3060 Internal Thread Grinder

User Manual

Foreword

The information in this manual refers to equipment supplied by:

MATRIX MACHINE TOOL (COVENTRY) LIMITED
Matrix House, A2 Earlplace Business Park
Fletchamstead Highway, Coventry, CV4 9XL
UNITED KINGDOM
sales@matrix-machine.com
http://www.matrix-machine.com

Preface

The Health & Safety section of this manual must be read and all safety related precautions observed before proceeding with the installation of this machine.

Support

Tel: +44 (0)2476 718 886
Fax: +44 (0)2476 678 899
Email: service@matrix-machine.com

If you have any queries or suggestions regarding the 3060 User Manual, please contact our Technical Publications Department: **publications@matrix-machine.com**

This manual describes the use of the 3060 Internal Thread Grinder. Any options taken or deviations from the standard are documented in each machines individual set of manuals.

Matrix Machine Tool (Coventry) Limited reserves the right to modify its products without notification and consequently to supply machines which are not in every detail in accordance with the descriptions and procedures in this publication.

(This manual was written using Calibri font , size 12)

Symbols & References

The table below lists symbols used throughout this document. Bold square brackets **[ ]** have been used in this manual to denote a button or key function on the operator control console.

symbol	[ ] ref	meaning
		General caution Indicates general cautionary, warning, or danger level information
		Electrical shock caution Indicates possibility of electric shock under specific conditions
	**[JOG]**	JOG mode selection
	**[MDA]**	MDA mode selection
	**[AUTO]**	AUTO mode selection
	**[TEACHIN]**	TEACHIN mode selection
	**[SBLK]**	SINGLE BLOCK mode selection
	**[RESET]**	RESET program cycle, alarm message
	**[CYCLE START]**	CYCLE start request
	**[SPINDLE START]**	Grinding spindle start request
	**[SPINDLE STOP]**	Grinding spindle stop request
	**[SP.INC]**	Increase grinding spindle speed override in 10% increments

	**SP.DEC]**	Reduce grinding spindle speed override in 10% decrements
100%	**[SP.100%]**	Set grinding spindle speed override to 100%
	**[Hand Unit Enable]**	MPG/Hand unit ON/OFF toggle function
	[Coolant OFF]	Coolant delivery ON/OFF toggle function
	[Machine Lights ON/OFF]	General machine lighting ON/OFF toggle function
	[YES]	Dialog prompt acknowledge button
	[Unlock Door]	Unlock guard door request
	[Block Skip]	Block skip ON/OFF toggle function
	[Gear ON/OFF]	Gearbox ON/OFF toggle function
	**[SETUP]**	Setup mode toggle function. Generally selected when using any of the setting cycles
	**[FIN]**	Acknowledge button used during setting and grinding cycle instruction prompts or to confirm the completion of a setting cycle sequence
	**[AUTO REF]**	Starts referencing all machine axes in a pre-defined order
X	**[X]**	machine X axis select
Z	**[Z]**	machine Z axis select
C	**[C]**	machine C axis select
A	**[A]**	machine A axis select

Menu selection

"**>**" is used to denote the sequence of softkey presses required to get a specific screen.

Example: Matrix > Main Menu > Part Data

Table of Contents

1 Health & Safety

This machine carries the CE Mark and complies with the Machinery Directive 89/392 as amended by the EC Directive 91/368.
The Safety Provisions are based on the draft European provisional standard for grinding machinery designated as document CEN/TC143/N141E.
The standard provides for both Operating and Setting modes and these are described in the Operating section of this manual.
Matrix Machine Tool has a safety record of which it is justly proud and in issuing this user manual they would like to bring to your operator's attention to *Section 7 of the Health & Safety at Work Act 1974*, which requires that the supplied machine is designed and constructed as far as reasonably practicable to be safe and without risk to health.

1.1 General Safety

Matrix machines are constructed for maximum operator safety under standard operating conditions, when recommended instructions are followed in the assembly and operation of the machine and its equipment.
All personnel engaged in the use of the machine should become familiar with its operation as described in this manual. Proper operation of the machine promotes safety for the operator and all workers in the vicinity.
Particular attention must be paid to the appropriate pages of this manual where the following symbols are shown.

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damages to the machine. The information described following the caution symbol must be strictly observed.

Indicates risk of electrical shock
Power source work must be entrusted to an electrician with a license to carry out electrical work. If a person without knowledge of electrical safety practices attempts this work, he or she could be electrocuted and possibly seriously injured or the machine could be seriously damaged.

Become familiar with material, inspection and mounting of grinding wheels, wheel speed limitations and correct setting and securing of wheel guards.

Many factories have wheel mounting specialists who because of their experience and knowledge, are designated the responsibility for properly mounting the wheel. When possible, such persons with this responsibility should be consulted to supervise or perform the work.

In reading the following guidelines for safety, it should be recognized that it is the responsibility of each individual to observe the prescribed rules as outlined. All warning and danger signs must be observed and obeyed. All actual or potential danger areas must be reported to your immediate supervisor.

1.2 Understanding Safety Rules & Regulations

Understand and obey safety regulations set out by your employer. Read the operating instructions in this and the CNC controller manuals.

1.3 Know your machine

An experienced operator will have knowledge of:

- alignment and mounting of work pieces or devices
- setting, operation and monitoring of the grinding machine
- selection and use of abrasive products
- recording of data for the machining of work pieces and optimisation of the machining process
- special hazards and safety requirements

Observe all warning plates on the machine. Understand these warnings and follow their directions as you operate the machine.

1.4 Maintain a safe working area

Your working area should be clean and uncluttered. Give yourself room for a firm, well balanced stance.

- Check all guards are in position and securely fastened
- Be sure all guards are in correct position before operating the machine
- Do not operate a machine with missing guards
- Be sure that all fasteners are being used and they are firmly tightened.
- Always wear safety glasses.
- Always make sure that you have no loose clothing when working on the machine, especially with the front door open and the axis moving, i.e. setting the part to run true with the C axis rotating.

CAUTION
DO NOT open the wheel guard while the grinding wheel is rotating
DO NOT adjust the grinding coolant nozzles when the wheel is rotating

Be certain that the component is mounted securely and the driver is in place and secure.

Never try to stop a coasting grinding wheel with your hand or hand held object.
Stop coolant flow before stopping wheel.

DO NOT:

- run coolant on a stationary wheel.
- modify the drive to get higher wheel speeds.
- use special pulleys, high speed motors or speed control devices which have been altered or made inactive.

Use standard wheel dressers.

1.5 Electricity

	**WARNING** ORANGE WIRING IS LIVE WHEN MAINS ISOLATOR IS SWITCHED TO THE OFF OR ON POSITION!

ALL ORANGE coloured wiring is LIVE at all times. This applies even when the electrical isolator on the machine is OFF position.

For all repairs and servicing turn the power off, at all sources of electrical and pneumatic supplies before servicing. Exceptions would be in the few cases where the machine must be in operation to make adjustments, and in these cases, the utmost care should be taken at such times.

	**WARNING** Switch off the main isolator before removing any panels or carrying out any electrical repair work on the machine.

Switching the main isolator OFF does not erase data from the CNC controller's memory and it can be used to isolate the electrical supply at any time.

1.6 Workshop hygiene

The adjustment setting, general operation of machines, wheel changing together with the removal of grinding debris are tasks which bring people into contact with oil.

There may be exposure to oil fumes or oil mist. Naked skin could come into contact with oil through splash, handling of wet work-pieces or drips from guarding

	**WARNING** Soluble oil emulsions provide a breeding ground for aerobic or anaerobic bacteria and infected systems may develop considerable quantities of slime, gums and sludge. In addition to health problems and foul odours, the performance of the cutting fluid will be reduced and corrosion problems will occur. The useful life of fluids can be reduced to weeks instead of months. The source of infection is invariably the residues from previous changes of emulsion, so the simplest and most beneficial step is effective draining, cleaning (both flushing with a chemical cleaner and physical cleaning) and preferably sterilising between changes. Industrial dermatitis can arise, especially amongst persons sensitive to skin irritations but a more fundamentally serious problem is the possibility of skin cancer of the scrotum.

1.7 Cancer of the skin caused by oil

Continuous contact with oil, soluble oil and particularly with straight cutting oils can cause cancer of the skin.

WARNING
The following precautions must be taken:

- **DO NOT** wear oil soaked clothes
- **DO NOT** put oily rags in trouser pockets
- wash all oil from body after work
- read the section on Workshop Hygiene
- wear protective clothing
- avoid unnecessary contact with oil
- wear oil resistant gloves

1.8 Machine Guards

Factory employers are required by law to guard and/or fence all dangerous parts of machinery. Employees are also required by law to use all the guards supplied as above.

DO

- Ensure that all fixed and adjustable guarding is secured in its correct position before the machinery is operated.
- Wear the correct protective equipment at all times in the workshop.

DO NOT

- Remove fixed guards without permission
- Remove adjustable guards except when necessary during setting up operations
- Clean any parts of the machine whilst the machine is in motion
- Use any machine unless you have been authorised to do so
- Leave tools or loose articles on machine tables and slides

If you suspect your machine is defective then **STOP** it immediately!
Never attempt to repair it yourself, whether it is a mechanical or electrical fault.
Switch off the main isolator switch and report the problem to your supervisor.

CAUTION
DO NOT open the wheel guard while the grinding wheel is rotating
DO NOT adjust the grinding coolant nozzles when the wheel is rotating

1.9 Grinding Wheels

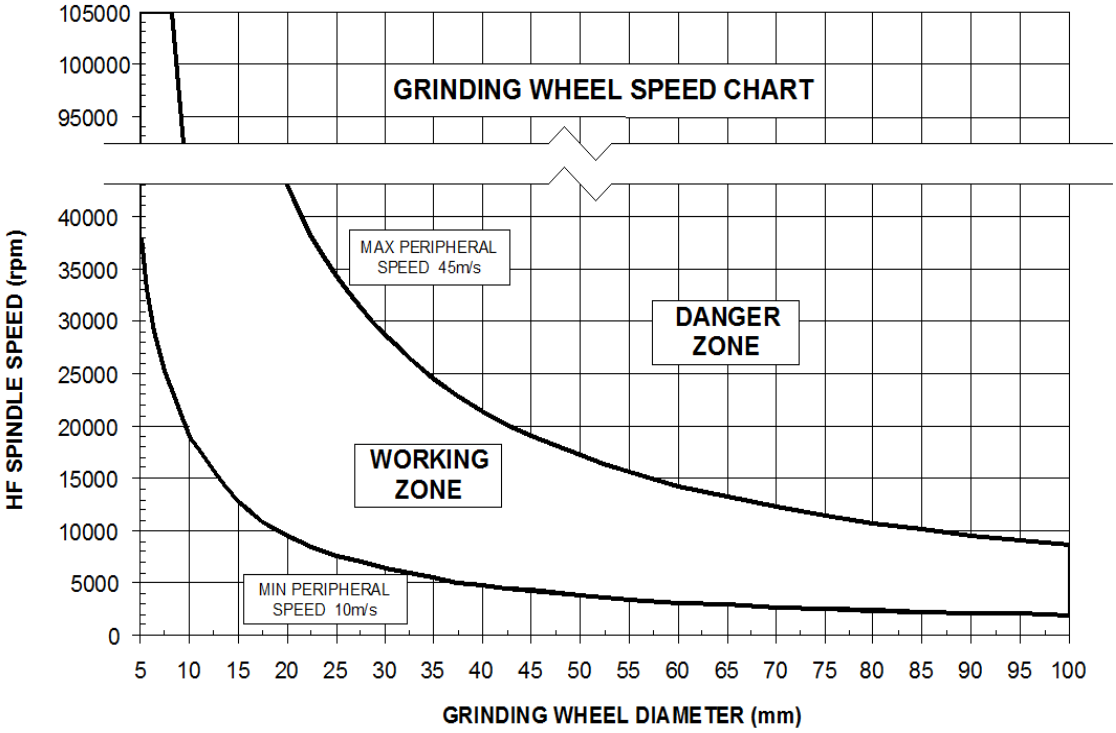
CAUTION

Never run-up the spindle to maximum speed during the start-up time when it is cold, otherwise, due to different thermal expansion characteristics in the bearings, stress conditions are produced, which can cause damage to the spindle.

If there are any doubts about the way in which the spindle is operating then stop the cycle immediately!

The machine is supplied with two independent grinding spindles. The spindles are motorised having their own built-in motor and supplied from a solid state high frequency inverter drive unit housed in the electrical control cabinet.

The grinding wheel speed chart shown below should be used as a guide to the permissible wheel surface speeds (in m/s) for the diameter of wheel fitted to the quill.



Every effort should be made to ensure that the grinding wheel speed operates within the “Working Zone” shown on the chart.

The programmed speed (RPM) of the wheel must **NEVER** exceed the maximum speed of the quill that it is fitted to.

DO

- Be certain that the component is mounted securely.
- Stop coolant flow before stopping wheel.
- Accept machine limits for wheel speed.
- Switch the main electrical cabinet isolator OFF or press the machine Emergency Stop push button to remove power before changing the wheel.
- Inspect a new grinding wheel before mounting it on the machine. Look for cracks, nicks or signs of damage. If you see these or have doubt about the soundness of the wheel, do not use it.
- Inspect wheel adaptor flange before mounting a wheel.
- Use light pressure when mounting a wheel.
- Check that you have the right wheel and that the machine spindle speed is correct for the wheel and the quill.
- Store wheels in a box and handle carefully.

DO NOT

- try to stop a coasting grinding wheel with your hand or hand held object
- run coolant on a stationary wheel
- modify the drive to get higher wheel speeds
- use special pulleys, high speed motors or speed control devices which have been altered or made inactive
- force a wheel on to a wheel adaptor

1.10 Machine User

Only properly trained and authorised personnel must be allowed to operate and maintain this equipment. All areas of responsibility for the operation, setting-up and maintenance of this equipment must be clearly specified and complied with.

	**CAUTION - RISK OF DANGER!** The relevant section of the user manual must be consulted where this symbol is marked on the machine.

	**CAUTION - RISK OF ELECTRIC SHOCK!** The relevant section of the user manual must be consulted where this symbol is marked on the machine.

Make yourself familiar with the Protection of Eyes Regulations, the Abrasive Wheel Regulation and the duty of all employees under the Health and Safety at Work Act.

Section 7 states; it shall be the duty of every employee while at work to take reasonable care of the Health and Safety of himself and other persons who may be affected by acts or omissions at work.

1.11 Service and Maintenance

Repairs to the equipment must only be carried out by trained and qualified personnel in accordance with the servicing and maintenance guidelines. Machine warranty will become void if any repairs or modifications are made without the express permission of Matrix.

2 Liability Exclusions

Matrix Machine Tool (Coventry) Limited are excluded from all liability where the equipment supplied has been used in a manner other than intended OR has been modified without the express written permission of Matrix Machine Tool (Coventry) Limited which has subsequently resulted in the machine to malfunction, become damaged or caused injury to the user.

Summary of exclusions (but not limited to):

1. Any usage or application beyond the specified scope of the supplied equipment.
2. Any usage or operation of the equipment in a technically imperfect condition.
3. Any usage or operation of the equipment without due provision for safety considerations or hazards.
4. Any usage or operation of the equipment in contravention of the instructions set out in this user manual.
5. Any usage or operation of the equipment in contravention of information in any third-party literature provided with the equipment.
6. Any usage or operation where faults that could affect safety are not remedied before start-up.
7. Any modification, bypassing or de-commissioning of equipment whose intended purpose is to ensure proper functioning or safety.
8. Unrestricted usage or operation of the equipment and/or active and passive safety.

The end user is responsible for providing a suitable padlock to secure mains isolator switch in the OFF position when the machine is not being used for prolonged periods.

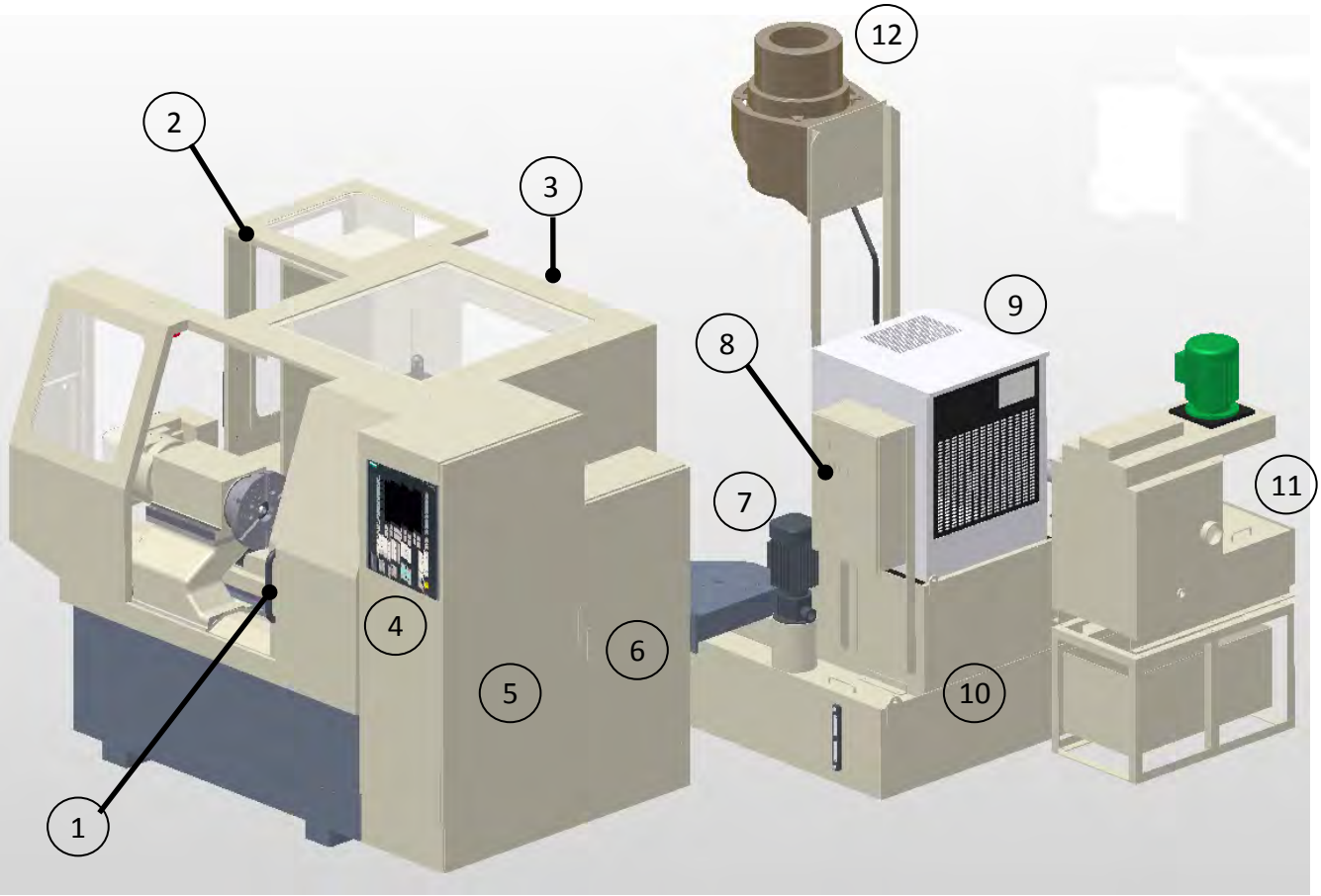
3 Technical Description

This compact modular built machine is a multi-axis CNC internal thread grinder specifically designed for the precision grinding of complex internally threaded workpieces.

The machine base, sub-slides and headstock are each constructed of single-piece high quality seasoned cast iron. Featuring a fully enclosed hood with a safety interlocked main operator access door and service access panels the machine is easily accessible from all sides.

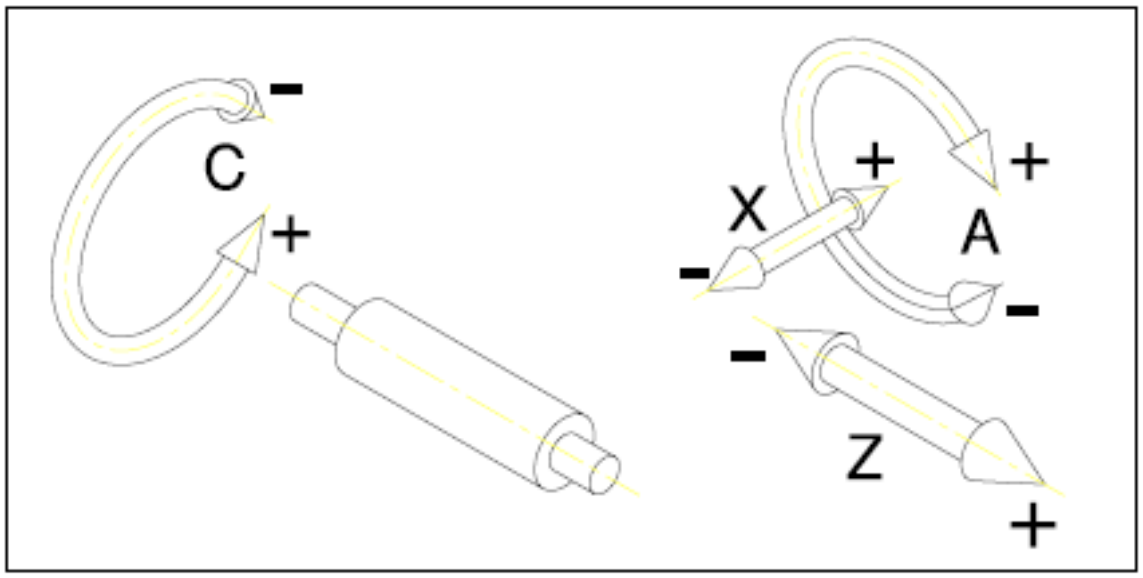
Its basic design embodies the latest technology available from the Siemens 840D SolutionLine CNC control system and Siemens SINAMICS digital servo drive system thus providing the machine with the dynamic performance and smooth operating characteristics required for high precision grinding applications.

3.1 Machine overview



1	Sliding operator access door (safety interlocked)	7	Main coolant delivery pump
2	Sliding service access door (manual interlock)	8	Coolant system control panel
3	Removable rear access panel	9	Coolant oil cooler
4	User console	10	Coolant oil tanks
5	Electrical Cabinet (EC)	11	Centrifuge unit
6	Services Cabinet (SC)	12	Fume extraction unit

3.2 Axis configuration

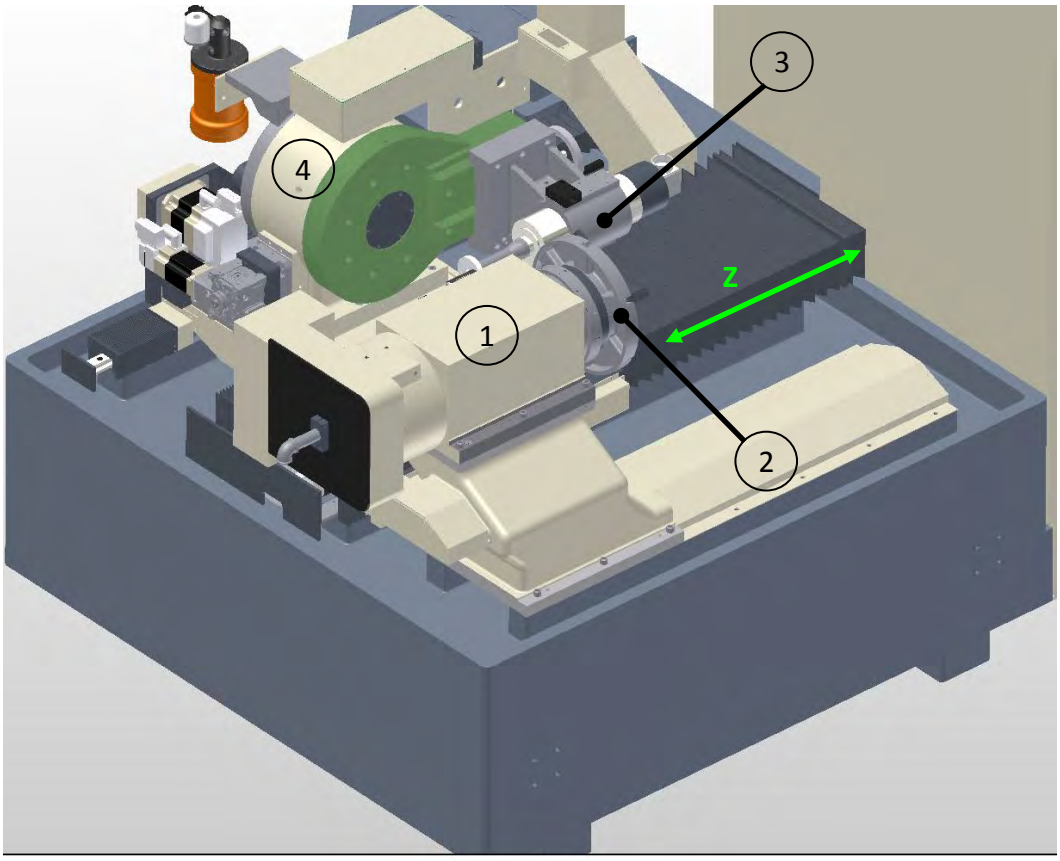


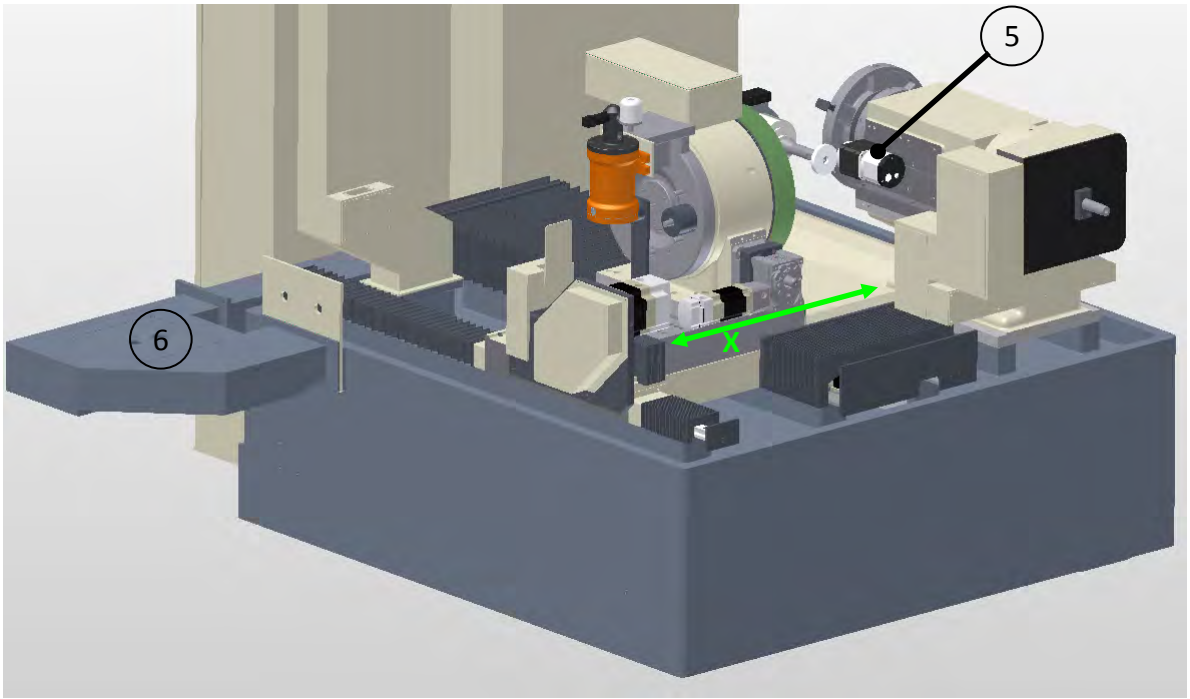
Axis	Description
X	Wheelhead radial infeed slide (linear)
Z	Wheelhead transverse slide (linear)
C	Workhead spindle (rotary)
A	Spindle helix (rotary)
S1	High Frequency grinding spindle
S2	Dressing spindle (mounted to the side of the workhead)

Absolute encoders are fitted as standard to the X, Z, C and A axes, so there is no need to reference the machine at power on.

The machine axes zero positions and software travel software limits are factory set.

