Operators Manual

FGH

		MAN	REM	AL1	AL2	TUNE	TALK

500

500

SP   1
SEG   2
EVNT OP

◀	▶	▲	▼	↻	✳

HOLD	FAST	START	STOP	PROG	↵

**FGH**   *Series 3000 Programmer*

Series 3000

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Contents

1.0 GENERAL

The Series 3000 is a highly advanced, 2 channel PID loop programmer/controller. It is designed to be flexible in application and yet straightforward to use. This manual provides all the information needed to operate it once installation and commissioning are complete. Installation, commissioning and communications are covered by more advanced handbooks provided.

1.1 Software version

When power is first applied to the instrument the main display shows the letters FGH, while the lower display shows the software version number, then 3000 is shown on the lower display. This display is replaced after a few seconds with the usual one described below.
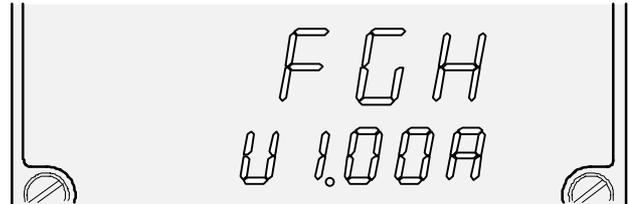
1.2 Front panel indications

The large main display usually shows the measured value, for example, the temperature of the process being controlled.
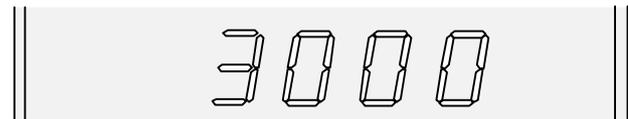
This display may flash alternately with a message indicating an error. The three possible error messages are:-

U-r	Indicates that the main input is under ranged.
O-r	Indicates that the main input is over ranged.
FAIL	Indicates that the main input value is outside the safety shutdown limits and the control outputs have been switched off.

The status indicators at the top of the display tell you several things.
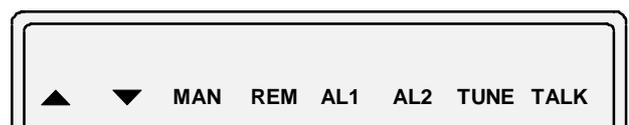
▲1	The heat output is on
▼2	The cool output is on
MAN	The controller is in manual mode
REM	The controller is obeying a remote setpoint.
AL1	alarm 1 is active
AL2	alarm 2 is active
TUNE	(Flashing) One shot tuner is on
TALK	The controller is being talked to via serial comms link

The bargraph gives an 'at a glance' indication of the current output power or valve position, whichever is configured. It can be

useful as a rough guide when the lower display is being used to display something different.

1.3 Short scroll

The 3000 powers up in short scroll. This means that the lower display is displaying one of a short list of parameters; setpoint, output, segment or event.

The mode indicators advise what is on the lower display, as follows:

SP Set Point, the aiming point being used for control. May be lit in conjunction with the 1 or 2 legends on a 2 channel profiler

OP Output, this is the current percentage output of the controller. When appropriate, heat is positive and cool is negative. This may be control output or a manually set value.

SEG (P3000 Only) Segment, this shows the segment of the program currently running, or if no program is running then the program number selected is displayed.

If a program is running then a message such as '**P 4.19**' or similar is displayed. This means that program 4 is running and is currently executing segment 19.

Two other indications are also provided under the **SEG** element of the short scroll, the display **PXX.PF** would indicate that program number XX is recovering from a power failure, and error indication **Err-x** indicates that the program that has been instructed to run is corrupt. x would be replaced with a number 1 to 9 to indicate the type of error. See Appendix C for a complete listing. To recover from this latter condition, press the star button momentarily to acknowledge the error and then enter the programmer scroll and repair the fault by re-entering the corrupt parameter. If the star key is pressed while the profile is running then the display will change to show the current segment elapsed time in hours and minutes.

