

CHATILLON® DFGS Series ACCUFORCE® AF3 Series

Digital Force Gauges with Integral Loadcell

Operating Instructions



*CHATILLON® DFGS Series
Digital Force Gauge*



*ACCUFORCE® AF3 Series
Digital Force Gauge*

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PRODUCT WARRANTY

This instrument is warranted against defects in workmanship, material and design for one (1) year from the date of delivery to the extent that AMETEK will, at its sole option, repair or replace the instrument or any part thereof which is defective provided, however, that the warranty shall not apply to instruments subjected to tampering or abuse, or exposed to highly corrosive conditions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED AND AMETEK HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. AMETEK SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, ANY ANTICIPATED OR LOST PROFITS.

This warranty is voidable if the purchaser fails to follow any and all instructions, warnings or cautions in the instrument's operation manual.

If a manufacturing defect is found, AMETEK will replace or repair the instrument or replace any defective part thereof without charge; however, AMETEK's obligation hereunder does not include the cost of transportation which must be borne by the customer. AMETEK assumes no responsibility for damage in transit, and any claims for such damage should be presented to the carrier by the purchaser.

PRECAUTIONS

- **Read the instruction manual completely before attempting to use the DFGS or ACCUFORCE 3 (AF3) Series.** By following the instructions contained in this manual, the optimum accuracy and performance can be attained.

***IMPORTANT NOTE:** The DFGS and ACCUFORCE 3 (AF3) gauges are identical in functionality. The procedures, specifications and operations in this manual apply to both products unless noted.*

- **Turn off the DFGS/AF3 Series** before connecting or disconnecting any cables to the instrument.
- **Do not overload the DFGS/AF3 Series!** The instrument can handle an overload of up to 150% of the rated full scale. The display will read “- - -” when the gauge exceeds approximately 120% of full scale. When the force applied is removed and “- - -” is no longer displayed, the gauge may not read above 121% of full scale in the Tension Peak or Compression Peak modes. Therefore, you must contact your local distributor to ensure the load cell was not damaged, unless you are 100% sure the force applied did not exceed 150% of full scale.
- **The DFGS/AF3 Series is designed for axial loading only!** Applying load on an angle or eccentric loading may cause an erroneous reading.
- **Do not use tools to attach the shaft adapter and accessories to the gauge.** Use “finger-tight” torque only to prevent damage to the load cell.

***IMPORTANT NOTE:** Before using your new DFGS/AF3 Series, fully charge the rechargeable Nicad battery by plugging the supplied battery charger into the battery charger jack at the top of the gauge and the proper AC outlet. Use only the battery charger supplied with the gauge. Using other chargers can overcharge and damage the battery.*

1.0 INTRODUCTION AND PRODUCT OVERVIEW

The *DFGS/AF3 Series* family of digital force gauges manufactured by AMETEK Test and Calibration Instruments Division. They have been designed to provide accurate compression and tension force measurements via an internal load cell. These instruments have been precisely crafted to provide years of reliable service. Each gauge comes equipped with a rechargeable battery pack, AC battery charger, Accessory Attachments, and a handy Carrying Case.

1.1 PRODUCT FEATURES

The key features of the *DFGS/AF3 Series* are:

- Load capacity up to 100 lbs (50 kg, 500 N)
- Internal sampling rate of 5000 Hz
- Displays Tension (T) or Compression (C)
- Configurable Setpoints (2) with Audible Alarm
- Simple keypad operation
- Automatic power shutoff
- Mounting arrangements for attaching to Manual and Motorized Test Stands
- Readings can be scaled using several engineering units: LB, KG, N, G, OZ
- Field calibration
- Analog and Digital outputs through common connector
- Can be controlled remotely via RS-232 port

1.2 ELECTRICAL SAFETY

These instruments have been assessed against the essential health and safety requirements of the Low Voltage and the EMC Directives listed below. Based on conformity with the listed directives, the DFGS and AF3 are compliant with the following:

Directive	Test Standard	
EMC Directive (89/336/EEC)	EN 50081-1	EMC Generic Emissions Standard
	EN 50082-1	EMC Generic Immunity Standard
Low Voltage Directive (73/23/EEC)	EN 61010-1	Safety Requirement for Electrical Equip

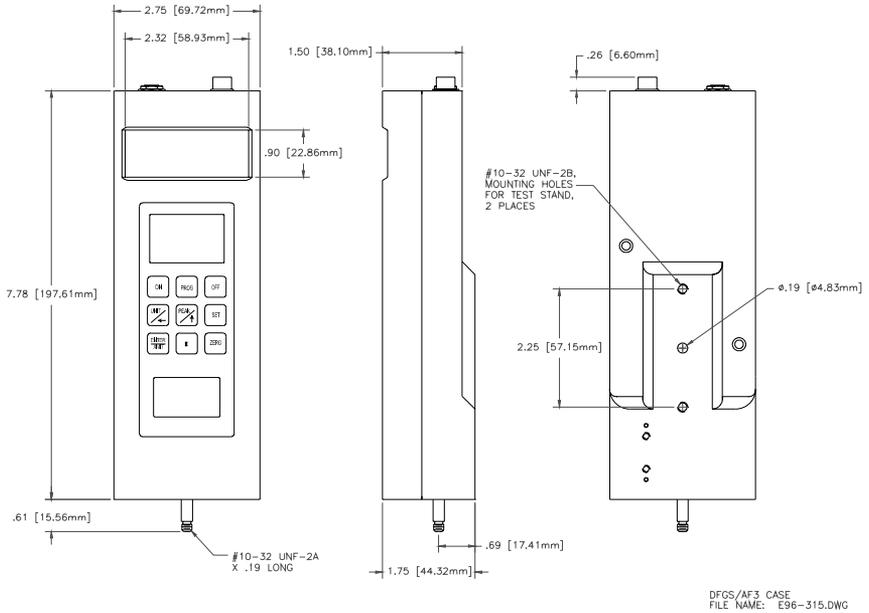
1.3 RECHARGING BATTERIES

A rechargeable NiCad battery powers the *DFGS/AF3Series*. Since NiCad batteries continue to discharge when not in use, it may be necessary to recharge the unit before use. When the battery power begins to lose its charge, the Battery Indicator will appear on the display. To recharge the battery, plug the battery charger included with the gauge into the correct voltage source and insert the charger jack into the receptacle on the end of the gauge. Charge the battery for 10-12 hours to yield approximately 8-10 hours of continuous operation. The gauge can be operated continuously with the charger connected.

- WARNING -

Before using the gauge, please fully charge the Nicad battery. Use only the battery charger supplied with the gauge. Using other chargers can overcharge and damage the battery.