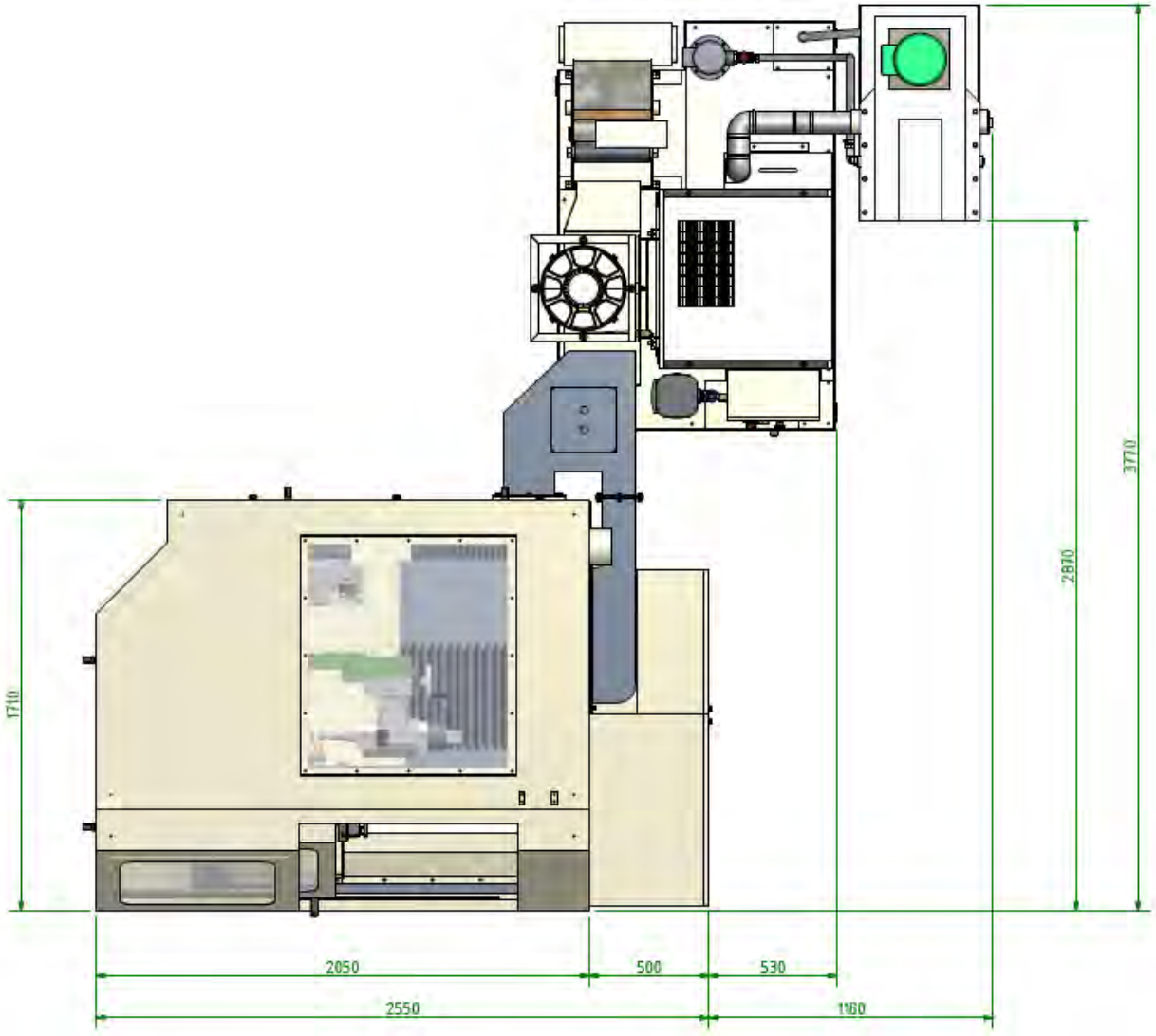
3.3 Machine arrangement

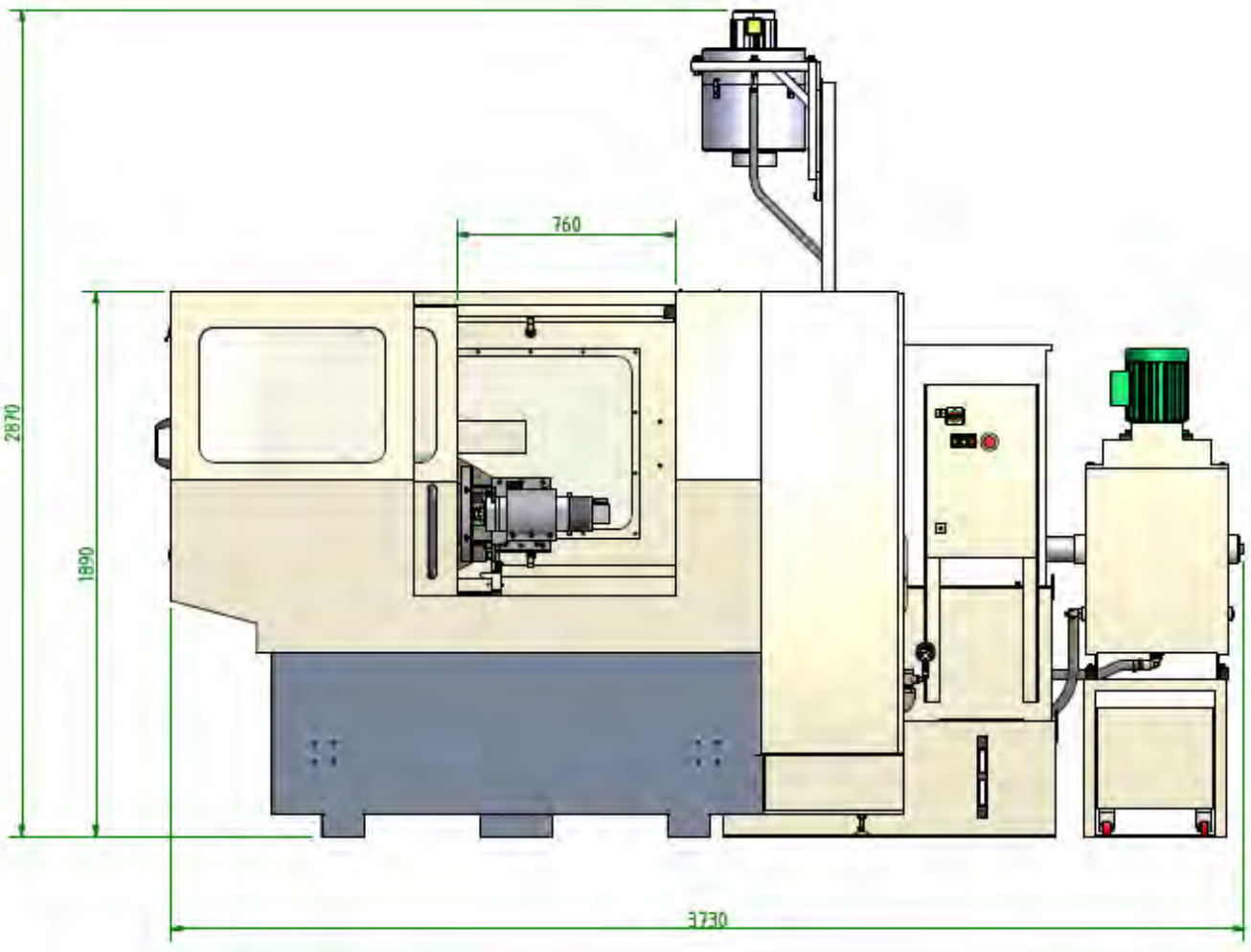




1	Torque motor workhead (C)	4	Spindle helix assembly (A)
2	Workhead interface to accept 6-jaw chuck or faceplate fixturing	5	Workhead mounted dresser spindle (S2)
3	HF grinding spindle (S1) with axial adjustment manual handwheel	6	Coolant return duct

3.4 Machine layout





Minimum workshop height where machine is to be installed = 3000mm

4 Technical Data

Workpiece	
Max Ø admitted	240mm
Max Ø of bore ground	150mm
Min Ø of bore ground	16mm
Max swing on diameter	500mm
Max thread length ground	300mm
Max workpiece mass (with workholding)	200kg

Grinding Spindle	
Standard HF cartridge spindle	5000 - 30000rpm
Optional HF cartridge spindle	5000 - 42000rpm
Optional HF cartridge spindle	60000 – 105000rpm
Spindle helix angle (programmable)	± 20°

Programming	
Pitch range	0 – 300mm
Pitch shift function	Yes
Pitch correction function	Yes
Lead correction function	Yes
Diameter correction function	Yes
Profile correction function	Yes
Matrix HMI dialog programming	Yes

Machine	
Weight (gross)	6,000kg
Floor area	3770 x 3730mm

Workhead (C axis)	
Torque motor rating	77Nm @ 120rpm
Programmable speed range	1 to 120rpm
Positioning resolution	5arcsec (0.0014°)

Wheelhead (X axis)	
Slide travel	310mm
Traverse speed	0 – 7M/min
Positioning resolution	0.0001mm

Wheelhead (Z axis)	
Slide travel	500mm
Traverse speed	0 – 7M/min
Positioning resolution	0.0001mm

Dressing System	
Workead mounted	Manually adjustable helix ±15°
Dresser spindle speed	0 – 6000rpm (bi-directional)
52mm Ø expanding collect	Yes

Control System	
CNC system	Siemens 840DSL
PCU	Siemens PCU50.3
Drive system	Sinamics S120
HMI panel	Siemens OP08T, 8” colour TFT

4.1 Optional items

Hardware Options	
Spindle chiller unit	Standard
Coolant system	Standard
Workpiece probing system	N/A
Single point diamond dressing attachment	Option
Special workholding/fixturing	Option
Diamond roll	Option
Diamond disc (4mm flat)	Standard
Diamond disc (sharp Vee)	Option
Diamond disc (radius)	Option
Heavy metal grinding quill	Option

Software Options	
ProfileMATE Thread profile software	Standard
ProfileMATE End-threading software function	Option
ProfileMATE Worm (ZI,ZA,ZN) profile software	N/A
ProfileMATE Worm (ZK) profile software	N/A
ProfileMATE Dual lead (duplex) worm function	N/A

5 Dresser System

The compact dresser system comprises of a helix backplate and a directly driven spindle unit. The backplate is available in two options: Fixed helix (0°) or Settable helix (±15°). As standard, the fixed helix backplate is fitted.

A diamond disc or profiled roll with a 52mm diameter bore is supported by this dresser system. In addition, a single point diamond can also used if the (optional) spindle point block attachment is fitted.

Located to the side of the workhead, the dresser system can easily be accessed from the front or side of the machine.

5.1 Fixed Helix backplate

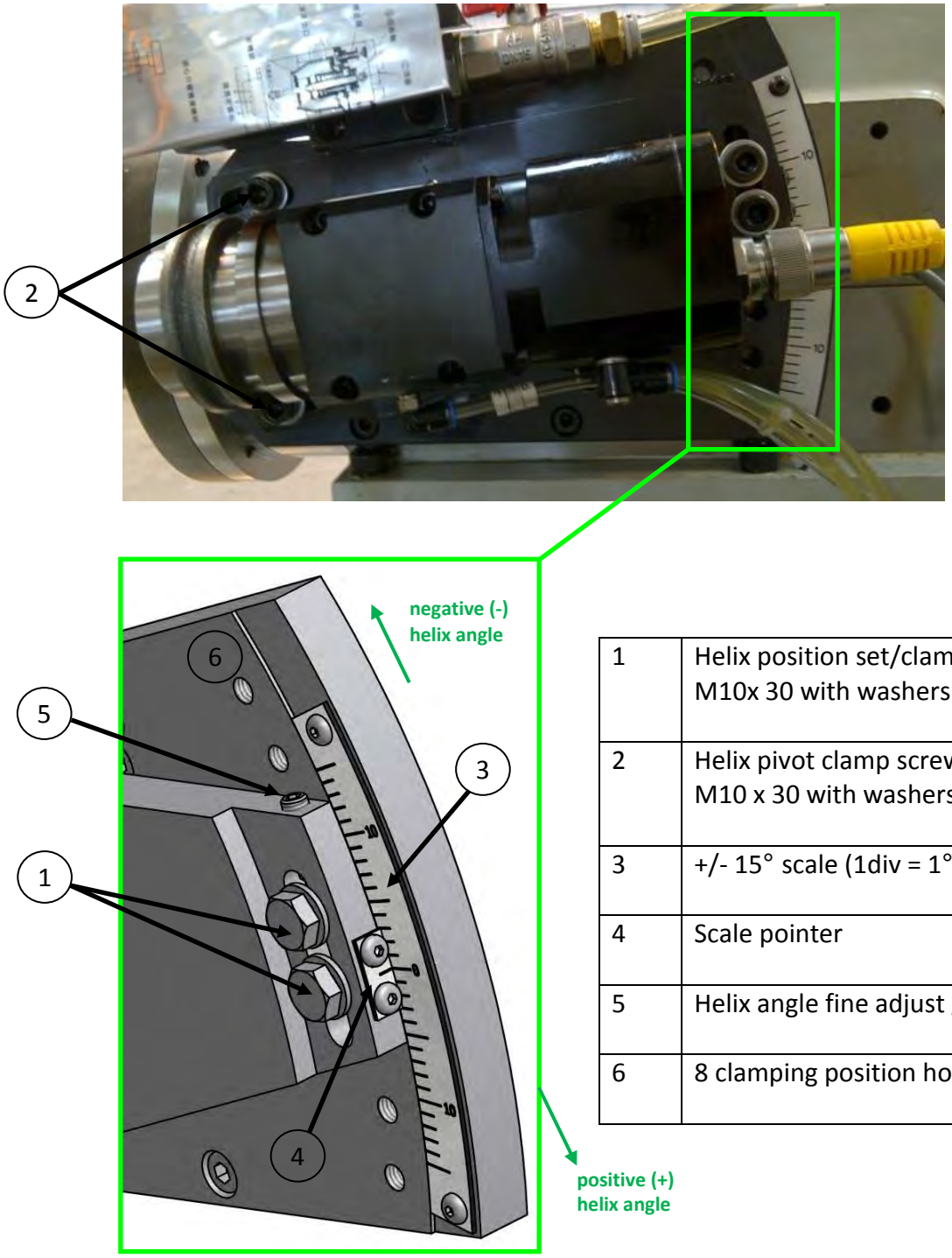
The standard helix backplate locks the position of the dressing spindle at 0° helix and there are no adjustments available to adjust to the dresser position.

During dressing cycles the grinding wheel spindle helix (A axis) must return to 0° position to perform wheel dressing. Upon completion of the dressing sequence the wheel spindle helix return back to the required helix angle used to grind the workpiece..

5.2 Settable Helix backplate (option)

The settable dresser helix option allows you to dress the grinding wheel with the wheel remaining set at its spindle angle for both grinding and dressing cycles. Therefore, machine efficiency is improved by this method.

However, it should be noted that this only applies when a diamond roll dressing tool is used. It does not work with diamond disc or single point dressing tools.



1	Helix position set/clamp screws M10x 30 with washers
2	Helix pivot clamp screws M10 x 30 with washers
3	+/- 15° scale (1div = 1°)
4	Scale pointer
5	Helix angle fine adjust grub screw
6	8 clamping position holes

Procedure for setting the dresser helix angle

1. Remove the dressing disc/roller and collet from the dresser spindle shaft.

2. Loosen the 2 x M10 helix **pivot clamp** screws using an allen key.

3. Loosen the 2 x M10 helix **position clamp** screws using an allen key.

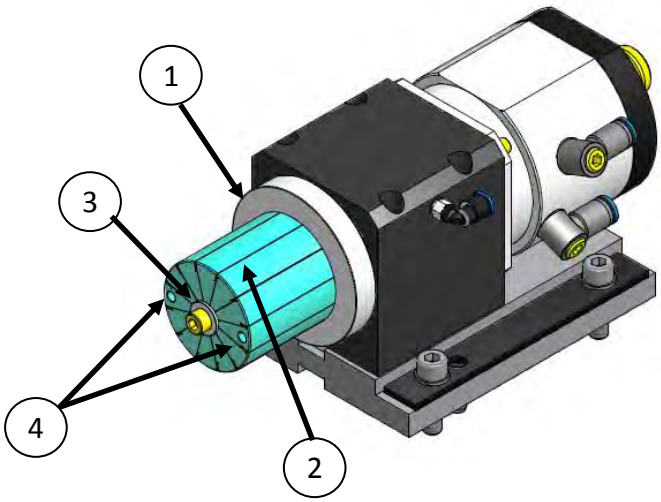
4. Set the dresser to the required helix angle on the scale. Note: 1div = 1°
   Note: If you need to set the helix angle above or below 5° then remove the 2x M10 **position clamp** screws and rotate the spindle to the required helix angle and then replace the screw in the nearest available clamp position hole.

5. Using an allen key turn the grub screw to make any final adjustment to the helix angle.

6. Finally, tighten-up the 2x M10 position clamp screws and the 2x M10 pivot clamp screws.

5.3 Dressing Spindle

The dresser spindle is fitted with an expanding collect to aid the installation and removal of the dressing disc or roll tool with a 52mm diameter bore.



1	Diamond disc/roll location face	3	Collet expand/retract screw (M6)
2	Expanding collet	4	Pin spanner location holes

Procedure for installation of the dressing disc/roll

1. Ensure the location face, collet and dressing tool bore are thoroughly clean before proceeding to install the dressing tool.

2. Slide the dressing disc/roll onto the collet. If you cannot slide the disc/roll easily then slacken the M6 collet screw using a 5mm allen key.

3. Push the disc/roll along the collet until it locates to the datum face.

4. Using the supplied pin spanner hold the collet steady and then tighten-up the M6 screw using the 5mm allen key. DO NOT overtighten the M6 screw as you could damage the collet or be unable to remove the dressing disc/roll later on.

5. Check the dressing disc/roll for axial and radial runout after you have installed it.

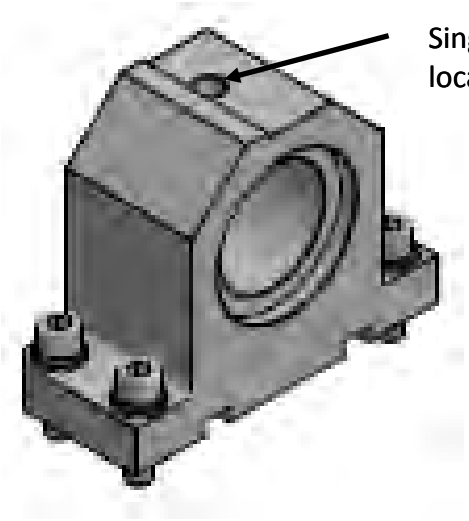
Procedure for removal of the dressing disc/roll

1. Using the supplied pin spanner hold the collet steady and then slacken the M6 screw using the 5mm allen key.

2. Carefully slide the dressing disc/roll off the collet without removing the collet.

5.4 Single-point diamond holder (option)

An alternative to the rotary truer system is the single point diamond system primarily used where wheel profiles demanding small profile radii (<= 0.1mm) are required.



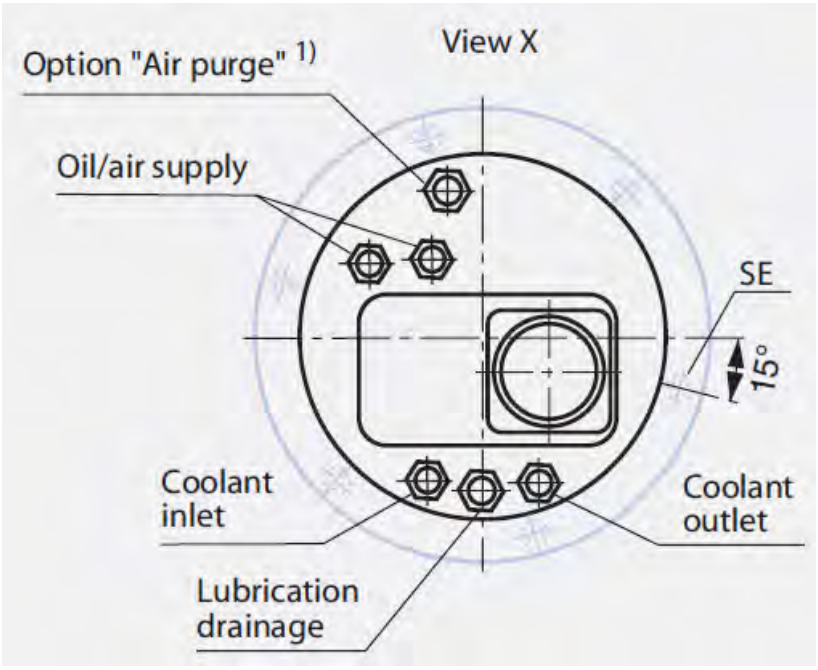
Procedure for mounting the single-point diamond holder

1. Remove the expanding collet from the dressing spindle an put it somewhere safe.
2. Locate the single point diamond holder to the backplate and carefully slide it over the exposed dresser spindle shaft.
3. Secure the holder in place using the 4 x 8mm socket screws provided.
4. Push the single-point diamond into to its location bore ensuring that it also locates to the machined flat on the holder.
5. Secure the diamond in place by tightening up the grub screw.

6 High Frequency Grinding Spindle

The spindle has a built-in motor and is supplied from a solid state high frequency inverter drive unit housed in the electrical control cabinet.

Warning
You must contact Matrix Machine Tool (Coventry) Ltd and seek advice from the Matrix technical support team if you wish to use a different spindle.



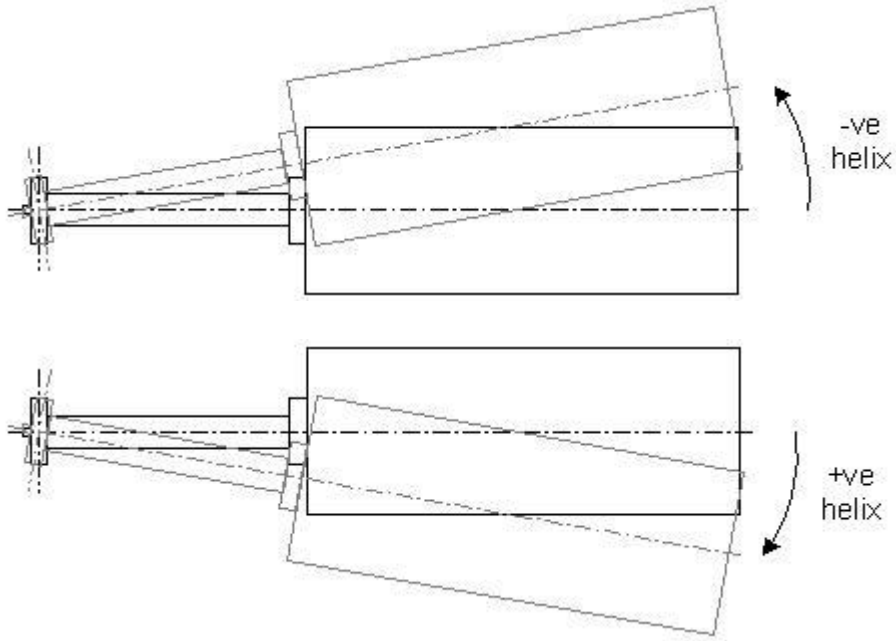
Spindle Lubrication System

A pressurised air/oil mist mixture is forced through tubes connected to the rear of the spindle. The air/oil mist is regulated by an oil pressure and air pressure switch in the services cabinet. The spindle lubrication cycle runs automatically during normal machine operation when the spindle is running.

Spindle Chiller System

The 3060 machine is supplied with a HF spindle chiller system as standard.

6.1 Helix angle direction



The sketches above show the direction of the spindle helix setting angle as viewed from the front of the machine.

Needless to say, the spindle helix angle and dresser tool setting angle must match to ensure wheel and dresser tool are in the same plane otherwise the grinding wheel will not be correctly dressed.

6.2 Helix and Approach Angles

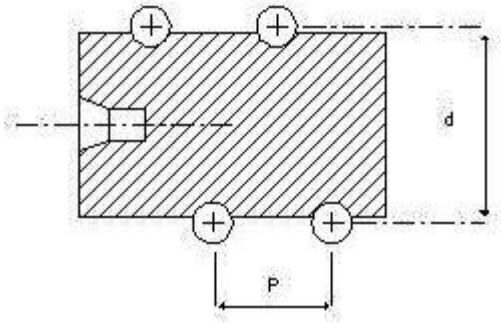
For ball profile applications, the Helix Angle and the Approach Angles are defined by the component geometry and in practice four conditions can occur.

- The helix angle is within ± 12°
- The helix angle exceeds the maximum machine setting of 12°
- The length of thread to be ground is limited by interference between the quill and the component.
- The helix angle is limited by interference between the quill and the component.

The majority of components will fall into the first category and all that is required is a normal helix angle setting.

$$Helix\ angle = tan^{-1}\left(\frac{Pitch}{\pi D}\right)$$

where D is the BCD of the ball profile



6.3 Approach Angle = 0° (standard)

The approach angle of a standard 3060 is always set as 0°. Therefore, if your machine purchase included the supply of the Ball Profile software then you always enter the approach angle value as 0° when prompted.

6.4 Approach Angle > 0° (option)

If your machine was purchased with the high helix option and the Ball Profile software then you can enter the approach angle with angle of the spindle wedge plate fitted to the machine.

The helix angle of the grinding wheel can be set by the manually adjustable, jacking screw located on the wheelhead assembly. The angular (helix) position of the wheelhead is determined by the graduated scale marks on the side of the wheel head. The Adjustment range is ± 12°.

The horizontal plane of the grinding wheel is set by installing a hi-precision, machined wedge between the spindle body housing and the machined face of the wheelhead casting. Matrix Machine Tool (Coventry) Limited can supply a set of wedges for the machine, based upon the range of components to be ground. A typical set of wedges can range from 1° - 5°, in 0.5° increments.

An approach angle, or a mismatched helix angle, increases the complexity of the wheel profile and can only be accurately achieved by using a CNC controlled dresser. It is not possible to set the spindle at the true helix angle for some components and special computer programs are available for determining the optimum combination of helix and approach angle values.

6.5 Spindle Warm-Up

As with any type of HF cartridge type spindle, it is essential that the spindle is warmed up for a period of time before it is used for workpiece grinding or wheel dressing cycles. This is especially so when the machine has been shutdown or left standing idle for periods >8hrs.

Procedure

1. Check that there is enough oil in the spindle lubrication tank located in the services cabinet. Top-up if necessary.

2. Start the machine at the machine control panel **[MASTER START]**.

3. If the spindle is already fitted with a grinding wheel and quill then make sure that it is clear of the workpiece (if fitted to the workhead) and the dressing tool.

4. Close the operator access guard door.

5. Select **[JOG]** mode and then start the spindle **[SPINDLE START]**. The spindle will start and run at the default speed 5000rpm with the spindle override set to 100%.

   If you want to warm-up the spindle at a higher speed than the default speed, then you can program the required speed in [MDA] mode using the following program command ***S1=****<desired spindle speed in rpm>*.

WARNING
DO NOT run the spindle at maximum speed during the initial warm-up cycle as this could cause result in damage to the internal spindle support bearings.

If spindle warm-up is to be performed with a quill and grinding wheel attached then DO NOT operate or program the spindle speed (RPM) to exceed the maximum rating of the both the quill and the grinding wheel.

6. Let the spindle continue to run uninterrupted for 20~30mins.

7. Stop the spindle **[SPINDLE STOP]**.

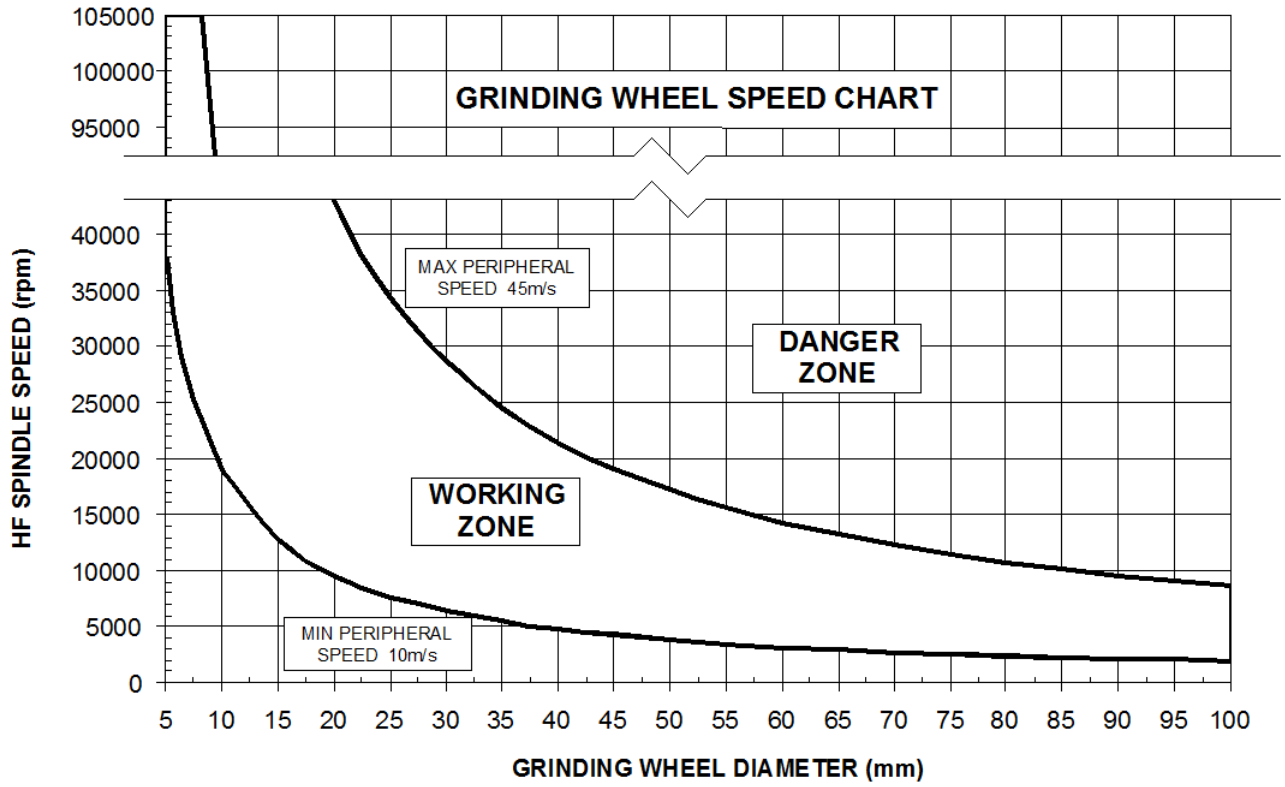
8. The spindle warm cycle is now complete. You can continue to use the machine as normal.

9. Done.

6.6 Grinding Wheel Speed Chart

CAUTION
The programmed speed (RPM) of the grinding spindle must not exceed the maximum rated speed of the quill and the maximum rated speed of grinding wheel fitted to it.

The grinding wheel speed chart shown below should be used as a guide to the permissible wheel surface speeds (in m/s) for the diameter of wheel fitted to the quill.



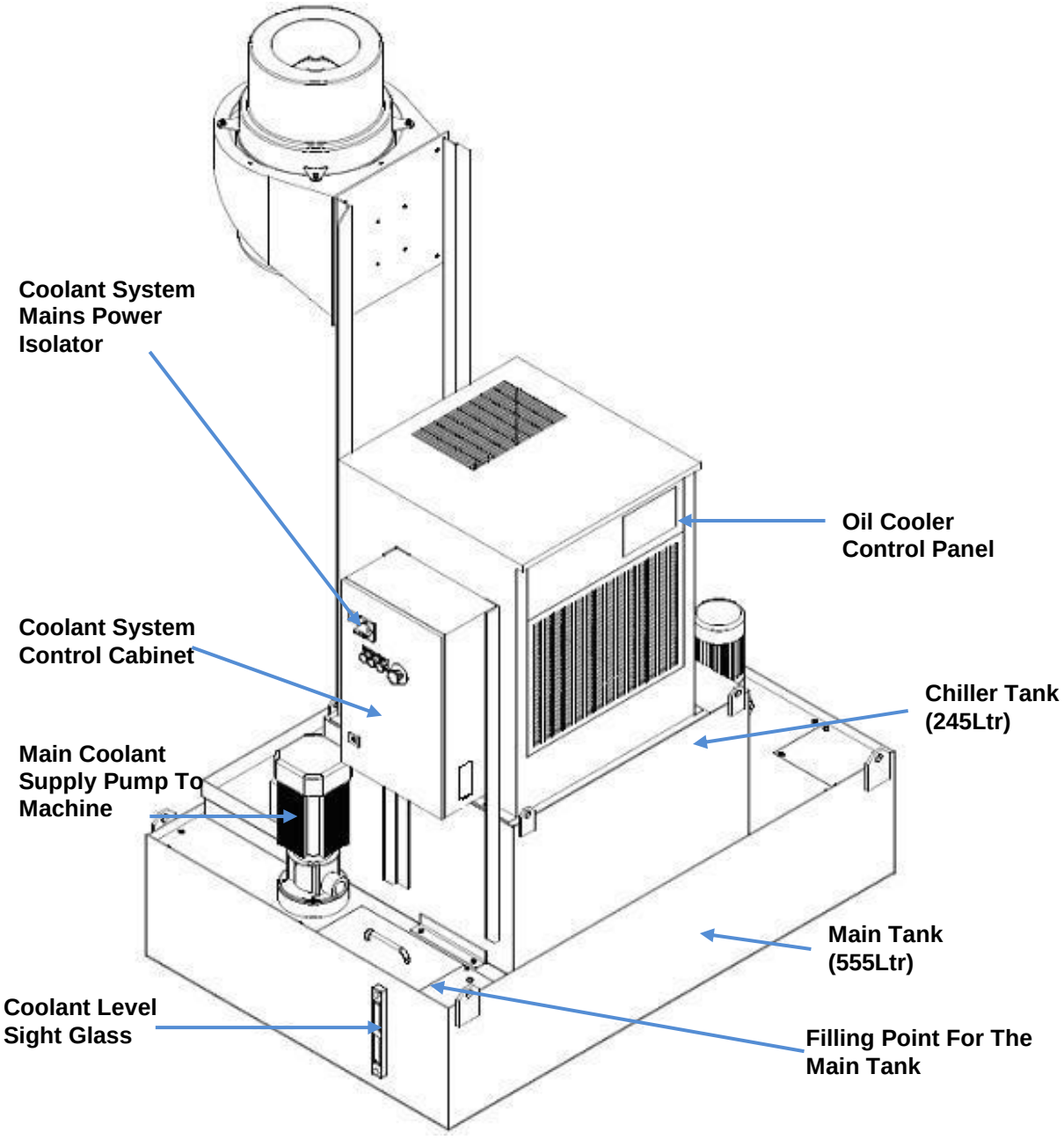
You should ensure that the grinding wheel speed operates within the “Working Zone” shown on the chart.

Using the expression below you can calculate the grinding wheel surface speed (M/s) for a given wheel diameter at a given rotational spindle speed (rpm):

$$Grinding\ Wheel\ Surface\ speed\ (M/s) = \frac{\pi \times Wheel\ diameter\ \times Wheel\ Speed\ (rpm)}{60000}$$

7 Coolant Clarifier System

The centrifugal coolant clarification system is supplied complete with refrigeration unit, magnetic separator and oil level monitoring.



