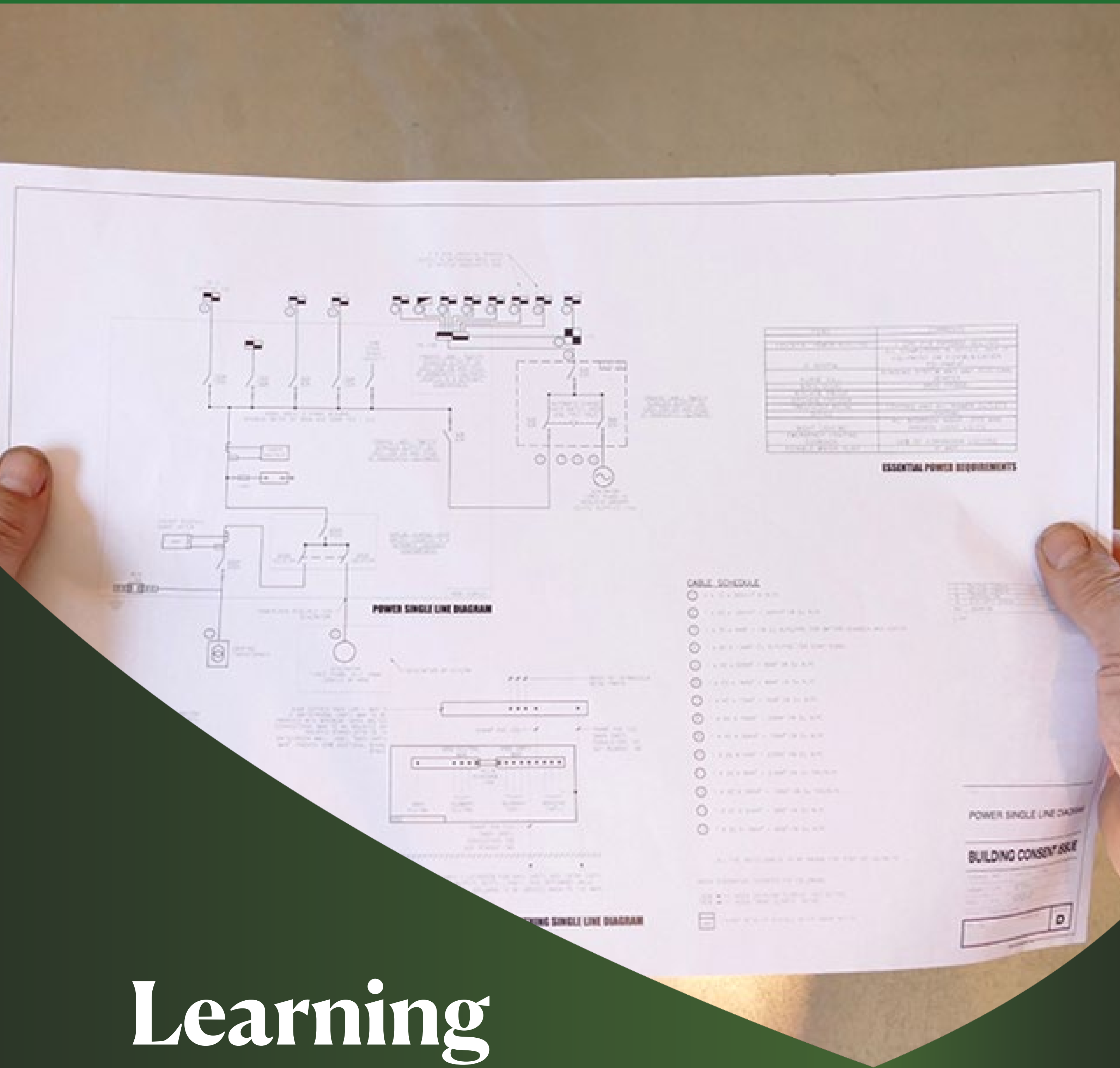


Learning resource

Draw and explain electrical diagrams

Level 3 | Credits 4

Te Pūkenga

Contents

Electrical diagrams

Electrical diagrams are vital documents for an electrical installation, they will need to be read and understood by a variety of people.

Good plans and diagrams are highly important in getting good outcomes, accurately installed - working installations and they are highly valuable for fault finding.

If you have ever had to work on a complex installation with inadequate information, you will understand the importance of good clear plans.

As the drawings will need to be read and understood by different people, it is important that standard drawing symbols, labelling techniques and terminology are used correctly to represent the various parts of a circuit.

The drawings must also be accurate. To achieve this, you must use the right instruments like a CAD program, or ruler, compass, protractor, and sharpened pencils to draw the circuits.

Types of electrical drawings

Electrical specification diagrams

A customer's requirements are set out as a specification. The specification usually consists of the following documents:

- Site plan
- Schedule of electrical plant and fittings
- Quantity schedule.

These documents contain detailed information about the electrical requirements. From the specifications, electrical drawings are developed by traditional (hand-drawn) or by computer-assisted draughting (CAD) systems.

The types of electrical diagrams are:

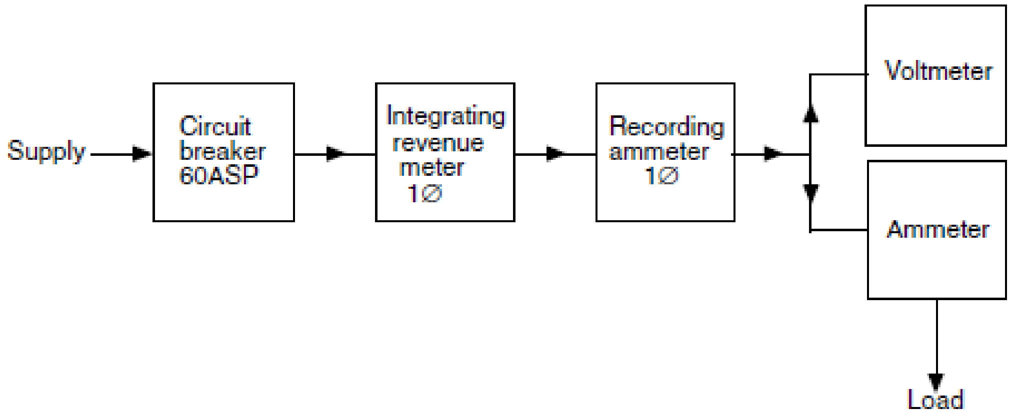
- Block
- Layout
- Circuit
  - Control circuit
  - Power circuit
  - Single line and power system circuit
- Wiring
- Location.

Let's look at these different types of diagrams.

Block diagrams

A Block diagram is drawn in simple block form to describe the general principles of operation of an electrical installation. The diagrams only show the operational flow sequence. Circuitry and component details are not shown. For this reason, they are also known as flow diagrams.

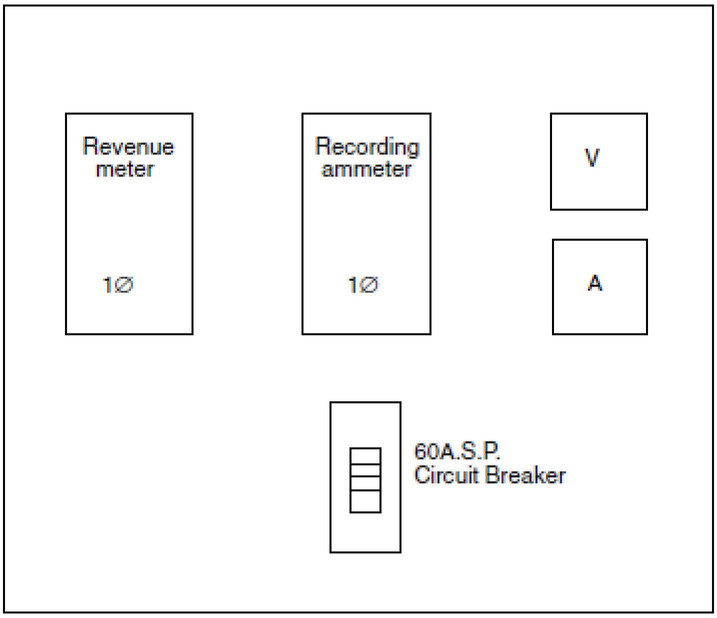
The block diagram is read left to right or top to bottom. The diagram below shows a supply on the left feeding a circuit-breaker, then on to a revenue meter and recording ammeter, a voltmeter and finally to the load through an ammeter.



