



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**ASSESSMENT ON FALSE TRIPPING PHENOMENON IN
LOWER GROUND FLOOR (RIGHT WING), MAIN BUILDING,
FACULTY OF ENGINEERING TECHNOLOGY, UTeM**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology
(Industrial power with Honours)

by

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This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Industrial Power) (Hons.). The member of the supervisory is as follow:

.....
(Project Supervisor)

ABSTRAK

Sistem perlindungan mempunyai peranan penting dalam mengekalkan kestabilan dan kebolehpercayaan grid kuasa elektrik. Biasanya, sistem perlindungan direka bertujuan untuk melindungi peralatan pada sistem tenaga tanpa menjejaskan integriti sistem. Dalam sistem perlindungan, terdapat beberapa masalah yang sering berlaku iaitu “blinding”, “false tripping”, “high-set instantaneous” and “loss off coordination”. Biasanya, masalah-masalah ini menyebabkan banyak kerosakan dan menjejaskan sistem elektrik. “False tripping” biasanya berlaku disebabkan oleh “Voltage dips (sag)” akibat daripada litar pintas luaran yang berlaku dalam sistem kuasa elektrik. “Voltage dips (sag)” merebak melalui sistem elektrik walaupun pada peralatan yang tidak berada atas jalan semasa. Objektif kajian ini adalah untuk mengenal pasti masalah yang menyebabkan acara “false tripping” sementara mengenalpasti faktor yang memberi kesan kepada kualiti kuasa. Kertas kerja ini akan memberi tumpuan kepada acara “false tripping” dan akan membincangkan pelbagai sebab yang menyumbang kepada terjadinya “false tripping”.

ABSTRACT

Protection systems have a significant role in maintaining the stability and reliability of the electric power systems. Usually, protection systems are designed with a purpose which is protecting given equipment on the power systems without compromising the integrity of the system. In protection systems, there are several problems that always occurs which is blinding, false tripping, high-set instantaneous and loss off coordination. Normally, these problems cause a lot of damage and affect the electrical system. False tripping event usually occur due to voltage dips or sag that result from the external short circuit that occur in the electrical power systems. The voltage dips spread through the electrical system even at the equipments which are not on the path of current. The objective of this research is to identify problems that cause false tripping event while identify the factor that affecting the power quality. This paper will focus on false tripping event and will discuss various reasons that contributed to false tripping event.

DEDICATION

To my beloved parents, friends and lecturer.

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Praise to Allah for guidance and guidance along cope with twists and turns and challenges in preparing this thesis. Without it, I would not be able to accomplish this task.

First of all, I want to express my sincere thanks and appreciation to my project supervisor, Mr Adlan Bin Ali for the guidance and counseling that has been provided. Last but not least, the assistant supervisor, Mr. Che Wan Mohd Faizal Bin Che Wan Mohd Zalani above advice and encouragement throughout enhance this project. They are like my mentor, always giving moral support and teach without boredom. In addition, thanks are also extended to family members who always support and encouragement during my studies at UTeM. Without them, I would not be where I am now.

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TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	vi
List of Figures	vii
List Abbreviations, Symbols and Nomenclatures	viii
CHAPTER 1: INTRODUCTION	1
1.1 Background	1
1.2 Problem statement	2
1.3 Objectives	3
1.4 Project scopes	3
CHAPTER 2: LITERATURE REVIEW	4
2.1 Protection Systems	4
2.2 Factor That Cause False Tripping	5
2.3 False Tripping	6
2.4 Factor that cause power quality problems.	6
2.5 Previous Methods to Avoid Sympathetic Tripping	9
2.6 Identify False Tripping Event by Site Visit	11
2.7 Identify False Tripping Event by Power Monitoring	12
CHAPTER 3: METHODOLOGY	15
3.1 Project Development Process Steps	15
3.1.1 Literature Review	15
3.1.2 Site Visit	16
3.1.3 Measurement Process	17

3.2	Flow Chart	24
CHAPTER 4: RESULT AND DISCUSSION		26
4.1	Relationship between Power and Power factor	26
4.2	Relationship between V RMS and V THD	29
4.3	Relationship between I RMS and I THD	32
4.4	Min, Max and Average Voltage	35
CHAPTER 5: CONCLUSION		38
5.1	Problem faced	38
5.2	Conclusion	39
REFERENCES		40

LIST OF TABLES

2.1	Factor that affect power quality.	8
3.1	Starting and recording process.	22
4.1	Data for Power in KV	27
4.2	Power Factor	28
4.3	V RMS	29
4.4	VOLTAGE THD	30
4.5	I RMS	33
4.6	I THD	33
4.7	Min, Max and Average Voltage	36

