0850/0850-T1 External Thread Grinder

User

Manual

Edition: 08/2013

Foreword

The information in this manual refers to equipment supplied by:

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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.

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This manual describes the use of the 0850 External Thread Grinder. Any options taken or deviations from the standard are documented in each machines individual set of manuals.

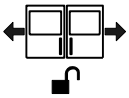
Matrix Machine Tool (Coventry) Limited reserves the right to modify its products without notification and consequently to supply machines which are not in every detail in accordance with the descriptions and procedures in this publication.

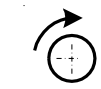
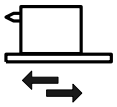
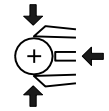
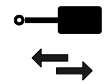
(This manual was written using Calibri font , size 12)

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
	**[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
	**[Lights ON/OFF]**	General machine lighting ON/OFF toggle function
	**[YES]**	Dialog prompt acknowledge button
	**[Unlock Door]**	Unlock guard door request
	**[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

	**[ROTATE]**	Workpiece continuous rotate
	**[TAILSTOCK ADV/RET]**	Tailstock advance/retract toggle
	**[STEADY OPEN/CLOSE]**	Workpiece steady open/close toggle
	**[PROBE ADV/RET]**	Probe advance/retract toggle
	**[WARM-UP]**	Machine warm-up cycle select
X	**[X]**	machine X axis select
Z	**[Z]**	machine Z axis select
C	**[C]**	machine C axis select
A	**[A]**	machine A axis select
W2	**[W2]**	tailstock 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!

WARNING!

- DO NOT EXCEED the maximum surface speed (usually specified in m/s) of the grinding wheel as recommended by the wheel manufacturer.

The maximum surface speed of the grinding wheel is determined by its usable diameter. The table below shows the max and min wheel diameters permitted on the machine and associated maximum surface speeds:

Grinding wheel diameter	Max surface speed @ 2000rpm
500mm (max)	52 m/s
400mm (min)	42 m/s

WARNING!

Only grinding wheels with the following tolerances mounted on Matrix flanges must be used on this machine. Grinding wheels with a coarser and softer specification than **80L** should not be used without reference to either Matrix or the grinding wheel manufacture.

Width	+/- 0.20mm
bore diameter up to 75mm	+ 0.025mm + 0.100mm
bore diameter 125mm to 200mm	+ 0.050mm + 0.150mm
bore diameter 225mm to 250mm	+ 0.050mm + 0.178mm

The maximum peripheral speed of the grinding wheel is limited to **50m/s** when the machine guard doors are open.

CAUTION!

Only **trained persons** that have been instructed in the safe mounting of grinding wheels are allowed to change and mount grinding wheels.

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 Machine Overview

The 0850 machine is a purpose built multi-axis CNC external thread grinder specifically designed for the precision grinding of many types of workpiece with an external thread or ballform requirement.

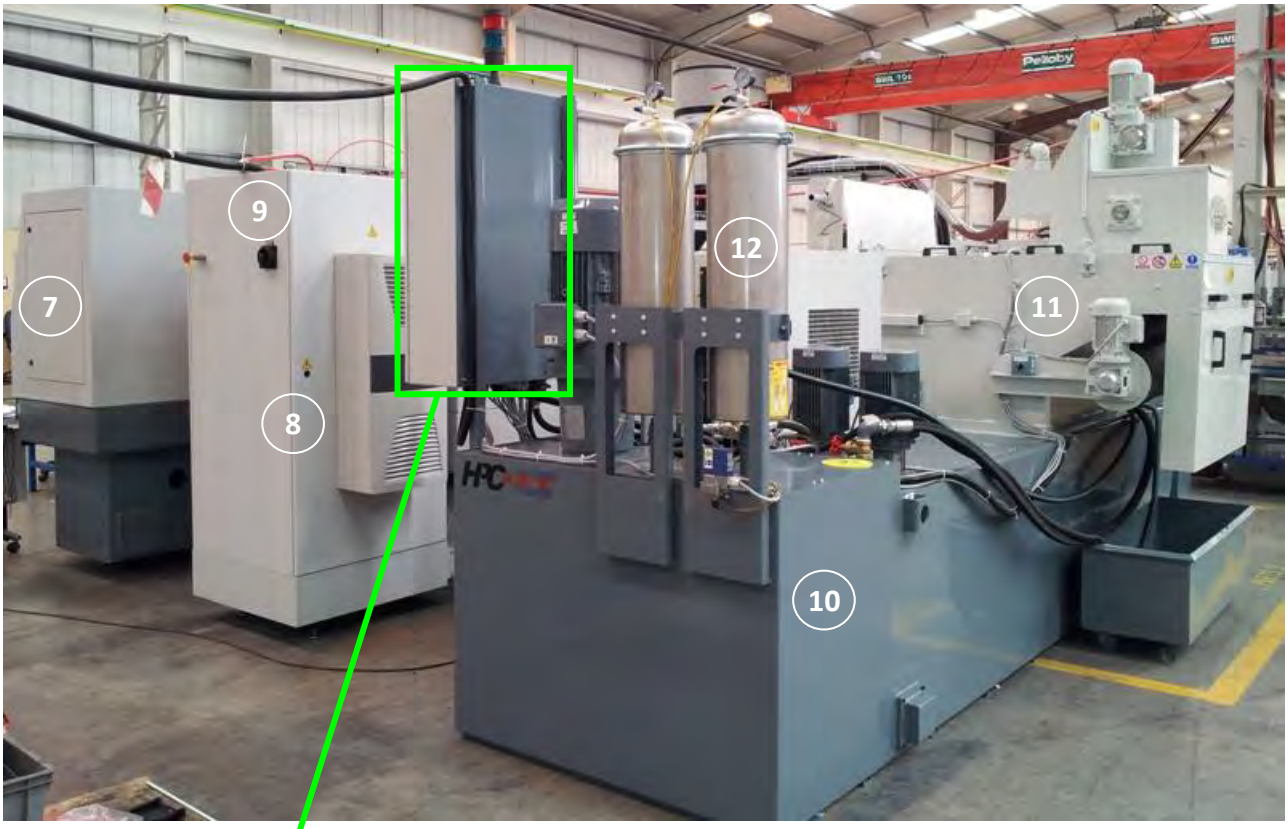
The machine base, sub-slides and headstock are each constructed of single-piece high quality seasoned cast iron. Featuring a fully enclosed hood with a safety interlocked main operator access door and service access panels the machine is easily accessible from all sides.

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.

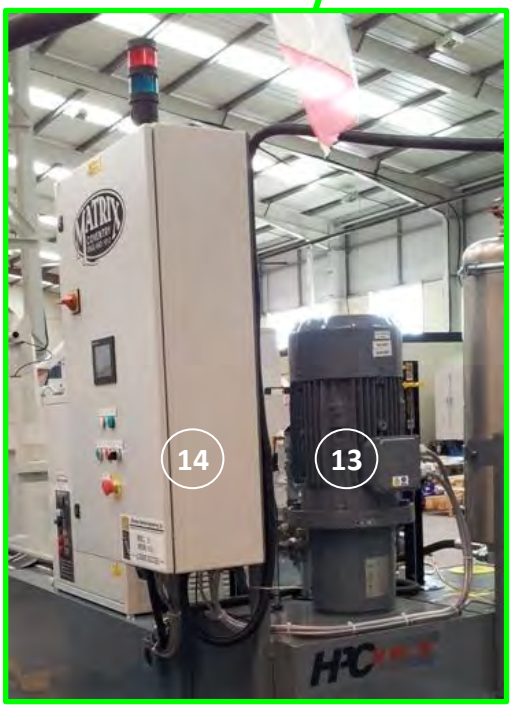
3.1 General layout

Front view of machine

1	Machine Control Console
2	Grinding wheel retract pushbutton
3	Power chuck open/close pedals (option)
4	Manual sliding operator access door (standard) with safety interlock Auto sliding door (option)
5	ANDON light stack (option)
6	Fume extraction unit



RH rear perspective view of machine



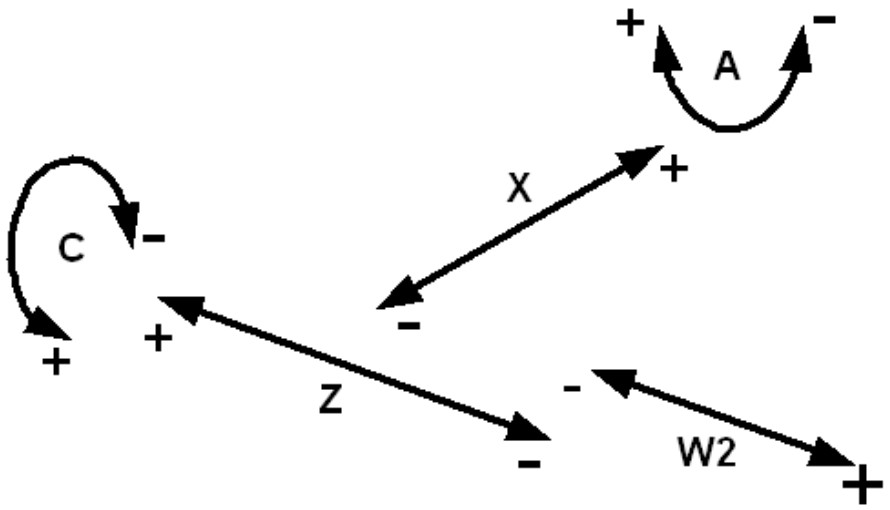
7	RH side machine service access door
8	Electrical Control Cabinet with AC unit fitted to door panel
9	Main electrical power isolator switch
10	Coolant system
11	Stage 1 coolant oil filtration
12	Stage 2 coolant oil filtration
13	High pressure lift pump
14	Coolant system control panel

LH rear perspective view of machine

15	LH side machine service access door
16	Machine rear service access doors
17	Operator/Setter sliding access doors (for wheel and dressing tool change)
18	Workhead chuck pneumatic services control panel
19	Return coolant oil sub-tank
20	Grinding and dressing spindles chiller unit

Coolant system view (rear of machine)

3.2 Axis configuration



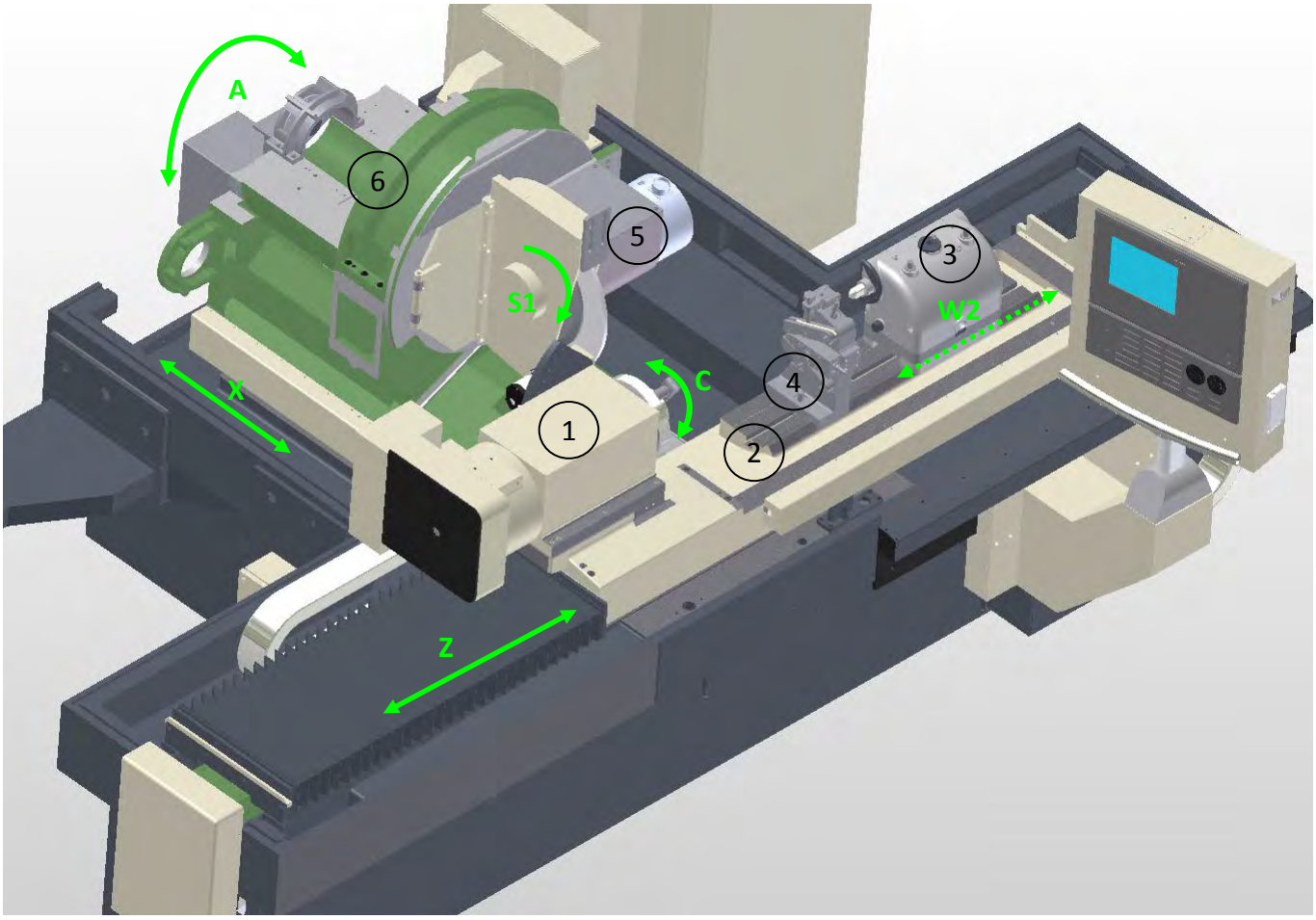
Axis	Description
X	Wheelhead linear infeed slide
Z	Wheelhead linear transverse slide
C	Workhead spindle (rotary)
A	Spindle helix (rotary)
W2	Tailstock linear sub-slide (option)
S1	High Frequency grinding spindle
S2	Dressing spindle (mounted to the side of the workhead)

Absolute encoders are fitted as standard to the X, Z, C, A and W2 (option) axes, so there is no need to reference the machine after power on.

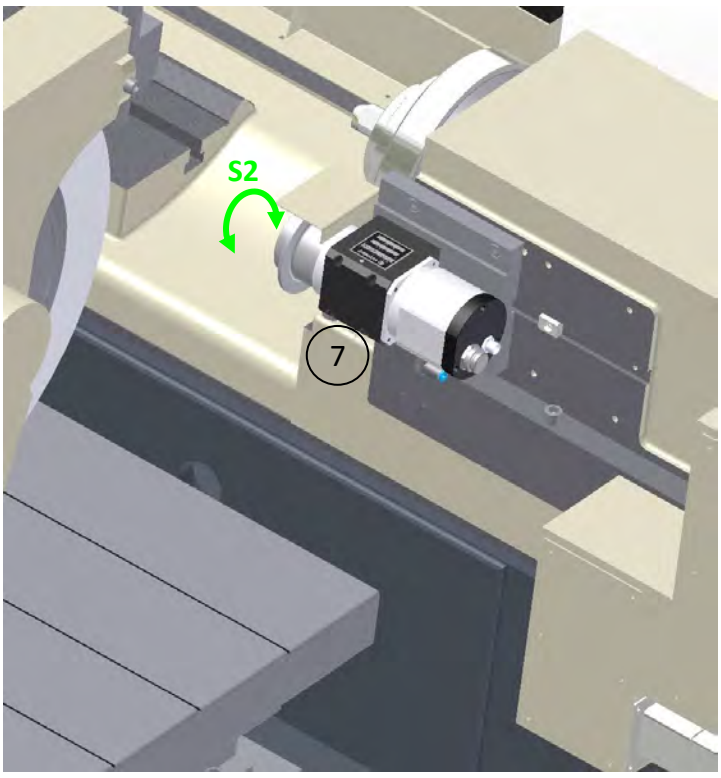
Note:
If the power chuck option is fitted to the machine then it will be necessary to reference the C axis because it is fitted with and incremental rotary position encoder.

⚠	**WARNING** Machine axis zero positions and software travel software limits are factory set and must NOT be altered otherwise the machine could get damaged and this is NOT covered by your machine warranty.

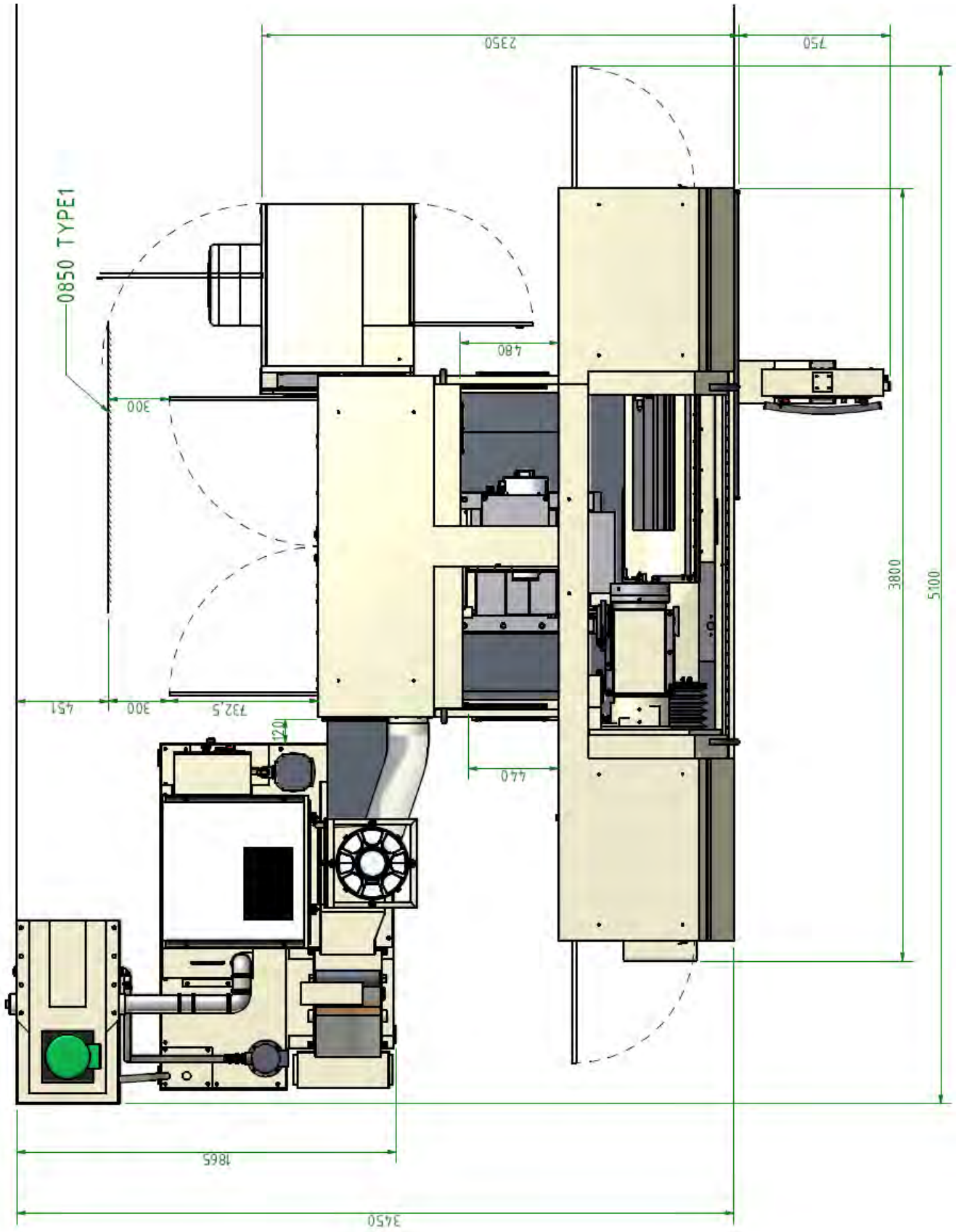
3.3 Machine configuration



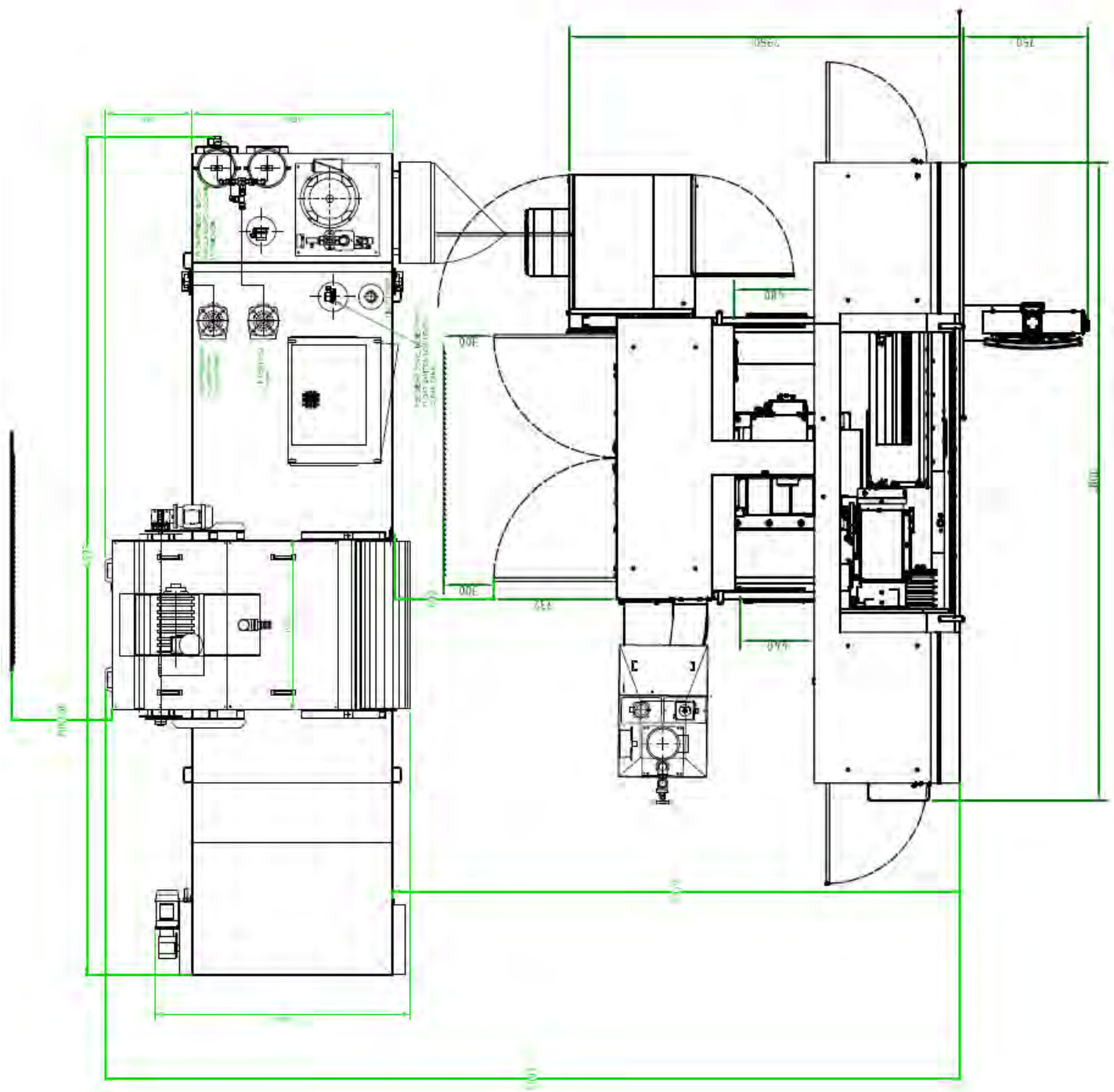
1	Direct drive torque motor workhead (C axis)
2	Traversing worktable (Z axis)
3	Manual Tailstock (standard) Traversing tailstock (option) Worktable is fitted with a servo drive sub-slide (W2 axis).
4	Manual workpiece steady (standard) Power steady (option)
5	Water cooled grinding spindle(S1)
6	Wheelhead helix table (A)
7	Dresser spindle (S2)



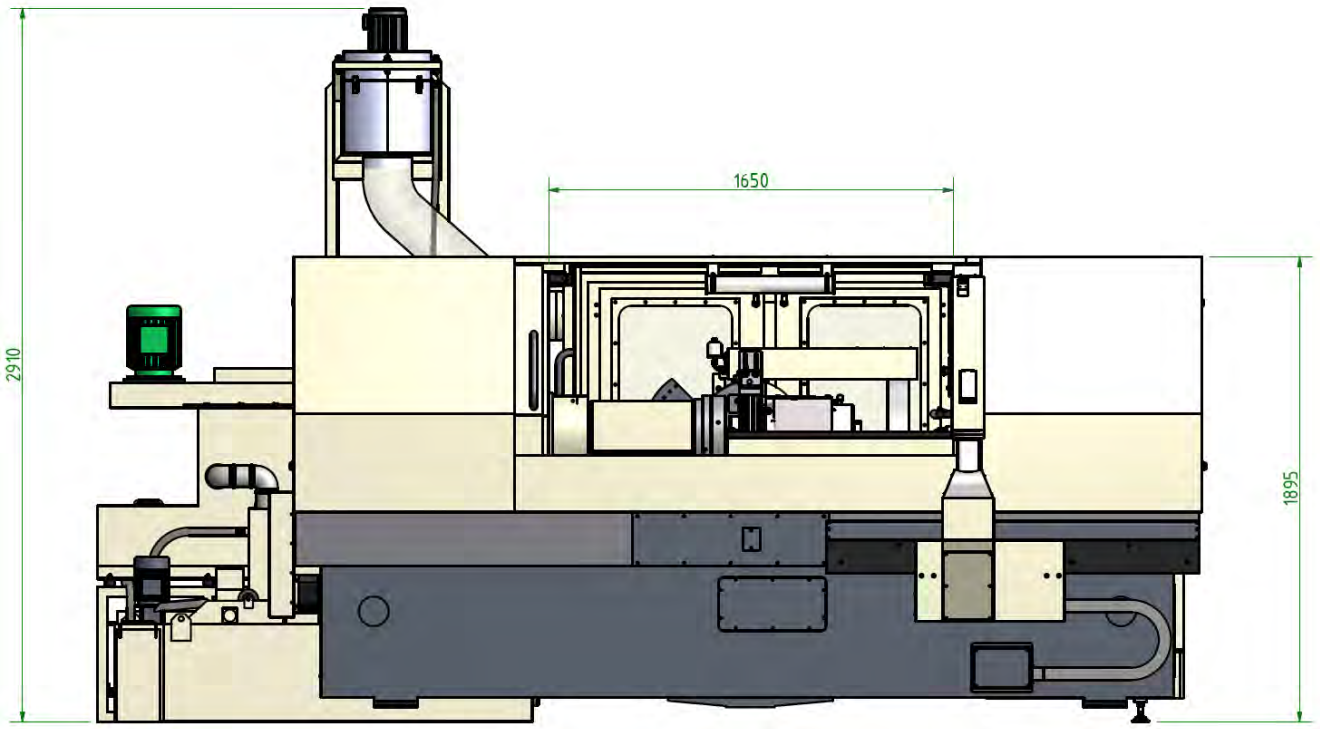
3.4 Machine floor layout (with 800L coolant system)



3.5 Machine floor layout (with optional high pressure 3000L coolant system)



3.6 Minimum workshop height requirement



The workshop floor-to-ceiling height where the 0850 machine and associated equipment is to be located must have a minimum room height of 4000mm.

4 Technical Data

Workpiece	
Max Ø admitted	350mm
Max Ø ground - with maximum wheel	350mm
Max Ø ground - with minimum wheel	350mm
Min Ø ground	10mm
Max length supported between centres	800mm
Max thread length ground (between standard centres)	800mm
Max workpiece mass (including workholding)	200kg

Programming	
Lead 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)	10,000kg
Floor area	4200 x 5100mm

Grinding Spindle	
Max Power	8.8kW
Speed range	500 – 2000rpm
Wheel adaptor interface	Tapered shaft with 70mm locknut
Integral wheel balancing system (SCHMITT)	Standard

Workhead Spindle (C axis) - standard	
Servo motor rating	154Nm @ 120rpm
Programmable speed range	1 to 120rpm
Encoder type	Heidenhain /Rotary /Absolute
Positioning resolution	5 arcsec (0.0014°)

Workhead Spindle (C axis) – with power chuck	
Servo motor rating	154Nm @ 120rpm
Programmable speed range	1 to 120rpm
Encoder type	Renishaw /Rotary / Incremental
Positioning resolution	5 arcsec (0.0014°)

Wheelhead Infeed (X axis)	
Slide travel	360mm
Traverse speed	0 – 7M/min
Encoder type	Heidenhain /Linear /Absolute
Positioning resolution	0.0001mm

Wheelhead Traverse (Z axis)	
Slide travel	950mm
Traverse speed	0 – 7M/min
Encoder type	Heidenhain /Linear /Absolute
Positioning resolution	0.0001mm

Wheel Helix (A axis)	
Programmable helix angle range	± 45°
Encoder type	Heidenhain /Rotary /Absolute
Positioning resolution	0.01°

Grinding Wheel	
Max wheel Ø	508mm
Min wheel Ø	408mm
Bore Ø	203.2mm
Min wheel width	10mm
Max wheel width	50mm
Wheel adaptor	1 supplied as standard

Dressing System	
Fixed helix (0°) workhead mounted dresser assembly	Standard
Adjustable helix (±45°) workhead mounted dresser assembly	Option
Dresser spindle power	0.63kW
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 display panel	Siemens OP010 / 10.4” colour TFT / 640 x 480 pixels
Program/jobfile storage media	Hard disk
USB port	Yes
Connectivity	Ethernet/LAN
ANDON light stack	Option

Hardware Options	
Spindle chiller unit	Standard
800L coolant system (5bar working pressure)	Standard
3000L coolant system (70bar working pressure)	Option
Workpiece probing system	Option
Special workholding/fixturing	Option
Powered workhead 3-jaw chuck	Option
Manual workpiece steady	Standard
Powered workpiece steady	Option

Dressing Tools	
Single point diamond dressing attachment	Option
52mm Ø bore diamond roll (with customer specific profile)	Option
52mm Ø bore diamond disc (4mm flat)	Standard
52mm Ø bore diamond disc (sharp Vee)	Option
52mm Ø bore diamond disc (radius)	Option

Software Tools	
HMI dialog programming and cycles package	Standard
ProfileMATE Thread profile software	Standard
ProfileMATE End-threading software function	Option
ProfileMATE Worm (ZI,ZA,ZN) profile software	Option
ProfileMATE Worm (ZK) profile software	Option
ProfileMATE Dual lead (duplex) worm function	Option

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 **Adjustable helix (±45°)**. 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. The roll or disc is attached to the dressing spindle with an expanding collet.

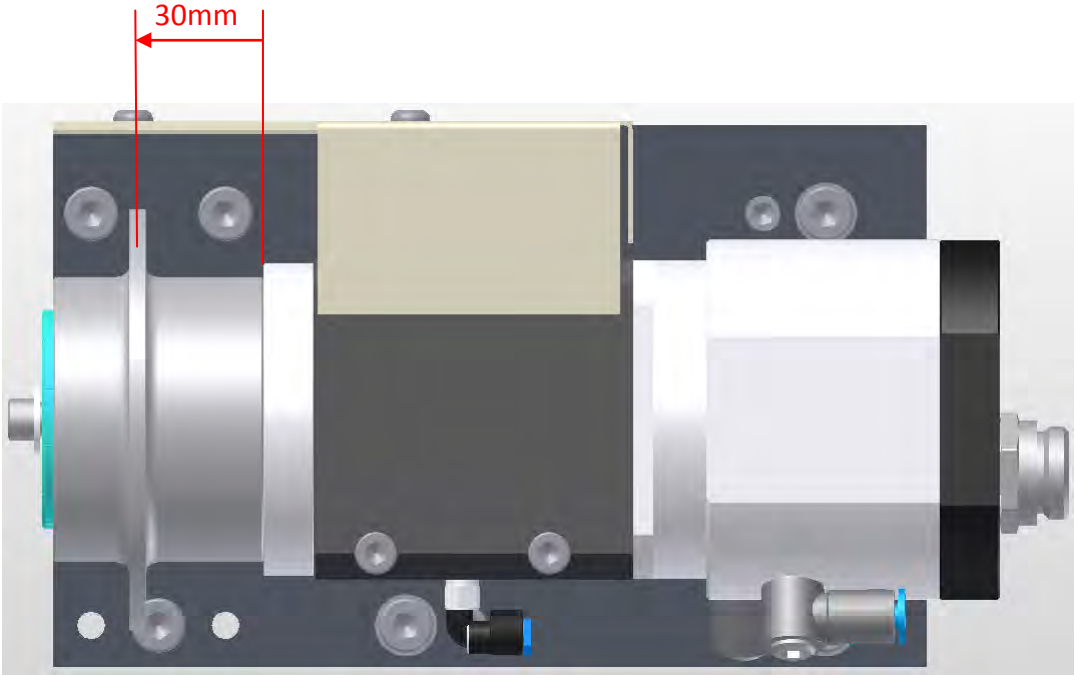
⚠	**WARNING** Never operate the dressing spindle with just the expanding collet fitted or the collet will be damaged.

The dressing system also supports the Matrix designed single point diamond holder block (option) which installs over the spindle shaft without the expanding collet. The single point diamond block accepts standard diamond pen holders.

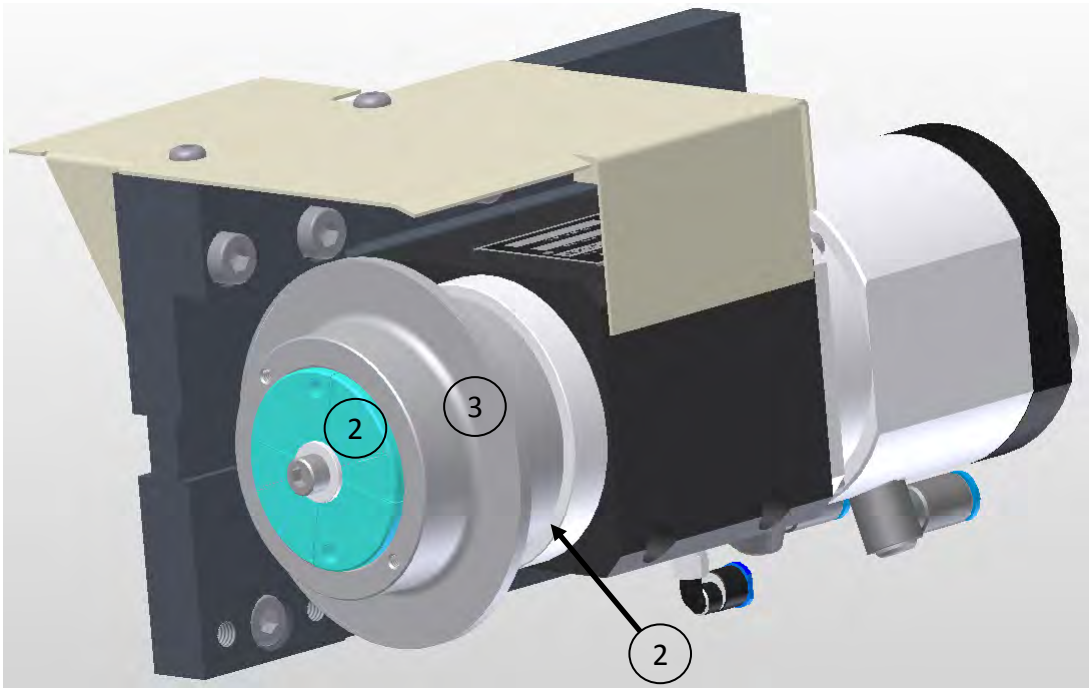
Located to the side of the workhead the dresser system can easily be accessed from the front or side of the machine.

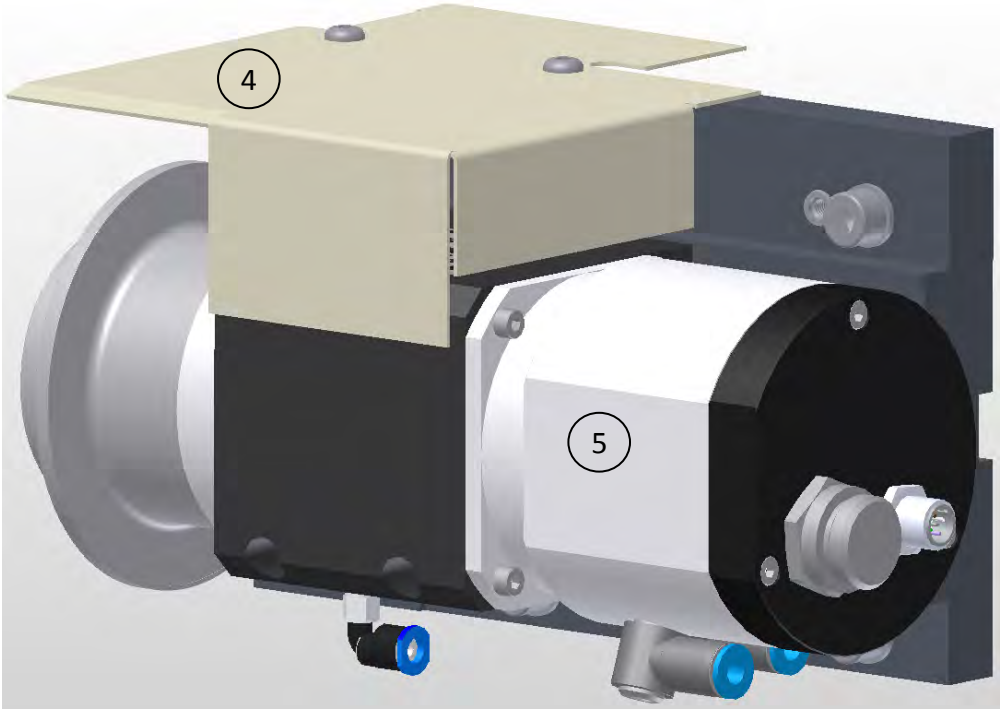
5.1 Fixed Helix backplate (standard)

The dressing spindle is locked at the 0° helix position. Therefore, you cannot make any adjustments to the dresser helix angle.



With this type of dresser unit the grinding wheel spindle helix (A axis) returns to 0° position when it needs to perform wheel dressing. Upon completion of the dressing sequence the wheel spindle helix then returns back to the helix angle required to grind the workpiece.





1	Diamond disc/roll location face	4	Coolant spray deflector
2	Expanding collet	5	Water cooled spindle motor
3	Dressing tool		

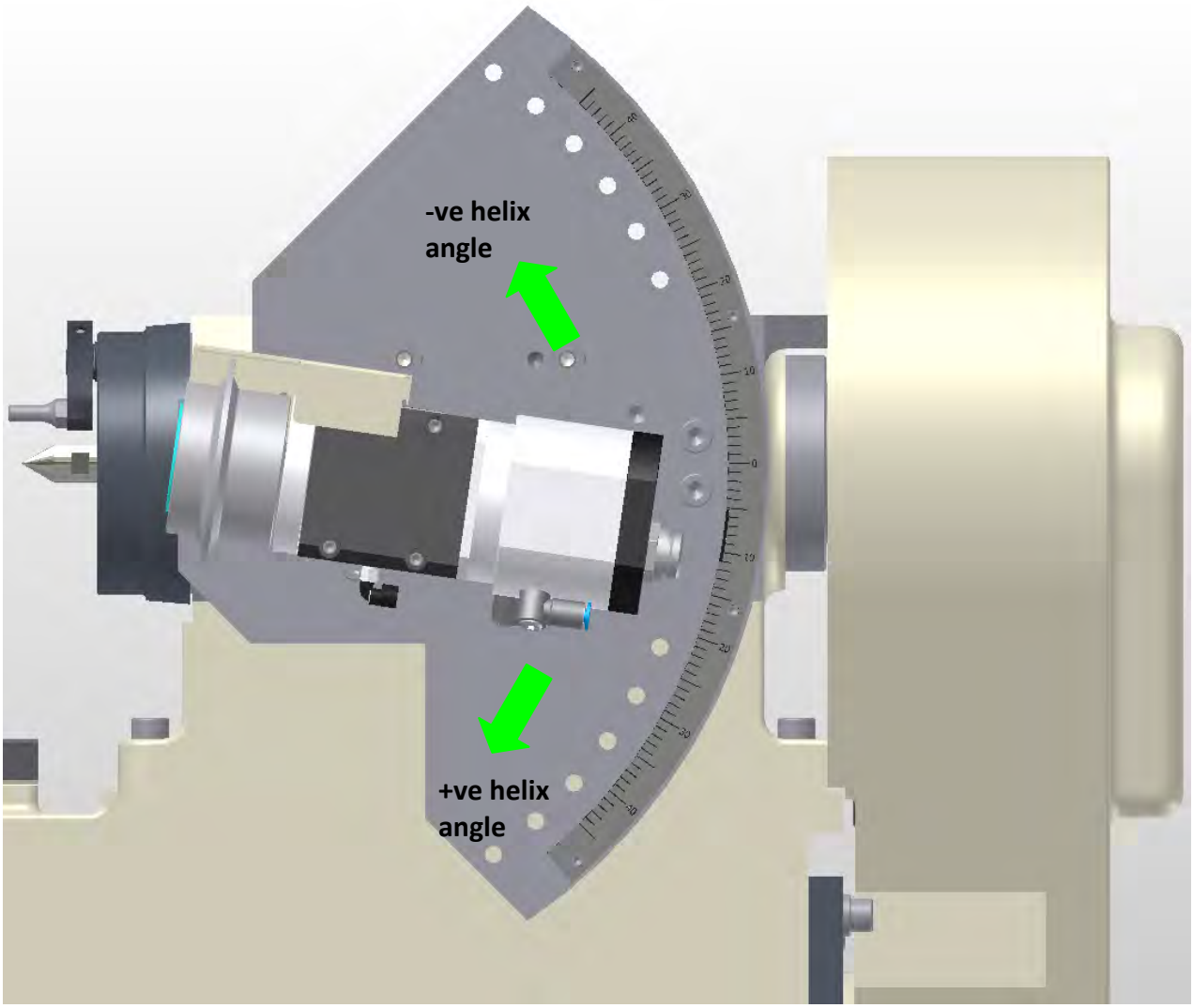
Dressing tools supported:

Diamond disc – sharp Vee, flat, radius
Profiled Diamond Roll
Single Point diamond

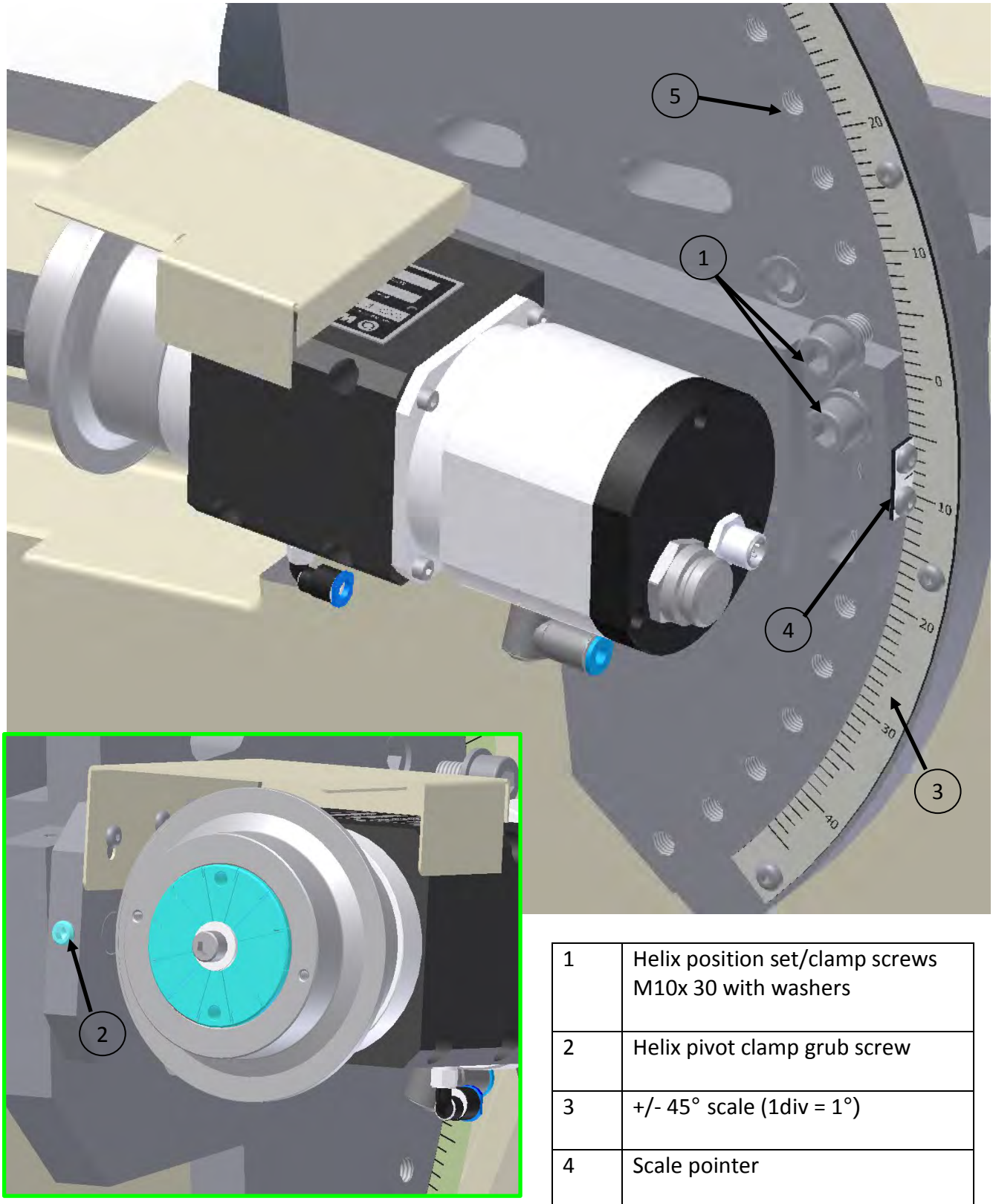
5.2 Adjustable Helix backplate (option)

The adjustable dresser helix option allows you to dress the grinding wheel whilst the wheel remains set at its spindle angle for both grinding and dressing cycles. Therefore, machine efficiency is improved by this method and production cycle time reduced.

However, it should be noted that this only applies when using a diamond roll dressing tool. It offers no benefit when wheel profile dressing is to be performed using a diamond disc or single point dressing tool.



Dressing spindle helix range: +/- 45°



1	Helix position set/clamp screws M10x 30 with washers
2	Helix pivot clamp grub screw
3	+/- 45° scale (1div = 1°)
4	Scale pointer
5	clamping position holes

Procedure for setting the dresser helix angle

1. Loosen the helix **pivot clamp** grub screw using an allen key.

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

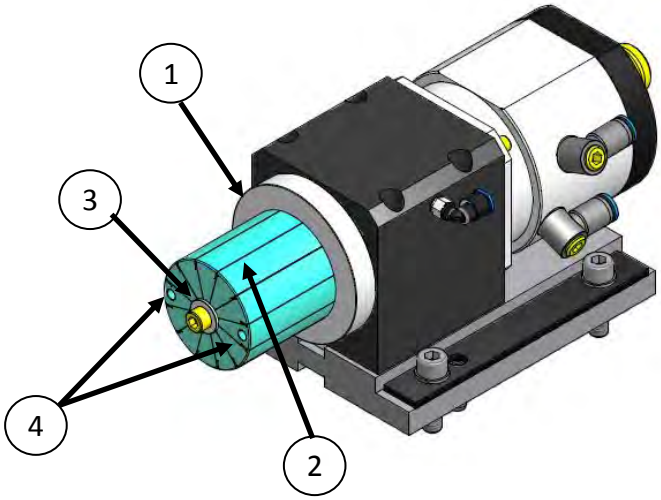
3. Set the dresser to the required helix angle on the scale. Note: 1div = 1°
   Note: If you need to set the helix angle above or below 5° then remove the 2x M10 **position clamp** screws and rotate the spindle to the required helix angle and then replace the screw in the nearest available clamp position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

4. Using an allen key turn the fine adjust grub screw to set to the helix angle.

5. Finally, tighten-up the 2x M10 position clamp screws and the pivot clamp grub screw.

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

WARNING
Never operate the dressing spindle with just the expanding collet fitted or the collet will be damaged.

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.

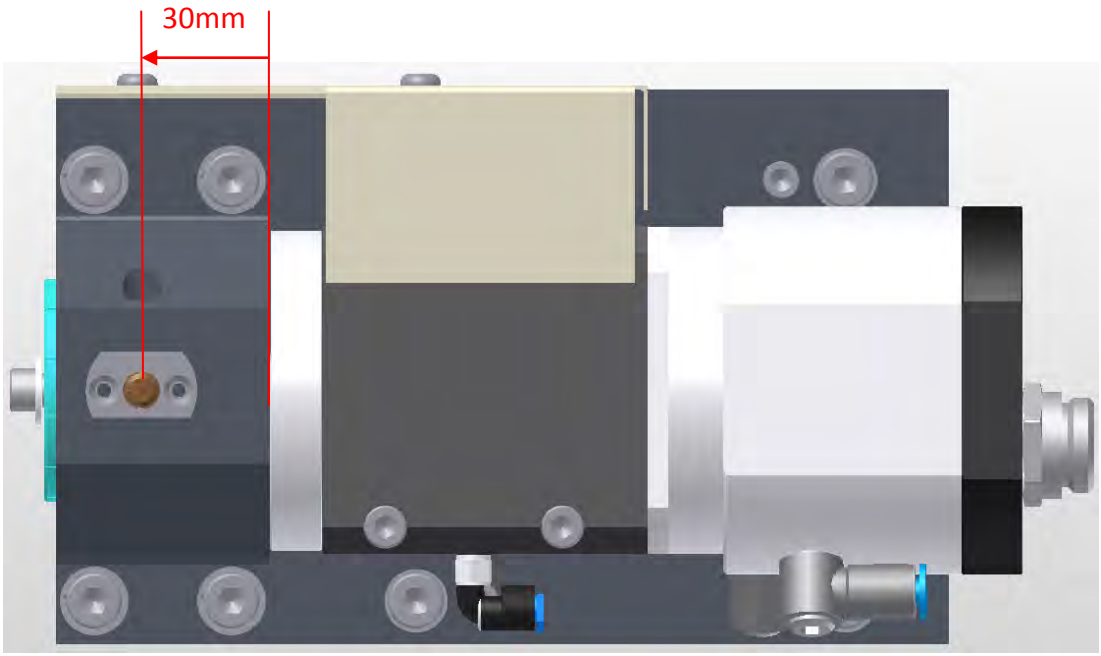
Procedure for removal of the dressing disc/roll

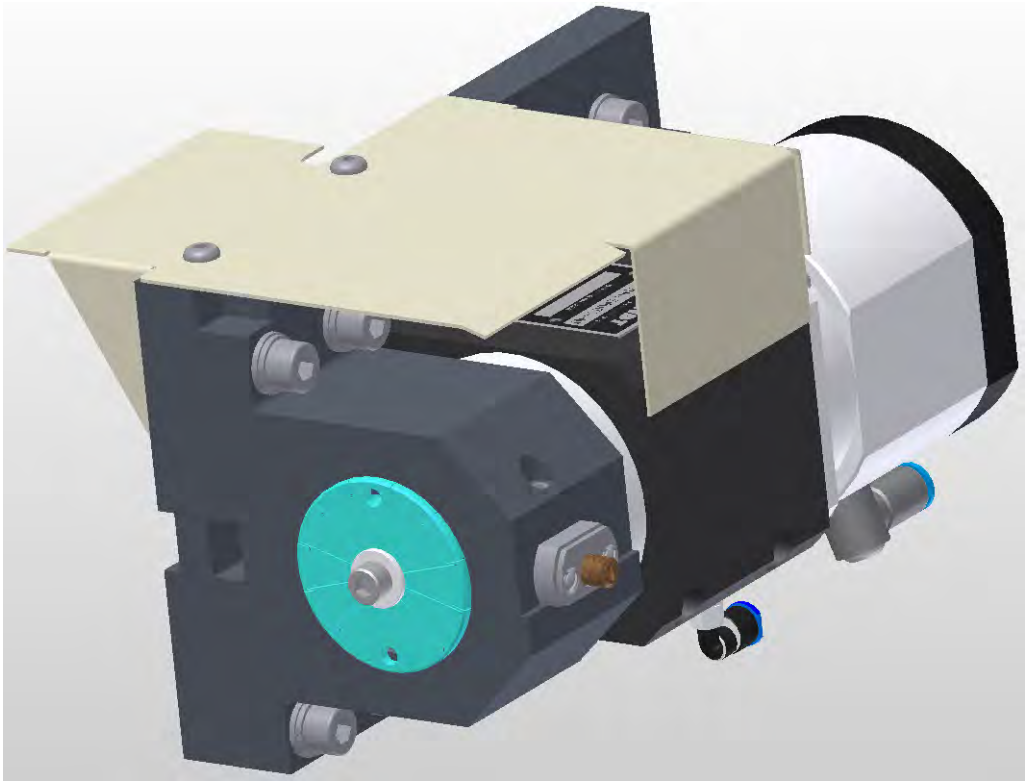
1. Using the supplied pin spanner hold the collet steady and then slacken the M6 screw using the 5mm allen key.

