

CP20

Cryogenic Prover

USER'S MANUAL



HP-331
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HOFFER
Flow Controls

Perfecting Measurement™

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2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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Specifications are subject to change without notice.
Some pages are left intentionally blank.

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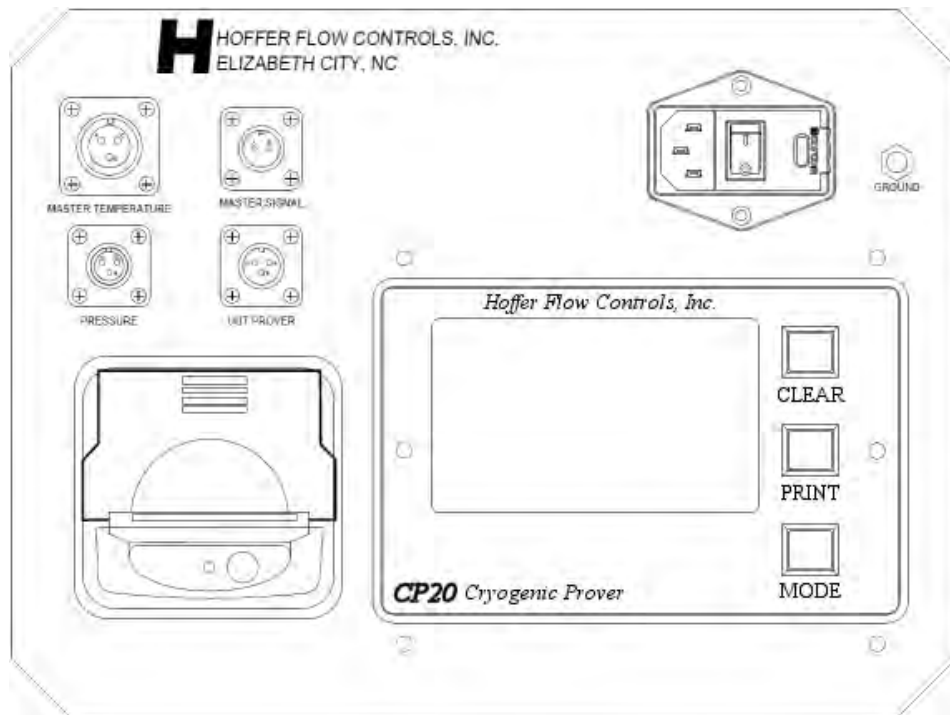
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Introduction

The CP20 Cryogenic Prover is Hoffer's next generation field calibration system for cryogenic flow metering applications. The system includes a transfer standard master flow meter and metering run mounted on a mobile cart for easy transport. The portable electronic unit is engineered using the latest technology to provide the most comprehensive features and has been designed in accordance with the cryogenic metering section of NIST HANDBOOK 44 and OIML R-81.

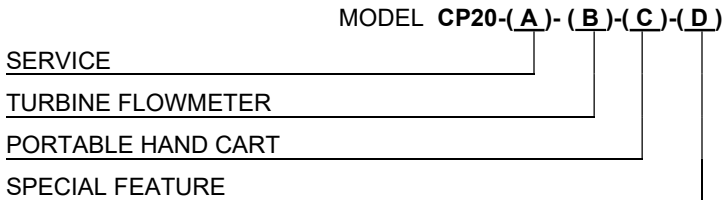
The CP20 uses a NIST traceable master flowmeter and compares measurements from the unit under test (UUT) to generate a series of K-Factors over the specified range of the meter. Data collected during the calibration runs is used to calculate the variables used for reports that may be displayed and printed to an integrated compact thermal printer. A System Check utility provides a way to verify the overall system accuracy of the UUT including any temperature and pressure sensors.

The electronics are housed in a 13.60" x 10.72" x 6.28" IP67 portable enclosure. The front panel includes a 4.3" full color graphical display, 3 rugged panel sealed pushbuttons, compact thermal printer and environmentally sealed military style electrical connectors.



