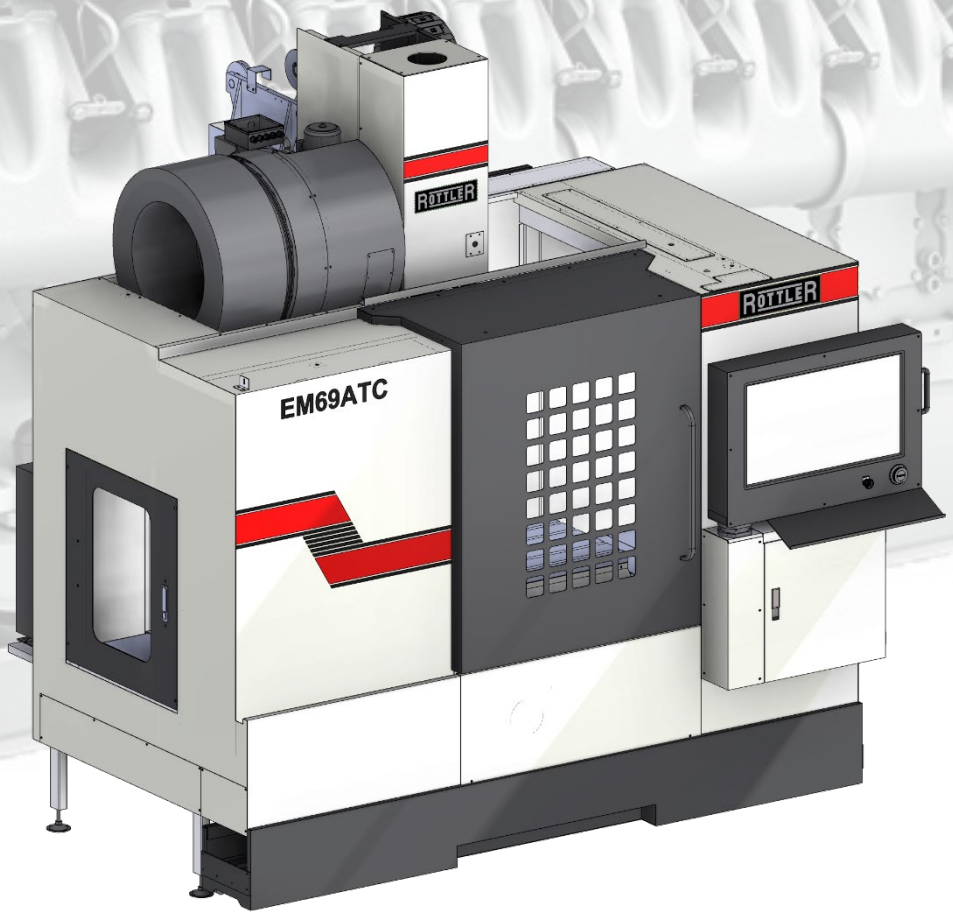
EM69ATC CNC MACHINING CENTER

MACHINE OPERATIONS MANUAL



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Rev 051622

PARTS ORDERING

For optional equipment catalogs, please visit https://www.rottlermfg.com/documentation.php

For fastest service ordering parts or equipment, contact us via e-mail with the information below. For customers within the U.S., send emails to parts@rottlermfg.com, for customers outside of the U.S., use intlparts@rottlermfg.com

Have the following information on hand to expedite the ordering process:

1. Your name, business name, and contact number
2. Customer number, or your billing address if you do not have a customer number
3. Shipping address if different from the billing address
4. Machine model and serial number
5. Part number and description of the item(s) to order
6. Preferred method of shipment

For customers outside of the U.S. requiring faster service, contact your local distributor.

In some cases, you may be requested to send a photo of the part you are ordering if it is a replacement part or does not appear in our database.

If you are unsure which part you need to order, contact our service department, and ask to speak to one of our service consultants. They will assist you in determining which part(s) you require.

THERE IS A MINIMUM ORDER OF $25.00

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INTRODUCTION

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Introduction

READ THE SAFETY CHAPTER BEFORE INSTALLING MACHINE. THOROUGHLY UNDERSTAND ALL SAFETY ISSUES BEFORE OPERATING MACHINE.

ATTENTION OWNER/BUSINESS MANAGER

To validate the warranty on your new Rottler machine, please be sure to sign and complete the "Installation Report" located in the Installation Chapter of this manual.

We suggest that the new user of the EM69ATC read the CONTROL DEFINITIONS to get an idea how the machine operates.

The Operating Instructions chapter should be read in order to familiarize the user with the actual button pushing sequences required to carry out a job. These chapters in the manual should be considered an introduction. As the operators of the EM69ATC series machines gain experience with using the different functions of the machine, complicated setups and programs will make more sense.

The rest of the manual contains information and part number reference on fixtures, cutting tools, and machine maintenance. The operator should read and become familiar with these areas as well.

Description

The model EM69ATC machine is a precision, single point boring, and high-speed surfacing unit. The machine can be equipped with tooling and accessories for surfacing and re-boring most American passenger car and truck engines, In-lines, as well as 90 and 60 degree V-types.

F60 machines can be easily tooled, to machine a wide range of engines, including European and Asian engines, also, the machine can be easily adapted to perform other boring and surfacing operations.

The machine is designed, to maintain alignment of cylinder bores, and cylinder head, deck surfaces to the pan rails and main bearing bore locations, as was done in the original factory machining. This overcomes the many inaccuracies and out-of-alignment problems associated with clamping portable boring bars to the cylinder head surface of blocks.

Convenient controls, fast block clamping, precise 3 axis CNC positioning and clamping, means considerable savings in floor to floor time, and operator involvement.

Change over or resetting time required to set up V-type or in-line engines is a minimum, making this machine highly suited to the jobber shop where engines cannot be run through in model lots.

All feeds and rapid travels are power operated and controlled form the control panel.

Disclaimer

The EM69ATC Manual (henceforth to be referred to as the “Manual”) is proprietary to Rottler Manufacturing LLC. (“Rottler Manufacturing”) and no ownership rights are hereby transferred. No part of the Manual shall be used, reproduced, translated, converted, adapted, stored in a retrieval system, communicated or transmitted by any means, for any commercial purpose, including without limitation, sale, resale, license, rental or lease, without the prior express written consent of Rottler Manufacturing.

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Limited Warranty

Rottler Manufacturing Company Model EM69ATC parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of installation or two years from the date of the original shipment from Rottler or whichever date occurs first. This only applies is the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual. A machine is warranted only if the Installation Report has been properly executed by a certified installation person and received by Rottler at the time of actual installation.

The products are warranted upon delivery to conform to their published specifications and to be free from defects in material and workmanship under normal use for a period of one year from shipment. Should a product not be as warranted, Rottler sole obligation shall be, at its option, to repair, correct or replace the product or to refund the amounts paid for the Product upon its return to a location designated by Rottler. No warranty shall extend to rapid wear Products (including tooling) or to Products which have been subject to misuse (including any use contrary to Rottler instructions), neglect, accident (including during shipment), improper handling or installation, or subject to any modification, repair or service not certified by Rottler. Rottler shall not be liable for any consequential, direct or indirect damages or for any other injury or loss. Buyer waives any right, beyond the foregoing warranty, to make a claim against Rottler. No warranty is provided for any Products not paid in full.

Merchandise cannot be returned to Rottler without prior approval. Customer must contact the Parts Department to get approval and to be issued a Return Goods Authorization number **(RGR#).** Merchandise authorized for return must be returned prepaid. If merchandise is returned with shipping charges collect, the actual amount of these charges may be deducted from any credit which may be due the customer. The **RGR #** assigned by the Parts Department should be written on the shipping label and must appear on a copy of the invoice(s) covering the original shipment. This invoice copy must be included in the box with the parts. Shipment must contain ONLY those items on the **RGR** as approved for return. Merchandise must be received within 10 days of the date of **RGR** or the **RGR** will be canceled. All returned merchandise may be subject to a 20% restocking fee on under $1,000.00 amount or 10% on any items over $1,000.00. Parts or tooling over 30 days old are considered as customer property and can only be returned with prior approval from Rottler Corporation Management.

The issuance of a **RGR DOES NOT** guarantee credit - it is only authorization for the return of the goods. Credit for return merchandise is at the sole discretion of Rottler. Credit will be issued only after inspection of returned goods.

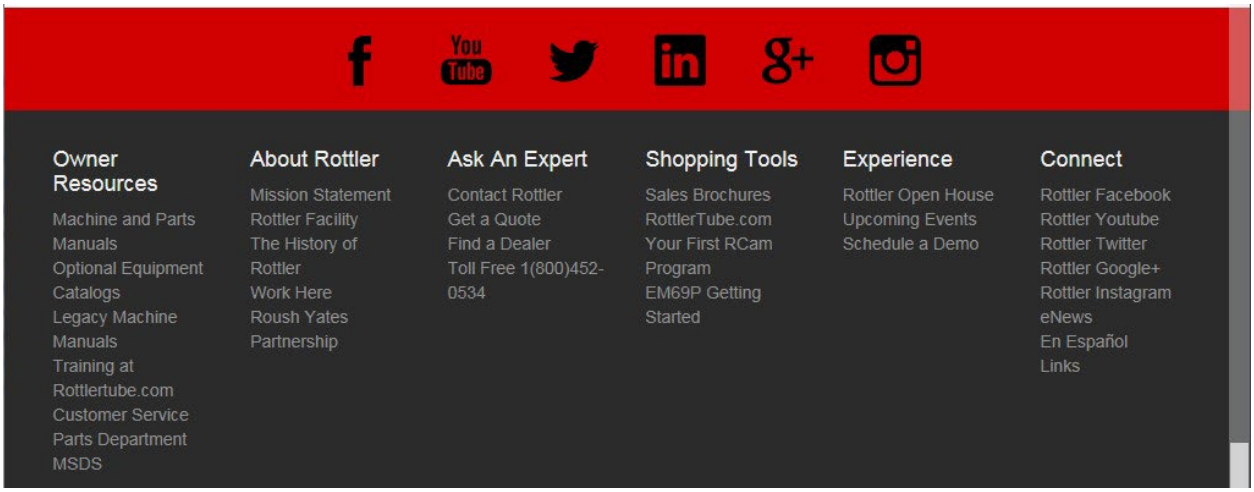
Tools proven to be defective within the warranty period will be repaired or replaced at the factory's option.

We accept no responsibility for defects caused by external damage, wear, abuse, or misuse, nor do we accept any obligation to provide compensation for direct or indirect costs in connection with cases covered by the warranty.

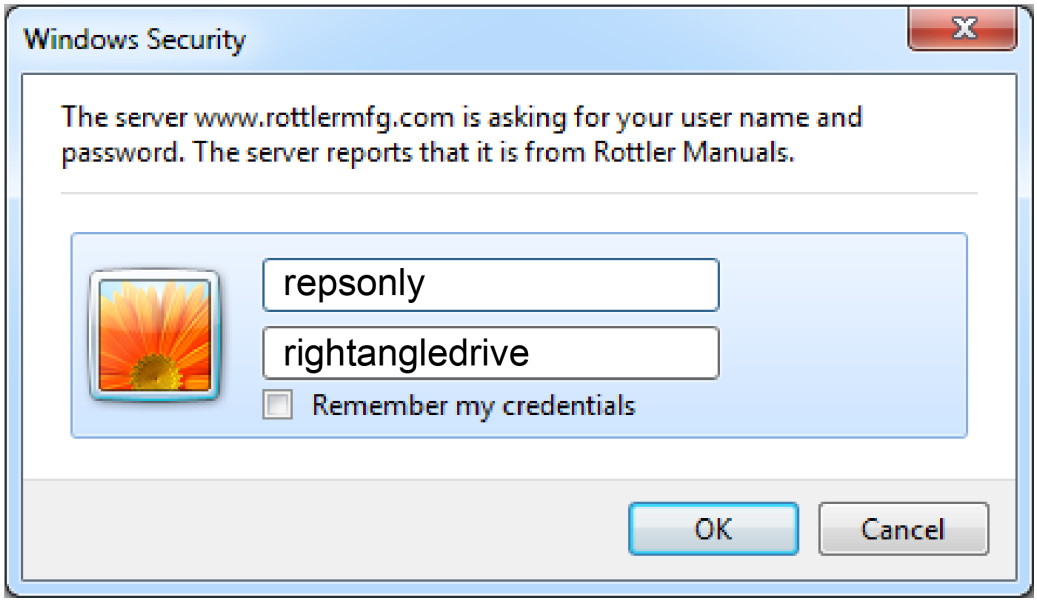
Online Documentation Access

Online documentation for machines and optional equipment can be accessed at the Rottler website. To access documentation open your browser and navigate to https://www.rottlermfg.com.

Scroll to the bottom of the page and under the Owner Resources title click the type of documentation you want to access.



If a log in window pops up asking for user name and password fill in the blanks as shown.



SAFETY

Contents

Safety Information

For Your Own Safety Read This Instruction Manual Before Operating This Machine.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Safety Instructions for Machine Use WARNING This machine is capable of causing severe bodily injury

ONLY A QUALIFIED, EXPERIENCED OPERATOR SHOULD OPERATE THIS MACHINE. NEVER ALLOW UNSUPERVISED OR UNTRAINED PERSONNEL TO OPERATE THE MACHINE. Make sure any instructions you give in regards to machine operation are approved, correct, safe, and clearly understood. Untrained personal present a hazard to themselves and the machine. Improper operation will void the warranty.

KEEP GUARDS IN PLACE and in proper working order. If equipped with doors, they must be in the closed position when the machine is in operation.

KEEP WORK AREA CLEAN. Cluttered areas and benches invite accidents.

KEEP CHILDREN AND VISITORS AWAY. All children and visitors should be kept a safe distance from work area.

WEAR THE PROPER APPAREL. DO NOT wear loose clothing, gloves, rings, bracelets, or other jewelry which may get caught in moving parts. Non-Slip foot wear is recommended. Wear protective hair covering to contain long hair.

ALWAYS USE SAFETY GLASSES. Also use face or dust mask if cutting operation is dusty. Everyday eye glasses only have impact resistant lenses, they are NOT safety glasses.

DO NOT OVER-REACH. Keep proper footing and balance at all times.

USE THE RECOMMENDED ACCESSORIES. Consult the manual for recommended accessories. The use of improper accessories may cause risk of injury.

CHECK DAMAGED PARTS. Before further use of the machine, a guard or other part that is damaged should be checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, breakage of parts, mounting, and other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

NEVER OPERATE A MACHINE WHEN TIRED, OR UNDER THE INFLUENCE OF DRUGS OR ALCOHOL.
Full mental alertness is required at all times when running a machine.

IF AT ANY TIME YOU ARE EXPERIENCING DIFFICULTIES performing the intended operation, stop using the machine! Then contact our service department or ask a qualified expert how the operation should be performed.

DO NOT MODIFY OR ALTER THIS EQUIPMENT in any way. If modifications are deemed necessary, all such requests must be approved and/or handled by Rottler Manufacturing. Unauthorized modifications could cause injury and/or damage to machine and will void the warranty.

SAFETY DECALS SHOULD NEVER BE REMOVED. They are there to convey important safety information and warn of potential hazards.

ALL LOCAL SAFETY CODES AND REGULATIONS should be followed when installing this machine.

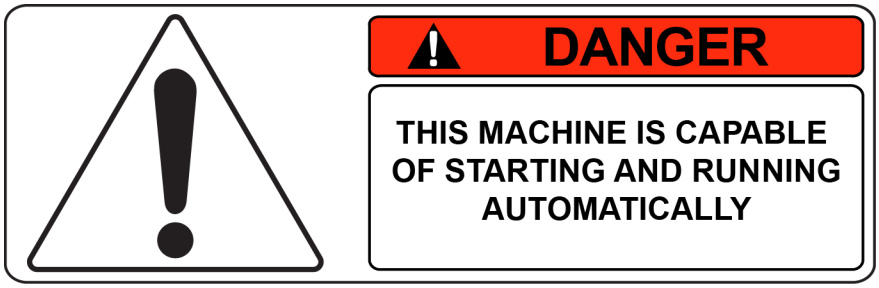
ONLY QUALIFIED PERSONAL should perform service on the electrical and control systems.

When boring the machine is capable of throwing metal chips over 10- feet from the cutting area. Always use the guards. Eye protection must be worn at all times by the operator and all other personnel in the area of the machine.

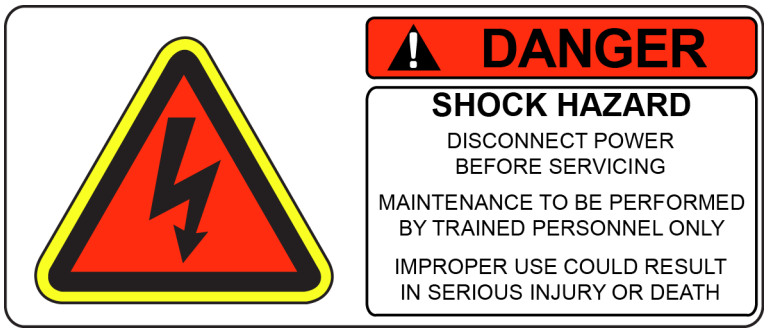
⚠ CAUTION No list of safety guidelines can be complete. Every piece of shop environment is different. Always consider safety first, as it applies to your individual working conditions. Use this and other machinery with caution and respect. Failure to follow guidelines could result in serious personal injury, damage to equipment or poor work results.

Electrical Power

THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANYTIME

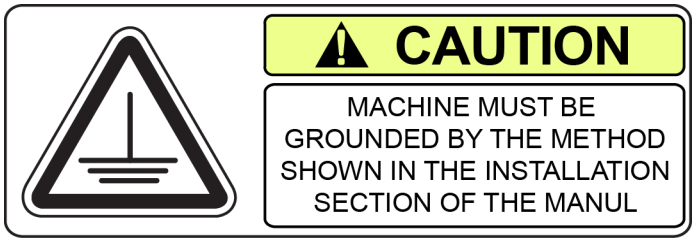


All electrical power should be removed from the machine before opening the rear electrical enclosure.



In the event of an electrical short, grounding reduces the risk of electric shock by providing a path of least resistance to disperse electric current.

Electrocution or a fire can result if the machine is not grounded correctly. Make sure the ground is connected in accordance with this manual. DO NOT operate the machine if it is not grounded.



⚠ CAUTION No single list of electrical guidelines can be comprehensive for all shop environments. Operating this machinery may require additional electrical upgrades specific to your shop environment. It is your responsibility to make sure your electrical system comply with all local codes and ordinances.

⚠ WARNING This machine operates under computerized control and, as is all computerized equipment, and is susceptible to extraneous electrical impulses internally for externally produced. The machine may make moves out of the operator control at any time. The operator should work in and around the machine with caution at all times.

The operator and nearby personnel should be familiar with the location and operation of the Emergency Stop Button.

Make sure all electrical equipment has the proper overload protection. This machine should have ***a fully isolated*** power supply to prevent damage and uncontrolled movement of the machine. If this machine is on the same power lines that are running to other electrical equipment (grinders, welders, and other AC motors) electrical noise can be induced into this machines electrical system. Electrical noise can cause the controller to see false signals to move. Not supplying a fully isolated supply to the machine may void factory warranty. Refer to the Power supply section located in the Installation section for voltage and amperage requirements of this machine.

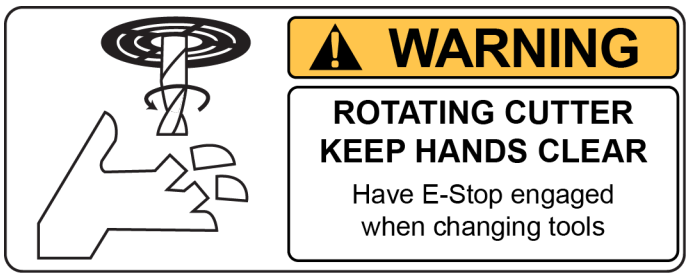
Machine Operator:

The operator of this machine should be a skilled machinist craftsman who is well versed in the caution, care, and knowledge required to safely operate metal cutting tools.

If the operator is not a skilled machinist he/she must pay strict attention to the Operating Instructions outlined in this manual, and get instruction from a qualified machinist in both production and operation of this machine.

This machine has the following areas of exposed moving parts that you must train yourself to respect and stay away from when they are in motion:

Cutting Tool Area – Any operation involving hands in the cutter head area, such as inspection or alignment of the cutter head or tools, changing Centering Fingers, tool insertion, and removal, cutter head changes, and size checking etc. requires the machine to be in Neutral.



Machining – Eye protection must be worn during all operations of the machine. Hands must be kept completely away from the cutter head. All chip guards must be in position during machine operations.

CAUTION **Work Loading and Unloading** – Carefully develop handling methods of loading and unloading work pieces so that no injury can result if hoist equipment or lift connection should fail. Periodically check lift components for damage that may cause failure.

CAUTION **Machine Maintenance** – Any machine adjustment, maintenance or parts replacement absolutely requires a complete power disconnection from the machine.

Emergency Procedure:

Assuming one of the following has occurred: tool bit set completely off size, work piece or spindle base not clamped, spindle is not properly centered, and these mistakes will become obvious the minute the cut starts

PRESS THE EMERGENCY STOP BUTTON (on the front control panel) **IMMEDIATELY!**

Find out what the problem is; return the spindle to its up position without causing more damage. To restart the machine, turn the Emergency Stop Button CW until the button pops out

Be alert to quickly stop the machine in the event of a serious disruption of the boring process either at the top or bottom of the bores.

"**REMEMBER**" metal cutting tools have the speed and torque to severely injure any part of the human body exposed to them.

Computer and Controller System Safety:

The computer and controller are located in the main rear electrical enclosure. This unit is a full computer, running Windows 7 64 Bit operating system. Contact the factory if more information on the computer system is required.

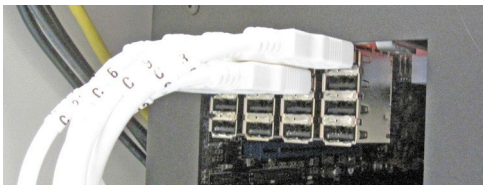
IMPORTANT The computer in this machine has the ability to connect to the World Wide Web via Ethernet or Wireless using a USB wireless (Wi-Fi) adapter. Updating the Rottler software should ONLY be done when directed to do so by a Rottler service technician. Updating Rottler Software when not directed by Rottler personnel will result in a non-operational machine.

The machine should be hooked up to the Internet anytime it is on. The software on the machine will automatically connect to our server to send back useful information on machine status.

Any "IT" personnel should **ALWAYS** get approval from Rottler before doing ANYTHING on the computer.

DANGER This machine is capable of causing severe injury or death. Doing any of the following without Rottler's direct consent may cause severe injury or death.

⚠ WARNING Do not attempt to install USB devices in the PCI ports. These ports have high voltage and any attempt to connect a USB device in these ports will result in destruction of that device. There is also the possibility of damage to the computer system of the machine.



IMPORTANT Downloading any program or changing any Rottler or Computer settings may cause the machine and/or software to become unstable. DO NOT install ANY screen saver, Anti-Virus, Spyware or any type of Security software on the computer. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

IMPORTANT DO NOT connect any type of external hardware to the computer via USB or any other means. Do not install any type of Device Driver. This could create a hazardous
environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

Electrical Safety Features Of Rottler DM Controlled Machines

All Rottler machines that use the DM operational control system are designed to comply with all applicable safety standards. This includes but is not limited to the following systems:

Thermal sensors in all motors and motor controls.

1. Current sensors in all motor control panels.
2. Electrical breakers to prevent voltage surges and spikes from reaching electrical system.
3. Electrical lockout on main electrical enclosure.
4. E-Stop that shuts down all operational systems in an event of an emergency.

All thermal and current limits for motors and motor controls are preset at the factory. In the event that any of those parameters are exceeded during operation of the machine, the machine control system will shut down the machine and a warning of the specific fault will appear on the control screen.

CONTROL DEFINITIONS

Contents

Control Definitions

The purpose of this chapter is to define the function of the buttons throughout the various screens. Certain button functions may not make sense right away in this chapter. As the operator reads through the Operating Instructions chapter of this manual, the function of these buttons will become clear.

Computer and Controller System Safety for DM Controlled Machines

The computer and controller are located in the main rear electrical enclosure. This unit is a full computer, running Windows 7 64 Bit operating system. Contact the factory if more information on the computer system is required.

IMPORTANT: The computer in this machine has the ability to connect to the World Wide Web via Ethernet or Wireless using a USB wireless (Wi-Fi) adapter. Updating the Rottler software should ONLY be done when directed to do so by a Rottler service technician. Updating Rottler Software when not directed by Rottler personnel could result in a non-operational machine.

It is recommended that the machine be hooked up to the Internet anytime it is on. The software on the machine will automatically connect to our server to send back useful information on machine status. It will also record performance parameters that will be used to evaluate any occurrence of a malfunction.

The Auto Update for the Windows Firewall (Security) and Windows Defender (Anti-Virus) is turned on. The computer will automatically download the updates and then install them when the computer is shut down every Friday night.

Any “IT” personnel should ALWAYS get approval from Rottler before doing ANYTHING on the computer.

⚠ WARNING Downloading ANY program from the Internet or by other means when not directed by Rottler is prohibited and will result in the machine warranty being NULL and VOID.

⚠ WARNING Downloading any program or changing any Rottler or Computer settings may cause the machine and/or software to become unstable. DO NOT install ANY screen saver, Anti-Virus, Spyware or any type of Security software on the computer. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

Master Power On/Off Switch

This switch is located on the main electrical control enclosure on the right hand side of the machine. The switch must be in the off position before opening the rear enclosure door.

When first applying power to the machine the computer will need to boot up. Be patient, it will take several minutes to complete booting. The Rottler program will not automatically start. Double tap the Rottler_WPF icon on the screen to start Rottler.

When turning the main power to the machine off there is a specific procedure to follow so as not to damage the computer. The computer must shut down its internal systems before main power is removed from it.

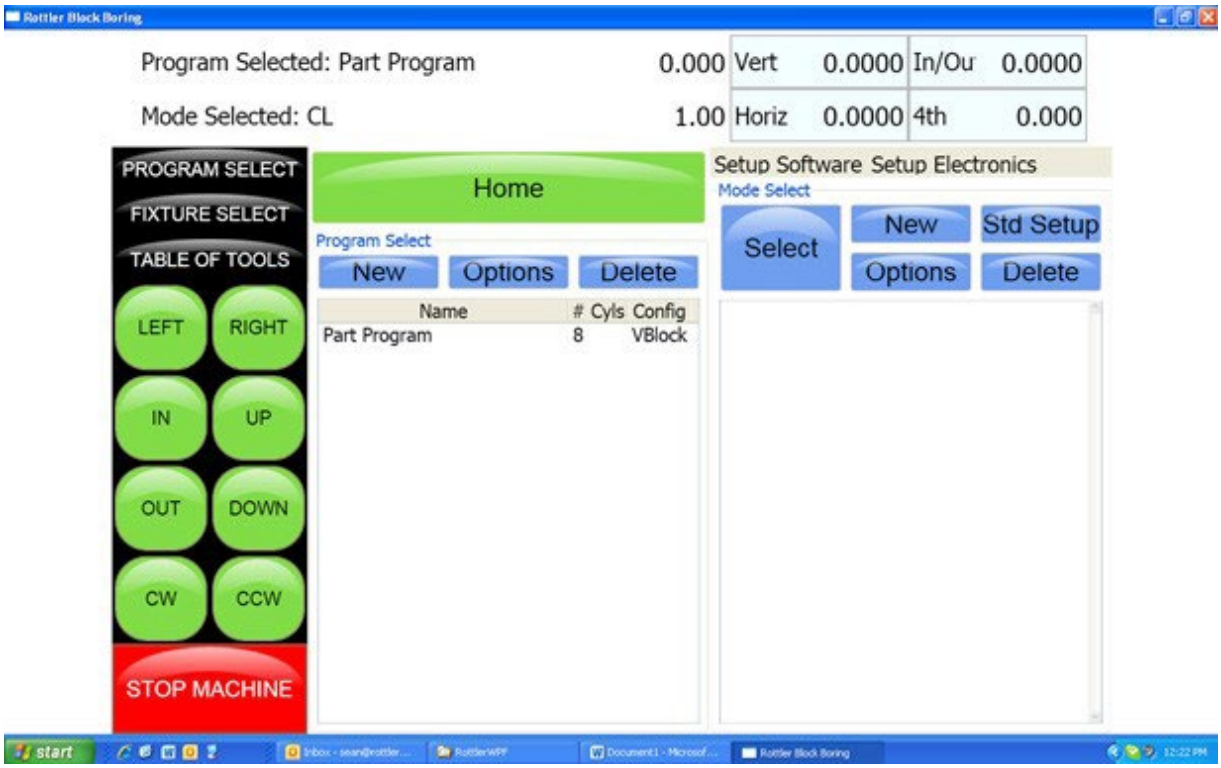
Press the “Start” button in the left-hand side of the Start Bar. This will bring up the “Start Menu”. Press the “Shutdown” line at the bottom of the Start Menu. This will bring up a Pop Up menu, make sure that “shut down computer” is selected and press “OK”.

This will shut down the computer. It is now OK to turn Main Power off to the machine.

Initialization Screen

When the EM69ATC is powered up the Rottler program will not automatically start. It may take several minutes for the computer to power. Start the Rottler program by double tapping the Rottler_WPF icon on the desktop Once the program is started, the Rottler Program Select will appear.

NOTE: Do not push any buttons or icons on the screen before the Rottler program starts or an error may be caused on the computer.



General Information

The Rottler software operates on a Block Model format. You select or create the block you are working with. Then select or create an operation to be performed on that block.

Home

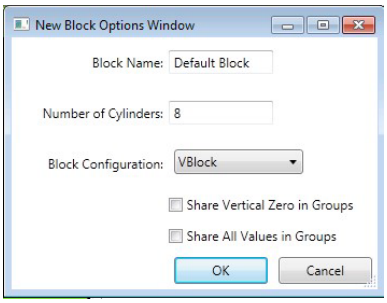
Pressing this button will cause the machine to move all axis to their home (Machine Origin) position. The vertical will home first to be sure it is clear to move the other axis. The machine MUST be homed after it is turned on. This is how the machine gets its reference points to operate.

Program Select

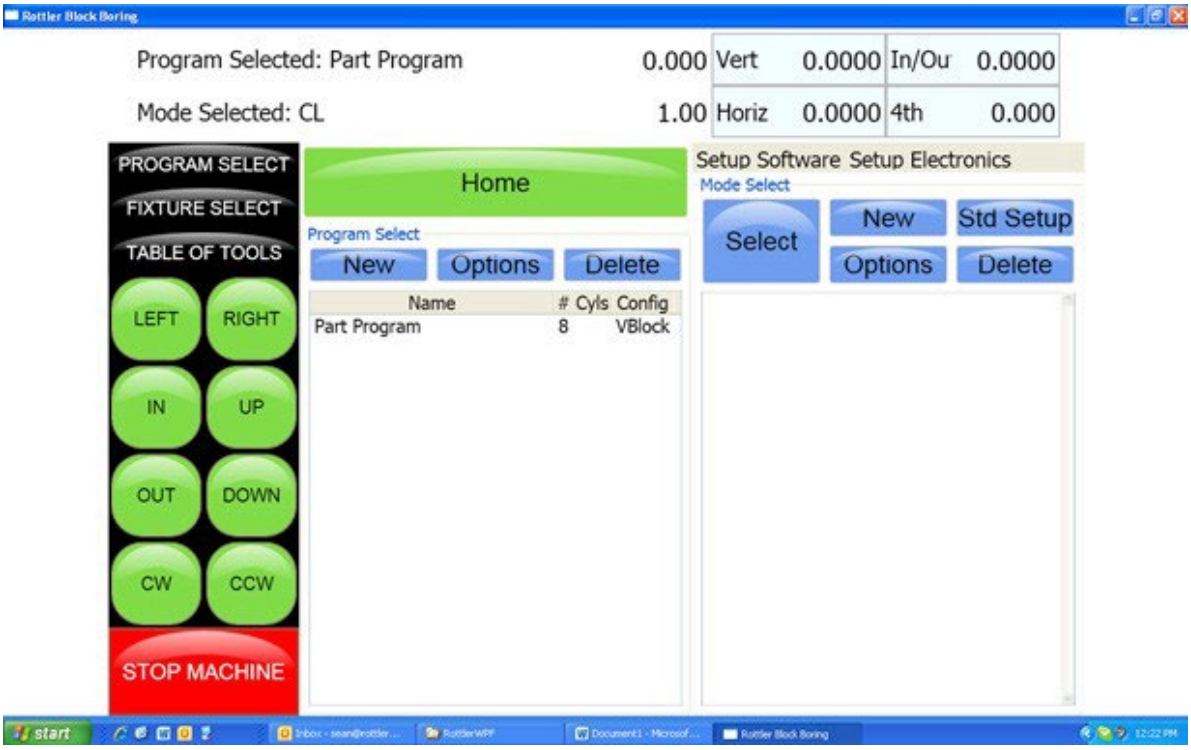
This is the left section of the screen. This is where you create and select blocks you will be working with.

New

Pressing this in the Upper level will cause a dialog box to appear. Here is where you name and configure the block i.e number of cylinders and Inline or V Block.



Pressing OK will result in the Block Model being inserted into the left hand side of the screen.



Options

This will bring up the same dialog box as described above if any of the information needs to be changed.

Delete

This will delete whatever block program is selected. A dialog box will appear to ask you if you want that program deleted.

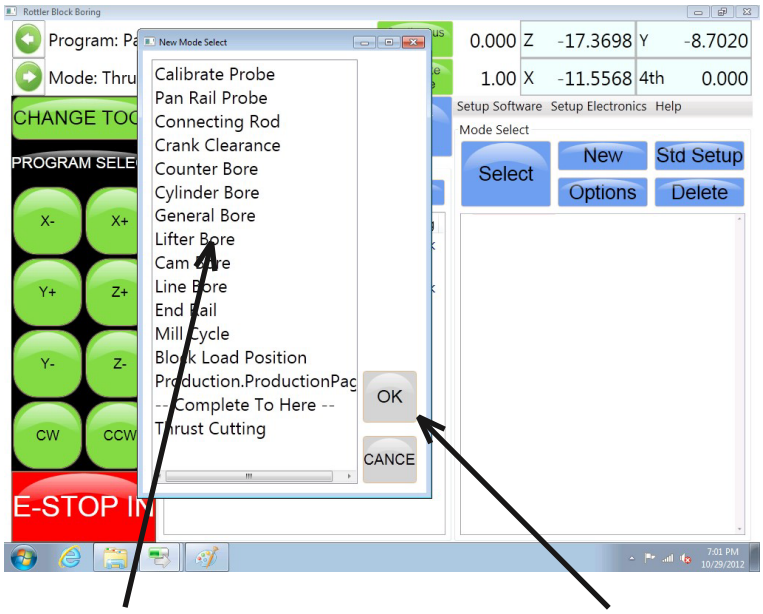
Mode Select

This is the right section of the screen. This is where you create or select operations to be performed on the selected Block. This area will be blank when you first create a block.

You can create only certain modes you will use on a block or use a standard set up that inserts all modes available. You can also create a new mode and rename if for a specific use.

New

Pressing this button will bring up a dialog box with Rottler standard operations.



Select the operation you want to create and then press OK. This will place a general Bore operation under the Cylinder bore mode in the right hand section.

To enter General Bore mode highlight it and then press Select. This will take you to the operation screens that will be described later.

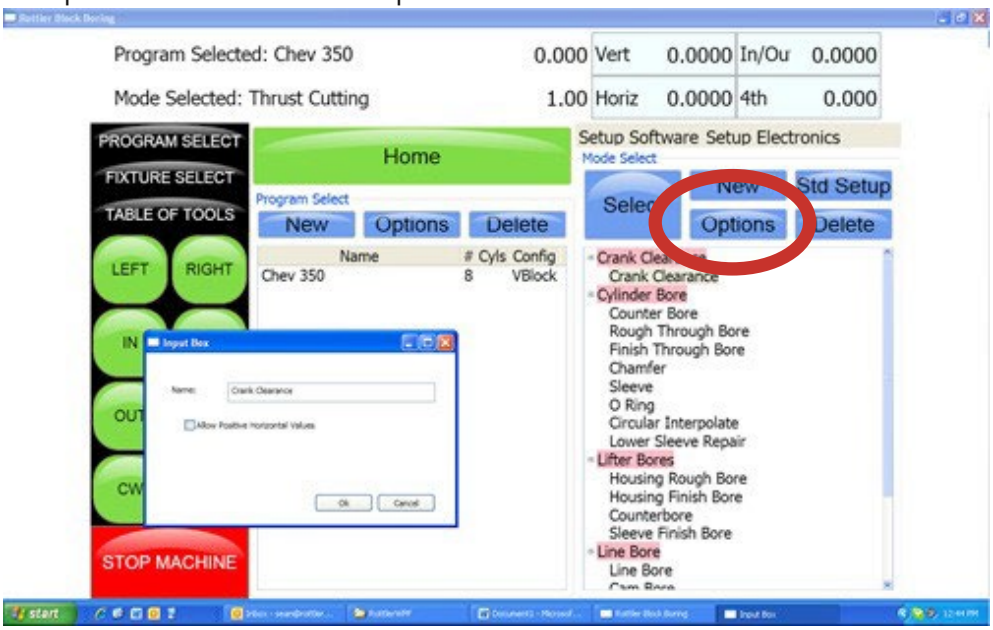
Std (Standard) Setup

Pressing this button will insert all the Rottler operations into the right hand section automatically.

Use the slide bar on the right hand side to scroll through all the operations.

Options

Press this button to bring up a dialog box to allow positive numbers to be entered in the horizontal stops. Most all programs are from left to right, the farther right you go the larger the negative number. However if a different zero point is used a positive number may be needed. For example, if you zero on the first cylinder on the left bank of a block and then “roll it over” the first cylinder is farther to the right than the zero position. Which would be a positive number.



Delete

This will delete the selected Mode. It will ask you if you want this mode deleted before deleting it.

NOTE: Once the control definition for a particular button has been discussed it will not be repeated in the different modes of operation. Only new buttons or buttons with a different function will be discussed in different modes.

For these descriptions the Tool# and Probe # are not being used. They will be described later in this chapter.

Cylinder Bore, General Bore 3 Axis (without Tool Changer):

Each buttons function will be described in this section. In the different MODES, the same buttons will not be described again.

Set Zero Tab

Actual Position

These are a numerical display showing the actual distance the axis are away from where they have been zeroed.

Velocity Override

The Velocity override is displayed in the upper left of the Actual Position display. The default is 100% of the programmed Feed Rate. When operating… turning the handwheel Counter Clockwise will override the axis rapid travel and feed rate 100 and 0% when in an automatic cycle.

Zero Buttons

These buttons will erase the actual position display of their associated axis and reset the displayed value to zero.

Handwheel Buttons

These buttons will activate their associated axis for use with the handwheel. The left button of each axis will move the machine in .010" per detent, the middle button .001" per detent and the right .0001" per detent of the handwheel. Pressing any of the axis Jog buttons will disengage the handwheel.

Spindle Start

This button will start the spindle at the RPM that is specified on the Auto Bore Cycle tab. Once the button has been pressed and the spindle is running the button will turn red and read Spindle Stop. Pressing the button again will stop the spindle and cause the button to go back to green.

CW and CCW Creep

These buttons will cause the spindle to rotate slowly CW or CCW direction. The spindle will continue to rotate as long as the button is pressed. The speed at which the spindle will rotate is set in the Machine Parameters and should not be changed unless instructed to do so by the factory.

Jog Buttons

These buttons control the rapid travel of the Vertical, Horizontal and In/Out axis. Pressing these buttons will allow you to move the machine through all ranges of its travel unobstructed. If the spindle is turned on these buttons become feed buttons and the machine will feed in whatever direction you have pressed. The rate at which the machine will feed is determined by the value set in the Auto Bore Cycle tab. When in rapid travel, these buttons are momentary contact and you will have to keep them pressed to keep the machine moving. When the spindle is on, they are latching buttons and once they are pressed the travel will continue until they are pressed again.

Move to

Pressing these buttons will bring up a dialog box for the associated axis. Enter a value that you want the axis to move to and press ENTER. That axis will then move to that position. You can do multiple "Move To" at the same time. One after another.

Move To Zeros

Pressing this button will cause the vertical to move the zero position first. The in/out and horizontal will move after the vertical has moved to zeros.

CW and CCW Index

Pressing either of these buttons will cause the spindle to rotate to the index position. Index position is with the tool to the right as you are facing the machine.

IMPORTANT

Setting Spindle Index

Any time the machine has been turned off the spindle index position must be set. Turn the spindle to the index position (tool holder facing to the right at 90 degrees from the operator). Then press the Zero button net to the spindle position read out. This will put a zero value in the display box.

This screen also shows the Spindle Load, programmed Feed Rate and Spindle RPM.

Probe Auto Center

The Probe is an option on the EM69ATC machine. When this button is pressed a single Probing routine will be run in the position the machine is currently at.

Vertical Stops Tab

This screen is used to set the Vertical stops the machine will use to bore a cylinder. There are four Vertical stops used on this screen plus two optional Lower Clearance stops.

If the machine is equipped with a probe there are two (2) additional stops, Probe Clearance and Probe Height.

The function of the Vertical stops will be defined in the Operating Instructions chapter in this manual.

To enter any of the Vertical Stops press the Data box next to the Vertical stop you want to enter. A pop-up menu will appear. Press the desired numerical value and then press ENTER. The numerical data will then appear in the data box. You can also move the Vertical physically to the location you want the stop to be at and press the “SET” button next to the Data Box. This will take the current position from the Digital read out and insert it into the associated Data Box.

Horizontal Offset for Honing

There is often the need to machine out the “webbing” at the bottom of a cylinder to get the correct honing clearance. Checking the box next to “Horizontal Offset for Honing” will bring up an additional screen section on the lower right.

This is where you will set the amount, direction and speed the offset will cut.

Left and Right Locations Tab

This screen is used to set the Horizontal and In/Out stops the machine will use to bore a block. The number of In/Out and horizontal stop on this page will change with the block configuration i.e V6, V8 or inline.

The function of the Horizontal and In/Out stops will be defined in the Operating Instructions chapter of this manual.

To enter any of the Horizontal and In/Out stops press the Data box next to the Horizontal or In/Out stop you want to enter. A pop-up menu will appear. Press the desired numerical value and then press OK. The numerical data will then appear in the data box

Cylinder Bore – Bore Locations

There are three (3) different modes you can operate the machine in on these screens, Blueprint, Indicated and Probing.

Blueprint

This mode of operation allows you to enter specific values for the bore locations from a blueprint type document.

It is helpful to have the blue print numbers entered on this screen even if you are not going to bore to the blueprint locations on a particular block. They help to set the general area of the bore if you are manually centering (indicating) or probing the block.

Move Buttons

When pressed, these buttons will move the machine, under power, to the Horizontal and In/Out positions shown in the data boxes below the Move button. The Vertical will move to the Clearance height before it makes the Horizontal or In/Out moves. After it has moved to the Horizontal and In/Out positions the Vertical will move to the Centering Height. After this, all motion stops.

Bore Buttons

Pressing this button once will cause it to turn yellow. This indicates when the “Bore Left” button is pressed this cylinder will not be bored.

Touching this button again (with a pause in between touches) will turn the button back to green. All green bores will be bored if the “Bore Left” button is pressed. The control will ask you if you sure you want to bore the selected bores.

Double Clicking a Bore button will keep it green and turn all other bore buttons yellow.

Indicated

This screen is designed to manually indicate each cylinder in for it's specific location.

Set Buttons

Once a cylinder has been indicate, pressing the associated Set Button will take the current machine position and place the values in the Data Box associated with that cylinder.

Copy Values

Pressing this button will bring up another window where you can select to copy the In/Out and Horizontal values from Blueprint, Indicated or Probed screen.

Difference

Checking this Box will cause a green check mark to be placed in the box. The Data Boxes will then display the difference in values from the blueprint screen to the indicated screen. This is helpful to know how far the cylinders actual location is from blueprint values.

Bore Left and Right

Pressing this button will cause the entire Left or Right bank to be bored automatically. The Bore buttons that are yellow will not be bored though.

Probing

The probe is an option on the EM69ATC machine.

This screen is designed to automatically probe one or all of the cylinders.

Probe Buttons

Pressing this button will cause a probing routine to be run on the associated cylinder.

Probe Left or Right

Pressing this button will cause the entire Left or Right banks to be probed automatically.

Probed Diameter

This Data Box will display the diameter of the cylinders as they are probed.

Lifter Bore

The Lifter Bore Mode and its buttons operate identical to the Bore Mode with a couple of exceptions.

On the Program Vertical Stops screen, lower Clearance Offset is not an option.

After a bore is complete the spindle will not offset .020” for tool clearance unless the “Horizontal Offset after Cycle” box is checked. This is used when a single point boring tool is used for lifter boring.

Cylinder Bore 4 Axis

Most of the Control Definition in the 4th axis is the same as the 3 axis version of software. Only the differences or new features will be discussed in this section.

Set Zero Tab:

Jog Controls

4Th-

Pressing this button will cause the 4th axis to rotate in a negative direction while held.

4Th+

Pressing this button will cause the 4th axis to rotate in a positive direction while held.

4th Axis Degree and Move

Touching the 4th Axis Degree Data Box will bring up a Pop-Up Menu so a degree can be entered. Once a value is entered (even zero), pressing the Move button will move the 4th axis to that position.

4th axis Brake

This shows the status of the 4th axis brake a well as manually turning the brake on and off. When the 4th axis is rotated using the jog controls the fixture will automatically switch the brake On and Off. **Light Clamp**

Pressing this button will cause light pressure to be exerted from the Tail Stock towards the Head stock. When the 4th axis is rotated using the jog controls the fixture will automatically switch from Full to Light clamp and back. **Full Clamp**

Pressing this button will cause full pressure to be exerted from the Tail Stock towards the Head stock.

Retract

Pressing this button will cause the tail stock to fully retract. A dialog box will appear when this button is pressed to assure you want to retract the tail stock. This is to prevent an accidental retraction when a block is in the fixture.

Table Of Tools

The Table Of Tools is a very powerful feature in this software. Most of the Rottler programs are designed to be used without interacting with the Table Of Tools.

Only the program specific uses will be described here.

Table Of Tools General Information

The Table Of Tools is used to set different tool lengths so multiple tools can be used in one program and reference the same vertical zero position.