1.4 PHYSICAL DIMENSIONS



Test Stand Type	Adapter Part No.	Description
LTS	-	Mounts directly to LTS mechanical test stand
LTC	-	Mounts directly to LTC mechanical test stand
HTC	HTCK-2	Adapts to HTC mechanical test stand
MT	SPK-MT-DFGS	Adapts to MT mechanical test stand
TT	NC002582	Adapts to TT pneumatic tester
LTCM-6	SPK-FM200-019	Adapts to LTCM-6 series motorized stand
TCM201	SPK-FM200-019	Adapts to TCM201 series motorized stand
LFPLUS	SPK/LFM/0005	Adapts to LFPLUS series digital stand
TCD200	SPK-FM200-019	Adapts to TCD200 series digital stand

Table 1.4 Test Stand Adapter Kits

1.5 REVERSIBLE HOUSING

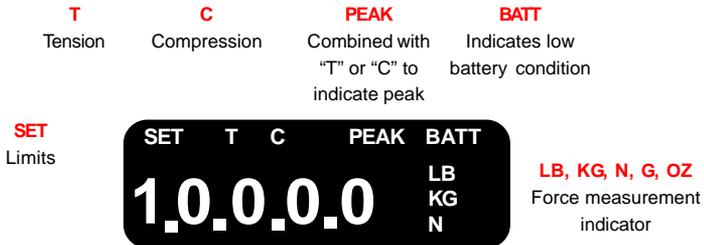
The *DFGS/AF3 Series* is shipped shaft-down for stand-mounted applications, and the display on the front of the gauge is configured accordingly. For performing operations in which the gauge will be hand-held, it may be desirable to rotate the front of the casing so that the display and logo will be shown right side up. To do so, remove the two screws from the back of the casing, carefully rotate the front of the casing 180 degrees being careful not to pull, pinch, or twist the wires inside, and then reinstall the screws.

NOTE: When removing the screws to the back casing for any reason, please take the proper ESD (Electro Static Discharge) precautions. Touching the circuit board without taking the proper ESD precautions may cause damage to the circuit board.



1.6 ABOUT THE DISPLAY

The display is an LCD seven segment display that is easily read even at a distance. The display illustrates different symbols such as: battery symbol (BATT) indicating the battery is running low; a "C" for compression or a "T" for tension. The peak operational modes are also displayed (T PEAK, C PEAK). The right portion of the display indicates the force measurement units (LB, KG, N, G, OZ). The display updates 4 times per second.



-WARNING -

Force reading accuracy may be affected by a low battery condition. BEFORE using the force gauge for the first time, fully charge the rechargeable NiCd battery. Plug the charger into the gauge's charge jack and into an AC outlet.

Always charge the battery whenever the BAT indicator is highlighted. A minimum charge of 8 hours is recommended.

1.7 ABOUT THE KEYPAD

The keypad consists of nine membrane keys. The keys are described below.

ON key is used to power the gauge.

PROG key allows you specify configurable functions including an audible buzzer that sounds when a limit is reached; communication with a test stand to stop the stand's crosshead travel when a setpoint or limit is reached; activate/deactivate the automatic power shutoff feature.

OFF key is used to turn power off to the gauge. An automatic power shutoff feature may be used that turns power off to the gauge when the gauge has been inactive for 10 minutes.

UNIT/_ key is a dual function key. The key is used to select the desired force measurement units (oz, lb, g, kg, N). The key is also used to navigate across a displayed value.

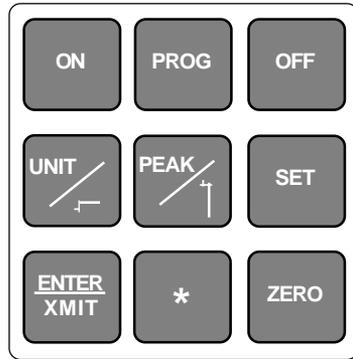
During setup the user can navigate from the left-most displayed value (Least Significant Count) to the right-most displayed value (Most Significant Count) and to the "T" for tension and "C" for compression.

PEAK/L key is a dual function key. The key is used to activate/deactivate the Peak Hold feature which freezes the display at the peak value that occurred during a test. The display will indicate "T PEAK" for peak tension or "C PEAK" for peak compression.

During setup, the key is used to change setpoint values. Depressing the **L** key will increase the currently displayed value by one value.

SET key is used to set the HIGH limit, LOW limit and to activate/deactivate the setpoint function.

ENTER XMIT is a dual function key. It is used to accept values configured into the gauge firmware (ENTER) and also used to initiate data transmission to an external device, e.g. personal computer (XMIT).



*Figure 1.2
Keypad Layout*

The ***** key is used in conjunction with other key combinations.

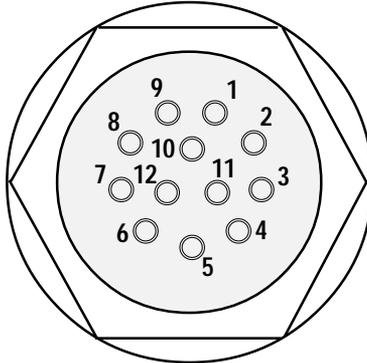
*** ZERO** is used to erase all values stored and zero the display.

*** PROG** is used after setpoint setup to activate the audible alarm.

ZERO key is used to zero the values being displayed. Use the **ZERO** key in combination with the ***** key to erase all values stored in the gauge memory and to zero the display.

1.8 CONNECTION TO EXTERNAL DEVICES

The *DFGS/AF3 Series* can be configured to accept input from an external source, and/or to send output to an external data-recording device, such as a strip chart recorder, an RS-232 or MITUTOYO printer, or a personal computer. It can be used in combination with CHATILLON Test Stands and application software such as NEXYGEN to meet a wide variety of application requirements. To connect the gauge to a device, attach the appropriate interface cable to the port located at the top of the gauge, and the other end to the external device.



*I/O Connector
(View from Solder End)*

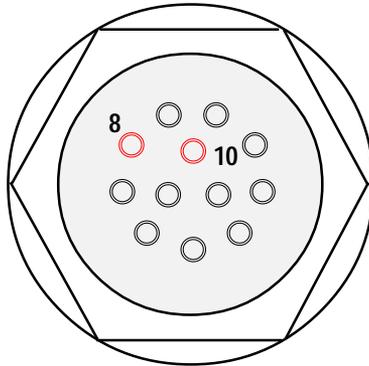
The *DFGS/AF3 Series* is supplied with a 12-pin female connector to provide both digital and analog outputs. AMETEK offers a variety of cables to handle most applications (Refer to [Section 1.10](#)). Select the cable type required to connect the gauge to the peripheral device using the mating connector. The pinout of the connector is shown above. Pin assignments are defined in the table below.

