



EBONITE MILL DRILL OPERATIONS MANUAL



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Congratulations on your purchase of the Ebonite Mill Drill Machine. While all of us at Ebonite thank you for your purchase we are also confident that you will find this to be a great addition to your pro shop business.

Mill Drill Set-Up

Section (1) Receiving New Machine

The Mill Drill machine was packaged complete in the factory and shipped to you in this manner for your convenience. Before removing the top and 4 sides of the crate be sure to note if there was any **damage** from shipping to the **crate**. This is **important** as the **freight company** should be **notified immediately**.

The Mill Drill Crate is 4' x 4' x 6 ½' and generally will not fit through the entry doors of the bowling center. Therefore remove the 4 sides and the top to the crate by removing all the Phillips head screws and discard them, before attempting to move the machine in the bowling center. Next remove the accessories, drill bits etc. from the stand and the bottom of the crate. All of these items are placed in the storage area of the stand to keep them from moving during shipping.

WARNING:

**The Mill Drill is very TOP HEAVY.
Use EXTREME CAUTION when moving the machine.**

Section (2) Locating New Machine

1. Remove the ½" lag bolts that hold the machine stand to the bottom of the wooden crate, being careful not to tip the machine in anyway.
2. Using an appliance dolly place it under that back of the machine the motor side, (*this step is best when there are at least 3 people, one to hold the dolly and guide the machine and one on each side of the machine to support and help guide the machine while moving*). When everyone is in place tip the machine back on the dolly and roll off



of the wooden base (*Extreme care should be used as this machine is top heavy so use caution and care*)

3. Roll the machine in the center to the front of your shop, measure the width of your door to make sure you can get the machine thru. If the door you must use is narrow simply set the machine down and then slide the dolly under the stand from the side of the machine (*Again use caution and, make sure you have plenty of help as the machine is top heavy*). Now roll the machine in to your location as close as you can and set down.
4. Remove the dolly from the machine and slide the machine into the location that you want. Again when sliding make sure that you do not tip the machine and use care as the machine is heavy enough to damage tile or carpet. You may find it best to place card board under the stand to help slide in to position. Once in place tip the machine slightly and pull the cardboard from under the machine. If the machine rocks due to the floor being unlevel you may need to shim the sides of the stand to firm the machine up and keep it from rocking during operation.

Section (3) Preliminary Set-Up

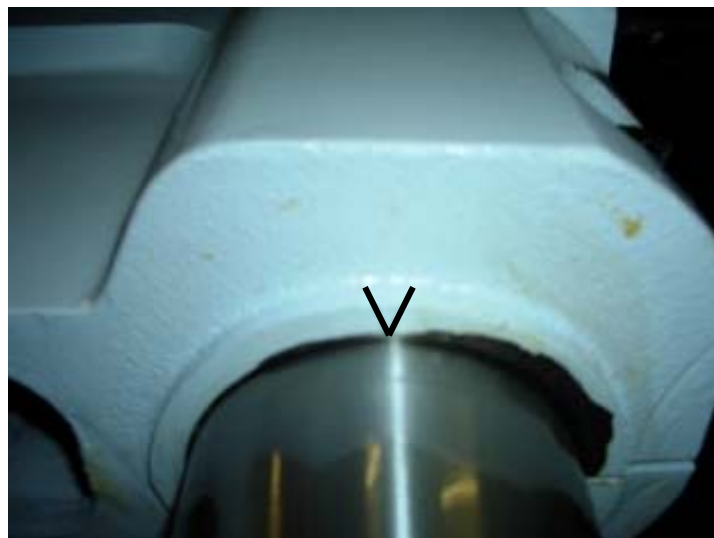
1. Using the silver wrench that is included loosen the two large nuts on the right hand side of the machine. (Right side as you are facing the machine) Pictured Below.



2. On the left hand side of the machine there is a black crank handle, cranking this will begin to raise the head of the machine until it is high enough to turn the head to its proper position. Turn the head. Pictured Below.



3. Now while cranking the head up look on the right hand side of the post. When you reach the proper height you will see a scribed line that is across the right side of the silver post. Raise the head until that line will line is just showing under the bottom of the head of the machine.



4. There will also be another scribed line on that runs up and down on the post along with another one scribed into the bottom of the head, pivot the head of the machine until these two lines are matched up. Once this is done tighten the large nuts on the right hand side again. This puts the head of the machine in the position that the machine was calibrated in at the factory. This centers the head of the machine but is not the final calibration that will come later in the set up process. (note when tightening these nuts make sure to tighten one then the other and go back and forth until they are tight, Tightening one all the way first could cause damage to the head of the machine so use caution)



5. Attach the 3 table crank handles to the table cranks and tighten set screws.



6. Next the digital are shipped with the batteries out of the unit. Remove the cover of each digital reader and place the batteries into each unit. Use care as the clips that hold the batteries in place are very fragile. (Do not try to bend the contacts) replace the cover and make sure that the connecting cords are in place. Push and hold the on button until the reader comes on. Push the mode button until it is reading in decimal inches.