For Example, if you were to use two boring bars in one program. One boring bar is 8” long and the other is 4” long. There is then a 4” difference in where the cutter of each bar will come into contact with the part to be machined. Using the Table of Tools you can set the 4” difference for one of the boring bars so that both of the cutting tools will come into contact with the material at the same vertical position.

Accessing Table Of Tools

Select TABLE OF TOOLS from any screen in the upper left hand corner. This will open up the Table Of Tools.

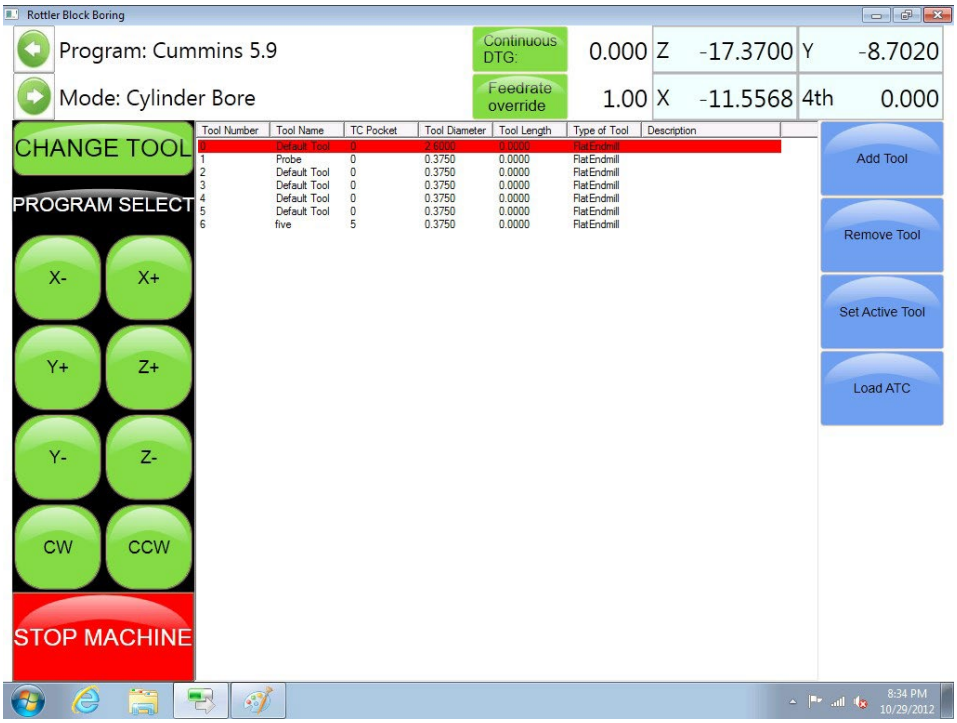
On this screen you will be able to Add, Remove or Set that tool Active (installed in spindle and being used).

The Table of Tools comes with Tool 0 installed with no offset amount. Tool 0 will remain tool 0 with no offset always. Tool 0 will be set active when you are using programs that do not require tool offsets.

Add Tool

To add a tool to the Table of Tools press Add Tool. This will open another window. Here you will name the Tool you are adding. Such as 2.9 production Stub. It is important to give an accurate name to the tool. You want the tool easily identifiable by its name. The only other data box the Rottler software uses is the Length Data Box. This will be discussed later. Press OK.

The Added tool will now show in the Table of Tools.



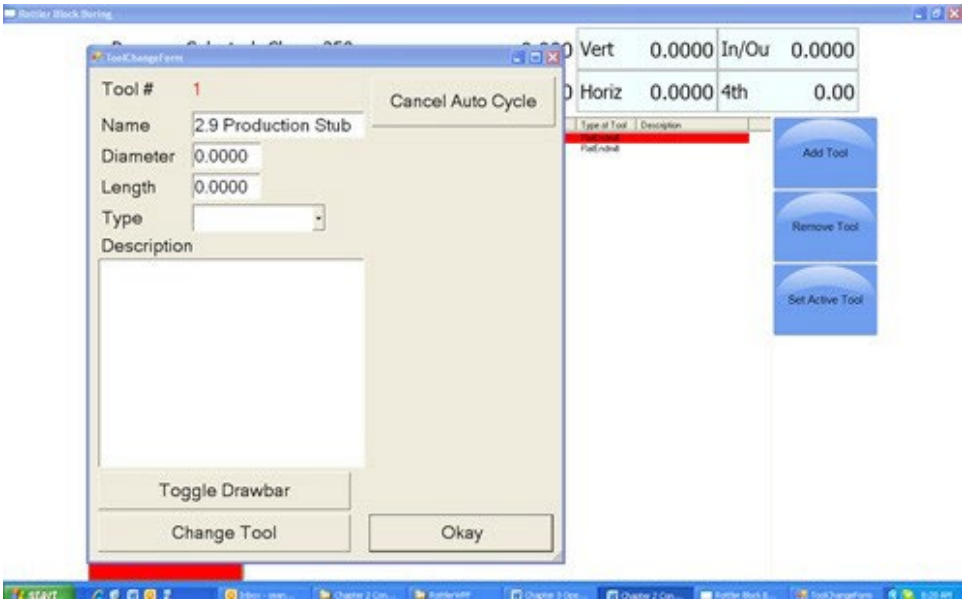
Remove Tool

Pressing this button will remove the highlighted tool from the Table of Tools.

Set Active Tool

Pressing this button will set the highlighted tool to an Active Status (tool installed and will be used) Any Vertical offset associated with that tool will be used when a program is run. You can tell which tool is active because it is highlighted in Red. When no offset is required in a program Tool 0, Default Tool should be active.

When setting a tool active another window will open. This is the Tool Change Form. It is basically there to verify the tool information before it is set to an active status. Verify the information and press OK.



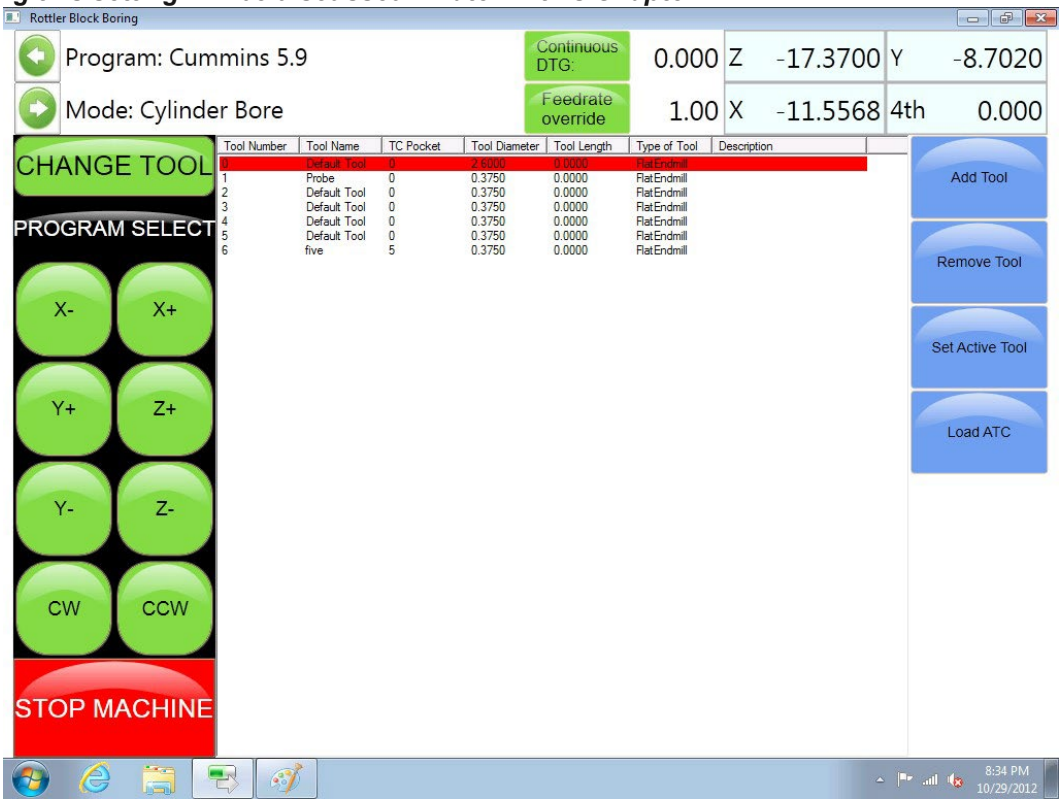
This window will open when the machine does an automatic tool change. This will be discussed in Chapter 3 Operating Instructions. After you press OK another window will open. This is a Warning Dialog box to inform the operator of the possibility of the spindle start if the tool change is done in an automatic program. Press OK.

Setting Tool Offsets

Add all the tools that will need offsets into the table of tools. Leave the Length value at 00.00 when you first enter them.

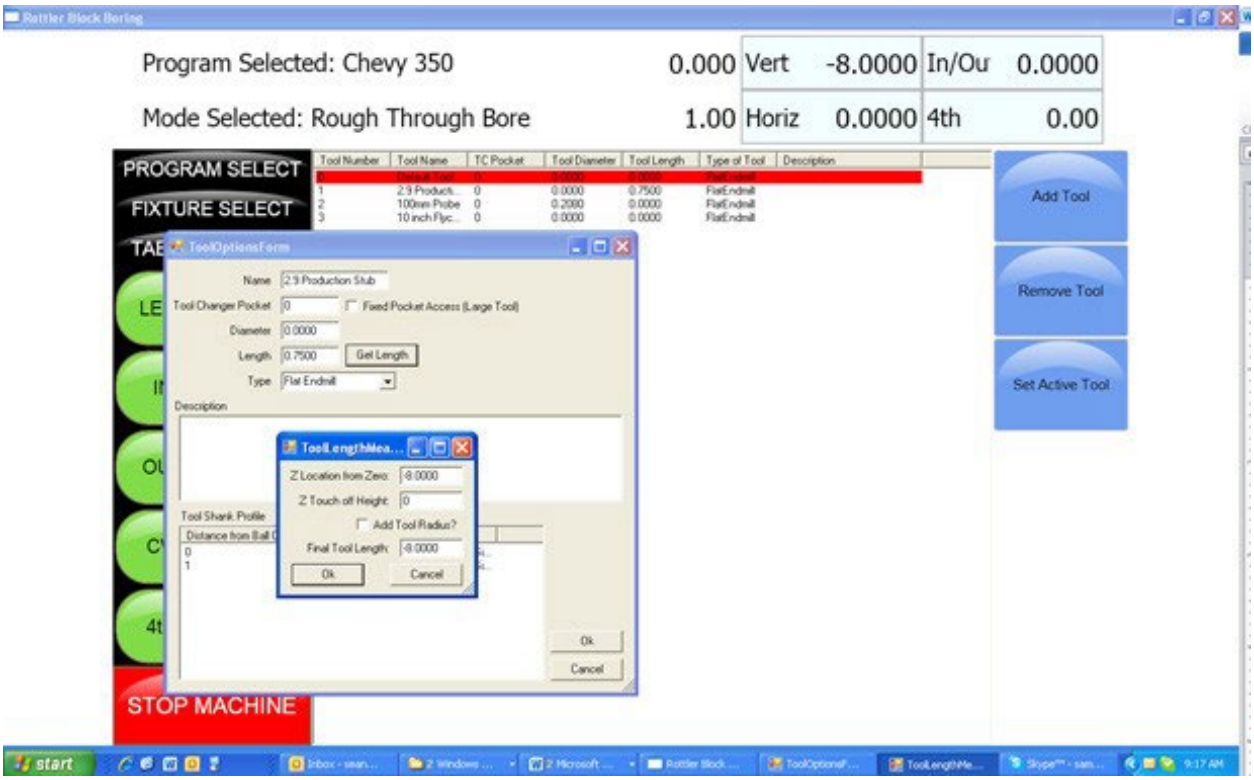
For this example we will be setting offsets for a 2.9 Production Stub, 100mm Probe and a 10 inch Fly cutter. Add these tools to the table of Tools.

NOTE: Only the Probe will use the Tool Diameter. The Probe will use the Tool Diameter when probing a cylinder, it will not use the Tool Diameter when touch off a surface such as a block deck. Changing this setting will be discussed in later in this Chapter.



To set Tool Offsets you will need a fixed vertical reference point on the machine that does not change such as the head stock of the 4th axis or Performance Fixture.

Install the first tool such as the 2.9 Production Stub with Cutting insert installed. Bring the cutting insert down until it just touches the flat on the head stock of the 4th axis fixture. Go to the TABLE OF TOOLS and double click the 2.9 Production Stub tool. Select Get Length from that window. This will bring up the Tool Length window.



Z Location from Zero

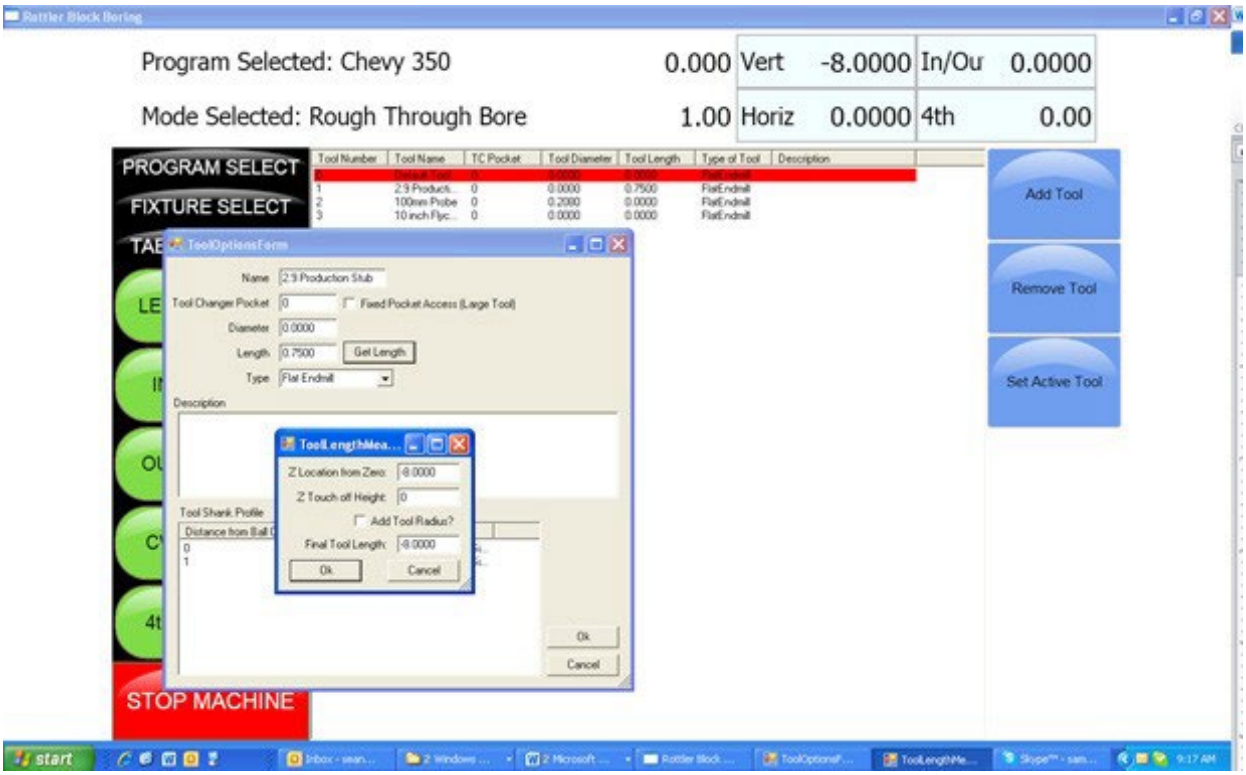
This is the distance the Vertical Axis is from the home position. NOT where the operator has set the Vertical Zero in the program. This value is set by the computer automatically. In this example the tool just touched the flat at 8.0000.

Z Touch Off Height

This value is an additional value you want added to the Z location from zero. For example, if you wanted to use the center of the Crankshaft as the vertical reference point, but you are touching the tool off of the flat of that head stock, you would enter the distance from where you are touching off to the center of the Crank (this value is stamped into the headstock by Rottler). The values from Z Location from Zero and Z Touch off Height are added together by the computer to get the Final tool Length value. If you are not referencing another vertical position then this value will remain 00.000.

Add Tool Radius?

Checking this box will add the Tool Radius to the Final Tool Length. This is not used in the Rottler programs and should remain unchecked for all tools.



Repeat this procedure for each tool. Touch ALL of them off from the same point.

When running a Rottler program the cutting insert for each tool will reference the Vertical Zero the operator set in the program and come into contact with the surface to be machined at the same vertical value.

Applying Table of Tools to Rottler Programs

The use of the Table of Tools to specific Rottler programs such as Bore and Mill will be defined in Chapter 3 Operating Instructions.

Fixture Select

This is also a very powerful tool. It is not generally used in the Rottler Programs. It's basic function is to offset a program and table of tools a set distance on each axis (if desired) and run the same program without resetting axis zero points.

For example, if you have to fixtures that are identical but are set at a different location on the table you can set the difference values in the table of fixtures and run the program.

It is recommended this is not used unless you are a very experienced operator.

OPERATING INSTRUCTIONS

Contents

Operating Instructions

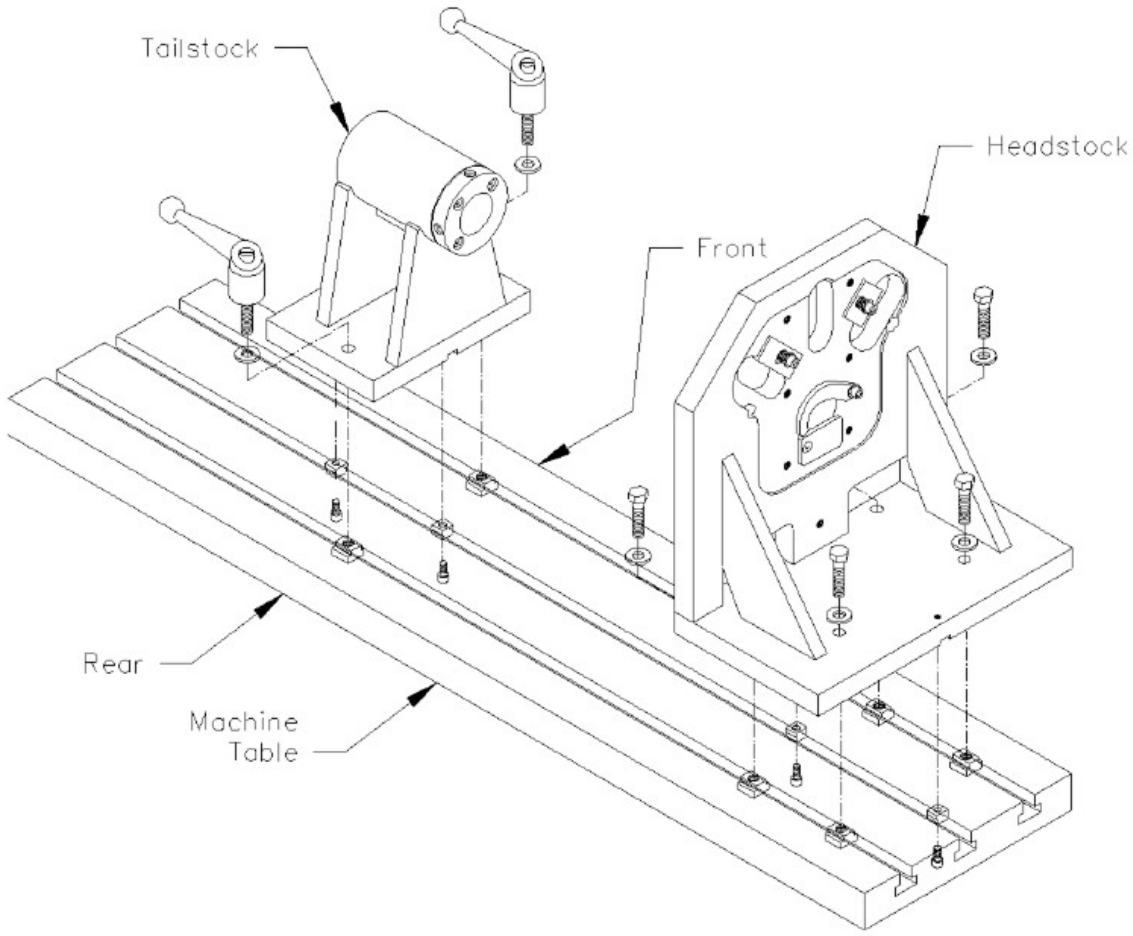
The purpose of this chapter is to explain and then guide the operator from loading blocks to running an automatic cycle.

All modes of operation will be discussed in this chapter.

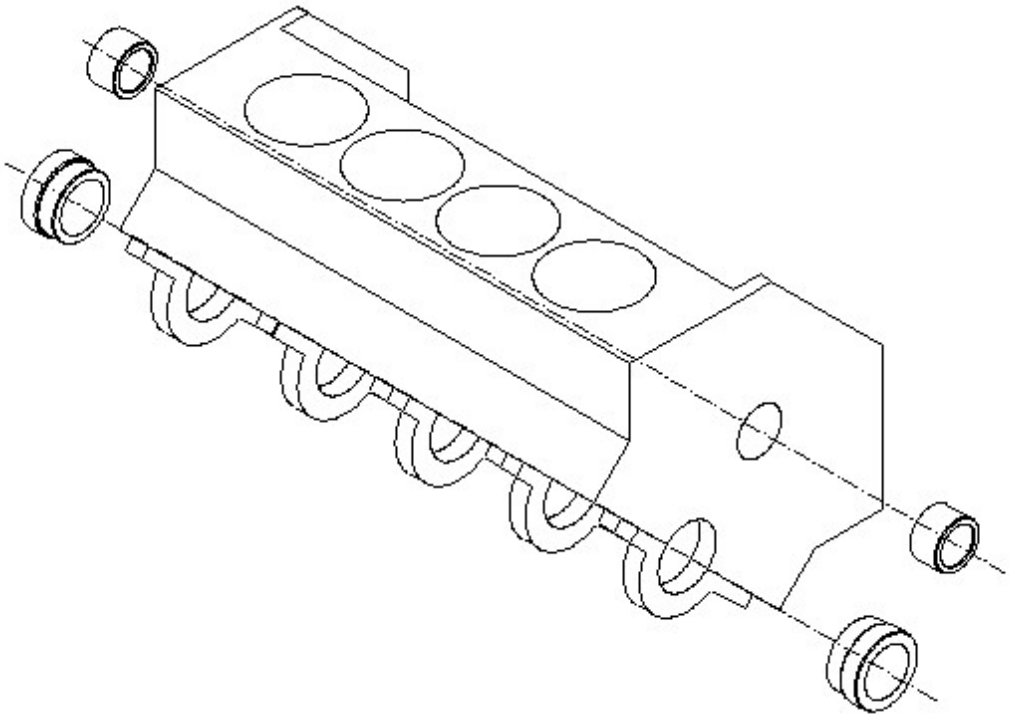
Loading a Block

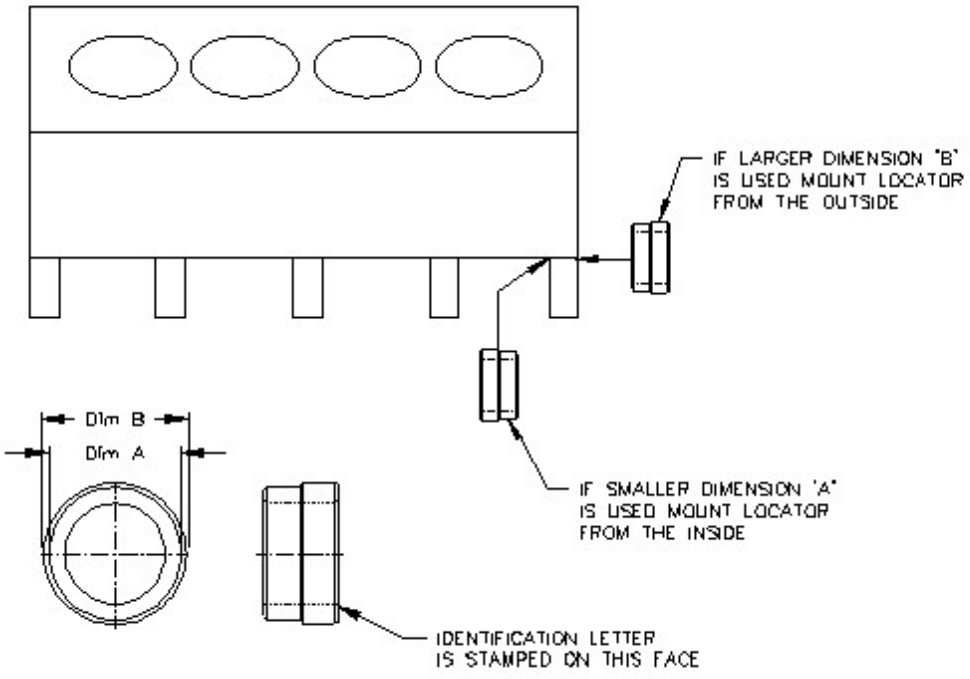
Performance Fixture 650-3-1 Cylinder Boring

Install and align the performance fixture head stock on the left hand side of the table as shown below.
Follow the alignment procedures for the Performance fixture in the Maintenance section of this manual.
Tighten the Head Stock to the table securely using the four Hex bolts and T-Nuts.
Install the Tail Stock onto the right hand side of the table but do not tighten down.



Select the correct Main and Cam bushing for the block you are going to be using from the tables in the Options section of this manual. Place bushings in block as shown below.



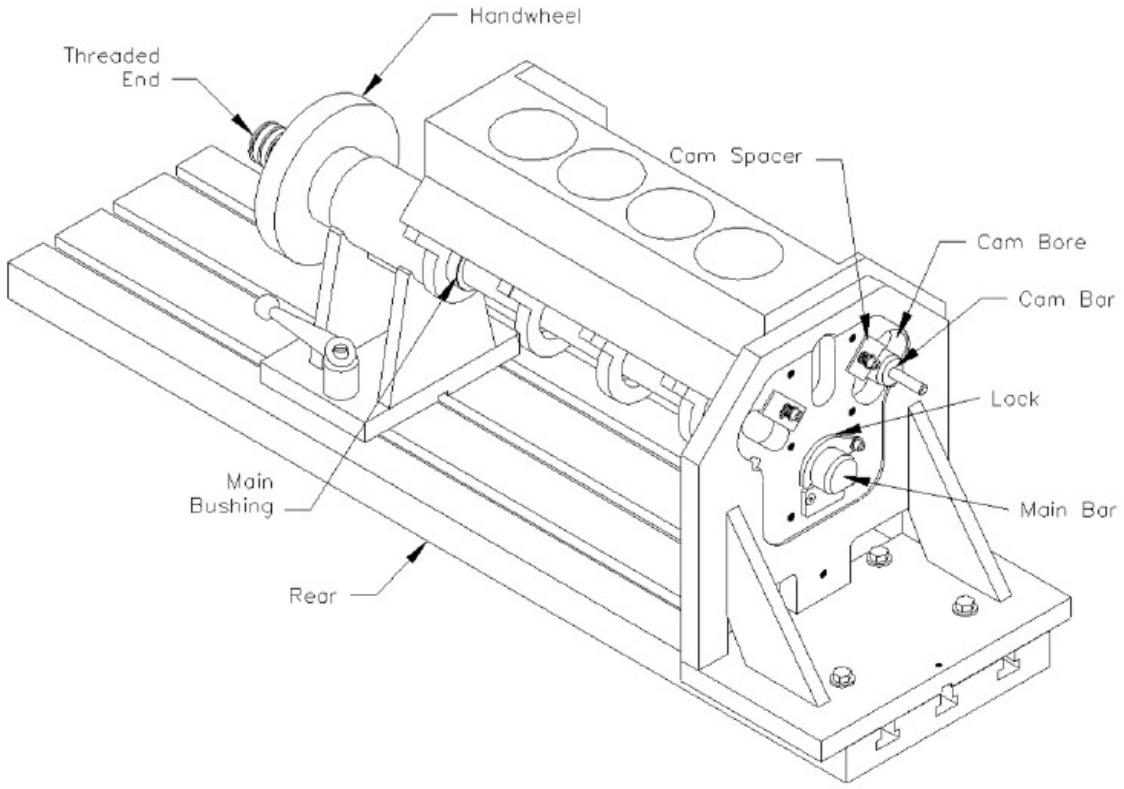


Note: Each locator covers two bearing diameters ('A' and 'B'). The unused diameter MUST be placed INSIDE the block to prevent interference with the Index plates.

1) Using a slow travel hoist, position the block between the Head stock and Tail stock with the Bell housing end of the block towards the Head stock.

2) Slide the unthreaded end of the Main Bar through the Tail stock, both Main bushings and into the Head stock with the flat facing down. The threaded end of the Main Bar should be on the Tail stock side of the table. Slide the Lock into the groove on the Main Bar.
3) Rotate the block until the bank you want to bore is facing up. Make sure the cam spacer is not in the cam Bore area at this time. Slide the Cam Bar through the two Cam bushings and into the Head stock with the reduced diameter at the Head stock.
4) Snap the Cam spacer into place.
5) Push the Tail stock up to the block. Tighten the Handwheel with a quick snapping motion.
6) Tighten the two handles on the Tail stock.

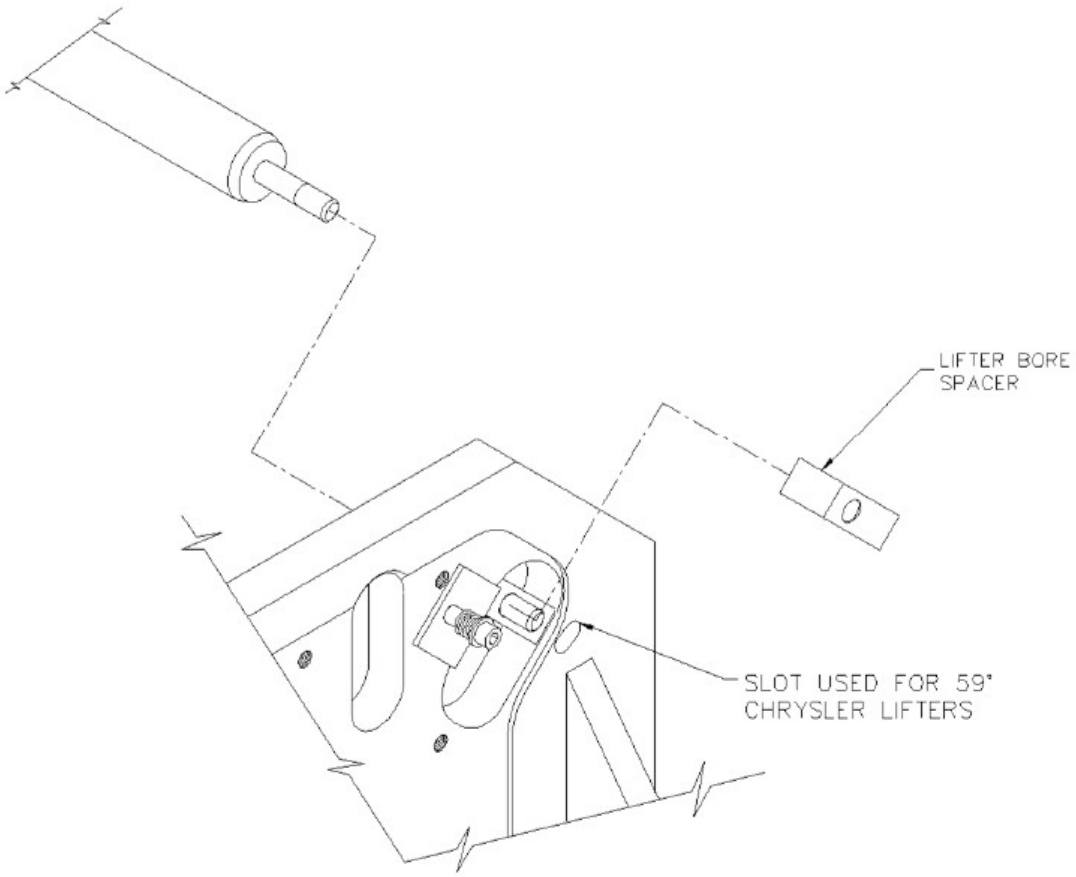
The block and fixture are now locked in place and ready for machining.



Performance Fixture 650-3-1 Lifter Boring

The same procedure for loading a block in Lifter boring as was used in Cylinder Boring with an exception in the Cam Bar area.

1) Instead of the Cam Bar being slid through the Cam Bore to its full Diameter, the small shaft on the end of the Cam Bar is used in conjunction with spacer Blocks.
2) Select the correct Spacer from the Chart in the Options section of this manual for the angle of the Lifter Bores.
3) The Cam Spacer must be out of the Cam Bore. 4) See illustration below for spacer installation.

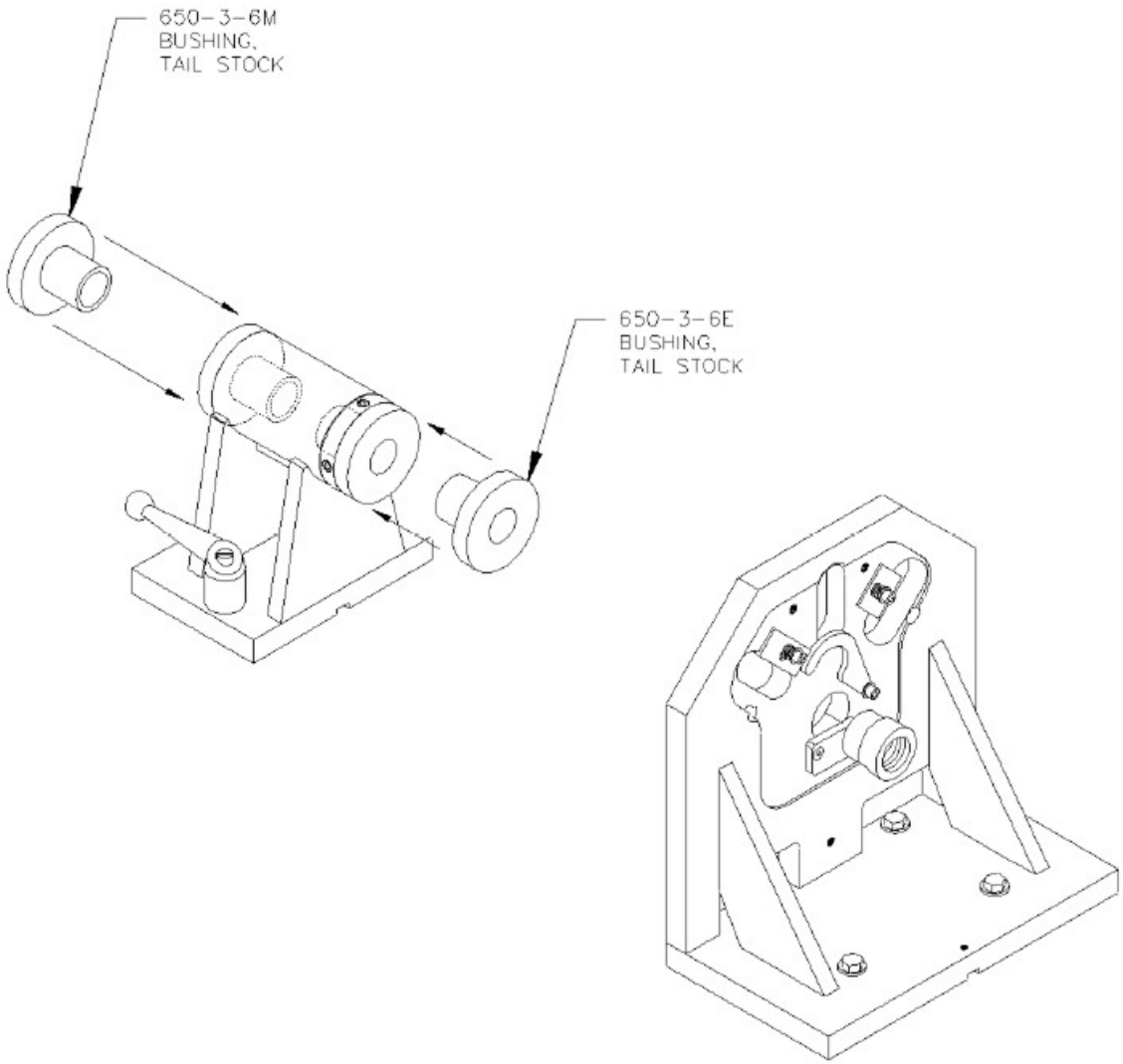


Lower End Machining Package 650-3-1A

1) Install and align the performance fixture head stock on the left hand side of the table as shown in the Performance Fixture section. Follow the alignment procedures for the Performance fixture in the Maintenance section of this manual. Tighten the Head Stock to the table securely using the four Hex bolts and T-Nuts.

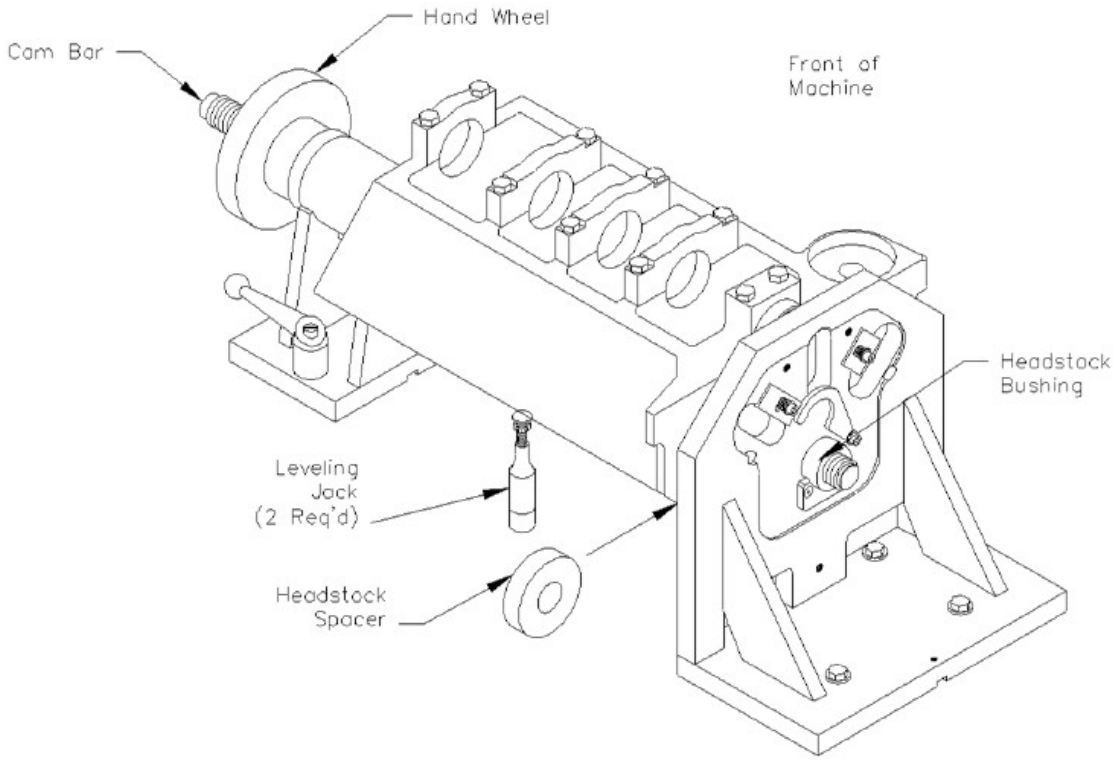
Install the Tail Stock onto the right hand side of the table but do not tighten down.

Install the Tail stock bushings 650-3-6E and 650-3-6M into the Tail stock as shown below.



2) Select the correct size Cam Bushings for the block you are using and install them into the block.
3) Using a slow travel hoist, position the block between the Head stock and Tail stock with the Bell housing end of the block towards the Head stock with the Main Caps facing up.
4) Install Head stock bushing into Head stock with the flat facing down and the smaller diameter into the Main bore of the Head stock.
5) Slide the Cam Bar (short threaded end first) through the Tail stock bushings, Cam bushings (installed in block) and Head stock Spacer.
6) Thread the Cam Bar into the Head stock Bushing until tight.
7) Slide the Tail stock up to the block.
8) Snug the handwheel up to the Tail stock but do not lock in place.
9) Install the Leveling Jacks between the underside of the block and the bed of the machine. One each side.
10) Rotate the block until the Pan Rails are even to each other.
11) Make sure there is even pressure on each of the Leveling Jacks.
12) Tighten the Handwheel into place.
13) Tighten the Tail stock into place using the handles.

The block and fixture are now locked in place and ready for machining.

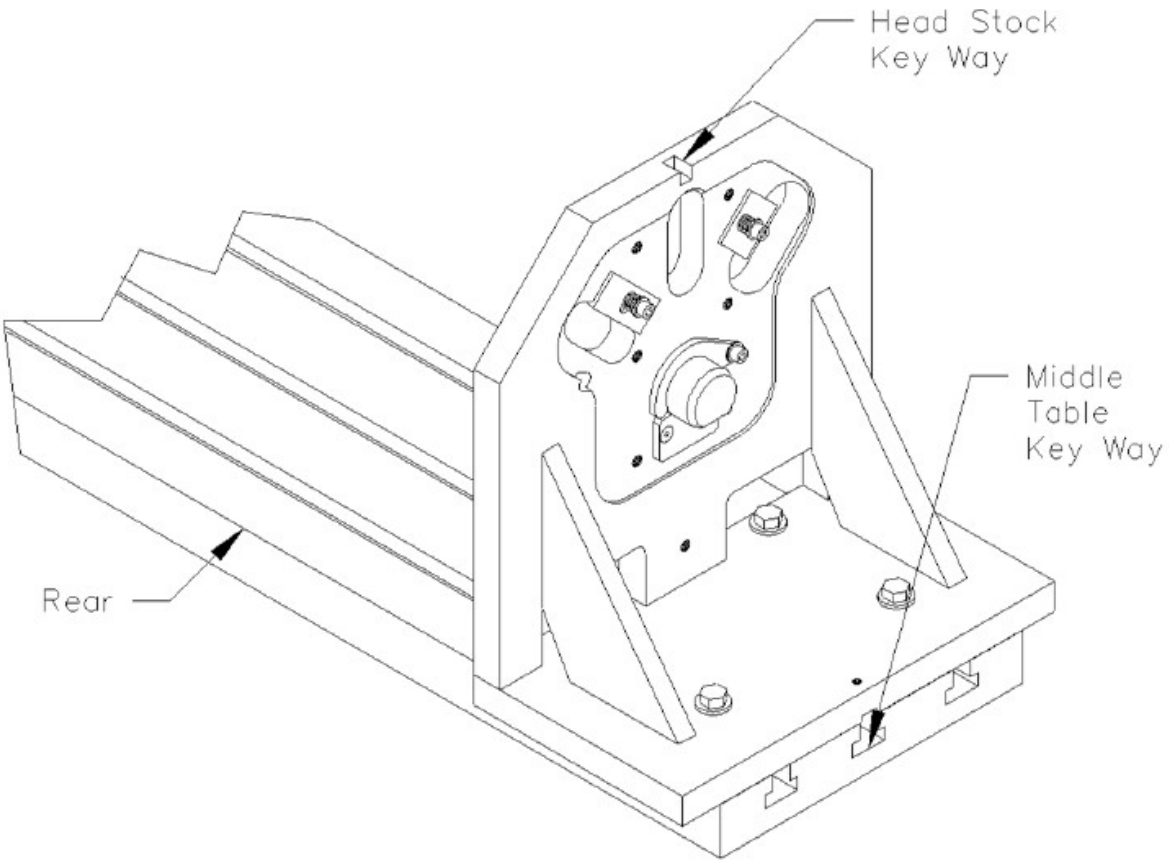


Block End Truing Fixture 650-3-30

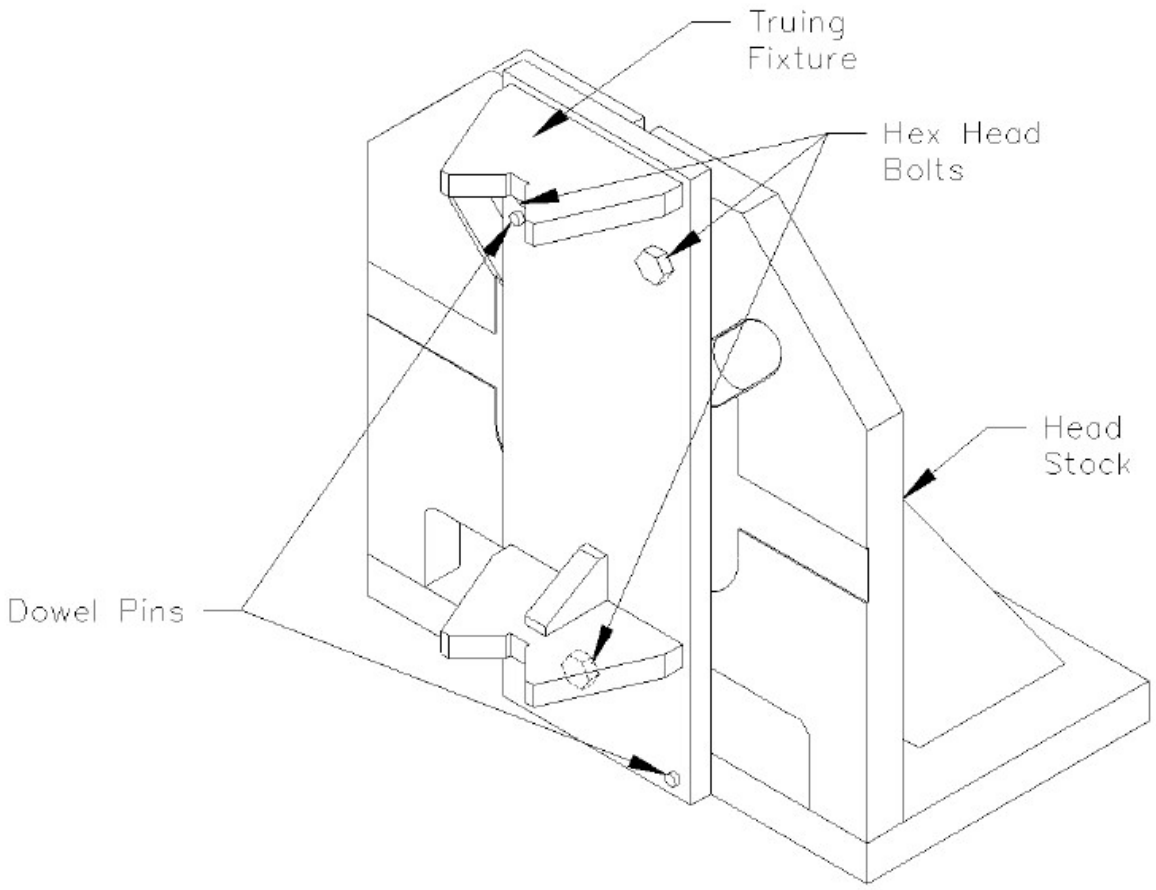
If you are truing the ends of a block use the standard Head stock mentioned in the Maintenance section of this manual.

