



# HIGHLAND VORTEX

Operator's Manual



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# SAFETY

- Please read and understand this instruction manual before using Highland Electrofusion Processors.
- Organization safety standards and precautions should be followed at all times.
- Treat all electrical equipment as a potential source of ignition and follow proper practices when working in an explosive atmosphere.
- Only properly trained and qualified personnel should operate Highland electrofusion processors.
- Before operating, always inspect the electrofusion processor and power source for any signs of damage or wear. If anomalies are observed, do not proceed with use.
- If operating a Highland electrofusion processor with a cooling fan (Vortex), ensure fan cover is not blocked, is free of debris, and is freely spinning. When connected to power, the fan will power on and begin to spin.
- **WARNING:** Do not use or store Highland Electrofusion processors where volatile gas concentrations may be present.
- **WARNING:** For protection against electric shock, always connect Highland Processors to properly grounded power outlets.
- Do not disconnect power supply or fusion leads of Highland electrofusion processors during fusion.
- Do not start fusion without first ensuring that proper electrofusion preparation has been completed.
- Do not lift, pull, or drag Highland electrofusion processors by cables.

# SAFETY

- Do not operate or store Highland electrofusion processors in adverse weather conditions.
- Do not leave Highland electrofusion processors unattended when connected to a power supply and/or fitting.
- Only use fusion information supplied by the manufacturer of the fitting.
- When scanning bar-codes, only scan bar-codes found on the connected fitting.
- Before any fusion is performed, it is the responsibility of the operator to always verify that all information displayed is correct per the fitting manufacturer's recommendations for fusing the connected fitting under the current ambient conditions.

# PRODUCT SPECIFICATIONS

Operating Type:	Controlled voltage.
Operating Modes:	Manual, Bar Code
Operating Languages:	English, French, Dutch, Polish, Russian, Spanish, German, Portuguese (others on request)
Operating Temperature <sup>1</sup> :	14°F to 120°F
Welding Voltage:	8 to 48 V ac (39.5 V)
Welding Current:	1 to 60 A ac (true rms)
Welding Power:	8 VA to 2000 VA
Welding Time:	1 to 3000 seconds
Supply Protection:	Class 1 – Grounded
Data log memory:	2048 fusions
Data download/upload:	USB flash memory drive
Protection Level:	IP54
Supply Voltage:	110 V ac (+/- 20%) 40 to 70 Hz
Supply Current:	1 to 32 A ac (true rms)
Supply Power:	3,500 W
Supply Voltage:	230 V ac (+/- 20%) 40 to 70 Hz
Supply Current:	1 to 15 A ac (true rms)
Supply Power:	3,500 W
Weight:	21lbs
Size:	18in x 14in x 7in

<sup>1</sup>An extended temperature unit is available with limits -40°F to 120°F.

*Highland Tools has a policy of continuously improving product design, and as such reserve the right to change specification of its products without prior notice and with impunity.*

# REQUIREMENTS

## POWER SUPPLY

When installing electrofusion fittings in field applications, it is necessary to have a reliable source of AC power for the electrofusion processor. The selected AC power source should:

- be well maintained and subjected to a periodic maintenance schedule.
- provide output voltage within the specified operating range listed in the product specifications.
- capable of providing a minimum of 3500w for sustained periods of time (10+ minutes), Consult the manufacturer of the generator to be sure that the output of your generator meets this requirement.
- be compatible with receiving the 30 Amp, 125v, NEMA L5 twist lock plug that the processor is equipped with.

## GENERATORS

Fuel powered generators are typically a good source of electrical power for Electrofusion Processors. Minimum fitting power requirements must be noted, and additional power capacity is recommended for intangibles (powering other accessories, wear & tear, etc.). Prior to beginning a fusion, it is important to insure the following:

- The generator has enough fuel to complete the electrofusion cycle.
- The auto-throttle is disengaged in anticipation of immediate power draw.

## INVERTERS

Inverters are an acceptable AC power source, though some produce output waveforms that are troublesome with specific fittings. We recommend performing compatibility tests using the lightest and heaviest anticipated loads before approving an inverter system. Feel free to contact us to discuss issues regarding the use of inverters.

