical service presently has a Square D PowerLogic Meter mounted in the 600AMP main switchboard. This meter has the ability to monitor KWH and KW demand and communicating with the building DDC system.

4) Data Center
   a. The campus Data Center is located on the grade level of this building and has been targeted by the College as a potential candidate for energy efficiency upgrades. The room contains several computer racks and cooling is provided by two Liebert DX computer room air conditioning units with exterior condensing units. The room is on at the perimeter of the building facilitating installation of exterior heat rejection equipment at grade. Photos of the Data Center have been included in the Appendix of this report.

Student Union

Year Built: 1972

Description: 4 floors, basement, penthouse, brick construction

Use: Classrooms and Faculty/Staff Offices

Gross Area: 103,813 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 3 inch HTHW mains from Haggerty enter the building within the basement mechanical room. There is more than 15 feet of straight run to accommodate a HTHW flow meter. There are no isolation valves within the mechanical room. It appears that any work to install a meter for this building would require isolation within the Haggerty building. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Cooling to this building and Haggerty is provided by a Carrier water-cooled chiller located in the basement mechanical room. The unit was installed in 2004.
   c. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the basement mechanical room in which metering devices would be installed.

2) Domestic Water Heating
   a. Domestic water is provided by a HTHW converter and a gas-fired 1,200 MBH boiler for summer use. Both devices are located in the basement mechanical room and both are connected to a large water storage tank also within the basement mechanical room. There is enough straight run of pipe within the HTHW piping serving the HTHW converter to accommodate a meter. There is also ample room to accommodate a gas flow meter in the gas piping serving the summer boiler. There is a high probability of asbestos in the insulation on the HTHW piping serving the water heater.

3) Electrical Service
   a. The building 480/277V electrical service presently has a Square D PowerLogic Meter mounted in the 1600AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

College Theatre, Dorsky Museum, Smiley Art

Year Built: 1963

Description: 1 floor, basement, brick construction

Use: Classrooms and Faculty/Staff Offices

Gross Area: 29,498 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 4 inch HTHW mains enter the building within the basement mechanical room. There is less than 4 feet of straight run to accommodate a HTHW flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Building heat is provided by a HTHW-to-water heat exchanger for air handling coils and a steam generator for perimeter steam heat. There is also a secondary gas-fired 500 MBH steam boiler in the adjacent mechanical room. In lieu of installation of a single meter in the 4 inch main, it would be possible to provide a meter in each of the 3 inch HTHW pipes feeding the heat exchanger and steam generator. There is ample straight run of pipe to provide a gas flow meter in the gas-fired boiler.
   c. Building cooling is provided by several DX rooftop air handling units and one small rooftop air-cooled chiller serving the Theatre. Metering of cooling systems in this building would be costly due to the large number of independent cooling devices.
   d. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the basement mechanical room in which metering devices would be installed.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 36kW tank type storage heater in the basement main mechanical room. There is also a domestic water storage tank in the mechanical room with HTHW coil that has been decommissioned and isolated from building systems.

3) Electrical Service
   a. The building 208/120V electrical service presently has a Square D PowerLogic Meter mounted in the 3000AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Fine Arts

Year Built: 1995

Description: 3 floors, basement, brick construction

Use: Classrooms and Faculty/Staff Offices

Gross Area: 29,498 SF

Existing Building Controls: Siemens DDC

1) HVAC
   a. The HTHW piping serving building heating system converters enters in the basement mechanical room. The exact size of the piping was indeterminable but appears to be 6-inch. There is approximately 69 inches of straight run to accommodate a flow meter. There is a low probability of asbestos in the insulation on the HTHW piping.
   b. Cooling is provided by a roof top chiller.
   b. The building DDC system is by Siemens. Controls panels are located in close proximity to potential metering device locations.

2) Domestic Water Heating
   a. Domestic water is provided by a hot water storage tank with HTHW heating coil. There is approximately 40 inches of straight run in the HTHW supply piping to the water heater to accommodate a meter.

3) Electrical Service
   a. The building 480/277V electrical service presently has a G.E. Digital Meter mounted in the 1600AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

   b. The building 208/120V electrical service does not have a digital meter mounted in the 2000AMP main switchboard. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

Parker Theatre

Year Built: 1961

Description: 2 floors, brick construction

Use: Classrooms and Faculty/Staff Offices

Gross Area: 21,057 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The HTHW piping serving building heating system converters enters in the basement mechanical room. The exact size of the piping was indeterminable but appears to be 3-inch. There is no significant straight run of pipe to accommodate a flow meter. The HTHW piping would need to be re-routed around an existing heat exchanger skid to provide an approximate 8 feet of straight length of pipe. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Building heat is provided by a HTHWconverter for coils and a steam generator for perimeter steam heat.
   c. Building cooling is provided by four DX rooftop air-handling units and two small spilt system fan coil units. Metering of cooling systems in this building would be costly due to the large number of independent cooling devices.
   d. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the mechanical room in which metering devices would be installed.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 4500 watt tank type storage heater in the basement main mechanical room.

3) Electrical Service
   a. The building 208/120V electrical service presently has a Cutler-Hammer Digital Meter mounted in the 1500AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Sojourner Truth Library

Year Built: 1968

Description: 3 floors, penthouse, concrete construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 110,983 SF

Existing Building Controls: Carrier DDC

1) HVAC
   - a The 4 inch HTHW piping serving building heating system converters enters in the basement mechanical room. There approximately 12 feet of straight pipe run to accommodate a flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   - b. Building cooling is provided by chilled water piping from the Lecture Center building chiller. There is ample straight run of chilled water piping to accommodate a flow meter if it desired to meter the cooling system for this building separately from the Lecture Center.
   - d. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the mechanical room in which metering devices would be installed.

2) Domestic Water Heating
   - a. Domestic water is provided by a single electric 4500 watt tank type storage heater in the basement main mechanical room.

3) Electrical Service
   - a. The building 480/277V electrical service presently has a Square D PowerLogic Meter mounted in the 2500AMP main switchboard. This meter has the capability of monitoring KWH and KW demand communicating with the building DDC system.

Lecture Center

Year Built: 1968

Description: 3 floors, penthouse, brick construction

Use: Classroom & Faculty/Staff Offices

Gross Area: 60,366 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 5 inch HTHW piping serving building heating system converters enters in the basement mechanical room. There is ample straight pipe run to accommodate a flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Cooling for this building and several adjacent buildings including Humanities, the Faculty Tower and the Sojourner Truth Library is provided by a pair of chillers in the main mechanical room.
   d. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the mechanical room in which metering devices would be installed

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 36kW tank type storage heater in the basement main mechanical room.

3) Electrical Service
   a. The building is fed from a transformer located in the Sojourner Truth Library that provides 480/277V electrical service to the building. There is presently a Square D PowerLogic Meter mounted in the 800AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Coykendall Science

Year Built: 1964

Description: 3 floors, basement, brick construction

Use: Classroom & Faculty/Staff Offices

Gross Area: 83,597 SF

Existing Building Controls: Siemens DDC

1) HVAC
   a. The 5 inch HTHW piping serving building heating system converters enters in the basement mechanical room. There is ample straight run of pipe to accommodate a HTHW flow meter. There is a low probability of asbestos in the insulation on the HTHW piping.
   b. Building cooling is provided by a pair of water cooled chillers in the basement mechanical room.
   d. The building DDC is a Siemens system. There is a DDC panel in the mechanical room in which metering devices would be installed

2) Domestic Water Heating
   a. Domestic water is provided by a secondary hot water-to-water converter located in the mechanical room. There is sufficient straight run of pipe in the hot water piping serving the heater to accommodate a flow meter.

3) Electrical Service
   a. The building 480/277V electrical service presently has a G.E. Digital Meter mounted in the 1800AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Wooster Science

Year Built: 1967

Description: 2 floors, basement, crawlspace, concrete construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 71,685 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 3 inch HTHW piping serving building heating system converters enters in the basement mechanical room. There is approximately 10 ft of straight pipe run to accommodate a HTHW flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   c. Building cooling is provided by several DX rooftop units and one small rooftop air-cooled chiller. Metering of cooling systems in this building would be costly due to the large number of independent cooling devices.
   d. The building DDC system is an older Carrier system. The control panels must be upgraded to allow for energy use measurement and calculation. There is a DDC panel in the basement mechanical room in which metering devices would be installed.

2) Domestic Water Heating
   a. Domestic hot water is provided by a HTHW converter in the basement mechanical room. There is no straight run of piping serving the converter long enough to accommodate a typical flow meter. The piping would need to be modified to accommodate a straight run of piping.
   b. Domestic water is also provided by a single electric 36kW tank type storage heater in the basement main mechanical room. Split-core CT’s will need to be installed at the electric water heater to monitor KWH and KW demand.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted in the 1200AMP main switchboard. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

Resnick Engineering Hall

Year Built: 1998

Description: 2 floors, basement, brick construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 15,755 SF

Existing Building Controls: Siemens DDC

1) HVAC
   a. The 2 inch HTHW piping serving building heating system converters enters in the basement mechanical room. There is approximately 7 ft of straight pipe run to accommodate a HTHW flow meter. There is a low probability of asbestos in the insulation on the HTHW piping.
   b. Steam is provided by a HTHW steam generator in the basement mechanical room. There is approximately 5 ft of straight pipe run in the HTHW serving the steam generator to accommodate a flow meter if it was desired to meter this device separately.
   c. Building cooling is provided by a DX air handling unit in the penthouse with a rooftop condensing unit and a rooftop air cooled chiller.
   d. The building DDC is a Siemens system. There is a DDC panel in the mechanical room in which metering devices would be installed

2) Domestic Water Heating
   a. Domestic water is provided by a single gas-fired 65 MBH tank type water heater in the basement mechanical room. There is sufficient space to accommodate a flow meter in the 1 inch gas piping serving this heater.

3) Electrical Service
   a. The building 480/277V electrical service does not have a digital meter mounted in the 600MP main switchboard and communicating with the building DDC system.

Faculty Office Building

Year Built: 2001

Description: 1 floor, modular, wood construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 11,787 SF

Existing Building Controls: None

1) HVAC
   a. Heating, ventilation and cooling for this building is provided by eight gas-fired roof top units. A gas flow meter could be utilized to meter gas to these units. Electric power to each unit could be metered to capture cooling energy use if desired.
   b. There is no existing building DDC system.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 10 gallon point of use water heater.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted in the 200AMP main panel. Additional metering devices will be required at the electric service panel to monitor KWH and KW demand. Typical for each of the 2 buildings which make up the “Faculty Office Building”.

Vandenberg Learning Center

Year Built: 1931

Description: 3 floors, basement, brick construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 88,441 SF

Existing Building Controls: Siemens DDC

1) HVAC
   a. Central services for this building are located in the attached annex building. The 4-inch HTHW piping enters this building in the basement tunnel. There is ample straight pipe run to accommodate a HTHW flow meter. There is a low probability of asbestos in the insulation on the HTHW piping.
   b. Hot water for heating is provided by HTHW converters. Steam for heating is provided by a HTHW steam generator in the basement mechanical room. There is approximately 6'-8"of straight pipe run in the HTHW serving the steam generator to accommodate a flow meter if it is desired to meter this device separately.
   c. Building cooling is provided by two split chillers located in the annex building.
   d. The building DDC is a Siemens system. There is a DDC panel in the mechanical room in which metering devices would be installed.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 36kW tank type storage heater in the basement main mechanical room.

3) Electrical Service
   a. The building 208/120V electrical service presently has a Cutler-Hammer Digital Meter mounted in the 600AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Old Main

Year Built: 1908

Description: 3 floors, sub-basement, basement, penthouse

Use: Classrooms & Faculty/Staff Offices

Gross Area: 77,257 SF

Existing Building Controls: Carrier DDC

1) The Old Main building is undergoing a full renovation at the time of this study. All new systems including HVAC and electrical switchgear in the building will be provided with metering equipment as part of LEED requirements for Measurement and Verification. The DDC System will be provided by Carrier.

Jacobson Faculty Tower

Year Built: 1968

Description: 10 floors, basement, penthouse, brick construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 45,900 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 5 inch HTHW piping enters the building in the basement mechanical room. There is approximately 6.5 feet of straight pipe run to accommodate a flow meter. The HTHW converter provides heating water to this building and the adjacent Humanities Building. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Cooling is provided by chilled water piping from the central chiller in the Lecture Center building. There is ample straight run of chilled water piping to accommodate a flow meter if it desired to meter the cooling system for this building separately from the Lecture Center.
   c. The building DDC is a newer Carrier system capable of meeting the requirements for metering.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 36kW tank type storage heater in the basement main mechanical room. Additional metering devices will be required at the electric water heater to monitor KWH and KW demand.

3) Electrical Service
   a. The building 480/277V electrical service presently has a Square D PowerLogic Meter mounted in the 1500AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Humanities

Year Built: 1968

Description: 3 floors, sub-basement, basement, penthouse

Use: Classrooms & Faculty/Staff Offices

Gross Area: 58,535 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. Hot water for heating and chilled water for cooling is provided by central systems in the adjacent Jacobson Faculty Tower. If desired, flow meters could be provided in each piping system to individually meter heating and cooling in this building. There is a high probability of asbestos in the insulation on the piping.
   b. The building DDC is a newer Carrier system capable of meeting the requirements for metering.

2) Domestic Water Heating
   a. Domestic water is provided by systems in the Jacobson Faculty Tower.

3) Electrical Service
   a. Fed from Jacobson Faculty Tower which has a Square D PowerLogic Meter mounted in its 1500AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Old Library

Year Built: 1954

Description: 2 floors, basement, penthouse, brick construction

Use: Classrooms & Faculty/Staff Offices

Gross Area: 15,755 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 3 inch HTHW mains enter the building within the basement mechanical room and serves a HTHW steam generator for building heat. There is approximately 5 feet of straight run in the HTHW piping serving the steam generator to accommodate a flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Building cooling is provided by several outdoor DX units.
   c. The building DDC system is an older Carrier system. The control system must be upgraded to allow for energy use measurement and calculation. The nearest DDC panel is located on the first floor.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 36kW tank type storage heater in the basement main mechanical room. Additional metering devices will be required at the electric water heater to monitor KWH and KW demand.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted near the 400AMP main distribution panel. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

College Hall D (Shepard Recital Hall)

Year Built: 1951

Description: 2 floors, basement (3 floors G only)
brick construction

Use: Student Housing & RA/CDA Offices

Gross Area: 106,362 SF

Existing Building Controls: None

1) HVAC
   a. The HTHW mains enter the building within the basement mechanical room. The exact size of the piping was indeterminable but appears to be 3-inch. There is approximately 12 feet of straight run to accommodate a HTHW flow meter. Building heat is provided by a HTHW steam generator. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Cooling is provided to only a few small office areas by two split system AC unit with exterior condensing units.
   c. This building is pneumatically controlled with no central DDC system.

2) Domestic Water Heating
   a. Domestic water is provided by three separate systems. The primary system is a HTHW converter. There is less than 4 feet of straight run to accommodate a flow meter in the HTHW piping serving this heater. A 750 MBH gas-fired heater with three storage tanks provides backup domestic water. There is ample straight run of pipe in the 2 inch gas line serving this heater to accommodate a flow meter. A 36kW electric storage tank type heater is also located in the basement.

3) Electrical Service
   a. The building 208/120V electrical service presently has a Square D PowerLogic Meter mounted in the 1600AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Hasbrouck Dining Hall

Year Built: 1968

Description: 2 floors, brick construction

Use: Food Services & Staff Offices

Gross Area: 30,015 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The 3 inch HTHW mains enter the building within the basement mechanical room. There is sufficient straight run of pipe to accommodate a HTHW flow meter in the main service. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. Building heat is provided by a HTHW converter. There is also a steam generator in the basement mechanical room. There is sufficient straight run of pipe in the HTHW piping serving both devices to accommodate a flow meter if it is desired to meter these units separately.
   c. A back-up 2,766 MBH gas-fired boiler on the first floor provides steam and domestic hot water for the kitchen. The 2 inch gas piping serving this boiler has ample straight run of pipe to accommodate a meter.
   d. Building cooling is provided by DX air handling unit with exterior condensing units.
   e. The building DDC is a newer Carrier system capable of meeting the requirements for metering.

2) Domestic Water Heating
   a. Domestic water is provided by HTHW converter in the basement mechanical room. There is straight run of pipe to accommodate a HTHW flow meter. Domestic water is also provided by the back-up boiler mentioned above.

3) Electrical Service – There are 2 electrical services associated with this building:
   a. The building 208/120V electrical service does not have a digital meter mounted in the 1600AMP main switchboard. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

   b. The building 480/277V electrical service does not have a digital meter mounted in the 450AMP main switchboard. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

Service Building

Year Built: 1966

Description: 2 floors, brick construction

Use: Facilities and Operations

Gross Area: 33,180 SF

Existing Building Controls: Siemens DDC

1) HVAC
   a. The HTHW mains enter the building within the first floor locker room and run to the adjacent mechanical room where they serve a hot water converter for building heat. The exact size of the piping was indeterminable but appears to be 3-inch. There is a sufficient straight pipe run to accommodate a HTHW flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.
   b. The building DDC is a Siemens system. There is a DDC panel in the mechanical room in which metering devices would be installed

2) Domestic Water Heating
   a. Domestic water is provided by a large domestic water storage tank with HTHW heating coil and by a summer electric 6000 watt tank style heater. There is a sufficient straight run of HTHW piping serving the water heater to accommodate a flow meter. There is a high probability of asbestos in the insulation on the HTHW piping.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted near its' 1200AMP main distribution panel. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

Surge Building

Year Built: 1997

Description: 1 floor, metal construction

Use: Unoccupied

Gross Area: 2,500 SF

Existing Building Controls: None

1) HVAC
   a. Heating and cooling for this building is provided by two gas-fired furnaces with DX coils in the mechanical room. There is sufficient straight run of pipe in the ¾ inch gas line serving these furnaces to accommodate a meter. The electrical power for DX cooling system could be metered with current transformers if desired. There is a low probability of asbestos in this building in the areas affected by this project.
   b. There is no DDC system in the building to accommodate metering.

2) Domestic Water Heating
   a. Domestic water is provided by a single gas-fired 40 MBH tank type water heater.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted near its' 200AMP main distribution panel. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

School of Business Building

Year Built: 2001

Description: 1 floor, modular, wood construction

Use: Classroom & Faculty/Staff Offices

Gross Area: 18,216 SF

Existing Building Controls: Carrier

1) HVAC
   a. Heating, ventilation and cooling for this building is provided by nine gas-fired roof top units. A gas flow meter could be utilized to meter gas to these units. Electric power to each unit could be metered to capture cooling energy use if desired. There is a low probability of asbestos in this building in the areas affected by this project.
   b. Facility personnel have indicated that the building controls are provided by Carrier. However, it was not possible to locate any building control panels. The control panels may need to be upgraded to allow for energy use measurement and calculation.

2) Domestic Water Heating
   a. Domestic water is provided by a single electric 9,000 watt tank type storage heater in the basement main mechanical room.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted near its' 200AMP main distribution panel. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

Student Health and Counseling Center

Year Built: 1966

Description: 1 floor, brick construction

Use: Classrooms & Staff Offices

Gross Area: 14,103 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. Hot water for heating in this building is provided by a gas-fired 789 MBH dual fuel (gas and oil) boiler located in the central mechanical room. There is not sufficient straight run of pipe in the heating water piping to accommodate a flow meter. The piping would need to be modified to provide a sufficient straight run. There is a low probability of asbestos in this building in the areas affected by this project.
   b. Building cooling is provided by interior DX air handling units with exterior condensing units.
   d. The building DDC is a newer Carrier system capable of meeting the requirements for metering.

2) Domestic Water Heating
   a. Domestic water is provided by a sidearm heat exchanger on the boiler as well as a backup electric 2,500 watt tank type heater.

3) Electrical Service
   a. The building 208/120V electrical service presently has a Square D PowerLogic Meter mounted in the 400AMP main distribution panel. This meter has the capability of monitoring KWH and KW demand and communicating with the building DDC system.

Charles Cook Children Center

Year Built: 2002

Description: 1 floor, wood construction

Use: Child Care & Staff Offices

Gross Area: 5,906 SF

Existing Building Controls: None

1) HVAC
   a. Heating in this building is provided by two gas-fired boilers serving floorslab radiant heat. There is a sufficient straight run of pipe in the 2 inch gas line serving the boilers to accommodate a meter. There is a low probability of asbestos in this building in the areas affected by this project.
   b. There is no building DDC system to accommodate metering.

2) Domestic Water Heating
   a. Domestic water is provided by a single gas-fired 75 MBH tank type water heater. There is sufficient straight run of pipe to accommodate a flow meter in the ¾ inch gas line serving this heater.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted near its' 400AMP main distribution panel. Additional metering devices will be required at the switchboard to monitor KWH and KW demand.

Elting Gym and Athletics Center

Year Built: 1964

Description: 2 floors, basement, brick construction

Use: Classrooms & Staff Offices

Gross Area: 82,730 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. The HTHW mains serving the Elting Gym building enter the building in the basement mechanical room. The size of the piping was indeterminable but appeared to be 4 inch. There is approximately 10 feet of straight run to accommodate a HTHW flow meter. Building heat is provided by a HTHW steam generator.
   b. The HTHW piping serving the Athletics center have an existing ultrasonic flow measuring device connected to a stand alone transmitter. The meter is not connected to the building DDC system.
   c. There is a low probability of asbestos insulation in the Athletics Center but the possibility of asbestos is high in the Elting Gym.
   d. Cooling is provided in the Athletic Center by two water cooled chillers.
   e. The building DDC is a newer Carrier system capable of meeting the requirements for metering.

2) Domestic Water Heating
   a. Domestic water is provided by a HTHW converter in the Elting basement mechanical room. There is ample straight run to accommodate a flow meter in the HTHW piping serving this heater. It was noted that the HTHW piping serving this heater is isolated with brass ball valves. Although these valves meet the pressure and temperature requirements, they do not provide a positive shutoff in HTHW systems and may leak by. This may cause an unsafe condition.
   b. A back-up gas-fired 1500 MBH boiler and storage tank located in the basement of Elting also provide domestic water. There is sufficient straight run of piping to accommodate a flow meter in the 2 inch gas line serving this boiler.

3) Electrical Service
   a. Elting Gym: The building 208/120V electrical service presently has a Square D PowerLogic Meter mounted in the 1400AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the DDC system.

   b. Athletic Center: The building 480/277V electrical service presently has a Square D PowerLogic Circuit Monitor mounted in the 1800AMP main switchboard. This meter has the capability of monitoring KWH and KW demand and communicating with the DDC system.

Terrace Restaurant

Year Built: 1994

Description: 1 floor, brick construction

Use: Restaurant

Gross Area: 4,500 SF

Existing Building Controls: Carrier DDC

1) HVAC
   a. Heating and cooling for the Dining Room is provided by a grade-mounted exterior air handling unit. A gas flow meter could be utilized to meter gas to this unit. Electric power to the unit could be metered to capture cooling energy use. There is a low probability of asbestos in this building in the areas affected by this project.
   b. Hot water for heating other spaces within the building is provided by a gas-fired boiler in the mechanical room. There is sufficient straight run of pipe to accommodate a meter in the gas line serving this boiler.

2) Domestic Water Heating
   a. Domestic water is provided by a single gas-fired tank type water heater. There is sufficient straight run of pipe to accommodate a meter in the gas line serving this heater.

3) Electrical Service
   a. The building 208/120V electrical service does not have a digital meter mounted near its 600AMP main distribution panel. Additional metering devices will be required at the electric service panel to monitor KWH and KW demand.

RECOMMENDED SCOPE OF WORK (GENERAL):

1) HTHW Metering

Three types of flow meters were investigated that will meet temperature, pressure, accuracy and turndown requirements of this application. They include Vortex Shedding (multiple manufacturers), Swirl (ABB) and the Accelebar (Veris Corporation). Product data sheets for each type of meter are attached. Simpler systems such as orifice plate or pitot tube technology would not provide the turndown requirements of the variable flow HTHW system. At the lower range of flows, these meters would not have the ability to measure flow. A comparison sheet listing the price, meter size, and required straight run of pipe for each type of meter in each building is included in the Appendix. The Veris Accelebar meter is the most forgiving of the three. This meter requires no upstream or downstream straight run of pipe and the meter size can be the same as the pipe and still achieve excellent turndown ratios. This minimizes piping modifications necessary to install the meter. Although the accuracy of all three types of meters are similar, it is recommended that the Accelebar and Vortex shedding be considered for this project alone based on price and ease of installation. To meet open sourcing requirements for New York State projects, both meters can be included as options in the project. Where sufficient straight runs of pipe exist, the Vortex shedding flow meter may be chosen. If significant piping modifications are required to provide a straight run of pipe, the contractor may choose the Accelebar that requires no straight run. The most economical method of installation was assumed for cost estimating purposes.

In addition to flow metering of the HTHW, temperature of the supply and return piping must also be measured to provide the required input to the DDC for calculation of BTU energy use. Product data sheets for an immersion-type Resistance Temperature Detector (RTD) are included in the Appendix. The thermowell in which the RTD is inserted is welded in the HTHW supply and return piping. The meter would include a transmitter capable of providing a 4-20mA output to the building DDC. The thermowell may be installed anywhere in the HTHW supply main upstream of any heat transfer devices and in the return main downstream of any heat transfer devices.

2) Domestic Hot Water Metering

Domestic water heating is accomplished by various means throughout the Campus including HTHW converters, electric storage tanks and gas-fired equipment. For HTHW units, a flow meter equal to that recommended for HTHW metering for the heating system would be provided. For electric storage tank heaters, current transformers (CT's) similar to those recommended for building power metering would be provided. For gas-fired equipment, a thermal mass flow meter equal to that manufactured by Sage Metering, Inc. would be provided. Product data sheets for this device have been included in the Appendix of this report.

3) Cooling System Metering

For those buildings where a primary chiller provides cooling, the simplest method of energy measurement would be metering of the electrical power feed to the chiller. This would provide monitoring for the majority of the energy utilized by the cooling system. If additional accuracy is desired, the chilled water pump(s), condenser water pump(s) and cooling tower fan motor current draw may also be monitored. Alternatively, a flow meter and temperature sensors could be installed in the chilled water flow to the building. The energy use of the chiller could then be calculated in a method similar to that recommended for the HTHW systems. The campus has not requested that cooling systems be monitored at this time. The DDC system improvements to each building necessary for monitoring of other utilities would provide the necessary base control system to interface with cooling system metering devices at a later date.

4) Gas Metering

Gas metering is required at various locations including gas-fired boilers, water heaters, and air handling units. The College has also requested that gas be metered for the three major kitchens on Campus; Student Union Building, Terrace Restaurant and Hasbrouck Dining Hall. The meter used would be similar to the Sage Metering Inc. thermal mass flow meter described above for gas-fired domestic water energy monitoring.

5) Building Controls Upgrades

It is the intent to interface new and future metering devices with the existing DDC systems in each building or to provide a new DDC panel where none exists. Both the hardware and software provided by Siemens is more easily configurable for energy monitoring than Carrier's system. Those buildings with existing Siemens DDC systems will not require upgrades to interface with energy metering equipment. Many of the buildings with Carrier DDC systems are older and will require an upgrade to interface with metering equipment and to allow for calculation of energy use and data trending. The existing panels would be upgraded to a Carrier Comfort Controller Model 6400. Product data for this controller is included in the Appendix of this report. Each controller is capable of 8 inputs and 8 outputs. It is recommended that a control panel be provided with one Model 6400 controller and one additional I/O model allowing up to 16 inputs and 16 outputs. The panel would have space to accommodate up to three additional I/O modules for a total of 48 points in each panel. This will provide the number of control points necessary to meter utilities in each building plus allow for future metering of additional systems.

By providing new, or upgrading existing DDC panels in each building, the facility will have the ability to meter and trend data in the existing DDC system primary operator's workstation (POS) in the Service Building. However, there is presently a workstation for each manufacturer's system. The College would like the ability for all energy management reporting to be accomplished at one workstation. The proposed scope of work for this project has been reviewed with both Carrier and Siemens representatives. Both have confirmed that it is not possible to directly interface the DDC trend data from both systems into one of the two existing workstations due to proprietary software restrictions. However, both manufacturers can deliver raw data output to a third party software package in a database format. The data output could be formatted into the required tables, charts or reports as desired. This would be a custom application and but it would provide totalizing and reporting of all buildings in one workstation.

In the above scenario, only the reporting would be performed in the third party software. Instantaneous meter information, trends, etc. would still be accessible within each manufacturer's workstation. However, Carrier does not offer an Energy Management software package specifically for metering applications. Carrier could create screens within the existing POS that would show real time metering information and trend data and output this data to third party software such as Microsoft Excel if desired. Siemens however, can provide its Utility Cost Manager application for its existing POS that is specifically designed to provide information management for metering applications including meter hierarchy layout capabilities along with energy consumption, demand, allocation and cost reports. Product Data for this software is included in the Appendix of this report. The flexibility of the Siemens software makes it an attractive package for consideration by the College. However, as stated above, this system will only work with buildings with a Siemens DDC. The only way to utilize the Siemens system would be to install a Siemens DDC panel in every building on Campus. The sole purpose of this panel would be to meter equipment. It would not be necessary for this system to interface with the existing

Carrier systems in anyway. The cost of such a panel would be comparable to the required cost of upgrades in existing Carrier panels necessary to accommodate metering. For the purposes of cost estimating, it is assumed that both Carrier and Siemens DDC systems would remain in their respective buildings, each manufacturer's POS would be updated with appropriate graphics for metering and a third party software package would be provided for reporting.

For those buildings without DDC, either manufacturer would provide the minimal DDC controller and panel necessary to receive inputs from metering equipment within the building. The panels would communicate to their respective POS in the Service Building via the existing Campus local area network (LAN). In this manner, Academic Buildings such as the Childrens' Center as well as all Dormitories could be provided with energy metering capability.

