TROUBLESHOOTING THE **DIGITAL COPIER**

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Course Overview

1.1 Why Teach Troubleshooting?

Technicians face problems every day that may have an impact upon performance and productivity. Job performance can be significantly improved by addressing the way in which problems are dealt with. Generally technicians acquire techniques for Troubleshooting by trial and error, but they do not often get the opportunity to learn and practice a set of skills that aid Troubleshooting. This CD-ROM, 'Trouble-shooting the Digital Copier' will provide this opportunity.

Initiating and following a systematic troubleshooting process in the search for a solution will result in performance and productivity improvements. The goal for any technician is to solve problems in the most complete, long-term way. This result can be achieved by a process that involves:

1. Fully understanding the problem
2. Developing a variety of possible solutions
3. Evaluating these solutions against factors that will influence their effectiveness
4. Choosing the most appropriate solution
5. Correctly implementing the solution

"It is a mathematical certainty that you will solve any reproducible problem" In other words, if it has worked before, you can make it work again. Approaching the troubleshoot-ing process with a clear mind, and thinking positively about the problem will produce results.

Course Overview

1.2 Course Objectives

- To teach Troubleshooting strategies, tactics and logical problem-solving approaches
- To teach the eight Konica steps to successful Troubleshooting
- To give instruction on how to use relevant tools and technology
- To demonstrate how correct procedures assist in solving problems
- To dispel common Troubleshooting myths

The Anatomy of Troubleshooting

2.1 Definitions

“Trouble”

If you refer to a dictionary the definition is something like:

- A condition of pain, suffering or malfunction. In the context of the copier, the word “Trouble” implies that something has gone wrong or that something is preventing it from operating as it was designed to.

“Troubleshooter”

Is usually thought of as one of the following:

- A person who hunts for and locates the causes of malfunctions and takes action to eliminate or clear them
- A person who locates the cause of trouble and removes or treats it
- A person who locates and repairs breakdowns

The Anatomy of Troubleshooting

2.2 The Purpose of Troubleshooting

- To quickly and effectively isolate the source of the malfunction
- To replace probability with certainty
- To return equipment to full operation as quickly as possible

The Anatomy of Troubleshooting

2.3 Troubleshooting Myths

“Great Troubleshooters are born, not taught”
WRONG! This is simply not true.
Troubleshooting can be greatly improved by following a systematic set of procedures along with having a positive attitude.

“Either you can Troubleshoot or you can’t”
WRONG! Some of us may be better than others, but this does not mean that you can’t improve your skills.

“Troubleshooting is model dependent”
WRONG! No matter what the model you are troubleshooting, with the correct procedures, technical training and a positive attitude, you will ensure yourself a positive outcome.

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

1. Have the correct attitude
2. Gather facts to define the symptoms
3. Attempt to recreate the problem
4. Consider possibilities based on facts
5. Localise the problem
6. Take the appropriate action to clear the trouble
7. Test
8. Inform and/or instruct the customer

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

2.4.1

Step 1: Have The Correct Attitude

This is the first and most important step in Troubleshooting. Having the correct attitude will help you to succeed – you cannot solve a problem unless first, you want to solve it, and second, you believe you can solve it.
The correct attitude will encourage open communication channels between you and the customer, vital when gathering facts to define the problem

2.4.2

Step 2: Gather Facts To Define The Symptoms

This process begins from the time the technician takes the service call and is, when the following information is generally collected:

- Machine location
- Machine model and serial number
- Description of the fault
- Meter reading
- Key operator name
- Whether a preventative maintenance (PM) is required
- The nature of the last service call on the machine
- Name of the last technician who visited the machine

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

Upon arrival at the reported machine, you should aim to gather as much supplementary information of relevance as possible. There are two obvious sources of information, the operator of the machine who reported the fault, and the machine service history.

The Customer

On arrival at the site, introduce yourself to the person who placed the service call. This initial encounter sets the tone for the rest of your interaction, so it is vital you convey a professional approach – remember that the customer will be making judgements about your friendliness, concern and ability. A professional, yet friendly approach will make the task of gathering facts that much easier for you – a customer who feels a part of the solution is more likely to reveal valuable information that may aid the Troubleshooting process. Customer interaction is vital because:

- The customer can be a rich source of information
- Their view of the problem may provide an invaluable insight
- The person operating the machine can sometimes be the source of the problem
- It may help you lessen the risk of fixing the wrong problem
- It will help to give you a clearer picture of the customers perceived problem

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

Asking the customer open questions ("Tell me what happened?") allows them to respond freely, to provide information they think is relevant or useful, which may or may not be the case. Open questions are usually a good way to begin gathering facts, but may not be so useful when you need to focus on specifics.

Closed questions limit the responses to a "yes" or "no" ("Did it make a noise before it stopped?" or "Has it ever done this before?") and let you take control of the conversation and focus on a direction that you think may lead to results.

Some of the open questions you might ask include:

- "When did the problem start happening?"
- "What indicates to you that there is a problem?"
- "How often does it seem to happen?"
- "Can you give details of any error messages, indicator lights or other abnormalities that you may have noticed?"
- "What seems to make it more or less frequent?"
- "Does any action make it seem to temporarily go away?"

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

Even seemingly insignificant details given by the customer may lead to the solution being found. Jumping to a hasty conclusion may result in time being unnecessarily wasted on the wrong problem – try to get as clear a picture in your head of the customer's perceived problem. Seek clarification from them, or request more information; "Exactly what happened when you turned it on?", "Did you say it occurs only when making double sided copies?". You can never ask too many questions of the customer.

The Machine Service History

In many cases, the source of the trouble can be located quickly and simply by consulting the machine service history. The machine service history can indicate that the same trouble has occurred regularly on that machine. For this exact reason, the machine service history is a useful source of information, and experienced troubleshooters make the time to refer to it, and update it for future reference.

2.4.3
Step 3: Attempt To Recreate The Problem

In order to verify the problem, and to make sure the equipment is actually behaving (or misbehaving) as reported by the customer, it is necessary to make a visual check of the machine and its environment. Where possible, you should verify the symptoms straight away to determine if the problem is operator induced.

It is essential to check for jammed paper or broken components, or for any abnormal odours (such as an electrical smell from burnt components or wiring), as this can prevent further damage that might be caused by running the machine. Once you have made this check, turn the machine on and take note of all indicator lights. Listen for any abnormal sounds such as grinding noises or motors slowing down. If possible, make copies and observe paper feed and the paper path if those areas are in question – remember, you can't fix what you can't see. Also observe the copy quality being produced and keep those copies for later reference.

If the problem does not occur at this time, it is necessary to run the machine until you can confirm that a problem does in fact exist. If the reported problem cannot be recreated, it is prudent to question the operator further to identify other avenues of investigation, or whether it is necessary to reinstruct them in the correct procedures and operation of the machine.
Where possible, printing out Management Lists and viewing the Data Collection can provide additional clues to help you pinpoint the problem.

2.4.4
Step 4: Consider Possibilities Based On Facts

By this stage, it is likely that you will have formed an opinion or a mental picture of the problem, utilising information from the customer, from operating the machine and from the Management Lists or Data Collection.
Experienced Troubleshooters would now try to rectify the problem by applying known solutions based on similar problems. The problem may be eliminated along the way, but If this process is unsuccessful, only a short amount of time will have been wasted.
Furthermore through eliminating parts of the machine that are not the cause of the problem, you will improve your overall understanding of the situation.

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

Some examples of applying known solutions are:

- No Power at the copier – check that the machine is plugged into the powerpoint, that interlock switches are operated and that the main switch is turned on
- Erratic operation – check for arcing in the Transfer / Separation corona blocks
- No feed from a particular paper tray – push the tray in and listen for operation of the lift motor

Before starting to narrow down or localise the problem, it may be advantageous to perform a preventative maintenance (PM).

This is particularly true in faults relating to copy quality. A PM is usually quick and may clear the problem.
Good Troubleshooters perform PMs regularly and carefully, as they can save a great deal of time and money, and will reduce machine downtime. Carrying out a PM can also prevent future troubles from occurring.

2.4.5
Step 5: Localise The Problem

When your sources of information gathered in step 4 fail to reveal the source of the problem, experienced troubleshooters adopt a logical system to assist in the narrowing down or localising of the problem. As this process is the least time efficient method of pinpointing the problem it is usually used as the last resort.

Before developing a logical systematic approach to a problem you must first know how to read the Service Handbook, Wiring diagrams, Timing charts, use a multimeter, and have a thorough understanding of how the copier works, this understanding is usually gained through classroom training and field experience.

There are a number of different approaches that you could use to localise the problem:

1. You could systematically test every part of the machine starting at one end and working through every part until the problem is found. While methodical this is not an effective approach to take as the search process is done randomly.
2. The preferred method used to localise a problem is the “split search” or “split-half search”. This procedure involves testing the machine at, or near a central point. This will reduce the search area by approximately half. If the test shows normal operation, the area preceding this point can be eliminated from suspicion.

2.4 The Konica 8 Steps To Successful Troubleshooting

The problem can be further localised by splitting the remaining area in half and so on. The object of this method is to eliminate a large portion of the machine at a time, it is not always possible to split the machine at exactly the middle point but somewhere close will allow rapid narrowing down of the problem. Experienced troubleshooters will stop using this search procedure when either they locate the problem or they develop an idea worth testing.

Your ability to localise and develop systematic testing procedures will improve with experience, this is not something that can be taught in a class, it develops over time.

Examples of Split search:
The digital copier is equipped with internal test patterns stored in its memory. These patterns can be printed out in order to perform tests on different sections of the machine.

Printing a test pattern can be a straight forward way of splitting the machine in half when attempting to localise a problem. If the problem remains after printing a test pattern, we know that the problem is not in the read section of the machine. We know this because the read section was not used in the production of the image.

For example, lets imagine the problem we have is light copies. If we produce an overall halftone test pattern at the default density of 255 (black) and the image is still light, we know the read section is OK.

We would then continue our split search and look at image formation to further try and reduce the search area. There is toner in the toner supply unit and the toner motor operates during the copy process. The toner image on the drum is also faint, this eliminates the transfer process from our search. Therefore the problem may be in the developer unit.

Running “47” mode code “054” Toner automatic replenishment, will ensure the toner level in the developer is correct. We now know the developer and toner concentrations are correct.

Previous experience and training tells us to check the developer sleeve rotation speed.
The developer sleeve rotation speed is incorrect (too slow) and is limiting the amount of toner available to form an image. After performing the D-Max adjustment in the 36 mode we can see that developing sleeve rotation is still slow. Our understanding of how the machine works will narrow the search to three areas:

1. Overtoned
2. Failure of the developing drive motor M3
3. Soilage of the Toner Control Sensor Board (TCSB).

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

We check M3 in the 47 mode and it operates normally. Having checked the toner concentration already, the problem is identified as being caused by soilage of the TCSB. We now clean the sensors and identify and repair the source of the soilage.
This has been a difficult fault to isolate and reinforces the fact that you must fully understand how something operates to be an effective troubleshooter.

Another example of how to use a split search is, consider we have a double image produced on the copy. Our experience will tell us that it could be caused by one of the following:

1. The photoconductor is not being cleaned
2. Possibly incorrect toner has been installed
3. The upper fixing roller may be soiled with toner

To further localise the problem we can stop the copy by turning the machine off at the main switch before the copy enters the fixing unit. If we then remove the copy and there is no double image then the problem can almost certainly be isolated to the fixing unit.

The Anatomy of Troubleshooting

2.4 The Konica 8 Steps To Successful Troubleshooting

Some of the tools used to aid the localising process include:

- Internally produced test patterns
- 25, 47 and running modes
- Replacement of major or complete component
- Troubleshooting flow charts
- Wiring diagrams
- Timing charts

(An explanation of how to use these items is given in section 3, “Troubleshooting Tools and Technology”)

2.4.6
Step 6: Take Appropriate Action To Clear The Trouble

Correct application of steps one through five should logically lead you to identify the cause of the problem. Once the problem has been identified, the necessary action that will eliminate the trouble can be taken. This may involve:

- Cleaning a unit
- Replacing a faulty component
- Making a suitable adjustment

or

- Performing a preventative maintenance

When dismantling the machine, laying out the parts that you have removed neatly and in an arranged order will aid you when it is time to reassemble the machine – drawing a diagram as you go is a good practice to adopt. It is vital that care be taken when replacing a part or control board suspected of being faulty, as often an undetermined fault in the equipment can and does damage the replacement part.

2.4.7
Step 7: Test

Before final testing is carried out, you should know what results to expect. Experienced Troubleshooters will always check the machine thoroughly to ensure the problem is cleared and the system is functioning normally, as it is very easy to create a new fault while clearing the old one.

When testing the machine, there are a number of questions you should ask yourself:

- Did the symptom go away?
- Did the right symptom go away?
- Did I create any other problems?
- Is there any way I could have improved my Troubleshooting process?

After testing the machine, remember to update the machine service history, as this will aid future technicians called to the machine.

2.4.8
Step 8: Inform And / Or Instruct The Customer

Inform the customer that the machine is back in operation. Telling the customer what you have done, and the cause of the problem will help to build a rapport with them. Try to avoid becoming overly complicated, or using technical jargon, as this is not an effective way of communicating information that will be useful to the customer. If the problem was due to operator error, offer correct operator instruction without demeaning or insulting them.

If a part is required to resolve the fault, make sure the customer is aware of this, and the date and time that you will return. If you get delayed, follow up with a telephone call as a professional courtesy.

The Anatomy of Troubleshooting

2.5 Safety Considerations

When Troubleshooting or performing maintenance, it is imperative to use safe work procedures to protect both yourself and others. It is the responsibility of every technician to use professional skills when servicing Konica products. There are no shortcuts to quality service. The safety of those who operate or service the copier is directly dependent upon the conscientious effort of each and every technician. Always remember, when performing service calls, to use good judgement to identify safety hazards or potential safety hazards, and to correct these problems as they are identified. The design of the copier is extremely important.
It is the design process that determines tolerances and safety margins for mechanical, electrical and electronic aspects.

It is not reasonable to expect individuals not involved in the product engineering to know what effect changing any aspect of the machine design may have. Such changes have the potential to degrade product performance and reduce safety margins.

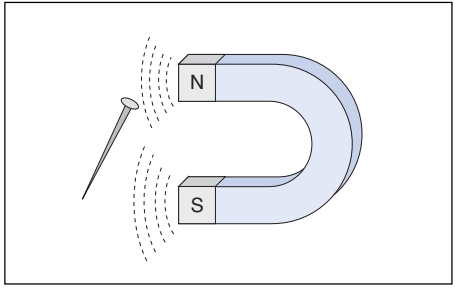
Please refer to section “C” at the front of any Konica Service Handbook for full information on the following items:

- Unauthorised modifications
- General safety guidelines
- Safeguards during service calls
- Using service materials
- Actions to take in the event of a serious accident
- Safety circuits

Understanding of Basic Devices

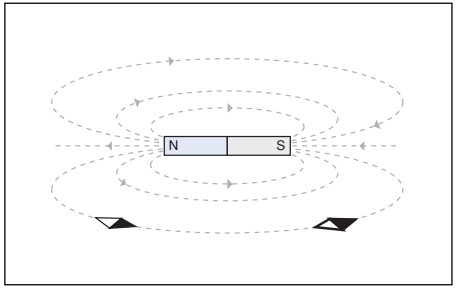
3.1 Principles

Items such as motors, clutches, solenoids and photosensors are some of the basic devices used in a photocopier. In order to successfully troubleshoot a problem you must first have a clear understanding of the principles behind how these devices operate. This section explains these principles:

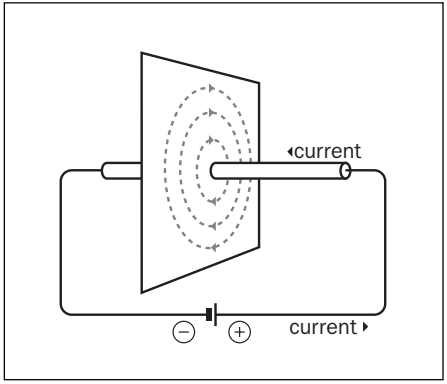


3.1.1
Magnetic field and magnetic lines of force

When you move a magnet towards a needle, the needle is attracted by the magnet. The area where the magnetic force is effective is called the “magnetic field”.



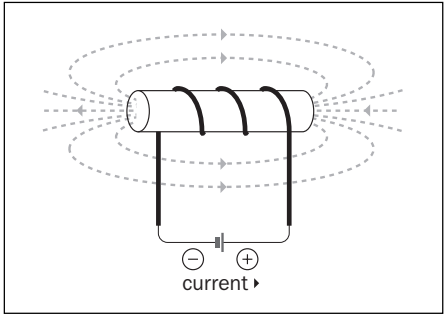
With a bar magnet, the direction of the magnetic field is as shown by the broken lines in the diagram. The lines, which are called “magnetic lines of force”, start at the north pole and flow to the south pole.



3.1.2
Ampere's Rule

When current flows through a wire, a magnetic field is generated. This example shows the relationship between the direction of the current and that of the magnetic flux.

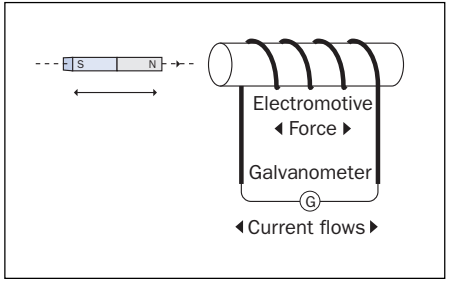
This is the fundamental law representing the relationship between current and magnetism and is called "Ampere's rule".



3.1.3
Electromagnet

When current flows through a cylindrically wound wire, the magnetic flux travels in the direction indicated.
The structure shown is referred to as an "Electromagnet" or a "Solenoid".

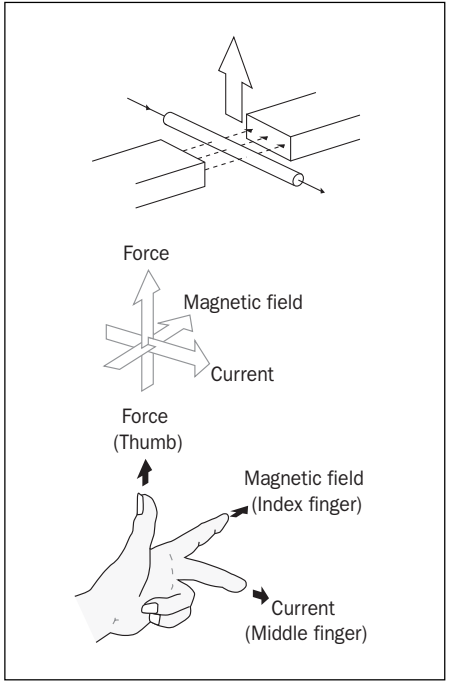
Note: a galvanometer is an instrument to measure current whose needle is able to swing in either direction.



3.1.4
Induced electromotive force and Lenz's law

When a bar magnet is moved in and out of a cylindrically wound wire (coil) as shown here, electromotive force and therefore current is generated. This phenomenon is called "electromagnetic induction" and the electromotive force generated at the coil is called "induced electromotive force".

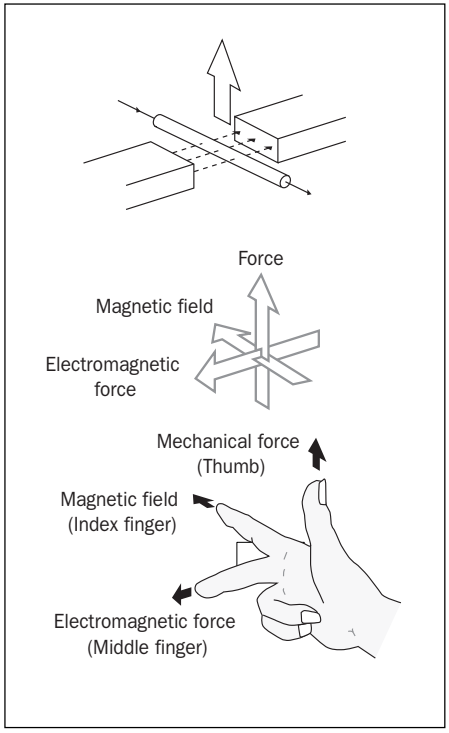
Electromagnetic induction does not take place without a change in the magnetic flux passing through the coil. This is because the magnet has to be moved. The quicker the magnetic flux changes the greater the electromotive force. Electromagnetic induction is subject to the following rules:



3.1.5
Fleming's Rules

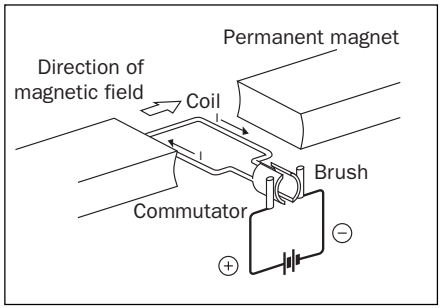
When a motor is supplied with current, it begins to turn. Motors are fitted with magnets. The relation of the magnetic force from this magnet, current and mechanical force is subject to Fleming's rules.

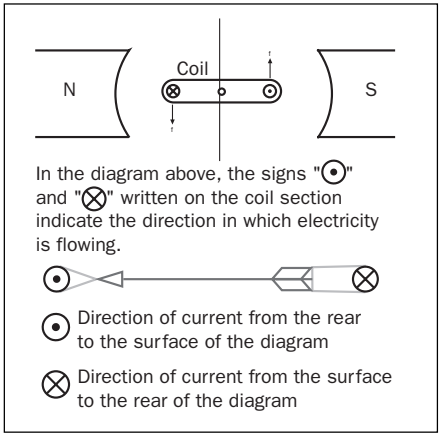
Fleming's left hand rule:
When you place a conductor in the magnetic field of a fixed magnet and supply it with current, a force acts upon the conductor to move it in the direction of the arrow. The direction of movement is determined by what is called "Fleming's left hand" rule. At this point magnetic flux, current and mechanical force are all at right angles to one another.



Fleming's right hand rule:
When a conductor is moved in the field of a fixed magnet, electromotive force in the direction of the arrow is generated. This is represented by "Fleming's right hand" rule.

In this case, the direction of magnetic flux, mechanical force and electromotive force are as shown.





