MODIG
MACHINE TOOL SWEDEN

HHV DUO OPERATOR MANUAL

Contents

1. General

This manual is intended for operators of the Modig HHV DUO Mill. It is important that the personnel who are to handle and maintain the machine study this instruction manual properly before they attempt anything with the machine. Failure to do so may result in serious damage to equipment and personal injury. This is to ensure the personnel are fully conversant with the control system, the safety devices and with the possible dangers that can arise. If any aspects of this manual are unclear, please contact Modig or the relevant third party parts suppliers for clarification before carrying out any procedures relating to the operating of the Modig HHV DUO.

The manufacturer renounces all responsibility with regard to injury arising from safety instructions being disregarded, failure to carefully read through the instruction manual or as a result of incorrect handling. Furthermore, we reserve the right to modify working parts, accessories and technical data in line with technical developments.

Prior consent from Modig is necessary before any copying of these instructions or forwarding to a third

Before the machine becomes operable, this *Operator manual* must be read carefully and its contents understood. If there are any questions that are not answered by the instruction manual, Modig or an agent for the said company, must be contacted. Modig accepts no responsibility for accidents that occur as a result of the failure to read and understand the instruction manual.

The Modig HHV DUO Extrusion Mill machine is intended solely for the processing of aluminum material. If other materials like carbon fiber are machined, the machine must be equipped with filter and vacuum units.

1. Safety Precautions

1.1 Safety Precaution Instructions

WARNING
Read all safety precaution instructions throughout this manual and on safety signs attached to this equipment.

Failure to follow all safety precaution instructions could result in death or serious injury.

1.2 Definition of Lockout Procedure

A lockout procedure is a procedure to put each necessary energy isolating device in its safe position to prevent the energization of the equipment, such as when a maintenance procedure should be carried out.

A lockout is the use of a device, for example, a padlock, to make sure that an energy isolating device, such as a power supply disconnector, cannot be operated.

It is only one main switch on the machine that turns off all equipment related to the machine, except the light inside the electrical cabinet.
The cables that are still energized are orange to indicate that there is still power on them.
The switch is located on the electrical cabinet.

1.3 Safety Messages Description

This manual contains operator instructions for the Modig Horizontal High Velocity Extrusion Mill, HHV DUO

Prior to machine installation

See the **HHV Pre-Installation** manual and the **HHV Installation manual**

Preventive maintenance manual

For maintenance: See the **HHV Preventive Maintenance Manual**: Provides operators and/or maintenance technicians with information on preventive maintenance of the HHV DUO.

Why is preventive maintenance important?

For the HHV to perform at its maximum capacity over a long period of time, it is necessary to perform preventive maintenance. Follow the intervals and easy steps in this manual and Your HHV will operate with the safety and the accuracy You expect from it. Preventive maintenance will save you money and valuable downtime. Remember: Preventive measures is always cheaper than repairing.

Limitation of warranty

NOTE: For warranty reasons all preventive maintenance must be conducted and documented in accordance with the manual. If the preventive maintenance is not carried out and/or not documented properly, the warranty is no longer valid. This also applies to the uptime guarantee.

Personal safety

Machine owners, operators, maintenance and service personnel must know that the daily safety procedures are an important part of their work. Measures to prevent accidents must be one of the main purposes of the job, whatever the activity.

Get to know and respect your machine. Read and exercise the safety regulations and control procedures. Make sure that everybody who works for, with, or close to, you completely and fully understand and – more importantly – agree with the following safety regulations and the procedures at this machine.

Accidents, due to clothing and other articles becoming entangled in millers, knobs, levers or moving mechanical parts, can lead to personal injury to you or others. The following proposals will help you to prevent such accidents.

- Never wear ties, scarves, loose hanging clothing and jewelry (i.e. watches, rings and necklaces) by machines in motion.
- Use barehand gloves when they are used for handling sharp cutting tools, heavy, sharp or hot parts.
- Restrict long hair with a cap or hairnet.
- Use protective equipment and keep it in good condition.
- Use clean, approved goggles or face guard.
- Wear approved safety shoes with steel toecaps and non-slip soles to prevent harm.
- Always use ear protection.
- Never use or repair equipment if you are under the influence of alcohol, drugs or other substances or conditions that impair alertness or judgement.
- Only use trained personnel, who have been instructed in safety, on the machine.

This applies for the following activities:

- Installation foundation
- Transportation
- Commissioning
- Operation of machine
- Preventive maintenance
- Repairs
- The service personnel must be specially trained in commissioning and maintenance of motor spindles.

General safety instructions

The user of the machine is responsible for supervising the correct compliance with the safety instructions associated with the machine. We recommend repeating the safety instructions for the operators at regular intervals and that this is documented in writing.

When you use the multi-operation machines, the parameters that are specified in the section machine specification, must be observed.

Failure to follow the instructions on this page can lead to serious personal injury.

Cutting tools:

Use adequate hand protection on all occasions when you handle cutting tools with sharp edges.

Training, experience and competence of the user groups

Generally, the following user groups are employed during the service life of the machine:

- Transportation specialist (shipping agent, external)
- Transportation specialist (from Modig Machine Tool)
- Operating personnel (the user's)
- Maintenance technicians, service technicians (the user's)
- Maintenance technicians, service technicians (from Modig Machine Tool)
- Commissioning technicians (from Modig Machine Tool)
- The fundamental principles for the ergonomic design of the machine are based on the Machinery Directive 2006/42/EC. The requirements for the physical capacity in the user groups originate from these.
- The individuals, as user groups, must not have any impaired physical functions (e.g. impaired sight or hearing, body size, strength).
- Users of the machine must wear workwear. It must be ensured that personnel do not have long, free-flowing hair or were loose clothing or jewelry (including rings!) during work on the machine.
- It is presumed that all those in the user group are familiar with the basic health and safety regulations and regulations for the prevention of accidents and they have been instructed on the use of the machine. This includes these individuals having read and understood the instructions for use and annexes, updates or changes included in these.

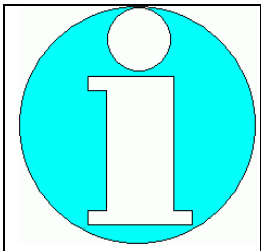
Warning instruction and signs

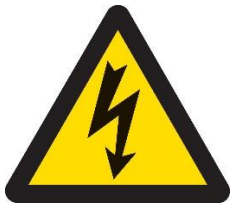
The following pictograms or warning signs and safety regulations are used in the operating instructions and on multi-operation machines.

DANGER 	Regarding direct units, faulty sensors or motors can only be replaced by personnel approved by Modig Machine Tool! When you change motors, the special safety provisions for the handling of strong magnetic components shall be observed. In the event of improper manipulation of sensor systems, serious personal injury or serious damage to the machine are to be expected!

CARE 	Pay attention to risks when performing manual tool changes at the tool station and on the work spindle! The tool most be held securely when it is loosened or be secured in another way from falling out of the tool holder. Pay attention to the risk when operating the machine in the SET-UP mode, when the work room's guard may be open. There is a risk for injury due to rotating tools and moving mechanical parts. Pay attention to the risk for injury in the following activities: When you place tools in the loader station due to sharp cutting edges on tools, during manual tool changes on the spindle due to sharp cutting edges on tools, when you change the workpiece in the loader station of the machine bench because of the creation of burrs on the workpiece or shavings.

WARNING 	It is important that all internal/external personnel comply with the workplace's fire safety rules regarding equipment and evacuation routes.

	This symbol stands for: Attention, Note, important Layout of signs: white pictogram on a blue background in a circle

	Danger due to electric power The sign is linked to all of the areas where electrical devices are located that involve danger. Special care should be observed at these points. Layout of signs: Black flash of lightening on a yellow background with black frame

	Laser beam This sign warns about dangers due to laser beams. This symbol is fastened in the work area where checks for tool fracture are performed using laser beams. The wavelength of the laser is between 400 nm and 700 nm and is split up based on the German standard VDE 0837.

	Suspended load This sign warns about dangers due to suspended loads. This symbol is affixed in the work area where it is necessary to warn for suspended loads.

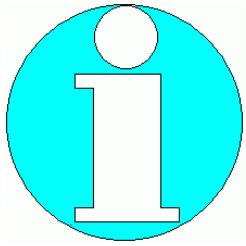
	Obstacles/Risk for tripping This sign warns about dangers due to obstacles or risk for tripping. This symbol is affixed in the work area where it is necessary to warn for suspended loads.

	Fall risk This sign warns about dangers due to fall risk. This symbol is affixed in the work area where it is necessary to warn for suspended loads.

	Pressurized containers This sign warns for pressurized containers. Information signs on pressurized containers for pneumatic or hydraulic systems showing that these containers are pressurized.

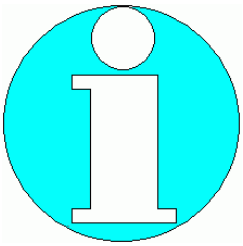
Information on machine guards

The owner of the machine must ensure that the machine and its safety equipment is in a safe condition before initial commissioning. This is also necessary during operation at suitable and regular intervals, see the service and maintenance manual.

ATTENTION 	Inform the person responsible, for example the foreman, if the condition or operation of the machine's behavior changes due to faults. When necessary, turn off the machine by switching off the main power switch. Remove damaged parts from the machine as soon as they are detected, even if no machine fault has occurred! This applies to cables and conductor in the electrical equipment!

Safety in the work area

Always keep your workplace clean. Dirty work areas with risks such as oil, garbage or water on the floor could cause someone to fall to the floor, into the machine, or on to other objects that could cause serious personal injury.

ATTENTION 	Read this and the other manuals thoroughly prior to work in the machine. In your own interest, make sure you understand all the safety instructions and observe them when you work with the machine! This applies for individuals who only work on the machine occasionally, for example, for troubleshooting, maintenance or cleaning. Always keep the user manuals handy by the machine! When you work on the machine, do not wear: long, free-flowing hair loose fitting clothes jewelry, including rings! All mechanical parts that are reached on foot are provided with non-slip surface. Do not walk on other parts of the machine! To prevent damage to the telescopic guard when performing maintenance work, suitable protective measures must be taken.

Make sure your workplace is free from dangerous obstacles and be aware of protruding mechanical parts.

Place tools and similar equipment in their correct storage place immediately after use. Keep work surfaces clean, tidy and in good order.

Report unsafe working conditions to your superior manager or safety department. Objects such as: worn or broken floors, steps, railings and unstable or slippery platforms or scaffolding must be reported and repaired prior to use. Use approved tools when climbing.

WARNING MAGNETISM

All HHV3-machines built prior to 2019 (and the HHV DUO) have electric linear motors that cause strong magnetic fields. These magnetic fields can be hazardous, especially if the operators or other personnel have pacemakers and come close to the magnets. These magnetic fields are active even when the main switch is turned off.

The HHV2 (previously called HHV Professional) do not have these electric linear motors

A safety message is always accompanied by a safety alert symbol and a signal word. The safety alert symbol is used to alert about potential personal injury hazards. To avoid hazards, obey all safety messages that follow this symbol. The following safety alert symbols and signal words are used in this manual to inform the user of hazards.

 DANGER	Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Caution indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
CAUTION	Caution without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

1.4 Emergency Stop

Emergency stop devices are used to stop this equipment immediately in an hazardous situation. Learn the positions of all emergency stop devices and how to use them.

Location of emergency stop devices
Described in section 2

Instruction
When pressing the E-stop the push button it needs to be reset manually at the E-stop that has been activated and there will be a alarm message on the operator panel (HMI) that the machine has been E-stopped and this alarm has to be cleared manually. See section 9.3.

When the E-stop is active all power to all motors, spindle, hydraulic unit, chip conveyour system, coolant pumps is turned off and pneumatic pressure is released.
E-stop button need to be manualy released, alarm on operator panel need to be cleared by pressing reset or pmc message clear and the power need to be turned on by pressing power on button on operator panel.

Testing, must be tested more than once per year; In accordance with EN ISO 13849-1:2015 Category 3 PL d. **See HHV Preventive Maintenace Manual**

Instructions for a normal stop are included in this manual.

1.5 Safeguards

WARNING
Moving machinery.
Never defeat or bypass the interlocking devices.

There are one door in the front of the machine and one door at the backside of the machine with movable guards which makes it impossible to open the door while running.

for example, doors and covers leading to hazardous zones, are fitted with interlocking devices where required. These devices are usually electric safety switches that are parts of the safety system and must never be defeated, bypassed, or otherwise made inoperative. See section 8.3.

The doors can only be opened when the machine is not in cycle and the spindle is not running. The frontdoor will be automatically reset when closed and the back door has a reset button next to the entrance that need to be reset before it is possible to start the machine.
Testing, must be tested more than once per year;

In accordance with EN ISO 13849-1:2015 Category 3 PL

1.6 Warning lamp

A warning lamp is a column of warning lights:

- **Green**:
  Steady green light: the machine runs in automatic mode with no alarm and the feed override is set above 90%.
  Flashing green light: feed override below 90 %.

- **Yellow**:
  Steady yellow light: machine not run in automatic mode, no alarms, the feed override below 90%.
  Flashing yellow light: feed override over 90 %.

- **Red**:
  Steady red light: machine in alarm state, with feed override at zero.
  Flashing red light: feed override other than zero.

All lamps flash when the Service key is On.

1.7 Personal Protection

This section applies to all personnel at all times when this equipment is in operation.

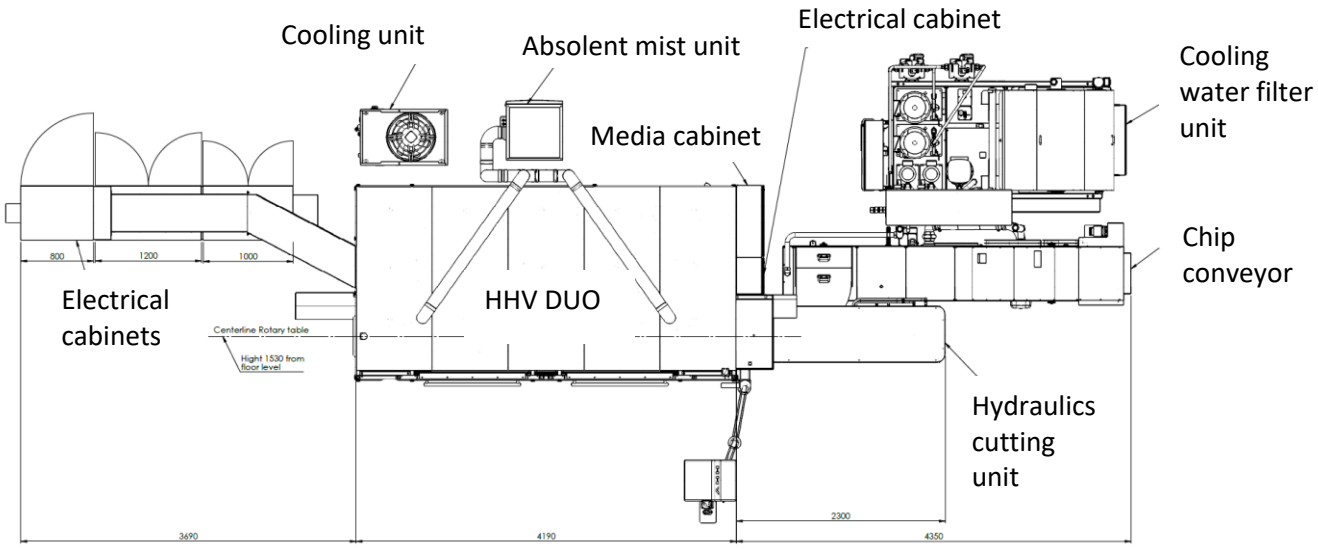
1.8 Noise Hazard

WARNING Hazardous noise.
Risk of impaired hearing. Wear hearing protection whenever this equipment is in operation.

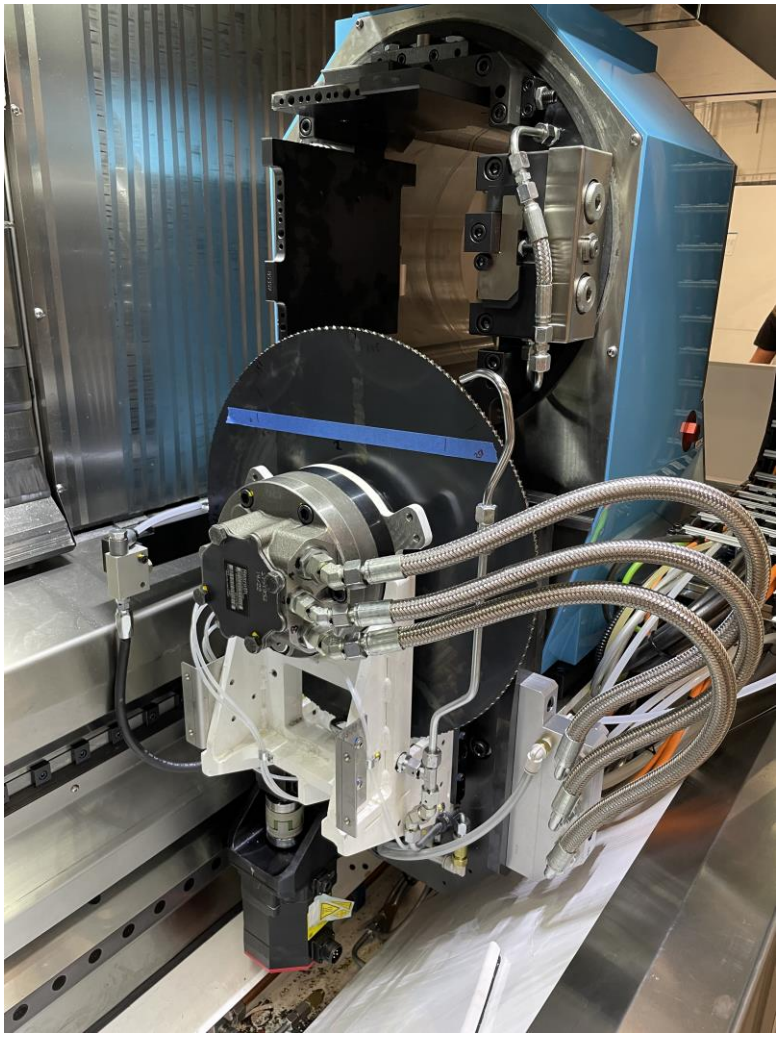
1.9 Entanglement Hazard

WARNING Risk of entanglement.
Do not wear jewelry or loose clothing when working on or near this equipment. Long hair may not be loose.

2. Safety & machine overview



View from above



The HHV DUO has a hydraulic operated cutting saw which is movable up and down.

2.1 Machine safety and emergency stop devices

NOTE: Walk around the HHV DUO and locate all of the emergency stop devices before you use the machine for the first time.

