DIGITAL READOUTS

Operation Manual

(JCS900-2AE JCS900-3AE)

ShenZhen jcgs Precision Instrument CO.,LTD

Dear Users,

1. Thank you for purchasing and using digital readouts with the registered trademark "jcgs/精测光栅®" of ShenZhen jcgs Precision Instrument CO.,LTD. The product is used to do inspection and positioning for different kinds of manual machine tools and inspection devices. It is a precise product for measurement.
2. ShenZhen jcgs Precision Instrument CO.,LTD. has the trademark registration rights for the European trademark "jcgs®" and the trademarks of "jing®"、"精测®" and "jingce®" etc.

Note: Users shall arrange the device gently when using it, otherwise the precision of the device will be affected. In addition, please read through the following safety precautions to ensure using the new digital readouts safely.

Safety Precautions
Sign Description
Warning Instructions

This manual gives signs for warnings. Such signs are instructed by signal text to describe the extents of danger. Please comply with the warnings and operate cautiously to avoid accidents, injuries and property losses.

Danger!... This sign reminds the cases which shall be avoided, otherwise they will directly cause death or serious injury.

Warning! ... This sign reminds the cases which shall be avoided, otherwise they will cause death or serious injury.

Cautious!... This sign reminds the cases which shall be avoided, otherwise they may cause death or serious injury.

Cautious:

- **To avoid electric shock or fire, the device shall not be dampened or sputtered by coolant.**

Warning:

- **To prevent electric shock, please do not open the shell unauthorizedly. There are not any parts which users can repair. For inspection and repair， please contact ShenZhen jcgs Precision Instrument CO.,LTD., its agent or professional technicians.**

⚠ Cautious:

- **If there is smoke or it smells abnormal, please remove the power plug immediately. If one continues to use the device, it may cause fire or electric shock. Please contact ShenZhen jcgs Precision Instrument CO.,LTD. or its distributor. Please do not try to repair it unauthorizedly.**
- **The digital readout connects to the optical electronic ruler to be a precise measuring device. If the lines for connecting electronic ruler and the digital readouts are broken or damaged on its surface, it may result in inspected data failure. Users shall pay special attention on it.**
- **Please do not try to repair or reassembly the digital readouts unauthorizedly, otherwise it will result in failures, faults or injuries. If there is anything abnormal, please contact ShenZhen jcgs Precision Instrument CO.,LTD. or its distributors.**
- **Once the optical electronic ruler used with the digital readouts is broken, please do not use electronic rulers of other brands, because the products from different companies have their special features, indexes and line connection. No one can connect them without instructions from professional technicians, other wise it will cause faults of the digital readouts.**

CE This displacement sensor is in line with European electrical safety low voltage instruction 2006/9SEC and electromagnetic compatibility instruction 2004/108/EC.

The company has comprehensively passed the quality management system certification IS09001M, environment management system certification IS014001 and the certification of occupational health and safety management system OHSAS18001

Remarks: All the rights of interpretation belong to ShenZhen jcgs Precision Instrument CO.,LTD. The company does not give notifications separately for product update.

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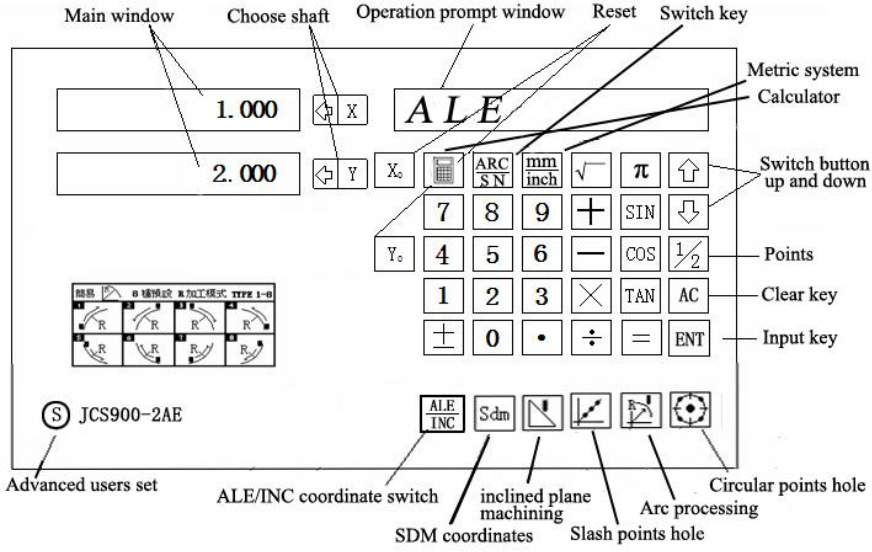
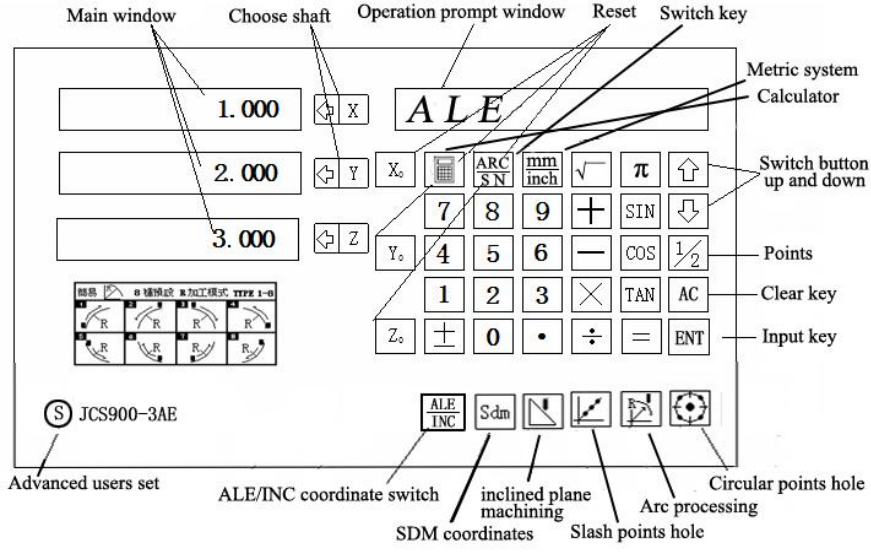
JCS900-2AE DRO

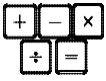


JCS900-3AE DRO

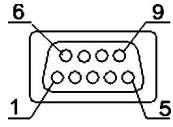
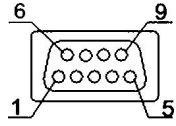
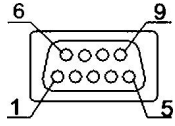


1.1 Description of the Keys

Keys	Function Description	JCS900-2AE	JCS900-3AE	customize
X0 Y0 Z0	Zero clearing for umber axis	No Z0		
Y X Z	Number axis selection & preset value	No Z		
mm inch	Metric/ British system switch			
1/2	Center division key for number axis values			
ALE INC	ALE/INC(absolute/relative) coordinate switch			
Sdm	SDM coordinate selection (200 sets of auxiliary coordinates provided for processing point preset)			
0 ~ 9	Number			
.	Decimal input			
+	Symbol input			
ENT	Operation confirm			
	Calculation function (Enter or exit calculator)			
AC	Calculator zero clearing			
ARC S N	Function switch (Calculate anti-trigonometric under the function of calculator. Enter SDM coordinate input under SDM coordinate display.)			
sin cos tan	Trigonometric function (Calculate trigonometric and anti-trigonometric)			

Keys	Function Description	JCS900-2AE	JCS900-3AE	customize
	Calculation key (Add, subtract, multiply and divide)			
	Square or rooting			
	Circumference rate			
	EDM processing	No 	No 	
	Circumferential hole making (making equal division on the arc)			
	Oblique line hole making (making equal division on the arc)			
	Arc processing (making arcs for certain surfaces of workpieces)			No 
	Inclined plane processing (making inclined plan for certain surfaces of workpieces			No 
	Up or sown selection			

1.2 Description of the interfaces

No.	Interface type	Interface diagram	Positio	Signal
1 (Default)	9-pin TTL interface		1	+5V
			2	0V
			3	A
			4	B
			5	R
			6	empty
			7	empty
			8	empty
			9	empty
2 (Optional)	9-pin TTL interface		1	empty
			2	0V
			3	empty
			4	empty
			5	empty
			6	A
			7	+5V
			8	B
			9	R
3 (Customize)	EDM signal interface		1	Normally opened
			2	common port
			3	normally closed
			4	empty
			5	empty
			6	empty
			7	empty
			8	empty
			9	empty

Chapter II Basic Operation Instruction

2.1 Start-up

Function Introduction:

Turn on the power and the digital readout is on normal display. When starting the device, press and hold Ⓢ and enter the internal settings.

The digital readouts have memory function when the power is off. When the power is off, the device has a memory of current coordinate position, ALE/INC/SDM coordinate methods and metric/British measurement methods. Upon next start-up, the three functions mentioned above can be resumed to the conditions before the power off to avoid setting the parameters repeatedly.

