

# FORCE FIVE™

## MULTI-CAPACITY

# FORCE GAGE

## OPERATION MANUAL

The unique Force Five™ featuring interchangeable Force Cell Modules.

One Gage  
Five Capacities!

To change the  
capacity simply  
change the  
Force Cell Module.

### **FORCE FIVE™**

A full feature  
digital force  
gage with  
unprecedented  
flexibility at an  
economical  
price

**P**ATENTED MODULAR DESIGN!

# **IMPORTANT**

## **READ THIS BEFORE USING THE FORCE FIVE**

- 1. CAUTION: EXCESSIVE OVERLOADS, over 25% above maximum capacity, or IMPACT LOADING may cause permanent damage to the load cell. EXERCISE CAUTION to prevent overloading or impact loading.**
- 2. CAUTION: The FDV 5 and FDV 10 models, 5 lb and 10 lb respectively, are extremely easy to overload. Use special caution to prevent overload damage.**
- 3. CAUTION: In order to prevent accidental overloads, the capacity on the battery cover must correspond to the capacity of the Force Cell Module (FCM) in use. When changing the FCM, remember to change to the matching battery cover supplied with each FCM.**
- 4. CAUTION: When "HELP" is displayed it may indicate either:**
  - Force Cell Module is not securely connected.**
  - Force Cell Module has been overloaded and is damaged.**

**Call Wagner Instruments for instructions.**

- 5. CAUTION: Switch FDV power off prior to disconnecting power supply (battery or battery eliminator); not doing so may result in losing menu and auto-calibration settings.**
- 6. CAUTION: "LoAd" will appear on the display when the gage is first activated if the gage has been disconnected from the battery or AC power for an extended period of time, and the set-up menu has reverted to default settings. User must reset "LoAd" (see Section F.) and should check other menu settings before testing to assure that previously selected values are as desired. The FDV cannot be shut off in this mode until a value for "LoAd" has been selected.**

# WAGNER FORCE FIVE™ DIGITAL FORCE GAGE FDV SERIES

## OPERATION MANUAL

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## **A. FORCE FIVE FEATURES**

### **CONSTRUCTION**

- Patented modular design - one Force Display Module accommodates up to five Force Cell Module capacities.
- Compact Size: 7 3/4" x 2" x 1 3/8"
- 4 1/2" Force Cell Module for upward or downward pointing shaft.
- Optional adapter plates for easy mounting on all popular test stands.
- One year warranty.
- Made in the USA.

### **OPERATION**

- Change Force Cell Module to change capacity - 5, 10, 30, 50, & 100 lb.
- Menu Driven Selections.
- Fast Update: Up to 100 samples per second.
- All functions easily programmable on keyboard.
- Peak hold memory retains maximum tension and compression readings.
- Filtering of current and peak readings.
- Automatic shut-off after selected period of time: 1, 5, 10, 20 and 30 minutes.
- Non-volatile memory retains set-up after gage shutdown.

### **DATA OUTPUT**

- RS232, Mitutoyo and analog outputs.

### **POWER REQUIREMENTS**

- Unique power system provides up to 300 hours of continuous use with a single Lithium battery.
- Optional use of 9V alkaline battery, rechargeable Ni-Cad battery or battery eliminator.
- Display warns of low battery charge.

### **ACCESSORIES**

- The complete Force Five™ FDV System includes: Force Display Module, Force Cell Module, Lithium battery, battery eliminator, flat head, hook, carrying case, operating manual and NIST calibration certificate.
- Optional accessories include: Additional Force Cell Modules (5,10, 30, 50, and 100 LB), Ni-Cad or alkaline batteries, test stand adapter, various implements, accessories and data output cables.