EVNT Event. If the instrument has been configured as having at least one event output then this displays the current status of the eight events, a high bar being on and a low bar being off. The events read from left to right.

A flashing lower display indicates that the profile is in hold.
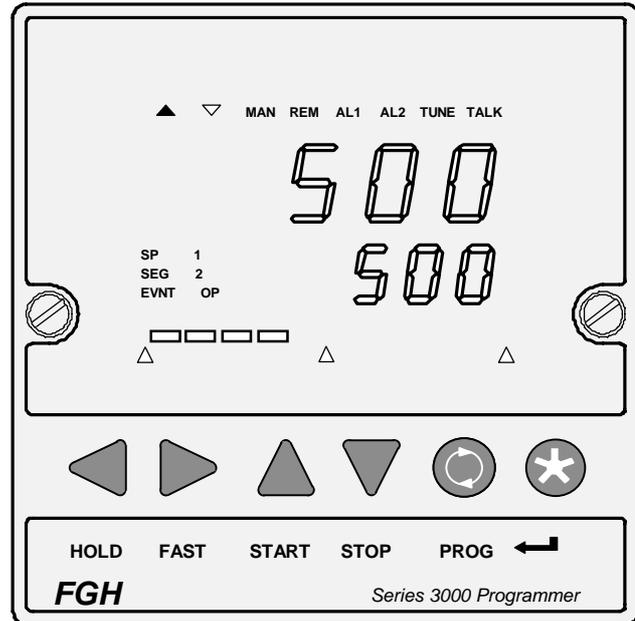
1.4   Using the keypad

The left and right buttons select a
parameter to be viewed or
modified. When one of these
buttons is pressed, the next
parameter in the scroll list is
selected, scrolling forwards or
backwards.

In the short scroll these buttons
select which of a short list of
parameters, consisting of setpoint,
output, segment (and event if the controller is configured with any), is on the lower
display.

The up and down buttons adjust
the value of the parameter
selected. When the button is
pressed it is changed by one at
first but then at an increasing
rate. This makes it easy to make
large changes quickly.

Auto/man button. Used to place
the instrument in automatic or
manual modes. See section 1.5,
Auto and manual modes.

Star button. This button is used to
access the alternate functions of
the keypad as shown below the
buttons. The star button is
pressed and held and the other
button then pressed to achieve
the desired programmer function.
The star button is also used to unlatch latched alarms when the alarm level is
displayed in the long scroll, to show remaining number of repeats and acknowledge
failure to start a corrupt program. The star key is also used for initially configuring
the programmer/controller.
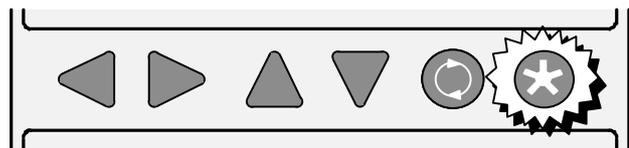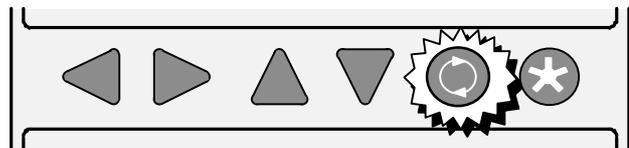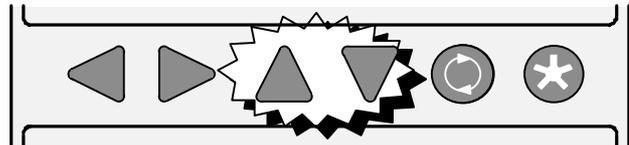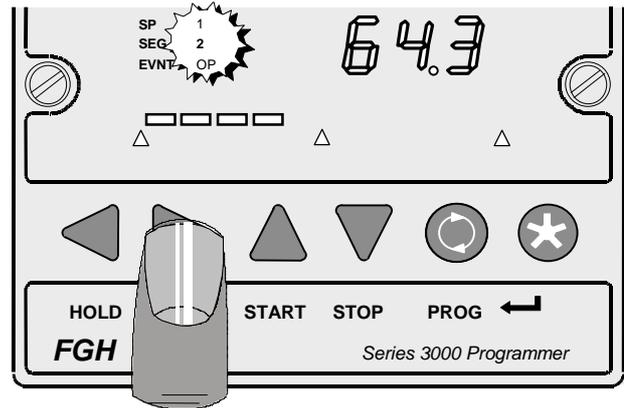
1.5 Automatic and manual modes.

