Ogden Kodiak 6ft. 6in. Saw Operation Manual

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Introduction

0.1 Manual Overview

This is an Operation Manual for the Ogden Kodiak 6'6" Saw (Bruce Peninsula Stone equipment number *332*) with revised control system. Each chapter topic covers one operator screen, along with related controls and indicators. The following format is used for indicating tips and information **i** and cautionary notes **!** where necessary. As an example, figure 1 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.

i The Main Screen shown in Figure 1, 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.
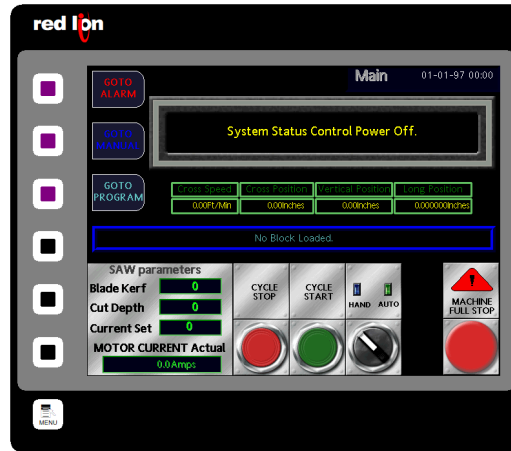
Figure 1: Example Screen

0.1.1   Screen Layout Style

Screen navigation is done through the use of the left hand Terminal Pro-
grammable 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 labelled 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. As a note, there
are times when an FKey is programmed to do an action as a Push Button.
These are always indicated by a different coloured label beside them, than
the blue used for navigation to other screens. Alarm messages and Informa-
tion 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 in-
teraction is required by the Operator since it is information only. All Alarms
are displayed in the Alarm Screen Alarm Message Display Area, but indica-
tion 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

1.1 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 Op-
erator Message Centre which provides the Operator with current and relavent
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.
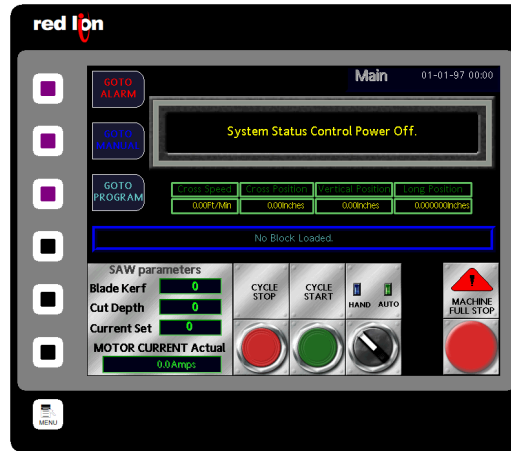
Figure 1.1: Main Screen

1.2 Main Screen Details

Main Screen Details are divided into the general categories.

⋄ **Screen Navigation**

⋄ **Operator Message Centre**

⋄ **Saw Information**

⋄ **Program Details**

⋄ **Operation Control**

1.2.1 Screen Navigation

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.
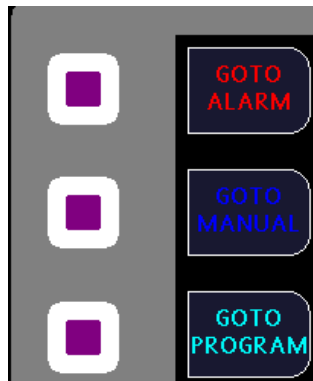
Figure 1.2: Main Screen Navigation

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

Figure 1.4: Main Screen Axii Position

1.2.2   Operator Message Centre and Axis Position

The   message display area located on the Main Screen below the Screen Title, is the Operator Message Centre. It is used to display information for the Operator during machine use. It doesn't display Alarm details, those are found on the Alarms Screen, though it will indicate if an Alarm condition exists.   The *Operator Message Centre* is shown in Figure 1.3. The display will scroll through messages continuously based on conditions and state change. The Operator isn't required to initiate any message change, or acknowledge a message, this display is merely for their information.

Axis Position   (Figure 1.4) is displayed below the *Operator Message Centre* and shows positional data from the feedback for each of the saw's axii, as well as the current velocity of the cross travel axis.
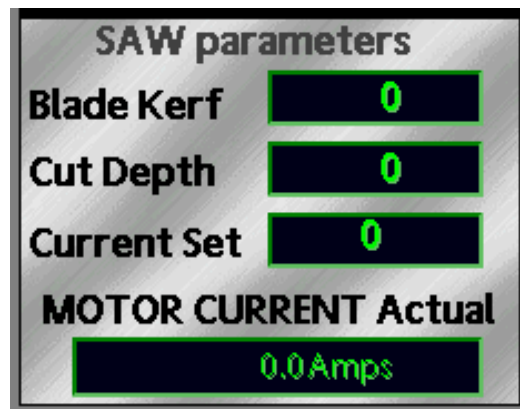
Figure 1.5: Main Screen Saw Information

1.2.3 Saw Information

Is an area where the Operator can see information about the Saw 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.

