INSTALLATION AND INSTRUCTION MANUAL

FOR MODEL 560

PROCESS MONITOR WITH OPTIONAL CONTROL

Manual Version 2.1

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INTRODUCING THE MODEL 560 PROCESS MONITOR

GSE has recognized the need for a competitively priced, easy to use, single-channel Process Monitor by creating the Model 560. It was designed primarily for applications requiring a single-spindle Torque and Angle Monitor with SPC capabilities, but can also be operated as a Force Monitor. Since many applications do not require motor control, the solenoid driver is an option kit that contains a transformer and small PC board that can be either factory or field installed.

PRODUCT OVERVIEW

The self-contained Model 560 is easy to install and features a choice of up to four limit sets, operator selectable either by an external switch or keypad selection. This feature allows you to apply the Model 560 to four different joints or assemblies using the same torque motor or press. The 560 maintains separate data files and statistical evaluations for all limit sets.

Stats and Statistical Data can be easily displayed on the front panel to monitor process control and capability including XBAR, Range, ±3 Sigma, Cpk and Cr. The Model 560 can also produce printed reports for immediate feedback on the operation of your equipment right on the shop floor. As a member of the GSE product family, it can communicate on the GSE Data Network to interface with SPC software programs run on a central computer for full powered SPC.

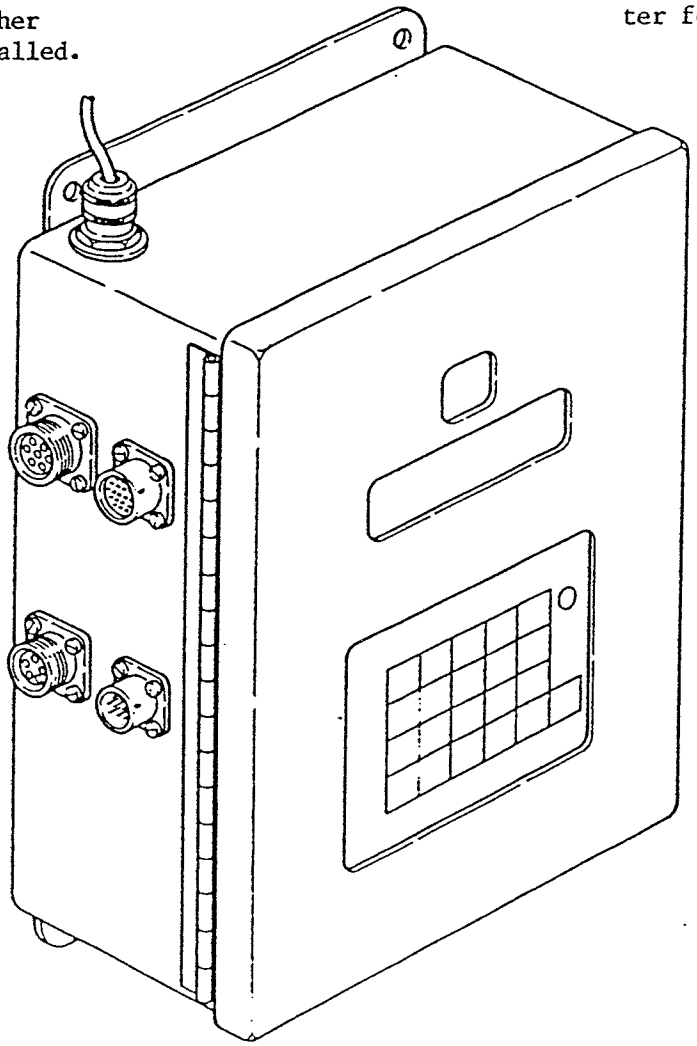

Figure 1 GSE Model 560 Process Monitor

SPECIFICATIONS

Accuracy ... ±0.2% of Instrument Full-Scale.

Frequency Response ... Selectable, 44-3K Hz, (46 possible positions).

Bridge Excitation ... ±5 VDC (50 mA Maximum Current).

Input Signal ... 0.5 to 4.0 mV/V Instrument Full-Scale.

Angle Input ... +5 VDC Quadrature, Resolution = 1X or 4X Input Frequency.

Calibration ... Cal Value entered through Keyboard. Span calibrated with potentiometers.

Calibration Offset Compensation ... ±3% of Full Scale.

Zero Offset Compensation ... ±7% of Instrument Full Scale, compensated automatically.

Inputs ... Cycle-On, Limit Set Select, Sample and Hold (Measurement Input).

Limit Sets ... Four available, selectable by keypad or remote switch.

Data Display ... 2 line by 16 character LCD, w/backlight.

Keyboard ... 21 Key Membrane with separate switches for statistics and print command.

Labels & Displayed Messages ... English language standard (German, Spanish and others available upon special order).

Accept/Reject Lights ... 3 LEDs: Red for High Angle or High Torque/Force, Green for Torque/Force/Angle In Limit, Yellow for Low Angle and Low Torque/Force.

Stats Annunciator ... Yellow LED

Remote Accept/Reject Driver ... 2 (used for Output Remote Lights or PLC), 230 V at 5 amps resistive. Accept relay (normally open & normally closed contacts); Reject Relay (normally open & normally closed contacts).

Relay Board Relays ... Aromat DSP1E-DC12V, rated at 5A @ 120 VAC or 240 VAC; 1/6 HP - 380 VAC Max. or 5A @ 30 VDC.

Solenoid On/Off Relay ... OPTO 22 DC output 0 to 60 V at 3 amps.

Optional Current Controlled Solenoid Driver ... 2 amps peak for 10 milliseconds, then 0 to 0.7 amps hold current (adjustable with potentiometer) until shut off.

Data Memory Capacity ... Torque or Force System: 4500 when using 1 or 2 limit sets; 3000 when using 3 limit sets; 1500 when using 4 limit sets. Torque-Angle System: 4500 readings with 1 limit set; 2500 with 2 limit sets; 1500 with 3 limit sets; 1250 with 4 limit sets.

Printer Output Port ... RS-232-C, 8 bit word, 1 stop bit, no parity, 9600 baud standard but user programmable (see Table 6, p. 12 for pinouts and Table 8, p. 12 for mating connector).

Printer Requirements ... Epson Graphics compatible with a serial port and 32K buffer (a serial board with 32K buffer is available from GSE, ordering Part# 41-10-0403). NOTE: The printer must have a 32K buffer to run the torque/time plots.

Computer SPC Port ... RS-422, 8 bit word, 1 stop bit, no parity, 9600 baud standard but user programmable (see Table 7, p. 12 for pinouts and Table 8 for mating connector).

Analog Output ... 3V for Instrument Full Scale

Ambient Operating Temperature ... 0 to 50°C

Humidity ... 20 to 90% Non-condensing.

Enclosure ... NEMA-12 (12"h x 10"w x 5"d).

Input Power ... 115 VAC +10%, 50/60 Hz (100 VAC, 220 VAC, 230/240 VAC available upon special order).

USER-FRIENDLY OPERATION

Taking advantage of many years of related software experience, GSE engineers have created a very user-friendly way to set up and operate the Model 560. This unit features a 2 line by 16 character alphanumeric LCD display and a 4x5 membrane keypad. By following the user prompts on the display, you can quickly and easily program all limit values and examine cycle data. The user prompts, limit names, and alarm or diagnostic messages are written in English. The use of Error Codes, look-up Tables, and abbreviations has been virtually eliminated.

COMPACT SIZE, DURABLE ENCLOSURE

The Model 560 is a self-contained unit requiring very little wall space to mount. The rugged NEMA enclosure is only 10" wide x 12" high x 5" deep and can be easily mounted to most surfaces close to the worker. The unit requires only a single 110 VAC supply, and uses quick disconnects for all signal cables. The memory is backed up with a battery to insure that critical data is not lost when power is removed.

STATISTICAL CAPABILITIES

An added feature of the Model 560 is its ability to perform some of the basic evaluations of your process control and capability right at the work station. The Model 560 updates stats values based on a programmable sample size for XBAR and RANGE after each rundown or cycle. These values can be observed by monitoring the appropriate parameter. A Stats Alarm Indicator Light on the front of the 560 alerts the operator when the average or range exceed preset limits.

In addition, upon demand the 560 calculates process capability statistics based upon the entire store of data in memory. These include process average (XDOUBLE-BAR), process range (RBAR), standard deviation, +3 sigma, capability index (Cpk) and capability ratio (Cr).

The Computer Port allows you to interface the 560 with a computer for more complex statistical evaluations through the GSE FASNET network using high-level SPC software.

DIAGNOSTIC CAPABILITIES

One of the design goals of the Model 560 was to provide evaluations of critical assemblies in an enclosure that could be easily installed. To aid with installation, several diagnostic routines are included in the software to allow you to open or close outputs, display the status of the inputs, or watch an angle counter increment and decrement as the spindle turns. To assist in evaluation, you can attach a printer and get cycle data on a part-by-part basis or only when there has been a rejected assembly. The 560 is also capable of transmitting a Torque (or Force) vs. Time plot to an Epson graphics-compatible printer with a serial port and a 32K buffer.

ADDITIONAL DIAGNOSTIC CAPABILITIES

In addition, the Force or Torque and Angle signals are available on a test connector to allow you to attach a GSE Model 840 or 845 which will allow you to store the waveform and plot it in a number of ways to perform detailed analysis. With the Model 845, a particular portion of the waveform can be closely examined. Such things as Force or Angle vs. Time, Torque and Tension vs. Angle, or Torque vs. Tension can also be plotted.

COMPUTER INTERFACE

A standard RS-422 Full duplex serial port is included for upload of data into a host computer or PLC. The GSE FASNET RS485 multi-drop network can link several workstations together to build a data network of multiple stations on a single multiconductor cable that can extend for thousands of feet and communicate at speeds of up to 38.9KBaud. In addition to transmitting the data, the 560 is capable of uploading and downloading limit values to and from the host.

MINIMAL DOWN TIME

GSE knows how important reliable equipment is to you and designed the electronics for ease of maintenance. The Model 560 offers a simple modular approach in electronic packaging. All electronics have been designed to simplify field repair through the use of quick disconnects for all power and signal lines. This greatly simplifies field service and keeps repair time as short as possible.

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A SAMPLE FORCE APPLICATION

When measuring the force required to press a bearing onto a drive shaft or to turn over a freshly assembled engine, an initial spike will occur as friction or inertia is overcome. However, what you want to record is the force level which occurs after this peak. The Model 560 helps you acquire this data by allowing for a time out in the recording cycle after threshold is reached so that extraneous initial peaks are ignored.

A TORQUE-ANGLE APPLICATION

If cross-threaded and stripped fasteners are a problem, a Torque and Angle equipped Model 560 can help. In most cases, Torque-only equipment will indicate that the fastener was tightened to an acceptable peak torque value. However, these systems cannot detect whether the fastener threads were stripped after the torque peak was reached. A Model 560 featuring Torque-Angle measurement will detect these unacceptable joints due to the high angle of fastener rotation even though the peak torque had fallen within limits.

ANOTHER TORQUE-ANGLE SOLUTION

Conventional thinking follows that perfect torque will provide a perfect joint. However, since as much as 80-90% of fastener torque can go into friction in the threads and under the head, leaving as little as 10% of the force for tension to clamp the joint. Just a small change in the coefficient of friction can produce a relatively large change in the tension. Friction in the joint may vary due to deviations in materials, lubrication, thread finish, etc., leading to wide variations in clamping force. If torque only is measured, there is no indication of how these factors are affecting the integrity of the joint.

For example, if the fastener material is harder than normal, the fastener will reach the desired peak torque level before it is fully tightened. If the fastener is softer than normal, the joint will be overtightened when it reaches the desired peak torque. By employing a torque and angle measuring system, such joints would be rejected because the angle of rotation is too low or too high even though peak torque is within acceptable limits.

THE DISPLAY

The display is a two line by 16 character alpha-numeric LCD panel. The upper line will usually show the number and name of the parameter that is currently displayed. The lower line will show the number of the limit set (if two or more limit sets are used), the data pertinent to the displayed parameter, and will also display questions which pertain to the programming of the Model 560 and messages in the event of error.

When looking at Data Readout parameters, such as PEAK or FINAL ANGLE, the data will be flagged high or low if it is out-of-limit. Some sample displays are shown below.

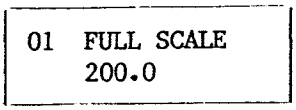

Figure 2a Programmable Parameter Display
(1 limit set & no units)

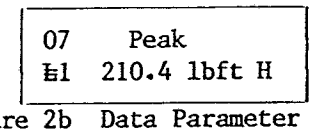

Figure 2b Data Parameter Display
(Limit Set 1, Lb-Ft Units, and flagged High)

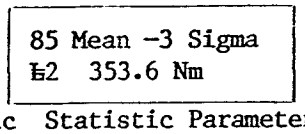

Figure 2c Statistic Parameter Display
(Limit Set 2, Newton-Meter Units)

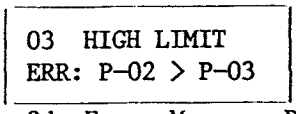

Figure 2d Error Message Display
(HIGH LIMIT was entered with
lower value than LOW LIMIT)

Figure 2 Model 560 Sample Displays

THE KEYBOARD

The Model 560 keyboard is used to select parameter codes and values, and to display, change or print torque and statistical data. It is formatted in a 4 key X 5 key membrane pad, with numeric characters (including a decimal point) and 9 special function keys (see Figure 3 below).

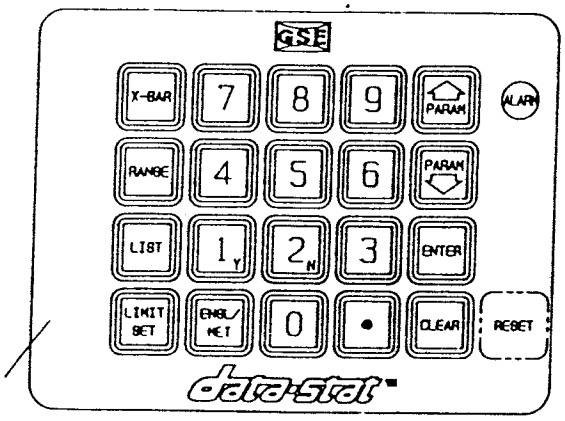

Figure 3 Model 560 Keyboard

BASIC KEYBOARD OPERATION

Operation of the Model 560 is simplified through the use of the interactive keyboard and display. There are two basic keyboard operations required to program and use the 560: moving from one parameter to another, and changing the values contained in a programmable parameter.

DISPLAYING PARAMETERS: Press [▲ PARAM] once to advance to the next parameter, or hold it down and the 560 will move forward quickly.

Press the [▼ PARAM] key to back up to the lower numbered parameter, or hold it down to move backward faster.

ENTERING NEW PARAMETER VALUES: To change the value for the displayed parameter: press [CLEAR], enter the new value, press [ENTER], and the new value will replace the old.

KEY FUNCTIONS

Going clockwise around the keyboard starting from the upper right:

[▲ PARAM] is used to advance to a higher numbered parameter.

[▼ PARAM] is used to back up to a lower numbered parameter.

[ENTER] is used to enter a parameter value into the Model 560 program.

[CLEAR] is used to clear an existing parameter value before entering a new value. It is also used during a Master Reset.

[RESET] is used to perform a Push-Button Reset or when initially configuring the system.

[ENGL/MET] is used to convert the units of measure from primary to secondary units, for instance from NM to lb-ft. The primary and secondary units are designated by parameter P-47.

[LIMIT SET] is pressed to change from one set of torque and angle limits to the other.

[LIST] is pressed to display the last "n" readings, also called the Sample Size. This value is set by parameter P-72.

[RANGE] is pressed to display the range of the last statistical group of readings.

[X-BAR] is pressed to display the average or mean of the last group of readings.

[Y] and [N] appear in the lower right corner of the numeral 1 and 2 keys respectively. These are used while setting up the Model 560 and to answer questions which appear in the display. Press the numeral 1 to answer "YES" and 2 to answer "NO".

ABOUT THIS MANUAL

The GSE Model 560 has been designed to be as user friendly as possible. Yet there are so many different ways to apply products like this that many questions typically go unanswered. One of the basic design considerations was making installation, check out, and calibration as simple as possible. This manual was written to eliminate as much confusion as possible when you install and service the equipment yourself. Any comments, questions, or suggestions concerning this manual can be addressed to the Technical Writer at GSE, Inc., 23640 Research Drive, Farmington Hills, MI 48024.

1. INSTALLATION

This part of the manual guides you through installation, connection of all wires and cables, and calibration.

1.1 MOUNTING

The Model 560 should be mounted At Eye Level or Above in a location that is as close to the operator as possible. Mounting the unit close to the work will minimize the length of the wires carrying the transducer and angle signals.

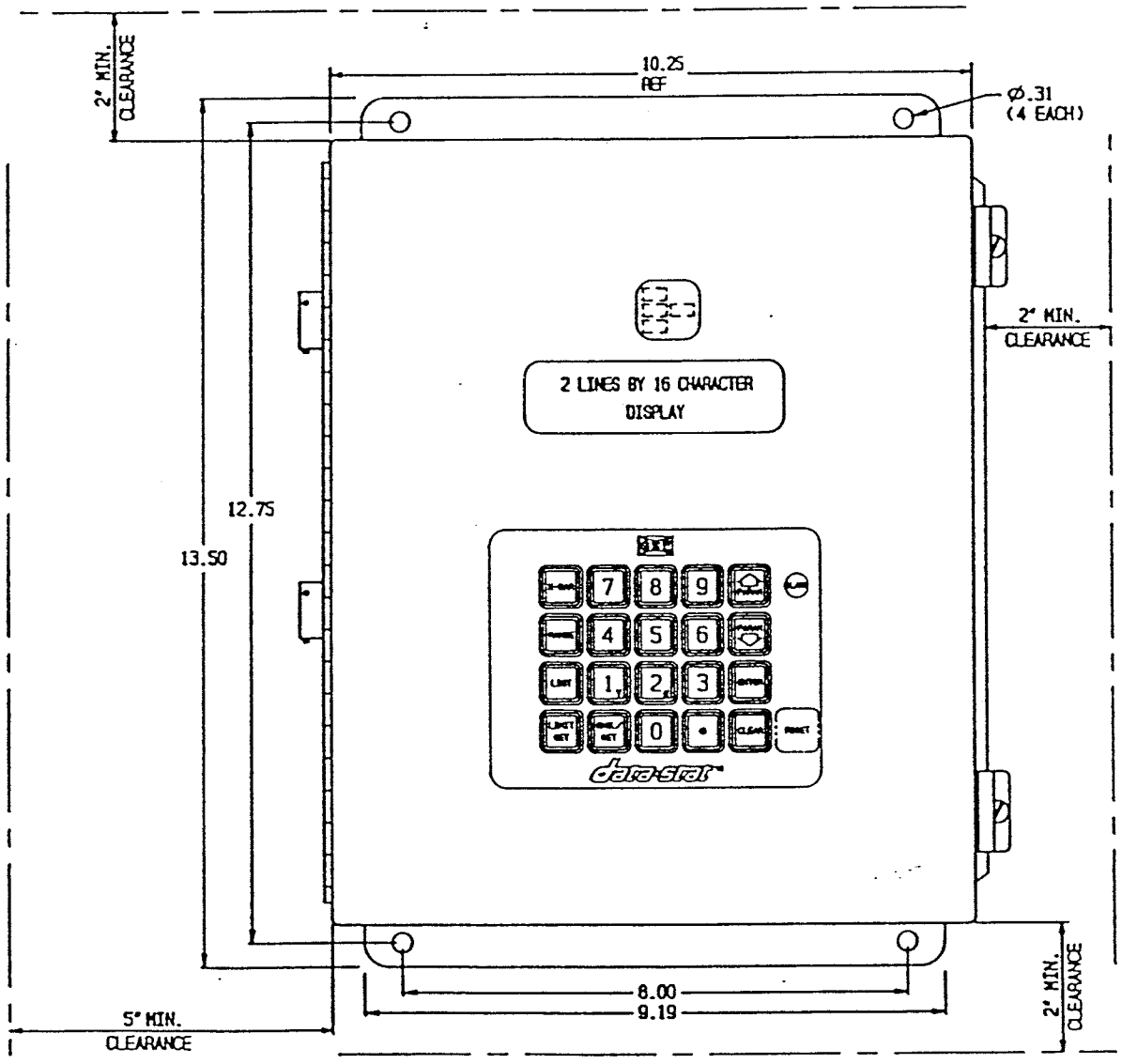

Figure 4 Model 560 Mounting Requirements

The 560 should be mounted so that it is protected from heavy machinery like fork-lift trucks that move heavy pallets of parts. The location should not be near large electrical systems, motors, or welding equipment. Also, keep the unit away from areas of temperature or moisture extremes.

Do not mount the Model 560 to a vibrating structure! Figure 4 illustrates the mounting hole bolt pattern and minimum side clearances. Note these clearances, especially on the left side which requires a minimum of 5" to allow enough room for the 19 pin ANGLE connector.

1.2 DRILLING HOLES FOR POWER AND SIGNAL INPUTS

Figure 5 shows the recommended hole locations for routing the AC power and I/O signal lines. Drill or punch one hole to bring AC power in, and a second hole for the control signals. You may want to drill two holes to isolate the input and output signal wiring.

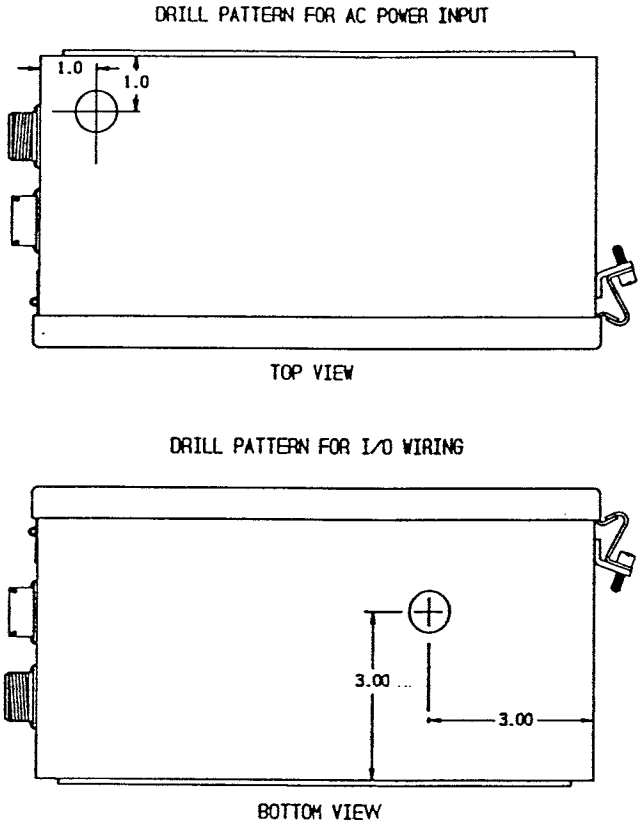

Figure 5 Drill Patterns for Power and I/O Wiring

When drilling holes in the Model 560 case, Be Extremely Careful That No Metal Shavings Fall into the Electronics! Even a very small metal chip can short the electrical signals and cause the 560 to cease functioning. Place a protective covering over all electronic assemblies while drilling the enclosure, and lay the unit on its side to allow all metal shavings to fall to a safe area. Remove all metal shavings before installing.

Once the holes are made, install the conduit connectors, grommets, etc. before mounting the enclosure to the wall. Mount the Model 560 enclosure using 4 fasteners of 0.25" diameter.

* Important Grounding Note *

To help in grounding the 560, place a toothed star washer under the heads of the mounting bolts to cut through any paint and help ground the case to the structural steel. Adding a braided ground conductor between the 560 case and the structural steel will assure a good electrical ground. Use braided wire rather than multi-strand copper wire, since braided cable conducts high frequency "noise" better than even very heavy solid copper wire.

1.3 WIRING

After the enclosure has been mounted, install the power wiring and I/O lines. If the solenoid option is installed, the transformer will be pre-wired for the proper voltage.

1.3.1 POWER INPUT CONSIDERATIONS

Since the Model 560 is actually a microcomputer, there are limits on what it can stand regarding AC power input. If there is excessive noise on the power line, add an appropriate line filtering device (see 1.3.4, Electrical Noise Testing p. 10).

If the power will be subject to over-voltage and under-voltage conditions, add an appropriate constant voltage transformer. The 560 is rated at 115 VAC $\pm$ 10% in its standard configuration, but can be ordered to accept input voltages between 195 and 260 VAC.

1.3.2 AC POWER LEADS

Keep the AC power leads inside the box as short as possible to minimize radiation of power line electrical noise. GSE engineers have added a line filter to stop electrical power noise, and adding long power leads inside the 560 enclosure defeats the purpose of this filter. It is recommended that service loops not be used, but if they are required, place them in a junction box or wire trough somewhere near the system.

1.3.3 RELAY BOARD WIRING

* Important Input Wiring Note *

When installing the input wiring for Sample and Hold, Cycle-On and the Limit Select Switch, the incoming cables must be shielded and the shields grounded to the 560 enclosure! This keeps electrical noise from interfering with the operation of the 560. GSE recommends using Belden 8760 cable which can be ordered from GSE using #22-10-3100. Attach the shields to the panel mounting screw located in the lower left corner of the 560 enclosure adjacent to the Relay Board. Use a crimp-on ring terminal and a star-toothed washer to insure optimum contact. Do not ground the shields at the switch or the input device end!

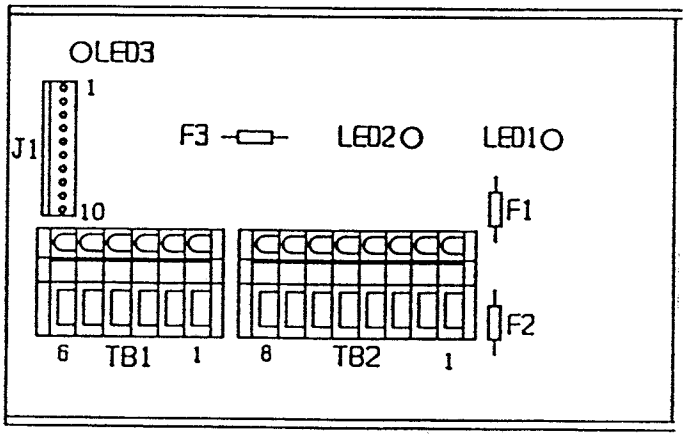

Figure 6 Relay Board Layout

INPUT WIRING. Three inputs terminate at the Relay Board Input Terminal Block (TB1): Cycle-On, Limit Select, and Measurement Input (also known as Sample and Hold). All three inputs require an isolated contact closure to DC Common (DC Common is available at TB1), and DO NOT require any additional power supply. The pin definitions for the Terminal Blocks for the Relay Board are described in Table 1.

If 3 or 4 limit sets will be used with a remote selector switch, attach the additional pair of limit set leads at the Measurement Input terminals. The remote limit selector switch should use the following logic for selecting limit sets:

Limit Set #	TB1 Pins 3-4	TB1 Pins 5-6
1	open	open
2	grounded	open
3	open	grounded
4	grounded	grounded

OUTPUT WIRING. Three outputs terminate at TB2 of the Relay Board. There are two single-pole double-throw relays for the ACCEPT and REJECT outputs which can be wired for normally open (N.O.) or normally closed (N.C.) operation. There is also a solid state output to furnish a Cycle Complete signal, to another device such as a PLC. The solid state output is typically not used for solenoid control since the optional Solenoid Driver Board is used for control applications. Pin definitions are listed in Table 1 below.

Table 1 RELAY BOARD Terminal Wiring

Input Terminal Block 1 (TB1)	
Signal Name	Connector Pin
Cycle-On	1
GND (Cycle-On Return)	2
Limit Select	3
GND (Limit Select Ret.)	4
Sample & Hold (Meas. In.)	5
GND (Sample and Hold Ret.)	6
Output Terminal Block 2 (TB2)	
Signal Name	Connector Pin
Accept N.C.	1
Accept Com.	2
Accept N.O.	3
Reject N.C.	4
Reject Com.	5
Reject N.O.	6
Cycle Complete +	7
Cycle Complete -	8

NOTE 1: If power is required for the outputs, it must be provided from outside of the 560. DO NOT use the 12 VDC supply of the 560! This keeps the the power and ground lines from being used for I/O and keeps the ground line of the microprocessor free from noise.

NOTE 2: If the outputs of the 560 are used to drive the coils of relays, transformer type "press to test" lights, or any other inductive load, A FLYBACK DIODE SHOULD BE ADDED TO THE DC RELAY COILS, OR AN MOV (Metal Oxide Varistor) ADDED TO THE AC COILS. These will help to suppress inductive flyback when the current into the load is shut off. Place these snubbing devices as near the inductive coil as possible.

1.3.4 ELECTRICAL NOISE TESTING

Care should be taken on all field wires to assure they are as electrically "quiet" as possible. Route all field wires away from electrically noisy devices. Inductive devices typically generate very strong electrical and magnetic fields so keep all I/O lines as far from motors, relays, contactors, etc. as possible.

If you do not know if a device is radiating electrical noise, use an AM/FM radio to help you determine field strength.

1. Turn the radio onto AM, and tune the dial near the center free of any stations.
2. Turn the radio up and listen for static.
3. Turn on the devices in question (motors, relays, press-to-test lights, etc.) and listen for an increase in static level.
4. If the level of static increases or the radio makes a crackling noise similar to when a lightening bolt strikes nearby, electrical noise is present. See Step 8.
5. If the device under question cannot be turned off, turn on the radio on 50 to 100 feet away in an area that has as few electrical devices as possible.
6. Note the static level, and then walk toward the device and place the radio near the device in question. If the static level increases, follow Step 8.
7. Repeat these tests using the FM band.
8. If any of the above tests indicate that a high degree of electrical noise is present, then guard all 560 lines by placing them inside conduit. You should also consider adding flyback diodes to any DC relay coils or an MOV to any AC coil within 10 feet or so of the 560.

1.4 SOLENOID CONTROL (Optional)

The Model 560 offers an optional solenoid control package. Although this option is usually installed at the factory, it can be added at a later date.

The solenoid control option package includes a printed circuit board, a transformer assembly, and a cable assembly. The Solenoid Board snaps into a track in the lower right corner of the main enclosure and the transformer mounts directly above it (see Figure 23, page 40). The solenoid driver uses a controlled current to actuate the valve and operates a Normally Closed (N.C.) valve.

1.4.1 SOLENOID DRIVER WIRING

There are many ways of wiring solenoid valves. The proper system wiring for motors with control capabilities is shown in Figure 7, p. 11. Please note that this example includes a manually operated electrical switch to generate a Cycle-On input into the 560, and wiring from the 560 to the solenoid coil. These leads can be run to the 560 in two different ways.