2.2 Zero Clearing

Function Introduction:

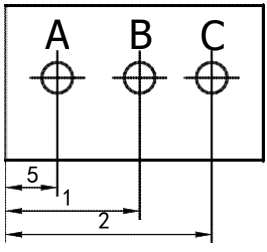
When the digital readouts are displayed normally, the value zero clearing for the coordinate axis can be done at any points.

- After zero clearing of ALE, INC value displayed are cleared to zero at the same time.
- After zero clearing of INC, ALE and SDM values displayed are not influenced.
- After zero clearing, if the grating ruler are not moving, press the zero clearing key at the same axis to cancel last zero clearing and resume the data before zero clearing.

2.3 Preset Values for Certain Axes

Function Introduction:

When the digital readouts are displayed normally, set the current displayed values of current position.



Operation procedures:

Example: Making holes A & B along the direction of X axis.

1. After making hole A as shown in the picture above, the work piece is moved.

2. Now hole B needs processing. After aiming at the hole A with the tool, press [X] → [5] → [ENT] to enter values. (When entering the values, if there is any error entered, press "AC" key to cancel the input.)

3. Move the tool to the position displayed as 27 and make hole B.

Notes: When in SDM coordinate system:

The SDM number setting direction is set as '0', the displayed value equals to the input value.

The SDM number setting direction is set as '1', the displayed value equals to opposite number of the input value.

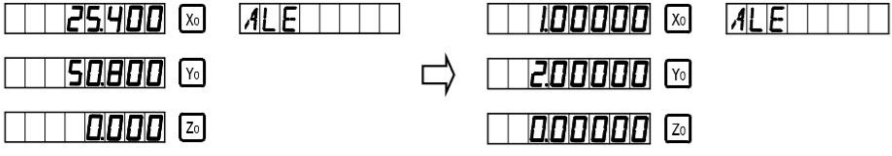
The SDM number setting direction is set in the internal settings.

2.4 Metric/British Shift

Function Introduction

The dimensional units displayed are shifted between 'mm' (metric) and 'inch' (British). Both parts of British measurement and the ones of metric measurement can be processed. Example: As shown in the diagram, the original display is metric and now British units are needed to be displayed (1 inch =25.4mm). The operation procedures are:

Press [mm/inch], shift between metric and British measurements.

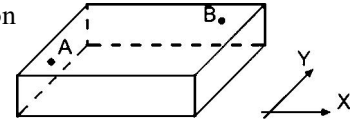


When the number axis is at the function of encoder, pressing [mm/inch] does not work.

Operation procedures:

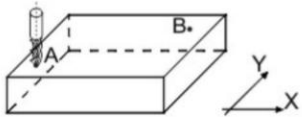
2.5 Automatic Center Division

Function Introduction: Find the central position Between 2 points.
Example: There is a rectangle working piece shown in the diagram. Find the central position between A and B.

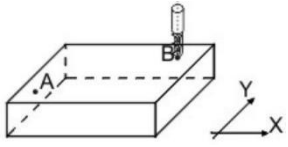


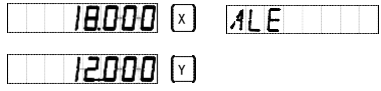
Operation procedures:

1. Move the tool to aim at A, press [X0] and [Y0], reset the values at axis X and axis Y.

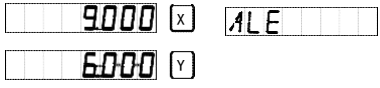


2. Move the tool to aim at B;

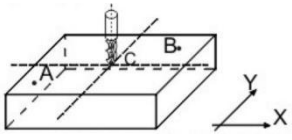


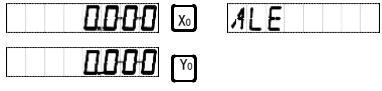


3. Press [1/2] at axis X and axis Y, do center division for the values at axis X and axis B respectively.



4. Move the tool to find the point at which both values at axis X and axis Y are displayed as zero. That is the central position of A and B.





Note: When the number axis is set as a rotary encoder, the operation of center division does not work.

2.6 Absolute/Relative/200 Sets of User Coordinate System

Function Introduction

Jcgs® digital readouts provide 3 coordinate display ways, Absolute Coordinate System (ALE), Relative Coordinate System (INC) and 200 sets

Operation procedures:

Of User Coordinate Systems (SDM001-SDM200).

1: The zero point is set at the coordinate origin point of ALE;

2: When changing ALE origin, the relative distance between SDM origin and ALE origin is not changed.

I: Shift between the three coordinate systems.

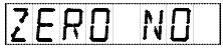
Coordinate system shift is only possible when the device is normally displayed. Press [ALE INC] to shift between ALE and INC.

- The sub-window displays INC shows the state of INC.
- The sub-window displays ALE shows the state of INC (At this state, it is not at the sated of SDM. Press [Sdm] to shift to SDM.

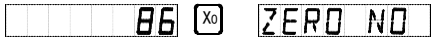
II：Under the coordinate system SDM, input new SDM set No.

Operation Procedures:

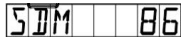
1: Press [Sdm] to enter SDM for coordinate selection. As shown in below diagram, it means that new SDM set No. can be entered.



2: Enter the set No. For example, enter 86



3: Press [ENT] to confirm the input, sub-window stops flashing and the SDM set No. is turned into 86.



III：Coordinate Selection

Press [⇧] or [⇩] to enter any coordinates.

2.7 Function of Grinder Vibration Removing

During the grinding process, the vibration of grinder makes the values on the digital readouts change repeatedly and quickly, which results visual discomfort. The digital readouts have a function of figure filter, that is usually called ‘vibration removing function’ which enables the display of the readouts not to change quickly and avoid visual confusion.

Operation Procedure: Under the coordinate system ALE, press [π] 5 times consecutively and the cue column displays 'SHIFT ON' which means the function of vibration removing is on. Under this function, press [π] again to turn this function off and the cue column displays 'SHIFT OFF'.

2.8 Function of Lathe

When processing workpieces, some devices have two shafts installed to the same direction, the machine platform is the sum of the displacements of two shafts. Such mode is called lathe mode.

When lathe mode is 0, the function of lathe is turned off;

When lathe mode is 1, Axis X value displayed = Axis X value displayed + Axis Y value displayed;

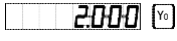
When lathe mode is 2, Axis X value displayed = Axis X value displayed + Axis Z value displayed;

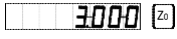
When lathe mode is 3, Axis Y value displayed = Axis Y normal value displayed + Axis Z normal value displayed;

Operation Procedures:

1: Set lathe mode in the internal function settings (refer to the chapter of internal parameter setting);

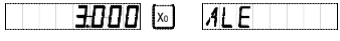
A Normal display

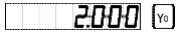


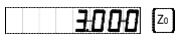


B Lathe mode 1

Axis X value displayed = Axis X normal value displayed + Axis Y normal value displayed;

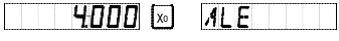


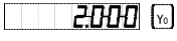




C Lathe mode2

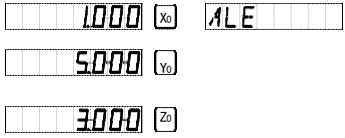
Axis X value displayed = Axis X normal value displayed + Axis Z normal value displayed;





D Lathe mode 3

Axis Y value displayed = Axis Y normal value displayed + Axis Z normal value displayed;



Chapter III Function of 200 Sets of Auxiliary Zero Positions

Jcgs® Provides 3 kinds of coordinates: Absolute Coordinate System (ALE), Relative Coordinate System (INC) and 200 sets of User Coordinate Systems (SDM001-SDM200). 200 sets of User Coordinate Systems can be used to reset during processing.

ALE is Absolute Coordinate System which is set up at the initial stage of workpiece processing. 200 sets of User Coordination Systems are relative to the definition of Relative Coordinate System. When the user's ALE coordinate changes, the SDM null point moves certain distance with the change.

When processing, only one basic null point cannot meet the user's requirements. Currently, the added SDM coordinates can provide several sets of basic null points. Each auxiliary null point equals to a coordinate origin defined by the user himself/herself. In this coordinate system, each point is based on the auxiliary null point of the current SDM system. In such a relatively independent coordinate system, various special kinds of processing are possible.

