

# Ogden Kodiak 6ft Saw Operation Manual

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# Introduction

**Manual Overview** This is an Operation Manual for the Kodiak Saw (BPS NNN) revised control system. Each chapter topic covers one operator screen, along with related controls and indicators. The following format is used for indicating tips ( **i** ) and cautionary notes

( **!** ) where necessary. As an example, the figure below shows the Main Operator Screen. Details that would follow the image of the screen shall include items of interest, such as control items and information areas, as well as status indicators. The descriptions and explanations are given from the perspective of proper equipment operation by the reader. A basic understanding of machine operation and safety procedures specific to the facility housing the equipment, should be considered a pre-requisite.



Figure 1: Example Screen

**i** The Main Screen shown above, and all of the Operator Screens, use the same layout style. Navigation between screens is done using the physical buttons on the left side of the terminal, with the labels referencing what screen to goto. The operator can always return to the Main Screen from any other screen by pressing the Menu button located at the bottom left of the terminal.

**!** A fault will be triggered by the program logic if the Operator tries to begin an Automatic Cycle without first entering a valid cut program.

Above notes are examples of Information and Cautionary notes related to the display screen being discussed.

**Screen Layout Style** Screen navigation is done through the use of the left hand Terminal Programmable keys and the Terminal Menu key. If a Programmable Key can be used to navigate to another screen, it will be noted by a label next to that key. In the above figure of the Example Screen, there are labels next to the top three Programmable Keys. This would indicate that the Operator can navigate to the labeled Screens by pressing the adjacent key. In this example, the Operator is able to navigate to either the Alarms Screen, the Manual Screen, or the Cut Program Screen. The Menu key will always return the Operator to the Main Screen from any other screen. Alarm messages and Information messages scroll through all active messages continuously until they are no longer active. Alarms are active until the Operator acknowledges them by resetting them using the Alarm Reset button on the Alarm Screen. On the Main Screen above, the Message Display Area is at the top of the Screen below the Title. The Message Area will display messages for the Operator's information, which will change according to the state of the machine. No interaction is required by the Operator since it is information only. All Alarms are displayed in the Alarm Screen Alarm Message Display Area, but indication an alarm condition exists will be displayed in the Information Display Area. Looking at the Main Screen figure above, there are control buttons located at the bottom of the screen. These are an example of how Operator Control devices and Indicator devices will be displayed and interacted with. All of the Buttons and Pilot Lights have been chosen to resemble physical Industrial Operator and Indicator devices that would normally be found on a control panel for a machine.

# Chapter 1

## The Main Screen

**Overview** The Main Screen is the primary display screen. It is shown at power up, and is where Operation Mode (Hand or Automatic) is selected. It displays the Operator Message Centre which provides the Operator with current and relevant machine state information. There are also controls for *Mode Hand/Auto*, *Automatic Cycle Start* and *Automatic Cycle Stop*, plus *Machine Full Stop*. There is an information area for Saw details, and one for the current running cut program. Finally, there are screen navigation keys provided for Operator access to other machine functions.



Figure 1.1: Main Screen

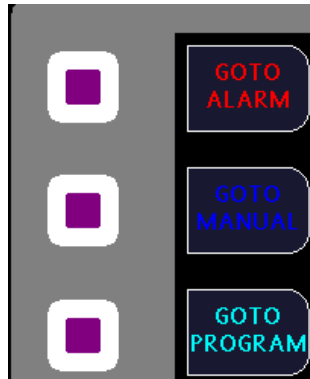


Figure 1.2: Main Screen Navigation

**Main Screen Details** Main Screen Details are divided into the general categories.

- ◇ **Screen Navigation**
- ◇ **Operator Message Centre**
- ◇ **Saw Information**
- ◇ **Program Details**
- ◇ **Operation Control**

**Screen Navigation** Is performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 1.2). For the Main Screen there are three screens accessible using the labeled FKey's, **Alarms**, **Manual**, and **Program**.

