

**KELCO IPG20  
INTELLIGENT PUMP GUARD  
PROGRAMMING INSTRUCTIONS**

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**PLEASE READ ME FIRST**

The IPG20 pump guard is supplied pre-loaded with a simple program. Provided the IPG20 is unlocked you can restore it to this default state at any time by pressing and holding down the (P) button and pressing the (R) reset button at the same time. Doing this removes any settings you may have entered and restores the controller to its original default state.

**Introduction**

The IPG20 intelligent pump guard is a pressure and flow based device that “learns” the operating pressure each time the system is started. This allows for finely targeted parameters where any significant variation in the operating pressure or loss of flow will trigger an alarm and shut the system down.

With irrigation systems such as farm dairy effluent the operating pressure will change each time the irrigation system is moved to a different hydrant or even a different height on the same hydrant. It is normally impossible to give a high degree of protection against over pressure due to a blockage or low pressure due to a leak. With the IPG20 each time the pumping system is started and after the operator has verified the system is running correctly the learning phase of the controller can be instigated.

The controller then starts to “learn” what the operating pressure will be on this particular set up. If a stable pressure is reached within the allotted time the switch will lock this pressure in as the set point and apply the predetermined under and over pressure settings. If there is no expected change of pressure; e.g. fixed sprinklers, stationary irrigator, travelling irrigator on flat land and little change in the liquid level relative to the IPG20 then the low pressure and high pressure margin can be set very close to the set point. The pressure change only relates to each pumping cycle. For instance if the pumping cycle is going to be 2 hours we are only concerned about any likely pressure change during that time. If the source is gradually being depleted from day to day the switch will automatically compensate for that each time it starts.

Once the switch has locked in the set point it will monitor the pressure and flow, and any loss of pressure or flow outside the margins will trigger a shut down after the pre-set delays expire. The switch will then display the reason for the shutdown, and if configured, close the alarm relay to trigger an optional external alarm or dialler which can text to alert the operator of a problem. If the system recovers within the pre-set delay period it will resume normal operation.

This method of fault detection is particularly suited to positive displacement pumps or systems where the pressure will change if there is a leak or blockage.

With a travelling irrigator on undulating terrain Auto Terrain Compensation should be selected. The switch will then adjust itself to compensate for a changing contour. This allows for very small over and under pressure margins which gives a very high degree of protection against leaks or blockages

## **DETERMINE THE PRESSURES**

When pumping to a hydrant or group of hydrants for the first time, once it has been confirmed there are no leaks or blockages and the switch has locked in a set point the operating pressure should be recorded against the hydrant number or numbers as a group. The recorded pressure can then be used as a useful reference for subsequent pumping to the same hydrant or group of hydrants. If the pressure is the same as it was previously then it can be assumed there are no leaks or blockages.

Alternatively the irrigation system should be checked visually each time the pump is started.

## **Programming the Controller**

The IPG20 intelligent pump guard is fully programmable. It accepts input via 4 push buttons. The buttons are marked (P) for programming, up and down for data entry, and a reset button (R). Pressing the (P) button during normal operation stops the pump and allows entry to the pump guard's menu. Subsequent pressing of the (P) button steps you through the menu from one option to the next. Each option can be adjusted using the up and down buttons.

Pressing the (P) button stores the settings you make into the IPG20's memory and steps you to the next option. When you reach the end of the option list the pump guard asks you to press the reset button (R) to accept the settings you have made and to resume normal running. You can automatically save any changes you have made and exit out of the menu at any stage during programming by simply pressing the reset button (R). The settings you make are non-volatile and are recorded in the pump guard's memory. Your settings will not be lost if the controller is switched off for extended periods. When the unit is switched back on it will automatically boot up and operate using the settings recorded in its memory.