Layout diagrams

A layout diagram shows the positions the components are to be mounted. Generally little or no wiring information is included in a layout drawing.

The diagram here shows how the components described in the block diagram above could be mounted on a panel.



Circuit diagrams

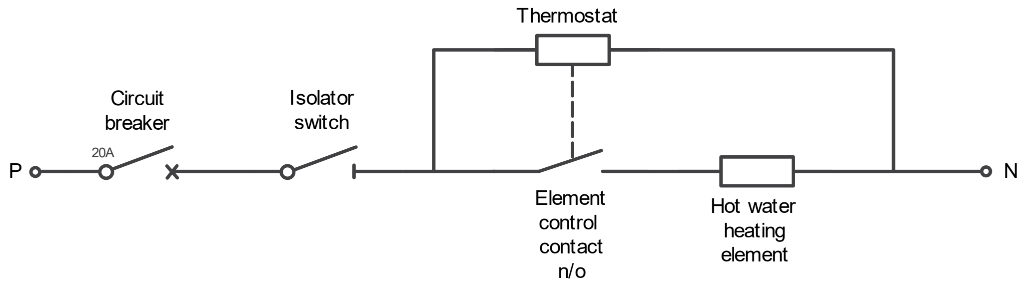
Electrical circuit diagrams can be divided into the following three types:

- Control circuit diagrams
- Power circuit diagrams
- Single-line and power system diagrams.

Control circuit diagrams

A control circuit diagram (also known as a schematic diagram), is used to describe industrial control circuits. It shows the complete operational sequence of an installation.

The diagram normally comprises of two vertical parallel lines with horizontal rows of control devices between them arranged in a logical sequence.



The control circuit above shows a hot water heating circuit. This drawing is in a horizontal orientation because the control devices are shown horizontally.

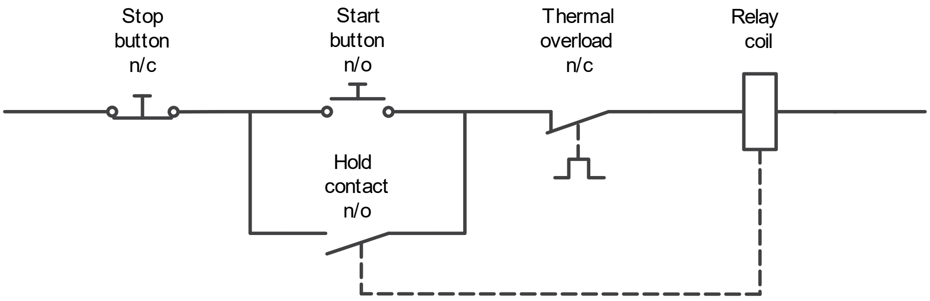
Control circuits can also be drawn vertically, that is in vertical orientation.

An explanation of how this circuit operates would be as follows:

When the circuit breaker and the isolating switch are closed, the hot water heating circuit energises. If the water is cooler than the temperature setting on the thermostat the thermostat closes the element control contact, the heating element is energised and heats the water.

When the water reaches the set temperature of the thermostat, the thermostat opens the element control contact and the element is de-energised. This on-off cycle continues to repeat and maintains the water temperature at the setting of the thermostat until the control circuit is de-energised.

The control circuit below shows a start/stop section of an industrial motor starter.



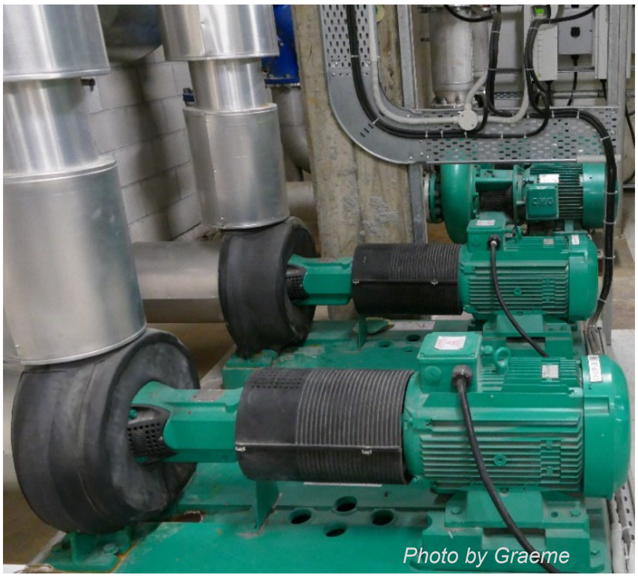
When the start button is pushed, the relay coil is energised and the normally open hold relay contact closes. The start button can now be released and the control relay stays energized through its own (hold) contact.

If either the stop button is pushed, or the thermal overload operates because of an overload, the relay coil de-energises, the relay hold contact opens and the circuit resets back to how it was before the start button was pushed.

The relay coil operates contacts in the motor circuit which is separate to this control circuit. When the relay coil is energised, the motor supply contacts will close and the motor will run. When the coil becomes de-energised the motor supply contacts open and the motor will stop.

Note: In the circuit above, the stop button is placed first in the control circuit. While it will still work as long as it is placed anywhere in the series parts of the circuit, the stop button is the most important function of the circuit and it is good practice to put it at the beginning of the circuit. That way, all of the control circuit is de-energised when the stop button is operated. If you are observant, you might notice that the second start/stop circuit in this resource does not follow this practice.

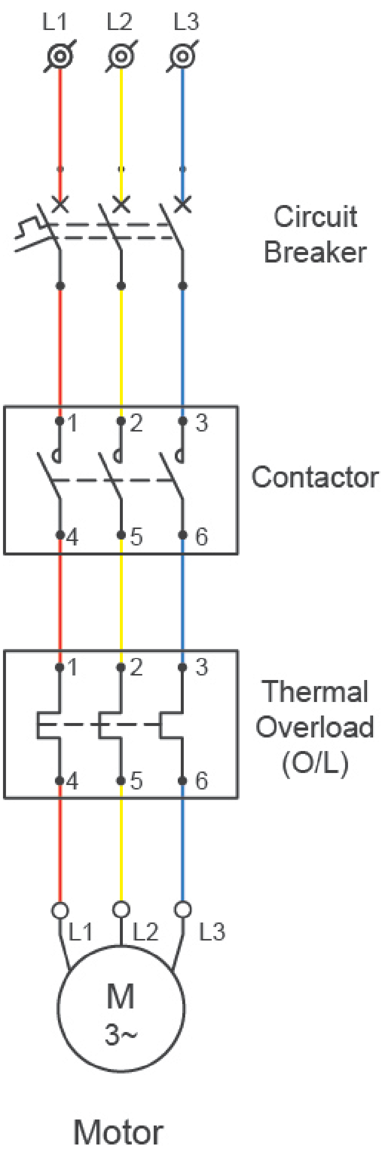
You can see an example of the motor side of the circuit in the next section on power circuit diagrams.



Power circuit diagrams

A power circuit diagram shows the power flow sequence of the main power components and conductor connections with the control circuitry omitted. As with control circuit diagrams, power circuits may be drawn with horizontal or vertical orientation.

The diagram below shows a three-phase direct on-line motor starter power circuit in vertical orientation.



Note: Circuit diagrams show components and conductors in their electrical relationship — not how they are physically laid out as in wiring diagrams.

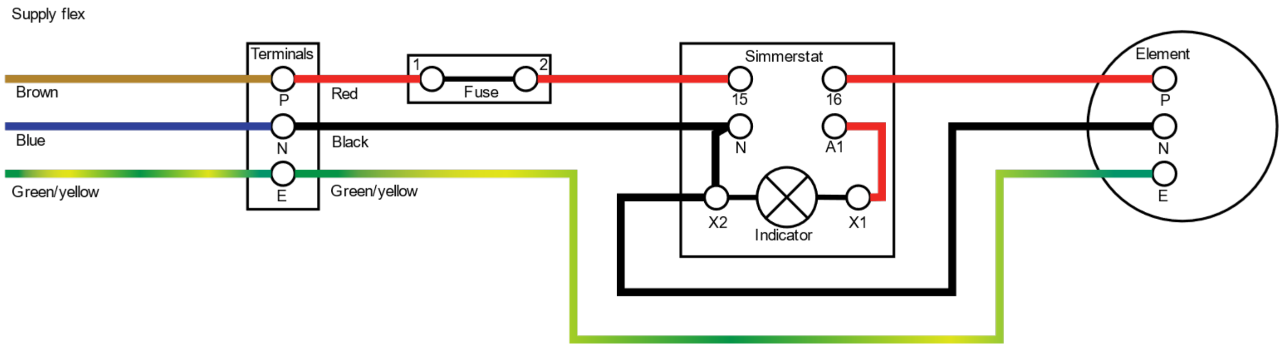
Wiring diagrams

Wiring diagrams, also known as ‘connection diagrams’ are point-to-point” diagrams showing details of the complete wiring layout.