Both the Siemens and Carrier DDC controllers have the ability to communicate via open communication protocol such as BacNet or Lon Works with lighting systems provided by others. It is recommended that independent lighting control systems with DDC interface capability be provided in future projects. In this manner, the DDC acts as only an interface and the lighting control system responsibility rests in the hands of the lighting control system manufacturer.

6) Electrical Power Metering

Buildings with existing Siemens and upgraded Carrier DDC systems will interface with current transformers (CT's) installed at each electrical service. Product data for two types of metering devices has been included in the Appendix of the report. These CT's will monitor Kilowatt Hour (KWH) and kilowatt demand usage at each building electrical service. Electrical services containing existing digital power metering devices will not require the installation of CT's because the meters already possess the capability to report building KWH and KW demand. These too, will interface with either Siemens or Carrier building DDC systems.

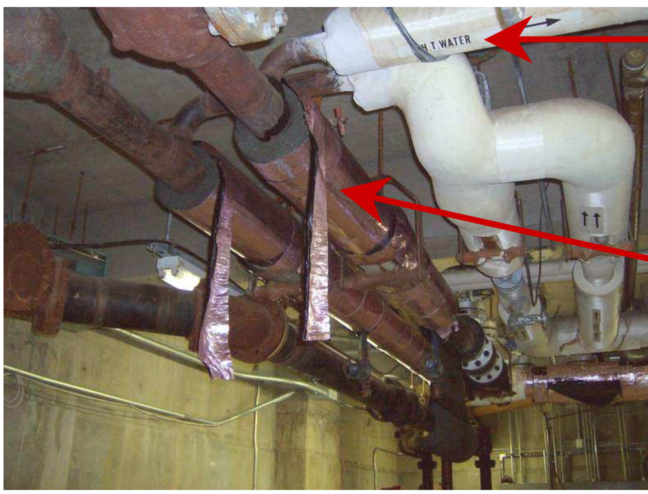
7) Phasing

The majority of the recommendations of this report will require minimal disruption to existing systems to install and can be coordinated with facility personnel without difficulty. Only the work associated with installation of meters and sensors in the HTHW piping will require significant outages. In many buildings, the meter would need to be installed upstream of the primary building isolation valves due to space constraints. A shutdown of the Campus HTHW system would be required to install these devices. In those buildings where the isolation valves are double-valved and suitably located, it would be possible to perform the installation with only disruption to the building HTHW system. Presently, the Campus shuts down their HTHW system for the entire summer. This would allow ample time to install metering devices in all buildings. However, the College is considering reducing their Central Heating Plant summer shutdown to as little as two weeks in the near future. This would require the work to be performed in a much tighter time frame. Although possible, proper coordination would be critical.

RECOMMENDED SCOPE OF WORK (BUILDING SPECIFIC):

Haggerty Administration

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. Provide a flow meter in the 2” HTHW supply serving the heat exchanger providing heat to Haggerty. The existing 2” supply line has a reasonable straight length of pipe (approx. 30” or 15 pipe diameters) to accommodate a Vortex Shedding flow meter. Provide a 1” Vortex shedding flow meter and the required reducer fittings and flanges or provide a 2” Accelebar meter. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Install meter in 2” HTHW supply pipe to building heat exchangers.

4” HTHW mains to Student Union Building to remain.

2) Domestic Hot Water Metering
   a. Provide one set of CT’s,Veris #H8035-0100-2 and clamp over circuit conductors in hot water heater control panel located in Penthouse. Connect in-line-fuse leads to power lugs in control panel. Provide ¾” conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾”conduit and wire from existing electrical switchboard meter to DDC panel.

Haggerty Administration (continued)

5) Energy Conservations Measures – Data Center

The Data Center is relatively small but could still benefit from energy efficiency upgrades. The following recommendations would improve overall Data Center energy performance:

a. Remove all non-essential or abandoned wiring, conduit or other utilities from the floor plenum. Although the floor plenum is relatively clear as can be seen in the photo in the Appendix, anything that can be done to minimize obstructions would be beneficial to airflow and overall system efficiency. This work can be performed by Campus personnel at minimal cost.

b. Locate and seal all extraneous penetrations within the Data Center room to assist in temperature and humidity control. This work can be performed by Campus personnel at minimal cost.

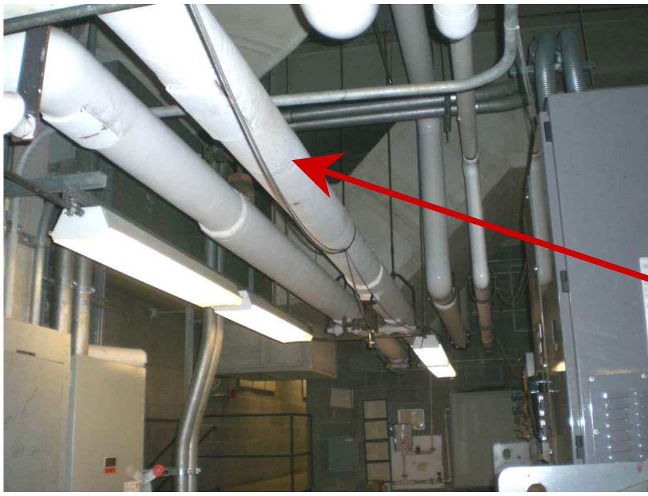
c. Re-arrange the rack to a hot aisle/cold aisle configuration to optimize air flow and cooling equipment efficiency. This would require significant coordination by the operator to phase relocation of operational equipment into a revised floor plan. It would also include relocation of floor tiles with air supply grilles into cold aisle locations. The quantity of these air supply tiles should be evaluated at that time to verify adequate airflow is delivered from the supply plenum. This work is best performed by Campus personnel due to the extensive coordination required.

d. Operate the AC Units with a set point and dead band range of 68 deg F to 77 deg F. This is still within the recommended temperature range for Data Centers. The higher temperature set point will result in energy savings due to greater refrigeration cycle thermodynamic efficiency. The higher dead band will prevent "fighting" between AC Units, a significant source of inefficiency. There is no additional cost required to implement this modification.

e. Consider replacement of the computer room AC units with more efficient equipment. The equipment appears to be nearing the end of its recommended useful life. Newer air-cooled units utilize variable speed compressors and variable speed condenser fans providing a much greater efficiency than the existing units. Also, water-cooled units are available that reject heat via exterior drycoolers. The glycol heat rejection fluid can be routed through a cooling coil within the AC unit to provide "free cooling" when outdoors air temperature drop below 30 deg F +/-. This is a standard option with water-cooled AC units and it is an appealing option for systems operating in the Northeast climate. Replacement of the two AC units would be approximately $70,000.

Student Union Building

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is an ample straight length of pipe to accommodate the installation of any meter. Provide a 1-1/2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 3" Accelebar meter in the 3" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Install meters in 4" HTHW supply pipe in basement mechanical room.

2) Domestic Hot Water Metering
   a. As domestic hot water is provided by both a HTHW converter and a gas-fired boiler, it is necessary to provide meters in both services to monitor energy use at all times. Abate asbestos containing insulation at the HTHW converter and provide a HTHW meter in the HTHW service to this heater. Due to space constraints it is assumed that a Accelebar meter would be provided. Provide a gas flow meter gas piping serving the summer boiler.

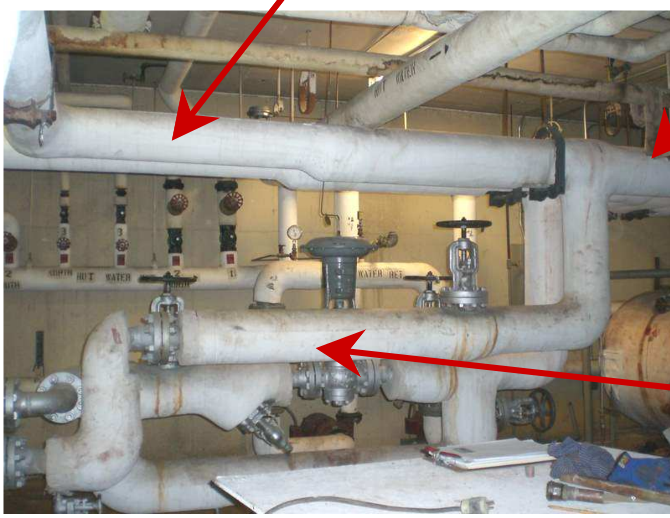
3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Gas Metering
   a. Provide a gas flow meter in the gas main entering the building serving the kitchen food service equipment.

5) Building Electrical Metering
   a. Provide ¾"conduit and wire from existing electrical switchboard meter to DDC panel.

College Theatre, Dorsky Museum, Smiley Art

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. It is not possible to accommodate a single flow meter in the HTHW service for the building due to space constraints unless the Veris Accelebar meter is provided. An alternative to the Accelebar meter would be installation of meters in the supply piping to the steam generator and the heating water heat exchanger. The most cost effective method would be to provide the single 4” Accelebar meter in the 4” HTHW supply main. Provide a Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



2) Domestic Hot Water Metering
   a. Provide one set of CT’s,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾” conduit and wire from water heater to DDC panel.

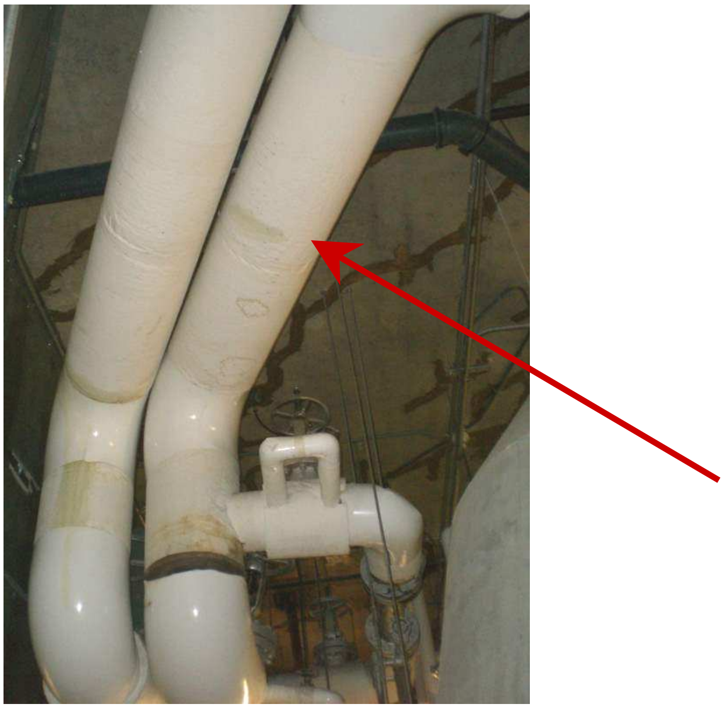
3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Gas Metering
   a. Provide a gas meter in the 1-1/2” gas main serving the backup steam generator.

5) Building Electrical Metering
   a. Provide ¾”conduit and wire from existing electrical switchboard meter to DDC panel.

Fine Arts

1) HTHW Metering
   a. There is a straight length of pipe to accommodate the installation of any meter. Provide a 3” Vortex Shedding flow meter and the required reducer fittings and flanges or a 6” Accelebar meter in the 6” HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 6” HTHW main.

2) Domestic Hot Water Metering
   a. There is a straight length of pipe to accommodate the installation of any meter. Provide a Vortex Shedding flow meter and the required reducer fittings and flanges or an Accelebar meter in the HTHW piping serving the water heater. Provide socket-welded thermowell fitting and temperature sensors in the supply and return piping.

3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾”conduit and wire from existing electrical switchboard meter to DDC panel.

Parker Theatre

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is not and adequate straight length of pipe to accommodate the installation of a Vortex Shedding flow meter. Provide required piping modifications necessary to provide a minimum of 4 ft of straight run and provide a 1" Vortex Shedding flow meter and the required reducer fittings and flanges. Alternatively, provide a 3" Accelebar meter in the 3" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.

Provide meter in 3" HTHW main.

2) Domestic Hot Water Metering
   a. Provide one set of CT's,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾" conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾"conduit and wire from existing electrical switchboard meter to DDC panel.

Sojourner Truth Library

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is a straight length of pipe approximately 12 feet long of adequate length to accommodate the installation of any meter. Provide a 1-1/2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 4" Accelebar meter in the 4" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.

Provide meter in 4" HTHW main in 12 ft straight run (downstream of piping shown).

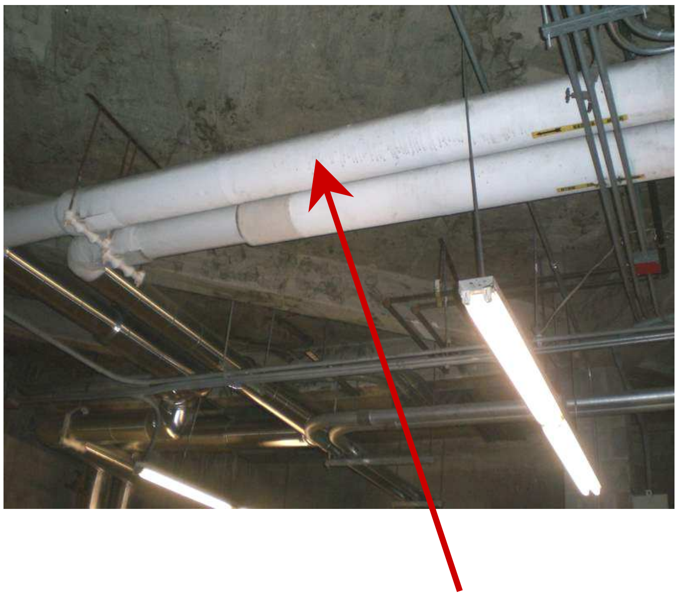
2) Domestic Hot Water Metering
   a. The size of this water heater is very small and monitoring may not be cost effective. If desired, the following work would be required: Provide one set of CT's,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾" conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾"conduit and wire from existing electrical switchboard meter to DDC panel.

Lecture Center

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is an ample straight length of pipe to accommodate the installation of any meter. Provide a 2” Vortex Shedding flow meter and the required reducer fittings and flanges or a 5” Accelebar meter in the 5” HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 5” HTHW main.

2) Domestic Hot Water Metering
   a. Provide one set of CT’s,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾” conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾”conduit and wire from existing electrical switchboard meter to DDC panel.

5) Energy Conservations Measures
   a. Consider providing a HTHW converter for domestic hot water needs in the mechanical room. The electric hot water heater would be maintained for use during the Campus HTHW system summer shutdown period.

Coykendall Science

1) HTHW Metering
   a. There is an ample straight length of pipe to accommodate the installation of any meter. Provide a 3” Vortex Shedding flow meter and the required reducer fittings and flanges or a 5” Accelebar meter in the 5” HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.

Provide meter in 5” HTHW main.

2) Domestic Hot Water Metering
   a. Provide a flow meter in the secondary hot water piping serving the hot water heater.

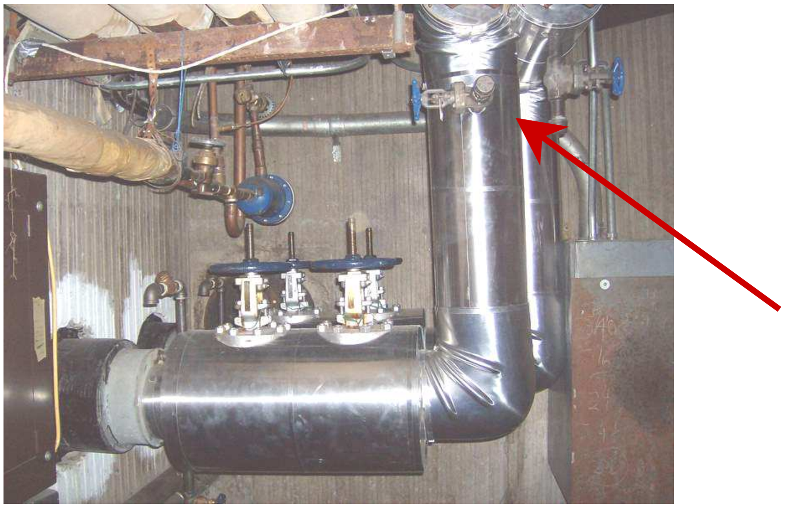
3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾”conduit and wire from existing electrical switchboard meter to DDC panel.

5) Energy Conservations Measures
   a. This building primarily consists of teaching laboratories. As such, a significant amount of airflow is required to meet code requirements for air quality. Airflow is maintained in spaces with a mixture of variable and constant volume boxes connected to the supply and exhaust ductwork. It may be possible to replace or retrofit constant volume boxes within lab spaces with variable air volume boxes. This would require the exhaust-side equipment such as fume hoods to be modified for variable airflow. In addition, it may be possible to reduce airflow rates throughout the labs during unoccupied times if this has not already been done. Heat recovery of exhaust air may be considered but would require substantial modifications to the penthouse mechanical room to accommodate heat recovery equipment. The complexity of the building systems would make any significant modification very costly. The few recommendations included above could potentially cost in excess of $500,000. If the Campus desires to further examine improvements to energy efficiency in this building, it is recommended that an in depth analysis of the building air flows and mechanical systems be performed and a detailed scope of work be created. Such an analysis is beyond the scope of this study.

Wooster Science

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is an ample straight length of pipe to accommodate the installation of any meter. Provide a 1-1/2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 3" Accelebar meter in the 3" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 3" HTHW main (downstream of piping shown at ceiling level).

2) Domestic Hot Water Metering
   a. Provide one set of CT's,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾" conduit and wire from water heater to DDC panel.
   b. Abate asbestos containing insulation at the HTHW converter and provide a HTHW meter in the HTHW service to this heater. Due to space constraints it is assumed that a Accelebar meter would be provided. Provide socket-welded thermowell fitting and temperature sensors in the supply and return piping.

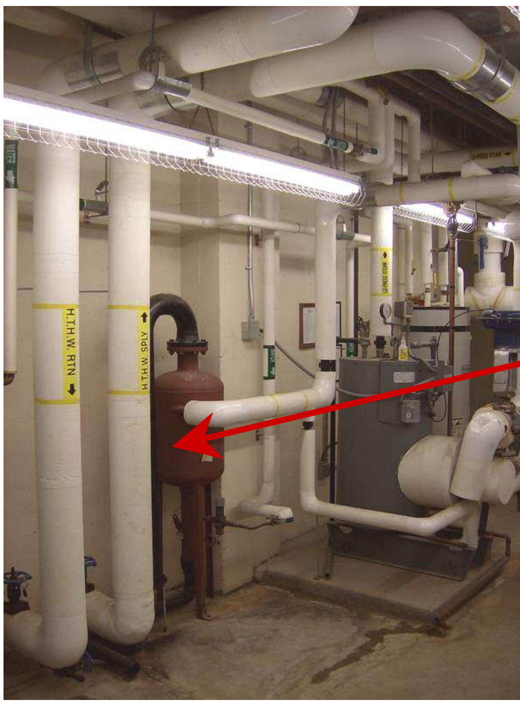
3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-1600-4 and clamp over circuit conductors in electric switchboard located in basement. Connect in-line-fuse leads to nearest power lugs in switchboard. Provide ¾" conduit and wire from switchboard CT's to DDC panel.

5) A major renovation of the entire Wooster Science Building is planned for the near future. The project is presently in the consultant selection stage. It may be prudent to incorporate metering upgrades in the future renovation rather than as part of an independent metering project.

Resnick Engineering Hall

1) HTHW Metering
   a. There is an ample straight length of pipe to accommodate the installation of any meter. Provide a 1” Vortex Shedding flow meter and the required reducer fittings and flanges or a 2” Accelebar meter in the 2” HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 2” HTHW main.

2) Domestic Hot Water Metering
   a. Provide a 1” flow meter in the gas line serving gas-fired water heater.

3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide one set of CT’s,Siemens #538-982 and clamp over circuit conductors in electric switchboard located in basement. Connect in-line-fuse leads to nearest power lugs in switchboard. Provide ¾” conduit and wire from switchboard CT’s to DDC panel.

Faculty Office Building

1) Heating and cooling
   a. Provide a gas flow meter in the main gas service to the building.

2) Domestic Water
   a. The minimal size of the water heater (10 gallons) makes flow measurement undesirable and it is not recommended.

3) Building Controls
   a. Provide a new DDC system in this building to meet the minimum requirements for metering. Locate the new DDC panel in the mechanical room.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-0300-2 and clamp over circuit conductors in electric service panel. Connect in-line-fuse leads to power lugs in panel. Provide ¾" conduit and wire from electrical panel CT's to DDC panel. Typical of 2 buildings.

Vandenburg Learning Center

1) HTHW Metering
   a. There is an ample straight length of pipe to accommodate the installation of any meter. Provide a 1-1/2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 4" Accelebar meter in the 4" HTHW supply main in the building basement mechanical tunnel. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.

Provide meter in 4" HTHW main.

2) Domestic Hot Water Metering
   a. Provide one set of CT's,Siemens #538-985and clamp over circuit conductors in electric hot water heater control panel located in basement mechanical room. Connect in-line-fuse leads to power lugs in control panel. Provide ¾" conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾"conduit and wire from existing electrical switchboard meter to DDC panel.

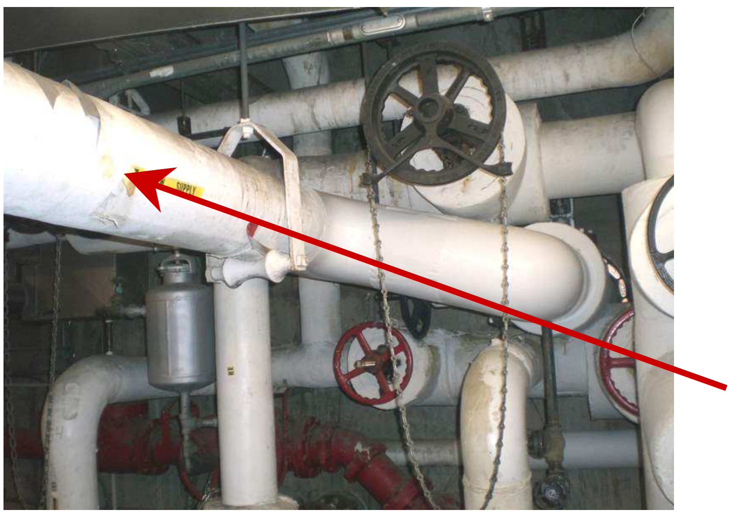
5) Energy Conservations Measures
   a. Consider providing a HTHW converter for domestic hot water needs in the mechanical room. The electric hot water heater would be maintained for use during the Campus HTHW system summer shutdown period.

Old Main

1) Building Controls Upgrades
   a. As this building will be provide with monitoring capabilities as part of the present renovations project, the only requirement is to integrate those systems with the central energy monitoring system.

Jacobson Faculty Tower

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is a sufficient straight length of pipe to accommodate the installation of any meter. Provide a 2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 5" Accelebar meter in the 5" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 5" HTHW main within straight run of approx 6'-6".

2) Domestic Hot Water Metering
   a. Provide one set of CT's,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾" conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾"conduit and wire from existing electrical switchboard meter to DDC panel.

5) Energy Conservations Measures
   a. Consider providing a HTHW converter for domestic hot water needs in the mechanical room. The electric hot water heater would be maintained for use during the Campus HTHW system summer shutdown period.

Humanities

1) Heating
   a. Abate asbestos insulation associated with the installation of meters in the hot water piping systems.
   b. Provide water flow meters in the heating water piping systems serving this building.

2) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

3) Building Electrical Metering
   a. Building is Fed from Jacobson Faculty Tower which has a digital meter mounted in its' switchboard. Provide ¾"conduit and wire from existing electrical switchboard meter in Jacobson to DDC panel in Jacobson.

Old Library

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices
   b. There is a sufficient straight length of pipe to accommodate the installation of any meter. Provide a 1” Vortex Shedding flow meter and the required reducer fittings and flanges or a 3” Accelebar meter in the 3” HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.

Provide meter in 3” HTHW main within straight run of approx 6’-6”.

2) Domestic Hot Water Metering
   a. Provide one set of CT’s,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾” conduit and wire from water heater to DDC panel.

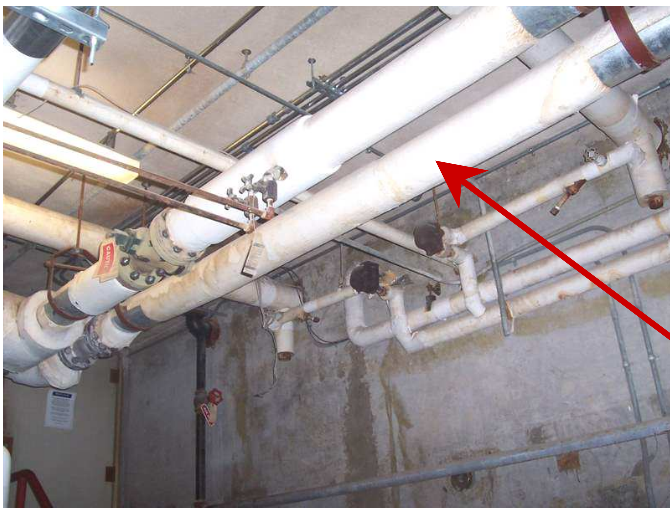
3) Building Controls Upgrades
   a. Provide upgraded Carrier control panels to provide metering capability throughout the building.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide one set of CT’s,Veris #H8035-0400-3 and clamp over circuit conductors in electric service panel. Connect in-line-fuse leads to power lugs in panel. Provide ¾” conduit and wire from electrical panel CT’s to DDC panel.

5) Energy Conservations Measures
   a. Consider providing a HTHW converter for domestic hot water needs in the mechanical room. The electric hot water heater would be maintained for use during the Campus HTHW system summer shutdown period.

College Hall

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is a sufficient straight length of pipe to accommodate the installation of any meter. Provide a 1-1/2” Vortex Shedding flow meter and the required reducer fittings and flanges or a 3” Accelebar meter in the 3” HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 3” HTHW main.

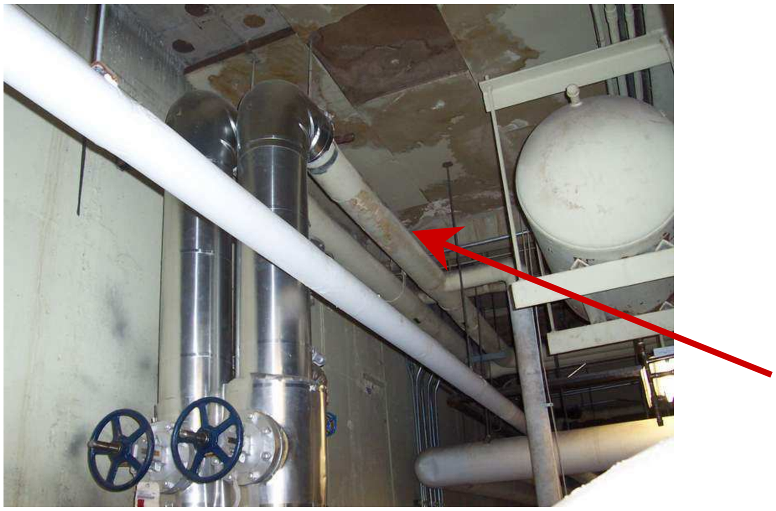
2) Domestic Hot Water Metering
   a. As domestic hot water is provided by both a HTHW converter, a gas-fired boiler, and an electric heater it is necessary to provide meters in all services to monitor energy use at all times. Abate asbestos containing insulation at the HTHW converter and provide a flow meter in the HTHW service to this heater. Due to space constraints it is assumed that a Accelebar meter would be provided. Provide a gas flow meter in the gas piping serving the gas-fired heater.
   b. Provide one set of CT’s,Veris #H8035-0100-2 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾” conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Provide a new DDC system in this building to meet the minimum requirements for metering. Locate the new DDC panel in the basement mechanical room.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide ¾”conduit and wire from existing electrical switchboard meter to DDC panel.

Hasbrouck Dining Hall

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is a sufficient straight length of pipe to accommodate the installation of any meter. Provide a 1-1/2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 3" Accelebar meter in the 3" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 3" HTHW main.

2) Domestic Hot Water Metering
   a. Abate asbestos containing insulation at the HTHW converter and provide a flow meter in the HTHW service to this heater.

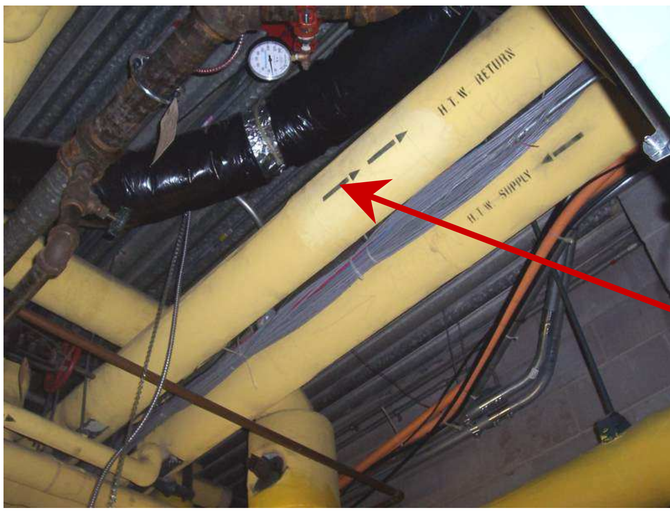
3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Gas Metering
   a. Provide a gas flow meter in the gas main serving the kitchen food service equipment and the 2" gas line serving the back-up boiler.

5) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-1600-4 and clamp over circuit conductors in 208/120V electric switchboard located in basement.
   b. Provide 1 additional set of CT's Veris #H8035-0800-3 and clamp over circuit conductors in 480/277V electric switchboard located in basement.
   Connect in-line-fuse leads to nearest power lugs in switchboards. Provide ¾" conduit and wire from switchboard CT's to DDC panel.