PIN	Symbol	I/O	Purpose	Description
1	TXD	O	RS-232	Transmitted Data
2	RXD	I	RS-232	Received Data
3	GND	-	Ground	Digital Ground
4		-	Clock	Mitutoyo Clock
5		I	Ready	Mitutoyo Ready
6		I	Request	Mitutoyo Request
7		O	Data	Mitutoyo Data
8		I	Detect	Sense Contact Closure
9		O	Setpoint	Setpoint Output Signal
10		-	Ground	Digital Ground
11		-	Analog GND	Analog Ground
12		O	Analog SIG	Analog Output

Table 4.3 I/O Connector Pinout

1.9 CONTACT CLOSURE APPLICATION

The *DFGS/AF3 Series* can be configured to capture force and peak readings based on a contact closure. When Pin 8 and Pin 10 on the output connector are shorted together, the gauge will stop reading data from the loadcell. The gauge will freeze both the displayed value and the peak value in memory at the moment the contact closure occurred. All remaining gauge functions remain operational. The peak value may be recalled from memory, the units changed, the data transmitted, etc. When the short across Pin 8 and Pin 10 is reopened, the gauge will return to normal operation.



*Contact Closure Application
(Short Between Pin 8 and Pin 10)*

1.10 INTERFACE CABLES

Cable	Description
NC000850-1	9 ft (2.7m), Connects to personal computer with 9-pin RS232 connection
NC000850-2	20 ft (6.1m), Connects to personal computer with 9-pin RS232 connection
NC000652	6 ft (1.8m), Connects to a personal computer with a 25-pin RS-232 connection.
NC000652-1	10 ft (3m), Connects gauge to a personal computer with a 25-pin RS-232 connection.
NC000652-2	15 ft (4.6m), Connects to a personal computer with a 25-pin RS-232 connection.
NC000652-3	20 ft (6.1m), Connects to a personal computer with a 25-pin RS-232 connection.
NC000653	6 ft (1.8m) Connects gauge to X-Y recorder (double banana)
NC000654	5 ft (1.5m) Connects gauge to a Mitutoyo device, 10-pin
NC000697	10 ft (3m) Connects gauge to a Mitutoyo device, RS232
NC000698	10 ft (3m) Connects gauge to a Datamate
NC000647	6 ft (1.8m) Connects to CHATILLON Model TCD
ENC0125	8 ft (2.4m) Connects to CHATILLON Model TCM

1.11 SETTING UP FOR SAFE USE

The *DFGS/AF3 Series* should be properly setup before accurate and most of all, safe measurements can be made.

Only when you have verified that you will be conducting a safe test, proceed as follows:

1. Determine what and how it will be tested and verify that the *DFGS/AF3 Series* can handle the test.
2. If desired, mount the gauge in the test fixture.
3. If you will be powering the instrument from the AC line, plug the charger into its jack on the instrument. Plug the charger into the correct AC voltage outlet (the required AC voltage and frequency are listed on the charger).
4. Otherwise, if you will be powering the instrument from batteries, fully charge the batteries before using.

IMPORTANT NOTE: Before using your new *DFGS/AF3 Series*, fully charge the rechargeable Nicad battery by plugging the supplied battery charger into the battery charger jack at the top of the gauge and the proper AC outlet. Use only the battery charger supplied with the gauge. Using other chargers can overcharge and damage the battery.

5. Attach all necessary attachments and plug in the cables. Route the cables so they do not interfere with the test.
6. Zero the gauge by depressing the ZERO key.
7. Attach the specimen and begin to take measurements.

2.0 FRONT PANEL OPERATION

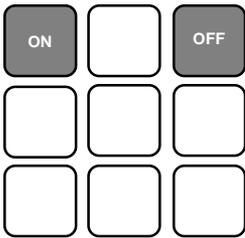
The *DFGS/AF3 Series* can operate in one of the three modes: Normal, Data Collect and Configuration.

2.1 NORMAL MODE

The principal function of the Normal mode is to provide indications of load applied to the load cell. *Instantaneous force*, *peak-tension* and *peak-compression* readings can be displayed and scaled in a variety of units of measure.

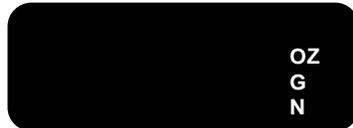
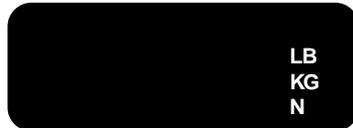
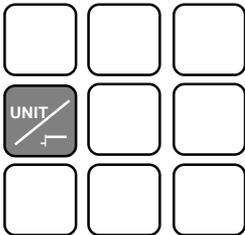
2.1.1 Powering Gauge

There are dedicated function keys to power the *DFGS/AF3 Series*. To apply power to the gauge, depress the ON key. To remove power to the gauge, depress the OFF key.



2.1.2 Selecting Units of Measure

Force indications can be displayed in LB, KG, and N or G, OZ and N. The gauge displays the active units of measure on the LCD display. Pressing the UNIT key will cycle between the three available measuring units.



With gauge power ON, depress the **UNIT** key to cycle through available force measurement units (LB, KG, N, G, OZ). Release the key when the desired unit is displayed.

2.1.3 Selecting Type of Measurement – Capturing Peaks

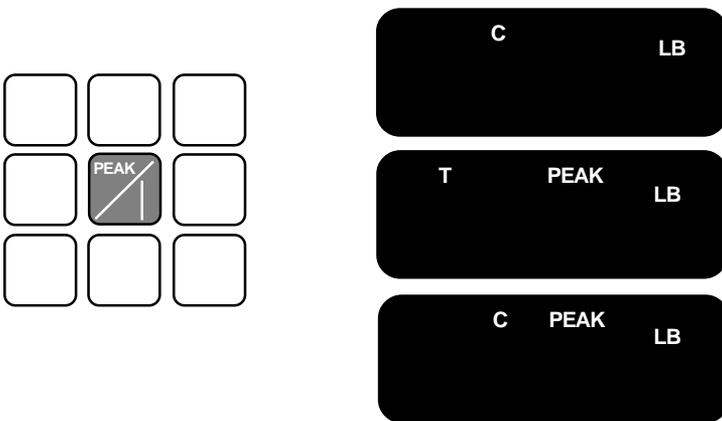
The gauge continuously measures instantaneous tension or compression forces (normal readings). It also captures peak-tension and peak-compression forces. The gauge displays which measurement is being indicated. Pressing the PEAK key will cycle between the available force measurement modes.