The auto/man button toggles the controller between automatic and manual modes. Check that output is displayed on the lower display, (mode indicator '**OP**' will be lit), then when the auto/man button is pressed the controller will, if valid, change modes. In manual mode the **MAN** indicator at the top of the display is lit.
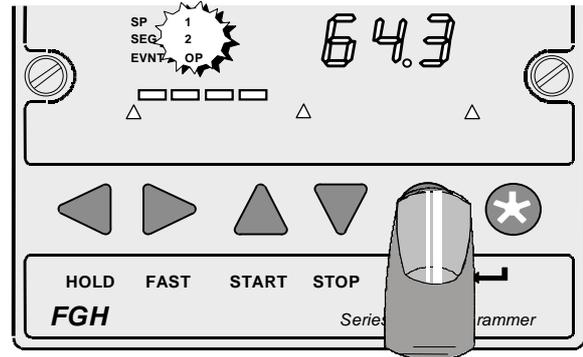

While the controller is in manual mode the output remains constant until changed by the operator or the instrument is placed back in automatic mode.

The output is changed by the up and down keys, but only within the limits set up in the long scroll.

1.6 Selecting a profile to run (P3000 Only)

To select a profile to be run, press the left or right button until the SEG mode indicator is lit. If no profile is currently running then the lower display will be indicating PrG and the number of the currently selected program.
To change this program to the one required, press and hold the star button, then repeatedly press and release the hand button until the program number desired is shown.

1.7 Starting and stopping a profile (P3000 Only)

The program currently selected may be started at any time from within the short scroll by pressing and holding the star button and then briefly pressing the up button.

A running program may similarly be stopped at any time from within the short scroll by pressing and holding the star button and briefly pressing the down button.

1.8 Fast on a running profile (P3000 Only)

When a profile is running and it is desired to proceed to a later part of the profile more rapidly than was programmed, and without stopping the running profile to change the program, then the 'fast' facility may be used.

To use Fast, press and hold the star button. With this button held, pressing the right button will cause the program to execute at about 20 times as fast as long as the star and right buttons are held. Release the buttons to return to normal executing speed.

Fast has no effect if a profile program is not running.

Fast will override any hold condition.

1.9 HOLD on a running profile (P3000 Only)

From within the short scroll the running profile may be held, that is prohibited from proceeding, by pressing and holding the star button and then briefly pressing the left button. The lower display will flash to indicate that a manual hold is in operation. To return the instrument to its running condition, press and hold the star button and briefly press the left button once more.

2.0 CONTROLLER SCROLL

While there are only a few parameters in the short scroll, the controller scroll is a long scroll, and has many more. Only relevant parameters are held in the controller scroll, so as the set-up of the instrument changes, so too will the contents of the controller scroll. Refer to APPENDIX A for a complete list.

To enter the controller scroll, press and hold the right button. After a couple of seconds the display will change. You are now in the controller scroll. To simplify operation the parameters scroll is split up into groups. Initially the user will scroll to the required group and then press the star button to enter the group. Further presses of the scroll key will then access the individual parameters within the group. Each parameter has a unique mnemonic, which is shown on the lower display when that parameter is being examined. Each press of the right or left button will scroll forward or backwards through the list. When the end of the group is reached the group name will be displayed again.