Section (4) Optional Accessories of your new machine

1. Place the drill bit holder on the machine and unpack the drill bits and place in the holder
2. Place the Ball holder accessory arm on the left hand side of the machine and the tool holder on the right hand side. These do have adjusting knobs so you can adjust to the position that fits your work the best.

Section 5) Electrical set up of your new machine.

1. Plug the power cord from the control box into your wall outlet. (NOTE this should be on 20 amp breaker) Next plug the cord from the motor into the back of the control box in the outlet marked motor.
2. Unpack the light and place it on the left hand side of the machine and plug into the proper outlet on the back of the control box
3. Plug your vacuum into the proper outlet
4. Plug your high speed sander in to the proper outlet

Section (6) Final Calibration of digital readers

1. Zero the table to the measurement marks forward and back as well as right and left.



2. Place a new ball in the jig and lightly tighten the safety plate onto the ball
3. Place the 3" plug trimming blade in to the chuck of the machine.
4. Turn the digital scales on and make sure that they are in decimal inches.
5. Pull the handle down to bring the blade close to the ball, turn the trimming blade with your hand until it is straight front to back. While bringing the blade closer to the ball

use the table handle on the front of the machine and adjust the table forward and back until the blade fits perfectly on the ball. As a double check take a dollar bill and slide under the front edge of the blade and then the back. If you have adjusted the table properly you will be able to slide the bill under the blade the same amount from each end. When this is complete go to the lower digital reader and push the Zero button until the screen shows perfect zero. You have now calibrated the digital reader for forward and reverse to the machine.



6. Turn the blade to a left and right position and slide your dollar bill under the left end of the blade and then the right. Using the right or left table adjusting handle move the table until the blade sets perfectly on the ball and check with your dollar bill again. Then push the zero button on the upper reader.



7. Next before moving the tables, look on the inside of the front and the right handles, each one has a ring with marks that indicate .001 of an inch. Each of these rings has a thumb screw, loosen the thumb screw and turn the ring so the 0 on the ring lines up on the line, then tighten the thumb screw. This is a fail safe that is used in the event a digital scale is not working properly. It allows you to have the same accuracy you have with the digital scales. (Note that in the zero position the ruled scales should be on the zero line as well)



8. Place an old ball in the jig and tighten the safety plate on top of the ball. Place the 1" bit in the chuck and drill into the ball until only the point of the bit is in the ball then stop and turn the machine off. Pull the down until it stops in the hole and tighten the quill lock, then on the front of the machine there is an adjusting screw for the ruler on the face plate on the head of the machine. Turn the adjusting screw until the marker is on the 3" line. This is your reference for zero depth as the point of the bit does not count when measuring the depth of the hole. From this point you can determine the depth of the hole you want to drill without ever needing to measure the depth every time.



9. Now your machine is ready for operation



Mill Drill Operations

Section (1) Pivoting Jig Option

How to use the Power House Pivoting Jig

The Pivoting jig is a 4 axis jig that is designed to allow the operator to drill all 3 holes with out removing the ball from the jig. Using the proper sequence you can also install a thumb slug, oval the slug and trim the slug before removing the ball. This type of drilling has been proven to be the most accurate and the most useful in providing the value and service to your customers.

1. Mark the ball with the lay out you have chosen. You must have the center of grip and the finger and span lines complete.
2. Place the ball in the jig with the center of the grip straight up towards the drill chuck. (To make the ball easier to place in the jig loosen the side locks on the outside of the jig and roll the jig forward, once in place roll the jig back until it appears to be level across the top)
3. Place the safety ring over the top of the ball (Note it will drop over the 2 adjusting bolts on the left hand side of the jig and then it will slide down on the ball and align itself) Next on the right side of the jig pull the lock nut up onto the safety plate and lightly tighten it.
4. This step is designed to provide pin point accuracy that most machines can not provide. Check to make sure that both your forward and reverse and left to right are set on zero. Next place a bit in the chuck and pull the point of the bit to about 1/8 of an inch above the ball and lock the handle into place. (To do this use the silver handle on the left hand side of the head of the machine, this is the quill lock and allows you to hold the bit close to the ball so both hands will be free. Loosen the outside locks nuts and roll the jig forward and back. If the ball is aligned perfectly straight in the jig the point of the bit will stay above the center line on the ball. If aligned then tighten the lock knob for the safety plate all the way and you are ready to move on. If not aligned loosen the lock knob and adjust the ball until the center line is straight under the bit. This step is very important as it insures a pin point accuracy and ball spec to be duplicated no matter who is drilling them. Basically if you start from the same point each time you drill a ball and you hit the lines they will all feel exactly the same.
5. Set the forward or reverse pitch by using the table handle on the front of the machine. If you want reverse in the thumb or forward in the fingers the ball will need to move



away from you. If you want left lateral the ball will move to the right, if you want right lateral the ball will move left. As an indicator for right and left if you look at the ruled scale on the front of the machine left will be left of zero and right will be right of zero.