1. The solenoid driver leads and Cycle-On input are available at the 19 pin ANGLE connector (pins K & L and M & N).
2. Discrete leads for the Solenoid can be run to Terminal Block 1 (TB1) on the Solenoid Driver Board. The Cycle-On input is also available at TB1 on the Relay Board.

If a right-angle nutrunner with a single 19 pin cable is used, it can be attached to the ANGLE connector where the solenoid and Cycle-On leads are picked up. Many in-line tools employ three cables, one each for torque, angle, and the solenoid. In that case you have the option of connecting the solenoid cable to the ANGLE connector or directly to the Solenoid Driver Board (see below).

Table 2 SOLENOID DRIVER BOARD Wiring

Terminal Block 1 (TB1)	
Signal Name	Connector Pin
Solenoid -	1
Solenoid +	2
Chassis Ground	3

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Care should be taken on all field wires to assure they are as electrically "quiet" as possible. Route all field wires away from electrically noisy devices. Inductive devices typically generate very strong electrical and magnetic fields so keep all I/O lines as far from motors, relays, contactors, etc. as possible.

If you do not know if a device is radiating electrical noise, use an AM/FM radio to help you determine field strength.

1. Turn the radio onto AM, and tune the dial near the center free of any stations.
2. Turn the radio up and listen for static.
3. Turn on the devices in question (motors, relays, press-to-test lights, etc.) and listen for an increase in static level.
4. If the level of static increases or the radio makes a crackling noise similar to when a lightening bolt strikes nearby, electrical noise is present. See Step 8.
5. If the device under question cannot be turned off, turn on the radio on 50 to 100 feet away in an area that has as few electrical devices as possible.
6. Note the static level, and then walk toward the device and place the radio near the device in question. If the static level increases, follow Step 8.
7. Repeat these tests using the FM band.
8. If any of the above tests indicate that a high degree of electrical noise is present, then guard all 560 lines by placing them inside conduit. You should also consider adding flyback diodes to any DC relay coils or an MOV to any AC coil within 10 feet or so of the 560.

1.4 SOLENOID CONTROL (Optional)

The Model 560 offers an optional solenoid control package. Although this option is usually installed at the factory, it can be added at a later date.

The solenoid control option package includes a printed circuit board, a transformer assembly, and a cable assembly. The Solenoid Board snaps into a track in the lower right corner of the main enclosure and the transformer mounts directly above it (see Figure 23, page 40). The solenoid driver uses a controlled current to actuate the valve and operates a Normally Closed (N.C.) valve.

1.4.1 SOLENOID DRIVER WIRING

There are many ways of wiring solenoid valves. The proper system wiring for motors with control capabilities is shown in Figure 7, p. 11. Please note that this example includes a manually operated electrical switch to generate a Cycle-On input into the 560, and wiring from the 560 to the solenoid coil. These leads can be run to the 560 in two different ways.

1. The solenoid driver leads and Cycle-On input are available at the 19 pin ANGLE connector (pins K & L and M & N).
2. Discrete leads for the Solenoid can be run to Terminal Block 1 (TB1) on the Solenoid Driver Board. The Cycle-On input is also available at TB1 on the Relay Board.

If a right-angle nutrunner with a single 19 pin cable is used, it can be attached to the ANGLE connector where the solenoid and Cycle-On leads are picked up. Many in-line tools employ three cables, one each for torque, angle, and the solenoid. In that case you have the option of connecting the solenoid cable to the ANGLE connector or directly to the Solenoid Driver Board (see below).

Table 2 SOLENOID DRIVER BOARD Wiring

Terminal Block 1 (TB1)	
Signal Name	Connector Pin
Solenoid -	1
Solenoid +	2
Chassis Ground	3

1.4.2 INSTALLATION OF SOLENOID DRIVER

The Solenoid Driver option can be installed in the field. The option package includes a Solenoid Transformer, the Solenoid Driver Board, and an 18" cable. Follow the procedure below and refer to GSE drawing T-21358-D when installing the Solenoid Control in the Model 560.

1. The Solenoid Driver Transformer will be installed in the space to the right of the Power Supply Transformer. Remove the screw that secures the AC power lead from the Power Supply Transformer.

2. Locate the Solenoid Transformer over the screw holes and secure it to the chassis with the screws provided. The hold down for the AC power lead should be attached with the top screw, and the ring loop connector from the 5" Solenoid Driver Board cable lead should be attached with the bottom screw.

3. Press the Solenoid Driver Board into the snap track beside the Relay Board.

4. The 4" lead from the Solenoid Transformer connects to the AC Power lead. The 5" lead connects to J2 on the Solenoid Driver Board.

5. The two pin connector on 18" cable that comes with the package connects to J1 on the Solenoid Driver Board. This cable should be routed above the snap track, above the Relay Board, then down along the left edge of the Relay Board and over toward the Main Board.

6. The cover over the Main Board must be removed. The screw that secures the Main Board on the lower right hand corner should be removed and the ring loop connector for the signal ground attached.

7. The connector locates on J13 of the Main Board.

8. Replace the Main Board Cover and the installation is complete.

1.4.3 SOLENOID OPERATION

Typically, the solenoid is controlled exclusively by the microprocessor. When the Cycle-On input goes true, the 560 microprocessor commands the solenoid valve to actuate.

When the solenoid output first goes active, it hits the solenoid with a high voltage (high current) to force it open, then reduces the amount of power going to the solenoid to a level just high enough to keep it open. Changing this power level is done to allow the valve to shut off quicker at the end of the cycle thus minimizing overshoot.

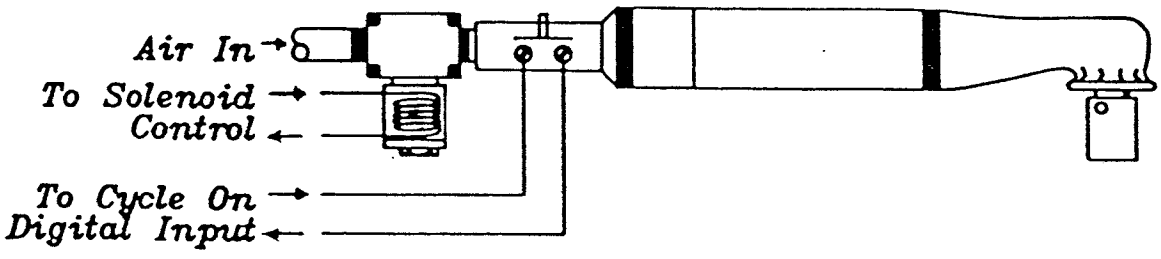

Figure 7 Normally Closed Solenoid Control Wiring

1.5 CABLING TECHNIQUES AND WIRING CODES

GSE has created a series of standard cables for use with the Model 560. However, it was not possible to create cables to interface the 560 to all tools and devices. Refer to the tables on this page when ordering standard cable assemblies or manufacturing your own.

1.5.1 TYPICAL CABLING

On the left side of the 560, the signals for the torque, angle, solenoid driver, and remote annunciator lights pass through the TORQUE and ANGLE connectors. This two connector scheme was designed to allow the 560 to be interfaced to an angle head nutrunner or a single in-line spindle. If a single in-line nutrunner is used, the typical cabling uses two separate cables coming off the tool: a torque cable and an angle cable.

1.5.2 STANDARD CABLE ASSEMBLIES

The cable assemblies listed below will interface to several common airtools, the Model 415 Port Multiplexer, and a Serial Printer. These have been shipped with your 560 if ordered. If not, consult your GSE Sales Engineer or Sales Rep for cable order information.

Table 3 STANDARD CABLES

DESCRIPTION	GSE PART#
M560 to 6 pin (PT06W)	299210-41XXX
M560 to 6 pin (PT01A)	299210-E9XXX
M560 to 6 pin (PT06A)	299210-J2XXX
M560 to 4 pin (PT06A)	299210-T3XXX
M560 to 4 pin (PT01A)	299210-T4XXX
M560 to 4 pin (PT06A)	299210-53XXX
M560 to 4 pin (PT06W)	299210-73XXX
M560 to IR Tool	299210-S1XXX
M560 to Stanley Tool	299210-S0XXX
M560 to CP Tool	299210-S2XXX
M560 to Rotor Tool	299210-T2XXX
M560 to T/A Sensor w/loose wires for Solenoid & Cycle-On	299290-09XXX
M560 to T/A Sensor	299210-P9XXX
M560 to Printer	299230-23XXX
M560 to M415	299220-37XXX
M560 to M840/M845	299290-08XXX

XXX = Length in feet (250 = 25 Feet)

1.5.3 CABLE WIRING CODES AND MATING CONNECTORS

Table 4 ANGLE CONNECTOR

Signal Name	Connector Pin
+ Excitation (+5VDC)	A
- Excitation (-5VDC)	B
+ Signal	C
- Signal	D
Shield	E
Angle Encoder Trailing	F
Angle Encoder Lead	H
Solenoid +	K
Solenoid -	L
Cycle-On Switch	M
Cycle-On Switch	N
D.C. Common (Shaft Encoder Common)	P
+ 5V (Shaft Encoder Power)	R
Low Indicator Light YEL	S
+ 12 VDC (Annunciator Pwr)	T
Good Indicator Light GRN	U
High Indicator Light RED	V

Table 5 TORQUE CONNECTOR

Signal Name	Connector Pin
+ Excitation	A
- Excitation	B
+ Signal	C
- Signal	D
Shield	G

Table 6 PRINTER CONNECTOR (RS 232C)

Signal Name	Connector Pin
Data Out of 560	A
Ground	B
Clear To Send	C
Data Into 560	D
Shield	E

Table 7 COMPUTER CONNECTOR (RS422)

Signal Name	Connector Pin
Data Into 560 +	A
Data Into 560 -	B
Ground	C
Data Out of 560 +	D
Data Out of 560 -	E
Ground	F
560's Clear To Send +	G
560's Clear To Send -	H
560's Request to Send +	J
560's Request To Send -	K

Table 8 Mating Connectors

NAME	CONNECTOR TYPE	GSE PART#
ANGLE	PT06A-14-19P(SR)	23-10-5200
TORQUE	MS3106A-16S-1P	24-10-6000
(clamp)	AN3057-8	24-60-2200
PRINTER	MS3106A-14S-5P	24-10-4400
(clamp)	AN3057-6	24-60-2000
COMPUTER	PT06A-12-10S(SR)	23-20-4000

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M560 to 4 pin (PT06W)	299210-73XXX
M560 to IR Tool	299210-S1XXX
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Shield	E
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Angle Encoder Lead	H
Solenoid +	K
Solenoid -	L
Cycle-On Switch	M
Cycle-On Switch	N
D.C. Common (Shaft Encoder Common)	P
+ 5V (Shaft Encoder Power)	R
Low Indicator Light YEL	S
+ 12 VDC (Annunciator Pwr)	T
Good Indicator Light GRN	U
High Indicator Light RED	V

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Signal Name	Connector Pin
Data Out of 560	A
Ground	B
Clear To Send	C
Data Into 560	D
Shield	E

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Signal Name	Connector Pin
Data Into 560 +	A
Data Into 560 -	B
Ground	C
Data Out of 560 +	D
Data Out of 560 -	E
Ground	F
560's Clear To Send +	G
560's Clear To Send -	H
560's Request to Send +	J
560's Request To Send -	K

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TORQUE	MS3106A-16S-1P	24-10-6000
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PRINTER	MS3106A-14S-5P	24-10-4400
(clamp)	AN3057-6	24-60-2000
COMPUTER	PT06A-12-10S(SR)	23-20-4000

1.6 POWER UP TESTING

Once the Model 560 is bolted in place and all power and I/O wiring is complete, turn the system on. When power is first applied the display should read "GSE, Inc., Model 560", or "RECONFIGURATION NEEDED".

If you are not satisfied with the contrast of the LCD display, a potentiometer can be adjusted to set the display contrast. This potentiometer (P1) is on the far left side center of the Main Board (see below).

1.6.1 SYSTEM CONFIGURATION

Depending on the application, some portions of the Model 560 System Configuration procedure may need to be completed before I/O wiring can be tested. Among other things, this procedure determines which inputs the Model 560 will use and which are ignored. For example, if the 560 is not configured to use Cycle-On, it will not monitor the input for this feature.

The Configuration Procedure consists of answering questions contained in the Configuration Menu. To reach this menu, place Switch 3 of U16 on the Main Board (see below) in the "ON" position. Press the [RESET] key, then press and hold the decimal point key until the RAM test is finished.

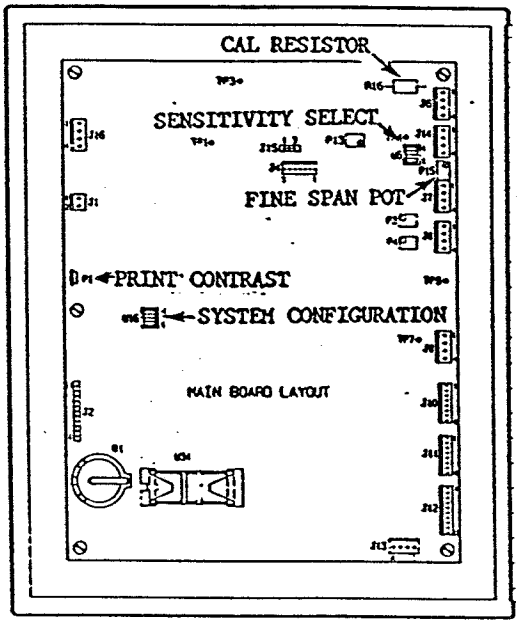

Figure 8 Main Board Adjustments (Cover Removed)

1.6.1 SYSTEM CONFIGURATION cont'd

The steps of this procedure that relate to testing I/O wiring are indicated by a *. Only those questions are included below. Answer "NO" to all unstarred questions. A complete description of the Configuration Menu is provided in 3.1.

Use the following procedure for configuring the Model 560:

A. Press [Y] (the numeral 1 key) to answer "YES".

B. Press [N] (the numeral 2 key) to answer "NO".

C. Press [▲ PARAM] to advance to the next configuration question, or press [▼ PARAM] to backup to the previous configuration question.

The configuration questions will appear in the following order:

1. The upper line of the display reads "CONFIGURATION MENU" and the lower line shows the first question, "ANGLE USED?" If angle measurement will be used in this application, answer "YES". If angle will not be used, press [N]. If you answer "NO" to this question, the three angle related questions below will not appear.

   A. "LOW ZONE ANG?"

   B. "MID ZONE ANG?"

   C. "REHIT REJECT?"

2. "SPC OUTPUT?"

3. "SAMPLE TIME?"

4. "END TIME?"

5. "SAMPLE DELAY?"

*6. "LIMIT SETS?" For this question you will enter the number of limit sets (1-4) that will be used. If multiple limit sets (two or more) will be used answer "YES" so that the Limit Set Input can be tested.

1.6.1 SYSTEM CONFIGURATION cont'd

*7. "MEAS. INPUT?" If a remote Measurement Input signal (Sample and Hold) has been wired to RELAY BOARD TB1 Pins 5-6, answer "YES". However, this input cannot be used for this purpose if 3 or 4 limit sets were requested in question 6. The measurement input cannot be used when the Motor Control feature is enabled.

*8. "MOTOR CONTROL?" If the solenoid driver output will be used, answer "YES".

*9. "CYC.ON INPUT?" If a remote input will be used to initiate the cycle, answer "YES". For Threshold Start, answer "NO".

10. "RESET PARAMS?" Since the 560 is being installed, answer "YES". This will set all programmable parameters to the default values. Answering "NO" would retain the present values.

11. "NEED SECURITY?" If you answer "YES", the Model 560 will ask you to enter a 4 digit code number. This code must be entered into parameter P-00 before the Model 560 can be programmed. If you answer "NO", P-00 will not appear and the 560 may be programmed without entering the code number.

NOTE: If you use the Security Access Code feature, be sure to record the code number you enter for future programming purposes.

12. Once the system is properly configured, return switch 3 of U16 to the "OFF" position.

1.6.2 DIGITAL INPUT CHECK

Once the configuration is complete, you can verify that all wires are properly connected and power brought to the appropriate pins by following these sequences of operation:

CYCLE-ON INPUT: Display parameter P-07 (press the [▲ PARAM] key until the upper line of the display shows "07 Peak"). Toggling the Cycle-On input will blank the display while the input is true, and show the parameter value when it is false.

If the optional Solenoid Board is installed, the Solenoid Driver output will go active when the Cycle-On input goes true. LED1 on the Solenoid Board and LED3 on the Relay Board will light up. Shorting Relay Board TB1 terminals 1 & 2 or pins M & N of the 19 pin ANGLE connector will also cause Cycle-On to go active.

LIMIT SELECT INPUT: This input is usable only if you entered 2, 3 or 4 in the "LIMIT SETS?" question in the Configuration routine. To see if the Limit Select input is properly functioning, access a parameter (such as P-01) that displays a limit value on the front of the 560. The Limit Set selection appears in the lower left corner of the display. The Limit Set selection inputs use the following logic:

Limit Set #	TB1 Pins 3-4	TB1 Pins 5-6
1	open	open
2	grounded	open
3	open	grounded
4	grounded	grounded

MEASUREMENT INPUT: This input is used only if you answered "YES" to the setup question "MEAS. INPUT?". Shorting RELAY BOARD TB1 terminals 5 & 6 will also cause the measurement interval to start. This is observed by the display blanking out.

1.6.1 SYSTEM CONFIGURATION cont'd

*7. "MEAS. INPUT?" If a remote Measurement Input signal (Sample and Hold) has been wired to RELAY BOARD TB1 Pins 5-6, answer "YES". However, this input cannot be used for this purpose if 3 or 4 limit sets were requested in question 6. The measurement input cannot be used when the Motor Control feature is enabled.

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*9. "CYC.ON INPUT?" If a remote input will be used to initiate the cycle, answer "YES". For Threshold Start, answer "NO".

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1.6.3 DIGITAL OUTPUT TEST

To check all relay outputs and indicator lights press the [RESET] key. A Reset causes all outputs to sequentially go active for a short time. LED1 and LED2 on the Relay Board will blink. This includes the ACCEPT and REJECT relays and the remote annunciator light signals that exit through the 19 pin Angle connector. If the solenoid driver is used, it is possible to check it by activating the Cycle-On input. LED3 on the Relay Board and LED1 on the Solenoid board will light.

There are two relays and one open collector output on the Relay Board. The relays are for ACCEPT and REJECT outputs, and are presented to TB2 terminals 1 thru 6. To protect the relay contacts and open collector output from overload, a 5 amp fuse is included in series with the Common terminal of each relay and the negative Output Terminal of the Open Collector driver, (F1, F2, and F3). These fuses are located near the relays and look like resistors. Recommended replacement is Littlefuse #255005.

In addition, the relays and fuses are socketed to simplify their replacement. These relays are rated at 50 million mechanical cycles with no load and 100,000 electrical cycles. They should not require replacement unless they are abused.

1.6.4 TESTING THE ANGLE ENCODER

If your Model 560 is configured for angle measurement and you want to make sure the encoder is operating properly, enter the correct value for counts per revolution into parameter P-20 (see 3.3 and 3.3.3). Then display parameter P-49, Angle Counts, and press [CLEAR] and [ENTER]. You can then turn the spindle and the 560 should show the angle indexing.

1.6.5 SOLENOID VOLTAGE ADJUSTMENTS

For critical control applications where overshoot is a factor, and for those applications that use large solenoid valves, a current adjustment pot (P1) on the Solenoid Driver Board allows you to adjust the holding level.

Apply the Cycle-On input. Attach the positive lead of a voltmeter on the test point labeled TP1 and the negative lead on TP2 (see Figure 9). Reduce the hold voltage using P1 until the solenoid drops out.

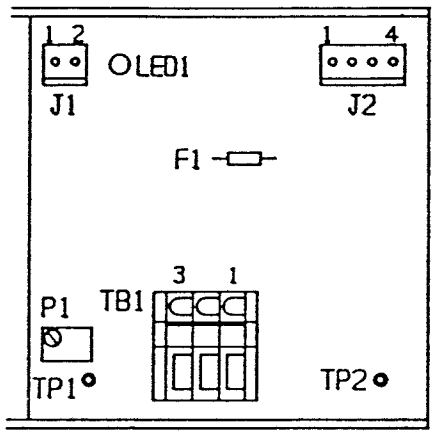

Figure 9 Solenoid Driver Board

Turn the voltage back up 1/4 turn to allow the unit to operate reliably with an acceptable amount of safety margin. This assures the best case response time for turning off the solenoid, and will minimize the angle overshoot after the 560 "turns off" the solenoid.

If it isn't possible to adjust the voltage low enough to cause some smaller solenoid valves to drop out, assume that the solenoid is on the verge of dropping out at the lowest voltage setting, and increase the voltage back up 1/4 turn to assure a proper safety margin. This process should be repeated every time a new solenoid valve is installed.

1.7 CALIBRATION RESISTORS

Three Shunt Calibration Resistors are supplied with the Model 560: 43.575K, 87.150, and 500K. They are used to simulate a known load and calibrate the Model 560. To determine the proper resistor value, you need to know the bridge resistance in ohms, and the output of the transducer at full scale capacity, typically in millivolts per volt (mV/V). These can usually be found by looking on the transducer's label or the paperwork that accompanies these parts. Otherwise consult the Tool Specifications in the Appendix or contact the manufacturer.

1.7.1 CALIBRATION RESISTOR SELECTION

Look in the Table below for the bridge resistance of the transducer to be used with the 560, then down the column for the transducer output. The Resistor value will be listed to the right. If needed, cal resistors can be purchased from GSE using the listed GSE Part Numbers on the far right.

NOTE: Half-Scale or Quarter-Scale calibration can be accomplished by doubling or quadrupling the resistor value.

If you purchase a shunt cal resistor from a source other than GSE, please note that the sockets in the PC board are designed to accommodate resistor lead diameters from .014" dia. to .022" dia. Using a resistor with lead wires greater than .022" will cause permanent damage to the sockets, and using one smaller than .014" will not assure good electrical connection. GSE recommends a ±0.025% wire wound precision resistor for accurate calibration.

1.7.2 CALIBRATION RESISTOR INSTALLATION

It is necessary to remove the aluminum cover plate that protects the Main Board to access the Shunt Cal resistor. Once the cover is removed, look for the resistor labeled R-16 "CAL RESISTOR". The mounting location is the upper right corner of the printed circuit board mounted on the door. This resistor is pushed into sockets in the board.

If the resistor in the board is not the proper one to match your transducer, gently remove it by pulling it straight out using a pair of needle nose pliers. Trim the leads of the new Cal Resistor to size and insert into place.

Table 9 Calibration Resistor Selction Guide

	TRANSDUCER BRIDGE RESISTANCE (in Ohms)				RESISTOR VALUE	GSE PART #	
	120	350	700	1000			
	0.998 mV/V	2.90 mV/V	-----	-----	30K	06-50-3002	
S	0.688	2.00	3.98 mV/V	-----	43.575K	06-50-4352	*
I	0.599	1.74	3.48	-----	50K	06-50-5002	
M	0.550	1.60	3.19	-----	54.512K	06-50-5452	
U	0.400	1.16	2.32	3.311 mV/V	75K	06-50-7502	
L	0.344	1.00	2.00	2.852	87.150K	06-50-8712	*
A	0.300	0.873	1.74	2.488	100K	06-50-1003	
T	0.275	0.801	1.60	2.283	109.025K	06-50-1093	
E	0.271	0.790	1.58	2.250	110.611K	06-50-1103	
D	0.200	0.583	1.16	1.661	150K	06-50-1503	
	-----	0.437	0.873	1.247	200K	06-50-2003	
O	-----	0.400	0.800	1.142	218.4K	06-50-2183	
U	-----	0.350	0.699	0.9980	250K	06-50-2503	
T	-----	0.291	0.583	0.8319	300K	06-50-3003	
P	-----	0.250	0.500	0.7133	350K	06-50-3503	
U	-----	0.200	0.400	0.5713	437.1K	06-50-4373	
T	-----	-----	0.350	0.4995	500K	06-50-5003	*
	-----	-----	-----	0.2499	1MEG	06-50-1004	

* Supplied with the Model 560.

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If you purchase a shunt cal resistor from a source other than GSE, please note that the sockets in the PC board are designed to accommodate resistor lead diameters from .014" dia. to .022" dia. Using a resistor with lead wires greater than .022" will cause permanent damage to the sockets, and using one smaller than .014" will not assure good electrical connection. GSE recommends a ±0.025% wire wound precision resistor for accurate calibration.

1.7.2 CALIBRATION RESISTOR INSTALLATION

It is necessary to remove the aluminum cover plate that protects the Main Board to access the Shunt Cal resistor. Once the cover is removed, look for the resistor labeled R-16 "CAL RESISTOR". The mounting location is the upper right corner of the printed circuit board mounted on the door. This resistor is pushed into sockets in the board.

If the resistor in the board is not the proper one to match your transducer, gently remove it by pulling it straight out using a pair of needle nose pliers. Trim the leads of the new Cal Resistor to size and insert into place.

Table 9 Calibration Resistor Selction Guide

	TRANSDUCER BRIDGE RESISTANCE (in Ohms)				RESISTOR VALUE	GSE PART #	
	120	350	700	1000			
	0.998 mV/V	2.90 mV/V	-----	-----	30K	06-50-3002	
S	0.688	2.00	3.98 mV/V	-----	43.575K	06-50-4352	*
I	0.599	1.74	3.48	-----	50K	06-50-5002	
M	0.550	1.60	3.19	-----	54.512K	06-50-5452	
U	0.400	1.16	2.32	3.311 mV/V	75K	06-50-7502	
L	0.344	1.00	2.00	2.852	87.150K	06-50-8712	*
A	0.300	0.873	1.74	2.488	100K	06-50-1003	
T	0.275	0.801	1.60	2.283	109.025K	06-50-1093	
E	0.271	0.790	1.58	2.250	110.611K	06-50-1103	
D	0.200	0.583	1.16	1.661	150K	06-50-1503	
	-----	0.437	0.873	1.247	200K	06-50-2003	
O	-----	0.400	0.800	1.142	218.4K	06-50-2183	
U	-----	0.350	0.699	0.9980	250K	06-50-2503	
T	-----	0.291	0.583	0.8319	300K	06-50-3003	
P	-----	0.250	0.500	0.7133	350K	06-50-3503	
U	-----	0.200	0.400	0.5713	437.1K	06-50-4373	
T	-----	-----	0.350	0.4995	500K	06-50-5003	*
	-----	-----	-----	0.2499	1MEG	06-50-1004	

* Supplied with the Model 560.

1.8 GAIN ADJUSTMENTS

Adjusting the gain of the Model 560 to match the transducer output involves three steps: 1) Coarse Span; 2) Shunt Calibration; 3) Fine Span Adjustment.

1.8.1 COARSE SPAN ADJUSTMENT

Use the DIP switch, labeled U6 to select the proper transducer sensitivity (see Figure 8). Switches 1, 2, or 3 select 1, 2, and 4 mV/V respectively (use one only!). Choose the range which is equal to or exceeds the output of your transducer. For example, if you are using a transducer with an output of 0.8 mV/V then select the 1 mV/V range (Switch 1 is ON and Switches 2, 3, & 4 are OFF).

To accommodate low output transducers, turning on Switches 1 & 4 will set the sensitivity of the Model 560 to 0.5 mV/V.

1.8.2 SHUNT CALIBRATION

NOTE: Be sure that the Full Scale value has been entered into Parameter 01 before continuing (refer to 3.3.1).

Enter the Calibration Value for the transducer into Parameter 16 (see 3.2.2). Then access Parameter 17 and observe the displayed value. If the number displayed in Parameter 17 doesn't match the value entered into Parameter 16, the Cal Alarm light will be triggered. If the Alarm Light remains on see Fine Span Adjustment below.

1.8.3 FINE SPAN ADJUSTMENT

If Parameters 16 and 17 do not match, access Parameter 17 and adjust the FINE SPAN ADJUST potentiometer until Parameter 17 matches the value entered into Parameter 16. The FINE SPAN ADJUST potentiometer (P15) is located on the upper right side of the main printed circuit board (see Figure 8, p. 13).

It will probably be necessary to adjust the FINE SPAN ADJUSTMENT potentiometer every time a new transducer is attached due to small differences in bridge resistance.

1.9 PROGRAMMABLE FILTER

On a Model 560 with Main Board PC-681-D or later, a programmable filter to adjust the 3 db cutoff frequency is located on the upper edge at U52. This 6-segment DIP switch selects the desired frequency using a binary hexadecimal code. Refer to Table 10 below for a guide to setting this frequency. O = Switch Segment Open; C = Switch Segment Closed.

Table 10

FREQUENCY	SWITCH					
	1	2	3	4	5	6
44 Hz	C	C	C	C	C	C
100 Hz	C	C	C	C	C	O
200 Hz	C	C	C	C	O	C
300 Hz	C	C	C	C	O	O
400 Hz	C	C	C	O	C	C
500 Hz	C	C	C	O	C	O
700 Hz	C	C	C	O	O	O
800 Hz	C	C	O	C	C	C
1 KHz	C	O	C	C	C	C
1.5 KHz	C	O	C	O	C	O
2 KHz	O	C	C	C	C	C

1.10 INTERFACING THE MODEL 560 WITH A COMPUTER

The Model 560 can be interfaced with computers through its computer port. RS-422 is standard, which would require installation of a COM 422 board in the computer. However, the 560 can be converted to RS-232 either on the Main Board or with an external converter. Refer to Section 4.5 for use of the Model 560 with a personal computer.

1.10.1 COM 422 INTERFACE

If a COM 422 board is installed in the computer, the interface cable can be connected directly from the Model 560 to the port of the RS-422 board in the computer without further alterations. If using GSE-SPC, make sure that the Software Lock/Hardware Key provided with the GSE-SPC® package is installed in the Parallel Port of the computer (refer to the computer's instruction manual to determine port configurations).

1.10.2 CHANGE FROM RS-422 TO RS-232

If your computing device has an RS-232 port and you want to change-over the 560 Main Board to RS-232 communications, use the following procedure:

1. Locate and remove IC U28 and IC U29. They can be found on the right side of the Main Board adjacent to J10.

NOTE: Use care and caution when removing IC chips from the Main Board.

2. Move the cable from J10 to J11.

3. Connect Jumpers JMP1 and JMP2 located near the J10.

1.10.3 RS-422/RS-232 CONVERTER

If the computer has an RS-232 serial port, an external converter can be used to interface with the standard RS-422 port of the 560 using the following procedure:

1. If using GSE-SPC®, install the Software Lock/Hardware Key provided with the GSE-SPC® package in the parallel port of the computer (refer to the computer instruction manual to find out which port is the parallel port).