Service Building

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is a sufficient straight length of pipe to accommodate the installation of any meter. Provide a 1" Vortex Shedding flow meter and the required reducer fittings and flanges or a 3" Accelebar meter in the 3" HTHW supply main in the building main mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 3" HTHW main.

2) Domestic Hot Water Metering
   a. As domestic hot water is provided by both a HTHW converter and an electric heater it is necessary to provide meters in both services to monitor energy use at all times. Abate asbestos containing insulation at the HTHW converter and provide a flow meter in the HTHW service to this heater.
   b. Provide one set of CT's,Siemens #538-985 and clamp over circuit conductors in electric hot water heater control panel located in basement. Connect in-line-fuse leads to power lugs in control panel. Provide ¾" conduit and wire from water heater to DDC panel.

3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide one set of CT's,Siemens #538-980 and clamp over circuit conductors in electric service panel located on first floor. Connect in-line-fuse leads to nearest power lugs in panel. Provide ¾" conduit and wire from panel CT's to DDC panel.

Surge Building

1) Heating
   a. Provide a gas flow meter in the ¾ inch gas line serving the gas-fired furnaces.

2) Building Controls Upgrades
   a. Provide a new DDC system in this building to meet the minimum requirements for metering. Locate the new DDC panel in the mechanical room.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

3) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-0300-2 and clamp over circuit conductors in electric service panel located on first floor. Connect in-line-fuse leads to nearest power lugs in panel. Provide ¾" conduit and wire from panel CT's to DDC panel.

School of Business Building

1) Heating
   a. Provide a gas flow meter in the main gas service to the building.

2) Domestic Water
   a. The minimal size of the water heater (9,000 watts) makes individual metering undesirable and it is not recommended.

3) Building Controls
   a. Provide a new DDC system in this building to meet the minimum requirements for metering. Locate the new DDC panel in the mechanical room.
   b. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-0800-3 and clamp over circuit conductors in electric service panel located on first floor. Connect in-line-fuse leads to nearest power lugs in panel. Provide ¾" conduit and wire from panel CT's to DDC panel.

Student Health and Counseling Center

1) Heating
   a. Provide a flow meter and temperature sensors in the heating water piping for the boiler

2) Domestic Water
   a. The minimal size of the water heater (2,500 watts) makes individual metering undesirable and it is not recommended.

3) Building Electrical Metering
   a. Provide ¾"conduit and wire from existing electrical meter to DDC panel.

Charles Cook Children Center

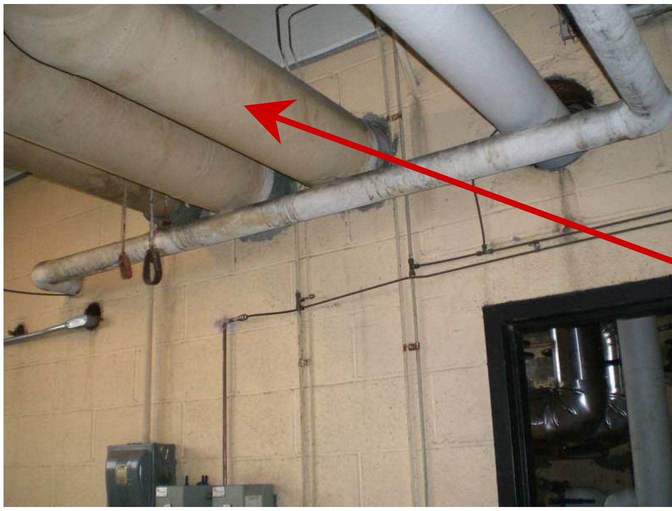
1) Heating
   a. Provide a gas flow meter in the main 2 inch gas service to the building.

2) Domestic Water
   a. The minimal size of the water heater (75 MBH) makes individual metering undesirable and it is not recommended

3) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-0400-3 and clamp over circuit conductors in electric service panel located on first floor. Connect in-line-fuse leads to nearest power lugs in panel. Provide ¾" conduit and wire from panel CT's to DDC panel.

Elting Gym and Athletics Center

1) HTHW Metering
   a. Abate asbestos in areas affected by the installation of the metering devices.
   b. There is a sufficient straight length of pipe to accommodate the installation of any meter in Elting Gym. Provide a 1-1/2" Vortex Shedding flow meter and the required reducer fittings and flanges or a 4" Accelebar meter in the 4" HTHW supply main in the building basement mechanical room. Provide socket-welded thermowell fitting and temperature sensors in the supply and return mains.



Provide meter in 4" HTHW main.

2) Domestic Hot Water Metering
   a. As domestic hot water is provided by both a HTHW converter and a gas-fired boiler, it is necessary to provide meters in both services to monitor energy use at all times. Provide a flow meter in the HTHW piping serving the water heater. Provide a gas flow meter in the 2-inch gas piping serving the summer boiler. It is also recommended that the isolation ball valves in the HTHW piping serving the water heater be replaced at this time.

3) Building Controls Upgrades
   a. Connect metering devices to the existing DDC system and provide associated programming to incorporate the metering in the main Energy Management System workstation.

4) Building Electrical Metering – Typical for Elting Gym and Athletic Center
   a. Provide ¾"conduit and wire from existing electrical switchboard meter to DDC panel.

Terrace Restaurant

1) Heating
   a. Provide a gas flow meter in the 1-1/4 inch gas main for the building. Provide the necessary piping modifications to provide sufficient straight length of pipe to accommodate a flow meter.

2) Building Electrical Metering
   a. Provide one set of CT's,Veris #H8035-0800-3 and clamp over circuit conductors in electric service panel located on first floor. Connect in-line-fuse leads to nearest power lugs in panel. Provide ¾" conduit and wire from panel CT's to DDC panel.

PHASING:

1) Ideally, all work requiring shutdown of the HTHW system within a building would be completed during the Campus summer heating plant shutdown. However, the Campus has expressed interest in reducing this shutdown in the future to as little as ten days. As many of the buildings do have relatively newer, double sets of isolation valves at the building entrance, it would be possible to accommodate the work outside of the heating plant shutdown as long as building heat is not required. Most buildings already have back-up alternative sources of domestic hot water (ie. electric or gas heaters) that would facilitate this work.

2) Metering of most other utilities could be done with minor disruptions to existing services and could be easily coordinated with the facility.

KEY ISSUES AND ISSUES TO BE RESOLVED:

1) Estimates for asbestos abatement in this report are based on the suspected presence of asbestos containing materials. All areas affected by the recommendations of this report must be tested for hazardous materials as part of the design phase.

2) Based on the recommendations of this report, the College may choose from three options for the configuration of the primary operator's workstation:
   a. Retain reporting functions in two separate primary operator's workstations maintained by Carrier and Siemens.
   b. Provide a third party software package to receive raw output data from both primary operator's workstations and output the data in customized tables, reports, etc.
   c. Provide a minimal Siemens DDC interface in every building to allow the use of the Siemens Utility Cost Manager Software.

ESTIMATE:

The attached Project Estimate dated May 18, 2009, indicates an estimated bid amount of $1,183,000. Please note the "Valid Until" date indicated on the Project Estimate. Beyond that date, the estimate will be subject to escalation and the possibility of further deterioration of existing conditions. The costs for each type of metering for each building are tabulated below. General conditions as well as design and bidding contingencies have been included in the tabulated values.

Building Name	HTHW Metering	Domestic Hot Water Metering	Controls Upgrades	Gas Metering	Electrical Metering	Energy Conservation Measures	Total
Haggerty	$18,800	$2,119	$9,953	---	$1,911	---	$32,783
Student Union Building	$18,135	$21,121	$9,953	$6,045	$2,015	---	$57,270
College Theatre/Dorsky Museum/Smiley Art	$17,385	$2,551	$9,953	$9,793	$1,479	$43,118	$84,280
Fine Arts	$17,446	$12,792	$6,890	---	$5,633	---	$42,762
Parker Theatre	$17,385	$2,830	$9,953	---	$1,911	---	$32,078
Sojourner Truth Library	$18,151	---	$6,890	---	$2,579	---	$27,620
Lecture Center	$21,121	$2,263	$9,953	---	---	$43,118	$76,455
Coykendall	$15,379	$12,792	$6,890	---	$2,631	---	$37,692
Wooster Science	$18,595	$19,602	$9,953	---	$3,843	---	$51,993
Resnick Engineering	$14,001	$5,561	$6,890	---	$3,494	---	$29,947
Faculty Office Building	---	---	$6,890	---	$1,569	---	$8,460
Vandenburg Hall	$14,041	$3,952	$6,890	---	$2,661	$43,118	$70,663
Old Main	---	---	---	---	---	---	---
Jacobson Faculty Tower	$19,973	$2,983	$6,890	---	$1,911	$43,118	$74,875
Humanities	$14,476	---	$6,890	---	$2,222	---	$23,588
Old Library	$17,869	$2,551	$9,953	---	$2,745	$43,118	$76,236
College Hall	$18,135	$23,672	$9,953	---	$1,309	---	$53,069
Hasbrouck Dining Hall	$18,135	$15,560	$9,953	$11,606	$5,699	---	$60,954
Service Building	$18,135	$17,823	$6,890	---	$6,099	---	$48,948
Surge Building	---	---	$9,953	$5,561	$2,145	---	$17,659
School of Business	---	---	$9,953	$5,561	$2,353	---	$17,867
Student Health Center	$13,542	---	$6,890	---	$1,911	---	$22,343
Childrens Center	---	---	$9,953	$5,561	$2,458	---	$17,972
Elting Gym and Athletic Center	$18,135	$21,121	$6,890	---	$3,586	---	$49,733
Terrace	---	---	$9,953	$6,045	$2,465	---	$18,463
Dormitories (9 total)	---	---	$103,355	---	---	---	$103,355
Primary Operator's Terminal	---	---	$45,936	---	---	---	$45,936
Totals	$328,841	$169,293	$354,470	$50,174	$64,630	$215,591	**$1,183,000**

APPENDIX:

1) Orientation Meeting Minutes of March 2, 2009
2) Campus Site Plan
3) HTHW Metering Options List
4) Veris Accelebar HTHW Meter Product Data Sheets
5) ABB Vortex Shedding and Swirl HTHW Meter Product Data Sheets
6) RTD Product Data Sheets
7) Gas Flow Meter Product Data Sheets
8) Siemens Energy Management Software Data Sheets
9) Carrier DDC Control Panel Product Data Sheet
10) Electrical Power Metering Device Product Data Sheets
11) Haggery Data Center Photos
12) OGS Cost Estimate Form BDC-178

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Orientation Meeting Minutes of March 2, 2009

SAGE
ENGINEERING
ASSOCIATES, LLP

1211 Western Avenue
Albany, NY 12203
(518) 453-6091
FAX (518) 453-6092

MEETING MINUTES

The following documents our understanding of the issues discussed during the subject meeting. For any questions or comments to these understandings, please contact David Layton as soon as possible.

PROJECT: **OGS Project No. S4448**
Study to Upgrade the Energy Management System
State University College at New Paltz
New Paltz, NY

MEETING DATE: March 2, 2009

MEETING PURPOSE: Project Scope Review Meeting

SEA PROJECT NO. 2301

ATTENDEES:

Name	Representing	Phone No.	Email
David Layton	Sage Engineering	453-6091	davidl@sagellp.com
Demetrios Koniaris	OGS D&C	474-1789	Demetrios.Koniaris@ogs.state.ny.us
Brian Pine	SUNY New Paltz	845-857-3322	pineb@newpaltz.edu
Gary Buckman	SUNY New Paltz	845-257-3306	buckmang@newpaltz.edu

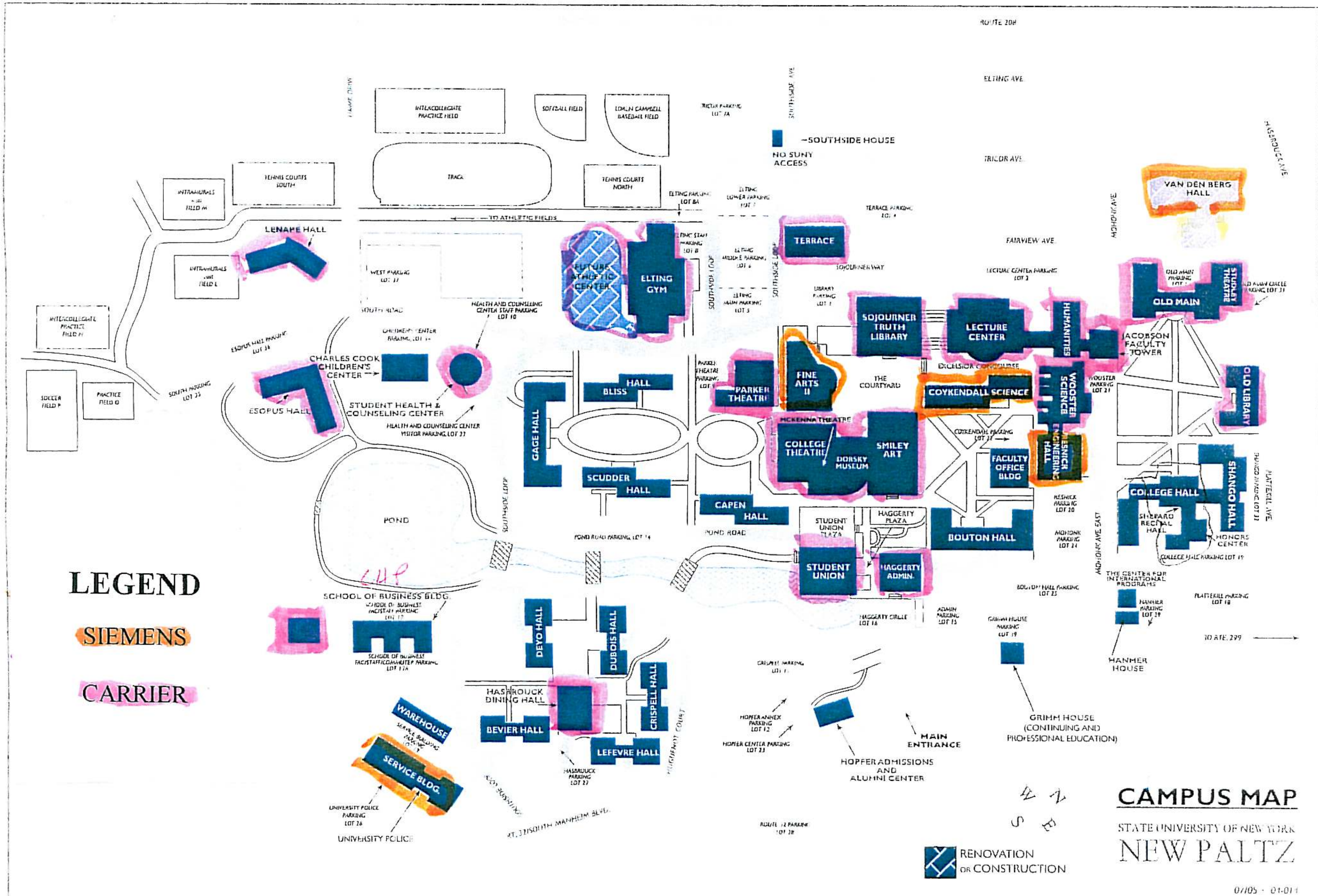
1. The intent of this meeting was to review the scope of work for the proposed project. Based on this work scope, the Consultant (Sage Engineering) will provide a Program Report to thoroughly define the work scope and provide detailed recommendations including associated costs. The recommended scope of work for each building will be formatted in such a way to permit the College to "pick and choose" those items deemed of high priority or with the highest potential for return on investment.
2. The primary scope of work for the proposed project will include modifications and upgrades to the Campus Energy Management System to provide campus wide monitoring of building energy usage including consumption of the following utilities: electrical power, HTHW, domestic hot water, cooling (chillers) and natural gas. The second part of the project will include modifications or replacement of the HVAC systems and HVAC controls in various buildings to provide more energy efficient systems. This may include air handling unit replacement, motor replacements, heat recovery ventilator installation, variable speed drive installation, commissioning, etc. The intent is to evaluate those options that would provide the largest energy savings.
3. The College would like the ability to monitor overall energy usage in each building prior to implementing the complete project, in order to establish a baseline energy usage rate

for each building. It was recommended that the Consultant provide a preliminary "breakout" report on the necessary modifications to provide monitoring of electrical power and HTHW flow to the buildings as quickly as possible. Because the installation of the HTHW flow measurement devices would require shutdown of active heating system, the College would like to complete this work during the May thru August 2009 heating plant shutdown.

4. Only the campus Academic buildings will be included in this project. Provisions should be made to provide the necessary "backbone" in the telecommunications or DDC systems in the Dormitory buildings as part of this project. Work within the dormitory buildings themselves will be provided as part of future DASNY funded projects.
5. The Campus provided a color-coded Campus map indicating the DDC system presently installed in each building. Both Siemens and Carrier have provided systems in buildings on Campus, with the latter being predominant.
6. The Campus would like the ability to "shed" electrical load as conditions require based on energy consumption. This would require the building DDC system to communicate with the energy metering system. It was therefore concluded that the best option would be to have the building DDC manufacturer provide the energy monitoring system as well as any DDC system modifications required to provide this capability. Both Carrier and Siemens market energy monitoring systems. The College does not wish to introduce a third party energy monitoring company to the Campus.
7. It is the desire of the College to have the DDC system manufacturer (Siemens or Carrier) who presently has systems in the building to provide the energy monitoring systems in that building. This would require sole sourcing of the system(s). The College has had similar DDC system sole sourcing approved in the past by the Office of the State Comptroller.
8. Those few building that do not have a DDC system at this time will be provided with the minimum DDC hardware necessary to provide energy monitoring as part of this project.
9. Although both Carrier and Siemens systems will be provided at the building level, the College would like the energy usage rates totalized on one of the two systems.
10. The College would like the DDC system modifications to include provisions for future lighting control.
11. The College would like the monitoring system to be capable of expansion for future monitoring of additional electrical power devices (i.e panels, etc.) within each building.

END OF MINUTES

Campus Site Plan


LEGEND
SIEMENS
CARRIER
CAMPUS MAP
STATE UNIVERSITY OF NEW YORK
NEW PALTZ
RENOVATION OR CONSTRUCTION
LENAPE HALL
ESOPUS HALL
CHARLES COOK CHILDREN'S CENTER
STUDENT HEALTH & COUNSELING CENTER
FUTURE ATHLETIC CENTER
ELTING GYM
TERRACE
SOUTHSIDE HOUSE
NO SUNY ACCESS
VAN DEN BERG HALL
SOJOURNER TRUTH LIBRARY
LECTURE CENTER
HUMANITIES
OLD MAIN
STUDLEY THEATRE
JACOBSON FACULTY TOWER
OLD LIBRARY
FINE ARTS II
PARKER THEATRE
THE COURTYARD
COYKENDALL SCIENCE
WOOSTER SCIENCE
RESNICK ENGINEERING HALL
MCKENNA THEATRE
COLLEGE THEATRE
DORSKY MUSEUM
SMILEY ART
FACULTY OFFICE BLDG
COLLEGE HALL
SHANGO HALL
SHEPARD RECITAL HALL
HONORS CENTER
GAGE HALL
BLISS HALL
SCUDDER HALL
CAPEN HALL
POND
POND ROAD
STUDENT UNION PLAZA
HAGGERTY PLAZA
BOUTON HALL
STUDENT UNION
HAGGERTY ADMIN.
THE CENTER FOR INTERNATIONAL PROGRAMS
HANMER HOUSE
SCHOOL OF BUSINESS BLDG.
DEYO HALL
DUBOIS HALL
CRISPELL HALL
HASBROUCK DINING HALL
BEVIER HALL
LEFEVRE HALL
WAREHOUSE
SERVICE BLDG.
UNIVERSITY POLICE
HOPPER ADMISSIONS AND ALUMNI CENTER
MAIN ENTRANCE
GRIMM HOUSE (CONTINUING AND PROFESSIONAL EDUCATION)
ROUTE 208
ELTING AVE
TRICOR AVE.
FAIRVIEW AVE
SOJOURNER WAY
EXCELSIOR CONCOURSE
MOHONK AVE
MOHONK AVE. EAST
HASBROUCK AVE
PLATTEKILL AVE
TO RTE. 299
TO ATHLETIC FIELDS
SOUTHSIDE LOOP
SOUTH ROAD
HUGUENOT COURT
INTRAMURALS FIELD M
INTRAMURALS FIELD L
TENNIS COURTS SOUTH
TENNIS COURTS NORTH
TRACK
INTERCOLLEGIATE PRACTICE FIELD
SOFTBALL FIELD
LORAIN CAMPBELL BASEBALL FIELD
INTERCOLLEGIATE PRACTICE FIELD H
SOCCER FIELD P
PRACTICE FIELD O
WEST PARKING LOT 17
SOUTH PARKING LOT 25
ESOPUS HALL PARKING LOT 36
HEALTH AND COUNSELING CENTER STAFF PARKING LOT 10
HEALTH AND COUNSELING CENTER VISITOR PARKING LOT 22
ELTING PARKING LOT 8A
ELTING STAFF PARKING LOT 8
ELTING LOWER PARKING LOT 7
ELTING MIDDLE PARKING LOT 6
ELTING MAIN PARKING LOT 5
TERRACE PARKING LOT 4
LIBRARY PARKING LOT 1
LECTURE CENTER PARKING LOT 2
WOOSTER PARKING LOT 21
COYKENDALL PARKING LOT 3
RESNICK PARKING LOT 20
MOHONK PARKING LOT 24
BOUTON HALL PARKING LOT 25
COLLEGE HALL PARKING LOT 19
HANMER PARKING LOT 29
PLATTEKILL PARKING LOT 18
POND ROAD PARKING LOT 14
HAGGERTY CIRCLE LOT 16
ADMIN PARKING LOT 15
GRIMM HOUSE PARKING LOT 19
HOPPER ANNEX PARKING LOT 12
HOPPER CENTER PARKING LOT 23
HASBROUCK PARKING LOT 27
UNIVERSITY POLICE PARKING LOT 26
SCHOOL OF BUSINESS FAC/STAFF/COMMUTER PARKING LOT 17A
RT. 32 SOUTH MANHEIM BLVD.
N
E
S
W
07/05 - 01-011

HTHW Metering Options List

SUNY NEW PALTZ	ACCURACY: Pipe Run Req'd	0.50% zero	1.00% 15 dia.	0.50% 3 dia.
BUILDING	**PIPE SIZE**	**VERIS "ACCELEBAR"**	**ABB VORTEX**	**ABB SWIRL**
1 RESNICK ENGINEERING	2"	5-30 GPM	(1") 8-30 GPM	(1 1/4") 4-30 GPM
		$3,945.00	$3,230.00	$4,220.00
2 OLD LIBRARY	3"	5-60 GPM	(1") 8-60 GPM	(1 1/2") 4-60 GPM
		$3,880.00	$3,230.00	$4,220.00
3 PARKER THEATER	3"	5-60 GPM	(1") 8-60 GPM	(11/2") 8-60 GPM
		$3,880.00	$3,230.00	$4,220.00
4 SERVICE BLDG	3"	5-60 GPM	(1") 8-60 GPM	(1 1/2") 8-60 GPM
		$3,880.00	$3,230.00	$4,220.00
5 JACOBSEN FACILTY TOWER	5"	10-150 GPM	(2") 16-150 GPM	(3") 18-150 GPM
		$4,810.00	$3,390.00	$4,886.00
6 HUMANITIES				
7 LECTURE CENTER	5"	10-150 GPM	(2") 16-150 GPM	(3") 18-150 GPM
		$4,810.00	$3,390.00	$4,886.00
8 FINE ARTS	6"	20-400 GPM	(3") 50-400 GPM	(3") 18-400 GPM
		$5,930.00	$3,845.00	$4,886.00
9 HAGGERTY ADMIN	2"	5-30 GPM	(1") 8-30 GPM	(1 1/4") 4-30 GPM
		$3,945.00	$3,230.00	$4,220.00
10 WOOSTER SERVICE	3"	5-115 GPM	(1 1/2") 13-115 GPM	(3") 18-115 GPM
		$3,880.00	$3,310.00	$4,886.00
11 COYKENDALL	5"	10-300 GPM	(3") 51-300 GPM	(3") 18-300 GPM
		$4,810.00	$3,845.00	$4,886.00
12 VANDENBURG HALL	4"	10-175 GPM	(1 1/2") 13-175 GPM	(3") 18-175 GPM
		$4,530.00	$3,310.00	$4,886.00

13 COLLEGE THEATRE	3"	5-100 GPM	(1 1/2") 13-100 GPM	(2") 18-100 GPM
		$3,880.00	$3,310.00	$4,335.00
14	3"	5-100 GPM	(1 1/2") 13-100 GPM	(2") 13-100 GPM
		$3,880.00	$3,310.00	$4,335.00
15 STUDENT UNION	3"	5-150 GPM	(1 1/2") 13-150 GPM	(3") 18-150 GPM
		$3,880.00	$3,310.00	$4,886.00
16 HASBROVEN DINING HALL	3"	5-150 GPM	(1 1/2') 13-150 GPM	(3") 18-150 GPM
		$3,880.00	$3,310.00	$4,886.00
17 COLLEGE HALL	3"	5-140 GPM	(1 1/2") 13-140 GPM	(3") 18-140 GPM
		$3,880.00	$3,310.00	$4,886.00
18 SOJOURNER HALL	4"	10-175 GPM	(1 1/2") 13-150 GPM	(3") 18-175 GPM
		$4,530.00	$3,310.00	$4,886.00
19 ELTING GYN	4"	10-175 GPM	(1 1/2") 13-150 GPM	(3") 18-175 GPM
		$4,530.00	$3,310.00	$4,886.00

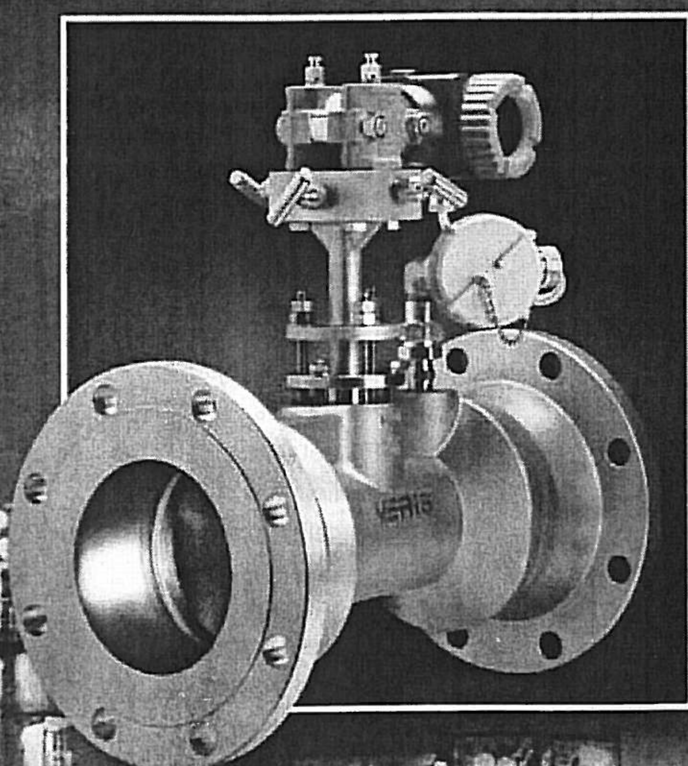
Veris Accelebar HTHW Meter Product Data Sheets

VERIS

Superior Flow Measurement Accuracy with No Straight Run Requirements and Operating Ranges Never Before Attainable

...Until Now

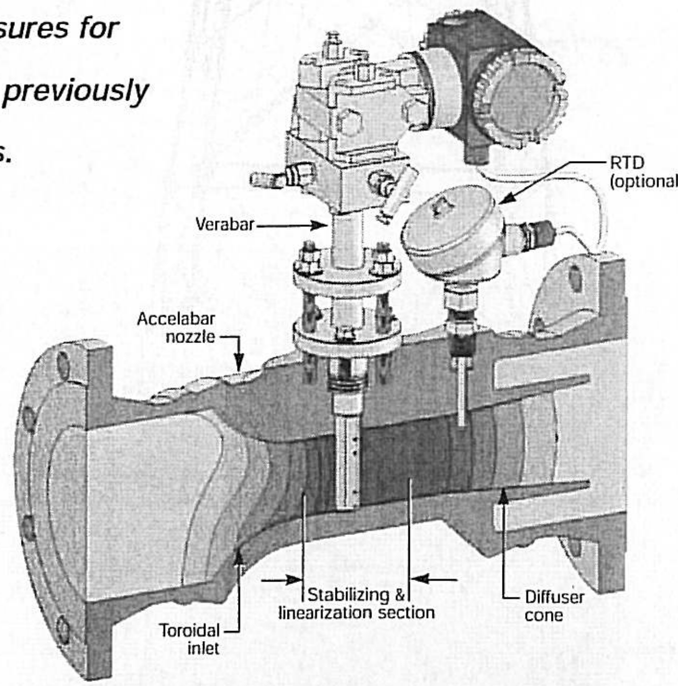
Accelabar®



Accelabar®... A New Idea in Flow Measurement

The Unique Accelabar Flow Meter

The Accelabar is a new and unique flow meter that combines two differential pressure technologies to produce operating ranges never before attainable in a single flow meter. It is capable of generating high differential pressures for measuring gas, liquids and steam at turndowns previously unattainable—with no straight run requirements.



How the Accelabar Works

The Accelabar consists of a unique toroidal nozzle design and a Verabar® averaging pitot. The nozzle has a patented straight run "settling distance" that accelerates, linearizes and stabilizes the velocity profile sensed by the Verabar. The Verabar located within the nozzle accurately measures and significantly increases the differential pressure output to increase the operating range (turndown). The Accelabar has a constant flow coefficient and produces an accuracy of up to ±0.50%.

