

ICE

(Integrated Cryogenic Electronics)

QUICK START GUIDE



HP-319
September 2015

H **HOFFER FLOW CONTROLS, INC.**
Perfecting Measurement™

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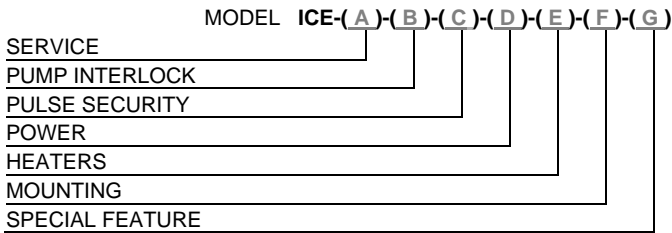
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INTRODUCTION

The ICE, Hoffer's latest in Integrated Cryogenic Electronics, is engineered using the latest technology to provide the most comprehensive features in a truck-mounted delivery system. The typical application includes ICE as the primary electronic indicating element of a bulk delivery system for CO₂ and Cryogenic liquids. Other system components typically include a turbine flow meter, temperature sensor, optional pressure sensor and optional printer. ICE has been designed in accordance with the cryogenic metering section of NIST HANDBOOK 44 and OIML R-81.

MODEL NUMBER DESIGNATION



SERVICE

MODEL ICE-(A)-()-()-()-()-()-()

OPTION (A)

- (1T) LIN/LOX/LAR - TEMP/COMP
- (2T) CO₂ - TEMP/COMP
- (3T) NITROUS OXIDE - TEMP/COMP
- (6T) LNG - TEMPERATURE COMP
- (V) TRUE VOLUMETRIC
- (P) FOR PRESSURE COMPENSATION (4-20 MA) ADD **P** TO ANY ABOVE OPTIONS, SPECIFY PRESSURE RANGE. INCLUDES PRESSURE TRANSMITTER CLEANED FOR OXYGEN SERVICE AND 6' CABLE.

PUMP INTERLOCK OPTION

(240 VAC, IMAX 30 AMPS)

MODEL ICE-()-(B)-()-()-()-()-()

OPTION (B)

- (PI) THE TEMPERATURE COMPENSATION OPTION MUST BE USED FOR THE PUMP INTERLOCK OPTION (**NOT AVAILABLE WITH PULSE SECURITY OPTION**)

PULSE SECURITY OPTION

(240 VAC, IMAX 30 AMPS)

MODEL ICE-()-()-(C)-()-()-()

OPTION (C)

- (PS) QUADRATURE INPUT PER ISO6551 LEVEL B COMPLIANT REQUIRES SECOND MAG COIL ON TURBINE **(DOES NOT INCLUDE COILS NOR TURBINE)**
- (X) NONE

POWER

MODEL ICE-()-()-(D)-()-()

OPTION (D)

- (12) 12 VDC STANDARD
- (24) 24 VDC OPTION
- (AC) 110/220 VAC POWER INPUT, STOCK #100-2052, 24 VDC POWER OUTPUT **(USED WITH PRINTER AND SKYDYNE CASE AND (NS) MOUNTING OPTION)**

HEATERS

MODEL ICE-()-()-()-(E)-()

OPTION (E)

- (H) HEATER - REQUIRED FOR BELOW 32 DEG. F.
- (X) NONE

MOUNTING

MODEL ICE-()-()-()-()-(F)-()

OPTION (F)

- (S) STANDARD - FLAT MOUNT WITH SHOCKS
- (SM) SHOCK MOUNTED SWIVEL STICK
- (E) EX AND NEMA ENCLOSURES
- (ND) NEMA 4X ENCLOSURE – FOR WALL MOUNTING

SPECIAL FEATURE

MODEL ICE-()-()-()-()-()-(G)

OPTION (G)

- (SW) POWER SWITCH (WEATHER PROOF)
- (CT) CUSTOM TICKETS
- (BTA) AIR CABLE
- (BTB) SOCKET CABLE
- (SP) ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL NUMBER, USE A WRITTEN PSCRIPTION OF THE -SP.

CABLES

(CABLES ARE SUPPLIED TO MATCH FEATURES PURCHASED)

NOTE: ALL CONNECTORS ARE ENVIRONMENTALLY WEATHERPROOF.

<u>CABLE</u>	<u>PART NUMBER</u>
10 FT. POWER CABLE	SCA-10CU3-P
10 FT. SIGNAL CABLE	SCA-10CC2-S
10 FT. TEMPERATURE CABLE	SCA-10CC2-TA
10 FT. PUMP INTERLOCK	SCA-10CU2-PI

NOTE: OTHER LENGTHS MAY BE ORDERED

SYSTEM OVERVIEW

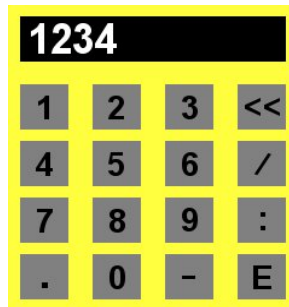
The front panel includes a 4.3" full color graphical display and 3 rugged panel sealed pushbuttons. The back panel includes environmentally sealed military style electrical connectors for all standard and optional I/O connections. The electronics are housed in a 4.35" L X 6.54" W X 4.125" H aluminum enclosure with shock mounts or optional tilt bracket.

THE USER INTERFACE

ICE is designed to be a user-friendly component of the delivery system, with an intuitive interface and easy access to the most common operations. The pushbuttons allow the user to quickly CLEAR the totalizer, PRINT a delivery ticket or change the MODE of operation.



