ANOTRONIC™

PC-Based EDM System

CNC Operation Manual

ANOTRONIC LTD.™

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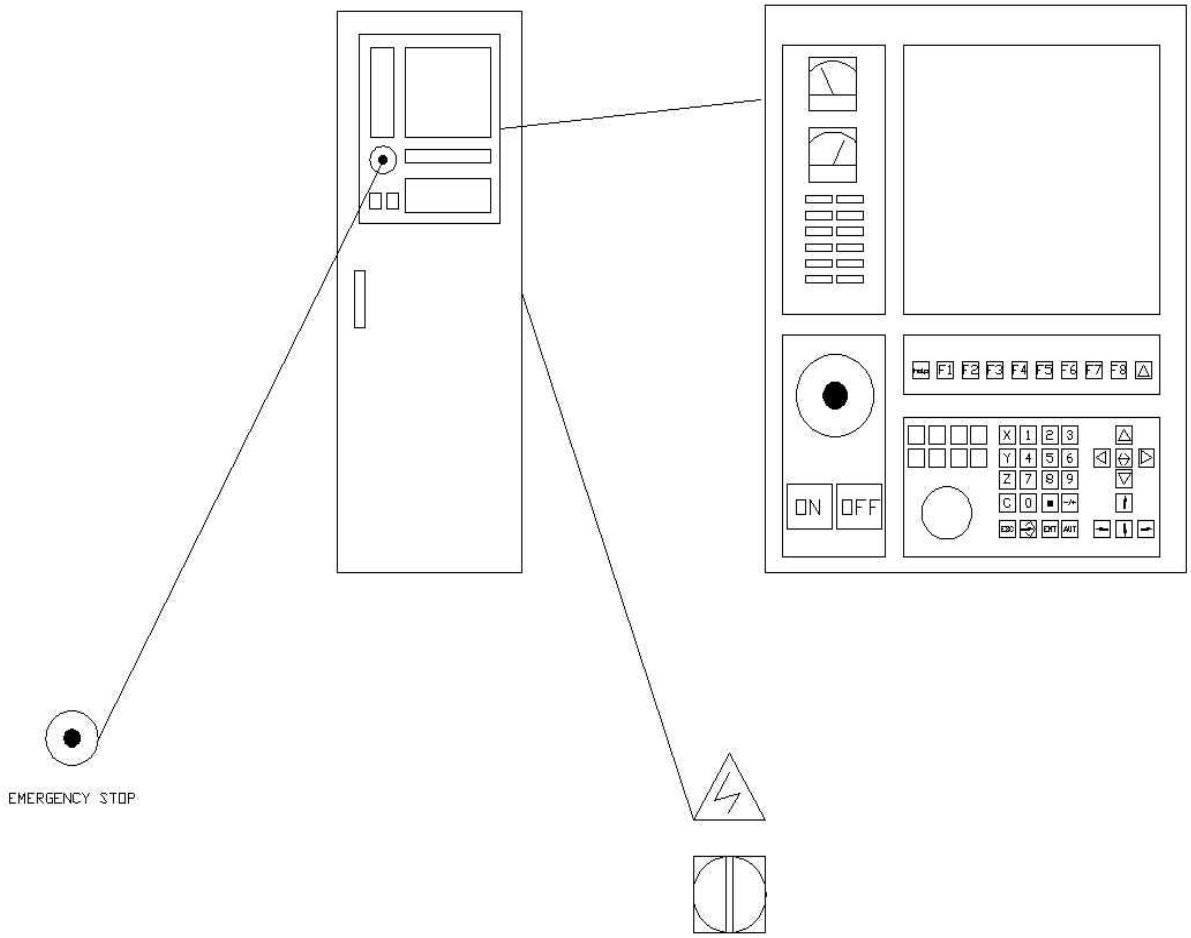
PC-BASE EDM SYSTEM

Installation Information

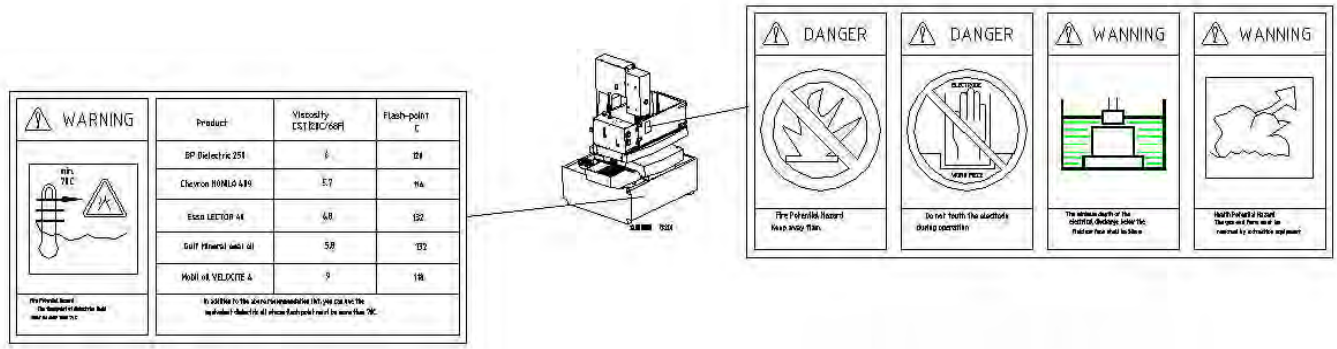
CHAPTER 1 EDM SPARKING SAFETY DESCRIPTION

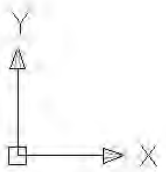
1-1 GENERATOR CABINET SAFETY SYMBOL POSITION

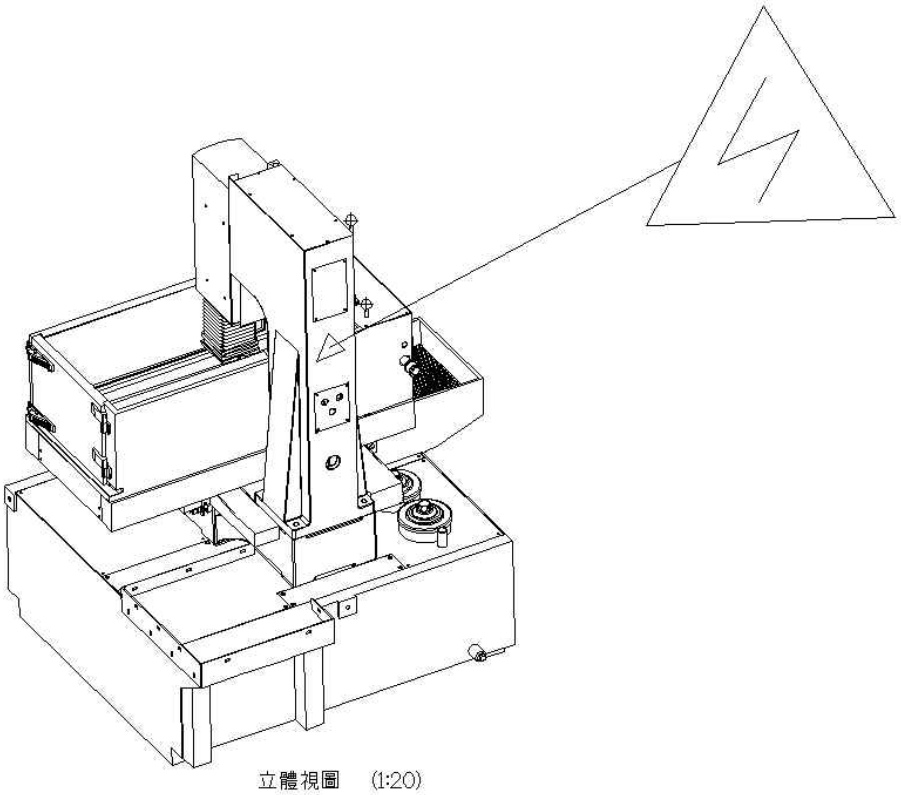


1. EMERGENCY STOP IS A YELLOW BOTTON WITH RED TOP FOR EMERGENCY SHUT DOWN.
2. ALWAYS TURN OFF THE MASTER POWER CONTROL SWITCH FOR SAFETY ASSURANCE BEFORE MAINTENANCE.

1-2 MACHINE SAFETY SYMBOL POSITION







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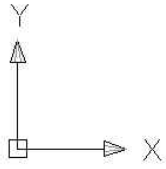


1-3 NOTICES FOR SAFETY OPERATION

Accident caused by abnormal operation and machine malfunction in case, always keep an eye on safety notices to protect damage and injury from machine and operator.

Machine have equipped many devices to protect human and machine safety, but over rely on those safety devices is a main cause result in accident also, never ignore safety check before working and watch below notices.

SAFETY NOTICE:

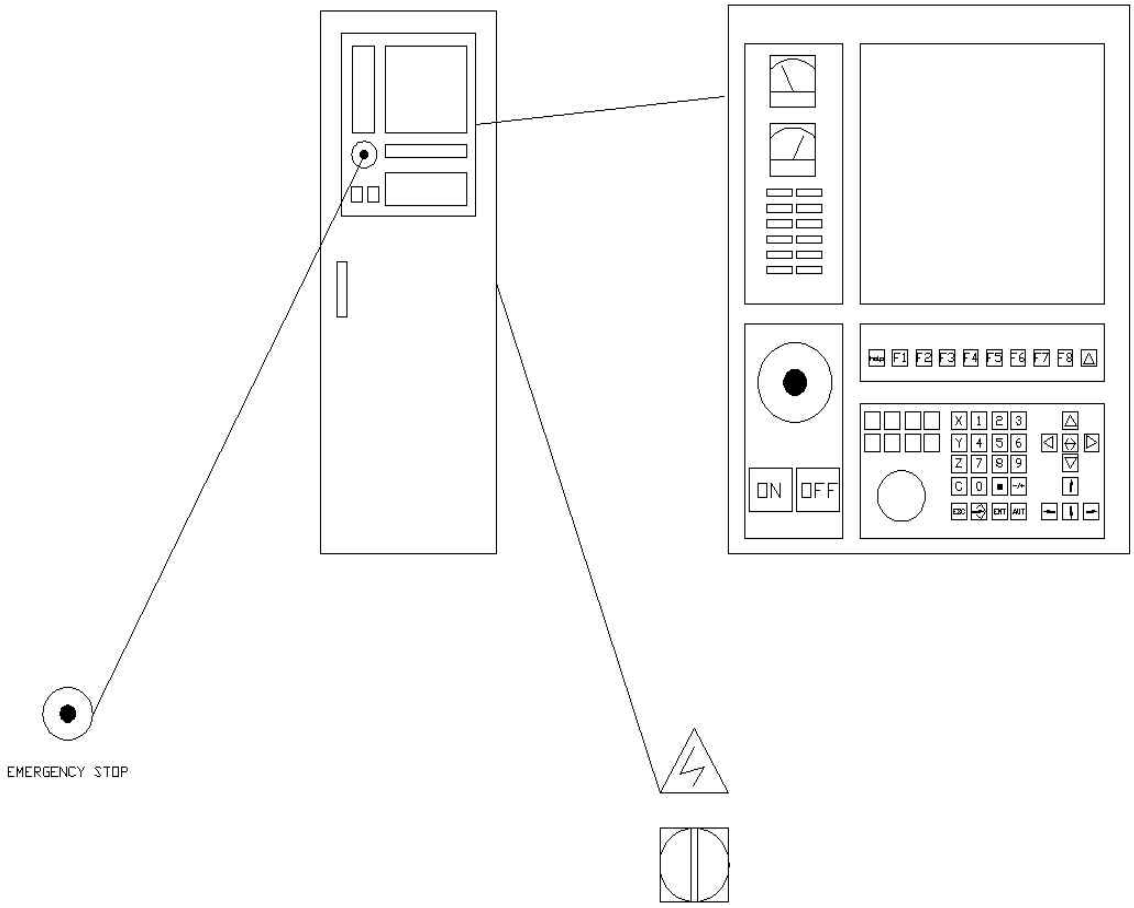
1. Always use EDM dielectric fluid, fluid flash point must higher then 72°C.
2. Smoke expel device is necessary during sparking, collecting smoke with proper handle or disposed to outdoor by factory exhaust system, the fume extraction pipe must cover top of full work tank, the evaporated fume and mist may cause human injury.
3. Belt on top machine may broken, please inform local agent check belt tensile every 6 month or 4500 working hours to prevent Z axis slide down from hurting people, spindle should be supported by a wooden bar during replace gear belt to avoid sliding.
4. Turn off the main power before change filters.
5. Dielectric fluid will injure skin, please wear oil-proof gloves, skin may hurt if touch dielectric fluid for a long time, skin cleaning is necessary if touch fluid.
6. SERIOUS WARING! There is dangerous voltage could cause people death during sparking. Prevent touch any part below isolated plate which including electrode strictly.
7. Be careful with flame during sparking.
8. Do not put the fingers into the space between upper, center and foundation base to avoid injury when X, Y move to limit.
9. Be careful fingers clipped when open the work tank door to the limit.
10. Dielectric fluid burning to damage property and life caused by touch of spark, dielectric and air make temperature upgrading while sparking without dielectric submerged, therefore, prevent sparking without dielectric submerged strictly, and dielectric fluid level must 40mm higher then work piece.
11. There is a fire extinguisher above the work tank, when abnormal spark occur machine will stop, buzzer will beeping and the FIRE MONITOR red indicator light on. Please check if dielectric fluid distortions reduce the flash point or sparking without dielectric fluid.
12. Arcing caused by bad chips expelling while sparking, electrode driven up by feedback signal over dielectric level, arc will ignite dielectric fluid, therefore, always turn on the arcing supervising switch while eroding.
13. Dielectric fluid overheats or too low will cause flame easily.
14. Shut down generator cabinet and exhaust device, and put out fire when fire alarm occur. If machine equipped with auto fire extinguisher, work area will lack of oxygen after extinguisher executing.
15. Never mix with another low flash point, high stickiness oil, and those materials will make dielectric fluid distortion and influence sparking speed, rubbish removal, result in arcing during fine eroding due to difficult chips removing specially.
16. Sparking must be executed under operator watching.

17. Special notices for flushing eroding are that operator supervising, dielectric fluid flash point higher than 72°C, efficient dielectric fluid flowing and fire extinguisher ready.
18. There is some dielectric fluid on work table surface make it slippery, never stand on top of it.
19. Power PE ground wire must be connected well to avoid electrical shock.
20. If there were crack either on the power cable or cable between generator cabinet and machine structure might cause electrical shock, please asking help from local agent to get away from such potential dangerous.
21. Sensors might out of order occasionally, always check their functions before operation.
22. No smoking allowed in the working area to prevent gas and smoke from burning.
23. Electrode and work piece are hot after and under working, never touch without insulated grove to prevent a burn.
24. Pay attention when install electrode and work piece, operator might hurt by squeezing or cutting.
25. Cooling fan inside generator cabinet always turning after power on, never put fingers into it.
26. Electricity exists inside machine structure and generator cabinet, never open cover plates to prevent electrical shock.
27. There is electricity remains inside capacitor even the power off, be careful of electrical shock.
28. Turn off power before open generator cabinet backside junction box to prevent electrical shock.
29. Never remove E and PE wires inside machine structure and generator cabinet to prevent electrical shock.
30. Never touch electrode during eroding to prevent electrical shock.
31. Hanging “NO SMOKING” and “PAY ATTENTION TO FIRE” symbols surround the machine 2 meters, and put necessary fire extinguishing devices in the suitable place.
32. Never put flammable materials into work tank.
33. PVC nozzles and rubber pipes can not put above the electrode to prevent fire igniting.
34. Turn off main power and generator cabinet power when open generator cabinet to prevent electricity shock.
35. Check on three-phase power terminal connect well, any phase will result in shortage of voltage.
36. Always check dielectric fluid level inside tank, inefficient dielectric fluid might result in fire disaster which caused by air pump into pipe and stock dielectric flowing.
37. Always check safety devices before operation, such as fire detector and dielectric level detector.
38. Waste materials after EDM process (waste dielectric fluid, mud, grease, filter and parts) shall look for specialist to clean according to local regulation.

1-4 SAFETY OPERATION FOR OPERATOR AND WORK SITE

1. Machine surrounding should be cleaned, keep away from leaking oil and chips.
2. Exhaust device is necessary in order to collect or expel smoke outdoor.
3. Operator should always wear protect goggles and safety shoes to avoid squeezing and sliding injury.
4. Operator should wear safety shoes during upload and download work piece from work table, be careful of work piece dropping.

1-5 HOW TO SHUT DOWN MACHINE



1. EMERGENCY STOP: During sparking or machine stand by, this button (emergency stop) always efficient to stop power and function completely.
2. MAIN-POWER-SWITCH: Position “ON” is power on, “OFF” is power off.
3. OFF BUTTON: Press the button will cut off main power and all functions.

1-6 SAFETY PREPARATION BEFORE OPERATE EDM

1. PREVIOUS INSPECTION BEFORE OPERATION

a. Make sure work piece fixed on work table well and correctly.
b. Make sure electrode cable stick on the electrode head well.
c. Check is there work table travel abnormal?
1) Make sure lubrication well after power on, pull the rod of oil pouring device twice then move 3 axes full travel.
2) Make sure no obstacles on the work table motion way.

d. CHECK FLUSH MODE SET UP WELL
1) Avoiding flushing coolant only while sparking.
2) Make sure flushing nozzle will not interfere with work piece and electrode.
3) Avoiding dielectric fluid level lower than sparking point.

2. PREVIOUS INSPECTION BEFORE SPARKING

a. Check dielectric fluid level is suitable.
b. Check dielectric fluid.
1) Check dielectric fluid pollution situation.
2) Dielectric fluid turbid and become white color means fluid quantity shortage.
3) Is there filter stocked result in low fluid flowing capacity?
c. Check is there dielectric fluid unexpected descending.
1) Check the door of work tank locked well.
2) Check door seal if hardened and damaged.
d. Check valid date of the fire extinguisher.

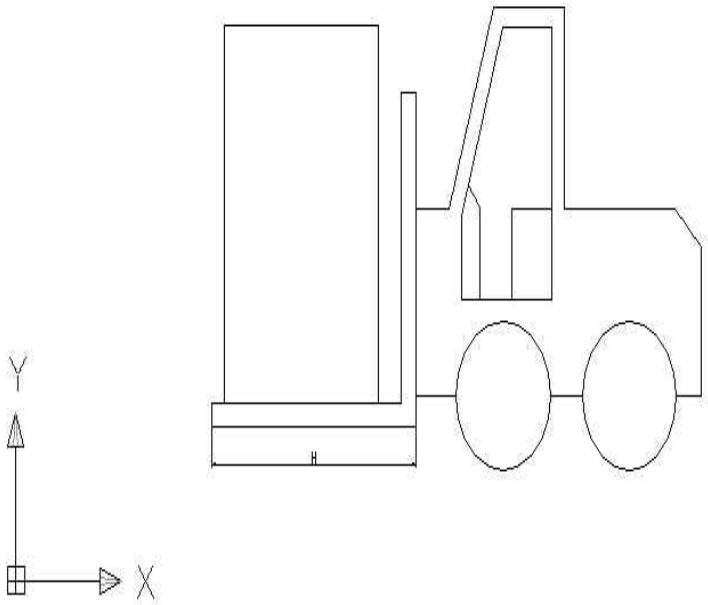
3. INSPECTION DURING SPARKING

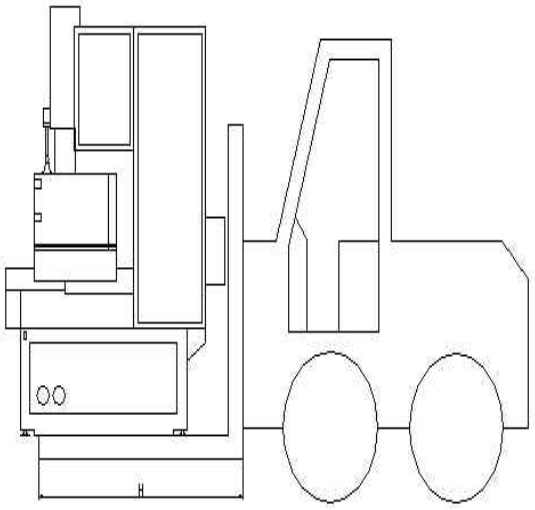
a. Check is there any leakage on the fluid flushing pipe.
b. Check dielectric fluid flushing pressure is setting suitable.
c. Check sparking conditions are setting suitable.
d. Check dielectric fluid temperature is normal.
e. Necessary inspection while doing non-people working.
1) Is sparking steady?
2) Is flushing pressure normal?
3) Is the dielectric fluid level steady?
4) Is the dielectric fluid temperature normal?

CHAPTER 2 EDM INSTALLATION DESCRIPTION

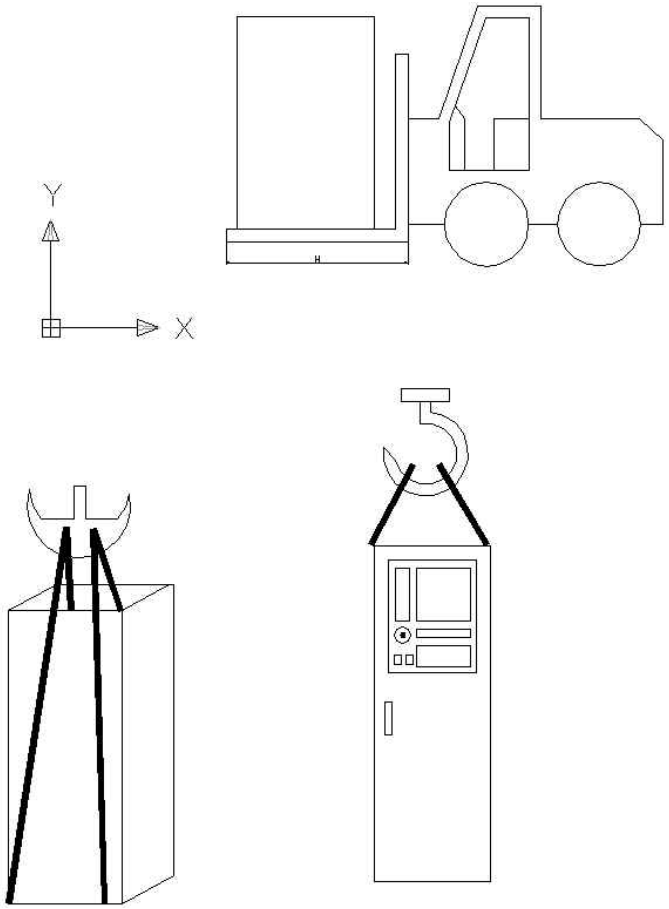
2-1 EDM MACHINE SPECIFICATION AND TRANSPORTATION

2-1.1 LIFTING WOODEN CASE AND MACHINE STRUCTURE VIEWING





2-1 GENERATOR CABINET TRANSPORTATION VIEW



2-2.1 GENERATOR CABINET SPECIFICATIONS

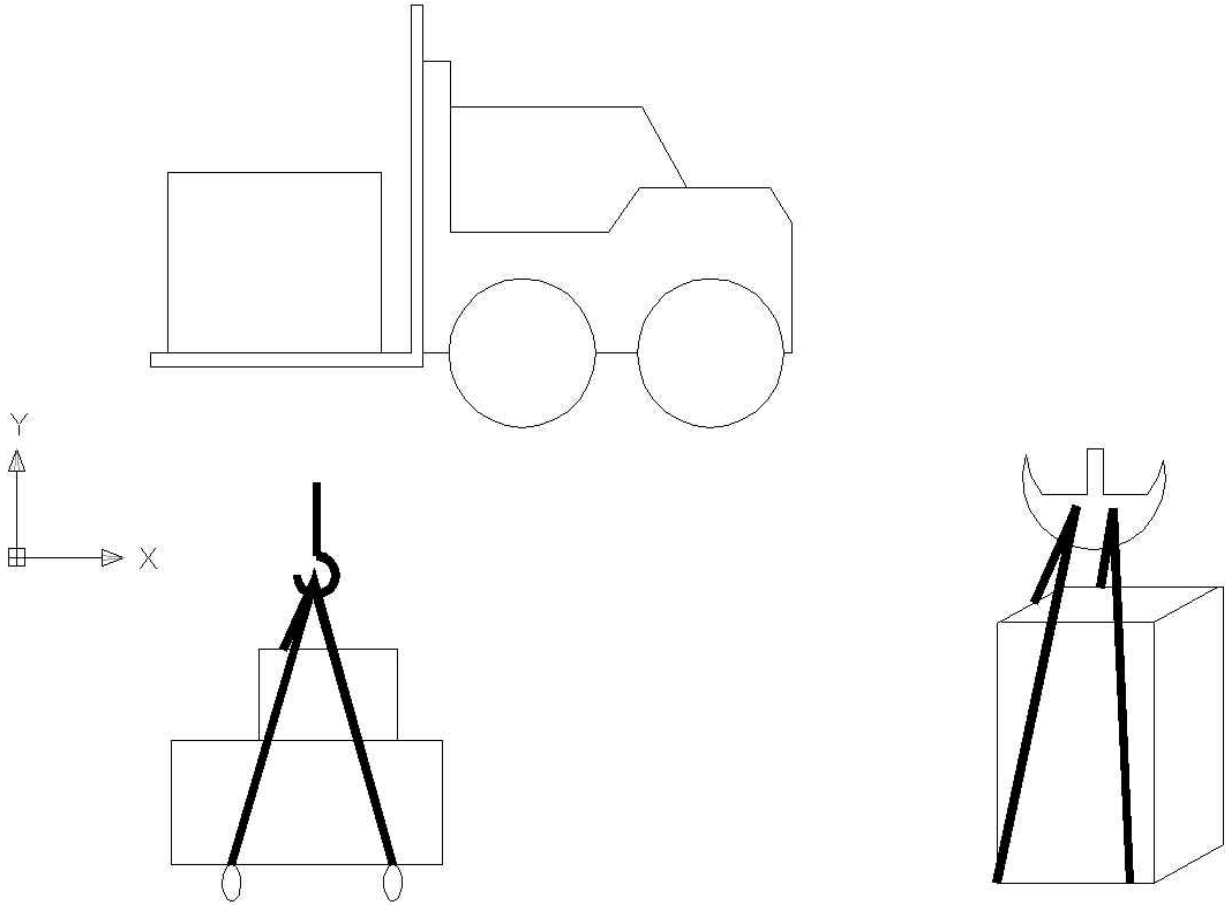
MODEL	LENGH CM	WIDTH CM	HIGH CM	WEIGHT
60A	80	56	180	
120A	105	56	180	
180A	217	56	180	
250A	217	56	180	
300A	217	56	180	

2-2.2 STEEL BELT SPECIFICATIONS

< θ ANGLE	SUPPORT WEIGHT
< θ≦45°	600KG

2-2.3 Lifting the wooden cast by suitable lifter, use steel belts hangs the machine from center of gravity to keep balance, workers have to keep away more than 10 feet from the lifting position, generator gravity is higher, workers have to support it during lifter moving from serious shaking.

2-2 OIL TANK TRANSPORTATION VIEW



2-3.1 OIL TANK SPECIFICATIONS

MODEL	LENGH (MM)	WIDTH (MM)	HIGH (MM)	WEIGH
V-30A	820	500	300	
V-35	1017	640	340	
V-45	1170	690	425	
V-46	1200	690	425	

2-3.2 STEEL BELT SPECIFICATIONS

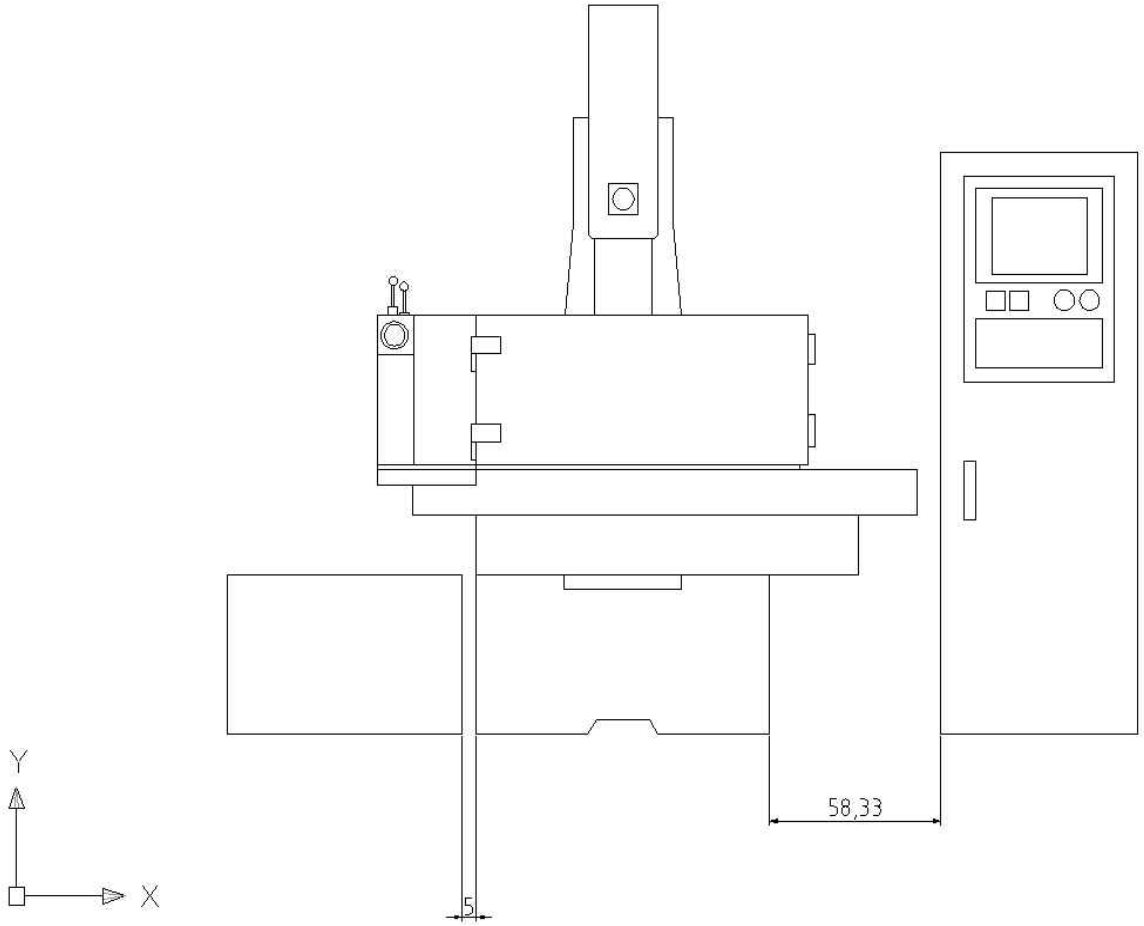
< θ ANGLE	SUPPORT WEIGHT
< θ≦45°	600KG

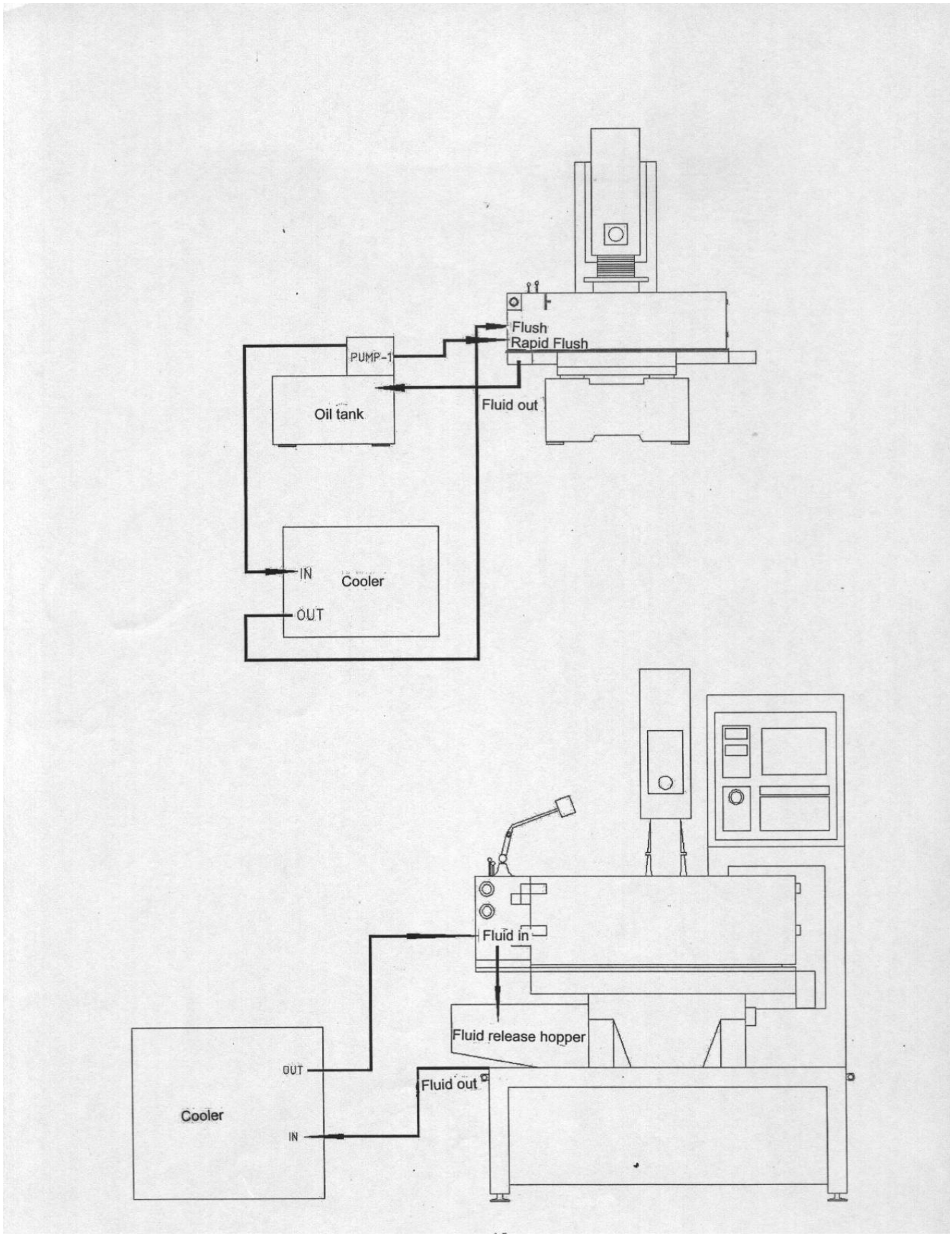
2-3.3 Lifting the wooden cast by suitable lifter, use steel belts hang the machine from center of gravity to keep balance, workers have to keep away more than 10 feet from the lifting position. Oil tank gravity center close to motor position, keeps balance during lifting from machine falling down to damage.

