TRAK® Lathes
Safety, Programming, Operating and Care Manual

Document:	P/N 29540
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Covers Current Models:
- **1630RX**
- **1630HS-RX**
- **1845RX**
- **2470RX**
- **3060RX**
- **30120RX**

TRAK MACHINE TOOLS

SOUTHWESTERN INDUSTRIES, INC.

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TRAK Machine Tools
Southwestern Industries, Inc.
TRAK Lathes ProtoTRAK RLX CNC Safety, Programming, Operating and Care Manual

1.0 Introduction

We are delighted to offer you the ProtoTRAK RLX, the most advanced control ever made for toolroom and small production turning. The ProtoTRAK RLX represents our decades of deep involvement in the world of making parts in small quantities. It transforms the best of technology into the ultimate tool for the people who make things on the shop floor.

The **Touch Screen** Interface enables you to interact with your programs and set ups with more certainty and control than ever before.

Defaults allow you to customize the ProtoTRAK RLX for how *you* make parts; they are easy to set and easy to change.

The **large LCD screen** and **fly out windows** allow you work with everything you need at the same time without flipping between screens.

Enhanced ProtoTRAK Assistance (EPA) is always available for you to quickly look up the information you need for what you are doing at the time.

Manual machining is always available and made easier with features like power feed, rapid positioning, tool offsets and all the best features of sophisticated DRO's.

Small lot production is programmed and run with unprecedented flexibility. Programs may be entered at the control or imported from CAD/CAM files. Advanced color graphics show program features. TRAK CNC Turret interface is easy to set up and easy to program.

With a little practice, you will find that the ProtoTRAK RLX is the easiest to use, most powerful ProtoTRAK ever…and that is saying a lot!

1.1 Using This Manual

This manual provides enough information for most users in most situations. If you ever need more information or clarification, we want to help.

- Call us at 800-421-6875, ask for Applications

- Visit our website http://www.trakmt.com

- Talk to your local ProtoTRAK representative

Section 2 Safety provides important safety information. We **highly** recommend that all operators of this product review this safety information.

Section 3 Description provides a description of the TRAK TRL Lathes and the ProtoTRAK RLX CNC. Machine Control Options are described in this section.

Section 4 Operation describes the operation of the lathes and some basic operations of the ProtoTRAK RLX CNC.

Section 5 Definitions, Terms and Concepts defines some terms and concepts useful in learning to program and operate the ProtoTRAK RLX CNC.

Section 6 Information Keys describes the innovative Information Keys including Defaults, Options and EPA (Enhanced ProtoTRAK Assistance). ** All New Information **

Section 7 DRO Mode describes the powerful capabilities in DRO mode that will make your manual work more productive than ever.

Section 8 Programming, Part 1: Getting Started and Some General Information covers some general programming information and Instructions on starting new programs.

Section 9 Programming, Part 2: Program Events – with instructions for the canned cycles, or events, used to program the ProtoTRAK RLX CNC.

Section 10 Edit Mode gives instructions for making global changes to current programs including the powerful Spreadsheet Editing.

Section 11 Set Up Mode has information about setting Reference Positions, viewing Tool Path and other routines to get the program ready to run.

Section 12 Run Mode gives instructions on running the program.

Section 13 Program In/Out has information about storing and retrieving files and the convenient new Temp File feature.

2.0   Safety Specifications & Lubrication

The safe operation of the TRAK TRL 1630RX, 1845RX, 2470RX, 3060RX and 30120RX ProtoTRAK CNC depends on its proper use and the precautions taken by each operator.

- Read and study this manual. Be certain every operator understands the operation and safety requirements of this machine *before* its use.

- Always wear safety glasses and safety shoes.

- Always stop the spindle and check to ensure the CNC control is in the stop mode before changing or adjusting the tool or workpiece.

- Never wear gloves, rings, watches, long sleeves, neckties, jewelry, or other loose items when operating or around the machine.

- Use adequate point of operation safeguarding. It is the responsibility of the employer to provide and ensure point of operation safeguarding per ANSI B11.6-2001.

2.1   Safety Publications

Refer to and study the following publications for assistance in enhancing the safe use of this machine:

Safety Requirements for The Construction, Care And Use of Lathes (ANSI B11.6-2001). Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

Concepts and Techniques Of Machine Safeguarding (OSHA Publication Number 3067). Available from The Publication Office - O.S.H.A., U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 20210.

All other regulations specific to the State in which the machine is installed.

2.2   Danger, Warning, Caution, and Note Labels and Notices As Used In This Manual

DANGER - Immediate hazards that **will** result in severe personal injury or death. Danger labels on the machine are red in color.

WARNING - Hazards or unsafe practices that *could* result in severe personal injury and/or damage to the equipment. Warning labels on the machine are orange in color.

CAUTION - Hazards or unsafe practices that *could* result in minor personal injury or equipment/product damage. Caution labels on the machine are yellow in color.

NOTE - Call attention to specific issues requiring special attention or understanding.

208 Volts

⚠ WARNING

Do not operate this spindle at a higher RPM than rated by the chuck manufacturer.

Set the maximum RPM limit in the ProtoTRAK SET-UP mode.

Take special precautions with chucks that have four or more jaws and unbalanced parts.

Do not shift headstock gears while spindle or motor is running.

i01162
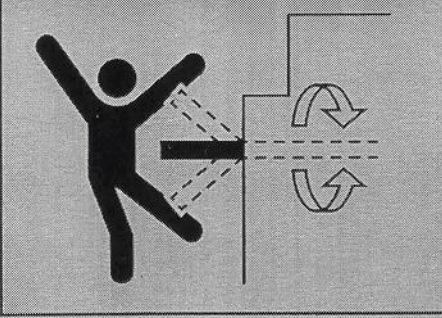
WARNING

- IMPROPER OPERATION OR IMPROPER MAINTENANCE OF THIS MACHINE MAY CAUSE SERIOUS BODILY INJURY.
- DO NOT OPERATE THIS MACHINE UNTIL YOU HAVE RECEIVED OPERATING AND SAFETY INSTRUCTIONS FROM YOUR EMPLOYER.
- FOLLOW ALL SAFETY PRACTICES PRESCRIBED BY YOUR EMPLOYER AND OUTLINED IN THE PROGRAMMING, OPERATING AND CARE MANUAL.
- ALWAYS AVOID UNSAFE OPERATING CONDITIONS SUCH AS EXCESSIVE FEEDS AND SPEEDS.
- ALWAYS BE SURE ALL SAFETY DEVICES ARE IN GOOD OPERATING CONDITION (SEE MANUAL).
- ALWAYS BE CERTAIN THAT SERVICE IS PERFORMED ONLY BY QUALIFIED PERSONNEL.
- IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PROVIDE AND ENSURE POINT OF SAFEGUARDING PER ANSI B11.6-1984 (R1994) & ANSI B11.8-1983 (R1994).
- THE MANUFACTURER IS NOT LIABLE (RESPONSIBLE) FOR ANY DAMAGE OR INJURY OF ANY KIND TO PERSONS OR PROPERTY CAUSED BY OR RESULTING FROM THE IMPROPER OR UNAUTHORIZED USE, OPERATION, MAINTENANCE, ALTERATION, MODIFICATION, CHANGE IN CONFIGURATION OF THIS MACHINE OR ANY OF ITS COMPONENTS, PARTS, OR THE USE OF THIS UNIT WITH ANY THIRD PARTY ACCESSORIES OR PARTS.

DO NOT REMOVE THIS SIGN FROM MACHINE.

i00923

⚠ WARNING

DO NOT EXTEND MATERIAL BEYOND THE SPINDLE WITHOUT SUITABLE GUARDING.

23863

i01161

⚠ CAUTION

Crush hazard.
Keep hands clear.

S-S2230

⚠ WARNING

Bars may only protrude
beyond this point if adequate
additional guarding and
support is provided.

S-S2140

S-S1111

⚠ CAUTION

Please remove
the transit
bolts before
powering up
the machine.

S-S3110

⚠ WARNING

Do not put your hands close
to the center to avoid injury.

S-S2030

⚠ CAUTION

1. Air pressure must be
   between 6 - 7kgf/cm²
   (85psi-100psi).

2. Filter and Lubricator
   must be maintained
   once a week.

3. Recommended Air line
   – 12mm (1/2 inch).

S-S2050

Eye protection
must be worn

Read and understand
operator's manual
and all other safety
instructions before
using this machine.

Do not touch moving
chuck or parts.

Crush hazard.
Keep hands clear when
opening / closing door.

LOCKOUT
FOR
SAFETY

Do not operate with
any guard removed.
Lockout / tagout
before servicing.

⚠ WARNING

Never open door during operation.
Do not operate with door open / removed.
Flying objects can cause injury or death.

1. Do not tamper with any safety devices.
2. This equipment should only be operated
   by qualified personnel that have been
   trained in the operation and use of this
   equipment.
3. Do not operate with any guard removed.
   Lockout / tagout before servicing.

FAILURE TO OBSERVE THESE
INSTRUCTIONS MAY CAUSE SERIOUS
PERSONAL INJURY OR MACHINE DAMAGE.

S-S2340

TRAK MACHINE TOOLS

SOUTHWESTERN INDUSTRIES, INC.

2615 HOMESTEAD PLACE,
RANCHO DOMINGUEZ, CA 90220

MODEL

S/N

THIS UNIT HAS _____ POWER SOURCE(S)
ELECTRICAL RATINGS:

VOLTS ____ AMPS ⎡ 3 ⎤ PHASE
⎡ 60 ⎤ Hz

VOLTS ____ AMPS ⎡ 1 ⎤ PHASE
⎡ 60 ⎤ Hz

FLA OF LARGEST MOTOR ____ AMPS

SHORT CIRCUIT CURRENT RATING ____ AMPS

ELECTRICAL DRAWING #:

MACHINE (ONLY) MADE IN TAIWAN
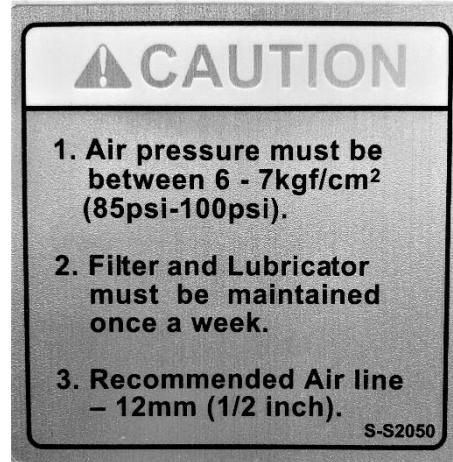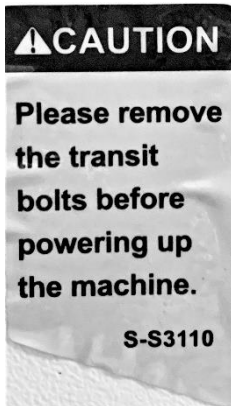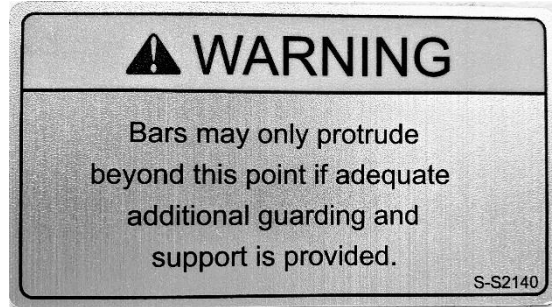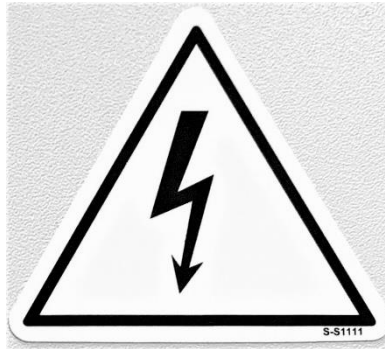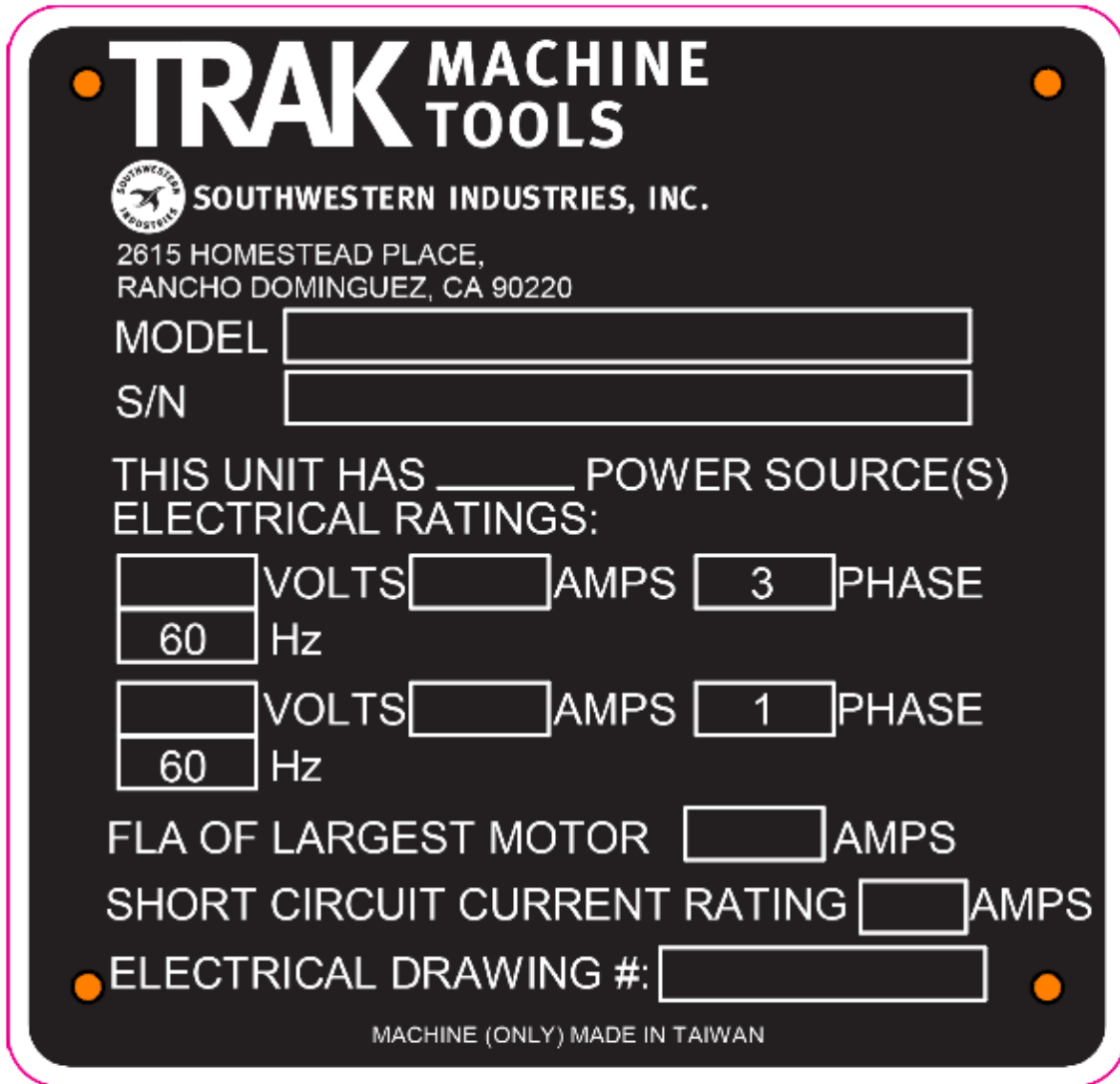
Safety & Information Labels Used On The TRAK TRL 1630RX, 1845RX, 2470RX, 3060RX & 30120RX Lathe

It is forbidden by OSHA regulations and by law to deface, destroy or remove any of these labels

2.3   Safety Precautions

WARNING!
Use only chucks which are rated to the maximum RPM of the lathe

1. Do not operate this machine before the TRAK TRL 1630RX, 1845RX, 2470RX, 3060RX, 30120RX and ProtoTRAK VL CNC Programming, Operating and Care Manual have been studied and understood.

2. Do not run this machine without knowing the function of every control key, button, knob, or handle. Ask your supervisor or a qualified instructor for help when needed.

3. Protect your eyes. Wear approved safety glasses (with side shields) at all times.

4. Don't get caught in moving parts. Before operating this machine, remove all jewelry, including watches and rings, neckties, and any loose-fitting clothing.

5. Keep your hair away from moving parts. Wear adequate safety head gear.

6. Protect your feet. Wear safety shoes with oil-resistant, anti-skid soles, and steel toes.

7. Take off gloves before you start the machine. Gloves are easily caught in moving parts.

8. Remove all tools (wrenches, chuck keys, etc.) from the machine before you start. Loose items can become dangerous flying projectiles.

9. Never operate any machine tool after consuming alcoholic beverages, or taking strong medications, or while using non-prescription drugs.

10. Protect your hands. Stop the machine spindle and ensure that the CNC control is in the STOP mode:

    - Before changing tools
    - Before changing parts
    - Before you clear away the chips, oil or coolant. Always use a chip scraper or brush
    - Before you make an adjustment to the part, chuck, coolant nozzle or take measurements
    - Before you open safeguards (protective shields, etc.). Never reach for the part, tool, or fixture around a safeguard.

11. Protect your eyes and the machine as well. Don't use a compressed air hose to remove the chips or clean the machine (oil, coolant, etc.).

12. Stop and disconnect the power to the machine before you change belts, pulley, gears, etc.

13. Keep work area well lighted. Ask for additional light if needed.

14. Do not lean on the machine while it is running.

15. Prevent slippage. Keep the work area dry and clean. Remove the chips, oil, coolant and obstacles of any kind around the machine.

16. Avoid getting pinched in places where the spindle, carriage, cross slide or sliding door create "pinch points" while in motion.

17. Securely clamp and properly locate the workpiece in the chuck or in the fixture. Use proper tool holding equipment.

18. Use correct cutting parameters (speed, feed, and depth of cut) in order to prevent tool breakage.

19. Use proper cutting tools for the job.

20. Prevent damage to the workpiece or the cutting tool. Never start the machine (including the rotation of the spindle) if the tool is in contact with the part.

21. Don't use dull or damaged cutting tools. They break easily and may become airborne. Inspect the sharpness of the edges, and the integrity of cutting tools and their holders.

22. Large overhangs on cutting tools when not required result in accidents and damaged parts.

23. Prevent fires. When machining certain materials (magnesium, etc.) the chips and dust are highly flammable. Obtain special instruction from your supervisor before machining these materials.

24. Prevent fires. Keep flammable materials and fluids away from the machine and hot, flying chips.

25. Never change gears when the spindle is rotating.

26. Do not rotate the spindle by hand unless the Red Emergency Stop button is pressed.

27. Guard against stock whipping hazard. A rotating workpiece extending beyond the normal extremities of the headstock is a hazard. Either avoid this practice or equip the lathe with a guard such as a stock tube.

3.0 Description

3.1 ProtoTRAK RLX Control Specifications

The ProtoTRAK RLX CNC provides you with an extraordinary combination of power and ease of use. Programming and operations are kept simple and at any moment you may select Help Screens or make changes to the programming defaults using the Info Keys.

3.1.1 System Specifications

Pendant Control Hardware
- Two-axis CNC, two-axis DRO
- Electronic Handwheels for manual operation
- 15.6" Touchscreen LCD
- Intel® 2.0 GHz processor
- 4 GB Ram
- At least 32 GB of mSATA SSD
- 5 USB connectors
- 2 Ethernet Ports (1 for user and 1 for motion control)
- Override of program Feedrate
- Override of spindle speed
- LED status lights built into run panel
- E-stop
- Spindle Control (FWD, REV, OFF)
- Feed STOP and GO
- Fine vs Course EHW resolution control
- Accessory button to control coolant or air and AUTO mode in RUN mode
- Power Reset Button to energize the servos
- Headphone jack for video sound (headphone supplied)

Computer Module Control Hardware
- 2 axis motor control – X, Z axes
- 14 inputs
- 9 outputs
- CNC Turret interface

Software Features – General Operation
- Clear, uncluttered screen display
- Fly out windows for instant access to features and information
- EPA (Enhanced ProtoTRAK Assistance) for system help
- Programming Defaults to simplify part programming
- Event Options to modify control behavior
- QWERTY touchscreen keyboard
- Calculator places data in program for you
- Prompted data inputs
- English language – no codes
- Soft keys - change within context
- Windows® operating system
- Color graphics with adjustable views
- Gestures for pan, zoom, rotate
- Inch/mm selectable
- Convenient modes of operation
- Networking

Info Soft Keys
- Status shows current state of the ProtoTRAK RLX
- Tool Table for instant access to tool set ups
- EPA (Enhanced ProtoTRAK Assistance) help information for ProtoTRAK RLX operation
- Math Help to easily calculate missing print data
- Options appear when available while programming
- Defaults to customize the programming style
- Key board to enter alphanumeric and special symbols
- Calculator for simple calculations
- Warnings appear when you must resolve a condition

Status Features
- IN/MM selection
- Tool Group – Single, Gang, 4-tool or 8-tool CNC Turret, 8-tool Hydraulic Turret
- Check current program name
- Check software and firmware versions
- Purchased Options Status: Advanced Features w/ Verify, DXF Converter, Parasolid Converter, Cam Out Converter, Auxiliary Functions, Clear Off Event, MTConnect, Electronic Handwheels, and 4th Axis. (**Note -** *Electronic Handwheels and 4th Axis are not available on the VMC2.*)
- Turn on/off Control Options: Advanced Features, Networking, Electronic Handwheels

Tool Table Features
- Tool Library for using tools in multiple programs and DRO
- Program Specific Library to manage tools in the current program
- Tool Set-up with graphics for easy tool definition
- Tool type reference
- Tool material reference
- Tool tip radius
- X, Z Offset displays
- X, Z modifier

EPA (Enhanced ProtoTRAK Assistance) Features
- Context sensitive topics for ProtoTRAK RLX control operations
- Keyword search
- Brief explanations of specific operations
- Screen shots for clarity
- Videos for more advanced explanations
- Updated with software release versions

Math Help Features
- 21 separate intuitive routines
- Calculate missing print data using data provided
- Screen Graphics to guide data inputs
- Feed – IPM / MMPM conversions
- Speed – RPM / SFPM conversions
- Cartesian / Polar conversions
- Right triangle calculations
- Load Beg – loads solution as X and Z Begin
- Load End – Loads solution as X and Z End
- Load Center – Loads solution as X and Z Center

Programming Defaults
- Instant access to all defaults via fly out window
- Feedrate per Minute or per Revolution
- Spindle speed RPM or Surface Speed
- Spindle direction Forward, Reverse
- Peck type for drill events
- Finish Cut for Cycle, Bore and Groove events
- X, Z Soft limits
- X, Z Home positions
- Units: Inch or mm
- Maximum Rapid Feedrates
- Conrad/Chamfer
- Cycle Events Number of passes/Depth per cut
- Cycle events finish cuts
- Cycle events retract distance
- Thread events Number passes/depth per cut
- Thread events retract distance
- Groove events finish cut amount
- Groove events continuous cut or plunge/side cut
- Groove event Step over %
- Groove event Peck type
- Bore events Finish cut
- Bore events retract distance
- Cutoff event peck type

Keyboard Features
- QWERTY style
- Touchscreen operation
- Numbers
- Special characters: $ @ # ? % ( ) < = * + -
- Caps Lock

DRO Mode Features for Manual Machining
- Incremental and Absolute dimensions
- Virtual handwheels to control Override of Axis Feed and Spindle RPM
- Jog at rapid with override
- Powerfeed X or Z
- Programmable Go To dimensions
- Servo return to Home
- Do One - Tapers for any angle
- Do One – Radius
- Do One – Fillet
- Thread Repair (O)
- MAX RPM – set maximum RPM for spindle to run
- Tool offsets from Tool Library

Program Mode Features
- Circular interpolation
- Linear interpolation
- Automatic tool nose radius cutter compensation
- Incremental and absolute dimensions may even be mixed on a single point
- Look – graphics at all times

- Program data editing
- Part graphics update while programming
- Selectable display between size of drawing and number of events
- List Step graphics relate Events to Drawing
- Editing of programmed data
- Swipe to move through programmed Events
- Selectable Options within events
- Canned cycles
- Alphanumeric program names
- Math helps with auto-load of solutions
- Nesting
- Programmable spindle speeds
- Constant surface speed
- Aux operations – coolant (standard) and programmable auxiliary output (O)

Event Options
- Spindle speed RPM/Surface Speed
- Spindle direction Forward/Reverse
- Event comments off/on (O)
- Peck type
- Feed Rate Per Minute or Per Rev
- Dwell request
- Retract distance
- Conrad/Chamfer
- Number of Passes / Depth of cut
- Z Finish cut
- Peck type
- Finish cut Continuous or Plunge/side cut
- Step over %
- Left hand Tap (O)
- Custom Thread (O)
- Pipe Thread (O)

Note: Please don't confuse Event Options with Optional Features. Features are standard except where noted by (O).

Canned Cycles (Event types):
- Position
- Drill
- Bore
- Turn
- Arc
- Cycle
- Thread
- Thread Repair (DRO Mode, Optional)
- Repeat
- Groove
- Tap (O)
- Cut Off
- Aux Event

Edit Mode Features
- Group Delete of Events
- Search Edit to make changes to multiple events (O)
- Erase current program
- G-Code Editor (O)
- Clipboard to copy events for insertion elsewhere (O)

Set-up Mode Features
- Toolpath graphics with selectable views
- Estimated Run Time clock
- Step forward and backward through Toolpath graphics
- X,Z tool position locations displayed in Step through mode
- Verify Make Part – solid model graphics of programmed toolpath (O)
- Verify View Part – solid model of finished part
- Home Turret
- Tool Group Select between Single, Gang, 4-and 8-Station CNC Turret *(Not applicable to 3060RX and 30120RX)*
- Tool Group Select between Single, Gang, and 8-Tool Hydraulic Turret *(3060RX and 30120RX only)*
- Ref Position – convenient table for setting Retract, Homes and software limits
- Service Codes for infrequent machine and control settings

Run Mode Features
- G code file run
- Override of Programmed Axis Feed and Spindle Speed from 0 – 150%
- Virtual handwheels to control Override
- Tap override of Axis Feed and Spindle RPM
- Real time conversion of programmed RPM / SFM
- Real time conversion of programmed IPM / IPT
- Status display:
  - Event #
  - Turret position#
  - Control system Ready
  - Current Tool #
  - Repeat #
  - Countdown clock to next pause or tool change
  - Event Comments (O)
- Start at beginning
- Start at any Event
- Start at any G code line
- Start at rough or finish pass
- Start at tool # for GCD programs
- Show Absolute Dimensions during run
- Show Incremental Dimensions
- Show Tool Path – real time graphics with Tool icon
- Show Program
- TRAKing® - you control programmed X and Z feeds with Electronic Handwheels (O)

Program In/Out Mode features
- Program storage to USB device plugged into Control Pendant
- Program storage to Network via RJ45 Port
- Browse file locations
- Create New Folders
- CAM program converter
- Convert prior-generation ProtoTRAK programs to current (.PT10)
- Save Temp – saves all current programs, tools and other settings
- Open Temp – opens the data saved at last "Save Temp"
- Rename programs
- Cut, Copy, Delete, Paste of program(s)
- Look - Graphics preview without opening files

Advanced Features Option
- Verify Make Part – solid model graphics of programmed toolpath
- Event Comments
- Search Edit
- G-code editor
- Thread Repair
- Clipboard
- Gang Tool setup
- Tap event
- Custom Thread
- Pipe Thread

Auxiliary Functions Option
Enables programming and control of:
- Coolant
- Programmable Output signal (O)

DXF File Converter Option
- Import and convert CAD data into ProtoTRAK programs
- DXF or DWG files
- Chaining
- Automatic Gap Closing
- Layer control
- Part alignment
- Feature analysis (circle/arc radius and position)
- Simple CAD construction/editing tools
- DXF-output capability
- Easy, prompted process you can do right at the machine
- Ability to switch between DXF and program modes

TRAKing®
- TRAKing® of programs during program run
- Go To Dimensions in DRO Mode

Offline Programming Option
- ProtoTRAK RLX user interface for Windows PC
- Program parts and simulate CNC Run
- Modify files from current and former ProtoTRAK models

3.2   ProtoTRAK RLX Options

You may purchase software options with the original control purchase or later. If you purchased them with your original order, they should come pre-installed from our factory. You can easily tell if you have an option activated on your control by pressing the Status Key. You can also see all the available options by referring to Service Code 318 (see below).

To purchase Software Options, call our Sales Support Team at 800-421-6875 for pricing and to place your order. Before you install the option, we recommend that you first assure that you are running the most recent version of the ProtoTRAK RLX.

Once you purchase the option, the Sales Support Rep will give you an Activation Code.
1. Go to the Set-up Mode
2. Select Serv Codes
3. Enter 318, INC SET or ABS SET
4. Tap the option you want to activate from the list.
5. When prompted, enter the Activation Code.

3.2.1 Advanced Features

In order to make the ProtoTRAK RLX easier for a basic user, we have segmented some of the more complex features into an Advanced Features Option. Advanced Features, once installed, may be turned off or on in the Status Fly Out window.

3.2.2 TRAKing®

Electronic Handwheels are standard on the TRL RX lathe. They are active only in DRO Mode, Set up Mode to set tools and reference locations and Run Mode for TRAKing® and Chip Clear. Otherwise, the machine will not respond to the movement of the handwheel. You may easily turn the Electronic Handwheels on or off through the Status Information Screen.

The TRAKing® option allows you to control the Program Run by turning the electronic handwheels. Use the X-axis handwheel for slower speeds and the Z-axis handwheel to go faster. It is a great way to assure that what you programmed is what you want to machine. We highly recommend that you see a demo of this amazing feature, or look for TRAKing Pat on the TRAK Machine Tools YouTube channel.

3.2.3 DXF File Converter Option

The DXF File Converter Option gives you powerful capability for quickly and easily translating DXF and DWG files into ProtoTRAK RLX programs. If you work with CAD drawings, we highly recommend the DXF file converter. You can also use the DXF Out feature to output DXF files for reverse engineering.

The DXF File Converter Option has its own manual which is shipped with the software. You may also view a copy of the manual on our web site at www.trakmt.com.

3.2.4 RLX/RMX Offline Programming Option

The Offline Programming Option is software that you install on your Windows® PC. It is an exact replica of the screens you encounter on the ProtoTRAK RLX display. With Offline, you may write, edit and manage your programs on your PC.

The Offline Programming Option has its own manual which is shipped with the software. You may also view a copy of the manual on our web site at www.trakmt.com.

3.2.5 USB Memory Option

This Option is a Delkin® Thumb drive, configured to work seamlessly with your ProtoTRAK RLX CNC. It is the best performing thumb drive we know of in terms of processing speed and reliability. We believe in this option so much that we offer it to you for almost the same price we buy it in quantity.

This is the thumb drive our engineers trust to safeguard their hard work. We hope you do, too.

3.2.6 Verify Option

Part Verify allows you to see a solid model rendition of your programmed part as well as the programmed toolpath. It is very useful to prove out a program and prevent mistakes.

3.3   Display Pendant

3.3.1 Front
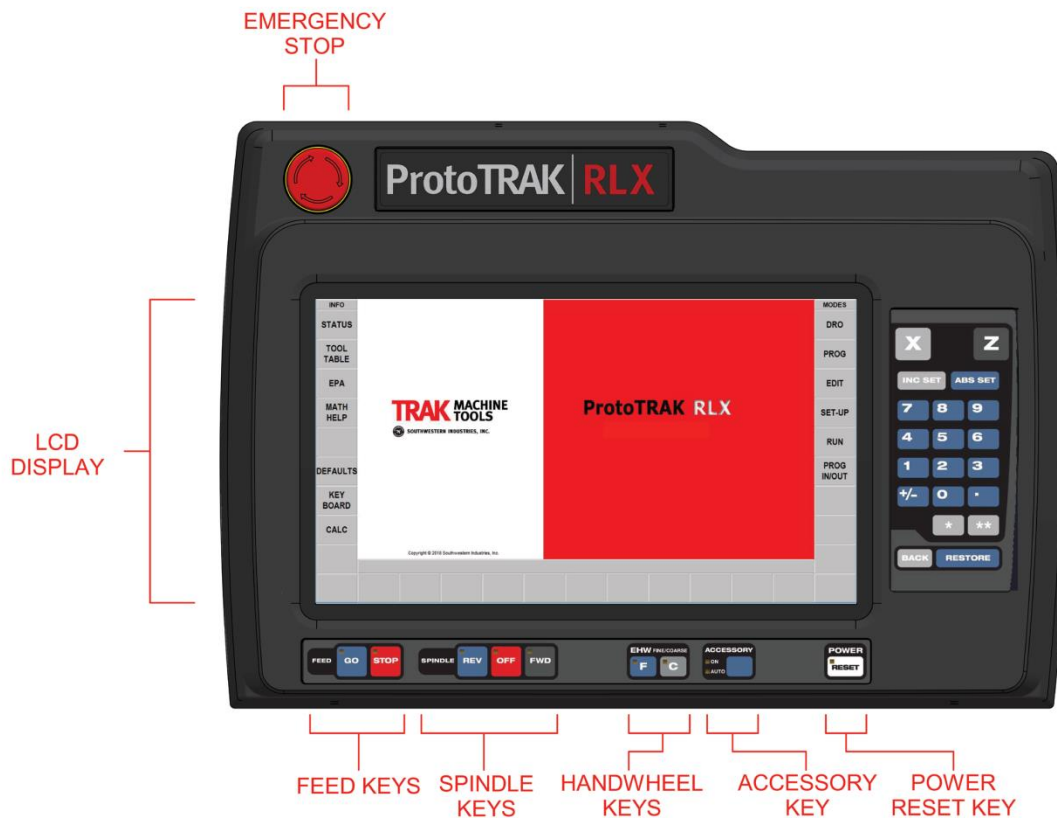
Figure 3.3.1 - *The front of the ProtoTRAK RLX Control Pendant*

Keyboard Hard Keys

X, Z: selects axis for subsequent commands

INC SET: loads incremental dimensions and general data

ABS SET: loads absolute dimensions and general data

0-9, +/-, . : inputs numeric data with floating point format. Data is automatically + unless **+/-** key is pressed. All input data is automatically rounded to the system's resolution

RESTORE: Clears an entry, aborts a keying procedure.

BACK: Moves back within the screen or the DIL when there isn't a better way to do it.
* KEY – Not used at this time.
** KEY – Not used at this time.

Feed Keys:
GO: Initiates motion in Run. The green LED on the GO key will be lit when the servomotors are moving the machine or when the program run has been initiated by the GO key.
STOP: Halts motion during Run. The red LED on the STOP key will be lit when the servos motors are not moving the machine.

Spindle Keys:
REV: Runs the spindle in reverse at programmed speed with any override.
OFF: Turns spindle off and servo brakes to a stop.
FWD: Runs spindle in the forward direction at programmed spindle speed with any override.

EHW FINE/COURSE:
Selects the resolution for the Optional Electronic Handwheels.
C: Moves the cross slide at 0.100" per revolution for X, moves the carriage at 0.400" per revolution for Z

F: Moves the cross slide at 0.02" per revolution for X, moves the carriage at 0.100" per revolution for Z

ACCESSORY: When the switch is in the On position, the flood coolant pump (or spray coolant) will come on and stay on during machining operations. It will not turn off during tool changes.

In the Auto mode, the coolant pump will be controlled as programmed by the Optional Auxiliary functions. To get to the Auto operation, press and hold the Accessory key. If neither light is on, the coolant pump will not operate. The coolant will turn off at tool changes automatically.

POWER / RESET: The LED on indicates there is power to the servo motors. After starting the ProtoTRAK, Press and hold this key until the white LED comes on RLX to initiate. This button will need to be pressed any time the control gets into a critical fault condition. An example of this would be if you press the Emergency Stop button.

Keyboard Soft Keys
Once the ProtoTRAK RLX pendant has booted up, the soft keys are enabled and operated by the touchscreen.

Fly Out Windows
Touching one of the INFO Soft Keys initiates another window to open (or "fly out"). When one of these windows is active, the associated INFO Soft Key will be yellow. In order to put the window away, or switch to another Fly Out Window, press the INFO Soft Key again.

Warnings are also presented in a Fly Out Window. When a Warning appears, you must press the Clear soft key to dismiss the warning.

3.3.2 Display Back
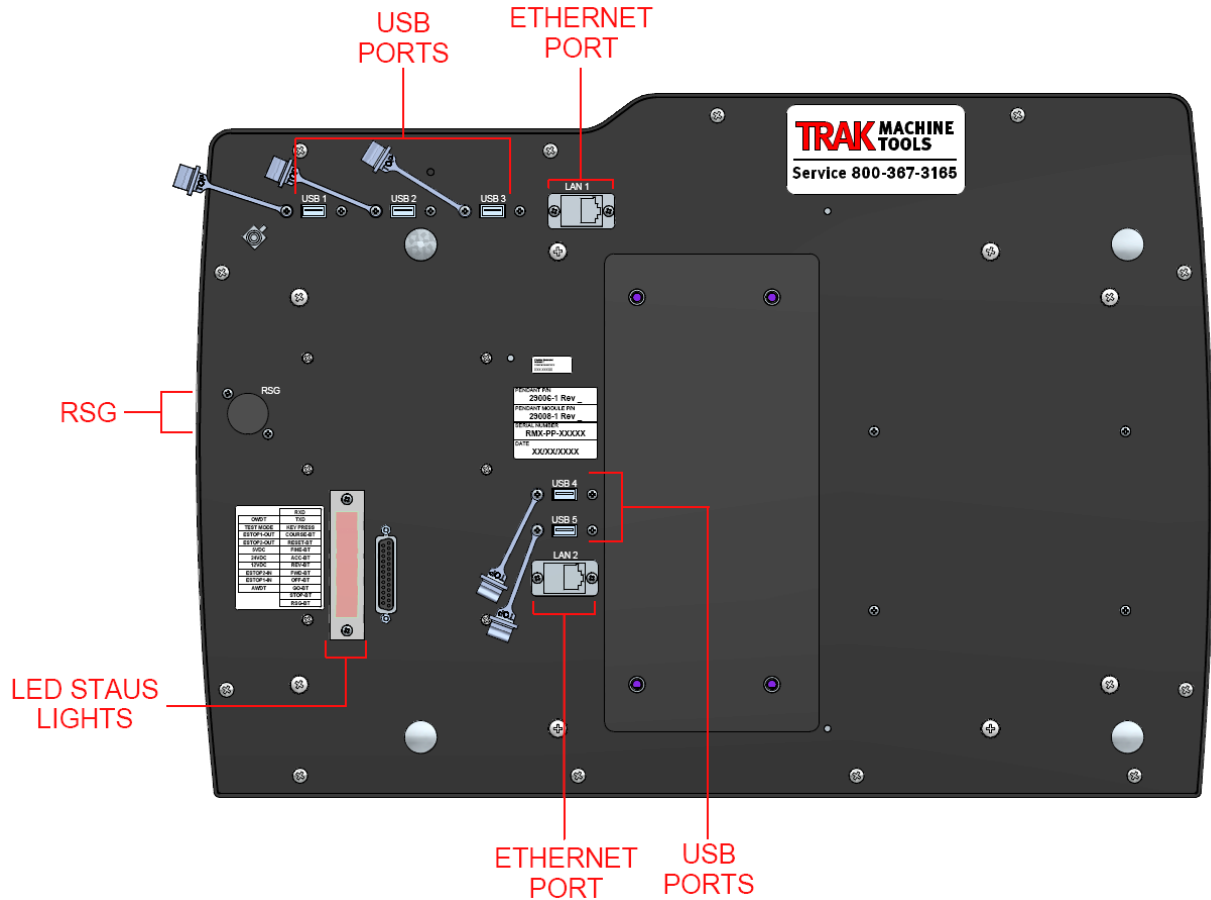
Figure 3.2.2 - Back of the Pendant

Installing and Using the USB Thumb Drive Flash Memory
The first time you install the USB Thumb Drive, we recommend that you install it after the ProtoTRAK RLX has booted up. Once it is installed, the memory will be accessible on Drive D. We highly recommend that you use the high-quality Delkin® thumb drive we provide with the USB Memory Option.