<b>IPG20 Functions</b>
Functions (# Settable)
# Manual or automatic operation
# Auto terrain compensation
# Drift allowance in Kpa (auto terrain compensation only)
# Pre-start delay timer
# Use alarm relay
# Absolute low limit (system pressure must always be above this setting)
# Low pressure margin (fine leak detection)
# Absolute high pressure limit
# High pressure margin (partial blockage)
# Set point margin
# Start-up timer
# Ramping up timer
# Set point timer
# Pressure dip timer
# Pressure spike timer
# Run-on timer
# Cyclic running (not available with auto terrain compensation)
# Auto restart on a fault (not available with auto terrain compensation)
Displays the system pressure in kPa
Displays the high & low pressure margins
Displays the operating pressure
Displays the time the pump ran for
Displays the reason for stopping on a fault
Instigate learning process using remote switch (manual operation)
No-flow protection at all times
Stops the pump if flow stops
Stops the pump instantly on absolute high pressure
Stops the pump on absolute low pressure
Stops the pump on low pressure margin after delay
Stops the pump on high pressure margin after delay

## **MANUAL OPERATION**

In manual operation the learning phase of the start-up process is instigated by the operator activating the remote switch once it is established the system is running as expected, and at a pressure which is appropriate for the particular outlet/hydrant setup.

The IPG20 provides the user with a non-isolated nominal 24VAC supply from its LV (Low Voltage) active terminal whenever it is operated from the mains or from a 24VAC supply. The 24VAC supply can be connected through a remote switch and the return wire can be connected to the "R" (remote input) terminal on the IPG20's terminal block.

When operated from a 24VAC /DC supply, the 24V active or the supply positive can be used as the source of low voltage to the remote switch and the return wire can be connected to the "R" terminal. It is critical that the remote switch has voltage free contacts. Under no circumstances apply an

external voltage directly to the “R” terminal of the IPG20 pump guard.

A remote momentary on switch can be used to actuate the IPG20 controller. **This is necessary if manual operation is selected in the program.**

**It is important that there are no leaks or other problems at this stage as they could be locked in by the switch as being normal.**

If the remote switch is not activated within the allotted ramp-up time the switch will shut down the pump and display an error message.

## **AUTOMATIC OPERATION**

In automatic operation after a predetermined ramp-up time to allow the system to achieve a stable pressure the switch will go into its “learning” mode without input from the operator, and if the pressure is stable will lock in the set point pressure for that particular outlet/hydrant setup. This mode allows for the controller to be remotely started, perhaps by an auto dialler, level switch or other device.

**Again, it is important that there are no leaks or other problems at this stage as they could be locked in by the switch as being normal. If the automatic mode is selected it is strongly recommended that a visual check of the system is done.**

## **AUTO TERRAIN COMPENSATION**

Where a significant change in pressure is expected due to either a change in the water level relative to the IPG20 e.g. pumping from a small tank with the switch in a fixed position, or a travelling irrigator moving over a changing contour then auto terrain compensation can be used.

In this mode the switch constantly monitors the pressure relative to the set point pressures and if the pressure changes slowly within the ranges specified then the switch will move the set points to accommodate the gradual change in height of the irrigator or water level. This means the tolerance to a change in pressure can be very fine giving un-paralleled leak detection.

This is described as drift allowance and expressed as kPa per minute.

For example, if a travelling irrigator is moving either up or down a slope then the expected change in pressure is directly related to the change in height. If the irrigator travels 100 meters per hour and the steepest slope it is expected to move over is 5 meters per 100 meters then the expected change in pressure will be 5 meters (50kPa) per hour. The switch calculates this every minute so the switch setting would be  $50\text{kPa}/60\text{ minutes}=0.83\text{kPa}$  expected pressure change per minute. In theory then a 1kPa setting would be sufficient. In practice a 1kPa setting would have very little tolerance for an unexpected larger pressure change such as a sudden dip in the paddock and the small pressure variations from the pump so a more realistic setting is advisable.

If the switch sees a pressure change just outside what it expects as the terrain changes it will shut down the pump and display the pressure set point it was using at the time and the amount of pressure outside the set points that caused it to trip. By doing this the operator can differentiate between a setting which is too fine, to a trip from a genuine leak or blockage.

