

The **Smith Meter™ Supervisor Computer** is a data collection and control computer for use in conjunction with GeoFlo's and GeoProv's. It provides centralized operator control by use of a color graphic CRT screen and a standard alphanumeric keyboard. The system can also read out status and control numerous valves associated with the metering, tank levels, pressures, temperatures, pump control, sampling, additive injection, etc.

## Features

- **Multiple-meter-bank (skid) capability**, multiple-meter-run-per-bank capability, multiple-prover (dedicated or shared) capability.
- **Communicates with per-meter-run** GeoFlo's, per-prover GeoProv's, for per-meter-run and per-prover redundancy.
- **Data entry via standard alphanumeric keyboard.**
- **Full-color-graphic visual displays** with RGBI CRT.
- **Menu-driven prompting** for entry of system operational commands via keyboard.
- **Menu-driven system cold-start** via CRT display and keyboard (no external devices required).
- **Outputs for report printer, event logger, and host computer** for data acquisition.
- **Outstanding mathematical and computational accuracy.**
- **Automatic temperature correction** performed according to API Standards 2540, Tables 6A, 6B, 6C, 54A, 54B, and 54C.
- **Digital calibration** of analog inputs and outputs.
- **Secure data storage** of totals and constants using a 10-year, non-volatile memory.
- **User-configurable security and alarms.**
- **Dual pulse security** per IP252/76 and ISO6551.
- **Remote batch start** and product selection via host communication.
- **Host communication** available via RS-232 with Smith standard protocol.
- **Programmable daily report initiation.**
- **Alarm indication** and logging.
- **Three-stage flow up and down ramp for batch control: start-up rate, load rate, and cutoff rate.**
- **Back-pressure control** for turbine meter applications.
- **Dual-prover-volume capability.**



- **Four-way diverter valve control, status, and seal integrity monitoring.** Meter-run outlet and prover inlet valve control and status.
- **Designed for use with bidirectional provers, piston provers, Smith Small Volume Provers, or unidirectional provers.**
- **Proving report printout** per API guidelines.
- **Modular construction** for application flexibility and ease of troubleshooting.
- **Compact 19-inch rack-mount circuitry** with ribbon cable to GeoFlo's, GeoProv's, and field terminals which can be conveniently located.
- **Full graphic and audible annunciator capability** per ISA sequence.
- **Security key switch** for lockout of privileged parameters.
- **Large repertoire of standard firmware** available.
- **Relatively low-cost special firmware** available.
- **Automatic proving** based on temperature change or flow rate change.
- **Batching, pipeline, production, and light product control algorithms** available.

## Applications

This product is ideal for multiple meter-bank (skid) stations, with or without provers, where petroleum liquid measurement accuracy, accountability, and operator convenience is paramount, such as pipeline deliveries or batch deliveries.

## ***Principle of Operation***

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The Smith Meter™ Supervisor software consists of a number of standard modules specifically developed for petroleum measurement usage, in compliance with the API manual of Petroleum Measurement Standards. Specific packages are available for batch-type operation (for tanker, barge, tank farm, truck, or rail car loading and/or unloading) and for pipeline or other continuous flow operations. Standard color-graphic screens are available for multiple meter runs and provers, and also for multiple meter banks or skids, each with its own prover or with shared provers. Screens can provide general overall views of multi-skid system operation or details of each meter and valve. Complete annunciator functions are incorporated to provide visual, audio, and printed response to many user-set alarm limits and conditions.

The Supervisor computer is able to log out reports to various printers and/or event loggers, and the format is flexible. In addition, the computer can act as an RTU to a central host computer and can communicate using a variety of protocols.

Serial backup to the supervisory computer is provided via the per-meter-run GeoFlo instruments. If the Supervisor computer should fail, meter totals would not be lost and operation could continue using the individual GeoFlo and GeoProv displays and keyboards.

## ***Proving***

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The Supervisor station can interface with different types of provers for each meter bank or share provers on separate meter banks.