- ◇ **GOTO ALARM** Navigate to Alarms Screen.
- ◇ **GOTO MANUAL** Navigate to Manual Screen.
- ◇ **GOTO PROGRAM** Navigate to Cut Program Screen.

**i** The Menu Key located on the terminal at the lower left below the FKey's, will return the Operator to the Main Screen, from all other screens.



**i** The Menu Key is pictured as it looks on the Terminal.





Figure 1.3: Main Screen Message Centre

**Operator Message Centre** Is the message display area located on the Main Screen near the Title. It is used to display information for the Operator during machine use. It doesn't display Alarms, that is done on the Alarms Screen, though it will indicate if an Alarm condition exists. The *Operator Message Centre* shown in Figure 1.3 will display information messages for the Operator. If more than one message is active the display will scroll through all messages continuously on a timed basis automatically. The Operator is not required to initiate any message change, or acknowledge a message, this display is merely for the Operator information.

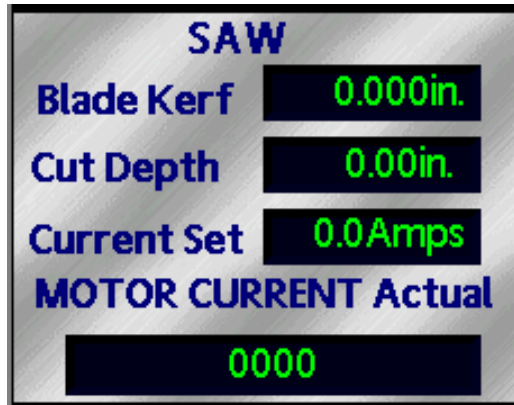


Figure 1.4: Main Screen Saw Information

**Saw Information** Is an area where the Operator can see Saw information at a glance. **Saw Kerf**, **Cut Depth**, and **Current Set** are displayed along with the **Motor Current Actual**.

( **i** ) This information is display only, in order to make changes to the saw parameters *Blade Kerf*, *Cut Depth*, and *Current Set* the operator must navigate to the Program Screen. Where they may be changed at any time and in any mode, even while running in automatic/manual or faulted. More details on those settings can be found in the chapter dealing with the Cut Program Screen.

Active Cut Program			
Block Number	Cut Number	Cut Quantity	Cut Width
0 Of 0	0 Of 0	0	0.00 in.

Figure 1.5: Main Screen Program Details

**Program Details** Display area will show the Operator details about the current block being cut as per the *Cut Program* the Operator entered, while the Mode is automatic and the program is being executed. If the mode is automatic and the program execution is interrupted, or has completed, the display will show the last block details executed. If the Mode is Manual (Hand), and automatic operation has not been started/completed/interrupted, then it will display the first block of the cut program. Otherwise, the display will be the last block details from program execution, the same as if in Automatic mode.

( i ) The saw will keep track of where it is in the Cut Program execution cycle, even if cycle stop is pressed. Further details about how the Cut Program is executed, and what behaviour to expect from cycle interruption due to completion, alarms or Operator action can be found in the section(s) following. The Program details (figure 1.5) will display information about the current Block being worked on, if running in Auto Cycle. If the cycle has been stopped, the details displayed will be about the current block being worked on, this is the same in both Hand and Auto Modes, as well as in the case of a faulted condition. This means that if the saw has finished cuts for a block entirely, the display will actually show details about the next block to work on since it is now the current block. If the cycle has completed without error, then the details of the last block programmed will be displayed, in either Hand or Auto Modes. If the program has not been run, and the Mode is either Hand or Auto (not in cycle) then the first block in the program will have it's details displayed.



Figure 1.6: Main Screen Operation Control

**Operation Control** Is provided by a group of Push Buttons and Selector Switches that allow the Operator to Select Modes (*Hand/Auto*), Start and Stop the Auto cycle (*Cycle Start*, *Cycle Stop*) or execute a *Machine Full Stop* command.

