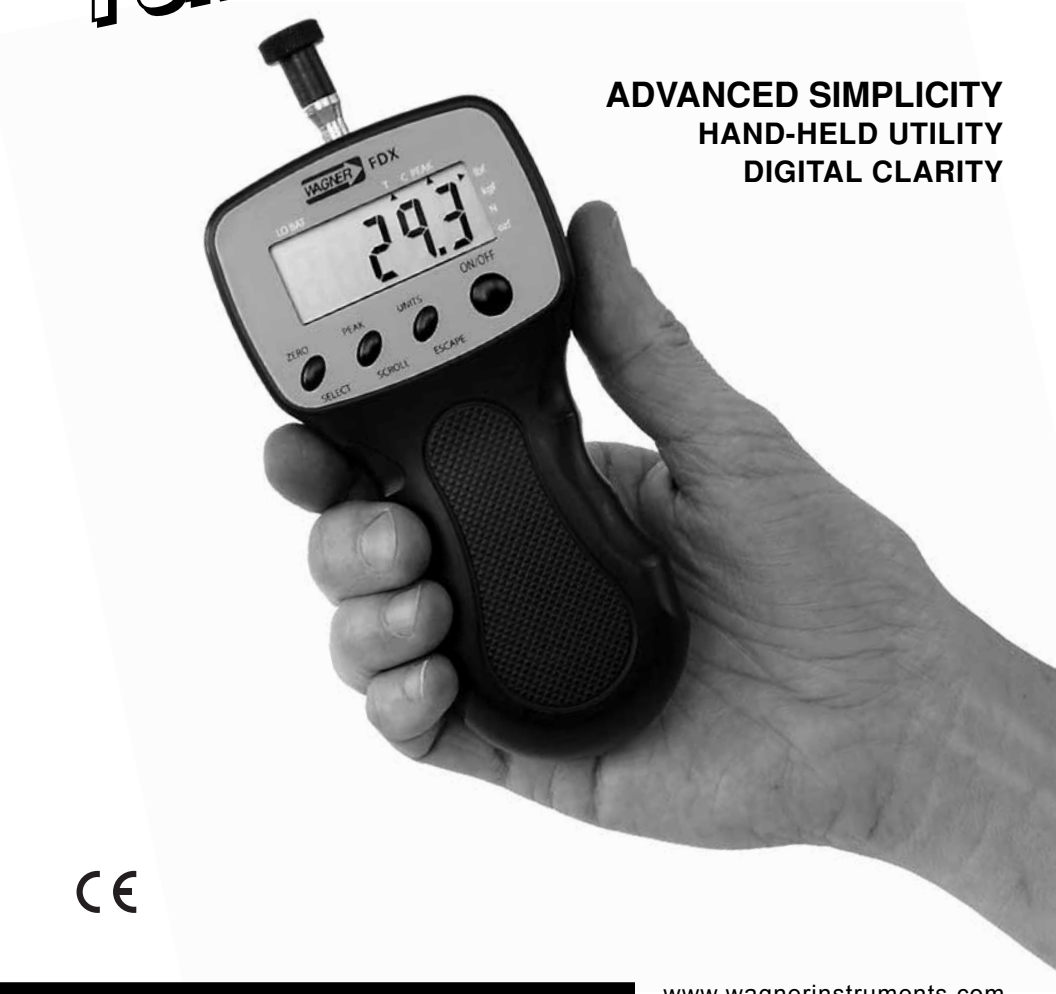
OPERATION MANUAL

FORCE TEN™

FORCE TEN™ FDX
COMPACT
DIGITAL FORCE GAGE



ADVANCED SIMPLICITY
HAND-HELD UTILITY
DIGITAL CLARITY

CE

CALL TOLL FREE: 800 345 4188
www.wagnerinstruments.com
sales@wagnerinstruments.com
Wagner Instruments • Greenwich CT 06836-1217 • Fax: 203 698 9696

fdxman_171129_ag

MOST IMPORTANT - READ BEFORE USING THE FDX FORCE GAGE

OVERLOADS:

- ***FDX provides overload protection of its load cells. However, EXCESSIVE OVERLOADS or IMPACT LOADING will cause permanent damage.***
- ***Prior to reaching an overload condition, the FDX displays "StoP". Continuing to apply force will damage the FDX.***
- ***When HELP is displayed, it indicates that the FDX has been damaged or overloaded.***

CORRECT LOADING: ***FDX is intended for axial loads only. Application of force to the load shaft at an angle or twisting the load shaft will cause erroneous readings. If these forces are excessive, damage will occur.***

ATTACHING IMPLEMENTS: ***Attach implements "finger-tight" only. Use of tools to attach implements to the load shaft will cause damage to the Force Cell Module.***

AC ADAPTER/CHARGER: ***Use only the AC adapter/charger supplied with FDX. Using other adapter/charger units will damage the battery.***

SYMBOLS: ⎓ ***Indicates: Direct Current (dc) Power***

⚠ ***Indicates: Caution Required - Risk of Danger***

WAGNER INSTRUMENTS
P.O. Box 1217, Greenwich, CT 06836-1217, USA
Telephone: (800) 345-4188 or (203) 698-9681
Fax: (800) 443-4149 or (203) 698-9696
sales@wagnerinstruments.com

www.wagnerinstruments.com

FDX OPERATION MANUAL

FEATURES

CONSTRUCTION
- Firm pistol grip handle.
- Fiberglass reinforced plastic housing.
- Full 5 digit, 0.5” display.
- Selectable Units: lbf, kgf, N and ozf.
- Displays: LO BAT, T, C and PEAK.

OPERATION
- Simple 4 button control and menu access.
- Selectable peak sampling: 100 or 1000/second.
- Filtering of current and peak readings.
- Tension and compression peaks held in memory.
- Auto-off conserves battery power.

POWER
- Rechargeable 40 hour NiMH battery.
- Continuous operation with AC adapter/charger.

ACCESSORIES
- NiMH battery, AC adapter/charger, hook and flat, case, manual and NIST Calibration Certificate.

ACCURACY
- Accurate to ± 0.3% of full scale.

WEIGHT & DIMENSIONS
- 0.5 lb [225 g]. Shipping: 2 lb [1 kg].
- 5” [13 cm] H x 2 5/8” [7 cm] W x 1 3/16” [3 cm] D

FORCE TEN™ FDX FORCE GAGE

FEATURES

ADVANCED SIMPLICITY
Hand-Held Utility
Digital Clarity

FORCE TEN™ FDX
Compact Digital Force Gage

CE

Pistol Grip Handle

Large 5 Digit 0.5'' Display

0.3 % Accuracy

Re-chargeable
40 Hour Battery

Selectable 100 or 1000
Peak Sampling Rate

Overload Protection

Selectable
lbf/ozf/kgf/N

Auto Calibration

NIST Certified

The **FDX** is a **low cost digital force gage** designed for basic **hand-held portability -** compact size, firm grip, large digital display, 40 hour battery, overload protection, power conservation, simple keypad and selectable peak sampling rates.

TABLE 1 FDX DIGITAL FORCE GAGE & FORCE CELL MODULES

Model	Capacity/Graduation			
FDX 10	10 x .01 lbf	160 x .2 ozf	5 x .005 kgf	50 x .05 N
FDX 25	25 x .02 lbf	400 x .5 ozf	10 x .01 kgf	100 x .1 N
FDX 50	50 x .05 lbf	800 x 1 ozf	25 x .02 kgf	250 x .2 N
FDX 100	100 x .1 lbf	1600 x 2 ozf	50 x .05 kgf	500 x .5 N

Included: NiMH battery, AC adapter/charger, hook, flat, case, manual and NIST Calibration Certificate.