6. Place the bit in the chuck for the ring finger as that will be the first hole drilled. We start with the ring finger first as it is generally the smaller of the fingers and if you were to select the wrong bit it can be fixed with out needing to plug the ball. There are two preferred methods of drilling a ball. We recommend drilling fingers first for the following reasons. A Fingers first provides a safety net as if you miss a line while drilling the fingers you can compensate before drilling the thumb with compromising the accuracy. When drilling fingers first it allows you to drill grip holes and place the grips in the hole then pull a thumb span by using a span tool and making an arc from each hole with the finger grips in place. This means you only need to worry about the full span and not have to subtract the thickness of the grips from the span when marking the ball. This process allows for more accuracy and saves time in the drilling process.
7. Align the bit to the bridge line first. This can be done by rotating the chuck with your hand until the blade on the bit is left to right. Then loosen the to lateral lock knobs on the front of the jig and rotate the jig left to right until the edge of the bit is on the line. (Remember you can bring the bit close the ball and tighten the quill lock so that both hands are free) Tighten the lateral locks. Next turn the chuck by hand until the blade is front to back, then loosen the side locks and rotate the jig forward or back until the edge of the bit is on your line and tighten the outside lock knobs.
8. Drill the ring finger hole to the desired depth. We recommend 1 1/2" deep for finger tips weather using grips or not. This allows enough room for most grips to be installed with out the need for cutting them. It also will keep the amount of weight removed from the fingers close to the same as the thumb making it less likely to make an error in the balance of the ball.
9. Next change the bit the desired size for the middle finger.
10. Set the pitches for the middle finger
11. Align the bit to the lines by moving the jig
12. Drill the hole to the desired depth
13. Remove the drill bit and if using finger inserts place them in the ball. (Do not loosen the safety plate) Next using your span tool if you have already marked your thumb span on the ball take a moment to double check making sure your line is still correct. If



it is not you can change it at this point by making an arc from each finger using the proper span for each finger. By following this process you have check points that allow you to prevent a costly mistake.

14. Place the bit in the chuck needed for the thumb hole
15. Loosen the front lateral locks and align bit to your line left and right and tighten the locks. Next loosen the side locks and align the bit to your line by rotating the jig forward or back until the edge of the bit is on your line and tighten the locks

Section (2) Installing Slugs

There are many ways to install slugs into the ball, some are easier than others. The old way was to mark where the slug would go then drill the hole and then take the ball out of the jig to the bench and then glue the slug and drive in with a hammer, then cut the top off of the slug and remark the ball and put back in the jig. The following steps are the simplest procedure and you will find to be the most accurate.

1. Mark the ball as you normally would for the correct span (Remember that if using finger grips and you are drilling the thumb first you must subtract the thickness of the finger grip from the full span)
2. Place ball in machine—when ready to drill the thumb hole set your pitches then align the ball using the drill bit for the thumb size. At this point it is just to align the ball. When everything is aligned and you are ready to drill remove the thumb bit and replace it with the size for the slug you want to use. Next drill into the ball until the point of the bit is in the ball and stop. Take the slug you are going to use and hold it up to the rule indicator on the front of the machine. Doing this allows you to determine the proper depth so that you leave only 1/8th inch of material above the ball. Drill the hole to that depth.
3. Remove the bit and vacuum all dust and residue from the hole
4. Take your slug and try it in the hole to see if it is too tight. You should be able to slide it into the hole about 1/3 of the way. If the slug is too tight Loosen the outside locks and roll the ball forward towards you and lightly sand the hole being very careful not to bevel the top of the hole. When you have it correct loosen the outside locks and roll the ball back then place the slug bit back in the chuck and use the bit to realign the ball. When complete you can pull the bit back in the hole.



5. Place a small amount of glue in the hole about an inch below the surface then take the slug your are wanting to use and place at the top of the hole, set another slug on top of it and then pull the chuck down to the slugs. Next continue pulling the chuck down until the slug seats in the bottom of the hole. CAUTION IF THE HOLE IS TO TIGHT USING THIS PROCESS CAN CAUSE DAMAGE TO THE MACHINE—BE SURE TO FOLLOW STEP 4 ALSO IF YOU STOP BEFORE THE SLUG IS ALL THE WAY IN THE BALL IT WILL SET UP AND AGAIN TRYING TO FORCE IT IN WITH THE MACHINE WILL CAUSE DAMAGE AS WELL—Make sure once you start pulling the slug in that you continue with out stopping.
6. Next place the thumb size back in the chuck and drill thru the bottom of the slug—Remember you must drill thru the bottom of the hole for the ball to be legal.
7. If you are drilling an oval in the hole now follow those steps
8. After all drilling is complete we are ready to trim the remaining material. We will use the 3" trimming blade that came with the machine. CAUTION WHEN USING THIS TOLL DO NOT EVER REACH YOUR HANDS NEAR THE BLADE OR HAVE LOOSE CLOTHING AS IT COULD RESULT IN SERIOUS INJURY Place the trimming blade in the chuck
9. Take a yellow pencil and draw lines all of the way around the slug approximately 3" away from the slug all the way around. These are safety lines as when you get close to the ball the blade will actually scuff these lines before it cuts the ball. Following this step is important as you can damage a ball very severely if not using the tool properly.
10. Set both all pitches to zero and using the pivoting motion of the jig center the slug under the blade. Also double check to make sure that you are not to close to the top plate as the blade can damage that as well. In the event you are to close loosen the top plate and realign the ball this way then tighten the plate.
11. Start the machine and slowly bring the blade to the slug. Start your cut slow as the blade will only cut on part of the slug. Continue until you see he scuff lines on the ball and stop. If your machine has been calibrated properly the slug should trimmed flush with the ball.
12. Remove the ball and bevel the hole