To process the workpiece as shown in the diagram， ALE origin is set at the 0 point of the workpiece center and the other four auxiliary null points are A, B, C, D as shown in the diagram;

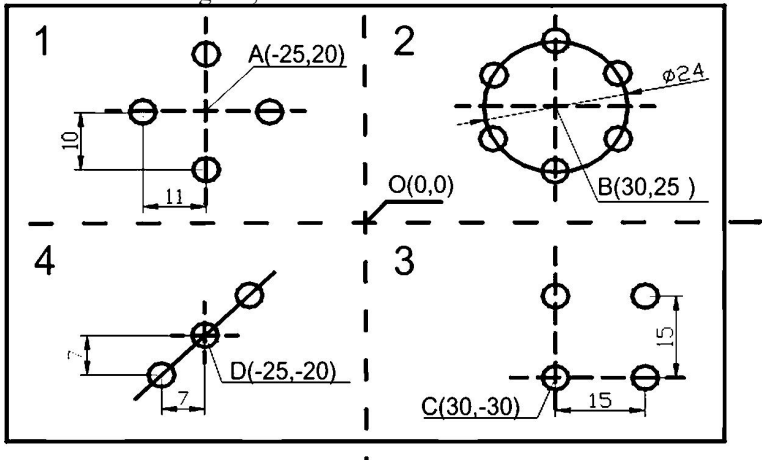


图 3.1

There are two methods to set auxiliary null points:
1) Coordinate input;
2) Zero clearing in place.

3.1 Input SDM Null Points Directly

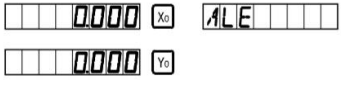
There is no need to move the machine platform. Preset the user coordinate null points directly according to the size on the user processing drawings to set the user coordinate null points accurately and quickly.

Under the User Coordinate System (SDM coordinate), input auxiliary null points at the position of absolute coordinate null point, it displays the coordinate position of absolute coordinate null point (point 0) at the coordinate of auxiliary null point. Under the Relative Coordinate System, point 0 is at (25, -20) of point A, (-30,-25) of point B, (-30, 30) of point C and (25, 20) of point D. They are just the opposite numbers of each point under the absolute coordinate positions. If relative null points are input at points out of Absolute Coordinate System, it displays the position of this point at this user coordinate. If the user coordinate auxiliary null point of point B is entered at point A, the displayed value of B is (-55, -5). Therefore, when presetting values under SDM coordinate system, a minus is added to the opposite number is taken. Thus, coordinate value of the processing workpiece can be input directly.

Operation Procedures:

1. Under the Absolute Coordinate System(ALE), move the machine platform and make the tool aim at the center point 0 as shown in Fig. 3.1.

   Press X0, Y0 to reset the values at axis X and Y to confirm the null point of absolute coordinate.

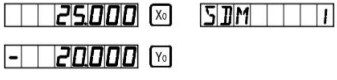


2. Press SDM key to get into User Coordinate System and SDM1 coordinate, set the position of point A and enter the coordinate value (-25, 20) of point A.

If there are any errors during the input, press "AC" key to cancel the input.

Press [X] → [2] → [5] → [%] → [ENT]

Press [Y] → [2] → [0] → [ENT]



3.Press [⇧] to get into the coordinate system SDM 2. Set the position of point B and

enter the coordinate value (30, 25) of point B.

Press [X] → [3] → [0] → [ENT]

Press [Y] → [2] → [5] → [ENT]

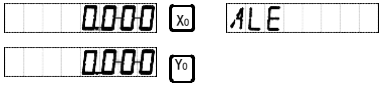
4. Following the same principle, set auxiliary null points for point C and D according to Step 2.

5. After setting the auxiliary null points, users can process workpieces under corresponding coordinate system of auxiliary null points. As shown in the diagram, hole making can be done for the arc under the coordinate system of auxiliary null point of point B.

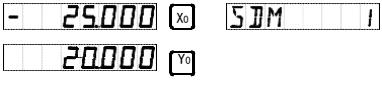
6. When the processing done, press SDM key or ALE/INC to exit SDM coordinate system.

3.2 Zero Clearing in Place

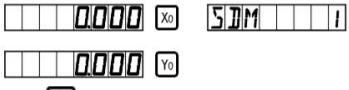
1. Move the tool to absolute coordinate.
2. Under the Absolute Coordinate System (ALE), as shown in Fig. 3, move the tool to point 0, press X0, Y0 to do zero clearing for the data for axis X and axis B and confirm the zero position of absolute coordinate (If users reprocess workpieces, SDM coordinate system can be generally reset before setting again.)



3. Press SDM key to get into SDM1 coordinates, set the position of point A and move the tool to point A and the digital readouts display the following:



Press X0, Y0 the SDM coordinates of point A is set successfully.



4. Press ⇧ to get in to SDM 2 to set the position of point B, move the tool to point B and the digital readouts display the following:

Press X0, Y0 the SDM coordinates of point B is set successfully.

5. Follow the same principles to set auxiliary null points of point C and D according to Step 3.

6. After the processing is done, press SDM key or ALE/INC to exit SDM Coordinate System.

7. When processing work pieces of the same size, as long as the ALE null point is set after point 0, SDM null point is set automatically. As shown in Fig. 3.1, get into SDM1 Coordinate System, move to the position at which the displayed values of axis X and axis Y are zero which is the basic point of SDM1 Coordinate System. Users can process the work pieces base on this. When doing mass processing, with these User Coordinate Systems, users can save a lot of time to set null point of user coordinates. In this way, processing efficiency is highly enhanced.

Notes:

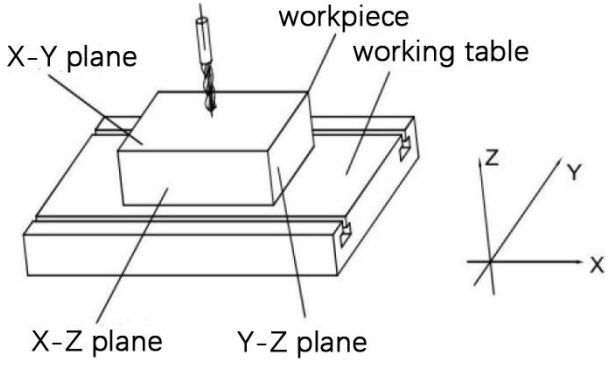
- When using the user coordinates, doing zero clearing under corresponding User Coordinate System is actually resetting auxiliary null point. Doing zero setting at certain position and such position is the new user coordinate origin.
- When using the user coordinates, doing center division is also resetting auxiliary null point. The new coordinate origin is at the central point and the coordinate origin set originally is replaced by the new one.
- Press ⊡ ten times to reset the SDM Coordinate System generally. After clearing, the 200 sets of coordinates are in line with ALE coordinates.
- When setting SDM coordinates again, zero clearing shall be done first for axis X and axis Y under ALE Coordinate System to set null point of absolute coordinate, otherwise the SDM coordinates set is not correct.

Chapter IV Exclusive Functions

Apart from inspection and positioning, Jcgs® digital readouts provide the following exclusive processing functions:

Oblique line hole making (JCS900-2AE/3AE)
Circumferential hole making(JCS900-2AE/3AE)
Inclined plane processing (JCS900-2AE/3AE)
Arc processing (JCS900-2AE/3AE)
Discharge processing (customiz)

To make the user's existing equipment more effective. When using the exclusive functions of the digital readouts, coordinate system shall be known first.



As shown in the horizontal plane, the direction in parallel with the operator is axis X, the direction is perpendicular to axis X is axis Y and the direction is perpendicular to horizontal plane is axis Z. The direction of arrowhead is the positive position of coordinate. Users can also change the positive direction of numbering in the internal parameter setting according to user habits.

4.1 Oblique Line Hole Making

Function Introduction

Jcgs® digital readouts provide oblique line equal hole making function. It is used to process evenly distributed holes on XY plane centers in the same straight line. The operator shall only input the following parameters:

LINE DIS：The distance of oblique line (The distance between the starting hole center to the ending hole center).

LINE ANG: The angle of oblique line (The angle between the oblique line and the positive direction of axis X).

HOLE NUM: Hole number (**The hole number must >1**)

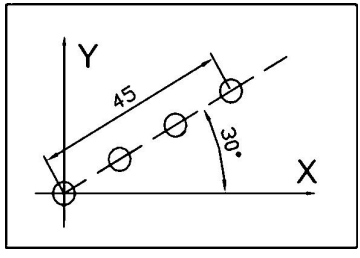
After inputting the parameters, the digital readouts calculate the hole positions at the oblique lines automatically. The operator presses ⇧ or ⇩, selects hole number and move the tool to the position at which both the displayed values of axis X and axis B are 0.000. That is the position of the hole.

Example: For the work piece shown in the diagram, the settings are as follows

The distance of oblique line (LINE DIS): 45mm

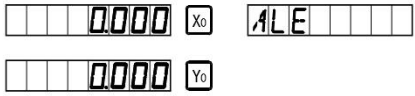
The angle of oblique line (LINE ANG): 30 °

Hole Number (HOLE NUM): 4



Operation Procedures:

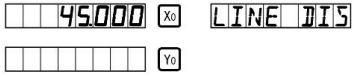
1. At the state of normal display, shift the metric/British to metric system. Move the machines tool and the vertex of lathe tool aims at the first hole center. Axis X is zero clearing. Axis Y is zero cleating.



2. Press  and get into the function of oblique line hole making; if the parameters are the ones input previously, there is no need to change. Press  to start oblique line whole making directly.