3.2.1
Brush Type motor

This type of DC motor consists of the following components:

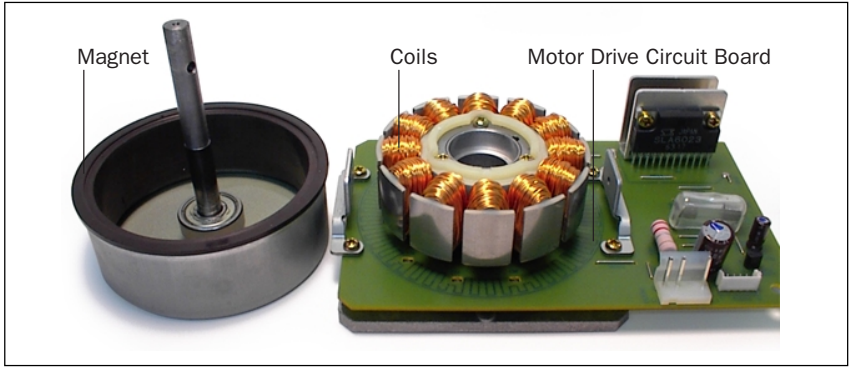
- Permanent magnets
- Commutator
- Brushes
- Coil (Armature)

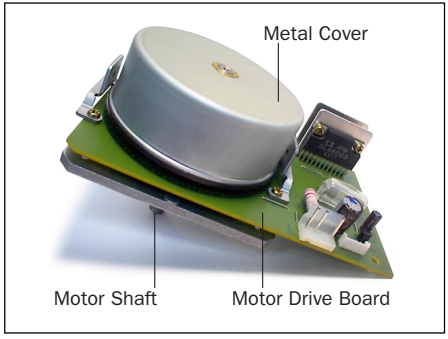
When current flows to the coil through the brushes and commutator, force is generated according to Fleming's left hand rule. The direction of force "F" is as shown bottom left.

3.2.2
Brushless DC Motor

In the brush type DC motor described previously, the magnet is stationary while the coil rotates. In the brushless motor, the coil is stationary and the magnets rotate.

A number of coils are attached in a circle around the motor shaft on the motor drive circuit board. A circular magnet, which is constructed of alternating north and south polarised segments fits around these coils. The magnets are bonded to a metal cover that in turn is fixed to the motor shaft. The motor drive board switches the position of the magnet poles so that the magnet is caused to rotate.





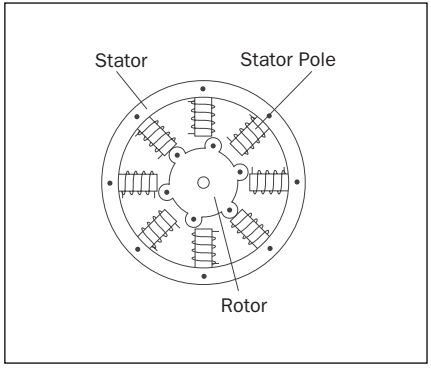


Figure 1. Cross section of a variable reluctance (VR) motor.

3.2.3
Stepper motor Basics

A stepper motor is an electromechanical device, which converts electrical pulses into precise mechanical movements. The shaft or spindle of a stepper motor, usually called the rotor, rotates a precise amount when electrical command pulses are applied to the windings around the fixed magnets inside the motor. The fixed magnets are known as the stator.

- The direction of rotation of the motor shaft is directly related to the sequence of these pulses.
- The speed of rotation is directly related to the frequency of the pulses.
- The distance the motor will turn is directly related to the amount of pulses applied to the motor.

Stepper motor types:
There are three basic types of stepper motor

- Variable reluctance
- Permanent magnet
- Hybrid

Variable-reluctance (VR)

This type of stepper motor has been around for a long time. It is probably the easiest to understand from a structural point of view. Figure 1 shows a cross section of a typical VR stepper motor. This type of motor consists of a soft iron multi-toothed rotor and a wound stator. When the stator windings are energised with DC current the poles become magnetised. Rotation occurs when the rotor teeth are attracted to the energised stator poles.

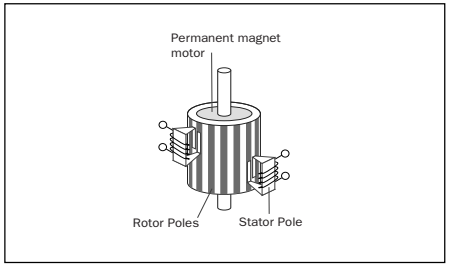


Figure 2. Principle of a PM or tin-can stepper motor.

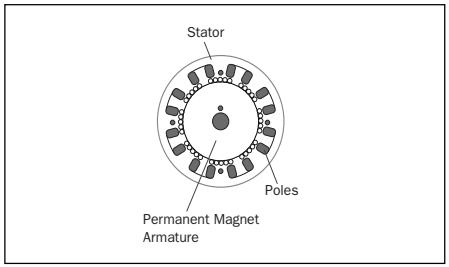


Figure 3. Cross-section of a Hybrid stepper motor

Permanent Magnet (PM)

Often referred to as a "tin can" or "canstock" motor the permanent magnet stepper motor is a low cost and low resolution type motor with typical step angles of 7.5° to 15°. PM motors as the name implies have permanent magnets added to the motor structure. The rotor no longer has teeth as with the VR motor. Instead the rotor is magnetised with alternating north and south poles situated in a straight line parallel to the rotor shaft. These magnetised rotor poles provide an increased magnetic flux intensity and because of this the PM motor exhibits improved torque characteristics when compared with the VR type.

Hybrid (HB)

The hybrid stepper motor is more expensive than the PM stepper motor but provides better performance with respect to step resolution, torque and speed. Typical step angles for the HB stepper motor range from 3.6° to 0.9° (100 – 400 steps per revolution).
The hybrid stepper motor combines the best features of both the PM and VR type stepper motors. The rotor is multi-toothed like the VR motor and contains an axially magnetised con-centric magnet around its shaft. The teeth on the rotor provide an even better path, which helps guide the magnetic flux to preferred locations in the air gap. This further increases the detent, holding and dynamic torque characteristics of the motor when compared with both the VR and PM types.

3.2 DC Motors

The two most commonly used types of stepper motors are the permanent magnet and the hybrid types.

Advantages of Stepper motors

- Precise positioning and repeat-ability of movement since good stepper motors have an accuracy of 5% of a step and this error is non cumulative from one step to the next.
- Excellent response to starting / stopping / reversing.
- Very reliable since there are no contact brushes in the motor. Therefore the life of the motor is simply dependant on the life of the bearing.
- The motors response to digital input pulses provides open-loop control, making the motor simpler and less costly to control.
- Open loop control means no feedback information about position is needed. This type of control eliminates the need for expensive sensing and feedback devices such as optical encoders. Its position is known simply by keeping track of the input step pulses.
- It is possible to achieve very low speed synchronous rotation with a load that is directly coupled to the shaft.
- A wide range of rotational speeds can be realised as the speed is proportional to the frequency of the input pulses.

  The motor has full torque at standstill (if the windings are energised).

Understanding of Basic Devices

3.3 AC Motors

As AC motors are rarely used in copiers today, they will not be covered here.
If you wish to acquire an understanding of their operation there are many books available on this subject.

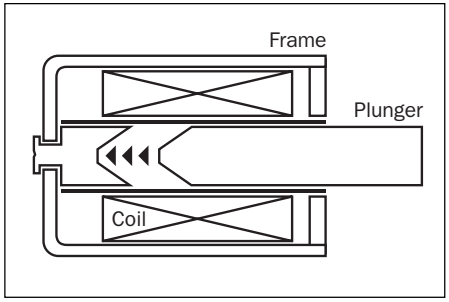
Understanding of Basic Devices

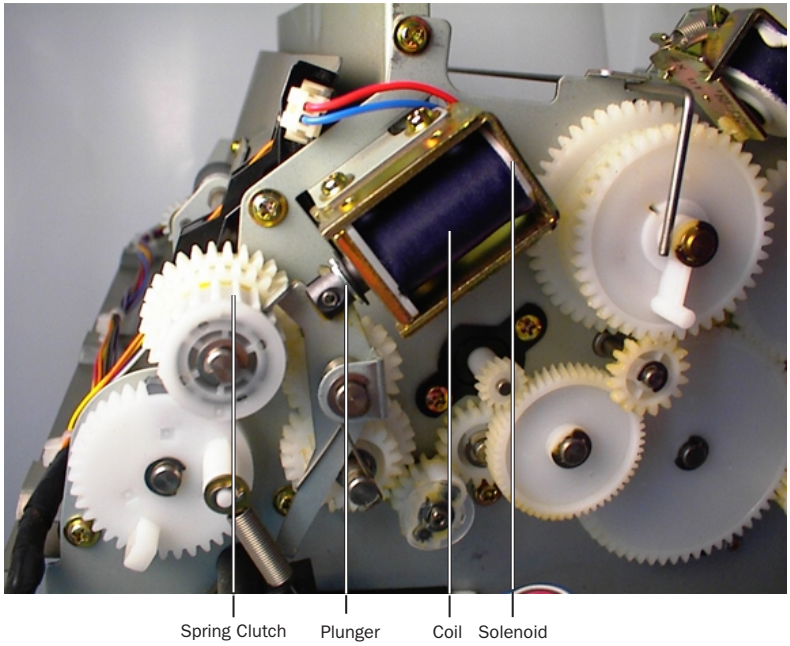
3.4 Solenoids

Solenoids are electromechanical devices, which use electrical energy to perform a mechanical action using the principles of electromagnetism.
There are two types of solenoids used in Konica copiers, ‘Plunger’ and ‘Armature’ type. Solenoids are generally used to control spring clutches and paper path gates.

3.4.1
Plunger

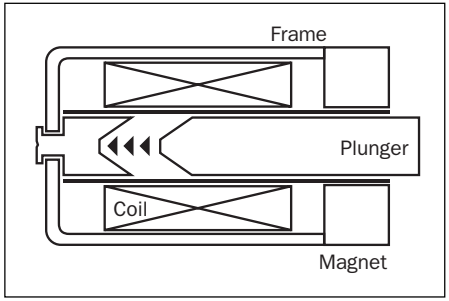
This type of solenoid consists of a coil of wire wrapped around a cylindrical tube and a metal rod referred to as a plunger. The coil of wire acts as an electromagnet when electrical current is applied, drawing the plunger into the solenoid.

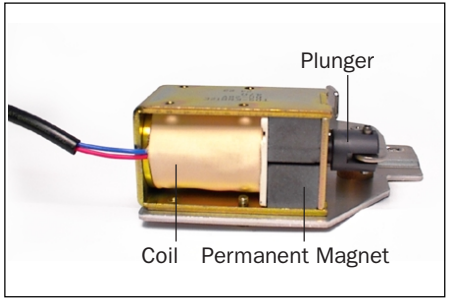




Understanding of Basic Devices

3.4 Solenoids





There is a variant of the plunger type solenoid known as the “Memory” solenoid. A memory solenoid is a plunger solenoid that has a permanent magnet attached to the plunger end of the coil.

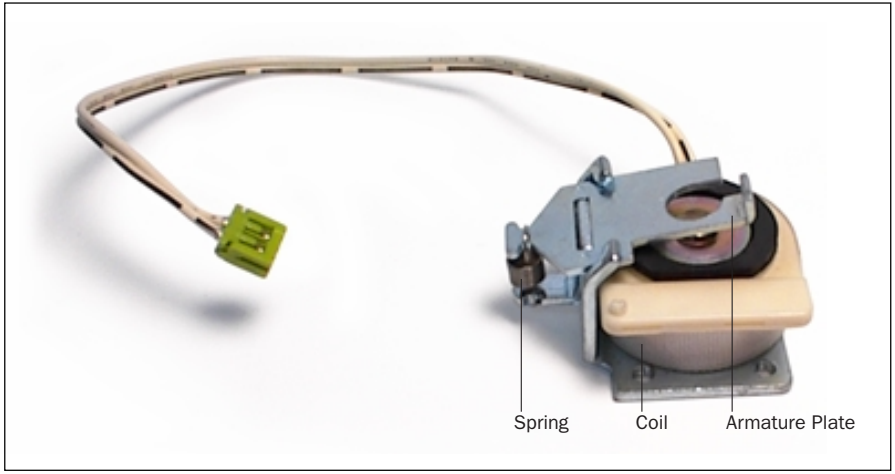
When power is applied to the coil, the plunger is pulled into the electromagnet. The permanent magnet holds the plunger inside of the coil after the power is removed.

To push the plunger back out of the coil, power must be applied again but with the polarity reversed.

3.4.2
Armature Type

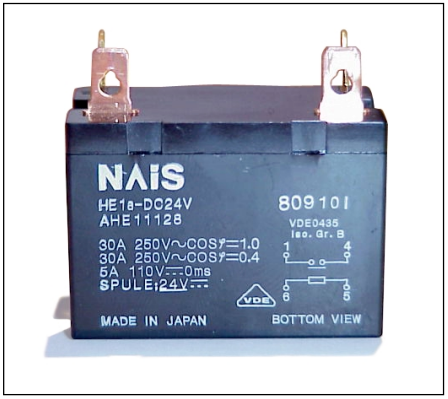
Like the plunger type solenoid, an armature solenoid works on the principles of electromagnetism. This type of solenoid, however, does not have a plunger. Instead a plate called the “armature” is attracted to the coil when current is supplied. When power is removed, an external spring pulls the armature away from the coil.

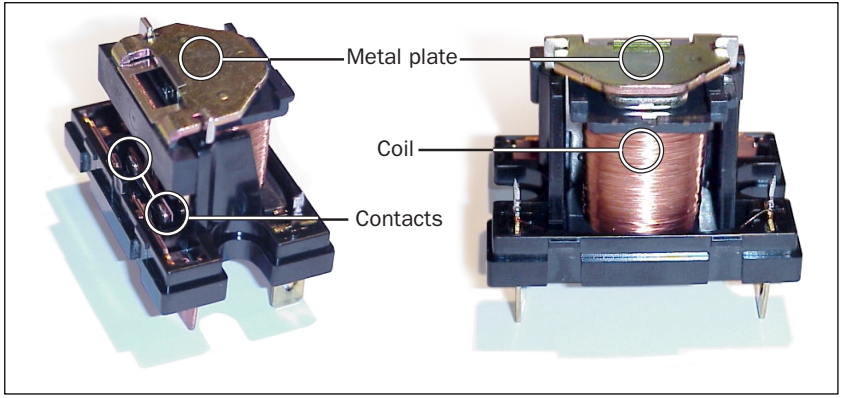
Armature solenoids have an advantage over plunger type solenoids in that they are smaller in size and quieter in operation. However, they are generally weaker. In a wiring diagram solenoids are abbreviated by the letters “SD”.



Understanding of Basic Devices

3.5 Relays





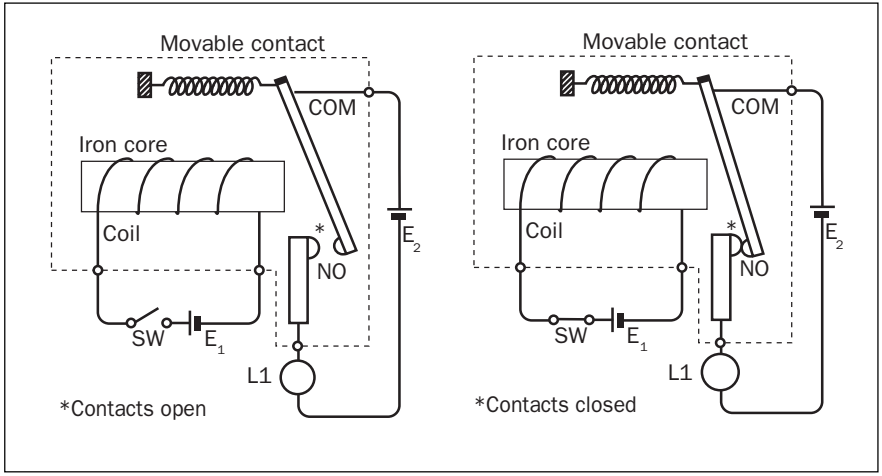
A relay is simply an electrically operated switch. This allows the operation of switches through circuitry rather than through physical operation by an operator or by mechanical equipment. A relay contains an electromagnet that attracts a metal plate, called an armature. The armature moves contacts to open or close circuits.

A relay may have a single set of contacts or multiple sets of contacts in a single unit.

3.5 Relays

When activated the relay opens or closes contacts depending on its design. Relays generally use a low DC voltage of 12 or 24 volts to control its operation, though it can be used to switch high AC or DC voltages.

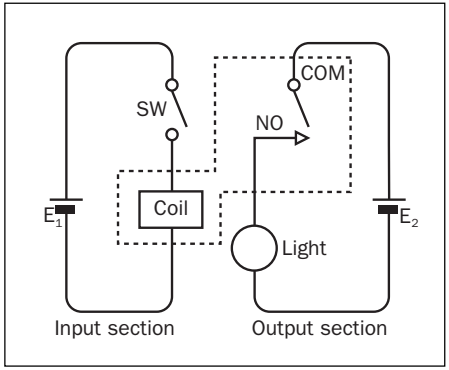
Because the switch is open no current flows to the coil. A spring holds the contacts in the normally open (NO) condition. When the switch is closed current flows through the coil, causing the iron core to become an electromagnet. When this happens, the armature is attracted to the electromagnet causing the contacts to close. As a result, L1 lights.



The example above shows a relay connected to a light and an external switch.

Understanding of Basic Devices

3.5 Relays



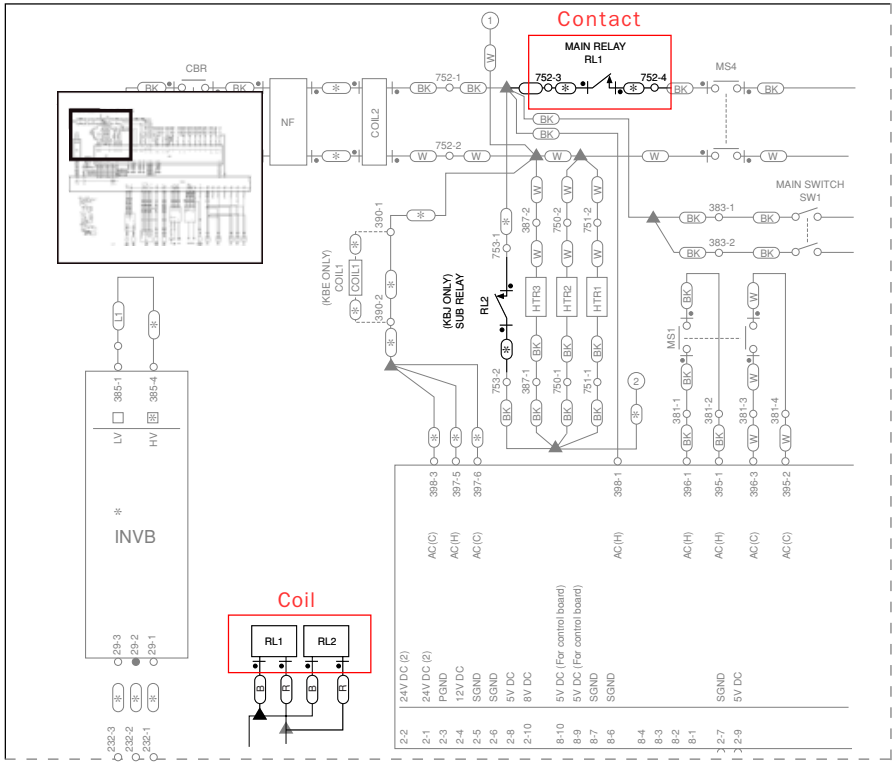
Shown Left is the circuit diagram for the relay example that we looked at previously. Note that the coil (input) and contact (output) sections are electrically separate from each other. The only connection is the physical mounting, the operation of the contacts is done through electromagnetism.

When referring to a wiring diagram, the relay coil and contact sections are displayed separately. The relay coil is generally located close to the controlling circuitry, while the contacts are shown near the load to be operated. Relays are abbreviated by the letters “RL*” in a wiring diagram. The number in place of the * will depend on the number of relays used in the machine.

Understanding of Basic Devices

3.5 Relays

The coil and contact sections of the relay are drawn on the wiring diagram as shown.



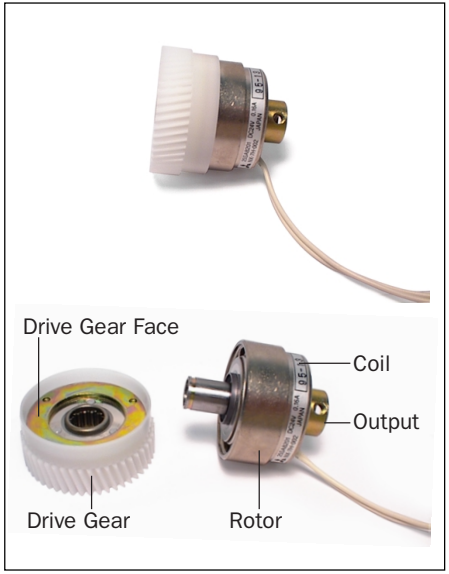
3.6 Clutches

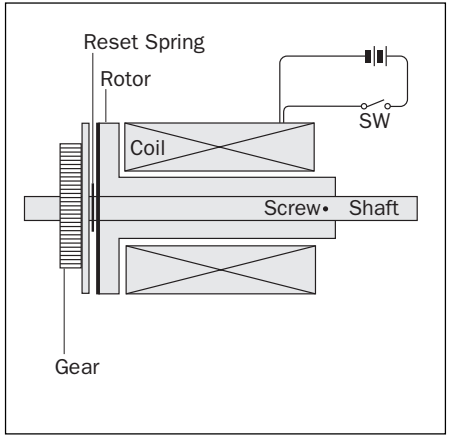
The purpose of a clutch is to interrupt the drive force between two components. Many types of clutches are used in photocopiers including the following:

- Magnetic clutch
- Spring clutch
- Magnetic spring clutch
- One way clutch

3.6.1
Magnetic Clutch

Magnetic clutches are electromechanical devices used to transfer rotational drive between a drive gear and a shaft. When drive is not required, the clutch remains disengaged, but when drive is required application of electrical current causes the clutch to operate, transferring the drive to the shaft. Magnetic clutches are used in many areas of the copier including the 1st paper feed, 2nd paper feed and also areas such as the ADU and inverting sections. When voltage is applied to a magnetic clutch the time taken for engagement of drive is very small when compared to other forms of clutches.





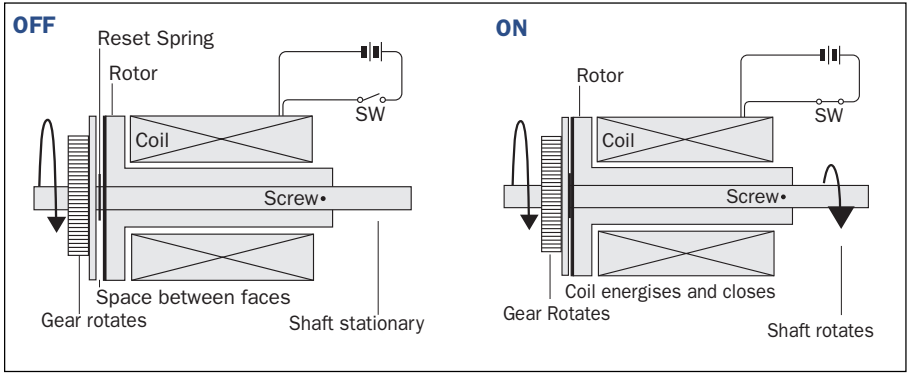
Above is a cross-sectional drawing of a typical magnetic clutch.