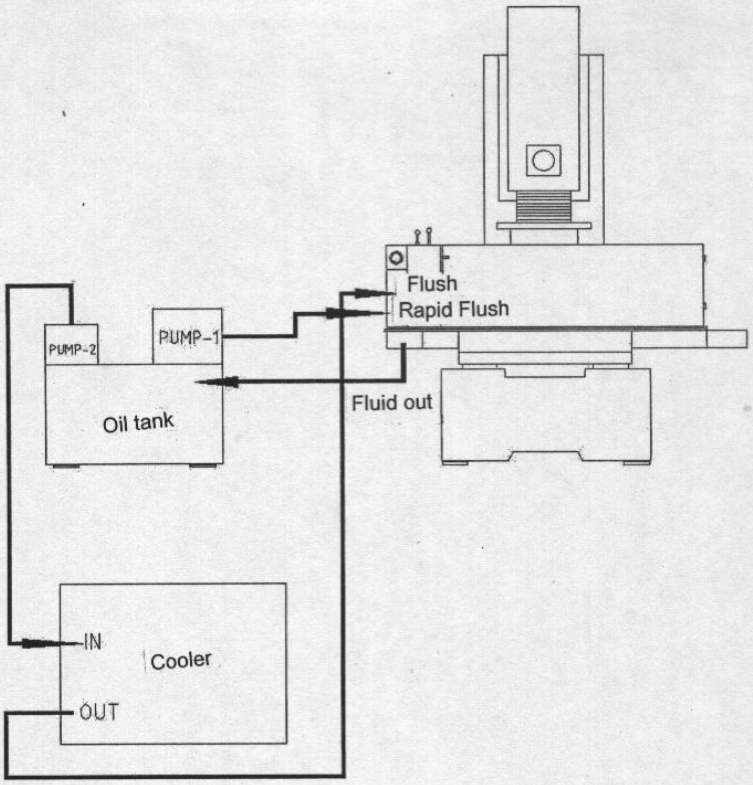
CHAPTER 3 EDM SYSTEM DESCRIPTION

3-1 EDM INSTALLATION AND WIRING DIAGRAM

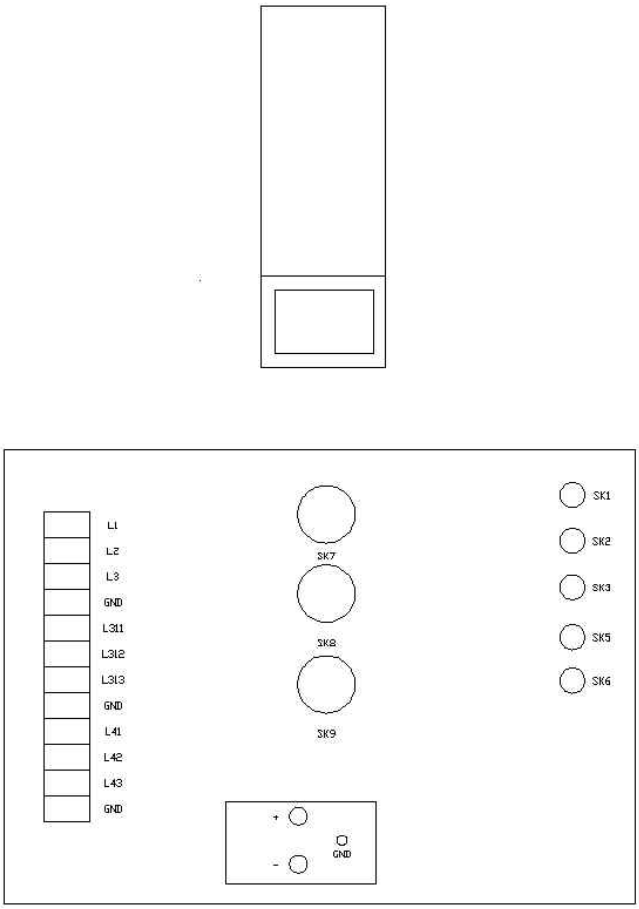
3-1.1 INSTALLATION




Flush
Rapid Flush
PUMP-1
Oil tank
Fluid out
IN
Cooler
OUT
Fluid in
Fluid release hopper
OUT
Fluid out
Cooler
IN


Flush
Rapid Flush
PUMP-2
PUMP-1
Oil tank
Fluid out
IN
Cooler
OUT

3-1.2 WIRING DIAGRAM

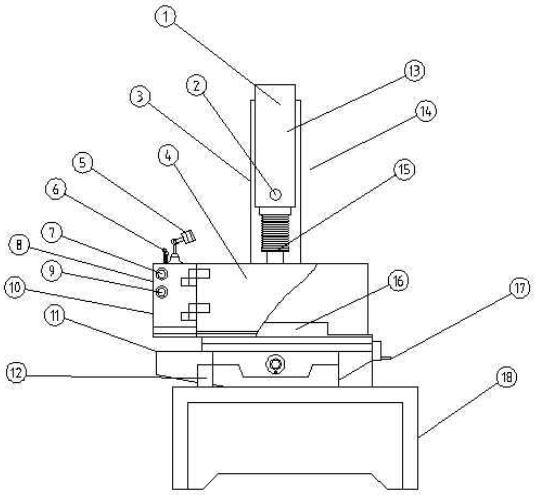


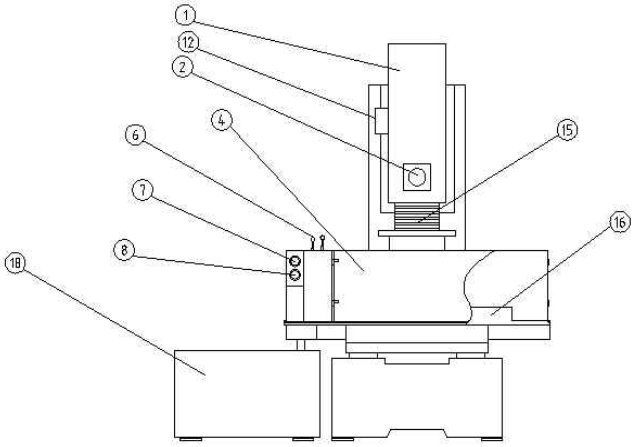
GTB 1: THREE-PHASE POWER INPUT, PUMP POWER OUTPUT, BACKUP POWER

THREE PHASE POWER INPUT	PUMP POWER OUTPUT	BACKUP POWER OUTPUT
L1	L311	L41
L2	L312	L42
L3	L313	L43
GND	GND	GND

1) SK1: X Axis liner scale input connector (D-9 PIN)
2) SK2: Y Axis liner scale input connector (D-9 PIN)
3) SK3: Z Axis liner scale input connector (D-9 PIN)
4) SK4: Backup
5) SK5: Remove control signal connector (D-15 PIN)
6) SK6: Machine safety device signal connector (D-25 PIN)
7) SK7: X Axis limit switch signal, DC servo motor output connector (metal 10 PIN, except ZNC).
8) SK8: Y Axis limit switch signal, DC servo motor output connector (metal 10 PIN, except ZNC).
9) SK9: Z Axis limit switch signal, DC servo motor output connector (metal 10 PIN, except ZNC).
10) SK10: Sparking current output (Electrode cable ”red”+ Ground wires “black”)

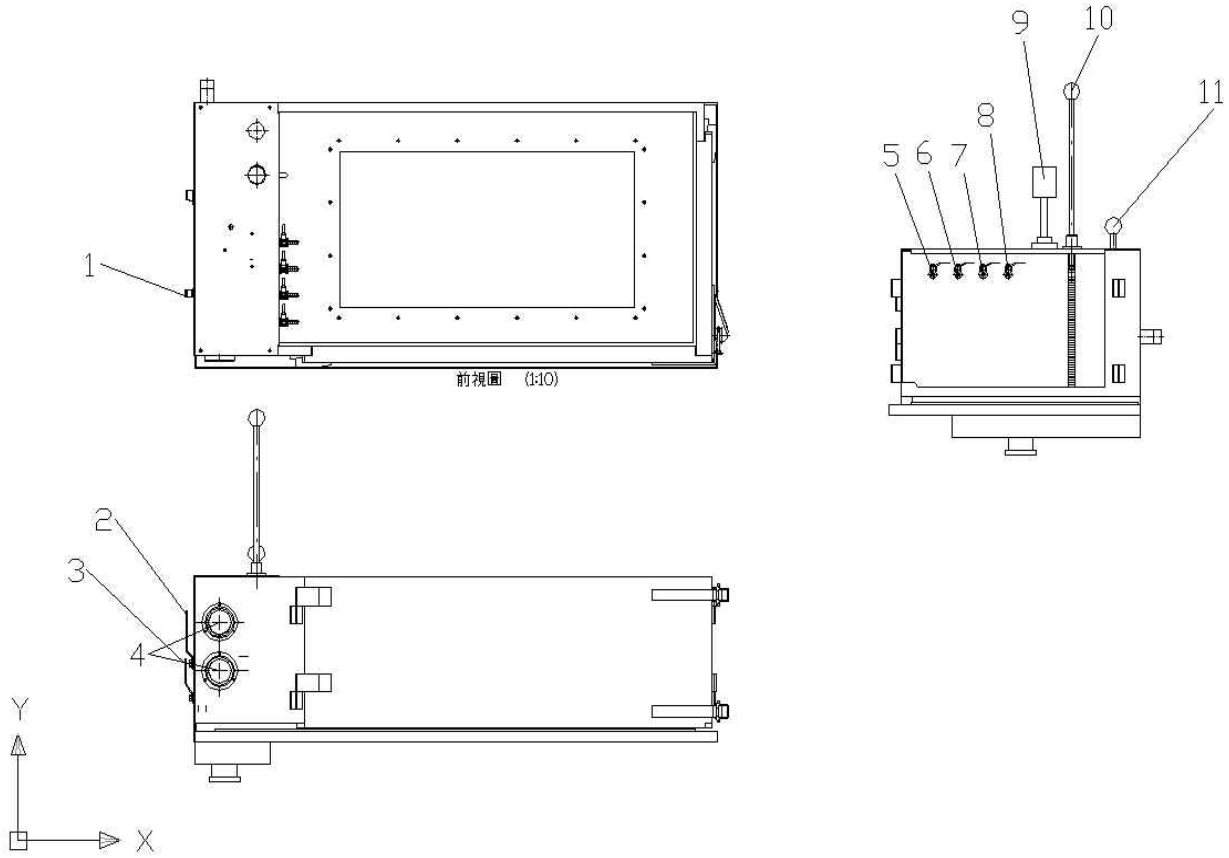
3-1.3 THE MACHINE AND ACCESSORIES





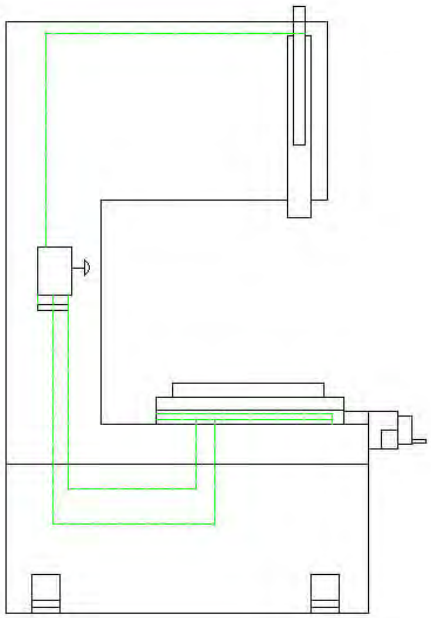
1. SPINDLE: LOGO
2. DIAL INDICATOR
3. COLUMN LEFT SIDE HAND WHEEL
4. WORK TANK
5. WORK LAMP
6. DIELECTRIC FLUID RELEASE VALVE ROD
7. PRESSURE METER
8. DIELECTRIC FLUID PRESSURE VALVE
9. SUCTION PRESSURE METER
10. DIELECTRIC FLUID FLUSHING CONTROL VALVE
11. DIELECTRIC FLUID LEAKAGE TANK
12. LUBRICANT POURING DEVICE
13. SPINDLE: DC SERVO MOTOR PART
14. COLUMN RIGHT SIDE HAND WHEEL
15. ELECTRODE
16. WORK TABLE
17. HAND WHEEL
18. DIELECTRIC FLUID TANK

3-1.4 WORK TANK STRUCTURE

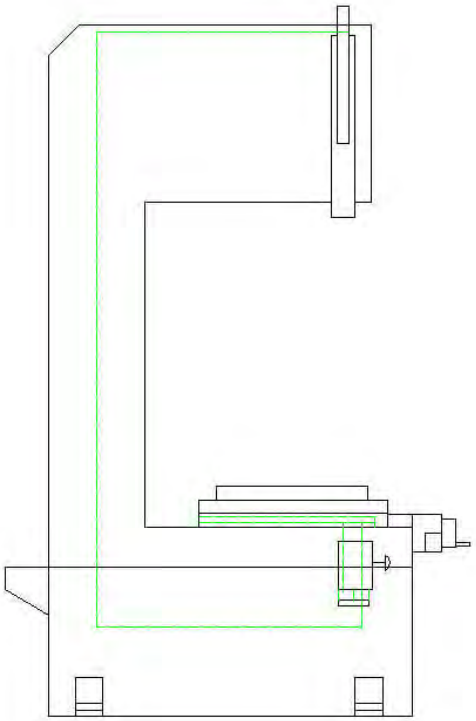


1. WORK TANK FRONT VIEW
2. SUCTION VALVE
3. FLUSHING VALVE
4. PRESSURE METER AND VACUUM METER
5. FLUSHING PIPE
6. FLUSHING PIPE
7. FLUSHING PIPE
8. FLUSHING PIPE
9. WORK LAMP
10. DIELECTRIC FLUID LEVER
11. DIELECTRIC FLUID LEAKAGE LEVER

3-1.5 DIELECTRIC FLUID LEVEL MEASUREMENT

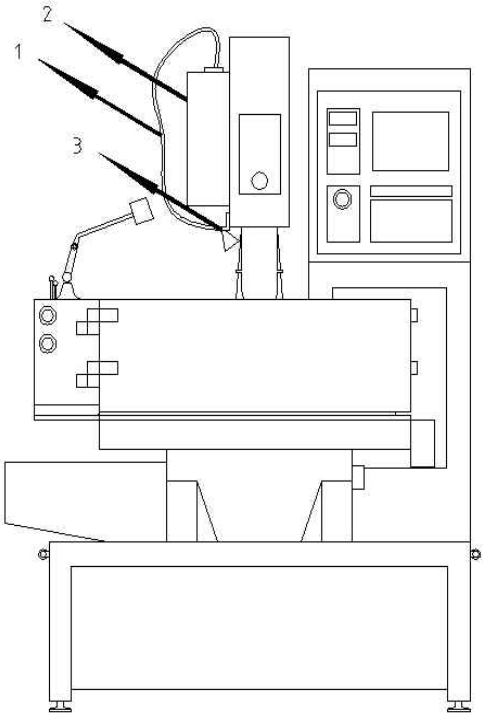


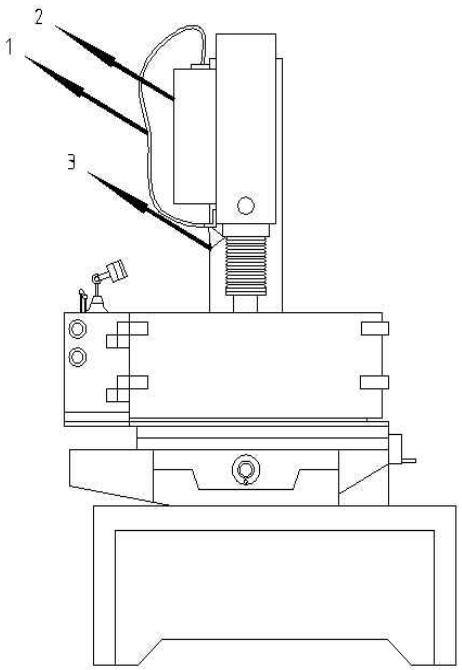
V-35 MODEL



V-45 MODEL

V-30A/V-35 **V-45**

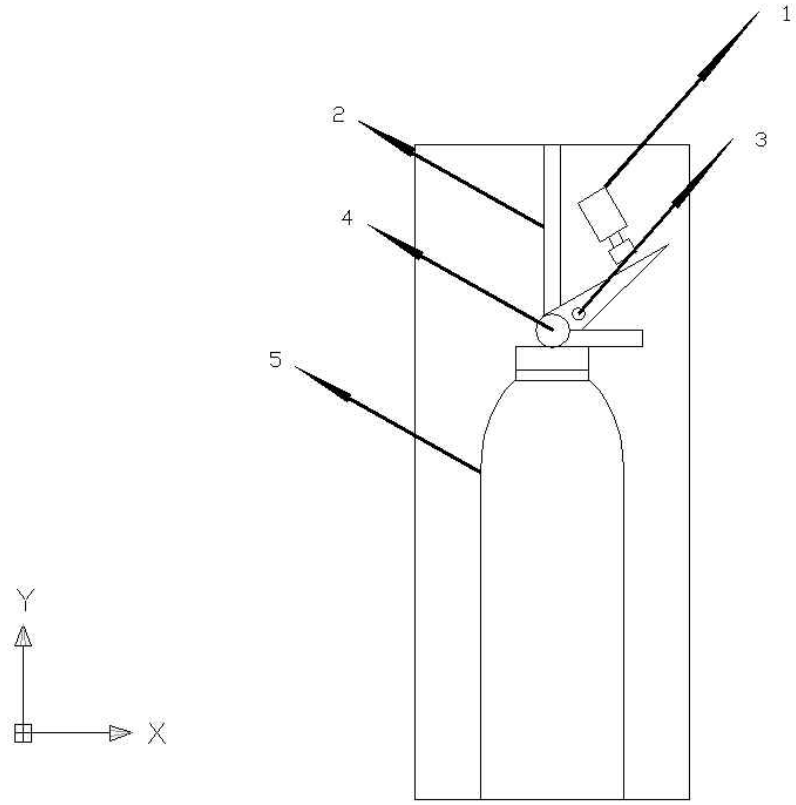




1. Fire extinguisher pipe.
2. Fire extinguisher fixed box.
3. Fire extinguisher spray nozzle

INSTRUCTION:
1. Turn the fire extinguisher spray nozzle to sparking position.
2. IF FIRE OCCURRED
A. Fire Sensor stops EDM sparking.
B. Fire extinguisher executed, gas spray out to put off fire through the lead pipe, once fire extinguisher be executed, working area will be asphyxias.
C. Serious warning! If flushing sparking needed, operator have to be aware of sparking condition, dielectric fluid flash point must higher than 72°C and must have efficient dielectric fluid flush working area.
D. Always switch on OIL LEVEL, working area covered with efficient dielectric fluid.
E. Always switch on dielectric fluid supervision and work tank fire supervision switch.

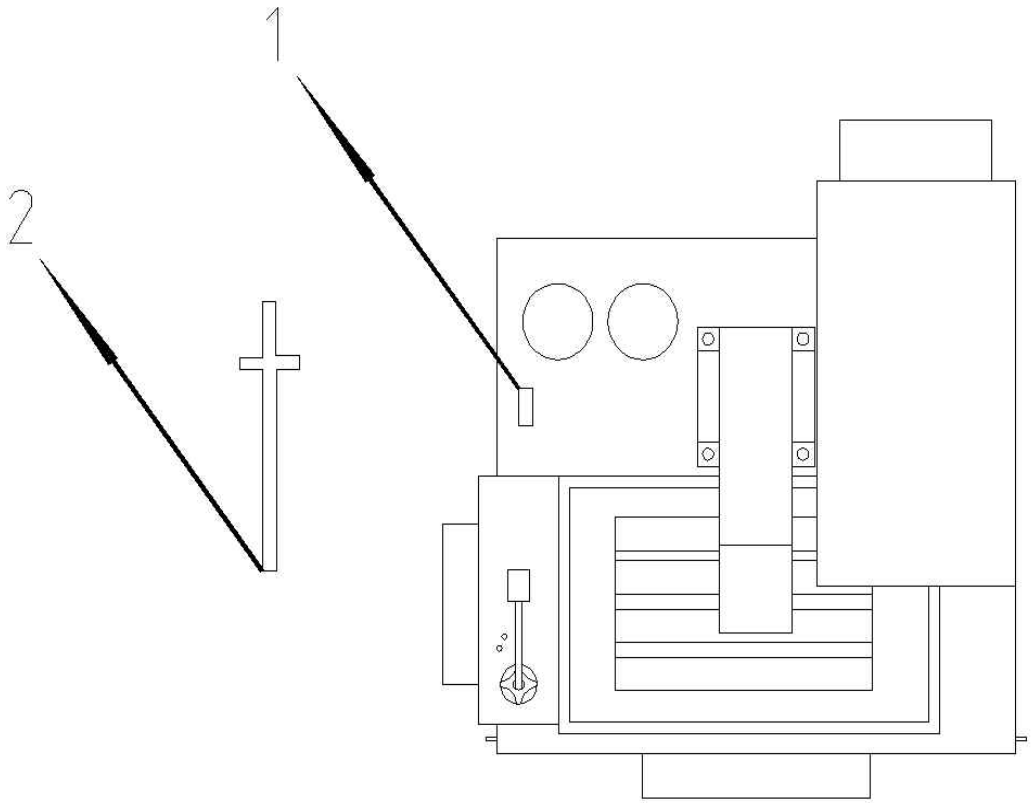
Fire extinguisher profile



1. Fire extinguisher start lever
2. Fire extinguisher pipe
3. Pin (pull off the pin before use, otherwise, fire extinguisher can not be used)
4. Fire extinguisher volume indicator
5. Fire extinguisher body

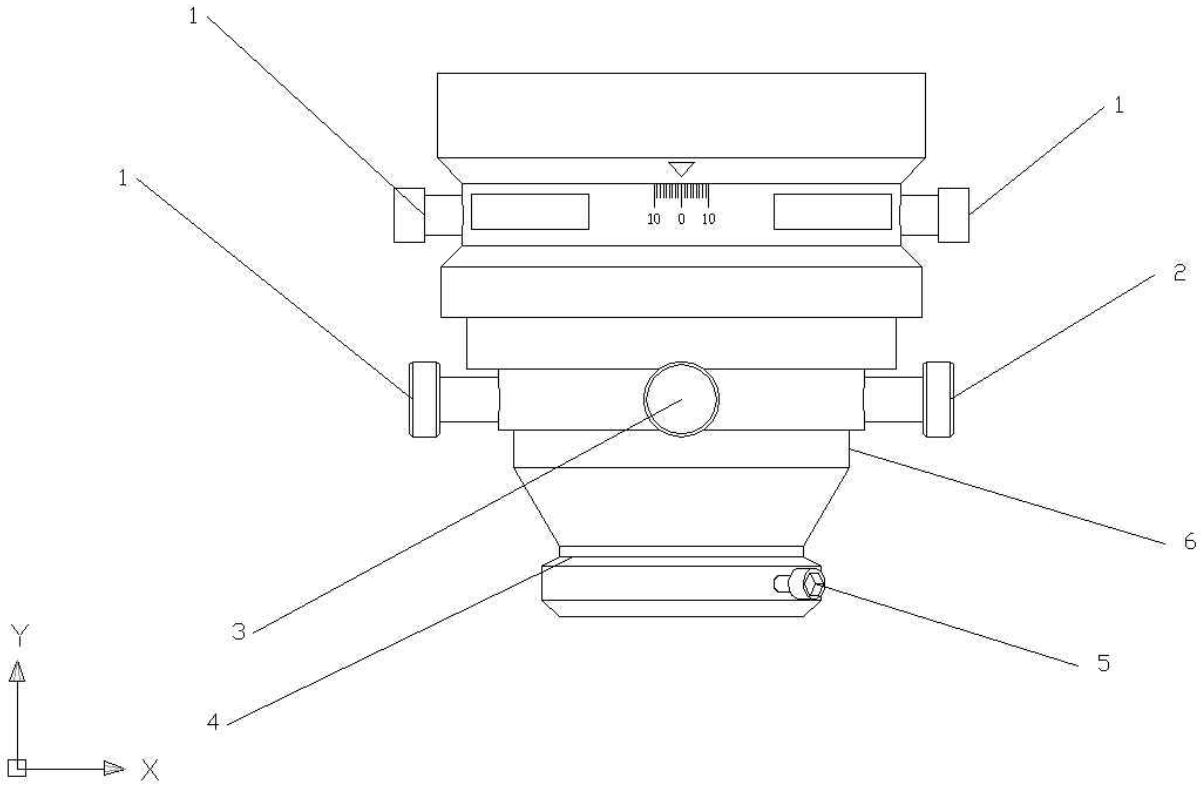
Oil tank level measurement

V-30A/V-35 DOWNWARD FIGURE



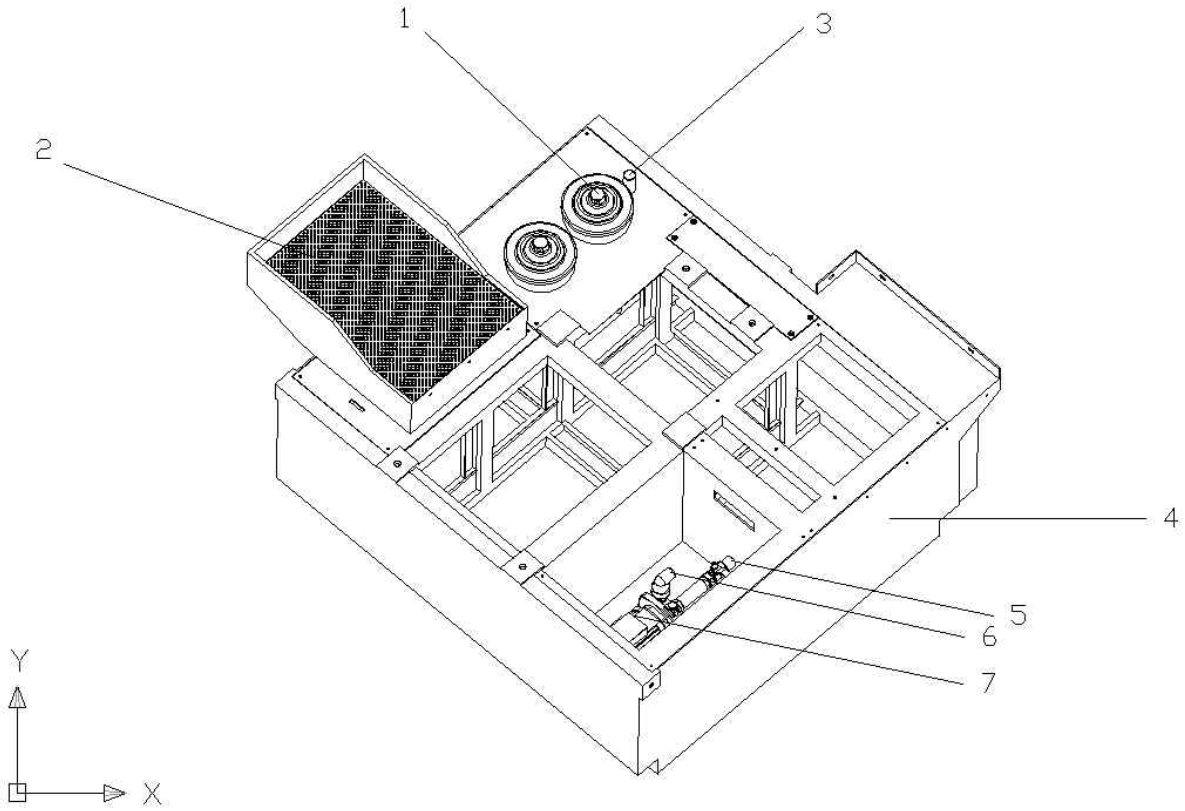
1. Oil tank level detect hole
2. Oil level detect ruler: Check oil level and make up shortage by inserting ruler into oil level detect hole every daily, weekly, season and a half year routine check.

3-1.6 ELECTRODE HEAD



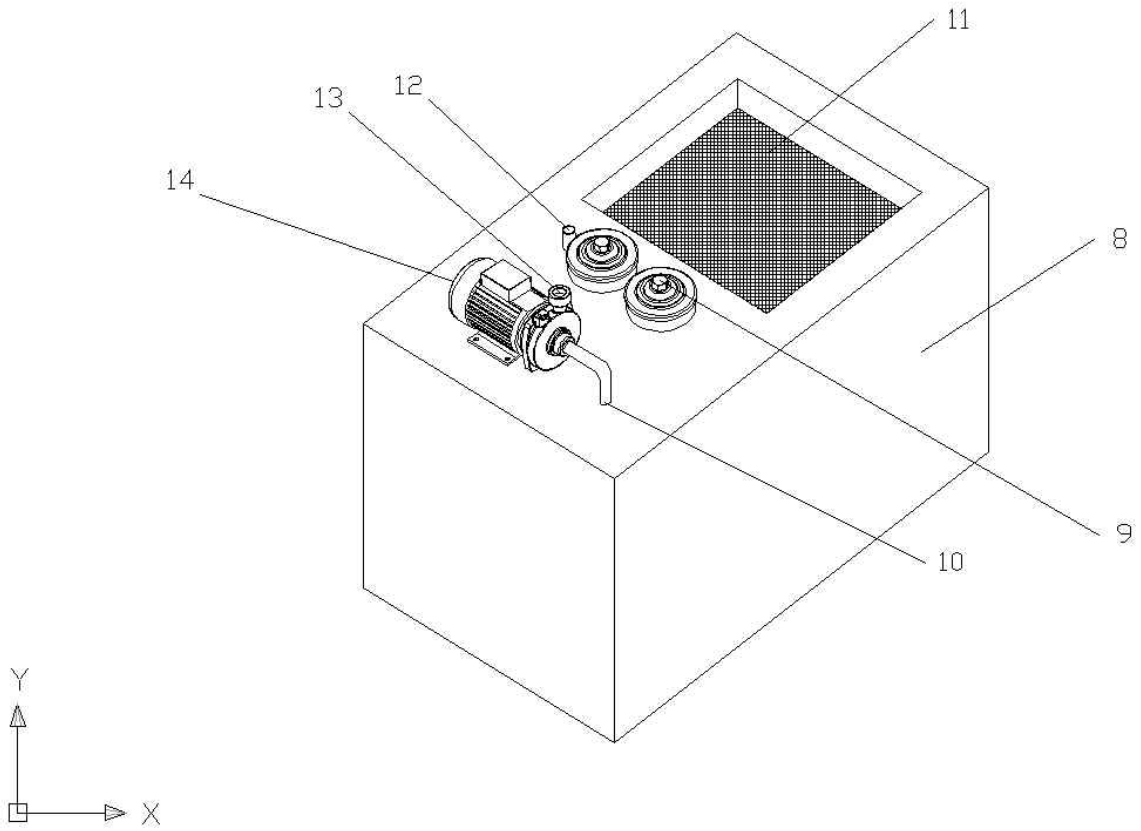
1. ELECTRODE ANGLE ADJUST SCREW
2. LEFT-RIGHT HORIZONTAL ADJUST SCREW
3. FRONT-REAR HORIZONTAL ADJUST SCREW
4. V SHAPE CHUCK
5. ELECTROD CLAMPING SCREW
6. ISOLATING BOARD BETWEEN ELECTROD AND MACHINE BODY

3-1.7 OIL TANK FILTER SYSTEM
CS MODEL OIL TANK



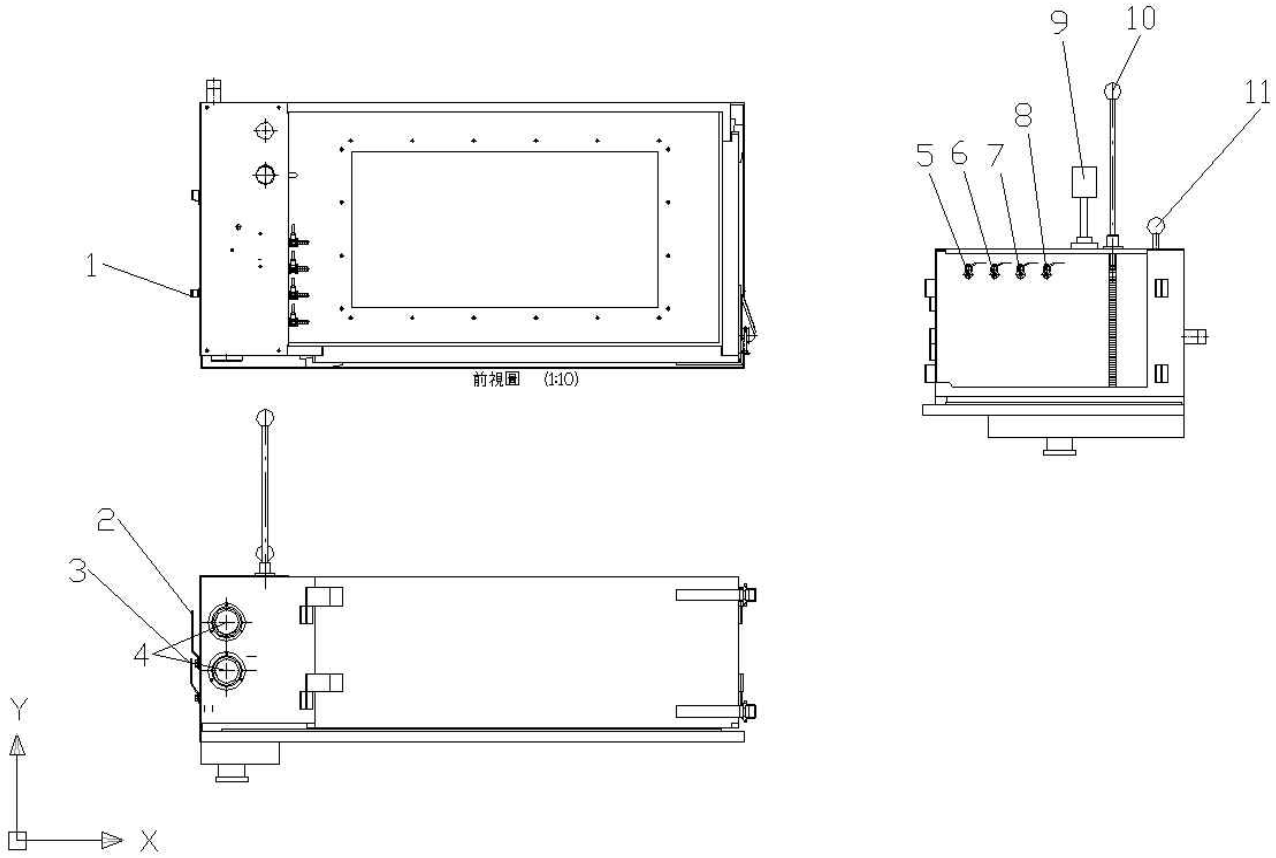
1. Filter network
2. Dielectric fluid return tank
3. Dielectric fluid pouring pipe
4. Dielectric fluid tank
5. Flow control valve
6. Fast dielectric fluid feeding pipe
7. Pump

C/M/L MODEL DIELECTRIC FLUID TANK

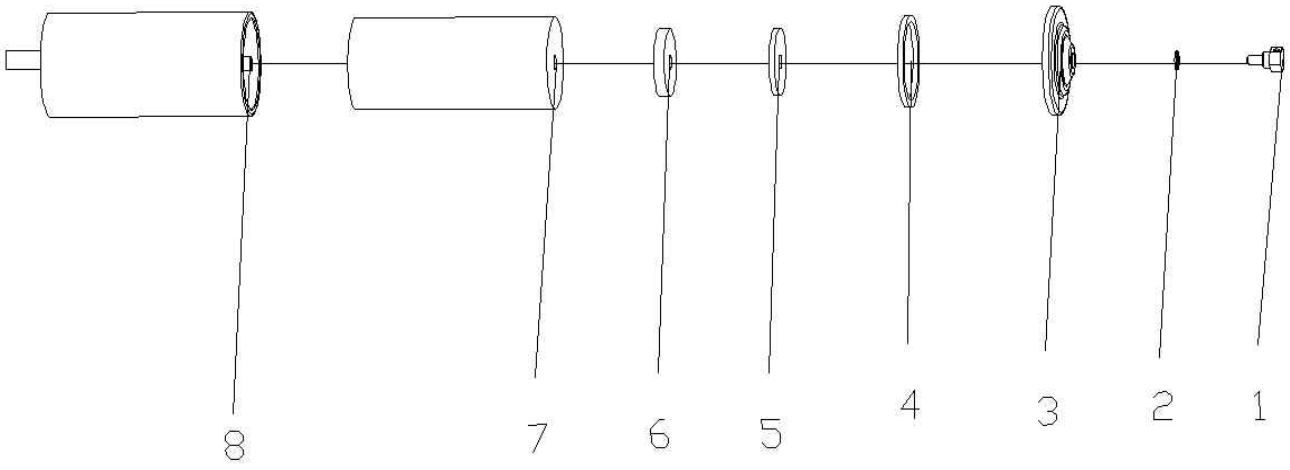


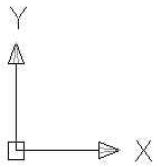
8. Dielectric fluid tank
9. Filter network
10. Reverse-proof valve
11. Dielectric fluid return tank
12. Dielectric fluid pouring pipe
13. Fast dielectric fluid feeding pipe
14. Pump

3-1.4 Work Tank Structure and pipe distribution



1. Work tank front view figure
2. Suction valve
3. Flushing valve
4. Pressure and vacuum meter
5. Flushing pipe
6. Flushing pipe
7. Flushing pipe
8. Flushing pipe
9. Work lamp
10. Dielectric fluid control lever
11. Dielectric fluid leakage lever



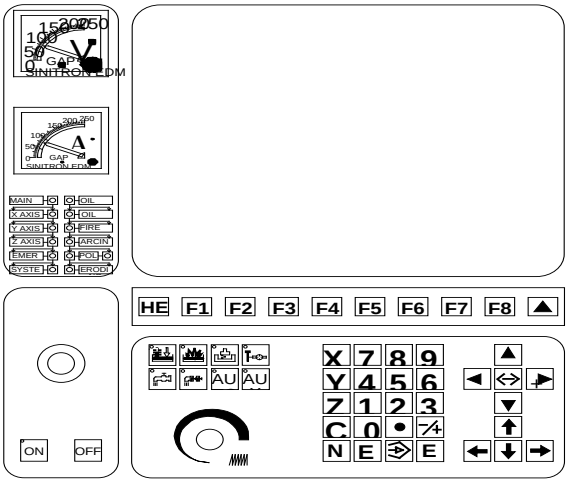


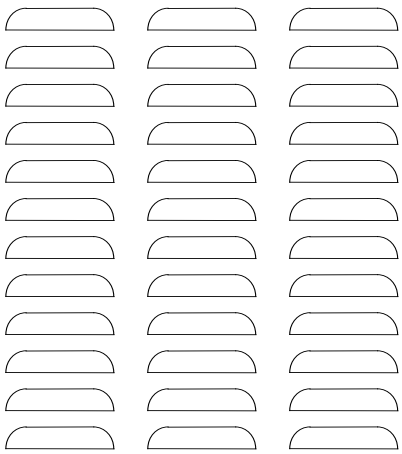
1. Screw
2. Leakage-proof rubber circle
3. Filter cover
4. Oil seal
5. Flat washer
6. Oil resist rubber
7. Filter network
8. Filter tube