Otherwise, thumb drives are readily available in a variety of stores. While not as reliable, customers also have success with the SanDisk® brand. Other brands may require the installation of separate drivers, a hassle you could probably do without.

RLX Option Key
Each ProtoTRAK machine will come with an USB Option Key that will be plugged into one of the USB ports on the back of the pendant. It normally is plugged in one of the USB ports above the lower Ethernet port. This key must be plugged in to allow certain standard software features to work and also to allow optional software features to work.

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3.4 Machine Specification

Capacity	1630RX	1630HS-RX	1845RX	2470RX	3060RX	30120RX
Height of Centers	8″	8″	9″	12″	16.5″	16.5″
Distance Between Centers	30″	30″	45″	70″	60″	118″
Swing Over Bed	16″	16″	18.1″	24″	33″	33″
Swing Over Saddle Wings	16″	16″	17″	24″	33″	33″
Swing Over Cross Slide	8.6″	8.6″	9.13″	14.5″	21.2″	21.2"
Cross Slide Travel	8.5″	8.5″	10.6″	12.5″	20.5″	20.5"
Tool Section Max.	¾″	¾″	1″	1″	1.5″	1.5"
Coolant	8 gal.	8 gal.	13 gal.	15 gal.	35.6 gal.	48 gal.
Oil Pump – Way Lubrication	2 liter	2 liter	2 liter	2 liter	2 liter	2 liter
Oil Reservoir – Headstock	1.5 gal.	1.5 gal.	1.85 gal.	5.3 gal	> 10 Gallons	> 10 Gallons
Rapid Speeds (ipm)	400 ipm on Z axis					
	200 ipm on X axis					
Bed						
Width	12.6″	12.6″	13.4″	14.57″	18″	19.69"
Height	12.6″	12.6″	12.4″	15″	15.75″	18.7"
Headstock						
Spindle Nose	D1-6	A2-4	D1-6	D1-8	A2-11	A2-11
Spindle Through Hole	2.12″	1.57″	2.36″	4.09″	6.3″	6.3"
Spindle Taper	MT#6	MT#5	MT #6	MT #8	Non standard taper in spindle	Non standard taper in spindle
Taper in Reduction Sleeve	n/a	n/a	MT #4	MT #5	MT #6	MT #6
Spindle Diameter Front Bearing (ID)	3.15″	2.56″	3.35″	5.51″	7.87″	7.87"
Number of Bearings	2	5	2	2	2	2
Number of Spindle Speed Ranges	1	1	2	2	2	2
Spindle Speed Range (RPM)	150-2500	150-4000	80 – 850	40 - 670	20-415	20 - 415
			250 - 2500	100 - 1800	40-1300	40 - 1300
Spindle ID Thread on end of Spindle	M56 X 2 MM Pitch	M56 X 2 MM Pitch	N/A	N/A	M185 X 3.0	M185 X 3.0
Tailstock						
Quill Travel	5.75″	5.75″	6″	8.5″	8	8"
Quill Diameter	2.36″	2.36″	2.56″	3.5″	4.13″	4.13"
Quill Taper Hole	MT#4	MT#4	MT#4	MT #5	MT #6	MT6
Spindle Motor						
H.P.	7.5	7.5	10	15	30	30
Voltage	200 to 240	200 to 240	200 to 240	200 to 240	432 to 528	432 to 528
Amps, Full Load Machine	44	44	54	73	62	62
Phase, Hz	3/60	3/60	3/60	3/60	3/60	3/60
Dimensions						

Net Inches L x W x H lbs.	82 x 45 x 72", 2750	82 x 45 x 72", 2750	88 x 55 x 70", 3285	129 x 84 x 79", 6500	150.31" x 86.61 x 88.25"	212.6" x 86.61" x 79.53", 18920
Ship Inches L x W x H lbs.	87 x 45 x 70", 3420	87 x 45 x 70", 3420	91 x 52 x 79, 3800	134 x 65 x 79", 6900	162" x 90.55 x 96.25"	222.44" x 90.55" x 110.23", 19270
Other						
Coolant Pump Motor, H.P.	1/8	1/8	1/8	1/8	1/4	1/2
Spindle Motor Brake	Dynamic Braking	Dynamic Braking	Dynamic Braking	Dynamic Braking	Dynamic Braking	Dynamic Braking
Way Surface Hardness	400-450 HB		480 – 560 HB			
Headstock Lubrication	Oil Bath	Grease*	Oil Bath	Oil Bath	Oil Bath	Oil Bath
Options						
Tooling Kit	¾"	¾"	¾" or 1"	1"	1 ¼"	1 ¼"
Chuck	8", D1-6	6", A2-4	8", D1-6	12", D1-8	20"	20"
5C Collet Closer	D1-6	A2-4	D1-6	n/a	n/a	n/a
Turret Option	¾", 8-Position	¾", 8-Position	¾ or 1" 8-position	1", 4-position	1", 8-position (hydraulic)	1", 8-position (hydraulic)
	¾", 4-position	¾", 4-position	¾ or 1" 4-position	1", 8-position		

3.5   Optional Equipment

3.5.1 Collet Closer

The Collet Close option features an extended nosepiece that mounts in the taper of the spindle.

If you purchase a collet closer from another source, be sure to get the extended nose type. The tapered-sleeve bushing style of collet closer sits too far back in the spindle and exposes the chuck mounting holes. This makes it likely for contamination to enter the spindle bearings.

The Collet Closer is not available for the TRAK TRL 2470RX, 3060RX and and TRL 30120RX.

3.5.2   Chuck

This is a Buck Chuck, Direct Mount, three-jaw, self-centering chuck.

Lathe model	Size	Through-hole	Spindle
1630RX	8"	1.969"	D1-6
1630HSRX	6"	1.77"	A2-4
1845RX	8"	1.969"	D1-6
2470RX	12"	4.16"	D1-8
3060RX/30120RX	20"	6.3"	A2-11

All chucks are rated by their manufacturer for the top RPM of the machine.

Rear Chuck Option (3060RX and 30120RX Only)

Lathe model	Rear Chuck	Rear Adapter
3060RX/30120RX	16"	A2-11

WARNING!
Use only chucks which are rated to the maximum RPM of the lathe.

3.5.3   Gang Tooling

The gang tooling option is a software feature that allows you to mount multiple tools on your crosslide. The tool path is different than our other modes of operation in that the tool moves straight back in the Z axis when a tool is done with its cutting. This is to ensure other tools don't hit the workpiece when the tool moves back to home. Once the tool reaches the Z home position, we now move the next tool that is ready to cut to the X and Z home and then take a straight line to the workpiece.

You must have the Advanced Features Option active to program automatic tool changes with gang tooling.

3.5.4 CNC Turret Options

TRAK CNC Turret – 8 Tool
The TRAK CNC 8-position turret is available in ¾" tooling for the 1630RX, either ¾" or 1" tooling for the 1845RX and 1" tooling for the 2470RX. Coolant is supplied at each tool.

TRAK CNC Turret – 4 Tool
The 4 tool turret is available in ¾" tooling for the 1630RX, either ¾" or 1" tooling for the 1845RX and 1" tooling for the 2470RX.

8 Tool Hydraulic Turret
An 8-position hydraulic turret in 1" tooling is available only for the 30120RX. The hydraulic turret clamps using hydraulics and coolant is supplied at each tool.
Note: *The 8-position and 4-position TRAK CNC turret is not supported by the 30120RX model.*

If installation is required outside the factory, there is an additional charge.

3.5.5 Coolant Pump

The optional coolant pump is mounted inside the machine bed. It is plugged into the electrical cabinet and may be configured to operate as commanded by the Accessory key on the ProtoTRAK RLX front panel.

3.5.6   Steady Rest

Model	Diameter	Type
1630RX	.500 to 5.5"	Roller
1845RX	0.400 to 7.87"	Roller
2470RX	1.5 to 8"	Roller
3060RX/ 30120RX	1.18 to 11.02" 10.43 to 21.65"	Roller

3.5.7 Tooling Kit

The tooling kit option contains a tool post and a variety of different tool holders. The tool post has a quick release mechanism for quick and easy changes of tool holders, repeatable to within .001".

It is available in ¾" tooling for the 1630RX, ¾" or 1" tooling for the 1845RX, 1" tooling for the 2470RX, and 1¼" for the 3060 and 30120 RX.

The tooling kit package includes:
- A quick-change tool post;
- 4 each square tool holders for turning, facing and boring

- 1 each Morse taper drill holders
- 1 each tool holder, boring

3.5.8   Remote Stop/Go Switch

The Remote Stop/Go Switch (RSG) is a hand-held, push-button switch that does exactly the same thing as the STOP/GO button on the ProtoTRAK RLX display.

3.5.9   Face Plate

Model	Diameter
1630RX	14.17" or 360 mm
1845RX	13.98" or 355 mm
2470RX	20"
3060RX/ 30120RX	30"

3.5.10 Follow Rest

Solid brass nib type except for the 3060 and 30120 which use rollers.

Model	Max Workpiece Diameter (in)
1630RX	5.00"
1845RX	3.93"
2470RX	6.00"
3060RX/ 30120RX	7.87"

3.5.11 Work Lamps

The work lamps are optional for the 1630RX, 1845RX, and 2470RX models. One of the work lights mounts on the underside of the chip enclosure and the second one mounts to the top of the chip enclosure and allows you to position the light to where it is needed.

The TRL 3060RX and 30120RX comes standard with three lamps; two are located on the enclosure, and one is located underneath the door.

3.5.12 Tailstock

The tailstock is optional for the 1630RX only; it is standard on the other lathe models.

The tailstock on the 3060 and 30120 has air assist to help slide the tailstock. There is a lever on the tailstock to turn the air assist on and off. Air is plugged into an air regulator at the tailstock end of the lathe. Air pressure should be between 85 and 100 psi.

3.5.13 Headstock Cooler

The headstock cooler is an option on the 2470RX lathes only. We only recommend this for applications where the lathe will be running at high RPMs and for extended periods of time.

The TRL 3060RX and 30120RX comes standard with a headstock oil cooler.

3.5.14 Fan Assembly Option for Electrical Cabinet

This option consists of two fans, housings and filters. It is installed in locations prepared in advance for the option.

The Option is recommended for:
- Production applications with sustained headstock operation.
- In a hot environment with a lot of ambient heat

The option is not recommended for:
- Toolroom with intermittent headstock operation
- Production applications in cool environments.
- Users who machine graphite or similar materials

The Cabinet fan is meant to head off problems when running continuously for long periods of time during hot days. If you live in a hot climate, don't have air conditioning and run the lathe continuously for hours at a time, it is recommended to get this option. It is not standard because many TRAK Lathes are run in applications where these conditions do not exist. Unless it is needed, it is better to avoid a fan sucking ambient air into the electrical cabinet since there is a risk of contaminants that the filters don't catch causing the internal electronics to fail.

Note: *This option is not available with the* 3060RX and *30120RX, because it comes with an electric cabinet temperature chiller.*

3.5.15 Electrical Certification

To help with sales in heavily regulated environments, an on-site inspection by an outside agency is done to obtain Electrical certifications that meet the following: (UL508A & NFPA79).
- UL508A – Standards for Industrial Control Panels (our electrics box)
- NFPA 79 – Provides safeguards for industrial machinery to protect operators, equipment, facilities, and work-in-progress from fire and electrical hazards.

3.5.16 Chip Conveyor

The chip conveyor is an option for the 3060RX and 30120RX only. The conveyor removes chips from the machine by carrying them and unloading them into a container.

The conveyor receives power directly through a switch located on the pendant, as marked in the figure below.
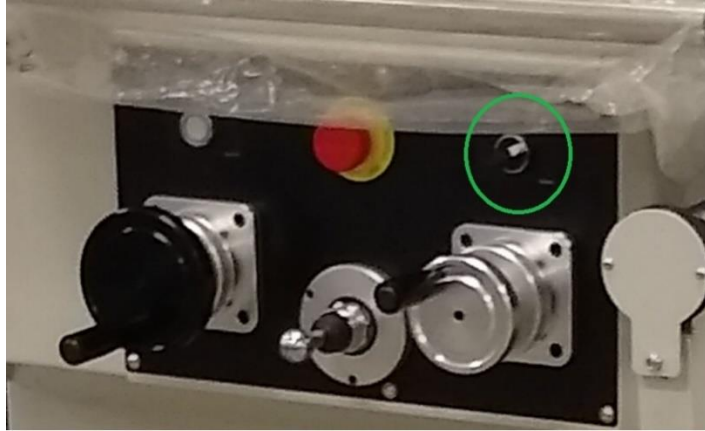
The chips are manually swept onto the conveyor using a chip broom in order to unload them into the container.

The conveyor can also run in reverse to help free up tangled chips in the conveyor shoot.

3.6 Lubrication System

The way and ballscrew lubrication pump is wired to operate when the spindle is running. It also turns on each time you turn on your machine to lubricate the axis before movement.

Factory Default Values
Interval Time – 60 min.
Discharge Time – 15 sec
Discharge Pressure – Approximately 100 – 150psi

To adjust the amount of Discharge Pressure displayed on the lube pump gauge, loosen the jam nut and turn the adjustment screw located on the top right side of the lube pump while the lube pump is activated. To activate the lube pump turn spindle on and press the Feed for continuous pumping and RST for a single programmed pump.

CAUTION!
Failure to properly lubricate the lathe will result in the premature failure of bearings and sliding surfaces.

The settings for the lube pump can be viewed and adjusted in Service Codes.
> Set Up Mode
> Serv Codes
> E. Lube Pump Setup

Enter:
> 300 to choose between Manual and Automatic pump discharge
> 301 to set the cycle time (length of time between automatic discharges)
> 302 to set the amount of time of the automatic discharge

3.7 Electrical Cabinet

The TRAK lathes***** run on 200 to 240-volt 3 phase power. Shops with 415 to 480-volt incoming power will require an optional step-down transformer. See section 3.5.14 above for information about an optional fan *assembly* for keeping the electrical cabinet cooler during hot days.

Note: *The* 3060RX and *30120RX lathe runs on 480-volt, 3 phase power.*

3.8 Servo Motors

The servo motors for the X Axis are 750-watt brushless motors. The Z Axis utilizes 2000 (2kW) watt brushless motors, but the Z Axis on the 3060RX and 30120RX uses a (3kW) watt brushless motor.

4.0   Basic Operation

The TRAK TRL RX Lathes have been designed to give you unprecedented power in a CNC user experience that is natural and easy to use. This section will walk you through some basics of using the ProtoTRAK RLX CNC.

4.1   Powering Up the System

To turn on power to the entire machine and control system, rotate the power switch on the Electrical Cabinet to the On position.

The control will go through its boot up sequence. When it is finished, the following screen will appear.
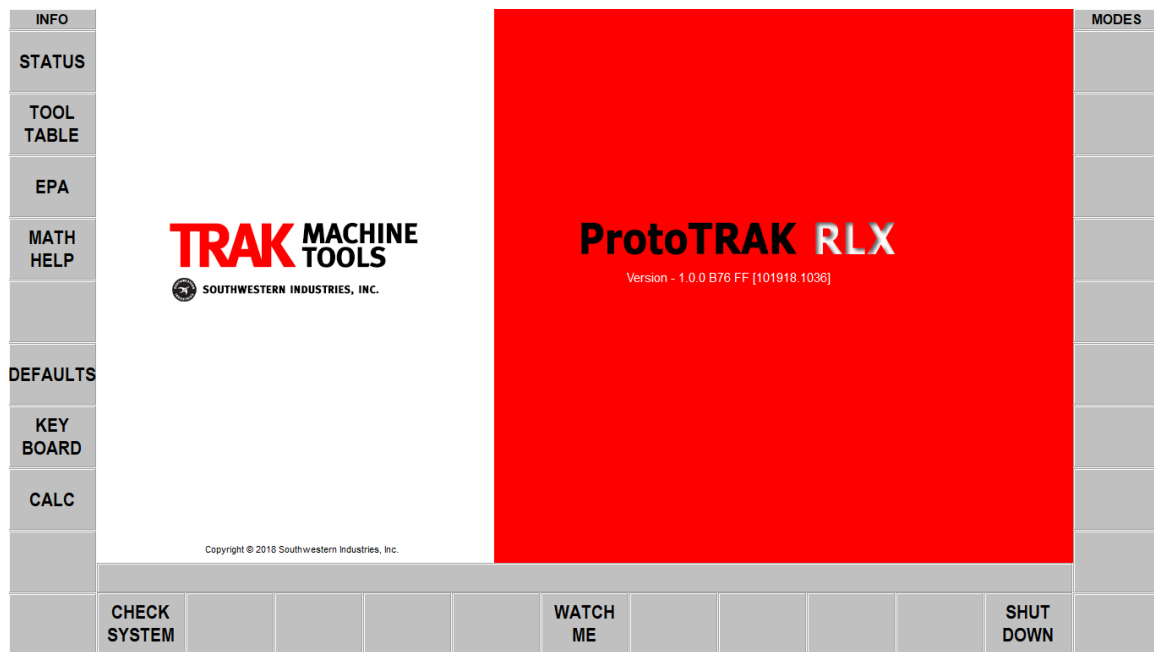
Figure 4.1 - The ProtoTRAK RLX will display this Startup screen after it boots up.

To begin using the ProtoTRAK RLX CNC, do the following two steps:
- Tap the Check System soft key. As a safety feature, you will see a prompt to Enter the Maximum Spindle RPM. Enter the value that is safe for the chuck or other set up you will be turning.

WARNING!
Never exceed the maximum rated speed for the chuck you are using. Use special care when machining with a face plate or other special setups. Get help if you are unsure.

- Press the POWER Reset hard key and hold it for a few seconds until the white LED comes on.

If you are using the ProtoTRAK RLX for the first time, we recommend you tap the Watch Me key. This will launch some videos that will help you to get started. The videos have sound so first plug in the headphones included with the machine.

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4.2 Shutting down the ProtoTRAK RLX CNC

> **Important:** The system must be turned off properly or you may lose unsaved data such as programs or certain machine configurations. The SHUT DOWN soft key will initiate the process of shutting down safely. When the screen goes blank, turn the power switch at the back of the electrical cabinet to the Off position.

In order to reach the SHUT DOWN soft key, first close any Fly Out Windows that are open. We also recommend that you complete any prompted activity, such as programming an Event. Press the BACK hard key repeatedly until you get to the screen shown in Figure 4.1 above.

The ProtoTRAK control should be shut off every few days. Failure to reboot may cause the control to run slowly. For example, the INFO screens may move in and out slowly. This is a sign the control should be restarted. Take advantage of the SAVE TEMP feature prior to shut down as mentioned in the note below.

Note: You can save your current positions, tool information and program using the Save Temp feature in the Program In/Out mode.

4.3 Operator Run Keys

4.3.1 Feed

The Feed Keys control the Go or Stop of programmed toolpath in the Run Mode. When running a program in the Run Mode, you will be prompted for when to start the feed by pressing the GO button.

> **WARNING!**
> Pressing the GO button will initiate automatic machine motion!

4.3.2 Spindle Control

The Spindle Forward/Off/Reverse is controlled through the Spindle hard keys just below the screen on the ProtoTRAK RLX control pendant. Spindle RPM is controlled through inputs in the DRO and Program Modes.

The spindle will not operate unless the ProtoTRAK RLX CNC is in the DRO or Run Modes.

4.3.3 EHW Fine/Coarse

These buttons are used to set the Electronic Handwheel resolution for manual turning.

F or Fine:
Z Axis EHW
- CCW movement in DRO Mode moves saddle toward the headstock – 0.100" per handwheel revolution with a screen resolution of 0.0005"
X Axis EHW
- CW movement in DRO Mode moves the crosslide away from the user – 0.020" per handwheel revolution with a screen resolution of 0.0001"

C or Coarse:
- CCW movement in DRO Mode moves saddle toward the headstock – 0.400" per handwheel revolution with a screen resolution of 0.002"
X Axis EHW
- CW movement in DRO Mode moves the crosslide away from the user – 0.100" per handwheel revolution with a screen resolution of 0.0005"

4.3.4 Accessory

When the switch is in the On position, the flood coolant pump will come on and stay on during machining operations. The pump will not turn off during tool changes, unless you are using the turret.

In the Auto mode, the coolant pump will be controlled as programmed by the Optional Auxiliary functions. To get to the Auto operation, press and hold the Accessory key.

If neither light is on, the coolant pump will not operate. The coolant will turn off at all tool changes.

4.3.5 Power / Reset

Push and hold for a few seconds to initialize power to the X and Z servo and motors. This is required after start up, after an Emergency stop or any critical fault.

4.4   Manual Operation of the Cross Slide and Carriage

With the Electronic Handwheels, the TRAK TRL RX may be used manually while in the DRO Mode. Manual positioning and jog (using jogstick) are active in other situations when needed, such as when setting tools.

When not in the DRO Mode, moving the Electronic Handwheel will not result in movement of the machine.

4.5   Emergency Stop

Press the button to shut off power to the spindle motor and axis motors. Rotate the switch to release. You may also want to press in the Emergency Stop at the end of the day if you would like to leave the machine on but prevent the operation of the coolant pump or the Electronic Handwheels.

You must reset the power after each Emergency stop by pressing and holding the Power/Reset hard key.

4.6   Data Input Keys

Data Input keys (hard keys) are used to input numeric data and set as an Absolute or Incremental reference.

4.7   Modes

The Modes soft keys are always active. With the ProtoTRAK RLX it is always possible to switch freely between Modes once you close any Fly Out window.

As you move into and out of a Mode, the operations will almost always be where you left them the last time you went out.

This manual will deal with each Mode thoroughly in the Sections following.

4.8   Gestures

The touchscreen is operated with the following gestures:

Tap – Tap is used to select an item such as an Info Key. To Tap, lightly touch the screen with one finger.

Double Tap – in Program In/Out mode, double tapping will open a file or folder.

Swipe – Swipe is used to move from one screen to another, for example you move forward and back through Events in the Program Mode with swipes. To Swipe, touch the screen with one finger and move rapidly in the direction you want to move.

Pan – Pan is used to move content, such as a part drawing, around the screen. To Pan, touch the screen with one finger and move slowly in any direction.

Spread / Pinch - these gestures are used to zoom in or out of a drawing. Use your thumb and finger.

Touch and Hold – Touch and hold works much like the right click of a mouse to initiate a pop up menu for selections, when one is available. Touch the screen item and hold for 2 seconds.

Drag – Drag is used to move some of the information windows to more convenient location on the screen. Touch the window header or title area and drag it to where you want.

Rotate – Rotate is used to rotate a drawing or a solid model. Touch the screen with 2 fingers and twist to rotate the part along and axis projecting out of the screen. Move your 2 fingers to the right to rotate around a vertical line on the screen. Move your 2 fingers to the left to rotate around a horizontal line on the screen. Move your 2 fingers CW or CCW on the screen to rotate around a point.

Note: *If you find the ProtoTRAK RLX gestures have become sluggish, it is time to restart the control. Press the Back hard key until you encounter the Startup screen (Figure 4.1 above) and tap Shut Down.*

4.9   Features – TRL 3060RX and 30120RX Only

The following features are only applicable to the TRL 3060RX and 30120RX.

4.9.1 Door Open Button

While the program is running, the Saddle Guard Lock must be full engaged. This locks the door to the saddle. The door now moves with the saddle.

To disengage the door from the saddle, press the "Door Open" button. This will retract the Saddle Door Retract Plunger towards the operator and then allow you to slide the door independent from the saddle. You may need to pull the door retract plunger towards you.

Note: *The door open button also unlocks the part loading guard access panel.*

Door Open Retract Pin Switch
In the event that the Saddle Door Retract Plunger is not fully retracted towards the operator, a "Door interlock not fully engaged" message will be displayed on the control.

While the notification is on, the operator will not be allowed to run the program or move the sadldle with the EHW's or jogstick. The operator should also refrain from sliding the door as this could cause the door switch trigger pin to break or bend.

4.9.2 Spindle Jog

To turn on the Spindle Jog feature, you must turn the Spindle Knob to the left
and then press the Spindle Jog Button. This feature is only available in DRO and RUN modes.

When the feature is activated, the spindle and chuck will rotate slowly, allowing the operator to
then shift gears by turning the gear lever to high or low. While the feature is on, the operator will
not be able to turn the spindle at the control.

To turn off the feature, turn the Spindle Knob back towards the center.

4.9.3 Spindle Hold

To activate the Spindle Hold feature, you must turn the Spindle Knob to the right. This feature is
only available in DRO mode.

The Spindle Hold feature allows the operator to load big, heavy work pieces while the spindle and
chuck stays in place. When the feature is activated, the operator may not turn the spindle on at
the control.

To turn off the feature, turn the Spindle Knob to the center.

4.9.4 Chuck Guards

On the 3060RX and 30120RX, there are four guards; the Chuck Guard, Rear Chuck Door, Part
Loading Guard Access Panel and Spindle Motor Access Door.

In the event that any of the four guards or door is not properly closed, a "Chuck guard open"
message will appear on the control, and the spindle will not be allowed to run.

4.9.5 Tailstock Engagement Switch

When the Tailstock Engagement Switch feature is activated, a signal will be sent to the control,
which will immediately reduce the speed at which the saddle slides along the Z axis to 78 ipm.

When the feature is on, the operator may only jog using the handwheel and jog stick. You will
not be able to run a program with the switch engaged.

4.9.6   Door Side Safety Strips

Each side of the door has a safety strip that will trigger an emergency stop condition if pressed
(spindle and axis motors will be turned off). These strips are meant to protect the user if the
door was to hit the user while moving. The Power Reset button will need to be pressed again to
turn the servos on if either of the safety strips are triggered.

5.0   Definitions, Terms & Concepts

5.1   ProtoTRAK RLX CNC Axis Conventions

Z Axis: positive Z-axis motion is defined as the carriage moving to the right when facing the lathe. Measurement away from the chuck is positive on the workpiece.

X Axis: positive X-axis motion is defined as the cross slide moving toward you. Measurement away from the part centerline and toward you is positive. All X motion is displayed as diameter (not radius) dimensions.

5.2   Absolute & Incremental Reference

The PROTOTRAK RLX may be programmed and operated in either (or in a combination) of absolute or incremental dimensions. An absolute reference from which all absolute dimensions are measured (in DRO, and program operation) can be set at any point on or even off the workpiece.

To help understand the difference between absolute and incremental position, consider the following example:

i00222
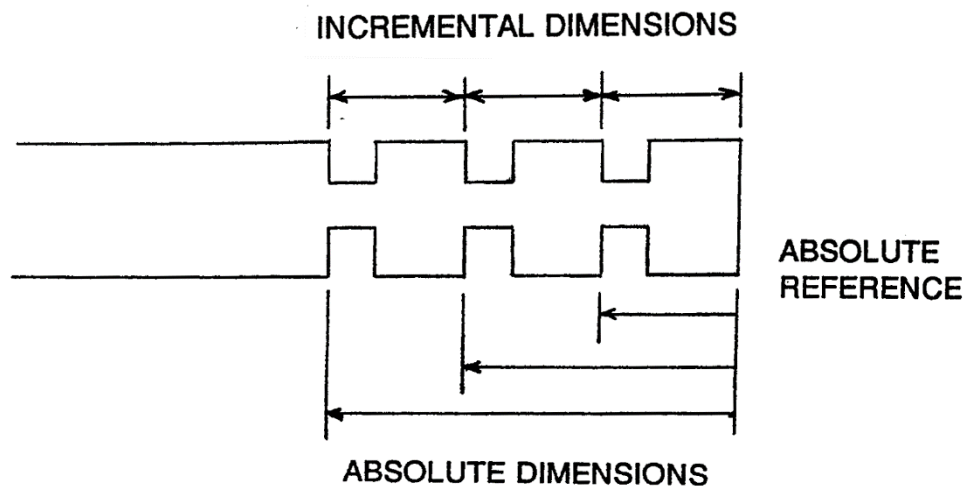
5.3   Referenced and Non-Referenced Data

Data is always loaded into the ProtoTRAK RLX by using the INC SET or ABS SET key. X, Z positions are referenced data. In entering any X, or Z position data, you must note whether it is an incremental or absolute dimension and enter it accordingly. All other information (non-referenced data), such as tool offset, feedrate, etc. is not a position and may, therefore, be loaded with either the INC SET or ABS SET key. This manual uses the term SET when either INC SET or ABS SET may be used interchangeably.

5.4   Tool Tip Radius Compensation

When turning along the side of a part (constant X), or along the face (constant Z), the tool tip radius is not particularly important. However, as soon as you begin to machine a taper or contour, the tool tip radius has a substantial impact.

Consider the drawing below. If you had an infinitely sharp tool (no tool tip radius), assume its point was at X0, Z0. Another tool with a tool tip radius of R1 and another of R2 are also shown. Note that all three positioned as shown have the same X contact (X0, X1, X2) and if moved sideways, would cut the same diameter. Likewise, they all have the same Z contact, and if moved in would cut the same face length. However, if moved on a 45-degree taper (or any other angle) so that the cutting point was in the middle of the radius, the three tools would cut or contact along much different lines.

i00217
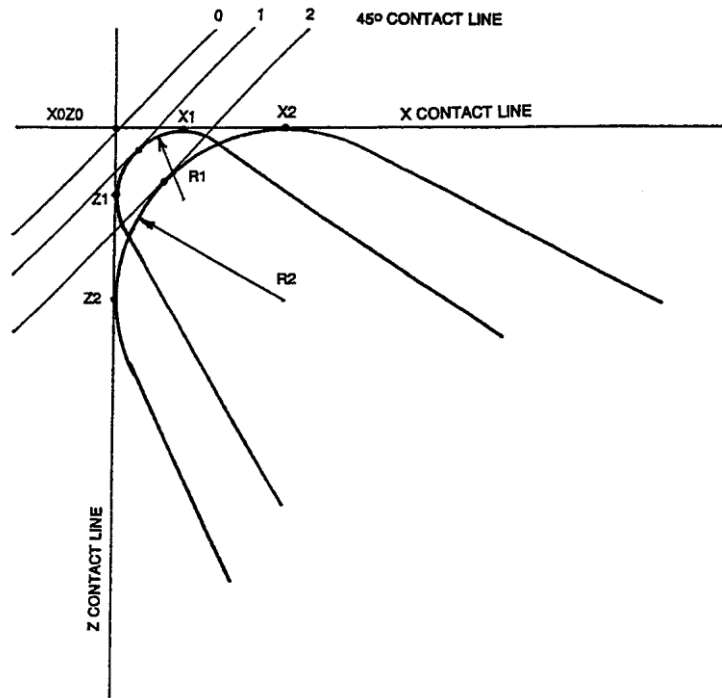
5.5   Tool Offset

When you define the shape of the part to be turned, you must also specify where the tool should be relative to the part. This is done by looking along the direction of the tool motion and declaring whether the tool is to the right or left of the part.

Examples of tool left are:

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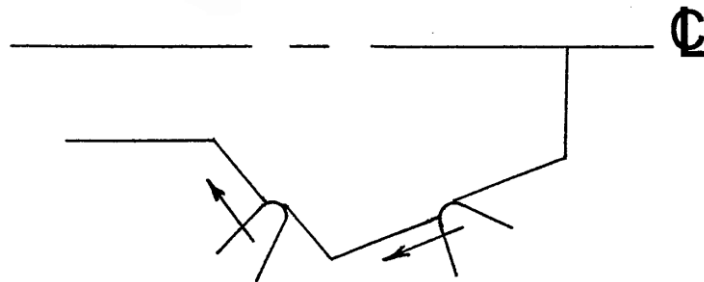
Examples of tool right are:
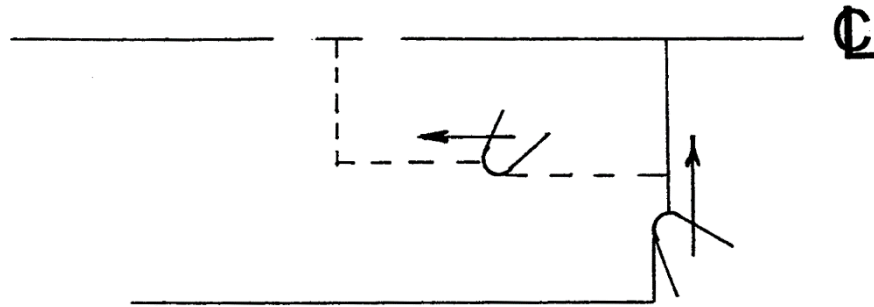
Tool center may be programmed for special circumstances where you wish to ignore the effects of tool geometry and radius.

5.6   Connective Events

Connective events occur between two turning events (either Turn or Arc) when the X and Z ending points of the first event are in the same location as the X and Z starting points of the next event. In addition, the tool offset and tool number of both events must be the same.

5.7   Conrad

Conrad is a unique feature of the PROTOTRAK RLX that allows you to program a tangentially connecting radius between connective events. For the figure below, you simply program a Turn event from X1, Z1 to X2, Z2 with tool left offset, and another Turn event from X2, Z2 to X3, Z3 also with tool left offset. During the programming of the first Turn event, the system will prompt for Conrad at which time you input the numerical value of the tangentially connecting radius (r=k). The system will calculate the tangent points T1 and T2, and direct the tool cutter to move continuously from X1, Z1 through T1, r=k, T2 to X3, Z3.

i00238

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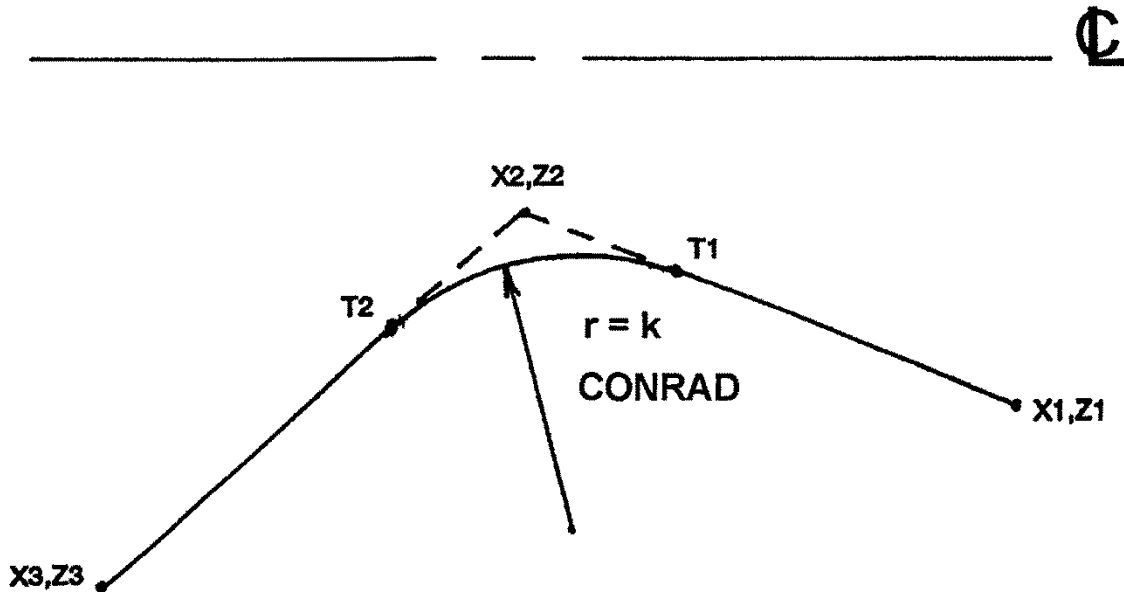
For the figure below, you program an Arc event from X1, Z1 to X2, Z2 with tool offset left, and another Arc event from X2, Z2 to X3, Z3 also with tool offset left. During the programming of the first Arc event, the system will prompt for Conrad at which time you input the numerical value of the tangentially connecting radius r=k3. The system will calculate the tangent points T1 and T2 and direct the tool cutter to move continuously from X1, Z1 through T1, r=k3, T2 to X3, Z3.
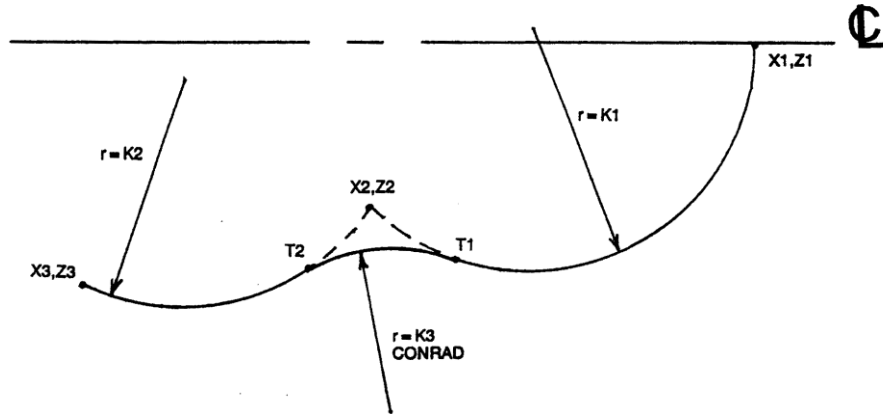
i00239

Note: *Conrad must always be the same as or larger than the tool radius for inside corners. If conrad is less than the tool radius, and an inside corner is machined, the PROTOTRAK RLX will ignore the Conrad.*

Note: *If you program an arc using Conrad rather than an ARC, never use a Conrad whose radius is as large or larger than the length of either line connected by the Conrad plus the tool tip radius. In the figure below, R plus the tool nose radius must be less than the programmed line ab or bc; otherwise, program the arc with an ARC Event.*
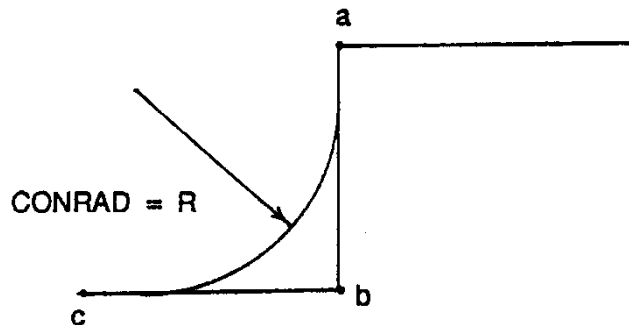
i00220

5.8   Chamfer

The PROTOTRAK RLX also allows for easy chamfer input. A chamfer may be programmed between two turn events, two arcs, or a turn and an arc. The default angle is 45°.
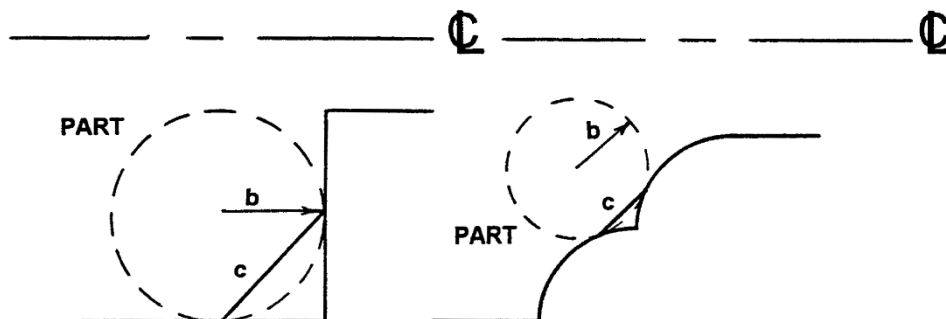
i00221

In both cases above a chamfer programmed with dimension b will cut a chamfer along line c.

5.9   Absolute, Tool, and Program References

When you operate a lathe, what you are interested in is where your tool is relative to the workpiece. However, what the PROTOTRAK RLX monitors is how far the carriage and cross slide move. This creates two problems.

