

DC-3000 DRO

USER'S MANUAL

VER3.07



Safety Precaution



Warning



- ◆ Do not use the display unit with voltages other than the indicated power voltage (AC 100-240V, 50-60HZ), and do not connect multiple plugs to a single outlet as this may result in fire or electric shock.



- ◆ Do not damage, modify, excessively bend, pull on, place heavy objects on or heat the power cord, as this may damage the power cord and result in fire or electric shock.
- ◆ Do not handle the power plug with wet hands as this may result in electric shock.
- ◆ Do not open the cover of the display unit to disassemble or modify the unit or to replace the fuses, as this may result in burns or injury. These actions may also damage the internal circuitry.



Caution



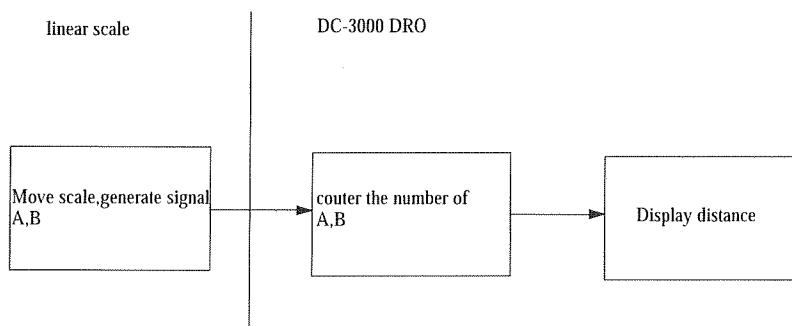
- ◆ When unplugging the power plug, do not pull on the power cord as this may damage the cord and result in fire or electrical shock. Be sure to grip the power plug when unplugging it from the socket.
- ◆ The unit does not have an explosion-proof structure. Therefore, do not use the unit in an atmosphere charged with inflammable gases as this may result in fire.



- ◆ When the unit will not be used for an extended period of time, be sure to unplug the power plug from the socket for safety.
- ◆ Be sure to turn off the power before connecting or disconnecting power and signal connectors in order to prevent damage or misoperation.
- ◆ The unit does not have an earthquake-proof structure. Therefore, do not use the unit in moving areas or areas exposed to strong shocks.

Principle

DC-3000 DRO provides displaying distance and position for machine tool, projector, and image measurement machine etc. Its principle is as follow:



DC-3000 Serial DRO Specifications

Input power voltage	100V - 240V
Power consumption	MAX.15W
Operating temperature	0 °C- 40 °C(32 °F --104 °F)
Storing temperature	-20 °C- 40 °C(-4 °F --104 °F)
Relative humidity	< 90%
Weight	1.5Kg
Dimension	295 x 185 x 68 (Unit: mm)
No.of axes displayed	3 axes
Interface of linear scale	9PD/15PD
Scale Signal	TTL, drive capacity > 10 mA
Resolution of scale	to be able to set.
Encoder Resolution	to be able to set, too.
Precision of scale	High grade $\pm (3+3L / 1000)$, standard grade $\pm (5+5L / 1000)$
Printer interface	Centronic interface
RS232 interface	A pin for TX signal, a pin for RX signal
Edge detection	High voltage 5V, drive capacity > 10mA
Foot switch	
Micro printer	(optional)

Handing Instruction

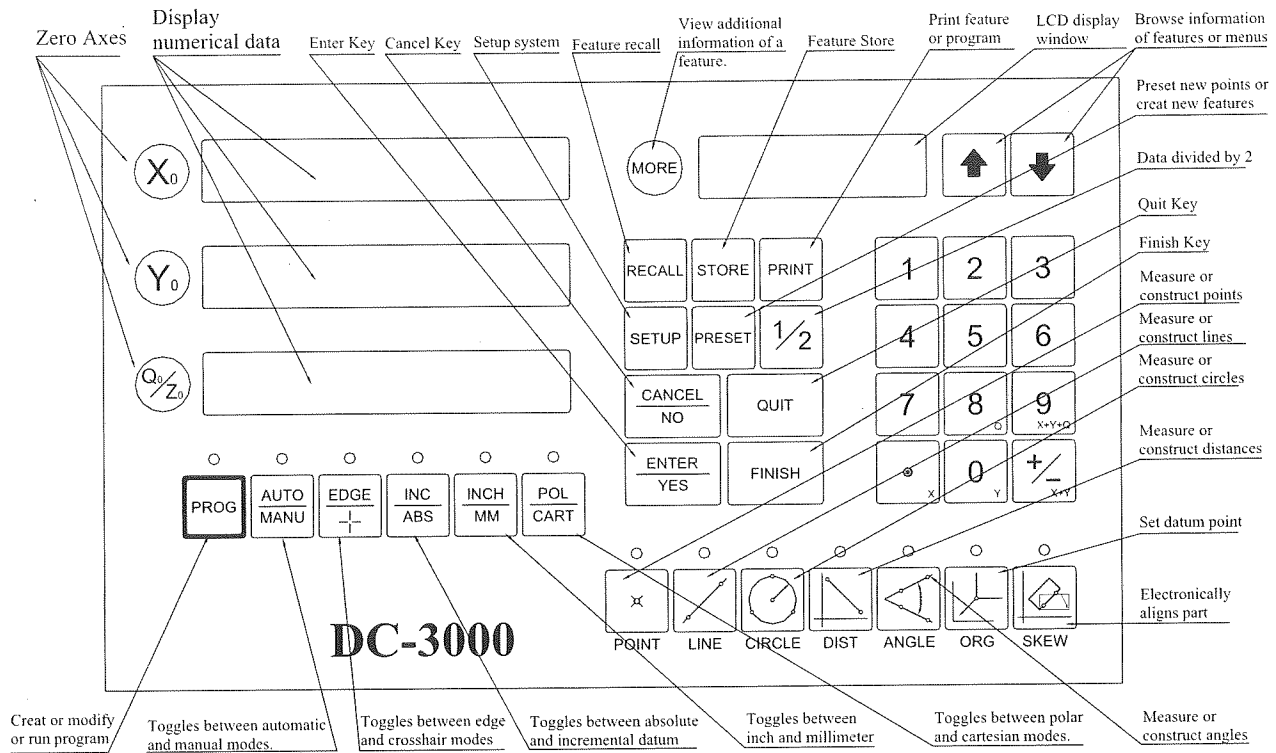
- ◆ Do not route the head connecting cable, power cord, etc, together with the machine power line in one duct.
- ◆ Supply power from an AC lamp source (AC 100 – 240 V, 50 – 60HZ) .
- ◆ Connect the ground terminal to the machine with the supplied ground wire. Make sure the machine is grounded.
- ◆ Place the display unit more than 0.5m (20") away from a high voltage source, large current source, large power relay, etc.
- ◆ For installation of the display unit, avoid a location exposed to chips, cutting oil, or machine oil. Lf unavoidable, take adequate countermeasures.
- ◆ Do not put a vinyl cover directly over the display unit or put it in a closed container.
- ◆ The ambient temperature should be in the range of 0°C to 40°C(32 to 104°F). Avoid exposure to direct sunlight, hot air currents, or heated air.
- ◆ If the power supply voltage is lower than specified, the display may not be illuminated even with the power switch turned on. Be sure to use the power in the specified range.
- ◆ Note that if the power is interrupted momentarily or the voltage drops temporarily below the normal operating range, an alarm may operate or a malfunction may occur.
- ◆ Be sure to use the display unit inside.

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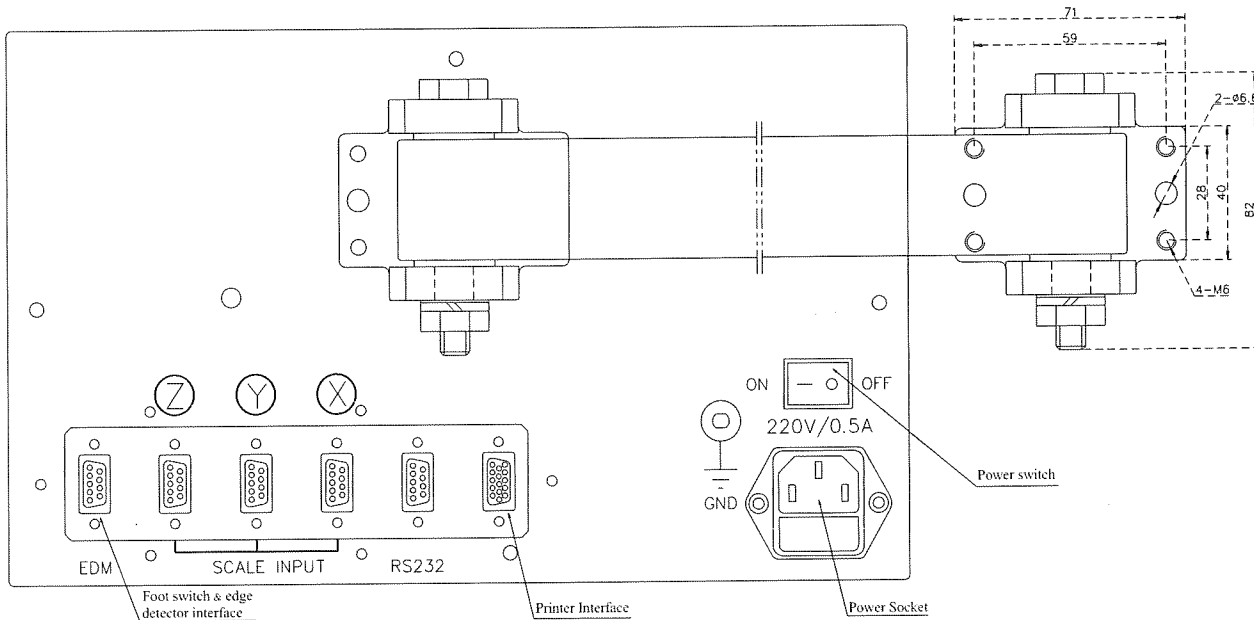
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1. ESSENTIAL INFORMATION

1.1 FRONT PANEL












1.2 BACK PANEL



1.3 Instructions On Keys

	Sign	Name	Function
1		Zero Key	Zero the displayed value of the assigned axis
2		Data divided by two	Divide the displayed value of the assigned axis by two
3		Toggles between incremental and absolute modes	Select one of the two modes
4		Toggles between inch and millimeter	Toggle the displayed value between inch mode and millimeter mode
5		Toggles between polar and Cartesian coordinates	Toggle the displayed value between Polar coordinate and Cartesian coordinate
6		Toggles between edge and crosshair modes	Toggle the operation between edge mode and crosshair mode
7		Toggles between automatic and manual modes	Toggle the operation between automatic mode and manual mode
8		Program key	Carry out the operation related to user program
9		Preset key	Carry out the operation related to presetting
10		Store key	Store the operation
11		Recall key	Recall the stored features
12		Print key	Carry out the operation of printing
13		Setup key	Set the system parameters
14		Enter key	Enter the operation
15		Cancel key	Cancel the numbers entered last time
16		Finish key	Finish the operation
17		Quit key	Quit the operation
18		Numerical key	Enter number
19		Decimal point	Enter decimal point
20		Positive sign and negative sign	Negate the inputted number

21		View key	View the features or the function table
22		MORE key	View more information of a certain feature
23		Original point key	Define the original point or offset the coordinate
24		Point feature key	Mearsure or construct points
25		Line feature key	Mearsure or construct lines
26		Circle feature key	Mearsure or construct circles
27		Distance feature key	Mearsure or construct distances
28		Angle feature key	Mearsure or construct angles
29		Skew key	Electronically aligns part for accurate measurement

1.4 INTRODUCTION

This manual is divided into several sections. The Information Section is the first section you should read for it provides all the information you need to understand the Demonstration Sections.

If you are an advanced user of digital readouts, some of the information contained in this manual will be very familiar to you, so you can read selectively but not entirely.

A NOTE TO DEALERS AND SUPERVISORS

All the parameters of DC-3000 will be set up for end-users by the dealer, and this set up includes calibration according to the user's optical comparator or similar device, and installation of Linear Error Compensation or Segment Linear Error Compensation (optional) on the user's comparator.

If the end-user installs a new comparator, then it may be necessary to do everything all over again. In that case, the supervisory users may want to refer to the Set Up and SLEC sections of this manual. Otherwise, they should contact their original dealer

A NOTE ON ACCURACY AND PRECISION

The DC-3000 is an instrument of great accuracy and precision. You may find that the accuracy of the machine's human operators is less than the accuracy the machine is capable of. You may also find that the machine displays measurements to more significant figures than you need, but the DC-3000 is designed for those applications where great accuracy and precision are required.



WARNING:

DO NOT open DC-3000's cover, since there are no user-serviceable parts inside. As with other similar devices, the danger of electrical shock exists if the back is removed. Please refer all maintenance to your original dealer.

ABOUT THIS SECTION

This section provides the information necessary to operate the DC-3000 Digital Readout System to its utmost potential. Although the DC-3000 is easy to operate, reading this section will release you much trouble.

OTHER SECTIONS

This manual is written to cover the basic DC-3000. Information about the options (additional, available features) is provided in the Option Section of this manual. The manual is divided into five main sections, which are intended to aid you in using the manual and the DC-3000 Digital Readout.

The Demonstration Section is designed to give you a working knowledge of the DC-3000 and provides complete instructions for measuring the sample part included in this manual.

CONVENTIONS USED IN THIS MANUAL

The terms DC-3000 or DRO when used in this manual refer to the DC-3000. This manual uses the term comparator to refer to any device (here we mainly mean Linear Scale and Rotatory Encoder) intended to measure parts in two dimensions.

It is assumed for all demonstrations that if you move your crosshairs to the right, the count increases from 1 to 2 to 3, not from -1 to -2 to -3. The same holds true for the Y axis: If you move the crosshairs up, and the count increases from 1 to 2 to 3. If you find that your machine is not reading properly, don't worry. The examples in this manual will tell you how to adjust the count direction to match this convention.


For most examples, the display resolution in this manual will be 0.00005 inch or 0.001mm. But please note that the display resolutions shown in this manual are not meant to suggest resolutions that should be set on your DRO, they are only examples.


In the graphic examples, the light circle above the key as shown below on the left represents "ON", and the darkened represents "OFF" on the right.



In the illustrations, there may be "optional" key presses shown. If the indicator light above the key on the DC-3000 is already in the state shown in the illustration, you won't need to press that key.

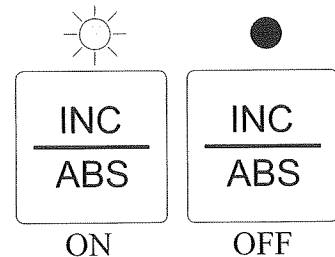
The terms Program Steps and Key Presses mean the same, a single line item in a User Program.

A Program is a series or sequence of Key Presses that make up a procedure used to perform a measurement activity.

When you see a picture of a key with a letter underneath it (as shown here), you should press that key when you come to that step in the demonstration. For this example you would press the  key when you reach step b. of the instructions.

When three periods are observed at the end of a prompt in the message window (e.g. Record program?) it indicates additional information may be viewed by pressing the  key.

All menu items followed by a YES or NO may be changed by pressing the desired key i.e., press the  key to select "Reverse X: YES" and press  "Reverse X: NO".



GETTING STARTED

We assume that your DC-3000 has been set up and is ready for you to turn on.

The DC-3000's power switch is located at the lower right corner of the back panel. Turn the DC-3000 "On" (Figure 1-1).

The axes windows labeled X, Y and Z/Q and the message window are your primary sources of information while you are using the DC-3000. The numbers you see in the X, Y and Z/Q axes window are the DC-3000's Digital Read Out (DRO). Move the crosshairs slightly and watch the displayed numbers change.

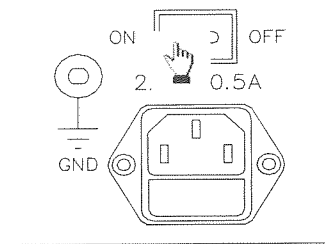



Figure 1-1

GETTING OUT OF TROUBLE

In most cases, except for programming, pressing the  key twice will cancel what you have been doing and bring you back to the DRO. As a last resort, you can turn off the DC-3000 and wait for 5 seconds, then turn on again.

1.5 THE DC-3000'S MODES

The DC-3000 has several different operating modes, all of which fall into one of three main groups, Targeting Modes, Display Modes and Configuration Modes.


Targeting Modes define how data points must be entered for the DC-3000 to accept them. Display Modes define how that data is displayed. Configuration Modes tell the DC-3000 how to interpret the data it receives from your comparator.

These modes described above are in order to prepare you for the examples in the remainder of the manual. Please refer to these pages if "Mode Madness" starts to trouble you.

CONFIGURATION MODES

Setup Mode

You match the DC-3000 to the signal output of the comparator the DC-3000 is used with. When you press the

 key, there will be various functional items in the message window, and they are set in the Setup Mode.

MODE KEYS

The Mode keys are located at the lower left corner of the front panel. These pairs of mode keys aren't mutually exclusive. However, the items within the pairs are mutually exclusive.

DISPLAY MODES (normal status)

Incremental/Absolute

Remember that the DC-3000 has 2 coordinates. When the light is "ON", the distances displayed are measured from the incremental datum and all measurements are relative to that datum. When the light is "OFF", the distances are measured from the absolute datum.

Inch/Millimeter


When the INCH/MM light is “ON”, all measurements displayed are in inches. When the light is “OFF”, all measurements are displayed in millimeters.


Polar coordinate/Cartesian



When the light above the POL/CART is “OFF”, the DC-3000 is in Cartesian coordinate. All distances are displayed in the form of an axis pair (x, y) where ‘x’ is the horizontal distance from the current coordinate and ‘y’ is the vertical distance.

When the light is “ON” the DC-3000 is in Polar coordinate, all distances are measured from the current datum and are displayed in that form (r, a).



TARGETING MODES***Edge/Crosshairs***



If the  key light is “ON”, the DC-3000 is in Edge Mode. In this mode, the display is updated and a “beep” is generated after every edge crossing. An edge crossing occurs when the light sensor crosses from a light area to a dark area or from dark to light. This mode facilitates easy targeting of points that lie on shadow boundaries.

To target and enter a point along an edge, cross the edge (if in Manual Edge Mode, press the  key). For best results, try to cross the edge perpendicularly. That is, cross the edge “straight on.”


If the light above the  key is off, the DC-3000 is in Crosshairs Mode. In this mode, the display is updated continuously, and the crosshairs is the targeting device. To target and enter a point in this mode, place the crosshairs over the point to be entered and press the  key.

Auto/Manual

If the light above the  key is “ON”, and the light above the  key is “ON” too, that indicates the DC-3000 is in Auto Edge Mode. The sample points are probed automatically when edge is detected.









If the light above the  key is “OFF”, and the light above the  key is “ON”, the DC-3000 is in the Manual Edge Mode. The Manual Mode is used for point entry, where every point must be confirmed with a manually entered key -presses.

Programming

When the light above the  key is “ON”, the DC-3000 is activated for one of the three types of programming functions: Running, Recording, or Editing, Refer to the Programming Section.

FEATURE KEYS

The DC-3000’s front panel has seven function keys located in the lower right corner. These are called Feature Measure Keys.

Pressing these keys:     and  will initiate its respective feature measurement, i.e., pressing  key will start the procedure for measuring or constructing a circle. The  key is used to move the datum to a new point. The  key is used to align a part with respect to the comparator's bed to provide convenient measurements. When measuring a part you should first skew it.

1.6 MEASURING WITH THE DC-3000

The DC-3000 greatly simplifies the use of an optical comparator to perform precise, repeatable measurements. The DC-3000 is capable of a wide variety of measurements: points, lines, circles and other geometric shapes. The DC-3000's advantage is not just what it can do, but also the ease with which it can do it.

With the DC-3000, you always measure distances from a given datum point, which is known as the Absolute origin. It has coordinates (0, 0). The DC-3000 allows you to set the Absolute Datum to any physical point on or off the part you are inspecting. Additionally, the DC-3000 allows you to set the orientation of the X and Y axes—they do not have to be parallel with your comparator's axes.

Once you have established the Absolute Datum and the orientation of the axes you have defined a Reference Frame. This Absolute Datum allows you to set a zero reference point from which to measure additional points, and also set an Incremental Datum from which you can make intermediate measurements.

The DC-3000 will perform complex geometric and algebraic calculations for you at the touch of a few buttons. For example, you can calculate the position of a circle's center and find its radius by giving a few points on the circle's edge. Of course, you can calculate the angle two legs of a part make with each other, again by giving the DC-3000 a few points.

When you need to measure a particular point (instead of just any point that lies on a boundary), you will need to target that point with crosshairs.

Here, it is very necessary to mention two conceptions: Forward Annotation and Backward Annotation. They are called two ways to target points (the next section will discuss them). Forward Annotation means that before operation the operator has determined the number of the targeted points for every feature to be measured. Backward Annotation means that the operator determines the number of targeted points in the process of measuring provisionally.

CROSSHAIRS


The DC-3000 allows you to toggle between crosshairs and edge detector (providing you have the edge detector option). In order to do this, the DC-3000 must know how far apart the edge detector's screen sensor and the crosshairs are. Refer to the Crosshairs paragraph in the Demonstration Section. This calibration must be done every time you move the edge detector's screen sensor or change magnification.

TARGETING POINTS

You are almost ready to jump over to The DC-3000 Demonstration. But first you must know how to target a point.

“Targeting a point” is process of telling the DC-3000 that you wish to capture a particular point in the current measurement calculation. You may target up to a maximum of 50 points for each individual feature except a distance.

In the Demonstration Section of this manual, you will be targeting points using either the edge detector (in the Auto Mode) or crosshair. When the DRO is in Auto Edge Mode configuration you only need to cross an edge on the part you are measuring and you will hear a “beep” and observe that a point has been entered.

If you are using crosshair on a comparator with a video probe or a microscope, align the crosshairs on the feature you are measuring (e.g., the circumference of the circle you are entering) and press the  key.




WHAT IS A FEATURE?

Data points collected that define a geometry element (at a point, along a line, or on the perimeter of the circle) are used by the DRO to generate a graphic and numeric representation of the measured geometry, which is called a Feature. Each feature can be displayed graphically or numerically, and has different distinguishing information. For example, a circle has a center and a radius, a point has a location, and an angle has degrees.