The components are shown, as best as possible, in their relative physical positions along with cable connections. Cable sizes, colours, terminating particulars and other details may also be included.

The idea of wiring diagrams is that you can look at it, and even if you don’t necessarily understand how the circuit works, you could wire the equipment successfully by following the diagram.

The diagrams below, shows a simple single cooker element wiring diagram.



Single-line diagrams

Single-line (or power system) diagrams use single lines to represent cables and circuits to make the overall layout of complicated installations simple and easy to read.

Single line diagrams are used extensively in the electrical supply industry and switchboard manufacturing industry.

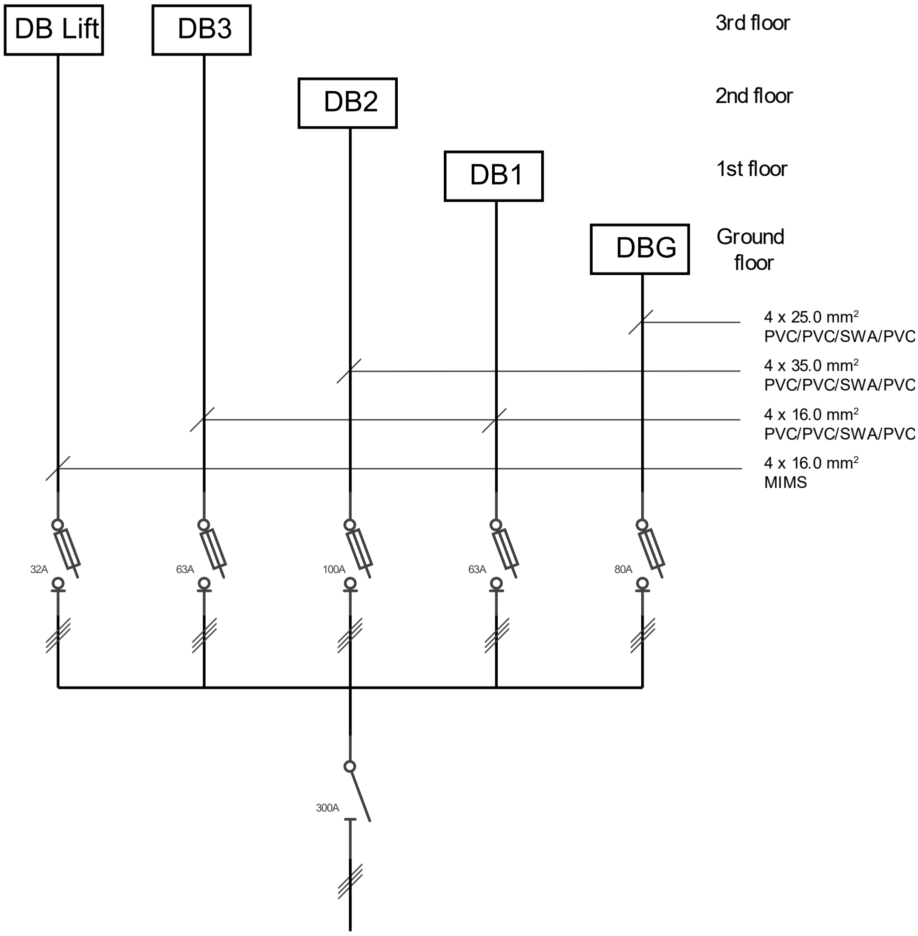
They are useful to gain an understanding of the overall layout of an installation without the complication of too many details. They are great for estimating loading, fault finding and other activities that do not need more specific installation details.

Most details are simplified or omitted, for example, a multi-pole contactor in a three-phase circuit would be represented by a single-pole marked to indicate the number of poles. The number of phases is indicated by angled lines across the cable instead of drawing all of the cores of the cable.

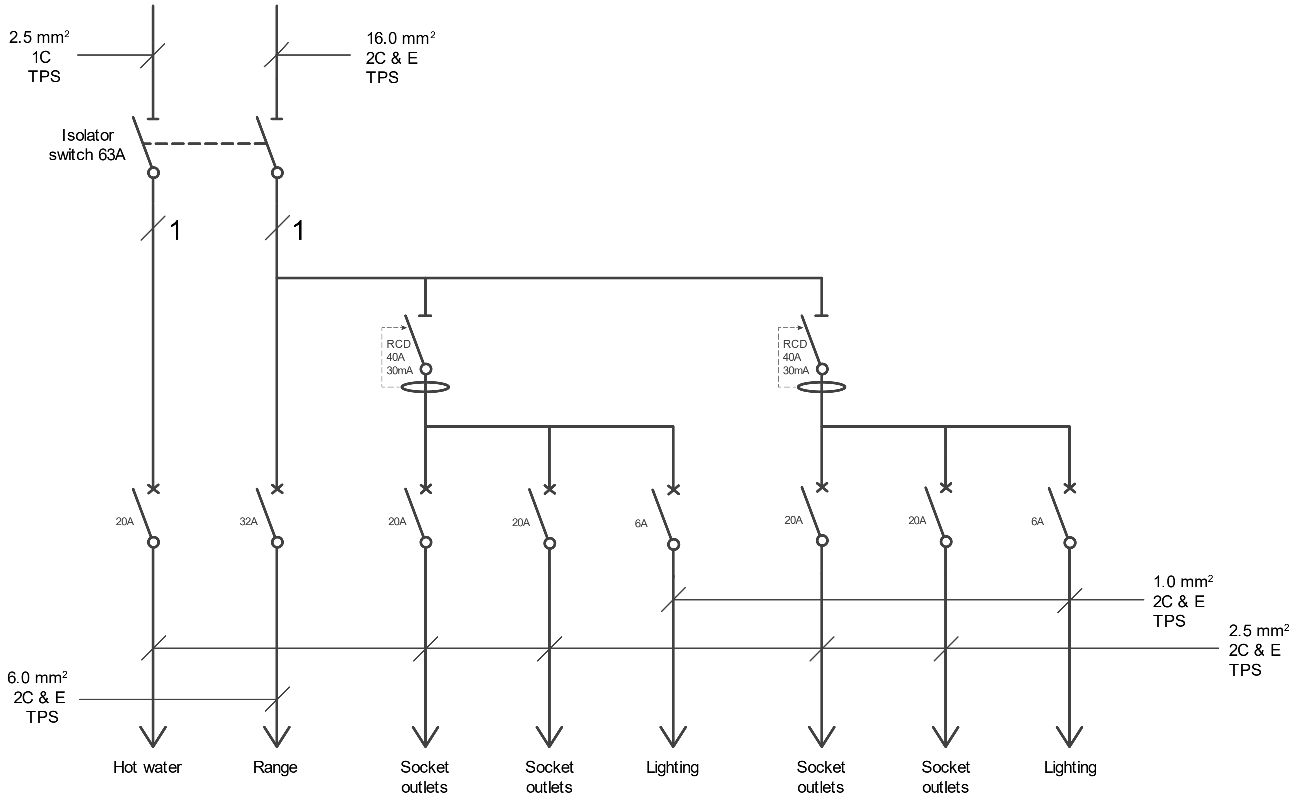
This symbol indicates a three phase cable for example. 

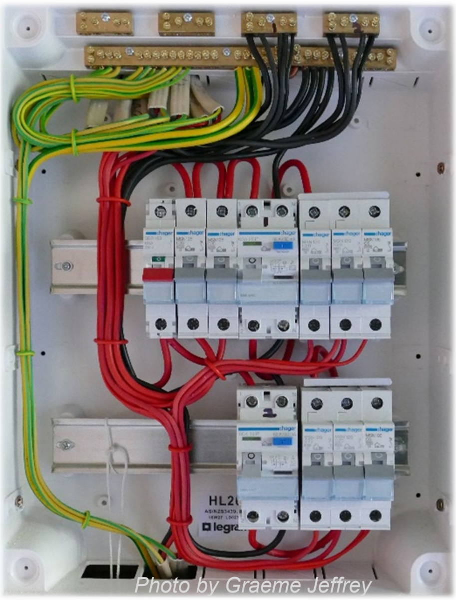
The ratings of equipment and cable sizes are often shown - as this information is often useful with these types of drawings.