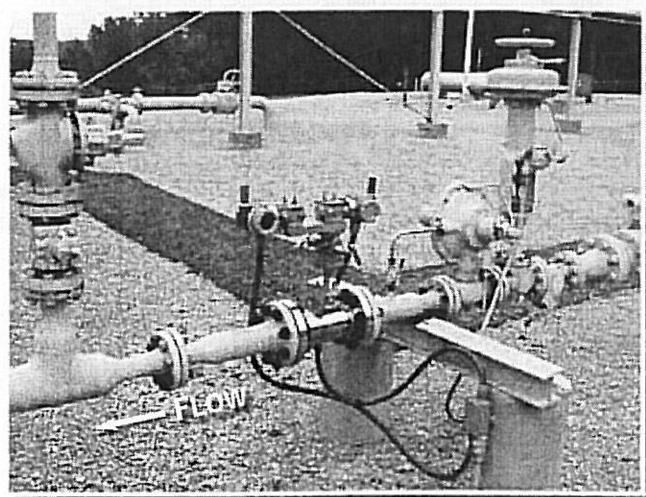
Other manufacturers claim high accuracy, but over a limited turndown.

No Straight Run Required

The Accelabar can be used in extremely limited straight run piping configurations. The straight run is integral to the meter. The stabilization and linearization of the velocity profile within the throat of the nozzle eliminates the need for any upstream run.

Engineering Specifications

- Low velocity flow rates
- High accuracy: to ± 0.50%
- Repeatability: ±0.050%
- Verified flow coefficients
- No calibration required
- Extended turndown
- No straight run requirements
- Low permanent pressure loss
- Mass or volumetric flow

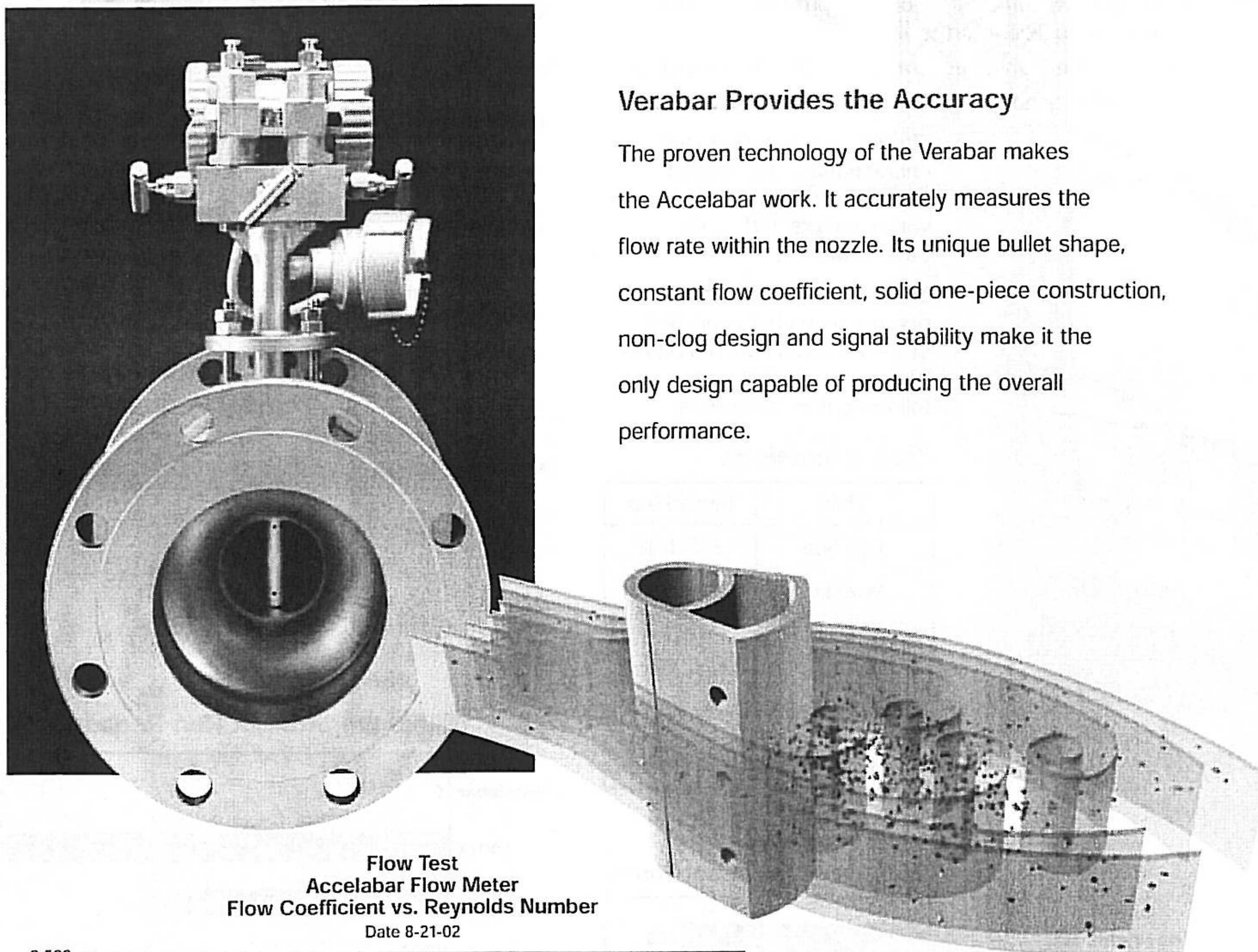


Actual Application (see data on page 4)

Application:	3" Sch 40 Natural Gas
Operating Pressure/ Temperature:	50 PSIG/70° F
Max/Min Flow Rate:	60,000 SCFH/1,000 SCFH
Flow Turndown:	60:1
Straight Run:	0"

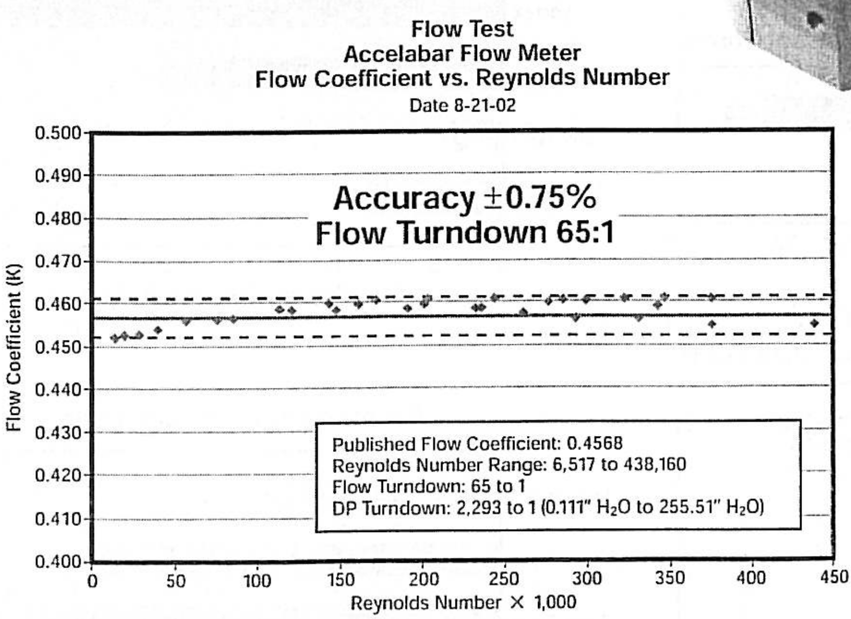
US Patent No. 6,868,741 B2 and various foreign patents pending.

Engineered to be the Best



Verabar Provides the Accuracy

The proven technology of the Verabar makes the Accelabar work. It accurately measures the flow rate within the nozzle. Its unique bullet shape, constant flow coefficient, solid one-piece construction, non-clog design and signal stability make it the only design capable of producing the overall performance.



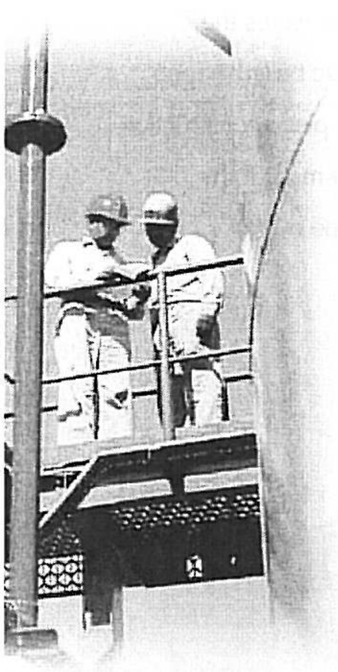
Verified Accuracy and Flow Coefficients

Empirical test data from independent laboratories verified an analytical model and flow coefficients as constant and independent of Reynolds Number and within ±0.75% of the predicted value over a flow turndown of 65:1 (see actual test). ***This eliminates the need for calibration.***

Comparative Analysis vs. Other Flow Meters

The Accelabar fills the need not presently being filled by other flow meters for applications that:

- Do not have sufficient velocity to produce a readable signal or sufficient turndown
- Require the highest accuracy over an extended range
- Have little or no straight run piping before the meter



The Accelabar performance characteristics far exceed those of other DP meters, vortex meters and many other flow meters.

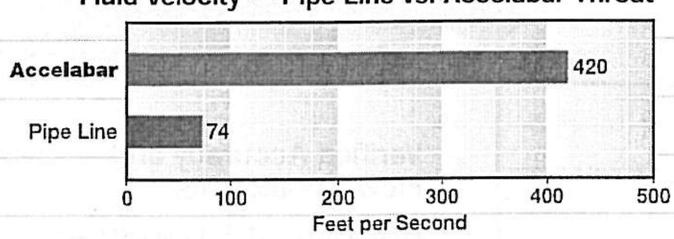
These charts show the actual performance characteristics of the Accelabar versus other flow meters based on the following flow conditions:

Flow Conditions

Fluid	Natural Gas
Pipe Size	3" Sch 40
Max Flow	60,000 SCFH
SG	0.6
Pressure	50 psig
Temperature	70°F
Pipe Line Velocity	74 ft/sec

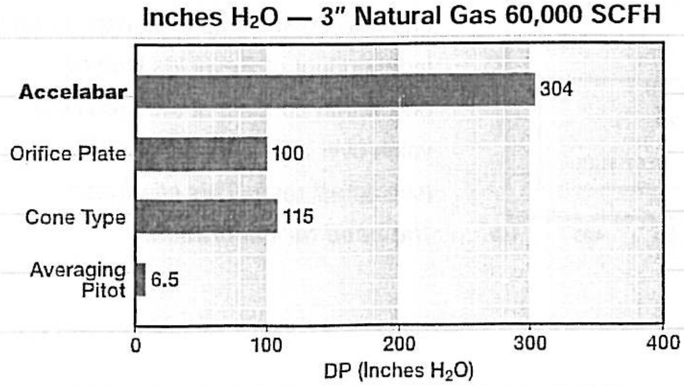
Accelabar Increased Velocity

Fluid Velocity — Pipe Line vs. Accelabar Throat



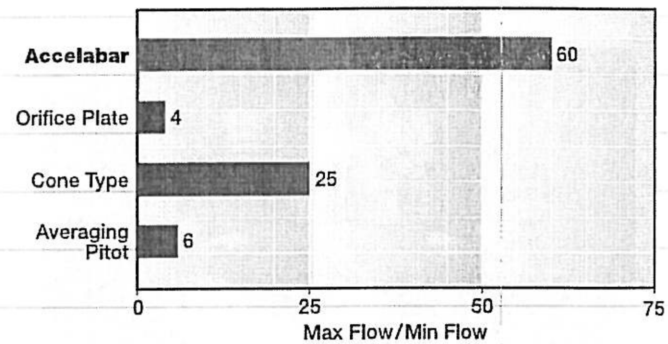
DP at Maximum Flow

Inches H_2O — 3" Natural Gas 60,000 SCFH



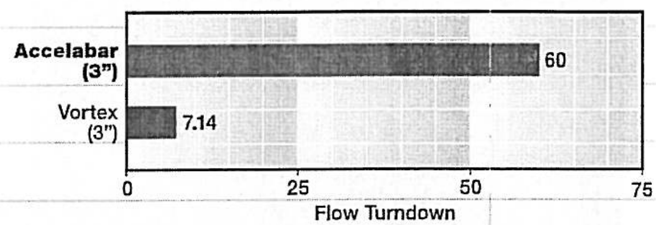
Flow Turndown

Maximum & Minimum

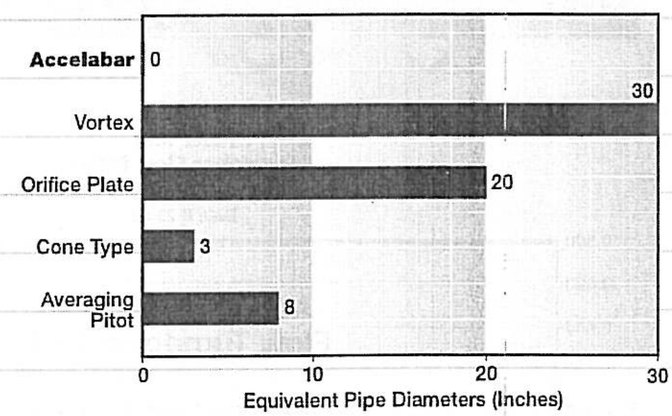


Flow Turndown

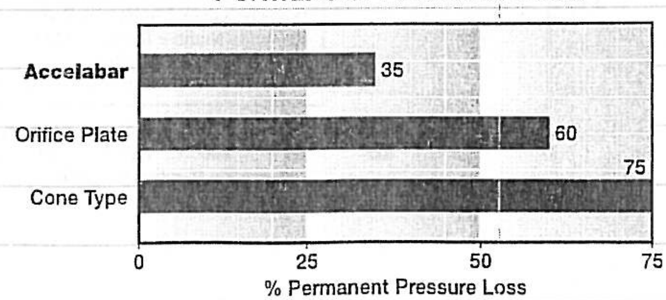
Accelabar vs. Vortex



Minimum Straight Run Requirements



Permanent Pressure Loss

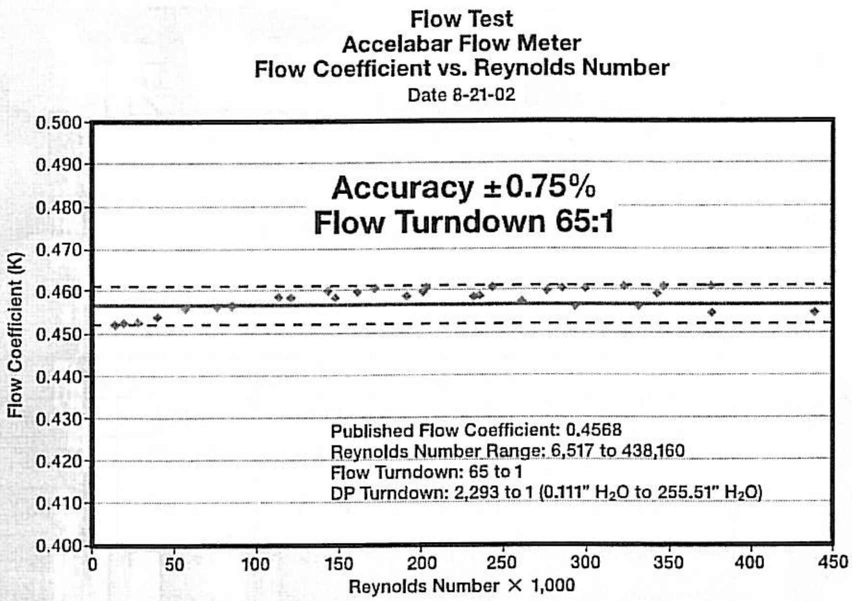


Accelabar® Test Data

The Proof Is In The Data

Many flow meters claim high accuracy and rangeability or turndown. However, few manufacturers define their limitations and even fewer can support it with actual test data. The tests below show the performance capabilities of the Accelabar.

Turndown Test



Test Specifications*

Pipe Size:	3" sch 40
Fluid:	Air
Flow Rate:	145 ACFM
Max Pressure:	60 psig
Max Temperature:	75°F

Results

The Accelabar produced a DP of 255.5" H_2O at 145 ACFM. An accuracy of ±0.75% was maintained over a Reynolds Number range of 65 to 1. No other flow meter is capable of this operating range.

*Independent, NIST traceable tests were performed as follows:

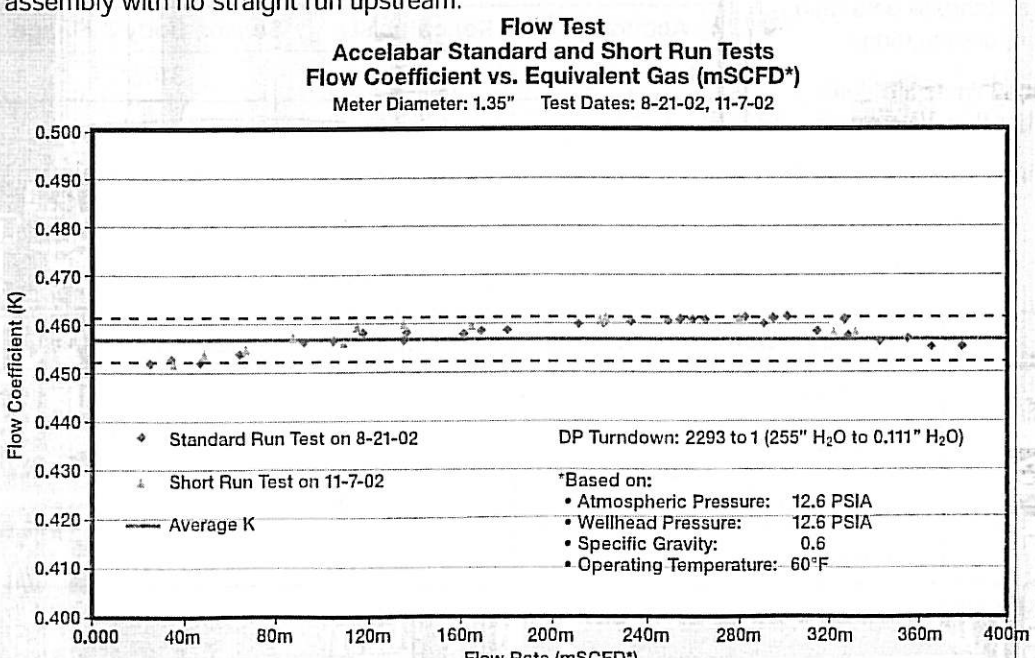
- Air tests in 3", 4", 6" and 12" pipes
- NIST traceable water tests
- Large turndown natural gas testing
- Short straight-run testing

Consult factory for a copy of certified tests.

No Straight Run Test Comparison

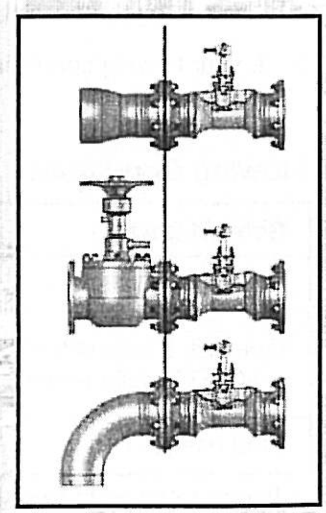
Test Specifications

The Accelabar was tested immediately downstream of a valve, tee and expander assembly with no straight run upstream.



Results

The short run test plotted with the standard straight run test verifies there is no shift in the flow coefficient.



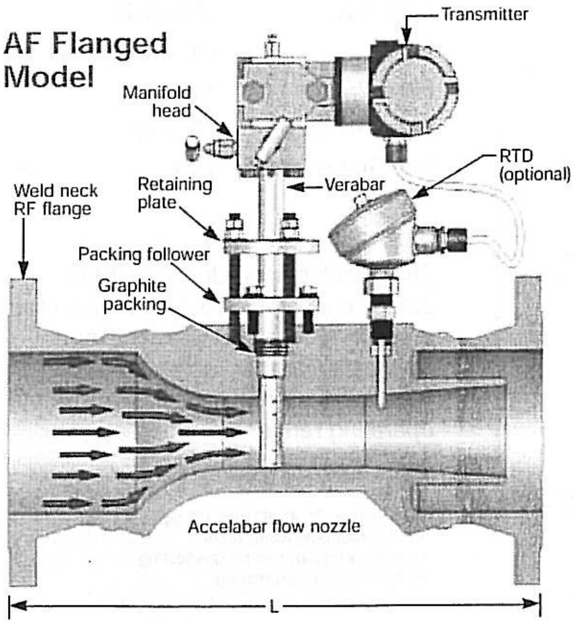
Models and Specifications

Ready to Install

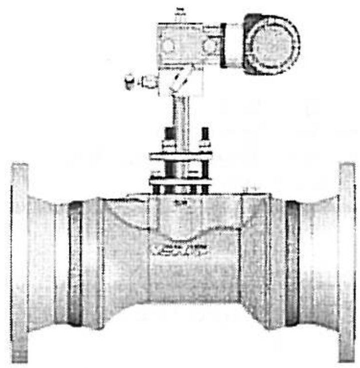
The Accelabar is a complete flow meter ready to install. It comes complete with single or dual transmitters depending on the turndown requirements.

An optional RTD is supplied in a Thermowell for dynamic compensation (required for use with multivariable transmitter).

AF Flanged Model



Single Transmitter



Dual Transmitter

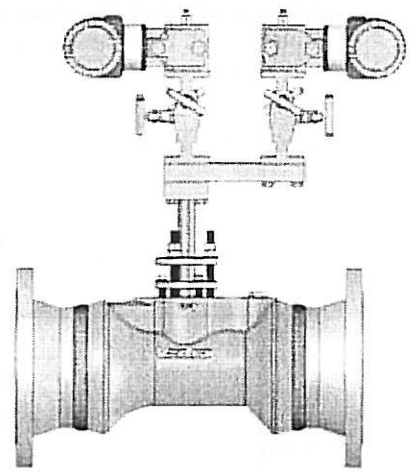


Chart A

Meter Size	Verabar Sensor	Face to Face "L"*		
		150#	300#	600#
3" (75mm)	-05 1/2"	13.78"	14.53"	15.28"
4" (100mm)	-05 1/2"	15.15"	15.90"	17.65"
6" (150mm)	-10 1"	19.15"	19.90"	21.90"
8" (200mm)	-10 1"	21.40"	22.15"	24.40"
10" (250mm)	-10 1"	23.15"	24.40"	27.65"
12" (300mm)	-10 1"	26.17"	27.78"	29.67"

* Face to face dimensions nominal. Custom lengths available.

Specifications

Accuracy	Repeatability	Sensor, Body & Flange
to ± 0.50%	±0.050%	316SS

Accelabar Model Selection

1. Furnish your flowing conditions. A flow calculation is required to determine the DP and verification of the operating limits.
   - Each meter size has a standard beta ratio sized for the optimal operating range.
   - The maximum operating limits are determined by the Accelabar flow calculation.
2. If your flowing conditions exceed the operating limits, a larger or smaller model (meter size) must be selected.

Flowing Conditions

General Data	Fluid Parameters	Maximum	Normal	Minimum	Units
Tag number	Flow Rate				
Pipe size & schedule or exact ID & wall thickness	Pressure				
	Temperature				
Fluid name:	Density*				

*Density is not required for steam applications.

Ordering Information

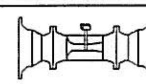
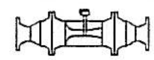
Model	Accelabar 316SS
AFS ABS	Flanged Connections Bevel for Weld
	User Mating Pipe Size and Schedule or Exact ID and Wall Thickness

Code	User Mating Flange (Model AFS Only)
150 300 600	150# ANSI Class 275 psig @ 100°F, 80 psig @ 800°F (19 Bars @ 38°C, 5.5 Bars @ 426°C) 300# ANSI Class 720 psig @ 100°F, 330 psig @ 800°F (49.6 Bars @ 38°C, 22.8 Bars @ 426°C) 600# ANSI Class 1440 psig @ 100°F, 660 psig @ 800°F (99.3 Bars @ 38°C, 45.5 Bars @ 426°C) If other than ANSI, specify Standard (DIN, JIS) Size and Rating

Code	Flange Material
C S	Carbon Steel Stainless Steel

Accelabar Meter Size

Important: If the selected meter size is larger or smaller than the user's mating pipe and flange, expanders or reducers are required. Consult the factory for price and delivery.

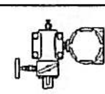
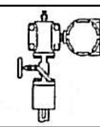
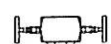
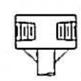
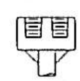



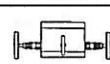
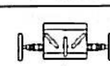
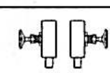
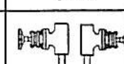
3" (75mm)	4" (100mm)	6" (150mm)	8" (200mm)	10" (250mm)	12" (300mm)

Code	Verabar Size
05 10	7/16" (11mm) 7/8" (22mm)

Code	Pipe Orientation
H V	Horizontal Vertical

Instrument Head Connections (Select Remote or Direct Mount Transmitter—Sold Separately)

Direct Mount Transmitter (Flanged 450°F/232°C Max.)		Remote Mount Transmitter (1/2" NPT)		
Manifold	Transmount	Valve	Regular	Parallel
 Integral		 Integral		
M	**F**	**T**	**R**	**P**

Manifolds (Optional)				Instrument Valves (Optional)	
Direct Mount				Remote Mount	
3-Valve		5-Valve		Needle	Gate
					
Soft Seat	Hard Seat	Soft Seat	Hard Seat	1/2" NPT	1/2" NPT
F3SC (CS) **F3SS** (SS)	**F3HC** (CS) **F3HS** (SS)	**F5SC** (CS) **F5SS** (SS)	**F5HC** (CS) **F5HS** (SS)	**C2NC** (CS) **C2NS** (SS)	**C2GC** (CS) **C2GS** (SS)

Optional

Code	RTD in Thermowell
H1 H2 HT NH	Hazardous Location, Class 1 Div 1, Explosion Proof Hazardous Location, Class 1 Div 2, Non-Incendive Wiring High Temperature (500°F to 900°F, 260°C to 482°C) Non-Hazardous Location

Optional

Code	Connection Cable to Transmitter (Direct Mount Only)
XP N4	Explosion Proof (hazardous locations) NEMA 4

Optional

AFS	6"Sch 40	150	SS	4"	05	H	R	C2NC	H2	XP	For Transmitter Selection, see Page 8.

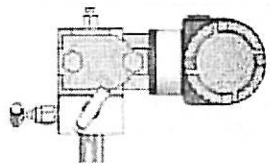
Accelabar®...The Right Choice

Transmitter Selection

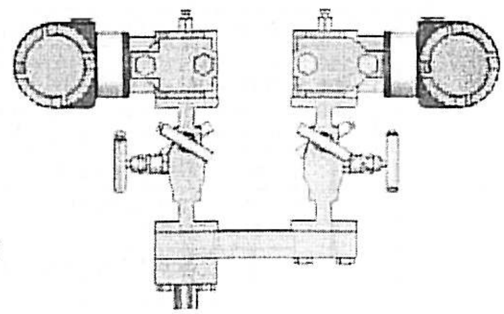
Accelabar accuracy is *percent of rate.* The Accelabar maintains a constant flow coefficient over a wide range of flow rates and differential pressures.

DP transmitter accuracy is *percent of scale.* While most Accelabar installations are equipped with one DP transmitter, some applications requiring superior accuracy over an extreme DP turndown may require a dual DP transmitter installation.