( i ) The cut program may be restarted from any position, providing it was *Cycle Stopped*. If the machine was stopped by pressing the *Machine Cycle Stop* Button, the program will need to be re-entered as this is considered a faulted condition initiated by the Operator when machine safety is a concern. The same applies to any Fault generated by other emergent conditions that require the saw to be stopped mid-cycle. If the saw is stopped by pressing the *Cycle Stop* Button, it may be placed into *Hand* by the Operator if manual control is required. From a cycle stopped state, selecting *Auto* and pressing *Cycle Start* will restart the *Cut Program* at the last known cut location and depth.

( ! ) Extreme Caution must be exercised when restarting the *Cut Program* after a *Cycle Stop*. If motion in the Long Travel Axis has been made after cycle stopping, there is a high probability that the saw will not return to the exact cut location due to mechanical tolerances in the axis. The saw will move the *Vertical Axis* to the last programmed height when *Cycle Stop* was pressed. Both of these conditions when combined, can lead to re-engaging a cut pass in a Block which is not perfectly in line with the original path the saw blade had established prior to stoppage. An example would be if the Long Axis was moved in the positive direction prior to a restart being



Figure 1.7: Main Screen Operation Control

issued, it would attempt to return to the last cut location from the home end of the machine. It accomplishes this type of move by traveling past the cut location back in the direction of home, then moving to the desired cut location. The repeatability of the saw position is not small enough to guarantee near perfect alignment of the blade with an existing cut. The vertical axis would then lower to the last cut height. If the saw blade is now near perfect in alignment with the existing cut location, the saw will finish the cut without incident due to misalignment. However, if the alignment is a blade width out in either direction, the potential for damage to product and possibly the equipment is greater.

**Mode Set** Refer to Figure 1.7 shown above. The *Hand/Auto* selector switch is provided for the Operator to be able to select *Hand* or *Auto* modes. Above both mode positions is an indicator light. As well as the switch position, the corresponding light will be on indicating which of the modes is selected. The blue light on will indicate that *Hand* mode is selected. While the green light indicates *Auto* mode is selected. When the selector is set to ***Hand***, the *Blue Hand Indicator* will be on solid if no faults exist and flash if there is a fault, or if the machine needs homing of any axis. Selecting *Hand* while in *Auto* will change the mode to *Hand*, even if a programmed cycle



Figure 1.8: Main Screen Machine Full Stop

is running. When the *Hand/Auto* selector switch is set to **Auto**, the *Green Auto Indicator* will flash if the saw is ready to run a cut program. In order to be ready to run a cut program in *Auto* all of the saw axii must have been homed, no faults of any kind may exist, and a valid cut program must have been entered. When in *Auto* mode, and once the *Cycle Start* Pushbutton is pressed, the saw will begin *Automatic* execution of the *Cut Program* the Operator entered and the *Auto Indicator* will be on solid.

**Cycle Stop** When pressed while an *Auto* cycle is executing a *Cut Program*, will cycle stop the saw at completion of the currently executing step of the cycle. In practical terms what this means is that if the saw was moving to a new cut location, it would stop motion, and pause *Auto* cycle, once that particular move was completed. This includes *Cross Travel* motion, *Vertical* motion, and *Long Travel* motion. The saw will remain in *Auto* mode after a **Cycle Stop** has occurred.

**Machine Full Stop** Refer to Figure 1.8 above. **Machine Full Stop** pushbutton is intended to be used in the event the Operator feels an immediate stop of automatic or manual motion is necessary. Unlike the **Cycle Stop** pushbutton, pressing **Machine Full Stop** will immediately stop all motion of the saw and exit *Auto* mode.

**!** Unlike an Emergency Stop pushbutton, this is a programmed response to an Operator perceived hazard potential and **must not** be relied upon as a safety measure in any respect.