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

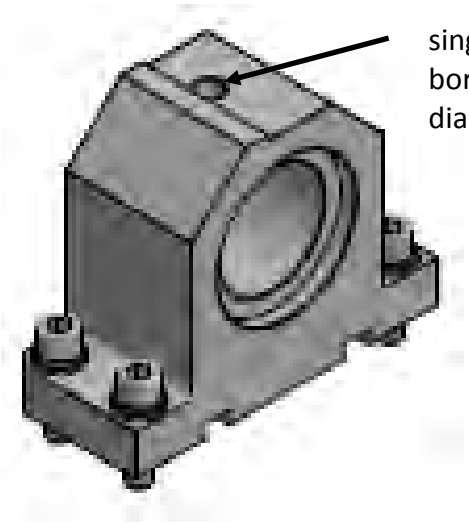
5.4 Single-point diamond holder (option)

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.





⚠	**CAUTION** The expanding collet must be removed before you fit the single point mounting block.



single point diamond location bore to accept standard size diamond holder/pen.

Procedure for mounting the single-point diamond holder

1. Remove the expanding collet from the dressing spindle and put it somewhere safe.

2. Locate the single point diamond holder to the backplate and carefully slide it over the exposed dresser spindle shaft.

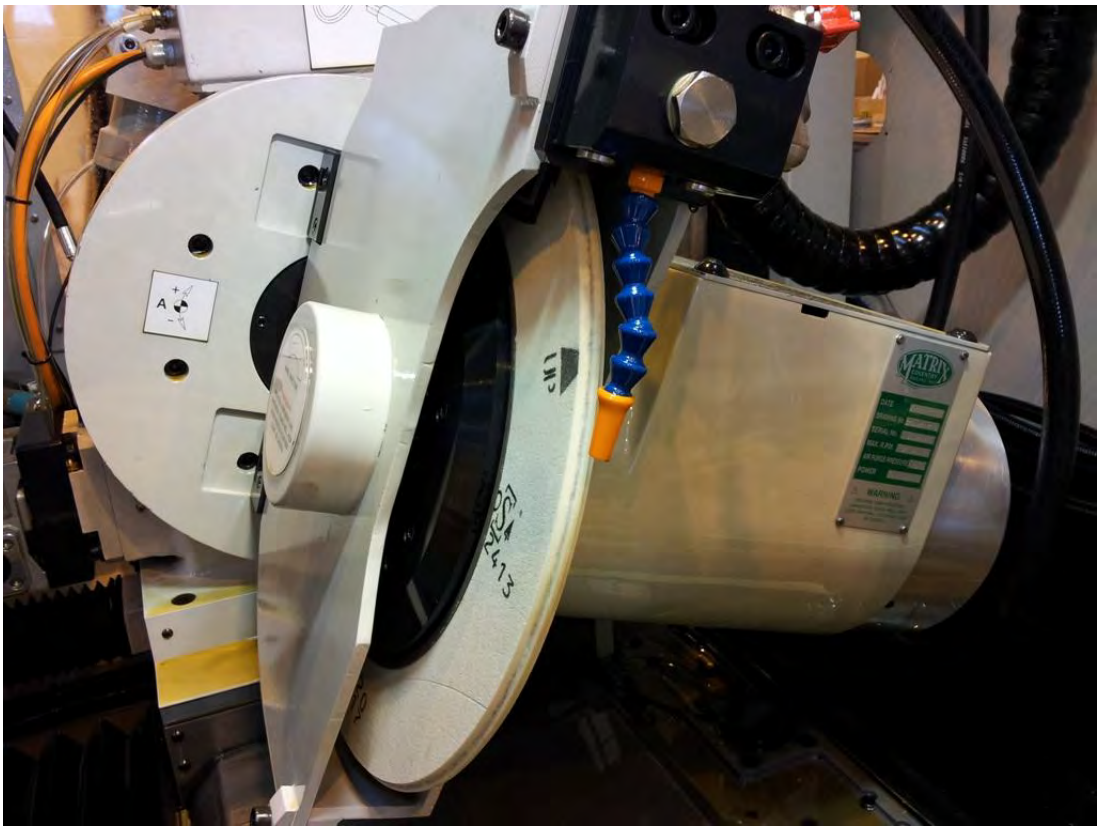
3. Secure the holder in place using the 4 x 8mm socket screws provided.

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 Grinding Spindle

The 8.8kW built-in motor and is supplied from a solid state high frequency inverter drive unit housed in the electrical control cabinet.



The grinding wheel guard has been designed and manufactured in accordance with the safety requirements for the stationary grinding machinery standard (ref: EN13218).

Mounted directly above the grinding and to the fixed part of the wheel guard is the coolant oil manifold block into which can accept upto 3 flexible coolant nozzles.

Spindle Chiller System

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

6.1 Spindle Warm-Up

As with any type of grinding spindle, it is recommended 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

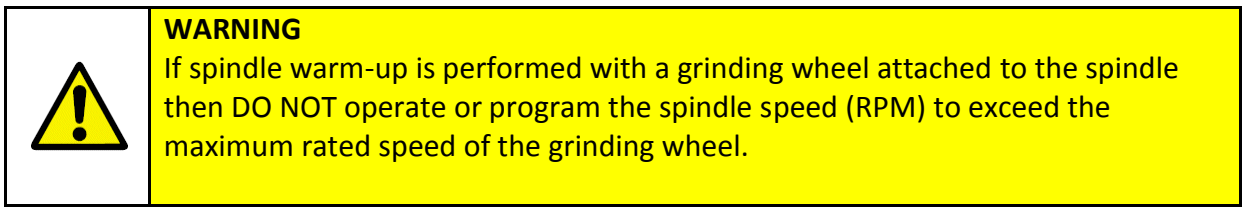
1. Start the machine at the machine control panel **[MASTER START]**.

2. Close the operator access guard door.

3. Select **[JOG]** mode and then start the spindle **[SPINDLE START]**. The spindle will start and run at the default speed 500rpm with the spindle override set to 100%.

   If you want to warm-up the spindle at the typical grinding speed then select [MDA] and [SETUP] mode at the MCP then enter the required speed using the command ***S1=<desired spindle speed in rpm>***.

   For example, if you wanted to run the spindle at 1000rpm then enter S1=1000 in the MDA command window followed by pressing [CYCLE START] to execute the command.



4. Select the wheel balancer screen [Menu Select] > [Balancer] and select the [AUTO] balance function.

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

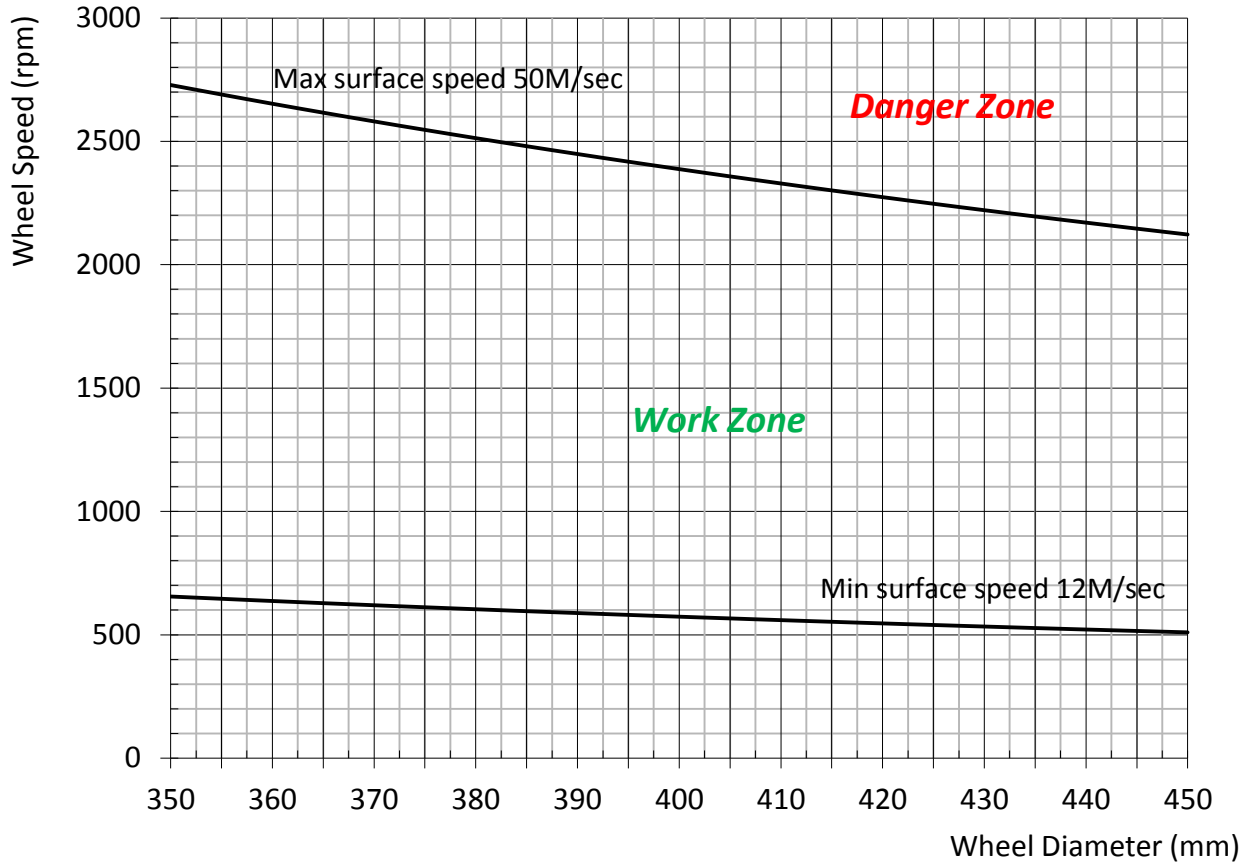
6. Stop the spindle **[SPINDLE STOP]**.

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

8. Done.

6.2 Grinding Wheel Speed Chart

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



Ensure that the grinding wheel operates within the "Work Zone" area as shown in the chart above.

CAUTION
The programmed speed (RPM) of the grinding spindle must NEVER exceed the maximum rated speed marked on the grinding wheel.

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):

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

6.3 Handling 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!

WARNING!

- DO NOT EXCEED the maximum surface speed (usually specified in m/s) of the grinding wheel as recommended by the wheel manufacturer.

The maximum surface speed of the grinding wheel is determined by its usable diameter. The table below shows the max and min wheel diameters permitted on the machine and associated maximum surface speeds:

Grinding wheel diameter	Max surface speed @ 2000rpm
500mm (max)	52 m/s
400mm (min)	42 m/s

WARNING!

Only grinding wheels with the following tolerances mounted on Matrix flanges must be used on this machine. Grinding wheels with a coarser and softer specification than **80L** should not be used without reference to either Matrix or the grinding wheel manufacture.

Width	+/- 0.20mm
bore diameter up to 75mm	+ 0.025mm + 0.100mm
bore diameter 125mm to 200mm	+ 0.050mm + 0.150mm
bore diameter 225mm to 250mm	+ 0.050mm + 0.178mm

The maximum peripheral speed of the grinding wheel is limited to **50m/s** when the machine guard doors are open.

CAUTION!

Only **trained persons** that have been instructed in the safe mounting of grinding wheels are allowed to change and mount grinding wheels.

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

6.4 Checking the grinding wheel

1. Inspect a new grinding wheel before mounting it on the machine. Look for cracks, nicks or signs of damage. If in any doubt about the soundness of the wheel then **DO NOT USE IT!**

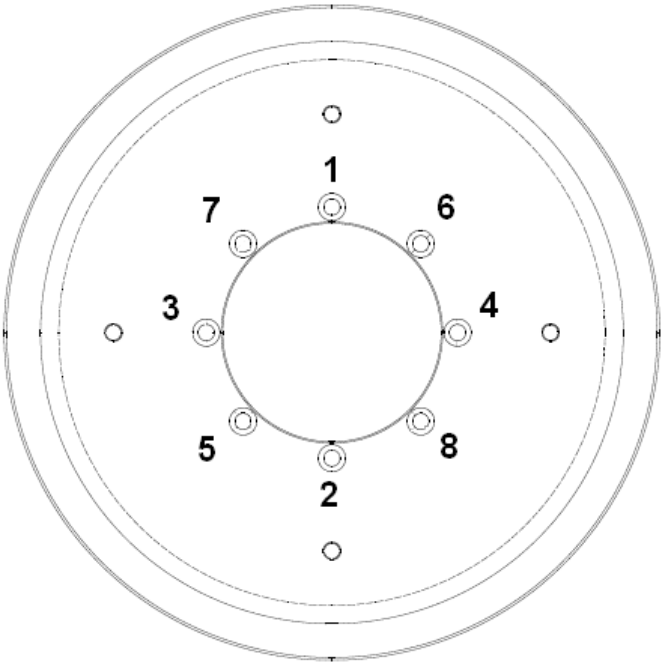
2. Inspect wheel adaptor flange. Before mounting a wheel be sure the adaptor flange is sound and the wheel can be clamped evenly. Check adaptor flanges for flatness and for proper undercuts where the adaptor flanges join the cylindrical hole. Fillets must not exist and the adaptor flanges must not exert intense pressures on the corners of the wheel hole.

3. Check wheel speed rating and is suitable for use on the machine.

6.5 Mounting the grinding wheel

	**CAUTION!** Only **trained persons** that have been instructed in the safe mounting of grinding wheels are allowed to change and mount grinding wheels.

Use light pressure when mounting a wheel. Do not force a wheel on to a wheel adaptor. Use new paper blotters.

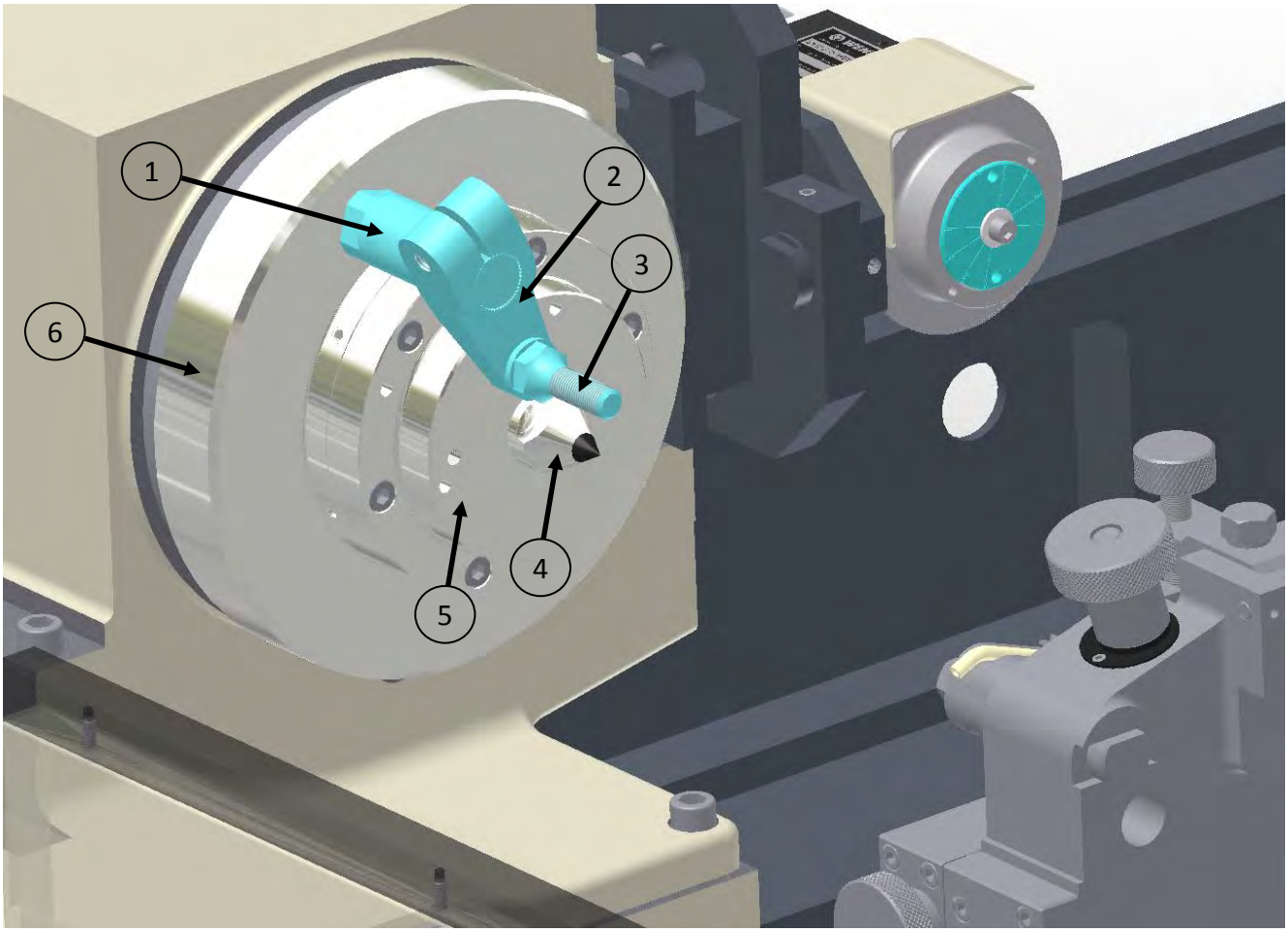


Tighten the wheel adaptor screws in the sequence shown above using a 6mm A/F allen key. Gently tighten each screw by the same amount and go round the sequence again several times until all 8 screws are tight enough to give a firm but not crushing pressure to the wheel.

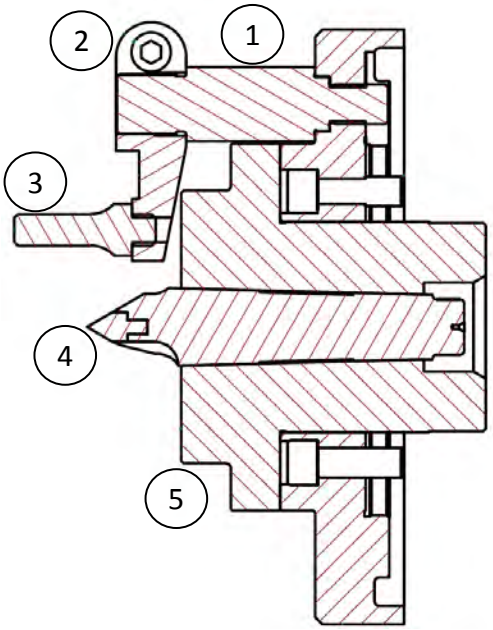
7 Workhead

7.1 Standard Workhead

The direct drive 154Nm torque motor driven workhead spindle is supplied with a No.4 MT floating centre and workpiece driver arm assembly.



1	Splined driving peg
2	Driving arm
3	Driving pin
4	No.4 MT centre with carbide tip
5	Floating centre
6	Floating centre drive plate



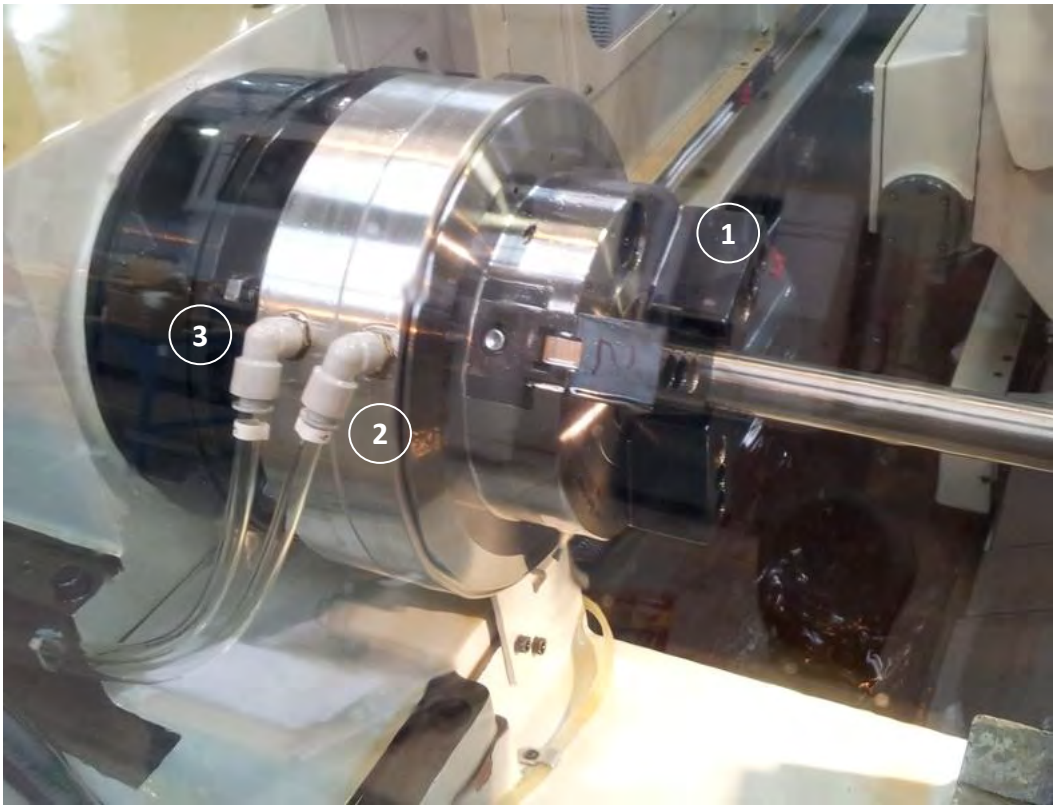
7.2 Power operated workhead chuck (option)

The 3-jaw power chuck option saves you time during part load and unload sequences when the machine is used for high volume production grinding work.

With the machine setup to operate in automatic cycle mode then the chuck open and close function is performed automatically by the machine once the sliding front guard doors have closed. In non-automation mode, the machine operator is responsible for closing and opening the power chuck using the foot pedals located at the front of the machine.

7.2.1 3-Jaw chuck arrangement

Each chuck jaw is numbered uniquely to associate it with its mating actuator on the chuck body. The jaws are pneumatically operated and move simultaneously when opened or closed.

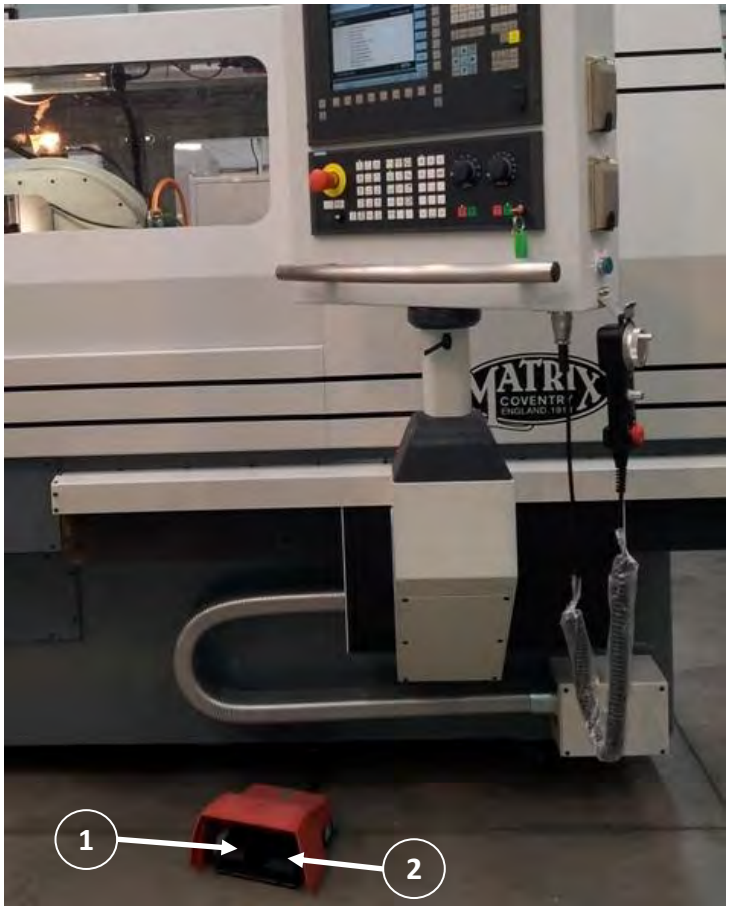


1	3x numbered jaws
2	Chuck **open** compressed air inlet port
3	Chuck **close** compressed air inlet port

7.2.2 Opening and closing the chuck manually

The pneumatic 3-jaw power chuck can be manually operated by using the two foot pedals when the machine is set in JOG mode.

Note: The foot pedals are disabled when the machine is operated in AUTO cycle.



Chuck open procedure

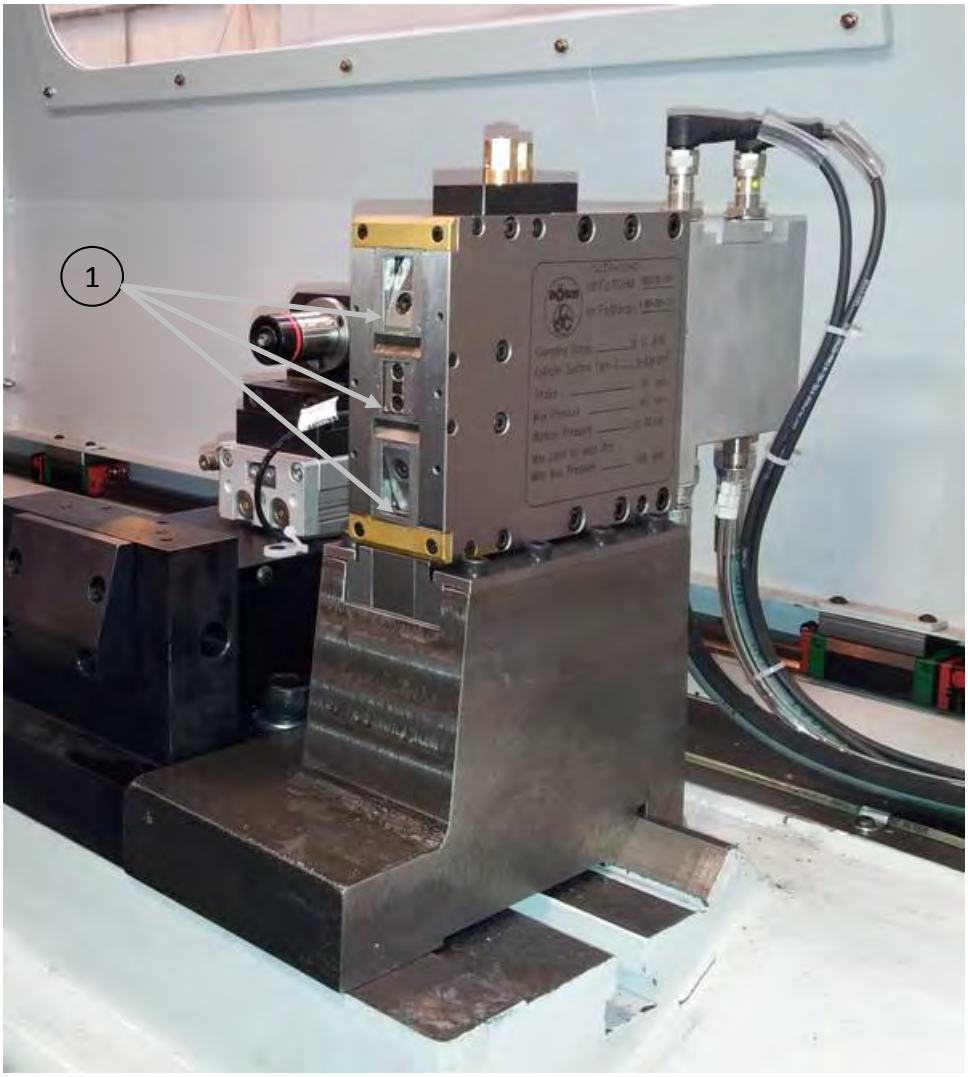
1. Select **[JOG]** mode at the machine control panel.
2. Push down on the left-hand (LH) foot pedal **[1]**

Chuck close procedure

1. Select **[JOG]** mode at the machine control panel.
2. Push down on the right-hand (RH) foot pedal **[2]**

8 Powered workpiece support steady (option)

The ROHM SLZV-1540 is a highly repeatable self-centering hydraulically powered workpiece steady/rest and locates across the vee-and-flat section of the worktable.

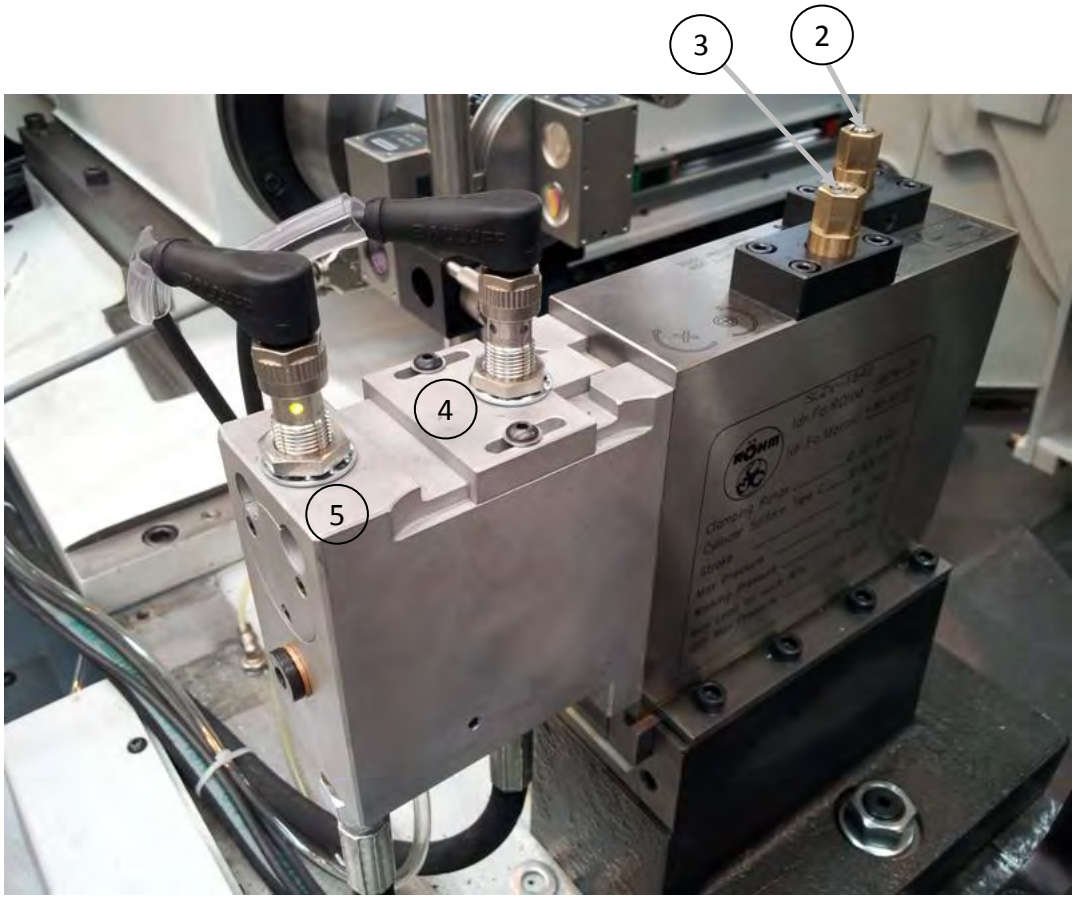


1	3x steady arms (shown in retracted position)

Fully retractable arms **(1)** are a key feature of this steady, leaving the working area free from unwanted obstruction when loading and unloading workpieces.

Clamping range: Ø12 - Ø40
Working Pressure: 10 – 30 bar

You can adjust the steady arms clamping pressure at the hydraulics power pack (see section 8.3.1)

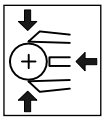


2	X axis fine adjustment screw	4	Steady in advanced position sensor
3	Y axis fine adjustment screw	5	Steady in retracted position sensor

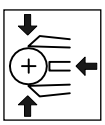
8.1 Operating the steady

You can manually open and close the steady arms at the control console while the machine set in JOG mode.

Open Steady

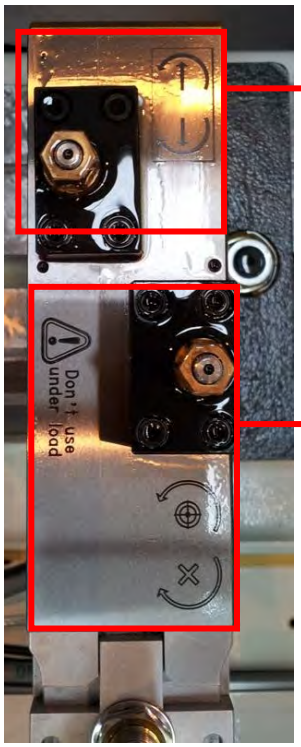
1. Select JOG mode
2. Momentarily press the steady open/close  key at the machine control panel.
3. The LED indicator above the button will flash as the steady arms advance.
4. The LED indicator will change to the steady ON state when the steady arms are in the advanced position and stopped moving.

Close Steady

1. Select JOG mode
2. Momentarily press the steady open/close  key at the machine control panel.
3. The LED indicator above the button will flash as the steady arms retract.
4. The LED indicator will change to the steady OFF state when the steady arms have retracted inside the steady body.

8.2 Fine Adjustment Screws

Two screws located at the top of the steady rest body allow you to make a fine micro-adjustment setting of the centreline of the steady rest arms in relation to the workpiece centreline.

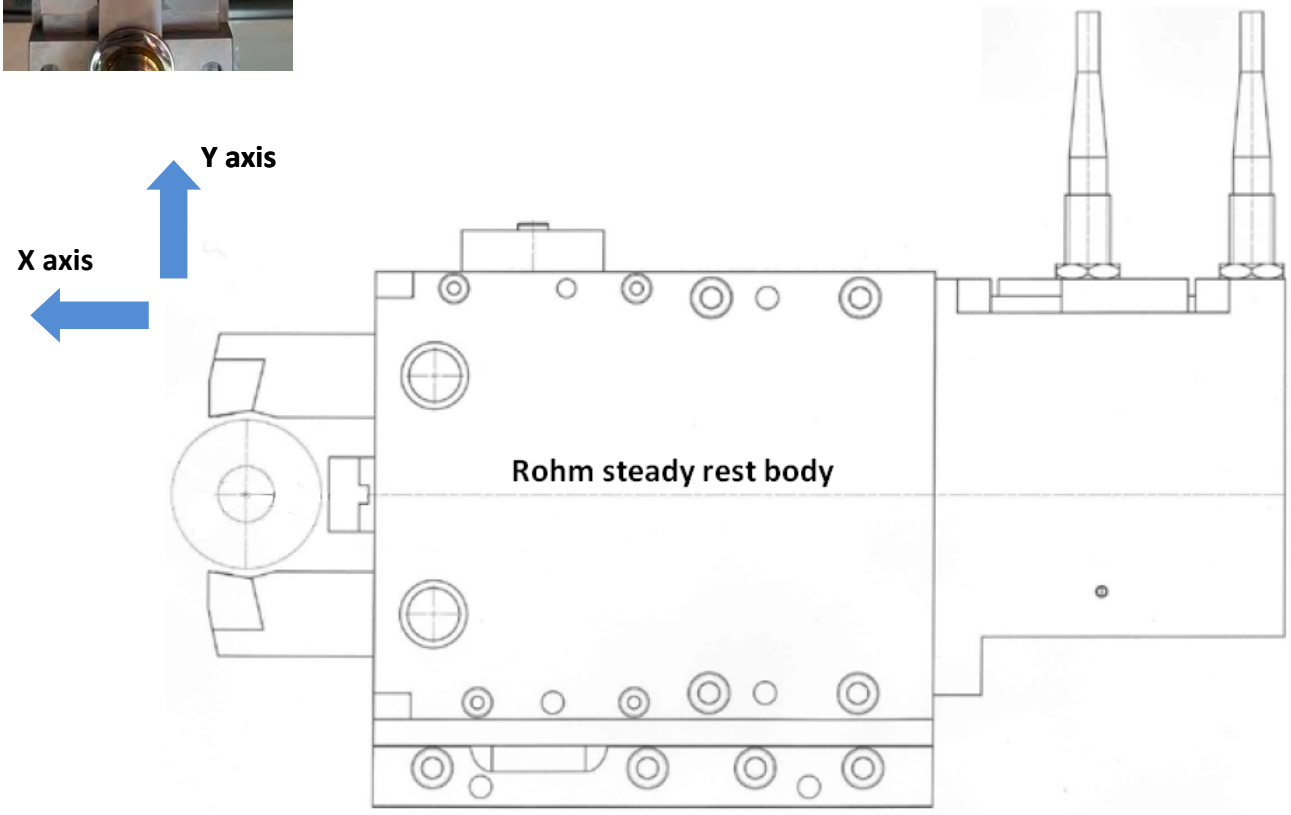


X axis

Turn the screw counter-clockwise (CCW) to move steady arms towards the workpiece. Turn the screw clockwise (CW) to move steady arms away from the workpiece.

Y axis

Turn the screw counter-clockwise (CCW) to move the steady arms up. Turn the screw clockwise (CW) to move steady arms down.



Warning
Never turn the fine adjuster screws when the steady is under load.

8.3 Procedure for fine alignment of the steady rest

It is recommended to carry out the fine adjustment of steady rest whilst the work piece is centre on the steady rest with an offset along the positive X axis and Y axis of about 0.01 mm.

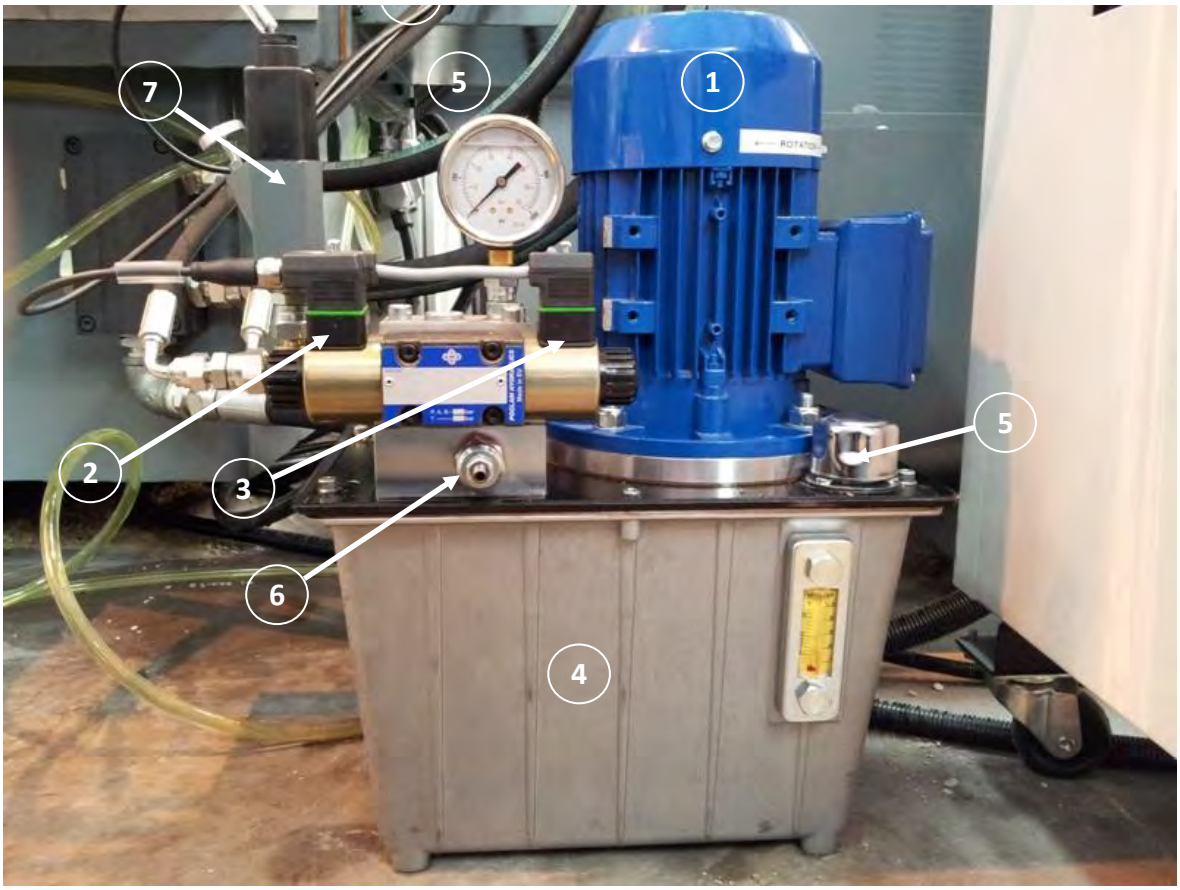
Minor errors (<= 0.02 mm) along the X axis can be corrected as follows:
1. Undo and retract the clamping arm.
2. Undo the clamping screw on the fine adjustment (do not remove).
3. Apply a low torque to set the 11 mm (brass) adjustment nut according to the direction +/-
4. Move forward and clamp the clamping arms.
5. Check the radial run.
6. Either re-adjust (clamping arms retracted) or tighten the clamping screw (approx. 1 Nm).

Note 1:
The maximum permissible adjustment travel of the steel bolt is +/- 2 to 3mm, depending on the size of the steady rest.

Note 2: max movement of the steady centre is +/- 0.12 mm (120um).

8.4 Steady Clamping Pressure

The hydraulic steady system has a working pressure range of 10 to 30bar. Adjustment of the clamping pressure can be set at the hydraulics power pack unit which is located at the rear of the machine.



1	0.75kW Pump motor 50/60Hz	5	Oil pressure gauge
2	Steady advance solenoid valve	6	Oil pressure adjuster screw
3	Steady retract solenoid valve	7	In-line oil pressure sensor
4	10L oil tank with level sight glass	8	Hydraulic oil filler cap

Fill up the tank with 10 litres of **DTE light Hydraulic oil ISO VG32** (or equivalent) through the filling point located at the top of the tank.

To increase steady pressure
Turn the adjuster screw **(6)** counter-clockwise (CCW) to reduce the oil supply pressure to the steady.

To decrease steady pressure
Turn the adjuster screw **(6)** clockwise (CW) to increase the oil supply pressure to the steady.

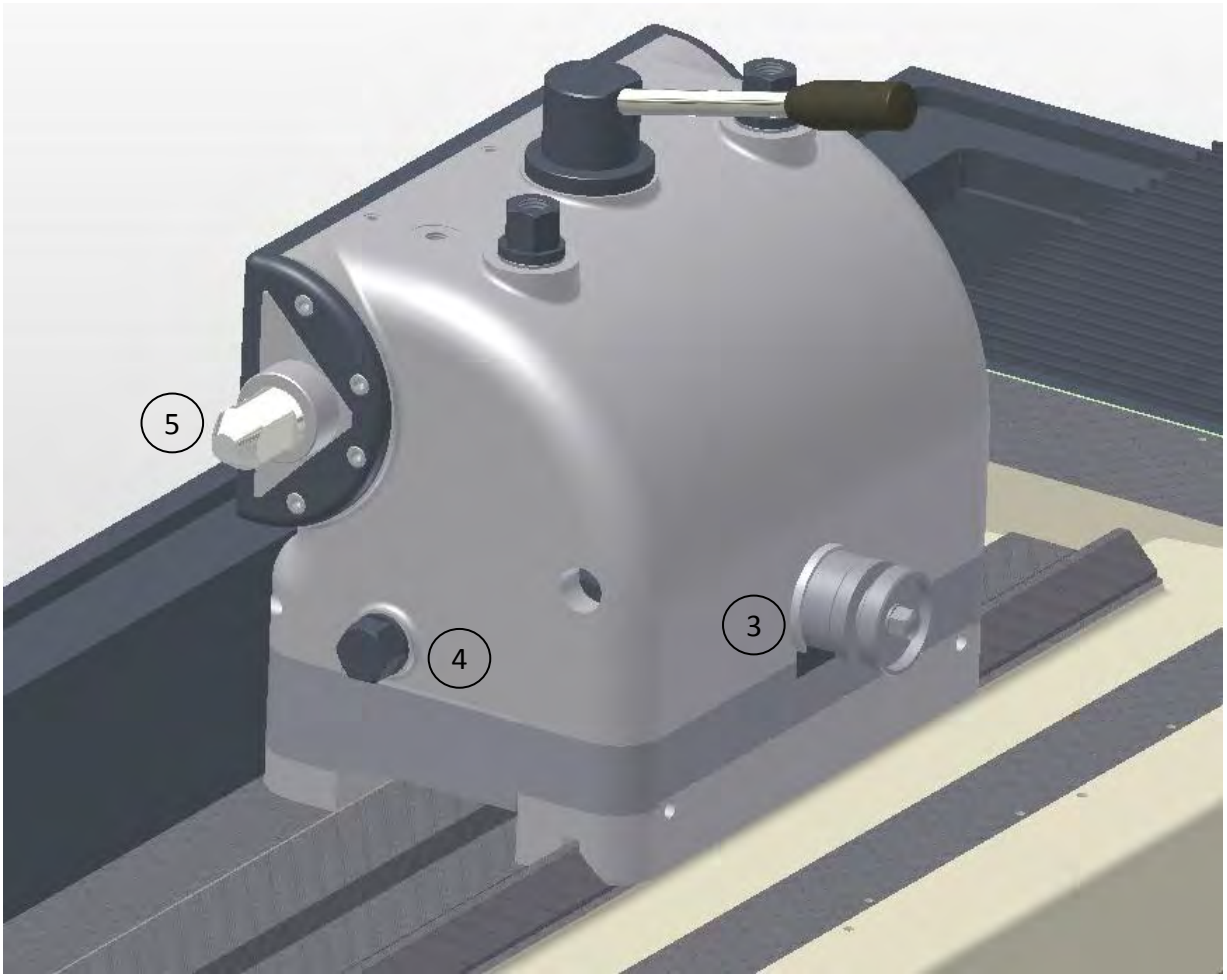
9 Tailstock

The basic 0850 model is offered with the manual type tailstock as standard. An optional semi-automated pneumatic version of the tailstock is also available for low to medium production applications.

In addition, Matrix also offer a fully automated travelling tailstock which is better suited for high volume production applications of where the machine operation is entirely automated using a gantry type robot for part load and unload.

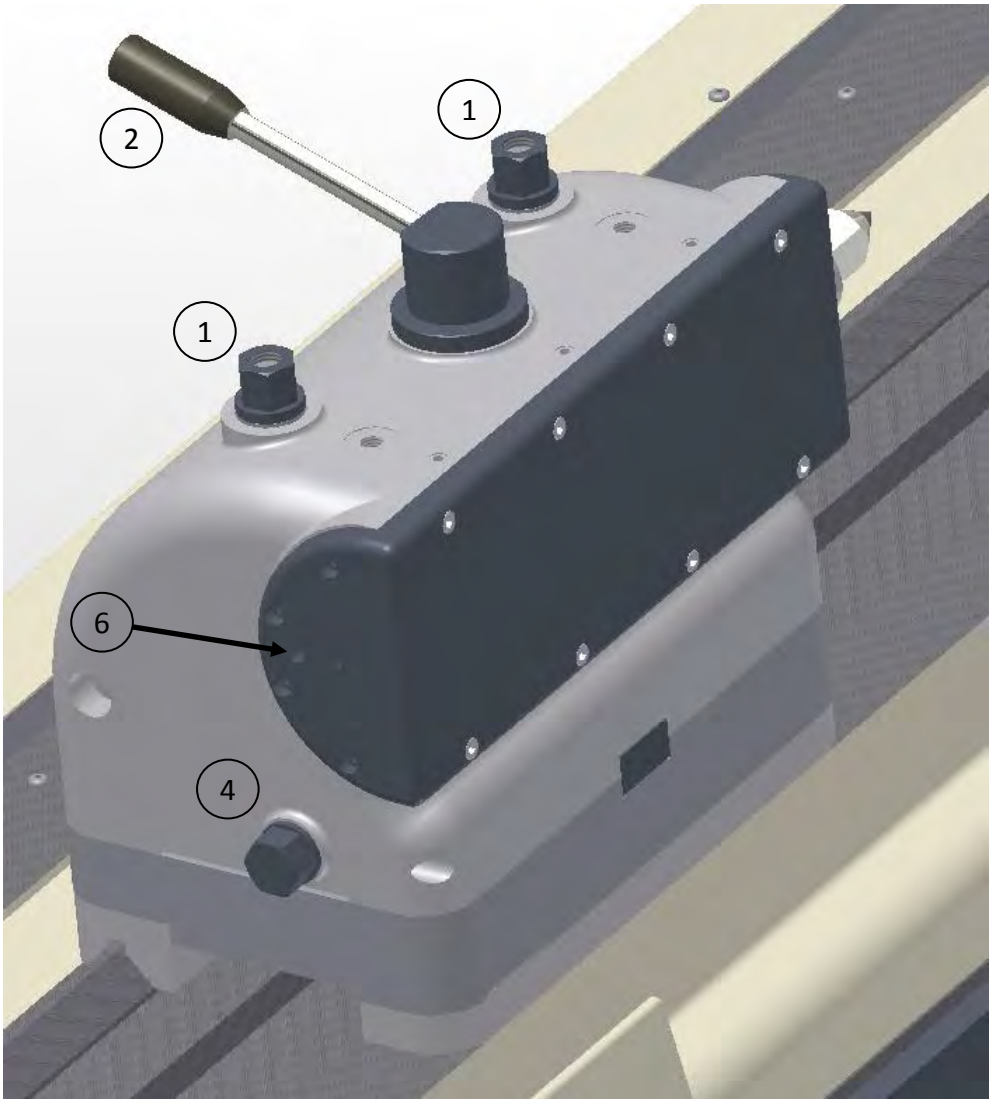
Note: All tailstock variants are designed to accept a No.4 MT dead centre only.

9.1 Manual Tailstock (standard)



The tailstock sits on the worktable across the Vee-and-flat ways and it can be clamped in any position to suit the length of the workpiece to be ground.

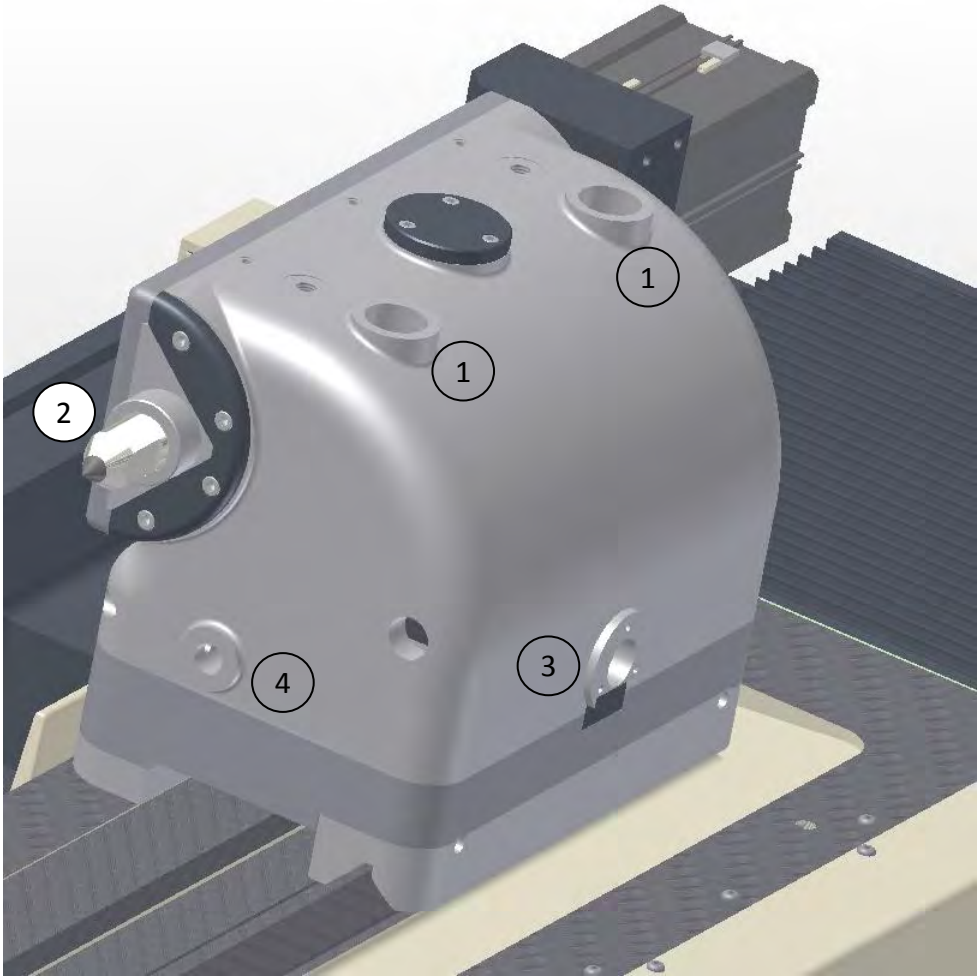
Note: this only applies to the standard manual or pneumatic tailstock versions.