Proving Reports are generated from information retrieved from the GeoProv. The Supervisor notifies the operator at the end of the prove by sounding an alarm and printing a prover report. The meter factor is presented to the operator for acceptance. If accepted, the meter factor is sent to the GeoFlo for use on completion of a proving sequence.

Flow control is accomplished by interface to the GeoFlo. For multiple-meter-run systems, the Supervisor can be programmed to automatically bring meter banks on- and off-line; within their preset linear ranges; in response to a station-preset flow rate, or, in the case of pipeline operation, in response to changes in flow rates.

## ***Specifications***

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### ***Accuracy***

Flow Totalizing: Within one count of input pulses.

Computational: 80-bit internal floating point and 64-bit external floating point, rounding, and truncation per API-MPMS Chapter 12.

Analog Inputs: 0.1% of full scale input.

## ***Electrical Inputs***

### ***Instrument Power:***

Nominal from 115 Vac, 50-60 Hz or 230 Vac, 50-60 Hz. 150 watts maximum including CRT but not printers.

### ***Power Fail:***

Critical data is stored in a 10-year, lithium, battery-powered CMOS RAM.

### ***Special Analog Inputs Available for Temperature and Pressure:***

Type: Four-wire, 100  $\Omega$  platinum-resistance temperature detector (PRTD). Temperature coefficient @ 32°F = 0.00214  $\Omega/\Omega^\circ\text{F}$  (0.00385  $\Omega/\Omega^\circ\text{C}$ ).

Linearization: To BS1904.

Self-Calibrating: Lead length compensation that requires no resistance balance of leads.

Accuracy: 0.04% of full scale, or 0.2°F (0.1°C) (whichever is greater).

Option Note: Temperature inputs may be 4-20 mA or 1-50 Vdc in place of RTD.

### ***Analog Inputs:***

Type: Two-wire 4-20 mA current loop receiver isolated from ground. Voltage loss in circuit @ 20 mA = 6.6 Vdc.

Accuracy: 0.1% of full scale input.

Options: 1-5 Vdc for pressure input.

### ***Analog Inputs (BS&W):***

Quantity: Maximum of one per meter bank.

Type: Two-wire 4-20 mA current loop receiver isolated from ground. Voltage loss in circuit @ 20 mA = 6.6 Vdc.

Accuracy: 0.1% of full scale input.

Options: 1-5 Vdc or frequency input.

## ***Discrete Inputs***

### ***Block Valve and Strainer Status:***

Type: Optically-isolated, solid-state voltage sensors.

