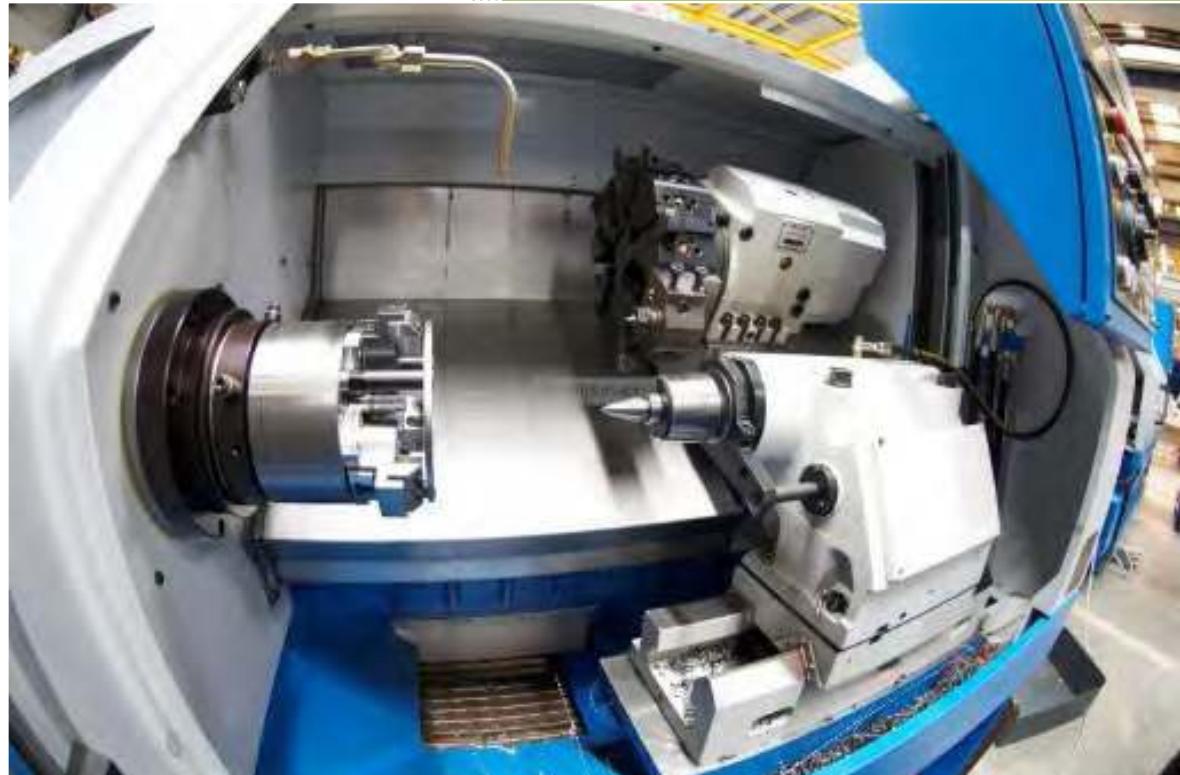


Maintenance Manual



ACE DESIGNERS LTD.,
Plot No, 7 & 8, 2nd Phase,
Peenya Industrial Area,
BANGALORE – 560058
Phone Nos.: (+91-80) 22186700 (24 Lines)
Fax Nos. (+91-80) 22186850/723
E-mail: acetsg@vsnl.net.in ;
acedesigners@acemicromatic.com

Maintenance Manual



BASIC MECHANICAL ELEMENTS

ACE machines are built with the concept of unit construction. The various units are Bed, Headstock, Tailstock, Axes assembly, Turret, Electrical cabinet for interfacing CNC system and to mount Drive controllers and accessories like power pack, lubrication unit, coolant pump, Panel cooler, Chip conveyor etc.

The bed is made of cast iron of grade 25. It has been designed with suitable cross section and supporters, so as

- To take the deformation due to cutting load and also acts as dampening element.
- For easy chips flow and coolant back to tank for reuse
- To accommodate Coolant tank and Power pack tank (optional)

The bed is well seasoned so as to take up other natural phenomenon and maintained high precision accuracy by scraping / machining before machine building. In principle, the layout of the bed is designed so as to mount the headstock, slides, tailstock, electrical cabinet and the sheet metal structure. At the bottom, it has got bolt holes such that when leveled paralleled to the ground (0.02mm/mtr), the total machine weight and the other machining forces gets distributed equally.

Do's:

- Level the bed before machine is being used.
- Clean the drain hole frequently, wherever provision is provided.
- Clean the area behind the sliding guards, spindle motor mounting area, tailstock area etc. frequently.

Don'ts:

- Do not weld any extensions to the bed.
- Do not attempt to grind / any machining on the bed.

Maintenance Manual



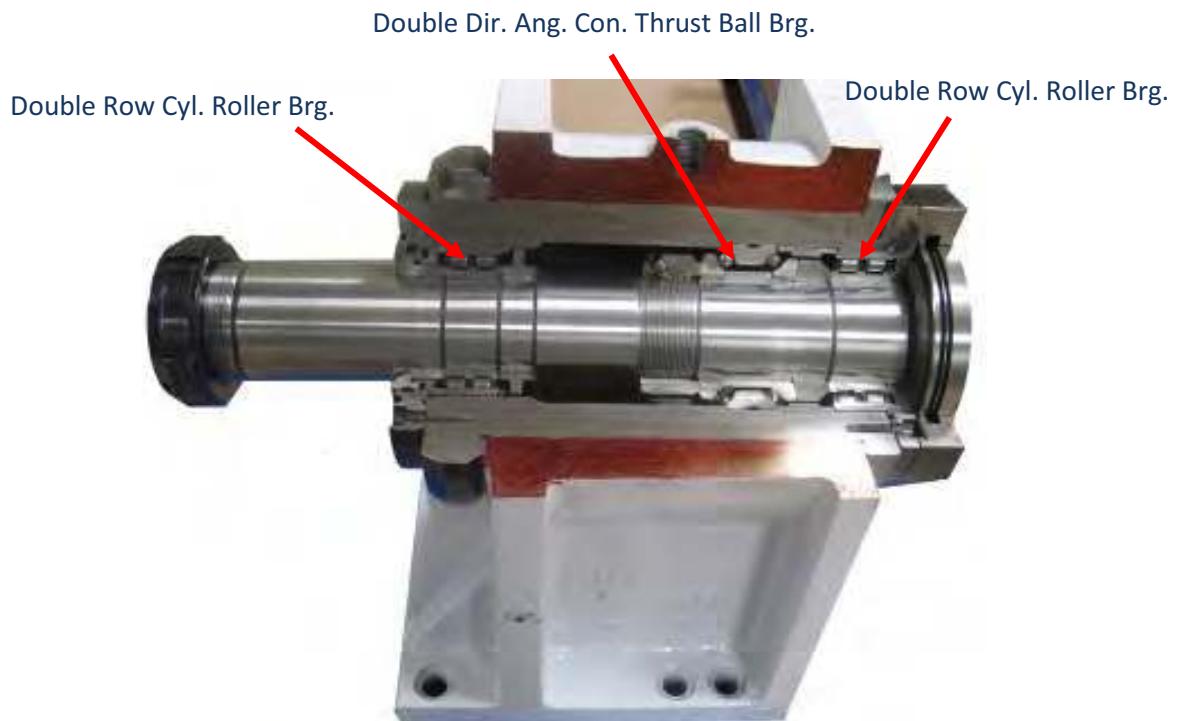
HEADSTOCK ASSEMBLY:

It consists of a headstock body, a spindle, front and rear bearings, a labyrinth cover, a timing pulley for feedback, a pulley for drive, a chucking cylinder with/without coolant collector, a work holding like hydraulic operated self-centered chuck or special fixture, a drawbar to connect work holding and chucking cylinder etc.

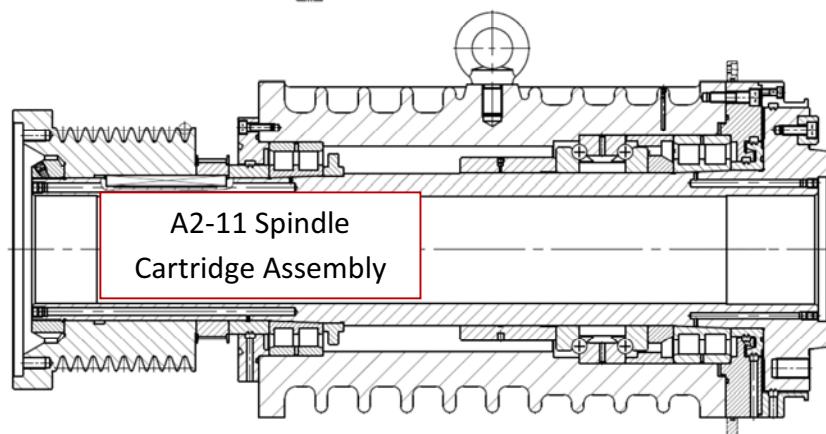
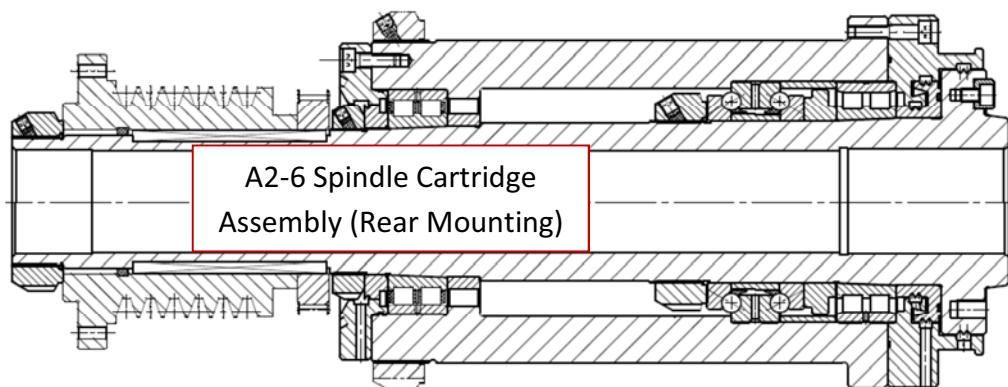
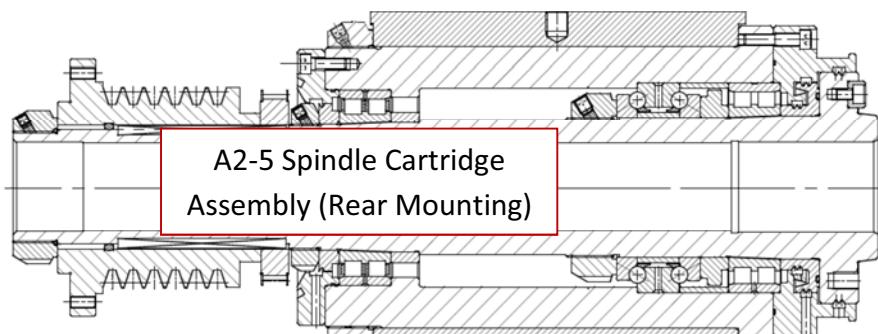
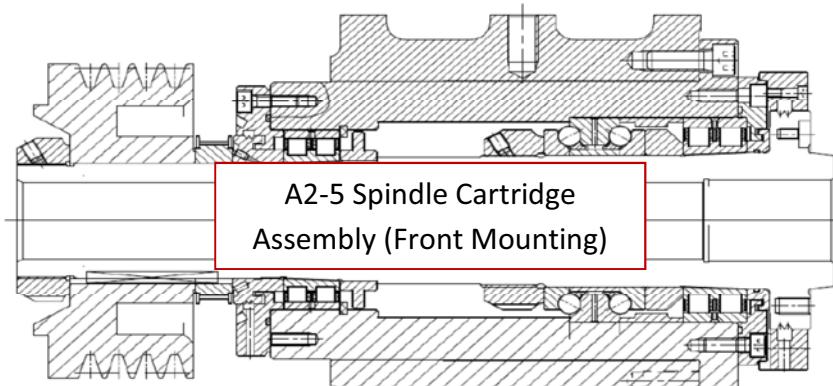
The headstock body is made of cast iron of grade 25. It houses a cartridge housing in which a 58-60 HRC case hardened, precision ground spindle assembly is mounted.

Spindle Assembly:

The spindle assembly is the heart of any machine and is assembled, tested and stabilized in a controlled clean room environment. The spindle provides drive to the work piece and also transmits fully the available motor power. The spindle assembly runs smoothly and quietly at higher rpm and rigid enough to maintain running accuracy to overcome cutting forces and imbalance or centrifugal forces. Spindle is made of case hardened steel, manufactured in series of operations like turning, drilling, case carburizing, finish turning, hardened, pre-grinding, stabilizing, finish grinding, threading to obtain the required dimensional accuracy. The spindle is available in different sizes viz., A2-5, A2-6, A2-8, A2-11, Flat nose etc. The spindle is supported by the bearings at both ends. The bearing configuration gives high stiffness to the spindle assembly in both axial and radial directions. The bearings are grease lubricated for life with KLUBER ISOFLEX NBU-15 /NB-52. The bearing configuration for various spindles as follows.



Maintenance Manual



Maintenance Manual

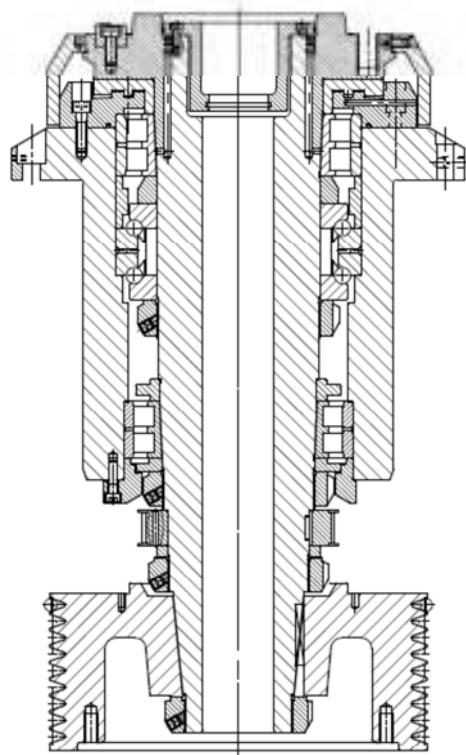


A labyrinth cover is provided in the front side to force/drain out the coolant, which could enter in the gap between spindle and labyrinth cover. Holes / slot (01 slot and 3 holes for A2-5 Cartridge, 6 holes for A2-6/A2-8& A2-11 cartridges) are provided at the bottom of the cover for the same. These holes are to be cleaned every day, failing in which the coolant may enter into the bearings area and damages the same. A pulley is provided at the rear end to receive drive/power transmission from AC servomotor through a set of V belts.

Key Elements:

SPINDLE:-

- Case hardened steel.
- Series of manufacturing process(turning, drilling, case carbonizing, finish turning, heat treatment/nitriding, pre-grinding, stress relieving, finish grinding, threading) in a temperature controlled environment, to obtain the required dimensional accuracy.



Cartridge Assembly for VTL Series

LABYRINTH COVER:-

- To force out / drain out the coolant.

PULLEY:-

- To receive power from spindle motor.

TIMER PULLEY:-

- To get spindle rpm / feed back

ENCODER ASSEMBLY:-

- To get feedback from spindle through timer belt



Spindle



Labyrinth Cover

Maintenance Manual



Housing



Spindle Pulley



Timer Pulley



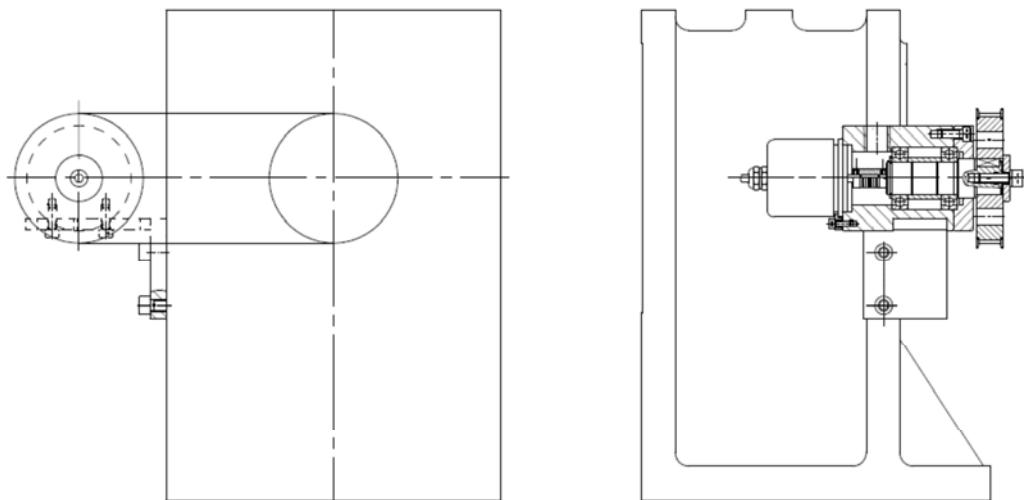
Cartridge



Encoder Assembly

A timing pulley is mounted directly on the spindle pulley to drive encoder assembly (a shaft supported by two ball bearings is assembled in a MS housing. At one end of the shaft, the encoder coupled with a flexible coupling and at the other, a timing pulley is keyed on to it) through a timer belt, which gives spindle feed back to CNC system. Generally a 1024 pulses encoder is being used for this purpose.

Encoder Assembly

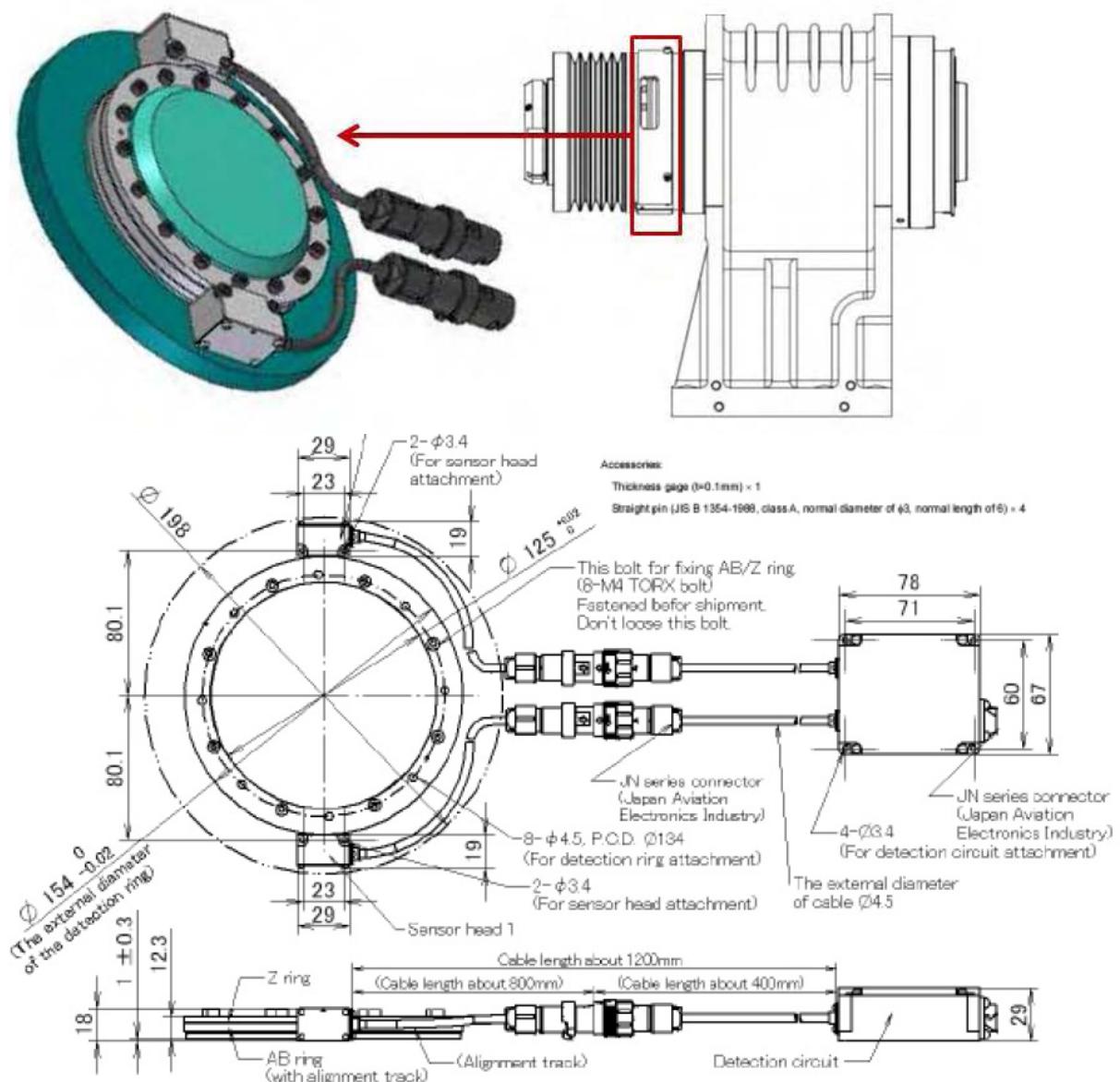


Maintenance Manual



C-Axis Sensor:

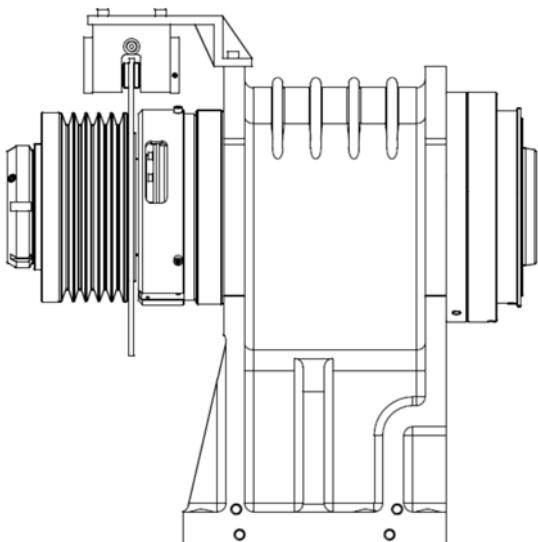
In case of turnmill centers for C axis application, a separate sensor (encoder) is used to measure a high precision angular displacement. This is a closed loop system with a spindle servo motor and worm gear. This gear assembly is directly mounted at the rear side of the spindle assembly as shown in figure. The sensor is protected with a split cover from foreign materials getting entered into gear & sensor area.



Hydraulic Brake Assembly:

In case of turnmill centres, the spindle brake mounting assembly is mounted at the back side of the assembly as shown in figure. The brake is actuated hydraulically and it locks the spindle in the oriented position.

Maintenance Manual



A chucking cylinder is mounted on to the rear face of the spindle pulley to facilitate power chucking cylinder through draw bar. A face plate is fixed on to the spindle front face, over the nose taper, in which threaded holes are provided for mounting the work holding.

Do's:

- The bearings are life lubricated with Kluber make grease. (Isoflex – NBU 15/NB-52, super LDS-15). Hence no re-lubrication is required.
- Proper tensioning of the transmission belts using tension indicator equipment and periodic check of the same.
- Labyrinth and labyrinth holes are to be cleared for free coolant passage out of the assembly every day. The method of cleaning - use a needle file / drill bit and scoop-out the muck collected in the hole.
- Drive belt (V belt) and timer belt for spindle feedback have to be checked for any ruptures of either the outer jackets or the inner chords and loose strands periodically.
- Smear with a layer of grease or rust preventive solvent to the exposed surfaces of the spindle, particularly the straight bore.
- Periodic geometric accuracy test for spindle alignment and run out checks — at least once in 6 months.
- Use of the latest techniques of condition monitoring for continuous monitoring of the spindle bearing condition.

Don'ts:

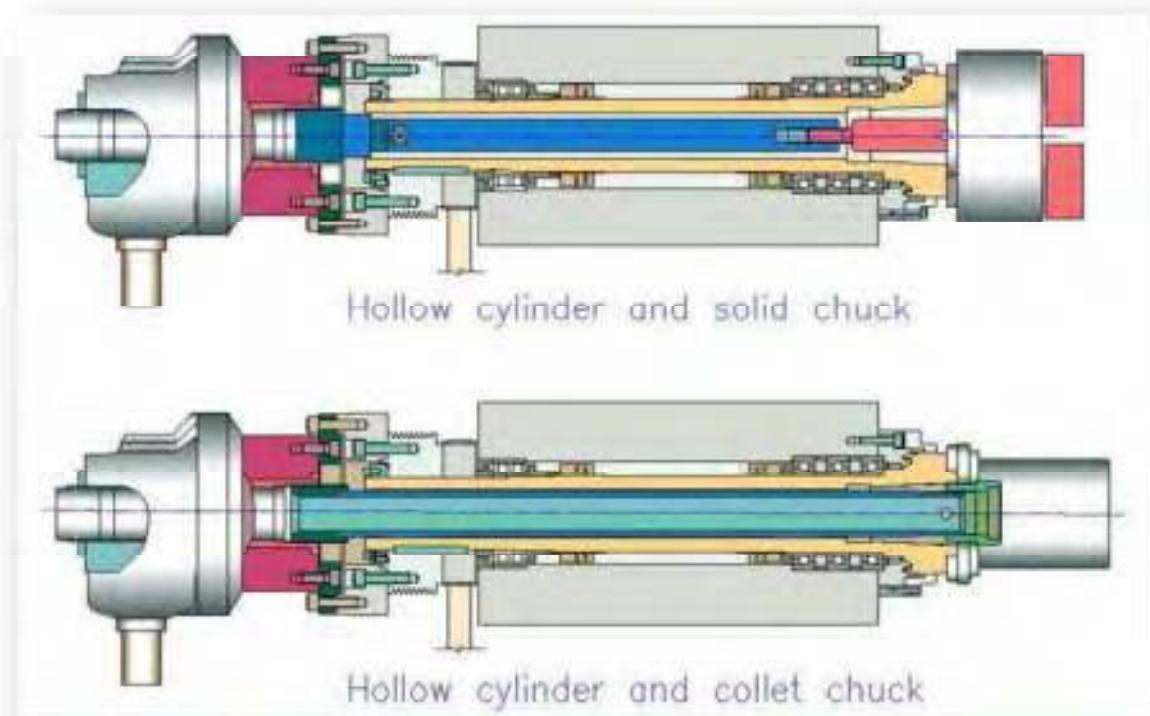
- Do not direct the compressed air jet or the coolant jet over and around the front of the spindle / work holding.
- Do not use an etching machine or any indenter to identify the work piece while the work piece is held in the spindle / work holding.
- Do not run the spindle above the specified maximum rpm.
- Spindle unit is not a user serviceable item, generally.

Maintenance Manual



Work Holding Assembly:

The main function of the work holding is to have a mechanism to hold the component rigidly and rotate along with the specified spindle speed. The mechanism consists of a hydraulic power chucking cylinder, a standard chuck or any special fixture and a draw bar, which connects power chucking cylinder and chuck or fixture.



Chuck:

The chuck is mounted on the faceplate, which is bolted on to spindle and is operated (opening or closing of jaws) by a foot switch or a set of M codes. This wedge type chuck achieves jaw movement by the action of the tail of the master jaw in a tapered wedge, which is moved longitudinally by a power chucking cylinder through a draw bar. The wedge, made of nickel chromium steel is hardened and ground on the entire working surface.



Maintenance Manual



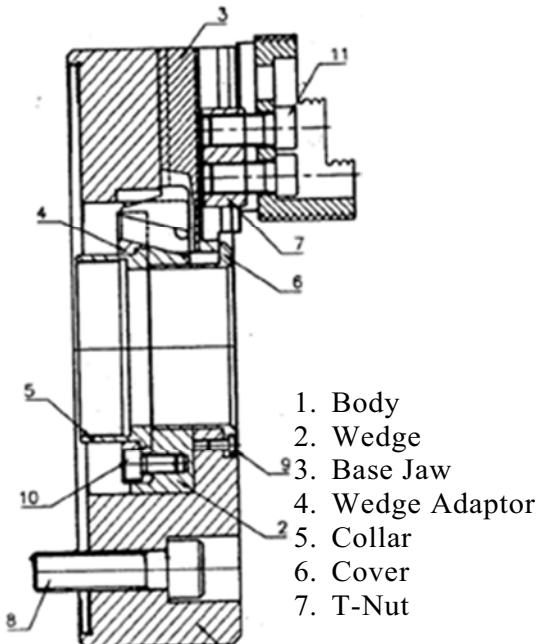
The base jaws are also made of nickel chromium steel, case hardened and ground to match both wedge and the body guide ways. The base jaws are guided in the deep, wide hardened slots in the body, which provides the ample bearing area necessary to withstand the forces resulting from high gripping force. Provision has been made for manual lubrication of the sliding surfaces through grease nipples. Serrations are ground on the top face of the base jaws. The reversible hard jaws have ground serrations on the bottom to match the base jaws.

Lubrication of Chuck:

The most common cause for the chuck problem is the lack of lubrication. Not only will a poorly lubricated chuck wear out faster, but may also easily become UNSAFE for operation. Chucks may easily lose 50% of their normal gripping force & accuracy if not properly lubricated. A new chuck should be greased after completion of every 500 to 1000 cycles or after completion of every 8 to 16 hours of operation with the help of grease gun thru' the grease nipples provided in all the Base jaws (Master Jaws) & periphery of the chuck. While applying grease by grease gun, move the master jaw for the full stroke(clamping & de-clamping) to ensure uniform distribution of grease on sliding surface.

A new chuck must be overhauled after completion of 5000 to 8000 cycles. Then periodically after completion of every 20000 to 25000 cycles. If castings / forgings are machined continuously, overhauling to be done once a month regardless of no. of cycles.

Other types of work Holdings:



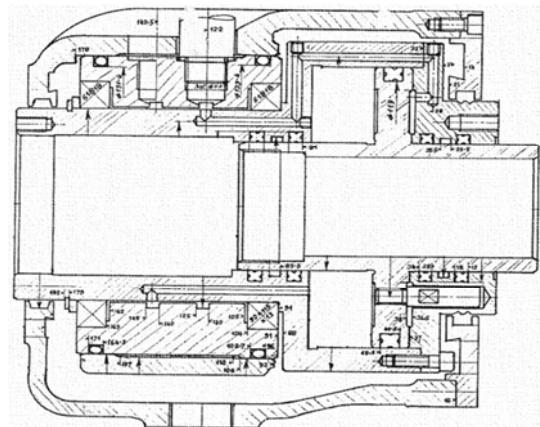
Maintenance Manual



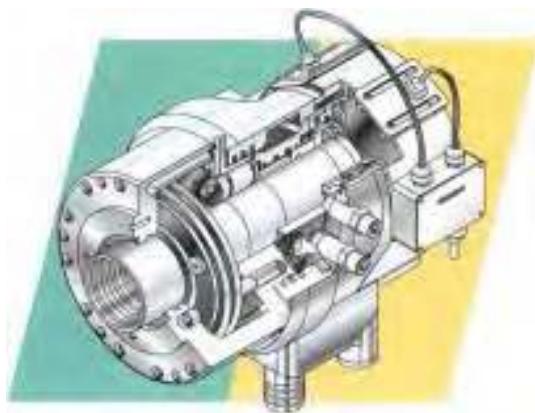
Chuckung Cylinder:

The cylinder is mounted on the rear side of the spindle pulley and operates the chuck through a draw bar. The primary requirement of the cylinder is to give a linear motion to either push or pull the wedge of the power chuck. These cylinders are dynamically balanced and are capable of rotating at high speeds. These cylinders are available with or without safety non-return valve, which ensures safety in the event of hydraulic failure. A stroke control unit with the hydraulic cylinder is also available. This helps monitor the stroke of the cylinder. The stationary distributor has three lines - pressure line P1, pressure line P2 and the drain line. This type of rotary joint gives certain amount of leakage and this drain line should be connected directly to the tank. These cylinders have Quadra ring on the sliding piston, which arrests inter port leakage. The cylinder is provided at the rear with a coolant collector and a face seal is provided to seal coolant entry in to the chucking cylinder (in case of P-series Pragati cylinders).

P-Series Cylinders: (Open Centre without Safety Valve)



PHS / SYH-Series: (Open Centre with Safety Valve)



Maintenance Manual



PSS-Series: (Closed Centre with Safety Valve)



Draw Bar:

The draw bar is an either hollow or solid tube, threaded at the both ends to connect Chuck nut and chucking cylinder. A thread sealant is applied at chucking cylinder end to prevent loosening of draw bar from the chucking cylinder at higher rpms.



Maintenance Manual



Do's:

- Lubricate the moving elements of the work holding once in every shift, with the correct grade of grease. (Kluber make — al temp QNB — 50, GN plus, Molykote BR — 2s, OKS 260, OKS 265 etc.)
- Overhaul the work holding at least once in a month, if not fortnight.
- Select the optimum clamping force sufficient for machining of the work piece.
- Prevent, by suitable means, entry of chips / dust particles / coolant in the inside of the work holding mechanism.
- Use the correct procedure for soft jaw boring, to get better accuracy in clamping. Similarly use the correct size of the collet as per the bar size.
- Clamp the work piece at the middle of the jaw stroke and keep the clamping plane of the work piece as near to the spindle as possible.
- Balance the work holding before use. This is very important when the work piece is of irregular shape and run at very high spindle rpm.
- Check the work piece clamping force, at regular intervals.
- Keep as stand by spare one work holding unit and essential spares like jaws, collets etc.,
- Use correct length of screws for mounting chuck on to the faceplate and Hard / Soft jaws on to the base jaws through T-Nuts.
- When machining bars, which are fed through the spindle, ensure the coolant collector assembly clear of any chip collection.

Don'ts:

- Do not use impact forces/undue force to tighten the jaws. Also periodically check the tightness of the jaws.
- Do not run the work holding and the clamping mechanism at higher than the rated maximum rpm.
- Do not exceed the recommended maximum clamping force of both the work holding and the clamping unit.
- Do not run the work holding without the work piece and the work holding being balanced.
- Ensure periodically, the tightness of the mounting screws of the work holding and chucking cylinder.
- Do not exceed the recommended maximum clamping force of both the work holding and the clamping unit.
- Do not run the work holding without the work piece and the work holding being balanced.
- Ensure periodically, the tightness of the mounting screws of the work holding and chucking cylinder.

Maintenance Manual



AXES ASSEMBLY:

The machine has two axes in general (except MY series, where third axis is also available), one parallel to the spindle axis called Z-axis and other perpendicular to the spindle axis called X-axis. The basic functions of the axes assembly are as follows.

- To hold a set of cutting tools / turret.
- Reliability in positioning accuracy and repeatability.
- Durability so that the accuracy lasts for a longer period / machine life.
- Response intune with the electronics system.
- Rigid enough to take cutting forces in all the directions.
- Should have higher rapid rates of movement.
- Should be maintenance free for normal operating conditions.

To satisfy the above, it consists of — saddle, slide, ballscrew, hardened ground guide strips / Linear motion guide ways, electromagnetic brake (not a standard supply), overload tripping clutch (not a standard supply), ballscrew supporting bearings, coupling / timer belt and AC servo motor with built in brake & absolute encoder etc.

Guide ways:

Guideways are used in machines to:

- Control the direction or line of action of the carriage / top table on which a tool post is held
- To absorb all the static and dynamic forces

Guideways are primarily of two types:

- Friction Guideways
- Antifriction linear motion guideways

Friction Guideways:

Guideways commonly used on machines have a number of different forms such as cylindrical, vee, flat, and dovetail. It is the flat or dovetail forms, which have been used on CNC machines. The flat guideway has better load bearing qualities than other form of guideways. The flat guideways are usually made of hardened steel and have to be bolted or fastened on to the main casting of the machine. It has been the practice for the other guideways to me machined out of the sides or top of the main casting of the machine. At one time, after the guideways had been bolted or fastened on to the casting of the machine bed, it was common practice that hand scraping to be done to ensure efficient bedding of the slide on the guideways. A limited amount of hand scraping may still be carried out on some machines, but the development of very efficient guideway grinding machines has reduced the amount of scraping required.

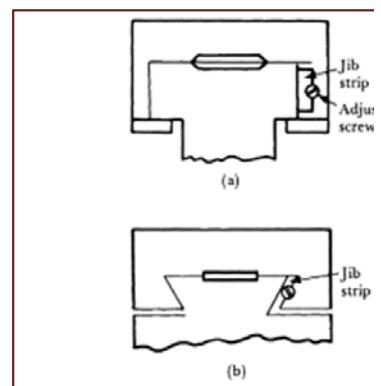


Figure 3.4(a) Flat and (b) dovetail gu

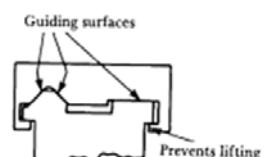
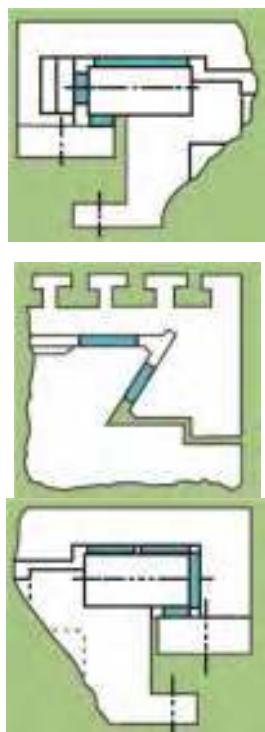


Figure 3.3 Vee and flat guideway

Maintenance Manual



After a period of use, wear may have occurred owing to the sliding of the surfaces over each other. Jib strips are used to ensure the accurate fitting of the slides to both the flat and dovetail guideways. The jib strips are tapered and can be adjusted to reduce excessive clearance caused by wear. The metal to metal contact on the flat, dovetail and vee types of guideways is normally cast iron to cast iron or cast iron to flame hardened and ground cast iron or cast iron to hardened steel. The hardened surfaces are ground to obtain accuracy required. A problem with the metal to metal contact is the relatively high coefficient of friction, and this inevitably results in wear and an increase in the power required to move the slide. This also have an impact on the geometrical accuracies of the machine.

There techniques used include hydrostatic guideways, linear bearings with balls, rollers or needles and surface coatings. As far as surface coating is concern, the guiding surfaces are coated with low friction material like PTFE, plastic strips with particles of graphite embedded into the surface, guideways coated with chromium, which is very hard wearing. Turcote is being

used in the most of the machines as a lining material between mating surfaces.

Turcote:

PTFE make lining material used in machine tools to provide a non-lube, low coefficient of friction surface between two moving metal-to-metal interfaces.

Advantages:

- Reduce friction – prevents wear and saves energy.
- Eliminates slip stick – ensures fast, accurate positioning.
- Tough and durable.
- Self-lubricating – wear resistant with low coefficient of friction. Act as a lubricant even though external lubrication system fails.
- Vibration damping.
- Renews worn equipment – restores to original accuracy.
- Easy to install – easy to apply.

The service life and the continuous precision of turcote are determined primarily by its wear behavior. Even the lubricant supply is suddenly interrupted, turcote will remain functional with low wear even for prolonged periods due to self-lubricating properties. The wear behavior is determined to a great extent by the ambient influences. It is important to protect the guides from external soiling by using covers and seals.

Maintenance Manual



Antifriction Linear Motion Guideways:

The linear guides consist of a mechanism in which steel balls are circulated infinitely to enable an infinite stroke of ball slides theoretically. Balls roll along the ball groove formed on a rail and a ball slide and there, they are scooped at the point A by the tip of an end cap. There, they are forced to

change their circulating direction by a return guide of the end cap and guided to a circulating hole provided inside of the ball slide. The balls continue to pass through the hole to the other end of the ball slide and further, go through the circulation circuit to the tip of the end cap of the other side and then, return to the ball grooves of rail and ball slide. Thus, the balls repeat their endless circulation motion.

The following are some of the important factors to be considered in selecting a LM Guide ways:

- Life of a linear motion system
- Basic static and dynamic load ratings
- Load acting onto linear motion
- Lubrication
- Friction resistance

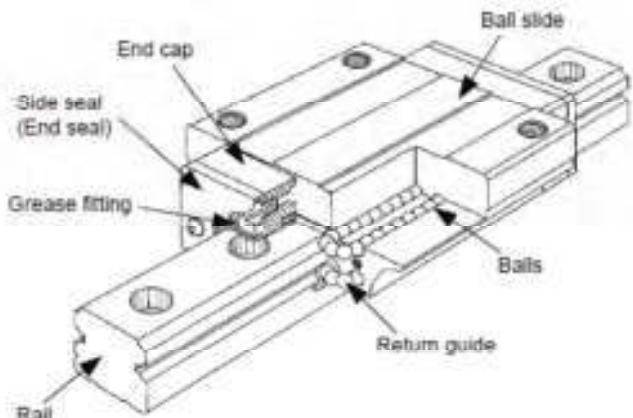
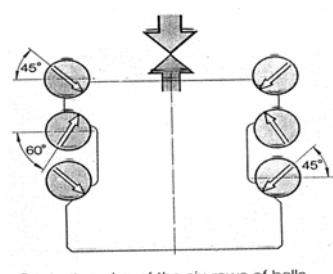


Fig. 1 Structure of LM Guideway[1]

Advantages:

- High Positional Accuracy
 - When a load is driven by a LM guideway, the frictional contact between load and bed desk is rolling contact. The coefficient of friction is only 1/50 of traditional contact.
- Long Life with high motion Accuracy
 - With a traditional slide, errors in accuracy are caused by the counter flow of oil film. Insufficient lubrication causes wear between the contact surfaces. In contrast, rolling contact has little wear, therefore machines can achieve a long life with motion



Contact angles of the six rows of balls

Maintenance Manual



accuracy.

- High speed motion is possible with low driving force
 - LM Guideways have little frictional resistance, only a small force is required to move a load.
- Equal loading capacitated in all directions
 - LM Guideways can take the load in either vertical or horizontal directions.
- Easy Installation
 - Installing a Linear Guideway is quite easy. Grinding or Milling the machine surface, following the recommended installation procedure, and tightening the bolts to the required torque can achieve highly accurate linear motion.
- Easy Lubrication
- Interchangeability

Maintenance of LM Guideways:

Maintenance Manual



Actuating Mechanisms:

Several actuating mechanisms are used in CNC machines to convert the rotational movement into a translational movement. The efficiency and responsiveness of the actuating mechanism (drive unit) have the greatest influence on the accuracy of the work produced. There are a number of essential requirements for an efficient drive unit, which includes:

- The drive must be stiff and responsive
- There must be virtually no backlash in the drive
- The drive must be free running with low temperature rise.
- There should be freedom from high frequency vibrations.

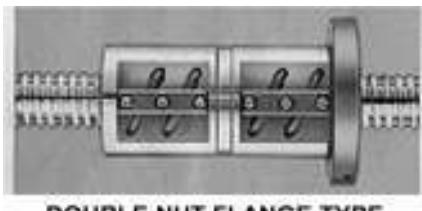
The general actuating mechanisms found in CNC are: screw & nut, rack and pinion and ram and piston.

Screw & Nut:

The screw and nut system is effective for medium traverses. With longer traverses the screw sags under its own weight. Longer the screw length, lower is the upper limit of transverse rates due to reduction in the critical speed. There are two types of screw and nut systems used on the CNC machines which provide low wear, accuracy over a long life, reduced friction, higher efficiency and better reliability. These are recirculating ballscrews and roller screws.

Recirculating Ballscrews:

It converts circular motion into linear motion. The threaded shaft and the nut rolling contact between each other, providing high efficiency of transmission. The balls rotate between the screw and the nut and at the some point they are returned to the start of the thread in the nut. In the figure shown, the balls are returned to the start point through an external tube. To enable the movement of slide to be bidirectional without any significant errors in position occurring, there must be a minimum of backlash in the screw and nut. One method of achieving a virtually zero backlash with ball is by fitting two nuts as shown in figure. The nuts are forced apart, so that the balls in one nut contact one side of the threads in the nut and the balls in the other nut contact the opposite side of the threads.



DOUBLE NUT FLANGE TYPE

Ball screw should be lubricated properly for their longer life, better accuracy and higher efficiency. Ball screws are coated for lubrication and rust prevention. But, the nut usually runs on a long threaded shaft and the shaft rotates which makes it difficult to retain oil. Therefore, much care should be taken so that no oil leakage takes place.

Due to friction within a ballscrew and nut, the movement of the slide produces a temperature rise in the ballscrew leading to its expansion. This results in compressive loading on the ballscrew in case of fixed-fixed mounting. For this reason, in such mounting arrangements, ballscrews are stretched to the extent of the expected thermal expansion. The efficiency of a recirculating ballscrew is of the order of 90% and is obtained by the balls providing a rolling motion between the screw and the nut. The mounting arrangement of a ballscrew depends on its required speed, length and size. The position of the ballscrew should be near the line of the resultant force arising from cutting, frictional and inertial forces.

Maintenance Manual



Ballscrew Mounting Methods:

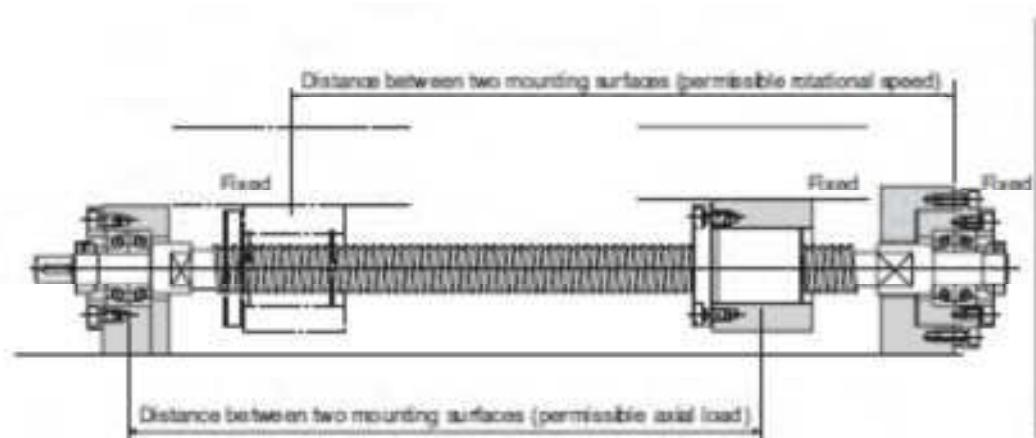


Fig.3 Screw Shaft Mounting Method: Fixed - Fixed

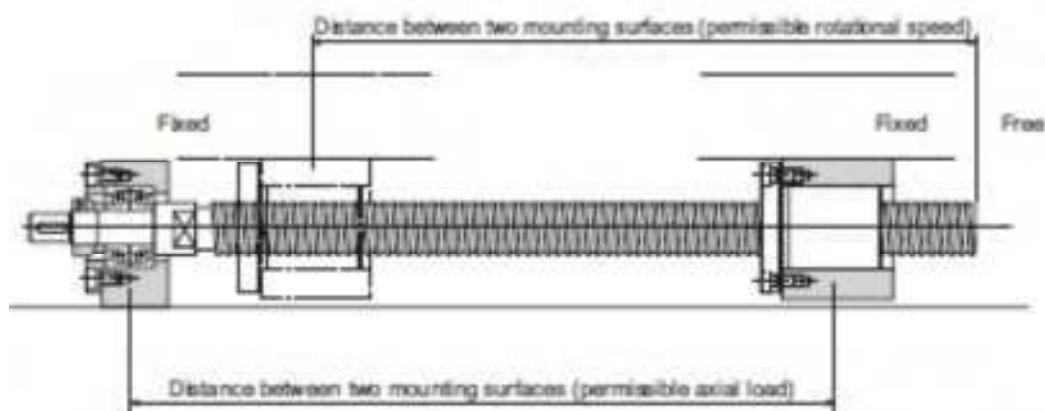
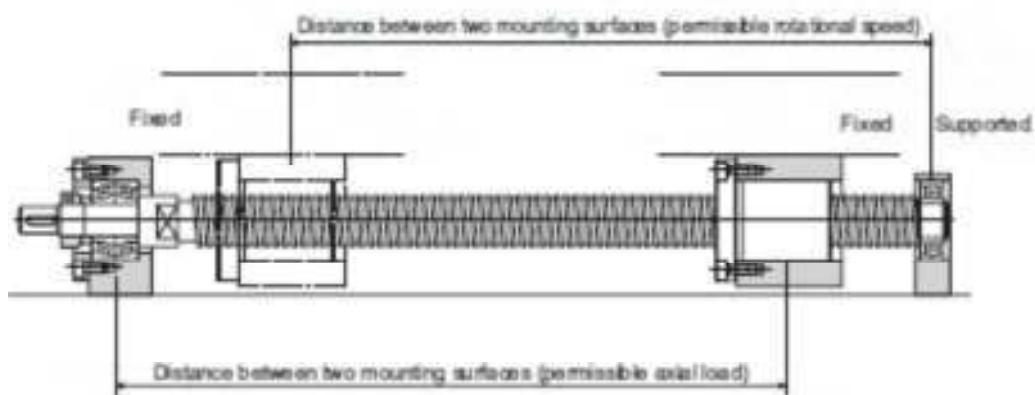


Fig.1 Screw Shaft Mounting Method: Fixed - Free

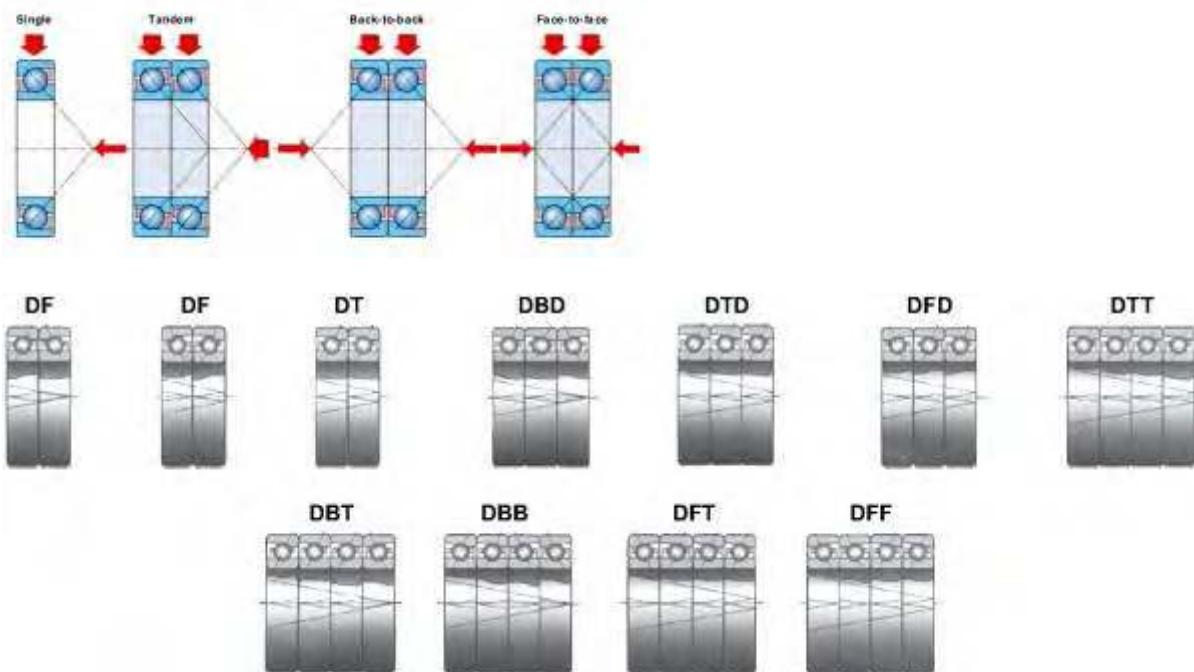


Maintenance Manual



In a ballscrew system, attention should be paid to the selection of end bearings to minimize the positioning inaccuracies. The function of the bearings in a ballscrew is to locate the screw radially and resist the axial thrust force. These bearings should have high load capacity, high axial stiffness and low axial run-outs.

Universal Arrangements for Angular Contact Ball Bearings



Maintenance of Ballscrew:

- A ballscrew must be thoroughly cleaned in white spirit and oil to protect against corrosion. Great care must be taken to ensure that the ball track is not struck by a sharp edged component or tool, and metallic debris does not enter the ball nut.
- Ballscrews demand accurate alignment and precision bearing arrangement. It is especially important to eliminate misalignment between the bearing housing center and the ball nut center, which would result in unbalanced loads. This can cause malfunction and reduce service life.
- To achieve the ballscrews' maximum life, it is recommended to use antifriction bearing oils as lubricant.
- Oil mist bath or drip feeds are also acceptable. However, direct application to the ball nut is recommended.
- Select a suitable support bearing arrangement for the screw. Angular contact ball bearings with 60° angle are recommended, which takes higher axial load capacity and ability to provide a clearance-free or preloaded assembly.
- A dog stopper should be installed at the end to prevent the nut from over travelling which results in damage to ballscrew assembly.

Maintenance Manual



Fig 4.1 Carefully clean and protect

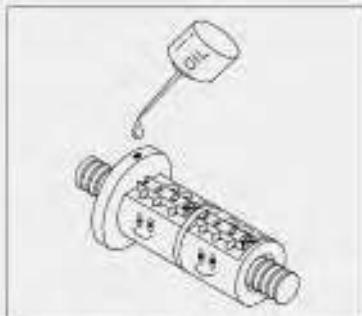


Fig 4.2 Oil lubrication method.

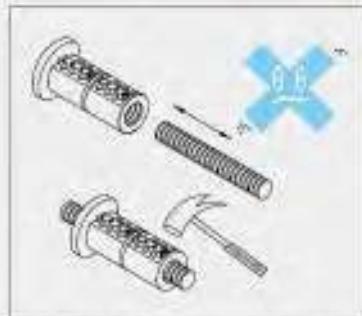


Fig 4.3 Carefully protect the nut

- In environments contaminated by dust or metallic debris, ballscrews should be protected using telescopic or bellow type covers.
- After heat treating the ballscrew shaft, both ends of the ball tracks adjacent to the journal have about 2 to 3 leads left soft, for the purpose of machining.

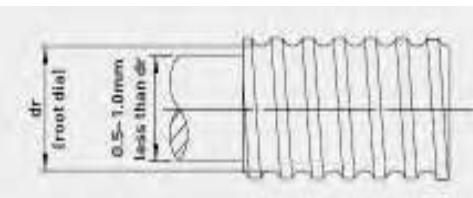


Fig 4.7 Special arrangement for the end journal of an internal recirculation screw

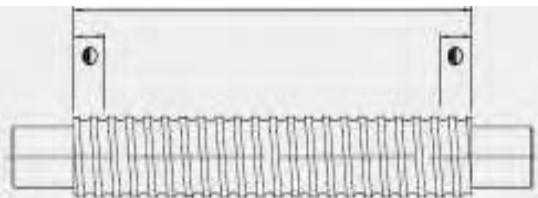


Fig 4.8 The heat treatment range of the ballscrew spindle

- Excessive preload increases the friction torque and generates heat which reduces the life expectancy. But insufficient preload reduces stiffness and increases the possibility of lost motion (backlash).
- The ball nut should never be removed from the ballscrew by the user as the balls will fall out of the ball nut. When the nut needs to be dismantled from the shaft, a tube with an outer dia. 0.2 to 0.4 mm less than the root diameter of the ball track should be used to release /connect the nut to from /to the shaft via one end of the shaft.

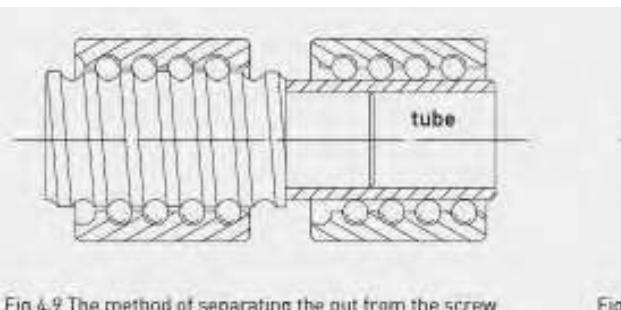


Fig 4.9 The method of separating the nut from the screw spindle

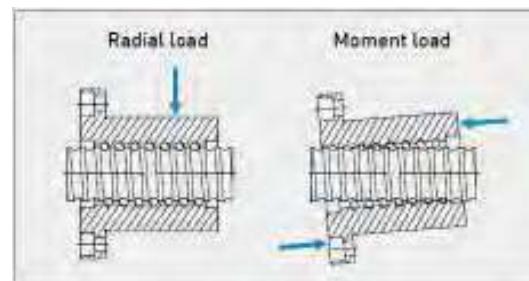


Fig 4.2(a) Unbalance load caused by misalignment of the support bearings and nut brackets, inaccurate alignment of the guide surface, inaccurate angle or alignment of the nut mounting surface

- The supporting bearing must have a chamfer to allow it to seat properly and maintain proper alignment.

Maintenance Manual



Torque Transmission Elements:

Timing belts and flexible couplings are generally used on CNC machines to transmit the torque from a servo motor to a ballscrew.

Timing Belts:

These are endless toothed belts. The teeth engage with a timing pulley having teeth on its periphery. The teeth profiles on the belt and the pulley are compatible with each other. They are more popular due to their inherent advantages of low cost, less noise, elimination of lubrication, less maintenance, and higher efficiency.



