

# **Trade of Electrician**

**Standards Based Apprenticeship**

## **Bell Circuit**

**Phase 2**

**Module No. 2.2**

**Unit Nos. 2.2.4**

**COURSE NOTES**

Created by Chris Ludlow - Dundalk TC

Revision 1 April 2000 By  
Chris Ludlow - Dundalk TC  
Eugene Trindles - Cork TC

Revision 2 Nov 2002 By  
Chris Ludlow - Dundalk TC  
Charlie Walsh - Athlone TC

Revision 3 May 2006 By  
Chris Ludlow - Dundalk TC

Revision 4. Feb 2008 By  
Chris Ludlow - Dundalk TC

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Chris Ludlow - Dundalk TC

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Chris Ludlow - Dundalk TC

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# Table of Contents

<b>INTRODUCTION .....</b>	<b>4</b>
<b>GRAPHICAL SYMBOLS .....</b>	<b>5</b>
<b>THE BELL CIRCUIT .....</b>	<b>7</b>
<b>THE TRANSFORMER.....</b>	<b>7</b>
<b>BELLS, BUZZERS AND CHIMES .....</b>	<b>9</b>
<b>THE BELL PUSH.....</b>	<b>12</b>
<b>BELL INSTALLATION TECHNIQUES.....</b>	<b>14</b>
<b>UNIT RELATED ETCI RULES .....</b>	<b>14</b>

## Introduction

Welcome to this section of your course, which is designed to enable you, the learner, understand the operation of basic electric bells, buzzers, chimes, bell pushes and bell transformers and how they are interconnected.

### **Objectives**

By the end of this unit you will be able to:






- Recognise and use important electrical symbols
- Understand the information supplied with a bell transformer
- Read circuit diagrams showing simple bell circuits
- Understand the operation of a basic trembler bell
- Understand the operation of a basic buzzer
- Understand the operation of a basic chime unit
- Install a transformer powered bell circuit

### **Reasons**







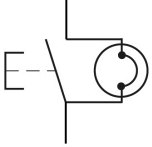

Understanding this information will allow you install correctly a transformer powered bell / buzzer circuit.

# Graphical Symbols

## Architectural Symbols

Bell	
Buzzer	
Pushbutton	
Illuminated Pushbutton	
Transformer	

## Circuit Symbols

Bell	
Buzzer	
Normally Open Contact ( N/O )	
Normally Closed Contact ( N/C )	
Actuator	
Pushbutton	
Illuminated Pushbutton	
Transformer	

## The Bell Circuit

Bell circuits in domestic premises are operated on **extra low voltage**. The advantages of using extra low voltage are as follows:

- Much safer than mains voltage ( **low voltage** ).
- Accessories are much cheaper.
- Lower grade cable may be used.
- Battery supply can be used to power bell circuit.

## The Transformer

A transformer is normally used to provide the extra low voltage supply. The construction and operation of transformers is covered in detail in Unit 2.1.10 of Phase 2. and at this stage we will take a very simplistic view.

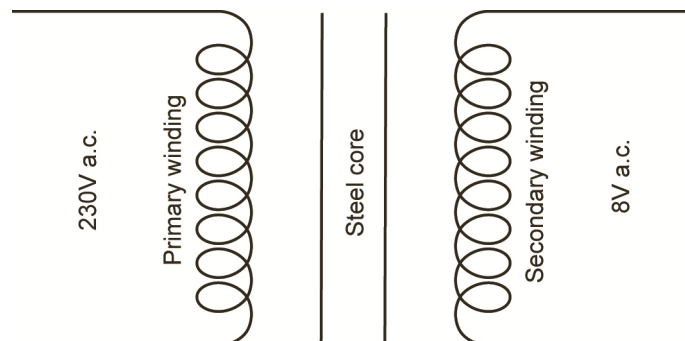
A transformer is a device which operates on AC only. It may provide an output voltage which can be less than, equal to, or greater than the supply voltage. A transformer which provides a voltage less than its supply voltage is referred to as a **step down transformer**. This is the type of transformer used for domestic bell circuits.

The transformer consists of two separate windings. These windings are electrically isolated from each other and therefore provide a **safe output voltage** which is totally isolated from the mains supply.

The following is a list of the standard voltage outputs available from the bell transformers in common use: 3 V, 4 V, 5 V, 8 V and 12 V. The transformer chosen should match the load requirements of the bell.

The input winding is called the **primary** winding and the output winding is called the **secondary** winding.

Figure 1 represents a transformer which is supplied on the primary side at 230 Volts AC while the secondary is arranged to provide 8 Volts AC.



