ACU-RITE®

Quick Count II

QWIKCOUNT II

DIGITAL READOUT SYSTEM

OPERATOR'S MANUAL

CONTENTS

THE **ACU-RITE** WARRANTY

GENERAL INFORMATION

Your new ACU-RITE® Qwikcount II digital readout counter is manufactured and warranted by ACU-RITE INCORPORATED.

The ACU-RITE system has been designed and tested to exacting specifications to provide years of trouble-free service. If you experience any problems with your system, notify the authorized ACU-RITE distributor from whom it was purchased. Please unpack your system carefully, and check the items received against those listed on the packing slip. Be sure the items are what you ordered. For your future warranty service or ordering reference, please record the following information in the spaces provided:

ACU-RITE
Qwikcount II Serial No. _____

Scale Assembly(ies)

Model _____

Model _____

Date of Purchase _____

ACU-RITE Distributor _____

Distributor Address _____

Distributor Telephone _____

WARRANTY TO THE USER

1. ACU-RITE Qwikcount II counter parts and labor are warranted against defects in material and workmanship to the consumer for a period of 12 months from date of purchase.
2. This warranty covers all parts, except lamps and other consumable items. It applies only to instruments and accessories which have been installed and operated in accordance with instructions in our reference manuals, have not been tampered with in any way, misused, suffered damage through accident, neglect or conditions beyond our control, and have been serviced only by our authorized distributor or ACU-RITE service personnel.
3. ACU-RITE INCORPORATED is not responsible for loss in operating performance due to environmental conditions, such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage or other conditions beyond our control.

There are no other warranties expressed or implied, and ACU-RITE INCORPORATED shall not be liable under any circumstances for consequential damages.

SECTION 1
INTRODUCTION

Your ACU-RITE Qwikcount II digital readout has been designed and manufactured by ACU-RITE to be used on machine tools, and for coordinate-measuring and gaging applications. This easy-to-use system has been proven reliable for precision metalworking operations while decreasing scrap and increasing productivity. As you use the system, you'll find that the accuracy already built into your machine tool or gage will be remarkably enhanced.

SYSTEM DESCRIPTION

The system includes two basic components: The ACU-RITE Qwikcount II digital position readout (DRO or counter), for control and display, and ACU-RITE scale assemblies installed on one or more axes of your machine to detect and display table movement. The DRO, available in one- or two-axis units, contains the solid-state electronics for displaying positional information.
Counter construction is durable and highly resistant to dirt, oil and other shop contaminants. Likewise, scale assemblies are built to be durable and provide long-lasting service. Available in two models - A-R/5 and Mini-Scale - scale assemblies consist of an ACU-RITE chrome-line glass scale, protective housing, and electronic reading head (also called a "transducer"). A cable from the reading head is connected to the rear of the counter. See the specific installation manual provided with each scale.

FEATURES

Inch-to-Millimeter Direct Conversion

Allows machining in either inch or millimeter dimensions and, with a flick of the INCH-mm switch on the DRO counter, conversion from one to the other without losing the zero reference.

Figure 1-1. ACU-RITE Qwikcount II Digital Position Readout

Machine Tool Geometry (Abbe) Error Compensation

Every machine tool is subject to geometric error due to the force of gravity, particularly when machining heavy or overhanging workpieces. The ACU-RITE Qwikcount II System can compensate for certain types of errors in increments of ±15 parts per million, up to ±458ppm.

Large Scale Integrated (LSI) Circuitry

All of the complex electronic circuitry is on one LSI chip. The ACU-RITE Qwikcount counter has completely interchangeable printed-circuit boards and modules.

LED Display

The display is visible within a 120-degree viewing angle and is easy to see at 15 feet or more. As you turn the controls on your machine, the numbers change instantaneously to indicate the exact position.

Other Features

A fault indicator, a lighted mark in the sign display, indicates a power interruption or an improper signal to the counter (e.g., excessive slew speed). Also, the counter faceplate withstands grease and dirt - you can clean its finish with the wipe of a cloth.

HOW TO USE THIS MANUAL

This manual has been prepared to familiarize you with the system and the various operating procedures you'll need to use. Other sections of the manual include:

2. Installation - How to install the counter and check out the system. To install scale assemblies refer to the appropriate installation manual.
3. Operation - How to use the counter controls and operate the system.
4. Machine Error Compensation - What machine geometry errors are, how to determine and correct them, and how to use the system to calibrate a machine tool. Functions of internal switches are also described.
5. Maintenance - The nature of system problems and how to correct them using a troubleshooting table and other procedures.

Refer to the table of contents for locating specific procedures. You will not find information on electronic parts replacement or repair in this manual.

In cases of malfunctions in the electronic network that cannot be remedied using the troubleshooting guide, contact your ACU-RITE distributor.

COUNTER SPECIFICATIONS

Axis	Two models: 1-axis and 2-axis
Display	LED, 7 digits (each .3" high). plus/minus sign, fault indicator.
Circuitry	Integrated circuits, including LSI.
Front-Panel Controls	On/off switch, auto enable/zero reset switch, Inch-mm switch.
Inputs	TTL compatible quadrature square waves (input noise filtered by signal-sampling technique).
External Connections	One signal input cable per axis.
Diameter/ Radius Display	Radius or diameter readout internally selectable.