NOTE: Every single emergency stop device (button) on the machine or on the KNOLL unit, will shut down all systems in the machine if pressed.

The operator panel has one emergency stop device

One emergency stop device on the main electric cabinet

One emergency stop device on the backside of the machine on the panel for open/close of the back door.

On the backside of the KNOLL, emergency stop device

Emergency stop device on the HMOP

2.2 Absolent Unit

The Absolent-unit placed behind the HHV DUO. It has sensors that shows filterstatus. (See HHV Preventive maintenance manual for filter-change etc)

The display shows the filterstatus. (See HHV Preventive maintenance manual for filter-change etc)

2.3 Spindle

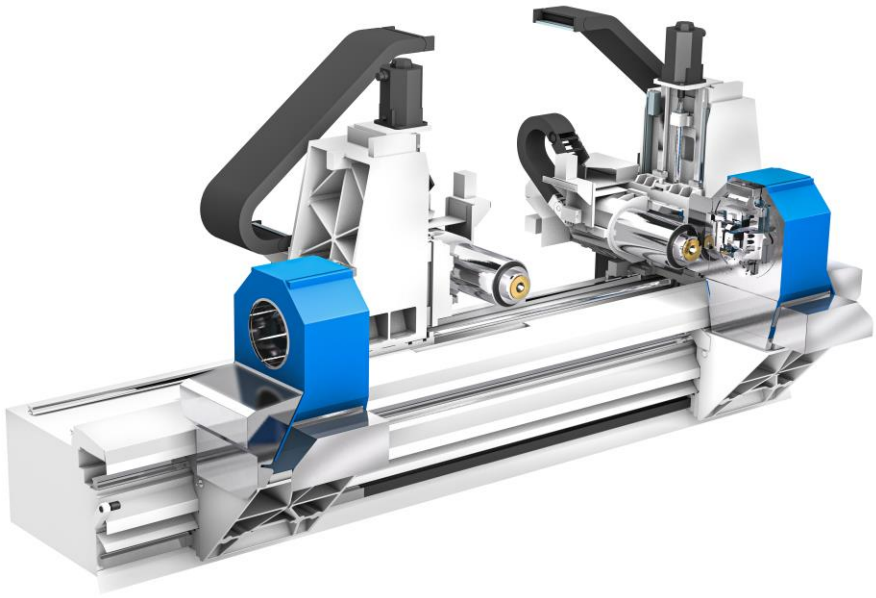
The Fischer spindle. The HHV DUO has two spindles that operate separately from eachother (se picture below). For maintenance see the HHV Preventive maintenance manual.

For lubrication of the spindle only use:

MOTOREX

SPINDLE LUBE ISO VG 68 HYPERCLEAN

NOTE: Only use the oil specified above for the Fischer spindles. The warranty will expire if other oils are used



2.4 Cooler SMC

For motor and bearing cooling, only use the anti-corrosive, low maintenance coolant MOTOREX COOL-X in purity class ISO 4406: 99; class 23/22/18

MOTOREX 300375 COOL-X 68766/KL3805

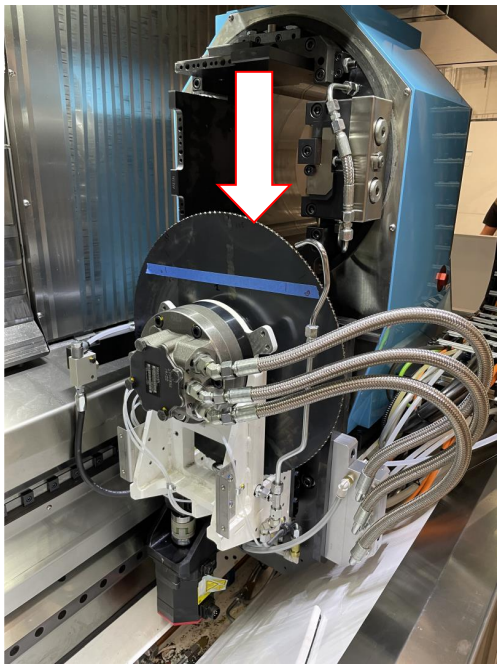
The SMC cooler for the spindles are placed on the backside of the machine. It is important to check the coolant level according to the HHV Preventive maintenance manual.

2.5 Tool Magazine

The two rotary tool-magazines for the HHV DUO holds 12 X 2 different tools

2.6 Rotary Table

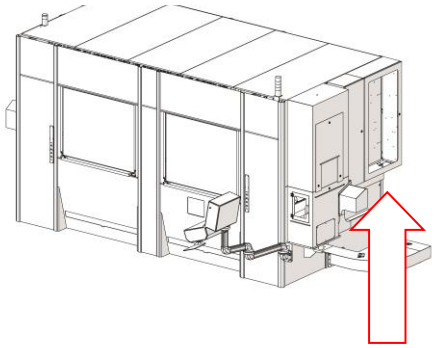
The three rotary tables clamps the extrusion-material and rotates it under the machining process.



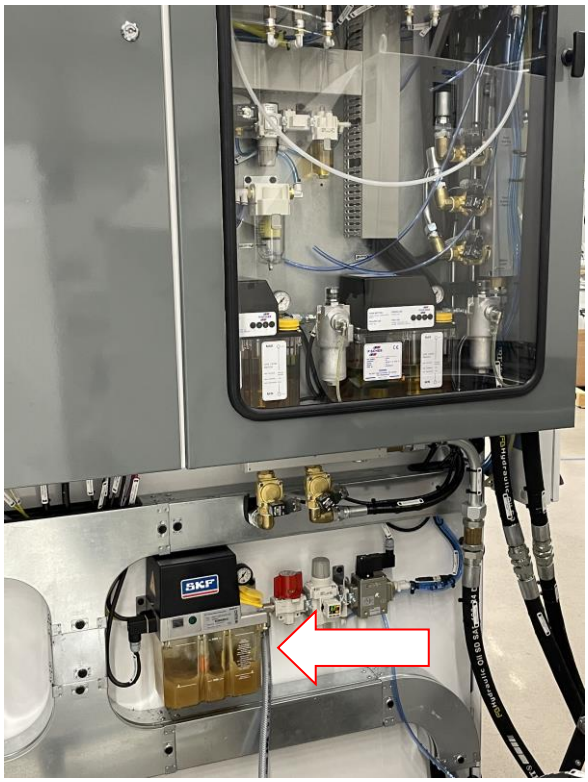
The HHV DUO has a special feature. A hydraulic operated cutting saw is movable up and down. There is only one saw located onto the A3 Rotary table

2.7 Media Cabinet

The media cabinet is where the main air is connected, it also contains the Fischer oilpumps, and more (See the HHV Preventive Maintenance manual)



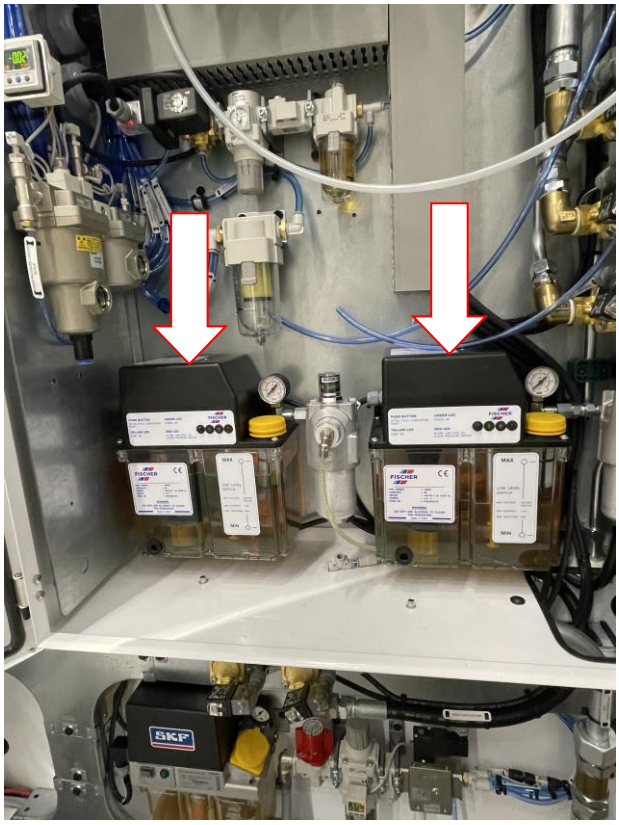
The sign on the side of the cabinet has all the information on the various valves etc that are located in the cabinet



The SKF grease pump is located under the media cabinet on the HHV DUO

The main air inlet inside the media cabinet. Digits will be grren when the pressure is okay. If the pressure is too low the digits will show in red.

NOTE: Check HHV Preventive maint.-manual for intervals etc



FISCHER pumps for the lubrication of the spindle. The HHV DUO has two spindles and therefor two FISCHER pumps inside the media cabinet

NOTE: Check HHV Preventive maint.-manual for intervals etc

2.8 Electrical Cabinet

The electrical cabinet beside the HHV DUO contains all of the FANUC-gear, the main electric switch on the right side of the cabinet.

The machine sign is placed on the side of the electrical cabinet.

2.9 Cover

The cover plates can be removed for servicework etc. Always consult Modig before removing any plates. Some of them are glued for watertight integrity.

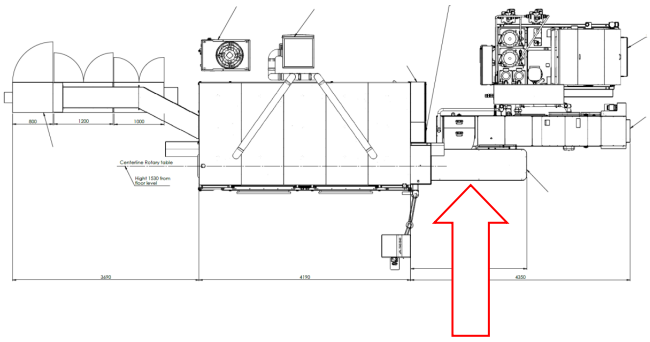
2.10 Hydraulics Rexroth, CYTROPAC and KNOLL chip/filter

The Modig HHV DUO can be equipped with Rexroth main hydraulic unit or HYDAC.

The hydraulic unit is placed on the back of the machine to the left just behind the service-door.

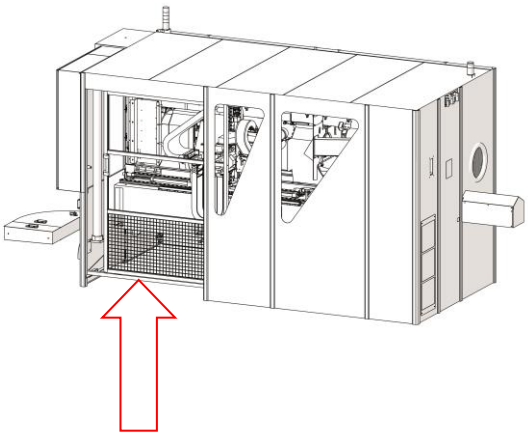
For maintenance see HHV Preventive maintenance manual.

The HHV DUO has two extra hydraulic units, the Rexroth CYTROPAC. Theese are for the hydraulic cutting-saw. (Above left)



The Rexroth Cytropac

The main hydraulic unit is located inside the machine (Picture above, right)



Knoll Chip Conveyor unit and filter unit

The KNOLL system concists of two machines operationg together. It is the chip conveyor system and the tank/filterunit with it´s pressure pumps wich

ON/OFF switch on the side of the KNOLL electrical cabinet.

DIFFERENT SYSTEMS CAN BE SUPPLIED. THIS SYSTEM HAS A SUPER CLEAN TANK WITH FLEECE-FILTER AND THREE DIFFERENT PUMPS WITH VARIOUS PRESSURE.

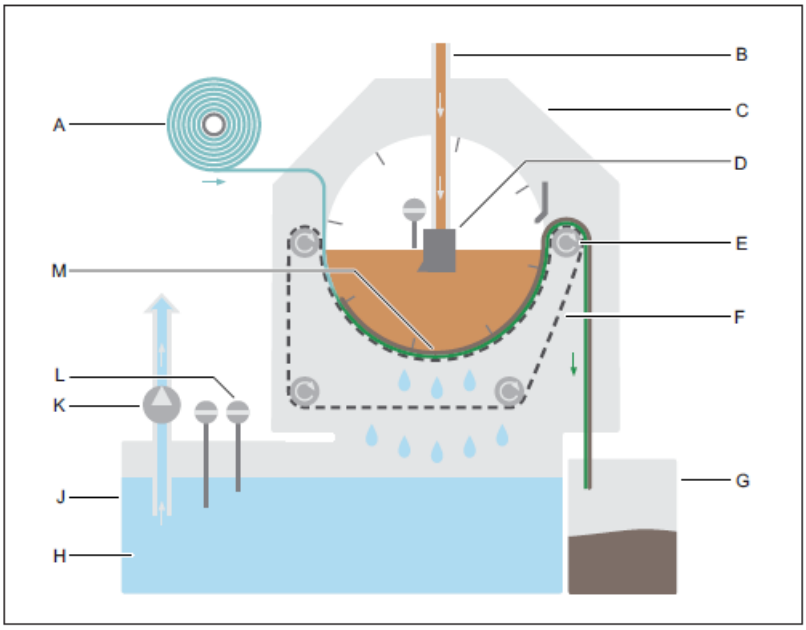


Fig. 3.5.1

A	Filter fleece	G	Collecting container (optional)
B	Inlet	H	Filtered fluid
C	Compact filter	J	Filtered fluid tank
D	Inlet box	K	Supply pump
E	Belt drive	L	Level monitoring
F	Carrier belt	M	Filter trough

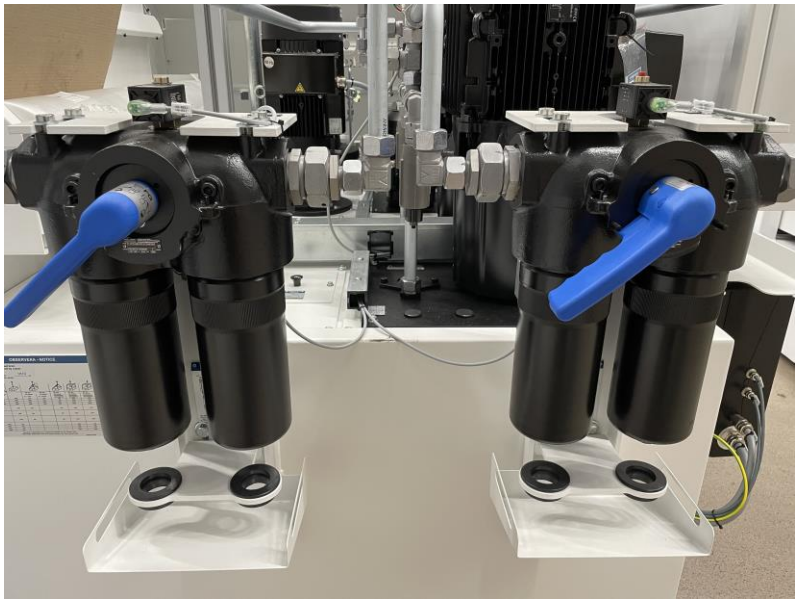
The KNOLL filter unit principle

NOTE: For more information regarding the KNOLL unit see the HHV Preventine maint.-manual

The KNOLL filter-fleece roll.

NOTE: Only use recommended filter fleece by KNOLL, see the HHV Preventine maint.-manual

The pump units on the filter tank with regulators, level gauge and manonometers.



The fine-filters on the KNOLL filter tank can be changed during operation

Behind/under the filter holders a sign explains how to change the filter cartridges

2.11 Power ON procedure

NOTE: Before startup, make sure that all fluids, oils, grease etc is filled according to HHV PRE-INSTALLATION MANUAL and that all steps in the HHV INSTALLATION MANUAL is done/checked according to the INSTALLATION CHECKLIST.

Cycle the main breaker on the back of the electrical cabinet to the on-position.

Wait for thecontrol to boot up to the log on screen. Press Ctrl-Alt-Del if prompted. The user name is Administrator, and the password is OPENCNC.

The control should boot up to the Fanuc interface screen (iHMI).

Press the machine "On"- button on the operator panel. It is the white button just below the emergency stop-knob to the left of the panel.

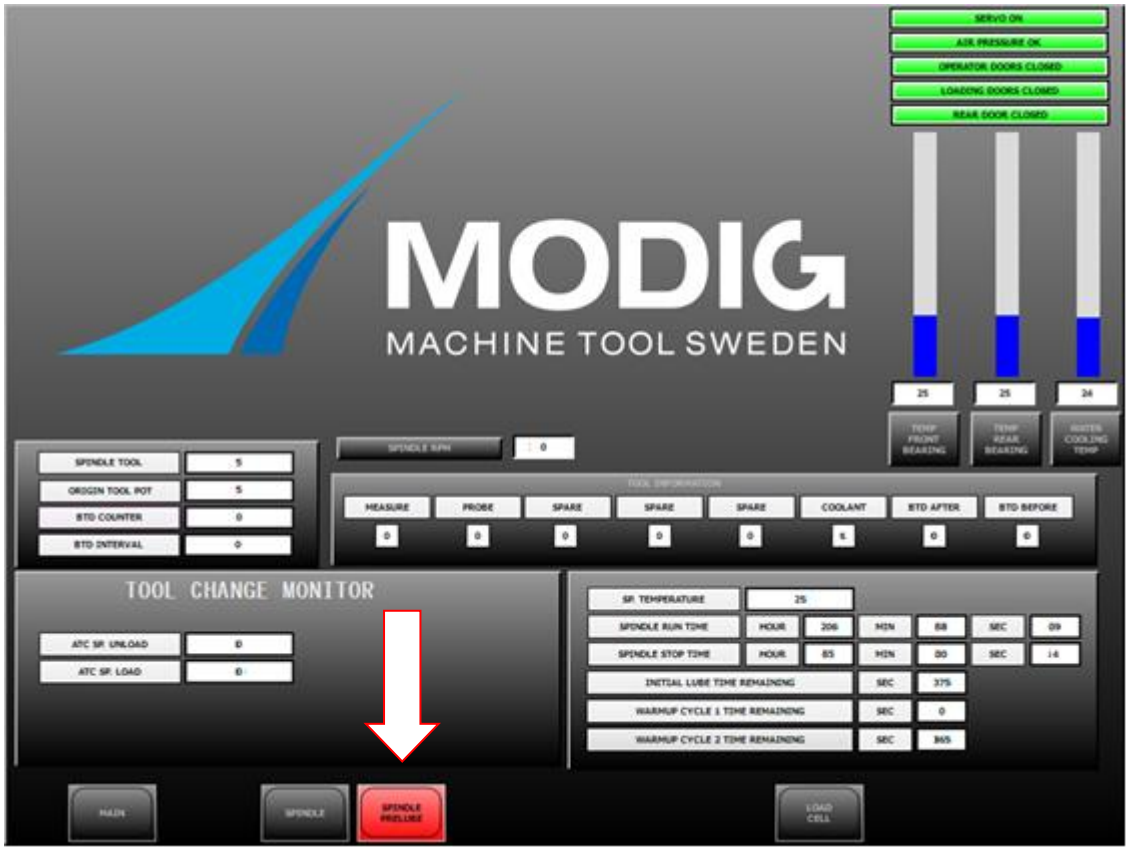
To clear the "2031 Prelube of Spindle is Not Complete, Cycle Start disabled" alarm, press the Custom 1 button and then press the Spindle Prelube softkey at the bottom of the screen. Once the Prelube cycle is complete the softkey will turn from red to green.