### **ACCURACY**

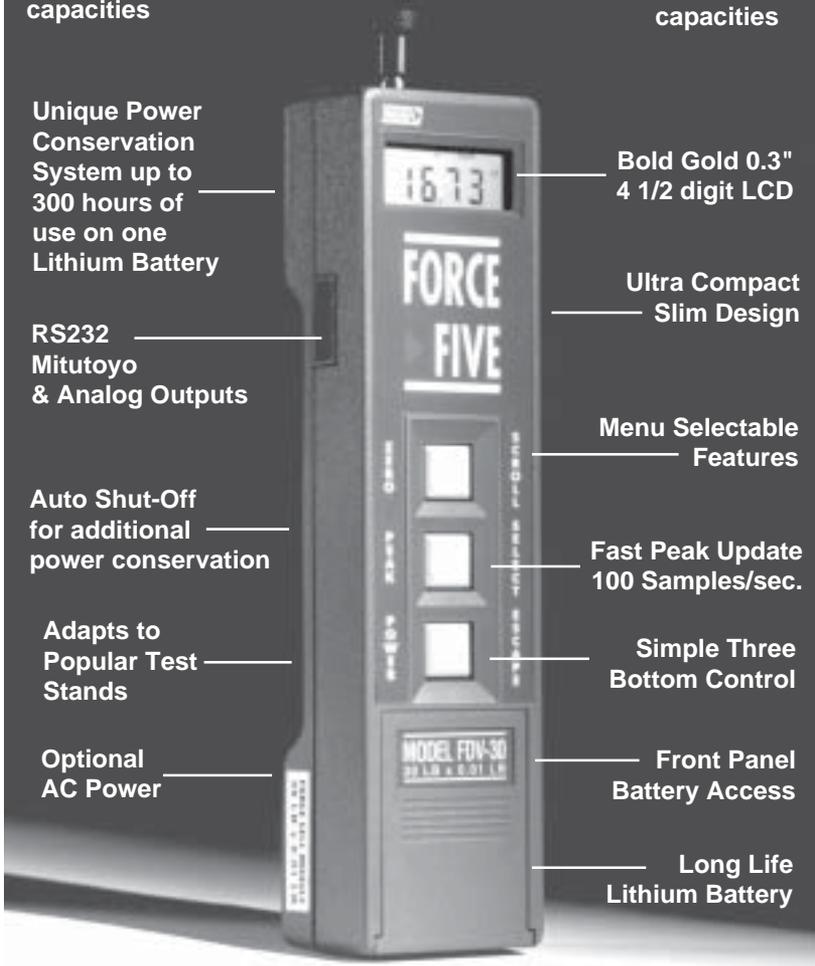
- Accurate to  $\pm 0.3\% \pm 1$  least significant digit; NIST calibration certificate is included with each gage.

## FORCE CELL MODULE

Five interchangeable modules available in 5, 10, 30, 50 & 100 lb capacities

## FORCE CELL MODULE

Five interchangeable modules available in 5, 10, 30, 50 & 100 lb capacities



Unique Power Conservation System up to 300 hours of use on one Lithium Battery

RS232 Mitutoyo & Analog Outputs

Auto Shut-Off for additional power conservation

Adapts to Popular Test Stands

Optional AC Power

Bold Gold 0.3" 4 1/2 digit LCD

Ultra Compact Slim Design

Menu Selectable Features

Fast Peak Update 100 Samples/sec.

Simple Three Bottom Control

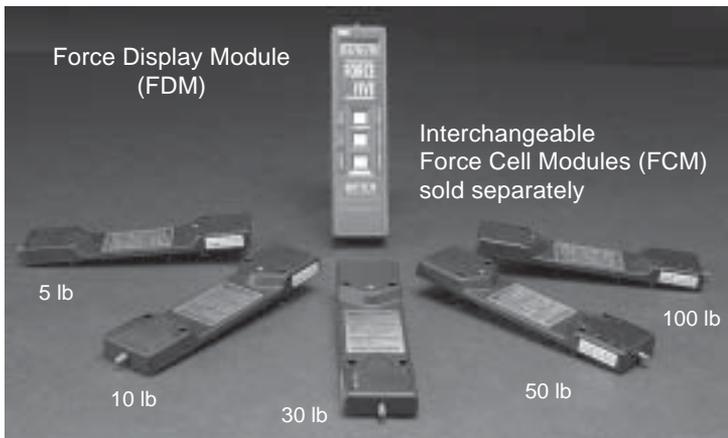
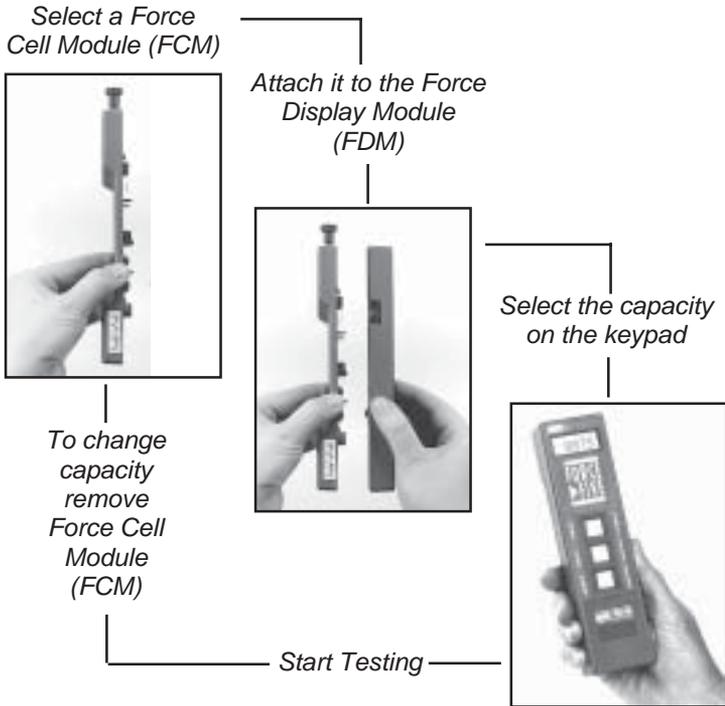
Front Panel Battery Access