The first has to do with using more than one tool. When you change tools, the tip on one will, most likely, not be in the same position relative to the part as the previous tool. Just changing the tool doesn't move the carriage or cross slide, so the PROTOTRAK RLX doesn't know that the new tip isn't where the other was. Obviously, what's needed is for you to tell the PROTOTRAK RLX what the differences (or offsets) are from tool to tool (this is done easily in the Set Up Mode), and to always tell the control which tool you are using at any given time.

The second problem has to do with establishing the machine and part reference. When you turn the PROTOTRAK RLX on, it has no idea where the carriage, cross slide, or tool tip is. It only knows how far it has moved since the last input reference since all references are lost when the control is turned off (**Note**: *if you use the Save Temp feature in the Program In/Out Mode, the references will be saved*). Also, if you are going to turn a part, the control has no idea where you have chucked it. Is it sticking out of the chuck a little? A lot? What you need to do is select a tool--and always tell the control which one--and tell the PROTOTRAK RLX where that tool is, relative to the workpiece.

In general, most programs and parts will have their centerline as the absolute zero reference in the X-axis. For the Z-axis, two handy references are the end of the part (generally after it has been faced), or any face of the chuck.

5.10 Feedrate Conventions

Carriage feedrate (Z motion) and cross slide feedrate (X motion) may, in most cases, be input directly as inches per minute (ipm) or as inches per revolution (ipr) of the spindle. The relationship between these is:

$$ipm = ipr \times RPM$$
or
$$ipr = ipm/RPM$$

Math Help 30 will calculate these values for you.

All feedrates must be programmed between 0.100 and 100 ipm (2.5 - 2500 mm/min) or between 0.001 and 0.099 ipr (0.025 and 2.5 mm/rev).

IPR programming is part of the Advanced Features Option.

5.11 Spindle Speed Conventions

Constant Surface Speed (CSS) Programming is part of the Advanced Features Option. If the Advanced Features Option is not active, only RPM Programming will be available.

For programmed parts, spindle speed may be set as direct RPM or as a surface speed in surface feet per minute (SFM) or surface meters per minute (SMM).

The relationship between RPM and SFM is

$$SFM = \frac{RPM \times Diameter \times \pi}{12}$$

or
$$SFM = 0.26 \times RPM \times Diameter \quad (in inches)$$

For example, when you are cutting at a diameter of 3 inches and a RPM of 600, then your SFM would be 0.26 x 600 x 3 = 468. Math help 31 will calculate RPM or SFM for you.

Surface speed is the relative speed between the workpiece and the tool during a cut. That is, it is the speed that the workpiece passes across the tool.

Notice in the formula above that if you wanted the SFM to be constant during the cut you would have to change RPM as the tool moved to a different diameter - for example while facing.

When you program the spindle speed as SFM in the program mode the PROTOTRAK RLX will assume that you want to maintain constant surface speed (CSS) and will automatically vary the spindle RPM to maintain the program value.

Note that if you program with constant surface speeds and inch per revolution feeds, then not only does the spindle RPM increase as you face cut towards the centerline but the cross slide will move at a faster rate as well.

6.0   Info Keys

Info keys on the left side of the screen enable you to:
- Configure your ProtoTRAK RLX to your preferences
- Make changes to system defaults
- Look up information
- Access advanced capability

Info Keys are always available; while you are doing any operation of the ProtoTRAK RLX you may tap an Info key.

Fly Out Windows
When you tap an Info key, the key will turn yellow and the associated fly out window will appear over the window you had been using. When you are finished with the window, tap the key again to close it.
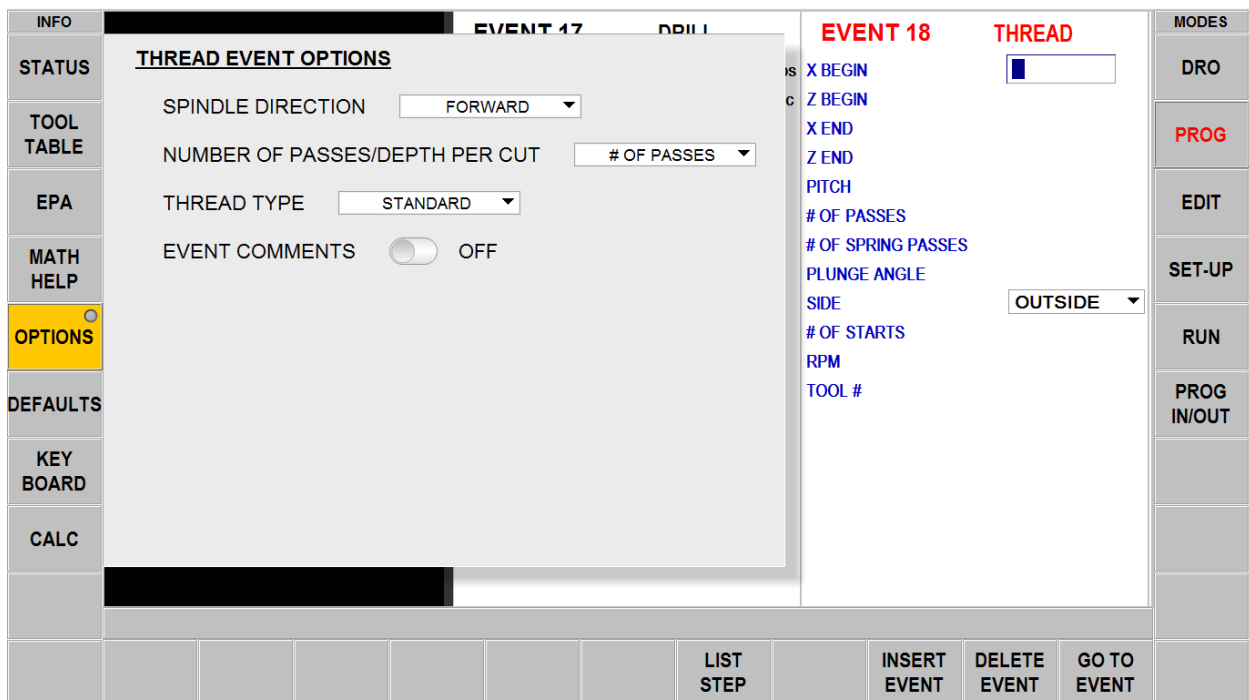
Figure 6.0 - The Option key opens a Fly Out Window over the event programming to give you instant access to relevant choices

Once you open a Fly Out Window, you must close it by tapping the associated Info Key.
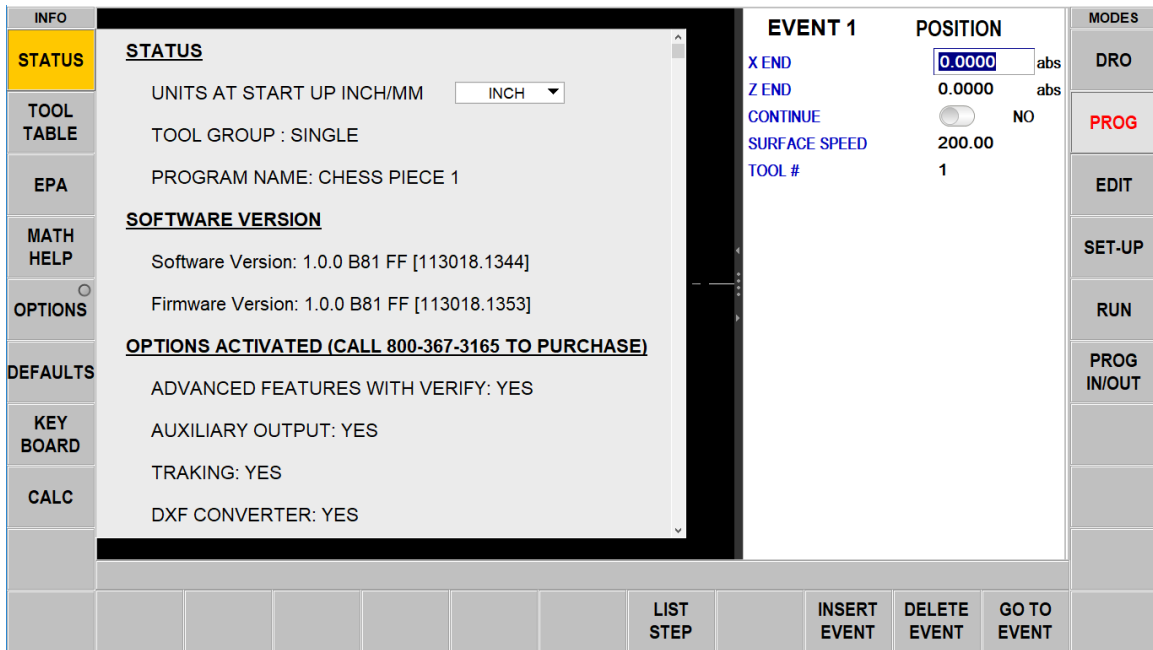
Figure 6.1 - The Status Fly Out Window

6.1   Status

The Status Info Key gives you a convenient look at the current status of your ProtoTRAK RLX.

6.1.1 Operational Status

Units – Chose between In and mm. All dimensional information will appear in the units you choose. If you change units, the change will take effect as soon as you tap the Status key to put the window away.

Tool Group – The active tool programming method, between Single, Gang (Optional) 4-Station Turret, 8-Station Turret, and 8-Tool Hydraulic Turret.

Program Name – For reference. You may rename a program in Program In/Out Mode or the Event 0 in the Program Mode.

6.1.2 Software Version

This will list both the current software and firmware.

6.1.3 Options Activated

This is a list of all available control options and whether or not they are activated. To purchase an option, call Customer Service at 800-367-3165 or Sales Support at 800-421-6875.

See Section 3 for a description of available options.

6.1.4   Features Off/On

Advanced Features – Optional Advanced Features may be turned off if you wish to simplify the operation of the ProtoTRAK RLX by eliminating features.

Network – Access to the networked drives may be turned off so that communications between the ProtoTRAK RLX and the network are halted.

Electronic Handwheels – The Electronic Handwheels may be turned off to assure the machine doesn't inadvertently move.

Note: When turned on, the Electronic Handwheels move the cross slide and carriage only during DRO Mode and TRAKing® in Run Mode.

6.2   The Tool Table

The Tool Table is presented anytime you tap the Info Tool Table Info key. Tap it again to put the table away. All information in the tool table may be input during or after programming.

The table is divided into three sections: the status of a Part Zero Base that establishes the tool offset reference; Program Tools that have been identified in your current program; and Tool Library that contains tool information that you have previously defined and saved.

6.2.1 Parts of the Tool Table Screen

Figure 6.2.1 - The Tool Table screen is divided into three parts.

Part Zero

This part of the screen will show you whether a part zero was established using a tool. When the ProtoTRAK RLX is first turned on, the Part Zero will read NOT SET in for both the X and Z Offsets.

When the Part Zero is set using any of the Library Tools you will see "Using Library Tool" to the right of the SET.

If tool has not been set up, the Part Zero box for X and Z will be orange and will say NOT SET.

When you set Part Zero using a Program Tool (and not a Library Tool):
The reference will say SET and be in *green* if there are no Library Tools or you first set Part Zero with a Library Tool.

The reference will say SET and be in *blue* if there are Library Tools but you didn't use a Library Tool to set Part Zero.

If you are going to use the Tool Library, we recommend that you always set Part Zero using a Library Tool.

The ProtoTRAK RLX will not allow you to run a program if you attempt to use tools that may have been set using different references – that is, it will not run a program if one of the tools you are attempting to use is in blue.

Program Tools
The Program Tools section of the screen shows all the tool numbers that have been entered into the program that is currently open. To eliminate a tool from the Program Tools you must eliminate it from all the program events that use it. All information in the tool table may be directly input during or after programming. As you program, you may open the tool table and set up the tool while it is still fresh on your mind.

Tool Offsets and Mods in the Program Tools are not saved when a current program is closed, erased or if the control is powered off. To save your program and all the tool information, go to the Prog In/Out Mode and tap Save Temp.

Program Tools are numbered by you as you enter the number in the Tool # prompt during programming. They may be any number from 1 to 99.

Tool Library
The ProtoTRAK RLX tool table enables you to set up and retain the set-up information for up to 99 library tools. Tool offsets and mods in the Library Tools are always saved until you deliberately erase them or erase the entire tool.

You may add tools to the tool library by inserting a tool, tapping on an empty row, and then tapping Tool Setup. We recommend that you give Library Tools a tool number. To keep them distinct from Program Tools, Library Tools may be any number from 101 to 199.

Column Headings
LIBRARY TOOL # is the tool number for Library Tools
TOOL # is the tool number given in the current program
TURRET LOC is the tool location on an optional 4 or 8 position indexer
TOOL TYPE is the type of tool chosen from drop down list
MATERIAL selects the tool material from a list (not required, for your reference)
TIP RADIUS enables the ProtoTRAK to calculate the proper toolpath for interpolation
DIA OR WIDTH is the diameter of a drill or the width of a groove or cutoff tool
X/Z Offset compensates for the difference in length between tools
X/Z Mod allows for small adjustments for tools or offsets

All information that is required before Run is highlighted in green or blue if complete. Information highlighted in orange is required before the program can be run. Information highlighted in blue indicates that different references may have been used to set up the program tool and the Library Tools (this could lead to a crash, see above).
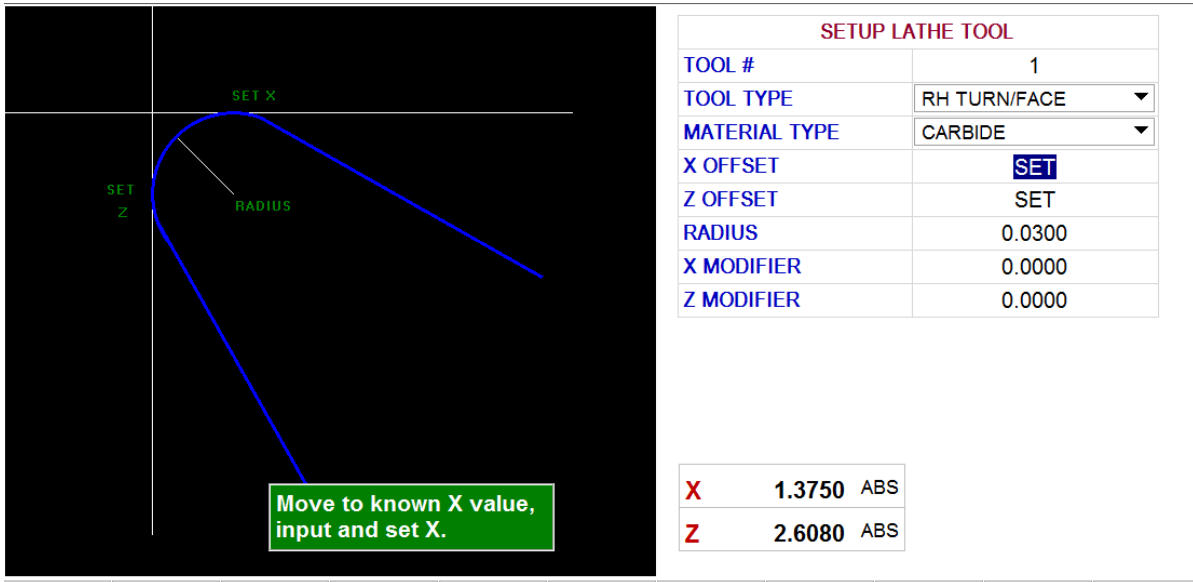
FIGURE 6.2.2 - Tap Tool Setup to enter the tools using the prompts.

Soft Keys

Tool Setup – Tap Tool Setup to define and touch off your tools.

Erase Library – Erases all the tool data stored in the Library.

Clear Lib # – First tap in the row of the Library Tool, then this key to clear the number.

Delete Tool – First tap in the row of the Library Tool and then this key to delete it from the Tool Library. To delete a tool from the Program Tools you must remove the tool number from all the events of the program that is currently open.

Delete Offset – Tap any X/Z offset and Delete Offset to erase it.

Add to Library – Tap any Program Tool # and Add To Library to include it in your library. Be sure its offsets are properly referenced (Step 7) to all Library tools

6.2.2   Setting Up Tools

To set up a tool: load a tool, press Tool Setup in Tool Table and follow the prompts.

To set up the cross slide, or X, we recommend that you put some stock into the chuck or collet. Machine a skin cut and measure the part. In the DRO Mode, press X, enter the diameter measurement, then press ABS SET. This tells the ProtoTRAK RLX that you are ½ that distance from the centerline, making the centerline the ABS 0.

For the longitudinal travel, or Z, touch off the front of the part (or machine a flat). Press Z and then ABS SET. That makes the front of the part ABS 0. Set up each tool using the same Z reference.

Setting Offsets Using Only Program Tools

Load your first tool, tap its Tool # and complete the tool description information.

For Offsets, tap the TOOL SETUP key and follow the green box instructions by touching off (or turning a diameter) on the part or some place on the chuck. Input the X and Z dimensions where you touched and SET. This will also set the Base for your reference Part Zero if you base was in a NOT SET state.

Repeat for each tool.

If you do not have any Library tools your offsets will be highlighted in green, otherwise in blue. The blue warns you that your Base reference for Program Tools is different from your Library tools

Setting Offsets Using All Library Tools
Once you have tools in the Tool Library, you can easily use the tool data in your programs. To do this, set the Part Zero using a Library tool in DRO Mode.

Using a Combination of Library Tools and Program Tools
To run a program using both Library Tools and Program Tools (not in the Tool Library), simply load in a Library Tool and set or reset the reference Part Zero in DRO Mode. Then load in your program tools and set their references using the same references.

Moving Tool Information
You can build your Tool Library using program tools. First, set up the Program Tool(s) using Tool Setup. Tap anywhere on the row of the Program Tool and then tap Add to Library. The tool information will appear in the Tool Library.

To use the Tool Library information for your Program Tools, tap the Tool # field for the library tool you wish to use. Enter the Tool # of the Program Tool.

6.2.3   Keeping References Consistent

The ProtoTRAK RLX offers you the convenience of establishing and using tool references so that you don't have to keep touching off the same tools on every job. It helps you to keep things straight with the color of the X and Z Offset box: green means the references between Program Tools and Library Tools were set consistently. Blue means that the references may not have been set consistently and you are likely to crash. The ProtoTRAK RLX will not let you run the program until it is sure that you have set the references consistently.

Resolving the Green / Blue box discrepancy is easy. Simply use a Library Tool in DRO Mode to set the Part Zero. Then set any tools with a blue box using the same references you just used.

To keep things simple, we also recommend that you set your Part Zero using a Library Tool each time the ProtoTRAK RLX is powered up.

6.3   EPA

The EPA (Enhanced ProtoTRAK Assistance) key will give you quick access to a collection of short tutorials that provide help for using the ProtoTRAK RLX CNC. While these tutorials are useful for resolving questions or jogging the memory, they are not intended to substitute for the user manual or for product training.
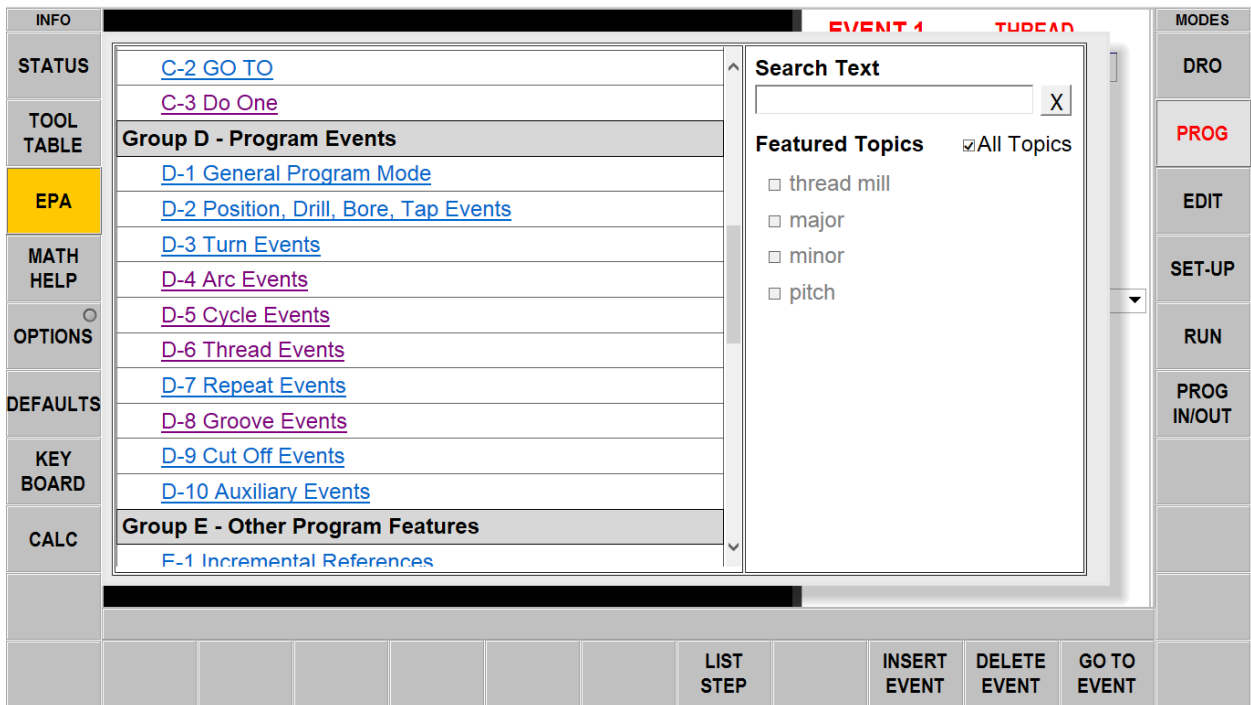
Figure 6.3 - The EPA Screen

6.3.1 EPA Index

The EPA Index will display the tutorials available depending on either the current operation or your selection in the Search Text box.

For example, if you are in the Program Mode, when you press the EPA key, the EPA Index will display the topics most likely to be of interest for Program Mode operations. Say you are programming a Groove Event and you want to check on the meaning of the Chamfer Bottom prompt. By pressing the EPA Info key, the EPA Index will appear. Instead of listing all the topics, a shortened list of only those topics likely to be of interest for that operation will appear so you will be able to quickly choose a tutorial with the information you need.

EPA Topics are arranged in Groups:
- A. General – overall operation of the ProtoTRAK RLX
- B. Information key
- C. DRO Mode
- D. Program Events
- E. Other Program Features
- F. Edit Mode
- G. Set-up Mode
- H. Run Mode
- I. Program In/Out

6.3.2 Searching the EPA Index

There are two ways to search for topics:
1. Enter a key word into the Search Text box. (See section 6.7 Keyboard). Only the applicable tutorials will appear in the EPA Index box. If you don't like the results, try a different word. To clear previously entered text, tap the X to the right of the Search Text box.

2. Select a Featured Topic from the list by tapping the topic word. A check mark will appear to indicate that the selection is successful. Selecting All Topics will display the full list of topics arranged by groups. To deselect, click the box again.

6.3.3 Navigating Through a Topic
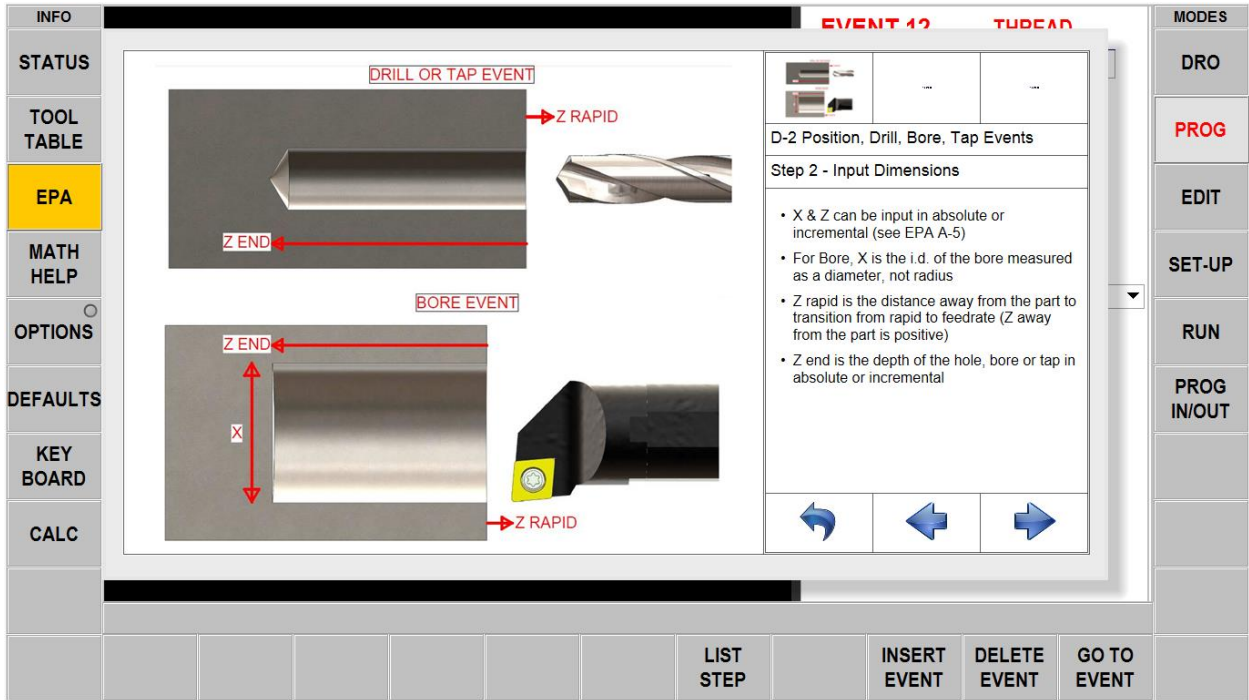
Figure 6.3.3 - An EPA topics screen

Display Area – The EPA will display helpful graphics, screen shots or videos as required to help explain the topic. It will be blank if the text does not need illustration.

Items Available – Sometimes there are more than one display available for the topic. Tap the one you want to display.

Use the arrow keys to move through the instructions or to return to the index.

6.4 Math Help

Math Helps are powerful routines that enable you to use data that you have available in order to calculate missing X and Z beginning, ends and centers.

You may enter into Math Help at any time by pressing the Math Help Info key.

The calculated data may be automatically loaded into your program by entering Math Help while you are programming a beginning, end or center.
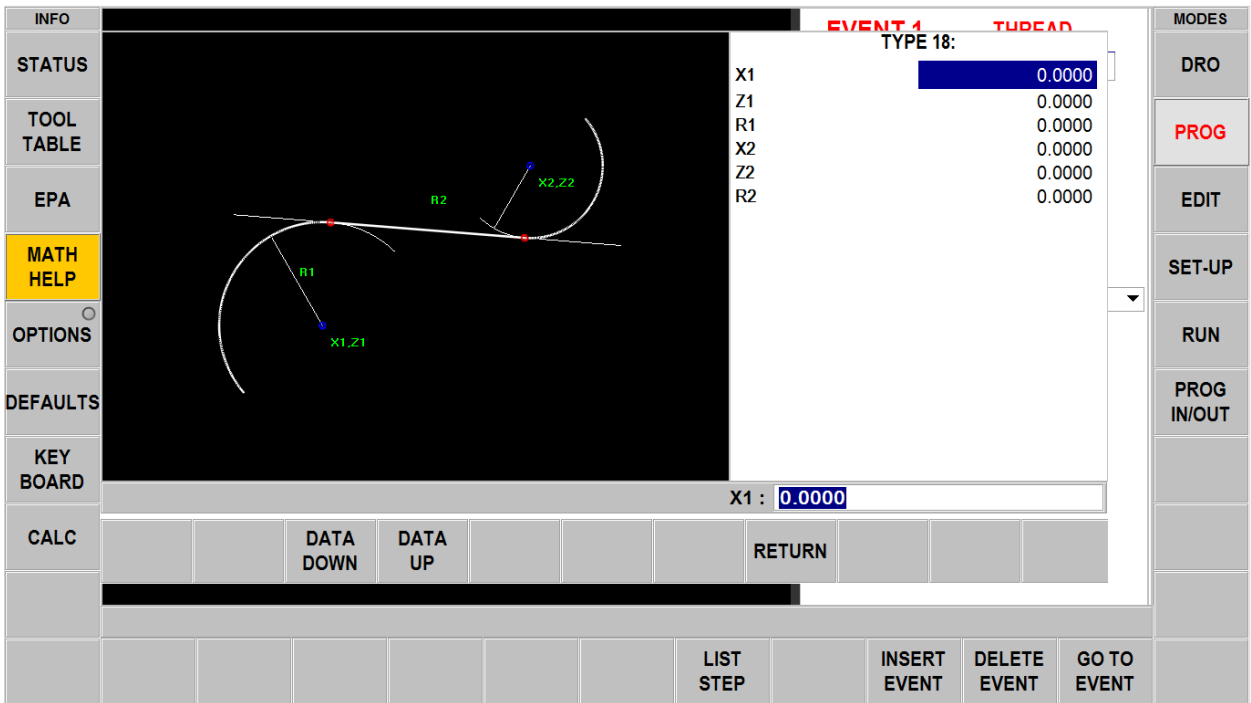
Figure 6.4 - Math Help 18

6.5   Defaults

Defaults make programming easier by customizing the ProtoTRAK RLX to your machining style and the type of work you are doing. If you usually work in tool steel, you would set a much lower number appropriate for that work.
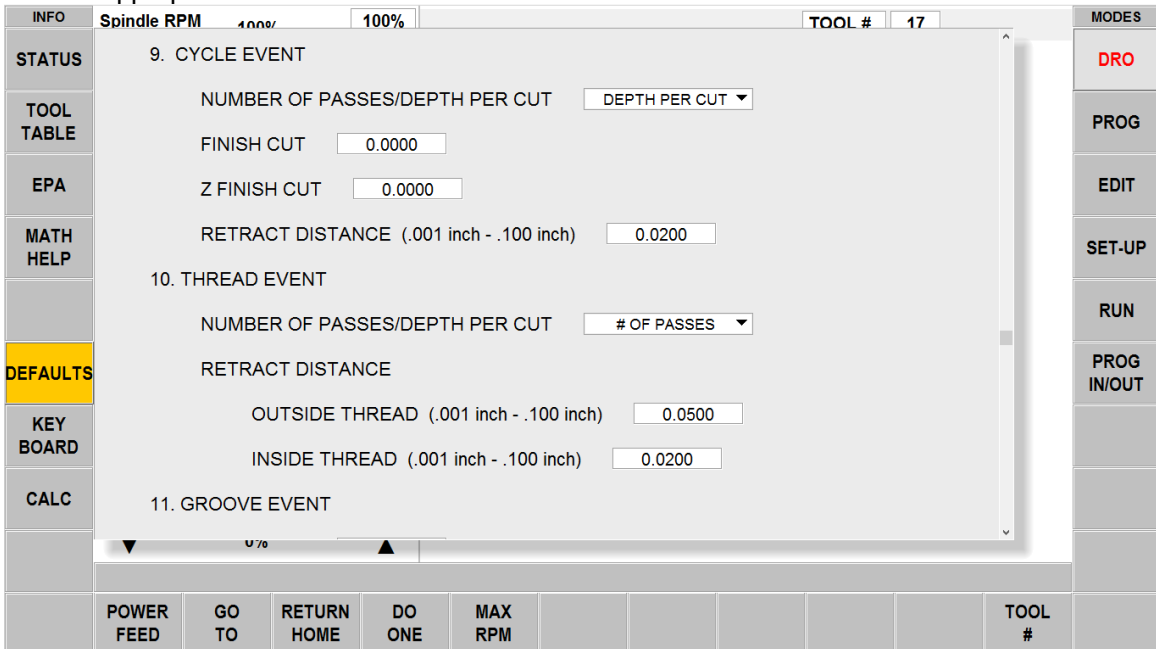
Figure 6.5 - The Defaults Flyout Window

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6.5.1   Default Entries and What They Mean

The following are the Default values that you may enter. The number corresponds to the number on the Defaults Flyout Window.

1. Feed Moves

        Feed per Min – the Feedrate in Inch per minute or mm per minute.

        Feed per Rev – the Feedrate in inch or mm per revolution of the spindle.

2. Spindle Speed Values

        RPM – Spindle speed in Revolutions per Minute

        SFM or SMM - Surface Speed in Surface Feet per Minute or Surface Meters per Minute, which is the speed of the spindle at the tip of the tool.

3. Spindle Speed Values – Drill & Tap Events

        User can set the spindle speed to RPM or SFM for just Drill and Tap events and choose a different default for all other events.

4. Spindle Direction

        Forward – regular rotation

        Reverse – in reverse

5. Peck type on Drill event

        Variable – progressively less each peck, full retract between peck

        Fixed – same depth each peck, full retract between pecks

        Chip break – retracts 0.020" between pecks

Chip break is the same as fixed but with a 0.020" retract between pecks

6. Reference Positions

        Limits – allow you to set default software limits that are relative to the X and Z Absolute values you set. The ProtoTRAK RLX will not go past these limits.

        Home position – In Run Mode, the ProtoTRAK RLX will return to these positions. These numbers are relative to the Absolute 0 set in DRO Mode.

7. Units Inch/mm

Setting the default will have the ProtoTRAK RLX operate in that unit each time it is turned on.

Note: *You may change your current operations from one unit to the other with the Status Info key.*

8. Maximum Rapid Feedrates

If you do not want the maximum of 400 inches per minute you can set the maximum here.

10. Cycle Event

        Number of passes/Depth per cut – Choose the prompt that will appear in event programming.

        Finish cut – The default profile finish cut.

        Z Finish cut – The default face finish cut.

        Z Finish Cut ON/OFF – Choose to turn on Z Finish Cut or not

        Retract Distance – The distance the tool will move at the completion of a cut and before the next move.

11. Thread Event

 Number of passes/Depth per cut – Choose the prompt that will appear in event programming.
 Retract Distance – The amount the tool will move away from the thread before making its next move.
 Outside thread
 Inside thread

12. Groove Event

 Finish cut – amount of material to leave for a final pass
 Finish cut type – continuous along the part or plunging in and out.
 Step over percentage – how much the tool moves over between plunges
 Peck type
 Variable – progressively less each peck, full retract between pecks
 Fixed – same depth each peck, full retract between pecks
 Chip break – retracts 0.020" between pecks. This is the same as fixed but with a 0.020" retract between pecks
 Different Top Conrad/Chamfer ON/OFF – Choose to have different top conrad/chamfer
 Different Bottom Conrad/Chamfer ON/OFF – Choose to have different bottom conrad/chamfer

13. Bore Event

 Finish cut – amount of material to leave for a final pass
 Retract distance – how much the tool moves away from the part before its next move.

14. Cutoff Event

 Peck type
 Variable – progressively less each peck, full retract between pecks
 Fixed – same depth each peck, full retract between pecks
 Chip break – retracts 0.020" between pecks. This is the same as fixed but with a 0.020" retract between pecks

15. Show Supported File Types Only

Can be turned ON/OFF. When turned OFF, the user can see all file types in PROG IN/OUT, select the file, and open it as any file type supported by ProtoTRAK.

6.5.2 Working with Defaults

As you are programming, press INC SET or ABS SET to accept the default value, or simply enter another value and press SET.

Whatever you choose as a default can be easily changed in defaults or overridden event by event with the prompt or in the Options Flyout window.

If you change Default value in the middle of programming an Event, the new Default value will not take effect on the Event you are on when you make the change. Instead, the new Default will take effect as of the next new event you program.

6.5.3 User Profiles

Each user can set and save their individual default profiles. Service Code 600 allows you to edit and manage User Profiles by using the ADD PROFILE, DELETE PROFILE, and RESET PROFILE buttons or selecting a user profile to change the user name.
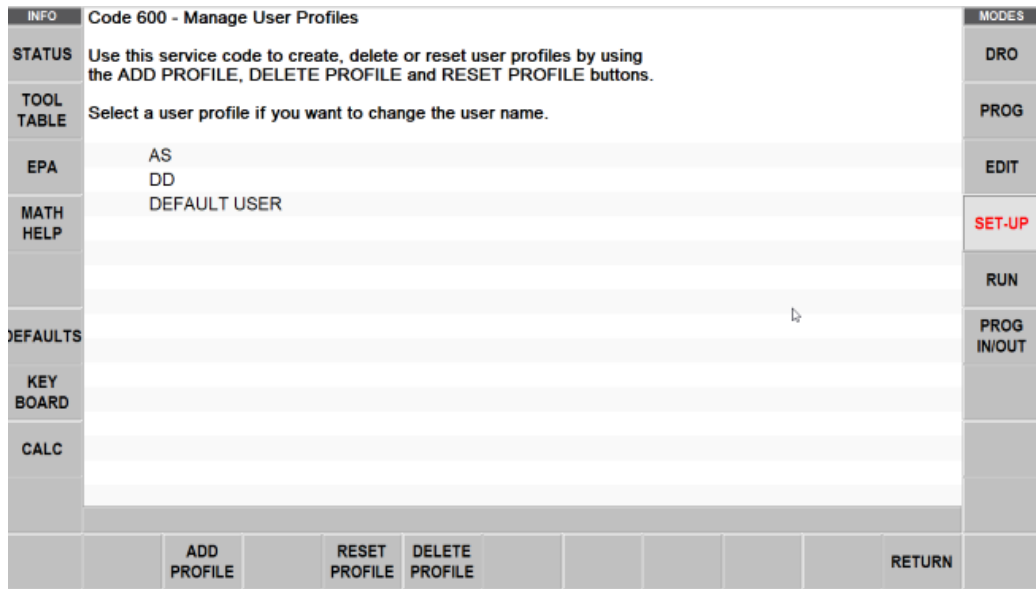
Figure 6.5.3 - Service Code 600 – Manage User Profiles Window

6.6   Options

The Options Info Key is active when you are in the Program Mode and you have choices for how you program a particular event. If it is not active, the space will be blank. Options give you additional choices for programming events and also allow you to override the default programming style. For example, if you have set the default Drilling to Variable Peck and you wish to change that to Fixed for this particular event, you can quickly do that in Options.
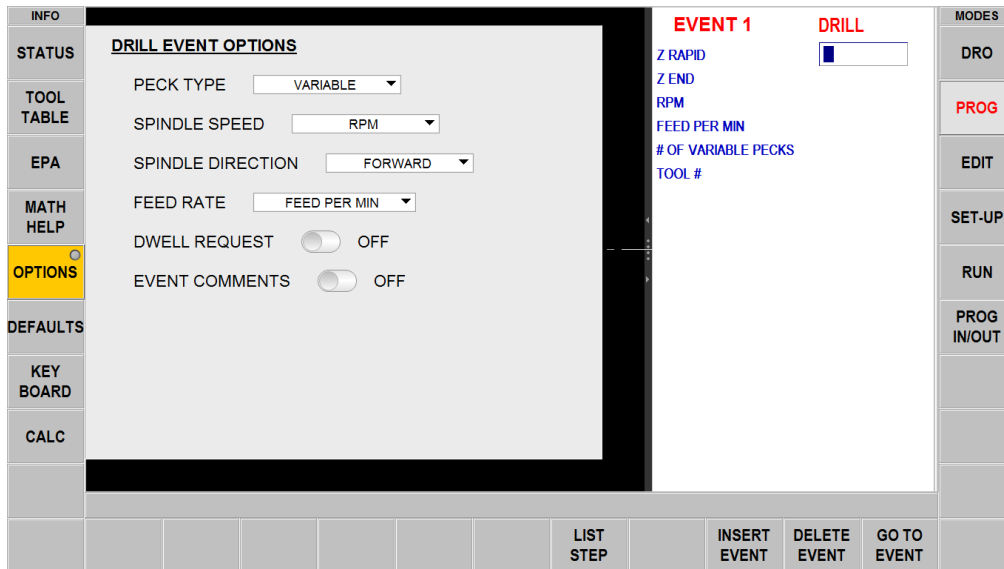
Figure 6.6a - Options enables you to override the defaults on the fly

You set your overall programming style in the Defaults Info Key (Section 6.5 above), but change them on the fly in Options if you wish. If you find yourself frequently changing a default value, we recommend that you change the value in the Defaults Info Key.