II

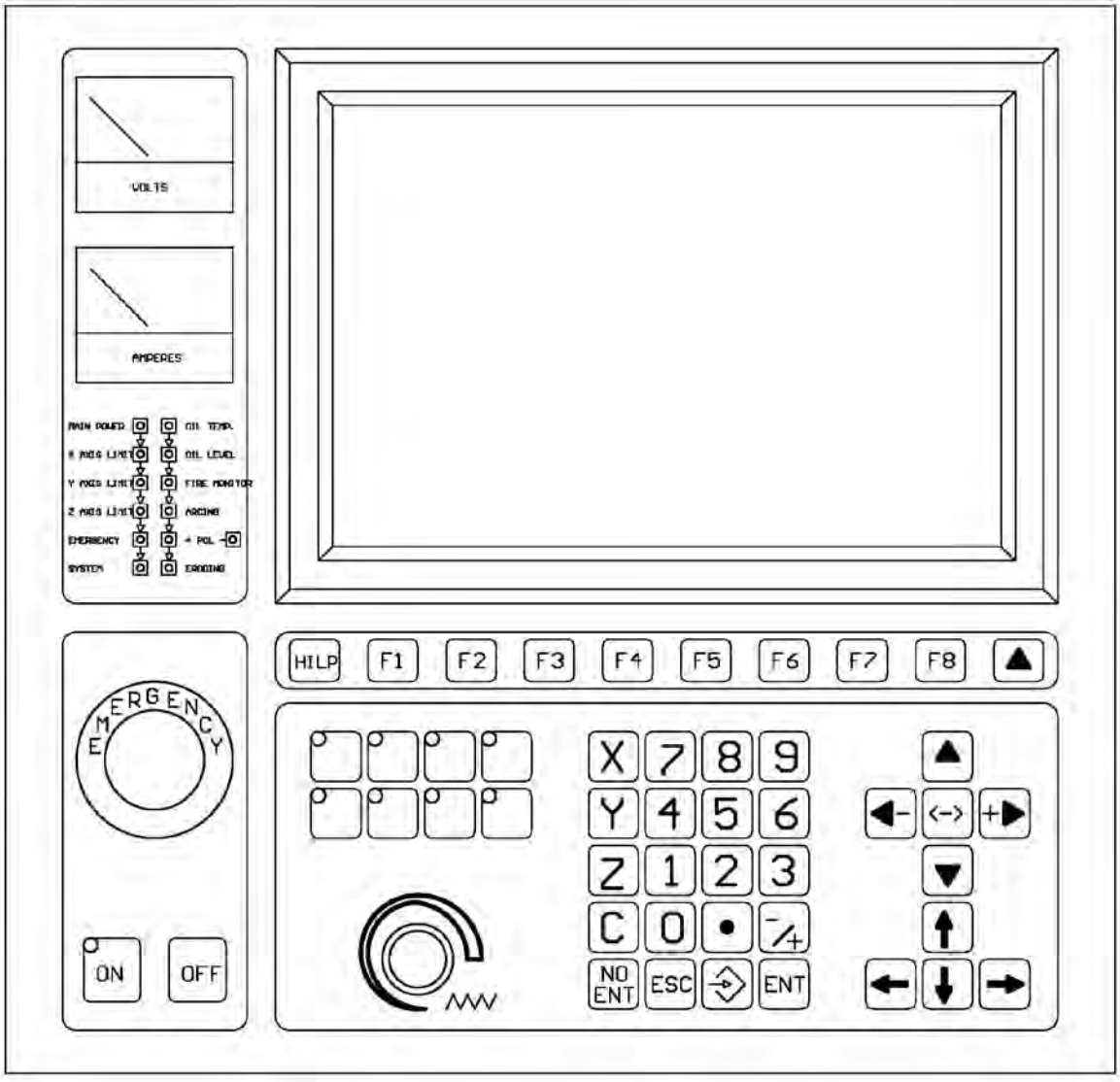
PC-Base EDM System

Operation Manual


MAIN
X AXIS
Y AXIS
Z AXIS
EMER
SYSTE
OIL
OIL
FIRE
ARCIN
POL
EROD
HE
F1
F2
F3
F4
F5
F6
F7
F8
ON
OFF



Machine Panel：



Preface

Ⅰ.Power Switch/ Button:

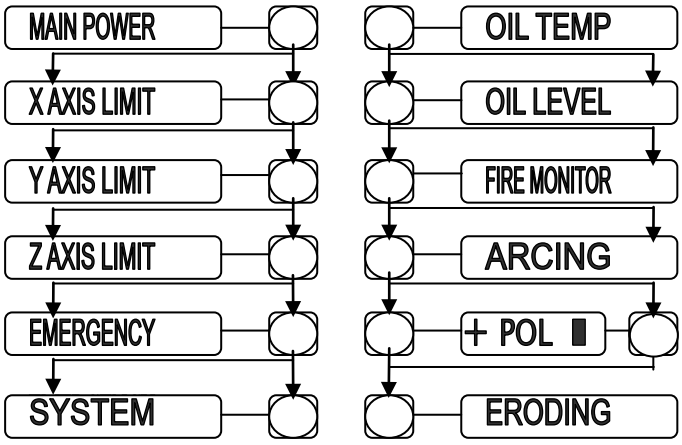
1. Power Switch Description :

- Button: **Main Power Switch(Prime Power)**
  Location: On the right hand side of the right side door
  Description: ON： Only switch on the computer system and secondary power supply. Machine stands by after this power is on.
  OFF： Switch off all the power in the machine.

- Button: **Power-ON(Power Enable)**
  Location: On the left and upper side of the panel.
  Description: 1.Swtich on all the power of the machine except the computer server and secondary power supply.
  2. After the computer system is ready, press F1 to execute system examination. And then press ON can turn on the main power switch.

- Button: **Power-OFF**
  Location: On the left and upper side of the panel
  Description: Switch off all the power except the power of computer server and secondary power supply.

2. System indicator on Panel:



- **After Main Power Switch ON, system supervision starts working**

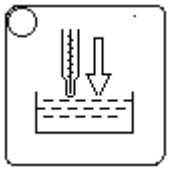
Indicator	Description	Normal	Abnormal
MAIN POWER	Main Power O.K.	ON	If not, the power can't be turned on
X AXIS LIMIT	X axis L.S. not touched	ON	If so, the power can't be turned on (ZNC can not control)
Y AXIS LIMIT	Y axis L.S. not touched	ON	If so, the power can't be turned on (ZNC can not control)
X AXIS LIMIT	Z axis L.S. not touched	ON	If so, the power can't be turned on
EMERGENCY	No Emergency Stop	ON	If not, the power can't be turned on
SYSTEM	PC Ready	ON	If not, the power can't be turned on

Caution :

If any one of the above Green indicator is not ON, and "Power Enable" will be impossible.

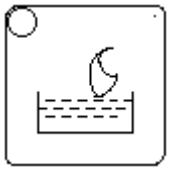
- **After Main Power Switch ON, system supervision starts working**

Indicator	Description	Normal	Abnormal
OIL TEMP.	Dielectric Temp. too High	OFF	If ON, then Spark OFF
OIL LEVEL	Dielectric Level too Low	OFF	If ON, then Spark OFF
FIRE MONITOR	Flaming Status	OFF	If ON, then Spark OFF
ARCING	Arcing Status	OFF	If ON, then Spark OFF
＋ **POL** －	Polarity Command display	ON 1	+ or – Sparking Polarity
ERODING	During Sparking working	ON	Sparking



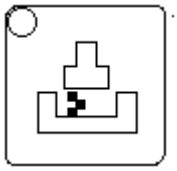
1.Dielectric Level & Temperature Supervision ON/OFF button

- Securing dielectric level & Temperature during sparking.
- Enabled automatically after system Start-up.
- Sparking OFF as soon as alarm happened.
- Alarm Indicator ON indicating alarm, Buzzer also works then.
- OIL TEMP — Indicator for Oil Over-Temperature
- OIL LEVEL — Indicator for Oil Level too Low
- After alarm status clear actually, pressing ENT key to erase alarm memory， START 』button pressed to continue sparking.



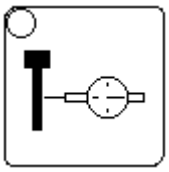
2. Flame Supervision ON/OFF button

- Securing flame during sparking.
- Enabled automatically after system Start-up.
- Sparking OFF as soon as alarm happened.
- Alarm Indicator ON indicating alarm, Buzzer also works then.
- FIRE MONITOR — Indicator for flaming。Please check
  1. Whether oil level is too low
  2. Whether oil temperature is too high.
  3. Whether arcing is happening.
- After alarm status clear actually, pressing ENT key to erase alarm memory, START button pressed to continue sparking.



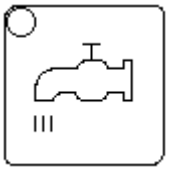
3.Arcing Supervision ON/OFF button

- Securing arcing during sparking.
- Enabled automatically after system Start-up.
- Sparking OFF as soon as alarm happened.
- Alarm Indicator ON indicating alarm, Buzzer also works then.
- ARCING — Indicator for Arcing
- After alarm status clear actually, pressing ENT key to erase alarm memory, START button pressed to continue sparking.

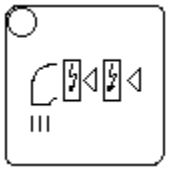


4.Electrode Alignment button (Short Supervision Disable)

- This function works only in “PROBE” Mode.
- This function can release sparking protection temporally to rectify sparking accuracy
- Be careful for traversing axes when this function is activated; there is no” Short” security then.
- When quitting the “PROBE” mode, the switch will be OFF automatically to restore sparking protection function.

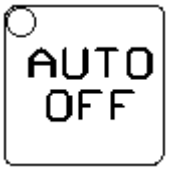


5.Dielectric Pump Manual ON/OFF button



6.Synchronized Flushing ON/OFF button

- Strengthening Flushing when electrode jumps back. In Auto. Jump cycle.
- Better for reducing wear rator of electrode.

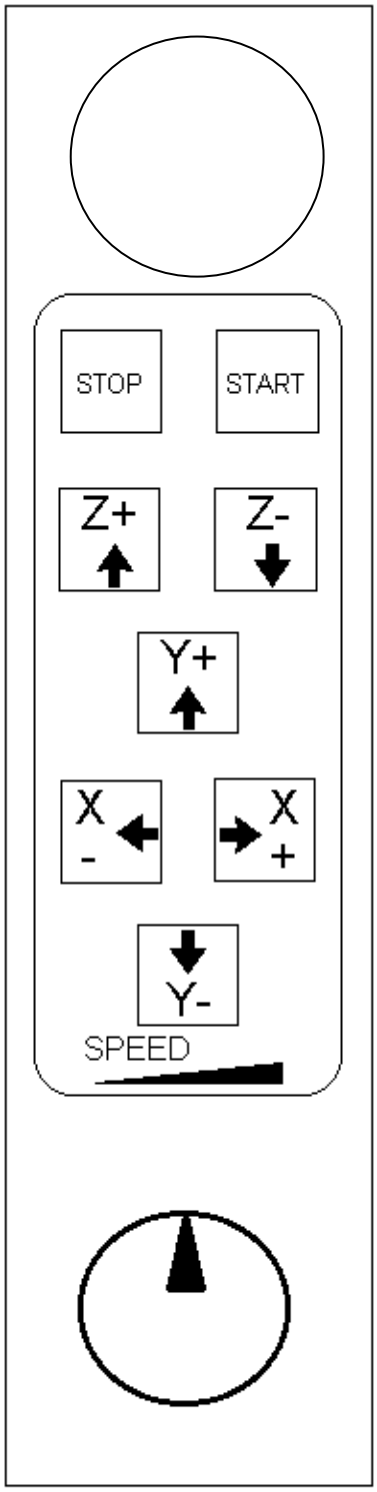


7.Automatical Power OFF button

- Power is off or not after Working completed.

8.Reserved button

Ⅱ.Removable Box:



1.start-up

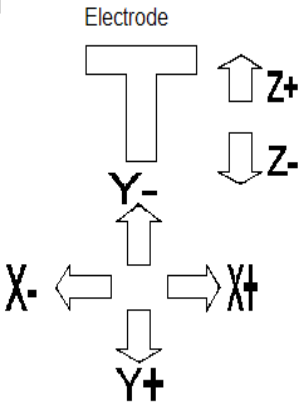
- Speed up after probing function, XY center and inner hold center is activated.
- Start sparking.

2.stop

- Stop all the execution
- During sparking, press STOP Sparking stops temporarily. Press axis +/m button to move out of the electrode. When START is pressed, Electrode back to sparking-interrupted point automatically and resume Sparking ON. ESC key is pressed for completely Sparking OFF.
- When Short happened between electrode and workpiece, axes moving prohibited. Pressing “STOP” button and Axis +/- button together to release electrode protection and force the electrode to move out of “Short” status.

3. Z＋
Electrode Manual traverse up
4. Z－
Electrode Manual traverse down
5. X＋
Electrode Manual traverse in X+ direction (not available in ZNC)
6. X－
Electrode Manual traverse in X- direction (not available in ZNC)
7. Y－
Electrode Manual traverse in Y-direction(not available in ZNC)
8. Y＋
Electrode Manual traverse in Y+ direction

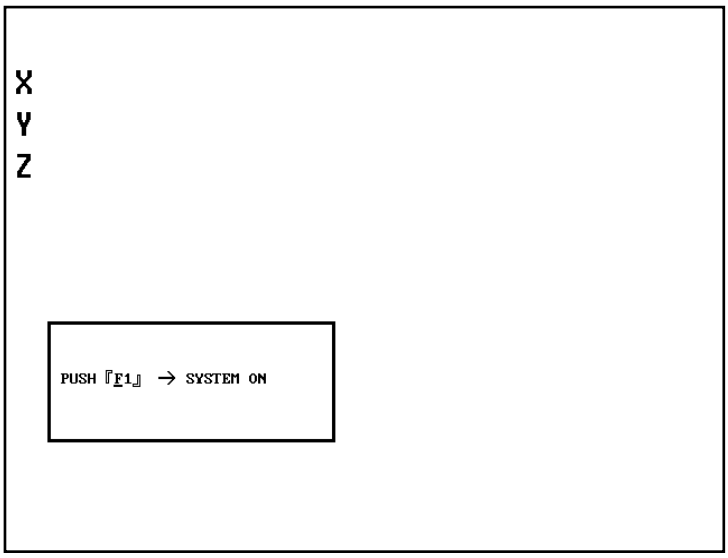
■



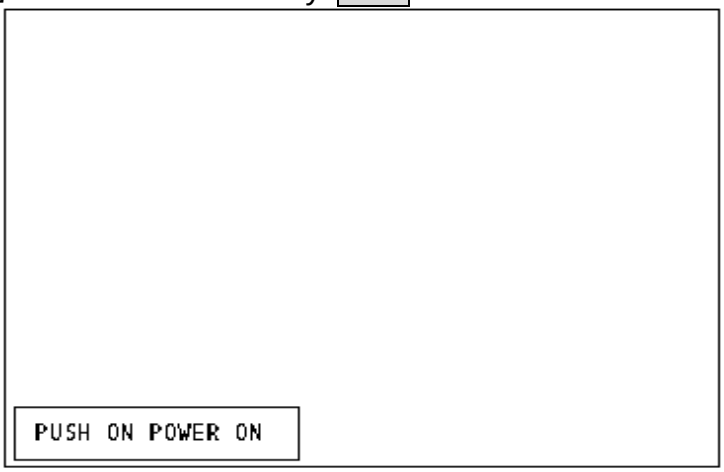
9. Feedrate override for Manual traverse

Ⅲ. Start-UP Procedure

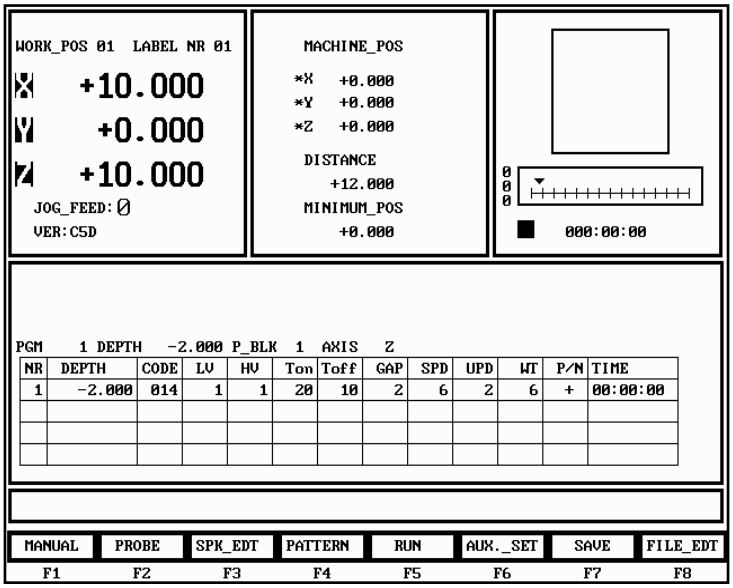
1. Switch ON(in C.W. direction) the Main-Power-Switch and the power enters control system. PC is ready and PC Monitor displays:



2. Press Function Key F1 to initiate the EDM PC-Base Control System.



3.Press ON to enable the Power for Sparking and Servo.



4.After “Start-Up” succeeds, system is operational for the following functions：

1. Manual Traverse:
   (1).Pressing one of the Axes keys (Z+,Z-,X+,X-,Y+,Y-) on removable box can make the axis moving .
   (2).System has” SHORT” security feature, Axis-moving inhibited when” Short” happened.
   (3). Press STOP button on Removable Box to disable the “SHORT” security feature, and press one of the Axis keys on Removable Box together to move out of “Short.”

   ATTENTION: When executing electrode short circuit protection mode, it is a must to move the axis key cautiously. Moving of wrong direction will lead to machinery damage. Please be noted!

   (4). Axis key speed has 4 steps running from 0-3 and can be controlled by removable box. The JOG speed can be shown on the screen.
2. Preset position coordinates:
   Method：Enter axes (X.Y.Z.) + coordinate value (number +/-)，and press ENT
3. Do the Sparking job
   （1）. Press F5 Function key (RUN) to run the Last Program and Sparking ON. Be sure that the Position data as before or not.
   （2）. Search machine home point and set up workpiece coordinate and back to the working coordinate. Press F5 Function key(RUN) to run the unfinished sparking.
   （3）. Sparking job can be interrupted by pressing STOP . To continue sparking, press START button on the removable box. Press ESC key for Sparking ON command cancelled.

Ⅳ.User-friendly Operation Instruction

1. System Start-up：

Switch ON the Main-Power-Switch which located on the right side of cabinet. Power of PC also is activated. Press F1 to start up the system and press ON to activate the main power.（refer to **PAGE 35** Start-up procedure）

2. Home point search：

Press F1 Manual Mode，and press F1 Homing to search machine home point automatically **PAGE 41**

3. Electrode and workpiece fix and rectification

Fix the electrode and workpiece. And then adjust and set up the vertical and horizontal datum surface between the electrode and workpiece.
Mold rectification measurement, centerline and datum point set up
Machining coordinates setup：Under F2 Probe Mode, proceeding probe testing and machining coordinate setup. Choosing an appropriate probing according the workpiece requirements. Please refer to CNC PROBE unit in this manual. **PAGE 44**

4. Machining mode and condition setup

A. Single-cave sparking mode

F3 CNC Spark Edit: Eroding code editing, inclusive of current, depth, Ton/Toff and proper orbital sinking way with radius expansion. Please refer to the CNC spark edit unit in this manual or the user's personal experience. **PAGE 55**

B. Multi-cave sparking mode

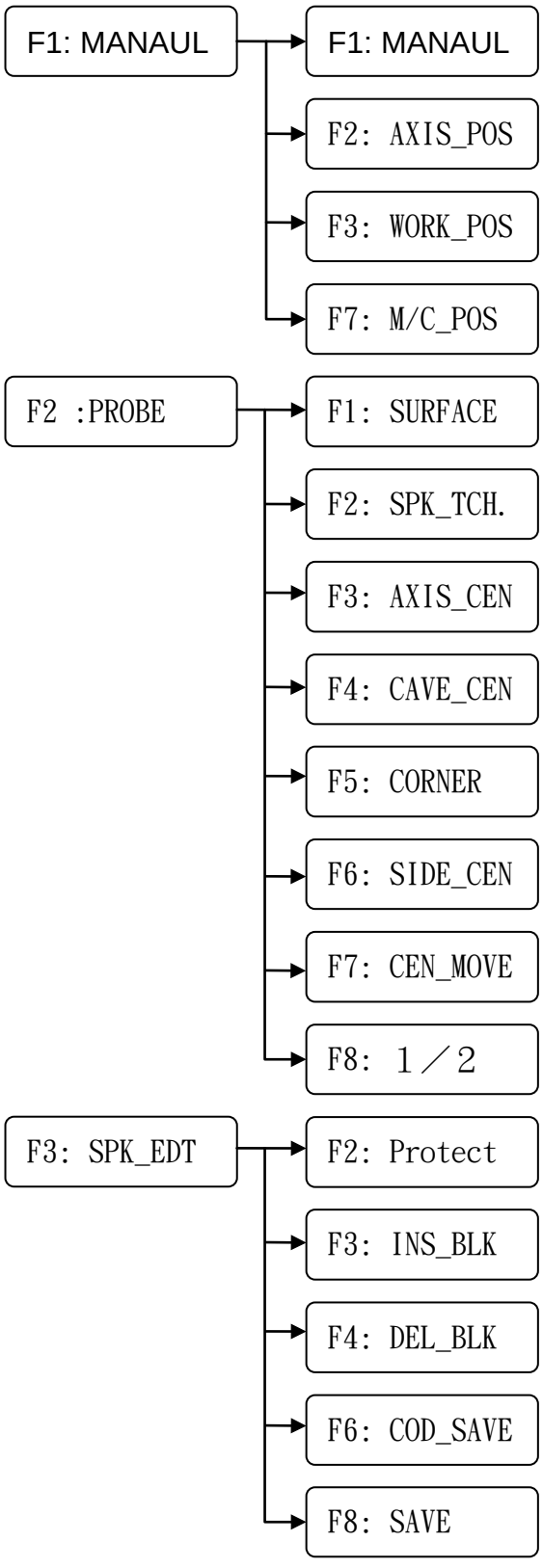
1. Executing F3 CNC Spark Edit to edit multi-cave sparking, depth, ton/off and proper orbital sinking way with radius expansion.
2. Activate F4 multi-cave function. Enter the number the sparked caves and detailed coordinate or refer to the CNC multi-cave editing unit in this manual.

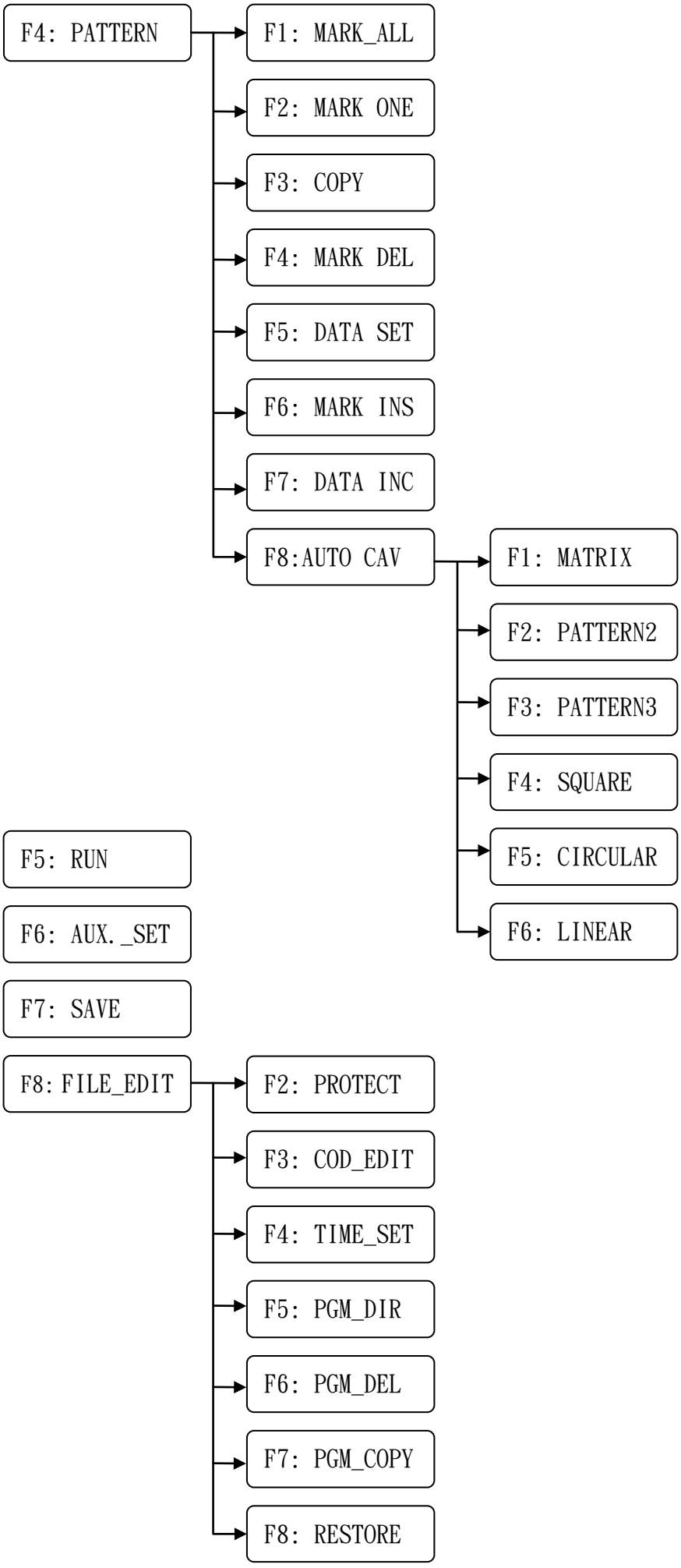
5. Sparking

A. Single-cave sparking mode
Move the electrode to the machining coordinates and choose the sparking codes. And then just pres F5 RUN on the panel. The system will activate single-cave sparking according to the edited sparking pattern. **PAGE 82**

B. After multi-cave sparking editing is finished, press F5 function on the panel to execute multi-cave sparking. **PAGE 64**

Ⅴ.System Function list




F4: PATTERN
F1: MARK_ALL
F2: MARK ONE
F3: COPY
F4: MARK DEL
F5: DATA SET
F6: MARK INS
F7: DATA INC
F8:AUTO CAV
F1: MATRIX
F2: PATTERN2
F3: PATTERN3
F4: SQUARE
F5: CIRCULAR
F6: LINEAR
F5: RUN
F6: AUX._SET
F7: SAVE
F8: FILE_EDIT
F2: PROTECT
F3: COD_EDIT
F4: TIME_SET
F5: PGM_DIR
F6: PGM_DEL
F7: PGM_COPY
F8: RESTORE

2. Function Description

F1 MANUAL → F1 HOME ：Search for home point automatically. If a power cut happenes, the machine will be back to the home point after it is rebooted.

F2 AXIS_POS ： Move to the assigned position automatically.

F3 WORK_POS ：20 sets of incremental coordinate can be set.

F7 M/C_POS ：Set up of machinery working condition. Except

F2 PROBE → F1SURFACE ：Probing 3 axes surface

F2SPK_TCH . ：With removable box to look for sparking position or center.

F3 AXIS_CEN ：Probing externally, Wokpiece midpoint

F4 CAVE_CEN ：Probing internally, Circle Center

F5 CORNER ：Probing Corner

F6 SIDE_CEN ：Probing Center point of 4 sides

F7 CEN_MOVE ：Move automatically to the assigned position

F8 1／2 ：Actual Pos. Data divided by 2. (Center point data)

F3 SPK_EDIT → F1 MARK_ALL

F2 PROTECT

F3 INS_BLK

F4 DEL_BLK

F6 COD_SAVE

F8 SAVE

F4 PATTERN → F1 MARK_ALL

F2 MARK ONE

F3 COPY

F4 MARK DEL

F5 DATA SET

F6 INC DATA

F7 DATA INC

F8 AUTO CAV – F1 MATRIX

F2 PATTERN2

F3 PATTERN3

F4 SQUARE

F5 CIRCULAR

F6 LINEAR

F5 RUN ：Program Run

F6 AUX._SET ：Sparking Auxiliary Condition setting

F7 SAVE ：Saving current system data as the initial information after the system is rebooted.

F8FILE_EDIT → F2 PROTECT ： Setup for file protection and release file protection.

F3 COD_EDIT ： Sparking codes editing

F4 TIME_SET ： Time-Control setting (Enable & Timer setting)

F5 PGM_DIR ： Program Directory

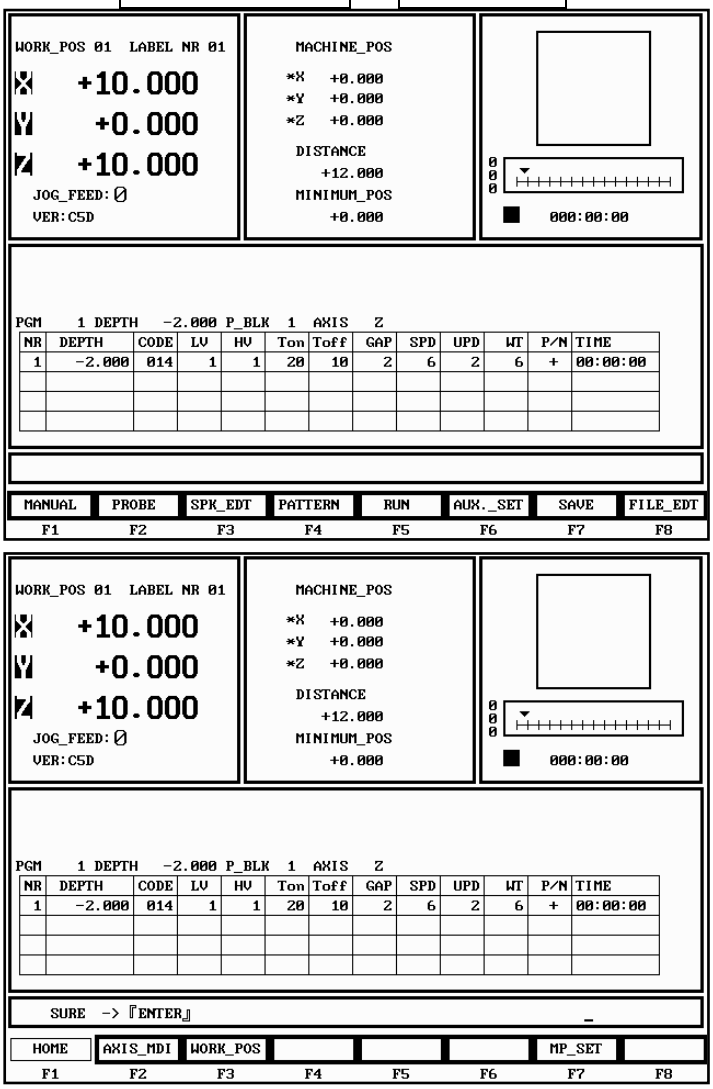
F6 PGM_DEL ： Program Delete

F7 PGM_COPY ： Program Copy

F8 RESTORE ： Restore the initial sparking code information

3.Program Function：

3.1.1 F1 MANUAL→ F1 HOME



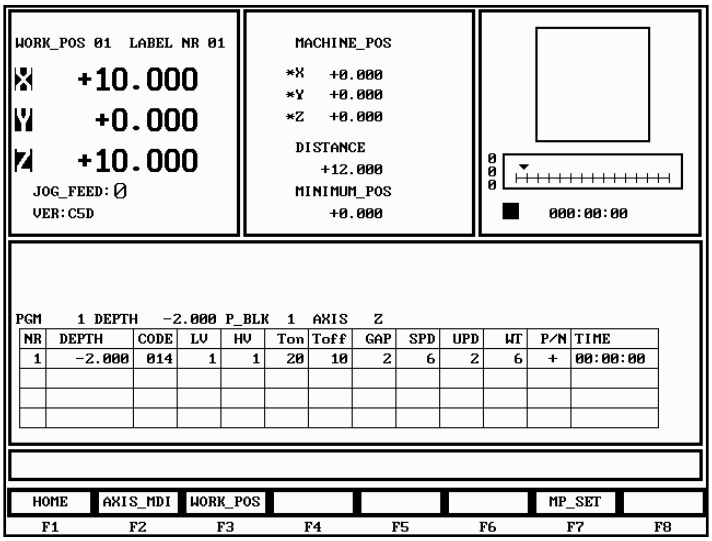
Procedure

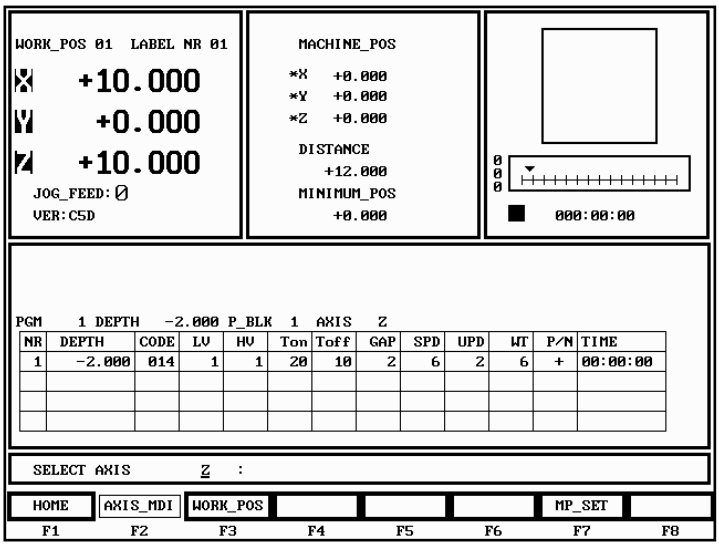
1. Press **F1 MANUAL** under Main Function key to enter manual mode.
2. Press **F1 Home** under manual mode to enter home point search mode.
3. Press Enter key to execute home point search.

Description

1. System：
   (1)Z axis up automatically until Limit Switch is reached.
   (2)X-, Y- then done in the same way one by one.
   (3)X,Y, Z axis moves back and find the home point. When the home point is found, the * mark of each axis will disappear and stop the movement.
   (4)The three axes will show the actual position.
2. When the axis travels back from the limit, the computer will set the home point shown on the linear scale as 0 automatically and then the axis will stop moving. Thus, when the home point of the axis if found, its stopped position is the base of machine home point.
3. Move electrode to the 0 point. (or Work position), and the position is the work position last time before switching off the power.