1	Tailstock body-to-table securing bolts	4	Taper adjust lock nut
2	Tailstock barrel centre advance/retract lever	5	No. 4 MT centre
3	Taper adjust wheel	6	Tailstock spring tension adjuster (option)

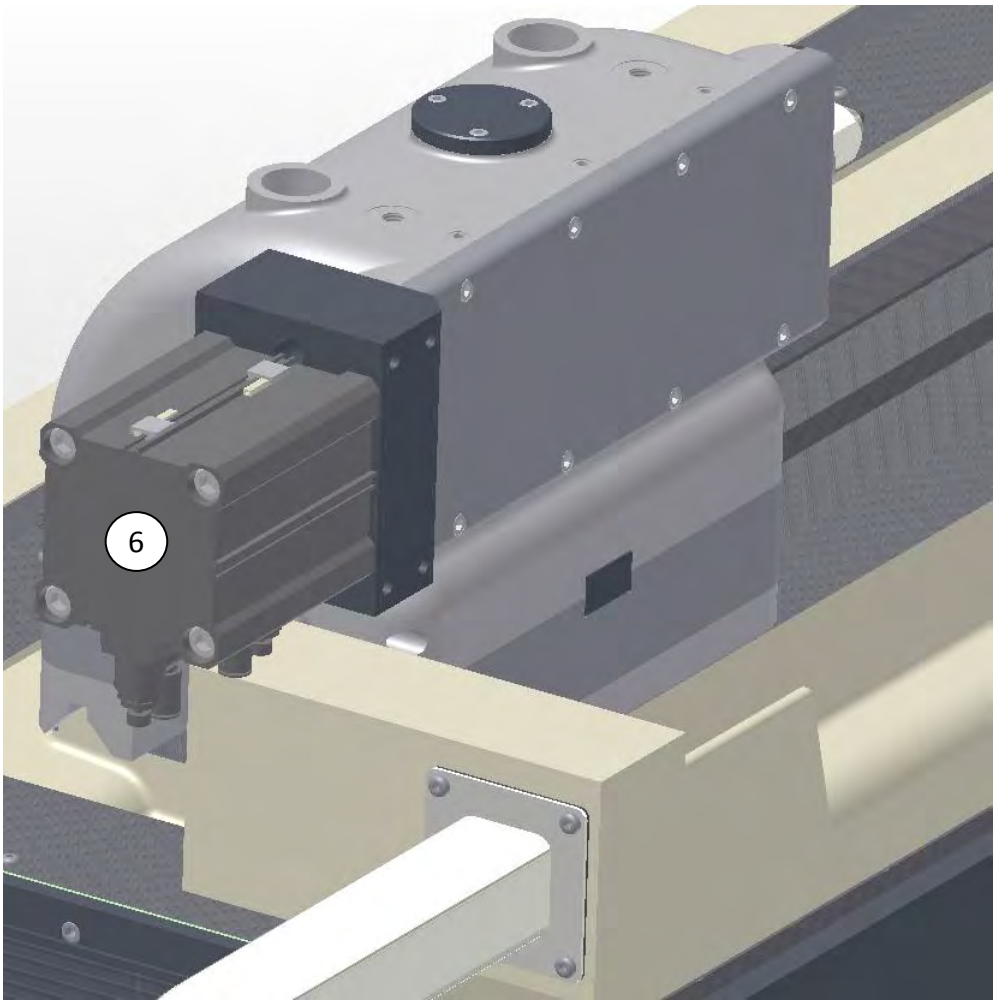
9.2 Pneumatic Tailstock (option)

The pneumatically operated tailstock option is similar in design to the manual version except that tailstock barrel advance and retract control is achieved with a pneumatically driven piston.



1	Tailstock body-to-table securing bolts	4	Taper adjust lock nut
2	Tailstock barrel centre advance/retract lever	5	No. 4 MT centre
3	Taper adjust wheel	6	Pneumatic piston for tailstock barrel centre advance/retract

This version of the tailstock is best suited to applications where the machine is intended to be used within an automation environment along with other automation options selected with the machine at the time of ordering.


6

9.2.1 Manual Operation Procedure

You can manually advance/retract control of the tailstock centre by pressing the **[TAILSTOCK ADVANCE/RETRACT]** toggle key at the machine control panel when the machine is set to [JOG] mode.

To advance the tailstock:

1. Select [JOG] mode
2. Select the **[TAILSTOCK ADVANCE/RETRACT]** at the MCP

As the tailstock moves the LED indicator above the key will change to the 'flashing' state to inform you that the tailstock barrel is moving. When the tailstock has stopped advancing the LED indicator changes from 'flashing' to 'ON' state.

If the LED indicator continues to flash after the tailstock barrel has stopped advancing then this means that the barrel has moved to its advanced limit position because either you did not load a workpiece to the machine or the tailstock has not been correctly positioned such that the dead centre can support the end of the workpiece.

To retract the tailstock:

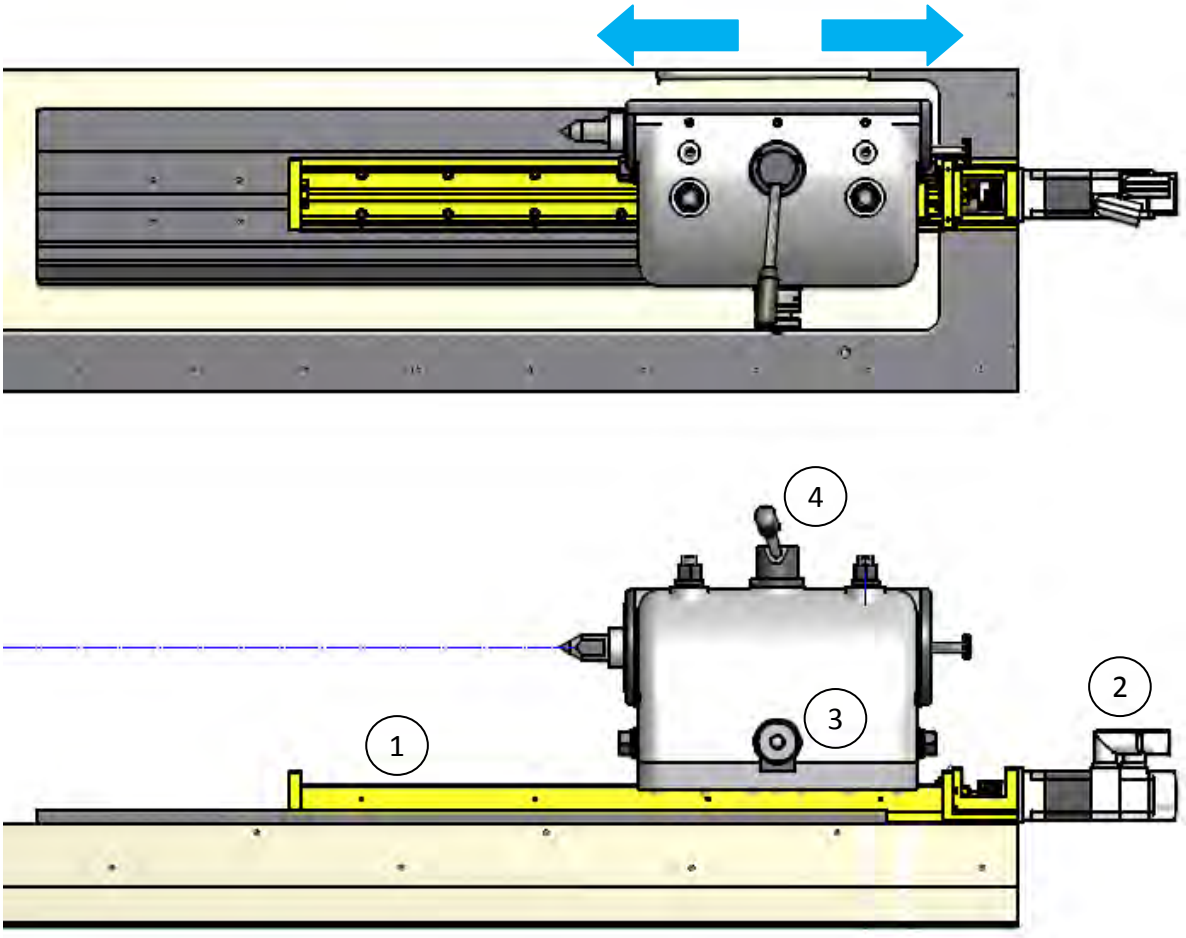
3. Select the **[TAILSTOCK ADVANCE/RETRACT]** again.

As the tailstock moves the LED indicator above the key will change to the 'flashing' state to inform you that the tailstock barrel is moving. When the tailstock has stopped retracting the LED indicator changes from 'flashing' to 'OFF' state.

9.3 Travelling Tailstock (option)

The travelling tailstock is a servo controlled version of the standard manual tailstock design. It features a linear ballscrew actuator sub-slide assembly driven by a servo motor with absolute position feedback.

The tailstock has traversing of 360mm.



1	Linear sub-slide (W2)	3	Taper adjust wheel
2	Servo motor with absolute position encoder	4	Tailstock barrel centre advance/retract lever

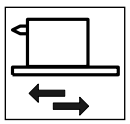
9.3.1 Manual Operation Procedure

Two methods are available to manually traverse the tailstock.

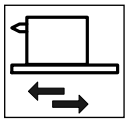
Method 1: Jogging the tailstock

1. Select [JOG] mode on the MCP
2. Select [W2] axis
3. Press the [-] key to drive the tailstock forward (advance) or press the [+] key to drive the tailstock back (retract).

Method 2: Advance/Retract toggle key (optional)

You can rapidly move the tailstock between the advanced and retracted positions by selecting the toggle key  in [JOG] mode.

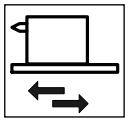
To advance the tailstock:

1. Select the [JOG] mode at the MCP
2. Select 

As the tailstock moves the LED indicator above the key will change to the 'flashing' state to inform you that the tailstock is moving. When the tailstock has stopped advancing the LED indicator changes from 'flashing' to 'ON' state.

If the LED indicator continues to flash after the tailstock barrel has stopped advancing then this means that the barrel has moved to its advanced limit position because either you did not load a workpiece to the machine or the tailstock has not been correctly positioned such that the dead centre can support the end of the workpiece.

To retract the tailstock:

3. Select  the key again.

As the tailstock moves the LED indicator above the key will change to the 'flashing' state to inform you that the tailstock barrel is moving. When the tailstock has stopped retracting the LED indicator changes from 'flashing' to 'OFF' state.

9.3.2 Setting the tailstock advance and retract positions

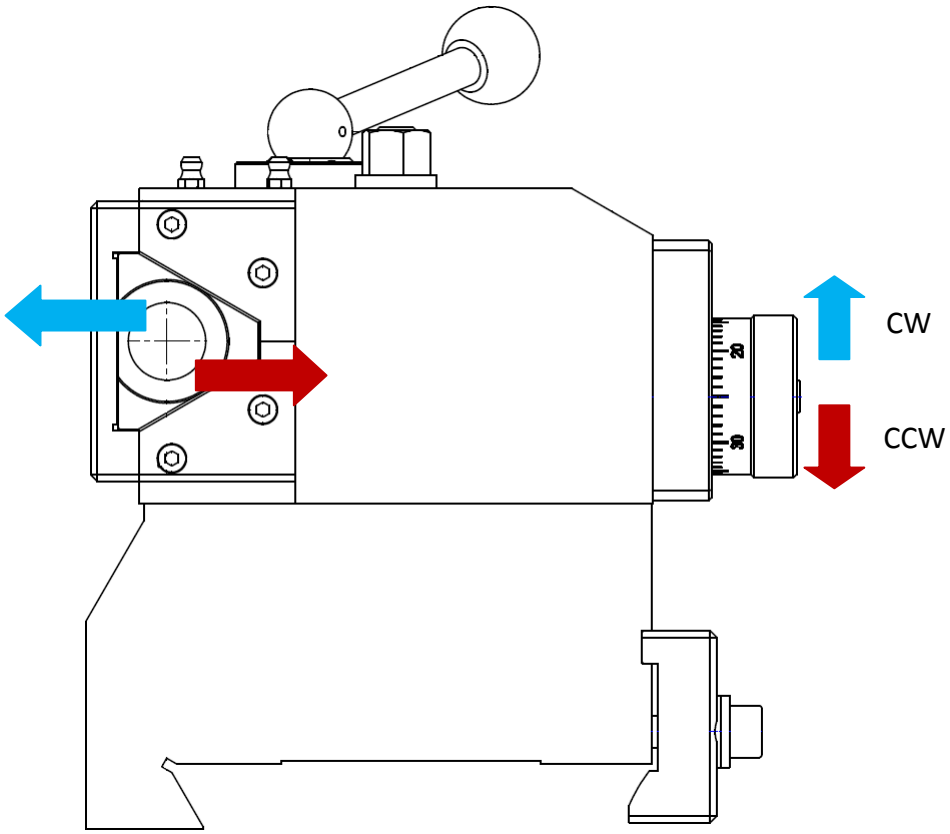
Add content here!

9.4 Taper Adjust Procedure

The taper adjust procedure below is applicable to all tailstock versions.

1. Slacken-off the taper adjust lock nut

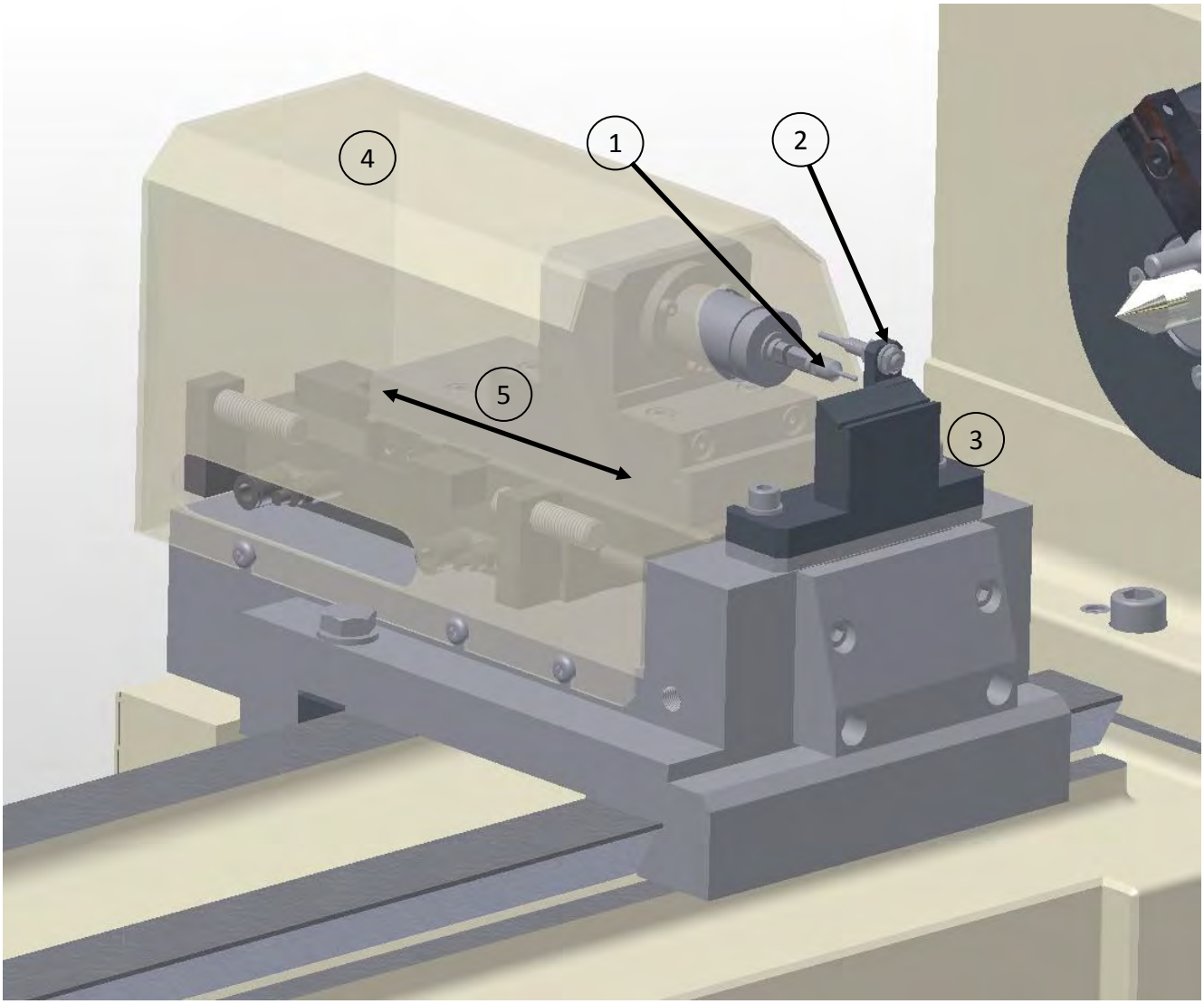
2. Turn the taper adjust wheel as required to correct the misalignment of the workpiece installed between the centres.



3. Tighten-up the lock nut when you have finished.

10 Workpiece probing (option)

This option permits the machine to automatically detect and calculate the thread pitch-in position for the conditioned grinding wheel. The probing sequence is executed at the beginning of the automatic machine cycle and prior to grinding the workpiece.



1	Measuring stylus	4	Cover
2	Part orientation proximity sensor	5	Pneumatic sub-slide
3	Workpiece support block		

The measuring probe head is mounted onto a pneumatically operated sub-slide, which advances during the automatic probing cycle once the component has been orientated to the correct start position.

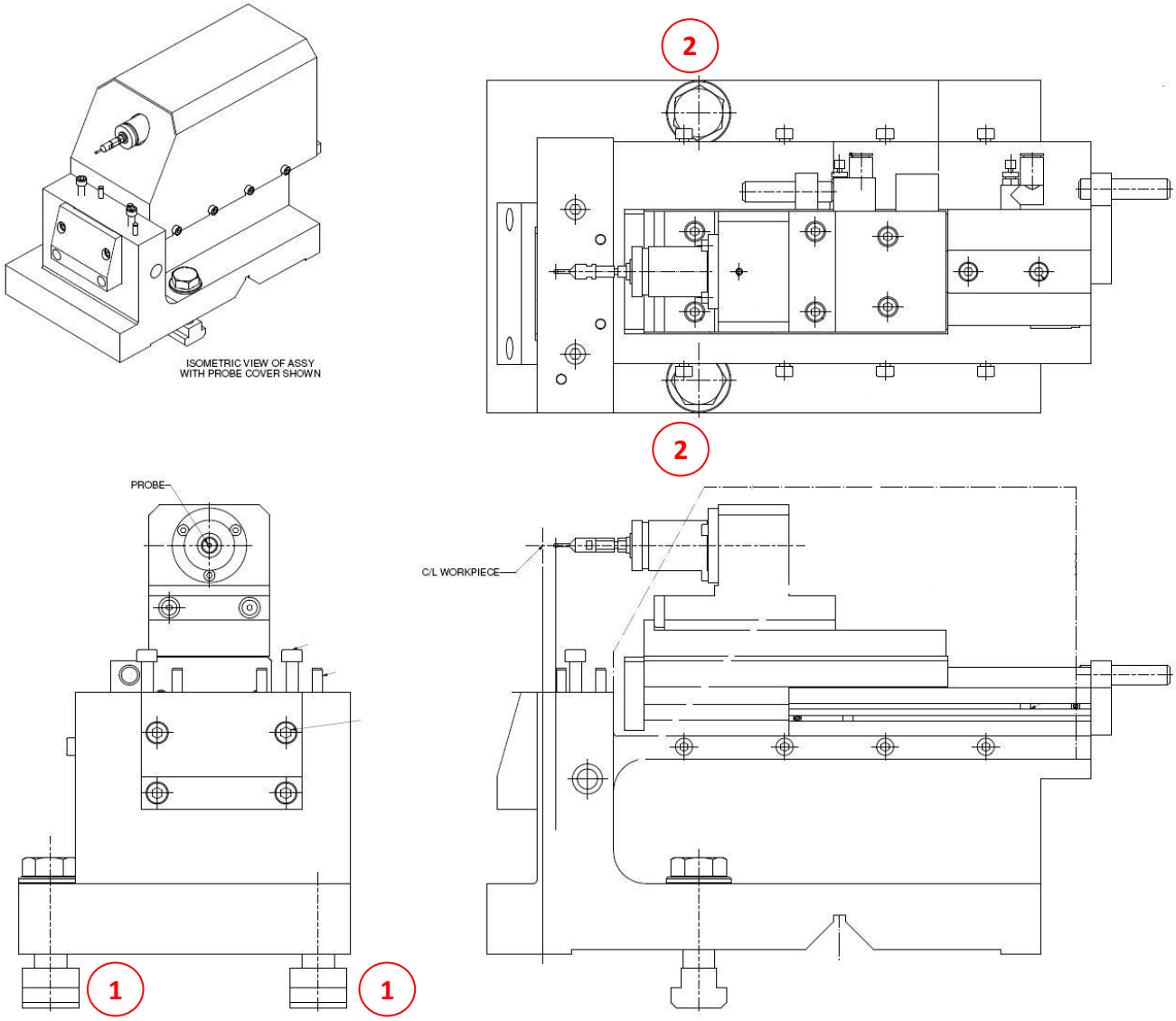
A proximity sensor fixed to the component location block is used to detect when the part has been orientated to the correct start position prior to advancing the measuring probe stylus into the workpiece groove.

The measuring stylus is monitored during the slide advance sequence. If an obstruction causes the stylus to deflect whilst the slide is advancing then the following sequence of actions take place:

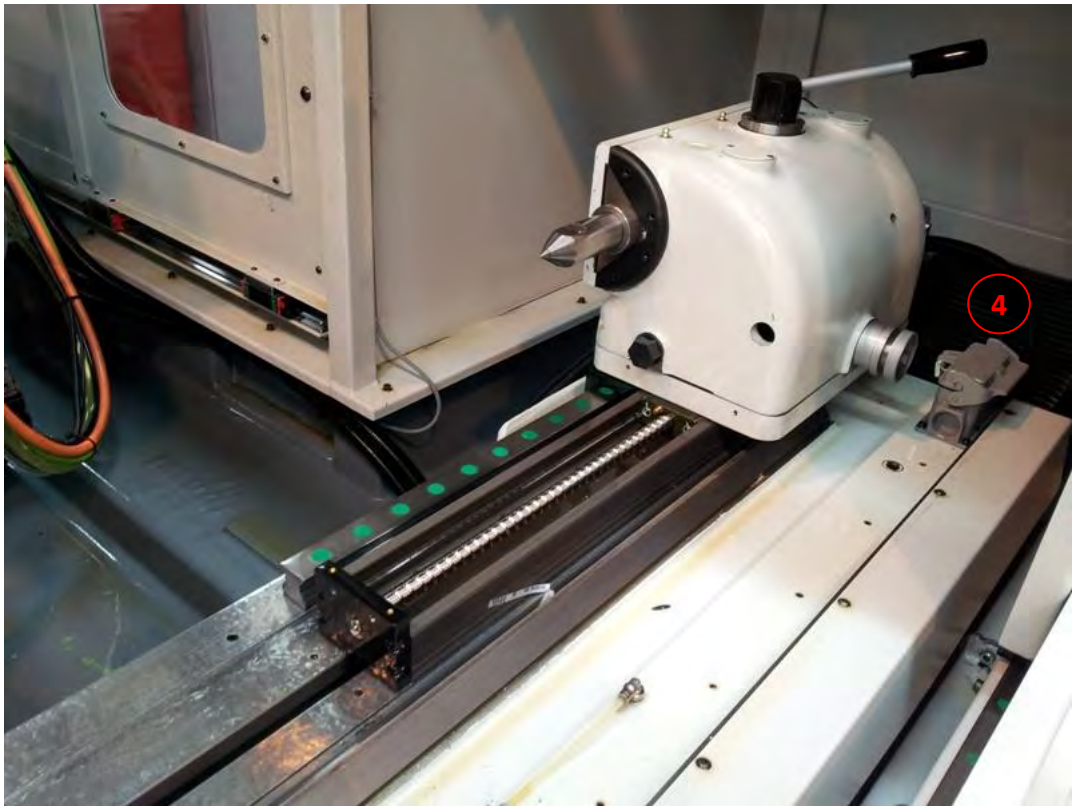
1. slide immediately forced back to retracted position
2. alarm message “Probe unexpected hit – probe cycle aborted” is displayed on the HMI screen
3. the automatic cycle stops

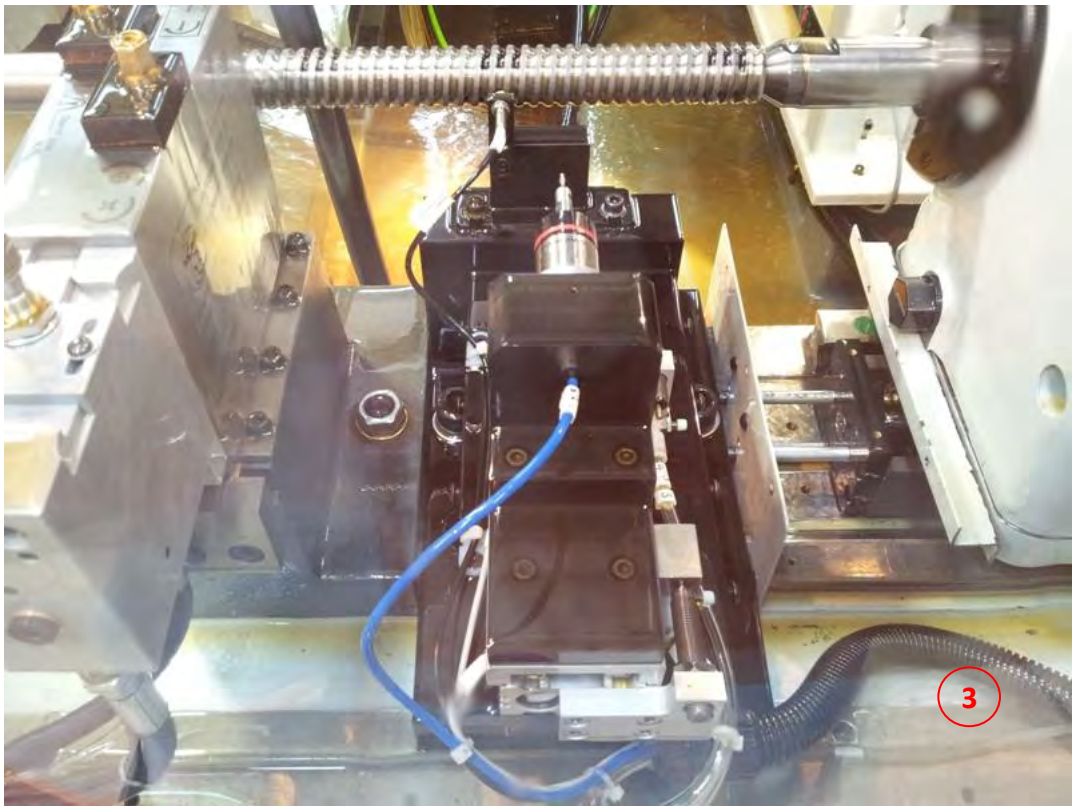
10.1 Fitting the probe unit to the work table

1. Locate and position the probe assembly directly onto the worktable across the Vee-and-Flat ways and secure it to the table by the 2x M16 T-nuts **(1)** and hexagon head bolts **(2)** provided.



2. The probe system is supplied with a pre-assembled flexible nylon conduit **(3)** containing electrical cabling and pneumatic tubing and a multi-pin plug connector fitted to the end. Plug the connector into the table mounted bulkhead socket **(4)**.





Probe assembly fitted in between the tailstock and workpiece steady rest (pic above)

10.2 Enabling the probe system signal interface

By default the probe system interface signals are switched off. Therefore, to prepare the probe system interface for use on the machine you must first enable the following signals:

signal	value
Control Unit MD **p680[1]** bit 1	TRUE
PLC signal **DB10.DBX107.0** (probe fine)	TRUE
PLC signal **DB10.DBX107.1** (probe coarse)	TRUE

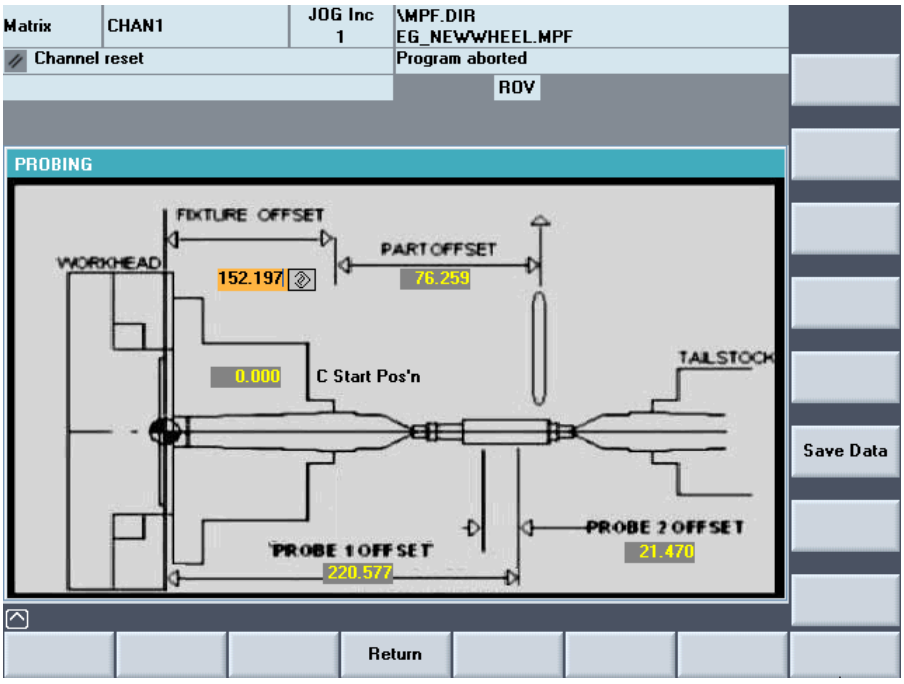
10.3 Setting the probe offsets

Before you can use the probe system as an integral function of the machine cycle you need to establish five fundamental probe offset parameters. The five parameters are:

- Fixture Offset
- Part Offset
- Probe 1 Offset
- Probe 2 Offset
- C axis start position

10.3.1Probe Offsets screen

Matrix > Main Menu > Setting Cycles> Set Work Datum > Probe Cycle



Editing Probe Offset parameters:

1. Set the ORANGE Siemens Key to position 3 on the MCP.
2. Select **[AUTO]** and **[SETUP]** mode.
3. Select the Probe screen [Matrix] > [Main Menu] > [Setting Cycles] > [Set Work Datum] > [Probe Cycle]
4. Select the **[Save Data]** softkey to store the probe offset values to internal an system file.

10.3.2Procedure for establishing offsets

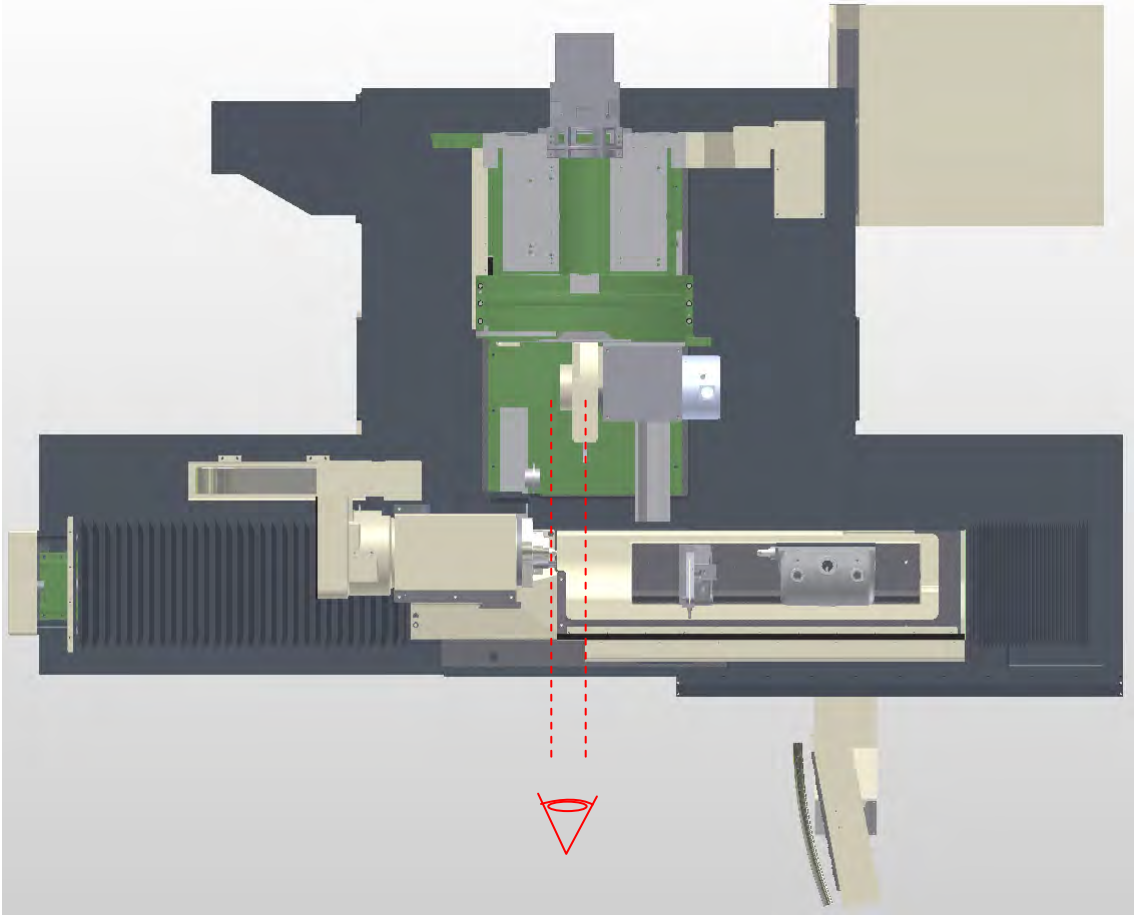
Follow the procedure below to determine and set the probe offsets.

1. Using the AUTO DRESS cycle, dress the grinding wheel with the required thread profile for the workpiece.

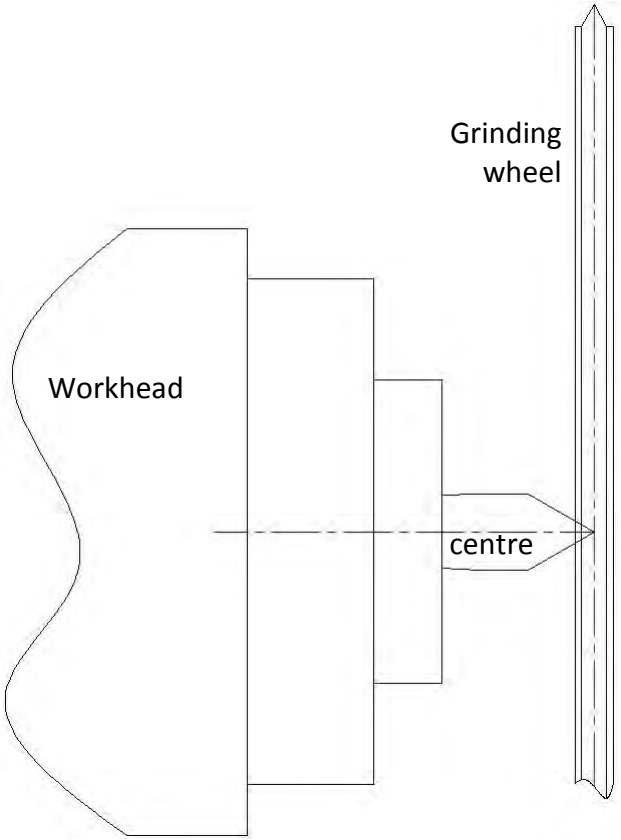
2. Select **[JOG]** mode + **[A]** axis and then jog it using the **[+] [-]** keys to set the grinding wheel at 0° helix angle.

   Alternatively, you could execute the following command in **[MDA]** mode: ***G0 A0***

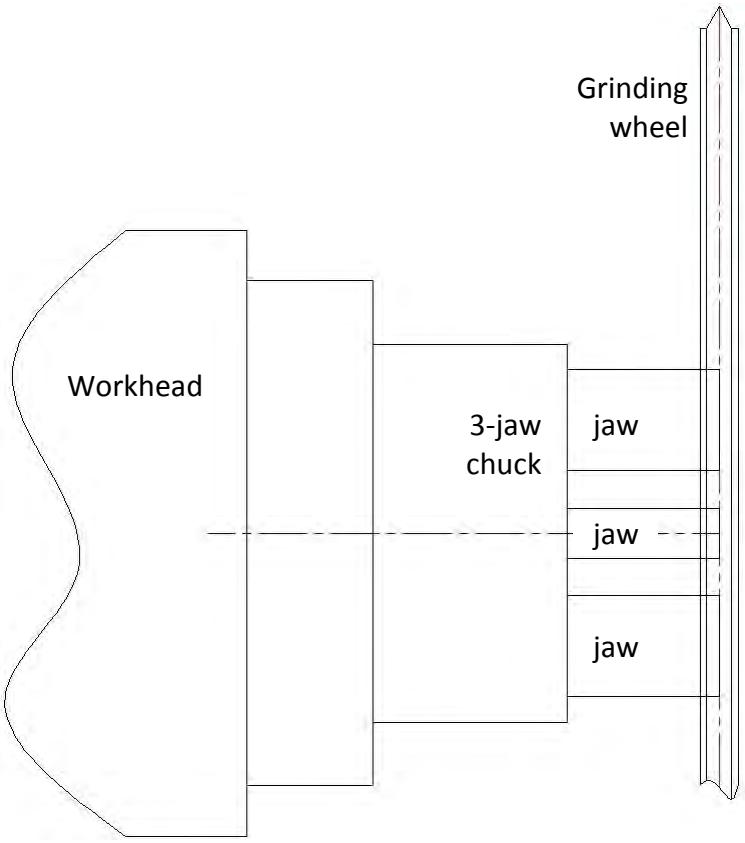
3. Select **[JOG]** mode and position the centre of the grinding wheel so that it is aligned to the workhead centre tip **(A)** or the face of the chuck jaws **(B)** if a workhead chuck unit is fitted.



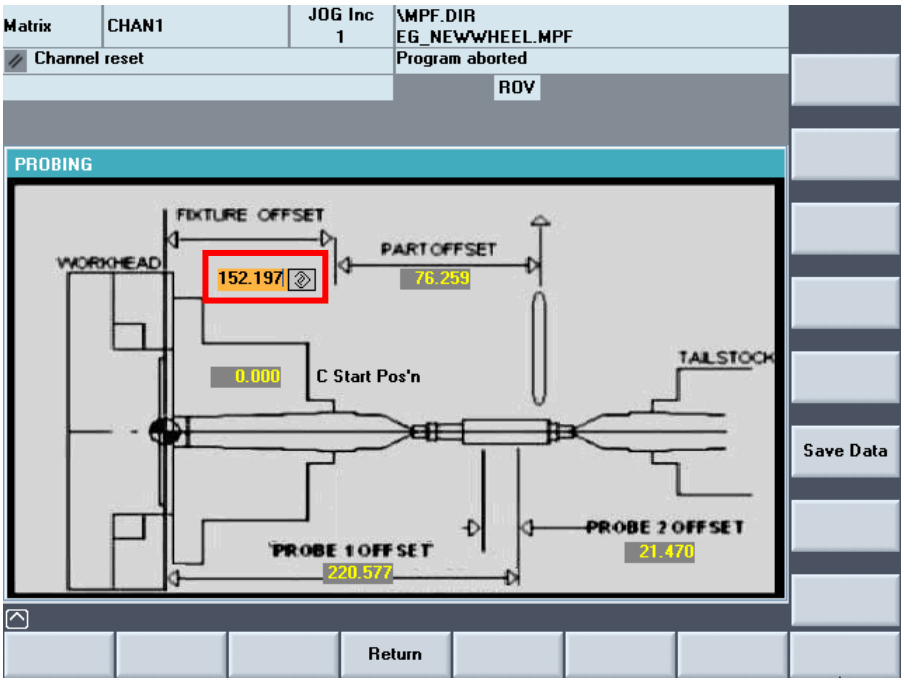
A. If workhead fitted with a standard centre: align wheel middle to tip centre



B. If workhead fitted with optional 3-jaw chuck: align wheel middle to chuck jaw face

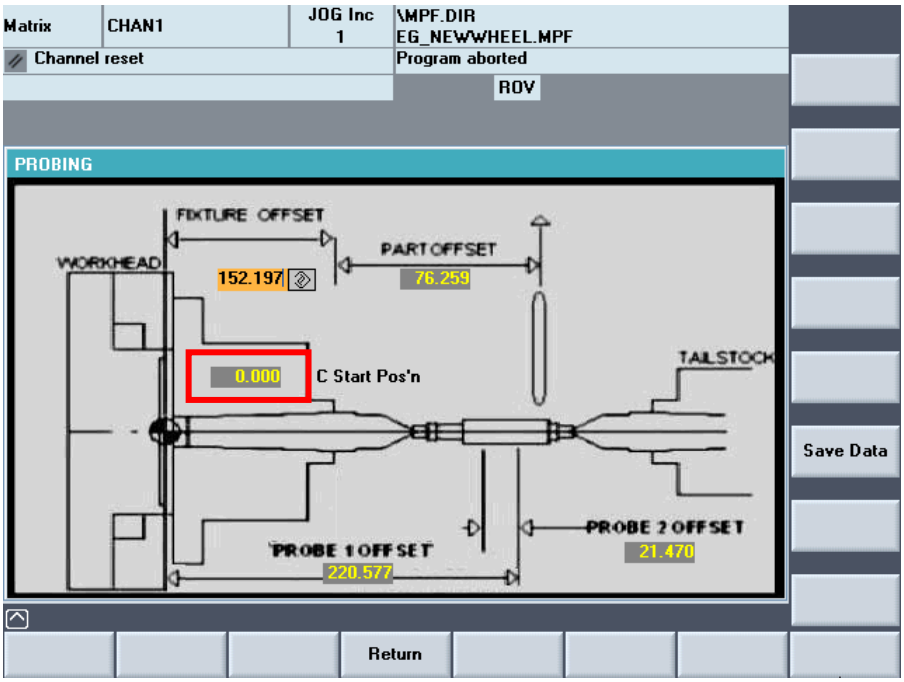


4. Enter the Z axis position as displayed in the machine coordinate system (MCS) into the **Fixture Offset** input field in the PROBE CYCLE screen (Setting Cycles > Set Work Datum > Probe Cycle)



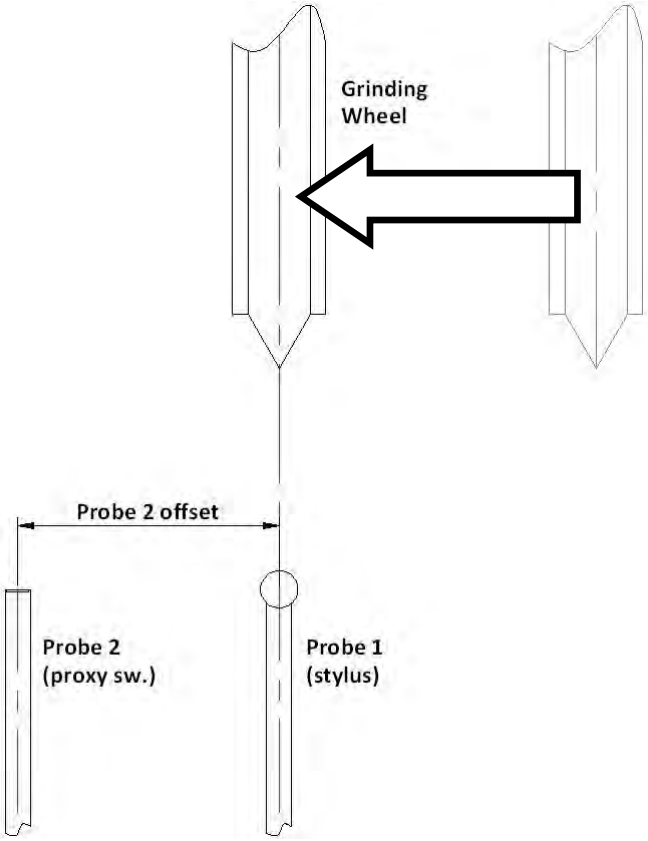
5. Load the pre-cut workpiece to be machine.

6. The **C Start Posn** input field is used to rotate the C axis to a specific position before the probing cycle starts. You can enter a value in here if you wish or just leave it set as 0.000.

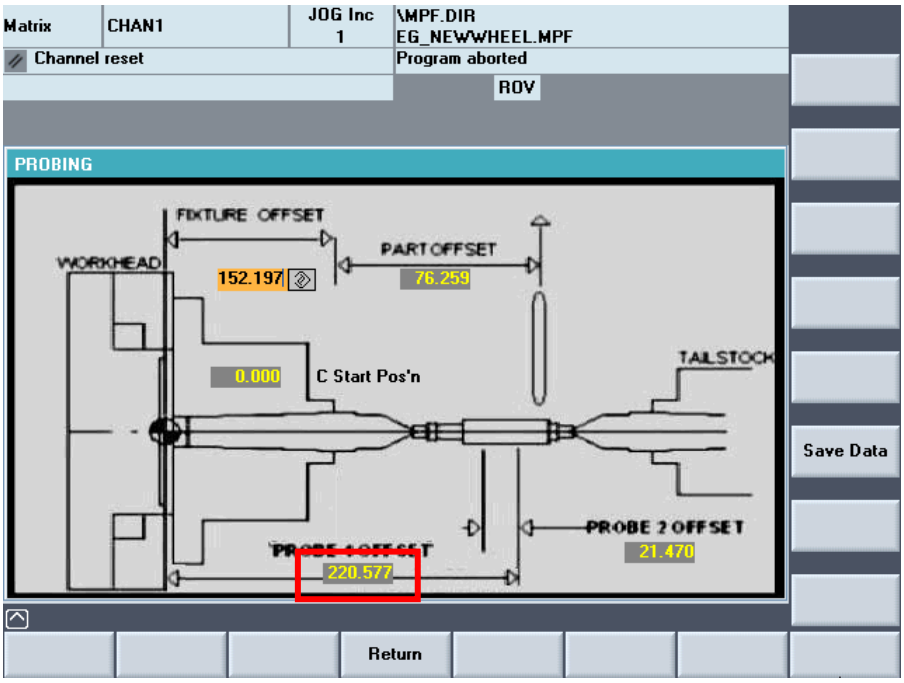


7. Select the [Advance Probe] button on the MCP to advance the probe slide. (Note: ensure the probe stylus is fitted!)

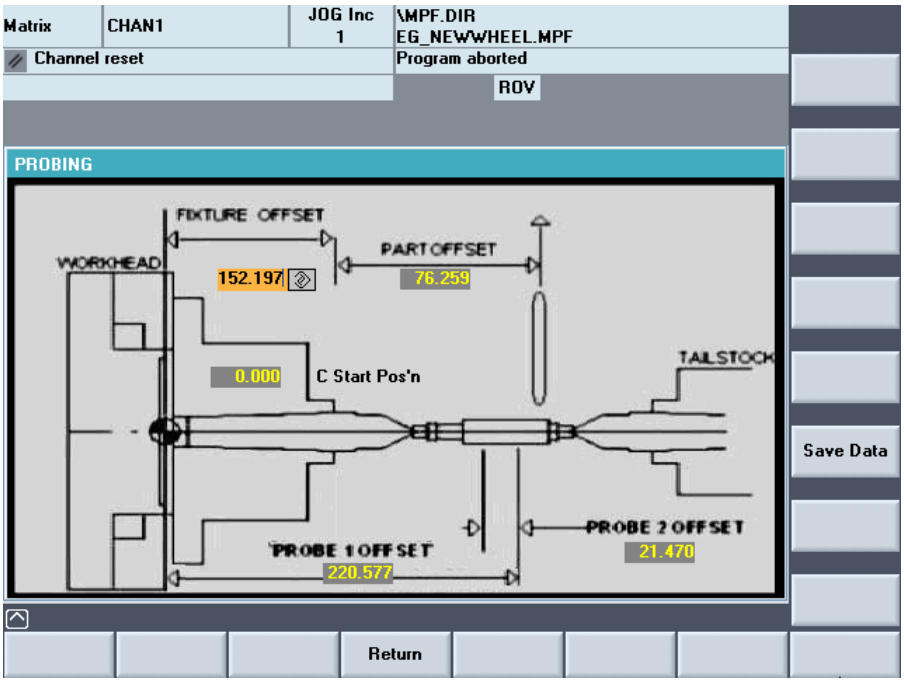
8. Using the handwheel align the grinding wheel centreline to the probe stylus. You must establish this position as accurately as you possibly can as this offset is very important.



9. Enter the Z axis position as displayed in the machine coordinate system (MCS) into the **Probe 1 Offset** input field.



10. Measure the distance between the probe stylus and the proximity switch using a steel measuring rule and then enter the distance into the **Probe 2 Offset** input field.



10.3.3 Part Offset

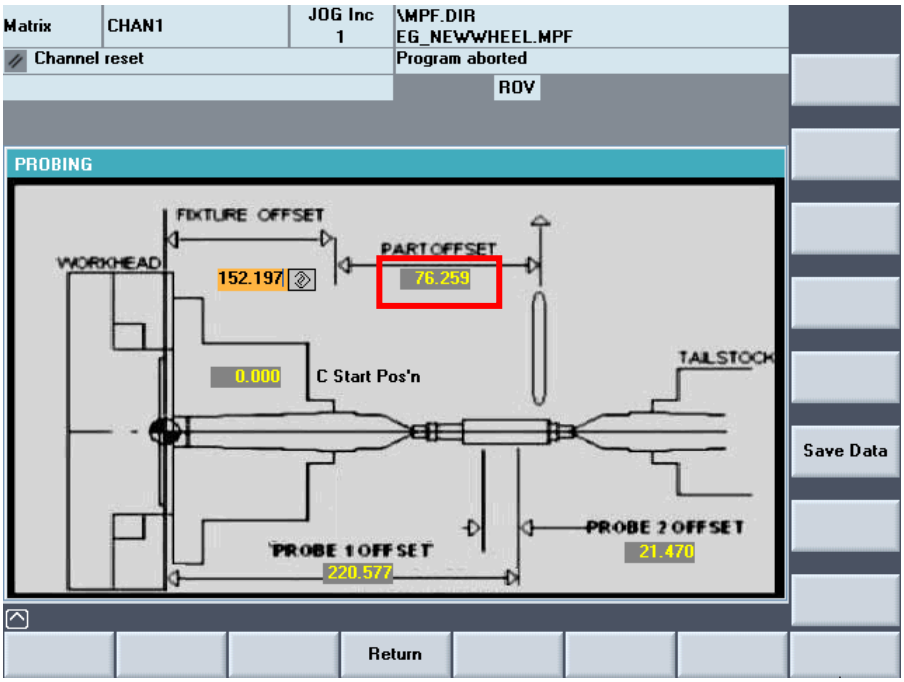
1. Set the wheel helix to the angle to be used for grinding the workpiece.

2. Select JOG mode and align the grinding wheel in X/Z to the start of the parallel grind position.
   Note: this is where you actually want the grinding to start on the workpiece.

3. Using the handwheel, manually pitch into the thread groove in X/Z in JOG mode.
   Note: you are not using the pitch-in cycle

4. Select the WORK DATUM screen and press the **[Set Z start posn]** key.

5. Select the **[Probe Cycle]** softkey to return to the probe cycle screen. You will notice that the **Part Offset** input field value has been automatically updated.



6. Probe system setup is now complete!

10.3.4 Testing Auto Pitch-in and correcting the Probe 1 offset

Before you start to use the machine with the probe system it would be a good idea to test that the probe cycle and automatic pitch-in position is working correctly before you start to do any production workpiece grinding.

Once the probing / auto pitch-in sequence has completed you can check that the grinding wheel is accurately engaging into the pre-cut workpiece thread by following the test procedure below:

1. Run the grinding cycle in **[Setup Mode]** with a stand-off distance applied (e.g 5mm)

2. Stop the cycle somewhere mid-way during the first parallel grind pass and then abort the cycle by pressing the **[Reset]** key on the MCP.

3. De-select the **[Gearbox]** at the MCP.

4. Select the handwheel in X only and carefully wind it until the grinding wheel just begins to make contact with the workpiece.

5. Now select a 1 um increment **[1 INC]** in Z and again using the handwheel determine the increment amount and direction by which you had to shift in Z to make the wheel contact* on both flanks of the thread.