Programming Variables Found in Options

The options key is active when there are additional choices for what is active in the window you are working in. In programming, the Options that appear when you tap the Options Info key depend on the event type.

Spindle Direction

Forward – regular rotation
Reverse – in reverse

Spindle Speed

RPM – spindle speed for the event in Revolutions per Minute
Surface Speed – Spindle Speed for the event in Surface Feet per Minute, which is the speed of spindle rotation relative to the tip of the tool

Event Comments

Turn this on in order to get the prompt to enter comments you wish to appear during program Run. Event Comments are part of the Advanced Features Option.

Peck Type

Override the default peck for the Drill event:
- Variable – progressively less each peck, full retract between pecks
- Fixed – same depth each peck, full retract between pecks
- Chip break – retracts 0.020" between pecks

Chip break is the same as fixed but with a 0.020 retract between pecks

Feed Rate

Overrides the default feed rate setting for the event:
Feed per minute in inches or mm per minute
Feed per revolution.

Dwell Request

Add a Dwell Time prompt to the Drill events measured in seconds.

Step Over Percentage

Overrides the default step over percentage for the event.

Retract Distance

Defines the distance the tool moves away from the workpiece before its next programmed or rapid move.

Conrad/Chamfer

Selects whether Conrad or Chamfer are programmed for connective moves. As you are programming, you may change the default by pressing ABS SET for Chamfer and INC SET for Conrad after you input the value.

Different Size Conrads/Chamfers at Top of Groove
When turned on give option to set different values: Conrad/Chamfer Top Z1 and Conrad/Chamfer Top Z4

Different Size Conrads/Chamfers at Bottom of Groove
When turned on give option to set different values: Conrad/Chamfer Bottom Z2 and Conrad/Chamfer Bottom Z3

Finish Cut Type
Choose continuous move or Plunge side cut only

Number of Passes/Depth per Cut
Selects whether the automatic toolpath calculated by the Cycle events are defined as number of passes or depth per each pass.

Z Finish Cut
Turn this on in order to get a prompt for a Z Finish cut amount in the cycle event.

Left Hand Tap
When selected, the user must turn the spindle on in reverse to perform the tap. Failure to do so, will result in an error.

Thread Type
Select between Standard, Custom Thread, NPT, and PSPT Taper Pipe,. Custom Thread enables you to define the major and minor diameters independently. See Figure below.

EVENT 1	THREAD		EVENT 1	CUSTOM THRD
X BEGIN	▮		X MAJOR BEGIN	▮
Z BEGIN			Z BEGIN	
X END			X MINOR BEGIN	
Z END			X MAJOR END	
PITCH			Z END	
# OF PASSES			PITCH	
# OF SPRING PASSES			# OF PASSES	
PLUNGE ANGLE			# OF SPRING PASSES	
SIDE	OUTSIDE ▼		PLUNGE ANGLE	
# OF STARTS			SIDE	OUTSIDE ▼
RPM			# OF STARTS	
TOOL #			RPM	
			TOOL #	
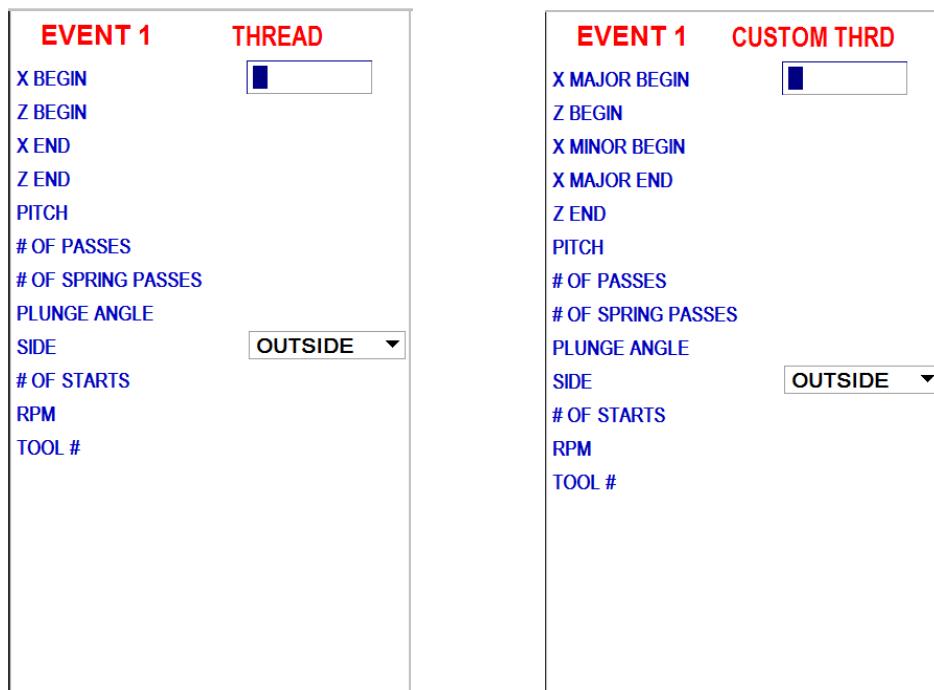
Figure 6.6b - Standard versus Custom Thread

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6.7 Keyboard

Tapping the KEYBOARD Info key will bring up the alphanumeric keyboard. Rather than being a Fly out window, the keyboard is a separate window that can be dragged around the screen for convenience. After the keyboard is opened, tap the field in which you want to type text or numbers. CAPS LOCK button key option is available. What you type must be set into memory using the Enter key (which is taken as an Abs Set entry). You may use the Abs Set and Inc Set keys on the keyboard as well as the hard keys.

Move the Keyboard by touching and holding the translucent bar at the top and dragging it to the desired position. Close the keyboard by taping the X on the upper right corner or by pressing the KEYBOARD info key again.

You can expand the keyboard to show numbers and other symbols by pressing the 123 button.

6.8 Calculator

The CALC info key will open a new window with a calculator. Rather than being a Fly out window, the calculator is a separate window that can be moved around the screen. Open the scientific calculator by clicking on the CALC header bar. When a numeric input is required while programming, the Inc Set and Abs Set will set the calculated value into the field that is being programmed.

Move the Calculator by touching and holding the translucent bar at the top and dragging it to the desired position. Close the Calculator by tapping the X on the upper right corner or by pressing the CALC INFO key again.

You can expand the calculator by double tapping the top white bar. It will not show additional functions.

Figure 6.8 - Calculator Window

7.0   DRO Mode

The ProtoTRAK RLX CNC operates in DRO Mode as a sophisticated 2-axis digital readout with jog and power feed capability. Most DRO operations, except power feed and Return Home, may be done with the sliding door open.

7.1   Status Bar in DRO Mode

The status bar in DRO mode displays 5 field boxes as shown in the figure below.

	TOOL #	1	TUR LOC	1

Figure 7.1 - Status Bar in DRO Mode

Status Bar Box #1: Currently not being used.
Status Bar Box #2: Displays tool # label
Status Bar Box #3: Displays information about the tool facing the spindle. This information will change based on manual tool and library tool.
Status Bar Box #4: TUR LOC label. Only displayed when you have Turret in the machine else this field is empty
Status Bar Box #5: Displays information on the turret location of the tool. This field will be empty if there is no turret.

7.2   DRO Functions

Once you press the DRO Mode key, you will encounter the following screen:
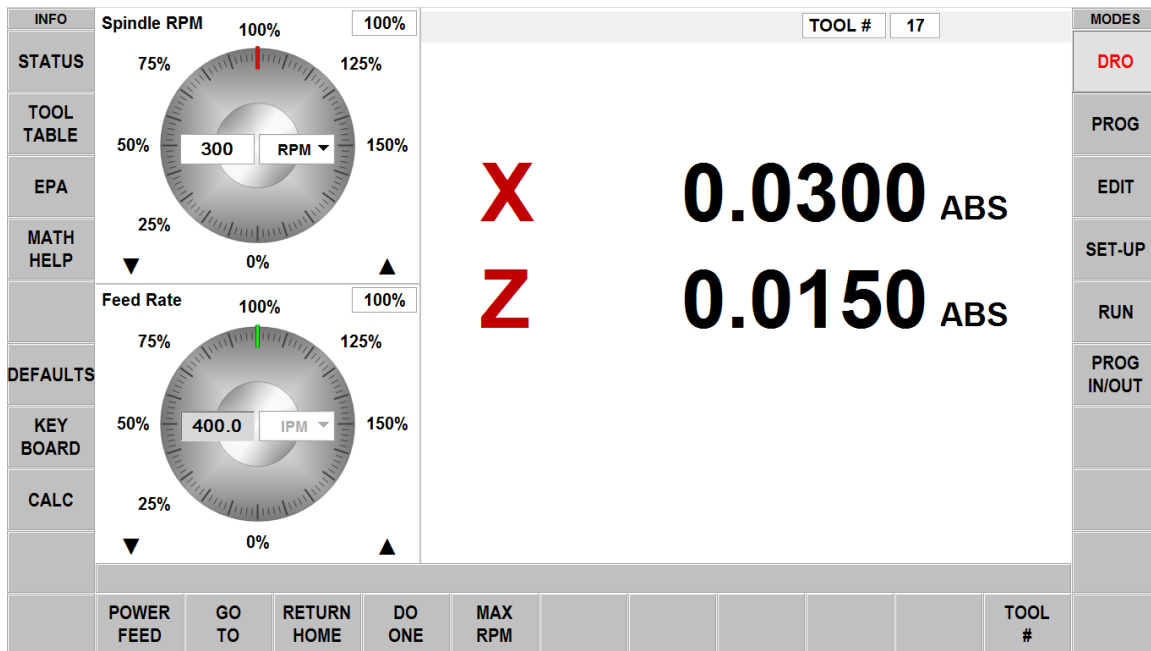
Figure 7.2 - The DRO screen

Inch to MM

To convert Inch to MM or MM to Inch tap the Status Info key and in Units at Start Up select Inch or MM. When you tap the Status key again the dimensions will be in the units you selected.

Selecting Dimension Reference

You may display your X and Z dimensions in Incremental or Absolute for each axis. You may have a mixture of Absolute and incrementally dimensioned data.

To select between Absolute or Incremental Dimensions tap the ABS/INC label. The label and dimensions will toggle between Absolute and Incremental.

Resetting Dimensions
To reset, or zero out, Incremental Dimensions press the X or Z hardkey and then the INC SET hardkey. The incremental dimension for that axis will be set to 0 (zero). To see the value, you must tap the ABS letters to switch the DRO to read INC. Tap again to get back to ABS. Note, whenever you change your Absolute number, whether you reset or preset, you will reset (zero out) the Incremental Dimension.

To reset, or zero out, Absolute Dimensions press the X or Z hardkey and then the ABS SET hardkey. The Absolute dimension for that axis will be set to 0 (zero). Please note that resetting the ABS Dimension will also reset the Incremental Dimension for that axis.

Presetting Dimensions
You can also enter preset dimensions in order to establish a reference from the current X and Z position to some other point.

To preset an Incremental Dimension, press the X or Z hardkey to select the axis. Enter the dimensional value and press INC SET. The incremental preset will have no effect on the Absolute dimension.

To preset an Absolute Dimension, press the X or Z hardkey to select the axis. Enter the dimensional value and press ABS SET. Presetting an Absolute dimension will also reset (zero out) the Incremental dimension for that axis.

7.3   Apply Tool Library Data to DRO Operations

The ProtoTRAK RLX enables you to apply the tool offsets from your tool Library while you are working manually. This will save you from touching off tools that have already been set.

Note: You may access the Tool Library at any time by pressing the Tool Table info key.

1. Tap the TOOL # soft key.
2. Enter the desired Library number. The tool library number must be between 101 and 199.
3. The X and Z dimensions will reflect the new Absolute dimension of the tool you entered. The Tool # at the top of the screen will display the tool number entered.
4. If you enter a tool # that doesn't exist in the Tool Library, no offset will be applied.

7.4 Spindle RPM
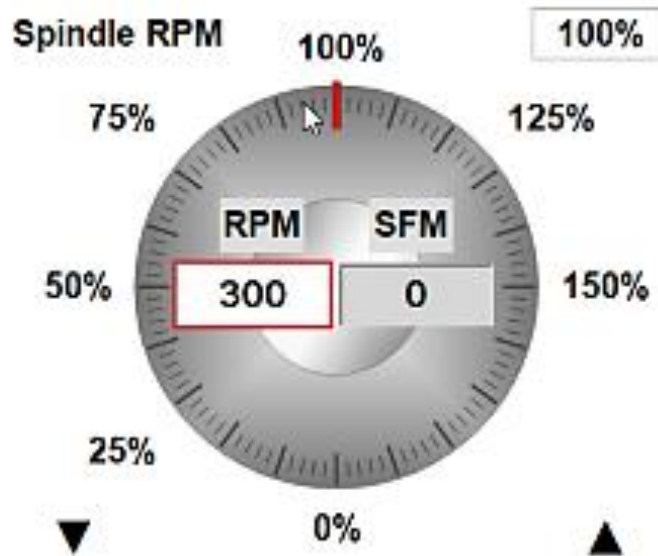
Figure 7.4 - The Spindle Speed control in the DRO Mode.

7.4.1 Setting Spindle Speed and Values

To Set Spindle Speed tap the Spindle Speed box, enter the value up to the maximum and then press SET. The maximum RPM is set at the factory for the maximum rating of your machine model. To change the Values between RPM and SFM at Start up, tap Defaults and then Spindle Speed values.

7.4.2 Overriding Spindle Speed

You may override the set Spindle Speed from 0% of set up to 150%.

To override do one of the following:
- For fine adjustment, tap the up or down Fine Override arrow keys
- Tap one of the set % values around the graphical dial, for example, 75%.
- Drag your finger in a circular motion along the diameter of the graphical dial as if you were physically turning it. If you move your finger out to a larger radius, you will notice that this still allows adjustment of the feedrate. It gives the user a finer control of the feedrate

Note: *As you "turn" the dial with your finger, the dial will "stick" to 100%. To resume turning, briefly lift your finger and put it back down. We put in this slight sticking at 100% so that you can move your attention away from the screen while ramping the override up or down.*

As you apply overrides, the Spindle Speed and the Override % will update to the new values.

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7.5   Feedrates in the DRO Mode

You can set and override in order to do Power Feed, Go To or one of the other powered operations in DRO Mode.
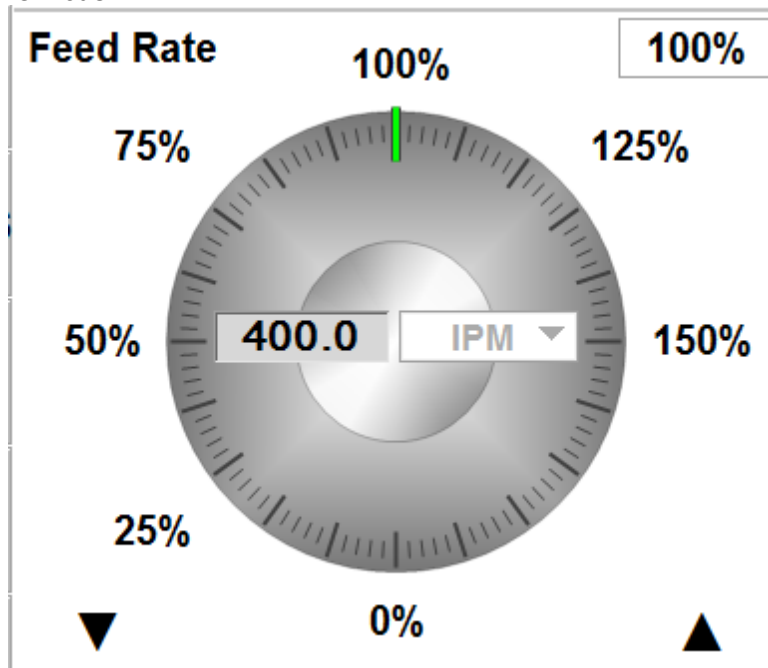
Figure 7.5 - The Feedrate control in the DRO Mode

7.5.1   Setting Feedrate and Units

To Set Feedrate in powerfeed tap the Feedrate box, enter the value and the press SET.

To change the Values between IPM (Inch or mm per minute) and IPR (Inch or mm per revolution) tap the drop down feedrate IPM box above and change to IPR.

7.5.2   Overriding Feedrates

You may override the set Spindle Speed from 0% of set up to 150%.

To override do one of the following:
- For fine adjustment, tap the up or down Fine Override arrow keys
- Tap one of the set % values around the graphical dial, for example, 75%.
- Drag your finger in a circular motion along the diameter of the graphical dial as if you were physically turning it.

Note: *If you lift your finger while turning, the dial will "stick" to 100%. To resume turning, lift your finger again first then it will respond when being dragged. We put in this slight sticking so that you can move your attention away from the screen while ramping the override up or down.*

As you apply overrides, the Spindle Speed and the Override % will update to the new values.

7.6   Power Feed

The servomotors can be used as a power feed for the cross slide and carriage, or both simultaneously.

a. Press the POWER FEED soft key.
b. A message box will appear that shows the power feed dimensions. All power feed moves are entered as incremental moves from the current position to the next position.
c. The default Feed Rate is 10 IPM. To change this value, enter a new number in the feedrate box before selecting the axis to move. While the machine is moving use the Feed Override to adjust it. You can switch to IPR by tapping the feedrate drop down box.
d. Enter a position by pressing the axis key, the distance to go and the +/- key (if needed). Input the entry by pressing INC SET. For example, if you wanted to make a power feed move of 2.00" of the carriage in the negative direction, you would enter: Z, 2, +/-, INC SET.
e. Do this for each axis you want to feed simultaneously. The message box will display what you've entered.
f. Run the machine with the spindle off, should be set to No (Service code 311)
g. Press STOP to halt power feed. Press GO to resume.
h. Press RETURN soft key to return to manual DRO operation.

7.7   Go To

The Go To function in the DRO mode allows you to set an Absolute dimension in X or Z at which you want the machine to stop moving when you are cranking manually. For example, if you wanted to machine manually to 2.000" Absolute, you would input: Go To, X, 2, ABS SET. While the Go To window is displayed, the ProtoTRAK RLX will not let you pass that 2.000" dimension you set.

a. Press the GO TO soft key.
b. Enter the axis, X or Z or both in turn.
c. Input the dimension(s).
d. Press Abs Set.
e. Crank the handwheel. Motion will stop at the entered dimension even if you continue to crank the handwheel. The jogstick will also work for this feature.

7.8   Return to Home

At any time during manual DRO operation you may automatically move the cross slide and carriage to the Home position you defined in the Set-Up Mode. When you tap the Return Home softkey, the message window will read "Ready to Begin: Press Go when Ready".

Make sure your tool is clear and press the GO key. The door must be closed. The servos will turn on, move the carriage and cross slide to the Home position (relative to the active tool) then turn off.

7.9   Do One

The purpose of the Do One Events is to allow you to make simple chamfer, taper, radius, and fillet moves, one at a time, within the DRO Mode and without the need for creating an entire program.

7.9.1   Taper Do One

When you select the TAPER soft key, the Data Input Line will prompt you to enter a taper angle.

The system defaults to a positive 45-degree taper angle for a convenient chamfer. If this is the angle you wish, acknowledge so by pressing SET. You may specify any other angle by inputting the number and pressing SET. The angle is in reference to the part centerline.

Turning the Z handwheel counterclockwise, or the X clockwise, will move the tool from Point A (where you are), towards or past Point B as long as you turn the handwheel (see below).

POSITIVE ANGLE   NEGATIVE ANGLE
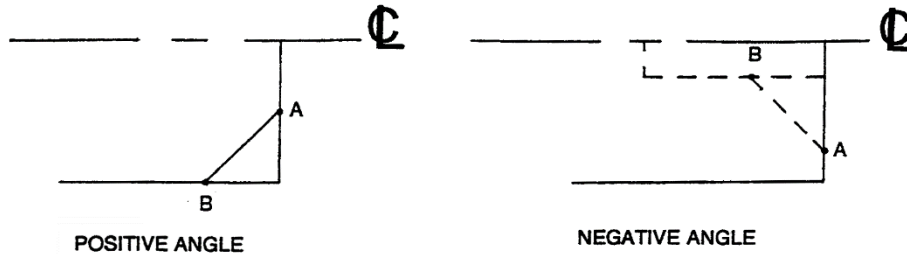
i00223

Press **RETURN** to revert back to normal DRO operation.

7.9.2   Radius Do One

When you select the **RADIUS** soft key, the Data Input Line will prompt you to enter a radius value.

Input and **SET** the radius you want through the keyboard. The radius may be positive or negative.

Turning the Z handwheel counterclockwise, or the X clockwise will move the tool from Point A (where you are), towards Point B (see below). The tool will automatically stop when you reach B.

POSITIVE RADIUS   NEGATIVE RADIUS
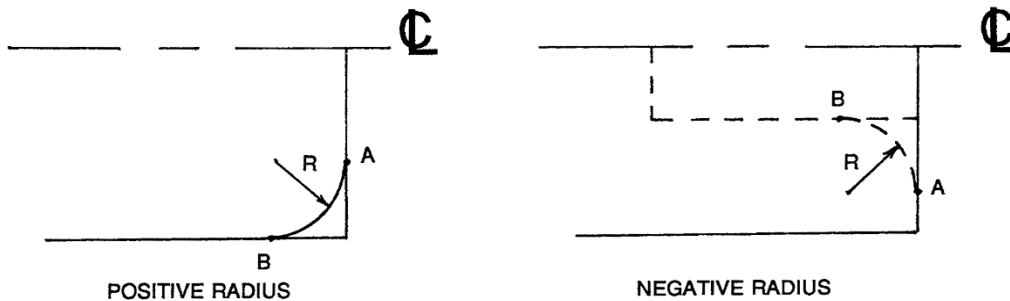
Press **RETURN** to revert back to normal DRO operation.   i00224

7.9.3 Fillet Do One

When you select the **FILLET** soft key, the Data Input Line will prompt you to enter a radius value.

Input and **SET** the fillet radius you want through the keyboard. The radius may be positive or negative.

Turning the Z handwheel counterclockwise, or the X clockwise will move the tool from Point A (where you are), towards Point B (see below). The tool will automatically stop when you reach B.

POSITIVE RADIUS   NEGATIVE RADIUS

Press **RETURN** to revert back to normal DRO operation.

7.9.4 Thread Repair

Note: *The Thread Repair feature is only available when the user has Advanced Options turned on.*

Before starting, we are assuming that you have your threading tool already setup and touched off properly.

Go into **DRO** -> **DO ONE** -> **THREAD REPAIR**.

Note that the options key is active for changing the machining parameters.

Part of the process is to turn the spindle on for a few seconds. This is to orient the spindle encoder to prevent the spindle from reversing direction when it comes to a stop.

It is important to take note when turning the spindle off whether or not the spindle backtracks after it comes to a stop. This will unfortunately throw the whole scheme off. If this occurs, just turn the spindle manually in the forward direction for at least one revolution.

After this step, DO NOT MOVE THE SPINDLE until you turn it on to run the thread.

When prompted on the screen, touch off your tool insert within a known good thread as close as you can (as shown below).
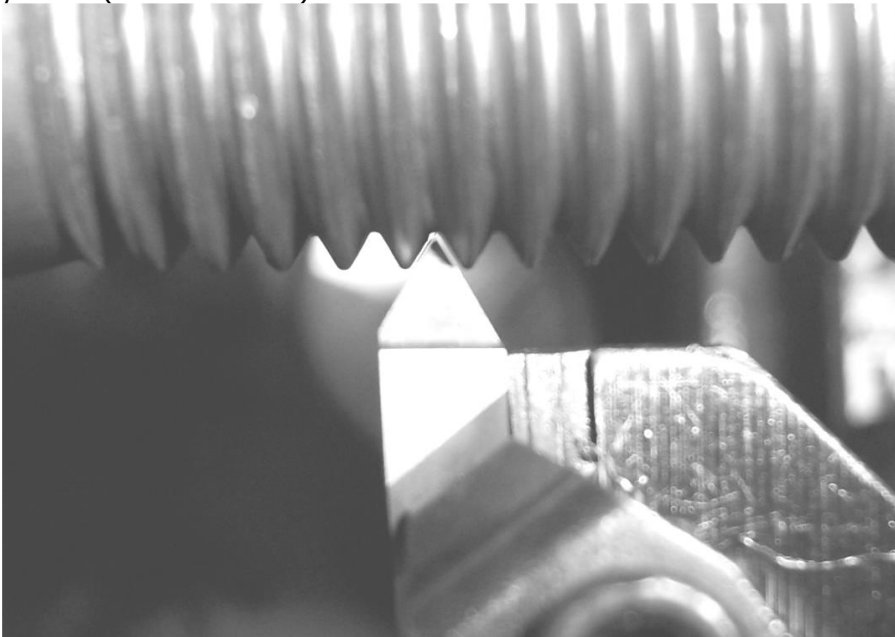
i01396

Note: *The more precisely you position the tool, the better your results will be. The Z axis position is the most crucial.*

Once you have the tool in a good spot, press the **ABS SET** button to capture the position, back the tool away from your part using the handwheels or jogstick, and then press **NEXT**. Where you stop the tool will be where the tool starts the program.

Start the spindle and Press **GO** to start the thread repair cycle.

You may run the thread repair routine as many times as you need.

7.10 Max RPM – Limiting Spindle Speed

The ProtoTRAK allows you to limit the maximum spindle speed. This opportunity appears at start-up of the ProtoTRAK RLX and in the DRO Mode.

When a maximum spindle speed is set it will limit the RPM of the spindle to this value no matter what speed is programmed. Programmed speeds and overrides will be ignored.

WARNING!
Set a maximum RPM that will not exceed maximum RPM rating of your chuck.

7.11 Tool

The ProtoTRAK RLX CNC allows you to use the offsets for tools in your Tool Table in the DRO Mode. To change tools, press the TOOL # soft key and enter the tool number when prompted by the Data Input Line.

If you do not wish to use the tools in the Tool Table, simply ignore the Tool # feature.

Tool Tip Radius Compensation in DRO Mode
As mentioned in Section 5.4, the tool tip radius is not important when you are turning along the side of a part (moving only Z), or along the face (moving only X). And in manual operation in the DRO Mode, these are the only motions that you can do. It's just not possible to move X and Z simultaneously with both hands along a precisely coordinated path. Therefore, even if your tool has a radius, the DRO will display point X0, Z0 in the figure in Section 5.4. In other words, it will display the X and Z contact line positions, which is where the tool will cut when you move either of the handwheels.

8.0 Program Mode Part 1: Getting Started and Some General Info

8.1 Programming Overview

The ProtoTRAK RLX CNC makes programming easy by allowing you to program the actual part geometry as defined by the print.

The basic strategy is to first fill in the initial program information in the Program Header screen and then program the features of the part by selecting the soft key event types (geometry) and then fill in the prompts one-by-one.

Enter the Program Mode by tapping the PROG Mode key. If you exit the Program Mode, the same screen displayed when you exit will be there when you return.

The ProtoTRAK RLX CNC will allow only one program in current memory. To write a new program, you must first erase the one in current memory (you may want to first store the program for use in the future). If there is already a program in current memory, entering the Program mode will allow you to edit or add to that program.

To open a previously stored program, see Program In/out mode.

8.2 Info Keys

The ProtoTRAK RLX gives you extraordinary power and control over how your part is machined. As you are programming, you may use the Info Keys at any time:

Status – Quick check of Program Name and other information.
Tool Table – Check tool reference information or set up your tools *as you program*.
EPA – Quick reference information on relevant topics to get you past some uncertainty about how to do something.
Math Help – Convenient routines to help you calculate missing print data. Answers may be loaded directly into the program event.
Defaults – Change the programming style that you have defined on the fly to fit the current work. Any changes to Defaults will take place for the next event you select.
Options – Override Defaults or initiate additional capability that you may need on a particular event. If you find yourself frequently overriding a Default, you may want to consider changing the Default itself.
Keyboard – Alphanumeric text and symbols for you to use to name the program.
Calculator – Basic calculator for quick math. Answers may be directly loaded into the event.

When you are finished with the Info Key, simply tap the key again to put the window away. Close the Keyboard and Calculator by tapping the X on the upper right corner of their window.

8.3 Program Header (Event 0) Screen

The first screen you see when you enter the Program Mode is the Program Header Screen.

The program name and general programming options you choose in the Program Header Screen will be summarized in the program as "Event 0".
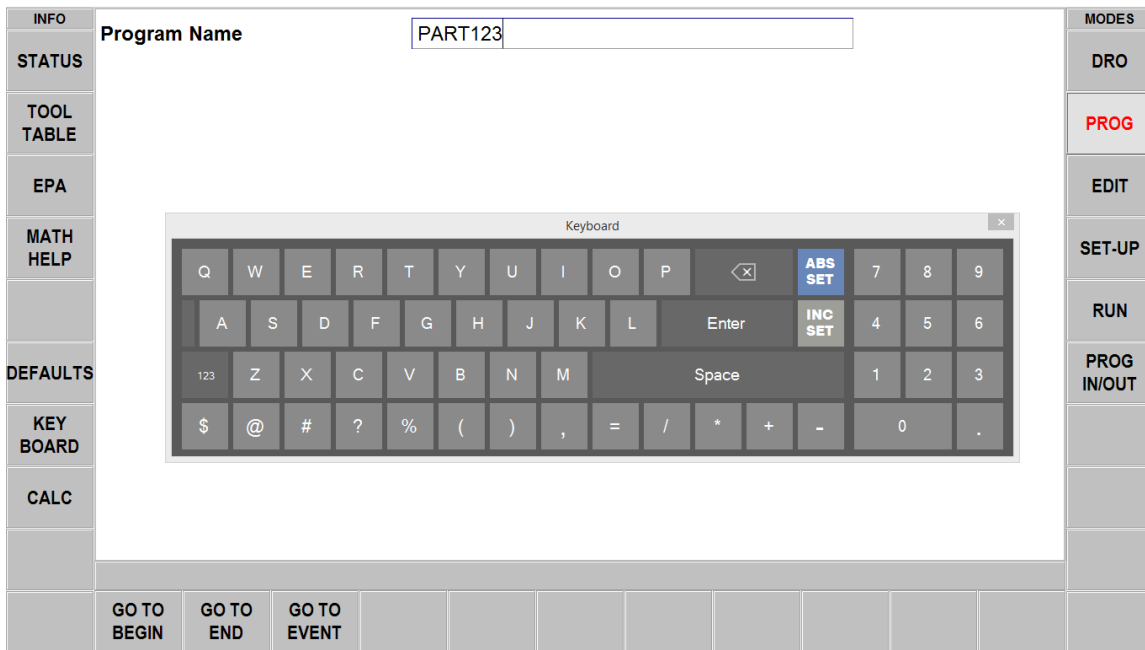
Figure 8.3 - The Program Header screen (event 0) with the Keybo0ard open for entering the part number.

Entering the Program Name
Letters, numbers and special characters are entered using the keyboard or the Data Input hard keys. Press either SET after entering. Program names may be any length, but up to 40 characters may be displayed in the field of the program name and up to 35 characters will be displayed in the Program Name field in the Status screen.

Go to Begin: Takes you from the Header Screen to the first event of the program. You may also simply swipe to the left.

Go to End: Takes you from the Header Screen to the last event of the program.

Go to Event: Will prompt you to enter an event number, then takes you to that event when you press SET.

8.4   Starting to Program
To start programming, select Go To Begin or simply swipe the screen to from right to left to launch Event 1. At any time you may move between the header and between events by swiping.
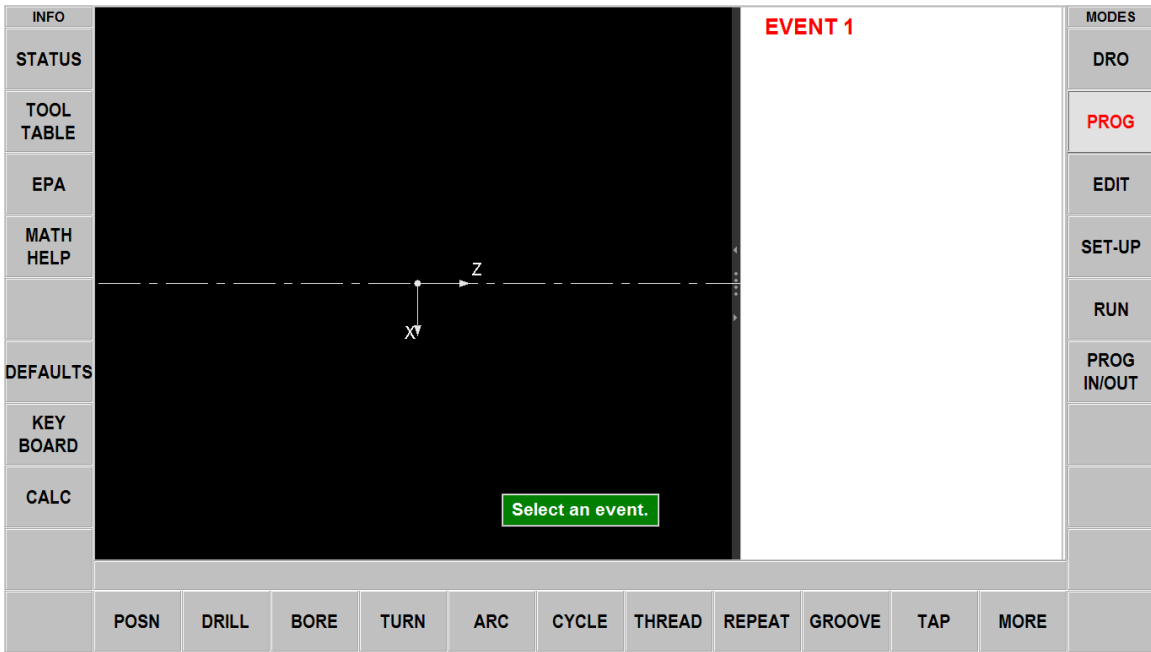
When an event is selected, all the prompts that need to be input will be shown on the right side of the screen. The first prompt will be highlighted. Input the dimension or data requested and press INC SET or ABS SET. For X and Z dimension data it is very important to properly select INC SET or ABS SET. For all other data either SET will do.

When all data for an event has been entered, the entire event will be shifted to the left side of the screen if shown and the message box will ask you to select the next event.

8.5   Part Drawing while Programming

As you program, your inputs will be used to make a drawing of the part to show you what you've programmed so far. You may display one or two events by swiping the right edge of the border of the drawing and the drawing will automatically resize to the amount of screen left to it.

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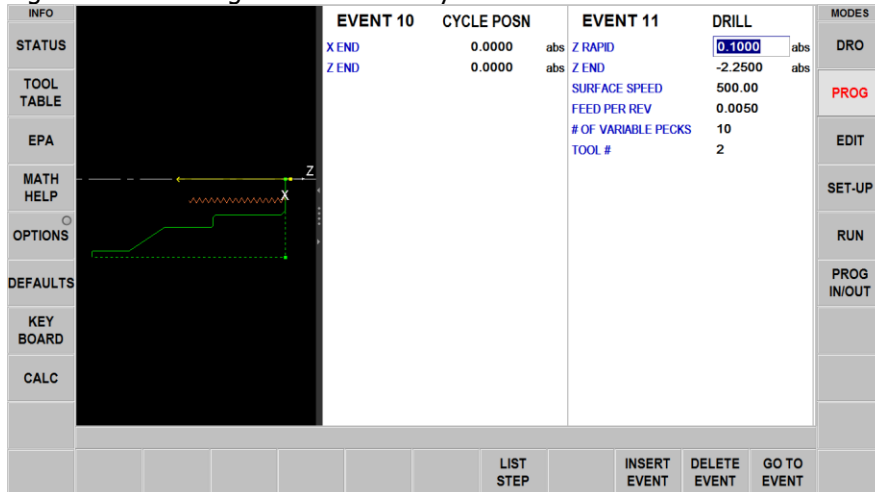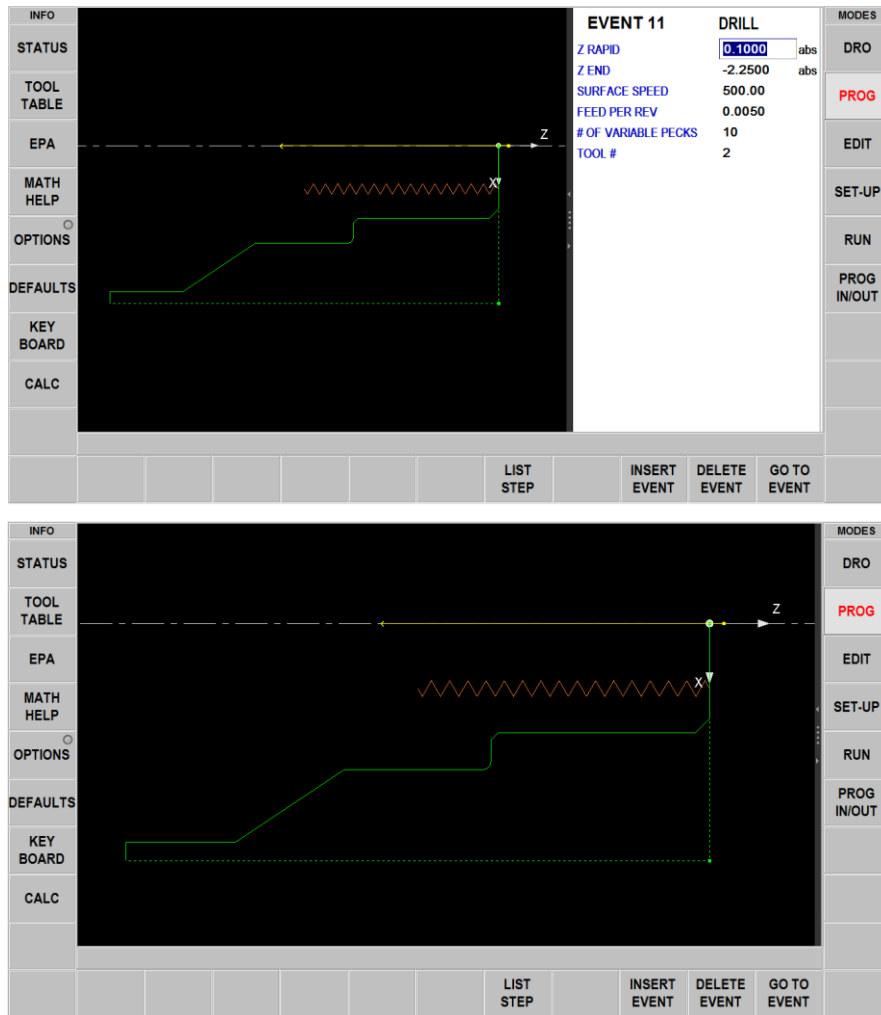
Figure 8.5 - Swipe the screen to select between views of the events and drawing

8.6   Soft Keys within the Event

Program Events will be described in the next section.

Once an event geometry is selected, the following Soft Keys will appear.

Figure 8.6 - Soft Keys within an event.

LIST STEP: launches a process to show the part geometry as related to the Event type and number.

INSERT EVENT: use this to insert a new event into the program. This new event will take the place of the one that was on the right side of the screen when you pressed the **INSERT EVENT** key. That previous event, and all the events that follow, increase their event number by one. For example, if you started with a program of four events, if you were to press the INSERT EVENT key while Event 3 was on the right side of the screen, the previous Event 3 would become Event

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4 and the previous Event 4 would become Event 5. If you insert a Subroutine event, the event numbers will increase by one as when you insert another kind of event.

DELETE EVENT: Deletes the event on the right side of the screen.

GO TO EVENT: Jumps you to the event you input.

When the LIST STEP key is selected, a list of the Event numbers and types appear on the right side of the screen and additional Soft Keys appear at the bottom:

STEP FWD: Each key press moves you up in event number. As this occurs, the drawing will highlight the geometry in the event by turning to purple and the event number will appear in the upper left of the drawing screen.

STEP BACK: Moves backward through the drawing.