3.1.2 F1 MANAUL→F2 AXIS_POS





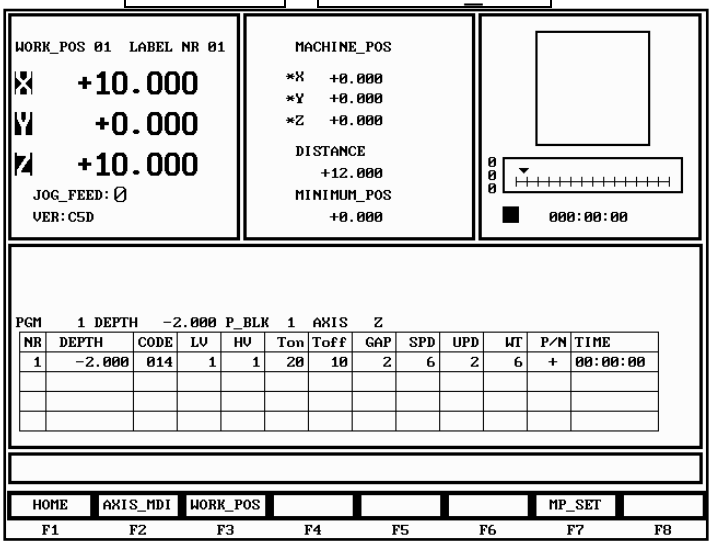
Procedure

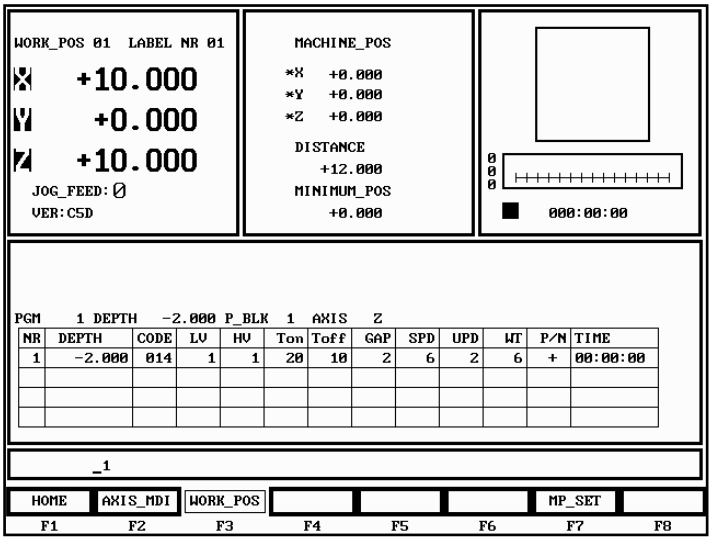
Press **F1 MANUAL** under main function keys and press **F2 AXIS_POS** under sub function keys.

Description

- Select Axis for positioning: X or Y or Z . Enter position coordinate(number＋／－) and then press ENT key will move to the position of coordinate.
- Press ▲ key to move back to the Last Menu.

3.1.3 F1 MANUL→F3 WORK_POS





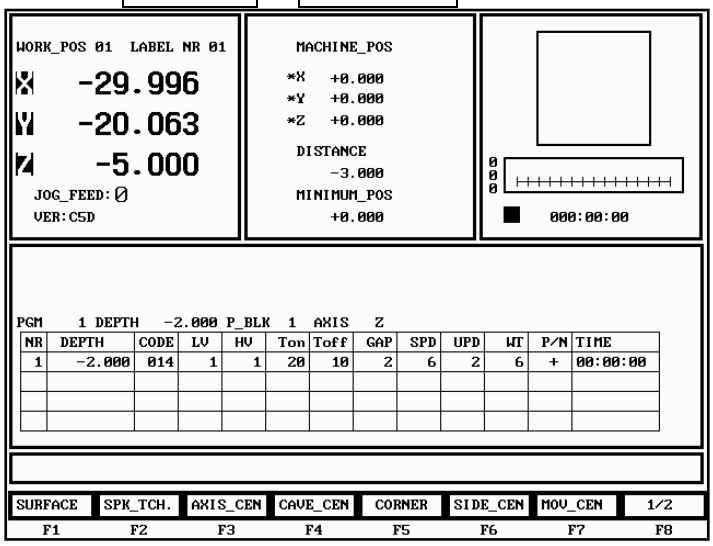
Procedure

Press **F1 MANUAL** key under the main function keys and press **F2 WORK_POS** under sub function keys to enter work coordinate mode. There are 20 sets of coordinates can be set.

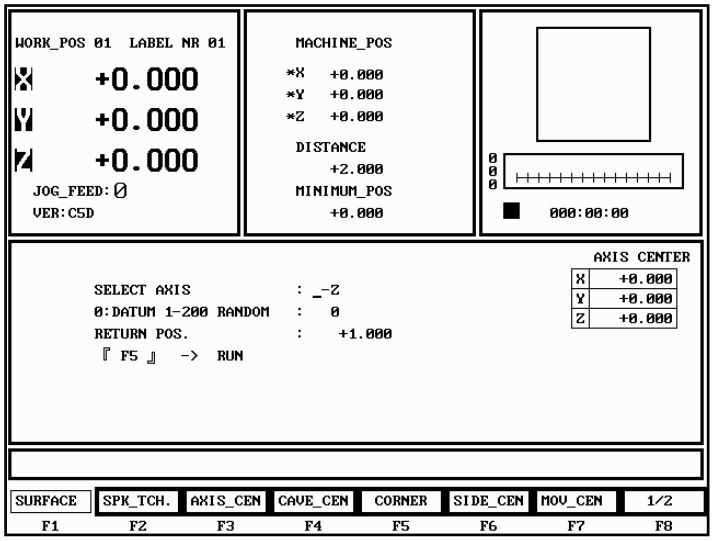
Description

- After the coordinates is set, the current work coordinate can be shown on the left hand and upper side of the screen.
- There are 20 sets of coordinates can be set for application, which means there are 20 work home points or 20 work positions can be recorded.
- There is an interaction between the multi-cave position and work coordinates. When the work coordinate changes, the multi-cave position will be various.
- Press ▲ to move back the last Menu.

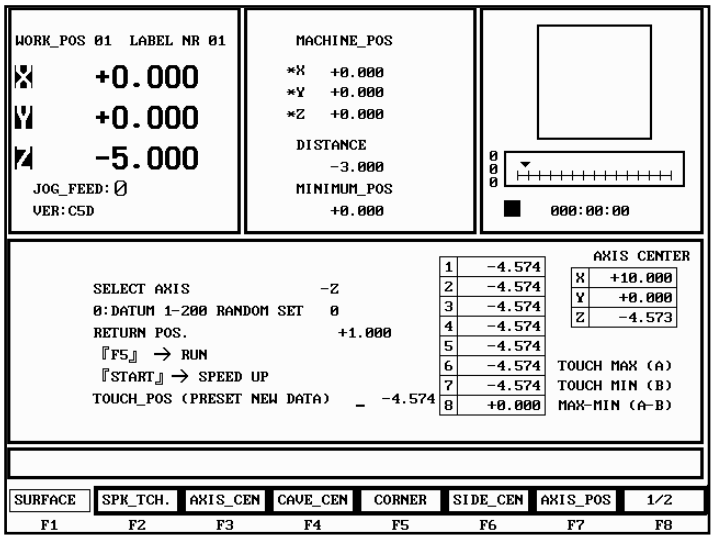
3.2.1 F2 Probe→ F1 Surface

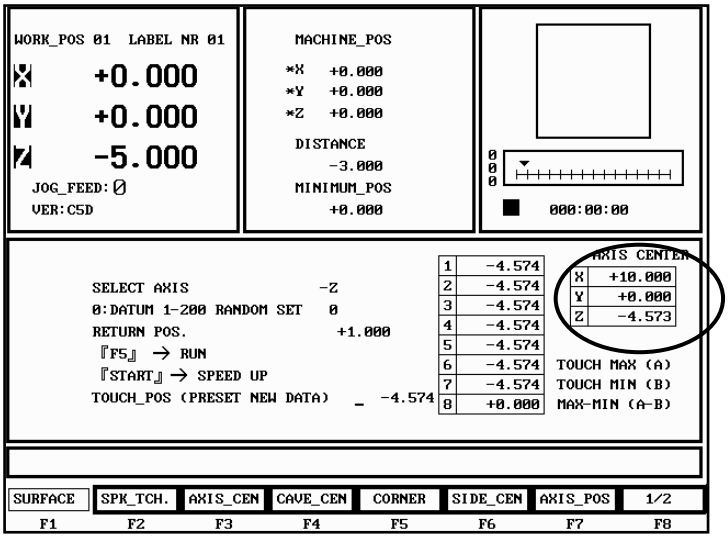


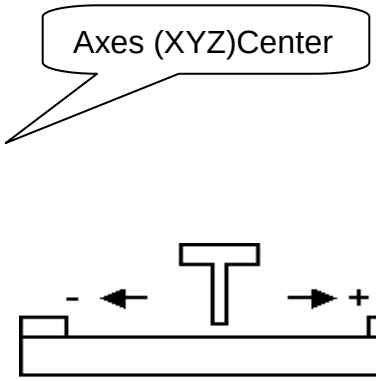
Main Function Screen



Screen Before Surface Testing







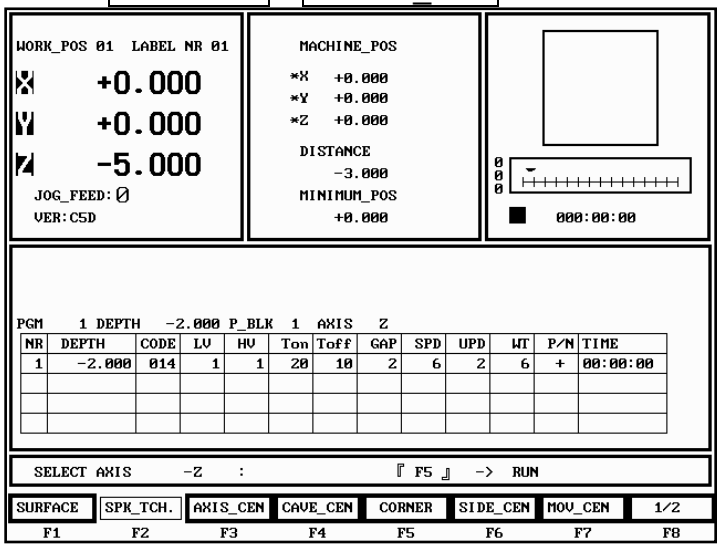
Procedure

- Press F2 PROBE key under the main function keys, and press F1 SURFACE under sub function keys to enter Surface testing mode.
- Press ▲ key to move back to the Last Menu.

Description

1. **Surface Testing Screen：**
   - Select Axes：Press ← - 、 +→ key on the screen to select measured axis.
   - 0=set up,1-200 cave number coordinate record：Select the tested coordinate value and save the recorded point during multi-cave machining.（Entering ”0”means it is not saved in the recording point. But after testing, the coordinate value on the surface can be set.
   - Retreated distance after sparking：The sparking will keep a distance between the surfaces after touching it. This distance is adjustable.
   - To execute the program, press F5 key：Press F5 to activate surface testing.
   - To speed up, press START key ：When the surface testing is activated, the electrode will move slowly based on the setup axis. When the distance between the electrode and the surface is too large, press the START button on the removable box to speed up the movement.
   - Touch coordinate value (settable or zeroing)：Set the coordinate of the surface touch. When the cave number coordinate record is set as 0, the setup here is available
   - The axis center form on the screen will divide the value of last two times into 1/2 . When the mold outer width is bigger and can’t be measured from the axis center of four side center, the axis center can be calculated here.
   - Take X axis measurement for example：
     1. Move the electrode toX+ direction and measure X+ surface. Move the electrode to X-, and measure X- surface.
     2. X axis center will be shown automatically on the “ Axes Center” form , which is located in the upper right of the screen.
     3. Executing axis movement, and move X axis the X axis center. The position is the measured X axis center.
     4. Press ▲ key two times to be back to the main screen.
     5. Set the X axis coordinate as 0 to finish X axis center setup

3.2.2 F2 PROBE→F2 SPK_TCH



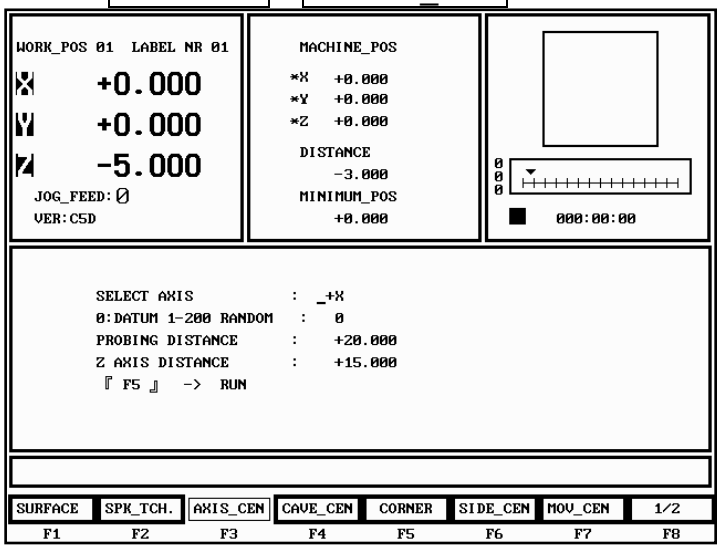
Procedure

- Main function key press F2 PROBE, sub-function key press F2 SPK_TCH., **in to SPK_TCH mode.**
- press ▲ key，back to last page.

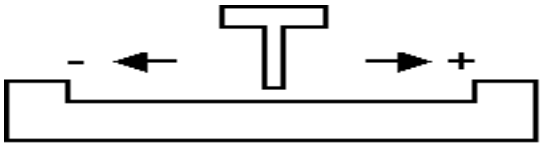
Description

1. Procedure:
   1. Reduced JOG_FEED to 0~1 step.
   2. Press the ← - 、 +→ key on the control panel to choice spark axis direction.
   3. Press F5 key on control panel or START key on the removable box to spark.
   4. Waiting till electrode down to touch the workpiece, when sparking happen jogging axes with (X+,X-,Y+,Y-)keys, watching the spark, till the axes move to wanted position.
   5. Press STOP key to finish.
2. When run the SPK_TCH function change the current condition to low sparking current.

3.2.3 F2 PROBE→F3 AXIS_CEN



Drawing1.External center probing



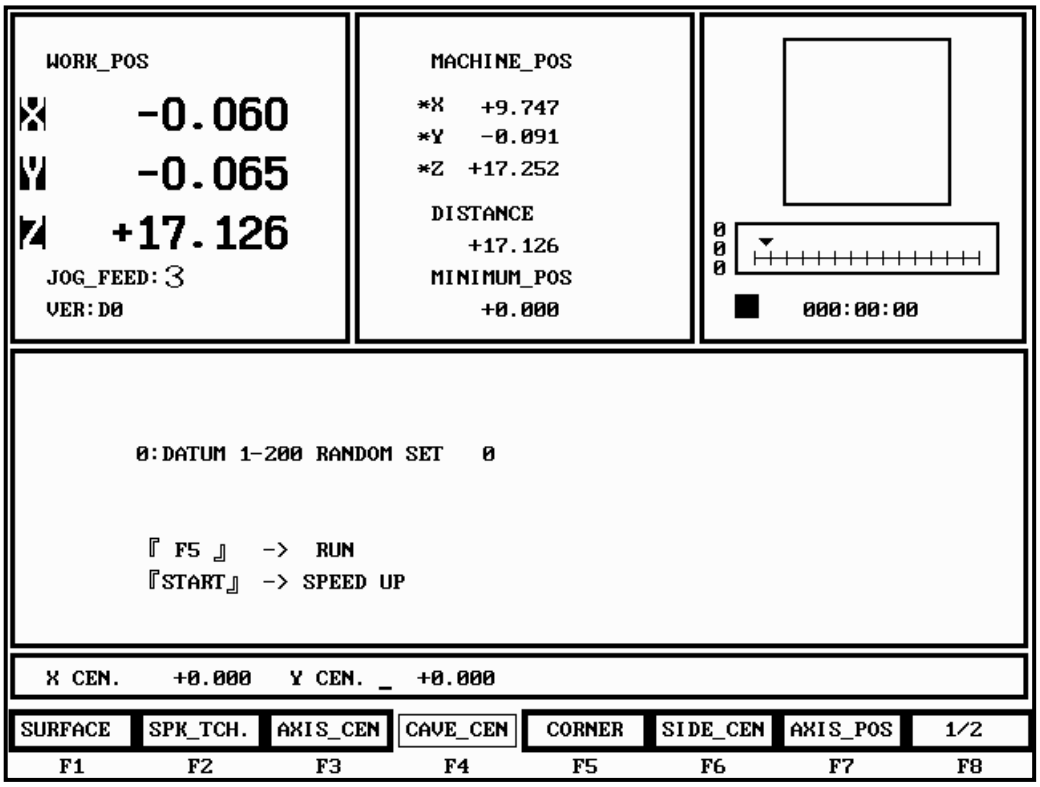
Drawing2.Internal center probing

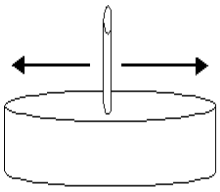
Procedure Main function key press F2 PROBE,sub-function key press F3 AXIS-CEN**, in to AXIS-CEN mode.**

Description

- **Select Axis: Choice Axis & Direction via** ← - 、 +→ key, (Mark A on drawing 1).
- **0:DATUM, 1-200 RANDOM SET: When set"0",Probing point can be preset or setting 0. When set 1-200 is for recording the probing point coordinates, the probing point can not be preset or setting 0 the probing data will be transfer to the corresponding position table for multi-cave position control sparking.**
- **Probing distance (included electrode): Input the 1/2 value of the total probing distance (included electrode), when probing the move distance of the electrode will be 2 setting value (see mark B of drawing 1). When set (+) is for probing external, when set (-) is for probing internal (see drawing 2).**
- **Z up distance: Z up position during probing. (See mark C of drawing 1).**
- **Press F5 key to start: Press** F5 key to start probing cycle.
- **Speed up press START key: Press "START" key to increase probing speed.**
- **TOUCH_POS (Preset or setting 0): After probing will show the center coordinates.**

3.2.4 F2 PROBE → F4 CAVE-CEN



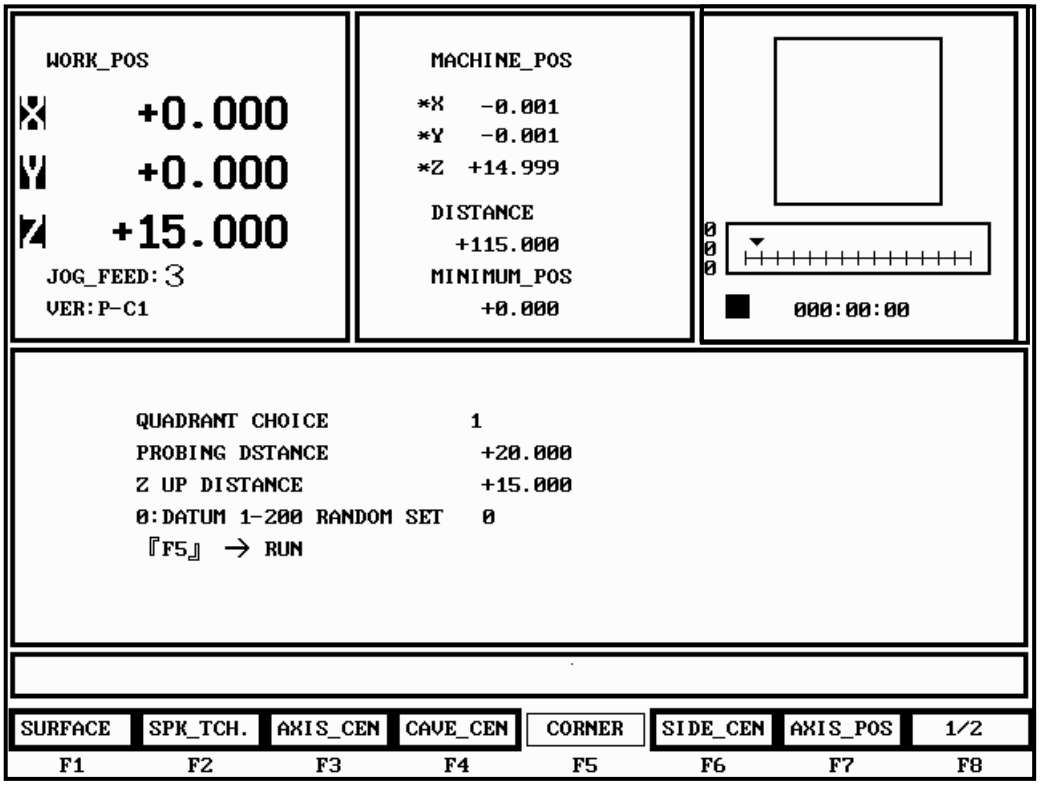


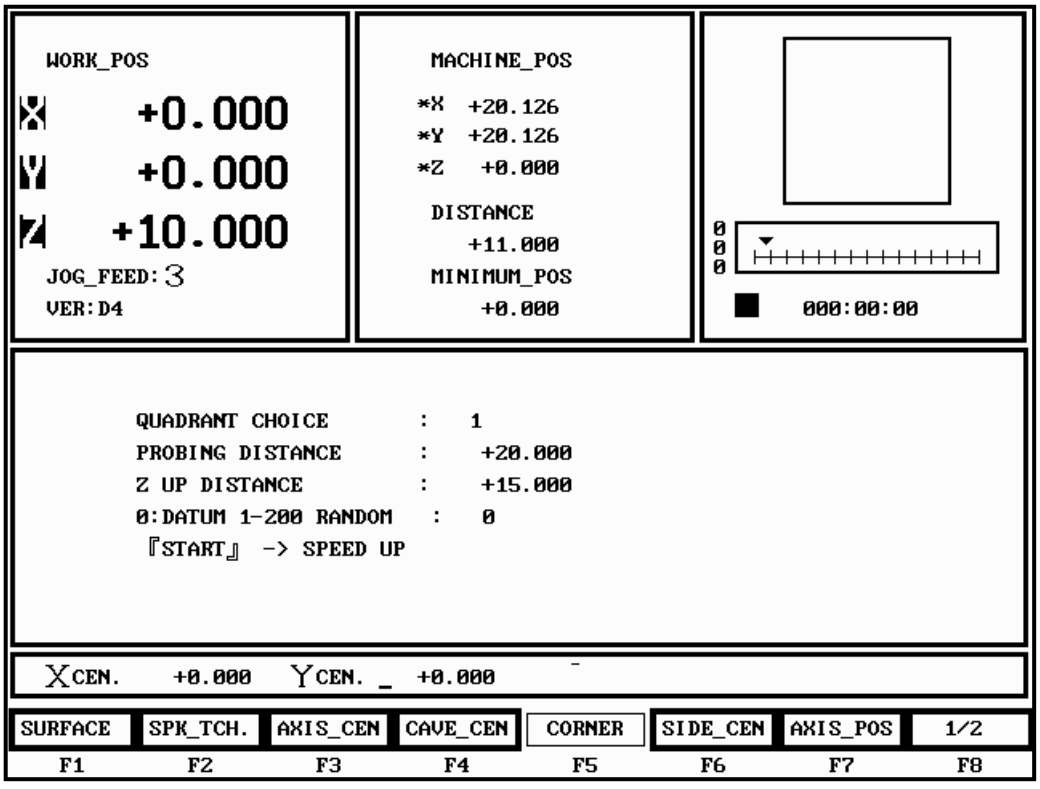
Procedure Main function key press F2 PROBE , sub-function key press F4 CAVE-CEN, **in to CAVE-CEN mode.**

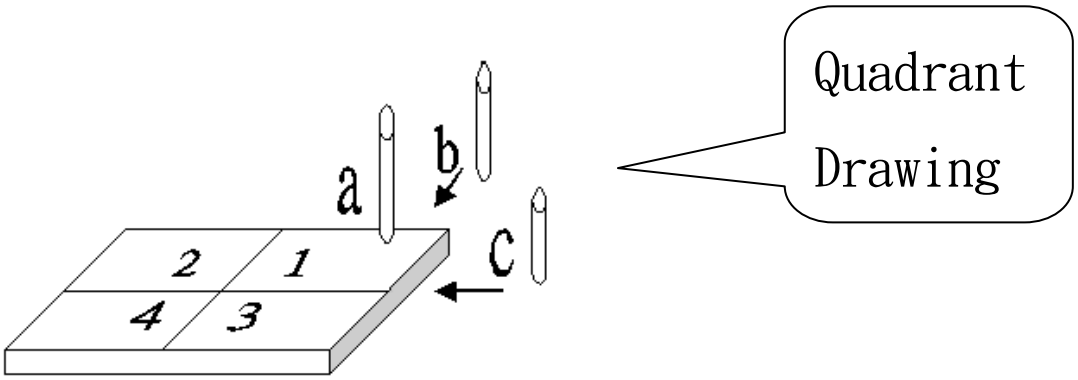
Description

1. Manual traverse the electrode into the probed cave.
2. 0: DATUM, 1-200 RANDOM SET: When set “0”, Probing point can be preset or setting 0. When set 1-200 is for recording the probing point coordinates, the probing point can not be preset or setting 0, the probing data will be transfer to the corresponding position table for multi-cave position control sparking.
3. Press F5 key to start: Press F5 key to start the auto cave centering.

3.2.5 F2 PROBE → F5 CORNER





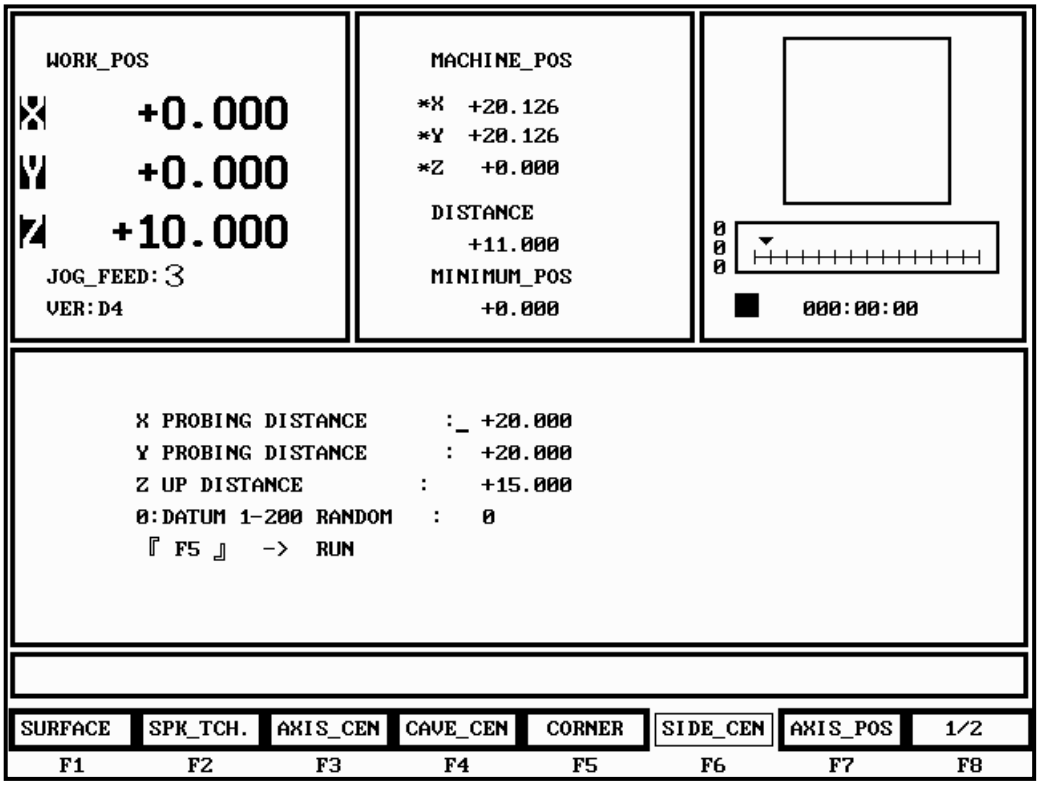


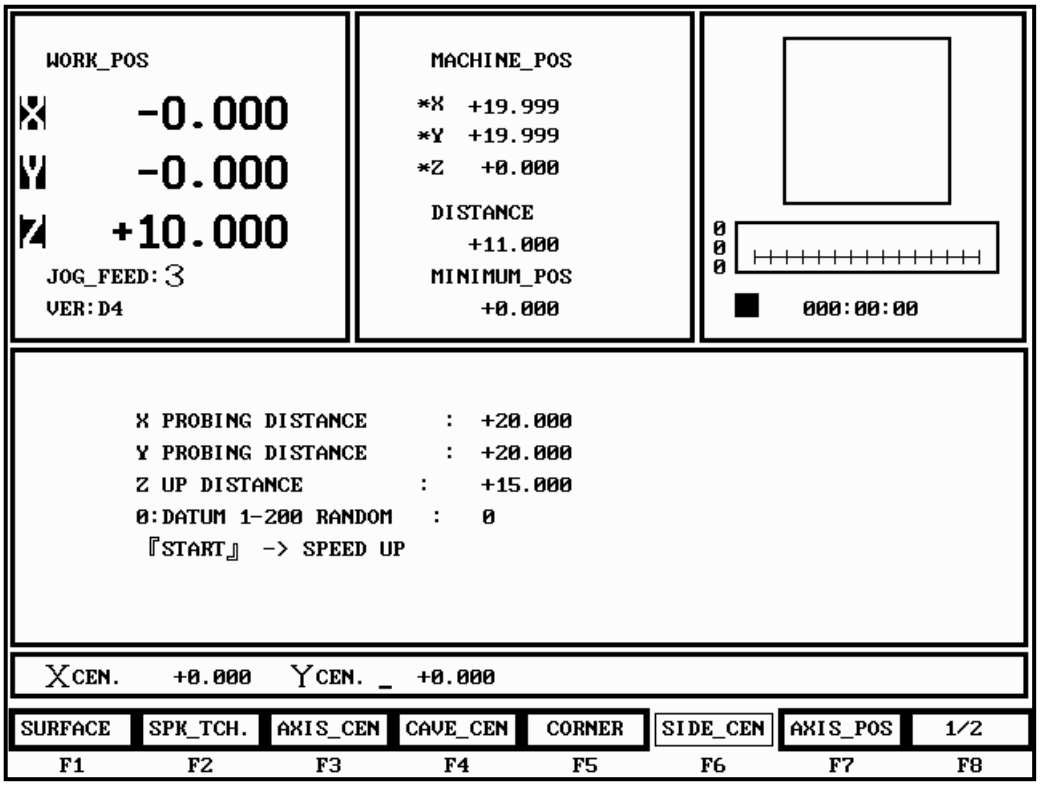
Procedure Main function key press F2 PROBE , sub-function key press F5 CORNER , **in to CORNER mode.**

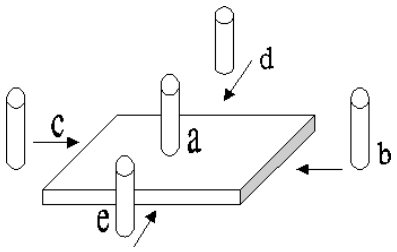
Description

1. Quadrant choice: 4 corners can be selected (see quadrant drawing).
2. Probing distance (included electrode): Input the bigger rough range of X and Y distance.
3. Z up distance: Down distance of Z axis for probing.
4. 0: DATUM, 1-200 RANDOM SET: When set “0”, Probing point can be preset or setting 0. When set 1-200 is for recording the probing point coordinates, the probing point can not be preset or setting 0, the probing data will be transfer to the corresponding position table for multi-cave position control sparking.
5. Press F5 key to start: Press F5 key to start the probing cycle.

3.2.6 F2 PROBE → F6 SIDE-CEN





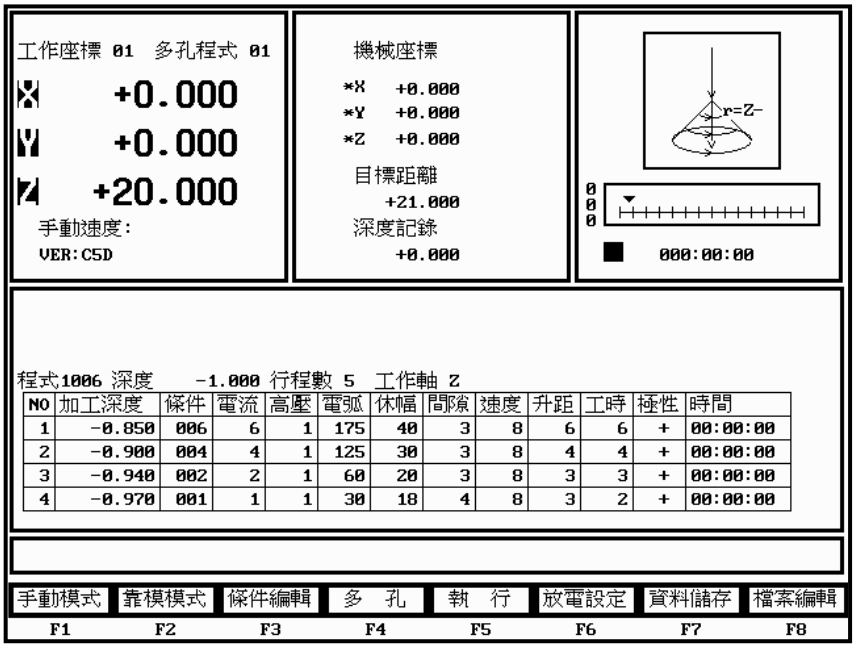


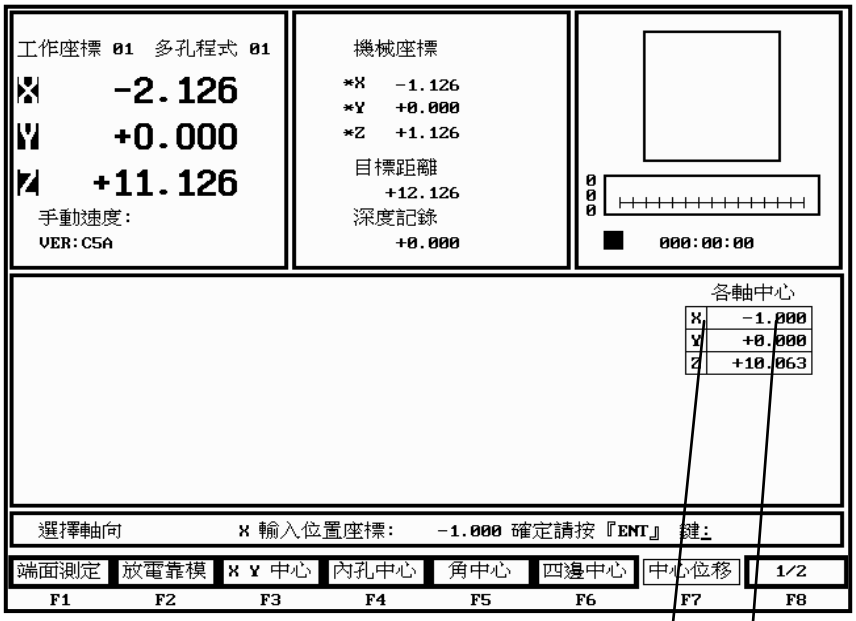
Procedure Main function key press F2 PROBE , sub-function key press F6 SIDE-CEN , **in to SIDE-CEN mode.**

Description

1. Manual traverse electrode to the rough center above the workpiece then press F6.
2. Input the data as require
   a. X probing distance: Enter the X width + electrode radius + 10 (safety clearance).
   b. Y probing distance: Enter the Y width + electrode radius + 10 (safety clearance).
   c. Press F5 key to start: Press F5 key to start probing cycle.
3. 0: DATUM, 1-200 RANDOM SET: When set “0”, Probing point can be preset or setting 0. When set 1-200 is for recording the probing point coordinates, the probing point can not be preset or setting 0, the probing data will be transfer to the corresponding position table for multi-cave position control sparking.
4. Speed up press START key: Press “START” key to increase probing speed.
5. After probing will show the value, press the arrow key to move the cursor to input the coordinates.
6. Press ▲ key back to last page.

3.2.7 F2 PROBE → F7 AXIS_POS





Procedure Main function key press F2 PROBE , sub-function key press F7 AXIS_POS , **in to AXIS_POS mode.**

Description 1. Follow the description on the screen to input data:

a. Choice axis: input " X axis".

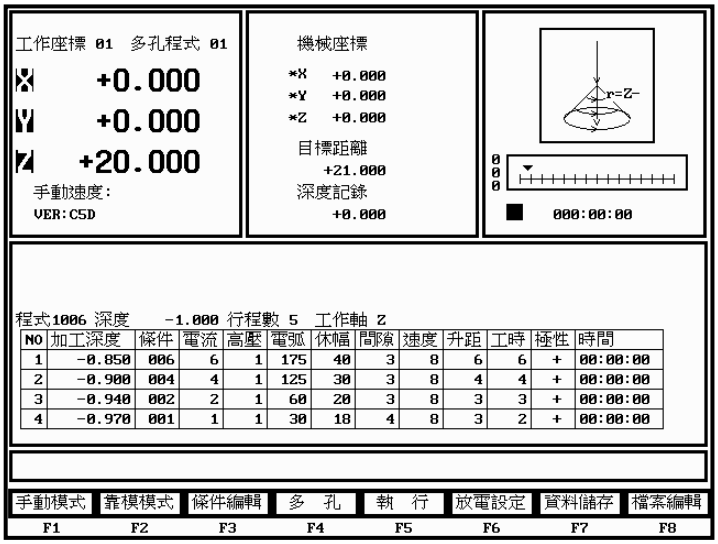
b. Input coordinate of position: Input the axis center coordinate. For example: - 1.000

c. Press ENT: Press ENTER key to confirm.