TABLE 2 FDX - OPTIONAL ACCESSORIES

FD/S-1*	Steel Hook - Large (100 lbf)
FD/S-2*	Flat Head - 1/2" diameter
FD/S-6	3" Extension Rod
FD/S-7	Hinged Hook - Large (100 lbf)
FD/S-8	Hinged Cradle - Large (100 lbf)
FD/RT	1 cm^2 Flat Rubber Tip
FDX/FP	3" x 1 1/4" Pressure Pad
FDX/NIST*	NIST Calibration Certificate
FDI/AC110*	AC Adapter - 110 - 120 Vac
FDI/AC220**	AC Adapter - 220 - 240 Vac

* Included with FDX.
** Included as alternate where appropriate.

FORCE TEN™ FDX FORCE GAGE SPECIFICATIONS

TABLE 3 FORCE TEN™ - TECHNICAL SPECIFICATIONS

Item	Specification
Accuracy	±0.3 % of Full Scale ± 1 Least Significant Digit
Display	5 Digit, 0.5" Liquid Crystal Display (LCD)
Display Update	8 per second
Resolution	1000 graduations (1250 for 25 lbf capacity)
Tare	± 10% of Full Scale (FS)
Overload Protection	Varies by capacity
Power	• 110 - 120 or 220 - 240 VAC Adapter/Charger • Rechargeable 9V form NiMH battery
Battery Endurance	Up to 40 hours at 100 Samples per second Up to 30 hours at 1000 Samples per second
Battery Charge	10 hours for full charge
Calibration	Auto-Calibration - One full capacity weight
Peak Force Sampling Rate	Selectable: 100 Samples per second 1000 Samples per second
Digital Filter	Non-Peak Mode: 100 Samples per second • Routine Testing: Peak Off: 9 HZ Input Band Width • Rapid Event Testing: Peak On: 33 HZ Input Band Width Peak Mode: 1000 Samples per second • Routine Testing: Peak Off: 90 HZ Input Band Width • Rapid Event Testing: Peak On: 330 HZ Input Band Width
Menu Selection	Menu selection of: • AoFF - Automatic Off • PSS - Peak Sampling Rate • L CAL - Auto-Calibration

A. Power Supply

The preferred power source is determined by FDX use, the rechargeable battery for portable use and AC adapter/charger for stationary use.

A.1 Battery and AC Adapter

The FDX is powered by a rechargeable 9V form Nickel Metal Hydride (NiMH) battery. With a 10 hour charge, the NiMH battery will provide power up to 40 hours used continuously on the 100 Hz setting. This can be extended by using Auto-Off - see C.2.3.

Low battery power is indicated on the display with an arrow pointing at LO BAT. With the AC adapter plugged in, FDX is charging when turned on or off and charges faster when off.

A.2 AC Power Adapter

- AC to DC, Input: 110 -120 Vac, 60 Hz, or,
  220 - 240 Vac, 50 Hz
  Output: 12 Vdc, 100 mA.
- Use only the AC power adapter - transformer - provided. Other AC power adapters may be dangerous and cause battery damage. Charge battery indoors only.

A.3 Battery

- Nickel-Metal-Hydride (NiMH), 9V form ⎓ *
- Replacement batteries must be the same.
- Non-rechargeable batteries must not be used.
- Charging a non-rechargeable battery will cause overheating, fire or explosion.