ICE is equipped with a touch screen feature that allows easy entry of data parameters by authorized personnel. A numeric keypad simplifies the entry of numeric data for password entry or programming.



The Numeric Keypad

<< The BACKSPACE button erases an incorrect entry.

E Then ENTER button accepts the entered value.

MODES OF OPERATION

The ICE user interface is organized into 4 distinct modes of operation:

- Delivery Mode**
- Maintenance Mode**
- Turbine Calibration Mode**
- System Configuration Mode**

Although a password is required to make configuration changes, the settings in each mode may be viewed by pressing the MODE button. When prompted for a password, simply press MODE to advance to each of the 3 other mode screens until returning to the Delivery Mode.

Delivery Mode

The Delivery Mode is the primary mode of operation for ICE, where all delivery data and error messages are displayed on a single screen for easy viewing. This is the default mode of operation when ICE is powered on, or when the display timeout expires in one of the other modes.



ICE Delivery Mode Screen

<i>Display Item</i>	<i>Digits</i>	<i>Decimal Places</i>	<i>Description</i>
Delivery Total	8	0 (00000000) 1 (0000000.0) 2 (000000.00)	The total quantity of product dispensed in selected volume or mass units. Pressing the CLEAR button while in the Delivery Mode will clear the Delivery Total and log the delivery information to the trip log.
Flow Rate	6	0 (000000)	The measured flow rate expressed in units per minute. Units are determined by the selection for Delivery Total.
Temperature	4	1 (000.0)	The measured operating temperature. If the temperature sensor fails or is removed, the default temperature for the selected liquid is used for calculations and indicated with the word DEFAULT.
Pressure	4	bar – 2 (00.00) psi – 1 (000.0)	The measured operating pressure. If the pressure sensor fails or is removed, the default pressure for the selected liquid is used for calculations and indicated with the word DEFAULT.
Accumulated Total	12	0 (000000000000)	The total quantity of product dispensed from all deliveries. Units are determined by the selection for Delivery Total. The Accumulated

Delivery Mode Display Parameters

<i>Display Item</i>	<i>Description</i>
Fluid Name	The current fluid selected for dispensing.
Reference T&P	The reference temperature and pressure display is dependent on the compensation method and delivery units selected: <ul style="list-style-type: none"> • If compensation method is NONE, “Uncorrected” will be displayed • If Compensation Method is something other than NONE and Delivery Units are gallons or liters, “NBP, (1 atm)” is displayed • If Compensation Method is something other than NONE and Delivery Units are ft³, ft³X100 or m³, the actual temperature and pressure reference is displayed, i.e. 21 C, 101.325 kPa
Date/Time	The current date and time.
<i>Message Area</i>	The bottom portion of the screen is reserved for displaying error messages.

Additional Delivery Mode Display Items

The CLEAR button clears the Delivery Total from the Delivery Mode screen. The PRINT button prints a Delivery Ticket from the Delivery Mode screen.

Maintenance Mode

The Maintenance Mode contains diagnostic fields, programmable fields for Trailer Number and Date/Time as well as some additional Clear and Print functions. Fields not enclosed in a gray button are read only items, used for diagnostic purposes. If a correct password has been entered, touching a gray button on the display will execute the Print or Clear function or bring up the screen to edit a setting.

Maintenance Mode		
Print Config	Coil Ohms:	1081.8
Print Trip Report	Coil Hertz:	100.0
Clear Trip Report	RTD Counts:	539
Clear Acc Total	Internal Temp (F):	75.5
Audit Trail	Pump Hours:	153.2
Trailer:	12345678	12/22/2011::10:32

ICE Maintenance Mode Screen

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Print Config	N/A	Prints the current ICE configuration parameters to an attached printer.
Print Trip Log	10, 20, 40, 100	Prints the most recent delivery information from the trip log for the selected number of entries.
Clear Trip Log	Clear Trip Log	Clears all delivery information from the trip log and resets the delivery number.
Clear Acc Total	Clear Acc Total	Clears the Accumulated Delivery Total.
Audit Trail	10, 20, 50, 100, 500, 1000	Displays/Prints the most recent configuration changes with date/time stamp for the selected number of entries.
Trailer:	Numeric Entry	Enter up to an 8-digit number between 1 and 99999999.
Coil Ohms:	Display Only	Displays the turbine coil resistance in Ohms.
Coil Frequency:	Display Only	Displays the turbine frequency in Hertz.
RTD Counts:	Display Only	Displays the A/D counts for the RTD Temperature Input.
Internal Temp (F):	Display Only	Displays the ambient temperature inside the ICE enclosure in degrees F.
Pump Hours:	Display/Clear	Displays the number of hours of liquid flow at a resolution of 1/10 th of an hour. Press the Pump Hours button to reset.
Date/Time	Numeric Entry	Enter the Date/Time as mm/dd/yyyy:hh:mm

Maintenance Mode Menu Options

Turbine Calibration Mode

The Turbine Calibration Mode screen is used to configure all parameters related to the turbine flowmeter calibration. Touching any gray button on the display will bring up the edit screen for that field.