-WARNING -

Normal mode readings are an average of 600 instantaneous readings taken over a 120mS period. It is the force displayed whenever the peak mode is not configured (T PEAK or C PEAK). This digital filtering is used to eliminate the effects from noise or vibration that may cause false readings.

No digital filtering is used when the peak mode is configured. A noise elimination algorithm is employed however.

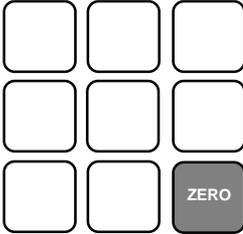
The peak reading is the maximum value of the individual instantaneous reading which the gauge captures.



With gauge power ON, depress the **PEAK** key to cycle through available force modes (C, T, T PEAK, C PEAK). Release the key when the desired unit is displayed. The display will indicate C until tension is applied to the loadcell. This will cause the display to indicate tension (T).

2.1.4 Tare, Zero and Clear Memory

Zeroing allows you to exclude the weight of accessories and attachments from the indicated force readings. It also clears captured peak tension and compression readings. To zero the gauge, momentarily press the ZERO key. Only the current measurement type (i.e., NORM, T-PK, C-PK) will be zeroed. To zero and clear all measurement types press and hold the PEAK key and then press the ZERO key. Zeroing the gauge takes approximately 0.5 seconds.



To TARE, affix the required adapter or fixture to the gauge. Orient the gauge so that it is positioned as it will be during testing. Depress the ZERO key to tare the gauge.

To ZERO, after a test, depress the ZERO key to zero the force readings. Removing power to the gauge will also zero the force readings.

To CLEAR all stored force readings in the gauge memory, simultaneously depress * and ZERO.

2.1.5 Setting Limits

Limits are set by depressing the SET key. It is very important when setting limits to clearly understand the relationship between limits and whether the gauge is in tension or compression mode.

-WARNING -

Tension (T) is considered as negative compression. Therefore, the more negative of the two limits for the gauge must be stored as the LOW LIMIT.

For tension testing, where the two limits are 5 lbs and 20 lbs, the 20 lb limit is more negative and must be entered as the LOW LIMIT. The HIGH LIMIT would be set at 5 lbs.

For compression testing, where the two limits are 5 lbs and 20 lbs, the 5 lb limit is more negative and must be entered as the LOW LIMIT. The HIGH LIMIT would be set at 20 lbs.

The audible alarm will "buzz" if the limits are set incorrectly.

2.1.5.1 Setting High Limit



To set the HIGH LIMIT (C), depress **SET**. The high limit will be displayed. The SET icon will also be displayed along with the "C" indicating that you are in the setup mode for HIGH LIMIT.

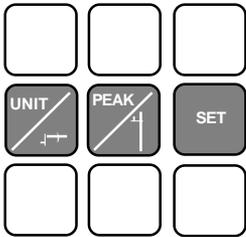
The least significant count (right-most number) will flash repeatedly. A flashing number may be changed using the **↑** key. To change the number, depress the **↑** key to the required number. When the gauge displays the required number, move to the next number by depressing the **→** key. The number will flash indicating that it can be changed. Use the **↑** key to change the number. Continue moving through the display until you have specified the desired HIGH LIMIT.

Depress the **ENTER** key to accept the displayed HIGH LIMIT value. You may depress the ENTER key at any time to accept the displayed value.

-WARNING -

The least significant count is only displayed as a half count (5 or 1) on gauges with the following capacities: 10 and 100.

2.1.5.2 Setting Low Limit



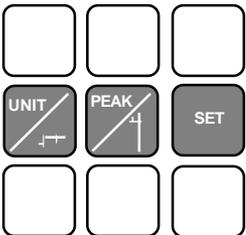
To set the LOW LIMIT (T), depress **SET**. The low limit will be displayed. The SET icon will be displayed along with the "T" indicating that you are in the setup mode for LOW LIMIT.

The least significant count (right-most number) will flash repeatedly. A flashing number may be changed using the  key. To change the number, depress the  key to the required number. When the gauge displays the required number, move to the next number by depressing the  key. The number will flash indicating that it can be changed. Use the  key to change the number. Continue moving through the display until you have specified the desired LOW LIMIT.

Depress the **ENTER** key to accept the displayed HIGH LIMIT value. You may depress the **ENTER** key at any time to accept the displayed value.

2.1.6 Activating Limits

Once the Limits setup is complete and the ENTER key is depressed, the display will indicate "LLO". If the "LLO" is flashing, the specified limits are ACTIVE. If the "LLO" is displayed in a steady state (Not flashing), the limits are not active.



The gauge will display a flashing LLO when the LIMITS are **ACTIVE**. To change to an inactive state, depress the  key.

If the display indicates a steady LLO, the LIMITS are **NOT ACTIVE**. To change to an active state, depress the  key.

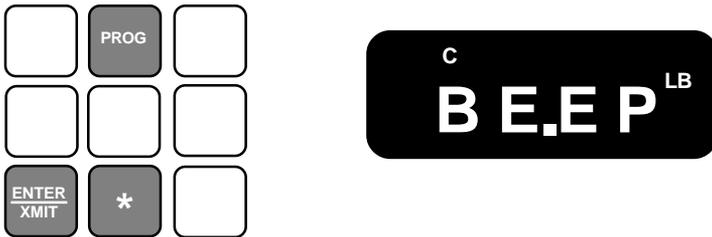
2.1.7 Audible Alarm, Auto Shutoff, Machine Control

-WARNING -

The Audible Alarm (buzzer), Auto Shutoff and Machine Control features cannot be independently configured. All three features must be configured each time a change is made to any of the three features.

2.1.7.1 Activating Audible Alarm- Buzzer

The DFGS/AF3 Series features an audible alarm that is associated with the setup of limits. When limits are setup for the gauge, the gauge can be configured to “buzz” whenever the HIGH or LOW limit is reached. The audible alarm cannot be configured until the limits have been configured. The user can also elect not to use the audible alarm and deactivate the alarm feature.



-WARNING -

To activate the audible alarm, you must first configure the High and Low LIMITS. The alarm will not “buzz” unless the limits are first selected. You may NOT configure the alarm before the limits are set.

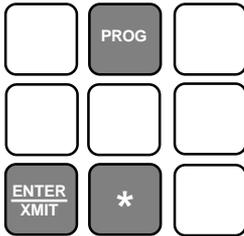
To activate the ALARM “buzzer”, depress and HOLD the * key and simultaneously depress the PROG key. The display will indicate a flashing “BE.EP”.

