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Maintenance and Safety Manual

VTX/HTX Machining Centers

August, 2004



Maintenance and Safety Manual

**for Hurco
VTX/HTX Machining Centers**

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	Page
Daily (Every 8-10 Hours)	
<input type="checkbox"/> Clean and lubricate spindle taper	3-1
<input type="checkbox"/> Perform daily operational checks	3-1
<input type="checkbox"/> Clean machine.	3-2
<input type="checkbox"/> Inspect floppy drive and diskettes for dirt or damage.....	3-2
<input type="checkbox"/> Make sure all lubricant levels are correct	3-4
<input type="checkbox"/> Inspect/clean tool lock pins	3-13
<input type="checkbox"/> Make sure the FRL Unit air pressure is correct	3-14
<input type="checkbox"/> Inspect/clean coolant levels and filters	3-18
<input type="checkbox"/> Clean chip screens.	3-19
Weekly (Every 40-50 Hours)	
<input type="checkbox"/> Clean heat exchanger filter	3-3
<input type="checkbox"/> Make sure the filler screen is clean.....	3-9
<input type="checkbox"/> Refill the autolube reservoir	3-10
<input type="checkbox"/> Make sure the auto moisture drain on FRL unit operates correctly	3-15
<input type="checkbox"/> Clean oil chiller filter	3-16
Monthly (Every 150-200 Hours)	
<input type="checkbox"/> Inspect external conduit, cabling and wiring for signs of wear or damage ...	3-3
<input type="checkbox"/> Inspect tool holders for damage or excess wear	3-13
<input type="checkbox"/> Make sure limit switch and dog fasteners are tight.....	3-20
Every 3 Months (Every 500 Hours)	
<input type="checkbox"/> Clean/replace FRL filter element	3-15
<input type="checkbox"/> Drain moisture from the air lines	3-15
<input type="checkbox"/> Clean/replace coolant filters and change coolant	3-17
<input type="checkbox"/> Clean chip conveyor tank	3-19
<input type="checkbox"/> Measure ground impedance (resistance to true earth)	3-20
Every 6 Months (Every 1000 Hours)	
<input type="checkbox"/> Grease rotary (tilt axis) incline shaft side (VTXU only)	3-4
<input type="checkbox"/> Grease rotary (tilt axis) incline shaft side gearcase (VTXU only)	3-4
<input type="checkbox"/> Grease rotary table gearbox (HTX500 only)	3-6
<input type="checkbox"/> Grease rotary table side (refer to HTX500 lubrication table).....	3-6
<input type="checkbox"/> Grease rotary union bearing assembly	3-11
<input type="checkbox"/> Make sure the machine is level.....	3-20
Annually (Every 2000 Hours)	
<input type="checkbox"/> Replace autolube reservoir suction filter.....	3-7
<input type="checkbox"/> Replace ATC cam oil	3-11
<input type="checkbox"/> Replace ATC gearbox oil (HTX500 only)	3-11

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Using This Manual

Standard Text Icons

This manual may contain the following icons:



Caution

The machine may be damaged, or a part ruined, if the described procedure is not followed.



Hints and Tricks

Useful suggestions that show creative uses of the Ultimax features.



Important

Ensures proper operation of the machine and control.



Troubleshooting

Steps that can be taken to solve potential problems.



Warning

The operator may be injured and the machining center severely damaged if the described procedure is not followed.



Where can we go from here?

Lists several possible options the operator can take.



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Machine Components

Overview

Hurco machining centers use microprocessor-based computer numerical control (CNC) digital control systems. Part programs are entered in either Conversational or Conventional NC (G-Code) format.

All machining centers described in this manual have either a vertical or horizontal spindle with programmable spindle speeds, and a multi-tool Automatic Tool Changer (ATC) and 4 or 5 axes. Options are available to accommodate various machining applications. Check with your full service distributor or Hurco about available options.

Closed loop servo drive systems and motors with rotary encoders power the mechanical drives that position the axes. The rotary encoders and linear scales provide positioning feedback information to the control. Limit switches mounted on each axis determine end-of-travel and establish reference points for initial machine zeros.

Ultimax positions an axis by sending a command to the appropriate servo drive, which in turn supplies voltage to the connected axis servo motor.

Refer to the Parts Listings and Wiring Diagrams Manual for mechanical and electrical component drawings for your machine.



Important

Machine linear positioning accuracy was set at the factory, in an ambient temperature of 68°F (20°C). Continual operation at higher or lower temperatures may require that you re-compensate the linear positioning accuracy.

Machine Model Name

The machine models described in this manual are:

- VTXU
- HTX500



Frame

The major structural assemblies (base, column, head, and table) of each Hurco machine are constructed of thick-walled, fine-grain cast iron. This construction provides strength and excellent dampening characteristics, keeping deflection and resistance at a minimum during machining.

The machine base (including leveling bolts) is the substructure for the column and table. The column is a rigid box type, and allows for machining a variety of part sizes. The base supports the table and preserves “table flatness.”

Table

The machine table provides easy setup for a variety of part sizes.

- The VTX table is equipped with five (5) 14 mm (0.55 in.) wide T-slots, 100 mm (3.94 in.) spacing on centers.
- The HTX table contains two pallets, each with a 24-16 mm (0.63 in.) hole matrix, 100 mm (3.94 in.) spacing on centers.

Machine Table specifications appear below:

Machine		Floor to Table Surface	Working Surface	T-slot Width	T-slot Spacing on centers	Number of T-slots	Load Capacity	
VTXU	mm	1085	600 x 500	14	100	5	kg	265
	in.	42.7	23.6 x 19.7	0.5	3.9		lbs	584
HTX500	mm	1190	500 x 500 each pallet	16	100	24	kg	500
	in.	46.9	19.7 x 19.7 each pallet	0.63	3.9		lbs	1100

Table 1-1. Machine Table Specifications



Head

The cast iron head assembly is designed to produce superior cutting accuracy. The VTX machine has a fixed vertical spindle and uses a motor brake for the Z axis. The HTX machine has a horizontal spindle and uses a motor brake for the Y axis. The Z axis on a VTX machine is perpendicular (vertical) to the machine table and on an HTX machine is parallel (horizontal) to the machine table.

Guideways

The X, Y and Z axes guideways are oversized, precision linear rails.

Switches and Sensors

Limit switches, proximity switches, and electrical sensors monitor machine functions. These devices report their state to the control. If a malfunction is detected, a stop condition shuts off power to the servo systems and spindle.



Enclosure

Full chip enclosures are standard in Hurco machining centers.

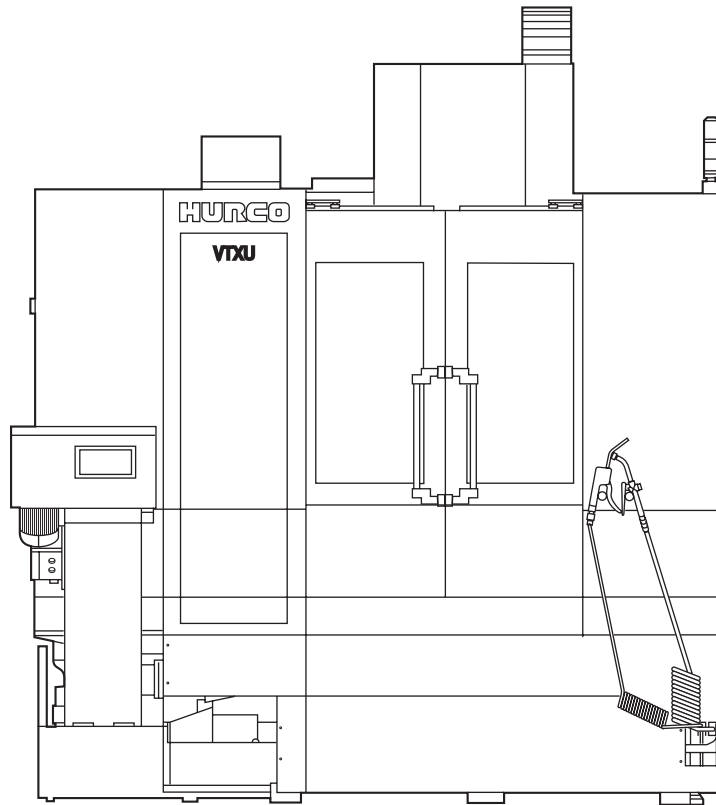


Figure 1-1. Full Chip and Coolant Enclosure—VTX

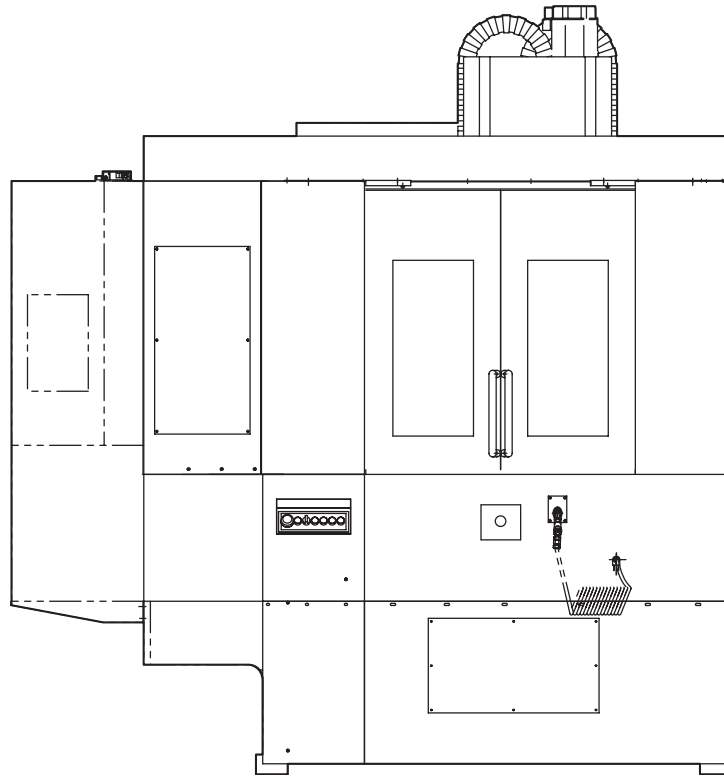


Figure 1-2. Full Chip and Coolant Enclosure—HTX

Standard features include a wash down system, a chip auger, and a chip pan.



Spindle and Drive System

The spindle and drive subsystem consists of a spindle, motor with encoder, pulley arrangement and drive unit. Different size spindles, motors and pulleys gives each machine its unique cutting power specification.

Machine	Max RPM	Base Speed RPM	Motor HP – Continuous		Motor HP – Peak (1 min. rating)		Spindle Torque – Continuous (900 RPM)		Spindle Torque – Peak (1 min. rating @720 RPM)	
			kW	HP	kW	HP	N·m	lb-ft	N·m	lb-ft
VTXU	12,000	900	11	15	18	24	119	87.5	237	175
HTX500	12,000	900	11	15	18 @720 rpm	24 @720 rpm	119	87.5	237	175

Table 1–2. Spindle Drive System Specifications

Note

VTX/HTX series machines can be equipped with a coolant-thru spindle option.

Spindle

VTX/HTX series machining centers have a cartridge type spindle. This spindle is precision balanced, and made of high-grade alloy steel. The spindle shaft (inside of the cartridge) is supported by ABEC-7 class angular contact bearings.

Heavy disc springs retain the tool holder in the spindle by clamping the tool holder pull stud via a drawbar. Pneumatics release the tool holder during a tool change. A dual-piston air cylinder supplies the necessary thrust force to the drawbar for tool release.

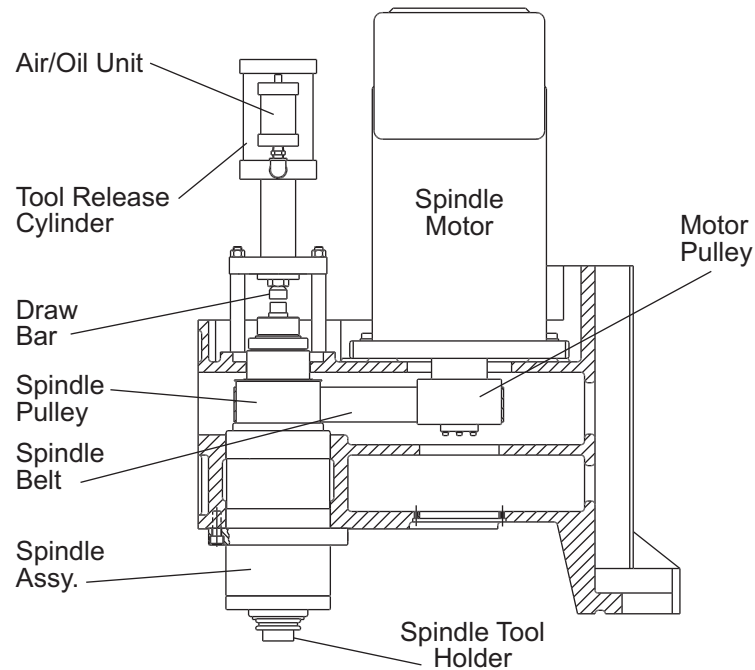


Figure 1-3. Example of Spindle and Drive

AC Spindle Drive Unit

The spindle drive unit contains closed-loop control and controls the spindle motor using an encoder. A microprocessor governs the closed-loop control, including monitoring.

The following messages are output at terminals via relay contacts:

- Ready/Fault
- Main Spindle Messages
- Heat Sink Temperature Monitoring
- Motor Over-temperature

Electronic Spindle Orientation

The standard spindle on VTX/HTX machines uses electronic spindle orientation. The spindle is stopped at a fixed position through signals sent from an electronic encoder assembly attached to the spindle motor shaft.



Proximity Sensor Spindle Orientation

VTX/HTX machines with the Coolant-thru Spindle (CTS) option use proximity sensor spindle orientation. This method of orientation uses a proximity switch mounted on the spindle and a screw on the collar of the spindle shaft, or a slot on the spindle shaft, as its target.

Spindle Motor

The spindle motor and spindle are coupled using a no-slipage gear belt. The motor is fully enclosed, uses forced-air cooling, and has no brushes to inspect or replace.

Machine	Spindle Drive/Belt Ratio
VTXU	1:1.2
HTX500	1:1.2

Table 1-3. Spindle Drive Belt Ratio

To allow machining of a variety of parts, the spindle RPM is specified in the part program. A manual spindle speed override on the control console permits fine-tuning of the spindle RPM for a specific machining cycle, without changing the part program.

Tool Retention Knobs

Caterpillar V-Flange tooling is standard. BT tooling is optional.

Hurco recommends using the tool retention knobs listed in the following table. For information about which retention knobs to use with optional CTS, contact your full service distributor or Hurco.

Machine	Tooling	Retention Knob Part No.
VTXU	Cat 40 V-Flange	Hurco #802-1860-002
	BT-40	Hurco #802-1860-004
HTX500	Cat 40 V-Flange	Hurco #802-1860-002
	BT-40	Hurco #802-1860-004

Table 1-4. Recommended Retention Knobs



Axes Motion System

Hurco machining centers use AC servo drive systems to power the X, Y, and Z axes. Approximate positioning specifications appear below.

Machine	Axes	Motor Torque – Continuous		Motor Torque – Peak		Axis Thrust – Continuous		Axis Thrust – Peak		Rapid Feed Rate	
		N·m	lb-in	N·m	lb-in	kN	lbs.	kN	lbs.	m/min	ipm
VTXU Rev B	X	28.4	252	71.1	630	12.5	2805	31.1	7000	35	1378
	Y,Z	28.4	252	71.1	630	9.5	2137	23.8	5335	35	1387
VTXU Rev A	X	48.0	425	119	1050	21	4730	52	11,681	35	1378
	Y	35	310	87.6	776	11.7	2629	29.3	6587	35	1387
	Z	28.4	252	71.1	630	9.5	2137	23.8	5335	35	1387
HTX500	X	28.4	252	71.1	630	9.5	2137	23.8	5340	32	1260
	Y,Z	28.4	252	71.1	630	9.5	2137	23.8	5340	32	1260

Machine	Axes	Motor Torque—Continuous		Motor Torque—Peak		Rapid Feed Rate
		N·m	lb-in	N·m	lb-in	rpm
VTXU	A	8.34	74	23.3	207	5.5
	C	5.39	48	13.8	122	22.2
HTX500	B	48.0	425	48	425	33.3

Table 1-5. Axes Positioning System Specifications



Servo Motors

Ultimax controls axes velocity and travel direction using AC servo motors. These motors are enclosed, transistor-driven, and self-cooled. Because they are designed without brushes, the motors are free from flashover and commutation loss.

In the VTX series, servomotors power ballscrews by belt drive on the X axis and by a direct drive transmission on the Y and Z axes.

In the HTX series, servomotors power ballscrews by a direct drive transmission on the X, Y, and Z axes.

Ballscrews and Bearings

The precision ballscrews are the double ballnut type. Ballscrews are hardened and ground to minimize “drag torque” and reduce backlash.

Axes positioning drives are supported at the drive-ends by ABEC-7 class bearings.

Feedback Systems

Each drive has circuitry to detect conditions in the servo’s closed-loop system.

Each axis motor is equipped with a rotary encoder that provides velocity and position feedback signals for each closed-loop system. These signals are required for motor control and accurate positioning.

Limit switches mounted on each axis establish reference points for initial machine zeros and for determining end-of-travel.

Machine Electrical Cabinet

The machine’s electrical control cabinet contains CNC-related electronics and power-related circuitry.

Safety Procedures for Electrical Service

Before removing or working on any printed circuit board (PCB), cables, fuses, breakers, or other machine components, make sure that the main disconnect switch on the electrical cabinet door is in the OFF position.



Whenever work will be performed in an area away from the main disconnect switch, post a warning at the switch informing others that the machine is being serviced and the power must remain OFF.



Warning

High voltages inside the electrical cabinet can cause serious injury or death. Only qualified personnel may service the machine, and must follow all safety rules and precautions. The line-side of the main disconnect switch is energized (hot), unless the AC source is disconnected.

Handling Printed Circuit Boards

Use the following procedures to prevent damage when removing printed circuit boards (PCB), or when checking the boards for proper and secure connections.



Important

Avoid flexing PCBs. Rough handling can cause hairline cracks in the printed circuit etching. Problems caused by cracks in PCB boards can be hard to isolate. Avoid touching the components on a PCB because they can be damaged by static electricity.

- Always put on a static safe handling wrist strap before touching PCB assemblies inside the cabinets, and before removing replacement boards from their static protective packaging.
 - Visually inspect the wrist strap every time you put it on, making sure that the snap fasteners are properly connected.
 - Be sure the strap fits snug to the wrist. Taking off the wrist strap should be the last thing you do when finished inside the cabinet.
 - After the replacement PCB is properly mounted in the cabinet, place the defective PCB assembly into the static shielding and return it to Hurco.