Fault Indicator	Power interruptions and excessive count rates are flagged on the display to prevent measurement errors.
Resolutions	Internal switches can be set to match any of the following scale resolutions: 10 µm (.0005"), 5 µm (.0002"), 2 µm (.0001"), 1 µm (.00005").
Machine Tool Geometric Error Correction	Output count can be modified in increments of ±15 ppm up to a maximum of ±458 ppm to compensate for some types of machine or temperature error.
Power	100, 115 VAC ± 10%, 50-60 Hz; or 220, 240 VAC ± 10%, 50-60Hz.
Operating Temperature	32°F to 122°F (0°C to 50°C)
[redacted]nsions	6.7" W x 4.2" H x 7.8" D (16.9 cm W x 10.6 cm H x 19.9 cm D).
Weight (net)	4.6 lbs. (2.1 kg).

SCALE SPECIFICATIONS

Specification	Resolution	Data
LINE DENSITY	10 µm	25 (635)
LINES/mm	5 µm	25 (635)
(Lines/Inch)	2 µm	62.5 (1588)
	1 µm	125 (3175)
ACCURACY		
µm in 50 mm (inches in 2 inches)	10 µm	±6 µm (±.00025")
	5 µm	±6 µm (±.00025")
	2 µm	± 2 µm (± .00008")
	1 µm	± 1.5 µm (± .00006")
µm in 250 mm (inches in 10 inches)	10 µm	± 6 µm (± .00025")
	5 µm	± 6 µm (±.00025")
	2 µm	± 4µm (± .00015")
	1 µm	± 2.5 µm (± .0001")
µm in 1000 mm (inches in 40 inches)	10 µm	± 10 µm (± .0004")
	5 µm	± 10 µm (± .0004")
	2 µm	± 5 µm (± .0002")
	1 µm	± 5 µm (± .0002")
DRO SLEW SPEED	10 µm	1000 (40)
mm/sec	5 µm	600 (23.6)
(inches/sec)	2 µm	239 (9.4)
	1 µm	119 (4.7)

DISPLACEMENT RANGES

RESOLUTION	RANGE
10 µm	50 mm - 3050 mm (2" - 120")
5 µm	50 mm - 1525 mm (2" - 60")
	3240 mm - 19640 mm (128" - 773")
2 µm	50 mm - 1525 mm (2" - 60")
1 µm	50 mm - 1000 mm (2" - 40")

SECTION 2
INSTALLATION

WARNING

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the instructions manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits 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.

INSTALLATION OF COUNTER

General

This section includes complete installation instructions for the Qwikcount II counter. These installation procedures consist of locating the counter, making electrical connections, and setting counter internal switches.

Counter Location

When selecting the proper location for the counter, be sure of the following for safety and convenience:

- The operator can easily reach the panel controls.
- The counter is mounted at eye level for comfortable reading of the display and controls.
- There is no interference with operation or loading of the machine tool.
- The counter is located away from coolant splash and flying chips.

Electrical Connections

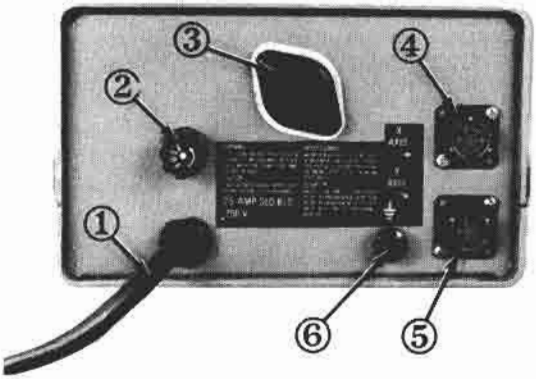
CAUTION

Do not operate the system with a supply voltage other than that marked on the counter nameplate. Incorrect voltage can damage the system.

1. After completing scale installation, in accordance with the directions in the appropriate scale installation manual connect the output cable from the scale reading head(s) to the input connector(s) on the back panel of the Qwikcount II counter (see Figure 2-3).
2. Connect a heavy-gauge braided ground strap or copper wire from the thumb-screw terminal on the rear of the counter to a convenient point on the machine base. Check that the ground wire is a minimum length and routed so that it will not be pulled or rubbed during machine operation. Ground the machine base by connecting it to a cold-water pipe or other solid earth ground. A metal stake driven several feet into the ground will suffice if no other ground is available. (No special grounding is required for scale assemblies).
3. Plug the counter power cord into a properly grounded outlet of the correct voltage.
4. Turn the counter on and check that the fault indicator at the left of the display functions. If the fault indicator does not function, check the line voltage connection to be sure there is power to the outlet.

   If the fault indicator still will not function, refer to System Troubleshooting in Section 5.

Mounting accessories are available and can be ordered through your Acu-Rite Distributor



1. Power cord
2. Fuse
3. Regulator
4. X-axis
5. Y-axis
6. Ground

Figure 2-1. Counter Electrical Connections

Internal Switch Settings

There are one or two identical printed-circuit axis/display boards (one for each axis) stacked at the left inside the counter. A typical board is shown in Figure 5-1 (page 15). On each board there are two switch assemblies: four-switch assembly S1 (toward the front) and nine-switch assembly S2 (toward the rear). On each board the individual switches in assemblies S1 and S2 must be set in accordance with your particular system and installation. Instructions for setting switches 1 through 6 on S2 are given in the Error Correction Procedure in Section 4. Set the remaining switches as indicated in Table 2-1 for resolution and decimal point location.