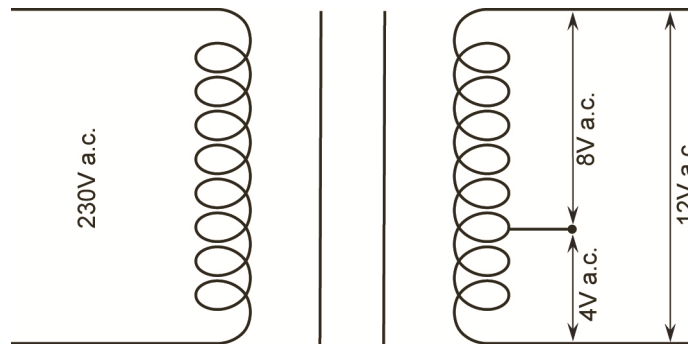
**Figure 1**

The primary winding of a bell transformer consists of a large number of turns of wire, having a CSA in the region of  $0.12 \text{ mm}^2$ . Consequently this winding will have a relatively high resistance, typically 300 - 900 Ohms.

The secondary winding consists of a small number of turns of wire, having a CSA in the region of  $0.43 \text{ mm}^2$ . Consequently it will have a much lower resistance, typically 0.1 - 3 Ohms.

It is **extremely important** that the mains supply is connected to the primary winding and not to the secondary winding.

Figure 2 represents a transformer which is arranged to provide three output voltages of 4 V, 8 V and 12 V.



**Figure 2**

The secondary winding is merely tapped at a point which will provide either 4 V or 8 V from the total output voltage of 12 V.

### Activity:

Using an ohmmeter:-

Apprentices to measure and record the resistance of both primary and secondary windings.

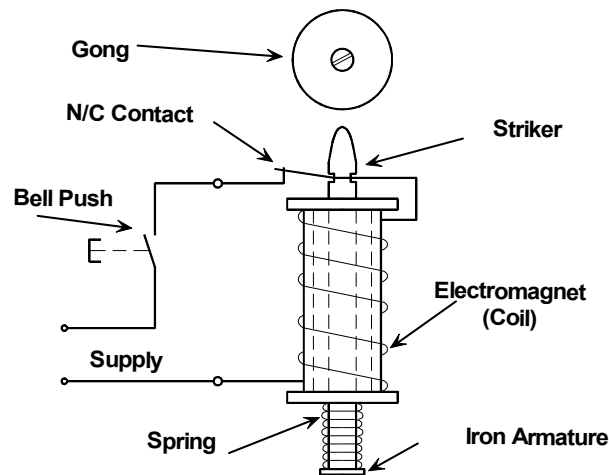


## Bells, Buzzers and Chimes

There is a wide range of these devices manufactured under the heading of bells, buzzers and chimes. The devices vary from the basic minibuzzer to an electronic doorchime providing a selection of many melodies.

### *The Trembler Bell*

Figure 3 shows how a simple trembler bell works. When the bell push is operated, the electromagnet is energized and the iron armature is attracted into it, causing the striker to hit the gong. This action, however, breaks the circuit via the N/C ( normally closed ) contact and the electromagnet de-energises. The spring returns the striker and armature to the original position, completing the circuit once again, and the electromagnet is again energised. This process is repeated until the bell push is released.



**Figure 3**

The bell may be supplied from a transformer or from a battery with an output voltage matched to suit the bell. The bell should be fitted the correct way up for proper operation. The correct mounting arrangement will be clearly indicated on the bell itself.

### The Buzzer

The buzzer operates on the same basic principle as the trembler bell. There is of course no gong present and the buzzing sound is simply the result of the iron armature vibrating forwards and backwards under the influence of the electromagnet and spring. See Figure 4.

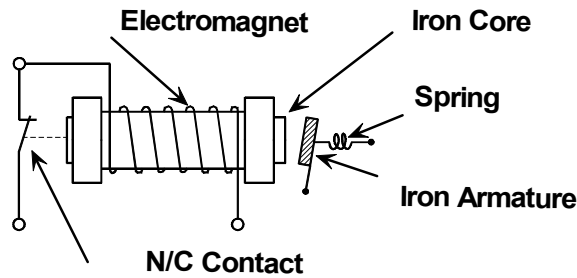


Figure 4

Figure 5 shows the buzzer correctly connected for AC operation. The AC supply is applied directly across the buzzer coil, through the bell push. In this case the N/C contact is not required as the AC supply will cause the buzzer to vibrate automatically. If the N/C contact is inadvertently used with an AC supply, the buzzer will still operate, but **not** as effectively as it should.