Section (3) Trimming Ball Plug

Again for this job we will use the 3" trimming blade provided with the machine and follow the same safety procedures described above

1. Set all pitches on the machine to zero
2. Place the ball in the machine with plugged area directly under the drill chuck
3. Tighten the top plate
4. Using a yellow pencil draw lines around the plugged area
5. Turn machine on and slowly bring the blade to the ball—advance the blade slowly as it will only cut on part of the slug at first. Continue slowly until the blade had reached your yellow lines
6. Remove the ball from the jig and finish as you normally would

NOTE: Anytime you are using the trimming blade extreme care should be used. This tool is a great time saver but used improperly it can also damage a ball or cause injury.

Section (4) Oval Holes

Drilling an oval hole is an extra that you can provide for your customers. This gives the customer a special comfort and feel that many have never felt. If you have never drilled these before we suggest some practice before working with a customer. The following is the process when using the Mill Drill machine. There are a few things to remember when using ovals.

Section (4a) Measuring for Oval Holes

1. Drilling an oval does not change the pitch when done properly. The oval cuts are parallel to the hole that was drilled
2. If your cuts are to large you will leave crease lines from the bottom of the hole to the top that will need to be removed with a flat file. This just causes more work and time.



3. Keep records of each cut you make in the process on your drill sheet as you should be able to duplicate any cut you make at anytime on any ball
4. First oval customers may not like the feel as the purpose of the oval is get grip pressure on the pad of the thumb and fingers for better control and feel. So be sure you explain properly up front with first time customer
5. Done properly can keep customers coming back for many years
6. When drilling the first oval for a customer we recommend that they are there for the entire process as you can be more accurate, after the first one the Mill Drill machine will allow you to recreate or duplicate each step as long as you noted each move on your spec sheet. GOOD NOTES ARE EVERYTHING!!!

Section (4b) Determining the Proper Angle

There are many ways to determine the angle for an oval hole. The simplest however is by using a Pro Sect Lay out tool. This tool has a straight edge for drawing the center line but also has a protractor ring attached as part of the tool.

1. First mark the center line of the grip on the ball you are using. This will be a line that runs between the fingers and thru the thumb. It is best if this is an existing ball the customer is using Next place their fingers in the ball and slide the thumb into the first knuckle.
2. Take a yellow pencil and mark a line on the ball that follows the knuckle of the thumb. This is the true angle the oval should be cut on
3. Next take the Pro Sect and align the flat part with the line you made and slide it up to the center of the hole. When in this position look at the protractor and read the degree that is on the center line of the grip
4. Take this number and mark on your Drill Sheet

Section (4c) Determining the Width of the Hole

Again there are many ways in which this can be done and as you become more proficient in drilling ovals you may even find a new way. However the following is recommended for the Mill Drill machine as it has been proven to be the simplest method.



1. Using the calipers that were supplied with your Mill Drill machine measure the thickness of the thumb. Simply slide the calipers up and down over the knuckle. Once you have the setting that will gently slide up and down on the thumb mark that on your drill sheet as the thumb hole size.
2. Next using the calipers now slide them up and down the side of the thumb. When you have this measurement simply note it on the side of you drill sheet.
3. Subtract the thickness from the width and that is how much you need to add to the hole in width. NOTE this is the total that you need to cut not the number that you move the tables. When using movements of both X and Y it basically adds 1/3 to the cut. In other words if you wanted to make a cut at 45degrees and add 30 thousandths in width to the hole you would move X (which is Left or right) .021 and then you would move Y (which is forward and back) .021 Then when you run the bit back in the existing hole it will add .030 to the hole at 45 degrees
4. Another example would be if found the width you needed to add to the hole was .090 we know you are only going to move the tables .060 You could move X .060 and then Y .060 then bring the bit back into the hole and it will add .090 in width.

Section (5) Drilling Ovals

Now that you have your measurements you are ready to drill the hole. If you have used a slug the process will begin after the thumb size has been drilled but before the top of the slug is trimmed. You can make this cut with the excess slug there and it won't hurt a thing.

1. Drill the initial thumb hole with the proper pitches in place. Do not move the jig or the pitch tables before drilling the oval as it will compromise your accuracy.
2. Determine if the width can be cut in one cut or multiple cuts. Remember if you make to large of a cut it will leave crease lines in the front and back of the hole that will need to worked out by hand
3. 45 Degree cuts are simple as they require the same movements of X and Y In other words equal movements will create a 45 degree angle.
4. Make you table movement for X Remember that you can reset your digital to Decimals by pushing the mode button and it will count for you as you move the table. Also remember you always make your cuts to the back of the hole as cutting the front will compromise your span measurement. To check yourself simply pull the bit to the edge



5. Make your table movement for Y again double checking yourself by pulling the bit close to the ball making sure you're going to cut where you want.
6. When you're sure you have moved the right direction turn the machine on and slowly pull the bit into the hole. It's important to remember to go slow as you advance the bit. There is no cutting on the point of the bit so going faster than the blade will cut will result in bit drift. Don't rush this process
7. If this is only cut you need to make then follow the procedure for removing the top of the slug and remove the ball.
8. It may be helpful to have the customer actually there and slide their thumb in the ball if this is the first oval you have sized for them. Simply remove the bit from the chuck and leave the ball in the machine. If you need to cut more put the bit back in, make your x and y movements and make your next cut.
9. Remember to keep track of the movements for each cut on your drill sheet for future drillings. Also we have included a chart that will break down the movements for any angle you may need. This can be a very helpful tool as well. Fitting and drilling ovals may take some practice so work on your equipment some first to raise your comfort level.