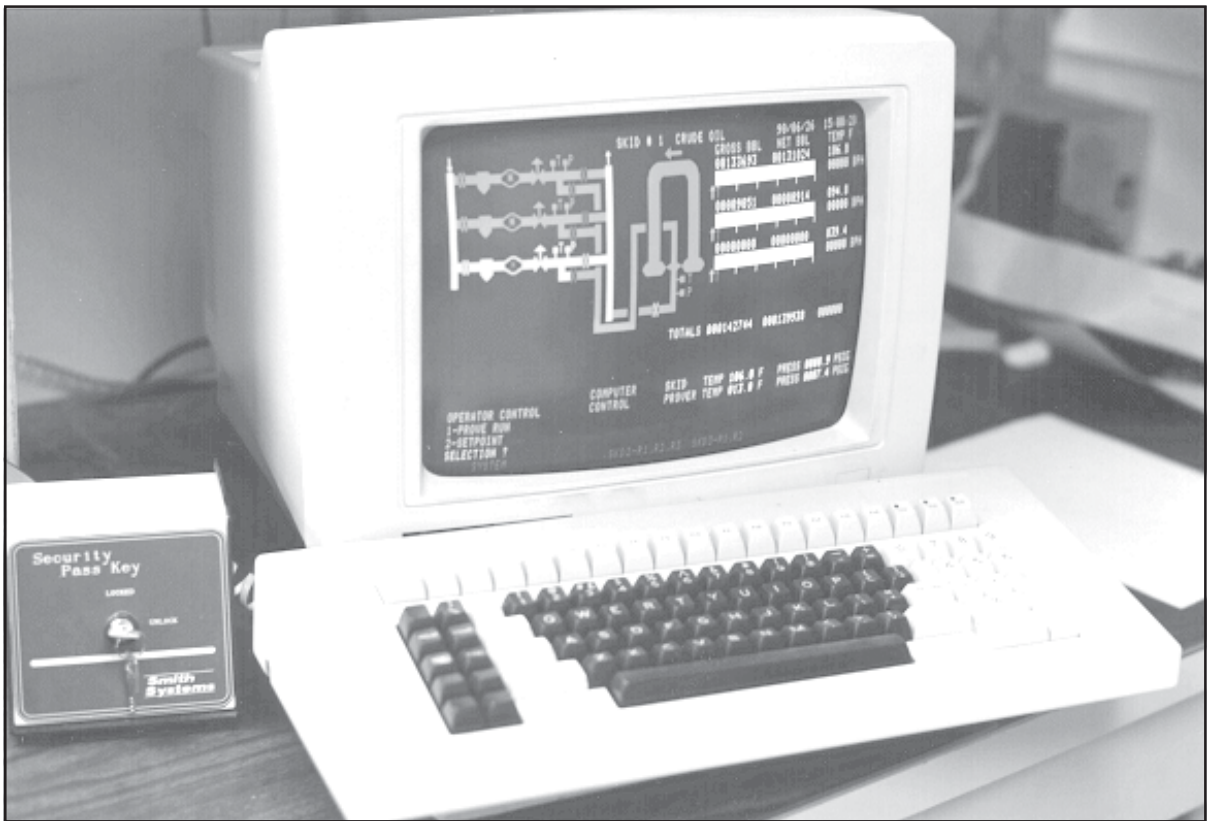
Input Voltage Range: 24 Vdc-compatible.

Current: 25 mA maximum.