Long Life Lithium Battery

## Patented Design

Patent #5,471,885

## B. HOW TO CHANGE CAPACITIES WITH FORCE FIVE™



Force Five (FDV) shown with all five optional Force Cell Modules (FCM)

### C. SPECIFICATIONS

ITEM	SPECIFICATIONS
Accuracy	0.3% of full scale 1 LSD
Sampling Rate	100 Samples per second
Power Consumption	Approximately 4 mA; 9V Lithium battery provides up to 300 continuous hours of operation
Display	High contrast 4 1/2 digit gold LCD with indicators for units, peak, tension, compression and low battery
Dimensions	7.75" x 2.0" x 1.35"
Weight	Approximately 10 ounces

### Wagner FDV Force Gages and Force Cell Modules

GAGE MODEL	FORCE CELL MODULE	ENGLISH	METRIC	NEWTONS
FDV 5	FCM 5	5 lb x 0.005 lb	2.5 kg x 0.002 kg	25 N x 0.02 N
FDV 10	FCM 10	10 lb x 0.01 lb	5 kg x 0.005 kg	50 N x 0.05 N
FDV 30	FCM 30	30 lb x 0.02 lb	15 kg x 0.01 kg	150 N x 0.1 N
FDV 50	FCM 50	50 lb x 0.05 lb	25 kg x 0.02 kg	250 N x 0.2 N
FDV 100	FCM 100	100 lb x 0.1 lb	50 kg x 0.05 kg	500 N x 0.5 N

## D. GENERAL INFORMATION

***The Wagner FDV Digital Force Gage is an economical full function electronic force gage. Before using the FDV, take time to become acquainted with its many features described in this manual.***

1. The FDV is equipped with a 9V Lithium battery, which provides up to 300 hours of operation. The long battery life is possible because of the power conservation features of the advanced circuit design and the high storage capacity of the Lithium battery. The automatic shut-off feature further extends battery life by allowing pre-set shut-off after 1, 5, 10, 20 or 30 minute intervals. (See Section F.4.3) When the "LO BAT" indicator appears on the LCD, a limited amount of power is still available from the battery.

The Lithium battery is recommended but may be replaced by any of the following 9V batteries: alkaline, carbon zinc, or NiCad rechargeable, with a reduction in operating time.

2. If the FDV is to be used in a stationary application, the battery eliminator (FDV/BE) may be preferred over a battery. To use the battery eliminator, connect the contact strap to the FDV battery strap and replace the battery cover after connection. A small slot is provided allowing the battery eliminator cord to pass through.
3. The FDV features a reversible Force Cell Module, allowing the gage to be used on a test stand with the shaft down or hand-held with the shaft up. To change the orientation, remove the four screws in the rear housing and carefully pull the front and rear halves apart. After rotating the halves 180°, carefully align the top and bottom housings and the center connectors, press the two halves together, and replace the screws.
4. The FDV features a programmable microprocessor with an internal sampling rate of up to 100 times per second. This sampling rate enables the gage to capture important peaks during testing. Varying degrees of filtering are also available to reduce the effects of electronic or mechanical background "noise" present in the test environment (See Section F. 4.4).

## READ THIS BEFORE USING THE FORCE FIVE

### RECOMMENDATIONS

1. *Warm-up time for the FDV is recommended. After initial power-on, allow 2 - 3 minutes for the electronics to stabilize. This will improve accuracy of readings.*
2. *Exercising the FDV is recommended. After initial warm up, apply approximately 100% of the FDV full load capacity prior to use. This eliminates residual hysteresis in the Force Cell Module.*
3. *Precise axial loading of 5 lb and 10 lb FDV force gages is recommended. When using the FDV 5 and FDV 10 Force Cell Modules take extra care to apply loads axially to the load shaft. This will avoid side loading of the Force Cell Module and prevent significant errors.*
4. *Lithium batteries are recommended. The FDV is originally equipped with a Lithium battery. The Lithium battery's shelf life is approximately 5 years and it will last 2 - 3 times longer than an alkaline battery, 8 times longer than a carbon zinc battery and 10 times longer than a re-chargeable NiCad battery.*
5. *A battery eliminator, AC power adapter, is recommended for stationary operations. When using an FDV on a test stand or fixture with AC power conveniently available, the battery eliminator is the preferred power source.*

## E. OPERATING INSTRUCTIONS

***The following instructions cover the basic operation of the FDV Digital Force Gage, allowing immediate use.***

1. To turn the FDV on, press the POWER button. If there is no display or if "LO BAT" is displayed, the battery may be low or not connected securely.