Single Transmitter

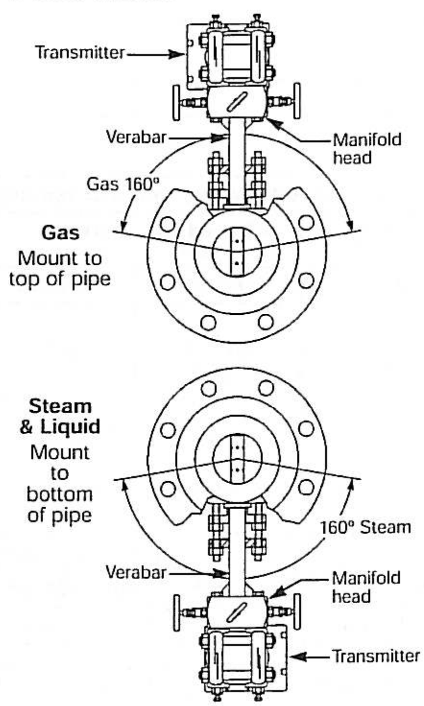


Dual Transmitter

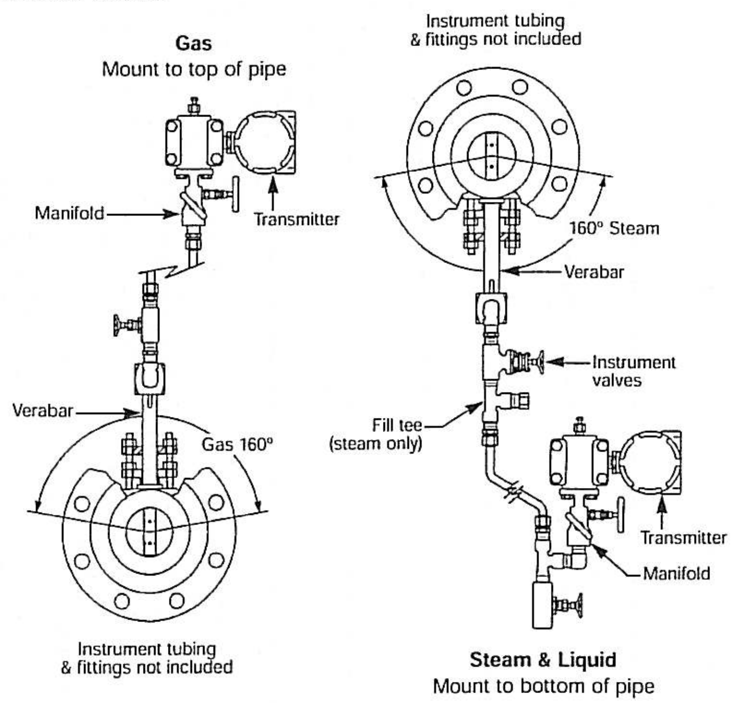


Installation Orientation

Direct Mount



Remote Mount



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E-Mail: contact@veris-inc.com • Website: www.veris-inc.com

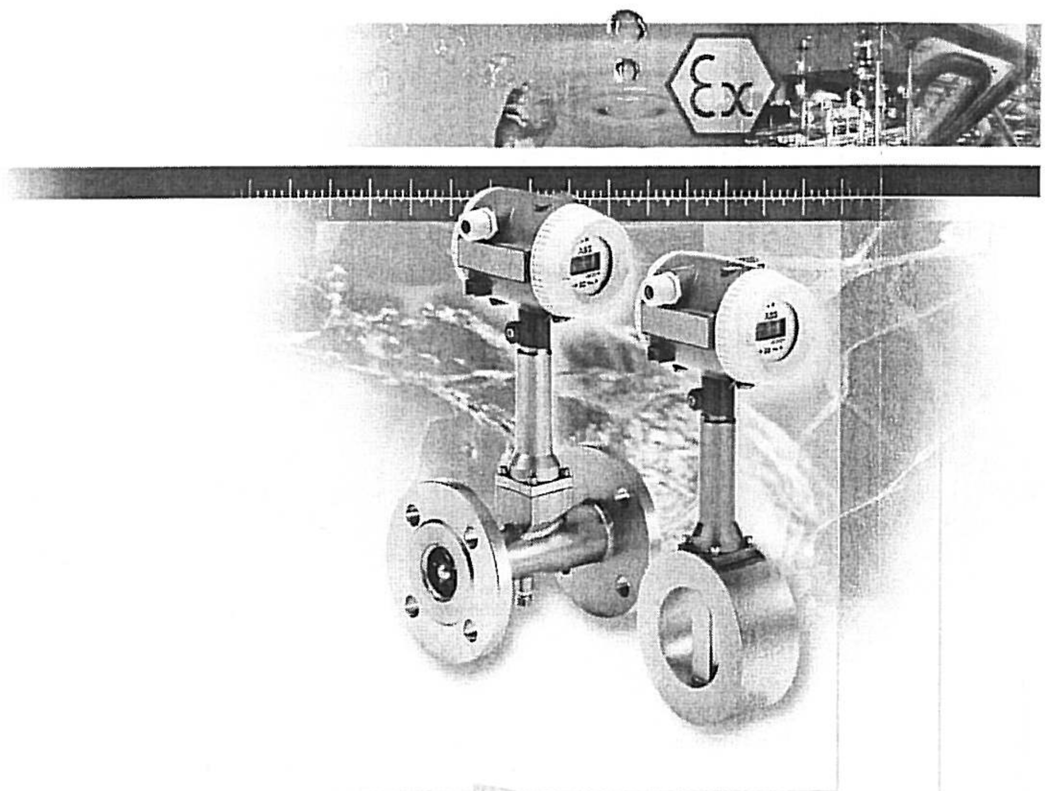
VB-7100F (6/08)

Printed in USA

ABB Vortex Shedding and Swirl HTHW Meter Product Data Sheets

Vortex Flowmeter FV4000 (TRIO-WIRL V)
Swirl Flowmeter FS4000 (TRIO-WIRL S)

For flow rate and volume measurement of liquids, gases and steam

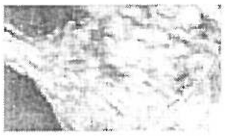


- Cost savings due to high accuracy
- Low investment cost through short straight inlet and outlet sections
- No wear, no maintenance – no moving parts
- Reduced stock keeping cost through flexible Ex concept (incl. Dust Ex)
- Economic saturated steam measurement using the 2-wire technology

ABB Instrumentation

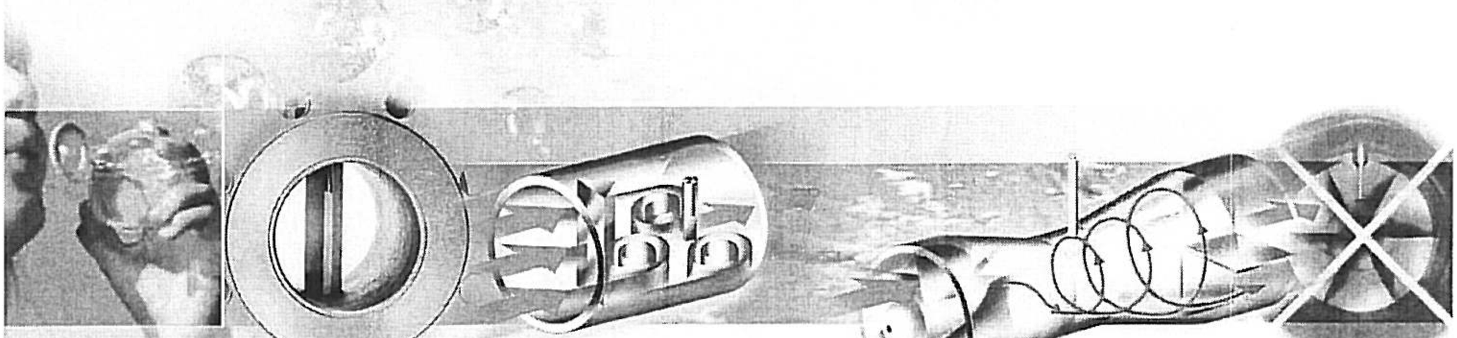
ABB

Technology that creates a whirl



Vortex and Swirl Flowmeters

When a flowing fluid meets an obstruction, pressure variations are created in the fluid, which cause eddies to shed at the obstruction. This phenomenon is utilized in the Vortex and Swirl flowmeters. The eddies are formed in the fluid at a geometrically defined obstruction (Vortex and Swirl bodies) whose frequency is measured by a sensor.
The flowrate of liquids, gases and steam is determined precisely and reliably from this frequency measurement.



Flow stream in the Vortex Flowmeter

Flow stream in the Swirl Flowmeter

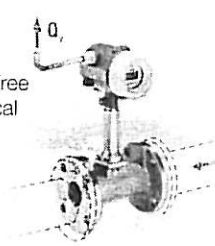
The Vortex Flowmeter FV4000 operation is based on the Karman Vortex Street, in which, the shedding frequency of eddies in a flow stream after an obstruction is measured.

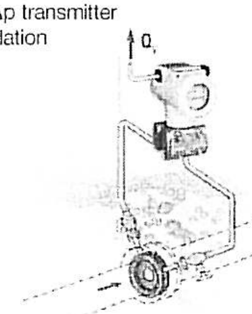
Fixed spiral vanes in the Swirl Flowmeter's entry body force the fluid into a rotation. The frequency of the resulting secondary rotation is then measured.

The shedding frequency of the eddies and the rotation are – over a wide Reynold's number range – proportional to the flow rate.

A worthwhile comparison

	Vortex Flowmeter	Ring Chamber Standard Orifice
Accuracy	1% of rate / 0.75% of measured value	approx. 2% of upper range value
Span	up to five times greater	small
Feed pipes	not required	requires 2 thin pipes to the Δp transmitter and multi-way valve for ventilation
Outputs	analog and pulse	analog, only
Installation	convenient, easy to commission	demanding
Maintenance	maintenance-free	requires much maintenance
Cost	very economical up to DN 200	economical only for DN 200 or higher





Striking flexibility

ABB is the only manufacturer offering high-performance Vortex and Swirl flowmeters, which, as a result of their innovative DSP-Technology (Digital Signal Processing), are extremely reliable. The instruments are designed in 2-wire technology.

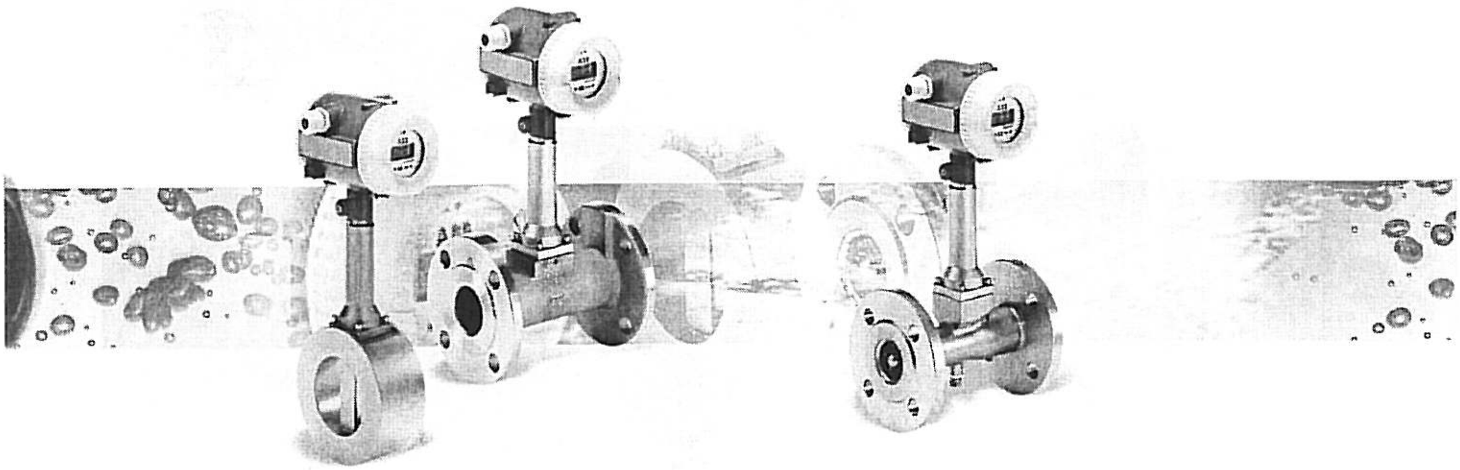
Most different measuring principles – special advantages

Vortex

- Easy orifice replacement through 65 mm installation length for wafer flange version
- Process safety through robust design (resistant to hammer-blows)
- Unaffected by sediments, hence requiring only little maintenance

Swirl

- Amazingly low installation cost due to uniquely short straight sections (inlet and outlet)
- Cost savings through high accuracy
- Suitable for liquids with a viscosity greater than 7 mPas (up to 30 mPas, depending on pipe diameter)



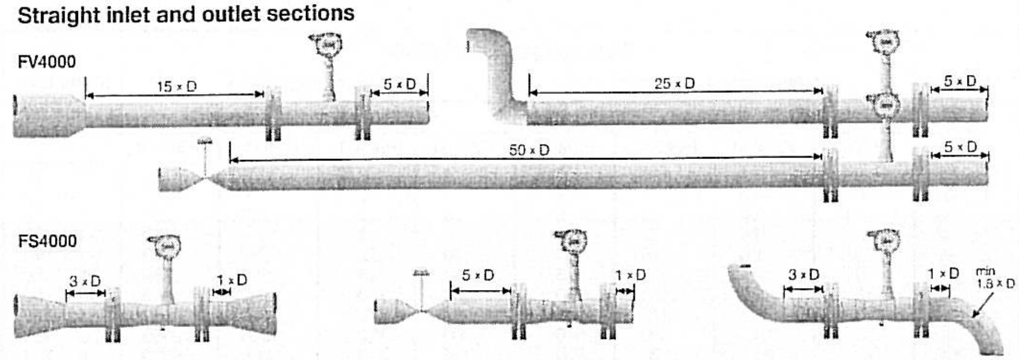
Undisturbed inflow

In order to provide optimum functionality, the flow profile of the Vortex flowmeter should be as undisturbed as possible. This is achieved by using a straight inlet section with a length of 15D (pipe diameters) and an outlet section 5D long. The inlet length requirement may increase depending on the location.

Very short straight inlet and outlet sections

Swirl-Flowmeter requires virtually no straight pipe sections on the inlet or outlet. Generally lengths of 3D at the inlet and 1D at the outlet are sufficient.

Straight inlet and outlet sections



Convincing intelligence

FV4000-VR4 resp. FS4000-SR4 with remote converter

The separate primary of this variant can be installed at even hardly accessible measuring points.

This measuring system is also designed for measuring points in a harsh environment. As the primary does not contain any electronic components, it can be exposed to ambient temperatures up to 70 °C (158 °F).

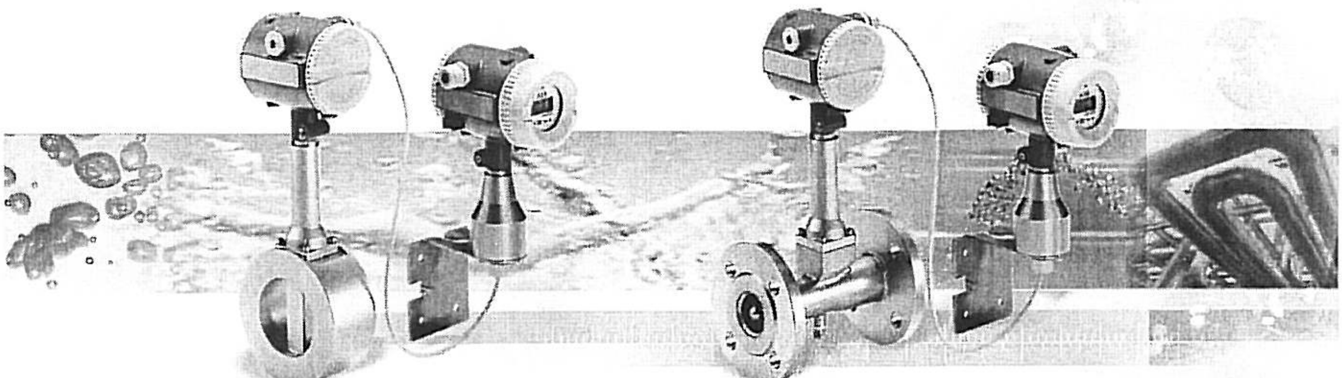
The primary can be operated easily and conveniently from a distance of up to 10 m.

Impressive arguments

All calibration data and parameter values are stored in a removable FRAM, allowing the converter to be exchanged quickly and easily.

The sensors are vibration compensated, (pipeline vibrations up to 1g are suppressed in the converter).

Identical sensors and converters are utilized for both measuring methods (vortex and swirl). This reduces stocking costs.



FV4000 (TRIO-WIRL V) FS4000 (TRIO-WIRL S)

	Vortex Flowmeter FV4000 (TRIO-WIRL V)	Swirl Flowmeter FS4000 (TRIO-WIRL S)
Principle	Karman Vortex Street	Swirl flow
Fluids	Liquids, gases, steam	Liquids, gases, steam
Temperature range	-55 °C...+400 °C (131 °F...752 °F)	-55 °C...+280 °C (131 °F...536 °F)
Process connection	Flanged, wafer design	Flanged
Protection Class	IP 67	IP 67
Communication	HART, PROFIBUS PA, FOUNDATION Fieldbus	HART, PROFIBUS PA, FOUNDATION Fieldbus
Accuracy	Liquids: ≤ ±0.75% of rate Gases/steam: ≤ ±1% of rate	≤ ±0.5% of rate

Flow ranges FV/FS4000

Meter Size		**Liquid**[1] Flow Range [m³/h]				**Gas**[2] Flow Range [m³/h]				**Meter Size**	
inch	DN	Qv_{min}		Qv_{max} DN		Qv_{min}		Qv_{max} DN		inch	DN
		FV4000	**FS4000**	**FV4000**	**FS4000**	**FV4000**	**FS4000**	**FV4000**	**FS4000**		
1/2	15	0.5	0.1	6	1.6	4	2.5	24	16	1/2	15
3/4	20	–	0.2	–	2	–	5	–	25	3/4	20
1	25	1.6	0.4	18	6	15	5	150	50	1	25
1-1/4	32	–	0.8	–	10	–	8	–	130	1-1/4	32
1-1/2	40	2.4	1.6	48	16	30	12	390	200	1-1/2	40
2	50	3	2.5	70	25	40	18	500	350	2	50
3	80	10	3.5	170	100	100	60	1200	850	3	80
4	100	10	5	270	150	150	65	1900	1500	4	100
6	150	30	18	630	370	300	150	4500	3600	6	150
8	200	70	25	1100	500	430	200	8000	4900	8	200
10	250	70	–	1700	–	–	–	–	–	10	250
12	300	135	100	2400	1000	810	530	14000	10000	12	300
16	400	–	180	–	1800	1410	1050	20000	20000	16	400

[1] water at 20 °C (68 °F) [2] air at 20 °C (68 °F), 1013 mbar

Versatile regarding...

use in hazardous areas

Type Fieldbus:
The Ex-version complies with the FISCO (Fieldbus Intrinsically Safe Concept) of the PTB (German Federal Establishment of Physics and Engineering).
- II 2 G EEx ia IIC T4
  II 2 D T85 °C...T_{Medium} IP67

With Dust Ex Certificate

Type 4...20 mA HART:
- Intrinsically safe power supply:
  II 2 G EEx ib IIC T4
  II 3 G EEx n(L) IIC T4
  II 2 D T85 °C...T_{Medium} IP67

Flame proof/intrinsically safe design:
- Non-intrinsically safe power supply:
  II 2 G EEx d [ib] IIC T6
  II 2 D T85 °C...T_{Medium} IP67
- Intrinsically safe power supply:
  II 2 G EEx ib IIC T4
  II 2 D T85 °C...T_{Medium} IP67

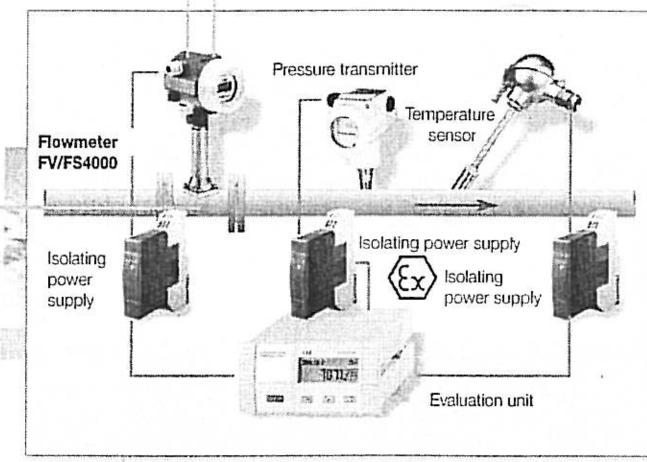
FM APPROVED

Advantage: Reduced stock requirement because the same instrument can be installed in either "EEx d" or "EEx ib" areas. This model is certified for hazardous area zone 2 as well.

interfaces to the process

Type 4...20 mA Analog output
- Contact output (pulse or alarm contact)
- HART-Protocol

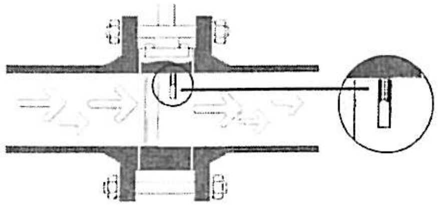
Type Fieldbus
- Contact output (pulse or alarm contact)
- PROFIBUS PA (Profile 3.0) or
- FOUNDATION Fieldbus
- EEx protection acc. to the FISCO Model



changing process conditions

Integrated temperature measurement

The measurement of the temperature and flowrate at the same location offers considerable advantages:
- Saturated steam measurement directly in mass flow units
- Higher accuracy through compensation of temperature effects
- High accuracy through advantageous positioning of the temperature sensor
- No additional wiring
- Fast response time



Sensor for flowrate and temperature measurements

Pressure and temperature compensation

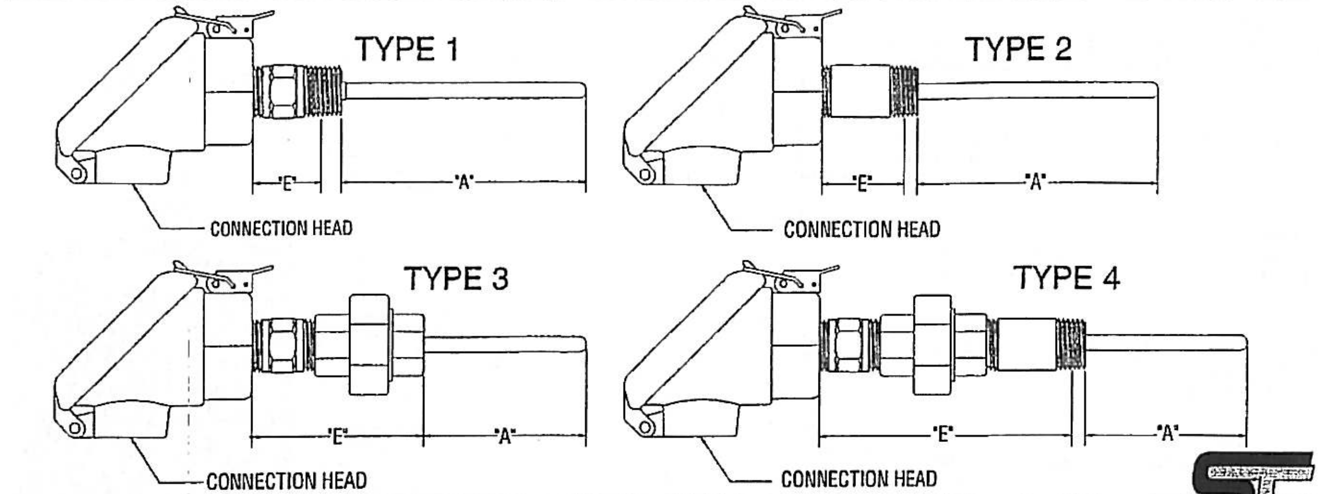
If the process conditions are changing, e.g. due to pressure variations, or overheated steam is to be measured, the integrated temperature measurement equipment is not sufficient for exact measurement and display of the gas flow (in mass or standard units) or steam mass flow. Swirl and Vortex flowmeter together with FCU400-G (gases) or FCU400-S (steam) are the optimal tools for these applications. The instrument supply is realized via the FCU evaluation unit, thus reducing the wiring efforts considerably.

Additionally used ABB components

- Pressure transmitter
  for absolute pressure, e.g. Multi Vision 2020 TA
- Resistance thermometer
  e.g. TSWT-R, optionally with integrated TH 02 head-mounted transmitter
- Evaluation unit
  FCU400-S, FCU400-G (SensyCal S/G)

RTD Product Data Sheets

RTD'S for THERMOWELLS



1	2	3	4	5		6	7	8	9		10	11	12	13
R	T	B	G	M	-	1	0	1	T	-	K	0	6	A

CONNECTION HEAD TYPE

SNAP-COVER STYLES
T = Cast Aluminum
V = White Polypropylene
4 = DIN "B" Size Aluminum
SCREW-COVER STYLES
W= Explosion Proof*
1 = Cast Aluminum
2 = Cast Iron
5 = White Polypropylene
8 = Stainless Steel (T-304)

ELEMENT TYPE

Resistance @ 0°C	2 Wire	3 Wire	4 Wire
Platinum 100Ω Single	A	B	C
Platinum 100Ω Dual	D	E	N/A
Platinum 500Ω Single	F	G	H
Platinum 1000Ω Single	K	L	M

ACCURACY & TEMPERATURE COEFFICIENT

Accuracy @ 0°C	Din.00385	Jis.00392
Class B (.12%)	G	H
Class A (.06%)	J	K
1/3rd (.04%)	M	N
1/10th (.01%)	Q	N/A

TEMPERATURE RANGE

-50 to +200° C	I
-50 to +450° C	M
-200 to +650° C	H

SHEATH LENGTH ("A" Fractional)

A = None	J = 3/8"
C = 1/8"	L = 1/2"
E = 3/16"	Q = 3/4"
G = 1/4"	

SHEATH LENGTH ("A")

Whole Inches: Example 04 = 4 Inches

SHEATH DIAMETER (Inch)

K = .250" (1/4")
N = .375" (3/8")

EXTENSION MATERIAL	Code
Steel / Malleable Iron	D
304 Stainless Steel	T
316 Stainless Steel	W

CONFIGURATION**	Type	"E"- Extension Length (Inches)
Head with hex nipple	1	01
Head with pipe nipple only	2	02, 03, 04, 06
Head with hex nipple & union	3	03
Head with hex nipple/union/nipple	4	04, 05, 06

**All are 1/2" NPT thread size and nominal length.

* Explosion Proof Head Meets the Following Location Classifications:
Class I, Groups C & D Class II, Groups E, F, & G
Class III, Div. 1 & 2
NEMA 7, Groups C & D NEMA 9, Groups E, F, & G

NOTES: All elements are spring loaded to ensure positive contact in the thermowell.
Sheath material is 316 SST regardless of well material.

Socket-Weld Design Thermowells For 1/4" & 3/8" Diameter Elements

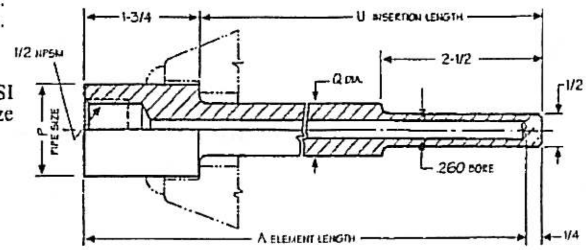
Application:
260W Series fits standard length 1/4" diameter elements.
385W Series fits standard length 3/8" diameter elements.

Connection Size:
3/4" or 1" nominal pipe size welding shoulder fits ANSI welding fittings, flanges, etc. Wells for larger pipe size fittings are available on request.

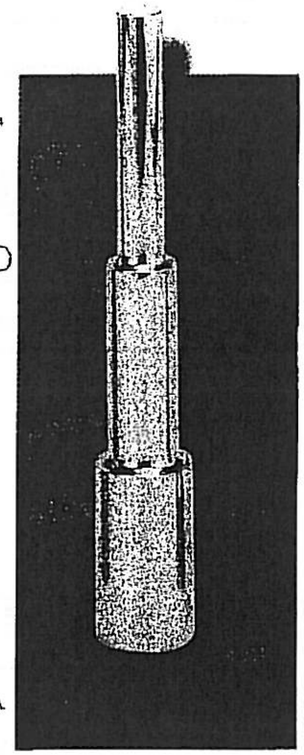
Materials:
Carbon Steel C-1018, A.I.S.I. 304, A.I.S.I. 316 are standard. Other materials are available upon request.

Lagging Extension:
When specifying lagging extension, choose a length which will permit the use of a standard element length. (See 260L and 385L lengths)

Plug & Chain:
Brass or Stainless Steel captive plug is available for keeping well bore clean when not in use.

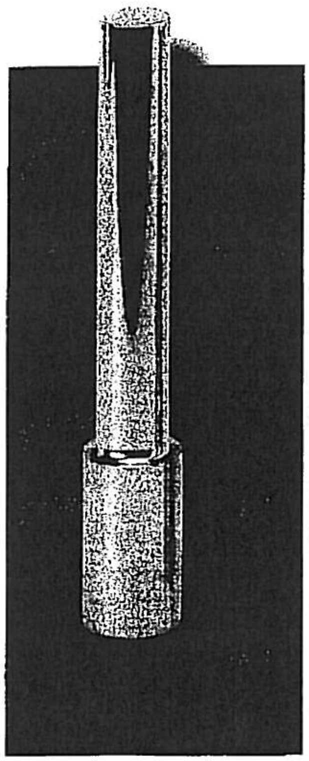


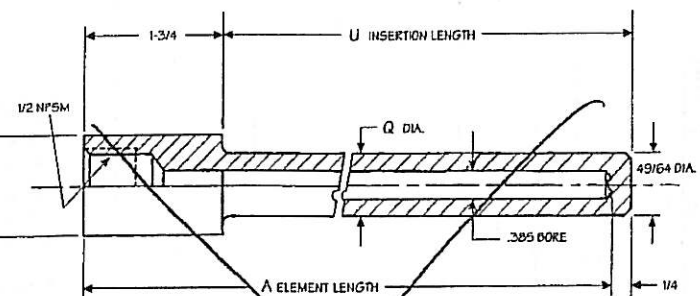
Series 260W



Pipe Size P	Type Number	Shank Dia. Q	P	Elem. Lgth. A	Insert. Lgth. U
3/4" Nominal (1.050 Dia.)	~~3/4"-260W -U 2-1/2~~	~~--~~	~~1.050~~	~~4~~	~~2-1/2~~
	-U 4-1/2	3/4	"	6	4-1/2
	~~-U 7-1/2~~	~~"~~	~~"~~	~~9~~	~~7-1/2~~
	-U10-1/2	"	"	12	10-1/2
	-U13-1/2	"	"	15	13-1/2
	-U16-1/2	"	"	18	16-1/2
	-U22-1/2	"	"	24	22-1/2
1" Nominal (1.315 Dia.)	1"-260W -U 2-1/2	—	1.315	4	2-1/2
	-U 4-1/2	7/8	"	6	4-1/2
	-U 7-1/2	"	"	9	7-1/2
	-U10-1/2	"	"	12	10-1/2
	-U13-1/2	"	"	15	13-1/2
	-U16-1/2	"	"	18	16-1/2
	-U22-1/2	"	"	24	22-1/2

Series 385W





Pipe Size P	Type Number	P	Elem. Lgth. A	Insert. Lgth. U
3/4" Nominal (1.050 Dia.)	3/4"-385W -U 2-1/2	1.050	4	2-1/2
	-U 4-1/2	"	6	4-1/2
	-U 7-1/2	"	9	7-1/2
	-U10-1/2	"	12	10-1/2
	-U13-1/2	"	15	13-1/2
	-U16-1/2	"	18	16-1/2
	-U22-1/2	"	24	22-1/2
1" Nominal (1.315 Dia.)	1"-385W -U 2-1/2	1.315	4	2-1/2
	-U 4-1/2	"	6	4-1/2
	-U 7-1/2	"	9	7-1/2
	-U10-1/2	"	12	10-1/2
	-U13-1/2	"	15	13-1/2
	-U16-1/2	"	18	16-1/2
	-U22-1/2	"	24	22-1/2

Pressure - Temperature Rating
lbs. per sq. inch

Material	Temperature - °F 70°	200°	400°	600°	800°	1000°	1200°
Brass	5000	4200	1000	---	---	---	---
Carbon Steel	5200	5000	4800	4600	3500	1500	---
A.I.S.I. - 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. - 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	---

Maximum Fluid Velocity
feet per second
(See Section on Velocity Ratings on page 6.)

