G2000 "GRINDER GAGE"

COMPUTERIZED FREELENGTH CONTROL SYSTEM

Built by:

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1.0 DESCRIPTION OF FEATURES

    <u>1.1 Length Control:</u> The G2000 Grinder Gage is designed to detect stone wear and provide automatic head movement to compensate for this wear. The gage measures each spring (in one row) and makes a calculation as to the length of the spring just now leaving the heads, and the accuracy of that calculation. Then it decides if and how much to adjust the heads.

    <u>1.2 Manual Adjustments:</u> The G2000 allows the operator to manually adjust the heads up, down, closer together, or farther apart. This is done via push buttons.

    <u>1.3 Length Display:</u> The G2000 displays the median length of the last 7 springs on a meter.

    <u>1.4 Other Features:</u> The G2000 can generate statistical printouts and can be configured with a Datamite (tm) compatible output (optional). Automatic add feed control is under development.

2.0 G2000 INSTALLATION AND SETUP

    2.1 Power Up: Be sure the power switch is off. Place the "STANDBY/RUN" switch in the "STANDBY" position. This switch position will sometimes be referred to as setup. Turn on the power switch. Turning on the power switch while in the "STANDBY" mode causes the G2000 to clear it's memory to begin a new setup. Later, when you know the gage is setup, you should turn the gage on while in the "RUN A" mode. Turning on the gage in the "RUN A" mode allows the gage to continue as if it were never turned off.

    2.2 Probe Target: Install on the probe assembly a target which is slightly larger than the diameter of the spring being ground.

    2.3 Install Probe Assy.: Install the probe assembly so that the target is directly over the spring path and relatively close the grinding stones.

    2.4 Set "DELAY": Count the number of springs between the probe target and the grinding stones. Initially set the "Delay" value to this number. When the "DELAY" knob is full CCW the value is set to 0. When it is set full CW the value is set to 64. The G2000 gage will delay adjustments by the number you have set plus 15. This allows the results of an adjustment to be checked before another adjustment is made.

    2.5 Set Micrometer: Be sure the gage is in "STANDBY" and the power is on. Place a ground spring under the probe target and adjust the micrometer until the "Length" displayed on the meter is close to 0. The probe target should be approximately flat on top of the spring. If it is not a slight adjustment of the sensor position may be needed. Please call Moyer before making such an adjustment. Turn the adjustment about 1/4 turn CW so the meter is slightly below 0.

    2.6 Calibrate Sensor + Side: Turn the micrometer CCW until the meter shows "0", note the number on the micrometer, then continue exactly 1 turn CCW (.025" on the micrometer). The meter should just reach +200% as the micrometer reaches the end of one turn. If the meter fails to reach +200 or reaches +200 too soon, it needs to be rescaled. To rescale, press the "UP" button while holding in on the "STAT" button. For best accuracy the meter should be checked and/or rescaled when ever the setup is changed.   This calibration is lost if the gage is manually cleared by power up in "STANDBY" mode. This calibration will give you accurate readings in the long direction.

    2.7 Calibrate Sensor - Side: Turn the micrometer CW until the meter shows "0", note the number on the micrometer, then continue exactly 1 turn CW (-.025" on the micrometer). The meter should just reach -200% as the micrometer reaches the end of one turn. If the meter fails to reach -200 or reaches -200 too soon, it needs to be rescaled. To rescale, to be rescaled, press the "DOWN" button while holding in on the "STAT" button. For best accuracy this should be checked and/or rescaled when ever the setup is changed. This calibration is lost if the gage is manually cleared by power up in "STANDBY" mode. This calibration will give you accurate readings in the short direction. Turn the adjustment CCW until the meter is past 0 then back CW until it is on 0. When adjusting sensor position, it is best to always finish the setting in the same (CW) direction.

     2.8 Set Sort Length: If the gage is to be used with a delay system and chute to sort the ground springs, then set the sort length by holding in on the "STAT" and "ABORT" buttons while adjusting the "R/F" knob so that the reject length indicates on the bottom meter scale. The setting of the delay system should be equal to the time it takes for the measured spring to reach the chute.