Front Panel Detail

MODEL NUMBER DESIGNATION



SERVICE

MODEL CP20-(A)-()-()-()

OPTION (A)

- (1T) LIN/LOX/LAR
FOR **LOX** SERVICE, 15 MINUTE HYDROSTATIC PRESSURE TEST IS REQUIRED. **ADD INTERNAL NOTE: LOX LUBRICANT REQUIRED.**
- (2T) CO2
- (P) FOR PRESSURE COMPENSATION (4-20 MA)

TURBINE FLOWMETERS

MODEL CP20-()-(B)-()-()

OPTION (B)

- (1") HO1X1-4-60-CB-1M-MS & 1" Meter Run (10"U x 5"D)
- (1 1/2") HO11/2X11/2-8-130-CB-1M-MS & 1 1/2" Meter Run (15"U x 8"D)
- (2") HO2X2-15-225-CB-1M-MS & 2" Meter Run (20"U x 10"D)

PORTABLE HAND CART

MODEL CP20-()-()-(C)-()

OPTION (C)

- (H) "U" ASSEMBLY MOUNTED ON CART WITH PNEUMATIC WHEELS.
- (HM) "U" ASSEMBLY MOUNTED ON CART WITH PNEUMATIC WHEELS AND WITH PROVER ELECTRONICS MOUNTED ON CART AT 45° ANGLE.

SPECIAL FEATURE

MODEL CP20-()-()-()-(D)

OPTION (D)

- (SP) ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP.

THE CABLES ARE SUPPLIED WITH THE SYSTEM:

<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>CABLE</u>
MS3102E-10SL-4P	BACK/BACK CONNECTOR ASSY	
SCA-6CC2-S	BOTH ENDS CONNECTORS	6 FT. SIG
SCA-6CC2-TA	BOTH ENDS CONNECTORS	6 FT. TEMP
SCA-6HP3-P	1 END HUBBEL TWIST 1 END 3-PRONG GROUNDED PLUG	6 FT. PWR
SCA-25AB1-G	1 END BANANA PLUG 1 END ALLIGATOR CLIP	25 FT. GRND
SCA-25CC2D-S	3 ENDS CONNECTOR REMOTE START/STOP	25 FT. DUAL
SCA-25CC2-S	PROVER START/STOP (SINGLE CABLE) 1 EACH MS3106A-10SL-3S 1 EACH MS3106A-12S-3P	25 FT. SINGLE

THE FOLLOWING ITEMS ARE SUPPLIED WITH PRESSURE COMP SYSTEM:

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
SCA-6CL2-PT	6 FT. PRESSURE TRANSMITTER CABLE PRESSURE TRANSMITTER

CALIBRATION

- LIN CALIBRATION WITH HOFFER MASTER PROVER @ CUSTOMER'S SITE IN LOWER 48 U.S. STATES.
- INCLUDES TRAVEL EXPENSES.
- FOR OTHER CALIBRATION OPTIONS OR LOCATIONS CONTACT FACTORY.

<u>ACCESSORIES</u>	<u>DESCRIPTION</u>
STOCK NUMBER 200-2141	THERMAL PAPER ROLL
STOCK NUMBER 100-2739	PRINTER

REPLACEMENT ELECTRONIC PACKAGES

CP20 ELECTRONICS ONLY

The User Interface

CP20 is designed with an intuitive user interface and easy access to the most common operations. Three pushbuttons allow the user to **CLEAR** the totalizer, **PRINT** reports or change the **MODE** of operation. The full color graphical touch screen provides 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



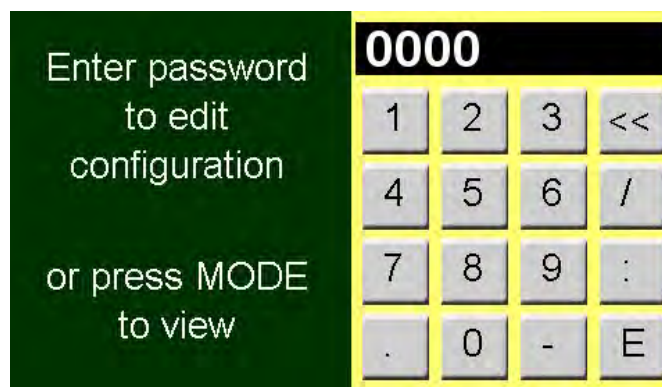
The BACKSPACE button erases an incorrect entry.



The ENTER button accepts the entered value.