Timing Pulley and belt

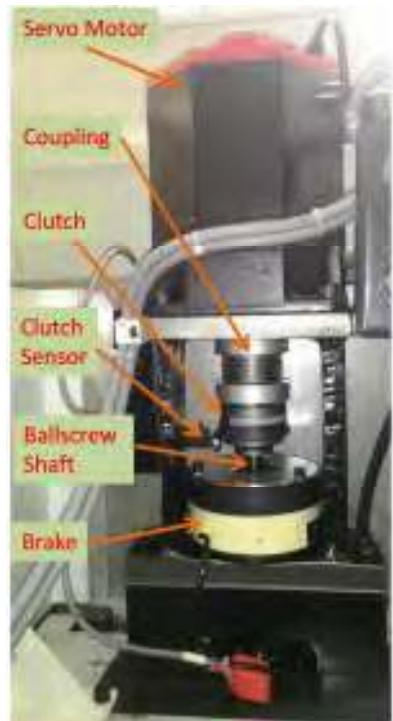


Flexible Couplings:

The servo motor and ballscrew are directly coupled using flexible coupling. These couplings behave like a rigid element in the direction of rotation. A certain amount of flexibility is built into the coupling to compensate radial and angular misalignments and also any misalignments due to heat and elastic deformation.



Coupling



Maintenance Manual



Taper Lock Bushes:

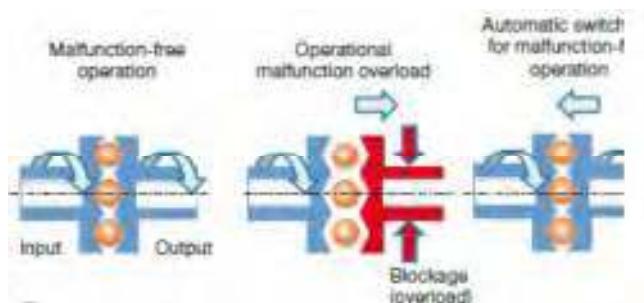
These elements are used to couple a shaft and a hub of a gear or timing pulley, etc., They are built in the form of taper rings with self-releasing tapers. These elements are capable of transmitting a torque without any backlash. For assembling the bushes, the male and the female tapers are forced onto each other by tightening the screws axially. This expands the bushes and generates an enormous radial force due to small taper angle which locks the hub and the shaft, and the torque is transmitted through friction.



Safety Devices:

Safety Clutches:

These are used to disengage the driven part (Ballscrew) from the driving part (servo motor), when the transmitted load or torque exceeds a permissible limit. A limit switch registers clutch disengagement and switches off the drive.

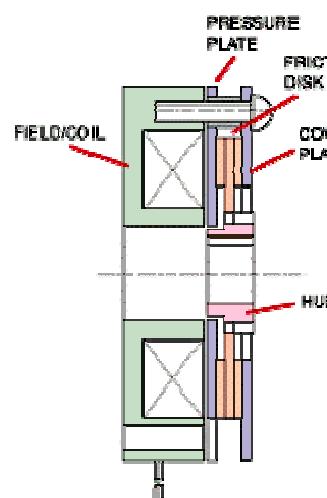


Electromagnetic (Electromechanical) Brakes:

Brakes slow or stops motion, using electromagnetic force to apply mechanical resistance. There are different types of magnetic brakes and the one used on CNC machines is power off brake or referred as fail safe brakes. These brakes are typically used on or near the motor. There are 2 types of holding brakes. The first is spring applied and the second is permanent magnet brakes.



In spring type, in the event of power failure, a spring pushes against a pressure plate, squeezing the friction disc between the inner pressure plate and the outer pressure plate. This frictional clamping force is transferred to the hub,



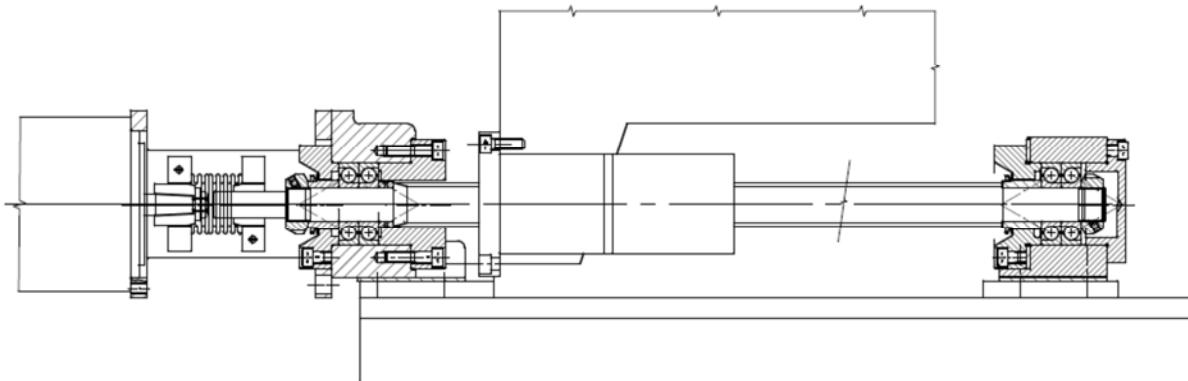
which is mounted to a shaft. In permanent magnetic type, a permanent magnet attracts a single face armature to the brake housing.

Maintenance Manual



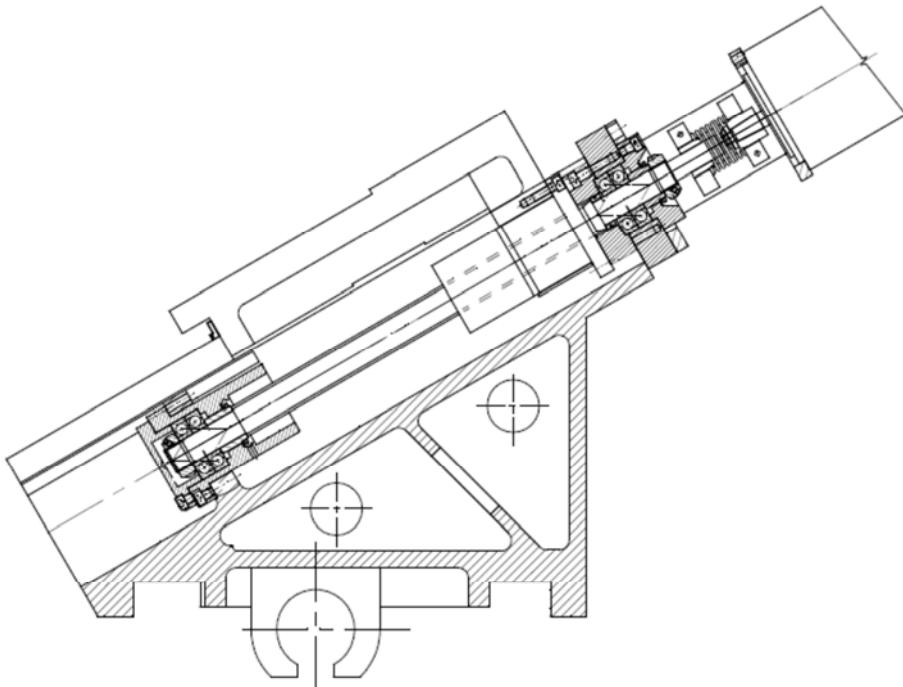
Jobber XL / Super Jobber Series:

Z-Axis:



The Z-axis slide moves over pair of hardened ground guide ways, which are fixed on to the bed. The mating sliding surfaces of the slide are lined with turcite for anti-stick slip properties. In case of LM series, the slide moves over pair of anti-friction LM guideways. The ball screw, which converts circular motion into linear motion, is supported at both ends by supporting bearings and also pre-tensioned to overcome temperature variations generated during normal running of the machine. An AC servomotor with built in brake and absolute encoder is directly coupled at one end of the ballscrew shaft through torsional rigid coupling.

X-Axis:



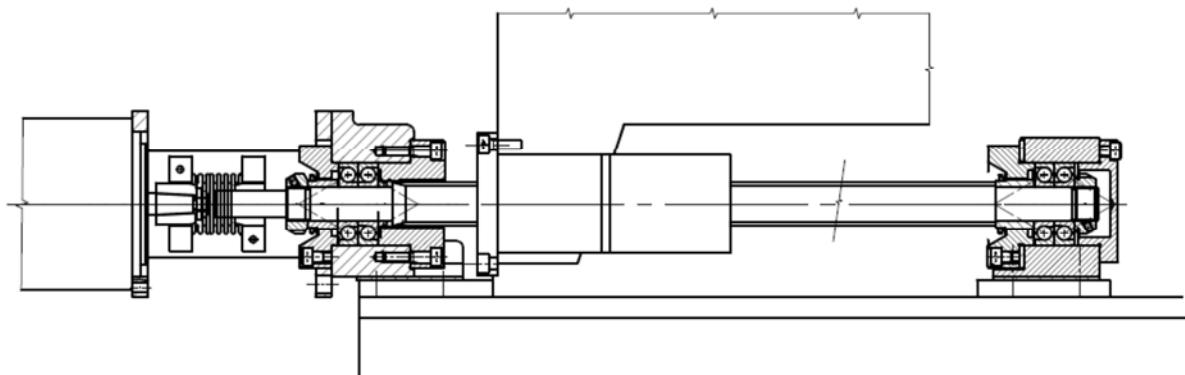
Maintenance Manual



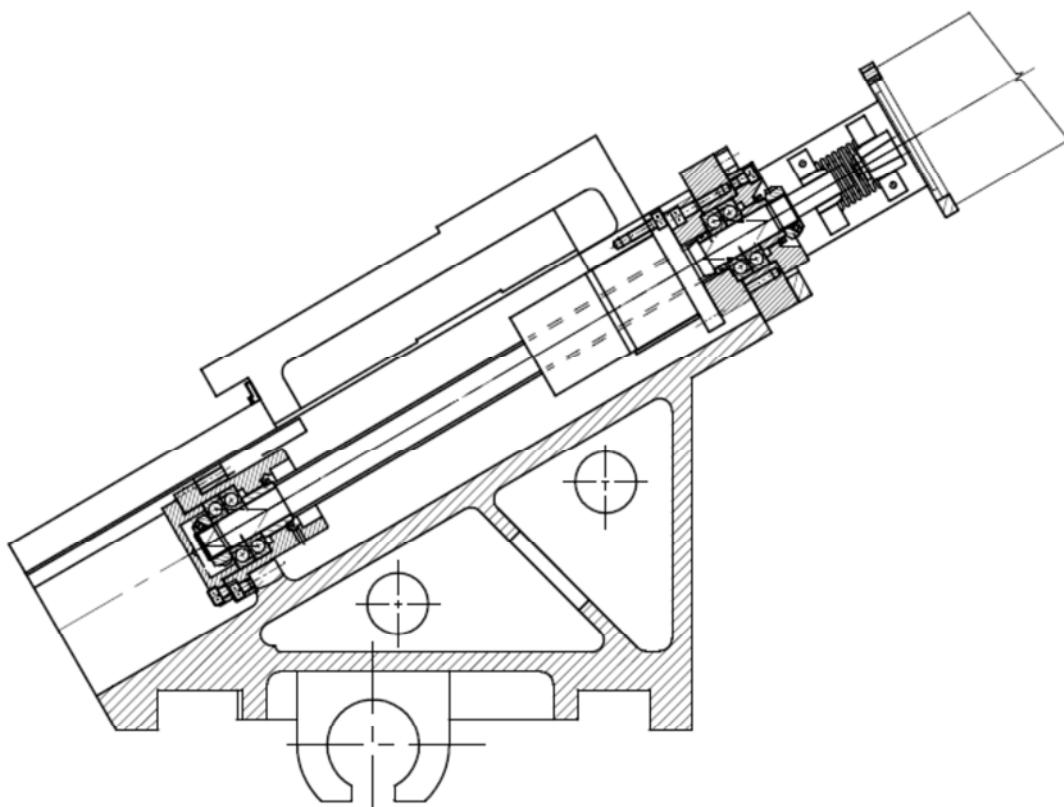
The X-axis moves over pair of hardened ground guide ways, which are fixed on to the saddle. The mating sliding surfaces of the top slide are lined with turcite for anti-stick slip properties. The ballscrew is supported at both ends by supporting bearings and also pretensioned to overcome temperature variations generated during normal running of the machine. An AC servomotor with built in brake and absolute encoder is directly coupled at one end of the ballscrew shaft through torsionally rigid coupling.

Jobber LM / Super Jobber LM Series:

Z-Axis:



X-Axis:



The Z and X slides move over a pair of anti-friction LM guides, bolted on to bed and saddle respectively. An AC servo motors are directly coupled to the ball screws through a torsionally rigid couplings. The ball screws are pretensioned and it minimizes the effect of

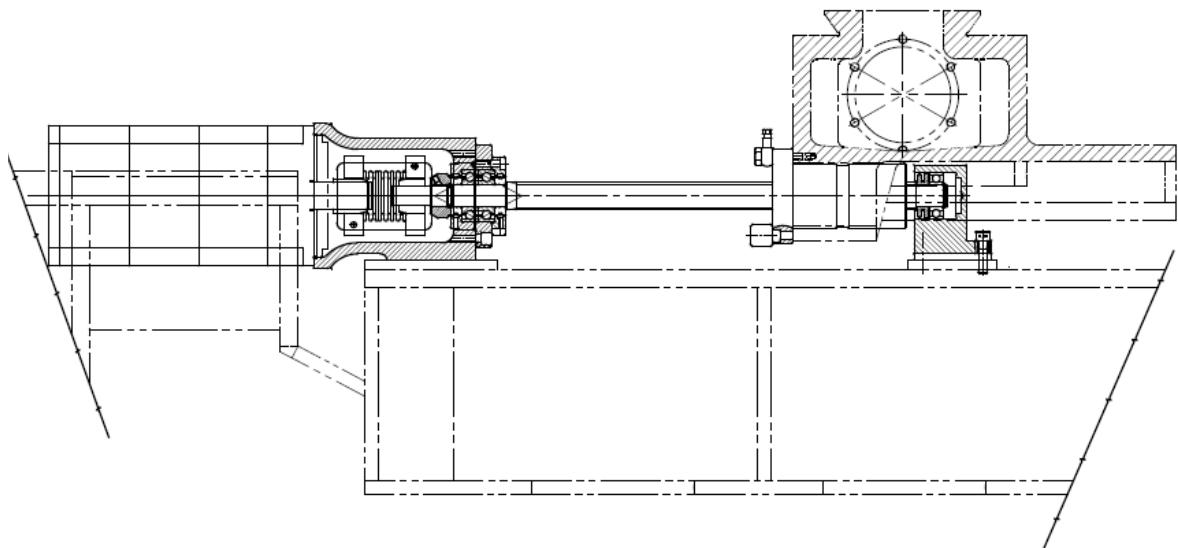
Maintenance Manual



temperature variations. The feedback for the axes is through the encoder built in to the motors. The motors are provided with absolute encoders.

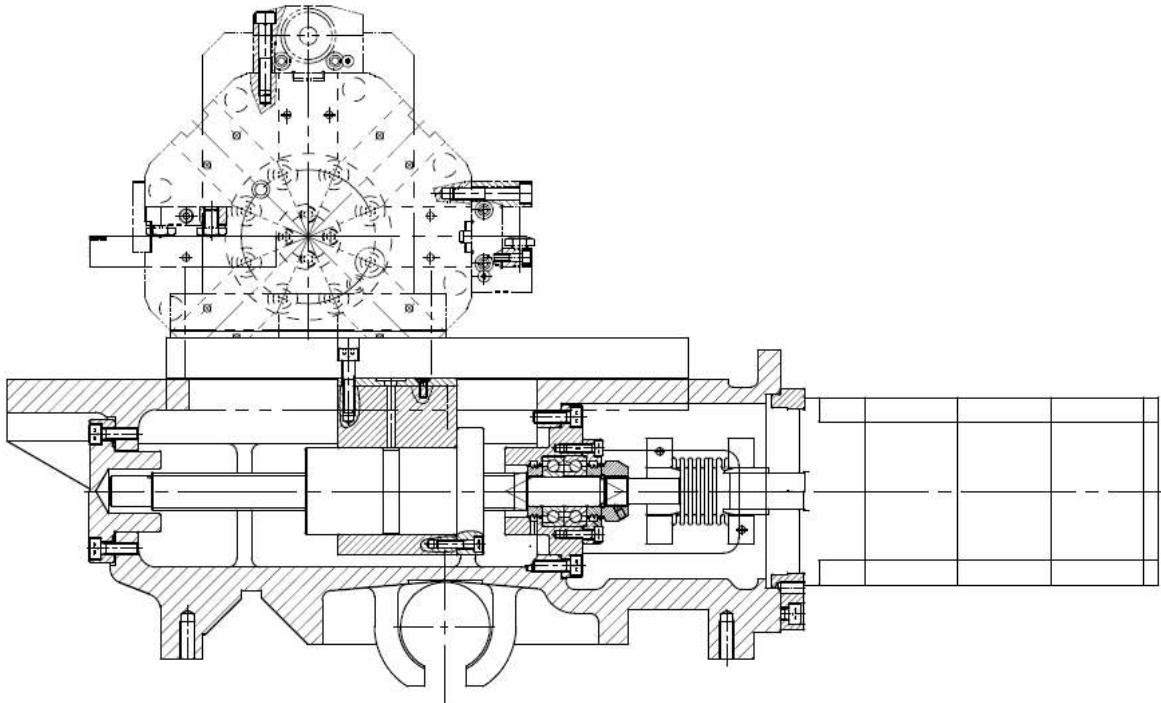
Colt/Cub Series:

The Z-axis slide moves over hardened and ground guide strips bolted on to bed of V and FLAT type construction. The mating surface on the slide is 'Turcite' lined to have stick slip free movement. In case of LM series, the slide moves over anti friction LM guideways.

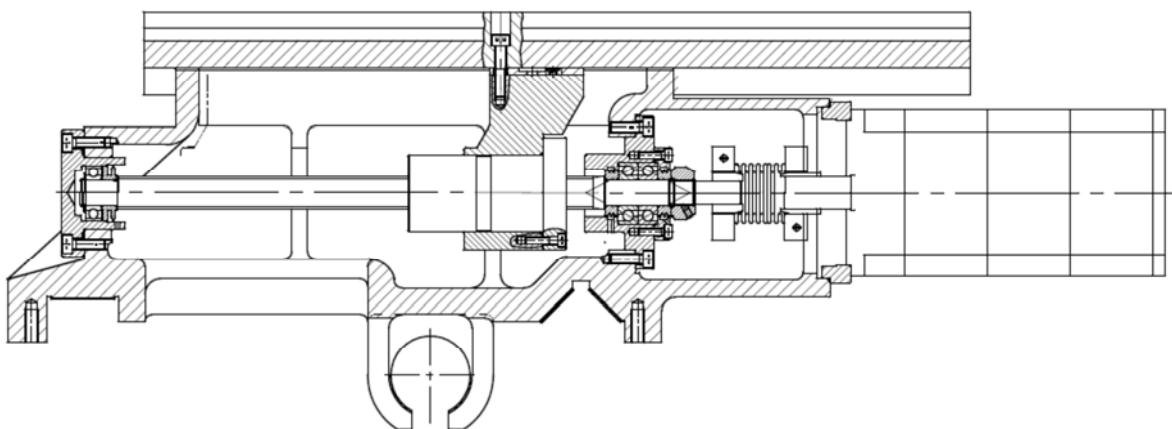


The Z-axis ball screw is mounted over a pair of precision ball screw support bearings on the drive end and supported by a deep groove ball bearing at the driven end.

Maintenance Manual



The X-slide moves over dovetail guides. The mating sliding surface on the slide is lined with 'Turcite' to have stick slip free movement. The X-axis ball screw is mounted over a pair of precision ball screw support bearings on the drive end and supported by a deep groove ball bearing at the driven end in colt and free in cub. The table slide is provided with full length of T-slots for mounting the tool blocks at any convenient point for an optimum tool layout in colt, where as a flat surface is provided to mount BTP-63 turret with 8 stations in Cub.



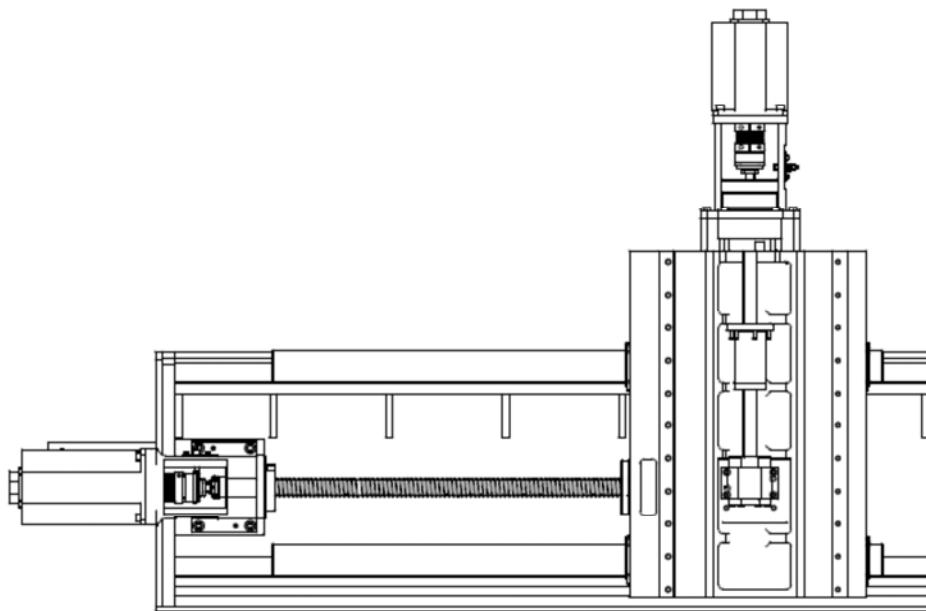
Both X & Z ball screws are connected to the AC servomotor by torsionally rigid flexible coupling. The servo motor features built-in encoder (with absolute or without), which gives feed back to CNC system and built-in brake. An over load clutch can also be offered as an option to minimize the effect of shock loads in case of accidents.

Maintenance Manual

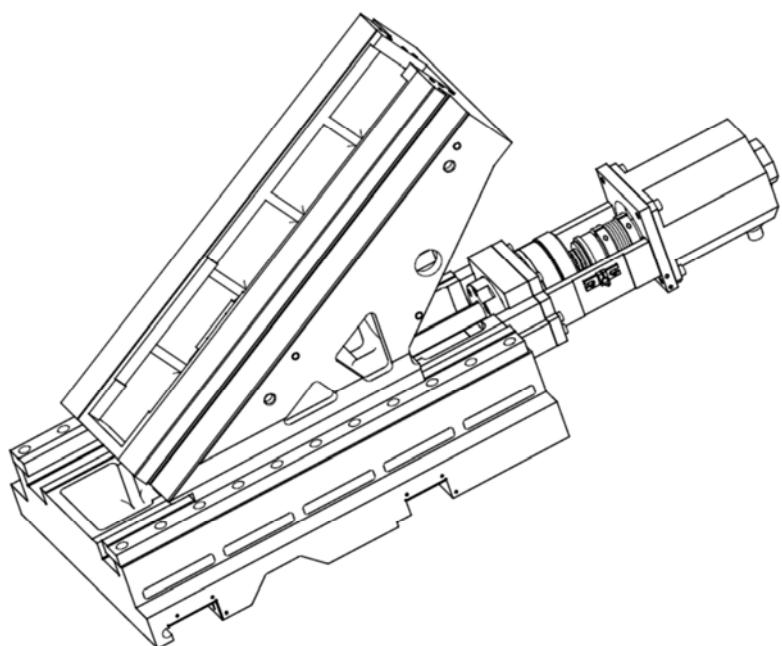


Vantage-MY series

Z-Axis:

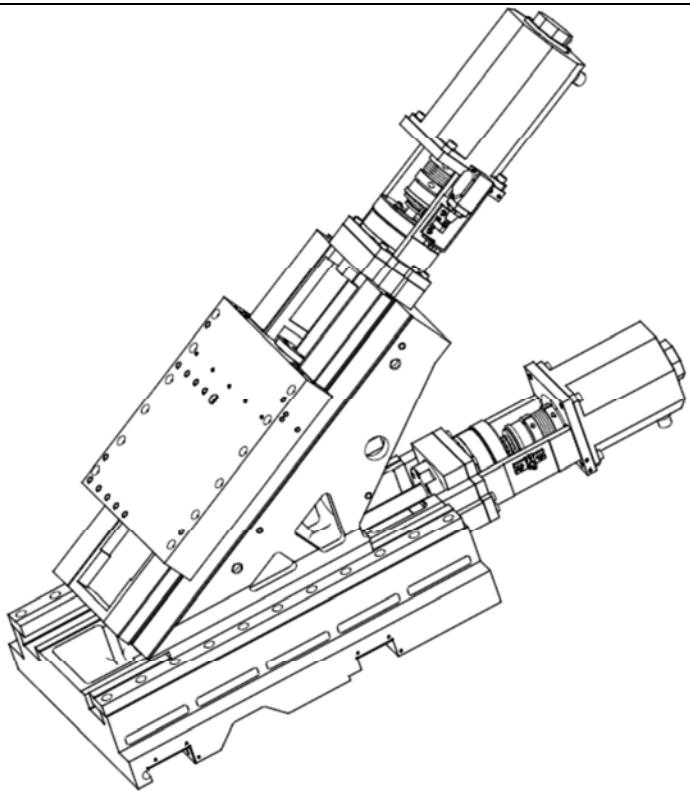


Y-Axis:



X-Axis:

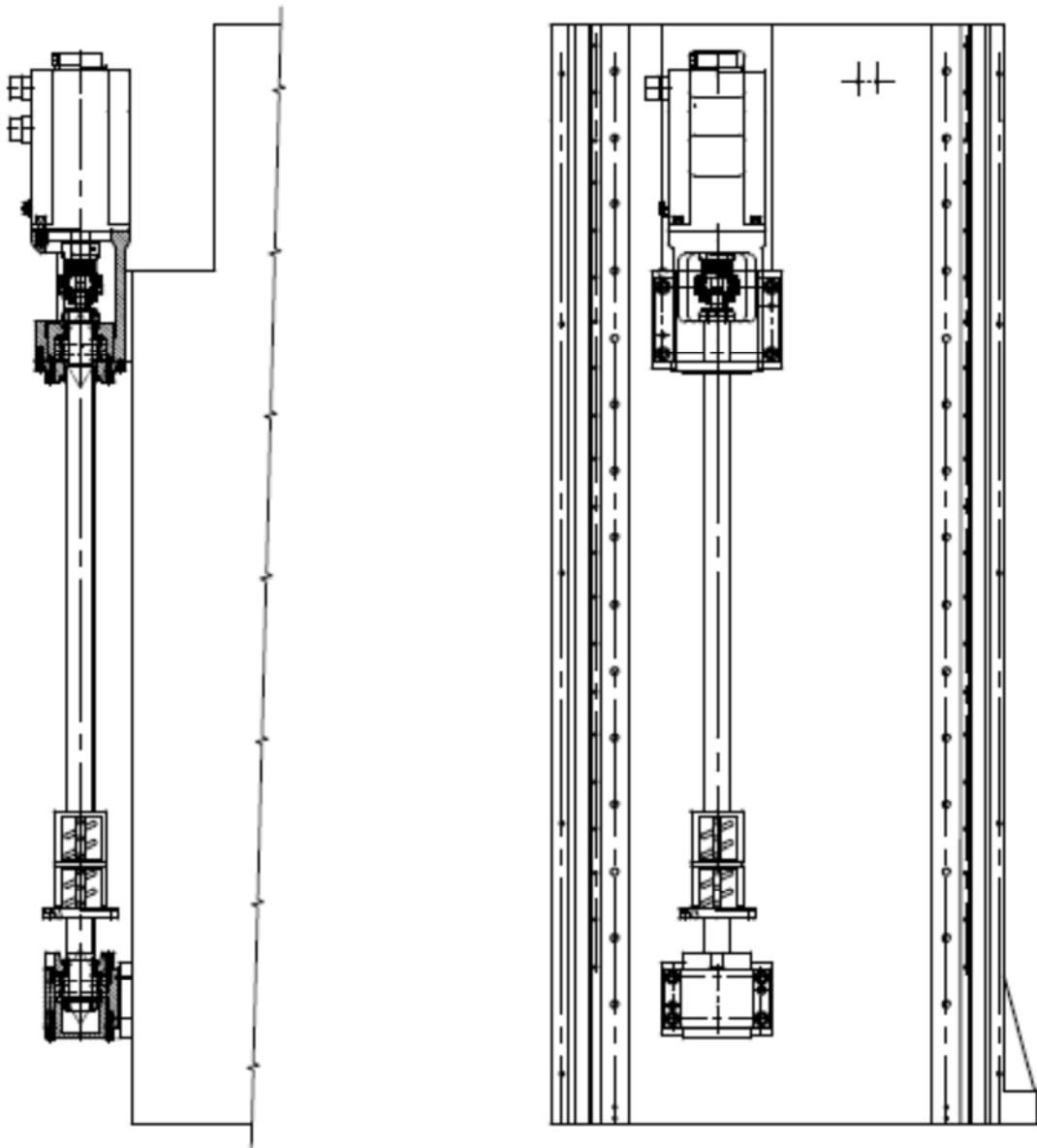
Maintenance Manual



VTL Series:

Z-Axis

Maintenance Manual

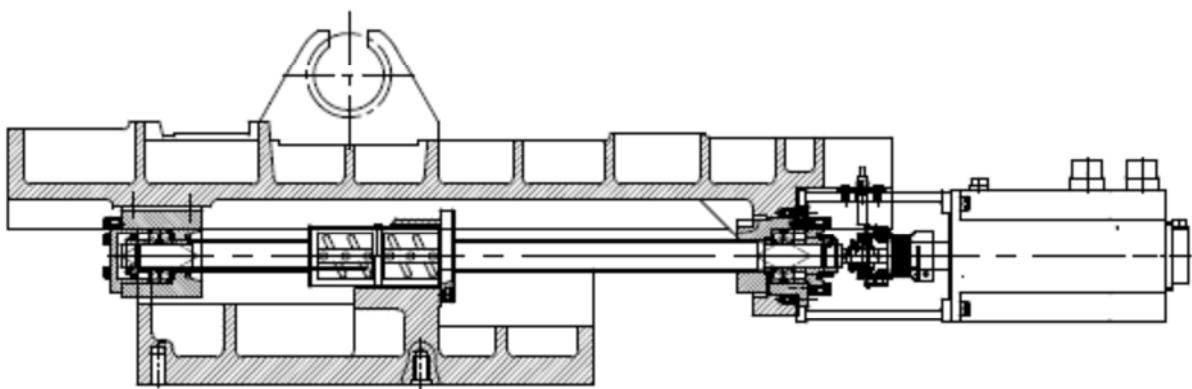
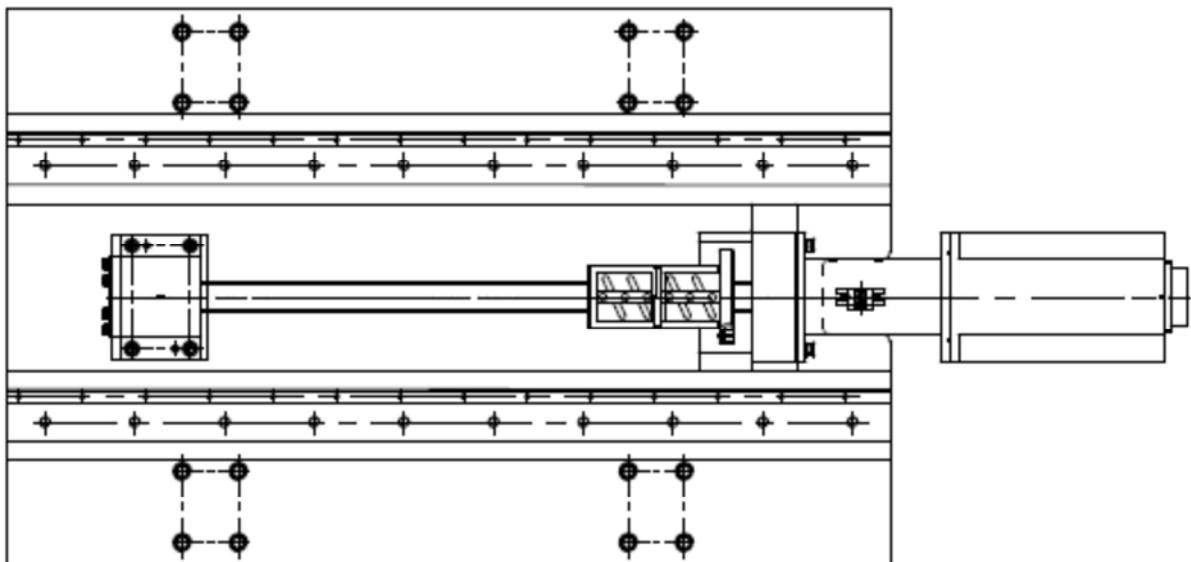


The Z-axis slide moves over a pair of LM guides of large cross section. An AC servo motor is directly coupled to the ballscrew. The ballscrew is mounted over a set of ballscrew support bearings as in figure and is pretensioned to minimize the effect of temperature. Hydraulic counter balance circuit for the Z-axis smoothens the torque requirement.

The axis system is provided with overload safety clutch to protect the machine against application of excessive motor torque on to the elements in case of accidents. The feedback for the Z-axis motion is through the encoder built into the motor.

X-Axis:

Maintenance Manual



The X-axis slide moves over a pair of LM guides of large cross section. An AC servo motor is directly coupled to the ballscrew. The ballscrew is mounted over a set of ballscrew support bearings as in figure and is pretension to minimize the effect of temperature.

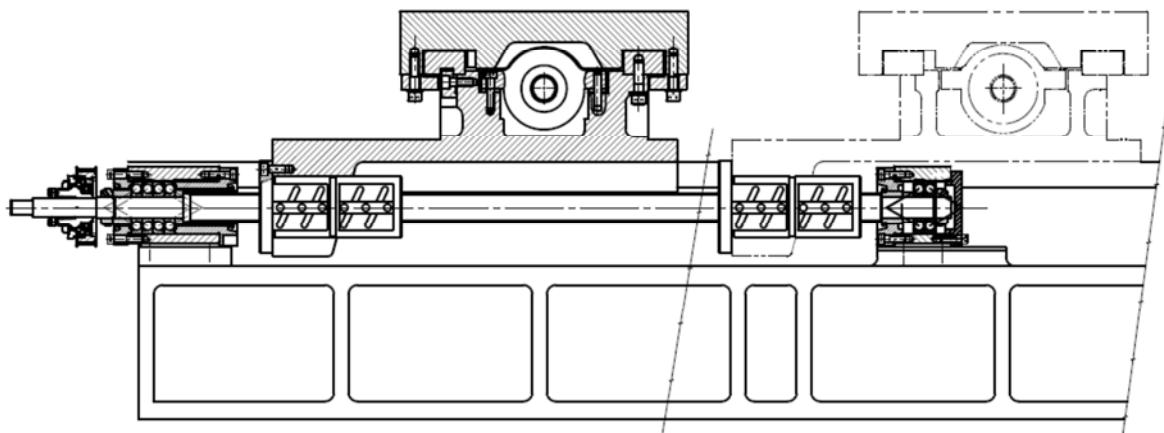
The axis system is provided with overload safety clutch to protect the machine against application of excessive motor torque on to the elements in case of accidents. The feedback for the Z-axis motion is through the encoder built into the motor.

Maintenance Manual



LT-25 / 30 / 40 Series (Box type Guideways):

Z-Axis:



The Z-axis slide moves over a pair of hardened and ground guide strips. The sliding surfaces are lined with turcite for anti-stick slip properties. An AC servo motor drives the ball screw directly. The ball screw is mounted over a set of ball screw supporting bearing of 2T2B combination at the fixed end and a pair of ball screw bearing of DB combination at the other end.

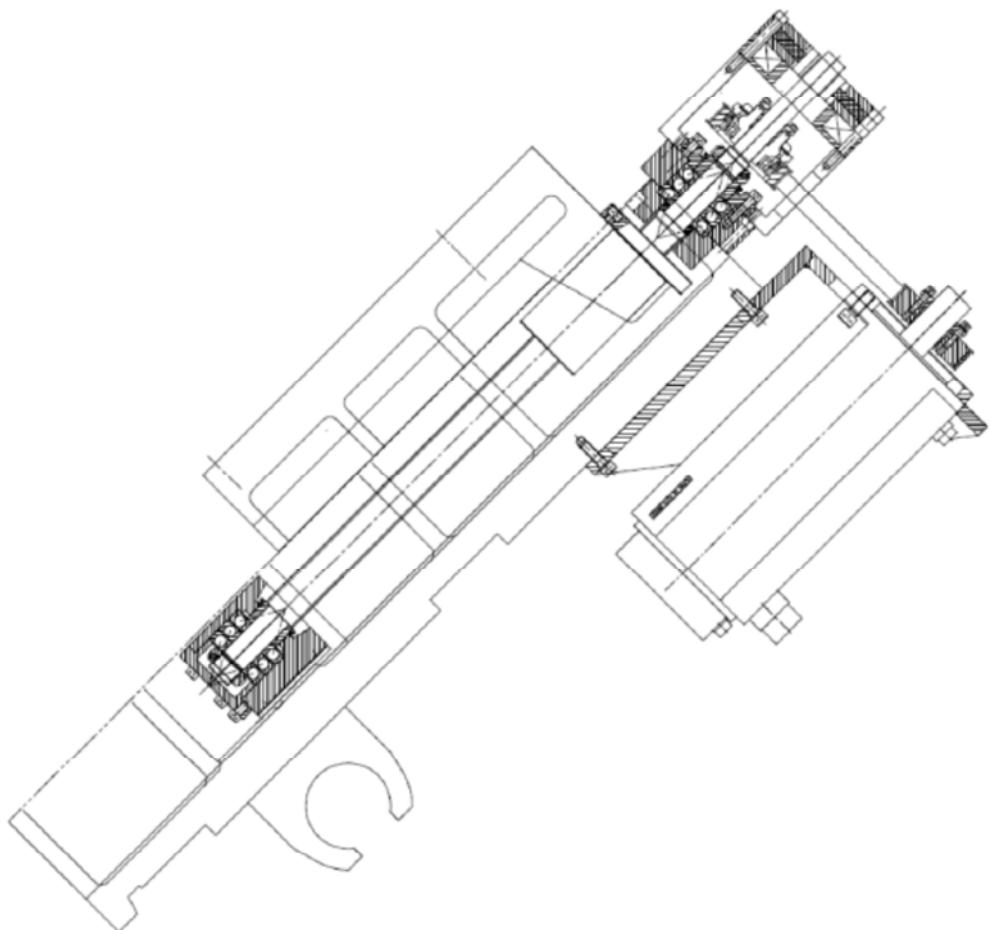
The pretensioned ball screw arrangement takes care of the expansion effect due to temperature variation. The axis system is provided with overload safety clutch to protect the machine against application of excessive motor torque on to the elements in case of accidents. The feedback for the Z-axis motion is through the encoder built into the motor.

X-Axis:

The X-axis slide moves over a pair of hardened and ground guide strips. The sliding surfaces are lined with turcite for anti-stick slip properties. An AC servo motor drives the ball screw directly. The ball screw is mounted over a set of ball screw supporting bearing of 2T2B combination at the fixed end and a pair of ball screw bearing of DB combination at the other end.

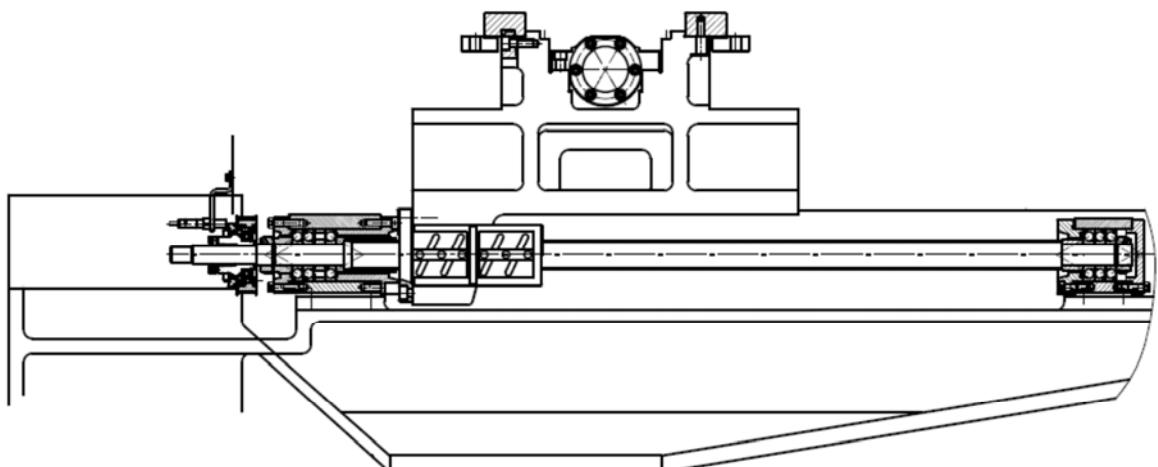
The axis system is provided with overload safety clutch to protect the machine against application of excessive motor torque on to the elements in case of accidents. The feedback for the X-axis motion is through the encoder built into the motor. An electromagnetic brake is coupled to the ball screw to arrest the motion of the slide in case of power failures.

Maintenance Manual



LT-20 Classic / LT-20 XL / Mega Jobber Series:

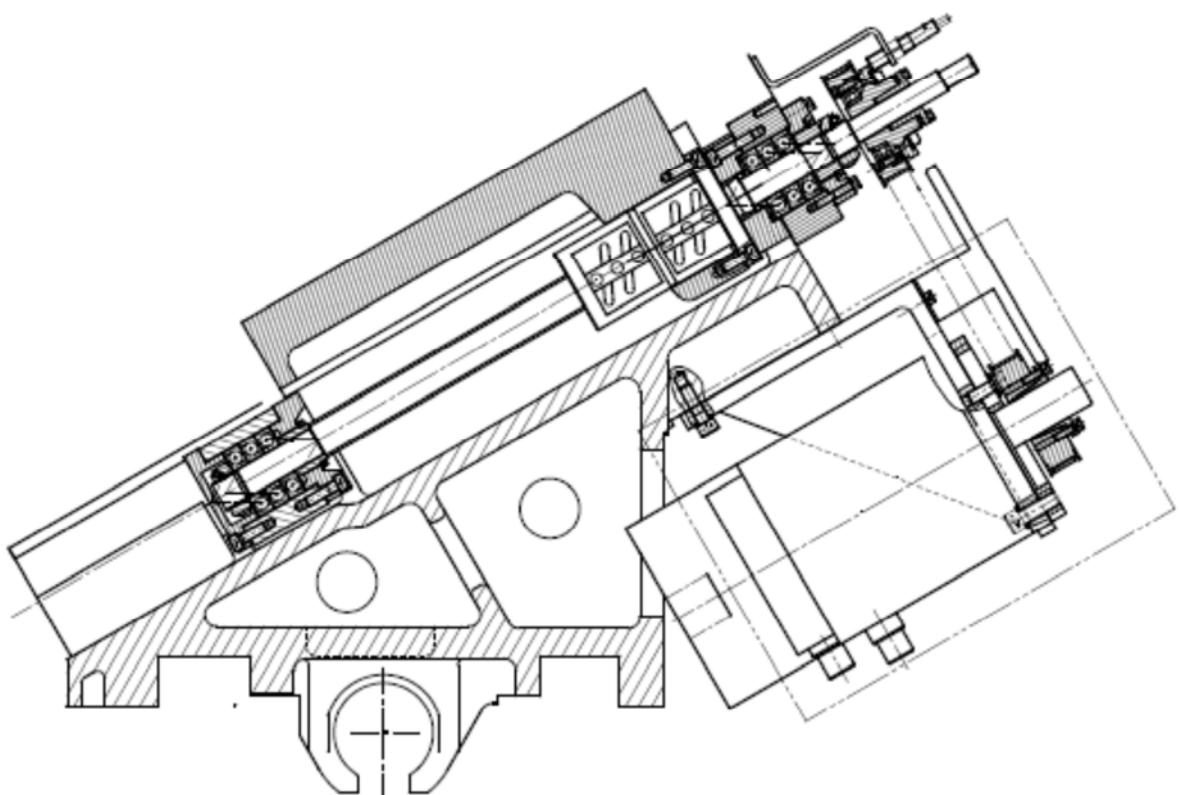
Z-Axis:



Maintenance Manual



X-Axis:



Common for all axes assemblies:

For setting the machine co-ordinates, actuating dogs and limit switches are provided in the case of machines without absolute encoder. Machine reference and emergency positions can be set with these limit switches. All the moving parts have been lubricated including Ball screw and guide ways through a centralized lubrication unit via distributor blocks and metering cartridges etc. A periodic check is essential to ensure proper lubrication to all the points. Particularly, ball screw should be checked frequently for lubrication for its longer life, better accuracy and higher efficiency. Wipers have been provided to the guide ways to protect them from chips and coolant. These wipers have to be periodically checked and replaced if necessary.

Dos:

- The ball screw support bearings are life lubricated and hence no frequent greasing is required.
- The guide strips and the ball screw are lubricated through the centralised lubrication system. The proper functioning of the lubrication unit and the metering cartridges should be periodically checked.

Maintenance Manual



- To ensure total transmission (no loss), the transmission elements to be checked periodically.
 - Direct drive: coupling condition
 - In directive drive: tightness of the timer Pulley, clearance in the key / key way, condition of the timer belt etc.
- The tightness of the mounting screws of the motor is to be checked / ensure periodically.
- The basic alignment checks as per the geometrical accuracy test chart to be done once in 6 months.
- Apply a thin film of lubricating grease over the exposed / unused portion of the ball screw and guide strips.
- If the motor and slide assembly is disconnected for any reason in the machines without absolute encoder servo motor, establish the marker pulse setting of the encoder with respect to the slide position.
- Check for proper functioning / condition of wipers and replace the same, if required.

Don'ts:

- Does not disassembly the ball nut from slide or ballscrew shaft, for any reason.

Axes timer belt changing procedure:

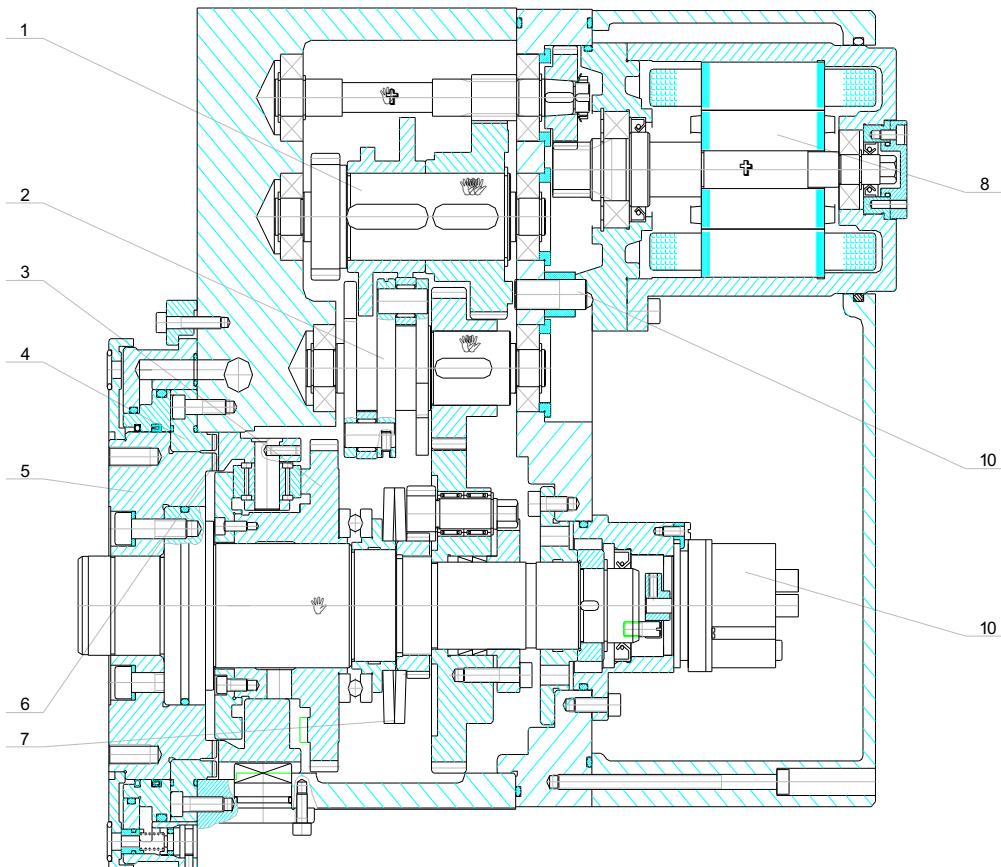
- Switch OFF the mains supply voltage.
- Loosen the four mounting screws of the axis motor mounting plate/bracket.
- Remove Electro-mechanical brake and brake mounting bracket, if provided.
- Gently lift the motor upwards in case of X-axis and push slightly towards ball screw in case of Z-axis and remove the old belt from the pitch pulley and replace it with new belt of correct size and specification.
- Now tighten the four screws of the motor and check the tension of the timer belt and adjust the same.
- Switch ON the mains supply.

Maintenance Manual



Turret Assembly:

The main functions of the turret are to hold a set of tools, similar to any tool post in a conventional machine and to index faster to reduce tool change over time. To achieve this, a bi-directional turret with 8 or 12 stations is mounted on the top slide.



There are 4 types of turrets are being used on ACE machines. They are BTP-63 (Cub), BTP-80 (JobberXL/LT16/LT-2XULT-20XL), BTP-100 (LT-20C) and BTP-125 (LT-25).

The working principle of turret is, an electrical motor drives a set of mechanical elements (combination of spur gears, cam follower mechanism, drum cam) to cause the rotation of the main spindle. A tool disc of 8 or 12 stations is mounted on the main spindle. As per the command given, the tool disc clamps at every station and the control system compares the position feedback (through encoder) with the command then once again



Maintenance Manual



indexes, if the two does not match. Turret can also be indexed in JOG mode by pressing the push button. The tool disc is designed to accommodate OD turning tools, boring blocks for mounting ID turning tools and C holders. The disc is aligned both in X & Z- axes within 0.01 mm This alignment may change in case of accidents. This needs to be checked and corrected immediately, if necessary. The disc also provides coolant to the tool point.

Type of Tool Disc:



VDI Disc



Slotted Disc



Disc with Tools Mounted



Disc with Tools Mounted



Test Mandrel for VDI

Maintenance Manual



Slotted Disc:

Alignment in X-axis:

The OD turning tool holder mounting surface is taken as the reference surface for alignment in the X-axis. A needle type dial indicator is placed over the tailstock housing/guide way surface. The slide is moved in the X direction and the dial reading is noted down. If the alignment is necessary, then slightly loosen all the eight disc-mounting screws and tilt the disc over the turret main spindle shaft to align with in the limits. Recheck the value after tightening all the screws thoroughly / uniformly.

Alignment in Z-axis:

The boring block mounting surface is taken as the reference surface for alignment in the Z-Axis. A plunger type dial indicator is placed over the tailstock guide ways and the plunger is loaded on to the boring bar mounting surface. The slide is moved in the Z direction and the dial reading is noted down. If alignment is necessary, then slightly loosen all the eight turret-mounting screws and tilt the body accordingly to align the disc within limits. Recheck the value after tightening all the screws thoroughly / uniformly.

VDI Disc:

Alignment in X-axis:

The OD turning tool holder mounting surface is taken as the reference surface for alignment in the X-axis. A needle type dial indicator is placed over the tailstock housing/guide way surface. The slide is moved in the X direction and the dial reading is noted down. If the alignment is necessary, then slightly loosen all the eight disc-mounting screws and tilt the disc over the turret main spindle shaft to align with in the limits. Recheck the value after tightening all the screws thoroughly / uniformly.

Alignment in Z-axis:

The boring block mounting surface is taken as the reference surface for alignment in the Z-Axis. A plunger type dial indicator is placed over the tailstock guide ways and the plunger is loaded on to the boring bar mounting surface. The slide is moved in the Z direction and the dial reading is noted down. If alignment is necessary, then slightly loosen all the eight turret-mounting screws and tilt the body accordingly to align the disc within limits. Recheck the value after tightening all the screws thoroughly / uniformly.

Maintenance Points:

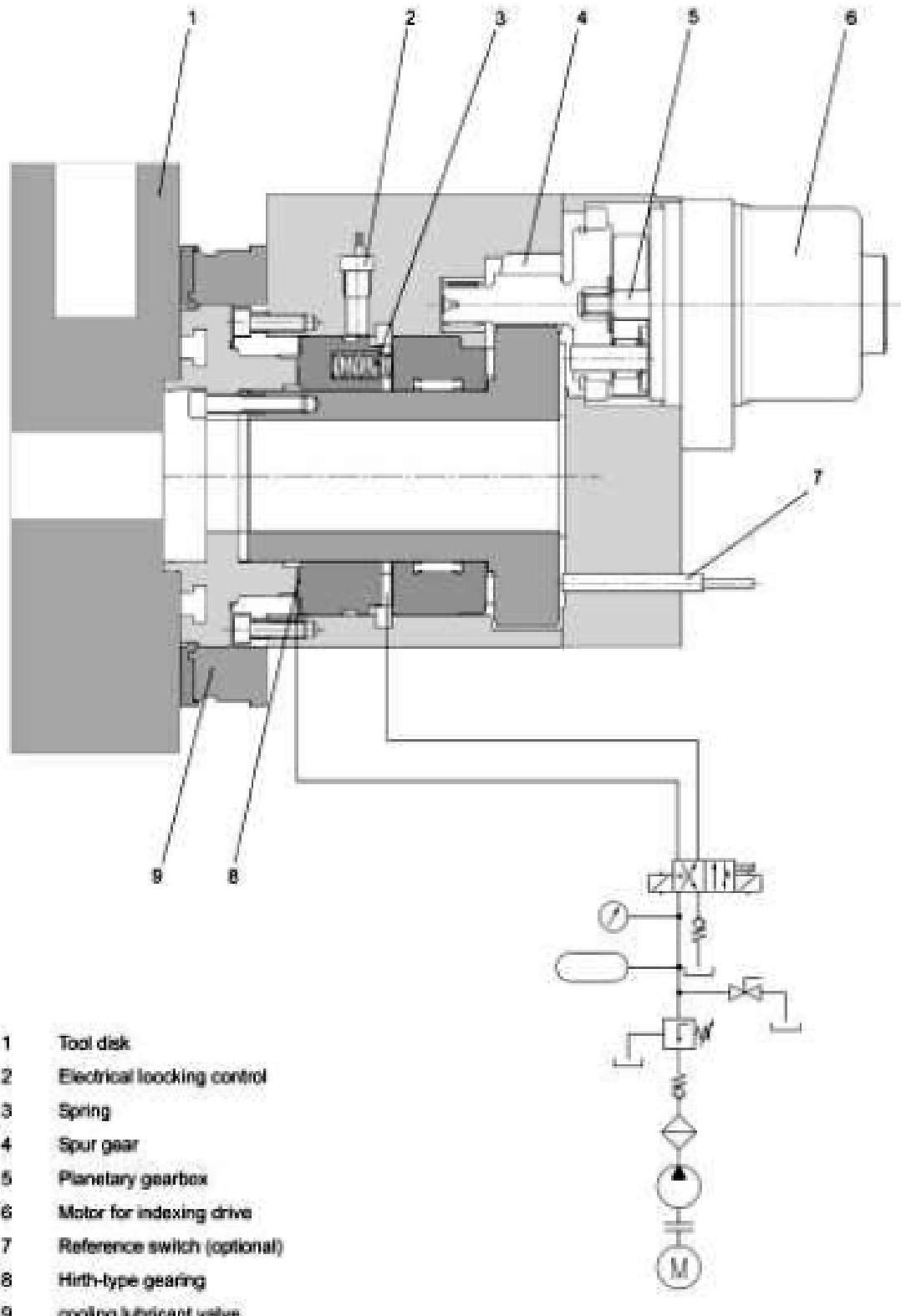
Dos:

- Ensure the tightness of all turret tool-mounting screws, disc-mounting screws, and tools mounting screws.
- Change the oil after initial running of 3 months and then change after every 6 months of running. The grade of the oil is
- Coolant flange assembly to be dismantled and cleaned once in 6 months.