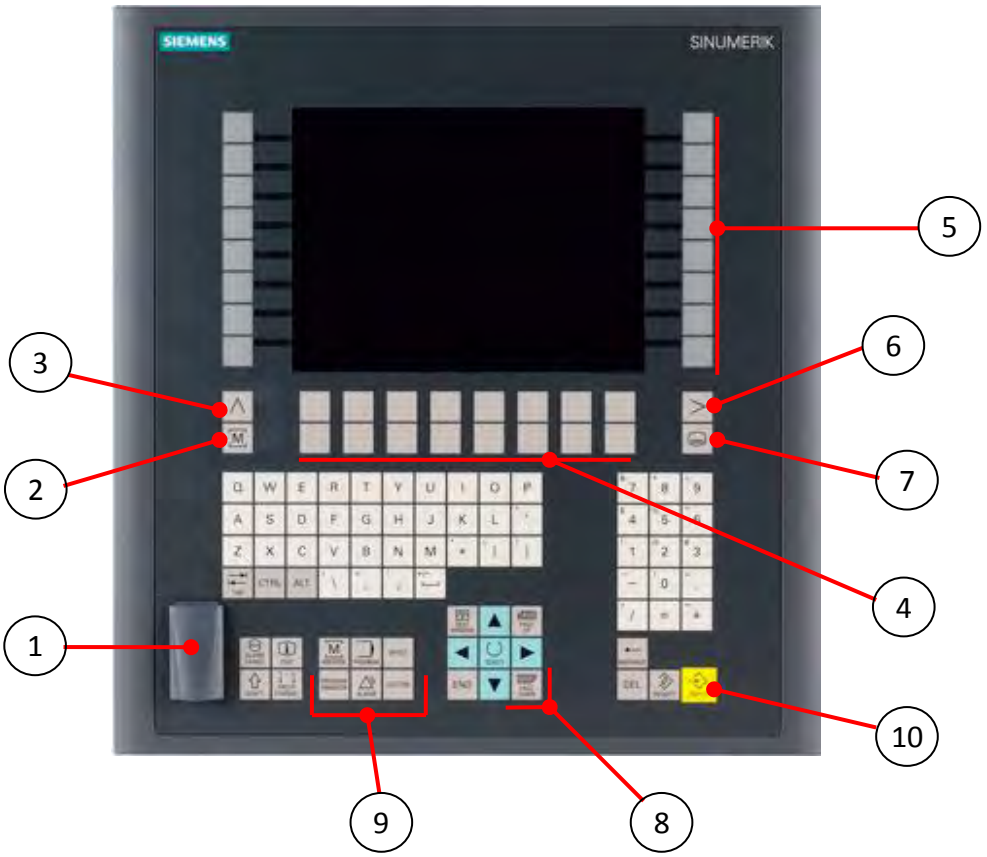
Tank Capacity 800L
Main Tank: 555L
Chiller Tank: 245L

8 Operator Console

The operator console is fixed to the side of the electrical cabinet and comprises of:

1x HMI panel featuring an 8” colour screen with integral keyboard
1x Machine control panel (MCP)
1x Handheld unit featuring a electronic handwheel (MPG) and axis selector switch
1x Ethernet connection port

8.1 HMI panel



1	USB port	6	Etc/ menu extension key
2	Machine area key	7	Area switchover key
3	Recall (return) key	8	Cursor and selection keys (blue)
4	Horizontal function select keys	9	Hot/shortcut keys
5	Vertical function select keys	10	Data input key (yellow)

Hot/shortcut keys

There are 6 hotkeys that the user can choose from in order to quickly select screens that are accessed often during machine operation. In particular, these are:

Direct access to the Program operating area

In the Diagnostics operating area, the last alarms, messages, service displays or PLC status can be called.

Access to Parameters operating area where the last tool offsets are directly called.

Access to the Matrix Advanced Programming and diagnostics screens.

Direct access to Program overview to show the last selected program management.

Direct access to the Machine operating area.

Area switchover key

You can switch to the main menu from any selected operating area by pressing this key. Press the key twice to change from the current operating area to the previous one.

Cursor and selection keys

Using the blue keys you can cursor up/down/left/right on any focusable screen field and then click into the field by pressing the select key.

8.2 Machine Control Panel (MCP)

The machine control panel is used to initiate actions on the machine such as traversing the axes, NC program start, etc. Details of the individual functions are described below.

1	Machine Start/emergency stop reset pushbutton (green illuminated)	7	JOG increment selection INC 1, 10, 100
2	Emergency stop actuator (turn-to-release)	8	Axis selection and manual JOG functions
3	Access rights keyswitch (0= lowest access, 3= highest access)	9	Grinding spindle (S1) start/stop/ speed override controls
4	Cycle/alarm reset button	10	machine axes feedrate override control switch (0% ~ 100%)
5	Cycle start button	11	Machine command functions
6	Control system operating mode JOG / MDA / AUTO		

When a key is pressed on the MCP the corresponding status indicator above the key is illuminated.

Master Start Button/Emergency Stop Reset
Press the green illuminating pushbutton to start the machine ready for operation.

Pre-conditions for the machine to be master started are:

1. All machine and connected auxiliary equipment emergency stop buttons must be in their released state
2. NC control system status OK (i.e. no system alarms)

The machine is ready for operation when the button is illuminated.

Emergency Stop
Push in the red actuator to stop machine operation. You can actuate the emergency stop button at any time when you suspect that there could be risk to your life or damage to the machine.

The emergency stop circuit shuts down all drives with the greatest possible braking torque in a controlled manner.

Warning
The grinding wheel spindle can take several seconds before coming to a standstill after the emergency stop is activated therefore **never** attempt to stop the rotating spindle/quill by hand.

When you actuate the emergency stop power is removed from the following equipment:

- Fume extraction unit
- HF Spindle chiller unit
- Coolant system and centrifuge unit
- Machine lube system
- HF spindle lube system
- Main air supply solenoid valve
- All electro-mechanical valves/actuators

Recovering the machine from an emergency stop

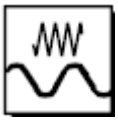
1. Ensure that all emergency stop buttons are in their released state.

2. Press the Master Start button on the MCP.

8.3 CNC operating modes

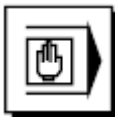
When you select a mode key, the corresponding mode becomes active. The active mode is signalled and confirmed by the associated LED which lights up.

JOG mode



Selection of this mode permits continuous motion of the selected axis using the direction keys or incremental motion using the direction keys or the hand-wheel.

MDA mode



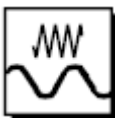
Selection of this mode permits control of the machine through execution of an NC command block (instruction) or a sequence of command blocks.

Program command blocks are entered via the input entry buffer window (bottom LH panel on the Siemens screen)

AUTO mode

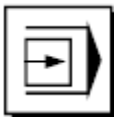
Selection of this mode permits control of the machine through the automatic execution of a sequence NC command instructions i.e part programs.

TEACH-IN mode



Selection of this mode permits you to create and execute interactive programs with the machine set in MDA or AUTO mode.

SINGLE BLOCK



Select this function if you want to execute part program commands one block at a time in MDA or AUTO mode.

Single Block can be de-selected at any time during program execution and the cycle continued un-interrupted by pressing the [CYCLE START] button again.

8.4 Program Cycle Start/Reset

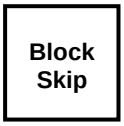
CYCLE START

Press this key to start execution of the loaded part program/cycle (displayed at the top of the screen) in AUTO or program command blocks entered in MDA mode.

The LED indicator above the key is illuminated whilst the cycle is active.

Note: The **[CYCLE STOP]** key is not used and has intentionally been disabled in the machine control software. Pressing this key has no effect.

BLOCK SKIP



Press this key at any time that you want to interrupt the grinding cycle whilst it is executing. You will most likely to use this function when you want to inspect the grinding wheel condition, inspect the workpiece or make any changes to the cycle data.

When block skip is activated the current grinding pass will complete and then move the grinding wheel clear of the workpiece to a safe position and then stop.

You can then make any changes required to the grinding cycle data or diameter, lead or profile corrections if necessary before resuming the cycle.

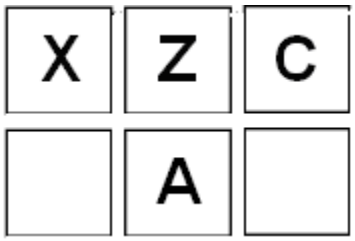
De-select **[BLOCK SKIP]** and then press the **[CYCLE START]** key to resume the grinding cycle.

RESET

Press the reset key at any time to abort (reset/rewind) the active program OR to clear an active alarm message when a cycle is not executing.

8.5 Axis selection and speed controls

AXIS SELECTOR

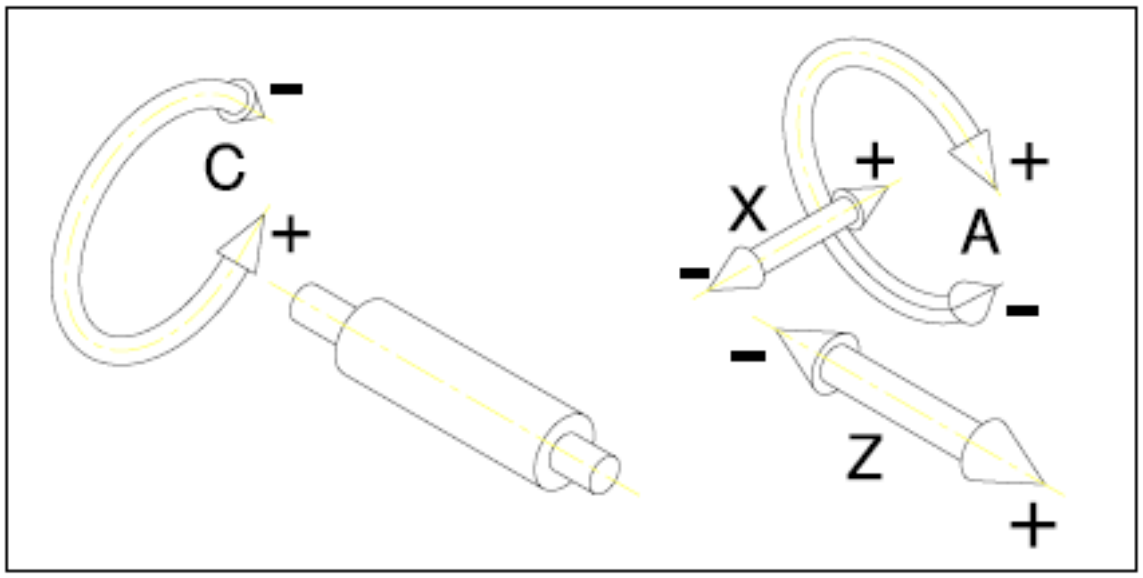


Press an axis letter key to select it. The indicator above the key will illuminate to signify the axis you have selected.

Note: multi-axis selection is not permitted.

You can now use the [+] and [-] jog keys to position the selected machine axis.

Note: When the **[HANDWHEEL]** function is enabled then axis selection is selectable only from the hand held unit.



JOG COMMAND

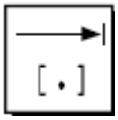
Press the [+] key to jog the selected axis in its positive direction axis in JOG mode.

Press the [-] key to jog the selected axis in its negative direction axis in JOG mode.

To jog the selected axis faster press and hold the [RAPID] key together with jog direction key [+] or [-].

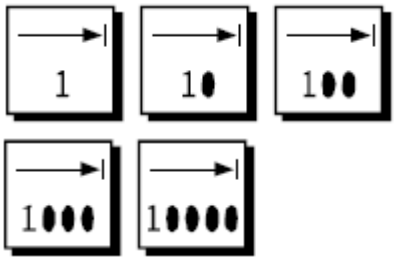
Use of the incremental jog selection keys described below is permitted in JOG, MDA or TEACH-IN modes.

JOG VARIABLE INCREMENT



Press this key if you want to jog the selected axis by an incremental amount as defined in the Siemens machine area screen (Machine > INC softkey)

JOG INC 1, 10, 100

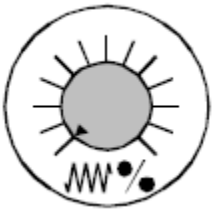


Select to jog the selected axis by a preset incremental amount with each press of the jog [+] or [-] key.

1 = 0.001mm (1micron)
10 = 0.01mm (10micron)
100 = 0.1mm (100micron)
1000 = 1mm increment selection not permitted
10000 = 10mm increment selection not permitted

When the **[HANDWHEEL]** function is enabled you must select a jog increment before the handwheel can be used.

AXIS FEEDRATE OVERRIDE

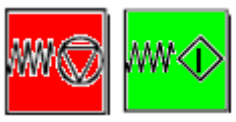


This rotary switch allows you to proportionally control the programmed machine axis speed during automatic cycle operation.

The switch is marked 0% to 120%.
All axis motion on the machine stops if the switch is set at 0% in any operating mode.

Set the switch at 100% (or above) to allow the machine axes to move at the programmed feedrate.

FEED START/STOP



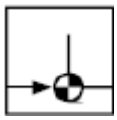
Feed start/stop functions are not selectable.

The feed stop function is always disabled.
The feed start function is always enabled.

8.6 Axis Reference

The 3060 machine is fitted with absolute axis position encoders throughout as standard, so it is not necessary to reference the machine when it has been powered on because the control system knows the position of all configured axes at all times.

AXIS REFERENCE MODE



The axis reference function can only be select when JOG mode is active.
On the 3060 machine manual or automatic axis referencing is not necessary. Therefore, this function should not be used establish machine axis datums.

8.7 Grinding Spindle Controls

SPINDLE SPEED OVERRIDE

The spindle speed can be controlled in proportional amount from 50% to 100% of the programmed spindle speed.

Press the [SPINDLE INC] key to increase the spindle speed by a proportional amount.

Press the [SPINDLE DEC] key to decrease the spindle speed by a proportional amount.

Press the [100%] key to set the spindle speed operate at its programmed speed.

SPINDLE START

Select JOG mode and then press this key to start the grinding spindle. The spindle will start to rotate upto its default speed 5000rpm.

Indicator status meaning:
Flashing: true whilst the spindle is running upto speed or during a speed change i.e ramp-up/ramp-down.
ON: spindle is operating at its commanded speed.
OFF: spindle is stopped.

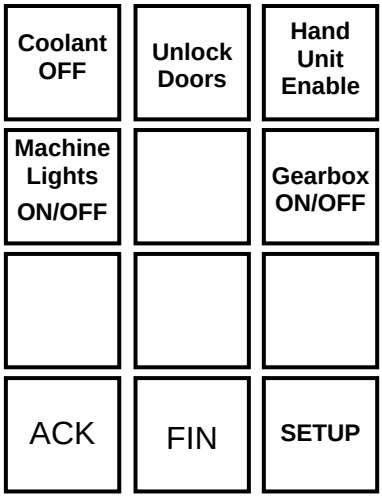
SPINDLE STOP

Select JOG mode and then press this key to stop the spindle.

Indicator status meaning:
ON: spindle is in stopped state
OFF: spindle is running.

8.8 Command functions

A selection of command functions are provides for your convenience.



The bottom row of function keys [ACK], [FIN] and [SETUP] are generally used when the grinding or setting cycles are used.

COOLANT ON/OFF

Coolant OFF

Coolant supply ON/OFF toggle.
The indicator above the key is illuminated then coolant supply to the machine is disabled i.e No basewash, grinding or dressing coolant permitted.

UNLOCK DOOR

Unlock Doors

Guard door unlock request.
Press this key to unlock the guard door when there is no active cycle running.
The indicator above the key flashes to inform you when the door is unlocked.

HAND UNIT ENABLE/DISABLE

Hand Unit Enable

Hand held unit ON/OFF toggle.
Press this key if you want to use the hand held unit functions.
The indicator above the key is illuminated when the handheld unit function is enabled.

MACHINE LIGHT ON/OFF

Machine Lights ON/OFF

General machine lights ON/OFF toggle.

GEARBOX ON/OFF

Gearbox ON/OFF

C/Z axis gear link ON/OFF toggle.

Press this key to link the C and Z axes together. Z axis jog is not permitted when the gearbox function is activated. However, when the C axis is jogged the Z axis will follow according the established C/Z gear ratio used by the active workpiece.

Use this function out-of-cycle when you need to test the relative position of the grinding wheel to the pre-cut workpiece thread or other inspection.

YES ACKNOWLEDGE

ACK

Used in conjunction with the Matrix cycles, to acknowledge dialog prompt messages that presented during cycle execution.

FINISH ACKNOWLEDGE

FIN

Used in conjunction with the Matrix cycles, to acknowledge the completion of a setup cycle sequence.

SETUP MODE

SETUP

Setup mode ON/OFF toggle.

Select this mode prior to executing any of the matix setting cycles i.e NEW WHEEL, SET WORK DATUM, PITCHIN, etc.

Note: When Setup mode is enabled then the machine is permitted to operate in cycle without doors closed, spindle running, coolant. Therefore, DO NOT attempt to run the grinding cycle with setup mode enabled!

9 Dialog Programming

The Matrix Interface is dialogue box, interactive menu driven, parametric programming system. The application enables quick set-up times due to the user friendly menu system. All of the parameters required for controlling the grinding and dressing processes only require simple parameter input, no prior CNC programming knowledge is required.

Under normal operating conditions the operator will have the Siemens Key in position 1. This ensures that if the operator opens the front door while the spindle is running then the wheel speed will drop to the de-fault speed, also the front door will be locked during an automatic cycle.

9.1 Displaying the Main Menu

[Custom > Matrix > Main Menu]

Press the **[CUSTOM]** key on the HMI panel to display the Matrix HMI menu screen then select the **[Main Menu]** softkey to display the main menu screen as shown below:

You can exit from any active Matrix HMI interface screen and return to the Siemens machine interface at any time by pressing the **[MACHINE]** key on the HMI panel.

Note: If you later press the **[CUSTOM]** key to get back to the Matrix interface screen then the previously selected Matrix screen is displayed and not the Main Menu screen. However, you can always get to the Main Menu screen from any other screen by selecting the **[Main Menu]** softkey.

9.2 Work piece Manager

[Custom > Matrix > Workpiece Manager]

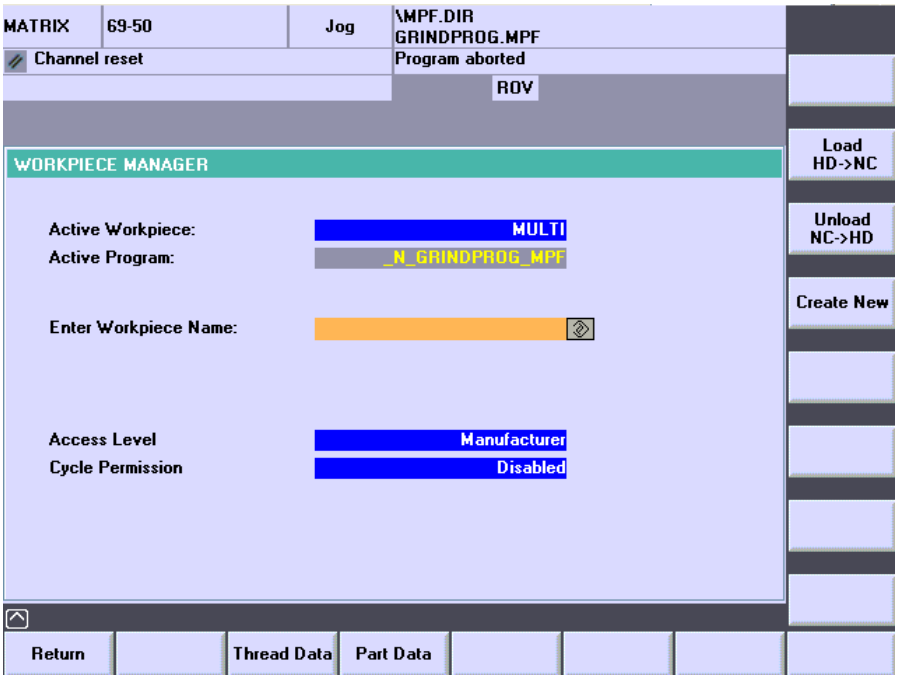
Before you can run any setup cycle or start to do any grinding on the machine you must load a workpiece (sometimes called a job file) to the NC. If there are no existing workpieces listed in the workpiece folder (Machine > Programs > Workpiece) available to use then you must create a new one.

9.2.1 Create and Load a new workpiece

1. Set the ORANGE Siemens Key to position 3 on the MCP.

2. Select [AUTO] and [SETUP] mode.

3. Select [Workpiece Manager] softkey from the main menu.



4. Enter a name (max 8 of characters) for a workpiece that you want to grind in the Enter Workpiece Name input field followed by pressing the yellow [INPUT] key on the HMI panel.

5. Select the [Create New] softkey to generate the workpiece data files and populate the Part Data fields with default data that you can edit.

6. Select the [Load HD >NC] softkey to load the workpiece data into the NC memory.

7. Select the [Return] softkey to return to the main menu screen.

9.2.2 Load an existing workpiece

1. Insert the ORANGE Siemens Key in position 3.

2. Select Select [Workpiece Manager] softkey from the main menu.

3. Enter a name (max 8 of characters) of an existing workpiece name that you want to use followed by pressing the yellow [INPUT] key.

4. Select the **[Load HD >NC]** softkey to transfer the stored workpiece data into the NC memory and make this the active workpiece. This action will restored part data and cycle data information for the workpiece.

5. Select the **[Return]** softkey to return to the main menu screen.

9.2.3 Unload the workpiece

1. Insert the ORANGE Siemens Key in position 3.

2. Select Select **[Workpiece Manager]** softkey from the main menu.

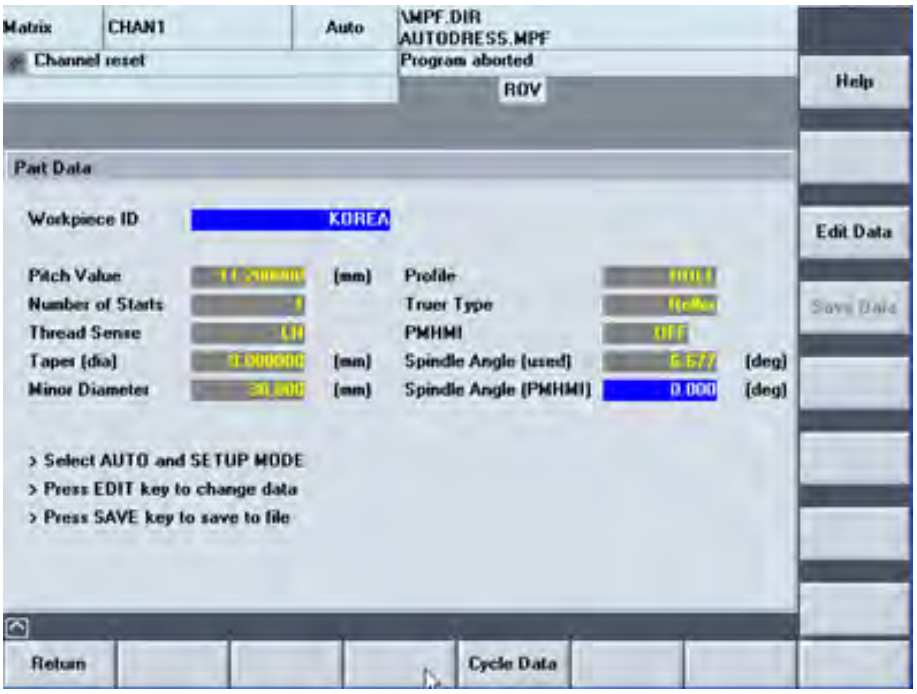
3. To unload the active workpiece enter the name of the active workpiece in the input field and then select the **[Unload NC > HD]** softkey.

4. Select the **[Return]** softkey to return to the main menu screen.

9.3 Part Data

[Custom > Matrix > Main Menu > Part Data]

The Part Data screen defines the workpiece thread profile requirement to the machine.



Before proceeding to grind a workpiece thread you **must** enter part data about the workpiece to be ground.

9.3.1 Edit and Verify Part Data

1. Select the **[PART DATA]** softkey from the main menu screen.
2. Set the orange keyswitch to position 3 on the MCP
3. Select **[AUTO] + [SETUP]** mode on the MCP
4. Select the **[EDIT DATA]** softkey in the Part Data screen
5. Enter or edit data in each input field as required followed by pressing the yellow **[INPUT]** key on the HMI panel
6. Select the **[SAVE DATA]** softkey when you have finished entering the part data.
7. Wait until you see the message ***"DATA VERIFICATION PASSED"*** appear.
   Note: If you do not see this message then that means there is an error with the data you entered. Therefore, you must check and re-enter the part data from step 4 again.

9.3.2 Explanation of the Input Parameters

Pitch value
Input Range: 0 – 100 mm
This is the axial pitch of the thread to be ground.

Number of Starts
Input Range: 1 - 12
This is the number of threads or starts to be ground on the workpiece

Thread Sense
Input selection: LH or RH
If the workpiece has a left-hand thread then select LH
If the workpiece has a right-hand thread then select RH
Press the blue **[Select]** key on the HMI panel to toggle between LH or RH thread.

Taper (dia)
Input range: 0 – 0.5 mm/mm
Amount of taper required on the workpiece.

Minor Diameter
Input range: 5 – 100 mm
Root or minor diameter of the workpiece thread.

This is the diameter at which the workpiece grinding will start. When establishing the minor diameter value, check the diameters of all of the components in the batch to be ground before you begin to run any setup cycles. Usually there will be some variation in start diameters so you should determine which component in the batch has the smallest minor diameter.

Profile
Name of the dress profile program that you want to use.
Note: This only applies when the PMHMI flag is OFF.

If you are using a diamond disc then enter the name of the dress profile program that you created with the Ball Profile software which has already been copied and loaded to the Sub-Programs folder in the PCU50. Leave this field blank if you are using a diamond roll.

Truer Type
Input selection: DISC or ROLL

If you want to use a diamond roll to condition the grinding wheel then select ROLL.
If you want to use a diamond disc or single point diamond to condition the grinding wheel then select DISC. Press the blue [Select] key on the HMI panel to toggle between DISC or ROLL.

PMHMI
Input selection: OFF or ON
Select if you are want to use the automatically generated dress program ACTIVEDRESS.SPF created with the PMHMI application using the thread profile and tool data you selected in the [Thread Data] screen.

Spindle Angle (used)
Input range: +/- 15°
Enter the grinding wheel helix angle that you want to use if you set PMHMI=OFF

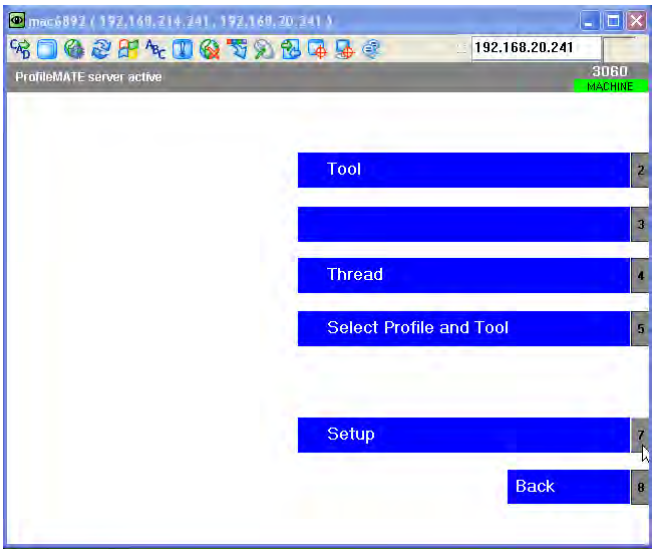
Spindle Angle (PMHMI)
READ ONLY field
This field displays the grinding wheel helix angle calculated by PMHMI.

9.4 Thread Data (PMHMI)

[Matrix] > [Main Menu] > [Thread Data]

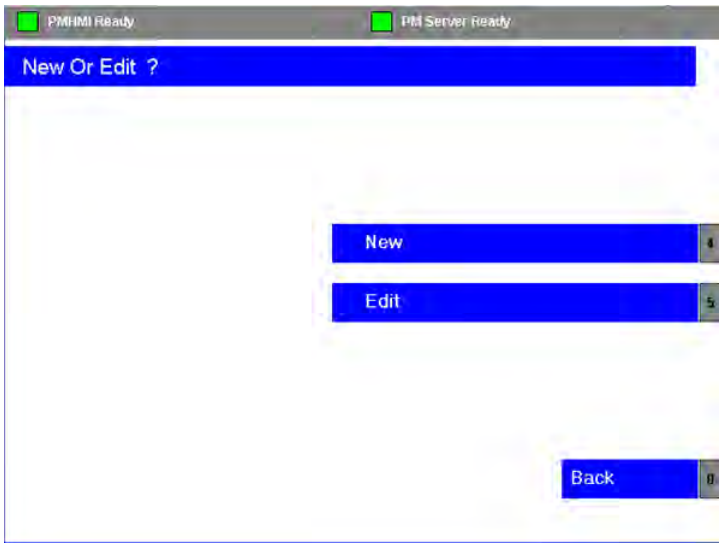
9.4.1 Create New Thread

1. Select the [Thread Data] softkey from the main menu screen to access the PMHMI thread and tool menu screen.

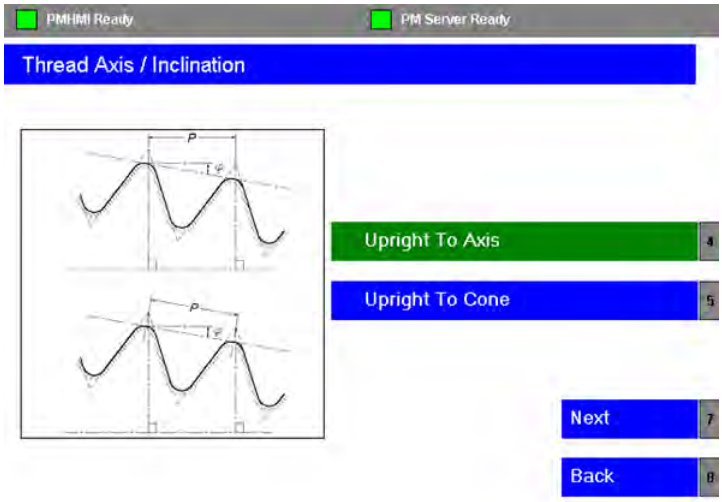


2. Select the [Thread] softkey

3. You are now prompted to create a new profile or edit an existing one. Select the [New] softkey to start creating a new thread profile.



4. How is the workpiece thread form defined on the manufacturing drawing?



Tapered Thread

If the workpiece is tapered then you need to determine how the taper thread has been defined. Is it relative to the axis or cone (slope) of the workpiece surface?

Select [Upright To Axis] softkey if the thread pitch dimension is specified axially to the workpiece (see fig 1 below) followed by selecting the [Next] softkey to continue.

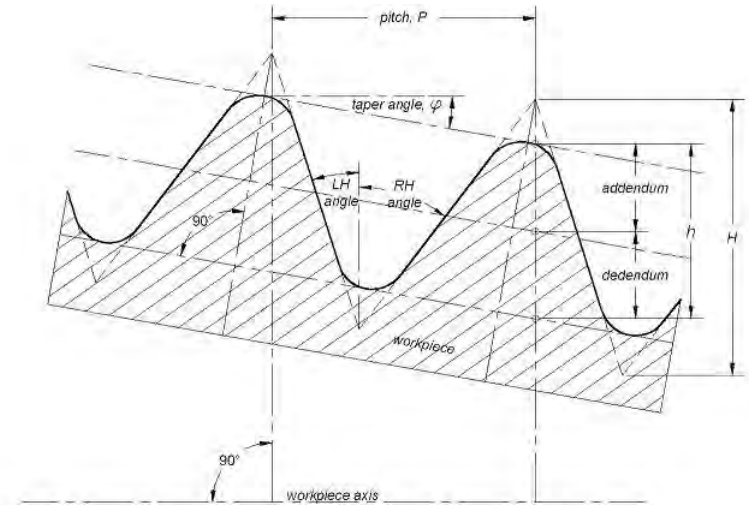


Fig.1 thread specified upright to the axis

Select [Upright To Cone] softkey if the thread pitch dimension is specified to the taper of the workpiece (see fig.2 below) followed by selecting the [Next] softkey to continue.