OVAL DRILLING GUIDE

For drilling an oval at angle alpha back a distance Z you must move the table a distance X over and Y up.

OVAL ANGLE (ALPHA DEGREES)	OVAL WIDTH (Z) (THOUSANDS, 0.001")															
	15		30		45		60		75		90		105		120	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
20	14	5	28	10	42	15	56	21	70	26	85	31	99	36	113	41
25	13.5	6.5	27	13	40.5	19.5	54	25	67.5	31.5	82	38	95.5	44.5	109	51
30	13	7.5	26	15	39	22.5	52	30	65	37.5	78	45	91	52.5	104	64
35	12.5	8.5	25	17	37.5	25.5	49	34	61.5	42.5	74	52	86.5	60.5	98	69
40	11.5	9.5	23	19	34.5	28.5	46	39	57.5	48.5	69	58	80.5	67.5	92	77
45	10.5	10.5	21	21	31.5	31.5	42	42	52.5	52.5	64	64	74.5	74.5	85	85
50	9.5	11.5	19	23	28.5	34.5	39	46	48.5	57.5	58	69	67.5	80.5	77	92
55	8.5	12.5	17	25	25.5	37.5	34	49	42.5	61.5	52	74	60.5	86.5	69	98
60	7.5	13	15	26	22.5	39	30	52	37.5	65	45	78	52.5	91	64	104
65	6.5	13.5	13	27	19.5	40.5	25	54	31.5	67.5	38	82	44.5	95.5	51	109
70	5	14	10	28	15	42	21	56	26	70	31	85	36	99	41	113



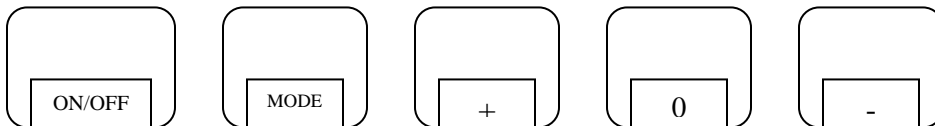
Digital Reader Program Instructions

Section (1a) Programming

Several functions of the digital display are user programmable. The following instructions describe what features are available and how to change the system's defaults to customize the display for a particular application.

The Keys pictured have multiple functions. Timing, which is how long a key, is depressed, and the combination of the keys pressed is important. This manual uses the term "*momentarily*" to describe a key press of typically less than 1 second. Whereas "*press and hold*" is used to imply a key press of typically longer than 1.5 seconds. As an example when using a PC keyboard to type a CAPITAL letter you would "*press and hold*" the SHIFT key and "*momentarily*" depress the appropriate letter key.

The "*function*" associated with the key(s) pressed is executed on the key RELEASE, not the key DEPRESS. This is important since some keys execute different functions based on how long they are depressed. These key operations, once tried, quickly become intuitive.



To enter programming mode, *press and hold* the MODE and then *momentarily* press the 0 (zero) key. The MODE key must be held for approximately 1 second before the depression of the 0 (zero) key.

Once you are in the Programming Mode, *momentarily* pressing the MODE key will advance through the Programming Parameter list.

To step backwards in the Programming Parameter list *press and hold* the ON/OFF key and *momentarily* press the MODE key.

Momentarily pressing the + (plus) key while displaying a Programming Parameter will increase the parameter setting.

Momentarily pressing the - (minus) key while displaying a Programming Parameter will decrease the parameter setting.

Momentarily pressing the 0 (zero) key while displaying a Programming Parameter will revert the parameter to its factory default setting.



CAUTION: The Limit Mode (See Programming 14, 15, 16, 17) functionality is still active even while the display is in programming mode. Changing LIMITS may result in the Limit/Monitor Signal hardware output becoming active immediately.

To exit programming mode, *press and hold* the MODE key and then *momentarily* press the 0 (zero) key.

The Display will automatically exit programming mode after 60 seconds of no key activity.

Programming Parameters are listed below. Values in [] are the available range of values that can be programmed for that entry. Factory defaults are shown in bold.

Pr0 – Encoder Direction [0, 1]

Change value to reverse the direction of measurement readings.

Pr1 – Enable/Disable Segment Offset [0, 1]

0 = For ABSOLUTE scales shorter than 430mm, (16.9in). ALL Incremental scales.

1 = for all ABSOLUTE scales longer than 430mm, (16.9in).

Pr2 – High Speed Read Head [0, 1]

0 = Normal Read Head.

1 = High Speed Read Head.

Use this setting *only* if instructed by special instructions included with High Speed Read heads. A setting of 1 will impact battery life.