Password Protection

The Configuration parameters are password protected to prevent unauthorized changes from being made. The unit is shipped with a default password of **0000**. After the password has been entered, the unit will remain unlocked until power is removed from the device. The configuration settings in each menu may be viewed without entering a password by pressing the **MODE** button. When prompted for a password, simply press **MODE** to advance to each of the 4 configuration screens until returning to the Home Screen.



Password Entry Screen

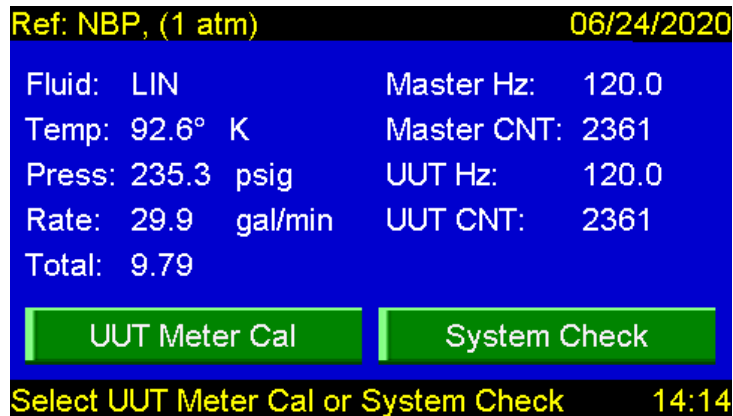
Modes of Operation

The CP20 is organized into 4 distinct modes of operation:

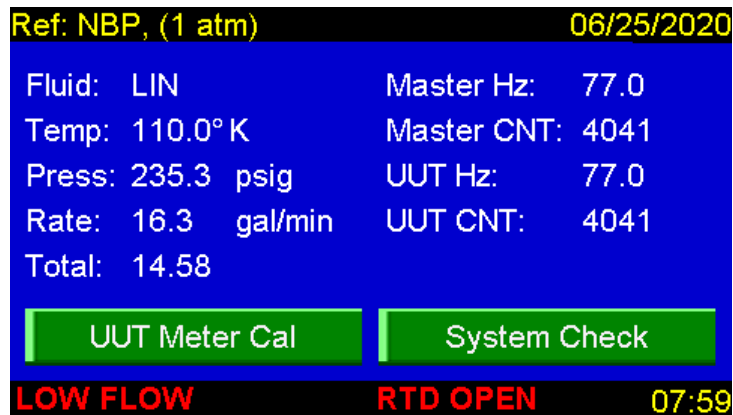
- Home Screen
- Configuration Mode
- UUT Meter Calibration
- System Check

Home Screen

The **Home Screen** is the default mode when CP20 is powered on and where the user returns when exiting the Configuration, UUT Meter Calibration and System Check. Various settings and process parameters are displayed as well as warning messages for any active faults or system failures. Two buttons on the touch screen provide direct access to the **UUT Meter Calibration** and **System Check** features.



Home Screen



Home Screen with Warnings

<i>Display Item</i>	<i>Description</i>
Ref : (Reference Conditions)	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
<i>Date/Time</i>	The current date and time.
Fluid:	The current fluid selected from Prover Configuration.
Temp:	The measured temperature from the master RTD. If the temperature sensor fails or is removed, the default temperature for the selected liquid is displayed and used for calculations.
Press:	The measured operating pressure. If the pressure sensor fails or is removed, the default pressure for the selected liquid is used for calculations.
Rate:	The measured flow rate expressed in units per minute. Units are determined by the selection for Delivery Units in the Prover Configuration Menu.
Total:	The total quantity of product measured by the Master Meter. Units are determined by the selection for Delivery Units in the Prover Configuration Menu. The Total may be reset by pressing the CLEAR button.
Master Hz:	The frequency measured from the Master Meter.
Master CNT:	The pulse count measured from the Master Meter. The counts may be reset manually by pressing the CLEAR button and are automatically reset when returning to the Home Screen from the other modes of operation.
UUT Hz:	The frequency measured from the UUT Meter.
UUT CNT:	The pulse count measured from the UUT Meter. The counts may be reset manually by pressing the CLEAR button and are automatically reset when returning to the Home Screen from the other modes of operation.

