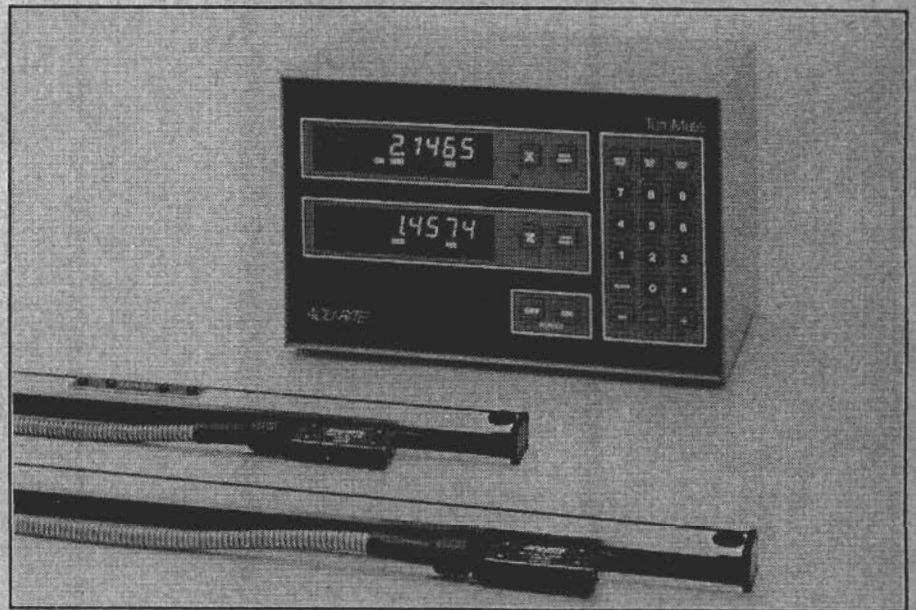


TurnMate

Digital Readout System for Lathes



REFERENCE
MANUAL

ACU-RITE®

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TurnMate

Section 1. Installation

For safety and convenience, a location for the TurnMate readout should be chosen so that:

- The readout is located near eye level, or is tipped towards the normal viewing location
- There will be no interference with the operation of the machine tool or the encoder cables
- The readout will be out of the way of chips and coolant
- The readout is securely fastened and cannot be accidentally knocked off its mounting

The TurnMate system comes complete with a mounting kit for installation of the readout. The 382252-000 kit provides a mounting block, 10" riser, 16" horizontal arm, and tray adapter. The 382254-000 tray kit provides a mounting tray for the TurnMate readout. If required, an additional 10" riser can be installed. Order kit number 382253-000 from your ACU-RITE distributor or OEM.

Connect the cable from the encoder attached to the cross-slide to the "INPUT A" connector on the rear panel of the TurnMate readout; this will correspond to the X-axis display. Tighten the two slotted connector screws. Connect the cable from the encoder attached to the lathe carriage to the "INPUT B" connector, and tighten the two screws. Lathe carriage movements will be indicated in the Z-axis display.

Location

Encoder connections

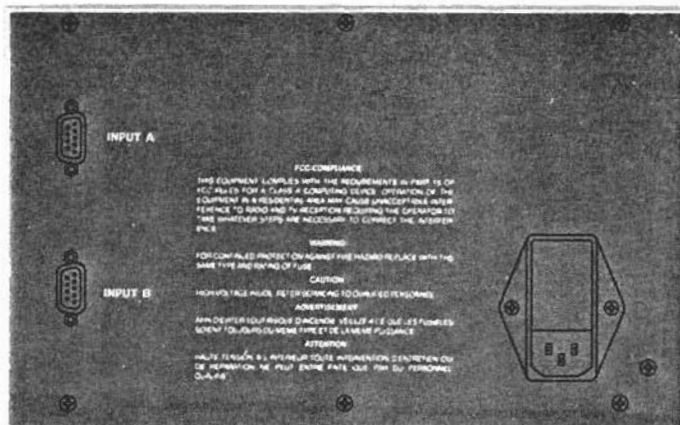


Figure 1-1. Rear view of TurnMate readout.

TurnMate

Electrical connections

A grounding screw has been provided on the rear panel. However, because of the internal grounding provided with the TurnMate system, an external ground is not required.