Pr3 – Enable/Disable the +, - and ZERO keys [0, 1]

0 = Disables operation of Zero, + and – keys (Display will be in Lock Mode.)

1 = Enables operation of Zero, + and – keys.

Pr4 – Display Resolution [0, 1 or 2]

Sets the display resolution in *decimal* mode. (No change in fractions Mode.)

0 = Reduced resolution Inch = xxx.xx MM = xx.x

1 = Normal resolution Inch = xxx.xxx MM = xx.xx

2 = Increased resolution Inch = xx.xxxx MM = xx.xx (Inch mode only)

Auto scaling will allow measurements of over 100 inches when in High resolution.

Measurements over 100 inches will automatically be reduced to 3 Decimal places.



Pr5 – Metric Display Units [0, 1]

Controls whether the measured value is displayed in millimeters or Centimeters when in metric mode.

0 = millimeters

1 = centimeters

Pr6 – Disable Fractions/Inches [0, 1, 2]

0 = All measurements modes (millimeters or centimeters, inches and fractions)

1 = No Fractions. Only decimal inches and metric units* will be displayed.

2 = Only Metric. No Imperial (decimal inches or fractions) will be displayed.

** Pr5 will determine if mm or cm are displayed for metric units.*

Pr7 – Scaling Factor [.001 .. 99.999] Default = 1.000 (No Scaling.)

The multiplier applied to the measurement. Scaling factors less than 1.000 will make the displayed measurement less than that of the actual measurement. Scaling factors greater than 1.000 will make the displayed measurement greater than that of the actual measurement.

Pr8 – Automatic Power Off [0 to 60] Default = 15

Sets the amount of time in “minutes without activity” before the Display automatically turns off.

0 = Disables Auto Off.

Encoder motion or ON/OFF key “wakes up” the display and resets the Timer.

Pr9 – Auxiliary Keys Enable/Disable [0, 7]

0 = ABS/INC, MON and HOLD Disabled

1 = ABS/INC Key Enabled

2 = MON Key Enabled

4 = HOLD Key Enabled

7 = All Keys Enabled

To enable keys, add up combination of key values. A value of 2 Enables only the MON key. A value of 7 enables all 3 keys.

Pr10 – Offset Addition Enable [0, 1]

0 = Offset Addition Disabled

1 = Offset Addition Enabled

SEE ALSO Pr11, Pr12, Pr13



Pr11 – Offset Addition 1 [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

When offset 1 is selected (see section 4 – Offset Addition), this value is added to the current ABS position. Default: 2.000IN

Only active if Pr10 is set to 1. Note: Default is set in inches

Pr12 – Offset Addition 2 [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

When offset 2 is selected (see section 4 – *Offset Addition*), this value is added to the current ABS position. Default: 1.500IN

Only active if Pr 10 is set to 1. Note: Default is set in inches

Pr13 – Offset Addition 3 [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

When offset 3 is selected (see section 4 – *Offset Addition*), this value is added to the current ABS position and displayed. Default: 1.500IN

Only active if Pr 10 is set to 1. Note: Default is set in inches

Pr14 – Output Signal Mode [0, 1]

Configures the hardware output signal for activation on MONitor drift Conditions or Upper/Lower limit alarm conditions. (24VDC displays only)

0 = Monitor Drift,

1 = Limit Alarm

SEE ALSO Pr15, Pr16, Pr17

Pr15 – Output Polarity [0, 1]

Used to configure the signal output. N/O or N/C in relation to circuit ground.

0 = N/O, the output is Normally Open (not conducting to ground).

1 = N/C, the output is Normally Closed (conducting to ground).

Pr16 – Lower Limit [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

Sets the lower limit alarm value. Default = 0.000IN.

Active only when parameter Pr14 = 1. Note: Default is set in inches

Pr17 – Upper Limit [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

Sets the upper limit alarm value. Default = 5.000IN.

Active only when parameter Pr14 = 1. Note: Default is set in inches



Pr18 – Drift Tolerance [.01 to 9999.99mm] or [.001 to 999.999in].

Range of motion allowed (+ or -) while in Monitor mode.

Default = .01IN. Note: Default is set in Inches

Pr19 – Automatic Monitor ON Time [0, 1 or 2]

Configures display to automatically activate Monitor mode after 30 or 60 seconds of encoder inactivity.

0 = disabled. 1 = 30 seconds. 2 = 60 seconds.

Pr20 – Automatic Monitor OFF Enable [0, 1]

Configures display to automatically exit Monitor mode after a Programmed distance (Pr21) has been exceeded from the drift Tolerance position (Pr18).

0 = disabled. 1 = enabled.

Pr21 – Automatic Monitor OFF Distance [0.001 to 999.999in] or [0.01 to 9999.99mm].

The distance that must be exceeded from the drift tolerance Position (Pr18) to activate auto monitor off. Default = 0.500in

This parameter is relevant only when Pr20=1. Note: Default set in Inches

Pr22 – Backlight ON time [0, 1, 2, 3 or 4]

The ON time of the LCD backlighting (24VDC displays only).

0 = always off. 1 = 3 seconds. 2 = 7 seconds. 3 = 15 seconds.