To return to short scroll, press and hold the right or left button again for a couple of seconds. Alternatively, if no buttons are pressed for 20 seconds then the instrument will automatically revert to short scroll.
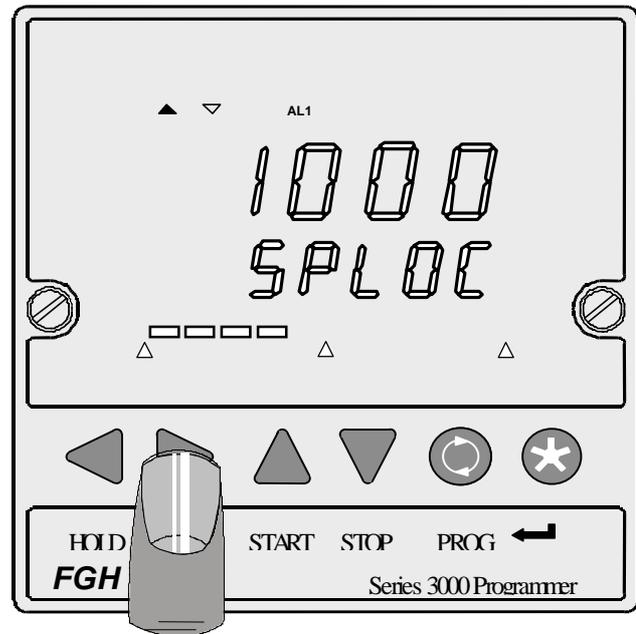
2.1   Modifying data

The up and down buttons are used to change the value of the parameter displayed. There will often be limits to the parameter being modified, and it will only be possible to change the value of the parameter within these limits.

If a parameter contains illegal data, for example when the configuration is changed, then the upper display will consist of all bars;(- - - -) to show this. Pressing the up or down buttons clears this and allows the parameter to be set to the desired value.
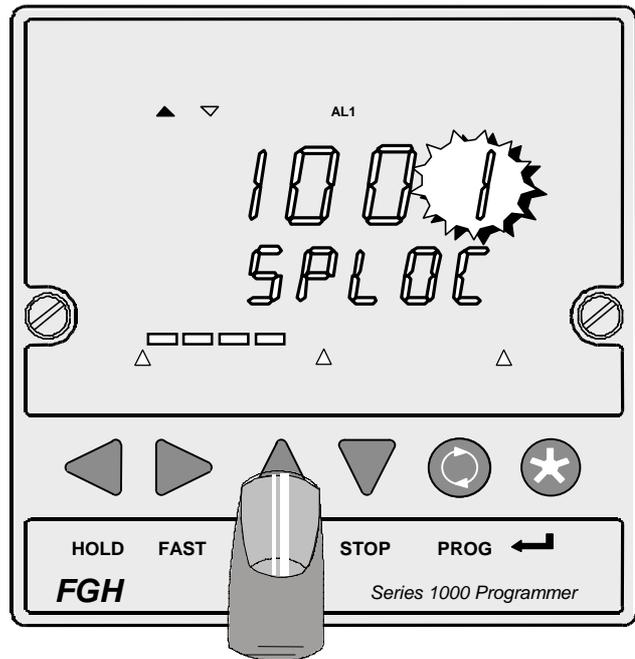
3.0   PROGRAMMER SCROLL (P3000 Only)

To enter the programmer scroll, press and hold the left button. After a couple of seconds the display will change. You are now in the programmer scroll.

To return to short scroll, press and hold the right or left button again for a couple of seconds. Alternatively, if no buttons are pressed for 20 seconds then the instrument will automatically revert to short scroll.

3.1   Profile Program structure

The standard P3000 profile generator can store up to 10, two channel profiles numbered 0 to 9. Each of these profiles consists of up to 25 segments numbered 1 to 25.

Each segment consists of a target time (in hours and minutes) and a target level for both channel 1 and channel 2. The programmer will move the control setpoint from the previous target to the current target level in the target time. In the case of segment 1, the previous target is taken as the current measured variable. This is known as servo start. (See servo start in the engineers manual for further information).

There are two further indications that may appear instead of a target time in segments 2 to 25.

End   This segment is the end of the profile. The profiler will terminate the current cycle when it encounters an end instruction

GO X   This segment is a GO instruction. The character X will be shown as a program number on the actual display. This instructs the profiler to jump to segment 1 of the given program number and continue execution from there.