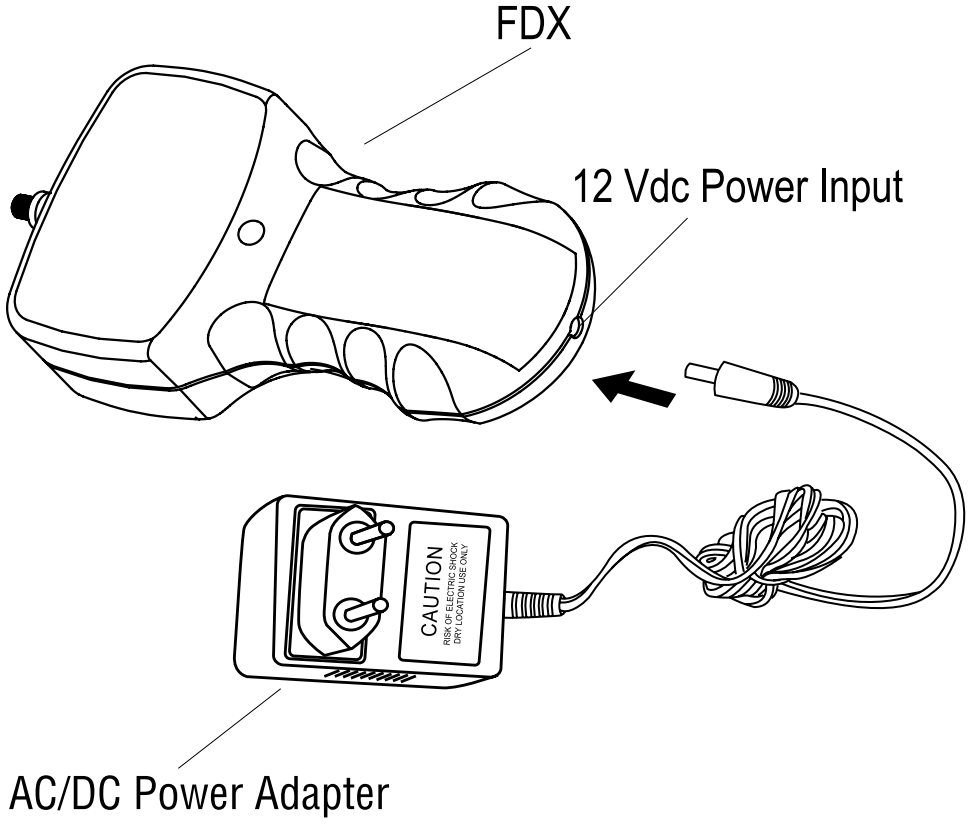
* ⎓ Indicates: Direct Current (dc) Power

⚠ Indicates: Caution Required - Risk of Danger

A.4 Environment

- Indoor use only - no protection provided for adverse indoor or outdoor conditions.
- Use at operating ambient temperature of 5 - 40ºC, maximum 75% relative humidity and pollution degree 2.

A.5 Charging the FDX NiMH Battery



B. Keypad

B.1 Keypad Description

FDX is operated with four button keypad that controls all functions.

ON/OFF
- Turns FDX on and off.
- Self-tests display if held down when turning gage on.
- At turn-on, display flashes Force Cell capacity and software version.

If there is no display or if low battery is indicated, the battery may be low or not securely connected. Connecting the AC Power Adapter will confirm this.

ZERO
- Returns display to zero in non-peak and peak mode.
- Returns display to zero with tare force or weight applied to the load shaft.

PEAK
- Activates peak mode and recalls peak readings.

UNITS
- Selects units of measurement: lbf, kgf, N, or ozf.

Each of the buttons, except ON/OFF, also has set-up functions.

B.2 Keypad Control

Three black keypad buttons have the following additional functions:

SCROLL
- Review menu options.
- Review selections within each option.

SELECT
- Select displayed item.
- Save selection.

ESCAPE
- Cancel and return to previous menu option.
- Exit set-up menu.

Prior to actual test use, gain keypad and menu familiarity with practice.

C. Menu Set-Up

C.1 Menu Description

FDX features options for selection in the set-up menu. At first level are options; at second level are selections within the options:

TABLE 4 MENU OPTIONS AND SELECTIONS

Display	Option - Level One	Selections - Level Two
AoFF	**Automatic Off**	**No*** or 30 minutes
PSS	**Peak Sampling Rate**	• Sampling rate: **100** samples per second.* Input bandwidth: 9Hz in non-peak 33Hz in peak. • Sampling rate: 1000 samples per second. Input bandwidth: 90Hz in non-peak 330Hz in peak.
L CAL	**Auto - Calibration**	See E.3 Auto-Calibration

* Factory default settings.

Input bandwidth: The band of frequencies that filtering passes thru from the load cell to the display. All other background noise or interference frequencies are excluded.

C.2 Menu Operations

C.2.1 Menu Access

- Turn FDX off.
- Push / Hold **ZERO**, push **On/OFF**.
- Release **On/OFF**, then **ZERO**, **AoFF** is displayed.