4 = always on.

Backlighting is activated when a key is pressed.

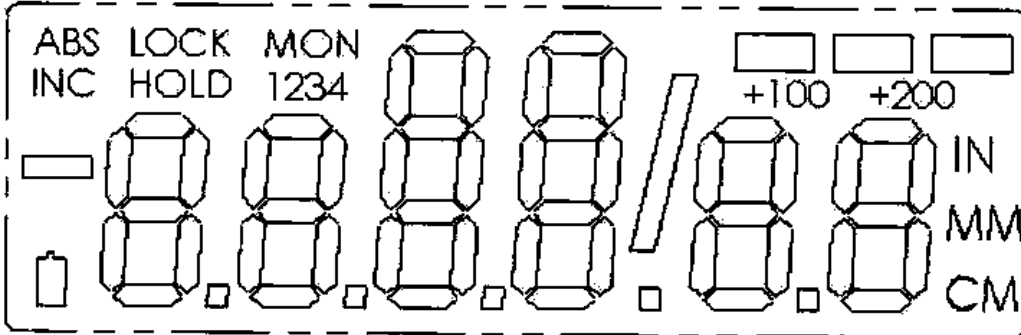
Pr23 – Future Enhancement DO NOT CHANGE [0, 1, 2] Default=1

Pr24 – Future Enhancement DO NOT CHANGE [0...63] Default=0

Pr25 – Future Enhancement DO NOT CHANGE [0...31] Default=0

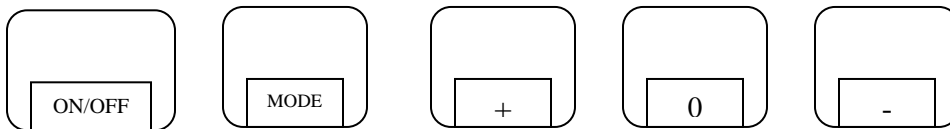
CAUTION: Pressing and holding the ON/OFF and MODE key for 10 seconds while the display is turned off will perform a full segment LCD test AND re-set all programming parameters to factory defaults

Section (1b) LCD



The above figure illustrates all the segments available on the Digital Display.

Section (1c) Display Keys



Section (1d) ON/OFF

Momentarily pressing the ON/OFF key will cause the display to turn on or off. The Firmware Version is displayed on power-up or when ON/OFF key is pressed. While on, if no key presses or positional changes occur within 15 minutes, the Digital Display will automatically turn itself off to conserve battery life. While off, if a position change is detected (.05mm or .002in) or the ON/OFF button is pressed, the display will automatically turn itself on with no loss of measurement information.

(Programming Parameter Pr8. Factory default set to 15 minutes.)

Battery voltage is displayed by pressing and holding the ON/OFF key for 5 seconds while display is turned off.

Section (1e) Mode



The digital display can show measurement information in imperial or metric. To change the current display mode, momentarily press the MODE key. With each key press the display will cycle through decimal inches, fractional inches (1/16), (1/32), (1/64) (If enabled by Programming Parameter Pr6) and metric (mm or cm based on setting of Programming Parameter Pr5).

When the display is in a decimal mode (mm, cm or in) it will auto-range to the next resolution if the value is displayable in the next range. This allows the display to be used with Mitutoyo Digimatic products in inch mode or different resolutions other than 2 decimal places.

When the display is in 1/16 or 1/32-inch fraction mode, a series of "bars" in the upper right corner of the LCD each represent an additional 1/64th of an inch measurement. I.e. When in 1/16 inch mode and three bars are showing, the measurement displayed is rounded *down* to closest 1/16 inch and each illuminated bar indicates an additional 1/64 of an inch ("heavy") measurement. For better resolution switch to 1/32 or 1/64 fraction mode. For the best resolution switch to a decimal mode.

When the measurement is greater than $\pm 99 \frac{63}{64}$ inches, a +100 or +200 will show on the upper right portion of the LCD to indicate this amount must be added to the displayed reading. I.e. If the measurement is $154 \frac{5}{8}$ inches, $54 \frac{5}{8}$ and +100 will be displayed on the LCD. If the measurement is $-307 \frac{23}{64}$ inches $-7 \frac{23}{64}$, +100 and +200 will be displayed on the LCD.

The Resolution of the display can be set for Normal; (.01mm or .001in), Reduced; (.1mm or .01in) or Increased; (.01mm or .0005in) (Programming Parameter Pr4.)

+, 0, and – Keys

Section (1f) Lock Mode

The user can "lock-out" the position offset adjustment functions (+, -, 0 keys) to prevent accidental changes of the current displayed position. To activate the lock, press and hold the ON/OFF and then momentarily press the MODE key. The word LOCK on the LCD display will turn on or off with each lock/unlock operation. When the LOCK symbol is displayed, the +, - and 0 keys will not change the displayed position. On Displays with an auxiliary keypad: ABS and INC modes have independent lock operations.

(See Programming Parameter Pr3. Factory default is enabled.)