If you are Boring the Cam Tunnels with this fixture follow the standard Head stock in the Maintenance section of this manual plus the procedure below:

1) Do not have the Head stock hold down bolts all the way tight, the fixture may need to be moved slightly.
2) The center of the Key Way on the Head stock need to be lined up with the center of the middle Key Way on the machine bed. This will place the center of the Main bore directly inline with the center of the Cam bore.
3) Lock the Head stock in place.



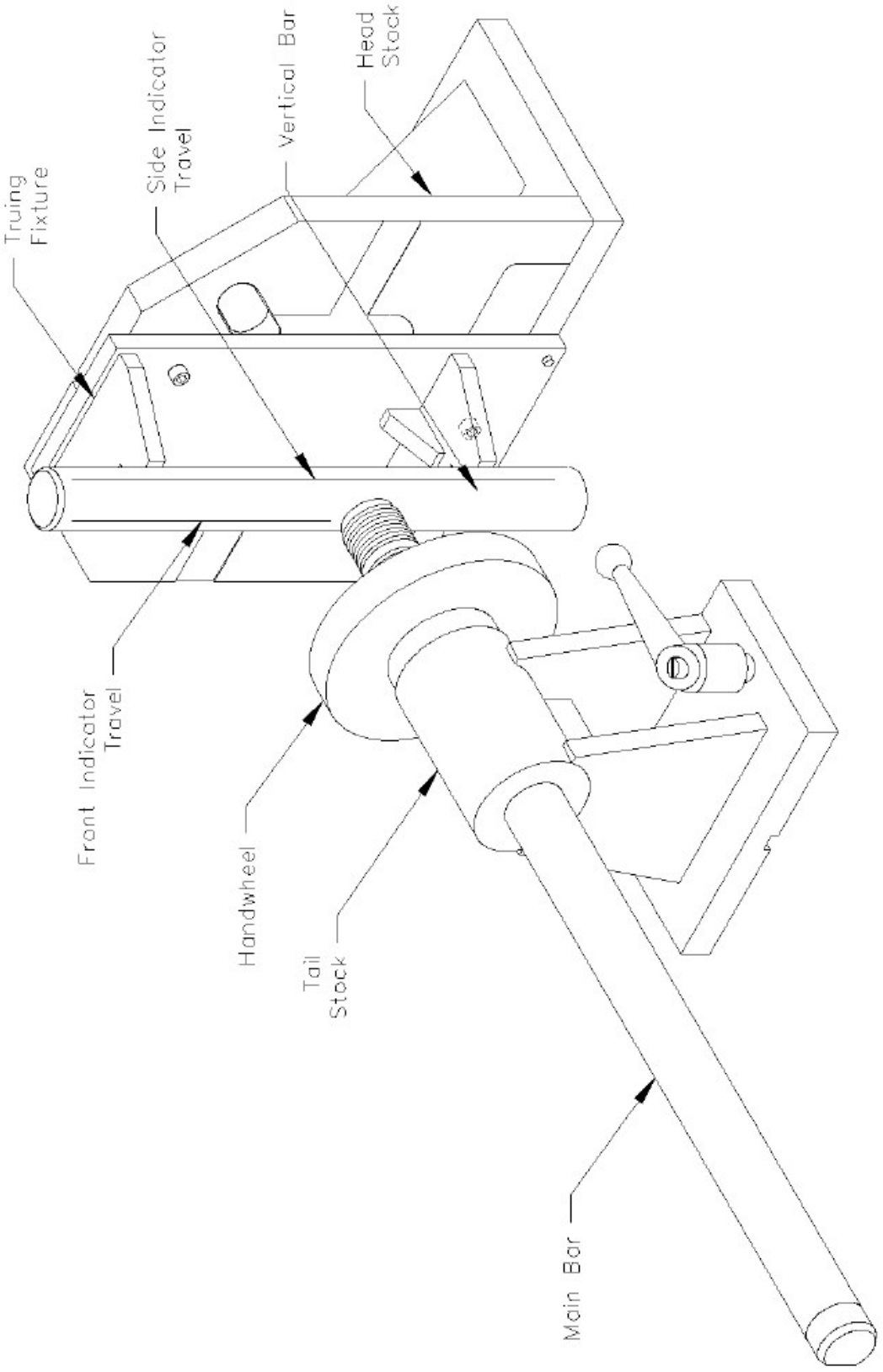
4) Install the Truing Fixture onto the Head stock. Slide the two Dowel pins on the Truing Fixture into the appropriate Dowel holes on the Head stock.
5) Bolt the Truing Fixture to the Head stock using the three supplied Hex Head Bolts.



The following steps are designed to check the Vertical Bar for straightness. This Bar was checked and tested at Rottler Manufacturing. The following steps are to make sure there is not a burr or debris between any of the parts.

6) Slide the Main Bar though the Tail stock (threaded end first).
7) Thread the Handwheel onto the Main Bar.
8) Place the Vertical Bar into the “V” on the Truing Fixture.
9) Slide the Tail stock towards the Head stock until the Main Bar just touches the vertical Bar.
10) Tighten the Tail stock down.
11) Turn the Handwheel until the Main Bar holds the Vertical Bar securely in place.
12) Attach a indicator to the machine spindle or cutterhead and run it up and down the front and side face of the Vertical Bar. It should be within .0015 variance.

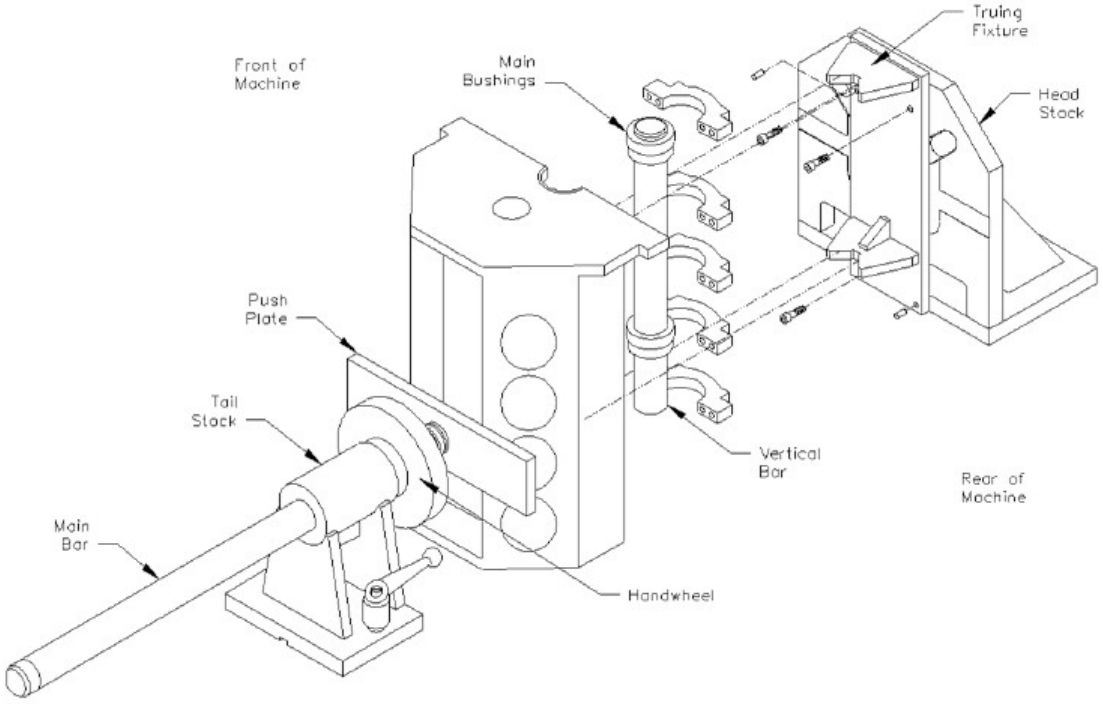
Note: Front face will only have half travel as the Main Bar obstruct full travel..



13) Loosen the Handwheel and remove the Vertical Bar.

14) Loosen the Tail stock and slide it to the right hand side of the machine table.
15) Select the correct Main Bushing for the block you are machining from the table in the Options section of this manual. Install the Main bushings as shown in the Performance Fixture earlier in this section.
16) Using a slow travel hoist position the block between the Head stock and tail stock with the Main Caps facing the Head stock as shown.
17) Slide the Vertical Bar into the Main bushings from the top. You will want to put a spacer on the table below the Vertical Bar so the bar does not go below the top V on the Truing fixture
18) Slide the towards the Head stock so that the Main Vertical Bar come to rest in the Vs on the truing fixture.
19) Slide the Tail stock up to the block and insert push plate as shown.
20) Tighten down the Tail stock.
21) Turn the Handwheel until the push plate has enough tension on it to keep the block from moving.

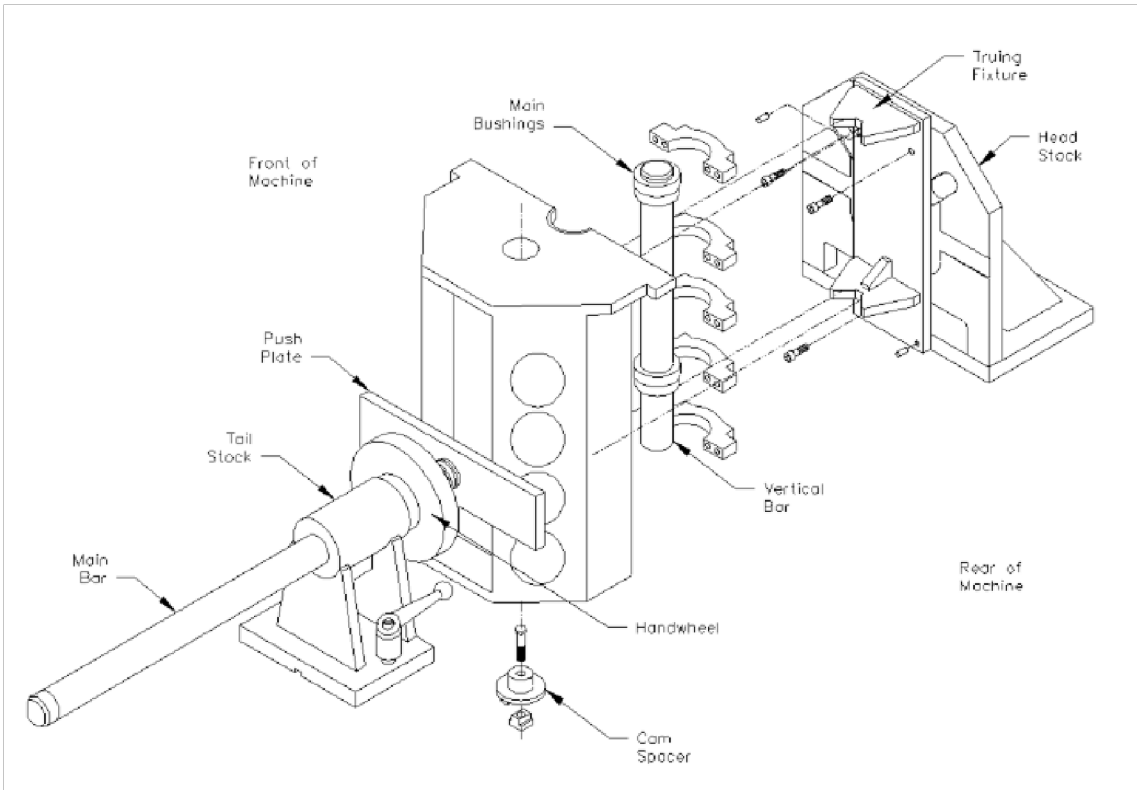
The block and fixture are now locked in place and ready for machining.



Block End Truing Fixture 650-3-30 when used with Cam Boring
When using the End truing Fixture for Cam Boring you will also need tooling package 650-3-43A

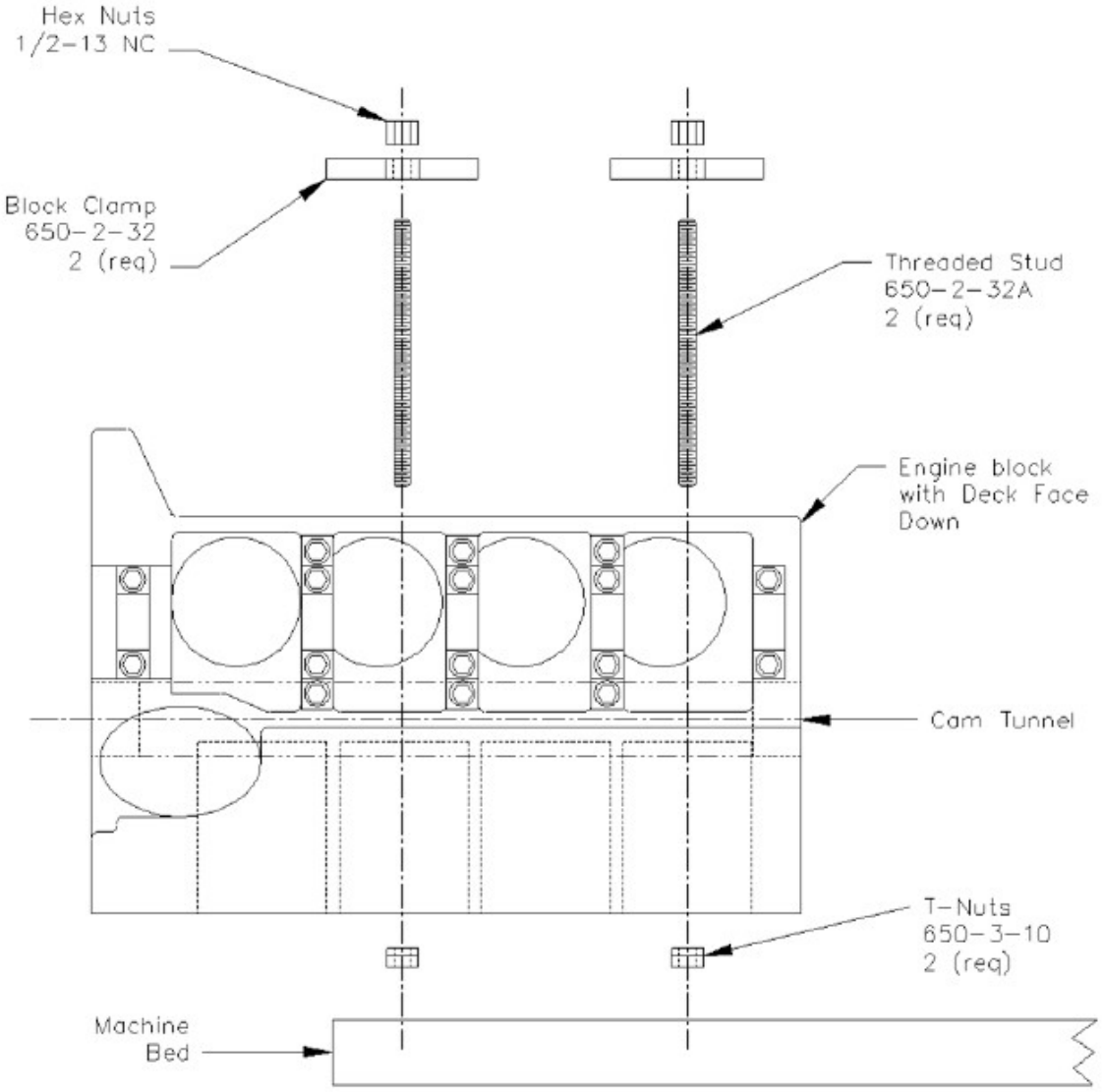
1) Use the same set up and line up procedure as with the standard End Truing Fixture discussed earlier in this section.
2) Place the Cam Spacer in the middle T-slot of the machine bed along with T-Nut and Bolt.
3) Select the correct Cam Bushing for the block you are going to be machining from the table in the Option section of this manual.
4) Place the Cam Bushing over the Cam Spacer. This will put the Cam and Main in-line and on center with the Fixturing.

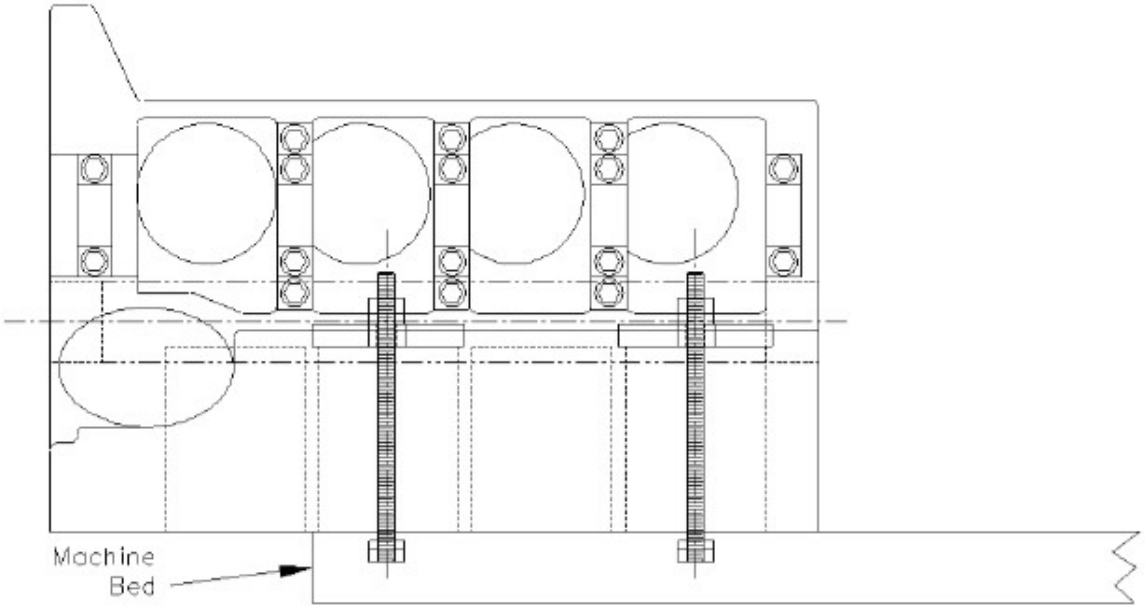
The block and fixture are now locked in place and ready for machining.



Cam Tunnel Boring

Place two T-Nuts in the outside key way (closest to operator).
Mount block onto machine bed, as shown below with the right most cylinder hanging off the machine bed.
Place threaded rod through the first and third bores and thread into T-Nuts.


Hex Nuts
1/2-13 NC
Block Clamp
650-2-32
2 (req)
Threaded Stud
650-2-32A
2 (req)
Engine block
with Deck Face
Down
Cam Tunnel
T-Nuts
650-3-10
2 (req)
Machine
Bed



Screw the supplied 1/2-13 NC nuts on to the threaded rod and snug them up. Do not tighten them all the way at this point.
Attach a magnetic base indicator to the spindle and run it along the upper pan rail to get it relatively straight. It does not need to be perfectly strait because a double flex coupling is used. Tighten the 1/2-13 nuts down.

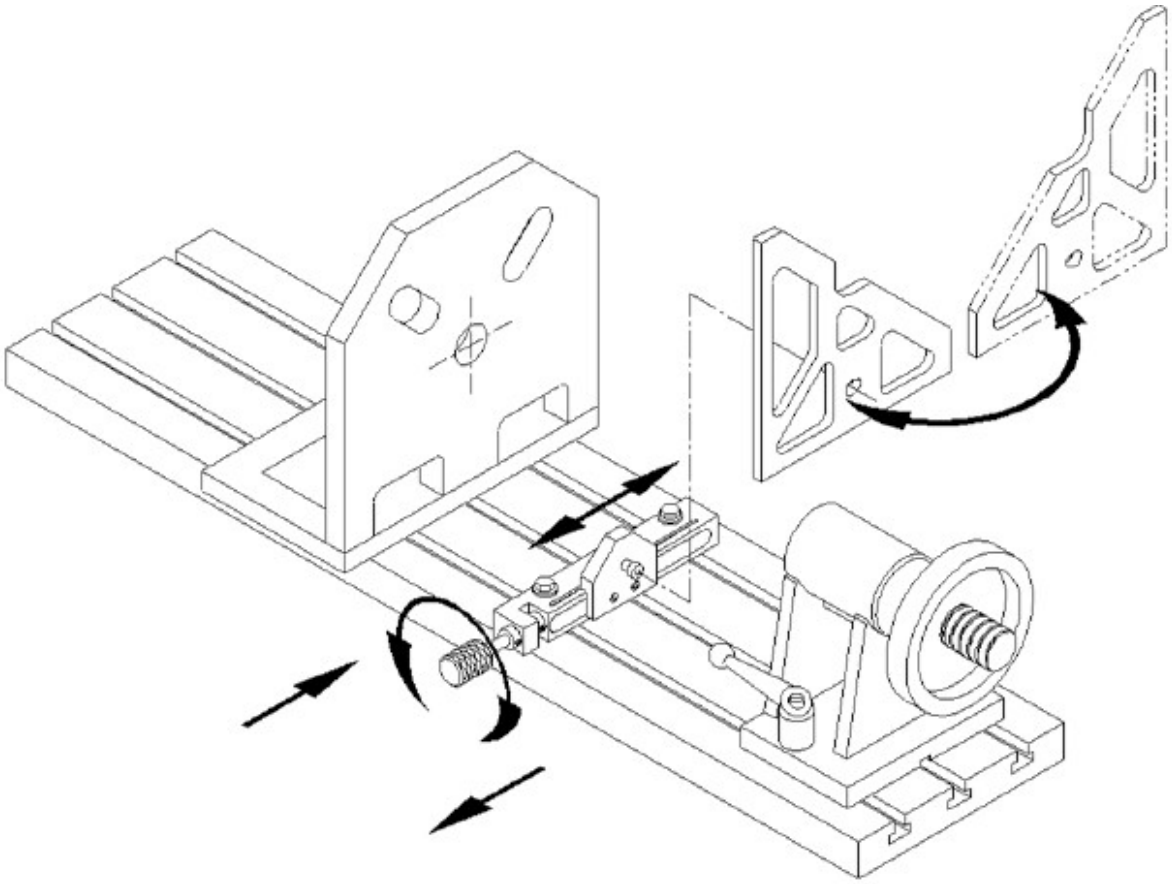
The block and fixture are now locked in place and ready for machining.

650-3-20A Pan Rail Wedge Fixture

Installation and Operation

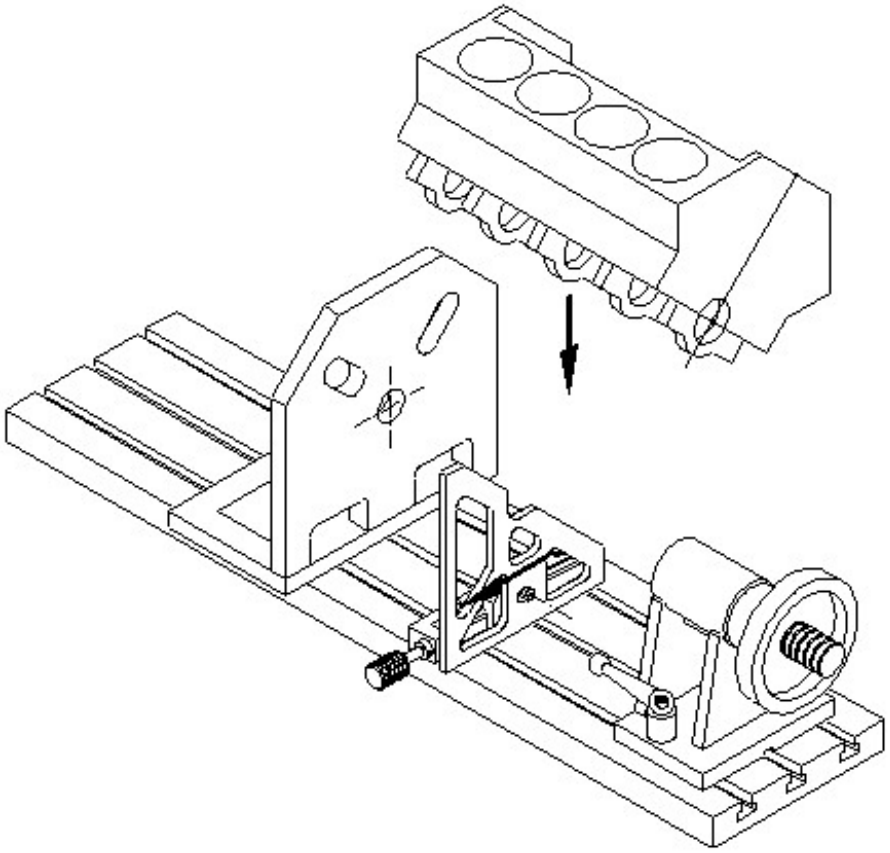
The 650-3-20A Pan Rail Wedge Fixture is used with the Performance fixture to set the correct cylinder bank angle for milling and boring operations. This fixture positions the block using the pan rail to set this angle. Both V-blocks and Y-blocks, as well as overhead cam blocks can all be set using this fixture.

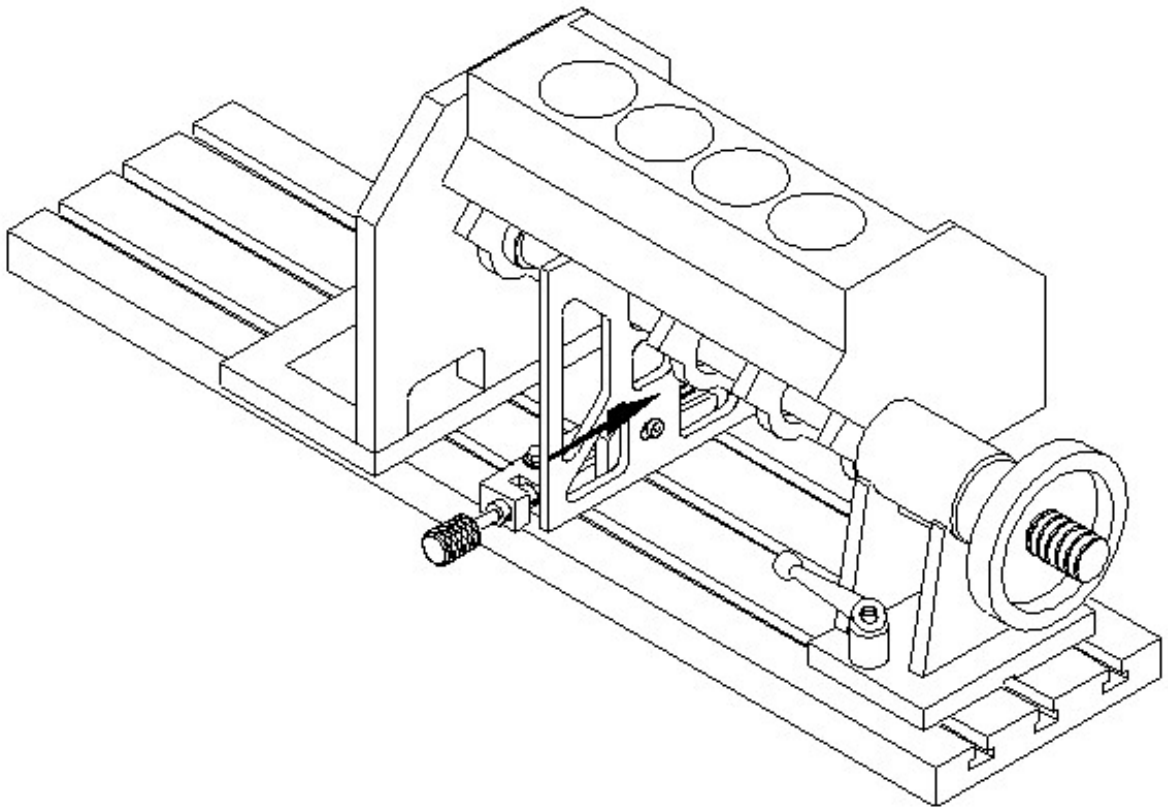
Mounting:
The pan rail fixture is mounted to the machine table between the head stock and tail stock of the performance fixture. Locate the fixture approximately centered between two of the main bearing caps. The key attached to base locates to the center keyway of the table. Once positioned, tighten the (2)(MF150) hex bolts to secure. Choose the correct wedge for the block being machined from the list below:
650-3-23H Tall 30 deg. Wedge – 60 deg. V-blocks
650-3-23G Tall 45 deg. Wedge – 90 deg. V-blocks
650-3-23B Short 30 deg. Wedge – 60 deg. Y-blocks
650-3-23A Short 45 deg. Wedge – 90 deg. Y-blocks
These wedges can be flipped to face angled surface toward front or rear, depending on which bank of the block will be machined first. Mount the wedge to the fixture by sliding the keyhole over the shoulder screw in the 650-3-24 support plate. Turning the knob clockwise moves the wedge towards the operator, counterclockwise moves the wedge away from the operator. Operate the knob to move the wedge away from the block for loading.



Loading the block

Note: for this fixture to work properly and with accuracy the block pan rails must be clean, smooth, and free of burrs. Burrs, dirt, and gasket material left of the pan rails will not let this fixture perform correctly. Install the wedge on the support plate with the angled surface facing the pan rails. Turn the knob to move support plate and wedge away from the centerline of the fixture to allow room to install the block in the fixture. Load the block with the bank you wish to machine approximately in position. Turn knob to bring wedge up to contact the pan rail. Once contacted, keep turning the knob until the wedge contacts both pan rails. At this point, the wedge should make firm contact with both the pan rails and the table. This contact can be checked with shim at both pan rails and front and rear at bottom of the wedge. Now the operator can tighten the performance fixture and proceed with machining. Note: this fixture is designed to position the block, not hold the block. Failure to tighten the fixture could result in block movement, causing possible block and/or machine damage and operator injury.



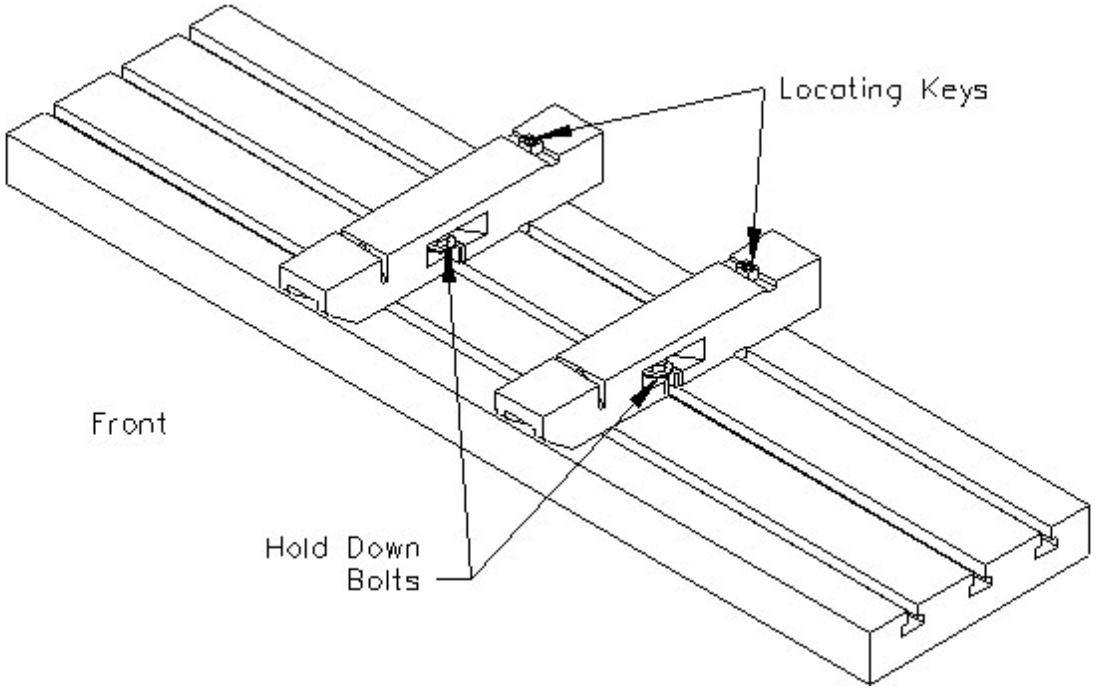


Switching banks

After machining the first bank, clear chips away from the fixtures moving parts, especially around the contact surfaces of the wedge. Turn the knob to move the wedge away from the pan rails. Move the support plate away far enough to disengage the wedge from the shoulder screw. Remove the wedge from the support plate. Loosen the block and rotate to the other bank, again, approximately in the correct position. Turn the knob to position the support plate to install the wedge, turned around to again face the angled surface to the pan rails. Make sure the contact surfaces of the wedge are clean and free of chips. Turn the knob to move the wedge into contact with the pan rails, and continue until full contact with pan rails is made. Full contact can be checked with shim at both pan rails and front and rear at bottom of the wedge. Tighten the performance fixture and proceed with machining.

V6/V8 Manual Fixture Assembly 502-1-72H

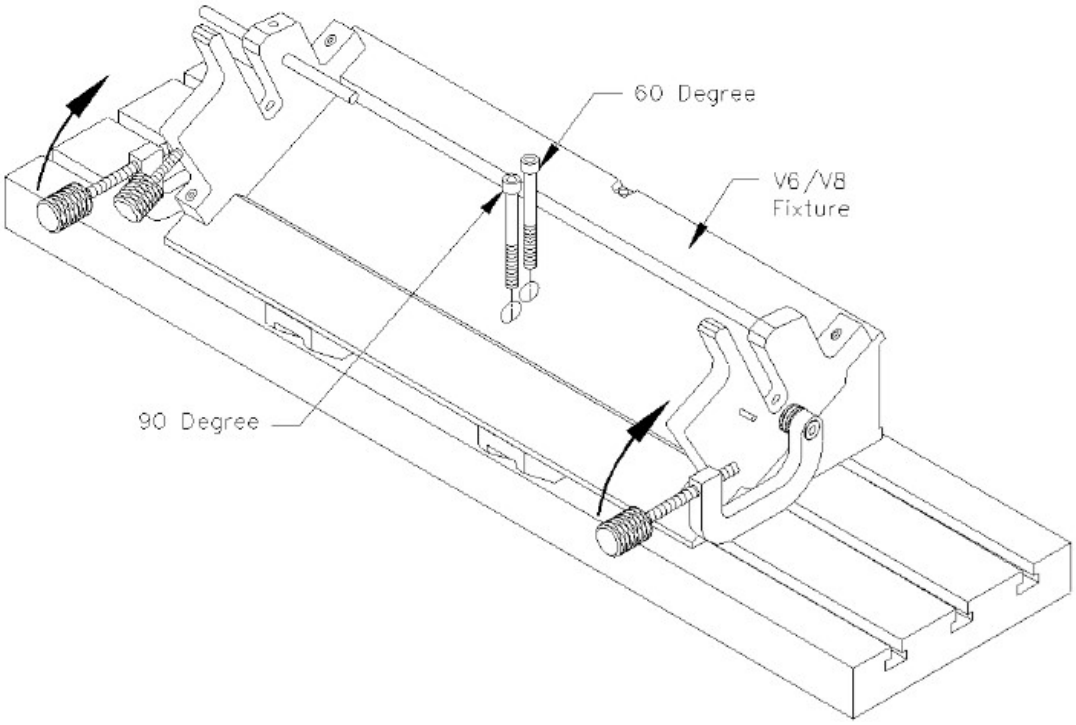
Place parallels 650-3-34 on Machine bed 10 inches apart and secure with T-Nut and Hex bolts that are provided. The keys on the bottom of the parallels go in the back Key Way.



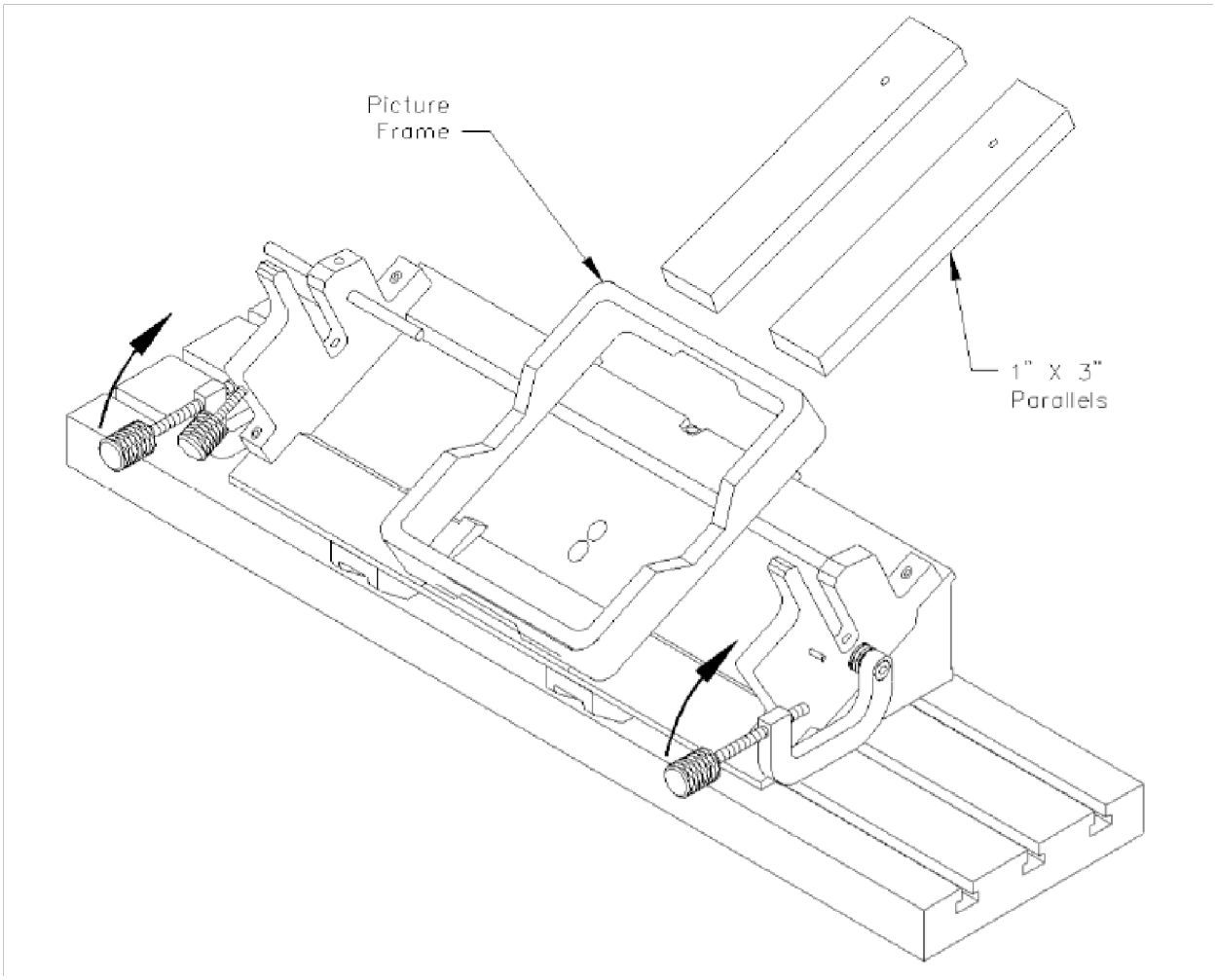
Select the 60 or 90 degree position for the fixture. Using a slow moving hoist, set the V6/V8 fixture onto the parallels.

Push the V6/V8 fixture back on the parallels until the keys in the top of the parallels line up to the machined sections on the rear of the V6/V8 fixture.

Use the supplied Socket Head cap Screw and T-Nut to secure the fixture in place.

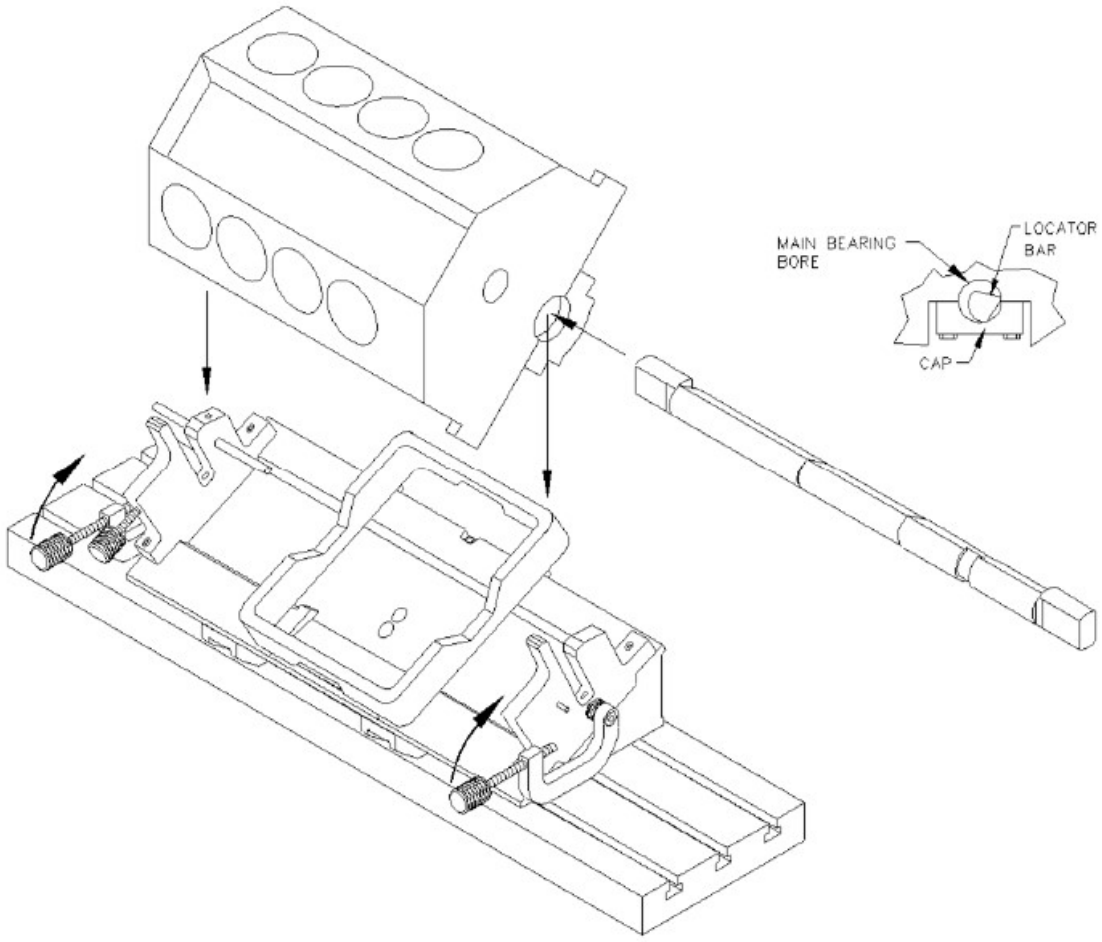


Decide if the Picture Frame or the 1” X 3” will need to be used.



Slide the Locator Bar through the Mains of the block.
Lower the block with the Locator Bar installed into the V6/V8 fixture. Clamp the Locator Bar with the screw in clamps. Shown on next page.

For a more detailed description on properly using and adjusting the V6/V8 fixture refer to the Manual V6/V8 Combination Fixture 502-1-72H in the Options section of this manual.



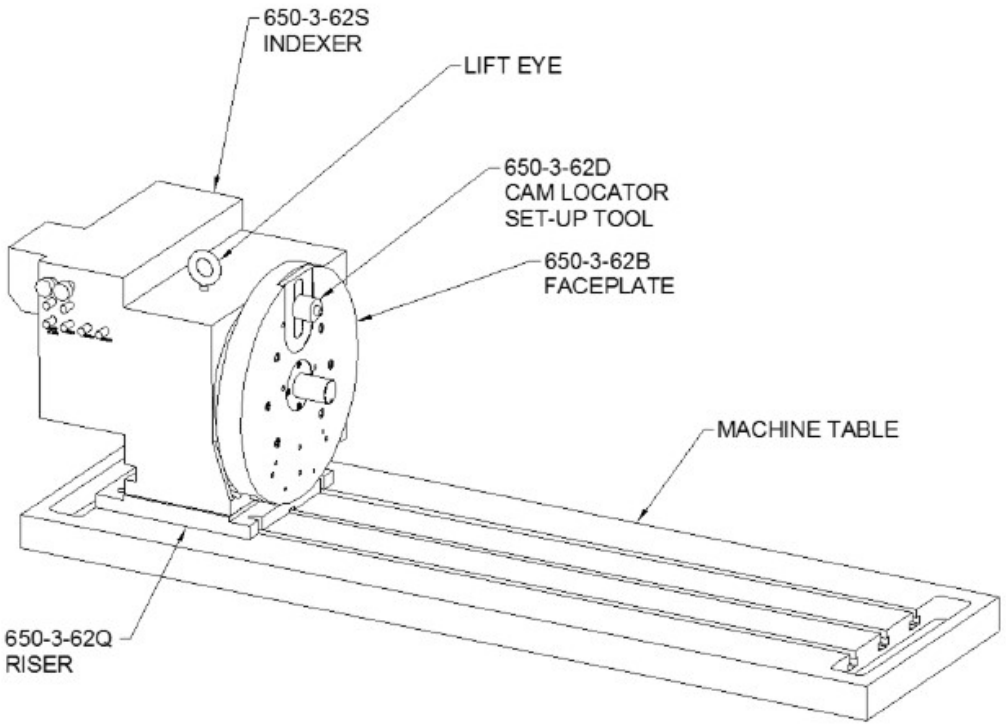
650-3-59 Automatic 4th Axis Fixture

The 650-3-59 Auto performance fixture is designed to quickly and accurately fixture v-style engine blocks for boring, surfacing, and other assorted machining operations. This fixture consists of an indexing headstock and an extending tailstock. This fixture is controlled with on screen commands on the F67 and F68 series machines. Locator sets are available to fit specific blocks and provide quick change over between different block styles. As with any precision tooling, careful machine set up and block preparation are critical to consistent accuracy and quality work.