Diameter Display Selection

In certain machining operations, such as, movement on the cross-slide of a lathe, a doubling of the measured dimension is often desired for a diameter display. To select this function, S2 switches 1, 2, 3, 4, and 5 must be on and switch 6 must be off (refer to Table 4-3). Note that when an axis is in the diameter display mode error compensation is not available for that axis.

Table 2-1. Internal Switch Setting

Scale Resolution	S2 Settings (for S2-1 through S2-6 see Section 4) 7	8	9	S1 Settings 1	2	3	4
.0005"	off	off	off	off	on	off	on
.00025"*	off	off	off	off	on	off	on
.0001"	on	off	off	off	on	on	off
10µm (.0005")	on	off	on	off	on	off	on
1µm (.00005")	on	on	on	on	off	on	off
2µm (.0001")	off	on	on	off	on	on	off
5µm (linear) (.0002")	off	off	on	off	on	on	off
5µm (.00025")** (diameter mode)	on	off	on	off	on	off	on

* The .00025" Mini-Scale is used for diameter measurement only. The counter will read out in .0005" increments.

**When the 5µm (.00025") scale is used for diameter measurements, the counter reads out in 10µm (.0005") increments.

NOTE: S2 Settings 1-6 are in Section 4, page 14.

SECTION 3
OPERATION

GENERAL

Operating your machine tool will be much easier with an ACU-RITE measuring system once you see what you can do with the system - and what it can do for you. As you move your machine table a chosen distance, the system tracks the movement and displays it on the DRO, clearly showing when the table has traveled the exact distance. You and your machine are in constant communication so that table position is always known within the tolerances you're working to, down to .00005" (1 µm), .0001" (2 µm), or .0005" (10 µm) depending on your system's resolution.

CONTROL PANEL

Control panel features are shown in Figure 3-1.

Fault Indicator

When you turn the counter on, the display shows a fault indicator at the left of each axis window (otherwise blank). This mark will not appear during normal system operation; but if it appears during operation (and the display blanks), you'll know that shop or system power has been momentarily interrupted or that the table has been moved too fast (excessive slew rate). This indication guards against false measurements on the display that may go unnoticed. In either case, you'll have to restart your operation.

LED Display

The seven-digit LED display includes plus and minus signs to indicate direction of travel.

Auto Enable/Zero Reset Switch

Pushing the Auto Enable/Zero Reset Switch down in each axis resets the display to zero. Pushing the switch up in each axis arms the Fiducial Trigger Output (FTO) from the scale. When an FTO is encountered, the display will reset. A mark on the display will indicate when the auto enable is armed (it disarms itself after sensing an FTO). Pushing the switch up when this feature is armed will disarm it.

INCH-mm Switch

Instantly converts measurement from inches to millimeters, and vice versa.

Operation

Once you've performed the installation and error-correction procedures in Section 4, operating the Qwikcount counter is a simple, five-step sequence:

1. Turn power switch on: fault indicator signal will appear in axis displays.
2. Select "INCH" or "mm".
3. Move your machine tool to the desired starting (or zero) point.
4. Push the RESET switch down.
5. Now, as you move the machine tool a chosen distance, the Qwikcount counter will track the movement and display the exact distance of travel.

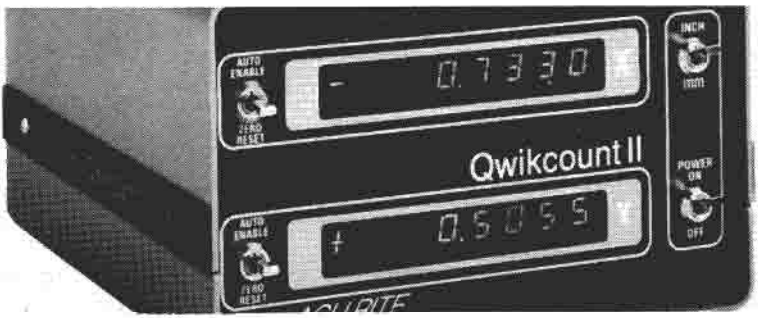


Figure 3-1. Panel Controls

SECTION 4
MACHINE TOOL ERROR COMPENSATION

WHY ERRORS OCCUR

In every machining operation, there is always some degree of error or inaccuracy due to at least one of the following machine tool deficiencies.

1. Gravity causes deflections in the machine tool structure (see Figure 4-1), particularly when a heavy workpiece is placed on a machine with overhanging table or ways.
2. The fit between mating surfaces is loose, because of either manufacturing tolerances, subsequent wear, or improper gib adjustment.
3. The ways are not scraped straight or are not aligned perfectly at assembly.
4. Driving and cutting forces cause deflections, since no material is totally rigid.
5. Temperature gradients can distort machine geometry.

In addition, machine tables and ways can be forced out of alignment if you use the lock improperly. Tables that are not completely locked in position can be caused to shift from the forces of machining and eventually wear.

HOW TO MEASURE ERRORS

Most errors resulting from the above conditions can be measured with a simple step-by-step procedure. You will need an accurate indicator and a recently calibrated measuring standard. Procedures vary slightly from one machine to another, but the concept remains the same.