A typical single-line diagram of a three-story building is shown below. As you can see, the final sub circuits for each floor are omitted for clarity. If you need more details for the final sub circuits, you would look on the location diagram.



A single line drawing of a domestic distribution board is shown below. It contains enough detail to see the lay out of the distribution board and information about the cable and equipment sizes.

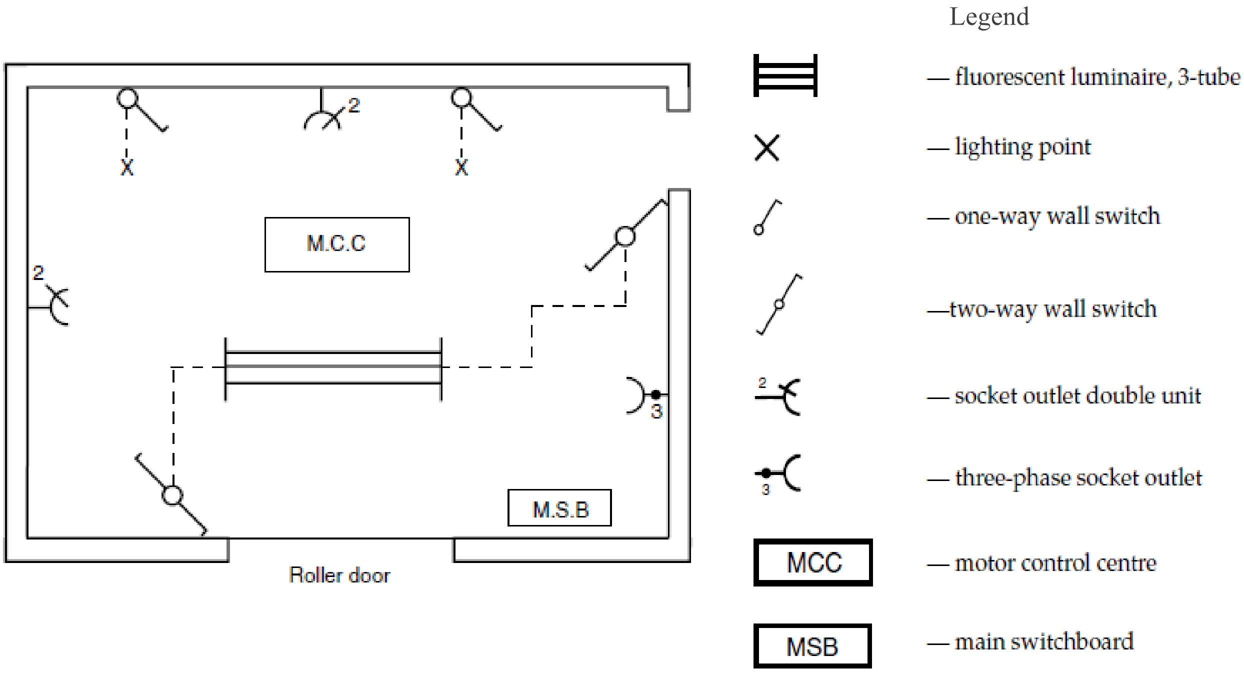




Location diagrams

A location diagram shows the position of electrical equipment such as motors, switchboards, power outlets, telemetry points and lighting, on an architectural plan of a building. Each item of equipment is briefly described on the plan or on the legend.

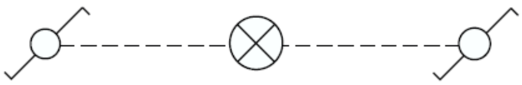
Below is a typical location diagram and legend.



Cable routes

Most location diagrams include indications of where cables run to or how they are to be run. These are usually shown as dotted lines that interconnect location symbols.

For example, the diagram here shows two-way switches operating a single lamp and the cables between.



Notes and instructions

Location diagrams are often used to prewire buildings and need to include information that is not easy to convey by drawing on a plan, such as the height of flush boxes and equipment.

Notes and special instructions will generally be written on a location plan and need to be taken into account when the work is done.

Here are some notes about what may need to be considered on a location diagram:


Photo by Graeme Jeffrey

- The height at which socket outlets and switches are set may vary. The norm is 1040mm above floor level for a light switch, 300mm for a socket outlet, and 1100mm for a socket outlet above a working counter.
- When placing sockets and lights, picture living and working in the proposed spaces of the building.
- Go through the drawings room by room and consider furniture. This applies to lighting and socket outlets.
- In the kitchen area, work closely with the kitchen manufacturer/installer. Socket outlets are inexpensive as a percentage of the building cost. Rather have two or three too many than be short. Extension cables across a kitchen counter never look good. Properly positioned lights and correct light fittings are critical in a kitchen. Again, kitchen units and accessories must be considered. The position of the stove is important because of the stove isolator. Moving the stove isolator point after building can be costly. Other fittings like extractor fans must also be considered.
- The socket outlets in a bedroom need to be considered with the furnishing in mind. Television, data, ceiling fans, air conditioning and telephone points may also be required. Remember home automation.
- Lighting in bathrooms is important, but one must remember that only light fittings made for bathrooms can be fitted. Look at the zones in AS/NZS 3000 as to where electrical fittings may and may not be installed.
- In living areas and lounges especially, electronic equipment becomes important. Connectivity for televisions, decoders, data, high-fi, speakers and so on needs to be considered. Modern wireless systems that connect electronic equipment together makes an installation easier, but it still needs to be thought through.
- Dimmer switches for lighting may also be required in living areas and bedrooms. 2-way switching where a light can be turned off and on from two different points may also be required.

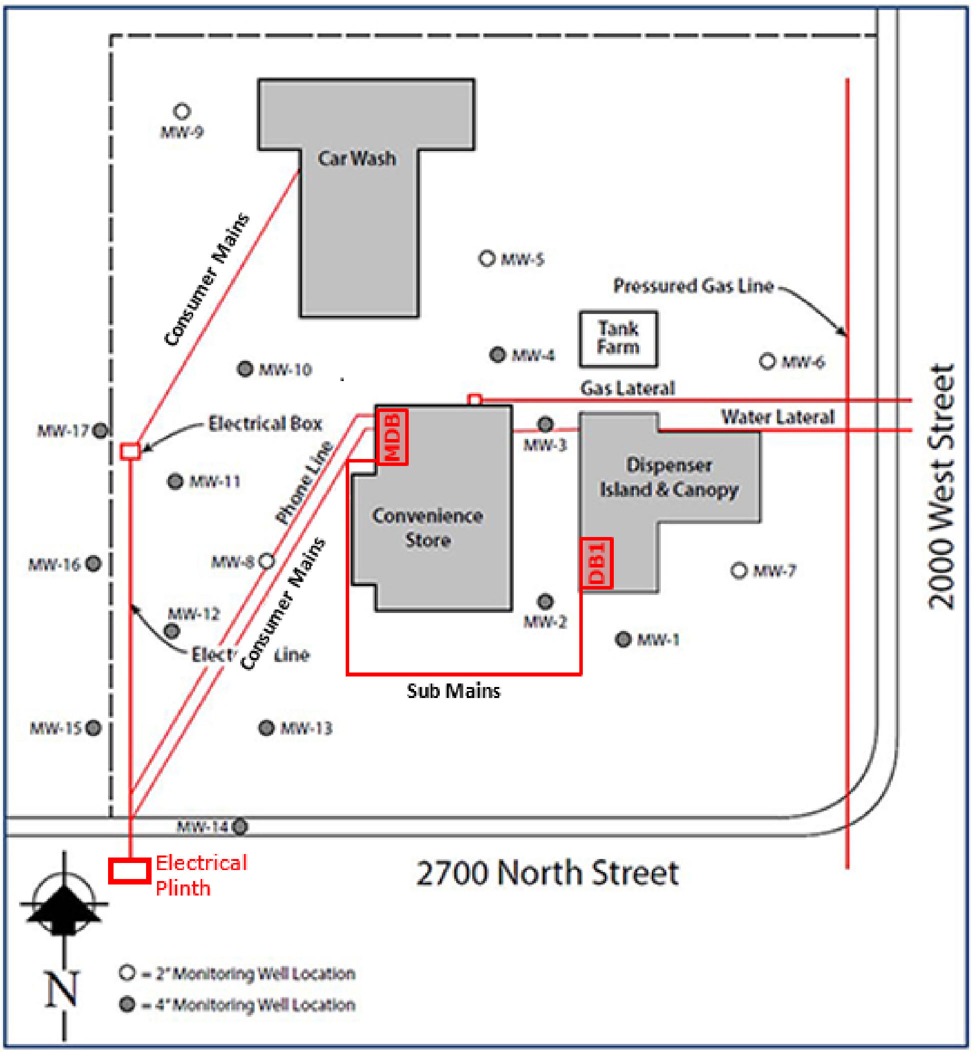
- Lighting in passages and on staircases needs to be adequate and safety must be taken into account. 2-way switching is almost always required in these areas.
- As the distribution board is not aesthetically pleasing, it is therefore usually positioned in the garage or utility room. The home automation system will usually be positioned in the same area as the distribution board.