Maintenance Manual



Servo Turret – working principle:



- 1 Tool disk
- 2 Electrical locking control
- 3 Spring
- 4 Spur gear
- 5 Planetary gearbox
- 6 Motor for indexing drive
- 7 Reference switch (optional)
- 8 Hirth-type gearing
- 9 cooling lubricant valve

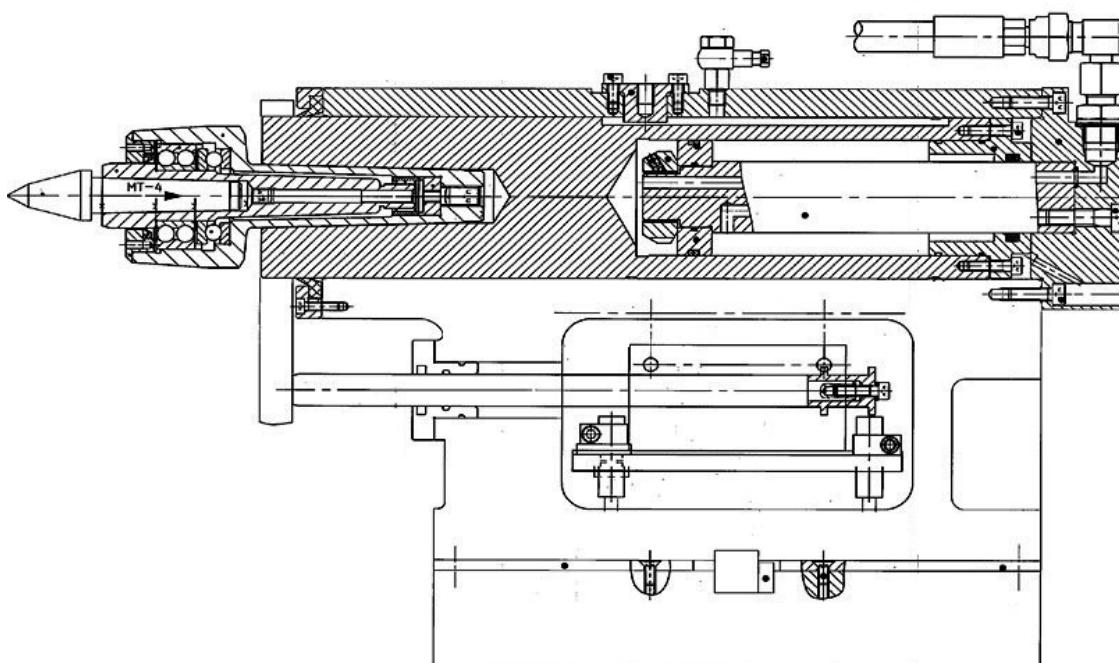
Maintenance Manual



TAILSTOCK ASSEMBLY:

The main function of the tailstock is to support the other end of the work that is being machined between centers. It consists of a body, a quill, a revolving center (built-in or add on), a guide/base and a piston cylinder mechanism for the quill movement. The different options provided in tailstock assembly are: Programmable/Manual quill movement and Programmable / manual housing / body movement.

The tailstock housing is a casting, which has a through honed bore to accommodate the hardened quill. The housing can be moved over V and Flat guide ways and positioned / clamped depending upon the component length using two clamping bolts (manual). In the case of programmable housing, this adjustment can be made using a hydraulic cylinder. This movement is achieved by pressing a foot switch or by a M code.



Maintenance Manual



The quill slides inside the bore with the help of a piston and cylinder mechanism. It has a Morse Taper (4 or 5) or plain bore at the front end to facilitate mounting of add on or built in revolving center respectively.



The quill can be advanced and retracted hydraulically using a foot switch. The same can be achieved by a set of M codes in case of a programmable quill. A wiper ring is provided in the front end of the quill to prevent entry of dust/chips and coolant between quill outer surface and honed bore housing. The condition of the seal to be checked periodically and replaced, if necessary. A set of dogs and limit switches / proximity switches are provided to give feed back to CNC system.

In case of LT-25, Housing can be moved along with Z-axis by engaging a plunger. De-clamping is being done by hydraulically, whereas clamping is done by spring pack assembly.

A set of 'o' rings / quad rings are provided inside the cylinder to arrest inter port leakage. As these seals are under pressure during every cycle of quill movement, wears out faster. These seals have to be replaced periodically depending upon usage of the quill.



In case of built in centers, similar to spindle assembly, a labyrinth cover is provided to drain out coolant entered between sleeve outer surface and V seal holder. These holes have to be cleaned once in a week irrespective of usage of the center. A 'V' (VA 40) seal also provided to avoid entry of coolant into bearings area. This seal has to be checked periodically and replaced, if necessary. The bullet can be removed from the center by a wedge / drift.

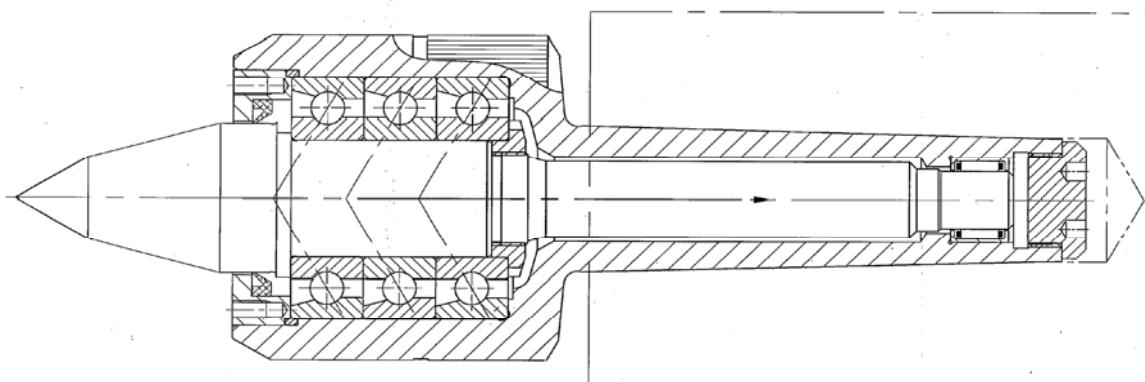
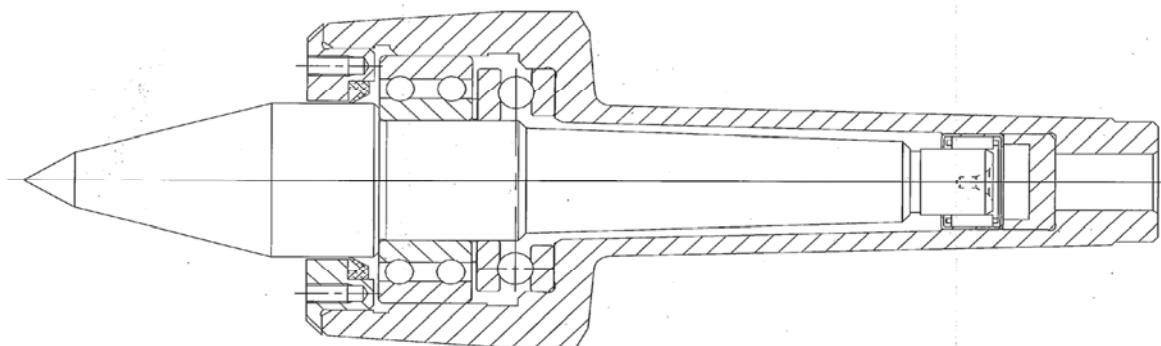
Maintenance Manual



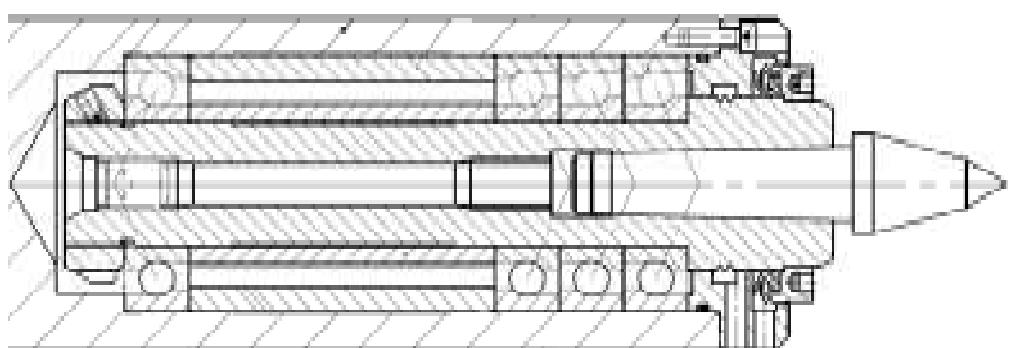
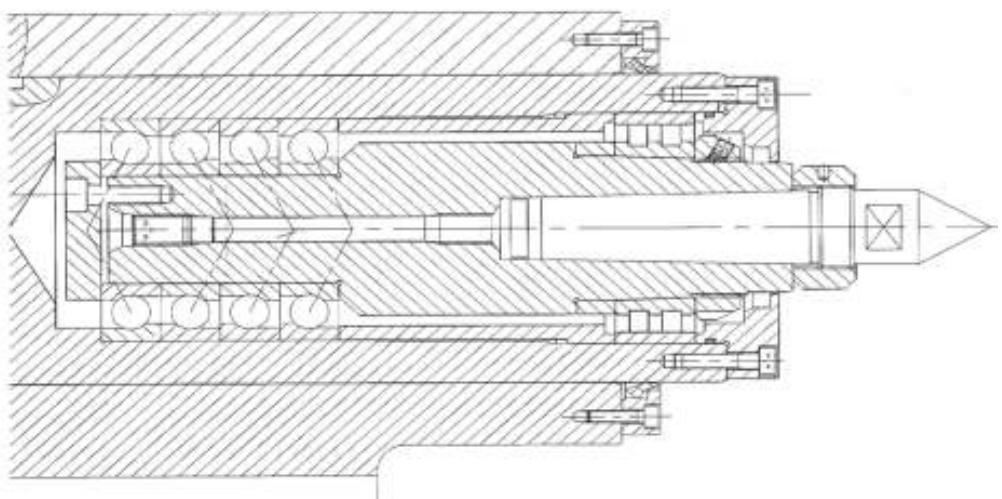
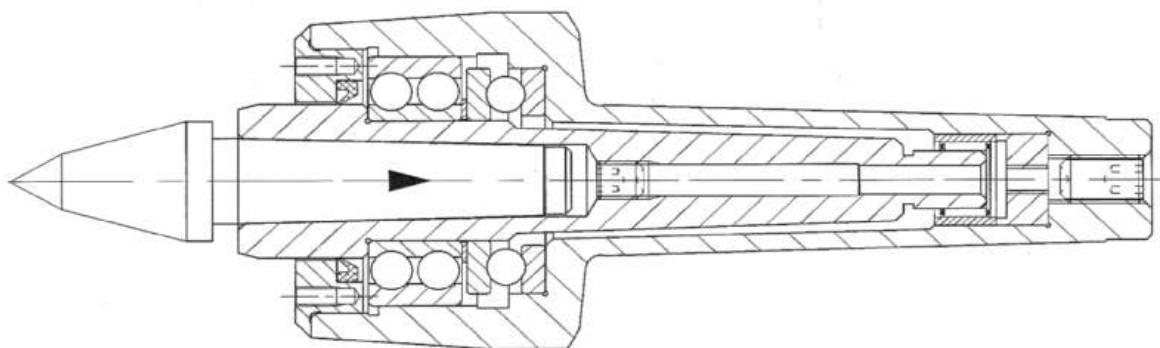
Revolving Centres:

A **live center** or **revolving center** is constructed so that the 60° center runs in its own bearings and is used at tailstock end of a machine. It allows higher turning speeds without the need for separate lubrication, and also greater clamping pressures. CNC lathes use this type of center almost exclusively and they may be used for general machining operations as well. Some live centers also have interchangeable centers. This is valuable when situations require a design other than a 60° male tip. The following are the various types of centers used on CNC lathes.

- Add On Bullet
- Built In Center (Angular Contact bearing)
- Integral Bullet
- Built In Center (NN30K)
- High Speed Precision



Maintenance Manual

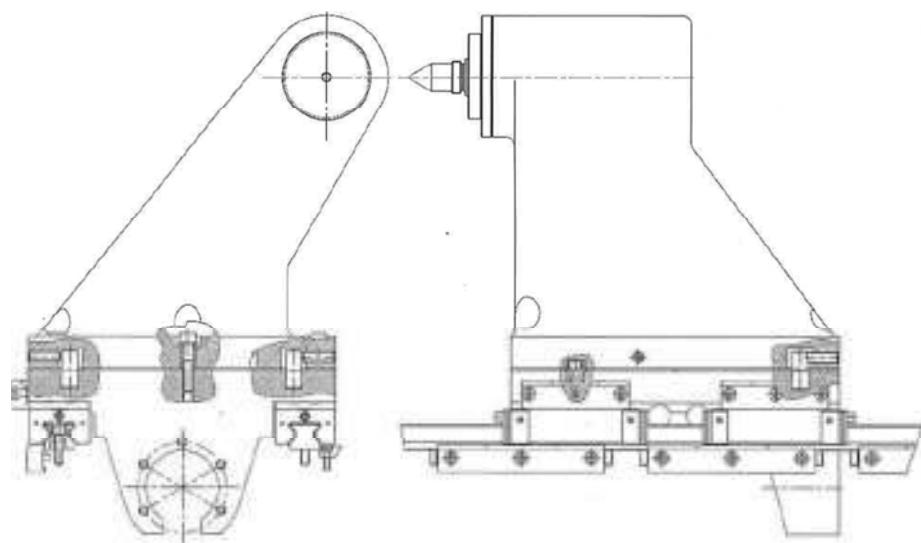
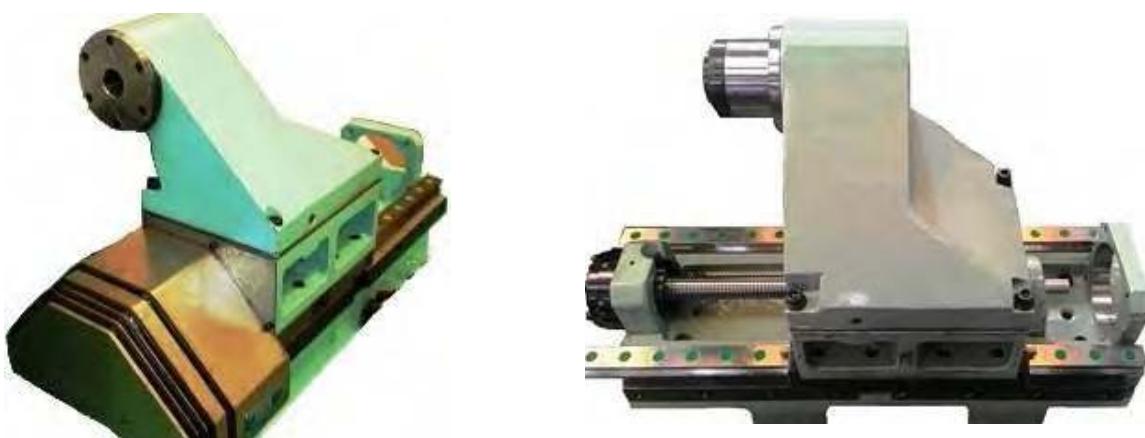


Maintenance Manual



Servo Tailstock Assembly:

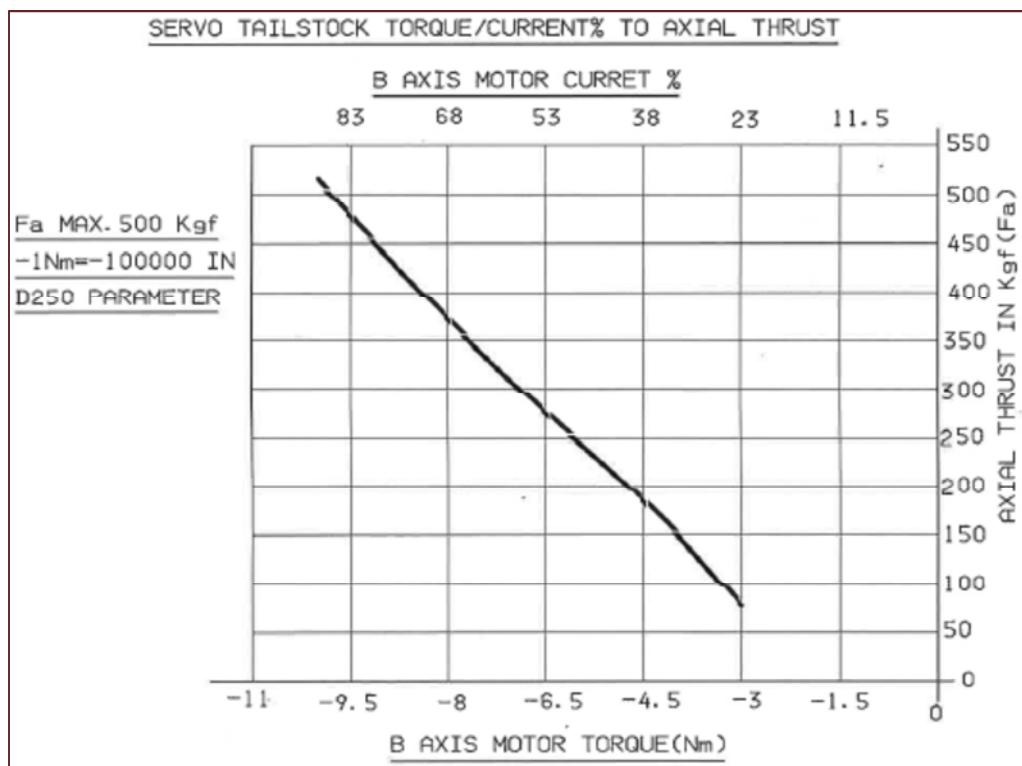
The tailstock assembly consists of built in MT-4 centre housed inside a cast iron body. The housing which is adjustable crosswise is mounted on a cast iron base which moves over a roller guide ways. The tailstock is moved forward and backward by a ballscrew which is coupled to a servo drive. The bullet can be removed from the centre assembly by an extraction nut. The guideways and ball screw are protected from chips by a telescopic cover.



Maintenance Manual



Torque Setting:



Do's: -

- When not used, apply rust preventive solvent to the exposed guide ways and Morse Taper in the quill and cover from the chip / coolant.
- The tailstock will not be used always. In such cases, if the tailstock is to be used after certain period operate the quill movement for about 10 minutes before the production.
- As the quill is a moving element, check for proper lubrication every day.
- In revolving centre, bearings are life lubricated with kluber grease. Hence no re-lubrication is required.
- Plan for stocking a spare revolving centre assembly as stand by at any point of time.
- In built-in centres, the labyrinth cover holes should be periodically cleared for free coolant passage.
- In case of programmable housing or quill, check for proper functioning of limit switches / proximities.
- In case of accidents, the tailstock alignment may change. Then check the alignment of the quill w.r.t the spindle axis and z-axis. (Please refer test chart)

Don'ts:

- Do not use the tailstock at pressures higher than the recommended maximum value.
- Do not use the tailstock with the covers removed.

Maintenance Manual



HYDRAULIC SYSTEM:

Hydraulics has been used in ACE machines for the following purposes:

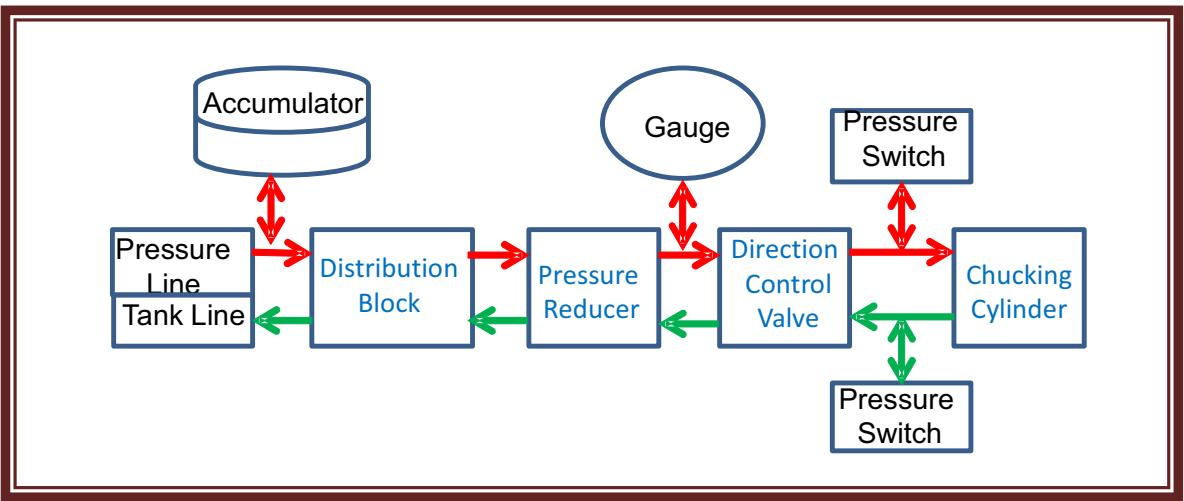
- Work piece clamping: Chucking cylinder movement through a draw bar.
- Tailstock Quill: Forward and retraction of quill.
- Tailstock housing: Tailstock housing de-clamping and forward and home position movement.
- Parts catcher: catcher arm home and forward movement.
- Steady rest: rollers clamp and de-clamp etc.,

The machine is equipped with the following hydraulic elements- the power pack (Motor, Pump, Suction strainer, RLF, Accumulator, etc.,), Distributor block, Solenoid valves, Pressure reducers, Pressure switches, Gauge isolator with gauge etc.,

The pump sucks oil from the power pack through suction strainer and delivers to the distributor block through a check valve. From the distributor block, various tapings are taken for supply to different hydraulic elements. The return lines of all these hydraulic elements are routed back to the tank through a return line filter. An accumulator is provided in the circuit as a safety measure. It supplies its stored energy whenever power goes off, so that component is held in the work holding rigidity. This accumulator is mounted only for the machines having chucking cylinders with no-safety valve.

The motor is an ordinary induction motor and is coupled to the pump through a love joy coupling. The pump is a variable displacement, pressure compensated, vane type of make Rexroth / Bosch / Yuken. The pump is set to $30\text{-kg}/\text{cm}^2$ pressure.

The distributor block distributes the pump pressure line to the various hydraulic elements like, chucking cylinder, tailstock, parts catcher, steady rest etc. For each hydraulic function, individual solenoid has been provided and with a pressure reducer, wherever required. To read the pressures of different points like system, chuck, tailstock etc., a push to read isolator is provided. Rotate the knob, select the position (spool sits in the notch)



Maintenance Manual



and press. Pressure can be read- on the gauge. Two pressure switches are connected in chuck line to take the positive feedback (clamp/de-clamp signal) to CNC system. The elements are connected as per the block diagram given below (This is for example only. For actual sequence of elements, please refer hydraulic circuit given in the instruction manual).

Dos:

- Change the oil once in 6 months and clean the tank interior during changing.
- Ensure proper sealing of the pump suction line and also ensure the direction of rotation after routine maintenance, if any.
- Replace suction strainer once in 6 months and definitely along with oil change.
- Monitor the clog indicator on RLF, periodically.
- Replace return line filter element
 - After one month of commission
 - After six months, subsequently
- Keep the return line filter hose end immersed in the oil, flow directed towards the reservoir wall.
- Always ensure the lid of the air breather in its position, properly.
- Clean the air breather filter before and after oil fill.
- Check the pre-charge pressure of the accumulator periodically.
- Ensure the throttle valve in the accumulator line to be always closed.
- Ensure the direction of the check valve i.e. flow / no flow while assembly. If any leakage found in reverse direction, replace the same.
- CHECK for the wear out of love joy coupling and replace the same if necessary.
- Use ENKLO 68 oil only.
- Clean power pack interiors once in 6 months.
- Check for oil level consistency and fill every month.
- Check for system pressure to be at 30 bar.
- Check for direction of rotation of pump whenever service / maintenance is carried out.
- Check for oil leakage and take necessary action to avoid the same.
- Ensure the pressure and tank line hose connections as per the colour coding, if removed.
- If the spool is sticky in case of DC and pressure reducing valves, cleaning only the solution. However if the spool or body bore is damaged, the complete valve needs to be replaced.

Don'ts:

- Do not dismantle the pump assembly.
- Do not disturb the pump settings - flow, noise, and pressure.
- Do not disturb the system pressure setting for any reason.
- Do not over tight the fittings.

Maintenance Manual



TROUBLE SHOOTING IN HYDRAULIC SYSTEM:

Major symptoms are:

- Abnormal noise
- Excess heating
- Improper flow
- Incorrect pressure
- Malfunction

Abnormal noise:

- Pump-Cavitation
 - Minimum oil level
 - Restriction in suction line
 - Suction strainer clogged
 - Air breather clogged
 - Pump speed too high
 - Entry of air
- Aeration of fluid
 - Fluid level low
 - Return line above oil level
 - Loose suction joints
 - Improper air bleeding
- Alignment-pump-motor
- Worn out parts- vanes in pump, bearings, seals etc.,

Excess Heat:

- Heat in pump
 - Fluid heated
 - Cavitation
 - Air in fluid
 - Excessive load (not matched with electric motor speed)
 - Relief valve set too high
 - Worn / damaged pump
- Motor heated
 - Fluid heated
 - Excessive load
 - Worn / damaged motor
- Fluid heated
 - System pressure too high
 - Fluid dirty or low supply
 - Incorrect fluid viscosity
 - Faulty fluid cooling system
 - Worn / damaged pump, motor, cylinder etc.,

Maintenance Manual



Improper flow:

- No flow
- Low oil level
- Motor not operating
- Faulty drive coupling
- Pump operating in wrong direction
- Relief valve / throttle valve partially / fully opened
- Directional control valve set in wrong direction
- Damaged pump
- Incorrect assembly of pump and motor
- Flow control set too low
- External / internal leakages
- Rpm of pump drive motor incorrect
- Worn out parts — pump, motor, valves, cylinder seals, etc.,

Incorrect pressure:

- Low pressure
 - Pressure relief valve partially opened
 - Pressure reducing valve set too low
 - Pressure reducing valve worn out / damaged
 - Worn out parts — pump, valves, cylinder seals etc.,
- Erratic pressure
- Air in fluid
- Worn relief valve
- Contamination in fluid
- Accumulator defective / lost charge
- Worn out parts — pump, motor, cylinder seals etc.,

Malfunction of components:

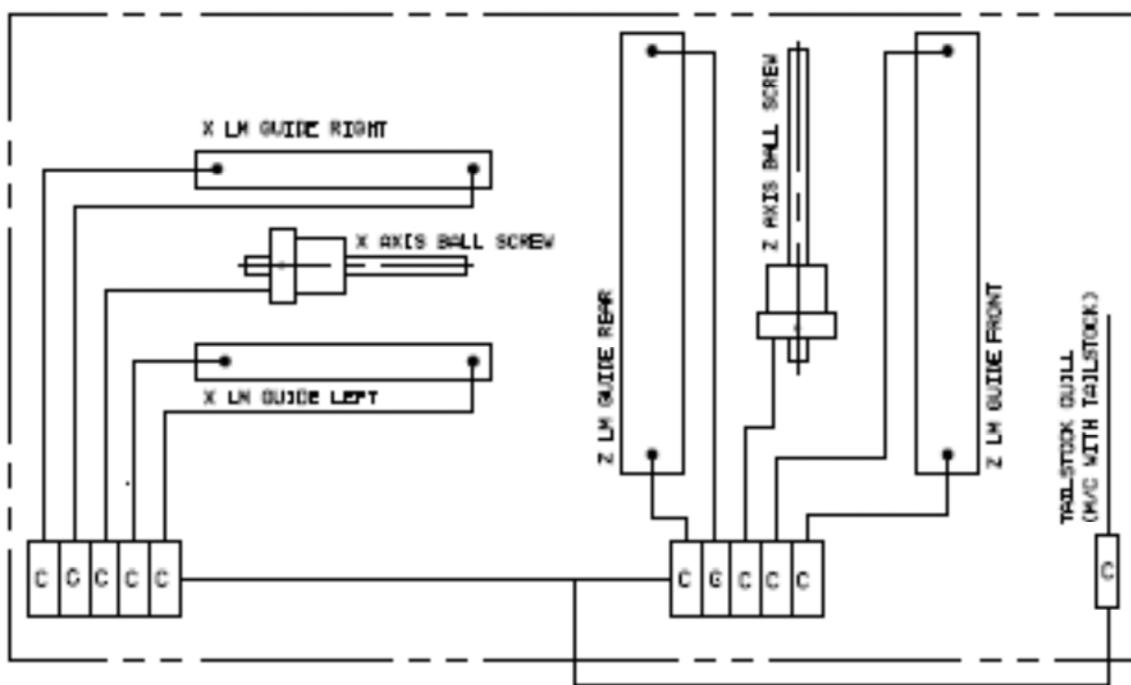
- Sticking of valves
- Failure of moving parts
- Oil leakage

Maintenance Manual



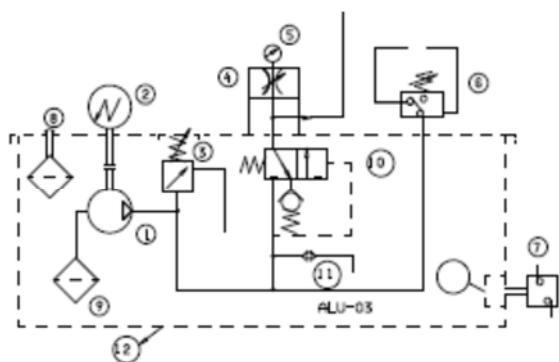
LUBRICATION SYSTEM:

CNC machines work to a high degree of accuracy and are expected to sustain this accuracy over a long period. This requires proper control of friction and wear parts, which are in relative motion and calls for effective lubrication of the vital elements like balling screw, sliding ways etc., this is achieved in ACE machines by using a Centralized Lubrication System.



Oil Lubrication:

The system contains an automatic lubrication unit, manifold blocks, metering cartridges and a network of tubing. The pump gets on immediately after switching on CNC, whenever emergency switch is activated and every thirty-minute of CNC ON for a period of 3 sec. However for checking the function of motor, metering cartridges etc., motor can be run in JOG mode by pressing LUB INCH push button.



1	PUMP
2	MOTOR
3	RELIEF VALVE
4	PRESSURE GAUGE DAMPNER
5	PRESSURE GAUGE
6	PRESSURE SWITCH
7	FLOAT SWITCH
8	OIL FILLER CUM BREATHER
9	SUCTION STRAINER
10	PRESSURE REGULATING VALVE
11	BLEED VALVE
12	RESERVOIR
13	CARTRIDGE 0.25CC/STROKE

Maintenance Manual



The lubrication unit is a mini hydraulic power pack, where a rotary positive displacement pump of low discharge is driven by an electric motor. The pump delivers oil to the various points in the machine through metering cartridges and tubing. The metering cartridge is a valve, which ejects a metered amount of oil (0.25 cc) per stroke in only one direction i.e acts like a check valve. A pressure switch is provided in the circuit to ensure the pressure developed by the pump is 15 bar. A float switch is incorporated for sensing the oil level. When the oil in the tank goes below minimum level, it warns for filling. For both the cases, as a safety measure, an interlock has been provided, such that the machine cannot run in auto cycle. A relief valve also provided in the circuit to protect the system from over load.

Dos:

- Use absolutely clean oil.
- The oil level should be monitored daily and the level should be maintained to ensure proper lubrication to the all parts of the machine.
- All metering cartridges should be periodically checked for its proper functioning and replaced immediately, if necessary.
- The flexible hoses should be checked for any damage / punctures.
- Check the direction and rotation of motor for proper indicated direction after servicing / maintenance.

Don'ts:

- Do not use used or perished oil.
- Do not run the unit, when the oil level is below the float level.
- Do not disturb pressure switch setting.
- Do not disturb ON/OFF time of motor.

Grease Lubrication:

The motorized pump (LHL) "P-107" is designed to lubricate each point on a machine by delivering small amount of grease through a metering valve. The grease level switch is attached to the as standard. This switch is incorporated in the cartridge adaptor. It starts to function before LHL in the cartridge becomes completely short in order to prevent air from mixing in the LHL.



Turn the cover CCW and remove it from the pump. Turn the empty cartridge CCW and remove it. Mount a new cartridge. When mounting, turn the cartridge together with an inner plug attached to the cartridge container by turning it CW. Put the cover back and turn it CW with hands until it stops. During replacement, ensure no air or foreign particle is introduced. Make sure to bleed air when it introduced into the pump. Loose the air bleeding valve with a spanner by one turn CCW. Switch ON the pump. Air and LHL come out from the hole at the end of the valve. Stop the pump, ONLY when LHL starts coming out. Turn the valve CW and tighten it.

Maintenance Manual



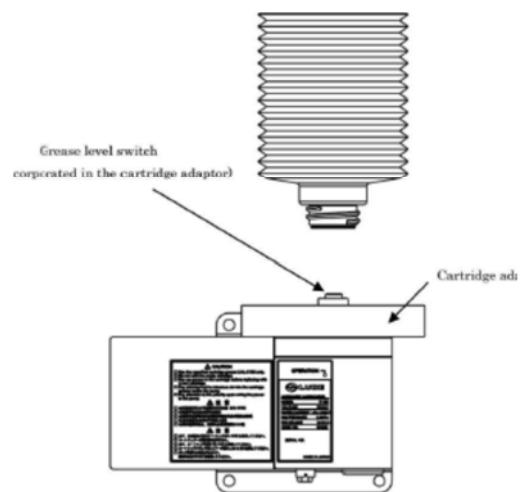
Do's:

- Use recommended grease (lithium based).
- Ensure no foreign particles enter into the system, when the cartridge is changed.
- After changing the cartridge, bleed the air inside the pump opening the air bleeding valve.

Don'ts:

- Do not use any greases containing substances that attack brass and rubber.

Notes:



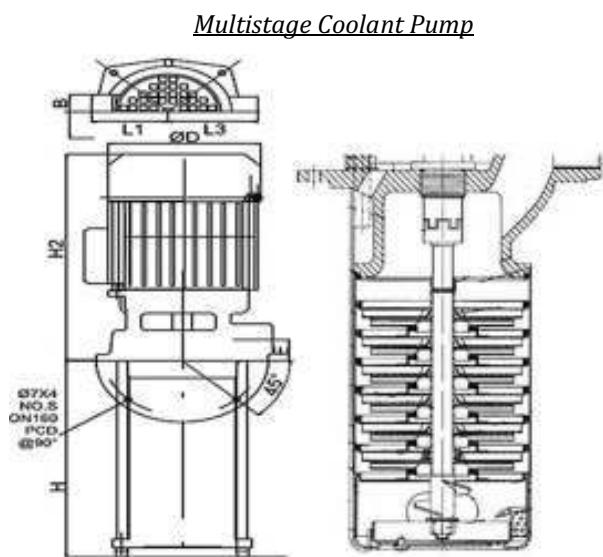
Maintenance Manual



COOLANT SYSTEM:

Coolant is used in CNC machine mainly to remove the heat generated during metal removal. In the process it helps in increased productivity, improved surface finish, and longer tool life, cleaner working conditions etc., The coolant pump used in ACE machines are of Centrifugal pumps of immersion type.

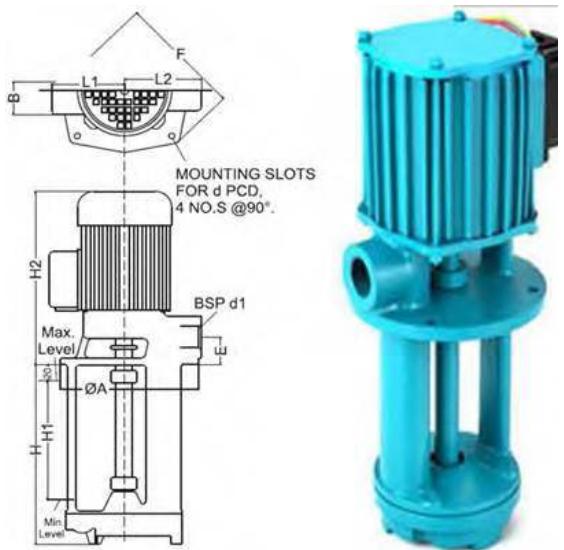
The coolant is sucked in to the suction area as the impeller rotates along with the motor. In these pumps, for a given diameter of impeller, the pressure and flow are fixed. Hence to increase the pressure, two or more impellers are arranged serially. i.e. the output of one impeller is fed to the next impeller's input. Hence pressurized coolant is delivered from the out let port. From the out let port, coolant is



runs on permanently shielded roller ball bearing hence no extra lubrication is required.

There are 3 varieties of coolant pumps used on ACE machines. These are RV series (with one impeller for low pressures), RKM series (multi stage with 2 impellers for high pressure) and RR series (multi stage with 2 impellers for high pressures).

Low Pressure Coolant Pump-RV100



supplied to various points like Turret, top of the spindle, cleaning of chips etc., through a distributor block.

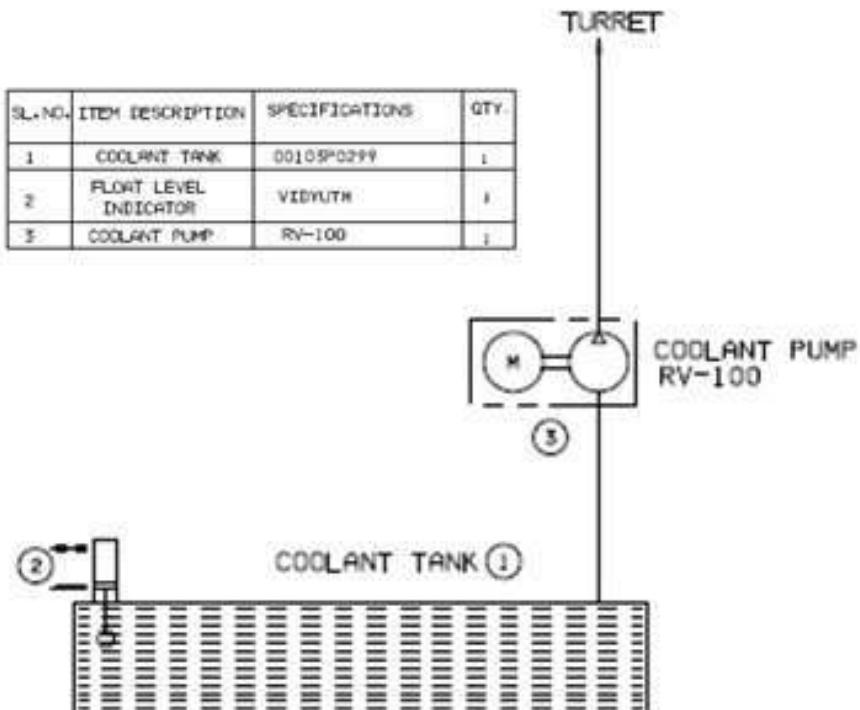
As the pump portion is always immersed in the coolant and the impeller is mounted on the extended shaft of the motor, the pump do not require any priming. A mechanical seal is used to avoid the leakage through the shaft entry hole at the pump housing. The motor is mounted on the pump stem portion and is protected by the gap below the motor and the stem.

The only wearing part in the coolant pump will be the impeller, because of abrasive materials or the chemical in the coolant. The pump

Maintenance Manual



Typical Coolant Circuit:



Dos:

- Maintain coolant to maximum permissible level to avoid reduced discharge.
- Care should be taken particularly in case of RR series pumps, that cotton waste, large chips etc., are to be filtered before pumping, otherwise, these will clog the input, resulting in reduced pressures and discharge or sometimes the impeller may break.
- Choose correct proportion of mixing of coolant oil and water and ensure that the water should be soft.
- Ensure that the coolant jet (above chuck) is directed towards component, else the coolant will splash all over and lead to leakages.

Don'ts:

- Do not run the pump without pump portion immersed in coolant.

Maintenance Manual



PANEL COOLER SYSTEM:

Panel cooler is designed specifically to cool and dehumidify the internal environment of electrical / electronic cabinets. This panel cooler assures a cool and clean atmosphere essentially required for electronic circuitry of machinery. The hot air generated inside the electronic cabinet is drawn into the area where evaporator coils are located through a fan. The hot air, which passes through the evaporator coil gets cooled and discharged back into the cabinet. Any moisture in this air condenses on the evaporator coil and ultimately collects in the condensate tray. The condensed water is discarded to the outside of the panel cooler through the condensate drain tube, which projects out of the panel cooler.

Room or ambient air drawn into the panel cooler through the inlet filter, passes through the condenser coil and discharged back to ambient. The temperature of this discharged air will be warm or hot depending on the ambient temperature and the workload imposed on the panel cooler.

The inlet filter will assure relatively clean air to pass through the condenser coil provided the inlet filter is properly maintained by frequent cleaning / replacement. Dirty filters hamper the optimum operating efficiency of the panel cooler.

Maintenance points:

Compressor:

- The compressor requires no maintenance. It is hermetically sealed, properly lubricated at the factory and should provide years of satisfactory operating service.
- Should the R134a charge be lost, recharging ports on the suction and discharge sides of the compressor are provided for recharging and or checking suction and discharge pressures.

Inlet filter:

- Proper maintenance of the inlet filter will assure normal operation of panel cooler. If maintenance of filter is delayed or ignored, the maximum ambient temperatures under which the unit is designed to operate will be decreased.
- As the operating temperature of the compressor increases above normal due to dirty or clogged inlet filter for plugged condenser coil, the panel coolers compressor will stop operating due to actuation of the thermal overload cut-out switch located in the compressor housing. As soon as the compressor temperature has dropped to within the cut-in setting, the compressor will restart automatically. However, the above condition will continue to take place until the inlet filter has been cleaned or replaced.
- Continued operation under the above conditions can and will damage and shorten compressor life. The panel cooler features an easily removable inlet filter to facilitate necessary cleaning. There should be no reason to neglect this necessary maintenance.

Dos:

- The inlet filter is properly maintained by frequent cleaning / replacement.

Maintenance Manual



- Make sure that the outlet plastic condense drain tube is not blocked.
- Check for thermostat setting at 32° c.
- Check the cooling effect of panel cooler in the electrical cabinet.

Don'ts:

- Do not operate panel cooler while the door is open, which admits humid air, which the panel cooler must then dehumidify.
- Do not open the door frequently.
- Do not run the panel cooler when the inlet filter is removed.
- Under any circumstances compressor's access fittings should not be loosened, removed or tampered with. As it is not a user serviceable.
- Do not disturb thermostat setting for any reason.

Maintenance Manual

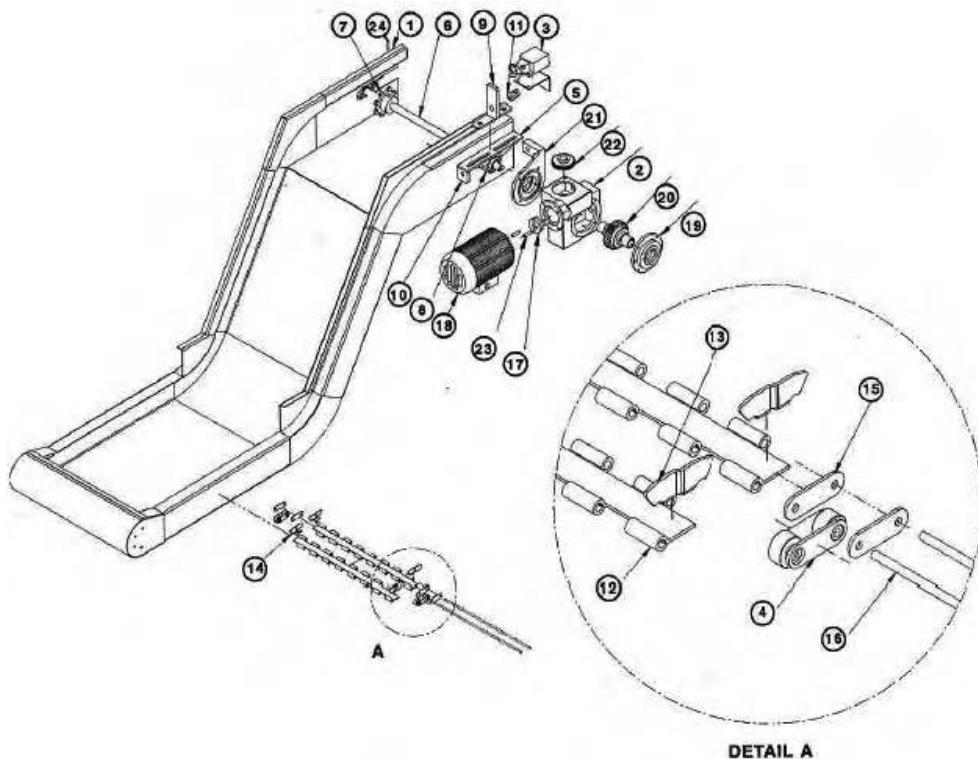


CHIP CONVEYOR SYSTEM:



Chip conveyor is a mechanical system to move /convey metal debris in the process of metal removal. There are various types of conveyors used in CNC machines for different applications. The common used conveyor is a steel hinged belt type conveyor.

Exploded View of MT-10 Hinge Steel Belt conveyor



Maintenance Manual



Exploded View of MT-10 Hinge Steel Belt conveyor

Item No.	Title	Item No.	Title
1	Conveyor Trough	13	Side Wing (RH)
2	Small Gear Box Body	14	Side Wing (LH)
3	Limit Switch	15	Outer Link
4	Roller Block	16	Spindle
5	Take Up Flat	17	Shear Pin Coupling Set
6	Drive End Shaft	18	0.25 HP Motor / 0.5 HP Motor
7	Sprocket	19	Round Cover
8	UCP Bearing	20	Secondary Internals Set
9	Take Up Bracket	21	Torque Arm Cover LH / RH Mounting
10	Take Up Pad	22	Shear Pin (Nylon)
11	Tension Spring	23	Primary Internals Set
12	Hinge	24	Spring Dowel Pin

Chips and coolant from the machine flow into the conveyor. It consists of a motorized drive, sections of heavy-duty chain, and a series of pans with pusher bars mounted between the chains. Chips accumulate on the hinge pan and are carried out for disposal as the belt rotates along with the motorized drive. The chips are collected in the chip bin. Coolant exits through a manifold arrangement, made below the chain.

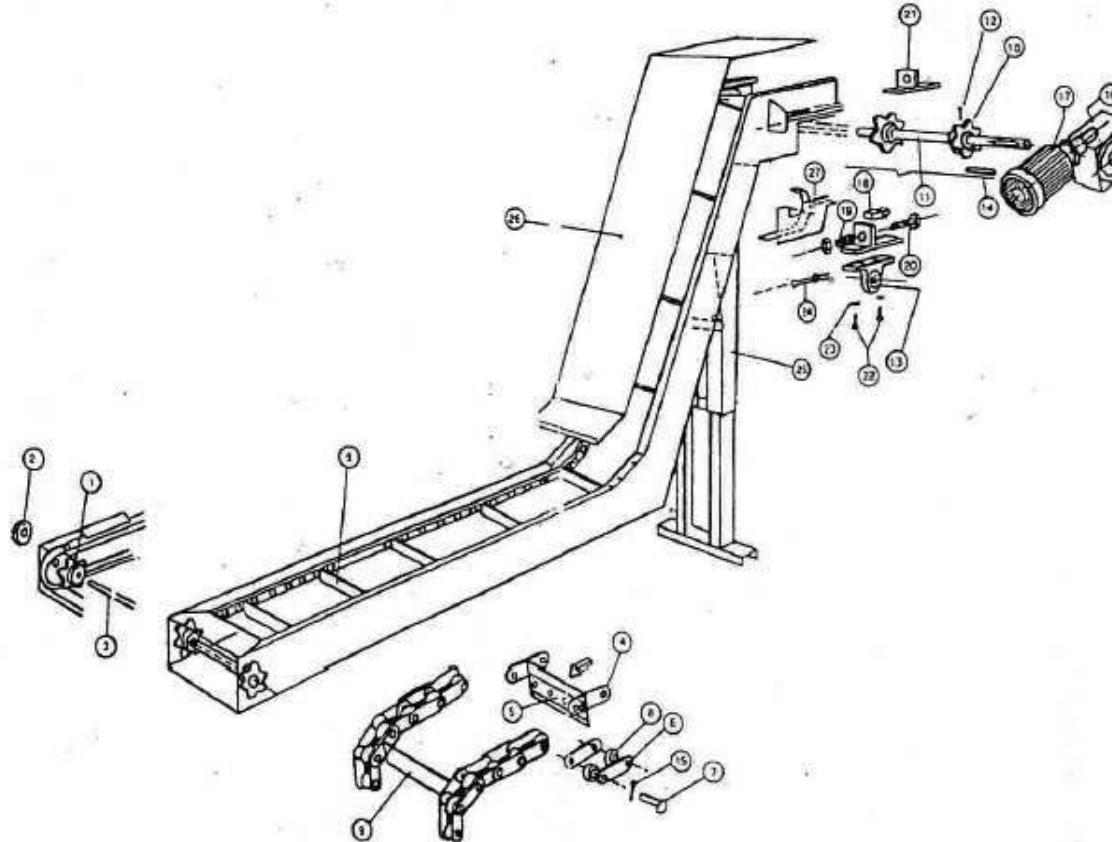
Exploded View of Scraper / Drag Belt conveyor

Item No.	Title	Item No.	Title
1	Tail End Sprocket	15	Split Pin
2	Bush	16	Speed Reducer
3	Tail End Shaft	17	Electric Motor
4	Link (inner)	18	Limit Switch
5	Nylon Scraper	19	Spring
6	Link (Outer)	20	Bolt
7	Belt pin	21	Limit Switch Support
8	Roller	22	Take Up Bolt
9	Scraper	23	Nut
10	Drive sprocket	24	Tension Bolt & Nut
11	Drive Shaft	25	Adjustable Stand
12	Grub Screw	26	Cover
13	Take Up Bearing	27	Sprocket Guard
14	Square Key		

Maintenance Manual



Exploded View of Scraper / Drag Belt conveyor



Do's:

- Conveyor should run continuously along with the machine running
- Discharged swarf should be kept clear off underside of belt. A minimum distance of 200 mm to be maintained
- Belt has been adjusted for proper tension prior to dispatch. Readjust the slackness/tension after initial 200 working hours and periodically after every 2000 working hours.
- Grease the bearings after every 2000 working hours.
- Clean the whole conveyor with soft cotton waste. Ensure that during cleaning cotton waste does not entangle with rotating parts.
- Check oil level in gear box periodically and fill, if required. The gear box is pre-filled with SAE 90 EP Gear Oil of any reputed brand. After initial working of 250 hours approximately this oil should be drained out. Replace with fresh oil as specified above. Repeat the same procedure every 6 months or after working of 2000 hours approximately.
- Change gear oil after 200 working hours and thereafter every 400 working hours.
- Clean conveyor casing chain once in 6 months.

Maintenance Manual



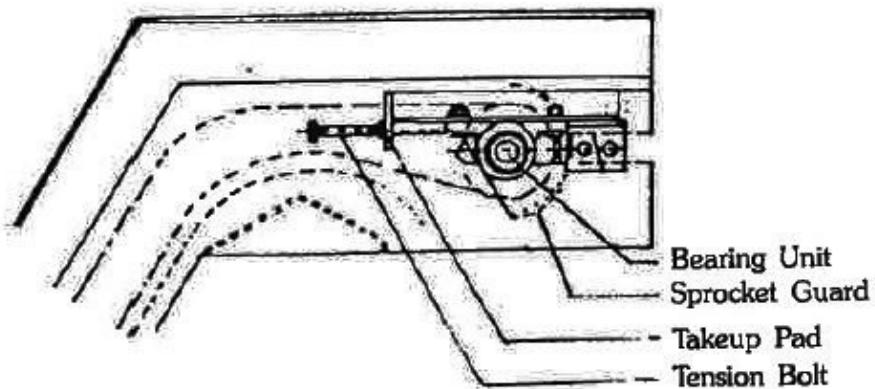
- Check / tighten fasteners periodically.

Don'ts:

- Do not disturb overload sensing limit switch position and torque for any reason.
- Do not run the conveyor continuously in reverse direction, when it is jammed. Use INCH/JOG mode for releasing the jam.
- Do not allow chips to heap up in the chip bin, which will likely to get carried away by the return chain and thus causes damages to the conveyor.
- Never operate conveyor continuously in reverse direction when it is jammed. Use inching / jog mode for releasing the jam.

Belt Adjustment:

- Switch off the mains.
- Slide back the sprocket guards on either side leaving adequate space for chain tensioning.
- Loosen bearing unit on both the sides. Do not remove nuts.
- Loosen lock nuts on tension belt.
- Turn tension bolt in clockwise direction until belt moves smoothly without bending or sagging. Adjust both sides equally.
- Tighten lock nuts on both the sides.
- Tighten bearing unit nuts both the sides.
- Switch on the mains
- Ensure smooth running of the conveyor.



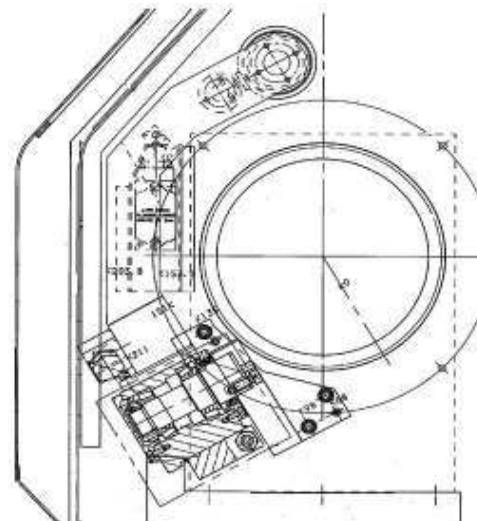
Maintenance Manual



TOUCH PROBE SYSTEM:

Touch probes are used on CNC machines for different applications like automatic tool offset updating, broken tool detection, dimensional measurements, component location etc. In ACE machines touch probe is used to update tool offsets automatically.

This touch probe is a simple manually operated 'pull down - push up' system, which is permanently mounted on to the headstock housing below the chuck. It consists of an arm, which swings down during taking offset. A sensor with four trigger points is mounted on the arm and integrated to the CNC system. During taking offset, the arm swings down, the tool comes and touches the sensor. A signal is generated by the sensor and transmitted to the CNC system. In the process, the offset of that particular tool will be updated automatically. The same exercise needs to be repeated for all the tools. When not in use, the arm is swung up above the chuck and latched against a catch. The center height of the probe, when it is in swing down position is maintained such that the tool tip is at the center of the trigger point.



Dos

- Tool need be moved in MPG/Handle step mode, during taking offsets with lower feed rate..
- Arm swing should be free from any interference with either component or tool.
- Check the home limit switch periodically for its proper functioning.
- Check the condition of the 'O' ring provided in the catch to avoid coolant entry. Its condition to be checked and replaced, if necessary.
- If the arm is met with an accident, the center height may change. In this case, correct the alignment and reestablish the triggering points.

Don'ts:

- Do not meddle with the parameters related to touch probe.

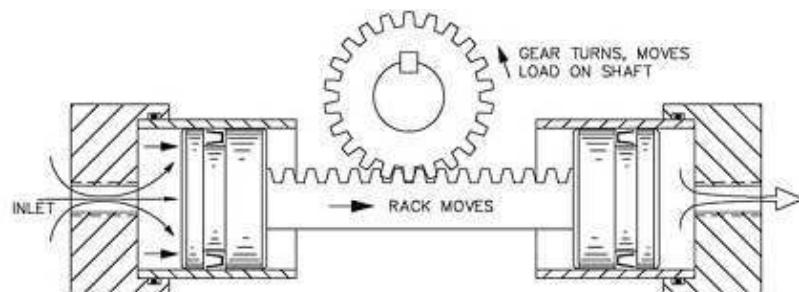
Maintenance Manual



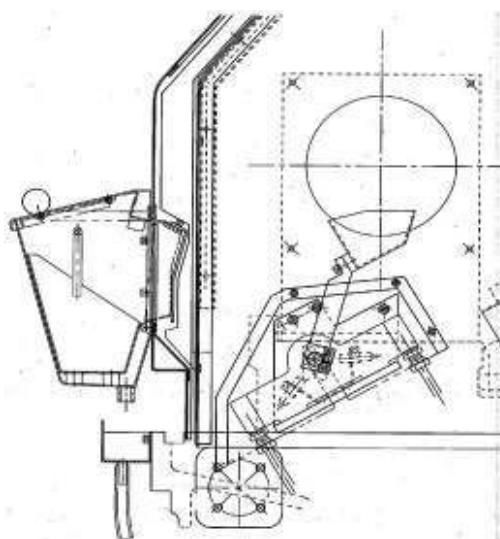
PARTS CATCHER SYSTEM:

The main function of a parts catcher is to collect the component, which is being parted off from the bar work generally. There are various types collectors used in CNC machines like hydraulic, pneumatic etc., In ACE CNC machines, a hydraulic rack and pinion rotary actuator, which converts liner motion into rotary motion is used for this purpose.

Pressurized oil is supplied to one side of the actuator/rack, which pushes the rack across a pinion gear. This action turns the shaft, generating rotary motion. This motion is transferred to the parts collector through an arm, which is mounted on the shaft. This is collector's forward or collecting position. When the oil is supplied to the other side of the rack/actuator, the collector comes to home position. In the process the parts, collected in the collector are thrown into the collector (outside) through a cutout or opening in the front door, so that the parts could be collected without disturbing the machine operations. The total rotary actuator assembly is covered with a sheet metal cover, to protect from coolant and chips. Two proximities are provided to give feedback (forward and home position) to CNC system. The actuation of this catcher is done by a set of M codes.



Single Rack & Pinion Rotary Actuator



Schematic Diagram

Maintenance Manual



Dos:

- Catcher should be always in home position, except during part collection.
- Check the proximities periodically for its proper functioning.
- Set the collector in such a way that it should not touch the door in home position and the turret / component in forward position.
- Ensure that coolant or chips do not enter in the proximity area, if the cover position is disturbed.
- A set of seals is provided on the rack and pinion to avoid oil leakage. Check its condition and replace, if necessary.

Don'ts:

- Do not run the machine with covers removed.
- Do not disturb proximity setting for any reason.