<i>Button</i>	<i>Function</i>
CLEAR	Resets Total, Master CNT and UUT CNT
PRINT	No function in this mode
MODE	Enters the Configuration Mode. Consecutive presses of the MODE button will return to the Home Screen.

Pushbutton Functionality on Home Screen

Configuration Mode

The Configuration Mode contains four main menus:

- UUT Info**
- Master Meter 1**
- Master Meter 2**
- Prover Configuration**

UUT Info

This menu is used to configure parameters related to the unit under test.

UUT INFO	
Meter SN:	98765
Elect SN:	54321
Trailer:	1234
Last Cal:	04/10/2019
Next Cal:	04/10/2020
Cal Points:	5
Amb Temp Units:	F
Amb Temp:	70°
Amb Humidity:	50%

UUT Info Screen

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Meter SN:	Numeric Entry	The flowmeter serial number may be up to an 8-digit number between 1 and 99999999.
Elect SN:	Numeric Entry	The flowmeter serial number may be up to an 8-digit number between 1 and 99999999.
Trailer:	Alpha-numeric Entry	Enter up to an 8-digit string of any combination of letters and numbers.
Last Cal:	Numeric Entry	Enter the date of the last calibration for the UUT in the format mm/dd/yyyy
Next Cal:	Numeric Entry	Enter the date the next calibration for the UUT is due in the format mm/dd/yyyy
Cal Points:	5 10	Select the number of calibration points to be used.
Amb Temp Units:	Fahrenheit Celsius	Select the temperature units to be displayed for the ambient temperature.
Amb Temp:	Numeric Entry	Enter the ambient temperature in the selected units.
Amb Humidity:	Numeric Entry	Enter an ambient humidity between 1% and 99%.

UUT Info Menu Options

Master Meter 1 and Master Meter 2

The CP20 allows calibration information for two master meters to be stored in the device. The Master Meter 1 and Master Meter 2 menu layouts are identical and allow all relevant information for each meter to be entered. The master meter to be used for the UUT Calibration and System Check functions is selected in the Prover Configuration menu.

Master Meter Configuration Screen

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Meter SN:	Numeric Entry	The flowmeter serial number may be up to an 8-digit number between 1 and 99999999.
Average K:	Numeric Entry	Enter a number between 0.001 and 99999.999 for the average k-factor.
K-Factor Table	Numeric Entry of 10 Frequency and K-Factor points.	Freq and K-Factor points 1-5 are entered on the first page. Press the More→ button to enter points 6-10. Press CLEAR to return to the Master Meter menu.
	Freq 1-10	Frequency points 1-10 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 1-10	K-factor points 1-10 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
Rate Units:	gallons/min liters/min	Select the volumetric units used to define the min and max flowrates. The selected units will be displayed in the UUT Meter Cal.
Min Flow:	Numeric Entry	Enter the minimum flowrate in selected units for this meter. Min and Max Flow will be used to calculate the target flowrate for each calibration point.
Max Flow:	Numeric Entry	Enter the maximum flowrate in selected units for this meter. Min and Max Flow will be used to calculate the target flowrate for each calibration point.

Turbine Calibration Mode Menu Options

Frequency & K-Factor Table			
Freq 1	10.000	K-Factor 1	220.100
Freq 2	60.000	K-Factor 2	220.200
Freq 3	110.000	K-Factor 3	220.300
Freq 4	160.000	K-Factor 4	220.400
Freq 5	210.000	K-Factor 5	220.500
More -->			

Frequency and K-Factor Table Page 1

Frequency & K-Factor Table			
Freq 6	260.000	K-Factor 6	220.600
Freq 7	310.000	K-Factor 7	220.700
Freq 8	360.000	K-Factor 8	220.800
Freq 9	410.000	K-Factor 9	220.900
Freq 10	460.000	K-Factor 10	220.000
<--BACK			

Frequency and K-Factor Table Page 2

Prover Configuration

The Prover Configuration is used to configure various parameters that define how the CP20 functions. The menu consists of two pages which are accessed using the More→ and ←Back buttons.

NOTE: The touch screen may be calibrated by pressing the PRINT button in the Prover Configuration menu. Follow the on screen instructions or wait 5 seconds for the calibration feature to time out.