2. Hook up the Model 560 to the computer, making sure of the following connections:

   A. The Bendix 10 pin socket plug of the Interface Cable connects to the Computer Port of the 560.

   B. The other end of the Interface Cable connects to the RS-422 port of the Converter.

   C. Plug the power supply for the converter into a wall socket.

   D. Connect the gender changer into the RS-232 serial port of the computer.

1.10.2 CHANGE FROM RS-422 TO RS-232

If your computing device has an RS-232 port and you want to change-over the 560 Main Board to RS-232 communications, use the following procedure:

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   A. The Bendix 10 pin socket plug of the Interface Cable connects to the Computer Port of the 560.

   B. The other end of the Interface Cable connects to the RS-422 port of the Converter.

   C. Plug the power supply for the converter into a wall socket.

   D. Connect the gender changer into the RS-232 serial port of the computer.

2. STANDARD FEATURES

The GSE Model 560 incorporates a number of features which can be enabled or disabled to suit your application. Some users may only need to collect data. Some may require motor control. Others faced with critical joints may want angle measurement and control, while others may need to use some of the more sophisticated timing features. This section of the manual describes these features and how they are used for some sample applications.

NOTE: Equipment such as the Model 560 is best suited to operations that are well-researched, especially if you want to take advantage of the sophisticated control and timing features it offers. For example, in a torque application, the type of fastener and threads, the material it is threaded into, the torque rate and efficiency of the motor, the state of lubrication, the presence of gaskets, and many other factors must be taken into account before attempting to set limits to control the operation. GSE manufactures a complete line of instruments and transducers for testing and evaluation of assembly operations.

2.1 BASIC LIMITS

In order to obtain any meaningful data, the following set of torque/force parameters must be programmed: P-01 Full Scale, P-02 Low Limit, P-03 High Limit, P-04 Threshold, and P-05 Cycle Complete. They are illustrated in Figure 10 which is based on a typical stall-type tool torque curve.

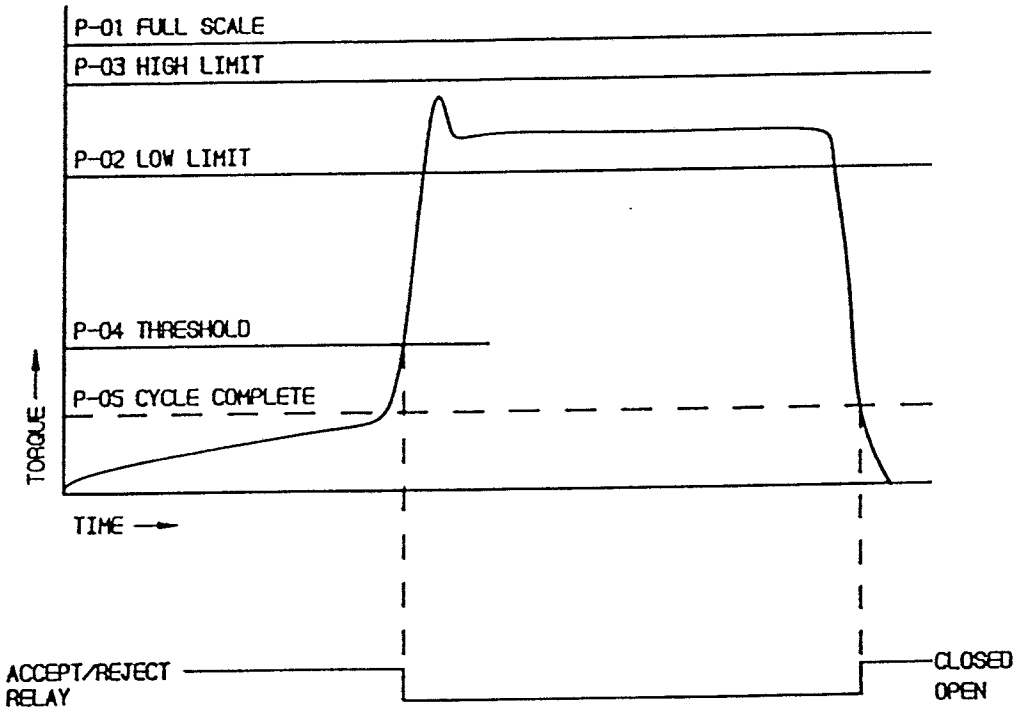

Figure 10 Basic System Parameters

Full Scale is used to establish the scaling and resolution of the Model 560. A fuller explanation of Full Scale is provided in Section 3.3.1. The High and Low Limits set the "window" of acceptability for the measured peak data. Threshold and Cycle Complete are used to start and end the measurement cycle respectively. If the peak occurs between the High and Low Limits, the GREEN status light is lit. If the peak falls below the Low Limit, the YELLOW status light is lit. If the peak occurs above the High Limit, the RED status light is lit.

* Important *

The High Limit must be equal to or less than Full Scale. Low limit must be less than High Limit. Threshold must be equal to or less than Low Limit. Cycle Complete must be less than Threshold.

2.2 CYCLE START

There are two basic forms of cycle start used with the Model 560: Threshold Start and Cycle-On Start. In addition, data sampling can be started by a Remote Measurement Input.

2.2.1 THRESHOLD START

This is the simplest form of the possible Model 560 configurations. The measurement cycle is triggered by the rising input signal from a torque, force or pressure transducer. The 560 presents the peak data and updates the status lights when the input signal drops below a programmed limit. It will then automatically reset itself for the next cycle. This configuration is selected by answering NO to the "CYC.ON INPUT?" question in the Configuration Menu.

Figure 11 below illustrates a Threshold Start system using a clutch-type tool. The cycle begins when the torque/force input rises above the level set by the Threshold parameter, P-04. The data display and the indicator lights are blanked and the search for a peak is begun. For a torque application this will typically be at a point after the assembly has been brought together, the head of the fastener has seated, and the actual tightening process has begun.

After the clutch releases and the input level falls below the Cycle Complete parameter, P-05, the peak data is displayed and transferred to the statistics memory and the appropriate status lights are turned on.

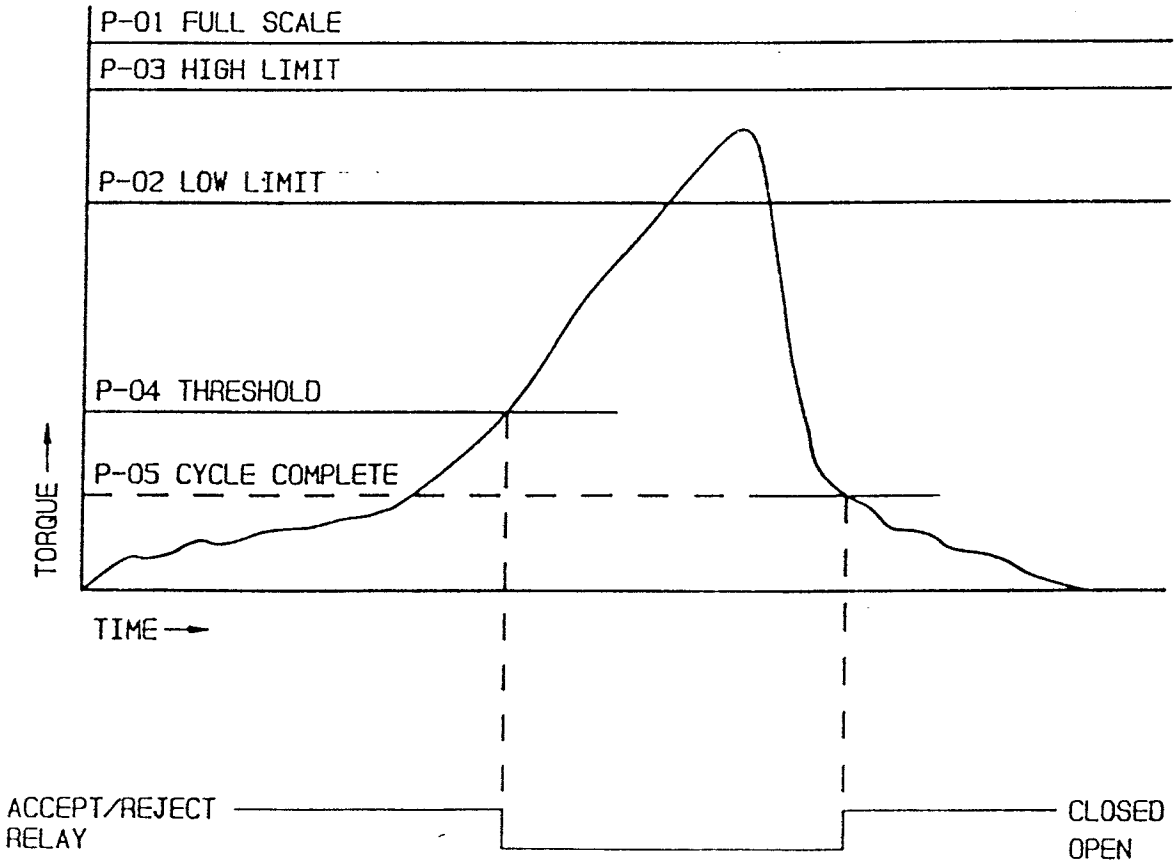

Figure 11 Threshold Start
Automatic Resetting Typically Used with Hand-held Tools

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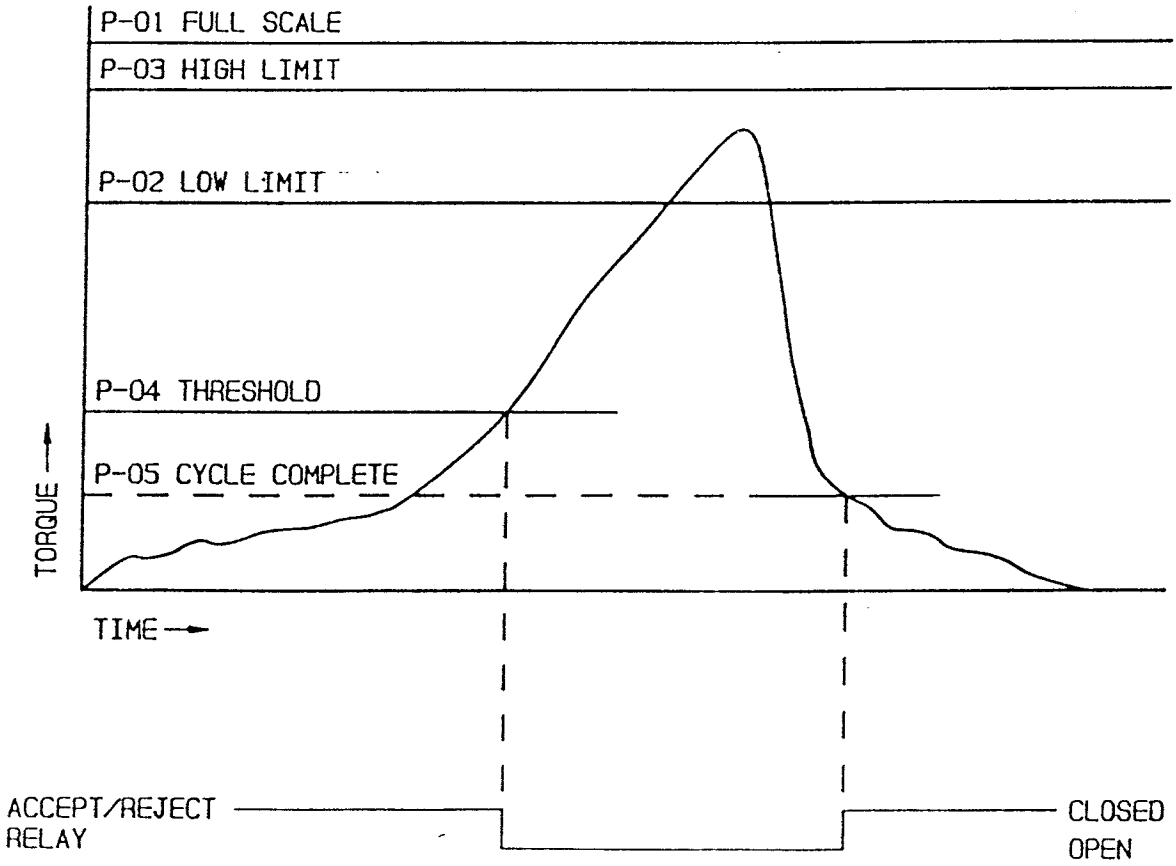

Figure 11 Threshold Start
Automatic Resetting Typically Used with Hand-held Tools

2.2.2 CYCLE ON START

This method of operation is selected by answering YES to the "CYC.ON INPUT?" question in the Configuration Menu. When this is selected, the Model 560 will begin the cycle when it receives the Cycle-On signal from a PLC or an isolated dry contact closure (see Figure 12). When the Cycle-On switch is closed, an Auto-Zero is performed and the status lights are turned off. The torque or force is then applied. When the Threshold level, P-04, is crossed, the previous peak reading is cleared from the display and the search for a new peak is begun.

If Angle Measurement is used (see 2.3), the 560 begins counting the angle of fastener rotation. When the motor stalls (in a torque application) or the press bottoms out (in a force application), the peak is reached and recorded. The torque or force is removed and the input level falls below Cycle Complete. Any number of additional runs could be performed while the Cycle-On is active, however, only the highest observed peak is retained. The display is updated and the appropriate status lights are turned on when the Cycle-On signal is removed. See Section 1.3.3, p. 9 for wiring a remote Cycle-On switch.

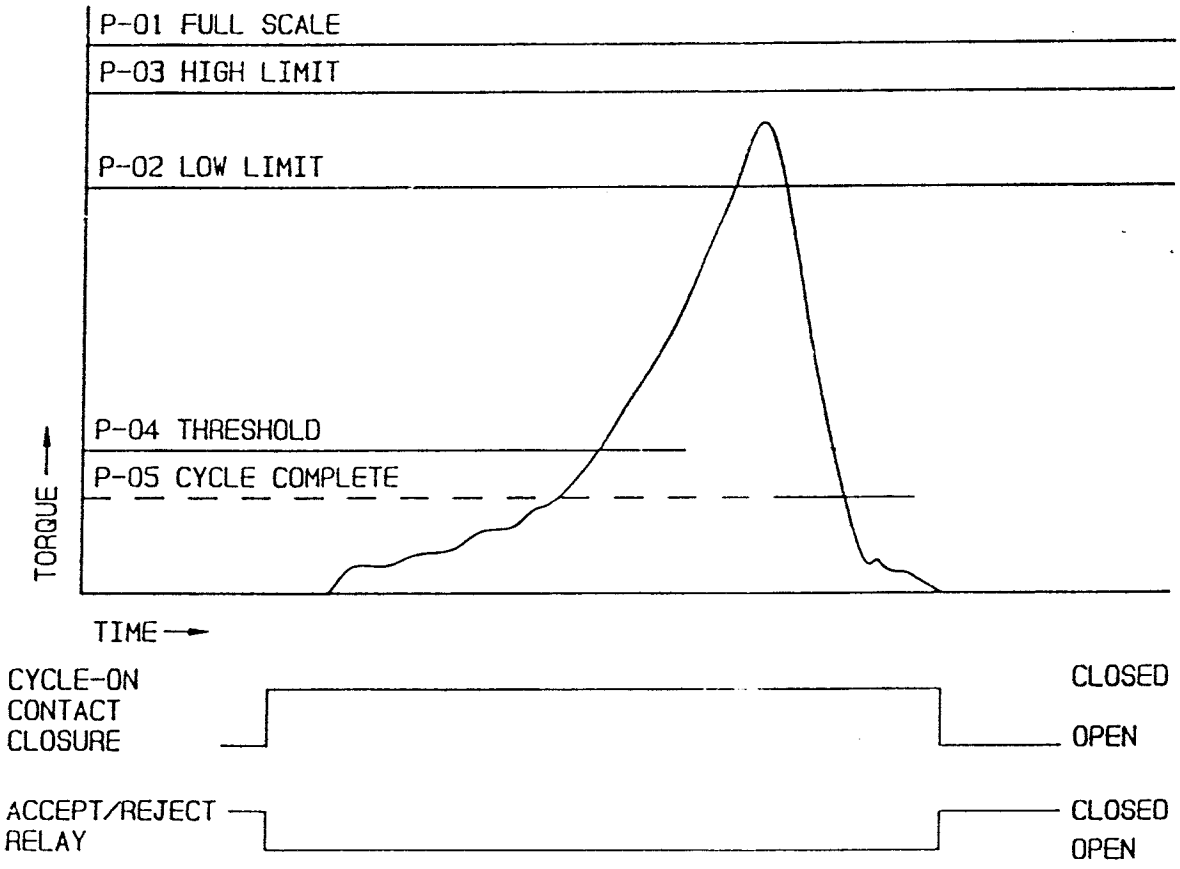

Figure 12 Cycle-On Start
Typical Automated Work Station

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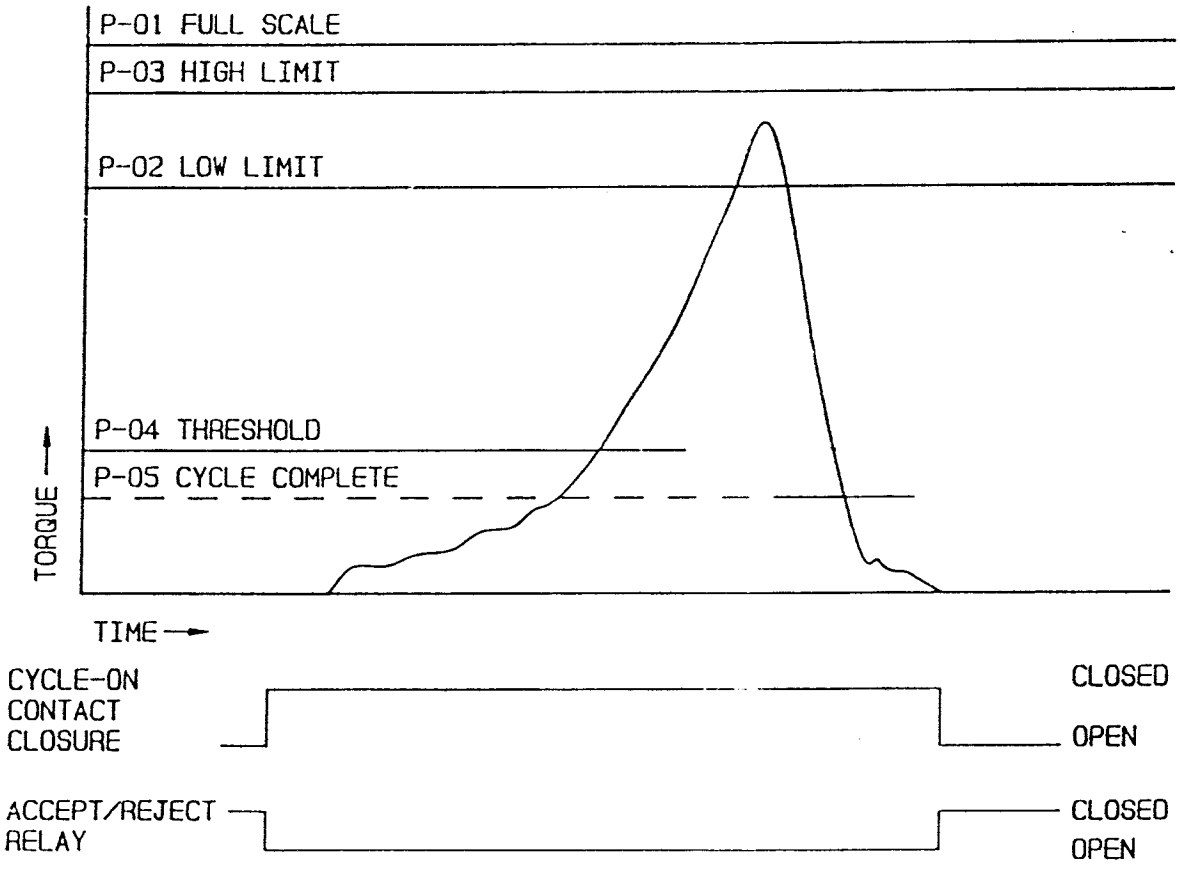

Figure 12 Cycle-On Start
Typical Automated Work Station

2.2.3 REMOTE MEASUREMENT INPUT

The Model 560 can be set up so that it begins to monitor data upon receiving a remote signal from a PLC or other source. This input is enabled by answering YES to the "MEAS. INPUT?" question in the Configuration Menu. See Section 1.3.3, p. 9, for wiring the remote Measurement Input.

NOTE: The measurement input cannot be used if the use of 3 or 4 limit sets is selected in the Configuration Menu. Also the Measurement Input feature cannot be used if the Motor Control feature is enabled.

In the press fit application in Figure 13 below, a pair of limit switches are used to trigger the measurement cycle. The limit switches were fixtured on the press so that the first one (L1) would close the Measurement Input after the start-up spike has dropped off and the insert has started to be pressed. A second limit switch (L2) was placed so that the Measurement Input would open just prior to the press bottoming out. In this way, only the force necessary to press the insert is measured. The initial spike and the bottoming out are ignored.

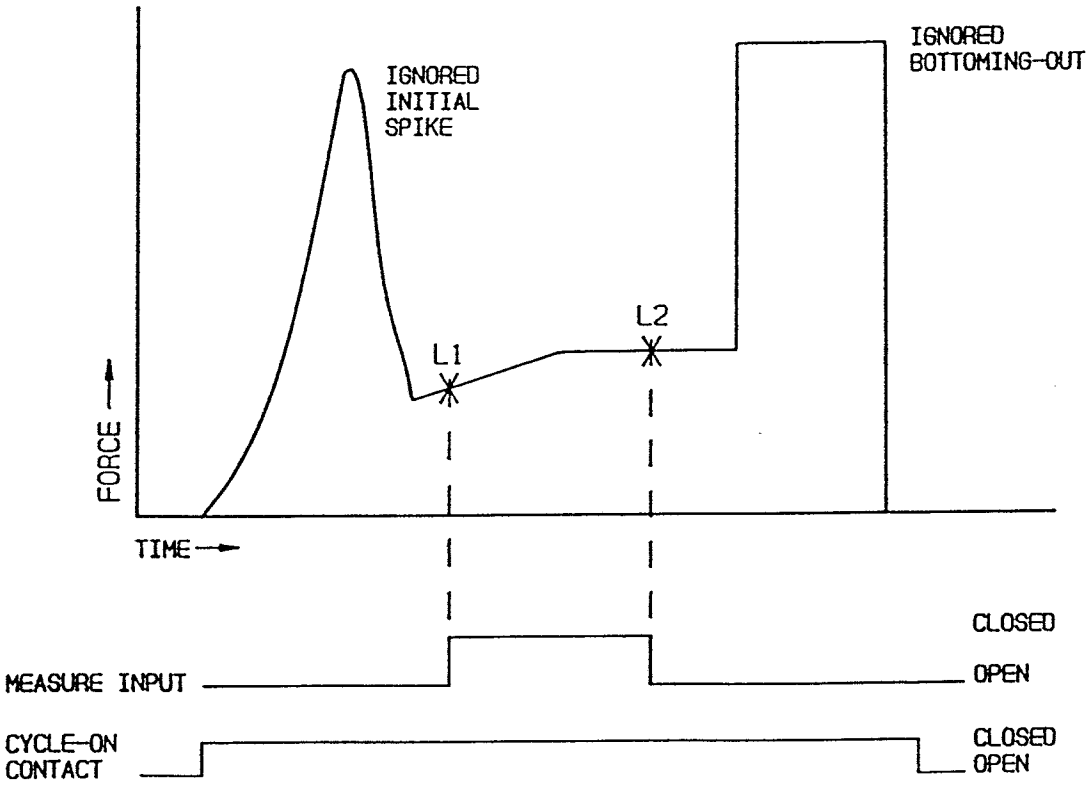

Figure 13 Remote Measurement Input
Press Fit Application

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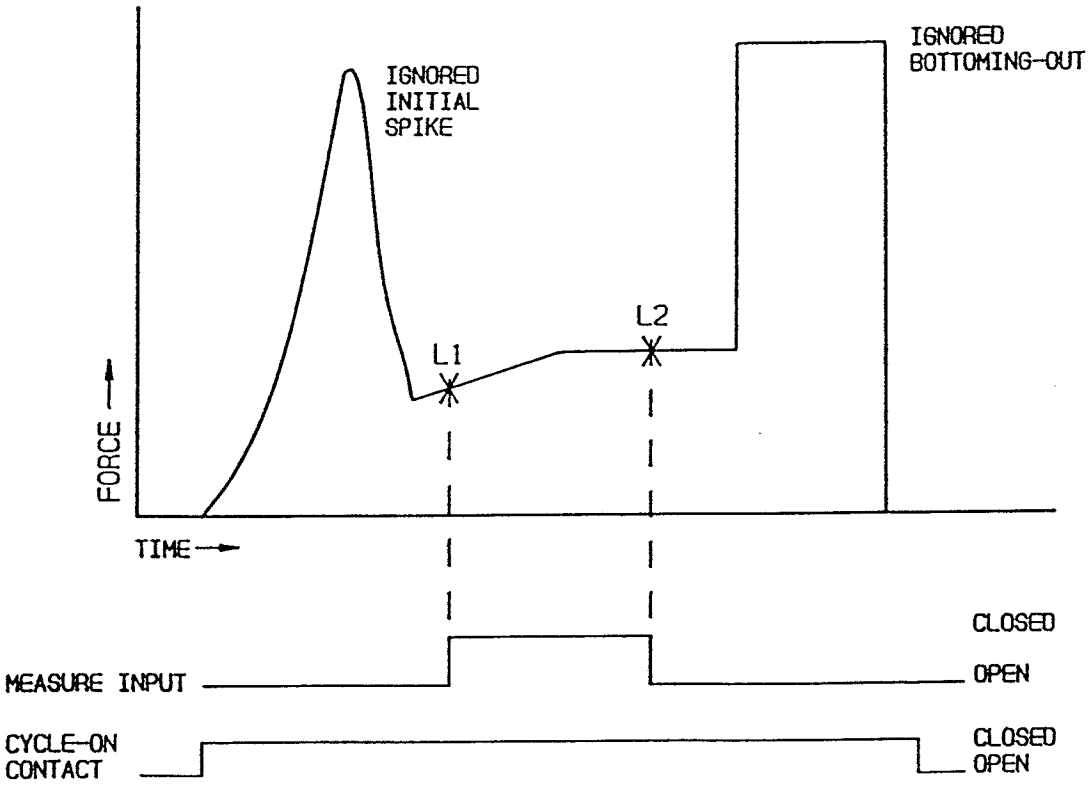

Figure 13 Remote Measurement Input
Press Fit Application

2.3 TORQUE OR FORCE MOTOR CONTROL

This feature allows you to set a torque or force target that when reached will send a shut-off signal to a PLC or cut power to the solenoid valve that controls air pressure to the tool. This feature is selected by answering "YES" to the "MOTOR CONTRL?" question in the Configuration Menu. The Model 560 will add P-06, Final Target, to the list of available parameters. Usually the target is set to a value slightly less than the cut-off point to compensate for overshoot. Also see Table 11A, p. 25.

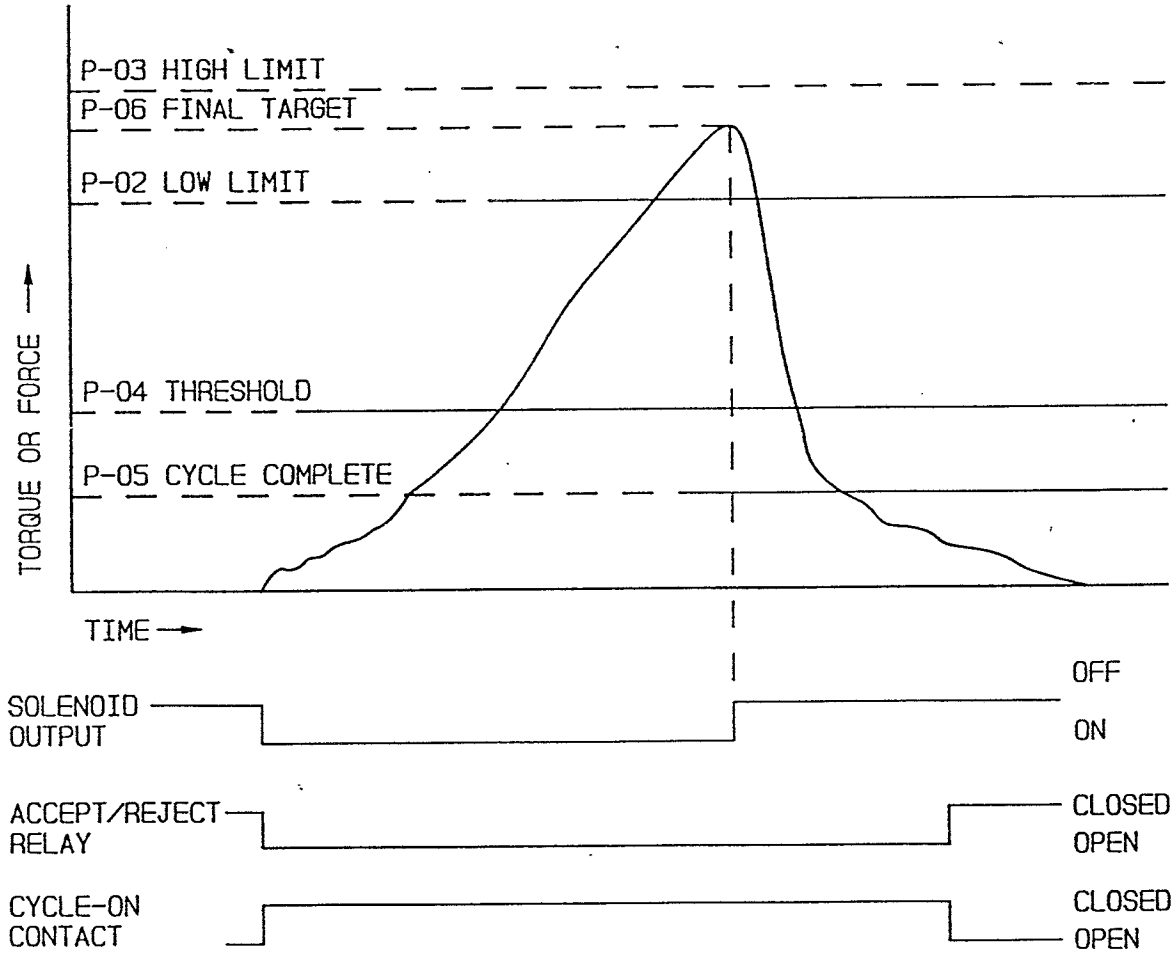

Figure 14 Torque or Force Motor Control Targets

2.4 ANGLE MEASUREMENT

In certain critical torque applications it becomes important to measure how far the fastener is rotated after being torqued to a certain level. Because the increase in the amount of clamping force generated by a threaded fastener is proportional to the helix of the threads, measuring angle of rotation is a more accurate way of assessing joint integrity.