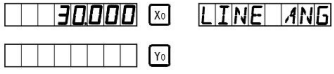
3. Input the length of oblique line

Press [4] → [5] → [ENT] successively



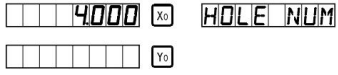
4. Input the angle of oblique line

Press [3] → [0] → [ENT] successively



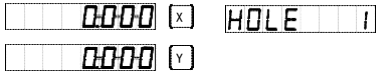
5. Input the oblique line hole making number

Press [4] → [ENT] successively



6. The sub-window displays ‘HOLE 1’

Move the machine tool to the position at which both window X and window Y display 0. Then it is the right point to make the hole.



7. When the first hole is made, press [⇩], and the sub-window displays ‘HOLE 2’, move the machine tool to the position at which both window X and window Y display 0. Then it is the right point to make the second hole.

Note: Press [⇧] or [⇩] to shift between different holes.

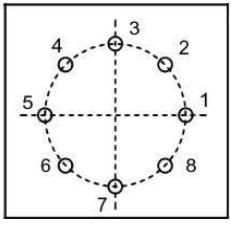
8. Make the 3rd and the 4th holes according to the same procedures;

9. After processing, press [⇲] to return to normal display.

4.2 Circumferential Hole Making

Function Introduction:

Jcgs®digital readouts provide the function of circumferential equal hole making, which can be used for processing evenly distributed holes on XY plane arc.



When getting into the circumferential hole making, the information window reminds the user the parameters to be defined.

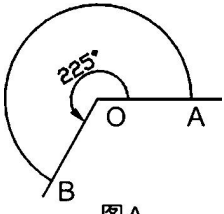
RADIUS: Arc radius (Art radius to be equally divided)

ST_ANGLE: Start angle (The angle of the first hole center on the arc)

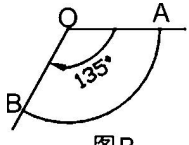
ENDANGLE: End angle (The angle of the last hole center on the arc

HOLE_NUM: Hole number (**The hole number must>1**)

DIRECT：Angle direction (Note: When the start angle equals to the end angle, it means to make the holes evenly on the whole circle).



图A



图B

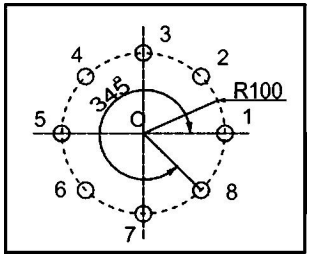
On any plane of XY, ZY or YZ, the angle directions include counter-clockwise and clockwise.

When the direction is set as ‘0’, it refers to that it is counter-clockwise from start angle to end angle. As the arc shown in Fig. A, it is counter-clockwise 225° from A to B.

When the direction is set as ‘1’, it refers to that it is clockwise from start angle to end angle. As the arc shown in Fig. B, it is clockwise 135° from A to B

After entering the parameters above, the digital readouts calculate the positions of the equal holes and set the position of each hole as 0. The user only has to press [⇧] or [⇩]to select the hole position which requires processing and move the tool to the position at which the displayed value is zero on both axis A and axis B to process.

Example: Holes on the circle of the part in the processing Fig.(E)



Radius (RADIUS):100mm

Start angle (ST_ANGLE): 0°

End angle (ENDANGLE): 315°

Hole Number (HOLE NUM): 8 (The processing hole number must >1)

Angle Direction (DIRECT): 0

Operation Procedures:

1. At the state of normal display, shift size unit to metric system; move the machines tool and set the coordinate origin at point 0.
2. Press [⊕] to get into the function of circumferential hole making. if the parameters are the ones input previously, there is no need to change. Press [⇩] to start circumferential hole making directly.
3. Input the radius

   Press [1]→[0]→[0]→[ENT] successively,then press [⇩]

   100.000 Xo RADIUS

   Yo
4. Input start angle

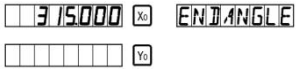
   Press [0]→[ENT] successively

   0.000 Xo ST_ANGLE

   Yo

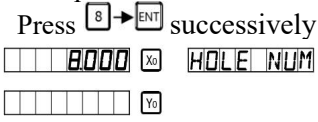
5. Input end angle

Press [3]→[1]→[5]→[ENT] successively



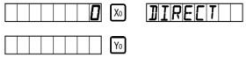
6. Input hole numbers

Press [8]→[ENT] successively



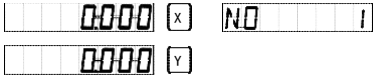
7. Input angle direction

Press [0]→[ENT] successively and enter processing



8. Sub-window displays ‘NO 1’;

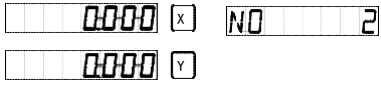
Move the machine tool to the position at which both window X and window Y display 0 and the first hole position can be processed;



9. After the first hole is processed, press [⇩] and the sub-window displays ‘NO 2’;

Move the machine tool to the position at which both window X and window Y display 0 and the second hole position can be processed at this point;

Note: Press [⇧] or [⇩], shift the hole positions between different holes.



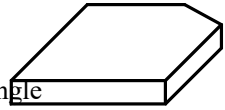
10. Process from the 3rd hole to the 8th hole according to the same procedures.

11. After processing is done, press [⌖] to return to the normal display.

4.3 Inclined Plane (Slope) Processing

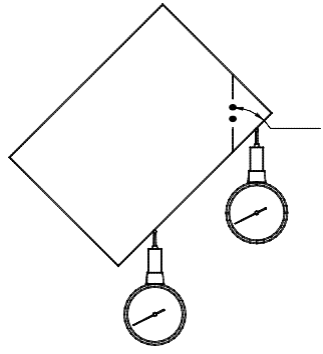
During processing, inclined plane processing can be used for processing bigger inclined planes and this function is the simplest and easiest one.

I. Slope correction



When inclined plane processing is on the XY plane, as the part shown in Fig. (a), before inclined plane processing, the slope angle of the workpiece shall be corrected. The function of inclined plane processing plays a role of slope correction.

The procedures of slope correction:



Put the workpiece on the work platform according to the required slope angle.

1. Press and get into inclined plane processing.
2. Select XY plane for processing plane.
3. Input slope angle (ANGLE).
4. Move the work platform and let the measurement tool (such as dialgage) installed on the milling machine contact the inclined plane, adjust it to aim at zero and move the work platform to the direction of axis X for a distance.
5. Press [Y], move to axis Y according to the display until it displays zero.
6. Adjust the angle of the work piece and make the work piece contact the measurement too to make it zero.

For example: Correct the workpiece to 45° as shown in Fig. (b)

1) Arrange the workpiece roughly 45°

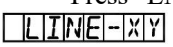
On the platform.

Press 

2) Select processing plane

Press  or  to select processing plane.

Press “ENT” key.



3) Input slope angle

Press [4] → [5] → [ENT]

45.000 X0 ANGLE

Y0

4) Move the work platform to the direction of axis X, the measurement tool contact workpiece mildly. After it is adjusted to zero, move a distance at axis X.

50.060 X0 MOVE X

0.000 Y0

5) Display the distance moved to the direction of axis Y

50.060 X0 MOVE Y

Press [Y] 50.060 Y0

6) Move work platform to the direction of axis Y, adjust the angle of the workpiece to make the slope correction plane to contact the measurement tool until it is zero.

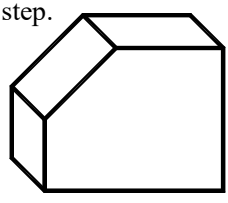
7) Move the work platform until the axis

Y displays '0'. Press [⌫] to exit this

inclined plane processing.

II. Inclined plan processing

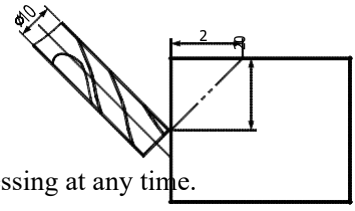
When the processing plane is at plane XZ or YZ, the function of inclined plane can instruct the operator to process the slope step by step.



Procedures of inclined plane processing:

When the processing plane is at plane XZ or YZ, please correct the slope angle of the main shaft head and tool setting of the machine tool. Press [⌫] to get into inclined

plane processing.



1. Select processing plane XZ or YZ.
2. Input the diameter of the tool (DIA).
3. Input the start point (ST XZ/YZ)
4. Input the end point (ED XZ/YZ)
5. Press to exit the inclined plane processing at any time.