1. Take measurements at the height above the machine surface where the workpiece is normally located.
2. Locate the standard on the machine table at the height where most machining takes place. Drill blocks, a step gage, a laser interferometer or other standards can be raised on parallels to meet this requirement.
3. With the indicator located in the spindle, take measurements along the standard at 2- to 6- inch intervals. All measurements should be taken in the same direction of table motion.

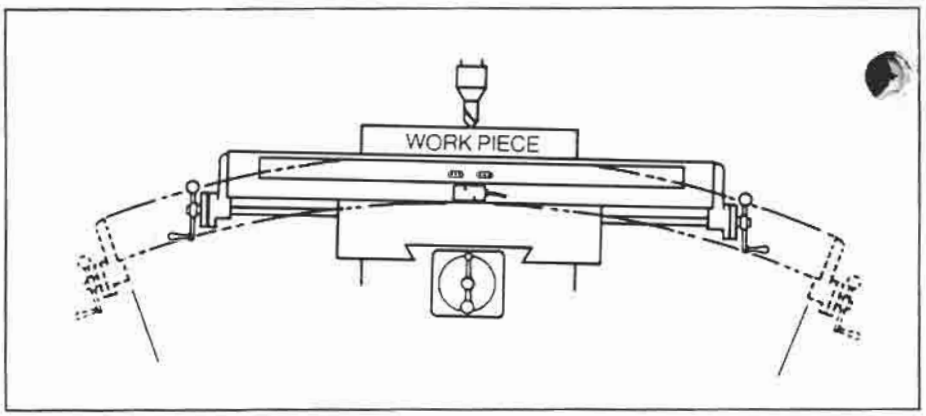


Figure 4-1. Exaggerated Curve of Table Travel on a Milling Machine with an Overhanging Table.

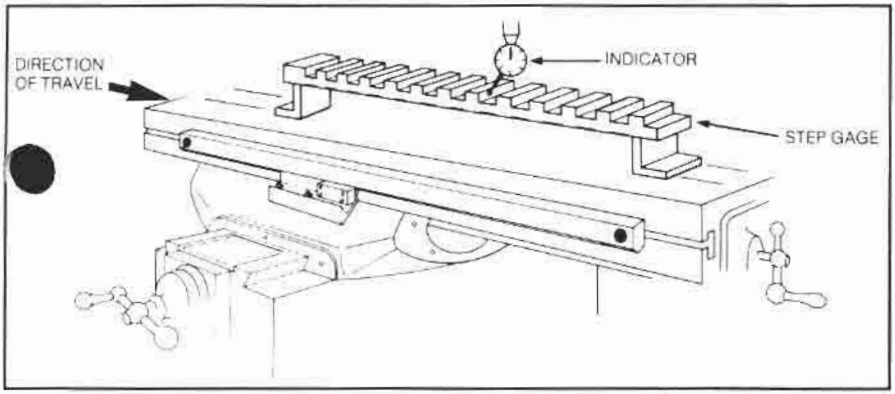


Figure 4-2. Example of Measurement Set-up Using Step Gage as a Standard

The following is an example procedure using a step gage as the measuring standard (see Figure 4-2).

1. Set up the step gage on the table at a height and position that coincides with that of a typical workpiece.
2. Insert a dial indicator into the spindle and lower it until the indicator can contact the first reference surface of the gage.
3. Set the dial indicator to zero.
4. Turn on the counter and reset it to zero (refer to Section 3 Operation).
5. Raise the spindle and move the table until the next reference surface is close to the dial indicator.
6. Lower the spindle and carefully move the table until the indicator contacts the gage surface and registers zero.
7. Record the distance moved as measured by the standard and as measured by the system and displayed on the counter. Then record the difference between the two measurements.

NOTE

Make sure that each measurement reading is repeatable.

8. Repeat steps 5 through 7 until you have moved the length of the standard.

Table 4-1 is an example of a set of recorded measurements from the standard and the display taken at 3" intervals over a 30" travel. The difference between these measurements can be plotted on a graph to determine what compensation is required to minimize the apparent error.

Table 4-1. Standard and Displayed Measurements (Inch)

Distance Measured by Standard	Measurement Displayed on Readout	Difference Between Measurements
0.0000	0.0000	0
3.0000	3.0000	0
6.0000	5.9995	-.0005
9.0000	8.9995	-.0005
12.0000	11.9990	-.0010
15.0000	14.9990	-.0010
18.0000	17.9990	-.0010
21.0000	20.9985	-.0015
24.0000	23.9985	-.0015
27.0000	26.9985	-.0015
30.0000	29.9980	-.0020