Figure 1.6: Main Screen Program Details

1.2.4   Program Details

The   display area will show the Operator details about the current step of the saw program. This will include such details as the current block being cut, or position moving to, 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 step being executed. If the Mode is Manual (Hand), and automatic operation has not been started/completed/interrupted, then it will display no block. Otherwise, the display will be the last step 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 1.7: Main Screen Operation Control and Machine Stop

1.2.5 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 1.8: 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 allignment 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 allignment with the existing cut location, the saw will finish the cut without incident due to misallignment. However, if the allignment 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*

Figure 1.9: Main Screen Machine Full Stop

will change the mode to *Hand*, even if a programmed cycle 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 and 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

2.1 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

2.2   Alarm Screen Details

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

  ⋄ **Screen Navigation**

  ⋄ **Recovery Option Popup Window**

  ⋄ **Alarm Acknowledge/Reset**

2.2.1   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 2.2: Alarm Screen Navigation

2.2.2 Alarm Recovery Popup Window

This window pops up if running in Automatic and an alarm condition occurs. It offers three choices to the Operator for recovery ...

⬦ **Continue**

⬦ **Skip Cut**

⬦ **Skip Block**

The *Alarm Recovery Popup Window* shown in Figure 2.3 will offer the Operator options on how to proceed from the alarmed condition back into running in automatic. If *Continue* is chosen, the Operator would then reset the alarm and restart the automatic cycle and the saw will continue from the current location. This option relies on the Operator assessment of the safety to the equipment if starting from that particular state. By choosing to *Skip Cut* the Operator is deciding to move onto the next cut location for the existing block being worked on by the program. This option will skip to the next cut location of the slab size being cut at the time of the faulted condition occurring. *Skip Block* by extension is used to skip the current block and begin the cycle at the next block first cut location. This offers options to the Operator on how they wish to recover based on the condition of the bed of material and the saw itself.
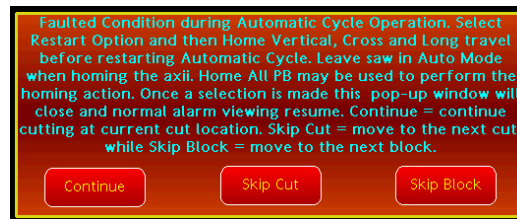
Figure 2.3: Alarm Recovery Popup Window

Figure 2.4: Alarm Acknowledge/Reset Pushbuttons

2.2.3   Alarm Messages and Acknowledge/Reset

The **_Alarm Reset_** pushbutton or the **_Alarm Acknowledge Button_** are how the Operator acknowledges a Fault to clear it. The Operator **must** acknowledge **all** Faults in order to clear them. Faults must be cleared before the Operator can change the Saw into *Auto Mode*. A number of faults clear whenever the faulted condition(s) are no longer present, these will remain until Acknowledged/Reset, but will change colour to reflect their state (to blue from red). If the fault is acknowledged but still active it will display in amber/yellow. Currently 100 fault lines can be displayed at one time.

i The details of the Fault which is causing the Alarm will be displayed in the **_Alarm Message Display Area_** of the window (which stretches from the buttons at the bottom of the screen to the title). The most recent fault is displayed first (at the top) and the least recent at the bottom. The *PREV* and *NEXT* buttons are used to scroll through the alarm messages. 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 by an Operator acknowledge(**Ack**) and reset(**RESET ALARM**) (see Figure 2.4) in order to be able to run an automatic cut program on the saw. The **_RESET ALARM_** PB is programmed as an FKey in this case. 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.

2.3 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 occurrance, 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 maintanence 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

3.1 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 accessable from the **Manual Screen**. This is described in detail below.

Figure 3.1: Manual Screen

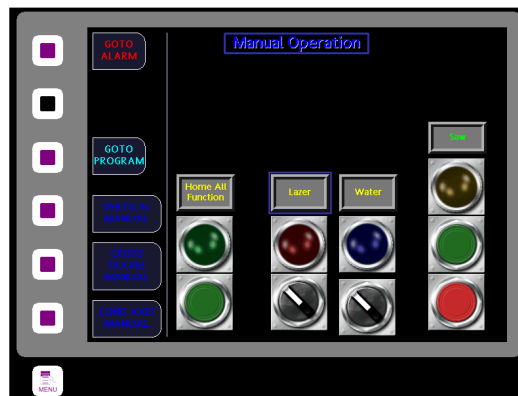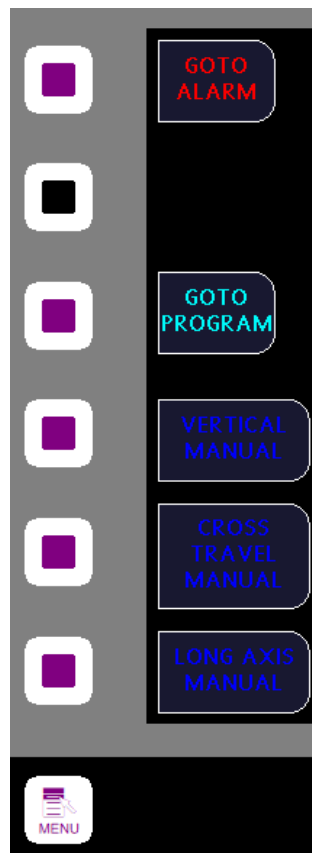Figure 3.2: Manual Screen Navigation

