



DVR

TECHNOLOGY

THE INTELLIGENT SOLUTION

PACKAGE DRIVE MOTOR

Instruction Manual

www.dvrsmartmotor.com

DVR ELECTRONIC DRIVE

The Digital Variable Reluctance (DVR) Package drive is a unique variable speed motor. The DVR motor uses smart motor technology to provide an incredibly smooth and powerful drive. The controller monitors the spindle position constantly and maintains spindle speed very closely. Additional power is added as it senses extra load from the application. The motor is almost maintenance free and designed with high reliability.

BENEFITS OF THE DVR PACKAGE DRIVE MOTOR

- **Intelligence**
Controlled by a micro-processor the motor can save and store speed information on different settings and switch from one to another immediately.
- **5 Favorite Speeds Function**
Pre-program your most favorite speeds for easy retrieval.
- **Adaptive Control Software**
Smart adaptive computer technology actually measures the weight of the work piece and adjusts its performance accordingly.
- **Safely Sensing Feature**
Intelligent DVR computer controller can sense abnormal operational conditions e.g. sudden increases of load - it can instantaneously shut down power to the spindle. Normal safety precautions would still apply.
- **Energy Efficient**
Unlike other 'dumb' electric motors, the Smart DVR Motor only inputs enough power to maintain the set speed – giving you potential for up to 50% power savings over conventional motors.
- **Wide Speed Range**
50-5,500 motor rpm, easy dial speed change.
- **DVR Direct Drive Motor**
Driven by unique Digital Variable Reluctance Motor Technology, with superior performance over AC or DC motors. Proven technology, with many thousands of users. Provides digital electronic dial variable speed with no belt changes.
- **2 Year Warranty**
2 Year Warranty on all electronics and electrical components.
- **Low Maintenance**
The motor is simple, brushless with no rotor windings (rotor is solid steel). The industrial grade electronics are built to last. There are no drive pulleys or belts to set up or come loose.

GENERAL SAFETY RULES

WARNING! Failure to follow these rules may result in serious personal injury.

1. **FOR YOUR OWN SAFETY, READ THE MANUAL BEFORE OPERATING THE TOOL.** Learn the machine's application and limitations plus the specific hazards particular to it.
2. **ALWAYS USE A FULL FACE SHILED.** Strongly recommended (must comply with ANSI STANDARD Z87.1 -USA) Everyday eyeglasses usually are only impact resistant and safety glasses only protect eyes. A full face shield will protect the eyes and face. Also use face or dust mask if cutting operation is dusty.
3. **WEAR PROPER APPAREL.** Do not wear loose clothing, gloves, neckties, rings, bracelets or other jewelry which may get caught in moving parts. Non slip footwear is recommended. Wear protective hair covering to contain long hair.
4. **USE EAR PROTECTORS.** Use ear muffs for extended period of operation. Use muffs rated to 103 DBA LEQ (8 hour).
5. **DON'T USE IN DANGEROUS ENVIRONMENT.** Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted. The DVR and 1624 lathe is intended for indoor use only. Failure to do so may void the warranty.
6. **KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents. Build up of sawdust is a fire hazard.
7. **KEEP CHILDREN AND VISITORS AWAY.** The DVR PACKAGE DRIVE is not recommended for children. Onlookers should be kept a safe distance from work area.
8. **MAKE WORKSHOP CHILDPROOF** with locks, master switches, or by removing starter keys.
9. **GROUND ALL TOOLS.** If the tool is equipped with a three prong plug, it should be plugged into a three hole electrical receptacle. If an adapter is used to accommodate a two prong receptacle, the adapter plug must be attached to a known ground. Never remove the third prong.
10. **MAKE SURE TOOL IS DISCONNECTED FROM POWER SUPPLY** while the motor is being mounted, connected, or re-connected.
11. **DISCONNECT TOOLS** from wall socket before servicing and when changing accessories such as blades, bits, cutters and fuses etc.
12. **AVOID ACCIDENTAL STARTING.** Make sure switch is in the Off position before plugging in power cord.
13. **NEVER LEAVE MACHINE RUNNING UNATTENDED.** Do not leave machine unless it is turned off and has come to a complete stop.
14. **KEEP GUARDS IN PLACE** and in working order.
15. **USE CORRECT TOOLS.** Do not use a tool or attachment to do a job for which it was not designed.
16. **USE RECOMMENDED ACCESSORIES.** The use of improper accessories may cause hazards.
17. **DON'T FORCE THE TOOL.** It will do the job better and be safer at the rate for which it was designed.
18. **MAINTAIN TOOLS IN TOP CONDITION.** Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.
19. **NEVER STAND ON TOOL.** Serious injury could occur if the tool is tipped or if the cutting tool is accidentally contacted.
20. **REMOVE ADJUSTING KEYS AND WRENCHES.** Form a habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
21. **DON'T OVERREACH** Keep proper footing and balance at all times.
22. **DIRECTION OF FEED.** Feed work into a blade or cutter against the direction of rotation of the blade or cutter only.
23. **ATTENTION TO WORK.** Concentrate on your work. If you become tired or frustrated, leave it for awhile and rest.
24. **SECURE WORK.** Use clamps or a vice to hold work when practical. It's safer than using your hand and frees both hands to operate tool.
25. **CHECK DAMAGED PARTS.** Before further use of the tool, any part that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function. Check for alignment of moving parts, binding of moving parts, mounting, and any other conditions that may affect its operation. Any damaged part should be properly repaired or replaced.
26. **DRUGS, ALCOHOL, MEDICATION.** Do not operate machine while under the influence of drugs, alcohol, or any medication.
27. **DUST WARNING.** The dust generated by materials can be harmful to your health. Always operate machinery in well-ventilated areas and provide means for proper dust removal. Use wood dust collection systems whenever possible.