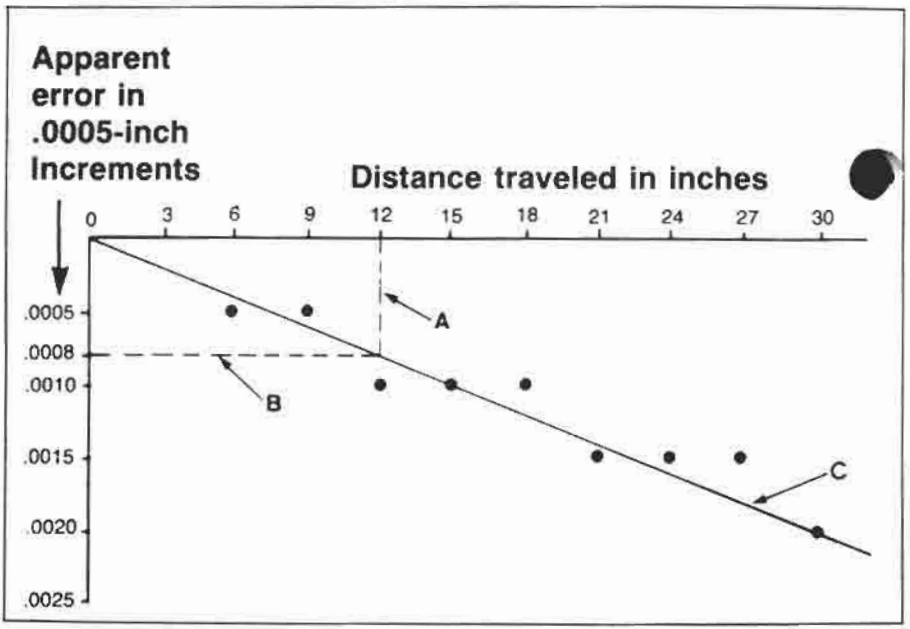


Figure 4-3. Error Slope Plotted in Inches

Figure 4-3 is a graph using the standard measurements to represent one coordinate, and the range of apparent error to represent the other coordinate. By plotting coincident points on the graph, a best-fitting straight line "C" can be drawn from the origin through the approximate center of the points plotted.

Drawing a vertical line "A" at any of the selected distance measurements and a horizontal line "B" where "A" intersects line "C", we determine the amount of correction necessary to reduce the total error. The following formula is used to compute the error:

$$\text{Error} = \frac{B}{A}$$

$$= \frac{-.00080 \text{ in.}}{12 \text{ in.}}$$

$$= -.0000667$$

Moving the decimal point 6 places to the right (equivalent to multiplying by one million), the resultant correction (or compensation) factor for the error is 66.7 parts per million. The Error Correction Procedure on page 13 explains how to use number.

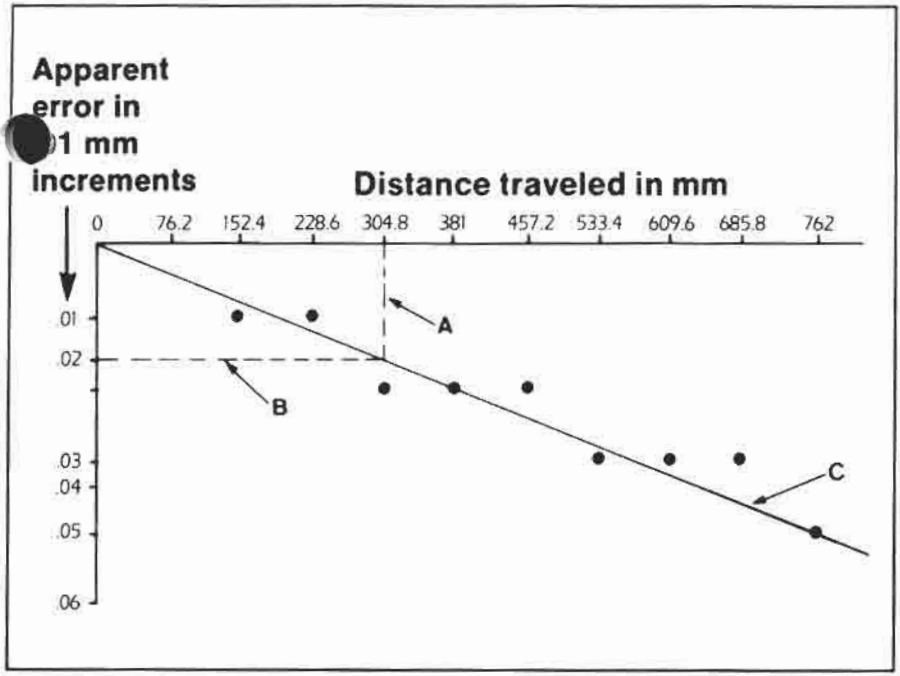


Figure 4-4. Error Slope Plotted in mm

Table 4-2 and Figure 4-4 repeats the same examples for determining error in metric measurements.

Table 4-2. Standard and Displayed Measurements (Metric)

Distance Measured by Standard (mm)	Measurement Displayed on Readout (mm)	Difference Between Measurements (mm)
0.0	0.00	0
76.2	76.200	0
152.4	152.388	.012
228.6	228.588	.012
304.8	304.775	.025
381	380.975	.025
457.2	457.175	.025
533.4	533.362	.038
609.6	609.562	.038
658.8	658.762	.038
762	761.950	.050

Error Correction Procedure

After computing the error, select the nearest correction from the list provided in Table 4-3. Disconnect power cord and remove the cover from the counter. Set switches 1-6 on switch set S2 in accordance with Table 4-3. In our example 66.7 ppm was the calculated correction factor. The closest correction factor in table 4-3 is 61.04. Be sure that the sign (+ or −) of the correction switch (#6) is chosen correctly. Since in this case the readout is displaying a shorter measurement than the standard, the procedure is to add a correction factor to make them equal, i.e., switch is off.

Repeat the procedure and check the readout display. A sign mistake here will double instead of cancel the error; therefore, the mistake can be very easily recognized and corrected by repositioning the sign switch (#6).