Well Type	Material	Insertion Length - "U" 2-1/2	4-1/2	7-1/2	10-1/2	13-1/2	16-1/2	22-1/2
3/4"-260W	Carbon Steel	290 (106)	123 (71.2)	44.9 (42.7)	22.8	13.8	9.3	4.9
	A.I.S.I. 304 & 316	300 (148)	128 (99.3)	46.4	23.6	14.3	9.6	5.1
1" - 260W	Carbon Steel	290 (106)	143 (84.3)	51.6 (50.6)	26.2	15.9	10.6	5.7
	A.I.S.I. 304 & 316	300 (148)	148 (117)	53.5	27.2	16.5	11.0	5.9
3/4"-385W and 1"-385W	Carbon Steel	428 (260)	192 (144)	69.5	35.4	20.5	14.6	7.7
	A.I.S.I. 304 & 316	449 (360)	199	71.9	36.6	21.2	14.8	8.0

260W and 385W Series

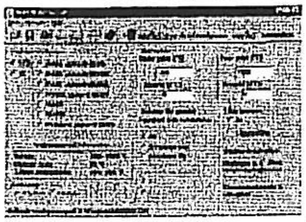
To Order, Please Specify:

1. Complete Type Number
2. Material
3. Plug & Chain - If Desired

5 YEAR LIMITED WARRANTY CE FM APPROVED

Q9
Basic Programmable 2-wire In-head Transmitters

Actual size



Basic Programmable 2-wire Transmitter for RTD and T/C

The Q9 is a basic, non-isolated, easy-to-use 2-wire transmitter for in-head mounting in DIN B and similar heads.

Configuration is made in seconds with the user friendly Windows software, Q9 Soft. No external power is needed.

The Q9 is programmable for RTD's in 3- and 4-wire connection according to different standards as well as for 11 T/C types.

Useful error correction functions improve the accuracy.

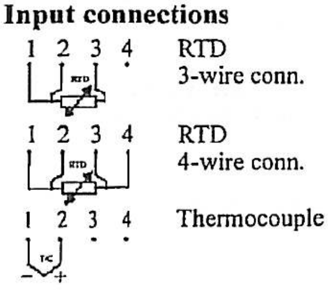
- **Measurements with RTD's in 3- and 4-wire connection**
  The Q9 accepts inputs from a number of standardized RTD's such as Pt100, Pt500 and Pt1000 acc. to IEC 60751 (α=0.00385), Pt100 acc. to JIS C 1604 (α=0.003916) and US standards (α=0.003902) as well as Ni100 and Ni1000 acc. to DIN 43760. 3- and 4-wire connection can be selected.
- **Measurements with thermocouples**
  The Q9 accepts inputs from 11 types of standardized thermocouples.
  For T/C input, the CJC (Cold Junction Compensation) is fully automatic, by means of an accurate measurement of the terminal temperature. Alternatively, the CJC can be disabled.
- **Temperature linear output**
  Fully temperature linear 4-20 mA output for RTD's and thermocouples.
- **Sensor matching and error corrections for maximum accuracy**
  A matching to a calibrated temperature sensor can easily be performed with the *Sensor Error Correction* function. The *System Error Correction* is a convenient way to adjust the sensor/transmitter combination (or just the transmitter) for highest accuracy in a certain measuring range.
- **NAMUR compliant**
  Output limitations and fail currents according to NAMUR recommendations.
- **Designed for harsh conditions**
  Rugged design tested for 5 g vibrations.
- **Mounting and wiring**
  The Q9 is designed to fit inside connection heads type DIN B or larger. The large center hole, dia. 7mm / 0.28 inch, and the robust terminals greatly simplify the mounting and wiring procedure.
- **Configuration without external power**
  Edit or read the configuration off-line by just connecting a PC.
- **Q9 Soft, easy-to-use Windows configuration software**
  The simple and user friendly software, Q9 Soft, is used for transmitter configuration in seconds. In one window all parameters are set, such as sensor type, measuring range, filter activation, CJC, sensor failure action, error corrections etc.

Specifications: Q9

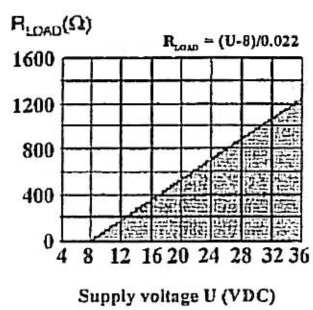
Input RTD's		
Pt100 (IEC60751, α = 0.00385)	3-, 4-wire connection	-200 to +1000 °C / -328 to +1832 °F
Pt 100 (JIS1604, α = 0.003916)	3-, 4-wire connection	-200 to +1000 °C / -328 to +1832 °F
Pt 100 (US, α = 0.003902)	3-, 4-wire connection	-200 to +1000 °C / -328 to +1832 °F
Pt1000 (IEC60751, α = 0.00385)	3-, 4-wire connection	-200 to +200 °C / -328 to +392 °F
Ni100 (DIN 43760)	3-, 4-wire connection	-60 to +250 °C / -76 to +482 °F
Ni1000 (DIN 43760)	3-, 4-wire connection	-100 to +150 °C / -148 to +302 °F
PtX (IEC60751, α = 0.00385)	3-, 4-wire connection	Any Pt function between Pt10- Pt1000
Sensor current		~ 0.4 mA
Maximum sensor wire resistance		25 Ω/wire
Input Thermocouples		
Range	Type: AE, B, E, J, K, L, N, R, S, T, U	Acc. to T/C standards
Maximum sensor wire resistance		500 Ω (total loop)
Monitoring		
Sensor failure monitoring		Upscale or downscale action
Adjustments		
Zero adjustment	All inputs	Any value within range limits
Minimum spans	Pt100 T/C	10 °C / 18 °F 2 mV
Output		
Analog		4-20 mA, temperature linear
Resolution		5 µA
Minimum output signal	Measurement/Failure	3.8 mA / 3.5 mA
Maximum output signal	Measurement/Failure	20.5 mA / 21.6 mA
Permissible load, see load diagram		725 Ω @ 24 VDC, 22 mA
Temperature		
Ambient, storage and operation		-40 to +85 °C / -40 to +185 °F
General data		
Selectable dampening time		~ 2 s
Update time		~ 1.5 s
Isolation In - Out		Non-isolated
Humidity		0 to 100 %RH
Power supply, polarity protected		
Supply voltage		8 to 36 VDC 2-wire
Permissible ripple		4 V p-p @ 50/60 Hz
Accuracy		
Linearity	RTD T/C	±0.1 % [1] ±0.2 % [1]
Calibration	RTD T/C	Max. of ±0.2 °C/ ±0.4 °F or ±0.1 % [1] Max. of ±20 µV or ±0.1 % [1]
Cold Junction Compensation (CJC)	T/C	±0.5 °C / ±0.9 °F
Temperature influence [3]	All inputs	Max. of ±0.25 °C/25 °C or ±0.25%/25 °C [1][2]
		Max. of ±0.5 °F/50 °F or ±0.28%/50 °F [1][2]
Temperature influence CJC [3]	T/C	±0.5 °C/25 °C / ±1.0 °F/50 °F
RFI influence, 0.15 to 1000 MHz, 10 V or V/m		±0.5% [1] (typical)
Long-term stability		±0.2 % [1] /year
Housing		
Material, Flammability (UL)		PC/ABS, V0
Mounting		DIN B-head or larger, DIN rail (with mounting kit)
Connection	Single/stranded wires	Max. 1.5 mm², AWG 16
Weight		50 g
Protection, housing / terminals		IP 54 / IP 00

[1] Of input span
[3] Reference temperature 23 °C / 73 °F
[2] If zero-deflection > 100% of input span: add 0.125% of input span/25 °C or 0.14% of input span/50 °F per 100% zero-deflection

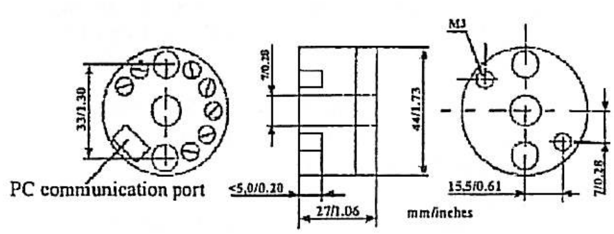
Input connections



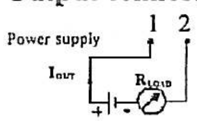
Output load diagram



Dimensions



Output connections



Gas Flow Meter Product Data Sheets

MONITOR NATURAL GAS AT THE PLANT, AT THE DEPARTMENT AND AT THE BURNER

NATURAL GAS FLOW MONITORING

At the Point of Entry of the Plant

With rising natural gas prices, it is critically important to determine your hourly and daily consumption by measuring the gas entering into the plant with a Sage Thermal Mass Flowmeter. With Sage, you can track the gas usage within your facility each minute, each hour, each day, and gain critical information about your natural gas demand. Are you maximizing operating efficiencies? Are you wasting energy heating a building with all the doors open? Are you adjusting for peak usage? Are you providing your Gas Broker an accurate assessment for your next gas allocation?

Installing a Sage In-Line or Insertion Thermal Mass Flow Meter will not only provide a back-lit readout and 4- 20 ma output of instantaneous mass flow rate, it will also automatically track the highest and lowest flow rate with a date and time stamp. In addition, the instrument will totalize continuously (up to 12 digits) and provide gas temperature as well. A convenient menuing system (through the RS232 output or via the "user-friendly" keypad) allows many other features including "looking back" an hour for average flow, changing decimal points, setting relays, clearing settings, changing units or conducting diagnostics.

Sub-Meter at Each Department

To get an even better handle on plant efficiency, also monitor the gas lines going into different building locations or departments. By sub-metering, you will be able to assess departmental inefficiencies, and assign costs to different operating areas. You will also have an opportunity to institute conservation measures as appropriate.

Combustion Control

By monitoring the natural gas (or backup fuel of propane) into a furnace or burner, along with the air or oxygen line, you can optimize your combustion process. Proper control of the air/fuel ratio can improve efficiency, lower fuel consumption, improve product quality and increase product yields.

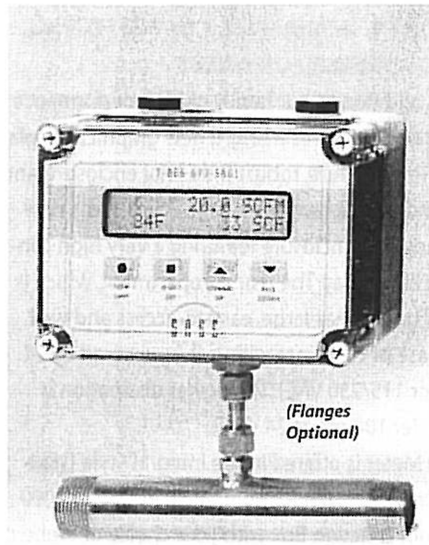
THERMAL MASS FLOW METERS

Sage Metering is your source for monitoring, measuring and controlling the gas mass flow in your industrial process. Our high performance, NIST traceable, thermal mass flow meters will help increase productivity, reduce energy costs, and maximize product yields. With over 70 years of combined experience in delivering quality in-line and insertion thermal mass flow meters for a wide variety of industrial needs, the Sage Metering management team is dedicated to providing you with the performance and customer support that you deserve.

Sage Thermal Mass Flow Meters are designed for high performance mass flow measurement of flow rate and consumption of gases such as natural gas, air, oxygen, propane and other gases and gas mixes. They are field rangeable and have a convenient user interface.

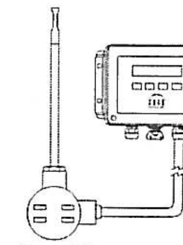
Sage Metering has distinguished itself by offering a higher standard – our mass flow meter output is virtually independent of even large process temperature variations, and our digital electronics is impervious to external analog noise. In addition, our meters feature a back-lit display that reports mass flow or velocity, totalized mass flow, and temperature. Isolated 4-20 ma outputs for mass flow and/or temperature, relays, and a convenient RS232 and keypad user-interface, gives you the flexibility to integrate the functions of flow measurement with your specific needs.

See Sage Metering product brochure for additional information and product benefits or contact us at 866-677-7243 for application assistance.

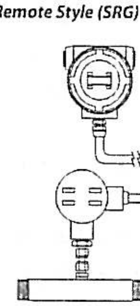


(Flanges Optional)

Integral Style (SIG)



General Purpose Remote Style (SRG)



Explosion Proof Remote Style (SRE)

HOW DOES THERMAL MASS FLOW MEASUREMENT BENEFIT YOU?

- Direct Mass Flow – No need for separate temperature or pressure transmitters
- High Accuracy and Repeatability – Precision measurement and optimal control of your process
- Rangeable over 100:1 Turndown (1000:1 with multiple calibrations) – Accommodates the extremes of your process with one instrument
- Low-End Sensitivity – Detects leaks, and measures flow, even on start-up
- Negligible Pressure Drop – Will not impede the flow nor waste energy
- No Moving Parts – Eliminates costly bearing replacements, and prevents undetected accuracy shifts
- Dirt Insensitive – Provides sustained performance

WHAT ARE THE BENEFITS THAT SAGE THERMAL MASS FLOW METERS OFFER YOU?

- *New:* Verify sensor cleanliness and validate calibration with self-check routine
- *New: Touch Screen Technology.* The cover does not need to be removed to access Menuing System
- *New: Lead-Length Compensation.* Remote electronics up to 2000 ft from probe
- *New:* Probe Junction Box requires no electronics. Suitable for harsh environments
- Available with up to four totally independent calibations (four different gases, sensitivities, or configurations). Channels A–D selectable by keypad, laptop or external switch closure
- Powerful state-of-the-art microprocessor technology designed for high performance mass flow measurement, and field rangeability
- Proprietary sensor drive circuit provides enhanced signal stability and is unaffected by process temperature changes
- Menu driven user configurability, including full scale setting, units of measure, pipe area, channel selection, pulsed outputs of total, and diagnostics
- Easy to read 2-line back-lit flow rate/totalizer and temperature display. Also serves as dialog window for menu selection of user options
- RS232 PC interface and free Sage VIP software – easy to use
- Ease of installation, and convenient mounting hardware
- Flow conditioning built in to large flow meters (3/4" and up)

"SAGE PRIME™" INDUSTRIAL & ENVIRONMENT THERMAL MASS FLOW METER

"SAGE PRIME™" HIGH PERFORMANCE, COST EFFECTIVE THERMAL MASS FLOW METER FOR GASES

Sage Prime is the latest addition to our family of high performance Thermal Mass Flow Meters. It features a bright new graphical display of Flow Rate, Total and Temperature, robust industrial enclosure, and easy to access power and output terminals. Sage Prime has a new dual-compartment windowed enclosure featuring a very high contrast photo-emissive OLED display. The rear compartment, which is separated from the electronics, has large, easy-to-access and well marked terminals, for ease of customer wiring. It is powered by 24 VDC (12 VDC optional, or 115/230 VAC). The power dissipation is under 2.5 watts (e.g. under 100 ma at 24 VDC).

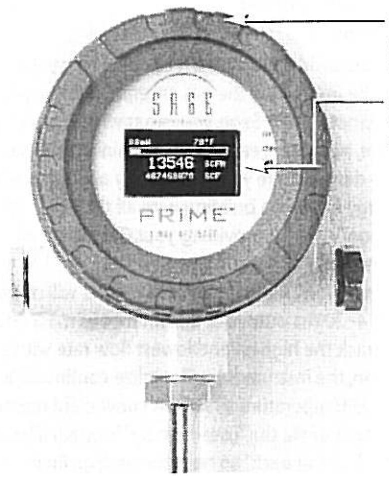
The Sage Prime Flow Meter is offered in the Integral Style (standard) or Remote Style (with lead length compensation up to 1000 feet) with explosion proof Junction Box with your choice of Probe or Flow Body depending on your pipe size. It has a 4-20 ma output as well as a Pulsed Output of Totalized Flow (solid state [sourcing] transistor drive). In addition, Sage Prime supports full Modbus® compliant RS485 RTU communications (IEEE 32 Bit Floating Point).

THERMAL MASS FLOW METERS

Sage Metering is your source for monitoring, measuring and controlling the gas mass flow in your industrial process or environmental application. Our high performance, NIST Traceable, thermal mass flow meters will help increase productivity, reduce energy costs, maximize product yields, and/ or help reduce environmental insult. With over 120 years of combined experience in delivering quality in-line and insertion thermal mass flow meters for a wide variety of industrial and environmental monitoring needs, the Sage Metering management team is dedicated to providing you with the performance and customer support that you deserve.

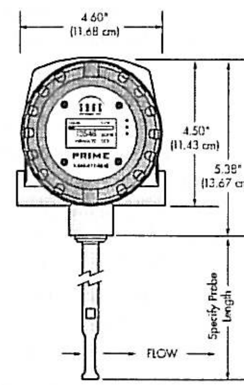
Sage Thermal Mass Flow Meters are designed for high performance mass flow measurement of flow rate and consumption of gases such as natural gas, air, oxygen, digester gas, landfill gas, biogas and other gases and gas mixes.

Sage Metering has distinguished itself by offering a higher standard – our mass flow meter output is unaffected by even large process temperature variations, and our digital electronics is impervious to external analog noise. Fast response, high resolution, and ultra sensitivity are features that are at the heart of every Sage Thermal Mass Flow Meter. See Sage Metering product brochure (Rev. 0808) for additional information and product benefits, or contact us at 866-677-7243 for application assistance.



Dual-Sided Industrial Enclosure, with large, easy-to-access terminals in rear compartment

Features a very high contrast display of Gas Flow Rate, Total and Temperature, visible even in bright sunlight



Note: DC Enclosure depth is 4.35" (11.05 cm)
AC Enclosure depth is 5.35" (13.59 cm)

HOW DOES THERMAL MASS FLOW MEASUREMENT BENEFIT YOU?

- Direct Mass Flow – No need for separate temperature or pressure transmitters
- High Accuracy and Repeatability – Precision measurement and optimal control of your process
- Turndown of up to 100 to 1 and resolution as much as 1000 to 1
- Low-End Sensitivity – Detects leaks, and measures as low as 5 SFPM!
- Negligible Pressure Drop – Will not impede the flow nor waste energy
- No Moving Parts – Eliminates costly bearing replacements, and prevents undetected accuracy shifts
- Dirt Insensitive – Provides sustained performance
- Low cost of ownership

WHAT ARE THE BENEFITS THAT SAGE PRIME THERMAL MASS FLOW METERS OFFER YOU?

- Powerful state-of-the-art microprocessor technology designed for high performance mass flow measurement, at a low cost-of-ownership
- Rugged, user-friendly packaging with easy terminal access
- Proprietary digital sensor drive circuit provides enhanced signal stability and is unaffected by process temperature and pressure changes
- Low power dissipation, under 2.5 Watts (e.g. under 100 ma at 24 VDC)
- High contrast photo-emissive OLED display with numerical Flow Rate, Total and Temperature, as well as Graphical Flow Indicator
- Displays calibration milliwatts (mw) for ongoing diagnostics
- Remote Style has Lead-Length Compensation. Remote electronics up to 1000 ft from probe, and the Junction Box has no electronics
- Modbus® compliant RS485 RTU communications (IEEE 754)
- Ease of installation, and convenient mounting hardware
- Flow conditioning built in to In-line flow meters (1/2" and up)
- Option for Solar Energy use (12VDC Models)

Flow Control Magazine
2006 Innovations Awards
WINNER

SAGE PRIME™ MASS FLOW METER SPECIFICATIONS

Sage Prime™ is a thermal dispersion type of Flow Meter, utilizing the constant temperature difference method of measuring Gas Mass Flow Rate. It contains two reference grade platinum RTD sensors clad in a protective 316 SS sheath. It features direct Mass Flow for gases, wide rangeability, low pressure drop, very low end sensitivity, and no moving parts.

The Prime is microprocessor based, does not have any potentiometers, and has Modbus® RS485 RTU communications. It is powered by 24 VDC (12 VDC optional, or 115/230 VAC). The power dissipation is under 2.5 watts (e.g. under 100 ma at 24 VDC) for the DC version. The power and output terminals are in a separate compartment for ease of installation. Sage Prime is CE approved[1].

The enclosure has a dual compartment for ease of wiring. The display is a high contrast photoemissive OLED display, and it displays Mass Flow Rate, Totalized Flow and Temperature as well as a graphical representation of Flow Rate in a horizontal bar graph format. In addition, the calibration milliwatts (mw) is continuously displayed, providing ongoing diagnostics. Outputs include a 4-20 ma signal proportional to Mass Flow Rate, and Pulsed Outputs of Totalized Flow (24VDC solid state [sourcing] transistor drive), as well as Modbus® compliant RS485 RTU communications (IEEE 32 Bit Floating Point).

The Flow Element (Integral and Remote, Insertion Style) consists of a 1/2" OD probe (3/4" optional) with lengths up to 36" long (typically 15" long) suitable for insertion into the center of pipes from 1-1/2" to 24". Mounting hardware choices (such as Isolation Valve Assemblies, Compression Fittings, and Flange Mounts) are optionally available.

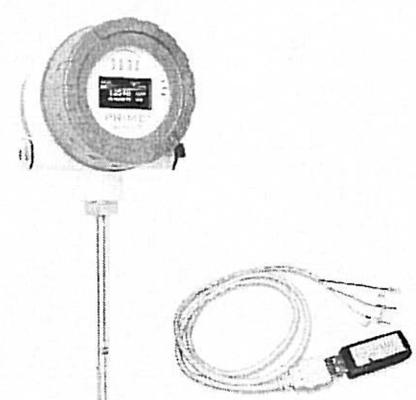
The Flow Element (Integral and Remote, In-line Style) consists of a choice of 316 Stainless Steel Schedule 40 Flow Bodies sized from 1/4" x 6" long to 4" x 12" long. Male NPT ends are standard, with flanged ends, tube, or butt weld optionally available. Note 3" and 4" Flow Bodies have flanged ends as standard.

Calibration is NIST traceable, and covers a wide variety of gas calibrations. Sage Prime™ can measure gas flow up to 450ºF (-40ºF to 200ºF standard, up to 450ºF optional on Remote, Insertion Styles) at pressures up to 500 PSIG (1000 PSIG, optional).

Calibration Self Check: Flow Meter has built in diagnostics—a display of the calibration milliwatts (mw) can be used to check the sensor's operation by being compared to the original reported "zero flow" value noted on last few lines of meter's Certificate of Conformance.

Accuracy is +/- 0.5% of Full Scale +/- 1% of reading with a turn-down of 100 to 1 and resolution as much as 1000 to 1. Higher accuracy available with lower turndown (contact Sage). Repeatability of 0.2%. The Flow Meter is Sage Metering, Inc. SIP Series (Integral Style) or SRP (Remote Style), with the trade name Sage Prime™.

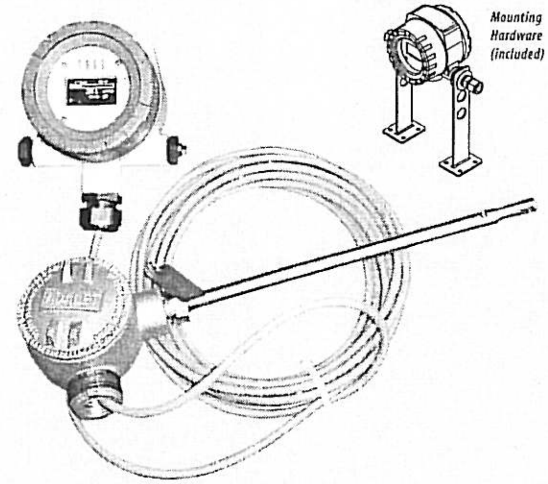
INTEGRAL



Optional Programmable Dongle[2]

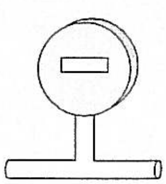
SIP Series

REMOTE



SRP Series[3,4]

IN-LINE



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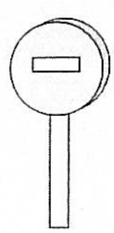
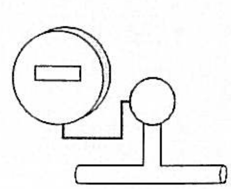


IN-LINE



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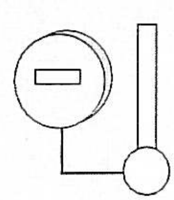


1 *Sage Prime™ is now CE Compliant (see www.sagemetering.com/Products/Product Approvals. Contact Sage for other approvals)*

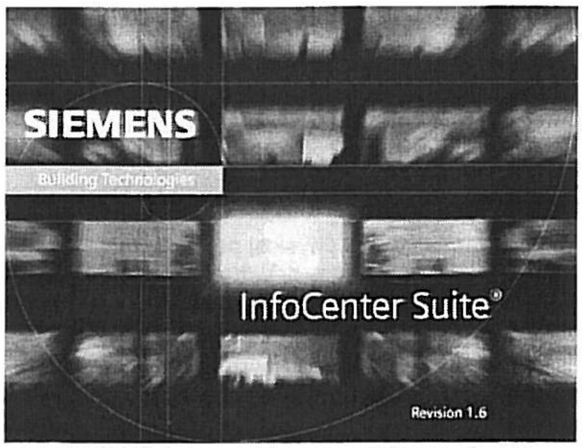
2 *Sage Prime™ Field Programmable (patent pending) "Dongle" for field modifications or resetting of totalizer now available (contact Sage for details)*

3 *Remote Mounting Brackets included (see drawing inset).*

4 *On the Remote Styles, the Flow Element's Junction Box is Explosion Proof (Class 1, Div 1, Groups B, C, D), and does not have any electronics – only a wiring terminal block. The Flow Element will be connected to the Electronics Enclosure by 25 feet of lead-length compensated cable. The cable (6-conductor) can be lengthened or shortened without affecting accuracy (max loop resistance 10 ohms; over 1000 feet).*

Siemens Energy Management Software Data Sheets

Utility Cost Manager for InfoCenter Suite



Description

The ability to measure energy usage is the first step in managing utility costs. As the pressures to cut operating costs increase, a solution that provides managers with the ability to make timely, informed decisions regarding their facility's energy use becomes invaluable.

Utility Cost Manager (UCM) for InfoCenter Suite® is designed to meet the ongoing facility needs for monitoring energy usage and allocating utility costs. Utility Cost Manager provides a means to organize 15 minute interval meter data to create daily load profiles, consumption and cost allocation reports for building areas where submetering devices have been installed to monitor energy usage.

As an InfoCenter Suite application, the Utility Cost Manager benefits from InfoCenter's data management capabilities. Specifically designed to archive, manage and retrieve large amounts of data, InfoCenter Suite provides a solid foundation for data storage and retrieval to tracking, analysis and documentation of facility energy usage. Standard Windows security protocols combined with the features of the InfoCenter Server ensure the integrity of the InfoCenter database. Having data secured in the InfoCenter Server allows the Utility Cost Manager to be used for reliable management of utility data.

System Architecture

The Utility Cost Manager requires the following software programs:

- Utility Cost Manager — InfoCenter client application designed to allow users to build extensive site metering hierarchies and create energy reports that display an organization's utility data on both a macro and micro level. Multiple predefined report templates can be scheduled or run ad-hoc to meet most utility reporting requirements.
- InfoCenter Suite® Advanced or InfoCenter Suite Base — InfoCenter server is the application that interfaces with Microsoft® SQL Server™ to provide automated data collection, data archiving, data security and advanced data processing to turn raw data into useful Information.
- Insight® or compatible third-party workstation — InfoCenter Suite can import data from a number of different systems. The primary data provider is generally Insight. Third-party workstations can be used to provide interval data to InfoCenter Server using OPC.

The Utility Cost Manager is an InfoCenter client application designed to help users convert raw meter data into useful utility information. As an InfoCenter client application, Utility Cost Manager includes the same licensing, security and operating system requirements as other InfoCenter Suite client applications. Utility Cost Manager can reside on Windows XP, Windows 2000, and Windows 2003 platforms. Access to the InfoCenter server is controlled by the same integrated Windows security functions as other InfoCenter Suite client applications. The licensing for InfoCenter Suite client applications is controlled at the server. InfoCenter Suite security is indifferent to the type of application connecting and only controls the number of connections.

Utility Cost Manager

The Utility Cost Manager client application provides the user interface for organizing and reporting on information stored in InfoCenter server. Through the Utility Cost Manager client, meter data records are organized into a structure that automatically rolls up data to provide both micro and macro views of how the utility services are being utilized throughout the facility. The Layout Hierarchy (see Figure 1) is a "tree" style view of the organization of the meters and the aggregation levels for the facility.