LIST OF FIGURES

1.1	Illustration at the affected Simulation Laboratory	2
1.2	Main Building of FTK, UTeM	4
2.1	Single line diagram of a typical system with sympathetic trip by R2 for faults at F1 or F3.	10
2.2	Transient bus voltage disturbance on preferable feeders.	14
2.3	Phase-to-ground voltage sag on preferred feeder	14
2.4	Phase-to-phase voltage sag at 480-V ASD for air handler unit	15
2.5	Phase current at input to ASD during a voltage sag event	15
3.1	Explanation from assistance engineer.	17
3.2	Site visit conducted at Electrical Simulation Laboratory 1	18
3.3	Site visit on the AHU room where Distribution board of the affected room was located.	18
3.4	Hioki Power Quality Analyzer PW3198	19
3.5	Hioki 9661 Clamp On Sensor 500A AC	19
3.6	Hioki voltage cord	19
3.7	Feature of power quality analyzer.	20
3.8	Measurement Flowchart.	21
3.9	Wiring connection mode.	22
3.10	Point of measurement.	22
3.11	Operation status and key operations relationship	24
3.12	The power quality analyzer need to be set as desired.	24
3.13	Clamp sensor and voltage cord.	24
3.14	Measurement Output	25
3.15	Flow chart of the methodology	25
4.1	Power VS Time	28
4.2	Power Factor Vs Time	28

4.3	V RMS VS Time	30
4.4	V THD VS Time	31
4.5	V RMS VS V THD Red	31
4.6	V RMS VS V THD Yellow	31
4.7	V RMS VS V THD Blue	32
4.8	I THD VS Time	34
4.9	I RMS VS Time	34
4.10	I RMS VS I THD Red	35
4.11	I RMS VS I THD Yellow	35
4.12	I RMS VS I THD Blue	35
4.13	Voltage Phase Red	37
4.14	Voltage Phase Yellow	37
4.15	Voltage Phase Blue	38

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

FTK= Fakulti Teknologi Kejuruteraan

RAM = Random-access memory

EF= Earth fault

OC= Over current

R1= Relay 1

R2= Relay 2

UV= Ultra-violet

ASD= Adjustable Speed Drive

RMS= Root Mean Square

THD= Total Harmonic Distortion

I THD= Current THD

V THD= Voltage THD

kW= kilo-watt

RCD= Residual current device

CHAPTER 1

INTRODUCTION

This section basically describes about the background of the research. It will be divided into a sub-topic which is problem statements, objectives and the project scopes.

1.1 Background

Power-system protection is a branch of electrical power engineering that deals with the protection of electrical power systems from faults. Usually, it isolated the faulted parts from the rest of the electrical network. However, when talking about matters related to the power system, it will not run away from problems. Hence, there are several problems that occur in power system protection as mention before and one of the problems is false tripping. False tripping in general is tripping of a healthy object due to its protection, which related to excessive load current caused by voltage dip, which in turn may be due to “occurrence and clearing” of a fault in another object of the network. The main cause of false tripping is a voltage dip (sag) usually due to an external short circuit. This voltage dip is spread over the network even on those parts not in the path of short circuit current flow (Mladenovic S. et al. 2010). This project is more towards research about the problem stated which is false tripping event. Studies and research will be done on several aspects. The aspects that will be covered in the research are the type of electrical installation, type of load and other possible factors such as earthing systems.

1.2 Problem statement

False tripping events in the Main Building of FTK cause a lot of damage. Upon tripping, electrical equipment such as computer in academic offices and computer laboratories will experience problems and this may cause damage (Scharlach R.C. et al. 2010) to the hardware of the systems such as Random-access memory (RAM), motherboard and also any plug and play devices connected to the computer such as thumb drive or external hard disc. Figure 1.1 shows the illustration of affected equipment due to false tripping event.