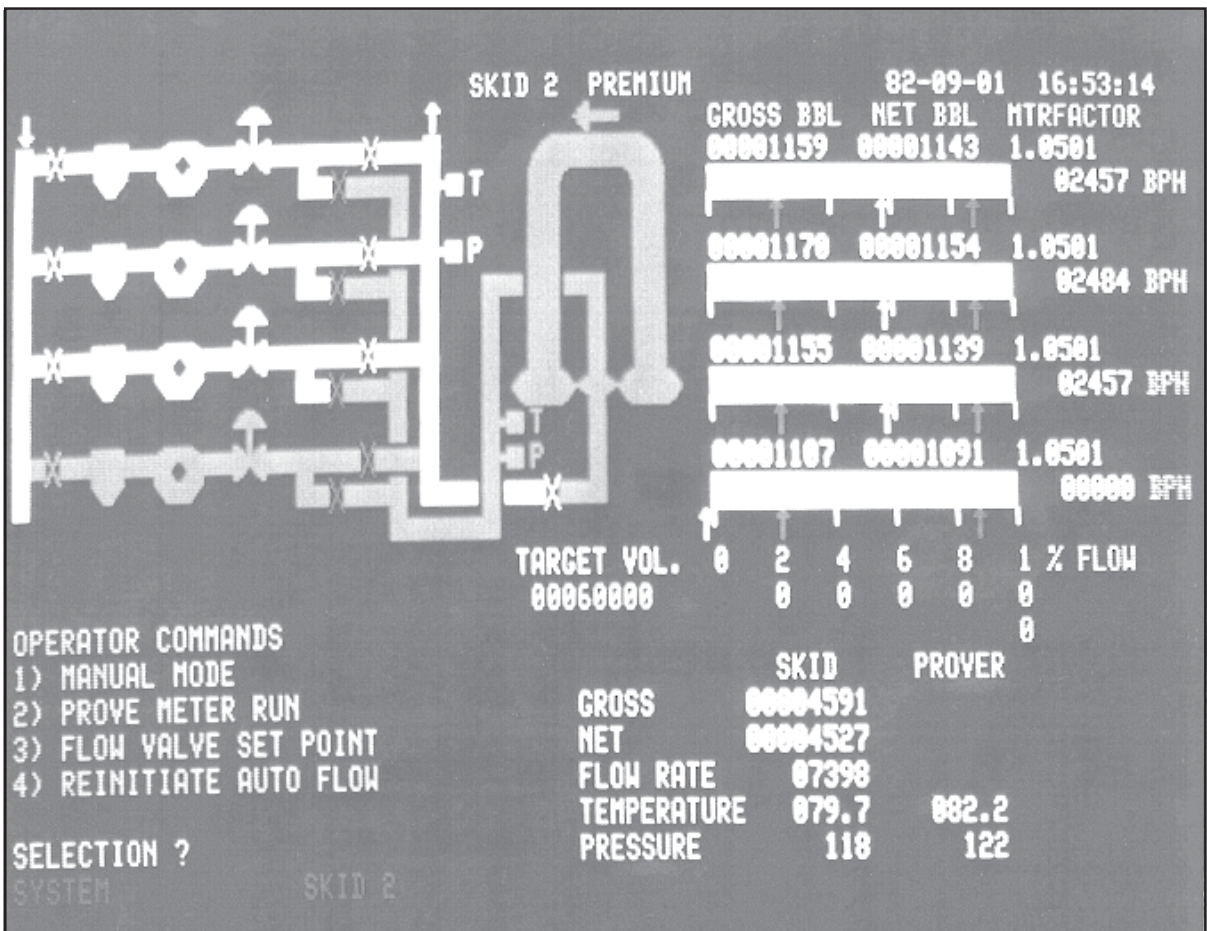
## ***Keyboard***

The keyboard provided with the system is a standard alphanumeric style with a numeric keypad and 19 function keys. Most of the function keys are defined to display top-level displays or to perform certain actions. An engraved legend plate is provided above the function keys to describe their function. The keyboard interface is provided through an RS-232 cable to the computer. A separate security keybox is provided to be used in conjunction with the keyboard. The security keybox provides configurable security for menu entries, displays, and alarms.

# Supervisory Computer Equipment



Typical Skid Graphic Display



## System Outputs

### **Control Contact (Block Valve):**

Type: Optically-isolated, open-collector transistor switches.

Switch-Blocking Voltage (Switch Off): 30 Vdc maximum.

Load Current (Switch On): 100 mA at 1.1V Vce saturation.

### **Pulse Outputs (Net and/or Gross Combined Pulse Stream):**

Quantity: Maximum one per bank typically to drive a sampler.

Type: Optically-isolated, open-collector transistor switch. Transmitter output resolution is one pulse per unit volume or mass divisible by any whole number from 1 to 65,000.

Switch-Blocking Voltage (Switch Off): 30 Vdc maximum.

Load Current (Switch On): 100 mA maximum at 1.1V Vce saturation.

Frequency: 25 Hz maximum.

Pulse Width: Adjustable 20 to 65,000 milliseconds (on/off).

### **Analog (Flow Rate or Flow Control):**

Quantity: One available for each combined skid.

Type: 4-20 mA, two-wire, isolated output.

### **Video Monitor - CRT:**

The system is provided with a video monitor commonly referred to as a CRT. The CRT is a readily-available type as used on personal computers. The CRT provides the operator with color-graphic displays and menus via the video board. The CRT requires interface to the video board through a nine-conductor RGBI cable. The resolution of the CRT is 640 pixels horizontal by 240 pixels vertical. Eight colors are available for use in displays. The standard CRT provided is a 12-inch diagonal; however, different sizes are available.

## Communications (I/O)

Multiple asynchronous ports available.

Examples: GeoFlo  
GeoProv  
PLC's

Type: EIA-RS-232C.

Data Rate: As required.

Data Format: As required.

**Note:** Output to customers' equipment is Smith standard protocol. Other protocols are optional for an additional charge. Consult factory for quote.

## Dimensions

### **Approximate Dimensions**

Card Cage: 7" (178 mm) height by 19" (483 mm) width by 8" (203 mm) deep. Ten pounds (4.5 kg).