Understanding of Basic Devices

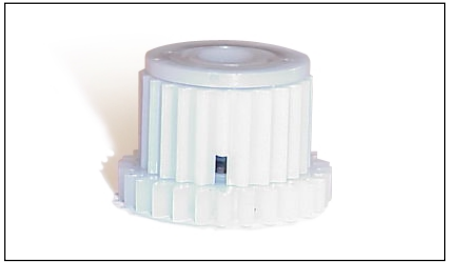
3.6 Clutches

When the coil is not energised the drive gear is separated from the rotor due to the force of the reset spring. Therefore the rotation of the is not transmitted to the rotor.

When the coil is energised, the drive gear face comes into contact with the rotor due to the magnetic force of the electromagnet. As a result, the rotation of the drive gear is transmitted through the rotor to the shaft. The shaft then in turn will drive whatever is connected to it. This may be feed wheels or a conveyance roller.



When referring to a wiring diagram, magnetic clutches are abbreviated by the letters “MC” or “CL”.



3.6.2
Spring Clutch

Spring clutches are mechanical devices that are used to transfer rotational drive, usually between a gear and shaft. When drive is not required the clutch permits slippage to occur.
However, when drive is required the releasing of a mechanical pawl or claw allows the clutch to “grab” and transfer drive. Spring clutches are generally used for the operation of feed wheels or items that do not require a very quick or accurate drive engagement time.

Operation

There are variations of the basic spring clutch although they are all made up of several basic parts. They include the following items:

- Clutch spring
- Output hub
- Ratchet
- Input gear (including hub)

Understanding of Basic Devices

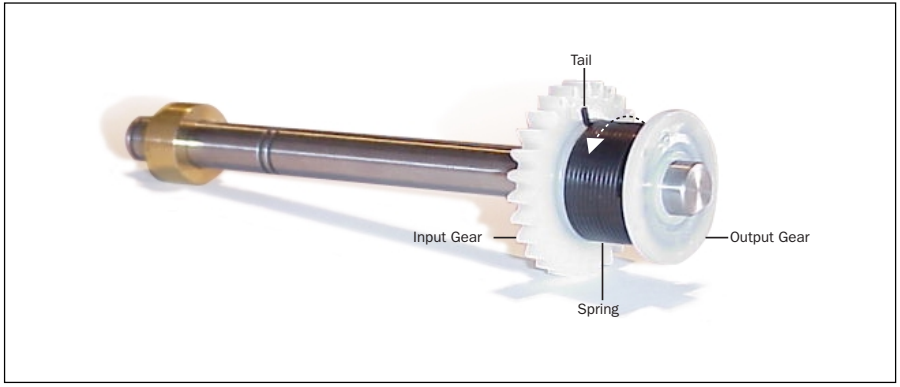
3.6 Clutches

In this type of spring clutch, the output hub and input gear slide onto the output shaft. The hub sections face each other with the spring wrapping around both. On the end of the spring that faces towards the input gear there is a small “tail”. This tail is the end of the clutch spring bent at a 90-degree angle, which points away from the hub. Around the outside of the spring is the ratchet, which is what controls the clutch operation.

The tail end of the clutch spring protrudes through a slot in the ratchet. A solenoid generally operates a pawl arm, which locks into protrusions around the outside of the ratchet.

When the pawl arm locks the ratchet, the spring is unable to tighten onto the input hub, however when the pawl arm is released the clutch spring contracts and tightens on the input hub which in turn provides drive to whatever is connected to the output hub.

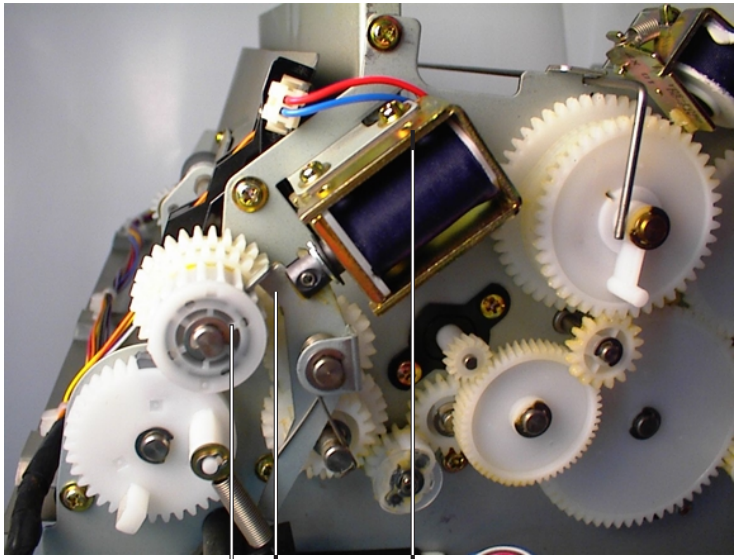
3.6 Clutches



The photo above shows a spring clutch with the ratchet removed and an arrow indicating the direction that the input gear is rotated.

Maintenance

Spring clutches are lubricated with grease during the manufacturing process. However, over time and during use, the grease will dry out and require re-lubrication. If cleaning and re-lubrication are not carried out, the result will be wear and noise leading to the eventual failure of the clutch. The service handbook will indicate which lubricant should be used but generally Konica Plas Guard no.2 or multi oil is used on the majority of spring clutches. Lubricate the spring clutch sparingly to avoid excess lubricant dripping onto the solenoid or other areas, which could result in new problems.



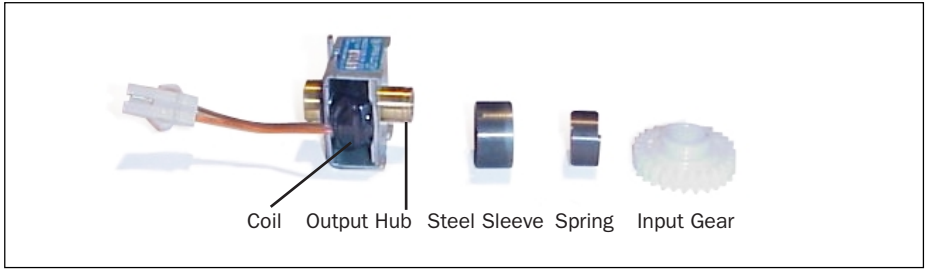
The pawl arm, which is operated by a solenoid, can be seen in the photo above.

3.6.3
Magnetic Spring Clutch

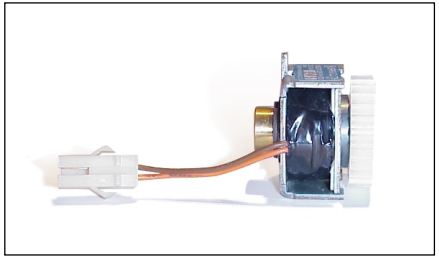
Magnetic spring clutches combine both a mechanical and electrical device in one. The magnetic spring clutch comprises the following items:

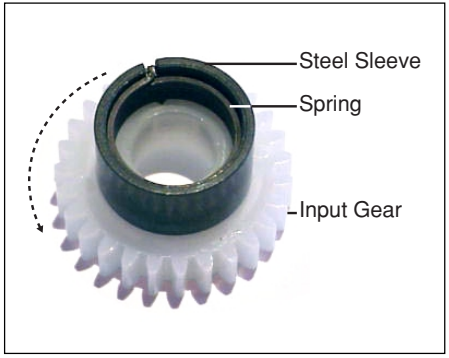
- Clutch spring
- Input gear
- Steel sleeve
- Output hub
- Coil

The mechanical part of this type of clutch works in the opposite fashion to that of the basic spring clutch. When the steel sleeve (the equivalent of the ratchet in this type of clutch) is permit ted to rotate, it turns with the input gear. The clutch spring does not tighten on the output hub, hence there is no rotation.



However when voltage is supplied to the coil that surrounds the outside of the clutch spring and steel sleeve, the electromagnetic field is created. This creates drag on the sleeve, which acts as a brake and slows its rotation resulting in the clutch spring contracting and tightening on the output hub. This in turn provides drive to whatever is connected to the output hub.





Maintenance

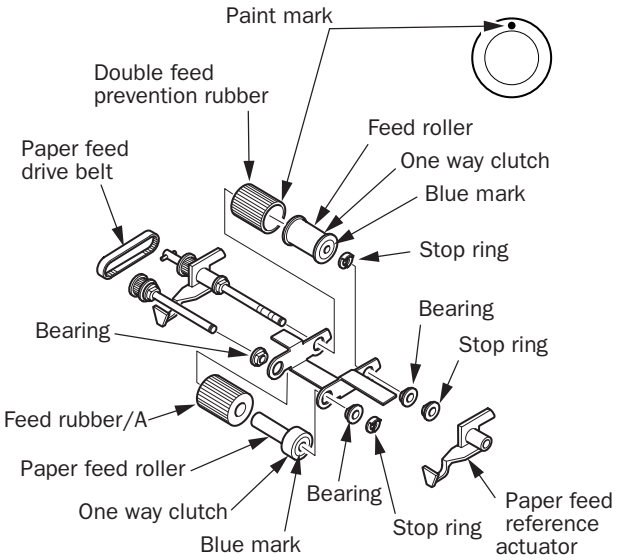
As the spring in the magnetic spring clutch is not as tight a fit on the hub as that in the standard spring clutch, there is virtually no wear created and the use of lubricant is not required, nor is it recommended.

One Way Clutch

The purpose of a one way clutch is to allow the transmission of drive in one direction only.

One-way clutches are mainly used in the paper feed area, to allow the "freewheeling" of paper feed wheels or conveyance rollers.

For example, when paper is fed from a tray to the second paper feed rollers, a loop in the paper is created - this is a result of the moving paper contacting the stationary second paper feed rollers. At this time, drive from the conveyance or feed rollers is stopped.



3.6 Clutches

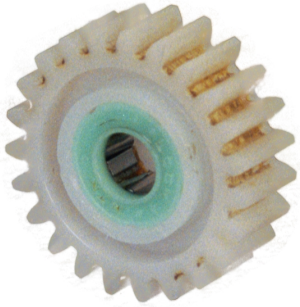
When the second paper feed rollers start turning again, the trailing edge of the paper is normally in contact with the conveyance rollers or feed wheels (particularly in the case of A3 (11x17) size copy paper).

To eliminate the need for these rollers to start rotating again they are fitted with a one-way clutch to allow them to “freewheel”. If a one-way clutch was not fitted, the paper that is being fed would attempt to turn the drive train of the copier resulting in a paper jam.

Understanding of Basic Devices

3.6 Clutches

Gear type one way clutch



Roller type one way clutch

Some one-way clutches contain steel rollers inside while others use a combination of gears, although the function remains the same.
Many everyday items use one-way clutches, for example, the bicycle.
The rear wheel on almost all bicycles is fitted with a one-way clutch to allow the drive from the pedals to turn the rear wheel and also to allow the pedals to freewheel even though the rear wheel is still turning.

Understanding of Basic Devices

3.7 Torque Limiter

Spring Type

Magnetic Field Type

Magnetic Powder Type

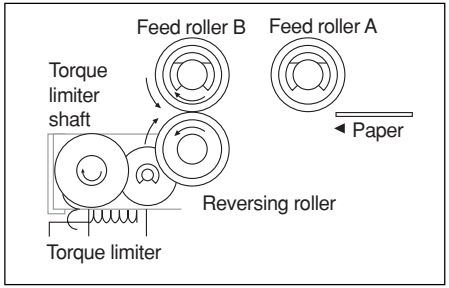
A torque limiter, as the name implies, is a device that limits the amount of torque or power that can be transmitted or passed through it.

Torque limiters are employed in the paper feed area of most current Konica copiers. They are used as part of the double feed prevention system to eliminate multiple feeding of copy paper. There are a number of different types of torque limiters used although their function is the same. Types include:

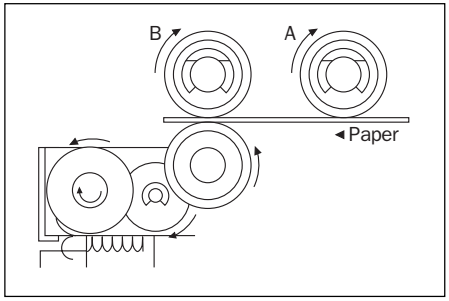
- Magnetic powder type
- Spring type
- Magnetic field type

Understanding how the torque limiter works by its self is relatively easy, understanding its operation working in the paper feed unit is rather more difficult. It will be profitable to first look at the operation of the torque limiter in a 7065 paper feed unit, and then to look at the different types of torque limiters and see how they differ.

3.7 Torque Limiter



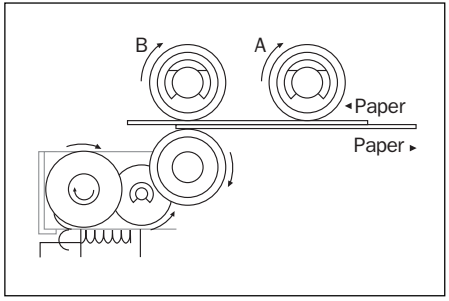
When drive is applied to the paper feed unit, prior to the first paper feed clutch energising, the torque limiter shaft is driving the reversing roller in a direction opposite to normal paper feed. As the reverse roller and the feed roller (B) are in contact, feed roller (B) also rotates in an opposite direction to normal.



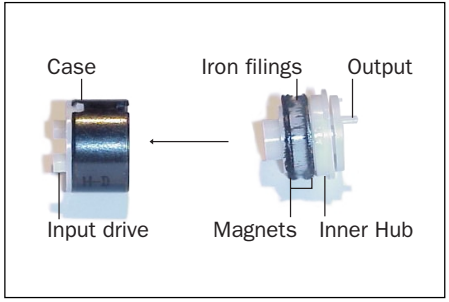
When the first paper feed clutch energises, drive is transferred to feed roller (A) and (B). At this time one sheet of paper is picked up by feed roller (A). Even though the reversing roller is being driven in the reverse direction via the main drive through the torque limiter, feed roller (B), driven from the main motor via a clutch, has far more torque than that present at the reverse roller.

So as the paper feeds through, the reverse roller will turn with the paper. At this time the torque limiter will slip internally.

3.7 Torque Limiter



If two sheets of paper attempt to feed together, feed roller (A) and (B) will convey the paper while the reverse roller will turn in the direction opposite to normal feed due to the slippage between the two sheets of paper. This will result in the lower sheet being returned to the paper tray while the upper sheet is fed as normal.

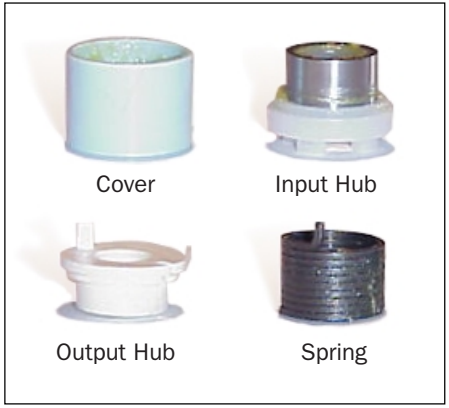


3.7.1
Magnetic Powder Type

The magnetic powder torque limiter was the first type of torque limiter used on Konica copiers. They are used today primarily in document feeders and ADU's. The torque limiter comprises a plastic hub to which a number of small magnets are attached and a surrounding case, which holds a small amount of iron filings.

The input drive connects to the surrounding case while, the output is connected to the inner plastic hub.

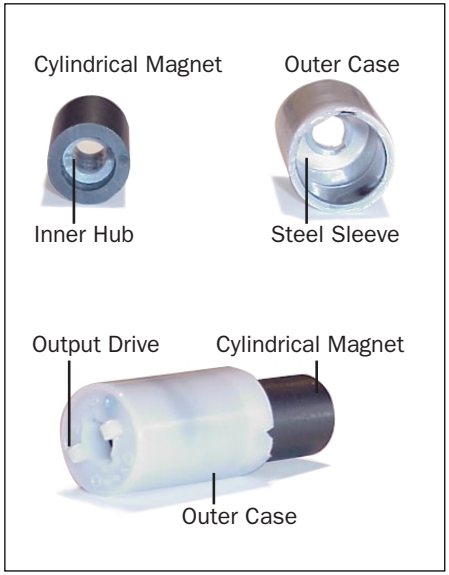
As the magnets attract the iron filings this creates friction between the plastic hub and the outer case resulting in the transmission of drive up to a designated amount of torque. This is a sealed maintenance-free device and should not be dismantled in the field.



3.7.2
Spring Type

The spring type torque limiter is used in the feed systems of the 7033/7040 machines and also older analog copiers. It contains two hubs and a spring from a spring clutch.

The spring connects to the output hub while the input hub rotates inside of the spring in a direction that continually attempts to release the pressure of the clutch spring. This results in a constant load. The Spring Type torque limiter is a maintenance item that requires cleaning and lubrication periodically. Without this the hub and spring will wear due to constant contact and rubbing.



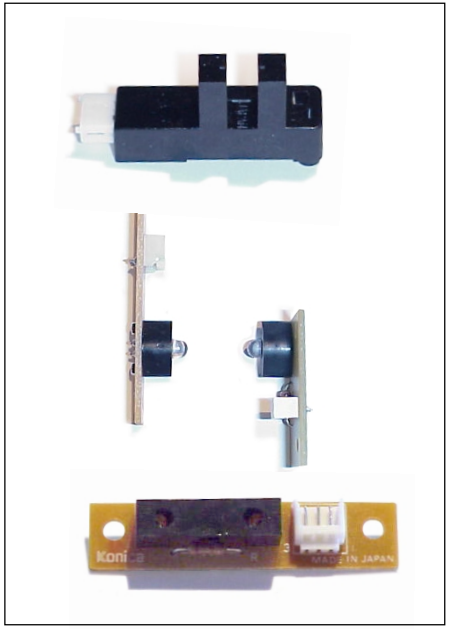
3.7.3
Magnetic field type

The Magnetic Field type torque limiter is used in the high-end digital copiers and 5370/6192 high-speed analog copiers. The torque limiter comprises of an outer case, which houses a steel sleeve, and an inner hub that is surrounded by a cylindrical magnet.

The input drive connects to the inner hub, which is bonded to the cylindrical magnet while the outer case drives the output. Based on the principles of magnets the cylindrical magnet is attracted to the steel sleeve and this creates the drag or load that is required. The magnetic field torque limiters also are a maintenance-free device that should never be dismantled.

Understanding of Basic Devices

3.8 Photosensors

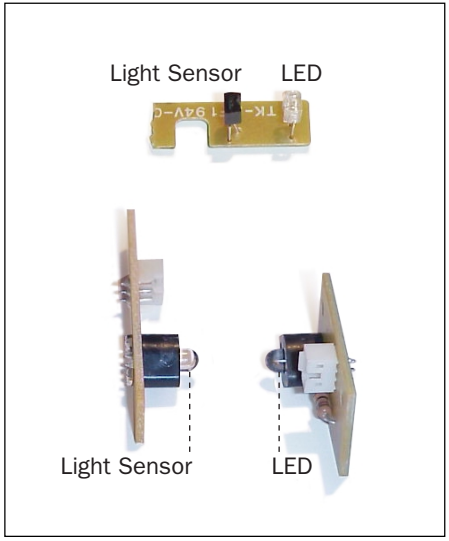


As the name implies, a photosensor is a device that senses light. There are different types of photosensors: the devices that turn on lights automatically by sensing the amount of sunlight, the photocells that power small calculators by converting room light to electricity and those used in mechanical equipment such as Konica copiers.

The types of photosensors used in Konica copiers can either be a composite device consisting of both the light sensor and the light source manufactured as a single unit (or the light sensor and the light source can be separate units). The light source usually comes from a light emitting diode (LED) while the sensor itself is a Phototransistor which is a solid state device that is sensitive to light.

The following two types of photosensors are used in our copiers.

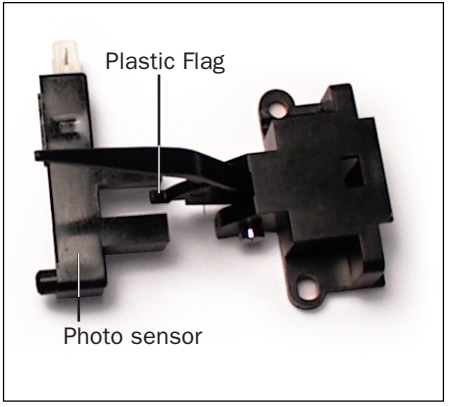
- Transmission type
- Reflective type



3.8.1
Transmission Photosensors

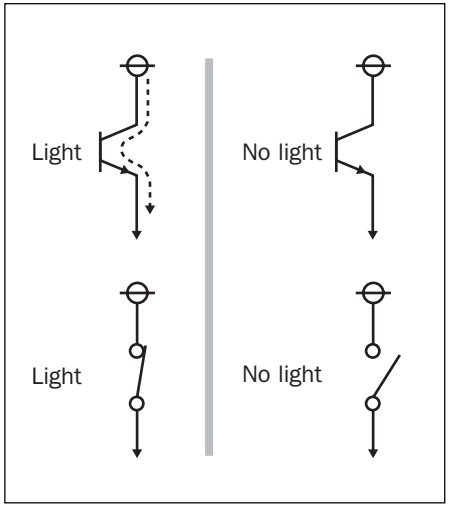
A transmission photosensor is designed so that light is aimed directly at the receiving sensor. Therefore as long as nothing is blocking the light path the sensor "sees" the light. This can be considered to be the "ON" state.

If an object such as a piece of paper or a "flag" interrupts the light path, the sensor is turned "OFF". This is due to the light source (LED) not being able to reach the sensor. The composite all-in-one sensor is used in conjunction with a plastic flag to detect both the paper position in the copier and the optics position. The two-part type sensor is also used to monitor paper position in areas such as the ADU and Sorter on many Konica Analog copiers.



