## Module 2

# SWITCHYARD RING BUS CONFIGURATION

## OBJECTIVES:

After completing this module you will be able to:

*Page 2* ⇔ 2.1 Given a diagram with at least two output lines, two sources of generation, system service and main transformers, describe how a typical 4 or 6 breaker ring bus functions.

2.2 Describe how a ring bus is designed to maximize:

*Page 2* ⇔ a) Reliability of station power,

*Page 1,2* ⇔ b) Transmission reliability/stability.

* * *

## INSTRUCTIONAL TEXT

## INTRODUCTION

This module will introduce the purpose and general layout of a simplified ring bus for main power output.

## SIMPLIFIED RING BUS

*Obj. 2.2 b)* ⇔ A ring bus provides multiple paths for the transmission of the power produced by the generator. In Figures 2.1 and 2.2 (both are foldout drawings at the end of the module), simplified ring bus configurations are shown. These arrangements shows that the generation supply has **multiple access paths** to any single output transmission (three shown in Figure 2.2). Multiple transmission lines decrease the probability of a full load rejection (ie. due to the loss of a single line) and **increase station and electrical system reliability/security** (ie. more paths in and out). **Failure of a single line or a single breaker will not disrupt power flows.**

As an example, let's take a look at Figure 2.2, more specifically, generator G1 and the three output lines. Line 3 can be fed from G1 through circuit breakers A – G, through B – H, through A – D – C – H and through B – C – D – G. Line 2 could be fed through circuit breaker A, through B – C – D and through B – H – G. Line 1 could be fed through circuit breaker B, through A – D – C and through A – G – H. Similar configurations can be derived for G2 to each output line.

## Reliability of Station Power

*Obj. 2.2 a)* ⇔

Similarly, from a system service transformer viewpoint, **power can be received from any of the three lines** in Figure 2.2 through various pathways. This helps ensure that there is a power supply available to supply the unit.

Table 2.1 shows the pathways of power that can be used to supply power to G1 System Service Transformer (assuming that generator G1, as a source of generation, has been lost).

### Table 2.1: G1 SST Power Sources

| SOURCE | PATHWAY TO G1 SST |
|---|---|
| Line 2 | Directly Through SST Circuit Breaker/Disconnect |
| Line 1 | C – D<br>B – A<br>H – G |
| Line 3 | G<br>H – C – D<br>H – B – A |
| G2 | D<br>C – B – A<br>C – H – G |

From Figures 2.1 and 2.2, we can extrapolate a larger "ring" with more output lines and more ties across the ring diameter. This increases the number of pathways for the power to flow to/from the station, which **will increase reliability of supplies.** The exact configuration of your ring bus will be discussed in your station specific training.

*Obj. 2.2 b)* ⇔

**Transmission stability is increased by using multiple parallel transmission lines.** This limits changes in the load angle of the remaining lines when a single line has been lost. This will be discussed in more detail in Module 8.

NOTES & REFERENCES

## SUMMARY OF THE KEY CONCEPTS

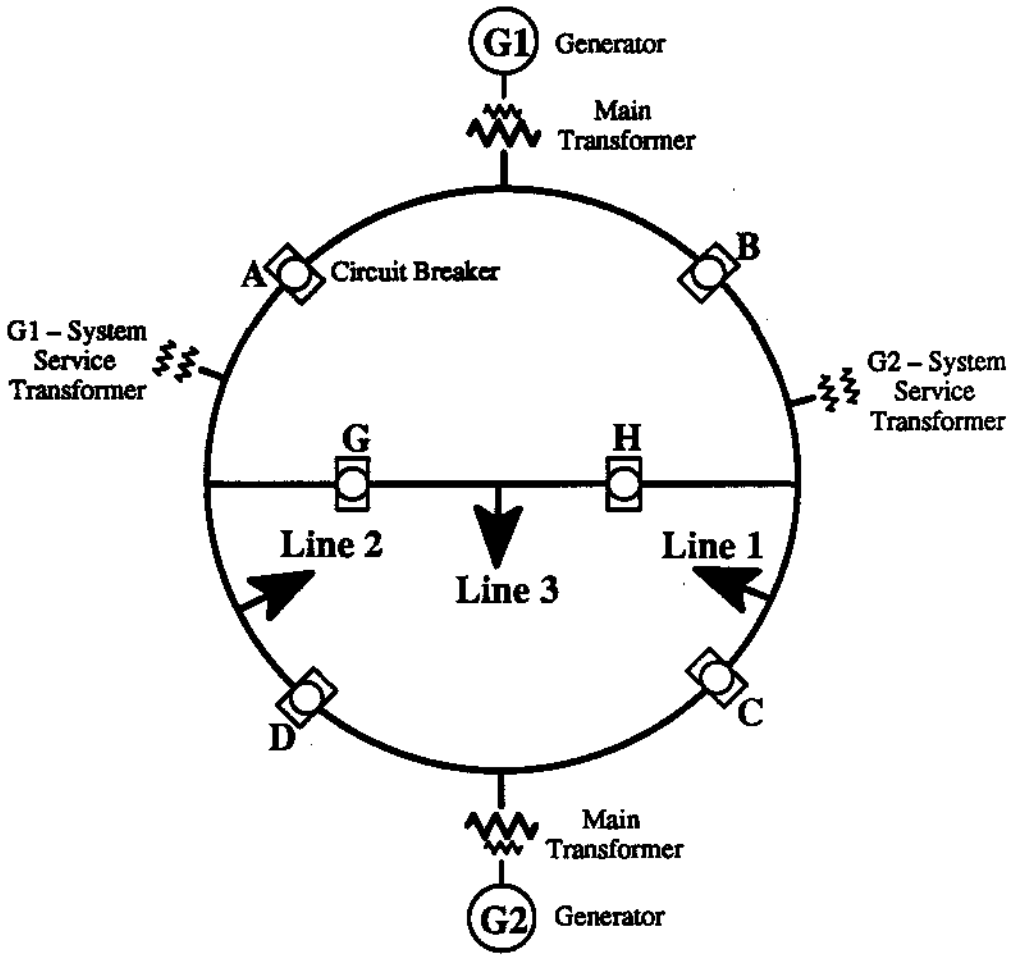
- The reliability of station power and transmission is increased by the use of a ring bus. The ring bus provides multiple paths for power flow to and from the station.
- The loss of a single line will not, in itself, cause a full load rejection or power outage for the unit/station (due to power transfer via the remaining lines).
- Transmission stability is increased by the use of multiple parallel transmission lines. This limits load angle changes on remaining lines after the loss of a single line.