**i** A program that has been ***Cycle Stop***'d can be restarted from the stop location, even if the program has been changed within the limits of the program as it was running until then. What this means in practice is that if the Operator determined they need to correct an error in the cut program, in a part that hasn't been cut yet, they would be able to cycle stop the saw, correct the error, then ***Cycle Start*** the program to continue.

**!** If a program has been modified after a ***Cycle Stop*** occurred, the restart of the cut program could generate an error if the data change exceeds the known saw limits. Refer to the chapter on **Cut Program** entry and details for further explanation.





# Chapter 2

## The Alarm Screen

**Overview** The Alarm Screen is the screen the Operator uses to diagnose the Saw when it is in a Faulted State. It will provide information to the Operator about the nature of the Fault, and allow for acknowledgement of the faulted state by the Operator.

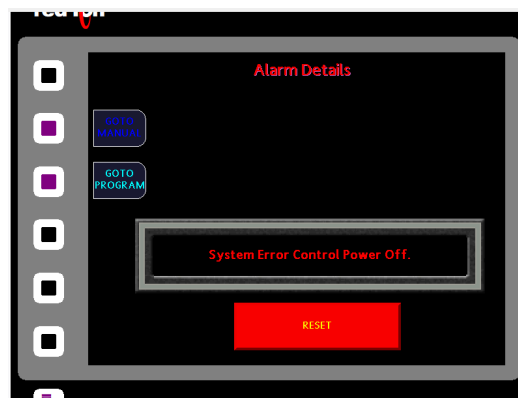


Figure 2.1: Alarm Screen



Figure 2.2: Alarm Screen Navigation

**Alarm Screen Details** The Alarm Screen details are divided into the following general categories.

- ◇ **Screen Navigation**
- ◇ **Alarm Message Centre**
- ◇ **Alarm Acknowledge/Reset**

**Screen Navigation** Is performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 2.2). The Operator may navigate to the *Manual Screen* and the *Program Screen*. and of course the *Main Screen* using the *Menu* FKey.

- ◇ **GOTO MANUAL** Navigate to Manual Screen.
- ◇ **GOTO PROGRAM** Navigate to Cut Program Screen.

**i** The Menu Key located on the terminal at the lower left below the FKey's, will return the Operator to the Main Screen, from all other screens.



**i** The Menu Key is pictured as it looks on the Terminal.



Figure 2.3: Main Screen Message Centre

**Alarm Message Display** Is the display area that details the Fault or Faults that have caused the Alarm. The Operator can use the detailed Fault information to take appropriate action to clear the Faulted condition. The ***Alarm Message Display*** will scroll through the Fault Details that are currently active. Some Faults will be interrelated and the action of clearing one will often clear other related faults. The *Alarm Message Centre* shown in Figure 2.3 will display Alarm messages for the Operator. If more than one message is active the display will scroll through all messages continuously on a timed basis automatically. The Operator is not required to initiate any message change, but is required to acknowledge a message in order to clear the related Fault.



Figure 2.4: Alarm Reset Pushbutton

**Alarm Reset** The *Alarm Reset* pushbutton is how the Operator acknowledges clearing a Fault. The Operator **must** acknowledge **all** Faults in order to clear them. All Faults must be cleared before the Operator can change the Saw into *Auto Mode*.

**i** The details of the Fault which is causing the Alarm will be displayed in the *Alarm Message Display*. The Operator can use this information as a guide to clearing the Faulted condition. Manual operation of the Saw is allowed under most Faulted conditions.

**!** A fault that is triggered must be cleared and acknowledged in order to be able to run an automatic cut program on the saw. All faults are programmed to help the Operator prevent damage to the saw through normal use. The surrounding work area, and it's upkeep and cleaning can have an affect on Saw operations. It is the Operators responsibility to ensure the area is kept clutter free and the equipment travel paths are relatively clean.