Understanding of Basic Devices

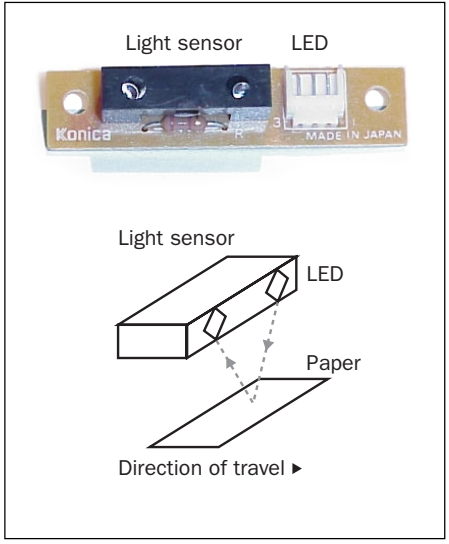
3.8 Photosensors



Transmission photosensors work in a fashion similar to a switch, either they are on or off.

Depending on the type of sensor, the ON/OFF states can be reversed from the state described earlier, so that when the phototransistor is exposed to light the state can be OFF and when there is no light , the state would be ON.

In the circuit the actual state of the sensor (ON or OFF) is not as important as the “change” in state. In fact, many sensors are ON or OFF at different times during the copy cycle, however the control boards only look at specific sensors at pre-determined times of the copy cycle.



3.8.2
Reflective Photosensors

In a reflective photosensor, the light source and sensor do not face each other directly as in the case of the transmission sensor. Instead operation of the sensor depends upon the light being reflected from some other object, such as a piece of paper or a photoconductor drum.

Unlike transmission photosensors, reflective photosensors can react to varying amounts of light. The more light, the greater the current flow through the sensor. This is particularly useful when it is necessary to determine amount not merely presence. Reflective sensors are used to detect toner density on the drum as well as for detecting paper presence in many Konica document feeders.

In both cases a base level of reflectivity is designed into the control circuitry. The difference in the actual value determines the course of action that the copier will follow, such as adding toner or confirmation of paper detection.

A reflective photosensor has the following characteristics when exposed to light:

- As more light reaches the sensor the resistance of the sensor decreases and the amount of current increases.
- Conversely as less light reaches the sensor the resistance increases and the amount of current decreases.

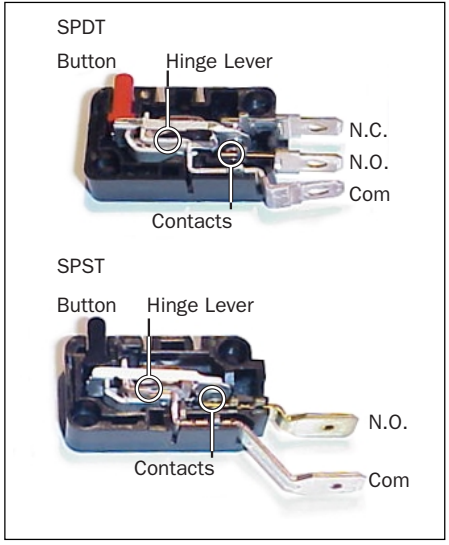
Understanding of Basic Devices

3.9 Switches

A switch is a device which can be used to open or close an electrical circuit. This can be used to turn a load on and off or to send a signal to a control board. Today copiers have changed from using many switches to using more photosensors due to their increased reliability and lack of moving mechanical parts. Switches are often used where there is a high current drain expected. The first place you will find a switch used on a copier is the main switch. Also some document feeders utilise a switch to cut the power to the document feeder motor when in the open position.

There are two types of switches used in Konica copiers:

- Microswitches
- Power switches

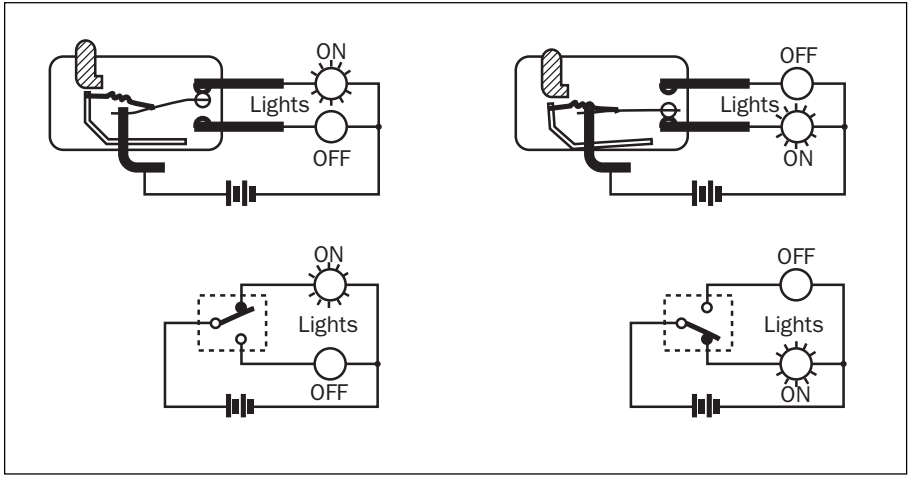


3.9.1
Microswitches

A microswitch is a small electrical control device, which either makes the connection between two contacts (single-pole single-throw, SPST) or changes the connection from one contact to another (single-pole double-throw, SPDT).
Inside the switch, a “snap-action” mechanism moves the contacts together at a constant speed regardless of the speed at which the actuator is pressed. The pictures show all of the parts that you will find in a microswitch.

The microswitches that are used in Konica copiers are either Single-Pole Single-Throw (SPST) or Single-Pole Double-Throw (SPDT). The word “Pole” describes the number of circuits that the switch will activate simultaneously. Single Pole = one circuit and Double Pole = two circuits. The word “Throw” describes the number of positions on the switch that activates circuits.

3.9 Switches



The above illustration shows how two lamps can be controlled by a single (SPDT) switch

3.9.2
Power Switches

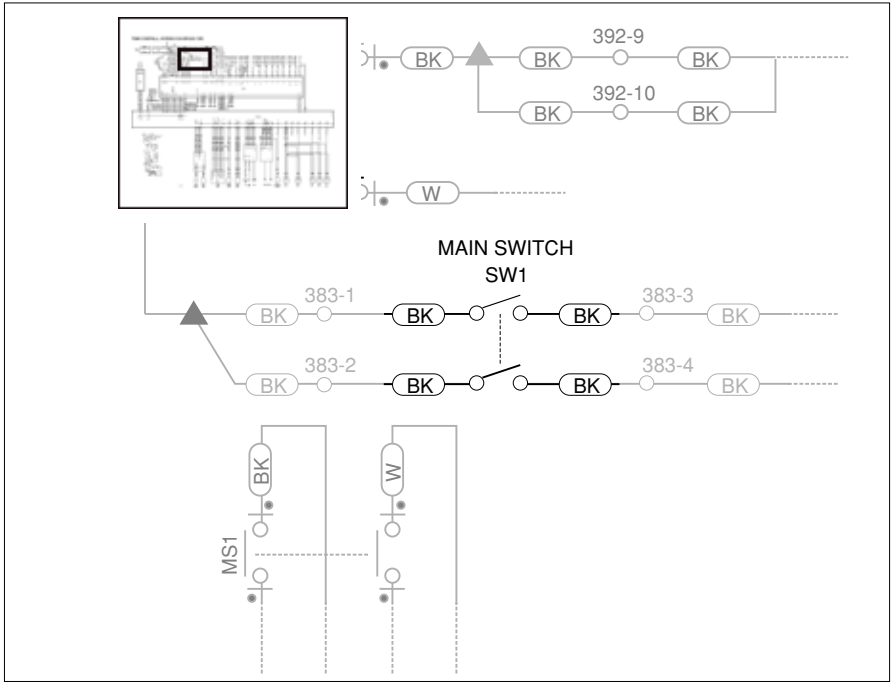
The second type of switch that we will look at here is the type used as the Main ON/ OFF switch on the current range of Konica copiers as seen in this picture.

This switch is a Double-Pole Single-Throw (DPST) - that is, it switches two separate circuits with only one moving and one stationary contact.

Understanding of Basic Devices

3.9 Switches

This wiring diagram shows the main switch as it is wired on a current Konica copier. The switch in this circuit is actually being used to switch the one common Hot AC power line to two separate AC inputs on the DCPS.

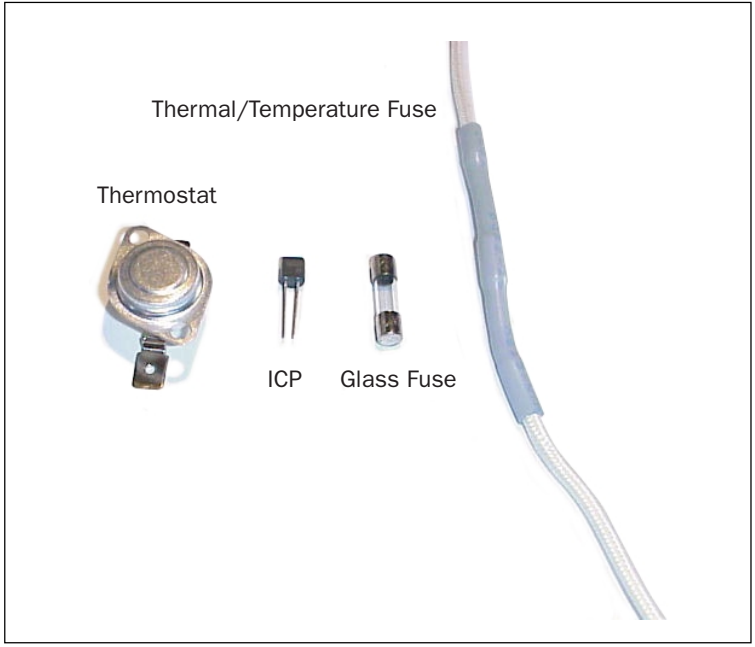


Understanding of Basic Devices

3.10 Fuses

Fuses are used to protect circuits or machines from excessive current or heat. The following types of fuses are used in Konica copiers:

- Glass type fuse
- Thermal/Temperature fuse
- Thermostat
- Integrated Circuit Protector (ICP)



3.10 Fuses

3.10.1
Glass Type Fuse

This type of fuse is basically a resistor with a very low amount of resistance. The resistance causes heat to be generated when current flows through the fuse. The temperature of the fuse rises rapidly due to the heat generation. When the small amount of heat that is dissipated by the resistor equals the amount of heat generated, the temperature of the resistor becomes constant. If the amount of heat generated exceeds the amount that can be dissipated, then the resistor begins to melt. The temperature where this begins to happen is called the “melting point”.

When the temperature becomes higher than the melting point of the resistors material, the resistor begins to melt, eventually breaking the circuit.

The temperature where this begins to happen is called the “melting point”. When the temperature becomes higher than the melting point of the resistors material, the resistor begins to melt, eventually breaking the circuit.

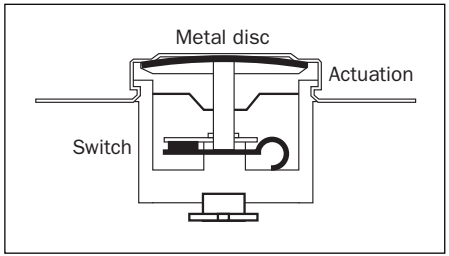
3.10.2

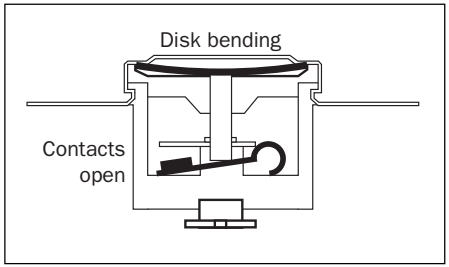
Temperature Fuse

A temperature fuse is sensitive to heat rather than current. If you look at one closely, you will notice that the rating is expressed in terms of temperature.
A temperature fuse can be made of tin, lead, bismuth, cadmium or alloys of these metals, all of which have low melting points. In other words, they melt at a relatively low temperature when compared to other metals.

Temperature fuses are not being used as often as they were in the past; instead, thermostats are taking their place.

If a temperature fuse is utilised, it is used as a safety device in case the exposure or fixing heater lamp stay on for too long. It is placed a small distance away from the lamp and is wired in series with the “hot” AC side of the lamp wiring. If the lamp stays on for too long the fuse will melt. When the fuse melts, current to the lamp is positively removed by opening the circuit.

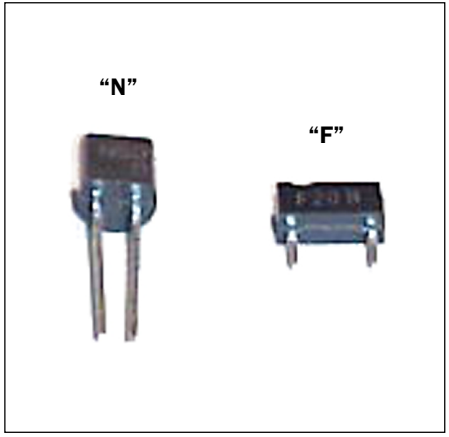




3.10.3
Thermostat

Like a temperature fuse, a thermostat is wired in series with the “hot” AC side of the lamp wiring. Thermostats are also mounted a small distance away from the lamp or device that they are wired to. The thermostat is made up of a curved metal disc, an actuator and a switch.

When the temperature of the lamp exceeds the thermal rating of the thermostat (determined by the disc) the disc in the thermostat becomes distorted. As the disc distorts (bends), it presses on the actuator, which in turn presses the switch contacts opening the AC circuit to the lamp.



Circuit protector chips

3.10.4
Integrated Circuit Protectors

In recent years a new type of fuse has been included on various circuit boards in the copier. This fuse is referred to as an Integrated Circuit Protector, or more commonly as an ICP or IC protector.

ICPs are just miniature fuses specifically designed to have a very rapid response to prevent damage to sensitive solid state components including integrated circuits and transistors. ICPs come in different shapes and current ratings. Some may look similar to a small transistor but have only two legs while others may look like a small rectangular box or resistor.

The current rating of ICPs can be determined by a code stamped on the side of them. Below is a list of ICP codes and their current rating.

Code:	Current:
*10	400mA
*15	600mA
*20	800mA
*25	1A
*38	1.5A
*50	2A
*75	2.7A

The * will either be the letter “F” or “N”, indicating the shape of the ICP.

Understanding of Basic Devices

3.11 Memory

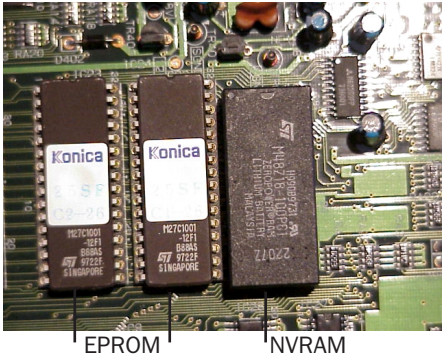
There are a number of different memory storage devices used in Konica copiers including:

- EPROM (Erasable Programmable Read-Only Memory)
- NVRAM (Non-Volatile Random Access Memory)
- Flash Memory
- SIMM (Single In-line Memory Module)

All of these memory devices provide a storage area for information (data). Some of them retain the information when the copier power is turned off (non-volatile) while some do not (volatile).

There are many books and internet web sites that provide detailed explanations on each of the mentioned memory devices, so discussion here will be limited to location and basic operation.

3.11 Memory

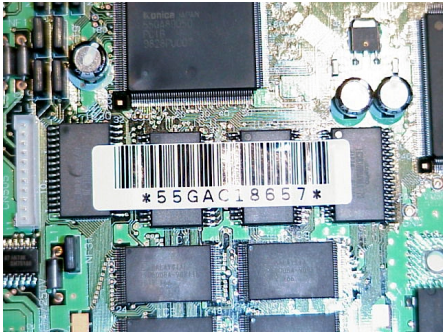


3.11.1 EPROM

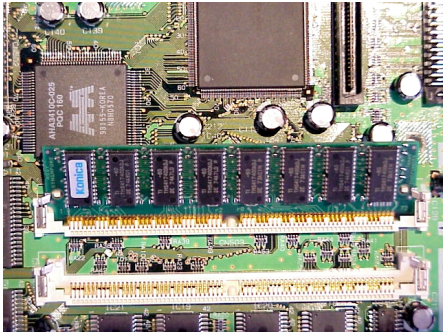
The EPROM holds information to control the overall operation of the copier. EPROMs retain their memory until exposed to ultraviolet light. This is accomplished by removing the label on the chip and placing it under a UV light for a set amount of time. To program an EPROM a special device called a PROM programmer or PROM burner is required.

3.11.2 NVRAM

The NVRAM holds specific information pertaining to the setup of the copier. Items such as the PM count, language, total count of copies and so on are all stored here. The NVRAM contains a small battery inside so that the memory is held when the power is switched off.



Flash Memory


SIMM

3.11.3
Flash Memory

Flash memory performs the same function as the EPROM in the copier. That is, it holds the information or program to control the overall operation of the copier. Flash memory is made up of a special type of EPROM that can be erased and reprogrammed in blocks instead of one byte at a time.
The advantage with flash memory is that a technician in the field can reprogram the copier using a standard computer or an ISW device supplied by Konica. This eliminates the need to return with a new set of EPROMs.

3.11.4
SIMMs

SIMMs are a small circuit board that hold a group of memory chips.
These chips are used on Konica copiers to allow the function of the ERDH (Electronic Recirculating Document Handler). This is a system that allows the “scan once print many” ability that our digital copiers have. The scanned original information is held in the SIMM’s memory and repeated copies made until the desired quantity is achieved. SIMM’s are also used in older computers, however these are becoming superseded by a faster memory called “SDRAM”.

Troubleshooting Tools And Technology

4.1 Key Differences in the Copy Process Between Analogue and Digital

When troubleshooting the digital copier it is important to have an understanding of the key differences between analog and digital. Analog copiers have been in the field for a long time and technicians generally have a good understanding of the operation with regard to the overall copy process. The digital copier is very similar to the analog copier in many areas such as the paper feed unit, fixing unit and the drum unit. However, because it is difficult, if not impossible to fix something if you do not understand how it works, here we will review some of the key areas that differ considerably with the digital copier. It is recommended if you have not already completed Konica's "Digital Copier Basics" CBT that you take the time to do so. This will give you an understanding of the principles of digital technology.

Key areas of difference:

- Reverse development process.
- Second paper feed timing.
- Laser writing method.

4.1.1
Reverse Developing

To understand reverse developing let us start with the copy process from the beginning.

As seen in figure 1, in the case of the analog copier light from the original is reflected directly via mirrors and a lens onto the photoconductor. However, in the digital copier, light is first converted into digital signals, then converted back into light in the form of a Laser beam, which then exposes the photoconductor.

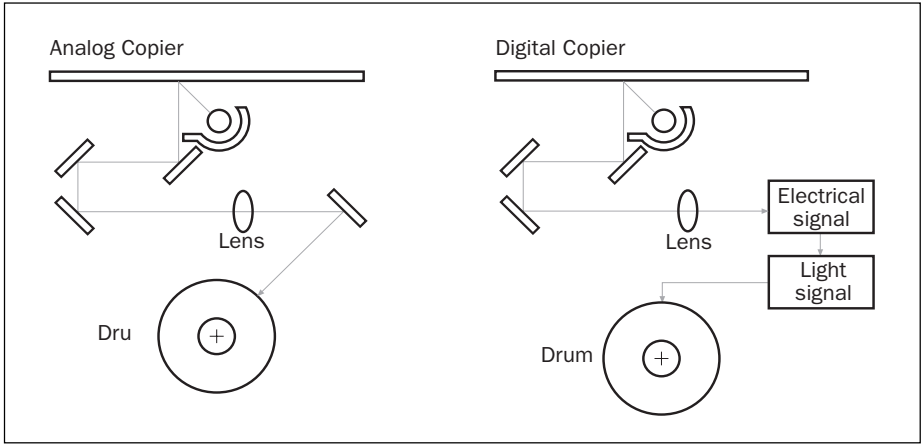
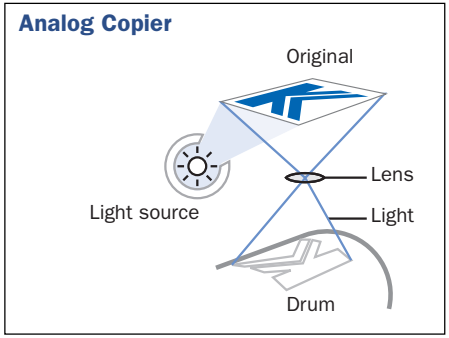
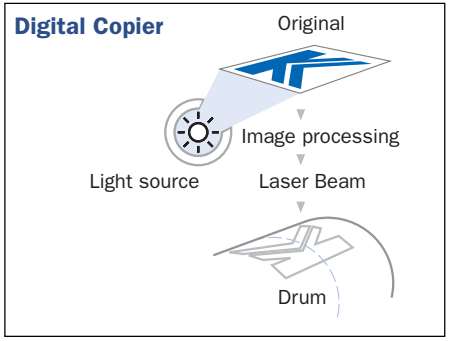


Figure 1

4.1 Key Differences in the Copy Process Between Analogue and Digital





The important point to understand here is that in the case of the analog copier the light that strikes the photoconductor discharges all of the negative charge except for the “K” area. In the case of the digital copier the Laser beam erases only the charge in the area of the “K”.

Charging:
Analog and digital copiers utilising an OPC photoconductor both employ a negative charging current.

Exposure:
In an analog machine, the drum is given a negative charge. Light from the white parts of the original is reflected down onto the drum and discharges the areas it strikes.

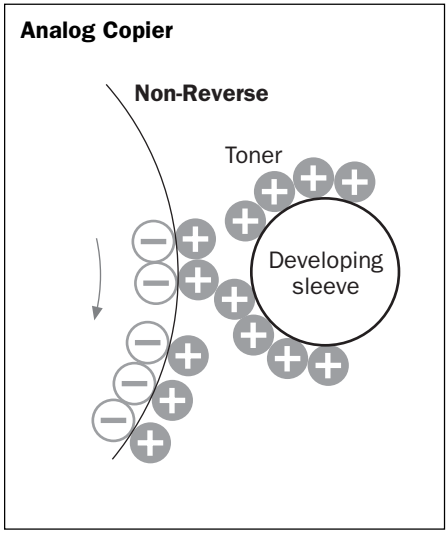
Reverse Developing

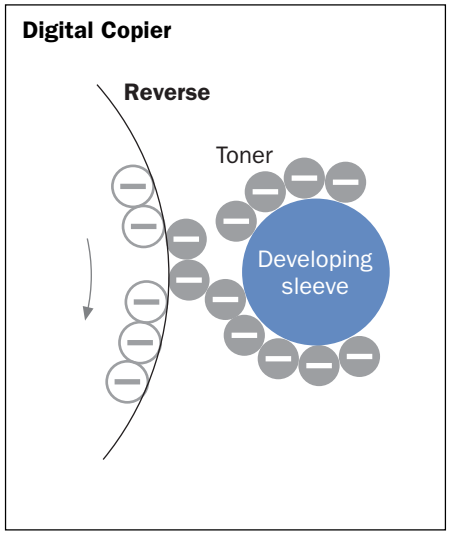
The process involved in a digital copier is called reverse developing. The laser beam strikes the negative drum and discharges the surface potential, pixel by pixel, until it builds up the latent image. The drum is turned as each separate line of the image is written.