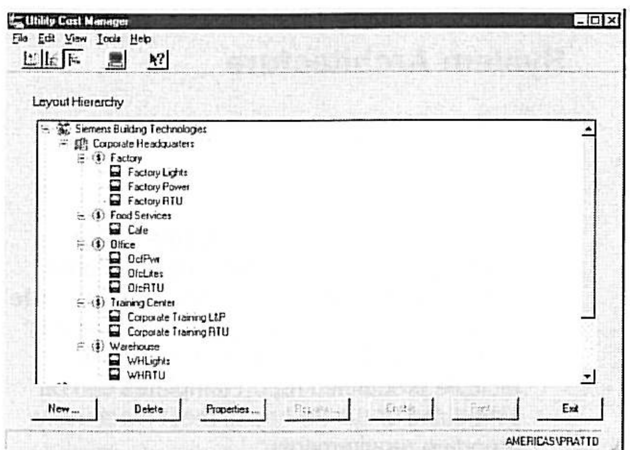


Figure 1. Layout Hierarchy - expanded view.

Utility Cost Manager allows users to interact with their data on a meter basis instead of individual points. Individual points collected from the system and stored in InfoCenter may simply be one data channel from a meter. Utility Cost Manager allows you to group individual data points such as KW and kWh, along with information such as account numbers, and utility costs to form a meter. Meter definition is facilitated by the use of a wizard application that guides the user through the steps of defining the meter parameters. Utility Cost Manager supports multiple energy types including, but not limited to: electricity, natural gas, steam, hot and chilled water and fuel oil.

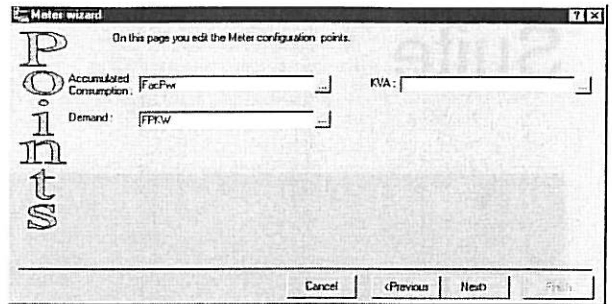


Figure 2. Meter wizard point association dialog for electric "meter."

For areas where no physical points or meters are located, a virtual meter or virtual submeter may be created to track energy for the area. Virtual meters and virtual submeters may be created based on formula calculations. The Formula Builder within Utility Cost Manager allows the user to select existing meters and submeters to be included in formulas and supports: operators such as +, -, *, /; functions such as SIN,COS, ROUND; and constants such as PI. Virtual meters allow you to reduce your hardware metering and data storage requirements.

The cost allocation feature in Utility Cost Manager is designed to allow users to distribute energy costs throughout a facility or organization, not reconcile energy cost with a utility bill. Utility Cost Manager uses a blended rate that is designed take into account all costs associated with a utility bill. These costs are made a function of utility consumption by dividing the total cost by the total consumption. By applying this blended rate to the lowest level of the hierarchy, you can effectively examine cost allocation at any micro or macro level desired. The average cost-pricing model includes an effective date, which allows users to vary the rate over time. This allows you to take into account rate variations over the life of the facility and see the impact of changes on a single report. Other rate specific information includes (see Figure 6) energy types, demand calculation options, service provider and billing periods.

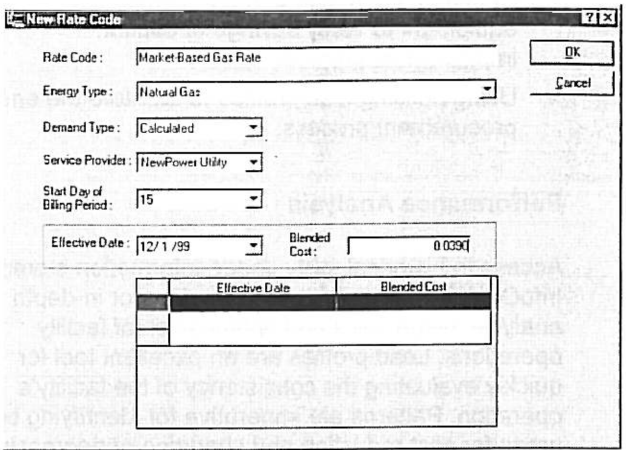


Figure 3. Rate Definition with Blended (Average) Cost.

Utility Cost Manager's reporting features are designed to turn your raw energy data into meaningful energy consumption and cost information. Utility Cost Manager includes five standard report templates that fall into three categories; Load Profile Reports, Energy Consumption Reports and Cost Allocation Reports. Each report template includes user definable parameters and can be run for any level of the hierarchy. Reports at the meter level can give a micro view of a facility's consumption, while reports run at a cost center or site level can provide a macro view of utility information.

Report Templates can be run adhoc or by using the Report Scheduler Wizard. The Wizard allows the user to schedule report templates to be run at predefined intervals based on user needs. Report schedules define the frequency of report production, the time to run the report and the report range.

Load Profile Reports provide a graphical view of consumption for a 24-hour period or range of days. Within the Load Profile formats, there are three templates:

- Daily Load Profile – displays a single day or specified range of days as an XY line graph, 3D chart or YZ chart (top view). Figure 5 shows Daily Load Profile (top view) for Office Lights.
- Daily Average Load Profile – displays an average for the day types selected within the date range specified; XY line graph style.
- Daily Peak Load Profile – displays the peak day(s) for the day types selected within the date range specified; XY line graph style.

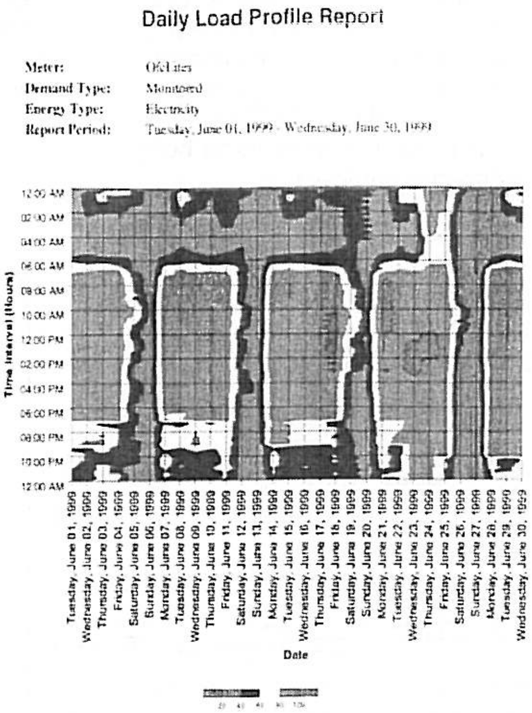
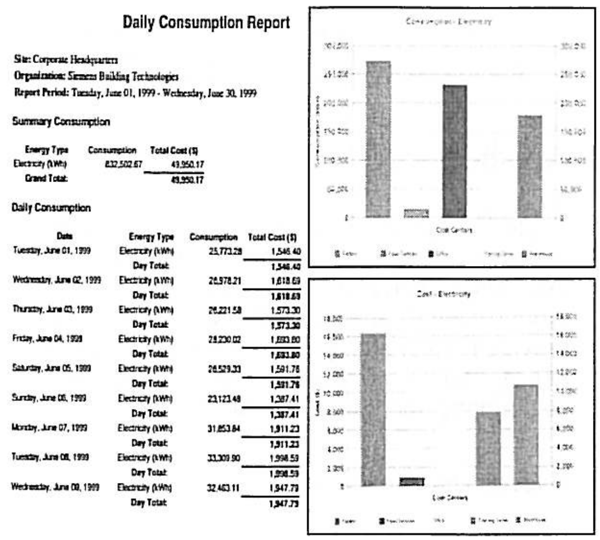


Figure 4. Daily Load Profile Report – YZ (top view).



Daily Consumption Report

Site: Corporate Headquarters
Organization: Siemens Building Technologies
Report Period: Tuesday, June 01, 1999 - Wednesday, June 30, 1999

Summary Consumption

Energy Type	Consumption	Total Cost ($)
Electricity (kWh)	832,502.67	49,950.17
Grand Total:		49,950.17

Daily Consumption

Date	Energy Type	Consumption	Total Cost ($)
Tuesday, June 01, 1999	Electricity (kWh)	25,773.28	1,546.40
	Day Total:		1,546.40
Wednesday, June 02, 1999	Electricity (kWh)	26,978.21	1,618.69
	Day Total:		1,618.69
Thursday, June 03, 1999	Electricity (kWh)	26,221.58	1,573.30
	Day Total:		1,573.30
Friday, June 04, 1999	Electricity (kWh)	28,230.02	1,693.80
	Day Total:		1,693.80
Saturday, June 05, 1999	Electricity (kWh)	26,529.33	1,591.76
	Day Total:		1,591.76
Sunday, June 06, 1999	Electricity (kWh)	23,123.48	1,387.41
	Day Total:		1,387.41
Monday, June 07, 1999	Electricity (kWh)	31,853.84	1,911.23
	Day Total:		1,911.23
Tuesday, June 08, 1999	Electricity (kWh)	33,309.90	1,998.59
	Day Total:		1,998.59
Wednesday, June 09, 1999	Electricity (kWh)	32,463.11	1,947.79
	Day Total:		1,947.79

Figure 5. Daily Consumption Report.

Daily Consumption Reports are tabular lists of daily totals by date and energy type. A summary shows the totals for each energy type for the report period. In addition, Daily Consumption Reports include charts of cost and consumption for each component of the selected level. For example, a Daily Consumption Report for a Cost Center will show the daily usage for the Cost Center along with charts showing the meters associated with the selected Cost Center.

Allocation Reports provide a summary of energy usage for the report period as well as an itemized list of allocated costs for the components included in the reported level. Allocation Reports also include the Fiscal Year-To-Date (FYTD) amount so that users can track year to date costs for budget or performance purposes.

Allocation Report

Cost Center: Office
Site: Corporate Headquarters
Area Size: 200,000 sq. ft.
Account #: 10-10-000
Report Period: Tuesday, June 01, 1999 - Wednesday, June 30, 1999
FYTD Period: Saturday, May 01, 1999 - Wednesday, June 30, 1999

Summary

Energy Type	Report Period		FYTD Period	
	Consumption	Blended Total Cost ($)	Consumption	Blended Total Cost ($)
Electricity (kWh)	233,309.29	13,998.56	458,439.02	27,506.34
	Grand Total:	13,998.56		27,506.34

Meters

Meter Name	Account #	Energy Type	Report Period		FYTD Period	
			Consumption	Blended Total Cost ($)	Consumption	Blended Total Cost ($)
Development Labs	None	Electricity (kWh)	46,926.83	2,815.61	95,534.77	5,732.09
OcfPwr	10-10-020	Electricity (kWh)	35,666.43	2,139.99	72,652.37	4,359.14
OfcLites	10-10-010	Electricity (kWh)	46,449.49	2,786.97	94,674.72	5,680.49
OfcRTU	10-10-030	Electricity (kWh)	104,266.54	6,255.99	195,577.16	11,734.63
			Grand Total:	13,998.56		27,506.34
			$/sq. ft.			

Figure 6. Allocation Report for Cost Center showing meters that make up the Cost Center's electric consumption.

Applications

Application solutions capabilities from Siemens Building Technologies, Inc. combined with the flexible InfoCenter Suite platform and the unique organizational capabilities of Utility Cost Manager provide reports structured to meet your individual needs. Utility Cost Manager delivers solutions to utility cost management needs including:

Energy Use Analysis

The ability to have an accurate picture of utility resource usage at a facility is an ongoing need that is growing as deregulation sweeps across the country. Most experts agree that collecting detailed energy usage data is a critical step toward successful energy procurement strategies in a deregulated utility market. Utility Cost Manager can support energy use analysis by:

- Reporting building load profiles for electricity, water, gas, steam and other utilities for usage tracking and baselines;
- Tracking usage to identify areas for energy improvements to reduce facility resource costs;
- Documenting usage of major consuming equipment to verify savings of capital improvement projects; and
- Using building load profiles to facilitate the energy procurement process.

Performance Analysis

Access to historical utility usage information stored in InfoCenter Suite provides information for in-depth analysis, diagnostics and optimization of facility operations. Load profiles are an excellent tool for quickly evaluating the consistency of the facility's operation. Patterns are imperative for identifying both areas for cost reduction and changing or decreasing energy efficiency. Decreasing efficiency can be an indication of mechanical problems that are wasting energy. Utility Cost Manager supports Performance Analysis by:

- Allowing users to track reporting period consumption with year-to-date performance for operational benchmarking;
- Reporting daily consumption values per utility service, including value and time of maximum demand.

Cost Allocation

Submetering a facility allows facility managers to track usage of utilities at a new level of granularity. This data can be combined with costing information about the utility service to permit departmental accounting of utilities. Costs are more equitably distributed according to usage compared to traditional methods of consumption based on square footage. Utility Cost Manager supports cost allocation applications by:

- Allowing the user to define meter data in a logical structure to associate meters with a particular user or department and allocate utility costs over a group of users;
- Assigning average utility costs at the meter level by effective date so that costs can be more directly allocated;
- Offering flexible reporting and automatic aggregation to capture and report costs at various levels in the organization.

Web-based Energy Reporting

By combining Utility Cost Manager with APOGEE GO for InfoCenter Suite, a Web-based energy reporting system can easily be implemented. Web-based implementation eliminates the need for client applications on local computers and allows users to access and run reports via the Internet/Intranet. This capability is very useful in applications were UCM is being used to provide load profiling on multiple sites or in enterprise-wide applications were UCM is being used to centrally collect data and provide reports to geographically distributed end users.

Report generation is as easy as navigating to your APOGEE GO for InfoCenter Suite URL, selecting an existing report template and report date range. This information is submitted to InfoCenter Suite's server and a report is displayed for review. (see Figure 7),

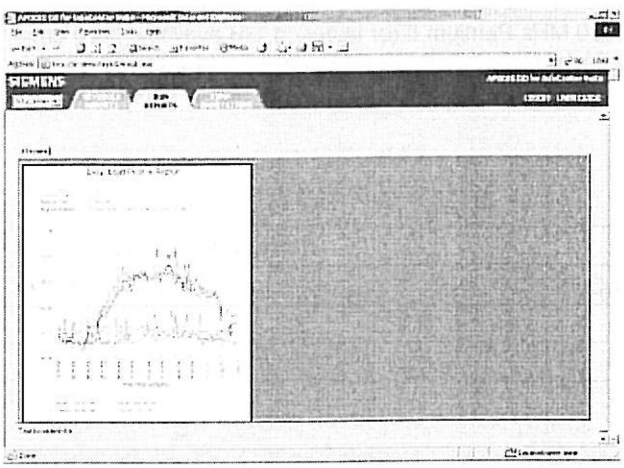


Figure 7. APOGEE GO for InfoCenter with the UCM.

Tenant Billing

For commercial property owners, the ability to allocate costs more equitably than square footage and to distribute common area costs is a reporting challenge. In applications where blended (or average) costs are accepted for tenant billing, Utility Cost Manager supports the computation of tenant bills, similar to departmental cost allocation applications described above in Cost Allocation. Blended cost allows you to include all factors of a utility bill and redistribute it as a function of consumption.

Budget Tracking

As deregulation of the utilities begins to affect traditional fixed rates and more companies try to manage costs and track consumables against budgets, the need for tracking utility costs becomes more significant. Utility Cost Manager can facilitate budget tracking through its Allocation Reports that include a Fiscal-Year-To-Date (FYTD) field for both consumption and costs of each utility.

Specifications

Utility Cost Manager Client System Requirements

Operating System	Windows XP Professional, Windows 2000 Server or Windows Server 2003.
Browser	Internet Explorer 5.5 or higher.
Required Personal Computer	*Recommended*: 500 MHz Pentium II (or faster), 1 GB available hard drive space, 8x CD-ROM (or faster), 256 MB RAM, video card with 1024 × 768 resolution and greater than 256 colors, and 10/100 MB Ethernet Adapter.

Ordering Information

Description	Product Part Number
Utility Cost Manager (UCM) Application Software for InfoCenter Suite	571-397
InfoCenter Suite Advanced Server	571-390
InfoCenter Suite Base Server	571-389

Document Ordering Information

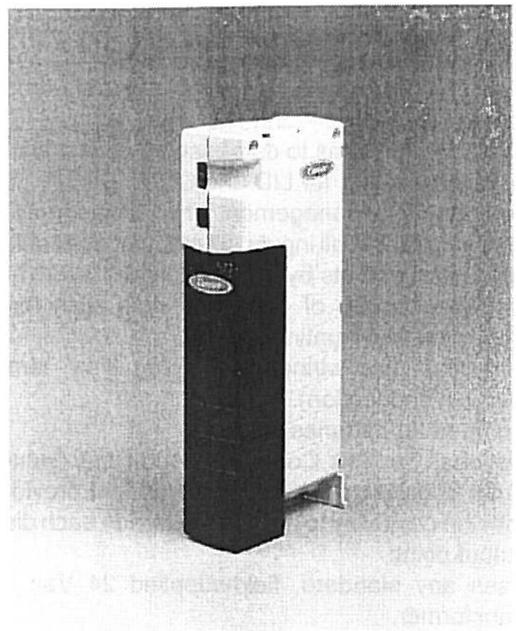
Utility Cost Manager (UCM) User Guide	125-2198
Application Guide- Leveraging APOGEE: A tiered approach to sub-metering your facility	125-3203

Carrier DDC Control Panel Product Data Sheet

Carrier COMFORT NETWORK

PRODUCT DATA

Comfort Controller 6400



The Comfort Controller 6400 (part number CEPL130201) is a microcontroller-based module that provides general purpose HVAC control and monitoring capability in a standalone or network environment using closed-loop, direct digital control. The *6400* gives the Carrier Comfort Network (CCN) the capability to control and communicate with non-Carrier equipment and Carrier HVAC equipment not equipped with Product Integrated Controls (PICs).

You can connect 16 field points (8 inputs and 8 outputs) to the *6400*. To connect additional field points, add optional input/output modules (8 inputs and 8 outputs per I/O module) to the *6400*. By using multiple I/O modules, you can connect up to 48 additional points, giving you the capability to control and/or monitor a total of up to 64 field points. The appropriate number of I/O modules are selected for each control situation and simply installed along with the *6400* in your field-selected NEMA-1 enclosure. This modular concept contributes to overall versatility and ease of installation. The Comfort Controller 6400 includes a diverse library of performance-proven control routines, written in plain English, using simple "fill-in-the blanks" format for fast, easy programming. Additionally, for custom applications, Carrier's BEST++ software provides custom programming capabilities to work independently, or in conjunction with the pre-engineered control routines.

FEATURES

- Stand-alone control and monitoring of up to 16 field points, using proven algorithms.
- Support of the UT203 FID family of I/O modules for retrofit and upgrade applications.
- Compatibility with the following interface devices: Local Interface Device (LID), ComfortWORKS, Building Supervisor III and subsequent versions, System Access Module (SAM), and Network Service Tool III and subsequent versions.
- Three LEDs, conveniently located on the front of the module, indicate processor status (red), CCN Communication Bus status (yellow), and I/O module communication status (green).
- Entire database at your disposal. Based on your application's requirements, you determine how many and which algorithms, inputs/outputs, schedules, alarms, and system functions to include in the database. Therefore, the database will only consist of the

8 INPUTS

Numbers	Specifications
1 to 8	Discrete, analog, or temperature Discrete Dry contact Pulsed dry contact Analog 4-20 mA 0-10 Vdc Temperature 5K & 10K ohm thermistors 1K ohm nickel RTD

8 OUTPUTS

Numbers	Specifications
1 to 8	Discrete or analog Discrete 24 Vdc@80 mA Analog 4-20 mA 0-11 Vdc (varies with point type)

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808-895 Rev. 01/01

items that are necessary for the application — valuable memory space is not wasted.
- Ability to display the amount of available database space.
- Ability to add items to database as necessary.
- Local connection for LID and CCN.
- Total facilities management when linked to a CCN.
- Ability to disable all inputs, all outputs, or disable both inputs and outputs by simply flipping a switch.
- Two-day backup of clock and data such as Data Collection and Runtime.
- Simplified field wiring using "plug type" terminals (two-pin connection).
- No need for batteries.
- Optional Comfort Controller 6400-HOA (Hand-Off-Auto) consisting of eight switches that provide you with the capability to manually override each discrete output point.
- Uses any standard, field-supplied 24 Vac, 60VA transformer.

FUNCTIONS

Cooling and Heating Control
Space Temperature Comfort Zone
Humidification and Dehumidification
Mixed Air Damper Optimization
VAV Fan Control
VAV Supply and Return Fan Tracking
Indoor Air Quality
Generic PID Control
Time Scheduling with/without Override
Analog Temperature Control
Discrete Interlock
Staged Thermostat
Proportional Thermostat
Primary/Secondary Pump Control
Staged Discrete Control
Permissive Interlock
Night Time Free Cooling
Morning Warm-up
Adaptive Optimal Start/Stop
Control Point Reset

On-Board Consumable Point
Calculates a usage value (kwh, gal/hr, lbs/hr,etc.) in applications where simple data collection is required.

On-Board Trending
Collects up to 48 data samples per point (with an adjustable iteration rate) on a revolving basis, or stops the trending after 48 samples are collected. Use as a means of troubleshooting.

Linkage to Airside (TSM) and Waterside (WSM) Systems
Optimizes efficiency by fully integrating all HVAC operations. (DAV)

Custom Programming (BEST++)
Enhances or supplements the industry-proven, pre-engineered algorithms with BEST++ by creating new algorithms to meet any unique control requirements.

CCN FEATURES

When included in a network with other CCN controllers, Option Modules, and user interfaces, the following additional capabilities are possible:

- Alarm processing, messages, and annunciation.
- Runtime, history, and consumable data collection and report generation.
- Demand limiting/loadshedding.
- Broadcast of data such as outside air temperature, outside air humidity, and time of day.
- Data transfer between system elements.
- Timed overrides for use with Tenant Billing.
- Airside and waterside linkage.

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808-895 Rev. 01/01

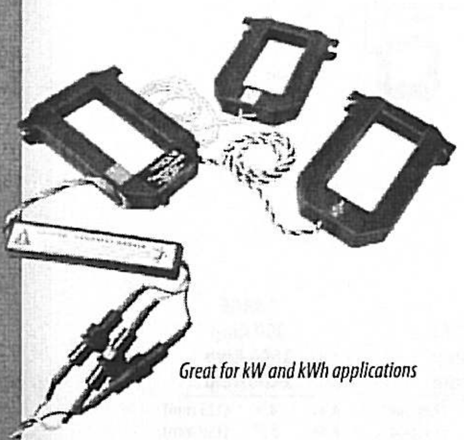
Electrical Power Metering Device Product Data Sheets

INTEGRAL SUBMETERING SOLUTION ELIMINATES THE NEED FOR SEPARATE ENCLOSURES

5 Year Warranty

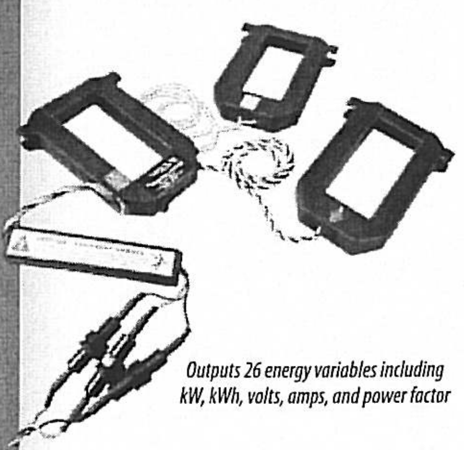
U.S. Patent No. 6,373,238

H8035



Great for kW and kWh applications

H8036



Outputs 26 energy variables including kW, kWh, volts, amps, and power factor

Enercept® Networked Power Meters (Modbus® RTU)

The **Enercept H8035/8036** are innovative three-phase networked (Modbus RTU) power meters that combine power metering electronics and high accuracy industrial grade CTs in a single package. The need for external electrical enclosures is eliminated, greatly reducing installation time and cost.

There are two application-specific platforms to choose from. The Basic Enercept Energy Meters (H8035) are ideal for submetering applications where only kW and kWh are required. The Enercept Enhanced Data Stream meters (H8036) output 26 energy variables including kW, kWh, volts, amps, and power factor, making them ideal for power monitoring and diagnostics.

Color-coordination between voltage leads and CTs makes phase matching easy. Additionally, these meters automatically detect and compensate for phase reversal, eliminating the concern of CT load orientation. Up to 63 power meters can be daisy-chained on a single RS-485 network.

APPLICATIONS

- Energy managing & performance contracting
- Submetering for commercial tenants
- Activity-based costing in commercial and industrial facilities
- Real-time power monitoring

The world's most cost-effective meter

- Monitor energy parameters (kW, kWh, kVAR, PF, Amps, Volts) at up to 63 locations on a single RS-485 network...greatly reduces wiring time and cost
- Fast split-core installation eliminates the need to remove conductors...saves time and labor
- Precision metering electronics and current transformers in a single package–reduces the number of installed components– huge labor savings
- Smart electronics eliminate CT orientation concerns–fast trouble-free installation

High accuracy

- ±1% total system accuracy, (10% to 100% of CT rating)

SPECIFICATIONS

Input Primary Voltage	208 to 480VAC RMS††
Number of Phases Monitored	One to Three
Frequency	50/60Hz
Primary Current	Up to 2400 amps cont. per phase††
Internal Isolation	2000VAC RMS
Insulation Class	600VAC RMS†††
Temperature Range	0° to 60°C (32° F to 140°F), 50°C (122°F) for 2400A
Humidity Range	0 - 95% non-condensing
Systems Accuracy	±1% of reading from 10% to 100% of the rated current of the CTs...accomplished by matching the CTs with a meter and calibrating them as a system
Output Physical Characteristics	RS-485, 2 wire + shield
Baud Rate	9600, 8N1 format
Protocol	Modbus RTU**(*)

*** Detailed protocol specifications are available at: http://www.veris.com/modbus/*
** Other protocols available. Please consult factory.*
†† Contact factory to interface for voltages above 480VAC or current above 2400 Amps.
††† Do not apply 600V Class current transformers to circuits having a phase-to-phase voltage greater than 600V, unless adequate additional insulation is applied between the primary conductor and the current transformers. Veris assumes no responsibility for damage of equipment or personal injury caused by products operated on circuits above their published ratings.

H8035 Data Output Specifications

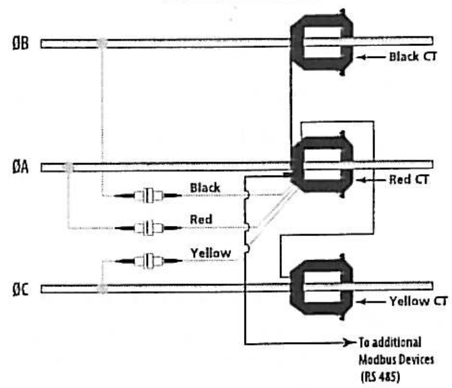
Data Output	kWh, kW

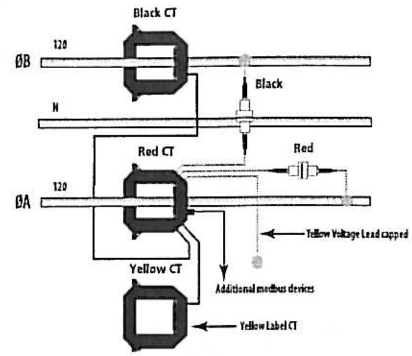
H8036 Data Output Specifications

Data output: kWh, Consumption
kW, Real Power
kVAR, Reactive power
kVA, Apparent power
Power factor
Average Real power
Minimum Real power
Maximum Real power
Voltage, line to line
Voltage, line to neutral†
Amps, Average current
kW, Real power ØA†
kW, Real power ØB†
kW, Real power ØC†

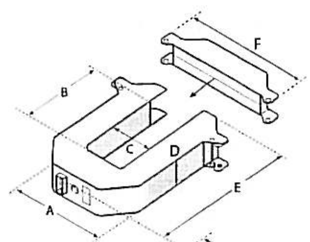
† Based on derived neutral voltage.

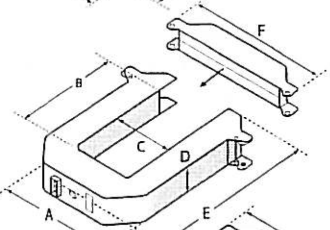
APPLICATION/WIRING EXAMPLES

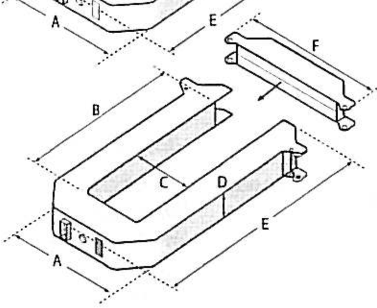




DIMENSIONAL DRAWINGS







	SMALL 100 Amp 300 Amp		MEDIUM 400 Amp 800 Amp		LARGE 800 Amp 1600 Amp 2400 Amp	
A=	3.8"	(96 mm)	4.9"	(125 mm)	4.9"	(125 mm)
B=	1.5"	(38 mm)	2.9"	(73 mm)	5.5"	(139 mm)
C=	1.3"	(31 mm)	2.5"	(62 mm)	2.5"	(62 mm)
D=	1.1"	(29 mm)	1.1"	(29 mm)	1.1"	(29 mm)
E=	3.9"	(100 mm)	5.2"	(132 mm)	7.9"	(201 mm)
F=	4.8"	(121 mm)	5.9"	(151 mm)	5.9"	(151 mm)

ORDERING INFORMATION

Modbus Basic Energy Meters*

MODEL	MAX. AMPS	CT SIZE
H8035-0100-2	100	SMALL
H8035-0300-2	300	SMALL
H8035-0400-3	400	MEDIUM
H8035-0800-3	800	MEDIUM
H8035-0800-4	800	LARGE
H8035-1600-4	1600	LARGE
H8035-2400-4	2400	LARGE

**H8035 models work with H8920-5 LON nodes*

LISTED 44XJ UL 508 C US E212445

Modbus Enhanced Data Stream Meters*

MODEL	MAX. AMPS	CT SIZE
H8036-0100-2	100	SMALL
H8036-0300-2	300	SMALL
H8036-0400-3	400	MEDIUM
H8036-0800-3	800	MEDIUM
H8036-0800-4	800	LARGE
H8036-1600-4	1600	LARGE
H8036-2400-4	2400	LARGE

**H8036 models work with H8920-1 LON nodes*

ACCESSORIES

CT Mounting brackets...see page 220.
H8920 LON nodes...see page 102.