3.2   Manual Screen Details

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

⋄ **Screen Navigation**

⋄ **Home All**

⋄ **Lazer**

⋄ **Water**

⋄ **Saw**

3.2.1   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 Op-

erator 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 axii.

⬦- **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

3.2.2   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***.
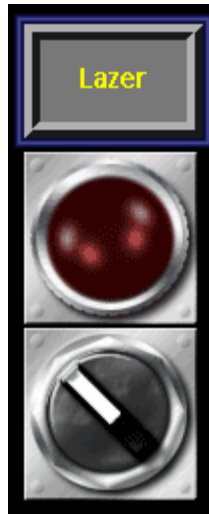
Figure 3.4: Manual Lazer Control

3.2.3   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

3.2.4 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

3.2.5   Saw

The   manual *Saw* control is made up of a **Start** pushbutton, a **Stop** push-button, 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. The exact point at which the **Indicator** comes on is determined by the saw motor Soft Start **Run** contact, and may not repesent full motor speed. 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 saw work area.

i The saw motor operation in *Auto* mode is done by the program control, not by direct Operator input. When the *Auto* cycle is started, the motor is turned on and after a time delay and run confirmation, the water is turned on. Once flow is established the Automatic Run State is entered.

Chapter 4

Vertical Manual Screen

4.1 Overview

The Vertical Manual screen (Figure 4.1) is the *Hand* mode operation screen for control of the **Vertical** axis of the saw. On this screen are the controls to move the **Vertical** axis through it's travel limits as well as **Home** the axis. There is also an **Indicator** for **Home** position indication, and a display area for position feedback of the axis. The **Vertical Manual** screen is a sub-screen of the main **Manual** screen. As this is the case navigation is capable back to the main **Manual** screen, the **Cut Program** screen, and both the **Cross Travel** and **Long** manual screens. As always, the **Menu** FKey will return the Operator to the **Main** screen.
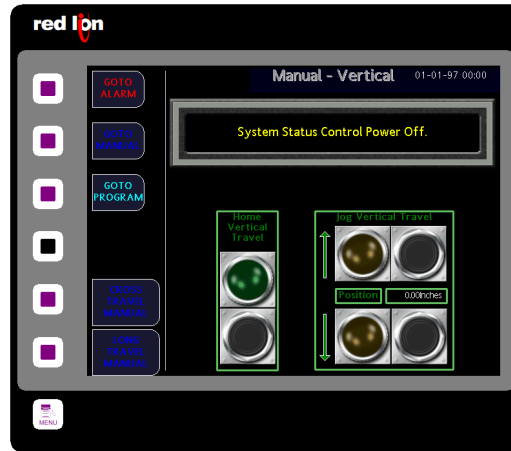
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Figure 4.1: Vertical Manual Screen

4.2   Details

The   Vertical Manual screen details are divided into the following categories ...

 ⋄ **Screen Navigation**

 ⋄ **Vertical Home**

 ⋄ **Vertical Travel**

4.2.1   Screen Navigation

Is   performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 4.2). The Operator may navigate to the following screens ...

 ⋄ **GOTO Alarm** Navigate to Alarm Screen.

 ⋄ **GOTO MANUAL** Navigate to Manual Screen.

 ⋄ **GOTO PROGRAM** Navigate to Cut Program Screen.

 ⋄ **CROSS TRAVEL MANUAL** Navigate to Cross Travel Manual Control Screen.

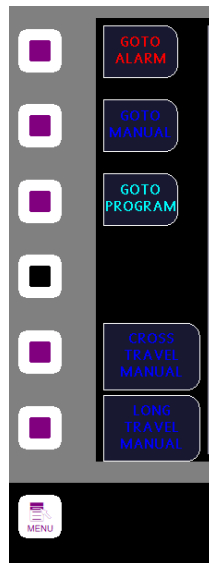 ⋄ **LONG AXIS MANUAL** Navigate to the Long Axis Manual Control Screen.

Figure 4.2: Vertical Manual Screen Navigation

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.