Electrical Cabinet Components

The electrical cabinet contains power circuitry and CNC electronics. The cabinet is attached to the machine column and connects to the machine systems via cable and harness assemblies.

Power-related circuitry distributes power, while CNC-related electronics control machine operation (e.g., spindle speed and axis positioning).

Electrical Cabinet Operating Temperature

The electronics inside the electrical cabinet are designed to tolerate reasonably high ambient temperatures. Fans on some of the electronic assemblies and a heat exchanger on the cabinet door circulate warm air away from components.

The cabinet contains a temperature sensor, mounted on the CANbus control board in the ISA control board rack. This sensor is preset to a high temperature limit. If the temperature exceeds the limit, the machine will enter an emergency stop condition.

Hurco Machining Centers that are not equipped with the air conditioning option may be operated in ambient temperatures up to 95°F (35°C), and in relative humidity (non-condensing) up to 95%.

Electrical Cabinet Layout

Electrical cabinet layouts may vary from machine to machine. See the *Parts Listings and Wiring Diagrams Manual* for your machine model.

Power Supply

The DC switching power supply mounted on the ISA control card rack converts the 115 VAC input power to the regulated DC voltages distributed by the DC distribution board. The DC distribution board supplies regulated DC voltages to all printed circuit board assemblies in the card cage, Ultimax console and control relays.

CNC Electronics

The primary CNC-related PC boards that are located in the machine's electrical cabinet are described below.



Ultimax ISA Control Card Rack

The Ultimax ISA Control Card Rack contains the following microprocessor control printed circuit boards:

- Main CPU (Single Board CPU and Passive Backplane)
- Peripheral Interface
- Dual VGA Board
- Motion Controller
- CANbus Controller
- CANbus DC I/O Backplane
- I/O Interface

Main CPU Board

The main CPU board is a single board computer with a microprocessor CPU.

The CPU board uses a passive backplane that provides both ISA and PCI buses, and is jumper-configurable to permit system performance enhancements. Since the board's memory requirements are based upon the application requirements, memory is upgradeable.

Peripheral Interface

The Ultimax control supports standard AT compatible peripherals including:

- Hard disk
- Serial interface—COM1 and COM2
- Floppy disk

The interface for the hard disk is an integrated disk electronics (IDE) interface. It is considered integrated because the hard disk controller resides on the drive itself and the interface resides on the motherboard. The connector for this interface is typically a dual row, 40-pin header.

The main CPU board supports a standard, 34-pin, PC/AT style, floppy disk interface. The base level system has at least one 1.44 MB drive.



VGA Board

The dual VGA board enables the CPU board to display text and graphics on the monitor. The dual VGA boards connect to the CPU board via the PCI bus.

Motion Control Board

The motion control subsystem uses a Digital Signal Processor (DSP) motion control board to control the servo amplifiers for the axes and the spindle pack.

A standard Matrix 4 board has the capability of controlling four servo axes or three servo axes and a spindle drive. The four identical servo channels on the board are updated and coordinated using two DSP integrated circuit microchips.

An optional Octavia DSP board may be installed on your machine. The Octavia DSP board has the capability of controlling eight servo axes.

CANbus Controller Board

The CANbus is a multi-master serial bus developed for the controller area network (CAN). This bus is the input/output (I/O) center of the Ultimex ISA platform.

The CANbus controller board and the DC I/O interface board handle the I/O control functions within the CNC controller. The external node used by the machining center is the console interface.

The CANbus controller board is an intelligent AT bus board for executing logic control programs, controlling CANbus I/O, controlling local 24-volt I/O, and monitoring the on-board A/D converter.

CANbus DC I/O Backplane

The CANbus DC I/O backplane distributes power and CANbus signals to the I/O interface board. The basic voltage levels are +5VDC, +/-12VDC, +24VDC. There are three isolated grounds: digital GND, machine GND, and analog GND. The backplane slot determines the node address of the board.)



I/O Interface Board

The CANbus I/O interface board forms the interface between the motion subsystem and the CANbus controller I/O. The I/O signals on this board are buffered and then routed within the enclosure over a ribbon cable to the motion or CANbus subsystems. The board uses Honda connectors.

CANbus DC I/O Node

The CANbus DC I/O Node board mounts on the CANbus DC I/O backplane in the extension enclosure to the ISA card rack. This board communicates with the machine through 32 input and 32 output connections, and transfers information through the backplane to the CANbus controller.

The 24 volt solid state outputs are current limited to 150mA. Outputs are disabled at power up and when the Emergency Stop button is depressed.

Multiple boards may be used to provide additional I/O. The extension enclosure accepts two of these boards in addition to the I/O interface board; all are connected to the CANbus DC I/O backplane. Expansion for other boards is possible. The following table shows machine-specific I/O signals.

Description	Signal Type
ATC	I/O
Spindle Amp	I/O
Drawbar Air Pressure	O
Drawbar Switch Limits (clamp/unclamp)	I
Spindle Unclamp PB	I
Spindle Unclamp Control	O
X, Y, Z Amp Alarm	I
X, Y, Z Amp Reset Servo Enable Signals	O
Washdown	O
Spindle Bearing Coolant Buildup Purge	O

Table 1-6. CANbus DC I/O Node Board Inputs and Outputs



Communication Ports

All communication ports are located on the Comm Port/Hour Meter/Light Switch panel assembly on machine control cabinet. The following connectors may be available:

Port	Connector Type	Use
PORTS 1 and 2	9-pin	RS-232 C Serial Communications
Indexer	8-pin military	Indexer
10-base T	RJ45	Network (Ethernet)
Coax In/Out	BNC	Network (Ethernet)

Table 1-7. Communication Ports

The communication ports are typically arranged as follows:

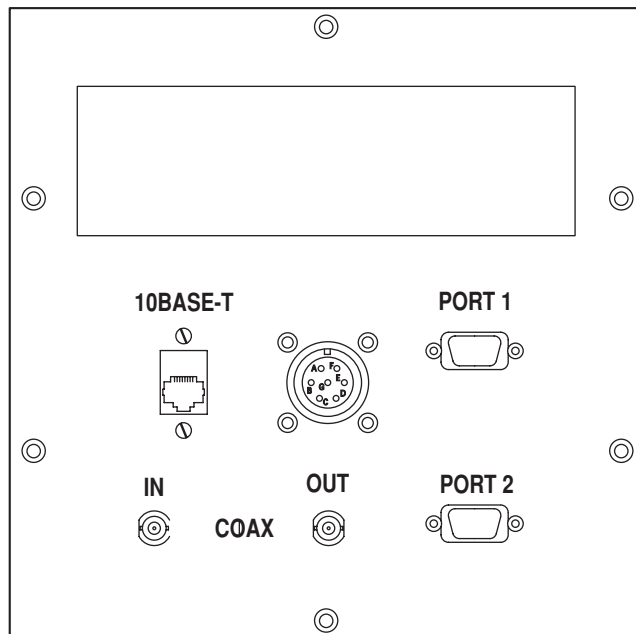


Figure 1-4. Communication Port Assembly



RS-232-C Serial Ports

The two RS-232-C serial ports (Port 1 and Port 2 in previous figure) can be used to connect peripherals to the machine. These ports may be addressed separately. The standard baud rates are software-selectable. Either port can be used as an output or input, depending upon the software.

The connector pin designated for each signal (RS-232-C) is shown below:

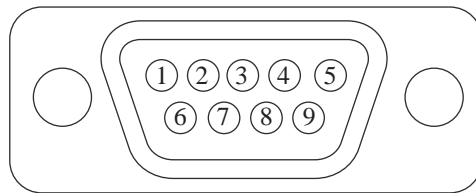


Figure 1-5. Male 9-Pin D-Type Connector

While the signals present at the serial ports conform to the RS-232-C standard, not all standard RS-232-C signals are available. Some peripheral devices may provide RS-232-C control signals that are not available at the ports described here. However, such devices can usually be adapted to these ports. In some cases, it may be necessary to add jumpers to the connector.



Signals available at the serial ports are:

COM 1/ COM 2	Signal Name	Signal on this Pin
1	Data Carrier Detect (DCD)	Not used by the control.
2	Receive Data (RXD)	Data received (by machine) in serial format from peripheral device.
3	Transmit Data (TXD)	Data transmitted (by machine) to peripheral device in serial format.
4	Data Terminal Ready (DTR)	Not used by the control.
5	Signal Ground (SG)	Line establishing the common ground reference potential for all interface lines
6	Data Set Ready (DSR)	Signal to notify printer that transmitter is ready for transmission.
7	Request to Send (RTS)	Line used by control to instruct peripheral device to get ready to receive data. Data can be transmitted after the Clear-To-Send signal is received from connected peripheral device.
8	Clear to Send (CTS)	Control line used by peripheral device to indicate that it is ready to receive data from machine.
9	Ring Indicator (RI)	Signal indicates modem has received the ring of an incoming call.

Table 1-8. RS-232-C Signals Available at Serial Ports

To connect a peripheral to the machine, fabricate an adapter cable. If a properly shielded low capacitance cable is used, cable lengths of up to 100 feet are permissible.

Be certain that you use the correct cabling before connecting the device to the machine. Consult the peripheral manual to determine whether the peripheral is a Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) device. The Hurco machine is a DTE device, and in most cases, so is a personal computer. A printer may be either a DTE or DCE device.



Indexer Port

Indexing signals are always present at the Indexer port, so there is no need to turn it on. It is the customer's responsibility to provide a harness from the Indexer to the Indexer port. Before making this harness, see the machine's *Parts Listings and Wiring Diagrams Manual* for the correct pin-outs.

Network Ports

The 10baseT (RJ45) and the two BNC connectors are used with the Ultinet option. This option requires an ethernet card, cabling from the ethernet card to the communications panel, V2.10 software or greater and an optikey diskette to enable the option.

Operator Control Console

Hurco VTX/HTX series machines come with a dual screen Ultimax 4 control console. Contact your full service distributor or Hurco for more information about features.

The dual screen Ultimax 4 console sits on a base-mounted pendant. Text is displayed on one screen of the console, and graphics on the other. A 3.5 in. floppy disk drive is located on the right side of the dual screen console.

For operating and programming information, refer to the *Getting Started Manual*, *Conversational Part Programming Manual* and the *NC Part Programming Manual* shipped with the machining center.



An Ultimax 4 console is pictured below:

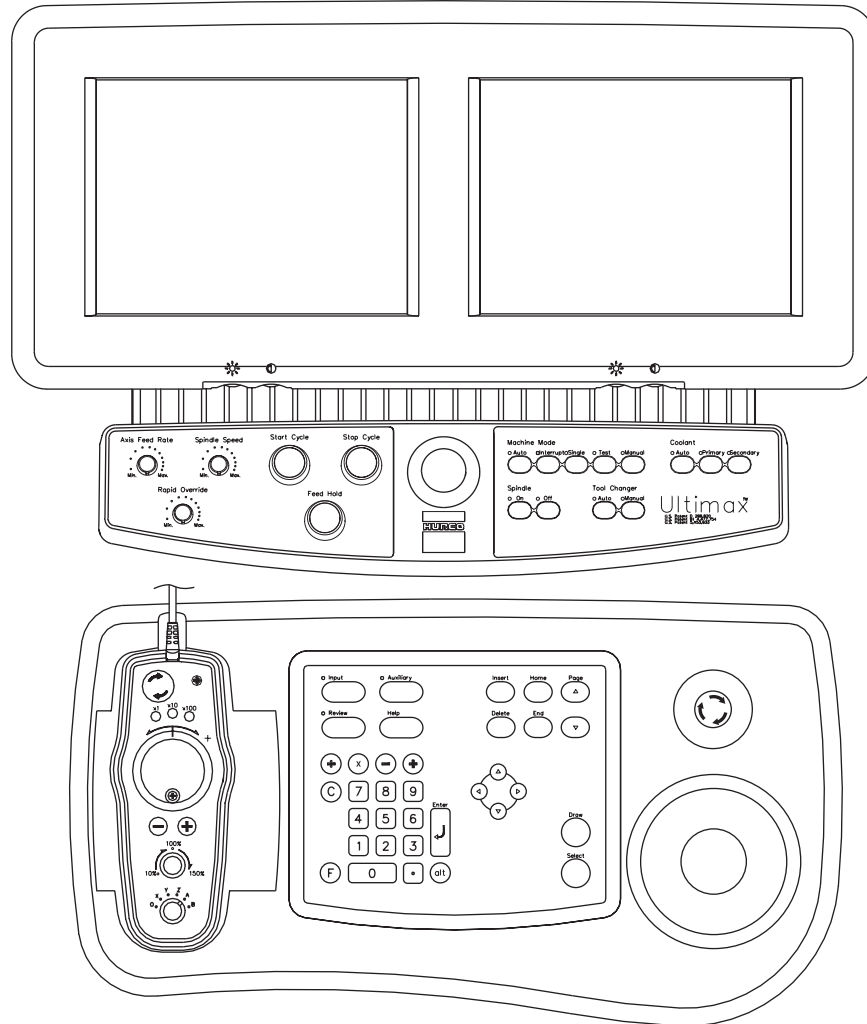


Figure 1-6. Ultimax 4 Control Console



Flat Panel Node PCB

The CANbus Flat Panel Node PCB is an intelligent slave that processes the operator interface I/O functions related to the console. This printed circuit board is located in the Ultimex control console and has the following features:

- An 8 x 8 keyboard matrix for scanning, decoding and debouncing of keys
- Outputs to control 16 discrete LEDs and three 24-volt status lamps
- Emergency stop hardware contacts and software input
- Green “Run” LED and red system fail “Sysfail” LED

For operating and programming information, refer to the *Ultimax Getting Started, Conversational Part Programming and NC Part Programming* manuals shipped with the machine.

Coolant System

A flood coolant system is standard on each machining center. A washdown hose and nozzle to clean chips from inside the enclosure are also included.

Machine	Tank Capacity		Flood Pump Rating		Wash Down Pump Rating	
	Liters	Gal.	Liters/min.	Gal./min.	Liters/min	Gal./min.
VTXU	350	92.5	60	16	60	16
HTX	580	153	60	16	60	16

Table 1-9. Coolant Capacity and Pump Rating

The flood coolant system cleans swarf from the cut and protects the part and tool. The system is self-contained. The operator can control the coolant system using console pushbuttons.



Pneumatic System

The pneumatic system regulates the air valves that supply compressed air to machine systems, such as spindle blow out. Compressed air is used in the tool release and in ATC motion.



Important

A factory-set air pressure detecting switch monitors the air supply to the solenoid control valves. Do not tamper with this switch.

The Filter, Regulator and Lubricator (FRL) Unit is connected to the air manifold and meters lubricant into the pneumatic system. The FRL prevents moisture from contaminating the compressed air supply, promotes trouble-free operation of air cylinders and valves, and extends the service life of metal components that come in contact with the air stream.

Incoming air pressure can be adjusted using the knob on top of the filter assembly. For information about maintaining the FRL Unit, refer to the Lubrication section of the Machine Maintenance chapter in this manual.



VTX Automatic Tool Changer

The VTX machining center uses hydraulics, pneumatics, and switches to operate a tool pot, swing arm, and an ATC door to exchange tools between the ATC magazine and the machine spindle. The ATC is a random-pocket tool changer that tracks tools in the magazine using an ATC Map. All ATC operations require that the servo power is on, that the machine is calibrated, and that the ATC is at Home position. The table below lists tooling specifications:

Machine	Taper	Number of Tool Pockets	Maximum Tool Diameter		Maximum Tool Diameter Adjacent Tool Pockets Empty		Maximum Tool Length		Maximum Tool Weight	
			mm	in.	mm	in	mm	in	kg	lbs
VTXU	40	32	75	2.9	125	4.9	280	11.0	7	15

Table 1–10. ATC Tool Specifications—VTXU

The basic sequence of operation, assuming that the magazine is positioned to the next tool required, is as follows:

1. The ATC door opens if the X and Y axes are at tool change position, the Z axis is at Height (refer to the following “ATC Diagnostics Screen, VTX” figure), and the spindle is oriented.
2. The tool pocket rotates from the Up position to the Down position.
3. The load arm rotates 60 degrees from the 0 degree position and simultaneously grasps the tool in the tool pocket and the tool in the spindle, if present.
4. The spindle unclamps the tool.
5. The load arm moves down, simultaneously pulling the tool from the tool pocket and the tool from the spindle, and rotates 180 degrees.
6. The load arm moves up and inserts the new tool into the spindle and the previous tool into the tool pocket, returning the load arm to the 60 degree position.



7. The spindle clamps the tool in the spindle.
8. The load arm rotates 60 degrees back to the 0 degree position.
9. The tool pocket rotates back to the Up position.
10. The ATC door closes.

The ATC can be operated in Auto mode or in Manual mode using ATC Diagnostics.

ATC Diagnostics for VTX Machines

Display the ATC Diagnostics screen in Manual mode by selecting the TOOL IN SPINDLE softkey followed by the ATC DIAGNOSTICS softkey.

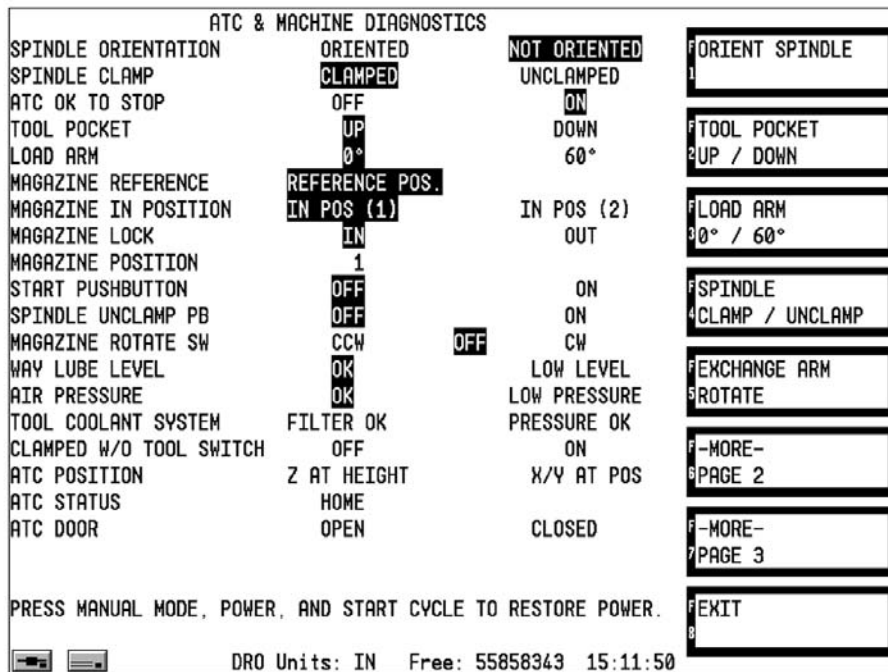


Figure 1-7. ATC Diagnostics Screen, VTX



The ATC Diagnostics screen displays the status of inputs for the ATC.