INSTALLING DVR PACKAGE DRIVE ON THE NOVA 1624-44 LATHE

Tools needed:

1 x 19mm Spanner

1x 4mm Allen Key

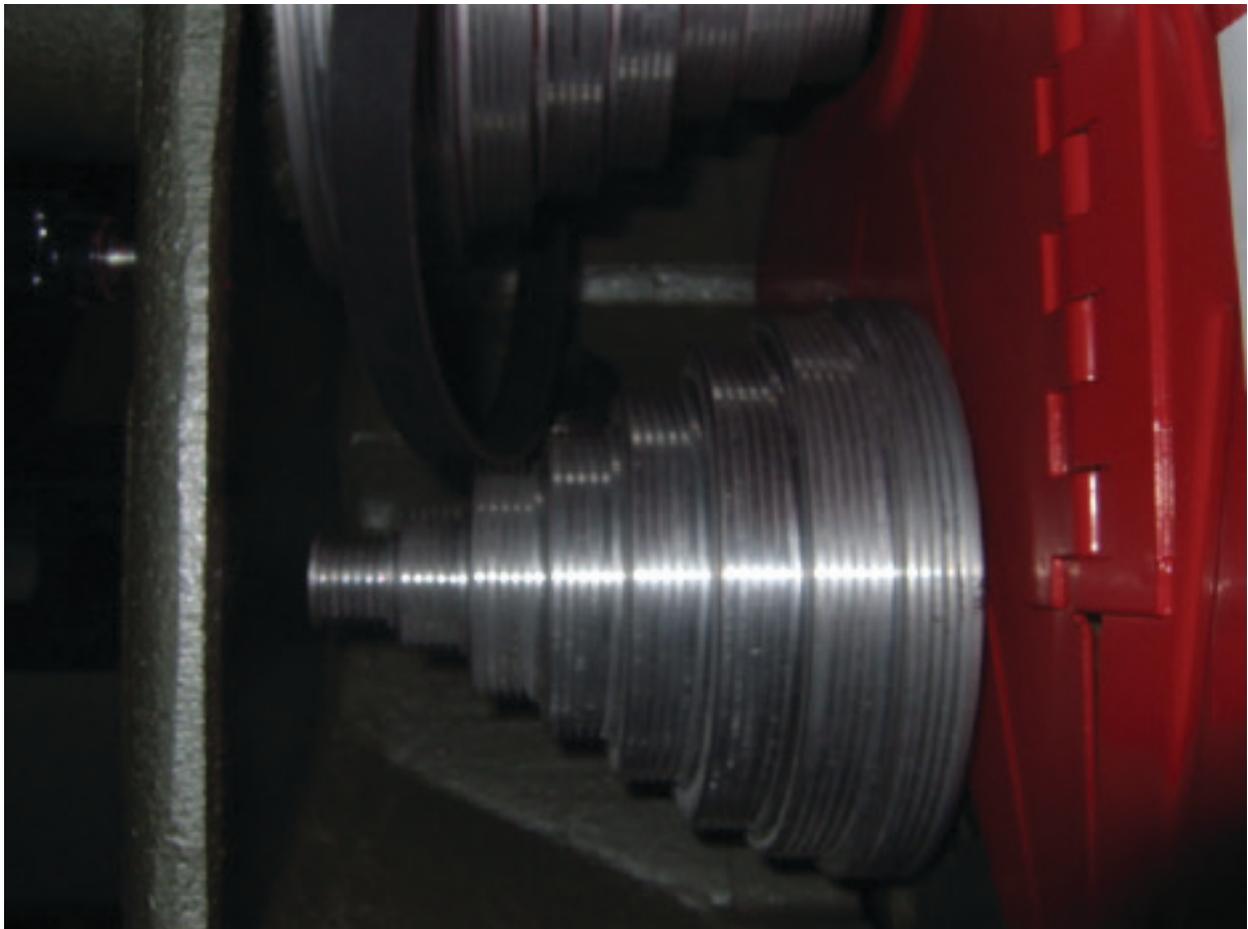
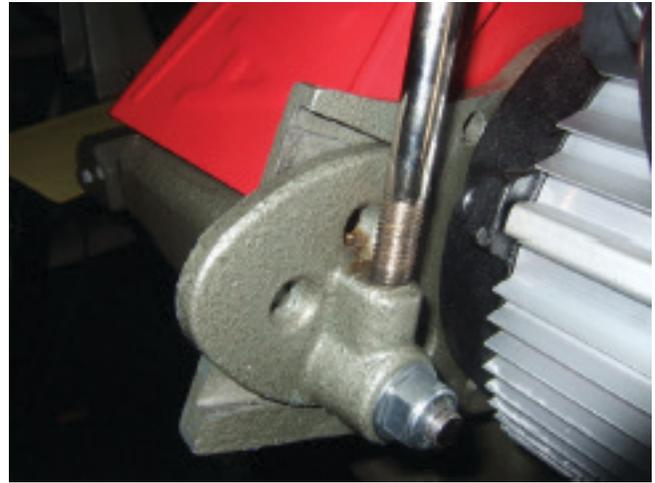
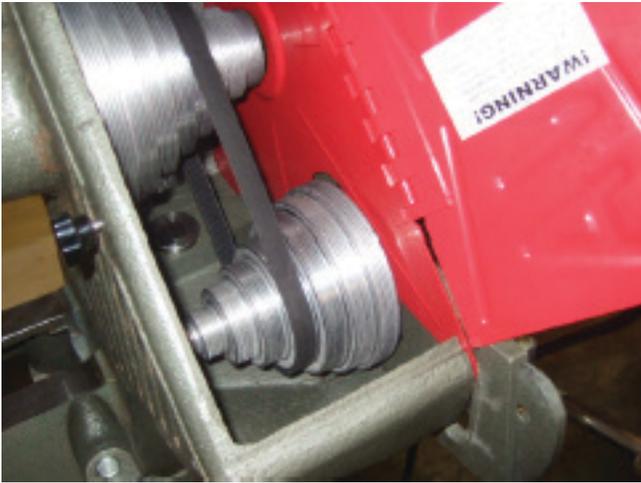
1 x Phillips Screwdriver