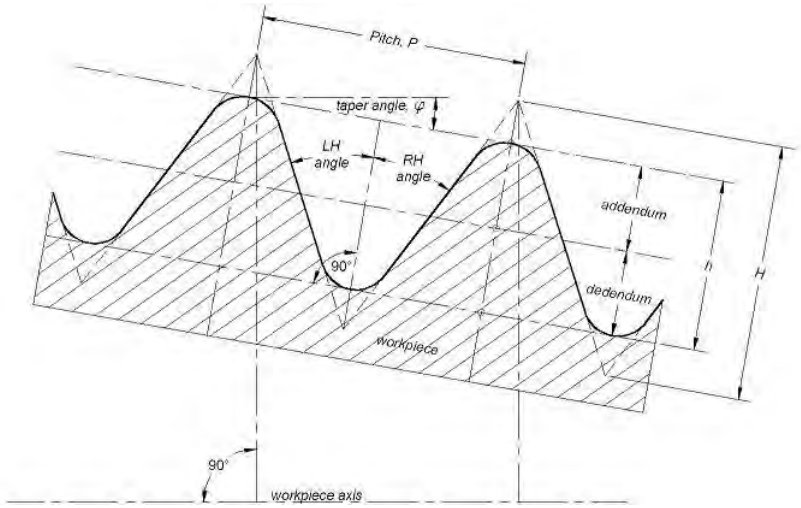


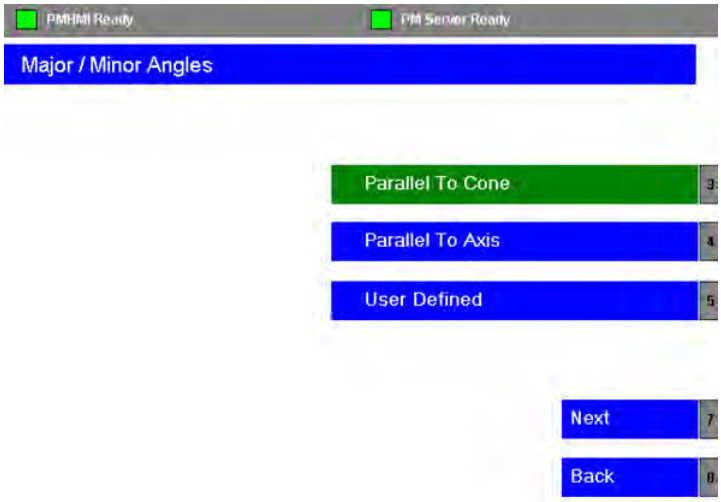
fig.2 thread specified upright to the cone

Parallel Thread

If the workpiece is parallel then you can select either [Upright To Axis] or [Upright To Cone] softkey followed by selecting the [Next] softkey to continue.

Note: the selection you make is highlighted in green.

5. What form does the thread take at the major and minor diameters?



Choose an option:

[Parallel To Cone]

Common thread forms are usually defined as being parallel to the cone.
Select [Parallel To Cone] followed by [Next] softkey to continue.

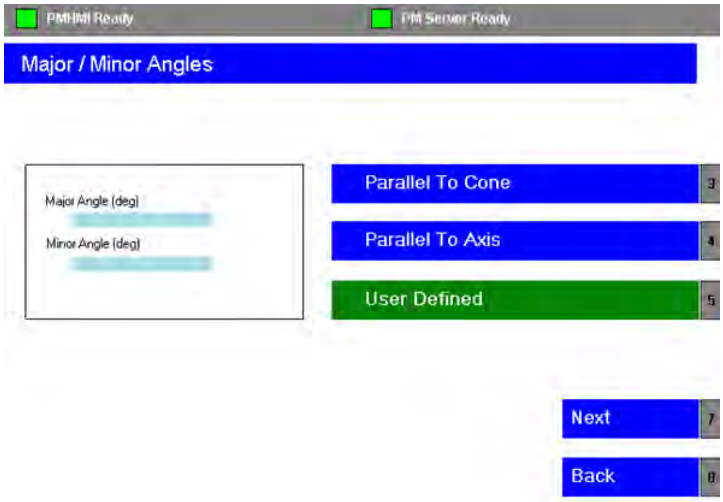
[Parallel To Axis]

Some axial thread types (such as API spec 5B BCSG sizes 16 and above) are actually defined such that the tip and root of the thread are parallel to the workpiece axis.
Select [Parallel To Axis] followed by [Next] softkey to continue.

[User Defined]

This option allows you to independently define the slope of the thread at the major and minor diameters.

Select [User Defined] followed by [Next] softkey to continue. You are then presented with the data input screen below:



Enter the Major (addendum angle) and Minor (dedendum angle) angle values in the input fields and then select the [Next] softkey to continue. The angle can be specified as a positive or negative value. Fig.3 below shows the affect that positive major/minor angle has on the thread profile.

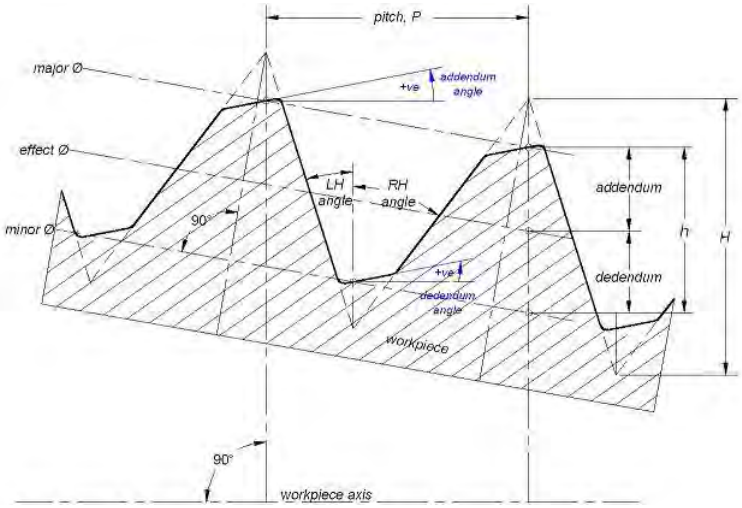
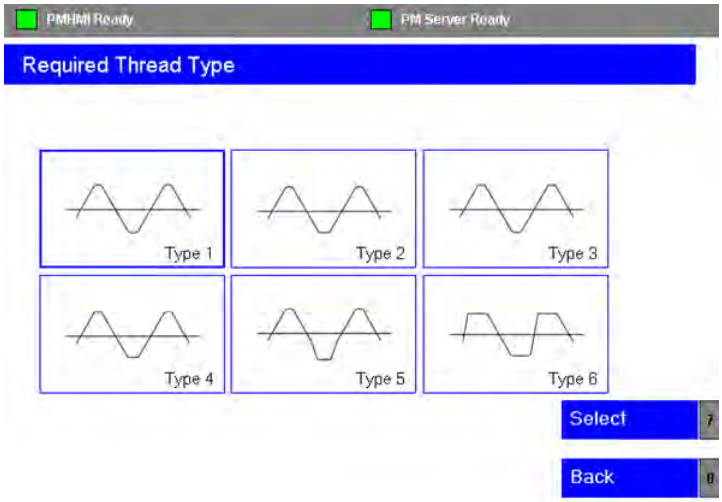


Fig.3 user defined major/minor angles

6. If all has gone well so far you should now have reached the point where you are presented with the Thread Type options screen as shown below:



7. Select Type 1 if to want to create a thread with radii at the crest and root.
   Select Type 2 if to want to create a thread with radius at the crest and flat at the root.
   Select Type 3 if to want to create a thread with flat at the crest and a radius at the root.
   Select Type 4 if to want to create a thread with flats at the crest and root.
   Select Type 5 if to want to create a thread with parted-out root.
   Select Type 6 if to want to create a thread with buttress form.

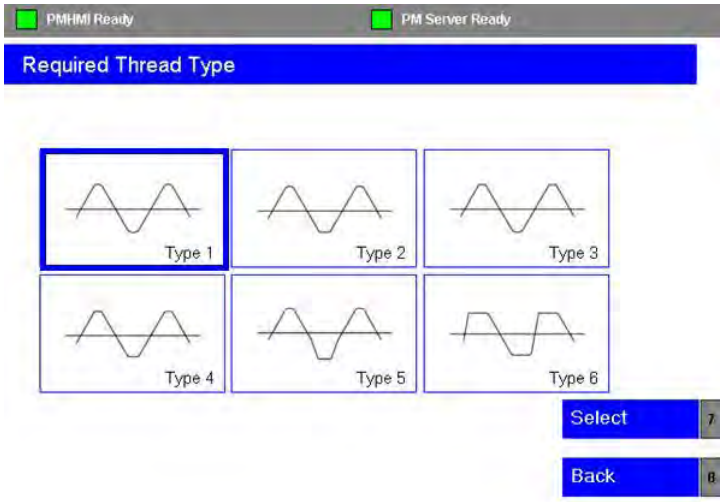
   Highlight the thread type that you want to create using the blue cursor buttons on the HMI panel and then press the [Select] softkey to continue.

9.4.2 Thread Parameter List

Parameter	symbol	range	units
Addendum Height This is the height of the thread above the effective diameter	*a*		mm
Left Hand Flank Correction This parameter is an adjustment of the LH side of flank from the nominal LH flank angle			deg
Righ Hand Flank Correction			deg
Dedendum Height This is the height of the thread below the effective diameter	*d*		mm
Name This is the name of the thread profile			
Pitch	*P*		mm
Left Hand Flank Angle	ϑ_1		deg
Right Hand Flank Angle	ϑ_2		deg
Effective Diameter	*E*		mm
Starts			
Taper Rate			
Number of Ribs This is the number of ribs you want to put on the grinding wheel with the same profile			

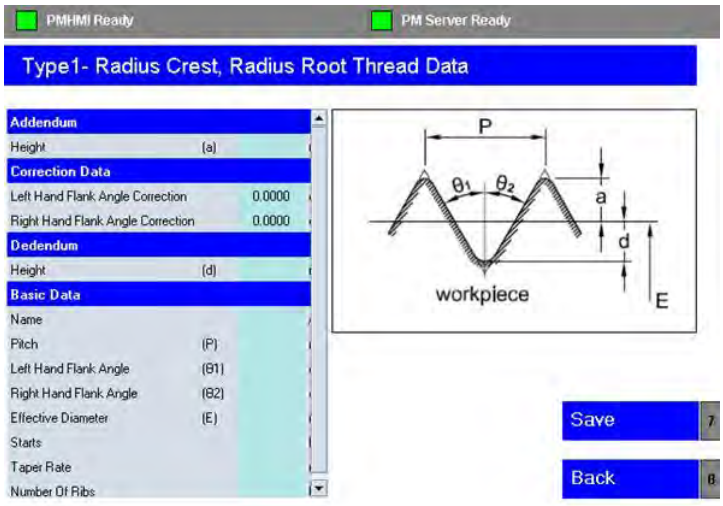
9.4.3 Thread Type 1

This thread option lets you proceed to define a thread profile where the thread crest and root are radii.



1. Highlight the Type 1 icon using the blue arrow keys on the HMI panel or by using the TAB key.

2. Select the [Select] softkey to continue to the input data screen.



3. Enter the thread definition data in the table.
   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

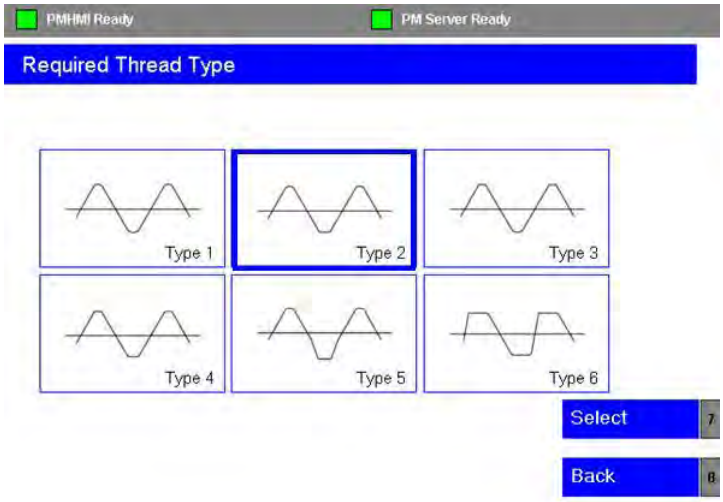
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

4. After you have finished inputting the thread data select the [Save] softkey to continue.

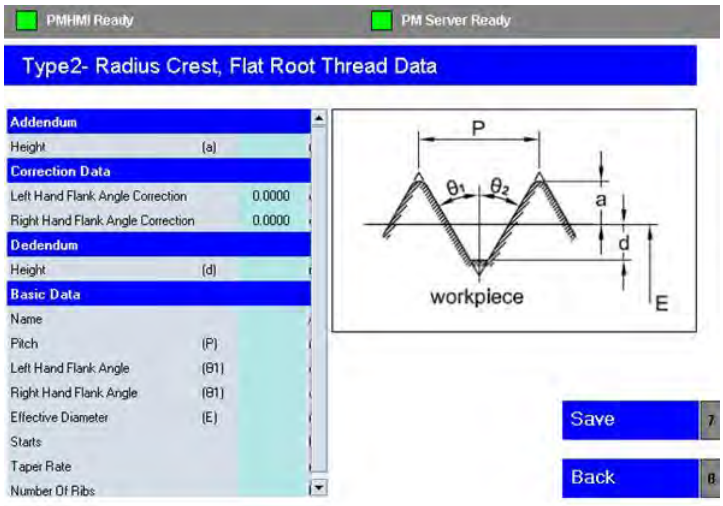
9.4.4 Thread Type 2

This thread option lets you proceed to define a thread profile where the thread crest has a radius and root is flat.



1. Highlight the Type 2 icon using the blue arrow keys on the HMI panel or by using the TAB key.

2. Select the [Select] softkey to continue to the input data screen.



3. Enter the thread definition data in the table.
   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

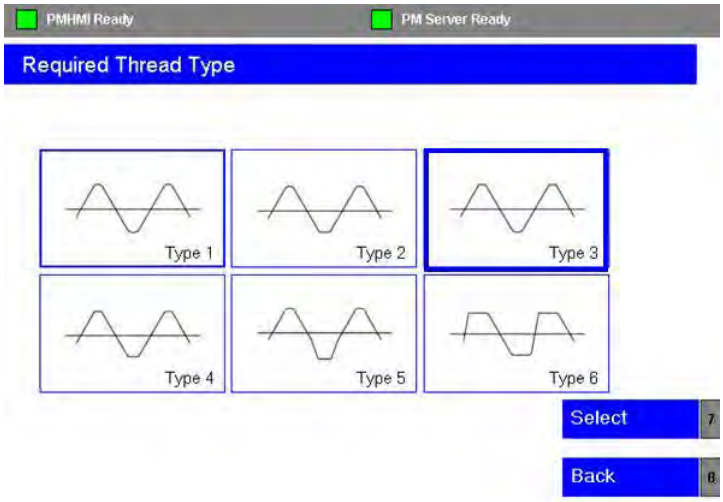
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

4. After you have finished inputting the thread data select the [Save] softkey to continue.

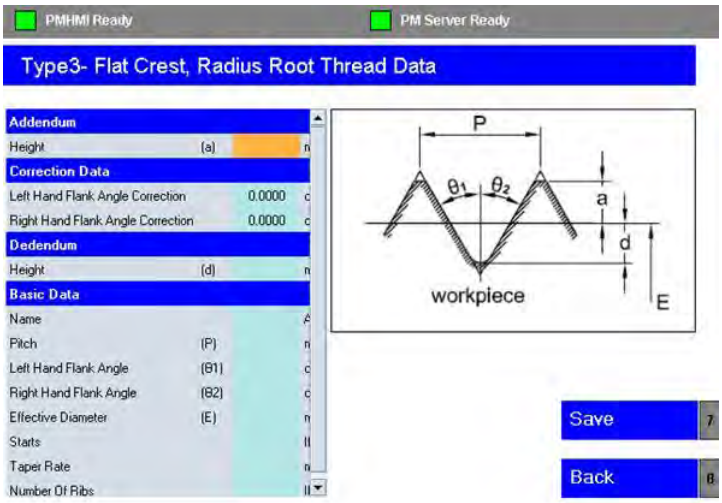
9.4.5 Thread Type 3

This thread option lets you proceed to define a thread profile where the thread crest has a flat and root has a radius.



1. Highlight the Type 3 icon using the blue arrow keys on the HMI panel or by using the TAB key.

2. Select the [Select] softkey to continue to the input data screen.



3. Enter the thread definition data in the table.
   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

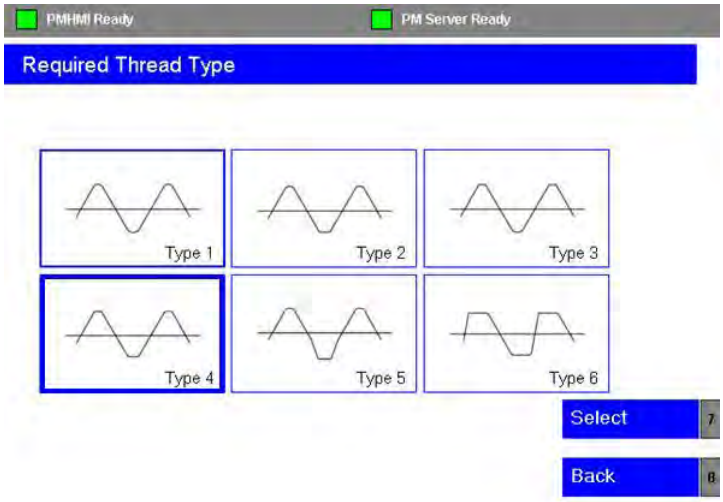
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

4. After you have finished inputting the thread data select the [Save] softkey to continue.

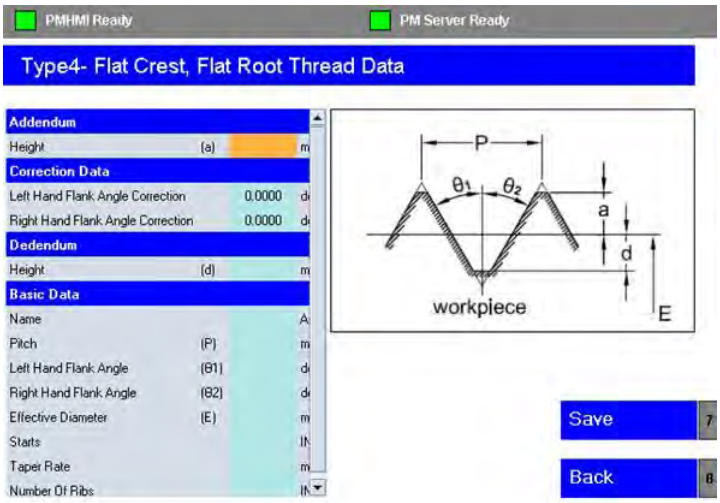
9.4.6 Thread Type 4

This thread option lets you proceed to define a thread profile where the thread crest and root are flat.



1. Highlight the Type 4 icon using the blue arrow keys on the HMI panel or by using the TAB key.

2. Select the [Select] softkey to continue to the input data screen.



3. Enter the thread definition data in the table.
   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

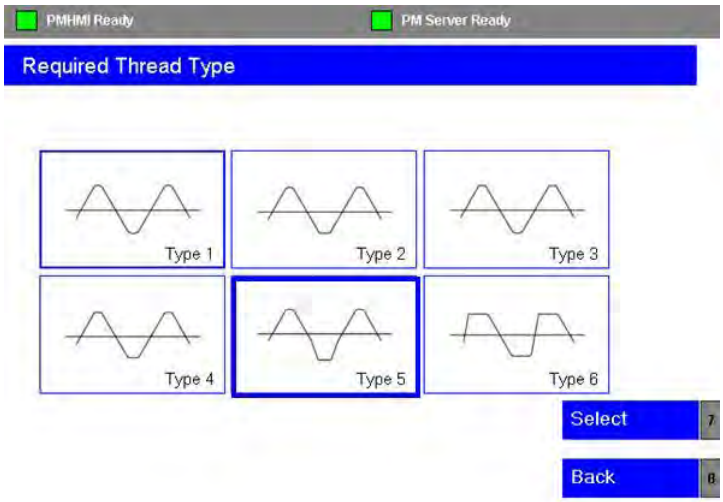
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

4. After you have finished inputting the thread data select the [Save] softkey to continue.

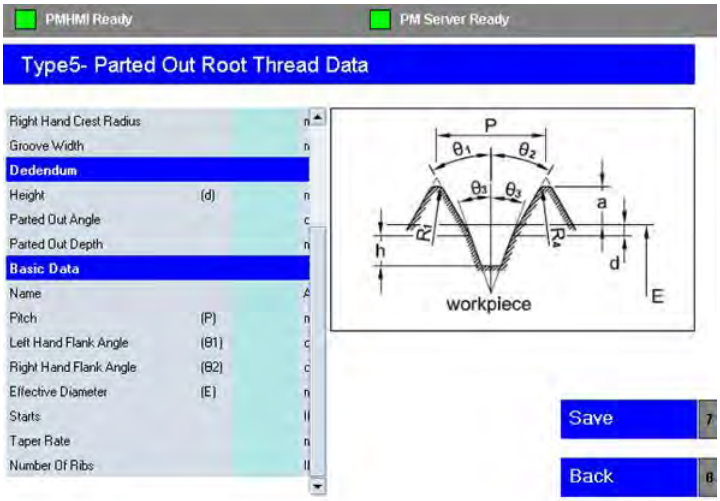
9.4.7 Thread Type 5

This thread option lets you proceed to define a thread profile with a parted-out root for an external thread (or parted-out crest for an internal thread).



1. Highlight the Type 5 icon using the blue arrow keys on the HMI panel or by using the TAB key.

2. Select the [Select] softkey to continue to the input data screen.



3. Enter the thread definition data in the table.
   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

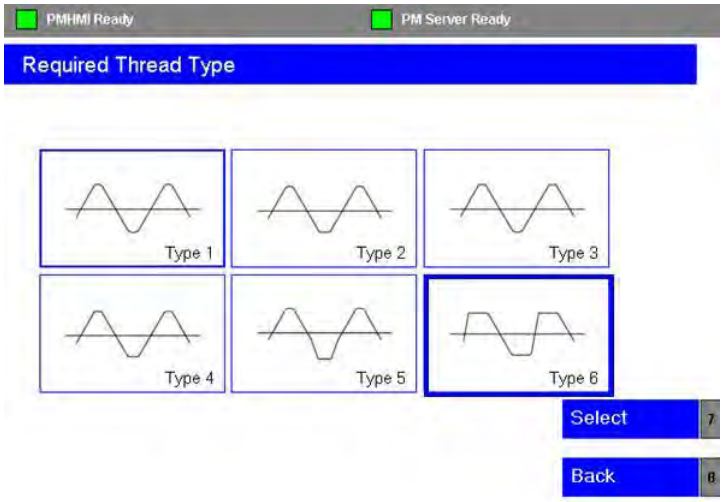
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

4. After you have finished inputting the thread data select the [Save] softkey to continue.

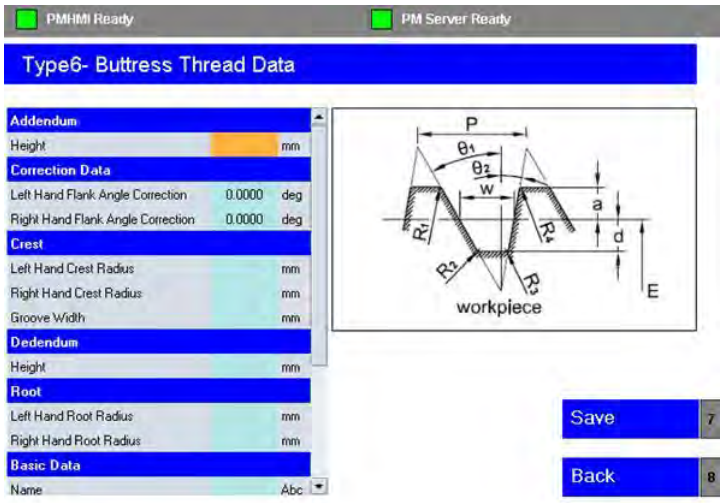
9.4.8 Thread Type 6

This thread option lets you proceed to define a thread profile with a buttress form.



1. Highlight the Type 5 icon using the blue arrow keys on the HMI panel or by using the TAB key.

2. Select the [Select] softkey to continue to the input data screen.



3. Enter the thread definition data in the table.
   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

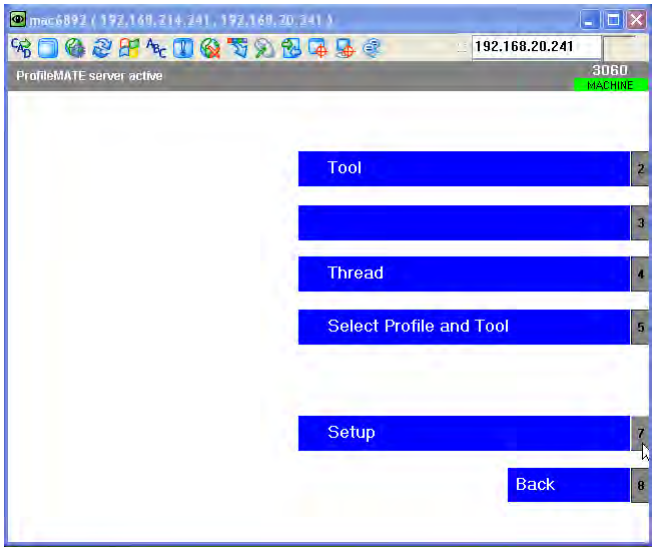
   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

4. After you have finished inputting the thread data select the [Save] softkey to continue.

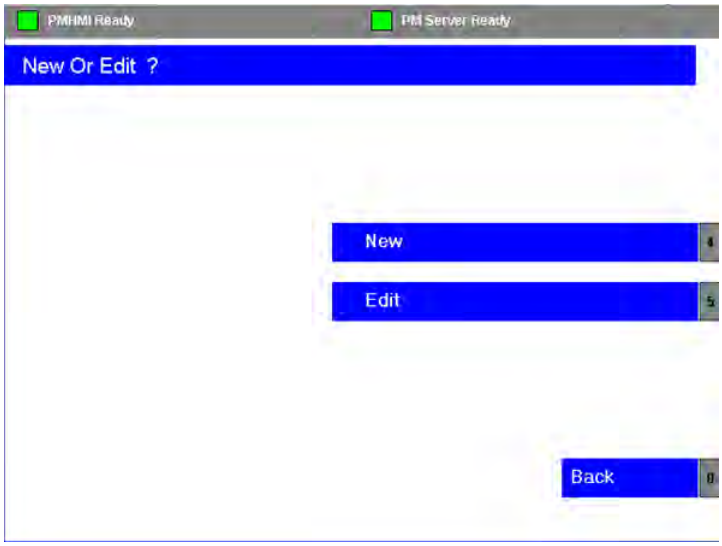
9.5 Create New Tool

[Matrix] > [Main Menu] > [Thread Data]

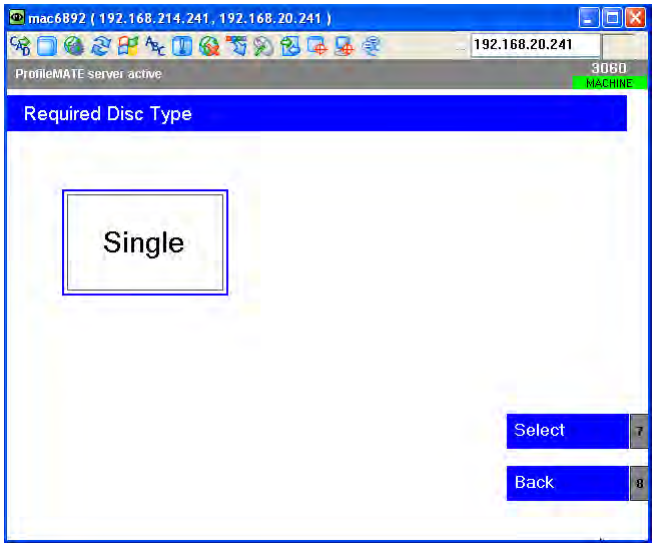
1. Select the [Thread Data] softkey from the main menu screen to access the PMHMI thread and tool menu screen



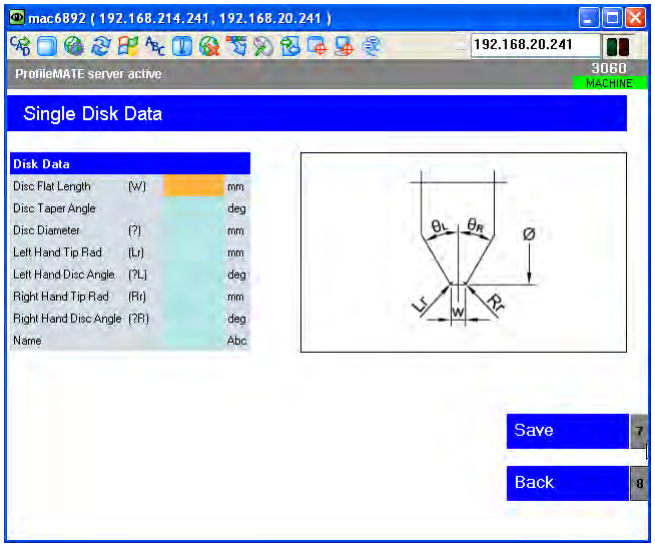
2. Select the [Tool] softkey
   You are now prompted to create a new tool or edit an existing one. Select the [New] softkey to start creating a new tool.



3. Highlight the Tool Type icon using the blue arrow keys on the HMI panel or by using the TAB key.



4. Select the [Select] softkey to continue to the input data screen.



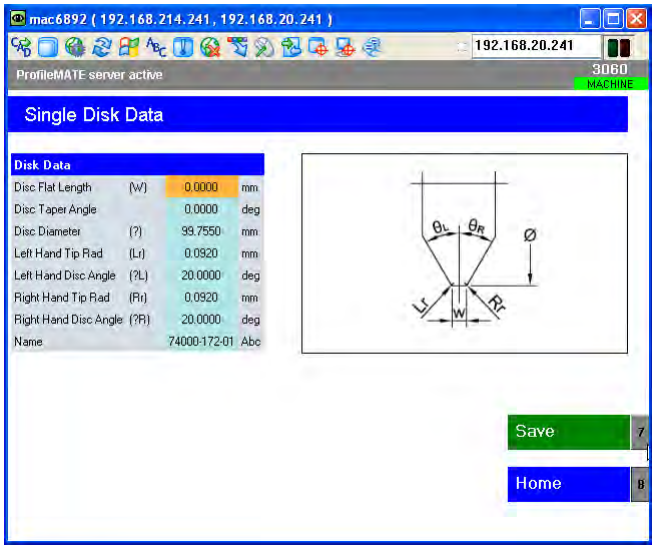
5. Enter the tool definition data in the table as required

   To enter data select the first input field in the table using the TAB key on the HMI panel. Input the required value from the keyboard followed by pressing the yellow [INPUT] key on the HMI panel.