To measure the angle of fastener rotation answer YES to the "ANGLE USED?" question of the Configuration Menu. Angle measurement adds 3 programmable parameters the basic complement previously discussed. They are: P-20 Counts per Revolution, P-27 Final Angle Minimum, and P-28 Final Angle Maximum.

The value for P-20 is dependent upon the type of encoder used to measure angle. The values entered as limits for angle (P-27 and P-28) can be established by determining how many degrees the fastener should turn after Threshold Torque is passed. These parameters are illustrated in Figure 15.

The typical application involves torque control and angle monitoring as shown in Figure 15 below. This is configured by answering "YES" to both "MOTOR CONTRL?" and "ANGLE USED?" in the Configuration Menu. The 560 then will provide two target parameters: Target Torque, P-06, which is set to the desired shut-off value, and Target Angle, P-30, which is set to "0".

When the torque level crosses Threshold, the Model 560 begins measuring fastener rotation. When the Target Torque is reached the motor is shut-off. Angle counting will end when the Cycle-On contact is opened (if used) or when the Cycle Complete torque level is reached (if Cycle-On is not used). At that point, the peak torque and final angle data will be displayed. If the measured angle falls outside the limits set by parameters P-27 and P-28, the appropriate status light will be turned on.

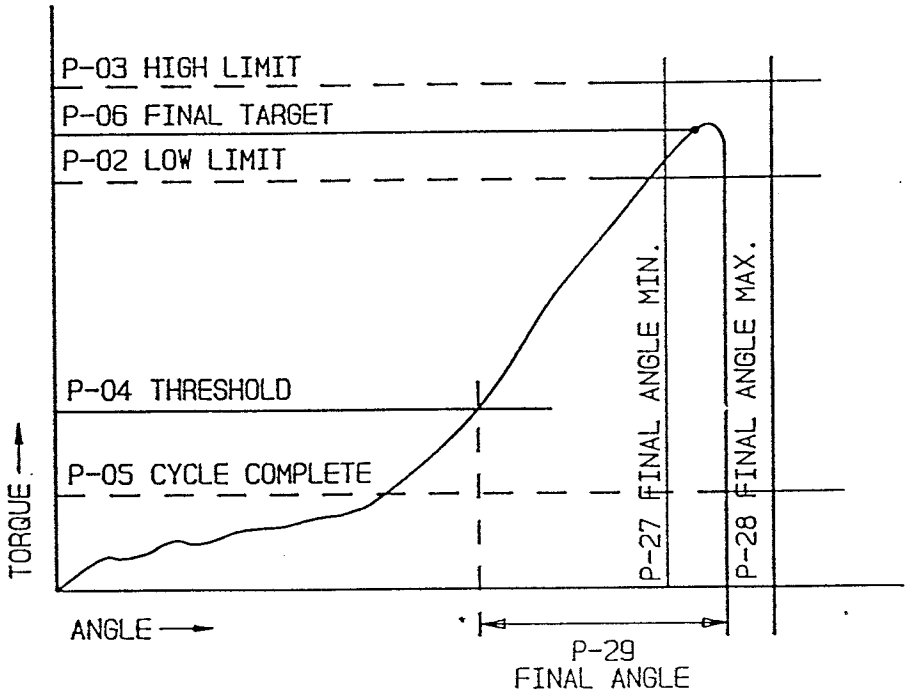

Figure 15 Torque Control with Final Angle Measurement

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When the torque level crosses Threshold, the Model 560 begins measuring fastener rotation. When the Target Torque is reached the motor is shut-off. Angle counting will end when the Cycle-On contact is opened (if used) or when the Cycle Complete torque level is reached (if Cycle-On is not used). At that point, the peak torque and final angle data will be displayed. If the measured angle falls outside the limits set by parameters P-27 and P-28, the appropriate status light will be turned on.

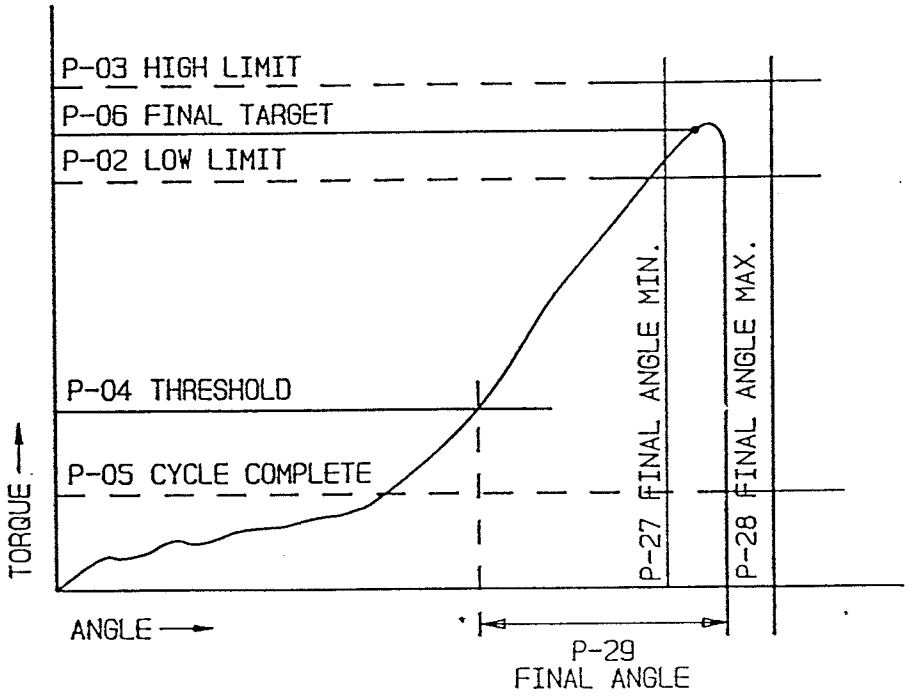

Figure 15 Torque Control with Final Angle Measurement

2.4.1 FINAL ANGLE MOTOR CONTROL

When configured for Torque and Angle with Motor Control, the Model 560 allows you to control the operation either by torque or angle, or both (see Table 11A below). When configured for both, the shut-off signal is sent when both the target torque and the target angle are reached.

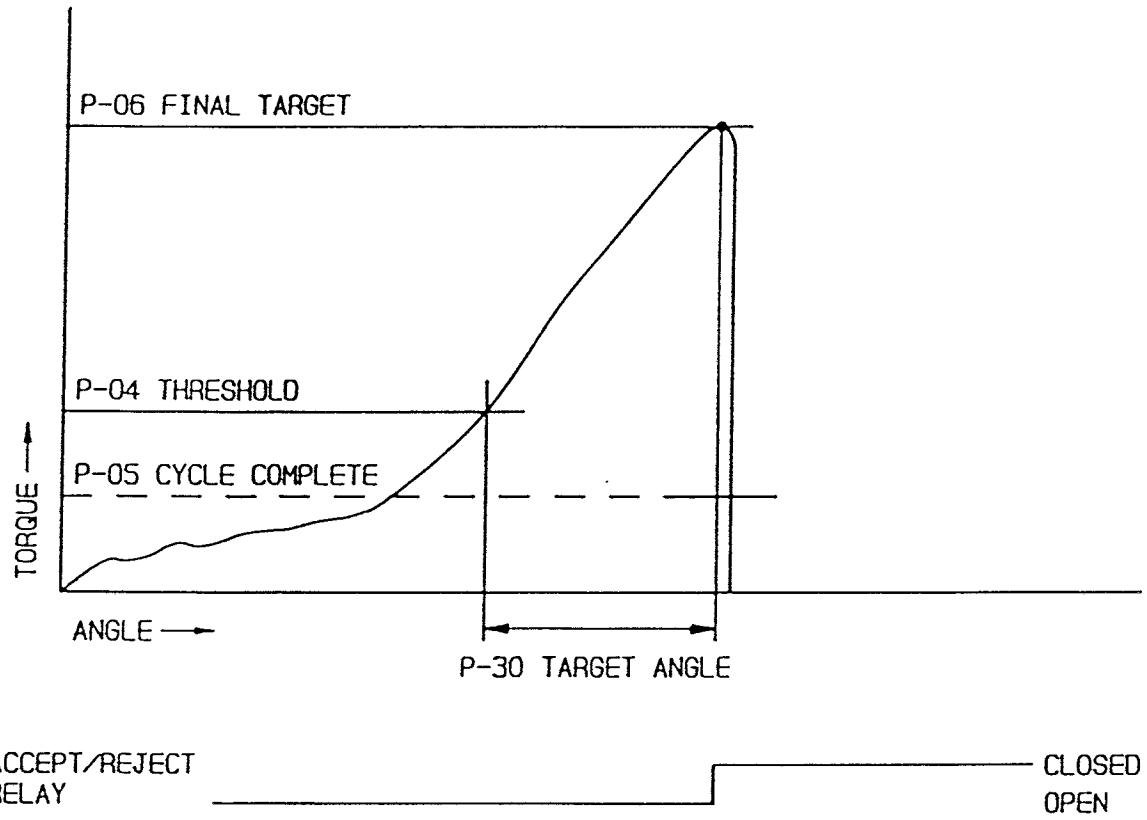

Figure 16 Torque and Angle Motor Control Targets

Table 11A Control Configurations

SYSTEM TYPE	CONTROLLED BY	CONFIGURATION MENU	PARAMETERS
Torque or Force	Torque or Force	MOTOR CONTRL? = Y	FINAL TARGET P-06 = XX
Torque & Angle	Torque	MOTOR CONTRL? = Y ANGLE USED? = Y	FINAL TARGET P-06 = XX TARGET ANGLE P-30 = 0
Torque & Angle	Angle	MOTOR CONTRL? = Y ANGLE USED? = Y	FINAL TARGET P-06 = 0 TARGET ANGLE P-30 = XX
Torque & Angle	Torque & Angle	MOTOR CONTRL? = Y ANGLE USED? = Y	FINAL TARGET P-06 = XX TARGET ANGLE P-30 = XX

XX = a valid shut-off value

2.4.2 LOW ZONE ANGLE

If Angle Measurement is configured for the Model 560, the amount of fastener rotation just prior to Threshold can be monitored by answering YES to the "LOW ZONE ANGLE?" question of the Configuration Menu. This feature allows you to measure the angle from the point where the torque level crosses Cycle Complete (P-05) to where it reaches Threshold (P-04). High and low limits (P-21 and P-22) can be set for this section of fastener rotation. This feature can be used to help detect cross-threaded or stripped fasteners since the angle would be too low or too high (see Figure 17).

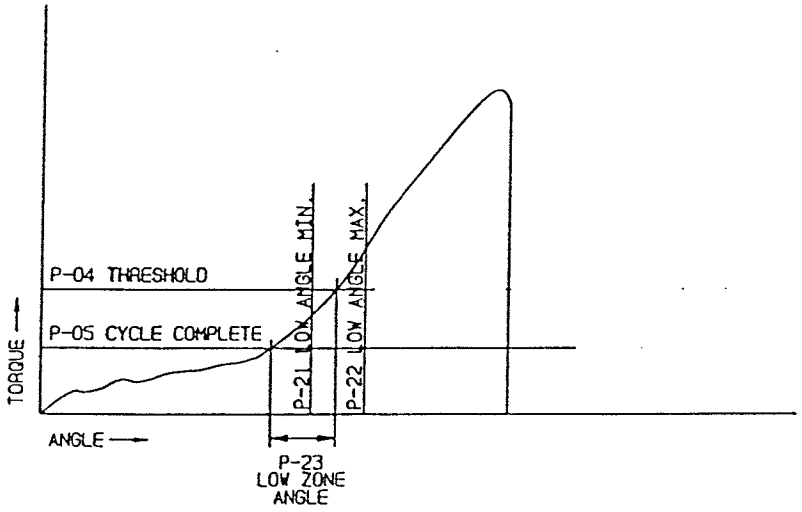

Figure 17 Low Zone Angle Measurement

2.4.3 MID ZONE ANGLE

For some assemblies it is important to record the amount of fastener rotation from the point where the torque crosses Threshold (P-04) to where it reaches Low Limit (P-02). High and low limits can be set for this section of the fastener rotation. This feature also helps in detecting cross-threaded and stripped fasteners (see Figure 18).

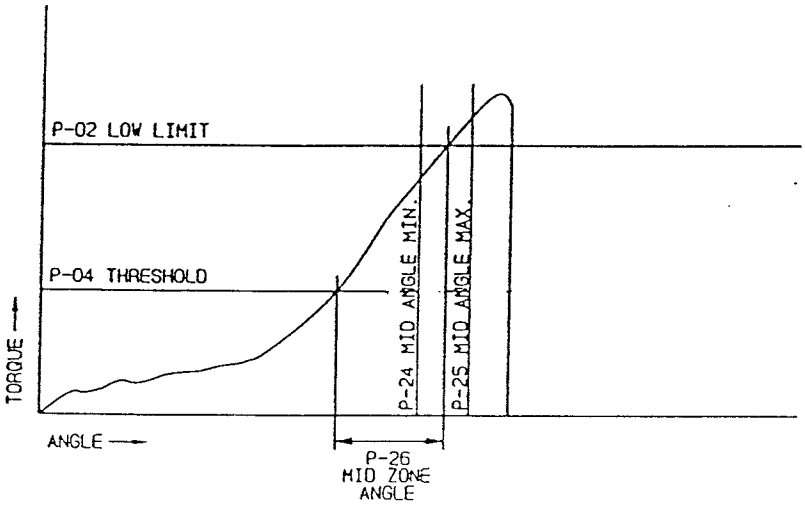

Figure 18 Mid Zone Measurement

2.4.4 REHIT DETECTION

This feature allows you to detect when previously tightened fasteners have been rundown a second time. If the fastener is rotated less than 4° in the time from where the torque crossed Threshold (P-04) to where it reaches Low Limit (P-02), the fastener is assumed to have already been tightened and all 3 status lights will be turned on. The angle data will be replaced by the word "RE-HIT" when a re-hit occurs. The torque data will appear as normal. You may want to use this feature instead of the Mid Zone Angle if the 4° standard is acceptable for your application. You do not have to set any limits when using the Rehit feature.

2.5 MULTIPLE LIMIT SETS

If your application requires that the Model 560 be used with more than one tool or with different sets of specifications, it can configured to store and use up to 4 different sets of limits. The number of desired limit sets is entered in the Configuration Menu at the question "LIMIT SETS?". Each set of limits is programmed separately. Different sets are selected for use by pressing [LIMIT SET] key or by a remote limit set select switch. See 1.3.3, p. 9, for details on wiring a remote Limit Set select switch.

The Model 560 can record up to 4500 readings per limit set if 1 limit set is configured for either a torque only system or a torque-angle system. This number will be reduced if 2, 3 or 4 limit sets are configured as described in Table 11B below.

NOTE: The remote Measurement Input cannot be used if 3 or 4 limit sets are selected in the Configuration Menu.

Table 11B Maximum Number of Readings Per Limit Set

SYSTEM TYPE	1 Set	2 Sets	3 Sets	4 Sets
Torque or Force	4500	4500	3000	2500
Torque & Angle	4500	2500	1500	1250

2.6 TIMING FEATURES

The Model 560 contains a set of electronic timers which can be used for specialized applications. They can be used to delay sampling, set a time limit for sampling, determine when a pulsing tool has completed its cycle, or other such applications.

2.6.1 SAMPLE DELAY

This feature can be used to ignore any extraneous peaks which may occur during tool start-up. It is selected by answering "YES" to the "SAMPLE DELAY?" question in the Configuration Menu. The Model 560 will add parameter P-31, Sample Delay, where you can enter a time-out period which will start when the input level reaches Threshold. For systems that use a remote Measurement Input signal, the delay begins when the Measurement Input signal is given.

Figure 19 below shows an application using self-tapping screws. Sample Delay is used to ignore the initial spikes which occur when the self-tapping screw cuts threads into the material. The Model 560 will begin sampling after the delay is over so that the actual torque peak is recorded.

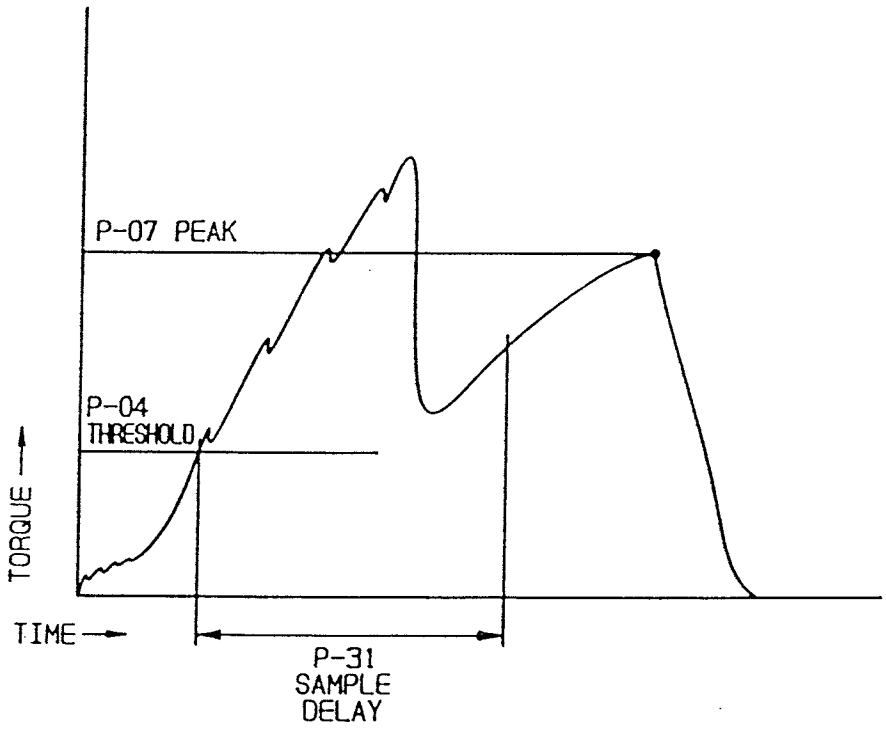

Figure 19 Sample Delay
Self-Tapping Screws

2.6 TIMING FEATURES

The Model 560 contains a set of electronic timers which can be used for specialized applications. They can be used to delay sampling, set a time limit for sampling, determine when a pulsing tool has completed its cycle, or other such applications.

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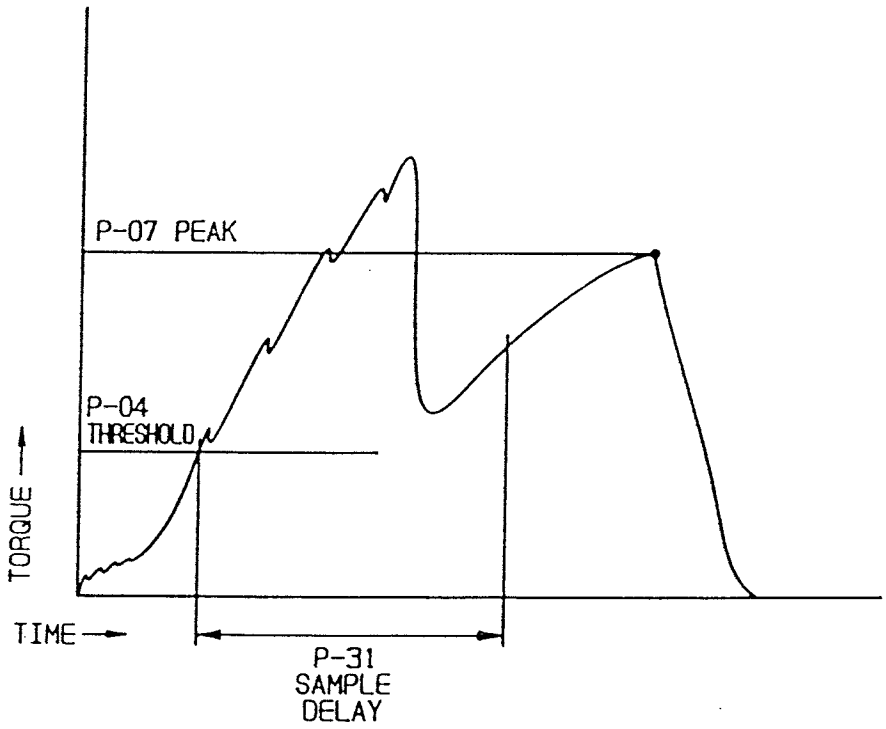

Figure 19 Sample Delay
Self-Tapping Screws

2.6.2 SAMPLE TIME

This feature sets a specific time limit during which the Model 560 will monitor and record data. This is useful when you want to limit the amount of time the 560 spends sampling data. It allows you to ignore any meaningless peaks which occur late in the cycle, such as when a press bottoms out.

This feature is selected by answering "YES" to the "SAMPLE TIME?" question of the Configuration Menu. The Model 560 will add parameter P-35, Sample Time where you enter the amount of sampling time. For Threshold Start and Cycle-On Start systems, this timer begins when Threshold (P-04) is exceeded.

If used with the Sample Delay feature, the Sample Time begins when the Sample Delay time is over (see Figure 21).

If the remote Measurement Input feature is used, the Sample Time begins when the Measurement Input signal is given (see Figure 22).

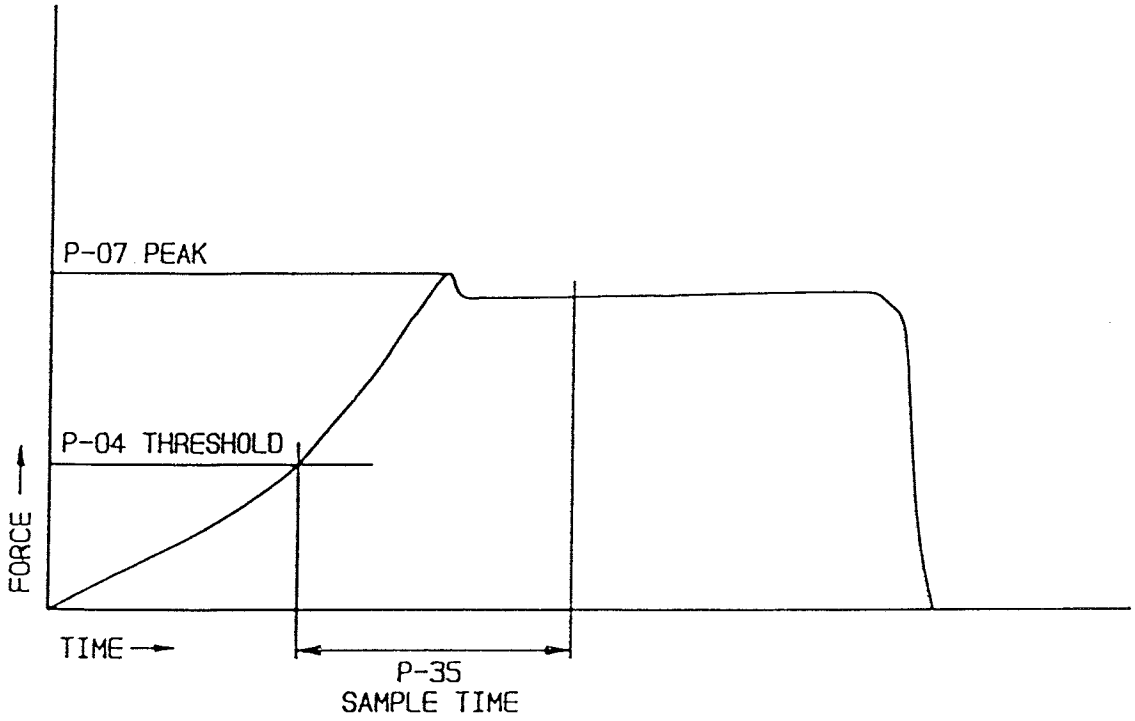

Figure 20 Sample Time

2.6.2 SAMPLE TIME

This feature sets a specific time limit during which the Model 560 will monitor and record data. This is useful when you want to limit the amount of time the 560 spends sampling data. It allows you to ignore any meaningless peaks which occur late in the cycle, such as when a press bottoms out.

This feature is selected by answering "YES" to the "SAMPLE TIME?" question of the Configuration Menu. The Model 560 will add parameter P-35, Sample Time where you enter the amount of sampling time. For Threshold Start and Cycle-On Start systems, this timer begins when Threshold (P-04) is exceeded.

If used with the Sample Delay feature, the Sample Time begins when the Sample Delay time is over (see Figure 21).

If the remote Measurement Input feature is used, the Sample Time begins when the Measurement Input signal is given (see Figure 22).