1. The first step for this process is to remove the plug from the wall to ensure you are safe when changing the motor.



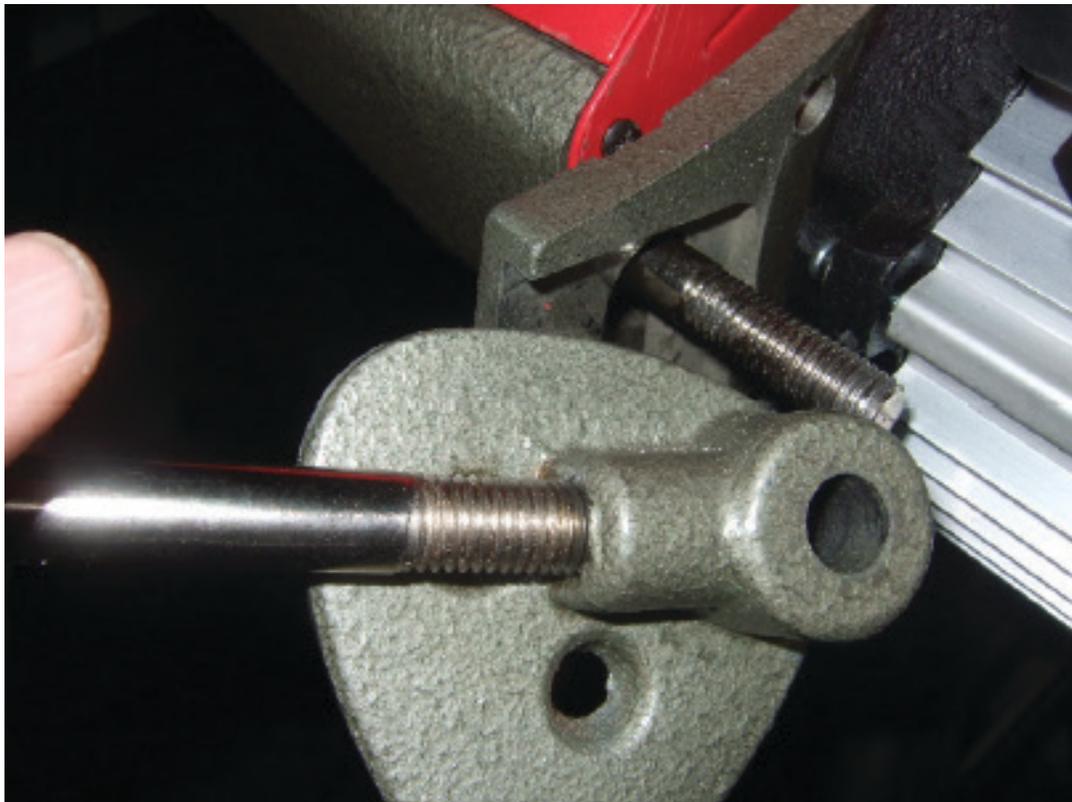
2. You need to open the red guard cover on the NOVA 1624-44 Lathe to expose the pulleys and belt. You will need to remove the belt from the motor pulley. This is achieved by moving the cam up to the position to remove the tension from the belt in order to lift the belt away from the pulley.



