

# Series RG

---

FORCE MEASUREMENT MODULES

## User's Guide

**MARK-10.**

# TABLE OF CONTENTS

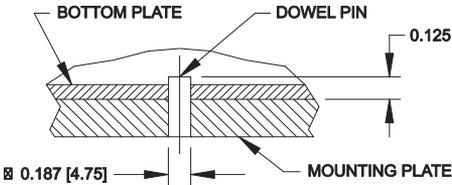
**GENERAL** .....2  
**MOUNTING** .....2  
**POWER** .....2  
**FILTERS** .....3  
**EXTERNAL TRIGGER MODE**.....3  
**SET POINTS** .....3  
**AVERAGE MODE**.....4  
**COMMAND SET** .....4  
**OUTPUTS** .....6  
**CALIBRATION** .....6  
**SPECIFICATIONS AND DIMENSIONS** .....7  
**WARRANTY** .....7

## GENERAL

The RG smart load cell is a force measurement building block designed for integration within assembly systems, weighing systems, and other process and testing automation applications. All functions are controlled by commands sent from a PC or PLC via its RS-232 connector. The RG's ASCII command library allows for various functions, such as peak force recall, set points, data averaging, data filtering, calibration, and many more. The RG's rugged aluminum housing makes it durable enough to withstand the rigors of manufacturing environments. Capacities are available from 2 lb to 200 lb (10 N to 1000 N).

## MOUNTING

The RG should be mounted to a surface with a dowel pin. A hole is provided in the rear of the housing for this purpose. Four threaded holes in the corners of the housing are provided for the mounting of screws for placement purposes.



The illustration at left shows the recommended use of a dowel pin:

## POWER

Power should be supplied from a wall outlet to the 9-pin connector with maximum input voltage of +9-12V. Refer to the pin diagram in Section 10 for connection information.

## FILTERS

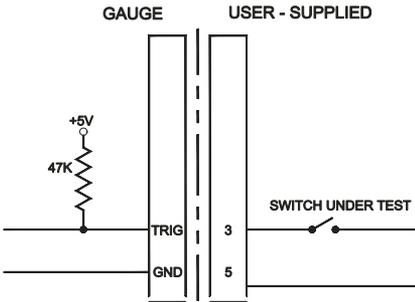
For maximum flexibility in noise suppression and peak capturing ability of the instrument, a digital filter is available. The filter utilizes the moving average technique in which consecutive readings are "pushed" through a buffer and the displayed reading is the average of the buffer contents. By varying the length of the buffer, a variable smoothing effect can be achieved. The RG is equipped with a buffer which can hold up to eight readings. The number of readings to be averaged can be set to 1,2,4 or 8. The selection of 1 will disable the filter since the average of a single value is the value itself.

*The filter should be disabled for highest peak capture speed.*

## EXTERNAL TRIGGER MODE

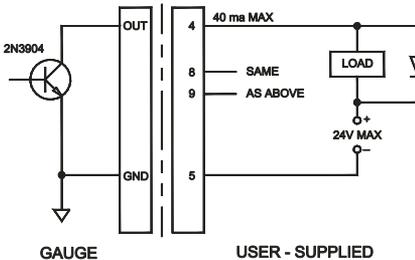
This mode of operation is useful for measuring electrical contact activation force as well as synchronization of multiple instruments for a "snap-shot" view of applied forces.

When in this mode, the RG stops outputting force readings when the trigger signal is applied. It is possible to capture the reading with a normally open contact (high to low transition of the trigger signal) or a normally closed contact (low to high transition). In "edge" mode, the RG will output the captured reading and hold this reading until the command CLR is sent prior to a new test. The "level" mode provides for the display to hold the reading only until the trigger signal returns to its original state. Refer to Section 8 for command details.



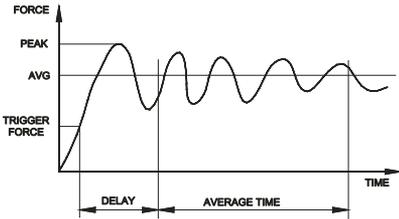
## SET POINTS

This feature is useful for force limit output to a PC or PLC, tolerance checking (GO/NO GO), alarm indication in process control applications, and other requirements. Two limits, high and low, are specified and stored in the non-volatile memory of the instrument and all readings are compared to these limits. The results of the comparisons are indicated through the three open-collector outputs provided on the 9-pin connector, thus providing "under", "in range" and "over" signaling. These outputs can be connected to indicators, buzzers or relays as required for the application. Refer to Section 8 for command details.



## AVERAGE MODE

This mode is used for obtaining an average force reading over a specified period of time. Applications include measurement of peel force, frictional force and any other tests requiring time-averaged readings. There are three user-programmable parameters associated with this mode: trigger force, initial delay and average time. Enter averaging mode, and then send the CLR command to begin testing.



The process of averaging begins as soon as the programmed trigger force is reached. The readings obtained during the initial delay will not be part of the average, but the peak value is stored for later recall. A new test may be started by sending the CLR command. Refer to Section 8 for command details.