The laser beam is switched on for every black pixel and stays off for every white pixel. Remember that an analog copier discharges the areas that reflect white, the digital copier discharges the areas that represent black.

Development:

The diagram on the far right shows the basic process of reverse development used in the digital copier. As you can see, the polarity of the electrostatic charge on the photoconductor is the same for the analog and the digital copier.





However the toner used in the analog copier has a positive potential whereas the toner on the digital copier has a negative potential.

Troubleshooting Tools And Technology

4.1 Key Differences in the Copy Process Between Analogue and Digital

If you think back to the exposure process for the analog copier, charge on the photoconductor corresponding to white areas on the original is erased.
Only the “K” has a negative potential charge that will attract the positive toner in the development process resulting in a visible toner image on the photoconductor.

The digital copier is, however, very different in this area. Areas corresponding to white on the original remain potentially charged whereas the “K” negative potential is erased.
Now as the toner has a negative potential (opposite to the analog copier) it is not possible for it to adhere to the charged areas of the photoconductor.
The toner will only adhere to the areas that have been discharged (those with a lower potential).

It is important to remember that basically everything in the developing is opposite between the analog and digital copier.

Troubleshooting Tools And Technology

4.1 Key Differences in the Copy Process Between Analogue and Digital

There are some problems that can occur in the digital copier that can be difficult to understand unless you know how reverse development works. Some of these are:

Problem:	**Symptom on a digital copier:**
Light entering copier & exposing photoconductor	Background, dark copies
Charge corona not seated down close enough against photoconductor	Background, dark copies
No charge corona output	Black copies

If you think about what result you would get on an analog copier given the above problems, you will see that the result on the digital copier is the opposite due to the reverse development system.

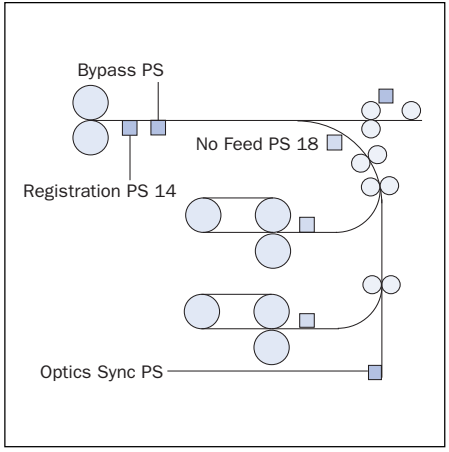
4.1.2
Second Paper Feed Timing

Generally when there is a problem, you will run through in your mind how the unit should work based on your knowledge, and then compare this against what is actually happening.

The operation of the second feed in an analog copier would go something like this:

- Copy button is pressed.
- Main motor starts.
- Paper feed begins and paper is conveyed to the second paper feed rollers where it operates a photosensor generally called the 'temporary stop sensor'.
- At this time the optics start to scan, and when a sensor in the optics section is operated (generally called the second paper feed restart sensor), the second paper feed clutch will operate after a given time.
- Paper is conveyed from the second paper feed rollers to the photoconductor.

4.1 Key Differences in the Copy Process Between Analogue and Digital



In the digital copier this operation is different due to “scan once print many” capability. Because the digital copier converts the original image into digital information that can be stored on memory chips (SIMMs), there is no need, in most cases, for the optics to perform multiple scans of a single original.

Therefore as the optics only scan the original once and then it is printed from memory, the signal that starts the second paper feed clutch no longer can come from a sensor mounted in the optics area.

The digital copier is fitted with an additional sensor in the paper feed unit (No feed PS), which is used as the timing signal to control the Laser write start timing. Laser write begins at a specifies period from when PS 18 goes on. Paper feed restart timing is controlled by the registration PS.

Troubleshooting Tools And Technology

4.2 Service Handbook Layout

Troubleshooting can be made easier if you know where to find everything in the Service Handbook. The purpose of this section is to ensure that all technicians know where the appropriate materials can be located.

Konica Service Handbooks are generally separated into the following sections:

- Process
- Mainbody
- Diagrams
- Adjustments
- Service

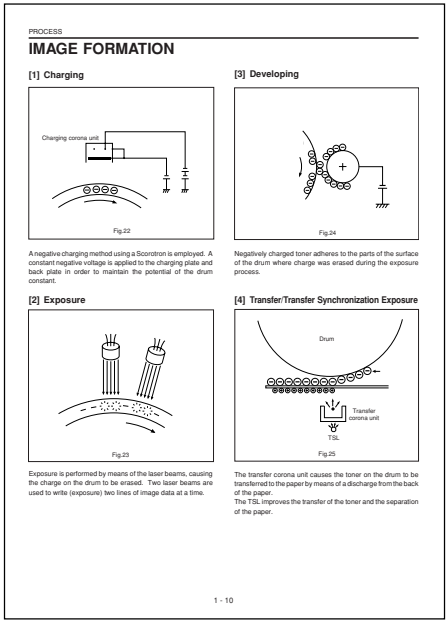
If the copier has any options that can be fitted, these sections will be included after the above items. Also an 'Operation' or 'Instruction Manual' section will be included.

4.2.1
Process

The Process section includes a detailed explanation of the following items:

1. Outline and composition of the copier
2. Image formation process
3. Other processes related to the copy process

This section can be very useful if you do not have a clear understanding of the overall copy process of the machine.



PROCESS

IMAGE FORMATION

[1] Charging

Fig.22

A negative charging method using a Scorotron is employed. A constant negative voltage is applied to the charging plate and back plate in order to maintain the potential of the drum constant.

[3] Developing

Fig.24

Negatively charged toner adheres to the parts of the surface of the drum where charge was erased during the exposure process.

[2] Exposure

Fig.23

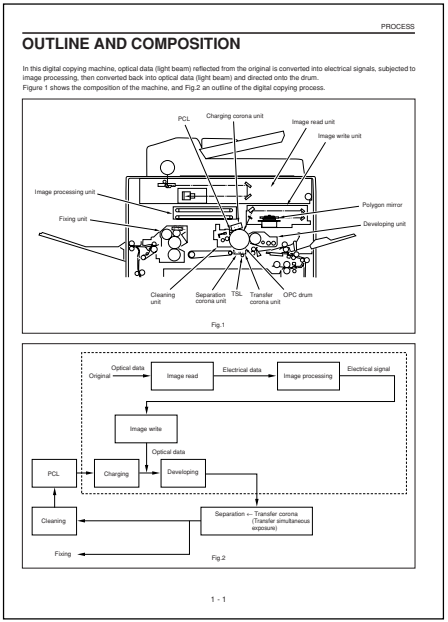
Exposure is performed by means of the laser beams, causing the charge on the drum to be erased. Two laser beams are used to write (exposure) two lines of image data at a time.

[4] Transfer/Transfer Synchronization Exposure

Fig.25

The transfer corona unit causes the toner on the drum to be transferred to the paper by means of a discharge from the back of the paper.
The TSL improves the transfer of the toner and the separation of the paper.

1 - 10



PROCESS

OUTLINE AND COMPOSITION

In this digital copying machine, optical data (light beam) reflected from the original is converted into electrical signals, subjected to image processing, then converted back into optical data (light beam) and directed onto the drum.
Figure 1 shows the composition of the machine, and Fig.2 an outline of the digital copying process.

Fig.1

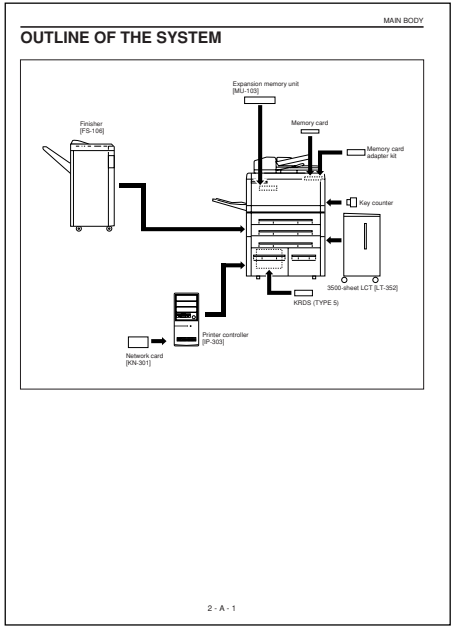
Fig.2

1 - 1

4.2.2 Mainbody

The Mainbody section covers the following items:

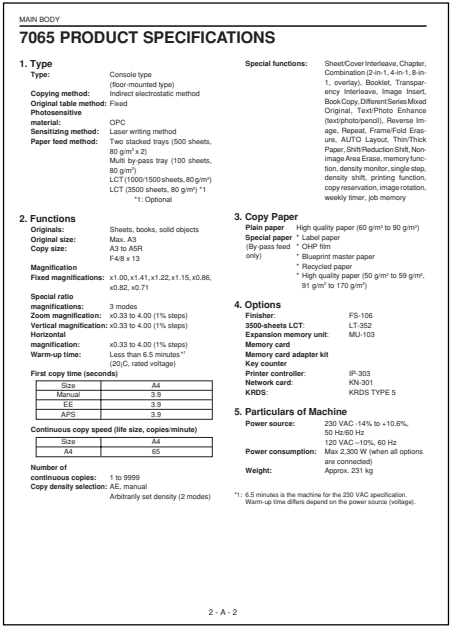
1. Outline of the system - illustrating which items are standard equipment and, if applicable, which items can be fitted as an option
2. Product specifications - some of the information included here covers suitable copy paper, warm up time, copy speed and power requirements



MAIN BODY

OUTLINE OF THE SYSTEM

2 - A - 1



MAIN BODY

7065 PRODUCT SPECIFICATIONS

1. Type

Type: Console type (floor-mounted type)
Copying method: Indirect electrostatic method
Original table method: Fixed
Photosensitive material: OPC
Sensitizing method: Laser writing method
Paper feed method: Two stacked trays (500 sheets, 80 g/m² x 2)
Multi by-pass tray (100 sheets, 80 g/m²)
LCT (1000/1500 sheets, 80 g/m²)
LCT (3500 sheets, 80 g/m²) *1
*1: Optional

Special functions: Sheet/Cover Interleave, Chapter, Combination (2-in-1, 4-in-1, 8-in-1, overlay), Booklet, Transparency Interleave, Image Insert, Book Copy, Different Series Mixed Original, Text/Photo Enhance (text/photo/pencil), Reverse Image, Repeat, Frame/Fold Erasure, AUTO Layout, Thin/Thick Paper, Shift/Reduction Shift, Non-image Area Erase, memory function, density monitor, single step, density shift, printing function, copy reservation, image rotation, weekly timer, job memory

2. Functions

Originals: Sheets, books, solid objects
Original size: Max. A3
Copy size: A3 to A5R
F4/8 x 13
Magnification
Fixed magnifications: x1.00, x1.41, x1.22, x1.15, x0.86, x0.82, x0.71
Special ratio magnifications: 3 modes
Zoom magnification: x0.33 to 4.00 (1% steps)
Vertical magnification: x0.33 to 4.00 (1% steps)
Horizontal magnification: x0.33 to 4.00 (1% steps)
Warm-up time: Less than 6.5 minutes*1 (20)C, rated voltage)

First copy time (seconds)

Size	A4
Manual	3.9
EE	3.9
APS	3.9

Continuous copy speed (life size, copies/minute)

Size	A4
A4	65

Number of continuous copies: 1 to 9999
Copy density selection: AE, manual
Arbitrarily set density (2 modes)

3. Copy Paper

Plain paper High quality paper (60 g/m² to 90 g/m²)
Special paper (By-pass feed only)
* Label paper
* OHP film
* Blueprint master paper
* Recycled paper
* High quality paper (50 g/m² to 59 g/m², 91 g/m² to 170 g/m²)

4. Options

Finisher: FS-106
3500-sheets LCT: LT-352
Expansion memory unit: MU-103
Memory card
Memory card adapter kit
Key counter
Printer controller: IP-303
Network card: KN-301
KRDS: KRDS TYPE 5

5. Particulars of Machine

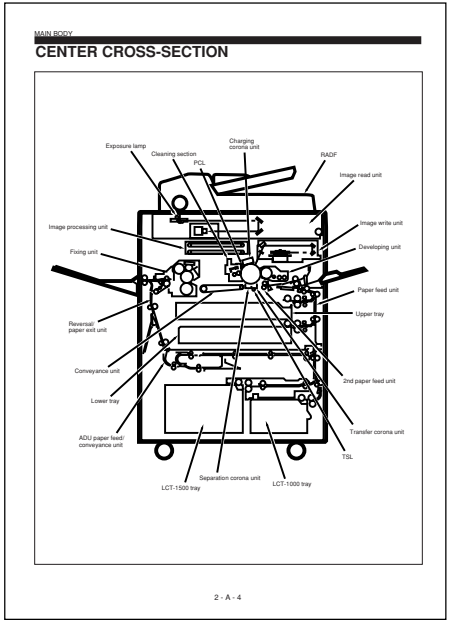
Power source: 230 VAC -14% to +10.6%, 50 Hz/60 Hz
120 VAC -10%, 60 Hz
Power consumption: Max 2,300 W (when all options are connected)
Weight: Approx. 231 kg

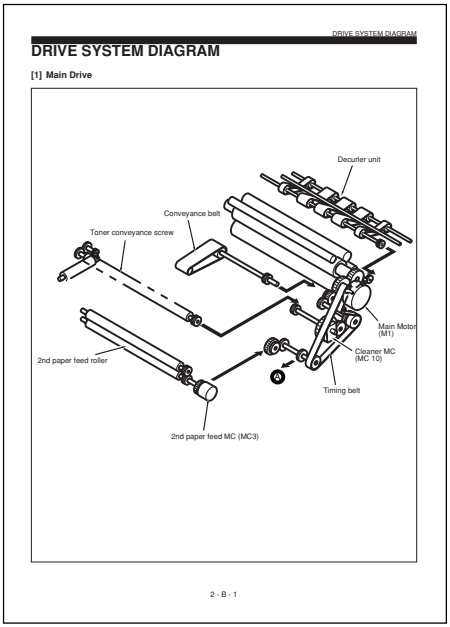
*1: 6.5 minutes is the machine for the 230 VAC specification. Warm-up time differs depend on the power source (voltage).

2 - A - 2

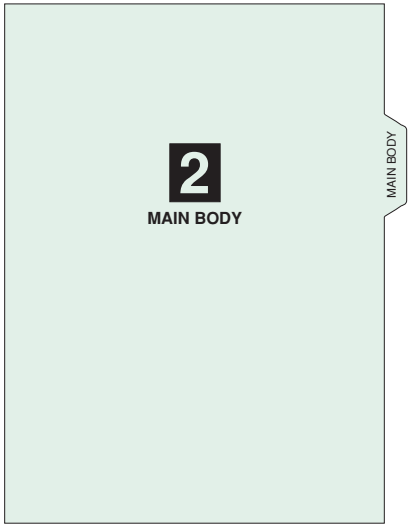
4.2 Service Handbook Layout

3. Center cross-section - a cutaway diagram gives a clear view of major component location and paper path
4. Drive system diagrams - here drawings clearly show the drive train from each motor and all the components associated with it





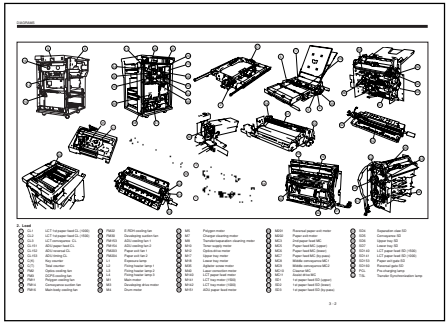
4.2 Service Handbook Layout



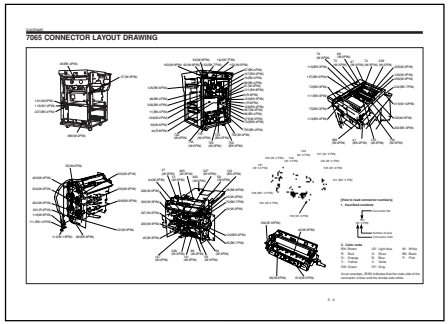
The rest of the Mainbody section covers detailed explanations of each and every section of the machine including composition, operation explanation, disassembly/re-assembly and encapsuled diagrams.

4.2.3
Diagrams

The Diagrams section covers the following items:

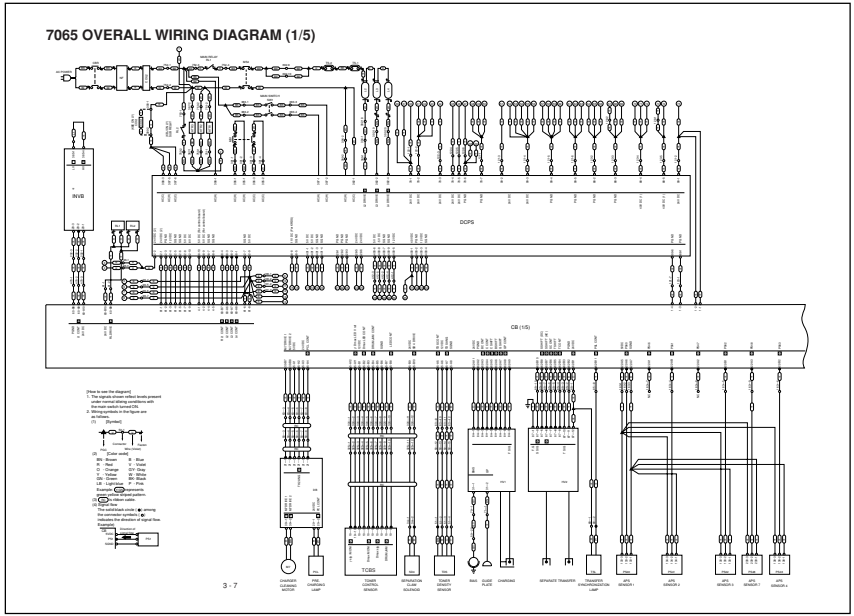


1. Electrical parts layout – necessary for location of components

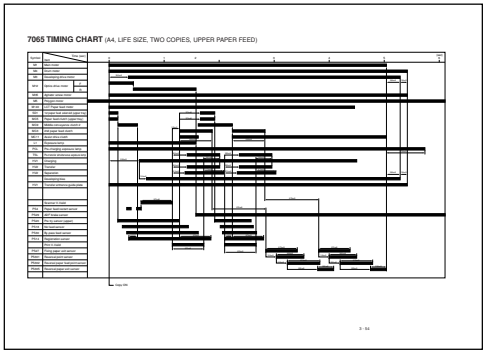


2. Connector layout – this makes finding a given connector number an easy task

3. Wiring diagrams and timing charts – these will be covered in detail later in this section

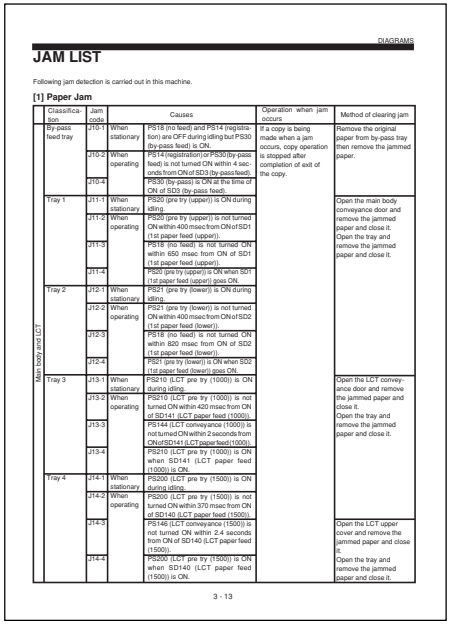


Wiring Diagram



Timing Chart

4. Jam list – different types of jams that may be encountered, including possible causes
5. Abnormality list – similar to the jam list gives an explanation and a possible cause along with the clearing method and assumed faulty part



DIAGRAMS

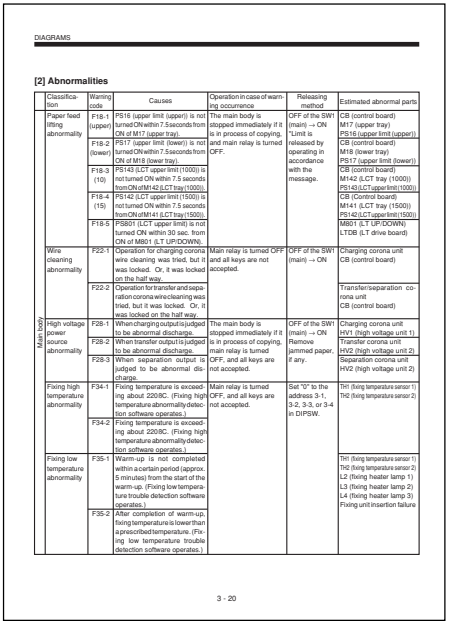
JAM LIST

Following jam detection is carried out in this machine.

[1] Paper Jam

	Classification	Jam code		Causes	Operation when jam occurs	Method of clearing jam
Main body and LCT	By-pass feed tray	J10-1	When stationary	PS18 (no feed) and PS14 (registration) are OFF during idling but PS30 (by-pass feed) is ON.	If a copy is being made when a jam occurs, copy operation is stopped after completion of exit of the copy.	Remove the original paper from by-pass tray then remove the jammed paper.
		J10-2	When operating	PS14 (registration) or PS30 (by-pass feed) is not turned ON within 4 seconds from ON of SD3 (by-pass feed).		
		J10-4		PS30 (by-pass) is ON at the time of ON of SD3 (by-pass feed).		
	Tray 1	J11-1	When stationary	PS20 (pre fry (upper)) is ON during idling.		Open the main body conveyance door and remove the jammed paper and close it. Open the tray and remove the jammed paper and close it.
		J11-2	When operating	PS20 (pre fry (upper)) is not turned ON within 400 msec from ON of SD1 (1st paper feed (upper)).		
		J11-3		PS18 (no feed) is not turned ON within 650 msec from ON of SD1 (1st paper feed (upper)).		
		J11-4		PS20 (pre fry (upper)) is ON when SD1 (1st paper feed (upper)) goes ON.		
	Tray 2	J12-1	When stationary	PS21 (pre fry (lower)) is ON during idling.		
		J12-2	When operating	PS21 (pre fry (lower)) is not turned ON within 400 msec from ON of SD2 (1st paper feed (lower)).		
		J12-3		PS18 (no feed) is not turned ON within 820 msec from ON of SD2 (1st paper feed (lower)).		
		J12-4		PS21 (pre fry (lower)) is ON when SD2 (1st paper feed (lower)) goes ON.		
	Tray 3	J13-1	When stationary	PS210 (LCT pre fry (1000)) is ON during idling.		Open the LCT conveyance door and remove the jammed paper and close it. Open the tray and remove the jammed paper and close it.
		J13-2	When operating	PS210 (LCT pre fry (1000)) is not turned ON within 420 msec from ON of SD141 (LCT paper feed (1000)).		
		J13-3		PS144 (LCT conveyance (1000)) is not turned ON within 2 seconds from ON of SD141 (LCT paper feed (1000)).		
		J13-4		PS210 (LCT pre fry (1000)) is ON when SD141 (LCT paper feed (1000)) is ON.		
	Tray 4	J14-1	When stationary	PS200 (LCT pre fry (1500)) is ON during idling.		
		J14-2	When operating	PS200 (LCT pre fry (1500)) is not turned ON within 370 msec from ON of SD140 (LCT paper feed (1500)).		
		J14-3		PS146 (LCT conveyance (1500)) is not turned ON within 2.4 seconds from ON of SD140 (LCT paper feed (1500)).		Open the LCT upper cover and remove the jammed paper and close it. Open the tray and remove the jammed paper and close it.
		J14-4		PS200 (LCT pre fry (1500)) is ON when SD140 (LCT paper feed (1500)) is ON.		