3. With the belt removed, now remove the two 19mm nuts and washers from the motor mounts, you will need to use a 19mm spanner for this.



Now remove the cam from the rear motor mount



After removing the two 19mm nuts, the two washers and the cam, leave the motor sitting in place. You now need to remove the red belt cover (guard) from the lathe.

4. The red cover is held in place by 6 phillips head screws, the first four are very easy to access and remove as can be seen below. The last screw is slightly hidden and can be found at the rear motor mount.



5. With the 6 screws removed you can now go ahead and remove the red cover from the lathe.



6. With the red cover removed you are now able to remove the old AC motor from the lathe. Be careful! This can be heavy.



7. Using the 4mm allen key, now remove the pulley from the motor. Also remove the key in the keyway. NOTE: This may require 2 standard screw drivers to gently pry off the pulley. Use at opposite sides underneath the pulley.



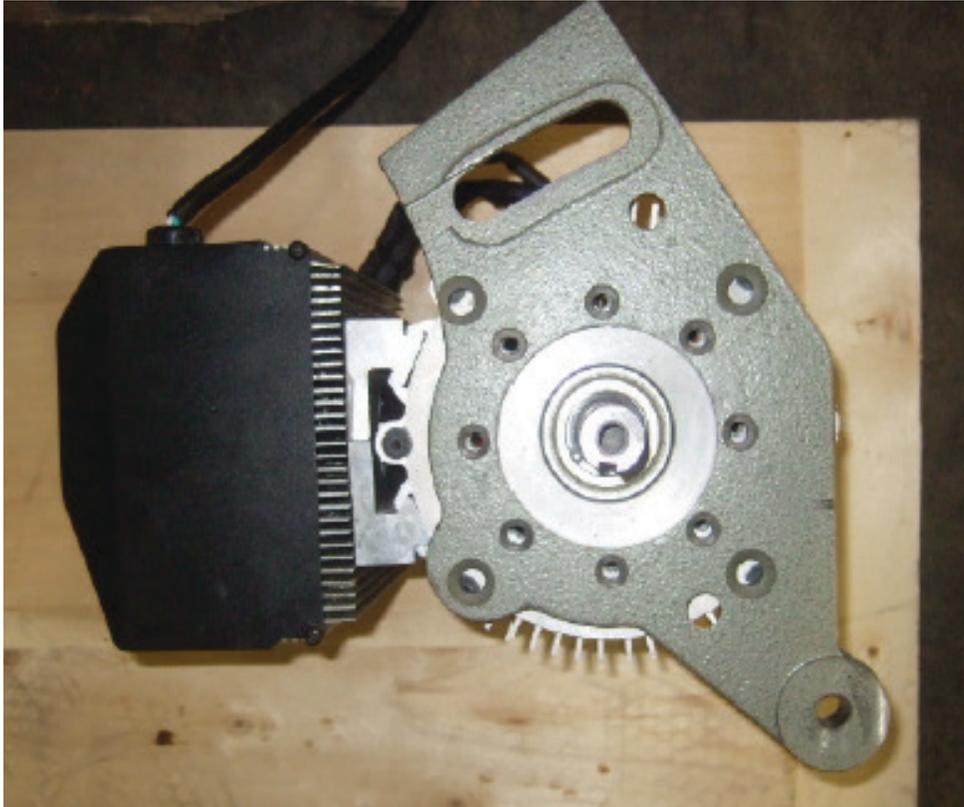
8. With the flange now exposed we will use the 4mm allen key to remove the 8 counter sunk screws that hold the flange to the motor.

9. Have the following parts removed from the lathe and laid out for easy reference as seen in the picture below:

- 1 x Red guard/ belt cover
- 1 x Motor pulley
- 1 x Flange
- 1 x Cam
- 2 x 19mm nuts
- 2 x Washers
- 1 x Key
- 6 x Guard screws
- 8 x Counter sunk screws that hold the flange to the motor.