   *Rock the wheel back-and-forth by hand till you can feel that the wheel is touching the workpiece flanks.

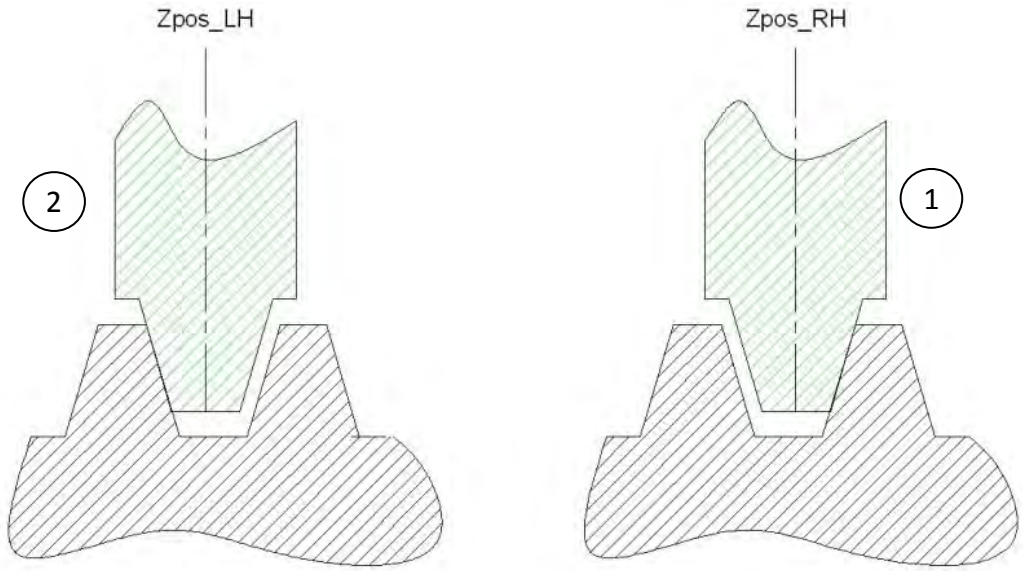
6. Add the amount of Z-shift to the **Probe 1 Offset** input field.

7. Repeat the test procedure again to check the correction made to the probe offset has been applied and also to confirm that the grinding wheel is being centrally positioned in the thread groove.

Remember: You are doing this to verify that the auto-probing (auto-pitch-in) cycle is working correctly before you start to do production grinding.

Increasing Probe 1 Offset applies offset bias towards the RH side of the groove **(1)**

Decreasing Probe 1Offset applies offset bias towards the LH side of the groove **(2)**



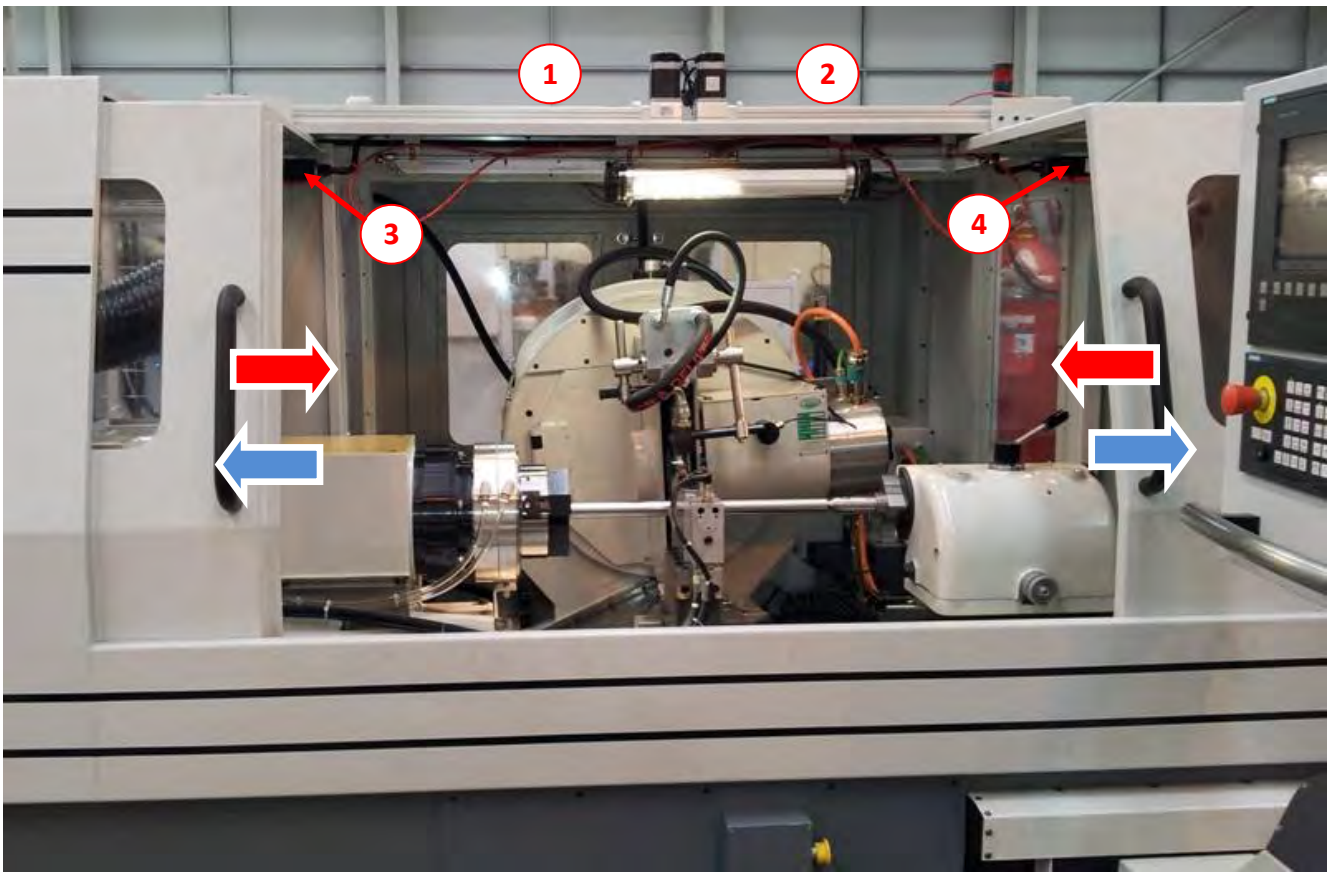
Z_correction = Zpos_LH - Zpos_RH

Therefore, the new probe offset becomes:

PROBE_1_OFFSET (new) = PROBE_1_OFFSET (old) - Z_correction

11 Automatic doors (option)

In this version of the 0850 machine enclosure the two front operator access doors feature independently servo driven linear actuator mechanisms. The complete assembly is mounted externally to the top of the enclosure thereby providing easy access for maintenance purposes.



1	LH door servo driven linear actuator	3	LH door close safety interlock switch
2	RH door servo driven linear actuator	4	RH door close safety interlock switch

Actuation of the front access door is triggered by pressing together the two-handed cycle start buttons located to the sides of the control console when the machine is set to operate in full automatic cycle mode.

Caution
Do not touch or put any obstacles in the way of the doors when they are operating. Do not put your head, arm or any part of your body in the machine when the doors are operating.

When the cycle is completed the front doors open automatically so that you can unload the processed workpiece and load the next workpiece to the machine.

11.1 Manual door operation

If the machine is setup to operate without the supported automation features then the front door must be closed manually by the machine operator prior to starting the cycle.

In this mode of operation the linear actuator assembly remains disabled.

12 Two-hand auto cycle start (option)

The two-handed cycle start feature located on the control console lets you safely initiate the automatic cycle and minimal interaction with the machine.

1	LH cycle start button
2	RH cycle start button

If the relevant options have been fitted to the machine then a typical automation sequence would be as follows:

- Close and lock the access guard door(s)
- Advance the tailstock centre towards the workpiece
- Close the power chuck jaws to clamp the workpiece
- Probe the workpiece
- Grind the workpiece

Then at the end of the cycle the automation sequence would be as follows:

- Open the power chuck jaws
- Retract the tailstock centre
- Open the access guard door(s)

12.1 Procedure for starting an automatic cycle using two-handed start buttons

1. Set Machine set in **[AUTO]** mode
2. Keyswitch set in **position 0**
3. Load the workpiece to be ground
4. Press in and hold together (within 0.5s) the LH and RH cycle start buttons until the door has fully closed.
5. The automatic cycle will now begin to operate.

13 ANDON Light (option)

The ANDON light stack provides a visual indication of the current status of the machine.

Machine fault/alarm condition

Machine idle / not in production

Machine operating in production

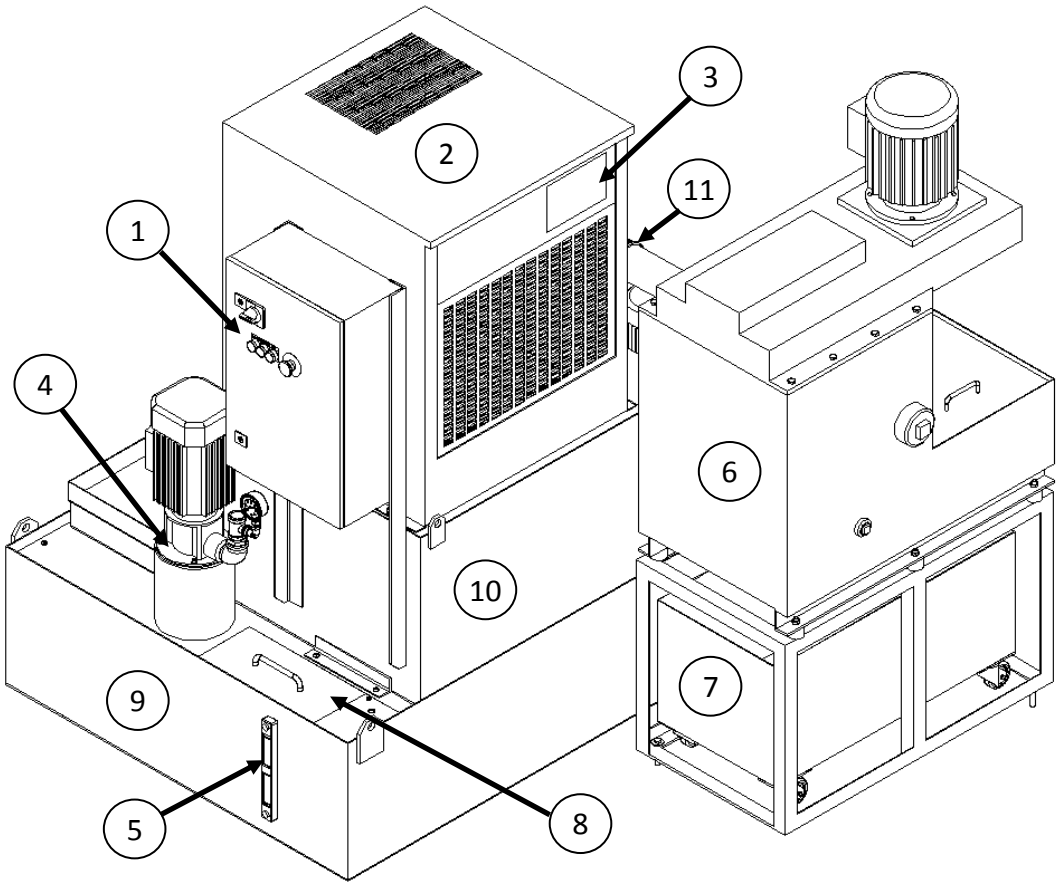
Indicator	Steady ON state	Flashing state
RED	Machine in emergency stop, alarm present or other fault condition	
AMBER/YELLOW	Machine is idle or waiting for operator interaction e.g waiting for part unload/load	Alert/Warning condition
GREEN	Machine running in normal production mode with FRO = 100%	Machine running production mode with FRO < 100% or operating in non-production mode

14 Standard coolant system (800L, upto 5bar working pressure)

This type of coolant system is generally suitable for use with conventional types of Aluminium Oxide grinding wheels. The centrifugal coolant clarification system is supplied complete with refrigeration unit, magnetic separator and oil level monitoring.

The coolant–clarifier unit is a free standing assembly having two separate tanks. The main tank capacity is 555 litres and is constructed as a steel weldment with partitions and baffle plates to separate and manage the coolant movement during the cleaning and preparation process.

The second tank known as the chiller tank is positioned on top of the main tank. This allows transfer of the cooled oil back into the main tank without using a pump. The returned cool oil mixes with the existing tank contents as it follows a controlled path to the main pump.

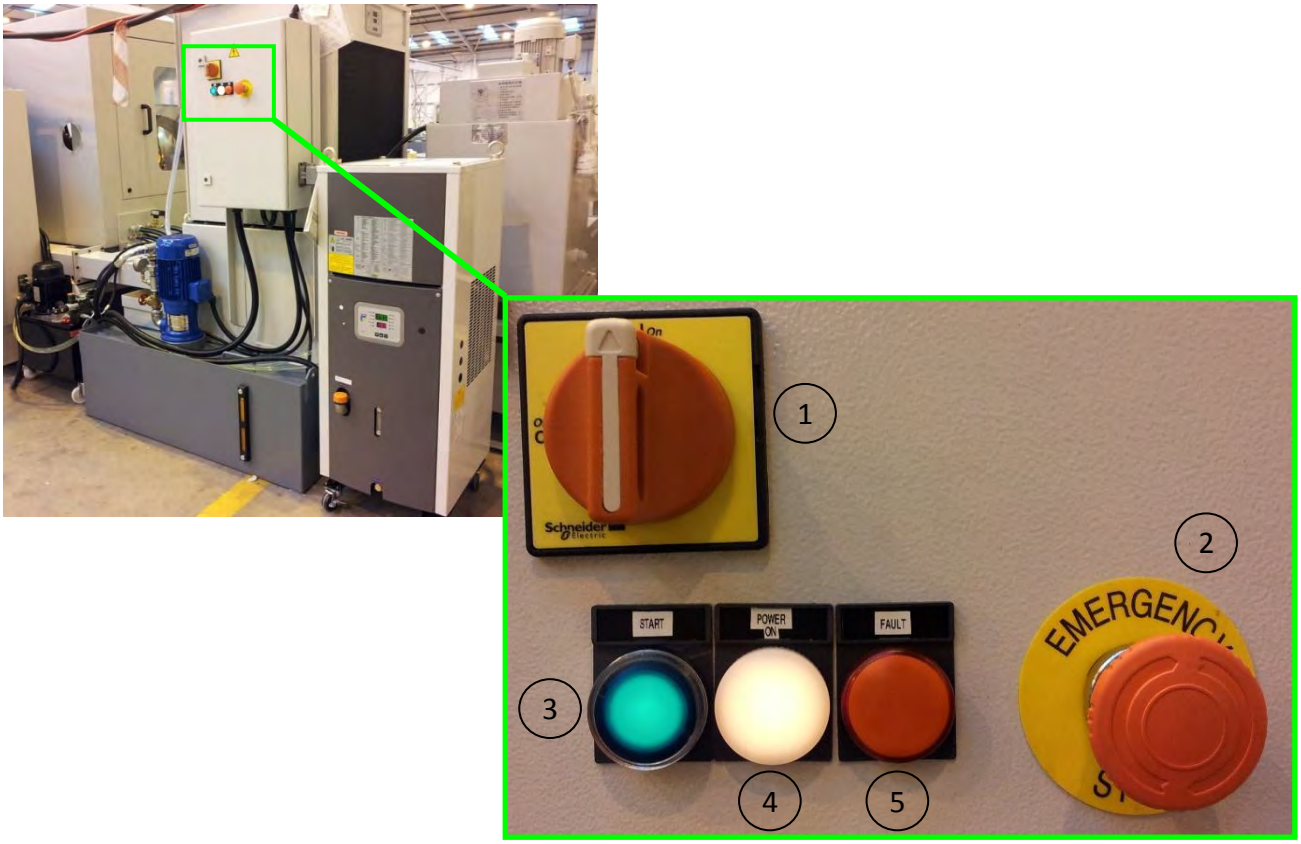


Tank Capacity 800L = Main Tank (555L) + Chiller Tank (245L)

1	Coolant system control panel	7	Centrifuge unit drum debris collection bin
2	Oil Cooler unit (Habor)	8	Coolant oil filling point
3	Oil cooler control panel (fixed temp regulation)		
4	Main supply pump (max 8bar) to machine (with pressure gauge + adjust tap)	9	Main tank, 555L capacity
5	Coolant tank level sight glass	10	Coolant oil chiller tank, 245L capacity
6	Centrifuge unit	11	Magnetic separator

14.1 Switching on the coolant system

1. Turn the power isolator to the ON position
2. Release the Emergency Stop button
3. Press the Start button



1	Power isolator	4	Power on status indicator (white)
2	Emergency Stop button	5	Coolant panel fault indicator (red)
3	Coolant system start button (green)		

When the coolant system has been started the magnetic separator, centrifuge lift pump and centrifuge units will run.

The main coolant delivery pump will only begin to operate after the machine has been started at the control station [MASTER START] and provided that the [COOLANT OFF] button indicator is not illuminated.

14.2 Stage 1 - magnetic separator filtration

Used or contaminated oil is discharged by a coolant chute at the left hand rear corner of the machine base. This oil is directed by a coolant discharge tray into the entry portion of the magnetic separator.

A magnetic drum separator provides the first stage removal of all ferrous particles from the oil returning back to the coolant system from the grinding process.

Waste debris extracted by the magnetic drum is discharged into a small sludge tank which is positioned adjacent to the drum unit.

14.3 Stage 2 – centrifugal filtration

Semi-clean oil which has passed through the magnetic separator is then pumped into the centrifuge unit where secondary extraction of unwanted particles, both metallic and non-metallic is carried out.

The centrifuge unit is fixed to a free standing support frame through anti-vibration mounts. The support frame should be bolted to the floor to prevent any movement. A discharge bin fitted with castors is positioned within the structure of the support frame and beneath the discharge outlet from the centrifuge.

Clean, but warm oil is gravity fed from the centrifuge unit to the coolant system clean oil tank through the large diameter transfer pipe.

14.4 Stage 3 – oil cooling

The cleaned oil fed from the centrifuge unit into the clean oil tank is then cooled down by the submerged cooling coils of the Habor oil cooler unit located directly above the clean oil tank.

Oil temperature is controlled a local display panel fitted to the oil cooler unit. Temperature setting is variable, but the standard setting for commissioning and shipment is set at 2°C below the ambient temperature.

The cooled oil is mixed by natural convection as it get directed by baffle plates back to the main coolant pump.

14.5 Stage 4 - Oil distribution

The main coolant pump delivers the oil to a distribution manifold located at the rear of the machine base which feeds two solenoid operated valves.

The valves direct the oil to the machine base (also called “basewash”) or switched to the grinding wheelhead via program M-codes when a grinding or dressing cycle is executed on the machine.

M08 grind/dress coolant ON
M09 grind/dress coolant OFF

14.6 Stage 5 - Oil Return

Oil flows from the machine back to the coolant system via oil return chutes and then the oil filtration and cooling cycle starts all over again from Stage 1.

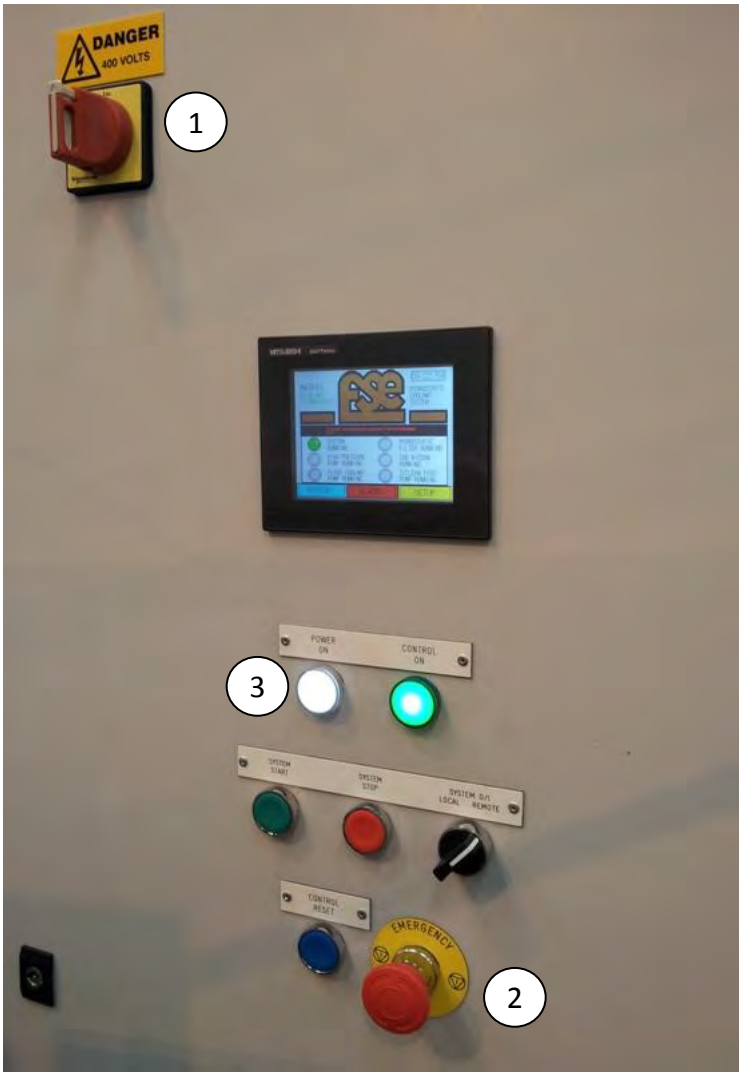
15 Optional HP coolant system (3000L, upto 70bar working pressure)

This type of coolant system is especially suited for workpiece production grinding using a plated or vitrified Cubic Boron Nitride (CBN) grinding wheel.

Please refer to the FSE coolant system manual for more detailed information about operation and maintenance of the system.

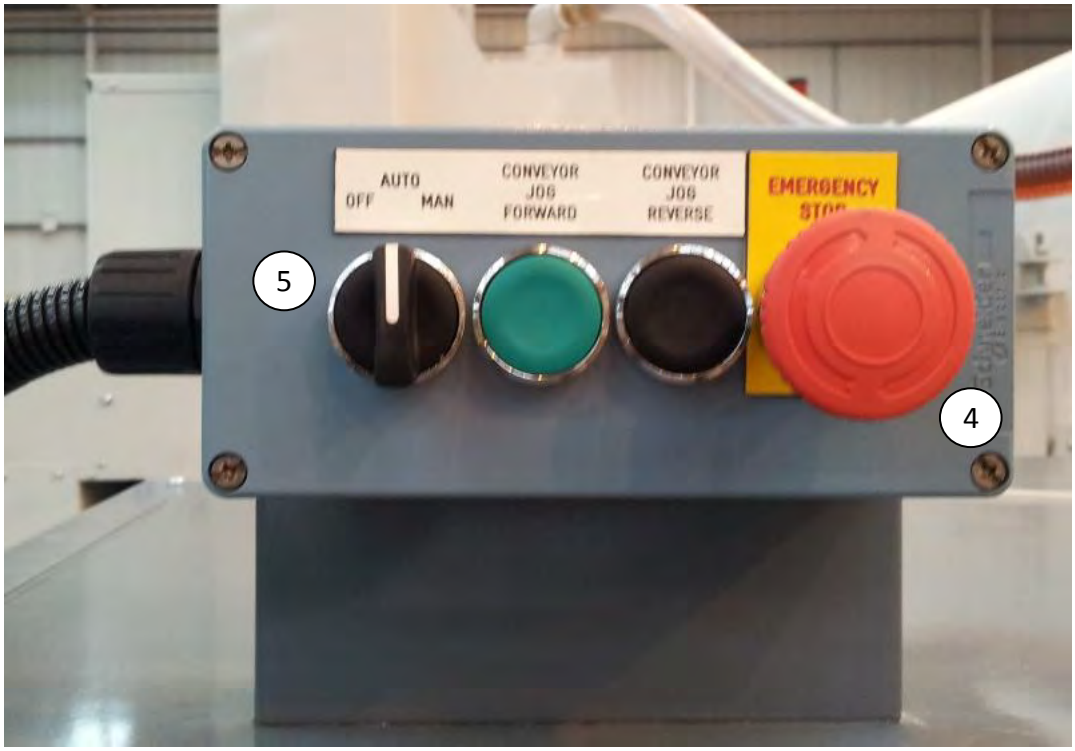
15.1 Switching on the coolant system

1. Turn control panel main isolator switch **(1)** to the ON position.

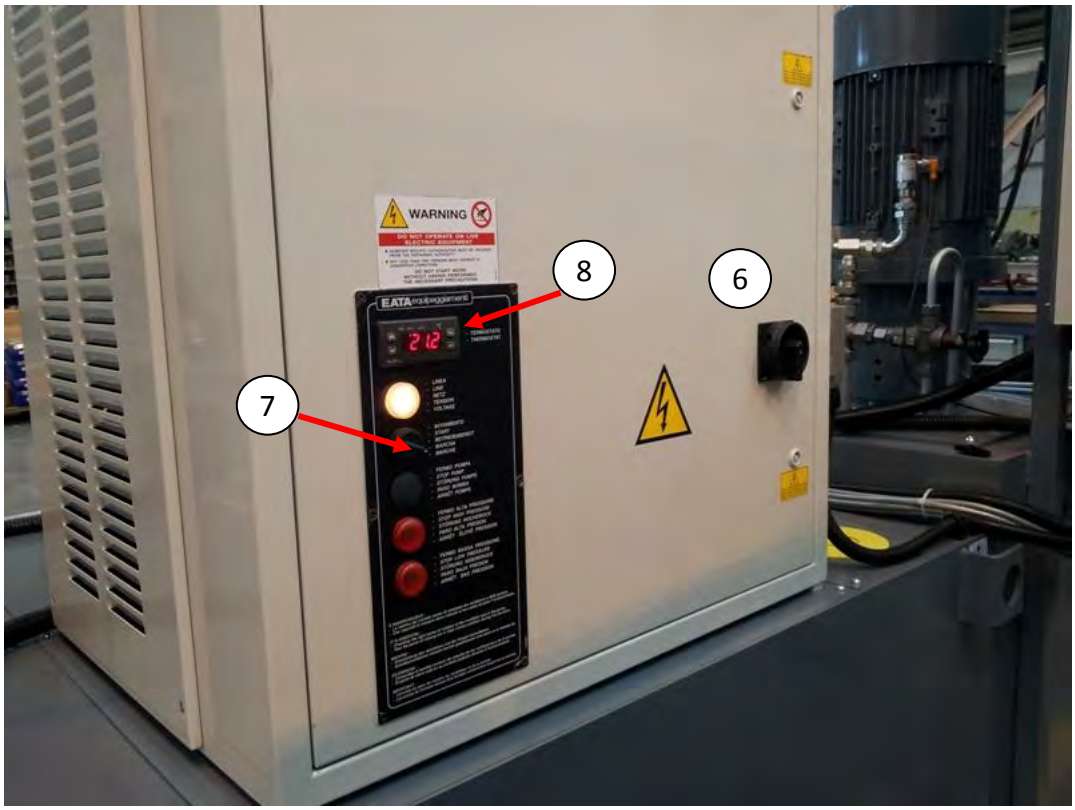


2. Reset the emergency stop button **(2)** at the control panel.
3. Check the Power ON lamp (white) **(3)** is illuminated.

4. Reset the emergency stop button **(4)** at the swarf conveyor control panel.
5. Set the mode switch **(5)** to the AUTO position

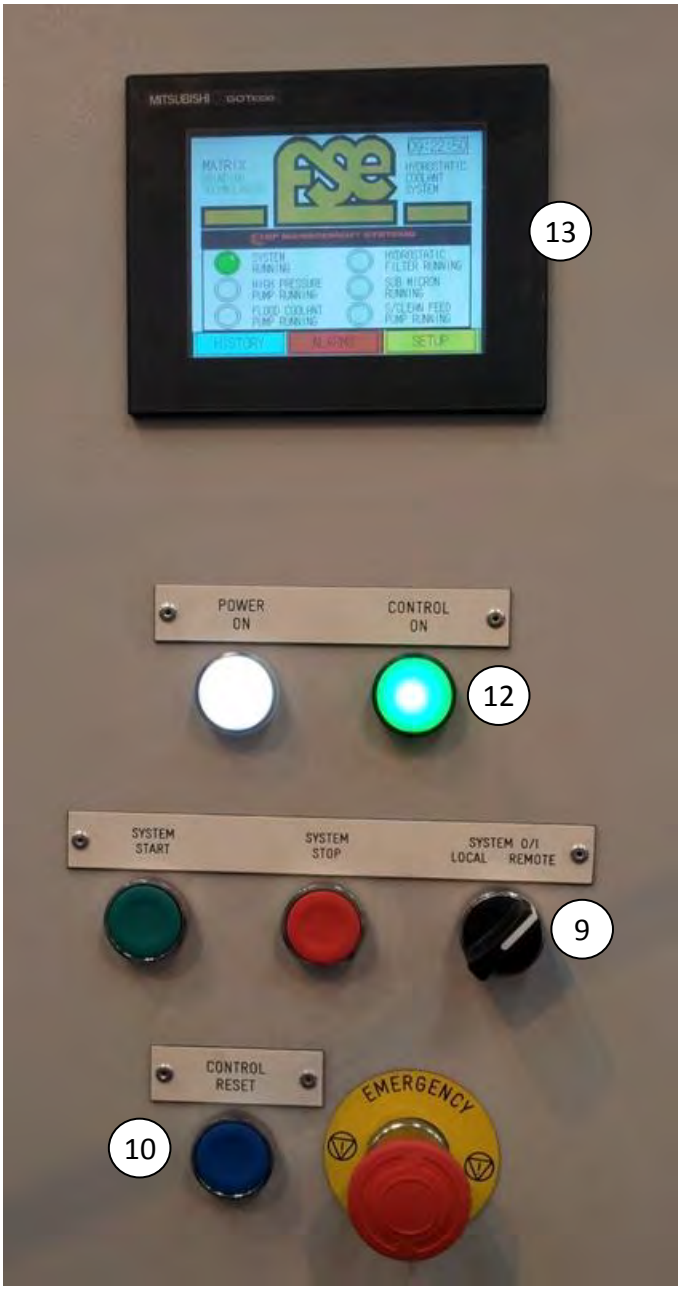


6. Turn chiller unit control panel isolator switch **(6)** to the ON position.
7. Set the chiller system control switch **(7)** to the start position.



8. Check the temperature display panel **(8)** is registering the current oil temperature and no chiller fault lights are illuminated.

9. Set the system selector switch **(9)** to the REMOTE position.



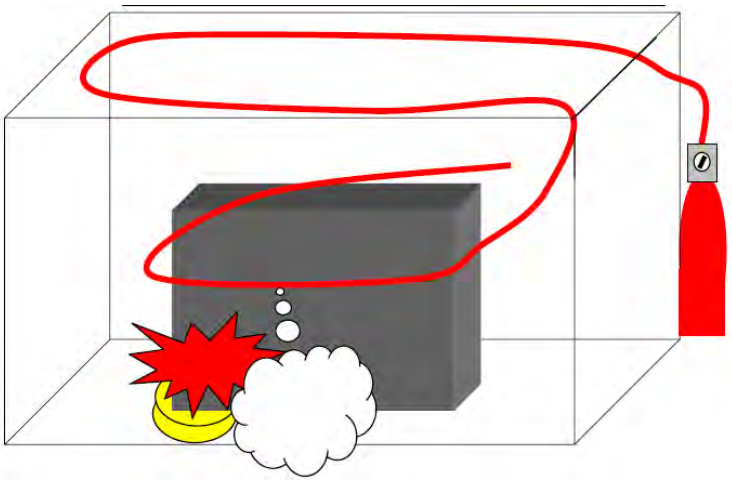
10. Press the blue control reset button **(10)** to start the system.
11. Check that the Control ON lamp (green) **(11)** is illuminated.
12. Check that no alarms are being displayed on the user display panel **(13)**.
13. The Coolant system is now ready for operation with the machine.

16 Automatic Fire System (option)

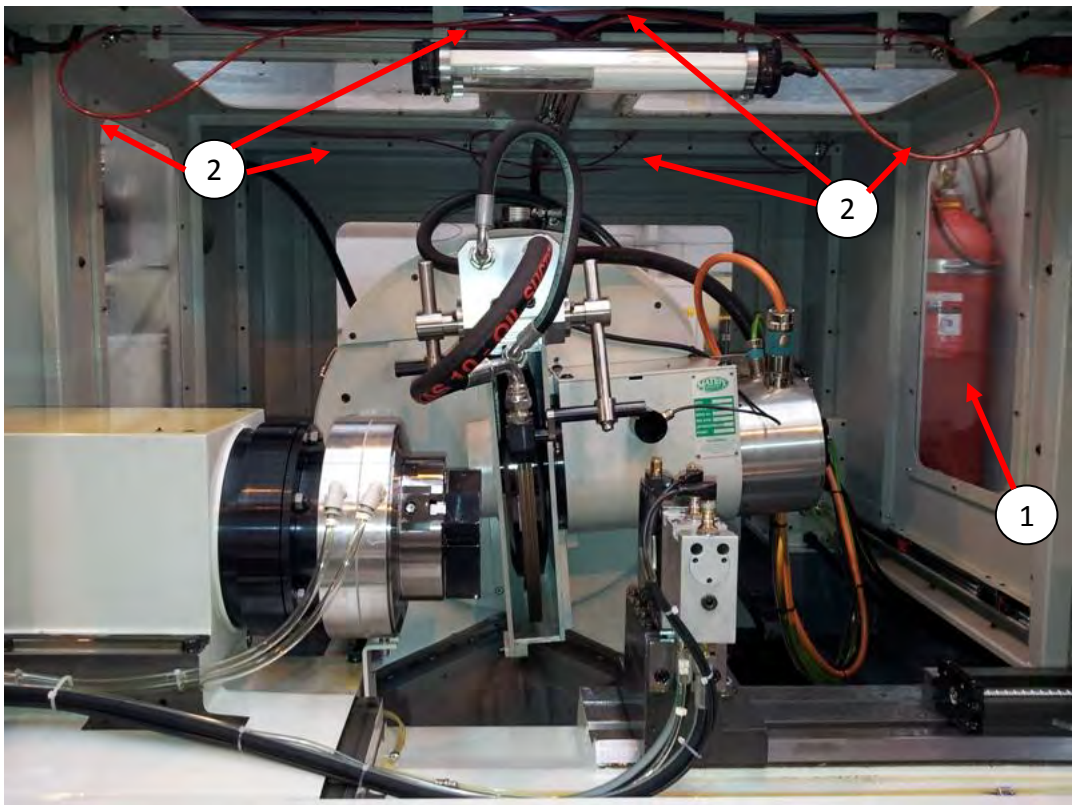
The automatic direct discharge CO_2 fire extinguisher system works on the tube burst/rupture principle.

16.1 Principle of operation

The principle is a simple self-activating system that offers the widest versatility and is absolutely safe against malfunction.



The flexible detection and delivery system tubing is manufactured from specially processed polymer materials to achieve the desired heat detection and delivery characteristics. When the temperature is increased to above 120°C or the automatic detection tube is touched by a flame the tube bursts and initiates the diffusion of the extinguishing medium instantly.



1	CO_2 fire extinguishant cylinder located in void between machine and LH side of the services cabinet	2	Red coloured low-melting point pressurised tubing runs along the inner roof section of the machine

As the automatic fire system is of the direct discharge type it will discharge the extinguishant contents directly from the point of the burst hole in the tube. Since this will be the closest point to the fire then it will also give the fastest extinguishing time and thus minimising the spread of fire within the machine area.

In addition, the machine's fume extraction port is blocked off to prevent any further spread of fire outside of the machine area.

Because the automatic fire system does not rely on any external energy source it remains operative even if the machine is powered off.

16.2 What happens in the event of a fire?

As soon as any part of the pressurised red tubing becomes ruptured by the fire then:

1. full contents of the CO_2 cylinder is dispensed into the machine enclosure area.
2. fume extraction port is shut-off
3. active grinding cycle will be stopped immediately when the fire system is operating.

16.3 Fire System Low Maintenance

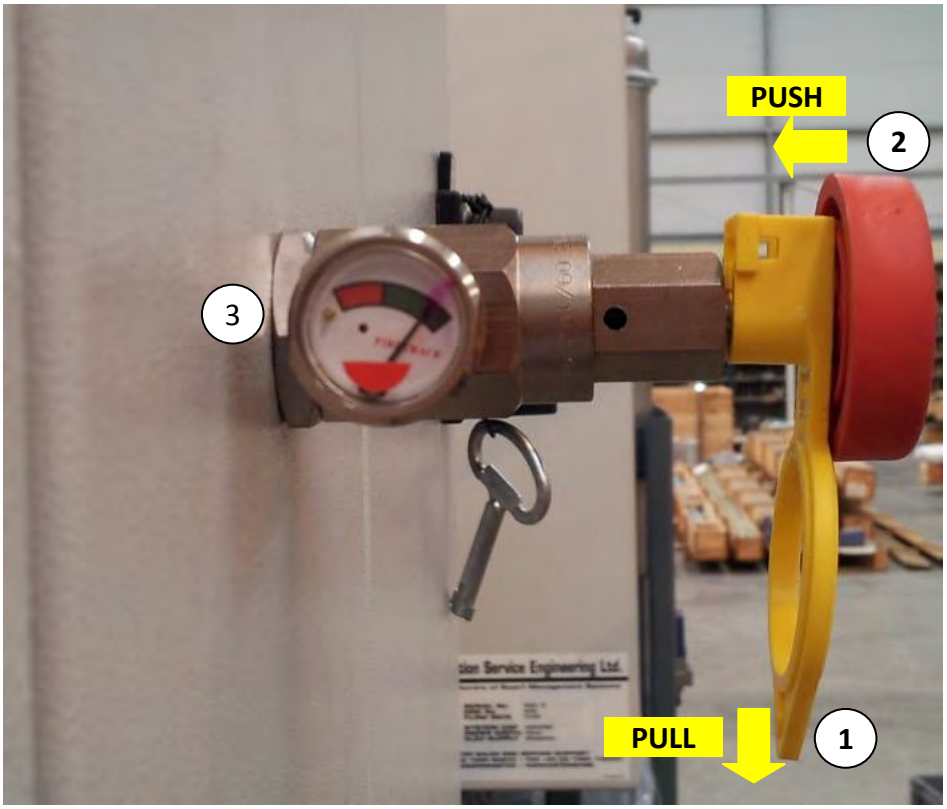
The simple design of the Firetrace automatic fire extinguishing system allows for a minimum of maintenance work. There is a greatly reduced risk of malfunction because there are virtually no moving parts, which reduces the risk of false alarms.

Maintenance of the Firetrace automatic fire extinguishing system is necessary to ensure system reliability and the periodic discharge requirements are comparable with standard portable fire extinguisher.

16.4 Manual triggering of the fire extinguisher

You can manually trigger off the fire extinguisher system as follows:

1. Pull down on the yellow tab **(1)**
2. Push the red button **(2)**



NOTE: The manual extinguishant release button is located on the side of the Services Cabinet.

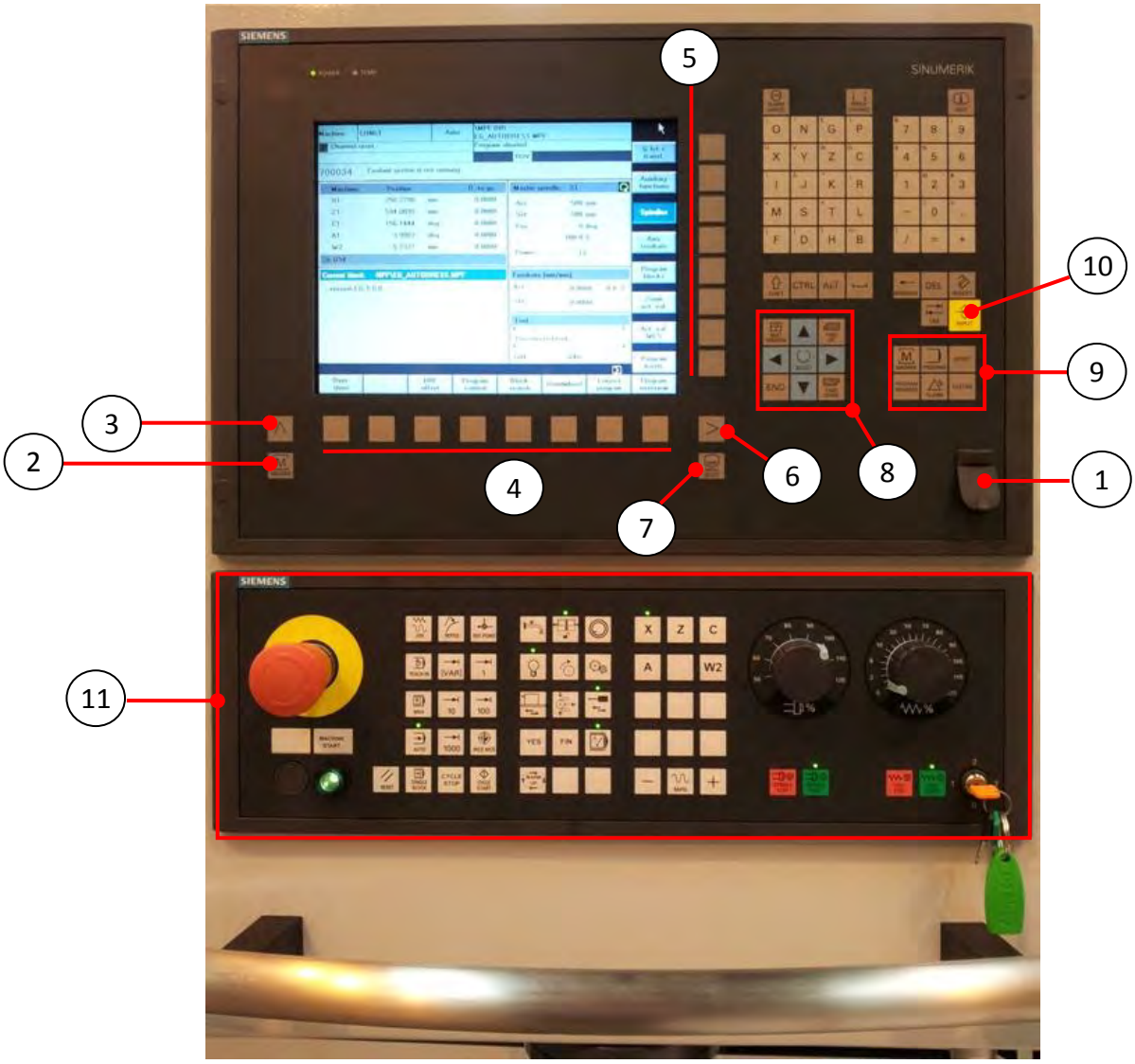
1	Manual pull tab (Yellow)	3	Fire system pressurised indicator gauge Green = system is pressurised Red = system not pressurised
2	Manual extinguishant release button (Red)		

17 Operator Console

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

1x HMI panel featuring a 10.4” colour screen with integral keyboard
1x Machine control panel (MCP)
1x Handheld unit featuring an electronic handwheel (MPG) and axis selector switch
1x Ethernet connection port (IP address: **192.168.20.241**, subnet mask: **255.255.255.0**)

17.1 HMI panel



1	USB port	7	Area switchover key
2	Machine area key	8	Cursor and selection keys (blue)
3	Recall (return) key	9	Hot/shortcut keys
4	Horizontal function select keys	10	Data input key (yellow)
5	Vertical function select keys	11	Machine Control Panel (MCP)
6	Etc/ menu extension key		

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

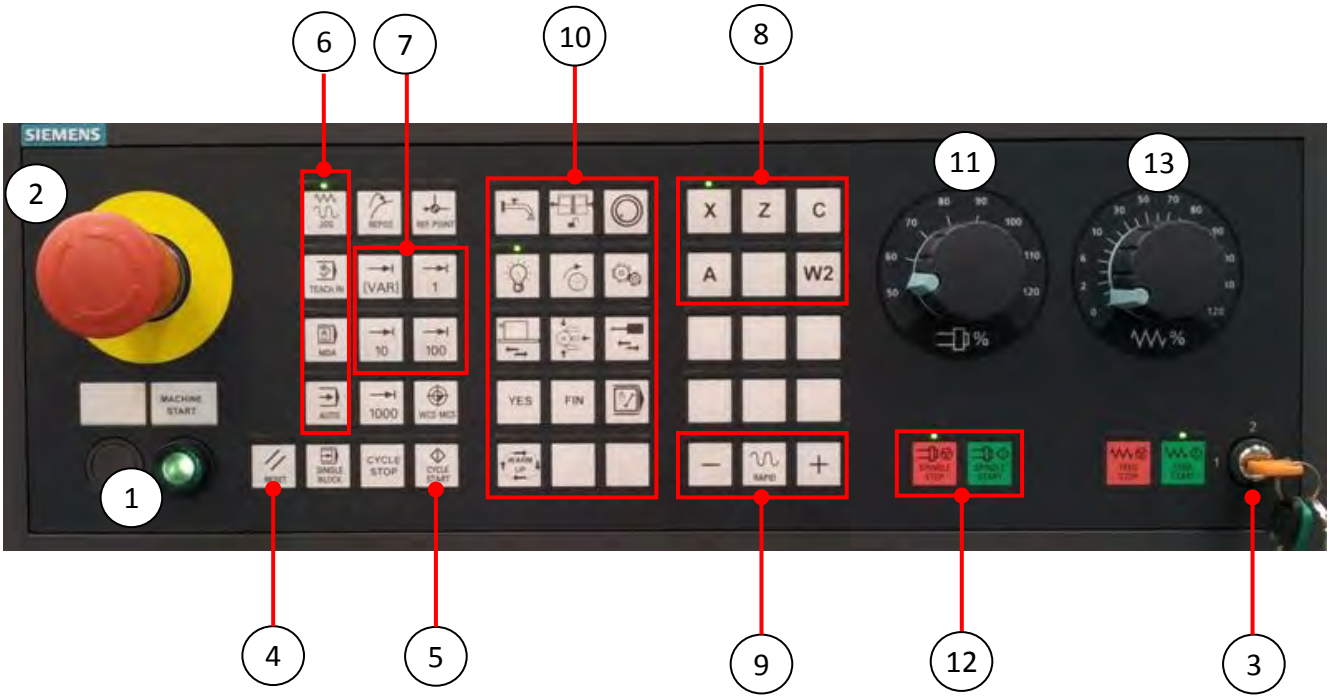
You can switch to the main menu from any selected operating area by pressing this key. Press the key twice to change from the current operating area to the previous one.

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.

17.2 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)	8	Axis selection keys
2	Emergency stop actuator (turn-to-release)	9	Manual JOG keys
3	Access rights keyswitch (0= lowest access, 3= highest access)	10	Machine command functions
4	Cycle/alarm reset button	11	Grinding spindle (S1) override control rotary switch (50 – 100%)
5	Cycle start button	12	Grinding spindle (S1) start/stop keys
6	Control system operating mode JOG / MDA / AUTO	13	Machine axes feedrate override control rotary switch (0 - 100%)
7	JOG increment selection INC 1, 10, 100		

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

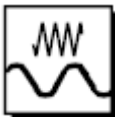
1. Ensure that all emergency stop buttons are in their released state.

2. Press the Master Start button on the MCP.

17.3 CNC operating modes

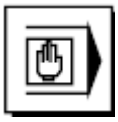
When you select a mode key, the corresponding mode becomes active. The active mode is signalled and confirmed by the associated LED which lights up.

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



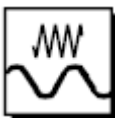
Selection of this mode permits control of the machine through execution of an NC command block (instruction) or a sequence of command blocks.

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

AUTO mode

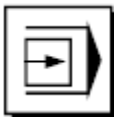
Selection of this mode permits control of the machine through the automatic execution of a sequence NC command instructions i.e part programs.

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.

17.4 Program Cycle Start/Reset

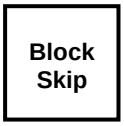
CYCLE START

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.

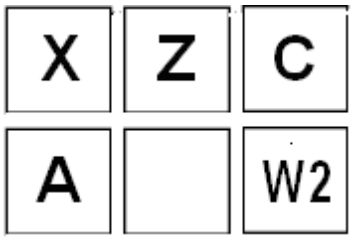
De-select **[BLOCK SKIP]** and then press the **[CYCLE START]** key to resume the grinding cycle.

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.

17.5 Axis selection and speed controls

AXIS SELECTOR

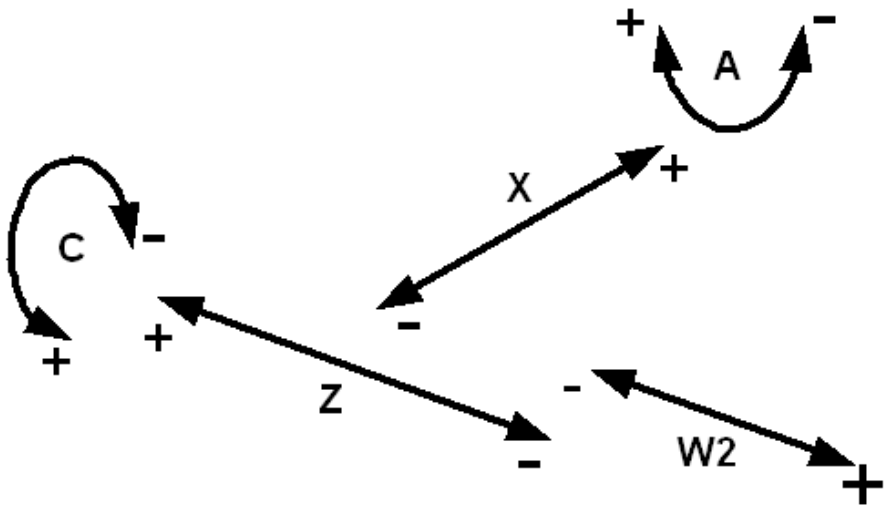


Press an axis letter key to select it. The indicator above the key will illuminate to signify the axis you have selected.

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

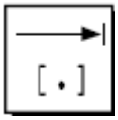
Press the [+] key to jog the selected axis in its positive direction axis in JOG mode.

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 [-].

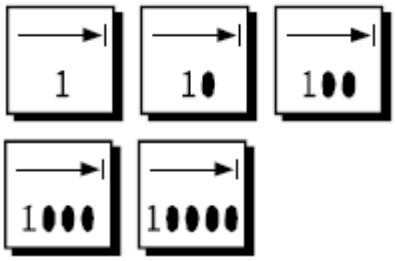
Use of the incremental jog selection keys described below is permitted in JOG, MDA or TEACH-IN modes.

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

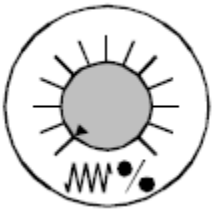


Select to jog the selected axis by a preset incremental amount with each press of the jog [+] or [-] key.

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

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

AXIS FEEDRATE OVERRIDE

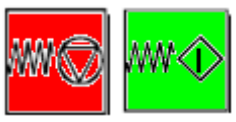


This rotary switch allows you to proportionally control the programmed machine axis speed during automatic cycle operation.

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



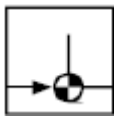
Feed start/stop functions are not selectable.

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

17.6 Axis Reference

The 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.
Manual axis referencing is not necessary. Therefore, this function should not be used establish machine axis datums.

17.7 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.

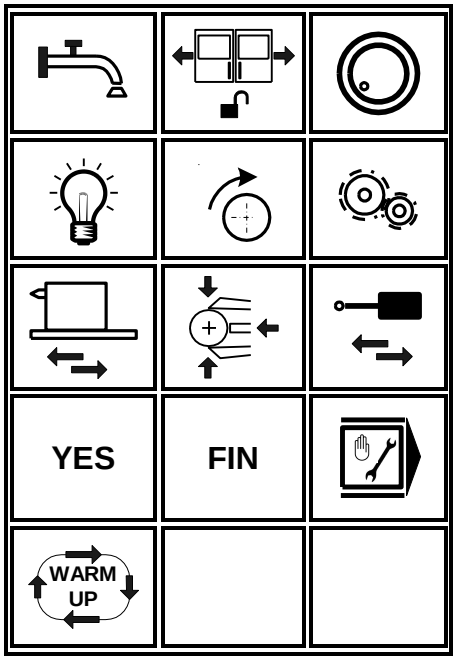
SPINDLE STOP

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.

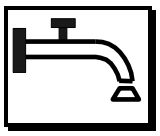
17.8 Command functions

A selection of command functions have been provided for your convenience.



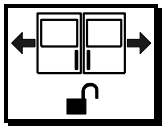
Function keys [YES], [FIN] and [SETUP] are generally applicable when the grinding or setting cycles are executed.

COOLANT ON/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



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 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

General machine lights ON/OFF toggle.

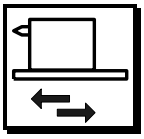
GEARBOX ON/OFF

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.