	PAGE NO.
CONTENTS	
A. STUDY OF CNC	
1. CONCEPTS OF CNC	3
2. CNC BLOCK DIAGRAM	5
3. SOFTKEY FUNCTIONS OF CRT / MDI PANEL	10
4. STUDY OF AXIS DRIVE AND SPINDLE DRIVE	26
5. Quick Start up code	33
6. INPUT AND PUT DATA	39
7. COMMUNICATION PROCEDURE	45
8. PROCEDURE FOR REPLACING FUSES /BATTERIES/FAN	
9. PROCEDURE TO READ I/O SIGNALS/SETTING PARAMETERS	74
10. TROUBLE SHOOTING WITH CNC-LINE DIAGRAM	77
B. RS-232C COMMUNICATION	
1. PROCEDURE FOR COMMUNICATION WITH FANUC – OI WITH PC	83
2. RS 232C COMMUNICATION CABLE DETAILS	
C. STUDY OF AXIS SERVO DRIVE	
1. REQUIREMENTS OF FEED DRIVE	
2. ELEMENTS OF AC PWM TRANSISTOR FEED DRIVE	
3. STUDY OF C/ DRIVE IN ACE CNC LATHE	
4. STUDY OF PSM POWER SUPPLY MODULE	88
5. TROUBLE SHOOTING AND ACTION OF PSM MODULE	90
6. PREVENTIVE MAINTENENCE OF SERVO MOTOR	93
9. TROUBLE SHOOTING OF SERVO AMPLIFIER MODULE	93
10. SERVO ALARMS	95
11. FISH BONE DIAGRAMS	105
D. STUDY OF SPINDLE DRIVE AND MOTOR	
1. STUDY OF SPINDLE DRIVE	114
2. REQUIREMENTS OF SPINDLE DRIVE	116

MAINTENANCE MANUAL

CONTENTS

	PAGE NO.
E. BLOCK DIAGRAM OF SUB-MODULES IN ACE CNC LATHE	118
1. BED	118
2. HEAD STOCK	119
3. SPINDLE ENCODER BELT SETTING	120
4. AXIS ASSEMBLY	121
6. TURRET	124
7. TAIL STOCK	125
8. HYDRAULICS	127
9. LUBRICATION SYSTEMS	130
10. COOLANT SYSTEMS	131
11. Chuck	132
12 Power Chucking Cylinder	135
F. MACHINE CONTROL PANEL	145
G. INTERLOCKS USED IN ACE CNC LATHES	154
H. MAINTENANCE	155
L. PREVENTIVE MAINTENANCE SCHEDULE	

Maintenance Manual



CONCEPTS OF COMPUTER NUMERICAL CONTROL (CNC) :

CNC is computerized numerical controller, to control the axes movement and spindle speed of machine tool as The part program written by the user.CNC also controls the various peripherals like Turret, Coolant, Hydraulic system, Lubrication etc.,

CNC SYSTEM (FANUC Oi MATE TD AND Oi TD CINSISTS OF :

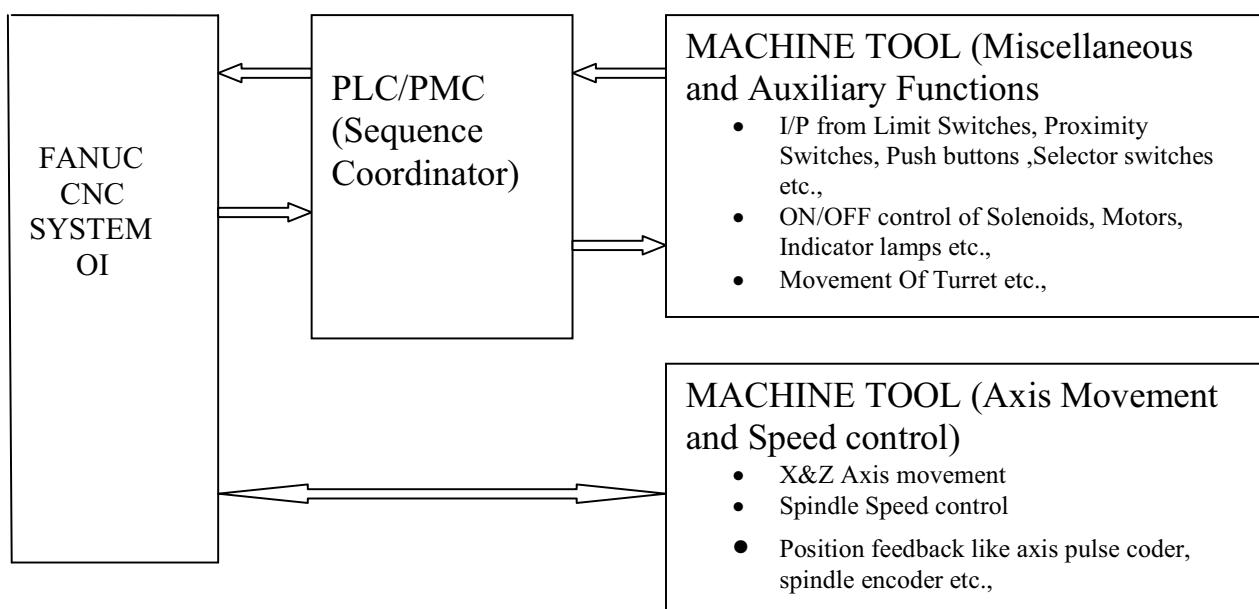
1. MAIN BOARD
2. I/O BOARD

Main board consists of :

1. Power PCB (built in) DC-DC Converter
2. Main CPU
3. Memory
 - a. System software
 - b. Macro Program
 - c. Ladder Program
 - d. Parameter and etc.
4. PMC control
5. I/O link control
6. Servo Control
7. Spindle control
8. Memory card interface
9. LED display
10. Reader and puncher interface
11. MDI control
12. Display Control

I/O Board Consists Of:

1. DI/DO
2. Manual Pulse Generator (MPG)
3. Data Server

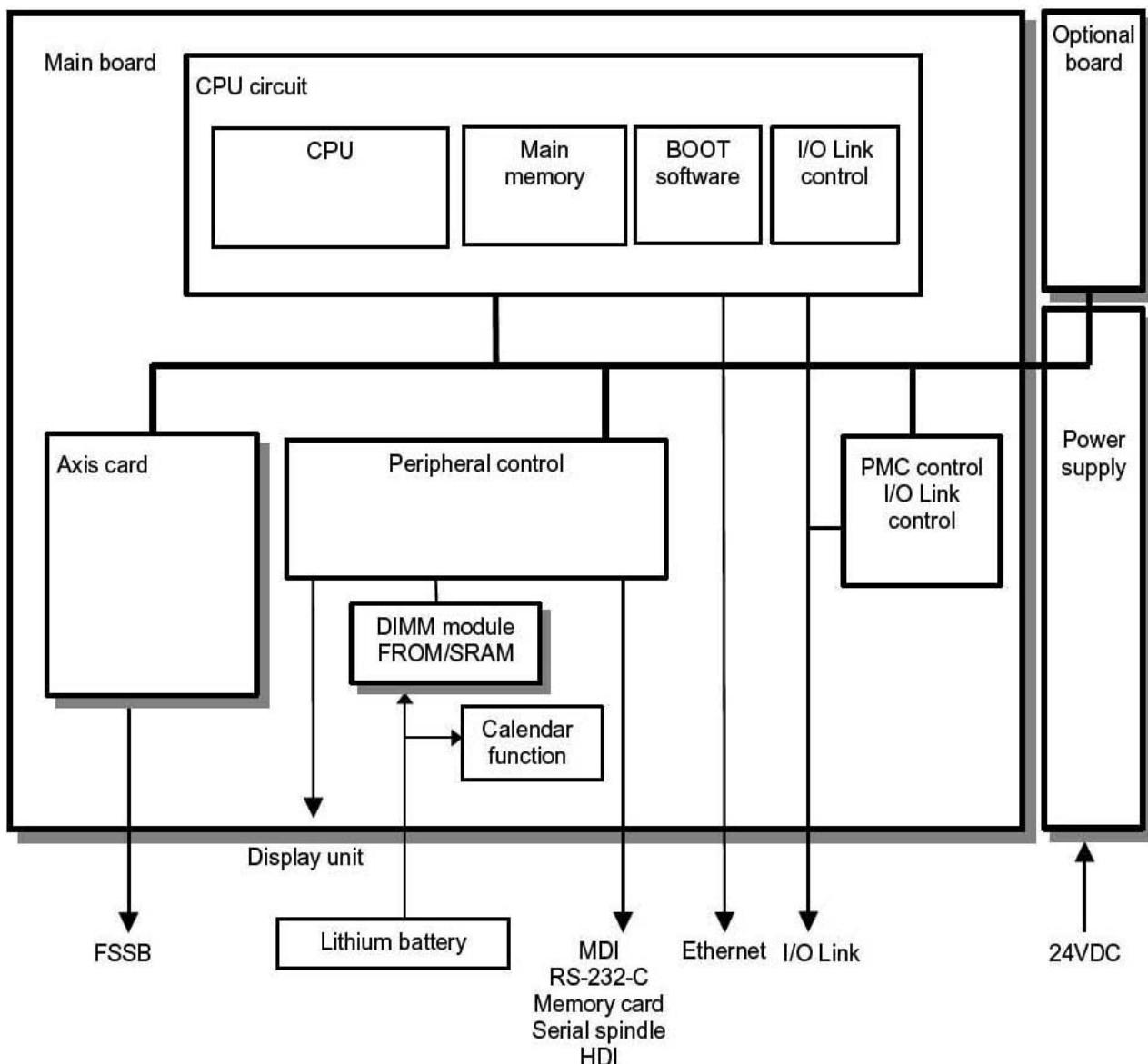


Maintenance Manual

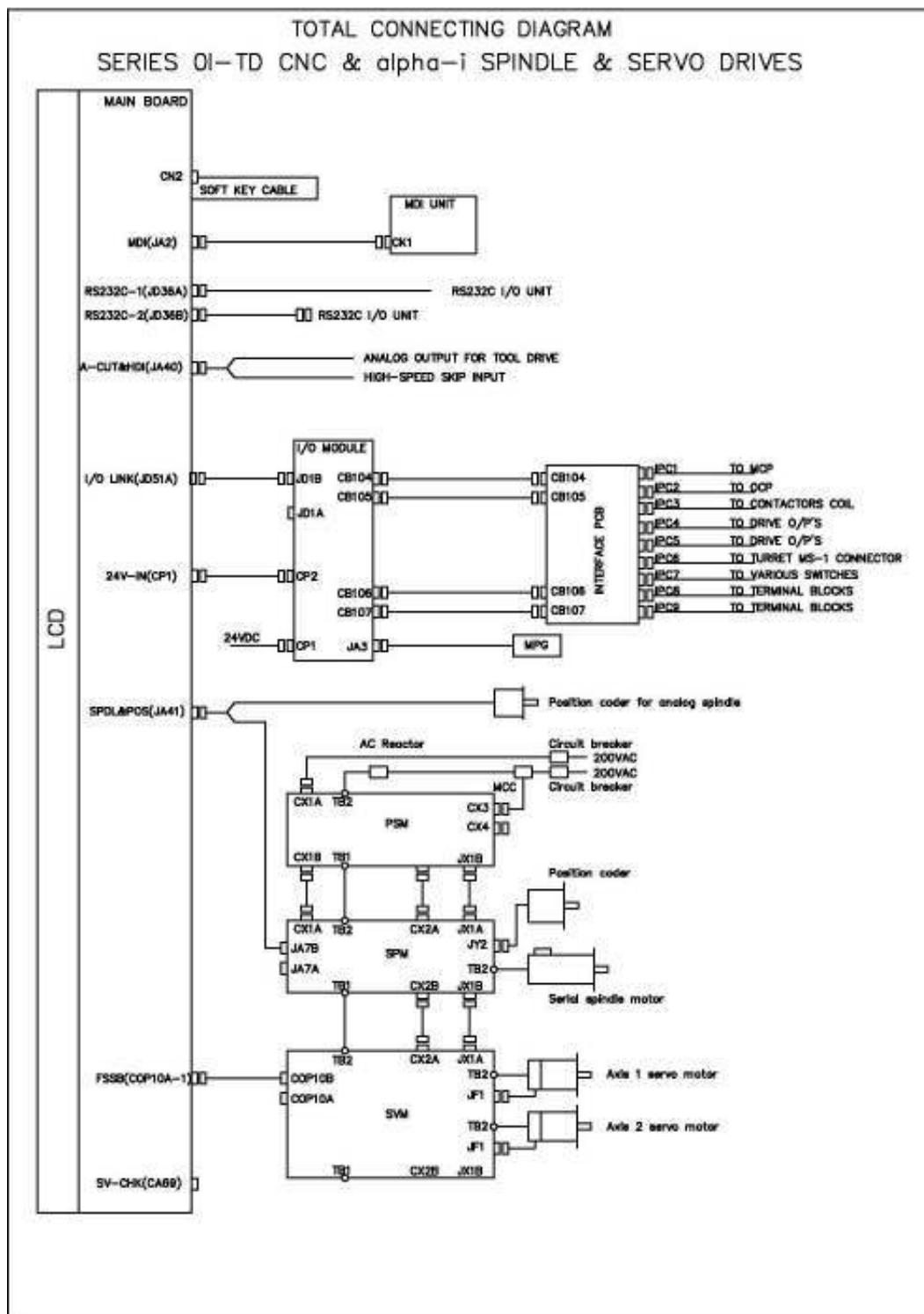


BLOCK DIAGRAM :

Block diagram



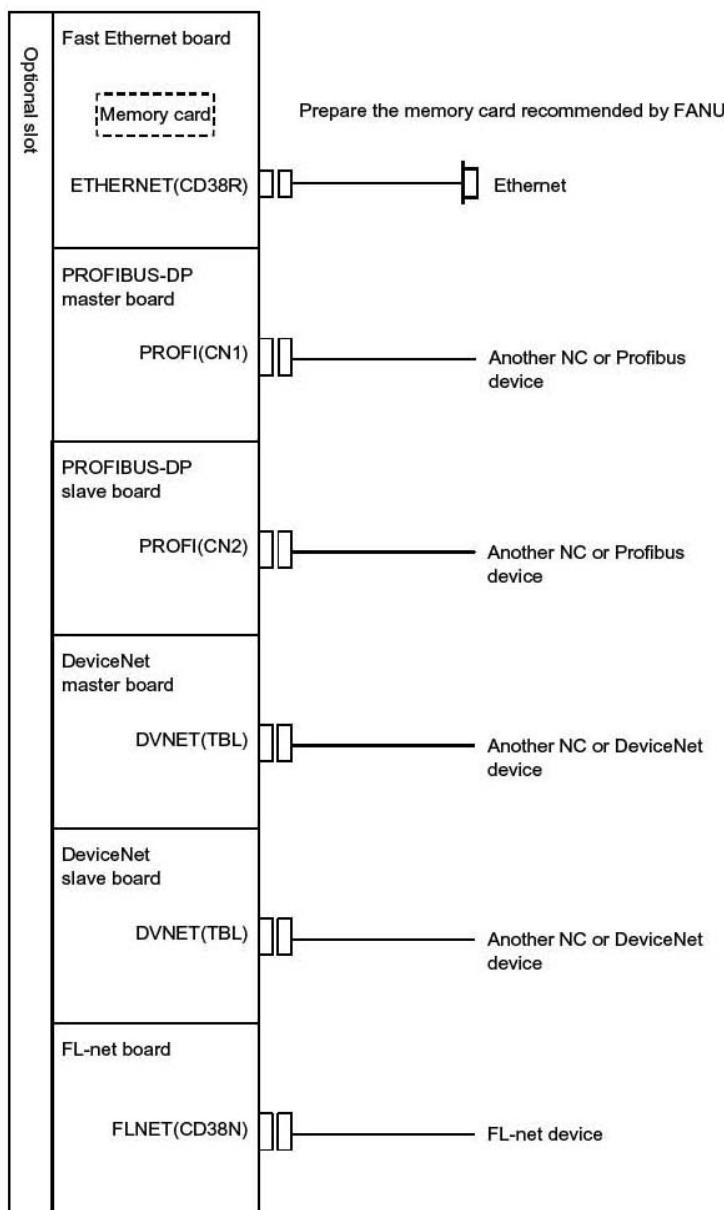
: Detachable card, module, or printed circuit board



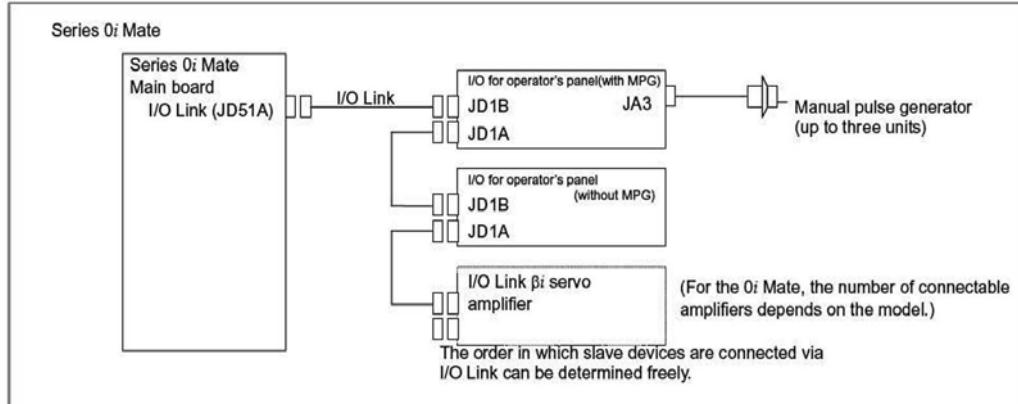
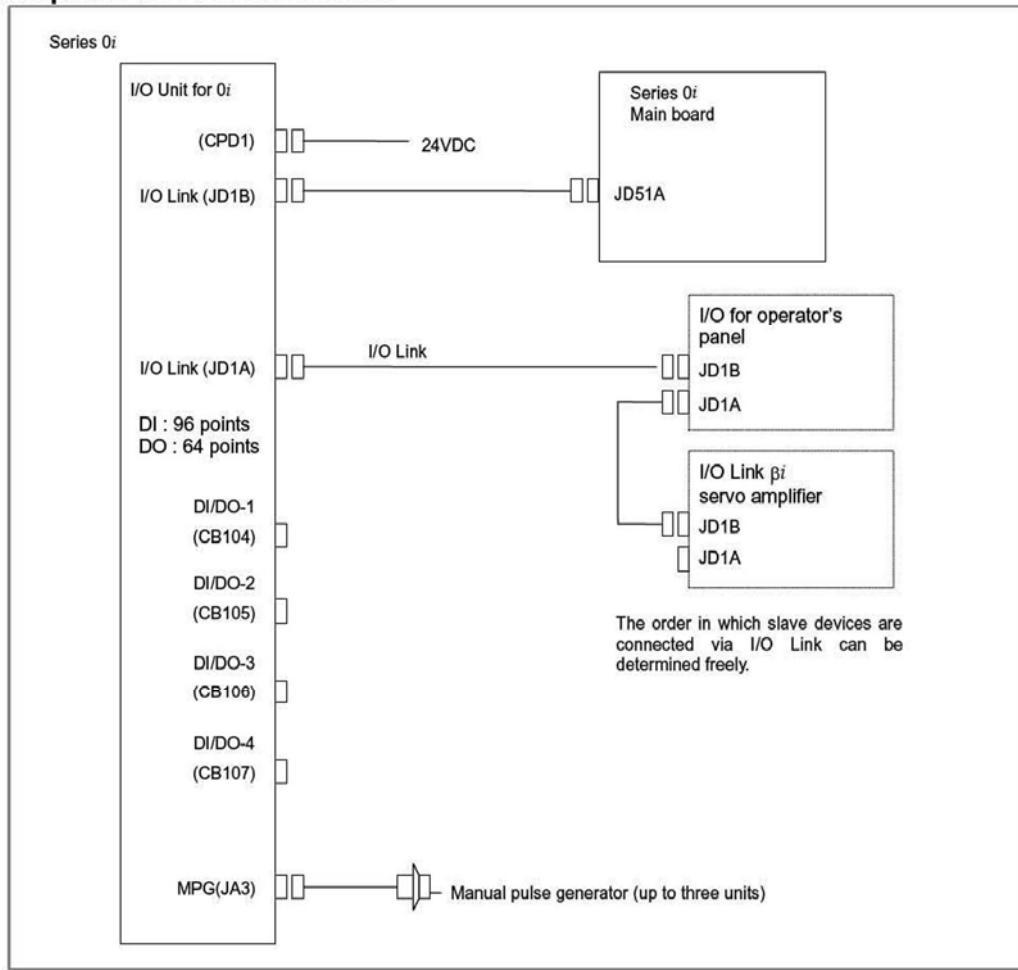
Maintenance Manual



When optional functions are provided

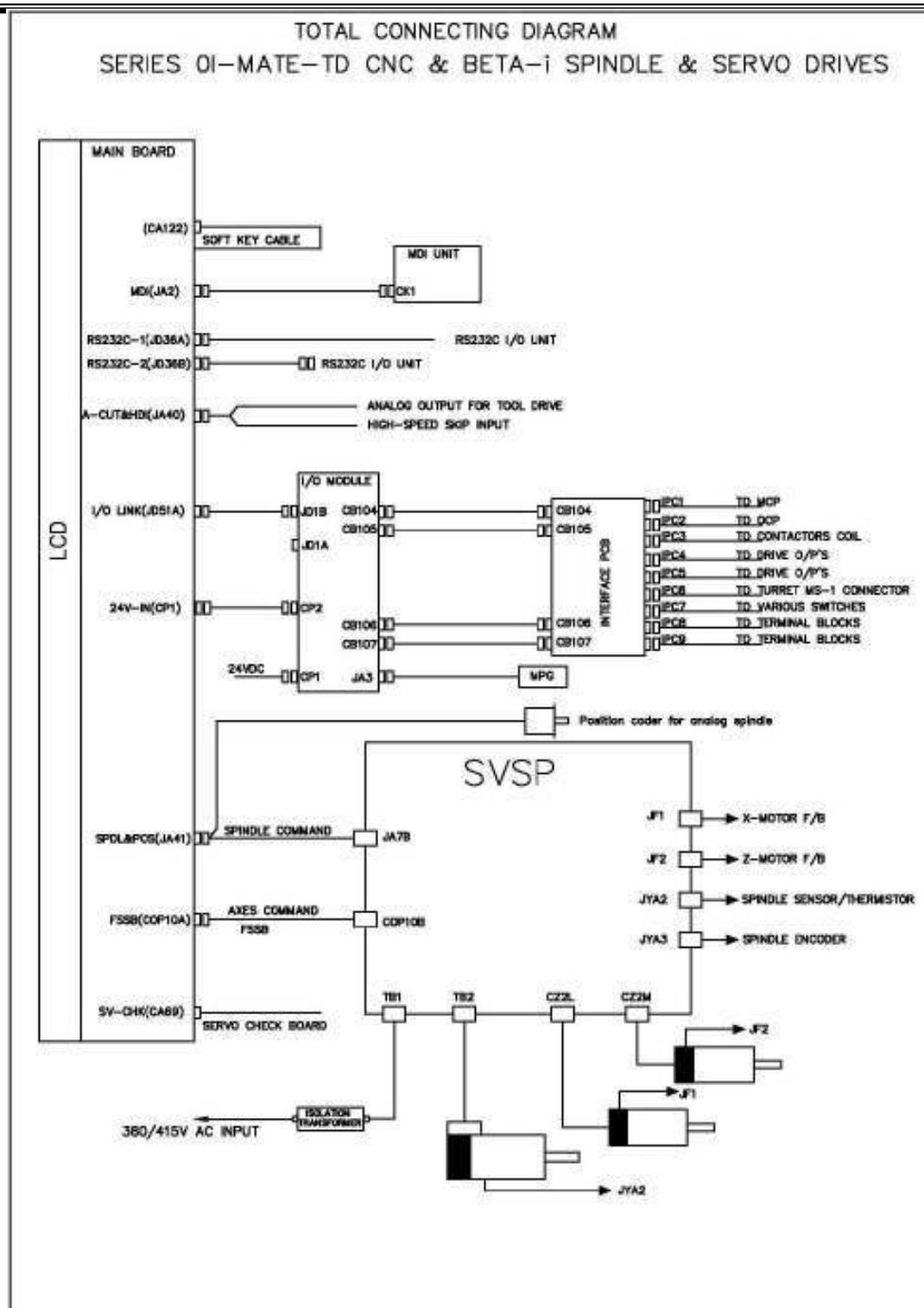


Example of I/O Link connection



Maintenance Manual

ACE
DESIGNERS



FUNCTION KEYS AND SOFT KEYS

Operation and soft key display status for each function key are described below :

Soft Key Structure:

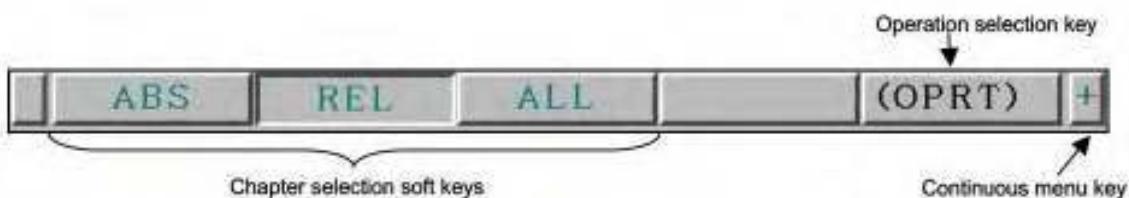
The function keys are used to select the type of screen (function) to be displayed. When a soft key (selection select soft key) is pressed immediately after a function key, the screen (section) corresponding to the selection function can be selected.

General Screen Operation:

Procedure:

1. By pressing a function key on the MDI panel, the chapter selection that belong to the function are displayed.

Example 1



2. When one of the chapter selection soft key is pressed, the screen of the chapter is displayed. If the soft key of the desired chapter is not displayed, press the continuous menu key. In a chapter a further choice may be made from multiple chapters.
3. When the screen of a desired chapter is displayed, press the operation selection key to display operations (operation selection soft keys). If address/numeric keys are used operation selection key may be displayed automatically.

Example 2

Maintenance Manual



Return menu key

Operation selection soft keys

4. Select a desired operation with operation selection soft key, Depending on the operation to be executed; an auxiliary menu of soft key is displayed. Perform the operation according to the indications on the auxiliary menu.

Example 3



Auxiliary menu

5. To return to the display of chapter selection soft keys, press the return menu key.

A general screen display procedure is provided above.

The actual display procedure varies from one screen to another.

Button design change depending on the soft key state.

The soft keys to displayed depend on the object to be selected.

- Chapter selection soft keys
- Operation selection soft keys
- Auxiliary of operation selection soft keys

Example 1

For the 8.4-inch LCD display unit

Chapter selection soft keys



Operation selection soft keys



Operation selection soft keys, auxiliary menu



Example 2
For the 10.4-inch LCD display unit

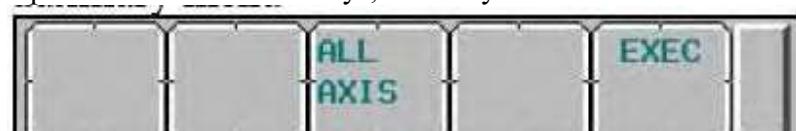
Chapter selection soft keys



Operation selection soft keys



Operation selection soft keys, auxiliary menu



Function Keys:

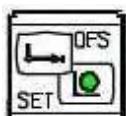
Function Keys are provided to select the type of screen to be displayed. The following function keys are provided on the MDI panel:



Press this key to display position screen.



Press this key to display program screen.



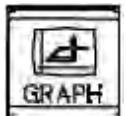
Press this key to display offset/setting screen.



Press this key to display System screen.



Press this key to display Message screen.



Press this key to display Graphics screen.



For small MDI unit press this.



Press this key to display Custom screen 1 (conversational macro screen or C language executor screen). For small MDI unit, there is no key that correspond to this key.

Soft Keys:

By pressing a soft key after a function key, the corresponding screen of the function can be displayed.

The chapter selection soft keys of each function are described below.

The four keys on the right-hand side are assigned to chapter selection soft keys. When multiple pages are used for chapter selection soft keys, [+] is displayed on the continuous menu key (rightmost soft key). Press the continuous menu key to switch between chapter selection soft keys.

NOTE:

1. Press function keys to switch between screens that are used frequently.
2. Some soft keys are not displayed depending on the option configuration or parameter setting.



For the 1.4-inch LCD display unit when pressing other than the function key  indicates positional display on the left side of the screen, the left half of the soft keys are shown below



Or



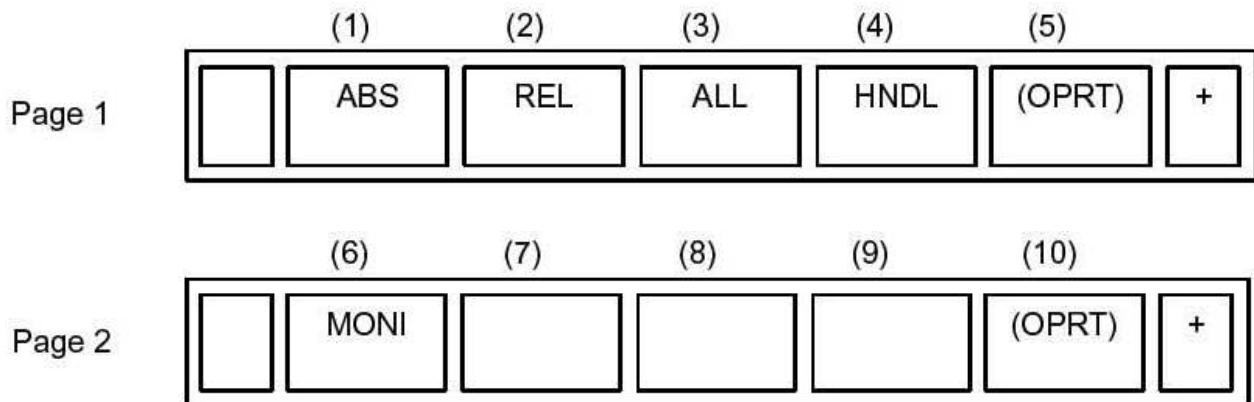
As for the soft key [MONITOR], refer Fanuc user manual.

Position Display Screen

Maintenance Manual



The chapter selection key that belong to function key  and function of each screen are described below.



Position Display Screen

No.	Chapter Menu	Description
(1)	ABS (ABSOLUTE)	Selects the absolute coordinate display screen
(2)	REL (RELATIVE)	Selects the Relative coordinate display screen
(3)	ALL (ALL)	Selects the Overall coordinate display screen
(4)	HNDL (HANDLE)	Selects the operation screen for manual handle operation
(6)	MONI (MONITOR)	Selects the screen for displaying the servo axis load meter, serial spindle load meter and speedometer

Program Screen:



The chapter selection key that belongs to function key  and function of each screen are described below.

In the MEM/RMT mode

	(1)	(2)	(3)	(4)	(5)	
Page 1		PROGRAM	CHECK	CURRENT	NEXT	(OPRT) +

	(6)	(7)	(8)	(9)	(10)	
Page 2		RESTART	DIR			(OPRT) +

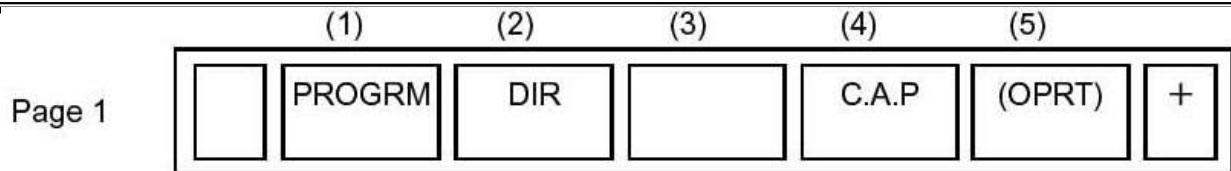
In the MDI Mode

	(1)	(2)	(3)	(4)	(5)	
Page 1		PROGRAM	MDI	CURRENT	NEXT	(OPRT) +

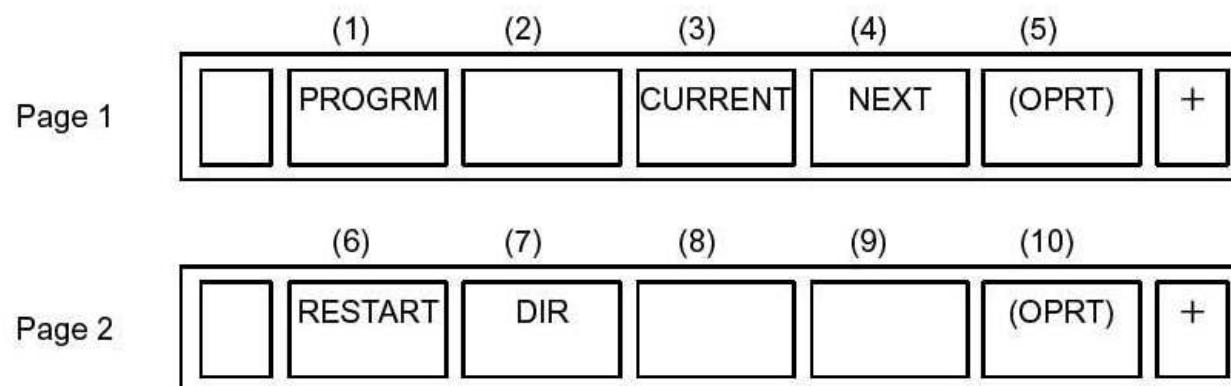
	(6)	(7)	(8)	(9)	(10)	
Page 2		RESTART	DIR			(OPRT) +

In the EDIT/TJOG/THND Mode

Maintenance Manual



In the JOG/HND/REF Mode



No.	Chapter Menu	Description
(1)	PROGRAM (PROGRAM)	Selects the screen for displaying a list of part programs currently registered
(2)	CHECK	Selects the program check screen for displaying program and axis position and modal command values
(2)	MDI	Selects the screen for editing and displaying the program in MDI mode.
(4)	CURRENT	Selects the screen for displaying modal command value and the command value of the block currently being executed from command values
(4)	NEXT (NEXT BLOCK)	Selects the screen for displaying command value of the block currently being executed and the command value of the block to be executed next from command values
(6)	C.A.P	Selects the screen for figure conversational input or the screen of the MANUAL GUIDE Oi (displayed only in EDIT mode)
(6)	RESTART	Selects the screen for restarting an interrupted program operation
(2)	DIR	Selects the screen for displaying a list of part programs currently registered
(7)		

Offset/Setting screen :



The chapter selection key that belongs to function key  and function of each screen are described below.

	(1)	(2)	(3)	(4)	(5)	
Page 1		OFFSET	SETTING	WORK		(OPRT) +
	(6)	(7)	(8)	(9)	(10)	
Page 2		MACRO	MENU	OPR	TOOLLF	(OPRT) +
	(11)	(12)	(13)	(14)	(15)	
Page 3		OFST.2	W.SHFT		BARRIER	(OPRT) +
	(16)	(17)	(18)	(19)	(20)	
Page 4			PR-LEV			(OPRT) +
	(21)	(22)	(23)	(24)	(25)	
Page 5			LANG.	PROT.	GUARD	(OPRT) +

Maintenance Manual



No.	Chapter Menu	Description
(1)	OFFSET (OFFSET)	Select the screen for setting the tool offset values
(2)	SETTING (SETTING)	Select the screen for setting the setting parameters
(3)	WORK (WORK)	Select the screen for setting a work piece coordinate system offset
(6)	MACRO (MACRO)	Select the screen for setting Macro variables
(7)	MENU (PATTERN MENU)	Select the screen for setting pattern data (Pattern data input)
(8)	OPR (OPERAT PANEL)	Selects the screen for operating part of operation switches on the machine operators' panel as soft switches on the CNC screen(software operators panel)
(9)	TOOLLF (TOOL LIFE)	Select the screen for setting TOOL LIFE data
(11)	OFST.2 Y OFFSET	Select the screen for setting Y-axis offsets (only for T-series)
(12)	W.SHIFT (WORK SHIFT)	Select the screen for setting work piece coordinate shift values (only for T-series)
(14)	BARRIER (BARRIER)	Selects the chuck tail stock barrier screen. (only for T-series)
(17)	PR-LEV PRECI LEVEL	Select the screen for setting precision level.(Machine condition selection function)
(22)	LANG (LANGUAGE)	Select the screen for setting a display language
(23)	PROT (PROTECT)	Select the screen for setting 8-level data protection
(24)	GUARD (GUARD)	Select the screen for setting wrong operation prevention

System Screen:



The chapter selection key that belongs to function key and function of each screen are described below.

	(1)	(2)	(3)	(4)	(5)	
Page 1		PARAM	DGNOS		SYSTEM	(OPRT)
	(6)	(7)	(8)	(9)	(10)	
Page 2			PITCH	SV.SET	SP.SET	(OPRT)
	(11)	(12)	(13)	(14)	(15)	
Page 3		W.DGNS	ALL IO		OPEHIS	
	(16)	(17)	(18)	(19)	(20)	
Page 4		PMCMNT	PMCLAD	PMCCNF	PM.MGR	(OPRT)
	(21)	(22)	(23)	(24)	(25)	
Page 5		COLOR	MAINTE	M-INFO		(OPRT)

Maintenance Manual



	(26)	(27)	(28)	(29)	(30)	
Page 6			FSSB	PRMSET		(OPRT) +
	(31)	(32)	(33)	(34)	(35)	
Page 7		EMBED	PCMCIA	ETHBRD	FL-net	(OPRT) +
	(36)	(37)	(38)	(39)	(40)	
Page 8		RMTDIAG	M-TUN			(OPRT) +
	(41)	(42)	(43)	(44)	(45)	
Page 9		ID-INF		MEMORY		(OPRT) +
	(46)	(47)	(48)	(49)	(50)	
Page 10		PROF.M	PROF.S	DNET M	DNET S	(OPRT) +

No.	Chapter Menu	Description
(1)	PARAM (PARAMETER)	Select the screen for setting parameters
(2)	DGNOS (DIAGNOSIS)	Select the screen for displaying CNC state
(4)	SYSTEM (SYSTEM)	Select the screen for displaying current system status
(7)	PITCH (PITCH ERROR)	Select the screen for setting Pitch error compensation
(8)	SV.SET	Select the screen for setting the servo-related parameters

	(SERVO SETTING)	
(9)	SP.SET (SPINDLE SETTING)	Select the screen for spindle-related setting
(11)	W.DGNS (WAVE DIAG)	Select the screen for displaying data such as servo positional deviation values, torque values, machine signals and so forth as graphs
(12)	ALL IO (ALL IO)	Selects the screen for inputting and outputting data
(14)	OPEHIS (OPERAT HISTORY)	Select the screen for displaying history of operations performed by the operators and issued alarms
(16)	PMCMNT (PMC MAINT)	Select the screen related to PMC maintenance such as PMC signal state monitoring and tracing and PMC parameter display/editing
(17)	PMCLAD PMC LADDER	Select the screen related to ladder display/editing
(18)	PMCCNF (PMC CONFIG)	Displays the screen for displaying/editing data other than ladder that makes up a sequence program and for setting the PMC function
(19)	PM.MGR (P.MATEMGR)	Select the screen of power mate CNC manager
(21)	COLOR (COLOR)	Select the screen for setting the colors to be used on the screen
(22)	MAINTE (PERIOD MAINTE)	Select the screen for setting maintenance item to be managed periodically
(23)	M-INFO (MAINTE INFO)	Displays the screen for displaying about maintenance performed
(27)	FSSB (FSSB)	Select the screen for setting to the high speed serial servo bus
(28)	PRMSET (PARAMETER SET)	Select the screen for setting parameters necessary for start-up and tuning
(31)	EMBED (EMBED PORT)	Select the screen for making setting related to the embedded Ethernet
(32)	PCMCIA (PCMCIA LAN)	Select the screen for making setting related to the embedded Ethernet(PCMCIA Ethernet card)
(33)	ETHBRD (ETHER BOARD)	Select the screen for making setting related to fast Ethernet/fast data server
(34)	FL-net	Select the screen for making setting related to FL-net
(36)	RMTDIAG (REMOTE DIAG)	Select the screen for making setting related to remote diagnosis
(37)	M-TUN	Select the screen for setting the parameters set for emphasis

Maintenance Manual



	(MCHN TUNING)	on speed (LV1) or emphasis on precision(LV10)	
(43)	MEMORY (MEMORY)	Displays the screen for displaying the contents of Memory	
(46)	PROF.M (PROFI MASTER)	Select the screen for making setting related to profibus master function	
(47)	PROF.S (PROFI SLAVE)	Select the screen for making setting related to profibus slave function	
(48)	DNET M (DEVNET MASTER)	Select the screen for making setting related to devise net master function	
(48)	DNET S (DEVNET SLAVE)	Select the screen for making setting related to devise net slave function	

Message screen:



The chapter selection key that belongs to function key and function of each screen are described below.

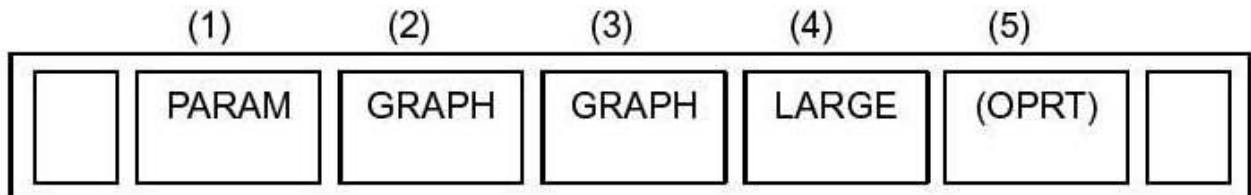
	(1)	(2)	(3)	(4)	(5)	
Page 1		ALARM	MSG	HISTORY		+
	(6)	(7)	(8)	(9)	(10)	
Page 2			MSGHIS			+
	(11)	(12)	(13)	(14)	(15)	
Page 3		EMB LOG	PCM LOG	BRD LOG	FL-net	+

No.	Chapter Menu	Description
(1)	ALARM (ALARM)	Selects the alarm message screen
(2)	MSG (MESSAGE)	Selects the Operators message screen
(3)	HISTORY (HISTORY)	Selects the screen for displaying the details of alarm issued so far
(7)	MSGHIS (MESSAGE HISTORY)	Selects external operators message screen
(11)	EMB LOG (EMBED LOG)	Selects the screen for displaying error message related to embedded Ethernet (embedded port)
(12)	PCM LOG (PCMCIA LOG)	Selects the screen for displaying error message related to embedded Ethernet (PCMCIA Ethernet port)
(13)	BRD LOG (BOARD LOG)	Selects the screen for displaying error message related to fast Ethernet/fast data server
(14)	FL-net (FL-net MSG	Selects the screen for displaying error message related to the FL -net

Graphic Screen :



The chapter selection key that belongs to function key and function of each screen are described below. When the graphic display screen is enabled:



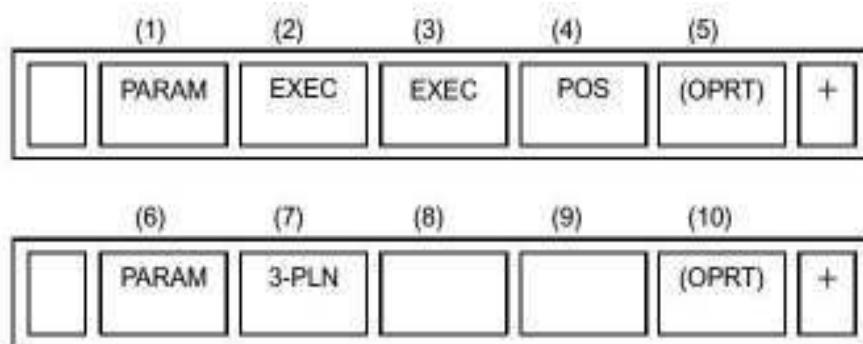
Maintenance Manual



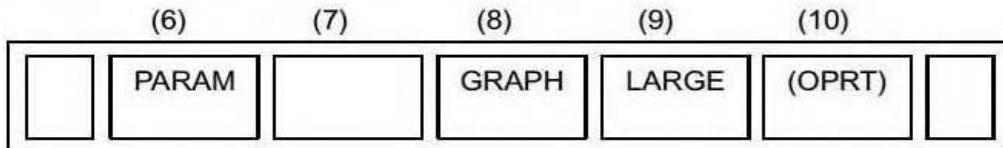
No.	Chapter Menu	Description
(1)	PARAM (PARAMETER)	Select the screen for setting graphic parameters
(2)	GRAPH (GRAPH)	Select the screen for performing the graphic display of tool paths(For M series system)
(3)	GRAPH (GRAPH)	Select the screen for performing the graphic display of tool paths(For T series system)
(4)	LARGE (LARGE)	Displays the soft key for setting the scaling factor of graphic display

When the dynamic graphic display is enabled:

M series:



T series:



No.	Chapter Menu	Description
(1) (6) (11)	PARAM (PARAMETER)	Select the screen for setting drawing parameters
(2)	EXEC (EXEC)	Select the screen for setting drawing tool paths
(3)	EXEC (EXEC)	Select the screen for setting drawing animations
(4)	POS (POSITION)	Select the screen for displaying tool position on tool paths during drawing tool paths
(7)	3-PLN (3-PLN)	Select the screen for displaying 3-plane drawings in animated simulation
(13)	GRAPH (GRAPH)	Select the screen for performing the graphic display of tool paths
(14)	LARGE (LARGE)	Displays the soft key for setting the scaling factor of graphic display

STUDY OF AXIS SERVO DRIVE AND SPINDLE DRIVE OF FANUC Oi-TD SYSTEM

The FANUC Oi-TD with *αi* series consists of the units and components listed below

- | | |
|--|----------|
| (1) Power Supply Module (PSM) | (Basic) |
| (2) Servo Amplifier Module (SVM) | (Basic) |
| (3) Spindle Amplifier Module (SPM) | (Basic) |
| (4) AC Reactor | (Basic) |
| (5) Connectors (for connecting cables) | (Basic) |
| (6) Fuses | (Option) |
| (7) Power Transformer | (Option) |

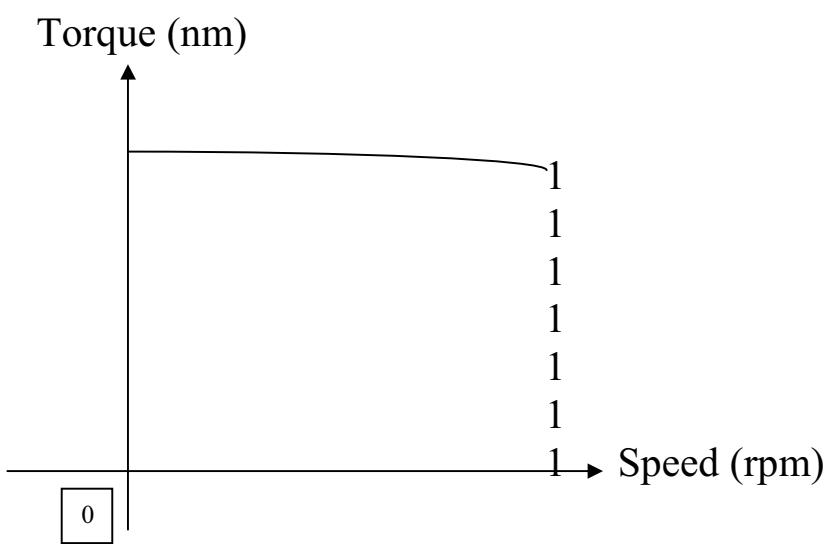
Requirement of Feed or Axis Drive:

- Constant torque over complete speed range.
- Excellent dynamic response i.e. High torque to weight ratio and low rotor inertia.

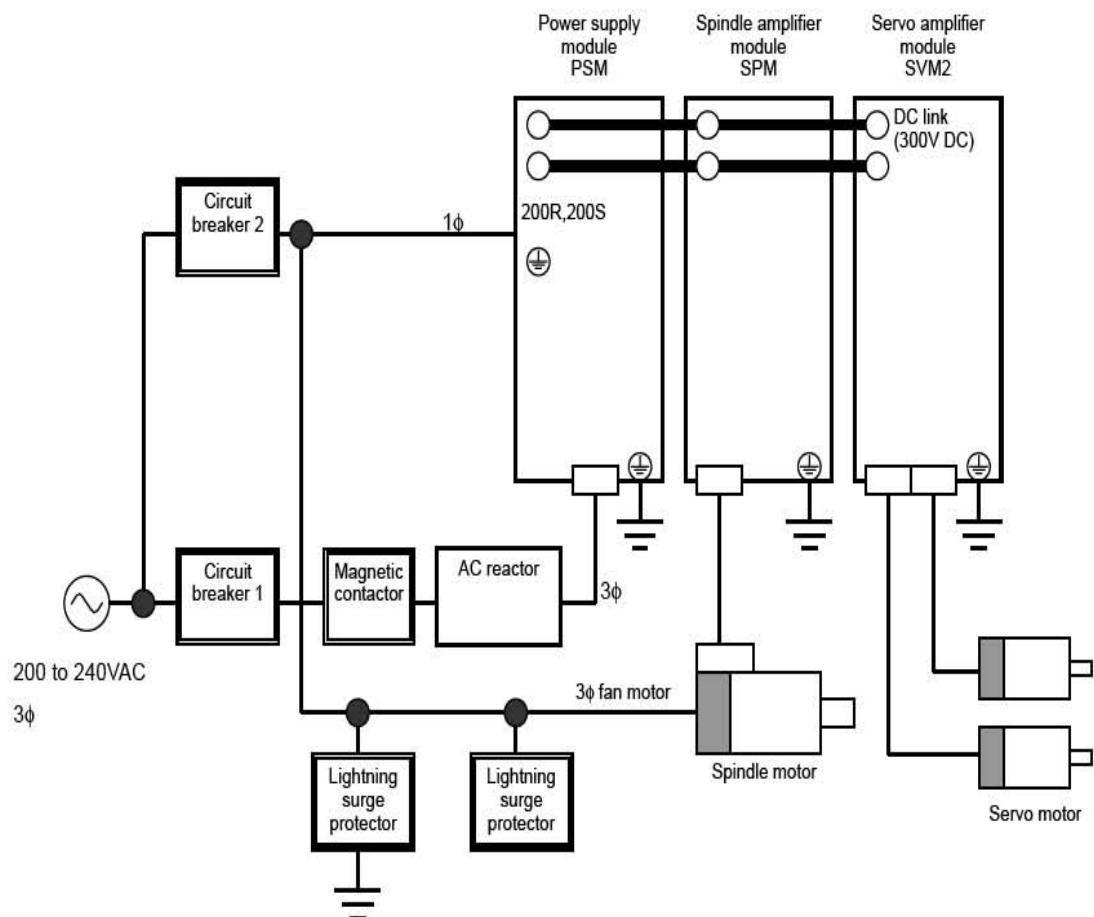
Maintenance Manual



- Smooth running at low speeds (<1RPM)
- High speed stability.
- Good positioning accuracy.
- Built-in feedback elements.



Constituent (example)



Maintenance Manual



(1) Single-axis servo amplifier modules (SVM1, 200VAC-input)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SVM1-20 <i>i</i>	A06B-6114-H103	A06B-6114-C103	A16B-2203-0691	A20B-2100-0740
SVM1-40 <i>i</i>	A06B-6114-H104	A06B-6114-C104	A16B-2203-0660	
SVM1-80 <i>i</i>	A06B-6114-H105	A06B-6114-C105	A16B-2203-0661	
SVM1-160 <i>i</i>	A06B-6114-H106	A06B-6114-C106	A16B-2203-0662	
SVM1-360 <i>i</i>	A06B-6114-H109	A06B-6114-C109	A16B-2203-0625	
				A20B-2100-0830

(2) Two-axis servo amplifier modules (SVM2, 200VAC-input)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SVM2-4/4 <i>i</i>	A06B-6114-H201	A06B-6114-C201	A16B-2203-0692	A20B-2100-0741
SVM2-20/20 <i>i</i>	A06B-6114-H205	A06B-6114-C205	A16B-2203-0695	
SVM2-20/40 <i>i</i>	A06B-6114-H206	A06B-6114-C206	A16B-2203-0670	
SVM2-40/40 <i>i</i>	A06B-6114-H207	A06B-6114-C207	A16B-2203-0671	
SVM2-40/80 <i>i</i>	A06B-6114-H208	A06B-6114-C208	A16B-2203-0672	
SVM2-80/80 <i>i</i>	A06B-6114-H209	A06B-6114-C209	A16B-2203-0673	
SVM2-80/160 <i>i</i>	A06B-6114-H210	A06B-6114-C210	A16B-2203-0674	
SVM2-160/160 <i>i</i>	A06B-6114-H211	A06B-6114-C211	A16B-2203-0675	

(3) Three-axis servo amplifier modules (SVM3, 200VAC-input)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SVM3-4/4/4 <i>i</i>	A06B-6114-H301	A06B-6114-C301	A16B-2203-0696	A20B-2100-0742
SVM3-20/20/20 <i>i</i>	A06B-6114-H303	A06B-6114-C303	A16B-2203-0698	
SVM3-20/20/40 <i>i</i>	A06B-6114-H304	A06B-6114-C304	A16B-2203-0680	

(4) Single-axis servo amplifier modules (SVM1, 400VAC-input)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SVM1-10HV <i>i</i>	A06B-6124-H102	A06B-6124-C102	A16B-2203-0803	A20B-2100-0740
SVM1-20HV <i>i</i>	A06B-6124-H103	A06B-6124-C103	A16B-2203-0800	
SVM1-40HV <i>i</i>	A06B-6124-H104	A06B-6124-C104	A16B-2203-0801	
SVM1-80HV <i>i</i>	A06B-6124-H105	A06B-6124-C105	A16B-2203-0802	
SVM1-180HV <i>i</i>	A06B-6124-H106	A06B-6124-C106	A16B-2203-0629	
SVM1-360HV <i>i</i>	A06B-6124-H109	A06B-6124-C109	A20B-1008-0099 (Driver PCB) A20B-2003-0420	A20B-2100-0831

(5) Two-axis servo amplifier modules (SVM2, 400VAC-input)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SVM2-10/10HV <i>i</i>	A06B-6124-H202	A06B-6124-C202	A16B-2203-0815	A20B-2100-0741
SVM2-20/20HV <i>i</i>	A06B-6124-H205	A06B-6124-C205	A16B-2203-0810	
SVM2-20/40HV <i>i</i>	A06B-6124-H206	A06B-6124-C206	A16B-2203-0811	
SVM2-40/40HV <i>i</i>	A06B-6124-H207	A06B-6124-C207	A16B-2203-0812	
SVM2-40/80HV <i>i</i>	A06B-6124-H208	A06B-6124-C208	A16B-2203-0813	
SVM2-80/80HV <i>i</i>	A06B-6124-H209	A06B-6124-C209	A16B-2203-0814	

Power Supply Modules

(1) Power supply modules (PSM, 200VAC-input, power regeneration type)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
PSM-5.5 <i>i</i>	A06B-6110-H006	A06B-6110-C006	A16B-2203-0640	A20B-2100-0760
PSM-11 <i>i</i>	A06B-6110-H011	A06B-6110-C011	A16B-2203-0641	A20B-2100-0760
PSM-15 <i>i</i>	A06B-6110-H015	A06B-6110-C015	A16B-2203-0642	A20B-2100-0760
PSM-26 <i>i</i>	A06B-6110-H026	A06B-6110-C026	A16B-2203-0630	A20B-2100-0761
PSM-30 <i>i</i>	A06B-6110-H030	A06B-6110-C030	A16B-2203-0631	A20B-2100-0761
PSM-37 <i>i</i>	A06B-6110-H037	A06B-6110-C037	A16B-2203-0632	A20B-2100-0761
PSM-55 <i>i</i>	A06B-6110-H055	A06B-6110-C055	A20B-1008-0081 (Driver PCB) A20B-2003-0420	A20B-2100-0761

(2) Power supply modules (PSM, 400VAC-input, power regeneration type)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
PSM-11HV <i>i</i>	A06B-6120-H011	A06B-6120-C011	A16B-2203-0647	A20B-2100-0760
PSM-18HV <i>i</i>	A06B-6120-H018	A06B-6120-C018	A16B-2203-0648	A20B-2100-0760
PSM-30HV <i>i</i>	A06B-6120-H030	A06B-6120-C030	A16B-2203-0636	A20B-2100-0761
PSM-45HV <i>i</i>	A06B-6120-H045	A06B-6120-C045	A16B-2203-0637	A20B-2100-0761
PSM-75HV <i>i</i>	A06B-6120-H075	A06B-6120-C075	A20B-1008-0086 (Driver PCB) A20B-2003-0420	A20B-2100-0761
PSM-100HV <i>i</i>	A06B-6120-H100	A06B-6120-C100	A20B-1008-0087 (Driver PCB) A20B-2003-0420	A20B-2100-0760

(3) Power supply modules (PSMR, 200VAC-input, resistance regeneration type)

Model	Order specification	Unit specification	Printed circuit board specification
PSMR-3 <i>i</i>	A06B-6115-H003	A06B-6115-C003	A16B-2203-0781
PSMR-5.5 <i>i</i>	A06B-6115-H006	A06B-6115-C006	A16B-2203-0782

Maintenance Manual



Spindle Amplifier Modules

The order specification varies according to the sensor (function) used.