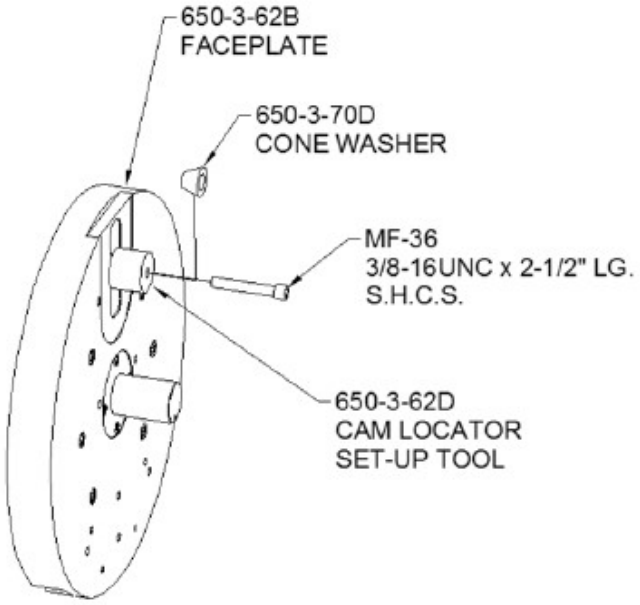
Mount the indexer unit to machine.

The indexer unit for this fixture can be lifted using the supplied lift eye on top of the indexer. This eye can stay on the indexer in use. The indexer should be positioned on the left end of the machine table with the keys on the bottom of the 650-3-62Q riser plate in the center keyway.

Push the indexer back so the keys are against the backside of the center keyway of the machine table and tighten (4) mounting bolts. Use an indicator to check 650-3-62B faceplate for straightness both vertically and horizontally.

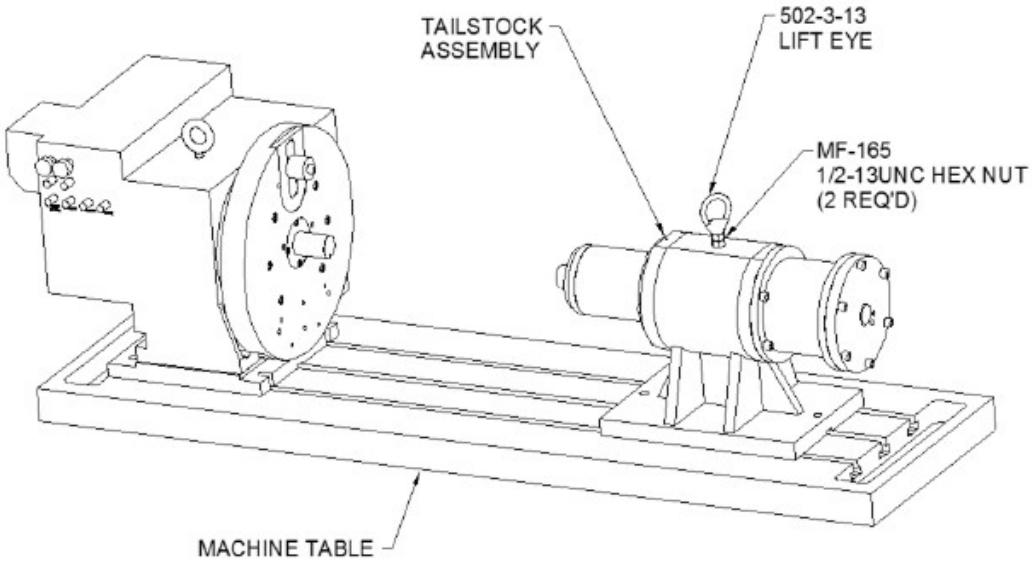


The 650-3-62D cam locator set-up tool should be installed on the indexer from the factory. This tool is used to check the angle '0' of the indexer. The diameter of this tool is the same diameter as the shaft on the 650-3-62H faceplate pinion. With the indexer set to 0 degrees these two shafts should be aligned vertically. An indicator can be used to check this. With the two shafts aligned vertically, the flat machined on the top of the 650-3-62B faceplate should indicate 0. The number stamped on the machined flat is the exact distance from the flat to the headstock centerline. The two flats milled at 45 degrees to each side of this central flat are set to the same distance from centerline.

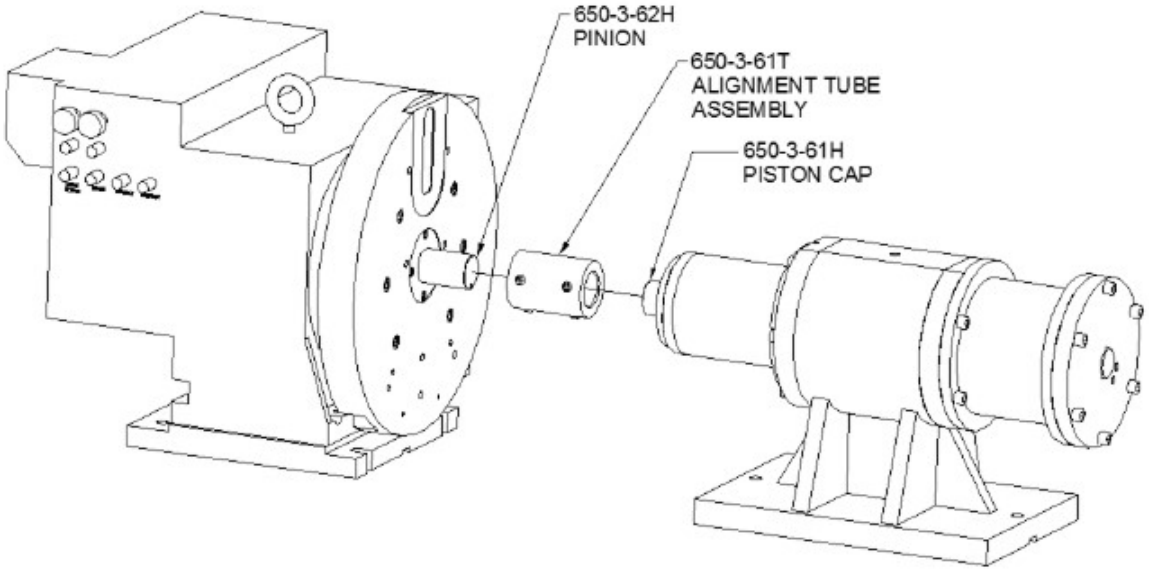


Mount the tailstock unit onto machine.

The tailstock can be lifted using the supplied 502-3-13 lift eye. Note: the lift eye has (2) 1/2-13unc nuts attached to it to prevent threading the lift eye too deep into the housing and contacting the 650-3-61G piston tube. Do not remove these nuts or substitute a longer thread as this will damage precision parts of this assembly. After moving the tailstock into position remove the lift eye and replace it with 650-3-61S 1/2-13 x 5/8" long socket button head screw to keep contamination out of the housing.

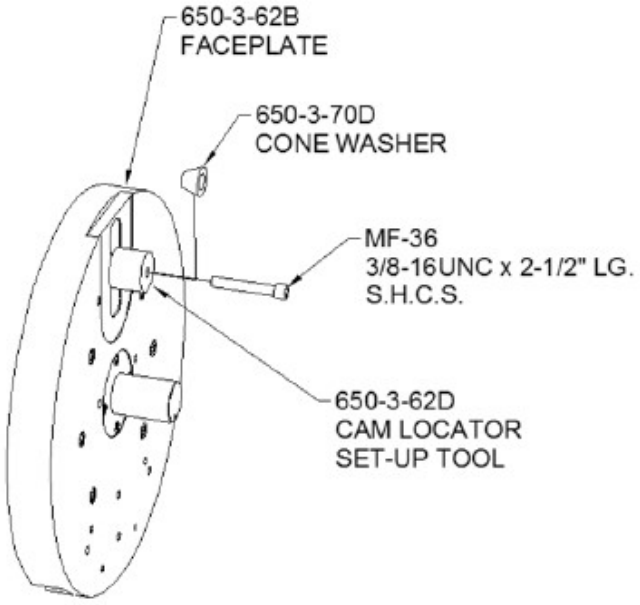


Install 650-3-61T alignment tool assembly to the pinion shaft of the indexer unit. Slide the tailstock up to place the 650-3-61H piston cap nose into the alignment tool. At this point the keys of the tailstock should be against the back of the machine table center keyway. When moving the tailstock to accommodate different block sizes the keys must be pushed against the keyway each time to ensure alignment before tightening the (2) mounting bolts. Remove the alignment tool assembly and place aside for future checking of alignment.



Using the 4th Axis Fixture

The 650-3-62D cam locator set-up tool should be installed on the indexer from the factory. This tool is used to check the angle '0' of the indexer. The diameter of this tool is the same diameter as the shaft on the 650-3-62H faceplate pinion. With the indexer set to 0 degrees these two shafts should be aligned vertically. An indicator can be used to check this. With the two shafts aligned vertically, the flat machined on the top of the 650-3-62B faceplate should indicate 0. The number stamped on the machined flat is the exact distance from the flat to the headstock centerline. The two flats milled at 45 degrees to each side of this central flat are set to the same distance from centerline.

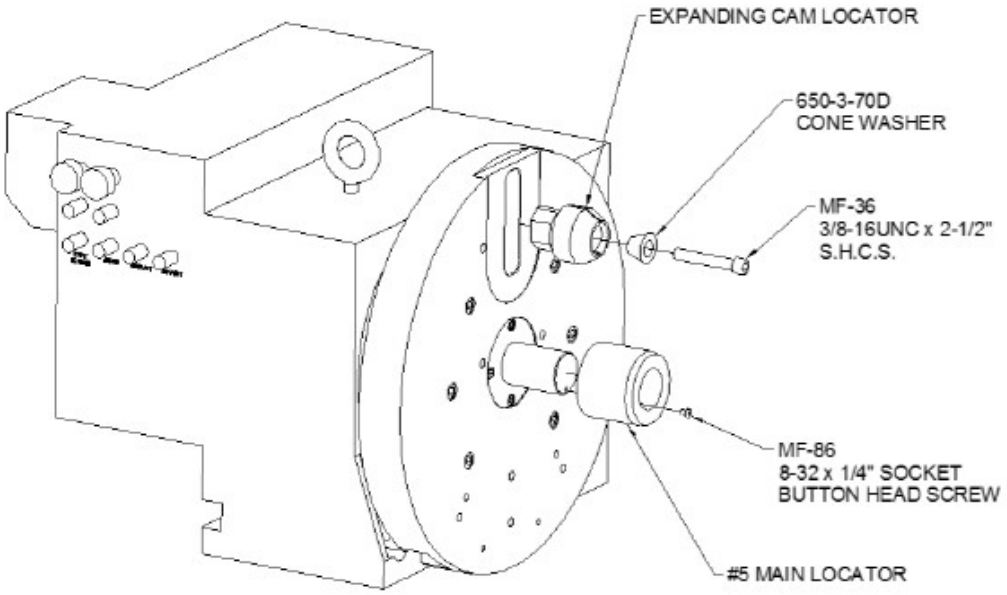


Locators: This fixture requires the use of locator sets, sized to fit individual engine blocks. These sets consist of (1) cam bearing bore locator, (1) #5 main bearing bore locator, and (1) #1 main bearing bore locator.

Main bearing bore locators: The #5 main locator is sized to fit onto the 650-3-62H faceplate pinion with the tapered end facing out. This locator is retained on the pinion by the MF-86 button head screw in the pinion. The #1 main locator is sized to fit onto the 650-3-61H piston cap of the tailstock with the tapered end facing out. This locator is also retained by an MF-86 button head screw.

Expanding cam bore locator: The cam bore locator is sized to fit into the 650-3-62B faceplate. To load the specific locator: remove the MF-36 3/8-16UNC cap screw and the 650-3-62D setup tool from the faceplate. The setup tool should be set aside for checking indexer '0' in the future. Install the cam locator with its socket fitting into the slot in the faceplate. The 650-3-70D cone washer is installed into the mating countersink in the locator, and held in by re-installing the 3/8-16UNC cap screw. This cap screw threads into the 650-3-62V cam locator nut that is trapped in the 650-3-62B faceplate Tighten the cap screw just enough to hold the locator in the desired location in the slot.

CAM AND MAIN LOCATOR INSTALLATION



Loading an engine block

This fixture requires the main bearing bores, the rear cam bearing bore, and the transmission mounting surface of the engine block be clean and free from nicks, dings, and foreign particles. Failing to ensure this will result in poor performance of your fixture.

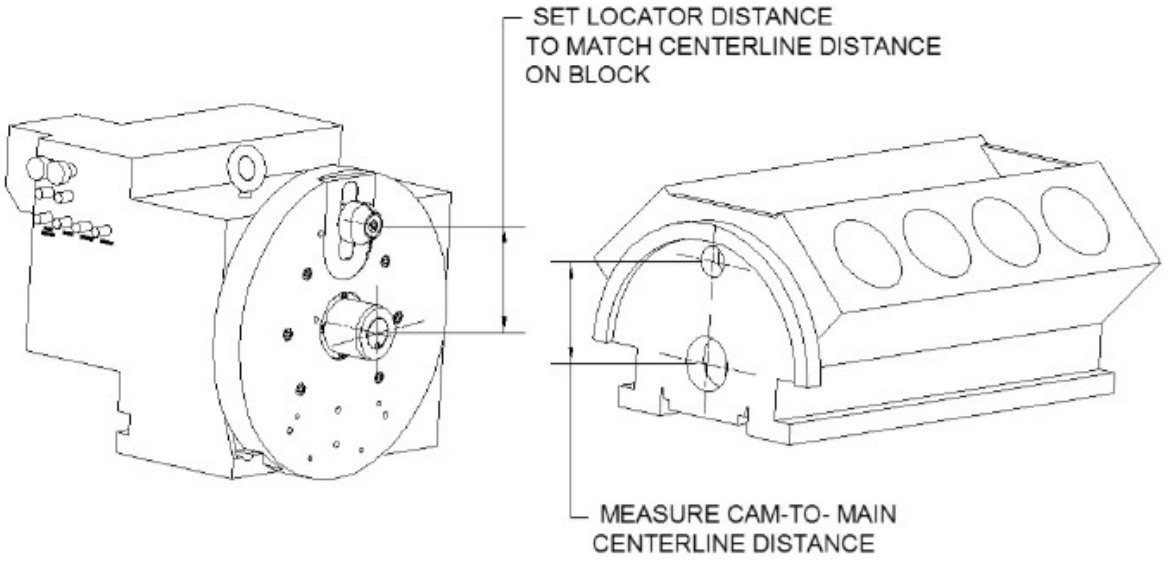
The tailstock must be positioned to allow space to install the engine block, but still be close enough to clamp the block within the 6" of stroke allowed by the tailstock piston. Approximately 3-1/2" of the stroke will be used to take up the required length of the locators, leaving approximately 2-1/2" of room to position the tailstock.

Generally, measure the overall length of the engine block and add 1". This will be the space to leave between the pinion noses of the headstock and tailstock with the tailstock piston retracted. Example: a

20” long engine block will require the pinion noses to be 21” apart. This will leave 1/2” of room on each end of the engine block for loading and still be within the stroke length of the tailstock.

After setting the distance between the pinion noses, tighten the tailstock down with its keys pushed back against the center keyway of the table.

Measure the distance between the centerlines of the main and cam bores of the block. Slide the adjustable cam locator to be equal to this distance. Lightly tighten the MF-36 cap screw to keep the cam locator in place.



Using a hoist, load the engine block down between the pinions with the bell housing surface facing the headstock. Slide the blocks main bore over the #5 main locator on the headstock and position the block to slide the cam bore over the cam locator. Tapers on the outside of both locators will aid in positioning. Push the block flush up against the faceplate and activate the ‘light extend’. This will extend the tailstock piston with limited pressure to locate the block on the tailstock. CAUTION: keep fingers and all other objects out of the path of the tailstock piston. Even with limited pressure, severe injury could occur if this rule is not followed. If desired, a hex socket and long extension can reach through the cam bores from the front of the block and be used to tighten the cap screw holding the cam locator in place. The 650-370D cone washer will expand the cam locator to provide a tighter fit on the cam bore, further centering the block on the indexer ‘0’. Once the block is located properly, full tailstock pressure can be applied after rotating the indexer to the desired angle.

After machining is complete, unload the block in reverse order. Loosen the cap screw on the cam locator to release pressure on the cam bore of the block. Position the hoist to hold block and retract the tailstock. Slide the block off the faceplate and locators to remove.

Readjusting tailstock piston alignment

Checking for tailstock alignment may be required after heavy use or after a crash has occurred. The first step is to check all possible variables before making adjustments.

Headstock: make sure the headstock is pushed back with the keys against the back of the center keyway of the machine table. Tighten the (4) bolts to secure the headstock to the table and check faceplate for squareness.

Tailstock: the tailstock also must be pushed back with the keys against the back of the center keyway of the machine table.

With both units tightened down as described above, an indicator can be used to check the alignment between the two pinions both vertically and horizontally. If the alignment is out more than .001 in either direction an adjustment must be made.

The headstock pinion should be checked for runout. With an indicator placed on the 650-3-62H pinion, rotate the indexer. The runout here should be no more than .0005. Runout of this pinion can be adjusted by loosening the (6) MF-33A 3/8-16 cap screws holding the faceplate to the indexer and tapping the faceplate until the pinion runs true. Retighten the (6) cap screws. Check both pinions with an indicator again for alignment. If still not aligned within specs the tailstock will need adjustment.

Begin with the tailstock piston retracted. Remove the 650-3-61K cushion from the tailstock piston cap. Note the timing of the 650-3-61H piston cap relative to the piston tube to reassemble in the same configuration. Remove the (4) MF-5 cap screws from the 650-3-61H piston cap. If the cap does not slide out, the MF-5 cap screws can be threaded into the four tapped holes of the cap and evenly tightened to push the cap out of the 650-3-61G piston tube. Beneath the piston cap is the 650-3-61J nose plate which is attached to the piston of the 650-3-61E stroking cylinder with a MF-172 1/2-20 hex nut. Activating the tailstock to light extend should push the nose plate out of the piston tube. Using the flats on the cylinder piston to keep it from turning, removed the 1/2-20 hex nut. Slide the nose plate off of the cylinder piston.

Remove the (4) MF-34 3/8-16 x 2” long cap screws holding the 650-3-61C tailstock extension on. The tailstock extension with the stroking cylinder should slide out through the back of the housing.

Slide the piston tube to be centered in the tailstock housing. Reinstall the 650-3-61H nose plate in the piston tube. Remove 6247A retainer, 6248 wiper, 6249 felt compressor, and 6251 felt oiler from front of 6225A bearing carrier. Loosen 100-82-2B 8-32 brass tipped set screw in bearing carrier. Tighten 6223 spindle nut until piston tube will not slide by hand. Loosen the (6) MF-32 3/8-16 cap screws holding the 6225A carrier on the housing. Loosen the (6) MF-31 3/8-16 cap screws holding the 650-3-61F rear bushing on the housing.

Install the 650-3-61T alignment tube assembly over the pinion of the headstock. Slide the tailstock up to fit the tailstock pinion into the alignment tube. Tighten (4) setscrews on the alignment tube to lock the two pinions in alignment. Push the tailstock housing to the rear to contact the keys with the middle keyway of the machine table and tighten its two mounting bolts. Check the piston tube with an indicator across the top and the back on both ends for straightness. Tap on either the carrier or the rear bushing to adjust alignment. The piston tube should be straight within .0005 in both directions. Retighten the 3/8-16 cap screws holding both the carrier and the rear bushing. Loosen the tailstock mounting bolts. Loosen the (4) set screws of the alignment tube assembly and slide the tailstock back from the headstock. Push the tailstock back on the middle keyway and tighten the mounting bolts. Recheck alignment of the pinions with an indicator in both directions. Recheck the straightness of the piston tube with an indicator. If alignment is within specs, reassemble the tailstock as follows:

Loosen the 6223 spindle nut until the piston tube can be moved by hand applying about 40-50 lbs. of force. Tighten the 100-82-2B set screw to lock the nut in place. Remove the 650-3-61H piston cap. Reinstall the 650-3-61C tailstock extension with the stroking cylinder attached and lightly tighten its (4) mounting cap screws. The stroking piston cylinder should be sticking out the front of the piston tube.

Reinstall the 650-3-61J nose plate and tighten the 1/2-20 nut to secure. Release the air pressure from the stroking cylinder and slide its piston back by hand into the piston tube until the nose plate contacts the bottom of the counterbore in the piston tube. Tighten the (4) cap screws holding the 650-3-61C tailstock extension on. Reinstall the 650-3-61H piston cap and 650-3-61K cushion.

Block Blueprint Dimensions

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.

Block Dimensions: Cylinder Bore Dimensions

Block Make & Model	Cylinder Bore Location Bank Left	Cylinder Bore Location Bank Right	Cylinder Bore Spacing	Cylinder Bank Offset	Cylinder E Center from Dowel Pin Location
Dimension From					
Chevy 302, 305, 307 327,350, 400	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	4.4	.880 offset	1.42
Chevy 396, 427	1. 2.24 front dowel 2. 7.08 3. 11.92 4. 16.76	1. 2.47 front dowel 2. 7.32 3. 12.15 4. 16.99	4.84		1.85
Chevy 454	1. 2.24 front dowel 2. 7.08 3. 11.92 4. 16.76	1. 2.47 front dowel 2. 7.32 3. 12.15 4. 16.99	4.84		1.85
Chevy LS1	1. 2.200 front dowel 2. 6.600 3. 11.00 4. 15.400	1. 2.200 front dowel 2. 6.600 3. 11.00 4. 15.400	4.4		2.2
Chevy SB 2	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	4.4	.880 offset	1.42
Ford 289,302,351W	1. 2.190 rear dowel 2. 6.570 3. 10.950 4. 15.33	1. 2.190front dowel 2. 6.570 3. 10.950 4. 15.330	4.38		Left Bank 2.115/2.125 Right Bank 2.118/2.122

Ford 351C, 351M & 400	1. 2.190 rear dowel 2. 6.57 3. 10.950 4. 15.33	1. 2.190front dowel 2. 6.570 3. 10.950 4. 15.330	4.38		Left Bank 2.120 Right Bank 2.120
Ford 390 & 427	1. 2.305/2.325 rear 2. 6.935/6.955 3. 11.565/11.585 4. 16.195/16.215	1. 2.305/2.325 front 2. 6.935/6.965 3. 11.565/11.585 4. 16.195/16.215	4.63		Left Bank 2.220 Right Bank 2.220

Block Make & Model	**Cylinder Bore Location Left Bank**	**Cylinder Bore Location Right Bank**	**Cylinder Bore Spacing**	**Cylinder Bank Offset**	**Cylinder Bore Center from Dowel Pin Location**
Dimension From					
Ford 428			4.63		
Ford 429 & 460	1. 2.45 rear dowel 2. 7.35 3. 12.25 4. 17.15	1. 2.45 front dowel 2. 7.35 3. 12.25 4. 17.15	4.9		
Ford 4.6 & 5.4			3.937		
Ford V10			3.937		
Chrysler 318,340,360	1. 4.02 rear dowel pan rail 2. 8.48 3. 12.94 4. 17.40	1. 3.14 rear dowel pan rail 2. 7.60 3. 12.06 4. 16.52	4.46	0.88	
Chrysler 383, 426 wedge	2.52 front dowel 7.32 12.120 16.92	2.52 front dowel 7.32 12.120 16.920	4.8		
Chrysler 426 Hemi, 440	2.52 front dowel 7.32 12.120 16.92	2.52 front dowel 7.32 12.120 16.920	4.8	9.5	
Chrysler V10 Iron					

Block Dimensions: Other Dimensions

lock Make & Model	Angle	ation Left Bank	Lifter Right Bank	Diameter	Diameter	am Bore to ink Bore Centerline
Dimensions From						
Chevy 302,305,307 7,350, 400	degrees Int & Ex	. 1.58 front dowel 2. 3.14 3. 6.16 4. 7.72 5. 10.38 6. 11.94 7. 14.96 8. 16.52	. 1.48 front dowel 2. 3.04 3. 6.06 4. 7.62 5. 10.28 6. 11.84 7. 14.86 8. 16.42	2.4906/2.4916 late model journal 2.6406/2.6416 sbc 2.8406/2.8416	ournal 2.0190/2.0210 2.009/2.0110	4.521
Chevy 396, 427	rld degrees Int. degrees Ex. Caution Dart Blocks are 38.75 degrees	. 1.34 front dowel 2. 3.14 3. 6.18 4. 7.98 5. 11.02 6. 12.82 7. 15.86 8. 17.66	. 1.57 front dowel 2. 3.37 3. 6.41 4. 8.21 5. 11.25 6. 13.05 7. 16.09 8. 17.89	2.9365/2.9375	2.1395/2.1405 th Journal 2.1295/2.1305	5.15
Chevy 454	rld degrees Int. degrees Ex. Caution Dart Blocks are 38.75 degrees	front dowel 2. 3.14 3. 6.18 4. 7.98 5. 11.02 6. 12.82 7. 15.86 8.17.66	front dowel 2. 3.37 3. 6.41 4. 8.21 5. 11.25 6. 13.05 7. 16.09 8. 17.89	2.9365/2.9375	st Journal 2.1395/2.1405 th Journal 2.1295/2.1305	5.15
Chevy LS1		. 1.4004 ft dowel 2. 3.227 3. 5.800 4. 7.627 5. 10.200 6. 12.027 7. 14.600 8. 16.427	. 1.173 ft dowel 2. 3.00 3. 5.573 4. 7.400 5. 9.973 6. 11.800 7. 14.373 8. 16.200	2.750/2.751	2.3276/2.3295 st & 5th Journal	4.885

Deck Height	lock Make & Model	Angle	ation Left Bank	ation Left Bank	Diameter	Diameter
	Dimension From					
9.0315	Chevy SB 2		. 1.518 front dowel 2. 3.353 3. 5.918 4. 7.753 5. 10.340 6. 12.152 7. 14.740 8. 16.552	. 2.306 front dowel 2. 4.140 3. 6.706 4. 8.540 5. 11.127 6. 12.940 7. 15.527 8. 17.340	st Journal	st Journal 2.0190/2.0210 th Journal 2.009/2.0110
9.8	Ford 89,302,351 W	degrees 15 min. Intake & Exhaust	. 1.375 Rear dowel 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245	. 1.375 front dowel 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245	2.4412/2.442 289/302 3.1922/3.1930 51 W	st journal 2.2041/2.2051 th journal 2.1440/2.1450
9.8	Ford C, 351M & 400	degrees 15 min Intake & Exhaust	. 1.375 rear dowel 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245	. 1.375 front dowel 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245	2.9417/2.942	ournal 2.2495/2.2505 2.1440/2.1450
9.235/9.245	Ford 390 & 427	degrees 15 min Intake & Exhaust	. 1.145/1.165 rear 2. 3.125/3.145 3. 5.775/5.795 4. 7.755/7.775 5. 10.745/10.765 6. 12.725/12.745 7. 15.375/15.395 8. 17.355/17.375	. 1.145/1.165 front 2. 3.125/3.145 3. 5.775/5.795 4. 7.755/7.775 5. 10.745/10.765 6. 12.725/12.745 7. 15.375/15.395 8. 17.355/17.375	2.9412/2.942	st journal 2.3095/2.3105 th journal 2.2495/2.2505
	Ford 428				2.9412/2.942	st journal 2.3095/2.3105 th journal 2.2495/2.2505

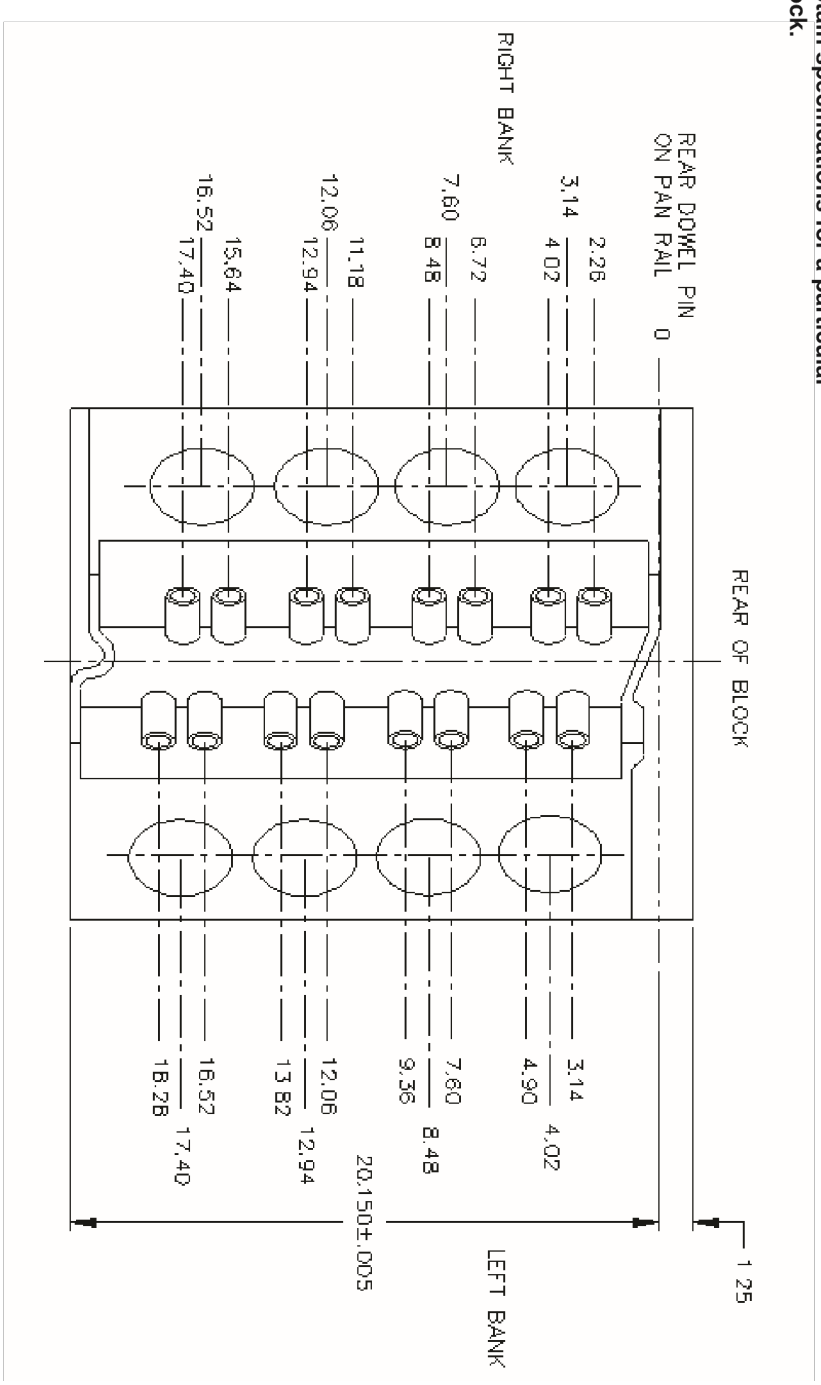
am Bore to ink Bore Centerline	Deck Height
4.521	
4.804/4.807	8.206
5.0435/5.0465	≤/ 10.292/10.302 400 9.206 C
5.0475/5.0485	
5.044	10.17

Chrysler 318 Dimensions

Block	k	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia
318	6.1215/6.1275		48deg or 59deg (All production small blocks are 59 degrees)	#1 2.1290 / 2.1305 #5 1.6915 / 1.6930

We have heard that these dimensions are the same for 318/340/360 but we have been unable to confirm.

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.

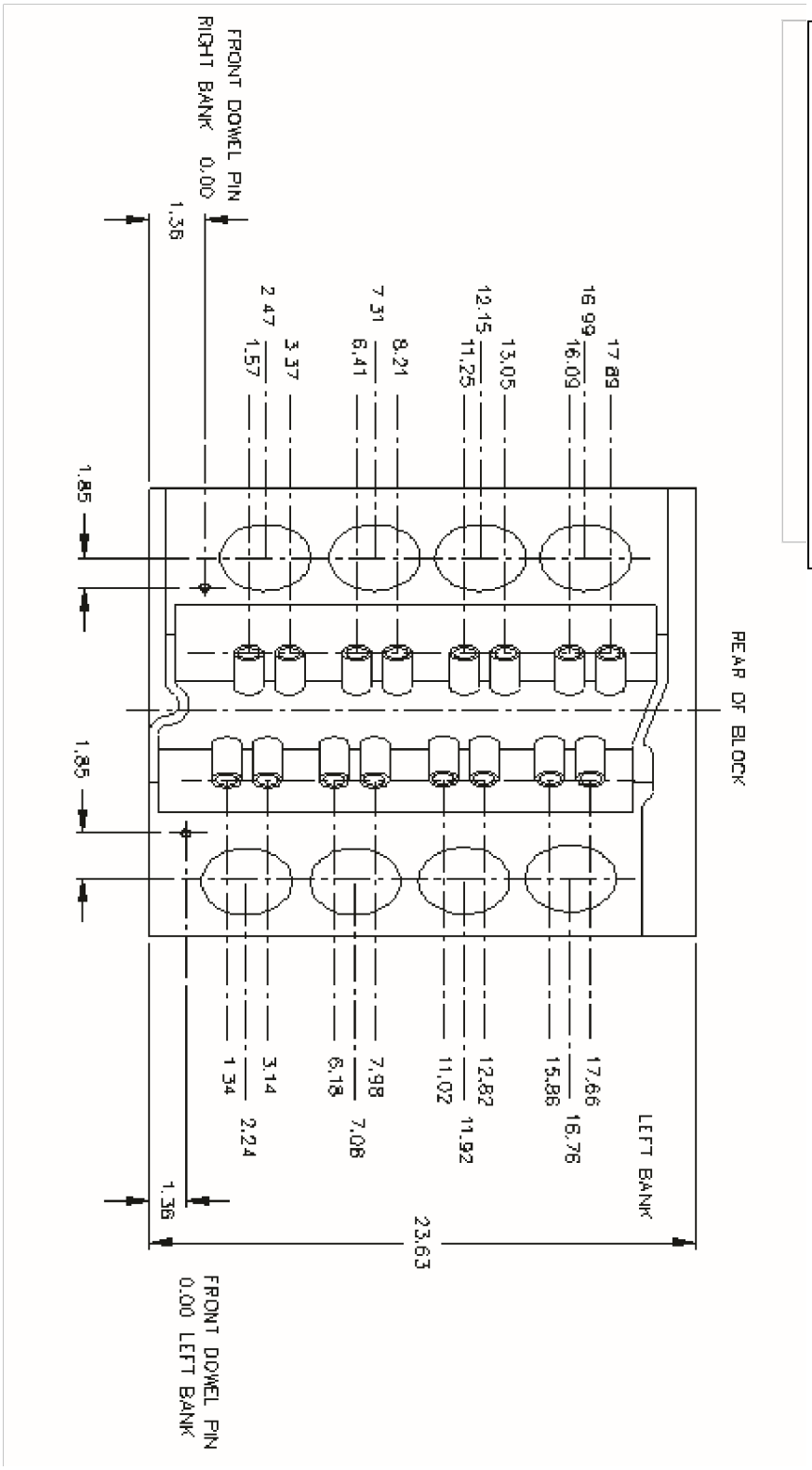


Crank Bore Dia	2.6925 / 2.6932	

Chevrolet Big Block Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Big Block Chev.	5.15	45 or 38(Tall Deck)	#1 2.1395 - 2.1405 #5 2.1295 - 2.1305	2.9365 - 2.9375

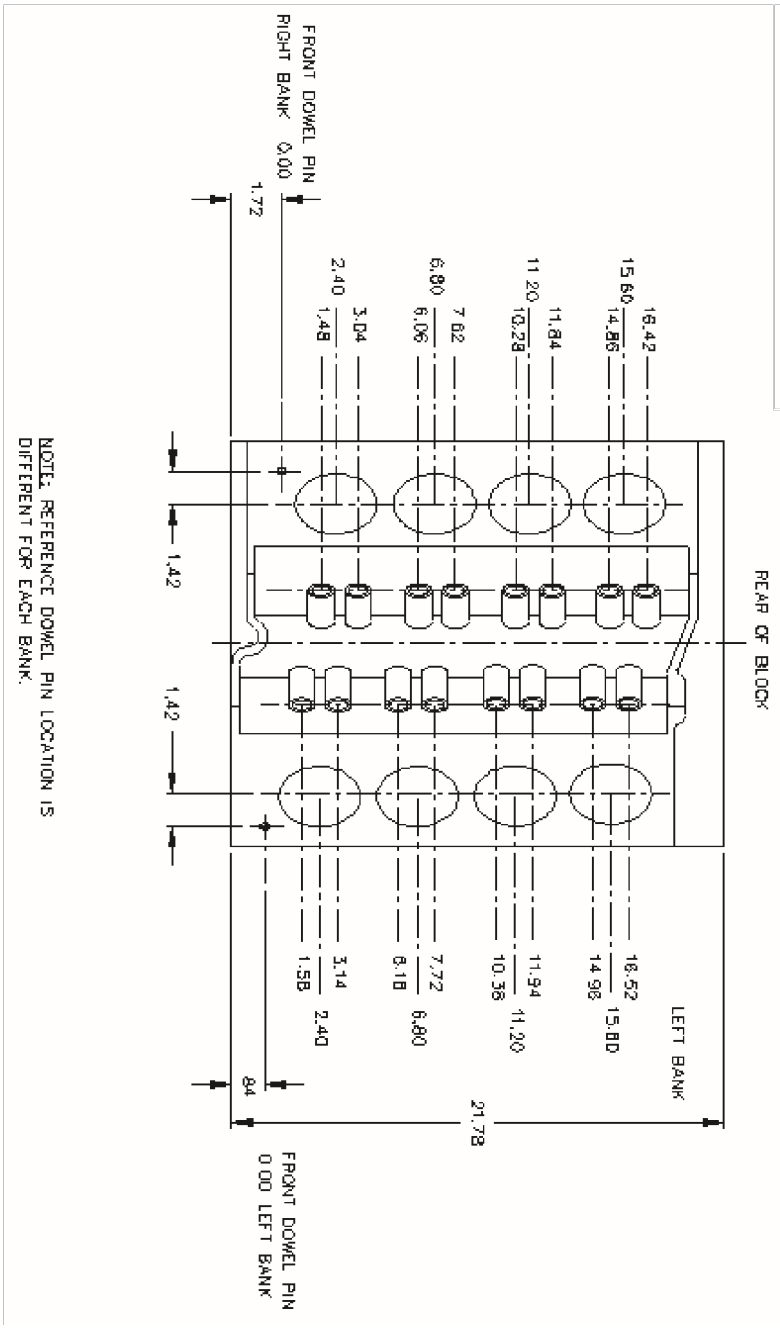
Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. *(HP Books "Chevrolet Power" IZBN #1-55788-087-5 available through most book stores)* We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year block.



Chevrolet Small Block Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Small Block Chev.	4.521	49	#1 2.0190 / 2.0210 #5 2.0090 / 2.0110	

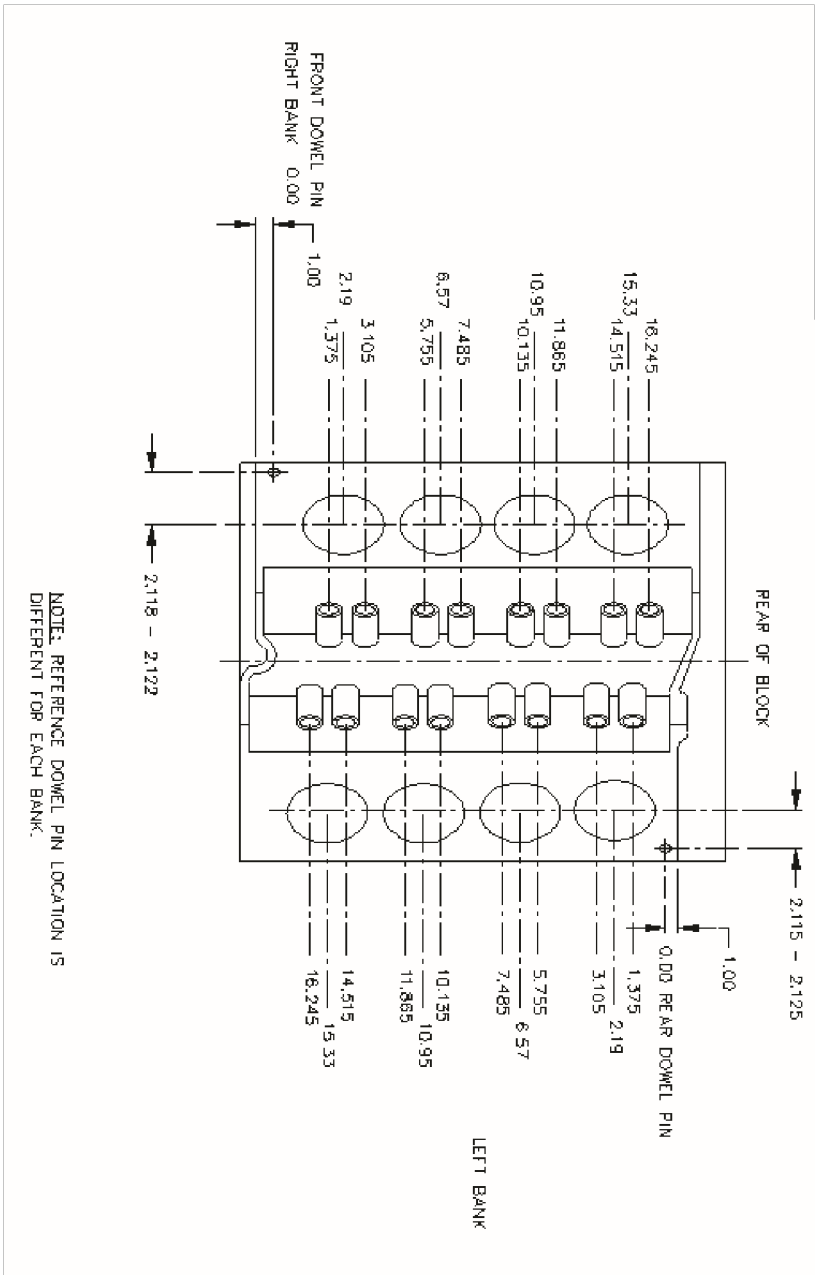
Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. *(HP Books "Chevrolet Power" IZBN #1-55788-087-5 available through most book stores)* We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year block.



Ford 289-302-351W Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Ford 289/302/351W Small Blocks	4.804" - 4.807"	41deg 15min / 41deg 45min	2.0925 - 2.0835	2.9417 - 2.9425

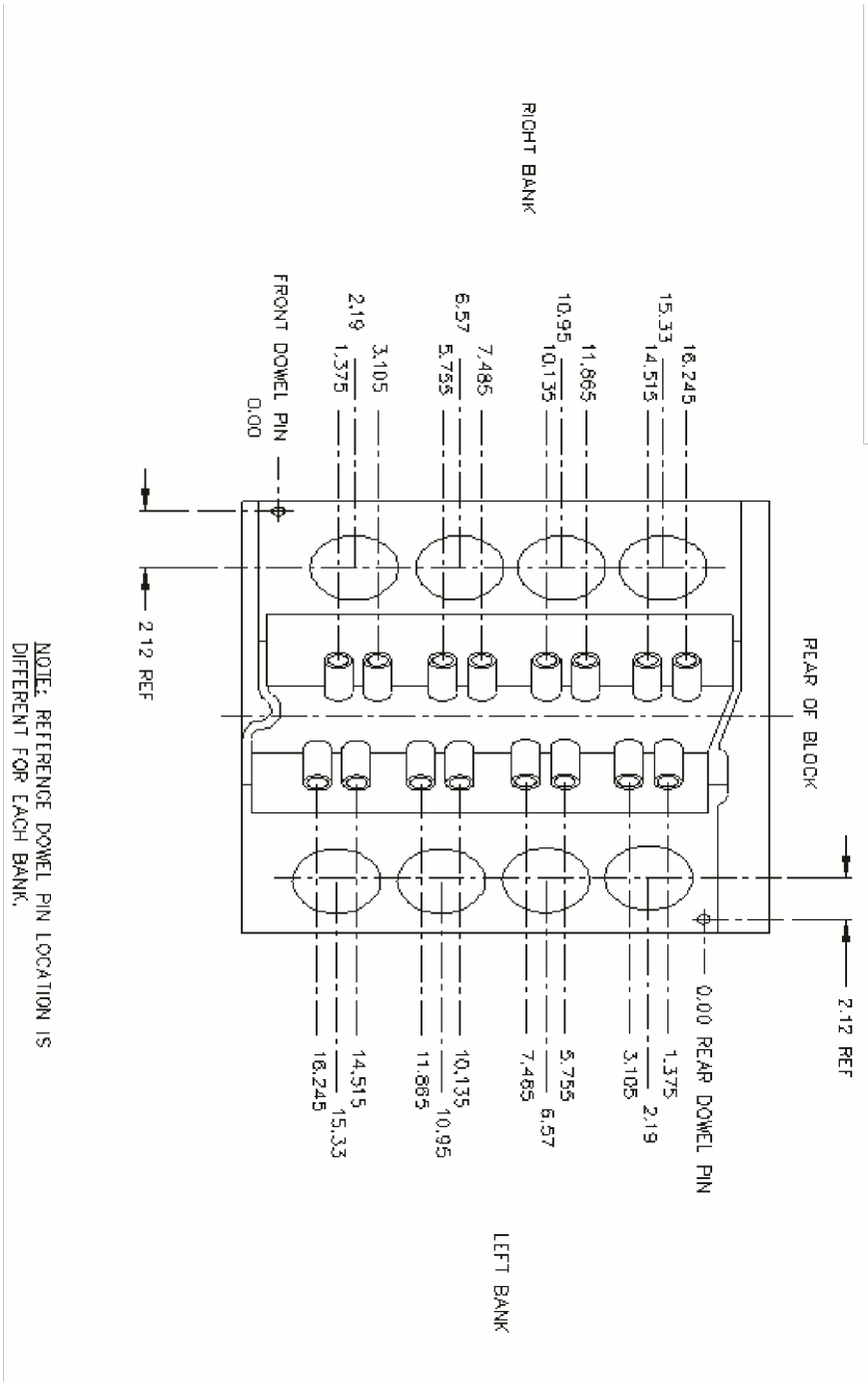
Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.



