



ACE II, an acronym for Advanced Cryogenic Electronics, is an improved system for the measurement and recording of LIN, LOX, LAR, CO2 and other cryogenic liquids for truck deliveries and in-plant applications.

Outstanding Features

- ◆ Easily upgrades from ACE to ACE II.
- ◆ Advanced HMI (human machine interface) with 128x68 graphical display and “soft-keys”.
- ◆ Infrared Communication Interface. (Optional)
- ◆ Flash memory for field upgrades.
- ◆ Self-diagnostics.
- ◆ Detailed, plain language error and help messages.
- ◆ Four fluid properties table allows to easily switch between fluids.
- ◆ 12 bit resolution for improved accuracy in temperature & pressure reading.
- ◆ Multiple flow calculations and compensation methods.
- ◆ Dual level password security to prevent unauthorized access to setup and maintenance modes.
- ◆ Audit trail support.
- ◆ Up to 100 trip report memory.
- ◆ Windows® based configuration program.
- ◆ Pump service feature provides message to notify user when preventive maintenance is needed.

General Description

ACE II incorporates the newest technological advances in electronics and the time proven solutions in cryogenic measurements from the Hoffer ACE system.

Graphical display and “soft keys” allows for easy interaction between operator and the instrument. Multiple, easy to follow messages displayed in full text help the user to navigate through the instrument menu. The menu is built up hierarchically for quick access to a desired function.

Electronic circuits are constructed with rugged, multi-layer boards and SMT (surface mount components).

The advanced computation algorithm provides multiple methods for calculating volume, mass and density of the fluid.

Extensive built-in diagnostic functions allow for quick troubleshooting and identifying faulty components.

Communication to external computing devices is accomplished through the RS232 serial port, and optional front panel infrared port. ACE II supports standard MODBUS protocol.

Modes of Operation

Operating: When power is first applied, ACE II will be functioning in the operating mode, displaying delivered mass or volume total. This mode is used to perform delivery and display all flow parameters. Delivery totals can be cleared and tickets printed. An operator password is required for clearing total.

Setup: This mode is used to enter all flowmeter parameters. Other entries may be made to configure the system for optional features. A password is required for access to setup.

Diagnostic: In this mode, the user can perform maintenance operations, enter maintenance records, and display results of troubleshooting and factory adjustments test. Additional utilities are provided to allow for serial interface testing. A password is required for access to maintenance.

Display Selections

ACE II performs a number of measurements, depending on how the system is configured. Variables available for display:

- ◆ Delivered volumetric/mass total.
- ◆ Accumulated volumetric/mass total.
- ◆ Volumetric/mass flow rate.
- ◆ Temperature.
- ◆ Pressure.
- ◆ Density.
- ◆ Date and time.

Printer/Communication Capabilities

The industry standard RS232 port is provided along with the option of an infrared port on all ACE II systems. Print functions:

- ◆ Delivery ticket
- ◆ Trip report
- ◆ Error log
- ◆ Configuration data
- ◆ Audit trail

Optional Pump Interlock System

The pump interlock works in conjunction with the temperature measurement of liquid in the discharge line. If the temperature falls into the gas region, an internal relay shuts down operation. During cool down, the pump cannot be started until a user defined fluid temperature is detected.

Optional Remote Electronic Counter

ACE II offers an optional pulse output which may be connected to a counter to permit remote indication of the delivered quantity. This output may also be used by vehicle monitoring systems to record delivery status and results.

Optional Pressure Compensation

ACE II is capable of taking in an analog signal from a pressure transmitter and using it to provide a more accurate measurement. This option also can enhance the pump interlock option by allowing ACE II to precisely determine the two-phase region and monitor pump cavitation.

Optional Analog Output

Optional 4-20 mA output can be configured for flow rate, temperature, pressure or density.

Auto Clear

After printing a delivery ticket ACE II automatically clears total when the next delivery begins.



Specifications

Environmental

Operating temperature:

-20° to +70°C (+4° to +158°F) *

Storage temperature:

-40° to +90°C (-40 to +194°F)

Humidity:

0-95% Non-condensing

* Heaters required for operation below 0°C (32°F).

Display

128x64 graphical backlit LCD display with optional heaters for extended temperature range. Character height is 0.3". English or metric units are user defined. Display indicates last delivery total when power is first applied.

Keypad

Three soft keys and two scroll keys. The soft keys can be individually disabled.

Flowmeter Input

Input Sensitivity: 10 mVrms.

Magnetic pickup compatible.

Temperature Probes – Optional

100, 1000, 2500 ohm, platinum and DIN100.

Pressure Transmitter (Optional)

Accepts 4 - 20 ma or 1 - 5 VDC analog input.