Power Supply: 5.25" (133 mm) height by 5.3" (135 mm) width by 7.5" (191 mm) deep. Twenty pounds (9.1 kg).

## Environmental

### **Ambient Operating Temperature Range**

30°F to 122°F (0°C to 50°C).

### **Ambient Storage Temperature**

-4°F to 140°F (-20°C to 60°C).

### **Humidity**

0 to 95% non-condensing.

## Flow Computer Details

### **General**

Through the use of color graphics and modular, function-oriented, hardware design, state-of-the-art technology enhances the operator's observation of the system and allows expandability and ease of maintenance. Through the use of the skid display, the operator can readily visualize the current state of the system. Operator control of the system is provided through numerous CRT menus. Selection of the main menus is accomplished through the use of function keys on the operator entry keyboard. The hardware design is based upon the STD-Bus, an industrial control system standard that allows function-dedicated boards to be added as the system requirements dictate. A description of each of the boards that are used as building blocks for each individual system is listed below.

### **Central Processor Board**

The design of the 8759 Central Processor Board is based around the Intel Corporation's 8088 Microprocessor of IBM PC fame. Included on the board is the high-performance 8087 Math Coprocessor which extends the instruction set and data registers of the 8088 CPU to perform IEEE floating-point standard operations. On-board programmable interrupt control, three-channel programmable counter timer operation, and one full megabyte of memory addressing are all included functions that allow high speed efficient control of the supervisory system.

### **Communications Board**

Each 4604 Serial Communications Board provides up to four channels of asynchronous communication for the supervisory computer. A programmable interrupt controller provides interrupt arbitration and service routine vectors for the 8088. Separate interrupts are provided for the transmitter and receiver on each of the four channels. On-board generated transmitter and receiver clock rates allow programmable baud rates from 50 to 19,200 for

each of the four channels. The 4604 Communication Board is used to allow interface to the operator entry keyboard, report printers, alarm and status logger, host computer systems, GeoFlo/GeoProv instruments, and PLC I/O subsystems. Several communications boards can be placed into a single supervisory computer to allow communication into needed system components.

### ***Memory Board***

The memory board used in the supervisory computer is the same board used in the GeoFlo/GeoProv instruments. This field-proven board has four sockets for EPROM devices, allowing up to 256 kilobytes of code. The board also has four sockets for RAM devices, allowing up to 128 kilobytes of data storage. In any or all of the RAM sockets, a battery-backed-up RAM device can be placed insuring that the data located in the memory chip is not affected by loss of power.

### ***Meter Run Board***

The Meter Run Board, MRB, is another circuit board that is shared between the GeoFlo instrument family and the supervisory computer. The MRB is used in supervisory systems that require analog input or a pulse output. The MRB allows for up to four analog interface modules to be inserted on the board. These interface modules allow for a variety of different types of analog signals to be available for use in the computer algorithms. The MRB is also capable of producing scaled pulse outputs to sampler or SCADA systems.

### ***Parallel Input/Output Board***

The parallel I/O board is used by the supervisory computer to interface to motor-operated valves and other specialized customer equipment. A single Valve Multiplex Board, VMB, allows a parallel I/O board to interface to four valves. Sixteen VMB's can be networked together to achieve a maximum configuration of up to 64 separate valves by a single parallel board. The VMB provides open and close command outputs and open, close, seal, and available input status signals for each valve.

### ***Video Board***

The video board is used to present the computer system to the operator in a user-friendly format. The video board allows displays to be developed using eight foreground colors, eight background colors, blinking and graphics characters. The video board uses memory-mapped screens and interrupt-driven write cycles to create rapid updating and jitter-free color-graphic displays. The video board interfaces to an IBM PC-style color CRT, which allows a wide range of terminal sizes and models to be used.

### ***Software Description***

The Supervisor computer software is written in INTEL PLM. PLM is a control-oriented, structured, high-level language. The supervisor software is composed of multiple field-tested modules. A full library of application modules is available to allow customers' special requirements to be met at minimum additional cost.

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

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