Site plan

When deciding wiring layout and cable routes, you must:

- Consider the building construction as well as the layout of other services such as plumbing, waste pipes and air-conditioning ducts
- Check for the availability of any ducts or wells provided in the building structure that could be used for electrical purposes
- Consult the site plan when considering the route of the supply service line, especially if it is an underground feed, as the layout of other services such as sewer, drains and water supply may affect the route plan and hence the materials required.

The diagram below shows an example of a site plan with the positions of the main switchboard and distribution switchboards shown. The approximate route for cables is shown on the plan using a line with the required designation. This is more an indication of interconnection rather than an accurate plan of the physical position of the wiring.



Developing control circuitry

Control circuitry terminology

As with any technical subject, there is some electrical jargon you will need to understand to understand electrical drawings. The table below gives a list of common electrical control terms and their meanings.

Term	Meaning
Initiate	Begin process
Activate	Bring into action
De-activate	Cause action to cease
Make contacts	Contacts that close when operated.
Break contacts	Contacts that open when operated.
Normal position (De-energised)	How the contacts of a contactor or relay sit when the contactor or relay is de-energised. They may be normally closed or normally open.
Normally open (n/o)	Contacts that in their normal (de-energised) state are open
Normally closed (n/c)	Contacts that in their normal (de-energised) state are closed
Energised position	How the contacts of a contactor or relay sit when the contactor or relay is energised.
Holding contacts (also known as maintaining contacts)	Normally open contacts which are connected in parallel to hold a control circuit energised after a momentary contact such as a start push button is pushed and released.
Overload contacts	Contacts operated by an overload detection device used to cause electrical equipment to stop in the event of an overload.
Auxiliary contacts	Contacts, either n/o or n/c, that form part of a contactor and are designed to operate within a control circuit
Interlock contacts	Auxiliary contacts on a mechanically interlocked pair of contactors, wired so that only one contactor can be operated at one time.

Term	Meaning
Manual	All functions are human controlled and do not change without human intervention.
Semi-automatic	Functions that are initially set by human involvement and then continue to adjust or maintain due to the environment automatically.
Automatic	Functions that are fully self-operating and are capable of adjustment, movement and independent function without human intervention.

Examples of control circuits

Contactor/relay contact arrangements

There are two types of contact arrangements:

- **Changeover contacts** - comprise two separate contacts and one common contact that is activated.
- **Double-pole changeover contacts** - enable the polarity reversal of two conductors, which is often required in control circuitry. (For example, motor reversal and intermediate switching in lighting circuits.) Reversal of polarity is shown in the circuit diagram in Figure 14. The arrows show how the polarity is reversed with contacts in number 1 position.

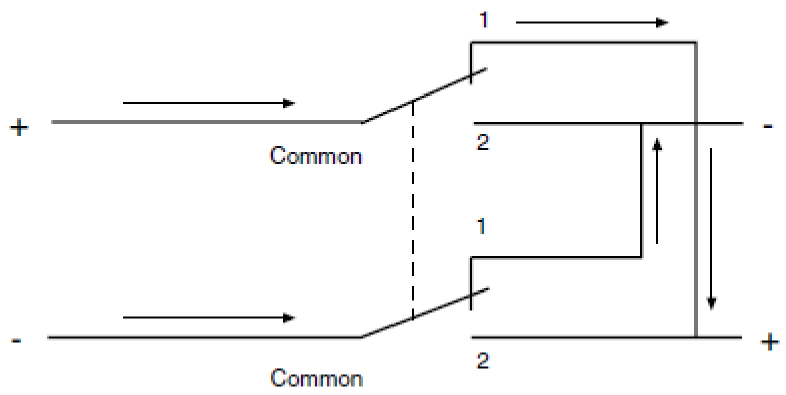


Figure 14: Double-pole changeover contacts

Push-button control

This simple circuit is not commonly used but is useful when momentary manual operation is required.

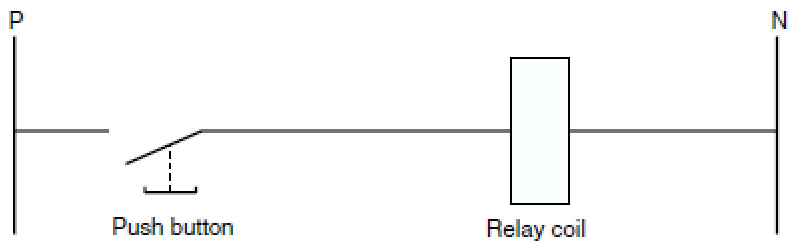


Figure 15: Push button control on/off

Operation

The relay coil is energised when the n/o button is pressed and de-energised when released.

Start-stop control

This control circuit is probably the most commonly used system for starting and stopping motors and other equipment operated by start and stop buttons. Because the button and control switches are in series with the relay coil, this control circuit is fail-safe in the event of a bad connection or broken wire. It also “unlatches on supply power failure preventing unexpected re-starting. In such cases, the coil becomes de-energised, stopping the system which cannot be restarted until the fault is corrected and/or the start button is pushed again.

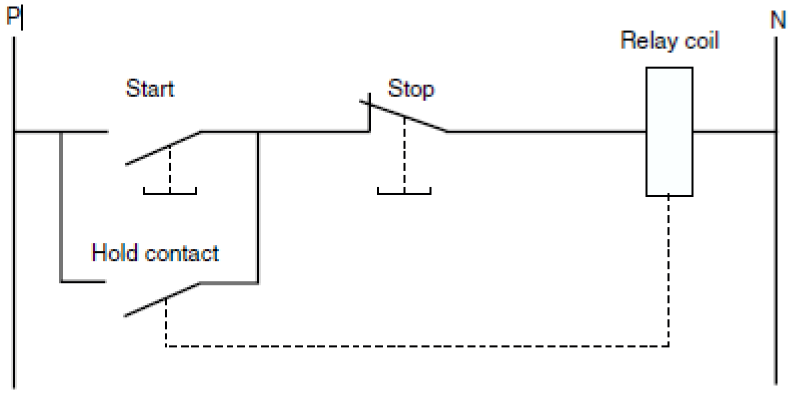


Figure 16: Start – stop circuit

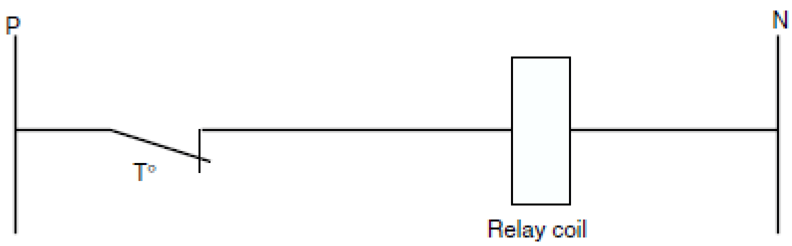
Operation

When the start button is pressed, the current passes through the n/c stop button and energises the relay. The n/o hold contact, which is part of the relay contact system, closes across the start button and maintains the circuit to the relay coil. The start button can now be released. The circuit will stay energised until the n/c stop button is operated, so that the circuit to the relay coil is de-energised. The n/o main contacts then open. Thus, a relay or contactor can be controlled by the operation of separate start and stop buttons.

Temperature activated contacts

Temperature control circuitry is necessary for heating equipment such as water, air or process heaters. It may also be used for thermal damage prevention in processes and machinery.