THE FEATURE LIST

When a new feature is generated, a mathematical representation is placed in the feature list. Later you will learn how to single out features in the feature list that you wish to make permanent. Permanent features are well kept when the DC-3000’s power is shut off.

The DC-3000 stores 100 Permanent Features plus the 10 most recent Temporary Features. (Temporary Features are lost when the DC-3000 is shut off.) When you create the 11th feature, the oldest Temporary Feature is deleted from the stack.

The feature list consists of two stacked lists. The temporary features, “a0” to “a9”, on the bottom and the permanent features, “00” up through “99”, stacked on top of the temporary features, Permanent features are created by selecting a temporary feature (viewing it in the message window) and pressing the  key. Permanent features are overwritten when the stack is full and a new feature is added. See Figure 1-1. Refer to the paragraph on the  and  keys in the Reference Guide.


“Pushing Features” refers to the process of adding a feature to the temporary feature list and moving the other features up to make room for the new one. When a new feature is added, it is inserted at the bottom of the list becoming “a0” and pushes the existing features up one (“a0” becomes “a1”, “a1” becomes “a2” etc.). If a feature is at “a9” and is pushed, the feature is deleted from the list.

"99"	XXXXXXXXXX	Permanent Features
"98"	XXXXXXXXXX	
"97"	XXXXXXXXXX	
...	...	
"02"	XXXXXXXXXX	
"01"	XXXXXXXXXX	
"00"	XXXXXXXXXX	






"a9"	XXXXXXXXXX	Temporary Feature
...	...	
"a2"	XXXXXXXXXX	
"a1"	XXXXXXXXXX	
"a0"	XXXXXXXXXX	

STORE FEATURES

The procedure of recording features is listed as follows:

- 1 Press the  key and the information displayed in the LCD will remind the user to enter a sequence number. (Figure1-2)

Store : 00
Feat Num(0-99)


Figure1-2
- 2 There is a default sequence number displayed in the LCD, if you directly press the  key, then you use the default sequence number, if not, you can enter a new one (ie.1), and then press the  key, now you use the new one.
- 3 The DRO displays the current information of the features, press the  or  key to find the feature you want to store, and then press the  key. After the operation finished, the DRO will display the information of the feature you stored just now. (Figure1-3)

01 Circle R/D
Press MORE Message



Figure1-3

RECALL FEATURES

Recalling features is to fetch the permanent features used as temporary features. The procedure is displayed as follows:

- 1 Press the  key, and the information is displayed as in figure1-4, it reminds the user to input a sequence number while the default one is displayed in the LCD.

Recall : 01
Feat Num (0-99)

Figure1-4
- 2 If you accept the default sequence number, directly press the  key, if not, enter a new one (ie.1), then press the  key.
- 3 The LCD will display the information of the feature you recalled just now (Figure1-5). And the operation is finished.

a0 Circle R/D
Press MORE Message

Figure1-5

GENERATING FEATURES

Now that you have been exposed to what features are and where they are used, each generation procedure will be described briefly to familiarize you with the different methods. Feature generation methods are further expanded upon in Section II, Demonstration.

Probing Features

One way to generate features, probably the method you'll use most, is to probe the feature using the crosshairs to target the point to be entered and pressing the key. To probe a feature with the Edge Detector, first you should select the Feature Type you wish to measure, and then cross the edge at the appropriate point of the feature and the DC-3000 will beep to show you that you have entered a point.

Each feature can be defined by as many as 50 probed points, with each point contributing to the final feature.

When you have entered the number of points you want, press the key. This tells the DC-3000 to calculate the resulting feature. This feature is automatically placed at the bottom of the Feature List.

Forward Annotation represents to probe a feature requiring a specific number of points; the number will be counted as the points are entered. When that number of points is reached, the resulting feature is automatically calculated. The number of points is decided before measurement, you can set the number at interior setting.

The number of points isn't determined before measurement. When you have entered the number of points you want, press the key, and then the feature is calculated. This is called Backward Annotation.

Constructing Features

Constructing features consists of taking previously generated features, grouping them together, and making a new feature. For example, if you have probed two circles the DC-3000 can construct a line that passes through the centers of both circles. The result will be the same as if you had targeted those circle centers while probing a line.

The DC-3000 can also take several circles and calculate the circle that comes closest to passing through those five circles' centers. This example is commonly called a Bolt Hole Circle.

Creating Features

The third way to generate features is to create them. You tell the DC-3000 that you want a circle with its center at absolute part coordinates (5, 6) and a radius of 10. This is done by entering the desired numbers in the appropriate fields of the feature.

Final note: You can't partially probe and then partially construct a feature or relation. You must completely probe or completely construct a feature or relation.

Note: It is possible to construct a feature from previously probed points.

GETTING HELP

Even though the DC-3000 can perform complex operations, it is fairly easy to use. However, if you need help, don't forget to use the manual.

The DC-3000 Demonstration is designed to let you actually use the DC-3000, and presents the basic measurement and relational capabilities of the DC-3000.

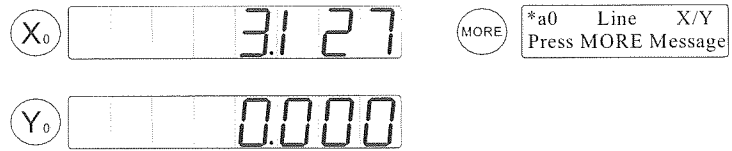


Figure 1-6 L1 Message

The User Program section provides you with the information needed to develop and utilize your own programs. There are even some sample programs at the end of the section.

Supervisor Setup provides the information need to connect a DC-3000 to a wide variety of measuring machines. If your DC-3000 is already connected and functioning properly, you have no need to read Supervisor Setup.

1.7 INFORMATION OF FEATURES

Features refer to a range of point, line, circle, distance, angle, rectangle and screw. In Cartesian and Polar coordinate, the displayed information of these features seems a little different, and the difference focuses on the position of the point that the feature displays. In the following, we will only take the information of point for example and briefly introduce the displayed information in Cartesian and Polar coordinate. As to the other features, we will introduce their information only in Cartesian coordinate, and the displayed information in Polar coordinate can be gained according to the toggles of the Cartesian format and Polar format.

Here it is very necessary to explain +T and -T. As to different features, +T and -T are endowed with different meanings. As to point feature, -T doesn't exist while +T indicates the farthest distance between the targeted point and the resulting point. As to line feature, +T indicates the farthest distance from the targeted point which is located over the upper right of the line to the line, and -T indicates the farthest distance from the targeted point which is located below the lower left of the line to the line. As to circle feature, +T indicates the farthest distance from the targeted point that is outside the circle to the circumference of the circle, and -T indicates the farthest distance from the targeted point that is inside the circle to the circumference of the circle.

1.7.1 POINT

- a) In Cartesian coordinate, the displayed information of the. Point covers the current position of X and Y, together with the +T value. The displayed information as in figure1-7 indicates that it is an existing point feature. In Cartesian coordinate, its current position can be expressed as (1.250,-3.985). The second line displayed in the LCD window implies that if you

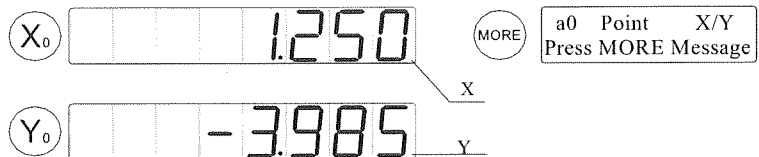




Figure 1-7

press , you can view other information of the point feature. Press the  key, and the message is displayed as in figure1-8.

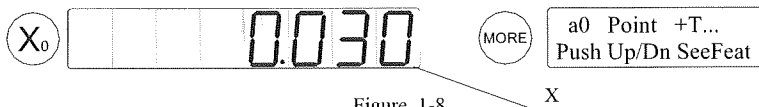


Figure 1-8

- b) In Polar coordinate, the information of the point is displayed as in figure1-9. The displayed value of the X axis indicates the distance from the very

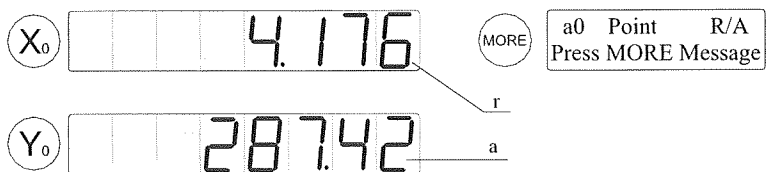


Figure 1-9

point to the origin, and the displayed value of the Y axis indicates the value of the included angle that was made by the positive direction of X axis and the line that was constructed by the very point and the origin. The +T value of the point is as same as the former.

1.7.2 LINE

The feature of line includes three pages of information.

- 1) The information of the point which is the nearest to the origin on the line (Figure1-10).The message displayed in the LCD indicates that a1 is a temporary feature, and the position of the point is shown as in figure1-11.

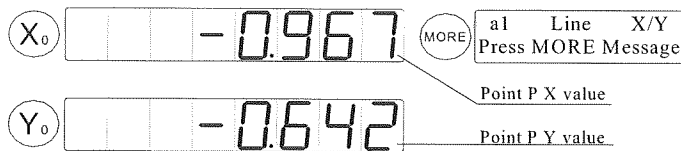


Figure 1-10

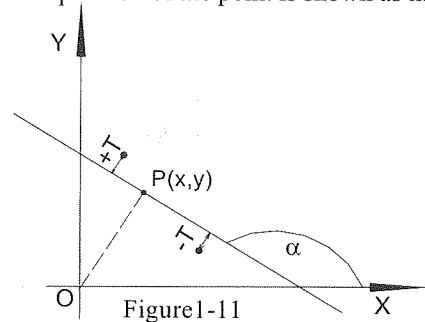


Figure1-11

- 2) Press **MORE**, and the message is displayed as in figure1-12. The displayed value on the X axis indicates the value of the included angle that was made by the line and the positive direction of X axis.

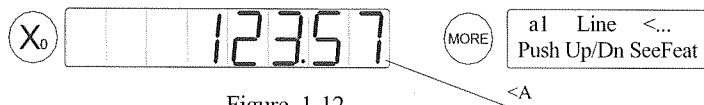


Figure 1-12

- 3) Press **MORE**, and the message is displayed as in figure1-13. The displayed values of the X and Y axes imply the linearity of a1.

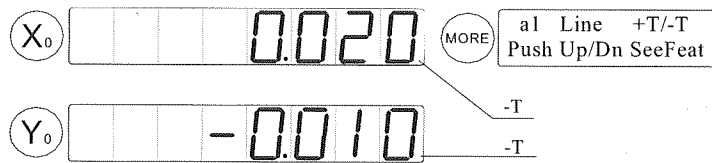


Figure 1-13

1.7.3 CIRCLE

The circle feature includes three pages of information.

- 1) The information of the center point is displayed as in figure1-14, and 00 displayed in the LCD window indicates that the circle is a permanent feature. The point P is shown as in figure1-15.

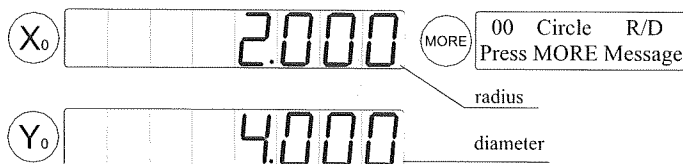


Figure1-14

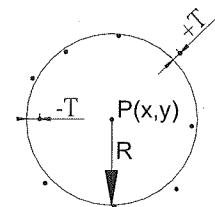


Figure1-15

- 2) Press **MORE**, and the message is displayed as in figure 1-16. The displayed values of the X and Y axes imply the value of the center of the circle.

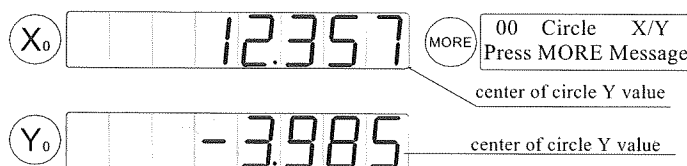



Figure 1-16

- 3) Press , and the information is displayed as in figure 1-17. The X and Y axes displayed values indicates the degree the circle being approximate to a perfect circle.

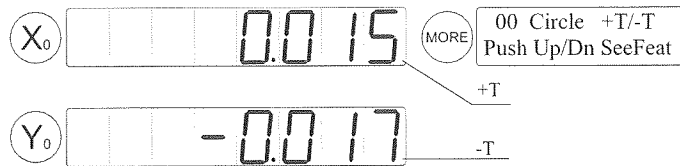


Figure 1-17

1.7.4 DISTANCE

The feature of distance includes three pages of information.

- 1) The first page of information is displayed as in figure 1-18, and the number 20 displayed in the LCD indicates that the feature is a permanent feature.

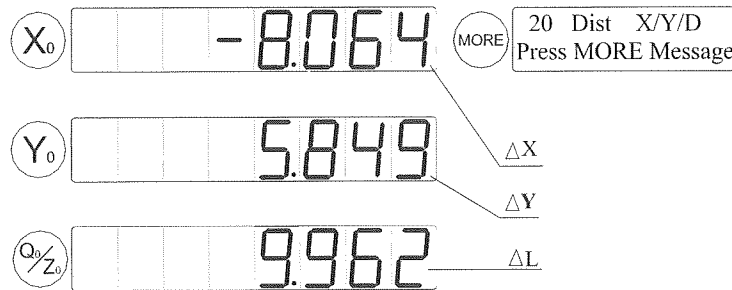


Figure 1-18

More details are displayed as in figure 1-19. In this figure, the circle b) and c) respectively indicates the real meaning of the distance from the point to the circle and from the line to the circle.

X window : Δx

Y window : Δy

Z window : $\Delta L = \sqrt{\Delta x^2 + \Delta y^2}$

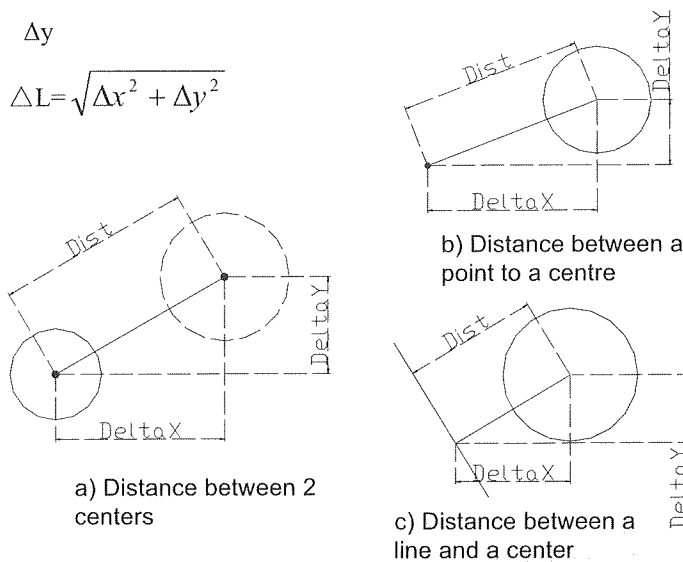



Figure 1-19

- 2) Press , and the information is displayed as in figure 1-20.

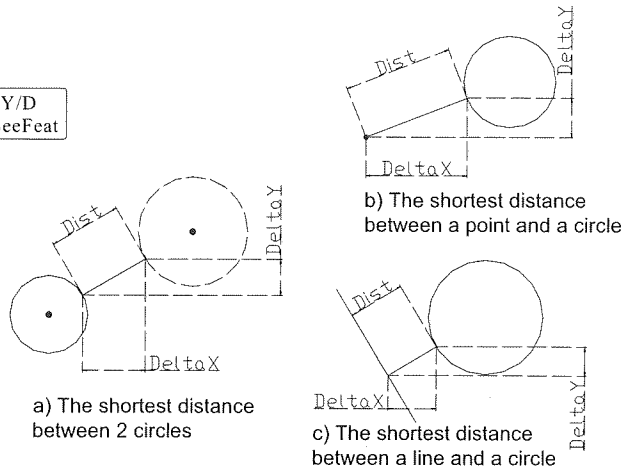
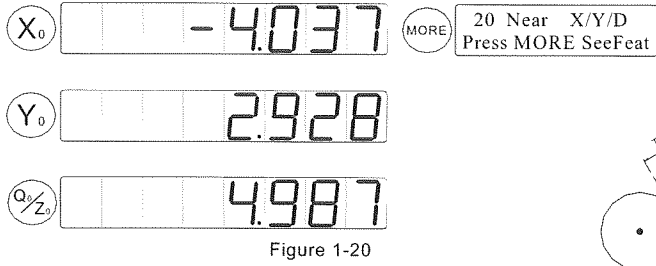


Figure 1-21

The displayed values on X, Y and Z axes respectively present the difference which is made by the two nearest points of the two features in the X direction and Y direction (Figure1-21 (a) DeltaX, DeltaY) Meanwhile, the values also represent the actual distance between the two nearest points of the two features. (Figure 1-21 dist) Figure (b) and (c) respectively represent the nearest distance from the point to the circle and from the line to the circle.

- 3) Press **MORE**, and the information is displayed as in figure1-22.

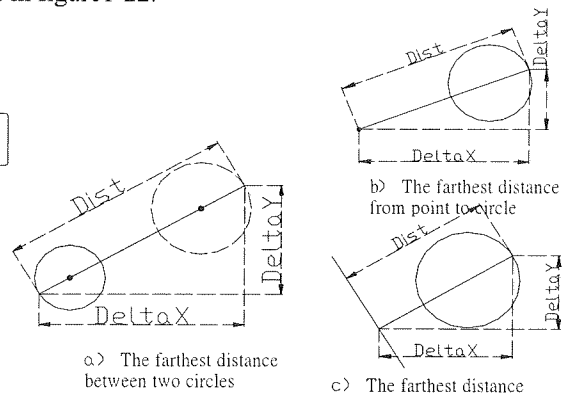
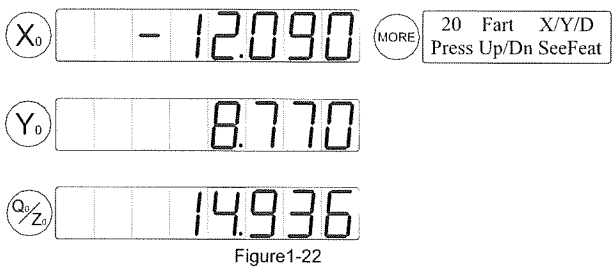


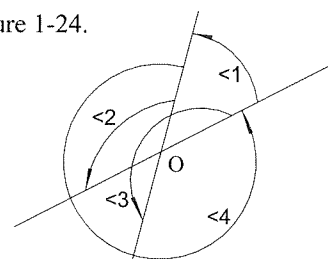
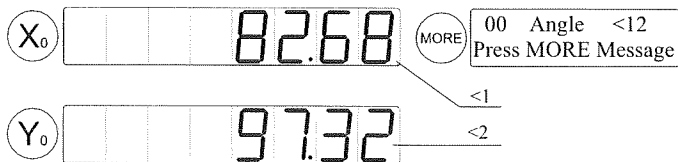
Figure1-23 The farthest distance

The displayed values on X, Y and Z axes respectively represent the difference which is made by the two farthest points of the two features in the X direction and Y direction.(Figure1-23 (a) DeltaX DeltaY) Meanwhile, the values also represent the actual distance between the two farthest points of the two features.(Figure1-23(a)dist) Figure(b) and (c) respectively represent the farthest distance from the point to the circle and from the line to the circle.


1.7.5 ANGLE

The feature of angle includes 3 pages of information.

- 1) The information of the measured angle's value is displayed as in figure 1-24.



The information 00 displayed in the LCD indicates that the feature is a permanent feature. The X axis displayed value is the value of $\angle 1$ (the value of the angle to be measured). The Y axis displayed value is the value of $\angle 2$ (the supplementary angle of $\angle 1$). (Figure1-25)

- 2) Press , and the information is displayed as in figure1-26.

The X axis displayed value indicates that $\angle 3 = 180 + \angle 1$. The Y axis displayed value indicates that $\angle 4 = 360 - \angle 1$.

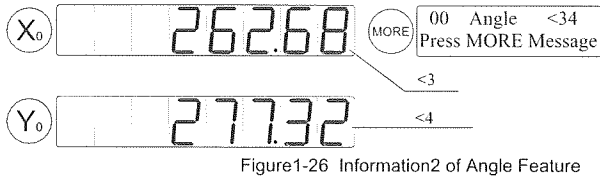


Figure1-26 Information2 of Angle Feature

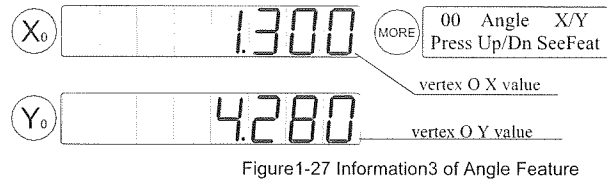



Figure1-27 Information3 of Angle Feature

- 3) Press , and the information is displayed as in figure1-27

The displayed values of X and Y axes imply the current position of the vertex of the angle.

1.7.6 RECTANGLE

The feature of rectangle includes three pages of information.

- 1) The length and width of the rectangle is displayed as in figure1-28.

The displayed information 00 in the LCD indicates that the feature is a permanent feature. The X axis displayed value represents the length of the rectangle while the Y axis represents the width.

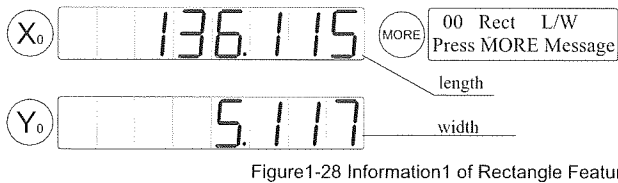


Figure1-28 Information1 of Rectangle Feature

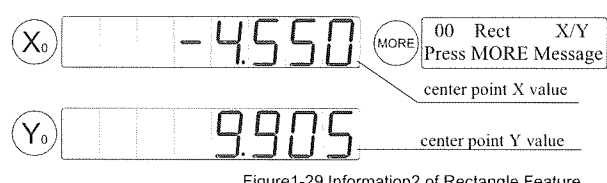



Figure1-29 Information2 of Rectangle Feature

- 2) Press , and the information is displayed as in figure1-29

The X and Y axes displayed values indicate the current position of the center point of the rectangle.