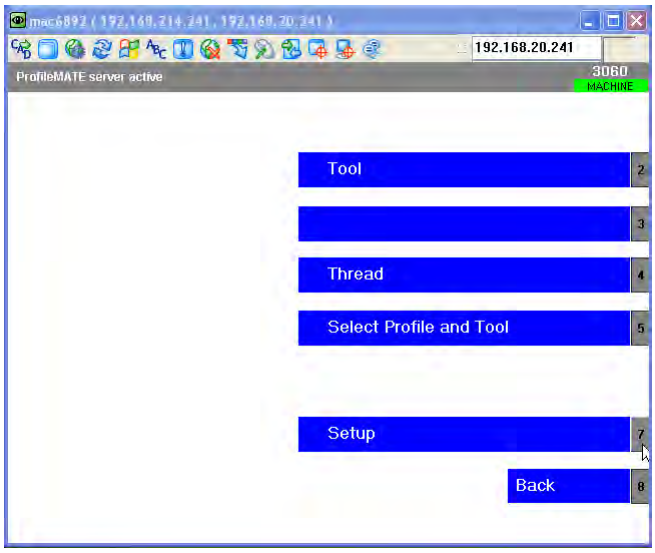
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

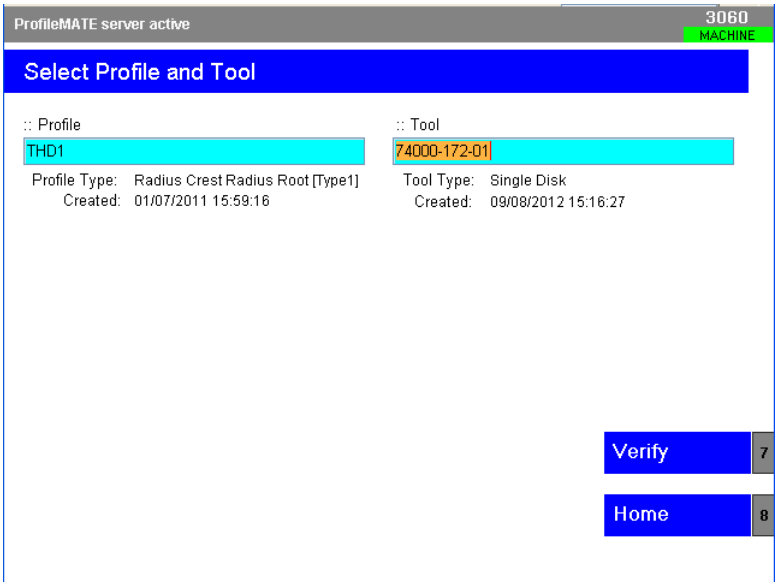
6. After you have finished inputting the thread data select the [Save] softkey to continue.



7. Select the [Home] softkey to return to the home screen.



8. Select the [Select Profile and Tool] softkey.



9. Press the [TAB] key to highlight the Profile field.

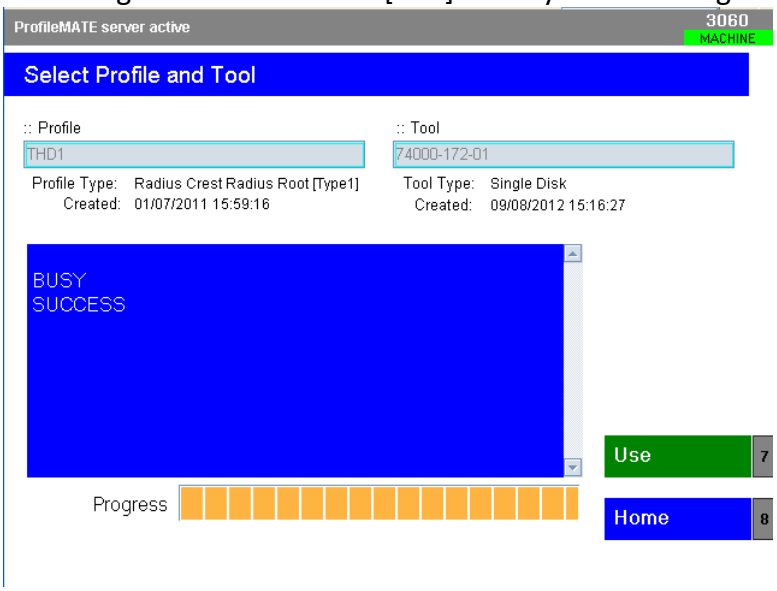
10. Using the blue up/down arrow keys scroll down the list and choose the profile that you want to use.

11. Press the [TAB] key again to highlight the Tool field.

12. Using the blue up/down arrow keys scroll down the list and choose the tool that you want to use to dress the profile onto the wheel.

13. Press the **[Verify]** softkey. PMHMI will now process the select profile and tool data and attempt to generate the dressing program.

14. If all has gone well then you should see status change and look like the screen below with the BUSY - SUCCESS message returned and the [USE] softkey colour changed from blue to green.



If PMHMI has returned an error message, then there was something incorrect with the profile data or with the tool you chose to dress the profile. Analyse the returned message and try again!

15. Press the [Use] softkey > [Home] softkey > [Back] softkey to return back to the main programming dialog screen.

9.6 Grinding Cycle Overview

[Custom > Matrix > Main Menu > Grinding Overview]

This overview screen is for the main grinding cycle. When each step in the setting process has been completed then this screen is selected in prior to starting the grinding process.

With the exception of **Cycle Hold** and **Restart at current diameter**, all visible fields are for information only.

Also, this is the only screen where you can load the grind cycle by selecting the **[Load Cycle]** softkey.

This screen automatically gets updated as grinding progresses through each of the defined grinding zone (G1 – G5).

Cycle Hold/Interrupt – ON/OFF toggle

It is possible to interrupt the grinding cycle at predetermined points for workpiece inspection. You can interrupt the cycle at t the end of the active grinding pass OR at the end of the active grinding zone (G1, G2, G3, G4 or G5)

Restart at Current Diameter – ON/OFF toggle

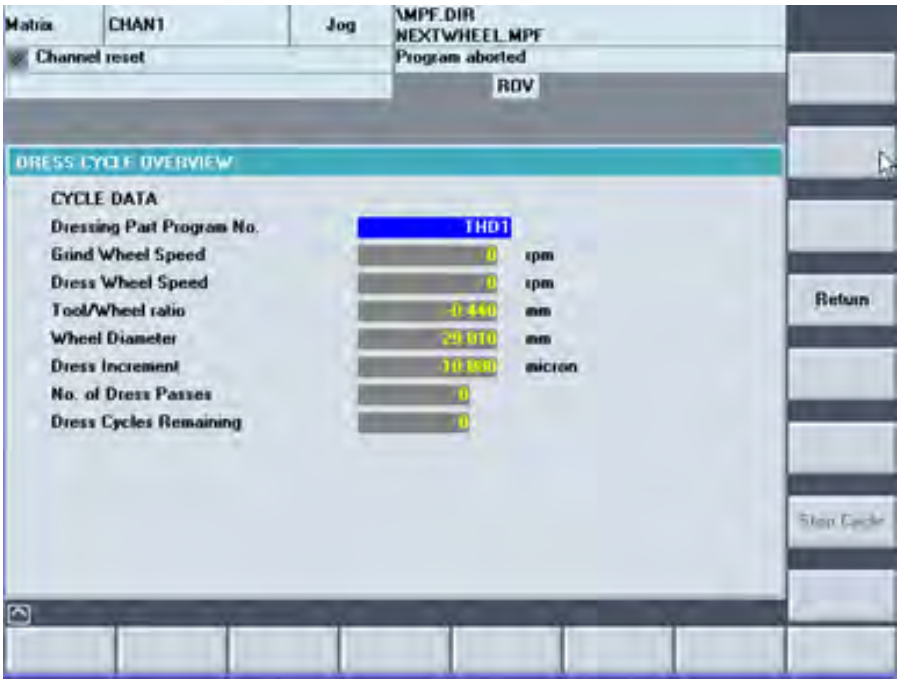
If the grinding cycle was aborted/stopped prior to its completion, it is possible to restart the cycle at the last current/active grind diameter rather than having to start again from the beginning of the cycle.

See section “Load and Grind” for instructions on how to run grinding cycle.

9.7 Dressing Cycle Overview

[Custom > Matrix > Main Menu > Grinding Overview > Dress Cycle Overview]

Select the **[Dress Overview]** vertical softkey in the grinding cycle overview screen.



This screen automatically updates to show the active dressing cycle sequence as the cycle progresses through each defined zone (G1 – G5).

9.8 Setting Cycles Menu

[Custom > Matrix > Main Menu > Setting Cycles]

In the Setting Cycles menu screen you can select and run the parametric user prompt driven cycles to assist you to setup the machine prior to grinding the workpiece.

1. **New Wheel Setting Cycle**
   Used to establish the relationship between the grinding wheel and the dressing tool

2. **Work Datum Setting Cycle**
   Used to establish the start, end grind positions (and pitch shift position if applicable)in the Z axis.

3. **Pitch-In Setting Cycle**
   Used to synchronise the conditioned wheel with workpiece to be ground.
   Two options are available.
   Option (a): Align the formed grinding wheel to a pre-cut component (X, Z & C axes).
   Option (b): Align the formed grinding wheel to a blank, non-pre-cut component (X axis).

4. **Steady Rest Setting Cycle**
   This setting cycle option is NOT applicable to internal thread grinding machines.

5. **Next Wheel Utility Cycle**
   With some internal grinding applications the wheel life is limited to, in some cases, only 2 or 3 mm on diameter. In such cases, if the batch quantity to be ground is large then the wheel change frequency will high.

   To minimise the time that would be lost in wheel change and resetting using The New Wheel Cycle, the Next Wheel Utility allows the user to quickly and precisely re-establish machine offsets for a new wheel and continue with production.

   The only pre-condition is that the New Wheel Cycle MUST be used initially to establish the wheel/dresser relationship and all subsequent new wheels MUST be the same diameter and width.

6. **Auto Dress Utility Cycle**
   Stand alone dressing cycle for use after New Wheel setting cycle has been completed.

7. **Correction Utility Cycle**
   Lead Correction - allows you to make small corrections to thread lead
   Taper Correction - allows you to make small adjustment to the taper of the ground thread
   Profile Correction - allows you to make small adjustment to the profile ground thread
   Diameter Correction - allows you to make small adjustment to the profile ground thread

Setting Cycle Access Procedure

1. Set the Orange keyswitch to position 3 on the MCP.
2. Select **[AUTO]** and **[SETUP]** mode from the MCP.
3. Select the Setting Cycles menu screen [Custom > Matrix > Main Menu > Setting Cycles]

In general you are expected to at least execute the following setup cycles in the order listed below:

1st run the NEW WHEEL cycle
2nd run the SET WORK DATUMS cycle
3rd run the PITCH-IN cycle

9.9 New Wheel Cycle

[Custom > Matrix > Main Menu > Setting Cycles > New Wheel]

This cycle is used establish the relationship between the grinding wheel and the dressing tool ie to teach the machine the relative position of the grinding wheel to the dressing disc or roll.

Once you have completed the New Wheel setting cycle the machine will be able to keep track of the active wheel diameter as grinding or dressing operations are performed.

A new grinding wheel may be a pre-formed wheel i.e. already dressed OR a brand new wheel i.e. Green wheel that has no profile.

IMPORTANT: **DO NOT** run the AUTO DRESS setting cycle before you have executed NEW WHEEL.

The NEW WHEEL setting cycle should be executed when the:
1. workpiece thread profile is changed
2. grinding wheel is changed
3. dressing tool is changed
4. workpiece is changed

Therefore, it is important first step to execute this setting cycle before any other setting cycle when preparing the machine for grinding a workpiece thread.

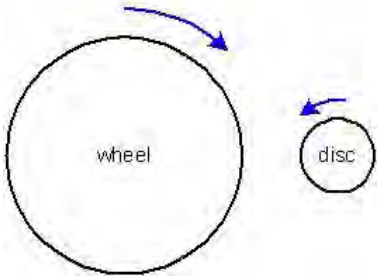
9.9.1 Explanation of the Input Parameters

Dress Wheelspeed
Input Range: 15 – 60 M/Sec
Peripheral or surface speed of the grinding wheel used during dressing

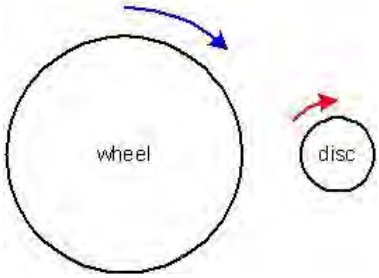
Speed Ratio
Input Range: -1.5 to 1.5
Ratio of the grinding wheel surface speed to the dressing tool surface speed

$$\boldsymbol{Speed\ Ratio} = \frac{\boldsymbol{Dressing\ Tool\ speed}\ (\boldsymbol{M/sec})}{\boldsymbol{Grinding\ Wheel\ speed}\ (\boldsymbol{M/sec})}$$

Positive (+) Speed Ratio – co-directional rotation of the wheel and dressing tool



Negative (-) Speed Ratio – contra-directional rotation of the wheel and dressing tool



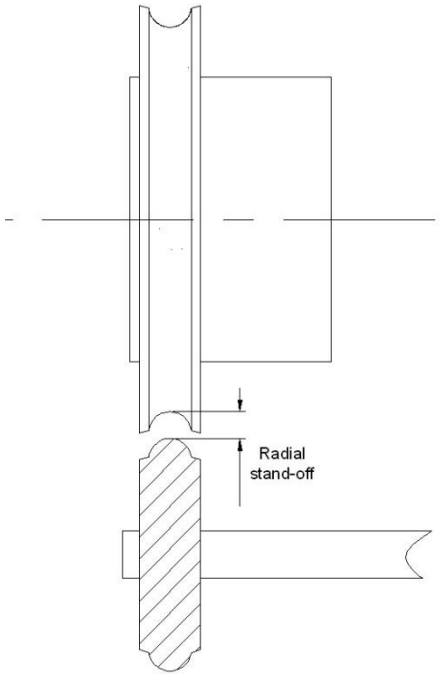
Dressing Feedrate
Input Range: 0.5 – 100 microns/rev
Linear traverse speed of the dressing tool per revolution of the grinding wheel

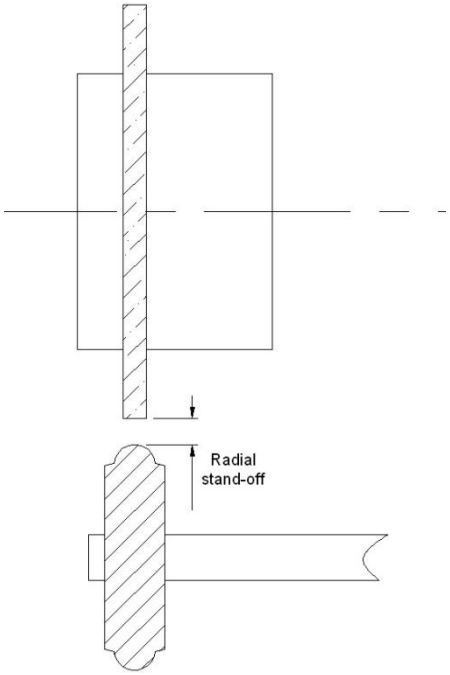
Radial Dress Increment
Input Range: 1 – 100 microns
The radial amount of stock removed from the grinding wheel per dressing pass

Dwell time roll only
Input Range: 0 – 99 seconds
Number of seconds that the diamond roll shall remain in contact with the grinding wheel at its current incremental position before the next radial dress increment is applied. THIS ONLY APPLIES WHEN A DIAMOND ROLL is used. If a diamond disc is used then this parameter is ignored.

Radial stand-off
Input Range: 0 – 20 mm

The radial distance by which the grinding wheel shall move clear of the dressing tool after each dressing pass. When using a diamond roll you don't generally need to use the radial stand-off because the wheel is plunging into the roll.





Max Wheel diameter
Input Range: 5 – 60 mm
Maximum useable diameter of the grinding wheel to grind the workpiece

Min Wheel diameter
Input Range: 5 – 60 mm
Minimum useable diameter of the grinding wheel to grind the workpiece

New Wheel diameter
Input Range: 5 – 60 mm
Diameter of the undressed or pre-formed wheel fitted to the quill.

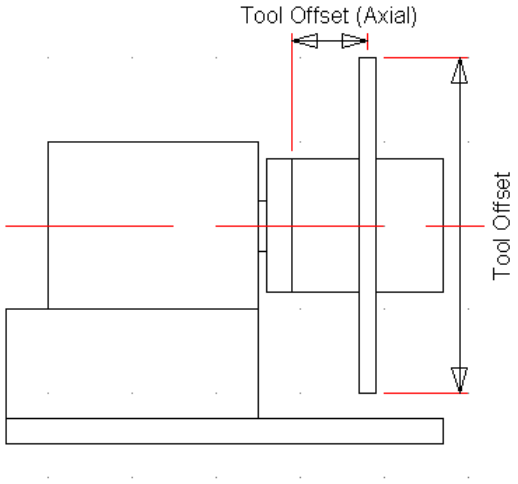
Active Wheel diameter
This is a read only display field and informs you of the active wheel diameter in machine currently

Max Wheel speed
Input Range: 5,000– 100,000 rpm
Maximum safe speed of the grinding wheel.

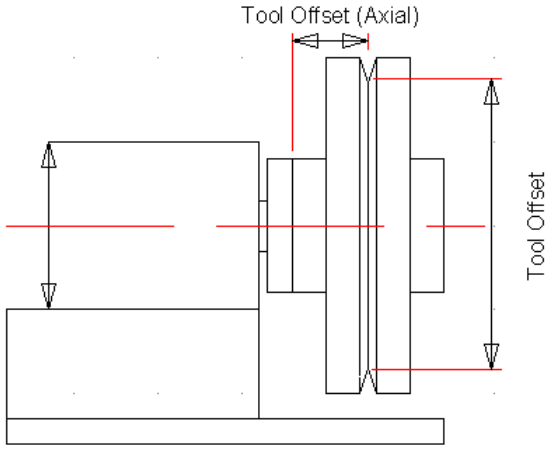
Dress set at helix
Input selection: YES/NO
Select YES if the dresser system is set to helix.
When using dressing disc or single point diamond dressing media then this field must be set to NO.

Tool Offset(axial)
Input range: -50 to 50 mm
Distance from the dresser datum face to the diamond media centreline (see sketch below).

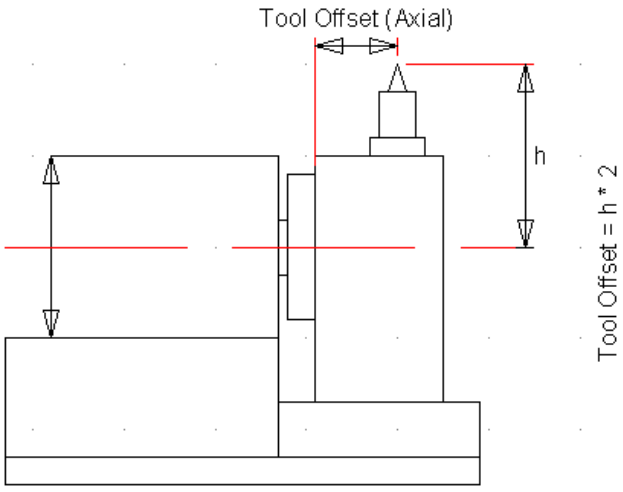
Tool Offset
Input range: 80 to 100 mm
For a diamond disc this is the peripheral diameter of the disc.
For a diamond roll this is the profile diameter at the root.
For a single point diamond this is the 2x radial distance from dressing spindle centreline to the diamond tip.



Diamond disc



Diamond roll



Single point diamond

9.9.2 Procedure for executing the NEW WHEEL setting cycle

1. Stop the grinding spindle **[JOG]** + **[SPINDLE STOP]** if it is already running

2. Select **[AUTO]** + **[SETUP]** mode on the MCP

3. Press the **[CYCLE START]** key.

4. Wait for the message prompt ***"Jog Z axis to safe position where quill can be retracted – press cycle start to continue'"***

5. Press the **[CYCLE START]** key to continue the cycle.
   The wheel will be moved to the dress position at rapid traverse rates. First the X axis will move out to its extreme positive position and then the Z axis will move to bring the wheel into the dressing position.

6. Press the **[CYCLE START]** and wait for the message prompt
   "Enter dress data in data fields – press cycle start to continue"

7. Enter data in each input field followed by pressing the yellow **[INPUT]** key on the HMI panel then press the **[Save Data]** softkey.

8. Press the **[CYCLE START]** and wait for the message prompt
   "MPG in X axis to contact wheel/ FIN button to accept"

9. Select the **[HAND UNIT]** function and an increment **[1, 10, or 100]** and set the axis selector switch on the hand unit to the X axis. Turn the handwheel slowly to bring the grinding wheel towards the dressing disc/roll until it lightly makes contact. Tip: Reduce the incremental jog as you get closer to the dressing disc/roll to avoid damage to the wheel.

10. Select the **[FIN]** button on the MCP when you have finished and wait for the message prompt
    "De-select test mode – start wheel and press cycle start"

11. De-select **[SETUP]** mode.

12. Start the grinding spindle **[SPINDLE START]**

13. Close the front guard door and ensure that the **[COOLANT OFF]** button is not illuminated.

14. Press the **[CYCLE START]** button to commence the continuous dressing cycle and the message prompt ***"MPG in X axis to contact wheel/ FIN button to accept"*** will be shown.

15. Select the **[HAND UNIT]** function and an increment **[1, 10, or 100]** and set the axis selector switch on the hand unit to the X axis. Turn the handwheel in the **negative direction** slowly to touch the grinding onto the dresser media as it moves around the profile.

16. Press the **[FIN]** key when contact between the wheel and dressing media has been established to store the X axis touch on position.

17. The current dressing pass will now completed and the wheel will move away from the dressing media to the maximum positive position in the X axis i.e the safe position.

18. New Wheel cycle complete!

The above sequence is based on using a dressing disc or single point diamond dressing tool. If a diamond roll is used then steps 11 to 17 are not performed as the dress cycle will continue to run automatically until the wheel has been dressed down to less than or equal to the maximum usable wheel diameter.

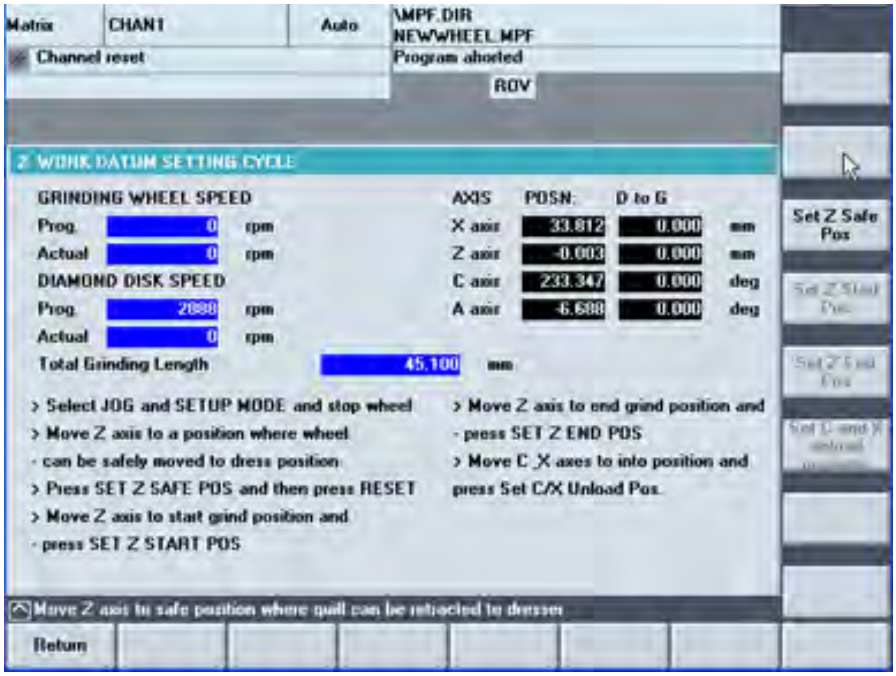
Upon completion of the NEW WHEEL setting cycle if you think that the wheel still requires more dressing then you use the AUTO-DRESS cycle if required.

9.10 Work Datum Setting Cycle

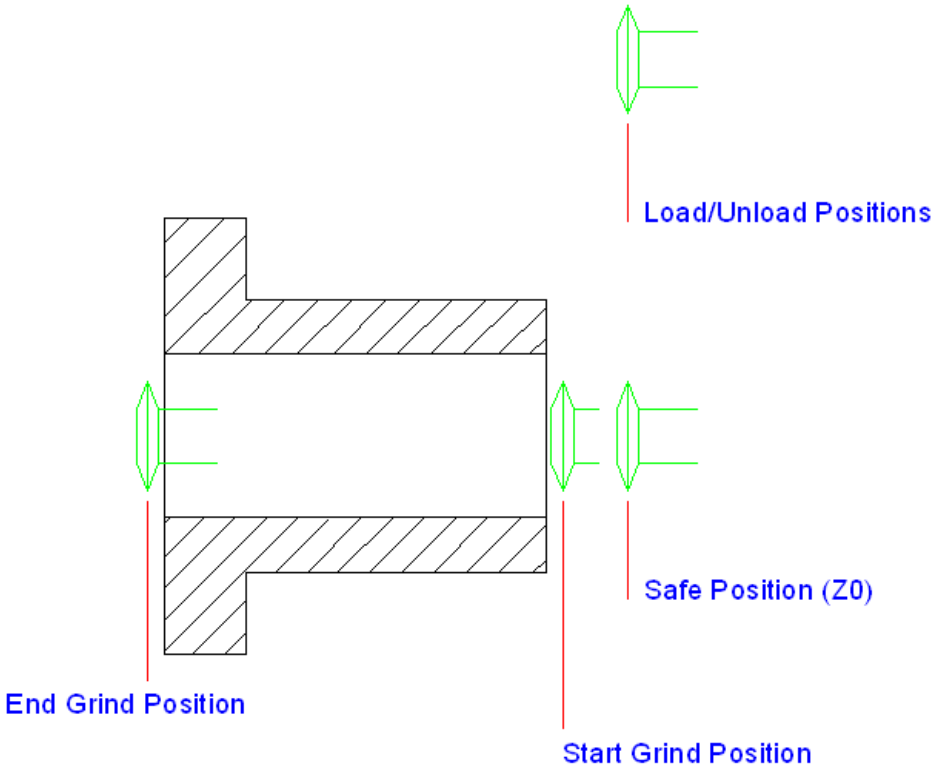
[Custom > Matrix > Main Menu > Setting Cycles > Set Work Datums]

This setting cycle is used to set the Z axis safe position and the Z axis start and end positions for the grinding cycle. If required, the X axis datum position can also be set.

NOTE: The safe position in the Z axis will always be set to zero in the work co-ordinate system.



There are 4 specific positions (see sketch below) that require to be set in this setting cycle.



9.10.1 Procedure for executing the WORK DATUM setting cycle

1. Set the orange keyswitch to position 3 on the MCP
2. Select **[JOG] + [SETUP]** mode on the MCP
3. Load the Work Datum setting cycle [Custom > Matrix > Main Menu > Setting Cycles > Set Work Datums]
4. Using handwheel or JOG buttons **[+][-]** move the wheel into a position where it is safe to retract to the dresser plane.
5. Press **[Set Z Safe Pos]** softkey
6. Using handwheel or JOG buttons **[+][-]** move the wheel into a suitable start grind position.
7. Press **[Set Z Start Pos]** softkey
8. Using handwheel or JOG buttons **[+][-]** move the wheel into a suitable end grind position.
9. Press **[Set Z End Pos]** softkey.
10. Using handwheel or JOG buttons **[+][-]** move the wheel into a suitable position for workpiece load/unload.

Tip: If you DO NOT want to set the C and X load/unload position then just press the **[CYCLE START]** button to complete the cycle.

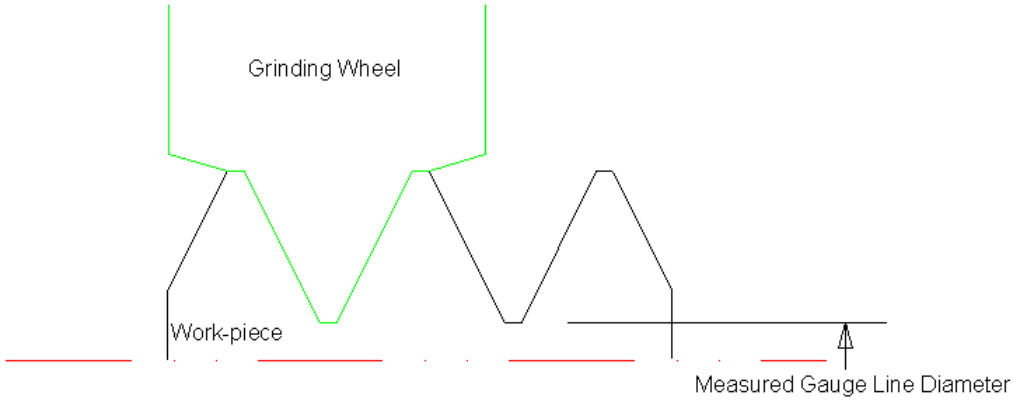
11. Press **[Set C & X Unload Positions]** softkey
12. The Work Datum Setting Cycle in now complete!

9.11 Pitch-IN Setting Cycle

[Custom > Matrix > Main Menu > Setting Cycles > Pitch-in Cycle]

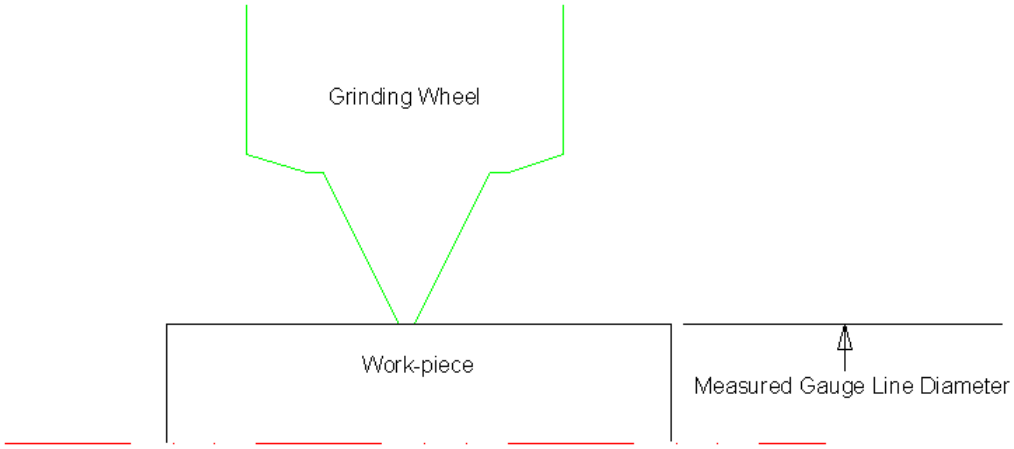
Use this setting to synchronise the grinding wheel to the pre-cut thread or non-threaded workpiece.

Pitch-in to a workpiece with a pre-cut thread



Using the handwheel in X,Z and C, align the formed grinding wheel to the pre-cut component.

Pitch-in to a blank or non-threaded workpiece



Using the handwheel in X,Z and C, align the tip of grinding wheel to OD of the workpiece.

9.11.1 Procedure for executing the PITCH-IN setting cycle

1. Set the orange keyswitch to position 3 on the MCP

2. Select **[JOG]** mode on the MCP and stop the spindle **[SPINDLE STOP]**

3. Select **[AUTO]** and **[SETUP]** mode

4. Select the **Pitch-In setting cycle** from the setting cycles menu screen
   [Custom > Matrix > Main Menu > Setting Cycles > Pitch-In]

5. Press the **[CYCLE START]** key and wait for the message prompt
   "Press Cycle Start to move wheel to workpiece centreline" to appear.