Pulse Output (Optional)

The pulse output is a scaled pulse (1 pulse per gallon, SCF, etc.) It is offered as a TTL/CMOS or open collector type pulse. Maximum output is 200 pulses/second.

Power Input

Input voltage:

10-30 VDC (1.2 AMP maximum current)

Input-filtered, reverse polarity and fault-protector. Trailer power suitable for positive or negative ground.

Printer/Communication Interface

RS232 Drive level compatibility.

Handshake methods XON/XOFF

Baud Rate: User selectable.

Typical compensation ranges

Product	Compensated Temperature Range
LIN	75 to 125°K
LOX	90 to 135°K
LAR	85 to 125°K
CO ₂	-30 to +20°F
CO ₂	-60 to +30°F (optional)

CO₂ delivery

CO₂ systems support both single and dual-pipe deliveries. During dual-pipe delivery, credit is automatically applied for CO₂ vapor returns. **This is a unique feature of Hoffer CO₂ systems and is expected to be incorporated in the forthcoming metering code.**

Pump Service Feature

The pump service feature is designed to help with pump preventive maintenance schedule. When pump is serviced or installed, user may enter the service date, the type of service and the maximum number of pump operating hours before the next service. ACE II will accumulate and display the total number of actual pump operating hours. If the number of actual hours exceeds the entered number of max. operating hours an error message will be displayed. The error message will stay on until the actual hours display is reset to zero. The PUMP SERVICE menu is located under the MAIN MENU and includes the following fields.

Max Operating Hours

User may enter a desired number of pump operating hours (0-9999) between the scheduled pump maintenance.

Operating Hours Since Last Service

ACE II displays number of hours pump has been in operation since the last service. User may reset the display to zero when a service is performed. If the operating hours exceeds the max. operating hours an alarm message is displayed on the front panel.

Last Service Date

User may enter the date of the last service.

Last Service Type

ACE II displays type of the last service performed. User may enter the type of service from the selection below.

- Hydraulic Motor Rebuilt
- Motor Shaft Lube
- Seal Replaced
- Bearing Replaced
- Pump Rebuilt

Hardware Failure Detection Capabilities

Coil failures, RTD failures, pressure transmitter failures.

Delivery Error Detection Capabilities

Error detection for flow, temperature, pressure, and density.

Temperature, pressure compensation out of range.

Two-phase flow detection.

Windows® Configuration

ACE II can be Windows® configured through the RS232 printer port or via the infrared front panel port which is a standard ACE II feature. It can also be configured through the front panel keys.

Enclosure

Dimensions: 5.26" High x 6.9" Wide x 9.30" Deep.

Rugged aluminum enclosure.

Environmentally-sealed MS connectors type E.

Standard Shocks with stainless steel hardware or optional 10° tilt bracket up/down with shocks for variable viewing angle.

Hoffer Systems are Designed to Comply with:

Handbook 44 Cryogenic Metering Code (NIST)

Shock and Vibration MIL-STD 810B

NBS TN 361 (Revised)

ASHRAE Physical Properties of CO₂

State of California Department of Weights and Measures

O.I.M.L. - R81 *

CE

* Approval pending

Overview of Cryogenic Flow Measurement

For 30+ years Hoffer Flow Controls has been providing turbine flowmeters to the cryogenic industry. Hoffer pioneered the commercial application of turbine flowmeters for cryogenic service. The resulting design brought about an increased service life and reliability second to none. Hoffer also pioneered temperature compensation for cryogenic products. Our focus is on product improvement and service to the industry.

Turbine Flowmeters in Liquid and Gas Service for the Cryogenic Industry

Turbine flowmeters have been reported as the most accurate flowmeters in industrial use. Hoffer offers a wide selection of turbine flowmeter sizes with flow ranges and physical configurations to fit most applications. The design is directed toward cryogenic service with ease of maintenance in mind. Special tools or training are not required to service Hoffer flowmeters.

The Hoffer line of cryogenic turbine flowmeters uses a unique self-lubricating bearing which prolongs the life of the flowmeter in fluids that offer poor natural lubricity such as liquid nitrogen. In fact, this bearing is used in gas service with excellent results. Hoffer flowmeters are designed to permit gas spinning with no damage to the flowmeter. The materials of construction assure oxygen compatibility.

For additional information on the Hoffer line of turbine flowmeters, request the Turbine Flowmeter Engineering Guide.

A Comparison of Volumetric and Temperature Compensated Systems

Broadly speaking, flow measurement systems may be classified as volumetric or mass types. Volumetric flowmetering systems measure the volume of fluid in units such as gallons or liters. Mass flowmetering systems measure in units such as pound or kilograms. Hoffer offers both volumetric and mass flow measurement systems.