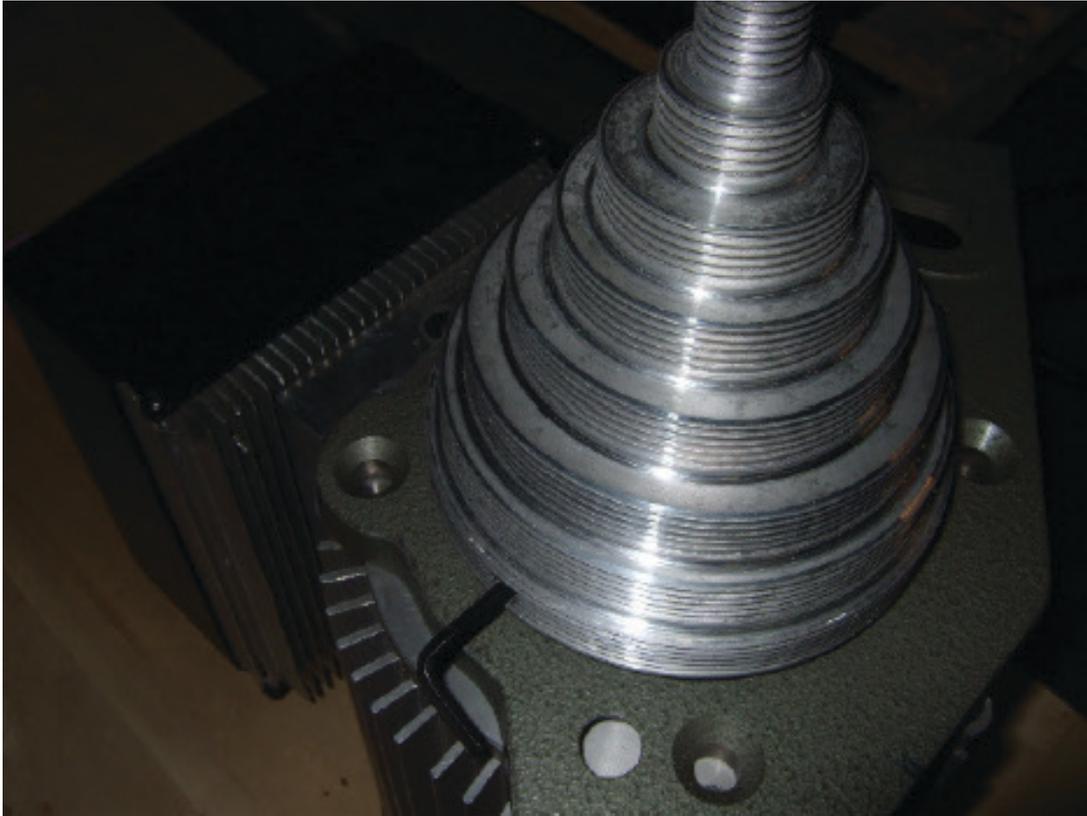
10. You can now start to assemble the DVR Package Drive onto the NOVA 1624-44. The first step is to place the flange onto the DVR Package Drive. **IMPORTANT:** Please not the counter sunk side of the screw holes should be facing upwards. Please line up the flange as shown in the picture, and then using the 4mm allen key, screw in all counter sunk screws.



11. Now place the key into the keyways of the DVR Package Drive motor spindle as shown in the picture below.



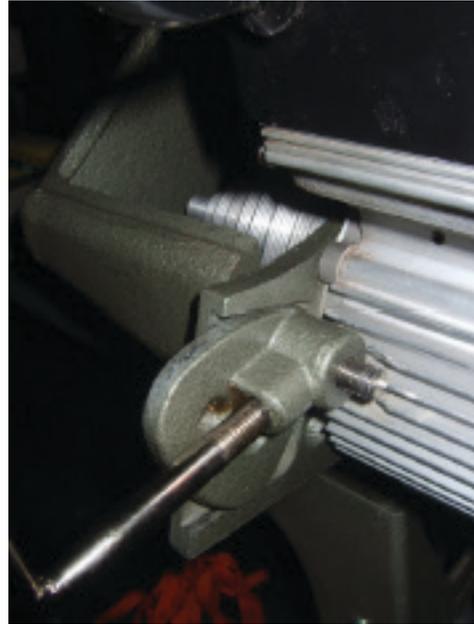
12. Place the motor pulley onto the DVR Package Drive and secure it into place by using the 4mm allen key to lock in the set screw. NOTE: A rubber mallet may be needed to lightly tap the pulley onto the spindle.



13. Place the DVR Package Drive onto the motor mounts.



14. Place the cam back onto the rear motor mount.



15. Now place the red cover onto the lathe and screw in the 6 screws to hold it in place. **IMPORTANT:** Remember to screw in the screw located near the rear motor mount.

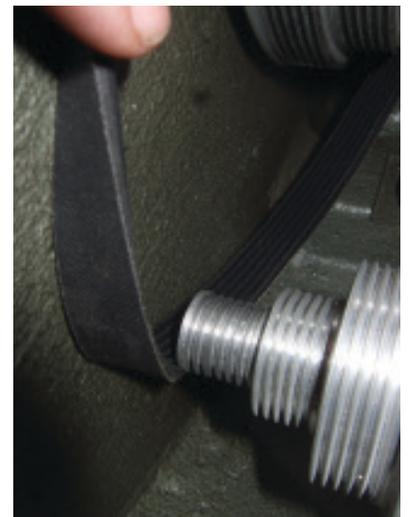
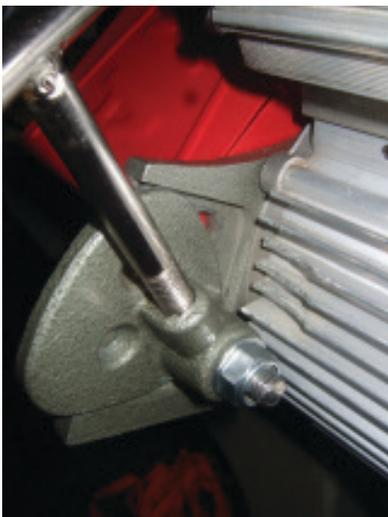


16. Using the 19mm spanner put back onto the two nuts and two washers on the motor mounts.



17. With the motor now attached to the lathe, all you need to do now is to place the belt back onto the motor pulley. This is exactly the same process as you would with the standard motor set up. First push the cam up to lift the motor, and then line the belt up on the correct pulley steps, and then release and lock the cam.