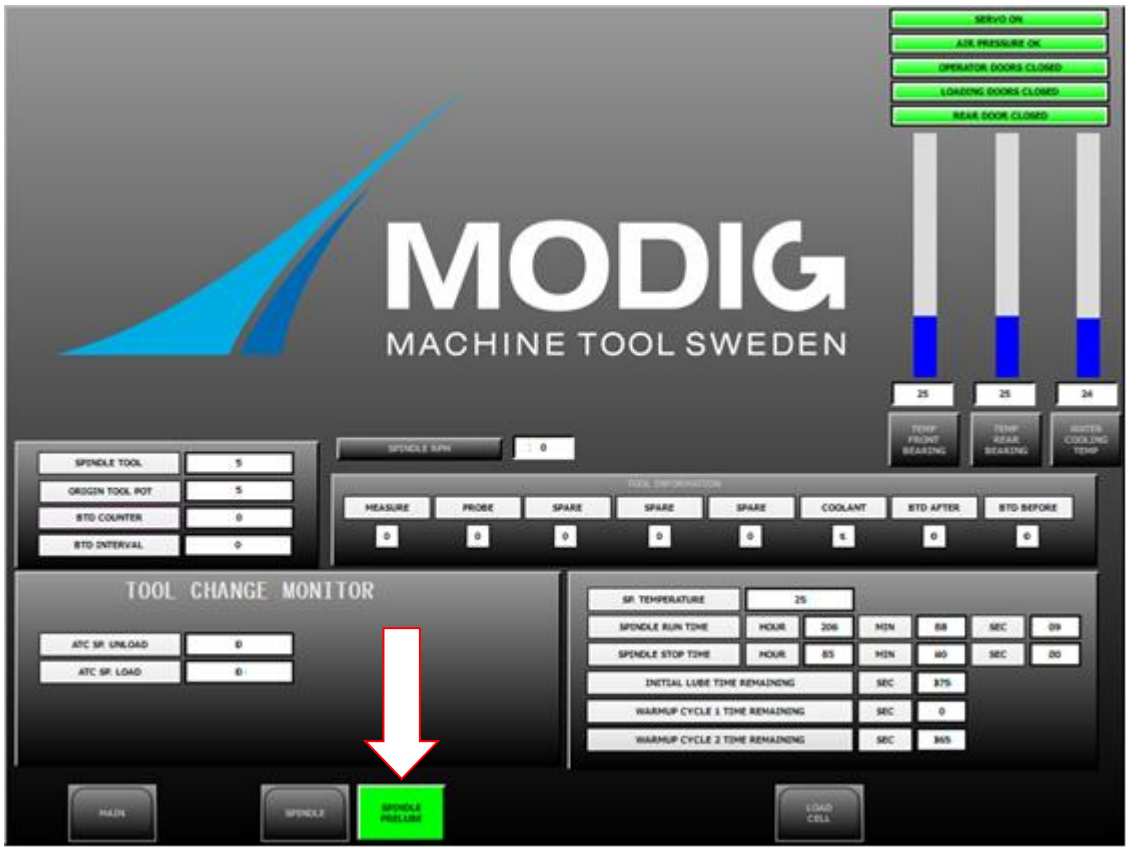
TXX;

M66;

If the spindle does not run for 1 hour you will be required to run the spindle prelube again.

NOTE: The following pictures in this manual shows the Screen display function (SDF) it is also possible to use the IHMI-display for most functions.





2.12 Power OFF procedure

Press Shutdown PANEL i

Press the Machine Off button. It is the black button just below the emergency stop-knob to the left of the panel.

Cycle the main breaker on the back of the electrical cabinet to the Off (down) position

2.13 Program management & file download

Right click anywhere on the Fanuc interface display to get the drop down menu. Click on "Data Input/Output." Using the "Browse…" button, change the address to the location of the file you are trying to download. Change this for the Memory Card and USB Memory.

- Press the Prog button
- Press the Edit button
- Press the Folder softkey on the right hand side of the display
- Using the arrow keys, navigate to the Folder you wish to load the program to.
- Press the Device Change hardkey.
- Press the USB Mem hardkey.
- Highlight the program you want to download and press Copy
- Change device back to CNC MEM.
- Change device back to CNC MEM.
- Press the right arrow hardkey and Press the Paste hardkey.

Common issues with downloading:

- The program file must start and end with the %.
- The first line after the % should be the program name. The program name can be an O followed by a four digit number. Ex. O1000. Or the program name can be inside <>. Ex. <TEST PROGRAM>. You are restricted in the type of characters you can use in your program name. See the Fanuc manual for details.
- The file has to be saved with no extension. Ex. TEST PROGRAM.TXT (won't work). TEST PROGRAM (will work).

Selecting a program

- Press the Edit button.
- Press the Program button.
- Press the Folder softkey.
- Using the arrows, highlight the program you want to select.
- Press the Main Program softkey at the bottom of the page.
- Press the Program softkey.

2.14 Tool management

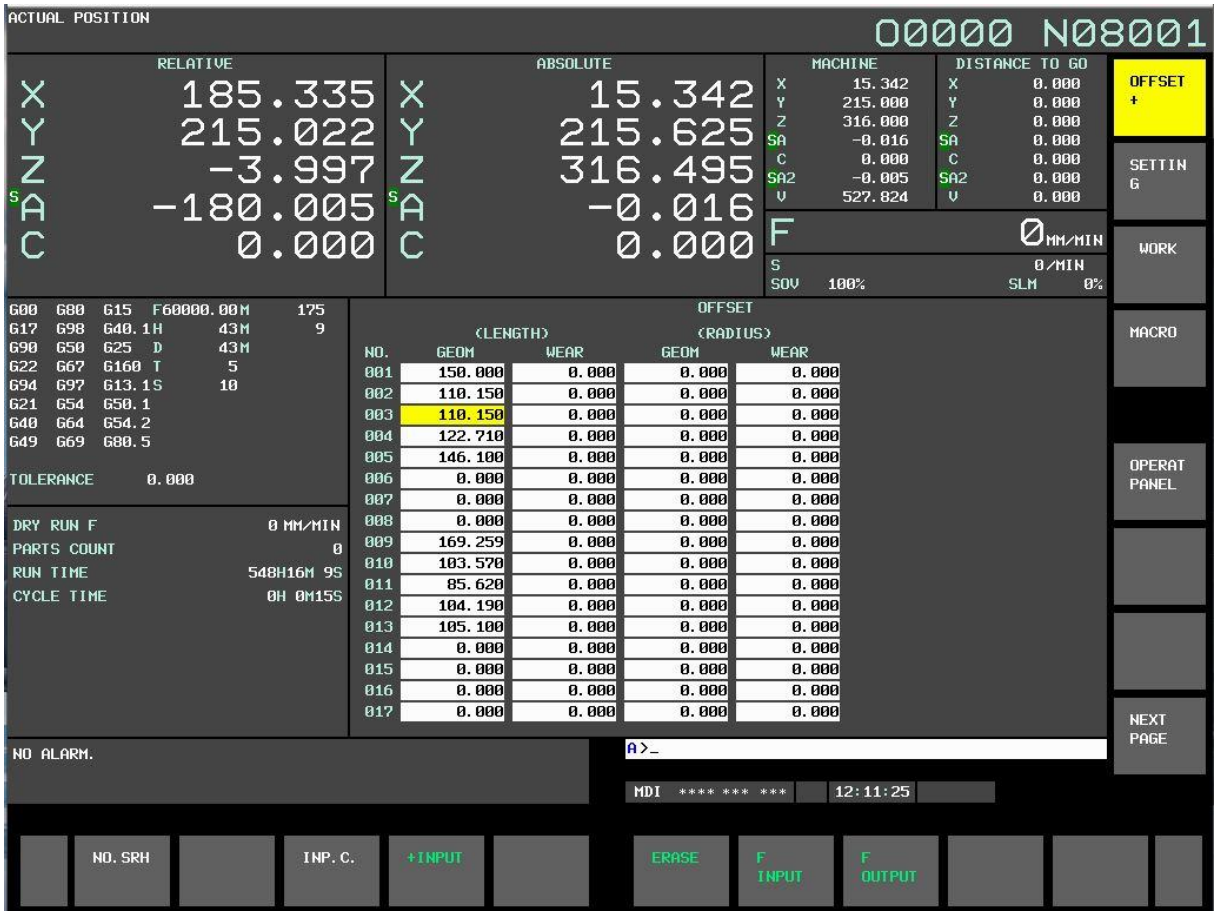
NOTE: The following pictures in this manual shows the Screen display function (SDF) it is also possible to use the IHMI-display for most functions.

NOTE: Also see the Fanuc manual regarding tool management

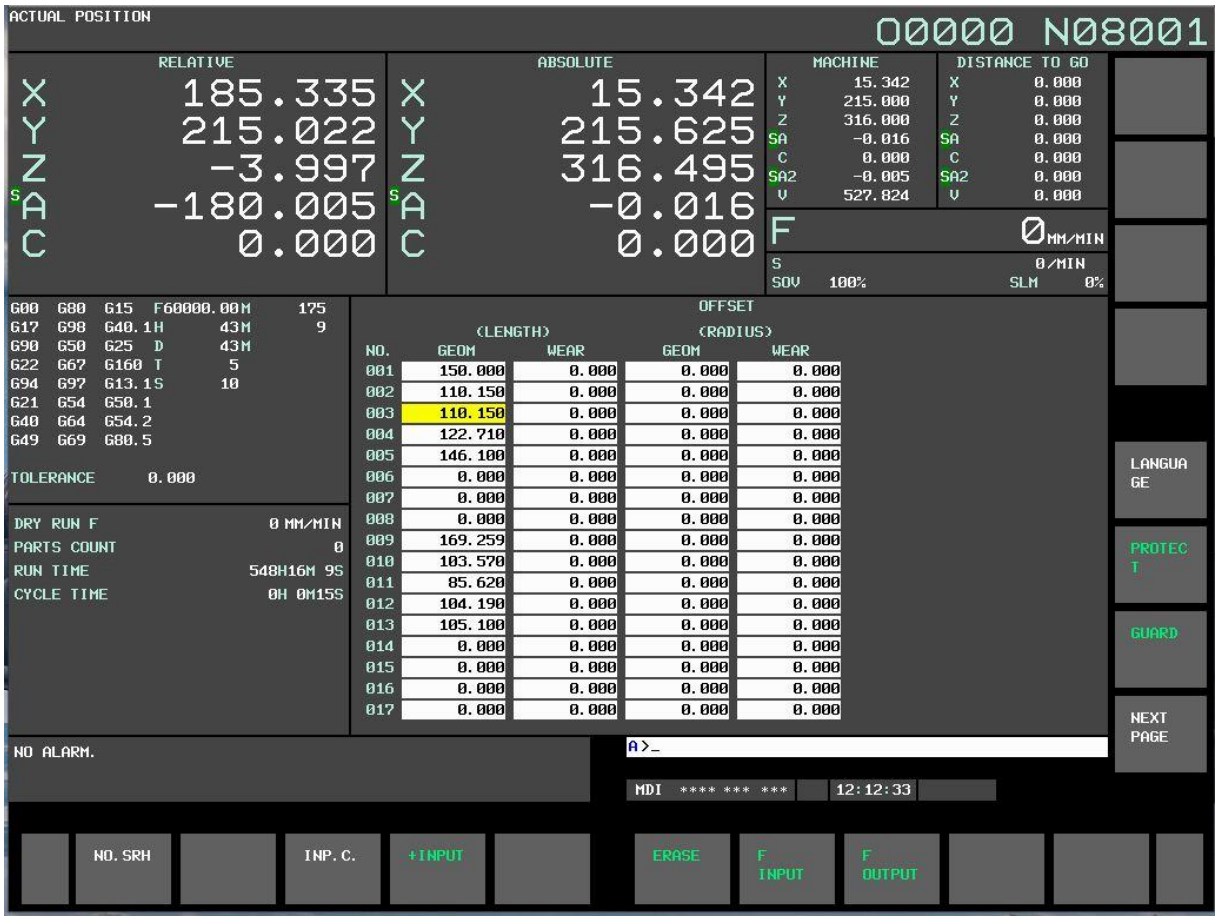
Tool management is separate for each path, Left path is magazine 1, and right path is magazine 2.

Press the OFS/SET on the Machine Operator Panel (MOP)

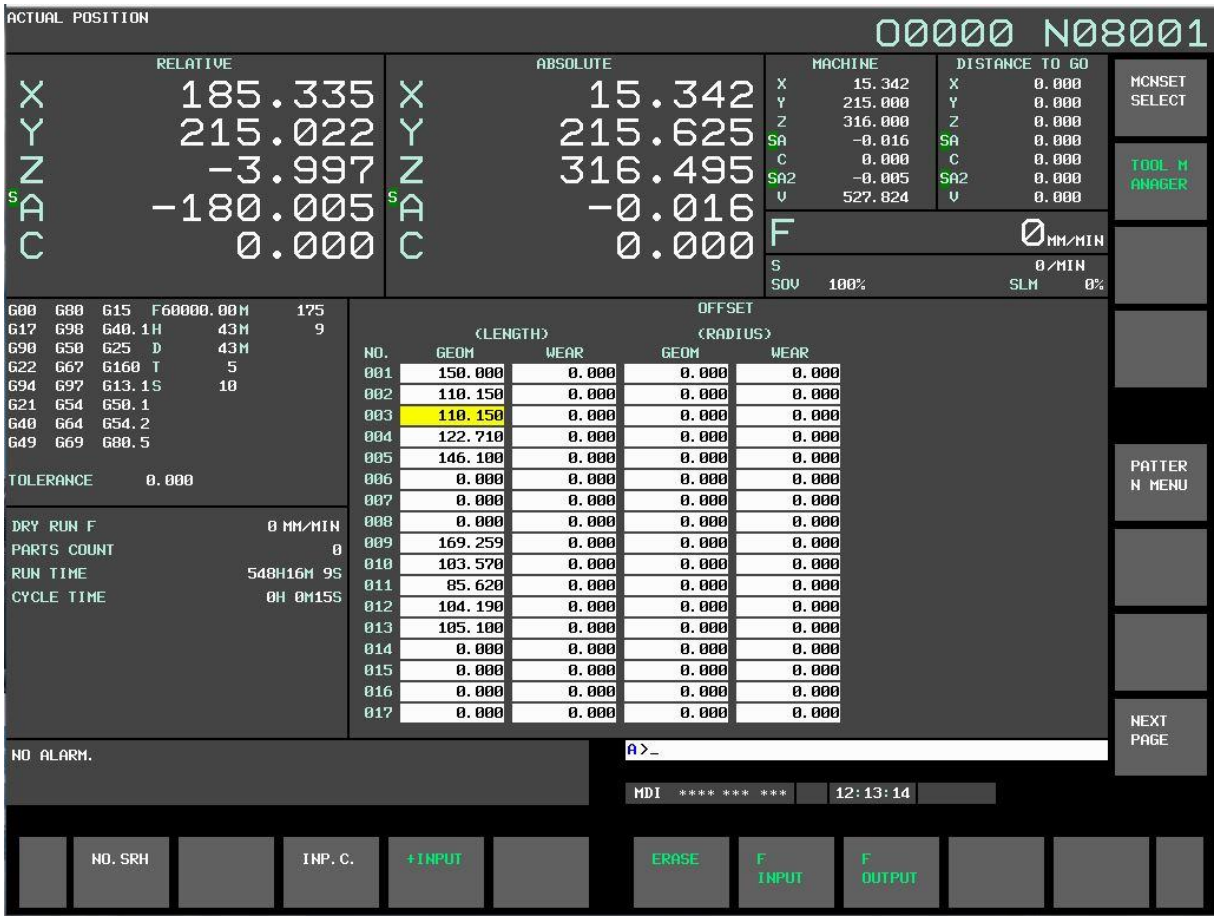
Note that it is not possible to have Left path as active path, and attach or detach tool on the right path, and wise versa.