TAILSTOCK ADVANCE/RETURN (option)

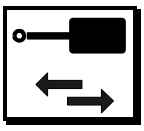


<u>If pneumatic tailstock barrel option fitted:</u>
Press this toggle key to advance or retract the tailstock barrel if th.

<u>If travelling tailstock option fitted:</u>
Press this toggle key if to drive the tailstock to the advance or retracted position.

The indicator above the key illuminates when the tailstock has moved to the advance position.

PROBE ADVANCE/RETURN (option)



Probe slide advance/retract toggle key.
Press this key to advance or retract the probe slide.

The indicator above the key illuminates when the probe slide has moved to the advanced position.

YES ACKNOWLEDGE

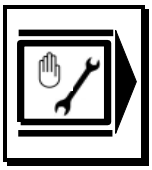
Used in conjunction with the Matrix cycles, to acknowledge dialog prompt messages that presented during cycle execution.

FINISH ACKNOWLEDGE

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

SETUP MODE

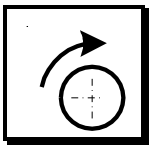
Setup mode ON/OFF toggle.



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

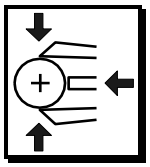
Note: When Setup mode is enabled then the machine is permitted to operate in cycle without doors closed, spindle running, coolant. Therefore, DO NOT attempt to run the grinding cycle with setup mode enabled!

WORK ROTATE (option)



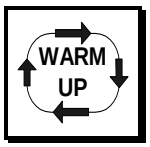
Press this key to execute the workpiece continuous rotate function.
The indicator above the key illuminates when the function is active.

STEADY OPEN/CLOSE (option)



Press this toggle key to open or close the steady rest arms.
The indicator above the key illuminates when the steady arms are clamped onto the workpiece.

WARM-UP (option)



Press this key to execute the machine warm-up ASUP cycle.
Machine warm-up routine includes:

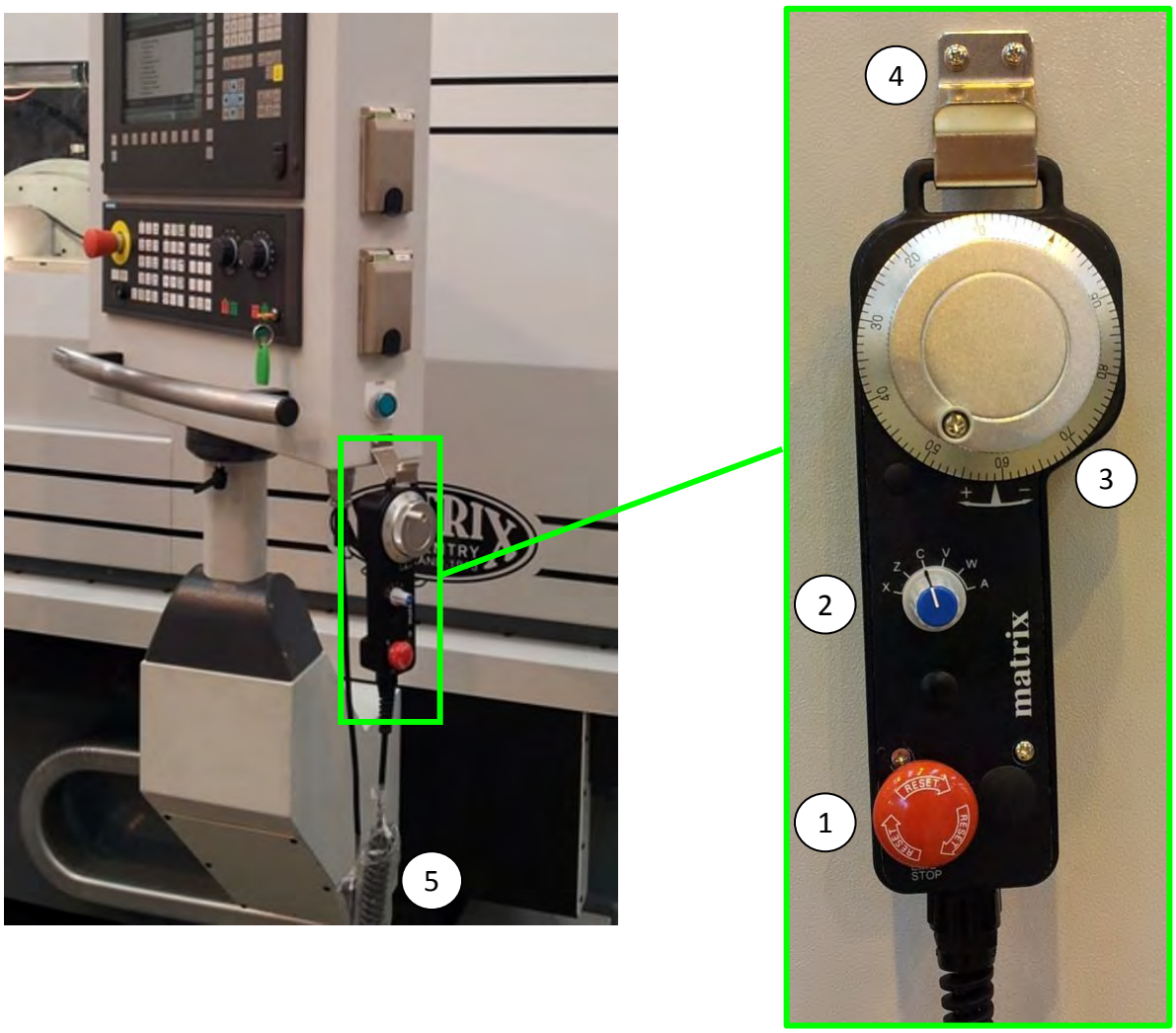
- Grinding spindle running
- Dressing spindle running
- Exercising the configured machine axes
- Coolant flow to machine area

Once initiated, the warm-up cycle will run for 60mins and then stop. However, you can interrupt the cycle at any time be pressing the [RESET] key.

The indicator above the key illuminates whilst the warm-up cycle is running.

17.9 Handheld Unit

The handheld unit is intended for use by the operator during machine setup. The hand unit connects to the electrical control cabinet (ECC) via a flexible coiled cable which can be extended upto 2 meters.



1	Emergency stop actuator (turn-to-release)	3	Electronic handwheel / MPG
2	Axis (X,Z,C,A) rotary selector switch	4	Handheld unit docking hook
5	Coiled cable (extendable upto 2metres)		

To use the handheld unit:

1. Select [HANDWHEEL ENABLE] function at the MCP
2. Select a jog increment [1], [10] or [100] at the MCP
3. On the handheld unit turn the rotary switch to select the axis position that you want to control with the MPG.

Note:

1. Whilst the handheld unit is in use axis selection at the machine control panel (MCP) is inhibited.
2. The handwheel cannot be used on the travelling tailstock axis (W2) if this option is fitted to the machine.

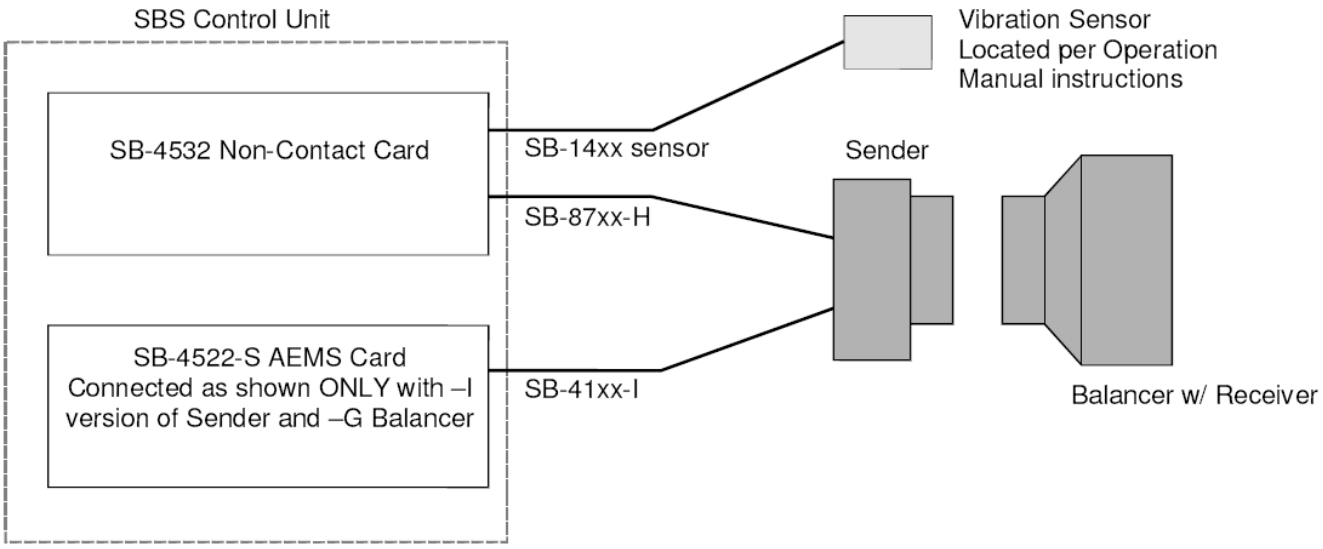
18 Automatic Wheel Balancer (SBS 4500)

A primary cause of vibration in the grinding machine is the existence of imbalance in the grinding wheel. Imbalance is often due to the nature of grinding wheel construction.

A wheel contains great numbers of unevenly distributed grains, which cause an intrinsic imbalance. This imbalance will be compounded by eccentric mounting of the wheel, varying width of the wheel, imbalance in the spindle arbor and coolant absorption into the wheel.

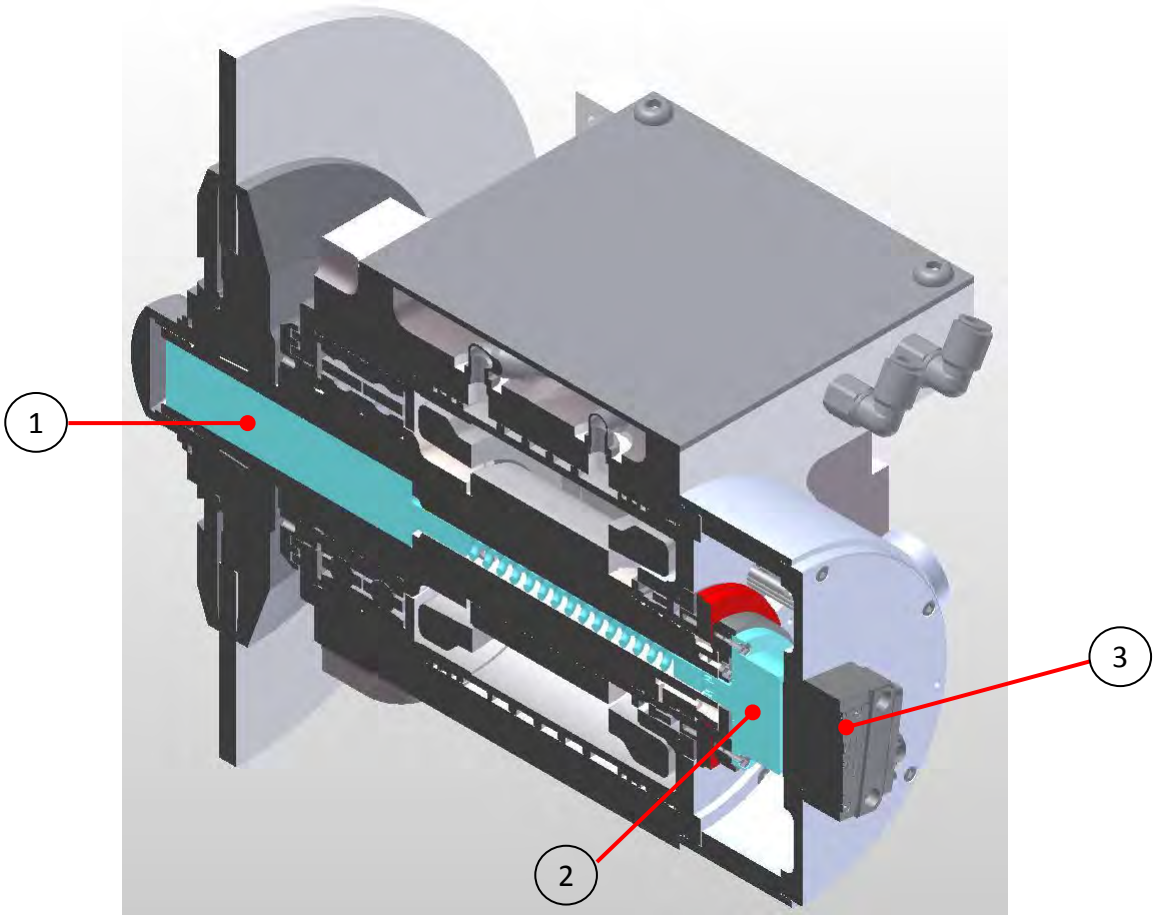
Due to wear and frequent dressing of the wheel periphery, the rotational dynamics of a grinding wheel are always changing. Therefore, dynamic balancing of the grinding wheel is considered to be an essential step in the production process.

18.1 Block diagram



18.2 Integral Balancer Unit

The integral balancer unit is mounted inside the bore of the grinding spindle shaft and forms part of the motorised grinding spindle assembly.



1	Integral balancer unit (containing motorised weights)	3	Non-contact sender unit
2	Receiver unit		

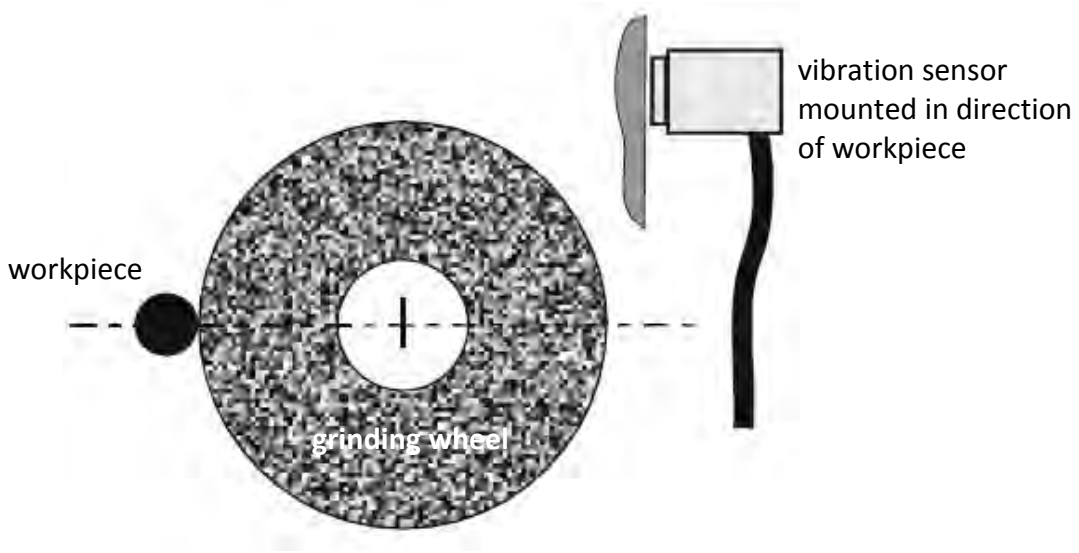
There are two moving weights inside the integral balance unit which are electronically controlled to compensate for any imbalance to the grinding wheel during running.

18.3 Vibration sensor location

The balance system relies on vibration signals received from the Vibration Sensor to accurately display the current vibration level, in peak to peak units, and to balance the grinding wheel.

Therefore, the location and installation of the sensor is crucial to the successful operation of the balancer system.

The vibration sensor provided has a magnetic mount and during initial setup will need to be moved around until good permanent location is found on the grinding machine for the sensor. The sensor can then be permanently fixed at that location (on a machined flat).



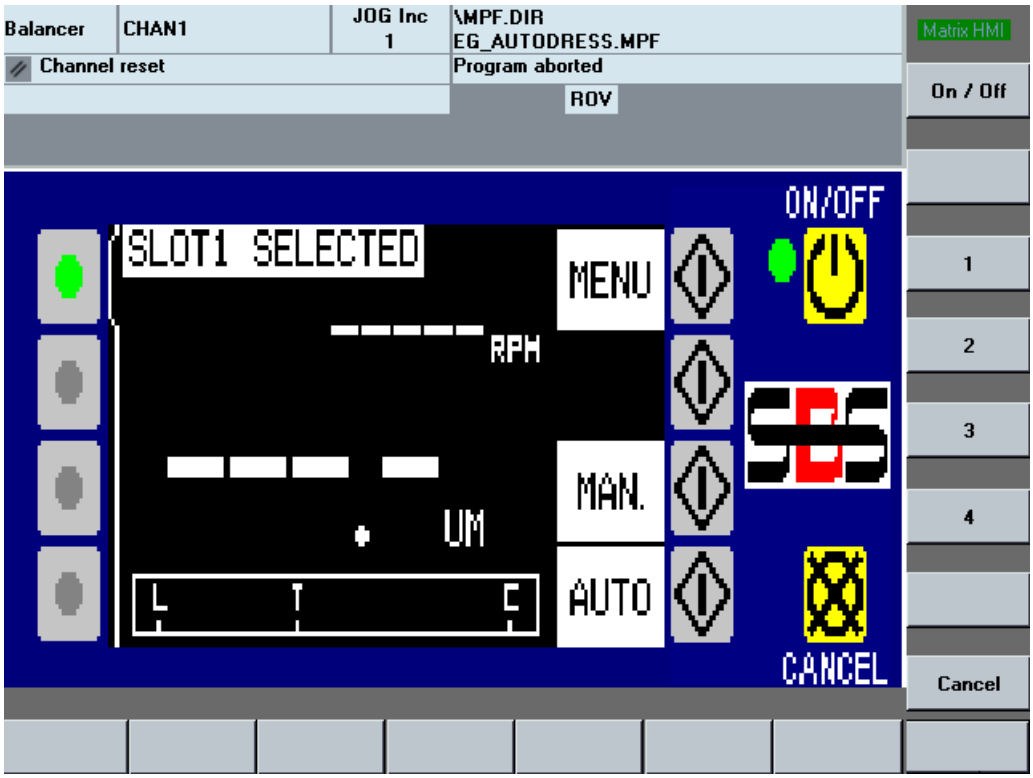
Points to note:

1. Locate the sensor in the same direction as the centreline between the grinding wheel and the workpiece.
2. Locate the sensor on a rigid part of the wheelhead assembly.

If possible the 0850 machine should be installed away from other sources of vibration that would generated by surrounding machinery.

18.4 Control Panel

The balancer control panel is accessed from the HMI screen. Select [MENU SELECT] > [Balancer] to launch the control panel display.



For specific setup and operating instructions please refer to the SBS user manual supplied in addition to this manual.

19 Dialog Programming

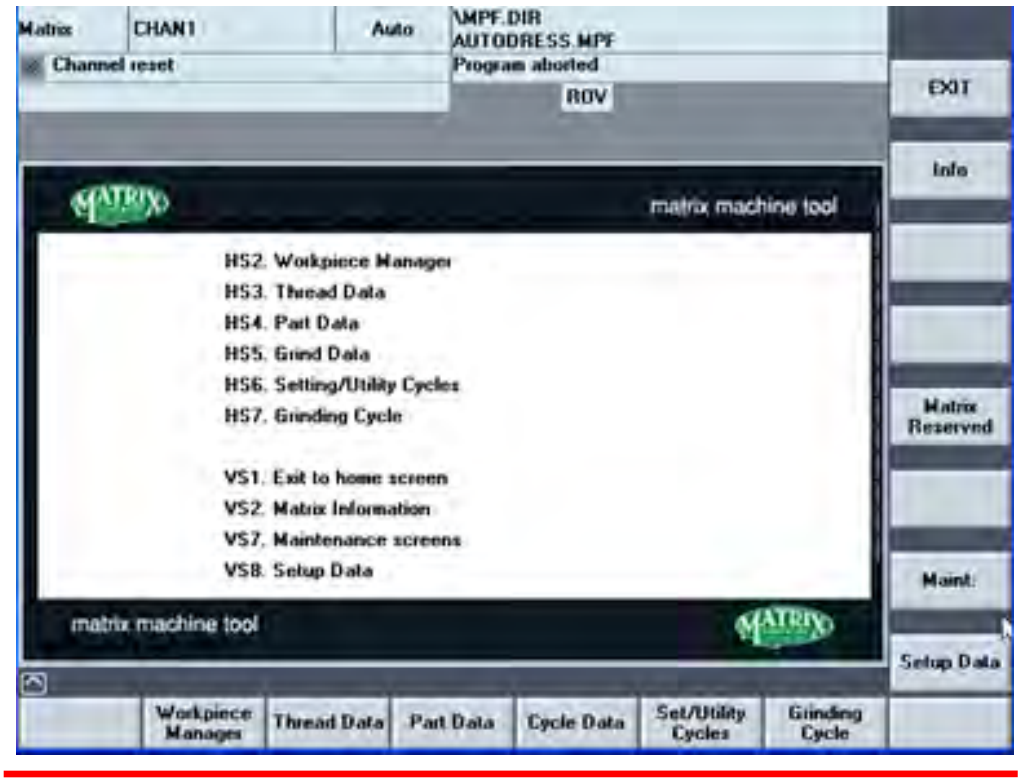
The Matrix Interface is dialogue box, interactive menu driven, parametric programming system. The application enables quick set-up times due to the user friendly menu system. All of the parameters required for controlling the grinding and dressing processes only require simple parameter input, no prior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

19.1 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.

19.2 Work piece Manager

[Custom > Matrix > Workpiece Manager]

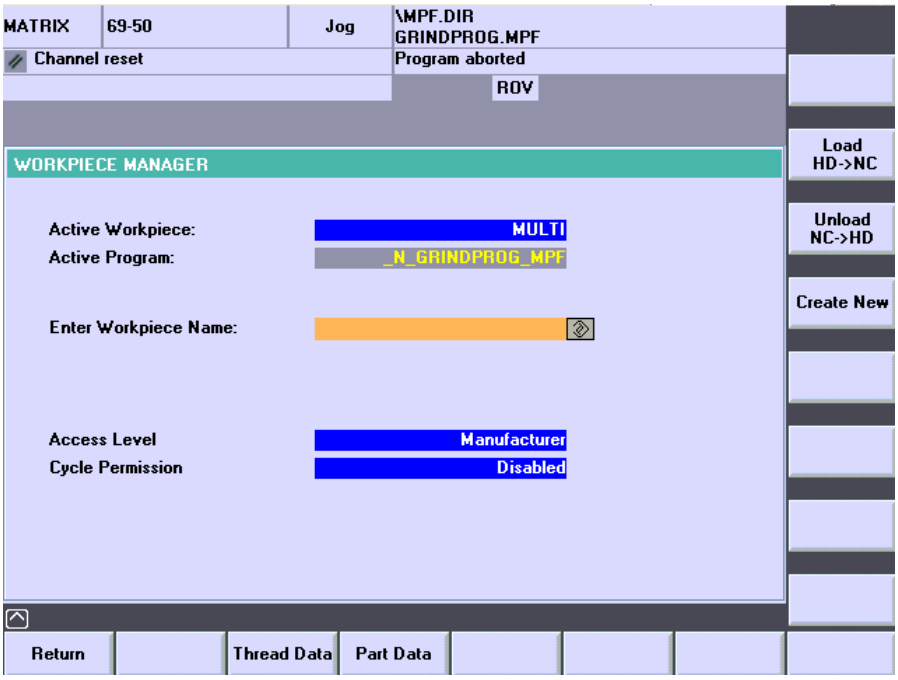
Before you can run any setup cycle or start to do any grinding on the machine you must load a workpiece (sometimes called a job file) to the NC. If there are no existing workpieces listed in the workpiece folder (Machine > Programs > Workpiece) available to use then you must create a new one.

19.2.1Create and Load a new workpiece

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

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

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



8. 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.

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

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

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

19.2.2Load 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.

19.2.3Unload the workpiece

1. Insert the ORANGE Siemens Key in position 3.

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

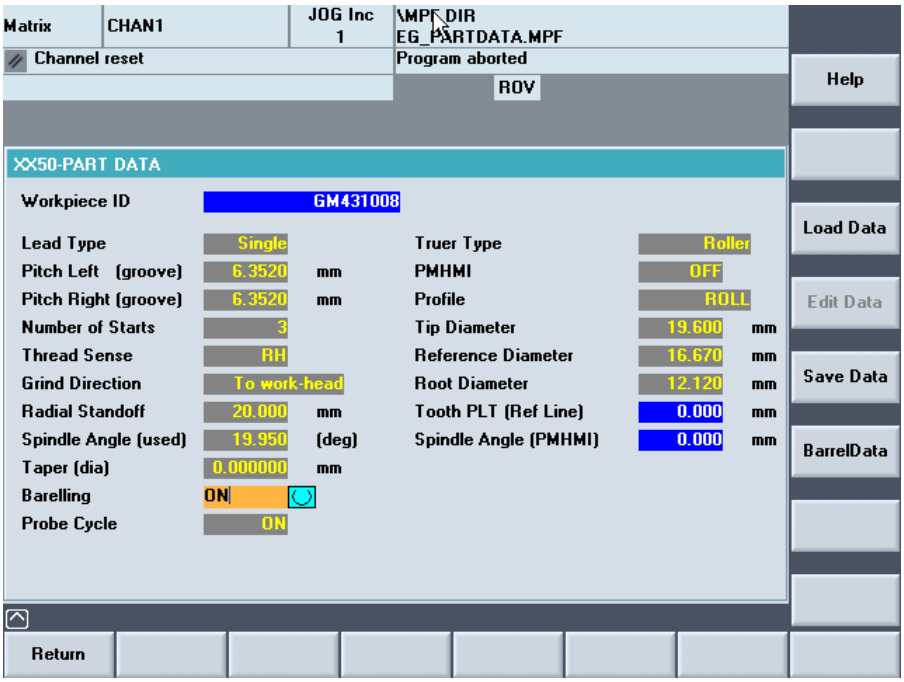
3. To unload the active workpiece enter the name of the active workpiece in the input field and then select the **[Unload NC > HD]** softkey.

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

19.3 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 that is to be ground by the machine. However, if you are planning to do profile dressing using the PMHMI function then you must select the profile and dressing tool in the Thread Data screen.

19.3.1 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.

19.3.2 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 final diameter at which workpiece thread grinding will stop. 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

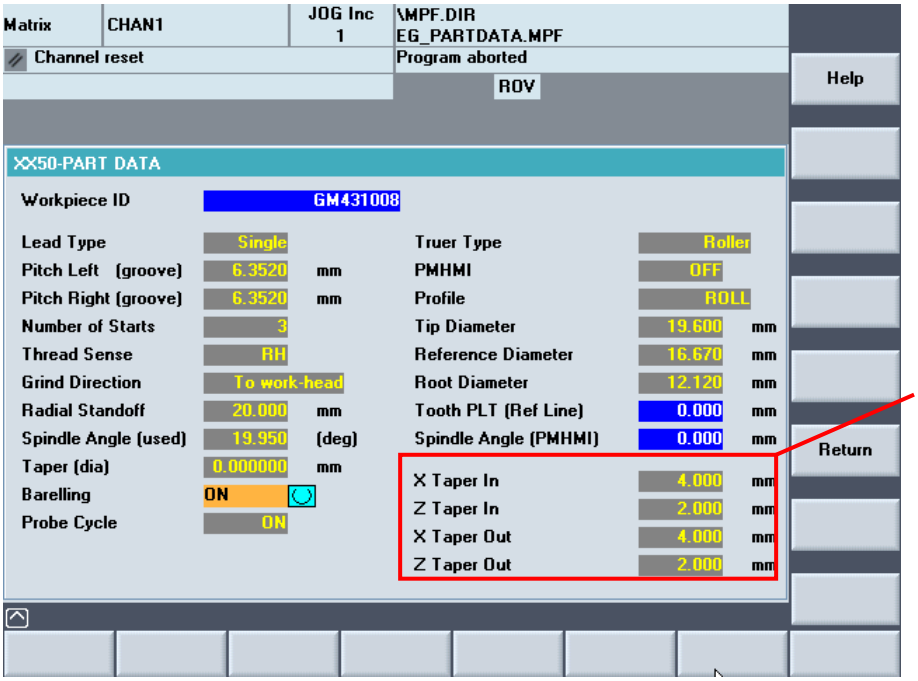
Spindle Angle (PMHMI)
READ ONLY field
This field displays the grinding wheel helix angle calculated by PMHMI.

Probe Cycle
Input selection: OFF or ON
Select this function if you are want to use the probing system to automatically determine the pitch-in position of the grinding wheel to the workpiece thread groove.

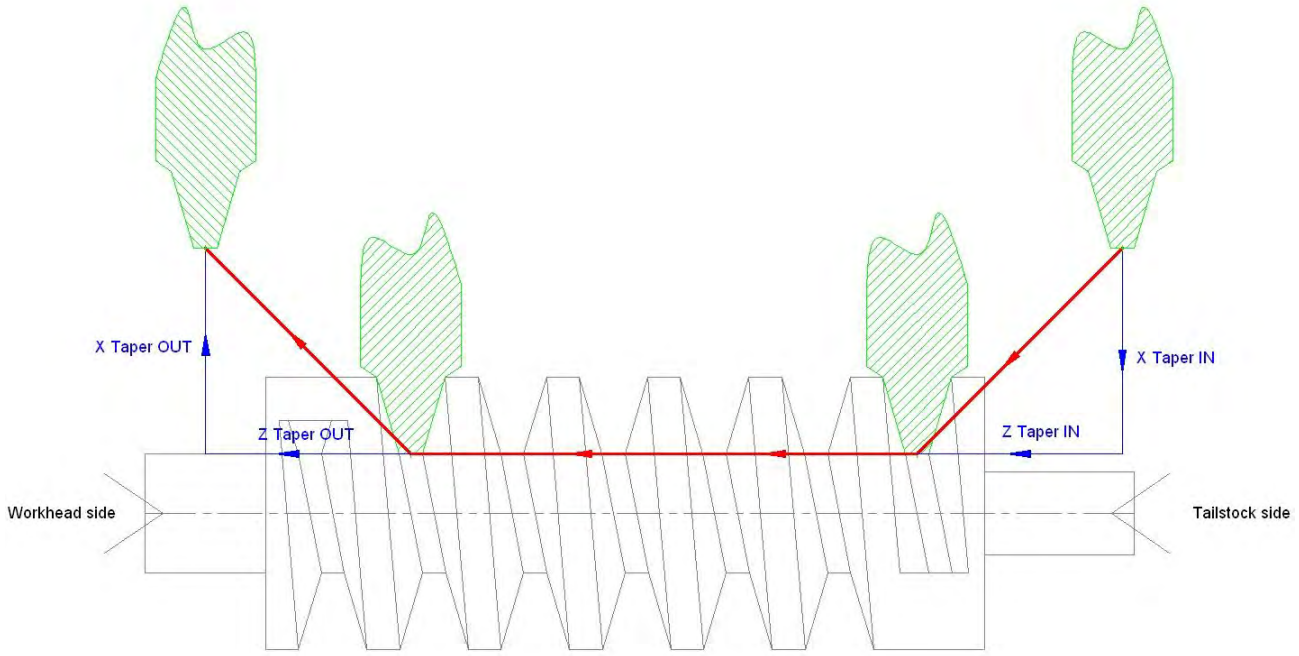
Barelling
Input selection: OFF or ON
Select this if you want to use the barrelling function (see section ?).

19.3.3 Taper In/ Taper Out

Select the [Barrel Data] vertical softkey in the Part Data screen if you want to define the point at which the grinding wheel enters and exits the workpiece thread to be ground.



input fields become visible when the BarrelData key is selected



Red directions arrows shown in the sketch above apply a right-hand threaded workpiece where the conventional direction of grind is from right to left i.e from tailstock side towards workhead side.

In the case of a left-hand threaded workpiece the conventional direction of grind would be from left to right.

However, it should be noted that this is not a restriction of the machine. For example, you could grind a right hand thread with the grinding wheel moving from left to right often referred to as 'climb grinding'.

X Taper In / X Taper Out

Note: X taper in/out position move is programmed radially i.e not as a diameter.

The amount of taper to apply to the grinding wheel moving in the X direction can be calculated using the following expression:

$$X\ taper = \frac{Tip\ Ø - Root\ Ø}{2}$$

Z Taper In / Z Taper Out

The amount of taper to apply to the grinding wheel moving in the Z direction is generally determined as follows:

$$Z\ taper = \left(\frac{Lead}{360°}\right) \times 90°$$

19.4 Thread Data (PMHMI)

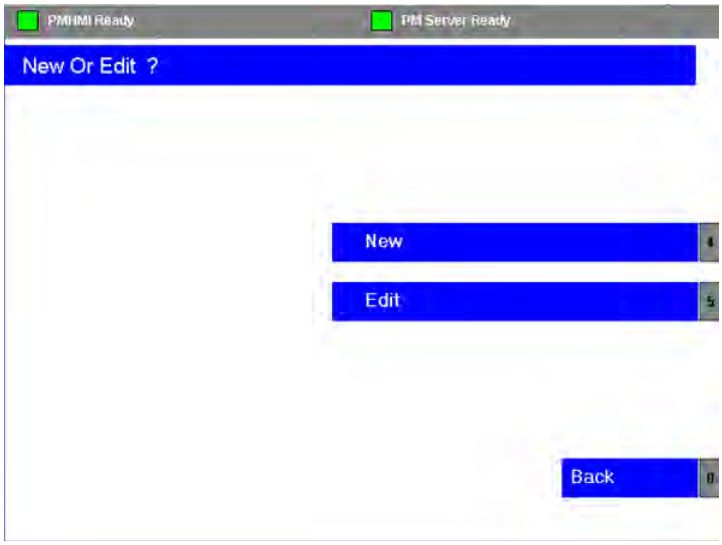
[Matrix] > [Main Menu] > [Thread Data]

19.4.1Create New Thread

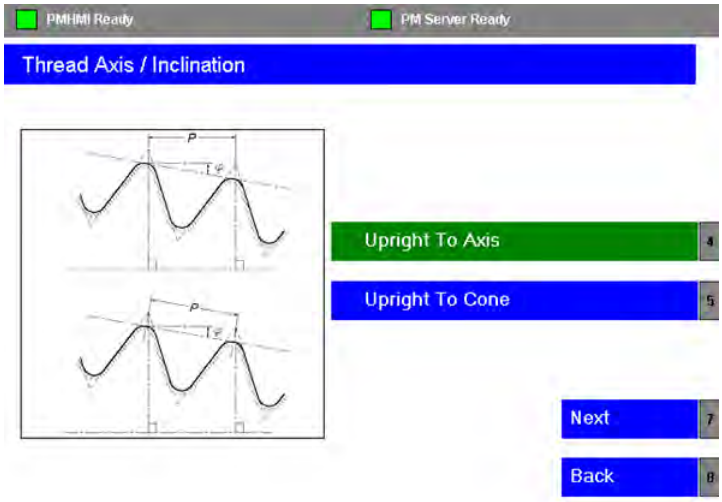
1. Select the [Thread Data] softkey from the main menu screen to access the PMHMI thread and tool menu screen.

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?



<u>Tapered Thread</u>

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.

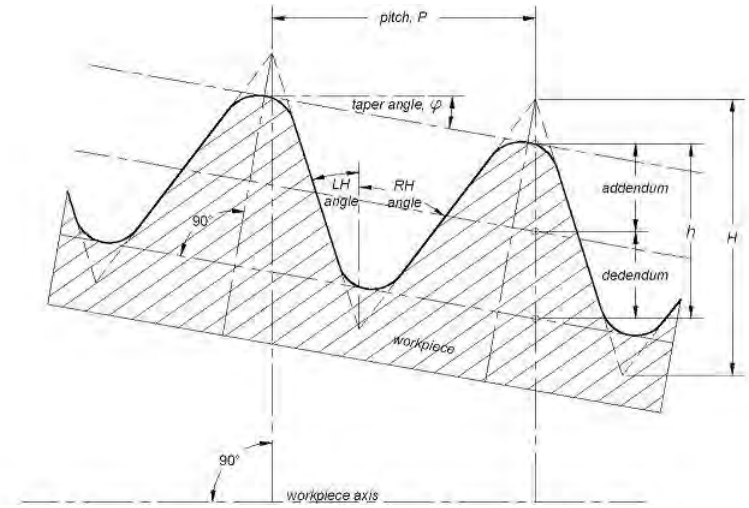


Fig.1 thread specified upright to the axis

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.

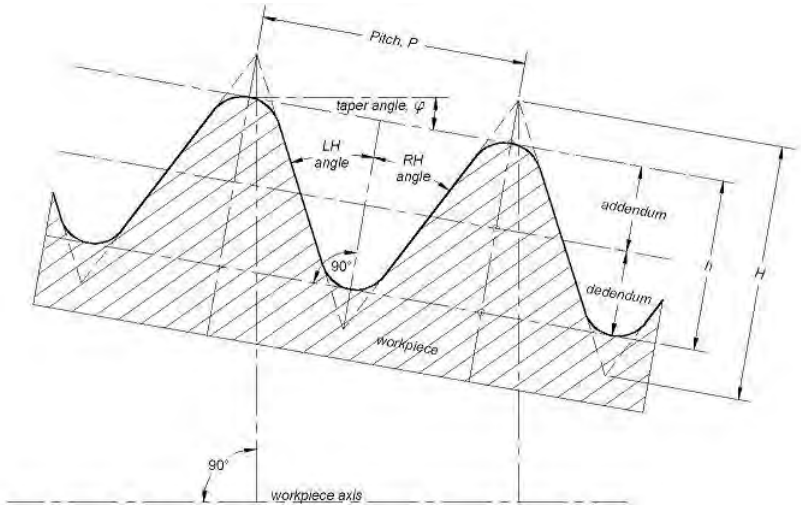


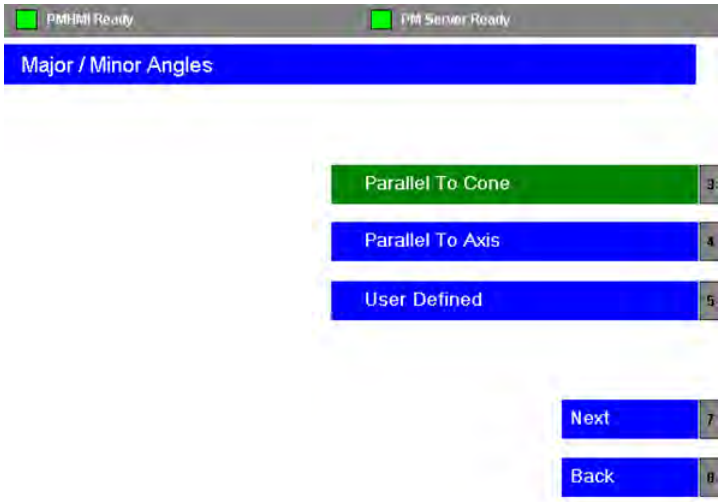
fig.2 thread specified upright to the cone

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.

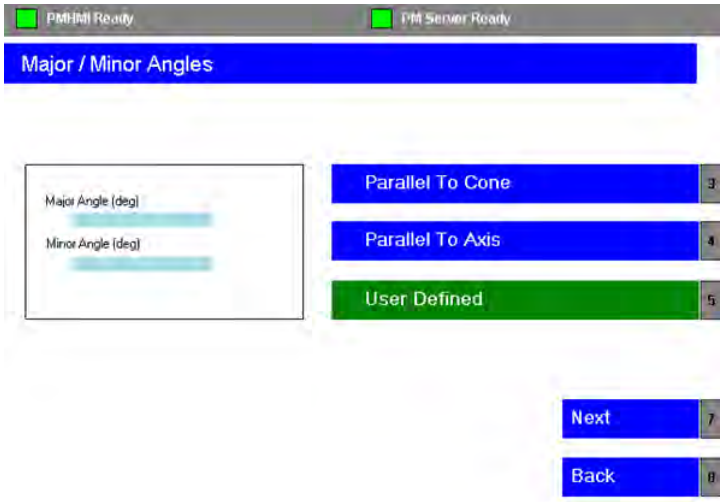
[Parallel To Axis]

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.

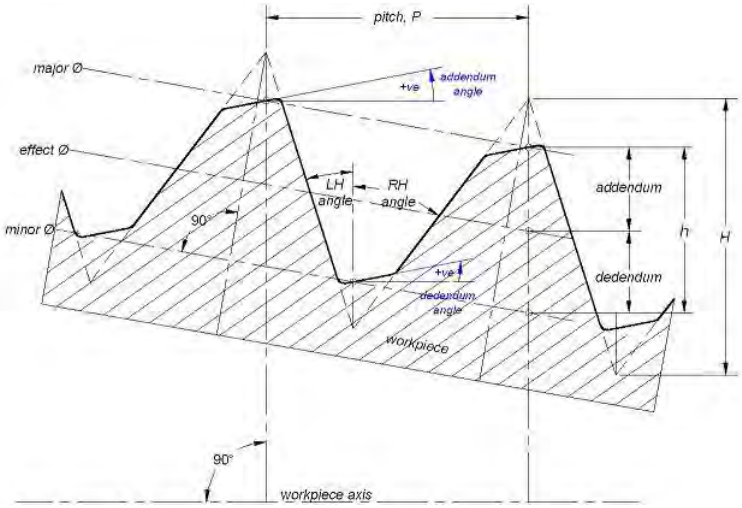
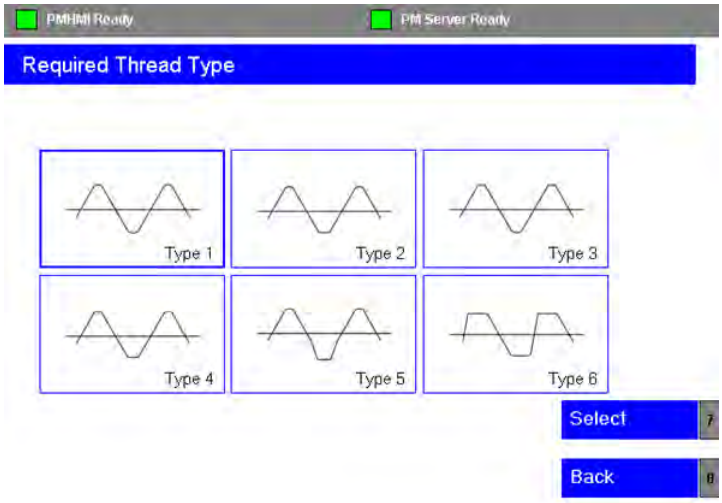


Fig.3 user defined major/minor angles

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.

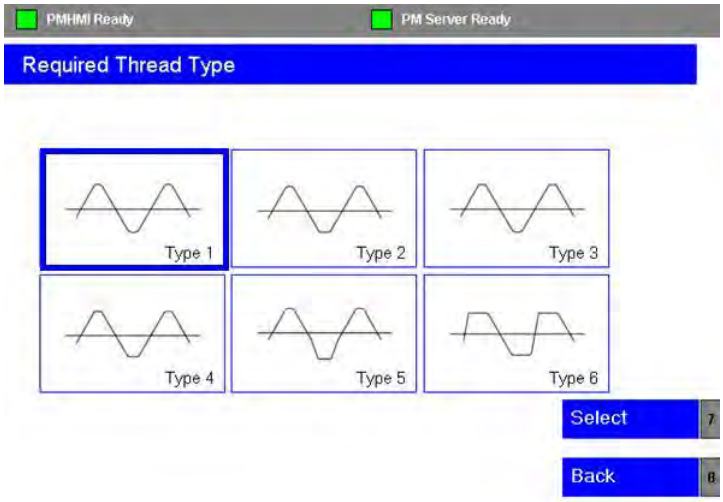
   Highlight the thread type that you want to create using the blue cursor buttons on the HMI panel and then press the [Select] softkey to continue.

19.4.2Thread 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			

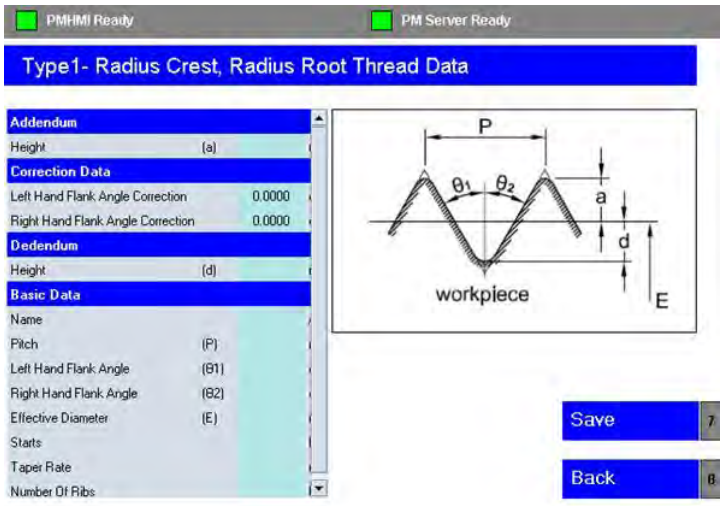
19.4.3Thread Type 1

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.

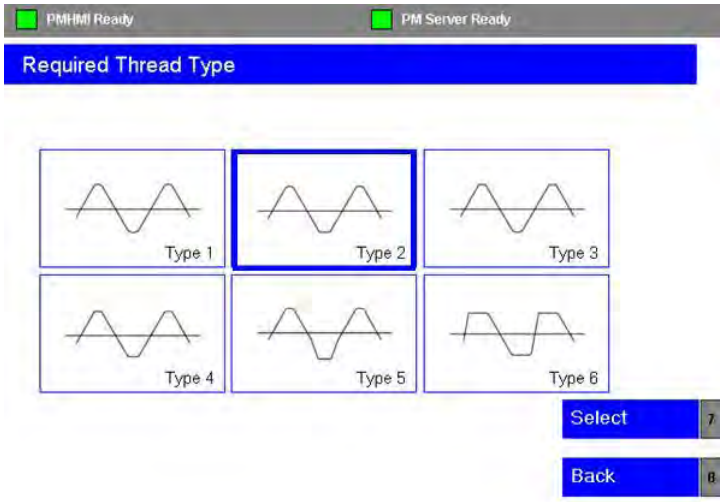
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   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.

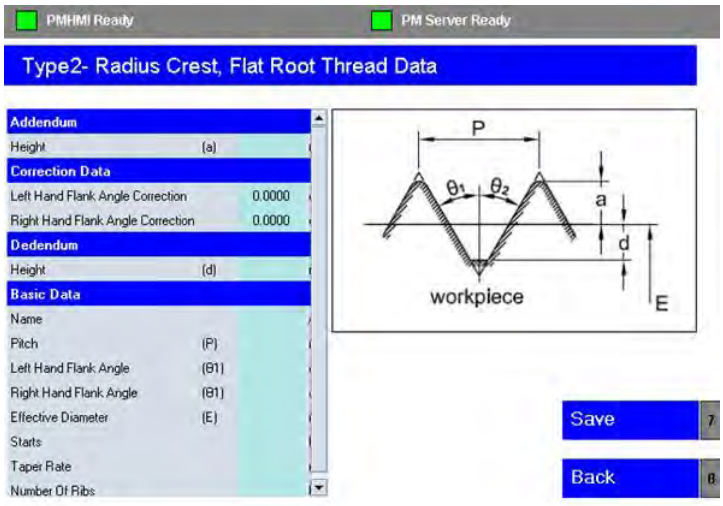
19.4.4Thread Type 2

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.

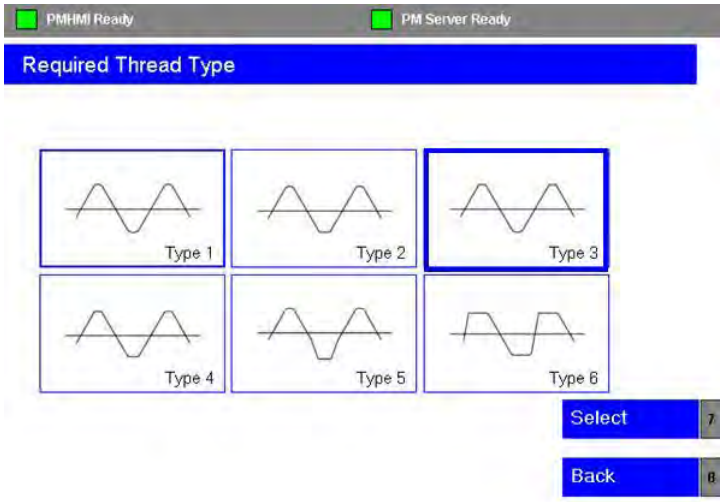
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   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.

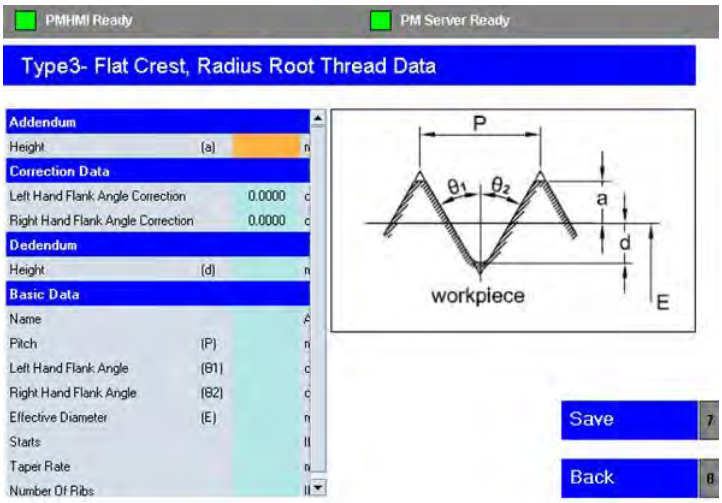
19.4.5Thread Type 3

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.

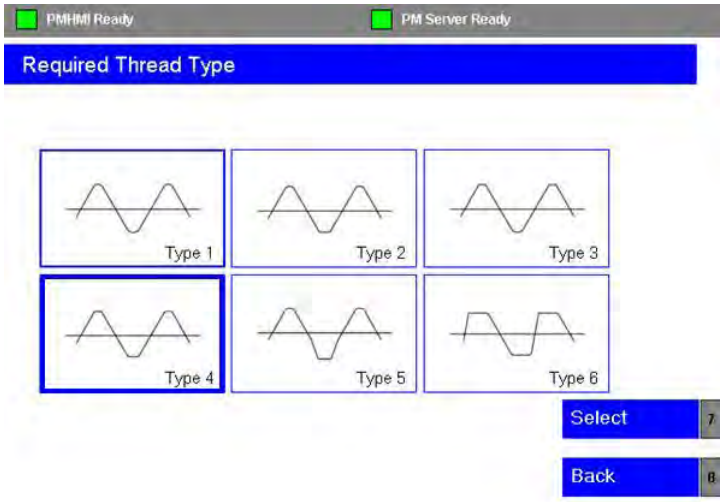
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   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.

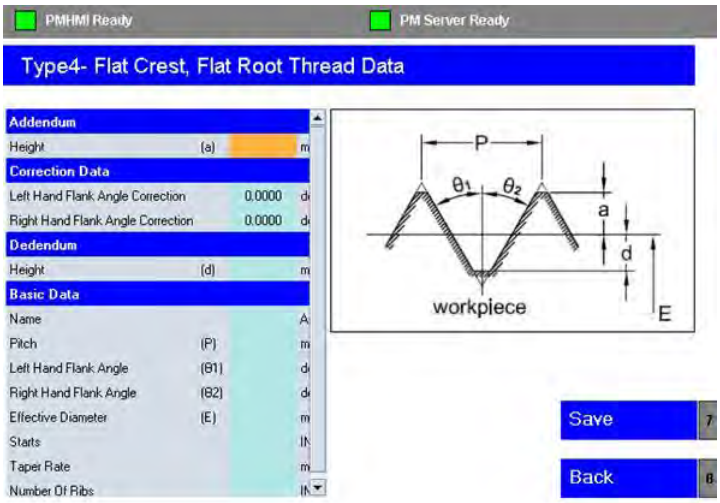
19.4.6Thread Type 4

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.

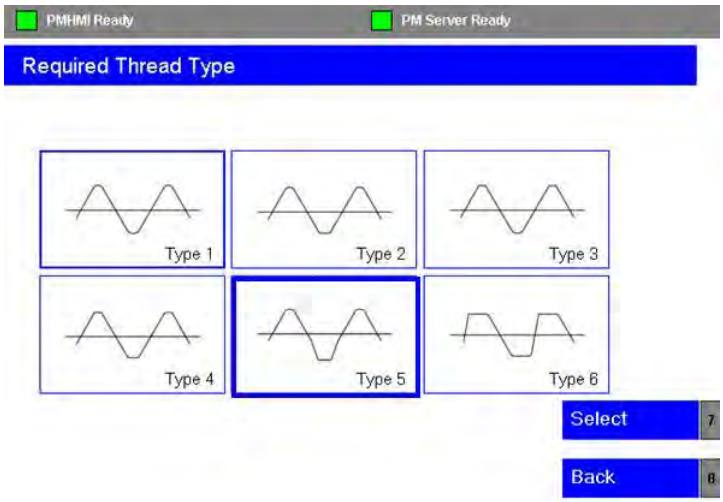
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   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.