Turbine Calibration Mode	
Meter SN: 123456789	Meter Size (inch): 2.00
Average K: 200.000	Min Flow (gpm): 15.0
K Method: Average	Max Flow (gpm): 225.0
K-factor Table	Min Delivery (lb): 220.0
Last Cal: 12/22/2011	
Next Cal: 12/22/2012	ICF SN: 123456789

Turbine Calibration Mode Screen

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Meter SN	Numeric Entry	Enter the turbine serial number. Valid entry is a number up to a 9-digits between 0 and 999999999.
Average K	Numeric Entry	Enter a number between 0.001 and 99999.999 for the average k-factor.
K Method	Average Linearization	Select flowmeter linearization method as Average (single K) or Linearization (5-point linearization table)
K-Factor Table	Numeric Entry of 5 frequency and k-factor points.	Enter the 5-point k-factor table.
	Frequency 1-5	Frequency points 1-5 must be a number between 0.100 and 5000.001 and must be at least 0.015 greater than the previous frequency entry.
	K-factor 1-5	K-factor points 1-5 must be a number between 0.001 and 99999.999.
Last Cal	Numeric Entry	Enter the date of the last calibration in the format mm/dd/yyyy

Next Cal	Numeric Entry	Enter the date the next calibration is due in the format mm/dd/yyyy
Meter Size	0.75 inch 1.00 inch 1.25 inch 1.50 inch 2.00 inch	Select the appropriate turbine meter size for the current application.
Min Flow (gpm):	Display Only	Displays the minimum flowrate in gallons per minute for the selected meter size.
Max Flow (gpm):	Display Only	Displays the maximum flowrate in gallons per minute for the selected meter size.
Min Delivery (lb):	Display Only	Displays the minimum delivery in pounds for the selected meter size.
ICE SN	Numeric Entry	Enter the ICE serial number. Valid entry is a number up to a 9-digits between 0 and 999999999

Turbine Calibration Mode Menu Options

Frequency & K-Factor Table			
Frequency 1	54.859	K-Factor 1	222.927
Frequency 2	54.876	K-Factor 2	222.927
Frequency 3	97.348	K-Factor 3	224.481
Frequency 4	138.628	K-Factor 4	223.121
Frequency 5	206.648	K-Factor 5	220.800

Frequency & K-Factor Table Screen

System Configuration Mode

The System Configuration Mode provides configuration parameters related to the flow measurement process and display preferences.

Touching any gray button on the display will bring up the edit screen for that field.

System Configuration Mode			
Default Temp:	83.2	Temp Units:	K
Default Press:	200.0	Press Units:	psia
Total Decimal:	0.00	Del Units:	gallons
Fluid:	LIN	Compensation:	T&P
Display T/O (sec)	600	Pump Delay (min)	1.0
Language:	English	Change Password	

System Configuration Mode Screen

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Default Temp:	Numeric Entry	Enter the default value for the fluid temperature to be used in case of a temperature probe failure. Valid entry is between 20 degrees Kelvin and the max temperature in the compensation range for a selected fluid.
Default Press:	Numeric Entry	Enter the default value for the fluid temperature to be used in case of a temperature probe failure. Valid entry is between 0.0 and 499.99 psia.
Total Decimal:	000 00.0 0.00	Select the display resolution for the delivery total.
Fluid:	LIN LOX LAR CO2 SINGLE CO2 DUAL N2O	Select the fluid to be measured.

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Display T/O (min)	Numeric Entry	Enter the number of minutes before ICE defaults back to the Delivery Mode screen from another mode. Valid entry is between 1 and 99 minutes. The display timeout is strictly time based, not activity based.
Temp Units:	Kelvin Fahrenheit Celsius	Select the units of measure for Temperature.
Press Units:	psia psig bar-a bar-g	Select the units of measure for Pressure.
Del Units:	gallons liters ft3 ft3X100 m3 pounds kilograms	Select the units of measure for Delivery Total. Flowrate will be displayed in the same units. NOTE: If Compensation Method is set to NONE, only gallons and liters will be available. If Fluid Type is CO2, only pounds and kilograms will be available.
Compensation:	None Temperature Temp & Default P Temp & Pressure	Select the method of compensation. Select None for pure volumetric measurement.
Pump Delay (min)	Numeric Entry	Enter the number of minutes between 0.0 and 99.0 used for the cool down phase.
Change Password	Numeric Entry	Enter a 4-digit password between 0000 and 9999. Default password is 0000.

System Configuration Mode Menu Options

THE DELIVERY PROCESS

There are three basic steps to the delivery process for ICE:

Cooling the System **Dispensing the Product** **Ending the Delivery**

Cooling the System

When ICE is powered on, an RTD temperature sensor detects when liquid is present at the pump and begins the Pump Cooling Timer. The timer, which is displayed on the Delivery Mode Screen, counts down from the value entered for the Pump Delay parameter in the System Configuration Mode. If equipped, the Pump Relay is enabled after the timer reaches zero and is disabled whenever gas is detected in the system.

Dispensing the Product

Once the system has been cooled down, the user should ensure that the ICE is zeroed and ready for dispensing. When the delivery valve is opened, the ICE begins totalizing the liquid flowing through the turbine and the one-minute start phase begins. During the first minute of the delivery, errors are displayed but not recorded in the Trip Log. After the first minute of the delivery, any error occurring more than one minute is recorded in the Trip Log. See section “Error Messages” for a comprehensive list of error messages.

Ending the Delivery

After dispensing the required amount of liquid, the delivery valve is closed to stop the liquid flow. The delivery remains active until one of the following occurs:

A Delivery Ticket has been printed **The Delivery Total has been cleared**

Once the PRINT or CLEAR function is executed, the active delivery ends and the delivery information is recorded in the Trip Log.

