**Main menu:**

* Calibrate
* Grind Capillary
* Face Capillary
* Face Chip

**Calibrate:**

* Manual movement
  + Jog up/down
    - 1 micron
    - 10 micron
    - 100 micron
    - 1000 micron
* Zero: user gets capillary somewhat close to plate manually
  + - Software travels down at 10 micron per second until sound signal digital output of “1” is received.
      * Stops
      * Moves up 10 microns
      * Lowers at 1 micron a second until sound signal “1” is sent.
        + Stops

**Grind Capillary**

* Set parameters
  + Inner diameter - resolution of 0.1 micron
    - ID = “user entry”
  + Outer diameter - resolution of 0.1 micron
    - OD = “User entry”
  + Angle degrees
    - Angle = “user entry”
    - //angle of capillary to grinding plate
  + Face width
    - FaceWidth = “user entry”
    - // width of face at pointed circular face at sharpened capillary end
* Grind is initiated
  + Did you calibrate/zero grinder?
    - Yes/no
      * Yes - begin grind
      * No - begin grind but run Zero code from above first
  + Grind?
    - Yes/no
      * No - exit to main menu
    - Yes
      * Calculate GrindDepthRemaining
        + double AngleRad = Angle \* M\_PI / 180;
        + int R = (OD - ID) / 2;
        + GrindDepthRemaining = R \* cos(AngleRad) - FaceWidth;
      * Turn on capillary motor
      * Wait GrindDelayTime (default value is 20 seconds)
      * If (GrindDepthRemaining/GrindStepDistance > 1)
        + StepDistance = GrindStepDistance
        + //(default value is 10 microns)
        + Move down StepDistance
        + At GrindSpeed rate
        + //(default is 100 microns/second)
        + GrindDepthRemaining = GrindDepthRemaining - StepDistance
        + Wait GrindDelayTime
      * Else if (GrindDepthRemaining/GrindStepDistance < 1)
        + StepDistance = GrindDepthRemaining
        + Move down StepDistance
        + At GrindSpeed rate
        + //(default is 100 microns/second)
        + GrindDepthRemaining = GrindDepthRemaining - StepDistance
        + Wait GrindDelayTime
        + Move up 20,000 microns At TravelSpeed

//default value is 2500 microns/second

* + - * + Give Grind complete message

OK

Return to main menu

* + - * Else
        + Printscreen = “error grind distance”

**Face Capillary**

* Set Parameters:
  + Amount to face off?
    - FaceDepthRemaining = “user entry”
  + //in microns
  + Capillary motor on or off?
    - If yes
      * CapillaryRun = True
    - If no
      * CapillaryRun = False
* Grind
  + Did you calibrate/zero grinder?
    - Yes/no
      * Yes - continue
      * No - continue but run Zero code from above first
  + Grind?
    - Yes/no
      * No - exit to main menu
    - Yes
      * If CapillaryRun = True
        + Turn on Capillary motor
      * Wait FaceDelayTime
      * //default value is 60 seconds
      * If (FaceDepthRemaining/FaceStepDistance > 1)
        + StepDistance = FaceStepDistance
        + //(default value is 1 microns)
        + Move down StepDistance
        + At FaceSpeed rate
        + //(default is 1 microns/second)
        + FaceDepthRemaining = FaceDepthRemaining - StepDistance
        + Wait FaceDelayTime
      * Else if (FaceDepthRemaining/FaceStepDistance < 1)
        + StepDistance = FaceDepthRemaining
        + Move down StepDistance
        + At FaceSpeed rate
        + //(default is 1 microns/second)
        + FaceDepthRemaining = FaceDepthRemaining - StepDistance
        + Wait GrindDelayTime
        + Move up 20,000 microns At TravelSpeed

//default value is 2500 microns/second

* + - * + Give Grind complete message

OK

Return to main menu

* + - * Else
        + Printscreen = “error face distance”

**Face Chip:**

* Set Parameters:
  + SmallestWidth
  + //resolution 0.1 microns
  + //width at the face of the chip
  + LargestWidth
  + //width at the end of the chip taper
  + //resolution 0.1 microns
  + TaperAngle
  + //resolution 0.1 degrees
  + //angle of taper on chip
  + TaperHeight
  + //resolution 0.1 microns
  + //Height perpendicular to the chip face from the beginning of taper to the end
  + FlatChannelDepth
  + //Depth of face channel along which there is not taper
  + //resolution 1 micron
* Amount to face off?
  + FaceDepthRemaining = “user entry”
  + //resolution of up to 0.1 microns
  + //values range 0 - 500 micron
* Desired Final Channel Width
  + Requested = “user entry”
    - If (Requested > LargestWidth)
      * Too large
        + Ok
      * Return to Desired Final Channel Width question
    - Else if (Requested < SmallestWidth)
      * Too small
        + Ok
      * Return to Desired Final Channel Width
    - Else
      * Adjacent = Requested - SmallestWidth
      * FaceDepthRemaining = Adjacent\*(tan(TaperAngle))
  + If (FaceDepthRemaining > TaperHeight)
    - Printscreen = “Error in Height Calculation”
  + Did you calibrate/zero grinder?
    - Yes/no
      * Yes - continue
      * No - continue but run Zero code from above first
  + Begin Facing?
    - Yes/no
      * No
        + Return to main menu
      * Yes
        + Wait ChipDelayTime
        + //Default is 30 seconds
        + Move down FlatChannelDepth
        + Wait ChipDelayTime
        + If (ChipDepthRemaining/ChipStepDistance > 1)

StepDistance = ChipStepDistance

//(default value is 5 microns)

Move down StepDistance

At ChipSpeed rate

//(default is 1 microns/second)

ChipDepthRemaining = ChipDepthRemaining - StepDistance

Wait ChipDelayTime

* + - * + Else if (ChipDepthRemaining/ChipStepDistance < 1)

StepDistance = ChipDepthRemaining

Move down StepDistance

At ChipSpeed rate

//(default is 1 microns/second)

ChipDepthRemaining = ChipDepthRemaining - StepDistance

Wait ChipDelayTime

Move up 20,000 microns At TravelSpeed

//default value is 2500 microns/second

Give Grind complete message

OK

Return to main menu

* + - * + Else

Printscreen = “error chip distance”