# REQUIREMENTS

## EXTENSION CORDS

Due to the high amperage draw of electrofusion fittings, the use of an extension cord is not encouraged. Extension cords must not be used on 14" and larger couplings. In the event such usage is necessary, the following lengths and wire gages are recommended:

Cord Length	Wire Gauge
Less than 25 feet	12/3
Less than 50 feet	10/3
Less than 100 feet	8/3

## TEMPERATURE MEASUREMENT

The processor's temperature sensor is located on the right side of the metal housing. The temperature sensor does not respond immediately to thermal changes. In order to assure accurate ambient temperature measurements, the output cable end should be left in the fitting environment for at least 15 minutes. Direct exposure to sun light and other heat sources will adversely affect accuracy.

## TEMPERATURE COMPENSATION

When using a Highland Electrofusion Processor in Barcode Fusion Mode or Manual Barcode Mode, to fuse fittings that require temperature compensation it is essential that care be given to ensure that the correct initial fusion temperature is measured. The processor will automatically adjust the fusion time per the measured temperature as specified by the fusion parameters.

When using the electrofusion processor in Manual Mode to fuse fittings that require temperature compensation, it is necessary to enter the appropriately adjusted time as specified by the fitting manufacturer.

## THE PROCESSOR WILL NOT AUTOMATICALLY COMPENSATE FUSION TIME IN MANUAL MODE

# INTENDED USE

This equipment is intended to fuse constant voltage electrofusion fittings suitable for low, medium and high-pressure pipe work systems, up to a maximum diameter of 16 inches<sup>1</sup>.

This unit has been designed to comply with the International Organization for Standardization standard ISO12176-2:2000 "Plastic pipes and fittings, equipment for fusion jointing polyethylene systems, part 2, electrofusion."

<sup>1</sup> *Tested using MTD 16" bifilar couplings.*

# INTRODUCTION

This manual gives instructions on the correct assembly and safe use of the unit. It is important that you read these instructions carefully and keep these instructions for the life of the unit. This manual does not detail the specific joining procedures for electrofusion. Please refer to the fitting manufacturer's joining recommendations.

# MAINTENANCE

Before each use, check for any obvious defects such as loose or damaged cables and connectors. Look for worn components and damaged covers or housings.

Before and after each use, check that the fan inlet and outlet are free from dirt, debris, and mud. Check that the fusion tips are free from dirt, debris, and mud.

There are no user serviceable parts inside the processor. Opening the unit could result in voiding of the warranty. Under no circumstances should the unit be opened by anyone other than a Highland technician.

After use, clean the outside of the unit with a soft brush or dry cloth. Carefully wind up and store the cables in the case.



# CALIBRATION

VORTEX has a default calibration interval of 2 years. This can be lowered to one year at customer request.

# USING THE EQUIPMENT

VORTEX measures the ambient temperature before each fusion in order to properly utilize fusion temperature compensation. Therefore, the unit must be allowed to come to ambient temperature before use.

1. Connect the processor input cable (power cable) to a suitable power supply and power on the processor.
2. Processor screen will show a welcome message, software version, and calibration due date. Owner details are also shown. The main menu is now shown.
3. Prepare fittings per manufacturer recommendation.
4. Connect fitting to processor.
5. Use the on-screen prompts and keypad to select fusion modes.

NOTE: The operation of VORTEX can be customized by enabling or disabling fusion modes along with other features. For information on how to customize VORTEX, see the SETUP OPTIONS located below.

# SETUP OPTIONS

## **Setting the date and time:**

From the main menu, press the D key to select options. From here, the time can be set by the operator.

## **Additional Options:**

These options are set for customer at time of order based on customer specifications. Any changes must be made by a Highland technician. To speak with a Highland technician, please contact us at 800.345.4726

## **Display Language:**

English, French, Dutch, Polish, Russian, Spanish, German, and Portuguese.

## **Modes of Operation:**

Fusion modes can be enabled or disabled. Data logging can be enabled or disabled.

## **Owner Details**

## **Download Format**

# BARCODE MODE

This mode of operation is designed to fuse bar-coded fittings automatically. From the main menu, press the B quick key to select Barcode Fusion.

```
A=MANUAL WELDING
B=BARCODE

D=OPTIONS
```

The data screen will now show. Here you can set the operator name, location, and any job references you wish. This screen can be skipped by pressing the A quick key. If this is skipped, the joint record stored by the processor will not include this information. GPS equipped unit will still store GPS information.