PROVER CONFIGURATION	
Print Config	Compensation: T&DP
Repeat Points: 2	Reference: NIST
Fluid: LIN	Del Units: gallons
Default Temp: 110.0	Temp Units: K
Default Press: 235.3	Press Units: psig
Prover SN: 12345	More -->

Prover Configuration Menu Page 1

PROVER CONFIGURATION	
06/24/2020::14:50	Temp Cal
Last Cal: 01/01/2020	Press Cal
Next Cal: 01/01/2021	Max Press: 485.3
Change Password	Master Meter: 1
Language: English	
<-- Back	

Prover Configuration Menu Page 2

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
Print Config	N/A	Prints the current Prover configuration settings.
Repeat Points:	Numeric Entry	Defines the number of times each calibration point and system check run is repeated. The minimum number of repeat points is 2 and the maximum is 10.
Fluid:	LIN LOX LAR CO2 SINGLE CO2 DUAL N2O LNG-93 LNG-95 LNG-97	Select the fluid to be measured.
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 pressure to be used in case of a pressure sensor failure.
Prover SN:	Numeric Entry	The Prover serial number may be up to an 8-digit number between 1 and 99999999.
Compensation:	None Temperature Temp & Default P Temp & Pressure	Select the method of compensation. Select None for pure volumetric measurement.
Reference:	NIST OIML PTB SIRIM ASIAN NORMAL NBP	Select the reference conditions appropriate for locale or regulatory agency.

<i>Menu Item</i>	<i>Selection</i>	<i>Description</i>
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.
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.
Date/Time	Numeric Entry	Enter the Date and Time in the format mm/dd/yyyy::hh:mm
Last Cal:	Numeric Entry	Enter the last Prover calibration date in the format mm/dd/yyyy
Next Cal:	Numeric Entry	Enter the next Prover calibration due date in the format mm/dd/yyyy
Change Password	Numeric Entry	Enter a 4-digit password between 0000 and 9999.
Language	English *Spanish	*Only English is available at this time.
Temp Cal	N/A	Used to calibrate the RTD input. WARNING: Consult the factory before calibrating the inputs as undesirable results may occur!
Press Cal	N/A	Used to calibrate the 4-20mA Pressure input. WARNING: Consult the factory before calibrating the inputs as undesirable results may occur!
Max Press:	Numeric Entry	This is the 20 mA value of the optional pressure sensor.
Master Meter:	Master Meter 1 Master Meter 2	Select the Master Meter to be used for the Flowmeter Calibration and System Check features.

Prover Configuration Menu Options

UUT Meter Calibration

Overview

The UUT Meter Calibration feature is used to generate a table of frequencies and k-factors to be entered into the UUT electronics. The calibration consists of either 5 or 10 calibration points based on the *Cal Points* setting in the **UUT Info** menu. The calibration points are spread evenly over the flow range specified in the **Master Meter 1** and **Master Meter 2** configuration menus. The CP20 automatically calculates and displays the target flow rate for each calibration point based on these settings. Each calibration point is repeated 2 to 10 times based on the *Repeat Points* setting in the **Prover Configuration** menu.

Warning: Pressing the **MODE** button when in the **UUT Meter Calibration** mode will return to the **Home Screen** and all calibration data will be lost!

Calibration Procedure

After the system has been properly cooled down, press the **UUT Meter Cal** button on the **Home Screen** to begin the flowmeter calibration procedure.

UUT METER CALIBRATION				
CAL POINT 1				
Run	Gal/min	Gallons	Freq	K-Factor
1	21.0	0.00	77.0	
2	0.0	0.00	0.0	
Avg:				
Repeatability:				START
Adjust flow to 25.0 gal/min				

Adjust the flow rate to the target flow rate displayed in the message area.

UUT METER CALIBRATION				
CAL POINT 1				
Run	Gal/min	Gallons	Freq	K-Factor
1	24.8	0.00	91.0	
2	0.0	0.00	0.0	
Avg:				
Repeatability:				START
Press START to begin				

When the measured flow rate is within +/- 10% of the target flow rate, the **START** button will turn green indicating that the system is ready to begin the first calibration point. Press **START** to begin.