SIEMENS

Digital Energy Monitor – Electrical, Series 1000/2000

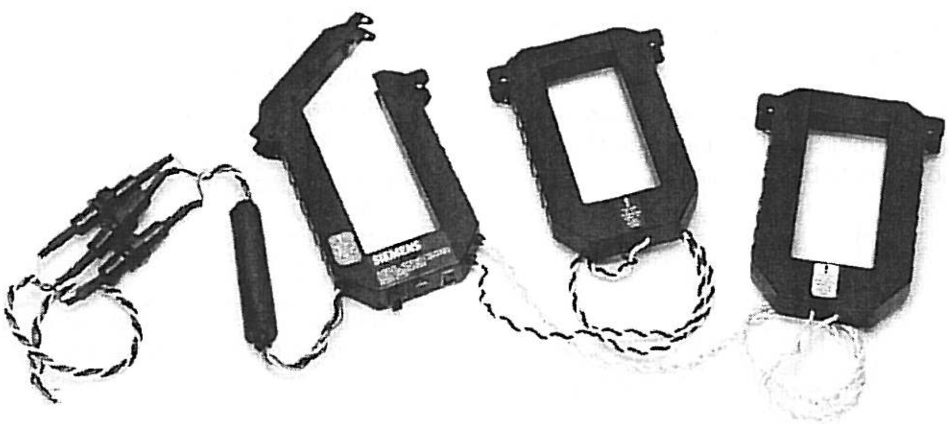


Figure 1. Digital Energy Monitor.

Description

The Digital Energy Monitor (DEM) – Series 1000 and Series 2000 are a family of digital power transducers for direct connection to the APOGEE™ Floor Level Network (FLN). The DEM combines a state-of-the-art communicating microprocessor-based power transducer and high accuracy split-core instrument grade current transformers (CTs) in a single package. It is a set of three CTs for three-phase consumption (kWH), demand (kW) and power diagnostic measurements (see comparison table, page 2). All processing and communications are self-contained within the main CT.

The DEM can be connected to any field panel (APOGEE or pre-APOGEE) with an FLN trunk such as the Modular Building Controller (MBC), Remote Building Controller (RBC), Floor Level Network Controller (FLNC), and Stand-alone Control Unit (SCU).

Features

- Direct connection to the FLN along with other FLN devices.
- Three CT sizes with load currents of 100, 300, 400, 800, 1600, and 2400 Amps cover a wide range of installations, including bus bar connections.
- Fused voltage leads automatically accept any voltage from 208-480 VAC with no external potential transformer for lower installed costs.
- Employs split-core, volt-signal CTs which are inherently safer than amp-signal CTs and have a high linearity at low loads.
- The DEM is "pre-wired" and self-contained to greatly reduce installed costs.
- No calibration required.
- Automatically compensates for CT orientation for ease of installation.
- Consumption value continuously accumulated and retained during power outages for data reliability.

Hardware

DEM installation is easily completed by placing the split-core CTs around the conductors and attaching the color-coded voltage leads to the corresponding power feed (e.g., red voltage lead and red CT must be on the same conductor). There is no enclosure to mount to the wall. The DEM automatically compensates for CT orientation. The main CT, which houses the microprocessor, has DIP switches for setting the FLN address, an LED status indicator, and a terminal block for the FLN connection.

The status LED indicates:
1. Normal operation
2. Overload condition (DEM is undersized)
3. CT/voltage lead mismatch (connected to different phases)

The latter is used during installation to help verify that the proper connections were made.

The appropriate DEM must be selected based on the expected maximum measured load and the physical size of the conductors to be measured.

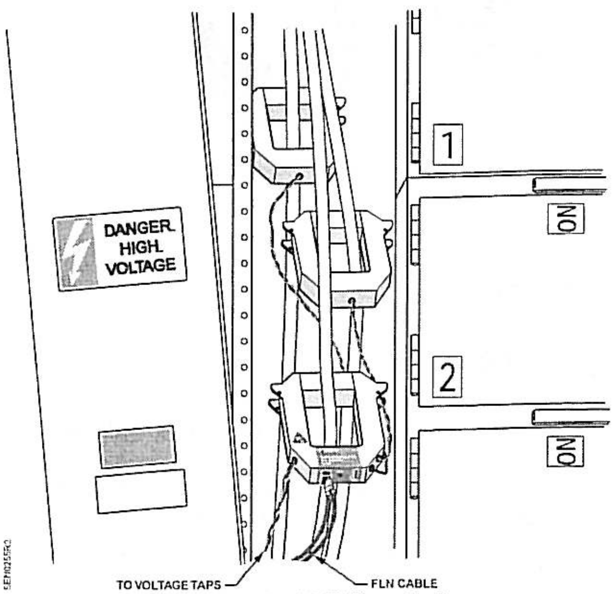


Figure 2. Typical DEM installation.

DEM 1000/2000 Comparison

INFORMATION PROVIDED	DEM 1000	DEM 2000
Consumption, kWh	X	X
Demand, kW (3-phase total)	X	X
Apparent power, kVA (3-phase total)		X
Reactive power, kVAR (3-phase total)		X
Power factor effective		X
Voltage		
Line to Line (3-phase average)*		X
Line to Neutral (3-phase		X
average)*		X
Phase A to B		X
Phase B to C		X
Phase A to C		X
Phase A to Neutral*		X
Phase B to Neutral*		X
Phase C to Neutral*		
Current (3-phase average)		X
Phase A		X
Phase B		X
Phase C		X

*Applicable for Wye power connected service, not Delta power connected service.

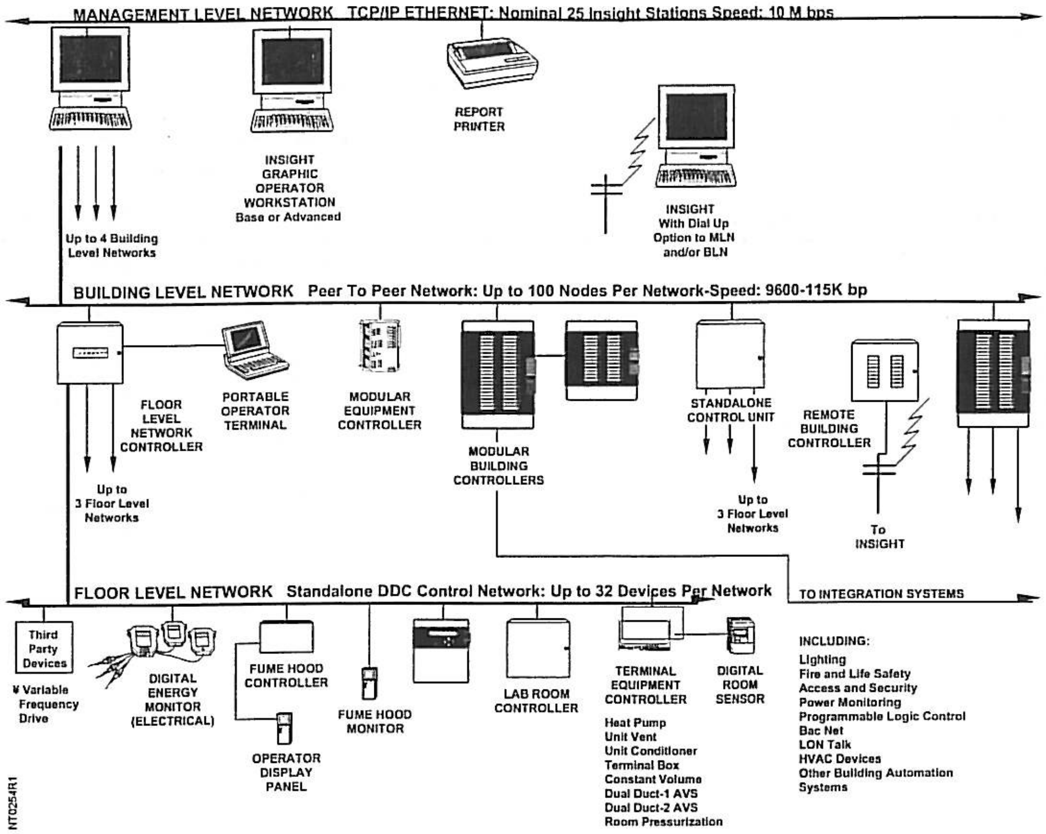


Figure 3. Digital Energy Monitor connection to APOGEE Building Management System.

Specifications

Three phase installations	277/480 VAC Delta and Wye; 120/208 VAC Delta and Wye
Single phase installations	120/240 VAC 3-wire 277 VAC 2-wire
Input primary voltage	208-480 VAC
Maximum primary current	100, 300, 400, 800, 1600, and 2400 Amps (depending on model)
Frequency	50/60 Hz
Internal isolation	2,000 VAC
Environmental (operating)	32°F to 140°F (0°C to 60°C) 90%RH, non-condensing
FLN connection	standard 3-pin removable terminal block
Certification	UL 1244 Listed CUL approved to C22.2M231

Current transformer		
	Type	split-core, volt type
	Case insulation	600 VAC
	Internal dimensions	Small (100 and 300 Amp) 1-9/16 x 1-1/4 in. Medium (400 and 800 Amp) 2-15/16 x 2-3/8 in Large (800, 1600, and 2400 Amp) 5-1/2 x 2-3/8 in.
Accuracy		+/- 1.0%, meets ANSI C12.1 metering standard for accuracy
Controls and Indicators		
Dip Switches		8 binary switches to set FLN address
Status Indicators		combination green/red LED shows normal/fault status

Ordering Information

Digital Energy Monitor		
	Product Number	
Description (Amperage Rating / CT Size)	DEM 1000	DEM 2000
100 / Small	538-985	538-993
300 / Small	538-984	538-992
400 / Medium	538-983	538-991
800 / Medium	538-982	538-990
800 / Large	538-981	538-989
1600 / Large	538-980	538-988
2400 / Large	538-979	538-987

Haggery Data Center Photos

Data Center Computer Racks and Floor Distribution Grilles

Supply Plenum Below Computer Room Floor

Liebert Downflow Computer Room AC Unit (Typical of 2)

Exterior Computer Room AC Unit Condensing Units

OGS Cost Estimate Form BDC-178

Design and Construction
AN ISO 9001:2000 CERTIFIED ORGANIZATION
Cost Control, 32nd Floor, Corning Tower
The Governor Nelson A. Rockefeller Empire State Plaza
Albany, New York 12242
Phone: (518) 486-1540 FAX: (518) 474-6120

ESTIMATE SUMMARY/HISTORY

Project No.: **S4448**

Study to Upgrade the EMS
SUNY at New Paltz
New Paltz, NY

Designer:	Sage Engineering		
Estimator:		Date:	15-May-09
E-mail:		Phase:	STUDY
Fax:	518-453-6092	Client Agency:	SUNY New Paltz
Phone:	518-453-6091	Prepared by:	DPL

Building GSF: (0) sq ft	INITIAL SCOPE ESTIMATE	CURRENT Bldg. $/gsf	CURRENT STUDY 18-May-09	PREVIOUS		
Construction						
HVAC			$1,070,000			
Plumbing						
Electric			$113,000			
Elevators						
Food Service Eq.						
Asbestos						
Other						
Other						
BUILDING SUBTOTAL			$1,183,000			
Sitework						
Env. Eng.						
Elec.Service						
HVAC Sitework						
Other						
SITE SUBTOTAL						
MAXIMUM CONSTRUCTION COST			**$1,183,000**			
ANCILLARY COST ESTIMATE:						
Change Order						
Bonus						
Other						
ANCILLARY TOTAL						
CONSTRUCTION TOTAL			$1,183,000			
ADDITIONAL COSTS:						
Equipment (8%)						
Other						
ADDITIONAL TOTAL						

CURRENT ESTIMATE SUMMARY

BID PACKAGES:	ESTIMATED BID AMOUNT	FIELD ORDER ALLOWANCES
Construction:		
HVAC:	$1,070,000	$65,900
Plumbing:		
Electric:	$113,000	$5,500
Other:		
TOTAL ESTIMATED BID AMOUNT	**$1,183,000**	

Valid until expected bid:

Bid Pk. #	ALTERNATES Amount	Description

OTHER ALLOWANCES (included in Bid Amount)

COMMENTS & REFERENCES:

Reviewed By: Date

Design and Construction
AN ISO 9001:2000 CERTIFIED ORGANIZATION
Cost Control, 32nd Floor, Corning Tower
The Governor Nelson A. Rockefeller Empire State Plaza
Albany, New York 12242
Phone: (518) 486-1540 FAX: (518) 474-6120

CONSULTANT ESTIMATE Project No.: **S4448-H**

Study to Upgrade the EMS	Consultant: Sage Engineering	To: Dana Dostie, P.E.
SUNY at New Paltz	Estimator: DPL	Date: 18-May-09
New Paltz, NY	Phone: 518-453-6091	Phase: STUDY
	Trade: HVAC	Client Agency: SUNY New Paltz
	New/Rehab: Rehab	Bid Package: H

DIV. 1	GENERAL CONDITIONS & ADMINISTRATION				
	Bonds	2.0%			$16,476
	Contractors Supervision / Proj Mgr.	80 days	$400	Day	$32,000
	Permits				
	Insurance	3.0%			$24,714
	Home Office Overhead	4.5%			$37,072
	Profit	8.5%			$70,024
	Equipment, Tools, Field Office				
1020	FIELD ORDER ALLOWANCE	8.0%			$65,900

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		Haggerty									
		HTHW									
		Asbestos Abatement	1	LS				2500.00	$2,500	2500.00	$2,500
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	1000.00	$1,000	24.000	77.00	$1,848	2848.00	$2,848
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		Student Union Building									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	900.00	$900	8.000	79.00	$632	1532.00	$1,532
		Meter Wiring	1	LS	500.00	$500	16.000	79.00	$1,264	1764.00	$1,764
		Domestic Water Heater									
		Asbestos Abatement	1	LS				1500.00	$1,500		$1,500
		HTHW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Gas meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Meter wiring	1	LS	500.00	$500	16.000	77.00	$1,232	1732.00	$1,732
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		Main Line Gas Meter	1	LS	3000.00	$3,000	12.000	79.00	$948	3948.00	$3,948

Subtotal this page		$37,200		$17,664	
Subtotal page 2		$139,600		$42,618	$182,218
Subtotal page 3		$156,950		$45,774	$202,724
Subtotal page 4		$101,050		$37,420	$138,470
Subtotal page 5		$111,850		$26,236	$138,086
Design Development Contingency	15.0%	$81,998		$25,457	$107,454

Summary				
	General Conditions & Administraton	$180,287	16.8%	
	Allowance	$65,900	6.2%	
	Material Cost	$628,648	58.8%	
	Total Labor	$195,169	18.2%	
	Total Cost	$1,070,003	100%	**$1,070,000**

Design and Construction
AN ISO 9001:2000 CERTIFIED ORGANIZATION
Cost Control, 32nd Floor, Corning Tower
The Governor Nelson A. Rockefeller Empire State Plaza
Albany, New York 12242
Phone (518) 486-1540 FAX: (518) 474-6120

CONSULTANT ESTIMATE Project No.: **S4448-H**

Study to Upgrade the EMS
SUNY at New Paltz
New Paltz, NY

Consultant: Sage Engineering
Estimator: DPL
Phone: 518-453-6091
Trade: HVAC
New/Rehab: Rehab

To: Dana Dostie, P.E.
Date: 15-May-09
Phase: STUDY
Client Agency: SED
Bid Package: H

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		College Theatre, Dorsky Smiley									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Gas meter in backup steam boiler	1	LS	4500.00	$4,500	24.00	79.00	$1,896	6396.00	$6,396
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		New HTHW DHW Heater	1	LS	25000.00	$25,000	40.00	79.00	$3,160	28160.00	$28,160
		Fine Arts									
		HTHW									
		Meter	1	EA	6000.00	$6,000	8.000	79.00	$632	6632.00	$6,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	1000.00	$1,000	18.000	79.00	$1,422	2422.00	$2,422
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Domestic Water Heater									
		HTHW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Parker Theatre									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		Sojourner Library									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4500.00	$4,500	8.000	79.00	$632	5132.00	$5,132
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Lecture Center									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4900.00	$4,900	8.000	79.00	$632	5532.00	$5,532
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	1500.00	$1,500	18.000	79.00	$1,422	2922.00	$2,922
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		New HTHW DHW Heater	1	LS	25000.00	$25,000	40.00	79.00	$3,160	28160.00	$28,160
		Coykendall Science									
		HTHW									
		Meter	1	EA	4900.00	$4,900	8.000	79.00	$632	5532.00	$5,532
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	18.000	79.00	$1,422	2172.00	$2,172
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Domestic Water Heater									
		HW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Subtotal This Page				$139,600			$42,618		$182,218

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CONSULTANT ESTIMATE Project No.: **S4448-H**

Study to Upgrade the EMS
SUNY at New Paltz
New Paltz, NY

Consultant: Sage Engineering
Estimator: DPL
Phone: 518-453-6091
Trade: HVAC
New/Rehab: Rehab

To: Dana Dostie, P.E.
Date: 15-May-09
Phase: STUDY
Client Agency: SED
Bid Package: H

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		Wooster Science									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	18.000	79.00	$1,422	2172.00	$2,172
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Domestic Water Heater									
		Asbestos Abatement	1	LS				2500.00	$2,500		$2,500
		HW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS		$6,500				6500.00	$6,500
		Resnick Engineering									
		HTHW									
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	18.000	79.00	$1,422	2172.00	$2,172
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS		$4,500				4500.00	$4,500
		Domestic Water Heater									
		Gas meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Faculty Office Building									
		Gas meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Vandenburg Learning Center									
		HTHW									
		Meter	1	EA	4500.00	$4,500	8.000	79.00	$632	5132.00	$5,132
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	12.000	79.00	$948	1698.00	$1,698
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS		$4,500				4500.00	$4,500
		New HTHW DHW Heater	1	LS	25000.00	$25,000	40.00	79.00	$3,160	28160.00	$28,160
		Jacobson Faculty Tower									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4900.00	$4,900	8.000	79.00	$632	5532.00	$5,532
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	18.000	79.00	$1,422	2172.00	$2,172
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS		$4,500				4500.00	$4,500
		New HTHW DHW Heater	1	LS	25000.00	$25,000	40.00	79.00	$3,160	28160.00	$28,160
		Humanities									
		Heating									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter in HW	1	EA	2500.00	$2,500	8.000	79.00	$632	3132.00	$3,132
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	350.00	$350	8.000	79.00	$632	982.00	$982
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS		$4,500				4500.00	$4,500
		Old Library									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	12.000	79.00	$948	1698.00	$1,698
		Meter wiring	1	LS	500.00	$500	12.000	77.00	$924	1424.00	$1,424
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		New HTHW DHW Heater	1	LS	25000.00	$25,000	40.00	79.00	$3,160	28160.00	$28,160
		Subtotal This Page				$156,950			$45,774		$202,724

Design and Construction
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Phone (518) 486-1540 FAX (518) 474-6120

CONSULTANT ESTIMATE

Project No.: **S4448-H**

Study to Upgrade the EMS
SUNY at New Paltz
New Paltz, NY

Consultant: Sage Engineering
Estimator: DPL
Phone: 518-453-6091
Trade: HVAC
New/Rehab: Rehab

To: Dana Dostie, P.E.
Date: 15-May-09
Phase: STUDY
Client Agency: SED
Bid Package: H

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		College Hall									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	900.00	$900	8.000	79.00	$632	1532.00	$1,532
		Meter Wiring	1	LS	500.00	$500	16.000	79.00	$1,264	1764.00	$1,764
		Domestic Water Heater									
		Asbestos Abatement	1	LS				1500.00	$1,500		$1,500
		HTHW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Gas meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Meter wiring	1	LS	500.00	$500	16.000	77.00	$1,232	1732.00	$1,732
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		Hasbrouck Dining									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	900.00	$900	8.000	79.00	$632	1532.00	$1,532
		Meter Wiring	1	LS	500.00	$500	16.000	79.00	$1,264	1764.00	$1,764
		Domestic Water Heater									
		Asbestos Abatement	1	LS				1500.00	$1,500		$1,500
		HTHW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	16.000	77.00	$1,232	1732.00	$1,732
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		Backup boiler Gas meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Main Gas Flow Meter	1	LS	3000.00	$3,000	12.000	79.00	$948	3948.00	$3,948
		Service Building									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	900.00	$900	8.000	79.00	$632	1532.00	$1,532
		Meter Wiring	1	LS	500.00	$500	16.000	79.00	$1,264	1764.00	$1,764
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Domestic Water Heater									
		Asbestos Abatement	1	LS				1500.00	$1,500		$1,500
		HTHW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Meter wiring	1	LS	500.00	$500	16.000	77.00	$1,232	1732.00	$1,732
		Surge Building									
		Gas flow meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Controls Upgrades	1	LS	6500.00	$6,500					$6,500
		School of Business									
		Gas flow meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Controls Upgrades	1	LS	6500.00	$6,500					$6,500
		Student Health Center									
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	900.00	$900	8.000	79.00	$632	1532.00	$1,532
		Meter Wiring	1	LS	500.00	$500	16.000	79.00	$1,264	1764.00	$1,764
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Childrens Center									
		Gas flow meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Controls Upgrades	1	LS	6500.00	$6,500					$6,500
		Subtotal This Page				$101,050			$37,420		$138,470

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CONSULTANT ESTIMATE Project No.: **S4448-H**

Study to Upgrade the EMS SUNY at New Paltz New Paltz, NY	Consultant: Sage Engineering Estimator: DPL Phone: 518-453-6091 Trade: HVAC New/Rehab: Rehab	To: Dana Dostie, P.E. Date: 15-May-09 Phase: STUDY Client Agency: SED Bid Package: H

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		Elting Gym and Athletics Centr									
		HTHW									
		Asbestos Abatement	1	LS				3000.00	$3,000	3000.00	$3,000
		Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	900.00	$900	8.000	79.00	$632	1532.00	$1,532
		Meter Wiring	1	LS	500.00	$500	16.000	79.00	$1,264	1764.00	$1,764
		Controls Upgrades	1	LS	4500.00	$4,500				4500.00	$4,500
		Domestic Water Heater									
		Asbestos Abatement	1	LS				1500.00	$1,500		$1,500
		HTHW Meter	1	EA	4000.00	$4,000	8.000	79.00	$632	4632.00	$4,632
		Temp Sensors	2	EA	300.00	$600	2.000	79.00	$316	458.00	$916
		Piping Mod's	1	LS	750.00	$750	8.000	79.00	$632	1382.00	$1,382
		Gas meter	1	LS	3000.00	$3,000	8.000	79.00	$632	3632.00	$3,632
		Meter wiring	1	LS	500.00	$500	16.000	77.00	$1,232	1732.00	$1,732
		Terrace Restaurant									
		Gas flow meter	1	LS	3000.00	$3,000	12.000	79.00	$948	3948.00	$3,948
		Controls Upgrades	1	LS	6500.00	$6,500				6500.00	$6,500
		Workstation upgrades	1	LS	15500.00	$15,500		14500.00	$14,500		$30,000
		Dormitory controls upgrades	9	LS	7500.00	$67,500					$67,500
		Subtotal This Page				$111,850			$26,236		$138,086

Design and Construction
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Phone: (518) 486-1540 FAX: (518) 474-6120

CONSULTANT ESTIMATE

Project No.: **S4448-E**

Study to Upgrade the EMS SUNY at New Paltz New Paltz, NY	Consultant: Sage Engineering Estimator: MA Phone: 518-453-6091 Trade: Electric New/Rehab: Rehab	To: Dana Dostie, P.E. Date: 18-May-09 Phase: STUDY Client Agency: SUNY New Paltz Bid Package: E

DIV. 1	GENERAL CONDITIONS & ADMINISTRATION				
	Bonds	2.0%			$1,377
	Contractors Supervision / Proj Mgr.	60 days	$400	Day	$24,000
	Permits				
	Insurance	3.0%			$2,066
	Home Office Overhead	6.0%			$4,131
	Profit	10.0%			$6,885
	Equipment, Tools, Field Office				
1020	FIELD ORDER ALLOWANCE	8.0%			$5,500
	Other Allowance				

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		Haggerty									
		DHW Heater Metering	1	LS		$768	8.00	77.00	$616	1384.00	$1,384
		Electrical Metering	1	LS		$170	14.000	77.00	$1,078	1248.00	$1,248
		Student Union Building									
		Electrical Metering	1	LS		$238	14.000	77.00	$1,078	1316.00	$1,316
		College Theatre, Dorsky Smiley									
		DHW Heater Metering	1	LS		$819	11.000	77.00	$847	1666.00	$1,666
		Electrical Metering	1	LS		$119	11.000	77.00	$847	966.00	$966
		Fine Arts									
		Electrical Metering	1	LS		$1,754	25.000	77.00	$1,925	3679.00	$3,679
		Parker Theatre									
		DHW Heater Metering	1	LS		$770	14.000	77.00	$1,078	1848.00	$1,848
		Electrical Metering	1	LS		$170	14.000	77.00	$1,078	1248.00	$1,248
		Sojourner Library									
		Electrical Metering	1	LS		$221	19.000	77.00	$1,463		$1,684
		Lecture Center									
		DHW Heater Metering	1	LS		$785	9.000	77.00	$693	1478.00	$1,478
		Electrical Metering - Included in Sojourner Library Above									
		Coykendall Science									
		Electrical Metering	1	LS		$255	19.000	77.00	$1,463	1718.00	$1,718
		Wooster Science									
		DHW Heater Metering	1	LS		$870	14.000	77.00	$1,078	1948.00	$1,948
		Electrical Metering	1	LS		$970	20.000	77.00	$1,540	2510.00	$2,510
		Resnick Engineering									
		Electrical Metering	1	LS		$1,435	11.000	77.00	$847	2282.00	$2,282
		Subtotal this page				$9,344			$15,631		
		Subtotal page 2				$14,877			$20,020		$34,897
Design Development Contingency			15.0%			$3,633			$5,348		$8,981

Summary	General Conditions & Administraton	$38,459	34.1%	
	Allowance	$5,500	4.9%	
	Material Cost	$27,854	24.7%	
	Total Labor	$40,999	36.3%	
	Total Cost	$112,812	100%	**$113,000**

Design and Construction
AN ISO 9001:2000 CERTIFIED ORGANIZATION
Cost Control, 32nd Floor, Corning Tower
The Governor Nelson A. Rockefeller Empire State Plaza
Albany, New York 12242
Phone: (518) 486-1540 FAX: (518) 474-6120

CONSULTANT ESTIMATE Project No.: **S4448-E**

Study to Upgrade the EMS SUNY at New Paltz New Paltz, NY	Consultant: Sage Engineering Estimator: MA Phone: 518-453-6091 Trade: Electric New/Rehab: Rehab		To: Dana Dostie, P.E. Date: 18-May-09 Phase: STUDY Client Agency: SUNY New Paltz Bid Package: E

CSI Number	Note Ref.	DESCRIPTION:	QUANTITY	UNIT	MATERIAL UNIT PRICE	MATERIAL TOTAL COST	LABOR MAN HRS /UNIT	LABOR UNIT COST or HrlyWage+T&I	LABOR TOTAL COST	TOTAL UNIT COST	MATERIAL & LABOR TOTAL COST
		Faculty Office Building									
		Electrical Metering - Typical of 2 Loc.	1	LS		$717	4.00	77.00	$308	1025.00	$1,025
			1	LS							
		Vandenburg Learning Center									
		DHW Heater Metering	1	LS		$1,503	14.000	77.00	$1,078	2581.00	$2,581
		Electrical Metering	1	LS		$275	19.000	77.00	$1,463	1738.00	$1,738
		Jacobson Faculty Tower									
		DHW Heater Metering	1	LS		$870	14.000	77.00	$1,078	1948.00	$1,948
		Electrical Metering	1	LS		$170	14.000	77.00	$1,078	1248.00	$1,248
		Humanities									
		Electrical Metering	1	LS		$835	8.000	77.00	$616	1451.00	$1,451
			1	LS							
		Old Library									
		DHW Heater Metering	1	LS		$819	11.000	77.00	$847	1666.00	$1,666
		Electrical Metering	1	LS		$869	12.000	77.00	$924	1793.00	$1,793
		College Hall									
		DHW Heater Metering	1	LS		$819	11.000	77.00	$847	1666.00	$1,666
		Electrical Metering	1	LS		$85	10.00	77.00	$770	855.00	$855
		Hasbrouck Dining									
		Electrical Metering	1	LS		$1,720	26.000	77.00	$2,002	3722.00	$3,722
			1	LS							
		Service Building									
		DHW Heater Metering	1	LS		$785	9.000	77.00	$693	1478.00	$1,478
		Electrical Metering	1	LS		$1,673	30.000	77.00	$2,310	3983.00	$3,983
		Surge Building									
		Electrical Metering	1	LS		$785	8.000	77.00	$616	1401.00	$1,401
		School of Business									
		Electrical Metering	1	LS		$767	10.000	77.00	$770	1537.00	$1,537
		Student Health Center									
		Electrical Metering	1	LS		$170	14.000	77.00	$1,078	1248.00	$1,248
		Childrens Center									
		Electrical Metering	1	LS		$835	10.000	77.00	$770	1605.00	$1,605
		Elting Gym and Athletics Centr									
		Electrical Metering	1	LS		$340	26.000	77.00	$2,002	2342.00	$2,342
		Terrace									
		Electrical Metering	1	LS		$840	10.000	77.00	$770	1610.00	$1,610
		Page 2 Subtotal				$14,877			$20,020		$34,897