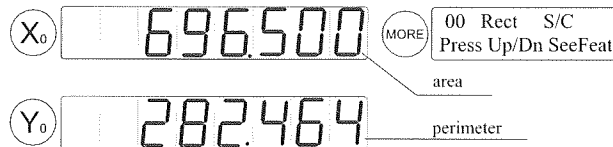



Figure1-30 Information3 of Rectangle Feature

- 3) Press , and the information is displayed as in figure1-30.


The X and Y axes displayed values respectively represent the area and perimeter of the rectangle (For the time being, the data doesn't exist).

1.7.7 SCREW

The feature of screw includes two pages of information.

- 1) The information of screw pitch, mid-diameter, rising angle is displayed as in figure1-31.

The information 01 indicates that among the permanent features the second feature is screw. The X axis displayed value is screw pitch, the Y axis displayed value is the mid-diameter, and the Z axis displayed value is the rising angle.

2) Press , and the information is displayed as in figure1-32.

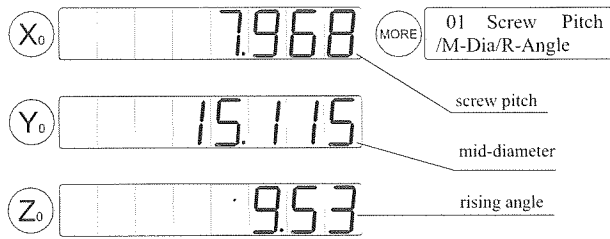


Figure1-31 Information1 of Screw Feature

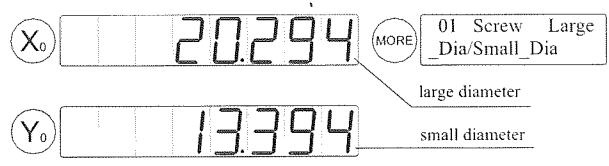


Figure1-32 Information2 of Screw Figure

The displayed values of X and Y axes respectively represent the values of large-diameter and small-diameter.

2. DEMONSTRATION


2.1 PREVIOUS READING

Before reading this section, you should have read Essential Information, because it offers you good background information for the material covered in this section.

ABOUT THIS SECTION



This section will lead you through the most frequently used operations of the DC-3000 Digital Readout.

We will assume that you will be operating in the Forward Annotation Mode. The difference between Forward Annotation and Backward Annotation is that, in Forward Annotation, the number of requisite points is determined before measurement. The requisite points in the display will decrease when the points are entered until the required number is reached. At that time the feature will be calculated. In Backward

Annotation, the operator may sample up to 50 points for a measurement but must press the  key after the required number of points probed.

THE DC-3000 IN ONE EASY LESSON

Included with your DC-3000 is a Quickie Slide. All the instructions that follow refer to that slide. Begin the lesson by turning on your comparator and the DC-3000. The opening message screen contains information such as the part number, DC-3000 and the software version. Press any key on the DC-3000's front panel to move past the opening message. The X, Y and Z/Q Axis Windows now contain Numeric and the message

window reads "Current Position". The indicator light above the  key is off, and it indicates the DRO is in the Cartesian coordinate. The indicator light above the  key is off, and it indicates that the DRO is in millimeter mode.

2.2 GETTING STARTED

Place the demonstration slide on your comparator (See Figure 2-1). Perform each step of this demonstration in the order that it is presented. Feel free to repeat any section until you are proficient with the concepts and the methods used.

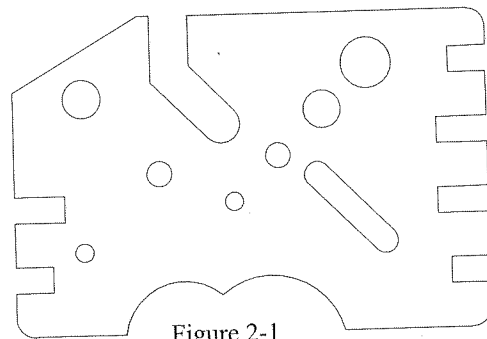


Figure 2-1

APPLYING POWER

To apply power, press the power switch located at the back panel of the enclosure and the DRO is ON, and it will initialize and display the power-up screen. (Figure 2-2)

Then the LCD screen displays "Please Waiting..." when the DRO is

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** DC-3000 V3.07 Rationa

Figure 2-2

reading some important data, such as parameters of status last power down, three axes counter etc.




If an axis or all axes have been set to Segment Linear Error Correction, then the LCD displays the message as in Figure 2-3, which remind you to move the axis near the RI point and press the  key to search axis' RI. Of course if you are sure that the axis has not been moved since last power down, you needn't to search RI. Press the  key and return to the normal status.



Figure 2-3

2.3 INITIAL DRO

2.3.1 PROBING METHOD

Points can be probed by using crosshairs or optical edge detector. If the probing method is not desired, select the desired probing method by pressing the  key.

2.3.2 REVERSING THE AXIS COUNT DIRECTION

The DC-3000 must be set up for the proper axis orientation. For the purpose of this demonstration, we suppose that if you move the crosshairs to the right, the X count will increase from 1 to 2 to 3 and not from -1 to -2 to -3. The same holds true for the Y axis. If you move the crosshairs up, the count will increase from 1 to 2 to 3.






Move the crosshairs to the right. The number in the X display should increase. If it does not, that's to say the X axis needs to be reversed.









Test the Y axis by moving the crosshair up. The number in the Y display should increase. If it decreases, that's to say the Y axis needs to be reversed.

Move anti-clockwise the Z/Q axis, the number in the Z/Q display should increase. If it decreases, that's to say the Z/Q axis needs to be reversed.

If you find that neither axis needs to be reversed, skip the paragraph about Reversing the Axes Direction and continue with Targeting Points. The user should better not reverse the setup that has been well done.

If you find that one or both axes need reverse direction, perform the following steps:

- a. Press the  key on the DC-3000's Front Panel. "Special measure" appears in the message window.
- b. Press the  or  key until "Axis Direction..." appears in the message window.
- c. Press the  key to enter the sub menu. "Reverse X: NO" appears in the message window.
- d. Press the  key to reverse the axis (if the X Axis needs to be changed).

- e. Press the  or  key. “Reverse Y: No” appears in the message window.
- f. Press the  key to reverse the axis (if the Y Axis needs to be changed).
- g. Press the  or  key. “Reverse Q: No” appears in the message window.
- h. Press the  key to reverse the axis (if the Q Axis needs to be changed).
- i. Press the  key, and “AXIS DIRECTION...” appears in the message window.
- j. Press the  key again to exit the Setup Menu. “Current Position” appears in the message window.

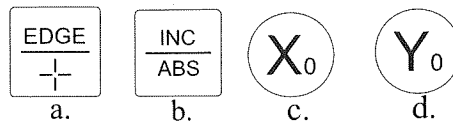
Repeat the axis orientation procedure located on a previous page to verify that the axes are reading correctly.




2.3.3 AXIS ZERO


The DC-3000 lets you select the origin points for measurements in both incremental and absolute coordinate. Absolute measurement is the distance between a fixed starting point on the part and a second point to which you move. [(0, 0) or origin is the fixed point from which all distances are measured.] Incremental measurement refers to a distance that is not measured with reference to a fixed origin. Instead, the distance is measured between the previous point and some new point. For example, if you move the crosshairs 5 mm in the positive X direction (to the right) from the origin (0, 0), the absolute measurement is 5.000 and so is the incremental distance. Suppose you zero the incremental datum and move an additional 5 mm in the same direction. Incrementally you have moved another 5 mm, so the absolute distance from the point of origin to the present location is 10 mm (5.000+5.000=10.000), not 5.000 as with the incremental.

The DC-3000 has two datum points, absolute and incremental, which can operate simultaneously. For this example, both datum points must be zeroed before you begin. Zero the absolute datum first then the incremental. When the absolute zero is set the incremental zero is set to the same location as the absolute zero.

To zero the absolute datum, first make sure that you are in Crosshairs Mode. Then center the comparator’s crosshairs over the point to become the origin and proceed as follows:



- a. Press the  key if the indicator light is on to turn it off.
- b. Press the  key if the light is on to turn it off.
- c. Press the  key. The X axis display will be zeros.

- d. Press the  key. The Y axis display will be zeros.


These steps have established the current position as absolute 0.000, 0.000 and also as the point from which incremental distances will be measured, and the pre-requisite is that the DRO is in display mode.

2.3.4 TARGETING POINTS

You may have read this paragraph before but it deserves repeating because it is important that you know how to properly target a point.


“Targeting a point” is the process of telling the DC-3000 that you wish to capture a particular point in the current measurement calculation.

In this section of this manual you will be using an edge detector or crosshairs. With the DRO in the Auto Edge configuration you only need to cross an edge of the part you are measuring. For each crossing you will hear a “beep”; if you are in a measuring routine you will see the point entered.



If you are in the manual edge mode, for one thing, align the crosshairs on the feature you are measuring (such as the circumference of the circle) and then press the  key.

2.3.5 SELECTING THE EDGE DETECTOR

Before using the Edge Detector, you must tell the DC-3000 that you wish to change from the crosshairs


to the Edge Detector. To achieve this press the  key and make sure the LED above the key is on. If you do not have the Edge Detector Option on your DRO, please skip Cross Cal section.

2.3.6 Unit of measurement (Linear)



Features can be measured in mm or inch. Select the desired unit of measurement by pressing the  key. The light above the  key is ON, which indicates the current unit is inch, otherwise mm.


2.3.7 POLAR COORDINATE

The DC-3000's Polar coordinate simultaneously computes the straight-line distance from the current datum to any point, and the angle that the line makes with the positive direction of X axis. Follow this procedure to see how it works.

If the message window reveals X and Y instead of R, A, therefore, press the  key to select Polar coordinate.

Notice the entries in the Feature List that had X and Y labels, and you'll find that they have been changed into R and A. The X, Y points (which were measured relatively to the current datum), become R, A Points, which were also measured from the current datum.

Use the  or  key to find a feature with an R, A component, and then look at the DRO Windows to see how the information of the feature is displayed in Polar coordinate.

Press the  key to return to Cartesian coordinate. Both the Feature Axes Windows and the Feature List display the information in an X, Y format.

Don't let polar measurements confuse you. The polar coordinates merely change the way the information is shown, it is still the same information, just as 1 inch and 25.4 millimeters are two different ways of expressing the same length.

In Cartesian measurements the distance is expressed with a pair of coordinates X and Y. This is the coordinate we are most familiar with. In a Polar coordinate we express a distance by using a pair of coordinates r and a. These represent the radial (straight line) distance and the angle magnitude.

Surveyors use polar coordinates all the time. When land is surveyed in the plot that is not defined by Latitude and Longitude (a version of Cartesian measurement) for all the corners of the property. Rather, it is defined by polar measurement. The survey will read "from boundary marker X23 (the origin) northeast 36° 52' for a distance of 65.1 feet". This is polar measurement, where distances are denoted by traveling some distance in some direction from an origin. The surveyor used north as 0°, but north is not a standard direction when it comes to comparators so we use the positive X axis as our 0° line.


Scientific convention dictates that we use the counter anti-clockwise direction (right hand rule) to measure angles. So if you swing from the positive X axis around to the positive Y axis, the angle will increase.

Polar measurements can be very useful for things like point-to-point distance measurements (when the line isn't aligned with the X or Y axes of the part) and quick angle measurements.







2.3.8 FORWARD – BACKWARD ANNOTATION














Forward Annotation refers to the process of designating a specific number of points for the targeting of a feature. When the number is reached, the DRO will display all the information of the feature.

Backward Annotation refers to the process that the user does not designate a predetermined number of points to measure a feature. When enough sample points are targeted, the DRO waits for the operator to end

the action of targeting points by pressing the  key to. When the operator has determined that a sufficient number of points (ranging from 2 to 50) have been targeted, he only needs to press the appropriate key.

If you want to change the annotation procedure, perform the following steps:



- 1) Press the  key on the DC-3000's Front Panel. "Special Measure" appears in the message window.
- 2) Press the  or  key until "Annotation..." appears in the message window.
- 3) Press , and "Back Annotation" appears in the message window.
- 4) Press the  or  key until "Forw Annotation" appears in the message window.

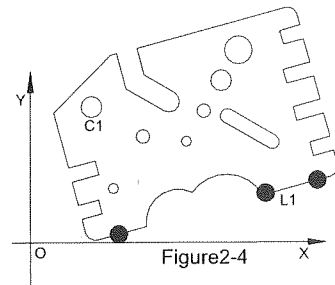
- 5) Press  if you wish to use Forward Annotation.
- 6) Press the  or  key to review the point defaults until "Point Points. #" appears in the message window.
- 7) Press the  key, and "Value: #" appears in the message window. Use the numeric keypad to enter the new number of points.
- 8) Press the  key, then press the  key, and "Line Points. #" will appear in the message window.
- 9) Press the  key. "Value: #" appears in the message window. Use the numeric keypad to enter the new number of points.
- 10) Press the  key, then press the  key, and "Circle Points. #" will appear in the message window.
- 11) Press the  key. "Value:" appears in the message window. Use the numeric keypad to enter the new number of points.
- 12) Press  to accept the entered number. "Circle Points. #" appears in the message window.
- 13) Press the  key. "Annotation..." appears in the message window.
- 14) Press the  key again to exit the Setup Menu, and "Current Position" appears in the message window.

2.3.9 SKEWING THE PART

The expedite measurement of a part demands you have the part perfectly aligned on your comparator's bed. An improperly aligned or "un-skewed" part may cause the measurement slow and inefficient. The first step to go should always be to align or skew the part properly.

If you want to skew a part, you must probe an edge, preferably, a horizontal edge. The more points you enter and the more uniformly distributed they are, therefore, the more exact your results will be. You may target between 2 and 50 points, for this example you can enter 3 points. The process is briefly described as follows. (Assume the current annotation mode is FORWARD ANNOTATION)

- 1) Press the  key. "Skew Axis", then "Probe Line 02" appears in the message window. (Figure2-4)
- 2) Press the  key to add a point for skewing. "03 More Points" appears in the message window.
- 3) Target the 3 points on the bottom (X axis) of the part and spread the points across the edge. After each point has been probed, the display will read "02 More Points", "01 More Points" etc. When



you have entered the points for the X-axis, and “X Skewed” (or “Y Skewed” if the angle is greater than 45 degrees) appears in the message window. The DC-3000’s incremental point will be (0, 0). (Figure2-5)

The part has now been skewed, or electronically rotated. If the edge of the part is not perfectly parallel with the axes of the comparator, the DC-3000 will automatically compensate for the misalignment of the part.

If your part is misaligned with respect to the travel of your machine, you will notice that more than one DRO axis display will change as you move along the axis. This is because the DC-3000 knows you are moving diagonally with respect to the part.

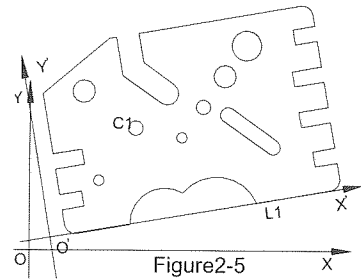


Figure2-5

2.3.10 Setting the datum for measurements

The system simultaneously uses 2 reference datum for measurement. One is fixed (absolute) while the other can be redefined (incremental) during the measurement session to make incremental measurements. Reference points for absolute and incremental measurements can be set by zeroing the absolute (datum 1) and incremental (datum 2) datum.

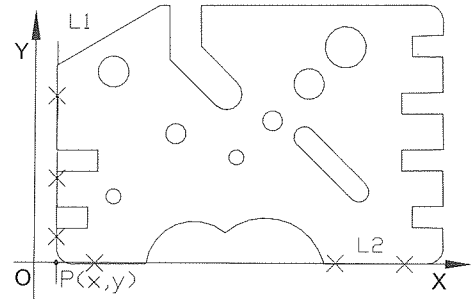



Figure 2-6 Set datum

Absolute datum

Absolute measurements are those referred to the absolute datum. The absolute datum is defined as the origin (0, 0), and should be set at the beginning of each measurement session.

In the following example, the absolute datum will be set at the constructed intersection (point P of fig 2-6) of the horizontal skew line and an edge on the Y axis of the part and the X windows and Y windows display the current position, and the LCD windows indicate the present measurement is line measurement.


a. Press the  key. The Probe Line screen will be displayed. (Figure 2-7)

X₀ 10.461

Y₀ -3.044

MORE Probe Line 02
Push LINE ADD Pts

Figure 2-7 Probe Line

- b. Target a minimum of 2 points along the L2. Press the  key after targeting each point. When all points have been entered, the Line Screen will show the actual orientation of the line. (Figure 2-8).
Figure 2-6 line L2.

X₀ 0.000

Y₀ 0.002

MORE a0 Line X/Y
Press MORE Message

Figure 2-8 Line Message


X₀ 3.127

Y₀ 0.000

MORE a0 Line X/Y
Press MORE Message

Figure 2-9 L1 Message

- c. Repeat step a, b to measure the line L1 as in Figure 2-6. Its message is displayed as in Figure 2-9.

- d. Press the  key. The Probe Point screen is displayed. (Figure 2-10).

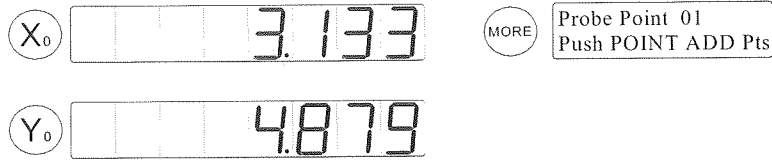


Figure 2-10 Probe Point

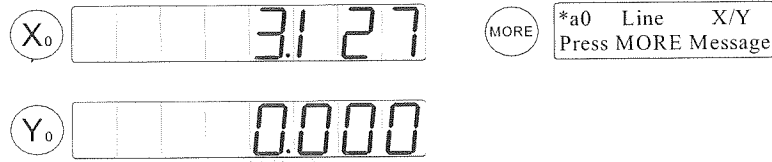








Figure 2-11 L1 Message

- e. Press the  or  key, and find vertical line L1. (Figure 2-11). Press the  key to select L1. A checkmark (*) will appear next to the line number in the feature list indicating its inclusion in the construction.

- f. Press the  or  key to find the horizontal line L2 (Figure 2-7). Press  key to select L2 (Figure 2-12).

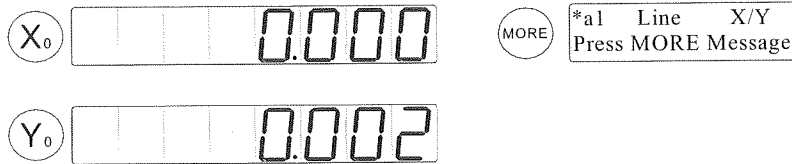


Figure 2-12 Line Message

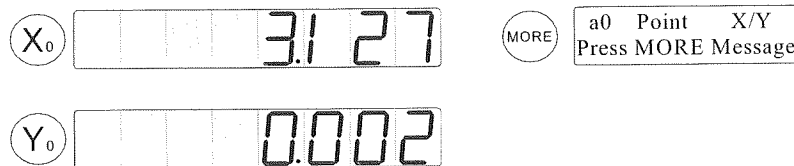





Figure 2-13 Point Message


- g. Press the  key to construct the point. A point will be constructed at the intersection of the vertical line and the horizontal line. The point (defined as a0) will be added to the feature list and its location will be shown on the Point screen. (Figure 2-13)




The two lines used to construct the point and the other messages of the point can be obtained in the

message window by pressing the  or  key.

Waiting for Key
Push SKEW ORG&SKEW

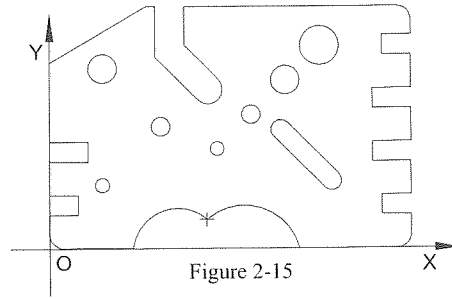
Figure 2-14


- h. Press the  key to set the datum at the constructed point of intersection of the line L1 and L2, and the LCD screen displays the message as in figure 2-14.

- i. Press the  or  key to find the point a0 and press the  key to select it. The DC-3000 will automatically set the datum to the constructed point.

2.4 POINT MEASUREMENT


Points are easiest to probe or construct because they require very little interaction between the user and the DC-3000. Follow these steps to measure several points on the part, as shown in the Figure 2-15.









- a. Press the  key. "Probe Point 01" is displayed in the message window.

If the message window displays "Point 00", that's to say, the DC-3000 is in Backward Annotation status. After each point has been probed the LCD will display "Point 01", "Point 02" etc.

If the DC-3000 is in **Forward Annotation**, the message window will display "Probe Point #" (default point setting and count down with each point entry). The operator may override the default

setting by pressing the  key to increase the number of points. The # represents the number of points wanted to probe.

For purposes of this demonstration we will assume that from here on the DRO is in forward annotation.

- b. Press the  key to target a point on the part. The number of points will minus by 1 automatically after pressing the  key every time. The point will be entered into the point storage list. (The    and  keys are active.)
- c. Repeat step b until the expected number is reached. The measurement will be ended automatically, at the same time "a0 Point X/Y" is displayed in the message window. (Figure 2-16)

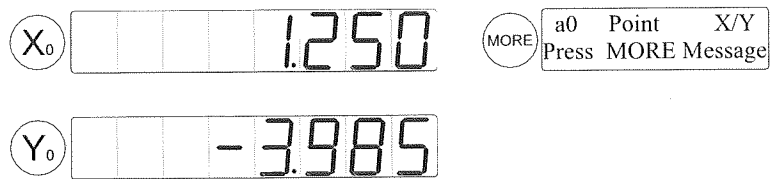



Figure 2-16 Point Message



Figure 2-17 Point Message

- d. Press the  key to see another message (Figure 2-17).

Average Point


The average point, or "multi-point point" is a way to obtain more accuracy in point measurements by targeting the point several times and then averaging all the positions entered when generating the POINT feature. As in other multipoint measurements, up to 50 points may be entered. Average points

(up to 50) may also be constructed by entering features containing positional information from the feature list.