START AT EVENT: Jumps you to the Event number in the drawing that you input.

RETURN: Takes you back to the previous soft key selections and screen view.

8.7   Editing Data while Programming

In addition to the List Step view, The ProtoTRAK RLX CNC allows you to move easily though your program by swiping the events back and forth. Previously programmed prompts and events may be easily edited. With your event on the right side of the screen, tap the data that you wish to change or replace. Simply enter the desired data and press INC SET or ABS SET. The ProtoTRAK RLX will adjust the program and update the drawing.

8.8   Finish Cuts

When applicable for the event geometry, a Finish Cut prompt will appear. If a value is entered, the prompts for Finish Feedrate, Finish RPM and Finish Tool # will remain. If a 0 is entered, indicating no finish cut, those prompts will disappear.

When a finish cut is programmed, the ProtoTRAK RLX will first rough out the material, leaving the amount of material specified in the Finish Cut prompt. This material will be machined at the programmed Finish Feedrate and RPM and with the programmed Finish tool.

9.0   Program Mode Part 2: Program Events

Events are fully defined pieces of geometry. By programming events, you tell the ProtoTRAK RLX what geometry you want to end up with; it figures the tool path for you.

9.1   Position Events

This event type positions the tool at a specified position. The positioning is always at rapid speed (modified by feedrate override) and in the most direct path possible from the previous location. Position is most often used to move the tool away from the part so that when it rapids to a next non-connective event or home, it will not crash into the workpiece.

Prompts for the Position event:

X END The X end position value

Z END The Z end position value

CONTINUE No - Moves to above X, Z values and stops; Yes - Moves to above X, Z values and then continues to the next event

SURFACE SPEED Can be changed to RPM through Options Flyout Window

TOOL # Enter your tool # from 1 – 99.

9.2   DRILL Events

This event allows you to drill a hole at the centerline of the part (X = 0 ABS) using the carriage and cross slide.

The event tool motion will be to rapid in a straight line to X = 0 ABS and the programmed Z RAPID position, then feed the programmed number of pecks to Z END, then rapid out to Z RAPID. The drill will also come out to Z Rapid after each peck (except for Chip Break).

Prompts for the Drill Event:

Z RAPID The Z rapid & retract position value

Z END The Z end (depth) position value

SURFACE SPEED Can be changed to RPM through Options Flyout Window

FEED PER REV Can be changed to IPM through Options Flyout Window

 # OF VARIABLE PECKS Can change peck type through Options Flyout Window

TOOL # Enter your tool # from 1 - 99

9.3   Bore Events

This event allows you to bore a part using a standard boring bar.

The event tool motion will be to rapid in a straight line to the programmed X dimension, the programmed Z RAPID position, then feed to Z FINAL, then feed .01 inch towards the centerline in X to clear the tool from the part, then rapid out to Z RAPID. The bore retract distance is a DEFAULT and OPTION setting.

Prompts for the Bore Event:

X Bore diameter

Z RAPID The Z rapid & retract value

Z END The Z end (depth) value

FIN CUT Finish cut value

SURFACE SPEED Rough cut can be changed to RPM through Options Flyout Window

FIN SURFACE SPEED Finish cut can be changed to RPM through Options Flyout Window

Z FEED PER REV Can be changed to IPM through Options Flyout Window

FIN FEED PER REV Can be changed to IPM through Options Flyout Window

TOOL # Roughing cut tool # from 1 - 99

FIN TOOL # Finish cut tool # from 1 - 99

9.4 Turn Events

This event allows you to turn in a straight line from any one XZ point to another, including an inside or outside taper. This event should be used for facing since this is also a straight line move from one XZ point to another. The event may be programmed with a CHAMFER or CONRAD if it is connective with the next event.

The event tool motion will be to rapid to the X BEGIN, Z BEGIN position, then feed to X END, Z END with consideration for CHAMFER or CONRAD if one is programmed.

Prompts for the Turn Event:

X BEGIN The X begin position value

Z BEGIN The Z begin position value

X END The X end position value

Z END The Z end position value

CHAMFER Input the value, then press ABS SET for Chamfer and INC SET for Conrad

TOOL OFFSET 0 = none, 1 = cutter comp right, 2 = cutter comp left

SURFACE SPEED Can be changed to IPM through Options Flyout Window

FEED PER REV Can be changed to IPM through Options Flyout Window

TOOL # Finish cut tool # from 1 - 99

9.5 ARC Events

This event allows you to turn with circular contouring any arc (fraction of a circle).

The event tool motion will be to rapid to the X Begin, Z Begin position, then feed to X End, Z End in a circular path.

Prompts for the Arc Event:

X BEGIN The X begin position value

Z BEGIN The Z begin position value

X END The X end position value

Z END The Z end position value

RADIUS Radial value of the arc

CHAMFER Input the value, then press ABS SET for Chamfer and INC SET for Conrad

DIRECTION Direction of arc, 1 = clockwise, 2 = counter clockwise

**TOOL OFFSET** 0 = none, 1 = cutter comp right, 2 = cutter comp left

SURFACE SPEED Can be changed to IPM through Options Flyout Window

FEED PER REV Can be changed to IPM through Options Flyout Window

TOOL # Finish cut tool # from 1 - 99

9.6   Cycle Events

The Cycle Event is not a single event, but rather a group of Turn and Arc events. It allows you to program complex shapes (including the shape of the starting material) that require several roughing passes without the need to program each tool motion step.
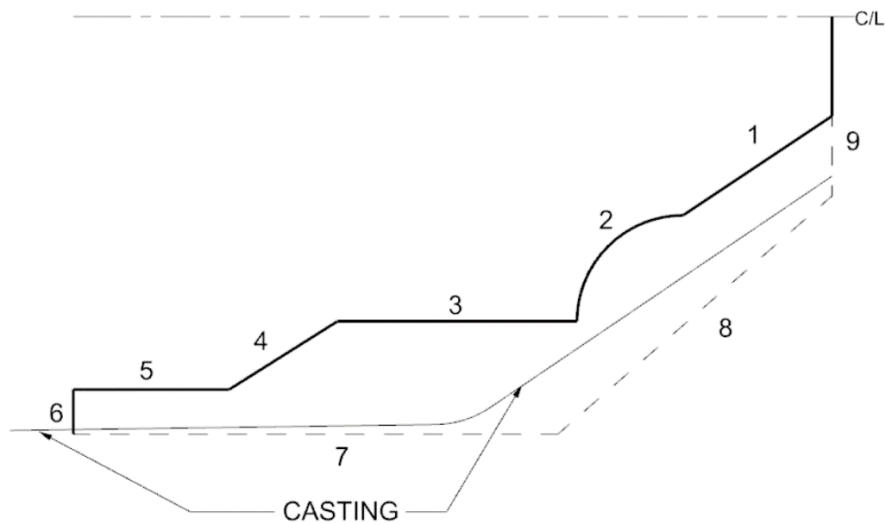
i00226

Consider the part above that is being machined from a rough casting. Lines 1-6 represent the finished part, and lines 7-9 represent the casting, or something a little bigger than the casting.

You program this part by first defining the finished part, lines 1 through 6 as Cycle Turns and Cycle Arcs. Then you define the casting, lines 7 through 9, by programming Cycle Position events for the line end points. The Cycle must be closed. In this drawing, this means that line 9 must end where line 1 begins.

In the Cycle header screen, you program how you want the entire sequence to be machined. One of the choices you make is whether you want the roughing passes to be in the X axis or the Z axis. For that reason, it is necessary that all features of the part must be entirely visible either in the X axis or Z axis. The following examples illustrate this. In order to understand the rule, forget for a moment any consideration of what kind of tool you would have to use to cut the part.
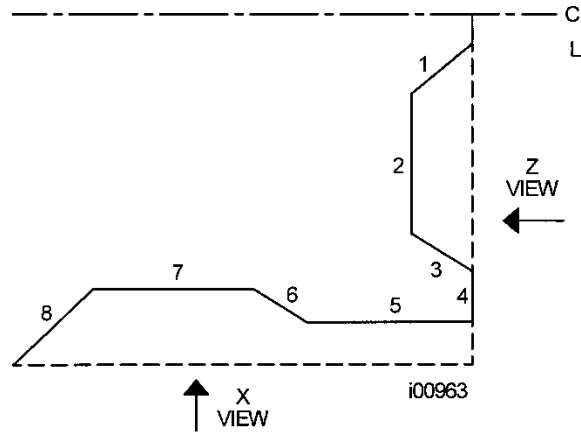
In the drawing above, not all of the features of the part are visible in either the X or Z axis. Looking at the part in the X view, line segments 1 through 3 are not visible. Looking at the part from the Z view, line segments 6, 7 and part of 8 are not visible. Since the part must be completely visible in one view or the other, this part cannot be machined with one cycle. The Z view may also be from the other direction, looking from the chuck. And the X view can also be from looking out from the centerline for ID turning.

The solution to this part is simple. Divide the part into two Cycles, one cycle to machine segments 1 through 4 and one to machine segments 5 through 8.

The tool motion in Cycle depends on whether you select to rough the material with successive turning passes (Z motion with constant X), or facing passes (X motion with constant Z). If you choose turning (approach = Z), the tool will rapid to a point at the programmed material. Then the tool will feed at a constant X position across until it nears one of the part lines leaving enough material for the programmed finish cut. This is repeated until the part is completely roughed. Then the tool will feed along the part lines standing off an amount equal to the finish cut. Then the carriage will move to home and call out the finish tool. This tool will rapid to the beginning of the first line and turn the part to its final dimension.

There are times where you have already completed the roughing passes and wish to go over the finish pass again – for example, after a tool modifier is entered. In the Run Mode, you will have the choice of starting at the roughing or finishing pass.

Prompts to begin Cycle events:

X BEGIN The X begin position value of finish profile

Z BEGIN The Z begin position value of finish profile

DEPTH PER CUT The amount for each roughing pass

APPROACH The direction of the rough cuts (parallel to X or parallel to Z)

SURFACE SPEED Roughing. Can be changed to IPM through Options Flyout Window

FEED PER REV Roughing. Can be changed to IPM through Options Flyout Window

TOOL # Roughing cut tool # from 1 - 99

FIN CUT Amount of stock to leave for diameter finish cut

Z FIN CUT Amount of stock to leave for Z finish cut (Options Info Key)

FIN SURFACE SPEED Finish cut. Can be changed to IPM through Options Flyout Window

FIN FEED PER REV Finish cut feed. Can be changed to IPM through Options Flyout Window

TOOL # Finish cut tool # from 1 - 99

PAUSE BEFORE FIN CUT Will pause and allow you to check size or modify before finish cut. This prompt is only available if you are using 1 tool in your cycle event.

When the Cycle event is complete, the ProtoTRAK RLX CNC will prompt you to input a series of TURN, ARC and POSITION events to describe the part and the original material.

Once you have defined the final part with Cycle Turn and Arc moves, you define the shape of the original material with CYCLE POSITION events. When the last CYCLE POSITION event is defined it must end where the first cycle event began. Tap the END CYCLE soft key to end the cycle event.

LOOK may be used to view the completed cycle event without each tool pass displayed. Use TOOL PATH to display all tool passes.

Special care must be taken with tool set up and the Cycle routine, especially when doing back cuts. When we designed the Cycle, we had to make a choice. The way other CNCs handle the tooling issue is to force the operator to define the tool that he is using very thoroughly. Instead of the few simple inputs required to set up the tools in the ProtoTRAK, they require you to put in several more dimensions – all so the CNC can determine whether or not the tool will do the programmed move without crashing. Keep in mind that the other CNC doesn't do anything to help you set the tools up, it just requires you to tell it a lot of information so that it can generate an error message. Rather than add this complication to our CNC, we chose to give you the capability to do the back cuts, and leave it to you to judge for yourself whether or not the tool will fit. Getting the right tool set-up is the same with either approach. With the ProtoTRAK, you don't have to deal with the complication of telling the CNC a lot more data.

Prompts for the Cycle Turn event:

X END The X end position value of the turn move

Z END The Z end position value of the turn move

CHAMFER Input the value, then press ABS SET for Chamfer and INC SET for Conrad

Prompts for the Cycle Arc event:

DIRECTION of arc, 1 = clockwise, 2 = counter clockwise

X END The X end position value of the arc move

Z END The Z end position value of the arc move

RADIUS Radial value of the arc

CHAMFER Input the value, then press ABS SET for Chamfer and INC SET for Conrad

Prompts for Cycle Position events:

X END The X end position value of the stock

Z END The Z start position value of the stock

If the last CYCLE POSITION event does not end at the beginning of the first cycle event, the system will prompt you that the cycle is not "Closed" and ask for a YES or NO response. If YES is selected, the system will automatically enter a closing CYCLE POSITION event If NO is selected, you may enter your own closing CYCLE POSITION event(s).

9.7   Thread Event

This event allows you to machine different types of I.D. and O.D. threads. They may be straight, tapered, and with single or multiple leads.

The spindle speed for a thread can only be programmed in RPM. The thread event will use the value you enter, as RPM, whether you tap INC or ABS SET.

The default thread type will be standard, which assumes you are machining a standard 60-degree thread angle. If you wish to program other types of threads, tap the Options Info key and then change the Thread Type for more options. See below for info on the different Thread Types.

It should be noted that all Thread Events assume the user is using a full profile threading insert. If the user uses a partial profile insert, you may need to use X modifiers to get the proper depth on your thread. See section 9.7.4 for more information.

9.7.1   Thread (Standard) Event

The ProtoTRAK RLX CNC will automatically calculate the minor diameter based on a standard 60-degree thread angle.

Prompts for the Thread Event:
X BEGIN - The X begin position value of the thread

Z BEGIN - The Z begin position value of the thread

X END - The X end position value of the thread

Z END - The Z end position value of the thread

PITCH - 1 / # of threads (inch) or enter the metric value if MM

 # OF PASSES / DEPTH PER CUT - Defines how the depth of each cut will be calculated.
# of passes will gradually decrease in depth, while depth per cut will be consistent.

 # OF SPRING PASSES - # of passes at minor or root diameter to take out flex

PLUNGE ANGLE - Pressing ABS/SET will default to 29.5, or enter any value

SIDE - OUTSIDE or INSIDE, user selectable

 # OF STARTS - # of leads – default is 1 (up to 10)

RPM - Spindle RPM used to cut thread

TOOL # - Defines tool # used, from 1 - 99

9.7.2 Custom Thread Event

A Custom Thread allows to machine a non-standard or custom thread by enabling the user to specify their own X minor diameter.

Prompts for the Custom Thread event:

X MAJOR BEGIN - The X major begin position value of the thread

Z BEGIN - The Z begin position value of the thread

X MINOR BEGIN - The X minor position value of the thread

X MAJOR END - X value at the end of the thread

Z END - The Z end position value of the thread

PITCH - 1 / # of threads (inch) or enter the metric value if MM

 # OF PASSES / DEPTH PER CUT - Defines how the depth of each cut will be calculated. # of passes will gradually decrease in depth, while depth per cut will be consistent.

 # OF SPRING PASSES - # of passes at minor or root diameter to take out flex

PLUNGE ANGLE - Pressing ABS/SET will default to 29.5, or enter any value

SIDE - OUTSIDE or INSIDE, user selectable

 # OF STARTS - # of leads – default is 1 (up to 10)

RPM - RPM used to cut thread

TOOL # - Finish cut tool # from 1 – 99

9.7.3   Taper Pipe Thread Events (Advanced Features Option)

The Pipe Thread event allows you to choose from predefined pipe thread standards and sizes. Once you choose a type, you will see an event that looks like the Custom Thread. Values such as the major and minor beginning diameters are automatically calculated and are displayed in red.

Prompts unique to the pipe thread event:
Z RAPID - Allows the user to optionally define a starting point further out from Z BEGIN, along the same taper as the rest of the thread. This can be left the same as Z BEGIN if not needed.

Z LENGTH - Defines the thread's incremental length relative to the Z BEGIN point.

Note that the values auto-calculated and displayed for X MAJOR BEGIN and X MINOR BEGIN represent the dimensions at Z BEGIN, not at Z RAPID.

For an NPT thread, the default for Z LENGTH is the L4 value defined in the machinery's handbook.

For a BSPT, the default for Z LENGTH is calculated from the maximum gauge length.

For either thread type, you may adjust the Z LENGTH or the X MAJOR END to any value, and the event will automatically recalculate the endpoint.
Changing any other red value in a pipe thread event will convert the event over to a custom thread event.

All data that can be applied to a custom thread will be carried over.

You may change the SIDE of the pipe thread event to either INSIDE or OUTSIDE, and the event will automatically adjust the dimensions accordingly.

9.7.4 Partial vs Full Profile Threading Tool

The ProtoTRAK control calculates the depth of all threads assuming that a full profile threading insert is used.

A full profile tool has the tooltip width equal to the root of the thread it is designed to cut.

A partial profile will tend to be sharper, so it may be used for multiple thread sizes.

The image below where the white area represents the thread cut with a partial profile tooltip, and the black area represents the same cut with a full profile tooltip.Both tools are programmed to cut at the same X diameter dimension.
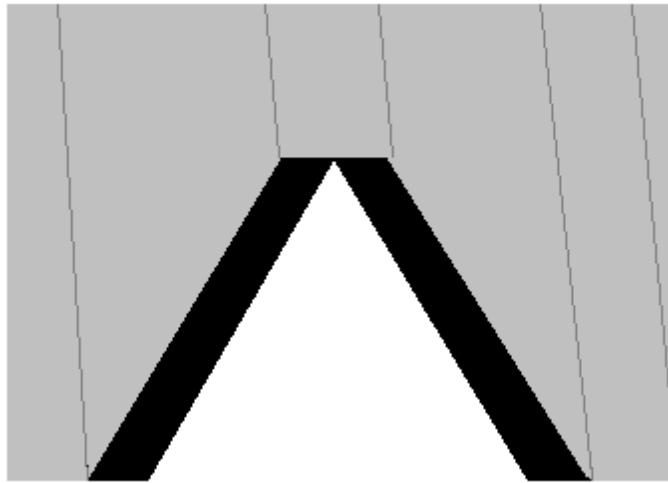
If you were to gauge the portion cut by the partial profile tool, the pitch diameter will measure as being too large. For the partial profile tool to cut the same material along the sides of the full profile tool, it must be driven deeper into the part along the X negative direction for an O.D. thread or X positive for an I.D. thread. Therefore, when using a partial profile threading insert, it is expected that your thread will come out slightly oversized, and you will need to use an X modifier to achieve the proper cut.

9.8 Repeat Events

The Repeat event allows you to repeat an event or a group of events up to 99 times, or insert events from the Clipboard with or without an offset in X and/or Z. This can be useful for a simple roughing cycle (and where a full CYCLE event is inappropriate) at increasing depths. It is also very useful in programming rough and finish events without having to worry about adjusting the dimensions for the finish cut (see Section 9.9 below).

Prompts for the Repeat Event:
FIRST EVENT # First event to repeat

LAST EVENT # Last event to repeat

X OFFSET X axis offset value

Z OFFSET Z axis offset value

 # REPEATS # of times to repeat these events

TOOL # Tool # from 1 - 99 for the repeats

CLIPBOARD: Pastes previously stored events from another program into the current program. After you tap the Clipboard key, you will enter the offset from the previous program's absolute zero to the current program's absolute zero (see figure below). For information about putting events into the clipboard, see Section 9.4. Clipboard is part of the Advanced Features Option.
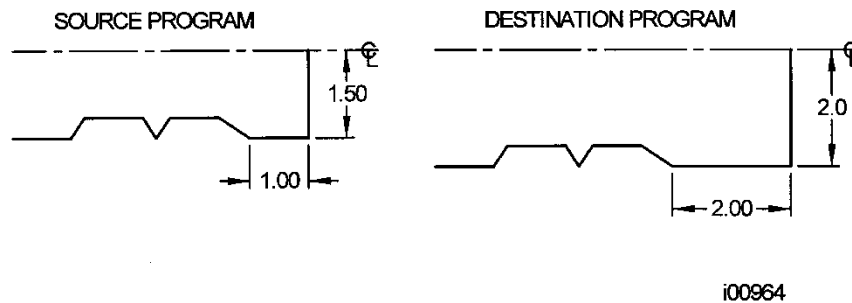

Figure 9.8 - In the above example, the offset that puts the turned shape in the desired location is X= 0.50 and Z = -1.00.

9.9   Groove Events

The Groove event allows you to program an ID or OD groove along the length of your part, or at the face. It requires the use of a grooving tool with a defined width.

The tool path of the groove event starts in the center of the programmed groove and works its way to each side, followed by the finish cut (if programmed). All roughing is done along the X-axis except where the walls are angled (like in Figure 9.9.1). For the angled sections of the groove, the tool will plunge along the X-axis and then follow the contour of the angled wall.

The tool path to the groove event starts in the center of the programmed groove and works its way to each side, followed by the finish cut (if programmed). All roughing is done along the Z-axis except where the walls are angled (like in Figure 9.9.2). For the angled sections of the groove, the tool will plunge along the Z-axis and then follow the contour of the angled wall.

9.9.1   OD/ID Groove Event

Prompts for the OD/ID Groove Event:

GROOVE TYPE Tap on OD/ID to switch to face groove

X BEGIN Major diameter of groove

Z1 1st Z leg of groove as measured from the tailstock end

Z2 2nd Z leg of groove measured from the tailstock end

X END Minor diameter of groove

Z3 3rd Z leg of groove measured from tailstock end or Z1/Z2 (INC)

Z4 4th Z leg of groove measured from tailstock end or Z1/Z2 (INC)

CHAMFER TOP Chamfer/radius at top of groove – Input the value, then press ABS SET for Chamfer and INC SET for Conrad

CHAMFER BOTTOM Chamfer/radius at bottom of groove

 # OF CHIP BREAK PECKS # of pecks to rough groove – type can be changed through the Options Flyout Window

SURFACE SPEED Roughing. Can be changed to RPM through Options Flyout Window

FEED PER REV Roughing. Can be changed to IPM through Options Flyout Window

FIN CUT Amount of stock to leave for finish cut

FIN SURFACE SPEED Finish. Can be changed to RPM through Options Flyout Window

FIN FEED PER REV Finish. Can be changed to IPM through Options Flyout Window

TOOL # Finish cut tool # from 1 - 99
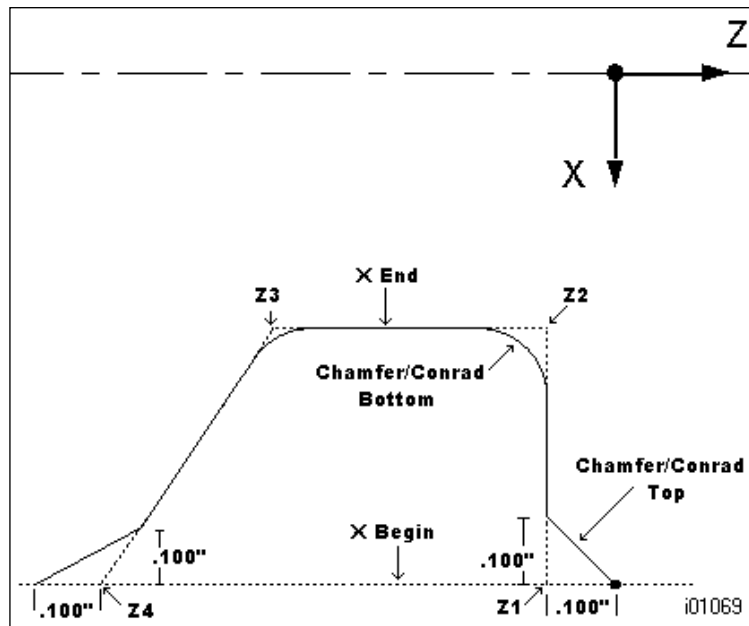
FIGURE 9.9.1 - The different areas defined by the groove event prompts.

9.9.2   Face Groove Event

Prompts for the Face Groove Event:

GROOVE TYPE Click on OD/ID to switch to face groove

Z BEGIN Major Z dimension of groove measured from face of part

X1 1st X leg of groove as measured from X0

X2 2nd X leg of groove measured from X0

Z END Minor Z dimension of groove measured from face of part

X3 3rd X leg of groove measured from X0

X4 4th X leg of groove measured from X0

CHAMFER TOP Chamfer/radius at top of groove – Input the value, then press ABS SET for Chamfer and INC SET for Conrad

CHAMFER BOTTOM Chamfer/radius at bottom of groove

 # OF CHIP BREAK PECKS # of pecks to rough groove

SURFACE SPEED Roughing. Can be changed to RPM through Options Flyout Window

FEED PER REV Roughing. Can be changed to IPM through Options Flyout Window

FIN CUT Amount of stock to leave for finish cut

FIN SURFACE SPEED Speed. Can be changed to RPM through Options Flyout Window

FIN FEED PER REV Speed. Can be changed to IPM through Options Flyout Window

Figure 9.9.2 - The different areas defined by the face groove event prompts.

9.10 Tap Event (Advanced Features Option)

Tap events allow you to tap holes using a floating tapping head. The feedrate will be calculated from the pitch and RPM entered (Feedrate = RPM x Pitch).

Prompts in the Tap event:

Z RAPID: Z rapid/retract point

Z END: Depth of tapped hole

PITCH: Equals 1 divided by the number of threads per inch or just enter metric value if MM

SURFACE SPEED: Can be changed to RPM through Options Flyout Window

TOOL #: Tool # of tap

9.11 Aux Event

Aux events may be inserted at the precise place you wish the Auxiliary function to begin. The tool path will not be altered by the onset of the Aux function.

Prompts for the Aux event:
COOLANT: Coolant auto on/off control

AUX OUTPUT: Used to interface to some secondary device (O)

The Accessory button on the Operator Run Keys must be in AUTO for coolant to work in your program.

Note: *The coolant will turn off automatically at all tool changes and then back on automatically when the program is resumed.*

To turn on your AUX OUTPUT, slide the slider bar as shown below. When you want your AUX OUTPUT to turn off, program a new event and have the output set to NO.
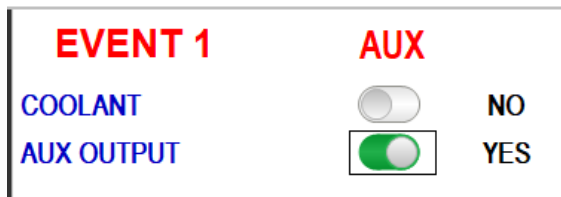
The Auxiliary Output is an option.

It provides a Normally Open (NO) contact and rated for 30 volts DC or AC and up to 1 amp.

The Auxiliary output feature also provides 24 volts. This Auxiliary power can be used to power a 24V Relay/Solenoid or other device through this Auxiliary Output. It is rated for 1 amp.

See the service manual for more information on this option and wiring requirements.

9.12 Cutoff Event

Prompts for the Cutoff event:

X BEGIN: Starting diameter of cutoff

X END: Finish diameter of cutoff

Z: Z depth of cutoff

CHAMFER: enter value (mostly used to break a sharp edge)

 # CHIP BREAK PECKS: Peck allowed for cutoff, peck type change with Options

SURFACE SPEED: Can be changed to RPM in Options

FEED PER REV: Can be changed to IPM in Options

TOOL #: Cutoff tool #

10.0   Edit Mode

Within Program Mode, you can recall and re-input data event by event. In contrast, the Edit Mode contains powerful routines for more extensive program changes.

The changes you make in the Edit Mode affect only the program in current memory. In order to preserve the changes, you must store the program again under the same name in the In/Out Mode.

10.1   Delete Events

Rather than delete one event at a time in Program Mode, you may delete a group of consecutive events in the Edit Mode.

In Edit Mode, press Delete Events.

The Data Input Line will prompt for the first event and then the last event to be deleted. Input the event numbers and press SET. The remaining events will be renumbered.

10.2   Search Edit (Advanced Feature Option)

Selecting Search Edit opens the powerful Spreadsheet Editing function of the ProtoTRAK RLX. Spreadsheet Editing allows you to view program data in a table. From there you can make global changes to the program by selecting which event prompts you want to view, sort or edit. This is particularly useful if you are working with a large program and you need to make changes to many events.

When you press the SEARCH EDIT soft key, the screen will load a table that contains data for the entire program sorted by event number. The screen will show 17 events. Use the Page and Data soft keys, swipe the screen or tap the scroll bar to see other events.

INFO	EV # ▲	TYPE	Z END	X BEGIN	Z BEGIN	X END	# PASSES	TOOL #	RPM/SS	TOOL OFFSET		MODES
STATUS	5	CYCLE TURN	-1.3000 abs	0.0000 inc	0.0000 inc	1.0000 abs						DRO
	6	CYCLE TURN	-1.5000 abs	0.0000 inc	0.0000 inc	1.0027 abs						
TOOL TABLE	7	CYCLE TURN	-1.5000 abs	0.0000 inc	0.0000 inc	1.4500 abs						PROG
	8	CYCLE TURN	-2.8000 abs	0.0000 inc	0.0000 inc	1.4500 abs						
EPA	9	CYCLE TURN	-3.0000 abs	0.0000 inc	0.0000 inc	1.4509 abs						EDIT
	10	CYCLE TURN	-3.0000 abs	0.0000 inc	0.0000 inc	1.7000 abs						
MATH HELP	11	CYCLE TURN	-3.5000 abs	0.0000 inc	0.0000 inc	1.7000 abs						SET-UP
	12	CYCLE TURN	-3.5000 abs	0.0000 inc	0.0000 inc	1.9500 abs						
OPTIONS	13	CYCLE TURN	-4.3000 abs	0.0000 inc	0.0000 inc	1.9500 abs						RUN
	14	CYCLE TURN	-4.3000 abs	0.0000 inc	0.0000 inc	2.1250 abs						
DEFAULTS	15	CYCLE POSN	0.0000 abs			2.1250 abs						PROG IN/OUT
	16	CYCLE POSN	0.0000 abs			-0.0000 abs						
KEY BOARD	17	GROOVE	-1.5000 abs	1.1000 abs	-1.3000 abs	0.7500 abs		3	300.00 S			
	18	POSITION	0.0000 inc			2.1250 abs		3	300.00 S			
CALC	19	GROOVE	-3.0000 abs	1.4700 abs	-2.8000 abs	1.2500 abs		3	300.00 S			
	20	THREAD	-1.4000 abs	1.0000 abs	0.0200 abs	1.0000 abs	5	4 (0.2500)	300.00 R			
	21	CUTOFF	-4.3000 abs	2.0000 abs		-0.0200 abs		5	300.00 S			

Z END : `0.0000  abs`

PAGE FWD	PAGE BACK	DATA TOP	DATA BOTTOM	GO TO EVENT	CHANGE ALL			RETURN

Figure 10.2 - The Search Edit key launches powerful Spreadsheet Editing.

Each row in the spreadsheet represents the data for the event number shown in the first column on the left. The event number and event type are always displayed in the first two columns, but the other data displayed on the table can be changed.

Soft Keys in Search Edit:
PAGE FWD: pages forward through the table.
PAGE BACK: pages backwards through the table.
DATA TOP: highlights the data in the first row current sort
DATA BOTTOM: highlights the data in the last row of the current sort
GO TO EVENT: highlights the data in the row of the corresponding event.
CHANGE ALL: enables you to make global changes of data, described below.

Note: the EV# (event number) and (event) TYPE may not be edited in Search Edit so the highlighter will not go there.

10.2.1 Selecting Data to be Displayed on the Search Edit Table

In order to change the data selected in the table, tap the Options info key. You can choose which data to display and the order of the columns by opening or closing the slide bar. Tap Reset to clear all the selections. Tap Options to close and the newly selected prompts will show in the table.

Figure 10.2.1 - The Options Info key in search edit enables you to pick the fields to display.

10.2.2 Sorting Data

Data may be sorted by any of the data types displayed in the column head. Red letters show which column is used for sorting the data.

Simply tap the heading of the column to sort its data in ascending order (smallest first) and tap again to change to descending order. The secondary sort will always be Event #.

10.2.3 Making Changes to Data

To edit a single entry tap the entry, input the change and press INC SET or ABS SET.

To edit a group of identical entries:
1. Sort on the entry prompt by tapping the column head. You may sort on any value that gets the data you want to change together.

2. Tap on the first data value you want to change (the highest on the list).

3. Tap Change All.

4. All data values that are the same and below the one you tapped will be highlighted.

5. Input the new value and ABS SET or INC SET. All highlighted entries will be changed to the new value.

The sequence below illustrates changing the # pecks in the program.

EV # ▲	TYPE	TOOL #	RPM/SS	Z FEED	XYZ FEED	FIN FEED	Z RAPID	Z END	# PECKS
1	MILL	1	2000.00 R	5.0	20.0		0.1000 abs	0.0000 inc	
2	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc	
3	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc	
4	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc	
5	DRILL	2	3000.00 R	7.5			0.1000 abs	-0.6000 abs	1
6	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
7	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
8	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
9	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
10	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
11	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
12	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
13	CIRC PCKT	3	2500.00 R	5.0	20.0	0.0	0.1000 abs	-0.2000 abs	
14	CIRC PCKT	3	2500.00 R	5.0	20.0	0.0	0.0000 inc	0.0000 inc	

INFO: STATUS, TOOL TABLE, EPA, MATH HELP, OPTIONS, DEFAULTS, KEY BOARD, CALC

MODES: DRO, PROG, EDIT, SET-UP, RUN, PROG IN/OUT

OF VARIABLE PECKS : 1

PAGE FWD | PAGE BACK | DATA TOP | DATA BOTTOM | GO TO EVENT | CHANGE ALL | | RETURN

Figure 10.2.3a - First, the data is sorted by Event in ascending order to get the drill events together and then #pecks in event 5 is selected.

EV # ▲	TYPE	TOOL #	RPM/SS	Z FEED	XYZ FEED	FIN FEED	Z RAPID	Z END	# PECKS
1	MILL	1	2000.00 R	5.0	20.0		0.1000 abs	0.0000 inc	
2	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc	
3	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc	
4	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc	
5	DRILL	2	3000.00 R	7.5			0.1000 abs	-0.6000 abs	1
6	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
7	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
8	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
9	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
10	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
11	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
12	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	1
13	CIRC PCKT	3	2500.00 R	5.0	20.0	0.0	0.1000 abs	-0.2000 abs	
14	CIRC PCKT	3	2500.00 R	5.0	20.0	0.0	0.0000 inc	0.0000 inc	

INFO: STATUS, TOOL TABLE, EPA, MATH HELP, DEFAULTS, KEY BOARD, CALC

MODES: DRO, PROG, EDIT, SET-UP, RUN, PROG IN/OUT

RETURN

Figure 10.2.3b - Next, tapping the Change All soft key highlight all the same #pecks from event 5 and down.

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INFO	EV # ▲	TYPE	TOOL #	RPM/SS	Z FEED	XYZ FEED	FIN FEED	Z RAPID	Z END	# PECKS	MODES
STATUS	1	MILL	1	2000.00 R	5.0	20.0		0.1000 abs	0.0000 inc		DRO
	2	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc		
TOOL TABLE	3	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc		PROG
	4	MILL	1	2000.00 R	5.0	20.0		0.0000 inc	0.0000 inc		
EPA	5	DRILL	2	3000.00 R	7.5			0.1000 abs	-0.6000 abs	2	EDIT
	6	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	
MATH HELP	7	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	SET-UP
	8	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	
OPTIONS	9	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	RUN
	10	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	
DEFAULTS	11	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	PROG IN/OUT
	12	DRILL	2	3000.00 R	7.5			0.0000 inc	0.0000 inc	2	
KEY BOARD	13	CIRC PCKT	3	2500.00 R	5.0	20.0	0.0	0.1000 abs	-0.2000 abs		
	14	CIRC PCKT	3	2500.00 R	5.0	20.0	0.0	0.0000 inc	0.0000 inc		
CALC											

OF VARIABLE PECKS : 2

	PAGE FWD	PAGE BACK	DATA TOP	DATA BOTTOM	GO TO EVENT	CHANGE ALL				RETURN

Figure 10.2.3c - Finally, the # pecks was changed to 2 in all the events from event 5 and down by pressing 2, SET.

10.3 Erase Program

Use the ERASE PROG soft key to erase the program from the current memory. Erasing the program from current memory will not affect any programs that are stored.

If you have made changes to the program and wish to save this modified program, you will need to store it in the Program In/Out Mode.

10.4 G-Code Editor (Advanced Features Option)

The G-Code Editor allows the edit of G-Code programs that are opened as .GCD files. Once edited, the program may be re-saved as .GCD files. ProtoTRAK Geometry-style programs may not be saved as .GCD files.

When you enter the G-Code Editor, the G-Code program is displayed starting at the first Block Number. Use the scroll bar to move up and down through the program. Search allows you to launch a simple find-and-replace routine to aid in editing large G-Code files.

Click in the Find What box and enter the item you want to find. Click on the Find Next box and the G-Code Editor will locate the next occurrence of that item. Use Match Whole Word to limit the search to the entire word. For example, if you want to find G2, but not G20 or G22, select Match Whole Word Only.

To make changes to Find What items, type what you want to have into the Replace With box. You can replace items one at a time by clicking first the Find Next box then the Replace With box for as many changes as you want to make. You can replace every item in the program with a single tap of the Replace All box.

Return closes the G-Code Editor and returns the screen to the Edit Mode.

Note: If you use the USB Thumb Drive to store a G-code (.gcd) program file, you must leave the Thumb Drive plugged into the USB port the entire time the program is in current memory. If you

unplug the thumb drive with the program still in current memory, the ProtoTRAK will display an error message.

10.5 Clipboard (Advanced Features Option)

The Clipboard feature is a way to copy events in one program in order to put them into a different program. It is a two-part process that takes place in two different Modes. First, in the Edit Mode, the desired events are copied, or placed on the Clipboard, from the source program. Then the events are inserted into the destination program in the Program Mode.

When you press the Clipboard key from the Edit Mode, you start the process that copies the events that you want to put into a different program than the one in current memory.

Before you do that, you should write a program or open the program file that has the events you want to copy. This is called the source program.

Inspect the events you want to copy. Make sure that the dimensioned data uses Absolute references in the first event to be copied and in all events where it will be important. Incremental references may be used, but keep in mind where the Incremental reference will be made from. See the section on Incremental Reference Position in this manual.

In addition, you may want to modify this program in order to get all the events you want together. For example, if you want to copy events 2-5 and 7-12, you may want to modify the program to delete events 1 and 6 first. That way, you can copy the all the events as they are now numbered from 1 to 10. Remember that you can modify this program just for this purpose and it will not affect the original program unless you save it with the modifications in the Program In/Out Mode.

When the source program is ready, press the CLIPBOARD softkey. A message will appear that says "Copy Events onto Clipboard" and the Data Input Line will read "From Event". Enter the number of the first event that you want copied and press SET.

The Data Input Line will read "To Event". Enter the number of the last event you want copied and press SET.

The group of events that you have specified is now on the clipboard and will remain there until you replace it with something else by going through the same procedure. When power is turned off to the ProtoTRAK RLX CNC the clipboard information will also be lost.

The events on the clipboard are inserted may now be inserted into a program in the Program Mode within the Repeat event. The repeat event will have a button called INSERT CLIPBOARD. When pressed, the user can offset the events in X and/or Z.

11.0   Set-Up Mode

11.1 Tool Path

When the TOOL PATH soft key is pressed, the program is processed and the tool path graphics are displayed. Large programs will take longer to process.

At the completion of running Tool Path, a time will appear in the upper left-hand corner of the screen with the estimated time to run the program.
When tool changes are manual, no time is allocated for the time required to change tools.