Table 4-3. Switch Assembly S2 Settings for Error Correction

S2 Switch Positions						Correction Factor	
1	2	3	4	5	6		
OFF	OFF	OFF	OFF	OFF	OFF	No Correc	
ON	OFF	OFF	OFF	OFF	OFF	+	15.26
ON	OFF	OFF	OFF	OFF	ON	–	15.26
OFF	ON	OFF	OFF	OFF	OFF/ON	+/–	30.52
ON	ON	OFF	OFF	OFF	OFF/ON	+/–	45.78
OFF	OFF	ON	OFF	OFF	OFF/ON	+/–	61.04
ON	OFF	ON	OFF	OFF	OFF/ON	+/–	76.29
OFF	ON	ON	OFF	OFF	OFF/ON	+/–	91.55
ON	ON	ON	OFF	OFF	OFF/ON	+/–	106.81
OFF	OFF	OFF	ON	OFF	OFF/ON	+/–	122.07
ON	OFF	OFF	ON	OFF	OFF/ON	+/–	137.33
OFF	ON	OFF	ON	OFF	OFF/ON	+/–	152.59
ON	ON	OFF	ON	OFF	OFF/ON	+/–	167.85
OFF	OFF	ON	ON	OFF	OFF/ON	+/–	183.11
ON	OFF	ON	ON	OFF	OFF/ON	+/–	198.36
OFF	ON	ON	ON	OFF	OFF/ON	+/–	213.62
ON	ON	ON	ON	OFF	OFF/ON	+/–	228.88
OFF	OFF	OFF	OFF	ON	OFF/ON	+/–	244.14
ON	OFF	OFF	OFF	ON	OFF/ON	+/–	259.40
OFF	ON	OFF	OFF	ON	OFF/ON	+/–	274.66
ON	ON	OFF	OFF	ON	OFF/ON	+/–	289.92
OFF	OFF	ON	OFF	ON	OFF/ON	+/–	305.18
ON	OFF	ON	OFF	ON	OFF/ON	+/–	320.43
OFF	ON	ON	OFF	ON	OFF/ON	+/–	33
ON	ON	ON	OFF	ON	OFF/ON	+/–	350.95
OFF	OFF	OFF	ON	ON	OFF/ON	+/–	366.21
ON	OFF	OFF	ON	ON	OFF/ON	+/–	381.47
OFF	ON	OFF	ON	ON	OFF/ON	+/–	396.73
ON	ON	OFF	ON	ON	OFF/ON	+/–	411.99
OFF	OFF	ON	ON	ON	OFF/ON	+/–	427.25
ON	OFF	ON	ON	ON	OFF/ON	+/–	442.50
OFF	ON	ON	ON	ON	OFF/ON	+/–	457.76
ON	ON	ON	ON	ON	OFF	Diameter (2X)*	

S2-6 determines the direction of linear correction as follows:
S2-6-OFF = increase in numerical readout
S2-6-ON = decrease in numerical readout

*See Diameter Display Selection, page 7.

SECTION 5
MAINTENANCE

GENERAL

This section is primarily devoted to trouble-shooting the system. Table 5-1 will assist you in isolating the problem and making the proper repair. Figures 5-1 and 5-2 identify electronic parts and test points on both the typical axis/display printed-circuit board and the power supply board.

All of the procedures that follow in this section are based on a 2-axis system.

The ACU-RITE Qwikcount II digital measuring counter can be conveniently serviced because of its modular design. Therefore, any malfunction can usually be traced to an easy-to-replace part. Some malfunctions that may occur in the ACU-RITE system can be corrected in the field with a minimum of downtime, if you have some electrical or electronic background. Replacement of circuit boards is relatively simple.