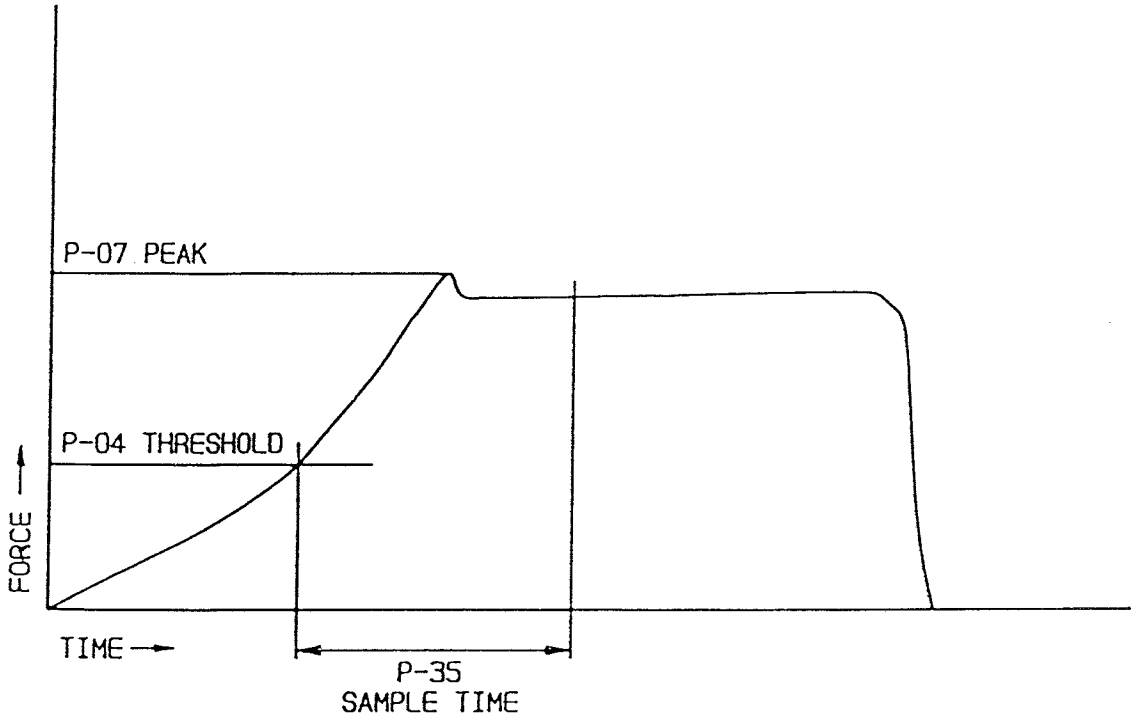

Figure 20 Sample Time

2.6.2 SAMPLE TIME cont'd

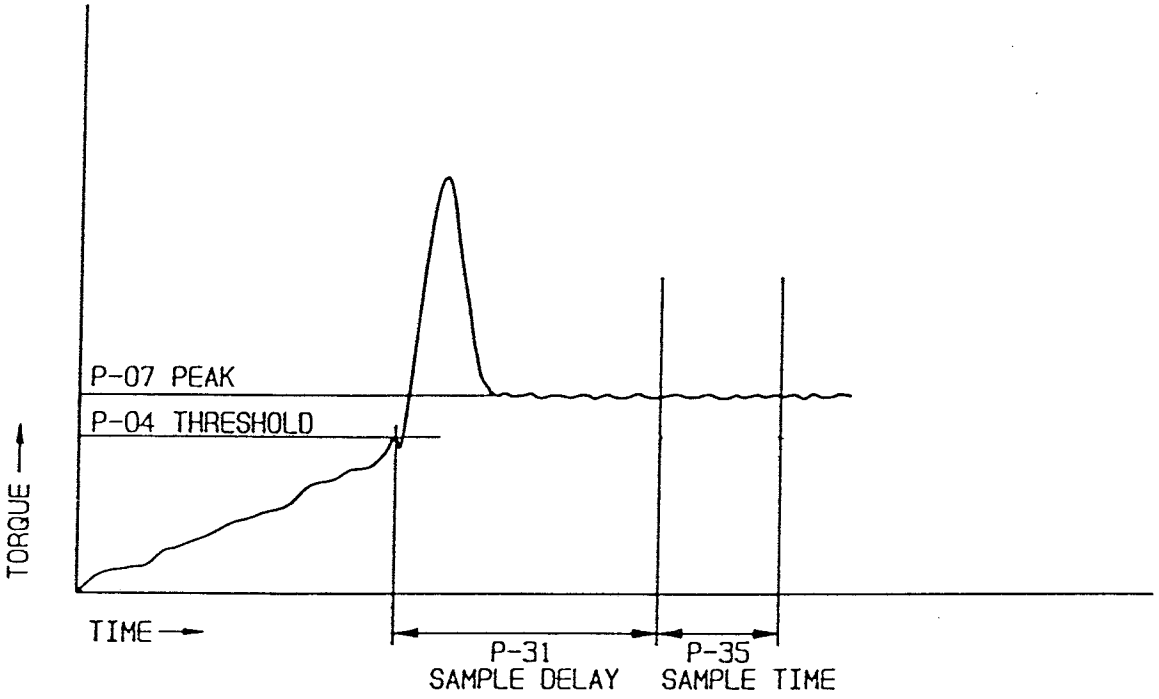

Figure 21 Sample Delay with Sample Time
Engine Overturning Torque Application

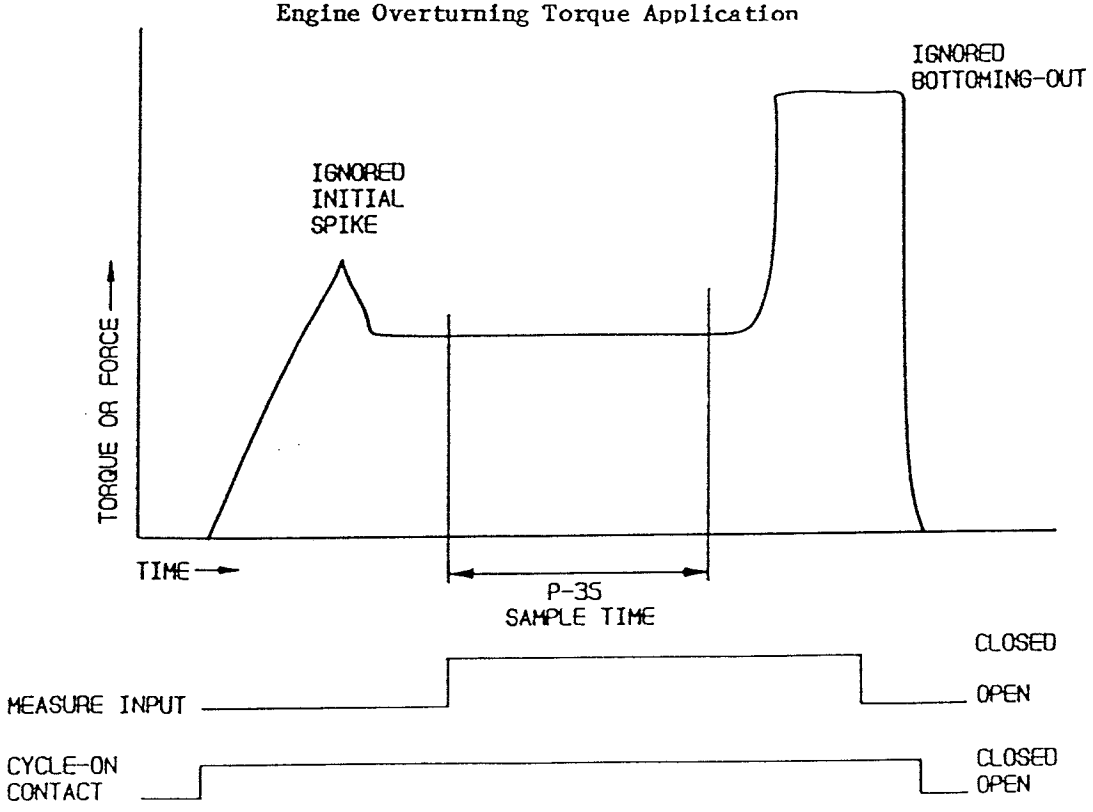

Figure 22 Sample Time with Measurement Input

2.6.2 SAMPLE TIME cont'd

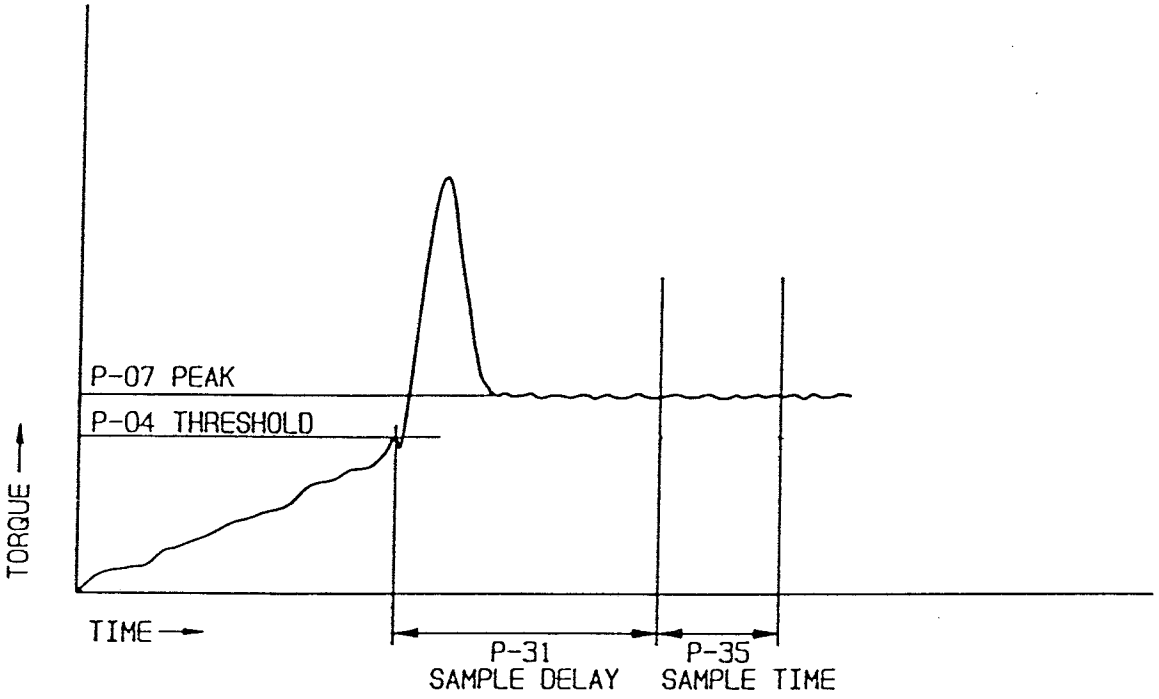

Figure 21 Sample Delay with Sample Time
Engine Overturning Torque Application

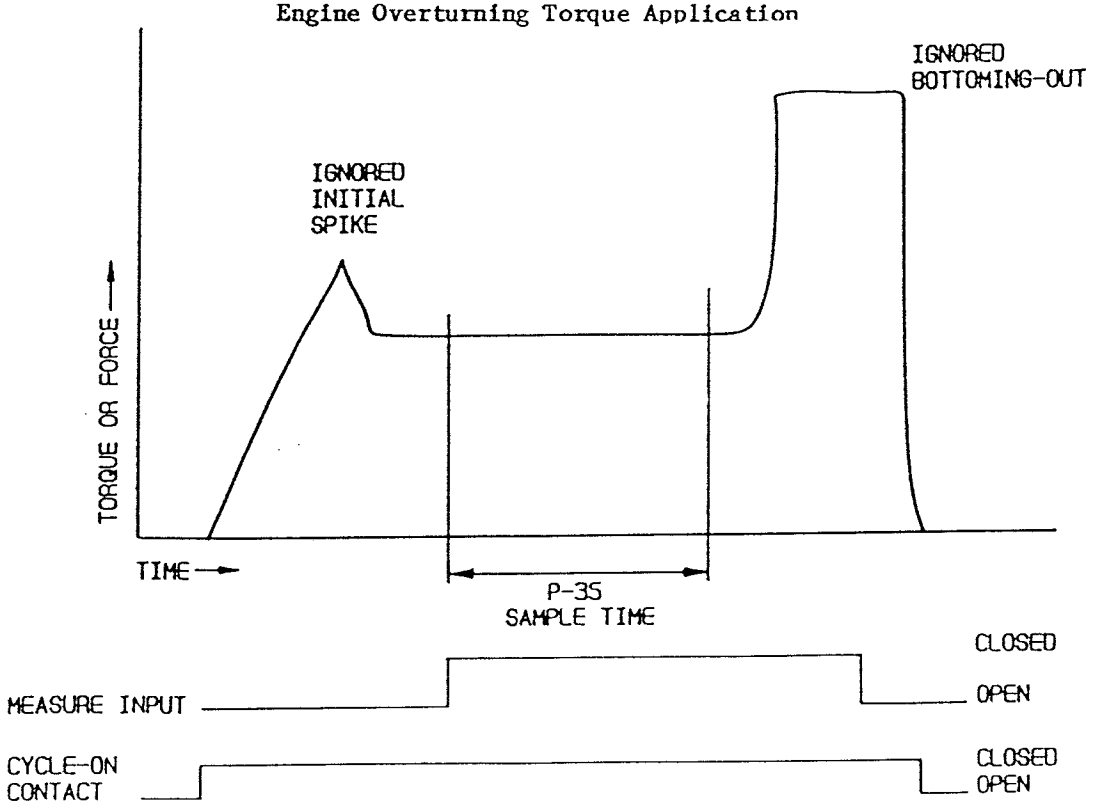

Figure 22 Sample Time with Measurement Input

2.6.3 RESET TIME

This feature was designed for use with pneumatic or DC hand-held tools that are equipped with a built-in electrically controlled solenoid valve. The Reset Time is programmed in parameter P-32 which appears when you answer "YES" to the "MOTOR CONTRL?" question in the Configuration Menu. This parameter sets a timeout that begins when Cycle Complete has been reached so that the operator has enough time to release the trigger before power is returned to the motor.

This feature can also be used in non-control situations when the operator may need to rundown the fastener more than once. If any additional rundowns occur during this timeout, they will be included in the data for the initial rundown. Only the highest peak will be recorded.

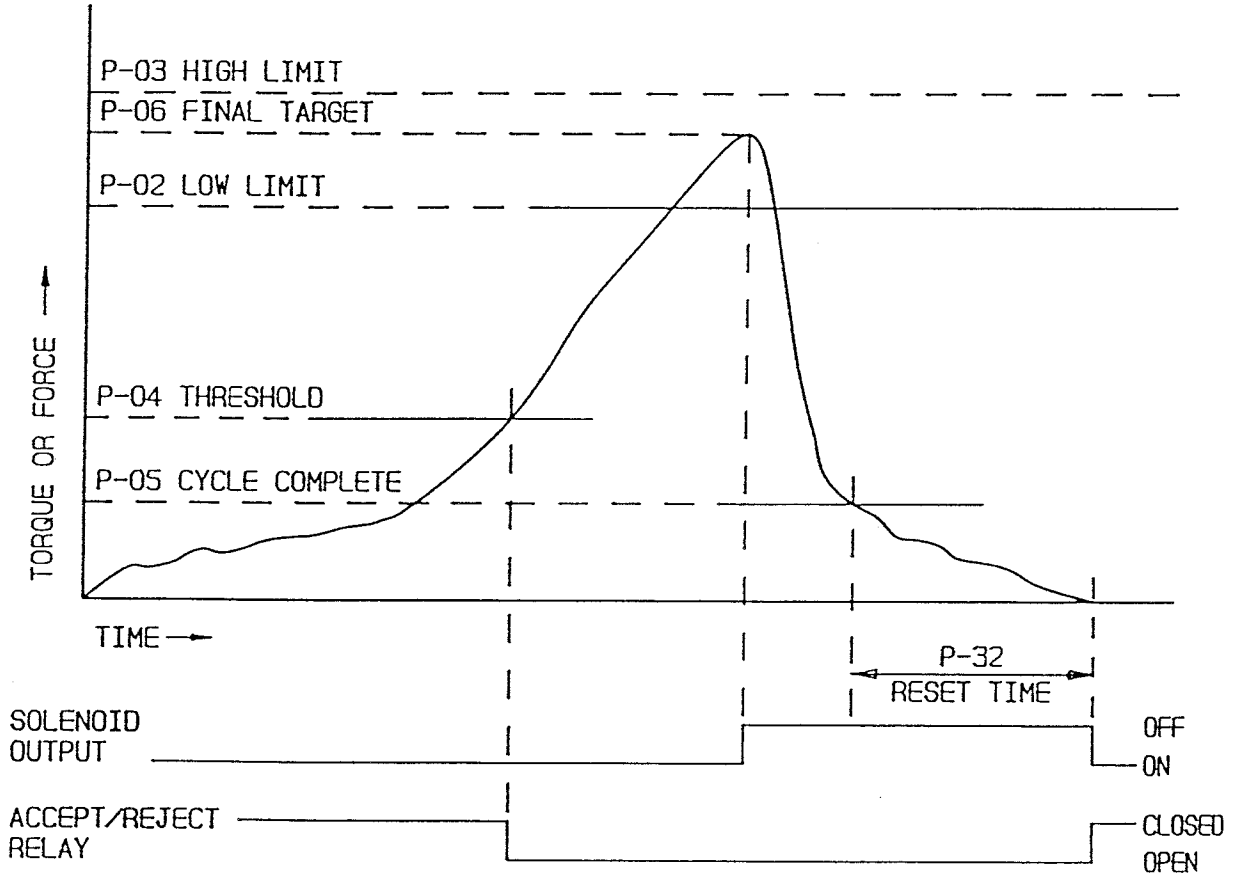

Figure 23 Reset Time
Typical Pneumatic or DC Hand-held Torque Shutoff Tool using Threshold Start

2.6.3 RESET TIME

This feature was designed for use with pneumatic or DC hand-held tools that are equipped with a built-in electrically controlled solenoid valve. The Reset Time is programmed in parameter P-32 which appears when you answer "YES" to the "MOTOR CONTRL?" question in the Configuration Menu. This parameter sets a timeout that begins when Cycle Complete has been reached so that the operator has enough time to release the trigger before power is returned to the motor.

This feature can also be used in non-control situations when the operator may need to rundown the fastener more than once. If any additional rundowns occur during this timeout, they will be included in the data for the initial rundown. Only the highest peak will be recorded.

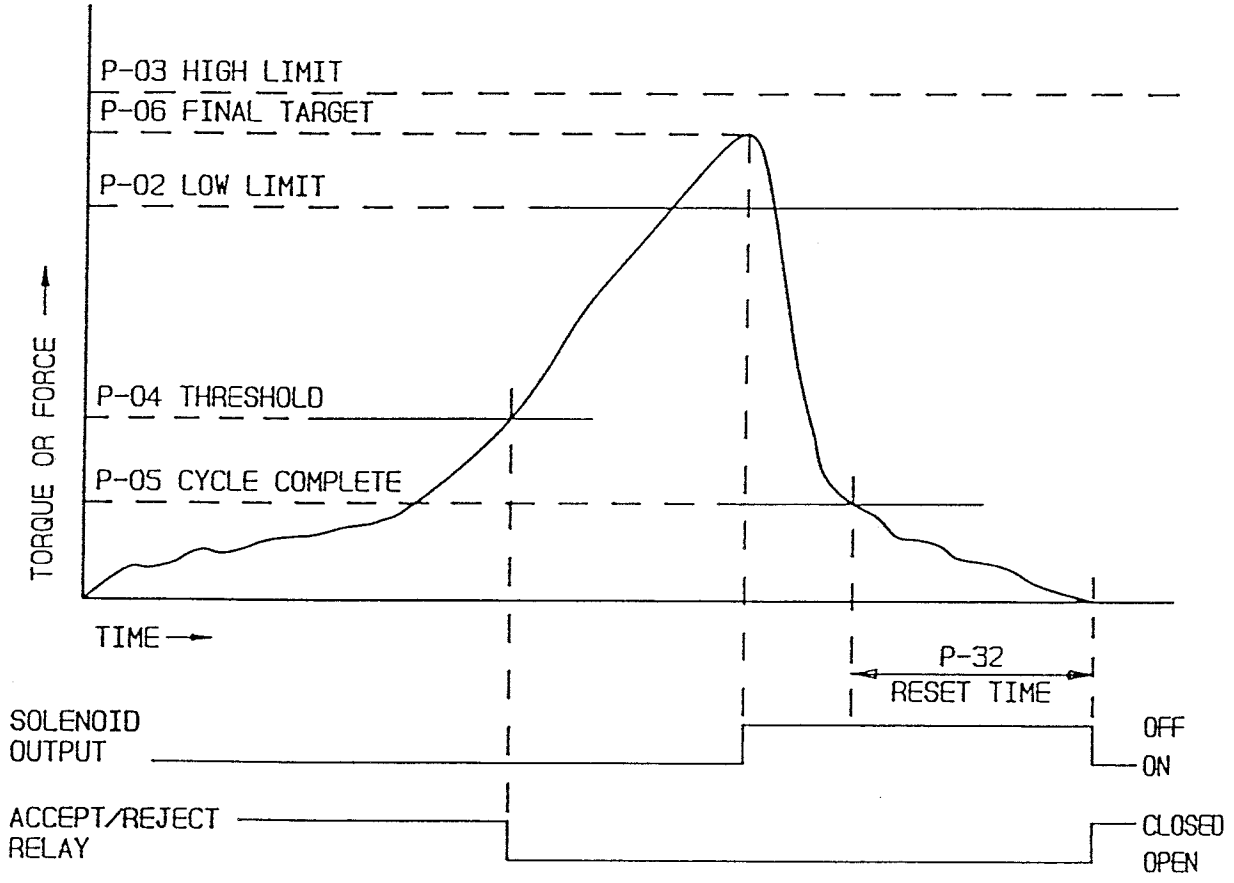

Figure 23 Reset Time
Typical Pneumatic or DC Hand-held Torque Shutoff Tool using Threshold Start

2.6.3 RESET TIME cont'd

Reset Time can also be used with certain clutch-type tools. Some clutch tools give out a tall narrow clutch-kick spike after the clutch releases which would be recorded as a second rundown. In this case, you can answer "YES" to the "MOTOR CONTRL?" question in the Configuration Menu and enter a time in Parameter 32 greater than the duration of the clutch-kick.

The Motor Control configuration includes the Final Target parameter, P-06. Since the tool shut-off is controlled by the clutch and not by a solenoid valve, you may set P-06 to any point between the High and Low Limits. This will simply toggle the unconnected solenoid output and have no other effect on the operation of the 560.

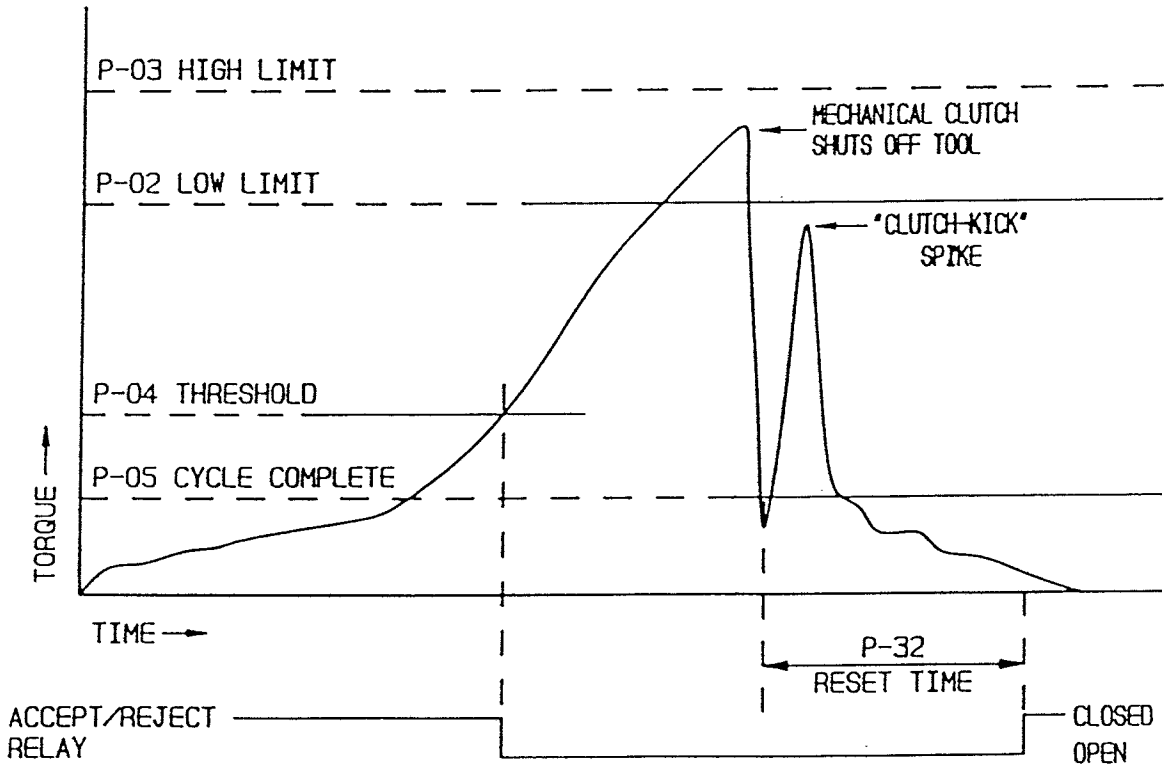

Figure 24 Reset Time
Typical Hand-held Clutch-type Tool

2.6.4 END TIME

This feature can be used on systems with pulsing tools to insure that the highest peak will be recorded. By answering YES to the "END TIME?" question in the Configuration Menu, you can set a time limit in parameter P-35 which begins when the torque level drops below Cycle Complete (P-05). If the torque level does not rise above Cycle Complete during the "End Time" period, the rundown is considered complete. However, should the torque level rise above Cycle Complete again during the "End Time" period, the timer is reset. Cycle Complete should be set to about 20% of the desired peak.

In the illustration below, the time interval between pulses, "A", "B", and "C", range between 20 to 50 milliseconds. A value of 100 milliseconds can be entered into P-35. Since the torque did not rise above Cycle Complete following the final pulse, the End Time period (interval "D") expired and the 560 considered the cycle complete.

NOTE: This feature uses the same timer as the Sample Time feature discussed previously. This timer can be used for only one of these features at a time.

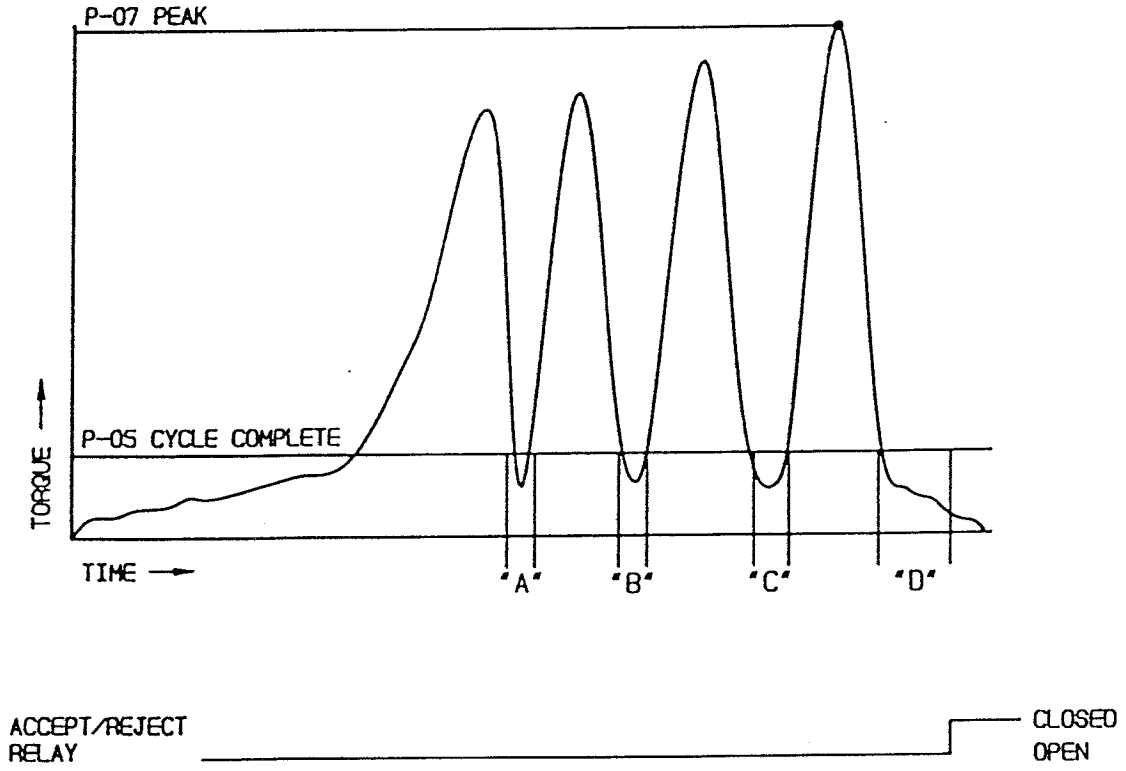

Figure 25 End Time
Typical Hand-held Pulse-type Tool

Table 11 Standard Features and Related Configuration Questions and Programmable Parameters

MODEL 560 FEATURE	CONFIGURATION QUESTIONS	RELATED PROGRAMMABLE PARAMETERS
THRESHOLD START The Model 560 cycle begins when the input (torque or force) rises above P-04.	CYC.ON INPUT? = N	P-01 Full Scale P-02 Low Limit P-03 High Limit P-04 Threshold P-05 Cycle Complete
CYCLE-ON START The cycle begins when the Cycle-On signal is sent from a PLC or contact closure.	CYC.ON INPUT? = Y	P-01 Full Scale P-02 Low Limit P-03 High Limit P-04 Threshold P-05 Cycle Complete
MEASUREMENT INPUT SIGNAL (Sample and Hold) The measurement cycle begins when the Meas. Input signal is given.	MEAS. INPUT? = Y (if Limit Sets = 1 or 2) MOTOR CONTRL? = N	See Threshold or Cycle-On Start
ANGLE MEASUREMENT Measures angle of fastener rotation.	ANGLE USED? = Y	P-20 Counts per Revolution P-27 Final Angle Low Limit P-28 Final Angle High Limit
LOW ZONE ANGLE Measures the angle from P-05 to P-04.	ANGLE USED? = Y LOW ZONE ANGLE? = Y	P-04 Torque Threshold P-05 Cycle Complete P-21 Low Zone Angle Low Limit P-22 Low Zone Angle High Limit See also Angle Measurement
MID ZONE ANGLE Measures the angle from P-04 to P-02.	ANGLE USED? = Y MID ZONE ANGLE? = Y	P-02 Torque Low Limit P-04 Torque Threshold P-24 Mid Zone Angle Low Limit P-25 Mid Zone Angle High Limit See also Angle Measurement
RE-HIT DETECTION If the angle from P-04 to P-02 is < 4° reject is indicated.	ANGLE USED? = Y REHIT REJECT? = Y	P-02 Torque Low Limit P-04 Torque Threshold See also Angle Measurement
MOTOR CONTROL	MOTOR CONTRL? = Y MEAS. INPUT? = N	P-06 Torque/Force Final Target P-30 Angle Target (if used)
MULTIPLE LIMIT SETS Program and use up to 4 different sets of limits.	LIMIT SETS? = X (where X = # of limit sets 1-4) MEAS. INPUT? = N (if Limit Sets = 3 or 4)	NA
SAMPLE DELAY Delay the start of measurement.	SAMPLE DELAY? = Y	P-31 Sample Delay P-04 Threshold (for Threshold and Cycle-On Start systems)
SAMPLE TIMING Set a time limit for data measurement.	SAMPLE TIME? = Y END TIME? = N	P-35 Sample Time P-04 Threshold (for Threshold and Cycle-On Start systems)
END TIME Useful for pulsing tools.	END TIME? = Y SAMPLE TIME? = N	P-35 End Time P-05 cycle Complete
RESET TIME Used for some Control or Clutch Tool operations.	MOTOR CONTRL? = Y	P-32 Reset Time

Table 11 Standard Features and Related Configuration Questions and Programmable Parameters

MODEL 560 FEATURE	CONFIGURATION QUESTIONS	RELATED PROGRAMMABLE PARAMETERS
THRESHOLD START The Model 560 cycle begins when the input (torque or force) rises above P-04.	CYC.ON INPUT? = N	P-01 Full Scale P-02 Low Limit P-03 High Limit P-04 Threshold P-05 Cycle Complete
CYCLE-ON START The cycle begins when the Cycle-On signal is sent from a PLC or contact closure.	CYC.ON INPUT? = Y	P-01 Full Scale P-02 Low Limit P-03 High Limit P-04 Threshold P-05 Cycle Complete
MEASUREMENT INPUT SIGNAL (Sample and Hold) The measurement cycle begins when the Meas. Input signal is given.	MEAS. INPUT? = Y (if Limit Sets = 1 or 2) MOTOR CONTRL? = N	See Threshold or Cycle-On Start
ANGLE MEASUREMENT Measures angle of fastener rotation.	ANGLE USED? = Y	P-20 Counts per Revolution P-27 Final Angle Low Limit P-28 Final Angle High Limit
LOW ZONE ANGLE Measures the angle from P-05 to P-04.	ANGLE USED? = Y LOW ZONE ANGLE? = Y	P-04 Torque Threshold P-05 Cycle Complete P-21 Low Zone Angle Low Limit P-22 Low Zone Angle High Limit See also Angle Measurement
MID ZONE ANGLE Measures the angle from P-04 to P-02.	ANGLE USED? = Y MID ZONE ANGLE? = Y	P-02 Torque Low Limit P-04 Torque Threshold P-24 Mid Zone Angle Low Limit P-25 Mid Zone Angle High Limit See also Angle Measurement
RE-HIT DETECTION If the angle from P-04 to P-02 is < 4° reject is indicated.	ANGLE USED? = Y REHIT REJECT? = Y	P-02 Torque Low Limit P-04 Torque Threshold See also Angle Measurement
MOTOR CONTROL	MOTOR CONTRL? = Y MEAS. INPUT? = N	P-06 Torque/Force Final Target P-30 Angle Target (if used)
MULTIPLE LIMIT SETS Program and use up to 4 different sets of limits.	LIMIT SETS? = X (where X = # of limit sets 1-4) MEAS. INPUT? = N (if Limit Sets = 3 or 4)	NA
SAMPLE DELAY Delay the start of measurement.	SAMPLE DELAY? = Y	P-31 Sample Delay P-04 Threshold (for Threshold and Cycle-On Start systems)
SAMPLE TIMING Set a time limit for data measurement.	SAMPLE TIME? = Y END TIME? = N	P-35 Sample Time P-04 Threshold (for Threshold and Cycle-On Start systems)
END TIME Useful for pulsing tools.	END TIME? = Y SAMPLE TIME? = N	P-35 End Time P-05 cycle Complete
RESET TIME Used for some Control or Clutch Tool operations.	MOTOR CONTRL? = Y	P-32 Reset Time

3. PROGRAMMING THE MODEL 560

This part of the manual contains the procedures for programming the Model 560. Complete explanations of the features and related parameters is contained in Section 2.

3.1 SYSTEM CONFIGURATION

The Model 560 comes with a variety of software features that can be selected or deleted to suit your application. This is done by accessing the Configuration Menu.

To reach the Configuration Menu, place switch 3 of U16 in the "ON" position (see Figure 26 below). Press the [RESET] key, then press and hold the decimal point key until the RAM test is finished.

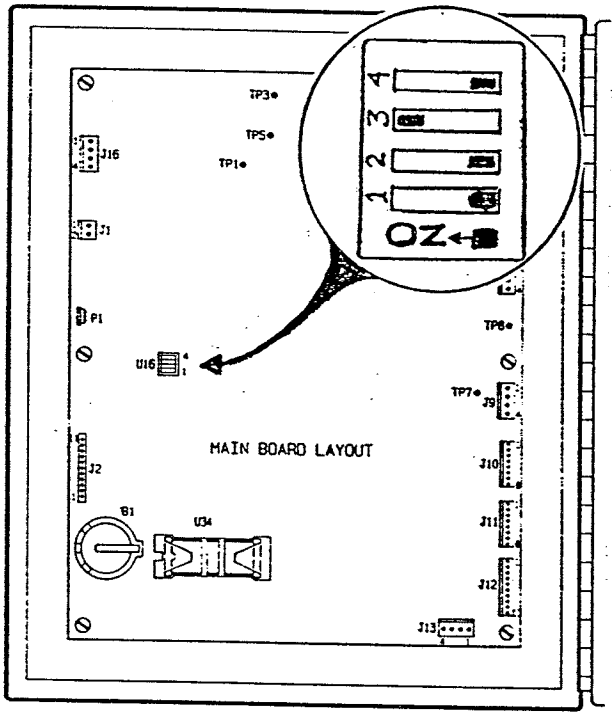

Figure 26 System Configuration Switch

Use the following procedure when configuring the Model 560.