While a delivery is active, the configuration may be viewed by pressing MODE, however no changes to the configuration are allowed. If an attempt is made to edit a configuration parameter while a delivery is active, the following message is displayed:

*“Delivery Active. Press CLEAR to exit.
Print ticket or clear total to end the delivery”*

Pressing the CLEAR button removes the message and returns the user to the previous view. Press the MODE button to return to the Delivery Mode and press CLEAR or PRINT to end the active delivery.

PRINT FUNCTIONS

Delivery Tickets, Trip Reports, Configuration parameters and the Audit Trail may be printed by connecting an optional serial printer to the RS232 port.

The RS232 port settings are listed below and are not user configurable.

Handshaking:	XON/OFF
Baud Rate:	9600
Word Length:	8 bits
Parity:	None

When a print function is requested, ICE checks to ensure that the printer is online and available and that there is paper in the printer. The following messages may be displayed when executing print functions:

Message	Description
Printer out of paper	There is no paper detected in the printer
Printer offline, no response from printer	The printer power is off or the serial cable is not connected between the ICE and printer.

Delivery Ticket

Press the PRINT button from the Delivery Mode screen to print a Delivery Ticket. This action ends the current active delivery and logs the delivery to the Trip Log. The number of decimal places for the Delivery Total follows the selection for Total Decimal in the System Configuration Mode.

METER DELIVERY TICKET
TRAILER NUMBER: 12345678
PRODUCT NAME: LIN
DELIVERY: 876543.21
UNITS: LITERS @ NBP
DATE: 01/13/2010
TIME: 13:55
DELIVERY NUMBER: 3
ACCUMULATED TOTAL: 109876543210

Sample Delivery Ticket

Trip Report

The Trip Report prints the stored trip log containing up to 100 previous deliveries. It can be thought of as series of delivery tickets, with the addition of any errors that were logged during each delivery.

From the Maintenance Mode screen, press the Print Trip Report button on the display. A screen will be displayed to select the last 10, 20, 40 or 100 stored deliveries to be printed. A password is not required to print the Trip Report.

If desired, after printing the Trip Report, press the Clear Trip Log button to clear all delivery information from the trip log. The following delivery will be logged as delivery number 1. A valid password entry is required to clear the trip log.

Print Configuration

From the Maintenance Mode screen, press the Print Config button on the display to print a detailed report containing the current configuration settings. A password is not required to print the configuration settings.

```
Configuration Printout
01/15/2010::10:40

Reference Conditions:
NIST (70 F, 14.7 psia)
Temperature units: Kelvin
Default temperature: 83.0
Pressure units: psia
Default pressure: 300.0
Delivery units: gallons
Total decimal places: 2
Fluid type: LOX
Display T/O (min): 10
Compensation:
TEMPERATURE & PRESSURE
Pump delay (min): 8
Trailer number: 12345678
Turbine serial number: 987654321
Meter size (inch): 2.00
K-factor method: Average
Average K-factor: 240.000
Last calibration date: 01/15/2010
Next calibration date: 01/15/2011

End of Configuration Printout
```

Sample Configuration Printout

Audit Trail

The Audit Trail contains a log of the last 1000 configuration changes in the following format:

1	Date/Time	3 Character Variable Code
	Old Value	New Value

From the Maintenance Mode screen, press the Audit Trail button on the display to bring up a screen to select the number of most recent entries to print. A password is not required to print the Audit Trail.

BEGIN AUDIT TRAIL		
DATE: 02/18/2010		
TIME: 16:20		
1	12/18/2009::08:35	AKF
	100.000	226.123
2	01/22/2010::13:22	FLU
	LIN	LOX
3	02/05/2010::11:05	MSZ
	1.50	2.00
END OF AUDIT TRAIL		

Sample Audit Trail Printout

Audit Trail Variable Code	Description
DTE	Date/Time
CAT	Clear Accumulated Total
AKF	Average K-Factor
KFM	K-Factor Method
F01 – F05	Frequency 1 – 5 for Linearization Table
K01 – K05	K-Factor 1 – 5 for Linearization Table
MSZ	Meter Size
DFT	Default Temperature
DFP	Default Pressure
FLU	Fluid
TEU	Temperature Units
PRU	Pressure Units
DLU	Delivery Units
CPM	Compensation Method

ERROR MESSAGES

The ICE provides extensive self-checking capability to assist the user in resolving faults and operational errors. Error messages are displayed on the bottom portion of the Delivery Mode screen and are recorded in the Trip Log if they occur for longer than one minute during a delivery.

DISPLAYED MESSAGE	DESCRIPTION
GAS PRESENT, TOTALIZATION STOPPED	The operating temperature is warmer than the specified liquid range and/or the operating pressure is below the saturated pressure. There is no longer liquid in the metering run. ICE stops totalizing and disables the pump relay if equipped.
GAS WARNING	The operating pressure is between saturated pressure and 5 psia above saturated pressure. The liquid is approaching a point where it may contain bubbles, resulting in a delivery error.
HIGH FLOW RATE	The flow rate has exceeded the limit defined by the Max Flow field for the selected meter size in the Turbine Calibration Mode. This message may appear if the turbine is being spun by gas.
LOW FLOW RATE	The flow rate has dropped below the limit defined by the Min Flow field for the selected meter size in the Turbine Calibration Mode.
COIL OPEN	Coil resistance is greater than 3000 Ohms. This message will appear if the turbine signal cable is removed.
COIL SHORT	Coil resistance is less than 200 Ohms.
TEMPERATURE OPEN	Temperature probe resistance input is greater than 1800 Ohms. This message will appear if the temperature cable is removed.
TEMPERATURE SHORT	Temperature probe resistance input is less than 90 Ohms.
PRESSURE FAIL	Pressure Analog input signal is less than 4 mA.
PRESSURE OVERRANGE	Pressure Analog input signal has exceeded 20 mA.
LOW BATTERY	Internal battery has dropped below 2.2 Volts DC and should be replaced as soon as possible.
MIN DELIVERY NOT REACHED	This message is displayed on the Delivery Ticket only and indicates that the minimum measurable quantity for the selected meter size has not been reached. The minimum delivery amount for the selected meter size is indicated on the Turbine Calibration Mode screen.