4.2.2 Vertical Home

Home Function is the stand alone homing routine for the **Vertical** axis. There is a **Control** pushbutton to initiate the homing function and an **Indicator** pilot light to indicate when the **Vertical** axis is in the **Home** position and has completed a homing function. On the saw the **Vertical** axis has it's **Home** position at the raised travel limit sensor. In fact the raised travel limit proximity sensor is the **Home** proximity sensor. A homing function will cause the axis to move in either direction depending upon the state of the **Home** sensor. If the **Home** sensor is off, the **Home** function will command the **Vertical** axis to raise up to the point the sensor comes on. The axis will then stop, reverse back off of the sensor, then creep back up until the sensor triggers again. By homing in this fashion, the repeatability of the **Vertical** axis is more consistent than homing until the sensor is triggered then stopping would be.
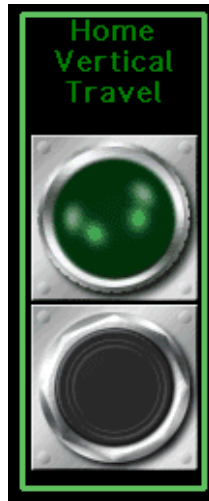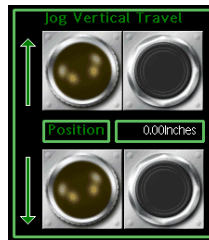
Figure 4.3: Vertical Manual Home Function

Figure 4.4: Vertical Manual Travel

4.2.3   Vertical Travel

Figure 4.4 shows the **Vertical Travel** function. The function is made up of a pushbutton to command **Vertical Travel Raise** with a corresponding **Indicator** pilot light that indicates motion commanded but not complete. There is also a corresponding **Vertical Travel Lower** pushbutton and **Indicator**. Finally, there is a position feedback display area which shows the current axis position in inches. This function is available in *Hand* mode and is intended for use by the Operator during Machine Setup and Maintenance activities.

i The position feedback should be considered invalid if the axis has not been homed yet, since the position encoder is an incremental encoder and does not retain position information on a power cycle. Therefore it is required to reference the axis feedback to zero on successful homing completion, in order to ensure positional accuracy and repeatability.

Chapter 5

Cross Travel Manual Screen

5.1   Overview

The   Cross Travel manual screen (Figure 5.1) provides the Operator access to control the **Cross Travel** axis while in *Hand* mode. The Operator is able to initiate a homing function, and there are indicators for **At Home**, plus while in motion. Navigation is possible to the main **Manual** screen, the **Cut Program** screen, both the **Vertical** and **Long Axis** manual screens, and of course the **Main** operation screen.

5.2   Details

The   Cross Travel Manual screen details are divided into the following categories ...

♦ **Screen Navigation**

♦ **Cross Travel Home**

♦ **Cross Travel Control**

5.2.1   Screen Navigation

Is   performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 5.2). The Operator may navigate to the following screens ...
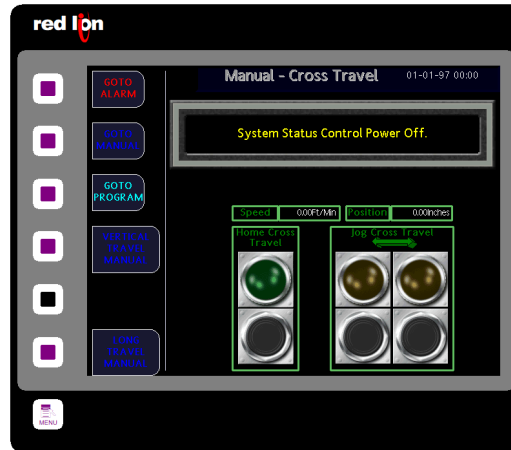
♦ **GOTO Alarm** Navigate to Alarm Screen.

Figure 5.1: Cross Travel Manual Screen
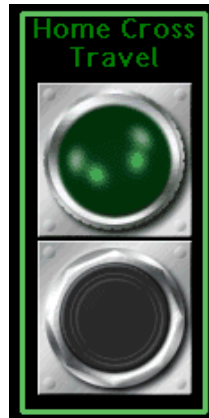

Figure 5.2: Cross Travel Manual Screen Navigation

Figure 5.3: Cross Travel Manual Home Function

⋄ **GOTO MANUAL** Navigate to Manual Screen.

⋄ **GOTO PROGRAM** Navigate to Cut Program Screen.

⋄ **VERTICAL MANUAL** Navigate to Vertical 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.