***CAUTION: When "HELP" is displayed it may indicate either:***

- 1) Force Cell Module is not securely connected.***
- 2) Force Cell Module has been overloaded and is damaged.***

***Call Wagner Instruments for instructions.***

***CAUTION: "LoAd" will appear on the display when the gage is first activated if the gage has been disconnected from the battery or AC power for an extended period of time, and the set-up menu has reverted to default settings. User must reset "LoAd" (see Section F.) and should check other menu settings before testing to assure that previously selected values are as desired. The FDV cannot be shut off in this mode until a value for "LoAd" has been selected.***

***RECOMMENDATION: Warm-up time for the FDV is recommended. After initial power-on, allow 2 - 3 minutes for electronics to stabilize. This will improve accuracy of readings.***

***RECOMMENDATION: Exercising the FDV is recommended. After initial warm up apply approximately 100% of capacity load prior to use. This eliminates residual hysteresis in the Force Cell Module.***

2. To turn the FDV off, press the POWER button. The FDV will shut down if set to do so and if no buttons have been pressed for the selected elapsed time. (See Section F. 4.3) All user defined functions remain stored in memory while the gage is shut off.
3. With the FDV oriented in the same position as it will be during use, press the ZERO button. This automatically tares the weight of any attachment on the shaft, sets the display to zero, and clears all peak readings.

**NOTE:** Although any weight or force up to 100% of the load cell capacity can be tared, the net capacity of the gage will decrease if the tare is more than 25% of the load cell nominal capacity:  
 $NET\ CAPACITY = 125\% \text{ NOMINAL CAPACITY MINUS(-) TARE}$

4. The LCD will display a "C" if the currently applied force is a compression force and a "T" if the currently applied force is a tension force.
5. Peak Hold - Displaying Peak Readings

The FDV continuously tracks the highest peak compression and highest peak tension readings. While tracking, the FDV also retains the peak values, allowing both peaks to be captured during a single test. Pressing the PEAK button activates the peak mode prior to commencing the test.

Pressing the PEAK button repeatedly, after concluding a test, displays in succession:

- Peak compression reading
- Peak tension reading
- Current applied force

If the currently displayed reading is a peak reading, then the "PEAK" indicator will be displayed. In addition, a peak compression reading will have the "C" indicator and a peak tension reading will have the "T" indicator displayed.

To clear the peak readings and zero the FDV for the next test, press the ZERO button. The FDV remains in the peak mode after the gage is zeroed. To exit the peak mode press the PEAK button, and to confirm, note that the "PEAK" indicator is no longer displayed.

**CAUTION: EXCESSIVE OVERLOADS over 25% above maximum capacity or IMPACT LOADING may cause permanent damage to load cell. EXERCISE CAUTION to prevent overloading or impact loading.**

**RECOMMENDATION:** Precise axial loading of 5 lb and 10 lb FDV force gages is recommended. When using the FDV 5 and FDV 10 Force Cell Modules take extra care to apply loads axially to the load shaft. This will avoid side loading of the Force Cell Module and prevent significant errors.

## F. SET-UP INSTRUCTIONS

*The FDV Force Gage features a variety of useful options. These options are selected through the set-up menu. The selection of many of these options needs only be done once.*

*The set-up menu is a two level menu that can be set by the user. At the top level are the menu options and within each of these options are the values to be selected for that option. The table below summarizes the menu options and the corresponding selectable values.*

<b>DISPLAY</b>	<b>MENU OPTIONS</b>	<b>SELECTABLE VALUES</b>
unit	Units	LB*, KG, N
AoFF	Automatic Shut-Off	no, 1, 5*, 10, 20, 30 minutes
FItD	Digital Filter Fc Current FP Peak	Average of 1, 2, 4*, or 8 samples Average of 1, 2, 4*, or 8 samples
LoAd	Force Cell Capacity	5, 10, 30, 50, 100 lb
SCAL	No User Access	None
232	RS232 Computer Interface	Enabled (E) or Disabled (d)*
tut	Mitutoyo Printer Interface	Enabled (E) or Disabled (d)*
CAL	Calibration	See Section H. Calibration

\* Asterisks indicate default or factory settings. Other values may be selected by the user.

## F.1 Accessing the Set-up Menu

1. Turn off the FDV
2. Press and hold SELECT
3. Press POWER
4. Release SELECT and POWER

The FDV will display “unit” (Units), the first Set-Up Menu option.

**NOTE:** An "Access to Set-up Menu" label is provided on the back of the FDV gage for quick reference.

## F.2 Button Control

The SCROLL button is alternately used to step thru:

- a) the menu options
- b) the selectable values within each option.

The SELECT button is used to:

- a) select the currently displayed value or,
- b) save the selected value.

The ESCAPE button is used to exit the Set-Up Menu.

## F.3 Basic Operation

1. After entry into the setup menu the display will first show “unit” (Units). Use the SCROLL button to step thru all the menu options. When a required option is displayed, press the SELECT button to move into the list of selectable values. The presently set value for that option is displayed first.
2. After an option is chosen and the presently set value for that option is displayed, review the alternatives by pressing the SCROLL button.