Status	Description
Spindle Orientation	Indicates if the Spindle is Oriented or Not Oriented. Oriented is required for ATC to begin.
Spindle Clamp	Indicates if the Spindle is clamped or unclamped.
ATC OK to Stop	Indicates Off or On. On is set during Load Arm rotation and disables the Load Arm motor and enables the brake. Off should be set when Load Arm is at 0 degree or 60 degrees.
Tool Pocket	Indicates Up or Down position. Up is required for ATC Status Home.
Load Arm	Indicates 0 degree or 60 degrees position. 0 degree is required for ATC Status Home. Cannot move to 60 degrees unless ATC Door is Open, Tool Pocket is Down, Spindle is Oriented and Clamped.
Magazine Reference	Indicates Reference Pos when the ATC calibration sensor is detected.
Magazine In Position	Indicates In Pos (1) or In Pos (2). In Pos (1) is required for ATC Status Home. In Pos (2) is active when magazine is rotating and not in position.
Magazine Lock	VTX machines are not equipped with a Magazine Lock Pin. Status is for display only.
Magazine Position	Indicates the current magazine position (note that this may not be the tool number).

Table 1-11. ATC Diagnostics Input Descriptions



General Status Conditions

The following table indicates general status conditions:

Status	Description
Start Pushbutton	Indicates Off or On. On is displayed when the Start pushbutton is pressed.
Spindle Unclamp PB	Indicates Off or On. On is displayed when the Spindle Unclamp pushbutton is pressed.
Magazine Rotate SW	Indicates the three settings for the Magazine Rotate switch, either CCW, Off, or CW. The magazine will rotate in the direction indicated until it is released back to Off.
Way Lube Level	Indicates OK or Low Level. A Low Level alarm will not allow programs to start running.
Air Pressure	Indicates OK or Low Pressure. OK is required to begin an ATC.
Tool Coolant System	Available with the Coolant Through Spindle (CTS) option. Indicates Filter OK and Pressure OK. Both are required for tool coolant operation.
Clamped w/o Tool Switch	This condition is not available. Indicates Off or On.
ATC Position	Indicates Z At Height and X/Y at Position. Both inputs are required for ATC to begin.
ATC Status	Indicates Home position. Home is required for ATC to begin.
ATC Door	Indicates Closed or Open position. Closed is required for ATC Status Home.

Table 1-12. ATC Diagnostics Input Descriptions, General



ATC Diagnostics Softkeys

There are three menus of softkeys for controlling the ATC operation. Pressing the PAGE softkey in each menu cycles the display to the next menu or to menu 1 from menu 3.

When all requirements for a softkey action are met, a prompt displays and the Cycle Start lamp flashes. Pressing Cycle Start executes the command. The Cycle Start lamp stops flashing during the execution of the command and is turned off when the command is completed.

Selecting another softkey before pressing the Cycle Start button cancels the pending command and stops the Cycle Start lamp flashing. If the requirements for a softkey action are not met, a message displays indicating why the action cannot be commanded.

Softkey	Description
Orient Spindle	Sets the command to orient the spindle. Oriented is required to begin an ATC cycle.
Tool Pocket Up / Down	Sets the command to move the Tool Holder Down or Up. Each press of the softkey switches the command between Down and Up.
Load Arm 0 Degree / 60 Degrees	Sets the command to move the Load Arm to 0 degree or 60 degrees. Tool Pocket must be Down and ATC Door Open before moving to 60 degrees. Each press of the softkey switches the command between 0 degree and 60 degrees.
Spindle Clamp / Unclamp	Sets the command to clamp or unclamp the spindle. Each press of the softkey switches the command between clamp and unclamp.
Exchange Arm Rotate	Sets the command to move the Exchange Arm down, rotate 180 degrees and up. Tool Pocket must be Down and ATC Door Open.

Table 1-13. ATC Diagnostics Softkey Menu 1, VTX



Softkey	Description
IO Maps	Displays the I/O maps.
Magazine Pin Lock / Unlock	VTX machines are not equipped with Magazine Lock Pin. Lock or unlock commands are not executed.
Retract Tool	Sets the command to move the Z-axis to zero.
Magazine CW	Sets the command to move the magazine clockwise one position.
Magazine CCW	Sets the command to move the magazine counter-clockwise one position.

Table 1-14. ATC Diagnostics Softkey Menu 2, VTX

Softkey	Description
Move X/Y to T/C Pos	Sets the command to move the X and Y axes at Rapid to the tool change position. At X/Y Pos is required to begin an ATC cycle.
Move Z-axis to T/C Height	Sets the command to move the Z-axis to the Tool Change Height position. Must be Z At Height for ATC to begin.
Open Close T/C Door	Sets the command to open or close the ATC Door. Each press of the softkey switches the command between open and close. Must be Closed for ATC to begin.
Exchange Arm Jog Reverse	Sets the command to pulse jog the exchange arm in the reverse direction. Pulse commands will stop once the Exchange Arm is at 0 degree.
Calibrate T/C Magazine	Sets the command to calibrate the magazine. Magazine will rotate to the Reference Pos.

Table 1-15. ATC Diagnostics Softkey Menu 3, VTX



IO Maps for VTX Machines

Selecting the IO MAPS softkey displays a menu to select a display of the control's input or output states. The outputs cannot be activated nor can the inputs be tested. Each of the softkeys identifies I/O boards in the control.

Displayed I/O maps include the input or output signal identifier list. The input or output signals are highlighted when the signal is activated or enabled. Refer to the machine's *Parts Listing and Wiring Diagram* manual for schematics and harnesses that will identify the signals and boards.

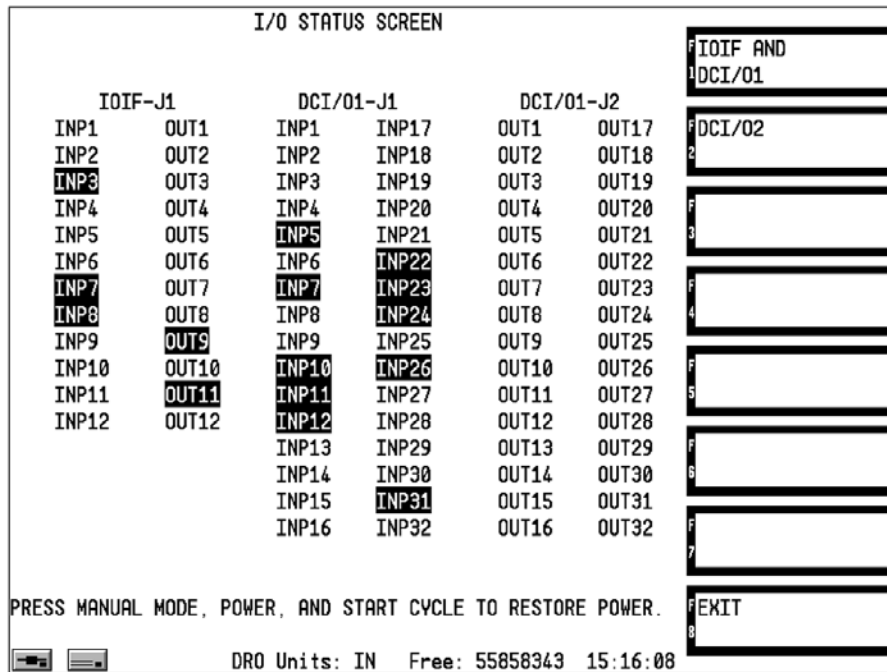


Figure 1-8. I/O Status, IOIF and DCI/O #1

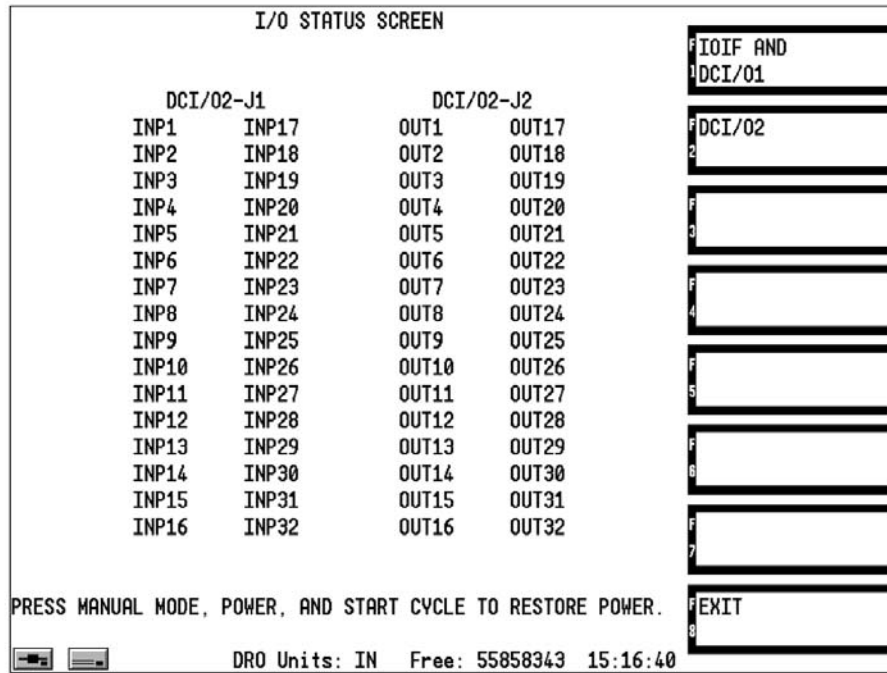


Figure 1-9. I/O Status, DCI/O #2



HTX Automatic Tool Changer

The HTX machining center uses hydraulics, pneumatics, and switches to operate a tool pot, swing arm, and an ATC door to exchange tools between the ATC magazine and the spindle. The ATC is a random-pocket tool changer that tracks tools in the magazine using an ATC Map.

The the following table lists tooling specifications.

Machine	Taper	Number of Tool Pockets	Maximum Tool Diameter		Maximum Tool Diameter Adjacent Tool Pockets Empty		Maximum Tool Length		Maximum Tool Weight	
			mm	in.	mm	in	mm	in	kg	lbs
HTX500	40	60	80	3.2	150	5.9	350	13.8	10	22

Table 1-16. ATC Tool Specifications—HTX500

All ATC operations require that the servo power is on, the machine is calibrated, and the ATC is at Home position. Refer to the following “ATC Diagnostics Screen — HTX” figure.

The basic sequence of operation, assuming that the magazine has positioned to the next tool required, is as follows:

1. The tool holder rotates 90 degrees from the 0 degree position to the 90 degree position and simultaneously the ATC door opens.
2. If the X, Y, and Z axes are at tool change position and the spindle is oriented, the exchange arm rotates 90 degrees from the 0 degree position to the 90 degree position and simultaneously grasps the tool in the tool holder and the tool in the spindle, if present.
3. The spindle unclamps the tool.
4. The exchange arm moves out, simultaneously pulling the tool from the tool holder and the tool from the spindle, the exchange arm rotates 180 degrees.



5. The exchange arm moves in, inserting the new tool into the spindle and the removed tool into the tool holder. The exchange arm moves out and returns to the 90 degree position.
6. The spindle clamps the tool in the spindle.
7. The exchange arm rotates 90 degrees back to the 0 degree position.
8. The ATC door closes and the tool holder simultaneously rotates 90 degrees back to the 0 degree position.

The ATC can be operated in Auto mode or in Manual mode using ATC Diagnostics.

ATC Diagnostics for HTX Machines

Display the ATC Diagnostics screen in Manual Mode by selecting the TOOL IN SPINDLE softkey followed by the ATC DIAGNOSTICS softkey.

```

**** ATC DIAGNOSTICS ****

SPINDLE ORIENTATION      ORIENTED      NOT ORIENTED
SPINDLE CLAMP            CLAMPED      UNCLAMPED
TOOL HOLDER              0°           90°
EXCHANGE ARM             0°           90°
MAGAZINE POSITION         26
MAGAZINE IN POSITION      IN POS (1)   IN POS (2)
MAGAZINE REFERENCE POS. REFERENCE POS.
MAGAZINE PIN            LOCKED      UNLOCKED

Z-AXIS POSITION           AT ZERO
ATC AXIS POSITIONS      AT X      AT Y      AT Z
ATC STATUS              HOME
ATC DOOR                CLOSED     OPEN
ATC CALIBRATED         YES       NO

TOOL IN SPINDLE        33

Choose appropriate softkey.

[Menu] [List]          DRO Units: IN   Free: 123036374 12:26:02

[1] ORIENT SPINDLE
[2] ATC DOOR OPEN / CLOSE
[3] TOOL HOLDER 0° / 90°
[4] EXCHANGE ARM 0° / 90°
[5] SPINDLE CLAMP / UNCLAMP
[6] EXCHANGE ARM 180°
[7] -MORE-
[8] EXIT
    
```

VH08921.00.00

Figure 1-10. ATC Diagnostics Screen—HTX



Status Conditions

The ATC Diagnostics screen displays the status of inputs for the ATC.

Status	Description
Spindle Orientation	Indicates if the Spindle is oriented or not oriented. Oriented is required for ATC to begin.
Spindle Clamp	Indicates if the Spindle is clamped or unclamped.
Tool Holder	Indicates 0 or 90 degree position. 0 degrees is required for ATC Status Home.
Exchange Arm	Indicates 0 or 90 degree position. 0 degrees is required for ATC Status Home.
Magazine Position	Indicates the current magazine position (note that this may not be the tool number).
Magazine In Position	Indicates In Pos (1) or In Pos (2). In Pos (1) is required for ATC Status Home. In Pos (2) is active when magazine is rotating and not in position.
Magazine Reference	Indicates Reference Pos when the ATC calibration sensor is detected.
Magazine Pin	Indicates Locked or Unlocked position. Locked is required for ATC Status Home.
Z-axis Position	Indicates At Zero position.
ATC Axis Position	Indicates At X, At Y, and At Z positions. All three are required for ATC to begin.
ATC Status	Indicates Home position. Home is required for ATC to begin.
ATC Door	Indicates Closed or Open position. Closed is required for ATC Status Home.
ATC Calibrated	Indicates Yes or No for ATC calibration
Tool in Spindle	Indicates the tool number in the spindle.

Table 1-17. ATC Diagnostics Input Descriptions



ATC Diagnostics Softkeys

There are three menus of softkeys for controlling the ATC operation. Pressing the MORE softkey in each menu cycles the display to the next menu or to menu 1 from menu 3.

When all requirements for a softkey action are met, a prompt displays and the cycle start lamp flashes. Pressing Cycle Start executes the command. The cycle start lamp stops flashing during the execution of the command and is turned off when the command is completed.

Selecting another softkey before pressing the Cycle Start button cancels the pending command and stops the cycle start lamp flashing. If the requirements for a softkey action are not met, a message displays indicating why the action cannot be commanded.

Status	Description
Orient Spindle	Sets the command to orient the spindle. Oriented is required to begin an ATC cycle.
ATC Door Open / Close	Sets the command to open or close the ATC Door. Each press of the softkey switches the command between open and close. Must be Closed for ATC to begin.
Tool Holder 0 Degree / 90 Degrees	Sets the command to move the Tool Holder to 0 degree or 90 degrees. Each press of the softkey switches the command between 0 degree and 90 degrees.
Exchange Arm 0 Degree / 90 Degrees	Sets the command to move the Exchange Arm to 0 degree or 90 degrees. Tool Holder must be at 90 degrees and ATC Door Open. Once rotated to 90 degrees, the Exchange Arm must be rotated 180 degrees or jog reversed back to 0 degree.
Spindle Clamp / Unclamp	Sets the command to clamp or unclamp the spindle. Each press of the softkey switches the command between clamp and unclamp.
Exchange Arm 180 Degrees	Sets the command to move the Exchange Arm out, rotate 180 degrees and in. Tool Holder must be at 90 degrees and ATC Door Open. Must be at 0 degree for ATC to begin.

Table 1-18. ATC Diagnostics Softkey Menu 1



Status	Description
Move Axes to TC Position	Sets the command to move the axes at Rapid to the tool change position. At X, At Y, and At Z are all required to begin an ATC cycle.
Move Z-axis to Zero Position	Sets the command to move the Z-axis to the Zero position.
Magazine CW	Sets the command to move the magazine clockwise one position.
Magazine CCW	Sets the command to move the magazine counter-clockwise one position.
Calibrate T/C Magazine	Sets the command to calibrate the magazine. Magazine will rotate to the Reference Pos.

Table 1-19. ATC Diagnostics Softkey Menu 2

Status	Description
IO Maps	Displays the I/O maps.
Exchange Arm Jog Reverse	Sets the command to pulse jog the exchange arm in the reverse direction. Once initiated, continue selecting until the Exchange Arm is at 0 or 90 degrees.

Table 1-20. ATC Diagnostics Softkey Menu 3



IO Maps for HTX Machines

Selecting the IO MAPS softkey displays a menu to select a display of the control's input or output states. The outputs cannot be activated nor can the inputs be tested. Each of the softkeys identifies an I/O board in the control and, in some cases, if the inputs or outputs are displayed.

Displayed I/O maps include the input or output signal identifier list and a description of the signal identifier. The input or output signals are highlighted when the signal is activated or enabled. Refer to the machine's *Parts Listing and Wiring Diagram* manual for schematics and harnesses that identify the signals and boards.