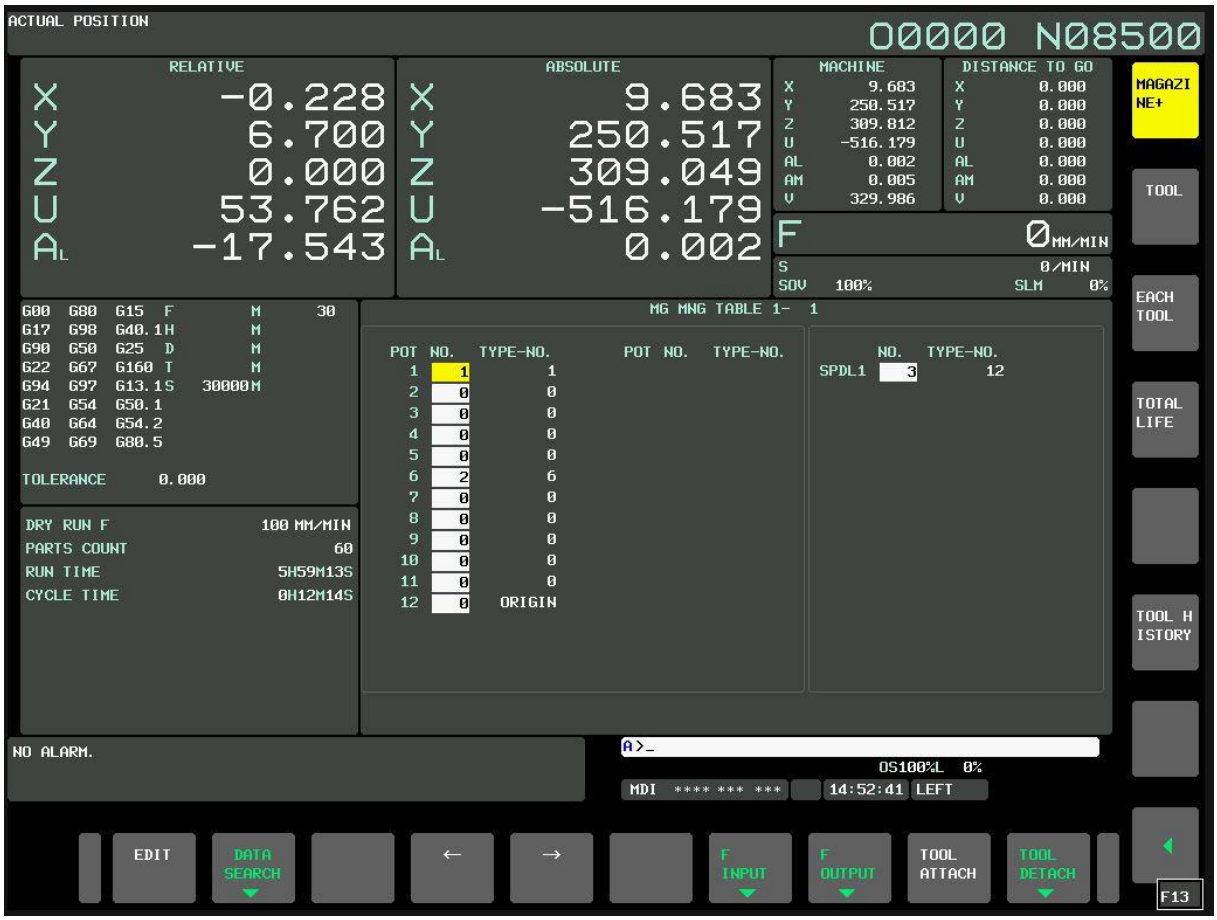
Press NEXT PAGE



Press NEXT PAGE



Press softkey TOOL MANAGER



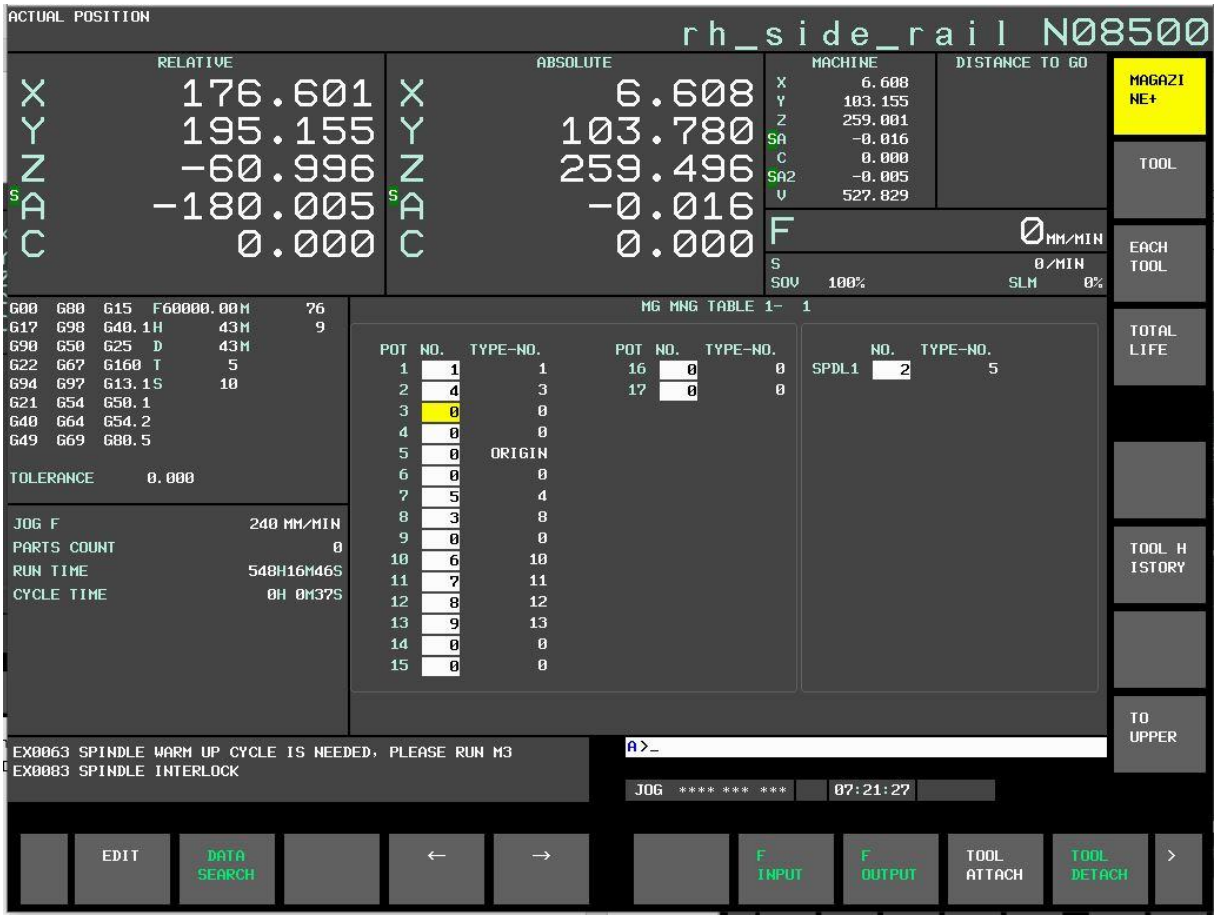
Now the Magazine table is show, here you can add new tool and remove tools from the magazine by TOOL ATTACH (add tool) or TOOL DETACH (remove tool)

When you attach a new tool (add), move the cursor to an empty pot position (an empty pot is indicated by a 0 at cursor position below, at this example it is at tool pot 3.

To attach a tool, the tool you want to attach must be placed into an empty spindle, if the spindle already have a tool, following command have to be executed to empty spindle first, and the tool to be attached has to be put into spindle manually after. Note, SPDL1 position below must show 0.

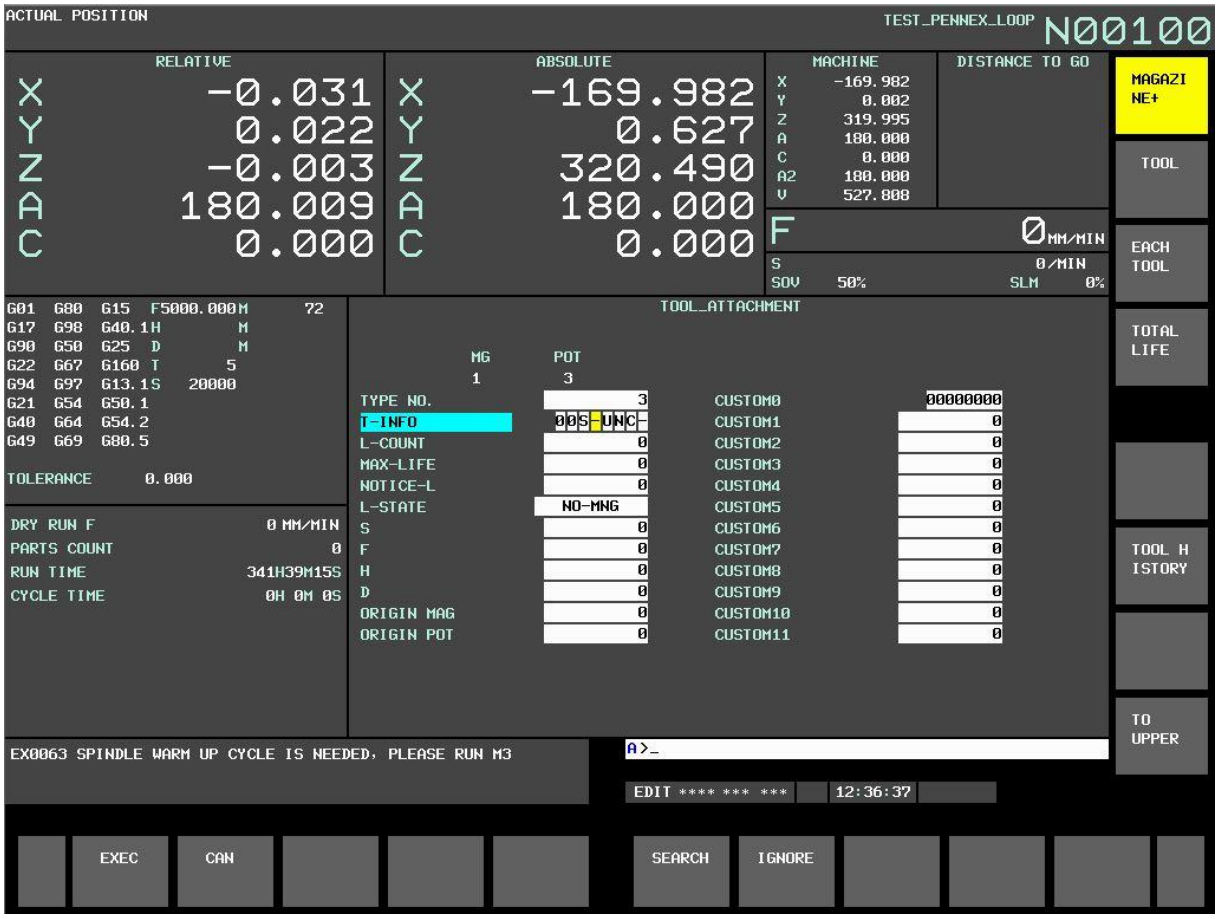
T0;

M66;



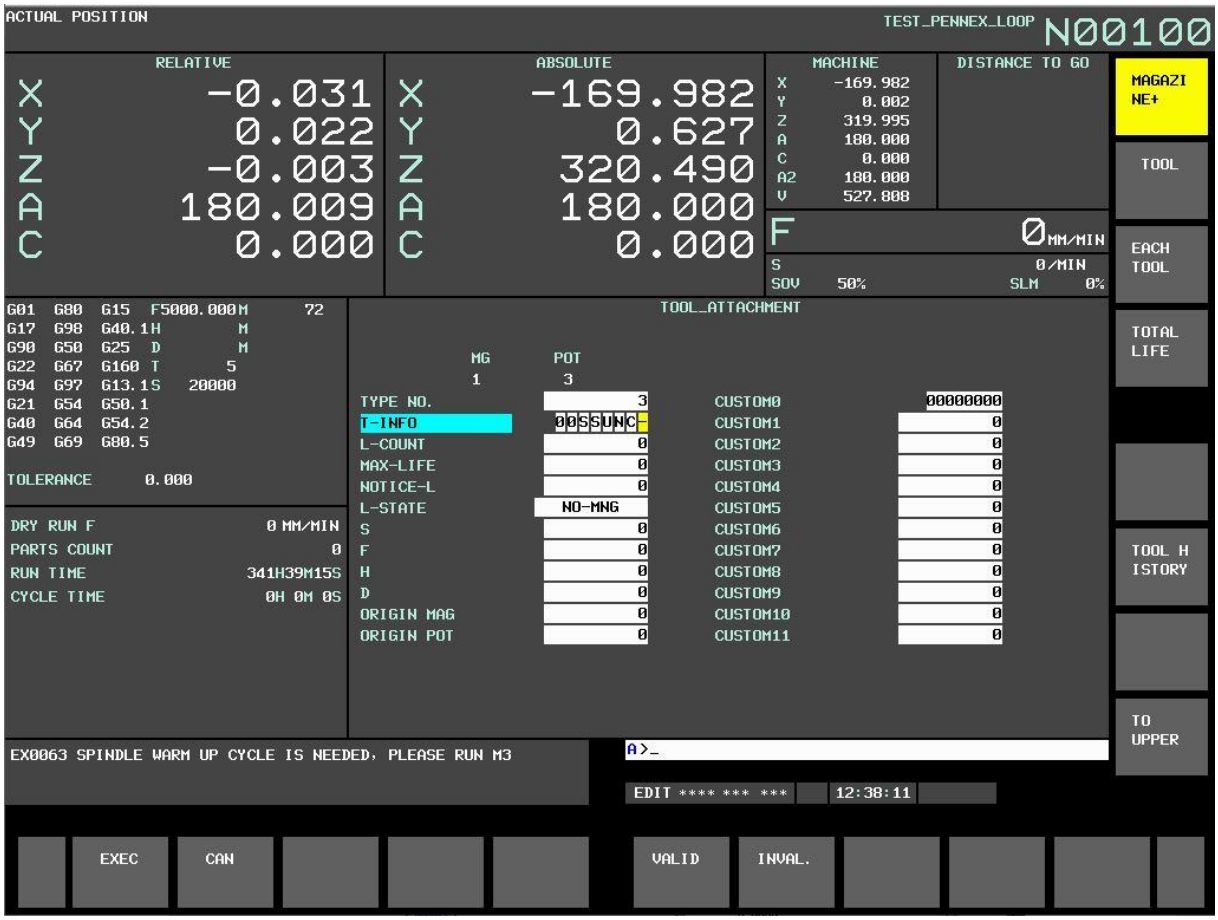
Press softkey TOOL ATTACH

First of all, the TYPE NO. must be entered, and that is the number that is used as the T-code for this tool in your machining program, in this case number 3.

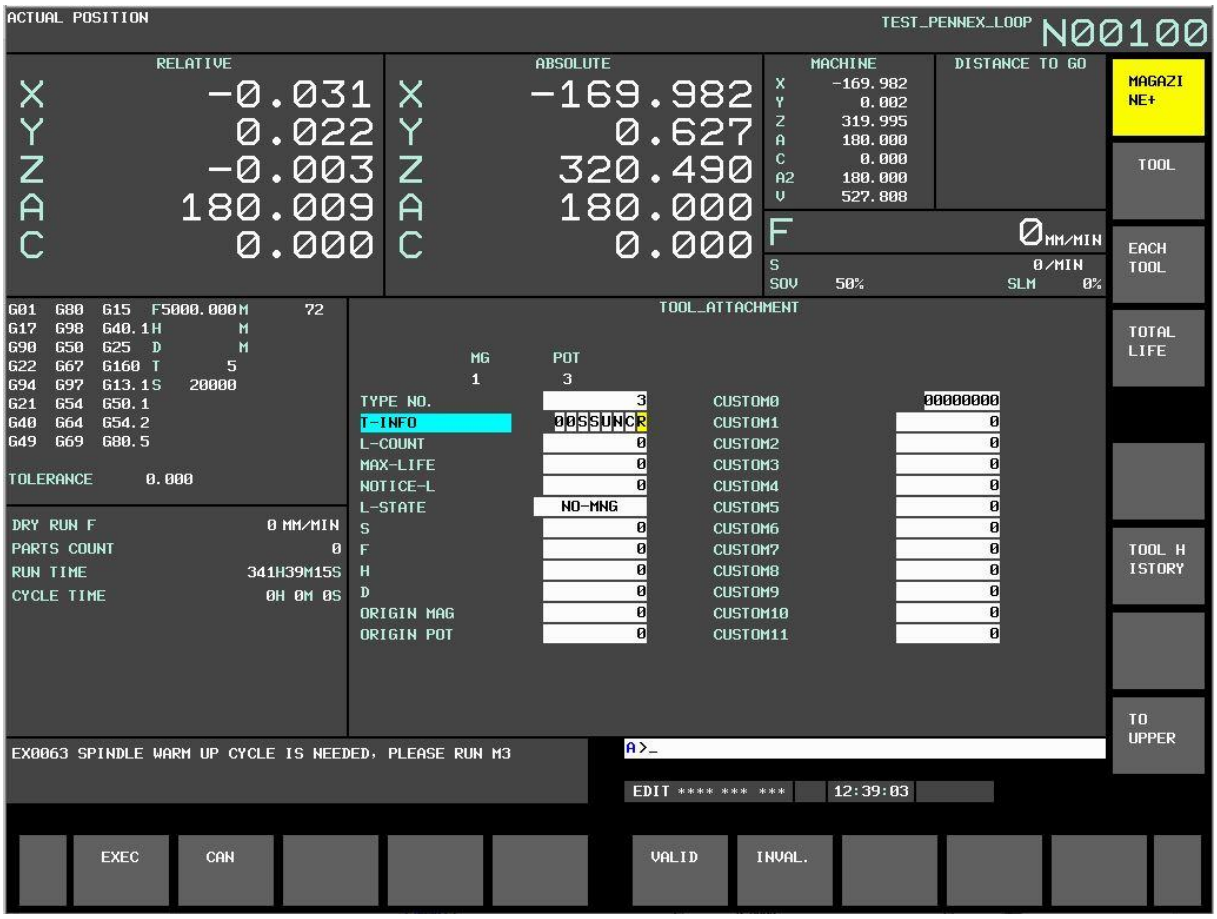


Then make this Tool searchable by selecting softkey SEARCH

And that is confirmed by the letter S in this position. Next step is to use arrow key to get to the last position in this T-INFO field



Press the softkey VALID, to make the tool valid.



And that is confirmed by the letter R in this position. Next step is to use arrow key to get to the input field marked H.

Enter the tool offset number used for the tool length compensation, easiest is to use the same number as the tool/pot number if no company standard for tool number is used, so in this case, number 3 and put also 3 into the D field, that is the tool offset number where the radius value of the tool is stored, normally the same as for tool length value.

Move cursor by arrow key to ORIGIN MAGAZINE and enter 1 as the origin magazine for Left spindle and 2 if it is right spindle, Note that it is not possible to have Left path as active path, and attach or detach tool on the right path, and wise versa.

Move cursor by arrow key to ORIGIN POT and enter and enter same as the pot number you attached the tool to, in this example number 3

Next is to add aditional information about the tool, and that is done in CUSTOM0 field

Above bit 2 is highlited, and that indicate that it is a tool with internal coolant, so that will enable the high pressure pump to be used

Bit 6 (the second bit from left, will tell it is a spindle probe that will be attached, and that will block the spindle to be started.

