CL series

HIGH PERFORMANCE SPEED CONTROLLER
HIGH TORQUE VARIABLE FREQUENCY MOTOR

USERS MANUAL

Installation and operating instructions for CL400 and CL750 series lathe and milling machine speed controllers.

!!PLEASE READ THESE INSTRUCTIONS CAREFULLY PRIOR TO USE!!

NEWTON TESLA

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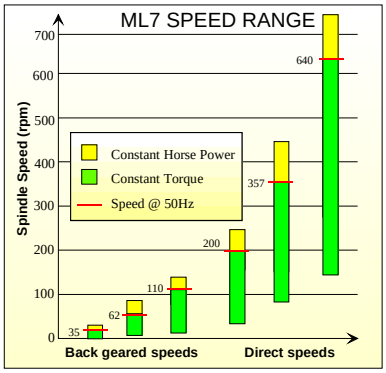
Installation and use instructions for the CL400 & CL750

Thank you for purchasing a CL series speed controller from us, we trust you will find variable speed indispensable once you have started using it.. These instructions have been written around a typical installation on a Myford type lathe and should be used as guide only for other machine installations..

The chart below gives you an idea of how variable speed gives the best flexibility from your machine. The red lines indicate the speeds available on a typical Myford ML7, as you can see with speed control each of those fixed speeds becomes infinitely variable over a 10:1 range.
For example the lowest direct belt speed of 200 RPM can be varied from 20 to 220 REVS with full motor torque available.



The chart (opposite) shows the typical speed ranges possible on a standard Myford ML7 fitted with our inverter & new motor but with the original motor pulley fitted.

0 - 1780 RPM motor speed.

Unpacking and inspection.

Carefully unpack the new three-phase motor and the CL series speed controller.
Every care has been taken to make sure it arrives in good condition but you should examine it now to make sure no damage has been caused during transit. If there has been any damage to the motor or it's controller in transit, you should notify us immediately and not proceed any further with the installation.

FREE 10 YEAR WARRANTY

Your CL400/ CL750 controller is covered by a free 10 Year Warranty.
In order for your CL controller to be registered for this cover, you will need complete the FREEPOST warranty registration card provided in an envelope attached to the CL controller. Once completed this should be posted to the FREEPOST address printed on the reverse side of the card

The 10 Year Warranty applies to the CL controller only. Motors supplied with the CL systems are covered by the manufacturer's standard 12month warranty.

Full terms and conditions about the 10 Year Warranty can be found in the leaflet that accompanies the registration document, and are also available from our website: www.newton-tesla.com

Functional test.

Before proceeding to install your new motor and speed controller on your lathe you should first carry out a quick functional test of the equipment. Place the motor on a firm level surface with the motor

shaft facing towards you.
Carefully plug the motor with its attached cable into the multi pin socket on the underside of the speed controller making sure that it is fully inserted, it has a keyway and can only be fitted one way round.

Make sure the controls are set for the functional test as follows;

Motor Plug & socket

Forward / Reverse.	Forward selected
Emergency stop	Pushed in!
Speed potentiometer	Fully anti-clockwise. (JOG position)

Now plug in the attached three-pin plug into a 13-amp socket outlet and switch on at the socket.
Un-twist the red emergency stop pushbutton (anti-clockwise) allowing the stop to spring upwards into its normal position.
Push the green "start" push button and the motor should rotate at its JOG speed setting.
Note the motor only runs while JOG is selected for as long as the green button is held pushed and stops as you release it, this is normal. Now check for correct motor direction***.*** *For **Myford series lathes** the motor should rotate in a **clockwise direction** when viewing the motor drive shaft face on*. If you are using your controller on other machines forward direction may differ.
If direction is wrong for your machine please check with us for advice.
Let go of the start button and the motor will stop.
.
Now increase the speed potentiometer clockwise from the JOG position, a click will be felt, now when you press the green button the motor continues to run after you let go of the green button, increase the motor speed to it's maximum checking that the motor runs smoothly and is making no unusual noises. Note that some amount of bearing noise is quite common at this stage as the pre-loaded grease will not yet be distributed evenly around the bearings.

Finally press the "normal stop" button causing the motor to decelerate to a standstill before finally pressing the emergency stop. You can now unplug from the mains and unplug the motor cable from the controller. Your functional test is complete and you can now proceed with the installation on your lathe.