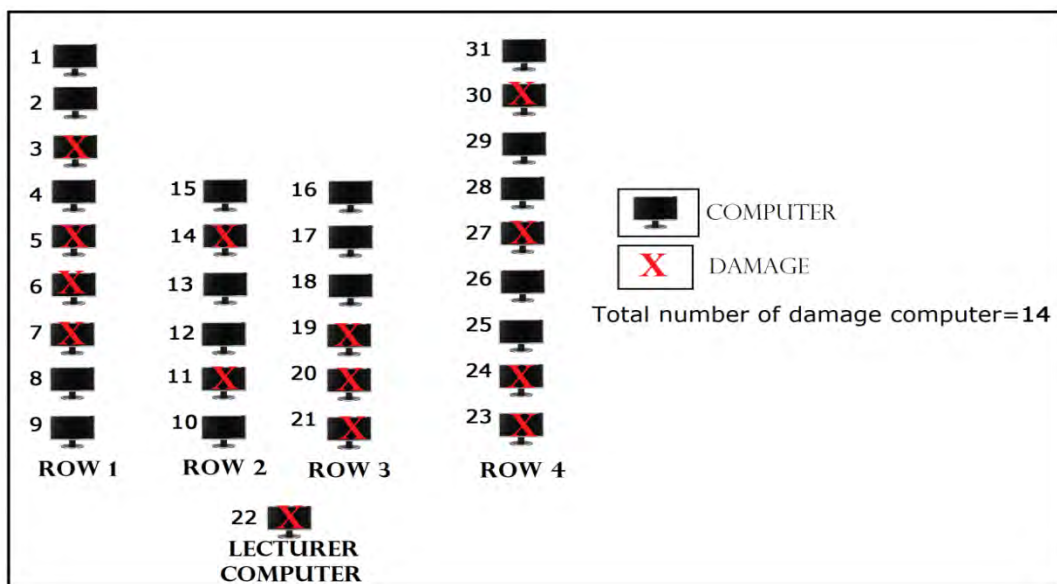


Figure 1.1: Illustration at the affected Simulation Laboratory.

If the problem is not resolved or reduced, huge losses could have occurred if seen in a long time period. Type of installation is very important in any electrical systems in a particular building. The installation would've a direct relationship with the electrical protection systems whereby if the wrong installation type is used; it could lead to the fault event which is undesired. Furthermore, when a particular electrical installation has been chosen, the size of cables and the ratings of protection devices must also be complied based on the relevant regulation such as Electrical Act 1990 and Electrical regulation 1994

1.3 Objectives

In order to complete this research, several objectives should be achieved:

- a) To identify problems that cause false tripping.
- b) To identify the factor that affecting the power quality.
- c) To analysis data from the power quality measurement.

1.4 Project scopes

In order to achieve the objectives, scope of the project should be highlighted. This project will follow the scope of study as below:

- i. Identify problems that cause false tripping by measuring process using Power Quality Analyzer.
- ii. Measurement of the power quality at Simulation Laboratories and Studio CAD.
- iii. To identify the factor that affecting the power quality from measurement result.

The location for the research is at the Main building of the Faculty of Engineering Technology as shown in figure 1.2. All studies and measurements were performed in this area. The focus is on the lower ground floor of the main building of FTK, UTeM.



Figure 1.2: Main Building of FTK, UTeM

CHAPTER 2

LITERATURE REVIEW

The literature review on false tripping event is very wide. The literature review was conducted based on different sources of references such as the articles, internet, journal, and books. The sources of finding need to be analyzed in a systematic way to understand about the topic clearly. Sometimes, there is much information that related to the research or study. Hence, it can be used as a guideline and references in completing the research of project. This part is divided into several chapters where each chapter will contains more than one journal or articles. The main objective of this section is to compare the research between articles or journals and combined the idea that gained from the comparison between the findings. As the result, a great inspiration will be arise for completing this project with flying colours.

2.1 Protection systems

The objectives of the certain articles play an important role in describing the goal or target that need to be completed. There are several objectives that have been review while conducting the literature review processes. From the journals that been written by S. Jonathan et al. 2010, the research is towards the reliability of the protection systems. As all know, protection system is very important in term of maintain and control the stability of the electrical power systems. It also functions as isolator where isolate fault that occurred in the electrical power systems. The objectives of the journals is to find the suitable way in reducing the problems that occur in protection systems while increase the reliability and effectiveness of the systems.

Next, the research is through the journals written by O. P. Dahal et al. 2011. The research is more towards the option to avoid false tripping. The objectives that have been stated in this paper were to model the systems in details and identify the options to avoid the tripping problems. The problem always occurred when the feeder was restored to services after the maintenance process. They conduct the modeling and analysis process to find the solution. The 34 kV feeders were simulated from the distribution networks to identify the problem that contributed to false tripping of the feeder. They also have simulate the solution with the model and recommended the best solution after reviewing the advantages and disadvantages. Then, B. B. Bailey et al. 1999 have conducted a research on the power quality evaluation. Power quality can be described as the interaction of electrical power and the equipment. If the electrical equipment correctly operated and run without being stressed or damaged, it can be stated that the electrical power have a good quality. On the other hand, if the electrical equipment that been used not function smoothly and damaged during normal usage, it can be predicted that the quality of power is very poor. From the several objectives of the journals, it can give idea and inspiration for conducting the research in proper way.