A. Press [Y] (the numeral 1 key) to answer "YES".

B. Press [N] (the numeral 2 key) to answer "NO".

C. Press [▲ PARAM] to advance to the next question or [▼ PARAM] to backup.

The questions are presented in the following order.

1. The upper line of the display will tell you if you have successfully pulled up the menu. The first question will be asked on the lower line, "ANGLE USED?" If you want angle measurement, press [Y]. If you answer "YES" to this question, three additional questions pertaining to angle appear. If not, press [N] and the remaining angle questions are skipped.

   A. "LOW ZONE ANG?" This feature monitors the angle generated as torque rises from Cycle Complete (P-05) to Threshold (P-04) and lets you set limits for this angle. Answer "YES" if you want to measure this angle or "NO" if not.

   B. "MID ZONE ANG?" This feature monitors the angle as torque rises from Threshold (P-04) to the Low Limit (P-02). Answer "YES" if you want to measure this angle or "NO" if not.

   C. "REHIT REJECT?" If less than 4 degrees of rotation occurs between Threshold (P-04) and the Low Limit (P-02), a reject is detected and the low reject light is presented to indicate low angle. Answer "YES" if you wish to use this feature.

2. "SPC OUTPUT?" If you answer "YES", the 560 will send an SPC data packet at the end of each run through the computer port for use with the GSE-SPC® II software program.

3. "SAMPLE TIME?" If you answer "YES", you will be able to set a time period for parameter P-35 (up to 99.99 seconds) during which the data will be sampled.

NOTE: The same timer is also used by the END TIME feature (see next page). You can select either SAMPLE TIME or END TIME.

3.1 SYSTEM CONFIGURATION cont'd

4. "END TIME?" This allows you to delay the cycle complete signal for use with pulsing tools. The time period is entered in P-35. This feature uses the same timer as the Sample Time feature.

NOTE: You cannot answer "YES" to both SAMPLE TIME and END TIME. Only one of those two features can be used.

5. "SAMPLE DELAY?" Answering "YES" allows the use of a selectable timer to delay sampling at the beginning of a cycle. This feature lets the 560 ignore any initial torque peaks which may occur during rundown. The time period is set in P-31 which will not appear unless this feature is configured.

6. "LIMIT SETS?" The desired number of limit sets (1-4) is entered here. With this feature you can create and use additional sets of limits and use the same tool on up to four different fasteners. Use of additional limit sets will lessen memory capacity.

7. "MEAS. INPUT?" The Model 560 can be configured to begin data measurement upon receiving a remote input signal. This feature is also known as Sample and Hold. This input signal may be given at a point after the usual start of a cycle. If such an input is going to be used, answer "YES". This input cannot be used if three or four limit sets will be used. This input cannot be used if the Motor Control feature is configured.

8. "MOTOR CONTRL?" If using the solenoid driver output for motor control, answer "YES".

9. "CYC.ON INPUT?" If a remote input is used to initiate the cycle, answer "YES". If Threshold Start will be used, answer "NO".

10. "RESET PARAMS?" If you answer "YES" the 560 will reset all programmable parameters to the default values, including the time, date, and year. If you answer "NO", the 560 will retain the current parameter values, but will erase any data in memory.

11. "NEED SECURITY?" This lets you choose whether or not the Model 560 programming will be protected by a Security Access Code#, parameter P-00. If you answer "YES", the unit will ask you to enter a 4 digit code number. If you answer "NO", P-00 will not appear and the 560 may be programmed without entering the 4 digit code. NOTE: Record the 4-digit code#. Any programming of the Model 560 is prohibited unless the Security Code# is entered.

Once the system is properly configured, return switch 3 of U16 to the "OFF" position to prohibit unauthorized system re-configuration.

3.2 PRE-PROGRAMMING OPERATIONS

Before entering any of the programming parameters into the Model 560, the unit should be MASTER RESET and the Security Access Code (if configured) must be entered.

3.2.1 MASTER RESET

Prior to programming the 560 for the first time or when re-programming it for an entirely different use, you should perform a MASTER RESET (a.k.a. Master Clear). This will reset all programmable parameters to the factory configured default values, except the Unit ID (P-50). NOTE: It is only after a Master Reset the Unit ID# (P-50) can be reset.

To do a Master Reset, press [RESET]. Press and hold [CLEAR] until the RAM test is finished.

3.2.2 P-00 SECURITY ACCESS CODE

If the Access Code was configured, this will be the first parameter to appear. The display should read "No".

Press [CLEAR], enter the four-digit security code digits and press [ENTER]. The display should read "Yes". You can proceed with parameter programming.

NOTE: If parameter P-00 was not configured, the programming of parameters can begin immediately after the RAM test. The display will show parameter P-01 after the RAM test is finished.

3.1 SYSTEM CONFIGURATION cont'd

4. "END TIME?" This allows you to delay the cycle complete signal for use with pulsing tools. The time period is entered in P-35. This feature uses the same timer as the Sample Time feature.

NOTE: You cannot answer "YES" to both SAMPLE TIME and END TIME. Only one of those two features can be used.

5. "SAMPLE DELAY?" Answering "YES" allows the use of a selectable timer to delay sampling at the beginning of a cycle. This feature lets the 560 ignore any initial torque peaks which may occur during rundown. The time period is set in P-31 which will not appear unless this feature is configured.

6. "LIMIT SETS?" The desired number of limit sets (1-4) is entered here. With this feature you can create and use additional sets of limits and use the same tool on up to four different fasteners. Use of additional limit sets will lessen memory capacity.

7. "MEAS. INPUT?" The Model 560 can be configured to begin data measurement upon receiving a remote input signal. This feature is also known as Sample and Hold. This input signal may be given at a point after the usual start of a cycle. If such an input is going to be used, answer "YES". This input cannot be used if three or four limit sets will be used. This input cannot be used if the Motor Control feature is configured.

8. "MOTOR CONTRL?" If using the solenoid driver output for motor control, answer "YES".

9. "CYC.ON INPUT?" If a remote input is used to initiate the cycle, answer "YES". If Threshold Start will be used, answer "NO".

10. "RESET PARAMS?" If you answer "YES" the 560 will reset all programmable parameters to the default values, including the time, date, and year. If you answer "NO", the 560 will retain the current parameter values, but will erase any data in memory.

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To do a Master Reset, press [RESET]. Press and hold [CLEAR] until the RAM test is finished.

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If the Access Code was configured, this will be the first parameter to appear. The display should read "No".

Press [CLEAR], enter the four-digit security code digits and press [ENTER]. The display should read "Yes". You can proceed with parameter programming.

NOTE: If parameter P-00 was not configured, the programming of parameters can begin immediately after the RAM test. The display will show parameter P-01 after the RAM test is finished.

Table 12 List of Model 560 Parameters

The parameters for the Model 560 Process Monitor and Control Station are accessible through the keyboard. They are listed in numerical order as they might appear when programming the Model 560. Under the column "TYPE", the parameters which may be programmed are indicated by a "p", and those which are readings only are indicated by a "r". The parameters which are made available through selection in the System Configuration Menu are indicated by the "c" prefix.

#	TYPE	NAME
00	c p	Security Code
		TORQUE/FORCE
01	p	Full Scale
02	p	Low Limit
03	p	High Limit
04	p	Threshold
05	p	Cycle Complet
06	c p	Final Target
07	r	Peak
10	c r	Peak Torque and Final Angle
		CALIBRATION
16	p	Cal Value
17	r	Cal Reading
18	r	Zero Reading
19	r	Cal/Zero Alarm
		ANGLE
20	c p	Counts/Rev.
21	c p	Low Ang Min
22	c p	Low Ang Max
23	c r	Low Ang
24	c p	Mid Ang Min
25	c p	Mid Ang Max
26	c r	Mid Ang
27	c p	Final Ang Min
28	c p	Final Ang Max
29	c r	Final Angle
30	c p	Target Angle
		TIMING
31	c p	Sample Delay
32	c p	Reset Time
35	c p	Sample/End Time
36	p	Graph Time
		MISCELLANEOUS
40	p	Time (24 HR)
41	p	Date
42	p	Year
43	p	Cal Relay
44	c r	Limit Set
47	p	Engrng Units
49	r	Angle Counts
		PRINTER
50	p	Unit ID #†
51	p	Print
52	p	Print Baud Rt
53	p	Compt Baud Rt
		STATISTICS-ANGLE
58	c r	Cpk (Capability Index)
59	c r	Cr (Capability Ratio)
60	c r	Angle Mean
61	c r	Angle Range
62	c r	Angle Mean Shift
63	c r	Ang Std. Dev.
64	c r	Ang Mean +3
65	c r	Ang Mean -3
66	c r	Ang High Rej.
67	c r	Ang Low Rej.
		STATISTICS-TORQUE/FORCE
68	r	Cpk (Capability Index)
69	r	Cr (Capability Ratio)
		X-BAR AND R
70	r	X-BAR
71	r	R
72	p	Sample Size
73	r	Peak Readings
74	c r	Angle X-BAR
75	c r	Angle R
76	c r	Angle Readngs
77	r	Stat Alarm
79	r	Valid Rdngs
		STATISTICS-TORQUE/FORCE
		(see parameters 68 and 69)
80	r	Mean
81	r	Range
82	r	Mean Shift
83	r	Std Deviation
84	r	Mean + 3Sigma
85	r	Mean - 3Sigma
86	r	Totl High Rej
87	r	Totl Low Rej
88	r	Total Accepts
89	r	Totl Readings††
		BACKLIGHT/EPROM#
90	p	Test
		STATISTICS LIMITS
91	p	X-BAR Min
92	p	X-BAR Max
93	c p	Ang X-BAR Min
94	c p	Ang X-BAR Max
95	p	R Min
96	p	R Max
97	c p	Ang R Min
98	c p	Ang R Max

† The Unit ID# is only programmable after a Master Reset or after the system has been re-configured.

†† The Total Readings Parameter is most often used as a readout parameter although its value may be programmed, as in the case where it is desired to erase old data.

Table 12 List of Model 560 Parameters

The parameters for the Model 560 Process Monitor and Control Station are accessible through the keyboard. They are listed in numerical order as they might appear when programming the Model 560. Under the column "TYPE", the parameters which may be programmed are indicated by a "p", and those which are readings only are indicated by a "r". The parameters which are made available through selection in the System Configuration Menu are indicated by the "c" prefix.

#	TYPE	NAME
00	c p	Security Code
		TORQUE/FORCE
01	p	Full Scale
02	p	Low Limit
03	p	High Limit
04	p	Threshold
05	p	Cycle Complet
06	c p	Final Target
07	r	Peak
10	c r	Peak Torque and Final Angle
		CALIBRATION
16	p	Cal Value
17	r	Cal Reading
18	r	Zero Reading
19	r	Cal/Zero Alarm
		ANGLE
20	c p	Counts/Rev.
21	c p	Low Ang Min
22	c p	Low Ang Max
23	c r	Low Ang
24	c p	Mid Ang Min
25	c p	Mid Ang Max
26	c r	Mid Ang
27	c p	Final Ang Min
28	c p	Final Ang Max
29	c r	Final Angle
30	c p	Target Angle
		TIMING
31	c p	Sample Delay
32	c p	Reset Time
35	c p	Sample/End Time
36	p	Graph Time
		MISCELLANEOUS
40	p	Time (24 HR)
41	p	Date
42	p	Year
43	p	Cal Relay
44	c r	Limit Set
47	p	Engrng Units
49	r	Angle Counts
		PRINTER
50	p	Unit ID #†
51	p	Print
52	p	Print Baud Rt
53	p	Compt Baud Rt
		STATISTICS-ANGLE
58	c r	Cpk (Capability Index)
59	c r	Cr (Capability Ratio)
60	c r	Angle Mean
61	c r	Angle Range
62	c r	Angle Mean Shift
63	c r	Ang Std. Dev.
64	c r	Ang Mean +3
65	c r	Ang Mean -3
66	c r	Ang High Rej.
67	c r	Ang Low Rej.
		STATISTICS-TORQUE/FORCE
68	r	Cpk (Capability Index)
69	r	Cr (Capability Ratio)
		X-BAR AND R
70	r	X-BAR
71	r	R
72	p	Sample Size
73	r	Peak Readings
74	c r	Angle X-BAR
75	c r	Angle R
76	c r	Angle Readngs
77	r	Stat Alarm
79	r	Valid Rdngs
		STATISTICS-TORQUE/FORCE
		(see parameters 68 and 69)
80	r	Mean
81	r	Range
82	r	Mean Shift
83	r	Std Deviation
84	r	Mean + 3Sigma
85	r	Mean - 3Sigma
86	r	Totl High Rej
87	r	Totl Low Rej
88	r	Total Accepts
89	r	Totl Readings††
		BACKLIGHT/EPROM#
90	p	Test
		STATISTICS LIMITS
91	p	X-BAR Min
92	p	X-BAR Max
93	c p	Ang X-BAR Min
94	c p	Ang X-BAR Max
95	p	R Min
96	p	R Max
97	c p	Ang R Min
98	c p	Ang R Max

† The Unit ID# is only programmable after a Master Reset or after the system has been re-configured.

†† The Total Readings Parameter is most often used as a readout parameter although its value may be programmed, as in the case where it is desired to erase old data.

Table 13 Programmable Limits Set Up Chart

You may find it helpful to use this chart when programming the Model 560. The factory test values that are pre-programmed in the system for check-out purposes may be valid for your application. They are listed below in parenthesis for reference.

TORQUE or FORCE Limits			
01	Full Scale	(200.0)	
02	Low Limit	(125.0)	
03	High Limit	(200.0)	
04	Threshold	(50.0)	
05	Cycle Complete	(25.0)	
06	Final Target	(170.0)	
16	Cal Value	(100.0)	

ANGLE Limits			
20	Counts per Revolution	(360)	
21	Low Angle Min	(0.0)	
22	Low Angle Max	(4.0)	
24	Mid Angle Min	(5.0)	
25	Mid Angle Max	(7.5)	
27	Final Angle Min	(10.0)	
28	Final Angle Max	(12.5)	
30	Target Angle	(11.3)	

TIMING Parameters			
31	Sample Delay	(1.00)	
32	Reset Time	(1.00)	
35	Sample/End Time	(1.00)	
36	Graph Time	(1.00)	

Miscellaneous			
40	Time	(12.00)	
41	Date	(01.01)	
42	Year	(88)	
47	Engineering Units	(none)	
50	Unit ID#		

Printer and Computer			
52	Printer Baud Rate	(9600)	
53	Computer Baud Rate	(9600)	

STATISTICS Limits			
72	Sample Size	(5)	
91	X-BAR Min	(125.0)	
92	X-BAR Max	(200.0)	
93	Angle X-BAR Minimum	(10.0)	
94	Angle X-BAR Maximum	(12.5)	
95	R Min	(0.0)	
96	R Max	(200.0)	
97	Angle R Minimum	(0.0)	
98	Angle R Maximum	(12.5)	

NOTE: An additional copy of this chart is located at the back of this manual.

3.3 PARAMETER PROGRAMMING

Parameter limits and values which adapt the unit to your specific intended use must be entered before use. The programmable parameters are explained in detail below. Parameters that are readings only are explained in Chapter 4.

Press [▲ PARAM] or [▼ PARAM] to advance or backup through the available parameters.

To change a displayed parameter value, press [CLEAR], enter the new value, press [ENTER].

NOTE: Some parameters may not appear due to selections made in the Configuration Menu.

3.3.1 TORQUE/FORCE PARAMETERS

P-01: FULL SCALE sets the scaling and resolution of the Model 560. Ideally this would be the full scale operating range of the transducer being used with the Model 560. However, this value must be entered with a leading digit of 1, 2, or 4. All other digits must be entered as zeros.

The resolution of the 560 is determined by the position of the decimal point when the Full Scale factor is entered. For example, if you enter the FULL SCALE as 100.00, the 560 automatically adds 2 decimal places to all other Torque/Force parameters. The displayed resolution will be the Full Scale factor divided by 2000 (e.g. 100.00/2000 = 0.05).

The Full Scale value should be selected such that the transducer Cal Value, P-17, and the High Limit value, P-03 (see below), will fall between 40% and 100% of the Full-Scale value.

FOR EXAMPLE: A 50 Lb-Ft tool transducer would use a 100 Lb-Ft Full Scale. The Cal Value would still be entered in P-16 as 50 Lb-Ft.

P-02: LOW LIMIT establishes the lower limit of acceptable Torque or Force data. Any peak reading below this limit turns on the YELLOW status light.

3.3.1 TORQUE/FORCE PARAMETERS cont'd

P-03: HIGH LIMIT sets the upper limit of acceptable Force or Torque data. Any peak data exceeding this value turns on the RED indicator light.

P-04: THRESHOLD sets the level above which the Model 560 begins searching for a new peak, and, if angle equipped, to count the angle of rotation.

P-05: CYCLE COMPLETE is the point which the input level must fall below to complete the measurement cycle. The value entered for Cycle Complete must be less than Threshold, P-04.

P-06: FINAL TARGET (Control Feature) sets the shut-off value for control applications. If angle has been configured, see P-30. If the system is configured for Threshold Start see P-32.

P-07: PEAK DATA will display the peak torque or force of the last rundown.

P-10: PEAK TORQUE-FINAL ANGLE will alternately display the Peak Torque (P-07) and the Final Angle (P-29) of the last rundown.

3.3.2 CALIBRATION PARAMETERS

P-16: CALIBRATION VALUE is provided by the transducer manufacturer and should be entered in the units selected in P-47.

If desired, you may calibrate at half or quarter scale by 1) dividing the Calibration Value by 2 or 4 before entering it into P-16, and 2) doubling or quadrupling the calibration resistor value. For example, to calibrate a 100.0 Ft-Lb transducer that normally uses an 218.4K ohm resistor at half scale, enter 50.0 into P-16 and install a 437.1K ohm resistor.

3.3 PARAMETER PROGRAMMING

Parameter limits and values which adapt the unit to your specific intended use must be entered before use. The programmable parameters are explained in detail below. Parameters that are readings only are explained in Chapter 4.

Press [▲ PARAM] or [▼ PARAM] to advance or backup through the available parameters.

To change a displayed parameter value, press [CLEAR], enter the new value, press [ENTER].

NOTE: Some parameters may not appear due to selections made in the Configuration Menu.

3.3.1 TORQUE/FORCE PARAMETERS

P-01: FULL SCALE sets the scaling and resolution of the Model 560. Ideally this would be the full scale operating range of the transducer being used with the Model 560. However, this value must be entered with a leading digit of 1, 2, or 4. All other digits must be entered as zeros.

The resolution of the 560 is determined by the position of the decimal point when the Full Scale factor is entered. For example, if you enter the FULL SCALE as 100.00, the 560 automatically adds 2 decimal places to all other Torque/Force parameters. The displayed resolution will be the Full Scale factor divided by 2000 (e.g. 100.00/2000 = 0.05).

The Full Scale value should be selected such that the transducer Cal Value, P-17, and the High Limit value, P-03 (see below), will fall between 40% and 100% of the Full-Scale value.

FOR EXAMPLE: A 50 Lb-Ft tool transducer would use a 100 Lb-Ft Full Scale. The Cal Value would still be entered in P-16 as 50 Lb-Ft.

P-02: LOW LIMIT establishes the lower limit of acceptable Torque or Force data. Any peak reading below this limit turns on the YELLOW status light.

3.3.1 TORQUE/FORCE PARAMETERS cont'd

P-03: HIGH LIMIT sets the upper limit of acceptable Force or Torque data. Any peak data exceeding this value turns on the RED indicator light.

P-04: THRESHOLD sets the level above which the Model 560 begins searching for a new peak, and, if angle equipped, to count the angle of rotation.

P-05: CYCLE COMPLETE is the point which the input level must fall below to complete the measurement cycle. The value entered for Cycle Complete must be less than Threshold, P-04.

P-06: FINAL TARGET (Control Feature) sets the shut-off value for control applications. If angle has been configured, see P-30. If the system is configured for Threshold Start see P-32.

P-07: PEAK DATA will display the peak torque or force of the last rundown.

P-10: PEAK TORQUE-FINAL ANGLE will alternately display the Peak Torque (P-07) and the Final Angle (P-29) of the last rundown.

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If desired, you may calibrate at half or quarter scale by 1) dividing the Calibration Value by 2 or 4 before entering it into P-16, and 2) doubling or quadrupling the calibration resistor value. For example, to calibrate a 100.0 Ft-Lb transducer that normally uses an 218.4K ohm resistor at half scale, enter 50.0 into P-16 and install a 437.1K ohm resistor.

3.3.2 CALIBRATION PARAMETERS cont'd

P-17: CALIBRATION READING shows the current span of the 560. The transducer is calibrated when viewing this parameter by pressing the [ENTER] key. If the value entered into P-16 and the reading displayed here do not match, the alarm light will be lit. If the light remains on, access P-19 to verify the nature of the alarm condition (see 4.3, p. 43). If the display indicates a Calibration Alarm, a calibration adjustment is necessary (see 5.1, p. 51).

P-18: ZERO READING displays the gross zero of the transducer.

P-19: CALIBRATION/ZERO ALARM indicates the location and nature of the alarm condition when the Alarm Light is lit (see 4.3).

3.3.3 ANGLE PARAMETERS

If angle measurement is configured, the following parameters establish angle limits.

P-20: ENCODER COUNTS PER REVOLUTION establishes the number of counts that the angle encoder generates per revolution of the spindle. If the angle encoder sends one pulse per degree, set this parameter to 360.

This parameter can be used to compensate for gear reduction ratios. For example, to compensate for the 6:1 ratio of a downshifting motor, this parameter should be set to 2160 (360 X 6). Threshold (P-04) should then then be set at a point above the torque level that occurs at the point of downshift.

*** Important ANGLE Parameter Note ***

The 560 will re-scale all angle parameters if P-20 is changed. Always set P-20 before any other angle parameters. Upon entry, all angle limits are converted internally so that a limit displayed later on may differ slightly from the entered value.

P-21: LOW ANG MIN, P-22: LOW ANG MAX (Special Feature) set low and high angle limits for angle data recorded between Cycle Complete (P-05) and Threshold (P-04).

3.3.3 ANGLE PARAMETERS cont'd

P-23: LOW ANG shows the angle measured between P-05 and P-04 on the last rundown.

P-24: MID ANG MIN, P-25: MID ANG MAX (Special Feature) are the minimum and maximum angle limits from Threshold (P-04) to Low Limit (P-02).

P-26: MID ANG shows the angle measured between P-04 and P-02 for the last rundown.

P-27: FINAL ANGLE MIN is the minimum angle limit from Threshold (P-04) to Peak (P-07). Final Angle measurement below this value will trigger a YELLOW status light.

P-28: FINAL ANGLE MAX sets the maximum angle limit from Threshold (P-04) to Peak (P-07). Final angle measurement above this value will trigger a RED status light.

P-29: FINAL ANGLE shows the angle measured between P-04 and P-07 for the last rundown.

P-30: TARGET ANGLE (Control Feature) sets a "target" for angle of rotation if the Control feature is used. Tool shutdown will occur if this target and the Target Torque (P-06) are both exceeded.

3.3.4 TIMING PARAMETERS

All timing parameters are entered in divisions of 0.01 seconds up to a maximum of 99.99.

P-31: SAMPLE DELAY sets the length of a timing delay before sampling starts triggered at the beginning of the cycle. This can be used to ignore any extraneous peaks that may occur during tool start-up. If configured for Threshold Start or Cycle-On, the delay begins when THRESHOLD is exceeded. For systems that use a remote Measurement Input signal, the delay begins when the Measurement Input signal is given.

P-32: RESET TIME is used most often with hand-held tools using control. This feature provides the operator with a specified time after CYCLE COMPLETE has been reached during which the trigger can be released before control is returned to the motor. A new cycle cannot begin until the timer is done.

3.3.4 TIMING PARAMETERS cont'd

NOTE: For Threshold Start systems P-32 must be set to something other than zero.

P-35: SAMPLE/END TIME depends upon which feature was selected in the Configuration Menu.

SAMPLE TIME sets a specific time limit during which the Model 560 will monitor and record data. For Threshold Start and Cycle-On systems, this timer begins when THRESHOLD is exceeded. If the the Measurement Input signal is used it begins when the Measurement Input signal is given. If used with the Sample Delay feature, this timer would begin when the Sample Delay time (P-31) is over.

END TIME is used for pulsing tools. It sets a time period after the torque level drops below Cycle Complete. If torque rises above Cycle Complete again during this time period, the timer is reset. This feature insures that the highest peak of a pulsing tool will be recorded.

P-36: GRAPH TIME sets a cycle time which is used by the 560 to establish the resolution of the Torque vs. Time graph (see P-51, p. 45). This should be set to a time interval longer than the actual cycle time (25 seconds max.). Consult the following table when programming this parameter.

Table 14 Graph Time

If GRAPH TIME =	RESOLUTION =
< 0.75 sec	1 reading/dot
< 1.50 sec	2 readings/dot
< 3.01 sec	4 readings/dot
< 6.02 sec	8 readings/dot
≥ 6.02 sec	16 readings/dot

The value used to plot each point is the average of the readings which that dot represents.

After all of the programmable limits for the Model 560 are set, you can perform a rundown or measurement cycle. If you have an Epson graphics-compatible printer with a serial port and a 32K buffer attached to your 560, access parameter P-51 and select the Torque/Time Plot printout. The 560 will then draw a time-based curve of the data. See 4.8.2.

3.3.5 MISCELLANEOUS PARAMETERS

P-40: TIME, P-41 DATE, P-42 YEAR display hour and minutes of a 24-hour clock (HH.MM), the month and day (MM.DD), and the year (YY). They are included in the heading of the printouts. When a Master Reset is done, the Time (P-40) is reset to "12.00" and the Date and Year (P-41, P-42) are reset to the software version date.

P-43: CAL RELAY can be used to calibrate a GSE Model 840 or 845 recorder that is attached to the Model 560. Press [ENTER] while this parameter is displayed and the Cal Relay will open or close.

P-44: LIMIT SET shows the number of the limit set currently in use.

P-47: ENGINEERING UNITS allows you to choose the primary/secondary units of measure. Press [Y] to select the currently displayed units or press [N] to view the other choices. When the desired choice is displayed press [Y]. NOTE: The 560 prints data in the primary units only. The choices are:

Table 15

PRIMARY	SECONDARY
lb-ft	Nm
lb-in	Nm
Nm	lb-ft
Nm	lb-in
N	lb
lb	N
none	none

P-49: ANGLE COUNTS shows the number of counts used to compute the last final angle data.

3.3.6 PRINTER PARAMETERS

P-50: UNIT ID# is a three digit number that will appear in the heading of printouts. This ID# is also sent to the GSE-SPC® program to identify data generated by this unit, so make sure all your units have different ID#s.

If you have done a Master Reset (as described in 3.2.1), you will be able to set the Unit ID# at this time. If you haven't recently Master Reset or re-configured the system, this parameter cannot be changed.

3.3.6 PRINTER PARAMETERS cont'd

NOTE: A Master Reset restores the factory default values and should be done before changing any parameters. If you haven't done a Master Reset and choose to do it now, you will have to re-enter any parameters you have changed.

P-52: PRINTER BAUD RATE sets the speed of transmissions through the printer port and must be compatible with the receiving device. Press [Y] to select the displayed speed or press [N] to view the next available selection.

P-53: COMPUTER BAUD RATE sets the speed for transmissions through the Computer Port and must be compatible with the receiving device. Press [Y] to select the displayed speed or press [N] to view the next available selection.

3.3.7 STATS & STATISTICS PARAMETERS

Refer to Section 4.9 for more on the following parameters.

P-58 through P-67: ANGLE STATS show the population statistics for angle.

P-68 & P-69: TORQUE/FORCE Cpk & Cr show the Capability Index and Capability Ratio for torque or force data.

P-70 & P-71: PEAK X-BAR & R show the average and range of the peak data.

P-72: SAMPLE SIZE sets the sample size for X-BAR and Range calculations. Sample size may be set between 1 and 25 (default set to 5).

P-73: PEAK READINGS will show the peak readings (P-07) used for the X-BAR & R computations.

P-74 through P-76: ANGLE X-BAR & R show the average and range of the angle data and the readings used to compute them.

P-77: STATS ALARM displays the reason for the Stats Alarm light being lit.

3.3.7 STATS & STATISTICS PARAMETERS cont'd

P-79: VALID READINGS shows the actual number of readings available for $\bar{X}$ and R.

P-80 through P-89: PEAK DATA STATISTICS provide the various statistics for peak data (P-07).

3.3.8 TEST PARAMETER

P-90: TEST allows you to turn the display backlight ON or OFF by pressing [ENTER]. The GSE Part# of the EPROM will appear for a few seconds followed by the EPROM date (YYMMDD) before the light is turned off or on. Knowing this Part# may be very useful when trouble shooting or when consulting with the factory service staff.

In addition, pressing [ZERO] while this parameter is displayed will perform a test of all lights and display segments. Pressing the decimal key will perform a RAM test without disturbing data.

3.3.9 STATS LIMITS

You can establish limits to control the stats alarm light with these parameters. When the X-BAR or Range for the Torque/Force or Angle Stats rises above or falls below the limits set for those values, the Stats Alarm Light will be turned on. Access P-77 to determine the exact nature of the alarm condition.

P-91, P-92: X-BAR MIN & MAX set the minimum and maximum limits for the Torque/Force X-BAR calculations.

P-93, P-94: ANG X-BAR MIN & MAX set the minimum and maximum limits for the Angle X-BAR calculations.

P-95, P-96: R MIN & MAX set the minimum and maximum limits for the Torque/Force RANGE calculations.

P-97, P-98: ANGLE R MIN & MAX set the minimum and maximum limits for the Angle RANGE calculations.

3.3.6 PRINTER PARAMETERS cont'd

NOTE: A Master Reset restores the factory default values and should be done before changing any parameters. If you haven't done a Master Reset and choose to do it now, you will have to re-enter any parameters you have changed.

P-52: PRINTER BAUD RATE sets the speed of transmissions through the printer port and must be compatible with the receiving device. Press [Y] to select the displayed speed or press [N] to view the next available selection.

P-53: COMPUTER BAUD RATE sets the speed for transmissions through the Computer Port and must be compatible with the receiving device. Press [Y] to select the displayed speed or press [N] to view the next available selection.

3.3.7 STATS & STATISTICS PARAMETERS

Refer to Section 4.9 for more on the following parameters.

P-58 through P-67: ANGLE STATS show the population statistics for angle.

P-68 & P-69: TORQUE/FORCE Cpk & Cr show the Capability Index and Capability Ratio for torque or force data.

P-70 & P-71: PEAK X-BAR & R show the average and range of the peak data.

P-72: SAMPLE SIZE sets the sample size for X-BAR and Range calculations. Sample size may be set between 1 and 25 (default set to 5).