## COMMAND SET

The RG is controlled by an external device through the RS-232 channel. The following is a list of supported commands and their interpretations. All commands must be terminated with a Carriage Return character (hex 0D) or with a Carriage Return/Line Feed combination (hex 0D+0A). The gauge responses are always terminated with a Carriage Return/Line Feed.

A	Enable Average mode
AD	Disable Average mode
AM	Select Average mode (if enabled)
ATn	Average time. n=0.1-300.0 seconds
DELn	Initial delay. n=0.1-300.0 seconds
TRFn	Trigger force. n=value (+ for compression, - for tension)
SP	Enable Set Point mode
SPD	Disable Set Point mode
SPHn	High set point. n=value (+ for compression, - for tension)
SPLn	Low set point. n=value (+ for compression, - for tension)
AOUTn	Auto-transmit every nth reading. n=0,1,2,4,8,16,32,64,128. 0=disabled
LB	Switch units to pounds
KG	Switch units to kilograms
N	Switch units to Newtons
G	Switch units grams
ET	Enable External trigger mode
ETD	Disable External trigger mode
ETE	Edge triggered External trigger mode
ETL	Level triggered External trigger mode
HL	Reading captured on a high to low transition
LH	Reading captured on a low to high transition
CUR	Current mode
PT	Peak Tension mode
PC	Peak Compression mode
CLR	Clear peaks, start a new average, or external trigger test

Z	Zero and perform the CLR function
?C	Request the current reading
?PT	Request the peak tension reading
?PC	Request the peak compression reading
?ET	Request the reading obtained during the External trigger mode
?A	Request the average reading obtained during the Average mode
FLTCn	Digital filter for current readings. n=1,2,4,8
FLTPn	Digital filter for peak readings. n=1,2,4,8
FULL	RS-232 transmission with units
NUM	RS-232 transmission without units (only numeric values)
MIT	Enable Mitutoyo output
MITD	Disable Mitutoyo output
POL	Mitutoyo outputs with polarity. (+ for compression, - for tension)
NPOL	Mitutoyo outputs without polarity (absolute value)
PM	Print/send data to a Mitutoyo compatible device
Sn	Set output bit (open collector, pull to ground). n=0,1,2
Cn	Clear output bit. n=0,1,2
Rn	Read current status of output bit or level of input pin. n=0,1,2,3
SAVE	Save current settings in nonvolatile memory
CAL	Enter Calibration mode. See Section 10 for more information
LIST	List current settings and status. Here is a typical LIST output: V3.00;LB;PC;FLTC8;FLTP1;FLTA0;AOUT00;AOFF05;FULL;MIT;POL;B0 All fields are separated by ";". The first field shows the software version, subsequent fields show the status of settings and feature using the same abbreviations as the commands to set them. <b>Note:</b> the fields FLTA0 and B0 are not applicable to Series RG.

Any detected errors are reported back by means of the following error codes:

*10	Illegal command
*11	Not applicable; e.g. SPHn command without enabling the set points
*21	Invalid specifier; e.g. AOFF2
*22	Value too large
*30	Calibration weight too high
*31	Calibration weight too low
*50	Communication error
*51	Command string too long

Following is a sample BASIC program illustrating the use of some commands. It switches the units to kilograms and sets the display to zero. Press any key to get a reading on the screen. Use "ESC" to exit the program:

```

10 CLS: OPEN "COM1:9600,N,8,1,RS,CS,DS,CD,LF" AS #1
20 PRINT #1 "KG"
30 PRINT #1 "Z"
40 PRINT "PRESS ANY KEY FOR READING OR <ESC> TO EXIT"
50 KEYPR$=INKEY$: IF KEYPR$="" THEN 50
60 IF KEYPR$=CHR$(27) THEN SYSTEM
70 PRINT #1 "?"
80 LINE INPUT #1,A$
90 PRINT A$
100 GOTO 40

```

# OUTPUTS

## RS-232

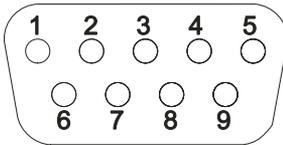
The data transmission can be initiated by sending the "?" command. The RG will respond by sending the current reading in either full or numeric format, depending on the configuration settings (refer to Section 3). Polarity sign indicates tensile (-) or compressive (+) forces. The transmitted string has the following format:

[POLARITY (SPACE OR -)][DATA][SPACE][UNITS (IF ENABLED)][CRLF]

## Mitutoyo BCD

This output is useful for connection to data collectors, printers, multiplexers or any other device capable of accepting Mitutoyo BCD data. The transmission is initiated by the receiving device (refer to Section 3 for settings).