CONSTRUCTION is not allowed when you PROBE a feature. Refer to the last paragraphs in this section for Construction information.

When the number is reached, the DC-3000 will calculate the feature and display it as "a0".

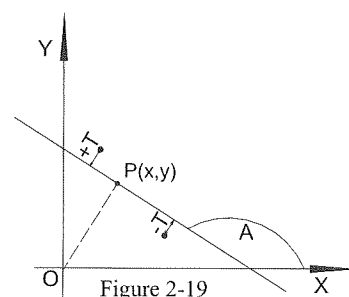
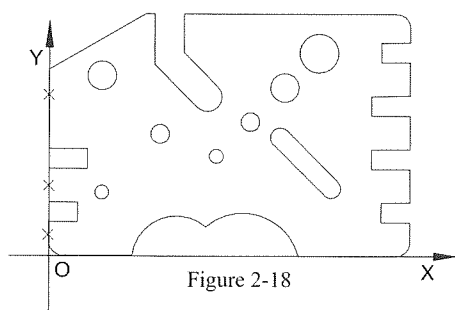
When you measure a point, you will see X/Y in the message window. The X and Y data displayed in the axes windows represents the X and Y distance from the current datum to the selected point. Press

the  key, the +T data is displayed in the X axis window.



2.5 LINE MEASUREMENT

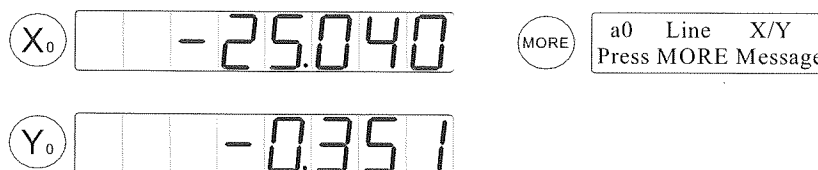
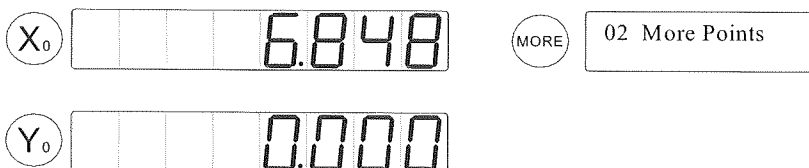
The DC-3000 can also measure lines. Targeting the points between 2 and 50, the DC-3000 will calculate the line which best fits those points.

Let's measure the line formed by the part's skewed axis and the left face as shown in Figure 2-18. The line feature's parameters are illustrated as in Fig2-19.




The line feature's parameters are illustrated as in Fig2-19.

- Press the  key to measure a line. In this example, Forward Annotation is available and the number of required data points for the line feature (3) is shown in the message window. If Backward Annotation is used, no requirement will be noted but the number of points entered will be counted.
- Move the part to place the crosshairs over the first point on the line and press  key. The location of the targeted point will be shown in the window (Figure 2-20) and the number of required points will be reduced.



- Repeat step b. until all the points are targeted and entered. The line feature data will be displayed in the window. (Figure 2-21)

- d. Press the  key to view another message (Figure 2-22).

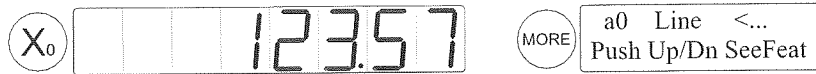


Figure 2-22 Line Message

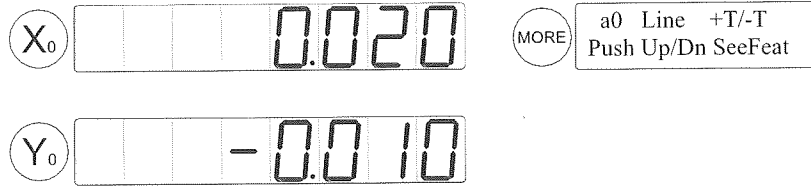





Figure 2-23 Line Message

- e. Press  key to see another message. (Figure 2-23).

When the DC-3000 calculates a line, it also computes the X, Y point on the line which lies closest to the Datum. However, this point, like all other points, is displayed relative to the current datum (either Absolute or Incremental). Pressing the  key will display the angle information.

The angle entry in the message window represents the angle the line makes with the positive X axis of the Reference Frame.

Then press the  key to view +T and -T. The +T data is displayed in the X axis window and the -T data in the Y axis window.

These +T/-T numbers tell how close the worst “outside” and “inside” points were to the best-fit construction. The +T measurement shows you where the “worst outside point” was; -T shows where the “worst inside point” was located. (Figure 2-24)

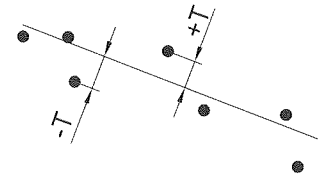


Figure 2-24 The mean of +T/-T

The +T and -T meaning for this feature is as follows:

- +T: Straight-line distance from worst point (on side of line away from the current datum) to best-fit line.
- T: Straight-line distance from worst point (on side of line facing the current datum) to best-fit.

2.6 CIRCLE MEASUREMENT

The DC-3000 enables you to make very precise calculations about any circle or arc of circle. Given anywhere from 3 to 50 points, the DC-3000 can calculate the circle’s center and radius.

For example, use the large circle in the demonstration part and follow these steps: (Figure 2-25)

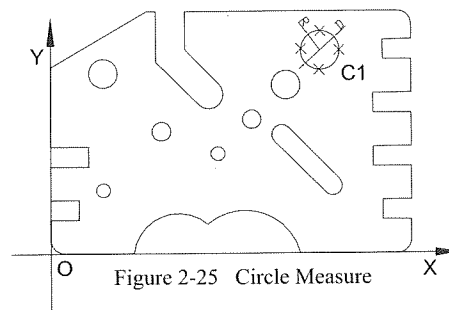



Figure 2-25 Circle Measure

- a. Press the  key to measure a circle. The message is displayed as in Figure 2-26. In this example, Forward Annotation was used and the number of required data points for the circle feature is 3 points. If Backward Annotation was used, no requirement would be noted but the number of points entered would be counted.
- b. Move the stage to place the crosshairs over the first point on the perimeter of the circle and press the

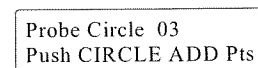


Figure 2-26 Probe Circle



key. The location of the targeted point will be shown as in Figure 2-27, and the number of required points will be reduced.

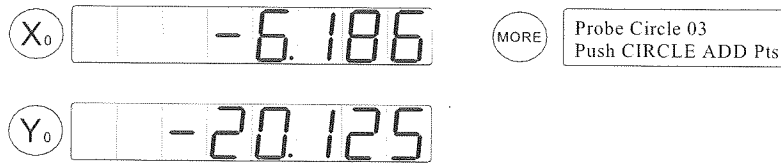


Figure 2-27 Probe Circle

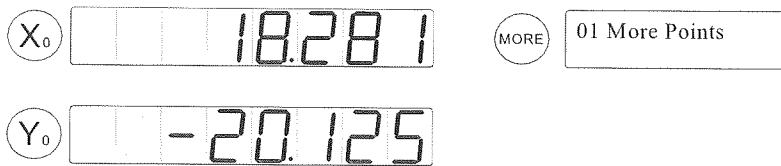


Figure 2-28 Probe Circle

- c. Move the stage to place the crosshairs over the second point on the perimeter of the circle and press the



key. The new location will be shown as in Figure 2-28, and the number of required points will be reduced again.

- d. Continue the process until all of the points have been targeted and entered. When all of the required points on the perimeter of the circle have been entered, the Circle Feature will be added to the feature list, meanwhile, its feature number and its data is displayed as in Figure 2-29.



Figure 2-29 Circle Message

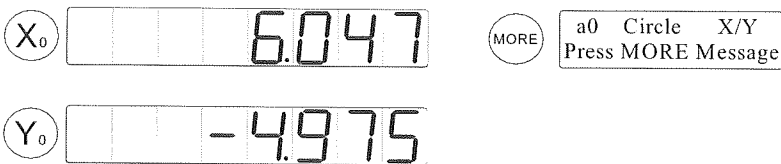


Figure 2-30 Circle Message

- e. Press the MORE key to view the other message. (Figure 2-30)

- f. Press the POL CART key to see the center of the circle displayed as a vector displacement from the datum with its displacement angle from the positive X axis. (Figure 2-31)

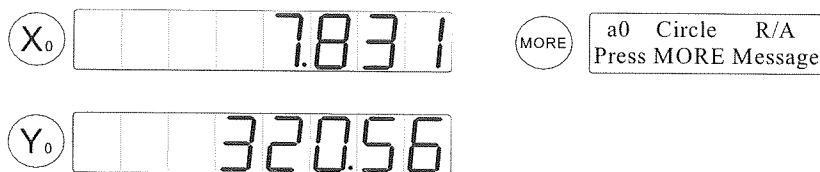


Figure 2-31 Circle Message in Polar Mode

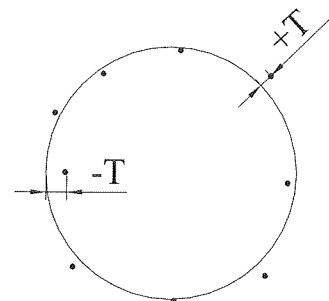


Figure 2-32 Circle Message

- g. Press the MORE key to view the coefficients/form data. The +T data is displayed in the X axis window while the -T data in the Y axis window. If the number of the probed

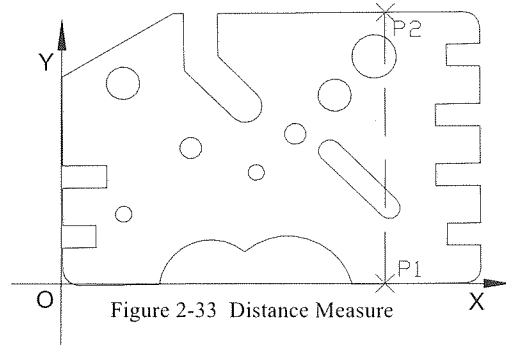
points is greater than 3, then the value is greater or less than zero, else their value is zero. The +T/-T value meaning is as follows (Figure 2-32):


- +T: Distance from worst point outside best-fit circle to best-fit circle.
- T: Distance from worst point inside best-fit circle to best-fit circle.

2.7 DISTANCE MEASUREMENT

Another function performed by the DC-3000 is distance measurement. The DC-3000 can calculate the Cartesian or polar distance between two points.

In the demonstration of this example, we will measure the distance of the part (the dimension of the part along the Y axis) using the following steps. (Figure 2-33 distance between the point P1 and P2)



- a. Press the  key to measure a single distance, the Message is displayed as in figure 2-34.

In this example, Forward Annotation is available and the number of required data points for the Distance feature is shown in the LCD window. However, 2 data points are required for Forward or Backward Annotation.

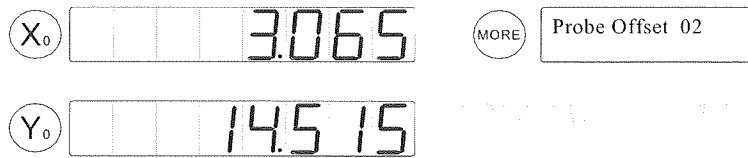




Figure 2-34 Distance Measure



Figure 2-35 Distance Measure

- b. Move the stage to place the crosshairs over the first point and press the  key. The location of the targeted point will be shown as in Figure 2-35.

- c. Move the stage to place the crosshairs over the second point, press the  key. The Distance feature data will be displayed as in Figure 2-36, and it will be added to the feature list with its data. The data will include displacement on the X axis, displacement on the Y axis, and the total vector displacement from the first to the second point.

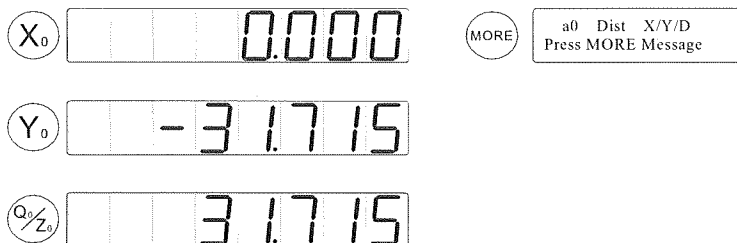


Figure 2-36 Distance Message

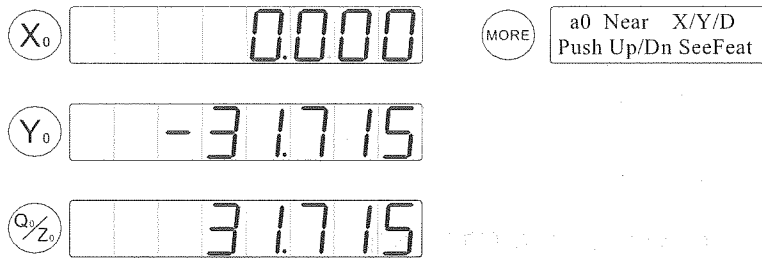


Figure 2-37 Distance Message

d. Press the **MORE** key to view another message. (Figure 2-37 and 2-38).

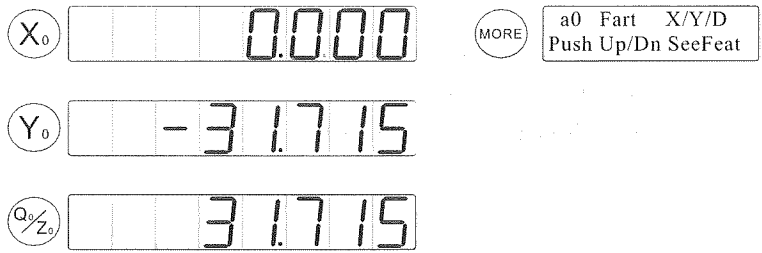


Figure 2-38 Distance Message



Note:

Distances are usually generated as relations between existing features. Constructions are explained later in this section.

2.8 ANGLE MEASUREMENT



Note:

You need to know the procedure when measuring angle with DC-3000. In the process of measurement, the first line and the second line are indefinite, and the included angle they make should be no more than 180° and rotated anticlockwise from the first line to the second. The figure2-39 vividly illustrates how an angle is constructed. As to figure a, in order to measure angle 1, you should first measure L1, then L2. But as to figure b, if you also measure it as measuring angle1, therefore, the angle you measured is not the angle 2 you need, but its supplementary angle, so you should first measure L2 and then L1, only in this case can you get the correct result. Similarly, the same problem exists when you measure an angle with three points. Therefore, you should know the procedure before measuring.

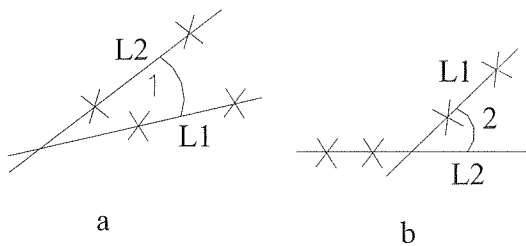


Figure2-39 measure angle

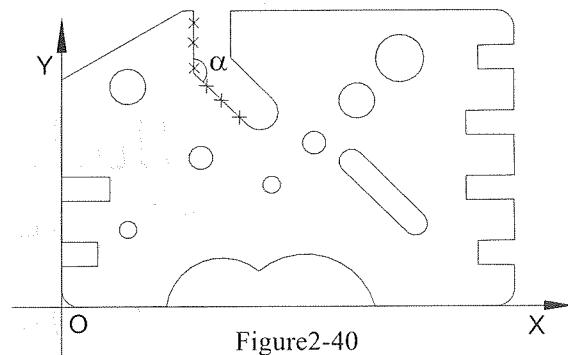


Figure2-40

Angle can be measured by targeting points on the two lines (legs) that develop an angle. The DC-3000 automatically guides the user through the process of targeting points on both lines, constructs the angle and

calculates the vertex. Each of the two lines can be measured by targeting between 2 and 50 points. When Backward Annotation is used, the number of targeted points on each line will be determined by the user. Generally, accuracy of the overall angle measurement is increased as more points are targeted. When Forward Annotation is used, the required number of data points will be shown in LCD screen for each line.

For this exercise, use the side and bottom of the demonstration part as shown in Figure 2-41 and follow these steps:

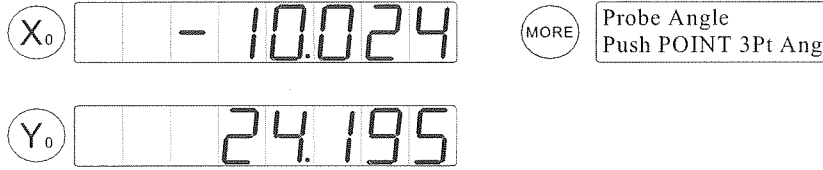


Figure 2-41 Angle Measure

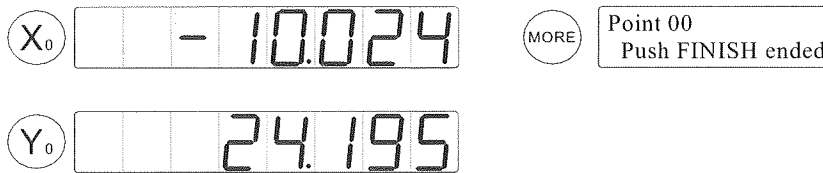





Figure 2-42 Angle Measure

- a. Press the  key to measure an angle α in figure 2-40. The message is displayed as in figure 2-42.

In this example, Backward Annotation is used and no specific number of data points is required. However, the number of points targeted for each of the 2 lines that form the angle will be counted. If Forward Annotation is used, the required number of data points for each line will be shown.

- b. Move the stage to place the crosshairs over the first point of the first line and press the  key. The location of the targeted point will be shown as in figure 2-43 and the number of data points entered for this line will be added.
- c. Continue the process until all of the points have been targeted and entered for the first line of the angle.

When all of the points have been entered, press the  key. A new line will be calculated and its data will be saved in the EEPROM. Then LCD displays “Second line”, “Probe line”, last the LCD displays the message as in figure 2-43, and the figure indicates the beginning of the targeting sequence for the second line of the angle.

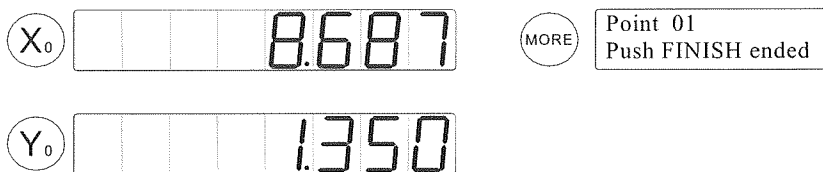


Figure 2-43 Angle Measure

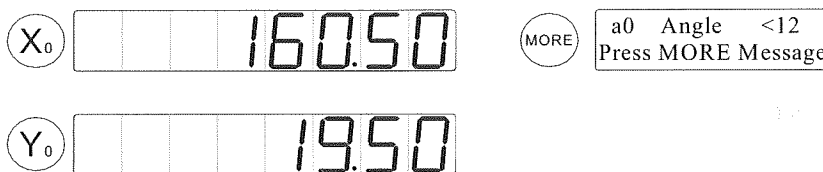


Figure 2-44 Angle

- d. Target and enter all of the points on the second line of the angle. When all the points have been entered,

press the FINISH key. The angle feature data will be displayed as in figure 2-44 and the feature will be added to the feature list with its data. The angle feature data will include the X and Y locations of the vertex of the angle, and the included angle between the two lines (legs), and other message.

- e. Press the MORE key to view the message of the angle. (Figure 2-45 and 2-46).

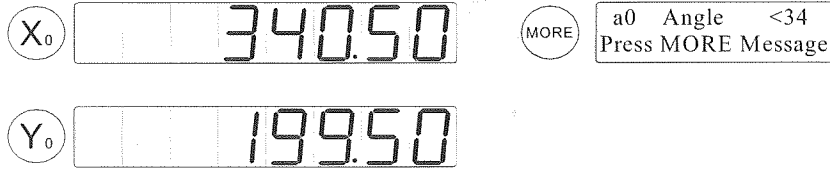


Figure 2-45 Angle Message

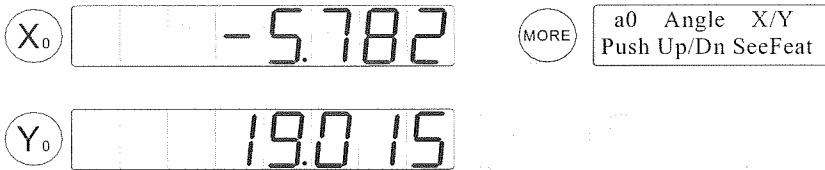


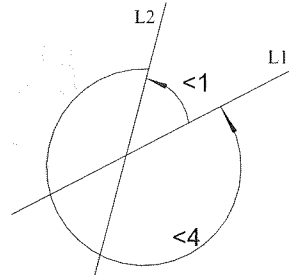
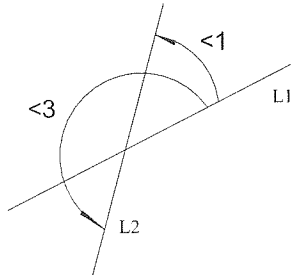
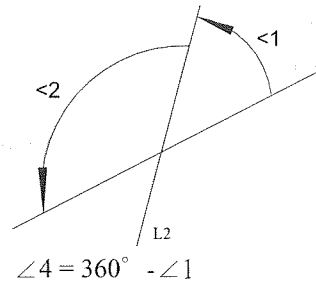
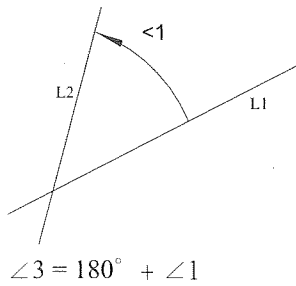
Figure 2-46 Angle Message

The message window displays information about the angle. Angle 1 is shown in the X display; angle 2 is shown in the Y display. Press MORE to view the data for angles 3 and 4. The first angle listed is the angle between the first and the second probed line. The order of entry of the features is very important. The other listed angles all have a geometric relationship to the first angle.