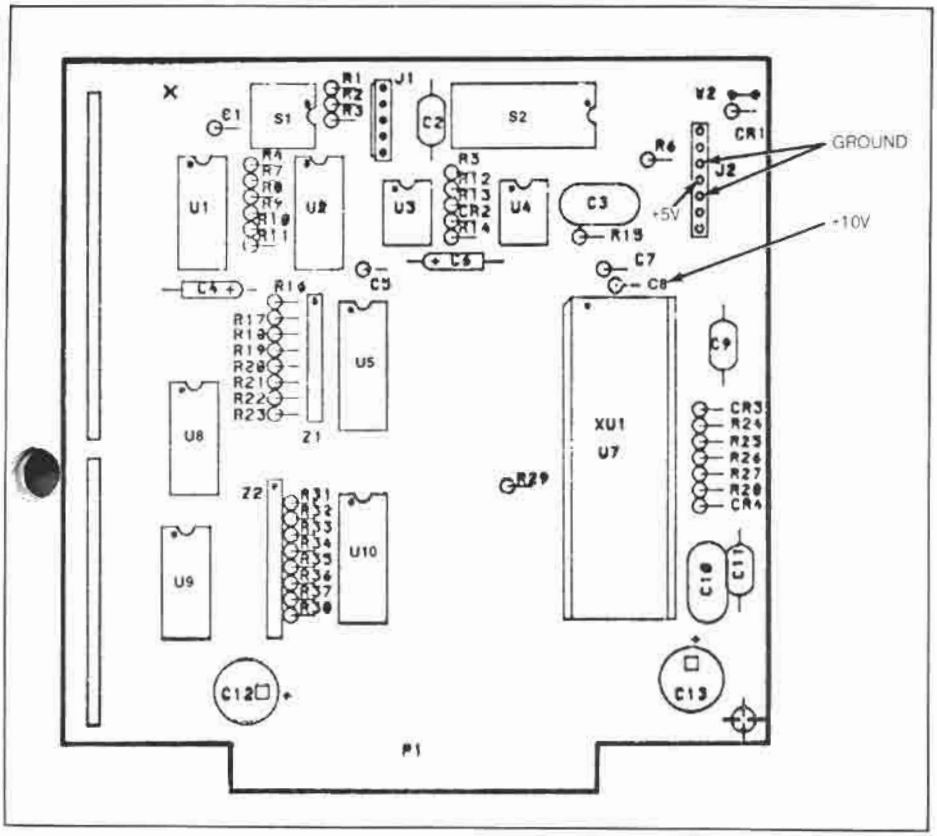


Figure 5-1. Axis/Display Board - Parts Layout

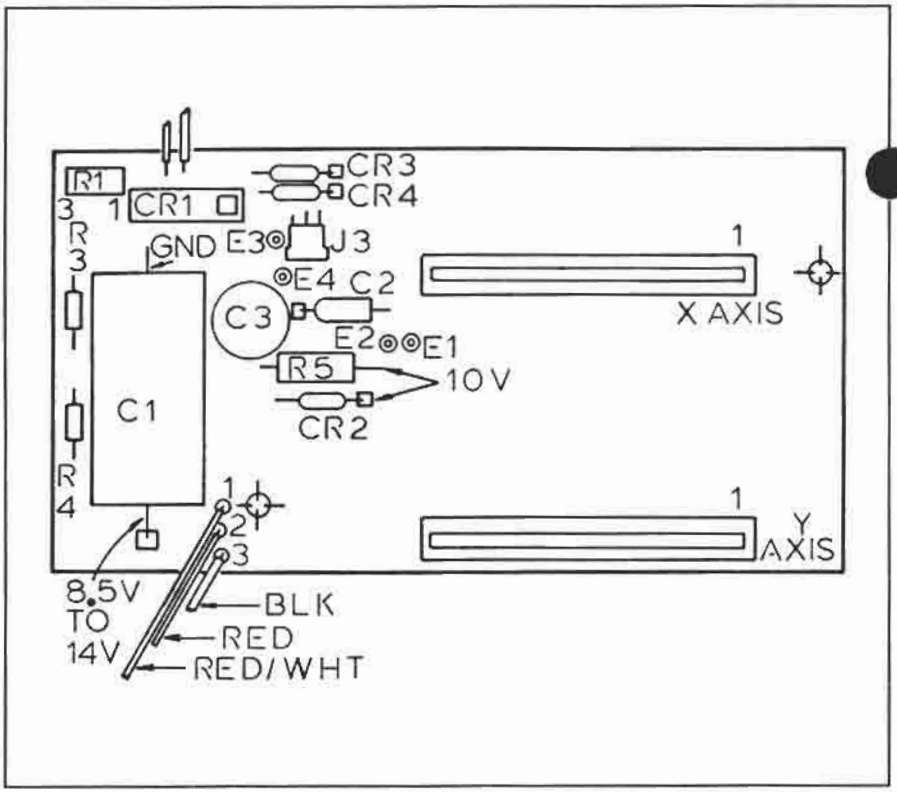


Figure 5-2. Power Supply Board - Parts Layout

PRELIMINARY TROUBLESHOOTING

All malfunctions will exhibit symptomatic readings on the digital display. However, different causes can sometimes produce similar symptoms. A simple diagnostic procedure combined with the correct interpretation of the symptoms will aid in isolating the faulty component. The first step is to determine the location of the malfunction by one of the two preliminary procedures below:

1. Switch the reading head cables from one axis to the other. If the symptoms change from one display to the other, the malfunction is in the reading head or scale assembly. If the symptoms do not change axes when the cables are switched, the *malfunction is in the counter.*
2. Using the same reasoning, individual circuit boards can be switched from one axis to the other to help in locating the faulty circuit board.

NOTE

Problems in the counter that cannot be remedied by simple parts replacement should be handled by a qualified electronic technician and must be referred to your ACU-RITE distributor.

SYSTEM TROUBLESHOOTING

Table 5-1 contains a list of possible problems that may occur in the system. Each is followed by the probable cause and procedures used to remedy the problem. If "a" is not the remedy, proceed to "b", "c" and so on. Be sure to read Preliminary Troubleshooting, above, before using this table.