Installation - General Notes

IMPORTANT SAFETY NOTICE

Whilst the installation of your new motor and it's speed controller should be quite straightforward you will need to remove the original motor and its' wiring from the lathe first.
If you have any doubts about your ability to do this safely then you must stop and consult a qualified electrician to do the work for you!

If your lathe has additional electrical equipment such as a suds pump or halogen lighting you will need to separate those circuits from the motor power wiring, if you are unsure how this can be done then you must always consult a qualified electrician.
First make sure that your lathe is disconnected from all sources of electrical power, unplug it's power cord from the mains and coil it up so that it can not be plugged back in again accidentally.
Note; while removing any wiring or disconnecting any wires on your lathe you should make a note of where they went in case you want to remove the speed controller and refit the original equipment later on for any reason.

Installation of the Motor

Disconnect the existing motor cable from its reversing drum controller or power switch box, leaving the cable attached at the motor end.
Slacken the motor belt tensioning handle on your lathe so that the belts are quite slack.

Unbolt the existing single-phase motor and carefully remove the motor, the motor is heavy and you may require an assistant to help you.
Slacken the grub screw holding the motor pulley to the motor shaft and remove the pulley. Set the old motor to one side.

Remove the tape holding the key in the key way of the new motor and carefully clean the motor shaft with a soft cloth moistened with white spirit to remove any adhesive or anti rust treatment. Refit the key into its' key-way, do not shorten the key as the motor has been balanced with a full key.

Carefully fit the motor pulley to the new motor making sure the key way is aligned properly. The pulley should be a good fit onto the shaft with no looseness but should not need to be fitted with excessive force, tighten the grub screw.
Bolt up the new motor to the mounting bedplate but do not tighten fully until the motor belt has been aligned with the lathe counter shaft pulley.

The Myford bedplate allows plenty of adjustment of the motor body. When you are happy that everything is aligned properly, the motor can be bolted down fully.

New Resiliently mounted 56-frame motor – as fitted to Myford Super 7 lathes.

Operate the countershaft belt-tensioning device which will take up

Tensioning the motor drive belt

the slack in the motor belt, check the belt alignment again carefully. At this point the weight of the motor alone will be tensioning the motor belt as it pivots with the bed plate, a little additional down force can be applied to the motor whilst at the same time the bed plate locking device is tightened. The motor belt should now be correctly tensioned.
Do not over tension the motor belt, it is unnecessary and places undue side thrust on the motor and countershaft bearings leading to premature wear.

At this point check that everything is correct and that the motor shaft and pulley does not foul the belt guards. Note that on the Myford Super 7, you should take care to refit the motor splashguard. The guard might need modifying slightly if it fouls the cable entry of the new motor.

Installation of the Inverter Controller:

Now that the motor has been fitted, you should fix the inverter controller to the lathe stand on the left hand side with 4mm screws and nuts.

Finally, plug in the motor plug into it's socket at the bottom of the controller, if there is any excess motor cable it can be made into a loop and taped neatly at the rear of the motor.
Take the attached 13 amp plug and plug it into a 13-amp wall socket and your lathe is ready to use with your new speed control.

Inverter controller shown fitted to Myford ML7

Instructions for use.

Please now completely familiarise your self with the controls to avoid any problems later on.

New variable speed three phase motor (motor supplied may differ according to lathe model)

Congratulations! Your lathe now has a high torque industrial grade three phase induction motor that along with its speed controller (Variable frequency drive) will make your lathe much more pleasurable to use. When you use your machine you will be amazed at how smooth it has become, gone are the vibrations, humming and rattles that your old single-phase motor created.
Each time you start the lathe it now starts progressively and smoothly without any jolting, jarring and snatching of the drive train. The speed controller smoothly accelerates the motor to the desired speed and there are no large currents whenever the motor starts unlike your old motor that could easily peak at 40 amps during start up, that's why single phase induction motors can be notoriously short lived!

Now please read the remainder of the manual carefully, the new drive system will easily deliver full motor torque at $10^{\%}$ motor speed so you need to exercise as much caution when the motor is turning slowly as at full speed. Learn firstly how to start and stop the motor normally or in an emergency, this is essential for your own safety.

Description of the controls.

Emergency Stop.

Pushing this will cut off all power to the inverter and the machine will coast to a standstill. To release the stop button, the head is turned clockwise allowing it to return to its' normal position. The machine can then be restarted with the green start button.