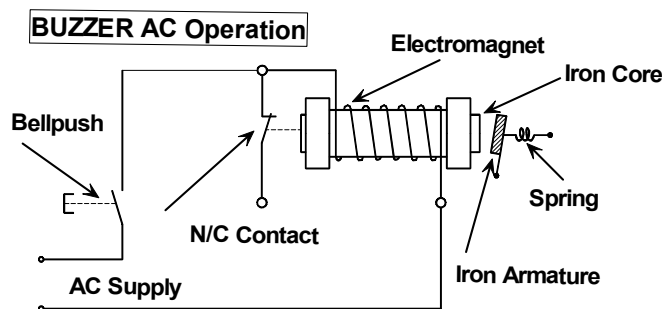


Figure 5

Figure 6 shows the buzzer correctly connected for DC operation. In this case the N/C contact **must** be used, otherwise the iron armature would remain in contact with the iron core when the bell push is closed. This would simply result in, one “click” from the buzzer on closing of the bell push, and another on opening of the bell push.

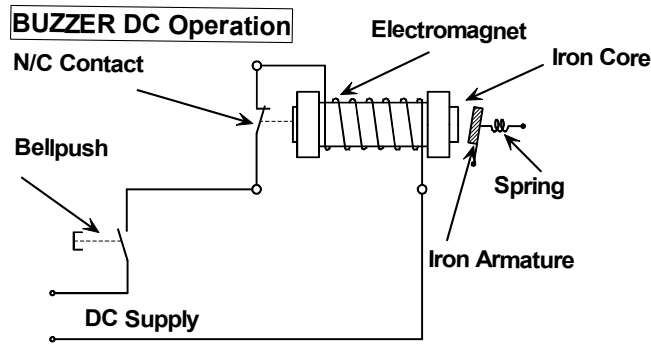


Figure 6

### Chimes

Figure 7 shows a door chime which produces a ‘ding-dong’ sound. It operates as follows:

When the bell push is depressed, the coil is energized. The resulting magnetic field attracts the soft iron rod with plastic end inserts. This causes it to move in the direction shown by the arrow, which will sound the “ding” chime. When the bellpush is released the spring will return the rod with enough force to sound the “dong” chime.

This is perhaps a more pleasant way to be alerted that there is a caller at the door, because if the bellpush is held closed the chime will not continue to sound.

This unit will operate on AC or DC.

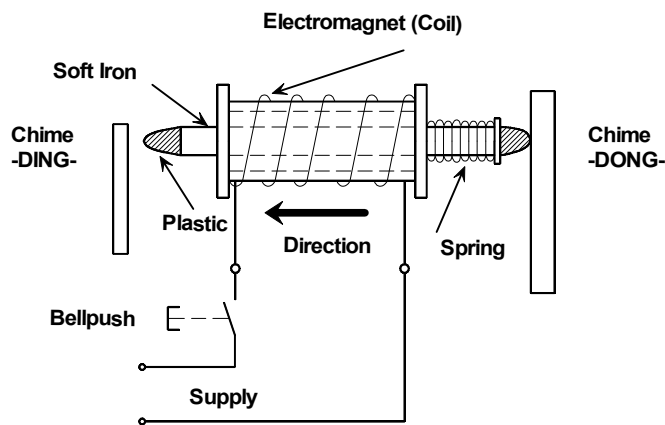


Figure 7

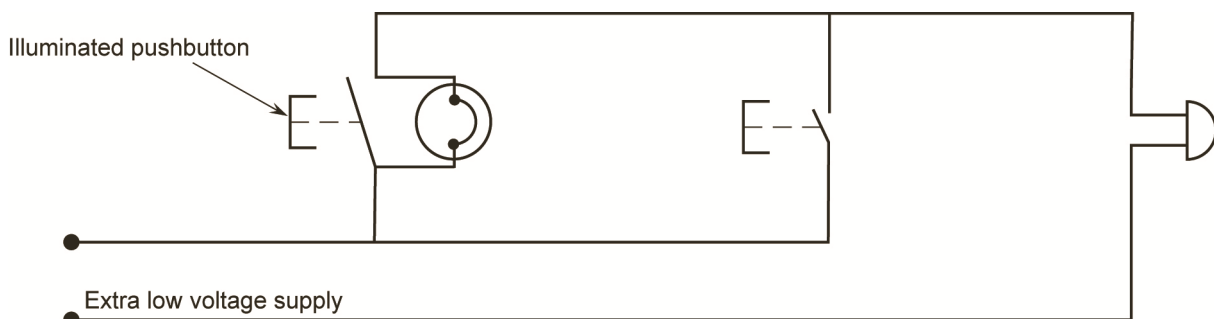
## The Bell Push

Bell pushes are available in various shapes and sizes. They may be button type, illuminated or non-illuminated, or illuminated with a name card. They may be manufactured from plastic, stainless steel or brass. The contact is usually a “springy section” of flat brass, operated by direct finger pressure on the push.

These steel or brass bell pushes are **not** required to be earthed, as they operate at Extra Low Voltage

### Multiple Bell Pushes

A bell may be operated by more than one bell push. If this is to be the case, the bell pushes must be connected in parallel as shown in Figure 8.