Refer to the examples:

1) Correct slope angle
   and tool setting

   Press 

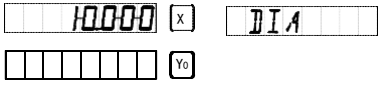
2) Select processing plane

   Press  or  , select plane XZ, press “ENT” key

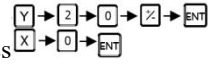
   

3) Input the diameter of the tool

   Press 

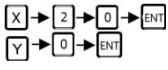
   

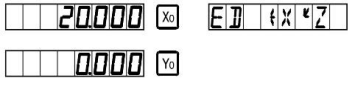
4) Input the coordinates of start point and end point

   Press 

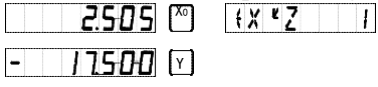
   

5) Input the coordinates of end point

   Press 

6) Get into the state of processing

7) Press  or  to display the positions of different processing points. Move the machine tool until the display of the axis is zero and they are the positions of different points on the slope.

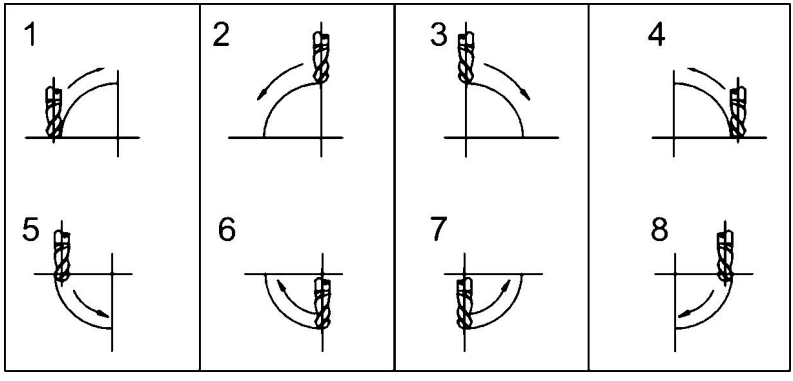
   Press  to exit inclined plane processing at any time.

4.4 Arc Processing

During the die processing, arcs are often processed. When the shape is simple and the production quantity is small, processing with digital machine tools is not economic. XH-2 provides simple arc processing, which enables convenient and quick processing for single pieces, such as die copper poles, on common milling machines. Control parameter 'MAX CUT' to remove equal arcs and control the smoothness of the arcs. The less MAX CUT', the smaller part removed, the smoother the arcs and the longer the processing time; The more MAX CUT', the bigger part removed, the rougher the arcs and the shorter the processing time. (During the processing, the user can press "ENT" key to do the setting again. MAX CUT or Z STEP).

A： Process Plane ZX, YZ

As for arc processing for plane ZX,YZ, there are 8 processing ways as shown below



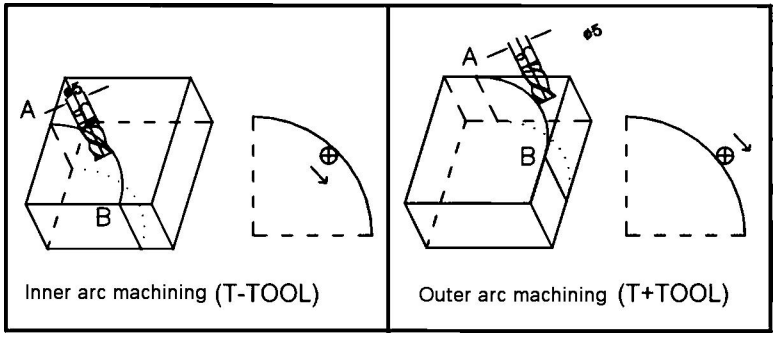
Note: When processing, flat bottom milling cutter and arc milling cutter can be used. Before using flat bottom cutter to process circles, the cutter diameter shall be set as 0.000.

B： Processing Plane XY

When processing plane XY, there are also 9 processing ways as shown above. The tool is vertical to the processing plane. Each ways has inner arc processing and outer arc processing. Therefore, when processing plane XY, tool compensation methods shall be selected: processing outer arc (T+T00L) and processing inner arc (T-T00L).

Note: When processing plane XY, whether round head knife or flat head knife, the tool radius shall be set according to actual value.

Select tool compensation direction (when doing processing on plane XY)



Input following parameters for arc processing:

TYPE 1-8: Art processing types

T+TOOL/T-TOOL: Select between inner/outer arcs (This parameter is special for processing plane XY)

RADIUS: Radius of arc to be processed

TOOL DIA: Tool diameter

Z STEP: Movement steps of axis Z for each processing (internal setting STEP. MODE is 0)

MAX CUT: Arc length of each processing (internal setting STEP.MODE is 1)

Example 1: Process the 90 °arc AB as shown in Fig. 4.4-1.Start from point A and end at point B.

The parameter settings are:

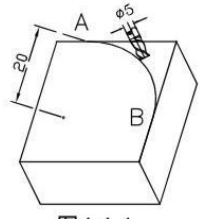


图4.4-1

Processing plane: XY

Arc processing mode: 3

T +TOOL mode

Radiu: 20mm

Tool diameter: 5m

Arc length of each processing: 1mm

Operation Procedures:

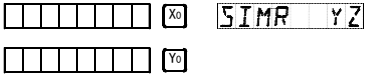
1. When the readouts are normally displayed, adjust the metric/British system to the metric ones.

2. Move the work platform, make the tool aim at point A, do zero clearing for axis X and Y.

3. Get into arc processing;

Press [▷] to enter arc processing

If there are parameters input previously, there is no need to change, press “ENT” key to start directly.



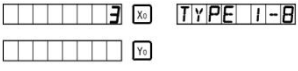
4. Select the processing plane:

Press [X] → [ENT] to select processing plane and get into the processing mode selection

Note: Press [X] to select plane XY; press [Y] to select plane YZ; press [Z] to select plane ZX; Also, press “ARC/SN” key to shift between plane XY. YZ and ZX.

5. Select processing types:

Sub-window displays ‘TYPE 1-8’, window X displays previous type, press [3] → [ENT], select processing type 3, enter and select inner arc processing or outer arc processing;



6 Select mode T + TOOL

Press [+] → [ENT], select outer arc processing and get into arc radius input;

Note: Press [+], T+T00L, select outer arc processing

Press [−], T-T00L, select inner arc processing

7. Input arc radius

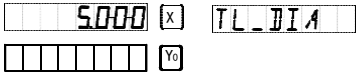
Sub-window displays ‘RADIUS’, window X displays the radius set originally

Press [2] → [0] → [ENT] successively to input the arc radius;

8. Input tool diameter

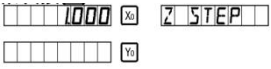
Sub-window displays ‘TL_DIA’

Press 5→ENT to complete the tool diameter input;



9. Input processing arc length of each time
   Sub-window displays ‘Z STEP’

   Press 1 → ENT successively



   Next step is processing arcs;

10. Processing arcs

   Sub-windows display ‘POIN 1’, process until the displayed value of window X and Y are ‘0.000’, the processing of the first point is finished. Then, press ⇩ to process point 2 and repeat the operation as last time until the sub-window displays ‘POIN 37’; press up/down to shift between the processing points;

   exit.

11. When processing is finished, press ⏎ to

Example 2

Process the arc AB as shown in Fig 4.4-2. Process from point A and the parameters are set as following:

Processing plane: ZX

Processing type: 3

Radius arc: Actual value

Tool diameter 0 (flathead)

Processing arc length: User custom

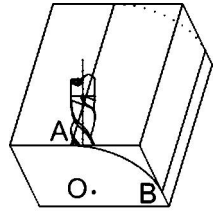


图4.4-2

Example 3

Process the arc CD as shown in Fig 4.4-3. Process from point D and the parameters are set as following:

Processing plane: ZX

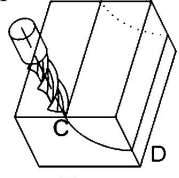


图4.4-3

Processing type: 5

Arc radius: Actual value：

Tool diameter: Actual value (round head tool)

Movement steps of axis Z are processed each time: user custom

Example 4

Process the arc EF as shown in Fig 4.4-4. Process from point E and the parameters are set as following:

Processing plane: YZ

Processing type: 7

Arc radius: Actual value

Tool parameters: Actual value (round head tool)

Arc length of each processing: user custom: user custom

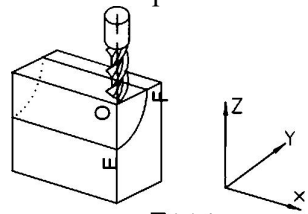


图4.4-4

Note: There are no axis Z installed forXH-2, X-2, ⇧ or ⇩ are used to simulate axis Z position. ⇧ is to move simulated axis Z to move to last processing point. ⇩ is to move simulated axis Z to move to next processing point.

Procedures:

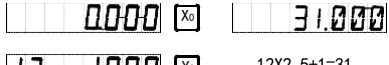
1: In SETUP, set 'STEP MODE' as mode 0 (i.e. Z STEP mode) and set boring ring value of axis Z (default value is 2.5mm)

2: Before processing, make the machine tool aim at position Z of R start point. At this moment, the position of axis Z is set as 0;

3: During processing, the sub-window shows the simulation height of axis Z, which refers to the simulation height of axis Z when current processing point stop processing.