18. Recommended pulley position: For most turning requirements, we recommend that the belt is left on the 1440 RPM pulley position (see the front decal window on the front of your NOVA 1624-44 Lathe). For those customers that require more torque, the belt can be positioned on the pulley steps to the right (RH) of the 1440 speed position, ie positions 1440, 1020, 684, 360, and 214 RPM. **IMPORTANT NOTE: In no way should the belt ever be positioned to the left (LH) of the 1440 steps as doing so will cause excessive RPM and exceed the safety limits of the belt and pulley system. The belt can be positioned on the 1440, 1020, 684, 360, and 214 RPM positions ONLY.**



CONTROLLER USER'S GUIDE

1. OVERVIEW

The DVR integrated electrical drive system contains the DVR motor with the Rotor Position Sensor (RPS), the drive control board and the human-machine interface (HMI). The control board, RPS and HMI represent the control system of the drive. The DVR is connected with the control board by six power wires and RPS cable.

The control board contains power input devices - input rectifier, power factor corrector with the DC link reactor, three-phase inverter and the control circuit based on the 16-bit Infineon microcontroller.

The HMI contains the interface board, the LCD and keyboard. The interface board is based on the STM32 microcontroller and connected with the control board through the insulated serial RS232 interface.

Both microcontrollers have flash program memory. The interface board microcontroller also contains the EEPROM memory in order to change and store the drive parameters. The control system has been specifically designed for control flexibility and to provide optimal drive performance the DC link reactor, three-phase inverter and the control circuit based on the 16-bit Infineon microcontroller.

The HMI contains the interface board, the LCD and keyboard. The interface board is based on the 8051 family Atmel microcontroller and connected with the control board through the insulated serial RS232 interface.

Both microcontrollers have flash program memory. The interface board microcontroller also contains the EEPROM memory in order to change and store the drive parameters. The control system has been specifically designed for control flexibility and to provide optimal drive performance.

2. MAIN PARAMETERS AND FEATURES

- The motor type – Switched Reluctance Motor (DVR)
- Nominal operating output power –1.25 -1.5 kW (2 HP 220V)
- Power supply range: 115V - 230V / 50 Hz - 60 Hz
- Power factor correction: PF ³ 0.95
- Speed range: 50 – 5500 rpm
- Smooth speed setting by keys
- 4 preset (favorite) speeds with save function on the controller key board, a total of 10 preset speeds within menu.
- PI speed controller with adaptive coefficients
- 3 preloaded coefficient curves: SOFT, NORMAL and HARD
- Load inertia measurement for improving the PI speed controller coefficients
- Reverse function
- Torque and speed ramp functions
- Overload protection
- Under-voltage / PFC fault protection

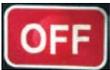
3. HUMAN MACHINE INTERFACE DESCRIPTION

The Human Machine Interface (HMI) provides a flexible choice of the drive parameters: run/stop, motor speed, direction of rotation, PI speed controller coefficients. HMI contains 2-lines, 16-position LCD display and keyboard. The drive parameters can be set by decreasing/increasing values incrementally. Some parameter values can be stored in the EEPROM of HMI.



FIGURE 1: Keyboard view

4. KEY BOARD DESCRIPTION

Key View	Short Description
	-Start Key- -run the motor-
	-Stop Key- -stop the motor and reset the system-
	-Fwd / Reverse Confirm Key- -change the direction of the motor rotation-
	-Menu Key- -access the menu to set parameters-
	-Short Cut Key F1- -quick access to first pre-set speed-
	-Short Cut Key F2- -quick access to second pre-set speed-
	-Short Cut Key F3- -quick access to third pre-set speed-
	-Short Cut Key F4- -quick access to fourth pre-set speed-
	-Rotary Dial- -change speed-

5. CONNECTING TO POWER

The power cord should be 3-wire, having a grounding conductor and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with local electrical codes.

! Warning! Improper connection of the motor can result in a risk of electrical shock.

If it is necessary to use an extension cord, the cord should be grounded. Use the correct wire size for the extension cord, for a given cord length, to avoid power loss and over-heating.

! IMPORTANT: A Surge Protection Device rated to at least 15 amps - for USA and Canada, other countries 10 or 15 amps - must be used to protect the DVR electronics from electrical spikes or surges, similar to those used on most Home PC's. Ground Fault Interrupters (GFI's) or Residual Current Detectors (RCD's) are helpful and are a recommended protection device for any powertool. Note some makes of GFI may not be compatible.

6. PREPARING THE MOTOR AND CONTROLLER

The motor connects to the controller, so only one power cable is necessary. In order to connect the motor to the controller the Molex Connector and the DB 9 Connector have to be attached. The Molex Connector is located on the left and only needs to be plugged in (see Fig. 1.1 - 1.2). The DB 9 Connector is located on the right and needs to be tightened in place with a small flat head screw driver (see. 1.3).