(1) αi series spindle amplifier modules (SPM, 200VAC-input) TYPE A

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SPM-2.2 <i>i</i>	A06B-6111-H002	A06B-6111-C002	A16B-2203-0650	A20B-2100-0800
SPM-5.5 <i>i</i>	A06B-6111-H006	A06B-6111-C006	A16B-2203-0651	A20B-2100-0800
SPM-11 <i>i</i>	A06B-6111-H011	A06B-6111-C011	A16B-2203-0652	A20B-2100-0800
SPM-15 <i>i</i>	A06B-6111-H015	A06B-6111-C015	A16B-2203-0653	A20B-2100-0800
SPM-22 <i>i</i>	A06B-6111-H022	A06B-6111-C022	A16B-2203-0620	A20B-2100-0800
SPM-26 <i>i</i>	A06B-6111-H026	A06B-6111-C026	A16B-2203-0621	A20B-2100-0800
SPM-30 <i>i</i>	A06B-6111-H030	A06B-6111-C030	A16B-2203-0622	A20B-2100-0800
SPM-45 <i>i</i>	A06B-6111-H045	A06B-6111-C045	A20B-1008-0090 (Driver PCB) A20B-2003-0420	A20B-2100-0800
SPM-55 <i>i</i>	A06B-6111-H055	A06B-6111-C055	A20B-1008-0091 (Driver PCB) A20B-2003-0420	A20B-2100-0800

TYPE B

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SPM-2.2 <i>i</i>	A06B-6112-H002	A06B-6111-C002	A16B-2203-0650	A20B-2100-0801
SPM-5.5 <i>i</i>	A06B-6112-H006	A06B-6111-C006	A16B-2203-0651	A20B-2100-0801
SPM-11 <i>i</i>	A06B-6112-H011	A06B-6111-C011	A16B-2203-0652	A20B-2100-0801
SPM-15 <i>i</i>	A06B-6112-H015	A06B-6111-C015	A16B-2203-0653	A20B-2100-0801
SPM-22 <i>i</i>	A06B-6112-H022	A06B-6111-C022	A16B-2203-0620	A20B-2100-0801
SPM-26 <i>i</i>	A06B-6112-H026	A06B-6111-C026	A16B-2203-0621	A20B-2100-0801
SPM-30 <i>i</i>	A06B-6112-H030	A06B-6111-C030	A16B-2203-0622	A20B-2100-0801
SPM-45 <i>i</i>	A06B-6112-H045	A06B-6111-C045	A20B-1008-0090 (Driver PCB) A20B-2003-0420	A20B-2100-0801
SPM-55 <i>i</i>	A06B-6112-H055	A06B-6111-C055	A20B-1008-0091 (Driver PCB) A20B-2003-0420	A20B-2100-0801

(2) αi series spindle amplifier modules (SPM, 400VAC-input) TYPE A

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SPM-5.5HV <i>i</i>	A06B-6121-H006	A06B-6121-C006	A16B-2203-0820	A20B-2100-0800
SPM-11HV <i>i</i>	A06B-6121-H011	A06B-6121-C011	A16B-2203-0821	A20B-2100-0800
SPM-15HV <i>i</i>	A06B-6121-H015	A06B-6121-C015	A16B-2203-0822	A20B-2100-0800
SPM-30HV <i>i</i>	A06B-6121-H030	A06B-6121-C030	A16B-2203-0627	A20B-2100-0800
SPM-45HV <i>i</i>	A06B-6121-H045	A06B-6121-C045	A16B-2203-0628	A20B-2100-0800
SPM-75HV <i>i</i>	A06B-6121-H075	A06B-6121-C075	A20B-1008-0096 (Driver PCB) A20B-2003-0420	A20B-2100-0800
SPM-100HV <i>i</i>	A06B-6121-H100	A06B-6121-C100	A20B-1008-0097 (Driver PCB) A20B-2003-0420	A20B-2100-0800

TYPE B

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SPM-5.5HVi	A06B-6122-H006	A06B-6121-C006	A16B-2203-0820	A20B-2100-0801
SPM-11HVi	A06B-6122-H011	A06B-6121-C011	A16B-2203-0821	A20B-2100-0801
SPM-15HVi	A06B-6122-H015	A06B-6121-C015	A16B-2203-0822	A20B-2100-0801
SPM-30HVi	A06B-6122-H030	A06B-6121-C030	A16B-2203-0627	A20B-2100-0801
SPM-45HVi	A06B-6122-H045	A06B-6121-C045	A16B-2203-0628	A20B-2100-0801
SPM-75HVi	A06B-6122-H075	A06B-6121-C075	A20B-1008-0096 (Driver PCB) A20B-2003-0420	A20B-2100-0801
SPM-100HVi	A06B-6122-H100	A06B-6121-C100	A20B-1008-0097 (Driver PCB) A20B-2003-0420	A20B-2100-0801

(3) *αCi* series spindle amplifier modules (SPMC, 200VAC-input)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
SPMC-2.2i	A06B-6116-H002	A06B-6111-C002	A16B-2203-0650	A20B-2100-0802
SPMC-5.5i	A06B-6116-H006	A06B-6111-C006	A16B-2203-0651	A20B-2100-0802
SPMC-11i	A06B-6116-H011	A06B-6111-C011	A16B-2203-0652	A20B-2100-0802
SPMC-15i	A06B-6116-H015	A06B-6111-C015	A16B-2203-0653	A20B-2100-0802
SPMC-22i	A06B-6116-H022	A06B-6111-C022	A16B-2203-0620	A20B-2100-0802

Quick start-up guide for ACE CNC Lathes

General Requirements:

- The machine and CNC should not be exposed to **direct sun light** or any other heat source.
- The area should be **free from dust, moisture, standing water, liquid or rain etc.,**
- The machine to be installed on **foundation** & the machine should not be placed near the vibrating **source** like punch press, Magnetic or electric sources.

Electrical supply requirements:

- Machine should be grounded **independently** to prevent the leakage and electrical noise, causing
- personal injury and malfunctioning of machine & it is very important to note that grounding shall not
- be along with the grounding of electric discharging machines, electric welder & punch presses etc.,
- Ground resistance shall be **below 100 ohms** and neutral to ground potential should **not exceed 3Vac**
- The ground cable shall be of copper, which is resistant to any corrosive condition.

Maintenance Manual



The recommended method is;

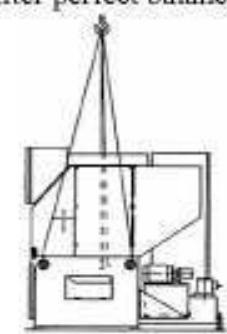
Lifting and Positioning of Ace machine

1. Remove coolant tank, Chip conveyor and other accessories mounted around the machine from the skid.& remove 04 Nos. cap nuts. Two provisions have been made to lift and position the machine. One is by crane and other by forklift. You can use any one of them.

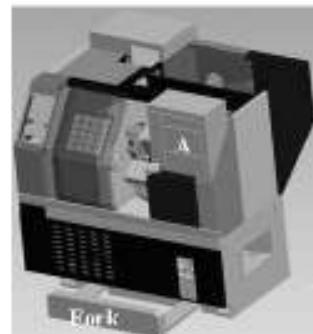
Crane:

2. The machine has 3 lifting blocks as shown in figure for lifting purpose. Remove left side cover and top cover to sling the machine.
3. Use a crane and rope or cable, which is capable of withstanding a weight of 5 tons and hang up the ropes as shown in the figure.
4. Check if the rope loads on any sheet metal cover or any parts of the machine. Provide waste cloth or wooden pieces, where the rope touches the sheet metal guard. (Refer figure)
5. Check for the balance of machine forward & backward, right & left with the machine slightly lifted.

Using Crane for Lifting



Using Forklift for Lifting



After perfect balance, lift the machine till it clears the clamping bolts.

IMPORTANT



Do not lift the machine any farther than necessary off the skid.

Forklift:

- The forklift must be capable of lifting a weight of **5 tons** with a fork width of 200 mm and 1000 mm long. Insert the fork into the front pocket provided at the bottom of the bed.
- Check the machine for perfect balance and then lift the machine slowly till it clears the clamping bolts.
- Move the machine as slowly and cautiously as possible to the location, where it is to be installed.
- Take leveling pads, grease the dimple in each pad and centre / locate them under the leveling screws. Use only leveling pads supplied along with the machine, else that may cause damage to the machine. Now lower the machine.
- Ensure the ‘V’ Shape of the screw seated properly on the corresponding shape in the pad.

IMPORTANT	Be careful to place the machine down slowly to prevent it from sudden dropping on the floor, which can cause injuries, result in expensive repairs and void the warranty. In case of lifting the machine by group, proper co-ordination between the members of the group has to be ensured.
------------------	---

Preliminary Inspection:

1. Check for any physical damage of the machine because of transportation and it has to be informed to ACE Designers Ltd., immediately.
2. Check all the items received as per Packing List both those mounted on the machine & those packed

Preliminary Cleaning:

Remove all bags containing moisture absorbents & remove the rust preventive solution applied to all around exposed surfaces by cleaning liquid and also jelly is applied to other machined exposed surfaces. Wipe the same with soft cloth, wherever necessary.

Fluid Preparation: Fill the hydraulic power pack tank with **68 grade viscosity oil**. Capacity of the hydraulic tank is **70 Liters**. Fill the lubrication tank with the same oil. Capacity of the lubrication tank is **3 Liters**. Fill the coolant tank with proper grade cutting fluid, which is mixed with distilled water in appropriate proportion. Capacity of the tank is 140 Liters. **Refer following table for complete details:**

Maintenance Manual



SL. #	ACE MACHINES	PARTICULARS		
		Hydraulic oil (V-68 grade)	Lubrication oil 68 grade)	Coolant
1	CUB	20 Liters	3 Liters	100 Liters
2	Jobber-XL	45 Liters	3 Liters	110 Liters
3	Classic	45 Liters	3 Liters	125 Liters

Checks before first power ON:

1. Connect 3-phase, ground & neutral wires to the terminals on top of the main switch. Ensure 3-phase

supply is 380Vac($\pm 10\%$), 50Hz (Refer the following pictures for connection details):



CUB



Jobber-XL



Classic

2. Ace **strongly recommends Voltage stabilizer** to maintain constant input supply to the CNC machine.
3. Ensure all electrical connection in the electrical cabinet. Transformer etc, are in right & firm before you switch ON power to the machine.
4. Ensure all the hydraulic hoses are tightly connected.
5. Ensure all the fastenings and stoppers made for machine transportation are removed.

Checks after power on:

1. Switch on the main power switch & If “**LUB FAULT**” light is **ON**, you must interchange any **2-phase wires at the input of the m/c** & check 415 V AC at F6 MCB (Transformer primary voltage).
2. Check 200 V AC at F7 MCB (Transformer secondary voltage).
3. Measure incoming voltages at Q1, Q2, Q3 & F3 and it should be 415 V ac.
4. Switch on F8 MCB and measure 24V DC at power supply output terminal.

5. Switch on Q1, Q2, Q3, Q4 (M PCBs) and check for 415 V AC.
6. Switch on the CNC and release emergency push button & check K10 contactor for getting on.

Checking of all the basic functions:

1. Check for chuck clamp / de-clamp function in JOG mode, MDI mode & make sure corresponding lights are ON, on the operator panel.
2. Check for the correct spindle belts tension & Command M03 / M04 at 100 rpm in **MDI** mode & check for any vibration / sound Increase the speed in steps of 200 rpm and ensure that there are no problems up to maximum speed, also check for spindle speed O/R switch function & spindle load meter.
3. Select **JOG** mode. Press **Lub inch** push button 10-15 times after every 3 seconds to properly lubricate the axes before moving the axes. Now at lower feed rates say 10% move the axes slowly in both directions, repeat the same by gradually increasing feed rates. Now reference both the axes and select **JOG mode** and press **Index on** push button. The turret indexing should be from station 1,2,3,...8
4. Select **MDI** mode, press **program** key, enter T0001, T5000, etc., to check the turret indexing.
5. Check tail stock quill function in **JOG** mode by foot switch, M32/M33 in **MDI** mode & check for the status of the corresponding lights on operator panel.
6. Check for proper functioning of coolant in JOG & MDI modes.
7. Check for the proper functioning of Chip conveyor.
8. Remove compressor clamps (of panel cooler) **before switching on the machine**

This is the clamp to be removed



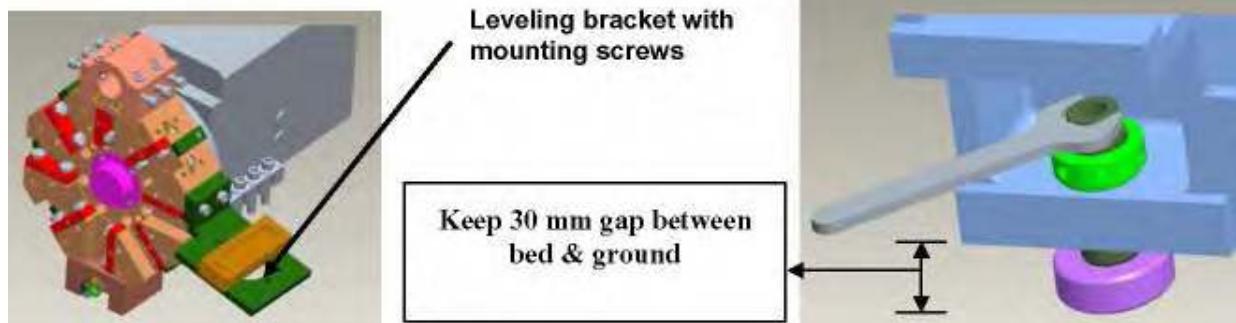
9. **Now level the machine:**
Jog the X & Z-axes to position the turret close to chuck.

10. Mount the bracket on Turret Disc in any one of the free stations. Ensure bracket is seating on the **tenon** and butting against the face of the disc **refer the diagram below:**

Maintenance Manual



11. Place the spirit level on the bracket along the Z-axis i.e. parallel to the spindle axis.



12. Adjust the bed using the levelling screws alternatively till the bubble of the spirit level reach/ come to center in horizontal as well as vertical direction. This ensures proper levelling of the machine.
13. Lock the nut and ensure that the screws are seated properly on the pad centre depressions.
14. Remove the bracket from the Turret.

IMPORTANT



**Do not index the turret while the bracket is mounted on the disc. This may cause damage to the sheet metal and the bracket itself.
Level screws should be extended as little as possible to reduce vibrations during normal running of the machine**

NOTE: Please Contact Ace Designers Ltd, India for any further clarifications.

INPUT AND OUTPUT OF DATA

Parameters, Offset values and other data can be backed up in external i/o devices. SRAM data can also be backed up at a time. This back up data can be restored to set data again easily. It is recommended that various type of data and SRAM data be backed up periodically in case data stored in CNC destroyed due to an operation error or back up battery exhaustion. The following steps explains how to INPUT or OUTPUT data such as parameters, programs, tool offset values ,with external I/O devices such as Memory card units.

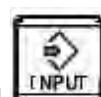
SETTING PARAMETERS FOR INPUT/OUTPUT

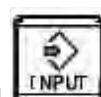
In setting procedure of parameters for input/output of data parameter writing is enabled with the following steps.

1. Set to MDI mode or emergency stop state.



2. Press function key  several times or press soft key[SETTING] to display SETTING (HANDY)screen.



3. Set the cursor to PARAMETER WRITE and press  and  keys in this order. Here alarm 100 will be displayed.



4. Press function key  several times to display the following screen.

Maintenance Manual



PARAMETER	(SETTING)	O1234 N12345
0000	SEQ	INI ISO TVC
	0 0 0 0 0 0 0 0	
0001		FCV
	0 0 0 0 0 0 0 0	
0012 RMV		MIR
X	0 0 0 0 0 0 0 0	
Y	0 0 0 0 0 0 0 0	
Z	0 0 0 0 0 0 0 0	
B	0 0 0 0 0 0 0 0	
0020 I/O CHANNEL		
	S 0 T0000	
REF **** *** ***	10: 15: 30	
[PARAM][DGNOS][[SYSTEM][(OPRT)]	

To make the cursor display in bit unit,
press the cursor key
 or .

5. Press soft key [(OPRT)] and the following operation menu is displayed.

<1> Soft key [NO.SRH] :

Search by number.

Examination) Parameter number → [NO.SRH].

<2> Soft key [ON : 1] :

Item with cursor position is set to 1 (bit parameter)

<3> Soft key [OFF : 0] :

Item with cursor position is set to 0 (bit parameter)

<4> Soft key [+ INPUT] :

Input value is added to the value at cursor.

<5> Soft key [INPUT] :

Input value is Replaced with the value at cursor.

<6> Soft key [F INPUT] :

Parameters are input from reader /puncher interface.

<7> Soft key [F OUTPUT] :

Parameters are output to reader /puncher interface.

- After the parameters have been input, set PARAMETER WRITE on the SETTING screen to



0.Press key to release alarm 100.

- Convenient method

<1> To change parameters in bit unit, press cursor key or , then the cursor becomes bit length and you can set parameters bit by bit (Bit parameter only).

<2> To set data consecutively, use key.



This key sequence sets data as follows:

0	1234
0	⇒ 4567
0	9999
0	0



This key sequence sets data as follows:

0	1234
0	⇒ 0
0	9999
0	0

<3> To set the same data sequentially, press .



This key sequence sets data as follows:

0	1234
0	⇒ 1234
0	1234
0	0

Maintenance Manual



<4> Bit parameters can be set as follows:

(Ex.1)

This key sequence sets data as follows:

0 0 0 0 0 0 0	0 0 0 1 1 0 0
0 0 0 0 0 0 0	⇒ 0 0 0 1 1 0 0
0 0 0 0 0 0 0	0 0 0 1 1 0 0
0 0 0 0 0 0 0	0 0 0 0 0 0 0

8. After the required parameters set , set the PARAMETER WRITE to 0.

INPUTTING/OUTPUTTING DATA

The CNC memorized the following data, outputting the data I/O device while is running normally

- (1) CNC parameter.
- (2) PMC Parameter.
- (3) Pitch error compensation amount.
- (4) Custom macro variable values.
- (5) Tool compensation amount.
- (6) Part program (machining program, custom macro program)

Confirming the Parameters required for data Input/output

NOTE: Data output cannot be done in an alarm state. The following parameters are required for FINPUT/FOUTPUT. In addition (*) indicates the standard setting for input/output devices made by FANUC. Change these setting according to the device you actually use.

(Parameters can be changed in MDI mode or emergency stop status)

0000	#7	#6	#5	#4	#3	#2	#1	#0
ISO	0:	Output with EIA code					ISO	

1: Output with ISO code (for RS-232-C serial port 1 or 2)

0020

Selection of I/O channel

- (*) 0 : Channel 1 (RS-232-C serial port 1: JD36A of main board)
- 1 : Channel 1 (RS-232-C serial port 1: JD36A of main board)
- 2 : Channel 2 (RS-232-C serial port 2: JD36B of main board)
- 4 : Memory card interface
- 5 : Data Server interface
- 9: Embedded Ethernet interface

NOTE

In the operation examples in this chapter, data input/output is done with an I/O device connected to JD36A. (I/O channel = 0)

0101	#7	#6	#5	#4	#3	#2	#1	#0
	NFD				ASI			SB2
NFD	0 :	Feed is output when data is output.						
	1 :	Feed is not output when data is output.						

ASI (*) 0 : EIA or ISO code is used for input/output data.

(input : automatic detection, output : setting of bit 1 (ISO) of parameter no.0000.

1 : ASCII code is used (to use the ASCII code ,set bit 1(ISO) of Parameter No.0000 to 1)

SB2 (*) 0 : No. of stop bits is 1.

1 : No. of stop bits is 2.

0102	Number specified for the input/output device	
Set value	Input/output device	
0	RS-232-C (Used control codes DC1 to DC4)	
1	FANUC CASSETTE ADAPTOR 1 (FANUC CASSETTE B1/B2)	
2	FANUC CASSETTE ADAPTOR 3 (FANUC CASSETTE F1)	
3	FANUC PROGRAM FILE Mate, FANUC FA Card Adaptor FANUC FLOPPY CASSETTE ADAPTOR, FANUC Handy File FANUC SYSTEM P-MODEL H	
4	RS-232-C (Not used control codes DC1 to DC4)	
5	Portable tape reader	
6	FANUC PPR FANUC SYSTEM P-MODEL G, FANUC SYSTEM P-MODEL H	

Maintenance Manual



0103

Baud Rate

1: 50 7: 600 11: 9600
3: 110 8: 1200 12: 19200 [BPS]
4: 150 9: 2400
6: 300 (*)10: 4800

0139

#7 #6 #5 #4 #3 #2 #1 #0

ISO 0: ASCII code input/output
1: ISO code input/output (with memory card)

0908

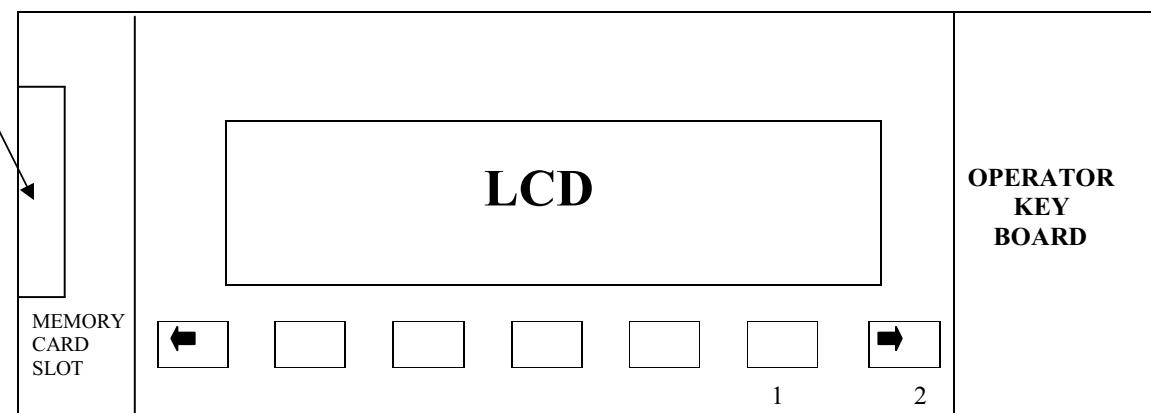
#7 #6 #5 #4 #3 #2 #1 #0

ISO 0: ASCII code input/output
1: ISO code input/output (with Data Server)

COMMUNICATION PROCEDURES IN Oi-MATE TD AND Oi-TD FANUC SYSTEMS

Procedure for loading the logic from Fanuc 0I-TD CNC System to Memory Card(Flash Card)

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the 0I CNC system Main Board Memory Card slot.



- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously
- System Monitor Main Menu is displayed on CRT as follows:
 1. END
 2. USER DATA LOADING
 3. SYSTEM DATA LOADING
 4. SYSTEM DATA CHECK
 5. SYSTEM DATA DELETE
 6. SYSTEM DATA SAVE
 7. SRAM DATA UTILITY
 8. MEMORY CARD FORMAT
- Select 6 (**SYSTEM DATA SAVE**) with the help of [**UP**] and [**DOWN**] soft Key.
- Press soft key 4 times to go to # 47 i.e. PMC 1 by using [**UP**] and

Maintenance Manual



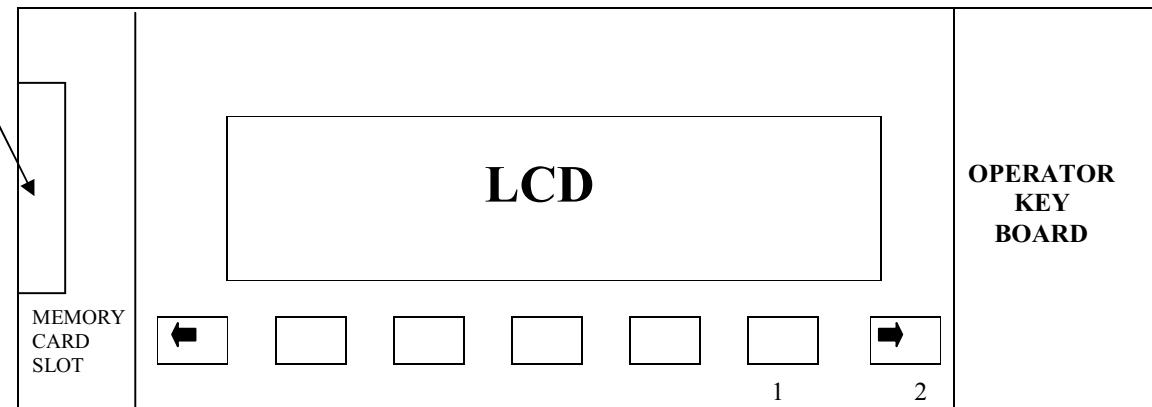
[DOWN] soft key.

- Press [SELECT] soft key then press [YES] soft key- Now logic will be copied from CNC to Memory card
- Once saving is complete select END by using [UP] and [DOWN] soft key.
- Switch off the whole machine and remove the Memory Card/Flash Card.

NOTE: While carrying out the above procedure, please do not press any other keys.

Procedure for loading the logic from Fanuc 0I-TD CNC System to Memory Card(Flash Card)

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the 0I CNC system Main Board Memory Card slot.



- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously
- System Monitor Main Menu is displayed on CRT as follows:
9. END

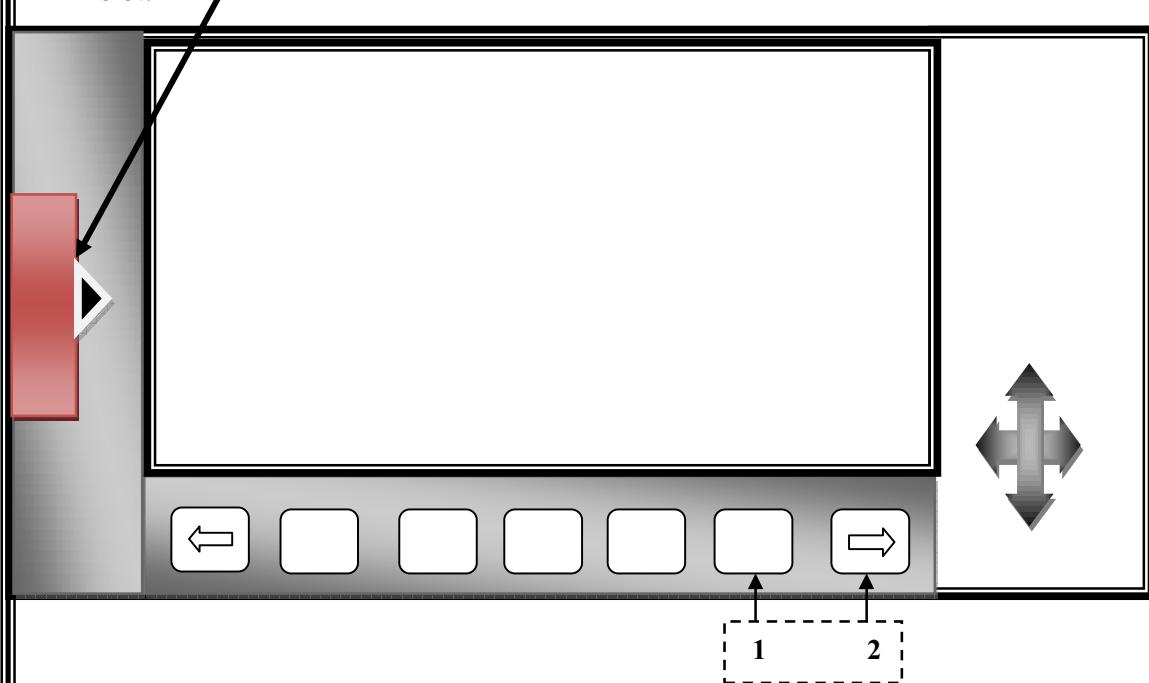
10. USER DATA LOADING
11. SYSTEM DATA LOADING
12. SYSTEM DATA CHECK
13. SYSTEM DATA DELETE
14. SYSTEM DATA SAVE
15. SRAM DATA UTILITY
16. MEMORY CARD FORMAT

- Select 3 (**SYSTEM DATA LOADING**) with the help of [**UP**] and [**DOWN**] soft key.
- Press [**SELECT**] soft key then system will display the logic file name in memory card as
PMC 1.000
1@ @@ @ CD1 @
- Now select the above file and press [**YES**] soft key.
- Now the system will start copying the logic file from memory card to CNC.
- Once loading is complete select **END** by using [**UP**] and [**DOWN**] soft key.
- Switch off the whole machine and remove the Memory Card/Flash Card.

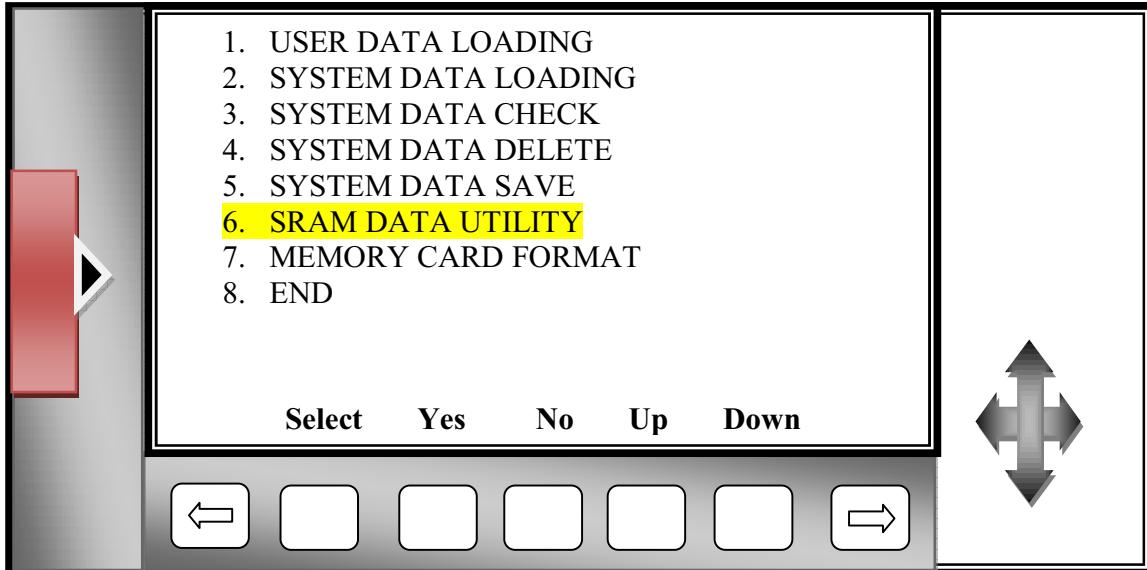
NOTE: While carrying out the above procedure, please do not press any other keys.

PROCEDURE TO LOAD SRAM DATA FROM FANUC OI CNC SYSTEM TO FLASH CARD

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.



- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously
- System Monitor Main Menu is displayed on CRT as follows:
 1. USER DATA LOADING
 2. SYSTEM DATA LOADING
 3. SYSTEM DATA CHECK
 4. SYSTEM DATA DELETE
 5. SYSTEM DATA SAVE
 6. SRAM DATA UTILITY
 7. MEMORY CARD FORMAT
 8. END
 - Select 6 (SRAM DATA UTILITY) with the help of [UP] and [DOWN] soft key.



- Press [SELECT] soft key and then select the required data by pressing [UP] and [DOWN] soft key.
- Select the following by using [UP] and [DOWN] soft keys & press [SELECT] soft key
 - RESTORE SRAM (CNC -MEMORY CARD -)
- Now Select **SRAM _ BAK.001** from the displayed
- Press [SELECT] soft key and then press [YES], once loading is complete Select the SRAM 2 also & load
- Press [SELECT] soft key and then select **END** by using [UP] and [DOWN] soft key.
- After **END** is selected press [SELECT] soft key and again select **END** in the **SYSTEM MONITOR MAIN MENU** by using [UP] and [DOWN] soft keys and then press [SELECT] soft key and press [YES] soft key.

Maintenance Manual

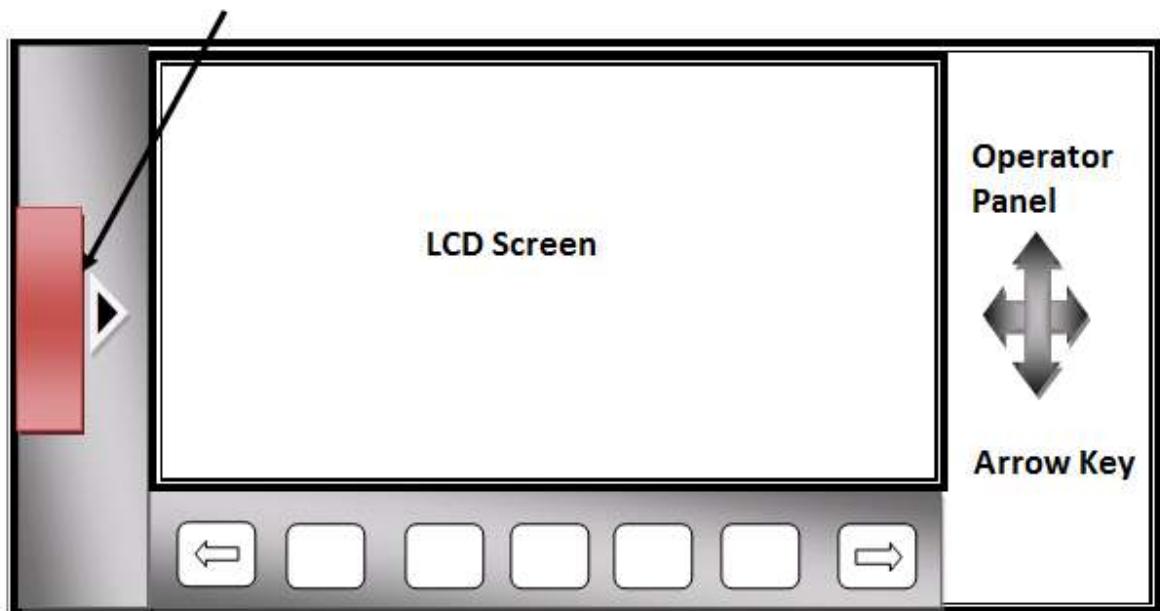


- While saving the logic file to card file name like **SRAM _ BAK.001** will appear on the screen .Same file we have to select while loading.
- Switch off the whole machine and remove the Memory Card/Flash Card.

NOTE: While carrying out the above procedure, please do not press any other keys.

PROCEDURE TO TRANSFER PROGRAM FROM FANUC OI-MATE TD CNC SYSTEM TO FLASH CARD

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.

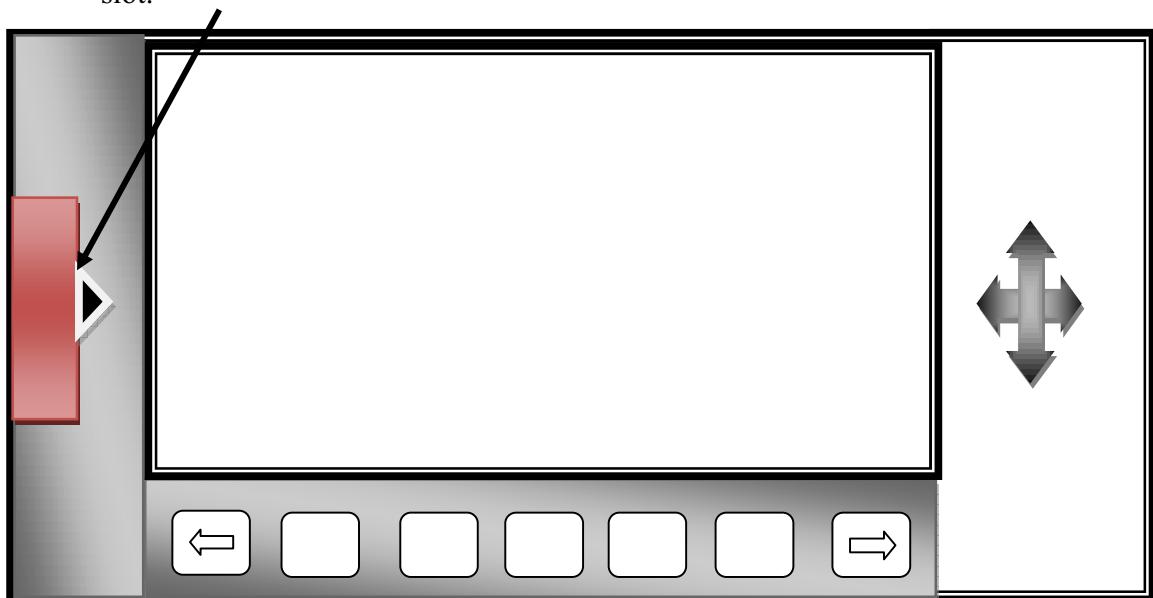


- Switch on the CNC. Select **MDI** mode by using mode selector switch.
- Press **OFFSET** key of MDI key Board Twice.
- Make **Parameter Write = 1** and **I/O Channel = 4**.

- Select **EDIT** Mode by using mode selector switch.
- Press Program key of **MDI** key Board.
- Press **DIR** (directory) soft key.
- Type the Program No. which you want to Transfer.
- Press  Soft key.
- Press **F/OUTOUT** soft Key.
- Press **EXE** (Execute) Soft Key.

PROCEDURE TO TRANSFER PROGRAM FROM FLASH CARD TO FANUC OI-MATE TD CNC SYSTEM

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the 0I CNC system Main Board Memory Card slot.



- Switch on the CNC. Select **MDI** mode by using mode selector switch.

Maintenance Manual

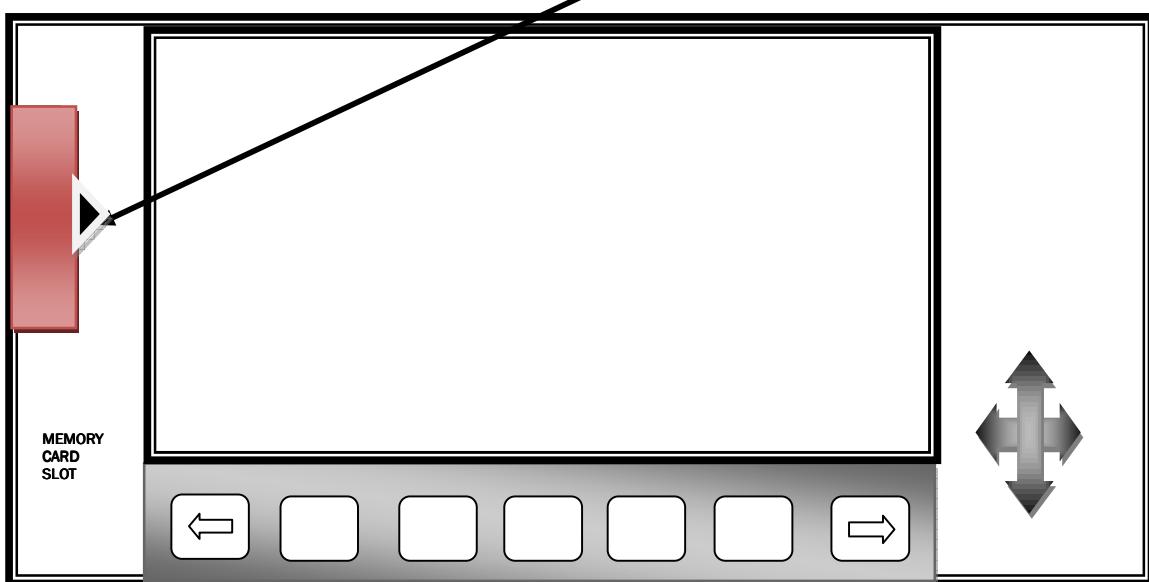


- Press **OFFSET** key of MDI key Board Twice.
- Make **Parameter Write = 1 and I/O Channel = 4.**
- Select **EDIT** Mode by using mode selector switch.
- Press **Program** key of **MDI** key Board.
- Press **DIR** (directory) soft key.
- Press Soft key.
- Press **DEVICE** soft key.

- Press **MEM CARD** (memory card) Soft key.(Here we can view the content of the Memory card)
- Here we can view the content of the Memory card
- Press **F/INPUT** Soft key.
- Type the **SI No.** of the Program to be copied.
- Press **F SET** Soft key.
- Press **EXE** (Execute) Soft Key.
- Select **CNC MEM** (CNC memory).

PROCEDURE TO DOWNLOAD PARAMETERS FROM FANUC OI-TD / mate-TD CNC SYSTEM TO FLASH CARD

- ✓ Switch off the power to CNC Machine.
- ✓ Insert the PCMCIA FLASH CARD on to **this slot** of OI-TD/ mate-TD CNC system



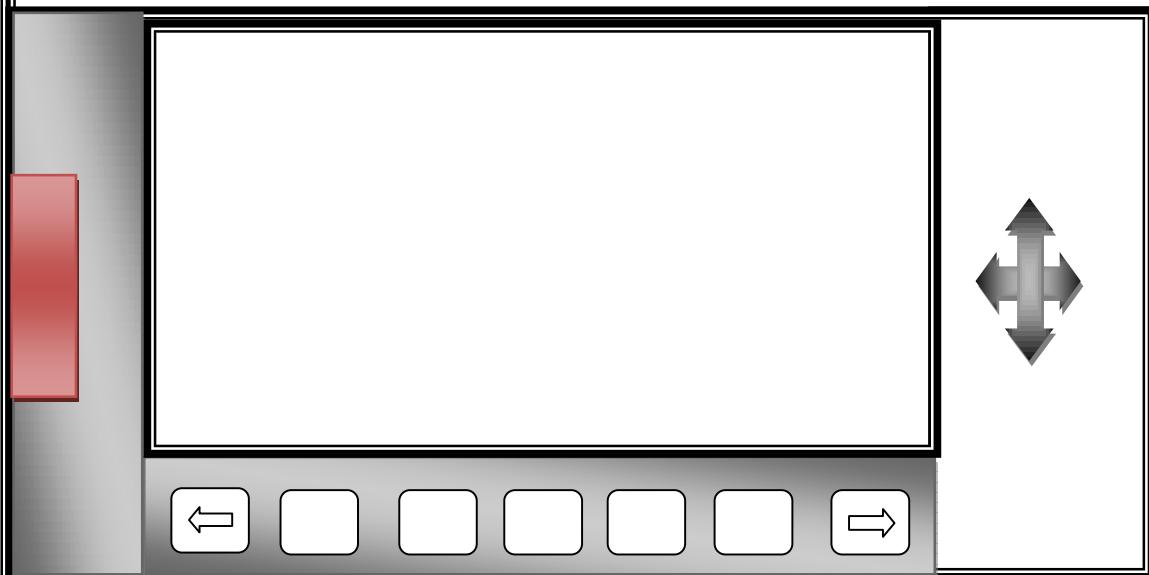
- ✓ Now Switch on power to the CNC machine
- ✓ **Switch ON** the CNC system
- ✓ Select **EDIT mode** by mode selector - rotary switch
- ✓ Press **SYSTEM** key on right side of the CNC screen, till you see **PARAMETER** on bottom of the screen
- ✓ Press **PARAMETER** soft key (located on bottom of the screen)
- ✓ Press **OPERATOR** soft key
- ✓ Press once
- ✓ Press **FOUTPUT** soft key
- ✓ Press **ALL** soft key
- ✓ Now Press **EXEC** soft key

Now system will copy all the parameters on to PCMCIA – FLASH card (during copying process system will display OUTPUT on bottom right side of the screen)

Maintenance Manual



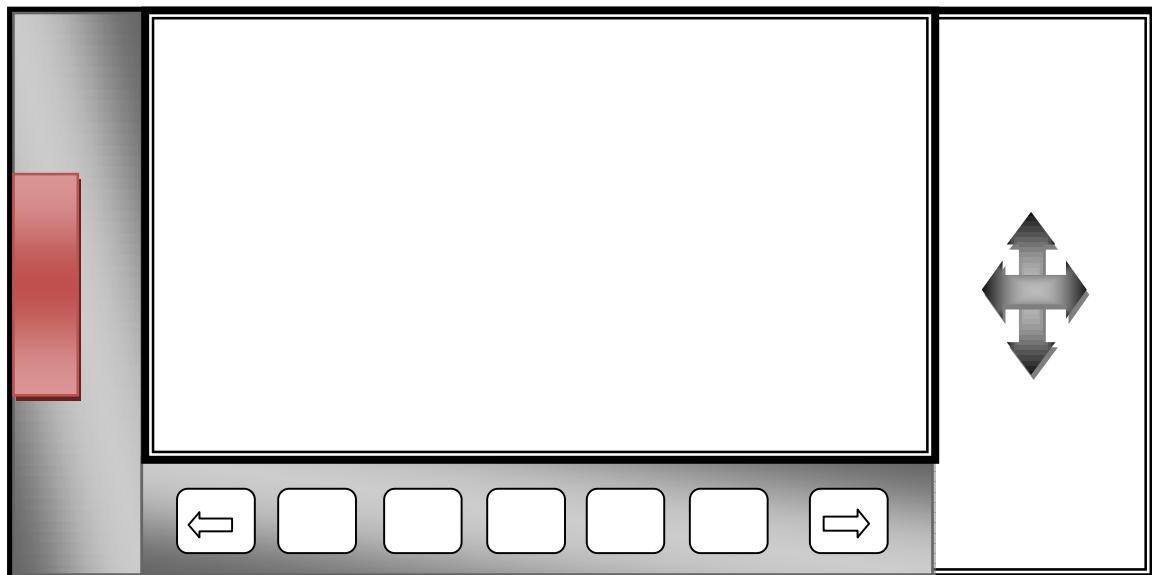
PROCEDURE TO DIAGONISE I/O SIGNALS-KEEPRELAY-TIMER AND COUNTER VALUES IN FANUC OI-MATE TD CNC SYSTEM



- Press **SYSTEM** key of MDI key Board.
- Press Soft Key Three Times.
- Press **PMCMNT** Soft Key.
- Press **STATUS** Soft Key. (**Note : At this step we can View Input / Output signals**)
- Press Soft key. (**Note : At this step we can View Keep Relay-Timer And Counters Values**)

Outputting Pitch Error Compensation :

If pitch error compensation is enabled, pitch error compensation is output.



- ✓ Select **EDIT mode** by mode selector - rotary switch.



- ✓ Press the function key



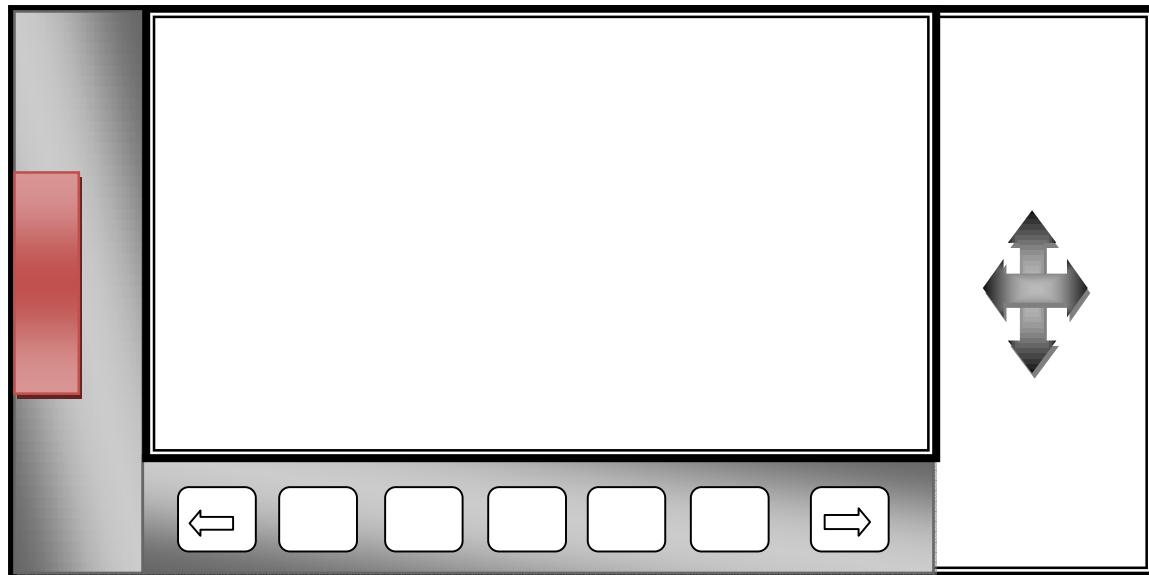
- ✓ Press continuous menu key  several times , then press soft key [PITCH] to select the pitch error compensation setting screen.



- ✓ Press soft key [(ORPT)] and continuous menu key .

- ✓ Press soft key [F OUTPUT] and [EXEC], then pitch error compensation amount is started to be output.

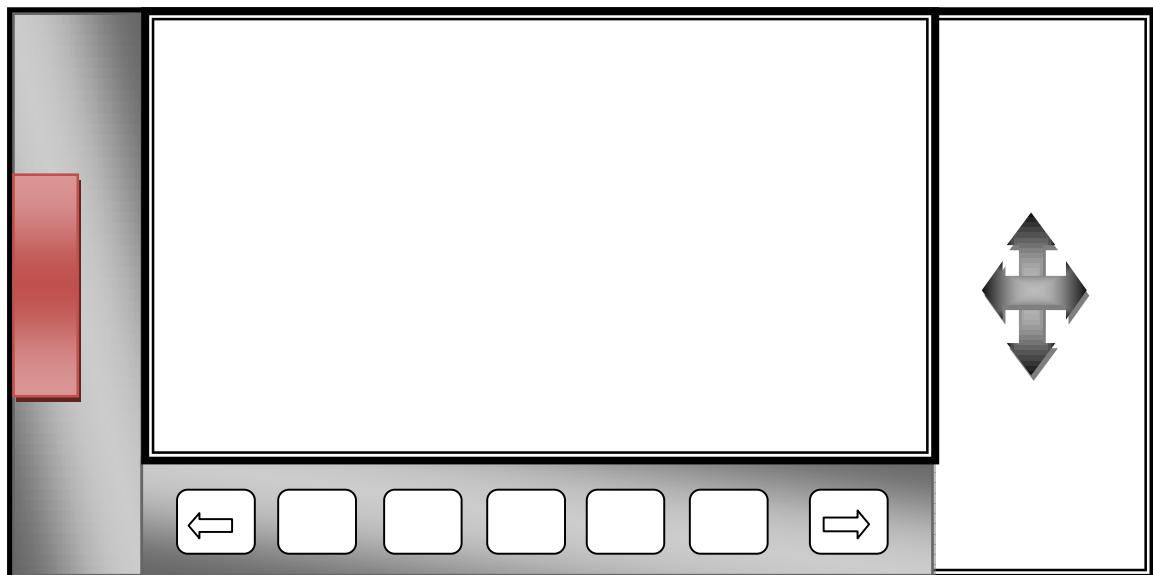
Inputting Pitch Error Compensation amount :



If pitch error compensation is enabled, a pitch error compensation amount is input.

- 1 Select EDIT mode.
- 2 Confirm that PARAMETER WRITE=1 on the setting screen.
- 3 Press the function key .
- 4 Press continuous menu key  several times, then press soft key [PITCH] to select the pitch error compensation setting screen.
- 5 Press soft key [(OPRT)] and continuous menu key .
- 6 Press soft keys [F INPUT] and [EXEC], then pitch error compensation amount is started to be input.
- 7 After a pitch error compensation amount is input, display the setting screen and reset “PARAMETER WRITE” to “0” on the setting screen.

Outputting Custom Macro Variable Values:



When custom macro function is valid, values of variable no.500 and later is output.

1. Select EDIT mode.



2. Press the function key



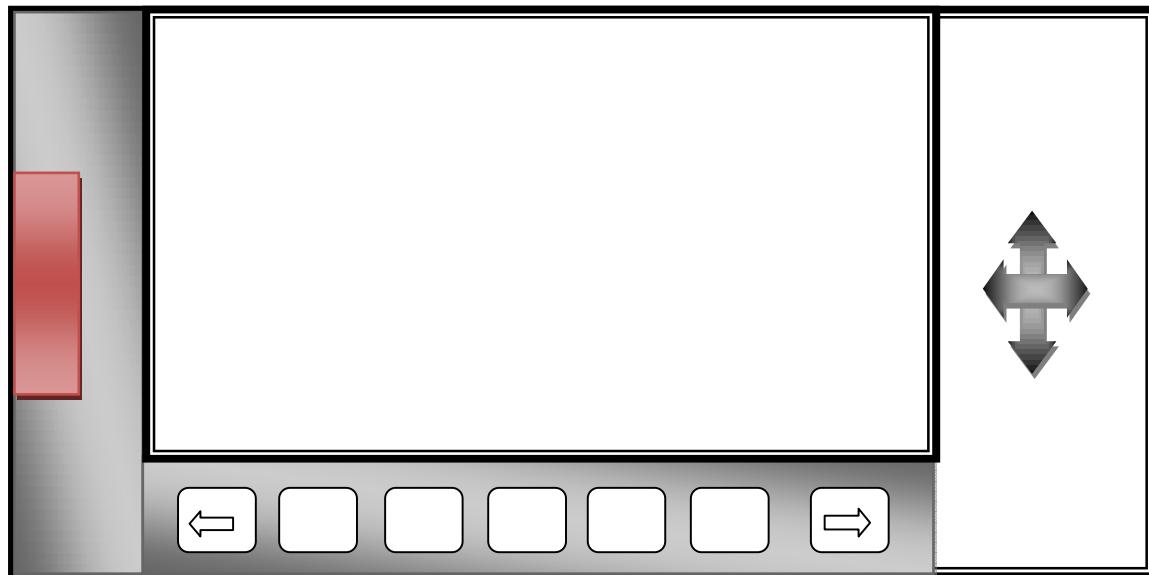
3. Press the continuous key several times then press [MACRO] to select custom macro variable screen.



4. Press soft key [(OPRT)] and then continuous menu key

5. Press soft keys [F OUTPUT] and [EXEC] , Then custom macro variable values are output.

Inputting Custom Macro Variable Values:



1. Select EDIT mode.
2. Turn OFF the program protect key (KEY2=1)



3. Press the function key



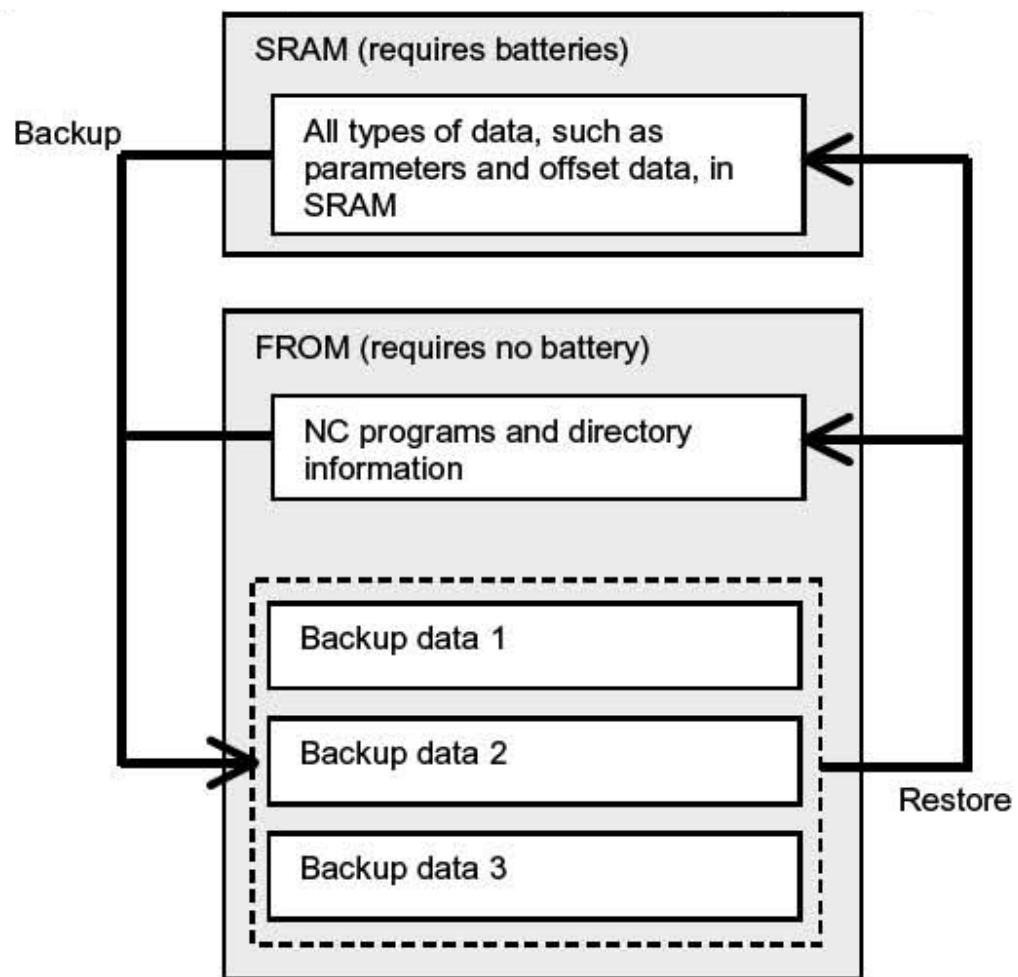
4. Press the continuous key  several times then press [MACRO] to select custom macro variable screen.



5. Press soft key [(OPRT)] and then continuous menu key .
6. Press soft keys [F INPUT] and [EXEC] , Then custom macro variable values are starte to be input.

AUTOMATIC DATA BACKUP

It is possible to back up data held in CNC's FROM / SRAM by storing it automatically in FROM, which requires no battery and to restore the backed-up data as required. If data is lost from CNC due to unforeseen circumstances, this function can be used restore the data easily. Also it possible to hold three occurrences of back up data .With this function the CNC data can be quickly switched to a post machine adjustment state or an arbitrary back up state.



NOTE

Automatic data backup function is optional function.

Explanation

Maintenance Manual



Data to be backed up: Data in the CNC is backed up by storing it in the FFROM, which require no battery.

- NC programs stored in the FFROM (which require no battery)
- Various types of data, such as parameters and offset values held in the SRAM (which requires batteries)
- Setting bit 2 (APP0 of parameter no. 10340 to 1 enables NC programs in the FROAM to be backed up, set this parameter only when necessary, because the required back up time and data storage is vary depending on the size of the program.
- Also it is possible to hold three occurrences of back up data.

BACKUP MODES

The following three back up modes are available.