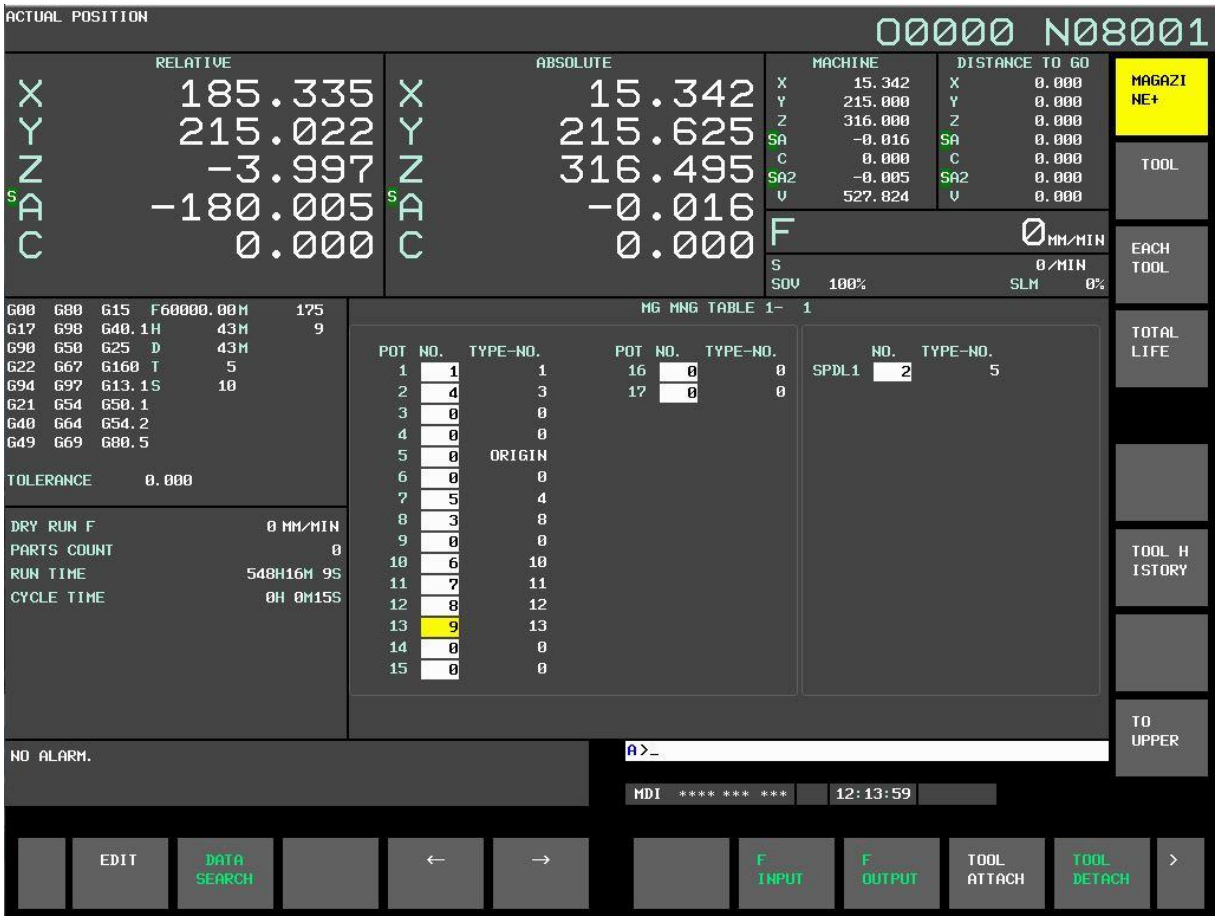
When this data is enter, press the softkey EXEC (note that the machine must be fully ready for operation, and no alarms active, it is recommended to press RESET, before this Tool attack or Tool detach is started.

When TOOL_IN is blinking on the screen, press the TOOL ATTACH/DETACH button on the Machine Operator Panel (MOP)

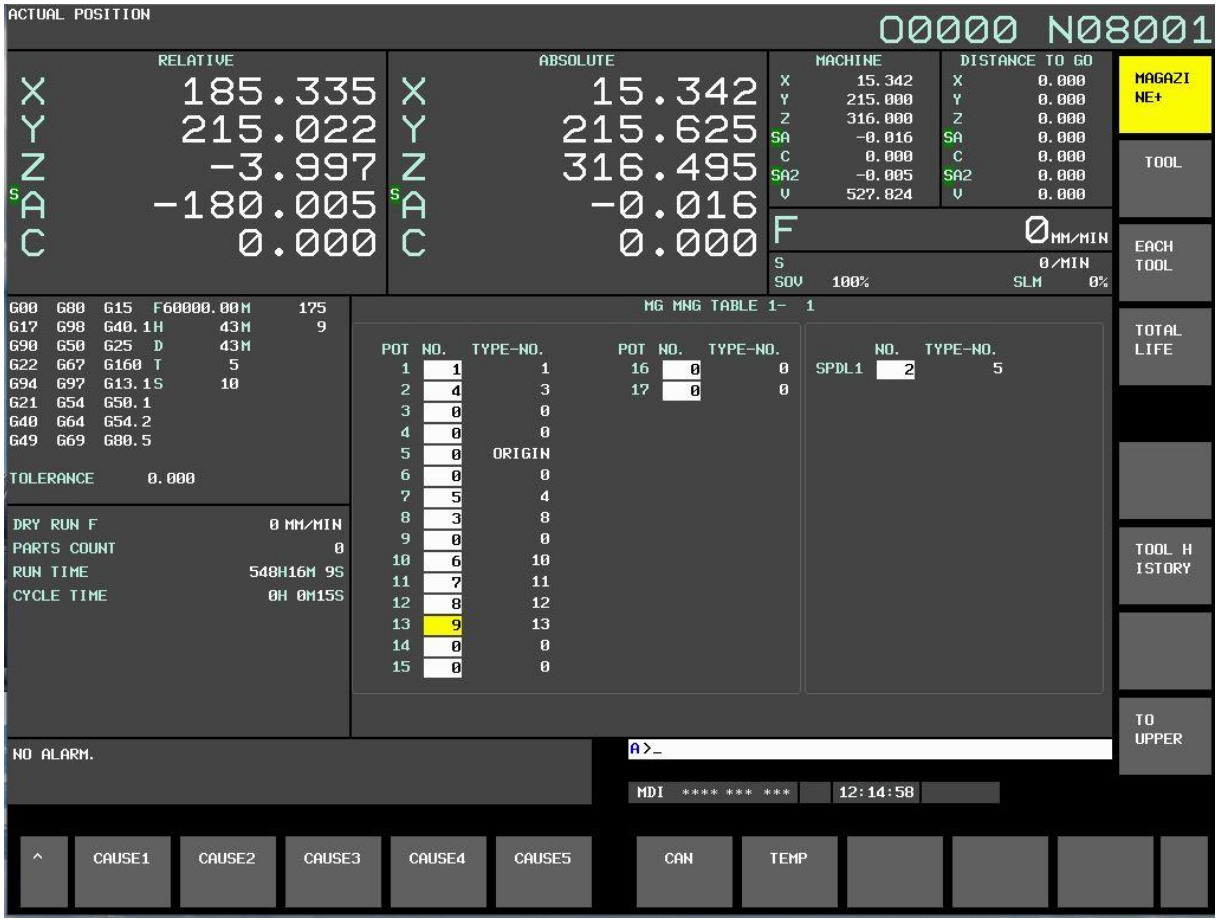
When the tool magazine door is open, the attach of tool will stop, and ask for confirmation that the tool pocket is empthy, that confirmation is done by pressing CYCLE START on the Machine Operator Panel (MOP)

Detaching a tool

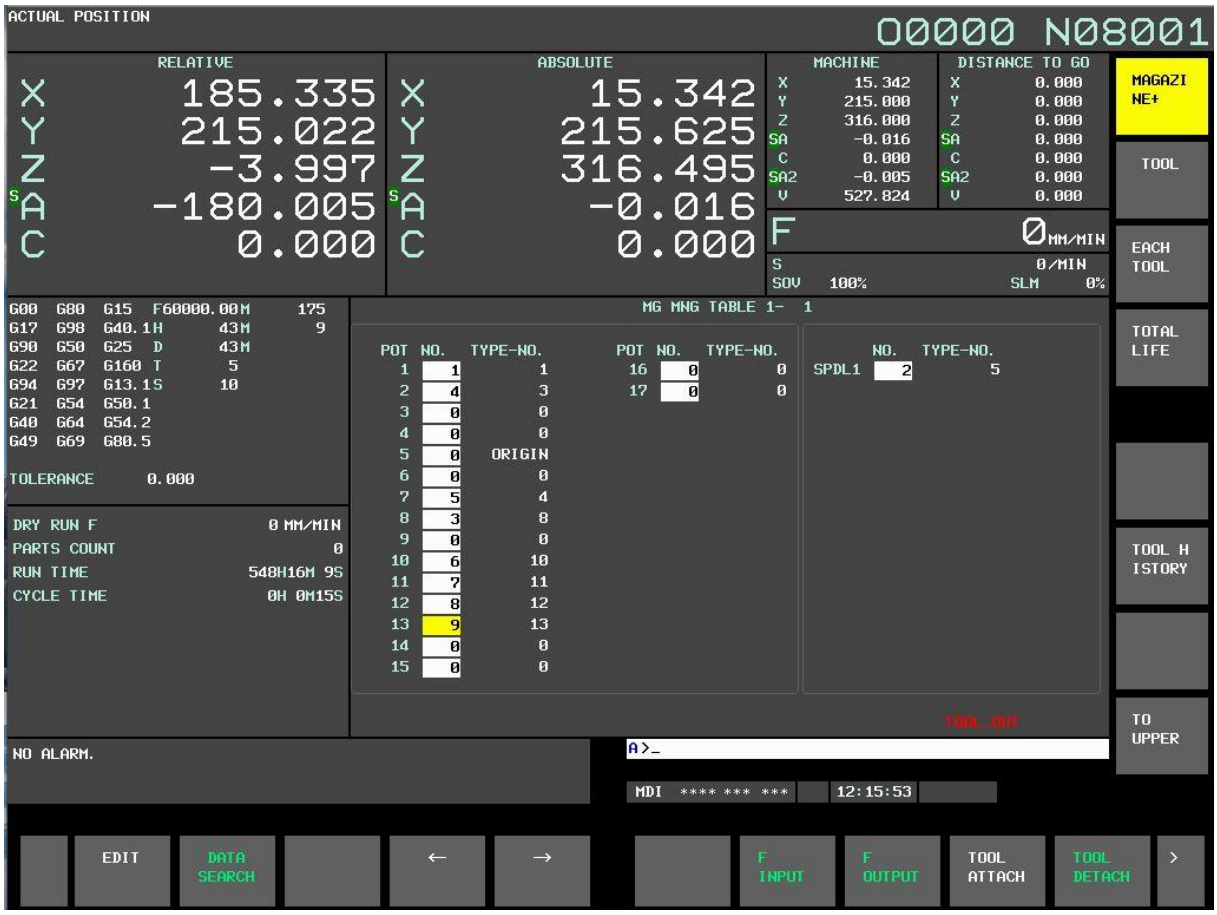
To Detach a tool from magazine (remove the tool) follow the steps above until you get to the magazine page of tool management. Then place the cursor on the tool pot you want to remove tool from and make sure the spindle is empty before
starting.



And press the soft key DETACH



Press one of the CAUSE1 to CAUSE5 soft keys, and Tool out starts to blink.



When TOOL_OUT is blinking on the screen, press the TOOL ATTACH/DETACH button on the Machine Operator Panel (MOP)

2.15 Instruction, check of distance between left & right spindle HHV DUO

- Clamp a piece of raw material in AL table, stick out from jaw face shall be around 680 mm.
- Jog UL axis so the material will stick out about 51-52 mm at AM table. Clamp AM with F4-F5 pressure.
- Use an endmill and do a clean cut so the edge of material will be at X-50.
- Take a probe point in X at the right path. Example of result 50.025.
- Unclamp AM
- Set relative coordinate for UL to 0 and jog UL 680 mm backwards.
- Use left spindle and take a probe point at the same point as the point at the right path was taken. Example of result: 10.16 mm
- Calculate as follows: 680-50.025-10.16 = 619.815
  The base dimension used for programming and machine setup is 620 mm so with this example the spindles are to narrow of each other by 620-619.815 = 0.185 mm

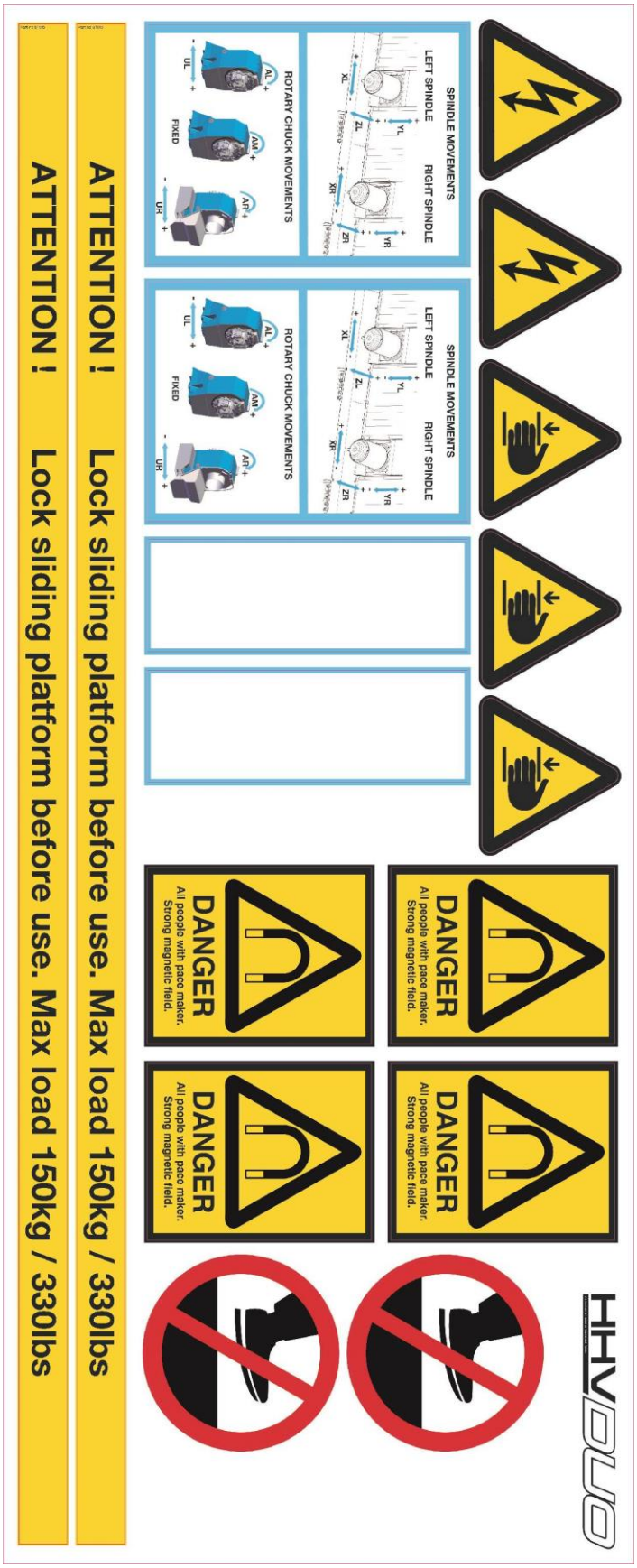
  To adjust this error place X-axis at 0.185 and set a new 0 point by setting bit 4 (APZ) in parameter 1815 to 0 and then back 1.
  Cycle power of the machine and re-measure to check result.

  If result is bigger than 620 mm the left spindle shall be positioned negative direction instead.

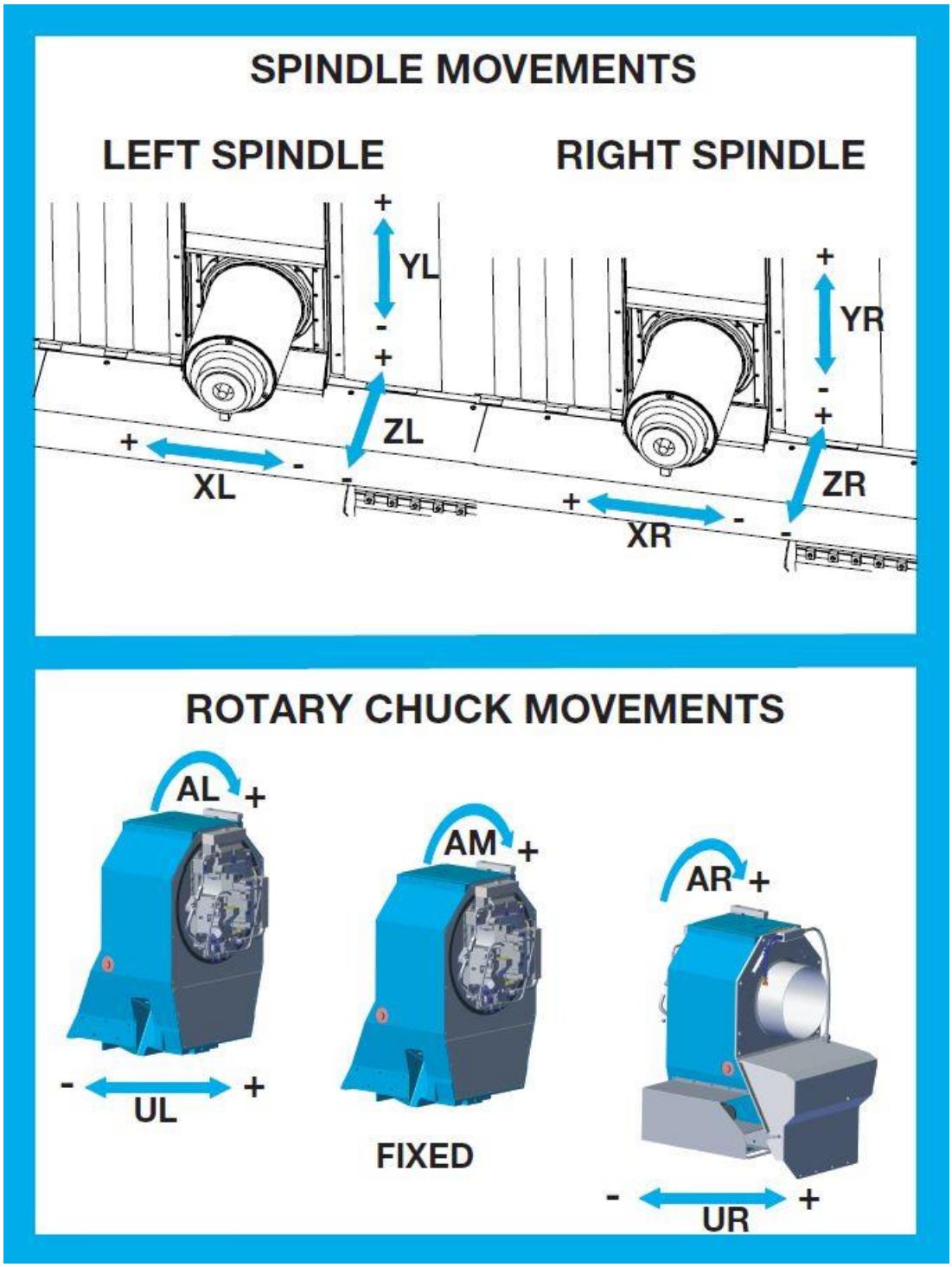
  If change is bigger than 0.15 mm a new tool change position must be set.