PULSE ERROR	Missing or double pulses have been detected in a dual coil meter system.
EXCESS PULSE ERROR	The number of missing or double pulses detected has exceeded the acceptable percentage of delivery total.
PULSE ERROR EXCEEDS LIMIT	This message is displayed on the Delivery Ticket only and indicates that the number of missing or double pulses detected during a delivery has exceeded the acceptable percentage of delivery total.

INSTALLATION GUIDELINES

- ICE should be installed with enough clearance to allow easy access to all cables. Care should also be taken to install ICE away from thawing pipes to minimize direct contact with moisture.
- Do not over tighten the mounting bolts. The recommended tightening torque for the shock mounts is 105 lbs-in.
- Hoffer recommends powering ICE directly from the truck battery. The DC+ power line may be wired through an external switch if desired, or ICE may be ordered with an optional power switch installed.
- Refer to the installation drawings located in the back of this manual for wiring information.

TECHNICAL SPECIFICATIONS

Environmental:

Operating Temperature:	-20°C to +70°C -40°C to +70°C with optional heater
Storage Temperature:	-30°C to +70°C
Relative Humidity:	0-95% Non-condensing

Physical:

Enclosure Dimensions:	4.35" L x 6.54" W x 4.125" H 11.05cm x 16.61cm x 10.47cm
Fully assembled:	5.6" L x 6.54"W x 4.875"H 14.224cm x 16.61cm x 12.38cm
Weight:	4.2 lbs. (1.91 kg)

Approvals:

Design Approvals, Standards and Regulatory Compliance

CE

Emissions EN55022 & FCC Part 15

Immunity EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-6

MIL-STD810G (Shock and Vibration)

NCWM Publication 14

NIST Handbook 44

National and State Legal for Trade

Australia – NMI

Brazil – INMETRO

China – OIML R81

European Union - MID

India – W & M

Indonesia & Malaysia - SIRIM

South Africa – SABS

United States – NTEP & CTEP

Enclosure:

Rugged aluminum NEMA 4X with shock mounts
Optional swivel bracket
Optional Ex-Proof

Display:

4.3" color LCD with touch screen

Keypad:

Clear, Print and Mode Keys. Numeric keypad for data entry via touch screen.

Power Supply:

Input Voltage: Range

10-30 Volts DC

NOTE: If Heaters or Pump Interlock option is required, a nominal voltage of 12 VDC or 24 VDC must be specified

Current:

0.25A at 12VDC typical

1.25A with LCD heater option ON

Protection:

Over current/reverse polarity protected

Battery:

User replaceable 3V lithium coin cell for real time clock 2-4 years typical battery life.

Flow Meter Input:

Frequency range:

0.2 to 5000 Hz

Amplitude:

15mV RMS to 50V RMS

Impedance:

10 k Ω

Linearization:

Single K-Factor or 5-point flow meter linearization

Pickup Coil Diagnostics:

Coil Short/Open Detection

RTD Temperature Input:

RTD type:

1000 Ω platinum probe, 2, 3 or 4-wire

Resolution:

12-bit

Accuracy:

0.025%

Diagnostics:

Probe Short/Open Detection

Pressure Input:

Type:

4-20mA

Resolution:

12-bit

Accuracy:

0.025%

Diagnostics:

Sensor Fail Detection

Pump Interlock Relay: Form 1C (SPDT), 30A at 120/240 VAC

Serial Communications:

RS-232 printer port

Baud Rate: 9600

Handshaking: XON/XOFF

Word Length: 8 bits

Parity: None

Miscellaneous System Features:

- Non-volatile memory for configuration parameters and delivery data
- Real Time Clock

Security Features:

Audit Trail records last 1000 configuration changes with Time/Date stamp
Password protection to prevent unauthorized configuration changes

Diagnostic Features:

Failure detection for RTD, analog and flow meter inputs
Multiple error messages
Tracking of pump operational hours

Measured Products:

Supports measurement of several predefined liquids: LIN, LOX, LAR, CO2 Single Pipe, CO2 Dual Pipe, LN2O and LNG

Units of Measure:

Rate and Total:	gal, L, lb, kg, ft3, ft3 x 100, m3
Temperature:	K, F, C
Pressure:	psia, psig, bar-g, bar-a

APPENDIX A

DRAWINGS

REV		DESCRIPTION		DATE	APP
UNLESS OTHERWISE SPECIFIED ALL WIRE TO BE 22 AWG					
HEATERS:					
FOR 12V INPUT, EQUIP 25 OHM 10W - STOCK# 100-0240					
FOR 24V INPUT, EQUIP 100 OHM 10W - STOCK# 100-0241					

MATERIAL	DRAWN	DATE
	CHECK	
	PROJ ENG	
FINISH		
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01 3 PLACE DECIMAL ±.005 FRACTIONAL ±1/64 ANGULAR ±1/2°		
CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.		
NEXT ASSY	USED ON	
APPLICATION		
H HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909		
TITLE		
WIRING, DISPLAY PANEL X-PROOF ENCLOSURE - ICE		
SIZE	CAGE CODE	DWG NO
A33321	ICE-306	REV
SCALE	NONE	SHEET 1 OF 1