1. Automatic power backup occurring every time when the power is turned ON.
2. Automatic power backup occurring at intervals of a specified number of days when the power turned ON.
3. Backup start manually at an emergency stop.

Automatic backup occurring every time the power is turned on

Data in the CNC can be backed up automatically when the power is turned on.

This mode can be used by:

- Setting bit 0 (ABP) of parameter No. 10340 to 1
- Setting bit 2 (AAP) of parameter No. 10340 to 1 if also NC programs in the FFROM must be backed up

Automatic backup occurring at intervals of a specified number of days when the power is turned on

Data in the CNC can be backed up automatically when the power is turned on for the first time in a specified number of days since the previous backup.

This mode can be used by:

- Selecting the first backup mode (automatic backup occurring every time the power is turned on)
- Setting parameter No. 10341 with a number of days at intervals of which automatic backup is to be made cyclically

Backup started manually at an emergency stop

Data in the CNC can be backed up by starting an appropriate procedure manually in an emergency stop state. This mode makes it possible to back up data without turning off the power for the CNC at an arbitrary timing, such as when machining has been set up or before a holiday.

If you want to back up NC programs in the FROM, set bit 2 (AAP) of parameter No. 10340 to 1 before backup operation.

[Backup procedure]

1. Put the machine in an emergency stop state.
2. Set bit 7 (EEB) of parameter No. 10340 to 1 to start backup. This parameter becomes 0 just after the backup sequence has started.
3. The execution status of backup can be checked with No. 1016 on the diagnosis screen described later.

NOTE

It takes time since the beginning of backup till the end of backup. So, if data being backed up is updated, it is likely that a mismatch may occur between the original data and backup data. When updating data in the CNC at an emergency stop, watch the automatic data backup in-progress signal ATBK and perform appropriate processing.

Backup execution status

In the backup modes used at power-on time, 10 dots “.” are used to indicate the execution status of backup. For example, the completion of backup is indicated with: “AUTO BACKUP :END

The diagnosis screen can also be used to check the execution status of backup as follows:

- No.1016#0 (AEX): Backup in progress
- No.1016#6 (ACM): Backup completed
- No.1016#7 (ANG): Error during backup
- No.1016#1 (DT1), #2 (DT2), #3 (DT3): Numbers of updated backup data items

- Write-protected backup data

Factory-set or post-adjustment machine status data can be held as write-protected backup data. The first piece (data 1) of backup data is handled as write-protected backup data.

This function is enabled by:

- Setting bit 1 (ABI) of parameter No. 10340 to 1
- Setting bit 2 (AAP) of parameter No. 10340 to 1 if also NC programs in the FROM must be backed up

Maintenance Manual



[Procedure for creating write-protected data]

1. Set bit 6 (EIB) of parameter No. 10340 to 1.
2. Turn the power for the CNC off and on again. When the power is turned on, the first piece of backup data is updated automatically, and bit 6 (EIB) of parameter No. 10340 becomes 0.

Then, the first backup data is handled as write-protected data until the same operation is performed again. The second and third pieces of backup data are updated each time another type of backup (automatic backup occurring every time the power is turned on, automatic backup occurring at intervals of a specified number of days when the power is turned on, or backup started manually at an emergency stop) is made.

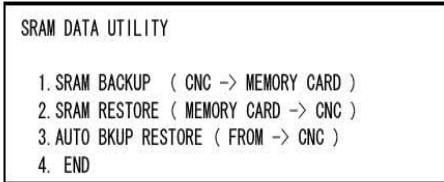
- Parity check

A parity check is made at backup. If a parity error is detected, the backup is not completed.

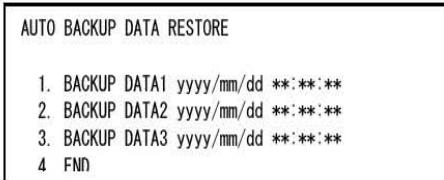
- Restoring backed-up data

With the BOOT SYSTEM, executing the following procedure can restore backed-up data from FROM.

1. From the BOOT's TOP menu, select "7. SRAM DATA UTILITY". The following menu appears. Select "3".



2. From the menu below, select data and run restore.



3. Exit BOOT.

Signal

Automatic data backup in-progress signal ATBK<F0520.0>

[Classification] Output signal

[Function] This signal is "1" during automatic data backup. When updating data in the CNC at an emergency stop, perform appropriate processing according to the state of this signal.

Signal address

F0520	#7	#6	#5	#4	#3	#2	#1	#0
								ATBK

Parameter

10340	#7	#6	#5	#4	#3	#2	#1	#0
	EEB	EIB				AAP	ABI	ABP

[Input type] Parameter input

[Data type] System-common type

0 **ABP** Automatic data backup at power-on is:

- 0: Disabled.
- 1: Enabled.

1 **ABI** Overwrite-protected backup data is:

- 0: Regarded as invalid.
- 1: Regarded as valid.

2 **AAP** Backup of NC programs in FROM is:

- 0: Disabled.
- 1: Enabled.

6 **EIB** When the CNC is turned on next, overwrite-protected backup data is:

- 0: Not updated.
- 1: Updated.

NOTE

This parameter is valid when bit 1 (ABI) of parameter No. 10340 is set to 1.

7 **EEB** When an emergency stop occurs, a backup operation is:

- 0: Not performed.
- 1: Performed.

10341	Interval at which automatic data backup is performed periodically
-------	---

Maintenance Manual



[Input type] Parameter input
[Data type] Word
[Unit of data] No unit
[Valid data range] 0 to 365

When automatic data backup is performed periodically, this parameter sets the interval as the number of days. When the power is turned on after a set number of days has passed from the date of the previous backup, a backup operation is performed. If 0 is set in this parameter, this function is disabled.

Diagnosis display

This function enables the status of backup execution to be checked.

1016	#7 ANG	#6 ACM	#5	#4	#3 DT3	#2 DT2	#1 DT1	#0 AEX
------	-----------	-----------	----	----	-----------	-----------	-----------	-----------

#0 AEX Indicates whether automatic data backup is being executed, as follows:

- 0: Not being executed
- 1: Being executed

#1 DT1 Indicates whether data 1 has been updated in the previous backup, as follows:

- 0: Not updated
- 1: Updated

#2 DT2 Indicates whether data 2 has been updated in the previous backup, as follows:

- 0: Not updated
- 1: Updated

#3 DT3 Indicates whether data 3 has been updated in the previous backup, as follows:

- 0: Not updated
- 1: Updated

#6 ACM Indicates whether automatic data backup has been executed, as follows:

- 0: Not executed
- 1: Executed

#7 ANG Indicates whether an error has occurred in automatic data backup, as follows:

- 0: Not occurred
- 1: Occurred

Caution

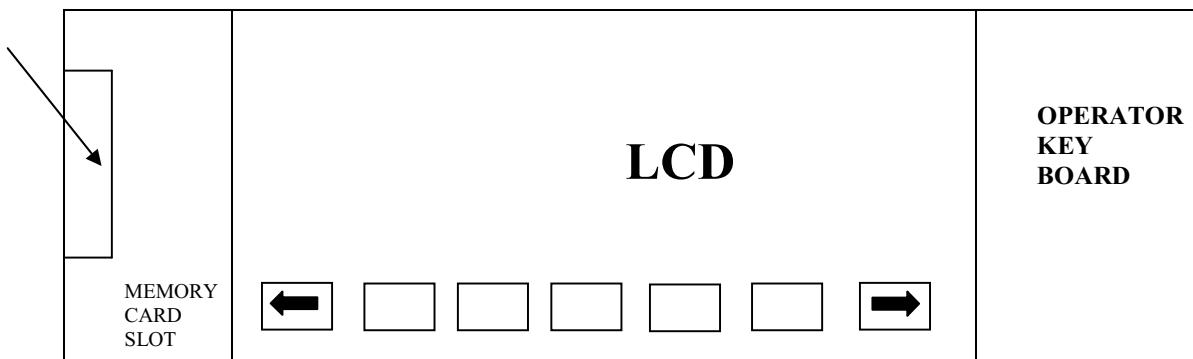
CAUTION

- 1 Do not turn off the power for the NC during backup or restoration.
- 2 If backed-up data is restored, parameters submitted to automatic backup are returned to the state in which they were when backed up. Change them as required.

COMMUNICATION PROCEDURES IN FANUC Oi CNC SYSTEMS :

Procedure for loading the logic from Memory Card (Flash Card) to Fanuc Oi CNC System

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the Oi CNC system Main Board Memory Card slot.
- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously



- System Monitor Main Menu is displayed on CRT as follows:
 - SYSTEM DATA LOADING
 - SYSTEM DATA CHECK
 - SYSTEM DATA DELETE
 - SYSTEM DATA SAVE
 - SRAM DATA BACKUP
 - MEMORY CARD FILE DELETE
 - MEMORY CARD FORMAT
 - END

Maintenance Manual

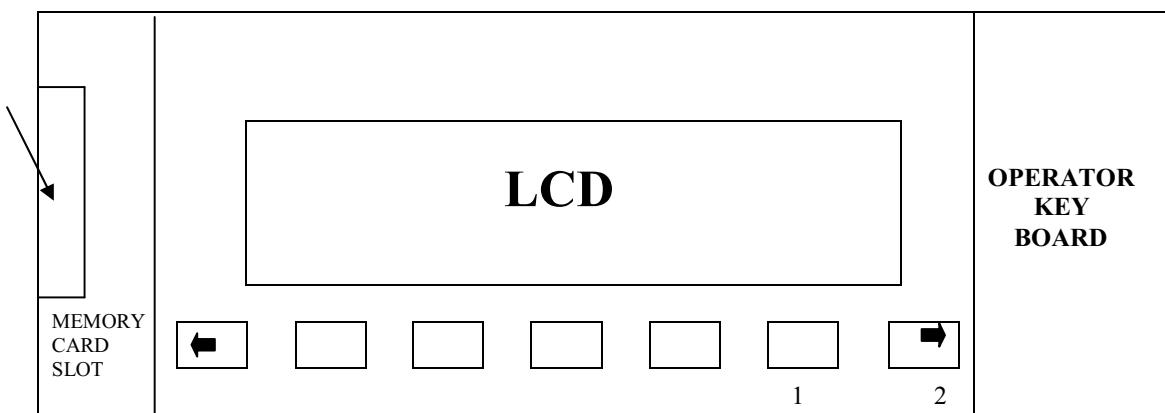


- Select 1 (**SYSTEM DATA LOADING**) with the help of [**UP**] and [**DOWN**] soft key.
- Press [**SELECT**] soft key and then select the required data (Eg.**PMC-RA.000**) with the help of [**UP**] and [**DOWN**] soft key
- Press [**SELECT**] soft key and then press [**YES**], once loading is complete press [**SELECT**] soft key and then select **END** by using [**UP**] and [**DOWN**] soft key.
- After **END** is selected press [**SELECT**] soft key and again select **END** in the **SYSTEM MONITOR MAIN MENU** by using [**UP**] and [**DOWN**] soft keys and then press [**SELECT**] soft key and press [**YES**] soft key.
- Loading **BASIC to DRAM** is displayed and system comes to **POS** screen.
- Switch off the whole machine and remove the Memory Card/Flash Card.

NOTE : While carrying out the above procedure, please do not press any other keys.

Procedure for loading the logic from Fanuc OI CNC System to Memory Card(Flash Card)

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.



- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously

- System Monitor Main Menu is displayed on CRT as follows:
 - SYSTEM DATA LOADING
 - SYSTEM DATA CHECK
 - SYSTEM DATA DELETE
 - SYSTEM DATA SAVE
 - SRAM DATA BACKUP
 - MEMORY CARD FILE DELETE
 - MEMORY CARD FORMAT
 - END
- Select 4 (**SYSTEM DATA SAVE**) with the help of [**UP**] and [**DOWN**] soft key.
- Press [**SELECT**] soft key (File directory will open)
-  soft key select required Data (Eg. PMC-RA(1)) by using [**UP**] and [**DOWN**] soft key. Press [**SELECT**] soft key.
- Press [**YES**], once saving is complete select **END** by using [**UP**] and [**DOWN**] soft key.
- After **END** is selected press [**SELECT**] soft key and again select **END** in the **SYSTEM MONITOR MAIN MENU** by using [**UP**] and [**DOWN**] soft keys and then press [**SELECT**] soft key and press [**YES**] soft key.
- Switch off the whole machine and remove the Memory Card/Flash Card.

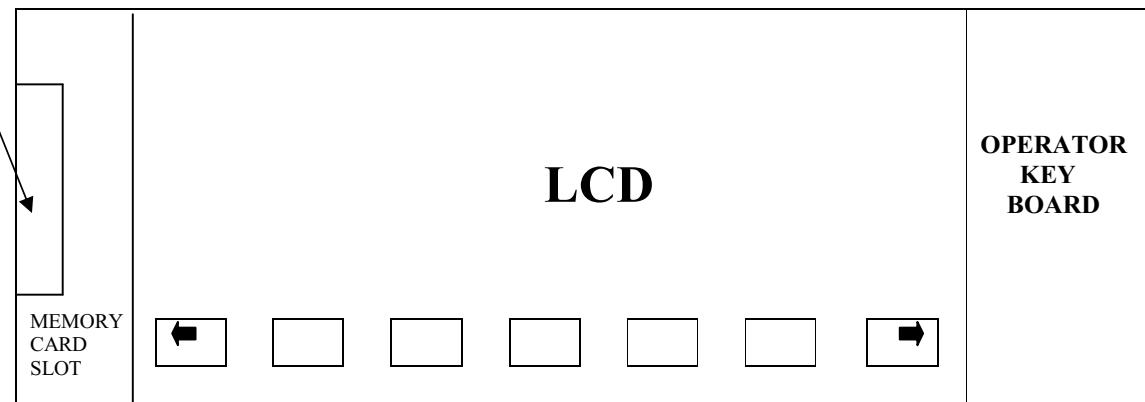
NOTE : While carrying out the above procedure, please do not press any other keys.

Maintenance Manual



Procedure for Program Transfer from Fanuc OI CNC System to Memory Card (Flash Card)

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.

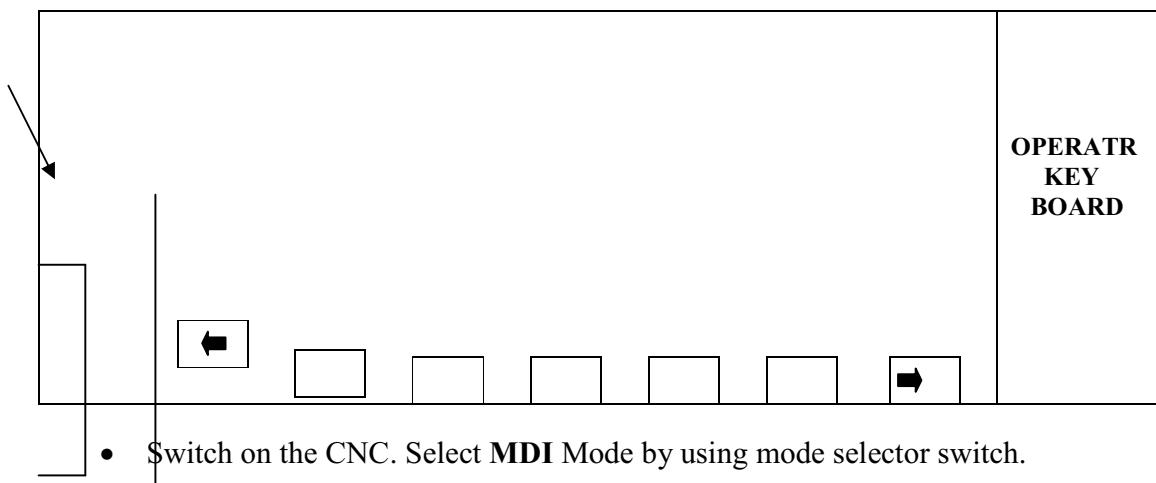


- Switch on the CNC. Select **MDI** Mode by using mode selector switch.
- Press **OFFSET** Key of operator key board Twice.
- Make **Parameter write = 1 and I/O Channel = 4.**
- Select **EDIT** Mode by using mode selector switch.
- Press **Program** key of operator key board.
- Type the program No. which you want to send.
- Soft key.
- Press **PUNCH** and then press **EXE**.

NOTE : While carrying out the above procedure, please do not press any other keys.

Procedure for Program Transfer from Memory Card (Flash Card) to Fanuc OI CNC System:

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.



- Switch on the CNC. Select **MDI** Mode by using mode selector switch.
- Press **OFFSET** Key of operator key board twice.
- Make **Parameter write = 1 and I/O Channel = 4.**
- Select **EDIT** Mode by using mode selector switch.
- Press **Program** key of operator key board.
- Type the program No. which you want to Receive.
- Soft key.
- Press **READ** and then press **EXE**.

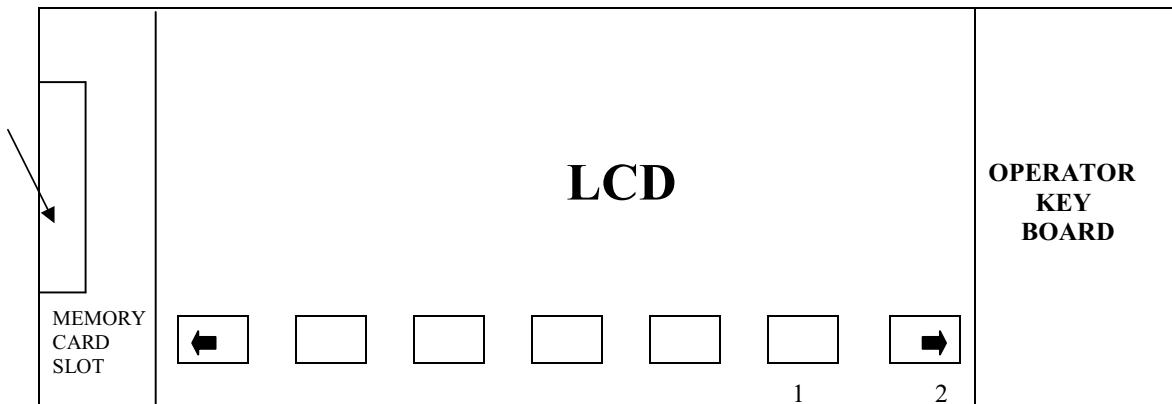
NOTE : While carrying out the above procedure, please do not press any other keys.

Maintenance Manual



PROCEDURE TO LOAD SRAM DATA FROM FANUC OI CNC SYSTEM TO FLASH CARD

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.



- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously
- System Monitor Main Menu is displayed on CRT as follows:
 - SYSTEM DATA LOADING
 - SYSTEM DATA CHECK
 - SYSTEM DATA DELETE
 - SYSTEM DATA SAVE
 - SRAM DATA BACKUP
 - MEMORY CARD FILE DELETE
 - MEMORY CARD FORMAT
 - END
- Select 5 (SRAM DATA BACKUP) with the help of [UP] and [DOWN] soft key.
- Press [SELECT] soft key and then select the required data by pressing [UP] and [DOWN] soft key.

- Select the following by using [UP] and [DOWN] soft keys & press [SELECT] soft key
 - RESTORE SRAM (CNC -MEMORY CARD -)
- Now Select **SRAM 1** from the displayed
- Press [SELECT] soft key and then press [YES], once loading is complete Select the SRAM 2 also & load
- Press [SELECT] soft key and then select **END** by using [UP] and [DOWN] soft key.
- After **END** is selected press [SELECT] soft key and again select **END** in the **SYSTEM MONITOR MAIN MENU** by using [UP] and [DOWN] soft keys and then press[SELECT] soft key and press [YES] soft key.
- While saving the logic file to card file name like **SRAM1 0A** will appear on the screen .Same file we have to select while loading.
- Switch off the whole machine and remove the Memory Card/Flash Card.

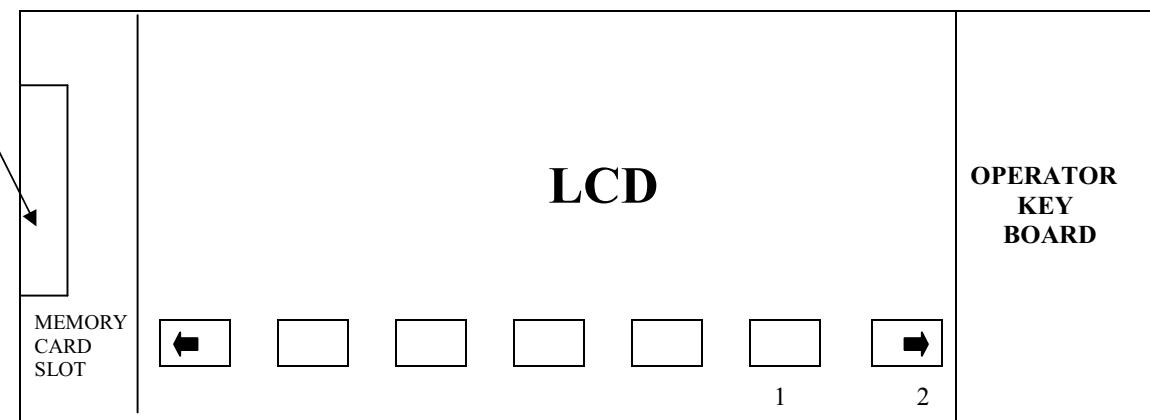
NOTE : While carrying out the above procedure, please do not press any other keys.

Maintenance Manual



PROCEDURE TO LOAD SRAM DATA FROM FLASH CARD TO FANUC OI CNC SYSTEM

- Switch off the CNC Machine.
- Insert the Memory Card provided by us into the OI CNC system Main Board Memory Card slot.



- Switch on the CNC by holding CNC soft keys 1 and 2 simultaneously
- System Monitor Main Menu is displayed on CRT as follows:
 - SYSTEM DATA LOADING
 - SYSTEM DATA CHECK
 - SYSTEM DATA DELETE
 - SYSTEM DATA SAVE
 - SRAM DATA BACKUP
 - MEMORY CARD FILE DELETE
 - MEMORY CARD FORMAT
 - END
- Select 5 (SRAM DATA BACKUP) with the help of [UP] and [DOWN] soft key.

Press [SELECT] soft key and then select the required data by pressing [UP] and [DOWN] soft key.

- Select the following by using [UP] and [DOWN] soft keys & press [SELECT] soft key
 - **RESTORE SRAM (MEMORY CARD -) CNC**
- Press [SELECT] soft key and then press [YES]
- Press [SELECT] soft key and then select **END** by using [UP] and [DOWN] soft key.
- After **END** is selected press [SELECT] soft key and again select **END** in the **SYSTEM MONITOR MAIN MENU** by using [UP] and [DOWN] soft keys and then press[SELECT] soft key and press [YES] soft key.
- While saving the logic file to card file name like **SRAM1 0A** will appear on the screen .Same file we have to select while loading.
- Switch off the whole machine and remove the Memory Card/Flash Card.

NOTE : While carrying out the above procedure, please do not press any other keys.

Maintenance Manual



PROCEDURE TO READ INPUT / OUTPUT SIGNALS :

- a. Press System key on CRT/MDI Panel.
- b. Press soft key [PMC] , then PMC screen is displayed.
- c. Press soft key [PMCDGN] then PMC's diagnostic screen is displayed.
- d. Press soft key [STATUS] .
- e. To search a specified address or signal name, input address number or signal name and press [SEARCH].

Note – X 0 - X 127– Input signals from Machine Tools.
Y0 – Y 127 – Output signals to Machine Tools.

PROCEDURE FOR PARAMETER DISPLAY :

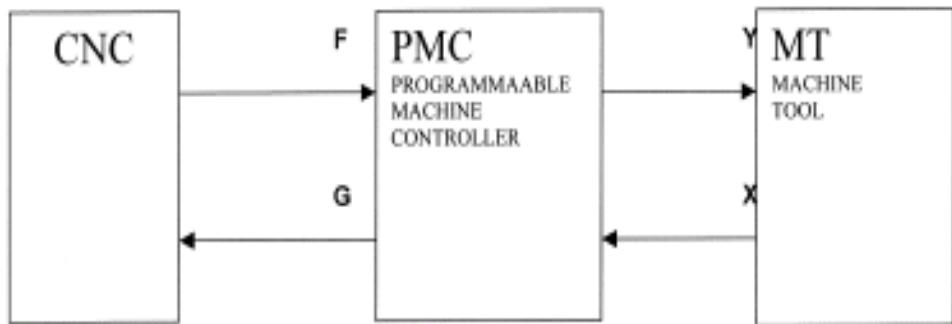
- a. Press System key on CRT/MDI Panel.
- b. Press soft key [PARAM].
- c. To search a specific parameter, input parameter no. and press [SEARCH].

PROCEDURE FOR SETTING PARAMETER :

MAINTENANCE MANUAL PAGES

NOTE : YOU ARE REQUESTED TO CONTACT EITHER M/S. **MICROMATIC** MACHINE TOOLS PVT. LTD., OR M/S. **ACE DESIGNERS** LTD., BEFORE CHANGING ANY PARAMETER.

INPUT / OUTPUT :



1. INPUT :

These are signals from the Machine tool to PMC system. These are designated by letter "X" followed by the No.

Example : X 000.0



2. OUTPUT :

These are signals to the Machine tool from the PMC system. These are designated by letter "Y" followed by the No.

Example : Y 001.0

3 Signals from PMC (Programmable Machine Controller) to CNC is designated by letter "G" followed by the No.

Example : G0007.2

4 Signal from CNC to Programmable Machine Controller (PMC) is designated by letter "F" followed by the No.

Example : F0094.0

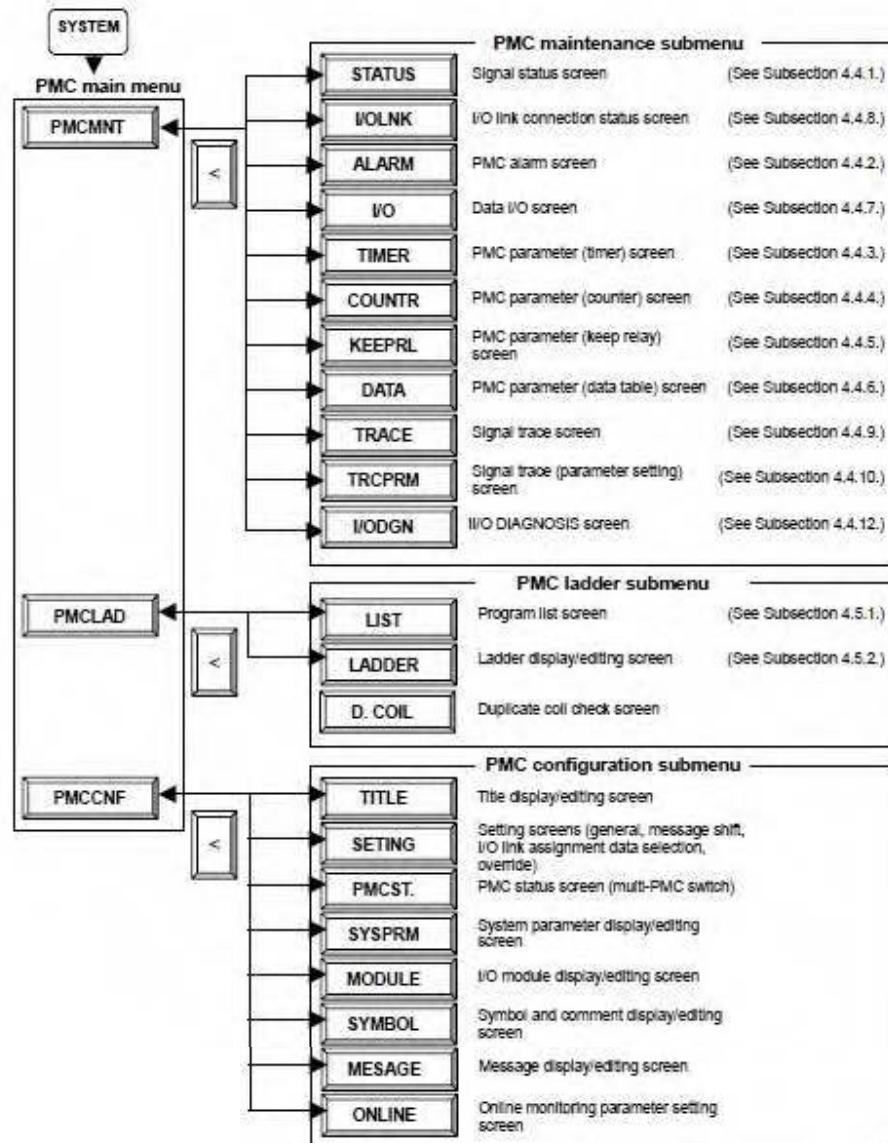
5 All Internal user flags are called Internal relays and are designated by letter "R" followed by the No.

Example : R 600.3

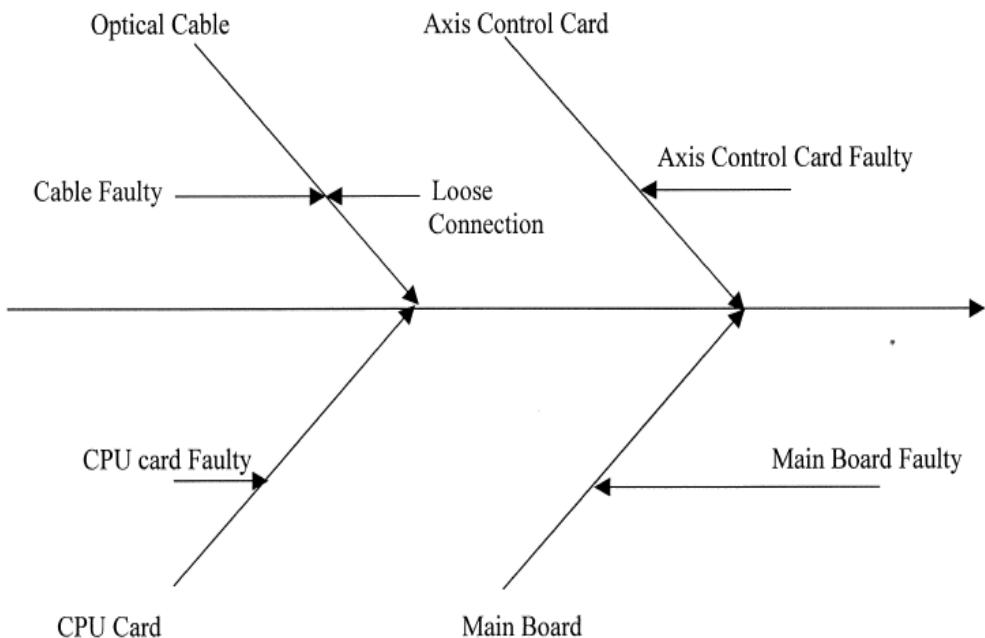
6 The Timers and Counter values are designated by letter "T" and "c" respectively.

Transition of the PMC Screens

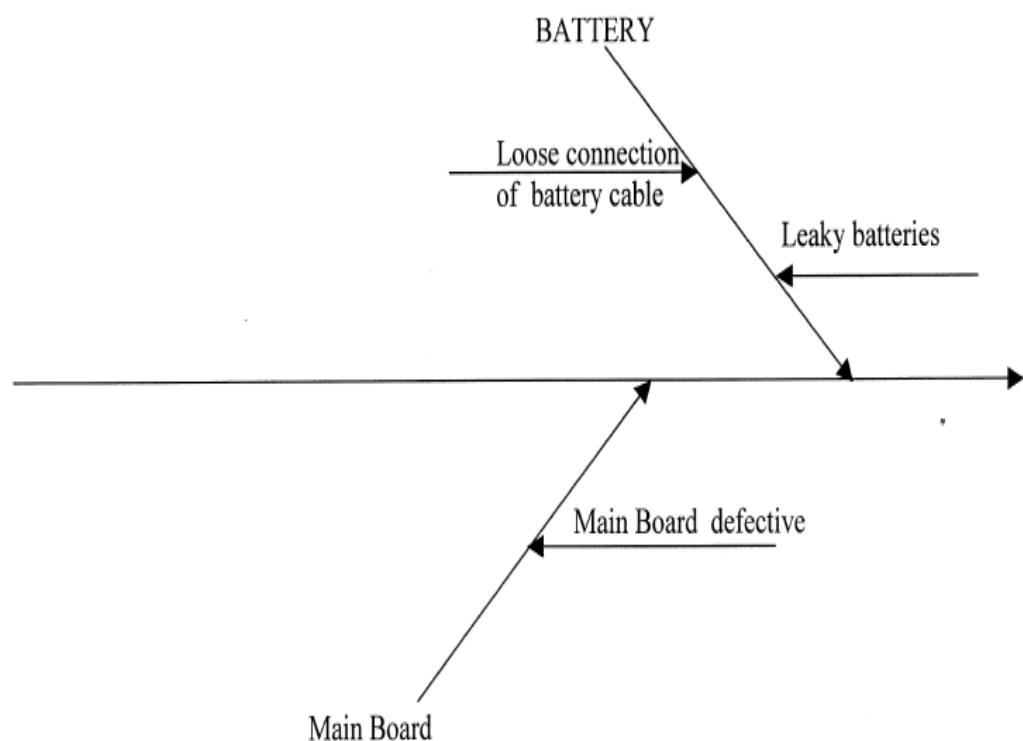
Maintenance Manual



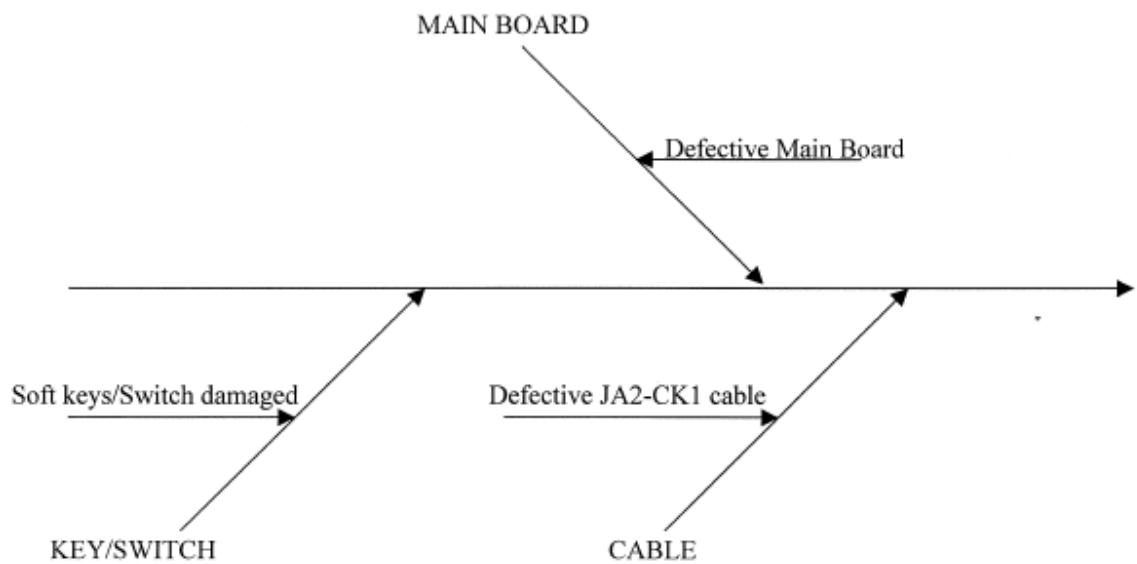
ALARM 920 (SERVO ALARMS)



BAT ALARM



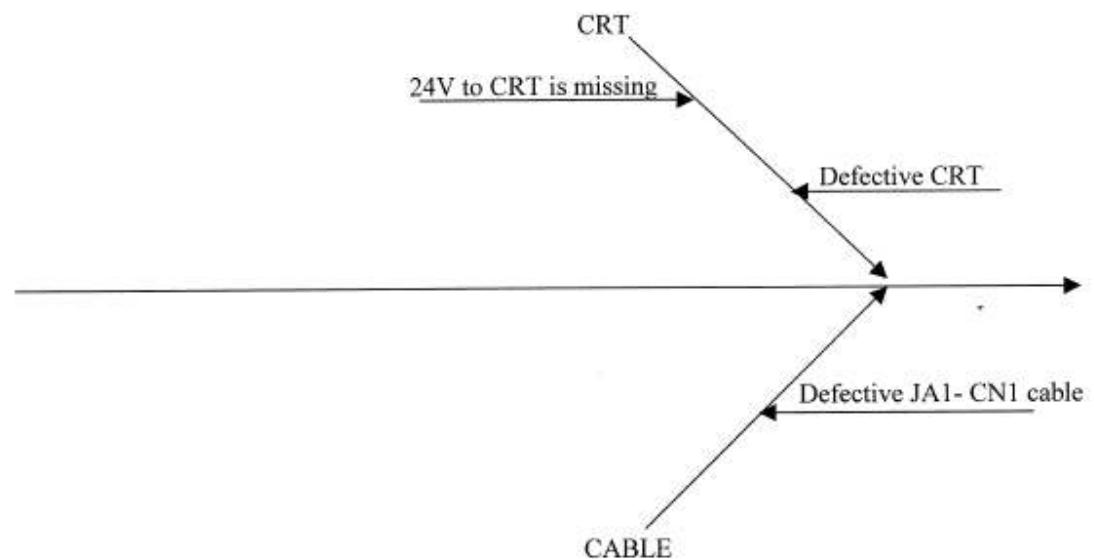
MDI PANEL KEYS NOT FUNCTIONING



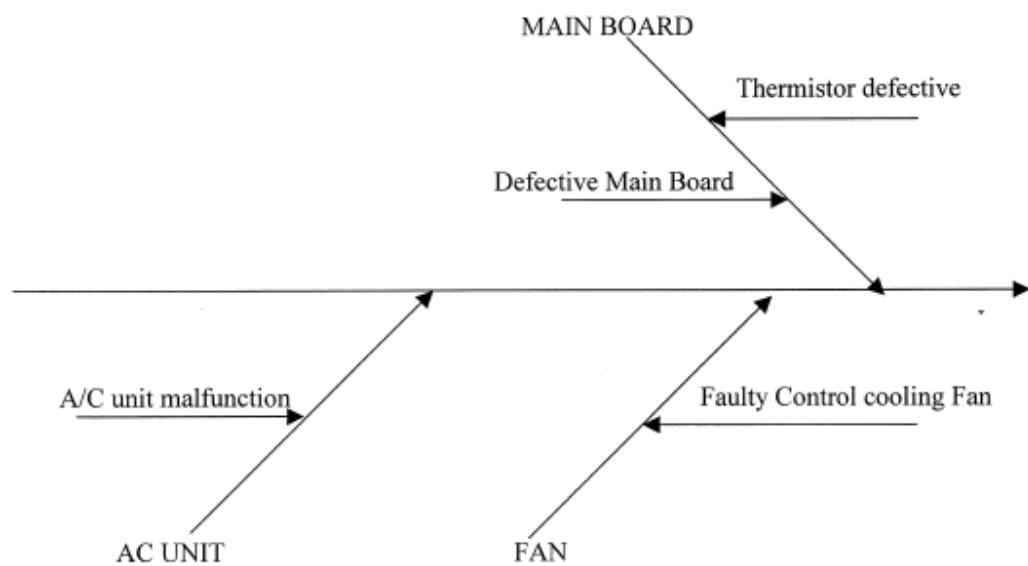
Maintenance Manual



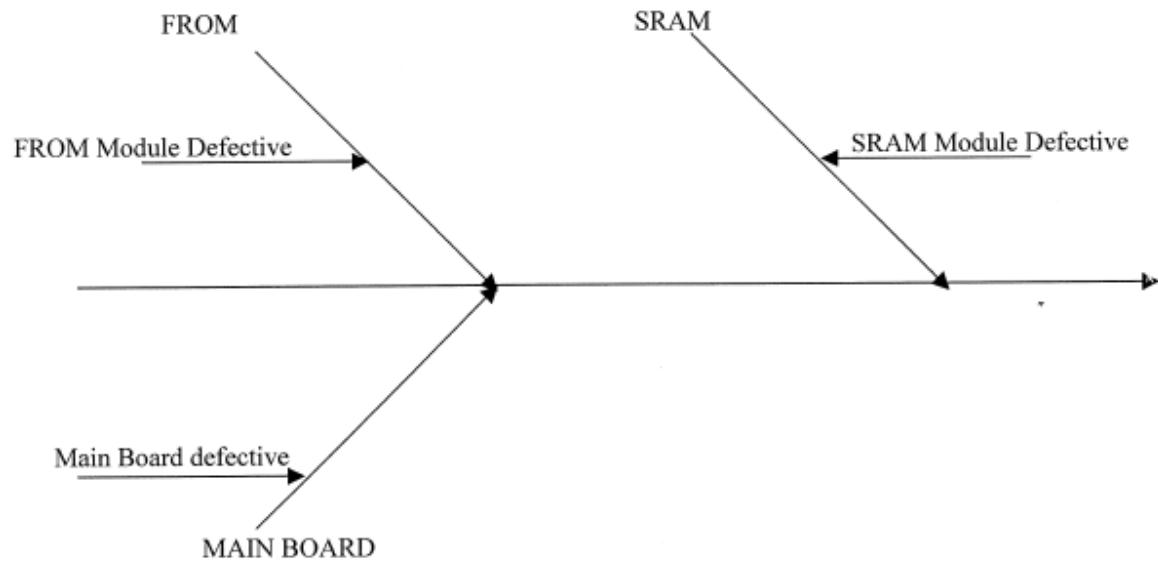
CRT DISPLAY NOT COMING BUT ALL OTHER M/C FUNCTION ARE OK



OVERHEAT ALARM 700 /701



ALARM 900 (ROM PARITY ERROR)



**RS 232 COMMUNICATION WITH
FANUC CNC SYSTEM-0i**

COMMUNICATION PROCEDURE

The Parameters, timer / counter values, Part Programs, Offset values etc., are communicated with CNC and PC.

TO Download the Partprogram from the CNC System :

At the computer end – use ACEICAPS communication software.

- Select **Settings, Enable Settings**, Enter the password as **Cadem**. The password is case sensitive.
- Select Settings Machine Data. Click on the Add button.
In the dialog box change the following parameters, leaving all the remaining entries unaltered.
 - Machine Name = Machine 1
 - Control System = F
- Click on **DNC Param** tab
Select the valid Com Port number (e.g. Com1 or Com2)
 - Baud rate = 4800
 - Parity = Even
 - Data bits = 7
 - Stop bits = 2
 - Handshake = None
- Leave all the other settings in the remaining tabs unaltered.
- Click on the OK button to exit Add machine dialog box.

You have now configured the communication parameters on the PC. The similar settings has to be made on the machine controller too.

Note: Plug in the RS-232C cable at PC end as well as CNC system end after switching off the power.

Receiving the program from machine to PC.

Now, the receiving end is the PC

On the PC,

- Double click on the machine & select Receive program from the menu that appears.
- In the dialog box that appears, enter From machine as the file name in which the received program must be saved.
- Click on the save button.

Now the PC is ready to receive the program from the Machine.
If the communication is successful, DNC will give a message **Program Received**. Check the program in the NC Editor.

On the CNC

- Select EDIT mode
- Press Program key in MDI panel and press soft key [PRGM] to display program text.
 Press [(OPRT)] key and press soft key 
- Input a program number to be output.
- Press [PUNCH] and [EXEC] key, then program output is started.

Now the message OUTPUT on the CRT starts flashing, stating that communication is under progress.

After communication is complete, the flashing OUTPUT message on the CRT disappears.

NOTE: The parameters to be checked at CNC end if communication is not taking place are as follows;

0000 bit 1 = 1
0020 = 1
0111 bit 0 =1
0112 = 4
0113 = 10

TO UPLOAD THE PROGRAM FROM PC TO CNC (FANUC SYSTEM)

AT CNC END:

- Select EDIT mode
- Keep "Program Protect Key" switch in ON position.
 Press PROG key in MDI Panel .
- Press soft key (OPRT) , 
- Press soft key (READ) and (EXEC), then data input is started

AT PC END:

- Select DNC, Manual Mode.
- Double click on the machine and select Receive Program from the menu that appears.
- In the dialog box that appears, select a program file (Program file will have an extension .PRG)
- Click on the Open button.

If the communication is successful, DNC will give a message

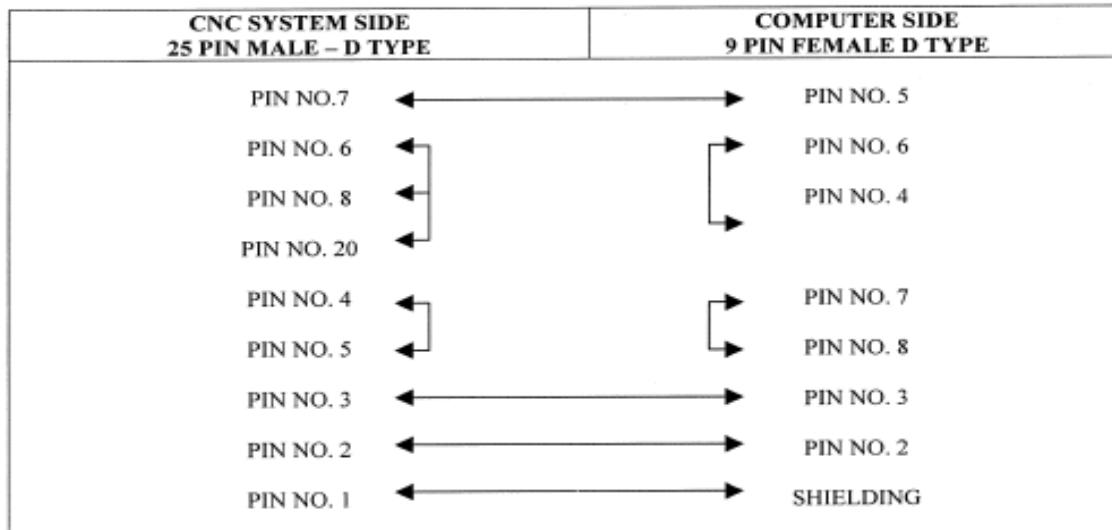
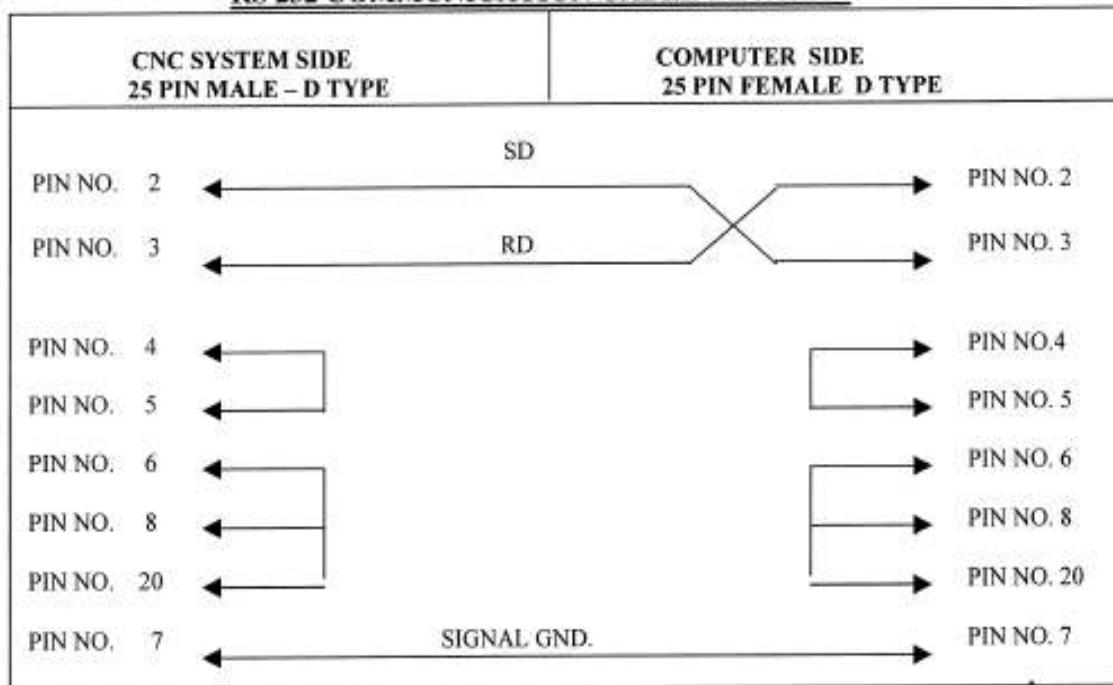
Program Transmitted. Check the program on the CNC.

When the communication is going on, the CNC will display message INPUT (flashing).
After the communication is completed the message INPUT disappears from the CRT stating that the communication is complete.

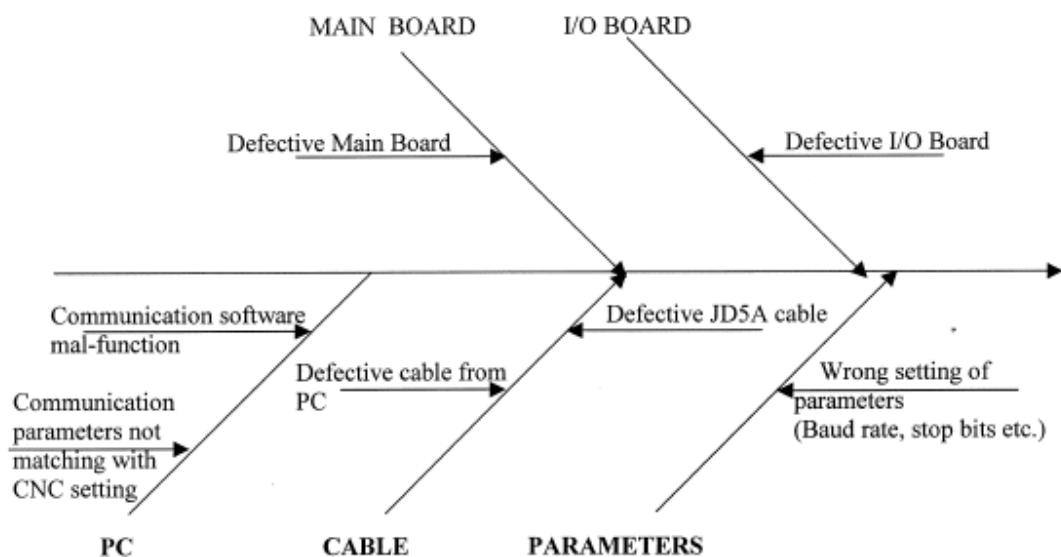
Maintenance Manual



RS 232 COMMUNICATION CABLE DETAILS :



RS232 COMMUNICATION ALARM 85 ~ 87



Maintenance Manual



STUDY OF POWER SUPPLY MODULE :

Specification of PSM-11i power supply module :

- | | | |
|--|---|--|
| 1. Input supply / Control power supply | → | 200V AC + 10% - 15%, 3 phase
50/60HZ ± 1 Hz |
| 2. Rated power output capacity | → | 11 KW |
| 3. Maximum output capacity | → | 20 KW |
| 4. Control method | → | Regenerative control |
| 5. Ambient temperature | → | 0° to 55°C |

Specification of PSM – 15i power supply module :

- | | | |
|--|---|---|
| 1. Input supply / control power supply | → | 200V AC +10% - 15%, 3 phase
50/60 HZ ± 1 Hz. |
| 2. Rated power output capacity | → | 15 KW |
| 3. Maximum output capacity | → | 28 KW |
| 4. Control method | → | Regenerative control |
| 5. Ambient temperature | → | 0° to 55°C |

Specification of PSM – 26i Power supply module :

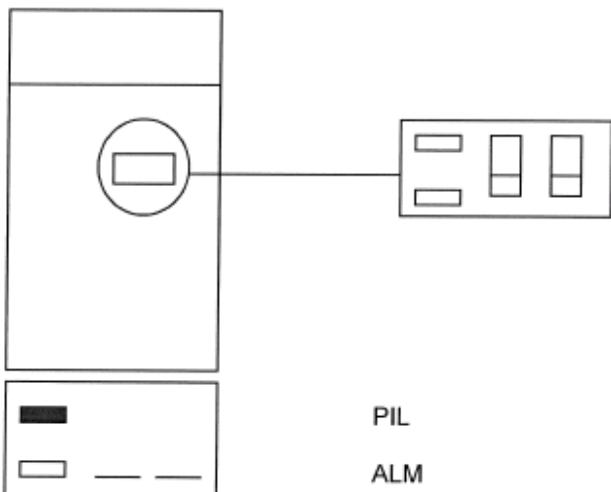
- | | | |
|--|---|---|
| 1. Input supply / control power supply | → | 200V AC + 10% - 15%, 3 phase,
50/60 Hz ± 1 Hz. |
| 2. Rated output capacity | → | 26 KW. |
| 3. Maximum output capacity | → | 40 KW |
| 4. Ambient temperature | → | 0° to 55°C. |

Power supply module supplies power to the servo and spindle amplifier modules by converting three phase 200 VAC input to DC. When Servo motors / Spindle motors are decelerated, the Power Supply Module return the energy generated by deceleration action to the power supply, forced air cooling is required.

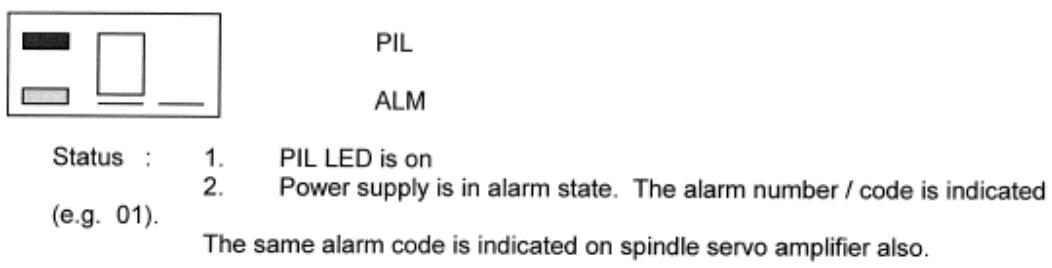
FOLLOWING VOLTAGES ARE GENERATED IN PSM.

- 300V DC BUS
- +5V, +24V DC, DC control voltages

STATUS DISPLAY ON POWER SUPPLY MODULE



Status : 1. PIL LED is on
 2. DC bus not generated.
 3. Power supply module is in NOT READY state.



Status : 1. PIL LED is ON.
DC BUS voltage is generated.
Power supply is READY.

Maintenance Manual



TROUBLE SHOOTING OF PSM MODULE :

If an alarm occurs, a RED LED (ALM LED) and 7-segment LED on the front of the power supply module indicates alarm number as explained earlier. The same alarm number is also indicated on spindle amplifier also.

ALARM NO. 1 :

Description :

The main circuit power module (IPM) has detected an abnormal condition .PSM 5.5i-15i
Over current has flown in the input of the main circuit - for PSM 15i, PSM 26i.

Causes :

I/P supply voltage

IGBT or Main circuit power module IPM is defective.

AC reactor has failed or AC reactor is not matching with PSM in use

Loose connection in CXA2A –CXA2B looping cable.

Remedy :

Check 200VAC 3 phase supply to PSM.

Replace IGBT

Check AC reactor specification.

Replace PSM.

ALARM NO. 2 :

Description :

Cooling fan for the control circuit has stopped.

Causes :

1. Cooling fan motor failed.

2. Cooling fan broken.

3. Loose connections in fan connection and CXA2A/CXA2B looping cable.

Remedy :

Replace the fan.

Check for loose connections.

ALARM NO. 03 :

Description :

The temperature of the main circuit heat sink has risen abnormally (overload alarm).

Causes :

Cooling of heat sink is not effective.

Air Circulation failure.

Device faulty (short).

Loose connection in CXA2A/CXA2B looping cable.

Remedy :

1. Check cutting conditions.

2. Check electrical cabinet temperature.

Defective control card.

Failure of IPM / IGBT module.

ALARM NO. 4 :

Description :

The DC voltage in the main circuit is too low.

Causes :

Loose connection at 200v 3 PHASE 50 Hz input supply to PSMi.

Defective power cable.

Defective PSM

Loose connection in CXA2A/CXA2B looping cable.

Remedy :

Check 200v 3 phase 50 Hz supply.

Replace cable.

Replace PSM

Faulty input contactor of PSMi (K10).

ALARM NO. 5:

Description :

The Input power supply is abnormal (open phase)

Causes :

Loose connection at the 200V 3phase 50Hz input supply to PSMi

Defective K10 contactor

Defective PSMi

Remedy :

Check 200v 3 phase 50 Hz supply

Change P.S. module.

Replace K10 contactor

Maintenance Manual



ALARM NO. 6 :

Description :

The control power supply voltage decrease

Causes :

1. Loose connection at the 200V 3phase 50Hz input supply to PSMi
2. Loose connection at K10 contactor / CXA2A/CXA2B looping cable.

Remedy :

1. Check 200V 3 phase 50Hz AC supply to PSMi.
2. Eliminate loose connections.

ALARM NO. 7 :

Description :

The DC power voltage in the main circuit is too high.

Causes :

1. A voltage greater than 200V + 10% is applied to PSM.
2. Loose connection at power section / CXA2A/CXA2B looping cable.
3. Defective PSM.

Remedy :

1. Check power transformer tapping.
2. Check for loose connection at contactor / circuit breaker end.
3. Replace PSMi.

PREVENTIVE MAINTENANCE FANUC SERVO MOTOR :

Vibration and noise :

Check the motor for abnormal vibration (by the hand) and noise when motor is –

1. Not rotating
2. Rotating at low speed
3. Accelerating or decelerating.

If unusual noise contact either local Micromatic Office or M/s. ACE Designers Ltd., Bangalore.