To do this, temperature sensitive contacts are used and have n/c contact arrangements connected in series with the heating device or the control circuitry. The temperature sensitive contacts open, de-energising the circuit when a pre-determined temperature limit is reached.



Standard labelling conventions

A schematic diagram (such as a wiring diagram, line diagram, or circuit diagram) is a visual representation of a circuit.

Since a schematic is to communicate information, a good schematic does this quickly, clearly, and with low chance of misunderstanding. There are some standard guidelines around labelling of components that should be followed when drawing an electrical diagram.

1. **Components need identification**

Each component in a drawing needs to be identified by a short easy to read unique label such as R1, R2, CLK etc. These make the circuit much easier to read and understand.

2. **Components are shown in their normal position**

Components that can change state such as contacts of a relay or contactor need to be consistently indicated so as not to create confusion about the operation of a circuit. The convention generally adopted is that components are shown in their normal (de-energised) state.

3. **Contacts are identified as to which contactor they are associated with.**

To understand how a circuit works, it is vitally important to identify which contactor coil operates which contact. There are often multiple contacts operated by one coil.

4. **A legend of components is included on plans.**

There can be a great deal of variation in what symbols look like from one electrical drawing to the next. It can depend on the country of origin, the company producing the drawing, the CAD package and sometimes the personal preferences of a designer.

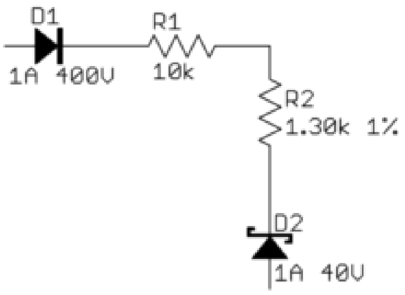
No matter what the symbols look like on a drawing, as long as there is a good clear legend explaining what each symbol represents, then the drawing can be interpreted by anyone picking it up. Having a legend is vitally important to an electrical drawing.

While you could choose to use a picture of a helicopter to represent socket outlets, it really wouldn't help the clarity of your diagram. Using reasonably standard easily recognised drawing symbols will help a lot with the clarity of a drawing.

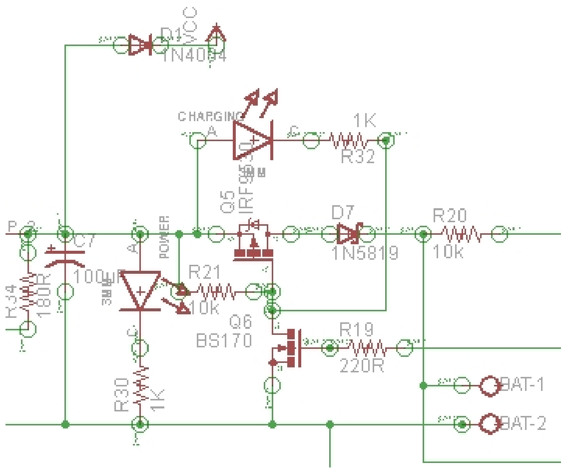
Here are some more things you can do to help make schematic drawings better:

1. ***Clean up text placement***

Vertical text can make schematic hard to read and should be avoided. For example, here are some parts at different orientations. Note how the text is in different places relative to parts to make things neat and clear.



Legible and meaningful



Messy and confusing

2. ***Use basic layout and flow conventions***

In general, if possible, it is good to put higher voltages towards the top, lower voltages towards the bottom, and logical flow left to right. That's clearly not possible all the time, but at least a general higher-level effort to do this will greatly illuminate the circuit to those reading your schematic.

3. ***Direct connections, within reason***

Spend some time with component placement reducing wire crossings and the like. The recurring theme here is *clarity*. Of course, drawing a direct connection line isn't always possible or reasonable. Obviously, it can't be done with multiple sheets.

You should be trying to help people understand the circuit easily, not make them figure it out despite the schematic.

4. ***Design for regular size paper***

Design your schematic so that individual sheets are nicely readable on a single normal page, and on the computer screen at about the same size. Having to scroll a page at that resolution to see necessary detail is annoying.

If that means using more pages, go ahead. You can flip pages back and forth with a single button press in Acrobat Reader. Flipping pages is preferable to panning a large drawing or dealing with outsized paper. One normal page at reasonable detail is a good size to show a sub circuit. Think of pages in schematics like paragraphs in a narrative. Breaking a schematic into individually labelled sections by pages can help readability, if done right.

5. ***Keep names reasonably short***

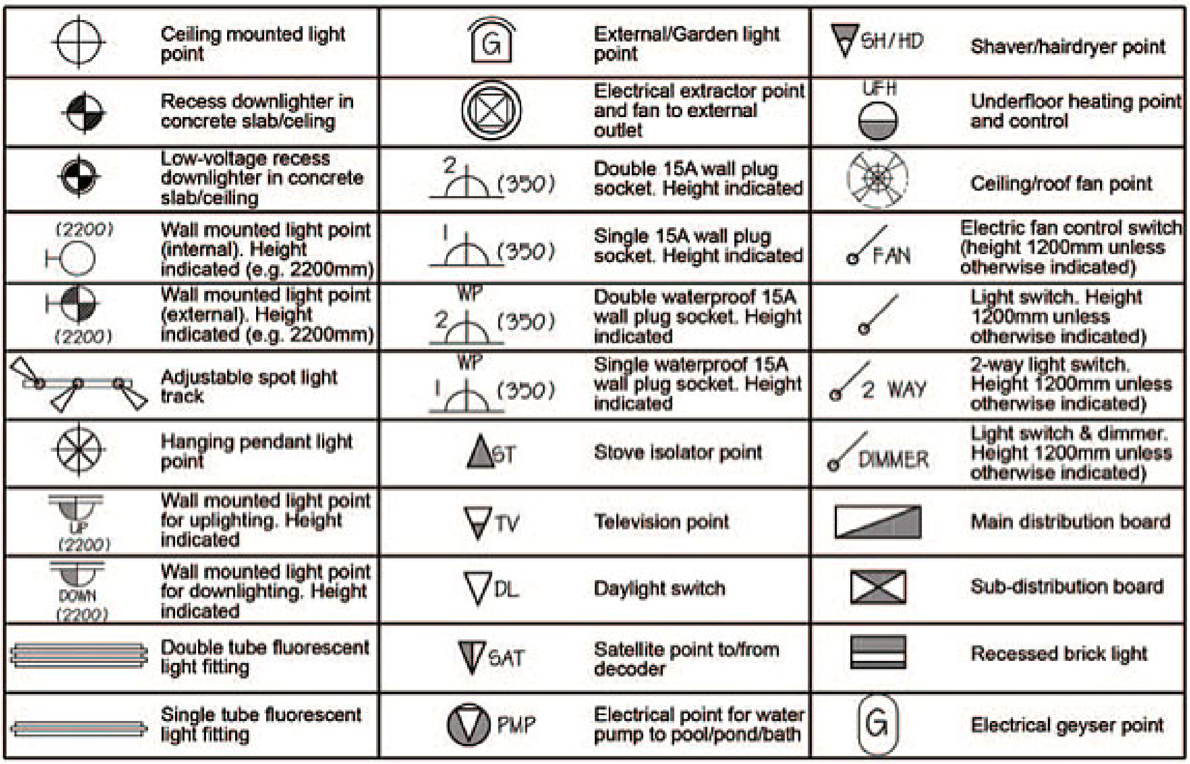
Just because your software lets you enter 32 or 64 character names, doesn't mean you should. Again, the point is clarity. No names = no information, but lots of long names are clutter, which then decreases clarity. Somewhere in between is a good trade-off. Don't get silly and write "8 MHz clock to my PLC", when simply "CLOCK" or "CLK" would convey the same information; or don't write "8 x 12 way vertical, surface mounted main switch board" when "MSB" would suffice for the purposes of the schematic. The long description would be used in the product specification document.

Remember: Even though you are using symbols to identify the component used in the schematic and lines to depict the connections, it is vital that you also label components so that someone reading the schematic understands the circuit. Use of symbols and appropriate labels go hand in hand to deliver a neat, well-presented schematic.

Legend

Without proper drawings and specifications, it becomes extremely difficult to undertake an electrical installation, if not impossible. In commercial and industrial projects where the electrical installation can be complex, drawings are in most cases provided by the architect or engineer.

An example of a simple electrical legend is shown below.