3. If you wish to change the value, press the SELECT button when the desired value is displayed; "donE" will appear on the display. To save the new value without changing any other values, press SELECT again. The new value selected has now been saved and the FDV returns to normal operation.
4. If all selectable values have been reviewed without SELECT having been pressed, the gage will return to the Set-Up Menu, retaining the presently set value.
5. To exit the Set-Up Menu and return to normal operation press the ESCAPE button at any time.

#### **F.4 Menu Options**

1. To access the Set-Up Menu:

- a) Turn off the FDV
- b) Press and hold SELECT
- c) Press POWER
- d) Release SELECT and POWER

**NOTE:** An "Access to Set-up Menu" label is provided on the back of the FDV gage for quick reference.

2. Units (unit)

The user has the option of displaying the readings of force in pounds, kilograms, or Newtons. During normal operation force units are displayed on the LCD. To change the units of force, scroll through the "unit" options and select the desired setting:

lb	pounds
kg	kilograms
N	Newtons

3. Automatic Shutoff (AoFF)

The FDV is designed to automatically turn off after a selected

period of inactivity (a period during which no buttons are pressed). The period of time can be selected as follows:

no	FDV does not shut off automatically
1	shuts off after 1 minute of inactivity
5	shuts off after 5 minutes of inactivity
10	shuts off after 10 minutes of inactivity
20	shuts off after 20 minutes of inactivity
30	shuts off after 30 minutes of inactivity

#### 4. Digital Filter (FItD)

Minor vibrations and electrical background noise in the test area, not related to the test, may be detected by the FDV. If it is impossible to isolate the FDV from these vibrations and/or electrical noises the FDV readings may be erratic. The FDV features four (4) levels of filtering for both the displayed and peak readings to minimize the effects of background noise.

- a) Filtering for Current Readings - The level of filtering required for currently displayed readings is quite similar to that required for peak readings. In this case however, the filtering for currently displayed readings will affect how frequently the display will be updated.

Filtering of currently displayed readings may be set as follows.

Fc1	Average of 1 sample (fast display update)
Fc2	Average of 2 samples
Fc4	Average of 4 samples
Fc8	Average of 8 samples (slow display update)

- b) Filtering for Peak Readings - The level of filtering required for peak readings is dependent on the nature of the test and the surrounding environment. Filtering will affect the maximum peaks recorded. To capture critical peak force, the lowest level of filtering (FP1) is recommended. If the gage is used in an environment with excessive background noise, the highest level of filtering (FP8) is recommended.

Filtering of peak readings may be set as follows:

FP1	Average of 1 sample (No filtering)
FP2	Average of 2 samples
FP4	Average of 4 samples
FP8	Average of 8 samples (High filtering)

c) Setting the Digital Filters - Fc and FP

After arriving at "Fltd" in the menu option, press SELECT to display the previous Fc setting (Fc 1, Fc 2, Fc 4 or Fc 8). To change the Fc setting press SCROLL until the desired setting is displayed. Press SELECT and "donE" will appear. DO NOT press SELECT again to save this setting.

Proceed immediately to the FP settings by pressing SCROLL after setting the Fc value ("donE"). The previous FP setting will appear (FP 1, FP 2, FP 4 or FP 8). To change the FP setting, press SCROLL until the desired setting is displayed. Press SELECT and "donE" will appear.

Now press SELECT again to save both the Fc and FP settings.

5. Force Cell Capacity (LoAd)

The capacity of the Force Cell Module (FCM) attached to the FDV must be entered into the setup menu (LoAd). After the "LoAd" option is chosen the presently set value is displayed first.

If the Force Cell Module (FCM) has been changed from one capacity to another, the new FCM capacity must be selected and saved. The choices are 1, 2, 5, 10, 30, 50, and 100 lb capacities (see Section G: Interchanging Force Cell Modules).

**CAUTION: "LoAd" will appear on the display when the gage is first activated if the gage has been disconnected from the battery or AC power for an extended period of time, and the set-up menu has reverted to default settings. User must reset "LoAd" (see**

**Section F.) and should check other menu settings before testing to assure that previously selected values are as desired. The FDV cannot be shut off in this mode until a value for "LoAd" has been selected.**

**NOTE:** Force Cell Modules in the 1 and 2 lb capacities are not available.

## 6. (SCAL)

NO USER ACCESS

## 7. RS232 Output (232)

The FDV Force Gage features an RS232 computer interface output, allowing the user to connect the gage to an IBM compatible computer. The RS232 output is enabled or disabled by selecting one of the following options:

232E	Enable RS232 output
232d	Disable RS232 output

## 8. Mitutoyo Output (tut)

The FDV also features a modified BCD output that is compatible with Mitutoyo printers. The Mitutoyo is enabled or disabled by selecting one of the following options:

tutE	Enable Mitutoyo output
tutd	Disable Mitutoyo output

## 9. Calibration (CAL)

It is most important that the FDV Digital Force Gage is tested periodically to confirm its accuracy. For a detailed procedure see Section H.