The TurnMate is supplied with a power cord and is set for use with 120VAC (USA standard). The voltage select switch on the power input module may be set for 100VAC, 120VAC, 220VAC, or 240VAC. Check the supply voltage to determine the proper setting for the selector switch.

To reset the selector switch, remove the cover of the power input module with a thin-blade screwdriver at the top (Figure 1-1). Set the thumb-wheel to the correct voltage. Snap the input module cover back in place.

Make certain that the voltage is properly set before plugging the readout into the supply. Damage to the readout could result from an incorrect voltage setting.

Plug the power cord into the socket on the power input module, and plug the opposite end into a properly grounded supply outlet of the correct voltage.

Operation check

Press the front panel ON key (Figure 1-2). The readout will flash **E1** in the X-axis display, which is a signal that power had been interrupted. Press the CLEAR key; the displays should both read **0.0000** (if the INCH message is visible in the display; or **0.000** if the MM message is visible).

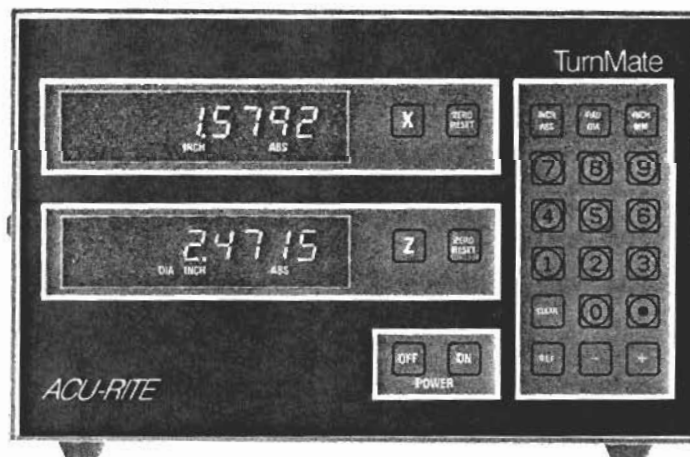


Figure 1-2. Front view of TurnMate readout.

Section 2. Configuration

Parameters that control several readout display options can be set to reflect operator preference. Parameters include: radius/diameter feature enable; display resolution; near-zero warning boundary value; count direction; and linear error compensation. **Descriptions of each parameter can be found in the following section.**

Parameters can be set independently for each axis. Initial values for all parameters have been factory set. The parameter setting steps are (refer to Figure 1-2 for locations of front panel keys):

1. Begin the parameter setup procedure by turning the readout OFF (pressing the OFF key). Hold the CLEAR key down and press the ON key; **P1** will flash on both axis displays, indicating that the parameter setting mode is active.

Setting parameters

P1
Both axes

2. The parameters are:

- P1 - radius/diameter feature enable
- P2 - display resolution
- P3 - near-zero warning boundary value
- P4 - count direction
- P5 - linear error compensation

3. Press one of the axis keys (X or Z) to begin setting parameters for that axis. **P1** and the current setting will appear in that display. The other display will be blank.

P1 rAd

For the selected axis, the radius/diameter feature is set to radius mode, disabling the RAD/DIA key

4. Parameters P1, P2, and P4 can be set to specific values by pressing the ZERO RESET key for that axis to change the current setting. P3 and P5 require numeric entry to set the parameters; use the number keys to enter a value (an existing value is cleared when entry begins).

P1 diA

For the selected axis, the radius/diameter feature is set to diameter mode, enabling the RAD/DIA key

5. Press the same axis key to advance to the next parameter.

P2 .0002

For the selected axis, the current setting for display resolution is 0.0005". If the readout is in metric measuring mode (the MM display message is lit) the display will be:

P2 .005

P5 -123

Last parameter for the axis, as set

P1 diA

Parameter setting program scrolls back to first parameter for that axis

P4 2 X

P4 2 Z

Displays during setting of Z-axis parameters

P1 diA X

P1 diA Z

Displays after pressing X axis key

P1 diA X

X-axis display showing last parameter setting made

1.0476

Typical displays after pressing the ON key. Display formats depend on parameter settings for each axis and operator key settings. The TurnMate system continues to measure machine movements during parameter setting. The current position is shown upon return to normal operation

P2 .001 X

X-axis display, showing a new (but not saved) setting for 0.001" display resolution

1.4836

Typical displays after pressing OFF and ON keys. Display formats depend on parameter settings for each axis and operator key settings. The TurnMate system continues to measure machine movements during parameter setting. The current position is shown upon return to normal operation

6. When all parameters for the first axis have been set and the axis key is pressed once more, the first parameter is shown again.