To enable the audible ALARM, depress the ENTER key. The display will indicate a flashing “S.SP” showing that the “buzzer” will sound whenever a limit has been reached and that the gauge is ready for machine control setup.

To disable the audible ALARM, depress the PROG key. The display will indicate a steady “S.SP” showing that the “buzzer” is not active. The “buzzer” will NOT sound whenever a limit is reached.

2.1.7.2 Activating Machine Control

Whenever the DFGS/AF3 Series is used with a TCD Series test stand, the gauge must be setup for machine control. This function permits the gauge to send the appropriate signal to the test stand to STOP the crosshead whenever the configured HIGH or LOW LIMIT is reached.



-WARNING -

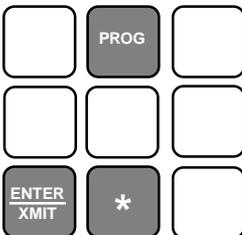
To activate Machine Control, you must first configure the High and Low LIMITS. Next you must configure the audible alarm. You may NOT configure the gauge for Machine Control until the Limits are setup and the audible alarm has been configured to be active or inactive.

To activate MACHINE CONTROL, depress the **ENTER** key. The display will indicate a flashing "L .H". This indicates that the gauge is configured for machine control. Whenever a limit is reached, the gauge will send a signal to the test stand that will stop the crosshead.

To deactivate MACHINE CONTROL, depress the **PROG** key. The display will indicate a steady "L .H" showing that the gauge is not setup with machine control.

2.1.7.3 Activating Auto Shutoff

The automatic shutoff feature is intended for battery operations and is designed to help preserve battery life. If the DFGS/AF3 Series is inactive (no changes in load, no key actions, no communications) for a 10 minute period, the gauge will automatically power down and shutoff.



-WARNING -

The Auto Shutoff feature removes power to the gauge. Whenever power is removed from the gauge, the gauge ERASES all stored peak data from memory. This information is NOT recoverable. Exercise care when activating this feature.

To activate AUTO SHUTOFF, depress the **ENTER** key. The gauge will display the specified operating mode.

To deactivate AUTO SHUTOFF, depress the **PROG** key. The gauge will display the specified operating mode.

2.2 CONFIGURATION MODE

The Configuration Mode facilitates the communications setup for the gauge.

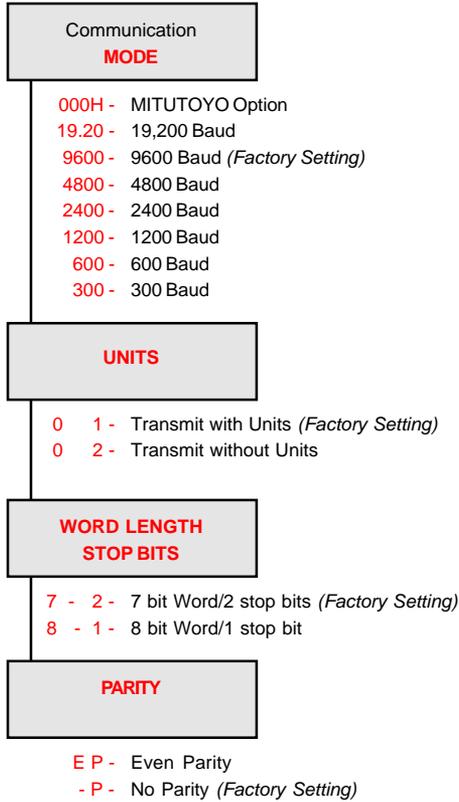


Figure 2.2 Communication Setup Hierarchy

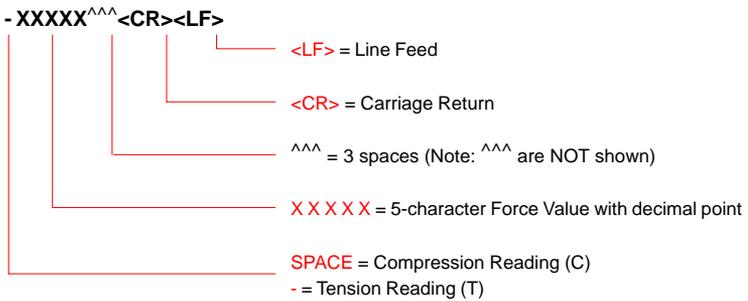
2.2.1 Configuring Output Port- Analog Output

The analog output is always available at the output port without configuration. The analog output is 0 to -2.0Vdc ($\pm 0.018\text{Vdc}$) in tension mode and 0 to 2.0Vdc ($\pm 0.018\text{Vdc}$) in compression mode.

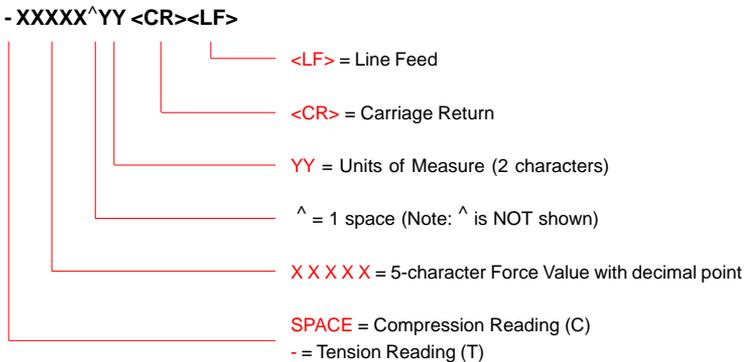
2.2.2 Configuring Output Port- Digital Output

The DFSG/AF3 gauge supports three types of digital output: Modified BCD (Mitutoyo), RS232 Numerical Data Only and RS232 Full Data.

When the digital output is configured for RS232 Numerical Data Only, the format of the data being transmitted to the external device is:

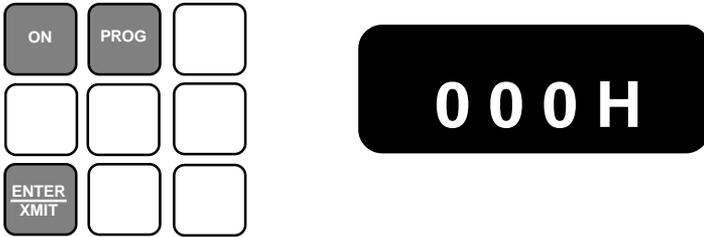


When the digital output is configured for RS232 Full Data, the format of the data being transmitted to the external device is:



2.2.2.1 Enabling MITUTOYO Digital Output

To enable the MITUTOYO digital output, turn the gauge power OFF.