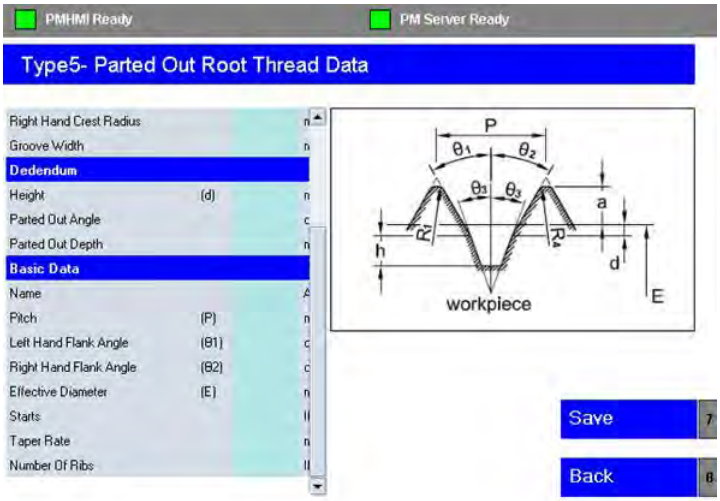
19.4.7Thread Type 5

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.

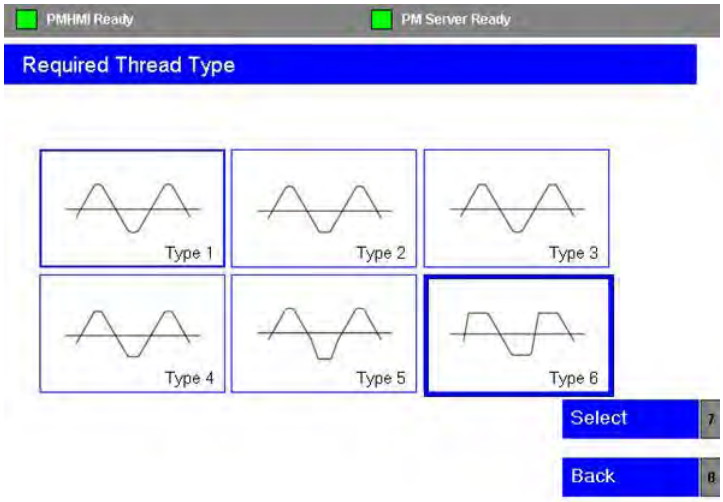
   Select the TAB key to switch into the next input field and continue to enter data until all input field have been filled.

   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.

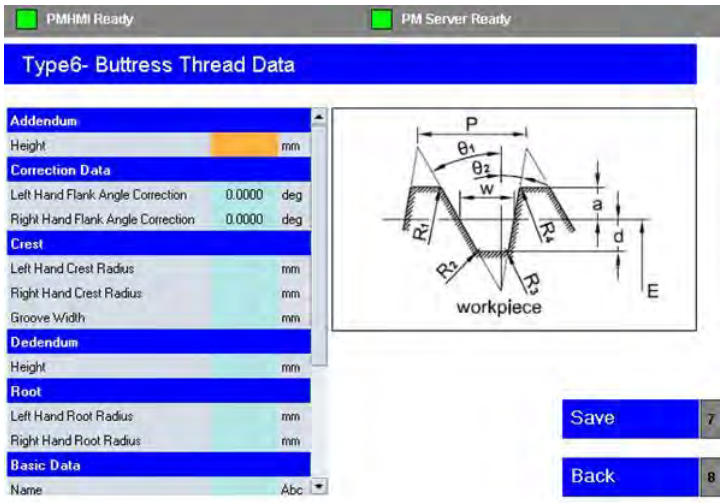
19.4.8Thread Type 6

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.

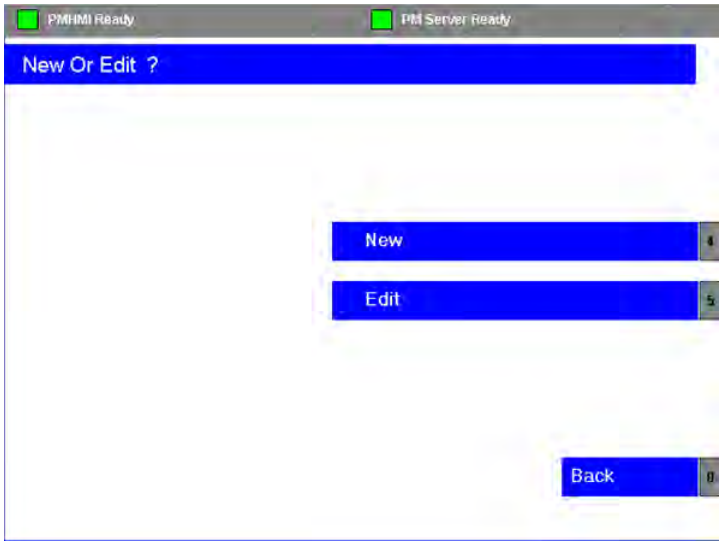
4. After you have finished inputting the thread data select the [Save] softkey to continue.

19.5 Create New Tool

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

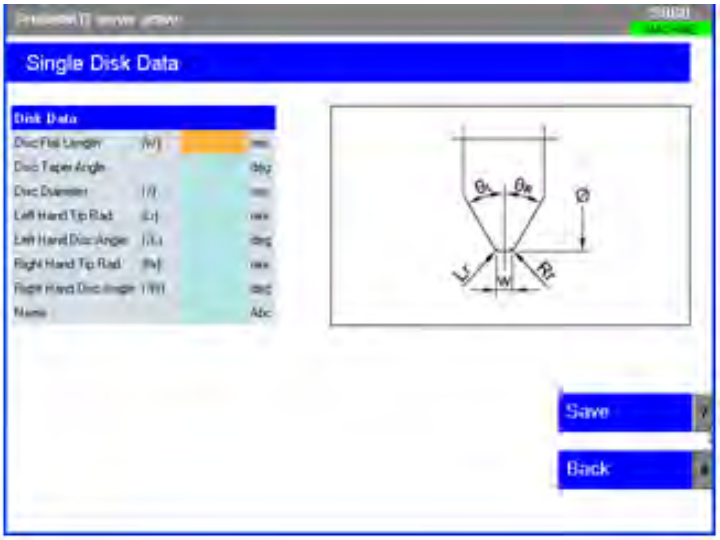
1. Select the [Thread Data] softkey from the main menu screen to access the PMHMI thread and tool menu screen

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.



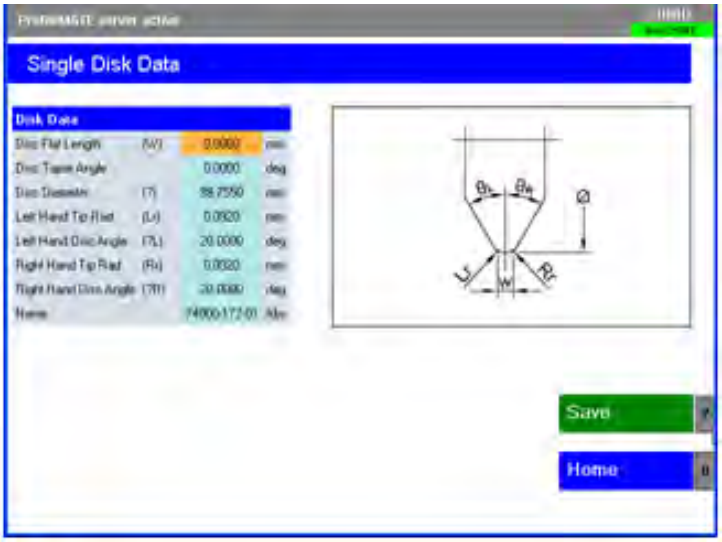
5. Enter the tool definition data in the table as required

   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.

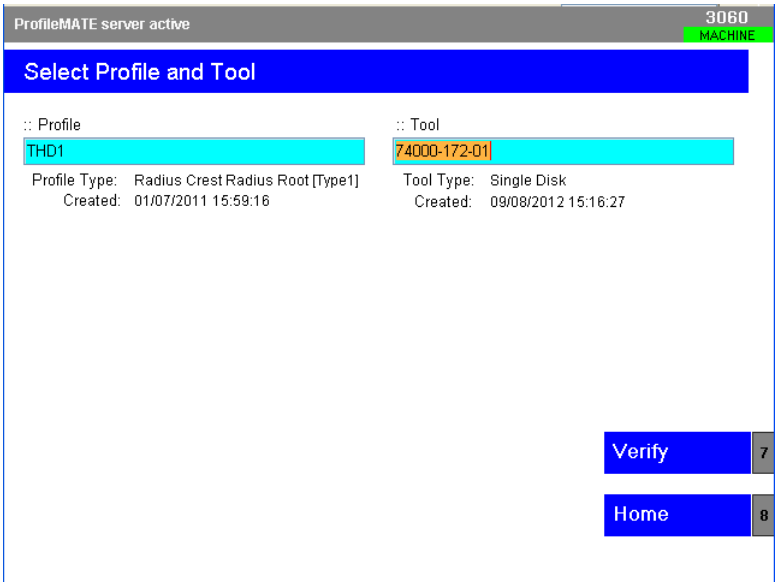
   Note: You can input the data in any order that you want. Just use the TAB key to switch into the required input field.

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.

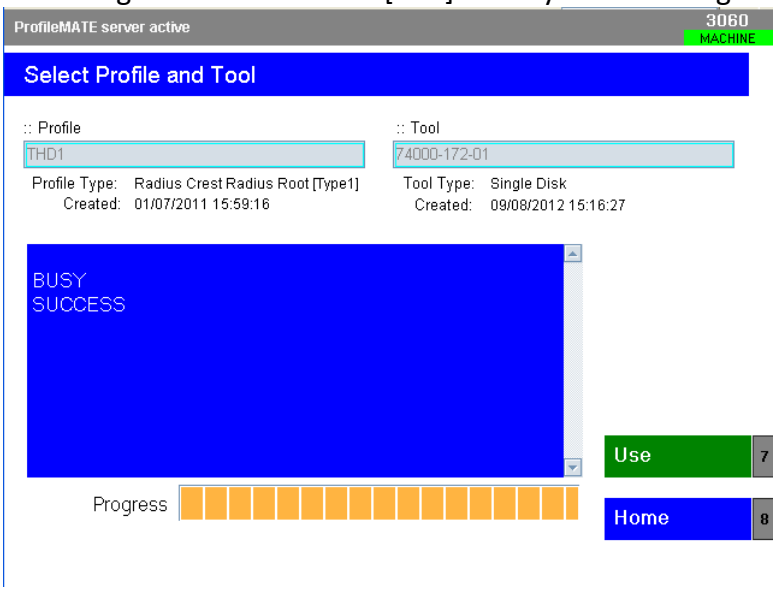
10. Using the blue up/down arrow keys scroll down the list and choose the profile that you want to use.

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.

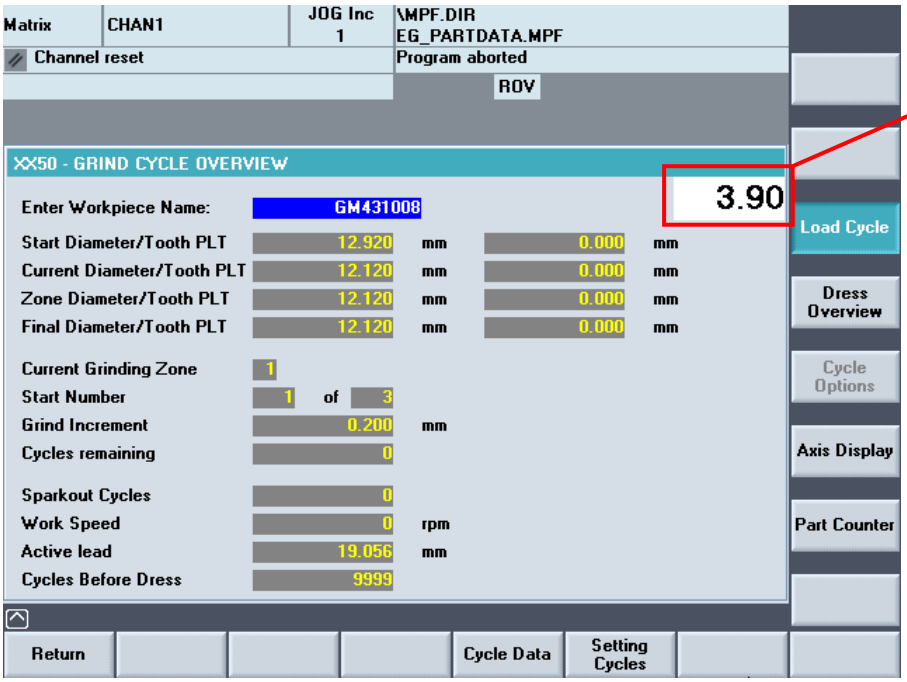
19.6 Grinding Cycle Overview

[Custom > Matrix > Main Menu > Grinding Overview]

This overview screen displays updated information related to the grinding cycle as each grinding stage (G1 – G5) completes.

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

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

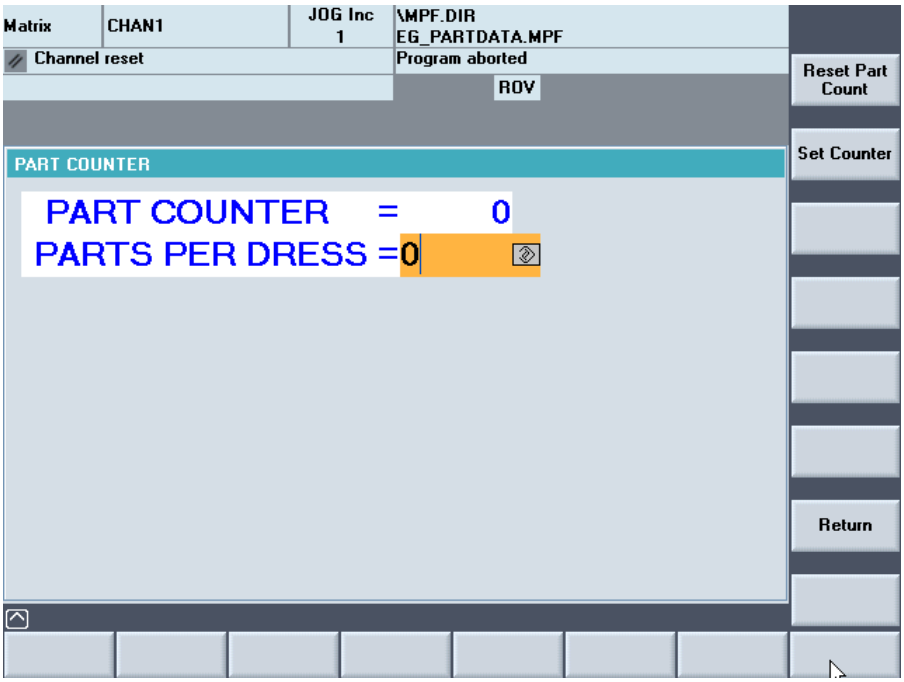


Go to section “Load and Grind” for instructions on what you need to do to run grinding cycle.

19.6.1Part Counter (option)

[Custom > Matrix > Main Menu > Grinding Overview > Part Counter]

In the Part Counter screen you can set the quantity of workpieces that are to be processed by the machine. You can also set the grinding wheel re-dress interval based on the number of parts processed.



Part Counter
Input Range: 0 – 9999
Enter a value in this input field to set the total number of workpieces to be processed by the machine.

Parts Per Dress
Input Range: 0 – 9999
Enter a value in this input field to set the total number of workpieces to be processed by the machine.

[Set Counter]
Select this soft key to enter values to the **Part Counter** and **Parts Per Dress** input fields.

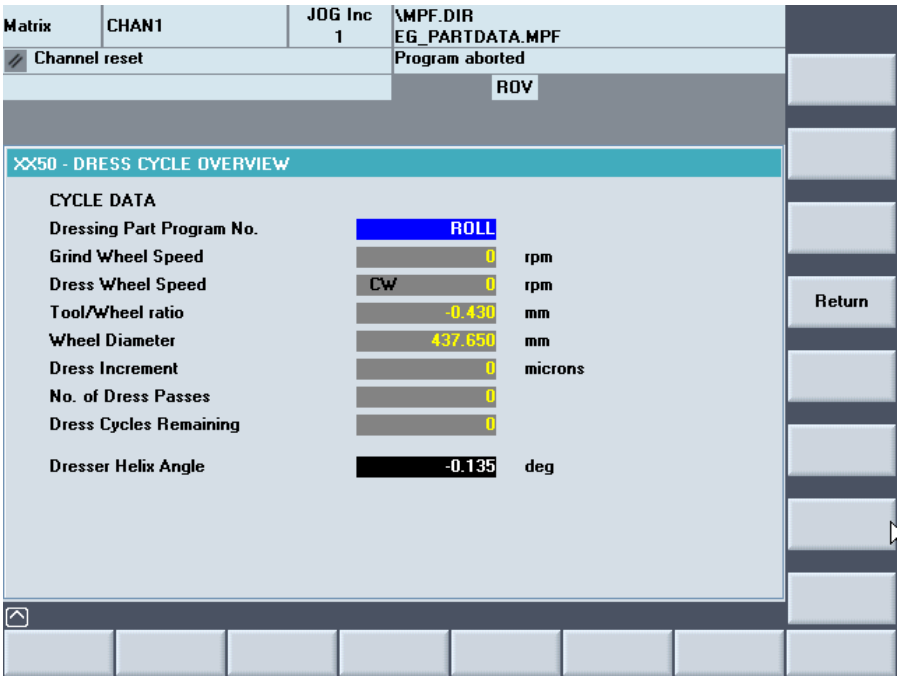
[Reset Part Counter]
Select this soft key to set the **Part Counter** and **Parts Per Dress** values to 0.

[Return]
Select this soft key to go back to the Grinding Cycle Overview screen.

19.7 Dressing Cycle Overview

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

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



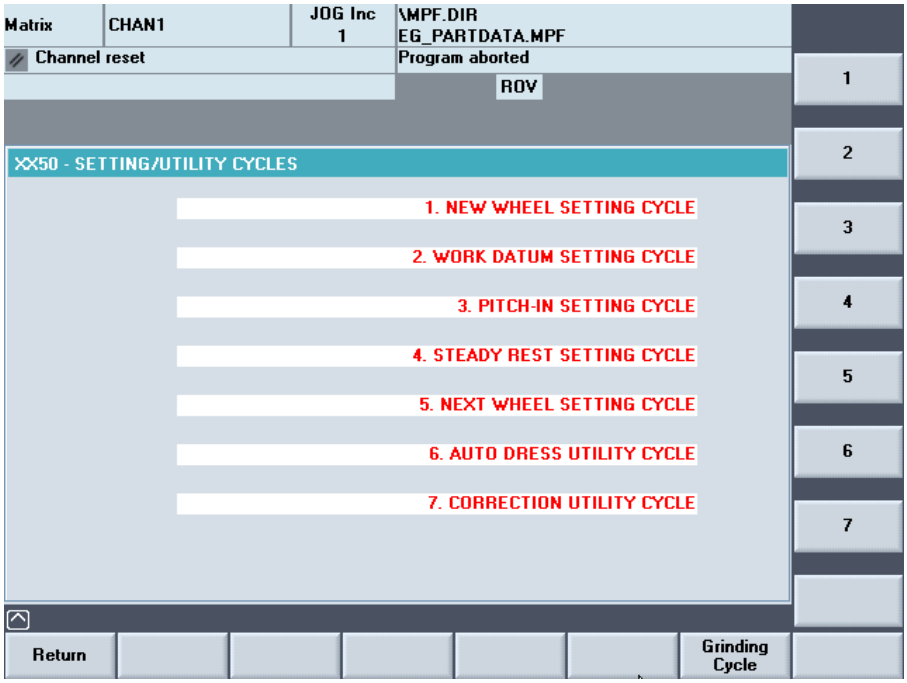
This screen automatically updates to show the active dressing cycle sequence as the cycle progresses through each defined zone (G1 – G5).

19.8 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.

The Setting Cycles are accessible only with the keyswitch set in position 3 and are not available when the machine is set to run in full automatic cycle using the two-handed cycle start option.



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 cycle option is NOT available on 0850 series thread grinding machines.

5. **Next Wheel Utility Cycle**
   This cycle option is NOT available on 0850 series thread grinding machines.

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

7. **Correction Utilities**

Correction type	Purpose
Lead	For making small corrections to the thread lead
Taper	For making small adjustment to the taper of the ground workpiece thread
Profile	For making profile small adjustment to the profile error on width and radially. Note: Only available if dressing tool selected as DISC
Diameter	For making small adjustment to ground workpiece diameter if any deviation found between actual measured diameter and the diameter that the machine thinks it is.
Barelling	For making specific adjustment to points along the workpiece length when the barrelling function is used

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:

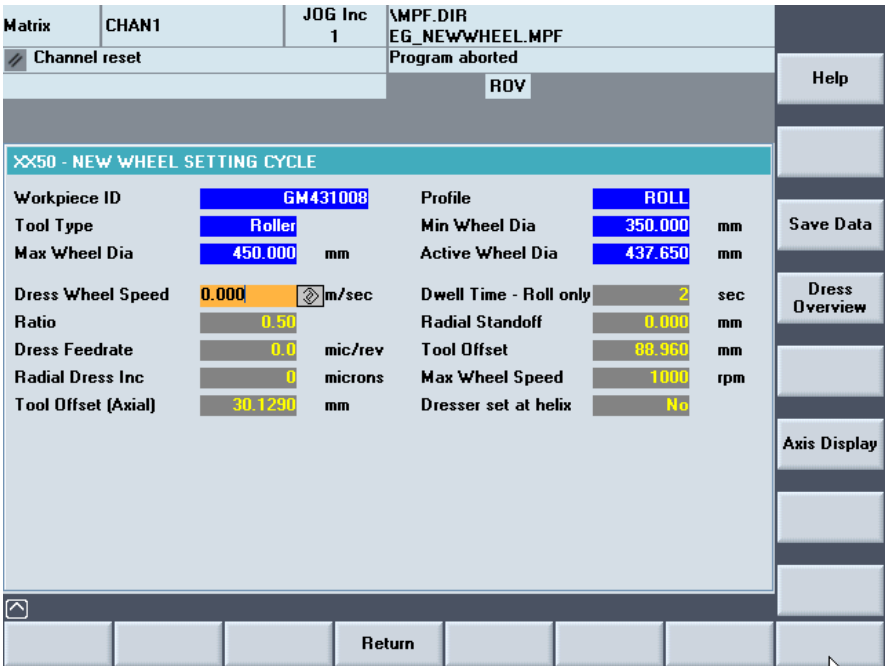
1st run the NEW WHEEL cycle
2nd run the SET WORK DATUMS cycle
3rd run the PITCH-IN cycle

19.9 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 can then keep track of the active wheel diameter as grinding and 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.

Caution
DO NOT execute 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.

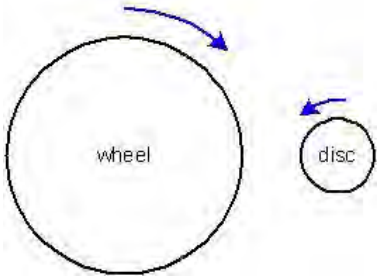
19.9.1Explanation of the Input Parameters

Dress Wheelspeed
Input Range: 0 – 70 M/Sec
Peripheral or surface speed of the grinding wheel used during dressing

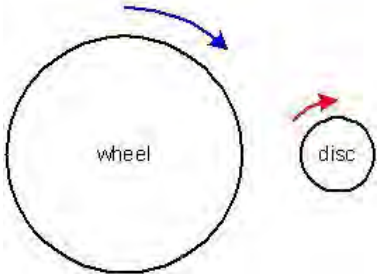
Speed Ratio
Input Range: -0.9 to 0.9
Ratio of the grinding wheel surface speed to the dressing tool surface speed

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

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 – 99 microns/rev
Linear traverse speed of the dressing tool per revolution of the grinding wheel

Radial Dress Increment
Input Range: 1 – 99 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

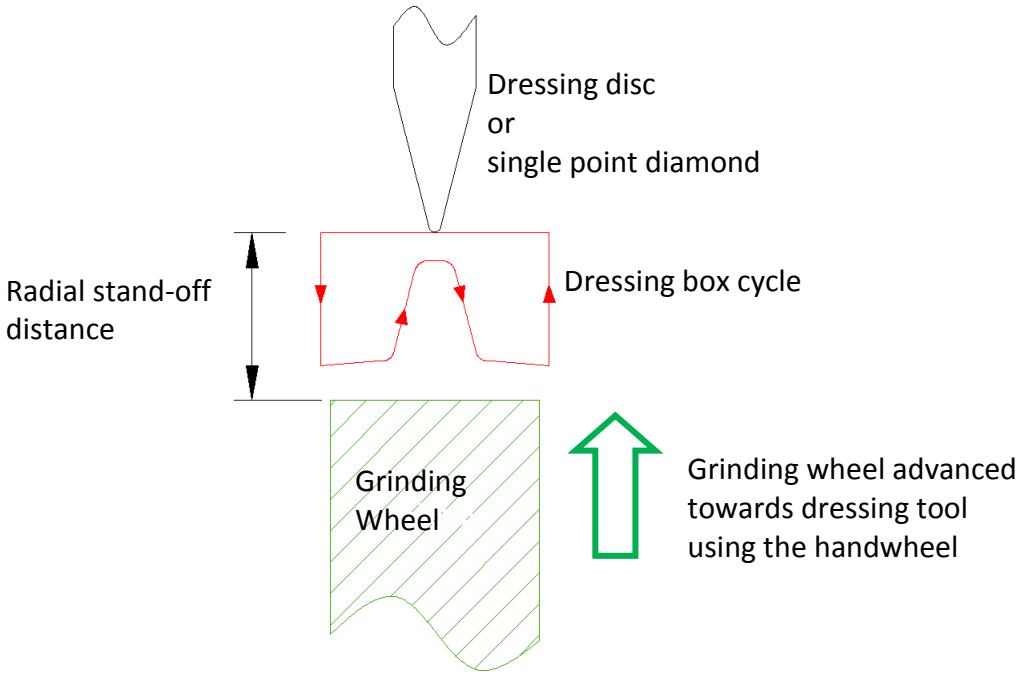
The radial distance by which the grinding wheel tip shall move clear of the dressing tool after initial touch-on (between the wheel and the disc).

When using a diamond roll:
This parameter has no effect.

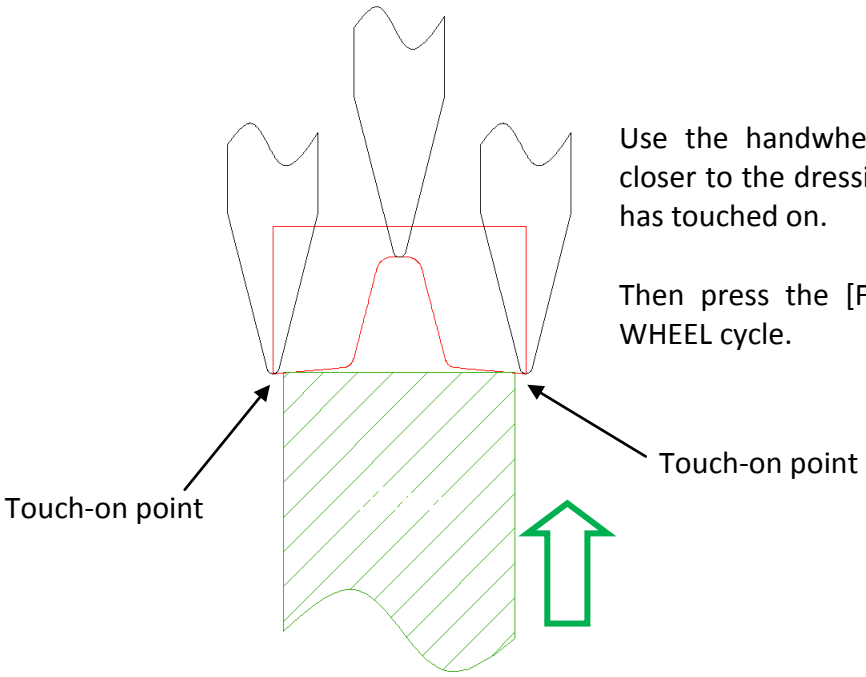
When using diamond disc or single point diamond:
It is highly recommended to enter a radial stand-off value especially when you fit a new no-profiled wheel to the machine. As a general guideline it is recommended that you specific the radial stand-off as two times the profile depth.

$$Radial\ StandOff\ = 2\ \times Thread\ Profile\ Depth$$

However, if a previously profiled wheel has been fitted to the machine then you can reduce the radial stand-off distance.



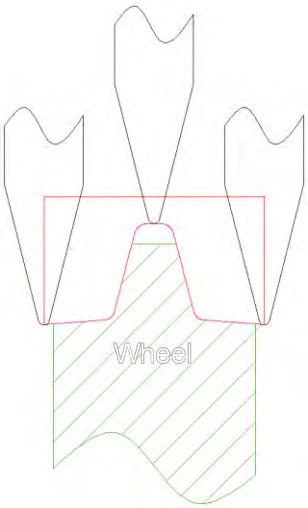
In NEW WHEEL the dressing box cycle will continue to run until you have selected the [FIN] key to terminate the cycle

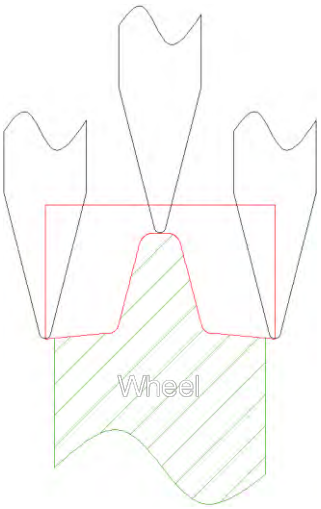


Use the handwheel to bring the grinding wheel closer to the dressing tool until you can hear that it has touched on.

Then press the [FIN] key to terminate the NEW WHEEL cycle.

Once the New WHEEL cycle has completed should then use the AUTO DRESS cycle to condition the wheel until the profile has been completely formed on the wheel.





Max Wheel diameter
Input Range: 350 – 450 mm
Maximum useable diameter of the grinding wheel to grind the workpiece

Min Wheel diameter
Input Range: 350 – 450 mm
Minimum useable diameter of the grinding wheel to grind the workpiece

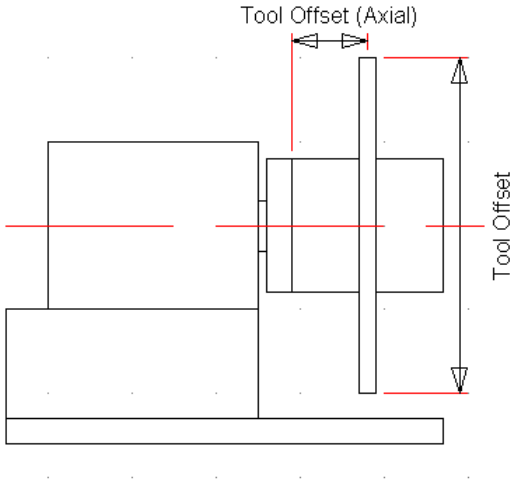
Active Wheel diameter
This is a read only display field and informs you of the active wheel diameter in machine currently

Max Wheel speed
Input Range: 500– 3000 rpm
Maximum safe speed of the grinding wheel.

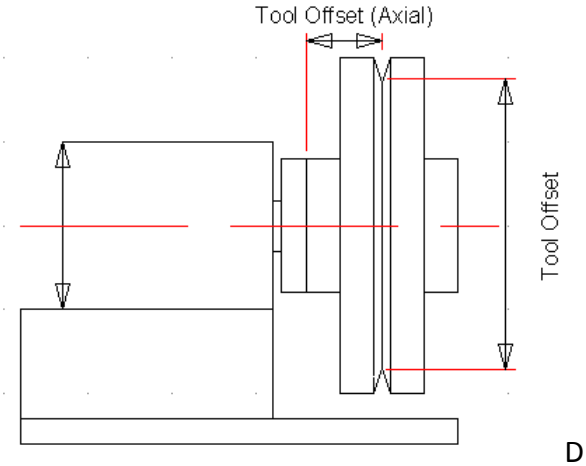
Dress set at helix
Input selection: YES/NO
Select YES if the dresser system is set to helix.
With fixed helix (0°) dresser system always set to NO.
When using dressing disc or single point diamond dressing media then this field must be set to NO.

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

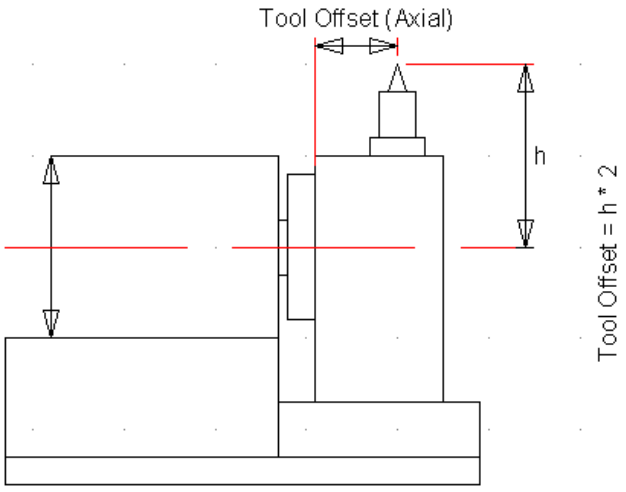
Tool Offset
Input range: 0 to 150 mm
For a diamond **disc** this is the **peripheral diameter** of the disc.
For a diamond **roll** this is the **profile diameter at the root**.
For a **single point** diamond this is the **2x radial distance from dressing spindle centreline** to the diamond tip.



Diamond disc



Diamond roll



Single point diamond

19.9.2Procedure for executing the NEW WHEEL setting cycle - if diamond ROLL fitted

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

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

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

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

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

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

7. 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.

8. Select the **[FIN]** key when contact between the wheel and dressing media has been established to store the X axis touch on position. The grinding wheel will move away from the dressing roll to a safe position in X and then stop.

9. New Wheel cycle complete!

You can now use the AUTO DRESS cycle to dress the wheel to full form with the profile on the diamond roll.

19.9.3Procedure for executing the NEW WHEEL setting cycle - if diamond DISC fitted

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

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

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

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

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

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

7. 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.

8. Select the **[FIN]** button on the MCP when you have finished (this will store the X axis touch on position to memory) and wait for the message prompt
   "De-select test mode – start wheel and press cycle start"

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

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

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

12. 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.

13. 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.

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

15. 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.

16. New Wheel cycle complete!

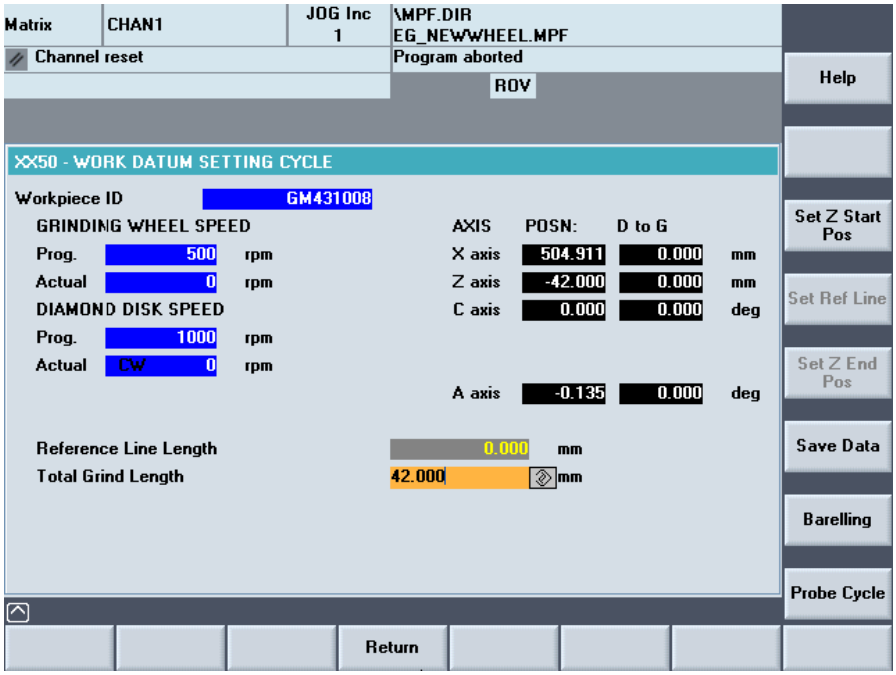
Upon completion of the NEW WHEEL setting cycle if you think that the wheel still requires more dressing then you use the AUTO-DRESS cycle if required.

19.10 Work Datum Setting Cycle

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

This setting cycle is used to set the Z axis start and end grind positions (this does not include the X and Z taper in/out moves when the grind sequence commences).

NOTE: The Z start position will always be set to zero in the work co-ordinate system (WCS).



19.10.1 Explanation of the Input Parameters

Reference Line Length
Input Range: 0 – 300 mm
Distance from the workpiece datum face to the reference line at which the workpiece measurement is to be based. This parameter usually applies to dual-lead worm thread applications (option).

Default value is 0.

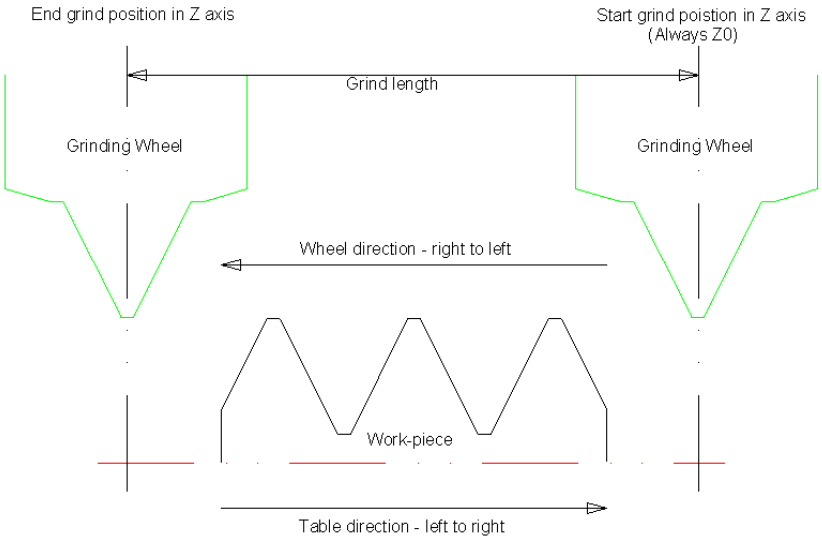
Total Grind Length
Input Range: 0 – 380 mm
Total axial grinding length of the workpiece.

Usually, the total grind length value is automatically calculated once the [Set Z Start Pos] and [Set Z End Pos] points have been set manually.

However, you can enter total workpiece grinding length once the start grinding position [Set Z Start Pos] has been set.

19.10.2 Setup method 1 – grind direction from right-to-left

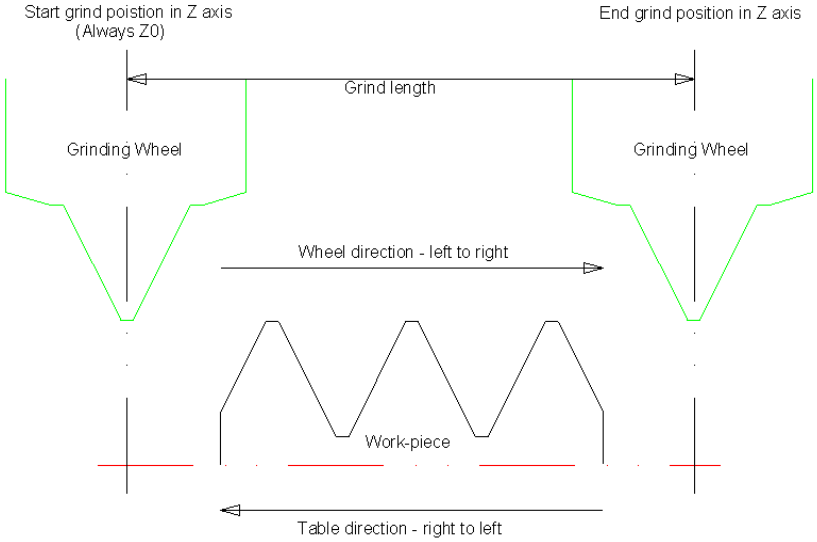
You should select this method of work datum setup if you are grinding a right-hand threaded workpiece.



The sketch above illustrates the start and end setting positions of the grinding wheel relative to the workpiece.

19.10.3 Setup method 2 – grind direction from left-to-right

You should select this method of work datum setup if you are grinding a left-hand threaded workpiece.



The sketch above illustrates the start and end setting positions of the grinding wheel relative to the workpiece.

19.10.4 Procedure for executing the WORK DATUM setting cycle

1. Set the orange keyswitch to position 3 on the MCP
2. Select **[JOG]** 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 **[+][-]** manually position the grinding wheel to the start grind position.
5. Press **[Set Z Start Pos]** softkey to store the Z start grind position value to memory.
6. Now use handwheel or JOG buttons **[+][-]** manually position the grinding wheel to the end grind position.
7. Press **[Set Z End Pos]** softkey to store the Z end grind position value to memory.
8. Work datum setup complete!

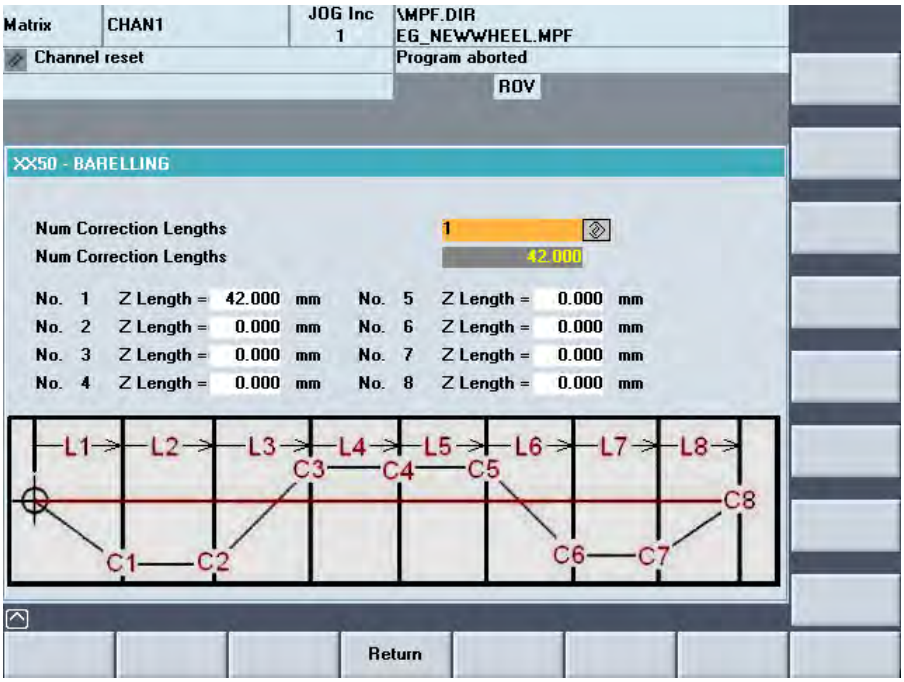
19.11 Barelling function (option)

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

With the barrelling function enabled you can apply fine positional adjustments to the grinding wheel infeed (X) axis at various points along the workpiece length as the grinding wheel moves along it.

This feature can be useful in applications where you may need to compensate for any deviations within the workpiece geometry along it length or to compensate for deviations at a work support steady if fitted to the work table.

The barrelling function is accessed from the Work Datum setting cycle screen.



Upto 8 corrections points can be defined **C1** to **C8** and the compensation datum is always based from the workhead side because this is a fixed datum point of the machine table.

19.11.1 Explanation of the Input Parameters

Num Correction Lengths
Input Range: 0 – 8
With parameter you can define how many correction points are required.
Default value is 0 i.e no correction points are applied.

Sum of Correction Lengths
Input Range: 0 – 380 mm
Total length over which the length correction will be applied during workpiece grinding.

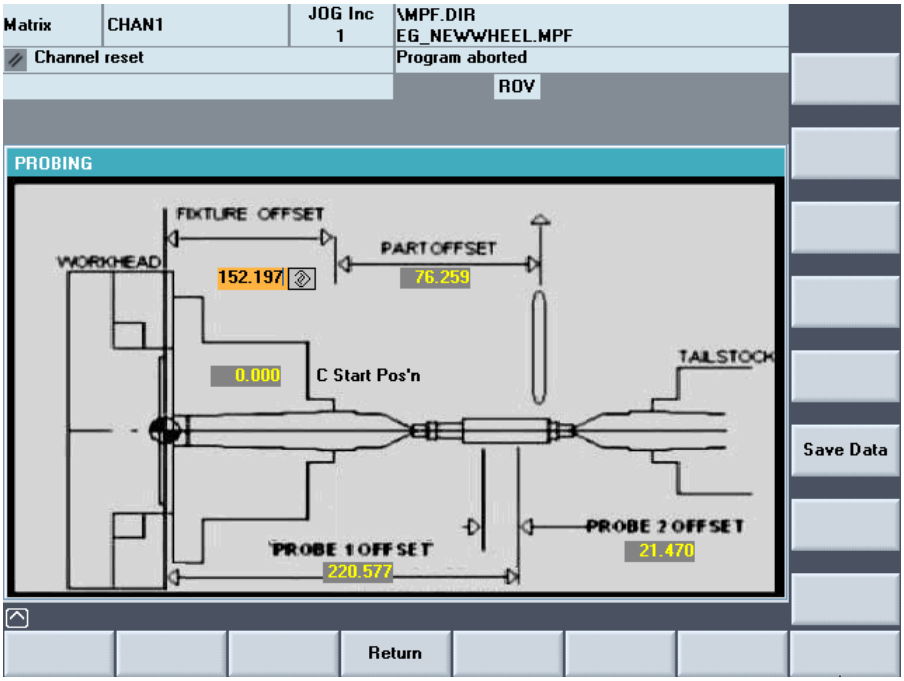
Z Length
Input Range: 0 – 380 mm
Length between adjacent correction points.

19.12 Probe system setup (option)

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

If the machine is fitted with the probe system option then a number of offset values relating to the unit must be set in the probe setup screen before the probing system can be used in the automatic machine cycle.

The probe setup screen is accessed from the Work Datum setting cycle screen.



19.12.1 Explanation of the Input Parameters

Fixture Offset
Input Range: 0 – 200 mm
Distance from the spindle nose datum to the fixture datum face.

Part Offset
Input Range: 0 – 400 mm
Distance from the fixture datum face to the start grind position (Z)

Probe 1 Offset
Input Range: 0 – 340 mm
Distance from the spindle nose datum to the Probe 1 centerline

Probe 2 Offset
Input Range: 0 – 100 mm
Distance between the centre of Probe 1 and Probe 2

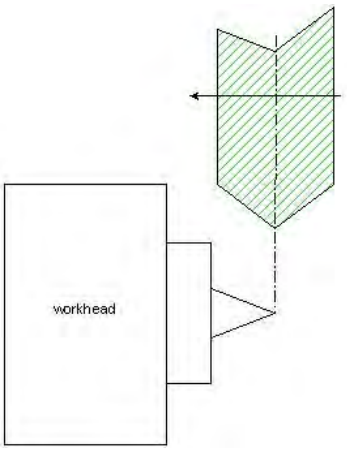
19.12.2 Procedure for setting up the probe system

The procedure below assumes that you have already fitted the probe system to the worktable and connected it up to the service column.

1. Dress the grinding wheel with required profile

2. Set the wheel helix angle to 0° i.e A = 0.00

3. Select **[JOG]** mode and then using the handheld unit manually align the grinding wheel position to the tip of the centre fitted to the workhead.



4. Make a note of the Z axis position as displayed on the screen in the machine coordinate system (MCS).

5. Select the Probe Cycle screen [Custom > Matrix > Main Menu > Setting Cycles > Set Work Datums > Probe Cycle] and enter the value you made a note of in the previous step into the **Fixture Offset** input field.

6. Load a workpiece between centres.

7. Adjust the probing system position along the worktable until both the proximity sensor and measuring stylus a somewhere close to the mid-point of the workpiece thread.

8. Clamp the probing system down to the table using a 17mm open-ended spanner.

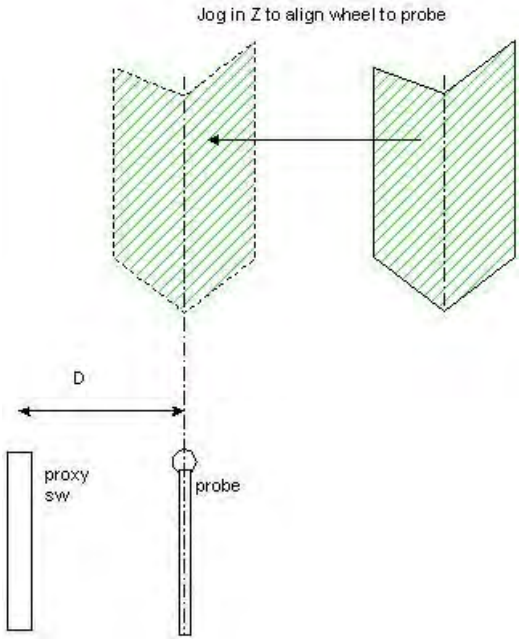
9. Select the C axis and rotate the workpiece to the desired start position for the probing cycle. Note: this step is optional.

10. Enter the C axis value as displayed on the screen in the MCS to the **C Start Pos'n** input field. Note: If you are unsure about the workpiece start position from the previous step then just set the value as 0.

11. Unload the workpiece.

12. Select **[Probe Advance/Retract]** at the machine control panel to bring the measuring stylus into its probing position.

13. Using the handwheel align the grinding wheel centreline to the probe stylus centreline.



Note: Establish this position as accurately as you possibly can because this is a very important offset.

14. Enter the Z position as displayed on the screen in the MCS into the **Probe 1 Offset** input field.

15. Physically measure the distance between the probe stylus and proximity switch using a steel measuring rule and enter the measurement into the **Probe 2 offset** input field.

16. Select **[Probe Advance/Retract]** at the machine control panel to retract the measuring stylus.

17. Load the workpiece back in again between centres.

18. Set the grinding wheel to the helix angle required for grinding.

19. Align the grinding wheel in X and Z to the start of the parallel grind position i.e this is where you actually want the grinding to start at when the automatic cycle runs.

20. Select the WORK DATUM screen and press the **[Set Z start posn]** soft key.

21. Select the **[Probe Cycle]** soft key to return to the probe offsets screen.
Notice that the **Part Offset** input field value has been automatically updated.

22. Press the **[Save Data]** soft key to save all probe system related offset and datums to memory.

23. Go back to the WORK DATUM setup screen and complete the procedure to set the end grind Z position.

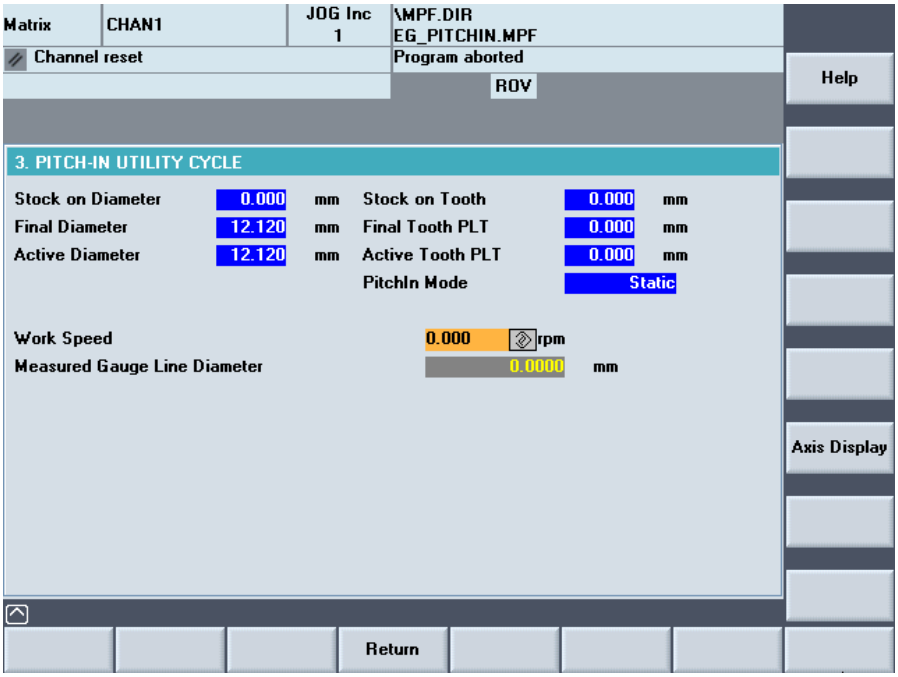
24. Test the probe cycle in [SETUP] mode to confirm that the workpiece can be probed correctly.