3.2   Programmer scroll global parameters

There is only one of each of the following parameters and they are not related to any particular profile program.

3.2.1   Delay Parameter

When the programmer scroll is first entered by pressing and holding the left button, the first parameter to be encountered is **DELAY**. This is an important parameter and shows a time in hours and minutes on the upper display. This time may be set with the up and down buttons to between 0 and 100 hours.

The time set represents a delay which will be executed after the program had been commanded to start and before the conditions of segment 1 of the selected program are applied.

This facility is provided so that a plant may be set to start up to 4 days after being programmed. For example, so that a furnace is ready for use first thing Monday morning, or to execute a process only during the night when cheap power is available.

3.2.2   Event relay reset status

If any of the instrument option slots have been configured as event outputs then pressing the right button causes the parameter '**Er- r**' to be displayed on the lower display. on the upper display are eight lines representing the status of the eight events to be used when no profile program is running, or when the programmer is in delay before starting a profile.

Each of the events can be set to be on or off. An on condition is indicated by a high mark and an off condition by a low mark. The events are edited one at a time, the event currently being edited flashes. To turn on an event use the up button, to turn it off use the down button. to edit the next event press and release the hand button.

The illustration shows that the reset condition is with events 1, 4 and 5 on and the rest are off. The hand button has been pressed so that event 2, which is now flashing, can be edited.

The above procedure for editing events is also used when editing events in program segments, which will be encountered later.

3.2.3   Parameter PROG

After the delay parameter, (or ready mode events have been configured), a further press of the right button will cause the **ProG** legend to be displayed. This is the program select parameter and use of the up and down buttons will allow selection of the program number to be viewed and/or modified.

The parameters following this element relate only to the program number just selected. There will be a hold band, hold type and repeats setting for each of the many profile numbers available within the instrument.

3.2.4 Parameters Hold and Hold type

Parameter **Hold** may be set between 1 and 100 digits. These are in the same units as the measured value. This setting represents the hold band of the profile, ie. if the difference between the measured value and the setpoint (the error) is greater than the hold band then the profile will hold if dictated by the hold type.
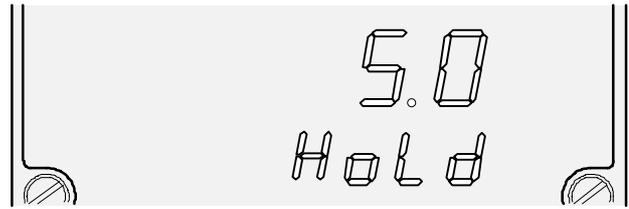
The 'hold type' parameter **HtYPE**, shows a line of four characters on the upper display, any or all of which may be replaced with a '_'
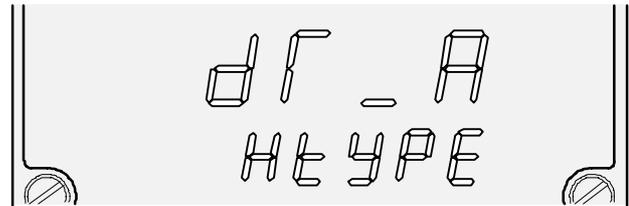
Use of the up and down buttons will cause the desired symbols to appear or be replaced with underscores. When the symbols are visible that parameter is active as follows.

The illustrations show an instrument which will go into hold on dwell or ramp segments only when the measured value goes more than 5.0 units above the control set point.

d   Dwell, enables profile hold when the program segment is of 'dwell' type. A dwell type segment is one in which the level, or aiming point of that segment is the same as that of the previous segment.

         Dwell enable must be accompanied by an above or below enable before dwell hold is active.

r   Ramp, enables profile hold when the program segment is of 'ramp' type. A ramp segment is one in which the aiming level of that segment is not the same as the previous segment.

         Ramp enable must be accompanied by an above or below enable before ramp hold is active.

b   Below, enables profile hold when the measured value is more than a hold band below the current setpoint.

A   Above, enables profile hold when the measured value is more than a hold band above the current setpoint.