As shown in the diagram, process plane ZX and window X displays the position of axis X. When X is displayed as 0, the processing to the direction of X finishes; the first two digits of window Y show the boring ring number, the latter 5 digits show the reading of boring ring, which means that the processing shall be done until the reading of that ring for current processing point.

If processing plane YZ, the window Y shows the position of axis Y. When Y is displayed as 0, the processing to the direction of Y finishes; the first two digits of window X show the boring ring number, the latter 5 digits show the reading of boring ring, which means that the processing shall be done until the reading of that ring for current processing point.



Chapter V Function of Calculator

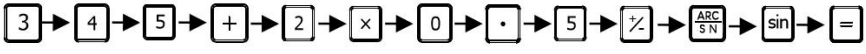
When the user is processing workpieces, some value calculation may be needed. Jcgs® digital readouts provide a function of calculator to make users more convenient when processing according to drawings. The calculator can transfer the calculated result directly into the axis which needs processing. The user shall only move the machine platform to the position which is displayed as 0, which is the position of the calculated result.

Under the state of normal display, press [CALC] to get into the function of calculator. After getting into the calculator function, press [CALC] to go back to normal display.

5.1 Calculation Examples

Example 1: 2+30x2-6/2 = 59

Example 2:345 + 2 x $\sin^{-1}$ (-0.5) = 285



Note: If the figure input is wrong, press [AC] to reinput; If there are errors during calculation, the system will give a warning sound. At this moment, press [AC] to reinput;

The absolute values of the figure and calculated results shall not be more than 9999999 or less than 0.000001, otherwise there will be a display failure.

5.2 Transfer calculated results

After the calculation, [X0] [Y0] or [Z0] and the calculated results transfer to axis X, Y or Z respectively **(values exceed the display limit cannot be transferred)**; Under the function of calculator, press [X] [Y] [Z] to transfer the displayed values

on the windows of axis X, Y or Z to the calculator.

Chapter VI Internal Parameter Setting

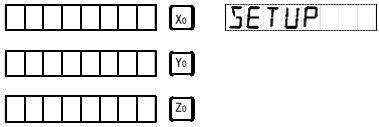
According to the grating ruler installation and actual requirements, set various parameters to realize correct operation.

Settings	Description
SEL TYPE	Set types of digital readouts
DIRECT	Set number counting direction of grating ruler
COM TYPE	Set types of deviation correction
R-D MODE	Set radius/diameter display mode
Z DIAL	Set boring ring values of axis Z
RESOLUTE	Set grating ruler resolution
SDM DIR	Set SDM number setting direction
SLOPMODE	Set the mode of movement steps of slope processing
AXISTYPE	Set axis type
STEPMODE	Set the mode of movement steps of arc processing
ANGLMODE	Set the angle display mode
ANGLTYPE	Set the angle display type
ERROR	Set error function switch
LATHMODE	Set lathe mode
DSP LEVE	Set brightness level
CLR ALL	General system clearing
QUIT	Exit system setting

Note: Only exit SETUP through QUIT can the data modified be effective (Except general system clearing). If the device is turned off or the power is off during the setting procedure, one needs to set it again.

6.1 Enter/Exit Internal Parameter Setting

During the 1 second of start-up, press the "ENT" key and the sub-window displays 'SETUP' to enter internal parameter setting. Press [⇧] or [⇩] to select parameters to be set.

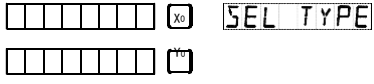


When parameter setting is done, hold [⇧] or [⇩] until the sub-window displays 'QUIT', press the "ENT" key to exit and save internal parameter setting. press "AC" key to exit without saving internal parameter setting.

6.2 Set types of Digital Readouts (SEL TYPE)

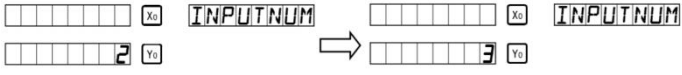
Because Jcgs® two-axis digital readouts and three-axis digital readouts share the software and they have a little difference in functions. Therefore, the types digital readouts shall be set before ex-factory. Only two-axis digital readouts and three-axis digital readouts are differentiated. General system clearing does not influence the setting of readouts type.

1) When entering the state of setting, the sub-window shows 'SEL TYPE'.



2) Press "ENT" key , the window of axis Y shows '2' or '3'. '2' refers to two-axis digital readouts (2AE,3AE). '3' refers to three-axis digital readouts(2AE,3AE).

3) Press [2] or [3] to change the types of digital readouts.



4) Press "ENT" key, save the new setting and exit this setting. Press "AC" key, the new setting is not saved and exit this setting.

6.3 Set Number Counting Direction of Grating Ruler (DIRECT)

After installing the grating ruler, the actual counting direction may be different from the user's expectation. This problem can be solved through internal setting.

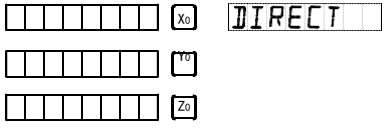
The number counting directions of grating ruler is set by installation personnel and the user shall not change them.

The ex-factory default values: 0

Example: Set the number counting direction as 1.

Operation Procedures:

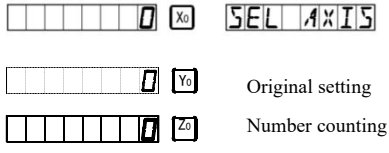
1) At the setting state, [⇧] or [⇩] until the sub-window displays 'DIRECT'.



2) Press "ENT" key to enter number counting direction setting;

The sub-window displays 'SEL AXIS' which shows the next step is axis selection.

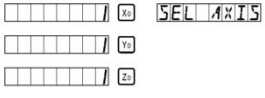
Window X, Y and Z display the original settings of axis counting direction '0' or '1' respectively ('0' and '1' shows reverse counting direction).



Original setting

Number counting direction of the axes

3) Select the axes, press [X], [Y], [Z],change the counting directions of the axes respectively.



4) Press "ENT" key to confirm the new direction setting and exit this setting;
Press "AC" key to exit the direction setting without changing the setting.

6.4 Set Types of Deviation Correction (COMTYPE)

Definition:

Linear and nonlinear deviation:

There is a deviation between the measured value and standard value of the grating ruler. Suppose the shapes of the two measured curves in the scope of the grating ruler are completely in line but not coincided, it is called linear deviation. If the shapes of the curves are not the same, it is called nonlinear deviation.

Linear correction: Compensate for linear deviation and make the displayed value equal to the standard value.

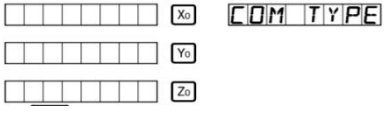
Note: The linear deviation correction values are set by the installation personnel and the user shall not modify, otherwise the measurement accuracy will be influenced.

Deviation correction has two types of settings: 1. Linear deviation correction; 2. Nonlinear deviation correction.

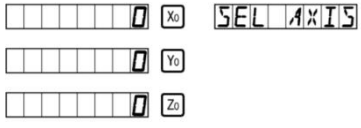
Example: Set the correction ways of axis X as nonlinear deviation correction.

Operation Procedures:

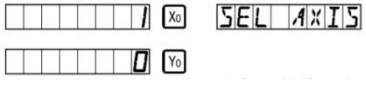
1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'COM TYPE'.

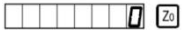


2) Press "ENT" key and the windows of X,Y, Z display '0'or '1' respectively. '0' refers to linear compensation mode. '1' refers to nonlinear compensation mode. The sub-window displays 'SEL AXIS' and it means the next step is axis selection.



3) Select the axes. press X, Y, Z, change the correction types of the axes respectively.





Change axis X correction type.

4) Press "ENT" key to confirm the new direction setting and exit this setting;
Press "AC" key to exit the direction setting without changing the setting.

6.5 Set Radius/Diameter Display Mode (R-D MODE)

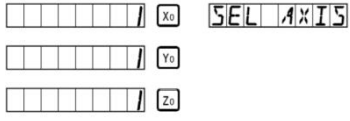
Ex-factory default value: Radius mode

Example: Set as diameter mode

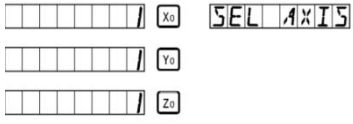
Operation Procedure:

1) Under the state of setting, hold [⇧] or [⇩] until the sub-window displays 'R-DMODE';

2) Press "ENT" key and the windows of X,Y, Z display '0'or '1' respectively. '0' refers to R mode and the displayed value is the actual value. '1' refers to D mode and the displayed value is two times the actual value. The sub-window displays 'SEL AXIS' and it means the next step is axis selection.



3) Select the axes. press [X], [Y], [Z], change the display modes of the axes respectively.



4) Press "ENT" key to confirm the new direction setting and exit this setting;

Press "AC" key to exit the direction setting without changing the setting.