The message displayed as in figure 2-45 and 2-46 means as follows:

$\angle 1 =$ Included Angle less than 180°

$\angle 2 = 180^\circ - \angle 1$



NOTE:

When measuring an angle, you first measure the line L1 and then the line L2. Note that from L1 anti-clockwise to L2.

2.9 RECTANGLE MEASUREMENT

The DC-3000 provides some special functions such as Rectangle measurement and screw measurement. Rectangles are measured by targeting 5 points. And there is no deference in using Backward and Forward Annotation. The required points will be reduced as points are entered.



Note:

You should target 5 points when measuring rectangle with DC-3000, and the way of targeting points is illustrated as in figure2-48, among the five points, P1 and P2 must be on the first line, and the other 3 points (P3, P4 and P5) are respectively targeted on the other 3 lines, it is very important that these sequence of targeting points be clockwise (P1 → P2 → P5 → P4 → P3) or anticlockwise (P1 → P2 → P3 → P4 → P5).

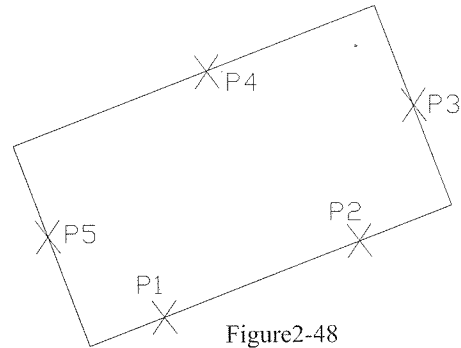



Figure2-48

Use the following steps to measure a Rectangle:

1) Press the  key; the LCD displays the message as in figure 2-49.

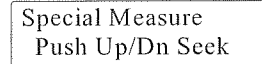



Figure 2-49 Rectangle Measure

2) Press  key and come to the special measurement. (Figure 2-50).

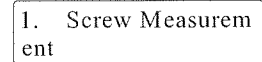




Figure 2-50 Special Measure

3) Press the  or  key until the LCD displays the message as in figure 2-51.

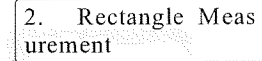



Figure 2-51 Special Measure

4) Press the  key to measure a Rectangle, and the message is displayed as in figure 2-52.

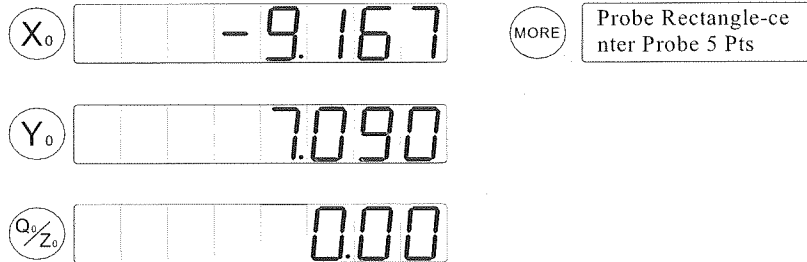


Figure 2-52 Rectangle Measure

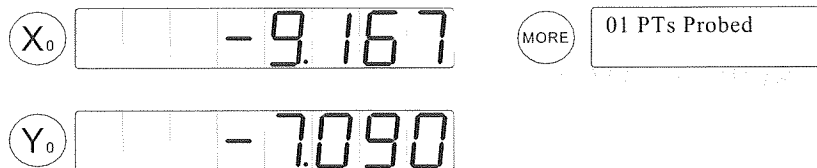



Figure 2-53 Rectangle Measure

5) Move the stage to place the crosshairs over the first point of the Rectangle and press the  key. The position of the targeted point will be shown as in figure 2-53.

6) Move the stage to place the crosshairs over the second point of the Rectangle and press the



key. The location of the targeted point will be shown as in figure 2-54.

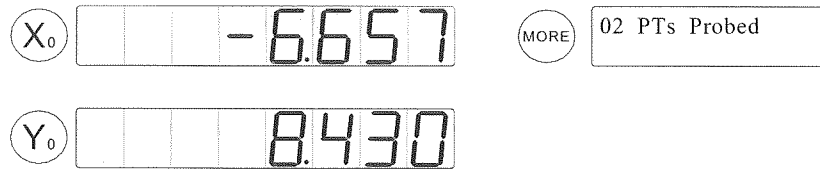


Figure 2-54 Rectangle Measure

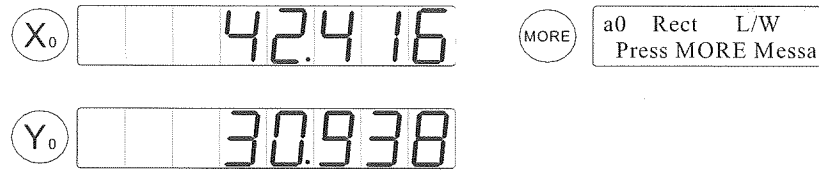


Figure 2-55 Rectangle Message

- 7) Continue the process until all of the requisite points have been targeted and entered. The Rectangle Feature data will be displayed as in figure 2-55 and the feature will be added to the feature list with its data. In figure 2-56, length of the Rectangle is displayed on the X axis and width of the Rectangle is displayed on the Y axis.
- 8) Press the **MORE** key to view the center of the rectangle. (Figure 2-56)

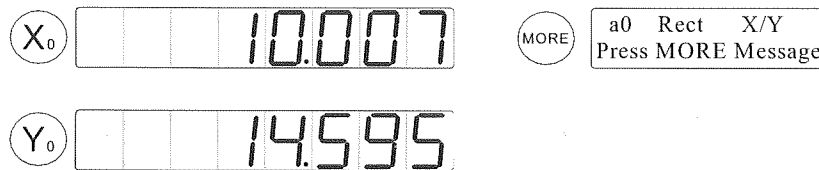


Figure 2-56 Rectangle Message



Note:

- I. The 5 points targeted from the rectangle are shown as in figure 2-57, the first point and the second point must be on the same line of the rectangle. The remained 3 points are on the other lines of the rectangle, respectively.
- II. Rectangle measurement can be continued until

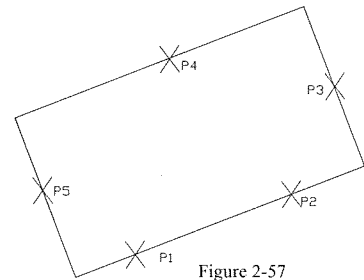


Figure 2-57

press the **QUIT** key then press the **ENTER/YES** key to quit this rectangle measurement.


2.10 SCREW MEASUREMENT

In the 3.07 version, the screw is measured by targeting more points.



Note:

You should target 2~50 points on the line L1, and then press **FINISH** key; target 1~50 points on the line L2, then press **FINISH** key; target 1~50 points on the line L4, then

press  key. Now, the Screw Feature data would be calculated. Of course, you can replace the line L1, L2, L4 with the line L4, L3, L1.

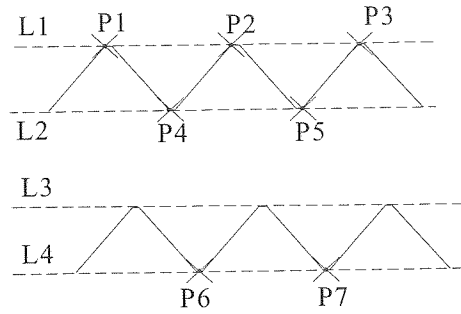








Figure 2-58

Use the following steps to measure a screw:

- 1) Press the  key; the LCD displays the message as in figure 2-59.
- 2) Press  key and come to the special measurement. (Figure 2-60).
- 3) Press the  key to enter the screw measurement menu. (figure 2-61)
- 4) Press the  or  key to select the screw type you want, then press the  key and come to the screw measurement. (as in figure 2-62)

Special Measure
Push Up/Dn Seek

Figure 2-59 Rectangle Measure

1. Screw Measurement

Figure 2-60 Special Measure

1. Normal Screw measurement 60(deg)

Figure 2-61 Special Measure

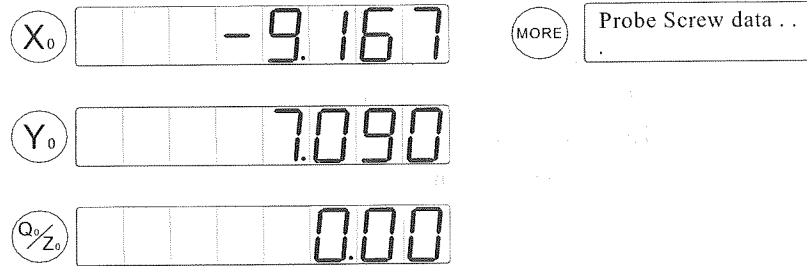


Figure 2-62 Screw Measure

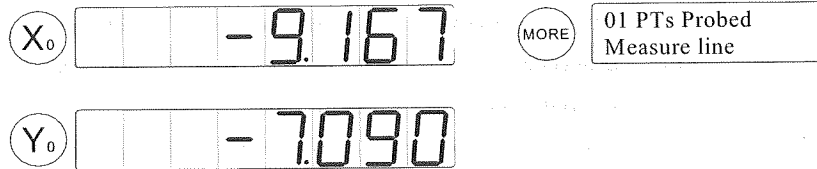




Figure 2-63 Screw Measure

- 5) Move the stage to place the crosshairs over the first point of the line L1 (figure 2-58) of Screw and press the  key. The position of the targeted point will be shown as in figure 2-63.
- 6) Move the stage to place the crosshairs over the next point of the line L1 of Screw and press the  key. The position of the targeted point will be shown as in figure 2-64.

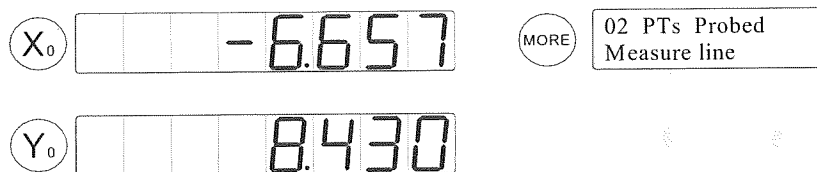


Figure 2-64 Screw Measure

- 7) Continue the process until all requisite points of the line L1 have been targeted and entered. And then target the line L2, L4. The Screw Feature data will be displayed as in figure 2-65 and the

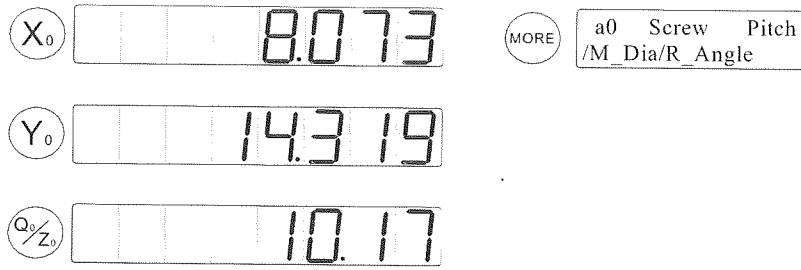


figure 2-65

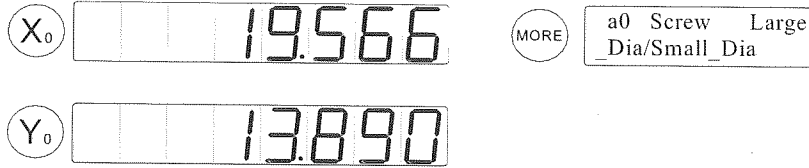





figure 2-66

8) Press the  key to view the large and small diameter of the Screw. (Figure 2-66)




Note:


- I. Screw measurement can be continued until press the  key then press the  key to quit this rectangle measurement.
- II. The Screw measurement is a simple function. If you want for a precise measurement, measure it by using other special apparatus.


2.11 MEASURE EASY

Measure Easy automatically analyzes a collection of data points, and it determines the feature type that was probed and calculates the appropriate feature data. Measure Easy can be only used to measure point, line and circle features if DC-3000 is configured to allow Measure Easy.





Measure Easy will work accurately only if the following simple probing techniques are followed:

Measuring a point: Enter only 1 point and press the  key,

Measuring a line: Enter 2 or more points on the line and press the  key.

Measuring a circle: Enter a minimum of 3 points on the perimeter of the circle and press the  key.

The following steps further instruct you how to set up Measure Easy on the DC-3000.

- a. Press the  key. The LCD displays the message as in figure 2-67.
- b. Press the  or  key until LCD displayed message as in figure 2-68.
- c. Press the  key and get into the submenu. (Figure 2-69)

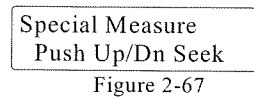


Figure 2-67

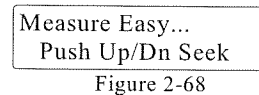


Figure 2-68

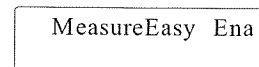


Figure 2-69


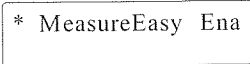

- d. Press the  key to select Measure Easy, and the LCD displays the message as in figure 2-70. The symbol “*” means you select this function, and then you can use Measure Easy to measure features. 
- e. Press the  key to quit the setup menu and return to the normal status.

Figure 2-70

2.12 CONSTRUCTIONS

Feature construction is the process of combining existing features to generate a new feature. A feature must either be totally constructed or totally probed; it cannot be generated by combining a construction and probing points.

There is a comprehensive list of all feature constructions allowed by the DC-3000. The list giving for each subtopic represents the components of the construction.

TYPE	YIELD
INTERSECTION	line-line, line-circle, circle-circle; Returns intersection points
EXTRACT	center of circle; point of line
OFFSET	points, parallel lines, circles.
RELATIONSHIP	distances and angles.
SYMMETRIC	midpoints, bisector lines.
PERPENDICULAR	line-points.
COMPLEMENT BUILD	point-distance, point angle.

The following chart provides a comprehensive list of allowed constructions. To use the chart, first determine the type of feature that you wish to construct, press the corresponding key for the feature you are going to calculate, then enter one or two previously measured features you are using for the construction of a


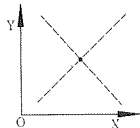

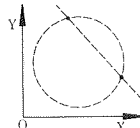












new feature. For instance, if you wish to find the point of intersection of two lines, first you press the  key and then enter the two lines from the feature list.

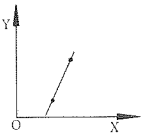

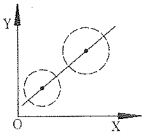

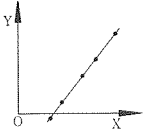

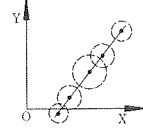

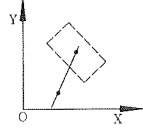

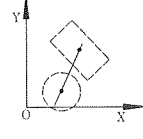

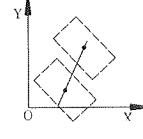

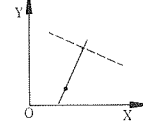

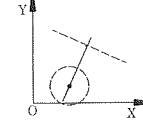

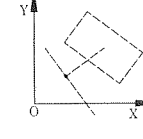

CHART of Construction feature

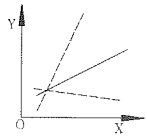

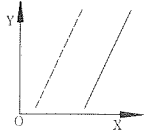

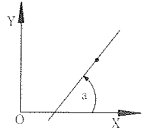

1) Construct point

Construct type	Figure	Operate step	Remark
Two lines		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two lines. 	If the two lines are parallel, no point of intersection is get.
A circle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a line and a circle. 	The number point of intersection maybe is one, or two. It is maybe no one, also.

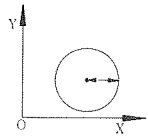

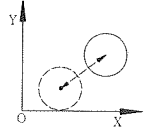

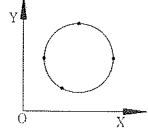

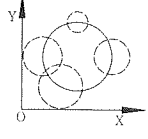

Construct type	Figure	Operate step	Remark
Two circles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two circles. 	The number point of intersection maybe is one, or two. It is maybe no one, also.
Two points		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two points. 	
A circle and a point		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle and a point. 	
A circle		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle. 	Extract the centre of a circle
A rectangle		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle. 	Extract the centre of a rectangle
A rectangle and a point		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle and a point. 	
Two rectangles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two rectangles. 	
A rectangle and a circle		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle and a circle. 	
A distance and a point		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a distance and a point. 	Move a point at the direct of distance.
A point and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a point and a line. 	The point must be out of the line.
A rectangle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle and a line. 	The centre of rectangle must be out of the line.

2) Construct line

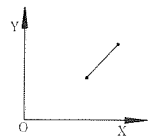

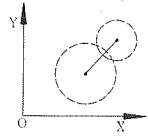

Construct type	Figure	Operate step	Remark
Two lines		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two lines. 	
Two circles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two circles. 	
Many points		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select many points. 	
Many circles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select many circles. 	
A rectangle and a point		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle and a point. 	
A rectangle and a circle		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle and a circle. 	
Two rectangles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two rectangles. 	
A point and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a point and a line. 	
A circle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle and a line. 	
A rectangle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangles and a line. 	

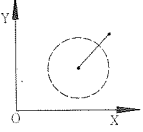

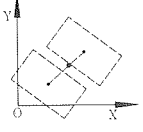

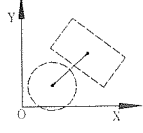

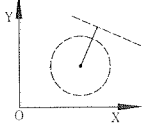

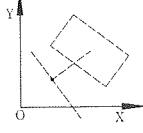

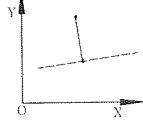

Construct type	Figure	Operate step	Remark
Two lines		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two lines. 	
A distance and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a distance and a line. 	
A angle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select an angle and a line. 	The line is the result of X axis rotating a designated angle and passing the designated point.

3) Construct circle

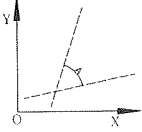

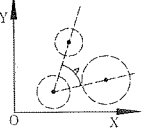

Construct type	Figure	Operate step	Remark
A distance and a point		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a distance and a point. 	The designated point is the centre of the circle and the distance is the radius of the circle.
A distance and a circle		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle and a distance. 	Move the circle a designated distance.
Many points		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select many points. 	
Many circles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select many circles. 	

4) Construct distance

Construct type	Figure	Operate step	Remark
Two points		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two points. 	
Two circles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two circles. 	Include the distance, the closest and farthest distance.

Construct type	Figure	Operate step	Remark
A circle and a point		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle and a point. 	Include the distance, the closest and farthest distance.
Two rectangles		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two rectangles. 	
A rectangle and a circle		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle and a rectangle. 	Include the distance, the closest and farthest distance.
A circle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a circle and a line. 	Include the distance, the closest and farthest distance.
A rectangle and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a rectangle and a line. 	
A point and a line		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select a line and a point. 	

5) **Construct angle**


Construct type	Figure	Operate step	Remark
Two lines		<ol style="list-style-type: none"> 1. Press  key to designate the type of constructing result. 2. Select two lines. 	
Three points or circles		<ol style="list-style-type: none"> 3. Press  key to designate the type of constructing result. 4. Select three points or circles. 	

Examples

The following are some examples which show you in detail to measure and construct some particular features.

Example 1: Construct a point feature from temporary line a1 and line a5.



- Refer to the Points portion of the Feature Construction Chart and search the item “two lines”.

To generate the point intersection of the two lines, press the  key.

Probe Point 01
Push POINT ADD Pts

(Figure 2-71)

Figure 2-71

- b. Press the  or  key, then the DC-3000 displays a current feature message in the Feature list. (Figure 2-72)

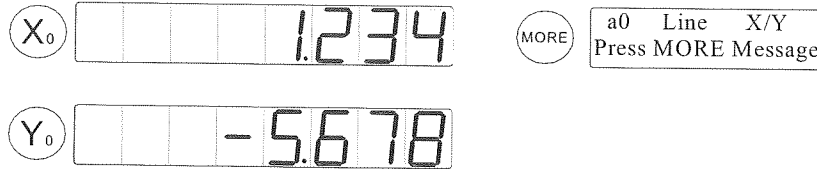





Figure 2-72



NOTE:

The  key could have been used to recall the desired feature instead of pressing the  or  key to select a feature.

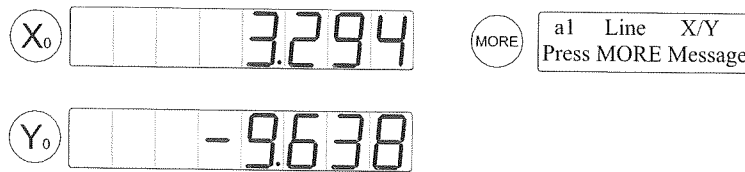




Figure 2-73

- c. Press the  or  key, until the displays the feature a1's message as in figure 2-73 Press the

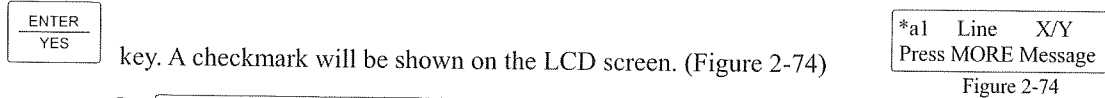


Figure 2-74

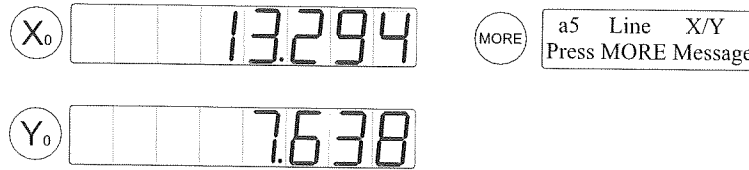




Figure 2-75

- d. Press the  or  key until the displays the feature a5's message as in figure 2-75 press the

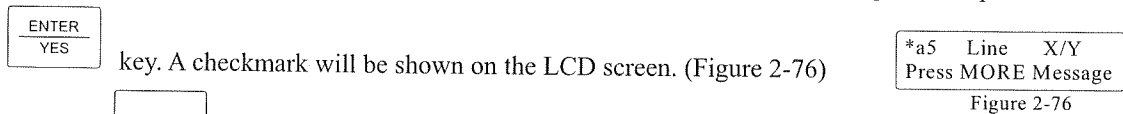



Figure 2-76

- e. Press the  key to construct the new feature. The new Point feature will be added to the bottom of the feature list and its data will be displayed as in figure 2-77.