**Faulted Conditions, Alarms, and the Operator** A machine as complex as a gantry rock cut saw, can have Faulted conditions arise from many areas of it's operation envelope. The severity of an alarm is a direct result of the severity of the Faulted condition that triggered the alarm. Therefore, it should come as no surprise to the Operator that some Faulted conditions are severe enough to prevent manual operation of part or all of the saw. The drives that move the Long, Cross, and Vertical axii of the saw are one such set of components that can have Faulted conditions that cripple the saw operation. Rectifying the condition that triggered the Fault is the one sure fired method of ensuring problem free operation of the saw. The Gantry Rock Cut Saw is a machine that works under harsh conditions. As such, it is to be expected that components will wear as the saw is used. This includes electrical and electronic components as well as the mechanical parts. After time, heavily loaded electrical components, such as saw motors, will suffer degradation of critical parts under stress. The Operator can note that there will be performance losses under such cases, and more frequent Faults of overload type, such as motor stalling. This will continue and usually worsen

until failure of the weak components occurs. Understanding how the machine operates under well maintained normal conditions is a great benefit to the Operator when it isn't operating as expected. Faults, and their frequency of occurrence, can help the Operator note a trend towards component failure. This can lead to better maintenance cycles through preventative measures, reducing downtime and scrap as a direct consequence. Some Fault conditions may never be observed by the Operator directly, whether they are masked by another Fault condition or only occur under certain maintenance steps. An example of such a Fault condition is the Communication Network(s) used in the Control System Architecture. If the communication fails in a part that feeds information to the HMI (from the PLC), the error couldn't be displayed. This is a moot point under that specific Fault condition since there would be no screen navigation or control capabilities either, and the Operator would be aware a problem exists as a consequence. If communication is lost to the Drives Network for instance, the Faulted condition would be announced and the Operator would have *Manual* mode capabilities. Trying to ***Cycle Start*** an *Auto* cycle without first entering in a correct cut program, is a Faulted condition that will trigger an alarm. The Operator would acknowledge such an Alarm by pressing the ***Reset*** pushbutton on the ***Alarms Screen*** to continue, then enter a valid cut program before trying to start another automatic cycle. Just like the Operator Message Centre on the Main screen, the Alarm Message Centre on the Alarms Screen is there for the Operator Information to assist in daily operations. Alarms can be expected to occur regularly during normal use.



# Chapter 3

## Manual Screen

**Overview** The *Manual Screen* is the screen the Operator navigates to in order to perform manual operations with the saw. The *Manual Screen* cannot hold controls and indicators for all controlled devices on one screen. Therefore, the manual controls are divided over several screens that are accessible from the *Manual Screen*. This is described in detail below.