- NOTICE -

You must power down the gauge to configure the digital output and communication specifications for the gauge.

To enable the MITUTOYO output, with gauge power OFF, DEPRESS and HOLD the XMIT key while simultaneously depressing the gauge power ON key. Release the XMIT key after approximately 2 seconds.

The gauge will display a flashing 000H which denotes the MITUTOYO option. To enable the MITUTOYO output, press the ENTER key. The gauge will activate the MITUTOYO option. The 000H display will stop flashing and the gauge will return to the standard operating mode ready for a test.

To change the MITUTOYO output to an RS232 option, you must turn the power OFF to the gauge. With the power OFF, depress and HOLD the XMIT key while simultaneously depressing the gauge power ON key. The gauge will display a flashing 000H (denotes Mitutoyo output option). Depress the PROG key and the gauge will display 19.20 representing a 19.2 baud rate. Continue to depress the PROG key until the desired baud rate is displayed. Press ENTER to enable the desired baud rate.

Once you have selected the baud rate, the gauge will sequence you through the remaining communication setup parameters, e.g UNITS, WORD LENGTH/STOP BITS and PARITY. Press PROG key to select different parameters and Press the ENTER key to enable the desired setup for each parameter.

- NOTICE -

Your gauge is shipped with the following factory settings:

Baud Rate = 9600

Units = 0 1 (Transmit with Units)

Word Length/Stop Bits = 7 - 2 (7 bit word/2 stop bits)

Parity = -P (No Parity)

2.2.2.2 Modifying Communication Parameters

You may change the communication parameters for the force gauge by sequencing through the communication setup display.



- NOTICE -

You must power down the gauge to configure the digital output and communication specifications for the gauge.

To modify any communication parameter, with gauge power OFF, DEPRESS and HOLD the XMIT key while simultaneously turning the gauge power switch to the ON position. Release the XMIT key after approximately 2 seconds.

The gauge will display the first available option designated as 000H for Mitutoyo output. To change to a BAUD RATE, depress the PROG key until the desired baud rate appears. Select XMIT to enable the desired baud rate.

- NOTICE -

Your gauge is shipped with the following factory settings:

Baud Rate = 9600

Units = 0 1 (Transmit with Units)

Word Length/Stop Bits = 7 - 2 (7 bit word/2 stop bits)

Parity = -P (No Parity)

2.2.2.3 Enabling RS232 Digital Output- Numerical Data Only (NO UNITS)

To enable the RS232 digital output with numerical data only (configure the gauge to transmit without units), turn the gauge power OFF.



- NOTICE -

You must power down the gauge to configure the digital output and communication specifications for the gauge.

To enable the **RS232 NUMERICAL DATA ONLY** (transmit without units) output, with gauge power OFF, DEPRESS and HOLD the **XMIT** key while simultaneously depressing the gauge power ON key. Release the XMIT key after approximately 2 seconds.

The gauge will display the current communication parameters for the gauge beginning with the Mode (See Figure 2.2). The parameters will be displayed in the following order: Baud Rate, Units, Word Length/Stop Bits and Parity.

- NOTICE -

Your gauge is shipped with the following factory settings:

Baud Rate = 9600

Units = 0 1 (Transmit with Units)

Word Length/Stop Bits = 7 - 2 (7 bit word/2 stop bits)

Parity = -P (No Parity)

To select the **RS232 NUMERICAL DATA ONLY** output, change the UNITS to **0 2** by depressing the **PROG** key until **0 2** is displayed. Once **0 2** is displayed (**0 2** will flash), depress the **XMIT** key to accept and proceed to the next communication parameter.

2.2.2.4 Enabling RS232 Digital Output- Full Data (Default) (UNITS)

To enable the RS232 digital output with full data (transmit output with units), turn the gauge power OFF. Full data means that UNITS will be included with your force value during transmission to an external device.



- NOTICE -

You must power down the gauge to configure the digital output and communication specifications for the gauge.

To enable the **RS232 FULL DATA** output, with gauge power OFF, DEPRESS and HOLD the **XMIT** key while simultaneously depressing the gauge power ON key. Release the XMIT key after approximately 2 seconds.

The gauge will display the current communication parameters for the gauge. The parameters will be displayed in the following order: Baud Rate, Units, Word Length/Stop Bits and Parity.

- NOTICE -

Your gauge is shipped with the following factory settings:

Baud Rate = 9600

Units = 0 1 (Transmit with Units)

Word Length/Stop Bits = 7 - 2 (7 bit word/2 stop bits)

Parity = -P (No Parity)

To select the **RS232 FULL DATA** output, change the UNITS to **0 1** by depressing the **PROG** key until **0 1** is displayed. Once **0 1** is displayed (**0 1** will flash), depress the **XMIT** key to accept and proceed to the next communication parameter.

2.3 DATA COLLECT MODE

The DFGS/AF3Series can accept and execute commands through the RS-232 serial port. The command set is tailored to make it easy to configure and operate the instrument under computer control.

2.3.1 About Data Collect Mode

Data transmitted by the gauge in Data Collect mode is a filtered average of 45 instantaneous force readings. Digital filtering is employed to eliminate false readings resulting from noise and vibration.

The external device, which the gauge is communicating to, e.g. personal computer, must be configured to transmit an ASCII character "F" to the gauge. This signals the gauge to go into, or out of DATA COLLECT mode.

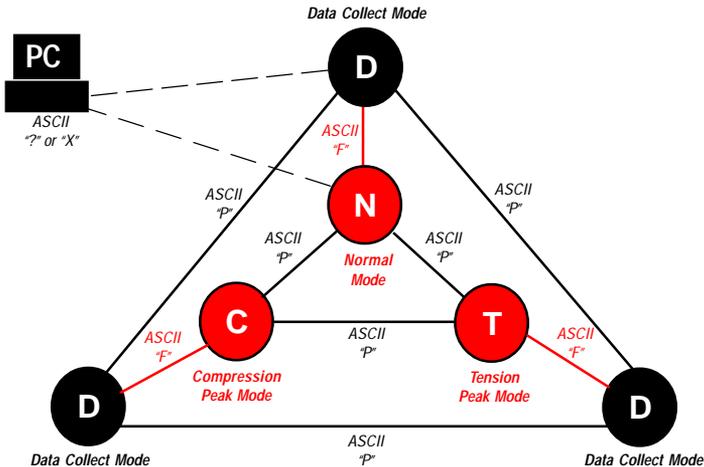
When the external device sends an ASCII character "?" or "X" to the gauge, the gauge will always respond even if the instantaneous reading is a zero value. This permits real time data collection to begin at a force reading or zero value. The ASCII character "?" or "X" is a request to the gauge to transmit data.