**Figure 8**

One of the bell pushes is of the illuminated type. With both bell pushes in the open position, the high resistance lamp used in the illuminated bell push will light up. This is because the lamp is connected in series with the bell coil which has a low resistance. The current which illuminates the lamp, also flows through the bell coil as the two are in series. This very low value current is not sufficient to cause the bell to operate.

When the illuminated bellpush is operated its contact shorts out its lamp and so the lamp is extinguished. The supply voltage is applied across the bell. Two illuminated bell pushes connected in parallel will cause the bell to “rattle” and this should be avoided. Illuminated bell pushes should **not** be used with electronic chimes as the current drawn may trigger the chime.

## Multiple Bell Installation

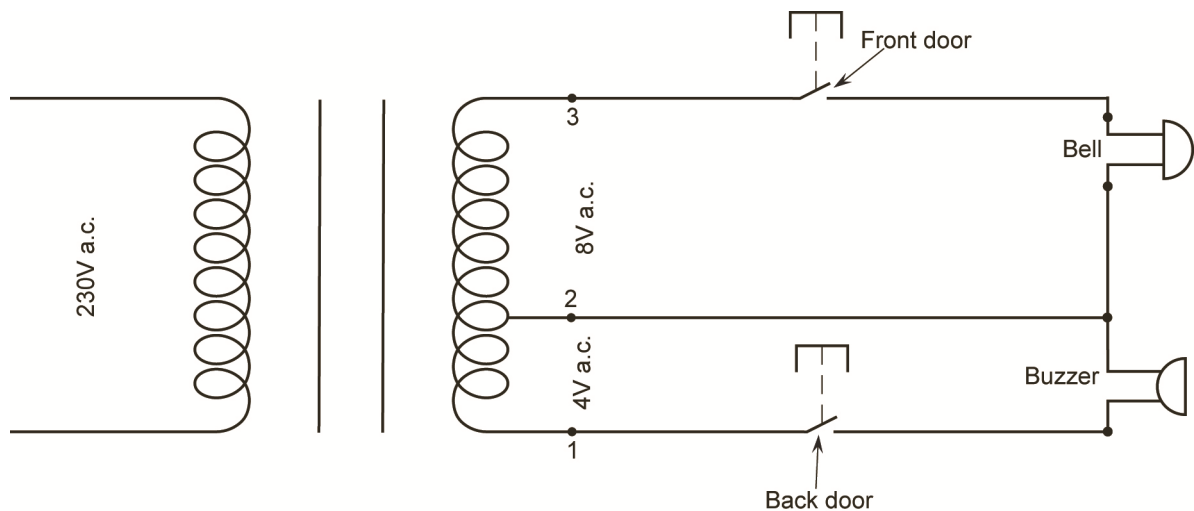
A bell push may be used to operate more than one bell. This may be required in larger premises, where one bell may not be audible in all rooms. It is simply a matter of connecting a second bell in parallel with the first. The bell transformer must be capable of supplying the extra load current. The circuit would be connected as shown in Figure 9.



**Figure 9**

If a bell push is required at the front and back doors of a premises, it is not simply a matter of connecting two bell pushes in parallel. If this were done the occupant would not know which door the caller was at. Door chimes are available with two separate sounds to overcome this problem. Another way to provide two sounds is to use a bell operated from the front door and a buzzer operated from the back door.

Figure 10 shows a bell and buzzer supplied by one transformer. The bell operates at 8 V while the buzzer operates at 4 V.



**Figure 10**

## Bell Installation Techniques

Bells are wired using an extra low voltage cable which is simply called bellwire. Bellwire is rated at 50 Volts and **must not** be used at a higher voltage.

It is a two core, solid conductor cable. Larger sizes should be used to avoid excessive voltage drop, in the case of long cable runs. Bellwire runs should be kept separated from low voltage cables to ensure complete safety of the extra low voltage circuit.

The recommended way to install a bell, buzzer or chime unit, is to use separate runs of twin bellwire to the unit from each bellpush and from the transformer. Any interconnecting of conductors can then be done at the unit. Units should be mounted on a wall, approximately two metres above floor level and away from any heat source.

When terminating conductors always form a loop of wire under the head of the screw to ensure good electrical contact. All terminal screws should be sufficiently tightened, including those which are not being utilised.

Bell transformers should be supplied from a lighting circuit FUSE or MCB, preferably rated at 6 A . The output of a bell transformer is not normally fused. This is allowed due to the fact that the transformer is incapable of overloading the bellwire, even in the case of a short circuit.

In the case of battery-powered bells, illuminated bell pushes should **not** be used as they cause a continuous drain on the battery, thereby reducing its life drastically.

## Unit Related ETCI Rules

<b>Limitations of Overcurrent by Characteristics of Supply</b>	<b>436</b>
<b>Adjacent Services</b>	<b>528</b> 528.0 528.1, 528.1.1 ( a only )