Symbol	Description	Symbol	Description	Symbol	Description
	Ceiling mounted light point	G	External/Garden light point	SH/HD	Shaver/hairdryer point
	Recess downlighter in concrete slab/celing		Electrical extractor point and fan to external outlet	UFH	Underfloor heating point and control
	Low-voltage recess downlighter in concrete slab/ceiling	2 (350)	Double 15A wall plug socket. Height indicated		Ceiling/roof fan point
(2200)	Wall mounted light point (internal). Height indicated (e.g. 2200mm)	1 (350)	Single 15A wall plug socket. Height indicated	FAN	Electric fan control switch (height 1200mm unless otherwise indicated)
(2200)	Wall mounted light point (external). Height indicated (e.g. 2200mm)	WP 2 (350)	Double waterproof 15A wall plug socket. Height indicated		Light switch. Height 1200mm unless otherwise indicated)
	Adjustable spot light track	WP 1 (350)	Single waterproof 15A wall plug socket. Height indicated	2 WAY	2-way light switch. Height 1200mm unless otherwise indicated)
	Hanging pendant light point	ST	Stove isolator point	DIMMER	Light switch & dimmer. Height 1200mm unless otherwise indicated)
UP (2200)	Wall mounted light point for uplighting. Height indicated	TV	Television point		Main distribution board
DOWN (2200)	Wall mounted light point for downlighting. Height indicated	DL	Daylight switch		Sub-distribution board
	Double tube fluorescent light fitting	SAT	Satellite point to/from decoder		Recessed brick light
	Single tube fluorescent light fitting	PMP	Electrical point for water pump to pool/pond/bath	G	Electrical geyser point

Without a legend the schematic becomes difficult to interpret.

So whatever set of symbols you use, whether IEC, IEEE, AS 1102 or any other set of symbols, as long as you have a legend and you have followed the key points regarding labelling, someone else will be able to understand and follow the schematic.

Other points that may not technically be electrical, or are installed by another contractor, can also be included on the electrical layout drawing. Some examples are:

- Telephone, TV, sound systems, data and security systems.
- Home automation.
- Intercom and electric gates.
- Water storage tanks.
- Swimming pool.
- Air-conditioning.
- Photo Voltaic (solar) panels and related connections.
- Heat pumps.
- Automated irrigation and bore holes.

Schedules

Schedules provide further information such as:

1. General lighting fixture schedule: This would specify the fixture type, specification, part number, mounting method and often have an image of the fitting as well.
2. Cable schedule: This would specify the cable type and size to and from each switchboard.
3. Panel schedule: This would specify the switchboard type, make, size and layout.
4. Electrical abbreviations: Abbreviations used in the plans or schematics and what each abbreviation means.
5. Drawing index: Where multiple drawings or schematics are used, an index is often useful.

Further information:

Further information on standard labelling conventions for electrical drawings can be found in the following standards:

BS EN 60027-1:2006+A2:2007
Letter symbols to be used in electrical technology.

AS/NZS 1102.102:1997
Graphical symbols for electrotechnical documentation.

IEC 60617 Ed. 1.0 b (2012)
Graphical symbols for diagrams.

SAA/SNZ HB 3:1996
Electrical and electronic drawing practice for students. This handbook contains extracts from AS 1103, AS 1100.101 and AS 1102 as well as original material.

Glossary of Electrical symbols

There are standards that deal with electrical symbols, but in reality, symbols used vary from plan to plan and company to company.

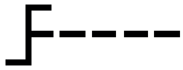
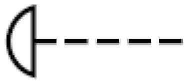
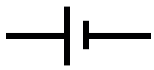
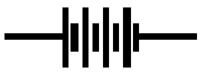
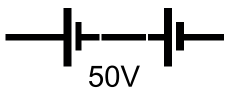
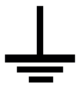
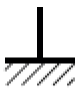
You will need to be able to identify any symbol presented to you.

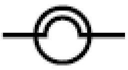
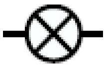
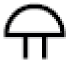
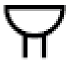
The key thing with electrical symbols is, to have a legend that identifies what each symbol is on the plan you are looking at.

Here are some examples of drawing symbols you may come across.

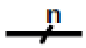
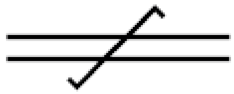
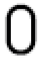
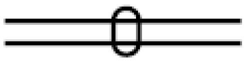
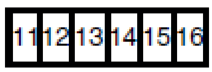
Group 1: General symbols

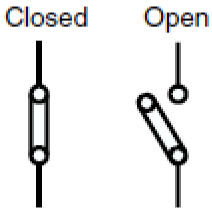
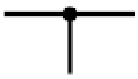
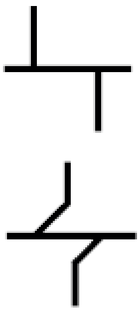
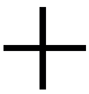
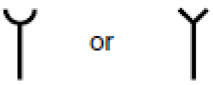
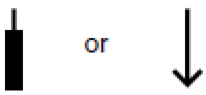
Item definition	Symbol	Comment
Direct current or steady voltage	—	
Alternating current (General symbol)	~	Used for all sinusoidal frequencies
Suitable for use on either direct or alternating supply	$\overline{\sim}$	
Alternating current three-phase with neutral 50 Hz, 400 V	**3N ~ 50 Hz 400V**	3N ~ 50 Hz 400 V New Zealand supply system
Positive polarity	+	
Negative polarity	−	
Three-phase winding, delta	△	

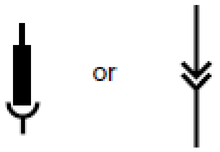
Item definition	Symbol	Comment
Mechanical, pneumatic or hydraulic connection (General symbol)		
Manually operated (General symbol)		
Operated by pushing		Start buttons, bell pushes
Operated by turning		
Emergency switch		Often used in motor control circuits
Primary cell or accumulator. The long line represents the positive pole, the short line, the negative pole.		
Battery showing the cells making up the battery.		
Battery. The nominal voltage should then be indicated.		Example: 50 V battery Can be used to describe any voltage
Earth / Ground (General symbol)		Is earth in New Zealand. Ground in United States.
Frame or chassis connection		

Item definition	Symbol	Comment
Filament lamp		Also known as incandescent lamp
Discharge lamp, gas filled (General symbol)		Neon signs and so on
Hot cathode tubular fluorescent lamp, gas filled		Fluorescent lamps in general
Signal lamp also used generally for light fittings		Used in control and power circuitry. (Note: the same symbol is used for a luminaire (location symbol))
Electric bell (General symbol)		
Electric buzzer (General symbol)		Note inverted symbol

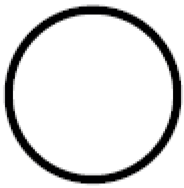
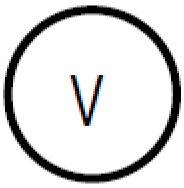
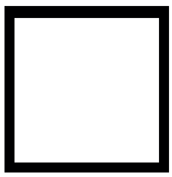
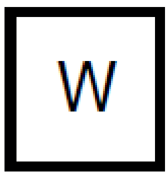
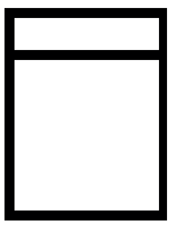
Group 2: Symbols for conductors and connecting devices

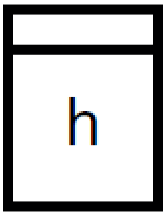
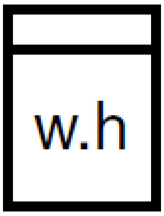
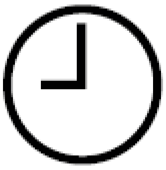
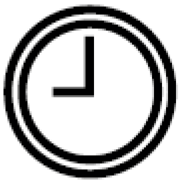
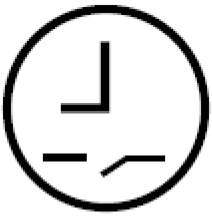
Item definition	Symbol	Comment
Conductor or group of conductors		A line for a particular path may be emphasised by increasing its thickness
Conductor or cable not connected		
Two conductors		
n conductors		For example, 3 phase + N, n = 4.
Twisted conductors (General symbol)		
Two conductors twisted		
Cable (General symbol)		
Two-conductor cable		
Terminal or tag		If necessary to indicate on which terminal a contact is hinged, the solid circle shall represent the bolted or hinged contacts, and the open circle the readily separable contacts
Terminal strip		The numbers shown are an example only