3 - 13



DIAGRAMS

[2] Abnormalities

	Classification	Warning code	Causes	Operation in case of warning occurrance	Releasing method	Estimated abnormal parts
Main body	Paper feed lifting abnormality	F18-1 (upper)	PS16 (upper limit (upper)) is not turned ON within 7.5 seconds from ON of M17 (upper tray).	The main body is stopped immediately if it is in process of copying, and main relay is turned OFF.	OFF of the SW1 (main) → ON *Limit is released by operating in accordance with the message.	CB (control board) M17 (upper tray) PS16 (upper limit (upper))
		F18-2 (lower)	PS17 (upper limit (lower)) is not turned ON within 7.5 seconds from ON of M18 (lower tray).			CB (control board) M18 (lower tray) PS17 (upper limit (lower))
		F18-3 (10)	PS143 (LCT upper limit (1000)) is not turned ON within 7.5 seconds from ON of M142 (LCT tray (1000)).			CB (control board) M142 (LCT tray (1000)) PS143 (LCT upper limit (1000))
		F18-4 (15)	PS142 (LCT upper limit (1500)) is not turned ON within 7.5 seconds from ON of M141 (LCT tray (1500)).			CB (Control board) M141 (LCT tray (1500)) PS142 (LCT upper limit (1500))
		F18-5	PS801 (LCT upper limit) is not turned ON within 30 sec. from ON of M801 (LT UP/DOWN).			M801 (LT UP/DOWN) LTDB (LT drive board)
	Wire cleaning abnormality	F22-1	Operation for charging corona wire cleaning was tried, but it was locked. Or, it was locked on the half way.	Main relay is turned OFF and all keys are not accepted.	OFF of the SW1 (main) → ON	Charging corona unit CB (control board)
		F22-2	Operation for transfer and separation corona wire cleaning was tried, but it was locked. Or, it was locked on the half way.			Transfer/separation corona unit CB (control board)
	High voltage power source abnormality	F28-1	When charging output is judged to be abnormal discharge.	The main body is stopped immediately if it is in process of copying, main relay is turned OFF, and all keys are not accepted.	OFF of the SW1 (main) → ON Remove jammed paper, if any.	Charging corona unit HV1 (high voltage unit 1)
		F28-2	When transfer output is judged to be abnormal discharge.			Transfer corona unit HV2 (high voltage unit 2)
		F28-3	When separation output is judged to be abnormal discharge.			Separation corona unit HV2 (high voltage unit 2)
	Fixing high temperature abnormality	F34-1	Fixing temperature is exceeding about 220?C. (Fixing high temperature abnormality detection software operates.)	Main relay is turned OFF, and all keys are not accepted.	Set "0" to the address 3-1, 3-2, 3-3, or 3-4 in DIPSW.	TH1 (fixing temperature sensor 1) TH2 (fixing temperature sensor 2)
		F34-2	Fixing temperature is exceeding about 220?C. (Fixing high temperature abnormality detection software operates.)			
	Fixing low temperature abnormality	F35-1	Warm-up is not completed within a certain period (approx. 5 minutes) from the start of the warm-up. (Fixing low temperature trouble detection software operates.)			TH1 (fixing temperature sensor 1) TH2 (fixing temperature sensor 2) L2 (fixing heater lamp 1) L3 (fixing heater lamp 2) L4 (fixing heater lamp 3) Fixing unit insertion failure
		F35-2	After completion of warm-up, fixing temperature is lower than a prescribed temperature. (Fixing low temperature trouble detection software operates.)			

3 - 20

4.2 Service Handbook Layout

A list of codes displayed if a given connector is unplugged is now included in the diagrams section of most digital copier service handbooks

DIAGRAMS

LIST OF DISCONNECTED CONNECTOR CODES

When an abnormality occurs, there is a possibility that a connector may have been disconnected. When the connector is connected normally, conduct trouble shooting in accordance with the jamming list.

[1] Paper Jam

Code	Number of disconnected connector
J10	CN53(Paper feed), CN233(Paper feed), CN112(Paper feed relay), CN120(Control board)
J11	CN38(Paper feed), CN230(Paper feed), CN234(Paper feed), CN327(Paper feed), CN112(Paper feed relay), CN120(Control board)
J12	CN38(Paper feeding), CN231(Paper feeding), CN234(Paper feeding), CN328(Paper feeding), CN112(Paper feed relay), CN120(Control board)
J13	CN205(LCT motor), CN204(LCT motor), CN720(LCT vertical conveyance), CN721(LCT vertical conveyance), CN726(LCT vertical conveyance)
J14	CN205(LCT motor), CN204(LCT motor), CN712(LCT horizontal conveyance), CN714(LCT horizontal conveyance), CN716(LCT horizontal conveyance)
J17	CN68(Peper feed), CN73(Optics), CN141(Paper feed), CN112(Paper feed relay)
J19	CN713(LCT horizontal conveyance), CN722(LCT relay), CN727(LCT horizontal conveyance)
J21	CN34(Drum), CN62(Control board), CN85(On the control board), CN87(2nd paper feed)
J30	CN86(2nd paper feed)
J31	CN32(2nd paper feeding), CN42(Upper portion of the control board), CN46(2nd paper feed)
J32	CN6(Control board), CN40(Fixing), CN98(Fixing drawer relay), CN392(Fixing drawer), CN620/621(Reversal unit relay)
J92	CN555(ADU), CN562(ADU vertical conveyance)
J93	CN551(ADU)
J94	CN532(ADU), CN534(ADU), CN550(ADU), CN553(ADU), CN557(ADU), CN559(ADU)
J96	CN552(ADU)

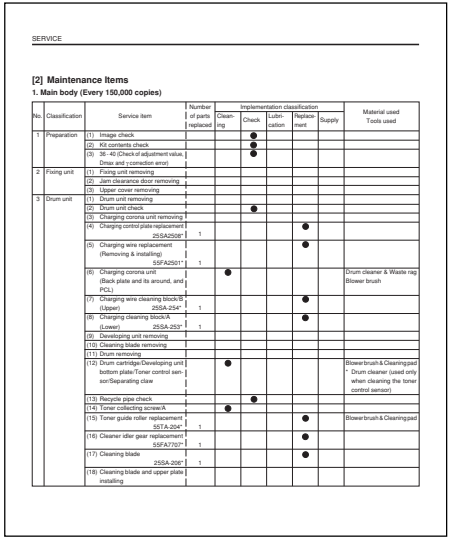
4.2.4
Adjustments

Section 5 of this manual explains this area in detail.

4.2.5
Service

The following items are covered here:

- Service schedule – recommended procedure to be carried out at specified times
- Copy materials – items that are included in maintenance and preventative maintenance (PM) kits

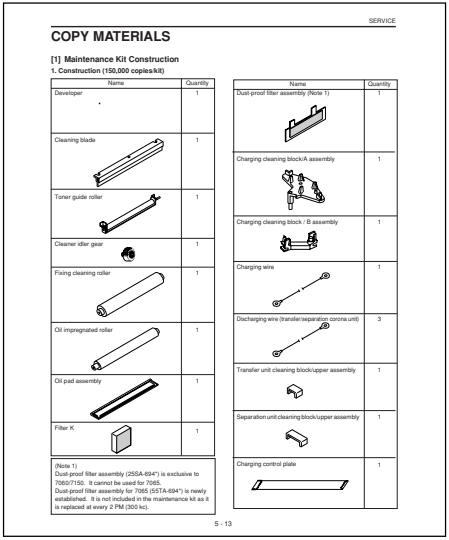


SERVICE

[2] Maintenance Items

1. Main body (Every 150,000 copies)

No.	Classification	Service item	Number of parts replaced	Implementation classification: Cleaning	Check	Lubrication	Replacement	Supply	Material used Tools used
1	Preparation	(1) Image check			●				
		(2) Kit contents check			●				
		(3) 36 -40 (Check of adjustment value, Dmax and γ correction error)			●				
2	Fixing unit	(1) Fixing unit removing							
		(2) Jam clearance door removing							
		(3) Upper cover removing							
3	Drum unit	(1) Drum unit removing							
		(2) Drum unit check			●				
		(3) Charging corona unit removing							
		(4) Charging control plate replacement 25SA2508*	1				●		
		(5) Charging wire replacement (Removing & installing) 55FA2501*	1				●		
		(6) Charging corona unit (Back plate and its around, and PCL)		●					Drum cleaner & Waste rag Blower brush
		(7) Charging wire cleaning block/B (Upper) 25SA-254*	1				●		
		(8) Charging cleaning block/A (Lower) 25SA-253*	1				●		
		(9) Developing unit removing							
		(10) Cleaning blade removing							
		(11) Drum removing							
		(12) Drum cartridge/Developing unit bottom plate/Toner control sensor/Separating claw		●					Blower brush & Cleaning pad * Drum cleaner (used only when cleaning the toner control sensor)
		(13) Recycle pipe check			●				
		(14) Toner collecting screw/A		●					
		(15) Toner guide roller replacement 55TA-204*	1				●		Blower brush & Cleaning pad
		(16) Cleaner idler gear replacement 55FA7707*	1				●		
		(17) Cleaning blade 25SA-206*	1				●		
		(18) Cleaning blade and upper plate installing							



SERVICE

COPY MATERIALS

[1] Maintenance Kit Construction

1. Construction (150,000 copies/kit)

Name	Quantity
Developer	1
Cleaning blade	1
Toner guide roller	1
Cleaner idler gear	1
Fixing cleaning roller	1
Oil impregnated roller	1
Oil pad assembly	1
Filter K	1

(Note 1)
Dust-proof filter assembly (25SA-694*) is exclusive to 7060/7150. It cannot be used for 7085.
Dust-proof filter assembly for 7085 (55TA-694*) is newly established. It is not included in the maintenance kit as it is replaced at every 2 PM (300 kc).

Name	Quantity
Dust-proof filter assembly (Note 1)	1
Charging cleaning block/A assembly	1
Charging cleaning block / B assembly	1
Charging wire	1
Discharging wire (transfer/separation corona unit)	3
Transfer unit cleaning block/upper assembly	1
Separation unit cleaning block/upper assembly	1
Charging control plate	1

5 - 13

4.2 Service Handbook Layout

- Service materials – items required to perform a PM
- Special tools list – tools and jigs required to maintain the machine

SERVICE

SERVICE MATERIALS LIST

Material No.	Description	Shape	Remark
000V-16-0	Drum cleaner	200 ml	
000V-17-0	Roller cleaner	200 ml	
00GR00020	Plus guard No. 2	25 g	
00GR00150	Molytherm grease	25 g	
000V-19-0	Setting powder	25 g	
000V-18-0	Cleaning pad	10 pcs 1 pack	

SERVICE

SPECIAL TOOLS LIST

Tool No.	Description	Shape	Quantity	Remark
7050K0010	Temp. sensor PS adjusting jig		1	
7050K0020	Optics position adjusting jig		2	
00M6-2-00	Door switch jig		1	
00M8-1-00	Thermostat PS adjusting jig (upper roller)		1	
00M8-2-00	Thermostat PS adjusting jig (lower roller)		1	
00VD-5000	New pyramid chart		1	

4.2 Service Handbook Layout

If optional units are applicable, a section will be included for each with the same layout as that used in the rest of the service handbook.

Either in the front or rear of the service handbook will be an operations or instruction manual section that will explain the operation of all features of the machine.

Troubleshooting Tools And Technology

4.3 How To Read Wiring Diagrams

A wiring diagram is a representation of the circuits used in a machine.
It shows the electrical and electronic components and the connections between them, and as such they are extremely useful in troubleshooting.

Wiring diagrams illustrate the following items:

- Components
- Electronic signals and their destination and origin
- Connector numbers
- Pin numbers
- Wire colours

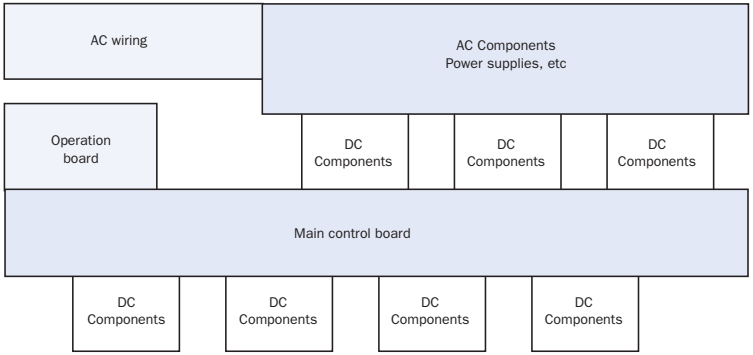
To be able to understand wiring diagrams it is important to have an understanding of basic electronics and the copy process, and know how to use the Service Handbook.

By learning how to read wiring diagrams you will be able to troubleshoot far more effectively. If you make the effort to understand them now, you will know how to use them when they are needed. We can learn many things about a machine just by studying the diagrams.

4.3 How To Read Wiring Diagrams

Konica wiring diagrams use several standards that are employed on all models. Items such as symbols and arrangement of the diagram are common from one machine to the next to make it easier to understand and use these diagrams.

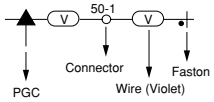
The top portion of all wiring diagrams contains the AC wiring. The active AC line is on the top with the neutral below it. Other AC components are attached to these lines. The diagram illustrates illustrates the basic placement of components in a wiring diagram.



4.3 How To Read Wiring Diagrams

Legend

[How to see the diagram]
1. The signals shown reflect levels present under normal idleing conditions with the main switch turned ON.
2. Wiring symbols in the figure are as follows.
   (1) [Symbol]



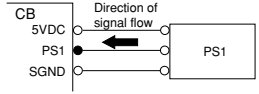
(2) [Color code]

BN - Brown	B - Blue
R - Red	V - Violet
O - Orange	GY- Gray
Y - Yellow	W - White
GN - Green	BK- Black
LB - Light blue	P - Pink

Example: (Y/GN) represents green yellow striped pattern.

(3) (RC) is ribbon cable.

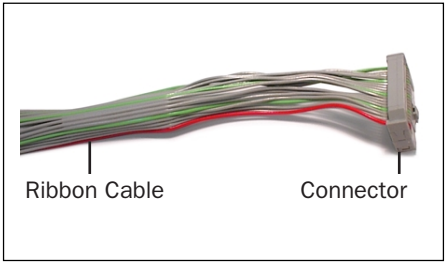
(4) Signal flow
The solid black circle (●) among the connector symbols (○) indicates the direction of signal flow.
Example)



On the wiring diagram you will also find the following items:

- A legend indicating the abbreviations used for the colour coding
- A diagram indicating the flow of signals
- A list of various symbols used throughout the wiring diagram

Often connections between circuit boards are made using a flat “ribbon cable”. In this case colour coding is not used and the cable will be represented by “RC”.



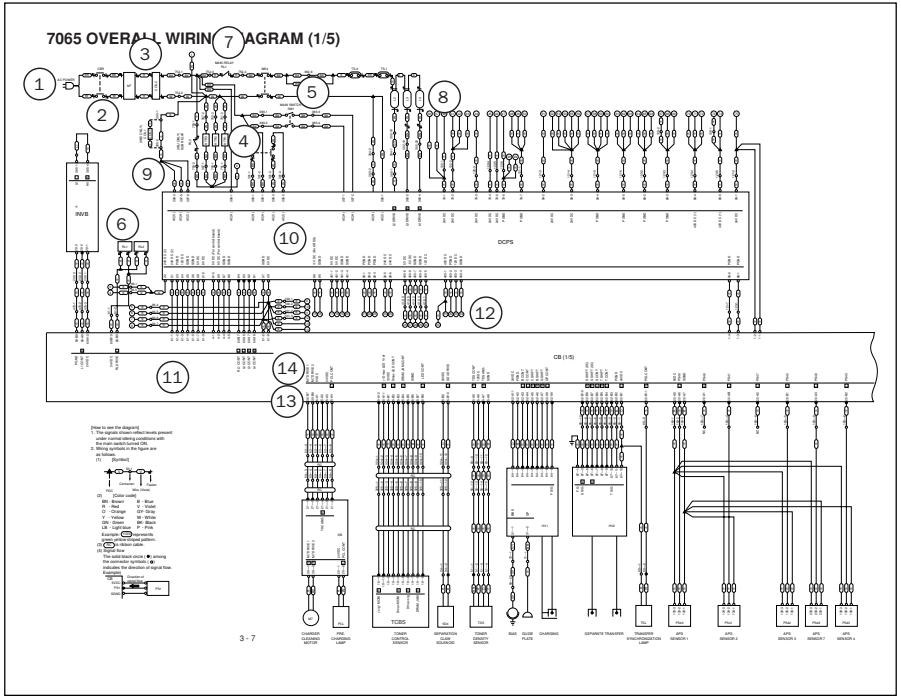
The wiring diagram is drawn with the main switch on and in the idling condition. This status is usually defined in the legend of the wiring diagram

4.3.1
Example Of a Wiring Diagram

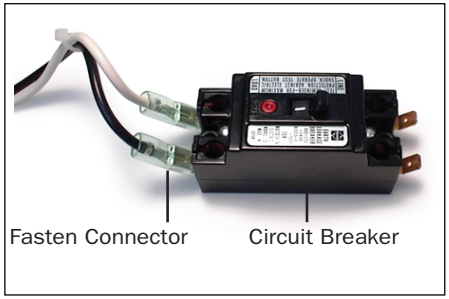
The description refers to the wiring diagram. The circled numbers in the text identifies the corresponding area on the diagram.

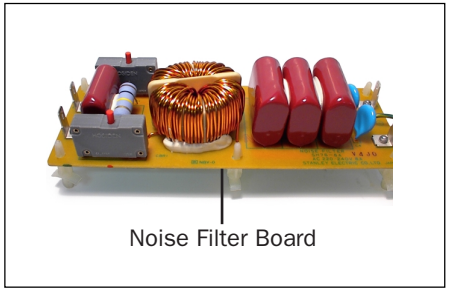
AC Section

At the top left corner of the wiring diagram is the AC power source plug (1). This is drawn to look like a common power plug, and has three wires coming from it. It is generally labeled with the input voltage used in the machine.



4.3.1 Example Of a Wiring Diagram

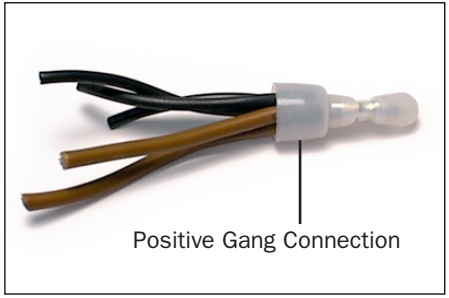




The active and the neutral wires both pass through circuit breakers ② before entering the noise filter ③. Here you will notice the symbol for a “faston” connector used on both sides of the circuit breaker and the noise filter. A faston connector is commonly referred to as a spade connector and is the type of connector used when a single wire is connected by simply pushing it onto a terminal.

The noise filter is installed to protect the machine from noise or spikes in the line voltage. It also protects the external AC line from machine-induced electrical noise.

4.3.1 Example Of a Wiring Diagram



To the right of the noise filter is the main switch and main relay. When the main switch is in the OFF position as shown in the diagram, some components will be ON. These include the noise filter and circuit breakers already mentioned and several heaters ④. Power is also present at the DC Power Supply when the main switch is in the OFF position.

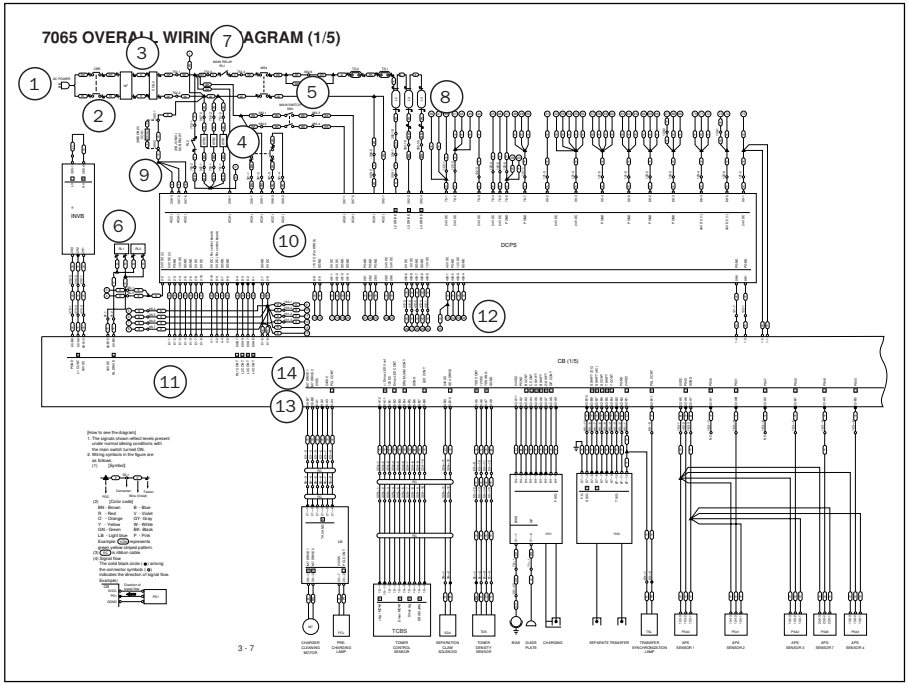
The heaters, which are installed to help prevent moist paper, are represented by rectangles and are called HTR1, HTR2 and HTR3. Previous Konica copiers used “PTC” to represent a heater, this stands for “positive temperature coefficient”

When the main switch ⑤ is turned ON 24V DC is supplied to the coil of relay 1 ⑥ causing the contacts of the relay ⑦ to close. Power is now supplied to the fixing unit heater lamps ⑧.