3.2.5 Repeats

rEPtS is shown on the lower display and a number on the upper display. This number may be set between 0 and 999 by use of the up and down buttons. This number represents the number of times that this profile program will be repeated when it is executed. Repeats occur between segment 1 and the segment containing an **END** or a **GO**. All repeats are completed before the end or go segment is executed.

A repeat value of 0 would cause the program to execute once only when evoked, and not repeat at all.

Whilst a program is repeating, this parameter will show the number of repeats that were originally set, but if the star button is pressed and held then the number of repeats remaining is displayed.

3.3 Profile program parameters

These parameters form the profile program itself.

3.3.1 Time segment 1

On a further depression of the right button, the parameter **t1 1** will be displayed. This may be set between 0 and 100 hours by use of the up and down buttons. This time is the time taken for segment 1 of the program selected to execute. A time setting of 0 would cause a step change in the setpoint when that profile program was executed. On two channel unsynchronised profilers each segment will have two time settings **t1 1** and **t2 1**. One for each channel.

3.3.2 Level segment 1

The next parameter in the programmer scroll is shown as **L1 1**. This is the level of setpoint that will be in effect after the time of segment 1 has expired. During segment 1 the setpoint will ramp for the period of time segment 1 on this profile, starting at the measured value at the time the 'start profile' command was issued, (servo start), and ending at level segment 1 set. On two channel profiles there is also the equivalent level **L2 1** for the second channel.

3.3.3 Segment events

If any of the instrument option slots have been designated as event outputs then each of the profile segments in each program will have associated with it, a set of eight events. These events are represented, as in the case of the reset event relays by the eight indicators on the upper display. Interpreting and editing of these events is as detailed in section 3.2.2

3.3.4 Segment terms sets

If the instrument is configured to use segment based terms sets then the element **Set** will appear. The user should enter the terms set number required for the current segment. This setting may be **oFF** meaning that the default P, I and D values are to be used.

3.3.5 Time segments 2 to 25

Further presses of the right button will allow the times and levels of segments 2 onwards of the selected profile to be viewed and modified. These times are much as set for segment 1, adjustable by using the up and down buttons to between 0

and 100 hours, but in addition, if the down button is pressed when a time of zero is indicated then '**End**' is shown on the upper display. This is an instruction to terminate this profile when this segment is run.

Further presses of the down button cause '**Go 9**' to '**Go 0**' to be shown on the upper display. These are instructions that cause control to switch to the start of another profile program of the specified number when this segment of this profile is executed.

Note. End and Go segments can only be entered in channel 1.

3.3.6 Level segments 2 to 25

Setting the level of segments 2 onwards is identical to that of segment 1 except that one further option is available. If the level is set to be identical to the level set in the previous segment the profile will dwell for the period of time set. This segment is then known as a dwell segment for the purposes of hold types.

4.0   PASSWORD PROTECTION

The Series 3000 is equipped with a versatile password protection system, which, when used correctly, protects the plant and contents against an unauthorised person changing the programmers settings. The setting of a password and its type is outside the scope of this manual, but the following is included to assist the operator if a password has been set.

4.1   Password entry

If a password has been set then on entry to the programmer or controller long scroll the password screen will be seen. At this point the sequence of four button pushes representing the password should be entered. The instrument will then briefly display good or bad depending on the correct password being entered, and then enter the appropriate long scroll. Unless the password is correctly entered, protected parameters can be viewed but not modified.
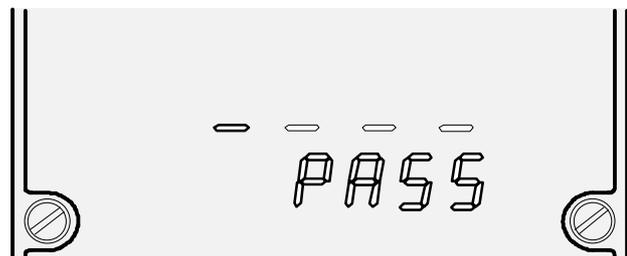
4.2   Manual mode with password protection