2. The electrode will automatic move to axis center.

3. Press ▲ back to last page to reset coordinate to finish the center setting.

3.2.8 F2 PROBE → F8 1/2



Procedure Main function key press F2 PROBE, sub-function key press F8 1/2, **in to 1/2 mode.**

Description

1. Choose axis to probe one end surface then coordinate set 0.
   a. Get the width of workpiece by moving the electrode to other end of workpiece.
   b. Run F8 1/2 to devide the coordinate by 2.
2. This function is easy for user to find the center coordinate.

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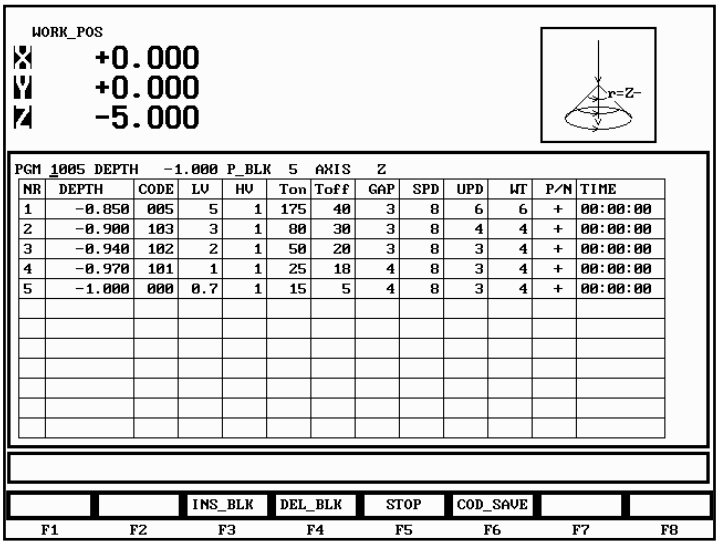
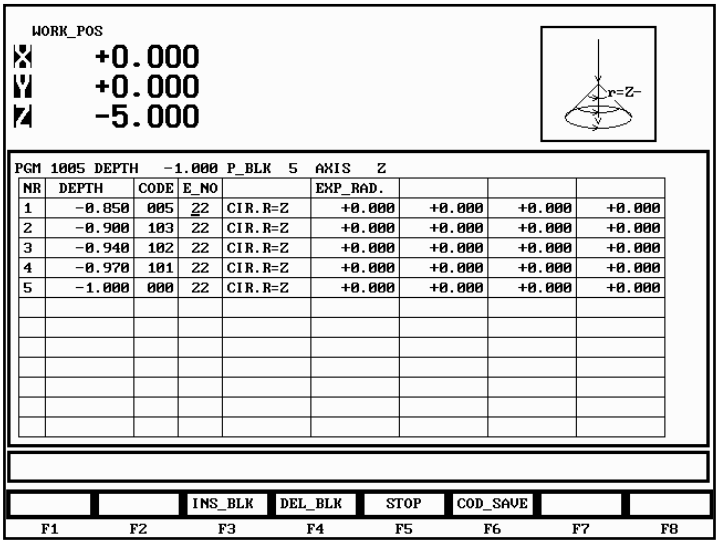
3.3.1 F3SPK_EDT



Program Editing1
Working Condition



Program Editing2
Cutting Method

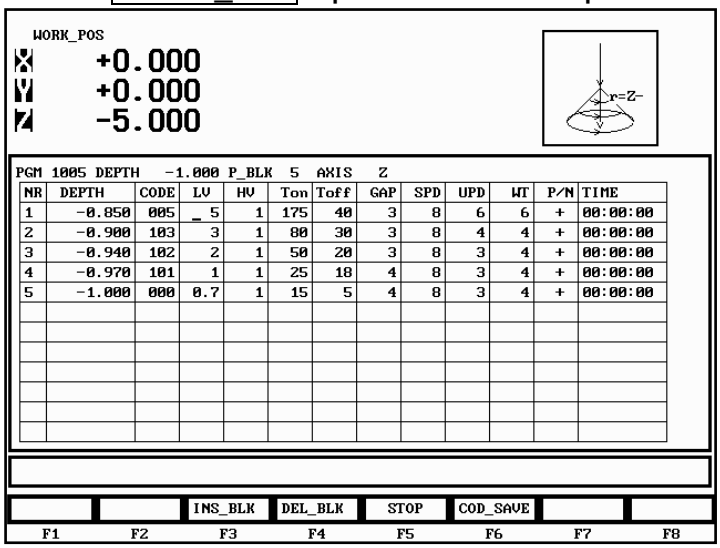
Procedure Description

Main function key press F3 SPK_EDT, in to SPARK EDIT mode.

1. This mode only show one program for spark edit.
2. Each program can be separated to serval spark cycles for users need.
3. User can edit the depth, current and OB head function.
4. Sub-function key description:

MARK ALL：Selecting whole table for POS. editing.
MARK ONE：Selecting the chosen cave NO. (cursor POS.) for POS. editing.
MARK INS：Inserting one POS. as the chosen cave NO. (cursor POS.) before it.
MARK DEL：Deleting the chosen cave NO. (cursor POS.).
DATA SET：Entering new POS. to marked data.
INC DATA：Adding the same data to all marked original data.
DATA INC：Adding incremental to all marked data one by one. (The 1st marked one no change)
AUTO CAV：Fixed pattern POS. editing.

3.3.2 F3SPK_EDT Spark edit description



Working Condition

Editing

1. **Description of program head line:**
   - **PGM**：**Program No.** 1 ～ 9999
     1. After accumulate experiences for EDM machining, user can input the parameters to separated steps for programming, to simplify the program saving & using.
     2. Existing suggesting program No. in buffer memory:
        1001 ～1025 ：Copper-steel, 1A－25A 。
        2001 ～2060 ：Graphite-steel, 1A － 60A。

     Entering the existing program for the wanted Current Code, and Depth command, the program can be Run then.

     For instance: 6A from rough to fine finish, 10 MM Depth, Copper -- Steel

     1) PGM: 1006 “ENT” (loading the existing program from Memory)

     2) DEPTH: -10 “ENT”

     3) Press ▲ back to last page

     4) Press ”START” or F5 RUN to Start Sparking.
   - **DEPTH**： Sparking depth command, Range +/- 999.999.
   - **P_BLK**：Total block Nr. in program, calculated by PC itself.
   - **AXIS**：**Working axis surface switch setting, it can be set X,Y surface of Z-axis, X, Z surface of Y-axis and Y, Z surface of X-axis.**

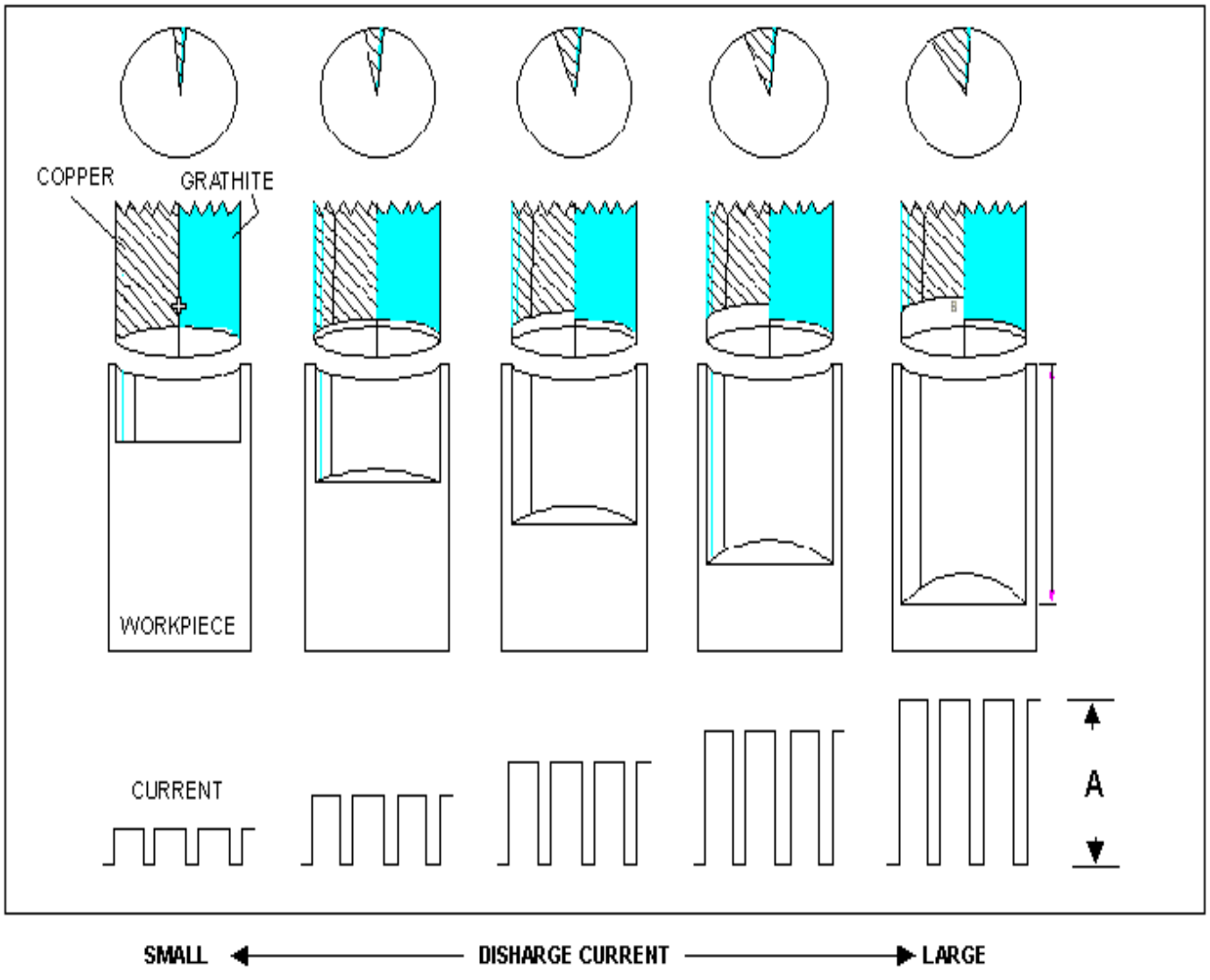
   (***** Notice: when setting the spark direction is base on the current coordinate and the sparking direction is decided by depth.)**

2. **ERODING TABLE DESCRIPTION:**
   - **NO ：**Programming Number.
   - **DEPTH:** Depth command for each block of program.,
     1. The coordinate of depth must in the sparking range.
     2. All the depth commands must be logical and sequence increase or decrease.
   - **CODE**： Sparking code command. Sparking codes stored in buffer memory. The contents can be modified when spark off.
     1. Using the key (←, →, ↑,↓) to search code or enter the code Nr. directly. And use the key (-, +) to increase or decrease value of each item.
     2. The condition data is the reference combined by current or other parameter for sparking.
   - Please refer to the “COD_EDIT” for detailed sparking edit. **LV:**Low Voltage Current command, Standard range０～６４A.

1) Can be modified only when spark off.
2) Bigger LV, then bigger spark, quicker, bigger gap, but rougher.
Smaller LV, then smaller spark, slower, smaller gap, better on surface.
Caution: When big LV is set, the security must be paid attention to especially.
Flame, Dielectric Level and Dielectric Temperature…
3) Only when matched well with Ton & Toff, better working efficiency is got.
4) Enter value directly or use ← - 、 +→ to fetch & set.

- **HV**: High Voltage Current
  1) Range 0.5 – 3.5
  2) Bigger HV, then bigger spark, quicker, bigger gap, but rougher.
  . Smaller HV, then smaller spark, slower, smaller gap, better on surface.
  3) Enter value directly or use ← - 、 +→ to fetch & set.
- **Ton**: "ON" duty of Sparking cycle.
  1) To decide roughness, wear ratio, gap and speed.
  2) Range 1 - 2000us, divided into 48steps. Ton set fetched by pressing ← - 、 +→ keys.
  3) Comparing with constant LV command, Bigger Ton, then worse roughness, bigger gap, lower wear ratio. Smaller Ton, then better roughness, smaller gap, higher wear ratio.

1、Current of Working Condition：



2. There is a formula between Ton vs LV for good sparking performance:

Copper → Steel, Rough eroding, Low wear-ratio, Ton/LV about 30
Medium eroding, medium wear, Ton/LV about 20 - 25
Finish eroding, higher wear, Ton/LV about 10 - 15

Suggesting table between LV & Ton for lower Copper electrode wear-ratio:

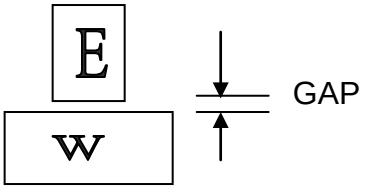
Ton/LV	0	1	2	3	4	5	6	7	8	9
0		30	60	90	125	150	175	200	200	250
10	300	300	350	350	400	450	450	500	500	550
20	600	600	650	650	700	750	750	800	800	850
30	900	900	950	950	1000	1000	1000	1100	1100	1100
40	1200	1200	1200	1200	1300	1300	1300	1400	1400	1400
50	1500	1500	1500	1500	1600	1600	1600	1600	1700	1700
60	1800	1800	1800	1800	1800					

Graphite→Steel, Rough eroding, Low wear-ratio, Ton/LV about 25
Medium eroding, medium wear, Ton/LV about 15 - 20
Finish eroding, higher wear, Ton/LV about 5 - 10

Recommended Working Conditions as followed：

Ton/LV	0	1	2	3	4	5	6	7	8	9
0		25	50	70	100	120	150	125	200	200
10	250	250	300	300	350	350	400	400	450	450
20	500	500	550	550	600	600	650	650	700	700
30	700	700	800	800	800	800	900	900	900	900
40	1000	1000	1000	1000	1100	1100	1100	1100	1100	1100
50	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
60	1200	1200	1200	1200	1200					

- **GAP**: Gap Voltage setting for retracting control.
  1) Range 0 – 15
  2) Smaller GAP, then smaller sparking gap, quicker, not easy to remove rubbish.
     Bigger GAP, then bigger sparking gap, slower, easier to remove rubbish.



  3) GAP data set by pressing [← -] 、[+→] keys to fetch.

- **SPD**: Speed of Auto. Jump.
  1) Range 0 – 15
  2) Smaller SPD, then slower jump for bigger area of electrode and fine sparking.
  3) Bigger SPD, then quicker jump for long electrode doing deep sparking,
     for longer jump distance, for rubbish removed easier.
  4) Matched well with UPD & WT, better efficiency got.
  5) Enter data directly [← -] 、[+→] or use keyed to fetch data.

- **UPD**: jump UP Distance

  1) Range 1 – 255 steps
  2) Smaller UPD, then save dry-run time. Bigger UPD, then waste longer dry-run time.
  3) Enter data directly or use [← -] 、[+→] keyed to fetch data.

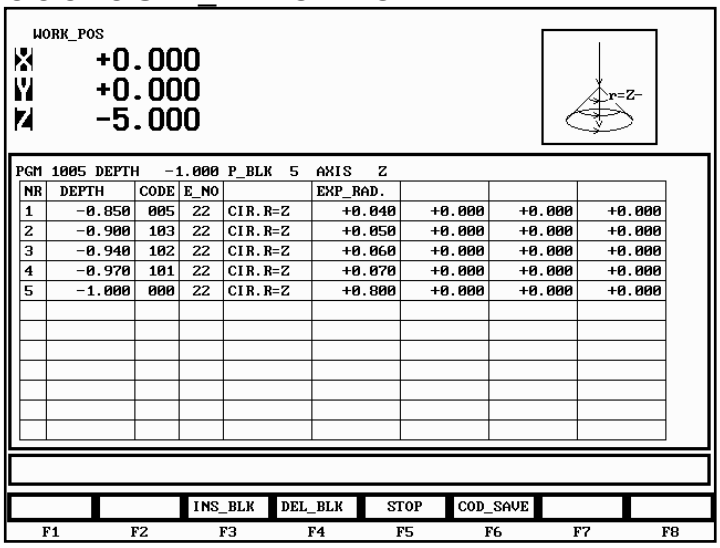
- **WT**: Working Time after auto. Jump
  1) Range 1 – 255 steps, WT=0 means no Auto. jump
  2) Smaller WT, then shorter working time, easier for rubbish removal.
  Bigger WT, then longer working time, harder for rubbish removal.
  3) Enter data directly or use ← - 、 +→ keyed to fetch data.

- **P/N**: Discharge Polarity
  1).“+”: Electrode be positive polarity, “-“ : Electrode be Negative polarity
  2).Changing the setting by ← - 、 +→

- **TIME**: TIME record of each block of sparking program, calculated by PC automatically.

- **CTL**: Control of Z_LOCK ON/OFF for extra external Orbit Head function.
  1：Orbit Head activated, 0：Orbit Head OFF

3.3.3 F3 SPK_EDT OB MODE

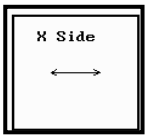
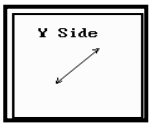
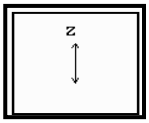
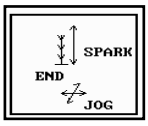
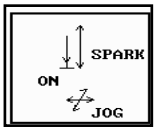


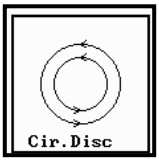
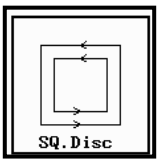
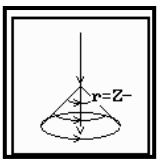
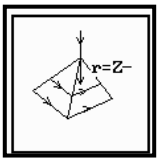
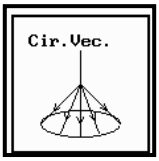
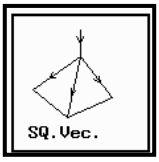
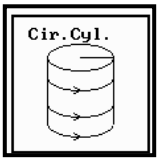
NR	DEPTH	CODE	E_NO		EXP_RAD.			
1	-0.850	005	22	CIR.R=Z	+0.040	+0.000	+0.000	+0.000
2	-0.900	103	22	CIR.R=Z	+0.050	+0.000	+0.000	+0.000
3	-0.940	102	22	CIR.R=Z	+0.060	+0.000	+0.000	+0.000
4	-0.970	101	22	CIR.R=Z	+0.070	+0.000	+0.000	+0.000
5	-1.000	000	22	CIR.R=Z	+0.800	+0.000	+0.000	+0.000

說明：

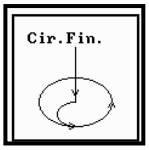
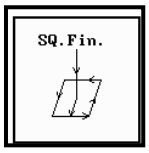
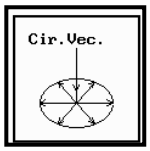
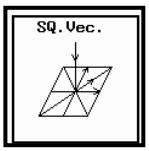
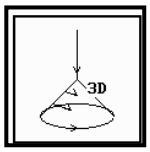
1. **Pressing < – > to page of the spark edit mode or OB-Code.**
2. <u>There are 3 kinds of codes in the OB-mode:</u>
   - **Single axis code**
   - **2.5D code**
   - **3D code**

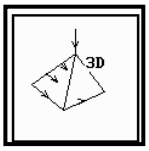
SINGLE AXIS CODE

DRAWING	CODE	NAME	DESCRIPTION
	**10**	X Side Eroding	1）.Depth can be + or - 2）.Retracting & Flushing in opposite direction 3）.STOP key pressed for Feed_Hold, then can be moved back.
	**11**	Y Side Eroding	1）. Depth can be + or - 2）. Retracting & Flushing in opposite direction 3）. STOP key pressed for Feed_Hold, then can be moved back.
	**12**	Z Side Eroding	1）. Depth can be + or - 2）. Retracting & Flushing in opposite direction 3）. STOP key pressed for Feed_Hold, then can be moved back.
	**18**	JOG+ SPK1	1. Z-Axis Jump sparking, X、Y can be moved by RCB.。 2. This can be used as sparking touch, when depth achieved, sparking ended and next program run.
	**19**	JOG+ SPK2	1. Z–Axis Fix sparking, X、Y can be moved by RCB. 2. This can be used as sparking touch, when depth achieved, program run (sparking) continuously. This will not stop sparking and move to next program.

DRAWING	CODE	NAME	DESCRIPTION
	20	Cir. Disc	Depth reached, only do plane circular expansion. **Coefficient: Expansion radius** 1) When programmed depth eroded, start to do the circular expansion eroding with the programmed expansion radius on the plane. 2) Retracting & Flushing: X、Y backward to circle center, Z upward. 3)STOP key pressed for Feed_Hold: X、Y backward to circle center, Z standstill.
	21	SQ. Disc	Depth reached, only do plane square expansion. **Coefficient: Expansion radius** 1) When programmed depth eroded, start to do the square expansion eroding with the programmed expansion radius on the plane. 2)Retracting & Flushing: X、Y backward to circle center, Z upward. 3)STOP key pressed for Feed Hold: X、Y backward to circle center, Z standstill.
	22	r=Z-	Circular expansion with Radius=Z Incremental **Coefficient: Expansion radius** 1) When Z position of OB_Start reached (PGM_Depth - Radius), Z keep sinking wth circular expansion, its Exp. r= Z Inc, till Z depth & Circular Exp. completed. 2)Retracting & Flushing: Z upward, X、Y backward to circle center. 3)STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.
	23	r=Z-	Square expansion with Radius=Z Incremental **Coefficient: Expansion radius** 1) When Z position of OB_Start reached (PGM_Depth - Radius), Z keep sinking with square expansion, its Exp. R = Z Inc, till Z depth & square Exp. completed. 2) Retracting & Flushing: Z upward, X、Y backward to center。 3)STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.
	24	Cir. Vec.	Circular Vector expansion with Radius=Z Incremental **Coefficient: Expansion radius、art/End/Incremental angle** 1) When Z of OB_Start reached (PGM_Depth - Radius), Z keep sinking with circular vector expansion, Exp. r= Z Inc, till Z depth & vector Exp. completed. 2) Retracting & Flushing: Z upward, X、Y backward to circle center. 3) STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.
	25	SQ. Vec	Square Vector expansion with Radius=Z Incremental **Coefficient: Expansion radius、Start/End/Incremental angle** 1) When Z of OB_Start reached (PGM_Depth - Radius), Z keep sinking with square vector expansion, Exp. r= Z Inc, till Z depth & vector Exp. completed. 2)Retracting & Flushing: Z upward, X、Y backward to center. 3)STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.
	26	Cir. Cyl.	To Exp. Radius, 2)Cylindrical+Circular contouring down. **Coefficient: Expansion radius** 1）.Eroding to the Exp. radius, then takes the cylindrical & circular contouring down, till the depth reached & circle completed. 2）. Retracting & Flushing: X、Y backward to circle center, Z upward,。 3）. STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.

3.3.3.2 3D CODE

Drawing	Code	Name	Description
	**30**	**Cir. Fin.**	Circular Fine Contouring on Depth **Coefficient: Expansion radius** 1）.When Z eroded depth reached, circular move to the Exp. radius, then do the final fine finished circular contouring eroding. 2）. Retracting & Flushing: X、Y backward to circle center, Z upward。 3）. STOP key pressed for Feed_Hold: X、Y backward to circle center, Z standstill.
	**31**	**SQ. Fin.**	Square Fine Contouring on Depth **Coefficient: Expansion radius** 1）.When Z eroded depth reached, move to the expansion radius, then do the final fine finished square contouring eroding. 2）. Retracting & Flushing: X、Y backward to circle center, Z upward。 3）. STOP key pressed for Feed_Hold: X、Y backward to center, Z standstill.
	**32**	**Cir. Vec.**	X、Y Vector Expansion on Depth & Circle **Coefficient: Expansion radius、Start/End/Incremental angle** 1）. When Z eroded depth reached, start vector expansion on plane & circle, till all linear vector eroding finished. 2）. Retracting & Flushing: X、Y backward to circle center, Z upward。 3）. STOP key pressed for Feed_Hold: X、Y backward to circle center, Z standstill.
	**33**	**SQ. Vec.**	X、Y Vector Expansion on Depth & Square **Coefficient: Expansion radius、Start/End/Incremental angle** 1）. When Z eroded depth reached, start vector expansion on plane & square, till all linear vector eroding finished. 2）. Retracting & Flushing: X、Y backward to center, Z upward 。 3）. STOP key pressed for Feed_Hold: X、Y backward to circle center, Z standstill.
	**34**	**3D Cir.**	Circular Expansion in 3D contouring **Coefficient: Expansion radius** 1）. When Z position of OB_Start reached (PGM_Depth - Radius), XYZ keep sinking in helical contouring path down, with circular expansion simultaneously. 2）. Retracting & Flushing: Z upward, X、Y backward to circle center。 3）.STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.



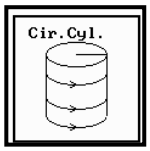
35 **3D SQ.** Square Expansion in 3D contouring

Coefficient: Expansion radius

1）. When Z position of OB_Start reached (PGM_Depth - Radius), XYZ keep sinking in helical contouring path down, with square expansion simultaneously.

2）. Retracting & Flushing: Z upward, X、Y backward to center。

3）.STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.



36 **Cir. Cyl.** 1. to Exp. Radius

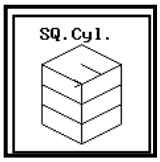
2. Cylindrical+Circular contouring down.

Coefficient: Expansion radius

1）.Eroding to the Exp. radius, then takes the cylindrical & circular contouring down, till the depth reached & circle completed.

2）. Retracting & Flushing: X、Y backward to circle center, Z upward,。

3）. STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.



37 **SQ Cyl.** 1) to Exp. Radius, 2)Cylindrical+Square contouring down.

Coefficient: Expansion radius

1）. Eroding to the Exp. radius, then takes the cylindrical & square contouring down, till the depth reached & square completed.

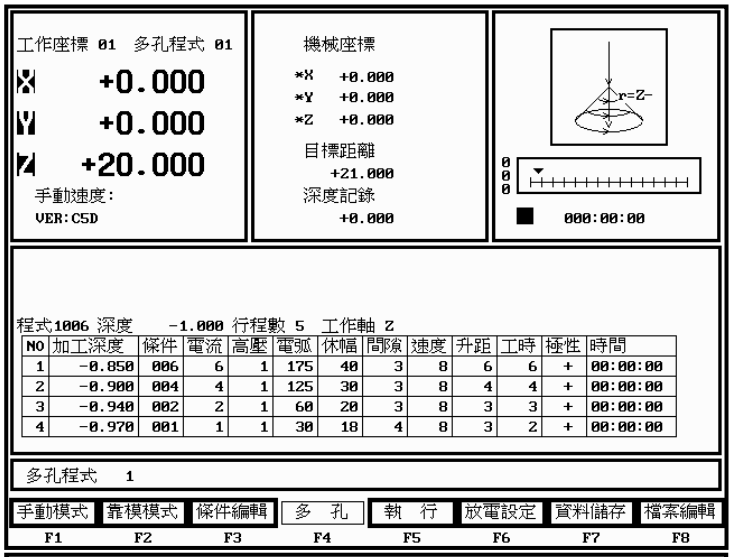
2）. Retracting & Flushing: X、Y backward to e center, Z upward,。

3）. STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.

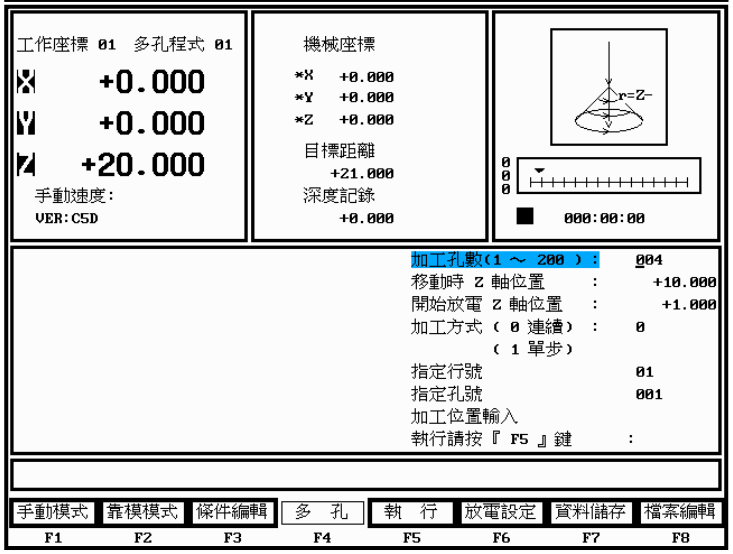
38 **L_X_ Y_Z :** **X,Y,Z synchronous Machining.**

1. Setting Values ： X,Y,Z-axis incremental values.
2. Z-axis depth achieved, 3 axis synchronous sparking from starting coordinate & program ended when 3 axis incremental values achived.
3. Retracting & Flushing: Back to the starting coordinate.
4. STOP key pressed for Feed_Hold: Z upward, X、Y backward, to OB_Start point.

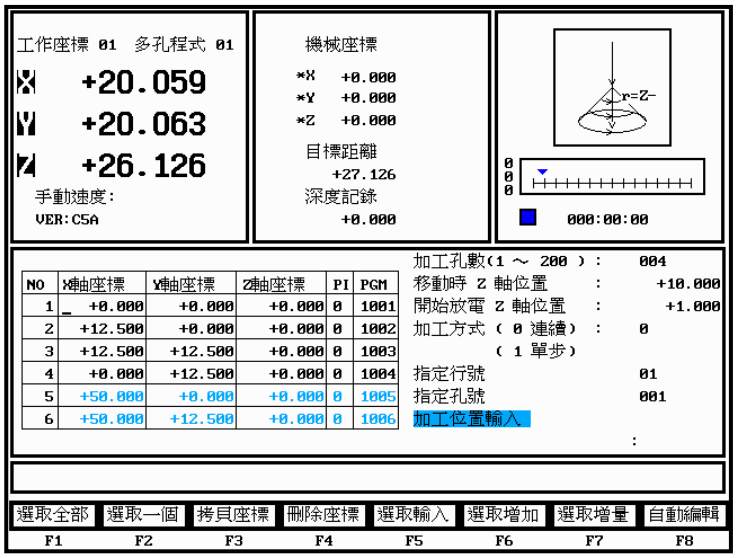
3.4.1 F4 PATTERN　Main Operational Mode



PIC.1
Multi-Caving
Setting



PIC. 2
Pattern Mode
Setting



PIC.3
Working
Coordinate
Setting

Procedure： Main function key press F4 PATTERN, in to PATTERN mode.

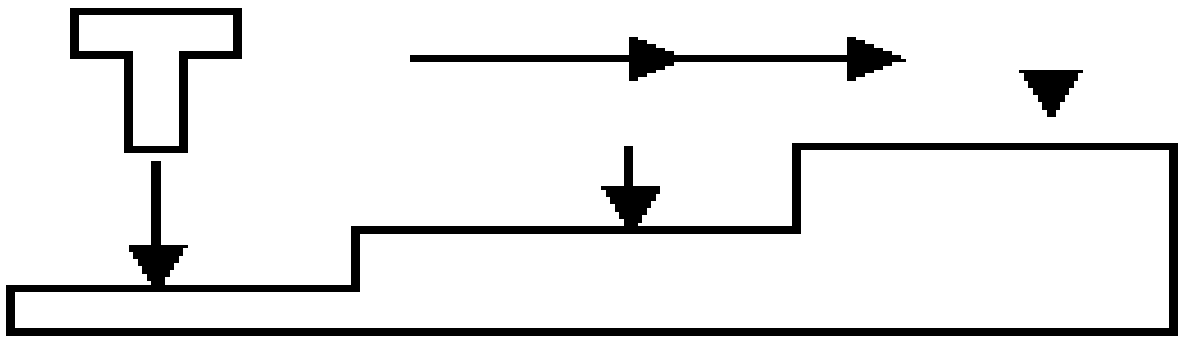
Description

1.For the multi-caves sparking, editing the Sparking Codes and Depth firstly.

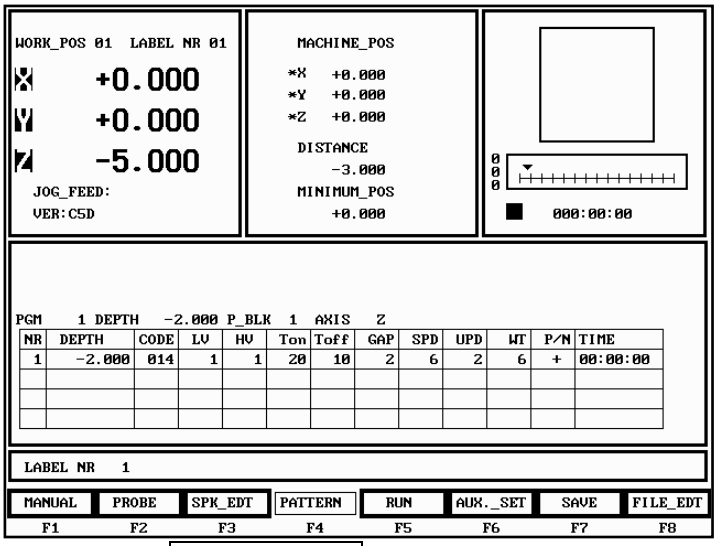
2.OPERATE SCREEN

- There are 3 main operate screens in the Pattern mode as the pictures above.
- Input pattern No. on screen 1, press ENTER confirm then go into screen2. Press ▲ key back to screen 1. Screen 2 input the pattern data to POS (X,Y,Z) ENT & press NTER to input working coordinate. Press ▲ to (X,Y,Z) POS Setting.
- Press F5to start pattern mode spark.
- When monitor is in the Screen 3 the function keys F1~F8 於 can be operated for multi-cave editing.

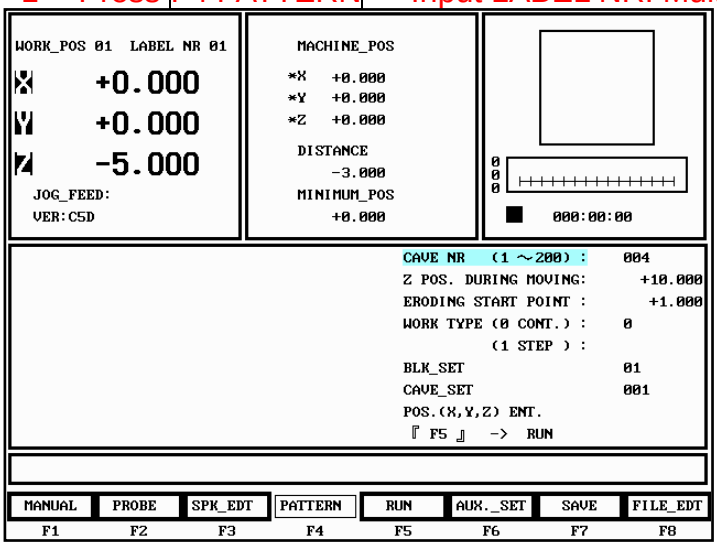
3. Preparation before PATTERN mode:
   - Fix and adjust the electrode and workpiece.
   - Finish probe the reference point and set the sparking position coordinate.
   - Complete the SPARK EDIT, DEPTH and PATTERN Mode programming
4. It can be manual input the spark position when do random spark position.
5. The POS. table can be editing or edited by F8 AUTO_CAV into fixed pattern.
6. AUTO_CAV can be edit up to 20 sets of pattern.
7. It can do the multi-cave side eroding when program set the X, Y-axis is working axis.
8. The multi-caves sparking is available on different planes as following:



3.4.2 F4 PATTERN BASIC INPUT SCREEN DESCRIPTION



1、 Press F4 PATTERN ，Input LABEL NR. Multi-Caving No.(1-200)



2、Into PATTERN Editing

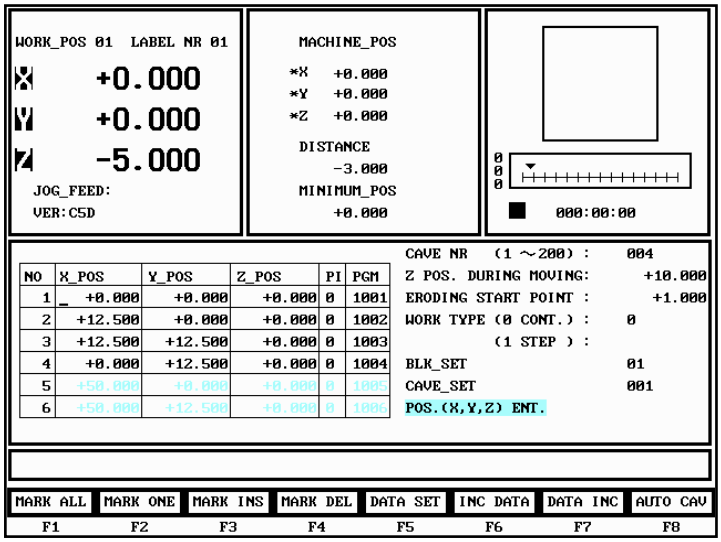
DESCRIPTION

- **POS (1～200)** ： The POS. table of pattern (Max. 200 POS).
- **Z position** ： When finish one cave the Z axis pull up position.
- **Z spark position** ： The position after pull up and move to next cave start to spark.
- **Caving method (0 cont/1 step)**：When PATTERN (Multi-Caving) set, can choose continuous or step sparking
  1. Continuous Sparking（0 CONT）：All steps of working conditions finished, moved to next caving & start sparking.