What is Temperature Compensation? Most fluids change density in a consistent manner with temperature. This property allows the density to be inferred from the temperature measurement. Mass flow in an inferential mass measurement system is calculated by multiplying the volume flow times the inferred density on a continuous sampling basis. Using the Hoffer patented compensation schemes, an accuracy of $\pm 0.25\%$ can be obtained in temperature compensators for cryogenic fluids for saturated pressures to 225 psig. This corresponds to a density change of 20%. Second order curve fits are used since straight line approximations result in considerable error. Readouts in gallons at NBP and cubic feet at NTP may be provided in accordance with the requirements of HDBK 44.

Where is Temperature Compensation used? Temperature compensation should be utilized whenever the mass flow or weight of the quantity transferred is more important than the volume delivered. On pressure transfer trailers and on most customer stations it is a must. In bulk transports, the added measurement accuracy often justifies the additional cost. HDBK 44 states that all billing be done in terms of mass units. Why not have your meters reading out in these units and simplify billing while improving accuracy?

Proven System Reliability and Accuracy

The Hoffer truck-mounted systems have been designed and built to withstand the rigors of over-the-road service and to operate reliably in the accompanying temperature extremes they will see in actual service.

Through the years Hoffer has worked with key industry leaders, NIST and various international weights and measure agencies to provide workable systems which conform to government standards. Copies of various test reports are available.

Ease of Field Calibration and Adjustment

All Hoffer systems currently available have provisions to facilitate field proving.

Factory Support

The Hoffer Applications Group is ready to assist you with sizing meters and recommending electronics options to meet your application needs. The Hoffer Engineering and Production Group ensures that each flow system is supplied fully programmed to the user's specifications, calibrated, and ready for easy installation.

Hoffer takes pride in its dedication to customer service and satisfaction. A toll free number is provided for factory support and service, as well as e-mail contacts on our website.

ORDERING INFORMATION

Basic Model Number ACE-II-		(A)	/	(B)	-	(C)	-	(D)	-	(E)	-	(F)	-	(G)	-	(H)	-	(I)	-	(J)	
(A) Volumetric Product Options (See note 1 & 2)																					
(1) LIN/LOX/LAR																					
(2) CO ₂ (must use temp. compensation option)																					
(3) Nitrous Oxide																					
(4) Liquid Hydrogen																					
(6) LNG																					
(7) LIN/LNG/Ethylene																					
(V) Volumetric																					
(B) Temperature/Pressure Compensation Options																					
(T) Temperature Compensation																					
(P) Pressure Compensation.																					
(TP) Temperature and Pressure Compensation.																					
(C) Pump Interlock Option 240 VAC, IMAX 5 Amps																					
(PI) Can be added to any product listed on Option A. (Temp. compensation option required if pump interlock selected.)																					
(D) Analog Output Options 12 BIT TRUE D/A																					
(7) 4-20 MA output.																					
(8) 1-5 VDC output.																					
(E) Scaled Pulse Output Options Pulse may be sent to vehicle monitoring system or to a remote electronic counter.																					
(1) Open Collector.																					
(2) TTL/CMOS.																					
(F) Pulse Security Option																					
(PS) Quadrature input per ISO6551 Level B compliant. Requires a second mag coil on turbine. (Turbine and coils sold separately)																					
(G) Power Input Options																					
(12) 12 VDC power input (8-30 VDC) 400 MA max. Includes power cable.																					
(24) 24 VDC power input (8-30 VDC) 400 MA max. Includes power cable.																					
(H) Heaters Optional																					
(H) Heater required for below 32° F.																					
(X) No heater required.																					
(I) Enclosure Options																					
(S) Standard – flat mount with shocks, Nema 4X.																					
(T) Tilt bracket with shocks, Nema 4X.																					
(E) Explosion-proof with 5 switches on cover. Meets NEC Class I, Groups B,C, & D; Class II, E,F, & G; Class III, UL Standard 886. CSA Standard C22-2 No. 30 & Nema 4.																					
(J) Special Features																					
(CE) CE mark required for Europe.																					
(SP) Any special features not covered in the model number. Provide a written description of the –SP.																					
(W) Windows® based RS-232 serial port configuration program with adapter and cable.																					

Notes:
 1. Up to four products can be loaded into the software when ordered and can be field selected.
 2. Any of the above products can be field configured via the front panel or by window through the infrared port.

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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.

CORPORATE SUSTAINING MEMBER
 CRYOGENIC SOCIETY OF AMERICA INC.

The quality system covering the design, manufacture and testing of our products is certified to International Standard ISO 9001.



ISO9001
 Registered Company