P-73: PEAK READINGS will show the peak readings (P-07) used for the X-BAR & R computations.

P-74 through P-76: ANGLE X-BAR & R show the average and range of the angle data and the readings used to compute them.

P-77: STATS ALARM displays the reason for the Stats Alarm light being lit.

3.3.7 STATS & STATISTICS PARAMETERS cont'd

P-79: VALID READINGS shows the actual number of readings available for $\bar{X}$ and R.

P-80 through P-89: PEAK DATA STATISTICS provide the various statistics for peak data (P-07).

3.3.8 TEST PARAMETER

P-90: TEST allows you to turn the display backlight ON or OFF by pressing [ENTER]. The GSE Part# of the EPROM will appear for a few seconds followed by the EPROM date (YYMMDD) before the light is turned off or on. Knowing this Part# may be very useful when trouble shooting or when consulting with the factory service staff.

In addition, pressing [ZERO] while this parameter is displayed will perform a test of all lights and display segments. Pressing the decimal key will perform a RAM test without disturbing data.

3.3.9 STATS LIMITS

You can establish limits to control the stats alarm light with these parameters. When the X-BAR or Range for the Torque/Force or Angle Stats rises above or falls below the limits set for those values, the Stats Alarm Light will be turned on. Access P-77 to determine the exact nature of the alarm condition.

P-91, P-92: X-BAR MIN & MAX set the minimum and maximum limits for the Torque/Force X-BAR calculations.

P-93, P-94: ANG X-BAR MIN & MAX set the minimum and maximum limits for the Angle X-BAR calculations.

P-95, P-96: R MIN & MAX set the minimum and maximum limits for the Torque/Force RANGE calculations.

P-97, P-98: ANGLE R MIN & MAX set the minimum and maximum limits for the Angle RANGE calculations.

4. OPERATION

This part of the manual describes the procedures related to operation of the 560 some of which may require additional operator input or interpretation.

4.1 ANNUNCIATOR LIGHTS

After the run is completed, the annunciator lights and the display reveal the status of the data for torque/force and angle.

1. The yellow light indicates that peak torque/force and/or final angle data fell below the programmed low limit. The display will indicate if the condition applies to the torque/force input or angle.

2. The red light indicates that peak torque/force and/or final angle data rose above the high limit.

3. The green light indicates in-limit torque/force and angle readings.

4.2 STATS ALARM LIGHT

This alarm light will be turned on if the calculations for Torque/Force X-BAR (P-70) and RANGE (P-71) fall outside the limits set in Parameters P-91 and P-92, P-95 and P-96. It will also be lit if (when configured for Angle measurement) the calculations for Angle X-BAR (P-74) and ANGLE RANGE (P-75) fall outside the limits set in parameters P-93 and P-94, P-97 and P-98. Access the Stats Alarm parameter, P-77, to find out the exact reason of the alarm (see 4.9.2, p. 46).

4.3 ALARM CONDITIONS

The Zero and Calibration Alarm feature alerts the operator to possible malfunctions, such as transducer and cable failure or the need for calibration adjustment. The alarm light located in the upper right hand corner of the keypad will turn on whenever the Model 560 detects a Zero Reading, P-18, or Cal Reading, P-17, that cannot be automatically compensated for by the system. When the alarm light comes on, select the Alarm Readout, P-19. The display will indicate the nature of the alarm.

4.3 ALARM CONDITIONS cont'd

Zero Alarm Condition: Select P-18 to display the zero offset of the transducer. If the offset is too large, the transducer may require repair. If the offset appears to drift, this may indicate a faulty cable or connector. This may also indicate an open circuit in the transducer bridge.

Calibration Alarm Condition: First, check the cables and connectors. Make sure that the Full Scale, P-01, has been properly selected. Then make sure that Parameter 17 matches the value entered into Parameter 16. If not, see Section 5.1, p. 51 if Calibration Adjustments are necessary.

4.4 ERASING DATA

The data of either limit set may be erased on the next rundown by setting the number of stored data points for that set (as selected in P-89) to "0".

If P-89 is accidentally set to zero and no further rundowns have occurred, enter "9999" into P-89 and press [ENTER]. The original number of readings and the old data will be restored.

4.5 MASTER RESET

When a Master Reset is performed, all programmable parameters (limits, Time, Date, etc.) are replaced by the default values and may need to be re-entered before further operation. It is only after a Master Reset or a System Reconfiguration that the Unit ID (P-50) can be changed. To perform a Master Reset, press [RESET]. Then press and hold the [CLEAR] key until the RAM test is completed. Master Reset will not affect selections already made in the Configuration Menu.

4.6 PUSH-BUTTON RESET

The Model 560 may be reset and still retain data and programmed values by pressing the [RESET] key.

4.7 READOUT PARAMETERS

The most commonly chosen parameter to monitor when operating a Model 560 is the Peak, P-07. For angle systems Final Angle, P-29, or Peak Torque/Final Angle, P-10, are often chosen. However, you may want to view certain statistical parameters in order to monitor process control (see Section 4.9). The following list summarizes the information obtained from the readout parameters.

P-07: PEAK displays the maximum measured torque or force during the last cycle. Units of measure may be converted from primary to secondary units by pressing the [ENGL/MET] key.

P-29: FINAL ANGLE will display the final angle of rotation measured between Threshold (P-04) and Peak (P-07).

P-10: PEAK TORQUE/FINAL ANGLE alternately displays the Peak (P-07) and Final Angle (P-29) recorded during the last cycle.

P-18: ZERO READING shows the gross zero offset of the transducer. Press [ENTER] if you want to perform an Auto Zero. The Model 560 will attempt to automatically correct any zero offset before each rundown. The Alarm light comes on if the gross zero exceeds ±25% of the value entered into Full Scale (P-01).

P-23: FINAL ANGLE (Low Angle Feature) shows the measured angle in the torque range from Cycle Complete (P-05) to Threshold (P-04). A reject occurs if this falls outside the limits set by P-21 & P-22.

P-26: FINAL ANGLE (Mid Angle Feature) shows the measured angle in the torque range from Threshold (P-04) to Low Limit (P-02). A reject occurs if this falls outside the limits set by P-24 and P-25.

P-44: LIMIT SET IN USE displays which limit set is in effect if the unit is configured for a second limit set.

P-49: ANGLE COUNTS is normally used to test the angle encoder. Press [CLEAR] [ENTER] and turn the spindle. The Angle Counts will be continuously displayed.

4.8 PRINTING DATA AND STATISTICS

All printing tasks are started by first accessing the PRINT parameter, P-51. Allow enough time for printing to be completed before beginning another rundown. One of the Continuous Print features can be selected prior to operation (see p. 46).

When the "Print Last 100 Readings" and "Continuous Print" reports are selected, certain letter codes will flag out-of-limit data. They are:

H: When the data was above the high limit either P-03, P-22, P-25 or P-28.
L: When the data falls below the low limit, either P-02, P-21, P-24, or P-27.
S: When the data caused an immediate shutdown of a motor control system.

In certain other situations, the data may be replaced with a special code: when the Measurement Input feature is configured and the torque/force input fails to reach Threshold (P-04), the 560 will print "<thrsh" in place of the data; when a "rehit" is detected by a torque-angle system the angle data will be replaced by the word "rehit"; if the measured angle exceeds 999.9 the 560 will print "Ang Er"; if the calculated values for CPK or CR (P-58, P-59, P-68, P-69) exceed ±199.9 the data will be replaced with "C +" or "C -" for CPK or with "CR +" for CR.

4.8.1 ORDERING A PRINTOUT

A printed report of the information recorded and computed by the Model 560 can be obtained by accessing the PRINT parameter, P-51. The 560 will display "Print" on the upper line and show the name of the first possible selection, "Last 100 Rdngs", on the lower line. Press [Y] to print the displayed selection or press [N] to view the next selection.

The printer will begin as soon as the first command is entered and will hold any subsequent commands for printing until the first task is complete. An advisory message will appear when the operator has entered more requests than the Model 560 can print immediately. These additional requests will be completed in order once the current task is accomplished.

4.7 READOUT PARAMETERS

The most commonly chosen parameter to monitor when operating a Model 560 is the Peak, P-07. For angle systems Final Angle, P-29, or Peak Torque/Final Angle, P-10, are often chosen. However, you may want to view certain statistical parameters in order to monitor process control (see Section 4.9). The following list summarizes the information obtained from the readout parameters.

P-07: PEAK displays the maximum measured torque or force during the last cycle. Units of measure may be converted from primary to secondary units by pressing the [ENGL/MET] key.

P-29: FINAL ANGLE will display the final angle of rotation measured between Threshold (P-04) and Peak (P-07).

P-10: PEAK TORQUE/FINAL ANGLE alternately displays the Peak (P-07) and Final Angle (P-29) recorded during the last cycle.

P-18: ZERO READING shows the gross zero offset of the transducer. Press [ENTER] if you want to perform an Auto Zero. The Model 560 will attempt to automatically correct any zero offset before each rundown. The Alarm light comes on if the gross zero exceeds ±25% of the value entered into Full Scale (P-01).

P-23: FINAL ANGLE (Low Angle Feature) shows the measured angle in the torque range from Cycle Complete (P-05) to Threshold (P-04). A reject occurs if this falls outside the limits set by P-21 & P-22.

P-26: FINAL ANGLE (Mid Angle Feature) shows the measured angle in the torque range from Threshold (P-04) to Low Limit (P-02). A reject occurs if this falls outside the limits set by P-24 and P-25.

P-44: LIMIT SET IN USE displays which limit set is in effect if the unit is configured for a second limit set.

P-49: ANGLE COUNTS is normally used to test the angle encoder. Press [CLEAR] [ENTER] and turn the spindle. The Angle Counts will be continuously displayed.

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S: When the data caused an immediate shutdown of a motor control system.

In certain other situations, the data may be replaced with a special code: when the Measurement Input feature is configured and the torque/force input fails to reach Threshold (P-04), the 560 will print "<thrsh" in place of the data; when a "rehit" is detected by a torque-angle system the angle data will be replaced by the word "rehit"; if the measured angle exceeds 999.9 the 560 will print "Ang Er"; if the calculated values for CPK or CR (P-58, P-59, P-68, P-69) exceed ±199.9 the data will be replaced with "C +" or "C -" for CPK or with "CR +" for CR.

4.8.1 ORDERING A PRINTOUT

A printed report of the information recorded and computed by the Model 560 can be obtained by accessing the PRINT parameter, P-51. The 560 will display "Print" on the upper line and show the name of the first possible selection, "Last 100 Rdngs", on the lower line. Press [Y] to print the displayed selection or press [N] to view the next selection.

The printer will begin as soon as the first command is entered and will hold any subsequent commands for printing until the first task is complete. An advisory message will appear when the operator has entered more requests than the Model 560 can print immediately. These additional requests will be completed in order once the current task is accomplished.

4.8.2 PRINTER PARAMETERS

NOTE: As mentioned in the Specifications on p. 2, the Model 560 requires an Epson Graphics compatible printer with a serial port and a 32K buffer (GSE can provide a serial interface card for Epson printers with 32K buffer: order Part# 41-10-0403).

P-50: UNIT ID NUMBER appears in the heading on all printouts and can be set only after the instrument is Master Reset or Reconfigured. This ID# is also sent to the GSE-SPC® program to identify this unit. If you have several units, make sure they have different Unit ID#s.

P-51: PRINT contains the print selections. After accessing this parameter, press [Y] if you want a copy of the displayed printout. Press [N] to view the other selections. The available selections are explained below.

"Last 100 Rdngs" produces a printout of the last 100 Peak and Final Angle readings (or less if the number of readings entered in P-89 is less than 100). High and Low data (torque/force/angle) will be flagged with an "H" or "L". Any data which causes an immediate shutdown will be flagged with an "S".

"Current Limits" prints the complete limit set. A sample obtained from a basic 560 appears below:

G S E Model 560 #001 12/31/89 03:29
Limit Printout

01 full scale	200.0
02 low limit	125.0
03 high limit	200.0
04 threshold	50.0
05 cycle complete	25.0
16 cal value	100.0
20 counts/rev	360.0
27 min angle	0.0
28 max angle	360.0

P-51: PRINT cont'd

"Statistics" prints all statistical information on both peak torque/force and angle. For example:

G S E Model 560 #12 03/19/90 14:46
[Limit Set 1]
Angle parameters

58 CPK	1.33
59 CR	0.75
60 Population Mean	12.8
61 Population Range	0.60
62 Mean Shift	-0.30
63 Standard Deviation	0.20
64 Mean + 3 sigma	13.4
65 Mean - 3 sigma	12.2
28 High Limit	14.0
27 Low Limit	11.0
66 High Rejects	0
67 Low Rejects	0

Torque parameters

68 CPK	1.28
69 CR	0.75
80 Population Mean	22.64
81 Population Range	1.60
82 Mean Shift	-0.86
83 Standard Deviation	0.53
84 Mean + 3Sigma	24.23
85 Mean - 3Sigma	21.05
03 High Limit	25.0
02 Low Limit	22.0
86 High Rejects	0
87 Low Rejects	1
88 Number Acceptable	24
89 Number of Readings	25

"System Config" prints the questions and answers of the Configuration Menu.

"Trq/Tim Plot" prints a torque or force vs. time curve on an Epson graphics-compatible printer that is equipped with a serial port and a 32K buffer. Refer to 3.3.4, p. 41, for details on P-36 GRAPH TIME which sets the resolution and scaling for this plot. When testing the 560 and related components, the scaling can be changed between rundowns to produce the desired plot, however the data from any previous rundown cannot be re-scaled.

4.8.2 PRINTER PARAMETERS

NOTE: As mentioned in the Specifications on p. 2, the Model 560 requires an Epson Graphics compatible printer with a serial port and a 32K buffer (GSE can provide a serial interface card for Epson printers with 32K buffer: order Part# 41-10-0403).

P-50: UNIT ID NUMBER appears in the heading on all printouts and can be set only after the instrument is Master Reset or Reconfigured. This ID# is also sent to the GSE-SPC® program to identify this unit. If you have several units, make sure they have different Unit ID#s.

P-51: PRINT contains the print selections. After accessing this parameter, press [Y] if you want a copy of the displayed printout. Press [N] to view the other selections. The available selections are explained below.

"Last 100 Rdngs" produces a printout of the last 100 Peak and Final Angle readings (or less if the number of readings entered in P-89 is less than 100). High and Low data (torque/force/angle) will be flagged with an "H" or "L". Any data which causes an immediate shutdown will be flagged with an "S".

"Current Limits" prints the complete limit set. A sample obtained from a basic 560 appears below:

G S E Model 560 #001 12/31/89 03:29
Limit Printout

01 full scale	200.0
02 low limit	125.0
03 high limit	200.0
04 threshold	50.0
05 cycle complete	25.0
16 cal value	100.0
20 counts/rev	360.0
27 min angle	0.0
28 max angle	360.0

P-51: PRINT cont'd

"Statistics" prints all statistical information on both peak torque/force and angle. For example:

G S E Model 560 #12 03/19/90 14:46
[Limit Set 1]
Angle parameters

58 CPK	1.33
59 CR	0.75
60 Population Mean	12.8
61 Population Range	0.60
62 Mean Shift	-0.30
63 Standard Deviation	0.20
64 Mean + 3 sigma	13.4
65 Mean - 3 sigma	12.2
28 High Limit	14.0
27 Low Limit	11.0
66 High Rejects	0
67 Low Rejects	0

Torque parameters

68 CPK	1.28
69 CR	0.75
80 Population Mean	22.64
81 Population Range	1.60
82 Mean Shift	-0.86
83 Standard Deviation	0.53
84 Mean + 3Sigma	24.23
85 Mean - 3Sigma	21.05
03 High Limit	25.0
02 Low Limit	22.0
86 High Rejects	0
87 Low Rejects	1
88 Number Acceptable	24
89 Number of Readings	25

"System Config" prints the questions and answers of the Configuration Menu.

"Trq/Tim Plot" prints a torque or force vs. time curve on an Epson graphics-compatible printer that is equipped with a serial port and a 32K buffer. Refer to 3.3.4, p. 41, for details on P-36 GRAPH TIME which sets the resolution and scaling for this plot. When testing the 560 and related components, the scaling can be changed between rundowns to produce the desired plot, however the data from any previous rundown cannot be re-scaled.

4.8.2 PRINTER PARAMETERS

P-51: PRINT cont'd

"Trq/Ang Plot" will appear if Angle is configured. This selection draws a Torque vs. Angle graph. The scaling for the X Axis (Angle) is based on the last value recorded in parameter P-28 (Final Angle). The Full Scale of the angle data will be rounded off to the next highest multiple of 180 degrees. For example, if 300° of data was recorded, the Full Scale of the X Axis would be 360°.

"X-BAR Plot" prints a simple X-BAR graph based on the data currently in memory. The Y-axis scaling will reflect the value entered as Full Scale (P-01). The graph will be drawn in a bar chart format with each "plateau" representing the average of consecutive samples of readings based on the Sample Size programmed in P-72.

"All Readings" prints all readings stored in memory.

"Continuous Prnt" prints the Peak readings at the completion of each cycle. High and low data will be flagged with an "H" or an "L". Data which caused an immediate shutdown of a motor control system will be flagged with an "S".

"Rejects Only" prints the readings of just the rejects, as determined by the Model 560, at the completion of each cycle.

P-52: PRINT BAUD RT sets the speed of the printer port. Press [Y] to select the displayed speed, or press [N] to view the next selection.

P-53: COMPT BAUD RATE sets the baud rate of the computer port. Press [Y] to select the displayed speed, or press [N] to view the next selection.

4.9 STATISTICS

Stats and statistics can be obtained by accessing one of the following parameters.

4.9.1 ANGLE STATISTICS PARAMETERS

If angle measurement is configured, the following parameters can be viewed. The calculations for these parameters are based on the complete store of angle data.

P-58: ANGLE CPK is a measure which indicates whether the process will produce units within the specified limits. If CPK is negative, the process mean (P-60) lies outside of the specifications; if CPK is between 0 and 1 then some of the ± 3 sigma spread falls outside the specs; If CPK is greater than 1, the ± 3 sigma spread is completely within the specs.

P-59: ANGLE CR is the ratio between the ± 3 sigma values and the specification limits. It may range from 0 to infinity in value, with a smaller value indicating a more capable process.

P-60: ANGLE MEAN is the average value of all the stored readings transferred from parameter P-29.

P-61: ANGLE RANGE is the range of the stored angle readings equal to the highest reading minus the lowest.

P-62: ANGLE MEAN SHIFT is the difference between the Angle Mean (P-60) and the mean of the Angle Limits (the mid-point between the High and Low Limits, P-28 and P-27 respectively). This is an indication of statistical capability which can point out when a process is in or out of control. It is also handy for making adjustments of the tooling to bring the process closer to the target or ideal value.

P-63: ANGLE STANDARD DEVIATION is a measure of the variation of the angle samples. It is often referred to by the Greek letter sigma.

4.9.1 ANGLE STATISTICS PARAMETERS cont'd

P-64: ANGLE MEAN +3 STANDARD DEVIATION is the Angle Mean (P-60) plus 3 times the value for sigma (P-63). It is often considered as the calculated natural upper control limit.

P-65: ANGLE MEAN -3 STANDARD DEVIATION is the Angle Mean (P-60) minus 3 times the value for sigma (P-63). If is often considered as the calculated natural lower control limit.

P-66: HIGH ANGLE REJECTS is the number of readings in the angle population which are above the high limit.

P-67: LOW ANGLE REJECTS is the number of angle readings which are below the low limit.

4.9.2 X-BAR AND RANGE STATS PARAMETERS

The stats in this group are based on the sample size as programmed in P-72.

P-70: $\bar{X}$ is the average value of the last "n" readings for peak (the value for "n" is set in P-72).

P-71: R is the range of the last "n" readings for peak (P-07).

P-72: SAMPLE SIZE is the number of samples ("n") used to determine $\bar{X}$ and R and is usually set at 5.

P-73: PEAK READINGS lets you view the last "n" readings beginning with the most recent by pressing [ENTER] once per reading.

P-74: ANGLE $\bar{X}$ shows the statistical average of the last "n" angle readings (P-29).

P-75: ANGLE R displays the range of the last "n" readings for Final Angle (P-29).

P-76: ANGLE READINGS shows the last "n" readings for final angle by pressing [ENTER] once per reading.

4.9.2 X-BAR AND RANGE STATS PARAMETERS cont'd

P-77: STATS ALARM will tell why the Stats Alarm Light is on, as described below.

Low X-BAR: Torque/Force X-BAR (P-70) is lower than the limit set in P-91.
High X-BAR: Torque/Force X-BAR is higher than the limit specified in P-92.
Low R: Torque/Force Range (P-71) is lower than the limit set in P-95.
High R: Torque/Force Range is higher than the limit specified in P-96.
Low Angle X-BAR: Angle X-BAR (P-74) is lower than the limit set in P-93.
High Angle X-BAR: Angle X-BAR is higher than the limit specified in P-94.
Low Angle R: Angle Range (P-75) is lower than the limit specified in P-97.
High Angle R: Angle Range is higher than the limit specified in P-98.

P-79: VALID READINGS displays the actual number of readings available for $\bar{X}$ and R computations.

4.9.3 TORQUE/FORCE STATISTICS PARAMETERS

The calculations for the parameters listed below are based on the entire population of torque or force data.

P-68: CPK is an indication whether the process will produce units within the specified limits. IF CPK is negative, the process mean (P-80) is outside the specified limits; if CPK is between 0 and 1 then some of the $\pm$3 sigma spread falls outside the specified limits; if CPK is larger than 1, the $\pm$3 sigma spread is completely within specified limits.

P-69: CR is the ratio between the $\pm$3 sigma values and the engineering specifications. This value can range from 0 to infinity with a smaller value indicating a more capable process.

P-80: PEAK MEAN shows the average value of all the stored peak readings.

P-81: PEAK RANGE shows the highest peak reading minus the lowest.

4.9.3 TORQUE/FORCE STATISTICS PARAMETERS cont'd

P-82: PEAK MEAN SHIFT displays the difference between the population mean (P-80) and the mean of the limits (P-03 minus P-02). This is an indication of process capability.

P-83: PEAK STANDARD DEVIATION is the spread of the values above and below the peak mean (P-80) for all the Peak readings in memory.

P-84: PEAK +3 STANDARD DEVIATION is the calculated upper control limit for peak torque or force measurement.

P-85: PEAK -3 STANDARD DEVIATION is the calculated lower control limit for peak torque or force measurement.

P-86: TOTAL HIGH REJECTS is the number of readings in the population which are above the high limit.

P-87: TOTAL LOW REJECTS is the number of readings which are below the lower control limit.

P-88: TOTAL ACCEPTS represents the total number of acceptable peak readings.

P-89: TOTAL READINGS shows how many peak readings are stored. When the maximum is exceeded, new data replaces the oldest. Old data can be cleared on the next rundown by setting P-89 to "0". If this parameter is accidentally set to zero and no further rundowns are performed, enter "9999" into P-89 and press [ENTER]. The original number of readings and the old data will be restored.

4.10 USING THE MODEL 560 WITH GSE-SPC®

If the SPC Output is configured in the System Configuration Menu, the Model 560 will send a Data Packet to the computer after each cycle is completed. In addition, whenever a parameter on the 560 is changed, either at the keyboard or by the computer, the 560 will send a Parameter Packet to the computer.

4.10.1 SENDING DATA AND PARAMETER PACKETS

The data is sent from the 560 in the following formats.

TORQUE or FORCE SYSTEM DATA PACKET	
Packet Type:	1 Byte ASCII "G"
Unit Number:	3 Bytes ASCII (ID# P-50)
Channel Number:	3 Bytes ASCII
Limit Set #:	1 Byte ASCII†
Extra ID:	2 Bytes ASCII*
Year, Month, Day:	6 Bytes ASCII
Hour, Minutes, Seconds:	6 Bytes ASCII
Peak Data:	8 Bytes ASCII
CR:	1 Bytes ASCII
Additive Checksum (up to and including CR):	1 Byte HEX
LF:	1 Byte ASCII
Total:	33 Bytes

TORQUE & ANGLE SYSTEM DATA PACKET	
Packet Type:	1 Byte ASCII "H"
Unit Number:	3 Bytes ASCII
Channel Number:	3 Bytes ASCII
Limit Set #:	1 Byte ASCII†
Extra ID:	2 Bytes ASCII*
Year, Month, Day:	6 Bytes ASCII
Hour, Minutes, Seconds:	6 Bytes ASCII
Peak Torque:	8 Bytes ASCII
Final Angle:	5 Bytes ASCII
CR:	1 Byte ASCII
Additive Checksum (up to and including CR):	1 Byte HEX
LF:	1 Byte ASCII
Total:	38 Bytes

† Limit set character will be a letter between A-D corresponding to Limit Set #1-4.

* The Extra ID consists of two blank characters.

4.9.3 TORQUE/FORCE STATISTICS PARAMETERS cont'd

P-82: PEAK MEAN SHIFT displays the difference between the population mean (P-80) and the mean of the limits (P-03 minus P-02). This is an indication of process capability.

P-83: PEAK STANDARD DEVIATION is the spread of the values above and below the peak mean (P-80) for all the Peak readings in memory.

P-84: PEAK +3 STANDARD DEVIATION is the calculated upper control limit for peak torque or force measurement.

P-85: PEAK -3 STANDARD DEVIATION is the calculated lower control limit for peak torque or force measurement.

P-86: TOTAL HIGH REJECTS is the number of readings in the population which are above the high limit.

P-87: TOTAL LOW REJECTS is the number of readings which are below the lower control limit.

P-88: TOTAL ACCEPTS represents the total number of acceptable peak readings.

P-89: TOTAL READINGS shows how many peak readings are stored. When the maximum is exceeded, new data replaces the oldest. Old data can be cleared on the next rundown by setting P-89 to "0". If this parameter is accidentally set to zero and no further rundowns are performed, enter "9999" into P-89 and press [ENTER]. The original number of readings and the old data will be restored.

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Additive Checksum (up to and including CR):	1 Byte HEX
LF:	1 Byte ASCII
Total:	33 Bytes

TORQUE & ANGLE SYSTEM DATA PACKET	
Packet Type:	1 Byte ASCII "H"
Unit Number:	3 Bytes ASCII
Channel Number:	3 Bytes ASCII
Limit Set #:	1 Byte ASCII†
Extra ID:	2 Bytes ASCII*
Year, Month, Day:	6 Bytes ASCII
Hour, Minutes, Seconds:	6 Bytes ASCII
Peak Torque:	8 Bytes ASCII
Final Angle:	5 Bytes ASCII
CR:	1 Byte ASCII
Additive Checksum (up to and including CR):	1 Byte HEX
LF:	1 Byte ASCII
Total:	38 Bytes

† Limit set character will be a letter between A-D corresponding to Limit Set #1-4.

* The Extra ID consists of two blank characters.

4.10.1 SENDING DATA AND PARAMETER PACKETS cont'd

PARAMETER PACKET

Packet Type:	1 Byte ASCII "P"
Unit Number:	3 Bytes ASCII
Channel Number:	3 Bytes ASCII
Limit Set #:	1 Byte ASCII
Year, Month, Day:	6 Bytes ASCII
Hour, Minutes, Seconds:	6 Bytes ASCII
Parameter Number:	2 Bytes ASCII
Data:	8 Bytes ASCII
CR:	1 Byte ASCII
Additive Checksum (up to and including CR):	1 Byte HEX
LF:	1 Byte ASCII
Total:	33 Bytes

NOTE: The Data Packet form listed on the previous page and the Parameter Packet form listed above reflect the packet form on current releases of the 560. Previous models did not include the 2 bytes for "EXTRA ID" and used only 4 bytes for time and 2 bytes for the date. The previous Data Packet form used only 6 bytes for the peak data.

4.10.2 SENDING LIMITS FROM COMPUTER TO 560

Parameter changes can be sent from the computer to the Model 560. Upon change of any limit, a parameter packet will be echoed back to the computer. This will not be done when the Limit Set is changed, since the change of limit sets will be reflected in the data packets and the data will be stored appropriately by the computer.

1. Starting from the MAIN MENU of GSE-SPC®, select the Create/Edit/Send Limit File item.
2. Select Model 57X.
3. Select the Create Limit File item.
4. Select the model type with 575 for a torque only system and 576 for a torque-angle system.
5. Enter the 3-digit Unit #.
6. Enter the Channel # as 000.
7. Enter the limit set, "A" for limit set 1, "B" for limit set 2, "C" for limit set 3, or "D" for limit set 4.
8. Enter the parameter number you wish to change and the appropriate value.
9. Repeat step 8 for each other parameter you want to change.
10. When the screen shows the Save Parameter display, press "Y".
11. Enter parameter #00 to quit and return to the MAIN MENU.
12. Select the Create/Edit/Send Limit File item from the MAIN MENU.
13. Select 57X.
14. Select the Send Limit File item.

4.10.2 SENDING LIMITS FROM COMPUTER TO 560
cont'd

15. The screen will show the limit files that have been previously stored (only the one saved above when sending limits for the first time).

16. Use the arrow keys to select the Limit File you want to send.

17. The screen will display the Limits and ask "Do you want to send these limits?" Press "Y".

18. After the limits have been sent the display will return to the MAIN MENU.

The data sent from the computer to the Model 560 are referred to as Control Packets. They use the following formats.

STORE PARAMETER PACKET

Mux Port Command:	1 Byte ASCII "P"
Unit/Port#:	2 Bytes ASCII
Packet Type:	1 Byte ASCII "S"
Channel #:	2 Bytes ASCII
Limit Set #:	1 Byte ASCII
Parameter #:	2 Bytes ASCII
Data:	8 Bytes ASCII
CR:	1 Byte ASCII
Additive Checksum (up to and including CR):	1 Byte HEX
LF:	1 Byte ASCII
Total:	20 Bytes

READ PARAMETER PACKET

Mux. Port Command:	1 Byte ASCII "P"
Unit/Port #:	2 Bytes ASCII
Packet Type:	1 Byte ASCII "R"
Channel #:	2 Bytes ASCII
Limit Set #:	1 Byte ASCII
Parameter #:	2 Bytes ASCII
CR:	1 Byte ASCII
Additive Checksum (up to and including CR:	1 Byte HEX
LF:	1 Byte ASCII
Total:	12 Bytes

NOTE: When Read and Store messages are received correctly, a parameter packet will be echoed back to the computer.

5. SERVICE AND TROUBLE-SHOOTING

Many technical questions can be answered by referring to the Specifications on p. 2 and by reviewing the material covered in the Installation Section starting on p. 7.

5.1 TRANSDUCER ADJUSTMENTS

Zero adjustments are performed by the Model 560 automatically. Other transducer adjustments may be required to compensate for wear or when changing transducers. The following routines may be needed.

ZERO ADJUSTMENT: Display P-18 and press [ENTER].