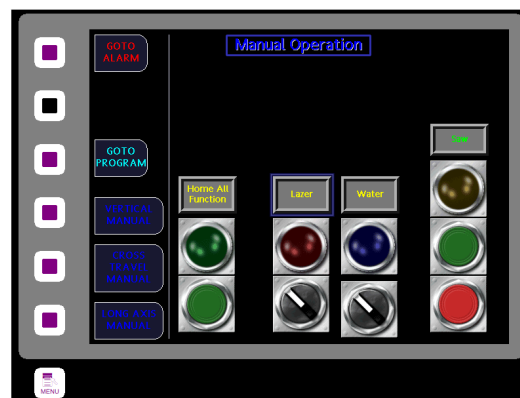


Figure 3.1: Manual Screen

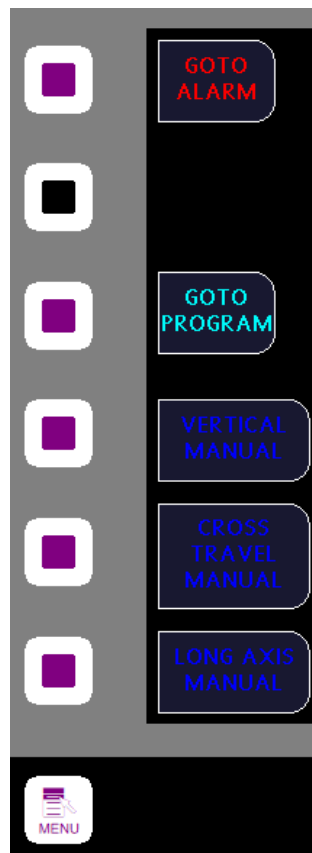


Figure 3.2: Manual Screen Navigation

**Manual Screen Details** The *Manual Screen* details are divided into the following categories.

- ◇ Screen Navigation
- ◇ Home All
- ◇ Lazer
- ◇ Water
- ◇ Saw

**Screen Navigation** Is performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 3.2). The Operator may navigate to the *Alarm Screen* and the *Program Screen* and of course the *Main Screen* using the *Menu*



FKey. As well, there are navigation keys programmed for going to the manual control screens for Long, Cross, and Vertical axis.

- ◇- **GOTO ALARM** Navigate to Manual Screen.
- ◇- **GOTO PROGRAM** Navigate to Cut Program Screen.
- ◇- **VERTICAL MANUAL** Navigate to Vertical Axis Manual Control Screen.
- ◇- **CROSS TRAVEL MANUAL** Navigate to Cross Travel Manual Control Screen.
- ◇- **LONG AXIS MANUAL** Navigate to the Long Axis Manual Control Screen.

**i** The Menu Key located on the terminal at the lower left below the FKey's, will return the Operator to the Main Screen, from all other screens.



**i** The Menu Key is pictured as it looks on the Terminal.



Figure 3.3: Manual Home All Function

**Home All Function** Referring to Figure 3.3. The ***Home All Function*** is actually a state of the saw, and this has special ramifications over the control of the saw. When a Home All command is initiated, providing there are no critical Fault conditions preventing the state from changing, the saw control system changes to that state. This precludes *Hand/Auto* modes entirely, and prevents *Cut Program* entry until the ***Home All Function*** has completed. When initiated, the function will command the following ...

- ◇ **Saw Off** Turn Off Saw Motor.
- ◇ **Disable Drives** Disable Vertical, Cross, and Long Drives.
- ◇ **Water Off** Turn Off Water Solenoid.
- ◇ **Enable Vertical** Enable Vertical Axis.
- ◇ **Home Vertical** Home Vertical Axis.
- ◇ **Enable Cross Travel** Enable Cross Travel Axis.
- ◇ **Home Cross Travel** Home Cross Travel Axis.
- ◇ **Enable Long** Enable Long Axis.
- ◇ **Home Long Axis** Home Long Axis.
- ◇ **Home Complete** Home Complete Indication.

Once Homing has begun, it continues through a predetermined sequence, until all motion has stopped and completed. Then Home Complete is acquired, and indicated to the control program. At this time the Saw transitions from the Homing State into the At Rest state. The mode will be whatever mode was active when entering the Homing State, and since Home can only be initiated from *Hand* mode, this will always be *Hand* mode. The **Home All Function** is made up of the **Home PB** and the **Home All Indicator**. When not homed completely (if homed by individual commands), or if **Home All Function** has not been completed, the **Home All Indicator** will be off. During the **Home All Function** executing, the **Home All Indicator** will be blinking. When all axii are at **Home** the **Home All Indicator** will be on solid.

**i** The **Home All Function** is a semi-automatic operation initiated by the Operator. Once initiated, it progresses through a predetermined sequence of operations to achieve the reference positions for all axii. This is irrespective of mode, and will only be stopped by completing the function, or a critical fault condition (including emergency stop), or a **Machine Full Stop** pushbutton press.