The gauge will return to Normal mode when it receives an ASCII character "F". The table on the next page shows the available ASCII characters and their functions.

The diagram below will illustrate how the gauge operates based on these ASCII characters.

- NOTICE -

Each ASCII character transmission will advance the gauge one step, similar to a keypad entry.



*Figure 2.3
Data Collect Mode and ASCII Command
Relationship*

The *DFGS/AF3Series* can accept and execute commands through the RS-232 serial port. The command set is tailored to make it easy to configure and operate the instrument under computer control. The string commands are sent as ASCII characters. The following string commands are recognized:

Command	Response	Description
	Legend: ^ is space (20 hex); 9 is a number 0 through 9; ± is a <u>space</u> or a minus; <CR> is Carriage Return (0D hex); <LF> is Line Feed (0A hex).	
	^^^^^^^^^^<CR><LF>	On power-up, this line is sent.
A	Unit^="lb"<CR><LF> Unit^="kg"<CR><LF> Unit^="N"<CR><LF>	Sends currently selected units to external device.
F		Toggles between Data Collect and the Normal and PeakModes
P		Steps through Normal and Peak Modes: Normal, Tension Peak, Compression Peak
R		Resets the gauge: zeroes all modes.
S	^N-MODE^^^<CR><LF> TP-MODE^^^<CR><LF> CP-MODE^^^<CR><LF> DC-MODE^^^<CR><LF>	Sends currently selectedmode: Normal, Tension Peak, or Data Collect
U		Steps through Units in the following order: lb, kg, N
X or ?	±99.99^lb<CR><LF> ±99.99^kg<CR><LF> ±999.9^N<CR><LF>	Sends data on display with the position of the decimal place the same as on display. If in Data Collect Mode, sends the Data Collect filter instead. If "Transmit Units" is set to transmit without units, lb, kg, and N are replacedby ^^.
Z	ERROR^^^^^^<CR><LF>	Response during force overload. Zeroes the currently selected mode: Normal, Tension Peak or Compression Peak.

3.0 CALIBRATING THE DFGS/AF3 SERIES

The *DFGS/AF3 Series* may be field calibrated, however, for optimum performance, it is recommended that your gauge be factory calibrated at least every other year or more frequently depending on your frequency of use. Field calibration is recommended every 6 to 12 months. A 2-point calibration (0% and 100%) is all that is required to properly calibrate the force gauge. It is not necessary to perform a multi-point calibration.

- WARNING -

The DFGS/AF3 Series should always be calibrated to full capacity. A 100 lbf capacity gauge should be calibrated at a full scale reading of 100 lbs. If you have a 100 lbf capacity gauge, yet you use the gauge between 0 and 50 lbf, YOU CANNOT calibrate the gauge as though the full load is 50 lbf.

- You must have a way to mount the load cell vertically oriented before applying tension and compression force.
- The *DFGS/AF3 Series* should be calibrated using deadweights representing 100% of the rated full scale.
- You must have a safe method of axially applying the deadweights to the load cell in compression direction.

- WARNING -

You must depress ZERO at the completion of the calibration procedure to record the calibration data into the instrument's electronics. Data is NOT SAVED until the ZERO key is depressed.

If, at any time during the calibration procedure that incorrect data is being displayed, simultaneously depress PEAK and ZERO keys to restart the calibration procedure.

3.1 CALIBRATION STEPS

This section leads you step-by-step through the calibration process for a *DFGS/AF3Series*:

STEP 1



Gauge Pre-Set

With gauge power OFF, PRESS and HOLD the **UNITS** and **PROG** key. Depress the power ON key.

Note: The gauge must be laying flat in a horizontal position with no load applied.

Note: Let the gauge warm-up a minimum of 5 minutes prior to the calibration procedure.

❑ **STEP 2**

Mount gauge securely to a weight stand in the compression position. Attach a platen or hanger to loadcell shaft.

❑ **STEP 3**



Calibrate Zero (0% load)

Exercise the loadcell three (3) times by applying and then removing a full load weight. With the platen or hanger attached and no weight added, depress the ZERO key. The display should read 1111. You should proceed to calibrate the gauge span.

❑ **STEP 4**

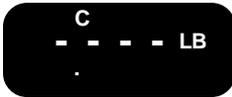


Calibrate Span (100% load)

After you have successfully calibrated 0% load, apply full load to the gauge in the compression direction.

Note: If you are using a 100 lbf capacity gauge and operating normally at 50 lbf, you must calibrate the gauge at full load, e.g 100 lbf. You cannot calibrate the gauge span using any other weight other than the gauge full load.

Once full load has been applied to the gauge, depress the ZERO key. The gauge will display 0000.



Loadcell Error

If your gauge displays - - - - during any point in the calibration process, you must repeat Step 1. This indicates that either the gauge has lost communications with the loadcell or that the loadcell is damaged or that it has been overloaded.

❑ **STEP 5**

Normal Operation

Once you have successfully calibrated to full load and the display reads 0000, you may now remove the full load. The display should read the full capacity of the force gauge being calibrated.

Your force gauge is now ready for use.

4.0 APPLICATION SOFTWARE

The DFGS/AF3 Series gauge may be used with the NEXYGEN GAUGE Series application software (p/n 40/0739) to provide you with an easy-to-use, economical data acquisition system.

The optionally available NEXYGEN GAUGE software package allows you to connect your force gauge to your personal computer and perform the following advanced functions:

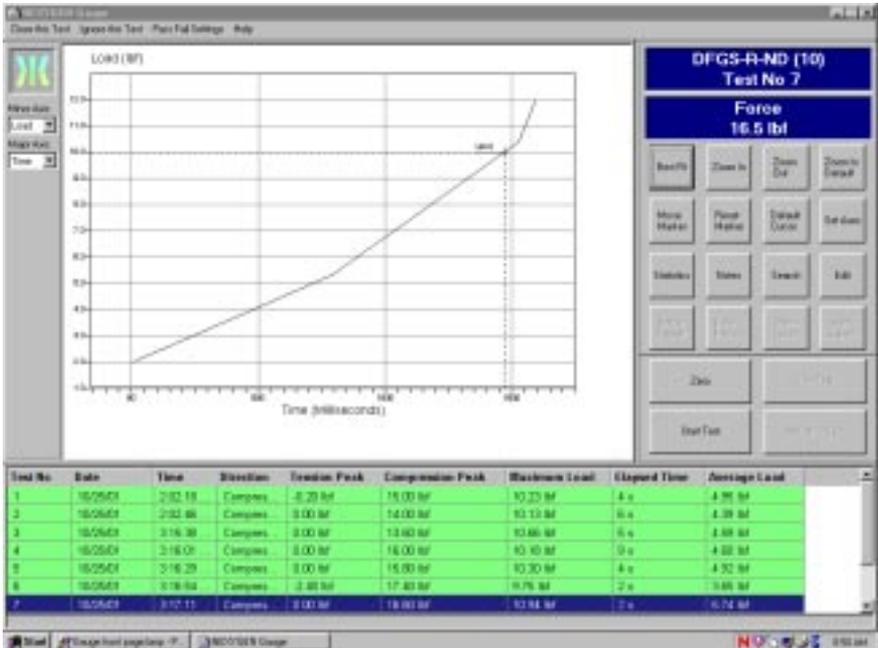
- Graphically present force vs. time results for each of your tests
- Record and stored tabular test results including peak values, load at break, pass/fail results