2.16 Signs and labels HHV DUO

The different labels on the HHV DUO



2.17 Axis directions X,Y,Z,A Left/Right



3. Operating the Equipment

3.1 Descriptions of MOP (Machine Operator Panel)

MOP Panel (Machine Operator Panel)

AUTO	Auto mode, if cycle start is pressed, the selected program will start
EDIT	In edit mode, you can edit or write new programs
MDI	Manual Data Input, is a semi auto mode, where short NC command can be executed without the need to create a new program.
JOG	Manual move of axis, by selecting axis by XYZ456 button, direction by + or- button and speed by feedrate override on MOP. Note the separate feedrate override switches.
SINGLE BLOCK	Allow to execute a program block by block, a cycle start is required after each executed block.
DRY RUN	Programmed feedrate will be ignored, and replaced by a fixed higher feedrate. This is for testing programs without cutting only.
OPT.STOP	Optional stop, when this is active, the program will stop at M01 in part program.
BLOCK SKIP	All program code from / until EOB will be ignored with this function
TOOL RET/REC	Tool retract and recover, this is a function, to interrupt an ongoing program and manually move axis away, and then the machine can move them back in reverse order to the point it was interrupted, and program can be restarted at that point, see further information in Fanuc manual B-64724 chapter 4:11 in Operation part.

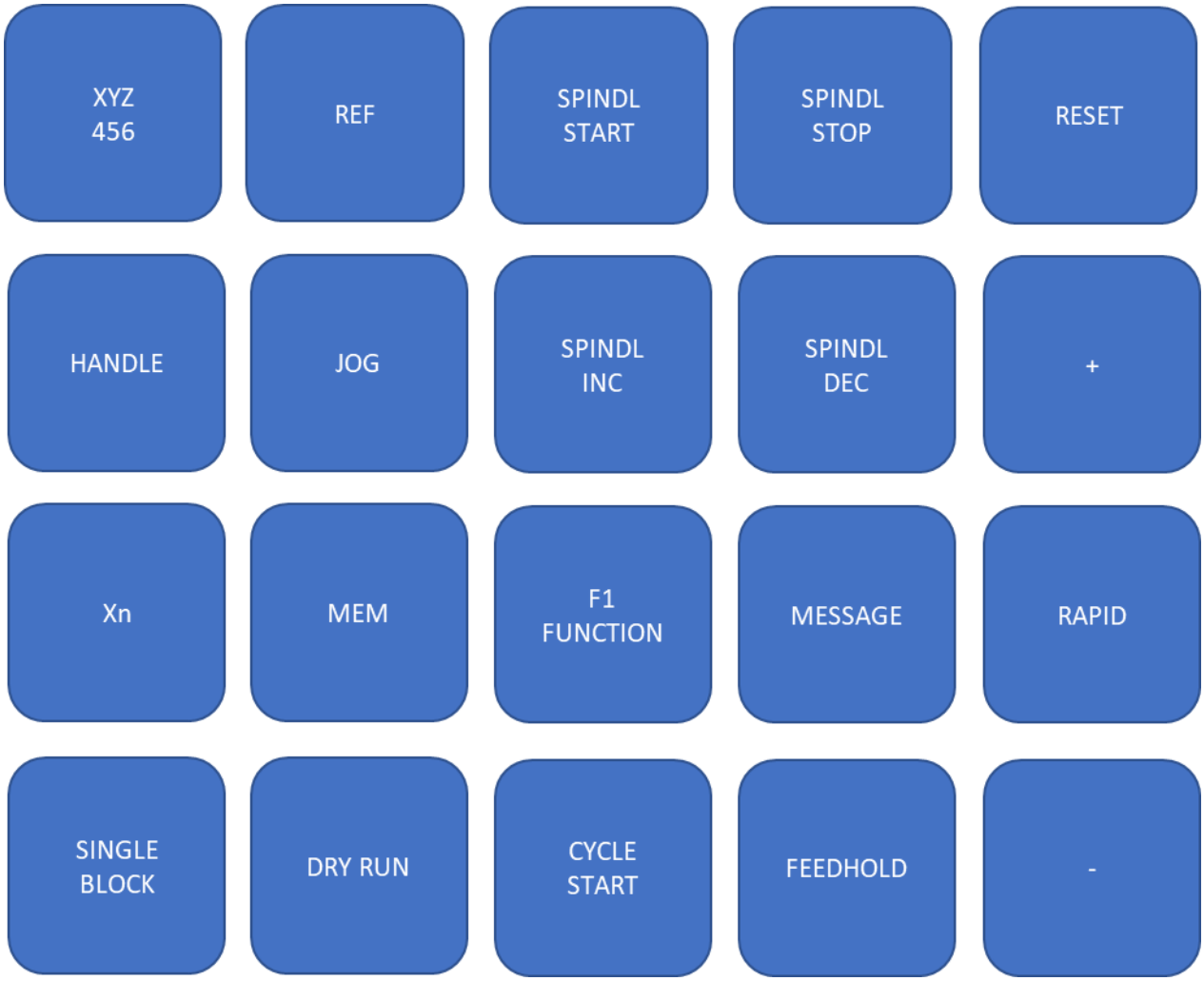
PROG CHECK	Program check is making a syntax check of the program, as well as check of software limits, this test is made at high speed and without any axis movements.
PROGR RESTART	Restart of an interrupted program. This should always be done with a huge care. see further information in Fanuc manual B-64724 chapter 4:9 in Operation part.
JAW ADJ	In manual mode and with open front doors, the clamps can be manually operated to adjust the clarence of profile and clamps when jaws are open and closed.
MATERIAL LOAD	Function to manually feed new profile into the machine.
TOOL ATTACH/DETACH	Will start to attach a new tool or remove a tool from tool magazine, further information how to use in the chapter tool management.
CYCLE STOP	Stops the execution of program.
CYCLE START	Will start/restart the active program if AUTO is selected, or start the command given in MDI
CLEAR PMC MESSAGES	Clear operator messages
RESET	Give reset to the CNC, stop program and spindle, and rewinds the program to top.
REF	By pressing this mutton, the reference procedure of A-axis starts, make sure to remove all material out of the machine before referencing. If A-axis already have reference, this button has no function.
MACHINE LIGHT	Switch on or of the light in the machine room.
COOLANT ON/AUTO	When AUTO mode is selected, this function become active automatically, and coolant is controlled by M-codes in part program. If this button is pressed in manual modes, there is possible to start coolant by selecting coolant function by keys.
COOLANT OFF	Switch all coolant off
COOLANT CHUCK AR	Turn coolant on AR top on
COOLANT CHUCK AM	Turn coolant on AM top on.
COOLANT CHUCK AL	Turn coolant on AL top on
COOLANT BELLOW COVER	Turn coolant on bellow cover on
COOLANT ROOF LEFT	Turn left roof spray on
COOLANT ROOF RIGHT	Turn right roof spray on
COOLANT SPINDLE	Turn coolant nozzles around spindle on
COOLANT CHIP DRAIN	Turn the chip drain coolant on

COOLANT HAND WASH	Turn the hand coolant on (Wash gun) note that front door must be open to use this function.
COOLANT JAWS AR	Turn coolant around the clamps AR on.
COOLANT JAWS AM	Turn coolant around the clamps AM on.
COOLANT JAWS AL	Turn coolant around the clamps AL on.
SPINDLE STOP	Stop spindle
SPINDLE CW	Start the spindle clockwise.
OT BYPASS	This is used if there is a 3D check alarm, select MPG, press reset and then press this button to get out of interference area.
AXIS GR 1	Use to select AL axis in jog together with axis A
AXIS GR 2	Use to select AM axis in jog together with axis A
AXIS GR 3	Use to select AR axis in jog together with axis A
PATH SYNC	When path sync is selected, the cycle start will start both paths
NEXT PATH	Toggle between paths
TOOL UNCLAMP	Unclamp right spindle if front door is open and JOG/MPG is active
X	Selecting X axis in jog and selected path
Y	Selecting Y axis in jog and selected path
Z	Selecting Z axis in jog and selected path
A	Selecting A axis in jog and selected path
U	Selecting U axis in jog and selected path
-	
RAPID	
+	

3.2 Descriptions of HOP (Hand Operation Panel)

HOP Panel layout.

Functions of the HOP panel.



The HOP can be used either in Manual more, or in Memory (Auto) mode.

Description of buttons for operation

XYZ456	Selecting axis in manual mode
REF	Selecting reference mode for referencing A-axis
SPNDL START	Start of spindle in manual mode with the last programmed S-code
SPNDL STOP	Stop spindle in manual mode
RESET	Reset clear most of the alarms, it also stop the execution of an active program, spindlestops and all axis stops, this reset is only active when HOP is turned on. Works in any mode, manual or in Memory(Auto).
HANDLE	Manual mode using handwheel to move axis, axis is selected by the XYZ456 button, and increment by Xn button. The amount of increment for each pulse is show on the HOP display.
JOG	Manual move of axis, by selecting axis by XYZ456 button, direction by + or- button and speed by feedrate override on HMOP.
SPNDL INC	Increase the spindle speed in manual
SPNDL DEC	Decrease of spindle speed in manual
+	Either + direction of jog of selected axis, or selecting spindle together with F1 function key.

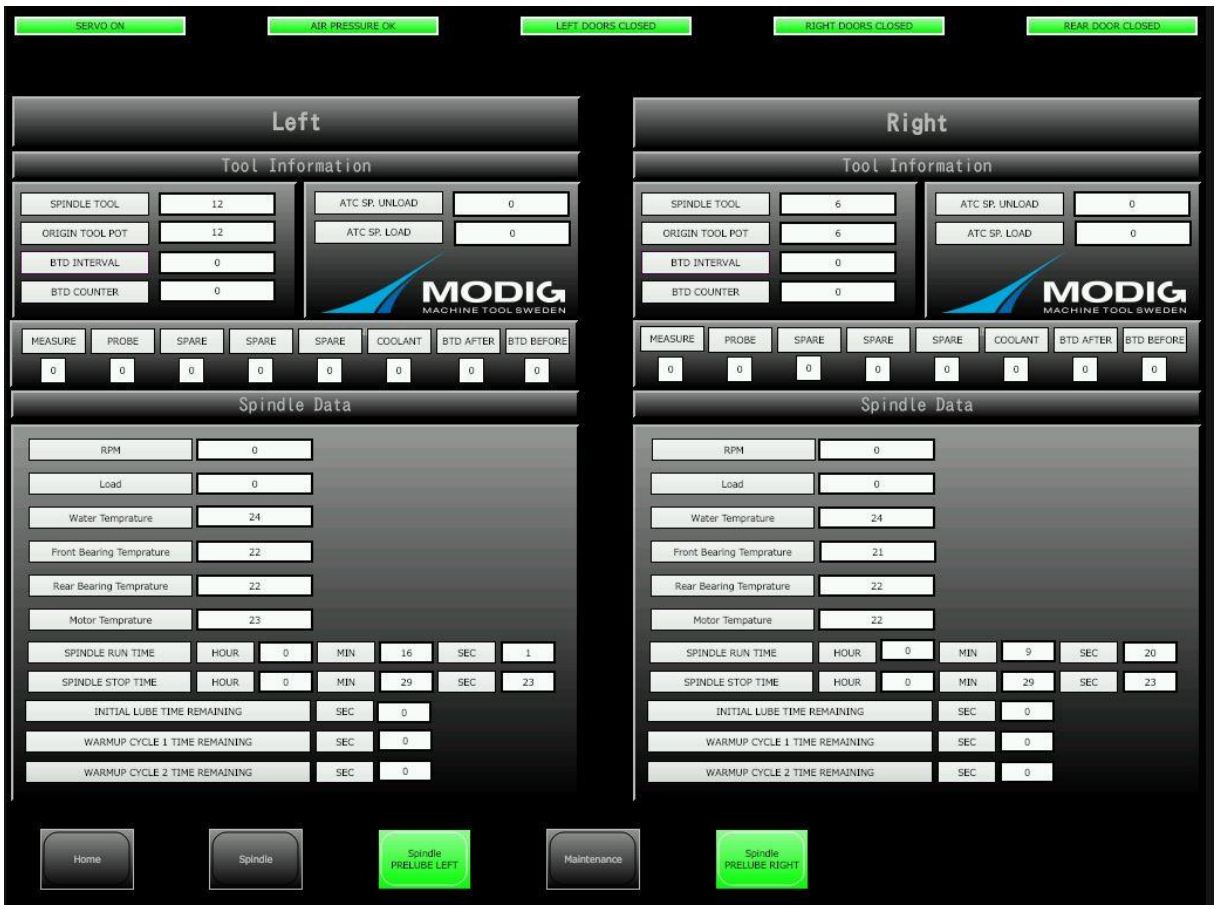
Xn	Select the increment in MPG or INC Jog of each pulse, can either be 1,10 or 100 microns for each pulse of handwheel or press of button + or – in INC Jog
MEM	Auto mode, if cycle start is pressed, the selected program will start
F1	Function key that can expand function on the keys on the HMOP. Now it is only used together with the + key, to change spindle (paths)
MESSAGE	No function yet.
RAPID	In jog mode, when this key is pressed together with + or – key, selected axis will move with a higher feedrate. Be careful when pressing this key in Jog mode.
SINGLE BLOCK	Allow to execute a program block by block, a cycle start is required after each executed block.
DRY RUN	Programmed feedrate will be ignored, and replaced by a fixed higher feedrate. This is for testing programs without cutting only.
CYCLE START	Starting selected program in Auto mode.
FEEDHOLD	Stop all program execution.
-	Selected Jog in minus direction of selected axis.

3.3 Help

See FANUC Maintenance manual B-64724EN/01 "Trouble shooting procedure"

3.4 Description of ATC Sequences

Description on ATC Sequences



ATC SP UNLOAD

If tool change is jammed, the actual sequence of tool change where it stop can be found in the screen above, and the number seen there, is explained below.

1 Check that ATC door is open
2 Dummy sequence
3 Move Y-axis to outside magazine position
4 Move Z axis to magazine position
5 Move Y axis to magazine position
6 Unclamp tool
7 Move Z axis to outside magazine position
8 Clamp spindle
9 Check if there is tool to be loaded

ATC SP LOAD

1 Check that ATC door is open
2 Move tool magazine to next tool pocket
3 Move Y axis to magazine position
4 Move Z axis to outside magazine position
5 Unclamp tool

6 Move Z axis to magazine position
7 Clamp tool
8 Move Y-axis to outside magazine position
9 Move Z-axis to retract position
10 Dummy Sequence
11 Dummy Sequence

4. Working in the Machine with Doors Open

It is possible to operate the machine manually at reduced speeds with doors open, but only with the remote control and dead man grip pressed in middle position.

When dead man grip is released, machine enter stand still monitoring state by the dual check safety function, and if any unpredicted moment occurs, the drives will be shut down.

If maintenance switch at the back of the machine is activated, it is also possible to run programs at full speed from the remote control and having back door open, but dead man grip has to been pressed at all time as long the program is running.

If dead man grip is released, machine will stop immediately by dual check safety function.

4.1 Tool Retract Recover

This function is useful future for checking the part when NC program is running in Auto mode.

- During operation press the Tool Ret/Rec button on the machine operator panel, the machine will stop and the spindle will be running.
- Take the hand held operator panel (HMOP) and press the dead man grip.
- Change to JOG mode while the dead man grip is pressed and jog the machine away from the part. If dead man grip is not pressed when changing from Auto mode to Jog mode the spindle will stop.
- Let go of the dead man grip when the tool has been retracted from the part and the spindle will stop. You are now able to jog the spindle away from the part (up to 20 moves), you can JOG all axis except U and U2 and the door can also be opened.
- To restart the program, change mode from JOG to AUTO and press Tool Ret/Rec button. The spindle will now start and the machine will move in the exact opposite order of when the spindle was retracted from the part.
- The machine will stop at a specific return position with the spindle running, press CYCLE START to continue the NC program.

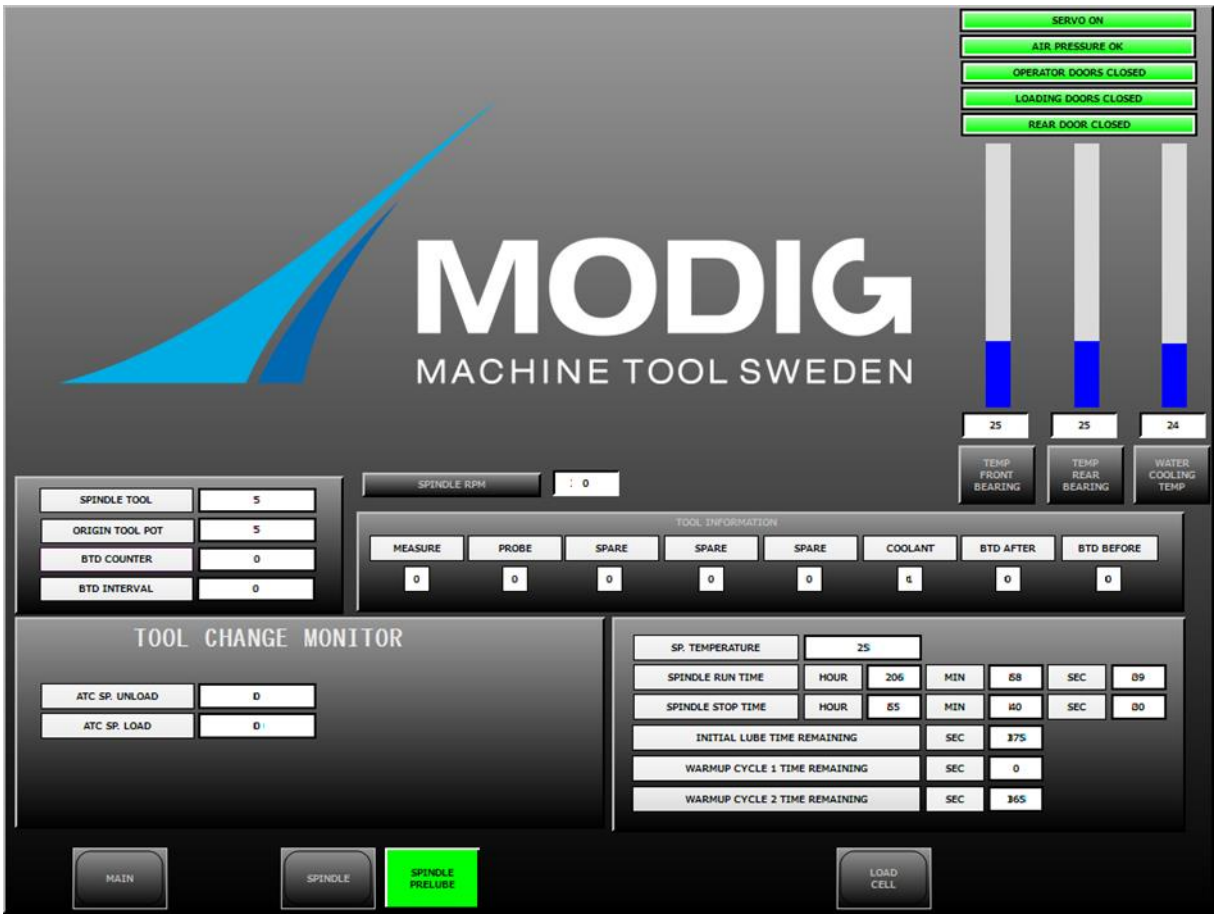
WARNING: When the Ret/Rec button is pressed to return to the initial position, the spindle will always start clockwise regardless of the direction it was turning or whether it was stopped.