ZONE REV: _____
 DATE: _____
 APP: _____

PWD NO. ICE-307
 REVISIONS: _____
 DESCRIPTION: _____

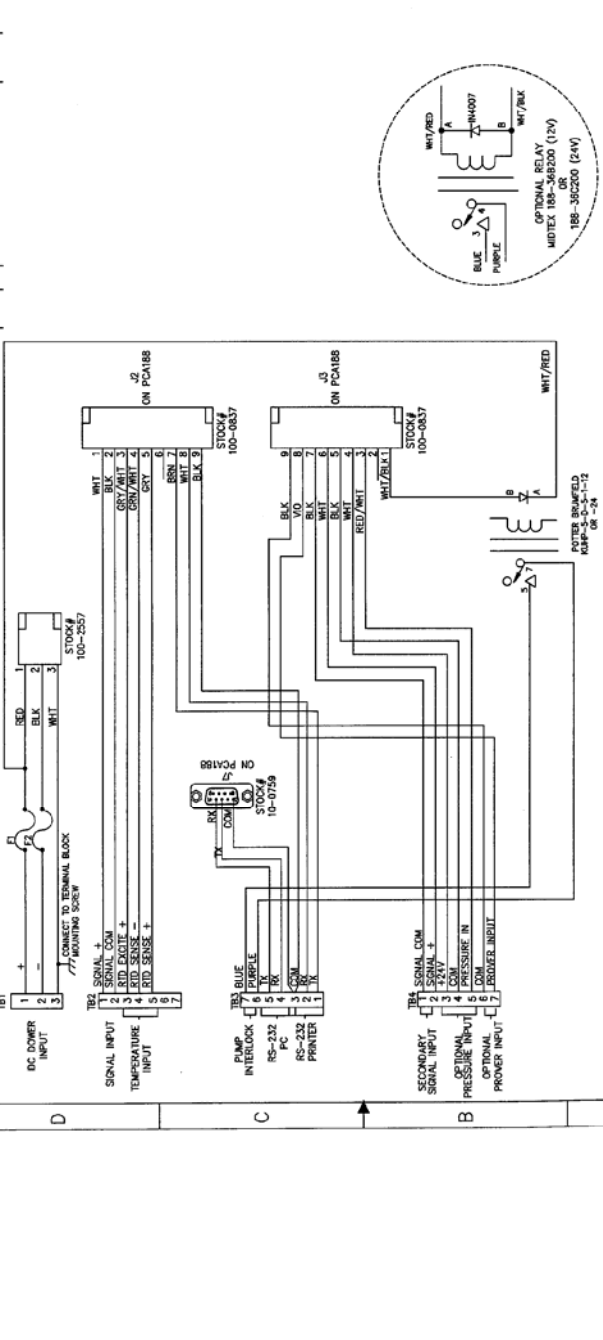
SHEET 1 OF 1
 REV: _____

DC POWER INPUT
 1 RED
 2 BLK
 3 WHT
 STOCK# 100-2557
 MOUNTING SCREW

SIGNAL INPUT
 1 WHT
 2 BLK
 3 GRN
 4 GRN/WHT
 5 GRN
 6 GRN
 7 PUR
 STOCK# 100-0857

PUMP INTERLOCK
 1 BLU
 2 PUR
 3 WHT
 4 GRN
 5 WHT
 6 PUR
 7 WHT
 STOCK# 10-0759

SECONDARY SIGNAL INPUT
 1 WHT/RED
 2 WHT/BLK
 3 WHT
 4 WHT
 5 BLK
 6 BLK
 7 RED/WHT
 STOCK# 100-0857



DATE: _____
 DRAWN: _____
 FIELD USE: _____
 MATERIAL: _____
 FINISH: _____
 NOTES: _____
 1. UNLESS OTHERWISE SPECIFIED ALL WIRE TO BE 22 AWG.