- Clean the dust on the motor daily.
- Check for damage on Motor cover (red plastic) for crevices and the Motor surface (black coating) for scratches and cracks.
If red cover is damaged replace it immediately.

4. Stains and Smudges :

Check the motor surface and bolt holes for oil or cutting fluid. Wipe off oil and cutting fluid on the motor surface periodically. Oil or cutting fluid can damage the coating by chemical reaction leading to the failure of motor.

TROUBLE SHOOTING OF SERVO AMPLIFIER MODULE :

The 7-segment LED on the front of the servo amplifier module indicates the alarm number.

ALARM NO. 1 :

Description :

The fan built into the servo amplifier module has stopped.

Causes & Remedy :

Check whether any foreign material in the fan.

Check that fan connector is attached correctly.

Replace the fan.

Replace the SVM

ALARM NO. 2 :

Description :

The control power supply under voltage

Causes :

200V input supply to PSM is below 0.85 times the rated voltage.

Defective servo amplifier

Loose connection in CXA2A-CXA2B looping cable.

Remedy :

a. Check input supply 200V AC to the PSMi.

b. Replace servo amplifier.

Maintenance Manual



ALARM NO. 5 :

Description :

The DC voltage in the main circuit is too low.

Causes :

Loose connection at the DC Link

Input voltage to PSM is less than 15% of the rated value.

Defective servo amplifier.

Loose connection in CXA2A-CXA2B looping cable

Remedy :

a. Check input 200V AC supply to PSM.

b. Defective servo amplifier.

c. Defective power contactor (K10) of PSM.

ALARM NO. 8 ,9,A (X,Z,3rd Axis) :

Description :

Invertor : IPM alarm

Remedy :

a. Defective Axis Motor Power Cable

b. Deterioration of Motor Insulation

c. Defective SVM

ALARM NO. 8,9,A (X,Z,3rd Axis) :

Description :

Invertor IPM Alarm (OH)

Remedy :

a. Check that Heat sink cooling fan is running

b. Over load operations

Cooling capacity of cabinet is sufficient

Ambient temperature is not too high

Defective SVM

ALARM NO. b,c,d (X,Z, 3rd Axis) :

Description :

Abnormal Invertor Motor Current

Causes :

a. Defective power cable.

c. Defective servo amplifier.

d. Defective servo motor.

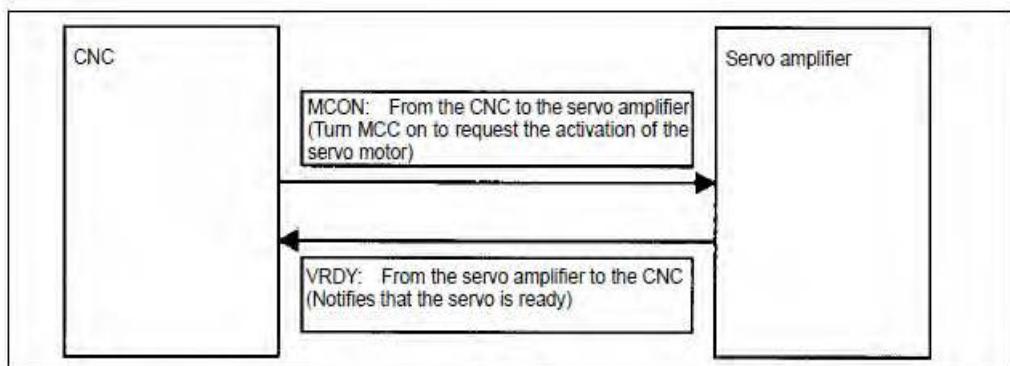
ALARM SV0404 (V READY ON)

Causes and Countermeasures

This alarm is issued if the servo ready signal (VRDY) of a servo amplifier remains on.

The servo amplifier or the axis control cards on the CNC may be defective.

- VRDY



The exchange of this information is performed via the FSSB (optical cable).

This alarm is issued if VRDY remains on when the CNC turns MCON off or if VRDY turns on before the CNC turns MCON on.

The exchange of this information is performed via the FSSB (optical cable).

This alarm is issued if VRDY remains on when the CNC turns MCON off or if VRDY turns on before the CNC turns MCON on.

- Replacing the servo amplifier

The servo amplifier may be defective. Replace the servo amplifier.

- Replacing the axis cards

If replacing the servo amplifier does not solve the problem, replace the axis cards.

ALARM OH0701 (OVERHEAT: FAN MOTOR)

Causes and Countermeasures

This alarm is issued if a fault occurs in any of the fan motors, such as the stoppage of a fan motor during the operation of the CNC.

- Fan motors

Fan motors are installed in the uppermost portion of the CNC control unit. This alarm is issued if a fault such as a stoppage occurs.

If this alarm is issued, replace the fan motor according to "Replacing the fan motor".

ALARM SV5134 (FSSB: OPEN READY TIME OUT)
ALARM SV5137 (FSSB: CONFIGURATION ERROR)
ALARM SV5197 (FSSB: OPEN TIME OUT)

Causes and Countermeasures

These alarms are issued due to a failure in the optical cable, axis control card, or a slave such as a servo amplifier connected to the FSSB.

No.	Message	Description
SV5134	FSSB:OPEN READY TIME OUT	In the initialization, the FSSB could not be in an open ready state. The axis card is thought to be defective.
SV5137	FSSB:CONFIGUR ATION ERROR	An FSSB configuration error occurred. The connecting amplifier type is incompatible with the FSSB setting value.
SV5197	FSSB:OPEN TIME OUT	The FSSB cannot be opened even though the CNC allowed the FSSB to be opened. Or, the connection between the CNC and the amplifier is incorrect.

- Checking the parameter settings

Check that the FSSB-related parameters are set correctly.

- Power supplies of the servo amplifiers

Check the power supplies of the servo amplifiers connected to the FSSB.

- Replacing the axis control cards, optical cables, and servo amplifiers

Replace the axis control cards on the CNC.

Replace the optical cables and servo amplifiers connected to the FSSB, one at a time, to identify the defective item.

ALARM SV5136 (FSSB: NUMBER OF AMPS IS SMALL)

Causes and Countermeasures

The number of servo amplifiers recognized by the FSSB is insufficient, compared with the number of controlled axes.

- FSSB setting screen

If this alarm is issued, display the amplifier setting screen from the FSSB setting screen. Only the servo amplifiers recognized on the FSSB are displayed.

- Optical cable or servo amplifier

The optical cable that connects together the last recognized amplifier and the next one may be defective.

Or, either of the amplifiers connected together with that optical cable may be defective. Check the power supplies of the amplifiers.

- Power fault of a servo amplifier

This alarm may be issued if a power fault occurs in a servo amplifier. A power fault occurs if the amplifier control power supply voltage drops, if the +5 V conductor of the Pulsecoder cable is ground, or for other reasons.

- Axis control cards

The axis control cards installed on the CNC may be defective.

SERVO ALARMS (SV04**, SV06**)

For an explanation of the following servo alarms, refer to the FANUC AC SERVO MOTOR *ai* series, AC SPINDLE MOTOR *ai* series, SERVO AMPLIFIER *ai* series Maintenance Manual (B-65285EN).

Number	Message	Description
SV0417	ILL DGTL SERVO PARAMETER	<p>A digital serve parameter setting is incorrect. [When bit 4 of diagnosis information No. 203 is 1.]</p> <p>An illegal parameter was detected by the servo software. Identify the cause with reference to diagnosis information No. 352.</p> <p>[When bit 4 of diagnosis information No. 203 is 0.]</p> <p>The CNC software detected an illegal parameter. Probable causes are given below (see diagnosis information No. 280).</p> <ol style="list-style-type: none"> 1) The value specified in parameter No. 2020 as the motor model falls outside the specified range. 2) The motor rotation direction in parameter No. 2022 is not set to a correct value (111 or -111). 3) The speed feedback pulse count per motor rotation in parameter No. 2023 is set to a negative or other incorrect value. 4) The position feedback pulse count per motor rotation in parameter No. 2024 is set to a negative or other incorrect value.
SV0420	SYNC TORQUE EXCESS	In feed axis control, for synchronization, the difference value of torque between a master and slave axes exceeded the parameter (No. 2031) setting value. This alarm occurs for a master axis.
SV0421	EXCESS ERROR(SEMI-FULL)	The difference between the feedback from the semi and full sides exceeded the setting of parameter No. 1729.
SV0422	EXCESS VELOCITY IN TORQUE	In torque control, the commanded permissible velocity was exceeded.
SV0423	EXCESS ERROR IN TORQUE	In torque control, the total permissible move value specified as a parameter was exceeded.
SV0430	SV MOTOR OVERHEAT	The servo motor has overheated.
SV0431	CNV. OVERLOAD	Power Supply (PS) : Overheat Servo Amplifier : Overheat

Number	Message	Description
--------	---------	-------------

Maintenance Manual



SV0432	CNV. LOW VOLT CONTROL	Power Supply (PS) : The control power supply voltage has dropped. Servo Amplifier : The control power supply voltage has dropped.
SV0433	CNV. LOW VOLT DC LINK	Power Supply (PS) : Low DC link voltage Servo Amplifier : Low DC link voltage
SV0434	INV. LOW VOLT CONTROL	Servo Amplifier : Low control power voltage
SV0435	INV. LOW VOLT DC LINK	Servo Amplifier : Low DC link voltage
SV0436	SOFTTHERMAL(OVC)	The digital servo software detected a software thermal (OVC).
SV0437	CNV. OVERCURRENT POWER	Power Supply (PS) : Overcurrent on input circuit section.
SV0438	INV. ABNORMAL CURRENT	Servo Amplifier : Motor overcurrent
SV0439	CNV. OVER VOLT DC LINK	Power Supply (PS) : The DC link voltage is too high. Servo Amplifier : The DC link voltage is too high.
SV0440	CNV. EX DECELERATION POW.	Power Supply (PS) : Excessive generative discharge Servo Amplifier : Excessive generative discharge, or abnormal error in generative power circuit
SV0441	ABNORMAL CURRENT OFFSET	The digital servo software detected an abnormality in the motor current detection circuit.
SV0442	CNV. CHARGE FAILURE	Power Supply (PS) : The spare charge circuit for the DC link is abnormal.
SV0443	CNV. COOLING FAN FAILURE	Power Supply (PS) : Internal cooling fan failure. Servo Amplifier : Internal cooling fan failure.

Number	Message	Description
SV0444	INV. COOLING FAN FAILURE	Servo Amplifier : Internal cooling fan failure.
SV0445	SOFT DISCONNECT ALARM	The digital servo software detected a disconnected Pulsecoder.
SV0446	HARD DISCONNECT ALARM	The hardware detected a disconnected built-in Pulsecoder.
SV0447	HARD DISCONNECT(EXT)	The hardware detected a disconnected separate detector.
SV0448	UNMATCHED FEEDBACK ALARM	The sign of the feedback signal from the standalone detector is opposite to that from the feedback signal from the built-on Pulsecoder.
SV0449	INV. IPM ALARM	Servo Amplifier : The IPM (Intelligent Power Module) detected an alarm.
SV0453	SPC SOFT DISCONNECT ALARM	Software disconnection alarm of the α Pulsecoder. Turn off the power to the CNC, then remove and insert the Pulsecoder cable. If this alarm is issued again, replace the Pulsecoder.

Number	Message	Description

SV0454	ILLEGAL ROTOR POS DETECT	The magnetic pole detection function terminated abnormally. The magnetic pole could not be detected because the motor did not run.
SV0456	ILLEGAL CURRENT LOOP	An attempt was made to set the current loop that could not be set. The amplifier pulse module in use does not comply with HIGH SPEED HRV. Or, requirements to control are not satisfied in the system.
SV0458	CURRENT LOOP ERROR	The specified current loop differs from the actual current loop.
SV0459	HI HRV SETTING ERROR	For two axes whose servo axis numbers (parameter No. 1023) are consecutively even and odd numbers, HIGH SPEED HRV control is possible for one axis and impossible for the other.
SV0460	FSSB DISCONNECT	The FSSB connection was discontinued. Probable causes are: 1) The FSSB connection cable was disconnected or broken. 2) The amplifier was turned off. 3) In the amplifier, the low-voltage alarm occurred.
SV0482	SEND CNC DATA FAILED	The correct data could not be received on a slave side because of the FSSB communication error.
SV0483	SEND SLAVE DATA FAILED	The correct data could not be received in the servo software side because of the FSSB communication error.
SV0485	READ ID DATA FAILED	A read of the ID information for the amplifier has failed at power-on.
SV0486	MOTOR/AMP. COMBINATION	The maximum current of an amplifier is different to that of a motor. Probable causes are: 1) The connection command for an amplifier is incorrect. 2) The parameter (No.2165) setting is incorrect
SV0488	HI HRV SETTING ERROR(AMP)	An attempt was made to set up HIGH SPEED HRV control for use when the controlled axis of an amplifier for which HIGH SPEED HRV control could not be used.
SV0600	INV. DC LINK OVER CURRENT	DC link overcurrent.
SV0601	INV. RADIATOR FAN FAILURE	External radiator cooling fan failure.
SV0602	INV. OVERHEAT	The servo motor has overheated.
SV0603	INV. IPM ALARM(OH)	The IPM (Intelligent Power Module) detected an overheat alarm.
SV0604	AMP. COMMUNICATION ERROR	The communication between Servo amplifier and Power Supply (PS) is in error.
SV0605	CNV. EX. DISCHARGE POW.	Power Supply (PS) : The motor regenerative power is too much.
SV0606	CNV. RADIATOR FAN FAILURE	Power Supply (PS) : External radiator cooling fan failure.
SV0607	CNV. SINGLE PHASE FAILURE	Power Supply (PS) : The input power supply has a missing phase.

Maintenance Manual



SPC ALARMS (SV03**)

For an explanation of the following SPC alarms (serial Pulsecoder alarms), refer to the FANUC AC SERVO MOTOR αi series, AC SPINDLE MOTOR αi series, SERVO AMPLIFIER αi series Maintenance Manual (B-65285EN).

Number	Message	Description
SV0360	ABNORMAL CHECKSUM(INT)	The checksum alarm occurred on the built-in Pulsecoder.
SV0361	ABNORMAL PHASE DATA(INT)	The phase data abnormal alarm occurred on the built-in Pulsecoder.
SV0362	ABNORMAL REV. DATA(INT)	The speed count abnormal alarm occurred on the built-in Pulsecoder.
SV0363	ABNORMAL CLOCK(INT)	The clock alarm occurred on the built-in Pulsecoder.
SV0364	SOFT PHASE ALARM(INT)	A digital servo soft detected an abnormality on the built in Pulsecoder.
SV0365	BROKEN LED(INT)	The digital servo software detected abnormal data on the built-in Pulsecoder.
SV0366	PULSE MISS(INT)	A pulse error occurred on the built-in Pulsecoder.
SV0367	COUNT MISS(INT)	A count error occurred on the built-in Pulsecoder.
SV0368	SERIAL DATA ERROR(INT)	The communications data could not be received from the built-in Pulsecoder.
SV0369	DATA TRANS. ERROR(INT)	A CRC error or stop bit error occurred in the communications data from the built-in Pulsecoder.
SV0380	BROKEN LED(EXT)	Separate detector error
SV0381	ABNORMAL PHASE (EXT)	An abnormal alarm in the position data occurred on the separate detector.
SV0382	COUNT MISS(EXT)	A count error occurred on the separate detector.
SV0383	PULSE MISS(EXT)	A pulse error occurred on the separate detector.
SV0384	SOFT PHASE ALARM(EXT)	The digital servo software detected abnormal data on the separate detector.
SV0385	SERIAL DATA ERROR(EXT)	The communications data could not be received from the separate detector.
SV0386	DATA TRANS. ERROR(EXT)	A CRC error or stop bit error occurred in the communications data from the standalone detector.
SV0387	ABNORMAL ENCODER(EXT)	An abnormality occurred on a separate detector. For more information, contact the scale manufacturer.

Spindle alarms (SP alarm)

Number	Message	Description
SP0740	RIGID TAP ALARM : EXCESS ERROR	The positional deviation of the stopped spindle has exceeded the set value during rigid tapping.
SP0741	RIGID TAP ALARM : EXCESS ERROR	The positional deviation of the moving spindle has exceeded the set value during rigid tapping.
SP0742	RIGID TAP ALARM : LSI OVERFLOW	An LSI overflow has occurred for the spindle during rigid tapping.
SP0752	SPINDLE MODE CHANGE ERROR	This alarm is generated if the system does not properly terminate a mode change. The modes include the Cs contour control, spindle positioning (T series), rigid tapping, and spindle control modes. The alarm is activated if the spindle control unit does not respond correctly to the mode change command issued by the NC.
SP0754	ABNORMAL TORQUE	An abnormal load was detected in a spindle motor. The alarm can be canceled by RESET.
SP1202	SPINDLE SELECT ERROR	In a multi spindle control, the spindle number other than the valid spindle number was selected by a position coder select signal. An attempt was made to select the spindle number of the system having no valid spindle.
SP1220	NO SPINDLE AMP.	Either the cable connected to a serial spindle amplifier is broken, or the serial spindle amplifier is not connected.
SP1221	ILLEGAL MOTOR NUMBER	The spindle No. and the motor No. are incorrectly matched.
SP1224	ILLEGAL SPINDLE-POSITION CODER GEAR RATIO	The spindle-position coder gear ratio was incorrect.
SP1225	CRC ERROR (SERIAL SPINDLE)	A CRC error (communications error) occurred in communications between the CNC and the serial spindle amplifier.
SP1226	FRAMING ERROR (SERIAL SPINDLE)	A framing error occurred in communications between the CNC and the serial spindle amplifier.
SP1227	RECEIVING ERROR (SERIAL SPINDLE)	A receive error occurred in communications between the CNC and the serial spindle amplifier.
SP1228	COMMUNICATION ERROR (SERIAL SPINDLE)	A communications error occurred between the CNC and the serial spindle amplifier.
SP1229	COMMUNICATION ERROR SERIAL SPINDLE AMP.	A communications error occurred between serial spindle amplifiers (motor Nos. 1 and 2, or motor Nos. 3–4).
SP1231	SPINDLE EXCESS ERROR (MOVING)	The position deviation during spindle rotation was greater than the value set in parameters.
SP1232	SPINDLE EXCESS ERROR (STOP)	The position deviation during spindle stop was greater than the value set in parameters.
SP1233	POSITION CODER OVERFLOW	The error counter/speed instruction value of the position coder overflowed.

Maintenance Manual



Number	Message	Description
SP1234	GRID SHIFT OVERFLOW	Grid shift overflowed.
SP1240	DISCONNECT POSITION CODER	The analog spindle position coder is broken.
SP1241	D/A CONVERTER ERROR	The D/A converter for controlling analog spindles is erroneous.
SP1243	ILLEGAL SPINDLE PARAMETER SETTING(GAIN)	The setting for the spindle position gain is incorrect.
SP1244	MOTION VALUE OVERFLOW	The amount of distribution to a spindle is too much
SP1245	COMMUNICATION DATA ERROR	A communication data error was detected on the CNC.
SP1246	COMMUNICATION DATA ERROR	A communication data error was detected on the CNC.
SP1247	COMMUNICATION DATA ERROR	A communication data error was detected on the CNC.
SP1969	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1970	SPINDLE CONTROL ERROR	Initialization of spindle control ended in error.
SP1971	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1972	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1974	ANALOG SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1975	ANALOG SPINDLE CONTROL ERROR	An position coder error was detected on the analog spindle.
SP1976	SERIAL SPINDLE COMMUNICATION ERROR	The amplifier No. could not be set to the serial spindle amplifier.
SP1977	SERIAL SPINDLE COMMUNICATION ERROR	An error occurred in the spindle control software.
SP1978	SERIAL SPINDLE COMMUNICATION ERROR	A time-out was detected during communications with the serial spindle amplifier.
SP1979	SERIAL SPINDLE COMMUNICATION ERROR	The communications sequence was no longer correct during communications with the serial spindle amplifier.
SP1980	SERIAL SPINDLE AMP. ERROR	Defective SIC-LSI on serial spindle amplifier
SP1981	SERIAL SPINDLE AMP. ERROR	An error occurred during reading of the data from SIC-LSI on the analog spindle amplifier side.
SP1982	SERIAL SPINDLE AMP. ERROR	An error occurred during reading of the data from SIC-LSI on the serial spindle amplifier side.
SP1983	SERIAL SPINDLE AMP. ERROR	Could not clear on the spindle amplifier side.
SP1984	SERIAL SPINDLE AMP. ERROR	An error occurred during re-initialization of the spindle amplifier.
SP1985	SERIAL SPINDLE CONTROL ERROR	Failed to automatically set parameters
SP1986	SERIAL SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1987	SERIAL SPINDLE CONTROL ERROR	Defective SIC-LSI on the CNC
SP1988	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1989	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1996	ILLEGAL SPINDLE PARAMETER SETTING	The spindle was assigned incorrectly. Alternatively, the number of spindles exceeded the maximum number allowed in the system. Check to see the following parameter. (No.3701#1,#4, 3716, 3717)
SP1998	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1999	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.

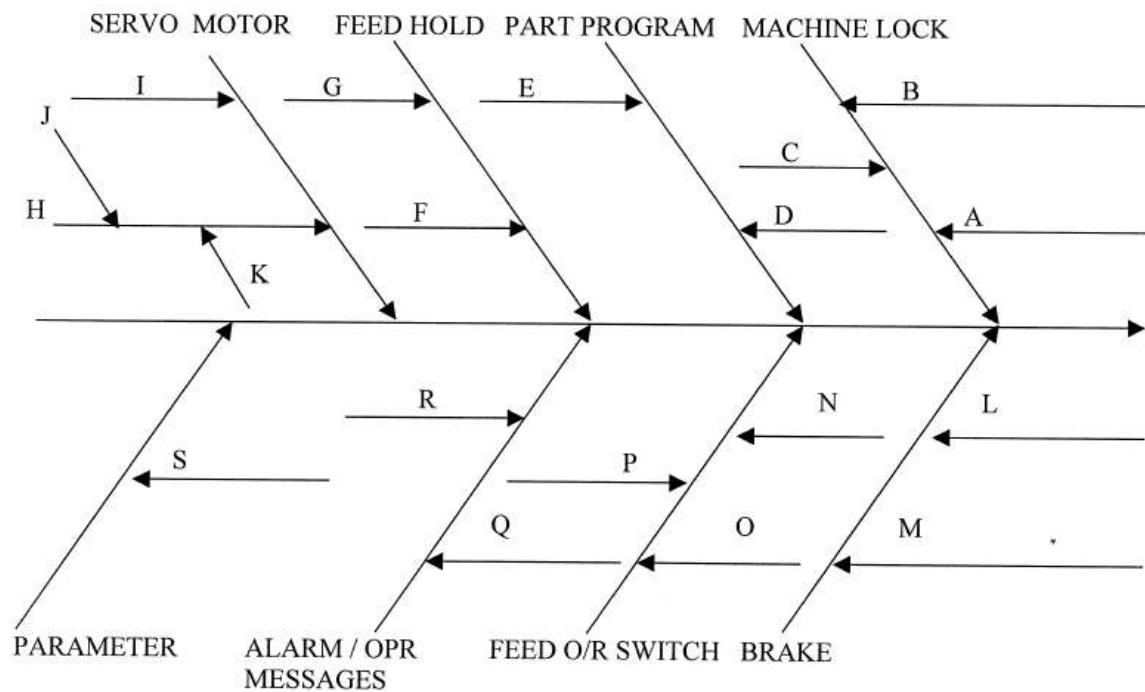
Overheat alarms (OH alarm)

Number	Message	Description
OH0700	LOCKER OVERHEAT	CNC cabinet overheat
OH0701	FAN MOTOR STOP	PCB cooling fan motor abnormality
OH0704	OVERHEAT	<p>T</p> <p>Spindle overheat due to detection of changes in the spindle speed</p> <ol style="list-style-type: none">1) When the cutting load is large, offload the cutting conditions.2) Check if the cutting tool became dull.3) Check if the spindle amplifier malfunctions.

Maintenance Manual

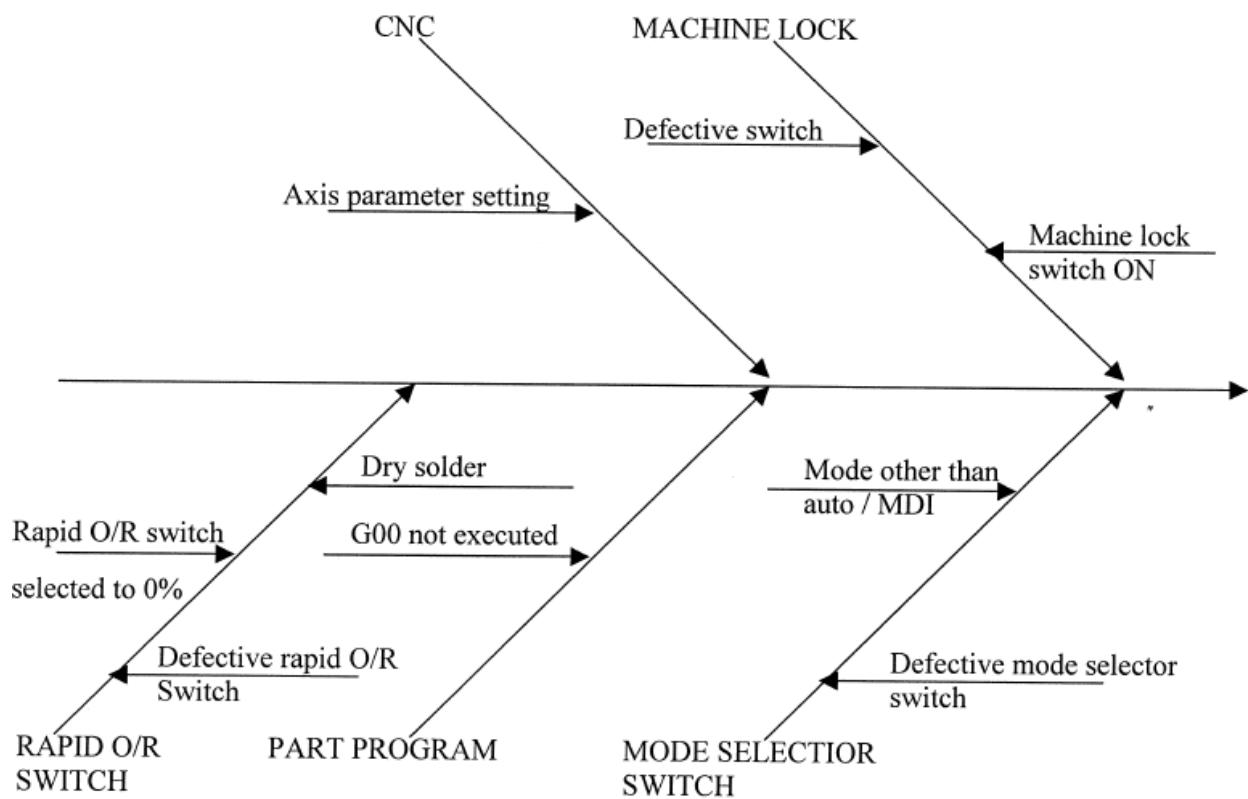


AXIS NOT MOVING IN FEED MODE (AUTO / MDI)

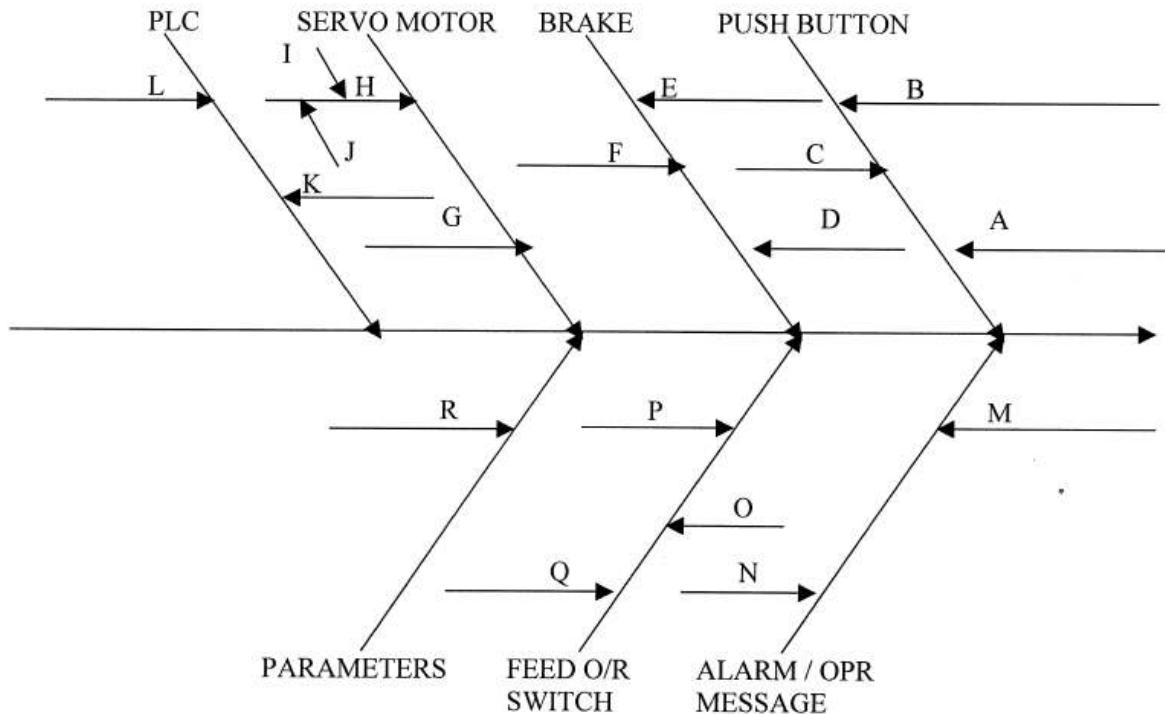


A	=	Dry solder in M/c lock switches	L	=	24V DC brake
B	=	Machine lock switch on	M	=	Dry solder
C	=	Machine lock switch defective	N	=	Feed O/R switch defective
D	=	Programmed error	O	=	Dry solder
E	=	Feed not mentioned	P	=	Feed rate at 0%
F	=	Feed hold pushbutton pressed	Q	=	400 etc., alarms
G	=	Feed hold pushbutton defective	R	=	Turret unclamp feed off
H	=	Motor defective	S	=	Axis parameters incorrect.
I	=	Loose connection in power section			
J	=	Winding resistance			
K	=	Shaft jammed			

AXIS NOT MOVING IN RAPID RATE AUTO / MDI

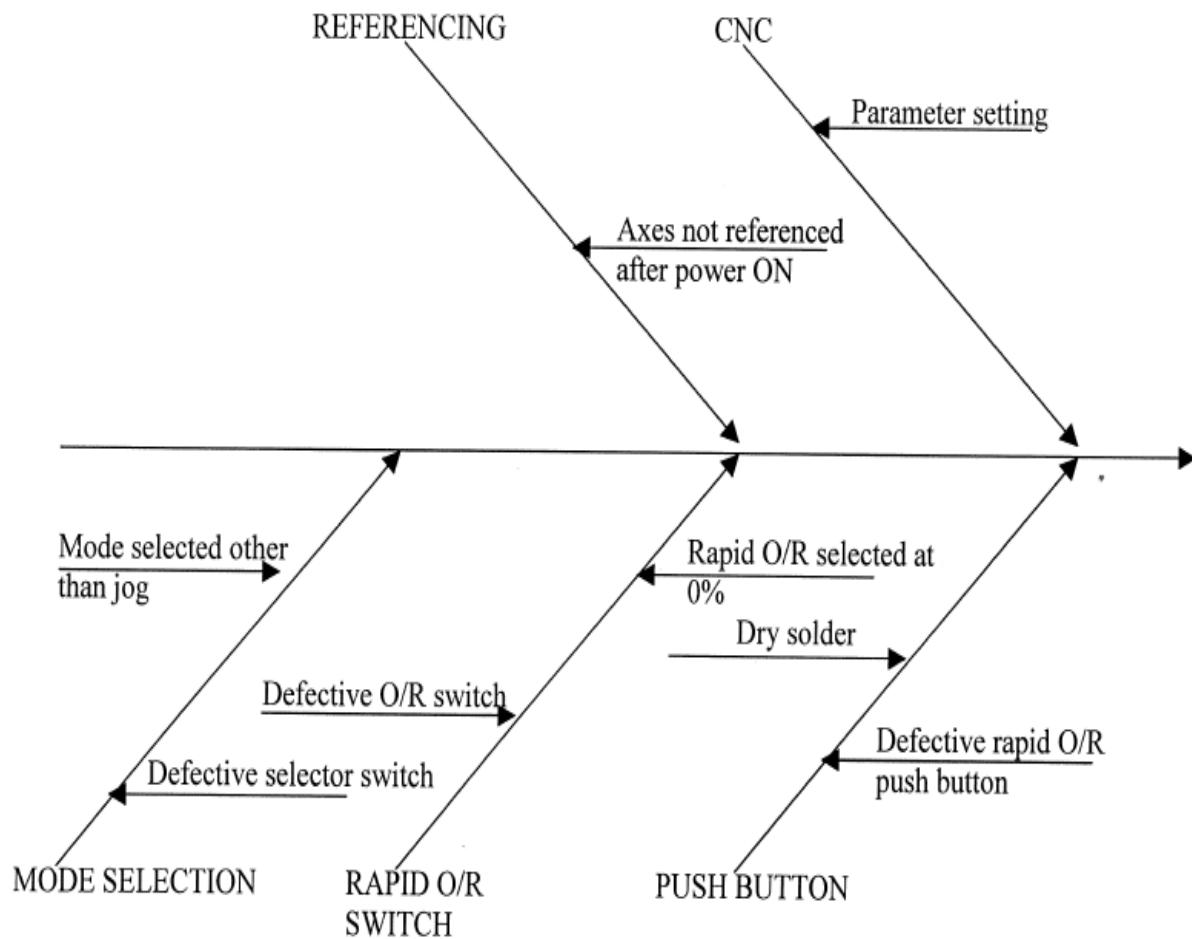


AXIS NOT MOVING IN JOG MODE

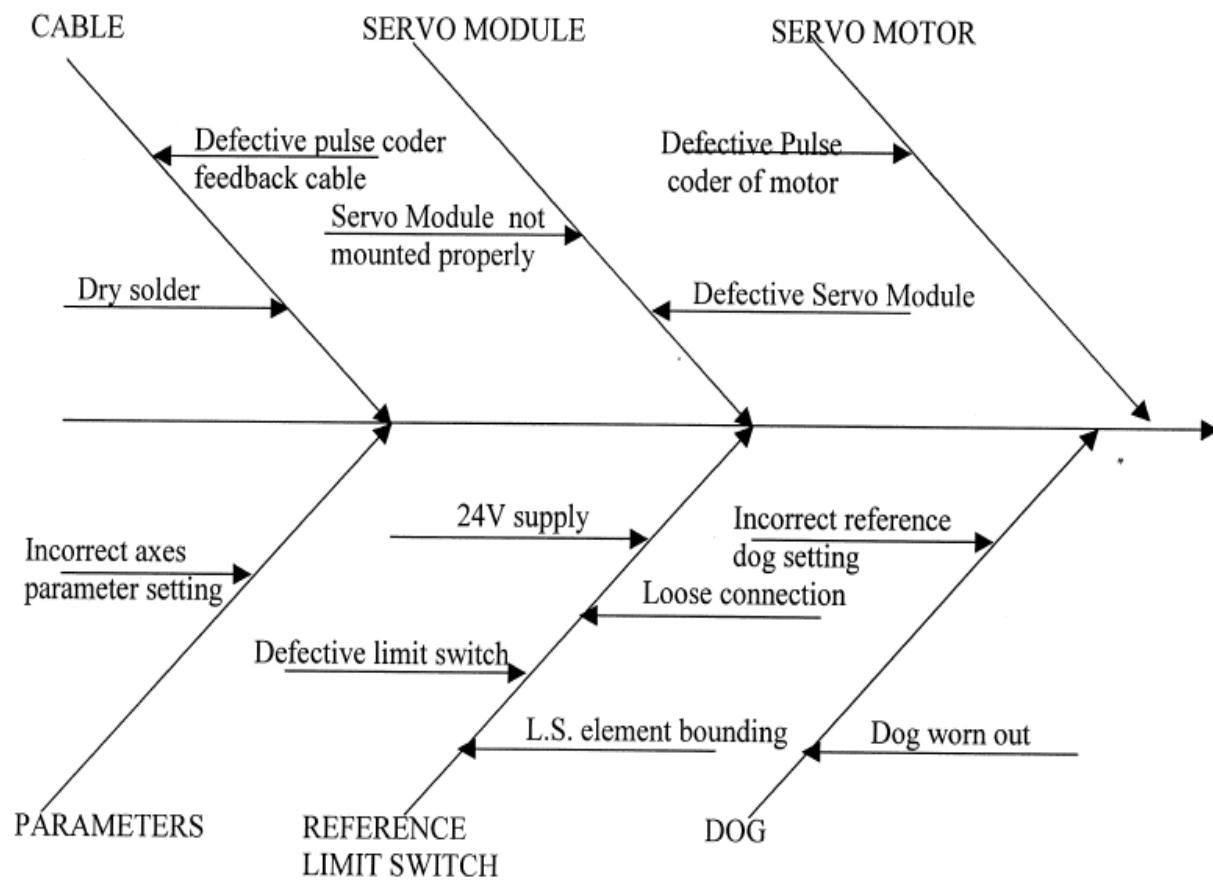


A	=	Loose connection of Connectors	M	=	Turret unclamp feed OFF
B	=	Axes jog pushbutton defective	N	=	Alarm 400 etc
C	=	Dry solder	O	=	Dry solder
D	=	24V DC supply to coil	P	=	Defective feed O/R switch
E	=	Defective E-M brake	Q	=	Feed O/R switch selected at 0%
F	=	Dry solder	R	=	Axis parameter incorrect
G	=	Timer belt			
H	=	Defective motor			
I	=	Wdg. resistance			
J	=	Shaft jammed			
K	=	PLC malfunction			
L	=	Axis I/L ON			

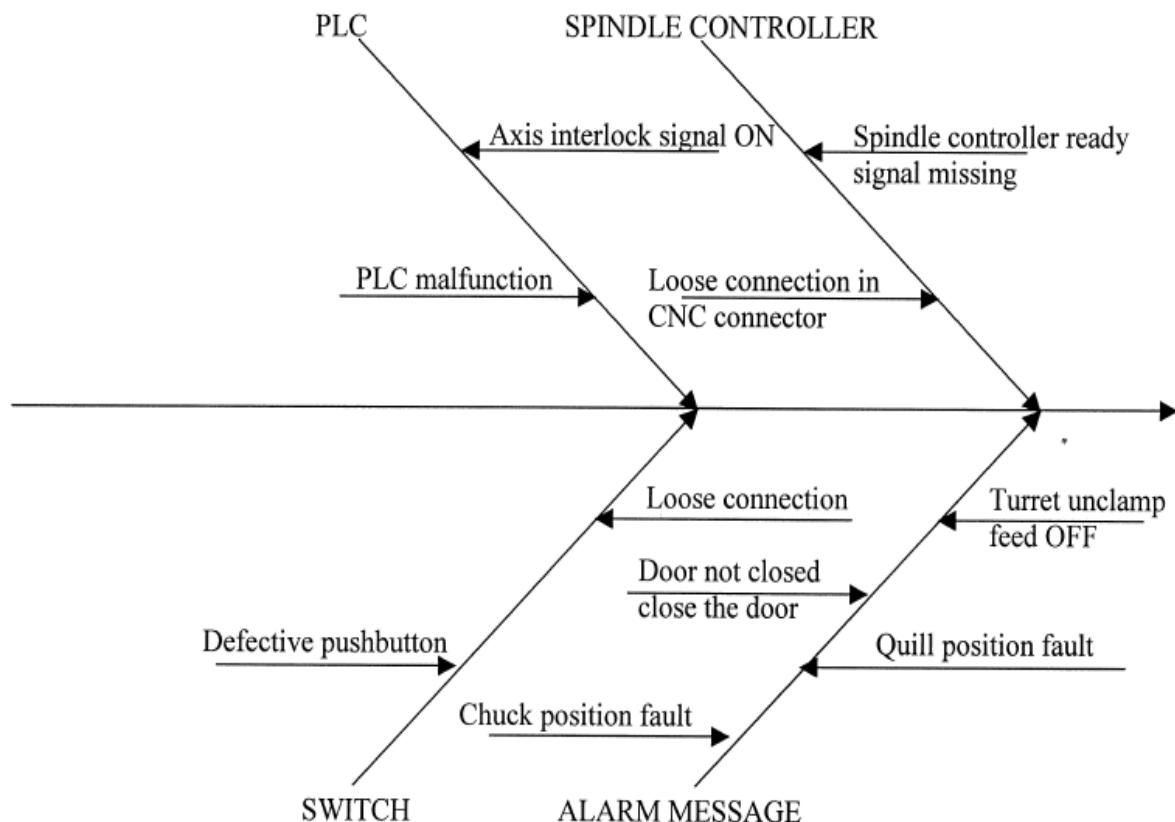
AXIS NOT MOVING IN RAPID RATE IN JOG



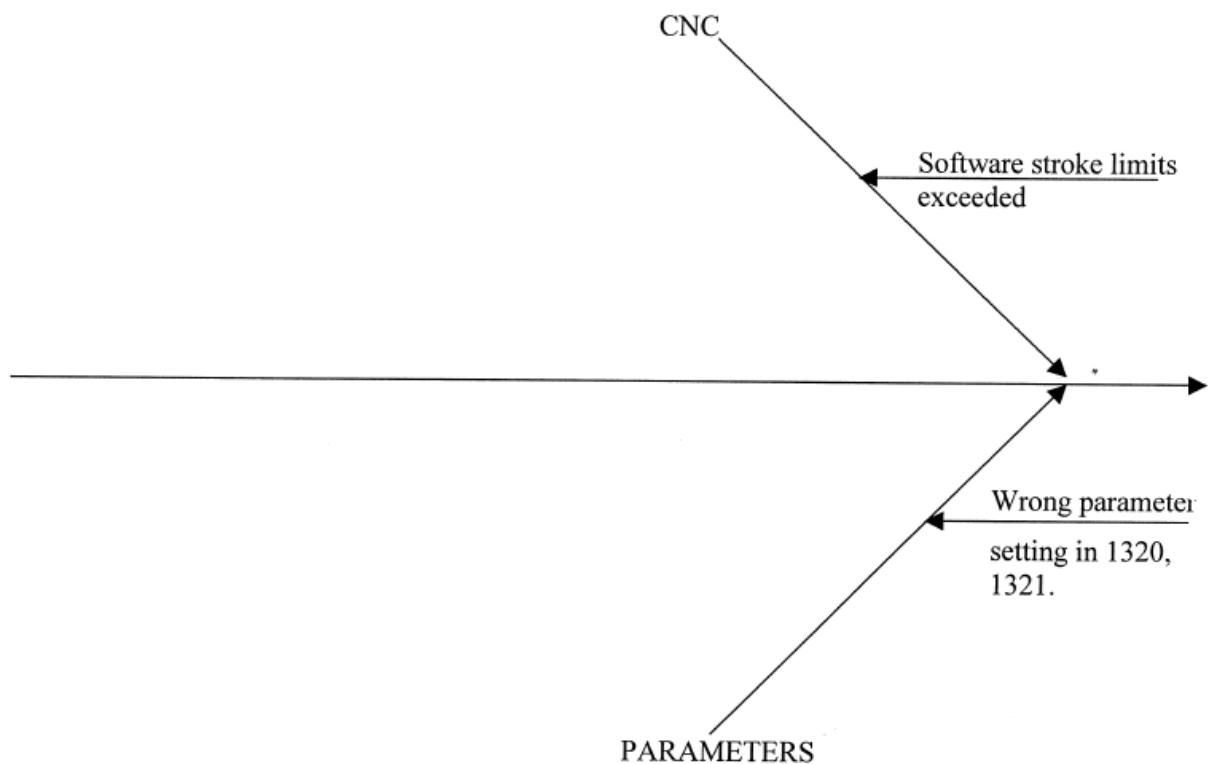
ABNORMAL REFERENCING OF X & Z AXIS



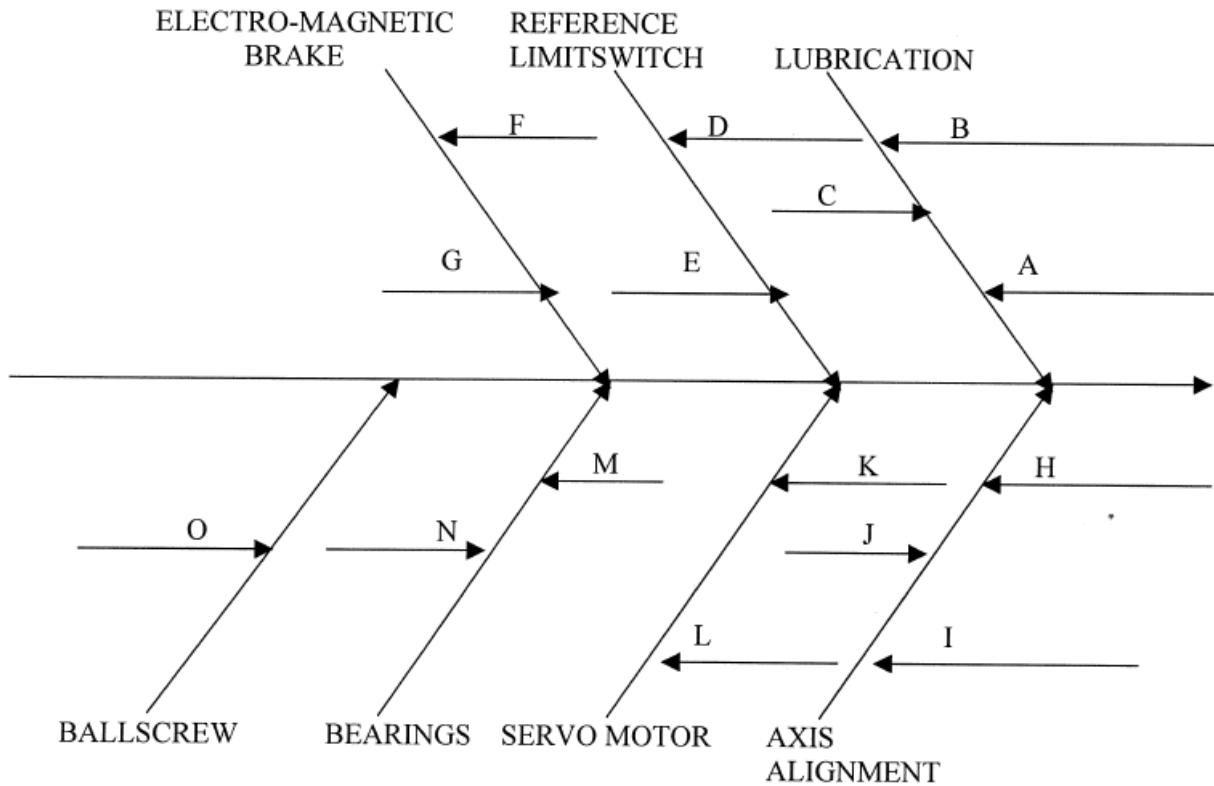
FEED HOLD LAMP ON



OVERTRAVEL ALARM 5n0, 5n1



AXIS JERKING WHILE MOVING



A	=	Defective metering cartridge	H	=	Defective LM blocks
B	=	Defective lubrication line	I	=	Locknut loose / jammed
C	=	Axes not lubricated	J	=	Defective LM guide ways
D	=	Loose connection	K	=	Defective motor
E	=	Defective reference limitswitch	L	=	Pulse coder defective
F	=	Misalignment of brake assembly	M	=	Bearings jammed
G	=	Defective brake	N	=	Defective bearings
			O	=	Defective ballscrew

STUDY OF SPINDLE SERVO DRIVE

STUDY OF SPINDLE DRIVE / MOTOR :

The spindle drive system consists of Spindle Amplifier unit (controller) and Main spindle motor. The Spindle drive system must provide constant cutting power over a wide speed range thereby minimizing the number of gear ranges in the machine.

As per the power / speed characteristics of a spindle motor, the constant power range is from the base speed to maximum speed.

The spindle drive system consist of :

- AC Spindle servo amplifier.
- AC spindle motor.

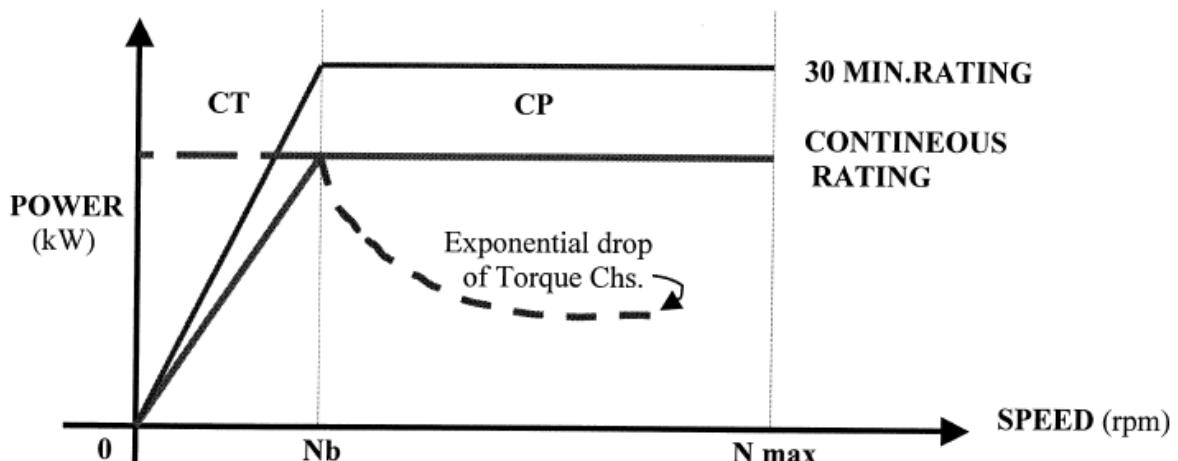
Feedback elements used in the spindle drive system :

Rotary encoder for motor speed feedback (Balluff make 1024 PPR).

Additional elements used on spindle drive system are :

- Thermistor for motor temperature monitoring.
- Cooling fan for motor cooling.

POWER / SPEED DIAGRAM OF SPINDLE MOTOR :



Nb = Base Speed

N max. = Maximum Speed

CP = Constant Power

CT = Constant Torque

REQUIREMENTS OF SPINDLE DRIVE

1. High rotational accuracy.
2. Wide constant power band
3. Excellent running smoothness.
4. Compactness.
5. Fast dynamic response.
6. Maximum speed up to 6000 rpm (on motor)
7. High overload capacity.
8. Small acceleration / deceleration times.

MECHANICAL SUB ASSEMBLIES

Maintenance Manual

ACE
DESIGNERS

Overview of Machine



BED

- Cast iron of grade 20 CI Gr.
- Highly Seasoned before usage.
- Rigidity - to take up the deformation due to cutting load and other natural phenomenon.
- Damping element - to absorb vibration.
- High precision accuracy maintained by Scrapping / machining (machined on 5 axes machine)
- To mount - head stock, slides, tail stock, electrical cabinet and sheet metal structure.
- Optional - as a coolant tank, power pack tank etc.,
- To carry out - easy chips flow, coolant back to tank for reuse.
- Leveling bolts provided - after spirit level, the total machine weight and other machining forces get distributed equally.

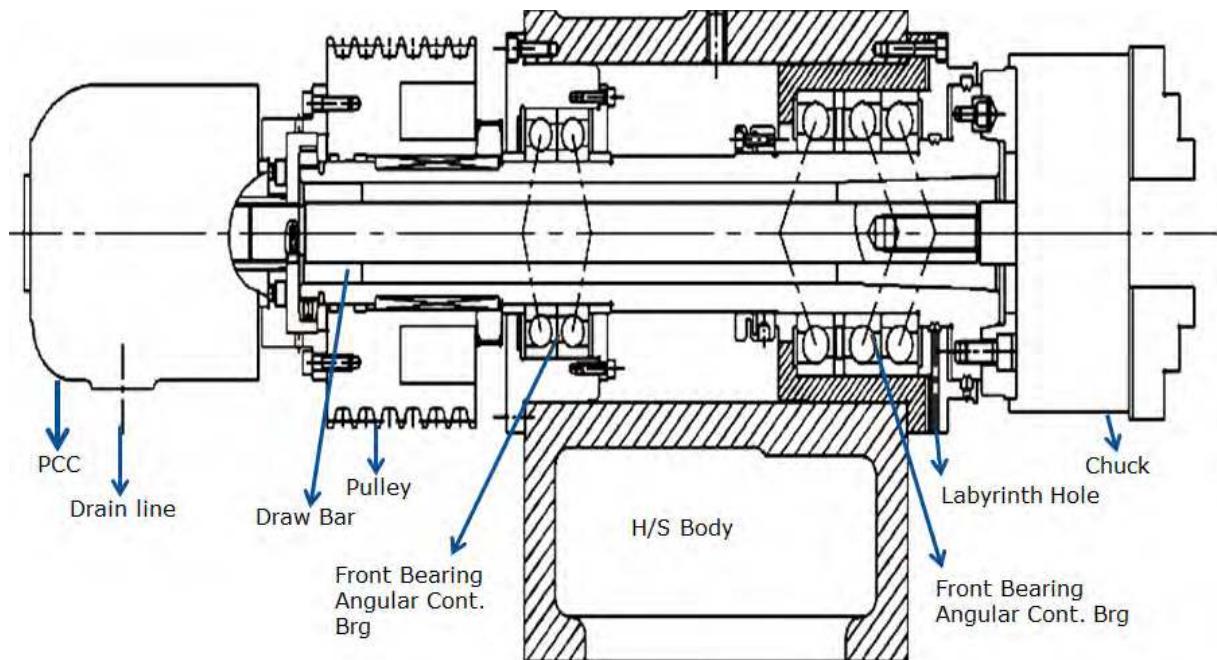
DO'S:-

- LEVEL the bed before machine is being used.
- CLEAN the drain hole frequently.
- CLEAN the area behind the sliding guards, L M Guide mounting area, spindle motor mounting area etc. frequently.

DO'TS:-

- DO NOT weld any extensions to the bed.
- DO NOT attempt to grind / any machining on the bed.

Head Stock Assembly



- A spindle provides drive to the workpiece.
- To transmit fully the available motor power
- To run smoothly and quietly at higher rpm.
- Rigid enough to maintain running accuracy to overcome cutting forces and imbalance or centrifugal forces.
- The elastic deformation of the spindle, its bearings, housing and other components of the arrangement affect the accuracy with which a spindle runs.
- The influence of front bearing stiffness on overall stiffness is quite considerable. Hence a bearing with higher stiffness should be located at the front.

Do's:

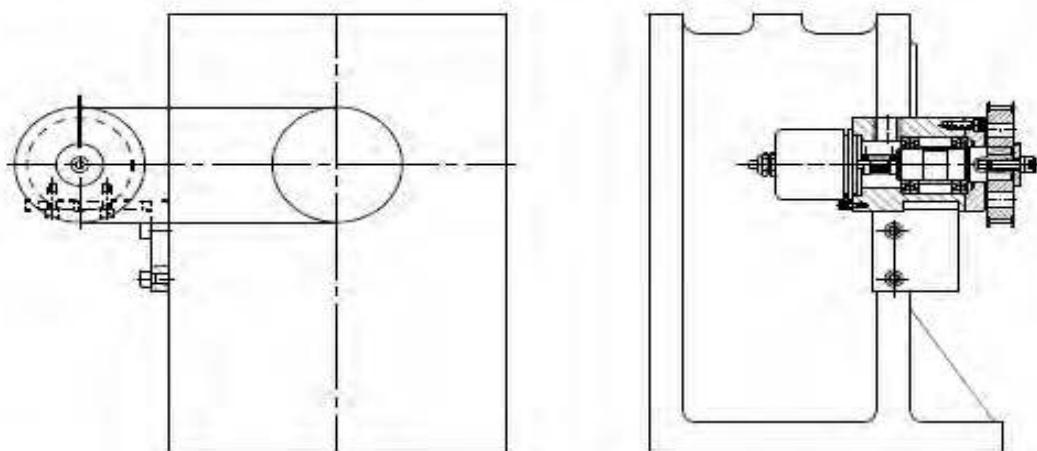
- ✓ Generally the bearings are LIFE LUBRICATED with KLUBER make grease. (ISOFLEX – NBU 15, SUPER LDS – 15). Hence NO RE-LUBRICATION IS REQUIRED.
- ✓ PERIODIC INSPECTION of both TRANSMISSION AND THE FEEDBACK BELT for any raptures of either the outer jackets or the inner cords.
- ✓ PROPER TENSIONING of the TRANSMISSION BELTS using TENSION INDICATOR equipment and periodic check of the same.
- ✓ LABYRINTH AND LABYRINTH HOLES are to be CLEARED for free coolant passage out of the assembly, AT LEAST ONCE A WEEK.

- ✓ SMEAR WITH a layer of GREASE OR RUST PREVENTIVE solvent the EXPOSED SURFACES of the spindle, particularly the Morse taper bore.
- d Periodic geometric ACCURACY TEST for spindle alignment and run out CHECKS – at least ONCE IN A 6 MONTHS.
- d USE of the LATEST TECHNIQUES of condition monitoring for continuous MONITORING of the SPINDLE BEARING CONDITION.