Ford 351C-400 Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Ford 351C/400 BIG Blocks	5.0435 - 5.0465	41deg 15min / 41deg 45min	#1 2.1258 - 2.1268 #5 2.0225 - 2.0235	2.9417 - 2.9425

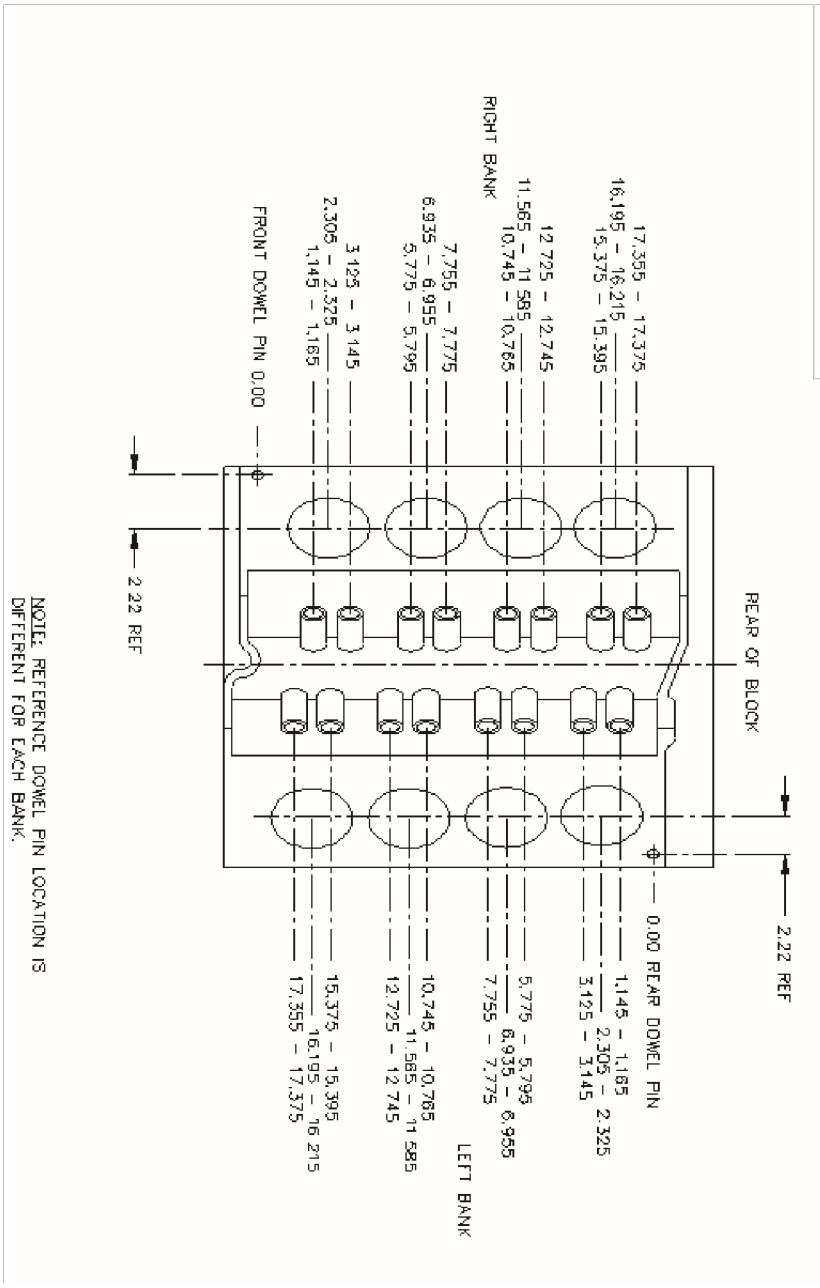
Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.



Ford 390-427 Dimensions

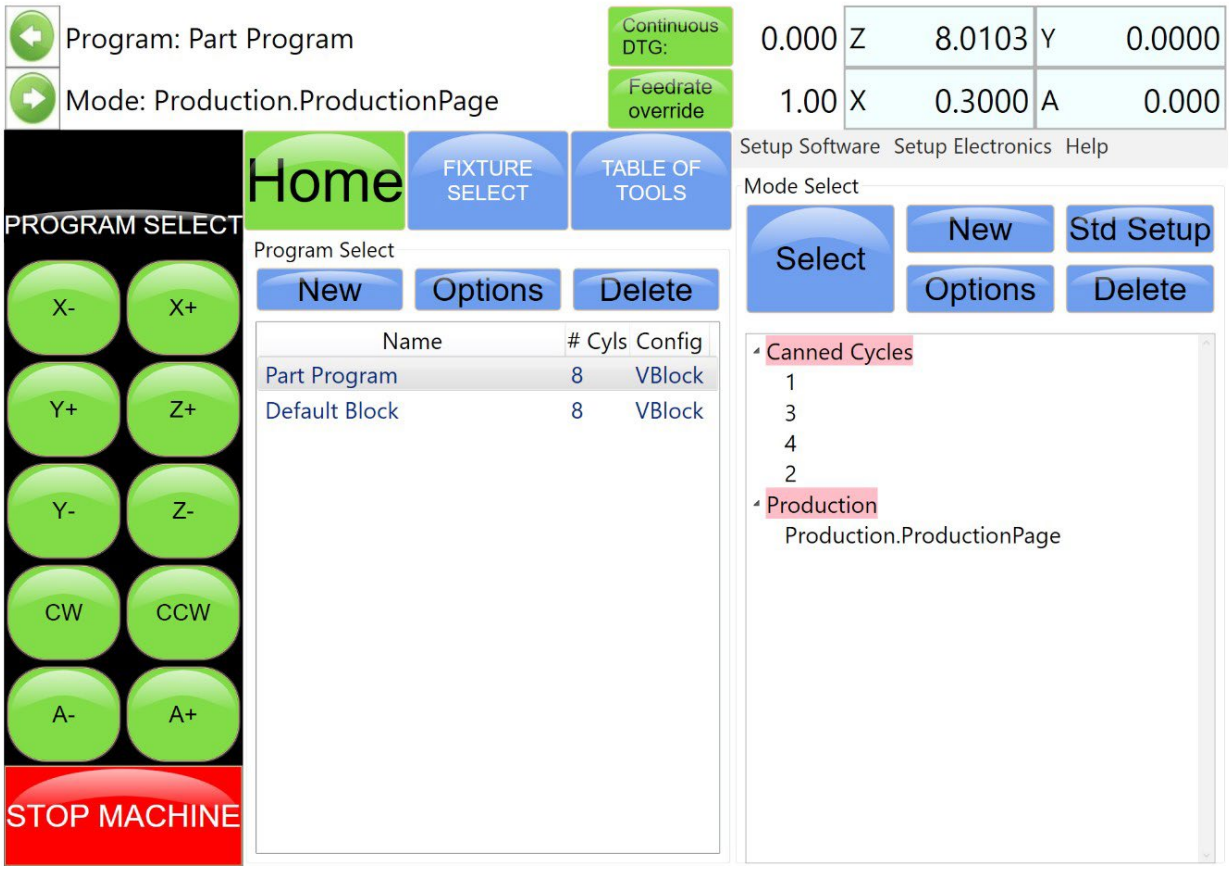
Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Ford 390 / 427 BIG Blocks	5.0475 - 5.0485	41deg 15min / 41deg 45min	#1 2.3095 - 2.3105 #5 2.2495 - 2.2505	2.9417 - 2.9425

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.

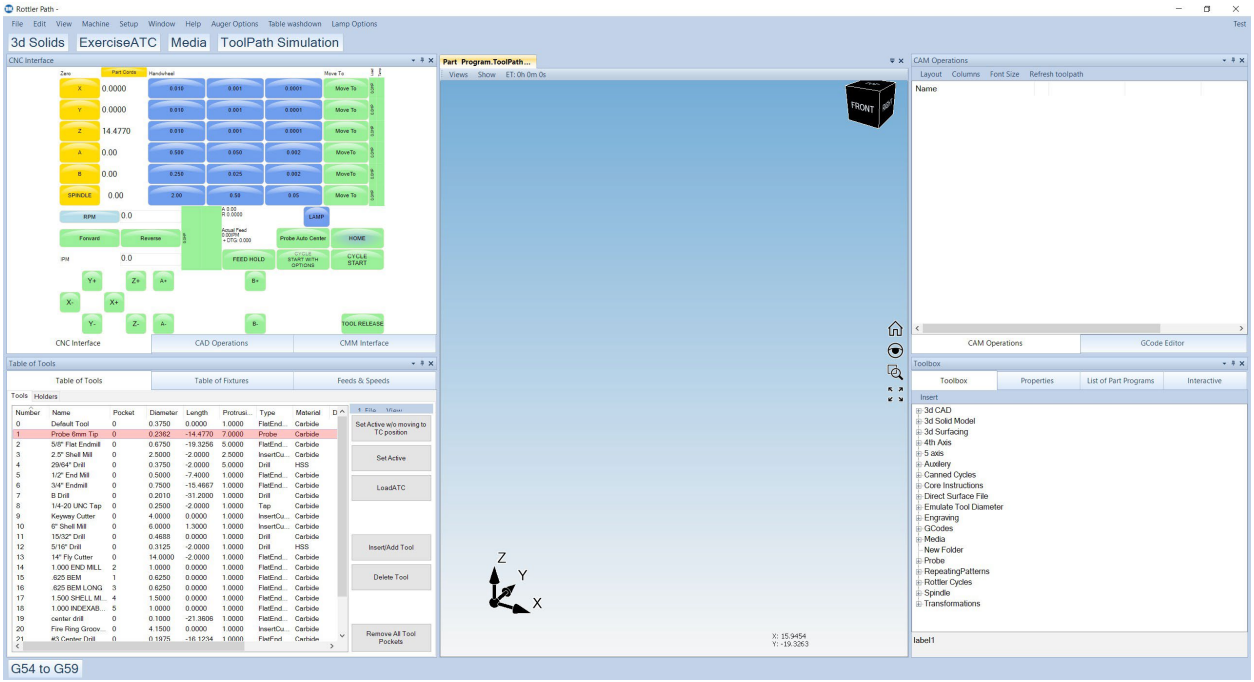


General Machine Information

The Rottler EM69ATC utilizes Computerized Numeric Control (CNC). From within any of the Rottler software packages the CNC control interface can be used to move the machines axis in any of the labeled directions. Below are images of the main user interfaces found in the RPATH/4C software and the Rottler Block Software program packages.



Rottler Block Software User Interface



Rottler RPATH/4C User Interface

Homing

The EM69ATC ***MUST*** be homed anytime it is restarted after it has been shut down. The machine will automatically prompt the user to home the machine before being able to program and run any cycles. Homing is required so that the axes reference their current locations so that parts can be machined correctly in their respective coordinate locations.

Building Programs

NOTE: The instructions within this operator manual will cover the creation and use of block machining programs in the Rottler Block Software. For information regarding the creation and use of Rottler's Rpath/4C software packages consult the Rottler Introduction to Rpath/4C training manual that is supplied with the purchase of that software package.

Create a Block Program

Within the Block Software's main screen under the program select tab, select the "NEW" button to create a new engine block file. Enter the engine block information for name, number of cylinders and block configuration and press OK when finished. On the Right side of the screen under the mode select tab, press new and select the type of operation you wish to perform to create the operation program within the engine block file. For this example we will create a cylinder bore program.

Options

If you need to change the block configuration or name of a block that has already been created, use the Options button. This will bring up the same window as when the block was created.

Std (Standard) Setup

Pressing Std Setup will cause all of the available Modes to be inserted into the Modes area on the right hand side.

Select

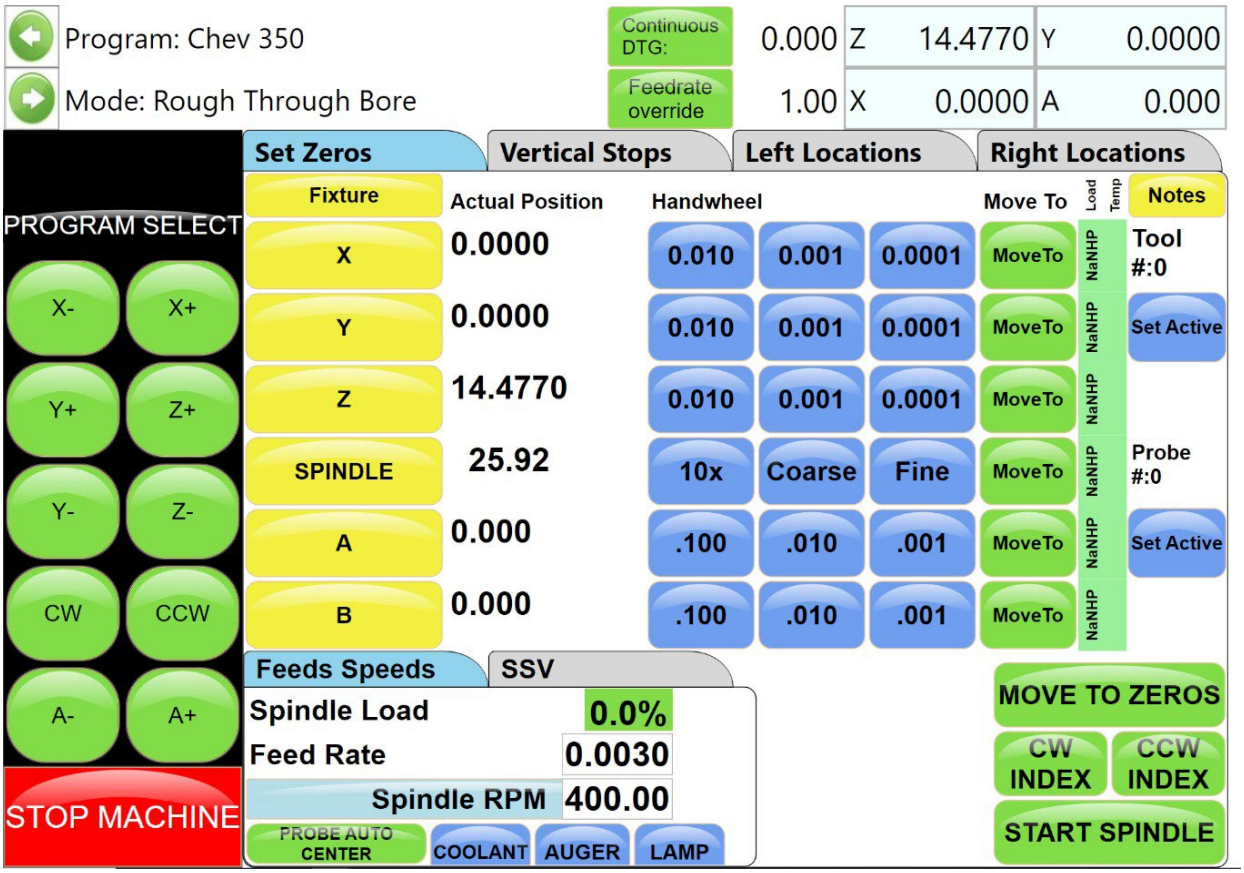
Pressing Select with a Mode highlighted will open the operations screens for using the program.

Options

Resetting the Options button with a Mode highlighted will open a window where you can change the mode name. There is also a check box to allow positive number to be entered into the program where they are normally forced to a negative value.

Cylinder Bore Mode 3 Axis

Select Cylinder Bore and then Rough Through Bore on the screen. This will bring up the boring program with the Set Zeros tab shown.

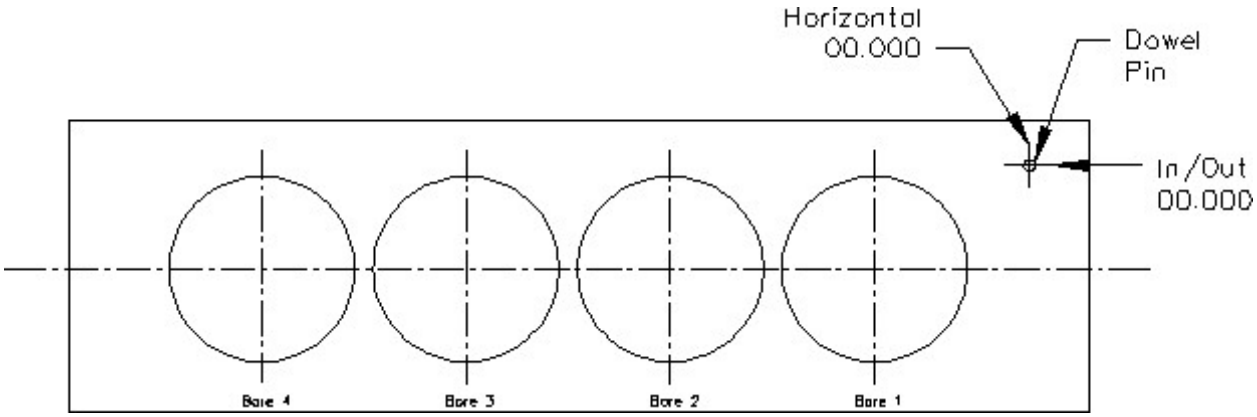


Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the operation. The zero points can be set at any point in the machines' travel. Every program will save it's individual zero positions, once the zero positions are set for an individual program then the operator need only to position the block in to be worked on in the same position each time to successfully run the operations.

X and Y Axis Zero's

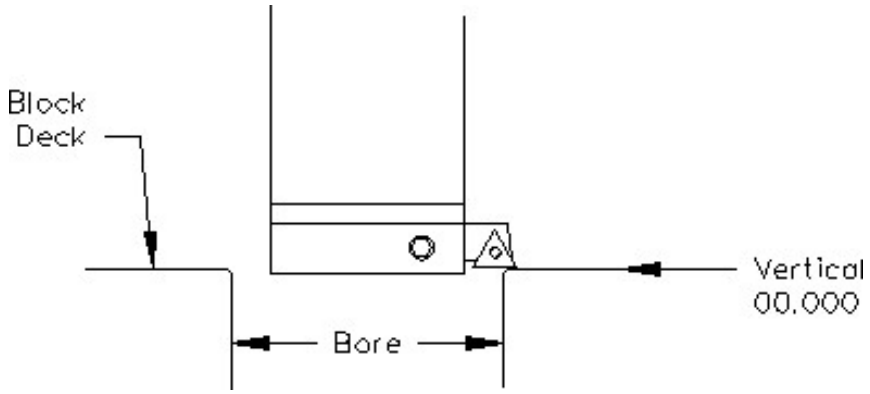
For this example, the Engine Block Dowel Pin will be our zero point for the **X-Axis** (Horizontal) and **Y-Axis** (In/Out) axis. Using either the touch trigger probe or a test indicator, find the center of the dowel pin. Without moving the machine, **double tap** on the **X and Y buttons** directly beneath the **Fixture button** on the **Set Zeros** screen. A window will pop up asking if you want to set the selected axis, **press yes to zero the axis.**



Vertical Zero

There are two different methods for setting the Z-axis zero for block machining

For this example, we will be using the block deck to zero our Z-axis (vertical axis). Insert a tool holder into the cutterhead you will be using to bore the block. Center the cutterhead over a cylinder. Using the Vertical Handwheel, bring the cutterhead down until the tool just touches the deck and press the Vertical Zero button. The display next to this button will go to zero. The Vertical zero has now been set.



The zeros points for all axis have now been set. All the numbers entered from this point on will reference these zero positions. You are finished with the Set Zeros screen, select the next Tab to the Right, Vertical Stops.

Blueprinting Method

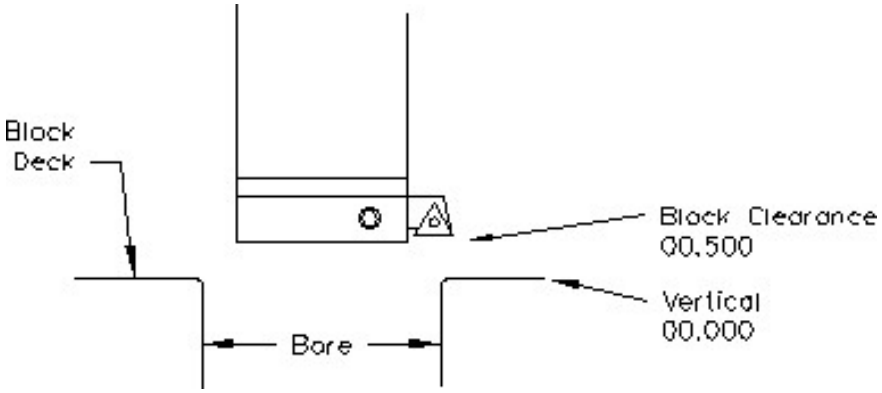
Even if you are not going to be boring a block to the blue print specifications it is recommended to have the Blueprint values entered. It will speed up the process of indicating and probing a block by giving the operator a close estimate of bore location.

Programming Vertical Stops

To build a program you must set the Vertical Stops for the program. This is done by filling out the boxes in the Vertical Stops Tab.

Block Clearance

This is the distance above the zero position or block deck allowing the cutterhead to move to the next bore unobstructed. If you are Blueprinting a block the number will be just enough to allow the cutterhead to clear the block deck. We recommend a .100” to .500” range for this value.

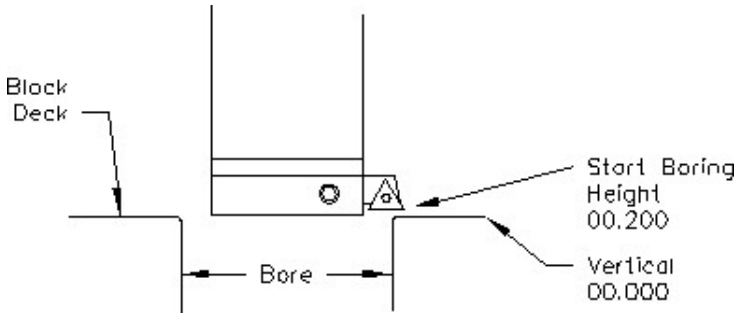


Centering Height

When Blueprinting this stop is not needed. It should be the same as the block Clearance Height.

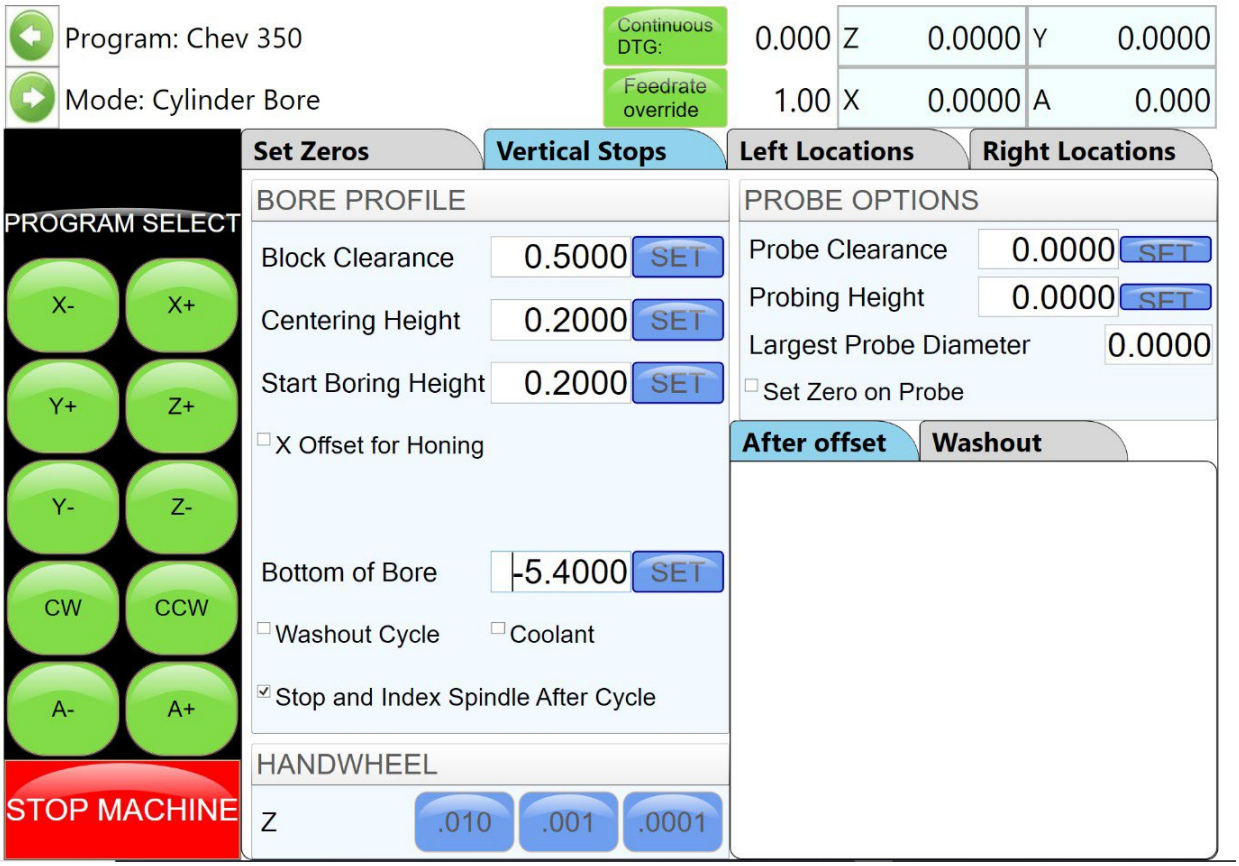
Start Boring Height

This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally, this is just a short distance above the block deck to minimize the amount of time the machine bores through air. We recommend .030” to .200” range for this value



Bottom of the Bore

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go back to the Block Clearance position. For blue printing you can use a OEM bore length specification.



X Offset for Honing

This feature is designed to offset the cutter at a certain height in the lower bore to cut out block web intrusions to make room for the honing process. Checking this box will add the offset parameters options to the Vertical Stops Tab.

Start Offset Height

This is the vertical depth at which the cutter will shift to the side to start cutting.

Horizontal Offset

This is the distance the cutter will offset from the bore center.

Change Speeds at Horizontal Offset

Often the clearance cut is much larger that the cut for the rest of the bore. For this you can check this box and enter a different RPM and Feed Rate. If a different speed and feed are not need do not check this box and the same feed and speed will be used that was used to bore the cylinder.

For each bank (of a V Block) you can select the direction required for the offset routine.

Washout Cycle

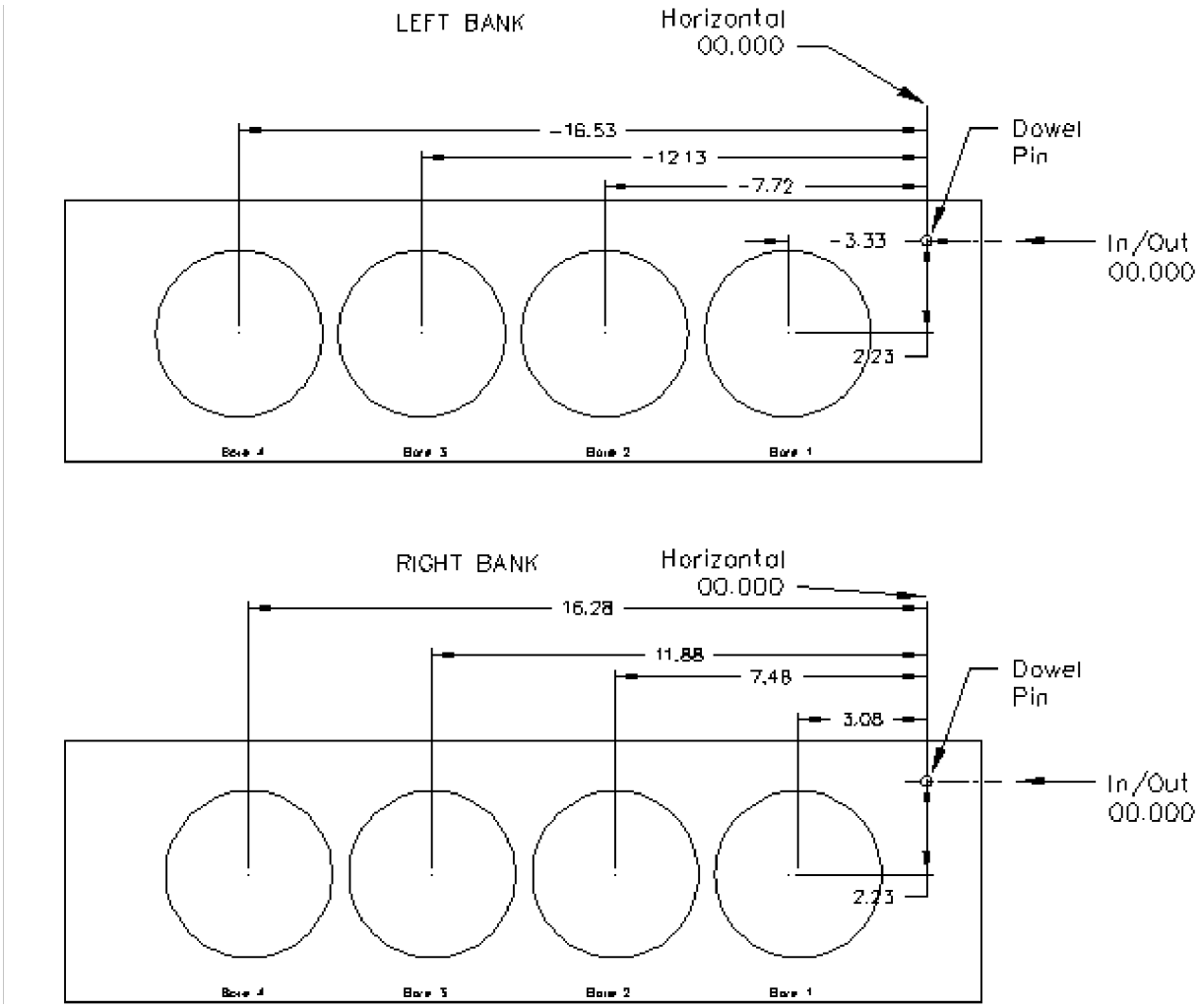
Checking this box will open another window on the right hand side of the screen. Here you can enter the RPM and number of revolutions that will be performed when the cutter reaches the Bottom of Bore position. This is used when a certain type of finish is required on a counter bore or the bottom of a sleeve cut. Typically the RPM is reduced during a washout cycle.

Stop and Index Spindle after Cycle

Checking this box will cause the spindle to be indexed to the three O'clock position after the cylinder has been bored but before it retracts. It will also offset to the left before the tool is retracted. This is the default setting. You would not want this check in an operation such as Lifter Boring.

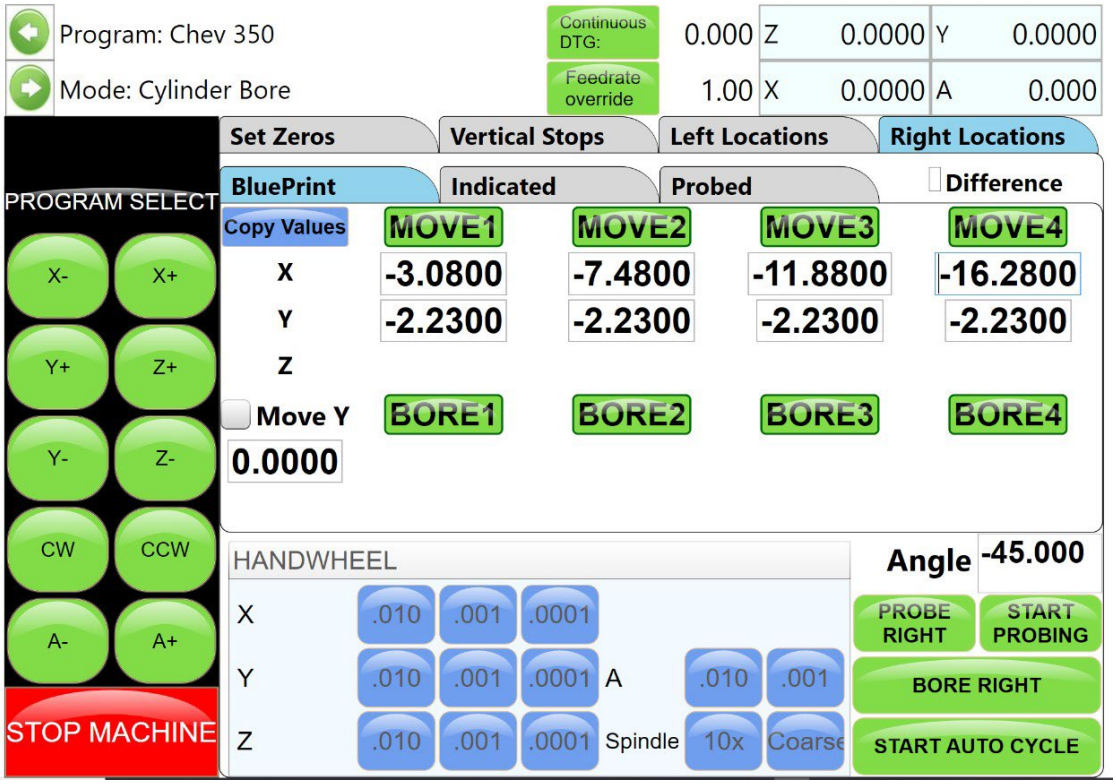
Bore Locations

To build a program you must set the X and Y axis locations for the individual cylinder bores. Since we previous set the program zero at the dowel pin location, we may now use the block blueprint dimensions to program the X and Y locations for the cylinders in reference to the dowel pin location.



Left Locations

Right Locations



Boring a Block

Once the Vertical Stops and Left/Right location stops have all been entered the Spindle RPM and Feed Rate need to be entered. This is done on the Set Zeros screen. Once this is done you can go to the Left and/ or Right Bore location screens and bore the cylinders.

Pressing the Bore Left for Bore Right buttons Will Bore all the cylinders that have Green bore button below them.

Pressing a Bore button once will turn that button Yellow. Any Yellow button will not be bored when the

Bore Left or Right button is pressed.

Double clicking any Bore button will turn all the Bore button yellow EXCEPT the one that was double click.

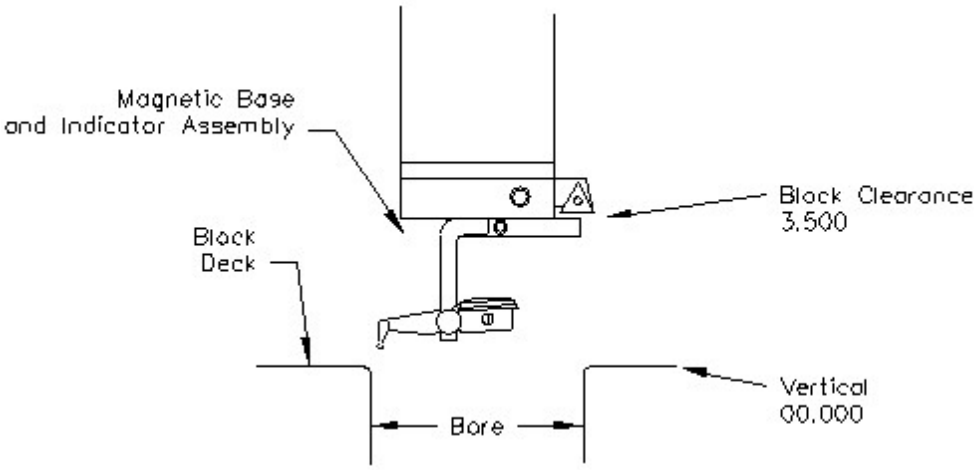
If your machine is equipped with a 4th axis fixture then the Start auto cycle button will bore both the left and right banks automatically and roll the 4th axis over in between the two banks.

Indicator Method

Sometimes it is necessary to us a dial indicator to find the bore locations of an engine block when creating the program. When this is required the programming is identical to the blueprinting method, with the only exception being that we will now take advantage of the centering height option. When using this method we want to program the machine so that it goes to the rough location of the bore, where we then can use a dial indicator to find the true center of the bore to be machined before saving the X,Y location.

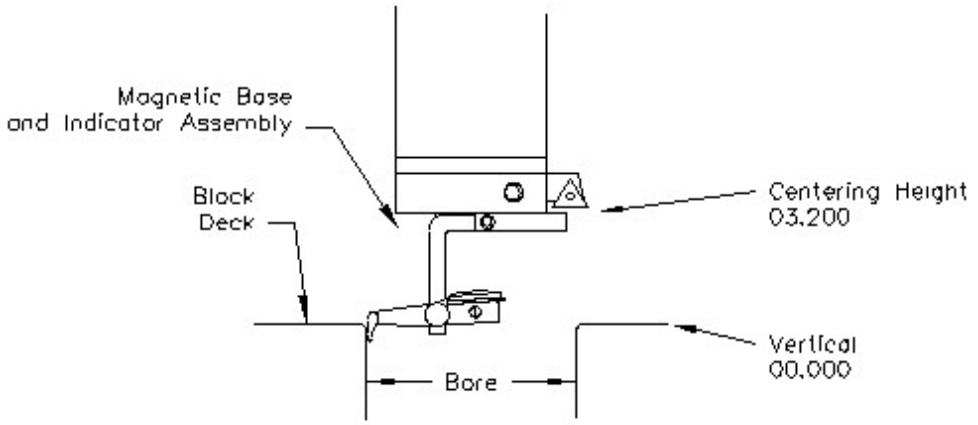
Block Clearance

This is the distance above the zero position or block deck allowing the cutterhead to move to the next bore unobstructed. When you are indicating the cylinders in you must have this stop set so the indicator will clear the block surface when traveling to the next cylinder.



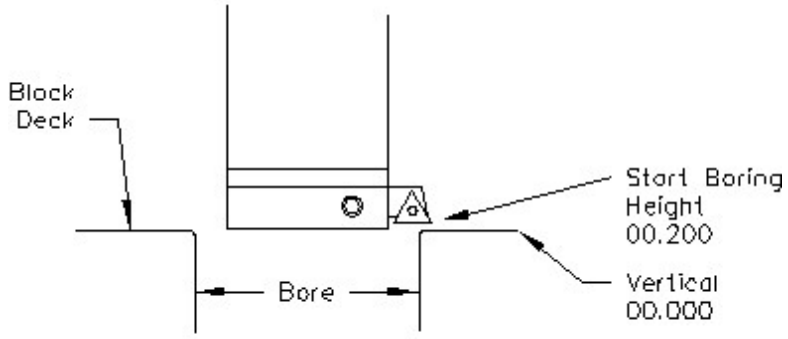
Centering Height

This is a distance above the vertical zero where you will be manually centering the block. The drawing below is a typical set up for manual centering or indicting a cylinder.



Start Boring Height

This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air.



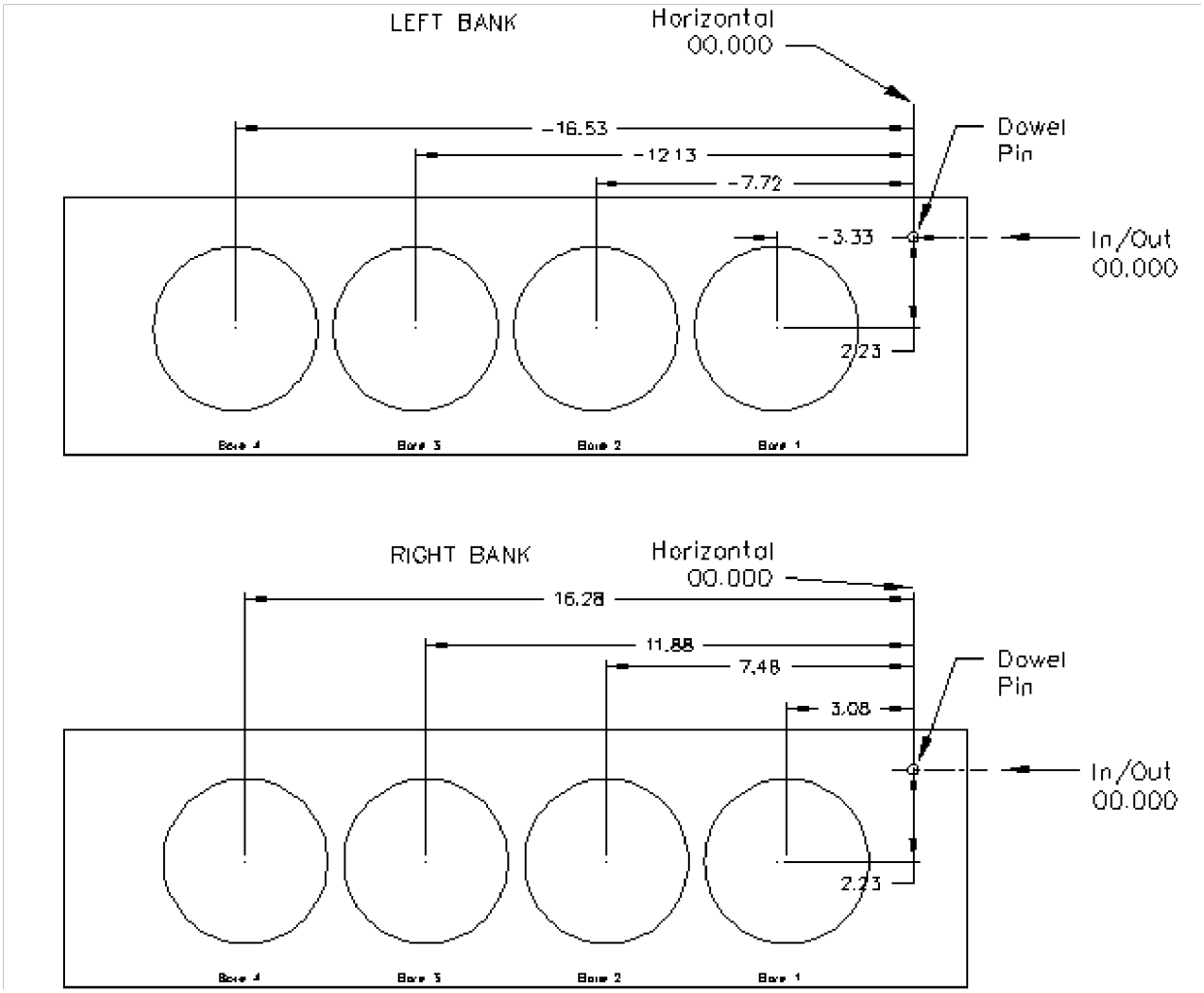
Bottom of the Bore

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go to the block Clearance position.

The Vertical stops have now been set. You are finished with the Vertical Stops screen, select Left and/or Right Locations.

Bore Locations

To build a program you must set the X and Y axis locations for the individual cylinder bores. Since we previous set the program zero at the dowel pin location, we may now use the block blueprint dimensions to program the rough X and Y locations for the cylinders in reference to the dowel pin location.



Select the left locations tab and then navigate to the indicated. If you have programmed the blueprint locations into this program, then press copy values and then blueprint. This will cause the values from the Blueprint page to be copied into the indicated page. This give you a starting point to indicate the individual cylinder from.

Press the Move 1 button. The machine will move to the first cylinder and stop at the centering position. Manually indicate the cylinder in using the X and Y axis handwheel options. Once the cylinder is centered press the Set 1 button. This will transfer the current position of the machine into the first set of Data Boxes. Repeat this process for all the cylinders that need to be indicated. Once the Left Locations have been indicated the same steps can be used to set the right locations.

Boring a Block

Once the Vertical Stops and Left/Right location stops have all been entered the Spindle RPM and Feed Rate need to be entered. This is done on the Set Zeros screen. Once this is done you can go to the Left and/ or Right Bore location screens and bore the cylinders.

Pressing the Bore Left for Bore Right buttons Will Bore all the cylinders that have Green bore button below them.

Pressing a Bore button once will turn that button Yellow. Any Yellow button will not be bored when the Bore Left or Right button is pressed.

Double clicking any Bore button will turn all the Bore button yellow EXCEPT the one that was double click.

If your machine is equipped with a 4th axis fixture then the Start auto cycle button will bore both the left and right banks automatically and roll the 4th axis over in between the two banks.

Probing Method

If your machine is equipped with a Renishaw touch trigger probe then we can use the machines probing routines to locate the block deck, cylinder locations, and set zero's automatically. When using this method we want to program the machine so that it goes to the rough location of the bore, where we then call the probing routine to probe the bore and record the calculated X,Y locations of the bore automatically.

Vertical Zero

If you have setup the table of tools and recorded tool length compensations values, then instead you can used the Probe Auto Center command and select the depth routine from within the pop up window to probe he block deck. This will feed the z-axis with down with the probe in the spindle until the probe finds the deck surface. After the cycle is complete the probe tip will be just touching the surface and you can double click the z axis button to set the vertical zero.

If you have not setup the table of tools then use the blueprinting methods strategy for setting you vertical zero by touching the cutter off of the top of the block deck surface.

Programming Vertical Stops

Block Clearance

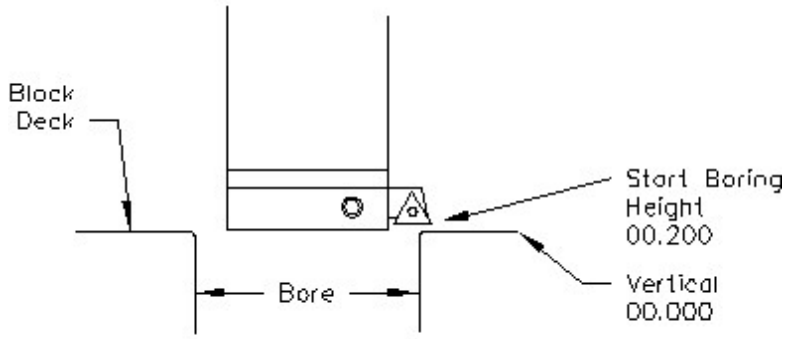
This is the distance above the zero position or block deck allowing the probe to move to the next bore unobstructed.

Centering Height

This stop is not used when you are using the probing feature. It is recommended that it be set to the same value as the Block Clearance.

Start Boring Height

This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air.



Bottom of the Bore

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go to the block Clearance position.

Probe Height

Using the handwheel bring the Probe down to the location in the cylinder you will be probing. Press the SET button next to Probe height. This will set the probing height position.

Using the handwheel move the probe up until it can safely move horizontal to the next cylinder. Press the SET button next to Probe Clearance. This will set the clearance height.

The Vertical stops have now been set. You are finished with the Vertical Stops screen, select Left and/or Right Locations.

Bore Locations

To build a program you must set the rough X,Y locations for the individual cylinder bores.

Select Left Locations and the Blueprint. Program the blueprint values (or close approximation) into the Horizontal and In/Out stops. Do the same for the Right Locations.