     2.9 Set Timing Prox.: Be sure the hand clutches are loose and a spring is directly under the target. Switch the gage to the "RUN A" mode. Install the timing prox so it's LED lights, and the gage gives a short blink (bottom light) as the spring comes directly under the target. The read signal is edge triggered, so it will not stay on, but there is an LED indication on the prox switch itself which stays on. This adjustment is easy if you place the prox directly over a hole in the dial plate and slowly move it toward the sensor/probe until it just comes on.

3.0 G2000 OPERATION

3.1 Initial Micrometer Set: With the probe installed, the hand clutches loose, and the gage setup and in "RUN A" mode, begin to grind springs manually. Now catch 7 springs noting the meter position as you see your 7th spring get measured.   The meter is calibrated so that 100% is equal to .0125", or each small line is .00125". Measure the 7 springs, ignore the 2 longest readings and the 2 shortest readings, and average the remaining three springs. Adjust the micrometer a distance equal to the desired length minus the actual length then plus the meter value. By example, say the length you want is 1.090", you measured the 7 springs and the center 3 springs averaged 1.092", and the meter indicates -0.006". You should adjust the micrometer 1.090" minus 1.092" plus the meter indication, which equals -.008". for a "-" value, adjust the micrometer in the CCW dirrection, for a "+" malue, adjust the micrometer in the CW dirrection. After you have been grinding springs, it may be necessary to make slight adjustments to the sensor height depending on length or load. Remember, the meter indicates an average of the three center lengths from the last 7 springs measured. If the gage is not configured for a Tandum grinder, any lengths outside of +/-0.012" from the center length are ignored as faulty data. If you are configured for a Tandum grinder, this value is +/-0.025". This is to allow for empty holes not being measured as very short springs.

3.2 Automatic Control Start Up: Tighten the hand clutches. Manually adjust heads to correct for the initial error by selecting the "TOP" or "BOTTOM" head and pressing the "UP" or "DOWN" button. The motors will move as long as you hold down on the "UP" or "DOWN" switches. If you just tap the switches, the amount of move will be about 0.001".

3.3 Automatic Control Fine Tune Length: If later you find you want to lengthen or shorten the grind length, all you need to do is adjust the micrometer CW for longer or CCW for shorter. The scale on the micrometer is marked each 0.001" and should be used as a referance.   To minimize the effect of backlash, you should always finish each adjustment in the CW direction. So if you need to grind the springs a little shorter, turn the adjustment CCW a little past the mark you want, then back up CW to the mark. If the adjustment is big, you may want to move the heads manually as in 3.2 to preempt automatic adjustment. Once the system is set correctly, further micrometer adjustment is usually not necessary.

3.4 "DELAY" Adjsutment: If the gage seems to have trouble keeping up with wheel wear then turn the "DELAY" down (CCW) a little. If the gage seems to over adjust, then back up, turn the "DELAY" up (CW) a little.

4.0 G2000 STATISTICS

4.1 Machine Capability Studyg: A machine capability study may be ran at any time the gage is in operation by depressing the "STAT" button for more than 1 second. Most front panel controls are disabled while you are running a machine capability study. The machine capability study is generated from 20 samples of 7 consecutive springs taken at the preconfigured interval. Information concerning stone wear is also printed. The results are calculated using common accepted statistical practices and presented as a Median/Range chart. All parts good or bad may be included in statistical processing to give you an accurate indication of the overall process.

4.2 Median / Range Chart: A sample for a median / range chart may be taken at any time that the gage is running and not processing a machine capability study, by depressing the "STAT" button for less than 1 second. Once studies of any type are started, the gage will continue to take samples as configured automaticly until aborted. The median / range charting uses the control limits established in the previous machine capability study and is valuable in determining if the process is maintaining the same level of quality. Some people use the range information to help establish the best time between dressing the stones. As before, wheel wear information is printed.