DON'TS:

- d DO NOT DIRECT THE COMPRESSED AIR JET or the COOLANT JET over and around the front of the spindle / Workholding.
- d DO NOT USE an ETCHING MACHINE or any indentor to identify the workpiece while the work piece is held in the spindle / Workholding.
- d DO NOT RUN the spindle ABOVE THE SPECIFIED MAXIMUM RPM.
- d SPINDLE unit is NOT A USER SERVICEABLE item, generally.

SPINDLE ENCODER ASSEMBLY :

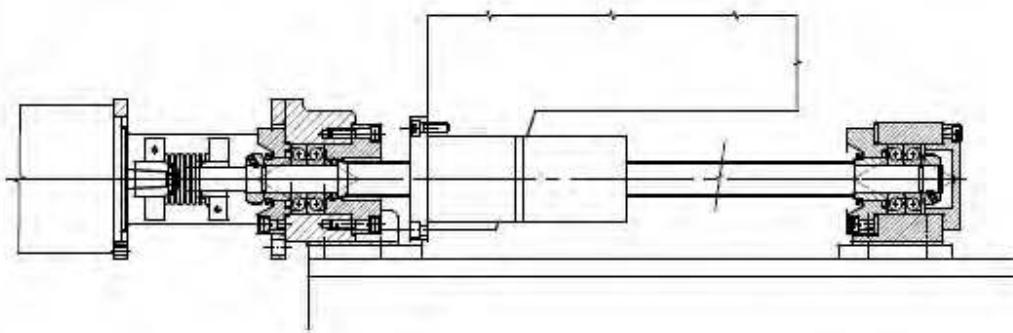


The spindle speed feed back is through an incremental rotary optical encoder which is driven by a timing belt.

Axis Assembly

- ✓ To hold a set of cutting tools / turret.
- ✓ Reliability in positioning accuracy and repeatability.
- ✓ Durability so that the accuracy lasts for a longer period / machine life.
- ✓ Response intune with the electronics system.
- ✓ Rigid enough to take cutting forces in all the directions.
- ✓ Should have higher rapid rates of movement.
- ✓ Should be maintenance free for normal operating conditions.

Z-AXIS ASSEMBLY :

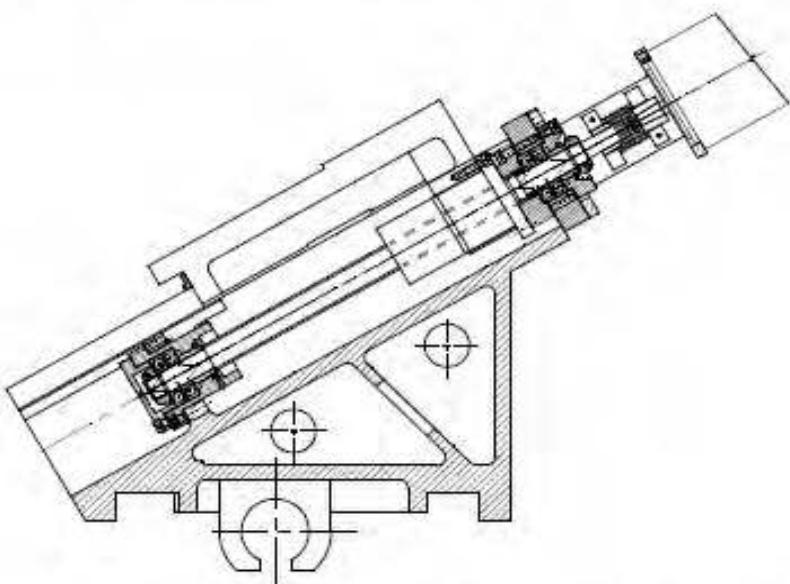


The Z-axis slide moves over a pair of hardened & ground guide strips. The sliding surfaces are lined with Turcite for anti stick slip properties. An AC servo motor is directly coupled to the ball screw thro' a torsionally rigid coupling. The ball screw is pre-tensioned and it minimises the effect of temperature variations.

The axis system can also be provided with overload safety device which protects the machine against application of excessive motor torque on to the elements in case of accidents.

The feedback for the Z-axis motion is through the encoder built into the motor. The motor is provided with absolute encoders.

X-AXIS ASSEMBLY :



The X-axis slide moves over a pair of hardened & ground guide strips. The sliding surfaces are lined with Turcite for anti stick slip properties. An AC servo motor is directly coupled to the ball screw thro' a torsionally rigid coupling. The ball screw is pre-tensioned and it minimises the effect of temperature variations.

The axis system can also be provided with an overload safety device which protects the machine against application of excessive motor torque on to the elements in case of accidents. The feedback for the X-axis motion is through the encoder built into the motor. The motor is provided with absolute encoder.

Maintenance Manual



DO'S:

- e The basic alignment checks as per the GEOMETRICAL ACCURACY test chart to be done ONCE IN 6 MONTHS.
- e APPLY a thin film of lubricating GREASE over the EXPOSED / UNUSED PORTION of the ball screw and LM Guide way. If the motor and slide assembly is disconnected for any reason, establish the MARKER PULSE setting of the encoder with respect to the slide position.

DON'Ts:

- e DO NOT DISASSEMBLY the BALL NUT from slide or BALLSCREW SHAFT, for any reason.
- e DO NOT DISASSEMBLE the LM block from the LM Guide ways. Since the slide is done with tailor made tools and fixtures with unique assembly procedures, it is not recommended for USER SERVICE.

TURRET



Bi-directional tool turret offers fast and accurate indexing. Indexing time for adjacent station is 0.5 sec. The disc also provides coolant to the tool point.

In case of minor accident, the turret disc might slip thereby lowering the tool's centre height & the turret body might slip on its mounting thereby causing the misalignment of the turret axis. This can easily be set right by the following procedure.

1. Loosen the turret disc mounting screws & dial the tool mounting face for external machining. Adjust the disc by lightly tapping with a mallet to get the adjustment within 0.02mm. Tighten all the screws & recheck the values. Centre height of the tool is now established.
2. Loosen all but one of the eight bolts used for mounting the turret body. Dial the face used for mounting the boring bar holders. Align within 0.02 mm over the entire length of the face(approx.. 85mm). Retighten the bolts firmly & recheck. The turret is now realigned.

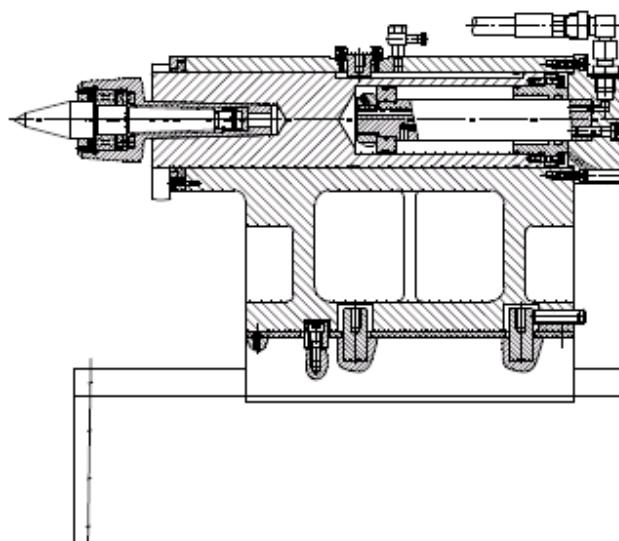
Tail Stock Assembly

The main functions of Tail stock are,

(a). It supports the other end of the work that is being machined between Centres.

(b). It holds the tool for performing operations like drilling, reamer etc. (On conventional machines only)

- PROGRAMMABLE QUILL
- PROGRAMMABLE TAILSTOCK
- REVOLVING CENTRE



DO'S: -

- ✓ When not used, APPLY RUST PREVENTIVE solvent to the exposed guide ways and Morse taper in the quill and cover from the chip / coolant.
- ✓ The TAILSTOCK WILL NOT BE USED always. In such cases, if the Tail stock is to be used after certain period OPERATE THE QUILL movement for about 10 minutes before the production.
- ✓ As the QUILL is a moving element, check for proper LUBRICATION EVERY DAY.
- ✓ In REVOLVING CENTRE, bearings are life lubricated with Kluber grease. Hence NO RE-LUBRICATION IS REQUIRED.
- ✓ PLAN for stocking a spare REVOLVING CENTRE assembly as stand by at any point of time.

☒ DO'S: -

- ✓ In designs having LABYRINTH feature, usually there will be DRAIN HOLES for coolant to escape. These holes should be PERIODICALLY CLEARED for free coolant passage.(in built-in centre assembly only)
- ✓ In case of PROGRAMMABLE HOUSING OR QUILL, check for PROPER FUNCTIONING of LIMIT SWITCHES / PROXIMITIES.

☒ DON'Ts:

- ✓ DO NOT use the Tailstock at PRESSURES higher than the RECOMMENDED MAXIMUM VALUE.
- ✓ DO NOT use the Tail stock with the COVERS REMOVED.

Hydraulic Assembly

A hydraulic system consists of a reservoir containing oil at atmosphere pressure.

- The pressure of this oil is increased using a pump driven by a motor .
- This high pressure oil is used to run hydraulic actuators.
- Hydraulic actuator converts hydraulic energy into mechanical energy

Hydraulic System consists of following main parts.

- a. Hydraulic power pack
- b. Hydraulic elements like valves, pressure switches
- c. Hydraulic piping assembly consisting of fittings ,hoses etc.

Hydraulic applications :

- a) Work piece clamping, draw bar movement & PCC rotary joint.
 - b) Tail Stock – Quill forward / retract movement
- Others - Body clamp / declamp & movement.
Turret clamping & indexing
High – Low gear changing in Head Stock
Touch probe movement, Parts Catcher
Steady rest arm movement
Spindle orientation lock

Other elements of hydraulic systems

- ✓ Power Pack tank
- ✓ Suction and Return line filters
- ✓ Pump, Motor, Accumulator, Check Valve, Throttle Valve, coupling etc.
- ✓ Control valves like D.C. Valve, Solenoid Valve, Pressure reducer, pressure switch, Isolator switch

Maintenance Hints

Hydraulic valves failure:

Reason for Failure:

- a. Contaminated oil.
- b. Solenoid not actuating properly.
- c. Excessive working temperature

Hydraulic hoses:

Reason for Failure:

- a. Continuous rubbing with stationary parts.
- b. Excess oil pressure.
- c. Excessive operating temperature

Oil leakage:

- ✓ Looseness of hydraulic fittings.
- ✓ Crack in the hose and hose fittings.
- ✓ Excessive operating temperature
- ✓ Incompatible oil used
- ✓ 'O' ring damage

System problems:

- ✓ Noisy pump
- ✓ Low or variable pressure
- ✓ No pressure
- ✓ Actuator fails to move
- ✓ Overheating of hydraulic fluid

Noisy pump:

Probable cause:

- ✓ Air entering pump inlet
- ✓ Misalignment of pump & drive unit
- ✓ Excessive oil viscosity
- ✓ Dirty inlet strainer
- ✓ Chattering relief valve
- ✓ Damaged pump
- ✓ Excessive pump speed
- ✓ Loose or damaged inlet line

Low or variable pressure:

Probable cause:

- ✓ Air in the fluid
- ✓ Pressure relief valve set too low
- ✓ Defective or worn pump
- ✓ Defective or worn actuator
- ✓ Pressure relief valve not properly seated
- ✓ Accumulator shutoff valve not closed.

No pressure

Probable cause:

- ✓ Pump running in wrong direction
- ✓ Low oil level in reservoir
- ✓ Pressure relief valve stuck open
- ✓ Full pump flow bypassed to tank due to faulty valve or actuator

Actuator fails to move:

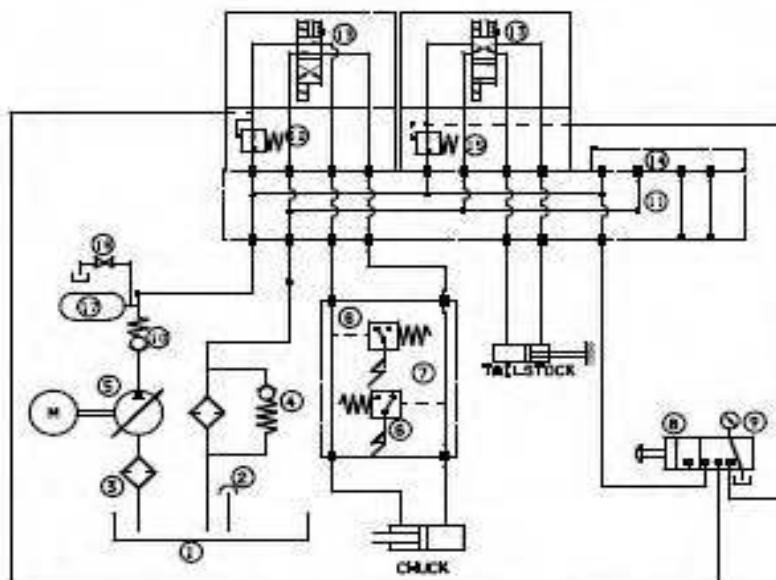
Probable cause:

- ✓ Directional control valve fails to shift
- ✓ System pressure too low
- ✓ Defective actuator
- ✓ Pressure relief valve stuck open
- ✓ Actuator load is excessive
- ✓ Faulty pump

Maintenance Manual

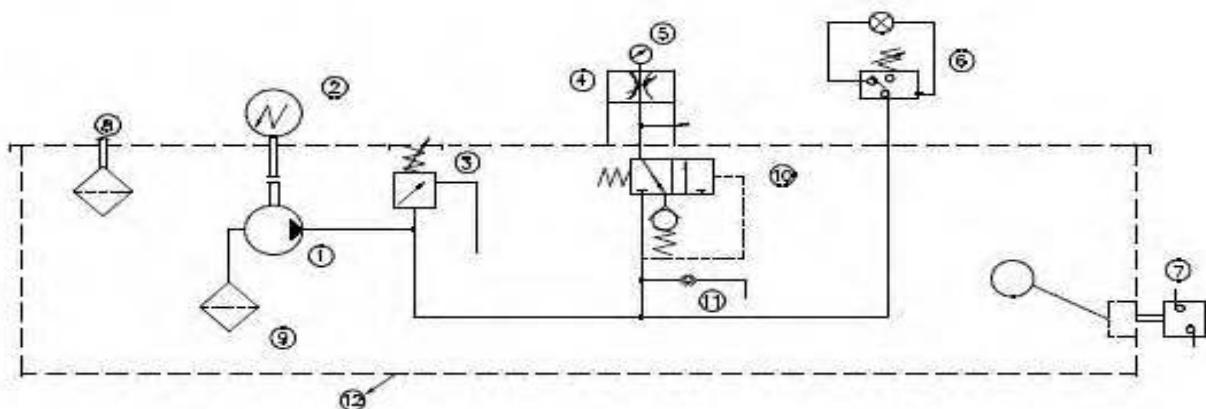
ACE
DESIGNERS

HYDRAULIC SYSTEM :



NO	DESCRIPTION	MAKE	SPECIFICATION
1	HYDRAULIC POWER PACK TANK	ACE DESIGNERS	99-104/0128-2
2	FILLER BREATHER	HYDRAK / ICT	FB-700-SH-40
3	SUCTION STRAINER	HYDRAK / ICT	MODEL 58
4	RETURN LINE FILTER	HYDRAK / ICT	RLF 06
5	VARIABLE DISPLACEMENT VANE PUMP	BOSCH/REINROTH	0513200101
6	PRESSURE SWITCH	POLYHYDRON	IPS 10-14
7	MANIFOLD BLOCK	ACE DESIGNERS	89-01/0568-5
8	MULTISTATION GAUGE ISOLATOR VALVE	ACE DESIGNERS	89-02/12-3m3
9	PRESSURE GAUGE	MASS / FIBIS	0-70 KSC
10	CHECK VALVE	YURAN/HYDROLINE/REINROTH	CIT-02-5-2080
11	MANIFOLD BLOCK	ACE DESIGNERS	89-01/0484-2
12	MODULAR PRESSURE REDUCING VALVE (P LINE)	VICKERS	D08X1SPPMW20
13	DOUBLE SOL. 2 POSITION DIRECTION CONTROL VALVE	BOSCH/REINROTH	0810091242 OR 4M6051/0F9624N24
14	BLANKING PLATE	ACE DESIGNERS	89-02/0298-4
15	MODULAR PRESSURE REDUCING VALVE (B LINE)	VICKERS	D08X1SPBMW20
16	SHUT OFF VALVE	HYLOC	NGL 02
17	ACCUMULATOR	HICO	531603400

LUBRICATION SYSTEM



- | | | | |
|----|-----------------------|-----|-------------------------|
| 1. | Pump | 7. | Float switch |
| 2. | Motor | 8. | Oil filler cum breather |
| 3. | Relief valve | 9. | Suction strainer |
| 4. | Pressure gauge damper | 10. | Pressure reducing valve |
| 5. | Pressure gauge | 11. | Feed valve |
| 6. | Pressure switch | 12. | Reservoir |

The machine is built with an automatic centralized lubrication system which supplies a metered quantity of lubricant at a set regular interval to the guide ways and the ball screw nuts. The quantity of the lubricant is regulated by metering cartridges and the time interval through a PLC timer. The lubrication system monitors the build up of pressure and oil level and gives suitable signals to the operator. An oil collector collects the spent lubricant which is to be disposed off at regular intervals. For lubricant system details refer to the annexure.

COOLANT SYSTEM :

The machine has got a coolant tank of 110 litres capacity. The coolant pump mounted on the tank delivers the coolant to the tool tip through the turret and tool disc assembly. The coolant which flows out through the turret, drains back to the tank. The machine guarding is designed to protect the drive elements from coolant splash and chips and to facilitate easy maintenance. A sight glass with safety grill is provided for viewing the machining operation with the front doors closed.

WORK HOLDING

WORK HOLDING :

The work holding mounted on the spindle front end and the chucking cylinder at the rear are connected by a drawbar. The clamping and declamping is achieved by the actuation of the draw bar.

Any standard work holding and chucking cylinder can be mounted on the spindle with suitable adaptors.

1. STANDARD CHUCKS AND CYLINDERS

Standard 3 jaw / 2 jaw chucks (GMT)

Hollow 3 jaw / 2 jaw chucks (GMT)

Standard chucking cylinders (PRAGATI)

2. STANDARD CHUCK

DISMOUNTING AND INSTALLING PROCEDURE

If the machine is supplied with a standard chuck (GMT 3B/2B x 200), follow the procedure given below to dismount the chuck.

- a. Put the chuck in clamping condition.
- b. Remove the jaws.
- c. Remove the centre piece.
- d. Remove the chuck mounting screw.
- e. Actuate the draw bar in out position. The chuck slides out from mounting flange.
- f. Hold the chuck firmly.
- g. Use the special Allen (or box spanner) supplied along with the chuck to loosen the draw bolt completely. The chuck will slide out. Avoid hammer blows on the Allen key.

While following the above procedure it is suggested that the hydraulics be put OFF.

HOLLOW CHUCK : Insert a suitable rod inside the draw bar and unscrew the draw nut of the chuck

FOR REINSTALLING FOLLOW THE STEPS GIVEN BELOW:

- a. Clean the chuck mounting surfaces with lint free cloth.
- b. If the chuck to be installed is a new one, it has to be dismantled, cleaned and greased as per the recommended instructions of the manufacturer. Then the chuck assembly without the hard/soft jaws and centre piece is to be mounted on the face plate.

- c. It is assumed that the relevant chucking cylinder and the corresponding drawbar is already installed on the machine. If it is not done, the appropriate chucking cylinder flange and the drawbar are to be fitted on to the chucking cylinder after cleaning the mounting surfaces.

Provisions for mounting the chucking cylinder flange exists on the face of the pulley on the spindle. Clean the surface well and mount the chucking cylinder together with the flange and the drawbar onto this surface. Check the alignment of mounting by dialling the reference surface at the rear of the chucking cylinder. The total indicated reading (TIR) should be preferably less than 0.04 mm to keep the spindle vibrations to the minimum.

Connect hoses to the input lines. The drain line should be directed downward and held in that position to avoid tilting, thereby preventing overflow of oil from the drain chamber.

- d. Switch on the hydraulics and actuate the chuck clamp, the draw bar will be drawn in. Mount the chuck in this condition. Engage the draw bar bolt into the draw bar and rotate the draw bolt till the chuck is seated on the face plate. Insert the mounting bolts and tighten them uniformly.

To set the clamping stroke, operate the foot pedal to release the chuck. Loosen the draw bar till it just meets the resistance. This is the fully opened position of the jaws. Now tighten the draw bolt by half a turn. Now the full stroke of the master jaws is available for clamping. Operate the clamp/declamp switch/foot pedal to ensure the above. Then insert the centre piece and fix it. Mount the hard/soft jaws suitably.

3. HOLLOW CHUCK INSTALLING PROCEDURE

This is almost similar to the mounting and dismounting of a standard chuck.

Following are the differences:

The draw bar is hollow and threaded to the piston of the chucking cylinder, and is prevented from loosening by applying suitable thread locking compounds, which also prevents coolant seeping through the threads.

The chuck being hollow, a draw nut is provided in it to fasten the draw bar. The draw nut needs a special tool to rotate it (supplied by chuck manufacturer).

The chucking cylinder is provided at the rear with a coolant collector, (connected to the housing) and a face seal is provided to seal coolant entry in to the chucking cylinder.

The chuck flange is not the same as that of a standard solid chuck.

4. STANDARD CHUCKING CYLINDERS(PRAGATI)

The hydraulic cylinders are suitable for operation of power chucks or collets. The cylinder is mounted on the rear of the lathe spindle, and operates the job holding device through a draw bar.

These cylinders have been designed with a hole through the entire assembly. The through hole can be used to supply air or coolant to the work holding fixture. It is also possible to use a length stop rod fitted from the rear of the cylinder to provide axial location for the workpiece. This rod rotates with the spindle, but always remains axially stationary with respect to the spindle, thus providing a positive reference point for job location.

The cylinders incorporate a non-contacting type of rotary joint, which is virtually free from maintenance problems. This type of rotary joint gives a certain amount of leakage. The leakage return tube should be of generous size and should be connected directly to the tank. Cylinders should be mounted in the HORIZONTAL position, with leakage oil connection pointing downward.

5. OPERATION AND ADJUSTMENT OF HYDRAULIC CHUCK UNIT

The hydraulic chuck is opened by depressing the foot pedal and closed by depressing it again.

- a. If reduced jaw opening is desired then the draw bolt has to be adjusted after removing the centre piece. The centre piece should be put back again after adjustment. For large adjustments, the jaws have to be shifted on the serration on the master jaw.
- b. **Jaw change :**

For jaw change, clean the serration of the master jaw and jaws, and the jaw nut fitting part carefully, and then install with the same serration engagement as at the time of jaw boring/turning.

- c. **Adjustment of the clamping force :**

Adjustment is done with the pressure reducing valve on the hydraulic power pack. Adjust while observing the pressure gauge. After the adjustment, it must be locked with the lock nut. The chuck pressure adjustment range is from 5 to 30 kg/cm².

- d. **Change between Chuck Clamp / Declamp (by M codes).**

To be used in MDI mode only and spindle should be OFF.

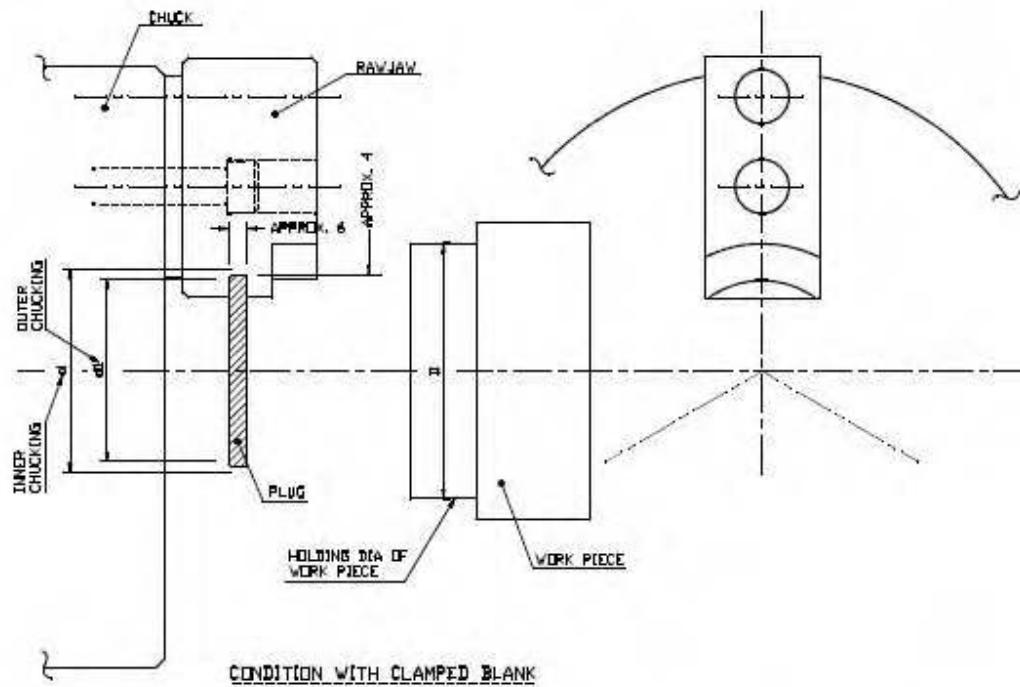
1. Select MDI mode
2. Enter M11 for chuck clamping
3. Enter M10 for chuck declamping
4. Press cycle start. The selected mode will be retained even after power OFF.

NOTE :

1. For execution of M03 and M04 ensure that chuck is clamped properly before starting the cycle.
2. Change over from internal to external clamping should be done through I.D./O.D. selection M codes i.e M16 for I.D. and M18 for O.D.

6. SOFT JAW BORING SEQUENCE FOR EXTERNAL CLAMPING

1. Install the soft jaws on the chuck.
2. Set the hydraulic chuck internal clamping by parameter (M11).
3. Use an inner diameter cutting tool to cut a hole (d) about 8 mm smaller than the workpiece clamping diameter (D) into the soft jaws installed in the chuck.
4. Set the hydraulic chuck external clamping by parameter (M10).
5. Clamp a blank (outer diameter $d-1$ mm, length about 6 mm) in the hole (d) of the machined soft jaws.
6. Bore the soft jaws according to the clamping diameter (D) of the workpiece and remove the blank after boring.
7. Remove burrs.



NOTE : For detailed explanations regarding the hydraulic chuck, refer to the instructions issued by the chuck manufacturer.

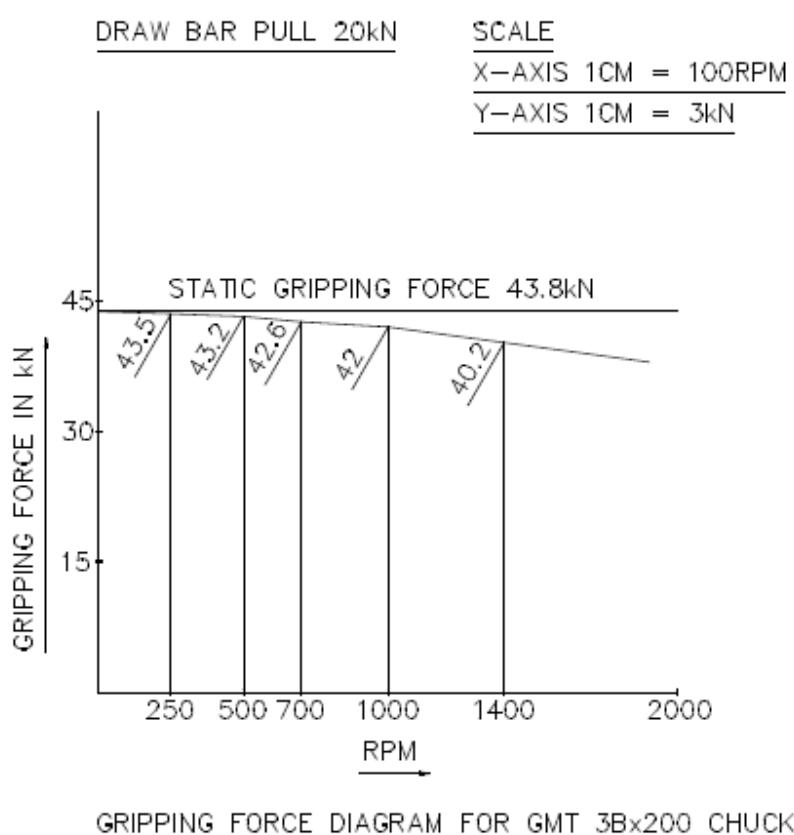
7. SPINDLE SPEED AND CHUCKING FORCE

1) Maximum chuck operating force :

The chucking force of the chuck may be decreased by the influence of centrifugal force in proportion to the spindle speed in case of O.D. chucking. However, in general, the maximum speed is defined as that speed at which the dynamic chucking force becomes a half of the static chucking force when the standard jaw is used under ordinary condition and chucked with a suitable cylinder.

2) Spindle speed and chucking force :

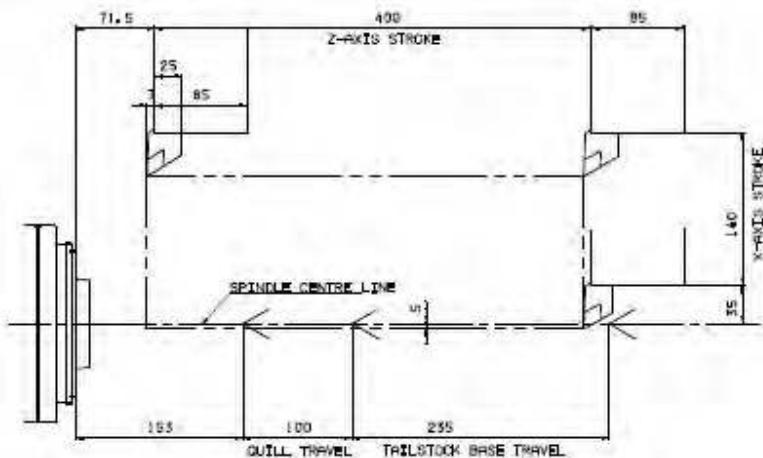
The decrease of chucking force against operational speed is shown in figure. The top jaw is the standard jaw and at the maximum operating position. This value is, however, the normal case and care must be taken because it generally varies depending on the adjusting position of top jaws, size of jaw and cutting conditions.



APPLICATION-

8 STATION TURRET

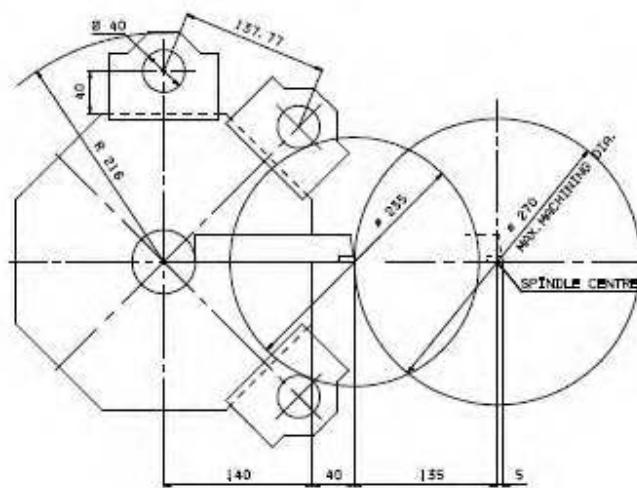
1. MACHINE MOVABLE RANGE



The tool movable range of the machine is as shown in the figure.

2. INTERFERENCE DIAGRAM

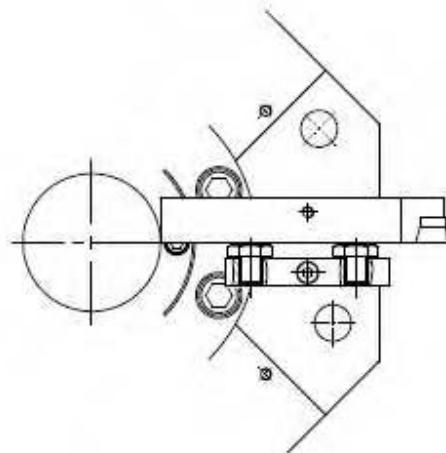
Assume that a 25 mm square shank standard cutting tool which is overhung by 40 mm is used to cut a workpiece up to the specific centre line. A boring bar 40 mm in diameter installed above and adjacent to the standard cutting tool interferes with the workpiece, if the diameter of the workpiece is 235 mm or more.



REVERSED CUTTING TOOL APPLICATION

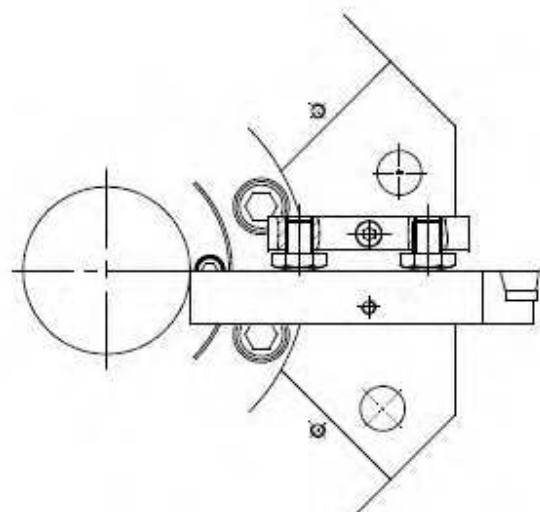
EXAMPLE (O.D. CUTTING TOOL)

The cutting tool can be installed by placing the clamping block and screws as shown.



NORMAL CUTTING TOOL APPLICATION

On the LT-16 XL a standard cutting tool is normally installed in the turret disc directly.



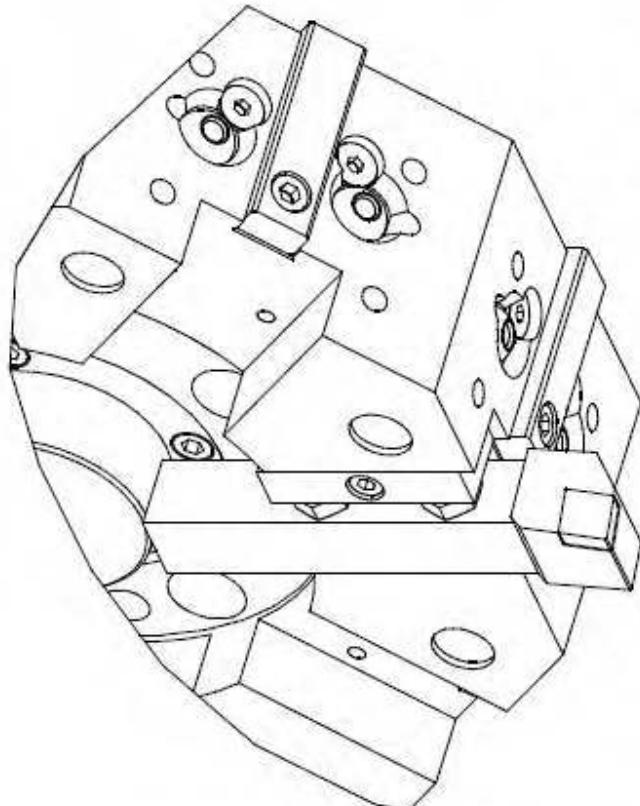
O.D. CUTTING AND FACING TOOL MOUNTING PROCEDURE

The clamping block on the turret disc is fixed in position with the retainer screw. Place a cutting tool between clamping block and the turret disc. Slightly press the tool towards the back and side locating faces and evenly tighten both clamping bolts.

To remove the cutting tool

- a) Sufficiently loosen the clamping bolts.
- b) Remove the cutting tool.

CUTTING OIL DISCHARGING SYSTEM

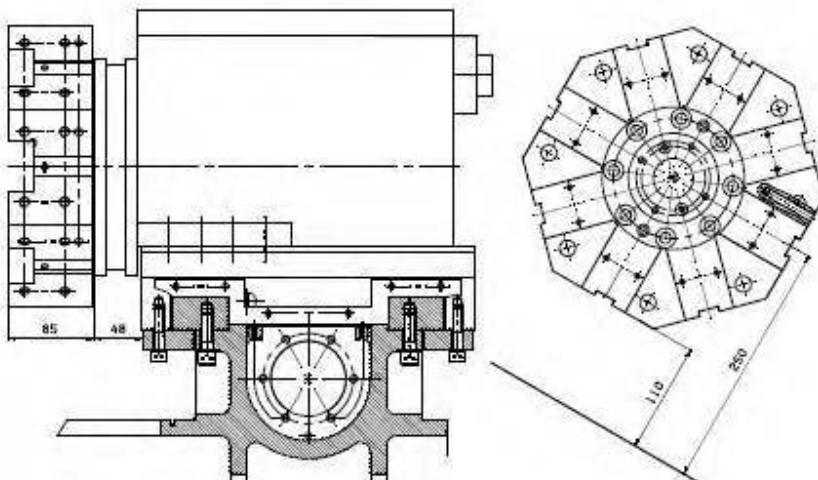


In the cutting oil discharge system for the directly mounted cutting tool, the cutting oil flows to the tool tip through the nipples mounted on the face of the turret disc.

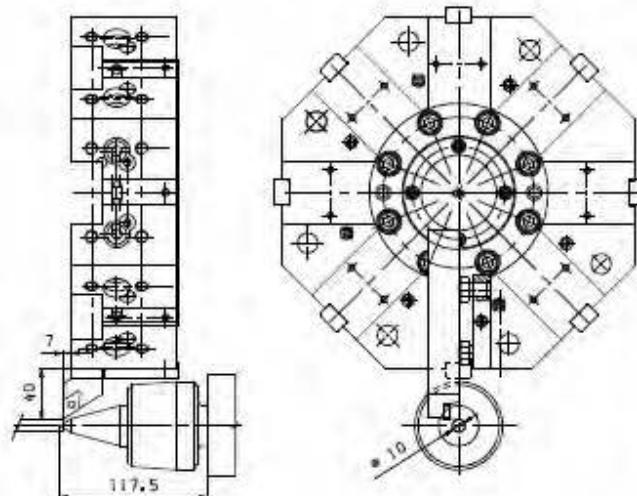
In various tool holders, the cutting oil discharge device is built-in. Since the spherical nozzle is provided, the cutting oil discharge direction can be adjusted as desired. When adjusting the nozzle loosen the set screw, adjust the position of nozzle and secure it with the set screw.

OVERHANG OF THE CUTTING TOOL

The relative position between the turret disc and the carriage cover is as shown. Set the overhang of the cutting tool to 105 mm or less from the turret disc face so that the cutting tool does not interfere with the carriage cover when the turret disc is indexed. The positional relationship between the turret disc and cross slide is as shown. Set the overhang on the rear side of the turret head to 25 mm or less.



TAILSTOCK INTERFERENCE



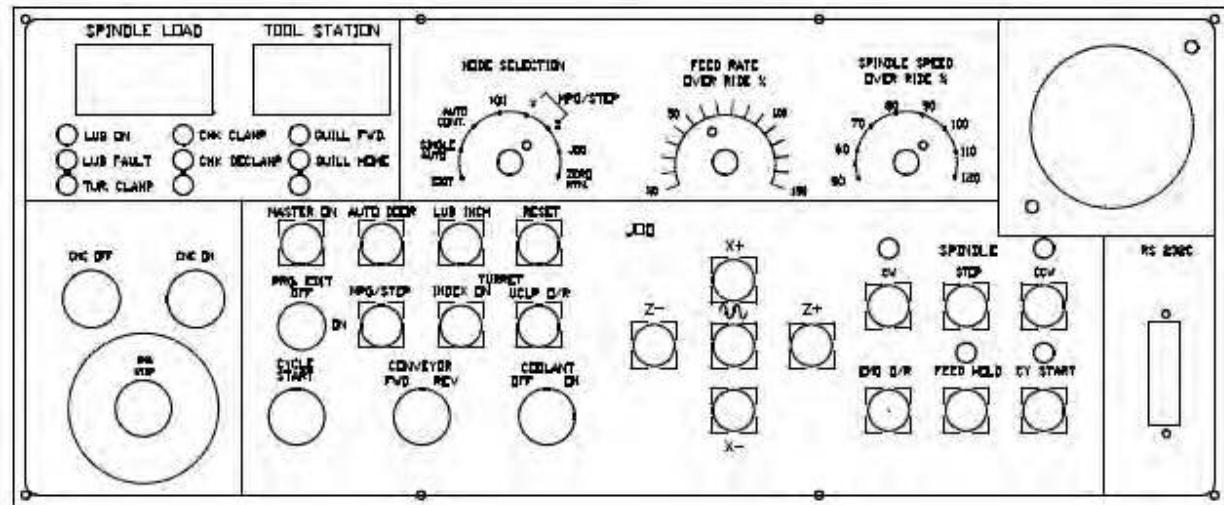
The drawing shows the interference of the tailstock and the turret when the cutting tool is projected by the standard amount (40 mm) and the workpiece is supported by tailstock. The tool can machine a minimum diameter of 10 mm. Therefore, the cutting tool must be projected more than 40 mm if the machining is to be done at a lower diameter.

2. Miscellaneous function code(M-code) list for ACE CNC lathes

M00	Program stop	M50	Spindle lock ON
M01	Optional stop	M51	Spindle lock OFF
M02	End of program	M52	
M03	Spindle rotation CW	M53	
M04	Spindle rotation CCW	M54	T.S. quill override ON
M05	Spindle stop	M55	Chuck signal override ON
M06		M56	T.S. quill interlock ON
M07	Coolant ON	M57	T.S. quill interlock OFF
M08	2nd Coolant ON	M58	
M09	Coolant OFF	M59	
M10	Chuck declamp	M60	Door interlock OFF
M11	Chuck clamp	M61	Door interlock ON
M12		M62	
M13		M63	
M14		M64	
M15		M65	Bar feeder ON
M16	Chuck clamp on I.D.	M66	
M17		M67	
M18	Chuck clamp on O.D.	M68	
M19	Spindle orientation	M69	
M20	Spindle orientation cancel	M70	
M21		M71	
M22		M72	
M23		M73	
M24		M74	
M25		M75	
M26		M76	Steady rest - B open
M27	Chuck low	M77	Steady rest - B hold
M28	Chuck high	M78	Steady rest - A open
M29		M79	Steady rest - A hold
M30	End of main program	M80	
M31		M81	
M32	T.S. quill forward	M82	T.S. body forward
M33	T.S. quill retract	M83	T.S. body retract
M34	Parts catcher forward	M84	T.P. arm forward
M35	Parts catcher retract	M85	T.P. arm retract
M36		M86	
M37		M87	
M38		M88	
M39		M89	
M40		M90	
M41	Spindle low gear select	M91	
M42	Spindle high gear select	M92	
M43		M93	
M44		M94	
M45		M95	
M46	Door open	M96	
M47	Door close	M97	
M48		M98	Sub program call
M49		M99	Sub program end22

MACHINE CONTROL PANEL

1. MACHINE CONTROL PANEL



The above operator panel is only for the user reference. For exact description of operator panel for the machine supplied refer to the relevant operator panel drawing supplied with the machine interface manual.

MACHINE CONTROL PANEL DETAILS

1. Emergency stop push button
2. CNC OFF/ON push button
3. Emergency override push button
4. +X jog push button
5. -X jog push button
6. +Z jog push button
7. -Z jog push button
8. Rapid override push button
9. Cycle start push button
10. Feed hold push button
11. Spindle CW/CCW push button
12. Spindle stop push button
13. Spindle speed override rotary switch
14. Rapid & Feed override rotary switch
15. MPG/STEP feed push button
16. Mode selection rotary switch
17. Program edit OFF/ON key switch
18. RS 232C port
19. Cycle start push button
20. Coolant OFF/ON selector switch
21. Turret index ON push button
22. Turret unclamp override push button
23. Reset push button

24. Lub inch push button
25. Chip conveyor Forward/Reverse spring return selector switch
26. Turret tool station display unit
27. Spindle load meter
28. Master ON push button
29. Auto door push button

LED indicators

- a. Lub. ON LED
- b. Lub. Fault LED
- c. Chuck clamp LED
- d. Chuck declamp LED
- e. Quill Forward LED
- f. Quill Home LED
- g. Turret Clamp LED

DESCRIPTION OF MACHINE CONTROL PANEL

1. EMERGENCY STOP PUSH BUTTON

Machine will be in emergency state if this push button is pressed. In emergency state power to the drives is removed and not ready message is displayed on screen. Hydraulic pump starts when this push button is released and pump stops when it is pressed.

2. CNC ON / OFF PUSH BUTTON

After the main supply is switched ON, CNC system can be switched ON by pressing CNC ON push button. After a few seconds delay the CRT display will come ON showing software version number and PMC number. The CNC can be switched OFF by pressing CNC OFF push button.

3. EMERGENCY OVERRIDE PUSH BUTTON

During machine operation if any slide actuates the end limit switch, the machine will come to emergency stop state. Jog keys become ineffective unless the emergency override push button and Reset push button are pressed. Keeping emergency override push button pressed jog the axis in opposite direction till the end limit switch is released. Then emergency override push button should be released. After this jog switches will remain effective.

4. +X JOG PUSH BUTTON

If this key is pressed in jog mode then X-slide will move in positive direction at a feed rate depending upon the feed override selected. When in reference mode and Z-axis reference is completed, this key can be used for X-axis homing.

5. -X JOG PUSH BUTTON

If this key is pressed, in jog mode then X-slide will move in negative direction at a feed rate depending upon the feed override selected.

6. +Z JOG PUSH BUTTON

If this key is pressed in jog mode then Z-slide will move in positive direction at a feed rate depending upon the feed override selected. When in reference mode and this key can be used for Z-axis homing.

7. -Z JOG PUSH BUTTON

If this key is pressed in jog mode then Z-slide will move in negative direction at a feed rate depending upon the feed override selected.

8. RAPID OVERRIDE PUSH BUTTON

When this push button is pressed along with any of the jog push buttons, the respective slide moves in rapid rate set for that slide. Rapid rate can be controlled using the feed rate override rotary switch.

9. CYCLE START PUSH BUTTON

This push button is effective in Auto single and MDI modes of operation

10. FEED HOLD PUSH BUTTON

Auto cycle is interrupted when this push button is pressed.

11. SPINDLE CW / CCW PUSH BUTTON

In jog mode spindle direction of rotation can be selected using these two push buttons. The spindle speed can be selected using S command and enable can be made using M-command in MDI mode.

12. SPINDLE STOP PUSH BUTTON

In jog mode spindle is disabled using this push button. In Auto/MDI mode, spindle can be stopped with this push button.

13. SPINDLE SPEED OVERRIDE ROTARY SWITCH

The programmed spindle speed can be varied from 50% to 120% in steps of 10%.

14. RAPID & FEED OVERRIDE ROTARY SWITCH

Rapid & Feed will be controlled through a single rotary switch named as "Feed Override switch". Feed can be varied from 0 - 150% in steps of 10%. But it is limited to 100%.

15. MPG / STEP FEED PUSH BUTTON

In handle/step mode without MPG option, this push button can be used to move the slides to a distance ranging from one micron to one millimeter using X or Z keys. With MPG option in handle/step mode, with every incremental rotation of the MPG, slides can be moved to a distance ranging one micron to 100 microns depending upon the push event of handle/step push button switch.

16. MODE SELECTION ROTARY SWITCH

Modes of operations such as EDIT, AUTO-SINGLE, AUTO CONT, MDI, HANDLE/STEP, JOG, ZRN can be selected using this switch.

17. PROGRAM EDIT OFF / ON KEY SWITCH

Program protection is possible only when this switch is in ON position. In order to edit the part program, this switch must be in ON position. This switch is removable only when it is in OFF position.

18. RS 232C PORT

This port can be used to upload or download the PLC program, part program or machine parameters from CNC system to the computer or other Fanuc system compatible peripheral devices.

19. CYCLE START PUSH BUTTON

This push button is effective in Auto continuous/Auto single and MDI modes of operation.

20. COOLANT ON / OFF SELECTOR SWITCH

Coolant can be turned ON/OFF using this switch in Jog mode and with M7 code in Auto/MDI mode.

21. TURRET INDEX ON PUSH BUTTON

In jog mode the turret can be indexed forward direction by pressing this push button provided turret is in safe zone and turret clamp signal is present.

22. TURRET UNCLAMP OVERRIDE PUSH BUTTON

If the turret is unclamped the axes can't be moved. This can be overridden by pressing this switch.

23. RESET PUSH BUTTON

This push button can be used to reset M, S or T functions when in execution. This push button can also be used to reset PLC messages and spindle alarm.

24. LUB. INCH PUSH BUTTON

Once this push button is inched lub motor will be ON for three seconds. Lubrication inching is possible only when the machine is not under emergency and sufficient oil is present in the lubrication tank.

25. CHIP CONVEYOR FORWARD / REVERSE SPRING RETURN

SELECTOR SWITCH

This is a 3 position centre off spring return selector switch. This switch is effective only when the machine is selected in manual mode. In manual mode, with this switch set in forward position, forward inching is possible and reverse inching is possible with reverse selection. Reverse inching can be made only for a short duration to prevent stalling of the chip conveyor motor and subsequent damages.

In auto mode, chip conveyor works continuously in forward direction irrespective of the conveyor forward/reverse selector switch.

In jog mode chip conveyor can be run forward/reverse, by using spring return selector switch.

In auto mode chip conveyor works in forward direction.

26. TURRET TOOL STATION DISPLAY UNIT

This can be used to indicate the turret station number of the tool being used.

27. SPINDLE LOAD METER

This meter indicates the load conditions of the spindle motor as a percentage of full load (0 to 120%). This indication is independent of the direction of rotation of the spindle. Cutting load should be within 100% irrespective of spindle speed.

28. MASTER ON PUSH BUTTON

Emergency state will get reset, if Master ON push button is pressed.

Interlocks used in CNC Lathe

Interlocks for the axes movement :

- ✓ Turret should be in clamped condition i.e. input X0001.1 should be high. Feed rate should be greater than 0%

Interlocks for turret indexing :

- ✓ Turret should be in safe zone (X in home position).
- ✓ Thermal contact of turret motor i.e. input X0001.2 should be high (i.e. Turret motor should not be overheated).

Interlocks for spindle function :

- ✓ Chuck should be clamped i.e. X0000.2 should be high.
- ✓ After giving clockwise / counter clockwise command, CW/ CCW push button should be pressed first time, after switching ON the CNC

Lubrication interlocks :

- ✓ LOW LUB OIL LEVEL CYC. INTR message should not be displayed on the CRT i.e. input X0000.6 should be HIGH.
- ✓ LOW LUB PRESSURE CYC. INTR message should not be displayed when LUB INCH push button is pressed i.e. input X0000.7 should be high.

Interlock for starting the auto cycle :

- ✓ Axes should be referenced (X-reference LED and Z-reference LED should be ON) (only for axis motors with incremental encoders)
- ✓ Door should be closed (X008.7 input should be HIGH) (Optional)
- ✓ Chuck should be clamped input X0000.2 should be high.
- ✓ Turret should be clamped input X0001.1 should be high.
- ✓ LUB fault LED should not glow.
- ✓ Rapid O/R selector switch and feed O/R selector switch should be selected to required value (it should not be at 0%).
- ✓ Program check, machine lock and dry run switches should be in OFF position.

Mains power ON interlock :

- ✓ Electrical cabinet door should be in the closed condition and "S0" RED switch in the electrical should be depressed firmly.

MAINTENANCE

1. DAILY MAINTENANCE

1)	Lubrication system (Alarm signal)	Check for oil level, pressure build up & film on sliding surfaces	At the start of the work
2)	Chuck	Greasing the master jaws through grease nipples. Tighten the jaws	At the start of the work
3)	Cutting tools	Tighten the tool blocks, tools and inserts	At the start of the work
4)	Hydraulic oil level	Check for level	Replenish if needed
5)	Pressure gauge	Check system pressure Check for chuck pressure	30 Kg/cm ² As per requirement
6)	Coolant level	Check for level	Replenish if needed
7)	Tubing and machine surroundings	Check for leakage and cleanliness	
8)	External wiring and cables	Check for disconnections and damage to sheath	
9)	Cleaning	Clean the work holding, turret and sliding guards to remove chips and coolant	At the end of the work

Maintenance Manual



2. PERIODIC INSPECTION

Coolant	Check for condition	Replace as required
Hydraulic system	Return line filter replacement	6 months
	Check condition of oil and replace	1 year
	Clean power pack and surroundings	1 year
	Clean suction strainer	1 year
	Check proper working of accumulator	6 months
Lubricating system	Check for proper working	1 month
	Check for oil lubrication lines	1 month
V belts and timing belts	Check for condition and tension	1 month
Motors	Check for rigid (proper) mounting	6 months
Chuck	Overhaul the chuck	1 month
Chucking cylinder	Check for leakage across the piston	3 months
Electrical cabinet	Vacuum clean the CNC and the electrical cabinets	3 months
Electrical contacts	Check for discolouration in the contacts	3 months
Electrical elements	Check for proper working of push button switches	3 months
Limit switches	Check for proper signals	3 months
Axes backlash	Check and compensate	6 months
Foundation	Check for level and relevel	6 months
Headstock	Clean labyrinth holes	1 month
Turret	Check for alignment and correct	As required

3. LUBRICATION

Lubrication is very important for machine tools since it greatly affects machine life. Use only recommended lubrication oils which can clean and free foreign matter. Periodically clean the tank and filter, inspect equipment or piping for damages to ensure optimum machine operation.

a. SPINDLE

The headstock houses the spindle in bearings which are lubricated for life with high grade grease (KLUBER ISOFLEX NBU-15). This grease can withstand low and high temperatures (-60⁰ C to +130⁰ C).

Spindle should be warmed up for approximately one hour when the machine has been stopped for a long period (e.g. five days or more on account of holidays etc.).

See **Cautionary details concerning Installation**

b. TAILSTOCK

The tailstock quill is connected to the central lubrication system. If the tailstock contains a built-in live centre, then it is lubricated for life with KLUBER ISOFLEX NBU-15 grease. It needs to be changed when the bearings are to be changed. If the machine is with add-on revolving centre there is no lubrication required.

3.1 COOLANT

A tank serving as a coolant tank on which a chip tray is placed (or optional chip conveyor) is installed in the rear side of the bed. It can be removed from the rear side of the machine. Therefore, it is easy to clean the inner part of the tank and to dispose chips. (Capacity 110 litres)

A coolant tank of 110 litres capacity, with a swarf tray (or chip conveyor) is placed in rear of the machine. The tank and tray can be removed from the rear side for cleaning etc.

3.2 CHUCK

Selection of grease depends on the chuck used. Never fail to supply grease once a day to the slideway of master jaw.

For GMT Chucks, it is recommended to lubricate the chuck once every shift.

Refer to the Chuck Manufacturer's Instruction Manual for details.

3.3 CENTRALISED LUBRICATION

The X & Z slideways, ballscrews and the tailstock quill are lubricated by automatic centralised lubrication. Each point of lubrication is connected through a metering cartridge of 0.25cc capacity/stroke. The provision for manual or automatic selection of lubrication is provided on the control panel, and the lubrication interval is usually set at once for three seconds for every 25 minutes.

It is recommended to supply enough number of lubrication shots by manual means before starting a machine which has been shut down for a long time. The number of shots required to fill the drained out lubrication lines after the lubrication metering cartridge depends upon the distance from the metering cartridge to the lubrication point.

For further details see annexure - Centralised Lubrication.

3.4 DAILY INSPECTION

By opening the rear door the lubrication oil distributor mounted beside the X-axis feed motor is monitored. Visual inspection of the distributor is not sufficient, so check oil at places where oil is distributed (such as slideways). (e.g. Touch the slideways to check for an oil film.)

Especially when the machine has been stopped for an extended period, the distributing pipe gets drained. There are cases when the oil does not flow even though the pipe is filled with oil. In such a case, check for oil flow by disconnecting the pipe.

If the machine is operated without supplying the lubricating oil to the sliding surfaces, it will cause seizure of the sliding surface. Be sure to perform the above mentioned inspection every day.

3.5 OIL GUIDE TABLE

Lubrication point	Lubrication system	Recomm. oil grade	Quantity
Head stock	Grease	KLUBER ISOFLEX NBU-15	
Ball screws, Guideways, Tailstock	Centralised lubrication	ISO VG-68	3 Litres
Hydraulic		ISO VG-68	45 Litres
Coolant			110 Litres

NOTE : Do not use oil other than the above mentioned.

Also, do not use the mixture of oils of different makes.

Maintenance Manual



3.6 STARTING CHECK TABLE

Check item

1.	Lubrication oil level Check a. Centralised lubrication unit tank b. Transmission
2.	Grease injection a. Check master jaw (Once every day)
3.	Oil flow Check a. Slideway b. Tailstock quill
4.	Oil leak from each part a. Transmission b. Hydraulic unit c. Chucking cylinder d. Peripheral area of machine
5.	Abnormal noise from spindle drive system a. Head stock b. Transmission c. Motor
6.	Electrical system a. Check for each indication b. Check for each switch function

4. HEAD STOCK REALIGNMENT

In case of axis misalignment of the spindle with respect to the Z-axis, follow the method given below for resetting:

1. Remove the chuck, chucking cylinder etc.
2. Clean the morse taper in the spindle.
3. Insert an inspection mandrel.
4. Open the left hand guard covering the head stock.
5. Loosen the mounting bolts of the head stock slightly and use the screws provided (A and B) to align the axis with respect to the Z-axis.
6. Tighten the clamping bolts and recheck the alignment in both primary and secondary planes of the Z-axis.
7. Shift the tailstock also if necessary in the appropriate direction using the cross adjustment provided in the tailstock (use a mandrel between centres for this task).
8. Refix the covers.

Maintenance Manual