Fig. 1.1: Unconnected Molex Connector



Fig. 1.2: Connecting Molex Connector



Fig. 1.3: Connecting DB 9 Connector

The motor controller is fully connected to the motor once both, the Molex Connector as well as the DB 9 Connector are attached (see Fig. 1.4).



Fig. 1.4: Molex and DB 9 Connector Connected

7. FAVORITE SPEEDS / PRE-SET SPEEDS



Fig. 2.1: Start screen

Start screen upon switching on the motor by pressing the red start button on the right side of the controller. (See Fig. 2.1)



Fig. 2.2: "Fav. Speed" highlighted

Press the "Menu" button to enter the menu. Hit "Confirm" to enter the "Fav. Speed" menu which should be highlighted dark in comparison the other menu options. (See Fig. 2.2)



Fig. 2.3: Select between fav. speeds

Here the user can select between ten favorite speeds by turning the rotary dial. Confirm desired speed by hitting the "confirm" button. That will start the motor at the specified speed. (See Fig. 2.3)

The user is also able to change pre-set speeds by selecting "Edit Value". (See Fig. 2.4)



Fig. 2.4: Changing pre-set speeds



Fig. 2.5: Confirming 750 rpm speed setting

This will bring up a new screen asking to confirm the new saved rpm. E.g. the following figures show the editing of pre-set speeds of 750 rpm and 1250 rpm (see Fig. 2.5 - 2.7).



Fig. 2.6: Editing preset speed of 750 rpm



Fig. 2.7: Confirming 1250 rpm speed setting

8. STEPPER FUNCTION



Fig. 3.1: Stepper item highlighted

The second selection item on the menu display is the stepper motor function (see Fig. 3.1). Selecting this item will transform the motor into a stepper motor (see Fig. 3.2).

The stepper function enables the user to step the spindle forward by manually moving the rotary dial (see Fig 3.3) in either forward or reverse.



Fig. 3.3: Rotary Dial - move to left or right



Fig. 3.2: The motor is now ready for stepper control

9. ACCELEROMETER



Fig. 4.1: Expanded I/O menu

The third selection item on the menu display is the accelerometer. In the expanded I/O menu it will list the Accelerometer and other sensors / devices that are added in the I/Os (see. Fig. 4.1).

The accelerometer will bring up the value of the configuration (see Fig. 4.2).



Fig. 4.2: Configuration Value

10. POWER BRAKING



Fig. 5.1: Power Braking highlighted and turned off.

The fourth menu item is the power braking function (see Fig. 5.1 / 5.2). Here you can turn the ability to brake on and off, allowing the motor to not just coast or brake (see Fig 5.3).



Fig. 5.3: Brakes Engaged



Fig. 5.2: Power Braking highlighted and turned on.

11. PROGRAMMED CYCLES



Fig. 6.1: Programmed Cycles highlighted

The next item on the menu display is "Program Cycles" where all your programmed Cycles are stored (see Fig. 6.1).

If there is a software update with newly added cycles, the new cycles will be displayed under "Full Demo" (see Fig 6.1).



Fig. 6.2: Added Cycles will be displayed under "Full Demo"

12. MOTOR CONFIGURATION



Fig. 7.1: Motor Configuration item highlighted

Motor Config will serve the user to select the minimum and maximum rpm (see Fig. 7.2), and the $ktint+/-kprop$ (see Fig. 7.5). The user can also adjust the speed ramp (see Fig. 7.3) and torque ramp. There is a total of five different configuration screens that you can select with the speed dial button (see Fig. 7.2 - 7.5).



Fig. 7.2: Config 1 - max / min speed



Fig. 7.3: Config 2 - custom speed ramp



Fig. 7.4: Config 3

Fig. 7.5: Config 4 - $ktint+ / kprop$ 

Fig. 7.6: Config 5 - temperatures

13. USB MODE



Fig. 8.1: USB mode highlighted

The DVR controller offers a USB mode which is the seventh item on the menu list (see Fig. 8.1). Under this item the USB mode can be turned off and on (see Fig. 8.2).



Fig. 8.2: Turn USB mode on / off

14. VERSION INFORMATION



Fig. 9.1: Version Info item highlighted

The last menu item to select on the controller screen is "Version Information" (see Fig. 9.1) which informs you about the version number of your HMI board (see Fig. 9.2).



Fig. 9.2: HMI board info

15. THERMAL RESET SWITCH



Fig. 10.1: Thermal Reset Switch

Next to the DB 9 Switch the user can locate the thermal reset switch (little black button - see Fig. 10.1). The thermal reset switch is a braker in the event that the controller runs too hot. The switch will automatically flick out if the controller heats up too much. As a result the motor and controller come to a halt.

The user can flick the thermal reset button back in at any time (see Fig. 10.2).

If required, the user can remove the fuse with a flat head screw driver (see Fig. 10.3).