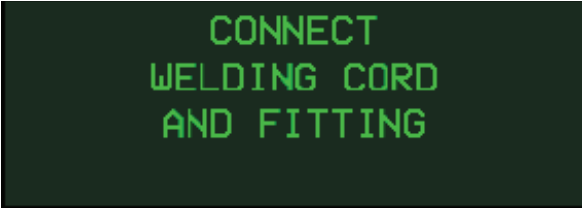
```
A=ACCEPT   BCD=CHANGE
B=OPERATOR
C=LOCATION
D=JOB REFERENCE
```

VORTEX will then confirm that the fitting to be fused has been prepped and secured properly per manufacturer's recommendations or your organizations policies.

```
PIPE SCRAPED AND
FITTING CLAMPED?
A = YES
B = NO      D = CANCEL
```

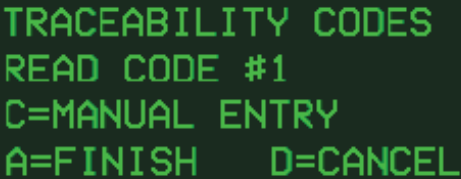
# BARCODE MODE

VORTEX will then prompt you to connect the fitting if you have not already done so.



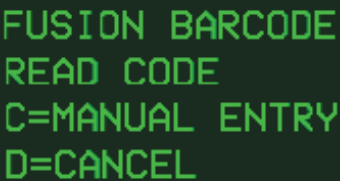
CONNECT  
WELDING CORD  
AND FITTING

Once connected, you will be prompted to scan or manually enter any ASTM F2897 traceability barcodes you wish to capture. Up to 5 barcodes can be stored per fusion. Press the A quick to skip or finish storing trace codes.



TRACEABILITY CODES  
READ CODE #1  
C=MANUAL ENTRY  
A=FINISH D=CANCEL

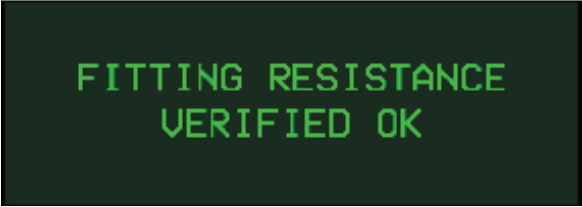
VORTEX will then prompt you to scan the fusion barcode of the fitting. It is important that you only scan or enter the fusion barcode of the fitting you are fusing.



FUSION BARCODE  
READ CODE  
C=MANUAL ENTRY  
D=CANCEL

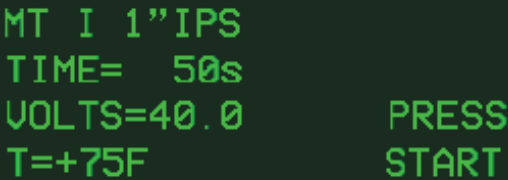
# BARCODE MODE

Once scanned, VORTEX will verify the resistance of the fitting.



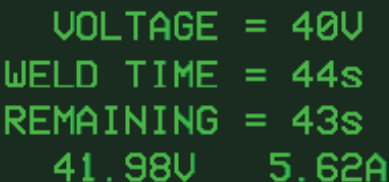
FITTING RESISTANCE  
VERIFIED OK

Decoded fusion information will be shown. VORTEX uses a set of symbols to reflect fitting type. For a table of those symbols, see page ##. The operator should review and confirm the information against the fittings before pressing start. Press start to begin fusion.



MT I 1"IPS  
TIME= 50s  
VOLTS=40.0           PRESS  
T=+75F                START

During fusion, VORTEX will show the fusion time, the remaining fusion time, the set welding voltage, and the power generated. Vortex will also monitor the fusion process to ensure that fusion parameters are maintained. Any faults that are detected will terminate fusion and an error message will be displayed.



VOLTAGE = 40V  
WELD TIME = 44s  
REMAINING = 43s  
41.98V    5.62A

# BARCODE MODE

At the end of fusion, VORTEX will display the completed status. The cooling time for the fitting will also be displayed. There is a cooling time counter that will start counting down. The current time and completed cool time will also be shown. This is a tool for the operator and it is not necessary to leave the fitting connected if operator has noted cooling times.

```

CURRENT TIME - 11:10am
COOL TIME REMAINING = 00:09:52
COOL END TIME - 11:20am
DISCONNECT CORD TO COMPLETE WELD
  
```

## MANUAL TRACEABILITY ENTRY IN BARCODE MODE

When operating VORTEX in barcode mode, it is possible to come across a fitting in which the barcode is not scannable. If this occurs, you have the option to manually enter the barcode information.