UUT METER CALIBRATION				
CAL POINT 1				
Run	Gal/min	Gallons	Freq	K-Factor
1	25.0	45.54	91.6	220.26
2	24.8	10.74	91.0	
Avg:				
Repeatability:				STOP
Flowmeter Cal Running				

The CP20 will begin collecting pulses from the UUT flow meter and incrementing the total volume measured by the master flow meter. When the CP20 has received 10,000 test pulses from the UUT flow meter, the K-Factor will be calculated and displayed, and the current run will be complete. The flow rate and frequency values will change from a live measurement to the average value measured during the calibration run. The message “Starting Next Run” will be displayed for approximately 3 seconds and then the next run will begin automatically. If **STOP** is pressed during the calibration run, the system will pause and wait for **START** to be pressed again in which case the current run will start over from the beginning.

UUT METER CALIBRATION				
CAL POINT 1				
Run	Gal/min	Gallons	Freq	K-Factor
1	24.8	45.43	91.0	220.26
2	25.3	45.50	93.0	220.27
Avg: 25.0 45.47 91.9 220.26				
Repeatability:		0.00%	NEXT	
Press NEXT to continue CLEAR to repeat				

After the last run of the current Cal Point is complete, the average values for all runs are displayed and the Repeatability is calculated and displayed. If the results of the current Cal Point are not acceptable, the calibration point may be repeated by pressing the **CLEAR** button. Press the **NEXT** button to advance to the next Cal Point. The same process is repeated for each Cal Point until the number of *Cal Points* selected in the **UUT Info** menu has been completed.

CALIBRATION RESULTS				
Point	Gal/min	Freq	K-Factor	
1	25.33	92.97	220.27	Average K: 220.43
2	49.25	181.0	220.45	
3	74.15	272.7	220.61	Linearity: 0.35%
4	99.16	364.9	220.81	
5	125.1	458.9	220.03	

Press PRINT or select Cal Point to repeat

After all Cal Points are complete, the data will be displayed on the Calibration Results screen. Press any numbered button to review the data for that Cal Point. At this time the Cal Point may be repeated by pressing the **CLEAR** button or press **BACK** to return to the Calibration Results screen. If the displayed data is acceptable, press the **PRINT** button to print the Calibration Report. Press **MODE** to exit the **UUT Meter Calibration** mode and return to the **Home Screen**. All calibration data will be cleared from internal memory.

System Check

Overview

The System Check feature is used to prove the accuracy of the UUT measuring system, including any temperature and pressure sensors. The System Check is repeated 2 to 10 times based on the *Repeat Points* setting in the **Prover Configuration** menu. The units of measure used for the System Check are determined by the *Del Units* (Delivery Units) setting in the **Prover Configuration** menu.

NOTE: The units selected must match the delivery units used on the UUT electronics.

System Check Procedure

After the system has been properly cooled down, press the **System Check** button on the **Home Screen** to begin the System Check procedure. The CP20 will disable the UUT flow meter input to prevent the UUT electronics from totalizing.

NOTE: Make sure to CLEAR the UUT electronics totalizer before starting the System Check and between each proving run.

SYSTEM CHECK			
Run	Gal/min	Gallons	UUT Total
1	85.4	0.00	0.00
2	0.0	0.00	0.00
Old K-Factor:			
New K-Factor:			
% Difference:			<input type="button" value="START"/>
Adjust flow to 85.6 gal/min			

Adjust the flow rate to the target flow rate displayed in the message area. The target flow rate is based on 75% of the *Max Flow* setting specified in the **Master Meter 1** and **Master Meter 2** configuration menus. The System Check may also be performed at any desired flow rate within the specified range of the selected master meter as indicated when the **START** button turns green.

SYSTEM CHECK			
Run	Gal/min	Gallons	UUT Total
1	85.3	83.95	0.00
2	0.0	0.00	0.00
Old K-Factor:			
New K-Factor:			
% Difference:			<input type="button" value="STOP"/>
System Check Running			

When **START** is pressed, the UUT flow meter signal is enabled and both the CP20 and UUT will begin totalizing. Each proving run will stop automatically after approximately 2 minutes OR the run may be stopped manually by pressing the **STOP** button.