Important note: The emergency stop push button should only be used for emergencies, or for example to provide safe power disconnection when setting change wheels for screw cutting or changing the lathe chuck etc. For all other situations use the "normal Stop" push button. ***Repeated use of the emergency stop button (several times over a few minutes) may cause damage to the inverter power circuits and should be avoided.***
When you have finished working with your lathe, push in the emergency stop button and switch off at the mains socket.

Stop button.

The red "normal" stop push button is to be used for all non-emergency stops. For example to measure a diameter on the work piece, to remove a work piece from the lathe chuck or to change a cutting tool. There is no limit to the number of times you can start and stop the motor using the normal stop push button; no damage will result to the inverter or motor.

Start button

The green start push button will cause the motor to run at the selected speed when the green button is released the motor will continue to run until stop button is pushed. Note that it is not necessary to decrease the speed to minimum before starting. The start button is also used in conjunction with the "JOG" setting.

JOG position selected.

With the rotary speed control in the JOG position, the motor will run at a pre-selected low speed only while the green button is pressed. JOG function is useful for setting a four jaw chuck or for checking clearances on an irregular shaped casting bolted to a faceplate. You can use JOG as frequently as you want with no adverse effects.

Forward / Reverse selector switch.
This switch determines the lathe chuck direction, forward or reverse as selected on the switch.
If the switch is operated whilst the motor is running the direction change is ignored until start button is pressed again or the stop button is pressed and then the machine restarted.
Take care when using reverse as some chucks can unscrew themselves from the lathe spindle.
Reverse is provided for convenience, for example to reverse out a tap held in the tailstock.

Motor speed dial.
This is the main speed control dial. The dial is graduated in motor speed, the colouration red through to green is to indicate that at low speeds motor cooling is reduced therefore continuous low speed running at high loads should be avoided. In practice though, the speed controller will protect the motor from overheating or overloading.
When running above 800 RPM motor cooling is sufficient to allow the heaviest loads that the machine is capable of without the motor overheating.
If you are concerned that the motor is becoming too hot then select a lower gear / belt pulley and run the motor faster to give the same chuck speed as before.

Most lathe work involves a series of cutting operations at low to high speed, stopping and starting, measuring, changing the work piece etc. In exhaustive testing on our own Myford ML7 we rarely caused the motor to become more than hand warm!
In practice, the motor is designed to run if necessary at temperature rises of 105 Deg.C above an ambient temperature of 40 Deg.C without any ill effects

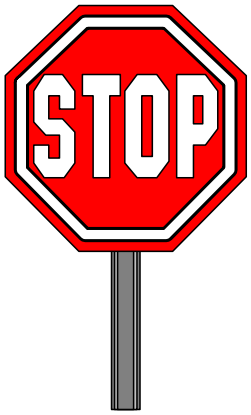
Lathe belt changing and back gear setting.
Depending on the job to be done, you should select the most appropriate belt speed.
Far less belt changing needs to be done with speed control and many jobs can be turned at slow speed without even using the back gears but you should always strive to have the lathe in a belt position which allows the motor to run quickly enough for its' cooling to be effective, this is more important when carrying out lengthy machining operations at low speed.
Over a short period of time you will quickly become familiar with what can be achieved and probably find that a middle range belt speed in conjunction with speed variation suits 80% of your machining needs.

Protection.
Your speed controller has been pre-programmed with all the motor parameters and will protect the motor against overloading. It is also protected against under or over voltage, over current, over temperature and short circuits on the motor output side.
To avoid an inverter trip, reduce the load on the motor by reducing the depth of cut or by changing into a lower belt (or back gear) speed.
If a trip does occur, simply press the emergency stop, wait for about 30 seconds and then release the emergency stop. The inverter can now be restarted.

Lathes fitted with Clutches.

Where a lathe has a clutch mechanism fitted on the countershaft allowing disengagement of the drive train from the motor it is perfectly possible to engage or disengage the clutch at will after the variable speed has been fitted. However care should be taken when running the motor at low revs that it is not idling for long periods of time with the clutch disengaged, your new three phase motor suffers no ill effects by frequent stopping and starting and should be stopped if the machine clutch is disengaged for any length of time to prevent heat build up at low speeds.
The clutch may be left permanently engaged if preferred and the controller used to start and stop.

!!! SAFETY FIRST!!!