25. Probe system setup is complete!

19.13 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.

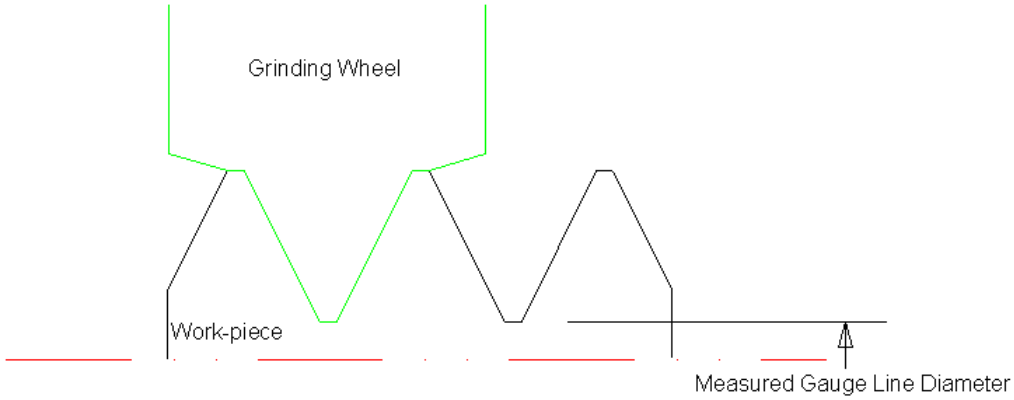


19.13.1 Explanation of the Input Parameters

Work Speed
Input Range: 0 – 50 rpm
Rotational speed of the workpiece when performing dynamic pitch-in

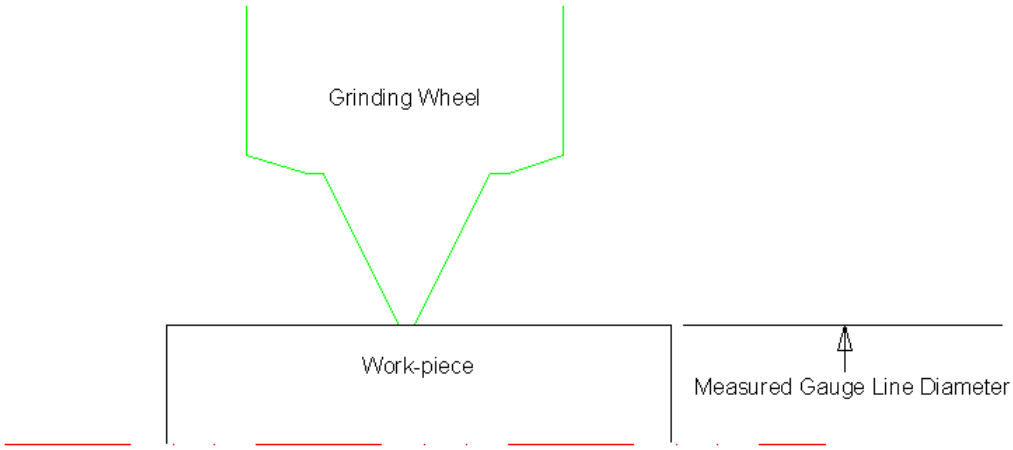
Measured Gauge Line Diameter
Input Range: 0 – 999 mm
Diameter of the workpiece at the periphery (tip) of the grinding wheel.

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



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

19.13.3 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.

19.13.4 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
   "Enter data in data field and press input – Press Cycle Start to continue" to appear.

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

7. Wait for the message prompt
   "Position wheel in centre of groove below tip diameter then press cycle start" to appear.

8. Press the **[CYCLE START]** key and wait for the message prompt
   "Select handwheel & increment. Move X & Z axes to pitch-in. Press FIN to terminate" to appear.

9. 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 groove.

10. Press the **[FIN]** key when you have finished aligning the wheel to the workpiece. The grinding wheel now move clear of the workpiece and then move to the start grind position (Z an C axes will move).

11. Wait for the message prompt
    "Do you want to touch on in pitch?" to appear.

If **YES** then:

12. Press the **[YES]** key and then **[CYCLE START]** key.

If **NO** then:

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

14. Pitch-in cycle complete!

19.14 Next Wheel Setting Cycle (option)

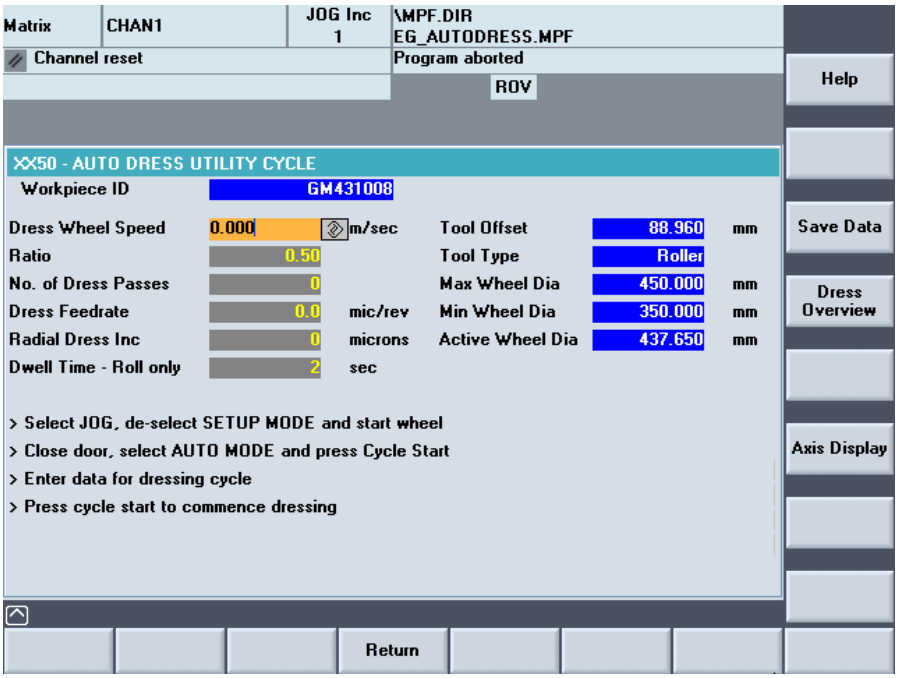
[Custom > Matrix > Main Menu > Setting Cycles > Next Wheel]

Option is not available with the machine.

19.15 Auto Dress Utility Cycle

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

This is a stand-alone cycle that can be used to dress the grinding wheel independently of the grinding cycle. Auto wheel dressing can be executed whenever you like provided that the New Wheel cycle or Next Wheel (option) cycle has been run previously.



Note: fields with a blue background are READ ONLY

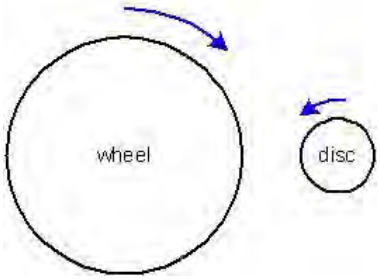
19.15.1 Explanation of input parameters

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

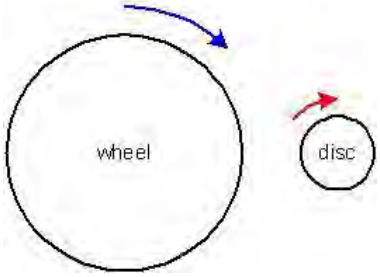
Speed Ratio
Input Range: -1.5 to 1.5
Ratio of the grinding wheel surface speed to the dressing tool surface speed

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

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

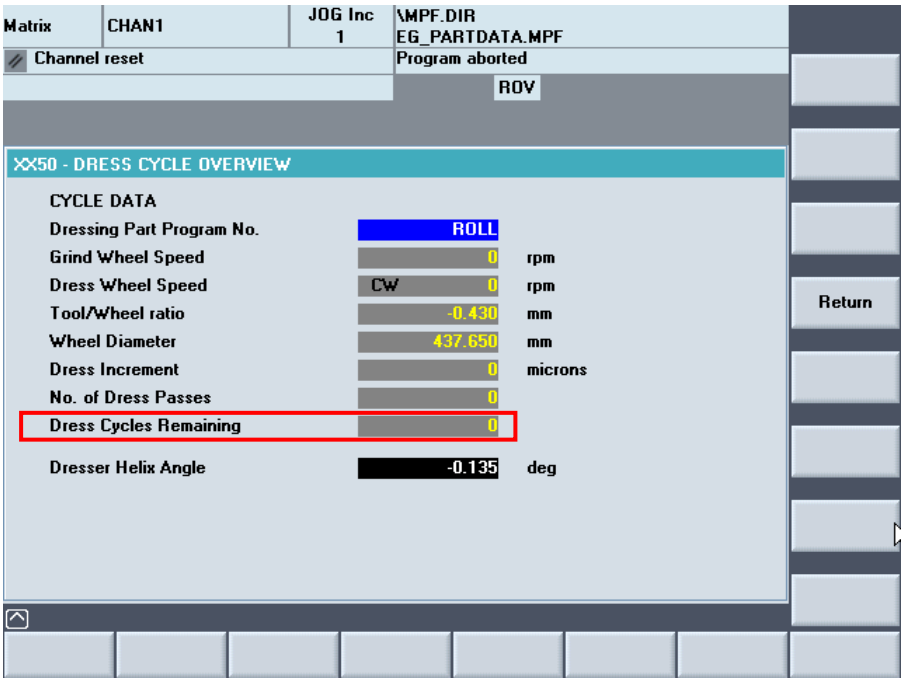
Radial Increment
Input range: 1 – 100 microns
Radial amount of stock to be removed from the grinding wheel per dressing pass

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.

19.15.2 Procedure 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.

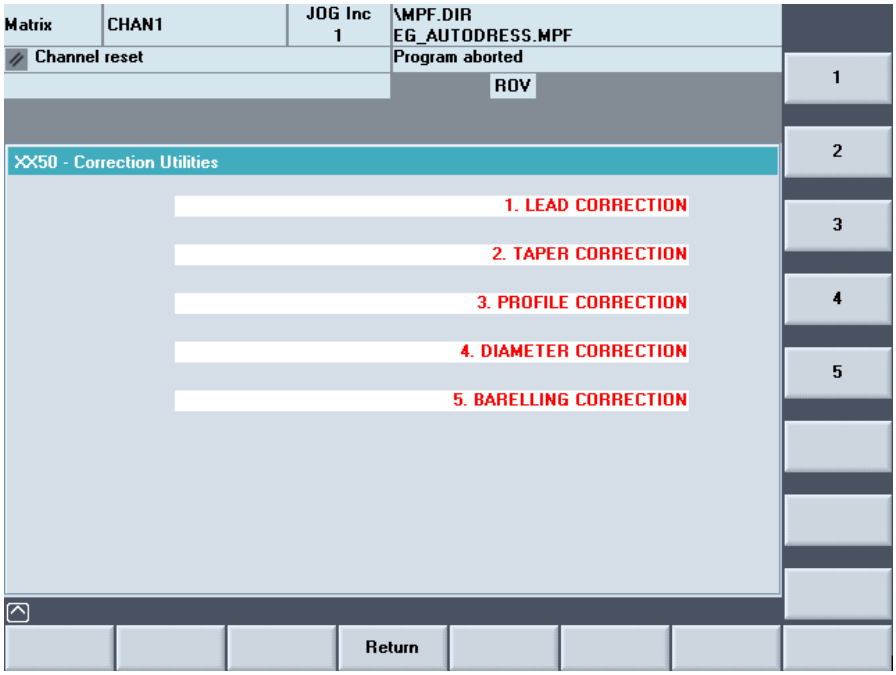
Select the **[Dress Overview]** vertical softkey from the Auto Dress screen to see the number of dressing passes remaining before the dress cycle completes.



19.16 Correction Utilities Menu

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

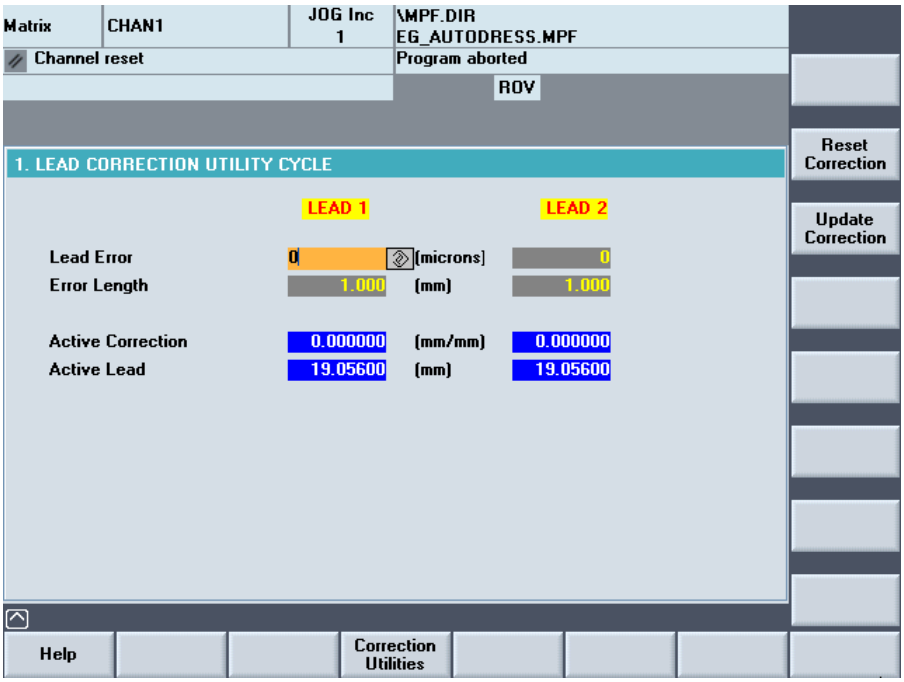
In the correction utilities menu you can select the type of correction to be applied to the machine.



19.17 Lead Correction

Errors in the thread lead of the ground workpiece can be corrected for in the lead correction screen.

The lead error is corrected by entering the amount of error and the length over which the lead was measured. The Lead Correction utility should be used when you need to correct for any errors to the active lead introduced by the machine.



The screen shows two columns LEAD 1 and LEAD 2. The LEAD 2 column only applies to dual-lead worm thread applications (option).

19.17.1 Explanation of input parameters

Lead Error
Input Range: 0 - 99 microns
Difference between the nominal length and the measured length

$$Lead\ Error = Nonimal\ length - Measured\ length$$

The lead error value can be positive or negative value.

Error Length
Input Range: 0 - 999 mm
Nominal length over which the lead error has been measured

$$Error\ Length = No.of\ leads \times Nominal\ lead$$

The error length must always be a positive value. Also, the length along the workpiece where the lead is checked does not matter.

Active Correction
Read Only field.
This field shows the calculated amount of correction that has been applied to the machine based on the input values for Lead error and Error length.

Active Lead
Read Only field.
This field shows the re-calculated lead that has been applied to the machine based on the input values for Lead error and Error length.

19.17.2 Procedure

To add Lead Correction

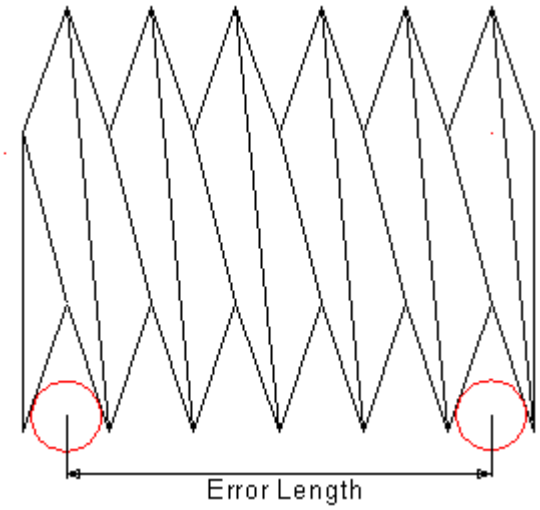
1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Lead Correction]** softkey.
4. Input the measured lead error (microns) followed by pressing the yellow **[Input]** key.
5. Press **[Update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

To reset the active lead correction

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

19.17.3 Applying lead correction

Before entering a lead correction you need to compare the results of the measured lead report from your inspection dept with the nominal lead data as defined on the workpiece engineering drawing.



Example,
Nominal Single Lead = 10mm
Number of Leads = 5
Measured Length = 50.017

Then,

Error Length = 10 * 5 = 50mm

Lead Error = (50 - 50.017) * 1000
= -17 µm

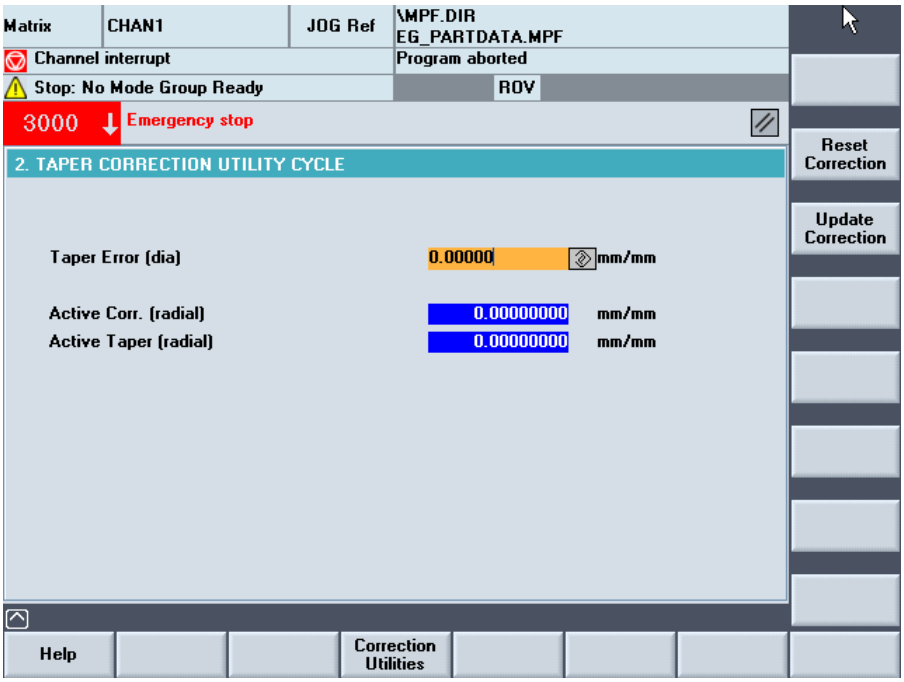
You must remember that it is the **error** and not the correction required that needs to be entered in the Lead Error input field.

if the measured error is -ve then enter a negative value into the lead error field
if the measured error is +ve then enter a positive value into the lead error field

The lead error value can be +ve or –ve but the error length must always be a positive value.

19.18 Taper Correction

You can use the Taper Correction utility to remove unwanted stock found on the ground workpiece after it has been measured. Taper correction is applied to the machine and remains active even when a new workpiece is setup or loaded to the machine.

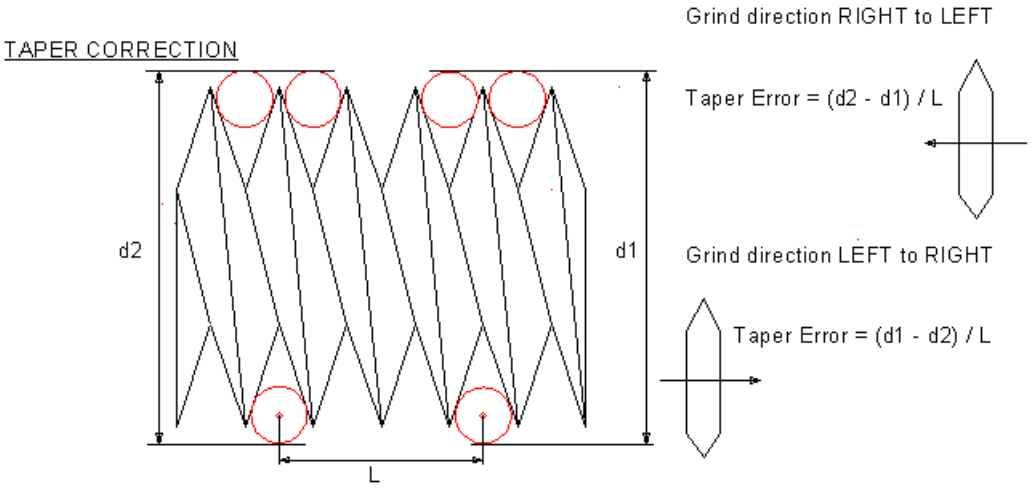


Scenarios where you might consider using the taper correction function:

1. parallel workpiece ground thread was measured and found to be showing a positive or negative taper
2. taper workpiece ground thread was measured and found to be showing a positive or negative taper

19.18.1 Explanation of input parameters

Taper Error
Input Range: 0 - 999 mm/mm
Amount of taper over a given workpiece length



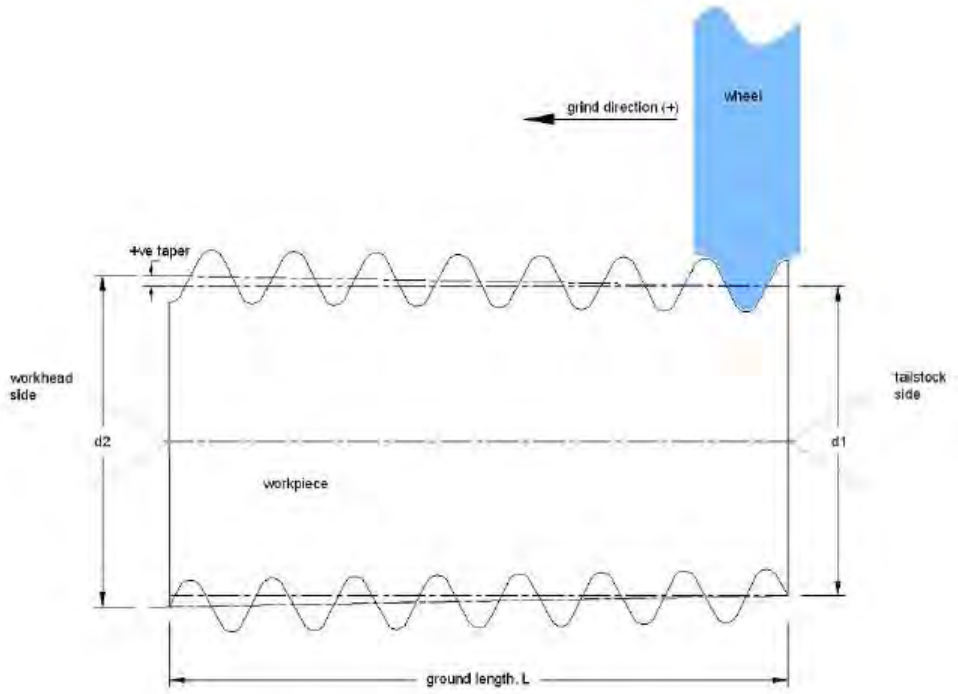
You must remember that it is the **error** and not the correction required that needs to be entered in the Taper Error input field.

Active Corr. (radial)
Read only field
Currently active radial taper correction applied to the machine.

Active Taper (radial)
Read only field
Currently active taper value applied to the machine.

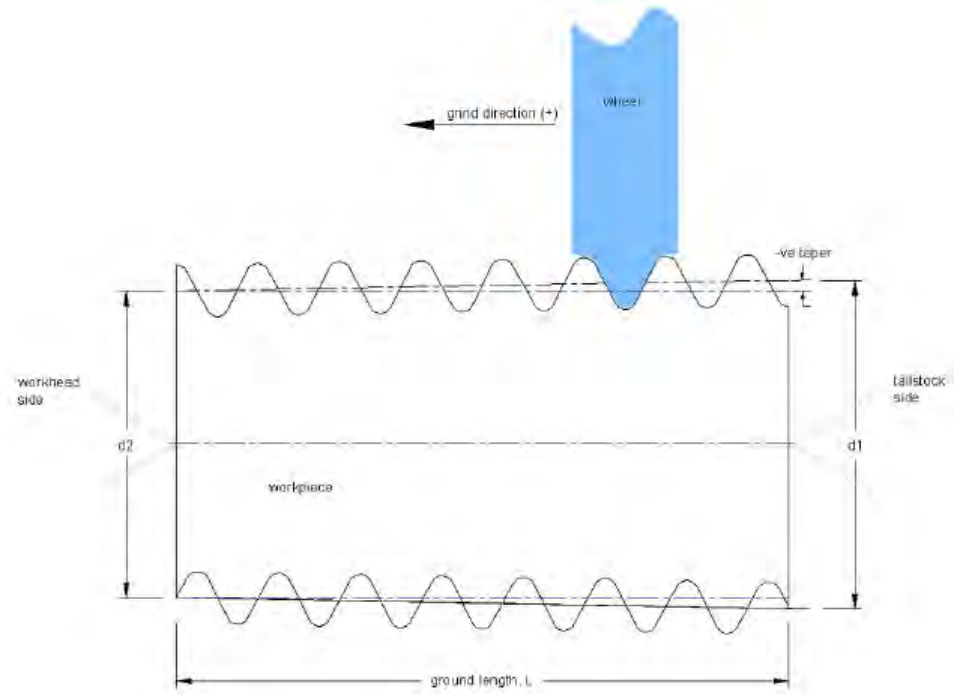
19.18.2 Positive Taper Error

A positive taper means that not enough stock is being removed from the workpiece by the grinding wheel as it moves along the workpiece where the grinding direction is from right to left.



19.18.3 Negative Taper Error

A negative taper means that more stock than required is being removed from the workpiece by the grinding wheel as it moves along the workpiece where the grinding direction is from right to left.



19.18.4 Procedure

To add Taper Correction

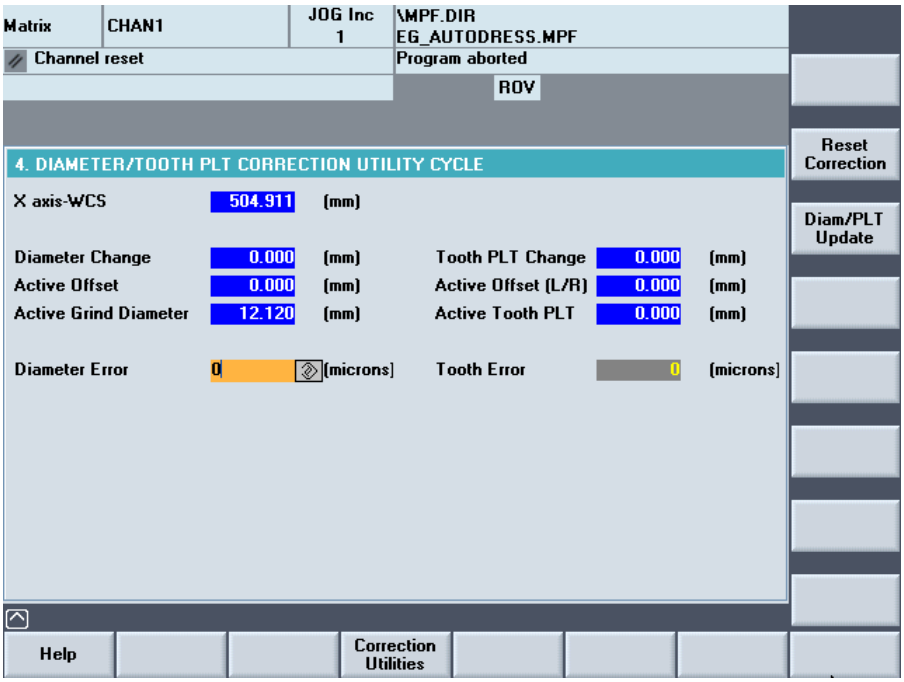
1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Taper Correction]** softkey.
4. Input the measured taper error (mm/mm) followed by pressing the yellow **[Input]** key.
5. Press **[Update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

To reset the active Taper correction

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

19.19 Diameter Correction

This utility allows small adjustments to be applied to the machine to correct for diameter error found after the ground workpiece has been measured.



19.19.1 Explanation of input parameters

Diameter Error
Input Range: 0 - 999 microns
Error between the measured diameter and the active machine diameter

Tooth Error
Input Range: 0 - 999 microns
Error between the measured tooth width and required tooth width.
This input field only applicable when grinding dual-lead worms.

19.19.2 Applying diameter correction

After the workpiece been ground on the machine and inspected you may find that the results of the measured diameter from your inspection department differ to the required size as per the workpiece engineering drawing.

Therefore, the same workpiece could to be re-ground on the machine in order to achieve the correct size *OR* the next workpiece to be ground will be applied with the diameter correction.

diameter error = measured diameter – active machine diameter

if the diameter error is -ve then enter a negative value into the diameter error input field
if the diameter error is +ve then enter a positive value into the diameter error input field

For example,

active machine diameter = 50mm
measured diameter after grinding = 50.02mm
Therefore, the diameter error is 50 - 50.02 = -0.02 = ***- 20 microns***

19.19.3 Procedure

To add Diameter Correction

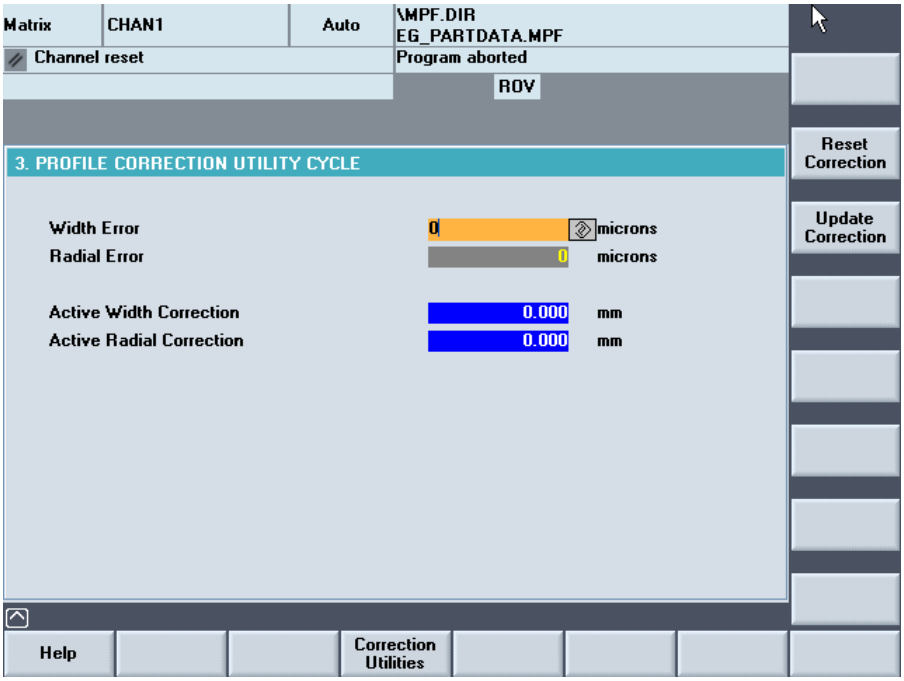
1. Select **[AUTO]** and **[SETUP]** mode
2. Select the Correction utilities screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]
3. Select the **[Diameter Correction]** softkey.
4. Input the measured diameter error (mm) followed by pressing the yellow **[Input]** key.
5. Press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

To reset the active Diameter correction

This function is not available.

19.20 Profile Correction

This utility allows you to make small adjustments to the width and height of the wheel profile.

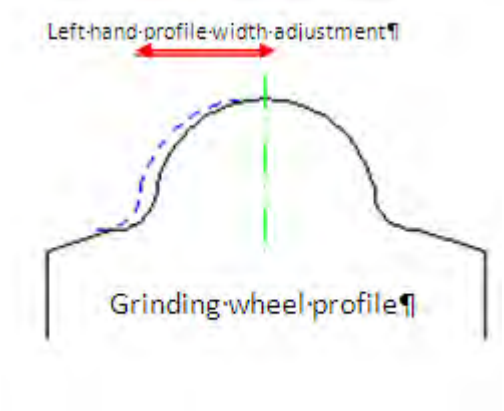


The adjustment is applied at the profile mid-point on completion of the right hand profile and prior to execution of the left hand profile.

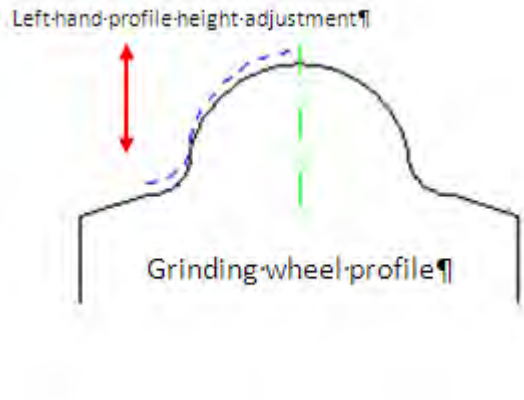
Note: This is only applicable to diamond discs.

19.20.1 Explanation of input parameters

Width Error
Input Range: +/- 300 microns
Adjustment of profile width



Radial Error
Input Range: +/- 300 microns
Adjustment of profile height



19.20.2 Procedure

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)

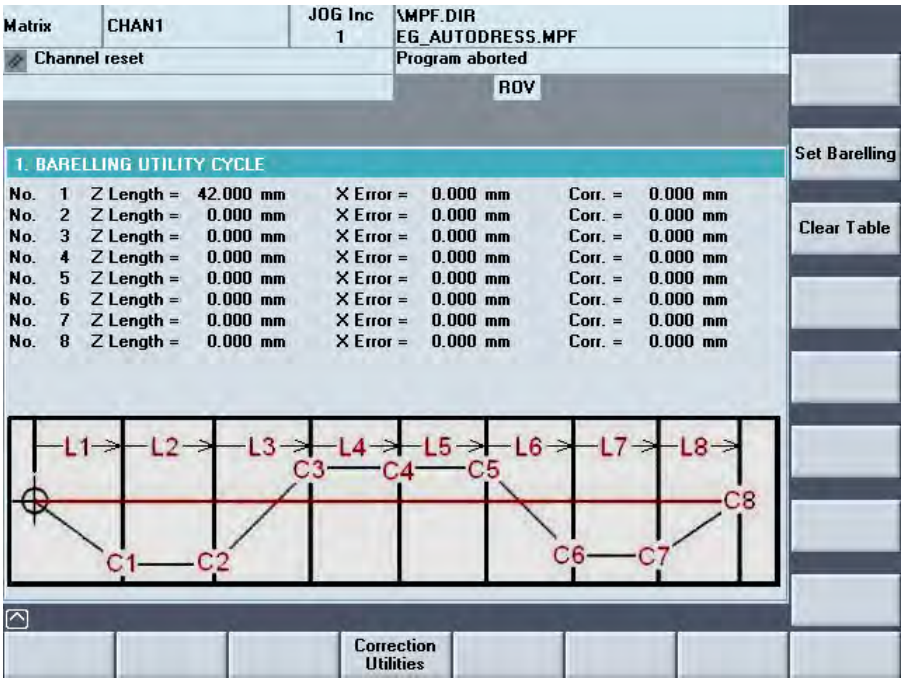
5. Press **[Update Correction]** vertical softkey

To reset the active Profile correction

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

19.21 Barrelling Correction

Adjustments at each barrelling point C1 to C8 can be made in the barrelling correction screen when the cycle is not running.



19.21.1 Procedure

To make corrections at barrelling points

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

2. Select the Barrelling corrections screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities > Barrelling]

3. Press the **[Set Barrelling]** soft key and enter the required values in the table followed by pressing the yellow **[Input]** key after each entry.

4. Press **[Update Table]** soft key to save the table entries to memory.

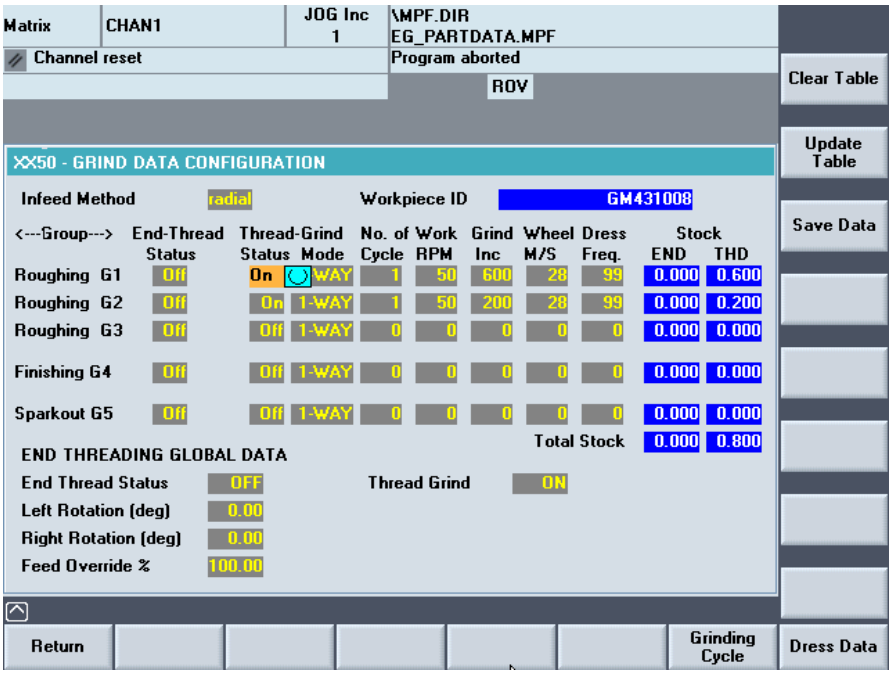
To reset/clear the table

Press the **[Clear Table]** softkey. All entries in the table will be reset to 0.

19.22 Cycle Data - Grind Table

[Menu Select > Matrix > Main Menu > Cycle Data > Grind Data]

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.

19.22.1 Procedure to edit Grind cycle variables

1. Select [AUTO] and [SETUP] mode

2. Select the Grind Data screen [Custom > Matrix > Main Menu > Cycle Data > Grind Data]

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.

19.22.2 Grinding 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 eliminating any possible wheel deflection. The grinding wheel will take n-passes across the finish ground workpiece at the final size on diameter.	No dressing is performed in this zone. Also the grinding increment is always set to 0.

Sparkout G5

The sparkout zone G5 is used to ensure that final size on diameter has been achieved after finish grinding has completed.

When the sparkout zone G5 is enabled then the grinding wheel will take n-passes across the finish ground workpiece at the final size diameter achieved in G4 to clean-up any small amount of material (if any) still remaining the workpiece.

Sometimes, sparkout passes are used to eliminate possible wheel deflection that may have occurred during grinding.

Note: Dressing cycles are not permitted during sparkout passes.

19.22.3 Explanation of parameters

End-Thread Status
Input range: toggle ON/OFF
Zone specific end thread grinding ON/OFF

Thread Status
Input range: toggle ON/OFF
Zone specific thread grinding ON/OFF

Grind Mode
Input range: toggle 1-WAY or 2-WAY
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

Example 1: *If No. of cycle = 5 and Dress Frequency = 2, 1 start thread*

Then the cycle sequence will be as follows:

Grind pass #1
Grind pass #2
Dress
Grind pass #3
Grind pass #4
Dress
Grind pass #5

Example 2: *If No. of cycle = 5 and Dress Frequency = 2, 2 start thread*

Then the cycle sequence will be as follows:

Grind pass #1 (for start 1)
Grind pass #2 (for start 2)
Dress
Grind pass #3 (for start 1)
Grind pass #4 (for start 2)
Dress
Grind pass #5 (for start 1)
Grind pass #6 (for start 2)
Dress
Grind pass #7 (for start 1)
Grind pass #8 (for start 2)
Dress
Grind pass #9 (for start 1)
Grind pass #10 (for start 2)
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 – for thread stock removal
READ ONLY field
Total amount of stock on diameter that will be removed from the workpiece after the grinding cycle has completed.

Total stock – for end-thread stock removal
READ ONLY field
Total amount of stock on diameter that will be removed from the workpiece after the end-threading cycle has completed.

19.22.4 End-threading parameters

End-Thread Status
Input range: toggle ON/OFF
Global end-threading function enable. If this parameter is set to OFF then the end-threading cycle will not be performed on the workpiece.

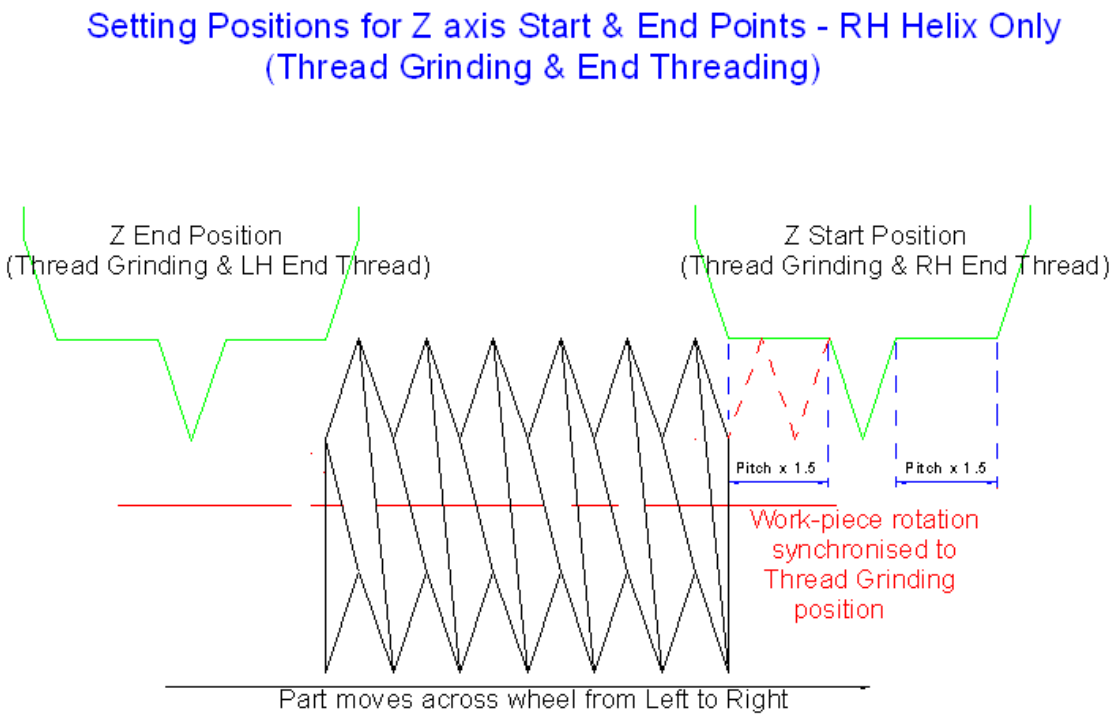
Left Rotation
Input range: 0 - 540°
Amount of end-thread on LH side of workpiece

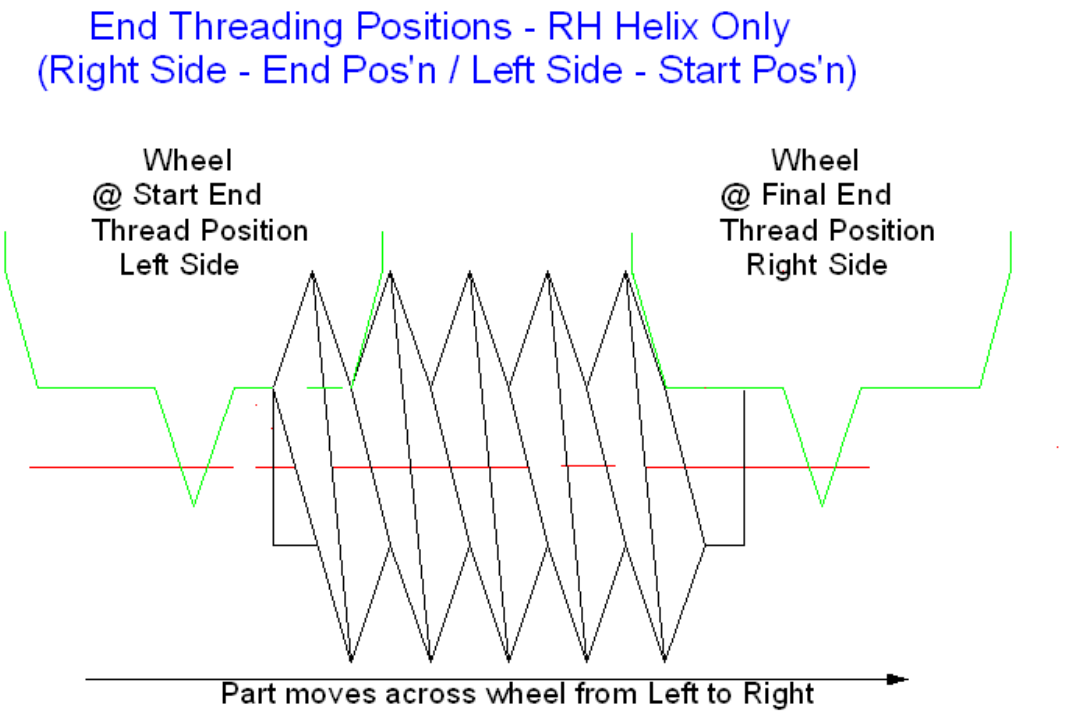
Right Rotation
Input range: 0 - 540°
Amount of end-thread on RH side of workpiece

Feed Override %
Input range: 1 - 100
Workspeed required for end-threading as a percentage of the thread grinding speed

Thread Grind
Input range: toggle ON/OFF
Global thread grinding function enable
If this parameter is set to OFF then the threading grinding cycle will not be performed on the workpiece.

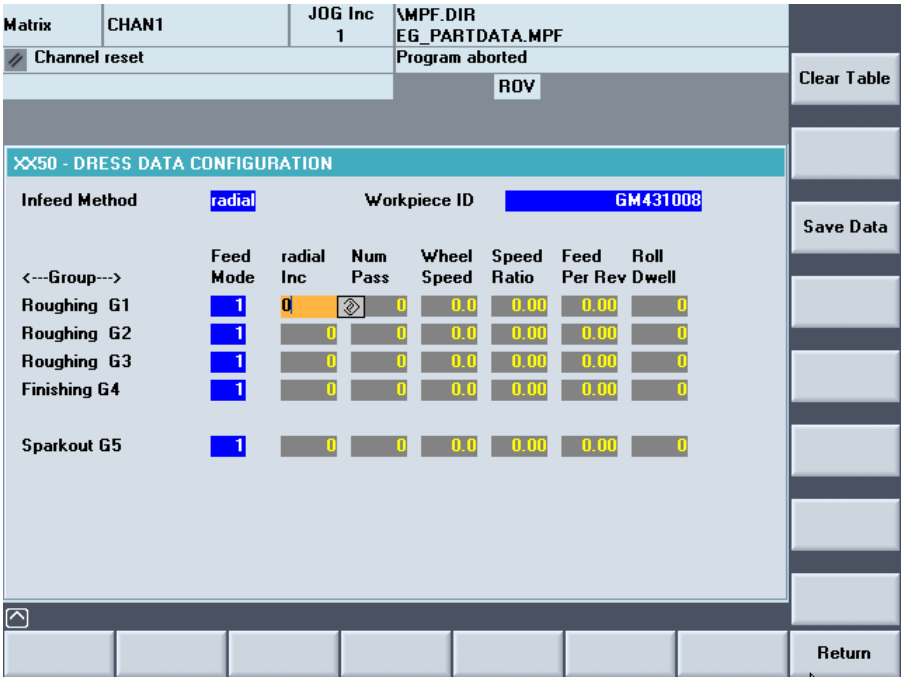
19.22.5 How to set the start and end points for end-thread grinding





19.23 Cycle Data – Dress Table

[Menu Select > Matrix > Main Menu > Cycle Data > Dress Data]



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

19.23.1 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.

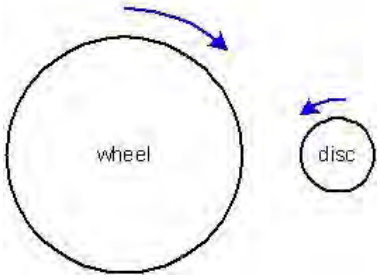
19.23.2 Explanation of parameters

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

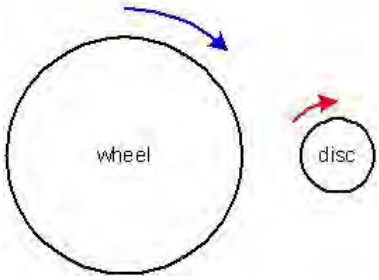
Speed Ratio
Input Range: -1.5 to 1.5
Ratio of the grinding wheel surface speed to the dressing tool surface speed

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

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.

19.24 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)

19.25 Cycle Stop/interrupt

You can stop the active grinding cycle in a number of ways as outlined in the table below which also details the consequences of the method by which you have chosen to stop the cycle.

Cycle stop action	*Is my workpiece likely to become scrap?*	*Do I need to run the cycle from the beginning?*
Press the Yellow [WHEEL RETRACT] button	NO	YES
Press the Red [EMERGENCY STOP] button	YES	YES
Power-off the machine at main isolator	YES	YES
Press the [RESET] key at the MCP	YES	YES
Select the [BLOCK SKIP] key at the MCP	NO	NO

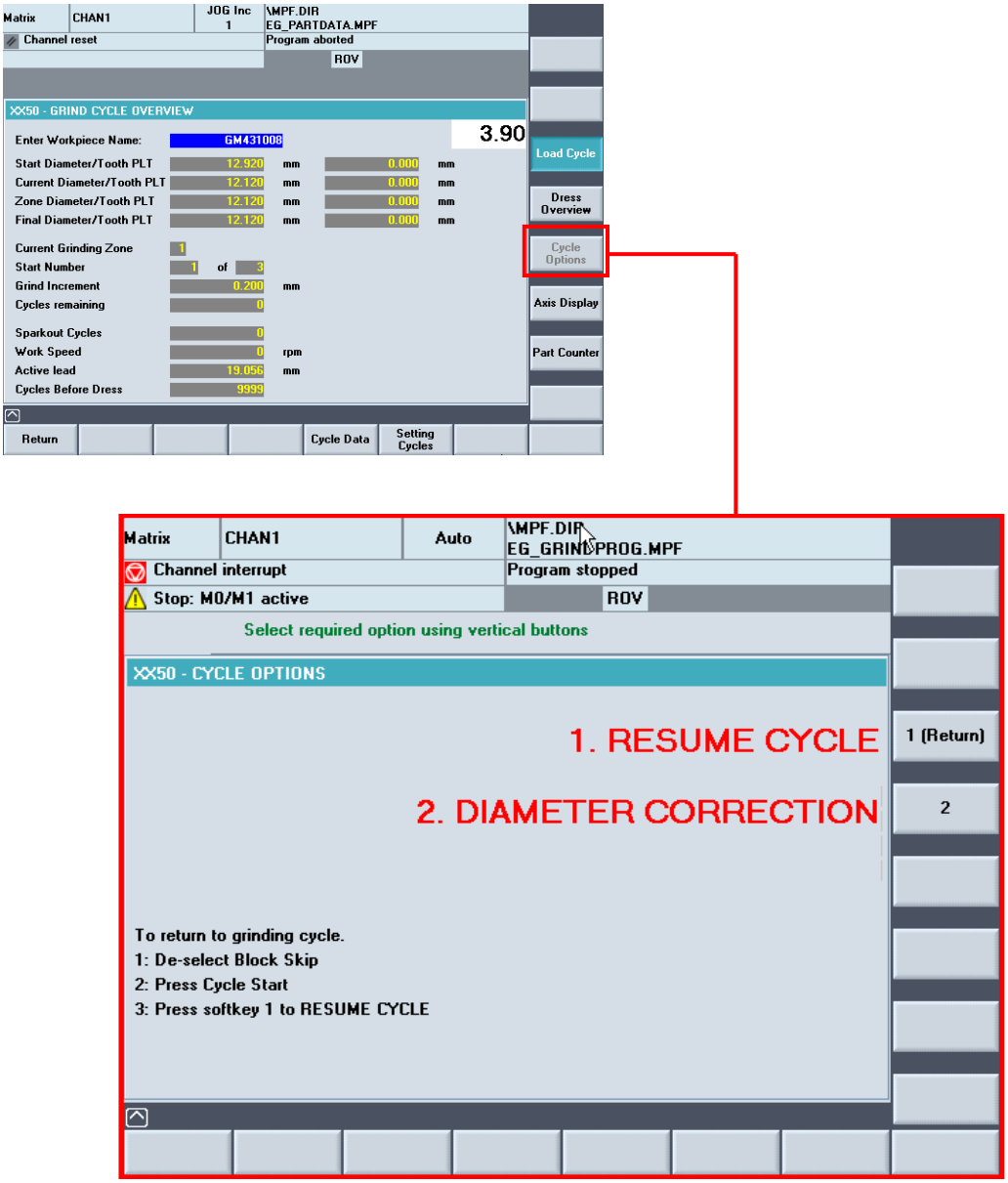
Should there be a need to interrupt or abort the active grind cycle it is recommended that you select the [BLOCK SKIP] function at the machine control panel to bring the cycle to a controlled stop.