SYSTEM CHECK			
Run	Gal/min	Gallons	UUT Total
1	85.4	171.47	169.88
2	85.6	171.96	<input type="text" value="0.00"/>
Old K-Factor:			
New K-Factor:			
% Difference:			<input type="button" value="START"/>
Enter UUT Total for Run 2			

At the end of each run, the user is prompted to enter the total recorded by the UUT. The UUT electronics totalizer must be reset between each proving run.

SYSTEM CHECK			
Run	Gal/min	Gallons	UUT Total
1	85.4	171.47	169.88
2	85.6	171.96	168.50
Old K-Factor:		<input type="text" value="0.000"/>	
New K-Factor:			
% Difference:		<input type="button" value="START"/>	
Enter Old K-Factor			

After all runs have been completed, the user is prompted to enter the Old K-Factor value from the UUT electronics.

SYSTEM CHECK			
Run	Gal/min	Gallons	UUT Total
1	85.4	171.47	169.88
2	85.6	171.96	168.50
Old K-Factor:		135.000	
New K-Factor:		133.011	
% Difference:		1.47%	
		<input type="button" value="START"/>	
Press PRINT to print report			

The CP20 will calculate the New K-Factor as well as the error between the CP20 and UUT. The System Check report may be printed by pressing the **PRINT** button. Press **MODE** to exit **System Check** and return to the **Home Screen**. All data recorded during the System Check will be cleared from internal memory.

Print Functions

The CP20 includes a compact thermal printer that may be used to print the configuration settings as well as Flowmeter Calibration and System Check reports. Ensure that the printer is powered ON and has paper loaded prior to printing.

Configuration

The CP20 configuration settings may be printed from the **Prover Configuration** menu by pressing the *Print Config* button.

```
PROVER CONFIGURATION
Software Version: 1.062920
Date: 06/29/2020
Time: 11:40

Prover SN: 12345
Prover Last Cal: 01/01/2020
Prover Next Cal: 01/01/2021
Fluid Type: LIN
Reference: NBP
Compensation: Temp & Def Press
Delivery Units: gallons @ nbp
Default Temperature: 110.0
Temperature Units: kelvin
Default Pressure: 235.3
Pressure Units: psig
Repeat Points: 2

Master Meter SN: 56789
Master Last Cal: 06/10/2019
Master Next Cal: 06/10/2020
Min Flow: 25.0
Max Flow: 125.0
Rate Units: gal/min
Frequency 1 = 10.000
K-factor 1 = 220.100
Frequency 2 = 60.000
K-factor 2 = 220.200
Frequency 3 = 110.000
K-factor 3 = 220.300
Frequency 4 = 160.000
K-factor 4 = 220.400
Frequency 5 = 210.000
K-factor 5 = 220.500
Frequency 6 = 260.000
K-factor 6 = 220.600
Frequency 7 = 310.000
K-factor 7 = 220.700
Frequency 8 = 360.000
K-factor 8 = 220.800
Frequency 9 = 410.000
K-factor 9 = 220.900
Frequency 10 = 460.000
K-factor 10 = 220.000
Average K-factor: 100.000

END OF CONFIGURATION PRINTOUT
```

Flowmeter Calibration Report

The Flowmeter Calibration Report is printed by pressing **PRINT** from the **Calibration Results** screen. The example below has been condensed to save space.

FLOWMETER CALIBRATION REPORT

Date: 06/29/2020
Time: 14:01

UUT Meter SN: 98765
Electronics SN: 54321
Trailer Number: 1234
Next Cal Due: 04/10/2020

Ambient Temperature: 70 F
Ambient Humidity: 50 %
Fluid Type: LIN

CALIBRATION POINT 1

Target Flowrate: 25.00 Gal/min

Gal/min Gallons Freq K

1 24.51 45.54 89.97 220.28
2 24.51 45.55 89.97 220.24

Averages
24.51 45.55 89.97 220.26

Repeatability: 0.02%

CALIBRATION POINT 5

Target Flowrate: 125.00 Gal/min

Gal/min Gallons Freq K

1 125.4 45.99 459.9 220.00
2 125.4 45.99 459.9 219.98

Averages
125.4 45.99 459.9 219.99

Repeatability: 0.01%

FINAL CALIBRATION REPORT

Pt Gal/min Gallons Freq K

1 24.51 45.55 89.97 220.26
2 51.69 45.66 189.9 220.47
3 76.12 45.67 279.9 220.63
4 100.5 46.06 369.9 220.82
5 125.4 45.99 459.9 219.99

Average K: 220.43
Linearity: 0.38%

END OF REPORT

System Check Report

The System Check Report is printed by pressing **PRINT** when prompted at the end of the proving runs.