6. Enter data into the input fields then press the **[CYCLE START]** key to continue.

7. Wait for the message prompt
   "Using handwheel move Z axis into position for PITCH-IN - Press FIN button when complete"
   to appear.

8. Select the **[HAND WHEEL]** with an increment **[1, 10 or 100]** and then using the handwheel move the Z axis to position the grinding wheel somewhere close to the pitch-in position on the workpiece.

9. Press the **[FIN]** key.

10. Press the **[CYCLE START]** key and wait for the message prompt
    "Using handwheel move X and Z axes to align wheel to work-piece - Press FIN button when complete" to appear.

11. Select the **[HAND WHEEL]** with an increment **[1, 10 or 100]** and then using the handwheel move the X and Z axis to align the grinding wheel into the pre-cut workpiece thread.

12. Press the **[FIN]** key when you have finished aligning the wheel to the workpiece.

13. Press the **[CYCLE START]** key and wait for the message prompt
    "Press Cycle Start to return wheel to work-piece centreline" to appear.

14. Press the **[CYCLE START]** key and wait for the message prompt
    "Press Cycle Start to retract quill to Z safe position" to appear.

15. Press the **[CYCLE START]** key and wait for the message prompt
    "Do you want to set X axis start grind position" to appear.

If **YES** then:

a. Press the **[ACK]** key and then **[CYCLE START]** to continue.

b. Wait for the message prompt
"Press Set X start position softkey then press Cycle Start" to appear.

c. Press the **[CYCLE START]** key and continue to step 16.

If **NO** then:

d. Press the **[CYCLE START]** key and continue to step 16.

16. Wait for the message prompt ***"Do you want to set C & X axis unload positions"*** to appear.

If **YES** then:

a. Press the **[ACK]** key and then **[CYCLE START]** to continue.

b. Wait for the message prompt
"JOG X and C axes to a suitable unload position - Press CYCLE START when complete"
to appear.

c. Jog the X, Z, C axes to the desired position for workpiece load/unload.
d. Press the **[CYCLE START]** key.
e. Pitch-in cycle is complete!

If **NO** then:

a. Press the **[CYCLE START]** key.
b. Pitch-in cycle is complete!

9.12 Next Wheel Setting Cycle

[Custom > Matrix > Main Menu > Setting Cycles > Next Wheel]

With some internal grinding applications the wheel life is limited to a only few millimetre on diameter. In such cases, if the batch quantity to be ground is large then a wheel change will occur more frequently.

Note: fields with a blue background are READ ONLY

To reduce the amount time that would be lost during wheel change the Next Wheel setting cycle can be used to quickly and precisely re-establish the machine offsets for a new wheel and thus continue with production.

However, a pre-requisite of using the Next Wheel cycle is that the New Wheel setting cycle MUST be used initially to establish the wheel/dresser relationship and ALSO all subsequent new wheels MUST be of the same diameter and width.

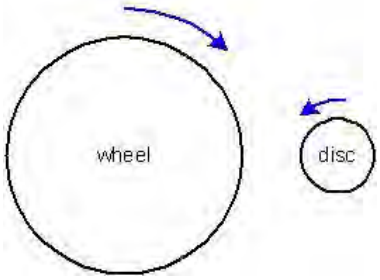
9.12.1Explanation of input parameters

Dress Wheel Speed
Input range: 15 – 60 M/sec
Surface speed of the grinding wheel required for dressing

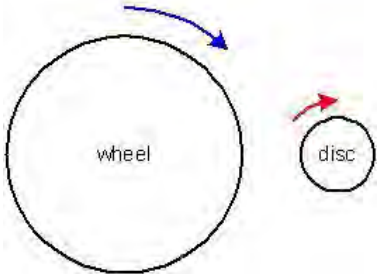
Speed Ratio
Input Range: -1.5 to 1.5
Ratio of the grinding wheel surface speed to the dressing tool surface speed

$$\boldsymbol{Speed\ Ratio} = \frac{\boldsymbol{Dressing\ Tool\ speed}\ (\boldsymbol{M/sec})}{\boldsymbol{Grinding\ Wheel\ speed}\ (\boldsymbol{M/sec})}$$

Positive (+) Speed Ratio – co-directional rotation of the wheel and dressing tool



Negative (-) Speed Ratio – contra-directional rotation of the wheel and dressing tool



Dress FeedRate
Input range: 0.5 – 100 microns/rev
Linear traverse speed of the dressing tool per each revolution of the grinding wheel

Radial Increment
Input range: 1 – 100 microns
Radial amount of stock to be removed from the grinding wheel per dressing pass

Dwell time
Input Range: 0 – 99 seconds

Number of seconds that the diamond roll shall remain in contact with the grinding wheel at its current incremental position before the next radial dress increment is applied. THIS ONLY APPLIES WHEN A DIAMOND ROLL is used. If a diamond disc is used then this parameter is ignored.

9.12.2Procedure for using the Next Wheel setting cycle

1. Select **[AUTO]** and **[SETUP]** mode

2. Select the Next Wheel setting cycle from the setting cycles menu screen [Custom > Matrix > Main Menu > Setting Cycles > Next Wheel]

3. Replace the used (or worn) grinding wheel with a brand new grinding wheel of the same diameter and width that you used when you first ran the NEW WHEEL setting cycle.

4. Press **[CYCLE START]** and wait for the message prompt *******Enter DRESS DATA in data field - Press cycle start to continue******* to appear.

5. Enter or edit the dressing data in the Next Wheel screen followed by pressing the yellow [INPUT] key after each entry.

6. De-select **[SETUP]** mode.

7. Close the door and start the spindle **[SPINDLE START]**

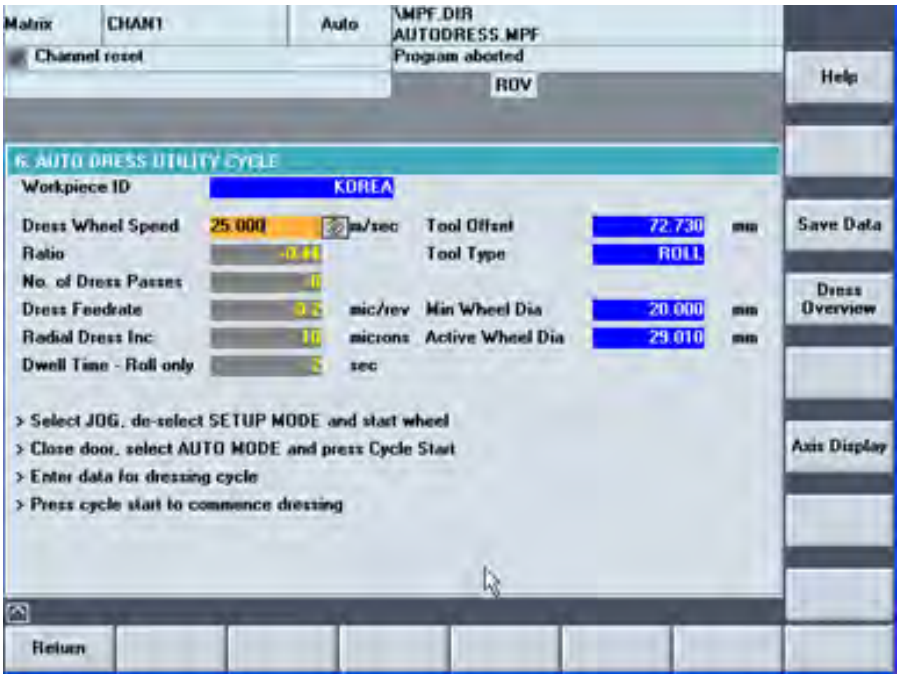
8. Press **[CYCLE START]** to continue. The wheel will now be dressed to the maximum useable diameter. (Note: the wheel will be positioned at the original NEW WHEEL position and then commence the dressing cycle.)

9. Done.

9.13 Auto Dress Utility Cycle

[Custom > Matrix > Main Menu > Setting Cycles > Auto Dress]

This is a stand-alone cycle for dressing the grinding wheel independently of the grinding cycle. The cycle can be run at any time, the only pre-condition is that the New Wheel cycle or Next Wheel cycle has been run previously.



Note: fields with a blue background are READ ONLY

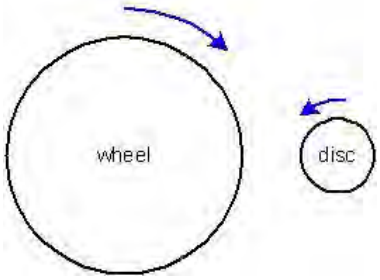
9.13.1Explanation of input parameters

Dress Wheel Speed
Input range: 15 – 60 M/sec
Surface speed of the grinding wheel required for dressing

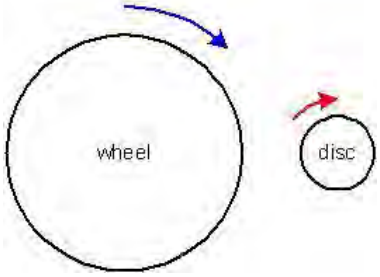
Speed Ratio
Input Range: -1.5 to 1.5
Ratio of the grinding wheel surface speed to the dressing tool surface speed

$$\boldsymbol{Speed\ Ratio} = \frac{\boldsymbol{Dressing\ Tool\ speed}\ (\boldsymbol{M/sec})}{\boldsymbol{Grinding\ Wheel\ speed}\ (\boldsymbol{M/sec})}$$

Positive (+) Speed Ratio – co-directional rotation of the wheel and dressing tool



Negative (-) Speed Ratio – contra-directional rotation of the wheel and dressing tool



No. of dress passes
Input range: 1 – 99
Number of passes that the dressing tool makes to the grinding wheel.

Dress FeedRate
Input range: 0.5 – 100 microns/rev
Linear traverse speed of the dressing tool per each revolution of the grinding wheel

Radial Increment
Input range: 1 – 100 microns
Radial amount of stock to be removed from the grinding wheel per dressing pass

Dwell time
Input Range: 0 – 99 seconds
Number of seconds that the diamond roll shall remain in contact with the grinding wheel at its current incremental position before the next radial dress increment is applied. THIS ONLY APPLIES WHEN A DIAMOND ROLL is used. If a diamond disc is used then this parameter is ignored.

9.13.2Procedure for using the Auto Dress cycle

1. Select **[AUTO]** and **[SETUP]** mode

2. Select the AUTO DRESS setting cycle [Custom > Matrix > Main Menu > Setting Cycles > Auto Dress]

3. Press **[CYCLE START]** and wait for the message prompt ***"Enter DRESS DATA in data field - Press cycle start to continue"*** to appear.

4. Enter dressing data into the input fields.

5. De-select **[SETUP mode]**

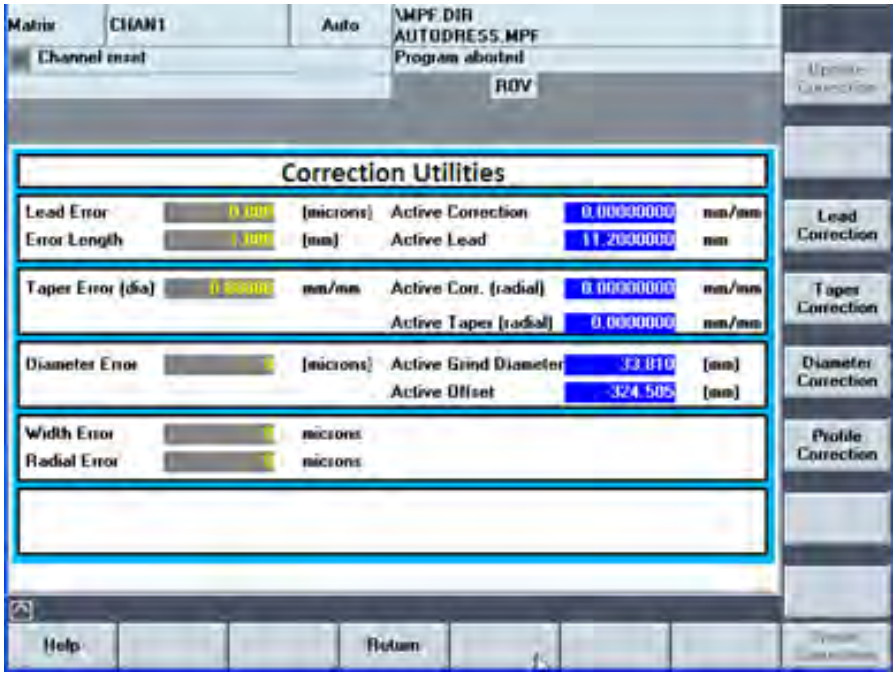
6. Start the spindle **[SPINDLE START]**

7. Press **[CYCLE START]** to commence with the dressing cycle. The cycle will automatically stop after the number of dressing passes has completed.

9.14 Correction Utility Cycles

[Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]

The correction utilities allow you to make minor adjustments to key features of the workpiece. Namely, lead, diameter, taper and profile.

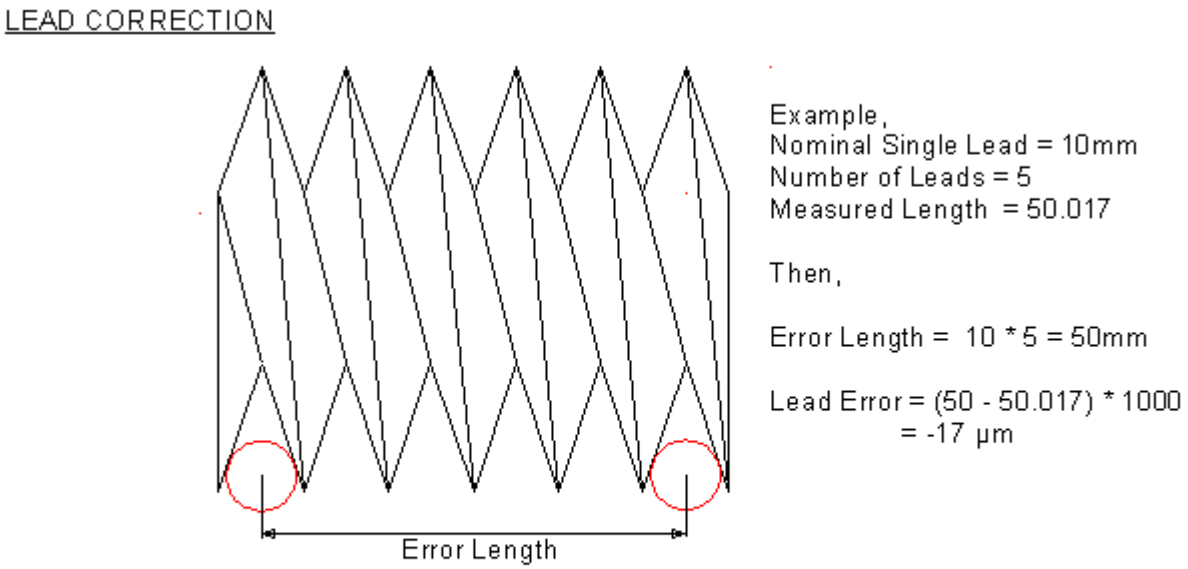


Note: fields with a blue background are READ ONLY

9.15 Lead Correction

The Lead Correction utility is used to make small corrections to the active lead of the machine.

NOTE: It is the **error** not the correction required that is entered i.e. if the measured cumulative lead is long (positive) then the error entered will be positive.



Error length = The nominal length over which Lead Error is measured (mm)
i.e. Nominal single lead (turn) * number of leads (turns)
Lead Error = The difference between the nominal length and the measured length (Microns)

To add Lead Correction

1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Lead Correction]** softkey.
4. Input the measured lead error (microns) followed by pressing the yellow **[Input]** key.
5. Press **[Update Correction]** vertical softkey

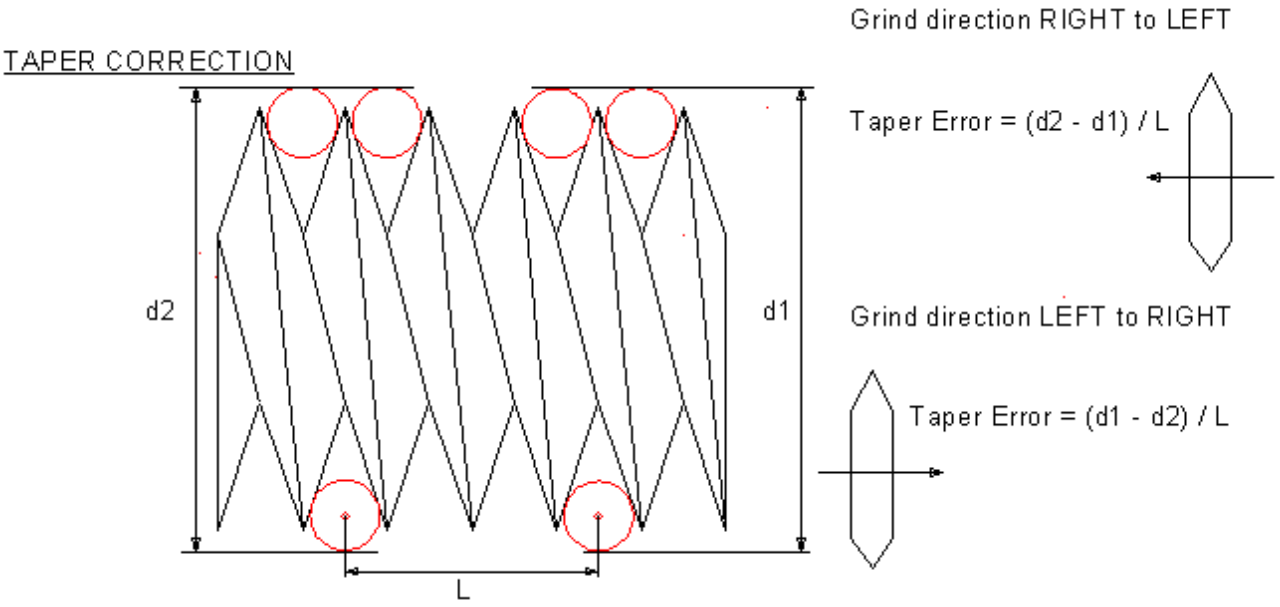
To reset the active lead correction

Press the **[Reset Correction]** softkey.

9.16 Taper Correction

The Taper Correction utility is used to make small corrections to the active taper of the machine. Taper correction can be used correct small errors in parallel components as well as tapered components.

NOTE: It is the **error** not the correction required that is entered i.e. if the measured taper is positive then the error entered will be positive.



To add Taper Correction

1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Taper Correction]** softkey.
4. Input the measured taper error (mm/mm) followed by pressing the yellow **[Input]** key.
5. Press **[Update Correction]** vertical softkey

To reset the active Taper correction

Press the **[Reset Correction]** softkey.

9.17 Diameter Correction

This utility allows small adjustments to be applied to the workpiece diameter.

To add Diameter Correction

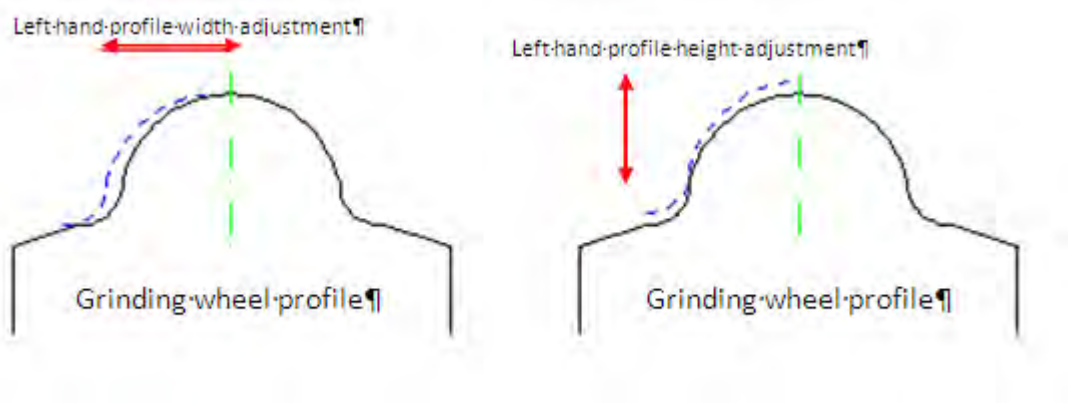
1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Diameter Correction]** softkey.
4. Input the measured diameter error (mm) followed by pressing the yellow **[Input]** key.
5. Press **[Update Correction]** vertical softkey

To reset the active Diameter correction

This function is not available.

9.18 Profile Correction

This utility cycle allows for small adjustments to be made to the width and height of the wheel profile.



The adjustment is applied at the profile mid-point on completion of the right hand profile and prior to execution of the left hand profile.

Note: This is only applicable to diamond discs.

To add Profile Correction

1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Profile Correction]** softkey.
4. Input the width and/or radial error (microns) followed by pressing the yellow **[Input]** key.

   Diamond Width Error - Adjustment of the profile width (Input range: +/- 300 micron)

   Diamond Radial Error – Adjustment of the profile height i.e the LH profile is offset with respect to the RH profile (Input range: +/- 300 micron)
5. Press **[Update Correction]** vertical softkey

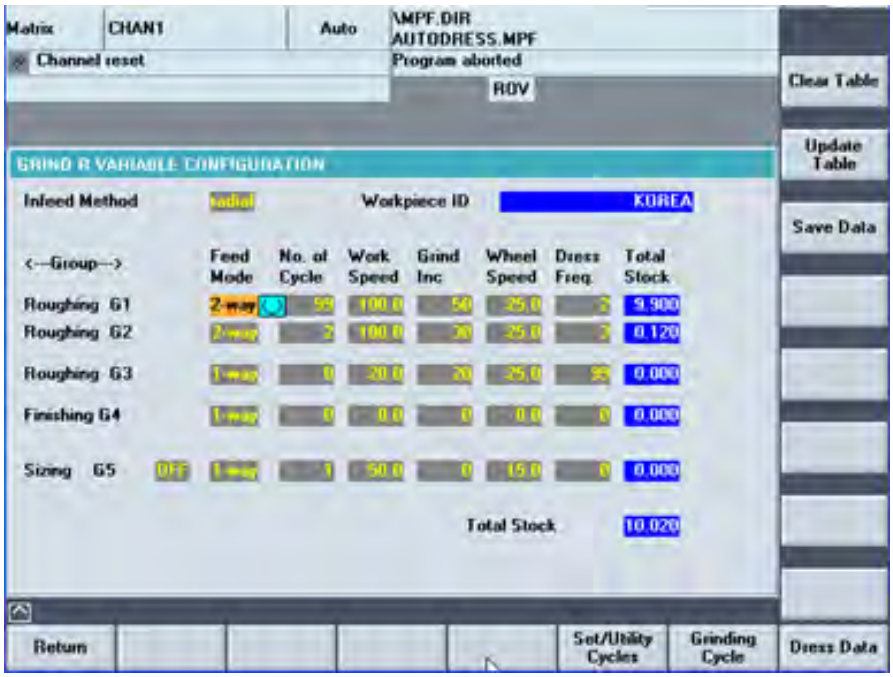
To reset the active Profile correction

Press the **[Reset Correction]** softkey.

9.19 Grind R Variables

[Menu Select > Matrix > Main Menu > Grind R Variables]

The Grind R variables screen presents you with a data table in which you can enter data to define how the workpiece is to be ground. The amount of stock to remove per grinding pass and wheel dressing interval between grinding passes is defined in this screen.



Note: fields with a blue background are READ ONLY

[CLEAR TABLE] Select this softkey to reset all the data table fields to zero.

[UPDATE TABLE] Select this softkey to re-calculate and update the total stock column for each defined grinding zone

[SAVE DATA] Select this softkey to store the cycle data entries to the active workpiece data file.

9.19.1Procedure to edit Grind cycle variables

1. Select [AUTO] and [SETUP] mode

2. Select the Grind R variables screen [Custom > Matrix > Main Menu > Grind R Variables]

3. Enter data in each zone field as required.

4. Press the **[UPDATE TABLE]** vertical softkey and check the total stock to remove in each zone (G1 to G5) you defined.

5. Finally, press the **[SAVE DATA]** vertical softkey to save the grinding cycle data to the workpiece data file.

9.19.2Grinding Zones

There are 5 grinding zones (G1 to G5) available for you to setup as needed to grind the workpiece down to the final or finish diameter. Un-used zones should be left blank.

Guideline to using the zones:

Zone	Usage	Note
G1	For heavy stock removal from the workpiece	
G2		
G3	For medium stock removal from the workpiece	
G4	For fine grinding to achieve final size	
G5	For minimising grind quill push-off or deflection that may have occurred during the grinding cycle	No dressing is performed in this zone. Also the grinding increment is always set to 0.

Sizing G5

You should only use the sizing zone G5 if final size has NOT been achieved in Finishing G4 i.e. under normal operating conditions, the cycle is executed with Sizing G5 turned OFF.

The grinding cycle would progress from G1 through to G4 to completion and the cycle would stop.

If however, after measuring the component diameter, there is still a small amount of material to be removed then Sizing G5 can be used to remove the remaining material.

Note:

1. If Sizing G5 is turned ON then G1 to G4 will NOT be executed.
2. Sizing G5 is a ‘one shot’ cycle and will automatically be reset to OFF on completion.
3. ‘Dress Freq’ (Number of grinding cycles/passes before calling dressing cycle) is not used in Sizing G5.
4. Dressing can only be carried out before Sizing G5 grinding passes are executed.
5. If dressing IS required in Sizing G5 then ‘Num Pass’ (Number of dressing passes) must be greater than 0.

9.19.3Explanation of parameters

Feed Mode
Input range: 1 or 2
1 = one-way grinding cycle
2 = two-way grinding cycle

No. of cycle
Input range: 0 - 99
This is the total number of grinding passes required in the zone

Workspeed
Input range: 1 – 99 rpm
Workpiece rotational speed

Grind Inc
Input range: 0 – 499 microns
Amount of stock to remove on diameter per grinding pass

Wheelspeed
Input range: 0 -70 M/sec
The grinding wheel surface speed during grinding

Dress frequency
Input range: 0 – 99
The number of grinding passes to do before calling the dressing cycle

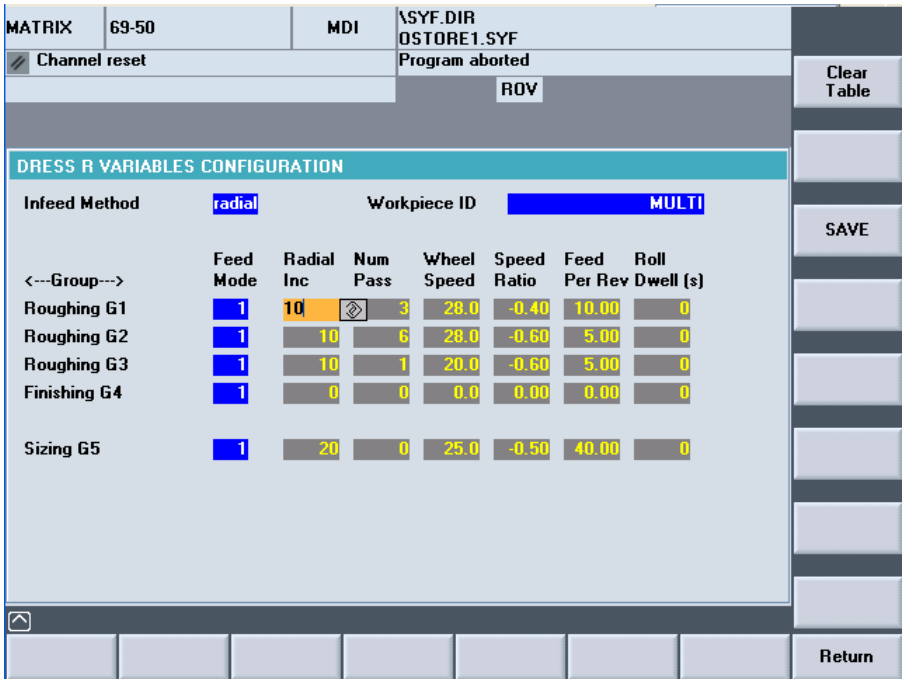
Eg. If No. of cycle = 5 and Dress Frequency = 2
Then the cycle sequence will be:
Grind 2 passes
Dress
Grind 3 passes
Dress

If you don't want to do any dressing in the selected zone then enter dress frequency to a value greater than the value in the No. of cycle field.

Total stock
READ ONLY field
Total amount of stock on diameter that will be removed from the workpiece after the grinding cycle has finished.

9.20 Dress R Variables

[Menu Select > Matrix > Main Menu > Dress R Variables]



Note: fields with a blue background are READ ONLY

For each zone (G1 to G4) where expect a dress cycle to execute you must equally enter zone specific dressing data.

[CLEAR TABLE] Select this softkey to reset all the data table fields to zero

[SAVE Data] Select this softkey to store the data table entries to the active workpiece data file

9.20.1 Procedure to edit Dress cycle variables

1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Dress R variables screen [Custom > Matrix > Main Menu > Dress R Variables]
3. Enter data in each zone field as required.
4. Finally, press the **[SAVE Data]** vertical softkey to save the dressing cycle data to the workpiece data file.
5. Press **[Return]** key to return to the Grind R Variables screen.

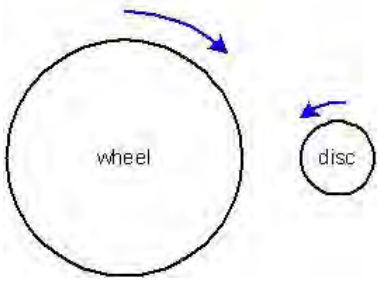
9.20.2Explanation of parameters

Dress Wheel Speed
Input range: 15 – 60 M/sec
Surface speed of the grinding wheel required for dressing

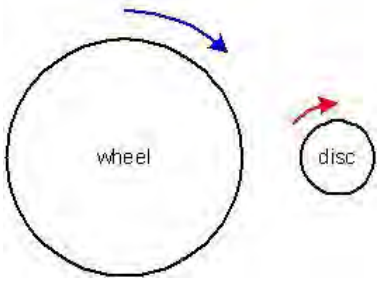
Speed Ratio
Input Range: -1.5 to 1.5
Ratio of the grinding wheel surface speed to the dressing tool surface speed

$$\boldsymbol{Speed\ Ratio} = \frac{\boldsymbol{Dressing\ Tool\ speed\ (M/sec)}}{\boldsymbol{Grinding\ Wheel\ speed\ (M/sec)}}$$

Positive (+) Speed Ratio – co-directional rotation of the wheel and dressing tool



Negative (-) Speed Ratio – contra-directional rotation of the wheel and dressing tool



No. of dress passes
Input range: 1 – 99
Number of passes that the dressing tool makes to the grinding wheel.

Dress FeedRate
Input range: 0.5 – 100 microns/rev
Linear traverse speed of the dressing tool per each revolution of the grinding wheel

Radial Increment
Input range: 1 – 100 microns
Radial amount of stock to be removed from the grinding wheel per dressing pass

Dwell time
Input Range: 0 – 99 seconds
Number of seconds that the diamond roll shall remain in contact with the grinding wheel at its current incremental position before the next radial dress increment is applied. THIS ONLY APPLIES WHEN A DIAMOND ROLL is used. If a diamond disc is used then this parameter is ignored.