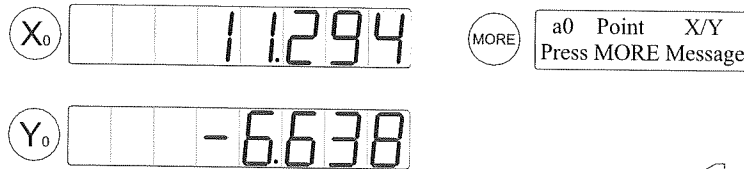


Figure 2-77

Example 2: Construct a Line feature from 4 circles in feature list (figure 2-78). (Assume these circles in the figure have been measured and stored at a0, a1, a2, and a3 as temporary features)

- a. Refer to the Lines portion of the Feature Construction Chart and find a combination of multiple circles.

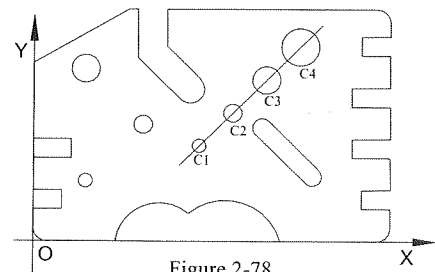






Figure 2-78

Press the  key, the LCD displays the message as in figure 2-79, which shows it is measuring a line.

Probe Line 02
Push LINE ADD Pts
Figure 2-79

b. Press  or  key, the feature a0's message is displayed in figure 2-80. Press the  key to select this feature.

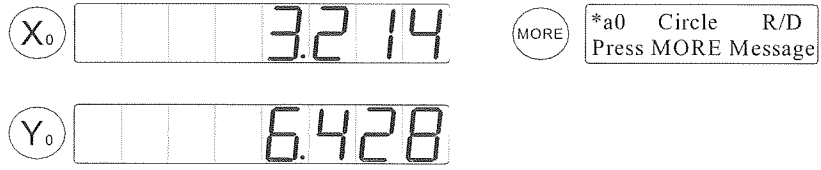


Figure 2-80

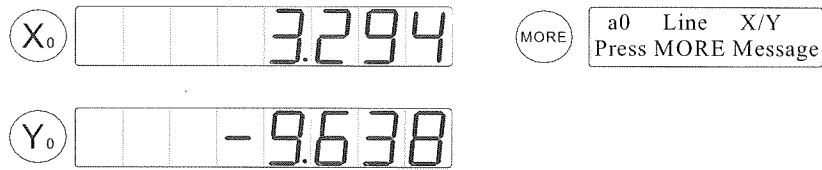

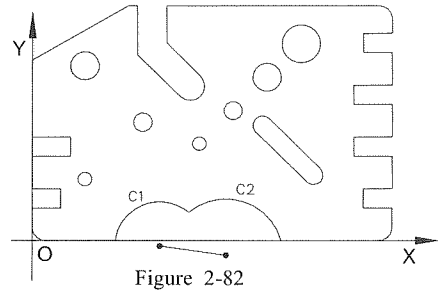



Figure 2-81

c. Repeat step b to select the other 3 circles. After the selections are finished then press the  key, a new line feature is added into feature list. And its data is displayed in figure 2-81.




Example 3: Determine the Distance between arc C1 and arc C2 in feature list (figure 2-82).



a. Refer to the Distance portion of the Feature Construction Chart and find a distance of 2 circle centers as following:

To construct a distance, press the  key, the message that indicates probing distance is displayed as in figure 2-83.

Probe Offset 02
Figure 2-83

b. Press the  or  key, find the feature a0, then press the  key to select this feature. The feature a0's message and a checkmark are displayed as in figure 2-84.

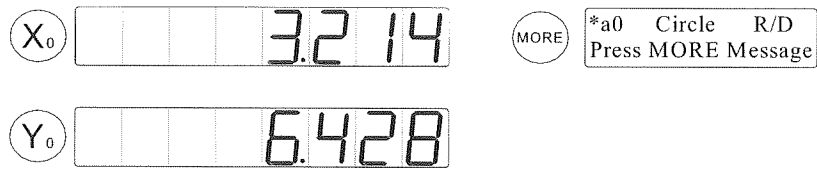


Figure 2-84

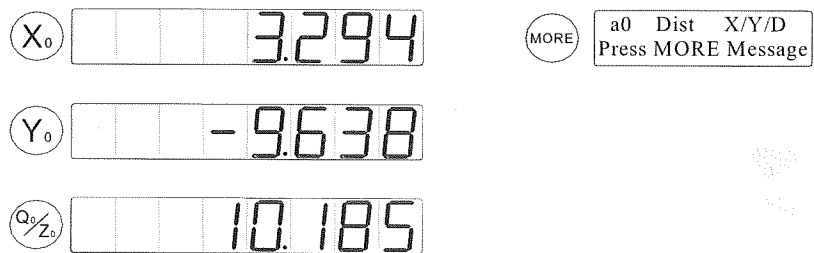




Figure 2-85

- c. Repeat step b to select another circle. After finishing the selection, press the  key. The new feature distance has been added to feature list. Its data is displayed as in figure 2-85.

2.13 PRESET FEATURES




Geometric features can be preset by entering data from the keypad into data fields, and these data fields are provided by the DC-3000 for the creation of each of the feature types. Features can be preset for points, lines, circles, distances, angles, datum point and part skew. Features that are preset from keyboard data are the same as features preset from probed data except that, since they are preset from ideal values, the features are geometrically perfect and do not include +T and -T values.

The process of creating a feature includes:

- Press the  key.
- Press the desired Feature selection key.
- Enter feature data into data fields provided.

The following example demonstrates the creation of a point feature.

1. Presetting a Point (1.864,-6.930) feature:




- Press the  key. The LCD displays the message as in figure 2-86.
- Press the  key to preset a point. The message is displayed as in figure 2-87, which shows that the DC-3000 is waiting for you to enter feature data. Data fields are provided for specifying the position of the new point feature. Data can be entered in Cartesian or Polar coordinates.
- Enter the point feature position data, such as entering 1.864 that is position of X axis. (Figure 2-88).
- Press the  key to accept the input data, and the LCD displays the message as in figure 2-89.

Axis to Preset?
Push Up/Dn Select
Figure 2-86

X : 0.000000
Figure 2-87

X : 1.864
Figure 2-88

Y : 0.000000
Figure 2-89

   a0 Point X/Y
Press MORE Message





 

Figure 2-90

- Press the  key after inputting the position of Y axis (i.e. -6.93). The new point feature is added to the feature list and its data is displayed as in figure 2-90.

NOTE  **Note:**



When you discovered error data without pressing the  key, you can press the



key to cancel the digit that was last entered until the DRO returns to the normal status.

The feature of the DC-3000 can be preset with the methods, such as line, circle, distance and angle and part skew. But only the data item is different, so the displayed message is different.

2. Presetting a line feature.

- Press the  key, the LCD displays the message as in figure 2-91.
- Press the  key to preset a line. The message is displayed in figure 2-92, which shows that the DC-3000 is waiting for you to enter feature data.
- The process is as same as presetting a point, you enter the point position on the line and an included angle that the line makes with the positive X axis.

Axis to Preset?
Push Up/Dn Select
Figure 2-91

X : 0.000000

Figure 2-92

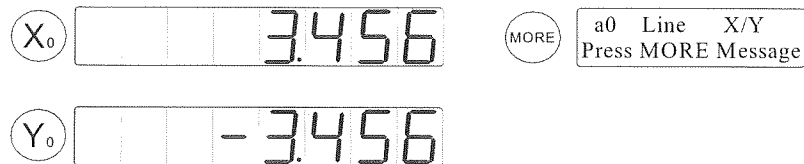


Figure 2-93

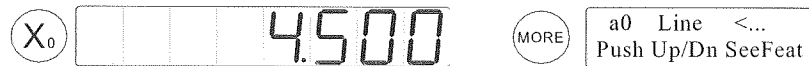


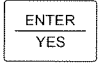


Figure 2-94

- The last result is displayed as in figure 2-93 and 2-94.

3. Presetting the coordinate skew angle's value.

- Press the  key. The LCD displays the message as in figure 2-95.
- Press the  key to preset a skew line. The message is displayed as in figure 2-96, which shows that the DC-3000 is waiting for you to enter feature data.
- Enter 15 and press the  key, the DRO is back to the normal status. The light above the key is ON, which indicates the operation is successful.

Axis to Preset?
Push Up/Dn Select
Figure 2-95

Skew : 0.000000





Figure 2-96

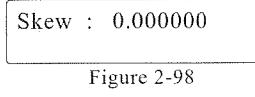
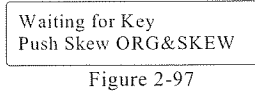


Note:

- If $45^\circ < \alpha < 90^\circ$, skew the Y-axis by $(90^\circ - \alpha)$ in clockwise;
 - If $135^\circ > \alpha > 90^\circ$, skew the Y-axis by $(\alpha - 90^\circ)$ in anti-clockwise;
 - If $45^\circ > \alpha > 0^\circ$, skew the X-axis by (α) in anti-clockwise;
 - If $135^\circ < \alpha < 180^\circ$, skew the X-axis by $(180^\circ - \alpha)$ in clockwise;
 - The range of α is $0^\circ \sim 180^\circ$.
- (Note : the α is the inputted value of the angle)

4. Presetting datum point.

- a. Press the  key, and the LCD displays the message as in figure 2-97.
- b. Press the  or  key to select a feature that can be a point, or a circle, or an angle. The feature will be the datum point as in figure 2-98.
- c. Press the  key to end the operation after finishing selecting the feature. The datum point is set at the new position.



NOTE 




Note:

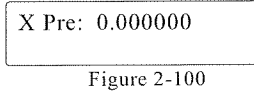
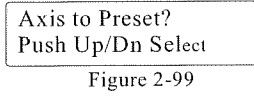
- 1. presetting a new datum point will cause the coordinate to move, which will change all the feature's values that are relative to point value, such as the point, the circle center and the vertex of an angle.
- 2. The selected feature must include the point feature, such as the point, the circle and the angle.
- 3. The line feature also includes the point feature, however, you can't use a line to preset a new datum point in this case.
- 4. If there is no feature to select, the LCD window will show you "No feature". And you can't select a feature to preset a new datum point.



2.14 RESET DISPLAY VALUE

You may want to establish an incremental or absolute datum offset from some datum without actually targeting the datum point. If so, follow these steps:

To preset the X axis display:

- a. Press the  key, and the message is displayed as in figure 2-99.
- b. Press the  key, and the message is displayed as in figure 2-100.
- c. Enter the number that you wish to preset (84.582 from the example), and press the  key. The X axis display reads **84.582**. The DC-3000 will start to measure from this new number.



To preset the Y axis display, follow steps a ~ c and press the  key instead of the  key in step b. The Y window displays 92.965. The DC-3000 will now start to measure from this new datum.

When you establish a new incremental or absolute origin point in either INC or ABS, you are in fact telling the DC-3000 that the new origin is the preset distance from the location position when you press the

 key.

3. USER PROGRAM

3.1 PREVIOUS READING

Before reading this section you should read The DC-3000 Demonstration, for that section provides the important information to help you understand the User Program.

ABOUT THIS SECTION

Sequences of front panel key-presses can be stored as programs and replayed at a later date. This capability is especially useful when a series of identical parts must be measured.

Once it has been verified that a series of measurements satisfy the requirements for a part, it is very simple to record the key-presses as a program that can be recalled and used any number of times by any operator to direct the measurement process.

All the measurements and the displayed functions of the DC-3000 that can be controlled from the front panel can be included in a program also.

Programs can be easily edited to insert or delete steps. A discussion of program editing will be included after the following demonstration of creating and running a program.

ABOUT USER PROGRAMS

The DC-3000 can totally store 10 user programs, and each program can store up to a maximum of 100 program steps, so the steps beyond 100 will be useless and not be stored. By using this programming capability, you may preset “electronic instructions” to automatically measure the features of the parts you commonly deal with. These instructions, called “User Programs” or just “Programs”, automate the sequence of key presses needed to examine a part, leaving you free to concentrate on targeting points and interpreting the results.

To help you learn to use the programming function, we’ll walk through the creation, modification, and run of a User Program designed to find the distance between two circles located on the DC-3000 Slide. The user programs are labeled using a 3 digits identifier, i.e., 000,001,002 up to 099 for a total 100 programs.

The concepts and exercises covered here will help you create programs to perform most any repetitive task. As would be expected for any powerful system, the more time you spend learning it now, the greater your rewards will be in the future.

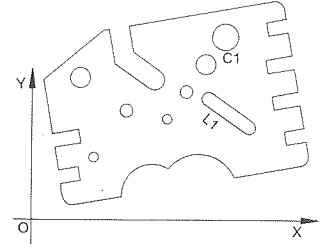


Note:


Before creating a user program, we assume the current status is in skew, and we adopt Forward Annotation, to the other status, we admit default value.

The following demonstration of the program will record the steps of the needed key-presses:

- ✓ Clear the skew settings and all the features from the feature list.
- ✓ Skew a new part.
- ✓ Zero the X and Y axes.
- ✓ Measure a circle.
- ✓ Measure a line.
- ✓ Obtain a distance between the line and the circle.



CAUTION

It is important to clear the old skew settings as a first step in the user program. The skew settings can be cleared by pressing the  key for about 3 seconds. It is not an essential step to clear the features from the feature list because new features generated by the program will replace the previously existing features, and in fact, that's to say, clearing the skew settings as the first step has made the previously existing features meaningless.

3.2 RECORD USER PROGRAMS

Basically, record a program includes the following activities:




and mark the figure that will be measured on the part, and make up the most effective order measurement.

Note:

Obtain the requirements of your measurement throughout deliberately evaluating after you record and edit the user program. Then list the features to be measured as well the orders of measurement. Therefore, it can save you too much time and the whole process seems to be quite systematical.

- ✓ Mount the part on the stage.
- ✓ Take the procedure of part skew, datum definition, and feature measurement as the user program.
- ✓ Run the program to verify the results.
- ✓ Edit the program if necessary to make the final adjustments.

Initiate the programming process:

1. Press the  key to record a program. The LCD screen displays the message as in figure 3-1.

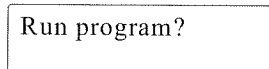




Figure 3-1

2. Press the  or  key until the LCD screen displays the message as in figure 3-2.

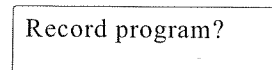



Figure 3-2

3. Press the  key to create a program. (Figure 3-3), first you must input a program ID number with its range from 0 ~ 9.

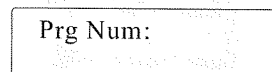




Figure 3-3

4. Input the ID number 0, and then press the  key. At this time the DRO is back to the normal status, the light above the  key will blink, which indicates that the DC-3000 is in the record



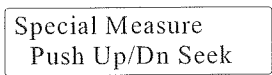


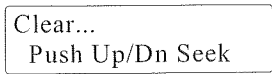

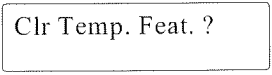



mode.




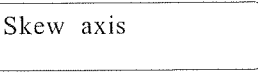
Note:

You are now ready to record the steps associated with this program. The light will be off all the time until you end the record. All you do is to perform the steps you wish, and which will be entered into the program. You may use any of the sample programs or one that you developed.

Clear skew settings and features:

5. Press the  key for about 3 seconds to exit the skew status. Meanwhile you will hear 2 beeps as the system exits the previous skew status.
6. Press the  key to enter setup mode. The LCD will display the message as in figure 3-4. 
7. Press the  or  key until the LCD displays the message as in figure 3-5. 
8. Press the  key and come to the submenu to clear the features and the program. The LCD displays the message as in figure 3-6. 
9. Press the  key to clear all temporary features. You will be asked to confirm your intention. Press the  key to clear all temporary features.
10. Then clear all the permanent features. The operation is as identical as step8 and step9.
11. Press the  key twice to exit the setup.

Skew the new part:

12. Mount the new part on the stage, and then move the stage to a position for convenient part targeting, and press  key to skew the part. The light above the key is blinking continuously, and the message is displayed as in figure 3-7 and 3-8. 

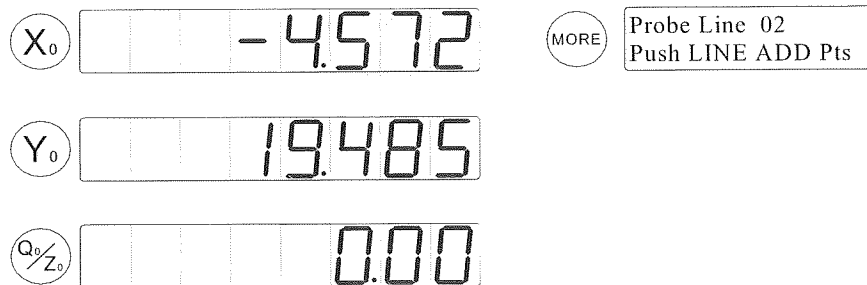





Figure 3-8


13. Probe and enter a minimum of 2 points to skew the part. The part skew settings will be displayed

in the LCD window. The light above the  key is ON and not blinking. And the DRO will return to the normal status after the part was skewed.

Set datum point:

14. Move the stage to place the crosshairs to a fit position. Then press the  and  keys to zero the axes and set new datum point.

Measure a circle:

15. Press the  key. The messages the and current location are displayed as in figure 3-9.

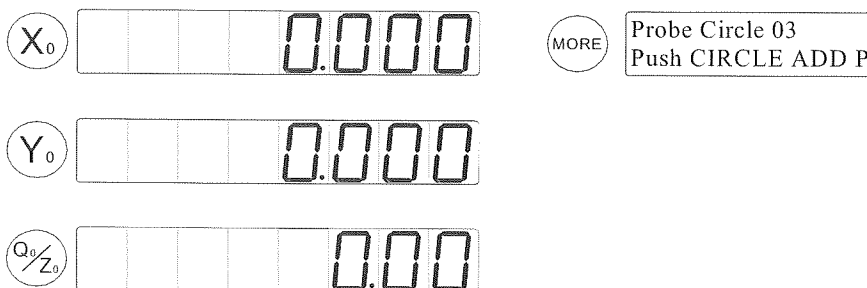


Figure 3-9

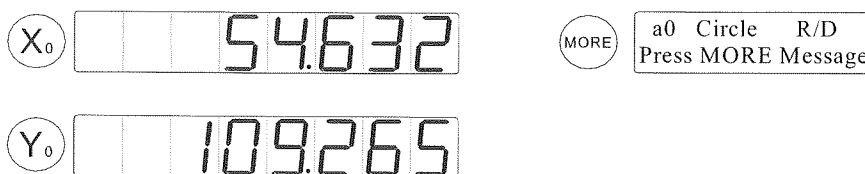



Figure 3-10

16. Probe and enter a minimum of 3 points to measure the circle feature, and the messages are displayed as in figure 3-10

Measure a line:

17. Press the  key. The messages and the current location of the measuring line are displayed as in figure 3-11.

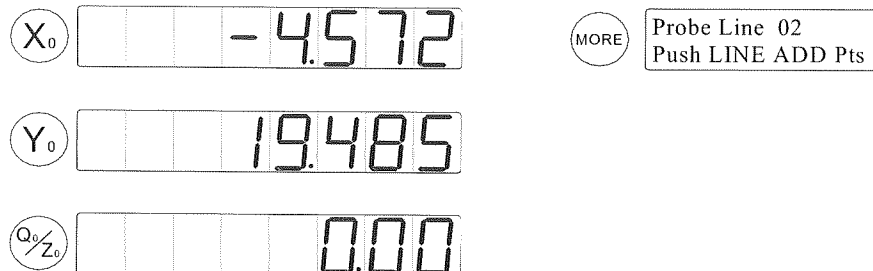






Figure 3-11



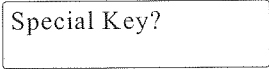


18. Probe and enter at least 2 points to measure the line feature. And the feature's data is displayed in the message window.

Construct a distance with a line and a circle:

19. Press the  key to measure a distance. And 2 points are needed to enter.

20. Press the  or  key to select the circle and the line measured. Then press the  key.










End the programming process:

21. Press the  key. And the message is displayed as in figure 3-12, and then you are required to record a special key, press the  key to answer YES. Then the LCD displays a message as in figure 3-13.
- 
Figure 3-12
22. Press the  key to end the created program. The light above the key is OFF and it shows that the DRO has returned to the normal status.
- 
Figure 3-13



Note:

The special keys in user program are listed as follows:

- (1). Finish Record? Quit the creation with saving the program.
- (2). Quit Record? Quit from creation without saving the program.
- (3). Run Prog? Running another program in the current program created
- (4). Finish? Insert a  key to the current position of the program
- (5). Quit? Insert a  key to the current position of the program
- (6). Cancel? Insert a  key to the current position of the program
- (7). Up? Insert a  key to the current position of the program
- (8). Down? Insert a  key to the current position of the program
- (9). Wait Enter? Insert a  key to the current position of the program, when the program comes to this step, the DRO will wait for the operator to press the  key.
- (10). Wait Finish? Insert a  key to the current position of the program, when the program comes to this step, the DRO will wait for the operator to press the  key.




3.3 RUNNING A PROGRAM

In the user program, the sequences of the key-presses include all the steps that are essential to complete a part measurement, and they are listed as follows:

- ✓ Make a mark near the reference point on the part.

- ✓ Mount the part on the stage.
- ✓ Run the program

Run the program:

1. Press the  key to run a program. The LCD screen displays the message as in figure 3-14.
2. Press the  key to run the program. (Figure 3-15), first you must input a program ID number with its range from 0 to 9.
3. Input the ID number 0, and then press the  key. The DRO starts to run the program0; it will quit the skew settings and clear all the features at first, and then skew a new part. The user program will stop when the new part was skewed, and it waits for the user to target points. The message is displayed as in figure 3-16.
4. Program runs to skew the part
5. The displayed value of X and Y axes are automatically zeroed.
6. Measure a line on the part.
7. Measure a circle on the part.
8. Get the distance between the line and the circle.

Run program?