19.25.1 Procedure for Cycle Interrupt

1. Press the blue **[BLOCK SKIP]** key at the machine control panel
   The machine will now complete its current grinding pass or sequence action and stop in the load/unload position.

2. Wait for the message prompt ***"Select required option using vertical buttons"*** to appear.

3. Select the [Cycle Options] screen [Custom > Matrix > Main Menu > Grinding Overview > Cycle Options]



4. You can now inspect the workpiece or make a correction to the diameter if required.

19.25.2 Resume the cycle

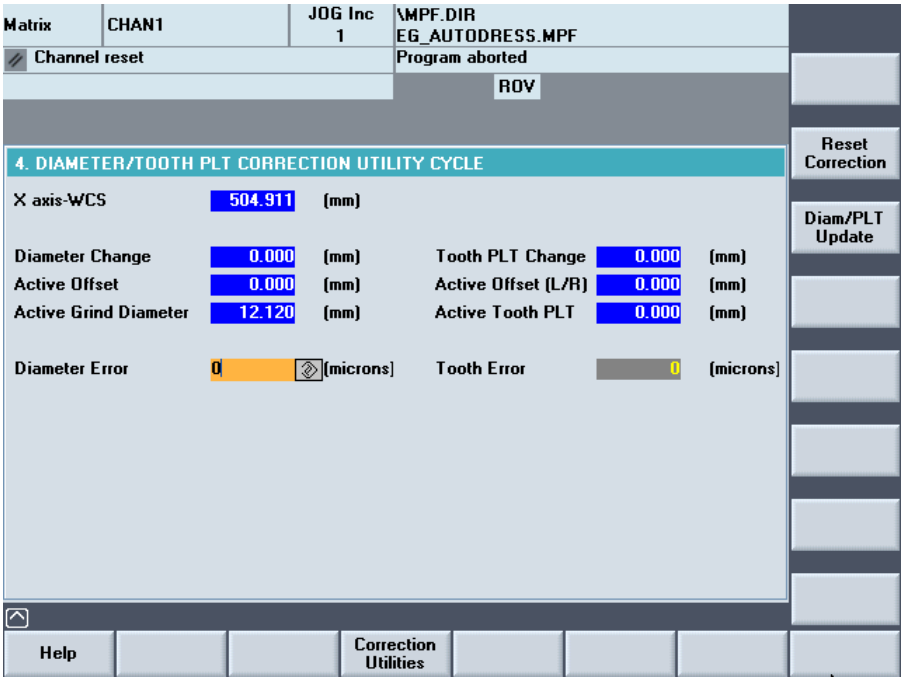
Select this option if you want to just continue with the cycle from the current diameter.

1. De-select [BLOCK SKIP] function
2. Press the [CYCLE START] key
3. Select option **[1]** softkey
4. The cycle will now execute and continue to grind the workpiece from the currently active diameter value as displayed in the Grinding Cycle Overview screen.

19.25.3 Make a correction to the diameter and then resume the cycle

Select this option if you want to make a correction to the diameter before resuming the cycle.

1. Select the Diameter Correction screen [Custom > Matrix > Main Menu > Setting Cycles > Correction Utilities]



2. Make the necessary change in the **Diameter Error** input field and then press the **[Diam/PLT Update]** softkey to update the entry.

3. Return back to the Cycle Options screen.
4. De-select [BLOCK SKIP] function
5. Press the [CYCLE START] key
6. Select option **[2]** softkey

The cycle will now execute and continue to grind the workpiece from the updated current diameter value as displayed in the Grinding Cycle Overview screen.

20 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.

21 Programming M/S/T Codes

code	function
M00	program stop
M01	optional Stop
M02	end of program with return to beginning
M03	spindle S1 start CW
M04	spindle S1 start CCW (not applicable)
M05	spindle stop
M07	dressing coolant on (no longer used)
M08	grind/dress coolant on
M09	grind/dress coolant off
M10	workholding chuck clamp/close
M11	workholding chuck un-clamp/open
M17	end of sub-program
M28	workpiece hold
M29	workpiece release
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 FIN 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
M62	close auto guard door
M63	open auto guard door (full)
M64	open auto guard door (mid-position)
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

code	function
M81	activate DRF
M82	de-activate DRF
M90	tailstock advance
M91	tailstock retract
M94	probe advance
M95	probe retract
M98	cancel distance to go (X, Z, C)
M99	reset acknowledge/YES button

S codes

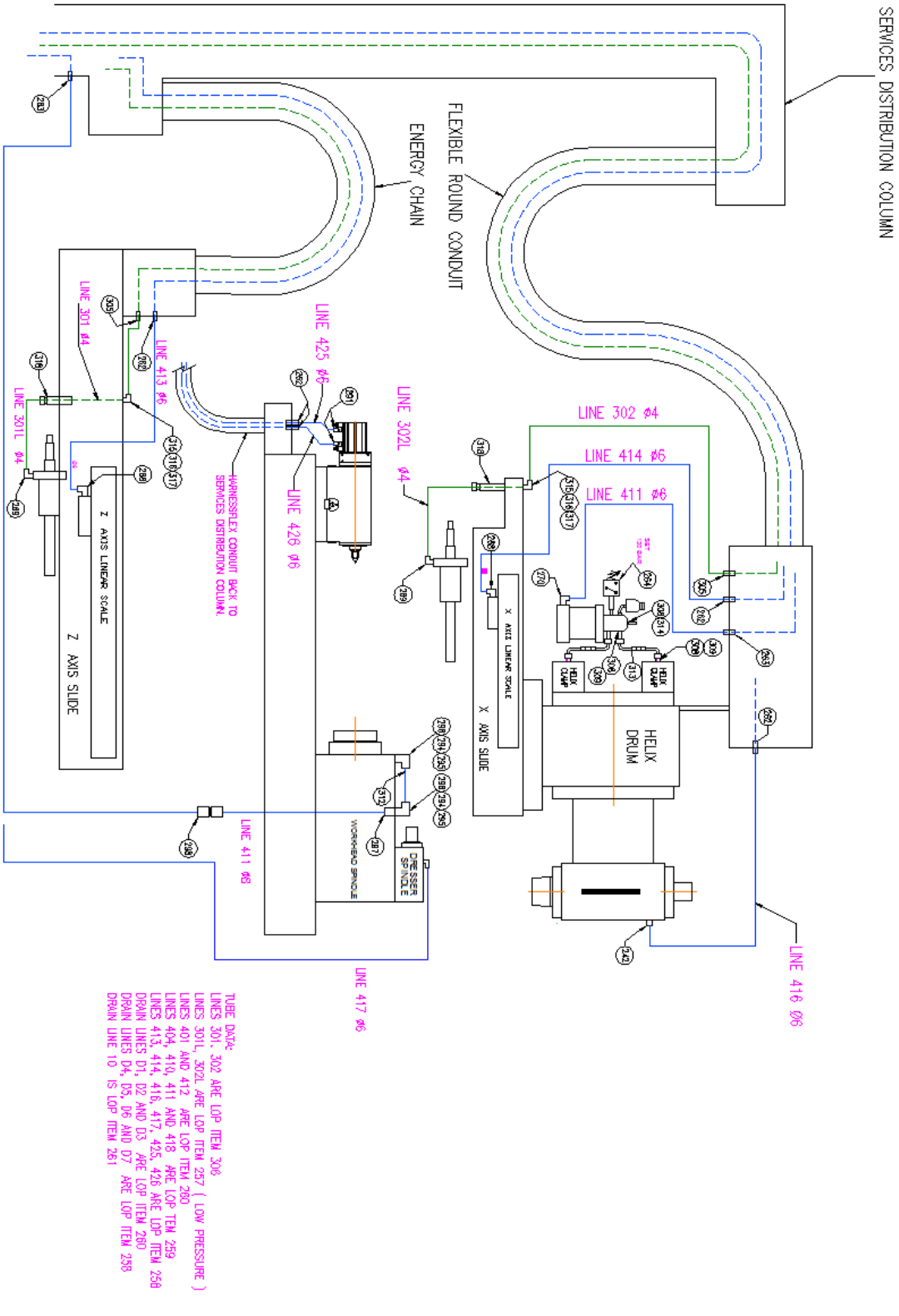
S1=nnnnn	grinding spindle speed, where nnnnn is the grinding wheel speed in rpm
S3=nnnn	dressing spindle CW speed, where nnnn is the grinding wheel speed in rpm
S4=nnnn	dressing spindle CCW speed, where nnnn is the grinding wheel speed in rpm

22 Maintenance

22.1 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



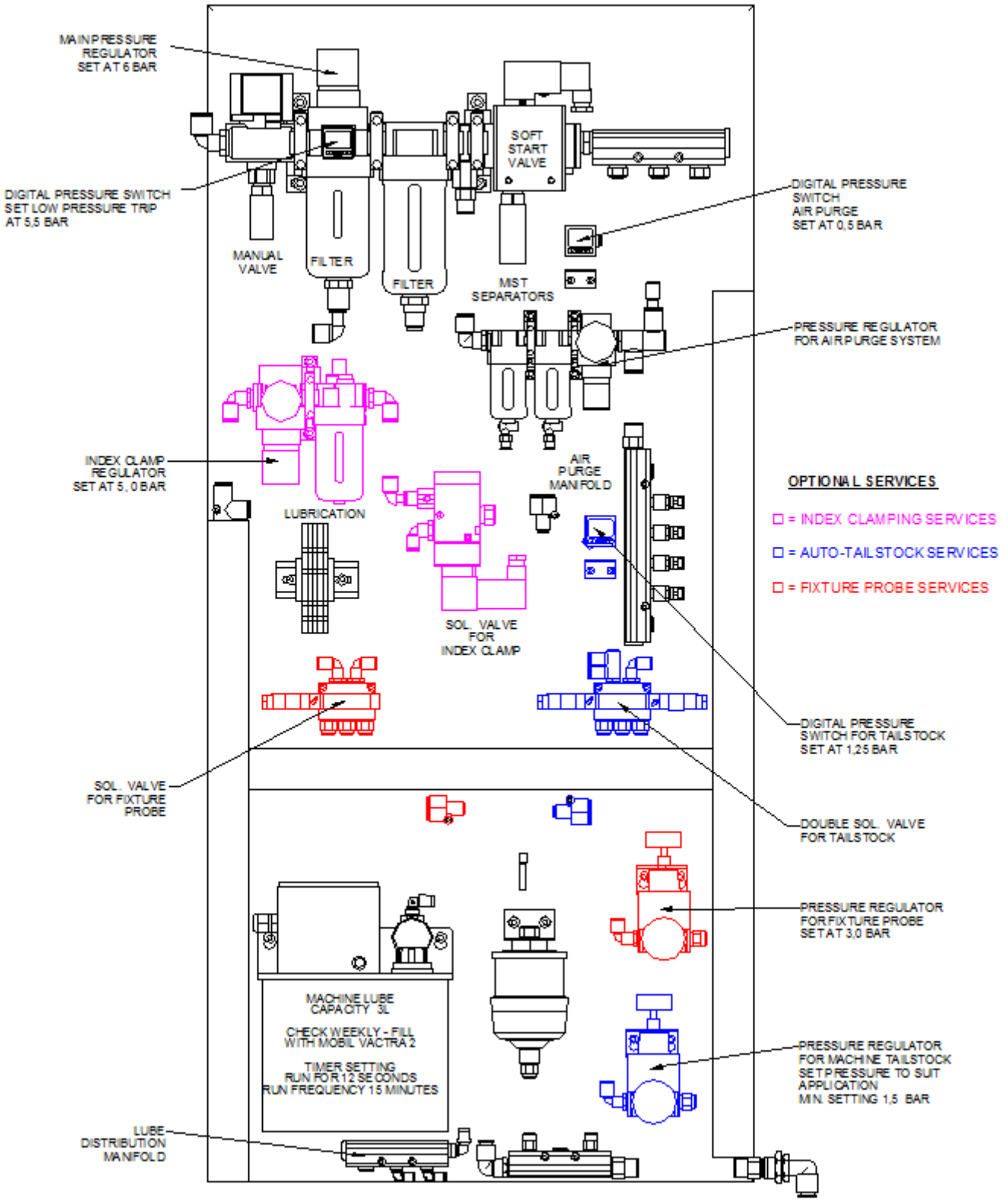
22.2 Electrical Control Cabinet (ECC)

The electrical control cabinet contains the Siemens 840DSL control and drive hardware modules in addition to controlgear, circuit protection devices, filters and power distribution hardware components, etc.

As standard the ECC if fitted with a door mounted air conditioning unit to maintain the internal cabinet temperature at 35°C.

22.3 Services Cabinet (SC)

The machine service cabinet located to side of ECC and contains gauges and switchgear for monitoring the air supply to the machine's pneumatically operated equipment.



22.4 Fume Extractor

The fume extraction system connects to a port on the rear RH side of the machine guarding via flexible ducting the fume extraction is attached to the coolant system on a purpose built fabrication.

During machine operation coolant vapours extracted from the machine is returned back to the coolant system as the filters become clogged.

Power to the fume extraction is connected via a junction box located at the base machine and the extractor unit operates automatically when the machine is started.

22.5 Recommended oils/fluids/additives

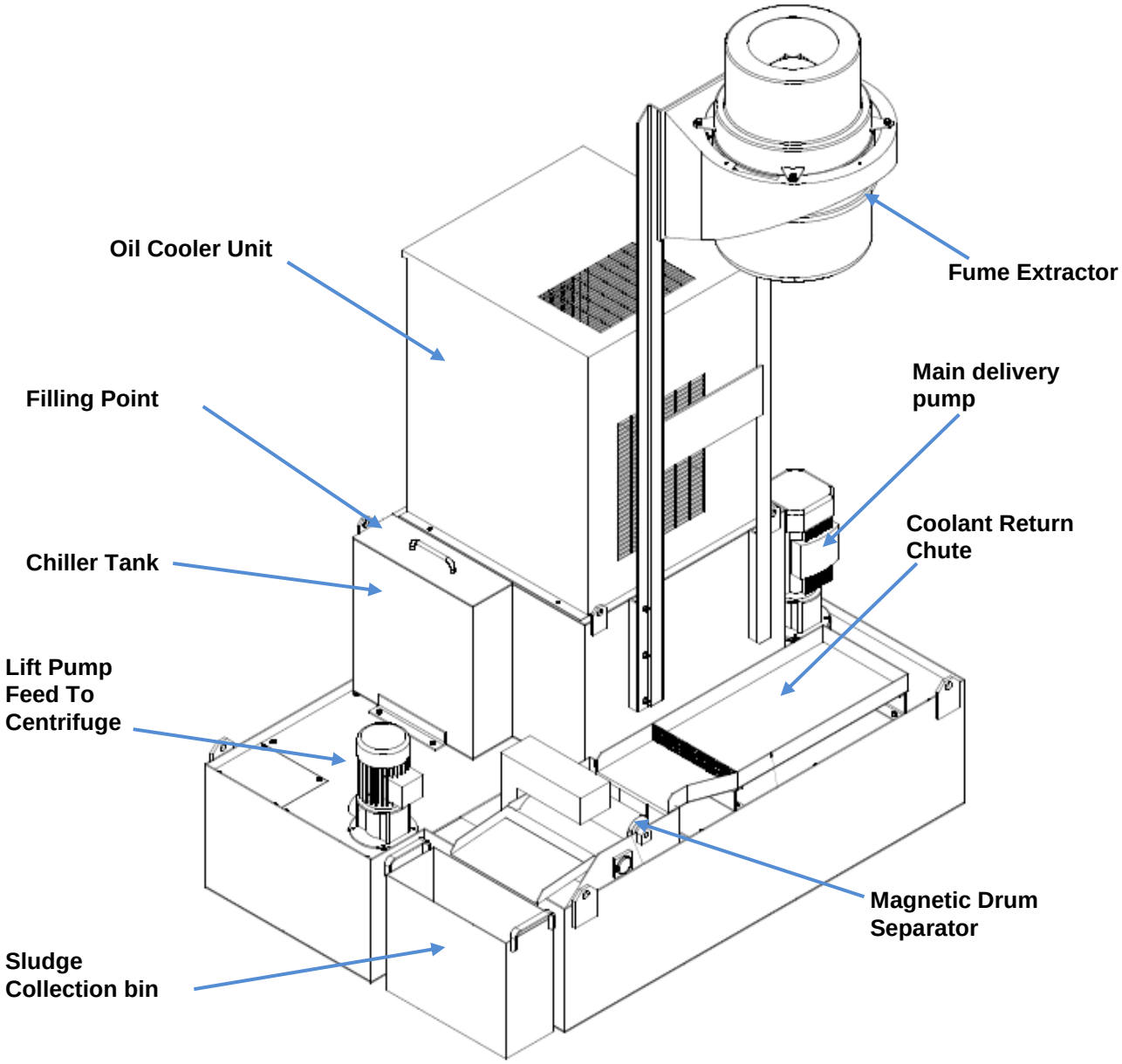
Machine Lubrication	
Centralised lubrication tank	BP Macurat 68 Shell Tonna T68 Mobil Vactra 2 Castrol Magna BD Texaco Way Lub D Caltex Way Lub68
Helix screw on wheel head adjustment nut	BP Macurat 68 Shell Tonna T68 Mobil Vactra 2 Castrol Magna BD
HF spindle	ISO VG32, DIN 51524-HLP-D32 ISO VG46, DIN 51524-HLP-D46
Dresser spindle	Mobil Vactra 2
Power Chuck Hydraulic Oil	DTE Light Hydraulic oil Mobil DTE Light, ISO VG32 Castrol HYSPIN ISO VG32

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

22.6 Coolant System



Filling the coolant system

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

22.7 Preparing the Spindle Chiller Unit

The free standing spindle chiller unit supplies and re-circulates chilled water to the main grinding spindle and the dresser spindle to prevent the spindles from overheating during normal machine operation.

The chiller unit is fitted with castors allowing it to be conveniently positioned to the rear side of the machine.

Before the chiller unit can be operated the 35L tank must be filled with:

95% normal tap water (33.25L)
5% anti-corrosion concentrate (1.75L)

Filling the spindle chiller unit

1. Remove the filling point cover (inset picture).
2. Using a suitable funnel first pour in 10L of normal tap water.
3. Now pour in 1.75L of anti-corrosion concentrate.
4. Finally top up with water until the sight glass is showing the tank full.
5. Replace the filling point cover.

1.1.1 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?

2.1.1 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.

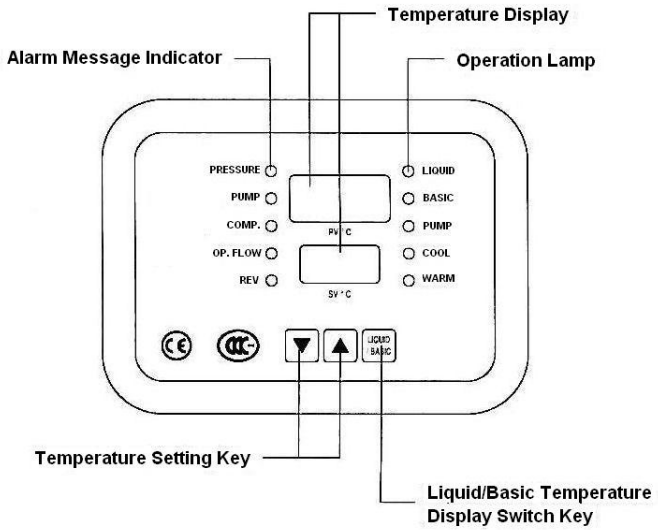


Fig. 24.2.2a. — Temperature Display.

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:

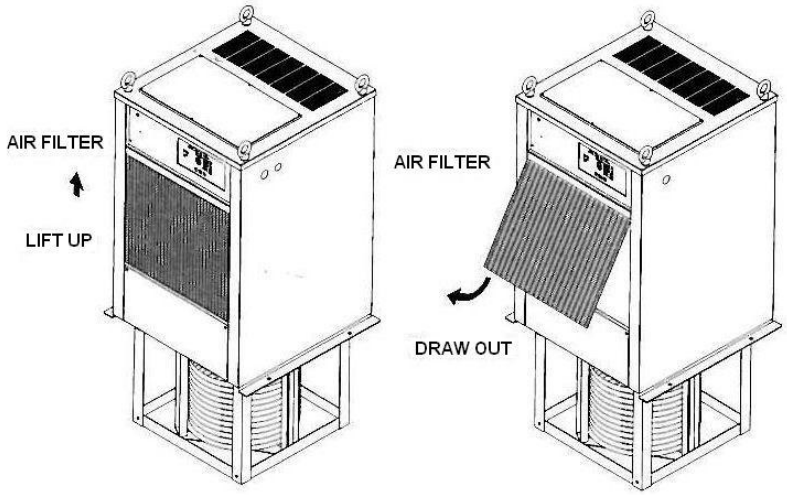
- Cooler body
- Condenser
- Air filter
- Cooling coil
- Oil tank
- Oil filter. (optional component installed by user).

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.

22.8 General Maintenance Schedule

The recommended maintenance intervals are based on assumptions that the machine is used for 40 hours 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** (see fig.1 below)
2.	**Check/top-up helix drum clamping system intensifier glass bowl lubricator** (see fig.2 below)
3.	**Check spindle coolant unit level**
4.	**Check coolant system level (at sight glass)**
5.	**Check/fix any leaks around the machine**
6.	**Lubricate power chuck at the grease nipple points (if option fitted)**

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)**
6.	**Inject oil (VG68) into tailstock lubrication nipples** (see fig.4 below)

Monthly	
1.	**Inject oil into helix drum slide nipples** (see fig.3 below)
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**

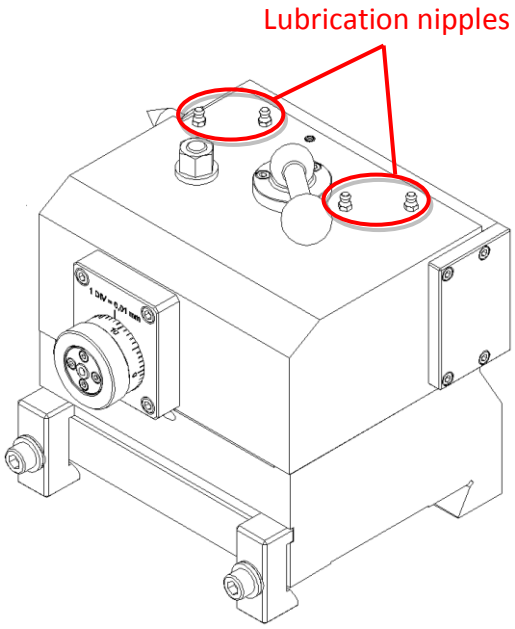
fig. 1

Note: do not exceed the tank capacity (3L) when filling with oil (VG68)

fig.3

fig. 2

fig. 4



22.9 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 ~ 6** Bar

Air Purge To Linear Scale
The Heidenhain linear encoder scales are supplied with a regulated and micro-filtered low pressure air purge to ensure that the scales remain clean at all times.

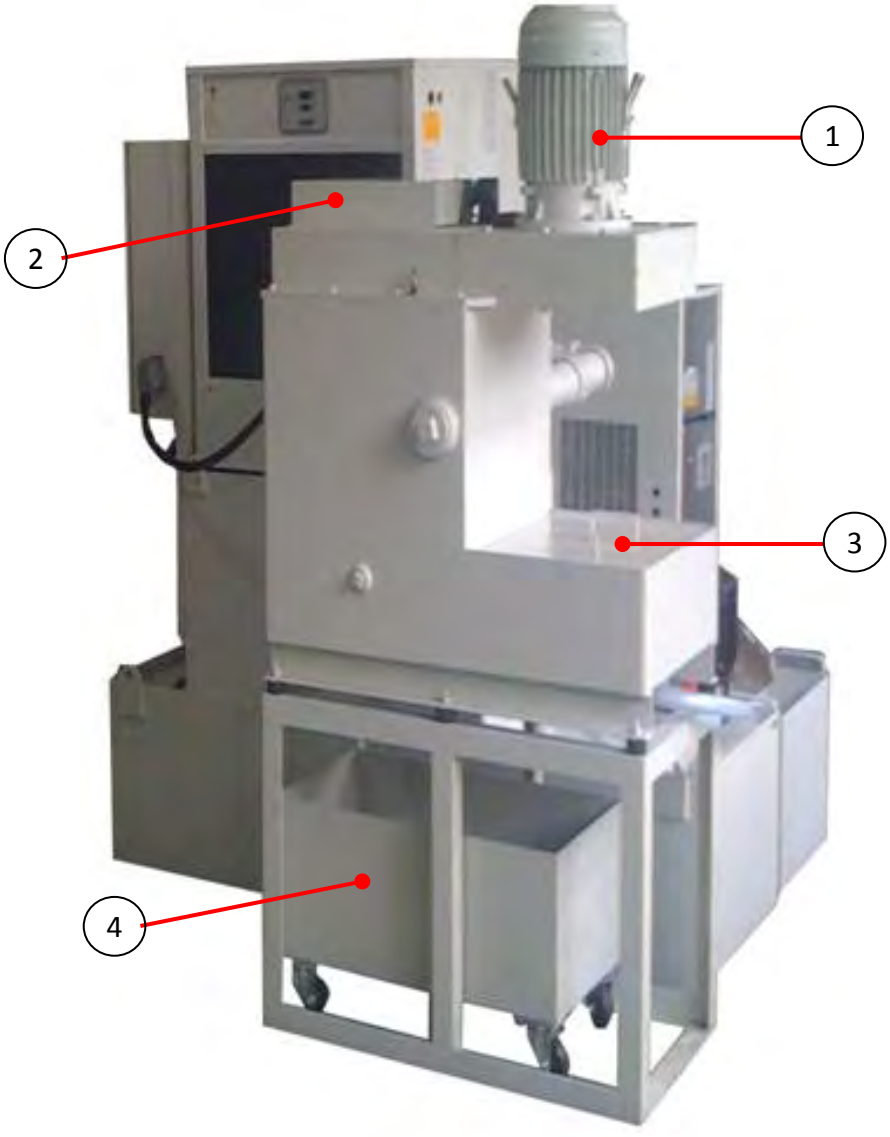
The micro-filter located in the services cabinet should be inspected at regular intervals (at least once a week) and changed when it becomes clogged up.

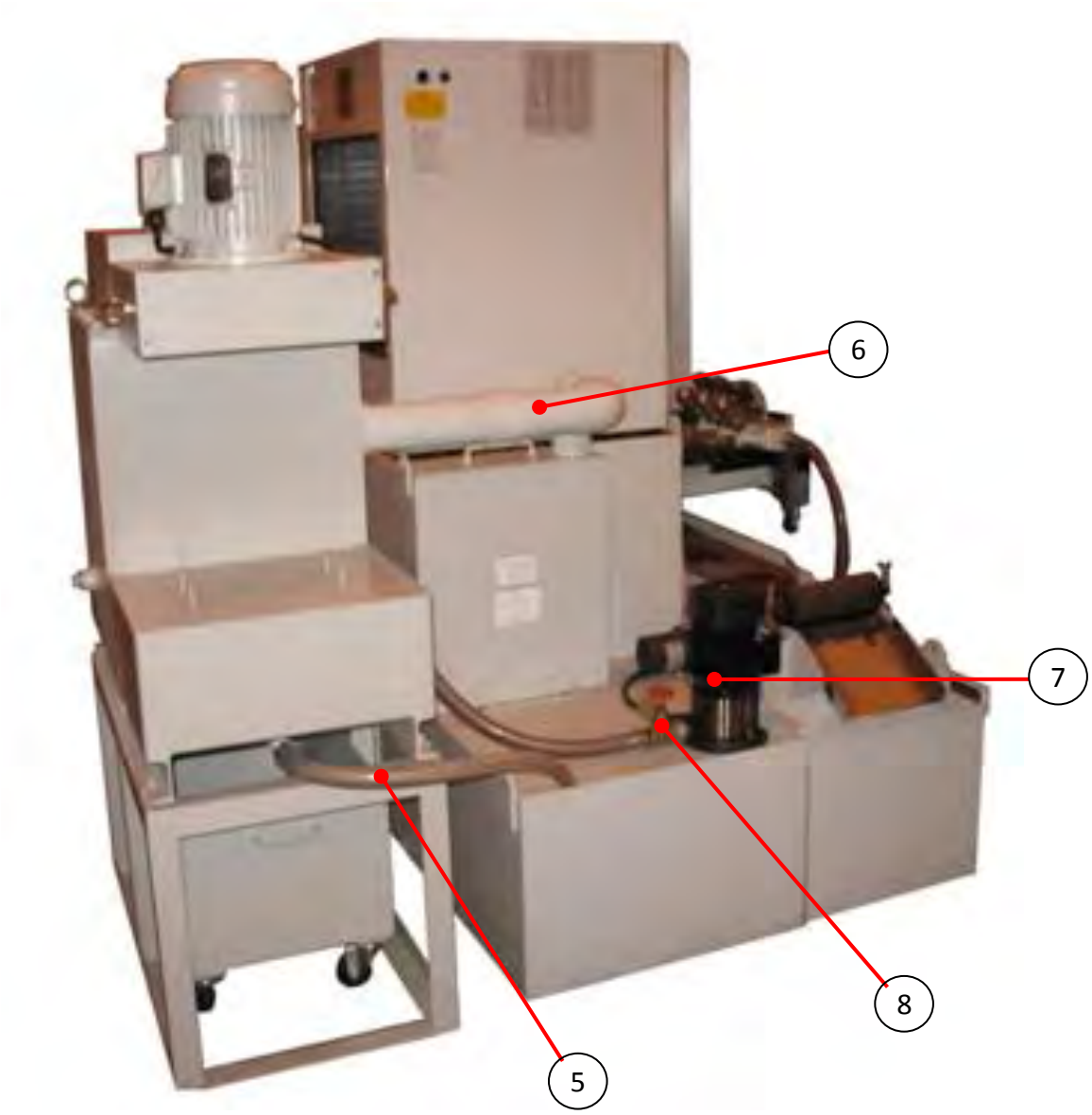
22.10 Cleaning the coolant system centrifuge

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.

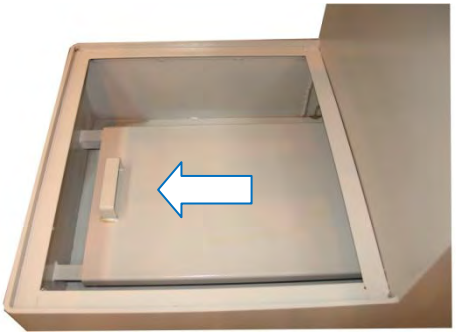




1	Centrifuge drive motor	5	Oil drain back hose
2	Hinged cover for access to drum lock lever	6	Cleaned oil exit pipe outlet feeding to clean oil tank
3	Removable inspection panel	7	Lift pump to transfer oil from main tank to the centrifuge
4	Debris collection bin on castors		Lift pump flow adjust valve

Debris catch plate positions

Catch plate shown in the normal operating position



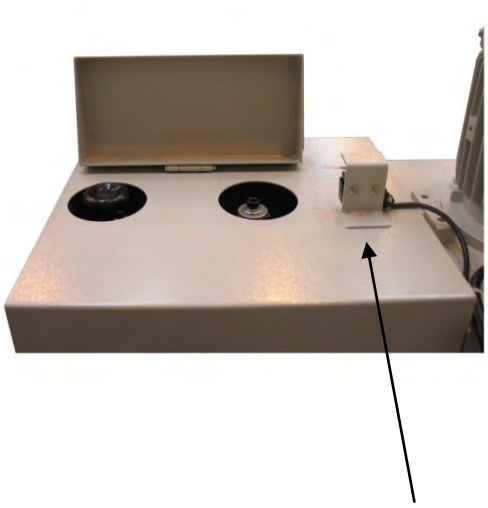
Catch plate shown in the maintenance position
Set to this position when cleaning the drum.

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

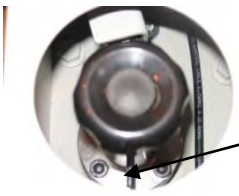
Drum Pulley

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 **lock 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. Set the drum to the **unlock position** by lifting and turning the drum lock knob through 90° back into the normal position.

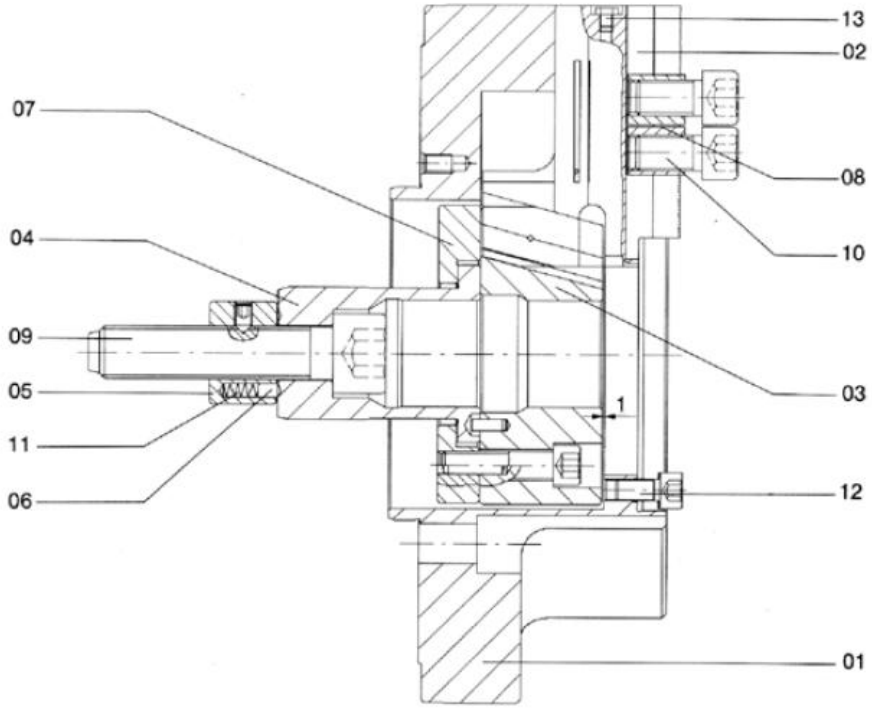
Normal position (the bar is horizontal)

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.

22.11 Power Chuck maintenance

Regular maintenance of the power chuck is necessary dependent upon its usage. Lubricate all lubricating points for every 20 hours of operation heavy soling every 8 hours.



1	Body	8	Sliding block
2	Base jaw	9	Draw bolt
3	Piston	10	Jaw mounting screw
4	Guide bushing	11	Compression spring
5	Lock nut	12	Centering adapter mounting screw
6	Pin	13	Grease nipple
7	Guide plate		

1. To maintain its reliability and high quality, the chuck must be lubricated at the 3 grease nipples at regular intervals. After lubrication, move the clamping piston several times over its full stroke in order to distribute the grease more evenly. Then lubricate again.

2. Performance and clamping force must be checked after some time, depending on the conditions of use. The most reliable method of measuring the clamping force is by means of a load cell.

3. Performance check: The clamping piston must move when the lowest possible actuating pressure of 3-4 bar is applied. However, this method is not reliable enough to serve as a substitute for the clamping force measurement.

If the clamping force has dropped substantially or if the clamping piston can no longer be moved with ease, the chuck must be disassembled, cleaned and re-lubricated.

4. Maintenance intervals: Depending on the conditions of use, but not later than after the specified periods. We recommend using Rohm special grease F80.

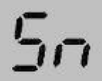
23 Troubleshooting Guide

23.1 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
	Possible Cause	Broken connection of the oil temperature sensor. Oil temperature sensor fault. Temperature controller failure.
PV °C	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.
SV °C		

2	Explanation	There is a problem with the ambient or machine body temperature sensor.
	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.
PV °C	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.
SV °C		

3	Explanation	Oil temperature is too high for the cooler to process.
	Possible Cause	Process load is over the limit of the cooler unit's capacity. Oil temperature sensor failure. Refrigeration system failure.
PV °C	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.
SV °C		

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.

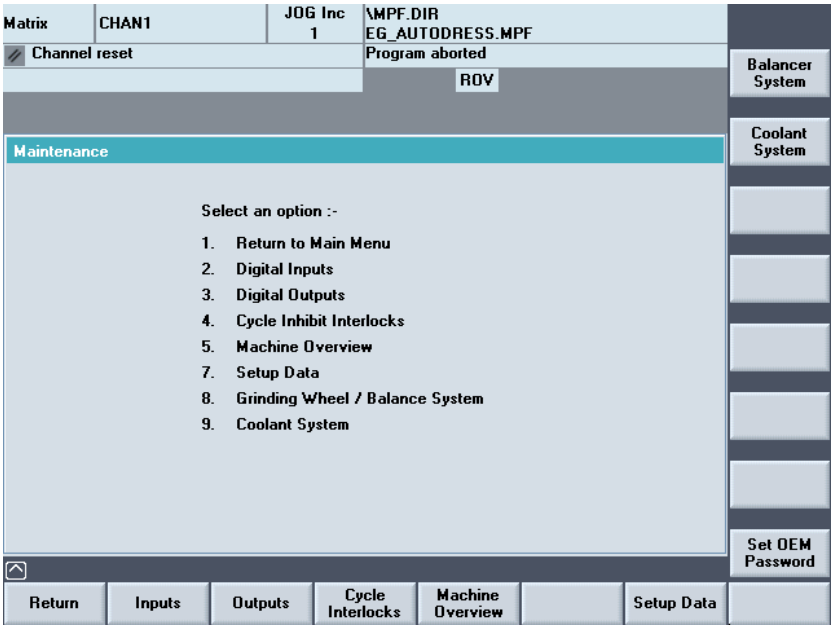
Status	**PV °C, SV °C display correctly.**
Possible Cause	Machine vibration has loosened wiring. Remote control connection is out. Temperature controller connection is out. Temperature controller failure.
Inspection	Are the remote control connections ok? Are the temperature controller connections ok?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

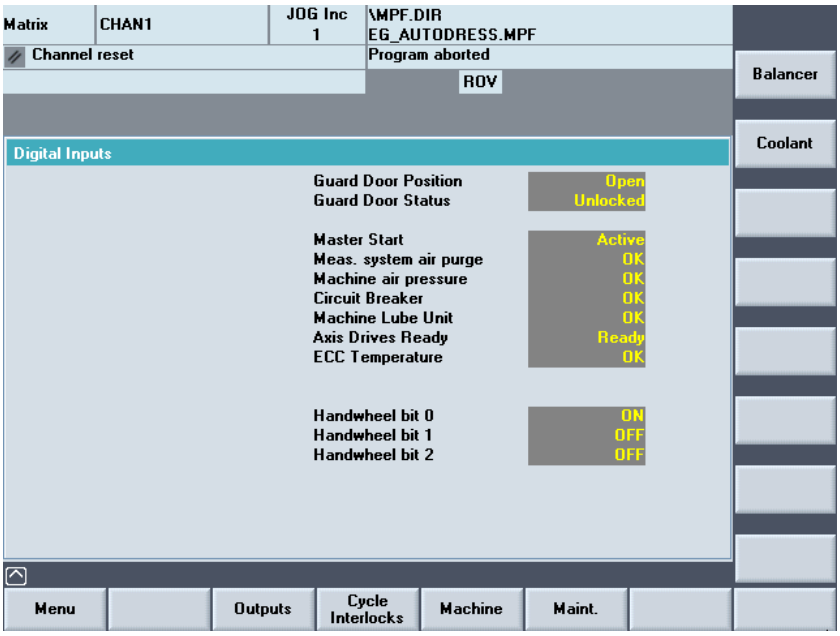
23.2 Machine Diagnostic Screens

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

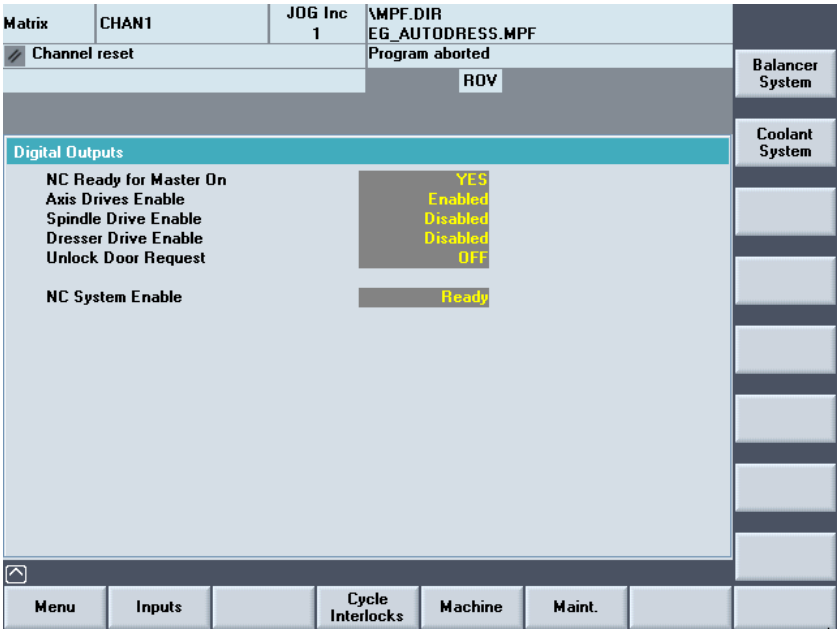
Maintenance diagnostics sub-menu



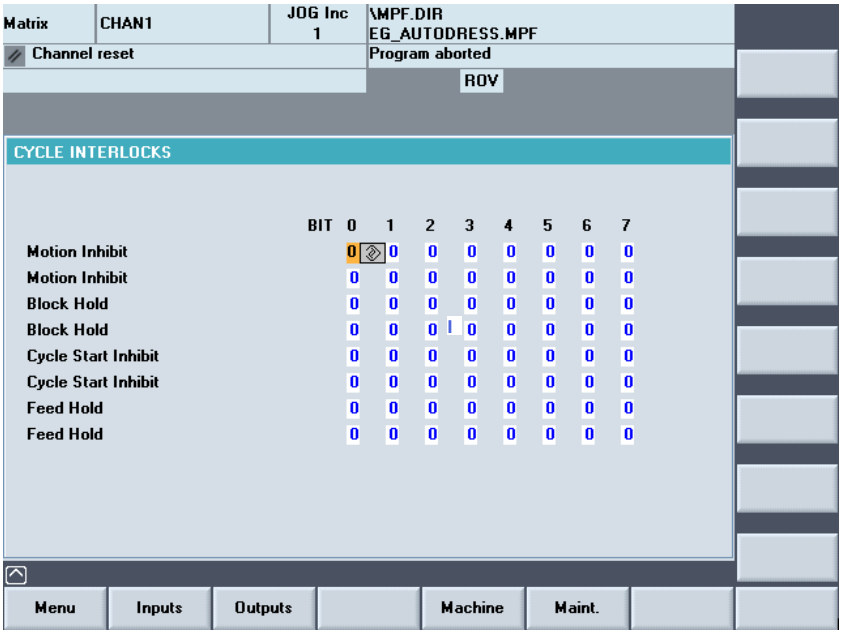
Digital Inputs



Digital Outputs



Cycle Interlocks

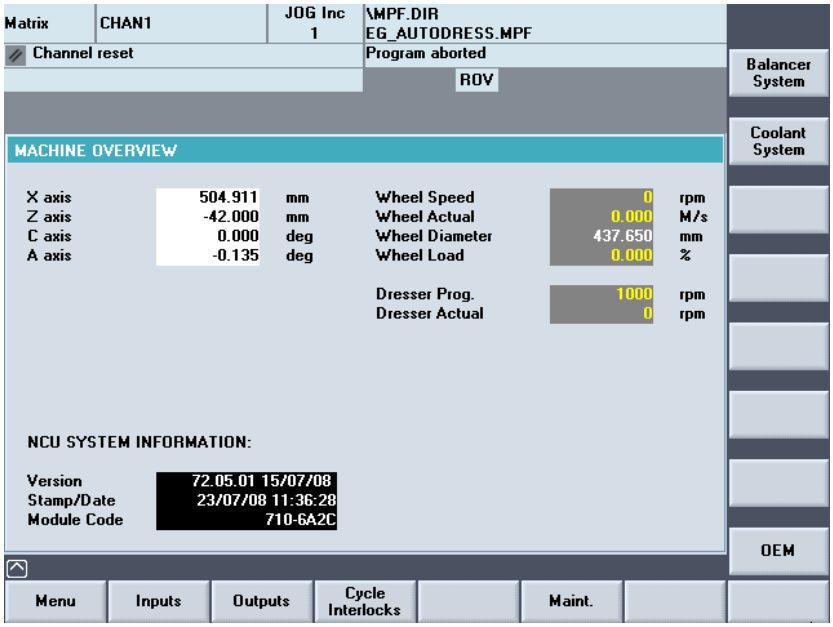


State = 0 interlock not active

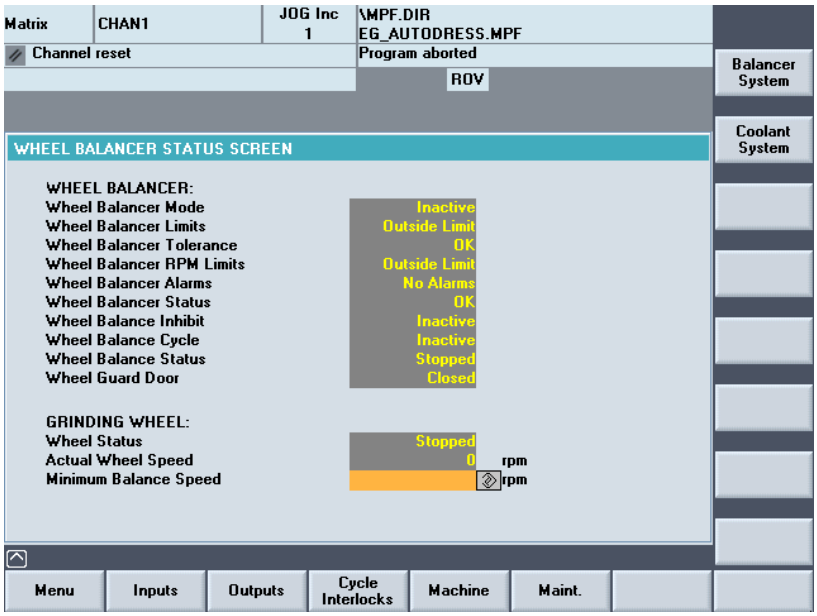
State = 1 an interlock condition is active that is currently preventing the cycle from operating

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.

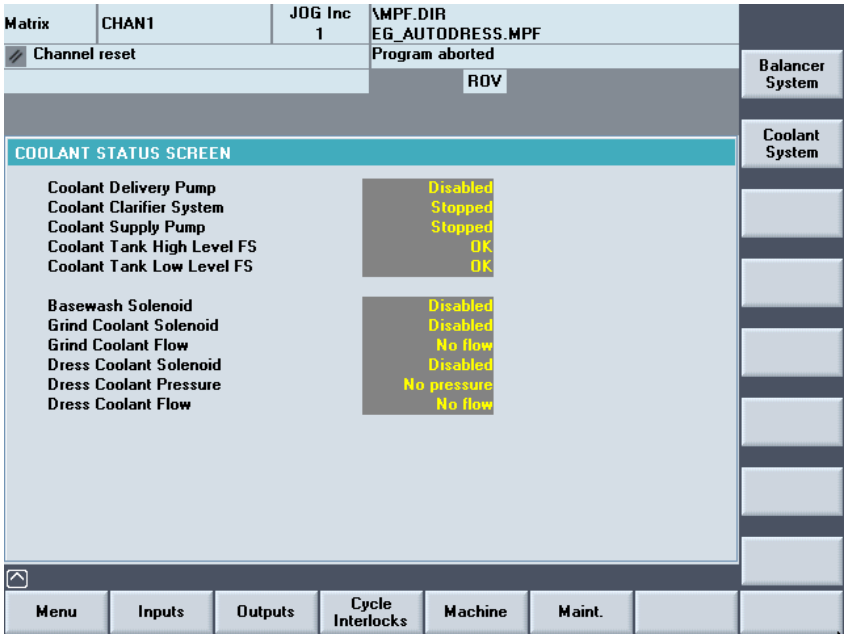
Machine Overview



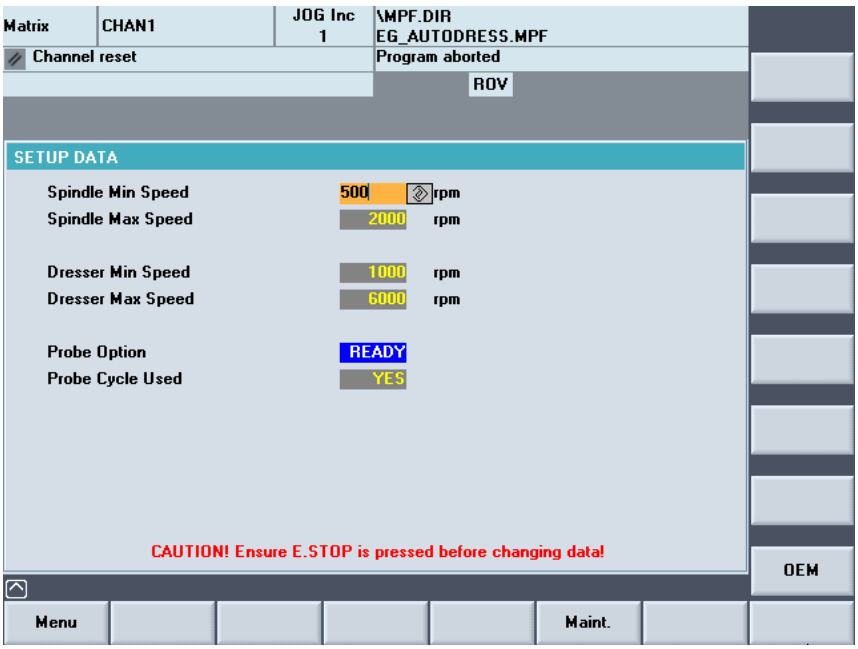
Wheel balancer system diagnostic screen



Coolant system diagnostic screen



Setup Data (Restricted Access)



This screen is only accessible at the manufacturer password level.

23.3 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.

700xxx Probe slide sequence failure
Cause: The probe slide did not complete the advance or retract request within the 3 seconds allowed.
Remedy: Check for any secondary alarms that indicate a separate problem which may have caused the sequence to be aborted.

700xxx Probe unexpected hit – cycle aborted
Cause: During the probe slide advance sequence, the probe trigger signal was detected indicating a deflection of the probe stylus had occurred.
Remedy: No probe stylus deflection should occur while the probe is being moved to the advanced or retracted position. Check for obstacles in the path of the probe slide that could have initiated a probe stylus deflection.

700033 Programmed wheel speed is too high
Cause: The programmed wheel speed is above the maximum wheel speed defined in the Matrix Setup Data screen
Remedy: Reduce the programmed wheel speed to below the maximum wheel speed. Wheel Speed changes should only be Performed while the wheel is Stopped.

700034 Coolant system not started
Cause: An attempt has been made to execute an NC program before the coolant system has been started up.
Remedy: Start the coolant system and check that the red fault indicator is not illuminated at the coolant system control panel. Check coolant centrifuge pump motor is operating Check coolant centrifuge unit is operating Check there is enough coolant in the tank

700044 Probe not retracted – Probe routine inhibited
Cause: Pressing [PROBE CYCLE] or [CYCLE START] will post this message if the probe slide is not retracted.
Remedy: Press the [RESET] key at the MCP and check that the probe slide has retracted

700055 CAUTION: Wheel guard is open!
Cause: An attempt was made to jog an axis with the wheel guard door open.
Remedy: Close and secure the wheel guard door. Check the proximity switch fitted to the guard door is operating correctly. Refer to electrical schematics to identify the digital input signal and check status in the Diagnosis > PLC status screen

700063 Wheel is not balanced
Cause: The grinding wheel has gone out of balance because it has not been
Remedy: Check the condition of the grinding wheel and ensure that it has not become chipped. Start the spindle. Select the wheel balancer screen Menu Select > Balancer and perform AUTO balance.

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 amplifier 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.

700129 Tailstock retract timeout
Cause: The tailstock failed to return to its retracted position within 4 seconds because there is not enough hydraulic pressure to drive it back to the retracted position.
Remedy: Check the pump on the hydraulic tank is functioning. Check that the hydraulic pipes connecting to the tailstock unit are not leaking. Check the tailstock advance/retract solenoid located inside the services cabinet.

700146 Minimum tailstock pressure not achieved - failure
Cause: The tailstock has advanced and reached its part present or maximum advanced position but no pressure signal was detected within 2 seconds after the position was detected. state change from 0 to 1 is seem within 2 seconds.
Remedy: With the workpiece supported between centres adjust the tailstock pressure regulator until the pressure signal state changes to 1.

23.4 Recovering from an axis software travel limit condition

The 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

23.5 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.

23.6 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