Select the Left Locations tab and then the probed tab. You can probe each cylinder individual by pressing the associated Probe button or you can probe the entire bank by pressing the Probe Left Button. **Probe Auto Center**

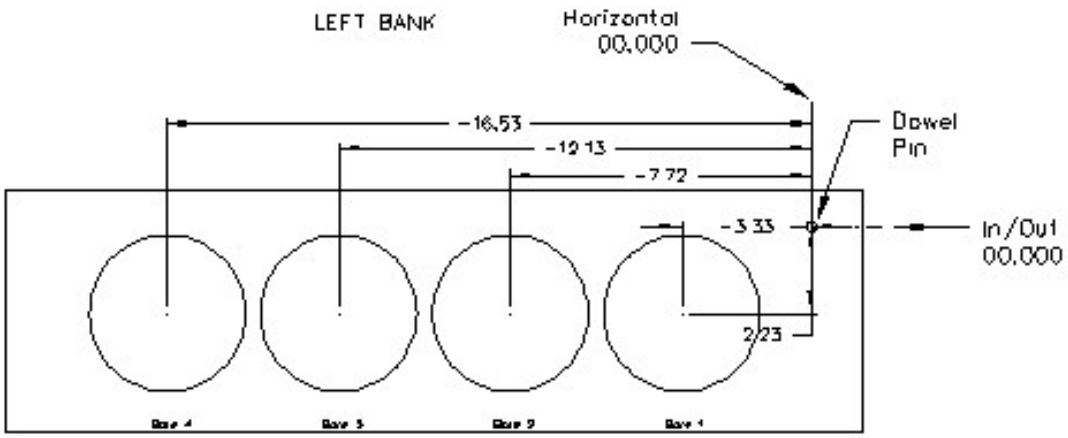
This feature is located on the Set Zero page. This allows easily find the center of a hole or cylinder. Roughly place the probe in the center of a cylinder. Press Probe Auto Center. The cylinder will be probed in 4 places, when finished the probe will move to the center of the probed cylinder. Pressing Horizontal and In/Out zero will then establish the center of that hole.

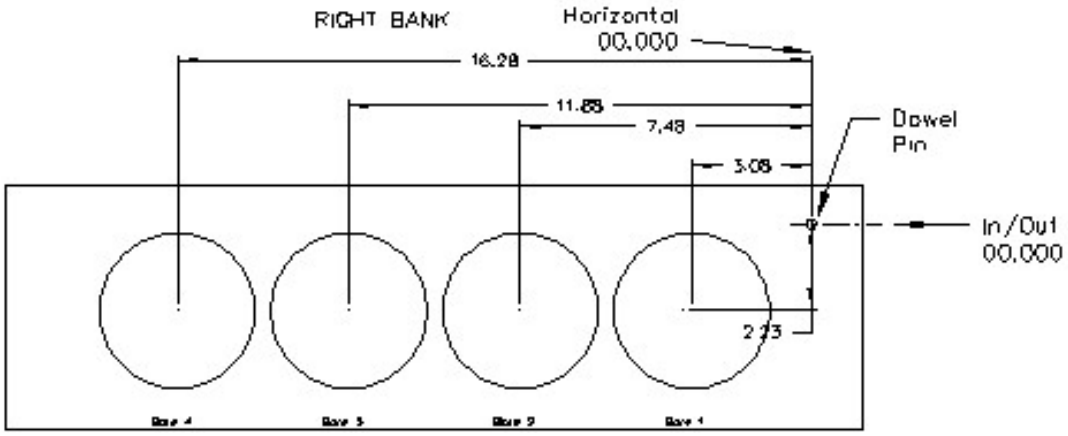
Automatic Probing Procedure

The probe will move to the center of the cylinder to be probed. It will then move to the right at a slow rate until the side of the cylinder is touched, it will then back off slightly and touch the same spot again to confirm position. The probe will then touch off the cylinder in three more spots and retract from cylinder.

As each cylinder is probed the Probed Diameter, Horizontal and In/Out positions will be placed into the Data Boxes for the corresponding cylinder.

Press the Right Locations tab and repeat the above procedure for the cylinders to be probed on the right bank..





Boring a Block

Once the Vertical, Horizontal and In/Out stops have all been entered the Spindle RPM and Feed Rate need to be entered. This is done on the Set Zeros screen. Once this is done you can go to the Left and/ or Right Bore location screens and bore the cylinders.

Pressing the Bore Left for Bore Right buttons Will Bore all the cylinders that have Green bore button below them.

Pressing a Bore button once will turn that button Yellow. Any Yellow button will not be bored when the Bore Left or Right button is pressed.

Double clicking any Bore button will turn all the Bore button yellow EXCEPT the one that was double click.

Cylinder Bore Mode 4th Axis

NOTE: The program with the 4th axis installed works basically the same as the 3 axis mode. ONLY the differences in operation and screens will be discussed here. Carefully read through the 3 Axis mode and then the 4th axis mode for operation and building programs.

Select Cylinder Bore and then Through Bore on the control panel. This will bring up the boring program with the Set Zeros tab shown.

Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point

in the machines' travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from.

4th Axis (Rotational) Zero

The Zero position for the 4th (Rotational) Axis should be preset from the factory. If the zero needs to be reset use the following procedure.

There are three (3) flats cut onto the Head Stock Plate. Use the middle flat to set the rotational zero. Using an indicator off of the spindle indicate the middle flat to Zero all the way along it. Use the 4th Axis hand wheel to do this. When the middle flat is indicated in press the 4th Axis Zero button. You 4th (Rotational) Zero is set.

Finding the In/Out (Y) Axis Zero with 4th Axis

The Head Stock Plate has a hole in it next to the Middle Flat. This hole is centered on the center of the Main and Cam locator shafts.

Building Programs with the 4th Axis

Program are built the same as in the 3 Axis mode with the exception of setting the Angle for each Bank. The Left and the Right Locations page each have an Angle Data Box. Here you enter the angle of each bank from the 4th Axis (Rotational) zero position. The zero position is with the Cam and Crank Locators lined up vertically.

Example: On a Chevy 350 the Left bank would be positive 45 Degrees and the Right Bank would be a negative -45 Degrees.

Setting Vertical Clearance with 4th Axis

It is very important when setting your Vertical and Probe Clearance height that you be sure to account for the Roll Over of the block from bank to bank. When in an automatic program the block will roll from the Left Bank to the Right bank at the Left Bank Bore1 position. It will also rotate from the Bore1 position when going from Right Bank to Left.

Table of Tools for 3 and 4th Axis Bore Mode

NOTE: The Table of Tools is not needed to run the Rottler automatic programs. It is recommended that it not be used except by the advanced operator.

Building a Program with Table of Tools

Build the program as described above for 3 and 4 Axis programs using the same vertical zero locations.

Put the tools to be used into the Table of Tools as described in Chapter 2. In Bore mode you are not referencing another vertical location such as the Crank centerline so the Z Touch off Location will remain at zero.

Assigning Tools

Tools to be used in the boring operations are set on the Set Zeros page. To select a Tool, double click on Tool # on the right side of the screen. This will bring up the Table of Tools window. Highlight the tool you will be using, such as 2.9 Production Stub and select OK.

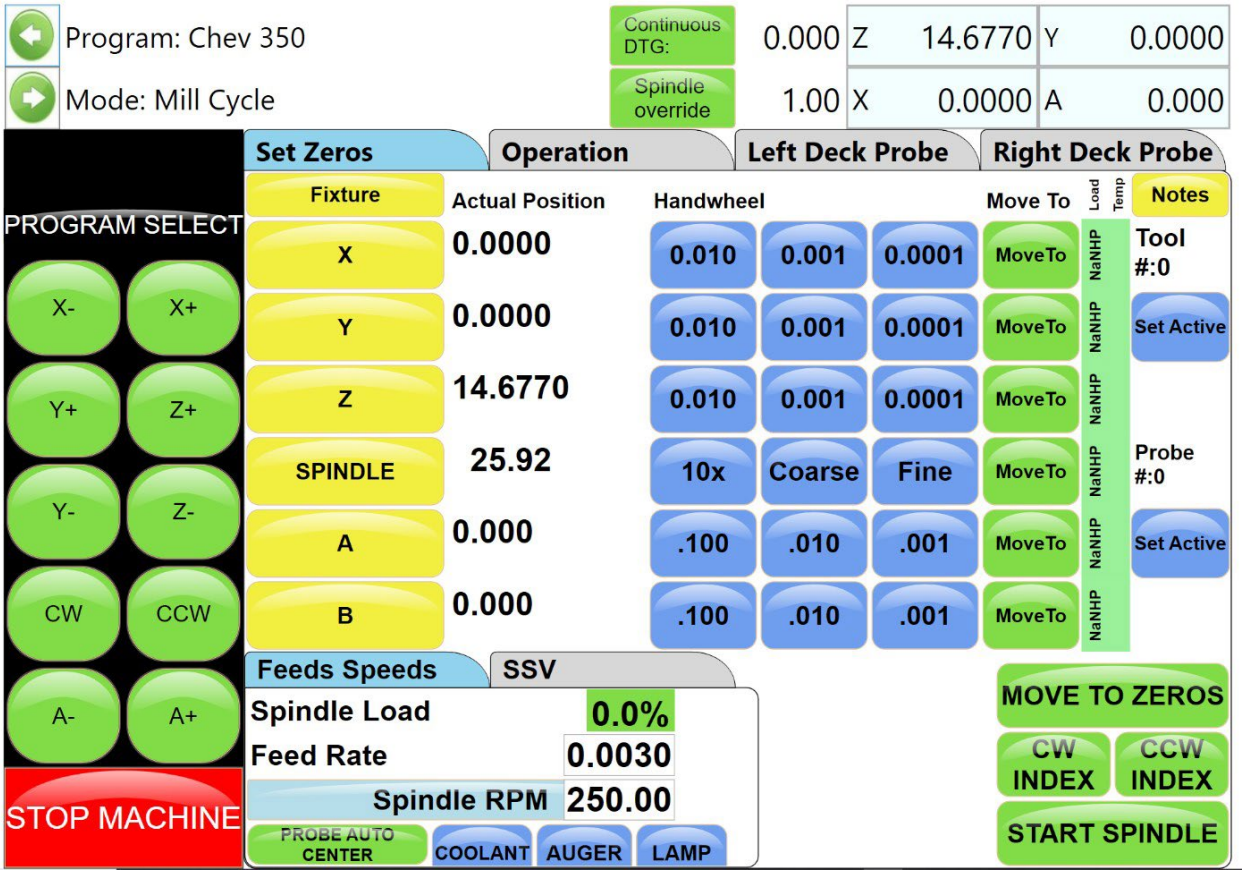
Do the Same to select the Probe you will be using, such as 100mm Probe.

NOTE: The Tool highlighted in red is the currently Active tool.

Mill Cycle 3 Axis

Mill Cycle

The mill cycle can be used for programming straight line toolpaths such as what is required for creating a surfacing/decking routine. From the mode select are in the main screen, select new and then select the mill cycle operation from the pop-up window. Once created, enter the mill cycle operations by selecting it in the mode select box.



Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis will need to have a zero point set for the machine to operate from.

Horizontal Zero (X-axis)

For this example, we are going to set the Horizontal Zero (X-axis) at the point where the selected fly cutter is approximately ¼" passed the right hand side of the block to be machined.

In/Out Zero (Y-axis)

For this example we are going to set the In/Out Zero at the center line of the work piece.

Vertical Zero (Z-axis)

For this example the Vertical Zero will be at the deck height of the work piece.

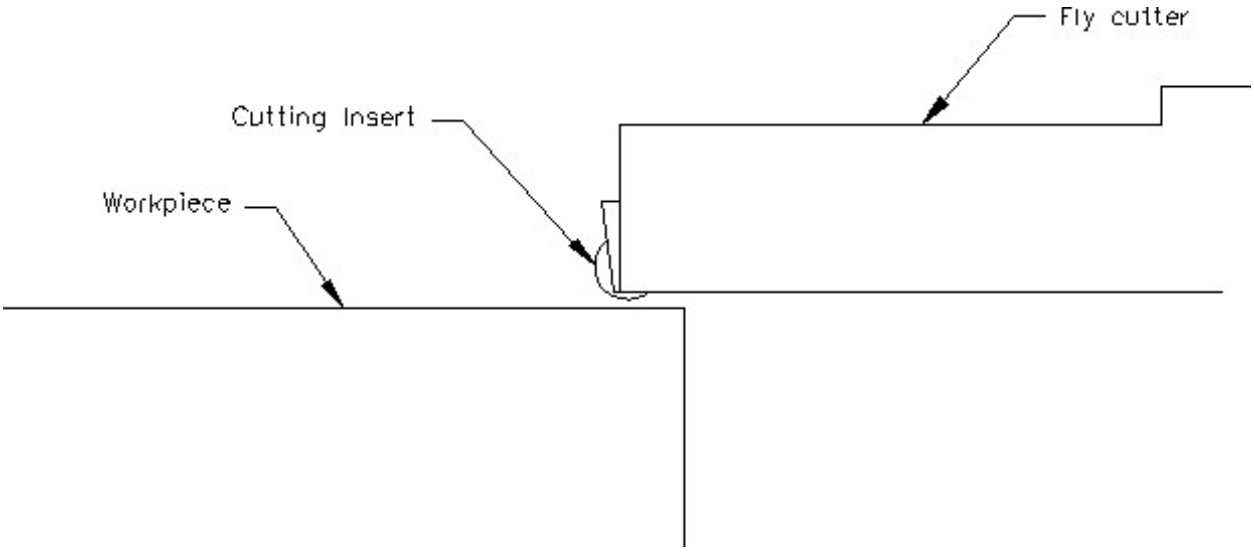
Feeds and Speeds (IPR/RPM)

The spindle RPM and Feed rate in IPR can be set in the lower left corner of the Set Zeros tab under the Feeds Speeds box. The RPM should be set based on the recommend SFM range for the insert being used, based on the material of the block being machined. Feed rate should be set based on the insert geometry, and surface finish requirements of the block to be machined.

Manual Procedure for Setting Vertical and Horizontal Zero's (Z-axis/X-axis)

Start the spindle. Select the .001" increment for the Z-axis handwheel and move the spindle down until you can hear or see the cutter just touching the block. Double tap the Z button to zero the Z-axis here.

Feed the cutter in the +X direction. When the cutter has cleared the block by approximately ¼" double tap the X button to zero the X axis.



Operation

Horizontal End

This is the programs ending location in the X axis. Since we are setting up on the right-hand side of the machine this number will be negative. To set this value the operator can either jog the machine to the left end of the block so the cutter to be used is passed the end of the block and then press SET to save the current location. Or if the length of the block is known then the operator can click the box next to the SET button and type in the length of the block plus the radius of the cutter to be used for the end location.

Amount Per Pass

This is the maximum depth of cut to be performed each time the cutter makes a pass across the block surface. This is used to set the depth for any roughing cuts that will be performed.

Vertical Start

This is the Vertical Position the machine will start cutting at. This value is usually Zero which is usually the starting Deck Height.

Vertical End

This is the Vertical Position the machine will stop cutting at. It is the Total amount of material you want to remove in the Milling process.

Copy Lowest/Copy Highest

These buttons are used in conjunction with the probe with mill for probing

Rough Settings

These values are used when taking multiple passes are necessary to remove material before finishing the block surface. Typically the rough settings will use more aggressive cutting parameters to remove material efficiently.

Rough Feed Rate

The desired roughing feed rate in IPR

Rough Spindle RPM

The desired roughing spindle speed in RPM

Finish Cut Settings

These are the cut parameters that the machine will automatically switch to when performing the final pass

Finish Amount

The amount to be removed on the last pass.

Finish Feed Rate

The desired Finish Feed Rate in IPR.

Finish RPM

The desired Finish Spindle RPM.

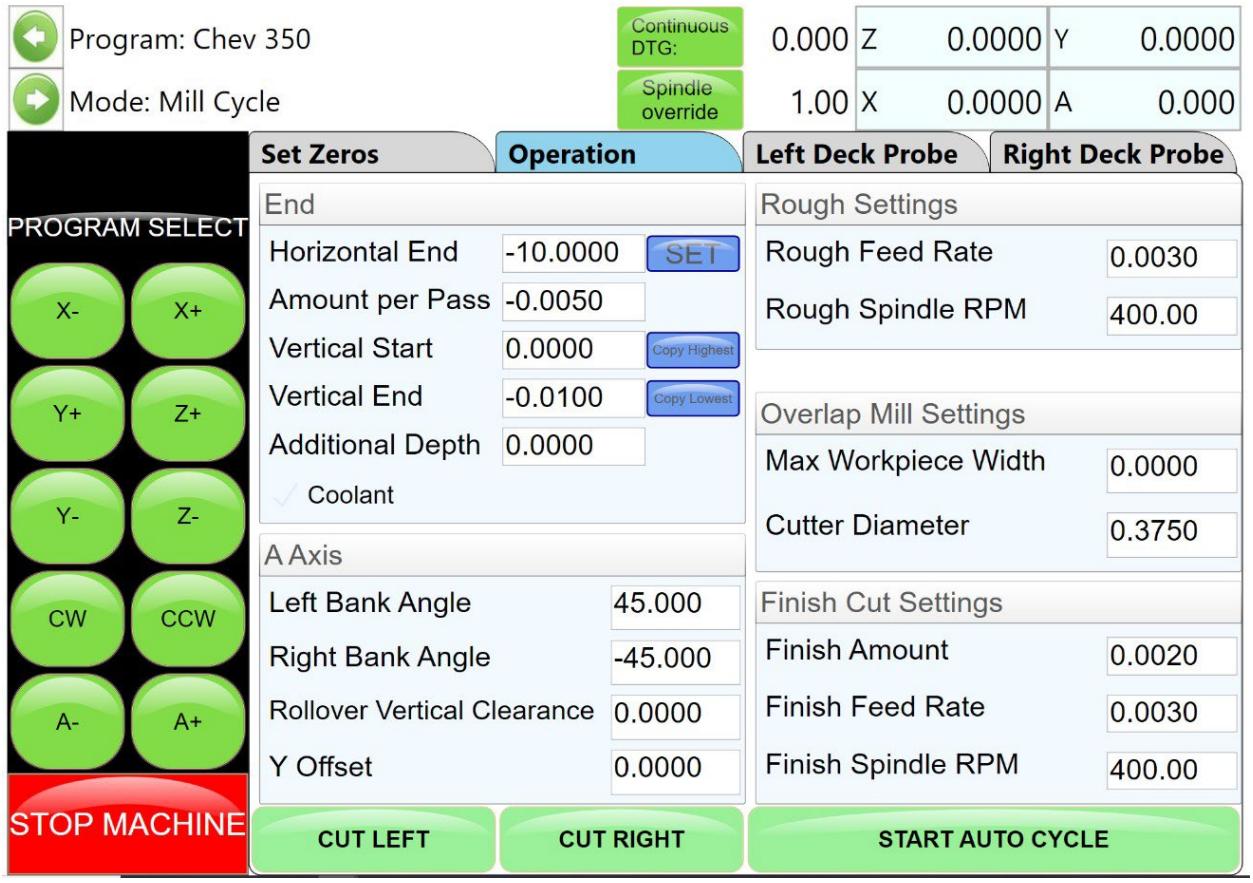
A-Axis

This is controls the 4th axis if machining a V-block.

Overlap Mill Settings

This is used if the cutter to be used cannot machine the entire width of the block in one pass.

NOTE: You do not need to have evenly divisible numbers in these sections. The computer will do the math to remove the maximum allowable material each pass while still using the specified finish cut settings.



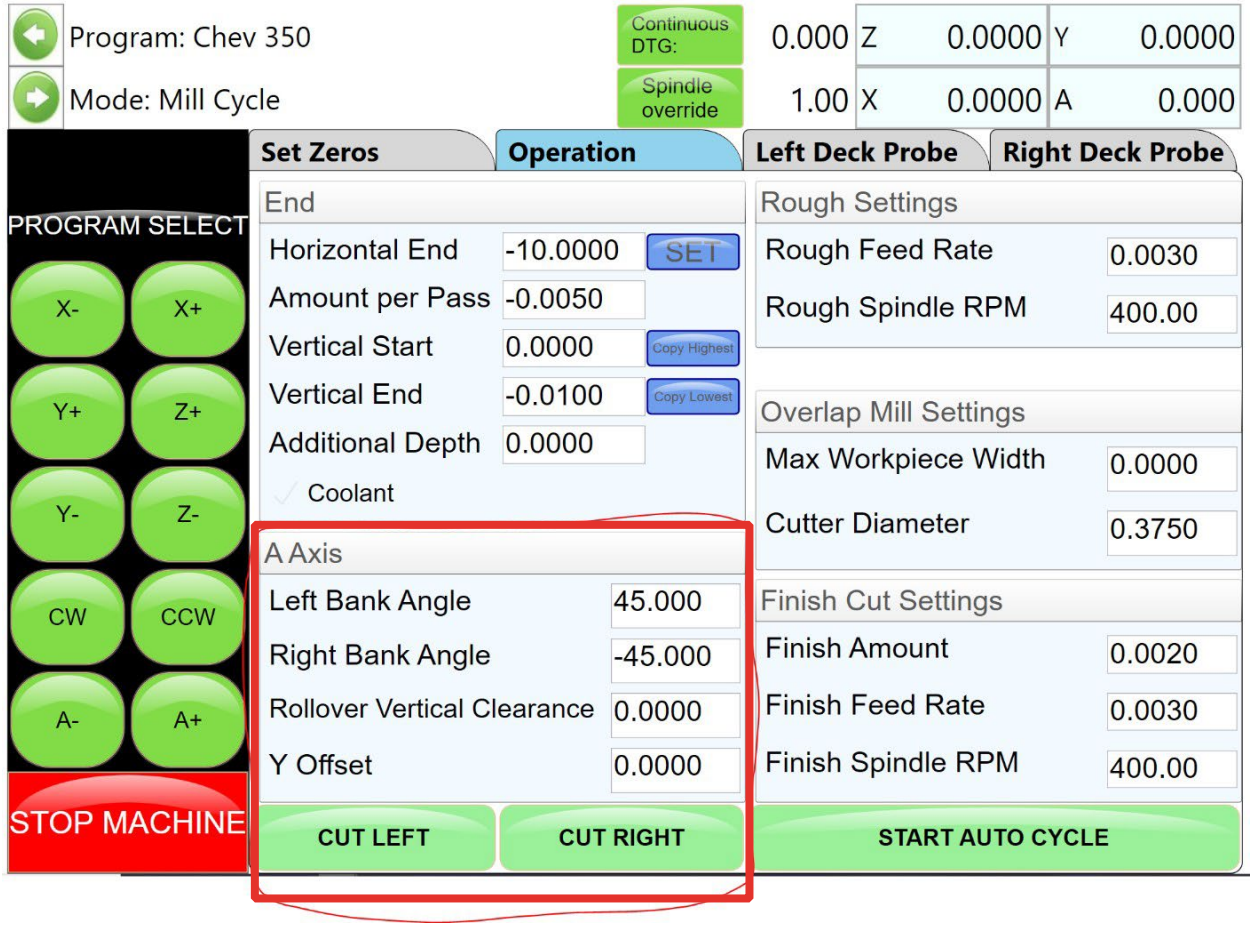
Start Auto Cycle

Pressing this button will start the machines automatic cycle. The cycle to be run is determined by the setting on this page. If you only require one pass to be made, do not enter any values into the Rough Setting, only the Finish Cut Settings.

Mill Mode 4th Axis

Program Additions to 3-axis Operation

The Program setup for a 4th Axis operation is largely the same as the programming for a 3-axis operation. The only difference is the addition of the A-Axis settings. When surfacing a V-block we first setup the surfacing operation on one deck and then fill out the A-axis settings to have the program repeat on the second deck.



4h Axis Angles

Left Bank Angle

Enter the angle of the Left Deck. This is the angle of the block in reference to the Cam and Crank bore being lined up Vertically.

Right Bank Angle

Enter the angle of the Right Deck. This is the angle of the block in reference to the Cam and Crank bore being lined up Vertically.

Rollover Vertical Clearance

Enter the value the Fly Cutter will have to move up vertically to clear the block when it rolls over from bank to bank. Make sure the block can completely rollover when in this position for safety

Cut Left and Cut Right

Pressing these buttons will cause the machine to run an automatic cycle (per the parameter defined in the Operations page) on the associated bank.

Start Auto Cycle

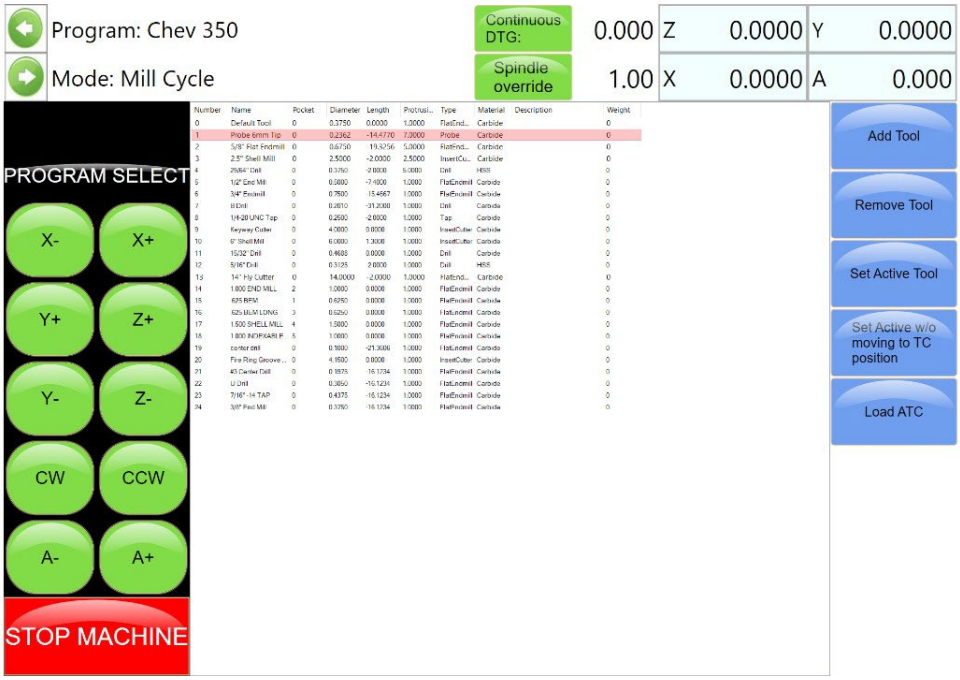
Pressing this button will start the machines automatic cycle. The cycle to be run is determined by the setting on this page. If you only require one pass to be made, do not enter any values into the Rough Setting, only the Finish Cut Settings.

Milling Using Automatic Deck Probing

The Rottler Milling program is set up to Automatically Probe the Deck height of a block and then Mill it to a set Deck Height. This can be done with both 3 and 4 axis operations.

Table of Tools for Milling

You MUST use the Table of Tools if you want to Automatically Probe the deck height and cut it to a set height. If you are unsure about how to setup the table of tools and set tool length compensation, then consult the Table of Tools section of the operator's manual before proceeding further in this section.

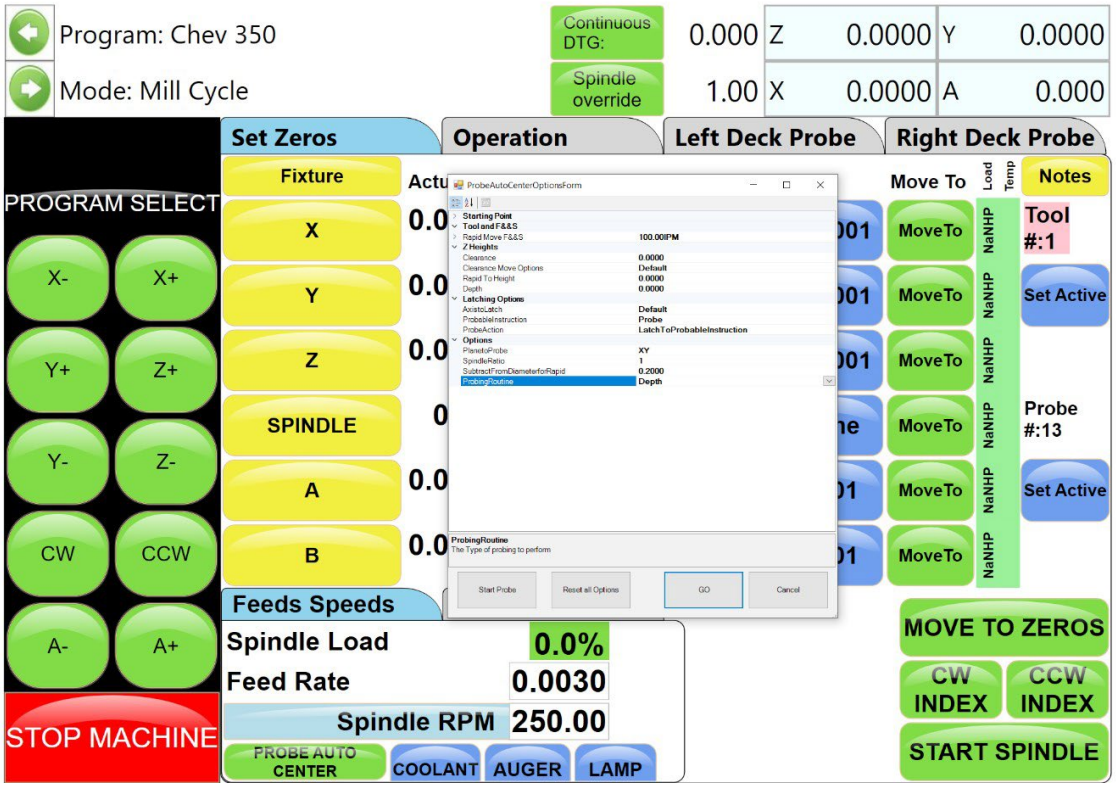


Building a Program Using the Probe and Table of Tools

Using the probe allows the programmer to setup different blocks that may require different tooling using only the probe to find locations and set zeros. Using the probe speeds up the setup time while also increasing the accuracy and precision of the blocks being processed. When surfacing we can use the probe to automatically find the lowest relative point of the surface and then use that gathered data to let the machine figure out how much material to remove.

Probe Auto Center

The probe auto center button can be found in the feeds and speeds tab within the set zeros page. Clicking this button will open the probe auto center form where the various probing routines can be called upon while jogging the machine. The Depth, Inside Diameter, and Outside diameter routines are the most used routines for performing engine work.



Probe Depth

Probes a surface in one point by moving down in the z-axis and stopping with the probe tip just touching the surface. When setting up a probing routine, you must run this operation and zero the z-axis while the probe tip is touching the surface to give the probe a starting reference.

Probe Inside Diameter

Probes 4 points 90 degrees offset from each other to find the center line of a circle in one plane.

Probe Outside Diameter

Probes 4 points 90 degrees offset from each other on the circumference of a circle to find the centerline in one plane.

Probing Engine Block Surfaces

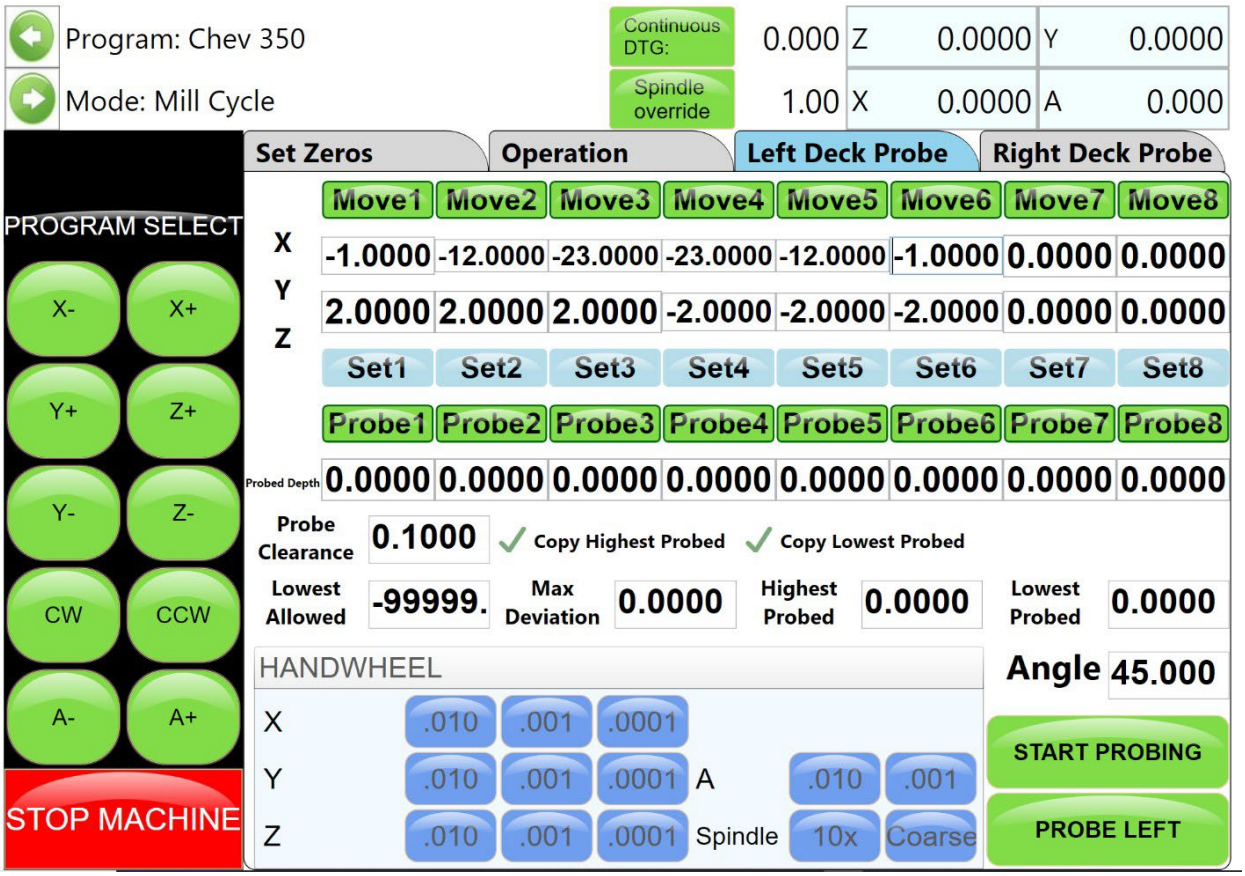
To probe the engine block deck surfaces we can use the left deck probe and right deck probe tabs from within the block software to define locations for the probe to move to and then run the depth probing routine

Left Deck Probe

Enter the positions you want the Probe to probe here. You can physically move the probe to the locations on the bank you want to probe and hit the set button also.

Right Deck Probe

Roll the block over to the Right Bank. Enter the positions you want the Probe to probe here. You can physically move the probe to the locations on the bank you want to probe and hit the set button also.



Probe Clearance

Position in the z-axis that the probe will return to when moving between points.

Lowest Allowed

Lowest Z-axis position that the machine will lower the probe to before stopping if it doesn't contact a surface.

Auto Probing

Press the Start Probing button. The machine will first probe each programmed location on the left bank and record the height. The spindle will move to Vertical Clearance height and the block will roll over to the right bank and probe the programmed locations and record them. The block will then roll back over to the Left bank and the spindle will move to the first Left location and stop.

Auto Milling

After the points have been probed the values gathered from the probe can be copied into the depth to cut within the operation tab.

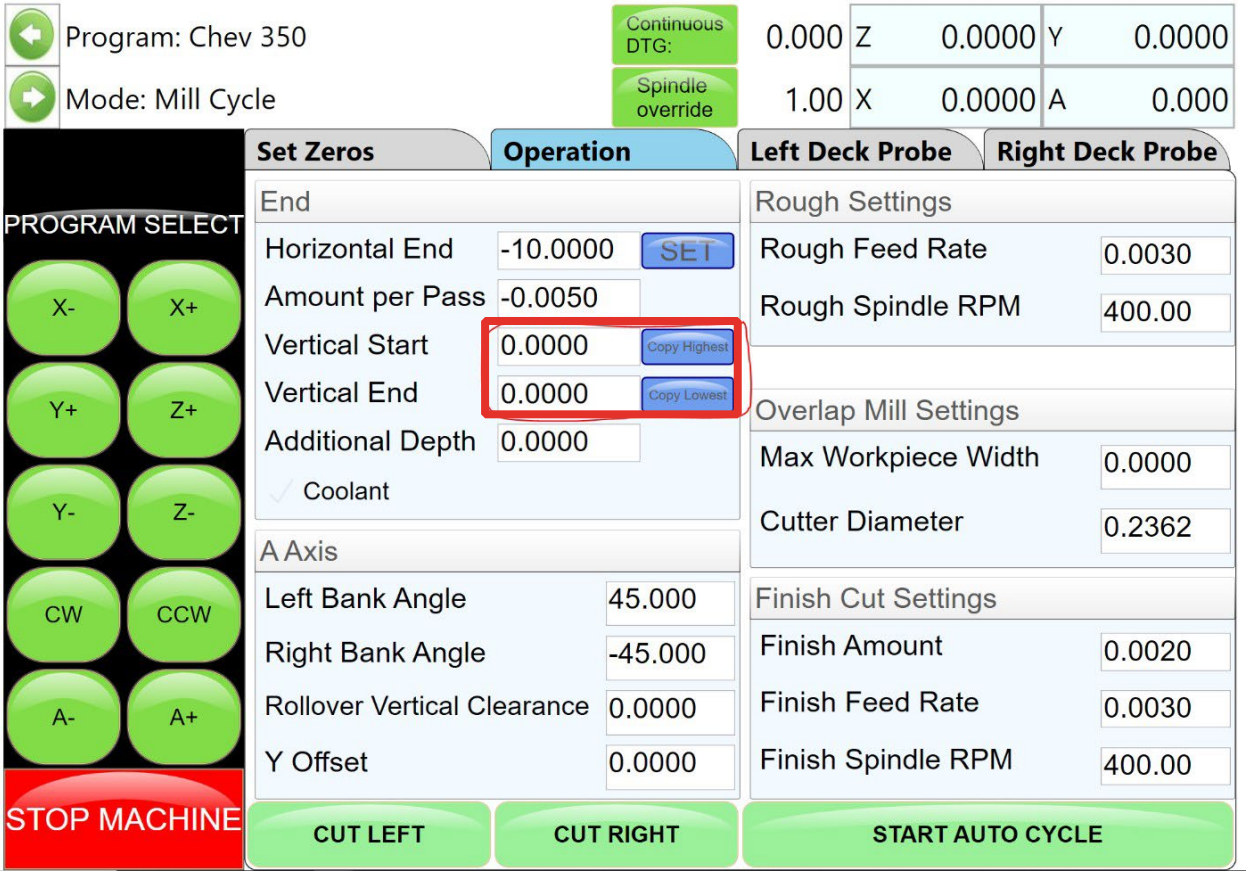
Vertical Start

Press Copy Highest next to Vertical Start. This will copy the Highest Probed point of either bank. This is the Height at which the Start Auto Cycle would start the first cutting pass.

Vertical End

Press copy lowest to copy the lowest point from the probed data into this box. This can be used to perform a minimum cleanup on the block, as the finish cut will end at the lowest probed points height. If

more material is to be removed, then the amount below the lowest point that the operator would like to cut can be entered manually in the box as done in previous methods.



Start Auto Cycle

Pressing this button will start the Auto Cycle for Both Banks. First the Left bank will be cut to the set parameters. The spindle will go to the Clearance Height and Roll over to the Right bank and cut it to the set parameters. The Spindle will again go to the Clearance Height and roll over to the Left bank. The machine will go idle at this point.

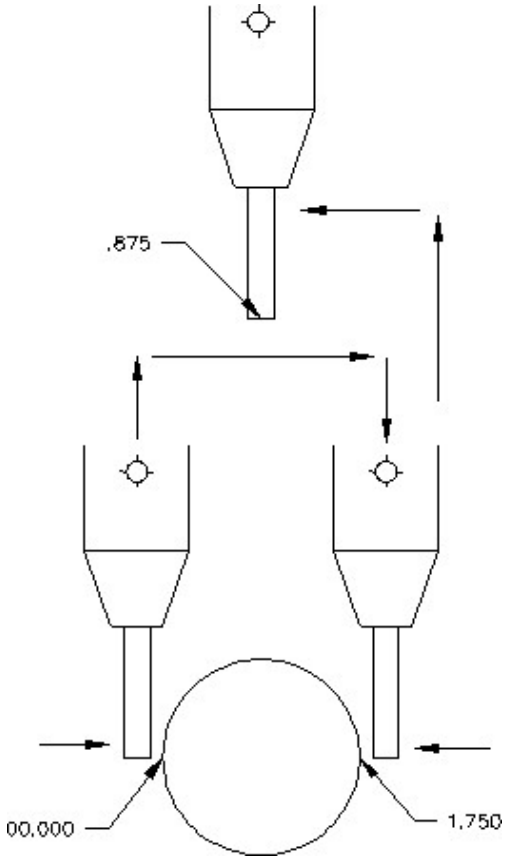
Lifter Bore Mode 3 Axis

Lifter Bore programs are built the same as described in the Bore Mode 3 Axis. The differences in locating the bores and tooling will be discussed in this section.

Y-axis Zero (In/Out)

The Y-axis zero position for lifters is the center line of the Cam Bore. An easy way to find the center of the cam line is to use the electronic probe. The following is an example of this procedure. Install the probe into the holder and the holder into the spindle. Bring the probe down until it is in the approximate center of the cam Bar Vertically. Press the Vertical Zero button now (this is only a temporary Vertical Zero position). Jog the Y-axis with the handwheel to bring the probe up to the Cam Bar until it lights. Press the Y-axis zero button here. Move the spindle up enough to clear the Cam Bar, move the probe to the other side of the Cam Bar. Bring the vertical down to the zero position. Hand wheel the probe into the Cam Bar until the light comes on. Note the Y-axis position reading. Divide this reading by two. Bring the spindle up until it can clear the Cam Bar. Use the Y-axis handwheel and move the Y-axis position until it matches the divided number. This is the center line of the Cam Bar. Press the Y-axis Zero button now. The Y-axis zero position has been set. The following illustration visual shows the above description.

Start Boring Height



Pay attention when setting this height, there are often protrusions in the casting that will not allow the end mill to travel unobstructed all the way to the start of the lifter bore. It is safest to set the Start Boring Height above the Deck.

Lifter Bore Angle

Rottler has specific Lifter Bore spacers that are installed on the Cam bar to set the correct angle for lifter boring when using the Performance Fixture.

Lifter Bore 4th Axis

Lifter Bore programs are built the same as described in the Bore Mode 4th Axis. Only the differences will be discussed in this section.

Start Boring Height

Pay particular attention when setting this height, there are often protrusions in the casting that will not allow the End Mill to travel unobstructed all the way to the start of the lifter bore. It is safest to set the Start Boring Height above the Deck.

Lifter Bore Angle

The angle for each bank is located on the associated Locations page. Press the angle numerical value and a pop-up will open so you can type in the Lifter Bore angle.

Calculate Y-axis zero

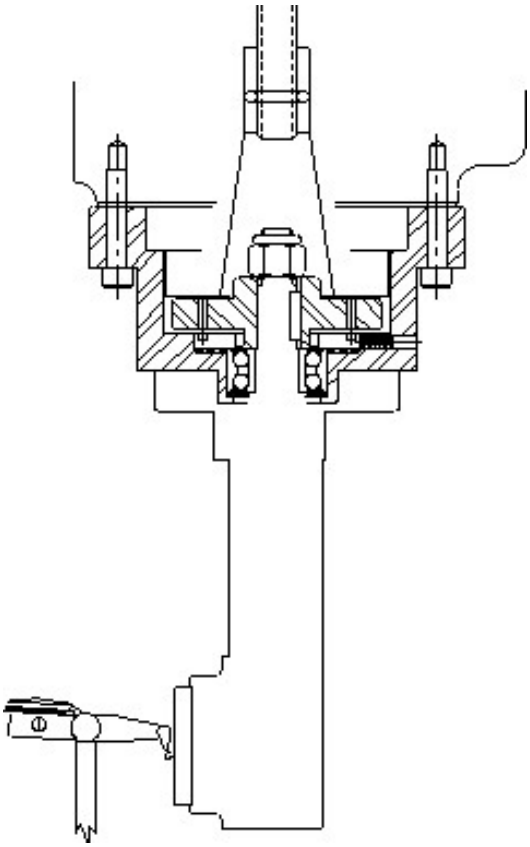
This button is located next to the Y-axis locations for each Bank. You must first have the correct angle entered in the angle data box. Then press the calculate In/Out button. A window will open where you

enter the center to center distance of the Cam to Crank bores. The In/Out locations will automatically be filled in.

Line Bore Mode

Create a Line Bore Operation in the mode select box from the main screen.

Mounting and Aligning the 90 Degree Head



Mount the 90-degree head onto the spindle and just snug mounting bolts. Use the following instructions to align the head. Mount a test indicator to the machine table or block. Align the indicator needle as shown in the figure below on the tool mounting surface.

Using the Y-axis handwheel increment move the indicator from one side to the other noting the amount of difference. Adjust the 90-degree drive until the variance across the face is less than .0005”. Tighten the mounting bolts for the head and check the surface again to be sure it did not shift when tightening the head.

Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines’ travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from.

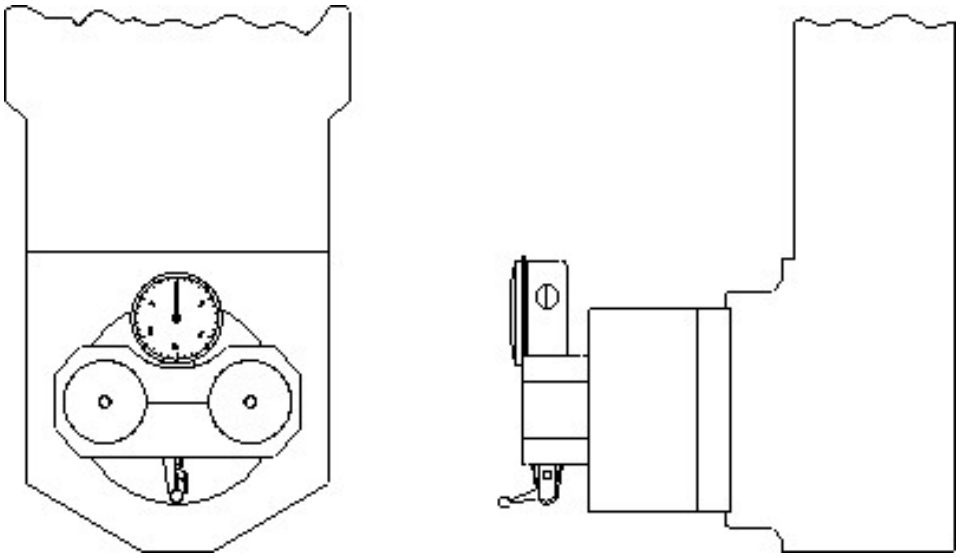
X-axis (Horizontal Zero)

The Horizontal should be set about .050” offset from the front of the first main to be bored, making sure that, that position will allow the head to travel up without interference. Bring the head down and roughly center it in front of the first main. It does not need to be

perfectly centered to set the horizontal zero. Double tap the X button from the set zeros tab to set the horizontal zero.