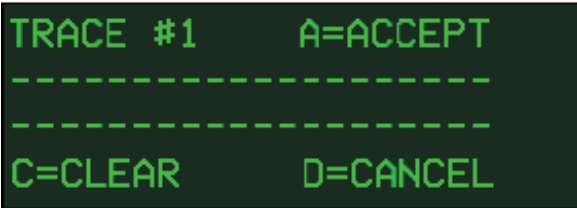
For manual traceability barcode entry, when prompted to scan the traceability barcode, press the C quick key.

```

TRACEABILITY CODES
READ CODE #1
C=MANUAL ENTRY
A=FINISH    D=CANCEL
  
```

# BARCODE MODE

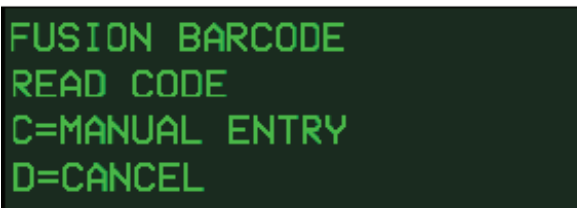
You can now use the keypad to manually input the 40 digit ASTM F2897 traceability code.



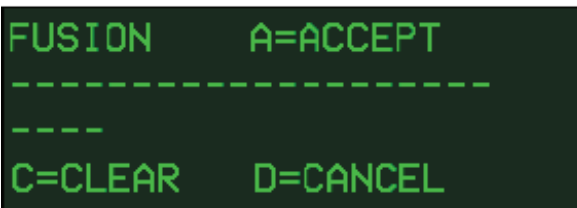
## MANUAL FUSION ENTRY IN BARCODE MODE

When operating VORTEX in barcode mode, it is possible to come across a fitting in which the barcode is not scannable. If this occurs, you have the option to manually enter the barcode information.

For manual fusion barcode entry, when prompted to scan the fusion barcode, press the C quick key.

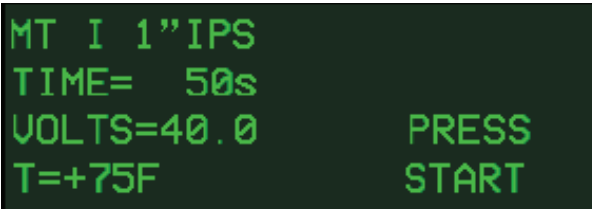


You can now use the keypad to manually input the 24 digit fusion code.



# BARCODE MODE

Decoded fusion information will be shown. VORTEX uses a set of symbols to reflect fitting type. For a table of those symbols, see page ##. The operator should review and confirm the information against the fittings before pressing start. Press start to begin fusion.



# MANUAL FUSION MODE

**CAUTION:**

FOR EXPERT OPERATORS ONLY! Manual Mode infers that the fusion voltage and time are obtained directly from the operator at the time of the fusion.

Manual Mode should only be used when the barcode is malfunctioning or unavailable. The temperature compensation must be calculated and entered manually, making it difficult to insure the proper implementation of time/temperature compensation for fittings requiring this feature.

Since compensation factors vary for different fitting types and manufacturers, the fitting manufacturer should always be consulted to verify proper fusion time, voltage, and cooling time.

**FAILURE TO VERIFY THAT THE FUSION INFORMATION IS CORRECT BEFORE STARTING A FUSION COULD RESULT IN SIGNIFICANT DAMAGE TO PROPERTY, PERSONAL INJURY, AND/OR DEATH.**



# MANUAL FUSION MODE

From the main screen, press the A quick key for Manual Welding.

```
A=MANUAL WELDING  
B=BARCODE  
  
D=OPTIONS
```

Use the quick keys and key pad to enter the fusion information.

```
                A=ACCEPT  
TIME=  0s  C=CHANGE  
t=+78F  
VOLTS=0.0  D=VOLTAGE
```

# WARRANTY

Subject to the conditions and limitations of this warranty, Highland Tools will warrant that Highland VORTEX Electrofusion Processor ("the Product") is supplied free from material defects in design, materials and workmanship for a period of 2 years from the date of purchase ("the Warranty Period").