7. To set parameters for the other axis, press the corresponding axis key. **P1** and the current setting appear in the newly-selected axis.

8. To save the new settings press the ON key. The readout returns to normal operation.

9. To exit without saving parameter changes, press the OFF key, then press ON to return to normal operation. The old parameter settings will be in effect.

Either axis can display radius or diameter measurements by pressing the RAD/DIA key. The radius/diameter enabling parameter must be set to allow the feature to be used.

Settings can be either **P1 rAd** (feature disabled; continuous radius measurements) or **P1 diA** (feature enabled; radius or diameter measurements with successive presses of RAD/DIA key). Press the ZERO RESET key to change the setting. The factory setting is radius measurements on both axes.

TurnMate readouts feature three display resolutions: high (fine), medium, or low (coarse) resolution. An operator can choose low resolution for rough machining, and high resolution for finish cuts.

Subsequently pressing the ZERO RESET key will cycle through high resolution (more precise), medium, and low resolution (less precise) values for display increments. Refer to Appendix B for a listing of the display increments with various setup parameter and operator key settings. The factory setting is for high resolution displays.

A boundary value parameter can be set to provide the operator a visual warning near the end of an intended machining operation. When the measurement is less than the boundary value, the NEAR ZERO display message will flash. The message will continue to flash until the measurement reaches zero, or until the measurement is increased again beyond the boundary value. The boundary value is an absolute value; the message will flash when the value is reached from either the negative or positive direction. The factory setting for this parameter is **P3 0**, which disables the feature.

The parameter is set by making a numeric entry using the appropriate number keys and decimal point key; any existing value is cleared as soon as entry is begun. The + and - sign keys are inoperative.

There are two unique characteristics to setting this parameter. First, the NEAR ZERO display message will flash during setting of the P3 parameter. Second, the current measuring units setting is important. The value entered is in the current measuring units; for a setting of 1.0000 inch, the NEAR ZERO message will flash whenever the measurement is less than 1.0000 inch or less than 25.40mm.

Parameter descriptions

P1 - Radius/diameter feature enable

P2 - Display resolution

P3 - Near-zero warning boundary value

P4 - Count direction

This parameter defines the counting direction for encoder movements. Movement in either direction can be defined as positive or negative, and varies with different applications. The count direction parameter can be set to match current practice.

The parameter display is toggled between **P4 1** and **P4 2** by pressing the ZERO RESET key; selecting the opposite mode will change the counting direction. The factory setting for this parameter is **P4 1**.

P5 - Linear error compensation

A linear error compensation factor can be set to correct for machine tool errors. Machine tool errors are usually the result of machine wear or Abbe error.

Compensation factors are entered and displayed as positive or negative whole numbers in the range $+/- 9999$, in parts-per-million (PPM). An example would be **P5 - 123**. The factory setting for this parameter is zero compensation.

A linear error compensation factor must first be calculated. Measure the errors across the machine movement and plot the error vs. distance traveled. Draw the best-fit line through the data, and pick two points at opposite ends of the line. Calculate the linear error compensation factor to be entered in parts-per-million by the following:

$$\frac{\text{Error}_2 - \text{Error}_1}{\text{Position}_2 - \text{Position}_1} \times 1,000,000 = \text{Linear error compensation (PPM)}$$

Compensation is set by making a numeric entry using the appropriate number keys and + or - sign key. The decimal point key is inoperative.

Section 3. Operation

When the TurnMate readout is first connected and turned on, the X-axis measuring display will be **E1**, indicating that power had been interrupted. The Z-axis measuring display will be blank. Both displays will have a combination of message displays lit, to indicate current settings.

Press the CLEAR key to return the readout to a normal-condition ready for measuring, with a "zero" value in both measuring displays (exact displays depend on previous parameter and operator key settings).