## G. INTERCHANGING FORCE CELL MODULES

*The WAGNER FDV Digital Force Gage presents the user with the unique ability to combine various capacity Force Cell Modules with a single Force Display Module.*

### G.1 Description

The FDV consists of two modules which connect to form a complete FDV Digital Force Gage.

The front half of the gage, the **Force Display Module (FDM)** contains the display, control buttons, battery, and electronics. All control functions are executed by the FDM, as well as user input by keypad entry and output by LCD display and output connector.

The rear half of the gage, the **Force Cell Module (FCM)**, contains a load cell force sensor and a structure capable of withstanding force loads up to 100 pounds. The Force Cell Module communicates the applied forces to the Force Display Module.

The versatility of the FDV is made possible with the interchangeability of the Force Cell Modules. After the initial purchase of a complete FDV gage, additional Force Cell Modules may be added to the system. This allows the user to interchange Force Cell Modules of 5, 10, 30, 50, and 100 pounds, by attaching them to the Force Display Module.

Interchangeability between Force Cell Modules is possible because all modules are calibrated to deliver a closely controlled output. All that is required of the user is to attach the required module and to enter the capacity of the Force Cell Module into the Force Display Module via the Set-Up Menu (See Section F).

### G.2 Connecting a new FORCE CELL MODULE (FCM)

1. Remove the 4 module attachment screws from the FCM (rear half).

2. Carefully detach the Force Display Module (front half) from the Force Cell Module (rear half) and set it aside.
3. Select the Force Cell Module you intend to use.
4. Carefully align the center connectors and press the modules together.
5. Replace the four screws. Proceed to the next Section - G.3.

**CAUTION: When "HELP" is displayed it may indicate either:**  
**1) Force Cell Module is not securely connected.**  
**2) Force Cell Module has been overloaded and is damaged.**

**Call Wagner Instruments for instructions.**

### **G.3 Selecting the Load Cell Capacity**

1. Enter the Set-Up Menu
  - a) Turn off the FDV
  - b) Press and hold SELECT
  - c) Press POWER
  - d) Release SELECT and POWER

**NOTE:** An "Access to Set-up Menu" label is provided on the back of the FDV gage for quick reference.

2. Scroll through the menu to the Load Cell Option (LoAd) and press the SELECT button.
3. Use the SCROLL button to step through the load cell capacities:

1	1 pound capacity (not presently available)
2	2 pound capacity (not presently available)
5	5 pound capacity
10	10 pound capacity
30	30 pound capacity
50	50 pound capacity
100	100 pound capacity

4. Press SELECT to make a selection; “donE” is displayed.
5. To save the option, press SELECT again. The display then returns to normal operation and the new load cell capacity is ready to use.

***CAUTION: In order to prevent accidental overloads, the capacity on the battery cover must correspond to the capacity of the Force Cell Module (FCM) in use. When changing the FCM, remember to change to the matching battery cover supplied with each FCM.***



*Force Five shown with optional Force Cell Modules.  
See Section N for available models.*

## H. CALIBRATION

***To ensure accuracy in force measurement, the FDV Digital Force Gage should be tested periodically to confirm that it is within tolerance.***

### H.1 Testing Calibration

The FDV Digital Force Gage is accurate to  $\pm 0.3\%$  of the gage's full scale capacity. To test calibration, a four point test is recommended, at weights equal to 25%, 50%, 75%, and 100% of the gage capacity. Four test weights, corresponding to the above percentages, are required. If the displayed weight should differ from the value of the test weight by more than 0.3%, the gage is out of calibration. Remember to tare any attachments prior to testing by pressing ZERO with the FDV shaft and hook attachment pointing down.

***RECOMMENDATION:*** Warm-up time for the FDV is recommended. After initial power-on, allow 2-3 minutes for the electronics to stabilize. This will improve accuracy of reading.

Since the FDV Force Gage consists of two separate parts, the Force Display Module (FDM) and the Force Cell Module (FCM), the total accuracy of the gage depends on the tolerance to specifications of either one or both of the modules. If the FDV does not meet the rated 0.3% accuracy, the gage should be returned to Wagner Instruments for evaluation and recalibration of the modules. Call Wagner Instruments for instructions prior to shipping.

### H.2 Auto-Calibration

Factory calibration is recommended but in special situations the gage may be calibrated in the field using the Auto-Calibration feature.

1. If the FDV is used **ONLY** as a non-interchangeable unit - only one Force Cell Module is used with only one Force Display Module - then the unit may be calibrated using the procedure outlined in Section H.3.

2. **If the FDV is used as an interchangeable system, then auto-calibration is NOT recommended.** When the Force Display Module is calibrated to one Force Cell Module, other Force Cell Modules cannot be interchanged or fitted to the Force Display Module.