5.2.2 Cross Travel Home

Home Function is the stand alone homing routine for the **Cross Travel** axis. There is a **Control** pushbutton to initiate the homing function and an **Indicator** pilot light to indicate when the **Cross Travel** axis is in the **Home** position and has completed a homing function. On the saw the **Cross Travel** axis has it's **Home** position at the travel limit sensor closest to the Control Panel. A homing function will cause the axis to move in either direction depending upon the state of the **Home** sensor. If the **Home** sensor is off, the **Home** function will command the **Cross Travel** axis to move towards the operator up to the point the (home) sensor comes on.
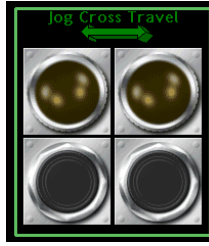
Figure 5.4: Cross Travel Manual Command

Figure 5.5: Cross Travel Manual Feedback

5.2.3   Cross Travel Positioning

Figure 5.4 shows the **Cross Travel Command** function. The function is made up of a pushbutton to command **Cross Travel Forward** with a corresponding **Indicator** pilot light that indicates motion commanded but not complete. There is also a related **Cross Travel Reverse** pushbutton and **Indicator**. Finally, there is a position feedback display area which shows the current axis position in inches and it's velocity in feet per minute. This function is available in *Hand* mode and is intended for use by the Operator during Machine Setup and Maintenance activities.

i The position feedback should be considered invalid if the axis has not been homed yet, since the position encoder is an incremental encoder and does not retain position information on a power cycle. Therefore it is required to reference the axis feedback to zero on successful homing completion, in order to ensure positional accuracy and repeatability.

Chapter 6

Long Travel Manual Screen

6.1   Overview

The   Long Travel manual screen (Figure 6.1) provides the Operator access to control the **Long Travel** axis while in *Hand* mode. The Operator is able to initiate a homing function or move to limit, and there are indicators for **At Home** and **At Limit**, plus for while in motion. Navigation is possible to the main **Manual** screen, the **Cut Program** screen, both the **Vertical Axis** and **Cross Travel Axis** manual screens, and of course the **Main** operation screen.

6.2   Details

The   Long Travel Manual screen details are divided into the following categories ...

⋄ **Screen Navigation**

⋄ **Long Travel Home and To Limit**

⋄ **Long Travel Control**
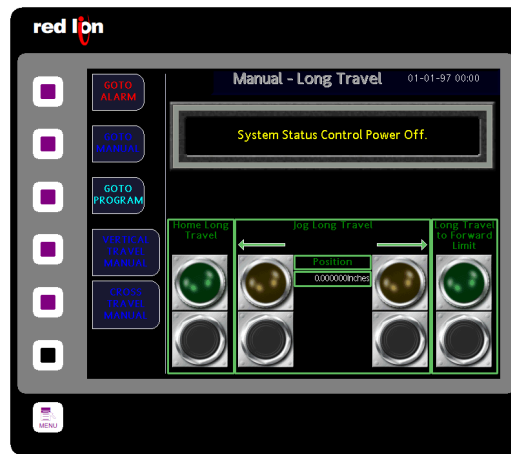
Figure 6.1: Long Travel Manual Screen

6.2.1   Screen Navigation

Is   performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 6.2). The Operator may navigate to the following screens ...

⋄ **GOTO ALARM** Navigate to Alarm Screen.

⋄ **GOTO MANUAL** Navigate to Manual Screen.

⋄ **GOTO PROGRAM** Navigate to Cut Program Screen.

⋄ **VERTICAL MANUAL** Navigate to Vertical 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.
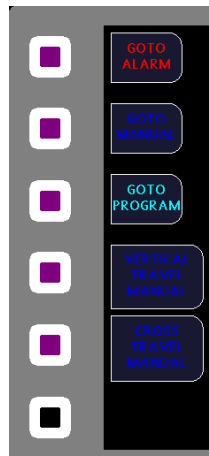
Figure 6.2: Long Travel Manual Screen Navigation

6.2.2 Long Travel Home and To Limit

Home and To Limit Functions are the stand alone homing and move to limit routines for the **Long Travel** axis. There is a **Control** pushbutton to initiate the homing/to limit function and an **Indicator** pilot light to indicate when the **Long Travel** axis is in the **Home/Limit** position and has completed a homing/move to limit function. On the saw the **Long Travel** axis has it's **Home** position at the travel limit sensor target furthest to the left when facing the Control Panel. A homing function will initiate a homing program in the master drive of the axis to home the axis. While a move to limit function will move the Long axis towards it's forward limit target.

Figure 6.3: Long Travel Manual Home Function

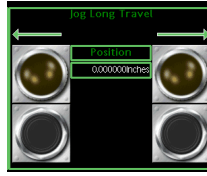Figure 6.4: Long Travel Manual To Limit Function

Figure 6.5: Cross Travel Manual Command

6.2.3 Long Travel Positioning

Figure 5.4 shows the **Long Travel Command** function. The function is made up of a pushbutton to command **Long Travel Forward** with a corresponding **Indicator** pilot light that indicates motion commanded but not complete. There is also a related **Long Travel Reverse** pushbutton and **Indicator**. Finally, there is a position feedback display area which shows the current axis position in inches. This function is available in *Hand* mode and is intended for use by the Operator during Machine Setup and Maintenance activities. This function uses inputs to the Master Drive of the axis to jog in either direction according to the parameters programmed into the drive for jogging.

i The position feedback should be considered invalid if the axis has not been homed yet. A Home command must be initiated in order to ensure positional accuracy and repeatability.