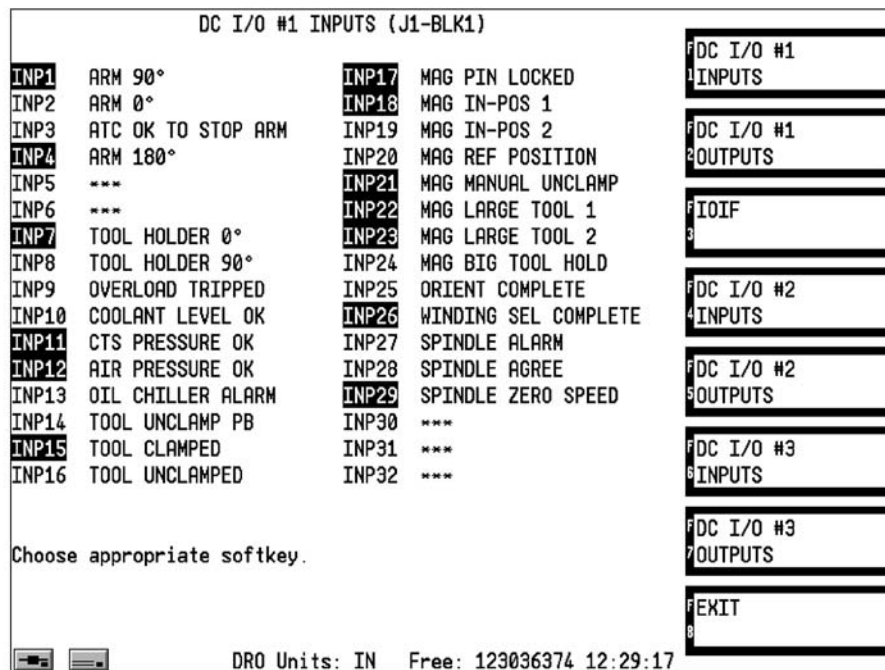


Figure 1-11. DC I/O #1 Inputs Display—HTX Only



DC I/O #1 OUTPUTS (J2-BLK2)

OUT1	ORIENT COMMAND	OUT17	***
OUT2	***	OUT18	***
OUT3	SOFT START CANCEL	OUT19	***
OUT4	SPINDLE ALARM RESET	OUT20	***
OUT5	OPERATION LAMP VEL	OUT21	***
OUT6	WORKING LIGHT	OUT22	***
OUT7	SPINDLE PURGE	OUT23	TOOL UNCLAMP
OUT8	ALARM LAMP RED	OUT24	***
OUT9	MAGAZINE PIN UNLOCK	OUT25	X-AXIS ENABLE
OUT10	MAGAZINE PIN LOCK	OUT26	Y-AXIS ENABLE
OUT11	ROTATE MAGAZINE CW	OUT27	Z-AXIS ENABLE
OUT12	ROTATE MAGAZINE CCW	OUT28	ENCL INT RUN RELAY
OUT13	TOOL HOLDER 0°	OUT29	***
OUT14	TOOL HOLDER 90°	OUT30	X-AXIS FAULT RESET
OUT15	ARM MOTOR FWD	OUT31	Y-AXIS FAULT RESET
OUT16	ARM MOTOR REV	OUT32	Z-AXIS FAULT RESET

Choose appropriate softkey.

FDC I/O #1
1 INPUTS

FDC I/O #1
2 OUTPUTS

F IOIF
3

FDC I/O #2
4 INPUTS

FDC I/O #2
5 OUTPUTS

FDC I/O #3
6 INPUTS

FDC I/O #3
7 OUTPUTS

F EXIT
8

DRO Units: IN Free: 123036374 12:29:46

Figure 1-12. DC I/O #1 Outputs Display—HTX Only

IOIF (J1-BLK3)

INP1	B-AXIS CLAMP SW	OUT1	AXIS ENABLE / WAY LUBE
INP2	B-AXIS UNCLAMP SW	OUT2	SPINDLE ENABLE
INP3	***	OUT3	INDEXER
INP4	COR STATUS	OUT4	***
INP5	B-AXIS FAULT	OUT5	AUX OUTPUT 1
INP6	X-AXIS FAULT	OUT6	AUX OUTPUT 2
INP7	Y-AXIS FAULT	OUT7	AUX OUTPUT 3
INP8	Z-AXIS FAULT	OUT8	AUX OUTPUT 4
INP9	AUX OUTPUT 1 OFF	OUT9	CONTROL ON (COR)
INP10	AUX OUTPUT 2 OFF	OUT10	CE DOOR LOCK
INP11	AUX OUTPUT 3 OFF	OUT11	AUTO MODE
INP12	AUX OUTPUT 4 OFF	OUT12	***

Choose appropriate softkey.

FDC I/O #1
1 INPUTS

FDC I/O #1
2 OUTPUTS

F IOIF
3

FDC I/O #2
4 INPUTS

FDC I/O #2
5 OUTPUTS

FDC I/O #3
6 INPUTS

FDC I/O #3
7 OUTPUTS

F EXIT
8

DRO Units: IN Free: 123036374 12:30:20

Figure 1-13. IOIF Display—HTX Only



DC I/O #2 INPUTS (J1-BLK4)						
INP1	MAGAZINE CW PB	INP17	APC UP	DC I/O #1	1	INPUTS
INP2	MAGAZINE CCW PB	INP18	APC DOWN	DC I/O #1	2	OUTPUTS
INP3	MAGAZINE AUTO SSW	INP19	APC POSITION 1	IOIF	3	
INP4	MAGAZINE MANUAL SSW	INP20	APC POSITION 2	DC I/O #2	4	INPUTS
INP5	ATC DOOR OPEN	INP21	APC PIN LOCKED	DC I/O #2	5	OUTPUTS
INP6	ATC DOOR CLOSED	INP22	APC OIL PRESSURE LOCK	DC I/O #3	6	INPUTS
INP7	***	INP23	APC DECEL 1	DC I/O #3	7	OUTPUTS
INP8	***	INP24	APC DECEL 2	EXIT	8	
INP9	APC CYCLE START PB	INP25	FRONT DOOR CLOSED			
INP10	APC STOP PB	INP26	COOLANT FILTER DIRTY			
INP11	CYCLE APC PB	INP27	HYDRAULIC ALARM-ATC/APC			
INP12	APC UP/DOWN PB	INP28	HYDRAULIC ALARM-UNCLAMP			
INP13	APC POSITION 1 PB	INP29	CHIP ENCL INTERLOCK 1			
INP14	APC POSITION 2 PB	INP30	CHIP ENCL INTERLOCK 2			
INP15	REMOTE E-STOP	INP31	INDEXER FINISHED			
INP16	APC REF POSITION	INP32	WAY LUBE LEVEL LOW			

Choose appropriate softkey.

DRO Units: IN Free: 123036374 12:38:42

Figure 1-14. DC I/O #2 Inputs Display—HTX Only

DC I/O #2 OUTPUTS (J2-BLK5)						
OUT1	B-AXIS ENABLE	OUT17	***	DC I/O #1	1	INPUTS
OUT2	B-AXIS FAULT RESET	OUT18	CTS PUMP	DC I/O #1	2	OUTPUTS
OUT3	***	OUT19	COOLANT PUMP 1 (ROOF)	IOIF	3	
OUT4	***	OUT20	COOLANT PUMP 2 (FLOOD)	DC I/O #2	4	INPUTS
OUT5	B-AXIS CLAMP	OUT21	COOLANT PUMP 3 (WSDOWN)	DC I/O #2	5	OUTPUTS
OUT6	***	OUT22	HYDRAULIC PUMP	DC I/O #3	6	INPUTS
OUT7	ATC DOOR OPEN	OUT23	CHIP AUGER FWD	DC I/O #3	7	OUTPUTS
OUT8	ATC DOOR CLOSE	OUT24	CHIP AUGER REV	EXIT	8	
OUT9	APC CYCLE START LAMP	OUT25	APC UP			
OUT10	APC STOP PB LAMP	OUT26	APC DOWN			
OUT11	CYCLE APC PB LAMP	OUT27	APC POSITION 1			
OUT12	APC UP/DOWN PB LAMP	OUT28	APC POSITION 2			
OUT13	APC POS 1 PB LAMP	OUT29	APC PIN UNLOCK			
OUT14	APC POS 2 PB LAMP	OUT30	APC AIR BLAST			
OUT15	***	OUT31	APC DECEL			
OUT16	***	OUT32	***			

Choose appropriate softkey.

DRO Units: IN Free: 123036374 12:39:16

Figure 1-15. DC I/O #2 Outputs Display—HTX Only



DC I/O #3 INPUTS (J1-BLK6)

INP1 ***	INP17 ***	FDC I/O #1
INP2 ***	INP18 ***	1 INPUTS
INP3 ***	INP19 ***	FDC I/O #1
INP4 ***	INP20 ***	2 OUTPUTS
INP5 ***	INP21 ***	FDC I/O #1
INP6 ***	INP22 ***	3 IOIF
INP7 ***	INP23 ***	FDC I/O #2
INP8 ***	INP24 ***	4 INPUTS
INP9 ***	INP25 LASER PROBE OK	FDC I/O #2
INP10 ***	INP26 LASER STATIC STATUS	5 OUTPUTS
INP11 ***	INP27 LASER DYNAMIC STATUS	FDC I/O #3
INP12 ***	INP28 PART PROBE STATUS	6 INPUTS
INP13 ***	INP29 PART PROBE ERROR	FDC I/O #3
INP14 ***	INP30 PART PROBE DEFLECT	7 OUTPUTS
INP15 ***	INP31 TOOL PROBE DEFLECT	FDC I/O #3
INP16 ***	INP32 ***	8 INPUTS

Choose appropriate softkey.

DRO Units: IN Free: 123036374 12:39:45

Figure 1-16. DC I/O #3 Inputs Display—HTX Only

DC I/O #3 OUTPUTS (J2-BLK7)

OUT1 PART PROBE RESET	OUT17 ***	FDC I/O #1
OUT2 ***	OUT18 ***	1 INPUTS
OUT3 ***	OUT19 ***	FDC I/O #1
OUT4 ***	OUT20 ***	2 OUTPUTS
OUT5 LASER TRANSMITTER	OUT21 ***	FDC I/O #1
OUT6 LASER RECEIVER	OUT22 ***	3 IOIF
OUT7 LASER BARRIER AIR	OUT23 ***	FDC I/O #2
OUT8 LASER SHUTTER AIR	OUT24 ***	4 INPUTS
OUT9 ***	OUT25 ***	FDC I/O #2
OUT10 ***	OUT26 ***	5 OUTPUTS
OUT11 ***	OUT27 ***	FDC I/O #3
OUT12 ***	OUT28 ***	6 INPUTS
OUT13 ***	OUT29 ***	FDC I/O #3
OUT14 ***	OUT30 ***	7 OUTPUTS
OUT15 ***	OUT31 ***	FDC I/O #3
OUT16 ***	OUT32 ***	8 INPUTS

Choose appropriate softkey.

DRO Units: IN Free: 123036374 12:40:13

Figure 1-17. DC I/O #3 Outputs Display—HTX Only



Machine Diagnostics

A status of control states can be displayed from Manual mode by selecting the TOOL IN SPINDLE softkey followed by the MACHINE DIAGNOSTICS softkey.

```

**** MACHINE DIAGNOSTICS ****
SPINDLE ORIENTATION      ORIENTED      NOT ORIENTED
SPINDLE CLAMP            CLAMPED      UNCLAMPED
TOOL IN SPINDLE          33
ATC STATUS                HOME
AXES CALIBRATED          YES           NO
AIR PRESSURE              OK           LOW PRESSURE
WAY LUBE LEVEL            OK           LOW LEVEL
COOLANT STATUS            OK           LOW LEVEL
HYDRAULIC STATUS         OK           ALARM
SPINDLE CHILLER          OK           ALARM
OVERLOAD STATUS          OK           OL TRIPPED

Choose appropriate softkey.

DRO Units: IN  Free: 123036374 12:25:39
  
```

F	1
F	2
F	3
F	4
F	5
F	6
F	7
F	EXIT
F	8

Figure 1-18. Machine Diagnostics Display



The following states are displayed:

Status	Description
Spindle Orientation	Indicates if the Spindle is oriented or not oriented. Oriented is required to begin an ATC.
Spindle Clamp	Indicates if the Spindle is clamped or unclamped.
Tool In Spindle	Indicates the tool number in the spindle.
ATC Status	Indicates if the ATC is Home (requires ATC Door closed, Exchange Arm at 0 degrees, Tool Holder at 0 degrees, and Magazine In Pos (1).
Axes Calibrated	Indicates Yes or No. Yes is required to run programs and an ATC.
Air Pressure	Indicates OK or Low Pressure. OK is required to begin an ATC.
Way Lube Level	Indicates OK or Low Level. Low Level alarm will stop a running program and will not allow programs to start running.
Coolant Status	Indicates OK or Low Level.
Hydraulic Status	Indicates OK or Alarm. OK is required to begin an ATC.
Spindle Chiller	Indicates OK or Alarm. OK is required to run the Spindle in Manual or Auto mode.
Overload Status	Indicates OK or OL Tripped. OK is required to run an automatic operation.

Table 1-21. HTX Machine Diagnostics Status Descriptions



Machine Parameters

In Manual mode, selecting the MACHINE PARAMETERS softkey displays a list of user-configurable parameters. There are three pages of Machine Parameters that can be changed by the operator. Each page lists a description of the parameter, the range of values that can be set for the parameter, and the current value. The values shown on the following figures are the default factory settings.



Caution

The machine, part, and/or tool may be damaged if parameters are changed without understanding the machine operation that may be affected by the change.

** MACHINE PARAMETERS **			F-PAGE 1-
DESCRIPTION	RANGE		1
WARM-UP CYCLE TIME (SEC)	0-32767	300	F-PAGE 2-
WARM-UP SPINDLE SPEED 1 (RPM)	0-25% MAX	100	2
WARM-UP SPINDLE SPEED 2 (RPM)	0-50% MAX	-1000	F-PAGE 3-
WARM-UP SPINDLE SPEED 3 (RPM)	0-100% MAX	3000	3
WARM-UP AXIS FEED RATE (MMPH)	0-MAX RAPID	2920	F
COOLANT DELAY TIME (SEC)	0-60	0	4
PULSATING WASHDOWN ENABLE	0-1	0	F
ALT WASHDOWN DWELL (0.01 SEC)	0-32767	500	5
ALT DWELL LT SIDE (0.01 SEC)	0-32767	0	F
ALT WASHDOWN OFF TIME (0.01 SEC)	0-32767	0	6
			F
			7
			F EXIT
			8

Enter warm-up cycle time for each pass in seconds.

DRO Units: IN Free: 123036374 12:27:35

Figure 1-19. Machine Parameters, Page 1



Warm-up Cycle Time, Warm-up Spindle Speed 1, 2, and 3, and Warm-up Axis Feed Rate

The first five parameters listed on Page 1 allow the operator to configure the machine's warm-up cycle. Warm Up Machine is a softkey selection in Manual mode. During Warm Up Machine, the spindle rpm is at the Warm-up Spindle Speed 1 RPM for the Warm-up Cycle Time while the X and Y axes move diagonally from corner to corner at the Warm-up Axis Feed Rate in the units indicated.

Note

The Z-axis is at zero and does not move during the Warm Up Machine cycle. The Tool In Spindle setting must be 0 before beginning Warm Up Machine.

After the Warm-up Cycle time expires, the spindle speed changes to the Warm-up Spindle Speed 2 RPM. Axis motion continues and will run until the Warm-up Cycle Time expires. This is repeated a third and final time at the Warm-up Spindle Speed 3 RPM.

Note

A negative value for Warm-up Spindle Speed will turn the spindle counterclockwise; a positive value will turn the spindle clockwise.

The Warm Up Machine cycle default settings run each step for 300 seconds at the maximum feed rate. Step 1 turns the spindle clockwise at 100 rpm, step 2 turns the spindle counterclockwise at 1000 rpm, and step 3 turns the spindle clockwise at 3000 rpm.



Coolant Delay Time (sec)

The Coolant Delay Time parameter pauses the running part program for the indicated time whenever the program enables the primary or secondary coolant. Set the Coolant Delay Time parameter to pause the program long enough to allow the coolant to pump from the coolant tank to the head-mounted nozzles before the tool enters the work piece.

The default setting for Coolant Delay Time is 0 seconds.

Pulsating Washdown Enable

Pulsating Washdown Enable is not functional for VTX and HTX machines.

The default setting for Pulsating Washdown Enable is 0.

Alt Washdown Dwell (0.01 sec)

Alternating Washdown Dwell is not functional for VTX and HTX machines.

The default setting for Alternating Washdown Dwell is 500 (or 5 seconds).

Alt Dwell Lt Side (0.01 sec)

The Alternating Dwell Left Side is not functional for VTX and HTX machines.

The default setting for Alternating Dwell Left Side is 0 seconds.



Alt Washdown Off Time (0.01 sec)

The Alternating Washdown Off Time is not functional for VTX and HTX machines.

The default setting for Alternating Washdown Off Time is 0 seconds.

** MACHINE PARAMETERS **			F-PAGE 1-
DESCRIPTION	RANGE		1
CAL TO LS VELOCITY X (MMPM)	100-2540	1270	F-PAGE 2-
CAL TO LS VELOCITY Y (MMPM)	100-2540	1270	2
CAL TO LS VELOCITY Z (MMPM)	100-2540	1270	F-PAGE 3-
CAL TO LS VELOCITY A (DPM)	100-2540	0	3
CAL TO LS VELOCITY B (DPM)	100-2540	2000	F
CAL TO LS VELOCITY C (DPM)	100-2540	0	4
AUTO BALANCE ENABLE	0-1	1	F
ATC DISABLE	0-1	0	5
RAPID OVERRIDE DISABLE	0-1	0	F
TILT AXIS SAFETY POSITION (DEG)	0-360	0	6
Enter the calibrate to limit switch velocity for X-axis.			F
			7
			FEXIT
			8

DRO Units: IN Free: 123036374 12:27:55

Figure 1-20. Machine Parameters, Page 2

Cal to LS Velocity X, Y, Z, A, B, C

The Cal to LS Velocity parameters set the feed rate for each axis as it is moving towards the calibration limit switch during a machine calibration cycle. Only the axes that are present on the machine need to be set. The units are indicated in parentheses and can be MMPM (millimeters per minute), IPM (inches per minute), or DPM (degrees per minute).

The default setting for Calibrate to Limit Switch Velocity is 1270 mmpm (50 IPM) for X, Y, and Z axes, 1000 mmpm (39.37 IPM) for A axis on VTXU, 2000 (78.74 IPM) mmpm for B axis on HTX, and 1000 mpmm (50 IPM) for C axis on VTXU.



Auto Balance Enable

Set the Auto Balance Enable parameter to 1 for all normal operating modes of the control. Only a trained technician performing diagnostic tuning of the servo amplifiers should set the Auto Balance Enable value to 0.

The default setting for Auto Balance Enable is 1.

ATC Disable

The ATC Disable parameter allows the user to completely disable all automatic tool change functions. Setting the ATC Disable parameter to 1 disables the Auto Tool Change button (for performing tool changes in Manual mode or Tool Setup) and the Auto Tool Change in Auto mode button (for running programs). With ATC Disable set to 1, all tools will have to be inserted and removed manually using the Spindle Clamp/Unclamp button mounted on the head.



Caution

When ATC is disabled, the Control assumes that the ATC is in a safe position to allow normal X, Y, and Z axis movement. Input status for the ATC at home position will not be checked. Failure to ensure that the ATC is in a safe position may result in machine damage.

The default setting for ATC Disable is 0.

Rapid Override Disable

The Rapid Override Disable parameter allows the user to enable or disable the Rapid Override potentiometer on the console. Rapid Override Disable set to 1 disables the Rapid Override potentiometer so that all rapid movements in an automatic operation will be at the programmed setting. Rapid Override Disable set to 0 enables the Rapid Override so that rapid movements in an automatic operation may be adjusted slower than the programmed setting.