### H.3 Auto-Calibration Procedure

1. Enter the Set-Up Menu
  - a) Turn off the FDV
  - b) Press and hold SELECT
  - c) Press POWER
  - d) Release SELECT and POWER

**NOTE:** An "Access to Set-up Menu" label is provided on the back of the FDV gage for quick reference.

2. Scroll through the menu until reaching "CAL", press SELECT button to start the calibration procedure.
3. The display will read "null", since no weights being hung from the gage.
4. Attach any accessories required for hanging test weights.
5. Press SELECT to accept the zero value - a short pause follows.
6. The gage will display "LXXX", where "XXX" is the capacity of the load cell.
7. Hang weights equal to the capacity of the gage, which should equal the "XXX" value.
8. Press SELECT to accept this as the full scale weight; the gage will pause.

**NOTE:** *If the test weight differs by more than 15% from the capacity of the load cell then the gage will not calibrate; the display will show "nnnn" if the weight is higher than expected, "uuuu" if the weight is lower than expected.*

9. If the calibration is successful the gage will display the full scale output of the Force Cell Module. Press SELECT to display "donE" and SELECT again to return to normal operation.

## H.4 Reversing Auto-Calibration

A gage that has been calibrated in the field using the auto-calibration feature is temporarily a dedicated gage, unable to be used with interchangeable load cells. A dedicated gage may be reset to accommodate interchangeable Force Cell Modules by reversing the auto-calibration function. This is accomplished by entering the setup menu, selecting CAL and attempting to CAL with a zero load.

1. Enter the Set-Up Menu
  - a) Turn off the FDV
  - b) Press and hold SELECT
  - c) Press POWER
  - d) Release SELECT and POWER

**NOTE:** An "Access to Set-up Menu" label is provided on the back of the FDV gage for quick reference.

2. Scroll through the menu until reaching "CAL", press SELECT button to start the calibration procedure.
3. The display will read "null", since no weights being hung from the gage.
4. Press SELECT to accept the zero value - a short pause follows.
5. The gage will display "LXXX", where XXX is the capacity of the load cell.
6. With a zero load value displayed, press SELECT.
7. Gage displays "uuuu" (under).
8. Press the power switch.

To confirm the successful completion of this procedure, re-enter the set-up menu and scroll to SCAL. Press SELECT. The SCAL value should read 2.500, the calibration value necessary for free interchange of FCM Force Cell Modules. If SCAL displays any value other than 2.500, the Force Display Module is still dedicated to a single Force Cell Module and is not interchangeable. The SCAL value may only be adjusted via the Auto-calibration feature. It is not accessible in any other way.

## J. DATA OUTPUT

*The Wagner FDV Force Gage offers data output in three formats: RS232, Mitutoyo, and analog. The following sections describe these outputs and their usage. Refer to Section K for output pin assignments.*

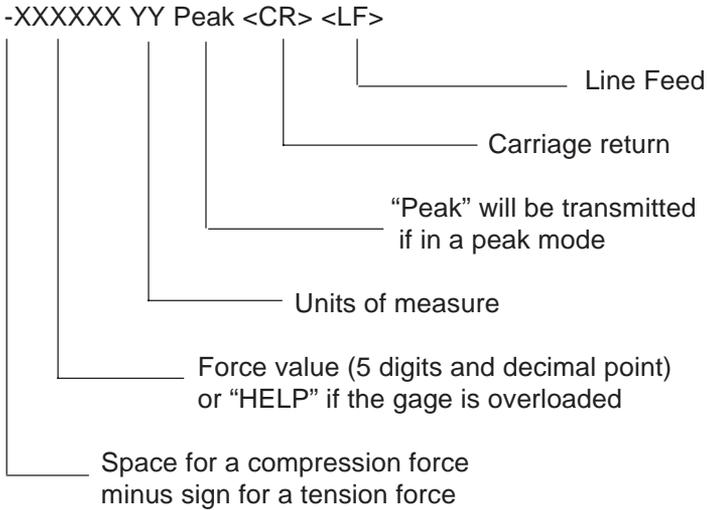
### J.1 RS232 Output

The FDV will transmit data in the RS232 format, which is commonly used in communication between IBM compatible computers and microprocessor controlled devices.

The RS232 data that is transmitted will be equivalent to the value that is shown on the gage display when the data is transferred. The RS232 data is transferred continuously at a rate of 4.5 points per second with the following parameters:

Baud Rate	2400
Word Length	8 bits
Stop Bits	1
Parity	None

The RS232 data is transferred in the following format:



## J.2 Mitutoyo Output

The Mitutoyo data format is a modified BCD (binary coded decimal) format that is used in communication with Mitutoyo statistical process control printers.

To transmit the value shown on the FDV display to a Mitutoyo printer, the user may either:

- A. Press the PEAK and ZERO buttons simultaneously,
- or
- B. Press the DATA button on the Mitutoyo processor.