6.6 Set Boring Ring Values of Axis Z (Z DIAL)

If the grating rulers are only installed for axis X and axis Y, when simulating axis Z height, the boring ring values shall be set. There are two ways to set boring ring values of axis Z: 1. Set screw pitch directly referring to the moved distance to the direction of axis z for one circle of the screw; 2. Set screw pitch and associate it with the liner number of the encoder.

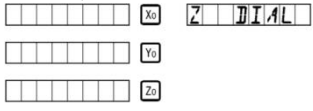
Note: This function is only effective for 3-axis digital readouts.

Ex-factory default value: 2.5mm

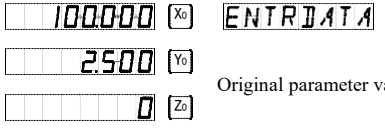
Example: Set the boring ring value as 2.2mm and associated it with 9000-line encoder.

Operation procedures:

1) Under the state of setting, hold [⇧] or [⇩] until the sub-window displays 'Z DIAL';



2) Press "ENT" key and the sub-windows displays 'ENTRDATA'. Window X displays the original encoder lines of axis Z. Window Y displays the original boring ring values of axis Z.



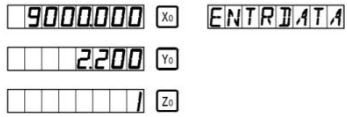
Original parameter values

3) Input encoder lines and boring ring values of Z axis;

Input [X] → [9] → [0] → [0] → [0] → [ENT] successively

Input [Y] → [2] → [·] → [2] → [ENT] successively.

Press [Z], select turn on-0 or turn off-1 the associated encoder lines of screw pitch. If the input is wrong, press "AC" key to input the figure again, if a negative figure is input, it will be treated as its absolute value.



4) Press "ENT" key to confirm the input values and exit the boring ring value setting.

6.7 Set Grating Ruler Resolution (RESOLUTE)

Jcgs ® digital readouts can be connected to 10 resolution ratios of grating rulers. There are nine kinds, 0.1μm, 0.2μm, 0.5μm, 1μm, 2μm, 5μm, 10μm, 20μm and 50μm. After installing the grating rulers, if the resolution ratio is different from the current value, it shall be set again in the digital readouts, otherwise the readings will be incorrect.

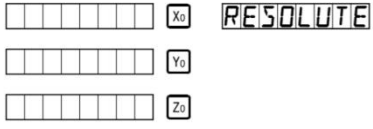
The parameters are set by the installation personnel and the user shall not modify them.

Ex-factory default value: 5μm

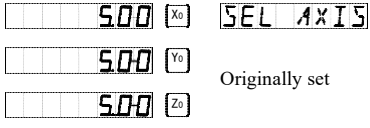
Example: Set all the resolution ratios of axis X, Y and Z as 1μm.

Operation Procedures:

1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'RESOLUTE';



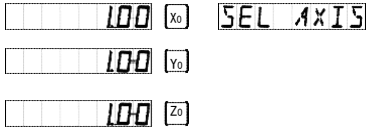
2) Press "ENT" key and the sub-window displays 'SEL AXIS' which means that the next step is axis selection. The windows of X, Y and Z display the original resolution rates of original grating rulers respectively.



Originally set

3) Select the axes. press X, Y, Z, to select axis X, Y or Z to set the resolution ratios respectively and the corresponding axis flashes.

4) Press ⇧ or ⇩ and the figures of 0.10、0.20、0.50、1.00、2.00、5.00、10.00、20.00、50.00 appear circularly. When 1.00 is displayed, press "ENT" key to select this resolution ratio and go back to the axis selection. If modification is to be given up, press "AC" key.



5) After the setting is done, press "ENT" key to exit the resolution setting.

6.8 Set SDM Number Setting Direction (SDM DIR)

Under SDM coordinates, there are 2 kinds of number setting modes:

Mode 0: Common number setting mode. The displayed value equala to input value;

Mode 1: Special number setting mode. The displayed value equals to the opposite number of the input value. It is applicable to coordinate preset according to the marked size of the drawing under SDM Coordinate System.

Ex-factory default value: SDM number setting mode is '0'.

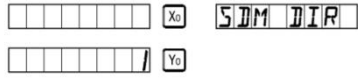
Example: Set SDM number setting value as '1'

Operation Procedures:

1) Under the state of setting, hold [⇧] or [⇩] until the sub-window displays 'SDMDIR';

2) Press "ENT" key and the window Y displays the original number setting mode.

3) Press [1] and set the number setting mode as '1';



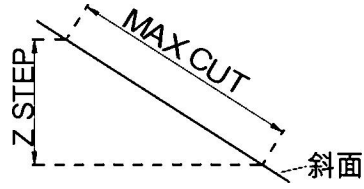
Note: Press [0] and change the number setting mode as 0, or press [⇧] or [⇩] to select.

4) Press "ENT" key to confirm the changed number setting mode and exit this setting;

Press "AC" key to exit the SDM DIR setting and the change made are ineffective.

6.9 Set the Mode of Movement Steps of Slope Processing (SLOPMODE)

When doing the inclined plane processing, there are two ways to set movements steps：



1. Set the movement steps Z STEP of the second axis.

   For XY plane, set movement steps of axis Y; for YZ plane and ZX plane, set movements plane of axis Z.

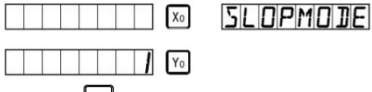
2. Set the slope length MAX CUT for each processing.

   Ex-factory default value: Set the movement steps of the second axis as Z STEP.

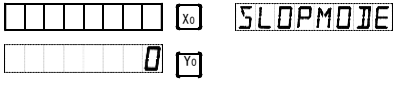
Example: Set the setting mode of slope parameters as MAX CUT

Operation procedures:

1) Under the state of setting, hold [⇧] or [⇩] until the sub-window displays 'SLOPMODE';
2) Press "ENT" key, Window Y displays the original mode. Press [1] and select MAX CUT mode.



Note: Press [0] to select Z STEP mode or press [⇧] or [⇩] to select MAZ CUT mode.



3) Press "ENT" key to confirm the new values and exit this setting;

Press "AC" key to exit the setting without keeping the changed settings.

6.10 Set Axis Type (AXISTYPE)

Jcgs® axes can be connected to grating rulers and rotary encoders. When connected to grating rulers, the distance is displayed. When connected to rotary encoders, angle is displayed

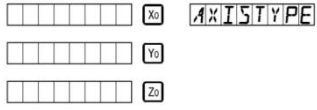
Ex-factory default value:

Installing grating rulers

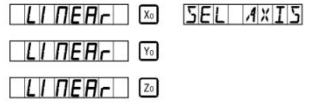
Examples: Set axis Z to install rotary encoder.

Operation Procedures:

1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'AXISTYPE'.

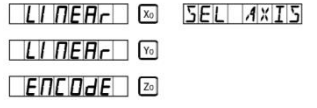


2) Press "ENT" key, Sub-window displays 'SEL AXIS' which means that the next step is axis selection. The windows of X, Y and Z display the original interface type. 'LINEA' refers to connecting to grating rulers. 'ENCODE' refers to connecting to rotary encoder.



3) Set axis Z as rotary encoder.

Press X, Y, Z, change the interface types of the corresponding axis;



4) Press "ENT" key to confirm the new values and exit this setting;

Press "AC" key to exit the setting without keeping the changed settings.

6.11 Set the Mode of Movement Steps of Arc Processing (STEPMODE)

When doing arc processing for YZ or ZX planes, Jcgs® can select the mode of movement steps of arc processing.

Ex-factory default value:

Movement steps of axis Z.

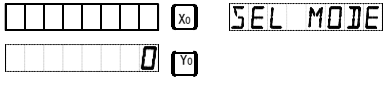
Example: Set as movement steps of arc length.

Operation Procedure:

1) Under the state of setting, hold [⇧] or [⇩] until the sub-window displays 'STEPMODE';

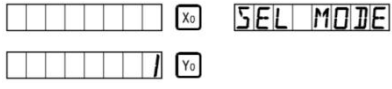
,

2) Press "ENT" key and the sub-window displays 'SEL MODE' which means the next step is the mode of movement step selection. Window Y displays the original setting. '0' refers to the movement steps of axis Z. '1' refers to the movement steps of arc length.



3） Set movement steps of arc length.

Press [1] and window Y displays the changed mode;



4）Press "ENT" key to confirm the new values and exit this setting;

Press "AC" key to exit the setting without keeping the changed settings.

6.12 Set the Angle Display Mode (ANGLMODE)

Jcgs® has three angle display modes.

- MODE1 displays 0°-360°;
- MODE2 displays -360°-360°;
- MODE3 displays -180 °-180°;

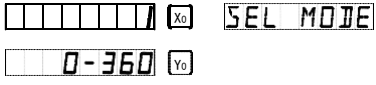
Ex-factory default value: MODE1

Example: Set the angle display mode as mode 2

Operation procedures:

1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'ANGLMODE'

2) Press "ENT" key and the window X displays the original setting. The sub-window displays 'SEL MODE' which means the next step is the mode of angle display mode.
Axis Y shows the display mode 1 displays 0° -360 ° .