As the set point pressure moves up or down with the terrain it is important to realise the sum of the operating pressure and the high or low margins cannot be greater or less than the overriding high or low set points. For example if the low pressure margin is 10kPa and the absolute low pressure limit

is set to 300kPa if the operating pressure falls below 310kPa the switch will see this as an error and will shut down and display “setting error check settings” message.

## **PRE-START DELAY TIMER**

The pre-start delay timer delays the starting of the pump for a selectable period. It can be set from zero to 99999 seconds (27.7 hours) in one second increments. If you choose to use this timer the actual starting of the pump will be delayed by whatever delay you set this timer to. Each time the controller is switched on it boots up and is prevented from starting the pump for the set time period. As soon as the set time has elapsed the pump will start and run normally, given there is safe flow. The pre-start timer can be used to allow peripheral equipment time to boot up. For example, some VS drives require a few seconds to stabilise and the IPG20’s pre-run timer can hold off the starting of the pump until the whole system has stabilised. The pre-start timer can also be used to stage or stagger the starting of multiple devices. It is often desirable to avoid the high current draw of multiple motors starting together, and the pre-start delay timer can facilitate this function.

## **USE ALARM RELAY**

Having decided whether or not you require an external input and pressed (P), the screen that follows asks you if you want to use the IPG20’s alarm relay. The IPG20 has a second relay (Relay 2) that provides a set of 240VAC 16A rated normally open voltage free contacts. The contacts of the alarm relay can be configured in a variety of ways both for alarm functions and to control all sorts of external equipment. For example, to control a mixer or aeration system during the pre-start delay as previously described.

If you select YES to the “Use Alarm Relay” question and press (P) there follows a menu that allows you to select the way in which the relay will behave. Pressing the up or down buttons allow you to move from one choice to the next. Pressing (P) confirms your selection and moves you to the next main menu function. If you decide to use the alarm relay, it can be configured in the following ways: -

### **Closed if any fault develops**

If the pump is stopped on any fault condition the alarm relay will close its contacts. This can be used for an alarm light or, perhaps, a dialler to alert the operator of a problem.

### **Closed only if flow stops**

The second alarm menu choice only closes the alarm relay if a true loss of flow is detected. In any other fault condition the IPG20 will shut the pump down and display an appropriate message as to what the fault was but the alarm relay will remain open unless the specific condition, in this case loss of flow, is detected.

### **Closed whenever pump is off**

With this choice the alarm relay will act as a set of contacts that are the reverse of the main pump relay’s contacts. When the pump relay (Relay 1) is on the alarm relay’s contacts will be open and when the pump relay is off the alarm relay’s contacts will be closed. This configuration has all manner of applications in general control and in operating peripheral equipment.

### **Closed whenever pump is on**

This configuration means the alarm relay will mimic the main pump relay. It will be on when the pump is on and off when the pump is off. Since Relay 1 and Relay 2 are electrically and mechanically separate this configuration allows two separate circuits to be controlled in synergy.

**Closed on a high pressure fault**

The alarm relay would only close if the pressure stays above the high pressure margin for the predetermined time.

**Closed on a low pressure fault**

The alarm relay will only close if the pressure stays below the set point margin for a predetermined time.

**Closed on very low pressure fault**

The alarm relay will only close if a very low pressure is detected.

**Closed on very high pressure fault**

The alarm relay will only close if the pressure rises above the very high pressure setting. There is no time delay on this setting.

**Closed if ramp up timer times out**

The alarm relay will only close if the ramp up timer times out. This can warn the operator he has failed to instigate the learning phase in the allotted time.

**Closed if reference pressure is not stable**

This will only close the alarm relay if the controller has been unable to lock in a set point because the pressure has not stabilised.

**Indicate use of remote input**

This will make the alarm relay contacts open and close every second during learning mode. This can be used to operate a light so the operator knows the switch is in its learning mode.

**ABSOLUTE LOW LIMIT**

This is an over-riding low pressure setting that gives overall protection against a major breach in the system that may have occurred between irrigation cycles. This would be set just below what would be the lowest operating pressure expected anywhere in the system.