Subject to the conditions and limitations set out below, if during the Warranty Period, written notice of a defect which is covered by this warranty is received by Highland Tools within 7 days of discovery and :

- the customer returns the Products at their expense; and
- Highland Tools, or its authorized and approved agent is given a reasonable opportunity of examining the Products, then Highland Tools will, at its discretion and option, repair or replace the Product which is found to be defective or refund the price of such defective Product in full.
- This warranty will also apply to any repaired or replacement Products supplied by Highland Tools from the date of original purchase.

## **Conditions of Warranty**

All diagnostic and repair work must be carried out by Highland Tools or an approved and authorized agent.

Highland Tools shall not be liable under the warranty in the event of:  
Failure to follow any and all instructions outlined in this manual;

- Abnormal use or use in abnormal conditions;
- Improper or inadequate maintenance;
- Modification, alteration, or repair of the Product which is not authorized in advance in writing by Highland Tools;
- Physical abuse or willful damage of the Product;
- Operation outside the specifications of the Product listed in this manual;
- Improper site preparation or site maintenance before use of the product;

# WARRANTY

- Damage or failure due to faulty, improperly prepared, and/or improperly maintained: pipes, fittings, joints, clamps, scrapers, peelers, generators, external power cords, power supplies, or any other tools, materials, or equipment not delivered with the Product;
- Wear and tear;
- Negligence of the user;
- A change to the Product made in order to comply with applicable statutory or regulatory requirements;
- Continued use of the Product after the defect is noticed
- Use of the product outside of the calibration date displayed by the Product.

## Limitations of Warrant

Highland Tools does not:

- Warrant the operation of the Product to be uninterrupted or error free;
- Accept any further liability than provided for under this warranty;
- Accept liability if the product, which is not intrinsically safe, be used in a gaseous or explosive atmosphere;
- Seek to exclude liability for dead or personal injury caused by the negligence of Highland Tools or those for which it is liable;
- Accept any liability beyond that which would arise under law, to which law only this warranty is subject

For specific terms and conditions not addressed above, standard terms and conditions of sale would apply. Standard terms and conditions can be viewed at <https://isco-pipe.com/terms-and-conditions>

# ERROR CODES

During operation, VORTEX monitors all aspects of its operation. If a fault occurs, an error message will be shown.

0: Weld OK  
No Fault, weld completed OK.

1: Stuck button on start up  
This fault shows when the power is first switched on. Either the Stop, Start, or a keypad button is stuck in. Free the button to clear the fault.

2: Output fault before weld start  
This fault shows when the power is first switched on. The unit will check the output terminals to make sure no voltage is present when first switched on. If this fault happens then the internal power relays have stuck in the closed position. The unit will need to be returned for service.

4: No calibration  
This fault happens when the unit has no calibration. This will normally not show, and if the unit has been calibrated, would be caused by a fault with the internal memory. Return the unit for service.

7: Ambient temperature less than -200C.  
The unit has detected that the ambient temperature is very cold or the sensor has broken. If the temperature is not below -200C then the unit will need to be returned to a service agent for repair.

8: Ambient temperature more than +450C.  
The unit has detected that the ambient temperature is very hot, or the sensor has broken or a wire has gone open circuit. The unit must be returned to a service agent for repair.

14: Relay failed to latch on weld start  
This fault could happen when the start button is pressed. If the main power relays do not operate correctly then this fault will be shown. The unit needs to be returned for service.

# ERROR CODES

## 20: Low output volts (-1.25%)

This fault will happen if the output voltage is 1.25% lower than the set point for more than 3 seconds. The unit needs to be returned for service.

## 21: High output volts (+1.25%)

This fault will happen if the output voltage is 1.25% higher than the set point for more than 3 seconds. The unit needs to be returned for service.

## 22: Excess output volts (+6.25%)

This fault will happen if the welding voltage is 6.25% more than the set point for more than 2 seconds. The unit needs to be returned for service.

## 23: Low output current (<2.5A)

This fault will happen if the welding current is below 2.5 amps for more than 3 seconds. It can be caused by a faulty fitting. Try another fitting. If this doesn't clear the fault then there is a problem inside the unit and it must be returned for repair.