Item definition	Symbol	Comment
Terminals or tags may be numbered as shown		
Link		
Junction of conductors using terminals		
Junction of conductors		
Double junction (either method may be used)		Double junctions of conductors are shown this way to avoid confusion with conductors crossing without electrical connection. The dot represents an electrical connection.
Conductors (crossing without electrical connection)		
Connection common to a group of apparatus		The short stroke indicates that the wire is multiplied over or is common to a number of similar items.
Socket (female) or one pole of a socket		
Plug (male) or one pole of a plug		

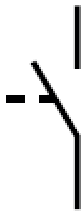
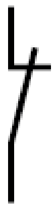
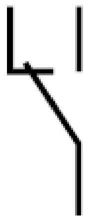
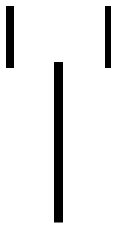
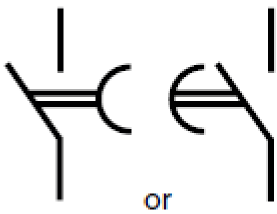
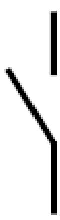
Item definition	Symbol	Comment
Plug and socket (male and female)		

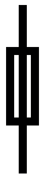
Group 3: Symbols for measuring instruments

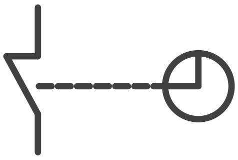
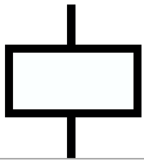
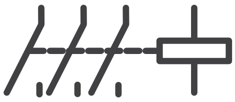
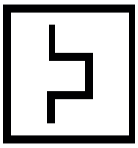
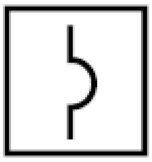
Item definition	Symbol	Comment
Indicating or measuring instrument (General symbol)		This is a general symbol in which the designation of the type of instrument is shown as in the examples below.
Example: Voltmeter		Symbols for other quantities are: - A—ammeter - W—wattmeter - var—varmeter (reactive power) - cosø—power factor meter - ø—phasemeter - Hz—frequency meter - Ω—ohmmeter - ↑—galvanometer - n—tachometer
Recording instrument (General symbol)		This is a general symbol in which the designation of the type of instrument is shown, for example, digital readout ammeter
Recording wattmeter		
Integrating meter (General symbol)		This is a general symbol in which the designation of the type of instrument is shown, for example, kWh

Item definition	Symbol	Comment
Hour meter		
Watt-hour meter		
Clock (and slave) (General symbol)		
Master clock		
Time switch		
Synchronous clock		

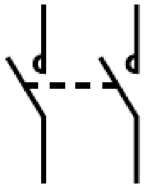
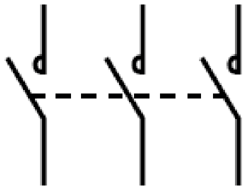
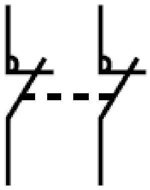
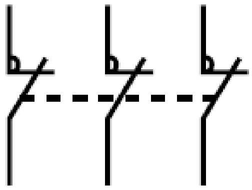
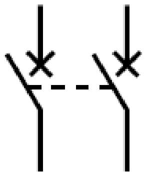
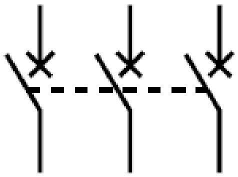
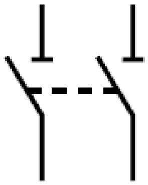
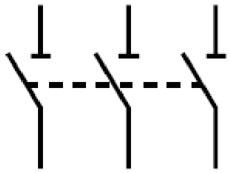
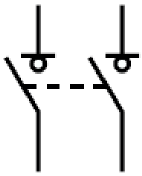
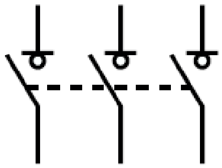
Group 4: Symbols for switching and protective devices

Item definition	Symbol	Comment
Make contact (will be draw with operating mechanism connected)		
Break contact		
Changeover contact		
Two-way contact with centre-off position		
Make contact delayed when operating		Note the use of the delayed action general symbol (semicircle)
Switch (General symbol)		

Item definition	Symbol	Comment
Limit switch, make contact		
Temperature operated (make contact can be draw as break contact also)		
Fuse (general symbol)		
Fuse switch Single pole		
Manually-operated switch (General symbol)		Some versions may have a circle at the hinge.
Push button switch		

Item definition	Symbol	Comment
Timer operated switch		
Relay, selector or contactor coil (General symbol)		
Contactor		
Overcurrent detection, thermal effect		Frequently used in motor starter circuitry
Overcurrent detection, electromagnetic effect		
Device operated by temperature		

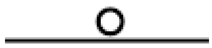
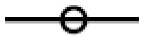
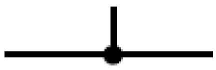
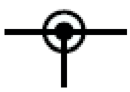
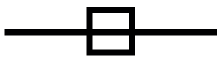
Group 5: Symbols for multipole devices

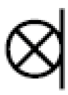
Item definition	Single pole	Double pole	Triple pole
Contactor — n/o contact			
Contactor — n/c contact			
Circuit-breaker			
Isolator			
On-load isolator			

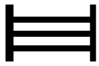
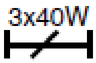
Note: n/o means normally open contacts and n/c means normally closed contacts.

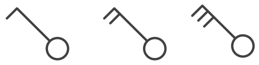
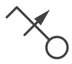
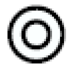
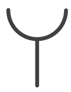
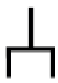
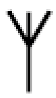
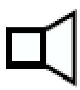
Group 6: Symbols for locations

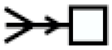
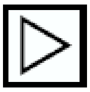
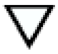
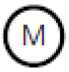
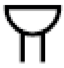
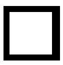
Note: Location symbols are not circuit diagram graphical symbols. These symbols are used on architectural drawings to show the position of electrical services like lights, power outlets, switches, water heaters, cookers, switchboards and cable routes.

Item definition	Symbol	Comment
Wiring line or cable		
Link between associated equipment		
Wiring or cable in conduit, pipe or duct		
Underground line		
Overhead line		
Wiring line or cable joint		
Example: Tee joint		
Junction box involving a cable joint		
Jointing chamber or box, cable pit or manhole		
Switchboard, distribution board, frame, panel or cubicle (General symbol)		Usually drawn into a pattern of blocks or including letters indicating the type of panel.

Item definition	Symbol	Comment
Example: Main switchboard	MSB	Other examples of letter symbols for coding of boards: ▶ CP = Control panel ▶ CN = Control station ▶ DBL = Distribution board light ▶ DBP = Distribution board power ▶ DSB = Distribution board ▶ IC = Instrument cubicle ▶ MB = Meter board ▶ MCC = Motor control centre ▶ MK = Marshalling kiosk ▶ MSB = Main switchboard ▶ PBS = Push-button station ▶ RCP = Remote control panel ▶ RP = Relay panel ▶ SAS = Security and alarm systems ▶ TB = Terminal box ▶ TP = Terminal panel
Luminaire, or signal lamp (General symbol)		
Luminaire fixed to a wall		
Emergency lighting: Luminaire		

Item definition	Symbol	Comment
Emergency lighting: Floodlight		
Fluorescent luminaire		
Example: Luminaire with three lamps		
Alternative		
Lighting outlet position, for example, batten holder		
Electric appliance (General symbol)		Examples of letter symbols for coding of electrical appliances: ◤ AC Air conditioner ◤ BWU Boiling Water Unit ◤ FH Fan Heater ◤ GDU Garbage disposal unit ◤ H Heater ◤ HD Hand dryer ◤ R Range ◤ SDU Sanitary disposal unit
Example: Air conditioner		

Item definition	Symbol	Comment
One-way switches, single-pole and two-pole		
Two-way switch		
Dimmer switch		
Push-button switch		
Socket-outlet (General symbol)		Note: Outlet is on semi- circle side
Socket-outlet with additional identifying information		
Socket-outlet for telecommunication (General symbol)		
Television outlet		
Antenna (aerial) (General symbol)		
Data outlet		
Loudspeaker		

Item definition	Symbol	Comment
Radio receiving set		
Amplifying equipment (General symbol)		
Telephone outlet		
Motor (General symbol)		
Electric bell		
Electric buzzer		
Horn		
Clock		
Generating station, planned		

Te Pūkenga

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