To set the instrument to manual mode when auto/man password protection is on, enter controller long scroll, type the correct password and exit long scroll by holding down the right or left button. Scroll to output with one press of the right button. The instrument may now be toggled between auto and man by using the auto/manual button, if valid, for the next 20 seconds. After this time auto/man changes will once more be locked out.
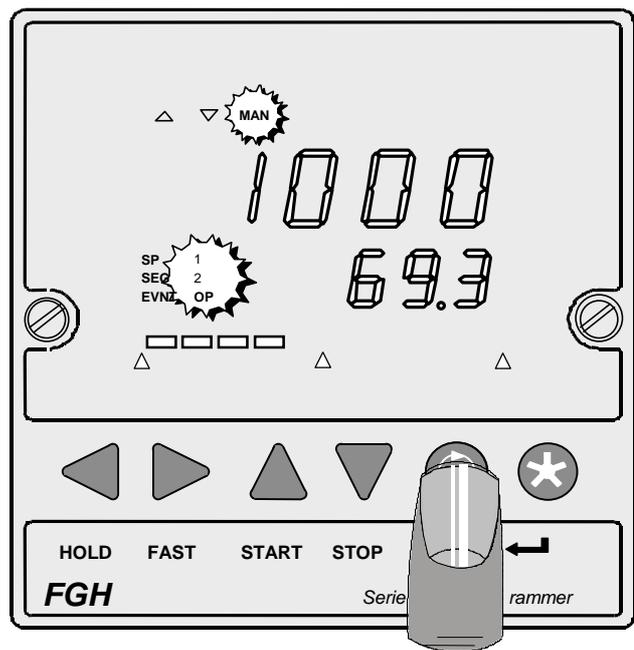
4.3   Selective password protection

There are four special groups of parameters which may be, together or singly, left unprotected by any password set. These four groups are auto/man changeover, alarms, setpoints and programmer scroll. During configuration any of these may be made unprotected to allow limited access to an operator not knowing the password. All other controller long scroll parameters are always protected if a password is set.

5.0   AUTOTUNE

5.1   General

The Series 3000 instrument is equipped with a one shot autotune facility. This enables the instrument to automatically derive its control parameters (proportional, integral and derivative terms) on demand. On the heat/cool version of the controller the relative cool proportional band is also calculated.

The tuner may be used to tune the controller to produce one of three response types. The required response type is set up in engineers mode.

Slow   This response type causes the tuner to select PI and D terms such that the resultant response from a step change of setpoint is over damped. This means that the process variable will move slowly and is very unlikely to overshoot its setpoint. Overall settling time will be large.

normal   This type results in a quicker response than the **Slo** type but is likely to result in the process variable overshooting its setpoint slightly. Overall settling time will be quicker than **SLo**.

FASt This type results in a Zeigler/Nicholls type response with large overshoots and undershoots. Settling time however will be fast.

WARNING
During tuning the tuner will, at times, apply 100% power to the plant .This is likely to cause large swings in the process variable. DO NOT use the tuner if 100% power or large swings may cause damage to your plant.

5.2 Starting the tuner

For the tuner to work correctly and produce meaningful results it is necessary that the measured value is close to the normal working value of the process and that the process is stable when the tuner is engaged. If the process is not stable then it may be made so by one of the following methods:-

- Setting the controller to manual mode so that the output power is fixed and waiting until the measured value settles. Remember to return the controller to auto mode when the tuner is started.

- In Auto, turn off integral and derivative actions, set prop band to a large value and wait for the measured value to settle.

In order to operate the tuner the following conditions must be satisfied:-

1. The auxiliary fixed outputs must not be selected. These are manually set levels of output which may be configured so that they are applied whenever the correct digital input is made.

2. The password requirements are satisfied. If a password has been set for the tuner then the correct password must be used when entering the long scroll.

3. The controller must be configured as a heat only, heat/cool or motorised valve instrument.

4. The profiler must be in its ready mode.

When the tuner is started the controller will switch to ON/OFF control mode. This will cause oscillations in the measured variable around setpoint. When the measured variable has crossed the setpoint five times the tuning is complete and new values for P, I, D and possibly Rel will be calculated and applied immediately.