4.1 NEXYGEN GAUGE SETUP REQUIREMENTS

If using the optional NEXYGEN GAUGE application software, please refer to the product's operating manual (p/n 01/ for software application and operational instructions).

NEXYGEN GAUGE applications require a personal computer with the following minimum specifications:

Pentium® II 400 MHz Processor
 128MB RAM
 16550 UART
 250MB Free Disk Space
 VGA Windows Display Driver
 1024 x 768 or Higher Monitor



5.0 TROUBLESHOOTING

The DFGS/AF3 Series digital force gauge has been designed to be very easy to use. Intuitive displays, intelligent prompts and function keys have been provided to support all levels of users.

The following table is provided to aide in basic troubleshooting for your DFGS/AF3 Series force gauge. For detailed troubleshooting assistance, please contact your local Sales Representative or your nearest AMETEK Sales Office.

No display after pressing ON key

Make sure that the battery is fully charged.

If using with AC power adapter, make sure that the source power is on and that the gauge is properly connected.

The display indicates "- - - -".

The loadcell may be have been over-ranged, or the gauge may be in need of calibration.

Perform the calibration procedure in Section X.0.

If after calibration, the gauge continues to display "- - - -", the loadcell is likely damaged from being over-ranged. Return for repair.

Gauge does not communicate to my TCD test stand.

Check to ensure that the proper cable is being used to communicate to the test stand.

Make sure the gauge is setup for machine control. You must setup the gauge HIGH and LOW limits.

Gauge does not communicate to my personal computer.

Check to ensure that the proper cable is being used to communicate to the personal computer.

Make sure the gauge communication output parameters are configured properly.

The external device, which the gauge is communicating to, e.g. personal computer, must be configured to transmit an ASCII character "F" to the gauge. This signals the gauge to go into, or out of DATA COLLECT mode.

6.0 TECHNICAL REFERENCE

Accuracy

DFGS Series $\pm 0.15\%$ of Full Scale ± 1 LSC

AF3 Series: $\pm 0.2\%$ of Full Scale ± 1 LSC

Tare Capacity

10% in order to utilize Full Scale (in lb Mode); can tare more than 10%, however user may not have use of gauge's Full Scale capacity during testing

Deflection (Inches)

0.007 \pm 0.003 for loadcell

Safe Overload

Gauge will display "- - -" when the force applied exceeds approximately 120% of the gauge's capacity

Overload

Maximum overload is 150%. Load Cell deformation may occur when overload exceeds 150%. Contact your local AMETEK Representative if you experienced an overload beyond 150%.

Analog Output

-2.00 to +2.00 \pm 0.018Vdc

Digital Output

RS-232 and MITUTOYO

Display Update

8 updates per second in Normal or Peak Mode

Sampling Rate

5,000 samples per second

Battery Life

8-10 hours of continuous operation between charges

Temperature Range

40 to 110°F (5 to 45°C)

Temperature Stability

0.06% per °F

Warranty

1 year

7.0 MODEL NUMBERS

CHATILLON® Brand

Model	Capacity
DGGS	8 oz x 0.005 oz 250 g x 0.1 g 2.5 N x 0.001 N
DFGS2	2 lb x 0.001 lb 1 kg x 0.001 kg 10 N x 0.01 N
DFIS10	10 lb x 0.005 lb 5 kg x 0.005 kg 50 N x 0.05 N
DFIS50	50 lb x 0.02 lb 25 kg x 0.02 kg 250 N x 0.2 N
DFIS100	100 lb x 0.05 lb 50 kg x 0.05 kg 500 N x 0.5 N

AMETEK® Brand

Model	Capacity
AF3-250G	8 oz x 0.005 oz 250 g x 0.1 g 2.5 N x 0.001 N
AF3-002	2 lb x 0.001 lb 1 kg x 0.001 kg 10 N x 0.01 N
AF3-010	10 lb x 0.005 lb 5 kg x 0.005 kg 50 N x 0.05 N
AF3-050	50 lb x 0.02 lb 25 kg x 0.02 kg 250 N x 0.2 N
AF3-100	100 lb x 0.05 lb 50 kg x 0.05 kg 500 N x 0.5 N





AMETEK

TEST AND CALIBRATION INSTRUMENTS

Internet Addresses:
www.ametek.com
www.chatillon.com
www.lloyd-instruments.co.uk

Americas

AMETEK Test and Calibration Instruments Division

8600 Somerset Drive
Largo, Florida 33773
USA

Tel +1-727-536-7831
Tel +1-800-527-9999 (USA only)
Fax +1-727-539-6882

Europe

AMETEK Lloyd Instruments

Forum House
12 Barnes Wallis Road
Segensworth East
Fareham
Hampshire PO 15 5TT
Tel +44 (0) 1489-486399
Fax +44 (0) 1489-8851118

AMETEK Lloyd Instruments SA

3 Avenue des Coudriers
Zone d'Activite de l'Observatoire
7810 Montigny-Le-Bretonneux
France
Tel +33-1-3057-4774
Fax +33-1-3057-5033

AMETEK Precision Instruments Europe GmbH

Rudolf-Diesel-Strasse 16
D-40670, Meerbusch
Germany
Tel +49-2-159-9136 0
Fax +49-2-159-9136 39

Asia Pacific

AMETEK Lloyd Instruments

No. 7 Sherwood Place
Alexander Heights
6064 Perth
Australia
Tel +61-8-9343-5725
Fax +61-8-9343-5723

AMETEK Singapore Pvt. Ltd.

10 Ang Mo Kio Street 65
#05-12 TECHPOINT
Singapore
569059
Tel +65 484 2388
Fax +65 481 6588

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