Chapter 7

Programming - Saw Parameters Screen

7.1 Overview

The **Programming - Saw Parameters** screen (Figure 7.1) provides the Operator programming access to the **Saw Operation Parameters** used while in *Auto* mode. The Operator is able to make immediately initiated changes to the *Cut Depth* the *Blade Kerf* and the *Motor Current Target*. Navigation is possible to the main **Manual** screen, the **Block Program** screen, both the **Vertical Axis** and **Cross Travel Axis** manual screens, and of course the **Main** operation screen.

7.2 Details

The **Saw Parameters** screen details are divided into the following categories ...
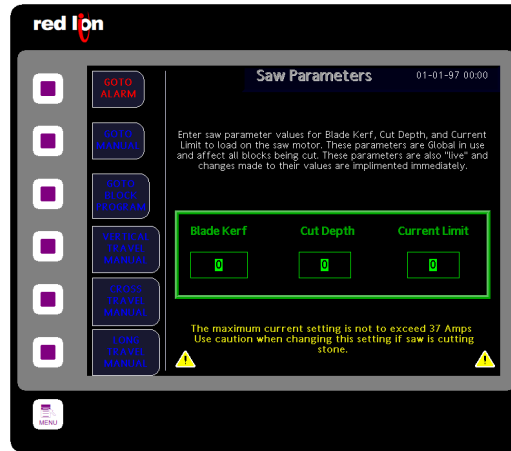
⋄ **Screen Navigation**

⋄ **Parameters**

Figure 7.1: Programming - Saw Parameters Screen

7.2.1 Screen Navigation

Is performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 7.2). The Operator may navigate to the following screens ...

- ◇ **GOTO Alarm** Navigate to Alarm Screen.

- ◇ **GOTO MANUAL** Navigate to Main Manual Screen.

- ◇ **GOTO BLOCK PROGRAM** Navigate to Block Program Screen.

- ◇ **VERTICAL MANUAL** Navigate to Vertical 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.
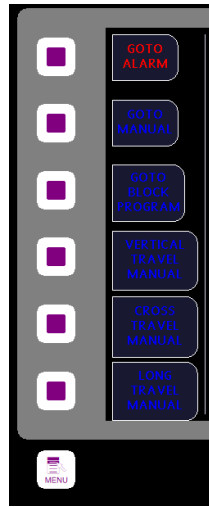
Figure 7.2: Saw Parameter Screen Navigation

Figure 7.3: Saw Parameter Entry Fields

7.2.2   Saw Parameters

Parameters   are "live" settings that take affect immediately after changing them. The Operator should exercise caution when changing them while running automatically. The ***Blade Kerf*** can be set to an accuracy of one thousandths of an inch by the Operator. The ***Target Current*** while cutting can be set within the stated limits specified on screen. Down to a tenth of an ampere in resolution. The ***Cut Depth*** can be set to any amount depending on Operator requirements, even decimal inches.

i   The Operator should exercise caution when changing these parameters while running in auto mode. The change will be applied immediately. It is especially important when adjusting cut depth, not to make too aggressive of a drop amount.

Chapter 8

Programming - Block Program

8.1 Overview

The **Programming - Block Program** screen (Figure 8.1) provides the Operator programming access to the **Block Program Details** used while in *Auto* mode. The Operator is able to create and edit block programs. Navigation is possible to the main **Alarm** screen, the **Saw Parameters** screen, the **Check Program** screen,the **Vertical Axis** and **Cross Travel Axis** and **Long Travel Axis** manual screens, and of course the **Main** operation screen.

8.2 Details

The **Block Program** screen details are divided into the following categories ...

    ◇ **Screen Navigation**

    ◇ **Block Details**
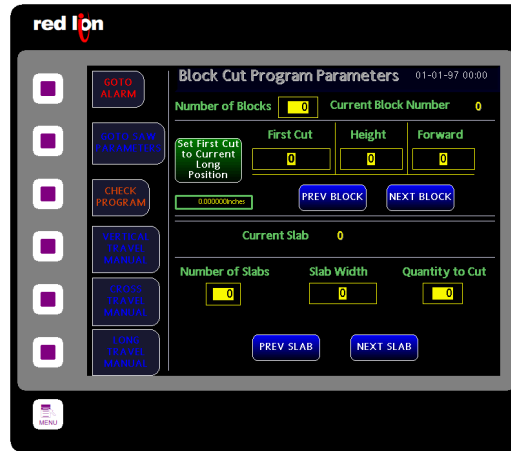
    ◇ **Slab Details**

Figure 8.1: Programming - Block Program

8.2.1 Screen Navigation

Is performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 5.2). The Operator may navigate to the following screens ...