Section (1g) Segment Offset Adjustments

For scales that are longer than 430mm (17 inches), multiple scale pattern segments are installed end-to-end on the aluminum extrusion. This provides a quasi-absolute measurement



capability in which the read head can calculate its position on any individual scale segment but cannot determine which particular segment it is on. To solve this problem, the Digital Display track which scale segment the read head is on by detecting the "splice" between one segment and adjacent segments.

In certain situations, the crossing from one segment to another may not be detected by the display. This may occur if the read head is disconnected from the digital display and then moved along the scale to another segment. It may also occur if the read head is moved too quickly between two segments. (Maximum slew rate us 400mm/sec, 15in/sec)

If the segment tracking count is incorrect because of one of the above situations, the user can re-adjust the display to correct the error. This adjustment is referred to as the *Segment Offset Adjustment*.

To add one segment value (430.08mm) to the displayed value, hold the MODE key and then momentarily press the + key. The displayed position will increase by 430.08mm (16.933 inches). To subtract one encoder segment from the displayed value, press and hold the MODE key and then momentarily press the – key. The displayed position will decrease by 430.08mm.

(See Programming Parameter Pr1 and SCALES in Section 1 of this manual for additional information. Factory Default is set to enable this function.)

Section (1h) Offset Addition

Offset addition allows the user to preset up to 3 different distances that are then added to the Digital Displays position when selected. This allows the user to quickly switch measurement modes from one reference point to another such as in the case of inside and outside measurements on ProPanel or multiple stations on a vertical panel saw. To utilize the offset addition feature, programming parameter Pr10 must be set to 1. The display will then flash one of "offset" numerals 1, 2, 3 or 4 located in the upper left corner of the LCD. Offset 1 is the ABS position with no offset addition. Offset 2 is the ABS position with parameter Pr11 (Offset addition 1) added to it. Offsets 3 and 4 have similar functions with parameters Pr12 and Pr13 added to the ABS position respectively. To move from "Offset" 1 to 2, momentarily press the F1 key. Each depression of the F1 key will advance to the next offset. After offset 4, the display will move back to offset 1.

(See Programming Parameters 9, 10, 11, 12 and 13)

Section (1i) Limit Mode

The digital display will show either "LL" for Low Limit or "UL" for Upper Limit if a pre-programmed upper or lower reading is encountered. Upper and Lower limits are set with



programming parameters Pr16 and Pr17 but are only active if Pr14 is set to 1. Display toggles between current position display and "LL" or "UL". The position is shown for 2 seconds and the "LL" or "UL" is shown for 2 seconds. This continues as long as a limit has been exceeded. Limit monitoring is always active, even in programming mode.

Numerous Programming parameters, including Offset Addition and Limit mode indicate a "factory default set in inches". The equivalent offset/limit value in mm or cm is applied if you switch the MODE of display to mm or cm. i.e. these parameter values take on the unit measurement MODE (mm, cm or inches) active when programming is entered.

Section (1j) Scaling

All general purpose digital displays have the ability to "scale" the actual measurement. This function is useful when the actual measurement must be multiplied or divided before being displayed. Care should be taken when using this function since invoking it will cause the unit to display a reading different than the actual measured or traversed value. This function is set using Programming Parameter Pr7. The factory default is set to 1.000 – No Scaling

Section (1k) Changing Batteries

A low battery indicator will appear in the lower left corner of the LCD display when new batteries are needed.

Surface Mount Displays: remove the screws in the upper right and lower left corners. Pull cover off. Remove the old batteries. Reinstall new AA Alkaline batteries, noting the proper orientation. Replace the cover and tighten the screws.

CAUTION: DO NOT BEND BATTERY CLIPS!

THESE CLIPS ARE DESIGNED TO BE LOOSE WHEN THE CASE IS OPEN AND WILL COMPRESS AND SECURE THE BATTERIES IN PLACE WHEN THE CASES ARE SCREWED TOGETHER.



Supplemental

Installing Pivoting Jig on existing Mill Drill:

The Mill Drill jig was designed not only to be used as a new complete unit but also it can be used as an upgrade to most any existing milling machine. Because of its low profile it can be added to most any milling machine with very few modifications. We found that in some cases it is necessary to change the drill bit hold arm and the arm for the control box. If you need these items they have been included with your new jig. If you do not need these simply discard them? Below we have listed the sequence for changing the jig.

1. Remove the old jig from the milling machine—saving the t-nuts.
2. Place your new Mill Drill jig on the mill table and align the t-nuts with the mounting holes in the new jig.
3. Start the round head allen screws thru the jig plate and into the t-nuts.
4. Align the jig with the center of the mill table and even with sides and tighten the 4 allen screws.
5. If needed change the support arms for the drill bit plate and the control box. If your machine does not have a control box that can be remounted Ebonite does have one you can purchase. This will also work for those machines that had no control box at all.
6. Loosen the lug bolts on the right hand side of the machine, as you will need to raise the head of the machine. If your machine has the black cap that covers the top of the post you will need to remove this also. To check the height you have to place a bit in the chuck of your machine and you should be able to remove the bit with out taking the ball from the jig. Tip of the bit should be $\frac{3}{4}$ to 1" above the surface of the ball. Once you have this set center the head and tighten the lug bolts.
7. Calibrate the machine as described earlier.
8. You should be ready to drill—follow drilling instructions as listed above.



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