9.21 Load and Run the Grind Cycle

Select the Grind Overview screen [Menu Select > Matrix > Main Menu > Grinding Overview]

1. Set the ORANGE Siemens Key in position 3.
2. Select **[LOAD CYCLE]** softkey. This will load the grind program into the NC ready for execution.
3. Start the spindle **[SPINDLE START]**
4. De-select the **[COOLANT OFF]** button
5. De-select the **[SETUP]** mode button
6. Close the guard door
7. Press **[CYCLE START]** button.
   THE MACHINE WILL NOW RUN THE GRINDING CYCLE and grind the workpiece in accordance with the settings you defined in both the GRIND R VARIABLES screen (Zones G1 to G5) and DRESS R VARIABLES screen(Zones G1 to G5)

9.22 Interrupting the Cycle

In the Grinding Cycle Overview screen you select the option to interrupt the active cycle at any time during processing.

Cycle Hold/Interrupt – ON/OFF toggle
It is possible to interrupt the grinding cycle at predetermined points for workpiece inspection. You can interrupt the cycle at t the end of the active grinding pass OR at the end of the active grinding zone (G1, G2, G3, G4 or G5).

9.22.1 Procedure for Cycle Interrupt

1. Cursor onto the **Cycle hold** selection field using the blue arrow keys.
2. Press the blue **[Select]** key and set ***Cycle Hold = ON***
3. The machine will now complete it current grinding or dressing pass and then stop at the load/unload position.

Restart at Current Diameter – ON/OFF toggle
If the grinding cycle was aborted/stopped prior to completion, it is possible to restart the cycle at the last current/active grind diameter rather than having to start again from the beginning of the cycle.

9.22.2 Procedure for Restart at current diameter

1. Cursor onto the **Restart at current diameter** selection field using the blue arrow keys.
2. Press the blue **[Select]** key and set ***Restart at current diameter = ON***
3. Press **[Cycle Start]** to commence the grinding cycle.
4. Wait for message prompt ***"Restart selected – program will restart at current diameter – press cycle start"*** to appear.
5. Press [Cycle Start] to continue with the grinding cycle from the currently active diameter.

10 Access Level Key Switch

The positions of the key switches located directly below the machine control panel (MCP) determine which features of the machine and control system are accessible to the user.

The defined access levels are: operator/setter/programmer (or manufacturing engineer)/ maintenance (or service engineer)

The machine operator has very limited access to the machine's manual control functions, HMI panel, and the MCP.

	**Position 0 (No Key)** Protection level 7	**Semi-Skilled Operator**	Operator panel can be used.
	**Position 1 (Black Key)** Protection level 6 - 7	**Machine Setter**	Operator Panel can be used Manual function. Pushbuttons at the control station can be used. Limited access to the MCP allowed. Limited access to the HMI panel allowed.
	**Position 2 (Green Key)** Protection level 5 - 7	**Programmer**	All manual functions are available. Full access to the MCP is allowed. Full access to the HMI panel is allowed.
	**Position 3 (Orange Key)** Protection level 4 - 7	**Maintenance**	All manual functions are available. Full access to the MCP is allowed. Limited access to the HMI panel.

11 Programming Codes

M codes	
M00	program stop
M01	optional Stop
M02	end of program with return to beginning
M07	dressing coolant on
M08	grinding coolant on
M09	grind/dress coolant off
M17	end of sub-program
M30	end of program reset/rewind
M42	X axis following/slave axis on
M43	X axis following/slave axis off
M50	cancel M53 latch
M51	prepare cancel distance to go with push-button
M52	cancel distance to go
M53	cancel no. of subroutine passes remaining in ch2
M54	pitch-in function enable
M55	pitch-in function disable
M58	Z axis following/slave axis overlay on
M59	Z axis following/slave axis overlay off
M60	acknowledge message
M69	cancel handwheel assignment (i.e handwheel off)
M70	cancel handwheel selection in cycle
M71	set handwheel overlay to X axis
M72	set handwheel overlay to Z axis
M73	set handwheel overlay to C axis
M78	select TEACHIN mode
M79	set VAR increment
M81	activate DRF
M82	de-activate DRF
M83	spindle stop in program
M98	cancel distance to go
M99	reset acknowledge/YES button

S codes

S1=nnnnn grinding spindle speed, where nnnnn is the grinding wheel speed in rpm

H codes

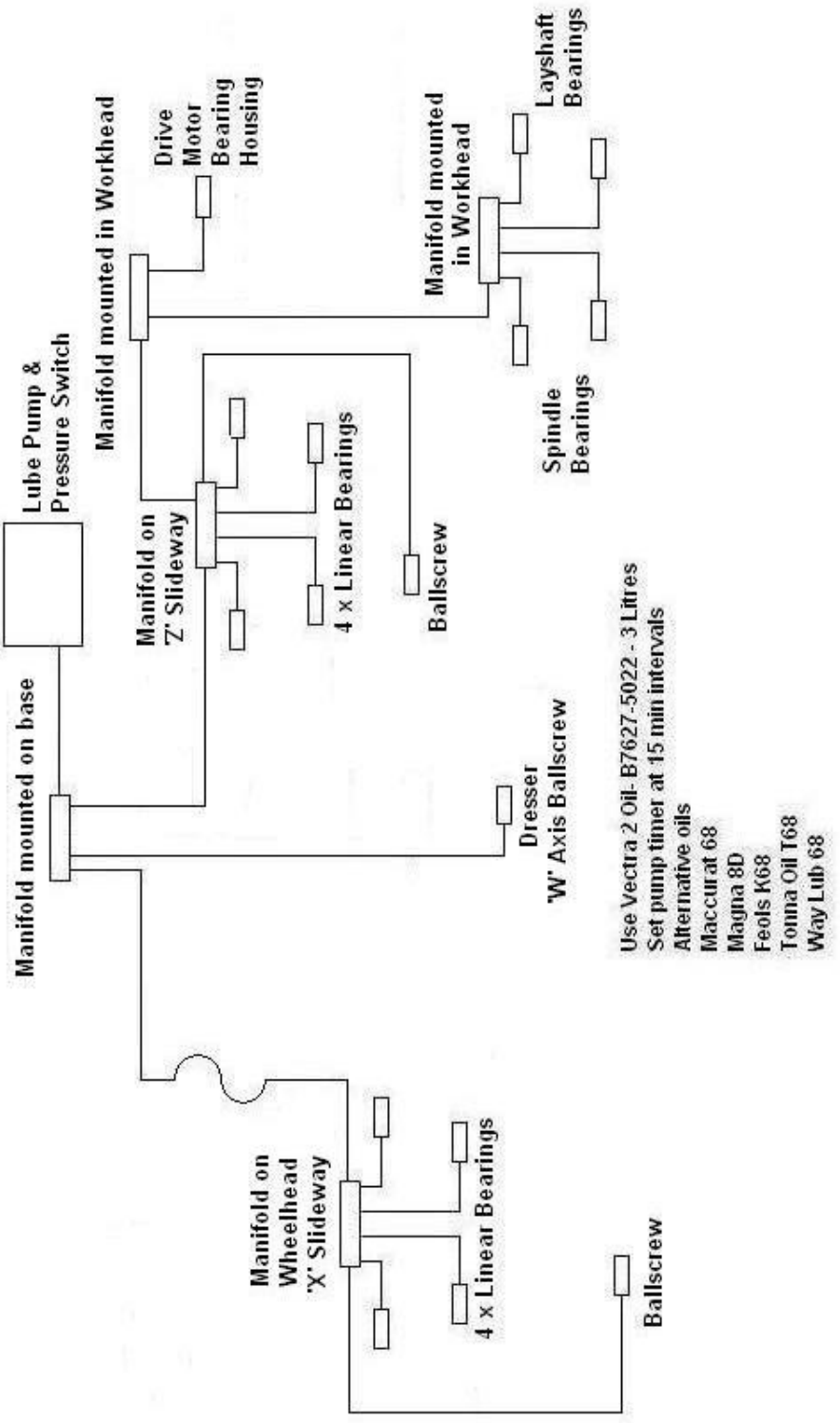
H3=nnnn dressing spindle CW speed, where nnnn is the grinding wheel speed in rpm
H4=nnnn dressing spindle CCW speed, where nnnn is the grinding wheel speed in rpm

12 Maintenance

12.1 Lubrication System

The machine is fitted with a positive displacement lubrication unit and is factory preset to automatically displace a 12sec oil shot every 15 mins to the various lubrication points around the machine via small plastic lube feed lines.

Oil Distribution Layout



12.2 Recommended oils/fluids/additives

Machine Lubrication	
Centralised lubrication tank	BP Macurat 68 Shell Tonna T68 Mobil Vactra 2 Castrol Magna BD Texaco Way Lub D Caltex Way Lub68
Helix screw on wheel head adjustment nut	BP Macurat 68 Shell Tonna T68 Mobil Vactra 2 Castrol Magna BD
HF spindle	ISO VG 32, DIN 51524-HLP-D32 ISO VG 46, DIN 51524-HLP-D46
Dresser spindle	Mobil Vactra 2

Spindle coolant additive	
Spindle cooling unit anti-corrosion additive	MOTOREX COOLANT-F Fully synthetic water-miscible corrosion protection concentrate for spindle cooling systems. Colour: yellow fluorescent Density @ 20°C: 1.15 pH value: 8.8 pH value 5 % in water 8.4 – 8.6 temperature range : 4 - 80°C

Matrix recommend using neat cutting oil for all types of thread grinding applications. A wide range of modern cutting oils are available from a number of suppliers. Details of oils which give good results are listed below.

Neat cutting oils	
CILORA 32	A low viscosity cutting oil containing extreme pressure and lubricity additives. Open Flash Point: 210°F Kinematic Viscosity @ 40°C: 32 cSt Manufacturer: BP
FRAPOL S 200	This oil contains both sulphurated and chlorinated additives. It gives fluidity and is used for internal thread and ball grinding where large flow of oil is necessary. Specific Gravity 0.88 Open Flash Point 145°C Kinematic Viscosity @ 20°C 22 cSt Supplier Edgar Vaughan & Company Limited
CUT-MAX CF13	A medium-low viscosity cutting oil fortified with EP additives to give excellent performance on medium duty applications. Specific Gravity 0.86 Open Flash Point 175°C Kinematic Viscosity @ 20°C 26 cSt manufacturer: Houghton
Spindle cooling unit anti-corrosion additive	MOTOREX COOLANT-F Fully synthetic water-miscible corrosion protection concentrate for spindle cooling systems. Colour: yellow fluorescent Density @ 20°C: 1.15 pH value: 8.8 pH value 5 % in water 8.4 – 8.6 temperature range : 4 - 80°C

13 Coolant Clarifier System

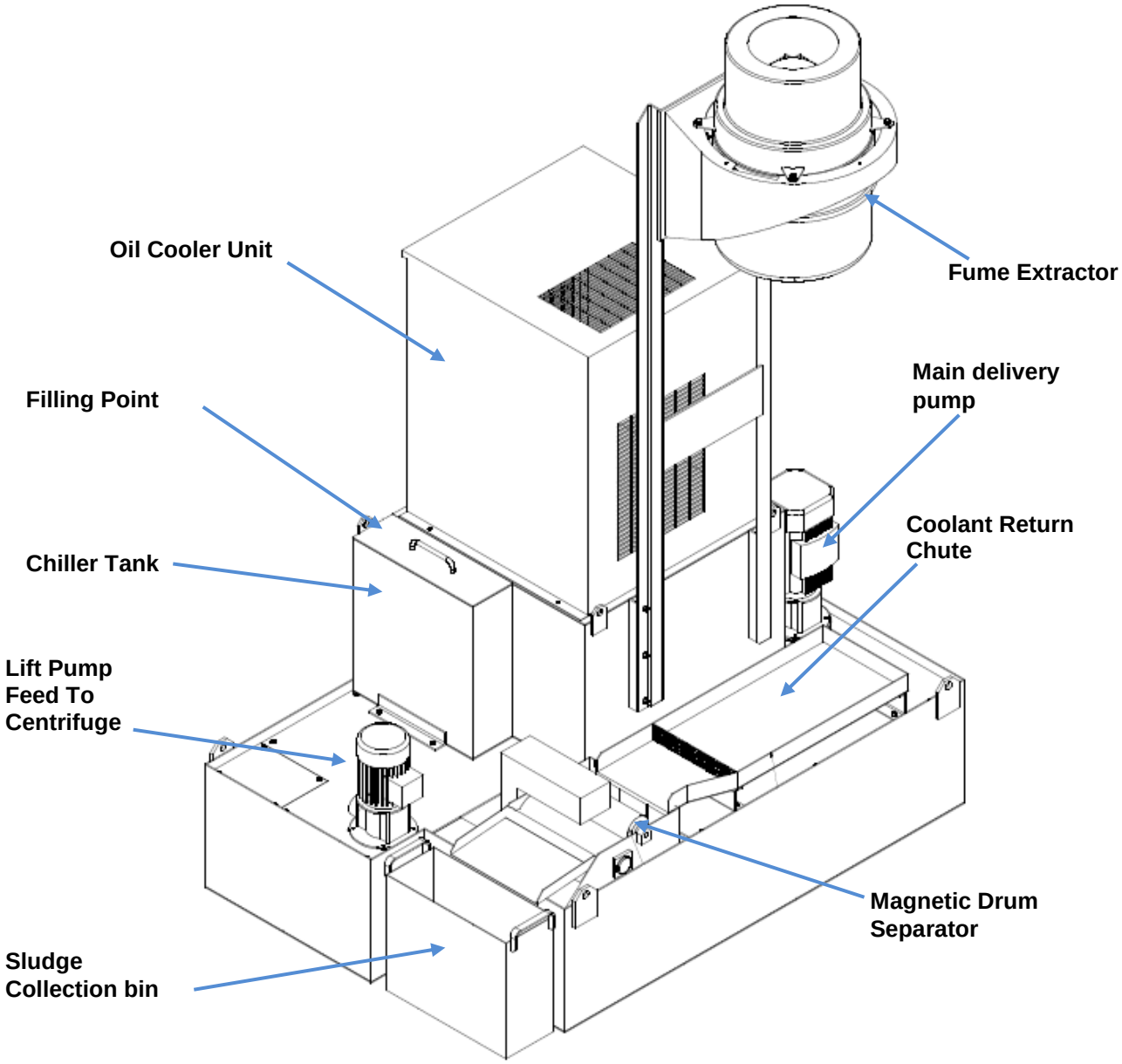


Fig.33.0a —Coolant Clarifier System.

Filling the coolant system

Remove the filling point cover
Pump 750 ~ 800 litres of neat cutting oil into the tank through the filling point
Replace the filling point cover

13.1 Oil Cooler Unit

Before starting the oil cooler:
Is the power source, ground and alarm signal properly connected?
Is the oil level within the required range?
Is the viscosity of the oil within the range of 0.5 ~ 200 CST?
Does the cooler unit start simultaneously with the machine?

Working Mode Of Cooler Unit Controller

The cooler unit will start the temperature control based on the set value (displayed in SV °C) when the power is on.

Temperature Control
Fixed Temperature Control: Keeps the temperature stable according to the value of SV °C.
Differential Temperature Control: Controls the temperature difference between liquid temperature and basic temperature (ambient temperature or machine body temperature) according to the value of SV °C.

Temperature Setting Range
Fixed temperature control: 10°C~40°C.
Differential temperature control: -10°C~+10°C.

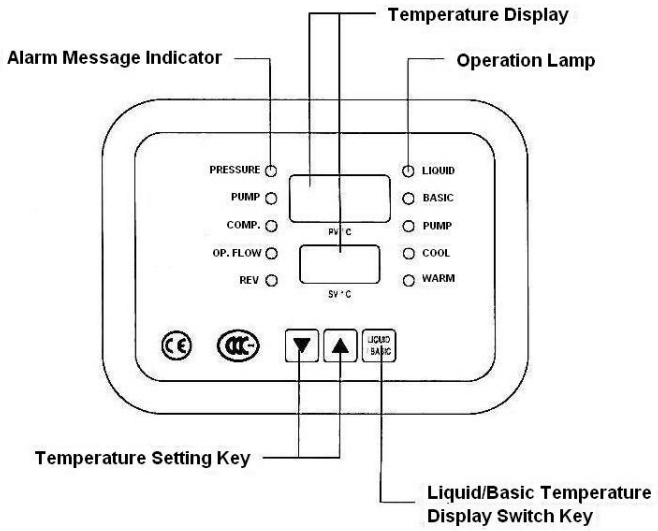


Fig. 24.2.2a. — Temperature Display.

Temperature Display:
PV °C: Displays the current oil temperature or the current basic temperature (ambient or machine body temperature).
SV °C: Displays the current set value.

Operation Lamp:
PUMP: Indicates if the mixing motor (optional) starts operating.
COOL: Indicates if cooling process starts.
WARM: Indicates if heater (optional) starts operating.

Temperature Setting Button:
Set temperature by using the arrow keys on the display panel. You must hold the key down for at least 0.5 seconds to change the values.

Liquid/Basic Temperature Display Switch:
The value of PV °C display changes to ambient or machine body temperature when the Liquid/Basic button is pressed; while the BASIC lamp is on. When released, the LIQUID lamp comes on and PV °C displays the temperature of the oil.
Note: This function is disabled for the fixed temperature control models.

Alarm Message Indicator:
Should any error occur during operation; the cooler unit will stop and display error messages.

Ensure you follow the steps below if repairs or maintenance are required:

1. Turn OFF the power supply to the cooling unit before attempting any repairs or maintenance.
2. Remove the cooler from the oil tank and remove all traces of oils and liquids before attempting any flame welding.
3. Only release refrigerant in a well ventilated area.
4. Locate the cooler in a well ventilated, obstruction free environment.
5. Cleaning

Switch OFF the mains power before proceeding with any maintenance or cleaning (even air filters). Removing any components during operation may cause serious injury or damage to the unit.

List of components that require cleaning regularly:

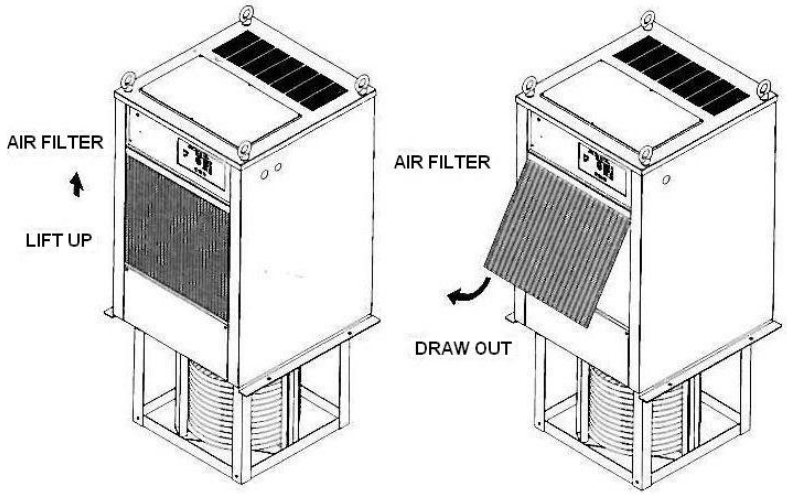
- Cooler body
- Condenser
- Air filter
- Cooling coil
- Oil tank
- Oil filter. (optional component installed by user).

Cleaning Procedure

1. Clean the surface of the cooling unit with neutral detergent or qualified soap. Do NOT use hot water, steel brush, polishing powder or any acidic solvents.
2. Clean internal cooler body avoiding any water splashes on the electrical components.
3. Use dry materials to clean electrical components.
4. Check the condenser is not clogged with any contaminants.
5. Use a long brush or compressed air to remove dust from condenser.

Oil Cooler cleaning procedure

1. Lift the air filter to remove it.



2. Use a vacuum cleaner, compressed air, water and brush to clean the filter. Allow the filter to dry after cleaning before re-assembling. Clean once every 2 weeks with neutral detergent.

Cooling Coil - Clean cooling coil with a brush and avoid any knocks or shocks to the coil.
Oil Tank - Water can form between the tank and the sink at the bottom. Drain at least once a month.
Oil Filter - Regularly clean the oil filter installed at the inlet point of the cooler unit. This will help prevent any build up of cutting powder on the cooling coil.
Leakage - Leaks from the oil hose can be fixed by tightening the tube clips or replacing.

14 General Maintenance Schedule

The recommended maintenance intervals are based on assumptions that the machine is used for five, eight hour shifts per week. For more intensive use of the machine, consult Matrix Machine Tool (Coventry) Ltd for a maintenance schedule.

Daily
1. Check/top-up lubrication unit tank
2. Check/top-up helix drum clamping system intensifier glass bowl lubricator
3. Check spindle coolant unit level
4. Check coolant system level (at sight glass)
5. Check/fix any leaks around the machine

Weekly
1. Check condition of fume extraction filter
2. Check condition of service cabinet SMC device filter elements
3. Clean the oil cooler filter
4. Clean the spindle cooler filter
5. Clean Electrical Cabinet door fan filter (if non-AC unit)

Monthly
1. Inject oil into helix drum slide nipples
2. Clean centrifuge unit drum and empty debris collection bin
3. Empty coolant system debris collection bins
4. Clean the oil filter installed at the inlet point of the cooler unit
5. Drain out any water formed between the tank and the sink of the coolant system's oil cooler unit

14.1 Pressurised air supply to machine

The main air supply solenoid valve to the machine is switched on automatically once the machine has been master started from the machine control panel.

The air supply to the machine is monitored at all times by an in-line mounted pressure switch. If the air pressure to the machine drops below the minimum preset value of 4 BAR then machine operation is suspended.

Min air pressure: 5.0 Bar
Max air pressure: 6.8 Bar
Normal working air pressure: 5.5 Bar

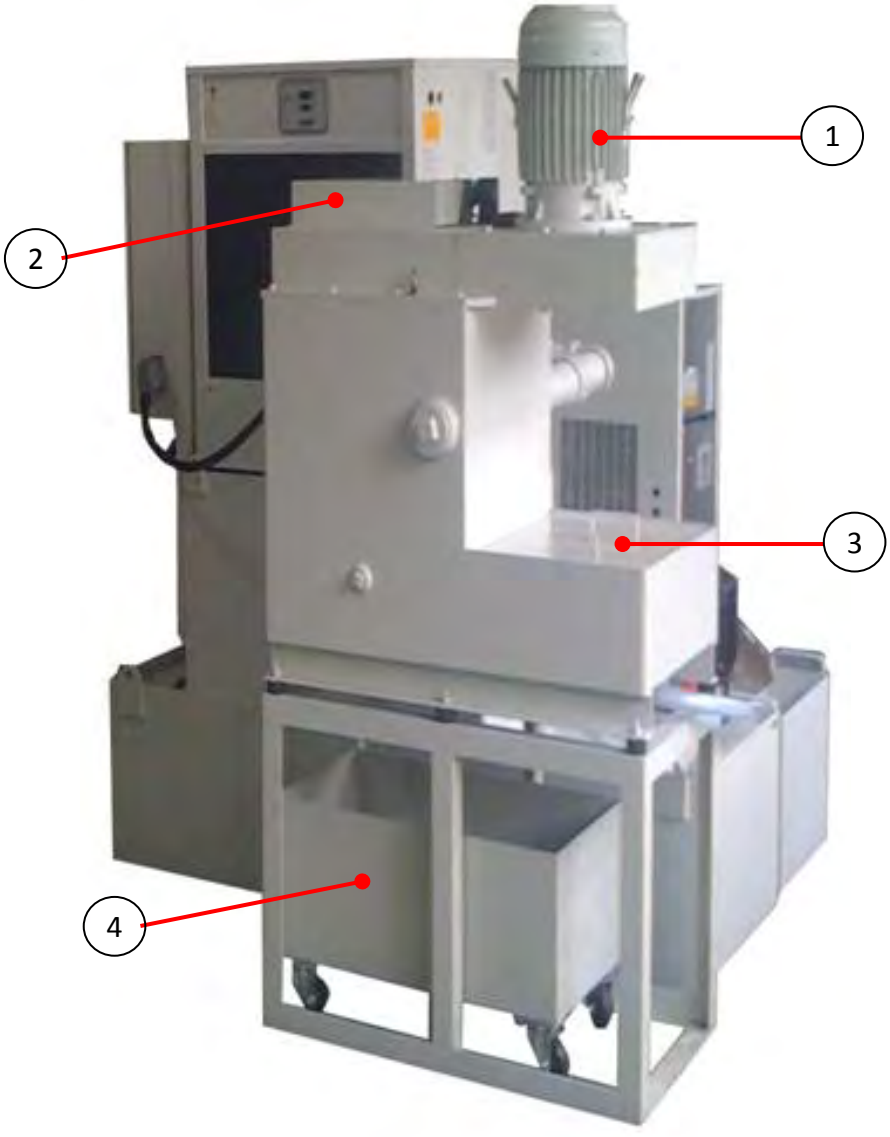
Air Purge To Linear Scale
The air purge circuit the Heidenhain scales is micro-filtered and regulated to ensure that the scales remain clean at all times by supplying clean dry low pressure air to them.

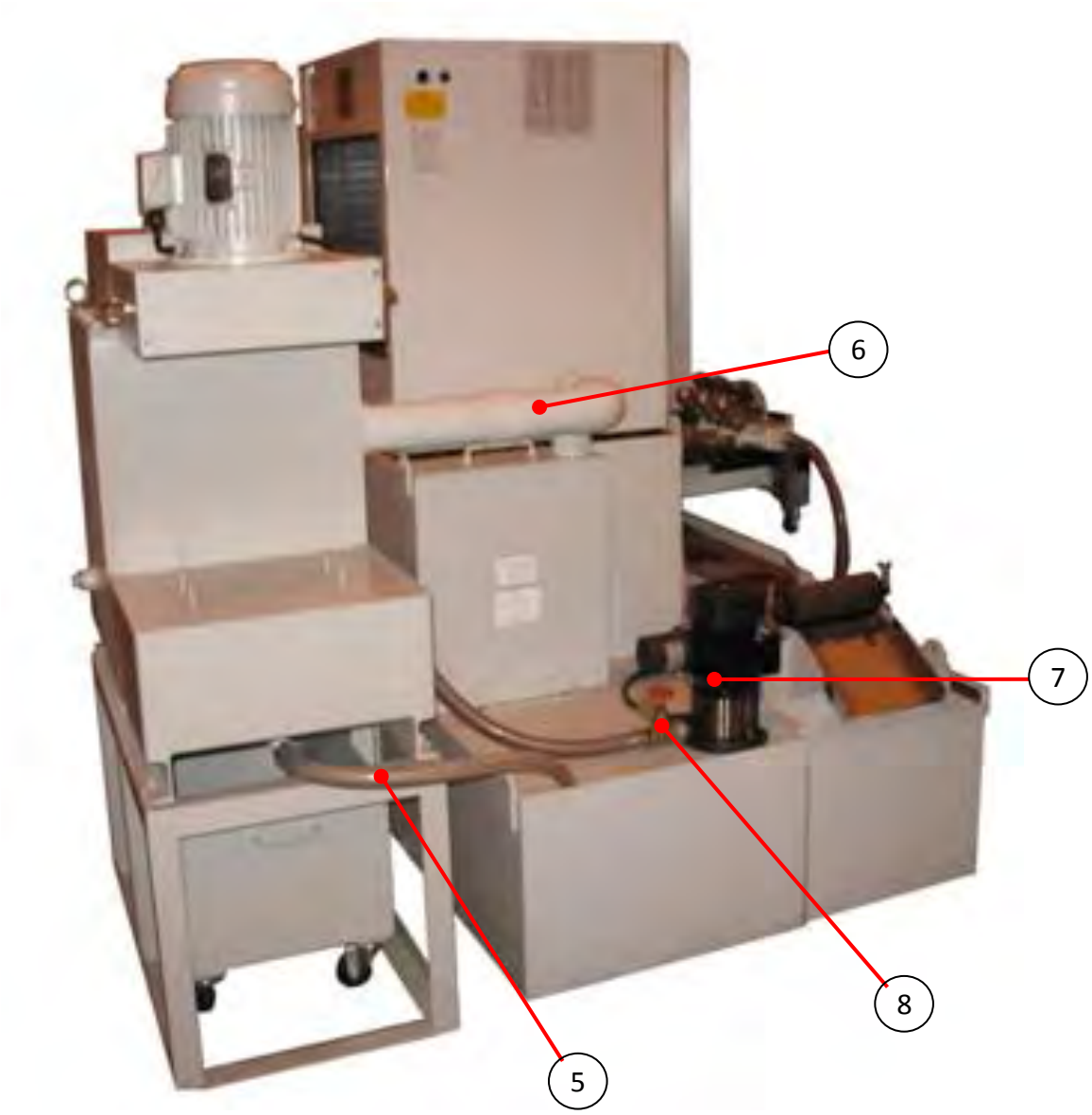
14.2 Cleaning the coolant system centrifuge

The centrifuge unit forms part of the coolant system and its function is to filter out any grinding debris present in the coolant oil as it passes through the centrifuge.

Over time, the heavier particles of grinding dust gather together and stick to the drum's inner surface and eventually the centrifuge unit will become unstable and start to vibrate because the drum has become imbalanced as it continues to rotate.

Therefore, regular maintenance cleaning of the centrifuge drum must be carried out to ensure trouble free operation.

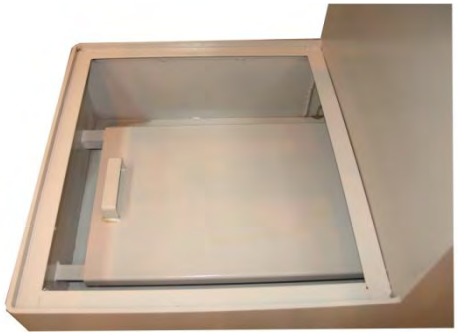




1	Centrifuge drive motor	5	Oil drain back hose
2	Hinged cover for access to drum lock lever	6	Cleaned oil exit pipe outlet feeding to clean oil tank
3	Removable inspection panel	7	Lift pump to transfer oil from main tank to the centrifuge
4	Debris collection bin on castors		Lift pump flow adjust valve

Debris catch plate positions

Catch plate shown in the normal operating position



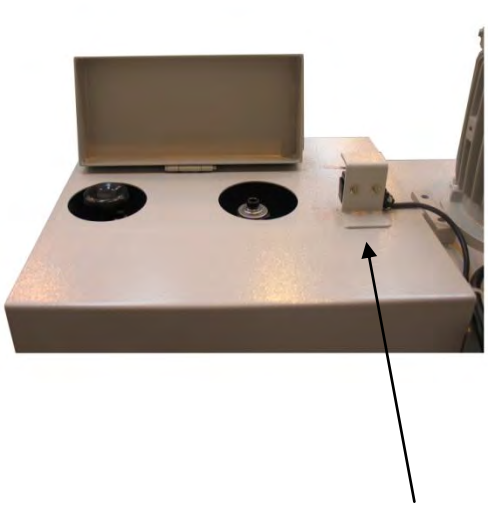
Catch plate shown in the maintenance position
Set to this position when cleaning the drum.

Drum Lock

The centrifuge unit is equipped with a drum lock function that is used to stop the drum from spinning when essential maintenance work is required to the centrifuge. Normally, the drum should be set to the locked position when the drive belts need to be changed or if the drum needs to be operated manually for cleaning out heavy debris deposits that may still be stuck to the inside wall of the drum.

The drum lock switch is accessed by removing the hexagon cap head screw securing the hinged access lid. The access lid is fitted with a cut out switch and kills the power to the drive motor when the lid is opened.

Access to the drum lock



Cut out switch

1. Using a hexagon key (allen key) remove the cap head that secures the hinged access lid.

Lift the access lid and wait until the centrifuge motor has stopped rotating.

2

CAUTION!

THE DRIVE MOTOR WILL CONTINUE TO RUN FOR APPROX 4 MINUTES UNTIL IT REACHES STANDSTILL. DO NOT ATEMPT TO ENGAGE THE DRUM LOCK WHILST THE DRUM IS STILL ROTATING OTHERWISE THERE IS A RISK OF PERSONAL INJURY AND THE LOCKING PIN WILL GET DAMAGED.