**LOW PRESSURE MARGIN**

This is the pressure allowed below the operating set point. If the operating pressure is not expected to change on any given "run" then this margin can be set very close to the set point but allow for small pressure fluctuations which can be present. This setting will detect a leak in the system that drops the pressure below the low pressure margin

## **ABSOLUTE HIGH LIMIT**

This would normally be set at the highest expected pressure anywhere in the system or perhaps at the maximum pressure rating of the pipeline.

The absolute high limit is the maximum pressure you want the system to reach before shutting down. The range of adjustment is 0 to 2000kPa. The high pressure trip point must be set to some value higher than the low pressure trip point. If you try to set the high-pressure trip to a lower value than the low pressure trip point the IPG20 will not accept the setting and advise you to check your settings. If you choose to leave the high pressure trip point set at zero, meaning you don't want an upper pressure limit, then the IPG20 will automatically set it for you to 2000kPa which is the maximum pressure the IPG20 itself can continuously tolerate. When the absolute high limit is reached any other settings will be over-ridden and the system will be shut down immediately.

## **HIGH PRESSURE MARGIN**

This is the pressure allowed above the set point.. If the operating pressure is not expected to change on any given "run" then this margin can be set very close to the set point but allow for small pressure fluctuations which can be present. This setting can be used to detect a partial blockage such as a blocked nozzle on a spray line or irrigator.

## **SET POINT MARGIN**

The set point will only be locked in if the switch measures six readings within the margin. This margin allows for some pressure variation as the pressure stabilises, eg. some air still being purged from the system. A setting of 20kPa is generally OK.

## **START-UP TIMER**

The IPG20 uses a paddle to detect flow. The paddle is held in the no-flow position by an adjustable magnetic screw that is located in a port under the electrical housing of the pump guard. If flow pushes against the paddle, the paddle moves. The movement is detected by the pump guard and identified as flow. Initially in a system that is not running or has all its valves shut there will be no flow and the paddle will be in the off, or no flow, position. In order to override this initial off state and allow the pump to start the pump guard uses the start-up timer.

The timer ignores the initial off state of the paddle and allows the pump to run for a settable time. As soon as flow is detected the start-up timer terminates its run and hands control of the pump over to the paddle. The start-up timer is adjustable from 0 – 240 seconds (0 – 4 minutes) in 1-second increments. The value you enter will depend entirely on your pumping system. For a fully primed system the start-up timer may only require one or two seconds to establish flow. In a submersible bore pump installation with a self-draining riser it may take several minutes to establish flow past the paddle.

## **RAMPING UP TIMER**

This timer must be set for sufficient time to allow the system pressure to stabilise before the switch goes into learning mode. Allowance should be made to fill any lines which may drain when not in use and to purge any air from the system.

## **SET POINT TIMER**

The time allowed for the set point to be measured and locked in once the system pressure has stabilised. The switch takes a pressure reading every 10 seconds and if it finds six readings within the set point margins it then averages these readings and calculates the set point and locks in the over and under margins. If it cannot find six readings within the allocated time it will shut down and display "pressure is not stable". If 60 seconds is selected then every reading must be within the margin. If a multiple of 60 seconds (120, 180, etc) is selected then the switch will have 12 or 18, etc, chances to find stable pressure readings. If it encounters any outside the margins it will discard them and look for other readings inside the margin. It will generally be better to select 120 seconds as a minimum. Once six readings are detected within the margin the IPG20 will terminate the learning process and lock in the set point.

## **PRESSURE DIP TIMER**

The time allowed if a low pressure is detected before the switch shuts the pump down. Once the set point is locked in the IPG20 enters normal running. Normal running is a condition where the system pressure is between the low-pressure set point and the high-pressure set point and flow is present. In this state the IPG20 monitors both flow and pressure and ensures the system is operating properly and remains within the set parameters. If the system pressure falls below your low pressure set point the IPG20 reverts to running the pressure dip timer.