The default setting for Rapid Override Disable is 0.



Tilt Axis Safety Position (deg)

The Tilt Axis Safety Position parameter sets the position for the tilt axis during an ATC if either the Move to Safe Pos During TC parameter is set to Yes (for Auto Run mode) or the Move to Safety Pos Manual Mode ATC parameter (for Manual or Input modes) is set to 1. After the Z retracts before the ATC, the tilt axis moves to the position indicated in degrees. After the ATC, the tilt axis returns to the original position.

The Tilt Axis Safety Position parameter is functional only for VTXU machines. The default setting for Tilt Axis Safety Positioning (deg) is 0.

** MACHINE PARAMETERS **			
DESCRIPTION	RANGE		
			F -PAGE 1-
			1
			F -PAGE 2-
AUX OUTPUT 1 CONFIRMATION ENABLE	0-1	>	0
AUX OUTPUT 2 CONFIRMATION ENABLE	0-1		0
AUX OUTPUT 3 CONFIRMATION ENABLE	0-1		0
AUX OUTPUT 4 CONFIRMATION ENABLE	0-1		0
DISABLE AUX OUT 1 DURING INTERRUPT	0-1		0
DISABLE AUX OUT 2 DURING INTERRUPT	0-1		0
DISABLE AUX OUT 3 DURING INTERRUPT	0-1		0
DISABLE AUX OUT 4 DURING INTERRUPT	0-1		0
SSM MOUSE SCALING FACTOR	>0		0.450
MOVE TO SAFETY POS MANUAL MODE ATC	0-1		0
			F -PAGE 3-
			3
			F
			4
			F
			5
			F
			6
			F
			7
			F
			8
			FEXIT
			9
Enter 1 to enable aux. output confirmation, 0 to disable.			
DRO Units: IN Free: 123036374 12:28:23			

Figure 1-21. Machine Parameters, Page 3

Aux Output 1, 2, 3, 4 Confirmation Enable

Aux Output 1, 2, 3, 4 Confirmation Enable set to 1 enables a confirmation signal for completion of each Auxiliary M-code Output. The program pauses until the confirmation signal is detected. A setting of 0 will not require a confirmation signal and will not pause the program during the Auxiliary M-code Output.

The default setting for each Auxiliary Output Confirmation Enable is 0.



Disable Aux Out 1, 2, 3, 4 During Interrupt

Disable Aux Output 1, 2, 3, 4 During Interrupt set to 1 disables each Auxiliary M-code Output when an Interrupt cycle is selected during Auto Run mode. Upon return to Auto Run mode, the Auxiliary M-code Output will automatically be re-enabled. However, if another mode is selected then the Auxiliary M-code Output will remain disabled until activated again in Auto Run mode. A setting of 0 will leave the Auxiliary M-code Output enabled when an Interrupt cycle is selected during Auto Run mode. It will remain enabled after exit from Interrupt cycle, even if to a different mode than Auto Run.

The default setting for Disable Auxiliary Output During Interrupt is 0.

SSM Mouse Scaling Factor

The SSM Mouse Scaling Factor parameter is not functional for VTX and HTX machines.

The default setting for SSM Mouse Scaling Factor is 0.450

Move to Safety Pos Manual Mode ATC

When the Manual Mode ATC operations parameter is set to 0 for an ATC command, the Z axis moves to tool change height and the ATC is completed at the current X and Y axis position. If this parameter is set to 1 then the Z axis moves at rapid to zero, the X and Y axes move at rapid to the table safety position (consult with Hurco service engineer to change this position), the Z axis moves to tool change height, and the ATC is completed. After the ATC completes, the Z axis moves to zero and the X and Y axes move at rapid back to the previous X and Y position.

Note

The Move to Safety Position for Manual Mode ATC only applies to Manual mode. ATC operations in Auto Mode are not affected by this parameter. To move the table to the safety position during an ATC in Auto Mode, set the Move to Safe Pos During TC from Program Parameters in Input.

The default setting for Move to Safety Pos Manual Mode ATC is 0.



Automatic Pallet Changer System

The Automatic Pallet Changer (APC) system is standard on HTX machining centers only. Equipped with two pallets, the APC provides the ability to simultaneously setup a job on one pallet while a job is machined on the other pallet.

The APC is hydraulically controlled by solenoids, switches, and software to permit pallet switching automatically within the part program. In addition, manual controls are also provided. The APC has two pallets that are numbered one and two, respectively.

The basic sequence of operation of the APC is as follows:

1. The APC Table must be squared before any motion can occur.
2. The APC Pin is unlocked.
3. The APC Clamp is disabled.
4. The APC Table is raised hydraulically.
5. The APC Table rotates 180 degrees by engaging hydraulic solenoids to rotate in the proper direction.



Important

The APC Table does not rotate through 360 degrees. The APC table returns to the previous position by rotating in the opposite direction.

6. The APC Table is lowered hydraulically.
7. The APC Clamp is enabled.
8. The APC Pin is locked.

Pallet Changer Solenoids and Adjustment

The APC solenoids are located at the bottom front of the enclosure beneath the remote APC Panel.

1. The top solenoid controls the speed adjustment. The left-hand adjustment is for high-speed rotation and the right-hand adjustment is for low-speed rotation. The high-speed rotation occurs from the beginning of the rotation until a proximity switch detects the Decel input. Then the low-speed rotation occurs until the Pallet is in position to be lowered. Adjust for smooth rotation into position.



2. The second level of solenoids is for rotating to Position 1 (left-hand solenoid) and Position 2 (right-hand solenoid).
3. The third level of solenoids is for raising (left-hand solenoid) and lowering (right-hand solenoid) the APC table.
4. The fourth level of solenoids is for the APC Pin Lock.
5. The fifth level of solenoids is for the APC Clamp.

Squaring the APC Table

Before any APC operation can occur, the APC Table must be squared. The APC Table is driven by a servo motor and uses encoder feedback for positioning and a proximity switch for the home position. During machine calibration, the APC Table is not automatically squared. Squaring the APC Table requires selecting the softkey in Pallet Changer Diagnostics.

In Pallet Changer Diagnostics, selecting the SQUARE PALLET FOR ROTATION softkey followed by pressing the Cycle Start button will rotate the APC Table into the proper position for the pallet exchange cycle. If the B-axis is jogged away from the squared position, selecting the SQUARE PALLET FOR ROTATION softkey rotates the table at the maximum rpm back to the squared location.

Manual Pallet Changer Operation

The remote APC Panel (see the Remote APC Panel figure) is located on the front of the enclosure below the front enclosure doors. The APC Panel may be used to manually raise and lower the APC Table and to rotate between Position 1 and Position 2.

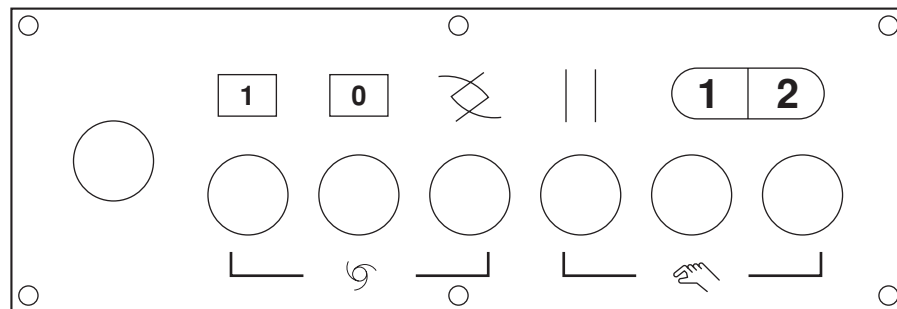


Figure 1–22. Remote APC Panel



The basic function of each of the buttons, left to right:

- **Emergency Stop** — Disables all axis servo drives. Removes power to the hydraulic pump that moves the pallet changer. All pallet movement stops.
- **Cycle Start** — Initiates a selected operation that runs until the operation is completed. The Cycle Start lamp flashes while the operation is pending, the lamp is steady when the operation is in process, and the lamp is off when the operation is complete.
- **Cycle Stop** — Cancels any pending operation (if the Cycle Start lamp is flashing, it will turn the lamp off). Pressing Cycle Start after an operation is canceled with Cycle Stop action results in no APC motion.
- **Workzone Confirmation Or Ready To Rotate** — Used for automatic operation only (see Automatic Pallet Changer Operation section).
- **Hydraulic Lift** — Issues a command to either raise or lower the APC Table. If the table is in the lowered position the table raises and if in the raised position the table lowers. Pressing Hydraulic Lift illuminates the Hydraulic Lift lamp and causes the Cycle Start lamp to flash. A Cycle Start action is required to begin lifting or lowering the APC Table. The Hydraulic Lift lamp will be off when the raise or lower operation is completed or is canceled by a Cycle Stop action.
 - If the APC Table is in the Down position, the Ultimex console will display the message, “APC unit will raise.”
 - If the APC Table is in the Up position, the Ultimex console will display the message, “APC unit will lower.”
- **APC Table Rotate To Position 1**— If the external pallet is Table 1 then press this button to initiate the command to rotate the APC Table to place Table 1 into the machining area. The APC Table Rotate To Position 1 button functions only with the APC Table in the Up position. Pressing the APC Table Rotate To Position 1 button illuminates its lamp and causes the Cycle Start lamp to flash. The Ultimex console displays the message, “APC unit will rotate to position 1.” A Cycle Start action is required to begin the rotation of the APC Table. The APC Table Rotate To Position 1 lamp turns off



when the operation is completed or the rotation is canceled by a Cycle Stop action.

- **APC Table Rotate To Position 2**— If the external pallet is Table 2 then press this button to initiate the command to rotate the APC Table to place Table 2 into the machining area. The APC Table Rotate to Position 2 button functions only with the APC Table in the Up position. Pressing the APC Table Rotate To Position 2 button illuminates its lamp and causes the Cycle Start lamp to flash. The Ultimex console displays the message, “APC unit will rotate to position 2.” A Cycle Start action is required to begin the rotation of the APC Table. The APC Table Rotate to Position 2 lamp turns off when the operation is completed or the rotation is canceled by a Cycle Stop action.

Note

When the Hydraulic Lift or either of the APC Table Rotate buttons are illuminated and the operation is waiting for a Cycle Start action, the Ultimex console Start Cycle button also flashes. Pressing the Ultimex console Start Cycle button cancels the pending request and turns off the illuminated button’s lamp.



Example of Manual Pallet Changer Operation

This example assumes that the APC Table has position 1 external or away from the machining area.



Important

Before initiating a manual APC operation:

- The Ultimex Control must be in Manual mode
- The machine must be calibrated
- Servo power must be on
- The ATC must be in Home position
- The Z-axis must be at zero
- Hydraulic Pressure must be OK
- The front enclosure doors must be closed
- The APC Table must be squared

Initiate a manual APC operation as follows:

1. Press the Hydraulic Lift button — the button lamp lights and the Cycle Start lamp flashes.
2. Press the Cycle Start button — the APC Table raises and the Cycle Start lamp stops flashing. When the APC Table is in the Up position, both the Cycle Start and the Hydraulic Lift lamps turn off.
3. Press the APC Table Rotate To Position 1 button — the button lamp lights and the Cycle Start lamp flashes.
4. Press the Cycle Start button — the APC Table begins a 180 degree high-speed rotation followed by low-speed rotation into position. The Cycle Start lamp stops flashing. When the APC Table is finished rotating, both the Cycle Start and the APC Table Rotate to Position 1 lamps turn off.
5. Press the Hydraulic Lift button — the button lamp lights and the Cycle Start lamp flashes.
6. Press the Cycle Start button — the APC Table lowers and the Cycle Start lamp stops flashing. When the APC Table is in the Down position, both the Cycle Start and the Hydraulic Lift lamps turn off.



Manual APC Table Rotation

Near the front of the APC Table is a Manual Table Release Lever. This lever provides the input for the APC Pin Lock. To manually rotate the table without using the remote APC Panel, pull the Release Lever out. This allows the APC Table to be rotated by hand for part setup. After rotating the APC Table, the arrows on the Pallet must be aligned with the arrows on the APC Table's platform before executing a pallet exchange.

Note

The APC Table must be in Down position before using the Manual Table Release Lever to rotate the table manually.



Caution

Failure to align arrows prior to executing a pallet exchange can result in the APC Table not positioning correctly in the machining area.



Automatic Pallet Changer Operation

The APC Table can be operated in Auto mode within a Conversational or NC part program. M-code M51 is defined to initiate a complete APC cycle (see basic sequence of operation) for HTX machines only. Using M51 does not require indicating whether Position 1 or 2 is in the machining area or setup area but will perform a full APC cycle.

To program an M51 operation within a Conversational program, select the MISCELLANEOUS softkey in Part Programming of Input mode followed by the MACHINE FUNCTION softkey to display the Machine Function Display.

BLOCK 1 MACHINE FUNCTION

M CODE > 0

M CODE	MACHINE FUNCTION
51	CYCLE PALLET CHANGER
52	M52 AUX OUTPUT #1
53	M53 AUX OUTPUT #2
54	M54 AUX OUTPUT #3
55	M55 AUX OUTPUT #4
62	M62 AUX OUT #1 OFF
63	M63 AUX OUT #2 OFF
64	M64 AUX OUT #3 OFF
65	M65 AUX OUT #4 OFF

F 1

F 2

F 3

F PROGRAM
4 PARAMETERS

F PART SETUP
5

F TOOL SETUP
6

F 7

F EXIT
8

PRESS MANUAL MODE, POWER, AND START CYCLE TO RESTORE POWER.
ATC DOOR IS OPEN.



  Prog Units: IN Free: 123946772 11:06:52

Figure 1-23. Machine Function Display



Important

The front enclosure doors must be closed and the Workzone Confirmation button pressed before the M51 will initiate the APC cycle. This indicates to the program that the setup of the next workpiece is complete and ready for the machining area.

If the front enclosure doors are open when the M51 is requested, then the program will be in a Feed Hold state with a message to close the front enclosure doors displayed. Close the doors and press the Workzone Confirmation button to continue the part program.

If the Workzone Confirmation button has not been pressed when the M51 is requested then the program will be in a Feed Hold state with the following message displayed, “Pallet setup confirmation required to cycle pallet changer.” Press the Workzone Confirmation button and the Cycle Start button on the remote APC Panel to continue the program.

Note

Pressing Feed Hold during an APC cycle will stop the cycle. Releasing Feed Hold will resume the cycle. However, Feed Hold followed by Spindle Off (or the Stop Cycle button) during an APC cycle will abort the program and the APC cycle. The APC must be returned to the home position using the Pallet Changer Diagnostics before an Auto program can be run again.



Pallet Changer Diagnostics

The Pallet Changer Diagnostics screen displays after selecting the TOOL IN SPINDLE softkey on the Ultimex console while in Manual mode.

```
***** PALLET CHANGER *****  
  
APC POSITION          DOWN          UP  
PALLET IN MACHINE   1              2  
APC PDH             LOCKED        UNLOCKED  
APC DECEL. SM       1              2  
APC REFERENCE       REFERENCE POS.  
  
HYDRAULIC STATUS    [X]          ALARM  
Z-AXIS POSITION       AT ZERO  
ATC STATUS          HOME  
PALLET STATUS       PALLET SOURCED  
  
PRESS MANUAL MODE, POWER, AND START CYCLE TO RESTORE POWER.  
ATC DOOR IS OPEN.  
[Left] [Right]      DR0 Units: IN   Free: 123946794 11:03:11
```

V08923.00.00

Figure 1-24. Pallet Changer Diagnostics Screen



APC Diagnostics Softkeys

Pallet Changer Diagnostics softkeys are not functional unless servo power is on and the machine has been calibrated. Each softkey flashes the Start Cycle button on the Ultimex console if all conditions are met for the requested command. Pressing the Start Cycle button initiates the command and the Start Cycle lamp lights during the execution of the command. The Start Cycle lamp is turned off when the command is complete.

Softkey	Description
Move Z Axis to Zero Position	Sets the command to move the Z-axis to the zero position.
Square Pallet for Rotation	Sets the command to square the pallet.
Cycle Pallet Changer	Sets the command to complete a full rotation of the APC Table (all eight steps of the basic sequence of operation).
Raise Pallet Changer	Sets the command to lift the APC Table to the Up position. The APC Table must be squared and the APC Table must not be Up.
Rotate APC to Position 1	Sets the command to rotate the APC Table to place Position 1 inside the machining area. The APC Table must be squared and Position 1 must not be in the machining area.
Rotate APC to Position 2	Sets the command to rotate the APC Table to place Position 2 inside the machining area. The APC Table must be squared and Position 2 must not be in the machining area.
Lower Pallet Changer	Sets the command to lower the APC Table to the Down position. The APC Table must be squared and the Table must not be Down.

Table 1-22. Pallet Changer Diagnostics Softkey Descriptions



Status Conditions

The Pallet Changer Diagnostics screen also displays the status of inputs for the APC system (Table 1-22).

Status	Description
APC Position	Indicates whether the APC Table is in the Up or Down position.
Pallet in Machine	Indicates whether the APC Table Position 1 or 2 is in the machining area.
APC Pin	Indicates whether the APC Pin is Locked or Unlocked. The APC Pin must Unlock before the APC Table can be lifted and rotated and Locked to complete the cycle.
APC Decel Sw	Indicates whether the Position 1 or 2 switch was seen during rotation. This switch enables low-speed rotation before the APC Table completes the 180 degree rotation.
APC Reference	Indicates whether the Manual Table Release Lever is in the Reference Pos or has been retracted. The Manual Table Release Lever must be at Reference Pos to begin an APC cycle.
Hydraulic Status	Indicates either OK or Alarm. Must be OK to begin an APC cycle.
Z-Axis Position	Indicates if the Z-axis is At Zero (calibration point). Must be At Zero to begin an APC cycle.
ATC Status	Indicates if the ATC is Home. Must be Home to begin an APC cycle.
Pallet Status	Indicates Pallet Squared. Must be Pallet Squared to begin an APC cycle.

Table 1-23. Pallet Changer Diagnostics Status Descriptions



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Machine Standards

European Community Machine Safety Standards

The information in this section complies with documentation requirements of the European Community's machine safety standards.

Directives

These directives apply to all machining centers sold in Europe:

- European Machinery Directive 98/37/EC
- Electromagnetic Compatibility Directive 89/336/EEC (amended by 91/263/EEC and 92/31/EEC)
- European Low Voltage Directive 73/23/EEC (amended by 93/68/EEC)

Harmonized Standards

These standards apply to all machining centers sold in Europe:

Safety

- EN 292-1
- EN 292-2
- EN 294
- EN 349
- EN 418
- EN 953
- EN 954-1
- EN 60204-1

EMC (Electromagnetic Compatibility)

- EN 50081-2
- EN 50082-2

Other Standards

- BS 5378 Parts 1 and 3



Safe Installation of Guarding System and Machine

Inspect the machining center to ensure that all parts are included and intact.