Fig 6

Drum Lock

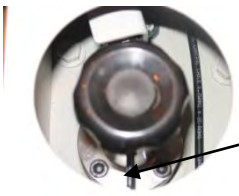
Drum Pulley

Cleaning procedure

To ensure reliable functioning of the centrifuge unit it should be inspected daily in order to determine whether the drum needs to be cleaned manually. Failure to do so will result in debris build-up on the inside of the drum which can result in the drum becoming imbalanced and thus making the centrifuge unit vibrate.

> **Caution**
> Always switch off the electrical power to the centrifuge unit before carrying out any maintenance work on it.

1. Set the drum to the locked position by lifting and turning the drum lock knob by 90°.



Locked position (the bar is vertical)

2. Remove the inspection panel and slide the debris catch plate over to the maintenance position.

3. Clean off any debris deposits that are on the catch plate.

4. Check/set the debris collection bin directly underneath the centrifuge unit.

5. Using the supplied 41mm socket and T bar turn nut fitted to the drum pulley in a back and forth motion until it feels easy to turn.

6. Check that the grinding debris or sludge has fallen out of the drum and into the debris collection bin.

7. Slide the debris catch plate back to the normal operating position and replace the inspection panel.

8. Unlock the drum by lifting and turning the drum lock knob through 90° back into the normal position.

Normal position (the bar is horizontal)

9. Close the drum switch access panel and secure with the hexagon cap head..

10. Start-up the centrifuge unit as normal from the coolant system control panel.

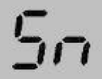
15 Troubleshooting Guide

15.1 Oil Cooler Unit fault codes

Possible reasons for failure of the cooler unit:

1. Wrongly positioned
2. Poor working environment
3. Collision
4. Wrong type of oil
5. Improper connection
6. Not enough oil in the tank when operating
7. No regular maintenance
8. Frequent restart of the cooler
9. Failure and Solution

1	Explanation	Oil temperature sensor fault
 PV °C  SV °C	Possible Cause	Broken connection of the oil temperature sensor. Oil temperature sensor fault. Temperature controller failure.
	Inspection	Check if the connection of the oil temperature sensor is broken. If the connection is not broken then there is the possibility that the temperature controller or sensor has failed.
	Solution	Reconnect or replace the wiring. Replace failed components.

2	Explanation	There is a problem with the ambient or machine body temperature sensor.
 PV °C  SV °C	Possible Cause	The wire connection of the ambient or machine body temperature sensor is broken. The ambient or machine body temperature sensor has failed. The temperature controller has failed.
	Inspection	Check if the wire for the ambient or machine body temperature sensor is still connected. If still connected then the sensor or temperature controller is faulty.
	Solution	Reconnect the wiring or replace the wire. Replace faulty components.

3	Explanation	Oil temperature is too high for the cooler to process.
 PV °C  SV °C	Possible Cause	Process load is over the limit of the cooler unit's capacity. Oil temperature sensor failure. Refrigeration system failure.
	Inspection	Check if the ambient & oil temperatures are over the limit of 45°C. Check if the cooler unit is capable for the process load. Check if the refrigeration system is in order. Check if the sensors are functioning correctly.
	Solution	Keep the oil temperature below 45°C. Change cooler unit to a larger cooling capacity . Replace the oil temperature sensor. Contact the refrigeration technician for refrigeration system failures.

4	Explanation	There is a pressure fault within the refrigeration system.

PV °C SV °C PRESSURE	Possible Cause	Low or overcharge of refrigerant. Obstruction/leakage in the refrigeration system. Condenser/air filters are dirty. Poor heat dissipation. Fan/motor failure.
	Inspection	The copper pipe near the low pressure side of the compressor is warm. Condenser fins are cold. Check if the cooler unit's internal temperature is too high. Check if fan/motor is out of order.
	Solution	Please contact the refrigeration service technician for faults in the refrigeration system. Clean the air filter and condenser regularly to improve heat dissipation. Remove any obstructions from the air intake and exhaust.

5	**Explanation**	**There is a fault in the compressor which is tripping out the overload protector.**
PV °C SV °C COMP	Possible Cause	Incorrect power voltage input. Compressor has burnt out. Overload protector has tripped out. Poor heat dissipation. Fan/motor failure.
	Inspection	Check if input power voltage is correct. Check if compressor has burnt out. Check if overload protector has tripped out. Check if cooler unit's internal temperature is too high. Fan/motor out of order.
	Solution	Input the correct power voltage. Replace burnt out compressor. Reset the overload protector. Improve the working environment to lower the ambient temperature and improve ventilation. Replace/fan/motor.

6	**Explanation**	**The power phase input has been reversed.**
PV °C SV °C REV	Possible Cause	Reversed phase of main power source. Power source is single phase. Reverse-phase relay failure. Temperature controller failure.
	Inspection	Check if the power phase input is correct. Has the reverse-phase relay failed? Has the temperature controller failed?
	Solution	Reconnect the power cable with the correct phase. Three phase cooling unit should be connected to a three phase power source. Replace faulty components.

Sudden Stop No Alarm Messages

Main power is input but cooling unit not running.

Status	PV °C, SV °C will not display on the control panel.
Possible Cause	The main power may not be properly connected. Main power source circuit breaker is in the OFF position. Control circuit board failure. Fuse on control circuit has blown. Remote control function is not properly connected. Timer (optional component) failure.
Inspection	Check if mains power source is supplying the power correctly. (If circuit breaker is in the ON position). Check if connection wire is connected properly. Check fuse on the control circuit. Check the remote control connection. Check if the timer is set properly. Has controller board failed?
Solution	Reconnect the main power source. Replace the blown fuse. Replace controller board. Reset the timer or replace.

Status	PV °C, SV °C displays temperature..
Possible Cause	Remote control function is not properly connected. Power voltage input is incorrect. Electromagnetic switch faults. Motor failure.
Inspection	Check the remote control connection. Check if the power voltage to the motor is correct. Check if the magnetic switch is in order. Check if the motor is still working correctly.
Solution	Reconnect the remote control function. The power voltage to the motor should be the same as the rated power voltage for the cooler unit. Replace faulty parts.

Cooler unit operating but there's an abnormal condition with the cooling process.

Status	No cooling is processed.
Possible Cause	The compressor will stop operating when the temperature reaches the set value of SV °C. Electromagnetic switch failure. Poor heat dissipation.
Inspection	Has oil temperature reached the required cooling range? Is the electromagnetic switch in order? Is the cooler unit's internal temperature too high.
Solution	It is normal for the compressor to stop operating when the oil temperature reaches the set value. Replace the electromagnetic switch. Improve the working environment to lower the ambient temperature. Improve ventilation.

Status	Cooling continues when set value has been reached.
Possible Cause	The process load is above the cooler unit's capacity. Poor heat dissipation. Leakage of refrigerant. Thermostat failure.
Inspection	Is the cooler unit's capacity suitable for the process load? Is cooler unit's internal temperature too high?

	Is the refrigeration system leaking? Has thermostat failed?
Solution	A larger capacity cooler unit is required. Improve the working environment to lower the ambient temperaqture. Improve ventilation. Contact the refrigeration service technician. Replace the thermostat.

Sudden stop of the cooler while operating and an alarm signal sent to the machine.

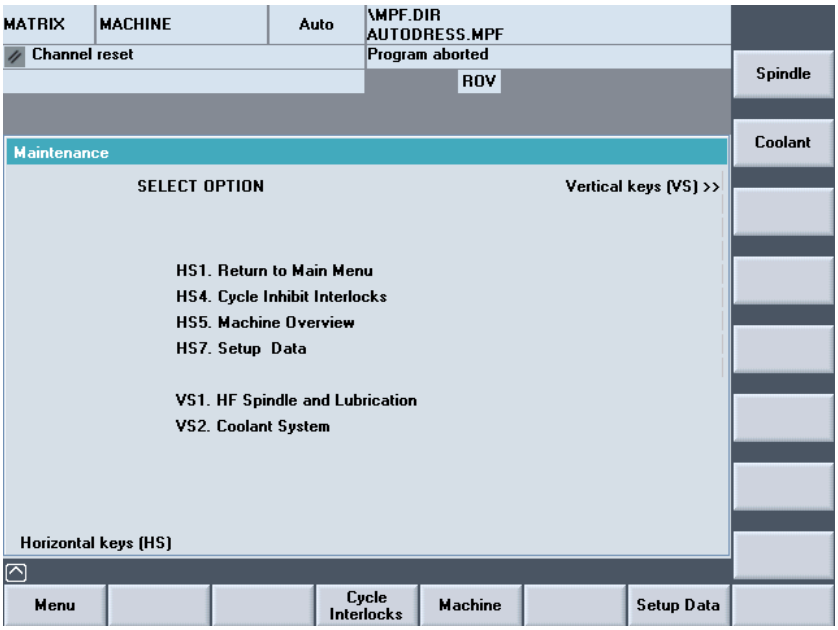
Status	**PV °C, SV °C display correctly.**
Possible Cause	Machine vibration has loosened wiring. Remote control connection is out. Temperature controller connection is out. Temperature controller failure.
Inspection	Are the remote control connections ok? Are the temperature controller connections ok? Is the temperature controller faulty.
Solution	Reconnect the connections. Replace temperature controller.

Status	**PV °C, SV °C does not display.**
Possible Cause	Circuit breaker on cooler unit may have jumped. Machine vibration has loosened wiring. Remote control connection is out. Thermostat connection is out. Thermostat has failed. Power supply has failed.
Inspection	Has the circuit breaker tripped off? Is the remote control connection ok? Is the thermostat connection ok? Is the power supply still working? Has the thermostat failed?
Solution	Set circuit breaker back on. Reconnect any loose wires on the remote control and thermostat. Replace faulty components.

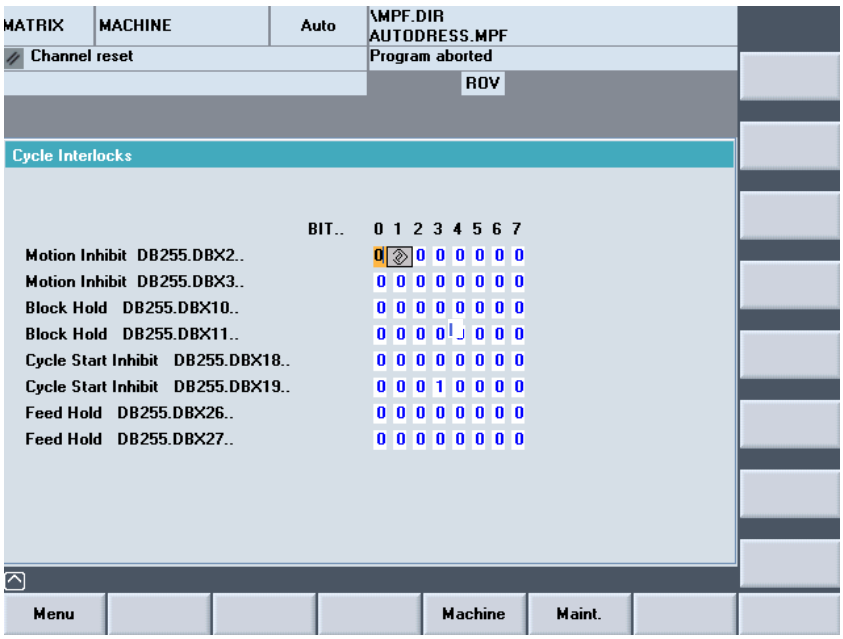
15.2 Machine Diagnostic Screens

Select [Custom > Matrix > Main Menu > Maintenance Menu] from the HMI screen panel to access the machine specific diagnostics.

Maintenance diagnostics menu



Cycle Interlocks

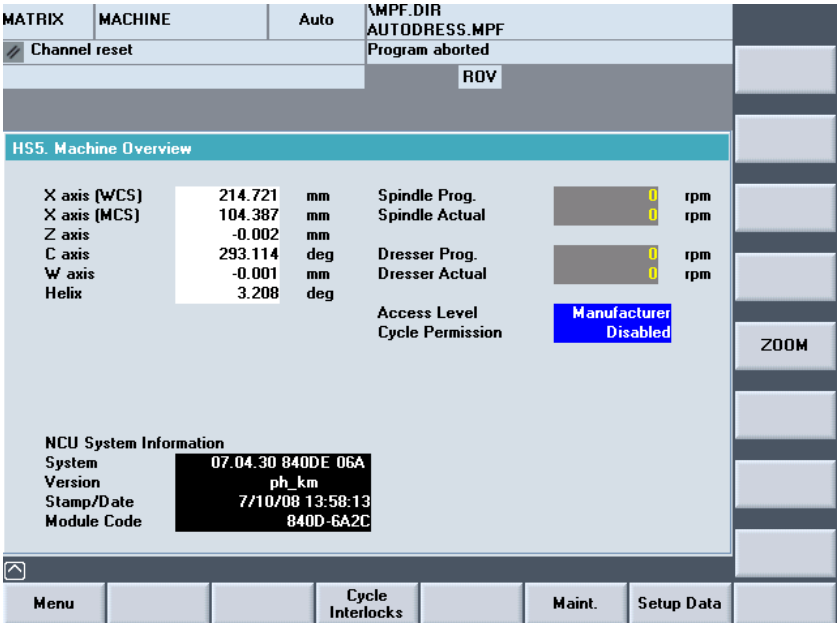


State = 0 interlock not active

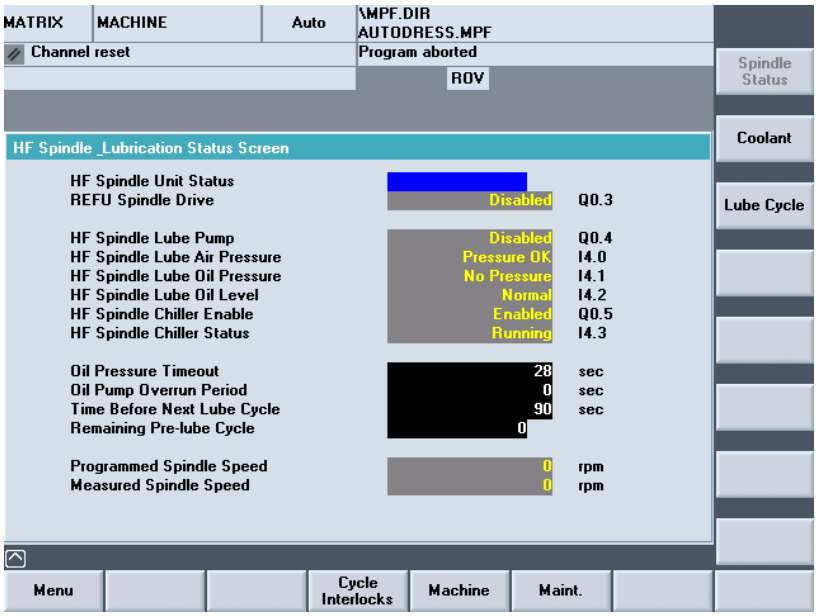
State = 1 an interlock condition is active that is currently preventing the cycle from operating

Using the blue arrow keys on the HMI panel cursor onto a bit field. Observe the message text in the lower status panel to give you specific indication of the area of the problem.

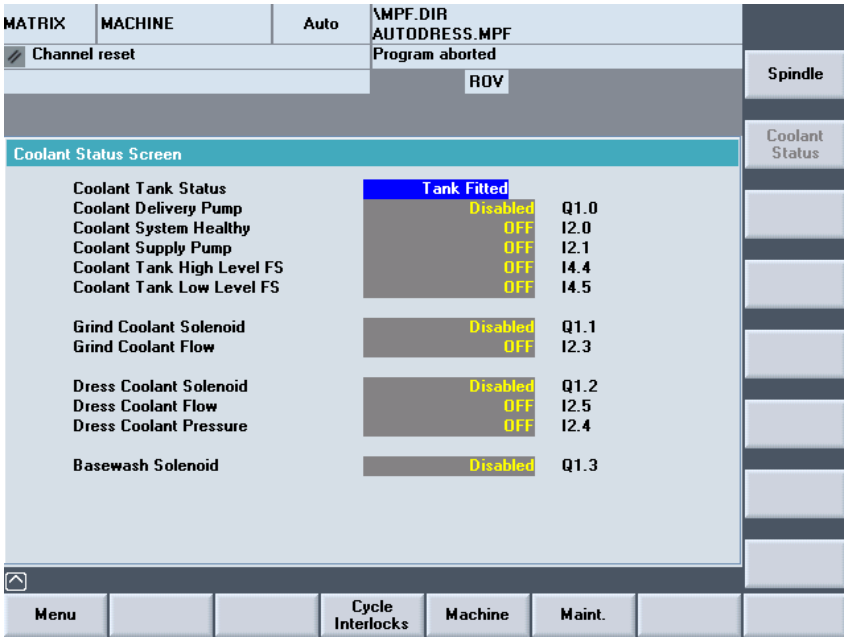
Machine Overview



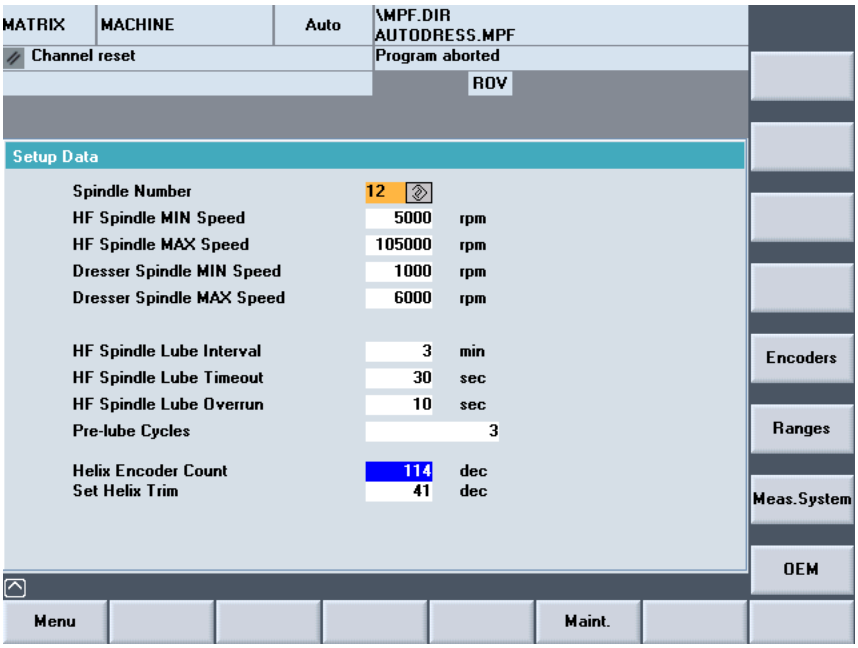
HF Spindle diagnostic screen



Coolant system diagnostic screen



Setup Data (Restricted Access)



This screen is only accessible at the manufacturer password level.

15.3 Alarm Messages

700002 Sinamics power supply WARNING!
Cause: The SINAMICS NC servo axis drives system reported a fault and therefore could not set the drive ready signal.
Remedy: Check input supply connections to the power supply module. Check all terminal block connections to the power supply and NCU module are full inserted. Refer to Siemens SINAMICS troubleshooting manual on DocOnCD or via the Siemens online documentation service DocOnWeb.

700004 Spindle drive not enabled
Cause: The main spindle fails to start following the user request because the spindle enable signal via the NCK > PLC interface is reporting that the spindle drive module has a fault.
Remedy: Check spindle drive module LED indicator is RED. Replace the spindle drive module. Refer to Siemens SINAMICS troubleshooting manual on DocOnCD or via the Siemens online documentation service DocOnWeb.

700006 Electrical cabinet temperature is too high!
Cause: The bi-metallic thermal switch located inside the electrical control cabinet has exceeded 45°C because the electrical cabinet (ECC) cooling system has stopped functioning. NC program execution is not permitted when this alarm is active.
Remedy: Shut-off electrical power to the machine from the mains isolator and open the electrical cabinet door to let it cool down. Check that the cooling system circuit breaker has not tripped. After 45 minutes close the cabinet door and then switch power back on. Check that the cooling system operates as normal. If the alarm re-appears immediately, then the bi-metallic thermal switch has not reset itself. Remove the switch from the ECC and put it into a refrigerator for 20minutes to get it back to the reset state. Re-fit the switch inside the ECC and check that the alarm clears.

700008 Axes Drives not ready - [Feed Start] required
Cause: The axis drives are ready but the [Feed Stop] key has been selected at the machine control panel. The axis drives are not ready for operation because of a fault or missing drive interlock signal.
Remedy: Select [Feed Start] key at the machine control panel. Check electrical interlock signals required to enable the drive system Refer to Siemens SINAMICS troubleshooting manual on DocOnCD or via the Siemens online documentation service DocOnWeb.

700009 Chiller unit not running
Cause: The chiller system failed to return the running status signal within 4 seconds after it had been started. Status signal is not being output by the chiller system. Chiller system is in a fault state.
Remedy: Check chiller system display panel. Refer to the chiller system manufacturer documentation if it is indicating and error state or displaying an error code. Check electrical connection between chiller system and the machine. Check that there is sufficient de-ionized water in the chiller tank.

700010 Servo drive system fault
Cause: The axis drives ready signal was not set by the Siemens drive system when the machine was master started. This could be because of an internal fault within a SINAMICS power module or the infeed power supply module.
Remedy: Refer to the Siemens SINAMICS drives documentation for troubleshooting instructions.

700014 Coolant pump not running
Cause: Cycle start attempted without first enabling the coolant system
Remedy: De-select the [coolant off] key at the machine control panel. Check coolant system is switched on and running.

700016 Helix drum clamp/unclamp pressure failure
Cause: The wheel head helix drum clamps failed to achieve clamping pressure (2200psi) within 3 seconds after the clamps were applied to the drum. Clamp pressure has been incorrectly adjusted. Faulty pressure switch or bad connection to the pressure switch. Helix drum clamp/unclamp solenoid not functioning.
Remedy: Manually operate the solenoid valve and check that the clamps release when the solenoid is energized and the clamps come on again when the solenoid is de-energized. Check /reset the clamping pressure switch.

700017 Machine circuit breaker tripped
Cause: One or more of the circuit breakers located in the electrical cabinet has tripped unexpectedly due to an excessive current demand from the load (pump, motor, etc).
Remedy: Check which circuit breaker has tripped inside the ECC and ensure that the current overload trip setting has been set in accordance with the FLC of the device being protected. Reset the circuit breaker.

700020 Grind flow switch failure
Cause: The grinding coolant flow could not be detected within 2 seconds after the grinding coolant supply solenoid was energized.
Remedy: Check Coolant system is switched on and the main coolant delivery pump is running. Check/replace the flow switch.

700024 Call to FC18 fault in Spindle FC block
Cause: The grinding spindle failed to start within 4 seconds after the user request to start the spindle or change to the programmed speed whilst operating in cycle.
Remedy: Contact your authorized Matrix Service representative for assistance to troubleshoot this fault.

700028 Air conditioning cooling unit fault K1 **700029 Air conditioning cooling unit fault K2**
Cause: The air conditioner unit fitted to the door of the electrical cabinet has developed a fault.
Remedy: Refer to the Rittal SK117 manual to troubleshoot this fault.

700100 Machine lubrication unit fault
Cause: The oil in the lubrication unit tank has gone below its minimum level. The lubrication unit pump motor has failed. The 220VAC power supply is not connected or fuse has blown.
Remedy: Top-up the oil in the lubrication tank. Check pump motor. Operate the lubrication unit manually to confirm operation and the green indicator is illuminated.

700101 NCK battery low
Cause: The NCK backup battery life has almost expired and needs to be replaced.
Remedy: Replace the NCK backup battery immediately.

700102 NCU module fan failure
Cause: The internal NCU module fan has failed to operate.
Remedy: Replace the fan immediately.

700103 Coolant flow switch not released
Cause: The flow switch is still detecting that there is coolant flow condition even though grinding coolant is not being supplied to the machine.
Remedy: Check/replace the grinding coolant flow switch.

700109 Maximum wheel speed not set - check setup data
Cause: The maximum grinding wheel speed is set to 0 or below the minimum speed

700110 Minimum wheel speed must be less than maximum speed
Cause: The minimum grinding wheel speed is set to a higher value than the maximum grinding speed.
Remedy: Check the maximum and minimum grinding wheel speed settings in Menu Select > Matrix > Setup Data Min speed should be >=500rpm but less than the max speed

700114 Machine air supply pressure is low
Cause: The main air supply pressure to the machine has reached a pressure below the minimum level required to operate the machine. Either there is not enough pressured air being supplied to the machine and/or the main air pressure solenoid has failed to operated.
Remedy: Check main air isolator is turned to the on position. Check air pressure supply to the machine is between 5.5 – 6.8bar. Check fuse that protects the air pressure solenoid circuit.

700116 Scale air purge pressure low
Cause: The air supply pressure to the measuring system has reached a pressure below the minimum level required to purge the X and Z axis linear encoders.
Remedy: Check main air isolator is turned to the on position. Check air pressure supply to the machine is between 5.5 – 6.8bar. Check fuse that protects the air purge solenoid circuit.

700117 Coolant tank level too high
Cause: There is too much coolant oil in the tank when the coolant system is in normal operation. The coolant high level float switch could have become stuck.
Remedy: Check the amount of coolant oil in the tank and siphon off excess coolant from the tank if necessary. Check the high level float switch operates correctly or replace it.

700118 Coolant tank level too low
Cause: There is not enough coolant oil in the tank when the coolant system is in normal operation. The coolant low level float switch could have become stuck.
Remedy: Check the amount of coolant oil in the tank and add more coolant to the tank if necessary. Check the low level float switch operates correctly or replace it.

700120 PI service failed to execute **700121 ASUP start error - FC9 did not run correctly**
Possible cause: The PI service fails because it unable to execute the ASUB program that was triggered to run, either because the ASUB program does not exist or is not loaded in the NC memory. There are 3 ASUP's defined as follows: GEARON.SPF this ASUB runs when the GEAR ON key is selected on the MCP GEAROFF.SPF this ASUB runs when the GEAR OFF key is selected on the MCP RETRACT.SPF this ASUB runs when the Yellow emergency wheel retract button is actuated Machine data relating to ASUB not set correctly.
Remedy: Check the following machine data are set: MD19500=1H MD10818=1 MD11602=3H MD11604=64 MD11610=2 MD11612=2 MD20117=F0FH MD20116=1H (chnl 1) MD20116=0H (chnl 2) Also, enter MW244, MW248,MW258 in PLC status (Diagnosis > PLC Status) and check error code returned 3 = Negative acknowledgment, job not executable - Internal error, try and NC reset 6 = FIFO full - Job must be repeated since queue is full 7 = Option not set - OB100 parameter "NCKomm" is not set 9 = Transmission occupied - Job must be repeated

700124 Minimum dresser speed not set
Cause: The minimum dresser spindle speed is set to 0 or >= the maximum grinding speed.
Remedy: Check the maximum and minimum dresser spindle speed settings in Menu Select > Matrix > Setup Data Min speed should be >=100rpm but less than the max speed

700125 Maximum dresser speed not set - check setup data
Cause: The maximum dressing disc/roll spindle speed is set to 0 or below the minimum speed.
Remedy: Check the maximum dresser spindle speed settings in Menu Select>Matrix>Setup Data Max speed should be <=600rpm.

700127 Dresser controller unit fault
Cause: The dresser spindle drive amplifier has developed a fault or the i/p supply is not available.
Remedy: Check the status indicator on the drive. If the LED indicator is red then the fault may be due failure of an electronic component in the amplier circuit board. Check the condition of the power and signal cables connecting to the dresser spindle. If cables appear damaged then the 5VDC supply to the spindle encoder may be shorted out. Replace the complete cable if necessary. Check circuit breaker protecting the input supply to the drive amplifier has not tripped. Reset if necessary.

15.4 Recovering from an axis software travel limit condition

The 3060 machine axes are factory configured with software position limits. If an axis has been unexpectedly jogged onto its software position limit then you will see an alarm message displayed on the machine HMI informing you of the axis which has reached its travel limit position.

Procedure

1. Select JOG mode at the machine control panel (MCP)

2. Select the axis that is on the software limit

3. If the axis is on the positive software limit then press the [-] jog button until the alarm message disappears

4. If the axis is on the negative software limit then press the [+] jog button until the alarm message disappears

15.5 Air conditioning unit alarm codes

Display Screen	System message	Possible cause	Measures to rectify the Fault
A01	Enclosure door open.	Door Open or door limit switch Incorrectly positioned.	Close door, position door limit switch correctly, check connection if necessary.
A02	Enclosure interior Temperature too high.	Cooling capacity too low / Unit under dimensioned. Error as a consequence of messages A03 to A17.	Check Cooling Capacity.
A03	Filter Monitoring	Filter mat soiled	Clean or exchange; Reset the comfort controller.
A04	Ambient temperature too High / too Low.	Ambient temperature outside Of admissible operating range (+10`C to +60`C).	Increase or lower the ambient temperature (e.g. heat or ventilate room)
A05	Icing Hazard	Operational display in case of Icing hazard. Evaporator fan may be mechanically Blocked or defective.	Set the enclosure interior temperature higher. Check the evaporator fan; release or exchange If necessary.
A06	PSA pressure-operated Switch.	Ambient Temperature to high	Lower the ambient temperature; Reset the comfort controller
		Condenser soiled	Clean the condenser; Reset the comfort controller.
		Filter mat soiled	Clean or exchange; Reset the comfort controller.
		E-Valve defective	Repair by refrigeration engineer; Reset the comfort controller.
		PSA pressure-operated switch defective.	Exchange by refrigeration engineer. Reset the comfort controller.
A07	Evaporator coil	Lack of coolant; sensor in front of or behind Condenser defective.	Repair by refrigeration engineer; Reset the comfort controller.
A08	Condensate warning	Condensate discharge kinked or blocked.	Check condensate discharge; remove any Kinks or blockages in the hose.
		Only in units with optional Condensate evaporation.	Check the evaporation unit, exchange if Necessary.
A09	Condenser fan	Blocked or defective	Clear the blockage; exchange if necessary.
A10	Evaporator fan	Blocked or defective	Clear the blockage; exchange if necessary.
A11	Compressor	Compressor overload (inner winding protection)	No action required; Unit switches on again independently
		Defective (check by measuring the winding resistance)	Exchange by refrigeration engineer.
A12	Condenser temperature Sensor	Open or short circuit	Replace
A13	Ambient temperature sensor	Open or short circuit	Replace
A14	Temperature sensor Icing	Open or short circuit	Replace
A15	Temperature sensor Condensate warning	Open or short circuit	Replace
A16	Temperature sensor Internal temperature	Open or short circuit	Replace
A17	Phase monitoring	For three-phase devices only: Incorrect rotary field/phase absent.	Exchange two phases.
A18	EPROM error	New board obstructed	Software update needed (only following board Installation with more recent software); enter The programming level with code 22; Press button 1 and confirm with “Set” until “Acc” appears. Then disconnect the unit from The mains and re-connect.
A19	LAN, Master – Slave	Master and slave not linked	Check setting and/or cable
A20	Voltage drop	Error display not shown	Result is stored in the log file.
E0	Display message	Connection problem between display And controller board.	Reset: Switch power supply off, then switch on Again after approx 2 sec.
		Cable defective; connection loose.	Exchange the Boards.

36 Coolant System Technical Data

Unit	Specification/rating data
Main coolant delivery pump	Grundfos CRK4-100-10 capacity: 80 l/min @ 5bar power:
Lift pump	Grundfos MTR5 – 8/3 A-W-A-HUUV capacity: 80 l/min @ 1bar power:
Magnetic separator	MA-12 capacity: 120 l/min power: 380/440V, 3ph, 50/60Hz
Oil Cooler Unit	Habor HK-2RMSB power: 380/415V, 3ph, 50/60Hz, 6.5A compressor: 380/415V, 3ph, 50/60Hz, 5.2A, 2.48kW temp. control: RT +/- 10°C refrigerant: R-407C 1.8kg

Space for your notes