Figure 3-14

Prg Num:



Figure 3-15



Probe Line 02
Push LINE ADD Pts

Figure 3-16



Note:

When the program is running, the different indications will appear at the different steps. For instance, when it steps to skew a part, the light above the  key is blinking, and the LCD displays the message which shows that skewing the part is being processed. When it steps to measure a circle, the light above the  key turns ON and the LCD displays “Probe Circle 03”, what the LCD displays indicates what the program deals with then.

When the DRO requires you to press the  key or the  key to enter a data point or to end the probed point, but you pressed other keys, the DRO will give an error message in the LCD window.


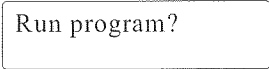


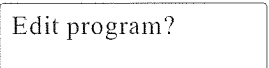

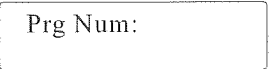

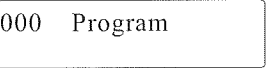


3.4 EDITING PROGRAMS


When a new program is tested, some adjustments might be added to increase measurement accuracy or efficiency. Also, existing programs can be edited to accommodate new (similar) parts. Programs can be easily edited to insert or delete program steps. Editing a program may involve some or all of the following procedures:



- ✓ Display the program steps.
- ✓ Expand a program to show details and change program steps
- ✓ Insert new program steps

- ✓ Delete program steps
- ✓ Delete programs.


Display program steps:



1. Press the  key to run a program. The LCD screen displays the message as in figure 3-17. 
Figure 3-17
2. Press the  or  key until the LCD screen displays the message as in figure 3-18. 
Figure 3-18
3. Press the  key to edit the program. (Figure 3-19), now you must input a program ID number with its range from 0 to 9. 
Figure 3-19
4. Input the ID number 0, and then press the  key. The message is displayed as in figure 3-20. The number “000” indicates the step of the program and next to the number is the action the program will run. 
Figure 3-20
5. Press the  or  key to show another program steps. A list of the program 0 is as follows.

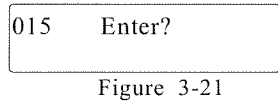
Step number	Program action	Explanation
000	Program	Indicate it is the user program
001	0	Indicate the user program number
002	Skew	Cancel previous skew settings
003	Skew	Skew a new part
004	Enter?	Probe a data point, and wait for the operator to press the  key
005	Enter?	Probe another point
006	Setup	Enter the Setup menu
007	Down	Step into the next menu
008	Enter	Enter the Clear features and program routine
009	Enter	Clear all temporary features
010	Enter	Confirm whether they are cleared.
011	Finish	Quit submenu
012	Finish	Quit main menu
013	X0	Zero X axis
014	Y0	Zero Y axis
015	Circle	Measure a circle
016	Enter?	Probe a data point
017	Enter?	
018	Enter	
019	Line	Measure a line
020	Enter?	Probe a data point, and wait for the operator to


		press the  key
021	Enter?	
022	Offset	Measure a distance
023	Down	Press the  key to display current feature's message.
024	Enter	Select current feature displayed
025	Down	Find the next feature
026	Enter	Select the feature found
027	Finish	End the selected features
028	End Program	End the user program

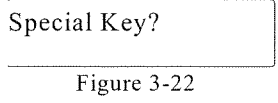
Insert new program steps:



New program steps can be inserted in front of any program step. The process of inserting a new step consists of selecting the insertion point, recording the new steps and pressing the  key. In the example below a line measurement is added to the end of the program created earlier.

6. Press the  or  key to move to the fifteenth step, the LCD displays the message as in figure 3-21.



7. Press the  key to insert a special key. The message is displayed as in figure 3-22 and 3-23.



8. Press the  or  key until the LCD displays the message as in

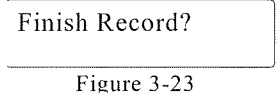

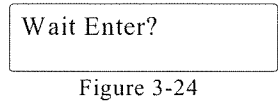

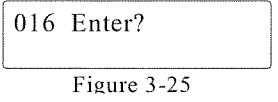


figure 3-24, then press the  key to insert the special action in the step. So when the program runs to this step, it will await the operator to press




the  key. At this time the LCD displays the message in figure 3-25, that's to say, the new step has been inserted between step015 and step016 with its present No.016, naturally, the original step 016 moves backward to 017, and 017 to 018 until the movement of 028 to 029.



9. Press the  key to save the newly added step and quit editing the program.

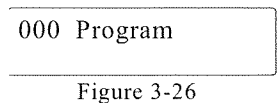


Note:

At the step 9, if you press the  key, the DRO will quit editing program without saving the modification.

Delete program step:

10. Edit the user program 0 and the LCD displays the message as in figure3-26.





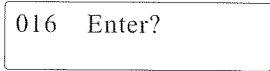



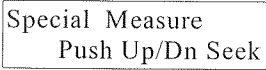

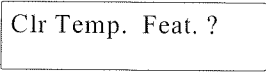

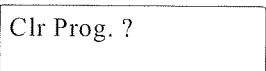


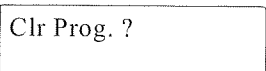





11. Press the  or  key to find the step 16, the LCD displays the message as in figure 3-27. 
12. Press the  key to delete this program step, and each of the back steps moves one step forward orderly, and one is decreased from the total number of the steps.
13. Press the  key to quit editing program with saving the program.

Figure 3-27

3.5 DELETING A USER PROGRAM

Programs can be deleted when they are no longer used, for the available room can be spared for the new programs.


Steps to delete a program:

- a. Press the  key to setup a menu. (Figure 3-28) 
- b. Press the  key and come to the next menu. 
- c. Press the  key to clear the feature or the submenu of the program.(Figure 3-29) 
- d. Press the  or  key until the LCD displays the message as in figure 3-30. It tells you that the program will be deleted. 
- e. Press the  key to delete a program. You must input a program number with which you can delete the program.
- f. Press the  key and you will be asked to confirm your intention. Press the  key to delete the program or the  key to abort the process.
- g. Press the  key twice to quit setup menu and return to the normal status.



Note:

Deleted programs cannot be restored. Deleting programs should be based on the deliberate consideration.

If you press the  key at step f. the program will be deleted from the list.

4. COMMUNICATION

4.1 PREVIOUS READING

Before reading this section, the most important information you should know when purchasing a printer for use with a DC-3000, is that it must be a serial printer.

ABOUT THIS SECTION

This section explains how to establish the interface between a printer or a computer and a DC-3000. There are many manufacturers of printers, and unfortunately not all printers are compatible. It would be impossible to support every one of them. The DC-3000 transmits the features or the value of the current position on the axes to the printer or computer.

The RS232 default settings are listed as follows:

- ✓ Baud Rate: 9600
- ✓ Parity: No Parity
- ✓ Stop Bits: 1
- ✓ Data Bits: 8
- ✓ Start Bits: 1

4.2 PACKED BCD FORMAT

A decimal number can be transformed into a binary number, for instance, a decimal number 3 can be transformed into a binary number 0011. A decimal digit can be expressed by 4 bit binary digits, so a byte stores 2 decimal digits, for instance, the decimal number 34 can be expressed as 0011, 0100 when the Packed BCD Format functions.

4.3 ASCII FORMAT

This format is a commonly used format, and it is quite easy to use, too. When the DC-3000 communicates with a computer, all the numbers are transferred into ASCII characters.

4.4 PRINT FORMAT

In the following, the “v” means to ignore the character it is substituted for i.e., X, Y, Z, r, d, /, T, R, A, etc

- “d” means digit
- “-” is the negative sign
- “s” means space
- “c” means carriage return

For positive outputs, the space character will be substituted for the negative sign “-“. The leading digits may be spaces.

When a DC-3000 is shipped from the factory, each output line is terminated by a carriage return (ASCII 13).

4.4.1 FEATURE PRINT FORMATS

Linear formats

Units (inch or mm) are always at position 15 and 16. The factory default Metric resolution is 1 micron. The factory default English resolution is 0.00001 inch. Default format is Metric.

Linear format (Metric)

For Metric values with a display resolution of 1 micron, the format is:

Character																			
Position	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Content	v	s	s	-	d	d	d	d	.	d	d	d	s	s	m	m	s	s	c
Example 1	r					3	2	4	.	0	5	1			m	m			
Example 2	x						-	5	.	3	0	3			m	m			

Linear format (English)

For English values with a display resolution of 0.00001 inch, the format is:

Character																			
Position	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Content	v	s	s	-	d	d	d	.	d	d	d	d	s	s	i	n	s	s	c
Example 1	r					2	.	0	2	1	3	0			i	n			
Example 2	x			-	1	5	.	1	4	4	2	0			i	n			

Angular formats The default format is DMS format.

Angle format (DMS)

In DMS (degrees, minutes, seconds) notation, the printout is as follows:

Character																			
Position	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Content	v	v	s	-	d	d	d	.	d	d	.	d	.	s	s	s	s	s	c
Example 1	∠	1				4	5	.	0	0	.	0	1						
Example 2	A					-	5	.	2	3	.	0	0						

Angle format (DD)







In DD (decimal degrees) notation, the printout is as follows:

Character																			
Position	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Content	v	v	s	s	-	d	d	d	.	d	d	d	s	s	s	s	s	s	c
Example 1	∠	1					4	5	.	0	0	1							
Example 2	A						-	5	.	3	0	3							

4.4.2 PRINT OPERATION

1) Print feature

The DC-3000 provides the function of printing a single feature or all features. Their operations are similar. And the following goes the steps.

- a. Press the  key; the message is displayed as in figure 4-1.
- b. Press the  or  key to browse the DRO menu until the message is displayed as in figure 4-2
- c. Press the  key and come to the submenu, and “Print Single...” is displayed in the message window, it means to print a single feature.
- d. Press the  key, then the messages are displayed as in figure 4-3 and 4-4 one after another. Input a number ranging from 0 to 109, (e.g. input number 0). Number 0 ~ 9 indicates this feature is a temporary feature, and number 10 ~ 109 indicates the feature is a permanent feature.
- e. Press the  key to print the first temporary feature (i.e. feature a0).
- f. After finishing printing the feature, the DRO will return to the normal status.

Print Prog?

Figure 4-1

Print Feats?

Figure 4-2




Input Feat Num:
(0 - 109)

Figure 4-3

FeatNum:
Feats Number 0 - 109

Figure 4-4

2) Print user program

- a. Press the  key and the message is displayed as in figure 4-5.
- b. Press the  key, then the message is displayed in figure 4-6. The DC-3000 asks you to input a program number. And you can input a number that is from 0 to 9.
- c. Press the  key, the DC-3000 begins to print the program. After finishing printing the program, the DC-3000 will return to the normal status.

Print Prog?






Figure 4-5

Prog Num:
Program Num (0 - 9)

Figure 4-6

3) Print axis display value

The DC-3000 allows you to print all the current display values on an axis or the axes. The following are the steps to go:

- a. Press  to print X-axis displayed value.
- b. Press  to print Y-axis displayed value.
- c. Press  to print Z/Q-axis displayed value.
- d. Press  to print X and Y-axis displayed values.
- e. Press  to print all axes displayed values.

5. SYSTEM PARAMETER SETUP

5.1 PREVIOUS READING

Before reading this section, you should have read the Essential Information. It gives you good background information for the material covered in this section.

ABOUT THIS SECTION

Before you operate the DC-3000, you should setup the various parameters according to the conditions of DRO and Linear Scale, which can ensure you regular operation. The well setup parameters can be kept unless you should make some changes in a new session.


The operating parameters of the DC-3000 must be configured prior to using DRO for the first time, or be configured in case of part measurement, reporting, or the changes of the requirements of the data communication.

All the operating parameters of the DC-3000 can be configured by using the functions in the Setup menu. These parameters include:


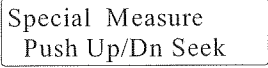



1. Special Measure
2. Clear
3. Measure Easy
4. Angle Type
5. Annotation
6. Axis Direction
7. Inverse Print
8. Macro Printer
9. Language
10. Super
11. Auto Setup? – Default setup parameters.
12. Encoder Resolution – Encoder resolution and type.
13. Set RI Mode
14. Compensation – Linear or Segment Linear error correction.
15. Program. Lock: No – Locking/Unlocking User Programs.
16. Prescale? – Axis prescale factor.
17. Print Interface.
18. RS232 Baud Rate...
19. Page feed...
20. Z Axis Type... - Angular / linear axis.

Parameter configurations will be retained by the DRO until they are changed again in the Setup menu in a new session.





ENTERING SETUP MENU


You can press the  key to set up parameters when the DRO is in the normal status.

The following steps can bring you into Setup menu and set the system parameters:

- a. Press the  key and come to the setup menu. The LCD displays the message as in figure 5-1. 
Figure 5-1
- b. Press the  or  key to browse the setup menu.
- c. Press the  key and come to the submenu or selected current item that is displayed in the LCD screen. If the symbol “*” is displayed ahead of a menu item, it shows this item is selected, if not, not selected. For instance, the message displayed as in Figure 5-2 shows that the available printer is Micro printer.


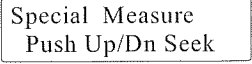


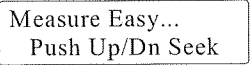

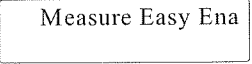

The following steps can save these setup parameters and exit setup.



Press the  key or the  key once to exit main setup menu and return to the normal status. If you are in submenu then you must exit submenu first and then exit main setup menu, so you must press the  key or the  key more times to exit setup menu and return to the normal status. And all the parameters are automatically saved.




If an ellipsis is attached to a submenu item, it indicates that the very item still includes some submenus; you can press the  key and enter the submenu. When the submenu includes several items, and “*” is attached to a certain item, that’s to say, the parameter of this item is selected and fixed, for instance, “* DMS Angle ” indicates the current angle unit is DMS. As to those without “*”, it means that the DRO doesn’t adopt them.

5.2 Set Measure Easy

In section II, we’ve mentioned Measure Easy and introduced how to apply it. In the following we’ll give a further instruction about how to setup it.

- 1) Enter Setup Menu by pressing the  key, the LCD displays the message as in figure 5-2. 
Figure 5-2
- 2) Press the  or  key until the LCD displays the message as in figure 5-3. 
Figure 5-3
- 3) Press the  key and come to the submenu. The message is displayed as in figure 5-4. 
Figure 5-4
- 4) Press the  key to allow the operator to use Measure Easy to measure.






- 5) Press the  key or the  key twice to exit the setup and return to the normal status.

If you want to forbid Measure Easy, you should only press the  or  key at step4 until the LCD displays “MeasureEasy Disable”, then press the  key.

5.3 Set angular unit

The angle unit has been mentioned before, and we know there are two kinds of units DMS (degree, minute, second) and DD (decimal, degree)

Here the Manual just introduces how to set the angular unit to DMS (degree, minute, second):

- 1) Enter Setup Menu.
- 2) Press the  or  key to browse the setup menu as in figure 5-5.
- 3) Press the  key and come to the submenu as in figure 5-6.
- 4) Press the  key to select the angle type as in figure 5-7.
- 5) Press the  key twice to return to the normal status.

Angle Type...
Push Up/Dn Seek

Figure 5-5

DMS Angle

Figure 5-6


* DMS Angle








Figure 5-7

5.4 Set Annotation

Annotation falls into the category of Forward Annotation and Backward Annotation.

Forward Annotation allows the user to set the number of point required for each feature before the measurement, when the number of the measured point reaches that of the preset points, the DRO will automatically end the measurement and reveal the outcome. Backward annotation allows the user to determine the maximum number of point to be measured for each feature up to 50 points, if he thinks that

the number of targeted point is sufficient, he will press the  key to end the measurement and the outcome will simultaneously be displayed in the message window. The following steps lead the user to set the DC-3000 in forward annotation:

- 1) Enter Setup Menu.
- 2) Press  or  key to browse the setup menu as in figure 5-8.
- 3) Press the  key and come to the submenu as in figure 5-9.
- 4) Press  or  key to move the menu item to “Forw. Annotation”.
- 5) Then press the  key to select the item; the message is displayed as in figure 5-10.
- 6) Press the  key twice to exit the Setup Menu.

Annotation...
Push Up/Dn Seek

Figure 5-8

Back Annotation
Push Up/Dn See



Figure 5-9

* Forw. Annotation
Push Up/Dn See


Figure 5-10

5.5 Set the number of data point needed for measuring a circle



1) Enter Setup Menu.

2) Press  or  key to browse the setup menu as in figure 5-11.


Annotation...
Push Up/Dn Seek
Figure 5-11

3) Press the  key and come to the submenu as in figure 5-12.


Back Annotation
Push Up/Dn See
Figure 5-12


4) Press  or  key to move the menu item, the message is displayed as in figure 5-13

Circle Points 03
More than 50 Pts
Figure 5-13

5) Press the  key to enter a number of points. (Figure 5-14)

Value : 03
Figure 5-14



6) Input the number 4, and press the  key, which means that the number of data points you set for measuring the circle is 4.

7) Press the  key twice to exit setup.


To improve the precision of the measurement, the user is advocated to take multi-point measurement, but as such has a limitation of entering a maximum up to 50 points, so the entered number should be beneath 50 (in Forward Annotation Mode). As to the measurement of point and line, the way of setting the number of targeting point is more or less as same as that of circle, and it won't be repeated here.

5.6 Set Axis direction



1) Enter Setup Menu.

2) Press the  or  key to browse the setup menu as in figure 5-15.



Axis Direction...
Push Up/Dn Seek
Figure 5-15

3) Press the  key and come to the submenu as in figure 5-16 (Notice: maybe the real displayed message is "Reverse X: YES", it is depended on the default setup).

Reverse X: NO
Figure 5-16

4) Press the  or  key until the message is displayed as in figure5-17.

Reverse Q: NO
Figure5-17






5) Press the  key and the message is displayed as in figure5-18, and the direction Q axis is opposite to the original direction (from NO to YES). But if you press the  key, what the LCD displays is as same as in figure5-17, and the direction also changes.

Reverse Q: YES
Figure5-18

The same way is also available to the X axis and Y axis.

5.7 Inverse Print

1) Enter Setup Menu.

- 2) Press the  or  key to browse the setup menu. (Figure 5-19)
- 3) Press the  key and come to the submenu as in figure 5-20.
- 4) Press the  key to select the function. The message is displayed as in figure 5-21.
- 5) Press the  key twice to return to the normal status.

Inverse Print...
Push Up/Dn Seek

Figure 5-19

Inverse Print
Push Up/Dn Select

Figure 5-20

* Inverse Print
Push Up/Dn Select






Figure 5-21



Note:

The parameters relevant to print include the printer type, page feed and inverse print associated with a micro printer. These parameters will directly bring impact to the effect of print, so we must pay great attention. Generally speaking, following the default setup is ok.

5.8 Printer type selection

- 1) Enter Setup Menu.
- 2) Press the  or  key to browse the setup menu. (Figure 5-22).
- 3) Press the  key and come to the submenu as in figure 5-23.
- 4) Press the  key to select this printer. The message is displayed as in figure 5-24 indicates that you've selected micro printer.
- 5) Press the  key to return to the normal status.

Micro Printer . . .
Push Up/Dn Seek

Figure 5-22

Micro Printer








Figure 5-23

* Micro Printer

Figure 5-24

The setup of Non Micro Pnt is more or less similar to the setup of Micro Printer. It won't be repeated here.

5.9 Language selection

- 1) Enter Setup Menu.
- 2) Press the  or  key to browse the setup menu. (Figure 5-25).
- 3) Press the  key and come to the submenu as in figure 5-26.
- 4) Press the  or  key to enter the submenu.
- 5) Press the  key when the message is displayed as in figure 5-27, and English is selected. If you press the  key as the

語言/Language...
Push Up/Dn Seek

Figure 5-25

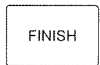
中文 / Chinese
Push Up/Dn Select

Figure 5-26

* 英文 / English
Push Up/Dn Select

Figure 5-27

message is displayed as in figure5-26, Chinese is selected.

- 6) Press the  key to return to the normal status.




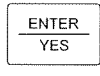



Note:

The version 3.07 of DC-3000 adds a Portugal language.

Next we'll introduce some setup parameters that are used by the supervisor. Every user who wants to setup super parameters must be careful.

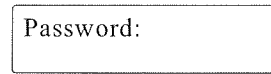
Entering supervisor setup

- a. Enter Setup Menu.
- b. Press the  or  key until the message is displayed as in figure 5-28.
- c. Press  key then "Password:" appears in the message window. (Figure 5-29)
- d. Input "332", then press the  key and come to the supervisor setup submenu. The message is displayed as in figure 5-30.



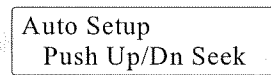
Super...
Push Up/Dn Seek

Figure 5-28



Password:


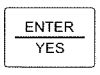
Figure 5-29



Auto Setup
Push Up/Dn Seek

Figure 5-30

5.10 Auto setup

- 1) Enter supervisor setup.
- 2) The first submenu item is "Auto Setup". Press the  key.
- 3) Input the password correctly.
- 4) Press the  key, then "Initial Starting" and "Please Waiting" are displayed in the message window orderly, and now the DC-3000 begins to reset all parameters, the program will return to the "Auto Setup" menu item after the resetting is over.



Note:

The operation of resetting DC-3000's parameters includes:



- 1) ABS zeroed.
- 2) INC zeroed.
- 3) The Resolution of X-axis and Y-axis is 1 micron, the Resolution of Q-axis is 0.01°, and the prescale coefficient is 1.0.
- 4) The printer port is Centronic, the Baud Rate of RS232 is 9600 bps, the angle display format is DD angle, and the measurement mode is Forward Annotation.
- 5) The X and Y-axis are of linear compensation mode.
- 6) All features and user programs are cleared.

5.11 Encoder Resolution

The unit of the entered resolution is millimeter (mm).


Example: Set the resolution of Y-axis to 5 μ m.

1) Enter supervisor setup.

2) Press the  or  key until the message is displayed as in figure 5-31.



Encoder Reso . . .
Push Up/Dn Seek


Figure 5-31

3) Press the  key. The message is displayed as in figure 5-32.

X Resolution?
Push Up/Dn Seek

Figure 5-32


4) Press the  or  key to browse the submenu until “X Resolution?” is displayed in the message window.

5) Press the  key, the message is displayed as in figure 5-33, and you should input a value.

Value: 0.000000



Figure 5-33

6) Input new resolution for Y-axis (e.g. 0.005).