Table 5-1. System Troubleshooting

Problem	Probable Cause	Remedy
1. Counter is turned on, but fault indicators do not function.	a. Improper or no line voltage at the power outlet.	a. Check the line voltage at the power outlet. It should match the rating on the serial number plate (rear of counter).
	b. Power cord not plugged, or improperly plugged, into the power outlet.	b. Check to make sure that the 3-prong power cord is properly plugged into the power outlet.
	c. A blown fuse.	c. Check the fuse on the counter back panel. (Spring inside fuse will be compressed if blown.) Replace if necessary.
	d. A short in the cable connecting the reading head to the counter.	d. Disconnect the reading head cable from the counter; replace reading head/cable assembly.
2. Counter is turned on, but one fault indicator does not function.	a. Internal connection is not making proper contact.	a. Disconnect the line cord, remove the counter cover, inspect all inside connections for proper contacts. Check the axis boards to be sure they are seated in their connectors properly. Unplug and reinsert the connector.
	b. Voltage supply(ies) on the axis board inadequate.	b. For qualified electronic technician only: Check the +10V D.C. (may range from +8.5V to 10.5V) and +5V D.C. (must be +5.1V ± .05V) supplies at points shown in Figures 5-1.
	c. Component-level repair or replacement is required.	c. Contact your ACU-RITE distributor for repair or replacement of the faulty component or repair of the counter.
3. Fault indicator functions, but no digits appear when ZERO RESET button is pressed.	a. Internal connection is not making proper contact.	a. Disconnect the line cord, remove the counter cover, inspect all inside connections for proper contact, and check the axis board on which the indicator is located to be sure it is seated in its connector properly. Unplug and properly reinsert all connectors, particularly J1, the zero reset connector.

Table 5-1. System Troubleshooting (continued)

Problem	Probable Cause	Remedy
	b. Axis printed-circuit board is faulty.	b. Interchange the faulty board with a good board to verify that the board is faulty.
	c. Voltage supply(ies) on the axis board inadequate.	c. For qualified electronic technician only: Check the +10V D.C. and +5 D.C. supply voltages (see 2.b.).
	d. Component-level repair or replacement is required.	d. Contact your ACU-RITE distributor for repair or replacement of the faulty components or repair of the counter.
4. Only one digit appears.	a. Faulty LSI chip.	a. Replace the axis board.
	b. Component-level repair or replacement is required.	b. Contact your ACU-RITE distributor for repair or replacement of the faulty component or repair of the counter.
5. Counting occurs only on least significant digit.	a. Faulty reading head assembly.	a. Interchange reading head cables between axes to isolate the problem to the reading head assembly or counter. Replace reading head, if necessary.
	b Faulty connection from axis board to input connector.	b. Check connection at rear of axis board and input connector for loose wires or plug. Correct if necessary.
	c. Component-level repair or replacement in the counter is required.	c. Contact your ACU-RITE distributor for repair or replacement of the faulty component or repair of the counter.
6. Counting occurs in one direction only.	a. Faulty reading head assembly.	a. Interchange reading head cables between axes to isolate the problem to the reading head assembly or counter.
	b. Reading head is not aligned correctly.	b. Check the reading head alignment. Refer to the appropriate scale installation manual for details of installing and aligning the reading head.

Table 5-1. System Troubleshooting (continued)

Problem	Probable Cause	Remedy
	c. Axis board is faulty.	c. Replace the axis board.
	d. Component-level repair or replacement is required.	d. Contact your ACU-RITE distributor for repair or replacement of the faulty component or repair of the counter.
7. System will not repeat to within a least count.	a. Scale assembly is not aligned correctly.	a. Check the spar brackets for alignment and stability. Refer to the appropriate scale installation manual for details of installing and aligning spars and scale assemblies.
	b. Low supply voltage.	b. For qualified electronic technician only. Check for low +5V D.C. (must be +5.1V ±.05V) supply voltage. See Figure 5-1 (also see 2. b.).
	c. Glass scale is dirty.	c. Gently clean the scale with a cotton swab and isopropyl (rubbing) alcohol to remove foreign matter. Keep swab saturated while cleaning.
	d. Reading head is defective.	d. Replace the reading head. Refer to appropriate scale installation manual.
8. Error accumulation on display.	a. Reading head and/or scale out of alignment.	a. Check head/scale alignment. Refer to appropriate scale installation manual.
	b. Low voltage supply.	b. For qualified electronic technicians: Check for low +5V D.C. (must be +5.1V ±.05V) supply voltage (see 2.b.).
	c. Improper ground from counter to machine tool base; or improper cable connections.	c. Check the ground wire and connectors of the counter and machine tool. Correct, if necessary.
	d. Machine tool geometry error has accumulated.	d. Refer to Machine Error Compensation section (Error Correction Procedure) for corrective action.

Table 5-1. System Troubleshooting (continued)

Problem	Probable Cause	Remedy
9. Fault indicator functions frequently during operation.	a. Machine tool table is either operating at an excessive speed or it is vibrating.	a. Check the machine tool operation for excessive speed or vibration, and correct as required.
	b. Reading head is not aligned properly.	b. Check the head for proper alignment. Refer to appropriate scale installation manual.
	c. Loose or improper ground connections.	c. Check all ground connections. Make sure the scale housing reading head and counter are properly grounded.
	d. Loose wire, component or board connection.	d. Disconnect the power cord, remove the counter cover, and tighten any loose connections. Unplug and reconnect all boards.
	e. Glass scale is dirty.	e. Clean scale (refer to 7. c., above).
10. Fault indicator appears or spurious (false) counts occur when machine tool (or shop equipment) is turned on or off.	a. Power outlet is on a circuit that should not be used for the system.	a. Transfer the power cord to another power outlet on a circuit with no potentially high or disruptive noise or surges.
	b. Loose or improper ground connections.	b. Check all ground connections.
	c. Machine tool is not protected against line power surges or noise.	c. For qualified electronic technician only: Suppress machine tool circuit breakers with R-C networks or transient voltage suppressors.
	d. System is not protected against line power surges or noise.	d. For a qualified electronic technician only: Interface a line noise filter or isolation transformer between power cord and power source.

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