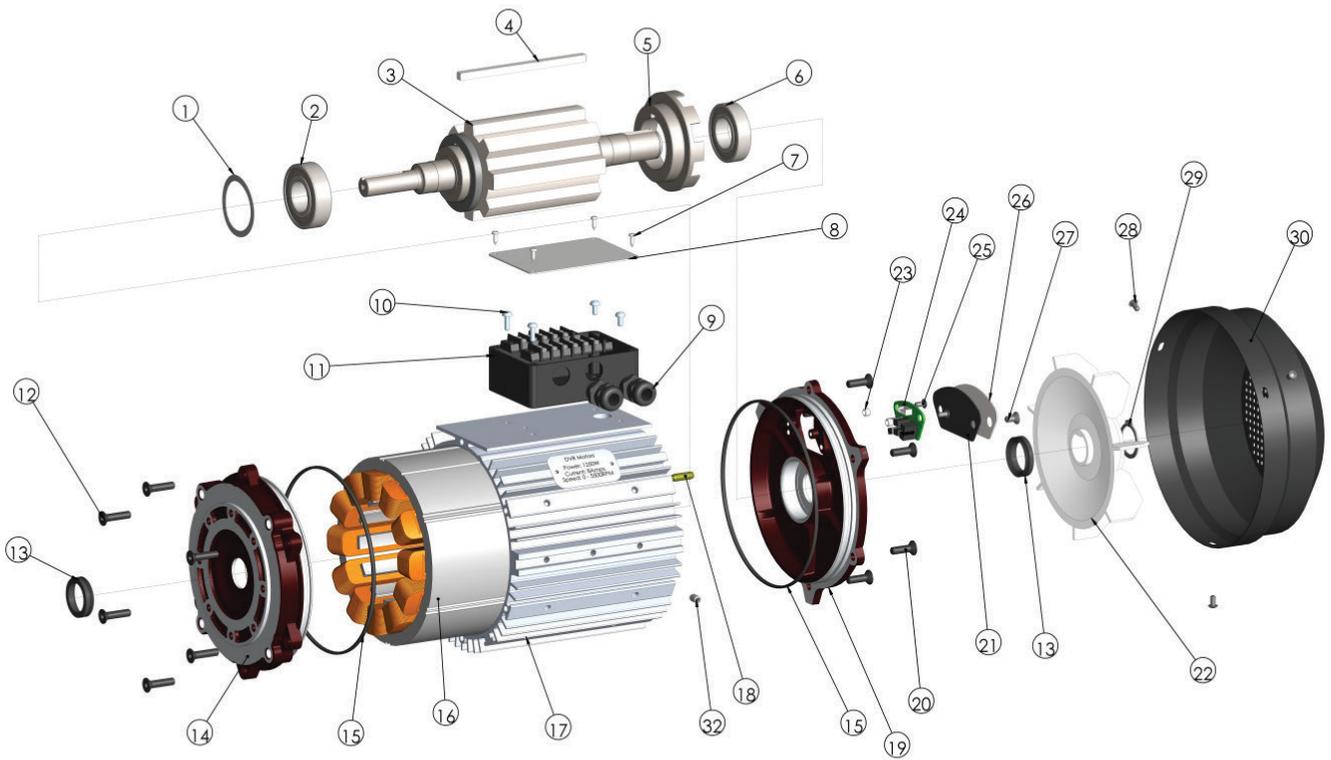


Fig. 10.2: Flicking Thermal Reset Switch back



Fig. 10.3: Removing Fuse

16. EXPLODED DRAWINGS



17. BILL OF MATERIALS

Item No.	Part No	Description	NEMA 56C / QTY.
1	BWW-50	50MM Wave Washer Spring Master EPL048	1
2	6205-2Z	Bearing	1
3	P03-670-001	Rotor Assembly	1
4	P03-670-039	Rotor Key	1
5	P03-670-013	Rotor Position Disk	1
6	6005-2Z	Bearing	1
7	SPP-AB	No.4x3/8	4
8	P03-670-043	Terminal Box LID	1
9	-	Cable Glands Metal - M16	2
10	MPB0412	Screw	2
11	P03-670-037	Terminal Box	1
12	K0625	Screw	6
13	25 VA R	V-Ring Shaft Seal	2
14	P03-670-016	B14 80C Front Endcap	1
15	P03-670-040 162 Oring		2
16	P02-670-025 DVR Stator	Stator	1
17	P03-670-036	Stator Shell Machined	1
18	Spring Pin Diameter 6x18		1
19	P03-670-015-B	Rear End Cap	1
20	Countersunk Head Cap Screw M6 x 20		6
21	P03-670-041	Sensor Cover Gasket Adhesive	1
22	P03-670-046	Motor Fan Y2 90 4 6 8P model	1
23	6x4.3x6.75	Dowel	2
24	P03-670-012	Position Sensor	1
25	Button Head Socket Screw M4 x 8		2
26	P03-670-031	Sensor Cover Plate	1
27	Countersink Head Cap Screw M5 x 10		2
28	Button Head Socket Screw M4 x 8		3
29	ECC 24	ECC 24	1
30	P03-670-044 Fan Cowling OTS		1
31	G0610	Set Screw	2



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