1. **Always use eye protection when using your lathe.**

2. **Never allow the speed controller or it's controls to become wet.**

3. **Keep swarf and cutting oils out of the motor ventilation slots and end shields.**

4. **Switch off the main power when not in use.**

5. **Do not allow the motor cable or power lead to become damaged or frayed.**

6. **Do not try to dislodge any swarf or material from inside the motor body at any time unless the power is completely switched off. High voltages exist within the motor even when the motor is at standstill!**

7. **Do not try to disassemble the speed controller; there are no fuses or user serviceable parts within the steel box. If there is a problem with the controller please phone first for advice.**

Trouble shooting.
The inverter will not run
Is the power plug pushed into a good working socket?

Is the motor plug inserted into its socket at the base of the speed controller?
Is the emergency stop button released? It has a stay put action when pushed in, turn the head counter clockwise to release it.
Check the fuse in the moulded 13-amp plug supplied with the speed controller, it may have blown if the emergency stop button has been used frequently to power down the system. If so fit another fuse of the same type and try again. If the fuse blows repeatedly there may be a problem with the inverter requiring attention at our workshop. Please phone for advice.

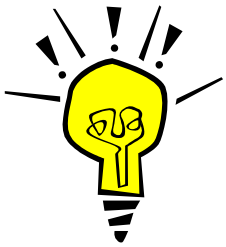
The motor appears noisy or a regular knocking noise is heard from the drive train, which gets worse as the machine speeds up.
Check that the drive pulley is a good fit on the motor shaft, any looseness of the pulley or grub screw holding the key in position will cause a knocking noise.
Check that the belts and pulleys are lined up properly and that the motor and headstock drive belts are in good condition with no tears or splits.
Make sure that the motor shaft and motor pulley are not fouling the belt guards and covers.
Make sure the motor and headstock belts are not over tightened.
If none of the above faults are found, remove the motor drive belt and run the motor in "Jog" mode, hold down the green start button and observe the motor pulley, it should rotate smoothly without any tendency to jerk or pulsate, if any pulsation's are visible or if the motor vibrates then there may be a problem with the motor or it's speed controller.

The inverter runs but trips after several minutes.
The inverter protective function has an inverse time reaction, simply this means that a very high overload greater than 150% causes the inverter to shutdown after a few seconds whilst an overload of say 110% takes several minutes. The rating of the inverter and motor is such that you are unlikely to experience any overload tripping during normal operation.
In the event of a severe machine "lockup" the inverter will trip instantly if the motor current exceeds 200% helping to limit damage to your lathes drive train.

The motor does not continue to run when the green start button is released.
The speed dial is in the JOG position, move it clockwise and try again.

Maintenance
Your speed controller should need no maintenance apart from keeping the outer box and controls clean.

The motor has 'lubricated for life' bearings, thus all that is required is to keep the motor clean and free from swarf.
In normal operation the controller should produce very little heat due to its high efficiency.



Variable frequency control.
By using a variable frequency controller all the advantages of a three-phase motor are retained and utilised to the full.

Now that the price of compact variable frequency drives (inverters) have reduced significantly it has become attractive to fit these devices to machinery in the home workshop giving full speed control from 240VAC mains. However the home machinist cannot be expected to have the necessary skill to install and connect an industrial inverter to a machine tool in a safe manner whilst also have the ability to program the inverter to suit the job expected of it.
To remove these potential problems we decided to design a complete pre-wired system comprising three-phase motor, Mitsubishi inverter and controls. The inverter with controls to be housed in a strong steel box requiring no setting up and no programming.

Your Lathe speed controller is primarily designed for the Myford ML & Super7 series lathes but can be used on other lathes (Raglan and Boxford's etc) and small milling machines such as the Tom-Senior, where the motor capacity does not exceed 1HP (0.75KW)
We decided on two power ranges, 0.4KW (½ HP,) and 0.75KW (1.0 HP) to suit Myford ML7 and Super 7 lathes. We have given the two models part designations; CL400, CL750 according to the motor power.

What is the efficiency of the inverter?
About 97% efficient!

What is the overall efficiency of the inverter and it's three-phase motor?
About 85% depending on the load, the greater the load the more efficient the system becomes.

What is the life expectancy of an inverter?
We supply Mitsubishi Electric inverters to industry up to a massive 900KW, they have to run 24 hours, 365 days a year without stoppages in all kinds of hostile environments. Many of these inverters date back to when we started the company back in 1987. The inverters we supply to model engineers are the same as those supplied to our industrial users so you can expect many years of trouble free usage

If you experience any problems with your speed controller, need advice or have any comments or suggestions on how we can improve our products, then please do not hesitate to contact us.
We will always be pleased to hear from you.

Newton Tesla Electric Drives Limited. Updated- 03/01/2006