Most programming errors that would prevent the program from running are detected when the tool path graphics are selected. The displayed graphic is automatically sized to fit the screen and an icon that represents the X and Z orientation is placed at the program's absolute 0 reference point. The path shown on the screen represents the center of the tool.
- Position and drill events are drawn in yellow.
- Rapid moves are in red.
- Programmed feeds are in blue.
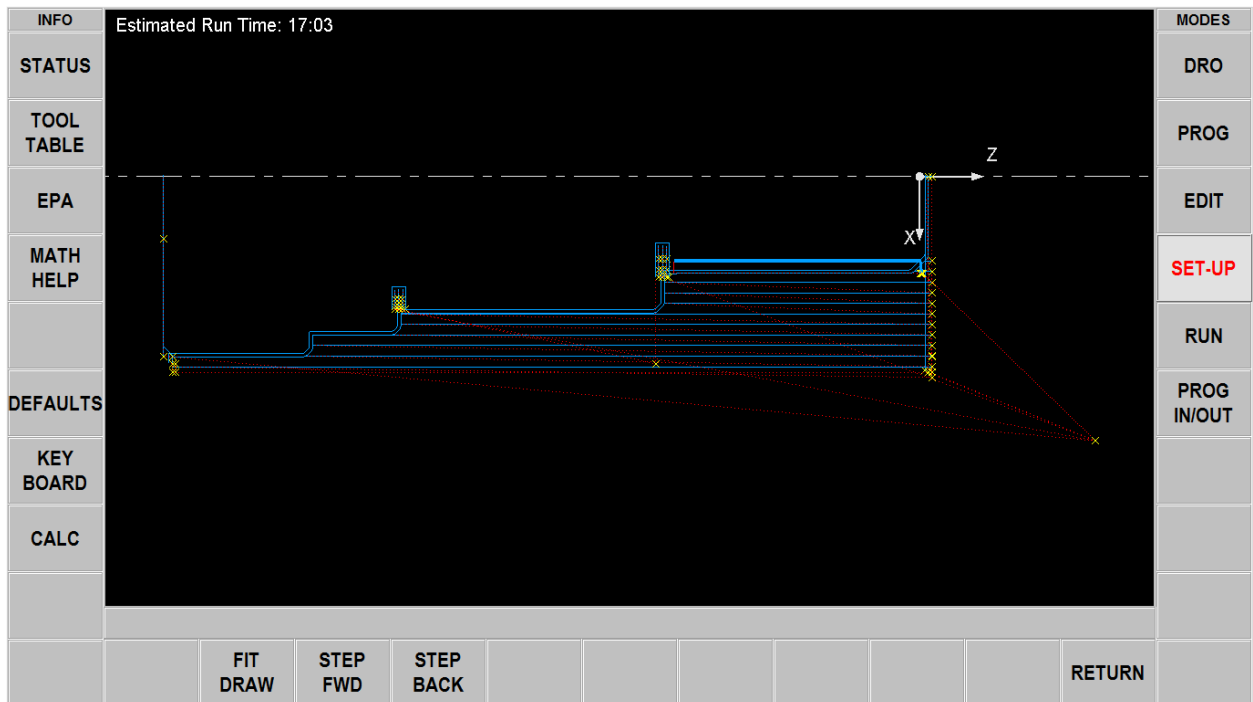
Figure 11.1 - The ProtoTRAK RLX processes the program and then displays the tool path.

When the drawing is displayed you may spread or pinch to zoom in or out. You may also pan up, down or sideways.

Soft Keys in Tool Path
FIT DRAW: Will re-draw, automatically sizing to fit the screen (necessary only if an adjustment changed the drawing from its initial sizing).
STEP FWD: Each press of the STEP FWD button shows the next tool move. To complete the drawing automatically, press FIT DRAW.

STEP BACK: Each press of the STEP BACK button moves backward in the program 1 move.

Note: Each step forward or backward shows the X and Z coordinate of that move.

RETURN: Returns to the previous soft keys, retaining the adjustments that were made to the drawing.

11.2 Reference Positions (REF POSN)

The Reference Positions screen shows the retract status, the home locations and software limits for all axes.

REFERENCE POSITION TABLE			
REF POSITION	POSITION		STATUS
X HOME	3.0000	abs	
Z HOME	1.0000	abs	
X LOWER LIMIT			OFF
X UPPER LIMIT			OFF
Z LOWER LIMIT			OFF
Z UPPER LIMIT			OFF

Soft keys (left column): INFO, STATUS, TOOL TABLE, EPA, MATH HELP, DEFAULTS, KEY BOARD, CALC

Soft keys (right column): MODES, DRO, PROG, EDIT, SET-UP, RUN, PROG IN/OUT, RETURN

Figure 11.2 - The reference positions in Set Up Mode.

Home Positions
X and Z home positions are where the cross slide and saddle go when there is a tool change or at the end of the program. These dimensions must always be from absolute zero. These can be set in Defaults.

Limit Positions
X and Z limit positions (one for plus direction, one for minus) will stop the program if they are exceeded during run. Note that pressing the LIMIT ON/OFF soft key will turn the prompted limit off, or back on to its input value. If the limits are turned on, your program and home positions must fit within the limits you define. If you turn on the limits and leave them at the default of 0 Absolute, the program will not run.

11.3 Verify Part (Advanced Features Option)

Verify Part is used to see a solid graphical representation of the tools making the part. There is no better way to see how your tool and part will interact than to see the solid model and tool

represented in Verify. You must define the tools in the program so the ProtoTRAK RLX can draw the correct shape for the tools you are cutting with.

Press VERIFY PART and the following soft keys will show:

DEFINE STOCK: If you wish to input dimensions of your round stock relative to the programmed absolute zero.

You don't necessarily have to define the stock because Verify will automatically calculate and define the stock based on the G code generated to run the program. The Z Min and Max values Verify calculates will be based off of the largest Z positive and negative value that is in the program. This means if you program a drill to go through the part it will make this value the Z bottom value.

By using Define Stock you can put in the actual stock size and therefore get a more accurate picture of the interaction between the tool and the part.

Note: *The stock size you end up with is saved with your program.*

AUTO: Will have Verify recalculate the stock for you.

ENLARGE STOCK: Each time you press this soft key, it increases stock by .1 inch.

Press MAKE PART and the display shows your stock material.

The status line shows whether simulation is on or off, the speed of the verification, the status of STOP or GO and the tool number for the tool that is being simulated. The speed can be adjusted from single stop all the way to a value of 20. The default speed is set to 1. Press the speed up or down buttons to adjust your speed. When on the single step speed, pressing GO will step the tool through each step of the program.

The first 4 soft keys are used to adjust the part view and can be tapped before the simulation or during the simulation when the tool is cutting the part.

VERIFY PART (O) will launch the solid graphic part verification routine as shown below. A Yellow progress bar will appear as the simulation of the tool path takes place. After the tool path simulation finishes, the part will be drawn as it will appear after machining.
SHOW PART: will skip the tool path simulation and show the finished part.
SPEED UP and SPEED DOWN (O): adjusts the speed of the tool path simulation.
STOP (O): Stops the tool path simulation
EXIT: exits the verification and returns you to the DEFINE STOCK page.

11.4 Tool Group

The ProtoTRAK RLX can be set up to use the following Tool Groups:
- Single or Manual tool change
- 8 Position Index Turret
- 8 Tool Hydraulic Turret *(3060RX and 30120RX only)*
- 4 Position Index Turret
- Gang tooling

When you select a Tool Group that group will be the default (when you turn the ProtoTRAK on) until changed and will be shown in Status Flyout Window.
WARNING: Always change the Tool Group selection whenever you change your Tool Group. Different Tool Groups change the rapid tool paths

Tool Path for Gang Tools
Gang tools are mounted on the cross-slide.
Each machine returns to Z Home after use in a straight line from the end of its last event. If necessary, you can program Position moves to prevent unwanted contact between the tool and part.
After the tool is used, the spindle stays on, and no Go press is needed to continue to the operations with the next tool. Then the next tool called out will move in a straight line to the next event beginning point. Again, program Position moves to prevent gouging the part.

Tool Path for Turrets.
Before cutting, the turret will rotate for the first programmed tool. For each tool change, the spindle stays on and the turret indexes to the next tool at the set HOME location. The program will continue to be run without it being necessary for you to press Go again.

11.5 Home Turret

Initiates a routine for you to home the 4- or 8- Station CNC Turret. The door must be closed to home the turret.

11.6 Pictures and Notes

Pictures and Notes are useful features available in Setup mode that help the user include pictures of their setup with PART program so when they run this part at a later date, they can remember how to set up the fixture and part.

11.6.1 Pictures

To save pictures with the program, go to SETUP mode, select the PICTURES soft key and choose pictures that you want to add. You can add up to 10 pictures for any given program. Once the pictures have been added, you can view the pictures to any given part using the PREVIOUS and NEXT button. Once the last picture is viewed and you select NEXT, the first picture is displayed.

Figure 11.6.1 - Example of Picture

11.6.2 Notes

The Notes function allows the user to include notes for themselves related to the program within the program for future reference. User has ability to have short and large notes. The software provides 4 pages for notes in which the first page has 9 short boxes for notes plus 1 large box. The following pages have 1 large box each for notes.
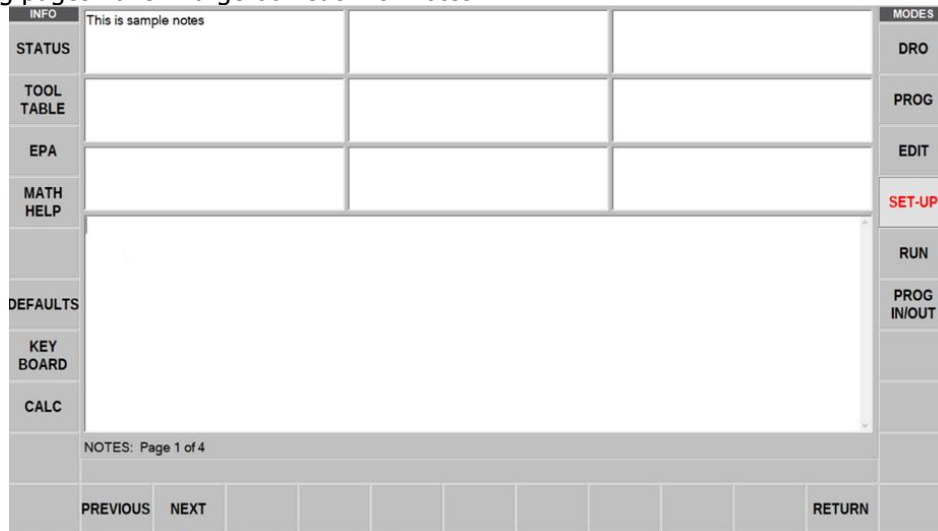
Figure 11.6.2 - Example of Notes Function Displayed

11.7 Service Codes

These are special codes that may be entered into the ProtoTRAK RLX CNC to call up routines used in installation, setting of preferences, machine checkout and service.

WARNING!
Before using service codes, be aware that some of the routines are very powerful and may change important system settings. Some of the routines cause the servos to come on and move at rapid speed.

The Service Codes are divided into logical categories. The table below summarizes the more important ones. See the service manual for more information on using Service Codes.

Software

Code	Description	Comment
33	Software, Firmware and PLC versions	Displays current software versions and system settings.
141	Load configuration file from USB thumb drive	To load configuration files from a USB thumb drive to the RX control.
142	Save configuration file to USB thumb drive	To save the configuration files for reloading later. When a computer replacement is necessary, saving the settings to a thumb drive for reloading them later is highly desirable.
316	Update Software	Runs the routine that copies new software from a USB thumb drive device to the ProtoTRAK system. Use this routine to install new ProtoTRAK software.
318	Converter and Software Options	Displays which software options are turned on. Options in bold letters mean the option is active.

Machine Set-Up

Code	Description	Comment
122	Axis Calibration Using Offset	This is a scale factor (one per axis) that is defined as the length of the part programmed divided by the physical dimension of the actual part measured. It is less than 1 for a part that was cut too big and greater than 1 for a part that was cut too small.
123	Calibration Mode	Use to calibrate the RLX control with a standard.
128	Backlash Calibration Constant	Use to load backlash compensation for each axis.
308	Reverse EHW Direction	Change direction of Electronic Hand Wheel on X axis or Z axis
311	Run Machine With Spindle Off	Allows the user to run a program on the machine with the spindle off. This normally would be something a service technician might want to do more so than a user.
312	Toggle Limit Switches On or Off	Turns limit switches on or off
338	Toggle Limit Switches from 1 to 2 input	Tells software which style limit switch is present.
400	Update Foreign Language MLS File	Used to update the software language table. Please contact your distributor for available languages and for more information.
510	Spindle Setup and Calibration	Allow for calibration of the spindle
530	Set Pendant and Machine Serial Numbers	Service code to record pendant, computer module and machine serial numbers. A warning will be given to user until this requirement is met.
535	8-Tool Turret Backlash and Home Offset	When the tools are heavy and unbalanced, the home offset and backlash can be set manually.
540	Disable File Based Write Filter	This service code must be used when changes need to make to the operating system. When networking the control or loading drivers, this service code must be run.

Diagnostic Codes

Code	Description	Comment
1	Program, Configuration File, Log Back up	The following service code captures all important data from the RX machine. This includes the user's program, configuration files, message log, fault log etc. This is meant to be used to help us solve problems that may pertain to our software. This file can then be emailed to our service department.
54	Continuous Run Mode	Cycles through the program in current memory.
81	Program Panel Keyboard Test	Gives a tone feedback to a button push and highlights the button.
131	Manual DRO	Turns off servos so you can check encoders. Shows motor encoders and glass scale counts and direction of counts.
132	Electronic Handwheel Test	Test the EHW signals
314	Toggle Test Indicator (Debug Lights)	Turns on diagnostic lights to help troubleshoot certain problems.
319	Message Log	Logs the machine as it runs. It captures all key presses, error messages and data as the machine runs. It is saved automatically with service code 1.
320	Fault Log	A log that captures all faults and error messages.

Code	Description	Comment
326	Look Up Message	Allows user to displays safety flashing messages, master messages and slave error messages on screen. Often used by translators converting English language to some other language.
327	Display Memory Check	Displays memory availability of various devices
521	Check Control IO (input/output)	Application used to check all machine input and outputs.

Operator Defaults/Options

Code	Description	Comment
79	Turn On/Off Beeper	Turn the beeper on or off
143	Spindle Stays on at Tool Change	Allows the spindle to stay on at a tool change.
328	EPA On/Off	Turns the EPA feature on or off
600	Manage User Profiles	Allows each user to save, delete, or reset individual default user profiles.

Lube Pump Codes

Code	Description	Comment
300	Lube Pump Switch Discharge	Allows the user to manual discharge the lube pump
301	Set Lube Pump Cycle Time	Sets the time in minutes between pumping cycles
302	Set Lube Pump Discharge Time	Sets the time in seconds for how long to pump for each cycle.

12.0 Run Mode

12.1 Run Mode Screen
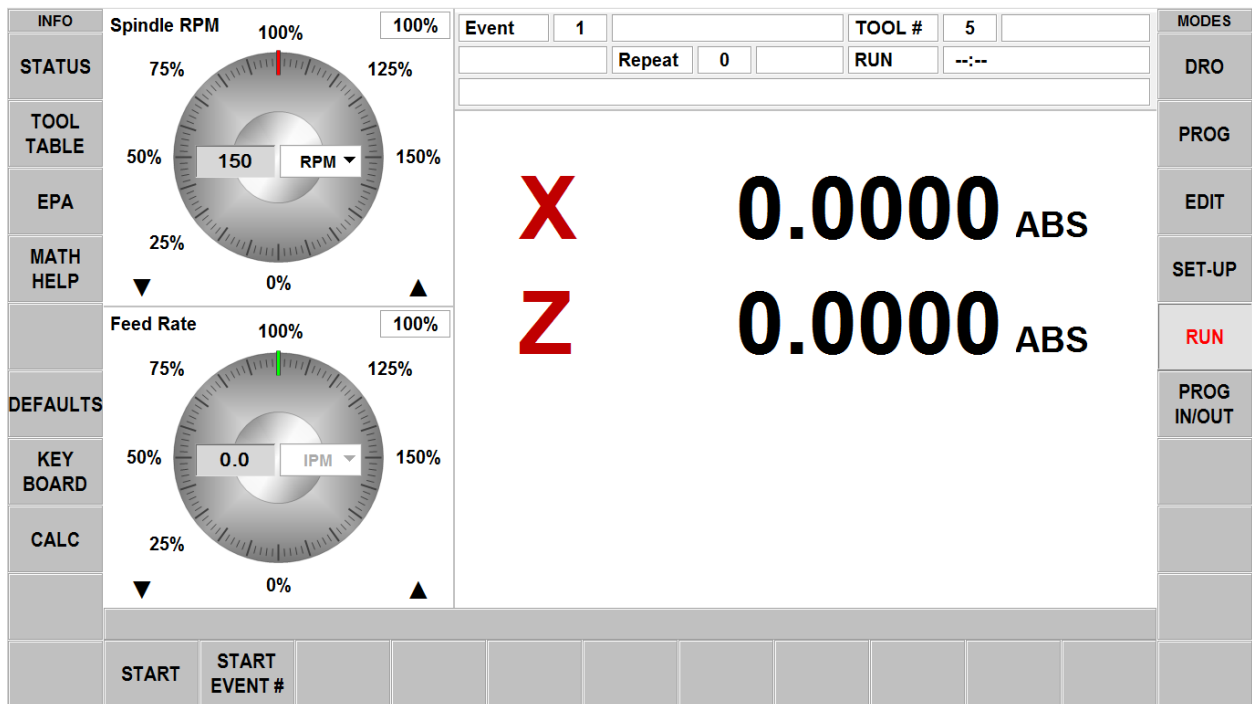
Items on the Run Screen:

Status Bar: The Status Bar in Run mode displays 14 field boxes as shown in the figure below.

Figure 12.1 - Status Bar

Status Bar Box #1: Event Label
Status Bar Box #2: Event Value
Status Bar Box #3: Event Name
Status Bar Box #4: Tool # Label
Status Bar Box #5: Tool facing the spindle
Status Bar Box #6: TUR LOC Label
Status Bar Box #7: TUR LOC of the tool facing the spindle
Status Bar Box #8: Placeholder
Status Bar Box #9: Repeat Label
Status Bar Box #10: Repeat value
Status Bar Box #11: Placeholder
Status Bar Box #12: Run Label
Status Bar Box #13: Total Run Time
Status Bar Box #14: Event Comments (O)

Event Counter: This will be the current event number and event type.

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Repeat: If a repeat event is in the event counter, this will show which repeat number, for example, if you program a drill with 5 repeats, this will show which repeat of the event that is being machined.

Tool #: The current tool number to load when prompted

Turret Loc: The current turret location. Only available when using the 4 or 8 tool turret.

Run: Shows RUN or TRAKing when in TRAKing mode. The box to the right shows the runtime clock. This does not count the time for a manual tool change. You must first run tool path in setup mode.

Countdown Clock: The space to the right of RUN will show the countdown clock for the run time estimator. This is available when you view you tool path in SETUP mode.

Event Comments: The lower box will show event comments when you have them turned on in your events.

12.2 Starting to Run

The program may be started in two ways:

START: Begins the program at Event 1 and assumes that the absolute zero that was last set in the DRO mode corresponds to the part program zero.

START EVENT #: Allows you to start in the middle of a program. When appropriate, you will be prompted to identify the repeat number you wish to begin or select between beginning at the Rough, Rest or Finish Tool.

12.3 Program Run

SHOW ABS: The absolute X and Z positions as the part is run.

SHOW INC: The incremental (or distance to go within the event) X and Z positions as the part is run.

SHOW PATH: The tool path graphics as the part is run.

SHOW PROG: The programmed data for the event being run, and the next event as the part is run.

The run procedure is very simple. Follow the instructions in the green message box and proceed by pressing the GO key.

At the beginning of a program or once the STOP hard key is pressed, additional softkeys will be available:

TRAKing: Tap this softkey to control the X and Z programmed motion with the table or saddle handwheel. The TRAKing/Electronic Handwheels Option must be active for this function.

CNC Run: Tap this softkey to start the CNC run
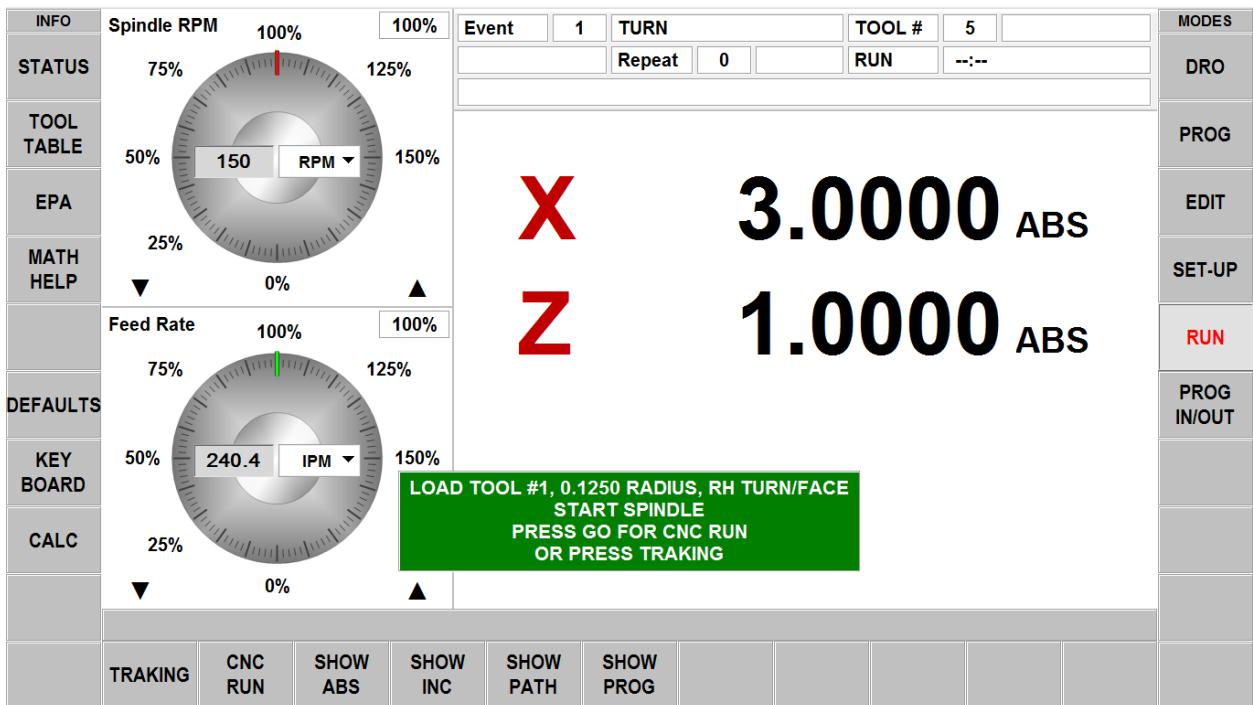
12.4 TRAKing® Option

TRAKing is a special kind of CNC run. When you tap the TRAKing soft key, the programmed saddle and cross slide motion are controlled by turning either electronic handwheel. Moving the Z handwheel in the counterclockwise direction moves forward through the program; moving clockwise moves backward through the program. The X axis EHW is just the opposite. Moving the X handwheel in the clockwise direction moves forward through the program; moving counterclockwise moves backward through the program. The spindle must be on in order to TRAK once the tool reaches the programmed Z Rapid position. To TRAK slowly, use the X handwheel. To TRAK quickly, use the Z handwheel.

TRAKing comes in handy whenever you are a little unsure about any aspect of your program or set-up. For example, on the first run of a part - instead of pressing GO and holding your hand on the stop button, use TRAKing to bring the tool to the part while you watch the DRO. Once assured that everything is all right, press STOP and get into CNC run.

12.5 Program Run Messages

While in the Run Mode, clear instructions and prompts from the RLX CNC will tell you exactly what to do to run the program. These messages will appear in a green box in the middle of the screen.

When a tool change is required, the tool information entered in the Tool Table will appear in the green box.

Any Event Comments you entered during programming will appear in the box directly above the XZ Dimension readouts. The Event Comments feature is part of the Advanced Features Option.

Once the program starts, a Run Time Clock will appear near the top of the screen. This clock displays the time remaining until the end of the program or the next tool change, and will count down as the program is run.

Note: *The program must first be viewed as Tool Path in the Set Up Mode to initialize the Run Time Clock. Otherwise, it will show 0.00.*

12.6 Stop

At any time, the program may be halted by pressing the **STOP** key. This freezes the program at that point. You may choose to continue running the program by tapping the CNC RUN softkey or pressing the **GO** key. You may also run the program by using the Electronic Handwheels on the table or saddle by tapping the **TRAKing** softkey.

12.7 Feedrate and Speed Overrides

In program Run Mode, the programmed XZ axis feeds as well as the rapid speeds may be adjusted. Likewise, the programmed spindle speed may be adjusted.

Use of the Graphical Spindle and Feed Rate Override is

Overriding Spindle Speed
You may override the set Spindle Speed from 0% of set up to 150%.

To override do one of the following:
- For fine adjustment, tap the up or down Fine Override arrow keys
- Tap one of the set % values around the graphical dial, for example, 75%.
- Drag your finger in a circular motion along the diameter of the graphical dial as if you were physically turning it. If you move your finger out to a larger radius, you will notice that this still allows adjustment of the feedrate. It gives the user a finer control of the feedrate

Note: *As you "turn" the dial with your finger, the dial will "stick" to 100%. To resume turning, briefly lift your finger and put it back down. We put in this slight sticking at 100% so that you can move your attention away from the screen while ramping the override up or down.*

As you apply overrides, the Spindle Speed and the Override % will update to the new values.

Overriding Feedrates
You may override the set Spindle Speed from 0% of set up to 150%.

To override do one of the following:
- For fine adjustment, tap the up or down Fine Override arrow keys
- Tap one of the set % values around the graphical dial, for example, 75%.
- Drag your finger in a circular motion along the diameter of the graphical dial as if you were physically turning it.

Note: if you lift your finger while turning, the dial will "stick" to 100%. To resume turning, lift your finger again first then it will respond when being dragged. We put in this slight sticking so that you can move your attention away from the screen while ramping the override up or down.

As you apply overrides, the Spindle Speed and the Override % will update to the new values.

12.8 Run Time Estimate

When you operate a CNC program, the machine's display provides crucial time information to guide you through the program's execution and signal when your intervention is necessary. Here's an easy guide to understanding the run time countdown clock display readings:

- **HH:MM:SS (Total Est)**: This is your initial estimate of how long the entire program will take to run for the first time. This estimate is calculated from the program's specifications, such as feed rate and G-codes.

- **HH:MM:SS (Next Est)**: On the first run, this countdown indicates the time until the machine anticipates a pause, requiring your input. This timer updates as the program progresses.

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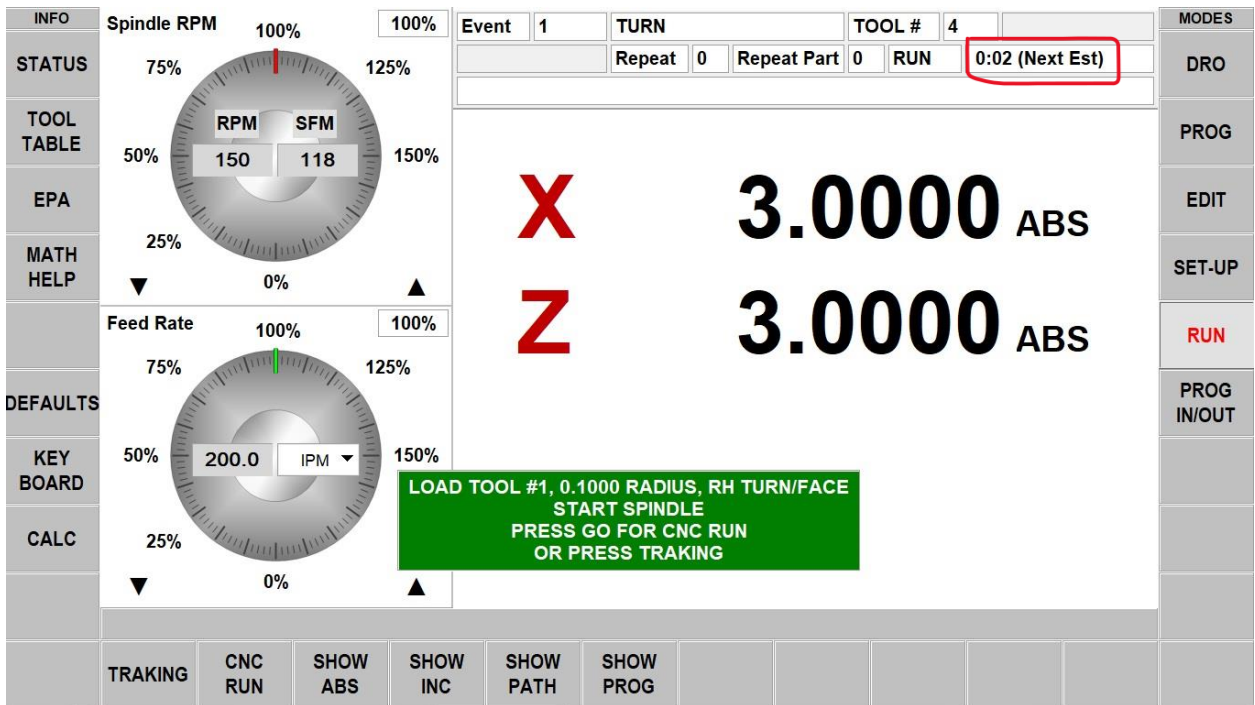
After the first execution, the display leverages the actual run data to enhance the timing accuracy for any subsequent runs of the same program:

- **HH:MM:SS (Total Act)**: This shows the adjusted total time for completing the program, derived from its actual duration on the last run.

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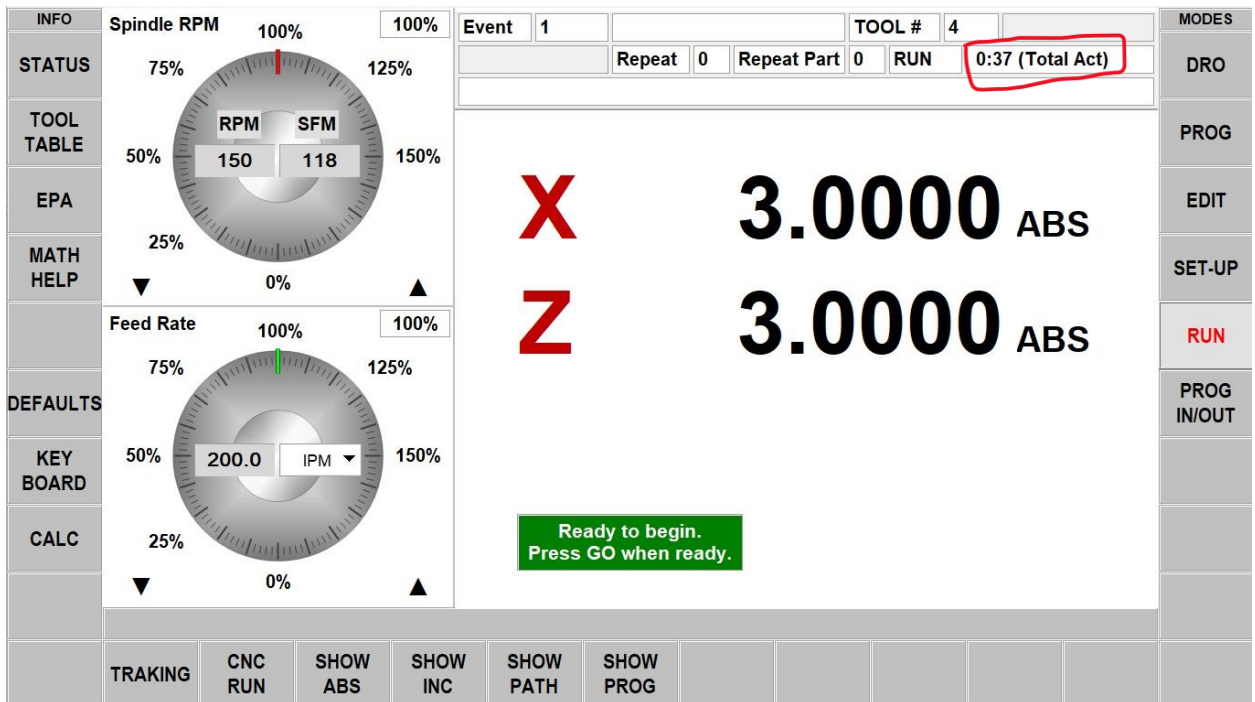
- **HH:MM:SS (Next Act)**: This countdown provides a more accurate prediction of when the machine will next pause for your action, based on the timings from the previous run.

The initial time estimate might not always be precise due to the dynamics of CNC operations. For instance, setting a high feed rate, like 1000 inches per minute, for a short distance won't allow the machine to achieve that speed, leading to potential inaccuracies in the estimated time. However, after you run the program once, the displayed "actual" times adjust based on real performance, offering a more accurate forecast for subsequent runs. This adaptive timing ensures that with each run, the predictions on when the program will need your attention or conclude become more reliable.

13.0   Program In/Out

The Program In/Out Mode is where you work with those programs you want to store, or receive from others.
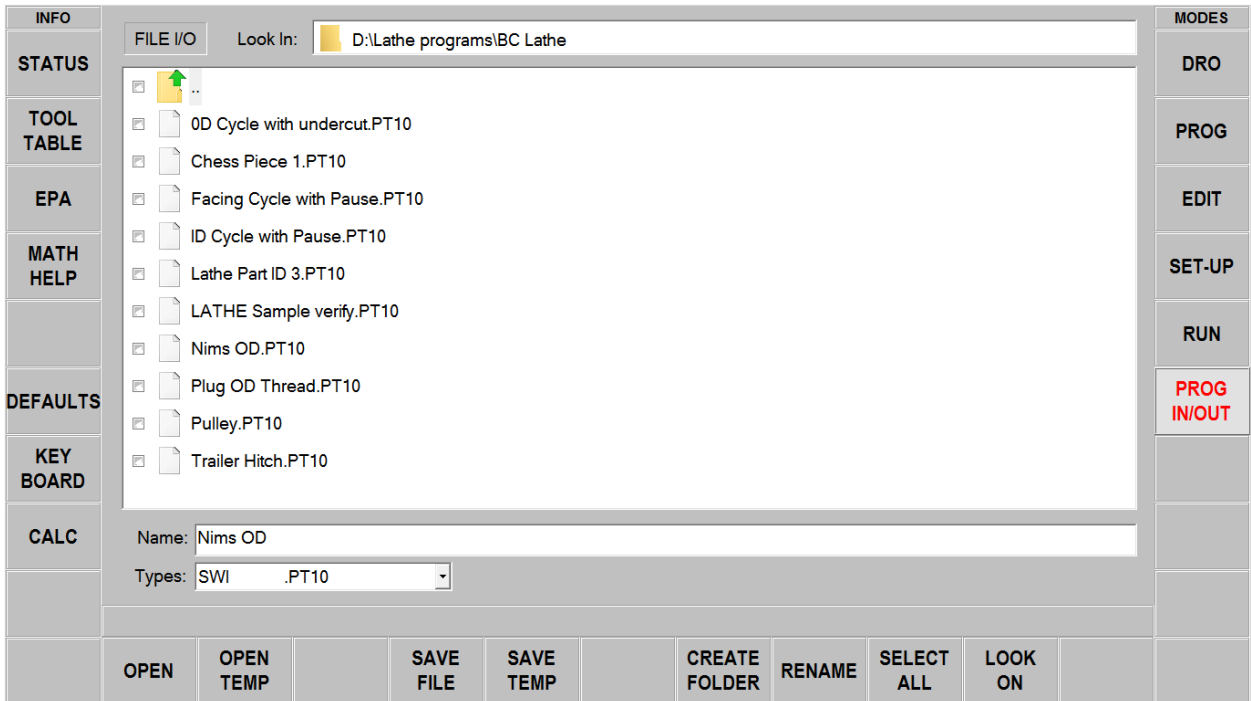
Figure 13 - The Program In/Out screen showing a few of the programs used to test the ProtoTRAK RLX before release.

13.1   Getting to Files and Directories
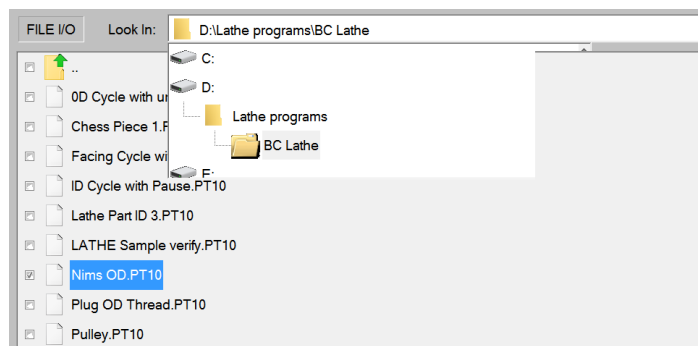
Figure 13.1 - Tap in the Look In box to see the available drives. Above, the file path is also shown for the highlighted program.

When you tap into the Look In box, the ProtoTRAK RLX will give you a view of the available drives. Tapping on the drive you want will expose its file structure in the main part of the screen. To open a drive, simply tap on the drive you want. Double tap the folder name or tap the Open soft key to open folders.

The Name box will display the name of the program in current memory until you highlight another folder or program.

The Types box will show which file types are displayed. If you purchased optional Converters, you will see the appropriate file type extension listed when you tap in the Types box. For example, if a DXF Converter is installed on the ProtoTRAK RLX, you will see the .DXF and .DWG extensions.

Thumb drives and Network locations are assigned to Drives D, E, F, etc. as you add them.

Note: *Although you may view the contents, the ProtoTRAK RLX will not allow programs to be saved to the C Drive. You must use either a USB Thumb drive or Network to save and retrieve saved programs.*

13.2 Saving a Program

To save a program you have written or edited, we recommend you do the following steps in order:

- In PROG IN/OUT – open the folder in which you want to save the program.
- The Program Name defined in the PROG mode will automatically be in the Name bar. When you press SAVE FILE, that file will be saved and should appear in the open folder.
- Otherwise, you can click on the text box next to Name, and use the keyboard to type in your program name.

If you want to save a copy of the file under a different name, simply tap in the Name bar and the Key Board will automatically launch. Erase the old name and then enter the new name. Close the Key Board and tap SAVE FILE.

13.3 Opening a Saved Program

To open a program, navigate to the one you want and then tap on it to highlight. Then either double tap on the file name or tap the OPEN soft key.

The ProtoTRAK RLX will only keep one program in current memory at a time so you will be reminded that opening a new program will overwrite the one in current memory.

Tip: *If you made changes to the program in current memory, save it again before opening another one.*

When the new program is loaded into current memory, the ProtoTRAK display will revert to the startup screen.

The LOOK ON soft key will show you an XZ line drawing of the program as you highlight them. If the program is large, the ProtoTRAK RLX may take a moment to display the drawing.

13.4 Temp Files

Temp files enable you to preserve the set up information for the part you are working on, in addition to the program. This is handy in case you would like to shut down the ProtoTRAK without losing the offsets, reference position and other information you need to run the program. You may also want to use Save Temp periodically as you are working if you are worried about losing power. It is three taps from programming to Save Temp and then back to where you were in the program.

All programs, tools and position info will be saved at the moment you tap Save Temp. Tapping Save Temp over-writes all data from previous Save Temp.

Tap Open Temp to restore all the information to the ProtoTRAK RLX.

Tip: After Open Temp, it is wise to check X, Z ABS zero in case something moved!

13.5 Deleting a Program or Folder

To delete a program or folder, press (not tap) and hold file name or folder in the data section until you see the highlighted circle, when you pick up your finger you will see the drop-down box. Press DELETE.   You will be warned before deleting.
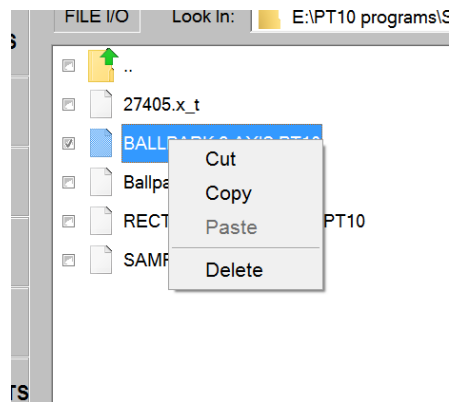
Note: to delete the program from current memory, go to Edit Mode, Erase Prog.