The owner is responsible for proper site preparation before the machine is installed. A Hurco Field Service Engineer must install the machine in the prepared location. This location must not subject the machine to uncontrolled cabinet temperatures or unfavorable work environment conditions that could cause electronic component failure.

If the owner decides later to move the machining center from its installed location, it is recommended that the owner call Hurco for assistance.



Warning

Improper moving of the machine may result in personal injury or damage to the machine.

Guarding System

Each machining center has a self-contained guarding system. Inspect the machine to ensure the guarding system is intact.

- The chip doors on the front of the machine lock during Automatic Run Mode to prevent access to the moving parts of the machine.
- The guards on each side of the machine are either movable or fixed. The movable guards can be opened to access the inside of the machine. A special key is required to open a fixed guard.

Machine

Check these items before the machine is installed:

Foundation Conditions

The foundation must be able to support the weight of the machining center, and should be constructed of continuous concrete (reinforced concrete is best). The thickness and consistency of the concrete must be compatible with industry standards for supporting the machine's weight.



Actual requirements will depend upon the physical properties of underlying soil. Friction pads or machine anchors may be required to assure optimal machine performance.

Electrical Service Requirements

Follow all requirements below to help ensure personnel safety and to prevent equipment damage.



Warning

Always disconnect machine power before working with electrical connections.

Connecting Electrical Service

Observe the following guidelines when connecting electrical service:

- On-site wiring must comply with all established directives and standards.
- Dedicated, grounded 3-phase AC power is required to prevent high and/or low voltages, spikes, surges, and high frequency noise caused by inductive loads.
- The AC power source must match the voltage specifications listed on the machine's data plate.
- Wiring to the machine must be capable of supplying continuous specified amperage.
- Failure to provide the required power parameters may affect machine safety, performance and warranty.
- A Hurco Certified Service Engineer must supervise final electrical connections to the machining center.



Recommended Isolation Transformer Configuration

If a transformer other than the one provided with the machine is used, it must meet Hurco's machine operating voltage requirements. Use one of the configurations shown in the figure below. Hurco recommends the Wye system.

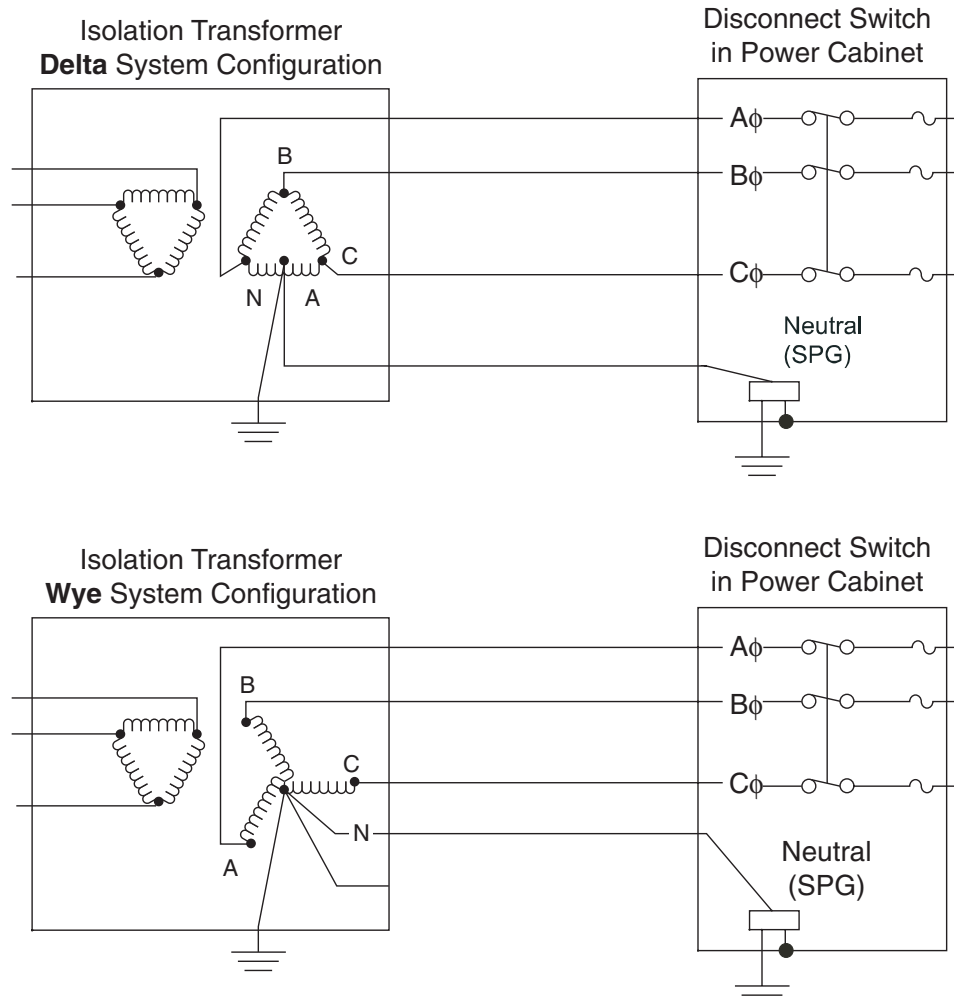


Figure 2-1. Delta and Wye Transformer Configurations



Grounding Equipment

The machine's electrical and electronic control systems are interconnected, terminating at the Protective Earth (PE) or ground point.

- The ground point must be properly connected to the ground circuit of the AC power source. The ground point is located inside the machine's power cabinet.
- The ground point provides only one conducting path between the machine and external ground, preventing an unwanted ground loop (ground differential voltage).

Compressed Air Requirements

A continuous supply of clean and dry air is essential for proper machine operation, and must be connected to the machine as described here.

Compressed Air Specification

Compressed air must conform to the specification: 5 CFM at 80-100 psi or 0.14 m³/min at 5.5 to 7.0 bar.

Connecting Compressed Air

The air supply line must meet these requirements:

- An NPT pipefitting must connect the air supply line to the machine.
- A regulator valve must be installed to control the air pressure into the machine.
- A factory-set pressure switch must be installed to shut off control voltages if the air pressure falls below the pre-set level.
- A minimum 1.27 cm diameter (1/2 inch, trade size) pipe, or an equivalent 1.99 cm (7/8 inch) diameter air hose supply line is required to provide adequate air volume.
- A drip leg should be installed in the line ahead of the filter/regulator assembly. The drip leg will help remove moisture accumulation in the supply, making the filter last longer.
- Quick coupler type fittings should not be used at the connection to the air filter/regulator, or within the supply line to the machine.



Anti-Vibration Mountings

Anti-vibration mountings, consisting of a spring-mounted ball bearing, are attached to each machine. Loose springs and balls are signs of excessive vibration.

Check the mountings before uncrating the machine to ensure that the machine has been handled properly prior to its arrival. Continue to inspect the mountings on a regular basis.

Initial Test and Examination

Follow the instructions below for performing the initial test and examination of the machine and its guarding system.

Contact your Hurco Distributor to arrange for a Hurco Service Engineer to perform the final machine setup. Complete these procedures prior to the Service Engineer's arrival:

1. Provide utilities to the machine.
2. Check all machine lubrication levels.
3. Place the flood coolant tank, tubing, and coolant pump motor near the machine base.

The Hurco Service Engineer performs these tasks:

1. Inspects the machine level and makes required adjustments.
2. Checks and connects electrical service to the machine.
3. Installs the control console.
4. Measures voltages in the electrical cabinet and control enclosure and makes adjustments, if needed.
5. Installs the flood coolant tank, tubing, and coolant pump motor.



Caution

Hurco is not responsible for failures of the motor encoder and cable assemblies resulting from abuse and direct spray of coolant.



6. Installs covers and enclosures.
7. Checks fans and pumps for proper operation.
8. Checks all axes for calibration and correct limit switch operation.
9. Tests the disk drive.

Safety Circuits

If the owner or operator modifies the hardware or software by removing, altering, disabling, or tampering with any safety circuit, safety switch, or other safety operation and operates the machining center with those modifications, such operation is extremely hazardous and is a *foreseeable misuse* of the machine, and voids the Hurco warranty. If such modifications are discovered, the machining center must be immediately shut off and not used. A Hurco service representative must be contacted for assistance in restoring the machine to safe operation.

Guidelines

The machining center safety circuit is designed to provide safe and reliable operation of Hurco products. The basic rules governing operation are as follows:

- The spindle cannot operate unless all enclosure doors are closed, not including doors that are fastened shut with bolts or screws.
- Enclosure doors must be closed and locked, or during automatic execution, warm-up cycle, calibration cycle, automatic tool changes, probing, or when running the spindle (excepting orient).
- In the event that the enclosure door is opened during automatic operation, or any time the doors are locked, an immediate command to stop all motion will be executed and control power will be removed.
- Redundancy is included in electrical design to detect single point failures.



- When the Emergency Stop button is pressed, power is cut off to the spindle, after allowing for deceleration (approximately 7 to 10 seconds).
- ATC electrical circuits will be isolated from source power when any door is open.

Tamper-resistant fasteners are used to hold combination door lock/ switches in place and to prevent access to internal wiring.

CE Safety Circuits Commissioning Checklist

Periodically check the safety circuits, especially after changing component parts. Checklists are provided below for Manual Setup, Automatic Preparation, and Automatic Production Modes:

Mode: Manual Setup

- Door(s) Status— Open
- Access code: Enabled (Limited operation)
A four-digit code is required for enabling limited safe operation such as jogging axes with the chip doors open. The code is entered in the CE Status & Diagnostics screen.

Safety Requirement	Verification	Pass	Fail
1. Control shall not allow “Spindle On” to be selected.	<Error message> displayed when Spindle On key depressed.		
2. Calibration cycle shall not be initiated.	<Error message> displayed when softkey is touched.		
3. Control shall not allow tool change to be initiated.	<Error message> displayed when tool change cycle initiated.		
4. Axes may be jogged at maximum feedrates of 2 M/min.	Initiate jog cycle at maximum allowable feedrate.		
5. Chip auger shall not run.	<Error message> displayed when auger softkey touched.		
6. Part program execution shall not be initiated.	<Error message> displayed when automatic mode enabled.		

**Mode: Automatic Preparation**

- Door(s) Status— Closed
- Mode— Manual

Safety Requirement	Verification	Pass	Fail
1. The axes may be jogged at maximum allowable feedrate without restriction.	<Error message> displayed when doors opened with jog key depressed; all motion ceases upon opening.		
2. All tool change cycles shall be permitted.	Verify all doors lock when tool change key selected. <ul style="list-style-type: none">• Front enclosure• Side enclosure• ATC loading (CAT50)		
3. Chip auger functions shall be permitted when function is selected.	Verify all doors lock when softkey function is touched. <ul style="list-style-type: none">• Front enclosure• Side enclosure• ATC loading (CAT50)		



Mode: Automatic Production

- Door(s) Status— Closed.

Safety Requirement	Verification	Pass	Fail
1. Doors shall remain locked throughout part program execution.	Verify all doors lock in auto mode when Start Cycle pushbutton is engaged. <ul style="list-style-type: none"> • Front enclosure • Side enclosure • ATC loading 		
2. Doors shall unlock in auto mode only after all motion ceases.	Verify doors unlock after axis and spindle stop with program abort engaged (Stop Cycle pushbutton or Interrupt Key)		
3. Doors shall remain locked during an Emergency Stop condition.	Verify all doors remain locked when Emergency Stop is engaged during part program execution. <ul style="list-style-type: none"> • Front enclosure • Side enclosure • ATC loading 		
4. Doors shall unlock only after the fault condition has been reset.	Verify all doors unlock only after control power is restored (reset and Control On).		

Safe Operation

This section addresses the safe operation of the machining center. The information presented here is not a substitute for operator training, skill, and good judgment. Hurco does not accept any liability for operator error.

Training for Operators

Hurco or a Hurco authorized distributor must train all machining center operators. Hurco offers classes to demonstrate the programming capabilities of its CNC system. The training classes provide hands-on development of part programs.



Study this manual before attempting to operate the machining center and become familiar with machine functions and safety features. Review all caution and warning messages, as well as all warning and instruction plates or decals on the machining center.

Setup

Follow these precautions during machine and production setup:

- Perform all setup work with the Emergency Stop engaged. Never put your hands near a part being machined.
- Clamp the work piece and fixtures securely before starting the machine. Loose objects such as wrenches and chuck keys can become flying projectiles if not removed before starting the machine.
- Wear gloves or use a shop cloth when handling tooling.
- Inspect tools and tool holders frequently. Use tools that are properly sharpened and in good condition.
- Never start the machine when the cutter is in contact with the work piece. Make sure the direction of spindle rotation is correct to prevent cutter breakage. Rotate the spindle clockwise for right-hand tools, and counterclockwise for left-hand tools.
- Keep the work area well lighted. Adjust lamps so that light does not shine directly into the operator's eyes.

Operation and Maintenance

- Know where the Emergency Stop pushbuttons are located.
- Do not leave the machine unattended, but stand away while it is running. Never lean on the machine.
- Be aware of all pinch points caused by the motion of the table, head and automatic tool changer. Be aware of protruding machine parts.
- Keep the electrical cabinet doors closed while power is on. Before opening the electrical cabinet doors, verify that the main disconnect switch has been turned Off.



Warning

High voltages present in the machine's electrical system can cause serious injury or even death.

- Do not remove or bypass safety limit switches, interlocks and other safeguards.
- Do not start the machine unless all systems contain the proper amount and type of lubricant.
- Make certain that all necessary guards and protective devices are in place before operating the machine.
- If unusual sounds, smoke, heat or damaged parts occur, turn off the machine.

Safe Working Practices

Follow the correct service and repair procedures to ensure safe operation of the machining center, and to reduce the likelihood of serious operator injury.

Observe these basic safety precautions when working near a machine:

Responsible Conduct

- Follow the instructions provided when performing a maintenance task.
- Keep all parts of your body away from moving parts.
- Be alert and keep safety in mind.
- Never attempt to operate or repair a machine if you have taken strong medication, used a prescription drug, or consumed an alcoholic beverage.
- Do not attempt to operate or repair a machine until you have read and understood all information that pertains to the machine, including all warning and instruction plates or decals mounted on the machine.
- Know how the machine functions, and understand its safety features.



Personal Care

Avoid frequent or prolonged skin contact with fresh or used cutting fluids and oils. If machining chemicals come in contact with your skin, wash the area immediately. Wash your hands thoroughly before eating. Change clothing that has become contaminated with machining fluids and oils.

For complete information about handling industrial chemicals used in machining, refer to the international Control of Substances Hazardous to Health (COSHH) materials from the chemical suppliers.

Wearing Apparel

- Wear eye protection and safety shoes while in the machining center work area. Safety glasses with side shields are recommended. Safety shoes should be in good condition, with steel toes and oil-resistant soles.
- Remove clothing and jewelry that could get caught in the machine's moving parts. Do not wear loose-fitting clothing. Roll long shirt sleeves above the elbow.
- Keep long hair tied-back so that vision is not obstructed and hair cannot become caught in moving parts.

Heavy Lifting

- Do not attempt to lift more than you can safely handle. When lifting, keep your back straight and use your legs.
- Use a hoist for heavy lifting, making sure that the load is evenly balanced and is raised slowly.
- Do not raise a large load over aisles and make certain that the landing area is clear and level.

Housekeeping

- Maintain a clean and orderly workspace around the machine. The floor must be free of spills and obstructions.
- Use only sturdy work platforms with anti-slip surfaces around the machine.
- Do not store tools, shop cloths, and miscellaneous parts on the machine.



- When removing chips, make certain the cutter is completely stopped. Use a brush or chip scraper to remove chips - do not use compressed air to blow chips from the spindle, table, controls, cabinet or floor. Do not remove chips by hand, or while the spindle is turning. Dispose of chips frequently.

Control Systems

Circuit diagrams for electrical, hydraulic, and pneumatic systems are available in the machining center's *Parts Listings and Wiring Diagram Manual*.

Noise Levels

The following noise level readings were taken in the vicinity of the Ultimax CNC, 1.6 meters from the floor, 1 meter from the machine's enclosure. The maximum ambient noise level reading taken for each machine at the time was 60 dB.

Measurements were made with background noise present using a dB meter set on A-rated scale. The sensor head was placed vertical to the floor.

Readings Measured From CNC	
Machine	dB Reading
VTXU	max 82 dB
HTX500	max 82 dB

Table 2-1. Noise Levels

Note

The noise emission levels in the previous table are for reference only, and are not necessarily safe working levels. While there is a correlation between the emission and exposure levels, this cannot be used to determine whether further precautions are required. Factors that influence the actual level of exposure of the workforce include characteristics of the workroom, other sources of noise, the number of machines and other adjacent processes. Also the permissible exposure level can vary from country to country. This information, however, will enable the user of the machine to make a better evaluation of the hazard and risk.



Persons Trapped in Machine

If all safety circuits are intact, it is not possible to run a machining center while in direct contact with any axis, the tool changer, chip conveyor, or chip auger.

To release a person trapped in the machine, press the Emergency Stop button

- With machine power off, the relief valves will depressurize, allowing manual movement of machine components (e.g., ATC arm).
- With machine power on, counter motions can be activated using the Ultimax control. In addition, power-piloted valves can be activated by pressing corresponding pushbuttons.



Warning

Pressing the Emergency button will lock enclosure doors.

Enclosure doors should not be closed while performing maintenance inside the machine enclosure.

Personnel should not perform maintenance inside the machine enclosure without someone else present.

To release locked enclosure doors, you must power On the machine:

1. Press the Machine Mode Manual console key.
2. Turn the machine power On.
3. The enclosure doors automatically unlock.



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Machine Maintenance

The maintenance schedule in this chapter is based on normal use (8 hours of operation per day). Your machine's maintenance schedule may vary. Machines operated for longer periods each day, or in warm or humid environments should be serviced more often.

Daily Operational Checks

The operator should perform the following each day:

- Check that all shields, covers and doors operate properly.
- Jog each axis through its full travel, watching for smooth operation.
- Ensure that all axis limit switches are functioning correctly and are adjusted to their proper travel limits.
- Inspect the guideways for scratches or excessive wear.
- Check that the way wipers are not damaged.
- Touch the guideways to check for proper lubrication. All axis guideways should have a thin film of lubricant.
- Run the spindle at various speeds, including the minimum and maximum RPM, while observing for proper start, stop and spindle operation.
- Program a loop and tap at 800 RPM. The spindle rotation should not exhibit abnormal noise or vibration, and speed changes should be smooth.
- Turn power off and rotate the spindle by hand. It should rotate easily.
- Check that all console control buttons and keys light when pressed, and activate the intended functions.
- Clean chips from way covers, enclosure, ATC, and chip conveyor.
- Wipe spindle taper with a lint-free cloth dipped in clean, light oil.