4.3 Pause & Abort: Stats may be paused by depressing the "ABORT" button for less than or aborted by depressing the "ABORT" button for more than 1 second.

5.0 CONFIGURATION & HARDWARE TEST

5.1 General Info: The configure routines are used to make changes to the internal settings of the gage, somewhat like setting the dip switches found in some computer equipment. This "back door" also includes a simple self diagnostic routine. They are not used often, but they are important and you should become acquainted with the features they make available.

5.2 Entering Back Door Routines: Turn the power off. Place the "STANDBY/RUN" switch in the "STANDBY" position. Now while holding in on the "STAT" button, turn on the power. Now let up on the "STAT" button. So long as the "STANDBY/RUN" switch in the "STANDBY" position, you are in the Config1 section. If you place the "STANDBY/RUN" switch in the "RUN A" position, you will be in the Config2 section. If you place the "STANDBY/RUN" switch in the "RUN B" position, you will be in the Hardware Test section. You may switch back and forth between these sections if you need. The only way out of these sections is to turn the gage off.

5.3 Config1: In the CONFIG1 section, you can set the gage for tandum and single headed grinders, turn the RS232 port on or off, set the baud rate for the RS232 port, set the printer type for stats print out, set the time interval for taking Median R chart samples, and set the time interval for taking Machine Capability Study samples.

5.3.1 Grinder Type: To toggle between tandum and non-tandum grinder gage function, press the "UP" button. If the "TOP UP" light is lit, you are set for tandum, otherwise you are set for non-Tandum.

5.3.2 RS232: To toggle between RS323 on and RS232 off, press the "DOWN" button. If the "TOP DOWN" light is lit, you are set for RS232 on, otherwise you are set for RS232 off. This output is optional and allows a computer or data collection device such as a Data Mite (tm) to be attached to the gage. If you gage was not ordered with this option, in may be installed for a small charge. If you are not using or do not have this option, it should be turned off.

5.3.3 Baud Rate: To toggle between 1200 baud and 9600 baud for the RS232 port, press the "ABORT" button. If the "BOTTOM UP" light is lit, you are set for 9600 baud, otherwise you are set for 1200 baud. This is only used if you have the RS232 option.

5.3.4 Printer Type: To toggle between the C.Itoh and Epson printer type, press the "STAT" button. If the "BOTTOM DOWN" light is lit, you are set for Epson, otherwise you are set for C.Itoh.

5.3.5 SPC Time: To set the SPC time (time interval between samples in the Median R chart), place the "TOP/BOTH/BOTTOM" switch in the "TOP" position. Now, using the R/F pot, set the meter needle to the number of min. to wait between samples using the bottom scale of the meter.

5.3.6 MCS Time: To set the MCS time (time interval between samples in the Machine Capability Study), place the "TOP/BOTH/BOTTOM" switch in the "BOTTOM" position. Now, using the R/F pot, set the meter needle to the number of sec. to wait between sanples using the bottom scale of the meter.

5.4 Config2: Config2 has only 1 function at this time. To set the RATIO value (the

number of revolutions the motor makes to move the head 0.010"), place the gage in Config2 by placing the "STANDBY/RUN" switch in the "RUN A" position and placing the "TOP/BOTH/BOTTOM" switch in the "TOP" position. Now, using the R/F pot, set the meter needle to the number of revs to move the heads 0.010". On a Moyer grinder this value should be set to 7.5. This is because the motor goes through a 25/1 gearbox and a 3/1 chain reduction to a .100 pitch lead screw giving 75 revs for 0.100" of head movement or 7.5 revs for 0.010" of movement. Other ratios can be calculated.

    5.5 Hardware Test: **Warning !!** Hardware Test may cause motors to run continually, further causing a potental for damage to the grinder. Please loosen the hand clutches on the gear boxes to avoid damage. For Hardware Test, place the "STANDBY/RUN" switch in the "RUN B" position.