2.STPE Sparking（1 STEP）：Only one step of working condition executed on one caving after another. When all cavings are finished, changed to next step of working condition and start sparking from the first caving to the last. When all steps of working conditions finished, program ends.

- **BLK_SET**：Set the step of working condition.
- **CAVE_SET**：Set the starting no. of caving hole.
- **POS(X,Y,Z) ENT**：Moving cursor here, the table of working coordinate will be auto shown up.。
- It can be manual input the coordinate or press F8 AUTO_CAV,to fast finish the input.
- **Press F5 to start** ： After edit press F5 RUN key to start.

3.4.3 F4 PATTERN　POS(X.Y.Z.) ENT.



1.Move Cursor to POS.(X.Y.Z)ENT enter the coordinate.
2.Press F8 AUTO CAV into Multi-Caving, Patterns of multi-caving can be set

Description

1. POS(X.Y.Z.) ENT Column description：

1. NO：Cave No. Automatic show up.
2. X-axis coordinate: Multi-cave position sparking X-axis coordinate.
3. Y-axis coordinate: Multi-cave position sparking Y-axis coordinate.
4. Z-axis coordinate: Multi-cave position sparking Z-axis coordinate. It is also start position of depth.
5. PI ：Coolant position setting
6. PGM ： Programs setting. Every set POS must be with independent working programs (these programs can be same or different to each other.)

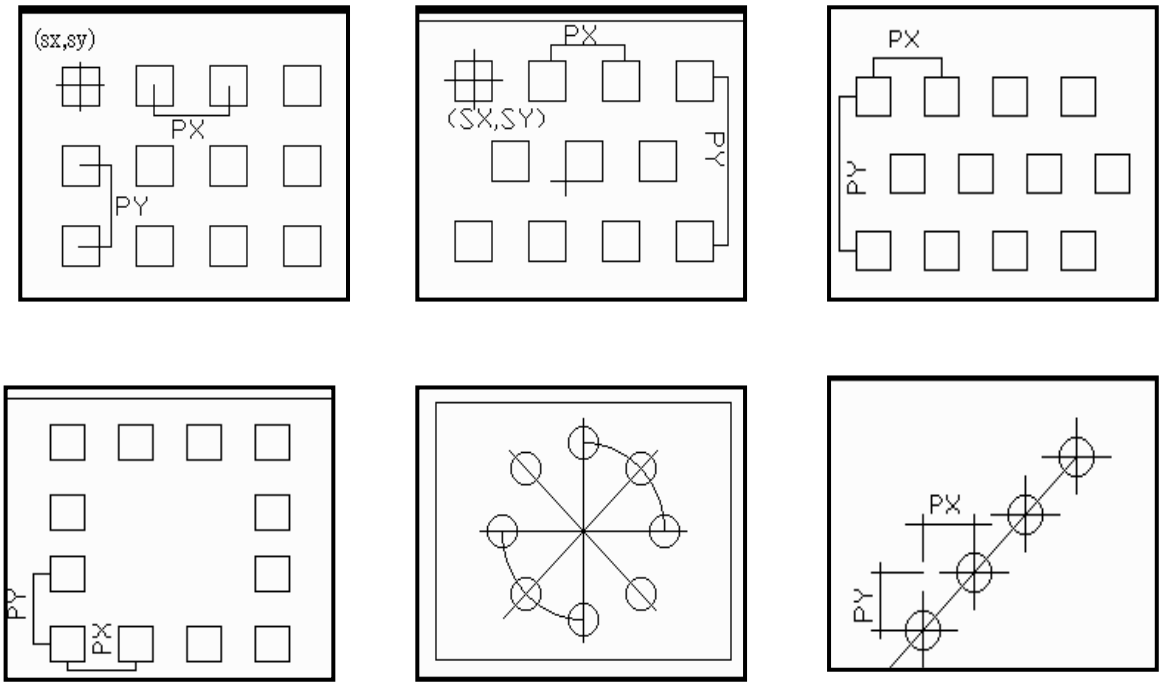
***** Cautions: When machining, the depth is based on Z-Axis Coordinate as starting point, all set working values are the needed working dimension. (incremental value.)**

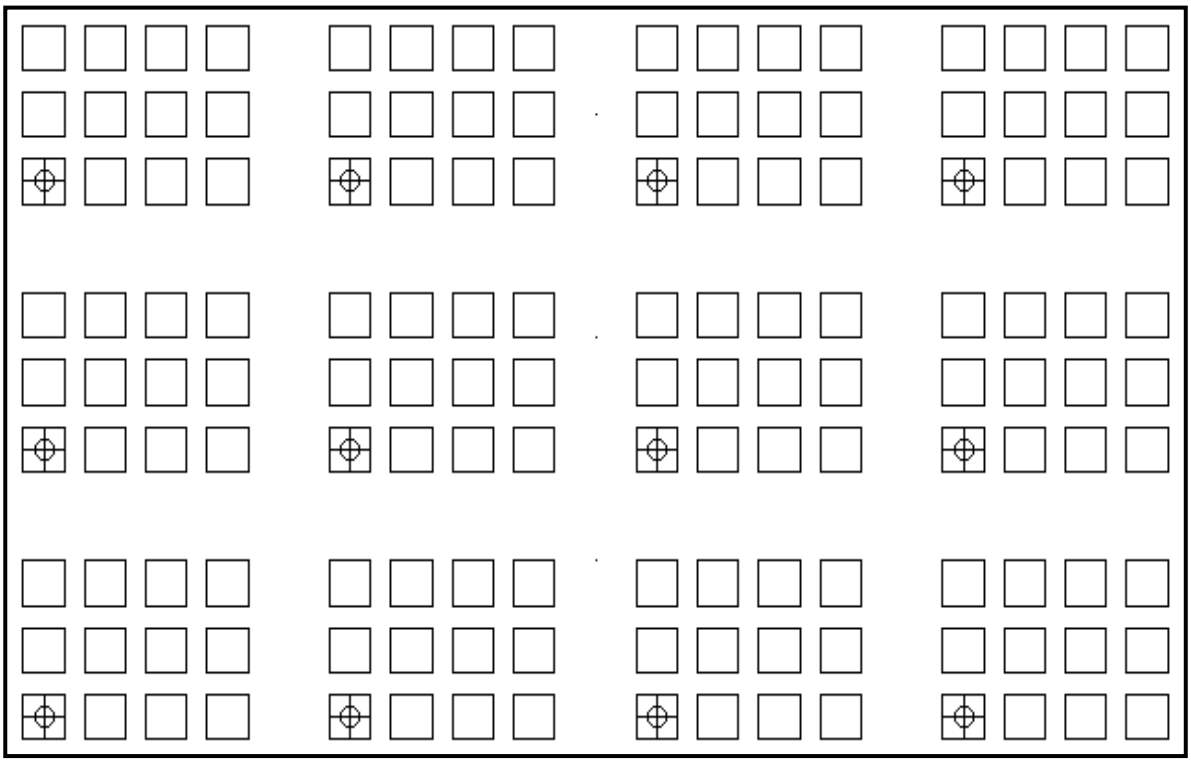
2. Function key description:

F1 MARK ALL：Selecting whole table for POS. editing.
F2 MARK ONE：Selecting the chosen cave NO.(cursor POS.) for POS. editing.
F3 MARK INS：Insert one new POS. as the assigned cave (cursor POS.)
F4 MARK DEL：Deleting the assigned cave NO. (cursor POS.)
F5 DATA SET：Entering new POS to mark data.。
F6 INC DATA：Adding the same data to all marked original data.
F7DATA INC ：Adding incremental to all marked data one by one. (The 1 st marked one no change)
F8 AUTO CAV：Fixed pattern POS. editing.

***** Moving the cursor to the wanted start cave NO. Press F8 for fixed pattern POS. editing**

3.4.3.1 F4PATTERN-> F8 AUTO CAVE





Description

- ***PATTERN with AUTO_CAV (fixed pattern cycle)***
- Standard procedure as below:

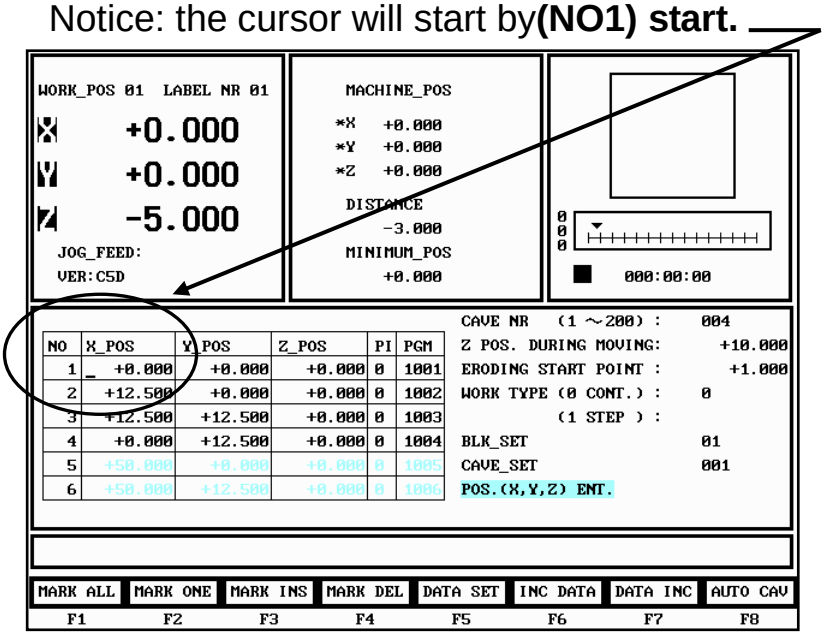
Fix the electrode and workpiece and set the coordinate.
Into the SPK_EDT to set the spark condition, depth and OB mode.
Into PATTERN mode set the multi-cave position No. and basic parameter.
Cursor moved to "POS. (X,Y,Z) ENT", the pattern POS. table appeared with cursor.
Pressing F8 (AUTO CAV) for fixed pattern cycle editing.
Selecting wanted pattern mode shown as above pic.)

Follow the screen instruction input the parameter.
Pressing ENT ; All the new calculated POS. data will be generated into the table.
Input the SPRK_EDT program(must input)
Ensuring the programmed caves POS.、NR.、Z POS. …are correct, press ▲ to finish pattern editing. Pressing F5 to run the pattern sparking.
Follow the instruction on the screen to input 1(start from 1st cave) or 2(start from set cave No. or line No.)to spark.
It can be paused by press the STOP key the press ESC key again to stop sparking.
During the pause the Z-axis can pull up (down), X Y-axis can move out of the sparking position to check the spark condition. Press the START key again the 3 axes will go back to original spark position to work.

Screen:

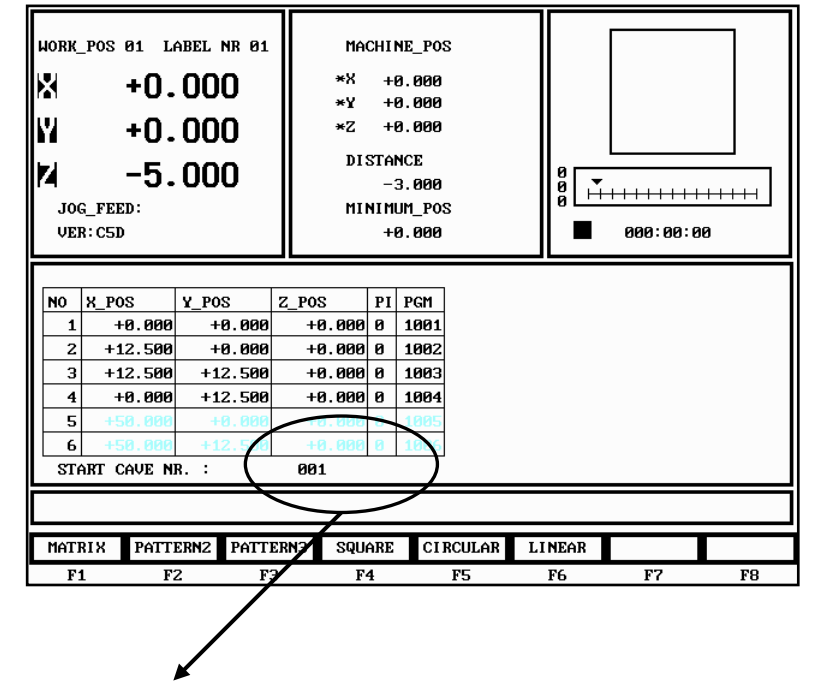
1. Cursor moved to "POS.(X,Y,Z) ENT", the left side shows coordinate column the cursor automatic go into the column.

Notice: the cursor will start by**(NO1) start.**



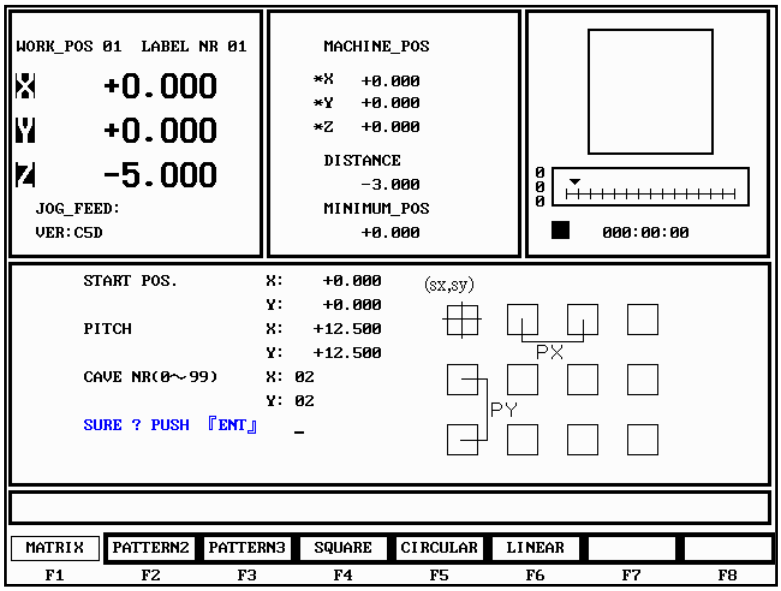
2. Press F8 AUTO_CAV

3. Select the needed PATTERN Mode (Matrix, PATTERN2, PATTERN3,SQUARE, CIRCULAR.LINEAR)

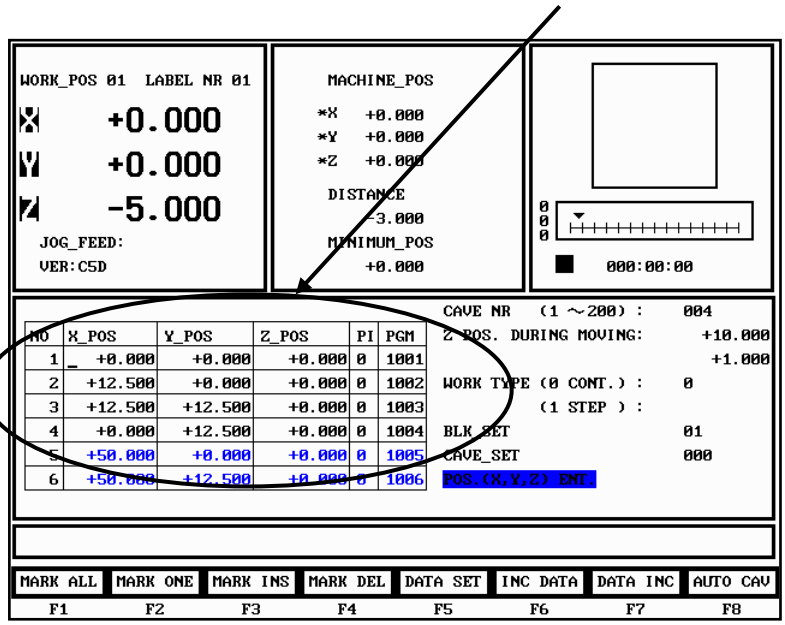


∗Notice the start cave No.

4. Follow the instruction to input the parameter



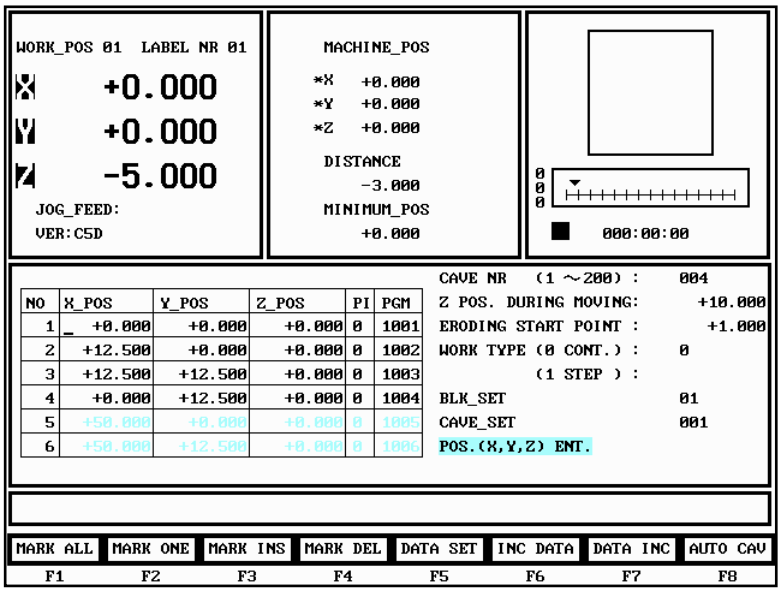
5. After confirm move the cursor to **ENT** **key, Press ENT the screen will back to last page and automatic insert the parameter to the column.** 。



6. Input the SPRK_EDT program (must input)
7. Ensuring the programmed caves POS.、NR.、Z POS. …are correct, press ▲ to finish pattern editing. Pressing F5 to run the pattern sparking.

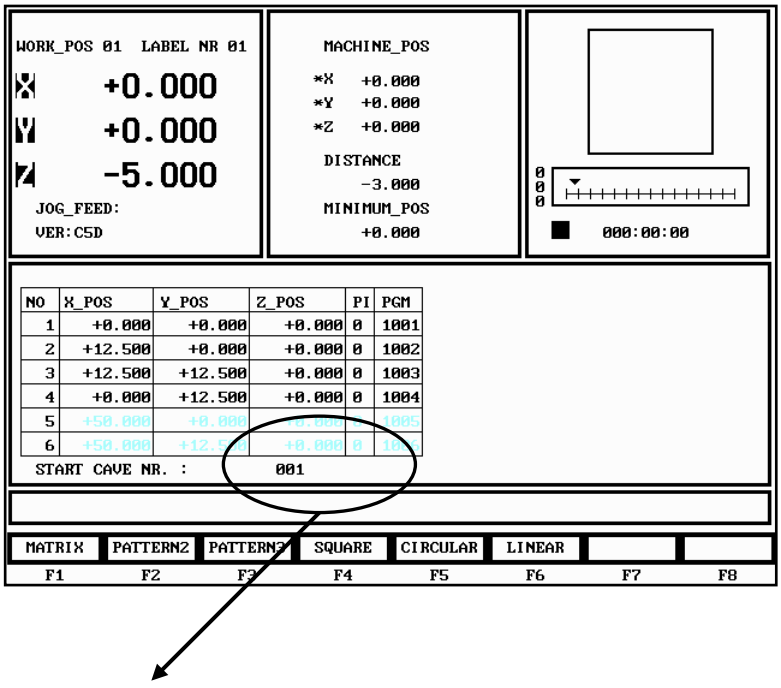
Cursor moved to "POS.(X,Y,Z) ENT", the left side shows coordinate column the cursor automatic go into the column.

Notice: the cursor will start by**(NO1) start.**



6. Press F8 AUTO_CAV

7. Select the needed PATTERN Mode (Matrix, PATTERN2, PATTERN3,SQUARE, CIRCULAR.LINEAR)



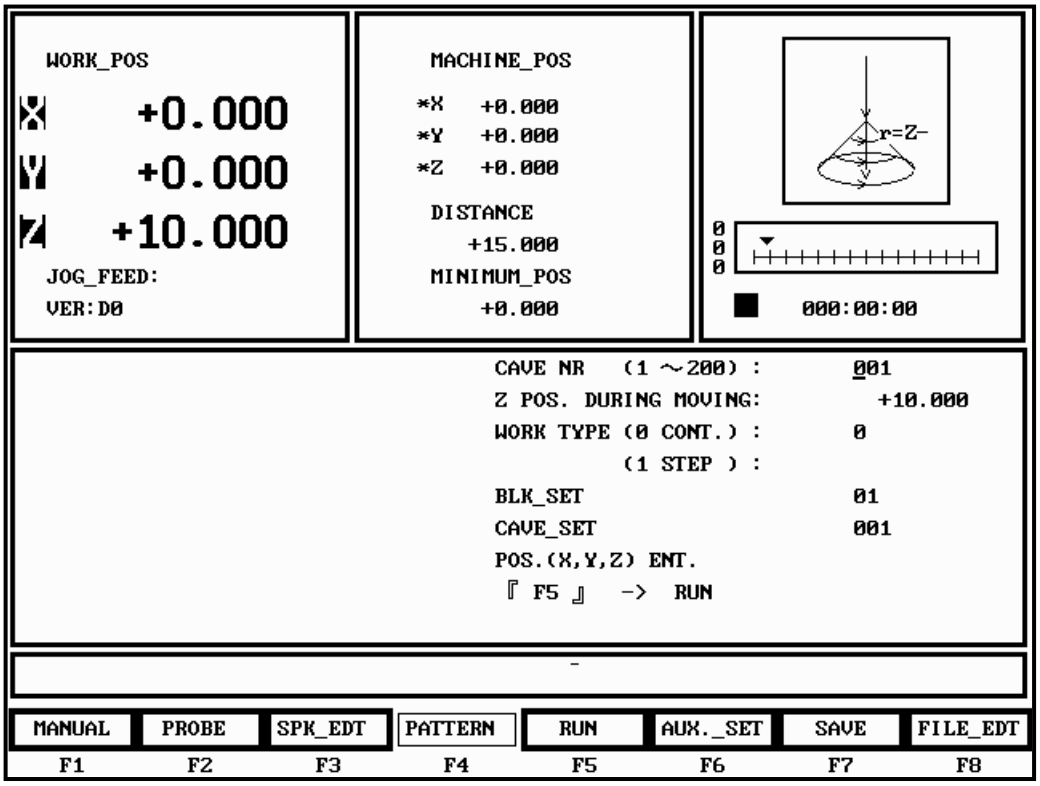
∗Notice the start cave No.

8. **Pressing F5 , Dialogue showed：**

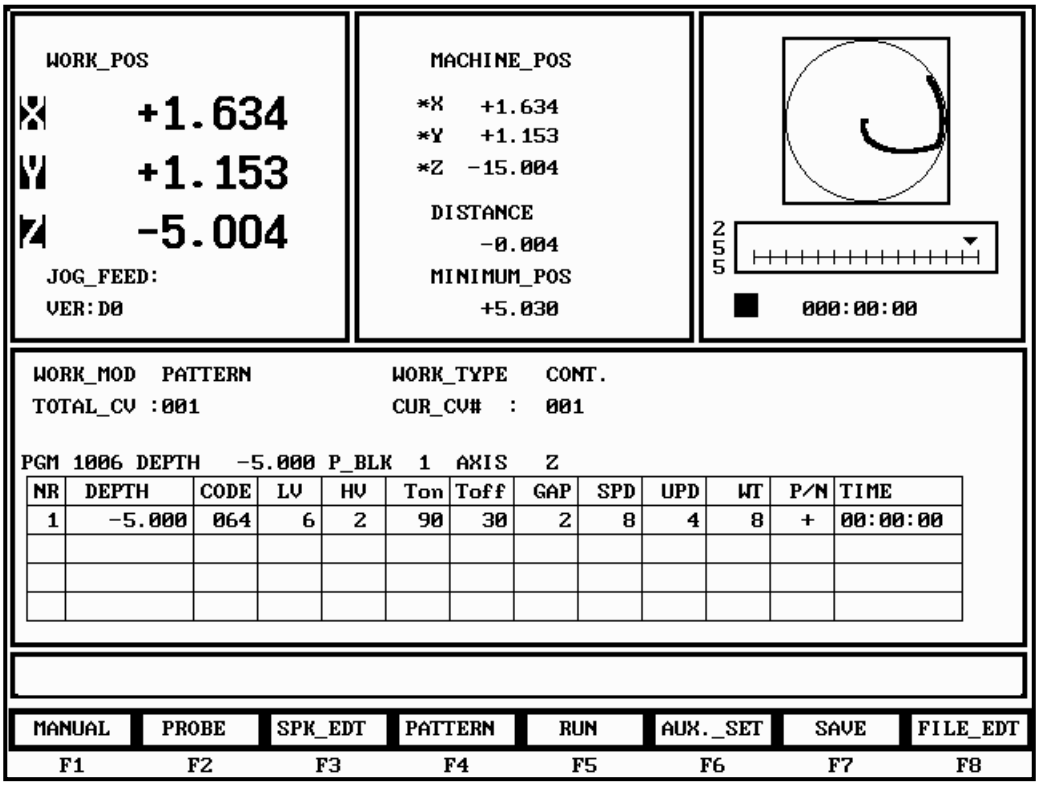
“ 1：FROM BEGIN, 2：SET BLK_NR,CAVE_NR：1”

1、 Pressing "1 + ENT" to spark from cave no. 1 of pattern table.

2、 Pressing "2 + ENT" to select BLK_NR. for starting CAVE NR. to start sparking.

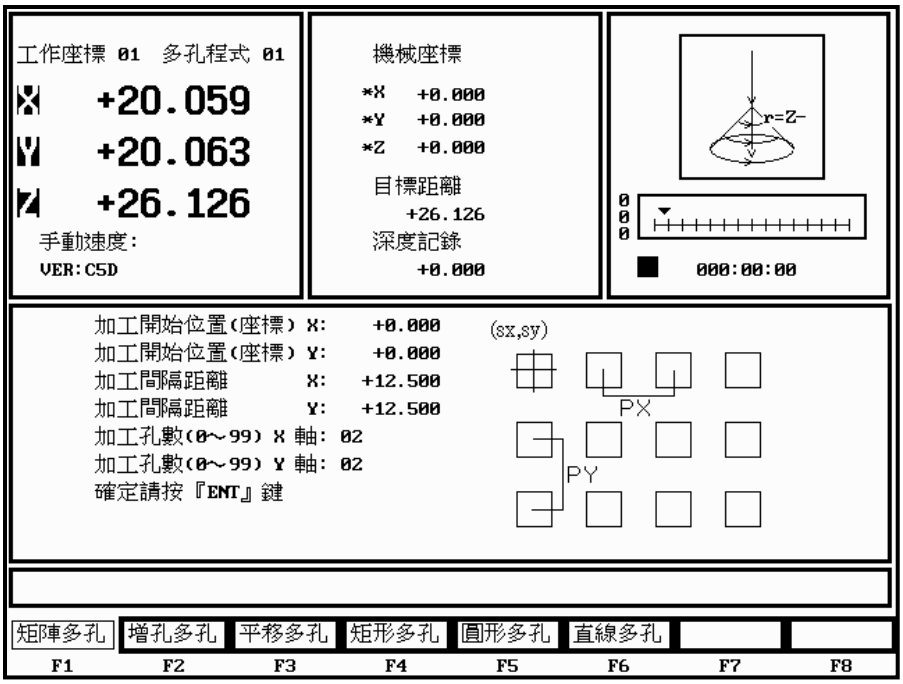


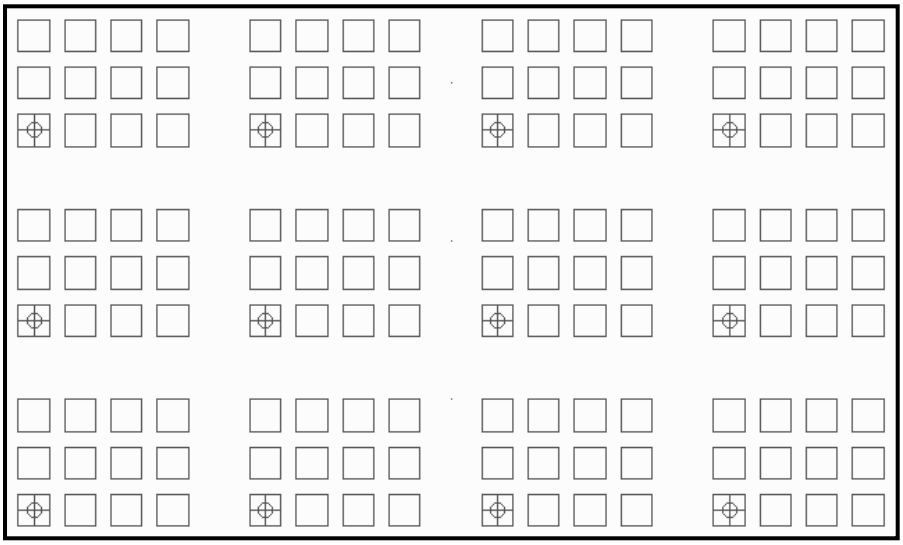
9. MULTI-CAVING PATTERN RUNNING:



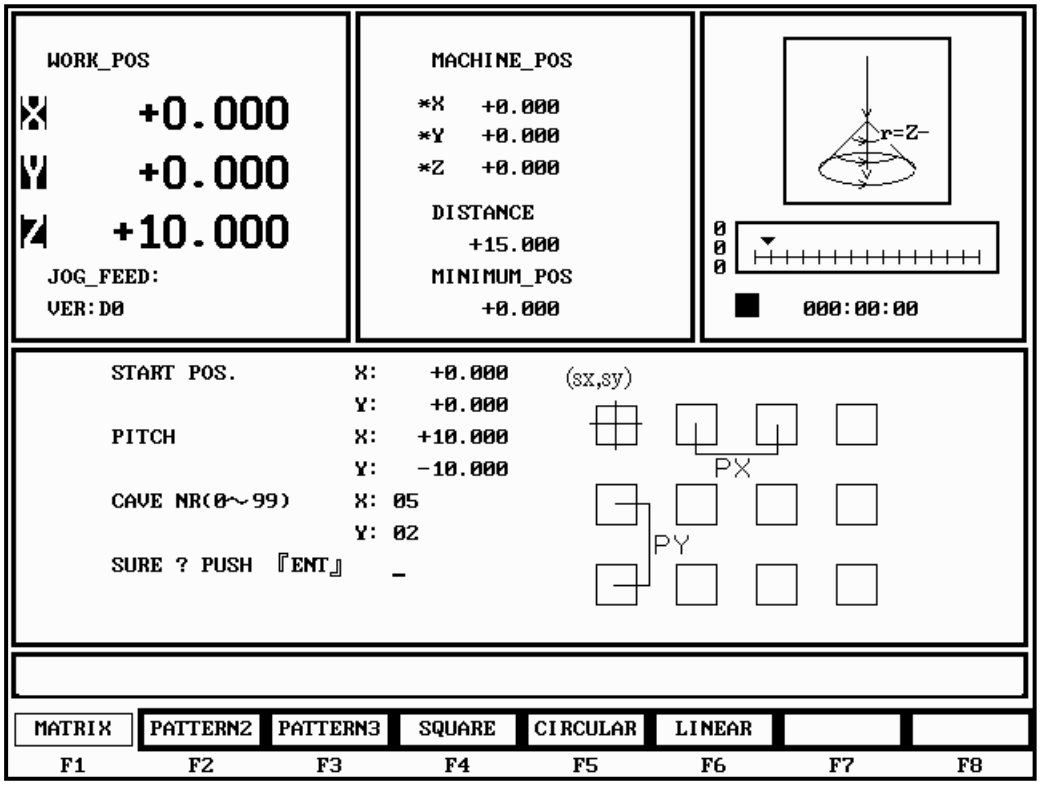
3.4.3.1.0 F4 PATTERN-> F8AUTO_CAV Auto Caving Editing

1、 Cursor moved to "POS.(X,Y,Z) ENT", the pattern POS. table appeared with cursor.
2、 Moving cursor to wanted 1st cave NO. of wanted pattern block. (Could be not the 1st cave of POS. table)
3、 Pressing [F8] (AUTO CAV) for fixed pattern cycle editing.
4、 Selecting wanted pattern cycle.
5、 Following the dialogue to edit the POS. Distance, Cave Nr. and so on.
6、 Pressing [ENT]；All the new calculated POS. data will be generated into the table.
7、 Moving the cursor to the next wanted 1st cave NO. of next wanted pattern block.
8、 Repeating the same procedures 4 – 6 to set up the 2nd caving data.
9、 Ensuring the programmed caves POS.、NR.、Z POS. …are correct, press [▲] to finish pattern editing.
10、Pressing [F5] to run the pattern sparking.





3.4.3.1.1 F4 PATTERN-> F8AUTO_CAV→F1 MATRIX

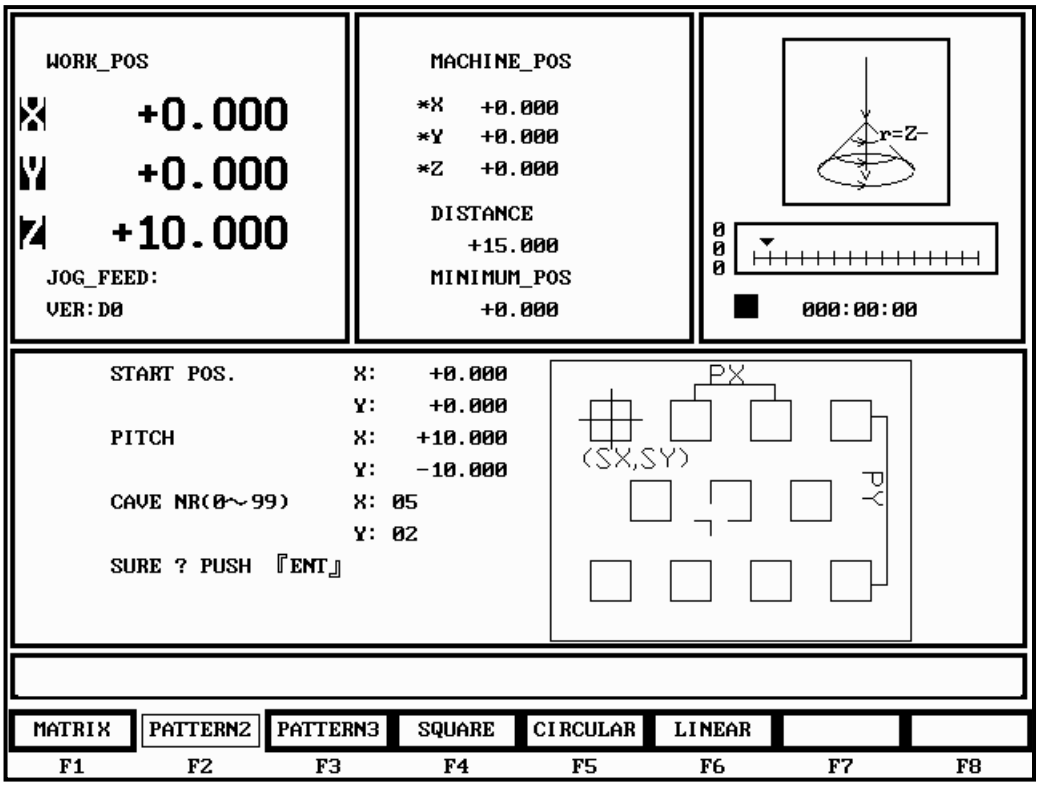


Desc. ：

1. Input
   - Starting Coordinate(As shown SX,SY)。
   - Pitch dimension(As shown PX,PY)。
   - Number of Multi Caving (X-Axis, Y-Axis)。
   - Press ENT to confirm.