A black triangle symbol ⑨ indicates a PGC (positive gang connector). This is a group of wires joined together by a crimp style fitting.

DC Section

Below the AC section is the DC power supply board (DCPS) (10) and the Control Board (CB) (11). The DCPS supplies a number of different DC voltages to various parts of the copier. Many of the connectors leaving the DCPS have a circle with a number inside of them (12). This indicates that there is a connection to another point on the wiring diagram. These circled numbers help keep the diagram easy to read by reducing the number of lines that would otherwise be required.



4.3.1 Example Of a Wiring Diagram

Control Board Section

The inputs and the outputs of the main control board occupy a large section of the wiring diagram. The control board can be considered the “brain” of the machine, as its connections are similar to the nervous system in the human body. Like our brains, the control board receives sensor inputs, and sends out control signals.

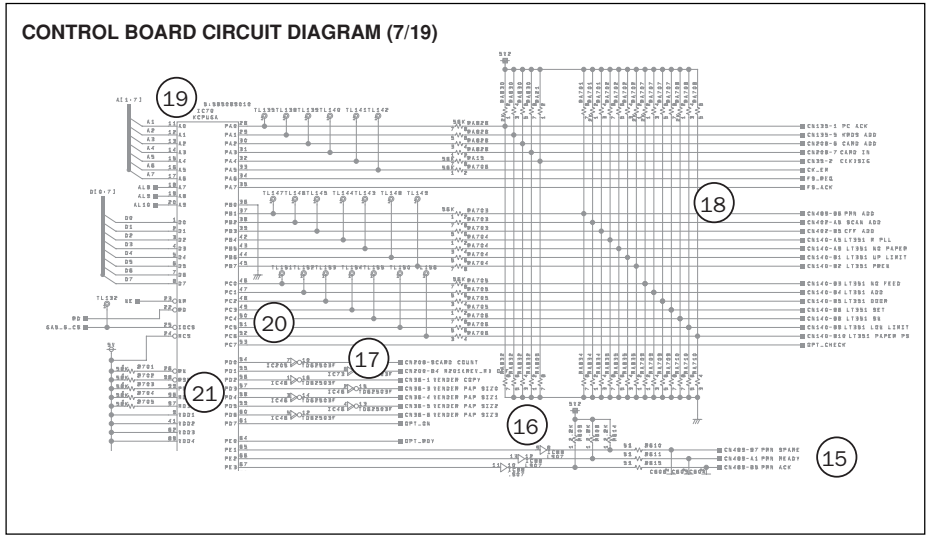
The inner section of the control board shows connector and pin numbers for the various inputs and outputs (I/O) (13). The signal names are also shown (14).

There are four different voltages supplied to the control board: 5V, 8V, 12V and 24 Volts DC.

The input signals to the control board can come from photosensors, switches or other boards such as the Image Processing Board, LCT or Operation Board. These signals inform the Control Board of the status of the copy process. In response, the Control Board operates various loads and software timers via output signals. An output signal turns on a load by allowing voltage to have a path to ground.

Control Board Circuit Diagrams

The various signals to and from the main Control Board can be monitored at the chip level. Sometimes it is difficult to check for a signal at a connector, such as in the case of a ribbon cable connector where all the wires are the same colour. To be sure of a signal it can be useful to know the IC and pin number where the signal is located. To find it, use the Control Board circuit diagrams found in the diagram section of the Service Handbook.



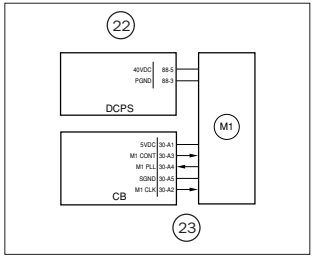
4.3.1 Example Of a Wiring Diagram

In general, every signal is sent to an IC on the Control Board. Use the steps below along with the control board circuit on the previous page to understand how to trace signals.

1. Find the connector and pin number of the signal on the Control Board wiring diagram (15).
2. Follow the signal to the IC. You may encounter the signal passing through other chips such as buffers (16), inverters (17) or resistor arrays (18). Remember that an inverter will change the state of a signal from LOW to HIGH or from HIGH to LOW.
3. The IC number is shown clearly (19). The correct pin numbers are listed on the outside of the IC (20). The numbers on the inside of the IC deal with internal chip architecture and the terminal name (21). Be careful not to confuse them.
4. Locate the pin on the IC. The IC will have a notch or indentation at one end. The pin numbers increase in a counterclockwise direction beginning with pin 1. Pin 1 is located to the immediate left of the notch or indentation.

4.3.1 Example Of a Wiring Diagram

[4] M1 (main) Control



M1 (main) is controlled by the CB (control board).

1. Operation (24)

M1 is a 40 V drive DC motor which drives the toner recycle, conveyance, 2nd paper feed and fixing sections. M1 is PLL-controlled by feedback signals from a speed sensor installed inside M1 itself, maintaining it at a constant speed. M1 goes ON when the Start button is pressed, and goes OFF again when the final copy has been exited.
During warm-up, M1 rotates, causing the fixing roller to rotate.

2. Signals (25)

a. Input signal

(1) M1 PLL (M1 → CB)
M1 rotation monitoring signal
[H]: Stop or abnormal or rotation
[L]: Normal rotation

b. Output signals

(1) M1 CONT (CB → M1)
M1 drive control signal
[L]: M1 ON
[H]: M1 OFF

(2) M1 CLK (CB → M1)
M1 rotational speed control reference clock signal

Example of an "Encapsuled Schematic"

Encapsuled Schematics

Sometimes it is much easier to refer to the encapsuled schematic of a circuit instead of using the large wiring diagram. Konica Service Handbooks have extensive circuit descriptions for the electrical loads in the copier. With each circuit description you will find an abbreviated or "encapsuled" schematic (22). These mini wiring diagrams show only components that apply to a particular circuit. The diagram focuses on the circuit in question and shows its relationship with other circuits and loads in the copier. This includes an indication of signal directions (23) and the related connector and pin numbers. Below the encapsuled schematic there is a description of the operation of the circuit (24) along with a listing of all relevant signals (25) including their origin and destination.

Encapsuled schematics are particularly useful when troubleshooting as the description of operation (24) explains how the item should operate while the signal list (25) details what signals should be present. Even if you are untrained on the particular machine this page will inform you on how this circuit operates.

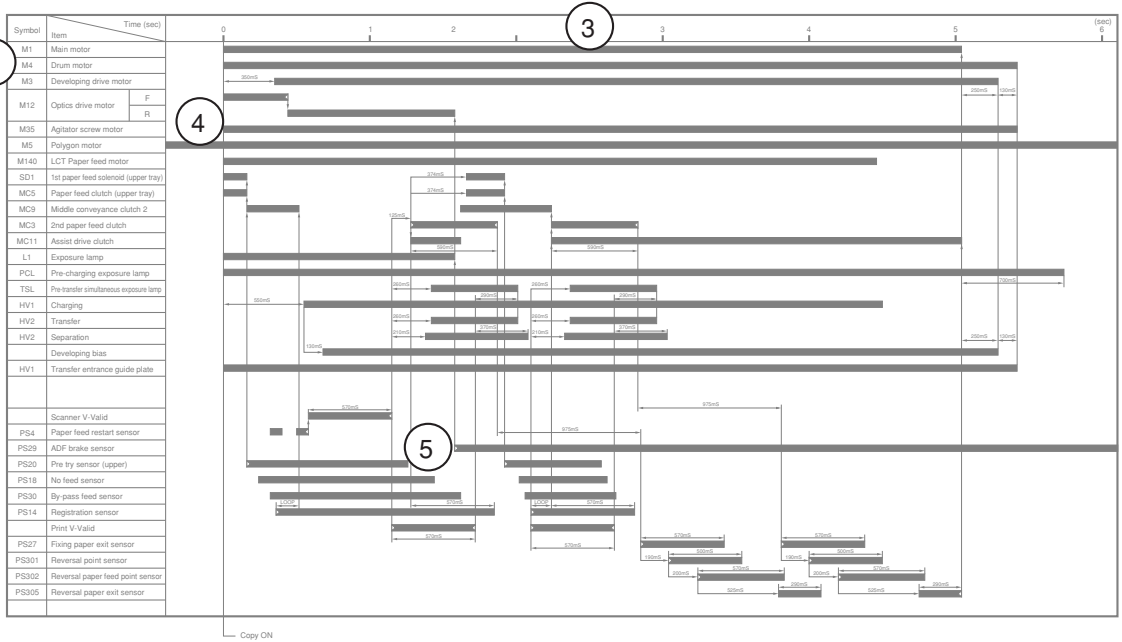
4.4 How To Read Timing Charts

A timing chart is a graphic representation of the state of the various loads and activities in a machine. By the chart's design, you can look at all of the key activities at the same time and observe the relationship between various events. It tells you when and why components are turned ON and OFF. By careful observation of the machine, you can determine what activity is occurring or not occurring at the appropriate time. As different machines contain different features, operate at different speeds, and sometimes use varying methods of implementing features which appear to be common, the Timing Charts are different for each model. Reading a timing chart is relatively easy once you know how.

The first thing that you must understand is how the timing chart is arranged and how to interpret the symbols that are used on it. Once you understand this, you can use the chart to help pinpoint a machine problem.

The explanation that follows refers to the following Timing Chart. The circled numbers will help you locate the specific areas on the chart to which the explanation refers.

7065 TIMING CHART (A4, LIFE SIZE, TWO COPIES, UPPER PAPER FEED)



4.4.1
Layout

At the top of each timing chart (1) is a summary of the machine conditions under which the chart was prepared. These items usually include:

- The copy paper size
- The magnification ratio
- The number of copies represented
- The paper tray being used

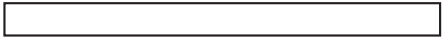
Down the left side of the timing chart (2) is a list of the various electrical loads (generally at the top of the column) that will be turned ON or OFF, and various input devices such as photosensors (at the bottom of the column) that detect machine activity. These are represented by a symbol (such as M1) and an item description (such as Main Motor).

Some timing charts also list some of the machine's timers that are used during the copy cycle (such as Scanner V-Valid).

The horizontal measurement on the chart represents time (3), expressed in seconds. The starting point of the copy cycle when the start button is pressed is at 0 seconds. The area before this indicates items that are operating while the machine is at idle.

4.4.2
Symbols

A solid black line (4) indicates that a load or input device is ON.



A white line (white space inside a box) indicates that the component may be either ON or OFF, depending upon other machine conditions. The sample timing chart has no white line included.
This is generally used when an item such as a toner motor is shown.

A white triangle inside the black line (5) indicates that this is causing another change of state in the machine.
To determine what it is, follow the line in the direction of the arrow.

4.5.1
Types Of Multimeter

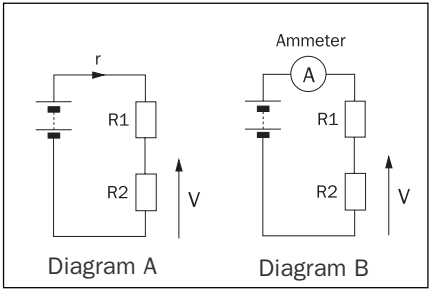
There are two basic types of multimeters: digital, which display numbers on an LCD, and analog, which use a needle to indicate readings.

Both analog and digital multimeters can measure AC and DC voltage, AC and DC current, and resistance. Because they can measure different units these meters are referred to as Multimeters.

A multimeter can be used for many tasks such as:

- Measurement of voltage
- Measurement of current
- Checking of fuses
- Testing of transistors

It is important for you to have a clear idea of how meters are connected into circuits. Diagrams *A* and *B* below show a circuit before and after connecting an ammeter:



Measuring Current:

To measure current, the circuit must be broken to allow the ammeter/ multimeter to be connected in series with it.

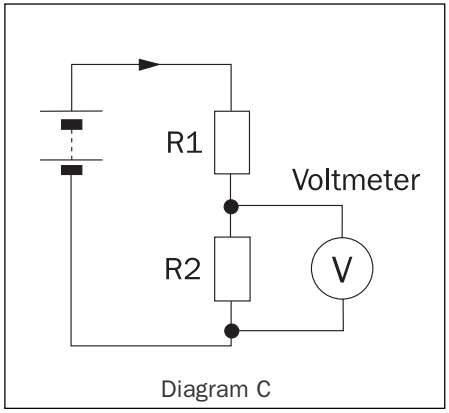


Diagram C

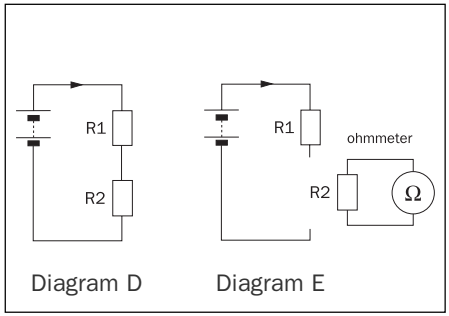


Diagram D Diagram E

The Black lead will be connected to one side of the break in the circuit and the Red lead connected to the other. In this way the meter bridges the open circuit you have created. Current will now flow through the meter and can be measured

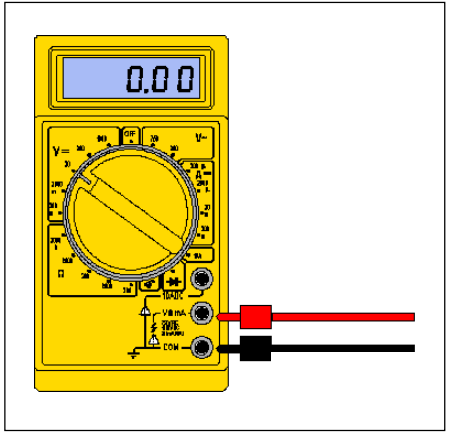
Measuring Voltage:

Diagram *C* shows the same circuit after connecting a voltmeter/multimeter:
This time, you do not need to break the circuit. The voltmeter is connected in parallel between the two points where the measurement is to be made. When measuring a DC voltage the common or Black lead is generally connected to the nearest available earth on the equipment and the Red lead is connected to the point at which the voltage is to be measured.
Always ensure you select the appropriate range for the voltage to be measured!

Measuring Resistance:

Ohmmeter's work by passing a small current through the component and measuring the voltage produced. If you try this with the component connected into a circuit that still has power applied to it, the most likely result is that the meter will be damaged.
Most multimeters have a fuse to help protect against misuse.
Always switch off the power before measuring resistance!

To properly measure the resistance of a component, the component must be removed from the circuit altogether as shown in diagram D and E.



4.5.2
Procedure For Operating a Digital Multimeter

A multimeter will have a number of sockets for test leads. This number can range from two to four depending on the brand and model. It is important that you read the instructions for your multimeter to avoid damage that could result through inserting the test leads into the incorrect sockets.

Digital meters give an output in numbers, usually on a liquid crystal display. The diagram on the left shows a switched range multimeter: The central knob has lots of positions, and you must choose which one is appropriate for the measurement you want to make.

If the meter is switched to 20V DC, for example, then 20V DC is the maximum voltage that can be measured. Sometimes you will want to measure smaller voltages, in this case, the 2V or 200mV ranges would be used.
The various ranges are indicated on the meter and there is also a diode checker, and a beeper, which is used for checking continuity.

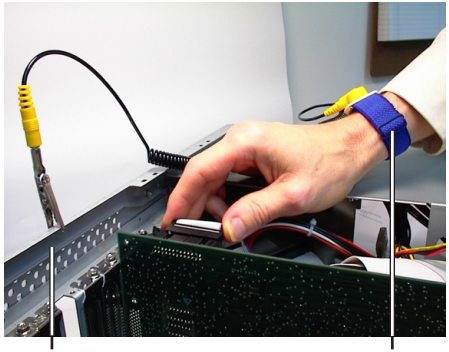
Troubleshooting Tools And Technology

4.6 Electrostatic Discharge

Electrostatic discharge or ESD, is the term most often used to describe the sensitivity of modern electronic components to static electrical charges. Many of these components, including integrated circuits (IC), SIMMs, EPROMs, electronic assemblies and circuit boards, can be damaged beyond repair by an electrical discharge of as little as 5 volts.

4.6.1 What Is Static?

Everyone has experienced static discharge at one time or another. A simple example would be when you walk across a carpeted floor and reach for the door handle. A snapping noise accompanied by an uncomfortable sting in the tips of your fingers is the discharge of static electricity. In this example, your body has actually built up an electrical potential of several thousand volts, which discharged through the air when your fingers came close to the door handle.



4.6.2
How Do You Stop ESD?

The best way to help prevent ESD is either to use a wrist strap, or a grounding mat. A grounding mat is generally not possible in the field, so Konica recommends using a wrist strap before handling any sensitive electronic components such as circuit boards. If a wrist strap is not available the next best thing is that you do properly ground yourself to ensure that you are at zero potential by touching an unpainted part of the copier or interface chassis before handling any electronic components.

Troubleshooting Tools And Technology

4.7 Test Chart Usage

A test chart is a sheet of paper with specific markings that are designed to allow for given items to be measured or checked. By making a copy of a test chart you can check for items such as focus, paper leading edge timing, distortion, mis-centring and skew, depending on the test chart used.

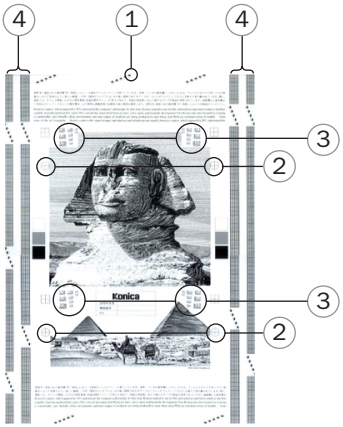
Konica produces two test charts for use on the digital copiers. They are the Pyramid chart and the ADF adjustment chart.

4.7.1
Pyramid chart

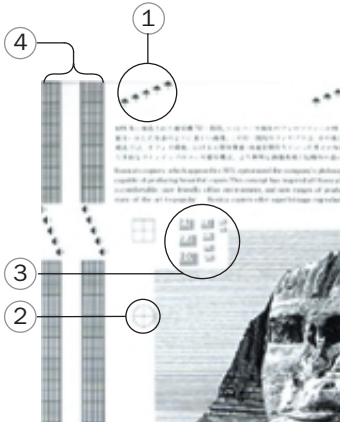
The Pyramid chart allows for checking of the following items:

- Paper leading edge timing
- Focus
- Magnification/distortion
- Paper mis-centering/paper skew

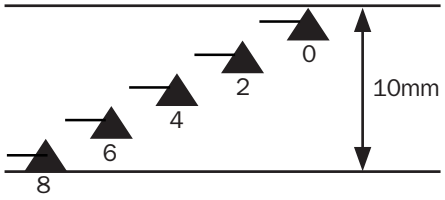
The picture here is a copy of the pyramid chart indicating the above items that can be checked.



1 Paper leading edge timing
2 Magnification/distortion
3 Focus
4 Paper mis-centering paper skew



1 Paper leading edge timing
2 Magnification/distortion
3 Focus
4 Paper mis-centering paper skew



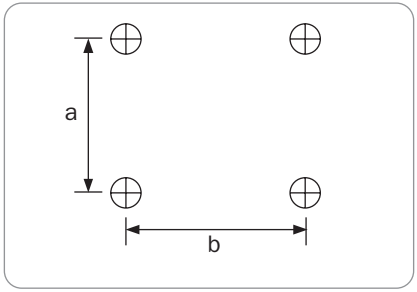
Paper Leading Edge Timing

The paper feed restart timing can be checked with the portion of the test chart shown here. The point of the 0 triangle should coincide with the edge of the copy paper. However, as most copiers are set with a small amount of leading edge deletion, the point of the 0 arrow can not always be used. In that case, measure from the back of the 8 arrow, to the edge of the copy paper - the measurement should be 10mm. The number next to the arrow indicates how many mm it is from the point of that arrow to the edge of the chart, while the thin black line indicates the “odd” mm measurements such as 1,3,5,and 7 mm.

The arrows are 2mm wide so when measuring from the rear end of the arrow you must add 2mm to the number indicated.

Focus

The focus of the copy can be checked when referring to the section of the chart shown here. The number beside each set of lines indicates how many lines there are within a 1mm wide area. When making a copy in 1:1 or enlargement mode the “5” lines must be seen as clear, sharp individual lines. If they are not, the focus is incorrect.



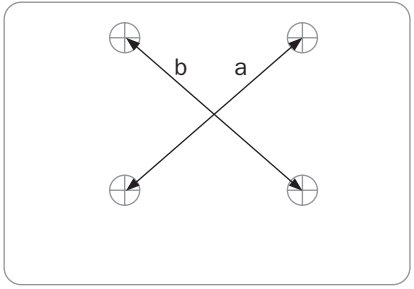
Magnification/Distortion

The magnification and the distortion can be checked by referring to the following section of the chart.

Measuring between the marks shown in the diagram on the left can check the magnification in both the vertical and horizontal direction.

The difference in the distance of “a” for vertical magnification and “b” for horizontal magnification between the copy and the test chart must be less than 0.5% at life-size copying.

To check distortion, the difference in distance of “a” and “b” must be less than 0.3%.



Paper Mis-Centring

Paper mis-centring can be checked by measuring the “a” and “b” area as shown in figure 1. The difference between a and b must be less than 2mm.

Paper skew

Paper skew can be checked by measuring the difference between the “a” and “b” section on the test chart shown in figure 2. The difference between the two must be less than 0.3%.