## 24: Shorted turn detected in fitting.

While welding, the unit has detected a sharp increase in welding current. This is normally caused by a shorted turn happening in the fitting. (An increase of 10%). If this happens then it is most likely a faulty fitting. This must be replaced. If the fault persists then it could be a fault within the unit.

## 25: User stop button pressed

The operator has pressed the stop button.

## 26: Relay unlatched

During welding, if the main power relay disconnects then this fault will be shown. It could be caused by the unit being knocked. If the fault persists then the unit should be returned for repair.

## 27: Fitting open circuit

This fault is shown if the output lead disconnects from the fitting while welding. Follow the guidelines from the fitting manufacturer, reconnect the lead and try welding again.

# ERROR CODES

29: High output current.

This fault is shown if the welding current is above a predefined limit for a set time. If the fault persists then the unit should be returned for repair.

30: Bar Code Mode: No fitting connected

This fault is shown if the output lead is not connected to a fitting when a bar code is read. Connect the fitting.

31: Bar Code Mode: Ohms error

This fault is shown if the connected fitting resistance is different from that coded into the bar code. Try another fitting.

40: Bar Code Invalid: Temperature Compensation.

Digits 22 and 23 of the bar code have been decoded incorrectly.

41: Bar Code Invalid: Resistance Coefficient.

Digit 18 of the bar code has been decoded incorrectly.

42: Bar Code Invalid: Welding Voltage.

Digits 13 and 14 of the bar code have been decoded incorrectly.

43: Bar Code Invalid: Regulation Mode.

Digit 12 of the bar code has been decoded incorrectly.

44: Bar Code Invalid: Fitting Size.

Digits 9, 10 and 11 of the bar code have been decoded incorrectly.

45: Bar Code Invalid: Cooling Time.

Digit 7 of the bar code has been decoded incorrectly.

46: Bar Code Invalid: Fusion Cycle Type.

Digit 5 of the bar code has been decoded incorrectly.

47: Bar Code Invalid: Energy Correction.

Digit 3 of the bar code has been decoded incorrectly.

# ERROR CODES

48: Bar Code Invalid: Component Type.

Digits 1 and 2 of the bar code have been decoded incorrectly.

49: Bar Code Invalid: Check Digit.

Digit 24 of the bar code has been decoded incorrectly.

50: USB Memory: Disc full.

This fault will happen if the USB flash memory pen is full. Delete some files from the device.

52: USB Memory: File not found.

When performing a software upgrade, the required file was not found on the memory drive. Reload the upgrade files onto the memory drive.

101: Converter electronics error – Low battery voltage

The battery voltage into the electronics is too low. The unit should be returned for service.

102: Converter electronics error – High battery voltage

The battery voltage into the electronics is too high. The unit should be returned for service.

103: Converter electronics error – High output voltage

The voltage out of the electronics is too high. The unit should be returned for service.

104: Converter electronics warning – Over current

The current out of the electronics is too high. The unit should be returned for service.

105: Converter electronics warning – Communications

The communications between the converter electronics and the microprocessor control have broken down. The unit should be returned for service.

# ERROR CODES

106: Converter electronics warning – Over temperature A

The temperature of the converter electronics phase A is too high. The unit should be returned for service.

107: Converter electronics warning – Over temperature B

The temperature of the converter electronics phase B is too high. The unit should be returned for service.

108: Converter electronics warning – Over temperature C

The temperature of the converter electronics phase C is too high. The unit should be returned for service.

109: Converter electronics error – Phase current

The current in the converter electronics is out of specification. The unit should be returned for service.

110: Converter electronics error – Relay open

The main control relay in the converter electronics is open circuit. The unit should be returned for service.

112: Converter electronics error – Voltage sense open

The voltage sensing relay in the converter electronics is open circuit. The unit should be returned for service.

113: Converter electronics warning – Peak time exceeded

The converter electronics timing circuit has broken. The unit should be returned for service.

114: Converter electronics warning – Phase current mismatch

The current in the converter electronics is out of phase. The unit should be returned for service.

127: Power off failure.

If the power is turned off while the unit is welding, this fault will be recorded to the data log.



**We know you have work to do, and downtime is the enemy. That is why our commitment to customers is a guaranteed 5 day or less turn around on calibration and service evaluation along with an industry leading 2 year warranty.**

**With multiple service locations across the US and Canada, we are equipped to get you back in operation as soon as possible.**



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