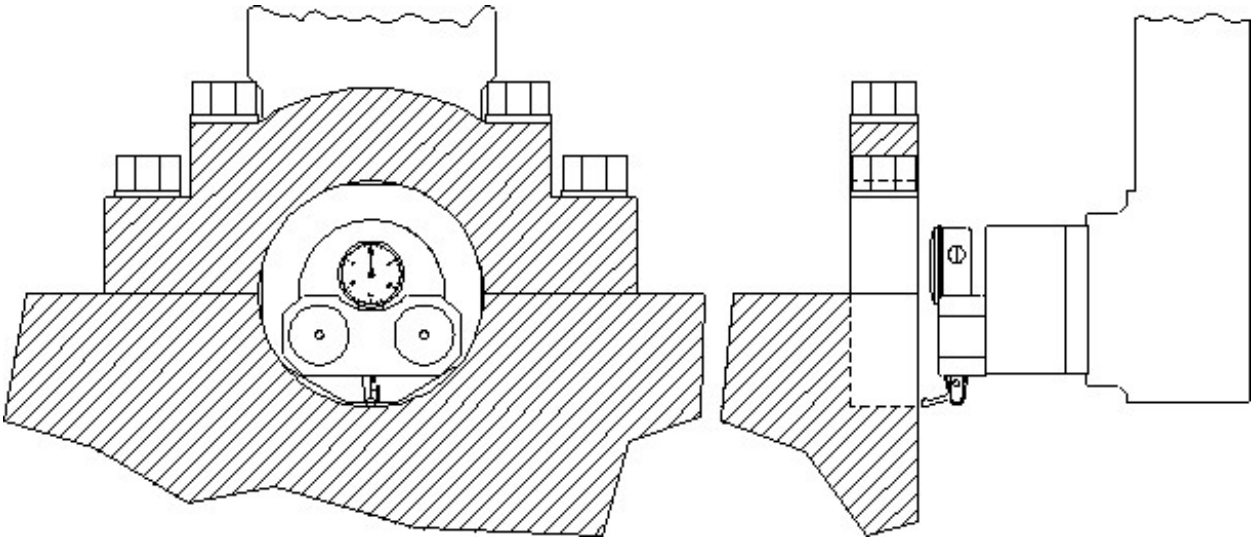
Y-axis (In/Out Zero)

Locate the supplied indicator and small magnetic base. Mount on cutterhead as shown below.



Using the X-axis handwheel increment option move the indicator inside the main bore, making sure the indicator is not touching the main bore at this point. You will be indicating both sides and the bottom of the saddle, generally the cap is not used while indicating the bore.

Physically move the indicator and mag base on the cutterhead until there is about .010” pressure on it. Start rotating the spindle CW and CCW watching he indicator. Move the machine in the Y-axis (In/Out) with the handwheel increment until the indicator readings are the same on both the sides and the saddle locations of the main. Once equal double tap the Y and Z buttons on the set zeros tab to set the zero locations for the program



Programming Vertical Stops

There are two (2) vertical stops used in the Line bore mode. These are Bore Centerline and Block Clearance.

Bore Centerline

The first vertical stop is on the main bore centerline. This is the same as the vertical zero that is set when indicating the block main in the previous section

Block Clearance

The block clearance height is the height that the spindle will retract up to before moving to the next main bore location. This height should be set somewhere above the block where the 90-degree head will not interfere with the block during horizontal movements.

Programming Horizontal Stops

The Horizontal Zero was set .050” before the first Main Bore. The first Horizontal stop will be 00.000. Measure the distance between each main and enter it into the corresponding stop number.

Programming Bore Length

Measure the length of each Main Bore and enter that value into the corresponding length box.

Running the Auto Cycle

You will need to set a Feed Rate and Spindle RPM on this screen to run an auto cycle. After this is done press the “Move to Zeros” button. The spindle will move up the Vertical Block Clearance distance if it is not already there. It will then move to the Horizontal and In/Out axis to the zero position. The vertical will then move down to the zero position and stop.

CAUTION: If you press the MOVE buttons or the Cycle Start button the machine will not move the In/Out axis to the zero position. You need to move the In/Out axis to the zero position manually before you press Cycle Start the machine will go idle at this time. Pressing the “Start Auto Cycle” button will cause the entire cycle to run. After a program has been completed the machine will move the spindle over to the first Main Bore at the Clearance Distance.

Thrust Cutting

Refer to Line Bore in this section for mounting the block and aligning the 90-degree head.

Note: It is important to read through the entire Thrust Bearing Cutting section before entering any values or starting the Auto Cycle. You will better understand how the program operates and how the values effect the operation of the Auto Cycle.

The Thrust Cutting program can cut a single or double thrust face using circular interpolation.

Select the Thrust Bearing Cutting button from the Main Menu. This will bring up the Thrust Bearing Cutting Bore Mode with the Set Zeros tab shown.

Setting Zeros

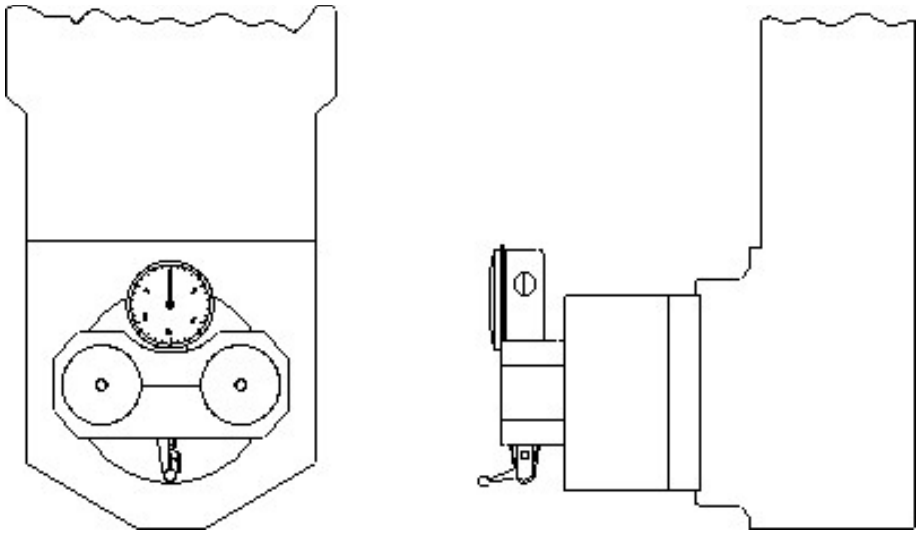
The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from.

X-Axis (Horizontal Zero)

The Horizontal should be set with the cutter to be used just touching the thrust face. Use the handwheel increment buttons to jog the cutter into this locations and then double tap the X button to set the program zero.

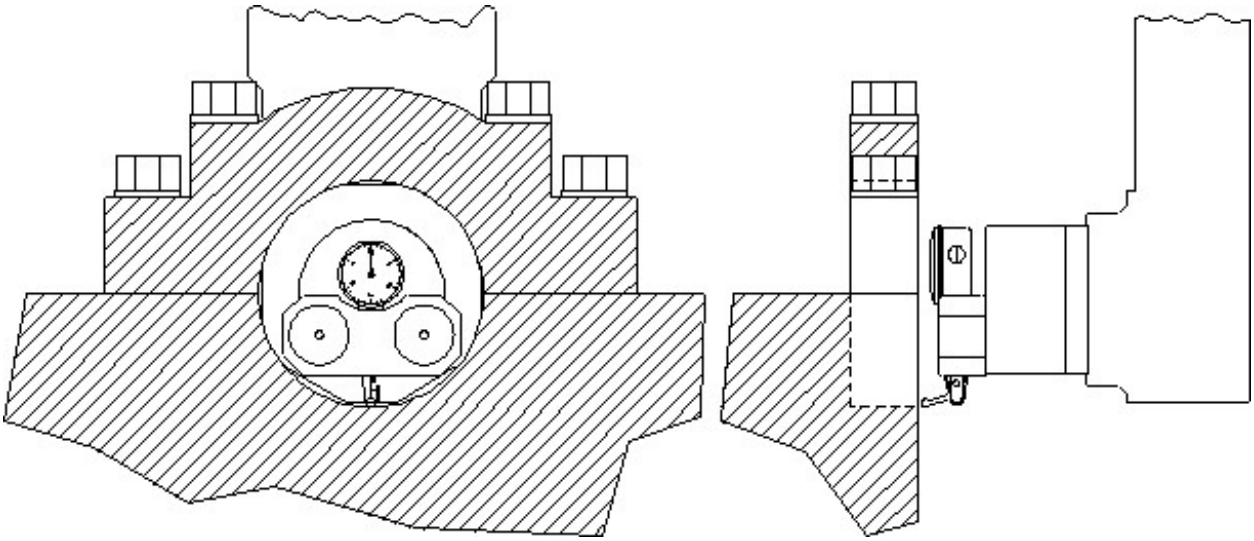
Y-axis (In/Out Zero)

Locate the supplied indicator and small magnetic base. Mount on cutterhead as shown below.



Using the X-axis handwheel increment option move the indicator inside the main bore, making sure the indicator is not touching the main bore at this point. You will be indicating both sides and the bottom of the saddle, generally the cap is not used while indicating the bore.

Physically move the indicator and mag base on the cutterhead until there is about .010” pressure on it. Start rotating the spindle CW and CCW watching he indicator. Move the machine in the Y-axis (In/Out) with the handwheel increment until the indicator readings are the same on both the sides and the saddle locations of the main. Once equal double tap the Y and Z buttons on the set zeros tab to set the zero locations for the program.



Dimensions & Auto Cycle

The program tab is where the critical dimensions are set for the thrust cutting process. Switch to this tab to enter the cutting dimensions and parameters.

Thrust Dimensions

Outside

This is the outside diameter of the thrust face to be machined.

Inside

This is the Inside diameter of the thrust face to be machined.

Cutter

This is the diameter of the cutting tool to be used.

Clearances

Z (Vertical)

This is the distance, from zero, the 90-degree head will have to travel up to clear the main caps on the block.

X (Horizontal)

This is the distance, from zero, the 90-degree head will have to travel to clear the main for the next vertical move.

Dimensions

Main Width

Width of the thrust face to be cut, this is the outside diameter minus the inside diameter.

Insert Width

This is the width of the cutting surface of the insert being used. This is used to calculate the step over required for interpolation.

Left Depth of Cut

This is the Inside diameter of the thrust face to be machined.

Right Depth of Cut

This is the diameter of the cutting tool to be used.

Cut Left Side

Cuts the left side thrust faces

Cut Right Side

Cuts the right side thrust faces

Cut Both Sides

Cuts both thrust faces.

Description and Running of the Auto Cycle

You will need to enter the Feed Rate and Spindle RPM the program will run at. There are no Move to buttons in this program. You **MUST** be at the zero positions when the Auto Cycle is started.

Start Auto Cycle

When you are at the corresponding zero positions press the Auto Cycle. The vertical feed will start at the programmed rate in an upward direction until the correct Outside diameter is reached. The circular interpolation will start at this point and go 360 degrees. It will then continue the circular interpolation back towards the center of the Main to clear the cutting tool from the thrust face. When the cutterhead is back at the center point (zero positions) of the Main, all motion will stop. The cutterhead will then rapid travel to the left taking the main width and the cutter diameter into account to reach the correct depth on the second thrust face. The same circular interpolation process will then be repeated for the second face. The cutterhead will then retract horizontally to the clearance distance then vertically to the block clearance distance.

When the program is running the “Start Auto Cycle” button will change to “Press to Pause”. If this button is pressed the machine will pause the program right where it is. At this point the screens are locked out from changing anything. The button will the change to “Press to Resume”. If you want to resume press the button and the program will continue from that point on. If you do not wish to continue press the “Stop” button. This will put the machine back in idle mode and changes can be made to the program.

Cam End Tunnel Boring

To bore the end tunnels on a Block refer to Block End Truing Fixture 650-3-30 when used with Cam Boring for setting up the block. Select a Cam bushing that will fit the existing Cam bore and place it in the Cam Spacer. Place the distributor end of the block facing up. You will need to be in the Bore Mode on the control panel. The Cam spacer placed in the center T-Slot should put the Cam tunnel in line with the Main bore.

Center the spindle over the Main bore using the electronic probe or magnetic base with indicator. Zero the X and Y axes.

Move the table the specified blue-print distance toward the Cam Tunnel. This distance should in the blue printing specifications for the block you are working with.

Check that you are on center of the cam bore with the electronic probe or indicator.

⚠ CAUTION ***Be very careful when correcting the existing Cam bore on the y-axis. This could cause the distributor gears to be damaged.***

Install the 650-2-3F cutterhead into the spindle.

Refer to the Bore Mode, programming Vertical Stops section earlier in this guide for guidance on setting up the vertical stops for this operation.

Note: It is important to bore the Cam End bores the full length of the cutterhead on both ends. If you do not you may have trouble getting the Cam Bar to bore the full length between Cam End Bores. Run the operation before proceeding.

Hint: It is helpful and more efficient to have three (3) tool holders set up for this procedure, two (2) of them for large material removal and one for a finish pass of .020” to .030”.

Note: To bore the oil groove in the Cam Bore, refer to the Cam Bore Oil Groove section in this chapter. This is a CNC operation.

Remove the block from the fixture, select a Cam bushing that will fit the bore that was made on the distributor end of the block.

Rotate the block so that the distributor end is now facing down. Tighten the block into the fixture. The Cam spacer will put the end bores in line.

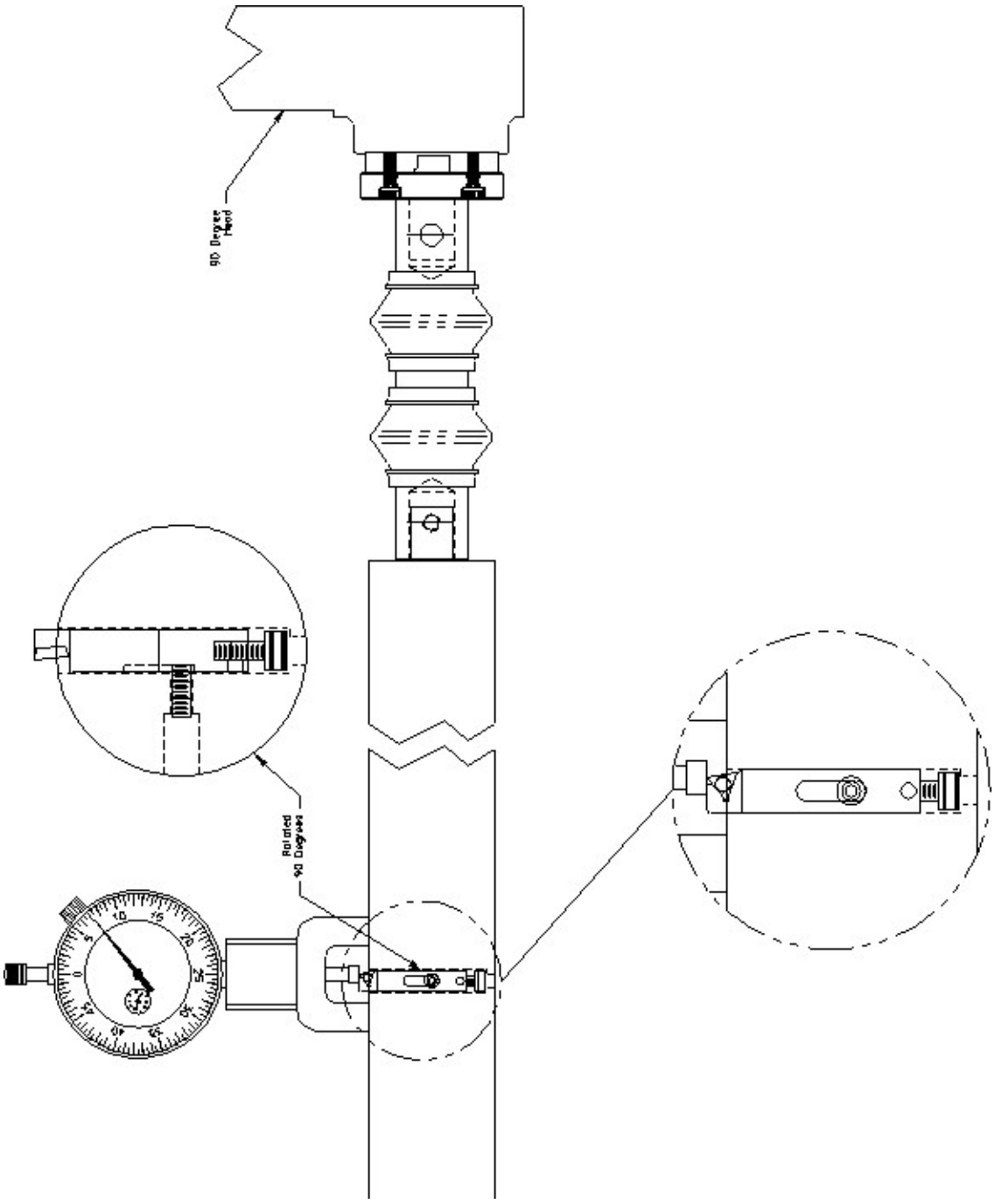
Press the move to zeros button.

Repeat the above process on this end of the block to finish boring the Cam End Bores.

Cam Tunnel Boring

To bore the center of the Cam tunnel, refer to Cam Tunnel Boring in the Block Mounting section of this chapter. Mount the block as shown.

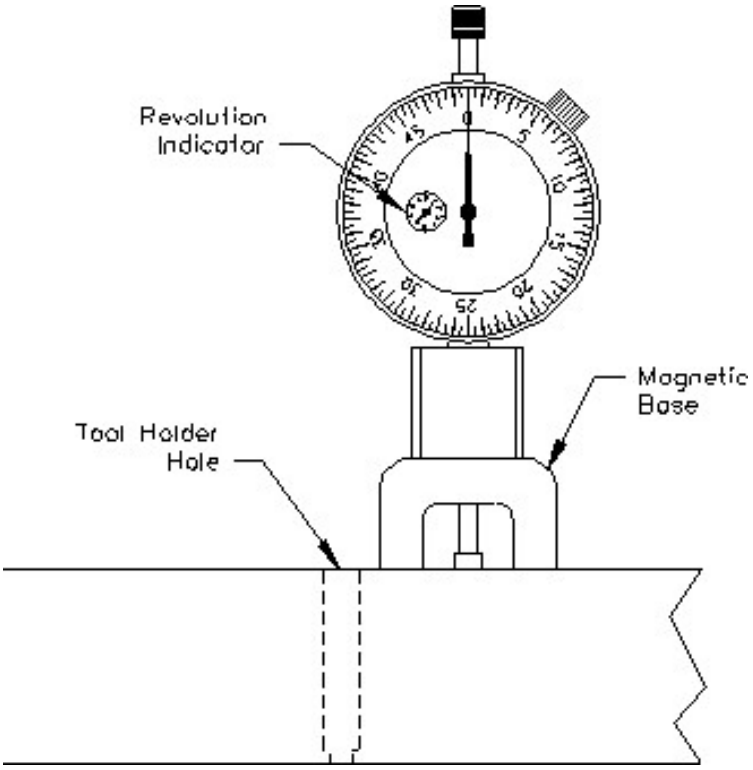
The following illustration shows the cutting tool and holder and how they are set inside the Cam Boring Bar.



Zeroing the Micrometer

Remove the magnet keepers from the bottom of the indicators magnetic base. These should be put back on when the magnet is not in use to keep the magnet strong.

Place the magnet on the smooth portion of the bar next to the tool holder hole. Set the zero on the indicators dial, noting the number of revolutions the dial has made.



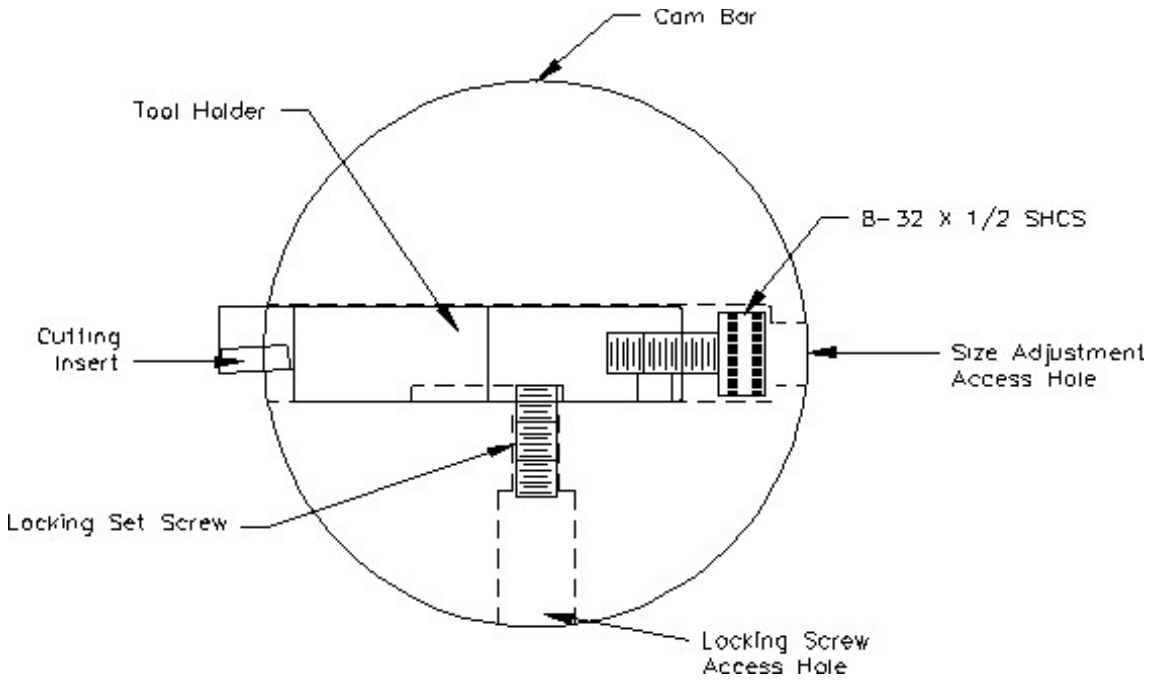
Setting Cutting Size

The diameter of the Cam Bar 650-2-32D is 1.7500”. The 8-32 X ½” socket head cap screw on the back of tool holder is used to adjust size. When the tool holder is inserted into the Cam Bar the cap screw goes against a ledge inside the Cam Bar. When the cap screw is turned in the size will get smaller. When the cap screw is turned out the size will get bigger.

⚠ CAUTION ***When adjusting the size on the tool holder, you must remember that the amount that will be taken off the diameter will be twice the reading on the dial indicator.***

When the dial indicator reads zero the bar will cut 1.7500”. Double the amount past zero on the dial indicator and add that to 1.7500” to determine the cut diameter.

Once the size has been set, lock the set screw in the Cam Bar to secure the tool.



Refer to the Line boring section of this chapter for mounting and alignment of the 90 degree head.

Select Line Bore Mode of operation.

Mount the dual flex coupling to the 90 degree head with the two (2) supplied socket head cap screws. Install one Cam Bearing Locator into the left side of the block.

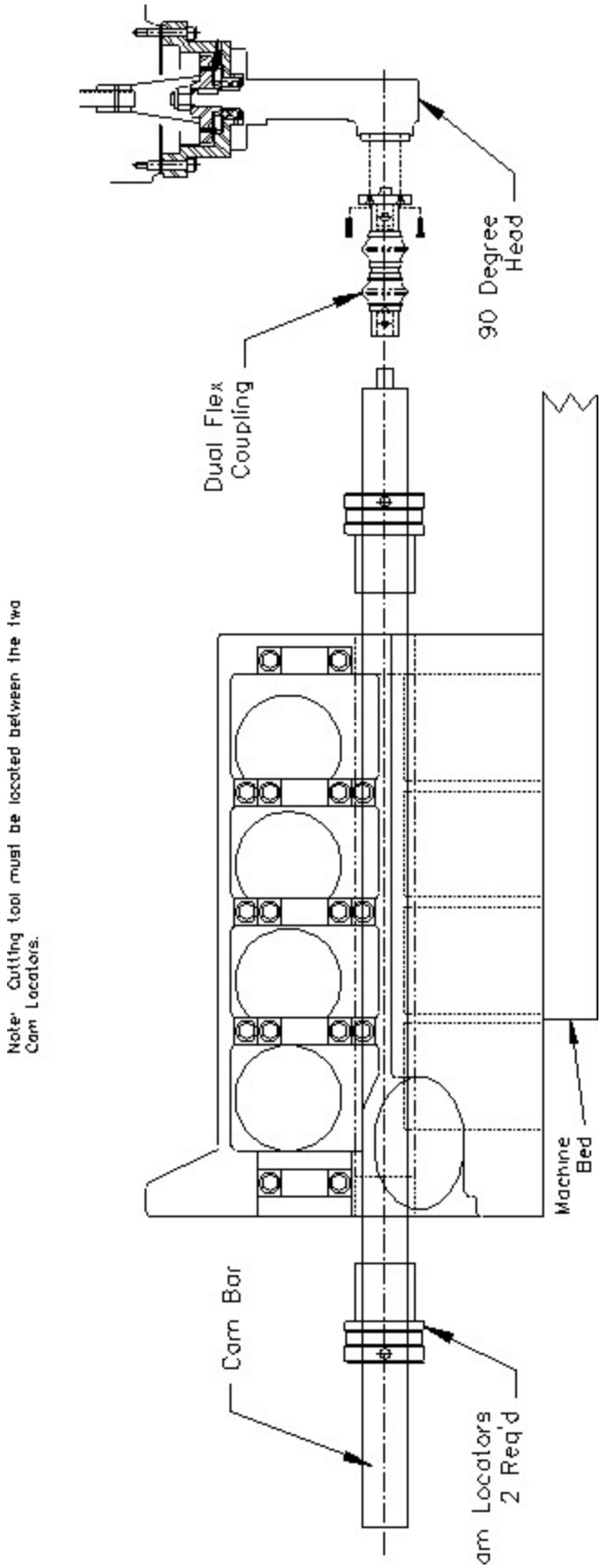
Slide the Cam Bar into the Cam Tunnel and then into the right side locator. Keep the end of the Cam Bar with the adapter on it to the right.

Slide the second locator onto the Cam Bar, then the locator into the Cam Bore. The cutting tool needs to be between the two (2) locators.

Bring the 90 degree head down and line up the end of the dual flex coupling with the adapter on the Cam Bar. This does not have to be a precise line up, the dual flex coupling will take care of any alignment variance. Tighten the socket head cap screw on the dual flex coupling on to the adapter on the Cam Bar.

Press the Vertical, Horizontal and In/Out zero buttons.

Final set up should look line the drawing on the following page. The mounting components are not shown on this drawing. Refer to the block mounting section of this chapter.


90 Degree Head
Dual Flex Coupling
Machine Bed
Cam Bar
Cam Locators 2 Req'd
Note: Cutting tool must be located between the two Cam Locators.

Circular Interpolation Tool Paths

Circular Interpolation is a common tool path that refers to using a tool smaller in diameter than the desired bore size and programming the machine to move in a circular move to mill the bore to the desired final diameter. Common applications include circular pockets, counter bores or semi-circular profiles such as internal or external radii or fillets. Both the RPATH and Rottler Block software's feature operations which can perform these various circular interpolation movements. The 2 main options for circular interpolation are as follows: Pocket, and Circular Move. Each of these are discussed in more detail below. For this lesson, the Rottler Block Software will be used in the sample images.

Objectives of this lesson:

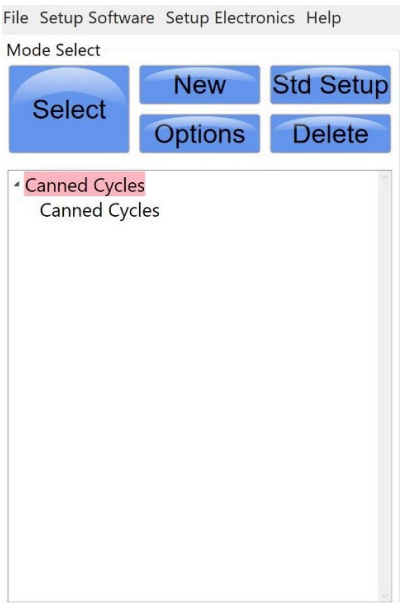
- Learn how to setup and program the 2 options for circular interpolation operations and the benefits for each method ○ Canned Cycle – Pocket
  - ○ Canned Cycle – Circular Move

*Note: All feeds, speeds, depth of cuts, and tool paths are for demonstration purposes only. The operator can change these to suit the machining philosophy of the shop and the tooling available. *

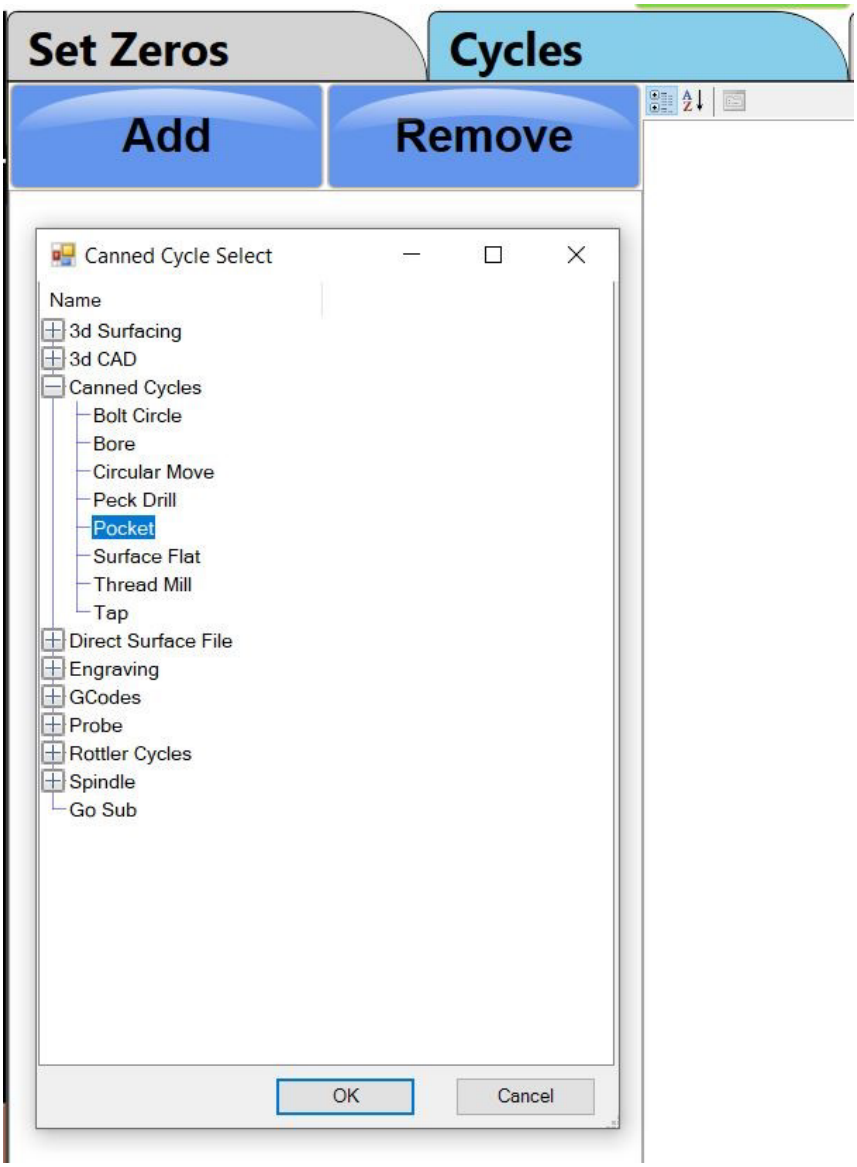
Canned Cycle – POCKET

The Pocket operation is a standard operation which can be used to remove material in a rectangular or circular recessed area such as a counter bore. This is typically used when the center of the area to be machined requires a significant amount of material removal.

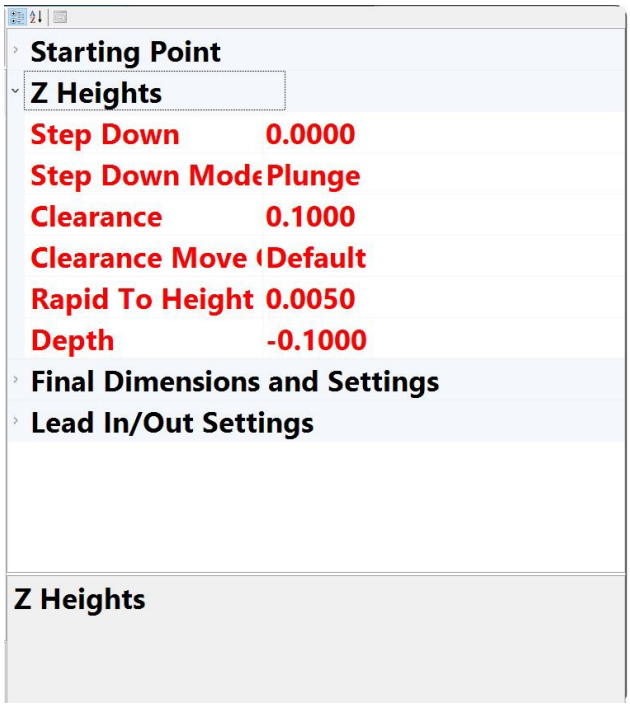
To add a canned cycle operation in the block software, select the program you wish to work form in the program selection area and then press NEW in the Mode Select area from the main screen. A pop-up window will appear, find and select canned cycle to create the mode in the block file.



Once created click on the Canned Cycles label to open the programming interface. Select the Cycles tab and you should see add and remove buttons on the left of the screen. From here select the add button and a window will appear where you can select the canned cycles drop down option which will allow you to select POCKET.



Press okay to confirm the selection. The pocket cycle will be added to the list and the properties for the pocket operation will appear in the right column of the screen in red text. These properties can be used to edit the type, size, and location for the pocket operation.



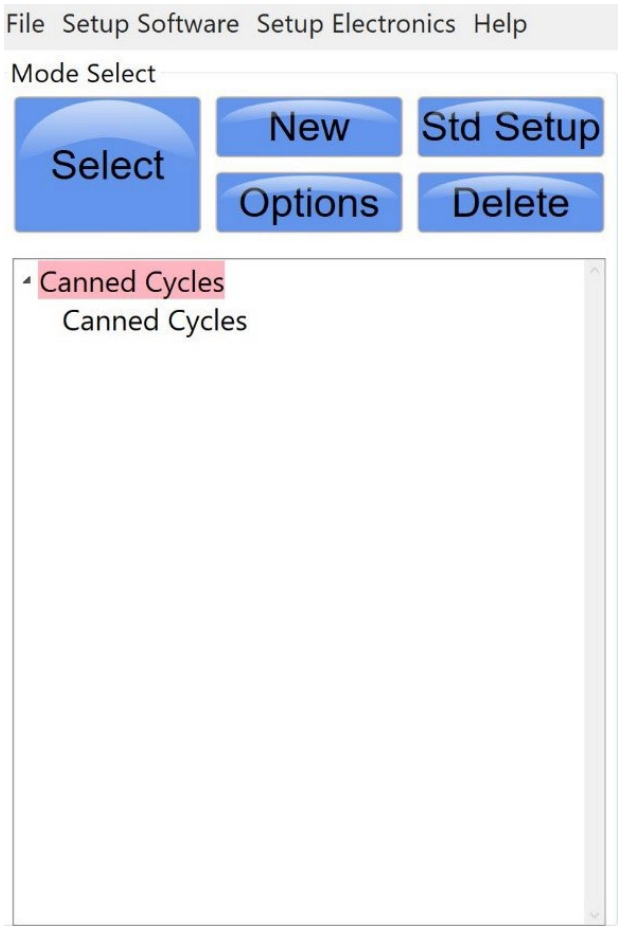
The Z Heights refer to the depth of the pocket and control where the cutter will start cutting as well as how much material to be removed per pass in the z-axis. You may also change the stepdown mode from plunge to ramp. Typically for pockets ramp is preferred.

The pocket dimensions and Pocket options are used to edit the dimensions of the pocket as well as the type. For circular interpolation change the Type of Pocket to Circular this will then use the Diameter setting for the pocket dimension. You may also change the max step out which controls the amount of material to be removed per pass radially. The cleanup option can be used to create a finish pass of a smaller amount than the standard step out.

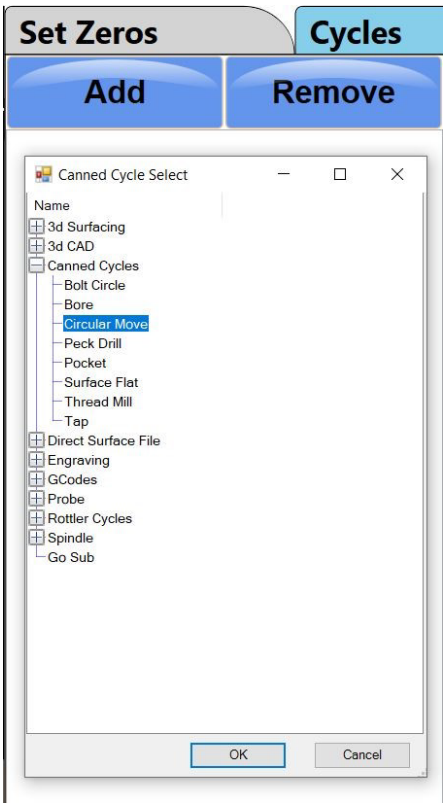
Canned Cycle – CIRCULAR MOVE

Circular move is a fixed diameter move that can be used to profile the ID or OD of a circular object. Circular move may also be used for creating a circular grove of a specific width. This is typically used to contour a single profile and clean up a surface or to create an o-ring groove.

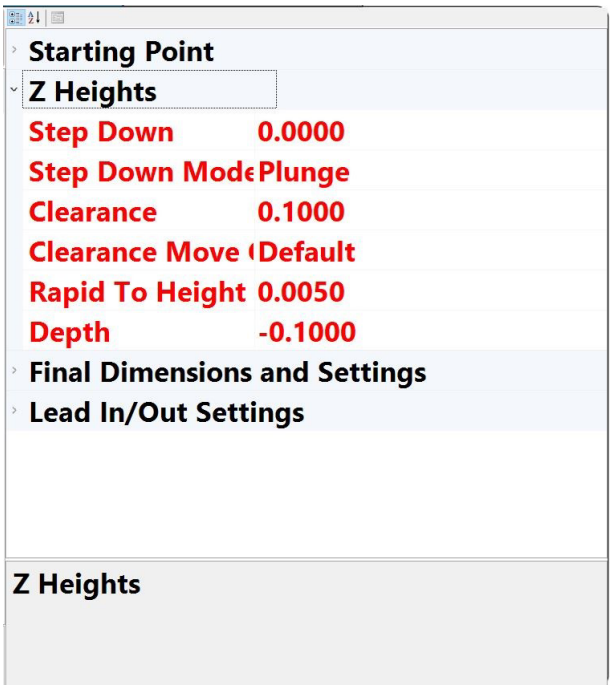
To add a canned cycle operation in the block software, select the program you wish to work form in the program selection area and then press NEW in the Mode Select area from the main screen. A pop-up window will appear, find and select canned cycle to create the mode in the block file.



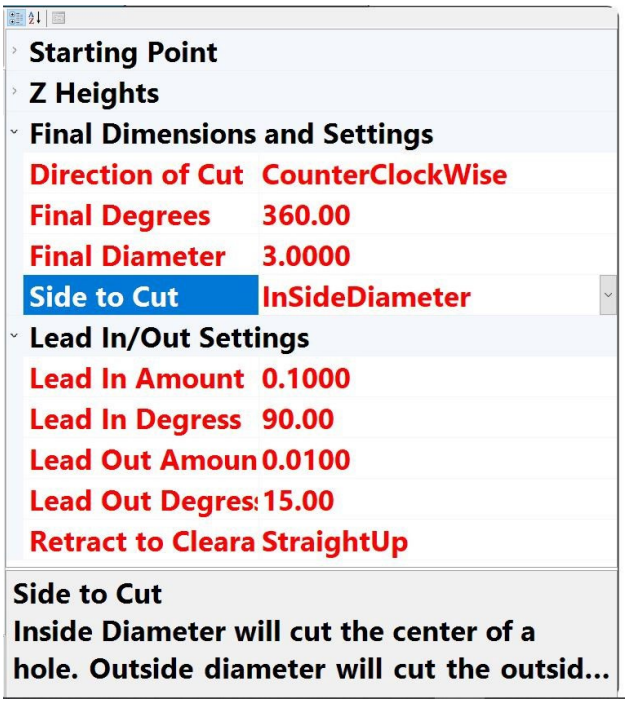
Once created click on the Canned Cycles label to open the programming interface. Select the Cycles tab and you should see add and remove buttons on the left of the screen. From here select the add button and a window will appear where you can select the canned cycles drop down option which will allow you to select CIRCULAR MOVE.



Press okay to confirm the selection. The circular move cycle will be added to the list and the properties for the circular move operation will appear in the right column of the screen in red text. These properties can be used to edit the type, size, and location for the circular move operation.



The Z Heights refer to the depth of the circular move and control where the cutter will start cutting as well as how much material to be removed per pass in the z-axis. You may also change the step-down mode from plunge to ramp. Typically for circular move plunge is preferred.



The Final dimensions and Settings are used to edit the dimensions of the operation as well as the type. For a full circle the final degrees will default to 360, this can be modified if less is to be

cut. The side to cut may also be changed to inside diameter, outside diameter, or no tool comp for grooving operations. The program will automatically account for the tool diameter so the final diameter should be set to the intended final dimension. Lead In/Out settings control the approach and exit of the cutter and can be modified should clearance be an issue.

Setting Vertical Stops

Make sure the machine is at the zero positions as described previously.

When using the Line Bore Mode to do the Cam Tunnel boring the vertical stops described here will never change. They must be used to run the cycle without damaging parts.

Block Clearance: -.001

Block Center Line: 00.000

Setting Horizontal Stops

All of the Horizontal stops are to remain at 00.000 when using the Line Bore Mode to do Cam Tunnel boring. The only setting that gets changed on this screen is the Bore Length for Horizontal stop 1. This will be the distance between the two (2) end Cam bores that needs to be bored out.

Auto Cycle

You **DO NOT USE** the Auto Cycle when Cam Tunnel boring. The only items that get used on this screen are the Feed Rate and Spindle RPM.

Recommended feeds and speeds will be discussed later in this chapter.

Manual Bore

This screen is used to bore the Cam Tunnel. With the Horizontal and the In/Out axis at the zero position and the Vertical at or above the Block Clearance Height, Press the BORE1 button.

The spindle will do a rapid move down to the Block Center Line position (this is only .001 so will not notice the move). The spindle and Horizontal feed will start at the programmed speed. The machine will continue boring horizontally until the horizontal position set in the Bore Length is reached. The Vertical will retract .001 and the horizontal will retract back to the zero position.

Recommended Boring Procedure

The three (3) tool holders included in this package should be used as dedicated holders. Two of them set for roughing passes and the third set for a final finish pass.

It is recommended to set the first two tool holders for a .100” pass each, then set the third tool for the finish size.

Size is not critical on the first two passes, these tools can be set and not adjusted for each use. The third tool should be checked with the dial indicator for final size each time you use it.

Recommended Feed Rate: .001 - .003

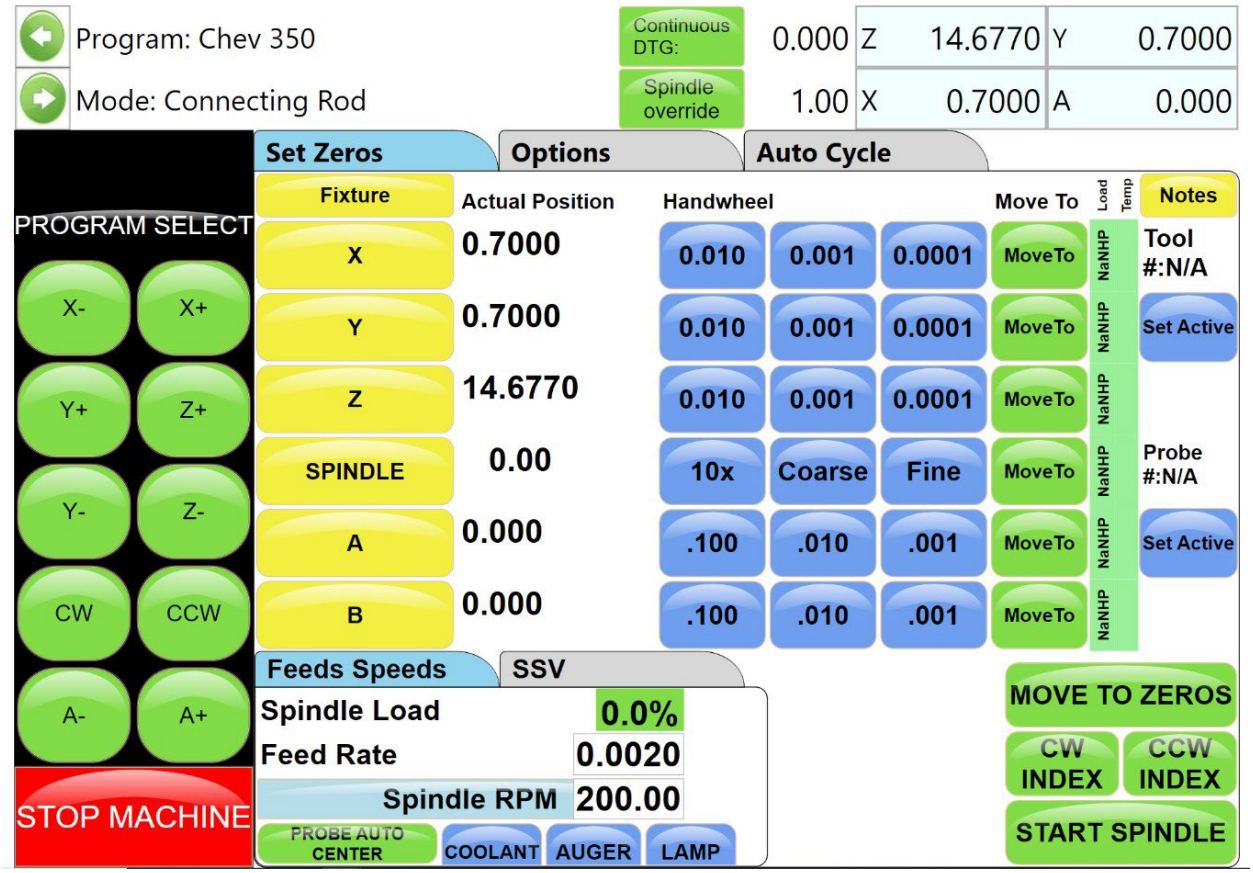
Recommended Spindle RPM: 300 – 500

IMPORTANT: You should put a light coating of light weight oil on the Cam Bar to prevent it from seizing up as it goes through the Cam Locators. At higher spindle speeds the bar heats up more.