    5.5.1 Lights & Outputs: In Hardware test, the R/F pot may be moved to activate all the light bulbs and ac outputs for test. The pattern is, form CCW to CW, F light (aux output), R light (aux output), TOP UP light (top motor up output), TOP DOWN light (top motor down output), BOTTOM UP light (bottom motor up output), BOTTOM DOWN light (bottom motor down output), and READ light (no output).

    5.5.2 RS232 Test: Pressing the "UP" button puts a test string out the RS232 port that should read "All Cars Eat Gas ! 1234567890 ".

    5.5.3 Printer Test: Pressing the "DOWN" button puts a test string out the Printer port that should read "Every Good Boy Does Fine ! 1234567890 ".

    5.5.4 Meter Test: Pressing the "STAT" button allows you to test the meter swing by turning the "DELAY" pot, otherwise the meter will display the sensor position.

6.0 G2000 QUICK FUNCTION CHART

```
STANDBY ---|
power on --|   (power up, clear & goto setup)
       |------ STANDBY           (goto setup below)
       |------ STAT ---- < 1 sec.   (take a sample)
       |           -- > 1 sec.   (machine capability study)
       |------ ABORT --- < 1 sec.   (pause)
       |           -- > 1 sec.   (abort)
       |------ UP ------ TOP       (top up .001"+)
       |           |-- BOTH      (both up .001"+)
       |           -- BOTTOM     (bottom up .001"+)
       |------ DOWN ---- TOP       (top down .001"+)
       |           |-- BOTH      (both down .001"+)
       |           -- BOTTOM     (bottom down .001"+)
not STANDBY|
power on --|   (power up & run)



STANDBY ------ STAT  --- ABORT --- R/F pot   (set sort length)
       |         |- UP             (set 200% = .025")
       |          - DOWN           (set -200% = -.025")
       |-- UP ------ < 1 sec. --- TOP    (top up .001")
       |      |            |- BOTH   (both up .001")
       |      |             - BOTTOM (bottom up .001")
       |      -- > 1 sec. --- TOP    (top up .005")
       |                 |- BOTH   (both up .005")
       |                  - BOTTOM (bottom up .005")
        -- DOWN ---- < 1 sec. --- TOP    (top down .001")
                |            |- BOTH   (both down .001")
                |             - BOTTOM (bottom down .001")
                -- > 1 sec. --- TOP    (top down .005")
                          |- BOTH   (both down .005")
                           - BOTTOM (bottom down .005")
STANDBY ---|
STAT ------|
power on  -|                 (now in background routines)
       |--- STANDBY ---- UP           (tandum/not tandum)
       |          |-- DOWN          (RS232 on/off)
       |          |-- ABORT         (set baud rate)
       |          |-- STAT          (set printer type)
       |          |-- TOP - R/F pot   (set SPC time)
       |          -- BOTTOM - R/F pot  (set MCS time)
       |--- RUN A ---- TOP - R/F pot     (set ratio)
        --- RUN B ------------     (meter displays LVDT,
                   |          lights and outputs
                   |          change with R/F pot)
                   |-- UP       (test RS232 port)
                   |-- DOWN      (test printer port)
                   -- STAT - DELAY pot (test meter)
```

7.0 G2000 MICROMETER ADJUSTMENTS

Meter is centered & Springs are
```
  |
  |- Long (Strong)
  |              turn the micrometer CCW to correct
  |- Short (Weak)
  |              turn the micrometer CW to correct
```
Meter shows Long &
Springs are
```
  |
  |- Long (Strong)
  |              decrease "DELAY" to correct
  |- Short (Weak)
  |              turn the micrometer CW to correct
  |- Correct
  |              turn the micrometer CW &
  |              decrease "DELAY" to correct
```
Meter shows Short &
Springs are
```
  |
  |- Long (Strong)
  |              turn the micrometer CCW to correct
  |- Short (Weak)
  |              increase "DELAY" to correct
  |- Correct
                 turn the micrometer CCW &
                 increase "DELAY" to correct
```

    In all cases, it is good to recheck the process soon after making a correction, to verify the effects of that correction. If the springs are out of print, it is best to make a manual correction to recenter the lengths.