During normal use, the TurnMate readout is commonly turned OFF at night. This does not interrupt power to the encoders. The unique Continu-TracSM feature continues monitoring encoder movements, and will display the correct measurement when the readout is again turned ON. The displays will correspond to the current parameter and operator key settings, and display messages will indicate current operator key settings.

TurnMate will display measurements in either inches or millimeters, corresponding to the current setting for measuring units. Measuring units are changed by pressing the INCH/MM key, and the current setting is indicated by a lighted INCH or MM display message.

TurnMate can keep track of two separate, but linked, measurements on each axis. They are known as the absolute and incremental measurements. Press the INCR/ABS key to change measuring mode; the current selection is indicated by a lighted INCR or ABS display message.

The absolute measuring mode is used to display measurements from the absolute zero point of a part to the current tool location. This mode is commonly zeroed only once on each part.

The incremental measuring mode is used to display point-to-point measurements (hole center-to-center, edge-to-edge, etc). This mode is commonly zeroed several times on each part, to begin the next measurement.

The RAD/DIA key allows either radius or diameter measurements to be displayed. Press the RAD/DIA key to change type of measurement. When the DIA display message is not shown, measurements will correspond to radius movements. With the DIA display message lit, radius measurements are doubled and displayed to show diameter measurements. The P1 parameter must be enabled (see **Setting**

Initial power-up

Normal power-up

Operator keys INCH/MM

INCR/ABS

RAD/DIA

parameters, page 2-1); otherwise measurements will be radius regardless of selection.

ZERO RESET

The current measurement must be reset to zero or "zeroed", before starting a new measurement sequence. Any axis display may be zeroed at any time by pressing the appropriate ZERO RESET key.

When the **incremental mode** is active, the current **incremental** measurement for that axis will be zeroed when the ZERO RESET key is pressed. When the **absolute mode** is active, **both absolute and incremental** measurements for that axis will be zeroed when the ZERO RESET key is pressed.

Number, decimal point, + and - sign

These keys are used during numeric entry of presets, reference presets, and parameters.

X, Z axis keys

The axis keys are used to indicate the axis to be operated on. They are used along with the CLEAR, REF, number, decimal point, and + or - sign keys during preset or reference operations. They are also used during the parameter setting routine to select an axis for parameter entry or to show the next parameter.

REF

The REF key is used to set reference presets. A reference preset can be used to show how much material to remove. This eliminates operator math while turning a part. The procedure is:

1. Take a skim cut on the part.
2. Measure the part diameter.
3. Select DIA, ABS modes (lighted DIA, ABS display indicators).
4. Reset the axis to zero (press ZERO RESET key).
5. Preset the measured diameter (press axis key; enter number; + or - key). SET display message lights when axis key is pressed, and extinguishes when the sign key is pressed.
6. Set the desired diameter (press axis key; enter number; REF; and + or - key).

The measuring mode will change from ABS to INCR mode as shown by the display indicators. The measuring display now shows the distance to be moved (or the amount of material to remove), to produce the desired diameter. After machining the part so that the INCR display is zero, the part diameter will match the entered reference preset; and the ABS display will show this diameter.

Operator features Absolute presetting

The absolute measuring mode is commonly set to zero to establish the workpiece zero point. For cross-slides, the absolute mode display is commonly preset to a specific measurement to match the diameter of a part after making a skim cut, so that a "zero" measurement would

be shown with the tool advanced to the part/lathe chuck centerline.

Presetting steps are:

1. Select ABS mode (lighted ABS display indicator).
2. Press the ZERO RESET key to set the axis to zero if desired.
3. Select an axis by pressing the axis key; the SET display indicator lights.
4. Enter the preset: enter number (an existing value is cleared when entry is started); + or – key. The SET display indicator goes out.

Note that setting an absolute preset will set the incremental mode measurement to zero. If not starting from zero, the preset is **added to** or **subtracted from** the current absolute display.

The incremental display is commonly preset to indicate the material to be removed for the next operation. The part is then machined until the display reads zero. To set an incremental preset:

1. Select INCR mode (lighted INCR display indicator).
2. Press the ZERO RESET key to clear the axis if desired.
3. Press an axis key to select the axis for presetting; the SET display indicator lights.
4. Enter a number (with a decimal point if required), then press either the + or – key to indicate the movement desired.