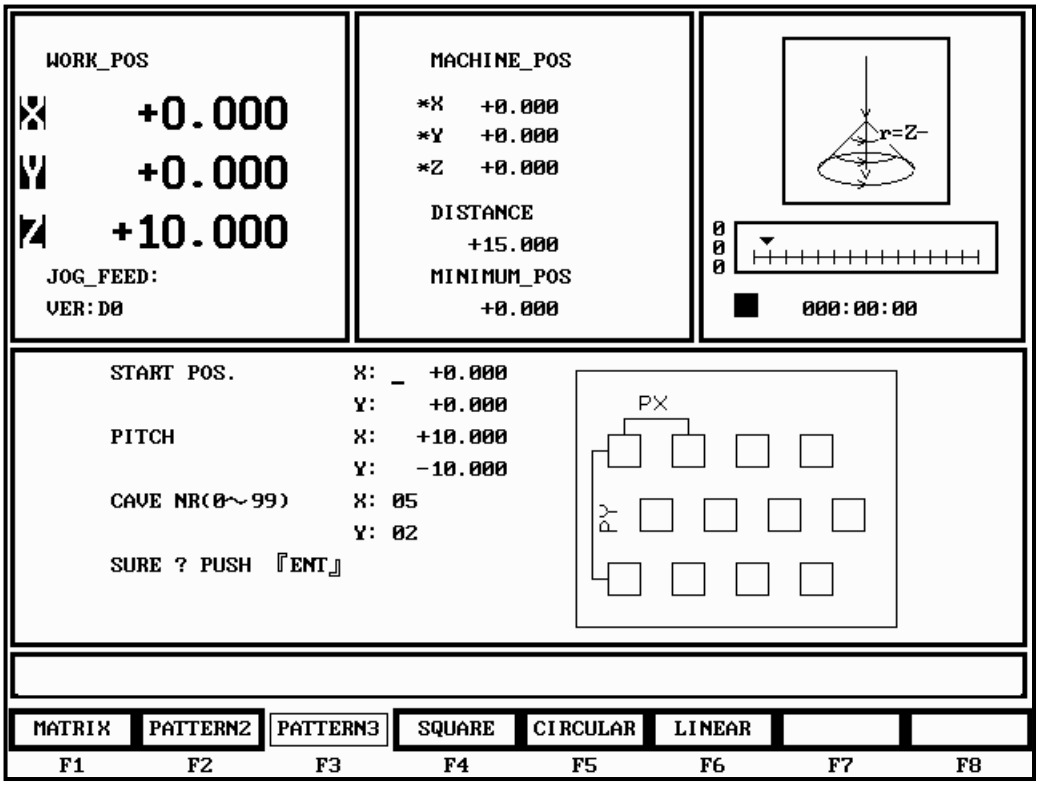
2. Controlling system will automatically calculate & save all the coordinates of all cavings.

3.4.3.1.2 F4PATTERN-> F8AUTO_CAV→F2 PATTERN2 (Pitch Center)Desc.：



1. PATTERN2 (Pitch Center) Add new pitch center cavings based on input pitch dimension.(X-axis pitch center、Y-axis pitch center).
2. As shown above,Multi-Caving with fixed pitch center can do sparking on the possible working area.Simple setting can do the automatic editing.
3. Input：
   - Starting Coordinate(As shown SX,SY)。
   - Pitch dimension(As shown PX,PY)。
   - Number of Multi Caving (X-Axis, Y-Axis)。
   - Press ENT to confirm.。
4. Controlling system will automatically calculate & save all the coordinates of all cavings.

3.4.3.1.3 F4PATTERN-> F8AUTO_CAV→F3 PATTERN3

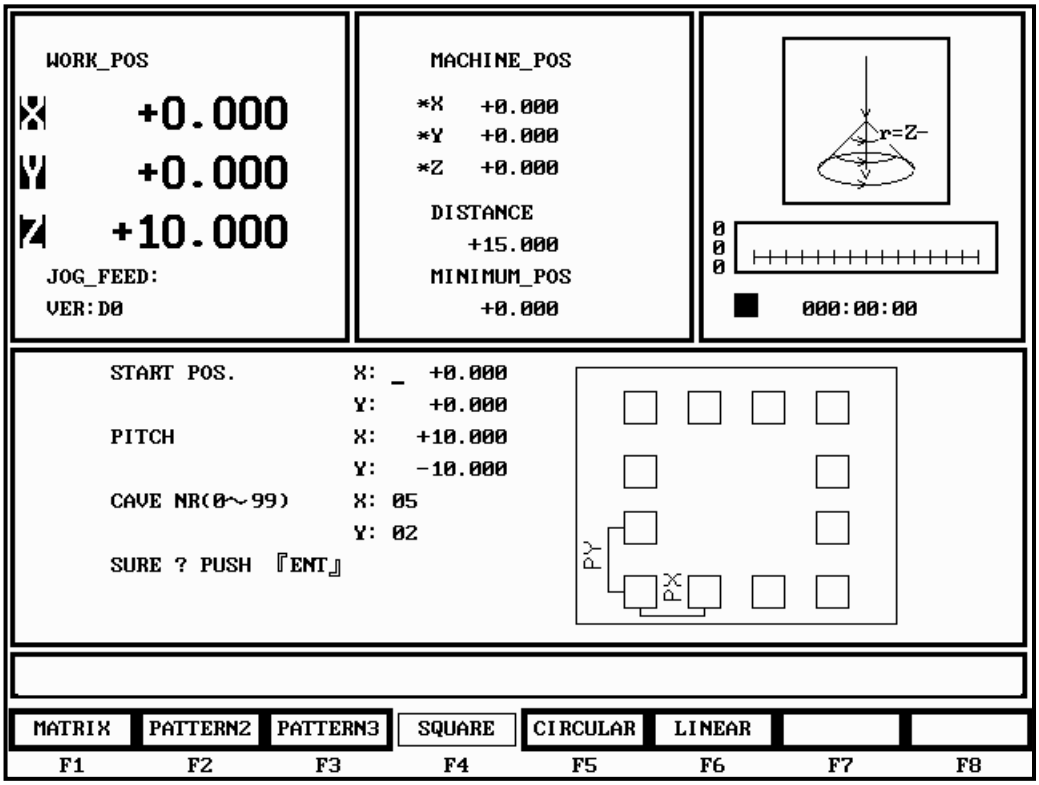


Desc.：

4. PATTERN2 (Pitch Center) Add new pitch center cavings based on input pitch dimension.(X-axis pitch center、Y-axis pitch center).
5. As shown above, Multi-Caving with fixed pitch center can do sparking on the possible working area. Simple setting can do the automatic editing.
6. Input：
   - Starting Coordinate(As shown SX,SY)。
   - Pitch dimension(As shown PX,PY)。
   - Number of Multi Caving (X-Axis, Y-Axis)。
   - Press ENT to confirm.。

4. Controlling system will automatically calculate & save all the coordinates of all cavings.

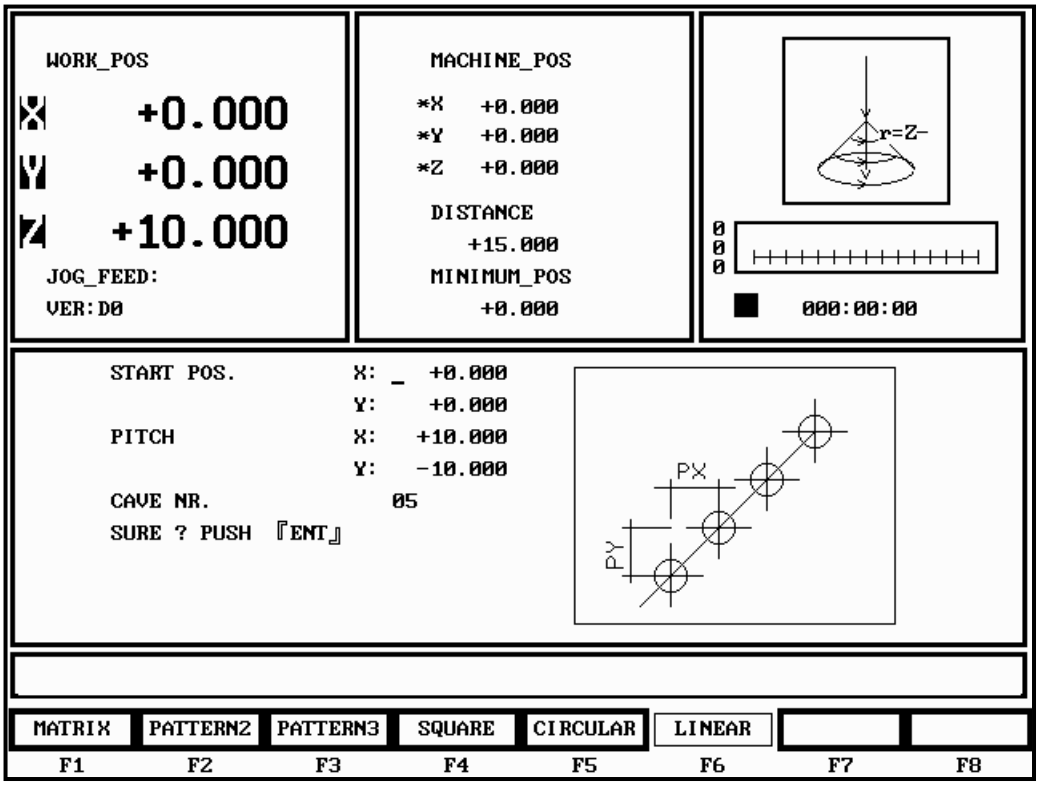
3.4.3.1.4 F4PATTERN-> F8AUTO_CAV→F4SQUARE



Desc.：

1. Press SQUARE to set pitch dimension & numbers of cavings, yet only square external cavings programmed.
2. Input：
   - Starting Coordinate(As shown SX,SY)。
   - Pitch dimension(As shown PX,PY)。
   - Number of Multi Caving (X-Axis, Y-Axis)。
   - Press ENT to confirm.。
2. Controlling system will automatically calculate & save all the coordinates of all cavings

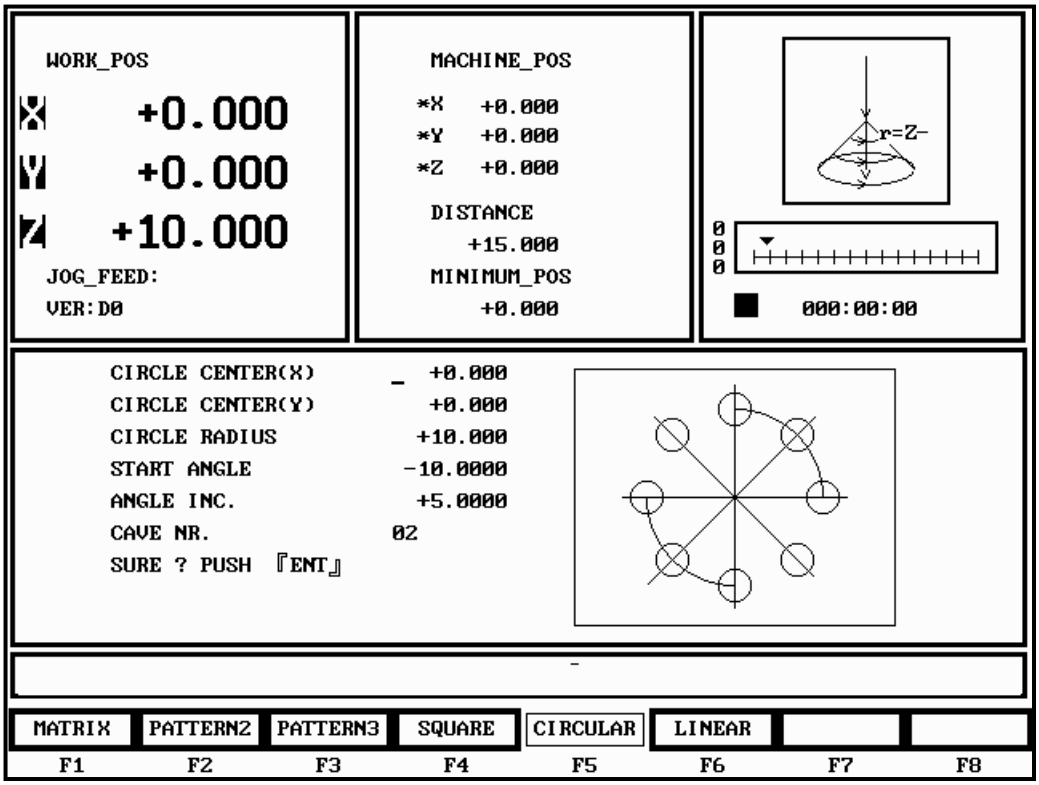
3.4.3.1.6 F4PATTERN-> F8AUTO_CAV→F6LINEAR



Desc.：

1. LINEAR this mode can edit the linear multi cavings.
2. Input：
   - Starting Coordinate(As shown SX,SY)。
   - Pitch dimension(As shown PX,PY)。
   - Number of Multi Caving (X-Axis, Y-Axis)。
   - Press ENT to confirm.
3. Controlling system will automatically calculate & save all the coordinates of all cavings.

3.4.3.1.5 F4PATTERN-> F8AUTO_CAV→F5CIRCULAR

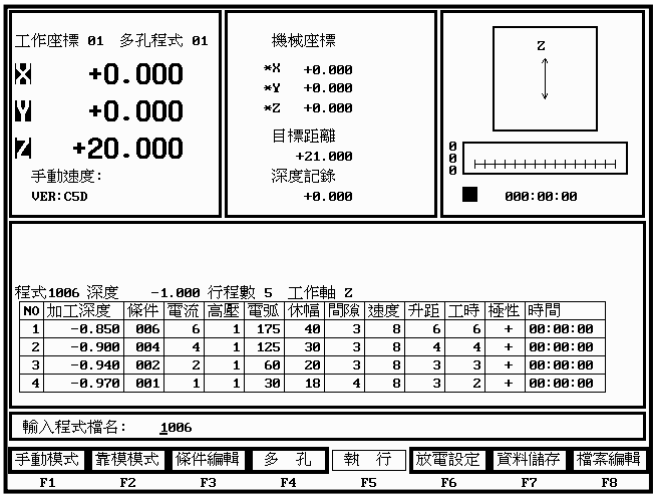


Desc.：

1. CIRCULAR Based on the center of circle, radius & angle this mode can automatically edit the coordinates of circular multi cavings.
2. Input：
   - The coordinate of circle center.
   - Circle radius.
   - Starting angle.
   - Angle increased.
   - Number of cavings
   - Press ENT to confirm.

Controlling system will automatically calculate & save all the coordinates of all cavings.

3.5 F5 RUN Program Run



Procedure：

Finished working conditions & pattern editing, press F5 RUN directly and input PGM no. for staring sparking.

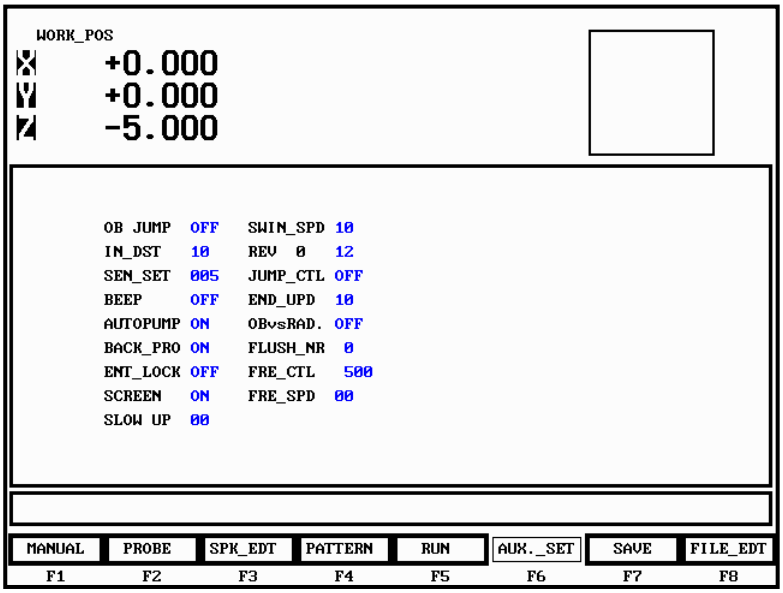
Desc.：

1. PNC/CNC pattern mode machining can be interrupted by pressing STOP on the remote control, pressing ESC for completely sparking (programs) off.

2. During interruption (HOLD shown on monitor), X,Y,Z-axis can be moved for intermediate checking. Pressing START on remote control, X,Y-axis will move automatically to interrupted position & Z-axis moves down to continue programmed sparking.

3.6 F6 AUX._SET Auxiliary sparking function Setting

● **By pressing ← - 、 + → to switch the AUX setting.**



Desc.:

1、OB JUMP ： While Orbit activated, the retracting range of Auto. Jump limited.

ON：With limit, not over the starting point of Orbit.

OFF：

2、IN_DST. : Distance to MIN._POS of sparking job for slow down. Range 20 steps.

3、SEN_SET : Sensitivity of retracting. Range 0 – 255.

Bigger SEN_SET, more sensitive to retract for rubbish removal, slower machining speed.

Smaller SEN_SET, less sensitive to retract for rubbish removal, better machining speed.

4、BEEP : Buzzer off delay ON / OFF control.

System activates alarm buzzer after PGM_END or malfunction encountered to call Operator to take care of it.

ON : keep BEEP until any key on panel be pressed.

OFF：BEEP 5 second only, then Beep off.

5、AUTOPUMP：Dielectric PUMP Automatically ON or not with Sparking ON.

ON : PUMP ON with Sparking ON

OFF : PUMP not ON with Sparking ON Automatically.

6、BACK_PRO：BACK Protection function activated or not when arcing happened due to poor rubbish removal, then sparking off to prevent electrode and workpiece damaged.

ON : BACK_PRO activated.

OFF : BACK_PRO not activated.

7、ENT_LOCK ：Entry Locked or not during sparking in case of careless mistake.
ON : program editing not allowed during sparking.
OFF : No ENT_LOCK.

8、SCREEN: SCREEN protection mode ON/ OFF.
ON : Activate Screen Protection mode, Screen background be black.
OFF: Screen Protection mode not activated.

9、SLOW UP ：Applied for big area electrode, while jumping with slower retracting speed. Compared with the Feed in speed in sparking PGM "SPD", the bigger entry, the slower up speed for stability. Max.=20.
"0" means Slow up speed = Feed in speed = SPD.
bigger entry, the slower up speed for stability. Max.=20.
"0" means Slow up speed = Feed in speed = SPD.

10、SWIN_SPD ：Obcut Speed

11、REV 0: Reserved function 0

12、JUMP_CTL：While Orbit activated, Auto Jump activated or not according to sparking happened or not.
ON：No sparking , no jump.
OFF：Jump all the time.

13、 END_UPD ：Electrode up distance after PGM END.
01 ~ 80 = 1 ~ 80 mm

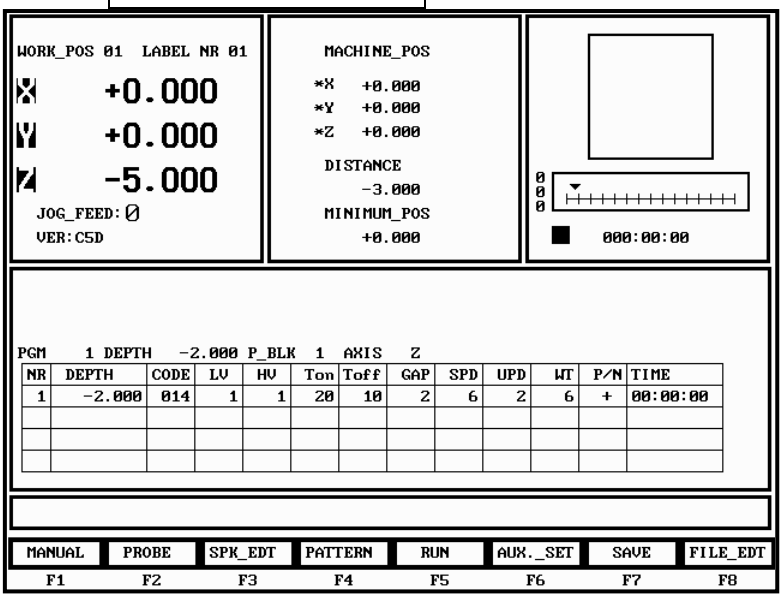
14、 OBvsRAD. ：While Orbit activated, priority between radius expansion and swivel.
ON：No swivel until radius expansion reached.
OFF：Radius expansion and swivel executed together.

15、FLUSH_NR：Flushing Nozzles Setting (Optional)

16、FRE_CCTL：When target depth is achieved & no more increased, starts inspecting the numbers of sparking and judge the finished percentage of machining. Program ends or continuously moves to next step according to the set working conditions.

17、FER_SPD:When the target of OB cutting is achieved & no more increased, continue the OB cutting according the programmed OB cutting detour. This function is for setting the speed of OB cutting & inspecting all angles or edges machining finished or not.

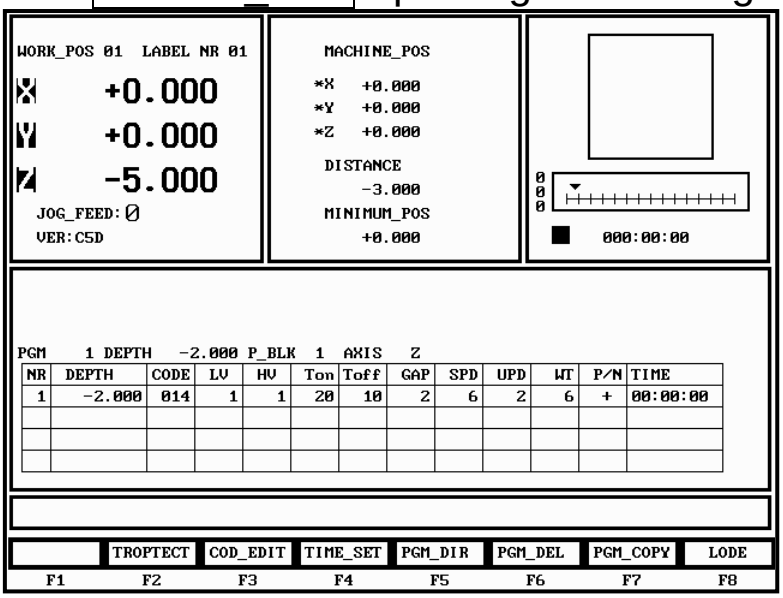
3.7 F7 SAVE MODE



Desc.：

- **Manually SAVE MODE. While electrode, workpiece, working coordinated setting finished, press F7 SAVE_MODE to save the working file into controller.**
  Restarting the machine, this mode can load the saved file of working conditions directly.
- **Automatically Saving：This controlling system will automatically save the data of working conditions & coordinates before execute sparking.**

3.8 F8 FILE_EDT Sparking File Editing Mode



Procedure：Under Main Menu pressing F8 FILE_EDT, 。

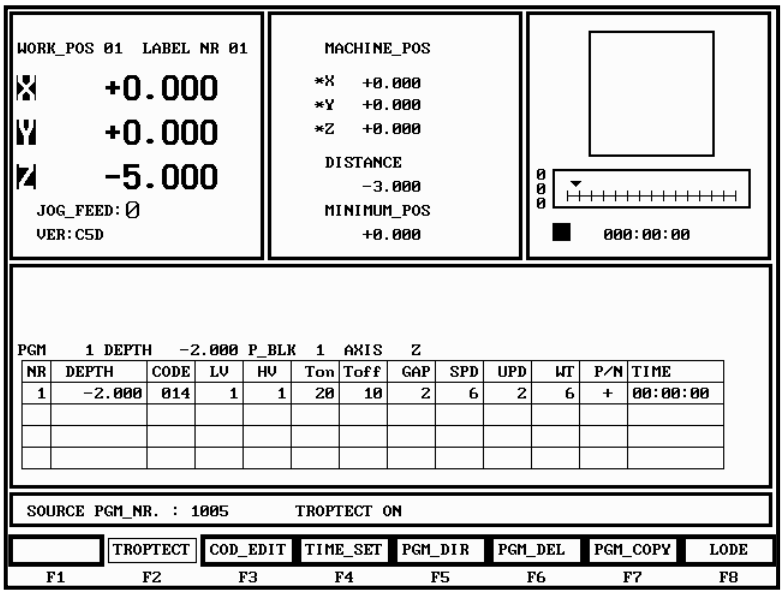
Desc.：

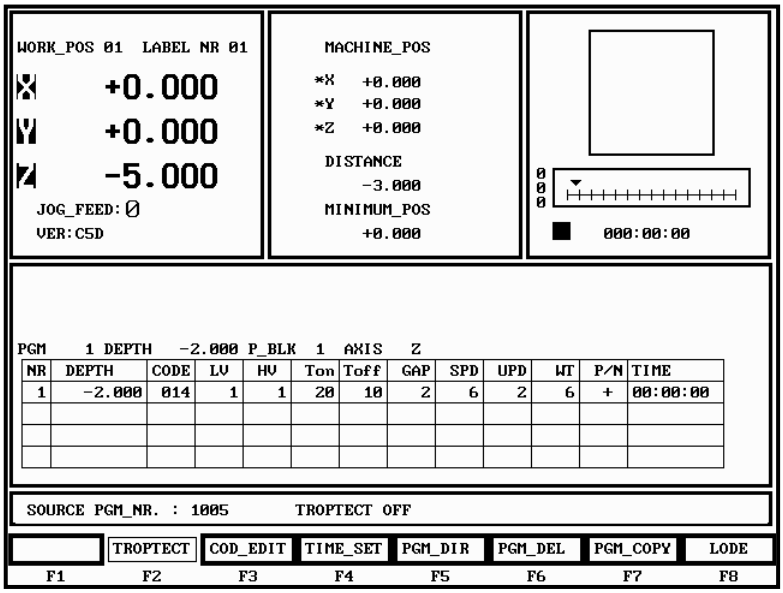
1. This mode provides the complete management & editing functions for the saved working files.

2.Sub-Function Mode：

- F2 PROTECT： The contents of file data can be set “PROTECTED”from rewriting, to avoid the initial files to be incorrectly deleted or amended.
- F3 CODE_EDIT：To edit the working conditions of files in database.。
- F4 TIME_SET：Besides the Z-Axis depth achieved, it can stop the sparking by setting requested working time.
- F5 PGM_DIR： Showing all the programs to search the files conveniently.
- F6 PGM_DEL： Delete the programs of directory.
- F7 PGM_COPY：To copy the used program and input a new file name. Maintain the initial one and get more working experiences
- F8: Restore the Initial programs (Code needed1606).

3.8.1 F8 FILE_EDIT-> F2 PROTECT

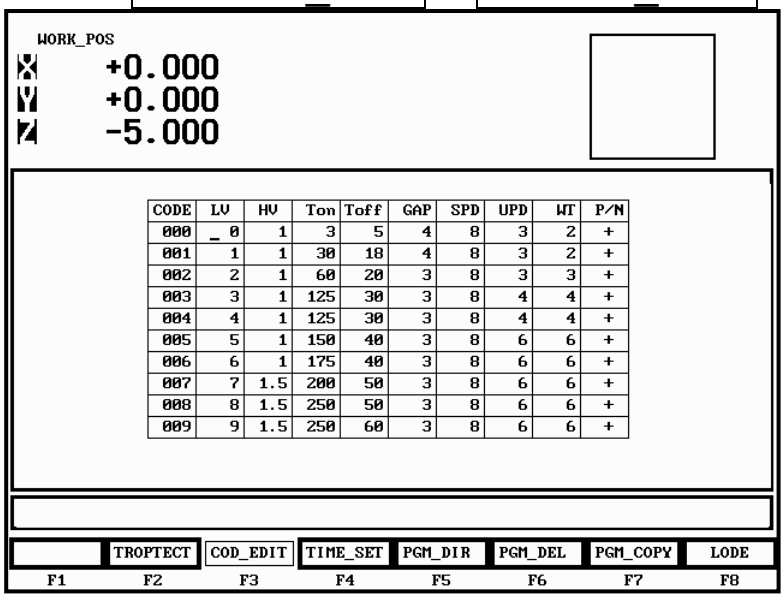




Desc. ：

3. Press PROTECT，input the program number as shown above, and the program will be protected.
4. Rerun the PROTECT can release the program from the “PROTECTED”status.

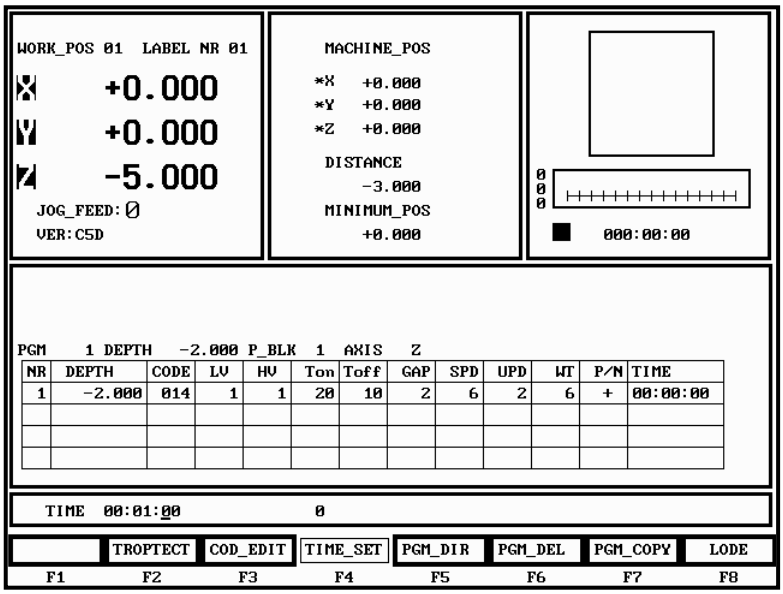
3.8.2 F8 FILE_EDIT-> F3 COD_EDIT

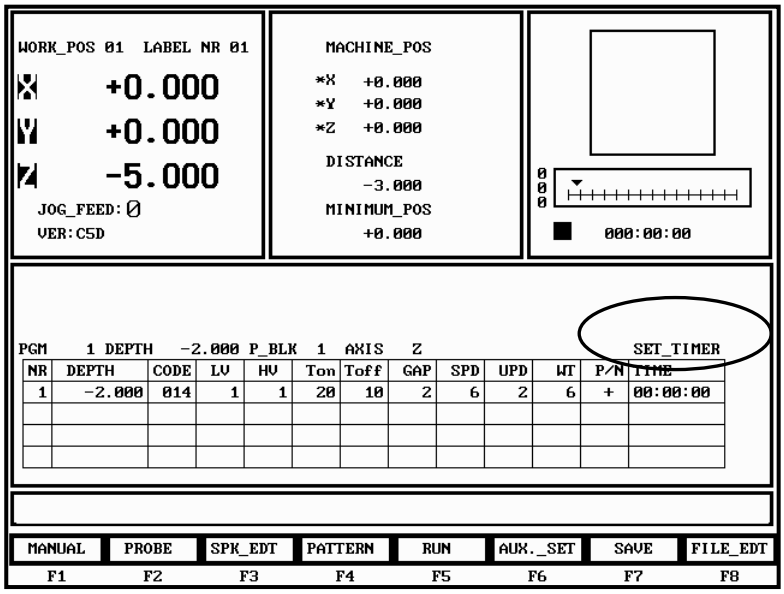


Desc.：

1. This mode provides the direct editing & management of working conditions of programs.
2. The working conditions in this database are sorted by the materials of electrode & workpiece as well as the working purposes. Based on the LV current and set up the basic referencing working condition in coordination to the values of HV,Ton, Toff, GAP, SPD, UPD, W/T.
3. The working conditions in the database can be used directly. According the sparking sizes of rough, fine & finer machining, this can arrange the combination of different current & related working condition to achieve the function of automatic sparking with different steps.。
4. This mode of file editing can provide the convenient method to edit the working conditions. According the sparking technology, experiences & special machining requests, users can also set up their own database of working condition.
5. There are 499 sets of working conditions stored, sorted by machined materials & purposes, and organized by working current in coordination with related working conditions:
   - 001 ~ 060 Copper(Steel 1A~60A(001~060),electrode wearing <1%，applied for rough & fine machining.
   - 061 ~ 100 reserved, can be set by users.
   - 101 ~ 160 Copper(Steel、Graphite(Steel 1A~60A(101-160) copper electrode wearing <5%，applied for fine & finer machining. Graphite electrode wearing <1%，applied for rough & fine machining.
   - 201 ~ 260 Copper to Steel、Graphite to Steel 1A~60A Working Condition List，Copper Electrode wearing>5%，Suitable for fine finishing. Electrode Graphite wearing<5%, Suitable for Mid & Fine finish.
   - 261 ~ 300 Reserved. These can be set by user.
   - 301 ~ 360 Copper to Carbide, Steel to Steel, 1A~60AWorking Condition List. It will be better working effect if works with C-Box (Carbide Box)
   - 361 ~ 400 Reserved, These can be set by user.
   - 401 ~ 460 Reserved for other machining conditions.
   - 461 ~ 499 Reserved for other machining conditions
6. Working Condition Edit：001 ～ 060 Copper Electrode → Steel. Working combination from 1A ～ 60A
   - → Different Current Setting
   - → Electrode Material & Working purpose.

3.8.3 F8 FILE_EDIT-> F4 TIME_SET





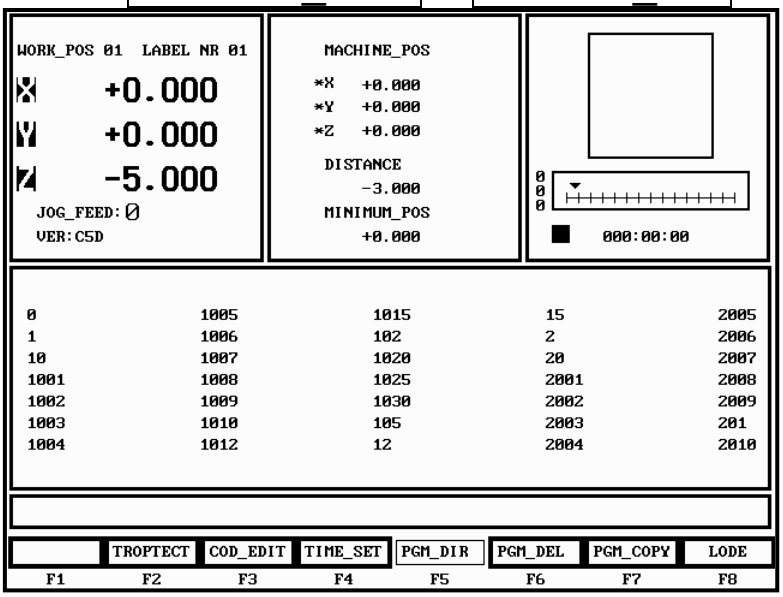
Desk.：

1. This mode can stop the sparking according the set time.
2. While working time set, on the monitor (see pic.) it shows the countdown of set time.
3. Time Set options:

Time_Set=0 When programmed depth or set time achieved, sparking stop. Countdown of set time starts as soon as the final step of program runs. Whenever the depth achieved or set time is out, sparking stops.

Time_Set=1 Depth achieved, maintain the lowest depth and sparking continuously until the set time is out.

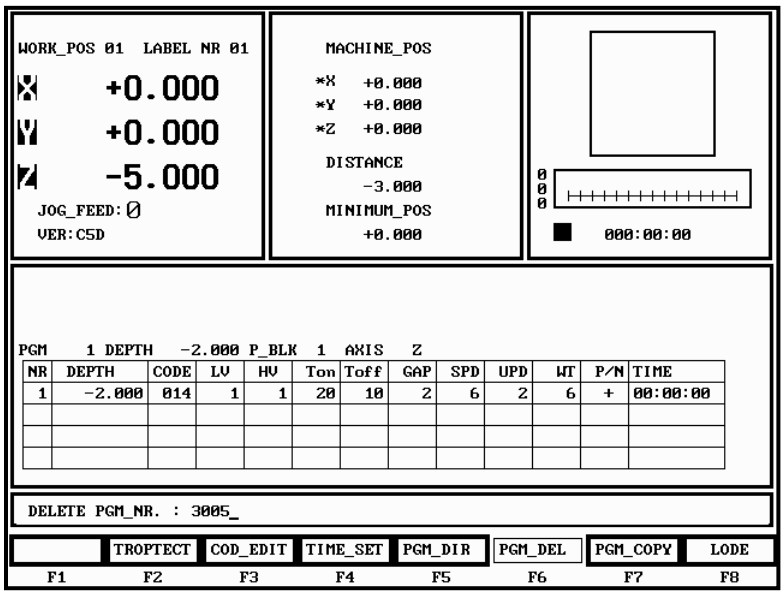
3.8.4 F8 FILE_EDIT-> F5 PGM_DIR



Desc.：

1. Showing all the programs to search the files conveniently.

3.8.5 F8 FILE_EDIT-> F6 PGM_DEL

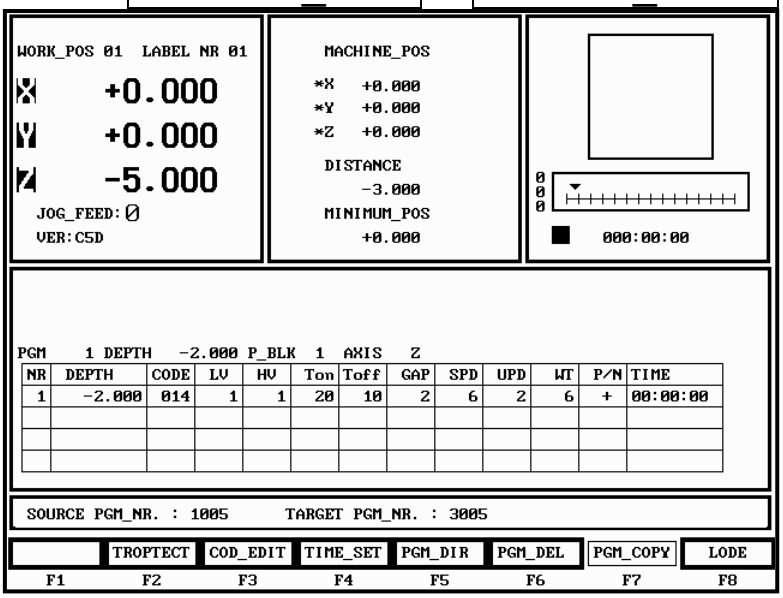


Desc.：

1.This can delete any program in directory.