2.2 Factor that cause False tripping

A research in a journal is conducted usually because there are several problems occurred and basically the problem will become as guidance to discuss a method or solution to encounter the problems. From the literature review, there are several problem statements that have been trace. Del J. Ventruella has written a journal about the false tripping event that involved the ground fault relays. The issue that can lead to false tripping event was addressed. In the journals, it's stated that the tripping event can occurred if there are no ground fault current sources at the feeders downstream from circuit breakers feeder's trips while the fault occurred elsewhere. Other than that, from the journals that are written by B. B. Bailey and H. C. Ernst et al. 1999, the problem that occurs is the tripping event always occur during rainy day. They also experience the power disturbances that contribute to the trip of the air conditioner and the large chiller at the medical center. Other than that, other

equipment such as x-rays machines and autoclaves also suffer from the tripping event frequently.

2.3 False tripping

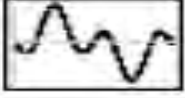

Research is conducted in connection with the false tripping event that occurred in electrical power systems. Therefore, strong basic knowledge and a deep understanding will help in understanding the whole problem studied. From the journal of S. Mladenovic et al. 2010, it was stated that the false tripping is the trip of healthy equipment due to its protection. It also is the result of the voltages dips. Other than that, the root cause of the tripping also mention in the journals. It is cause by voltage dip or voltage sag which is due to short circuit. The voltage dips spread through the electrical system even at the equipments which are not on the path of current. Agili et al. 2008 stated about the type of disturbance that can cause the voltage dips to occur. The two type of the disturbance are small and large disturbances. These two types of disturbance can cause the voltage dip or sag at the different magnitudes. Hence, these voltages dips are the reason of the false tripping event to occur. From the journal entitled “A Comprehensive Analysis and Solution for Sympathetic Tripping in Distribution Network”, it stated that the false tripping event is for high loads and unbalanced condition of the relays operation that occurs during or immediate after fault. In addition, the phenomenon’s also known as sympathetic tripping because the tripping occurs on healthy equipment.


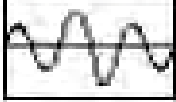
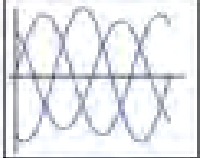
2.4 Factor that cause power quality problems

From the IEEE 100 Authoritative Dictionary of IEEE Standard Terms, the power quality is the concept of powering and grounding the electronic equipment or devices on the systems in an appropriate way that is suitable for equipment or device to operated and compatible with the wiring system and other connected equipment

utilities may want to define power quality as reliability. Hence, table 2.1 shows the factor that affect power quality.

Table 2.1: Factor that affect power quality.

<p style="text-align: center;">Harmonic distortion</p> 	<p>Definition: Current or voltages waveform that are non-sinusoidal shape and its corresponding to the sum of different sine-waves with different magnitude and phase, carry frequencies that are greater than the power-system frequency</p> <p>Causes: Non-linear loads-computer, voltages regulator, data processing equipment, switched mode power supplies, power electronics equipment including ASDs, high efficiency lighting.</p> <p>Effect:</p> <ol style="list-style-type: none"> 1. Nuisance tripping of thermal protections. 2. Resonance. 3. Neutral overload in 3-phase systems. 4. Cables and equipment overheated. 5. Electric machines loss efficiency.
<p style="text-align: center;">Voltage sag (or dip)</p> 	<p>Definition: The nominal voltages decreased to a level of 10 to 90 % of its nominal RMS value of voltages. Usually, the duration is about 0.5 to 1 cycles.</p> <p>Causes: The transmission of distributed network fault.</p> <p>Effect:</p> <ol style="list-style-type: none"> 1. Malfunction of IT equipment and lead to process stoppage.

	<p>2. Tripping of relay due to the thermal.</p>
<p style="text-align: center;">Voltage spike</p> 	<p>Definition:</p> <p>Causes: The voltage value have a very fast variation of for durations from a several microseconds to few milliseconds. These variations may reach thousands of volts, even in low voltage.</p> <p>Effect:</p> <ol style="list-style-type: none"> 1. Component and insulation materials destruction. 2. Data losses and error. 3. Interference of electromagnetic.
<p style="text-align: center;">Voltage fluctuation</p> 	<p>Definition: High frequency signals super imposed on the waveform of the power-system frequency.</p> <p>Causes: Electromagnetic interferences and improper grounding systems.</p> <p>Effect:</p> <ol style="list-style-type: none"> 1. Sensitive electronic equipment experienced disturbances. 2. Data losses and error.
<p style="text-align: center;">Voltage Unbalance</p> 	<p>Definition: A voltage variation which the magnitudes of the three voltages or the phase angle differences between them is not same.</p> <p>Causes: The loads of the single phase increased and incorrect distribution of all the single phase of the systems.</p> <p>Effect:</p> <ol style="list-style-type: none"> 1. Harmful to all three phase loads because unbalanced systems contributed the existence of a