C.2.2 Menu Instructions

- After entry into set-up menu, first option displayed is **AoFF**.
- **SCROLL** to review options: **AoFF, PSS** and **LCAL**.
- **SELECT** to choose an option and move thru selections.

Current setting is displayed. Push SELECT to retain that setting.

- **SCROLL** to review selections - see Table 4.
- **SELECT** to choose the selection: **donE** will appear on the display, previous menu is displayed.
- Push **ESCAPE** to exit after all selections are made or at anytime to exit menu.

Continuing to press SCROLL without pressing SELECT will move the display thru the available options with no changes made to settings.

FORCE TEN™ FDX FORCE GAGE MENU OPERATIONS

C.2.3 Menu Options

1) **AoFF** Automatic-Off - Useful for battery power conservation.

FDX automatically shuts off after a period if no buttons are pressed:

No Operates continuously, no automatic-off, consumes more battery power.

30 Shuts off after 30 minutes of inactivity, conserves battery power.

2) **PSS** Peak Sampling Rate and Filter.

FDX provides selectable peak sampling rates and corresponding filtering.

► **Routine Testing**

Peak sampling rate of 100/sec is preferable for slowly occurring events and significantly reduces battery power consumption.

► **Rapid Event Testing**

Peak sampling rate of 1000/sec is required to capture peaks of rapidly occurring events and break tests. The FDX takes 1000 “looks” per second to accurately capture a break point and display it.

► **Digital Filtering**

Filtering of displayed data provides accurate force readings by eliminating vibrations and electromagnetic interference. Filtering is simultaneously set with peak sampling rate as follows:

100 Samples/Second

- Routine Testing - Peak Off: 9 Hz Input Band Width
- Rapid Event Testing - Peak On: 33 Hz Input Band Width

1000 Samples Per Second

- Routine Testing - Peak Off: 90 Hz Input Band Width
- Rapid Event Testing - Peak On: 330 Hz Input Band Width

Input bandwidth: The band of frequencies that filtering passes thru from the load cell to the display. All other background noise or interference frequencies are excluded from the data display.

3) **L CAL** Auto - Calibration

FDX features “Smart Load Cell” calibration for verification and adjustment without returning it to the factory. See E.

D. GAGE OPERATIONS

D.1 Force Measuring - Non-Peak and Peak Modes

- **Non-Peak Mode** FDX displays **instantaneous force** being applied.
- **Peak Mode** FDX displays highest peak tension or compression force applied since peak memory was last cleared.

FDX continuously measures instantaneous tension and compression forces and continuously captures peak tension and compression forces. Thus, peak values are always available in both non-peak and peak modes.

D.1.1 Non-Peak Mode

Force values displayed vary with the instantaneous force applied. Use FDX in this mode for monitoring applied force as it varies.

At any time tension or compression peaks are needed, they may be recalled - see below.

- **Enter Non-Peak Mode** Push **PEAK** repeatedly until arrow pointing at **PEAK** disappears, push **ZERO** to clear the gage.
- **Run Test** Apply push or pull force, the gage tracks and displays applied force.
- **Recall Peaks** Push **PEAK** to display compression and tension peaks.
- **Clear Peak Memory** Push **ZERO** while arrow points at **PEAK**.
- **Return to Non-Peak** Push **PEAK**.

It is important to note that the peak value retrieved is not necessarily the peak from the last test excursion, it is the highest peak since peak memory was last cleared.

D.1.2 Peak Mode

Force values displayed by FDX are the highest peak(s) of tension or compression since peak memory was cleared. If peak memory is cleared, the next peak value displayed will be that of the next test. If additional tests are run after the first test, without clearing the peak memory, the peak value displayed will always be the highest peak from the series of tests.