4.2 Macro View

4.3 3D Interference Check View

3D interference check is an important function to reduce machine damage due to program errors, and it is very important that tool holders and tool length and radius is correct. Even tools that not use cutter compensations, like drills and reamers, a tool radius must be input into the tool offset page, otherwise the function will not take the tool into account in it's calculations.

5. Spindle View



In the spindle view you can check the temperature for front and rear spindle bearing, temperature for spindle cooling and spindle rpm.

5.1 Selecting right or left spindle

Selecting on MOP Panel
By using the key NEXT PATH, you can change between Left and Right spindle (PATHS)

Selecting on the HOP Panel

Press the F1 and + key, to toggle between Right and Left path

5.2 Probing Procedures

Renishaw inspection plus is included in the CNC-control

5.3 Tool Life management

NOTE: Also see FANUC manual

Table1.7.2.9 (a) System variables table

System variable number	Attribute	Content
#8400	R/W	Magazine number of spindle position or standby position
#8401	R	Tool management data number
#8402	R/W	Tool type number (T)
#8403	R/W	Tool life counter
#8404	R/W	Maximum tool life value
#8405	R/W	Tool notice life value
#8406	R/W	Tool life status
#8407	R/W	Customize data 0 (bit)
#8408	R/W	Tool information
#8409	R/W	Tool length compensation number (H)
#8410	R/W	Cutter compensation number (D)
#8411	R/W	Spindle speed (S)
#8412	R/W	Cutting feedrate (F)
#8413	R/W	Tool geometry compensation number (G)
#8414	R/W	Tool wear compensation number (W)
#8415	R/W	Tool geometry number
#8418	R	Origin magazine number
#8419	R	Origin pot number
#8420	R/W	Number of edge positions
#8431～#8470	R/W	Customizing data 1 to 40
#8497	R/W	Edge position in which read-write is done
#8498	R/W	Pot number in which read-write is done

Display of tool life status

The character color of the tool management data number changes according to the tool life status.
If the remaining life value of the tool is more than the notice life value, the color of tool management data numbers is black on the tool management data screen and the individual data screen. If the remaining life value is less than the notice life value, the color is yellow. If the tool life is expired or the tool is broken, the color is red.
The relation between the state of the tool life and the character color of the tool management data number is as follows.

Table 1.2.5.(b) Tool life status and color

Color of tool management data number	Tool life status	Display of tool management data screen and individual data screen
Black	Life remains or life is not managed.	"Invalid" "Remaining" (*1)
Yellow	Remaining life value has passed notice life value.	"Remaining" (*2)
Red	Life is expired or tool is broken.	"Unremaining" "Broken"

(*1) Notice life value is less than remaining life value (maximum tool life value - tool life counter).
(*2) Notice life value is more than or equal to remaining life value (maximum tool life value - tool life counter).

NOTE
1 The same type of tools must have the same life count type by using check function.
2 Tool life count period 8ms is valid when the tool information TIM (#1) is set to 1. When this bit is 0, tool life count period is 1 sec.

L-COUNT : The number of use/ cutting time of each tool is indicated.
Up to 99,999,999 times or 999 hours 59 minutes 59 seconds can be set.

MAX-LIFE : The maximum life value of each tool is indicated.
Up to 99,999,999 times or 999 hours 59 minutes 59 seconds can be set.

NOTICE-L : Noticed life value of a tool
Up to 99,999,999 times or 999 hours 59 minutes 59 seconds can be set.

L-STATE: Current tool state
One of the four states, including invalid (0), present (1, 2), not present (3), and broken (4), is indicated. The numbers in parentheses are data values used when these states are input in MDI.

5.4 Door Panel Function

NOTE: Doors can only be opened when machine is stopped

Left front door

With machine stopped, push green button to open doors.
Yellow light flashes if green "Open Door" button is pushed at a time when door opening is not allowed.
Jaw Open/Close buttons is only active when machine is stopped.
During "Material Load" sequence only A3 jaws can be clamped/unclamped.
During "Jaw Adjustment" cycle, all chuck jaws are clamped/unclamped.

Right front door

With machine stopped, push green button to open doors.

Yellow light flashes if green "Open Door" button is pushed at a time when door opening is not allowed.

Rear door

Rear maintenance access door can be bypassed using key override switch. All colors on the status light tree will flash as long as the override is active!

With machine stopped, push button to open door

Green light flashes if green "Open Door" button is pushed at a time when door opening is not allowed. With machine stopped, push green button to open door.

6. HHV adaptive saw control on w-axis

Adaptive saw control have 4 set points as can have indivuidual 2nd override factor on feedrate. Procent factor will be added with feedrate override value. As will result in a slowdown of the feedrate when average pressure (Cytropac 1 + Cytropac 2) reach set values as below table:

Set point is in bar, max value is xx bar
Procent value is between 1-100%
Activate function with K6.3

	PMC adress (W)	Ex. Bar		PMC adress (B)	Ex. %
Set point 1 =>	D20182	50	Feed reduction in procent	D20190	5
Set point 2 =>	D20184	60	Feed reduction in procent	D20192	10
Set point 3 =>	D20186	70	Feed reduction in procent	D20194	15
Set point 4 =>	D20188	80	Feed reduction in procent	D20196	20

Values in yellow is only as example, need be tuned according to needs in application

7. Codes

7.1 G-Codes

G-code	Group	Function	Modal	Active at power on
G00	**01**	Positioning (rapid traverse)	●	●
G01		Linear interpolation	●	
G02		Circular interpolation/Helical interpolation CW	●	
G03		Circular interpolation/Helical interpolation CWW	●	
G04	**00**	Dwell time, exact stop. Use X 1.0 is one second		
G05.1		High Precision Contour Control (AICC) Q0-Q3	●	
G08.1 P1		Finishing Cut		
G08.1 P2		Standard/Semi Finishing Cut		
G08.1 P3		Rough Cut		
G09		Exact stop		
G10		Programmable data input		
G11		Programmable data input mode cancel		●
G17	**02**	XpYp plane selection	●	
G18		ZpXp plane selection	●	
G19		YpZp plane selection	●	
G20	**06**	Input (inches)	●	
G21		Input (metric)	●	●
G27	**00**	Reference position return check		
G28		Return to reference position		
G31		Skip function		
G40	**07**	Cutter compensation cancel	●	●
G41		Cutter compensation left	●	
G42		Cutter compensation right	●	
G43	**08**	Tool length compensation + direction	●	
G49		Tool length compensation cancel	●	●
G52	**00**	Local coordinate system setting	●	
G53		Machine coordinate system	●	

G54	**14**	Work piece coordinate system 1 selection	•	•
G55		Work piece coordinate system 2 selection	•	
G56		Work piece coordinate system 3 selection	•	
G57		Work piece coordinate system 4 selection	•	
G58		Work piece coordinate system 5 selection	•	
G59		Work piece coordinate system 6 selection	•	
G54.1		Extended Work piece coordinate system P1-P48	•	
G61	**15**	Exact stop mode	•	
G62		Automatic corner override	•	
G63		Tapping mode	•	
G64		Cutting mode	•	•
G65	**00**	Macro call		
G66	**12**	Macro modal call	•	
G67		Macro modal call cancel	•	•
G68.2	**17**	Activation Tilted Work Plane (cancel on reset or G69, (only at machines with B-axis,HHV Hybrid)	•	
G69		Cancellation of Tilted Work Plane(only at machines with B-axis, HHV Hybrid)		
G73	**09**	Peck drilling cycle	•	
G74		Counter clockvise tapping cycle	•	
G76		Fine boring cycle	•	
G80	**09**	Canned cycle cancel	•	•
G81		Spot drilling cycle	•	
G82		Drilling cycle or counter boring cycle	•	
G83		Peck drilling cycle	•	
G84		Tapping cycle	•	
G85		Boring cycle	•	
G86		Boring cycle	•	
G87		Back boring cycle	•	
G88		Boring cycle	•	
G89		Boring cycle	•	
G90	**03**	Absolute command	•	•

G91		Incremental command	●	
G92	**00**	Setting for work coordinate system	●	
G93	**05**	Inverse time Feed	●	
G94	**05**	Feed per minute	●	●
G95	**05**	Feed per rotation	●	
G98	**10**	Return to initial point in canned cycles	●	●
G99	**10**	Return to R point in canned cycles	●	
G300		Precisely Machining (not at machines with B-axis)		●
G301		Standard Machining (not at machines with B-axis)		●
G302		Speedy Machining (not at machines with B-axis)		●
G500		X-Y Machining (not for HHV Hybrid)	●	
G501		U-Y Machining (not for HHV Hybrid)		
G543		Activation of length compensation of angleheads, value from custom 5 in TM		
G549		Cancelation of length compensation of angleheads		

7.2 M-Codes

M-Code	Function	Default at startup	1st M-code	2nd M-code	3rd M-code
M00	Program stop		x		
M01	Optional program stop		x		
M02	Program end		x		
M03	Spindle start Clockwise		x		
M04	Spindle start Counter Clockwise		x		
M05	Spindle stop	x	x	x	x
M08	Flood coolant on		x	x	x
M09	Flood coolant Off	x	x	x	x

M10	Chip drain coolant on		x	x	
M11	Chipdrain coolant off	x	x	x	x
M12	All Flush Coolant off (roof, Chuck A1-A3 and Chipdrain)	x	x	x	x
M13	Spindle start CW+ Flood Coolant On		x	x	x
M14	Spindle Start CCW+ Flood Coolant On		x	x	x
M15	Spindle stop, and All coolant Off	x	x	x	x
M16	Roof left flush on		x	x	
M17	Roof left flush off	x	x	x	x
M19	Spindle orientation		x	x	x
M20	External Chip conveyor on		x	x	x
M25	Small part unloading cycle	OPEN ITEM	x		
M26	Roof Right flush on		x	x	x
M27	Roof Right flush off	x	x	x	x
M30	Program end		x		
M31	RMP40 Probe start		x	x	x
M32	NC4i Probe start		x	x	x
M34	All probes off	x	x	x	x
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**

M40	Clamp Status check function		x		
M41	Spindle status check function		x		
M50	All clamps open (A1-A4)		x	x	x
M51	All clamps clamp (A1-A4)		x	x	x
M55	Part counting M-code				
M56	Alarm set SiViB	N/A			
M57	Cancel M56	N/A			
M60	LOAD EXTRUSION INTO MACHINE	OPEN ITEM	x		
M65	SYNCRONIZE A2 AND A3 AT THE SAME POSITION AS A(1)	NOT READY			
M66	ATC Cycle ready check function		x		
M72	Unsync AL-AM Ar-AM		x	x	x
M73	Sync AL-AM Ar-AM		x	x	x
M74	Unsync AM-AR	N/A	x	x	x
M75	Sync AM-AR	N/A	x	x	x
M76	Unsync UL-UR		x	x	x
M77	Sync UL-UR		x	x	x
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M80	SMALL PART HANDLER CYLINDER 1 TO REST POSITION	Called up by macro N/A			
M81	SMALL PART HANDLER CYLINDER 1 TO WORK POSITION	Called up by macro N/A			

M82	SMALL PART HANDLER SCRAPER TO REST POSITION	Called up by macro N/A			
M83	SMALL PART HANDLER SCRAPER TO WORK POSITION	Called up by macro N/A			
M84	SMALL PART HANDLER CYLINDER 2 TO REST POSITION	Called up by macro N/A			
M85	SMALL PART HANDLER CYLINDER 2 TO WORK POSITION	Called up by macro N/A			
M90	Tool unclamp	Called up by macro			
M91	Tool Clamp	Called up by macro			
M92	ATC Magazine door open	Called up by macro			
M93	ATC Magazine door Close	Called up by macro			
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M95	ATC Cycle Reset function	Called up by macro			
M96	X-AXIS INTERLOCK DURING TOOL CHANGE	Called up by macro			
M97	RESTTORE X-AXIS INTERLOCK AFTER	Called up by macro			

	TOOLCHANGE				
M100	Programmed pressure value A1		x		
M101	Unclamp All clampsA1		x	x	x
M102	Clamp All Clamps A1		x	x	x
M103	Unclamp Top Clamp A1		x	x	x
M104	Clamp Top Clamp A1		x	x	x
M105	Unclamp Side Clamp A1		x	x	x
M106	ClampSide Clamp A1		x	x	x
M107	Air clean on A1		x	x	x
M108	Air clean off A1		x	x	x
M109	Water clean on A1 Jaw		x	x	x
M110	Water clean off A1 Jaw		x	x	x
M111	All clean on A1		x	x	x
M112	All clean off A1		x	x	x
M113	Water clean on A1 Chuck				
M114	Water clean off A1 Chuck				
M120	READ PREASURE FEEDBACK FROM TOP CLAMP A1	Called up by macro			
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M121	READ PREASURE FEEDBACK				

	FROM SIDE CLAMP A1				
M122	WRITE PRESSURE ADJUST DATA A1 TOP	Called up by macro			
M123	WRITE PRESSURE ADJUST DATA A1 SIDE	Called up by macro			
M125	SAW MOTOR ON				
M126	SAW MOTOR OFF				
M130	Automatic pressure adjustment A1-A4				
M150	A-AXIS REF POSITION DOG	Called up by macro	Needs to be re-written for DUO		
M151	TRANSFER ATC POSITIONS TO DATATABLE D0	Called up by macro	Needs to be re-written for DUO		
M152	TRANSFER ATC POSITIONS TO DATATABLE D4	Called up by macro	Needs to be re-written for DUO		
M153	TRANSFER ATC POSITIONS TO DATATABLE D8	Called up by macro	Needs to be re-written for DUO		
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**

M154	TRANSFER ATC POSITIONS TO DATATABLE D12	Called up by macro	Needs to be re-written for DUO		
M155	TRANSFER ATC POSITIONS TO DATATABLE D16	Called up by macro	Needs to be re-written for DUO		
M156	TRANSFER ATC POSITIONS TO DATATABLE D20	Called up by macro	Needs to be re-written for DUO		
M157	TRANSFER ATC POSITIONS TO DATATABLE D24	Called up by macro	Needs to be re-written for DUO		
M158	TRANSFER ATC POSITIONS TO DATATABLE D28	Called up by macro	Needs to be re-written for DUO		
M159	TRANSFER ATC POSITIONS TO DATATABLE D32	Called up by macro	Needs to be re-written for DUO		
M160	TRANSFER ATC POSITIONS TO DATATABLE D36	Called up by macro	Needs to be re-written for DUO		
M161	TRANSFER ATC POSITIONS TO DATATABLE D40	Called up by macro	Needs to be re-written for DUO		
M168	TRANSFER ATC POSITIONS TO DATATABLE D44	Called up by macro	Needs to be re-written for DUO		
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M169	TOOL ATTACH COMPLETE	Called up by macro			

M170	TOOL DETACH COMPLETE	Called up by macro			
M171	Reading tool management data, read of cutom data 0,1	Called up by macro			
M173	Write Customdata 1 (Tool origin pot number)	Called up by macro			
M174	ACTIVATE NEW TOOLDATA FOR 3D INTERFERENCE CHECK	Called up by macro			
M175	DISABLE 3D INTERFERENCE CHECK DURING TOOL CHANGE	Called up by macro			
M176	ENABLE 3D INTERFERENCE CHECK AFTER TOOLCHANGE	Called up by macro			
M177	WRITE BIT 7 OF CUSTOMDATA 0 TO 1, AFTER TOOL ATTACH	Called up by macro			
M178	Change tooldata in 3D interference check	Called up by macro			
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M184	ATC Interference check on	Called up by macro			

M185	ATC Interference check off	Called up by macro			
M200	Programmed pressure value A2		x		
M201	Unclamp All clampsA2		x	x	x
M202	Clamp All Clamps A2		x	x	x
M203	Unclamp Top Clamp A2		x	x	x
M204	Clamp Top Clamp A2		x	x	x
M205	Unclamp Side Clamp A2		x	x	x
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M206	ClampSide Clamp A2		x	x	x
M207	Air clean on A2		x	x	x
M208	Air clean off A2		x	x	x
M209	Water clean on A2 Jaw		x	x	x
M210	Water clean off A2 Jaw		x	x	x
M211	All clean on A2		x	x	x
M212	All clean off A2		x	x	x
M213	Water clean on A2 Chuck		x	x	x
M214	Water clean off A2 Chuck		x	x	x
M220	READ PREASURE FEEDBACK FROM TOP CLAMP A2	Called up by macro			
M221	READ PREASURE FEEDBACK FROM SIDE	Called up by macro			

	CLAMP A2				
M222	WRITE MIN PRESSURE WINDOW A2 TOP	Called up by macro			
M223	WRITE MAX PRESSURE WINDOW A2 TOP	Called up by macro			
M224	WRITE MIN PRESSURE WINDOW A2 SIDE	Called up by macro			
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M225	WRITE MAX PRESSURE WINDOW A2 SIDE	Called up by macro			
M300	Programmed pressure value A3	Called up by macro	x		
M301	Unclamp All clampsA3	Called up by macro	x	x	x
M302	Clamp All Clamps A3		x	x	x
M303	Unclamp Top Clamp A3		x	x	x
M304	Clamp Top Clamp A3		x	x	x
M305	Unclamp Side Clamp A3		x	x	x
M306	ClampSide Clamp A3		x	x	x
M307	Air clean on A3		x	x	x

M308	Air clean off A3		x	x	x
M309	Water clean on A3 Jaw		x	x	x
M310	Water clean off A3 Jaw		x	x	x
M311	All clean on A3		x	x	x
M312	All clean off A3		x	x	x
M313	Water clean on A3 Chuck				
M314	Water clean off A3 Chuck				
M320	READ PREASURE FEEDBACK FROM TOP CLAMP A3	Called up by macro			
M-Code	**Function**	**Default at startup**	**1st M-code**	**2nd M-code**	**3rd M-code**
M321	READ PREASURE FEEDBACK FROM SIDE CLAMP A3	Called up by macro			
M322	WRITE MIN PRESSURE WINDOW A3 TOP	Called up by macro			
M323	WRITE MAX PRESSURE WINDOW A3 TOP	Called up by macro			
M324	WRITE MIN PRESSURE WINDOW A3 SIDE	Called up by macro			
M325	WRITE MAX PRESSURE WINDOW A3 SIDE	Called up by macro			
M400	Programmed pressure value internal coolant		x		

	Set by F argument 0-60				
M409	WATER ON SAW		x	x	x
M410	WATER OF SAW		x	x	x
M600-M699	WAITÍNG CODES BETWEEN PATHS				

7.3 Alarms, custom macro alarms- and operator messages

On the HHV-DUO, there are several levels of alarms and messages, there are alarms that are common for paths, and they are all in the EX5000+ area.

Then there are path specific alarms, in the EX1000+ area.