Note that setting an incremental preset will only affect the incremental measurement. If not starting from zero, the preset is **added to** or **subtracted from** the current incremental display. The value entered as a preset remains in memory; to move the same distance a second time, follow the above steps 1-3, then just press the + or – key.

TurnMate provides several error codes to alert the operator to problems. The error code shows in one or more of the displays to indicate the type and location of the problem. The codes are:

- E1** Power interruption. A.C. power was interrupted. Positioning information has been lost. Clear the error display and zero both axes by pressing the CLEAR key.
- E2** Encoder miscount detected. Positioning information for this axis has been lost. Clear the error display and zero the axis by pressing the CLEAR key.
- E3** Weak encoder signal. The counting signals from the encoder on this axis are weaker than expected (usually caused by dirt, oil, etc. on the glass scale), or the encoder connector is unplugged. Refer to the encoder manual for cleaning instructions. After correcting the problem, clear the error display and zero the axis by pressing the CLEAR key.
- E4** Display overflow. Measuring information is too large to be displayed. Move the machine so that the measurement is smaller, or set a new zero reference point and zero the display.

Incremental presetting

Error codes

Self-testing

The TurnMate readout has built-in self-testing circuits. Tests are provided to assist with diagnosing problems involving:

- Software version
- Memory - both ROM and RAM
- Front-panel keys
- Display

Self-testing is initiated from the OFF state; hold the decimal point key down and press the ON key. The software version will be shown on the X-axis display and the date issued shown in the Z-axis display. Software version information may be necessary when contacting your distributor, OEM, or the ACU-RITE Service Center for further assistance with your TurnMate.

Press the X axis key; a number is displayed in the X display. This is a check value used for factory testing. Press the X axis key again to begin the key test.

The front-panel key test begins with a **0** display for the X-axis. Each time a key is pressed (except for the X axis key and the ON and OFF keys), the number will increment one digit, up to nine; then start again at 0. Press the X axis key to begin the display test.

The display test lights all elements of all displays at the same time, both numeric elements and message displays. This allows a visual inspection of the displays to assure that all are lit. The numeric displays will show **8.8.8.8.8.8.8.8**. The message displays will show (from the left): NEAR ZERO, DIA, INCH, MM, INCR, ABS, and SET. Press the X axis key to begin a memory test.

A memory test is performed, and a **Good** or **bAd** message is shown in the X-axis display. Press the X axis key to return to the beginning of the test routine, showing the software version and date.

The test may be stopped at any time by pressing either the ON or the OFF keys.

Section 4. Appendices

Appendix A TurnMate system specifications

Operating conditions	0° to 40°C (32° to 104°F) 25% to 85% relative humidity (non-condensing)
Storage conditions	-40° to 60°C (-40° to 140°F) 25% to 95% relative humidity (non-condensing)
Input voltage requirements	100VAC setting: 90-110VAC 120VAC setting: 108-132VAC 220VAC setting: 198-242VAC 240VAC setting: 216-264VAC
Input frequency	47-63Hz
Input current	0.15A continuous
Electronics	Microprocessor/custom LSI with non-volatile memory for operating software, setup parameters, and operator settings
Display	Aqua vacuum fluorescent
Display resolutions	0.005mm (0.0002") 0.01mm (0.0005") 0.02mm (0.001")
Size	6.9"h x 11.0"w x 6.0"d
Weight	8.6 lbs
Mounting	From bottom, four #8-32 threaded holes
Recognition/approval	UL, CSA pending
FCC compliance	Class A

Appendix B

TurnMate display increments/P2 displays

Operator key settings	Display resolution setting (P2)		
	High	Medium	Low
INCH, RAD	0.0002	0.0005	0.001
INCH, DIA	0.0005	0.001	0.002
MM, RAD	0.005	0.01	0.02
MM, DIA	0.01	0.02	0.05

Table B-1. TurnMate display increments/P2 displays

1. Table B-1 illustrates TurnMate counting increments with combinations of internal parameter settings and front panel operator key settings.
2. The displays are the same during setting of P2, the display resolution parameter; except that there are no leading zeros displayed for P2 settings.
3. The listings corresponding to a DIA operator key setting are only valid if diameter displays are enabled.

Appendix C

FCC compliance statement

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions in this manual, may cause interference to radio communications. It has been tested and found to comply with the limits in effect at the time of manufacture for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.