2.As shown, input the file name, press ENT to delete the file.

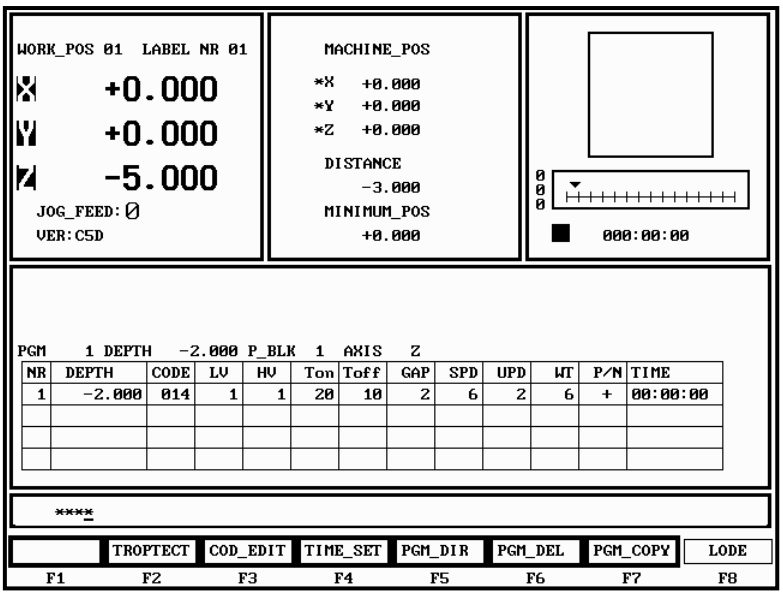
3.8.6 F8 FILE_EDIT-> F7 PGM_COPY



Desc.：

1. To copy the used program and input a new file name. Maintain the initial one and accumulate more working experiences.
2. As shown on monitor, input the original file name & target file name. Press ENTER to confirm.

3.8.7 F8 FILE_EDIT-> F8RESTORE



Desc.：

1. This is to restore the initial programs.
2. When the initial programs need to be restored. Press F8 RESTORE。
   Input entering code (1606) to restore the initial files.

III

PC-Base EDM System

Program Table

(Sparking)

材質 (Material)：銅 (Copper) → 鋼 (Steel)								
電流	高壓	電弧	休幅	GAPV	VDI	2GAP	損耗率	切削率
LV	HV	Ton	Toff			TWO GAP	WEARATIO	SPEED
A	A	μs	μs	V		mm	%	mm3/min
0	1	2	5	40	15	0.050	69.73	0.06
0	1	5	5	40	15	0.068	59.41	0.07
0	1	10	5	40	16	0.072	48.32	0.08
0	1	20	10	40	16	0.080	45.38	0.11
0	1	40	10	50	17	0.086	43.56	0.12
0	1	80	10	50	17	0.092	42.78	0.14
0	1	100	15	50	18	0.104	38.41	0.17
0	1	125	15	50	18	0.118	32.25	0.19
0	1.5	2	5	50	15	0.063	57.00	0.11
0	1.5	5	5	60	16	0.075	44.50	0.14
0	1.5	10	10	60	16	0.083	31.00	0.15
0	1.5	20	10	60	17	0.094	26.34	0.16
0	1.5	40	10	30	18	0.102	21.67	0.17
0	1.5	80	10	45	18	0.112	19.24	0.17
0	1.5	100	15	50	19	0.123	18.33	0.17
0	1.5	125	15	40	19	0.125	17.32	0.17
1	1	2	5	50	23	0.043	68.75	0.19
1	1	5	5	45	25	0.048	17.17	1.39
1	1	10	10	50	25	0.050	8.50	1.65
1	1	20	10	40	27	0.057	2.00	3.17
1	1	40	15	45	28	0.063	1.83	2.10
1	1	60	20	40	29	0.073	0.00	1.94
1	1	80	20	50	30	0.080	0.00	1.81
1	1	100	20	45	31	0.083	0.00	1.71

電流	高壓	電弧	休幅	GAPV	VDI	2GAP	損耗率	切削率
LV	HV	Ton	Toff			TWO GAP	WEARATIO	SPEED
A	A	μs	μs	V		mm	%	mm3/min
2	1	2	5	40	24	0.055	26.50	1.72
2	1	5	5	50	27	0.067	18.40	2.46
2	1	10	5	40	28	0.072	7.10	4.26
2	1	20	5	40	30	0.075	1.83	6.99
2	1	40	5	40	30	0.077	1.40	7.59
2	1	40	10	40	33	0.078	0.24	8.21
2	1	80	10	40	33	0.095	0.31	7.58
2	1	100	10	40	37	0.093	0.00	6.62
2	1	125	10	40	38	0.095	0.00	5.94
2	1	125	20	50	38	0.100	0.00	6.34
2	1	150	20	50	39	0.110	0.00	5.33
3	1	2	5	65	24	0.055	39.25	2.75
3	1	5	5	40	26	0.050	20.50	3.29
3	1	20	5	40	32	0.078	5.00	13.88
3	1	80	10	40	35	0.088	0.31	13.18
3	1	100	10	40	33	0.098	0.06	13.23
3	1	125	10	40	36	0.083	0.00	11.37
4	1	5	8	50	31	0.063	25.83	5.28
4	1	10	5	40	31	0.075	12.00	11.59
4	1	20	5	40	34	0.070	6.30	15.94
4	1	40	10	40	35	0.098	1.90	16.74
4	1	80	10	40	36	0.101	0.30	18.75
4	1	100	10	40	37	0.105	0.00	18.90
4	1	125	20	50	38	0.112	0.00	19.24
4	1	150	20	50	39	0.120	0.00	17.77
5	1	10	5	40	32	0.085	21.30	7.02
5	1	20	5	40	34	0.090	15.30	12.29
5	1	40	10	40	35	0.098	6.45	26.44
5	1	80	10	40	36	0.103	2.06	27.73
5	1	100	10	40	37	0.114	1.23	28.34
5	1	125	20	50	38	0.125	0.48	32.18
5	1	150	20	50	39	0.131	0.24	34.65
5	1	175	20	50	40	0.135	0.00	33.21

電流	高壓	電弧	休幅	GAPV	VDI	2GAP	損耗率	切削率
LV	HV	Ton	Toff			TWO GAP	WEARATIO	SPEED
A	A	μs	μs	V		mm	%	mm3/min
6	1	10	5	40	32	0.093	22.45	14.72
6	1	20	5	40	34	0.108	16.21	23.50
6	1	40	5	40	36	0.104	7.65	28.74
6	1	80	10	40	39	0.110	3.68	33.49
6	1	100	10	45	39	0.118	2.12	35.61
6	1	125	20	45	41	0.127	1.34	37.24
6	1	150	20	45	39	0.138	0.38	38.54
6	1	175	20	45	39	0.146	0.00	36.75
8	1	20	5	40	35	0.120	17.62	33.56
8	1	40	5	40	37	0.134	8.21	44.32
8	1	80	5	40	40	0.136	4.35	46.88
8	1	100	10	40	41	0.146	3.24	48.73
8	1	125	10	40	42	0.143	2.35	56.81
8	1	150	20	40	42	0.148	1.02	63.38
8	1	175	20	40	43	0.151	0.25	58.24
8	1	200	20	40	43	0.156	0.00	56.37
10	1	40	5	45	37	0.143	9.00	47.09
10	1	80	5	45	39	0.153	5.60	54.50
10	1	100	5	45	41	0.170	4.35	61.72
10	1	125	10	50	42	0.185	3.46	68.32
10	1	150	10	50	42	0.194	2.20	73.45
10	1	175	20	50	43	0.200	1.34	78.69
10	1	200	20	50	43	0.212	0.35	93.21
10	1	250	20	50	44	0.224	0.00	85.42
12	1	40	10	50	38	0.152	9.87	59.33
12	1	80	10	50	40	0.162	5.92	66.74
12	1	100	10	50	42	0.179	4.47	73.96
12	1	125	20	50	43	0.194	3.62	80.56
12	1	150	20	50	43	0.203	2.43	85.69
12	1	175	20	50	44	0.209	1.38	90.93
12	1	200	20	50	44	0.221	0.46	105.45
12	1	250	20	50	45	0.233	0.00	97.66

電流	高壓	電弧	休幅	GAPV	VDI	2GAP	損耗率	切削率
LV	HV	Ton	Toff			TWO GAP	WEARATIO	SPEED
A	A	μs	μs	V		mm	%	mm3/min
15	1	50	10	50	37	0.158	11.63	78.46
15	1	100	10	50	42	0.182	5.38	88.26
15	1	125	20	50	43	0.213	4.63	97.81
15	1	150	20	50	43	0.224	3.28	106.54
15	1	175	20	50	44	0.236	2.75	113.33
15	1	200	20	50	44	0.247	1.75	120.25
15	1	250	20	50	45	0.251	0.00	139.46
15	1	300	30	50	45	0.264	0.00	129.16
20	1	50	10	40	39	0.164	13.54	98.08
20	1	100	10	40	43	0.189	10.63	110.33
20	1	150	20	40	43	0.244	4.75	132.11
20	1	200	20	45	44	0.257	2.25	149.12
20	1	250	20	50	45	0.269	0.63	172.93
20	1	300	30	50	45	0.274	0.00	160.15
20	1	350	30	50	46	0.286	0.00	152.34
25	1	50	5	40	40	0.175	14.62	120.64
25	1	100	10	35	42	0.253	11.48	135.70
25	1	150	10	35	44	0.266	5.13	162.50
25	1	200	20	40	45	0.285	2.43	183.41
25	1	250	25	40	45	0.304	0.68	212.70
25	1	300	30	40	45	0.310	0.23	196.99
25	1	350	30	40	45	0.314	0.00	187.38
25	1	400	30	40	>45	0.318	0.00	148.38
30	1	100	10	40	>45	0.273	12.39	168.27
30	1	150	10	40	>45	0.287	5.54	201.49
30	1	200	20	40	>45	0.308	2.62	227.43
30	1	250	20	40	>45	0.328	0.73	263.75
30	1	300	30	40	>45	0.335	0.25	244.26
30	1	350	30	40	>45	0.339	0.00	232.35
30	1	400	40	40	>45	0.343	0.00	224.25
30	1	450	40	40	>45	0.350	0.00	221.78

材質 (Material)：石墨 (Carbide) → 鋼 (Steel)									
電流	高壓	電弧	休幅	GAPV	極性	2GAP	損耗率	切削率	VDI
LV	HV	Ton	Toff		P/N		WEARATIO	SPEED	
A	A	μs	μs	V	+/-	mm	%	mm3/min	
64	2	600	60	40	+	0.156	-1.00	198.55	45
64	2	550	55	40	+	0.183	-1.00	199.00	44
64	2	500	50	40	+	0.153	-0.13	202.93	44
64	2	450	40	40	+	0.165	-0.63	229.82	44
64	2	400	40	40	+	0.119	-0.88	220.34	44
32	2	350	30	40	+	0.171	-0.73	119.06	42
32	2	300	30	40	+	0.131	-0.38	119.81	42
32	2	250	20	40	+	0.151	-0.63	119.65	41
32	2	200	20	40	+	0.161	-0.63	120.68	41
32	2	175	20	40	+	0.174	-0.70	112.02	40
32	2	150	20	40	+	0.123	-0.25	117.44	41
32	2	125	20	40	+	0.151	0.40	105.64	40
32	2	100	20	40	+	0.142	0.98	111.93	41
16	2	250	20	40	+	0.135	-1.00	41.41	40
16	2	200	20	45	+	0.115	-1.24	42.28	40
16	2	175	20	45	+	0.118	-0.48	45.82	41
16	2	150	20	40	+	0.120	-0.77	46.63	41
16	2	125	20	40	+	0.161	0.17	57.62	40
16	2	100	20	40	+	0.139	1.50	55.34	39
16	2	80	20	40	+	0.135	2.98	51.86	39
16	2	40	20	40	+	0.142	5.82	47.72	38
8	2	150	20	60	+	0.073	-0.83	12.06	36
8	2	125	20	60	+	0.135	-0.42	12.07	39
8	2	100	20	65	+	0.113	-0.38	12.77	39
8	2	80	20	60	+	0.103	0.63	13.75	39
8	2	60	20	70	+	0.115	2.30	17.17	40
8	2	40	20	60	+	0.110	3.44	21.29	40
8	2	30	20	50	+	0.095	5.88	12.73	32
8	2	20	20	35	+	0.093	8.06	14.46	30

電流	高壓	電弧	休幅	GAPV	極性	2GAP	損耗率	切削率	VDI
LV	HV	Ton	Toff		P/N		WEARATIO	SPEED	
A	A	μs	μs	V	+/-	mm	%	mm3/min	
4	1	125	20	60	+	0.078	2.75	2.08	33
4	1	100	20	45	+	0.040	1.25	3.61	30
4	1	80	20	50	+	0.070	0.50	3.28	30
4	1	60	20	50	+	0.060	2.00	4.25	30
4	1	40	10	75	+	0.068	6.25	7.57	32
4	1	30	10	50	+	0.060	2.75	12.37	34
4	1	20	10	60	+	0.075	10.00	8.43	29
4	1	10	10	55	+	0.055	12.25	5.66	26
2	1	80	20	60	+	0.118	3.80	0.81	36
2	1	70	20	45	+	0.208	3.00	1.04	32
2	1	60	20	60	+	0.065	3.00	0.84	31
2	1	50	20	50	+	0.065	6.00	1.34	31
2	1	40	10	70	+	0.078	5.50	1.56	29
2	1	30	10	60	+	0.073	9.00	2.17	28
2	1	20	10	80	+	0.070	12.50	2.50	30
2	1	10	10	60	+	0.040	12.30	2.10	27
1	1	80	20	50	+	0.070	8.00	0.52	33
1	1	70	20	50	+	0.028	7.00	0.52	30
1	1	60	12	50	+	0.050	9.00	0.52	27
1	1	60	15	50	+	0.080	9.50	0.84	27
1	1	60	20	50	+	0.050	11.50	0.49	34
1	1	50	20	60	+	0.058	11.00	0.39	30
1	1	40	10	60	+	0.053	15.00	0.57	33
1	1	30	10	60	+	0.050	14.00	0.77	29
1	1	20	10	60	+	0.048	16.00	1.51	26
1	1	10	10	55	+	0.050	11.30	1.19	25

PGM example: Copper → Steel

PGM ：1001 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.960	014	1	1	30	10	2	6	2	4	+	00:00:00	0
2	-0.975	014	1	1	9	10	2	6	2	4	+	00:00:00	0
3	-0.990	004	0	2	2	5	2	8	2	2	-	00:00:00	0
4	-1.000	001	0	1	1	5	3	8	2	2	-	00:00:00	0
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PGM ：1002 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.935	025	2	1	50	10	2	6	2	4	+	00:00:00	0
2	-0.950	023	2	1	25	10	2	6	2	4	+	00:00:00	0
3	-0.965	013	1	2	10	5	2	8	2	4	-	00:00:00	0
4	-0.075	005	0	1	2	5	3	8	2	4	-	00:00:00	0
5	-1.000	001	0	1	1	5	3	8	2	4	-	00:00:00	0
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PGM ：1003 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.930	037	3	2	90	30	2	8	4	6	+	00:00:00	0
2	-0.940	034	3	2	30	20	2	8	4	6	+	00:00:00	0
3	-0.960	023	2	2	20	10	2	8	4	6	+	00:00:00	0
4	-0.970	023	2	2	9	10	2	8	4	6	+	00:00:00	0
5	-0.985	004	0	2	2	5	2	8	4	6	-	00:00:00	0
6	-1.000	001	0	1	1	1	3	8	4	6	-	00:00:00	0
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PGM ：1004 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.900	045	4	2	100	20	2	8	4	8	+	00:00:00	0
2	-0.920	034	3	2	50	10	2	8	4	8	+	00:00:00	0
3	-0.940	023	2	1	40	10	2	8	4	6	+	00:00:00	0
4	-0.960	021	2	1	6	10	2	8	4	6	+	00:00:00	0
5	-0.980	011	1	1	3	10	2	8	4	6	+	00:00:00	0
6	-1.000	004	0	2	1	5	2	8	4	6	-	00:00:00	0
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PGM ：1005 DEPTH ：-1.000 P_BLK ：5 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.920	058	5	2	125	30	2	8	4	8	+	00:00:00	0
2	-0.940	034	3	2	50	20	2	8	4	8	+	00:00:00	0
3	-0.960	023	2	1	20	10	2	8	4	6	+	00:00:00	0
4	-0.980	011	1	1	6	5	2	8	4	6	+	00:00:00	0
5	-1.000	004	0	2	2	5	2	8	4	6	+	00:00:00	0
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PGM ：1006 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.860	068	6	2	175	40	2	8	4	8	+	00:00:00	0
2	-0.900	064	6	2	80	30	2	8	4	8	+	00:00:00	0
3	-0.950	043	4	2	50	10	2	8	4	6	+	00:00:00	0
4	-0.980	030	3	2	10	10	2	8	4	6	+	00:00:00	0
5	-1.000	004	2	1	4	8	2	8	4	6	+	00:00:00	0
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PGM ：1007 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.920	078	7	2	175	40	2	8	4	8	+	00:00:00	0
2	-0.950	064	6	2	80	20	2	8	4	8	+	00:00:00	0
3	-0.980	042	4	2	20	10	2	8	4	6	+	00:00:00	0
4	-1.000	021	2	1	6	8	2	8	4	6	+	00:00:00	0
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PGM ：1008 DEPTH ：-1.000 P_BLK ：5 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.850	08	8	2	175	40	2	8	4	8	+	00:00:00	0
2	-0.910	064	6	2	80	20	2	8	4	8	+	00:00:00	0
3	-0.950	042	4	2	20	10	2	8	4	6	+	00:00:00	0
4	-0.980	031	3	2	10	8	2	8	4	6	+	00:00:00	0
5	-1.000	021	2	1	5	8	2	8	4	6	+	00:00:00	0
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PGM ：1009 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.900	097	9	2	175	40	2	8	4	8	+	00:00:00	0
2	-0.940	064	6	2	80	20	2	8	4	8	+	00:00:00	0
3	-0.970	042	4	2	20	10	2	8	4	8	+	00:00:00	0
4	-1.000	031	3	2	10	10	2	8	4	6	+	00:00:00	0
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PGM ：1010 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.860	108	10	2	200	40	2	8	4	8	+	00:00:00	0
2	-0.920	084	8	2	100	20	2	8	4	8	+	00:00:00	0
3	-0.970	043	4	2	50	10	2	8	4	8	+	00:00:00	0
4	-1.000	032	2	2	20	10	2	8	4	8	+	00:00:00	0
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PGM ：1012 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.850	114	12	2	250	40	2	8	4	8	+	00:00:00	0
2	-0.920	095	9	2	100	30	2	8	4	8	+	00:00:00	0
3	-0.960	063	6	2	50	10	2	8	4	8	+	00:00:00	0
4	-1.000	032	3	2	20	10	2	8	4	8	+	00:00:00	0
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PGM ：1015 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.850	119	15	2	300	40	2	8	4	8	+	00:00:00	0
2	-0.920	096	9	2	125	30	2	8	4	8	+	00:00:00	0
3	-0.960	064	6	2	80	20	2	8	4	8	+	00:00:00	0
4	-1.000	033	3	2	30	10	2	8	4	8	+	00:00:00	0
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PGM ：1020 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.850	123	20	2	300	40	2	8	4	8	+	00:00:00	0
2	-0.900	116	15	2	150	30	2	8	4	8	+	00:00:00	0
3	-0.950	095	9	2	80	20	2	8	4	8	+	00:00:00	0
4	-1.000	043	4	2	30	10	2	8	4	8	+	00:00:00	0
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PGM ：1025 DEPTH ：-1.000 P_BLK ：5 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.800	128	25	2	300	40	2	8	4	8	+	00:00:00	0
2	-0.850	124	20	2	150	30	2	8	4	8	+	00:00:00	0
3	-0.900	117	15	2	100	20	2	8	4	8	+	00:00:00	0
4	-0.950	104	10	2	60	15	2	8	4	8	+	00:00:00	0
5	-1.000	062	6	2	25	10	2	8	4	8	+	00:00:00	0
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☺ Practical application hint:

Electrode with sharp shape to penetrate workpiece for sparking, at beginning, it should work with smaller LV to prevent big wear ratio, then LV increased for efficiency when working area be bigger and bigger, then LV decreased for fine finish.

For instance, sharp Copper electrode ---- SKD-11 ：

PGM ：1109 DEPTH ：-40.000 P_BLK ：10 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-1.000	016	1	1	60	20	2	8	4	8	+	00:00:00	0
2	-2.000	028	2	1	80	20	2	8	4	8	+	00:00:00	0
3	-3.000	038	3	1	100	20	2	8	4	8	+	00:00:00	0
4	-4.000	047	4	2	125	30	2	8	4	8	+	00:00:00	0
5	-5.000	058	5	2	125	30	2	8	4	8	+	00:00:00	0
6	-7.000	078	7	2	150	30	2	8	4	8	+	00:00:00	0
7	-39.880	099	9	2	175	20	2	8	4	6	+	00:00:00	0
8	-39.920	044	4	2	80	20	2	8	4	6	+	00:00:00	0
9	-39.960	022	2	1	20	10	2	8	4	6	+	00:00:00	0
10	-40.000	011	1	1	5	10	2	8	4	6	+	00:00:00	0
11													
12													

Graphite electrode — Steel

PGM ：2001 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.970	201	1	1	50	20	2	8	4	6	+	00:00:00	0
2	-0.980	201	1	1	20	10	2	8	4	6	+	00:00:00	0
3	-0.990	201	0	1	3	10	2	8	4	6	-	00:00:00	0
4	-1.000	201	0	1	1	5	2	8	4	6	-	00:00:00	0
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PGM ：2002 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.960	202	2	1	50	20	2	8	4	6	+	00:00:00	0
2	-0.980	201	1	1	20	10	2	8	4	6	+	00:00:00	0
3	-0.990	201	0	1	3	10	2	8	4	6	-	00:00:00	0
4	-1.000	201	0	1	1	5	2	8	2	4	-	00:00:00	0
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PGM ：2003 DEPTH ：-1.000 P_BLK ：5 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.940	203	3	1	60	20	2	8	8	8	+	00:00:00	0
2	-0.960	202	2	1	30	10	2	8	8	8	+	00:00:00	0
3	-0.980	201	1	1	10	10	2	8	8	8	+	00:00:00	0
4	-0.990	201	0	2	3	10	2	8	8	8	-	00:00:00	0
5	-1.000	201	0	1	1	5	2	8	8	8	-	00:00:00	0
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PGM ：2004 DEPTH ：-1.000 P_BLK ：5 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.940	204	4	2	80	20	2	8	8	8	+	00:00:00	0
2	-0.960	202	2	1	50	20	2	8	8	8	+	00:00:00	0
3	-0.980	201	1	1	10	10	2	8	8	8	+	00:00:00	0
4	-0.990	201	0	2	3	10	2	8	8	8	-	00:00:00	0
5	-1.000	201	0	1	1	5	2	8	8	8	-	00:00:00	0
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PGM ：2005 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.910	205	5	2	80	20	2	8	8	8	+	00:00:00	0
2	-0.940	204	4	2	50	20	2	8	8	8	+	00:00:00	0
3	-0.960	202	2	1	20	10	2	8	8	8	+	00:00:00	0
4	-0.980	201	1	1	8	5	2	8	8	8	+	00:00:00	0
5	-0.990	201	0	2	3	5	2	8	8	8	-	00:00:00	0
6	-1.000	201	0	1	1	5	2	8	8	8	-	00:00:00	0
7													
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PGM ：2006 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.950	206	6	2	125	40	2	8	6	8	+	00:00:00	0
2	-0.970	206	4	2	60	40	2	8	6	8	+	00:00:00	0
3	-0.985	203	2	1	40	25	2	8	6	8	+	00:00:00	0
4	-1.000	202	1	1	20	20	2	8	6	8	+	00:00:00	0
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PGM ：2007 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.930	207	7	2	175	40	2	8	8	8	+	00:00:00	0
2	-0.960	206	6	2	80	30	2	8	8	8	+	00:00:00	0
3	-0.980	204	4	2	40	20	2	8	8	8	+	00:00:00	0
4	-1.000	202	2	1	20	10	2	8	8	8	+	00:00:00	0
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PGM ：2008 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.820	208	8	2	125	40	2	8	8	8	+	00:00:00	0
2	-0.960	206	6	2	80	20	2	8	8	8	+	00:00:00	0
3	-0.980	204	4	2	40	20	2	8	8	8	+	00:00:00	0
4	-1.000	202	2	2	20	20	2	8	8	8	+	00:00:00	0
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PGM ：2009 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.930	209	9	2	125	30	2	8	8	8	+	00:00:00	0
2	-0.960	206	6	2	80	20	2	8	8	8	+	00:00:00	0
3	-0.980	204	4	2	40	10	2	8	8	8	+	00:00:00	0
4	-1.000	202	2	2	20	10	2	8	8	8	+	00:00:00	0
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PGM ：2010 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.930	214	10	2	150	40	2	8	8	8	+	00:00:00	0
2	-0.960	207	7	2	80	30	2	8	8	8	+	00:00:00	0
3	-0.980	204	4	2	40	20	2	8	8	8	+	00:00:00	0
4	-1.000	202	2	2	20	10	2	8	8	8	+	00:00:00	0
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PGM ：2012 DEPTH ：-1.000 P_BLK ：4 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.930	214	12	2	150	40	2	8	8	8	+	00:00:00	0
2	-0.960	207	7	2	80	30	2	8	8	8	+	00:00:00	0
3	-0.980	204	4	2	40	20	2	8	8	8	+	00:00:00	0
4	-1.000	202	2	2	20	10	2	8	8	8	+	00:00:00	0
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PGM ：2015 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.850	219	15	2	150	40	2	8	8	8	+	00:00:00	0
2	-0.910	209	9	2	100	30	2	8	8	8	+	00:00:00	0
3	-0.950	206	6	2	60	20	2	8	8	8	+	00:00:00	0
4	-0.980	206	6	2	40	20	2	8	8	8	+	00:00:00	0
5	-1.000	204	4	2	20	10	2	8	8	8	+	00:00:00	0
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PGM ：2020 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.800	224	20	2	200	40	2	8	8	8	+	00:00:00	0
2	-0.860	216	15	2	100	30	2	8	8	8	+	00:00:00	0
3	-0.910	209	9	2	80	20	2	8	8	8	+	00:00:00	0
4	-0.950	206	6	2	50	10	2	8	8	8	+	00:00:00	0
5	-0.980	206	6	2	20	10	2	8	8	8	+	00:00:00	0
6	-1.000	204	4	2	5	10	2	8	8	8	+	00:00:00	0
7													
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PGM ：2025 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.800	224	25	2	200	40	2	8	8	8	+	00:00:00	0
2	-0.860	216	15	2	100	30	2	8	8	8	+	00:00:00	0
3	-0.920	209	9	2	70	20	2	8	8	8	+	00:00:00	0
4	-0.960	206	6	2	50	10	2	8	8	8	+	00:00:00	0
5	-0.980	206	6	2	20	10	2	8	8	8	+	00:00:00	0
6	-1.000	204	4	2	5	10	2	8	8	8	+	00:00:00	0
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PGM ：2030 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.750	234	30	2	250	40	2	8	8	8	+	00:00:00	0
2	-0.800	220	20	2	150	30	2	8	8	8	+	00:00:00	0
3	-0.850	216	15	2	100	20	2	8	8	8	+	00:00:00	0
4	-0.920	209	9	2	70	20	2	8	8	8	+	00:00:00	0
5	-0.960	206	6	2	50	10	2	8	8	8	+	00:00:00	0
6	-1.000	204	4	2	20	10	2	8	8	8	+	00:00:00	0
7													
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PGM ：2040 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.700	242	40	2	250	30	2	8	8	8	+	00:00:00	0
2	-0.800	220	20	2	150	20	2	8	8	8	+	00:00:00	0
3	-0.870	216	15	2	100	20	2	8	8	8	+	00:00:00	0
4	-0.930	209	9	2	70	15	2	8	8	8	+	00:00:00	0
5	-0.970	206	6	2	50	10	2	8	8	8	+	00:00:00	0
6	-1.000	204	4	2	20	10	2	8	8	8	+	00:00:00	0
7													
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PGM ：2050 DEPTH ：-1.000 P_BLK ：7 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.750	254	50	2	300	30	2	8	8	8	+	00:00:00	0
2	-0.820	220	20	2	125	20	2	8	8	8	+	00:00:00	0
3	-0.880	216	15	2	100	20	2	8	8	8	+	00:00:00	0
4	-0.920	209	9	2	70	20	2	8	8	8	+	00:00:00	0
5	-0.950	206	6	2	50	10	2	8	8	8	+	00:00:00	0
6	-0.980	206	6	2	20	10	2	8	8	8	+	00:00:00	0
7	-1.000	204	4	2	5	10	2	8	8	8	+	00:00:00	0
8													
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PGM ：2060 DEPTH ：-1.000 P_BLK ：6 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-0.700	264	64	2	350	30	2	8	8	8	+	00:00:00	0
2	-0.820	220	20	2	150	30	2	8	8	8	+	00:00:00	0
3	-0.880	216	15	2	100	20	2	8	8	8	+	00:00:00	0
4	-0.920	209	9	2	70	20	2	8	8	8	+	00:00:00	0
5	-0.950	206	6	2	50	10	2	8	8	8	+	00:00:00	0
6	-0.980	206	6	2	20	10	2	8	8	8	+	00:00:00	0
7	-1.000	204	4	2	5	10	2	8	8	8	+	00:00:00	0
8													
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☺ Practical application & example:

Electrode with sharp shape to penetrate workpiece for sparking, at beginning, it should work with smaller LV to prevent big wear ratio, then LV increased for efficiency when working area be bigger and bigger, then LV decreased for fine finish.

PGM ：2615 DEPTH ：-34.300 P_BLK ：7 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-4.000	206	6	2	100	25	2	8	8	8	+	00:00:00	0
2	-12.000	212	12	2	125	20	2	8	8	8	+	00:00:00	0
3	-34.000	217	15	2	200	20	2	8	8	8	+	00:00:00	0
4	-34.100	212	12	2	100	20	2	8	8	8	+	00:00:00	0
5	-34.200	206	6	2	80	10	2	8	8	8	+	00:00:00	0
6	-34.250	206	6	2	60	10	2	8	8	8	+	00:00:00	0
7	-34.300	204	4	2	20	5	2	8	8	8	+	00:00:00	0
8													
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PGM ：2620 DEPTH ：-34.300 P_BLK ：7 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-4.000	206	6	2	100	30	2	8	8	8	+	00:00:00	0
2	-12.000	218	15	2	125	30	2	8	8	8	+	00:00:00	0
3	-34.000	223	20	2	200	40	2	8	8	8	+	00:00:00	0
4	-34.100	217	15	2	100	30	2	8	8	8	+	00:00:00	0
5	-34.200	206	6	2	80	20	2	8	8	8	+	00:00:00	0
6	-34.250	206	6	2	40	20	2	8	8	8	+	00:00:00	0
7	-34.300	204	4	2	20	10	2	8	8	8	+	00:00:00	0
8													
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PGM ：2625 DEPTH ：-47.450 P_BLK ：8 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-3.900	206	6	2	90	10	2	8	8	8	+	00:00:00	0
2	-7.900	218	15	2	100	10	2	8	8	8	+	00:00:00	0
3	-10.000	222	20	2	150	20	2	8	8	8	+	00:00:00	0
4	-47.200	228	25	2	200	20	2	8	8	8	+	00:00:00	0
5	-47.300	216	15	2	100	10	2	8	8	8	+	00:00:00	0
6	-47.350	209	9	2	70	10	2	8	8	8	+	00:00:00	0
7	-47.400	206	6	2	50	10	2	8	8	8	+	00:00:00	0
8	-47.450	206	6	2	20	10	2	8	8	8	+	00:00:00	0
9													
10													
11													
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PGM ：2630 DEPTH ：-51.400 P_BLK ：8 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-4.800	206	6	0	90	30	2	8	8	8	8	00:00:00	0
2	-8.600	218	15	0	100	30	2	8	8	8	8	00:00:00	0
3	-11.000	223	20	0	175	40	2	8	8	20	20	00:00:00	0
4	-15.100	234	30	0	250	40	2	8	8	20	20	00:00:00	0
5	-51.200	216	15	0	100	30	2	8	8	20	20	00:00:00	0
6	-51.300	209	9	0	70	30	2	8	8	20	20	00:00:00	0
7	-51.350	206	6	0	50	10	2	8	8	20	20	00:00:00	0
8	-51.400	206	6	0	20	10	2	8	8	20	20	00:00:00	0
9													
10													
11													
12													

PGM ：2640 DEPTH ：-85.350 P_BLK ：8 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-7.000	206	6	0	90	30	2	8	8	8	+	00:00:00	0
2	-12.000	218	15	0	100	30	2	8	8	8	+	00:00:00	0
3	-25.000	223	20	0	175	40	2	8	20	20	+	00:00:00	0
4	-85.100	243	40	0	300	40	2	8	20	20	+	00:00:00	0
5	-85.200	216	15	0	100	30	2	8	20	20	+	00:00:00	0
6	-85.250	209	9	0	70	30	2	8	20	20	+	00:00:00	0
7	-85.300	206	6	0	50	30	2	8	20	20	+	00:00:00	0
8	-85.350	206	6	0	20	20	2	8	20	20	+	00:00:00	0
9													
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PGM ：2650 DEPTH ：-56.000 P_BLK ：8 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-5.000	206	6	0	90	30	2	8	8	8	+		0
2	-8.000	218	15	0	100	30	2	8	8	8	+		0
3	-15.000	223	20	0	175	40	2	8	20	20	+		0
4	-55.700	254	50	0	350	40	2	8	20	20	+		0
5	-55.800	222	20	0	150	40	2	8	20	20	+		0
6	-55.900	216	15	0	100	20	2	8	20	20	+		0
7	-55.950	209	9	0	50	20	2	8	20	20	+		0
8	-56.000	206	6	0	20	10	2	8	20	20	+		0
9													
10													
11													
12													

PGM ：2660 DEPTH ：-57.000 P_BLK ：8 DINECTION: - AXIS：Z

NR	DEPTH	CODE	LV	HV	Ton	Toff	GAP	SPD	UPD	WT	P/N	TIME	CTL
1	-4.000	206	6	0	90	30	2	8	8	8	+	00:00:00	0
2	-8.500	218	15	0	100	30	2	8	8	8	+	00:00:00	0
3	-16.000	222	20	0	150	40	2	8	8	8	+	00:00:00	0
4	-56.700	264	60	0	350	40	2	8	20	8	+	00:00:00	0
5	-56.800	222	20	0	100	40	2	8	20	15	+	00:00:00	0
6	-56.900	209	9	0	70	30	2	8	20	15	+	00:00:00	0
7	-56.950	206	6	0	50	20	2	8	20	15	+	00:00:00	0
8	-57.000	204	4	0	2	10	2	8	20	15	+	00:00:00	0
9													
10													
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Manual, ZNC, CNC

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EDM Drilling Machines
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