The Tuner will abort its tune operation under any of the following conditions:-

- A mains interruption has occurred

- An auxiliary output is selected

- The tuner is switched off.

- More than one hour has elapsed since the tuner was started.

The tuner is operated by entering the controller long scroll and scrolling to the **tunE** parameter, in the **Contr** group. Use the up arrow key to change the current status to be '**on**'. This will start the tuning process.

While the tuner is working the **TUNE** status indicator will flash.

5.3   Stopping the tuner

The tuner may be stopped at any time simply by entering the controller long scroll and scrolling to the **tunE** parameter, in the **Contr** group. Use the up arrow key to change the current status to be '**oFF**'. This will terminate the tuning process

APPENDIX A   CONTROLLER LONG SCROLL ELEMENTS

This table shows which parameters will be in the long scroll sequence and which may be, depending on the configuration of the instrument. The relevant column appears under the output type configured.

| Group | Mnemonic | Control Format | | | | Meaning | Password Group |
		ahs	heat only	heat/cool	motor valve		
SP	SPLOC	√	√	√	√	Local setpoint 1	S
	SPL 2	√	√	√	√	Local setpoint 2	S
	S-tyP	√	√	√	√	Setpoint type	All
	rAtE	√	√	√	√	SP Slew rate limit	All
	GAIN	√	√	√	√	Remote SP gain	S
	ASP1	√	√	√	√	Aux setpoint 1	S
	ASP2	√	√	√	√	Aux setpoint 2	S
Contr	tunE		√	√	√	Tuner on/off	All
	ProP		√	√	√	Proportional band	
	IAt		√	√	√	Integral time	
	rESEt		√	√	√	Manual reset	
	dAt		√	√	√	Derivative time	
	dAPr		√	√	√	Derivative approach	
	rEL			√		Cool relative prop	
	dbAnd			√		Heat/cool deadband	
rAtio	rAtio	√	√	√	√	Thermal head ratio	All
	hi-op	√	√	√	√	Max air setpoint	
	bAnd	√	√	√	√	Ratio band	
	th-hi	√	√	√	√	Hi thermal head limit	
	th-lo	√	√	√	√	Lo thermal head limit	
	rEF	√	√	√	√	Limit reference	
SEtS	SP X		√	√	√	Trigger setpoint X	All
	Pb X		√	√	√	Prop band X	
	IAt X		√	√	√	Integral time X	
	dAt X		√	√	√	Derivative time X	
	Hb X	√	√	√	√	Hold band X	
	Ht X	√	√	√	√	Hold type X	
ALrS	ALr-1	√	√	√	√	Alarm 1 level	A
	ALr-2	√	√	√	√	Alarm 2 level	A
OP	H PL	√	√	√		High/heat power limit	All
	L PL	√	√			Low power limit	
	C PL			√		Cool power limit	
	H CyC		√	√		Heat TP cycle time	
	C CyC			√		Cool TP cycle time	
	AOP1	√	√	√	√	Auxiliary output 1	
	AOP2	√	√	√	√	Auxiliary output 2	
	dbAnd				√	Valve deadband	
	VAt				√	Valve action time	

All parameters in the programmer scroll are protected if password is anything but '**CLR**' (clear) and the **P** element in the 'scope' is on.

APPENDIX B   CORRUPT PROFILE ERROR CODES

If it is attempted to start a profile program which for some reason has become corrupt then the lower display when in the SEG element of the short scroll, will indicate Err-x where the x will be replaced with a number between 1 and 7 to indicate which of the parameters have become corrupt as follows;

    x =   1 =   bad or corrupt profile number
          2 =   bad or corrupt hold band
          3 =   bad or corrupt hold type
          4 =   bad or corrupt repeats
          5 =   bad or corrupt end/goto
          6 =   bad or corrupt segment time
          7 =   bad or corrupt segment level
          8=   bad or corrupt terms set number

To clear this display press the star key.