◇ **GOTO ALARM** Navigate to Alarm Screen.

◇ **GOTO SAW PARAMETERS** Navigate to Saw Parameter Screen.

◇ **CHECK PROGRAM** Navigate to Block Program Check Screen.

◇ **VERTICAL MANUAL** Navigate to Vertical 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.

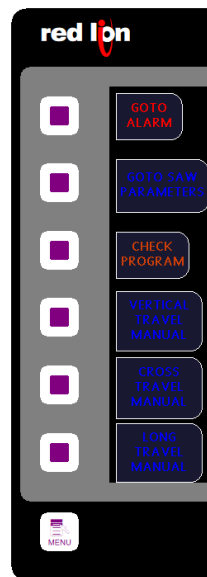**i** The Menu Key is pictured as it looks on the Terminal.

Figure 8.2: Block Program Screen Navigation

8.2.2 Block Details

Blocks   are the actual stone blocks as laid out on the cutting floor by the
Operator. The details about the block that are used in the program are shown
in Figure 8.3. The **Number of Blocks** is set by the Operator according to
the actual block count on the cutting bed. The **Current Block Number**
indicates to the Operator which block they are actively programming, it is
not settable. The PushButton **Set First Cut to Current Long Position**
will set the First Cut for the active block to the actual Long Axis Position
(displayed below the button). Of course, the Operator could just enter a
desired **First Cut** in the entry field provided. The **Block Height** must
be entered by the Operator, this determines where the depth of the first cut
for the block ends up as a result of the equation *Block Height - Cut Depth.*
The **Forward Position** for Cross Travel is entered by the Operator, to tell
the saw when the blade is out of rock. Since the Cross Travel will drift a
fair amount when stopping, this should be treated as the minimum distance
desired to ensure the blade has left the rock safely. The **PREV BLOCK**
and **NEXT BLOCK** buttons are used to scroll through the blocks to be
programmed. They are only active if there is a next or previous block to
view. If a block is desired to be cut with only a *First Cut* and no slabs, then
the Operator would need to ensure that there is a zero (0) in the **Number
of Slabs** entry field of the Slab Details (Section 8.2.3).

Figure 8.3: Block Details Entry Fields

i The Operator should use the Check Program pages to review the *Block Program* that was entered in a table form which shows details about each block and slab. Also, it is strongly advised to reset both the block program and the automatic sequence before entering a new block program. This can be done on the first **CHECK PROGRAM** screen.

! 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. The Block Height is a critical dimension, if not correct, it can result in damage to the saw blade.

Figure 8.4: Slab Details Entry Fields

8.2.3 Slab Details

Slabs   are the actual slabs to cut from the blocks as laid out on the cutting floor by the Operator. The details about the slabs that are used in the program are shown in Figure 8.4. The **Number of Slabs** is set by the Operator according to the actual slab count of different sizes that are being cut from the active block. The **Cut Width** entry field is where the Operator sets the width of the slab or slab size. The **Quantity to Cut** is where the Operator enters the number of slabs of that particular size to cut from the selected block. The **PREV SLAB** and **NEXT SLAB** buttons are used to scroll through the slabs to be programmed for the active block. They are only active if there is a next or previous slab to view.

i The Operator should use the Check Program pages to review the *Block Program* that was entered in a table form which shows details about each block and slab. Also, it is strongly advised to **reset** both the block program and the automatic sequence **before** entering a new block program. This can be done on the first **CHECK PROGRAM** screen.

Chapter 9

Programming - Check Program

9.1   Overview

The Programming -   Check Program screen 1 (Figure 9.1) provides
the Operator a table view of the **Block Program Details** they entered
to be used while in *Auto* mode. The Operator is able to ***Clear Program
Contents*** and ***Reset Auto Sequence*** from this screen. Navigation is
possible to the main **Alarm** screen, the **PREV** screen (Block Program), the
NEXT screen (next Check Program), and of course the **Main** operation
screen.

9.2   Details

The   Check Program screen details are divided into the following cate-
gories ...

   ◇ **Screen Navigation**

   ◇ **Block Details**

   ◇ **Cycle Reset and Program Clear**
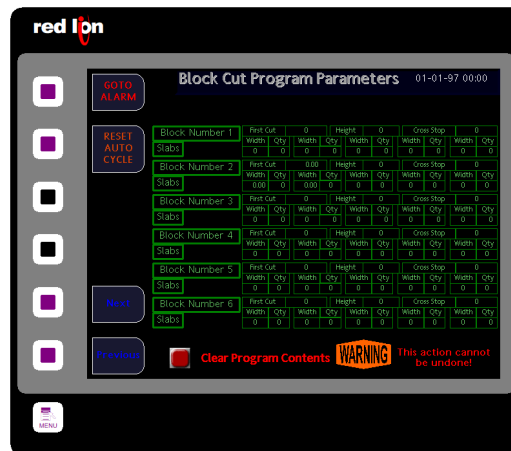
Figure 9.1: Programming - Check Program

9.2.1   Screen Navigation

Is   performed by using the programmable Function Keys (FKeys) located down the left hand side of the OI Terminal (refer to Figure 9.2). Since this screen, and subsequent **CHECK PROGRAM** screens are sub-screens of the **BLOCK PROGRAM** screen, except for navigating to the **ALARM** screen, navigation is from *current screen* to *next or previous screens.*The Operator may navigate to the following screens ...