13.6 Renaming a Program or Folder

To rename a program or folder from Program In/Out, first navigate to the item you would like to rename. Tap and highlight the Name box.

You will first need to erase the current name. Tap the Keyboard info key to launch the keyboard. Once it appears, tap into the Name box again so that what you do on the keyboard will be shown in the Name box.

Press Rename. The name of the file or folder will change. The old name will disappear (that is, you do not create a copy with a new name, leaving the old name as it was previously saved.)

13.7 Create a New Folder

To create a new folder, first highlight the drive or folder in which you want to have the new folder.

Launch the Keyboard by tapping the Keyboard info soft key. Then tap into the Name box. If there is a name already there, use the backspace of the keyboard to erase the name. The item with that name will not be affected.

Use the keyboard to write the name of the new folder. Press Create Folder and a new folder with the name in the Name box will appear.

13.8 Copy or Cut a File or Folder

To copy a file or folder, first navigate to the drive and double tap the folder where the program you want to copy is located.

Press (not tap) and hold file name or folder in the data section until you see the highlighted circle, when you pick up your finger you will see the drop down box.
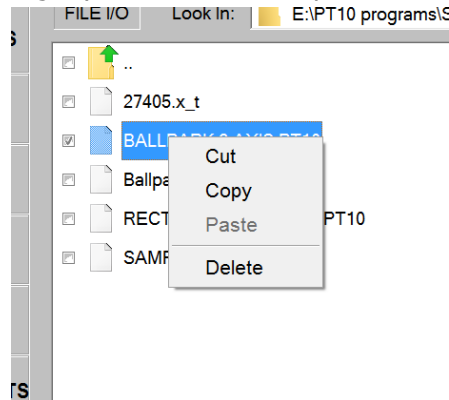
Figure 13.8 - Pressing and holding the file name will bring up the box as shown above.

Tap Copy to copy the item. Tap Cut to have the item deleted from the original location.

To place the copied item in a new location first navigate to the location where you want the copy to go.
Press and hold this drive, folder name or screen within the folder as above and select Paste.

If you selected Copy originally, the file or folder will not be deleted from the first location. If you selected Cut, it will be deleted from the first location.

13.9 Backing Up Programs

You may do a backup using the procedure above. When you tap the Select All soft key, all the files and folders visible on the screen will be selected. By pressing Copy, you may place these files into a new location all at the same time.

Note: *If you select a large number of files, the ProtoTRAK RLX may need a moment to perform the copy and paste.*

13.10 Look On

Press the Look On button to enable a preview window on the left-hand side of the screen. This will dynamically show you a top view of the program that is highlighted on the right-hand side of the screen. Press the Look Off button to disable the preview window.

13.11 File Extensions

Programs you write on the ProtoTRAK RLX will automatically receive the file extension .PT10. The following is a list of other program types and what will happen if you open them.

Extension	Description	Notes
.PT10	ProtoTRAK RX series	RLX files created and files converted and then saved.
.PT4	ProtoTRAK S, V and SX series	Some feature incompatibility.
.LX2	ProtoTRAK L2	Some feature incompatibility.
.LX3	ProtoTRAK L3	Some feature incompatibility.
.GCD	G-code Program	Will run as a G-code file
.CAM	G-code	to be converted to ProtoTRAK format
.DXF	a DXF file	Optional DXF converter will launch when the file is opened.
.DWG	an AutoCad DWG drawing file	Optional DXF converter will launch when the file is opened.

13.12 CAD/CAM and Post Processors

In addition to running G-code files, the ProtoTRAK will also accept CAM files and convert them into the ProtoTRAK events. This is a great advantage as it allows you to have your CAD/CAM programmer send files to the machine that the machinist can then work with in the familiar ProtoTRAK interface. The machinist can modify the program as necessary without having to go back to the CAD/CAM programmer.

In order to run a CAM program, the program must be posted through a post-processor that makes some adjustments to the output of the CAM software so that it is understood by the ProtoTRAK. The ProtoTRAK uses a post-processor that is very similar to the Fanuc 6T.

If you are not familiar with writing a post-processor, we recommend that you contact your CAD/CAM supplier. We will be happy to work with him to get you the post-processor you need.

13.12.1 Writing a Post Processor

The following are modifications to a Fanuc 6 post-processor that are necessary for writing the ProtoTRAK post-processor.

Beginning File Format – The ProtoTRAK has no special requirements, it does not need any special characters. This is unlike the Fanuc that uses the % to initiate the rewinding of the tape.

End of File Format – The ProtoTRAK requires the % to show the end of the file. Characters after the % will be ignored.

Beginning of an Operation – The ProtoTRAK requires that the tool number, feedrate, spindle speed and tool offset appear before, or on the same line as, a move command. The absolute zero of the ProtoTRAK is set in a different mode and does not need to be set at the beginning of each operation.

Lines – The line feed (or carriage return/line feed) signals the end of the line (ASCII code hex 0A or 0D0A). A semicolon is optional.

Coordinates – May be formatted in inch or metric. The coordinate words are X, Z, I, L and K. The valid ranges are:

- Inch: min -99.9999 to max +99.9999
- Mm: min -999.99 to max +99.999

Rapid Moves – May be modal or non-modal. Modal means that data is generated only if it is different from the last position.

Linear Moves – G01 are formatted the same as rapid moves.

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Arcs – Arc centers are specified by the address I and K for the X and Z axes. The number following the I and K are incrementally referenced from the starting point of the arc. Radius values are not allowed.

Tool Numbers and Tool Changes – The format of the tool number is from T1 to T99. Combined tool number and offset numbers cannot be used. During program run, the ProtoTRAK will rapid to home for a tool change and pause for the tool to be loaded manually and the operator to press GO. Automatic tool changes with an indexer may be programmed with the ProtoTRAK RLX.

Feedrates – The ProtoTRAK RLX can be programmed in inches (or mm) per minute. Valid ranges for G98 are .1" to 99.9" or 2.5mm to 2500mm. Valid ranges for G99 are 0.001" to 0.099" per revolution or 0.025mm to 2.5mm per revolution.

Spindle Speed – The ProtoTRAK RLX will recognize G96 or G97.

Diameter – The X-axis is programmed in diameter, not in cross slide motion.

File Name – Name your file with a .CAM extension so the ProtoTRAK will recognize the file as a CAM file and convert it into ProtoTRAK events when it is opened. Otherwise, use the .GCD extension so that the ProtoTRAK may run native g code as is without a conversion process. Note that editing the program must be done through our g code editor, and there will be no error checking performed when running in this mode.

13.12.2 Supported G Codes for CAM Converter

The following G-codes may be used in a CAM file that you want to have converted to ProtoTRAK program events. G Codes that are not on the list below have no correspondent operation in the ProtoTRAK events and will be ignored when the program is converted.

If a certain G-Code is essential to your program and you do not see it here, you can simply add an event to the resulting ProtoTRAK program that best represents the needed G-Code. This is probably the easiest way to insert a complex geometry like a custom thread into the program.

G Code	Description	Sample of Acceptable Format	Notes
G00	Position at Maximum Feedrate	G00 X0.0 Z0.0	
G01	Linear Interpolation	G01 X0.0 Z-1. F15.	F = Feedrate in Inches per minute
G02	Circular Interpolation (Clockwise)	G02 X1. Z2. I0. K2.	I & K define the X and Z center points respectively, incremental from the starting point of the arc.
G03	Circular Interpolation (Counter-clockwise)	G03 X2. Z0. I2. K0.	
G20	Input in Inch	G20	Default
G21	Input in Metric	G21	
G40	Cutter Compensation Cancel	G40	Default
G41	Cutter Compensation Left	G41	
G42	Cutter compensation right	G42	
G73	Peck Drilling Cycle	G73 X0. Y0. Z-1. R.1 Q.125 F15.	Q = depth of peck Chip break retract distance is saved in config.ini file (default 0.020 in.)
G76	Threading Cycle	G76 X_ Z_ I_ K_ D_ F_ A_ P_ Q_	(See explanation below in Lathe GCD section)

G Code	Description	Sample of Acceptable Format	Notes
G80	Canned Cycle Cancel	G80	
G81	Drilling Cycle	G81 X0. Z-1. R.1 F15.	Z = final depth, R = rapid position
G82	Drilling Cycle, Dwell at Bottom	G82 X0. Z-1. R.1 P500 F15.	P = dwell time in milliseconds
G83	Peck Drill Cycle	G83 Z-1.0 Q.25 R.01 F15.	Z = final depth R = Rapid position Q = Depth of each peck
G84	Tapping Cycle	G84 X0. Y0. Z-2. R.1 S300 F15.	S defines RPM, Pitch = F / S
G85	Boring Cycle	G85 X2. Z-2. R.01 F15.	
G92	Simple Threading Cycle	G92 X.75 Z-2. R0. F.1 X.73 X.71 X.69 X.67 X.65 X.63	X values are defining each pass of thread. Last X value defines the X Minor Diameter. Number of passes is determined by number of X values. It is recommended to have a G00 command prior to G92 to define starting X and Z values for thread. R = taper amount (incremental from starting X diameter). F = Pitch Angle, spring passes, and number of starts cannot be defined through CAM converter, and will use defaults of 29.5, 1, and 1 respectively. However, they can be edited through our user interface after being converted.
G96	Constant Surface Speed On	G96	
G97	Constant Surface Speed Cancel (RPM)	G97	Default
G98	Feed per Minute	G98	Default
G99	Feed per Revolution	G99	

Legacy SWI G Codes

G Code	Description	Sample of Acceptable Format	Notes
G130	**Peck Drill cycle**		
	G130 ZB+0.1000A ZE-1.0000I NP04 T05 S0600 RV0.004;		
			ZB = Z Begin
			ZE = Z End
			I = Incremental reference
			F= Feedrate
			NP = # of pecks
			T = Tool #
			A = Absolute reference
			SS = Constant Surface Speed
			S = RPM
			RV = Inches per Revolution
			Note that S or SS can be used.

G Code	Description	Sample of Acceptable Format	Notes
G137	**Standard Threading Cycle**		
	G137 XB+1.0000A ZB+0.0000A XE+1.0000A ZE-2.0000A PI0.1 NP10 SP 01 A29.5 SI1 ST01 S1200 T01;		
			XB = X begin
			XE = X End
			PI = Pitch, or 1 divided by # of threads per inch / mm
			NP = # of passes
			SP = Spring passes
			A = Plunge angle
			SI = Side (0=inside, 1=outside)
			ST = # of thread starts
G138	**Custom Threading Cycle**		
	G138 XB+1.0000A ZB+0.0000A XM+0.9250A XE+1.0000A ZE-2.0000A PI0.1 NP10 SP01 A29.5 SI1 ST01 S1200 T01;		
			XM = X minor diameter
M00	Program Stop (prompt for Press Go will appear)	M00	
M02	End of Program	M02	
M05	Spindle Off	M05	
M06	Tool Change	T1 M06	
M08	Coolant On	M08	
M09	Coolant Off	M09	
M30	Program End	M30	
M51	Auxiliary Output ON	M51	The Auxiliary Output option must be available
M53	Auxiliary Output OFF	M53	
	Additional Notes		
1	Decimal format for X and Z positions:		
	Inch = 999.9999		
	Metric = 9999.999		
	Decimal must be included, ok to truncate 02.0000 into 2.		
2	End of file character is the percent sign (%). This must be placed at the end of each file		
3	End of block is carriage return (ASCII 13) and linefeed (ASCII 10).		
4	Tools are defined using the T01 M06 command, where 01 is the tool # and M06 returns all axes to their home position, shuts off spindle and prompts the user for tool change.		
	Tool offsets, modifiers, and home positions are defined within the ProtoTRAK control and are ignored through G-Code.		
5	All information is modal.		
6	The above format is meant to be accepted as a CAM file on ProtoTRAK controls. The program file name should contain a .CAM extension. Files with LX2, PT4 or PT10 extensions use a different code format specific to ProtoTRAK machines.		

13.12.3 Supported G Codes for GCD Programs

G Code	Description	Sample of Acceptable Format	Notes
G00	Position at maximum feedrate	G00 X0.0 Z0.0	
G01	Linear Interpolation	G01 X0.0 Z-1. F15.	F = Feedrate in Inches per minute
G02	Circular Interpolation (Clockwise)	G02 X1. Z2. I0. K2.	I & K define the X and Z center points respectively, incremental from the starting point of the arc.
G03	Circular Interpolation (Counter-clockwise)	G03 X2. Z0. I2. K0.	
G20	Input in Inch	G20	Default
G21	Input in Metric	G21	
G40	Cutter compensation cancel	G40	Default
G41	Cutter compensation left	G41	
G42	Cutter compensation right	G42	
G80	Canned Cycle Cancel	G80	
G83	Peck drill cycle	G83 Z-2. Q.25 R.01 F15.	Z = final depth R = Rapid position Q = Depth of each peck
G84	Tapping cycle	G84 X0. Z-2. R.1 S300 Q.05	S defines RPM Q defines Pitch Feed = S x Q
G85	Boring cycle	G85 X2. Z-2. R.01 F15.	

G76	Threading cycle	G76 X Z I K D F A P Q	X = X End
			Z = Z End
			I = taper amount, or delta between X begin and X end, amount is in radius.
			   0 = straight, otherwise can be positive or negative.
			K = total thread depth, positive value in radius
			D = depth of the first pass, positive value in radius.
			F = thread pitch
			A = infeed angle, default is 0.
			P = infeed method, default is 1
			   P1 = Variable depth
			   P3 = Constant depth
			Q = threading start angle, default is 0.
			   If you wanted to cut a 2 lead thread, for example, you would define one G76 with Q = 0, and then another identical G76 except with Q = 180.

G96	Constant Surface Speed On	G96	
G97	Constant Surface Speed Cancel (RPM)	G97	Default
G98	Feed per Minute	G98	Default
G99	Feed per Revolution	G99	
M00	Program Stop (prompt for Press Go will appear)	M00	
M02	End of Program	M02	
M05	Spindle Off	M05	
M06	Tool Change	T1 M06	

G Code	Description	Sample of Acceptable Format	Notes
M08	Coolant On	M08	
M09	Coolant Off	M09	
M30	Program End	M30	
M51	Auxiliary Output ON	M51	The Auxiliary Output option must be available
M53	Auxiliary Output OFF	M53	

13.13 Networking

Prior to networking your control, you'll need to turn off the File Based Write Filter temporarily. In order to do this, you'll need to perform the following steps.

Press Mode, Setup, Service Code, input 540 and press ABS SET. When the following screen comes up, press Yes.
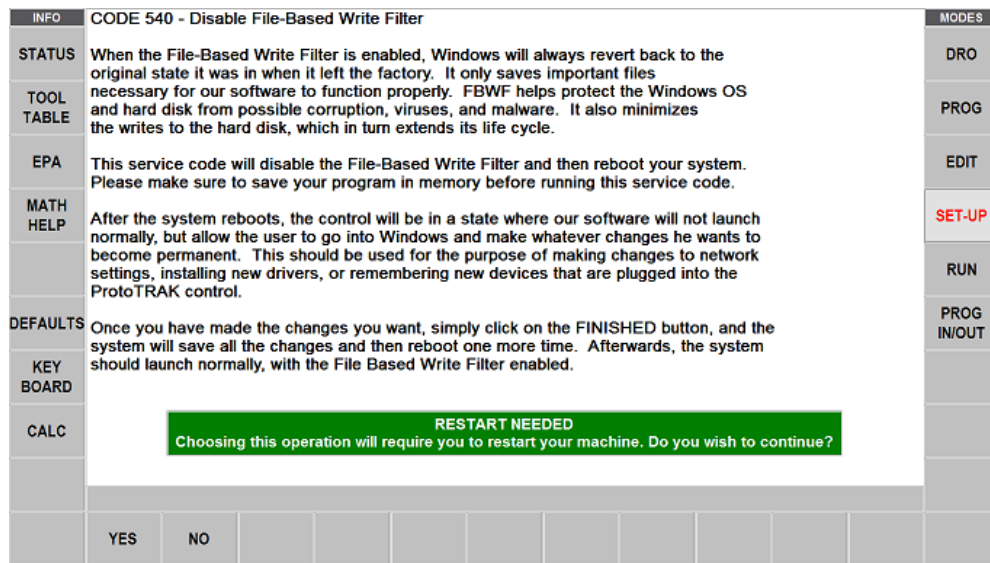
The machine will reboot and bring you to the Windows desktop. Here you'll make your changes, then once your changes are made, click Finished as shown below to reboot (Note, if you fail to click finish and reboot, you'll return to this screen. The RX software will not open up automatically on this screen)

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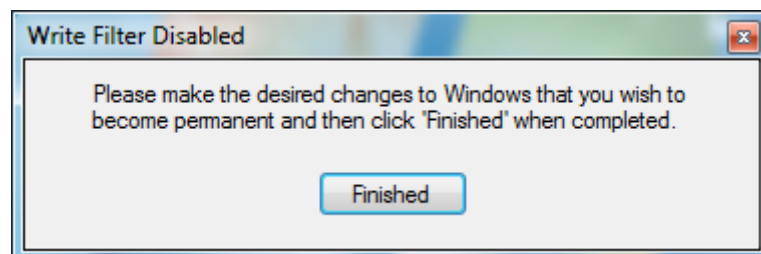
13.13.1 Networking – Windows 7

Networking Requirements:

- Setting up the RMX/RLX on a Workgroup for Windows 7
- Straight thru CAT 5 / Ethernet Cable
- Mouse & Keyboard plugged into the RX controller
- Local Admin rights to the PC
- Obtain a DSL Cable router with DHCP Services
- All clicking on the mouse will be done with left button (left click) unless specified to right click

Basic Peer to Peer Network Utilizing Workgroup

1. In order to establish a Workgroup Network in Windows 7, the computer and control must have the same workgroup name in order to be able to communicate with each other. You'll need to check the Workgroup name on your PC and if you wish to, modify the name as well and then adjust it on the RX side to match in order to be able to network the two together. To do this, perform the following steps:

   a. On your keyboard, press the Windows Logo Key to bring up the Start Menu, locate and right click Computer, then click Properties
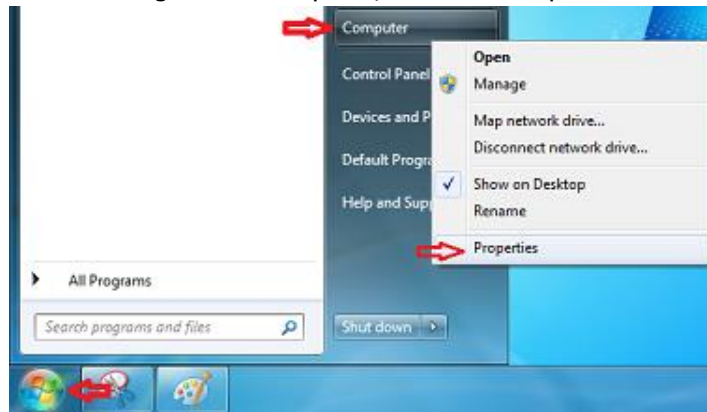
   b. Scroll down and locate Computer name, domain, and workgroup settings. Click Change Settings

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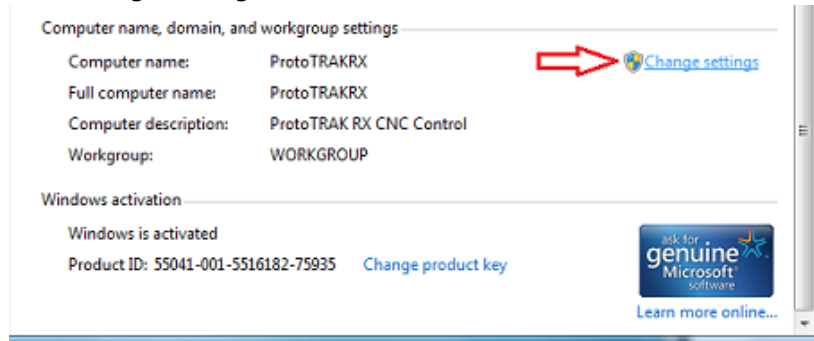
c. On the Computer Name tab, click Change
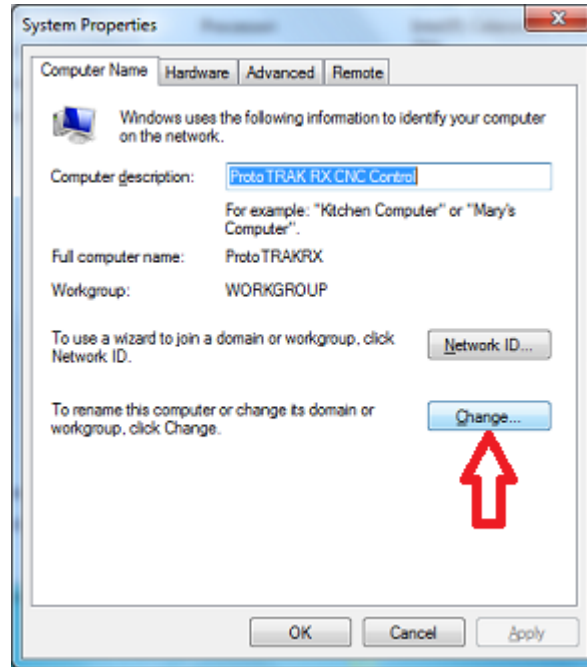
d. Write down the Workgroup name. If you prefer you, you can change the workgroup name here and press OK to change the workgroup name. Write down the name change and follow these same steps to change the workgroup name on the RX control to match the PC. *(**Note**: If you're networking multiple RX Controls, you may need to change the computer name for each one to a unique name. You can change that here as well while changing the Workgroup name)*
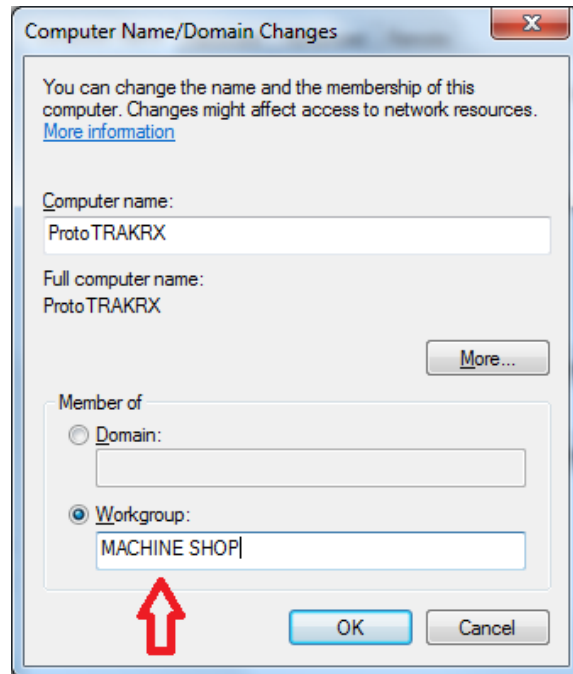
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2. **(Optional)** - Secure Network Setup. In order to do a secure network setup requiring a user name and password login, you'll need to create a user account on your PC that can be utilized on the RX control for secure access to a shared folder on your computer. You may also use an existing user account on the PC but it must have a password associated with it. To create a user account, do the following:

    a. On your PC, click Start and then click Control Panel

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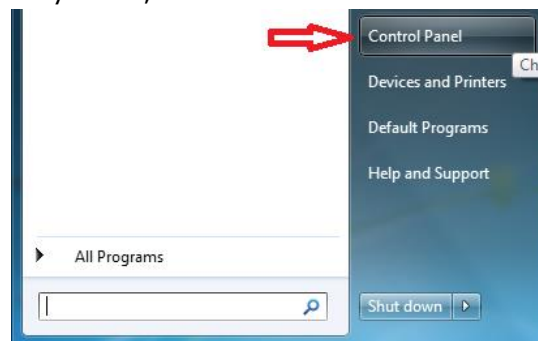
b. Under User Accounts, click Add or remove user accounts

c. Click Create a new account
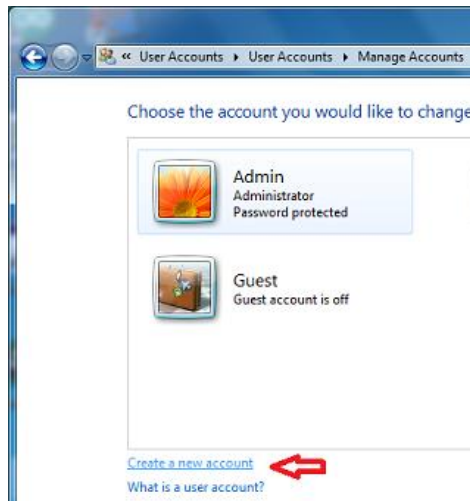
d. Input the user account name and select the user account type (Standard or Administrator) and click Create Account.

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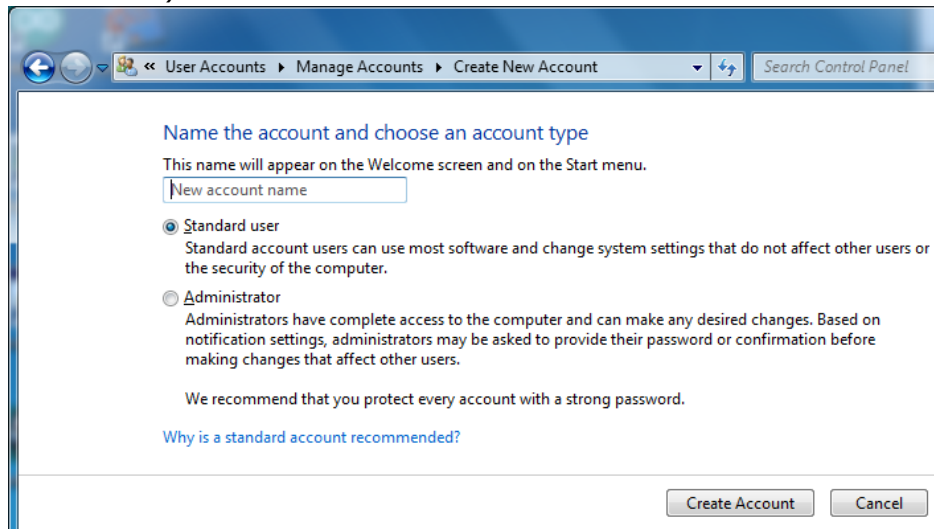
e. Once the account is created, click on the account you've created

f. Click Create a password
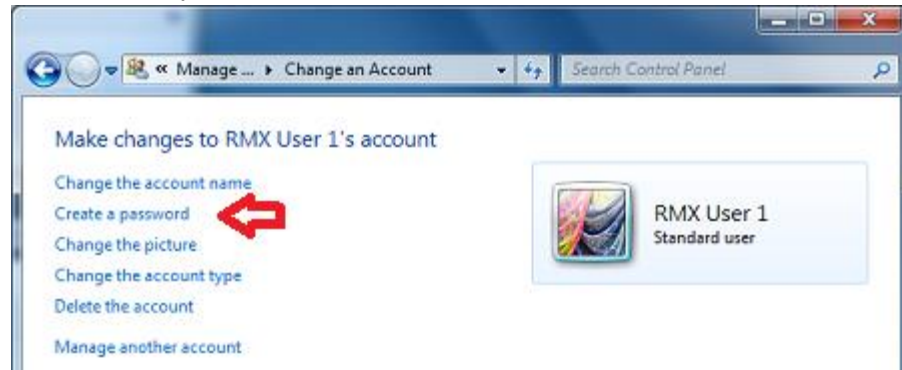
g. Create a strong password that you can easily remember and input a hint as to what your password would be to remind you in case you forget, then click Create Password.

3. Networking the RX control to the PC – With the workgroup names now changed and securely networking the control, the User account is created, the following are the instruction for creating a mapped network drive and for the control access in order to network the RX control to your PC. Make sure your PC and RX control are connected to the router. If the router has any special requirements, see the instructions for setting up your router or contact the router manufacturer beforehand. If you have any other special network requirements, see your IT Administrator or call into Customer Service 800-367-3165 with any questions for support. There are some common instructions between them so make sure you're following the instruction based on your operating system accordingly.

From the PC: (If you plan to use secure access, have a user account created on the PC for login permission. Make sure the Workgroup name on both PC and RLX are the same)

a. Press the Windows Start button on your keyboard and click Control Panel
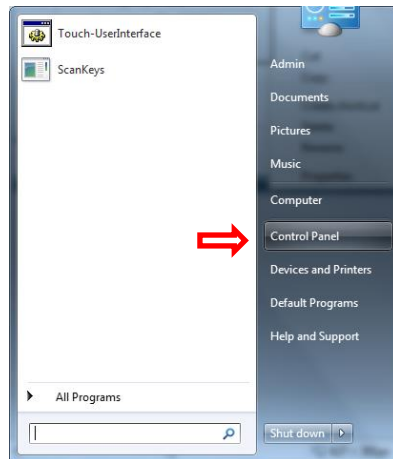
b. Click Network and Internet
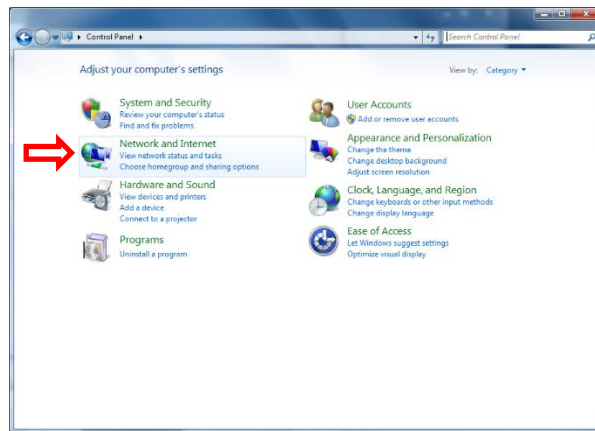
c. Click Network and Sharing Center, then Change advanced sharing settings
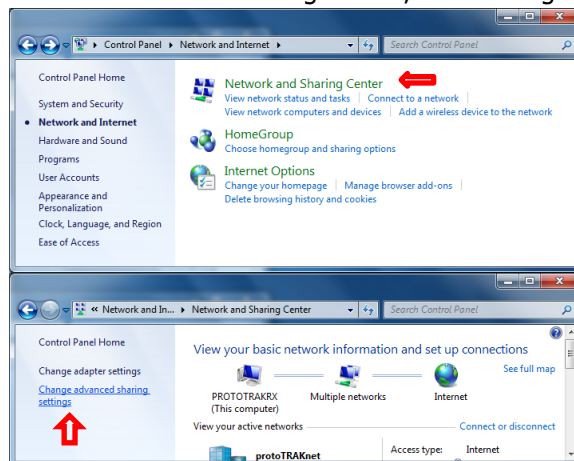
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d. Expand Guest or Public, Turn on file and printer sharing, then expand All Networks

e. Under All Networks, scroll down and Turn off password protected sharing (Turn on if you plan to log in with a user account. You must use the login of the user account from the PC.)

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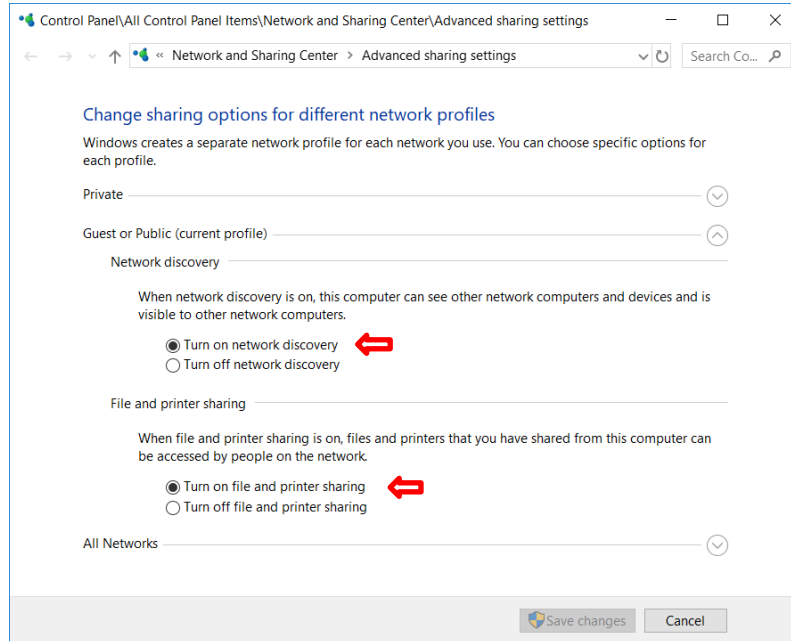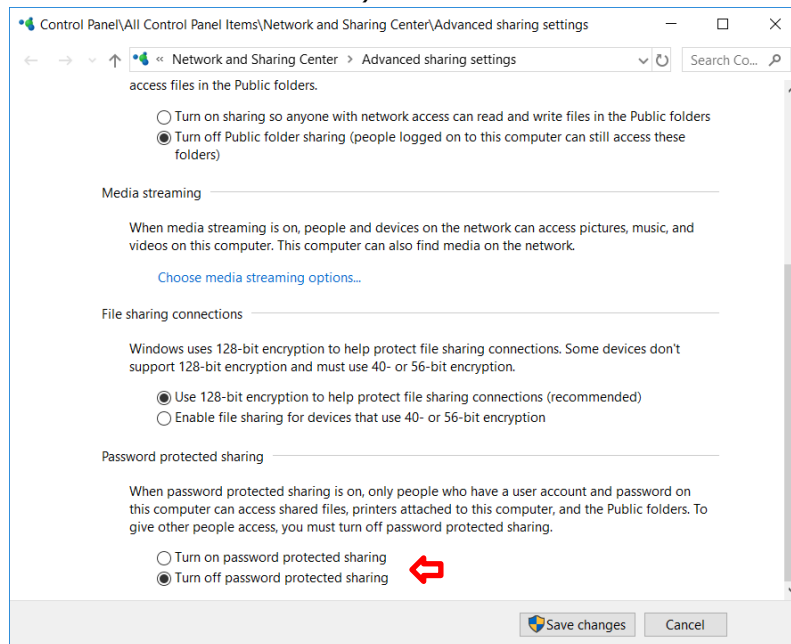
f.   Create a shared folder in desired location on the PC
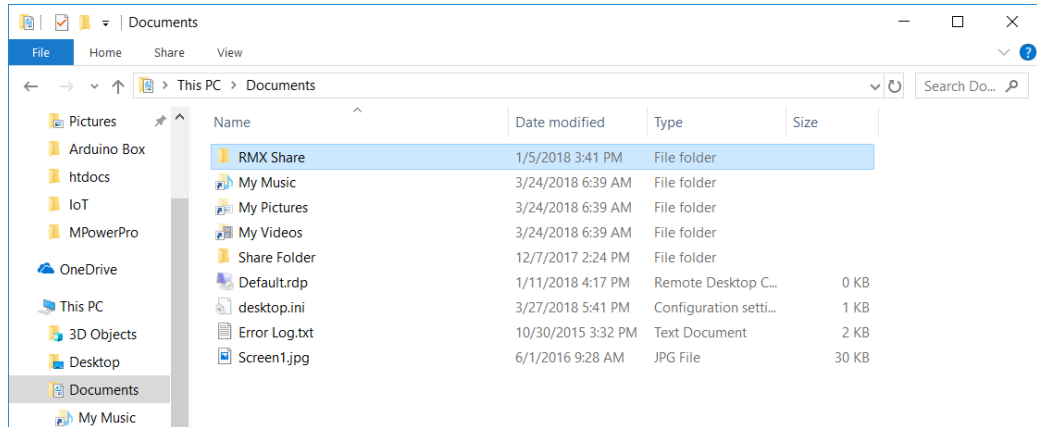
g.   Right Click and move your mouse to Share with, click Specific people
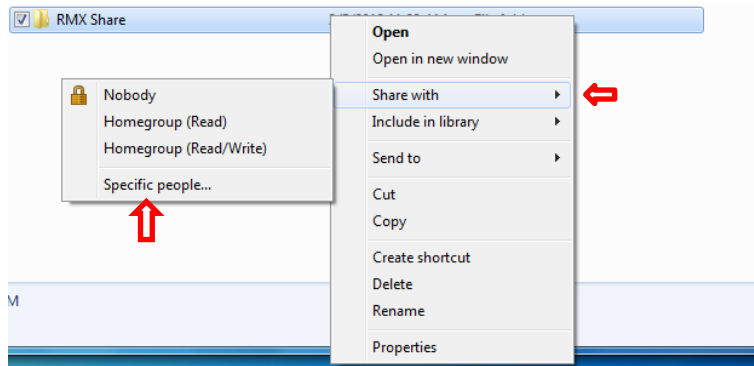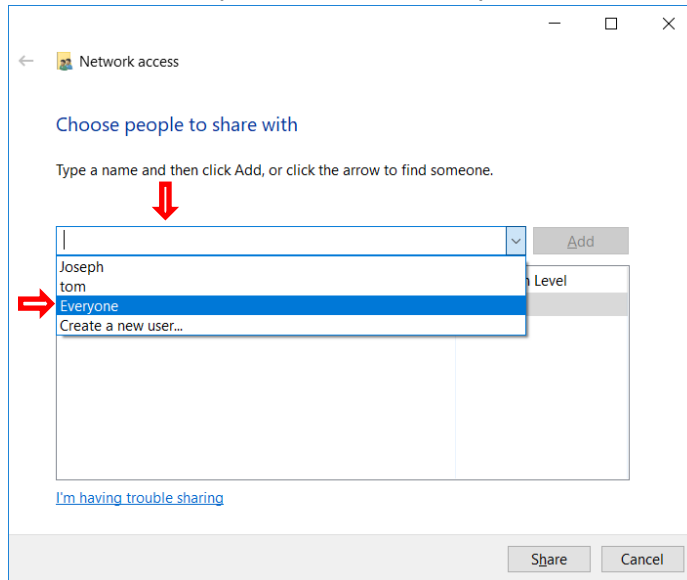
h.   Select the drop down and click Everyone

i. Change Permission Level to Read/Write, then click Share
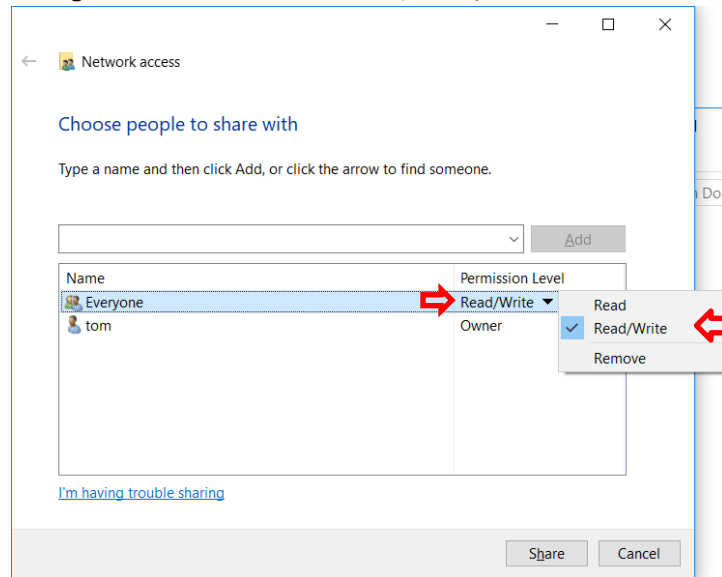
j. On the RLX, press the Windows Start key and click My Computer