The purpose of the pressure dip timer is to let the pump system tolerate minor dips in pressure without shutting down the pump. Minor dips in pressure can be caused by valves opening and closing in irrigation systems and for a variety of reasons. Without the pressure dip timer such minor pressure fluctuations would trigger an instant pump shut down. The pressure dip timer is an automatically self-terminating timer with an adjustment range of 0 to 240 seconds (0 to 4 minutes) in 1 second increments. The IPG20 is supplied with the dip timer pre-set to a default value of 10 seconds. Increase or decrease this value to suit your system using the up or down buttons and then press (P) to confirm your setting and to move to the next main menu question.

## **PRESSURE SPIKE TIMER**

The time allowed before the pump is stopped if a high pressure is detected. This is over-ridden by the absolute high setting. If the pressure rises to the absolute high value it will stop the pump instantly. Once the set point is locked in the IPG20 enters normal running. Normal running is a condition where the system pressure is in between the low-pressure set point and the high-pressure set point and flow is present. In this state the IPG20 monitors both flow and pressure and ensures the system is operating properly and remains within the set parameters. If the system pressure rises above the high pressure set point the IPG20 reverts to running the pressure spike timer. The purpose of the pressure spike timer is to let the pump system tolerate minor rises in pressure without shutting down the pump. Minor rises in pressure can be caused by valves opening and closing, or partial blockages. Without the pressure spike timer such minor pressure fluctuations would trigger an instant pump shut down. The pressure spike timer is an automatically self-terminating timer with

an adjustment range of 0 to 240 seconds (0 to 4 minutes) in 1 second increments. The IPG20 is supplied with the dip timer pre-set to a default value of 10 seconds. Increase or decrease this value to suit your system using the up or down buttons and then press (P) to confirm your setting and to move to the next main menu question.

## **RUN-ON TIMER**

The IPG20's built in run-on timer can be set to ignore minor interruptions to flow. For example, if air trapped in the pipework passes the pump guard's paddle the paddle will momentarily swing into the no-flow position. This would normally cause the pump guard to shut down the pump. The run-on timer lets the pump guard ignore such minor fluctuations in flow. Once triggered the run-on timer tries to keep the pump running for whatever time you have set it to, regardless of lack of flow.

During its run period the run-on timer monitors the state of the paddle and if the paddle is pushed back into the on position by flow, the run-on timer cancels its run and resumes normal running. If, however, the interruption to flow persists for longer than you have set the run-on timer to, then at the end of the run-on time the IPG20 will shut the pump down. The run-on timer can be set to any value from 0 – 900 seconds (0 – 15 minutes) in increments of 1-second.

For most applications an initial setting of a few seconds is quite adequate. The self-resetting action of the run-on timer means it will keep a pump running in spite of repeated or continuous interruptions to flow. In applications where entrained gas is present in the water, the run-on timer will ignore the continuous bouncing back and forward of the paddle by constantly resetting its time clock instant by instant.

## **CYCLIC RUNNING**

The IPG20 can be programmed to run and stop a pump for set periods of time. Both the running and stopping times can be set to any value you choose, from 1 minute - 99 hours 59 minutes (0 - just over 4 days) in increments of 1-minute. The cyclic running option is highly flexible. The run and stop timers are totally independent of each other. If a set running and stopping time are programmed in, the IPG20 will run the pump for whatever time it is set to and then stop for the time set on its stop timer. If a run time is set to some value and the stop time is left set at zero the pump guard will behave as a one-shot batch controller.

Each time the switch restarts the system after the stop time it will reapply the set point learnt in the initial start-up process.

## **AUTO RESTART ON A FAULT**

The system can be restarted automatically after a fault condition has shut the pump off. The switch will only restart the pump once after a predetermined time, and if the fault reoccurs it will stay off and close the alarm relay if that option is selected. This option is not available if auto terrain compensation is selected.

## **ACCEPT SETTINGS**

This is the end of the menu. Select “YES” to confirm all your previous settings or use the up and down buttons to select “NO”. If you select “NO” the IPG20 will transport you back to the start of the main menu and subsequent pressing of the (P) button will allow you to step through the menu and change any parameter you are not happy with. If you accept the default “YES” and press (P) you are then asked to press the (R) reset button to start the pump. The IPG20 will start the pump and attempt to run the system using the setting you have programmed in.