TITLE: WIRING, EXPLOSION PROOF ENCLOSURE - ICE
 HOFFER FLOW CONTROLS, INC
 ELIZABETH CITY, NC 27909

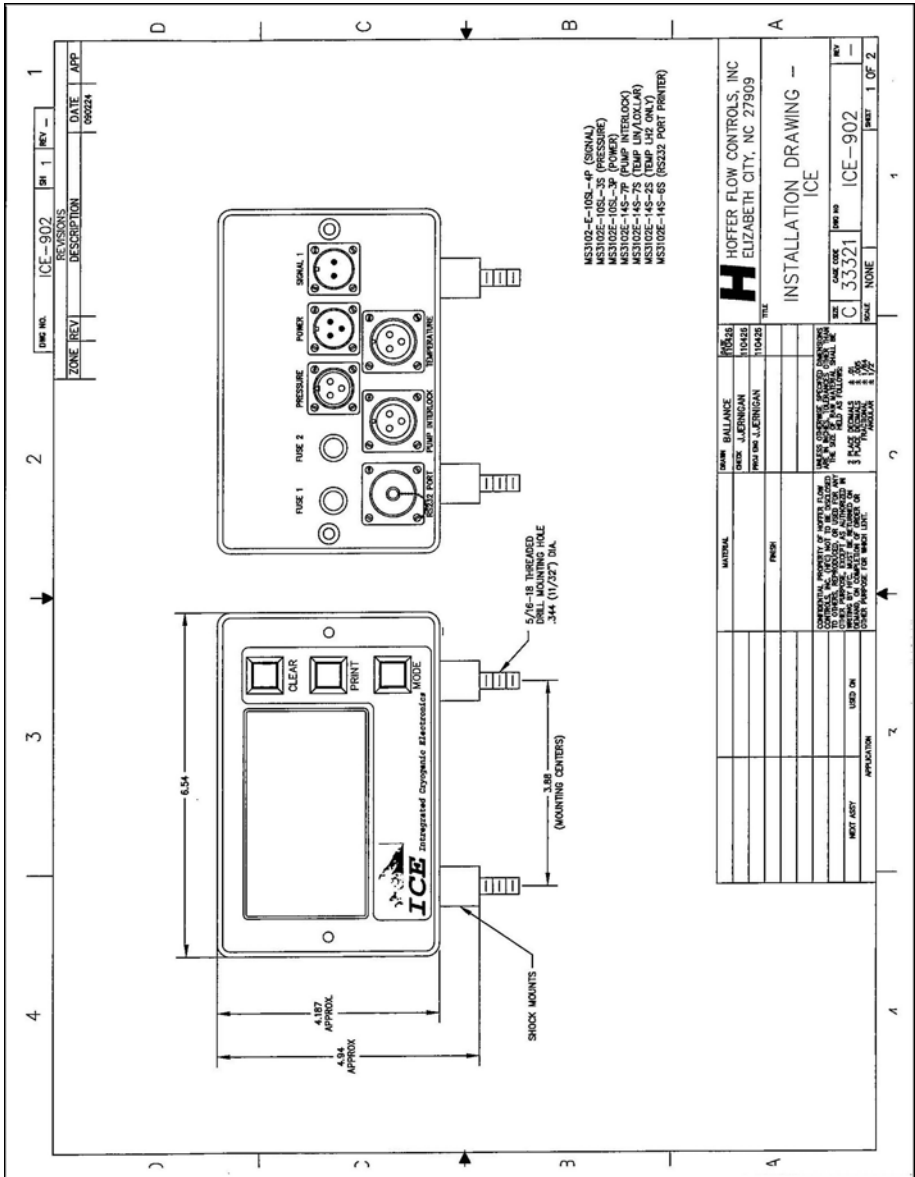
ORDER NUMBER: ICE-307
 SHEET: 1 OF 1

NEXT ASST: _____
 APPLICATION: _____
 USED ON: _____

1. UNLESS OTHERWISE SPECIFIED ALL WIRE TO BE 22 AWG.

Wiring External Cables to Explosion Proof ICE 6/23/2015

CABLE PART NUMBER	FUNCTION	CABLE WIRE COLOR	CONNECTION TO ICE TERMINAL BLOCK	ICE DESIGNATORS DRAWING ICE-307
SCA-XLU3-P	Power	RED	TB1-1	+
		BLK	TB1-2	-
		WHT	TB1-3	Chassis
SCA-XLT2-S	Signal Input	WHT	TB2-1	Signal +
		BLK	TB2-2	Signal -
SCA-XLT2-S	Secondary Signal Input	WHT	TB4-1	Signal +
		BLK	TB4-2	Signal -
SCA-XLT2-TA	Temperature Probe	WHT	TB2-5	RTD Sense +
		BLK	TB2-4	RTD Sense -
SCA-XCT4-RS	Serial Port (Printer)	WHT	TB3-2	RX
		GRN	TB3-1	TX
		BLK	TB3-3	COM
SCA-XCT4-RS	Serial Port (PC)	WHT	TB3-4	RX
		GRN	TB3-5	TX
		BLK	TB3-3	COM
SCA-XCU2-PI	Pump Interlock	RED	TB3-6	
		BLK	TB3-7	
SCA-10LT2-PT	Pressure	RED	TB4-3	+24V
		BLK	TB4-5	Pressure In