If the gage is overloaded there will be no response.

### J.3 Analog Output

The FDV features a  $\pm 1.0$  Vdc analog output which is used with analog recording devices, including strip chart recorders and X-Y plotters.

1. Compression Forces - The output is 0 Vdc with no force applied to +1 Vdc with full scale force applied.
2. Tension Forces - The output is 0 Vdc with no force applied to -1 Vdc with full scale force applied.



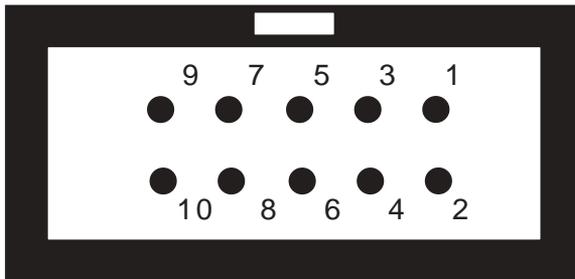
*Force Five shown with Wagner FTS 100 Tester and Mitutoyo printer*

## K. PIN ASSIGNMENTS

The 10-pin female output connector of the FDV is located on the left side of the gage. Three outputs - RS232, Mitutoyo, and Analog - are available from this connector. The pin assignments are as follows:

PIN#	SYMBOL	DATA TYPE	DESCRIPTION
1	GND	Mitutoyuo	Signal Ground
2	DATA	Mitutoyo	Transmitted Data
3	CK	Mitutoyo	Clock
4	RD	Mitutoyo	Ready
5	REQ	Mitutoyo	Request
6	GND	RS232	Ground
7	TXD	RS232	Transmitted Data
8	RXD	RS232	Not Used by FDV
9	AGND	Analog	Ground
10	AOUT	Analog	Analog Signal

The output connector has its pins arranged in the following manner:



## **L. MOUNTING INFORMATION**

***The FDV Digital Force Gage may be mounted onto most of the popular light capacity test stands using the two #8-32 threaded mounting holes provided on the back of the FDV Force Gage.***

### **L.1 Mounting on Wagner Test Stands**

The FDV may be mounted onto both the Wagner FTS 100 and FTC 100 test stands with the use of mounting kit FT/FDV included in the price of the stand. Please specifically request this kit when ordering either test stand.

### **L.2 Mounting on Ametek Test Stands**

The FDV may be mounted onto Ametek test stands, Models 100, RP and CTM with the use of the optional mounting adapter kit FDV/APR available in the Wagner catalog.

### **L.3 Mounting on Chatillon Test Stands**

The FDV may be mounted onto Chatillon test stands, Models LTS, LTC, TCM and TCD, with the use of the optional mounting adapter kit FDV/APL available in the Wagner catalog.

## **M. POWER SUPPLY**

### **M.1 PRIMARY SOURCE OF POWER**

The best source of power should be determined by the planned use of gage. For portable usage, battery power is the best choice. For stationary use, the battery eliminator is recommended.

### **M.2 BATTERY**

Any of the various 9 Volt (2 contact snap-on style) batteries may be used to power the FDV, but with a wide variation of endurance. Battery power options include; Lithium (supplied as original equipment), alkaline, carbon zinc or rechargeable Ni-Cad. Generally, the Lithium battery will last twice as long as an alkaline, eight times longer than a zinc-carbon, and ten times longer than the Ni-Cad. The shelf life of the Lithium battery is about 5 years, so keeping a spare Lithium battery in the FDV carrying case is recommended. However, any of the similar 9 Volt batteries may be used as a temporary backup.

### **M.3 CHANGING BATTERIES**

The FDV will display a "Lo Bat" indicator when battery power is low. Although a limited amount of battery life may remain when "Lo Bat" is indicated, it is recommended that the battery be changed as soon as possible. The FDV features easy access to the battery compartment via a sliding door located on the front of the gage below the POWER button.

To change the battery:

1. Always turn the FDV off before disconnecting the gage from its power source, either battery or AC power. Disconnecting the gage from its power source while the unit is running may result in the loss of menu and auto-calibration settings. Menu settings will also revert back to default values if the gage is left without any power source for several hours.

***CAUTION: "LoAd" will appear on the display when the gage is first activated if the gage has been disconnected from the battery or***

***AC power for an extended period of time, and the set-up menu has reverted to default settings. User must reset "LoAd" (see Section F.) and should check other menu settings before testing to assure that previously selected values are as desired. The FDV cannot be shut off in this mode until a value for "LoAd" has been selected.***

2. Remove battery door by sliding downward.
3. Carefully remove battery from snap - be careful not to pull battery leads away from the PC board.
4. Install new 9V battery into battery snap. Make sure that the contacts between the battery and the battery snap are snug.
5. Replace battery into compartment and slide battery door into place.

## N. FORCE FIVE™ DIMENSIONS