**!** While pressing the **Emergency Stop PB** will trigger a Faulted condition that would result in the **Home All Function** stopping, the **Safety Gate Interlock** circuit does not. Due to the nature of setting up and maintaining the Saw, it is necessary to have motion capabilities with the **Safety Gate Interlock** open. This includes the **Home All Function** which constitutes the first steps of setting up the saw. As a consequence, it is important for the Operator to be aware that the **Home All Function** may cause motion to occur automatically while the **Safety Gate Interlock** is open. The Operator **must** ensure the path of the Saw is unobstructed, and that no personnel are in the area of saw travel before initiating a **Home All Function**.

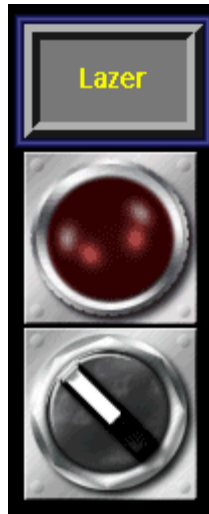


Figure 3.4: Manual Lazer Control

**Lazer** The ***Lazer*** Control is a selector switch that the Operator can use to turn on/off the Lazer. This is used during set up and entry of the cut program. Normally, the Lazer is off during operations. The red **Lazer Indicator** will turn on if the ***Lazer*** is on, otherwise it is off.

**!** The Lazer optics used on this Lazer are industrial rated optics. The Operator, and personell working in the vicinity, should **never** look directly at the lazer light without appropriate eye protection as this **will** result in damage to the eye. If using the Lazer for cut location, keep your back facing the Lazer light source, and turn it off when you're not needing to use it.

**i** The ***Lazer*** is a handy tool during cut program set up. If turned on in *Hand* mode, it will remain on until turned off by he Operator, or until the mode is switched to *Auto*. As the ***Lazer*** is not needed during cut program running, it does not run in *Auto* mode.

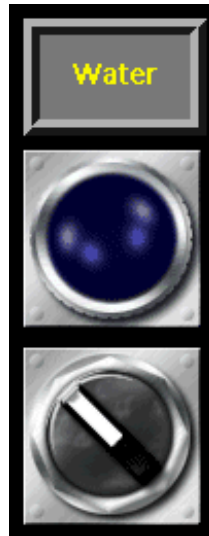


Figure 3.5: Manual Water Control

**Water** The manual **Water** control is a selector switch and indicator light, please refer to Figure 3.5. When the selector switch is in the On position (right) the **Water** solenoid is turned on and once water flow is verified the **Indicator** will turn on. During *Hand* mode operation, it is useful to be able to turn the water On/Off to verify solenoid and flow sensor operation. During *Auto* mode operations, the water solenoid and the state of the flow switch monitoring, is controlled by the PLC.

**i** Turning the water on and off in the Manual Screen is an easy way to test solenoid and flow switch operation prior to starting an Auto Cycle.

**!** If the **Flow Switch** does not indicate water flow while the selector switch is on, verify there is actual water flow, if not verify solenoid operation. If solenoid operation is verified, and water is not flowing establish proper flow then continue. Once flow is verified, and switch is still not operating, check switch for correct operation and replace if necessary. Without water flow demand and indication, **Cut Program** automatic execution is inhibited.



Figure 3.6: Manual Saw Control

**Saw** The manual *Saw* control is made up of a **Start** pushbutton, a **Stop** pushbutton, and an amber **Indicator** pilot light. In order to be able to **Start** the Saw motor, the **Safety Gate** interlocks **must** be closed, and the safety circuit satisfied. Pressing **Start** will begin start up of the saw motor. Since the blade is a rather large inertial load, start up is gradual and should be allowed for. Once the saw blade motor is running, the amber **Indicator** pilot light will turn on. To stop the saw blade motor, press the **Stop** pushbutton. The **Indicator** pilot light will turn off.

**!** The saw blade motor does not have a brake on it, and since the saw blade is a large inertial load, the entire rotating mass will take some noticeable time to come to a complete stop. Personell **must** wait for the saw blade to come to a complete standstill before entering the area.