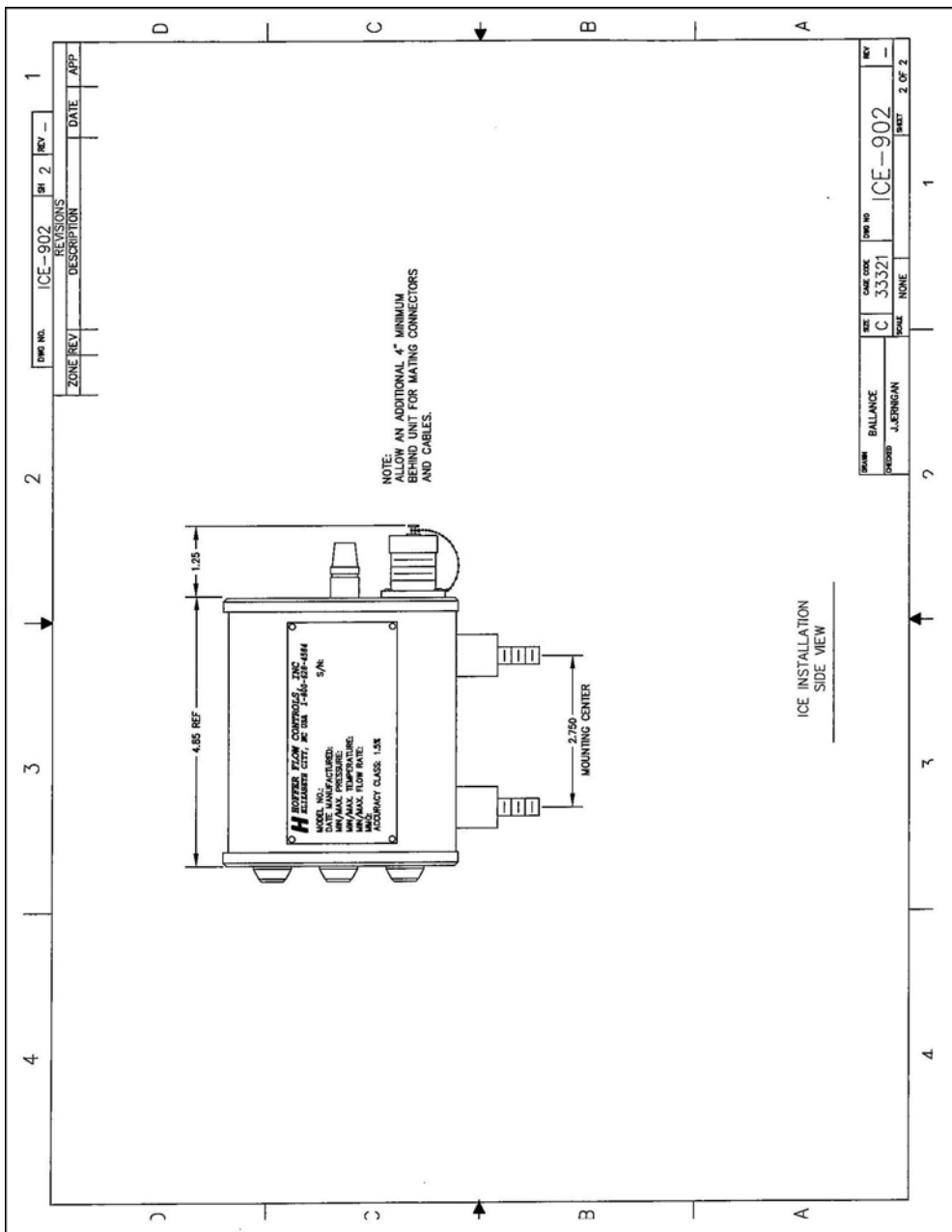
ENG. NO.	ICE-902	REV.	1	REV.	1
ZONE	REV.	DESCRIPTION	DATE	APP.	
			000224		

H HOFFER FLOW CONTROLS, INC
 ELIZABETH CITY, NC 27909

INSTALLATION DRAWING
 ICE

NAME	BALLANCE	PROSE	
DATE	JULIENIGAN	10/4/85	
PROJECT	JULIENIGAN	10/4/85	
MATERIAL			
FINISH			
NOTIFY ASBY			
USED IN			
APPLICATION			

CONTRACTOR: VERIFY ALL DIMENSIONS AND MATERIALS TO BE USED IN THIS DRAWING. VERIFY ALL DIMENSIONS AND MATERIALS TO BE USED IN THIS DRAWING. VERIFY ALL DIMENSIONS AND MATERIALS TO BE USED IN THIS DRAWING. VERIFY ALL DIMENSIONS AND MATERIALS TO BE USED IN THIS DRAWING.



APPENDIX B

ICE WEIGHT SCALE CALIBRATION PROCEDURE

ICE WEIGHT SCALE CALIBRATION PROCEDURE

Turbine flowmeters, when properly used, have been found to be more accurate than most weight scales in determining the amount of product delivered. Whenever possible use Hoffer portable Transfer Standard SY-14B to perform ICE system calibrations. This procedure requires the use of two tankers. One full of fresh cold product and a empty tanker. Place the full tanker onto the scales. Hook up the piping so that the full tanker will be pumping off to the empty tanker. Follow the steps below:

1. Power up the ICE unit and enter the MENU.
2. Select CALIBRATION mode. Set K-METHOD to AVERAGE.
3. Record the AVERAGE K-FACTOR value.
4. Select SYSTEM CONFIGURATION MODE. Set DELIVERY UNITS to mass (KG or LB).
5. Return the ICE to the OPERATING mode.
6. Pressurize and cool down the piping and flowmeter.
7. Press the **CLEAR** key on the ICE twice to clear the total.
8. Weigh the tanker and record its INITIAL WEIGHT. After weighing the tanker start the pump.
9. To determine the TEST SAMPLE SIZE, divide the scale increment by the accuracy requirement. For example, if scale increment is 10 pounds and the accuracy requirement is 0.5%, then $10 \text{ pounds} / 0.005 = 2000 \text{ pounds}$. It is best to use an accuracy requirement equal to the linearity rating of the flowmeter (typically 0.5%)
10. Open the discharge valve and allow the tanker on the scales to pump off an amount of fluid equal to the TEST SAMPLE SIZE. After the TEST SAMPLE SIZE is pumped, close the discharge valve. Weigh the tanker again, this is the tanker FINAL WEIGHT. Calculate the SCALE TOTAL by subtracting the FINAL WEIGHT from the INITIAL WEIGHT.

11. Record the DELIVERY TOTAL displayed on the ICE. Use the following equation to calculate the new AVERAGE K-FACTOR:

$$AVERAGE_K_FACTOR_{NEW} = \frac{DELIVERY_TOTAL}{SCALE_TOTAL} \times AVERAGE_K_FACTOR_{OLD}$$

12. Enter the ICE CALIBRATION mode and enter the new AVERAGE K-FACTOR
13. Repeat Steps 6 through 9 to verify the new calibration is within the accuracy requirements. If the new calibration is not within the accuracy requirements then repeat Steps 6 through 12.