3) Set the angle display mode as mode 2.
Press 2 and the window X shows the changed mode;
Axis Y shows the display mode 2 displays -360 °-360°.

4) Press "ENT" key to confirm the new values and exit this setting;
Press "AC" key to exit the setting without keeping the changed settings.

6.13 Set the Angle Display Type (ANGLTYPE)

Jcgs® has two angle display types.

- TYPE 0: Refer to the angle display is percentile.
- TYPE 1: Refer to the angle display is degree, minute and second.

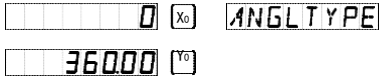
The ex-factory default value:

Type 0.

Example: Set angle display type as degree, minute and second.

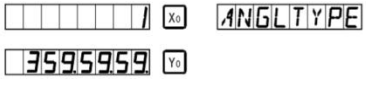
Operation procedures:

1) Under the state of setting, hold [⇧] or [⇩] until the sub-window displays 'ANGLTYPE';
2) Press "ENT" key, window Y displays original angle type, percentile (For example, 359° 59'). Window X shows the original setting.



3) Set the angle type as type 1.

Press [1], window Y shows the current type is degree, minute and second (For example 359° 59'59'')



Note: or press [⇧] or [⇩] to select angle display type.

4) Press "ENT" key to confirm the new values and exit this setting;
   Press "AC" key to exit the setting without keeping the changed setting

6.14 Set Error Function Switch (ERROR)

Jcgs® digital readouts have error inspection function (which shall be used with specific grating rulers or magnetic grating rulers). When the grating rulers or magnetic grating rulers are broken, installed wrongly or have figures missing, the digital readouts will blow and the main window of the corresponding axis will display 'ERROR'.

1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays ‘ERROR’; press "ENT" key to get into the setting. Press corresponding axis selection key to turn on or turn off this function. ‘0’ is turning off and ‘1’ is turning on.

6.15 Set lathe mode (LATHMODE)

Lathe mode 0: turn off lathe mode;

Lathe mode 1: Axis X display value = Axis X display value + Axis Y display value;

Lathe mode 2: Axis X display value = Axis X display value + Axis Z display value;

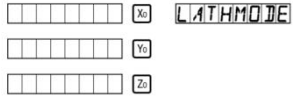
Lathe mode 3: Axis Y display value = Axis Y display value + Axis Z display value;

Ex-factory default value: Turn off lathe mode.

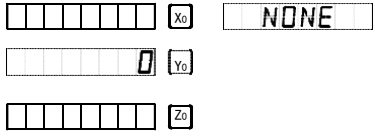
Example: Set the lathe mode as 3.

Operation procedures:

1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'LATHMODE";



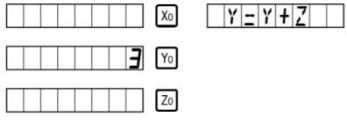
2) Press "ENT" key ,window Y display original lathe mode.



3) Set new lathe mode

Press 0, 1, or 2 to change the lathe mode. (In this example, the lathe mode is changed to 1).

Or press ⇧ or ⇩ to select lathe mode.



4) Press "ENT" key to confirm the changed mode and exit.

6.16 Set Brightness Level (DSP LEVE)

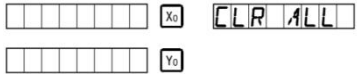
The brightness of digital tube can be adjusted according to the user's actual environment. It is divided into grade 0-7.
Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'DSP LEVE'; press "ENT" key to get into the setting, press ⇧ or ⇩ can shift the grades of brightness.

6.17 General System Clearing (CLRALL)

Clear all data except linear compensation and installed grating ruler number and set up parameters automatically. After general system clearing, the former data can not be resumed. The initial password for general system clearing: 4321

Operation Procedures:

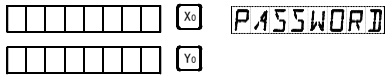
1) Under the state of setting, hold ⇧ or ⇩ until the sub-window displays 'CLR ALL';



2) Press "ENT" key and the sub-window displays 'password', the operator shall enter the password to do general system clearing. At this moment, there are two options:

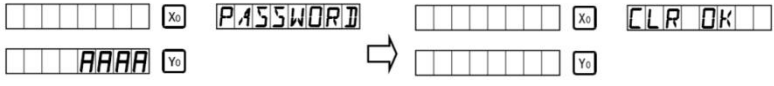
①Press "AC" key to exit general system clearing;

②Input correct password to do general system clearing.



3) Input the password

Enter the correct password and do the general system clearing. Window Y displays the password digits.



After clearing, return to the main menu.

Default parameters after general system clearing:

- Grating scale counting method. The counting value is added when A-phase signal is over B-phase signal;
- Compensation way: linear compensation;
- R/D mode selects R (Radius) mode;
- Boring ring value of axis Z = 2.5mm;
- Resolution ratio = 5μm;
- Under SDM, the number setting mode is '0'. Display value = input value;
- Slope processing setting is: movement steps of axis Z;
- Lathe function is off;
- Number axis type: grating ruler;
- Angle display mode is mode 1: 0-360°;
- Angle display type is 0: Percentile;
- Arc processing uses movement steps of axis Z;
- Error inspection function is turned off.

Note: General system clearing does not influence type setting of digital readouts. The original selection is 3-axis or 2-axis. After general system clearing it is still the original setting.

CHAPTER VII Linear Deviation Correction

There is a deviation between the measured value and standard value of the grating ruler. Suppose the shapes of the two measured curves in the scope of the grating ruler are completely in line but not coincided, it is called linear deviation.

Linear correction: Compensate for linear deviation and make the displayed value equal to the standard value.

Note: Linear correction values are set by the installation personnel. The user shall not modify it. Otherwise the measurement accuracy will be influenced.

Step 1: Get into internal parameters of digital readouts. The deviation correction type is 0 (linear compensation mode). (The specific setting methods refer to section‘6.4’.

Step 2: Get into linear deviation compensation system. There are two ways for setting:

1. According to the standard value and digital displayed value, calculate correction coefficient based on the formula;

2. Move the grating ruler to the standard value (The value must be the integral multiple of 10mm). After confirming the current position, the system calculates the compensation coefficient.

Example: Install standard measurement equipment (such as block gauge, laser etc.) Move the corresponding grating rulers on the work platform to standard measurement 1000mm. At this moment, the displayed value of digital readouts is 999.98mm.

Way 1: Input manually into the correction system and calculate according to the following formulas: Correction coefficient: S =(L-L')/(L/1000) mm/m

L---actual measured length, unit: mm

L'--- Displayed value of the digital readout, unit:mm

S---Correction coefficient mm/m, ‘+’ refers to increase and ‘-‘ refers to decrease.

The compensation range is: -1.500 mm/m~+1.500 mm/m

The actual measured length of the work platform is 1000 while the

displayed value of digital readouts is 999.98.

S=(1000-999.98)/(1000/1000)=0.02 mm/m

After getting the correction coefficient, press corresponding axis key, press "mm/inch" key to enter the setting interface, input the correction coefficient and confirm to complete it.

Way 2: Automatic calculation correction system

1. Long press corresponding axis selection key until 'LIN COMP' displayed and the axis flashes;
2. Move the corresponding grating rulers on the work platform to standard measurement 1000mm. At this moment, the displayed value of digital readouts is 999.98mm;
3. Press "ENT" key to complete the deviation correction.

Chapter VIII Debugging

The following table lists debugging ways. If the problems can not be solved, please do not dismantle the digital readouts to avoid electric shock. Please contact the company or the agencies for help.

Faults	Possible reasons	Debugging ways
Pressing single key is not effective	1: The single key is broken 2: System memory disorder	1: Change the keyboard 2: Do general system clearing
The digital readouts do not display	1: Power supply is not connected 2: The fuse is damaged 3: Poor connection of 220V power supply 4: Whether the power and voltage is suitable	1: Get power supply 2: Change fuse of the same type 3: The power plug shall be fine 4: Whether the input voltage is 100V~240V
The shell of the digital readouts are electriferous	1: Poor grounding of the lathe and the digital readouts 2: 220V power leakage	1: The lathe shell and the digital readouts shall be grounding well 2: Check 220V power supply
The display value of an axis is twice the normal value	1: The setting of the resolution ratio of grating ruler is not correct 2: An axis is set as diameter display mode	1: Set correct resolution ratio 2: Set radius display mode
Digital readouts-axis does not count	1: Bad contact of grating ruler 2: No output signal from the grating ruler 3: The counting function of the axis is broken	Shift with another grating ruler to see if counting is normal. If the counting is normal, the grating ruler is broken. If not, the digital readouts has defaults.
The display values of Window X, Y or Z is in a mess	1: System memory disorder 2: The grating ruler is broken. There is figures missing	1: Do general system clearing 2: Repair or change the grating ruler
All keys are ineffective	1: System memory disorder 2：Keys have short circuit	1: Change new keyboard do general system clearing 2: Change keyboard