Cleaning the Machine

Follow these recommendations when cleaning the machining center:

- Machined and unpainted surfaces should be wiped clean with a lint-free cloth dipped in a clean, light machine oil.
- Exterior painted surfaces may be cleaned with a soft cloth dampened with water and a mild detergent.
- The control console's exterior may be cleaned with a soft cloth moistened (not wet) with water and a mild detergent.
- The console screens may be wiped with a damp, soft, lint-free cloth.
- The machine enclosure should be thoroughly cleaned annually, or as needed.

Floppy Disk Drive and Diskettes

Follow the recommendations below for diskettes and the disk drive:

- Keep dirt, dust, coolant and oils away from the floppy drive.
- Keep the drive door closed when not inserting or removing a diskette.
- Keep diskettes away from heat, extreme cold and electromagnetic fields. Do not touch the diskette surface. Store diskettes in closed containers to protect them from dust and dirt.



Heat Exchanger

The heat exchanger removes heat from the control cabinet. Filters inside the heat exchanger become dirty with dust, and must be cleaned weekly.

For VTX series machines:

1. Lift the filter inside each heat exchanger (at the rear of the machine) to remove it.
2. Rinse the filters with clean water and dry.

For HTX series machines:

1. Remove the filter from its mount on the outside of the electrical cabinet door.
2. Rinse the filters with clean water and dry.
3. Install the filter into its mount on the outside of the electrical cabinet door.

Exterior Wiring

Inspect conduit, connectors, cabling and wiring external to the machine every month for evidence of fraying, cracking and looseness.



Lubrication

Periodically check and maintain all lubricant levels to keep the machine in good operating condition. Lubrication points and recommended lubricants appear in the table below. This list is not exhaustive. Lubricants that meet the same specifications as those listed below may be substituted. Local suppliers should be able to cross reference recommended lubricants.

VTXU			
Lube Point	Fill Level or Condition	Lubricant Type*	Lubricant Manufacturer
ATC Cam Oil	Sight glass 1/2 full	I.S.O. VG 150~220	Teresso 32 (Esso), DTE Oil Light (Mobil), Tellus Oil 32 (Shell), Turbo 32 (Shell), Magnus Oil 32 (Phillips), Hyken Golden (Kendall)
ATC Magazine Grease	Manually grease with brush		Mobil/M-Temp 78
ATC Tool Pot Slides	Manually grease with brush		Mobil/M-Temp 78
Rotary Table Side	4.0 liter	I.S.O. VG 100~150	
Rotary (Tilt axis) Incline Shaft Side	2.0 liter	I.S.O. VG 100~150	
FRL Oil	Between low and high marks on the lubricator unit.	I.S.O. VG 32	Teresso 32 (Esso), DTE Oil Light (Mobil), Tellus Oil 32 (Shell), Turbo 32 (Shell), Magnus Oil 32 (Phillips), Hyken Golden (Kendall)
<i>(continued on next page)</i>			

Table 3-1. Lubrication for VTXU Machines



VTXU (Continued)			
Lube Point	Fill Level or Condition	Lubricant Type*	Lubricant Manufacturer
Tool Release Cylinder Oil	Maintain at 1/3 full, not to exceed 1/2 full.	I.S.O. VG 32	Teresso 32 (Esso), DTE Oil Light (Mobil), Tellus Oil 32 (Shell), Turbo 32 (Shell), Magnus Oil 32 (Phillips), Hyken Golden (Kendall)
Way Lube Oil	Between high and low marks on reservoir. Refer to the "Autolube System" section of this chapter for more details.	I.S.O. VG 68	Febis K68 (Esso), Vactra No. 2 (Mobil), Tonna Oil T68 (Shell)
Way Lube Volume	4 liter		

* Viscosity ranges are based on ambient temperatures.



HTX500			
Lube Point	Fill Level or Condition	Lubricant Type*	Lubricant Manufacturer
ATC Cam Oil	Sight glass 1/2 full minimum	I.S.O. VG 150~220	Teresso 32 (Esso), DTE Oil Light (Mobil), Tellus Oil 32 (Shell), Turbo 32 (Shell), Magnus Oil 32 (Phillips), Hyken Golden (Kendall)
ATC Gearbox Oil	Sight glass 1/2 full minimum		MobilGear 460
ATC Magazine Grease	Manually grease with brush	I.S.O. VG 68	Mobil/M-Temp 78
ATC Tool Pot Slides	Manually grease with brush		Mobil/M-Temp 78
Rotary Table Gearbox	0.5 liter	I.S.O. VG 100~150	
Rotary Table Side	1.8 liter	I.S.O. VG 100~150	
FRL Oil	Between low and high marks on the lubricator unit.	I.S.O. VG 32	Teresso 32 (Esso), DTE Oil Light (Mobil), Tellus Oil 32 (Shell), Turbo 32 (Shell), Magnus Oil 32 (Phillips), Hyken Golden (Kendall)
Tool Release Cylinder Oil	Maintain at 1/3 full, not to exceed 1/2 full.	I.S.O. VG 32	Teresso 32 (Esso), DTE Oil Light (Mobil), Tellus Oil 32 (Shell), Turbo 32 (Shell), Magnus Oil 32 (Phillips), Hyken Golden (Kendall)
Way Lube Oil	Between high and low marks on reservoir. Refer to the “Autolube System” section of this chapter for more details.	I.S.O. VG 68	Febis K68 (Esso), Vactra No. 2 (Mobil), Tonna Oil T 68 (Shell)
Way Lube Volume	4 liter		

* Viscosity ranges are based on ambient temperatures.

Table 3-2. Lubrication for HTX500 Machines



Autolube System

The Autolube system automatically lubricates the slideways, guideways, and ballscrews. The pump cycles once every 15 minutes to send lube oil through the system when servos are On. The preset discharge rate is 3.0 cubic centimeters (cc) per pump cycle, and is adjustable.

If the machine will be idle for 30 days or more, add a rust preventative to the system lubrication. Initiate a manual lube cycle and move all axes for full travel several times to allow delivery throughout the system.

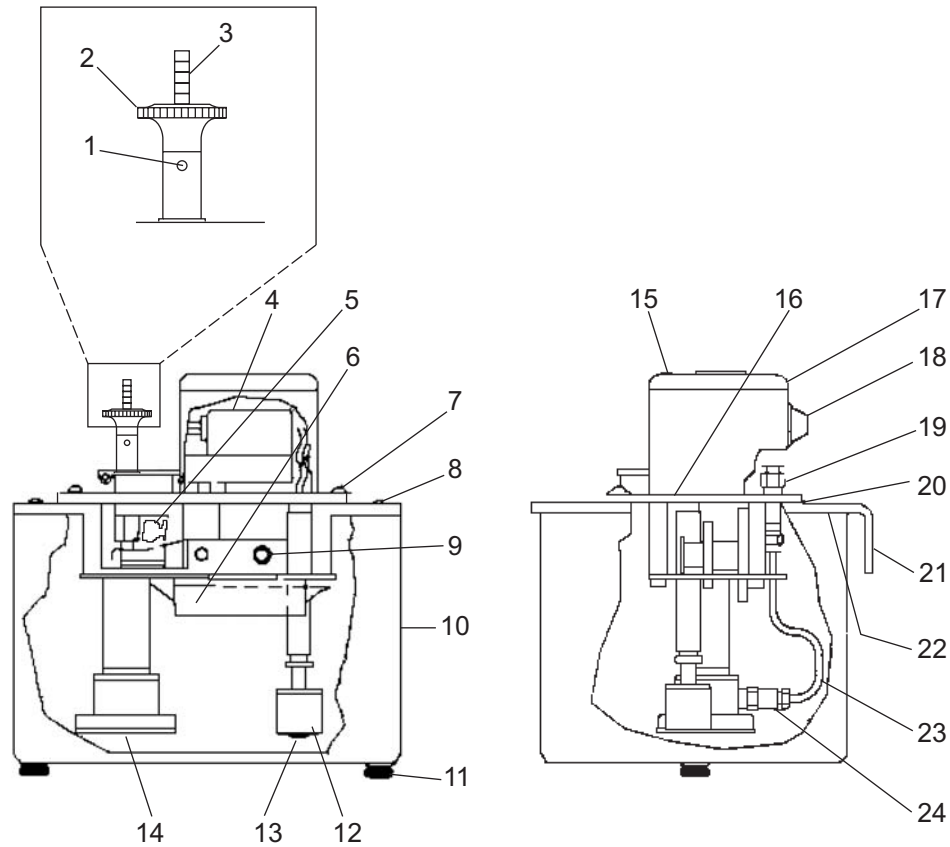
Note

Excess servo On time without table or head movement may cause oil to accumulate on the table and guideways. To eliminate excess lubrication, the Power Off Timer can be set to automatically shut off power to a machine that has been idle for a specified time.

The oil filter strainer prevents contamination from entering the system. The strainer must be checked periodically, and replaced if it becomes plugged.



Typical Autolube system diagram.



1	Set screw	9	Retaining ring	17	Motor cover
2	Discharge plunger	10	Reservoir	18	Grommet
3	Indicator rod	11	Screw	19	“Thru” coupling
4	Electric motor	12	Float switch assembly	20	Reservoir gasket
5	Strainer, oil filter	13	O-ring	21	Mounting bracket, reservoir
6	Reservoir worm and gear lube	14	Suction filter group	22	Reservoir gasket
7	Screw, cover mounting	15	Screw, cover mounting	23	Outlet tube assembly
8	Screw, reservoir mounting	16	Gasket, motor cover	24	Outlet check valve assembly

Figure 3-1. Autolube Pump and Tank Assembly



Check Filler Screen and Fluid Level

Maintain the fluid level and check the filler screen:

1. Lift the oil filler cap and check that the screen is clean. Clean and dry the screen before reinstalling it.
2. If needed, add oil to the tank. The level should be between the high and low marks (about 1/2 inch or 1.27 cm from top cover of tank). Replace the fill cap.

Activate System Manually

If the machine has been idle for a long time before powering up, or if the oil has just been replaced, follow these steps to manually activate the Autolube system:

1. Pull upward on the discharge plunger, then release it.
2. Stroke the plunger in this manner three to six times.

Adjust Autolube Discharge Rate

An indicator rod is located in the Autolube system's discharge chamber. The scale graduations on the flat surface of the rod indicate the discharge rate in cubic centimeters (cc) per pump cycle. To adjust the discharge rate of the Autolube system, follow these steps:

1. Loosen (but do not remove) the setscrew in the center of the discharge plunger body.
2. Turn the plunger body clockwise to increase or counterclockwise to decrease the pump discharge rate.
3. Once the required discharge rate is obtained, align the setscrew with the flat surface on the rod. Tighten the setscrew to secure the rod position.

Replace Oil and Suction Filter

To drain the reservoir and replace the oil and suction filter, follow these steps:

1. Shut off power to the machine.
2. Loosen and remove the two thumbscrews that secure the reservoir to its mounting bracket.
3. Lower the reservoir downward from the threaded spacers.



4. Remove the suction filter group by first carefully prying out the retaining ring.
5. Remove the filter discs and screws. Note their order of assembly.
6. Insert the new coarse screen (filter disc support), fine screen (screen disc, filter disc), filter clamp ring and retaining ring.
7. Clean any contaminates from inside of the tank. Dry the inside with a clean, lint-free cloth.
8. Check that the strainer in the filler opening is clean and not damaged.
9. Make certain that the gasket is installed and is in good condition.
10. Place the tank on its mounting bracket, guiding it over the threaded spacers.
11. Carefully tighten the two thumb screws that secure the tank to its mounting bracket.



Caution

Over-tightening these thumbscrews can damage the tank.

12. Check that the screen is installed in the filler opening.
13. Fill the reservoir with the recommended oil.
14. Manually activate the system.



Automatic Tool Changer

The lubrication required depends upon the type of ATC.

ATC Oil Unit

Maintain the Oil Level

Follow these steps to maintain the oil level:

1. Check the level.
2. If the oil is low, add the recommended type. See the Lubrication for ATC Cam Unit table for oil types.

Replace the ATC Oil

To replace the ATC oil, follow these steps:

1. Open the drain plug located near the bottom of the swing arm transmission casting. Drain the oil.
2. Flush the system. Use a non-volatile flushing agent that is suitable for a mineral-type lubricating system.
3. Replace the drain plug.
4. Add the new oil.

Greasing the Rotary Union Bearing Assembly CTS and CTS-Ready

If the machine is equipped with a Coolant Thru Spindle (CTS) or is CTS-ready, the head contains a rotary union bearing assembly that requires grease. Grease is applied through a Zerk fitting.

Machine	Coolant Thru Spindle	Recommended Lubricant	Amount of Lubricant	Schedule
VTXU/ HTX500	CTS-ready optional, CTS optional	Type: NLGI 2 Product Name: • Isoflex NBU 15 (Kluber Lubrication) – or equivalent –	5 cc into the Zerk fitting	Every 3,000 hours of operation or every 6 months (whichever comes first)

Table 3-3. Lubrication for Rotary Union Bearing Assembly



Lubricating the ATC Cam Unit

The cam unit on the 32-station or 60-station ATC requires oil. The oil level should always be in the middle of the round sight glass, located on the right side of the swing arm unit.

Machine Type	Recommended Lubricant	Amount of Lubricant	Schedule
VTXU	Type: ISO VG 220 Product Names: Kendall SR 12X (Kendall Refining) Mobiltac A (Mobil) – or equivalent –	5.8 quarts (5.5 liters)	Check every 3 months Change every year
HTX500			

Table 3-4. Lubrication for ATC Cam Unit



Important

The oil should be changed more often than annually if it appears to be darkening.

Greasing the ATC Magazine Chain

The magazine chain assemblies on 32-station and 60-station Automatic Tool Changers require grease.

Machine Type	Tool Changer	Recommended Lubricant	Amount of Lubricant	Schedule
VTXU	32-station	Type: NLGI 1 Product Name: Mobiltemp78 (Mobil) Kendall Grease L424 (Kendall Refining) – or equivalent –	Light coating	Grease every 6 months
HTX500	60-station			

Table 3-5. Lubrication for ATC Magazine Chain – VTXU and HTX500



To apply grease:

1. Using a brush, spread a light coating of grease over the chain assembly.
2. Avoid grease build-up.

Cleaning the Tool Lock Pins

To clean the tool lock pins located on the tool change arm:

1. Select Manual Mode.
2. Select the ATC and Machine Diagnostics utility. The machine must be in a calibrated state.
3. Position the arm down for cleaning.
4. E-stop the machine before cleaning.
5. Remove chips or debris with a lint-free cloth dipped in clean light machine oil.

Cleaning the Tool Holders

Check the condition of tool holders to ensure that they are clean and free of damage. To access tool holders in the magazine:

1. Open the enclosure maintenance door on the side of the machine to access the magazine.
2. Remove all tools from the magazine.
3. Move the magazine and the tool holder.
 - Use the magazine direction switch, located on the outside of the machine near the enclosure maintenance door, to move the magazine either clockwise
 - Use the rotate push button, also located on the outside of the machine near the enclosure maintenance door, to move a tool holder along the magazine.
4. Check each tool holder for damage. Clean tool holders with a lightly oiled, lint-free cloth.
5. Inspect tools and tool flanges for damage. Clean tools and tool flanges with a lint-free cloth dipped in light machine oil before replacing them in magazine's tool holders.



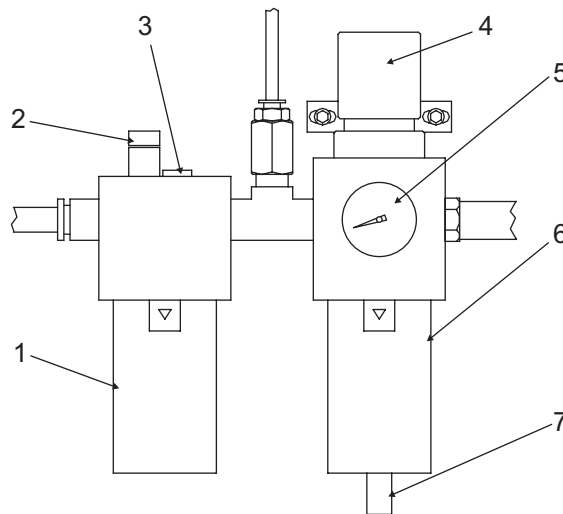
Pneumatic System FRL Unit

The pneumatic system includes a Filter, Regulator and Lubricator (FRL) Unit. The filter cleans incoming compressed air and expels accumulated moisture through a drain. The lubricator meters oil into the air stream to lubricate cylinders and valves. The rate at which lubricant is released into the pneumatic system (i.e., drip rate) is adjustable.



Important

The air supply requirement for the machine is a continuous 5 CFM of clean, dry compressed air at 80-100 psi (0.14 M³/min at 5.5 to 7.0 bar).



1	Lubricator unit	5	Air pressure gauge
2	Fill/Oil drip viewer	6	Filter unit
3	Drip rate adjust	7	Auto moisture drain
4	Air pressure adjust		

Figure 3–2. Filter, Regulator, and Lubricator

Set Air Pressure

If the air pressure reading on the gauge does not meet the required specification, adjust the knob on top of the filter unit to set the correct system pressure. To adjust the knob, pull it up and turn. To lock the knob, push it back down.



Maintain Lubricator Oil Level

Maintain the lubricator oil level between the low and high marks on the lubricator unit. If oil must be added, do not overfill.



Important

Shut off the compressed air supply before adding lubricant or removing one of the housings. Use only recommended oils or equivalents.

Adjust Drip Rate Screw

The oil drip rate was factory-set and should not require adjustment. However, if the oil drip is not visible at the top of the lubricator unit, turn the drip rate adjustment screw to obtain one drop of lubricant for every second tool change.

Check and Replace Air Filter Element

Check the air filter element regularly, and replace it when necessary. If the filter becomes clogged, the air pressure may still measure as acceptable, but air flow to the pneumatic system will be restricted.



Caution

When you remove the bowl to access the filter element, clean the bowl using a soft, lint-free cloth dabbed with the recommended FRL Unit lubricant. Do not use any type of cleaning fluid.

Before connecting the air supply, install the metal bowl guard.