7) Press the  key to confirm new resolution for Y-axis, and the DRO will return to the submenu item.

NOTE

Note:

- I. If the user wants to set the Encoder Resolution of Y-axis and Q-axis, please repeat the steps above until it comes to step3 then press the  or  key until “Y Resolution?” or “Q Resolution?” is displayed in the message window.
- II. The range of Encoder Resolution of X and Y-axis is from 0.1 micron to 10 micron, and the Q-axis is from 0.0001° to 0.1° or from 0.1 micron to 100 micron.

5.12 Setup Q axis resolution

Z/Q-axis can be configured for linear scale or rotation encoder display. If you want to configure rotation encoder for the Z/Q-axis, you must set the resolution of the Q-axis correctly.



The resolution of the Q-axis setup is not identical to the X and Y axes. First, you have to clear the default setup and return to the normal status, and then zero the Q-axis displayed value. Third, rotate the encoder for a circle. Do remember the Q-axis displayed value (e.g. 1228.67), finally, when you come to the resolution setup, you just have to enter the displayed value and you can get the Q-axis resolution.

NOTE

Note:


When you rotate the encoder, the displayed value won't exceed 360.00. If the default resolution is used, the displayed value may surpass 360.00 or more, when it surpasses 360.00, zero will appear but the number 360.00 never. Therefore, every time you make note for the displayed value which is gained by the encoder rotating a circle, you should pay attention to the times (assumed as N) that zero appears, and the final correct value is recorded as **360° N+ displayed value**, and that's what you want.

- 1) Enter Supervisor setup.

- 2) Press the  or  key until the message is displayed as in figure 5-34.



Encoder Reso . . .
Push Up/Dn Seek

Figure 5-34

- 3) Press the  key. The message is displayed as in figure 5-35.


X Resolution ?
Push Up/Dn Seek

Figure 5-35

- 4) Press the  or  key until the message is displayed as in figure 5-36.

Q Resolution ?
Push Up/Dn Seek

Figure 5-36

- 5) Press the  key, and then input the number (e.g. 1228.67) that has been calculated. (Figure 5-37).



Observe : 1228.67

Figure 5-37

5.13 Setup RI Mode


RI Mode directly affects the searching for the RI point. Its function is to avoid the errors that the Linear Scale will move after the system is shut up which cause the displayed value is not accurate after the system is processing. There are 8 kinds of RI modes in total from Mode1 to Mode8, and the default mode is Mode1.

- 1) Enter Supervisor setup.

- 2) Press the  or  key until the message is displayed as in figure 5-38.



Set RI Mode . . .
Push Up/Dn Seek

Figure 5-38

- 3) Press the  key and come to the submenu as in figure 5-39.


Set X RI mode . . .

Figure 5-39

- 4) Press the  or  key to browse the items until the message is displayed as in figure 5-40



Set Y RI mode . . .


Figure 5-40

- 5) Press the  key and come to the submenu until the message is displayed as in figure 5-41.

1 mode


Figure 5-41

- 6) Press the  or  key to browse the submenu and confirm a mode you want.

- 7) Then press the  key to select this mode. The message is displayed as in figure 5-42. In this example we select 8 mode.

* 8 mode

Figure 5-42

- 8) Press the  key to return to the normal status.

Error Correction

The DC-3000 DRO provides linear and segment linear error compensation. Each method compensates for encoder and machine travel variations using error correction coefficients developed by comparing actual measurements of a standard to the standard's nominal values.



Linear error correction (LEC) uses one correction coefficient that is for each axis to compensate for variations along the axis. The coefficient = actual value / display value.

Segment linear error correction (SLEC) divides each axis up to 100 segments. Each segment uses one error correction coefficient to compensate for variations within the segment. Each axis also includes a machine zero offset to refer the position of the standard's datum to the machine zero reference. The standard's nominal and measured segment values must be specified during the setup process. The machine zero offset for each axis must also be specified. When SLEC is used, the stage must be moved to cross a reference mark on each axis upon system startup to initialize SLEC.

5.14 Setting up the Linear Compensation


Example: Set the X-axis' Linear compensation's value.

1) Enter Supervisor setup.

2) Press the  or  key until the message is displayed as in figure 5-43.



Compensation . . .
Push Up/Dn Seek


Figure 5-43

3) Press the  key. The message is displayed as in figure 5-44.

*X Linear Comp.
Push Up/Dn Seek

Figure 5-44


4) Press the  or  key to browse the submenu until "X Compensation?" is displayed in the message window.

5) Press the  key, the message is displayed as in figure 5-45, and you are asked to input a value.

Std: 1.000000


Figure 5-45

6) Input a standard value (e.g. 150.000)

7) Press the  key to accept the standard value, and the DRO will ask you to input an observed value. (Figure 5-46)

Obs: 1.000000

Figure 5-46

8) Input an observed value (e.g. 149.99), then press the  key to enter the value into the system.

9) The DC-3000 will return to the submenu, and the message is displayed as in figure 5-47.

X Compensation?
Push Up/Dn Seek

Figure 5-47

NOTE

Note:

This setup can compensate the error between the measuring value and the standard value.



5.15 Setting up the Segment Linear Compensation

Different compensated modes require different ways of setting the compensated values. As to Linear Compensation, you just need to enter the standard value and the observed value and then press the




key. But Segment Linear Compensation is a little more complicated. And now we will elaborately instruct how to set the Y-axis' Segment Linear compensation's value.




To make the Segment Linear Error Correction (SLEC) effective, you must set the compensation mode to SLEC. This task is divided into 3 periods, as follows:

- i. Ready work
- 1) Measure the difference between the standard value and the uncompensated value (at least 3 times, and every time you should make note).
 - 2) Before setting up the SLEC, you must move the stage to the negative direction of linear scale. And when you are compensating the error, you should move the stage to the positive direction of the linear scale.
 - 3) Prepare a reference mode (the action of the standard scale must be as same as that of the axis to be compensated)
- ii. Setting up the SLEC value
- 1) Enter Supervisor setup.
 - 2) Press the  or  key until the message is displayed as in figure 5-48.



Compensation . . .
 Push Up/Dn Seek

Figure 5-48
 - 3) Press the  key. The message is displayed as in figure 5-49.


X Linear Comp.
 Push Up/Dn Seek

Figure 5-49
 - 4) Press the  or  key to browse the submenu until “ X Segment Comp.” is displayed in the message window and then press the  key to select the compensation mode. (Figure 5-50).



*X Segment Comp.
 Push Up/Dn Seek

Figure 5-50
 - 5) Press the  or  key to browse the submenu until the message is displayed as in figure 5-51.


Y Compensation?
 Push Up/Dn Seek

Figure 5-51
 - 6) Press the  key, then the message is displayed as in figure 5-52, and you are asked to move the stage near the RI point (Reference mark).

Move Near RI . . .

Figure 5-52
 - 7) Move the stage to the negative end of Y-axis, and then press the  key. “Search Y RI...” is displayed in the message window.
 - 8) Move the stage slowly and the DRO will make 2 beeps and the LCD displays the message that is “RI Founded”, and in an instantaneous moment, the LCD will display “Move axis to negative ender” and “Press Zero Key to zero axis” in order, press  and the message is displayed as in figure 5-53, you are required to enter the compensation point value.

node 00: 0.000000


Figure 5-53
 - 9) Enter the standard value into the DRO, then press the  key to accept the standard value, and the DRO will ask you to input the second compensation point value. The LCD displays the message as in figure 5-54.

node 01: 0.000000

Figure 5-54
 - 10) Move the stage to a certain position and then input the standard value, then Point 01 is inputted, and the same way is also available for

other points such as 02, 03, 04099. The range of the points is from a minimum 2 to a maximum 100.

- 11) After all compensation point values are entered, then

press the  key to end input, the LCD displays the message in figure 5-55, about three seconds later, the DRO will return to the submenu, and the message is displayed as in figure 5-56. The Y-axis compensation has been finished.


Finished . . .

Figure 5-55

Y Compensation?
Push Up/Dn Seek

Figure 5-56

iii. Additional work

- 1) After finishing setting up the compensation, press  key to exit parameter setup. And zero the displayed value on the axes that have been compensated.
- 2) Although you've selected the SLEC mode and finished the compensation, you will still be asked to search the RI point when you turn the DRO on every time. You needn't search the RI point if you can make sure that the Linear Scale has not been moved, otherwise, you must search it.

NOTE 

Note:

- ◆ The node value is the displayed value of the standard scale and the direction of the standard scale must be the same as the scale to be measured. The compensation point value must be input one-by-one from one end to the other end of the comparator, and the direction is the same as the counter direction of the axes. All the compensated points and their respectively relevant standard and observed values are illustrated as in figure 5-57.

- ◆ As to the uncompensated segment, if is ahead of the first compensated segment, then you can use the compensated value of the first compensated segment to compensate the uncompensated segment. If it is behind the last compensated segment, then you can compensate the uncompensated segment with the compensated value of the last compensated

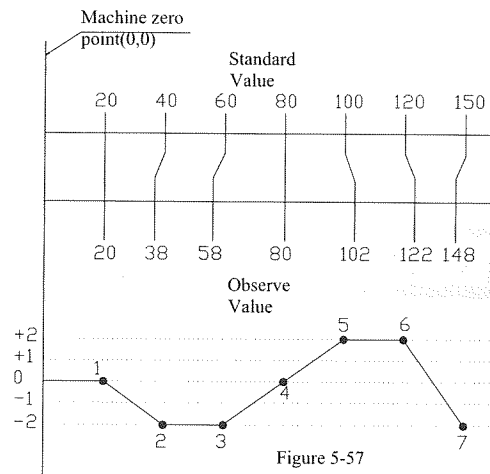


Figure 5-57

segment. As to the segment that is of good linearity and needn't be compensated, you can only enter the standard value, for example, the first segment above deserves no necessity of being compensated. In practical operation, enter compensated value 0.00 at node0 and enter 20 at node1. Do not enter 20 at node0, compensating from the first node will cause mistake, if so, the segment0-1 will be compensated with the value of the segment1-2, then the result you get is an incorrect one.



5.16 Correct and Search the SLEC Value

After finishing SLEC, the user may require or check that:


- Whether the entered standard value is correct.
- Correct the SLEC value of a certain point.
- Add compensated points

The following operation is to fulfill the three requirements above on the X-axis.



- Enter Supervisor setup.

- Press the  or  key until the message is displayed as in figure5-58.


Compensation . . .
Push Up/Dn Seek
Figure5-58

- Press the  key, and the message is displayed as in figure 5-59.



X Linear Comp.
Push Up/Dn Seek
Figure5-59

- Press the  or  key until the message is displayed as in figure5-60


X Compensation?
Push Up/Dn Seek
Figure5-60

- Press the  key, and the message is displayed as in figure 5-61


* ReCompensation?
Correct Compen?
Figure5-61

- Press the  or  key until the message is displayed as in figure5-62.

ReCompensation?
* Correct Compen?
Figure5-62

- Press the  key, and the message is displayed as in figure 5-63.

Move Near RI . . .
Figure5-63

- Move the Linear Scale to the negative direction of X axis, and then press the  key, and the message is displayed as in figure5-64.

Search X RI . . .
Figure5-64

NOTE

Note:

At the very moment, the RI point you are searching must be identical with the point you've searched when processing SLEC.

- Move the Linear Scale to search the RI point, when it is found, the DRO will make two beeps, and the LCD displays "RI Found", after a short time, the message is displayed as in figure5-65.

node 00: 0.000000
Figure5-65

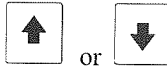
NOTE

Note:


When you are correcting the compensated value, the current value of the compensated axis is displayed in the X-axis window. The observed value of the compensated point is displayed in the Y-axis window. The standard value of the compensated point is displayed in the Z-axis window.

- 10) Move the stage to the position where the displayed value of X-axis is the same as that of Y-axis, and then zero the standard scale, after these operations are achieved, you can correctly correct the compensated value. If you really intend to correct the compensated value, you can carry out the operation of step11; otherwise, overleap step11 to carry out step15.

- 11) If you intend to correct the standard value of the second compensated point. First, press the



key to find the information displayed as in figure5-66, the LCD window displays the standard value of the compensated point, the Y-axis displays the observed value and the Z-axis displays the standard value, the X-axis displays the current position of the Linear Scale. Move the Linear Scale to a proper point, and input the displayed value of the standard

scale to DRO (Figure5-67), then press the  key.

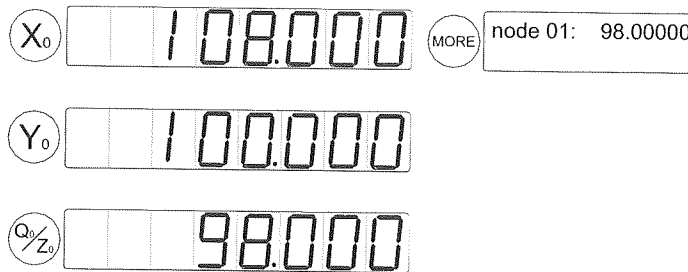


Figure5-66

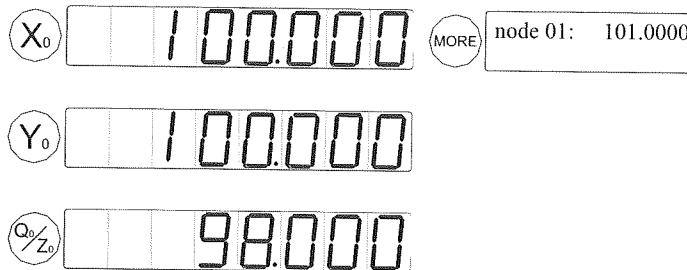




Figure5-67

- 12) At this moment, the message is displayed as in figure5-68. The user is required to select whether to add compensation point or to correct the compensated value.


* Add Compensation
Modified value



Figure5-68

- 13) Press the  or  key and select Modified Value as in figure5-69.

Add Compensation
* Modified value

Figure5-69

- 14) Press the  key, and the LCD displays an observed value and a standard value of a compensated point.

- 15) Press the  or  key to view the standard values and observed values of other compensated points.


- 16) The LCD displays the standard value of the next compensated point. (Figure5-70) if you want to correct the compensated value, you can carry out step11; if not, carry out step15 until the values of all the compensated points are displayed. In the process of the operation, if you press the

node 02 : 201.0000


Figure5-70



key at any time, the DRO will save the corrected value of compensated point and end

the correction of SLEC. If you press the  key, as to the corrected value of the compensated point, the DRO will ask you whether to save it, if not, the DRO will not save it.

NOTE**Note:**

You can add compensated points at step 13, you just need to press the  key.

5.17 Clear Axis SLEC Value

In the following, we just introduce the clearing of Y axis SLEC value, for the same operation is also available to X axis.

- 1) Refer to the process of 5.16 and enter the compensation setup.







- 2) Press the  or  key until the message is displayed as in

figure5-71. Then press the  key, and the message is displayed as in figure5-72.

- 3) Press the  or  key until the message is displayed as in figure5-73.

- 4) Press the  key, and the message is displayed as in figure5-74.

Clear Compensat?
Push Up/Dn Seek

Figure5-71

Clear X axis Seg
Compensation?

Figure5-72

Clear Y axis Seg
Compensation?

Figure5-73



Segment Compensat
been Cleared!


Figure5-74


5.18 Setup print interface

There are two kinds of print interface: Centronic and RS232.

- 1) Enter Supervisor setup.

- 2) Press the  or  key until the message is displayed as in figure 5-75.

- 3) Press the  key. The message is displayed as in figure 5-76.

- 4) Press the  key to select the interface. The message is displayed as in figure 5-77, and the print interface is Centronic.




- 5) Press the  or  key until the message is displayed as in

figure5-78, then press the  key, and the message is displayed as in figure5-79, the print interface is RS232.

Print Interface . . .
Push Up/Dn Seek

Figure5-75

Centronic
Push Up/Dn Seek

Figure5-76

* Centronic
Push Up/Dn Seek

Figure5-77

RS232
Push Up/Dn Seek

Figure5-78







* RS232
Push Up/Dn Seek

Figure5-79

NOTE**Note:**

- a. The default interface of print is Centronic.
- b. The other interface is RS232.

5.19 Setup RS232 Baud Rate

- 1) Enter Supervisor setup.
- 2) Press the  or  key until the message is displayed as in figure 5-80.
- 3) Press the  key. The message is displayed as in figure 5-81.
- 4) Press the  or  key until the message is displayed as in figure 5-82.
- 5) Press the  to select the baud rate (19200bps). The message is displayed as in figure 5-83.

RS232 BaudRate ...
Push Up/Dn Seek

Figure5-80

4800

Figure5-81





19200

Figure5-82

*19200

Figure5-83

5.20 Setup Page feed

- 1) Enter Supervisor setup.
- 2) Press the  or  key until the message is displayed as in figure 5-84.
- 3) Press the  key. The message is displayed as in figure 5-85.
- 4) Press the  key to select the function. The message is displayed as in figure 5-86.

Page Feed ...
Push Up/Dn Seek

Figure5-84

Page Feed
Push Up/Dn Selec

Figure5-85

* Page Feed
Push Up/Dn Selec





Figure5-86

NOTE

Note:

If you select the printer that is a micro printer with the projecting apparatus, you must select another option i.e. non-page feed

5.21 Setup Z-axis Type

- 1) Enter Supervisor setup.
- 2) Press the  or  key until the message is displayed as in figure 5-87.
- 3) Press the  key. The message is displayed as in figure 5-88.
- 4) Press the  key to select the function. The message is displayed as in figure 5-89. And Z-axis type is Rotary.

Z Axis Type ...
Push Up/Dn Seek

Figure5-87

Rotary Axis
Push Up/Dn See

Figure5-88

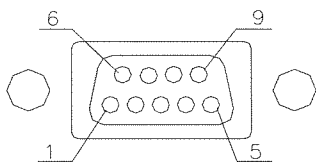
* Rotary Axis
Push Up/Dn See

Figure5-89

APPENDIX

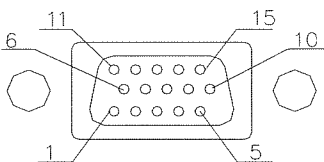
I. Scale interface

1) 9-Pin H-D D-SUB CONN.



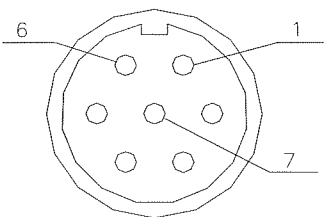
PIN NUM	SIGNLE	CABLE COLOR
1	+5V	RED
2	0V	BLACK
3	A+	BROWN
4	B+	YELLOW
5	ABS+	ORANGE
6	NC	
7	NC	
8	NC	
9	FG	WEAVE NET

2) 15-PIN H-D D-SUB CONN.



PIN NUM	SIGNLE	CABLE COLOR
1	+5V	RED
2	0V	BLACK
3	A+	BROWN
4	B+	YELLOW
5	ABS+	ORANGE
6	FG	WEAVE NET
7-15	NC	

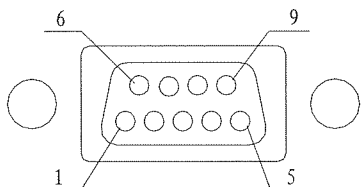
3) 7-PIN H-D D-SUB CONN.



PIN NUM	SIGNLE	CABLE COLOR
1	0V	BLACK
2	NC	
3	A+	BROWN
4	B+	YELLOW
5	+5V	RED
6	ABS+	ORANGE
7	FG	WEAVE NET

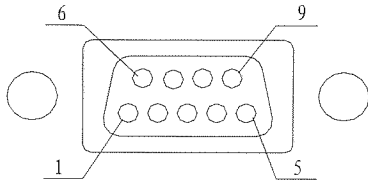
The standard configurator is 9-PIN H-D D-SUB CONN. 15-PIN H-D D-SUB AND 7-PIN H-D D-SUB CONN are option.

II. RS232 SIGNAL INTERFACE



PIN NUM	SIGNLE	CABLE COLOR
1	NC	
2	TXD	YELLOW
3	RXD	ORANGE
4	NC	
5	GND	BLACK
6-9	NC	

III. FOOT SWITCH AND EDGE DETECTOR CONNECTOR

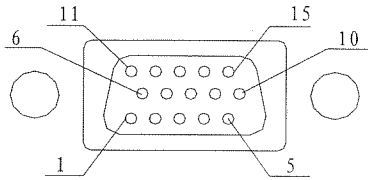


PIN NUM	SIGNLE	CABLE COLOR
1	FOOTSWITCH-1	RED
2	FOOTSWITCH-2	RED
3	GND	BROWN
4	VCC	BROWN
5	EXT0_PLUS	YELLOW
6	EXT0_RTN	ORANGE
7	EDGE_SIGN	BLUE
8	EDGE_GND	BLACK
9	SLEEP	WHITE

IV. PRINTER INTERFACE

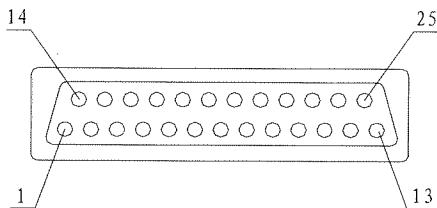
THE STANDARD CONFIGURATOR IS 15-PIN H-D D-SUB CONN. 25-PIN H-D D-SUB CONN IS OPTION.

1) 15-PIN H-D D-SUB CONNECTOR



PIN NUM	SIGNLE	CABLE COLOR
1	STROBE	RED
2	D0	BROWN
3	D1	YELLOW
4	D2	ORANGE
5	D3	BLUE
6	D4	PURPLE
7	D5	GREY
8	D6	WHITE
9	D7	GREEN
10	ACK	PINK
11	BUSY	LIGHT BLUE
12-15	GND	BLACK

2) 25-PIN H-D D-SUB CONNECTOR (OPTION)



PIN NUM	SIGNLE	CABLE COLOR
1	STROBE	RED
2	D0	BROWN
3	D1	YELLOW
4	D2	ORANGE
5	D3	BLUE
6	D4	PURPLE
7	D5	GREY
8	D6	WHITE
9	D7	GREEN
10	ACK	PINK
11	BUSY	LIGHT BLUE
12	GND	BLACK
13-17	NC	
18-25	GND	BLACK

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