- **Enter Peak Mode** Push **PEAK** then push **ZERO** to clear peak memory. Display defaults to **C** and **PEAK**.
- **Run Compression Test** With arrows pointing at **C** and **PEAK**. Begin compression test by applying push force. Peak force is displayed. If a higher force is applied, that peak force is displayed.
- **Run Tension Test** Push **PEAK** until arrows point at **T** and **PEAK.** Begin tension test by applying pull force. Peak force is displayed. If a higher force is applied, that peak force is displayed.
- **Recall Peaks** Push **PEAK** repeatedly to display compression and tension peaks.
- **Return to Non-Peak** Push **PEAK**.

Prior to actual test use, practice FDX non-peak and peak modes to gain familiarity.

FDX in non-peak or peak mode, is continuously measuring instantaneous force applied and continuously capturing peaks.

Peaks can be recalled in non-peak as well as peak modes.

E. Calibration

FDX should be periodically tested to verify it is within the specified tolerance.

E.1 Procedure Description

- **Verification - Testing Calibration** - Certified weights are applied in tension and compression to determine if the FDX can be certified and if the calibration procedure is necessary.
- **Calibration** - The FDX has **Auto-Calibration** enabling the gage to be calibrated by one full capacity test weight.

E.2 Verification - Testing Calibration

Warm-up FDX for 2-3 minutes after power-on to stabilize the electronics.

To verify, a five-point tension and compression test is recommended with weights equal to 20%, 40%, 60%,80%, and 100% of FDX capacity. If the displayed weight differs more than ±0.3% of full scale ±1 least significant digit, FDX is out of tolerance.

Accuracy verification requires testing fixtures: a test stand capable of supporting weights equal to the FDX capacity, and fixtures for applying test weights in tension and compression. Testing fixtures are available from Wagner Instruments.

E.3 Auto-Calibration (L CAL)

Auto-Calibration is used to return the FDX to its specified accuracy after verification indicates the FDX is out of tolerance, or if obvious that readings are incorrect.

Certified NIST traceable test weights are recommended, resulting in an NIST Calibration Certificate. Test weights are available from Wagner Instruments.

Unless FDX is tested with E.2 verification and an NIST Calibration Certificate issued, FDX is not certified to NIST standards. If certification is not required, Auto-Calibration is adequate in returning FDX to specified accuracy.

After Auto-Calibration, FDX accuracy should be confirmed using E.2 Verification.

E.3.1 Auto-Calibration (LCAL) Procedure

Test weights must match the Force Cell Module capacity to be tested.

Set UNITS to lbf - all calibrations are performed in pounds (lbf).

Attach FDX to the calibration test stand, and stop all movement.

Enter the set-up menu:

- Turn FDX off.
- Push / Hold **ZERO**; push **ON/OFF**.
- Release **ON/OFF**, then **ZERO**, **AoFF** is displayed.

Gage set-up:

- **SCROLL** to **L CAL** option.
- Push **SELECT** - FDX displays **null**.
- Push **SELECT** - FDX displays a force cell capacity after zero flashes.

If the capacity shown is not that of the attached Force Cell Module, SCROLL to the correct Force Cell Module capacity and proceed.

Calibrate:

- Apply full-scale weight matching the display - in lbf.
- Push **SELECT** with weight applied and movement stopped.
- FDX displays applied weight indicating successful calibration.

FDX will reject a calibration with weights that are higher or lower than FDX full-scale capacity. It is possible for FDX to accept a calibration with weights that are close to, but do not match the full scale capacity of FDX. This erroneous calibration will give inaccurate readings.

Calibration Accepted

- FDX displays the actual applied weight indicating successful calibration. If **uuuuu (under)** or **nnnnn (over)** is displayed the weight is not accepted, or other problems exist - see Calibration Rejected (below).

Verification is recommended by applying weights to check accuracy at various points of FDX range.

- To exit calibration, push **SELECT** when FDX full-scale capacity is displayed or at anytime during or after the five point weight test.
- FDX flashes **donE** and returns to normal operation.
- Auto-Calibration is complete and FDX is ready for use.