Check Auto Moisture Drain

Make sure the auto moisture drain is not stuck open and leaking air. If the drain is stuck open, follow these steps:

1. Shut off the compressed air supply to the machine.
2. Using a crescent wrench, turn the auto drain nut at the filter unit bottom counter-clockwise one turn.
3. Press upward on the nut to release any foreign material that may be lodged, and to reseal the drain valve.
4. Tighten the nut clockwise.



Spindle Oil Chiller

The optional spindle oil chiller is used to maintain the temperature of oil that circulates around the spindle cartridge. Cooling spindle oil reduces thermal growth, which improves machining accuracy. If the oil level in the tank is not maintained at or above the low mark, the system's pump could be damaged and spindle cooling would be impaired.

Service the spindle oil chiller according to the schedule in the VTX/HTX Maintenance Checklist at the beginning of the manual.

Maintain Oil Level in Spindle Oil Chiller Tank

Follow these steps to maintain the oil level in the spindle oil chiller tank.

1. Check the oil level. Units typically have a sight gauge.
2. If the level is low, shut off the oil chiller.
3. Add the recommended oil to the tank. Leave space at the top to allow for hot oil expansion. Do not overfill.

Inspect the Air Filter Screen

To inspect the air filter screen, follow these steps:

1. Shut off the spindle oil chiller.
2. Clean the air filter screen if it is dirty.

Maintain Oil in Chiller Tank

Drain, flush, and refill the chiller tank yearly, and any time the oil shows signs of contamination or overheating.

Follow these steps to drain, flush, and refill the spindle oil chiller tank:

1. Shut off the spindle oil chiller.
2. Drain and flush the tank. Use a non-volatile flushing agent suitable for use in a mineral-type hydraulic system. This agent must be compatible with the oil.
3. Add the recommended oil to the tank. Leave space at the top for hot oil expansion. Be careful not to overfill.



Coolant System and Chip Conveyor

The flood coolant system pumps coolant to the tool in the spindle. The washdown system uses a large flow of coolant to move chips to the front of the machine and onto the chip conveyor. A washdown spray gun is externally mounted on the machine to spray chips from inside the enclosure.

Used coolant is cleaned of chips and oil and recirculated into the coolant tank. Filters remove contaminants from the coolant.

Selecting Coolant

Coolant should have these qualities:

- Suitable for the work piece material and machining operation.
- Soluble in water.
- Mineral content of at least 35%. When synthetic coolants and coolants that contain too little mineral oil contact guideway lube oil, they can gum the guideways.
- Adequate rust protection.
- Anti-foam, anti-bacteria, and anti-fungi agents.
- No skin irritation when prepared to the manufacturer's specifications.
- Penetrating lubrication oil should float on the surface of the coolant (instead of dissolving in the coolant).
- Use the recommended coolant to prevent damage to the machine's oil, guideways, precision ballscrews, and painted surfaces. Use a non- or semi-synthetic water soluble coolant.
- Failure of devices or performance problems related to coolant are not a defect in Hurco's material or workmanship, and will not be covered by Hurco's warranty.



Preparing Coolant

Follow these guidelines when preparing coolant:

- Mix the coolant according to the manufacturer's instructions. Use deionized (preferred) or softened water for the coolant mixture. To prevent zinc contamination, do not store coolant in a galvanized container.
- Check coolant concentration regularly with a refractometer, or by titration.
- Screen off any residue floating in the coolant.
- Use coolant additives, such as bactericides, and anti-foam corrosion agents, only if recommended by the manufacturer.
- Do not allow foreign matter to mix with the coolant. Contaminated coolant can damage machine parts.

Maintaining the Coolant

Check the coolant level every day at the start of operation. If the machine is used more than 8 hours daily, check the coolant level every 8 hours. Find the level indicator on the coolant tank and maintain the level as follows:

1. If the flood coolant pump is off, then fill the coolant to the H (High) mark. Note that the machine should be off for at least 5 minutes before filling the tank with coolant.
2. If the flood coolant pump is delivering coolant to the machine, then fill to the MAX mark.



Caution

If the coolant level drops below the L (Low) level mark on the coolant tank, the coolant system may not operate properly

Replacing Coolant

To replace coolant, follow these steps:

1. Using a suitable brush, remove chips and other debris from the enclosure (and chip conveyor, if installed).
2. Drain used coolant from the system and tanks.



3. Clean, or change, pump filters and pick-up tubes.
4. Fill the coolant tank with a neutral aqueous cleaning agent and flush thoroughly.
5. Drain the cleaning agent.
6. Rinse the system thoroughly with a 1% coolant solution. If bacteria or fungi contaminate the system, use a cleaning agent recommended by the coolant manufacturer.
7. Drain the rinsing solution.
8. Dispose of used coolant and cleaning solution in compliance with applicable pollution control regulations.

Coolant Filter for CTS

The coolant through spindle (CTS) pump assembly has an internal filter to clean coolant used by the CTS system. The CTS pump assembly is located at the rear of the coolant tank.

The CTS coolant filter should be checked every week and cleaned when necessary. To access the CTS coolant filter:

1. Remove the filter housing unit from the CTS pump assembly. The CTS coolant filter resides inside.
2. Rinse the filter with clean, soapy water and dry. If the filter is damaged, replace it.

Chip Conveyor Tank

The optional chip conveyor runs horizontal to the machine base, near the floor. Chips that are not flushed out of the machining center collect in the chip conveyor tank. Hurco recommends cleaning the chip conveyor tank at the same time that you replace coolant. To clean the tank:

1. Attach a hose to the plug in the front of the chip conveyor tank to drain contaminated coolant.
2. Pull the tank forward and remove any remaining chips from the tank with a soft brush
3. Remove the two chip screens from the coolant tank (located on the ATC side of the machine). Rinse the screens and dry before replacing them.



Limit Switches and Dogs

Limit switches and dogs are mounted on each axis to determine end-of-travel and to establish reference points for initial machine zeros. Check the tightness of limit switch and dog fasteners:

1. Position the axes at their furthest negative location.
2. Open the enclosure maintenance door on the right-hand side of the machining center.
 - VTX — The X and Y limit switches and both dogs are located on the machine base. The Z limit switches and dogs are located in the column head.
 - HTX — The X and Z limit switches and dogs are located on the machine base. The Y limit switches and dogs are located in the column head.

Machine Electrical Ground

The machining center's ground is located inside the control cabinet, near the disconnect switch. A licensed electrician should measure the ground impedance (resistance to true earth) every three months.

Machine Level

Inspect the machine's level every six months by placing a precision level (resolution 0.0005 in/ft.) parallel and perpendicular to the worktable surface.

Spindle Taper

When the spindle is unclamped, air blows from the spindle taper hole. Any moisture in the air system will be detrimental to the taper, especially when the machine is stopped for an extended time.

Wipe the spindle taper clean each day with a lint-free cloth dipped in clean, light oil. If the machine will be idle, wrap the spindle taper in a cloth soaked with clean Autolube oil.



Troubleshooting

Failure conditions can be evident during power up and operation. Failure detection and prevention descriptions follow.

Power-Up Troubleshooting



Troubleshooting

If a problem occurs during power up, look for one of the following symptoms:

- No messages appear on the console screen. The system may beep, but does not start up.
- Error messages appear during the initialization process before the Input screen appears.
- Error messages appear on the Input screen.



Warning

Before testing live circuits or attempting any repairs to electrical connections, make sure that the power switch on the electrical cabinet is in the Off position. Follow all established safety practices. Remember that the power line from the source to the machine may be live even though the machine tool is not receiving power.

No Response on the Console

If no messages appear on the text screen after switching power on, make sure of the following:

- Power supply cord inside the electrical cabinet is properly connected to the power source.
- Power switch inside the electrical cabinet is in the On position.
- No floppy disk is in the floppy drive.



Initialization Error Messages

After power has been switched on, initialization messages appear on the text screen. Errors indicated by the following error messages below can be easily remedied.

“Non-system disk detected. Press any key.”	There is a diskette in the floppy drive. Remove the diskette and turn the power off and then back on.
---	---

“Security device is invalid or has failed.”	The software security device has been removed, is broken, or is not properly connected. Switch off the control and remove the security device. If the device is damaged, replace it. Reconnect the device and switch on power.
---	--

Other possible messages during initialization usually indicate missing or corrupted files. The usual solution for such problems is to restore or delete files. For help solving these problems, contact Hurco’s service department or the distributor’s service department.



Important

Before calling a Hurco service representative for assistance, always switch off the control at the power button, wait a few minutes, and then power on again.



Error Messages on Input Screen

Occasionally, the system will go through all of the initialization steps, display the Input screen, and then refuse to respond when console keys are pressed.

If this occurs, take careful note of any error messages on the Input screen. If there are no error messages, the cable to the front panel may be loose or defective. Check the custom cable inside a conduit. If a custom cable needs to be replaced, call technical services to perform the operation.

Corrective Measures

One or more of the following corrective measures may be necessary:

Swap Out a Printed Circuit Board

Sometimes, the printed circuit (PC) board is bad or has an intermittent problem, or the connector on the board is not making sufficient contact. In this situation, the PC board is suspect. If possible, swap out the suspect PC board with a replacement.

If swapping out a board corrects the error, install the original PC board to see whether the error returns. If not, the connector probably was not seated properly or the contacts need cleaning.

Check Wiring

Perform these checks:

- Trace the wiring as far as possible.
- Wiggle connectors and ensure they are properly seated.
- Test the connections with an ohmmeter.
- Unplug and reseal circuit boards; sometimes connectors become tarnished and do not conduct well. If the contact points on a PCB are dull looking, polish them with a rubber eraser.



Perform a Reset

Technical assistance personnel may ask you to reset a circuit board or the machine.

- To reset a PC board, press the board's reset button.
- To reset the machine, switch the main power off and then back on.

Emergency Stop Condition

Pressing the Emergency Stop button removes all servo power and power to the way lubrication pumps, and resets the current program to the beginning. A message on the screen indicates the Emergency Stop condition. To remove the Emergency Stop condition, execute these steps:

1. If the Emergency Stop button is depressed, twist and lift it.
2. Press these console buttons in this order:
 - a. Manual
 - b. Power On
 - c. Start Cycle

Machine Diagnostics

The control detects the status of various machine components, and presents this information on the Machine Diagnostics screen.

To reach the Machine Diagnostics screen, follow these steps:

1. Press the Machine Mode Manual console key.
2. Select the MANUAL FUNCTIONS SETUP softkey.
3. Select the CE DIAGNOSTICS softkey. The CE Status and Diagnostic screen appears.

If an error condition is displayed, follow these steps:

1. Follow the instructions on the CE Status and Diagnostic screen.
2. Once the error status is corrected, exit the CE Status and Diagnostic screen.
3. Restart and calibrate the machine.



Common Problems

Common operator problems are listed below, with potential causes and solutions. These problems are usually noticeable without the help of error messages, although error messages may occur. More than one problem can result from a single cause.

Power-on Self Test

When you turn on the machine, the control performs a self test. If an error in the control circuitry is detected, a pattern of beeps may sound instead of the normal start-up beep. A screen error message may appear – follow any screen instructions.

Machine Voltages

Missing or faulty connections can cause a combination of problems.

Connections	Description
Missing	<ul style="list-style-type: none">• Open grounds• Open neutrals• Open phase connections• Missing neutral-to-ground strap at main source
Improper	<ul style="list-style-type: none">• Phase and neutral reversed• Phase and ground reversed• Ground and neutral reversed• Ground and neutral shorted at panel
Loose	<ul style="list-style-type: none">• At main panels• At equipment• At other equipment in system• At service entrance

Table 3–6. Missing or Faulty Connections



Fluctuating voltages to the machine often occur when power usage in your region is high (typically on a very hot or cold day).

Problems	Causes	Solutions
Fuse blows.	Power sag.	Repair faulty in-plant wiring. Move any other machines on the circuit to separate circuits.
Power is lost.		
Motor(s) overheat.		
Control PC boards and/or microprocessor fail.	Power spike.	Move any nearby high current switching devices (arc welders, inductive motors) away from the machine. Properly ground equipment and install surge protection to insulate against lightning strikes.
Machine stops.		
Data is lost.		

Table 3-7. Problems Due to Power Fluctuation

If a machine malfunction occurs, consider the following issues:

- Is another machine that uses high current connected to the AC distribution power supply line?
- Is the ground impedance of the AC distribution power supply line sufficient?
- Are there fluctuations in the input voltage to the machine?
- Is there a source of “noise” nearby (crane, welder, etc.)?
- If other CNC or NC machines are connected to the same group of circuits, do any of those machines demonstrate similar problems?
- Was another machine operating at the same time the problem occurred?
- Does the problem occur mainly at a certain time of day?

Note

Power surges can occur when large loads are suddenly placed on, or removed from, an electrical system.



Coolant System

If a problem occurs with the coolant system, check these possibilities:

Problem	Cause	Solution
Coolant flows slowly or stops.	Clogging due to dirty coolant.	Flush lines, clean filters, drain and refill the system with fresh coolant.
	Pump is not working properly.	Check and service the pump. For mist system, check shop air pressure.
No liquid (only air) comes from mist nozzle.	Coolant tank is empty.	Fill coolant tank with fresh coolant.
	There is too much air in the system.	Close off valve, then slowly open again to get desired flow.
Coolant fails to start when head lowers to Z up level or below.	Coolant valve is not turned On.	Turn on the valve (via the control).
	Coolant is not programmed to be On.	Check the operating mode (auto or manual) or programming.
Coolant fails to stop when head is up to Z retract level.	Incorrect program parameters.	Check parameters and correct the setting.

Table 3–8. Coolant System Problems

Machine operation failures can be a programming or a hardware problem. Hardware includes electronic components, wiring, and electro-mechanical devices.



Motion and Spindle Rotation

If the spindle or an axis does not move the way it was programmed to, moves without being instructed to, or spindle rotation is incorrect, refer to the following table.

Problem	Cause	Solution
Spindle does not turn.	Program might not have proper RPM setting.	Check the RPM setting in the program. If this setting is wrong, check and correct the entire program.
	Spindle drive breaker is tripped.	Power down the machine, reset the breaker on the spindle amp and turn on power.
The machine's control power is Off and the screen shows a Motion Error message	Chip buildup causes a Motion Error.	Look under chip covers for excessive chip buildup. Clean and maintain to avoid reoccurrence.
	The X, Y and Z axes ballscrews are not well lubricated.	Check the lube oil level, lubrication to the way ballscrews, and lube pump operation. Correct as needed.
	Servo cable connections are not making good contact.	Check each connector (by hand, visual check is not enough). Clean, press together and wiggle. Replace the connection if it is intermittent during wiggling.
	Error LED is On servo(s).	Note the location of lighted LED(s). Phone for technical assistance.
	Servo encoder or decoder not working properly.	Jog the machine while watching position numbers on the screen.
	Actual collision or binding occurs between machine parts and product fixtures.	Examine the path, parts and fixtures for evidence of collision or rubbing.
<i>(continued on next page)</i>		

Table 3-9. Motion and Spindle Rotation Problems



Problem	Cause	Solution
The machine chatters while machining or cutting.	Machine feeds too fast.	Check the program settings for Feed and Speed – reprogram if they are wrong. Make sure that the actual speed matches the programmed speed.
	Wrong tool, tool is damaged, or tool is not sharp.	Make sure the right tool is being used for the application. Make sure the tool shaft is clean and not bent. Verify that the tool is sharp.
	Fixture is not rigid enough.	Check the fixture. Tighten or reinforce it if needed.
	Tool is not held perfectly straight.	Check the spindle taper for foreign material. Clean the taper if necessary. Check the tool holder to see that the tool is inserted straight. Reinsert the tool if needed. Check tool retention force on the draw bar.
Small errors in dimensions show up occasionally.	Temperature fluctuates as the part is machined.	Stabilize the temperature of the blank by providing enough coolant while machining.



Environmental Conditions

When the electrical cabinet overheats, the machine shuts down until the cabinet's temperature sensor registers that the temperature has dropped to an acceptable level. If this error occurs, check the temperature around the electrical cabinet to be certain the cabinet is not subjected to an additional heat source, such as a space heater or bright sunlight from a nearby window.

Temperature and other environmental variables can cause problems that might otherwise be attributed to the machine.

Problems	Causes	Solutions
Relatively small dimensional problems occur in the product.	Metal blanks stored in temperatures much higher or lower than the temperature of the machining area can expand or contract during and after machining.	Before machining, move the blanks to the machine area and allow the blanks time to reach ambient temperature.
Dust, debris, rust or discoloration accumulates on work surfaces.	Extreme temperatures are typical, and/or the environment is too humid or dusty.	Improve the machine's environment. For example, close the machining area to outside dust, etc., and install air conditioning to lower room temperatures and humidity.

Table 3–10. Environmental Factors



Ordering Replacement Parts



Important

If your local distributor is certified as a full service distributor, your call for replacement parts should be to that distributor.

Hurco maintains a large inventory of service parts. If your distributor is not a full service distributor, you may order parts from Hurco by telephone, fax, or mail:

Hurco Companies, Inc.

One Technology Way

P.O. Box 68180

Indianapolis, IN 46268-0180

Tel. (317) 293-5309 (products)

(317) 298-2635 (service)

(800) 638-1849 (service parts)

Fax (317) 298-2621 (service)

Hurco subsidiary contact information can be found on the Hurco website:
www.hurco.com

Providing Information Required for Parts Orders

In order for your full service dealer or Hurco to process your order and supply you with the correct part(s), you must provide the detailed information described below.

- Your company's purchase order number.
- Serial Number of the Hurco machining center. The machine serial number is located on the identification/data plate, which is attached to the electrical cabinet door.
- The part number, part name (description) and quantity desired. State where you found the part number. If you found the part number in a manual, include the manual's part number, revision or date, and page. If you located the number on the part, write "old part."
- Your company's name and complete address.



- Name and telephone number of person ordering the parts.
- Complete shipping address for the parts, including name of the person to ship to, delivery date, department, etc.
- Provide any special shipping instructions, including mode of shipment. Parts will be shipped prepaid and billed via invoice.
- Indicate the condition of the machine (inoperable or functional, etc.).
- Address to which invoices are to be mailed.

Returning Parts

When returning a part to Hurco, fill out a Return Authorization Tag and ship the part in its original container. All parts are subject to inspection before credit is issued. Non-warranty parts returned for credit are assessed a restocking charge. The purchaser is responsible for all shipping charges. Returned parts should be shipped prepaid. Hurco will not accept parts shipped COD or without a Return Authorization Number displayed clearly on the outside of the shipping container.



Important

After you contact either your full service dealer or Hurco, they will provide you with a Return Authorization Tag that includes the Return Authorization Number for you to display on the shipping container.

All defective parts replaced under warranty agreement must be returned within 30 days.



Record of Changes

704-0211-211, 04/15/04, ECN 15691

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Page	Subject	Changes
		New manual release, based on VMX Maintenance and Safety Manual, 704-0213-202



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