Connecting Rod Boring

Main Screen

Select the Connecting Rod operation from within the mode select tab. This will add the operation and you may then open the connecting rod operation to bring up the standard set zeros page.



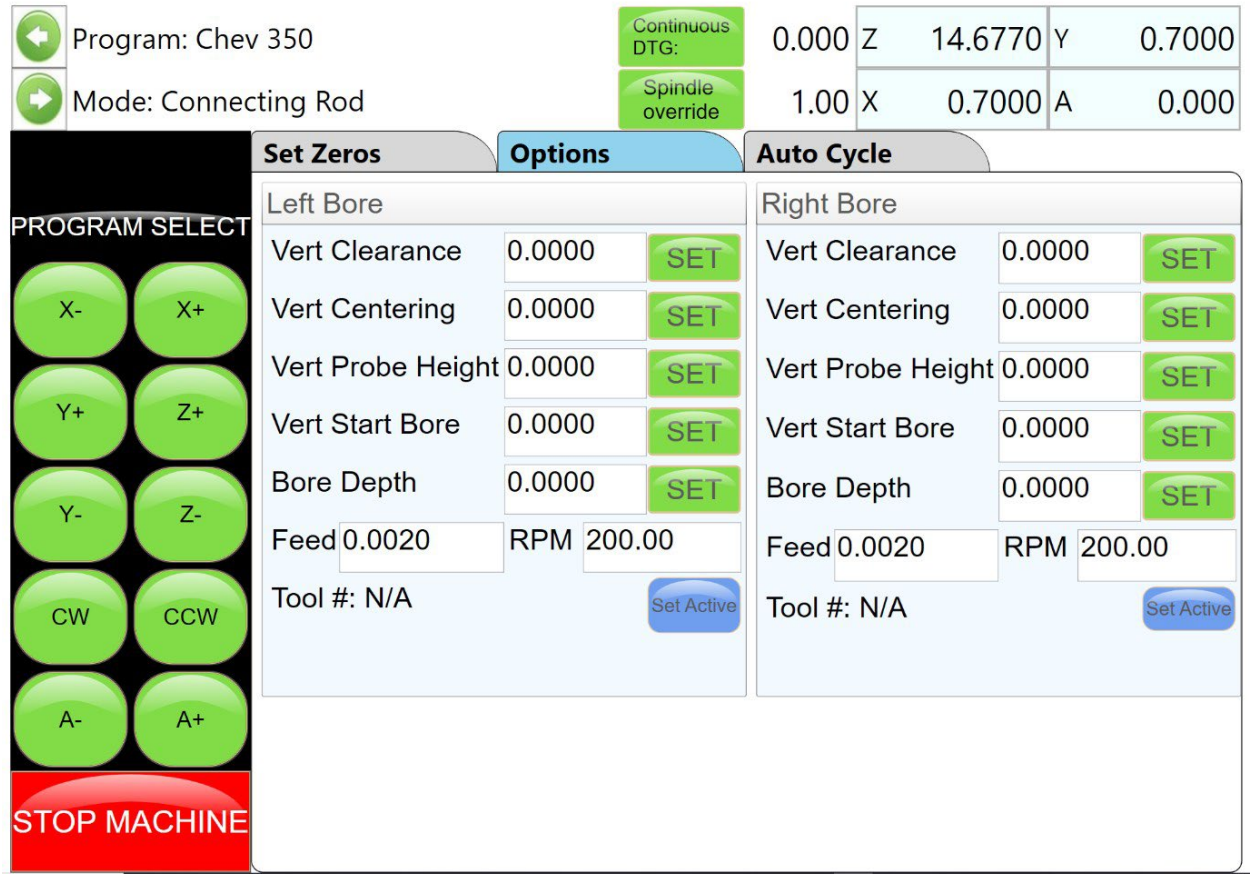
Setting Zeros

Using a dial indicator or the touch probe, find the center of the connecting rod large bore, typically this is done only on the connecting rod body side and not the cap side. Double tap the X and Y buttons to set the program zeros once the center is found.

Setting Vertical Zero

Using the electronic probe with the depth probing routine or the tool to be used. Touch off the top surface of the large bore on the connecting rod. Double tap the Z button to set the program vertical zero.

Program Options



This screen is used to input all the parameters for boring both the big and small end of the rod plus setting positions for centering and measuring.

Vert Clearance: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will move before any horizontal movements take place.

Vert Centering: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will move to allow the operator to center the machine with a dial indicator.

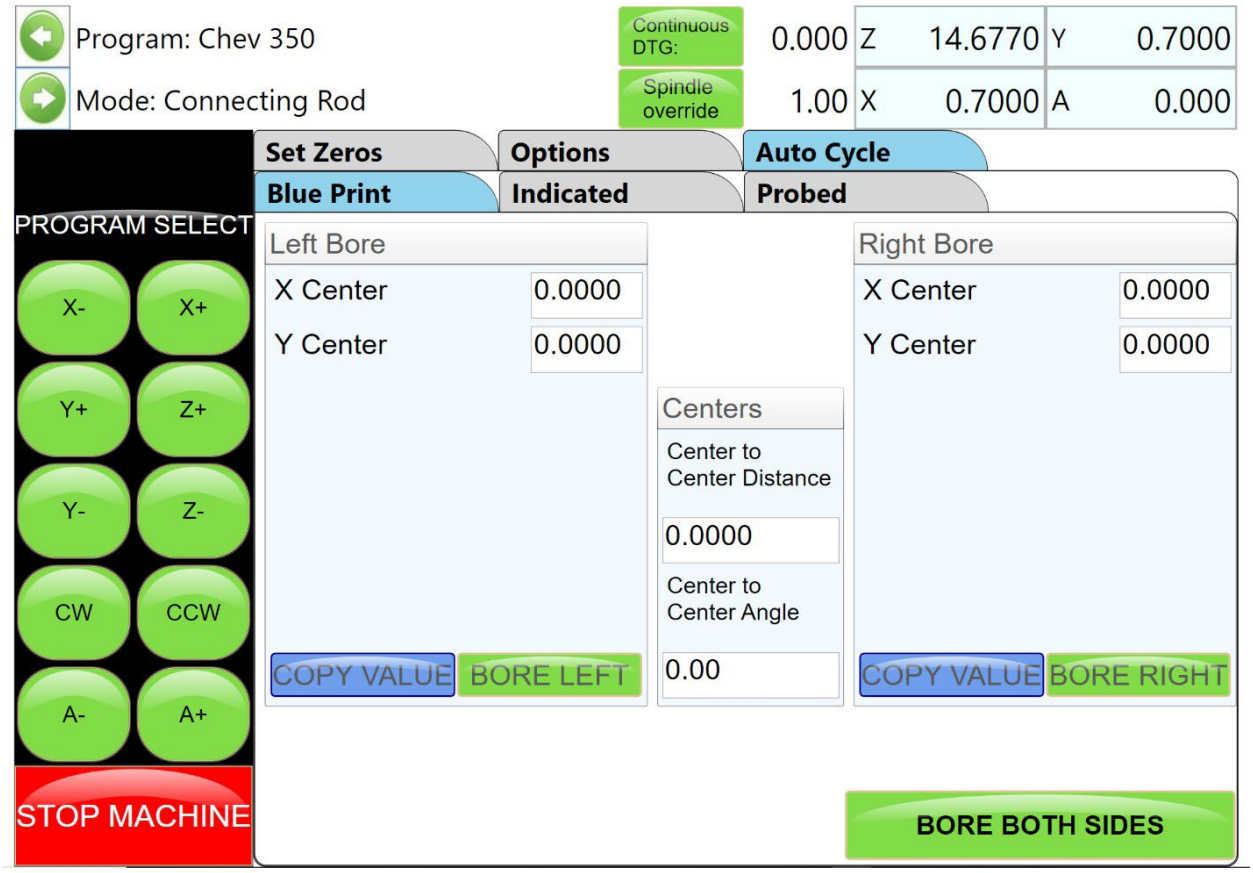
Vert Probe Height: This is the vertical height that the machine will move to before probing the bore to recenter the machine using the three-point probe routine.

Vert Start Bore: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will move to start boring the conrod. This is set about .040” (1mm) above the side of the connecting rod bore

Bore Depth: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will stop boring, index the boring tool and retract back to the clearance position after it’s finished cutting.

Tool #: Click the Tool word to bring up the tool select form and define the tool to be used for the individual bores.

Auto Cycle

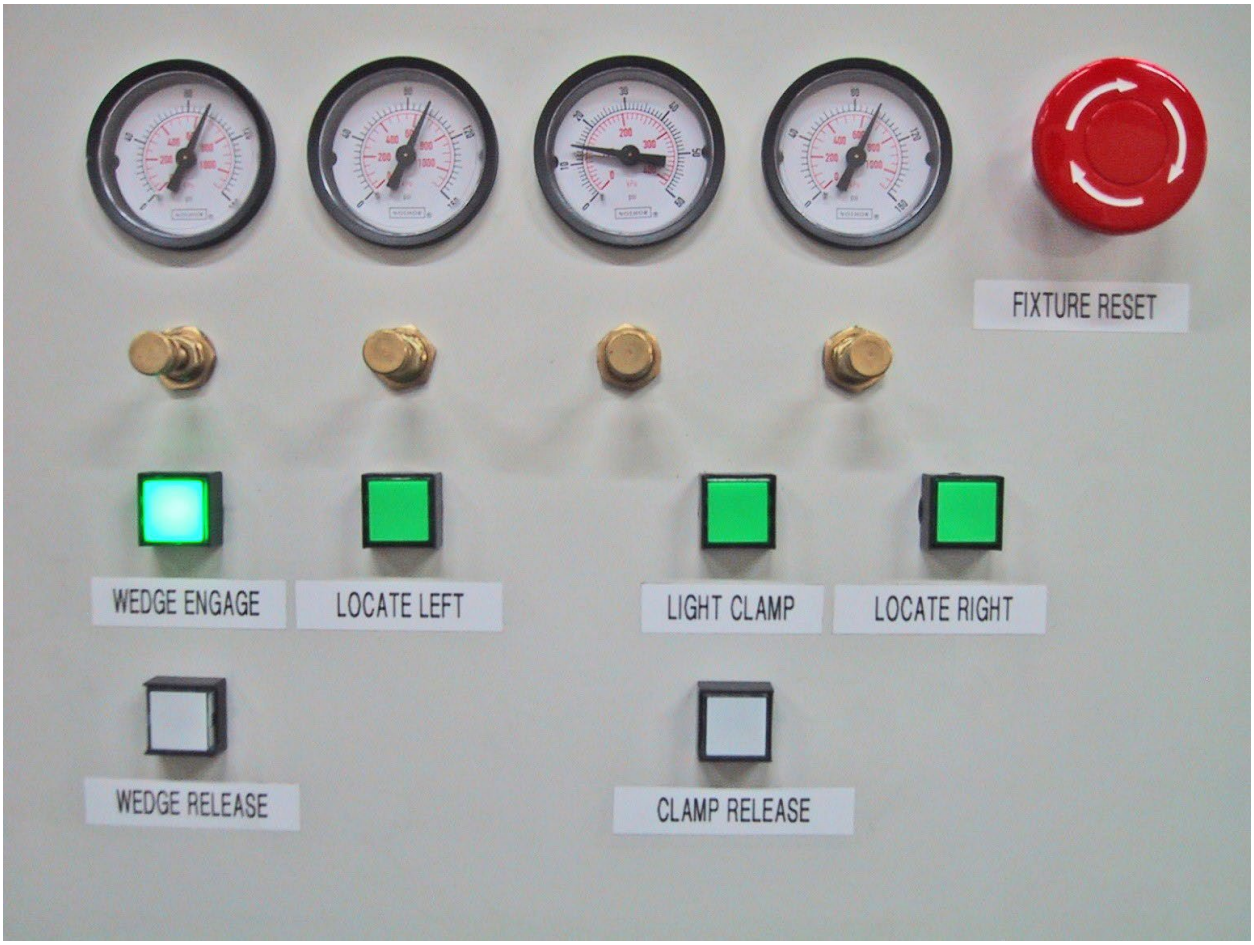


This screen is used to the connecting rod program. From the Auto Cycle tab the operator can use the Blueprint, Indicated or Probed tabs to machine using the respective methods as described in the 3 Axis Block Boring section.

Bore Both: If special cutterheads with big and small end tooling in one are being used, the block can be checked so that the machine will bore both big and small end in one cycle. Normally the big and small ends are bored with different cutterheads and this block will be unchecked.

Note: Do not stop an automatic cycle in mid cycle and then try to start it again. The CNC code running behind the Rottler screens use offsets in the controller. If the machine is stopped during an automatic cycle the machine must be shut down and restarted to clear the offsets. Otherwise the displayed position and actual position of the machine will not be correct.

Fixture Control Panel



Set Up Procedure For Conrod Fixture

Select the widest big and small end ball locators that will fit inside the conrod big and small end bores.

Press Locate Right and the right hand ball locator will move up and stop against it's end stop, then remove the air pressure supply to the conrod fixture so that the ball locator pivot arms may be moved manually.

Fit the selected ball locators to the right and left hand mounting positions. Be sure there are no chips and that the locators fix exactly in their mounting positions. Connect the air pressure to the fixture.

Press Locate Right Button, the right hand ball locator will move up and stop against it's end stop. Select the correct conrod support and place across the conrod fixture.

Place the conrod to be bored into the fixture so that the big end bore touches both the balls of the right hand ball locators.

Adjust the conrod rest so that the rod lies approximately horizontal.

Adjust the 3 big end support pads so that each support pad locates on the side of the big end and does not protrude into the big end bore. This will require removing and refitting the conrod to be sure the 3 support pads are correctly located and their hold down cap screws are tight.

Readjust the conrod support to allow the conrod to lie horizontal with no rock or tilt of the conrod on the 3 big end support pads.

Remove the conrod from the fixture.

Press locate left and the left hand small end ball locating device will lift up.

When the left hand ball locating device is at it's end of travel, place the conrod back in the fixture and adjust the left hand slide assembly so that both the left hand locating balls contact the bore inside the conrod small end.

Remove the conrod from the fixture.

Slide the left hand locating assembly approx 1/2" (12.7mm) to the right and lock both hold down handles securely, this will ensure that the small end ball locators contact the small end with some preload. Place the conrod in the fixture.

Position the clamp arms so that their feet are approx 1/8" (3mm) above the side of the big end, be sure that hey do nor protrude into the big end bore to be machined and adjust their travel limit stops and lock the lock nuts.

Press the Light Clamp button, this will places light clamping pressure on the clamp arms and lightly hold the conrod down against the 3 support pads under the big end of the conrod.

Press the Locate Left button, the small end ball locator will move up and contact the bore of the small end of the conrod and firmly press it against the big end and straighten the conrod along the center of the fixture.

Select a set of wedges that will allow the outside of the small end of the conrod to be supported during boring so that there is no chatter or vibration during boring.

Press Wedge Engage button, the wedges will be pressed against the outside of the small end.

The conrod is now ready to be bored.

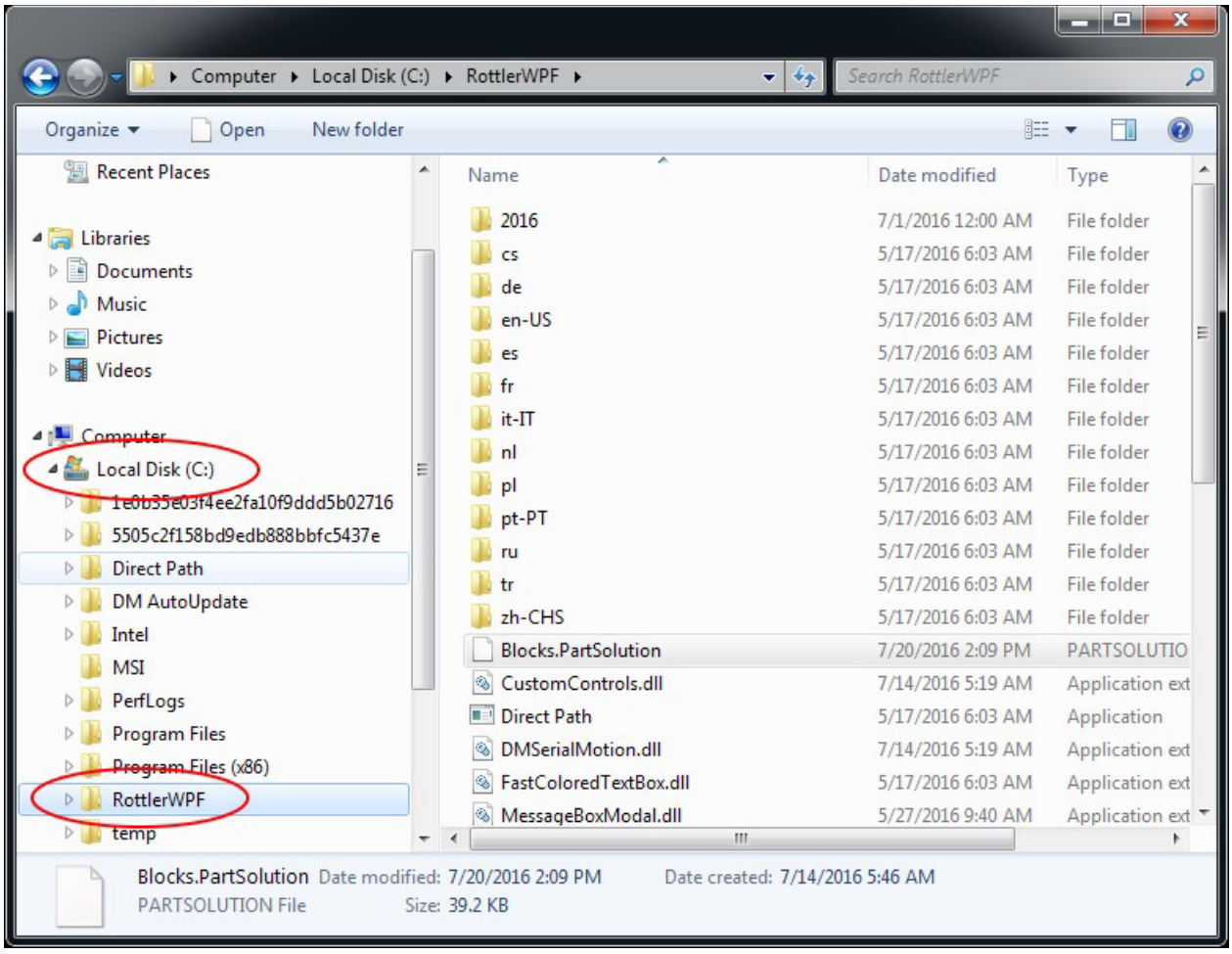
Air Pressure Settings

Right Hand Side Air Gage:	Locate Right	100psi (6.5Bar)
Second from Right Hand Side:	Light Clamp	15psi (1.0Bar)
Second from Left Hand Side:	Locate Left	30psi (2.0Bar)
Left Hand Side Air Gage:	Wedge Engage	30psi (2.0Bar)

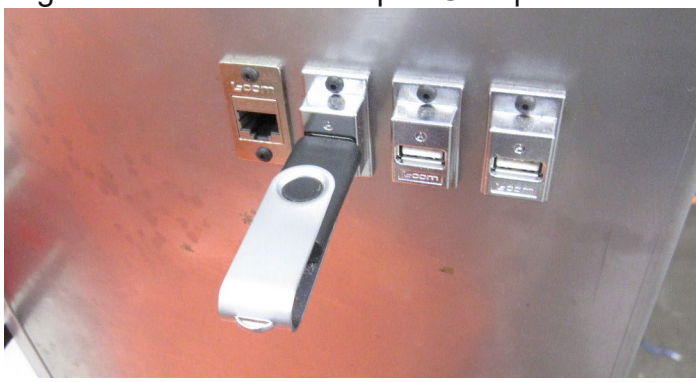
Backing Up and Restoring Block Profiles

This section will explain how to back up and restore the operator created block profiles for DM controlled machines for archival purposes or to transfer to a different machine.

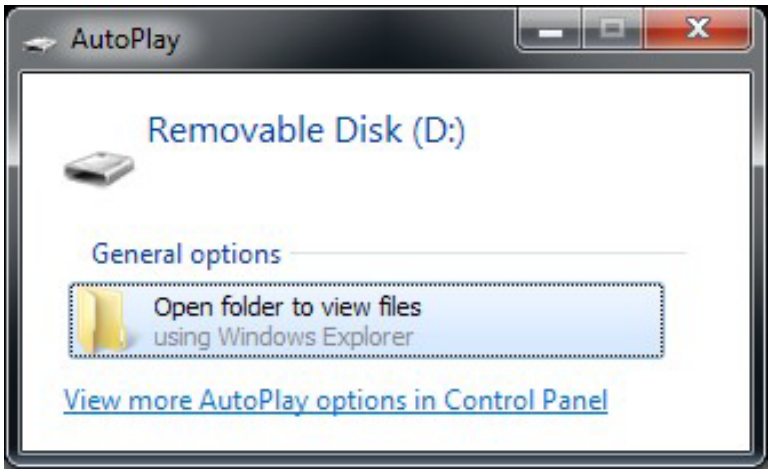
First step is to open your file bowser and locate the RottlerWPF file on the C disk drive.



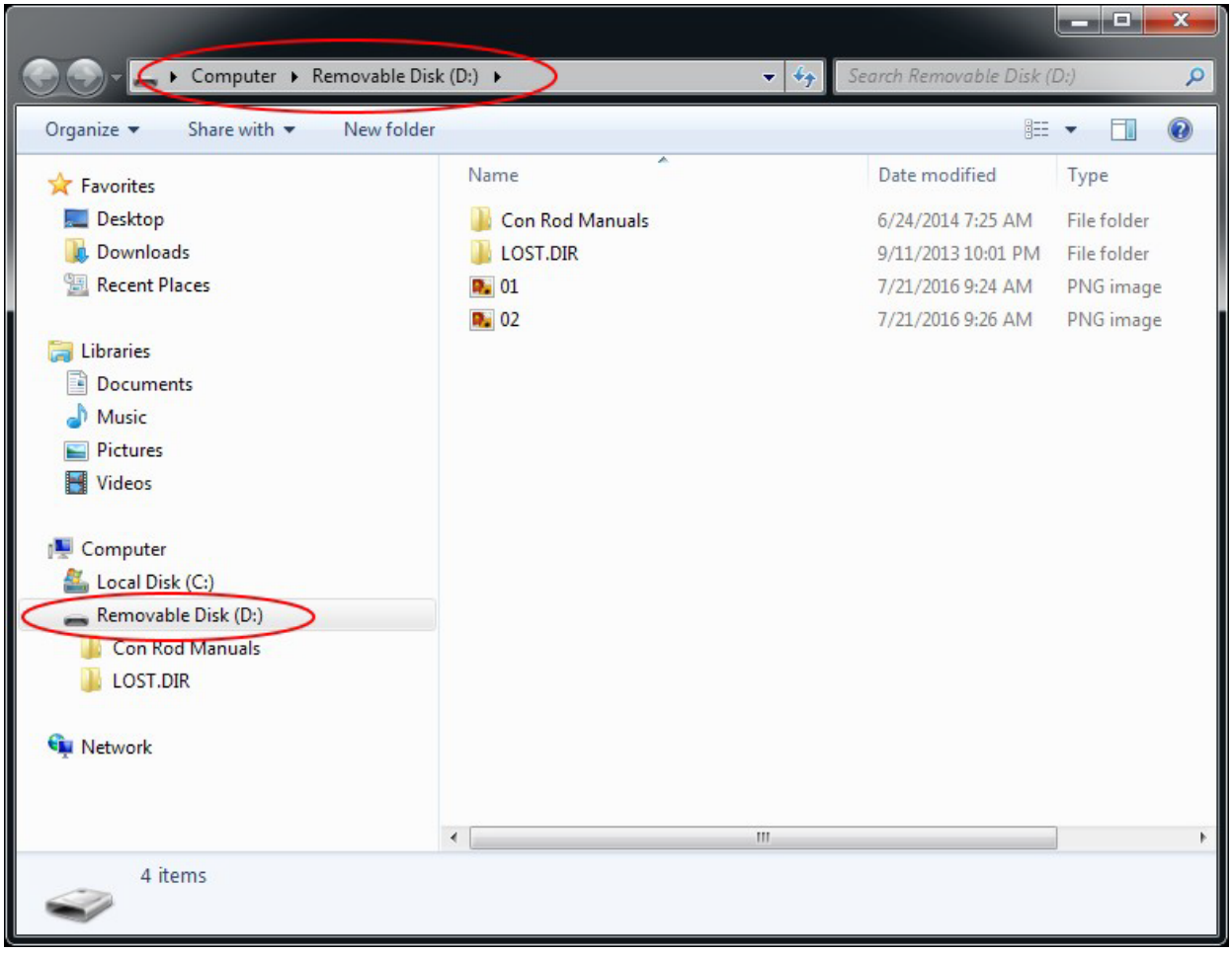
The next step is to plug in a flash drive to an open USB port



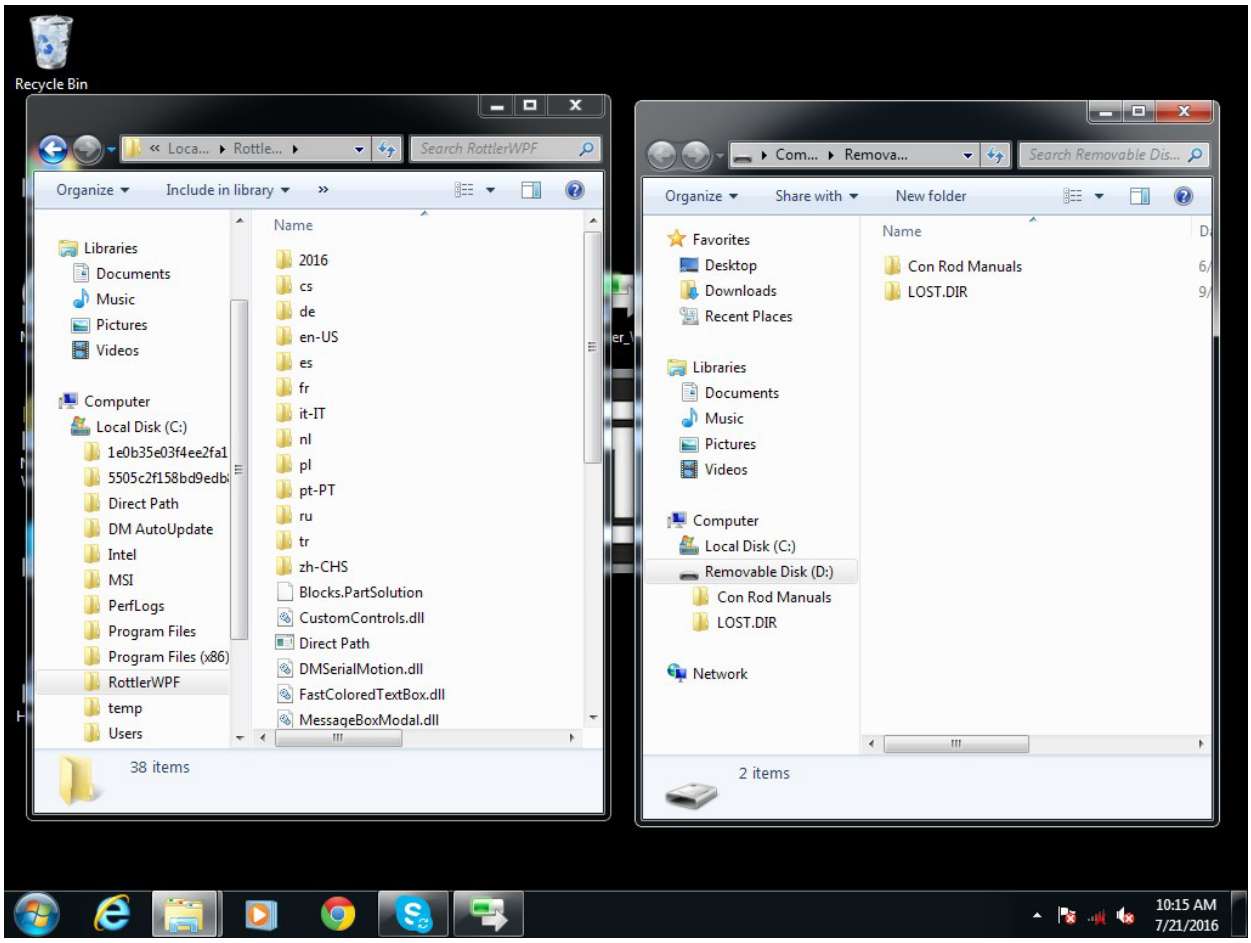
The following pop up box will appear on your screen.



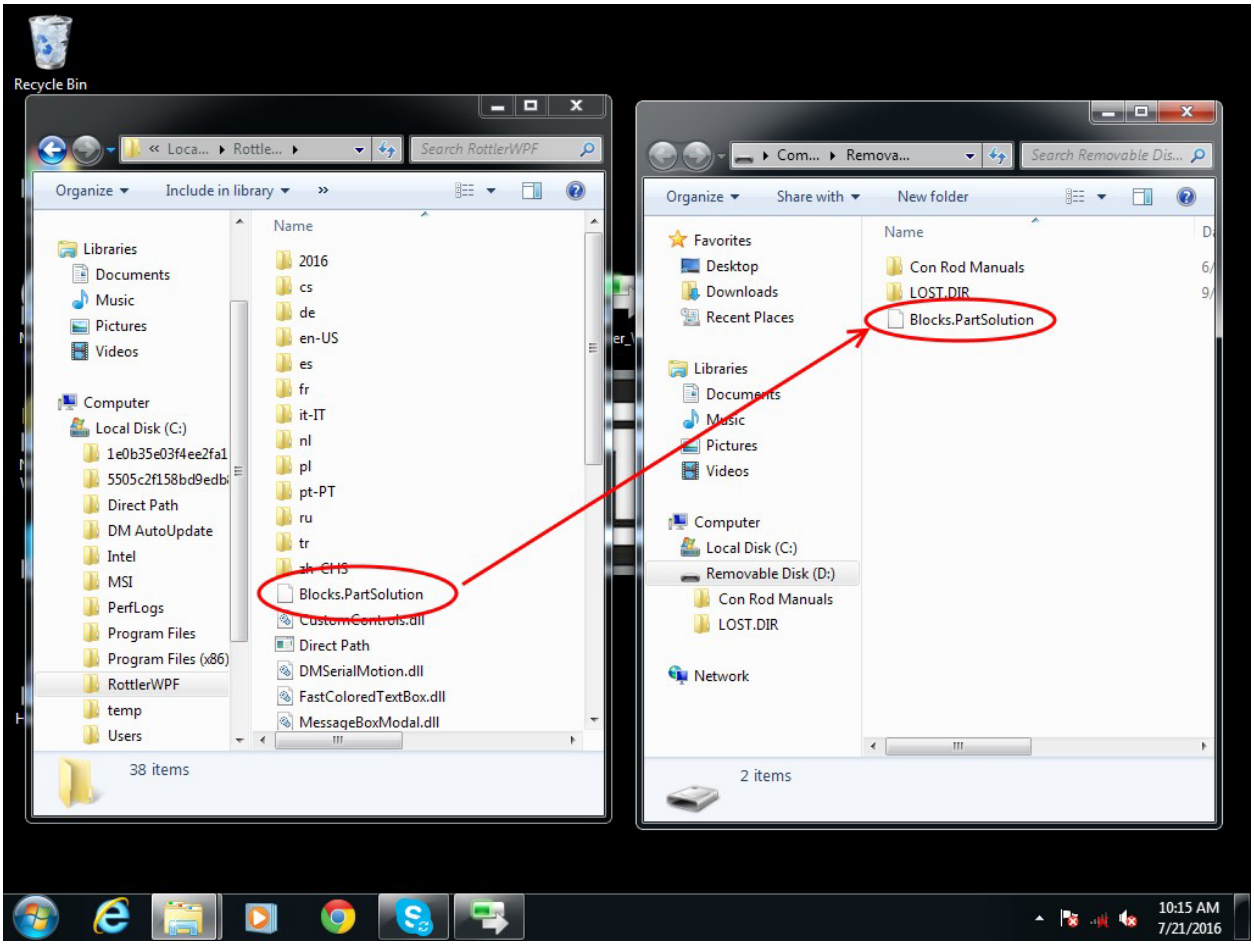
Click on the Open folder to view files option and the following screen will appear. This is the contents of the flash drive you just plugged in.



Next resize and arrange both file browsers so that they are side by side.



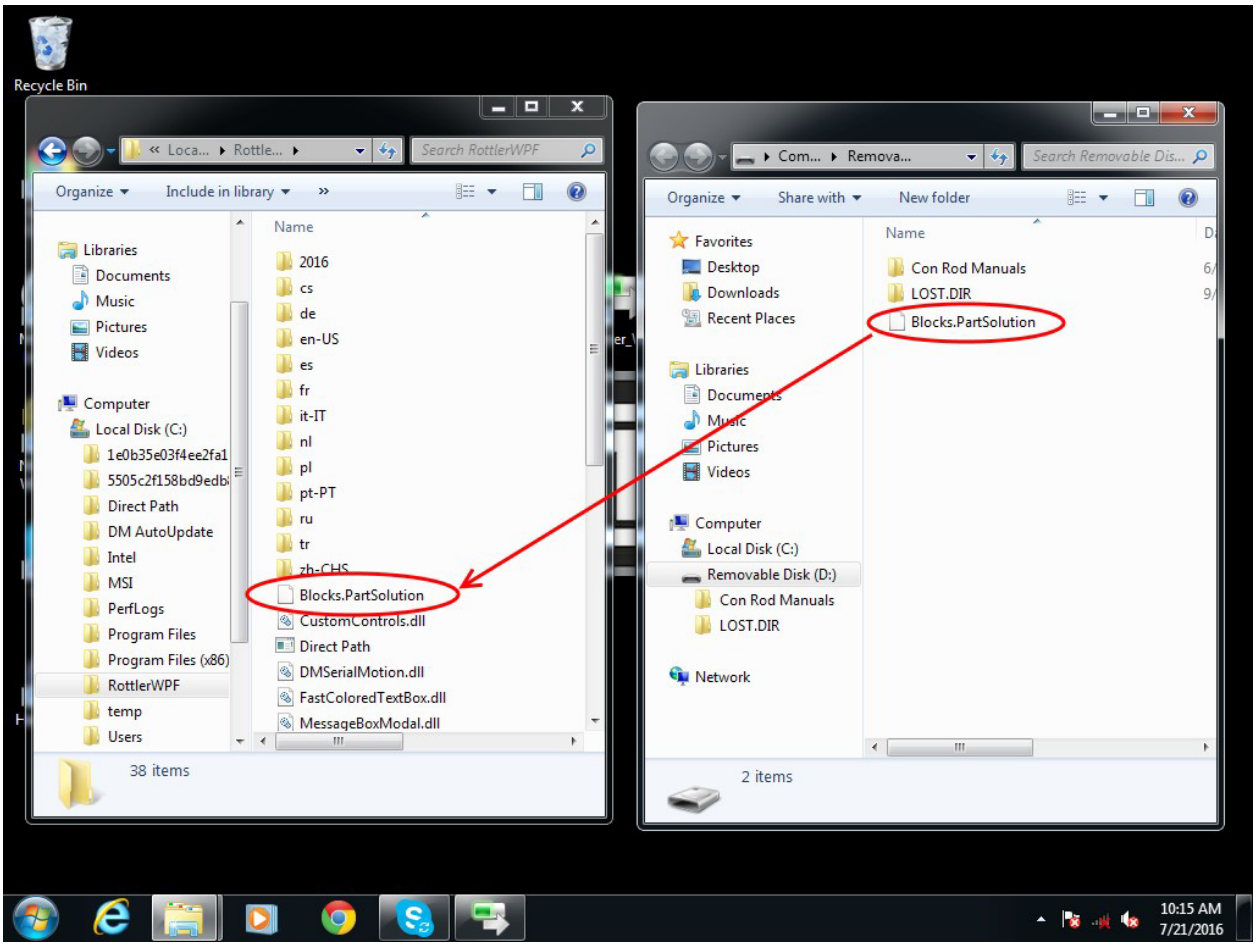
Block profiles are backed up each time the machine is run with the current profiles being shown in the RottlerWPF folder. All that needs to be done to back up the current profile is to simply drag it from the RottlerWPF folder to the flash drive folder. A copy of the file will be placed on the flash drive.



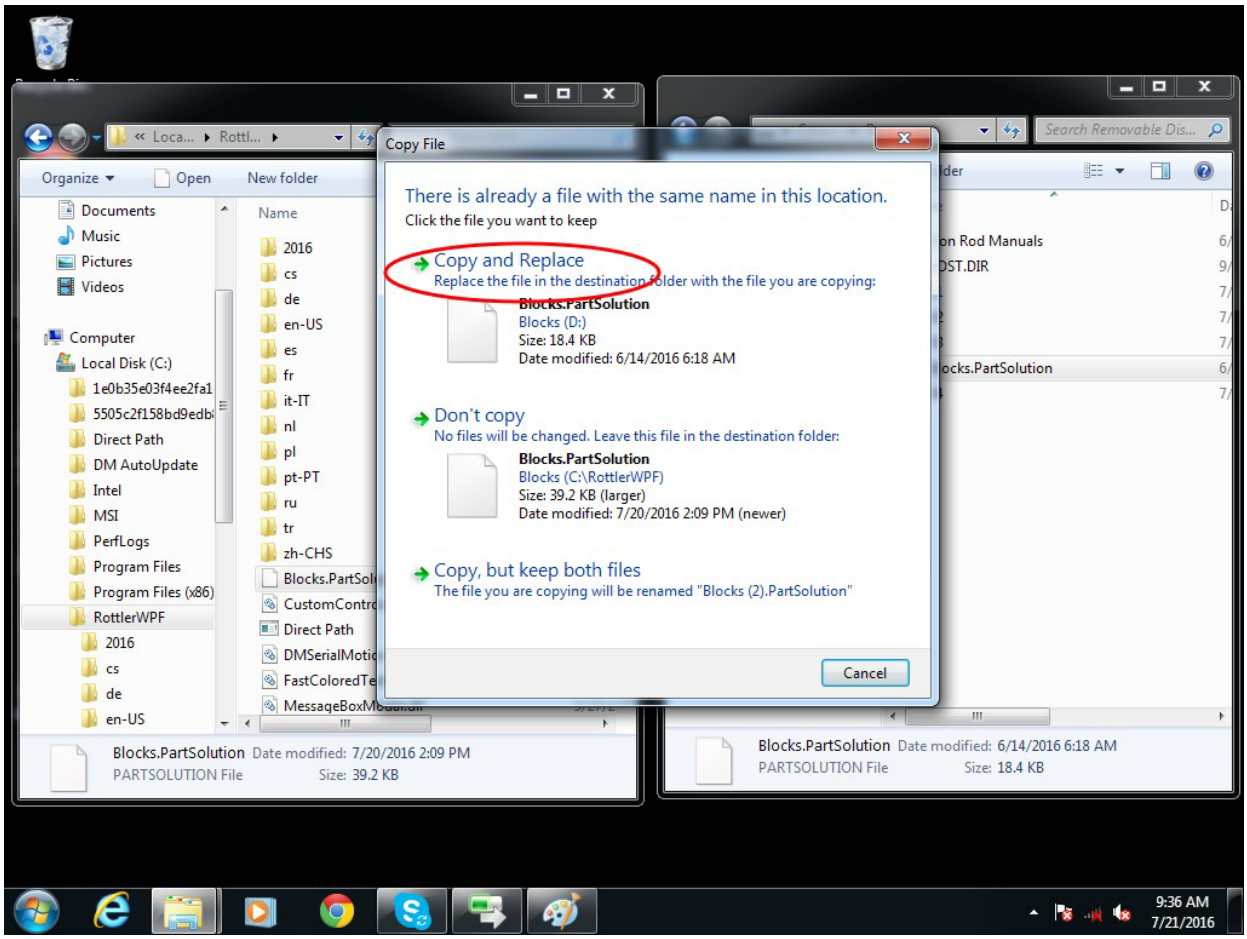
Backup is now complete. Close both file browser windows and remove the flash drive.

To restore or add block profiles go through the first 5 steps explained previously.

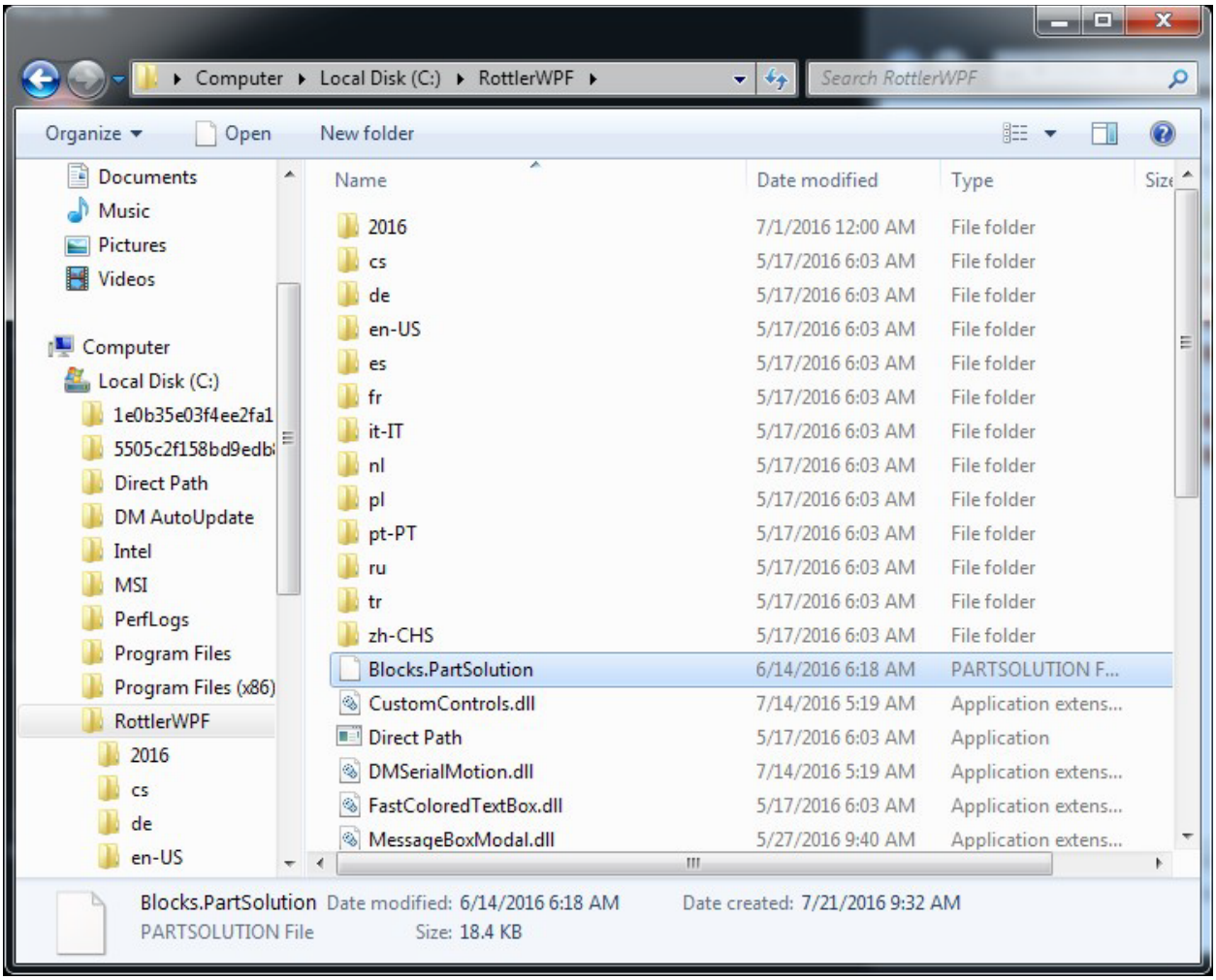
Highlight the block profiles file in the flash drive and drag it into the RottlerWPF folder on the local hard drive.



You will get a pop up window about there being a file of the same name in the destination folder. Click on the Copy and Replace option.



The archived block profiles will now be installed.



Close both browser windows and remove the flash drive. The restore process is now complete.

Using 3rd Party Tooling in Rottler Machines with CAT 40 Tooling.

When it is not convenient for the customer to order CAT 40 tooling from the factory or if the customer needs tooling that we don't stock, they may purchase tooling from 3rd party vendors such as MSC Metalworking.

Rottler uses a Parlec - A Style, CAT40 Taper, 5/8-11 Thread, 45 Degree Angle Radius, Standard Retention Knob with the following specifications: 1.68 Inch Overall Length, 0.281 Inch Coolant Hole Diameter, 0.74 Inch Knob Diameter, 0.12 Inch Flange Thickness, 0.64 Inch Knob to Flange Length, 0.635 Inch Pilot Diameter, Through Coolant.

The metric equivalent is a Parlec - A Style, BT40 Taper, M16 x 2
Thread, 45° Angle Radius, Standard Retention Knob 1.65 Inch Overall Length, 0.281 Inch Coolant Hole Diameter, 0.74 Inch Knob Diameter, 0.12 Inch Flange Thickness, 0.64 Inch Knob to Flange Length, 0.669 Inch Pilot Diameter, Through Coolant