SYSTEM CHECK REPORT			

Date: 06/29/2020			
Time: 14:01			
UUT Meter SN: 98765			
Electronics SN: 54321			
Trailer Number: 1234			
Next Cal Due: 04/10/2020			
Ambient Temperature: 70 F			
Ambient Humidity: 50 %			
Fluid Type: LIN			
Compensation: Temp & Def Press			
Delivery Units: gallons @ nbp			
Run	gal/min	Prover	UUT

1	73.67	147.34	148.55
2	72.62	145.85	146.89

Avg	73.15	146.59	147.72
Old K-Factor:	135.00		
New K-Factor:	136.04		
Percent Error:	-0.77		
END OF REPORT			

Warning Messages

The CP20 provides extensive self-checking capability to assist the user in resolving faults and operational errors. Warning messages are displayed on the bottom portion of the **Home Screen**.

DISPLAYED MESSAGE	DESCRIPTION
GAS PRESENT	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.
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 <i>Max Flow</i> field for the selected master meter specified in Master Meter 1 and Master Meter 2 menus.
LOW FLOW RATE	The flow rate has dropped below the limit defined by the <i>Min Flow</i> field for the selected master meter specified in Master Meter 1 and Master Meter 2 menus.
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 1500 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.

Technical Specifications

Environmental:

Operating Temperature:	-10°C to 50°C
Storage Temperature:	-30°C to 70°C
Relative Humidity:	0-95% Non-condensing

Physical:

Dimensions:	13.6"L x 10.72"W x 6.28"H
Weight:	6.9 lbs.

Enclosure:

Waterproof, crush resistant portable case
2-way locking latch system
IP67 rated
MIL-STD 810F 512.4 certified

Display:

4.3" color LCD with touch screen

Keypad:

3 rugged, sealed pushbuttons for CLEAR, PRINT and MODE functions
Numeric keypad for data entry via touch screen

Power Supply:

	Switched, fused IEC 320-C14 power receptacle with EMI, RFI filtering
Voltage:	100-240 Volts VAC
Current:	3A
Battery:	3V lithium coin cell for real time clock 2-4 years typical battery life

Flow Meter Inputs:

Frequency range:	0.2 to 5000 Hz
Amplitude:	15mV RMS to 50V RMS
Impedance:	10 k Ω
Linearization:	10-point flow meter linearization
Pickup Coil Diagnostics:	Coil Short/Open Detection

RTD Temperature Input:

RTD type:	1000 Ω platinum probe, 2-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

<i>Printer:</i>	Integrated compact thermal printer 1.417" (36mm) diameter thermal paper roll
Interface:	RS-232
Baud Rate:	9600
Data Bits:	8
Stop Bits:	1
Parity:	None
Handshaking:	None

<i>Processing and Memory:</i>	16-bit microprocessor @ 18 MHz 256 kB Flash Memory / 64k RAM Non-volatile memory for configuration parameters
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Units of Measure:

Rate and Total:	gal, L, lb, kg, ft ³ , ft ³ x 100, m ³
Temperature:	K, F, C
Pressure:	psia, psig, bar-g, bar-a

Features:

- UUT Meter Cal function performs a 5 or 10 point calibration to generate a table of frequencies and k-factors over the specified flow range.
- System Check function to prove the overall accuracy of the measuring system
- Intuitive user interface with touch screen for easy configuration and operation
- Calibration data stored for two master meters
- Thermal printer used to generate Calibration and System Check reports
- Password protection to prevent unauthorized configuration changes
- Failure detection for RTD, analog and flow meter inputs
- Dedicated area to display system faults and operational messages
- Single hardware and firmware package for all applications
- Supports measurement of several predefined liquids: LIN, LOX, LAR, CO₂ Single Pipe, CO₂ Dual Pipe, LN₂O and LNG