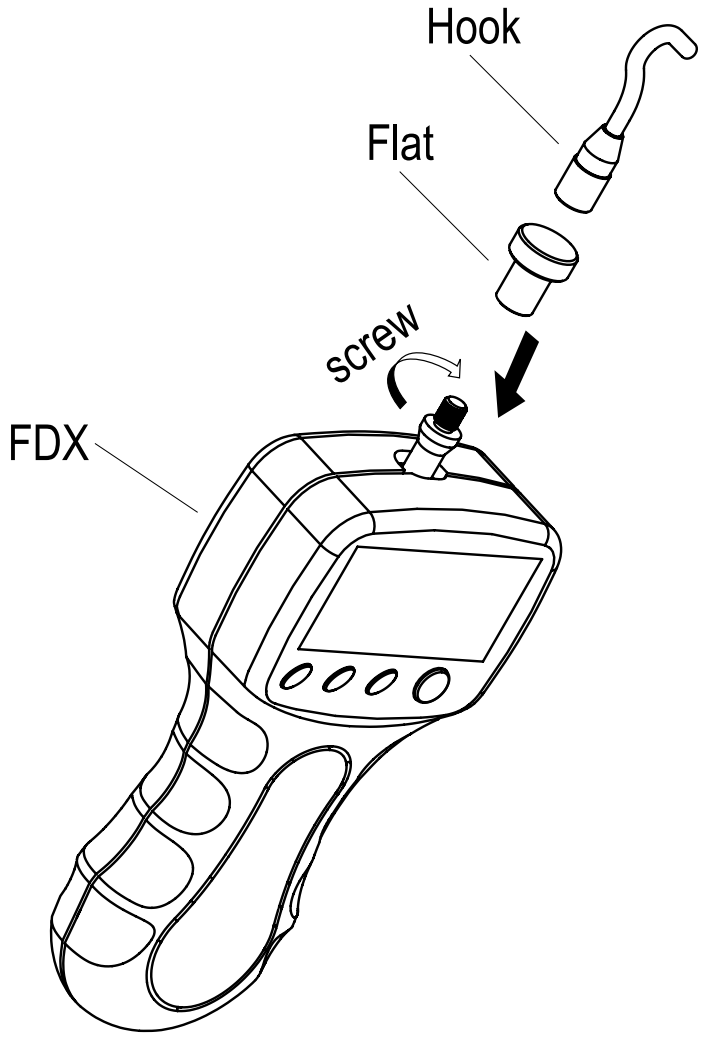
Calibration Rejected

- If the weight is not accepted, the display shows **uuuuu (under)** or **nnnnn (over)**. Verify weight applied matches the FDX capacity.
- If the weight used does not match FDX capacity, repeat E.3.1 Auto-Calibration with an accurate full scale weight.
- If **uuuuu** or **nnnnn** is displayed again after repeating Auto-Calibration, the FDX may be defective or damaged. Call Wagner Instruments for instructions.

F. Implements

Several implements are available for use with the FDX - see Table 2. A hook and flat implement are included with FDX. All implements are attached to the American Standard 10-32 FDX load shaft thread. Metric thread adapters are available.

F.1 Attaching the FDX Hook and Flat Implement



WARRANTY

Wagner Instruments expressly warrants for one year from the date of purchase, that the goods sold shall be free from defects in workmanship and materials under normal conditions. Wagner Instruments will, at its option, replace, repair, or refund, in full, the purchase price of the instrument or any part thereof which, in our opinion, is defective, provided the instrument has not been subjected to tampering, abuse, or exposed to highly corrosive conditions. An instrument that has been improperly used cannot be considered under this warranty. We make no warranties, expressed or implied, including, without limitation, any warranties of fitness or merchantability, except as expressly set forth above. We shall not be liable for any anticipated lost profits, incidental damages, consequential damages, costs, time charges, or other losses in connection with the instrument or any replacement parts thereof. If a manufacturing defect is found, we will replace or repair the instrument, or replace any defective part thereof without charge; however, our obligation hereunder does not include the cost of transportation, which must be borne by the customer. We assume no responsibility for damage in transit, and the purchaser should present any claims for such damage to the carrier. In addition, instead of replacing or repairing the instrument, as aforesaid, we may, at our option, take back the defective instrument and refund, in full settlement, the purchase price thereof.

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