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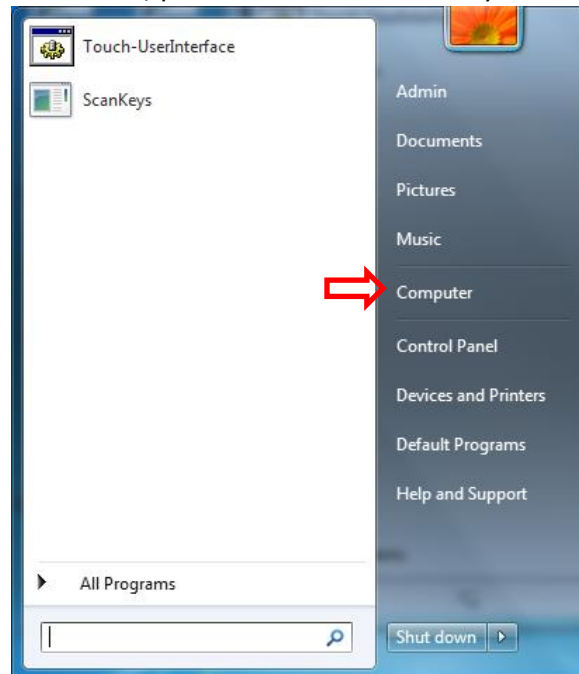
k. Click on Map Network Drive
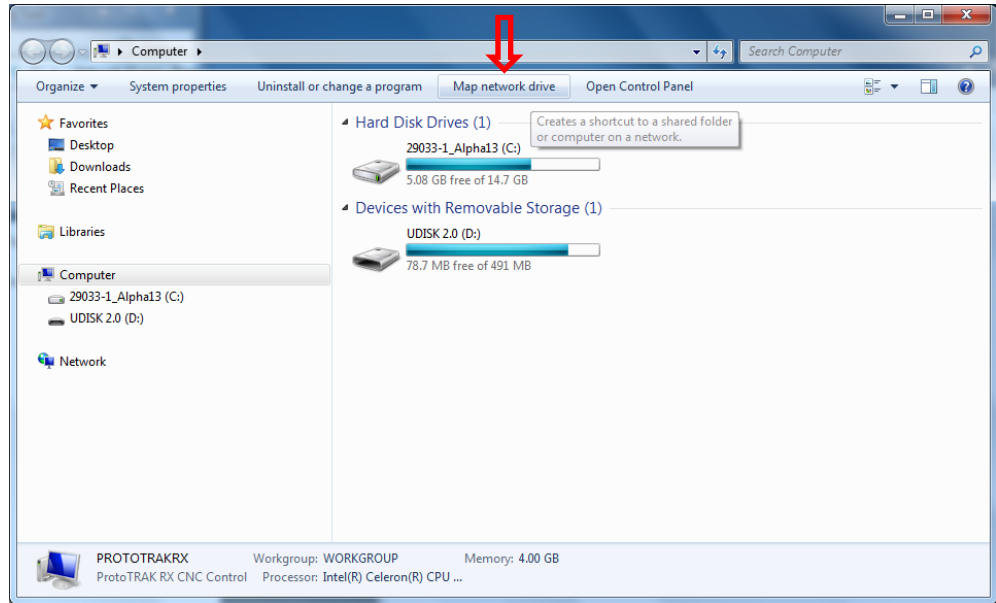
l. Click the Drive drop down menu and select a drive letter. Click Browse
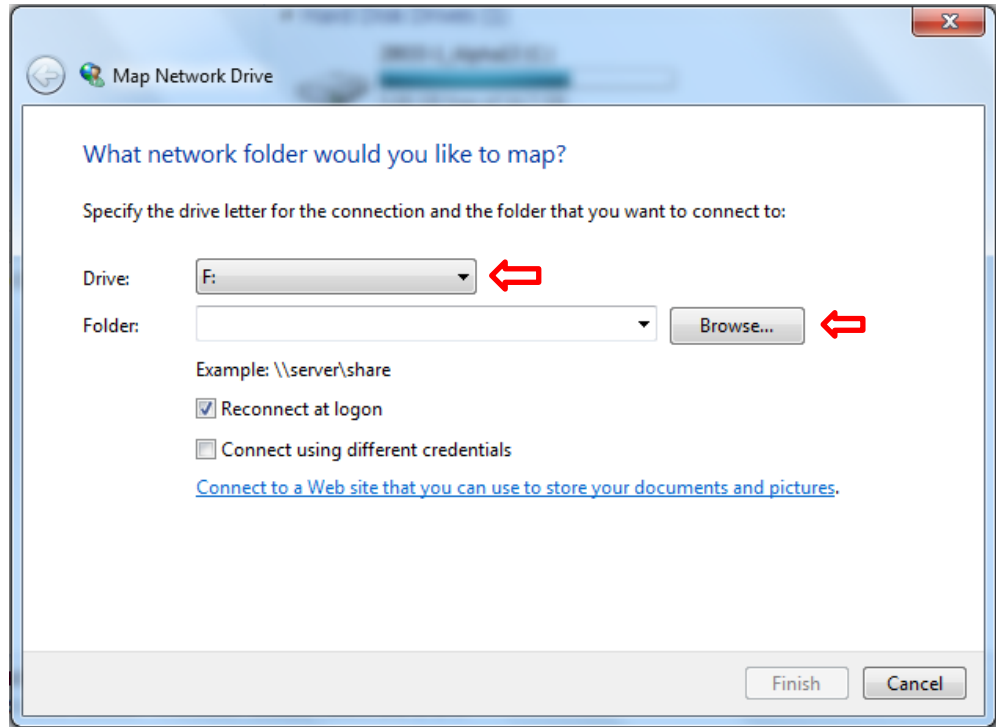
m. Navigate to the computer your shared folder is on. If you have Password protected sharing on, you'll be required to input your user name and

password from User Account you created on your PC (skip this if you have Password protected off). Make sure Remember my credentials is checked.
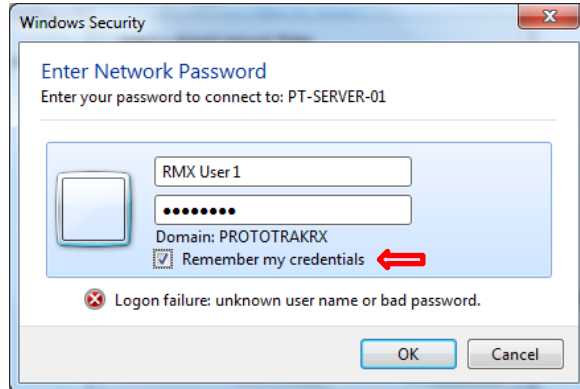
n. Navigate to and select the shared folder from the PC you're mapping to and click OK
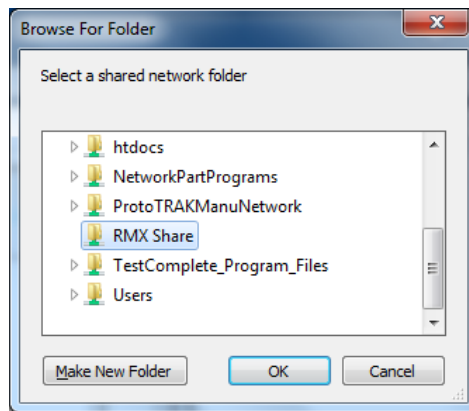
o. Click Reconnect at logon then click Finish
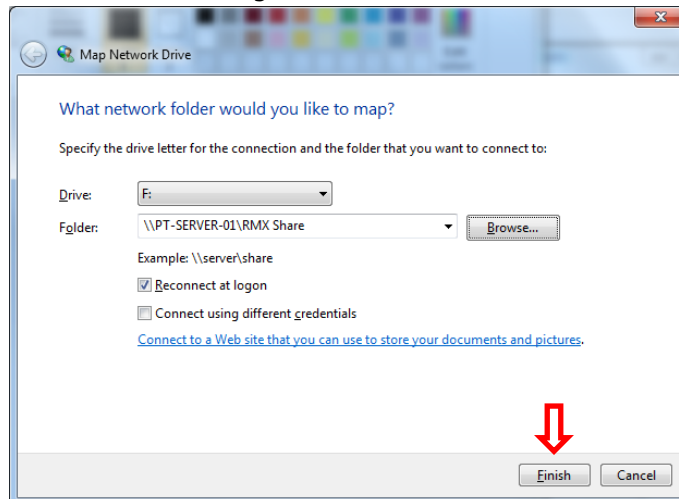
13.13.2 Networking – Windows 10

Networking Requirements:

- Setting up the RMX/RLX on a Workgroup for Windows 10
- Straight thru CAT 5 / Ethernet Cable
- Mouse & Keyboard plugged into the RX controller
- Local Admin rights to the PC
- Obtain a DSL Cable router with DHCP Services
- All clicking on the mouse will be done with left button (left click) unless specified to right click

Basic Peer to Peer Network Utilizing Workgroup

1. In order to establish a Workgroup Network in Windows 10, the computer and control must have the same workgroup name in order to be able to communicate with each other. You'll need to check the Workgroup name on your PC and if you wish to, modify the name as well and then adjust it on the RX side to match in order to be able to network the two together. To do this, perform the following steps:

   a. On the PC, Click on the Cortana Search bar and type in Workgroup, then click Change Workgroup Name.

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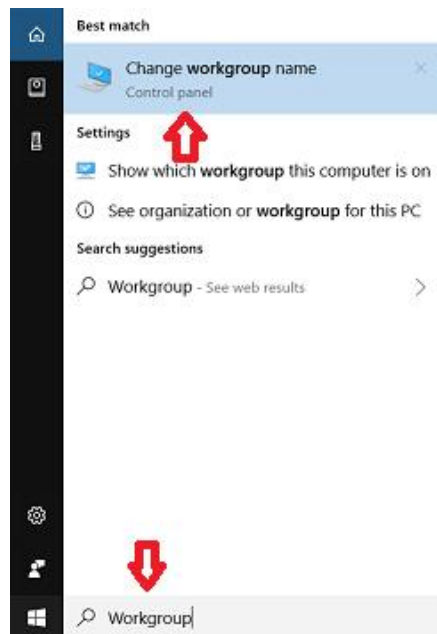
b. In the area highlighted, you can view the Workgroup names.
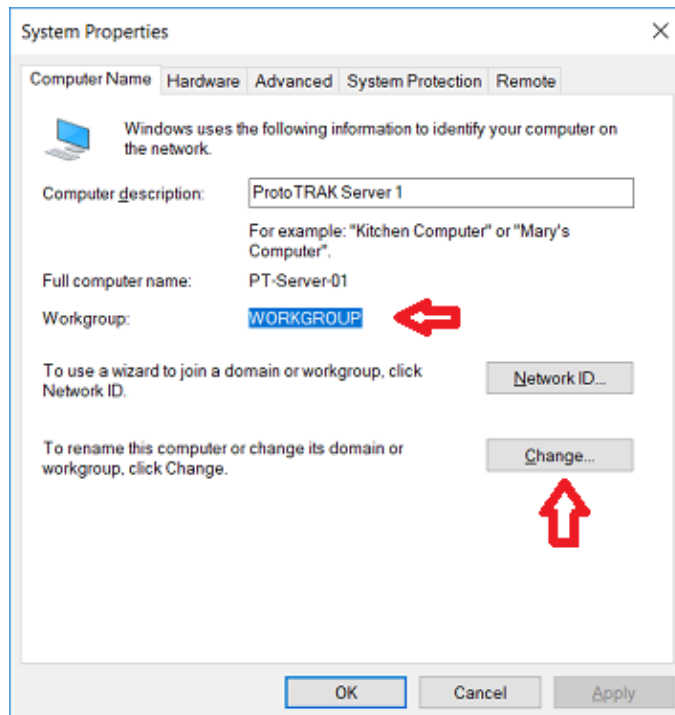
c. If you wish to change it, click Change. Under Workgroup, change the workgroup name in the text box and click OK
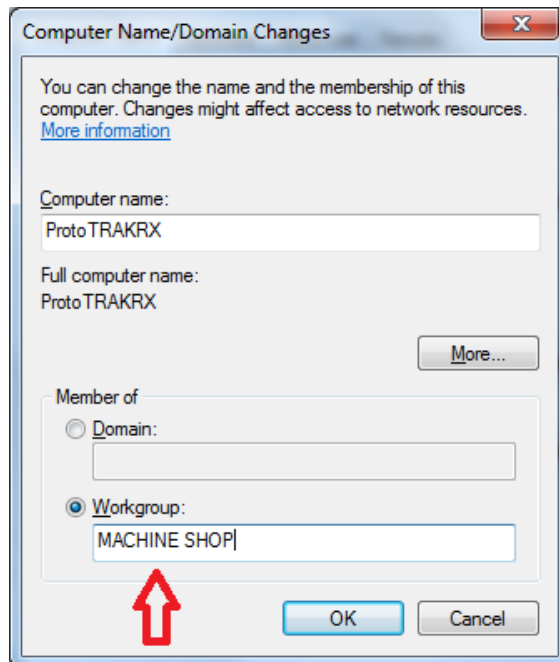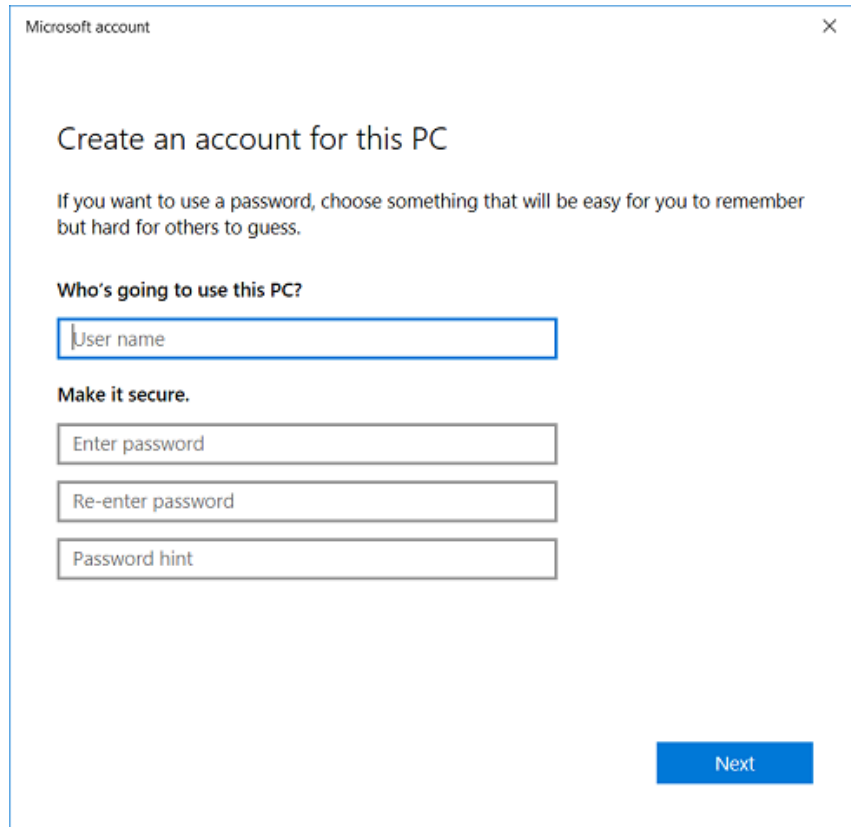
d. Follow steps 1-4 in the previous section 1.2.1 on the RX control to change the Workgroup name to match the Windows 10 workgroup name.

2. **(Optional)** - Secure Network Setup. In order to do a secure network setup requiring a user name and password login, you'll need to create a user account on your PC that can be utilized on the RX control for secure access to a shared folder on your computer. You may also use an existing user account on the PC but it *must* have a password associated with it. To create a user account, do the following:

    a. Click in the Cortana Search Bar and type in: User Accounts, then click Add, Edit, or Remove other people

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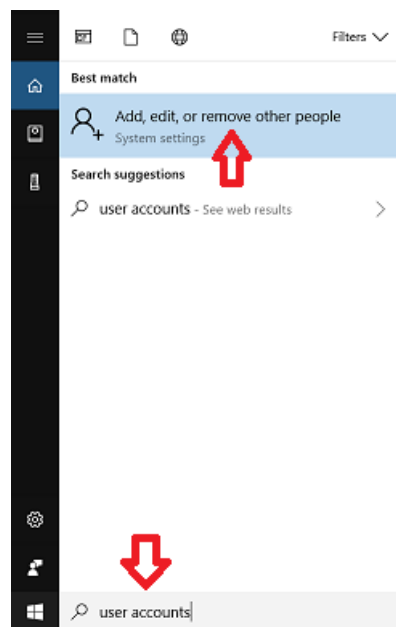
b. Click Add someone else to this PC
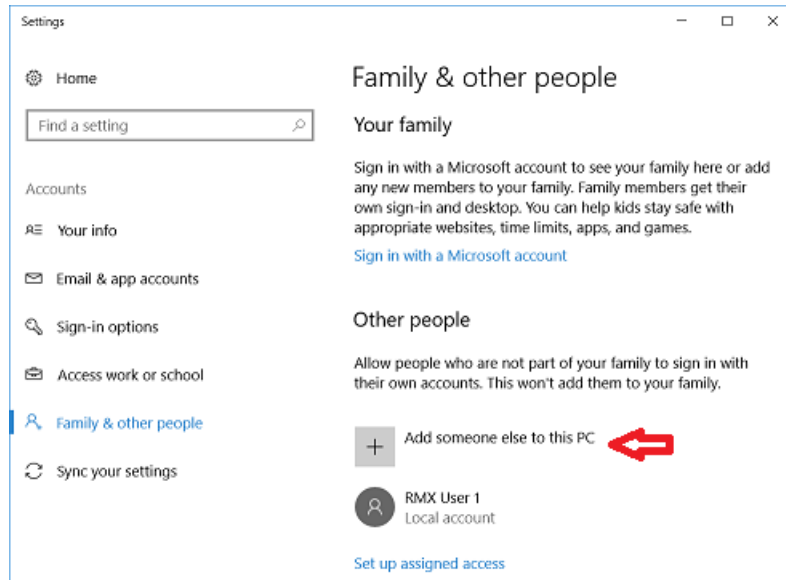
c. Then type in a desired user name, a strong password that you can remember, and a password hint that will remind you of what that password is in case the password is forgotten and click Next.

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3. Networking the RX control to the PC – With the workgroup names now changed and securely networking the control, the User account is created, the following are the instruction for creating a mapped network drive and for the control access in order to network the RX control to your PC. Make sure your PC and RX control are connected to the router. If the router has any special requirements, see the instructions for setting up your router or contact the router manufacturer beforehand. If you have any other special network requirements, see your IT Administrator or call into Customer Service 800-367-3165 with any questions for support. There are some common instructions between them so make sure you're following the instruction based on your operating system accordingly.

From the PC: (If you plan to use secure access, have a user account created on the PC for login permission. Make sure the Workgroup name on both PC and RLX are the same)
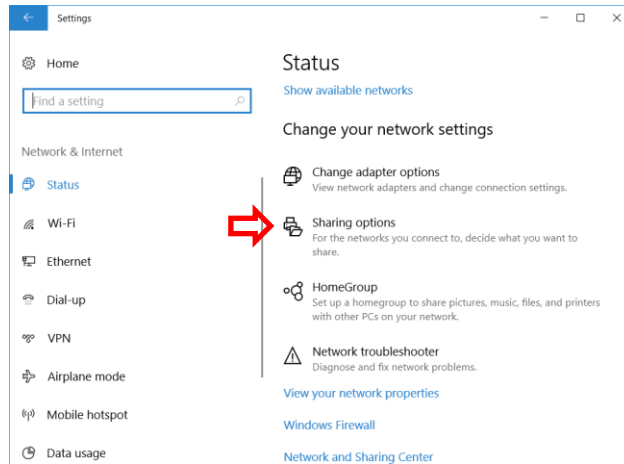
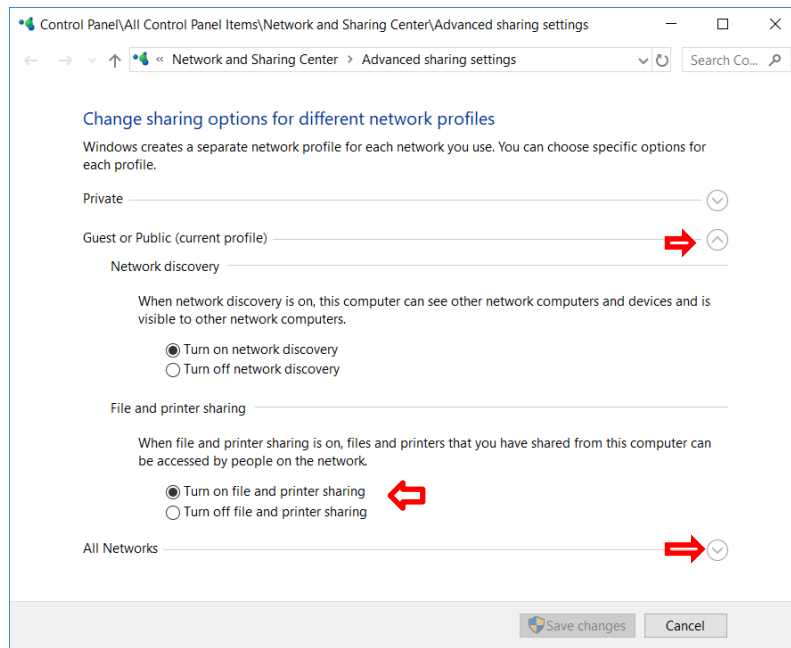a. Press the Windows Start button on your keyboard and go to Settings
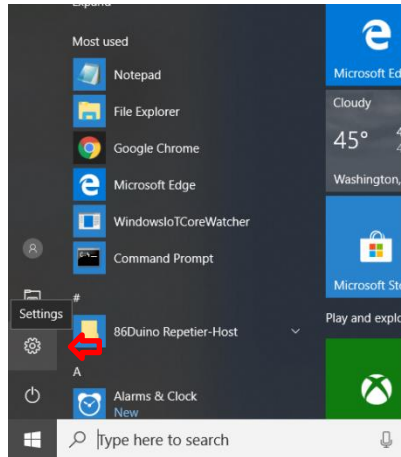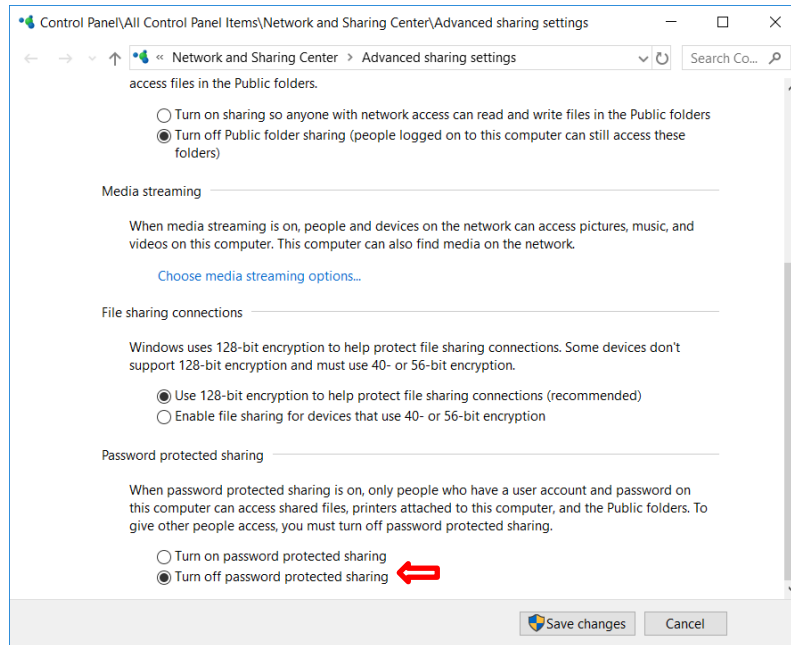

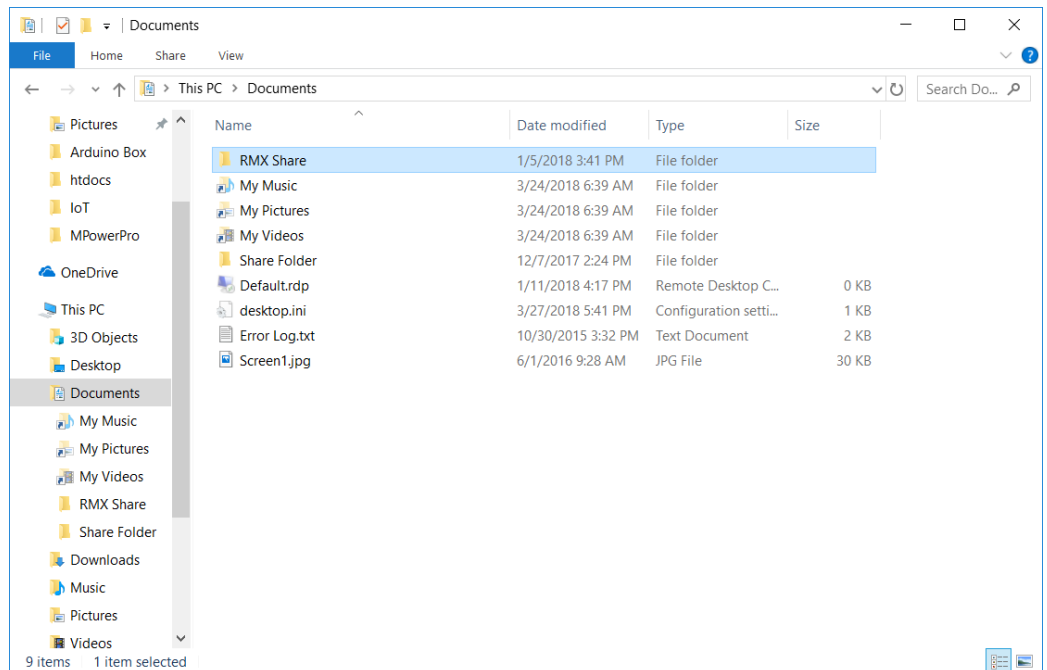
b. Click Network and Internet
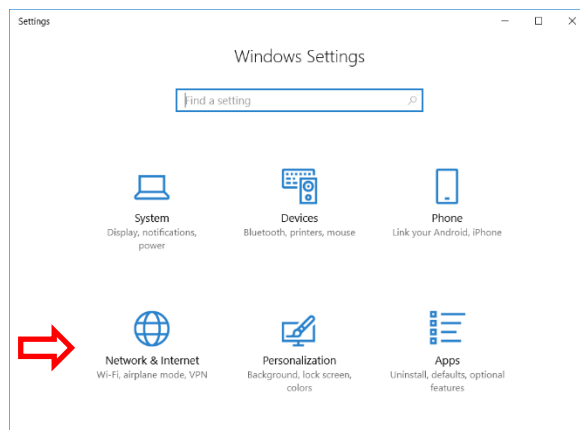
c. Click Sharing options

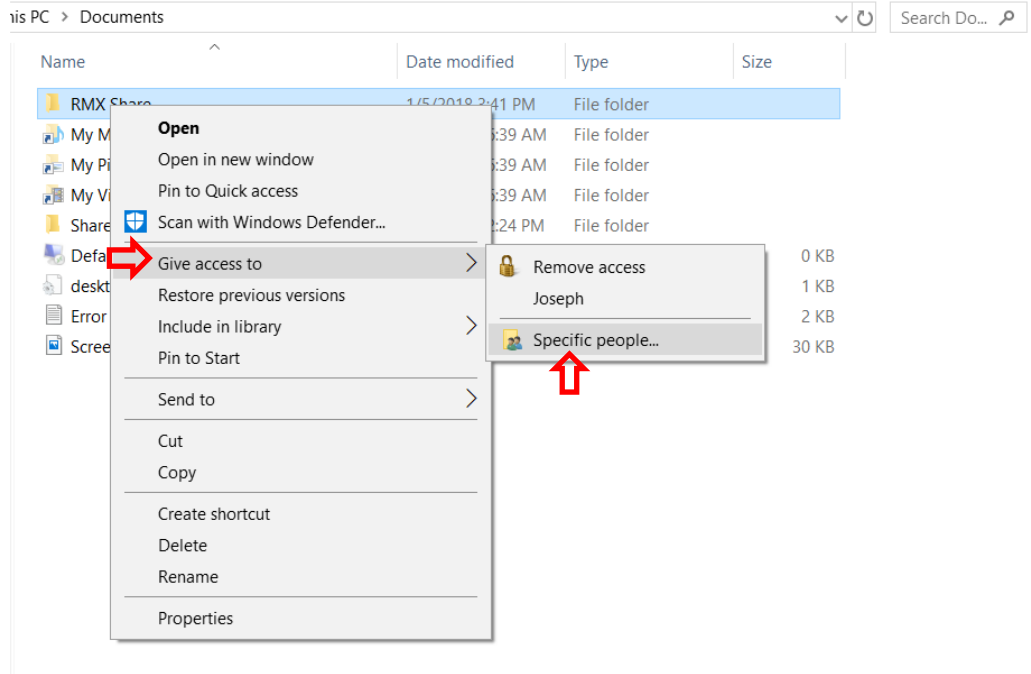d. Expand Guest or Public, Turn on file and printer sharing, then expand All Networks

e. Under All Networks, scroll down and Turn off password protected sharing (Turn on if you plan to log in with a user account. You must use the login of the user account from the PC.)
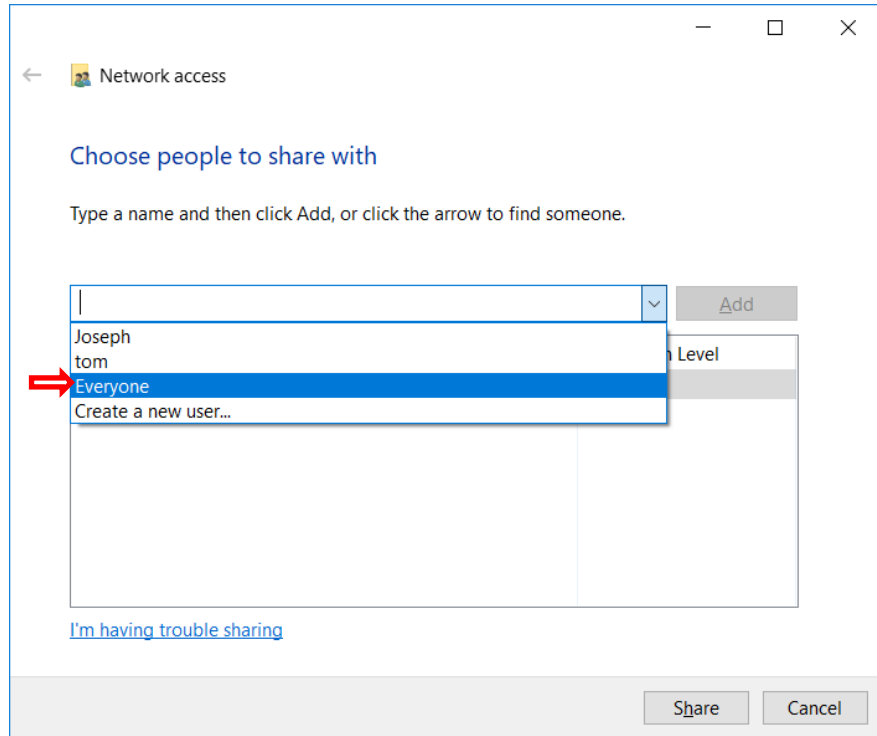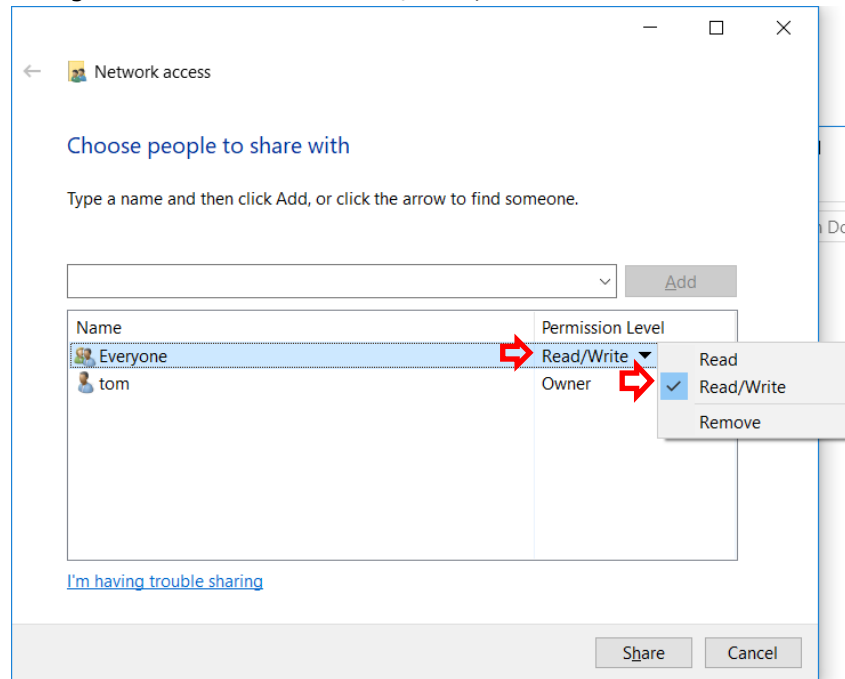

f. Create a shared folder in desired location on the PC

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g. Right click and move your mouse to Give access to, then click Specific People

h. Select the drop down and click Everyone

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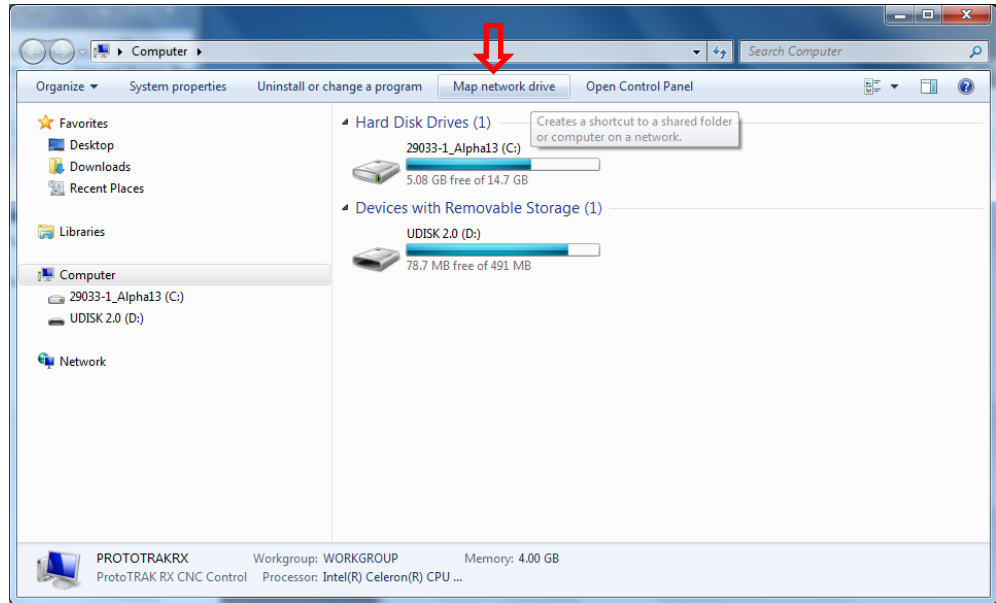
i. Change Permission Level to Read/Write, then click Share

j. On the RLX, press the Windows Start key and click My Computer

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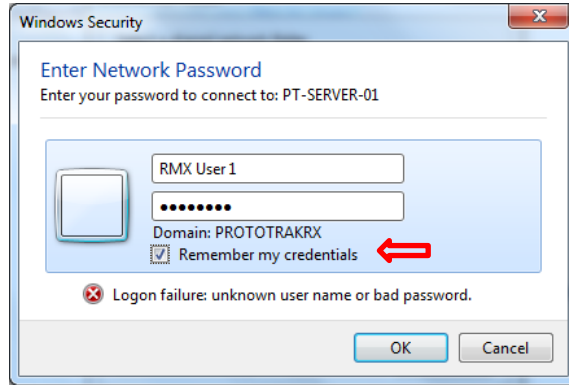
k. Click on Map Network Drive

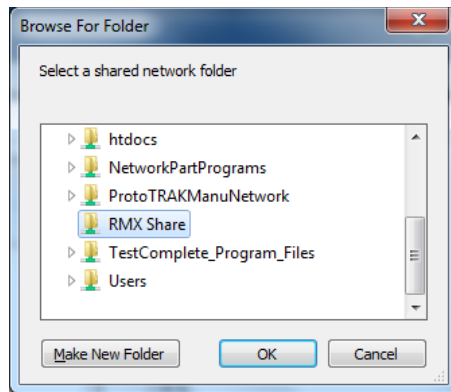l. Click the Drive drop down menu and select a drive letter. Click Browse

m. Navigate to the computer your shared folder is on. If you have Password protected sharing on, you'll be required to input your user name and

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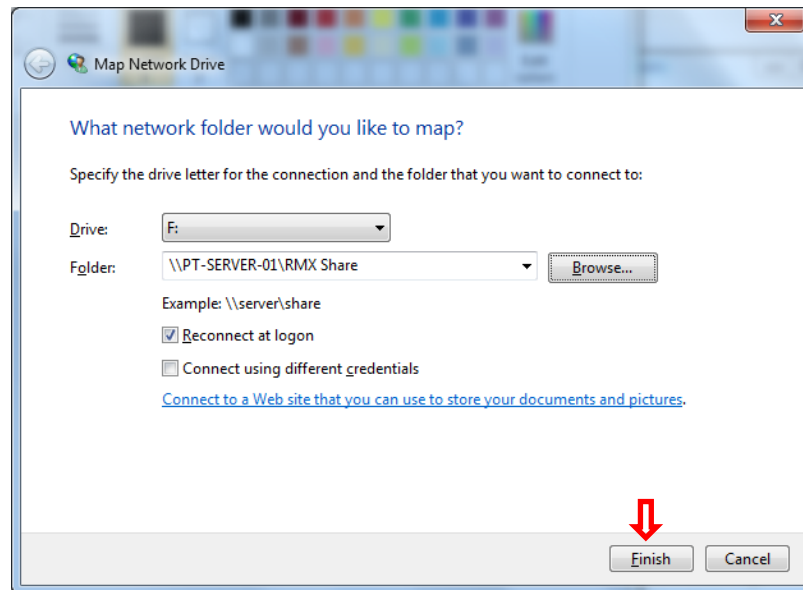
password from User Account you created on your PC (skip this if you have Password protected off). Make sure Remember my credentials is checked.

n. Navigate to and select the shared folder from the PC you're mapping to and click OK

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o. Click Reconnect at logon then click Finish

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TRAK Warranty Policy

Warranty

TRAK products are warranted to the original purchaser to be free from defects in workmanship and materials for the following periods:

Product	Warranty Period	
	Materials	**Factory Labor**
New TRAK/ProtoTRAK	1 Year	1 Year
Any EXCHANGE Unit	90 Days	90 Days

The warranty period starts on the date of the invoice to the original purchaser from Southwestern Industries, Inc. (SWI) or their authorized distributor.

If a product, subsystem or component proves to be defective in workmanship and fails within the warranty period, it will be repaired or exchanged at our option for a properly functioning unit in similar or better condition. Such repairs or exchanges will be made FOB Factory/Los Angeles or the location of our nearest factory representative or authorized distributor.

Warranty Disclaimers

- This warranty is expressly in lieu of any other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on the part of SWI (or any producing entity, if different).

- Warranty repairs/exchanges do not cover incidental costs such as installation, labor, freight, etc.

- SWI is not responsible for consequential damages from use or misuse of any of its products.

- TRAK products are precision mechanical/electromechanical/electronic systems and must be given the reasonable care that these types of products require. Evidence that the product does not receive adequate Preventative Maintenance may invalidate the warranty. Excessive chips built up around ballscrews and way surfaces is an example of this evidence.

- Accidental damage, beyond the control of SWI, is not covered by the warranty. Thus, the warranty does not apply if a product has been abused, dropped, hit or disassembled.

- Improper installation by or at the direction of the customer in such a way that the product consequently fails, is considered to be beyond the control of the manufacturer and outside the scope of the warranty.

- Warranty does not cover wear items that are consumed under normal use of the product. These items include, but are not limited to: windows, bellows, wipers, filters, drawbars and belts.

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