If the settings you have initially made prove unsatisfactory then simply pressing and holding down the (P) button for about 1 second and then releasing it will shut the pump down and take you to the top of the main menu where you can step through the settings and make appropriate changes. Having made a specific change you can confirm the setting by pressing the (P) button and then press the (R) reset button to exit out of the menu and return to normal running. You do not have to repeatedly press the (P) button and step right through the menu. Just make the specific change you want and then press (R) reset to resume normal running.

## **TOTAL RUN TIME DISPLAY**

The IPG20 keeps track of how long the pump runs for regardless of what it may be doing. On shutting down the pump for any reason the controller displays on its screen the total run time in minutes. The pump may have stopped because of high pressure or because flow was lost. Regardless of the reason and regardless of whether it ends up in permanent alarm or in auto restart waiting to restart, it displays the total time it previously ran for. In auto restart mode it does this by displaying alternate screens that change every 5 seconds.

One screen displays the reason for the shutdown and the time remaining before restart and the second screen displays the total run time. Total run time includes all peripheral times such as run-on and pressure dip time and the initial flow start and pressure start times. It also includes run time incurred during cyclic running. The run time display has a range of 1 minute to 9999 minutes (about 7 days). The run time display automatically resets to zero each time the pump starts. The total run time display accumulates time at all times the pump is running. The total run time display is only reset to zero by a power interruption or by pressing the (R) reset button on the IPG20.

## **AUTO-RESTART, PERMANENT ALARM & THE ALARM RELAY**

The alarm relay can be configured to close its contacts if one of ten fault conditions are encountered. The auto restart function in the IPG20 can be set to shut the pump down and restart after a delay time if one of eight fault conditions occur. The way the alarm relay responds to a fault and the way the controller in general responds to a fault are independent of each other.

It is therefore perfectly practical to have the controller shut down and either remain shut down or wait and automatically restart due to one fault condition while the alarm relay responds to a separate condition. For example, you could set the alarm relay to only close its contacts if the pump ran dry, and have the pump only automatically restart if it shut down due to low pressure.

## **NORMAL RUNNING**

When the IPG20 is running the pump normally with flow present and with a line pressure that is in between the high-pressure and low-pressure trip points, the IPG20 displays information about the system on its screen. The screen displays your high and low pressure trip points in kPa. It also displays the current dynamic pressure in the pipe.

At a glance you can see precisely what the system is doing and where the pressure is in relation to your pressure trip points. In addition the IPG20 displays the flow status as a green or red flow light on its top deck and the state of the pump, red for stopped and green for running. If a remote input is connected between the LV and R terminals of the IPG20 and the external switch is closed, the blue remote input light on the top deck of the IPG20 will also be on.

## **LCD SCREEN BACKLIGHT**

The LCD screen on the IPG20 pump guard has a built in backlight. The backlight switches on automatically whenever you are programming the controller and when the controller is displaying certain fault conditions. In normal operation the backlight remains off.

The LCD screen backlight can be switched on manually at any time by pressing and holding down the down arrow button. The screen will remain illuminated while ever you are depressing the down button. The screen will switch off as soon as you release the button. The LCD backlight can't be permanently switched on, it only operates while the down button is held in.

## **PROGRAM LOCK**

The IPG20 includes a hidden lock. When activated the lock disables the programming button (P), thus rendering the controller's menu inaccessible. To lock or unlock the IPG20, press the up and down buttons together while the pump is in normal operation (not while it is being programmed). Pressing the up and down buttons together while in normal running mode shuts the pump down and opens the controller's lock screen.

Once the lock screen is displayed the IPG20 can be locked or unlocked by pressing the up or down buttons. Pressing (P) then exits the lock screen and the controller resumes normal operation. When locked, pressing the (P) button has no effect on the F60 and does not take you into the menu in the usual way. Access to the menu can then only be obtained by first unlocking the (P) key.



## **WARNING**

**If the IPG20 Intelligent Pump Guard is used in a manner not specified by the manufacturer the pump protection provided by the controller may be impaired or negated. In addition, all warranties stated or implied will be rendered invalid.**

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