All alarms will stop the ongoing machining programs, and action must be taken to solve the cause of the alarm.

Then there are operator messages that are path specific, and most of them will not have influence on the program running, some will turn into alarm messages when program is stopped.

Alarms in the 3000+ area, comes from macros

The alarm and message numbers are the same for each path, so it is important to check what path is generating the alarm or message to be able to troubleshoot in an efficient way.

Alarm messages common to paths

EX5000 EMERGENCY STOP

EX5001 COLLECTIVE ALARM SPINDLE LUBE

EX5002 COLLECTIVE ALARM SMC COOLER

EX5003 LOW HYDRAULIC PRESSURE

EX5004 LOW OIL LEVEL HYDRAULIC UNIT

EX5005 GUIDEWAY LUBRICATION LOW PRESSURE

EX5006 LOW AIRPRESSURE MAIN

EX5007 HIGH TEMPERATURE HYDRAULIC UNIT

EX5008 COOLANT PUMP 1 OVERLOAD

EX5009 MAIN SWITCH COOLANT UNIT OFF

EX5010 OVERLOAD HYDRAULIC PUMP 1 SAW CYTROPAC 1

EX5011 OVERLOAD HYDRAULIC PUMP 2 SAW CYTROPAC 2

EX5012 WATER COOLING FLOW ALARM LINEAR MOTOR XL SMC

EX5013 WATER COOLING FLOW ALARM LINEAR MOTOR XR SMC

EX5014 WATER COOLING FLOW ALARM SPINDLE LEFT SMC

EX5015 WATER COOLING FLOW ALARM SPINDLE RIGHT SMC

EX5020 OVERLOAD SPINDLE LUBRICATION UNIT (F11)

EX5021 OVERLOAD GUIDEWAY LUBRICATION UNIT (F11)

EX5022 AIRFILTER OVERLOAD

EX5023 HYDRAULIC PUMP OVERLOAD

EX5024 COOLER UNIT ELECTRICAL CABINETT OVERLOAD

EX5025 COOLANT UNIT OVERLOAD

EX5026 INTERNAL CHIP CONVEYOR OVERLOAD

EX5028 TRANSFORMER T2 OVERLOAD

EX5030 24 VDC RELAY AND CONTACTORS OVERLOAD

EX5031 24 VDC INPUTS MAIN ELECTRICAL CABINET OVERLOAD

EX5032 24 VDC OUTPUTS MAIN ELECTRICAL CABINET OVERLOAD

EX5033 24 VDC MEDIA CABINET OVERLOAD

EX5034 24 VDC OUTPUTS MEDIA CABINET OVERLOAD

EX5035 24 VDC OUTPUTS MEDIA CABINET OVERLOAD

EX5036 24 VDC INPUTS COOLANT UNIT OVERLOAD

EX5037 24 VDC OUTPUTS COOLANT UNIT OVERLOAD

EX5041 TRANSFORMER T13 PRIM OVERLOAD

EX5042 230VAC IN/OUT FEEDER OVERLOAD

EX5043 F53 ISV4 24V OVERLOAD

EX5044 F13 FEEDER OVERLOAD

EX5069 SMC COOLING LIQUID TEMPERATURE IS TOO HIGH

EX5080 CYCLE START NOT POSSIBLE CHECK KNOLL

Alarm messages individual to paths

Left side

EX1001 COLLECTIVE ALARM SPINDLE LUBE

EX1010 SYNCH MASTER RIGHT ALREADY ACTIVE

EX1011 Left: Axis 5 is already synch master

EX1012 Left: Synch alarm axis 5 commanded but not synched

EX1013 Left: Axis 4 is already synch master

EX1014 Left: Synch alarm axis 4 commanded but not synched

EX1016 LOADER NOT READY

EX1017 AL CLAMPS NOT READY FOR LOADING

EX1018 UL NOT IN LOADING POSITION

EX1019 BAR LOADING ABORTED BEFORE FINISH

EX1040 ILLEGAR RESTART, PROGRAM MUST BE RESTARTED FROM BEGINNING

EX1045 HIGH PRESSURE PUMP OVERLOAD 6OL (LEFT)

EX1054 LOW BATTERYLEVEL RMP 40 PROBE (LEFT)

EX1055 PROBE ERROR RMP 40 PROBE (LEFT)

EX1057 M-CODE MUST BE EXECUTED FROM MACRO PROGRAM (LEFT)

EX1058 AIR PRESSURE FAILURE SPINDLE LUBERICATION (LEFT)

EX1060 TOOL HAVE MANUALLY BEEN INSERTED IN MAGAZINE (LEFT)

EX1061 TOOL HAVE MANUALLY BEEN REMOVED FROM MAGAZINE (LEFT)

EX1065 TOOL ID HAS BEEN CHANGED IN VARIABLE 517 (LEFT)

EX1066 CUSTOM DATA 0 HAS BEEN CHANGED IN VARIABLE 518 (LEFT)

EX1067 CUSTOM DATA 1 HAS BEEN CHANGED IN VARIABLE 519 (LEFT)

EX1068 TOOL ORIGIN POT HAS BEEN CHANGED IN VARIABLE 520 (LEFT)

EX1070 SIVIB ALARM B SPINDLE VIBRATION MONITORING (LEFT)

EX1071 SIVIB ALARM C SPINDLE VIBRATION MONITORING (LEFT)

EX1072 TEMP SPINDLE BEARING FRONT TO HIGH (LEFT)

EX1073 TEMP SPINDLE BEARING REAR TO HIGH (LEFT)

EX1074 TEMP SPINDLE BEARING FRONT TO LOW (LEFT)

EX1075 TEMP SPINDLE BEARING REAR TO LOW (LEFT)

EX1076 TOO HIGH VIBRATIONS (LEFT)

EX1077 SPINDLE UNCLAMP PRESURE TO HIGH (LEFT)

EX1078 SPINDLE UNCLAMP PRESSURE TO LOW (LEFT)

Alarms on Right side

1001=P02: COLLECTIVE ALARM SPINDLE LUBE

1011=Right: Axis 5 is already synch master

1012=Right: Synch alarm axis 5 commanded but not synched

1013=Right: Axis 4 is already synch master

1014=Right: Synch alarm axis 4 commanded but not synched

1040=ILLEGAR RESTART, PROGRAM MUST BE RESTARTED FROM BEGINNING

1045=HIGH PRESSURE PUMP OVERLOAD 6OL (RIGHT)

1054=LOW BATTERYLEVEL RMP 40 PROBE (RIGHT)

1055=PROBE ERROR RMP 40 PROBE (RIGHT)

1057=M-CODE MUST BE EXECUTED FROM MACRO PROGRAM (RIGHT)

1058=AIR PRESSURE FAILURE SPINDLE LUBERICATION (RIGHT)

1060=TOOL HAVE MANUALLY BEEN INSERTED IN MAGAZINE (RIGHT)

1061=TOOL HAVE MANUALLY BEEN REMOVED FROM MAGAZINE (RIGHT)

1065=TOOL ID HAS BEEN CHANGED IN VARIABLE 517 (RIGHT)

1066=CUSTOM DATA 0 HAS BEEN CHANGED IN VARIABLE 518 (RIGHT)

1067=CUSTOM DATA 1 HAS BEEN CHANGED IN VARIABLE 519 (RIGHT)

1068=TOOL ORIGIN POT HAS BEEN CHANGED IN VARIABLE 520 (RIGHT)

1070=SIVIB ALARM B SPINDLE VIBRATION MONITORING (RIGHT)

1071=SIVIB ALARM C SPINDLE VIBRATION MONITORING (RIGHT)

1072=TEMP SPINDLE BEARING FRONT TO HIGH (RIGHT)

1073=TEMP SPINDLE BEARING REAR TO HIGH (RIGHT)

1074=TEMP SPINDLE BEARING FRONT TO LOW (RIGHT)

1075=TEMP SPINDLE BEARING REAR TO LOW (RIGHT)

1076=TOO HIGH VIBRATIONS (RIGHT)

1077=SPINDLE UNCLAMP PRESURE TO HIGH (RIGHT)

1078=SPINDLE UNCLAMP PRESSURE TO LOW (RIGHT)

1083=UR AXIS MINUS DIRECTION INTERLOCK

1086=COOLANT THROUGH TOOL NOT ALLOWED (RIGHT)

1104=HYDRAULIC SAW ERROR: [I220,D20006]

1105=HYDRAULIC2 SAW ERROR: [I220,D20010]

Operator messages individual to paths

Left side

2006 SPINDLE HIGH TEMPERATURE WARNING LEVEL (LEFT)

2007 SPINDLE START AND NO TOOL OR UNCLAMPED TOOL (LEFT)

2009 INITIAL SPINDLE LUBE CYCLE RUNNING, CYCLE START DISABLED (LEFT)

2026 G1 COMMANDED WITHOUT CLAMPED WORKPIECE (LEFT)

2027 CUTTINGLOAD OF SPINDLE TOO HIGH (LEFT

2028 CUTTINGLOAD OF SPINDLE OVER 110% (LEFT)

2029 EW SPINDLE LUBRICATION STARTUP (LEFT)

2030 P01 ZERO OVERRIDE SET (LEFT)

2031 PRELUBE OF SPINDLE NOT COMPLETED, CYCLE START DISABLED (LEFT)

2035 Left: Synch lost axis 5, resynch necessary

2036 Left: Synch lost axis 4, resynch necessary

2045 REFERENCE A-AXIS (LEFT)

2048 SIVIB ALARM A SPINDLE VIBRATION MONITORING (LEFT)

2050 ERROR WRITING DATA TO SPINDLE (LEFT)

2051 SPINDLE POT NUMBER ERROR (LEFT)

2052 MAGAZINE POT NUMBER ERROR (LEFT)

2053 ERROR WRITING DATA TO MAGAZINE (LEFT)

2054 SPINDLE POT NUMBER ERROR (LEFT)

2055 MAGAZINE POT NUMBER ERROR (LEFT)

2056 WARNING TEMPERATURE FRONT BEARING SPINDLE IS HIGH (LEFT)

2057 WARNING TEMPERATURE REAR BEARING SPINDLE IS HIGH (LEFT)

2058 WARNING TEMPERATURE FRONT BEARING SPINDLE IS LOW (LEFT)

2059 WARNING TEMPERATURE REAR BEARING SPINDLE IS LOW (LEFT)

2063 WARM UP CYCLE IS NEEDED, CYCLE START DSBL IN AUTO, RUN M3 (LEFT)

2071 ALL AXIS INTERLOCK

2072 XL-AXIS INTERLOCK

2073 YL-AXIS INTERLOCK

2074 ZL-AXIS INTERLOCK

2075 UL-AXIS INTERLOCK

2076 AL-AXIS INTERLOCK

2077 AM-AXIS INTERLOCK

2078 VL-AXIS INTERLOCK(TOOL MAGAZINE LEFT)

2083 SPINDLE INTERLOCK (LEFT)

2086 COOLANT THROUGH TOOL NOT ALLOWED (LEFT)

2087 NO TOOL IN SPINDLE OR NOT CLAMPED WORKPIECE (LEFT)

2094 ATC MAGAZINE DOOR NOT OPEN CHECK SENSORS AND FUNCTION (LEFT)

2095 ATC MAGAZINE DOOR NOT CLOSED CHECK SENSORS AND FUNCTION (LEFT)

2099 RESET SPINDLE MAINTENANCE WRONG PROCEDURE (LEFT)

2101 PREVENTIVE MAINTENANCE ON SPINDLE (LEFT)

2102 CYCLE START DISABLED PM SPINDLE (LEFT)

2103 SCHEDULE SPINDLE MAINTENANCE (LEFT)

2118 OVERLOAD PROTECTION HIGH PRESSURE PUMP F11 (LEFT)

2119 COOLANT HIGH PRESSURE FILTER DURTY X14.4 (LEFT)

Operator messages individual to paths

Right side

2206 SPINDLE HIGH TEMPERATURE WARNING LEVEL (RIGHT)

2207 SPINDLE START AND NO TOOL OR UNCLAMPED TOOL (RIGHT)

2209 INITIAL SPINDLE LUBE CYCLE RUNNING, CYCLE START DISABLED (RIGHT)

2221 G1 COMMANDED WITHOUT CLAMPED WORKPIECE (RIGHT)

2222 CUTTINGLOAD OF SPINDLE TOO HIGH (RIGHT)

2226 G1 COMMANDED WITHOUT CLAMPED WORKPIECE (RIGHT)

2227 CUTTINGLOAD OF SPINDLE TOO HIGH (RIGHT)

2228 CUTTINGLOAD OF SPINDLE OVER 110% (RIGHT)

2229 NEW SPINDLE LUBRICATION STARTUP (RIGHT)

2230 P02 ZERO OVERRIDE SET (RIGHT)

2231 PRELUBE OF SPINDLE NOT COMPLETED, CYCLE START DISABLED (RIGHT)

2235 Right Synch lost axis 5, resynch necessary

2236 Right: Synch lost axis 4, resynch necessary

2245 REFERENCE A-AXIS (RIGHT)

2248 SIVIB ALARM A SPINDLE VIBRATION MONITORING (RIGHT)

2250 ERROR WRITING DATA TO SPINDLE (RIGHT)

2251 SPINDLE POT NUMBER ERROR (RIGHT)

2252 MAGAZINE POT NUMBER ERROR (RIGHT)

2253 ERROR WRITING DATA TO MAGAZINE (RIGHT)

2254 SPINDLE POT NUMBER ERROR (RIGHT)

2255 MAGAZINE POT NUMBER ERROR (RIGHT)

2256 WARNING TEMPERATURE FRONT BEARING SPINDLE IS HIGH (RIGHT)

2257 WARNING TEMPERATURE REAR BEARING SPINDLE IS HIGH (RIGHT)

2258 WARNING TEMPERATURE FRONT BEARING SPINDLE IS LOW (RIGHT)

2259 WARNING TEMPERATURE REAR BEARING SPINDLE IS LOW (RIGHT)

2263 WARM UP CYCLE IS NEEDED, CYCLE START DSBL IN AUTO, RUN M3 (RIGHT)

2271 ALL AXIS INTERLOCK

2272 XR-AXIS INTERLOCK

2273 YR-AXIS INTERLOCK

2274 ZR-AXIS INTERLOCK

2275 UR-AXIS INTERLOCK

2276 AR-AXIS INTERLOCK

2277 WR-AXIS INTERLOCK

2278 VR-AXIS INTERLOCK (TOOL MAGAZINE)

2283 SPINDLE INTERLOCK (RIGHT)

2286 COOLANT TRHOUGH TOOL NOT ALLOWED (RIGHT)

2287 NO TOOL IN SPINDLE OR NOT CLAMPED WORKPIECE (RIGHT)

2294 ATC MAGAZINE DOOR NOT OPEN CHECK SENSORS AND FUNCTION (RIGHT)

2295 ATC MAGAZINE DOOR NOT CLOSED CHECK SENSORS AND FUNCTION (RIGHT)

2299 RESET SPINDLE MAINTENANCE WRONG PROCEDURE (RIGHT)

2301 PREVENTIVE MAINTENANCE ON SPINDLE (RIGHT)

2302 CYCLE START DISABLED PM SPINDLE (RIGHT)

2303 SCHEDULE SPINDLE MAINTENANCE (RIGHT)

2318 OVERLOAD PROTECTION HIGH PRESSURE PUMP F11 (RIGHT)

2319 COOLANT HIGH PRESSURE FILTER DURTY X17.4 (RIGHT)

2320 SMALL-PART CYL1 NOT AT HOME POS

2321 SMALL-PART CYL1 NOT AT WORK POS

2322 SMALL-PART CYL2 NOT AT HOME POS

2323 SMALL-PART CYL2 NOT AT WORK POS

2324 SMALL-PART CYL3 NOT AT HOME POS

2325 SMALL-PART CYL3 NOT AT WORK POS

2326 SMALL-PART HANDLER NOT IN HOME POSITION

Custom Macro Alarms

3001 SPINDLE TOOL SENSORS BROKEN

3002 TOOLPOT NOT EMPTY

3003 TOOLPOT EMPTY

3004 TOOL POCKET DATA IN VARIABLE TOO SMALL

3005 TOOL POCKET DATA IN VARIABLE TOO BIG

3006 TOOL POCKET DATA FROM TOOL MANAGEMENT TOO SMALL

3007 TOOL POCKET DATA FROM TOOL MANAGEMENT TOO BIG

3008 WRONG TOOL IN SPINDLE

3009 ORIGIN TOOLPOT DATA MISSING OR WRONG

3010 NO TOOL IN SPINDLE TO ATTACH

3011 SPINDLE NOT EMPTY FOR DETACH

3012 TOOL LENGHT IS MISSING

3013 TOOL IN SPINDLE CAN NOT BE ATTACHED

3015 VALID S COMMANDS 0-359.99

3016 INVALID #514, 0-4095

3017 INVALID #514, WHOLE NUM ONLY

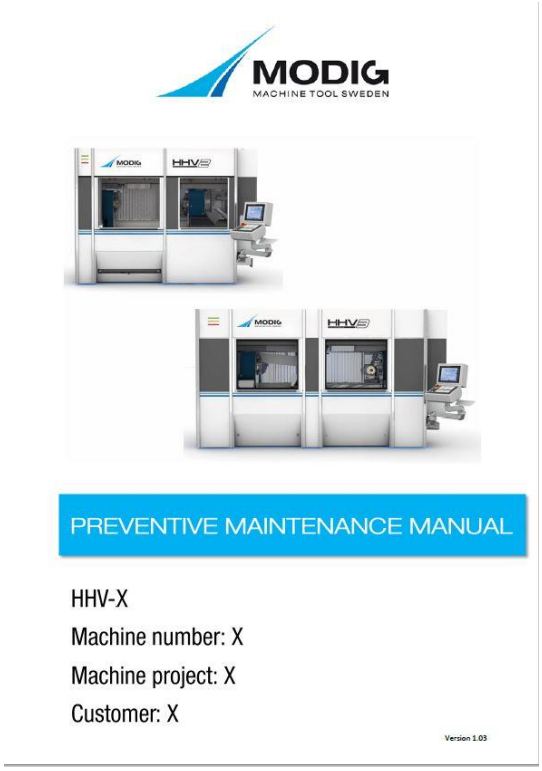
3037 SPINDLE WARM UP WITHOUT TOOL

3038 PROBE IN SPINDLE

8. Operator Maintenance, oils, grease etc.

Preventive Maintenance

NOTE: See separate manual, "MODIG HHV 2-3 Preventive maintenance manual"



Log over new editions

Version	Changes	Date	Changed by
1.0	First edition	2022-10-04	HW
1.01	Remake, changed order of chapters	2023-01-18	HW
1.02	Added: Instruction for checking distance between left and right spindle HHV DUO, section 2.15	2023-02-01	HW
1.03	Added, information on the adaptive saw-unit, section 6	2023-02-07	HW

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