## I/O connector pin diagram



DB-9P

1.	RS-232 receive	Input
2.	RS-232 transmit	Output
3.	Mitutoyo request	Input
	External trigger	"
	Input bit 3	"
4.	Mitutoyo clock	Output
	"Within" set point output	"
	Output bit 2	"
5.	Signal ground	---
6.	N/A	-
7.	+9-12V DC	Input/Output
8.	Mitutoyo ready	Output
	"Under" set point output	"
	Output bit 1	"
9.	Mitutoyo data	Output
	"Over" set point output	"
	Output bit 0	"

# CALIBRATION

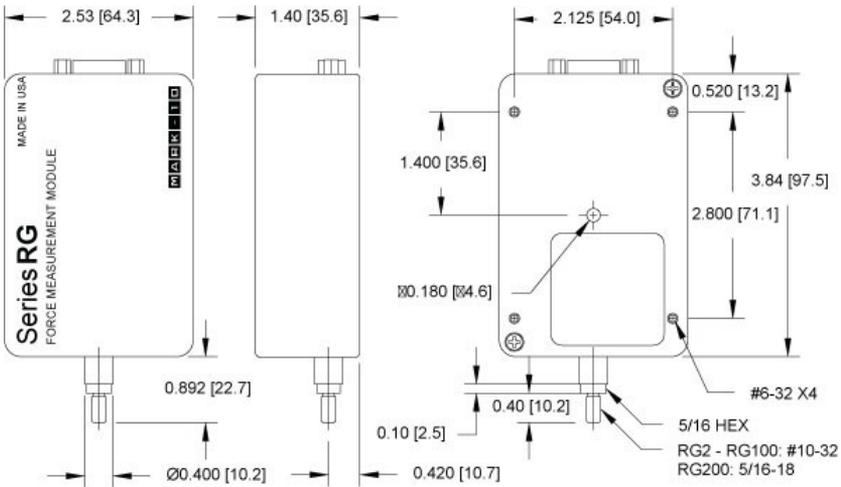
Calibration may be performed by the following steps:

1. Firmly mount the RG with the load cell shaft pointing downward.
2. Attach a hook and/or other attachments with which to suspend calibration weights.
3. Ensure that serial communication has been established and is operational.
4. Zero the RG by sending the 'Z' command from a PC or PLC.
5. Apply a calibration weight equal to the **full capacity, in pounds**.
6. Send the command 'cal'.
7. If the calibration weight was excessive or insufficient, the appropriate error code will be returned. See Section 9 for details. Such an error can also occur if the load cell has been damaged.
8. If calibration was successful, no further prompts will be shown and no further action is required.

## SPECIFICATIONS and DIMENSIONS

Accuracy:	±0.2% of full scale
Tare capacity:	110% of capacity
Overload capacity:	150% of capacity
Sampling rate:	65 samples per second
Load cell deflection:	See below
Outputs:	
RS-232:	Baud rates between 300 and 9600
Mitutoyo:	Standard Mitutoyo SPC BCD output
Connector:	9-pin D-type male
Power:	+9-12 VDC
Weight:	0.55 lbs [0.25 kg]

Model	Capacity x Graduation	Deflection at full scale
RG2	2 x 0.002 lb, 1 x 0.001 kgF, 10 x 0.01 N	0.009 [0.23]
RG5	5 x 0.005 lb, 2.5 x 0.002 kgF, 25 x 0.02 N	0.005 [0.13]
RG10	10 x 0.01 lb, 5 x 0.005 kgF, 50 x 0.05 N	0.010 [0.25]
RG20	20 x 0.02 lb, 10 x 0.01 kgF, 100 x 0.1 N	0.004 [0.10]
RG50	50 x 0.05 lb, 25 x 0.02 kgF, 250 x 0.2 N	0.010 [0.25]
RG100	100 x 0.1 lb, 50 x 0.05 kgF, 500 x 0.5 N	0.010 [0.25]
RG200	200 x 0.2 lb, 100 x 0.1 kgF, 1000 x 1 N	0.010 [0.25]



## WARRANTY

Mark-10 Corporation expressly warrants to its buyer for three (3) years from the date of delivery that the goods sold are free from defects in workmanship and materials. Mark-10 Corporation will, at its option, repair or replace or refund the purchased price of goods found to be defective. This remedy shall be the buyer's sole and exclusive remedy. Any modification, abuse, exposure to corrosive environment or use other than intended will void this warranty. This warranty is in lieu of all other warranties, including implied warranties of merchantability and fitness for an intended purpose. In no event shall Mark-10 Corporation be liable for any incidental and consequential damages in connection with goods sold or any part thereof.



*Mark-10 Corporation has been an innovator in the Force and Torque measurement fields since 1979. We strive to achieve 100% customer satisfaction through excellence in product design, manufacturing and customer support. In addition to our standard line of products we can provide modifications and custom designs for OEM applications. Our engineering team is eager to satisfy any special requirements. Please contact us for further information or suggestions for improvement.*



*We make a measurable difference in force and torque measurement*

**Mark-10 Corporation**

11 Dixon Avenue  
Copiague, NY 11726 USA  
1-888-MARK-TEN  
Tel: 631-842-9200  
Fax: 631-842-9201  
Internet: [www.mark-10.com](http://www.mark-10.com)  
Email: [info@mark-10.com](mailto:info@mark-10.com)