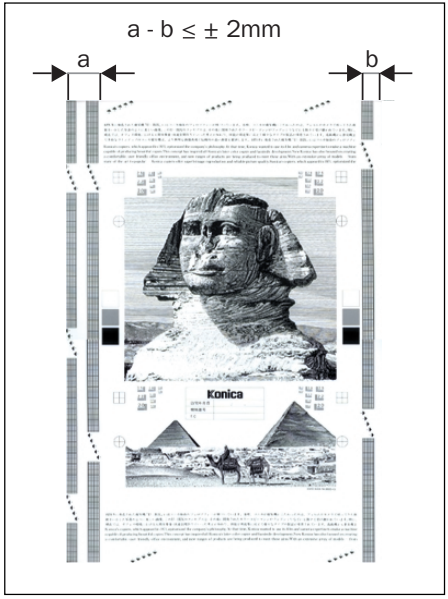


Figure 1

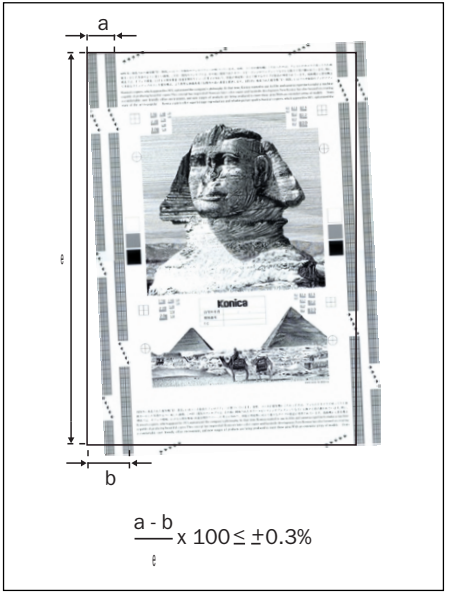


Figure 2

4.7.2
ADF Adjustment chart

The ADF adjustment chart allows for checking of the following items:

- RADF vertical magnification adjustment
- RADF restart timing adjustment
- RADF centring

RADF Vertical Magnification

The RADF vertical magnification can be checked by placing the ADF chart in the RADF and making a copy onto A3 size paper. The original can then be compared to the copy to see if the lengthwise lines coincide with each other. This can be accomplished by placing the original and the copy together then holding them up in the light to check that the lines coincide, or by folding the copy in half lengthwise and placing it on top of the original and making a comparison. If the two do not coincide this indicates that the RADF motor is turning at the incorrect speed which will require an adjustment to be made in the copier software.

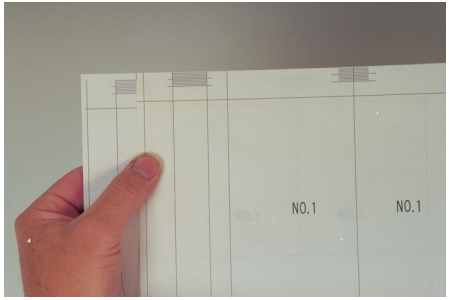
Note: The mainbody adjustments must be completed before attempting these adjustments.

← *Feed Direction*

4.7 Test Chart Usage

RADF Restart Timing

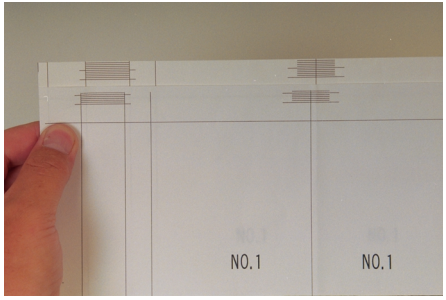
The RADF paper restart timing can be checked by placing the ADF chart in the RADF and making a copy onto A3 (11”x17”) size paper. Then by placing the copy on top of the original, any difference in the restart timing can be detected. The standard value is listed in the Service Handbook for the relevant model machine.



Feed Direction

RADF Centring

The RADF centring can be checked by placing the ADF chart in the RADF, and making a copy onto A3 (11”x17”) paper. Then, by folding the copy in half cross-wise and placing on top of the original, check that the longitudinal lines coincide with each other.



Feed Direction

Adjustment

5.1 Internal Test Pattern Usage

Troubleshooting copy quality problems on digital copiers can be made a lot easier by printing out internally generated test patterns. There are a number of internal patterns that are permanently held within the memory of the machine and can be printed out at any time to help isolate the problem area. The printing out of the patterns immediately indicates whether the problem lies in the “read” or the “write” section of the machine. When a test pattern is printed out, only the “write” section of the copier is used, the “read” section remains idle. So if the test pattern appears normal, the problem lies in the read section of the copier. Conversely, if the test pattern is abnormal the problem lies with the write section of the copier.

There are a number of test patterns that can be produced to test various parts of the machine, though here the focus will be on three of the most commonly used:

- Overall halftone
- Linearity evaluation pattern
- Gradation adjustment (LD1 and LD2)

When density is set to 70.

When density is set to 0.

When density is set to 255.

5.1.1
Overall Halftone

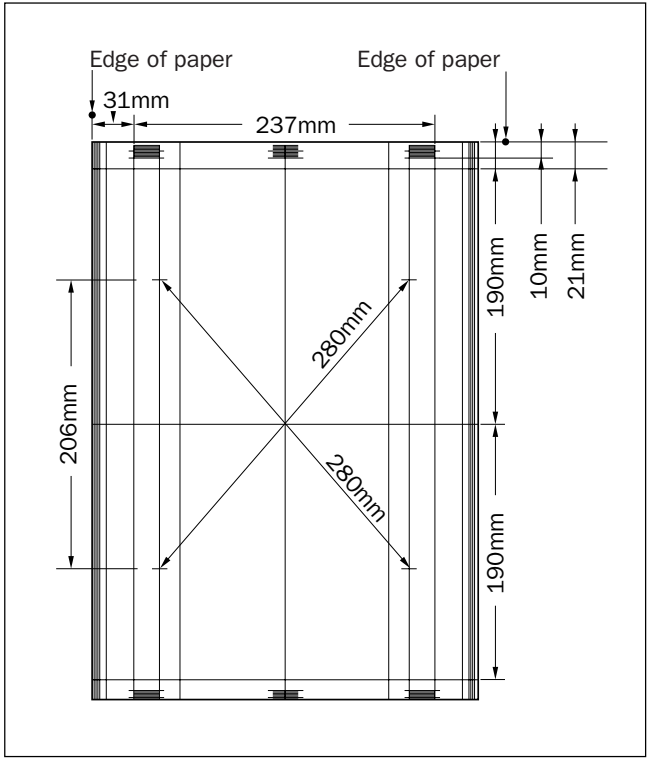
The Overall Halftone test pattern is ideal when image defects such as lines appear on the copies. This pattern is generated in the write section so if the pattern appears normal, the fault lies in the read section of the copier.
The density of this pattern can be changed within the copier software from a totally blank page to a totally black page. To show most image defects, a density of level “70” is best selected.

5.1.2
Linearity Evaluation Pattern

The linearity pattern is used to determine if the following errors are in the read section.

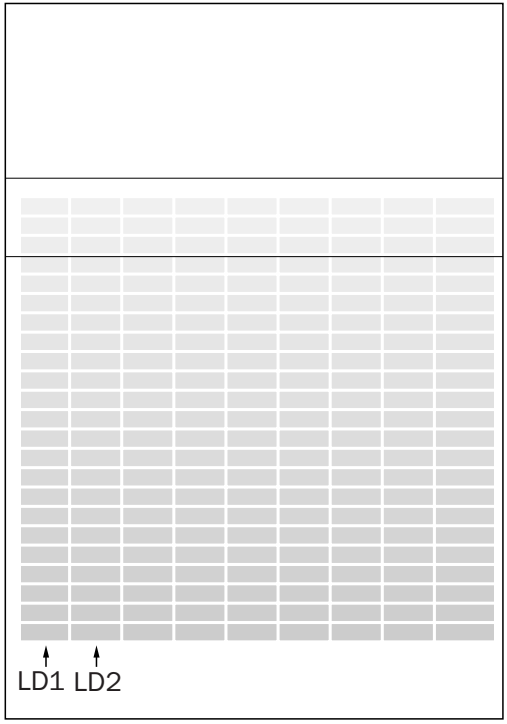
- Horizontal magnification
- Vertical magnification
- Leading edge timing
- Image skew

By measuring the test pattern as indicated, it can be confirmed whether or not the problem exists in the read section.



5.1.3
Gradation adjustment

The Gradation test pattern is used to check if the two lasers are uniform in density and that their visible density starts between the two black lines on the test pattern. If this is not within specification an adjustment is required in the service modes.



Adjustment

5.2 36 Running test Mode

The Running mode allows the machine to be operated without the need for copy paper. If there is a problem, for example with paper jamming, the machine can be operated without paper and it is possible to verify if the jam still occurs. If the machine does not display a jam in this case, it is likely that it could be a mechanical or paper problem. However if a jam still occurs, the cause could be due to an electrical problem such as a faulty or sticking sensor. There are also settings that allow intermittent copies to be produced. This allows you to recreate a problem that the customer may have.

The Service Handbook will explain the full details of this mode that can vary depending on the model.

The details of using the 47 mode can be found in the Adjustment section of the Service Handbook.

Adjustment

5.3 ‘47’ Mode

The 47 mode (or I/O mode as it is sometimes referred to), provides self-diagnostic functions, which allow the checking of, loads (Output) and signals (Input). This is very useful when there is a problem, as motors, clutches and many other loads can be operated and their operation checked. Furthermore if an input device such as a photosensor is suspect it too can be checked using the input function.

When referring to the Service Handbook you will observe that the “Input” and “Output” listings are separated to avoid confusion.

5.3.1
Input List

The input list is used for checking various input devices. To check an input, you first need to find the code number for that item from the list in the Service Handbook. Next enter the code using the copy quantity setting keys and observe the code status on the operation board. When checking a photosensor a "H" or "L" will be shown, indicating the present state of that device. By manually operating the sensor by hand the state on the operation board will change. That is, the "H" will change to "L" or vice versa. When checking the input from other devices a number may appear on the operation board indicating that item's current status. Turn the main switch off to exit the 47 mode.

Classification	Code	Symbol	Multi mode	Name		State of display and signal source H	L
Analog signal	001	TLD		Toner level detecting signal		Enough toner	Less toner
	002	DB		Internal temperature detecting signal		*	*
	003	TH1		TH1 signal		*	*
	004	TH2		TH2 signal		*	*
	005			Humidity sensor signal		*	*
	006						
	007	TCSB		Dmax MONI signal		*	*
	008	TCSB		Dmax signal		*	*
	009	TCSB		Drum jamming signal		*	*
Paper feed	010	PS12,13,15, 141,140	M	No-paper detecting signal	<Contents of M> -Common to 10, 12, and 19- 1: Upper tray 2: Lower tray 3: LCT right 4: LCT left 6: LT-352 -Only to 10- 5: By-pass feed -Only to 16- 1: Upper tray 2: By-pass feed	No paper	Paper
	012	PS16,17, 143,142	M	Tray upper limit detecting		OFF	ON
	016		M	Paper size signal <Display for each paper size> A3:1, B4:6, A4R:2, A4:3, B5R:7, B5:8, B6R:9, A5R:4,F4:10			
	019	PS20,21,210, 200	M	Pre-try detecting		OFF	ON
Paper feed and conveyance	020	PS14 PS18 PS19 PS144 PS146	M	Paper feed sensor signal 1: Regist. PS 2: No feed PS 3: Optics sync PS 4: LCT conveyance PS (1000) 5: LCT conveyance PS (1500)		OFF	ON
	022	PS27		Paper exit sensor signal		ON	OFF
	023	PS11 PS160 PS306 PS24	M	Interlock signals 1: Paper feed and conveyance door 2: LCT conveyance door 3: Left side door 4: Sensing whether or not the fixing lever is closed		OFF	ON
	024	PS20 PS21 PS210 PS200 PS802	M	Pre try signal 1: Pre try upper 2: Pre try lower 3: LCT pre try (1000) 4: LCT pre try (1500) 5: LT pre try (LT-352)		OFF	ON
Optics	030	PS7 PS3 PS5 PS4 PS45 PS2 PS28 PS9 PS29	M	Optics sensor signals 1: Optics Timing 2: Shading position 3: Optics return 4: Paper feed restart 5: APS timing 6: Scanner brake 7: Scan EE 8: ADF home position 9: ADF brake		OFF	ON

5.3.2
Output List

The output list is used for checking various loads. To check an output, you first need to find the code number for that item from the list in the Service Handbook. Next enter the code using the copy quantity setting keys then press the copy/print button to activate the selected load. To stop the load from operating press the stop/clear button. Turn the main switch off to exit the 47 mode.

Classification	Code	Symbol	Multi mode	Name	Impossible to install/ change to write in the field
Analog signal	000	L1		Exposure lamp	
	001	M10		Toner supply motor	
	002	HV1	M	Charging	×
	003	HV2	M	Transfer	×
	004	HV2	M	Separation (AC)	×
	005	HV2		Transfer + Separation (DC)	×
	006	HV2	M	Separation (AC + DC)	×
	007	HV1	M	Grid	
	008		M	Dmax / γ LED	×
	009			JAM detecting LED	
	010	HV1		Transfer guide plate	
	011	HV1	M	bias	
Temporary	012				
	013			Dmax level collection	36 mode adjustment
	014			γ correction level adjustment	36 mode adjustment
	015		M	Process adjustment 01: The following data in both the main body and KRDS is cleared. B1 (copy count for each size) , F0 (Number of sheets passed through the ADF) F1 (counter for each mode), J0 (JAM count) , E0 (F count) E2 (E count) , E3 (adjustment error count) 98: KRDS initialization	
	016				
	017				
	018			Dmax level adjustment + γ correction level	36 mode adjustment
	019				
Paper feed	020		M	1st paper feed solenoid 1: Main body upper 2: Main body lower 3: LCT right (1000) 4: LCT left (1500) 5: By-pass feed 6: Upper pre-feed SD 7: Lower pre-feed SD	
	021		M	Paper feed motor 1: 2: LCT (by-pass feed speed) 3: LCT (main body paper feed speed) 4: LT-352	
	022		M	1st paper feed clutch 1: Main body upper 2: Main body lower 3: LCT right (1000) 4: LCT left (1500) 5: By-pass feed 6: Main body upper middle 7: Main body lower middle 8: LCT middle 9: LT-352	
	023		M	1: Reversal gate SD 2: Paper exit gate SD	
	024	MC11		Assist drive MC	
	025	MC3		2nd paper feed MC	
	026	M201		Reversal paper exit motor	
	027	M202		Paper exit motor	
	028	SD5		Conveyance SD	
	029	SD4		Separation claw SD	

5.3.3
Multi-Mode

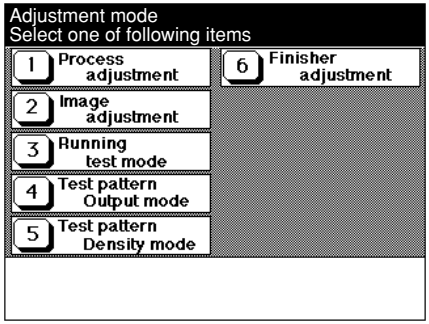
The 47 Mode on most Konica copiers contains a multi-mode. This multi-mode enables multiple I/O checks from a single I/O check mode. Functions that support a multi mode are indicated by an "M" in the multi-mode column of the input or output checklist. The details of using the multi-mode can be found in the 47 mode explanation section which is located in the Adjustment section of the Service Handbook.

Classification	Code	Symbol	Multi mode	Name	State of display and signal source H	L
Analog signal	001	TLD		Toner level detecting signal	Enough toner	Less toner
	002	DB		Internal temperature detecting signal	*	*
	003	TH1		TH1 signal	*	*
	004	TH2		TH2 signal	*	*
	005			Humidity sensor signal	*	*
	006					
	007	TCSB		Dmax MONI signal	*	*
	008	TCSB		Dmax signal	*	*
	009	TCSB		Drum jamming signal	*	*
Paper feed	010	PS12,13,15, 141,140	M	No-paper detecting signal <Contents of M> -Common to 10, 12, and 19- 1: Upper tray 2: Lower tray 3: LCT right 4: LCT left 6: LT-352 -Only to 10- 5: By-pass feed	No paper	Paper
	012	PS16,17, 143,142	M	Tray upper limit detecting	OFF	ON
	016		M	Paper size signal <Display for each paper size> A3:1, B4:6, A4R:2, A4-3, B5R:7, B5:8, B6R:9, A5R:4,F4:10 -Only to 16- 1: Upper tray 2: By-pass feed		
	019	PS20,21,210, 200	M	Pre-try detecting	OFF	ON
Paper feed and conveyance	020	PS14 PS18 PS19 PS144 PS146	M	Paper feed sensor signal 1: Regist. PS 2: No feed PS 3: Optics sync PS 4: LCT conveyance PS (1000) 5: LCT conveyance PS (1500)	OFF	ON
	022	PS27		Paper exit sensor signal	ON	OFF
	023	PS11 PS160 PS306 PS24	M	Interlock signals 1: Paper feed and conveyance door 2: LCT conveyance door 3: Left side door 4: Sensing whether or not the fixing lever is closed	OFF	ON
	024	PS20 PS21 PS210 PS200 PS802	M	Pre try signal 1: Pre try upper 2: Pre try lower 3: LCT pre try (1000) 4: LCT pre try (1500) 5: LT pre try (LT-352)	OFF	ON
Optics	030	PS7 PS3 PS5 PS4 PS45 PS2 PS28 PS9 PS29	M	Optics sensor signals 1: Optics Timing 2: Shading position 3: Optics return 4: Paper feed restart 5: APS timing 6: Scanner brake 7: Scan EE 8: ADF home position 9: ADF brake	OFF	ON

Adjustment

5.4 ‘36’ Mode

[36 Mode Menu Screen]



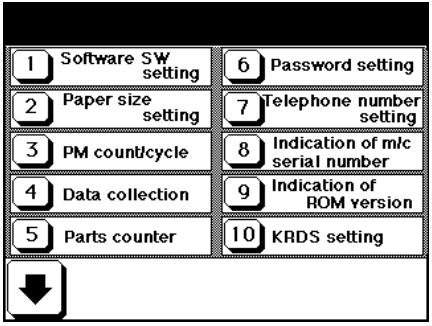
The above screen varies depending on the copier model.

The “36” mode is used to change data stored in the machine memory. This data is used by the microprocessor to establish certain parameters such as magnification, paper restart timing, laser intensity and so on. Adjustment of this data can affect both the mechanical and electrical operation of the machine.

The 36 mode can be accessed by the following procedure:

1. Turn the main switch off.
2. Turn the main switch back on while holding down the 3 and 6 copy quantity setting buttons. The 36 mode menu screen will then appear.
3. Press the desired number key of the item that you wish to adjust. The selected adjustment screen will then appear.
4. Press the up or down arrow buttons then select the item to be adjusted.
5. Enter the data and press the “set” key (if it is displayed).
6. Press the previous screen key to end the adjustment.
7. Turn off the main switch to exit the 36 mode.
8. The new data will take effect after restarting the machine.

[25 Mode Menu Screen]



The "25" mode has been provided to allow adjustments to the non-volatile storage and to specify other settings. Within this mode many items (depending on the model) can be adjusted such as:

- Software switches
- The paper size setting
- PM count
- Data collection
- Parts counters
- Adjustment of the various passwords used on the machine
- Telephone and fax number of the service department
- Machine and option serial numbers
- ROM version
- KRDS
- Date and time setting

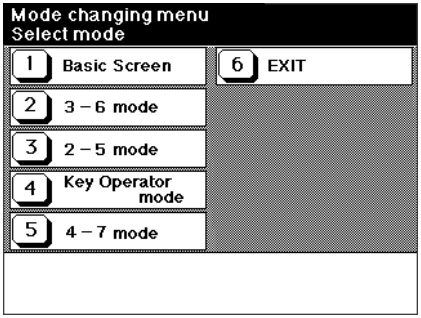
The 25 mode can be accessed by the following procedure:

1. Turn off the main switch.
2. Turn the main switch back on while holding down the 2 and 5 copy quantity setting buttons. The 25 mode menu screen will then appear.
3. Press the desired number key of the item that you wish to adjust.
4. Enter the desired data for the selected item.
5. Press the previous screen key to check the data has been entered.
6. Turn off the main switch to exit the 25 mode.
7. The new data will take effect after restarting the machine.

Adjustment

5.6 Mode Changing Menu Select

[Mode Changing Menu Screen]



Introduced on the 7065 machine is the new adjustment screen called the "Mode changing menu select". This new function allows the following modes to be selected without the need to repeatedly turn the machine on and off.

- Basic screen
- 36 mode
- 25 mode
- Key Operator mode
- 47 mode

The mode changing menu select mode can be accessed by the following procedure:

1. Turn the main switch on and wait for the "ready to copy" message.
2. Hold the P button down until the message "Enter 4-digit password to change" is displayed.
3. Enter the password 9272 and press the start/print button. (This is a fixed service mode and it cannot be changed)
4. Press the desired number key of the item to set.
5. To return to the Mode Changing Menu screen, hold down the P button until the Mode Changing Menu screen reappears.
6. When adjustment has been completed, press the "Basic Screen" button to return to the basic copy screen.

Adjustment

5.7 Key Operator Mode

The “Key Operator” mode has been incorporated into Konica machines to allow the key operator (generally the person who looks after the copier at the customer’s site) access to special functions that are not accessible to the general user. Functions such as modifying of machine settings, controlling of user activity and much more are possible. It is important for the technician not to overlook the adjustments that are possible here, otherwise time may be spent trying to rectify a fault that has been induced by the customer.

To inhibit the general user reading the Instruction Manual and attempting to make changes, it is recommended that a unique key operator password be established in the 25 mode.

The mode changing menu select mode can be accessed by the following procedure:

1. Turn off the main switch.
2. Turn the power back on while pressing the “HELP” button. (The Key Operator password screen displays when the 4-digit key operator password is set by service).
3. If the Key Operator Password screen is displayed, use the keypad on the touch screen to enter the 4-digit key operator password; then touch OK, to display the Key Operator mode screen.
4. Use the arrow key to select the item to be adjusted. Then follow the procedure listed in the Instruction Manual for the selected item.
5. The new data will take effect after restarting the machine.

Summary

This CBT program has presented 8 steps of Trouble Shooting a Konica Digital Photocopier.

The Konica Key Steps to Troubleshooting

1. The correct attitude
It all starts here. If you don't want to fix it, chances are you won't. Be positive and start with a clear mind.

2. Gather facts to define the symptom
The more information you can find on a problem the easier it will be to locate.

3. Attempt to recreate the problem
You can't fix what you can't see.
Ensure you find the correct problem.

4. Consider Possibilities based on facts
Is it similar to a previous fault. Consider all the possibilities. It may save time.

5. Localising
Logically test and eliminate parts of the machine to narrow down the search area.

6. Take the appropriate action to clear the trouble
Once located, repair the fault while being mindful not to create additional faults.

7. Testing
Thorough testing of the machine will ensure a long term happy customer.

8. Inform and/or instruct the customer
Put it in terms they will understand. Avoid using technical jargon.

Summary

We have seen examples of how to best use these steps and how effective they can be when applied in the correct way.
You've been guided through real life scenarios and gained hands on experience with the interactive tests.

Hopefully you have found this program to be informative, easy to use and has given you a better understanding of the basic Trouble Shooting processes involved with digital equipment.
You may have learnt new Trouble Shooting skills or perhaps improved your existing skills, either way you can now go back out to the field confident in your ability to solve any new problem you might face.

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