⋄ **GOTO ALARM** Navigate to Alarm Screen.

⋄ **NEXT** Navigate to next Check Program Screen.

⋄ **PREV** Navigate to Block Program Screen, or if on Check Program Screen num 2 or higher, return to previous Check 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.

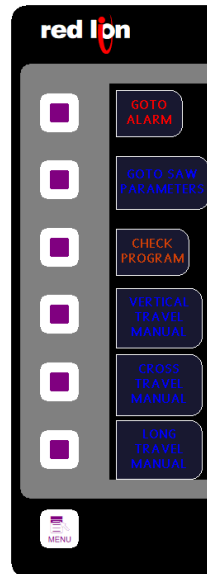**i**   The Menu Key is pictured as it looks on the Terminal.

Figure 9.2: Block Program Screen Navigation

9.2.2 Block Details

Blocks as programmed,are shown in a table form (Figure 9.3).If a block has been programmed (based on the ***Number of Blocks***) it will be displayed, even if the details haven't been fully entered in the Block Program screen yet. The same applies to the slabs associated with that block. There is the ability to view up to six (6) blocks per ***CHECK PROGRAM*** screen, and up to 5 different slab sizes per block. This allows viewing of up to 24 Blocks and up to 120 Slabs. In practical terms, it will likely never be used fully. The tabular form of the display of the block details, is similar in design to the paper forms currently used for machine setup details by the Operator. This should help when the Operator is reviewing the program details they entered for correctness, prior to running an automatic cycle using the programmed block data.

i The Check Program pages are a useful tool to review the *Block Program* that was entered in a table form which shows details about each block and slab. Also, it is **strongly advised** to **reset both** the *block program* **and** *the automatic sequence* **before** entering a new block program. This can be done on this ***CHECK PROGRAM*** screen.

Block Number 1	First Cut	0		Height	0		Cross Stop	0		
	Width	Qty	Width	Qty	Width	Qty	Width	Qty	Width	Qty
Slabs	0	0	0	0	0	0	0	0	0	0
Block Number 2	First Cut	0.00		Height	0		Cross Stop	0		
	Width	Qty	Width	Qty	Width	Qty	Width	Qty	Width	Qty
Slabs	0.00	0	0.00	0	0	0	0	0	0	0
Block Number 3	First Cut	0		Height	0		Cross Stop	0		
	Width	Qty	Width	Qty	Width	Qty	Width	Qty	Width	Qty
Slabs	0	0	0	0	0	0	0	0	0	0
Block Number 4	First Cut	0		Height	0		Cross Stop	0		
	Width	Qty	Width	Qty	Width	Qty	Width	Qty	Width	Qty
Slabs	0	0	0	0	0	0	0	0	0	0
Block Number 5	First Cut	0		Height	0		Cross Stop	0		
	Width	Qty	Width	Qty	Width	Qty	Width	Qty	Width	Qty
Slabs	0	0	0	0	0	0	0	0	0	0
Block Number 6	First Cut	0		Height	0		Cross Stop	0		
	Width	Qty	Width	Qty	Width	Qty	Width	Qty	Width	Qty
Slabs	0	0	0	0	0	0	0	0	0	0

Figure 9.3: Block Details Check Program

RESET AUTO CYCLE

Figure 9.4: Check Program - Auto Cycle Reset Button

! 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. The Block Height is a critical dimension, if not correct, it can result in damage to the saw blade.

9.2.3 Cycle Reset and Program Clear

RESET AUTO CYCLE PB is for the Operator to be able to reset the Automatic Sequence of Saw operation. This reset's control bit's that are used in tracking block completion, slab completion, and other intermediate operational data. This action should be performed even before entering a new block cutting program. By performing this operation, the Operator is ensuring the Saw is ready for a new program sequence to be run correctly.

PROGRAM CLEAR is for the Operator to clear out the Block Program Block and Slab data areas in the PLC (Controller). This wipes all data related to the Block Cutting Program that was currently in the Controller, reverting values to zero.

Clear Program Contents WARNING This action cannot be undone!

Figure 9.5: Check Program - Clear Program Contents Button

i The Operator will be prompted by an accept or cancel popup, to either accept clearing the program, or resetting the sequence, or cancel the operation. This is an immediate action and cannot be undone.