COARSE SPAN: Locate switch U6 on the upper right side of the Main Board (see Figure 21). Find the switch that matches the mV/V output of your transducer and place it in the ON position. Select only one combination at a time.

Table 16 Coarse Span Adjustments

Switch	mV/V
1	1
2	2
3	4
1 & 4	0.5

CALIBRATION: Display P-17 and press [ENTER].

FINE SPAN: Adjust potentiometer P15 so that the number displayed in P-17 matches the value entered into P-16.

5.2 CHANGING TRANSDUCERS

Transducers with the Same Specifications:

1. Shut off the power and disconnect the old transducer.
2. Attach the new transducer and turn on the power.
3. Zero the transducer.
4. Calibrate the transducer.
5. Adjust the Fine Span if needed.

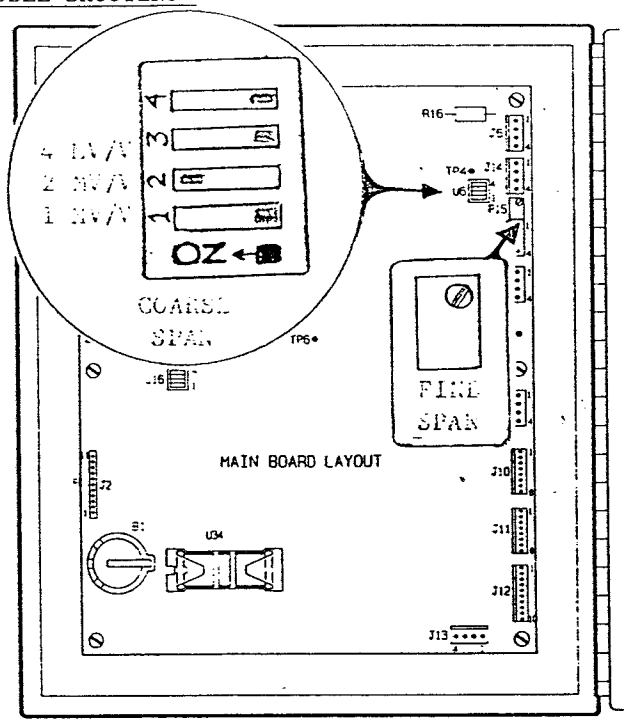

Figure 27 Span Adjustments

5.2 CHANGING TRANSDUCERS cont'd

For Transducers with Different Specifications:

1. Shut off the power and disconnect the old transducer.
2. Attach the new transducer and turn on the power.
3. If the calibration resistor must be changed:
   - A. Unplug the old resistor from its socket (located at R16 on the Main Board).
   - B. Trim the leads on the new resistor to size and push them through the holes.

NOTE: GSE recommends a precision wire wound ±0.025% resistor for accurate and repeatable shunt calibration.

4. Adjust the coarse span.
5. Zero the transducer.
6. Adjust the Fine Span.

5.3 ADVISORY MESSAGES

The Model 560 may display an Advisory Message to alert the operator to possible problems. Most of these messages are self-explanatory. Consult the table below for the probable cause and corrective action.

"ANGLE TOO LARGE" Angle count is too large to be displayed: Check P-20 for the proper value for Counts/Rev.

"BAD CAL VALUE"

1. Calibration is out of adjustment (P-16 and P-17 don't match): adjust potentiometer P15 on Main Board (see 5.1).

2. Missing or broken Cal resistor: replace or repair resistor.

"BAD ZERO VALUE"

1. The Transducer Zero Offset (P-18) is too large: make sure torque isn't applied to transducer when zero compensation takes place.

2. Transducer and/or cable may require repair.

"BAD CAL AND ZERO" P-16 and P-17 do not match and the transducer zero offset is too large: check the transducer and the cable; either one or both may require repair or replacement.

"CAL WHILE IN RUN" P-17 cannot be selected while in a rundown.

"CAPABLE" appears when you access parameter P-58 for angle or P-68 for torque/force and the calculated value for Cpk exceeds the display limitation of 199.99.

"CAPABLE OUT SPEC" appears when you access parameter P-58 for angle or P-68 for torque/force and the calculated value for Cpk exceeds the display limitations of -199.99.

"NOT-CAPABLE" appears when you access parameter P-59 for angle or P-69 for torque and the calculated value for Cr exceeds the display limitations of 199.99.

"ENTRY WHILE RUN" Parameter entry while in a rundown is not allowed.

"ERR: P-02 > P-03" The Low Limit (P-02) must be less than the High Limit (P-03): check these parameters for proper entry; enter lower limit first.

"ERR: P-05 > P-04" The Cycle Complete (P-05) must be less than Threshold (P-04): check these parameters for proper entry; enter lowest limit first.

"FULL SCALE ERR"

1. Full Scale P-01 was entered with leading digit other than 1, 2 or 4.

2. Another Torque/Force parameter was entered with a value greater than Full Scale P-01.

"MUST MASTER RST" P-50 can only be changed after a Master Reset is performed.

"NO DATA FOR STAT" Not enough readings exist in memory to calculate statistics: generate more data before accessing any of the statistics parameters.

"NON-ENTER PARAM" A reading-only parameter cannot be changed.

"P-00 NOT ENTERED" Security Code was not entered in P-00 before attempting a parameter change: you must enter the 4-digit Security Code before attempting a programming change.

"PRINT IN PROCESS" Only one print command can be processed at a time: wait until the current task is finished before selecting another.

"TOO LARGE NEGATV" Large negative numbers cannot be displayed.

"TOO LARGE POSITV" Excessively large numbers cannot be displayed.

"TOO MANY DIGITS" You attempted to enter too many digits.

"ZERO CAL VALUE" A number other than "0" must be entered into P-16.

"ZERO WHILE IN RUN" P-18 cannot be selected during a rundown.

5.4 MAIN BOARD COMPONENTS

B1 Battery for Memory Backup

Connectors

J1 Display Backlight
J2 Keyboard
J4 Remote Annunciator
J6 Torque/Force Input
J7 Angle Input
J8 Power Input
J9 Printer Output (RS232)
J10 Computer Output (RS422)
J11 Computer Output (RS232)
J12 Relay Board Input/Output
J13 Solenoid Driver Output
J14 Torque/Force Input
J15 Remote Annunciator Power Selector (+5V or +12V)
J16 840/845 Analog Output

Potentiometers

P1 Display Contrast Adjust
P3 +5V Analog Adjust
P4 +5V Digital Adjust
P13 Zero Adjust
P15 Fine Span Adjust

Resistor

R16 Calibration Resistor

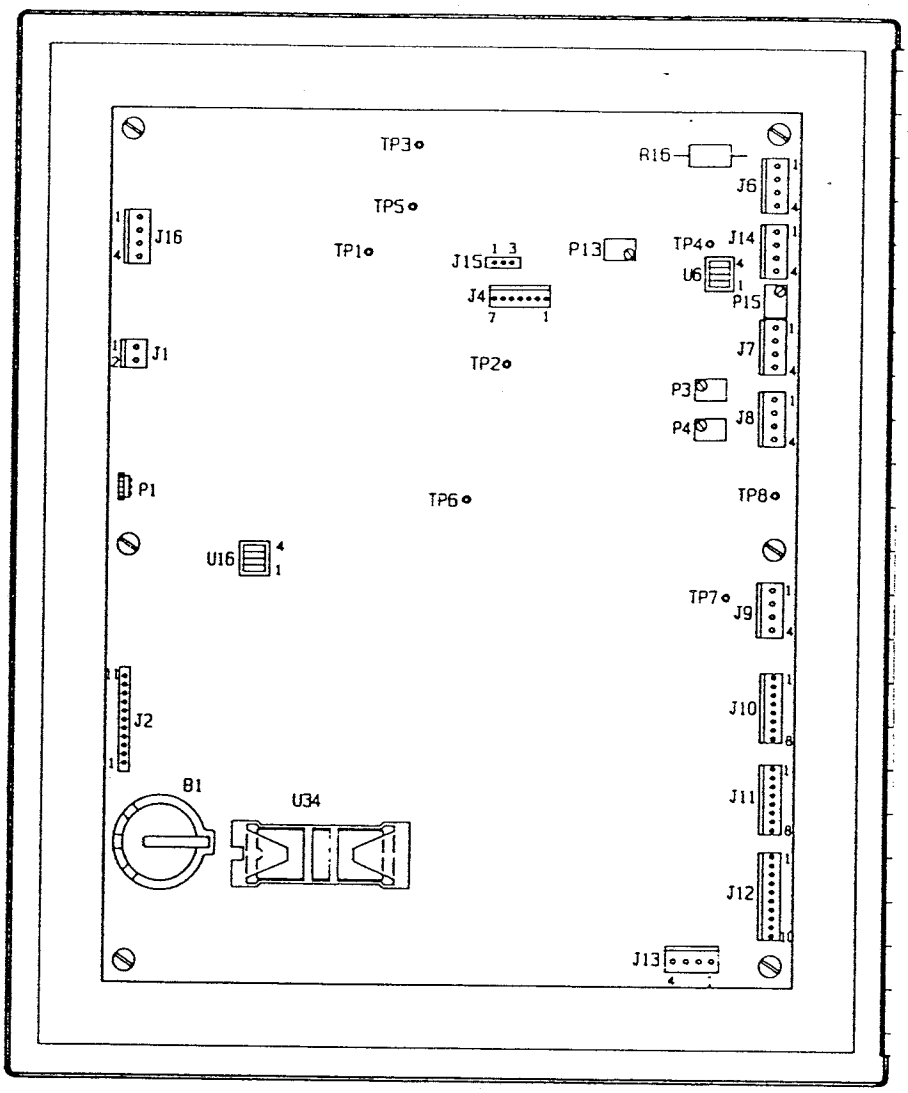

Figure 28 Main Board Layout (Cover Removed)

Test Points

TP1 Signal into A/D
TP2 -5V
TP3 Track Signal
TP4 Conditioned Analog Output
TP5 +5V Analog
TP6 Ground
TP7 -12V
TP8 +5V Digital

Microprocessor

U34 EPROM

5.5 LAYOUT: MAIN CHASSIS, RELAY BOARD, SOLENOID BOARD

MAIN CHASSIS

1FU AC Voltage Fuse
2FU AC Voltage Fuse
LF1 AC Input Line Filter
SW1 On/Off Power Switch (FOR SERVICE USE ONLY!)
T1 Power Supply Transformer
T2 Solenoid Driver Transformer
TB1 AC Input Terminal Block

RELAY BOARD LAYOUT

F1 Accept Relay Fuse
F2 Reject Relay Fuse
F3 Solenoid Fuse
J1 Input/Output Connector
LED1 Accept Relay Light
LED2 Reject Relay Light
LED3 Solenoid Light
TB1 Input Terminal Block
TB2 Output Terminal Block

SOLENOID DRIVER BOARD COMPONENTS

F1 Solenoid Voltage Supply Fuse
J1 Input Control Signal Connector
J2 Transformer Connector
LED1 Solenoid Light
P1 Hold Current Adjust Potentiometer
TB1 Output Terminal Block
TP1 Hold Voltage Test Point
TP2 Ground Test Point

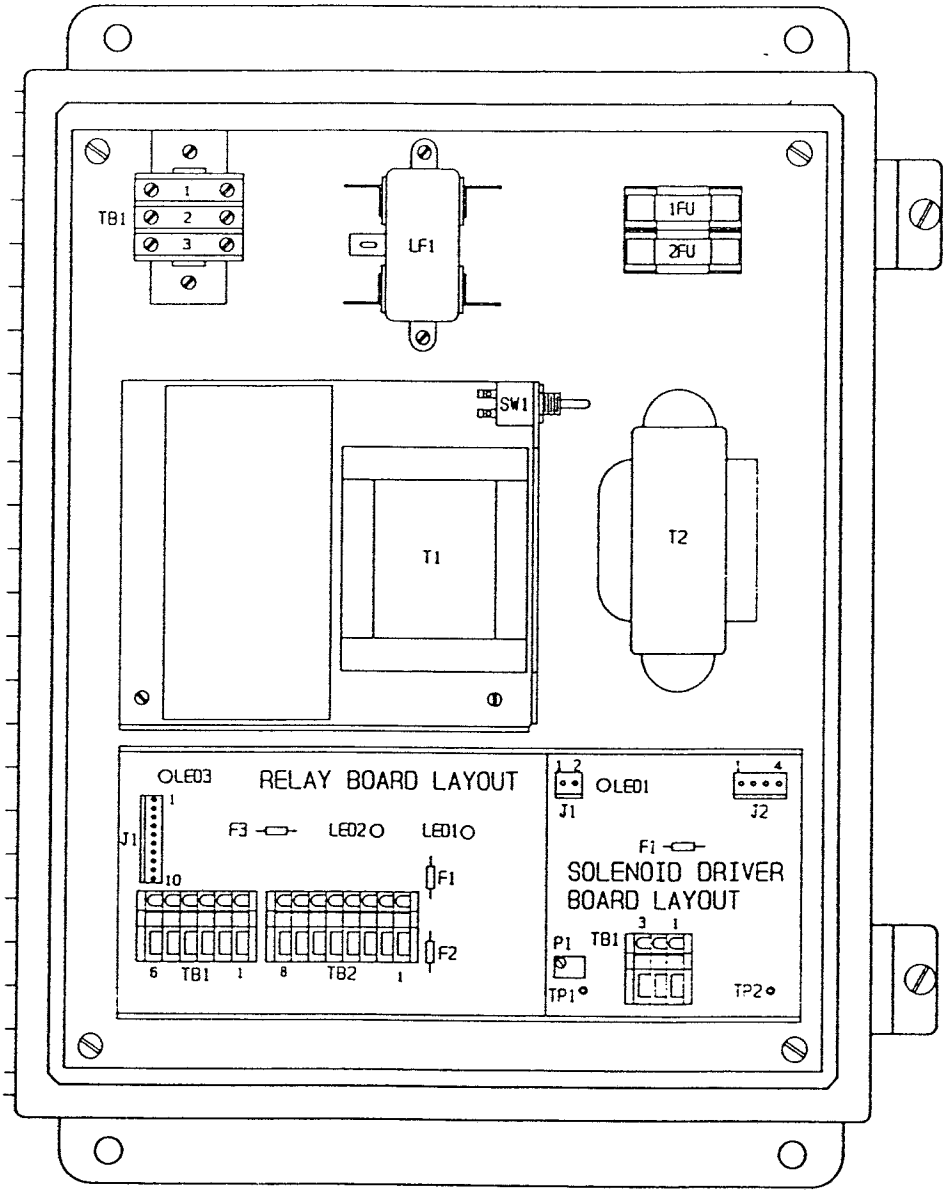

Figure 29 Layout for Main Chassis, Relay Board, and Solenoid Driver Board

5.5 LAYOUT: MAIN CHASSIS, RELAY BOARD, SOLENOID BOARD

MAIN CHASSIS

1FU AC Voltage Fuse
2FU AC Voltage Fuse
LF1 AC Input Line Filter
SW1 On/Off Power Switch (FOR SERVICE USE ONLY!)
T1 Power Supply Transformer
T2 Solenoid Driver Transformer
TB1 AC Input Terminal Block

RELAY BOARD LAYOUT

F1 Accept Relay Fuse
F2 Reject Relay Fuse
F3 Solenoid Fuse
J1 Input/Output Connector
LED1 Accept Relay Light
LED2 Reject Relay Light
LED3 Solenoid Light
TB1 Input Terminal Block
TB2 Output Terminal Block

SOLENOID DRIVER BOARD COMPONENTS

F1 Solenoid Voltage Supply Fuse
J1 Input Control Signal Connector
J2 Transformer Connector
LED1 Solenoid Light
P1 Hold Current Adjust Potentiometer
TB1 Output Terminal Block
TP1 Hold Voltage Test Point
TP2 Ground Test Point

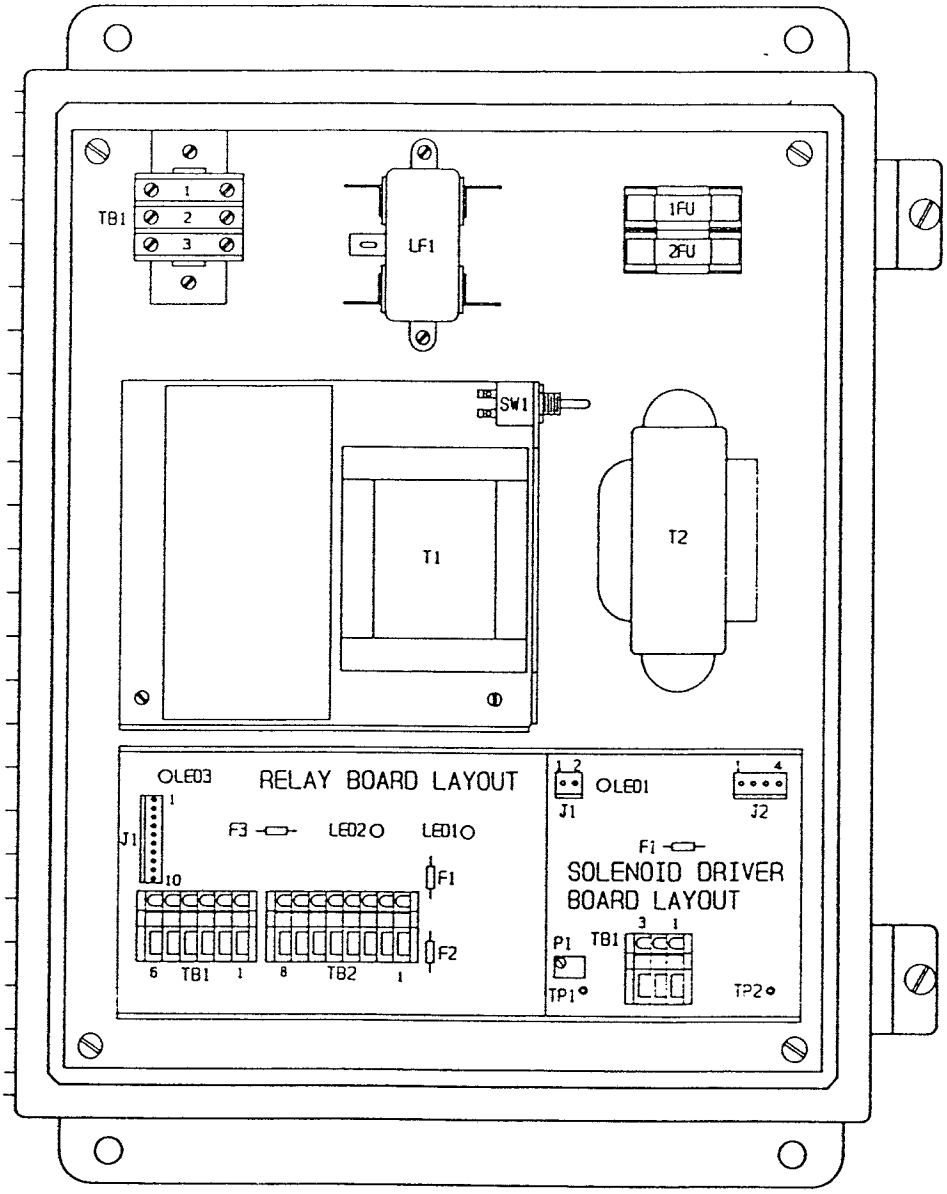

Figure 29 Layout for Main Chassis, Relay Board, and Solenoid Driver Board

5.6 SPARE PARTS LIST

DESCRIPTION	GSE PART #
Keyboard, T-20567-C	30-20-20567
M560 Main Board Assembly, PC681	420681-20801
Power Supply, HB12-1.7A PWRONE, 12V @ 1.7A	12-20-7003
Solenoid Driver Board	240560-20817
Model 560 120 VAC Power Supply Sub-Assembly	370560-PS120
Line Filter, 600A2, Potter	26-20-1630
Fuse, 3AG 5B 1A, Littlefuse 313001	13-10-0200
Fuseholder (for fuse above)	13-20-0400
Fuses for Relay Board (F1, F2, & F3)	13-10-4500
DSPIE-DC12V AROMAT Accept/Reject Relay	19-40-6150
ODC5, OPTO-22 Relay	19-30-0500
Relay PC Board, PC693	420693-20810
DL-2430, DURACELL 3V Battery (memory back-up)	12-10-1050
Cal Resistor 43.575K OHM	06-50-4352
Cal Resistor 87.150K OHM	06-50-8712
Cal Resistor 110.0k OHM	06-50-1100
Cal Resistor 218.4K OHM	06-50-2183
Cal Resistor 500K OHM	06-50-5003

APPENDIX A: TOOL TRANSDUCER SPECIFICATIONS

IN-LINE NUTRUNNERS

Most in-line nutrunners use the full scale of the transducer as the calibration value, except for ARO which uses the transdcuer full scale X 1.167. NOTE: The Transducer Full Scale is not necessarily the value entered as the Full Scale (P-01) of the Model 560.

MFG	MV/V	OHM	WIRING	CAL RESISTOR
ARO	1.00	700	WRSGS	87.150K
ATLAS COPCO	0.80	700	GSE	218.4K
CHICAGO PNUEMATIC	0.80	700	GSE	218.4K
CLECO/DRESSER	0.80	700	GSE	218.4K
COOPER AIR TOOL	0.80/2.0	700	GSE	218.4K/87.150K
DESOUTTER	0.80	700	GSE	218.4K
INGERSOLL-RAND	2.25	1000	WRSGS	110.0K
ROCKWELL INT.	0.80	700	GSE	218.4K
ROTOR TOOL	0.80/2.0	700	GSE	218.4K/87.150K
STANLEY	0.80	700	GSE	218.4K

RIGHT ANGLE NUTRUNNERS

Right-Angle nutrunners, offset tools, or other tools with gear reduction, may require some alteration of the calibration value prior to entry into P-16. The calibration for these nutrunners is the full scale of the transducer (which is not necessarily the value for the Full Scale, P-01, of the 560).

MFG	MV/V	OHM	WIRING	CAL RESISTOR
ARO	2.00	700	WRSGS	87.150K
ATLAS COPCO	0.80	700	GSE	218.4K
CHICAGO PNEUMATIC	2.00	700	GSE	87.150K
CLECO/DRESSER	2.00	700	GSE	87.150K
COOPER AIR TOOL	2.00	700	GSE	87.150K
DESOUTTER	2.00	700	GSE	87.150K
INGERSOLL-RAND	2.00	700	WRSGS/GSE	87.150K
ROCKWELL INT.	2.00	700	GSE	87.150K
ROTOR TOOL	2.00	700	GSE	87.150K
STANLEY	2.00	700	GSE	87.150K

CHICAGO PNEUMATIC TOOL SPECIFICATIONS

IN-LINE SPINDLES

TRANSDUCER	SPINDLE TORQUE RANGE (FT-LBS)	FULL SCALE OUTPUT (MV/V)	SHUNT CALIBRATION RESISTOR VALUE (OHMS)	SHUNT CALIBRATION TORQUE SIMULATED (FT-LBS)
CP-100	0-125	1.0	218.4K	100
CP-110-75	0-75	1.0	218.4K	60
CP-102	0-25	0.8	218.4K	25
CP-103	0-25	0.8	218.4K	25
CP-105	0-125	1.0	218.4K	100
CP-106	0-125	1.0	218.4K	100
CP-41-600-2	0-600 (IN-LBS)	0.8	218.4K	50 (IN-LBS)
CP-41-200-1	0-200 (IN-LBS)	0.8	218.4K	200 (IN-LBS)
CP-285	0-250	1.0	218.4K	200
C-129730	0-50	0.8	218.4K	50
C-122986	0-100	0.8	218.4K	100
C-133205	0-200 (IN-LBS)	0.8	218.4K	200 (IN-LBS)

ANGLE HEAD TOOLS

TRANSDUCER	SPINDLE TORQUE RANGE (FT-LBS)	FULL SCALE OUTPUT (MV/V)	SHUNT CALIBRATION RESISTOR VALUE (OHMS)	SHUNT CALIBRATION TORQUE SIMULATED (FT-LBS)
C-128569	0-50	2.0	87.150K	50
C-128570	0-100	2.0	87.150K	100
C-128571	0-200	2.0	87.150K	200
XC-126839	0-50	2.0	87.150K	50
XC-126890	0-100	2.0	87.150K	100
XC-129701	0-200	2.0	87.150K	200

CHICAGO PNEUMATIC TOOL SPECIFICATIONS

IN-LINE SPINDLES

TRANSDUCER	SPINDLE TORQUE RANGE (FT-LBS)	FULL SCALE OUTPUT (MV/V)	SHUNT CALIBRATION RESISTOR VALUE (OHMS)	SHUNT CALIBRATION TORQUE SIMULATED (FT-LBS)
CP-100	0-125	1.0	218.4K	100
CP-110-75	0-75	1.0	218.4K	60
CP-102	0-25	0.8	218.4K	25
CP-103	0-25	0.8	218.4K	25
CP-105	0-125	1.0	218.4K	100
CP-106	0-125	1.0	218.4K	100
CP-41-600-2	0-600 (IN-LBS)	0.8	218.4K	50 (IN-LBS)
CP-41-200-1	0-200 (IN-LBS)	0.8	218.4K	200 (IN-LBS)
CP-285	0-250	1.0	218.4K	200
C-129730	0-50	0.8	218.4K	50
C-122986	0-100	0.8	218.4K	100
C-133205	0-200 (IN-LBS)	0.8	218.4K	200 (IN-LBS)

ANGLE HEAD TOOLS

TRANSDUCER	SPINDLE TORQUE RANGE (FT-LBS)	FULL SCALE OUTPUT (MV/V)	SHUNT CALIBRATION RESISTOR VALUE (OHMS)	SHUNT CALIBRATION TORQUE SIMULATED (FT-LBS)
C-128569	0-50	2.0	87.150K	50
C-128570	0-100	2.0	87.150K	100
C-128571	0-200	2.0	87.150K	200
XC-126839	0-50	2.0	87.150K	50
XC-126890	0-100	2.0	87.150K	100
XC-129701	0-200	2.0	87.150K	200

PARAMETER LIST

The parameters for the Model 560 Process Monitor and Control Station are accessible through the keyboard. They are listed in numerical order as they might appear when programming the Model 560. Under the column "TYPE", the parameters which may be programmed are indicated by a "p", and those which are readings only are indicated by a "r". The parameters which are made available through selection in the System Configuration Menu are indicated by the "c" prefix.

#	TYPE	NAME
00	c p	Security Code
		TORQUE/FORCE LIMITS
01	p	Full Scale
02	p	Low Limit
03	p	High Limit
04	p	Threshold
05	p	Cycle Complet
06	c p	Target
07	r	Peak
10	c r	Peak Torque and Final Angle
		CALIBRATION
16	p	Cal Value
17	r	Cal Reading
18	r	Zero Reading
19	r	Cal/Zero Alarm
		ANGLE LIMITS
20	c p	Counts/Rev.
21	c p	Low Ang Min
22	c p	Low Ang Max
23	c r	Low Ang
24	c p	Mid Ang Min
25	c p	Mid Ang Max
26	c r	Mid Ang
27	c p	Final Ang Min
28	c p	Final Ang Max
29	c r	Final Angle
30	c p	Target Angle

#	TYPE	NAME
		TIMING
31	c p	Sample Delay
32	c p	Reset Time
35	c p	Sample/End Time
36	p	Graph Time
		MISCELLANEOUS
40	p	Time (24 HR)
41	p	Date
42	p	Year
43	p	Cal Relay
44	c r	Limit Set
47	p	Engrng Units
49	r	Angle Counts
		PRINTER
50	p	Unit ID #†
51	p	Print
52	p	Print Baud Rt
53	p	Compt Baud Rt
		STATISTICS-ANGLE
58	c r	CPK (Capability Index)
59	c r	CR (Capability Ratio)
60	c r	Angle Mean
61	c r	Angle Range
62	c r	Angle Mean Shift
63	c r	Ang Std. Dev.
64	c r	Ang Mean +3
65	c r	Ang Mean -3
66	c r	Ang High Rej.
67	c r	Ang Low Rej.
		STATISTICS-TORQUE/FORCE
68	r	CPK (Capability Index)
69	r	CR (Capability Ratio)

#	TYPE	NAME
		X-BAR AND R STATS
70	r	X-BAR
71	r	R
72	p	Sample Size
73	r	Peak Readings
74	c r	Angle X-BAR
75	c r	Angle R
76	c r	Angle Readngs
77	r	Stat Alarm
79	r	Valid Rdngs
		STATISTICS-TORQUE/FORCE
80	r	Mean
81	r	Range
82	r	Mean Shift
83	r	Std Deviation
84	r	Mean + 3Sigma
85	r	Mean - 3Sigma
86	r	Totl High Rej
87	r	Totl Low Rej
88	r	Total Accepts
89	r	Totl Readings††
		BACKLIGHT/EPROM#
90	p	Test
		STATS LIMITS
91	p	X-BAR Min
92	p	X-BAR Max
93	c p	Ang X-BAR Min
94	c p	Ang X-BAR Max
95	p	R Min
96	p	R Max
97	c p	Ang R Min
98	c p	Ang R Max

† The Unit ID# is only programmable after a Master Reset or after the system has been re-configured.

†† The Total Readings Parameter is most often used as a readout parameter although its value may be programmed, as in the case where it is desired to erase old data.

PROGRAMMABLE LIMITS SETUP CHART

You will find it helpful to use this chart when programming the Model 560. The default values are included in parenthesis for reference.

TORQUE or FORCE Limits			
01	Full Scale	(200.0)	
02	Low Limit	(125.0)	
03	High Limit	(200.0)	
04	Threshold	(50.0)	
05	Cycle Complete	(25.0)	
06	Target	(170.0)	
16	Cal Value	(100.0)	

ANGLE Limits			
20	Counts per Revolution	(360)	
21	Low Angle Min.	(0.0)	
22	Low Angle Max.	(4.0)	
24	Mid Angle Min.	(5.0)	
25	Mid Angle Max.	(7.5)	
27	Final Angle Min.	(10.0)	
28	Final Angle Max.	(12.5)	
30	Target Angle	(11.3)	

TIMING Parameters			
31	Sample Delay	(1.00)	
32	Reset Time	(1.00)	
35	Sample/End Time	(1.00)	
36	Graph Time	(1.00)	

Miscellaneous			
40	Time	(12.00)	
41	Date	(01.01)	
42	Year	(88)	
47	Engineering Units	(none)	
50	Unit ID#		

Printer and Computer			
52	Printer Baud Rate	(9600)	
53	Computer Baud Rate	(9600)	

STATISTICS Limits			
72	Sample Size	(5)	
91	X-BAR Min	(125.0)	
92	X-BAR Max	(200.0)	
93	Angle X-BAR Min.	(10.0)	
94	Angle X-BAR Max.	(12.5)	
95	R Min.	(0.0)	
96	R Max.	(200.0)	
97	Angle R Min.	(0.0)	
98	Angle R Max.	(12.5)	