*Pages 4 – 5* ⇔

You can now do **assignment questions 1 – 3.**

## ASSIGNMENT

1. For the ring bus shown below, complete the power source pathway table.




| SOURCE | PATHWAY TO G2 SST |
|---|---|
| Line 1 | 1) |
| Line 2 | 1)<br>2)<br>3) |
| Line 3 | 1)<br>2)<br>3) |
| G1 | 1)<br>2)<br>3) |

NOTES & REFERENCES

2. Describe how a ring bus is designed to maximize reliability of power transfer to or from the station.

3. Describe how transmission stability is affected by the use of a ring bus.

Before you move on to the next module, **review the objectives** and make sure that you can meet their requirements.

Prepared by: Nick Ritter, WNTD
Revised by: Paul Bird, WNTD
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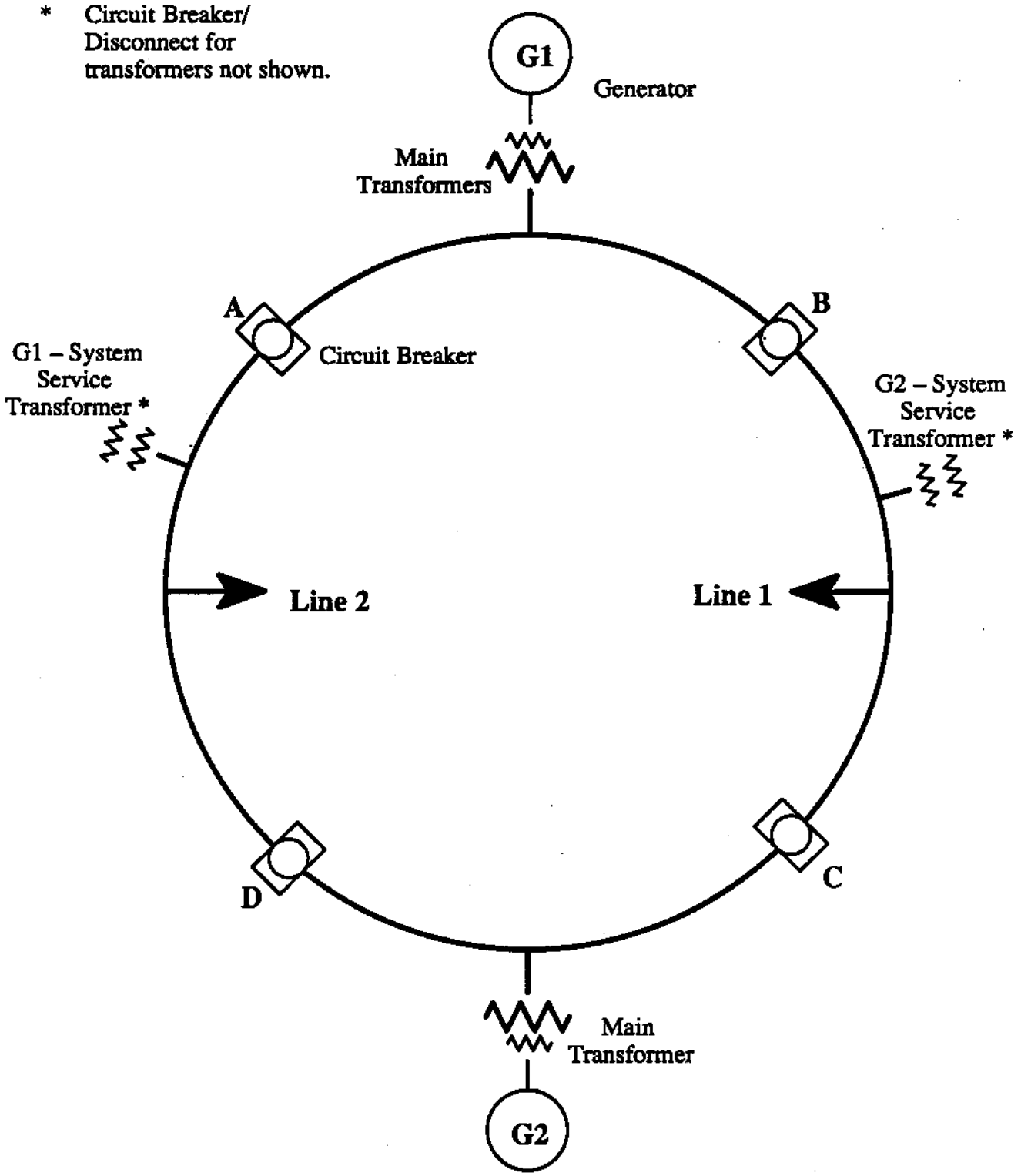


Figure 2.1 – Simplified 4 Breaker Ring Bus Configuration

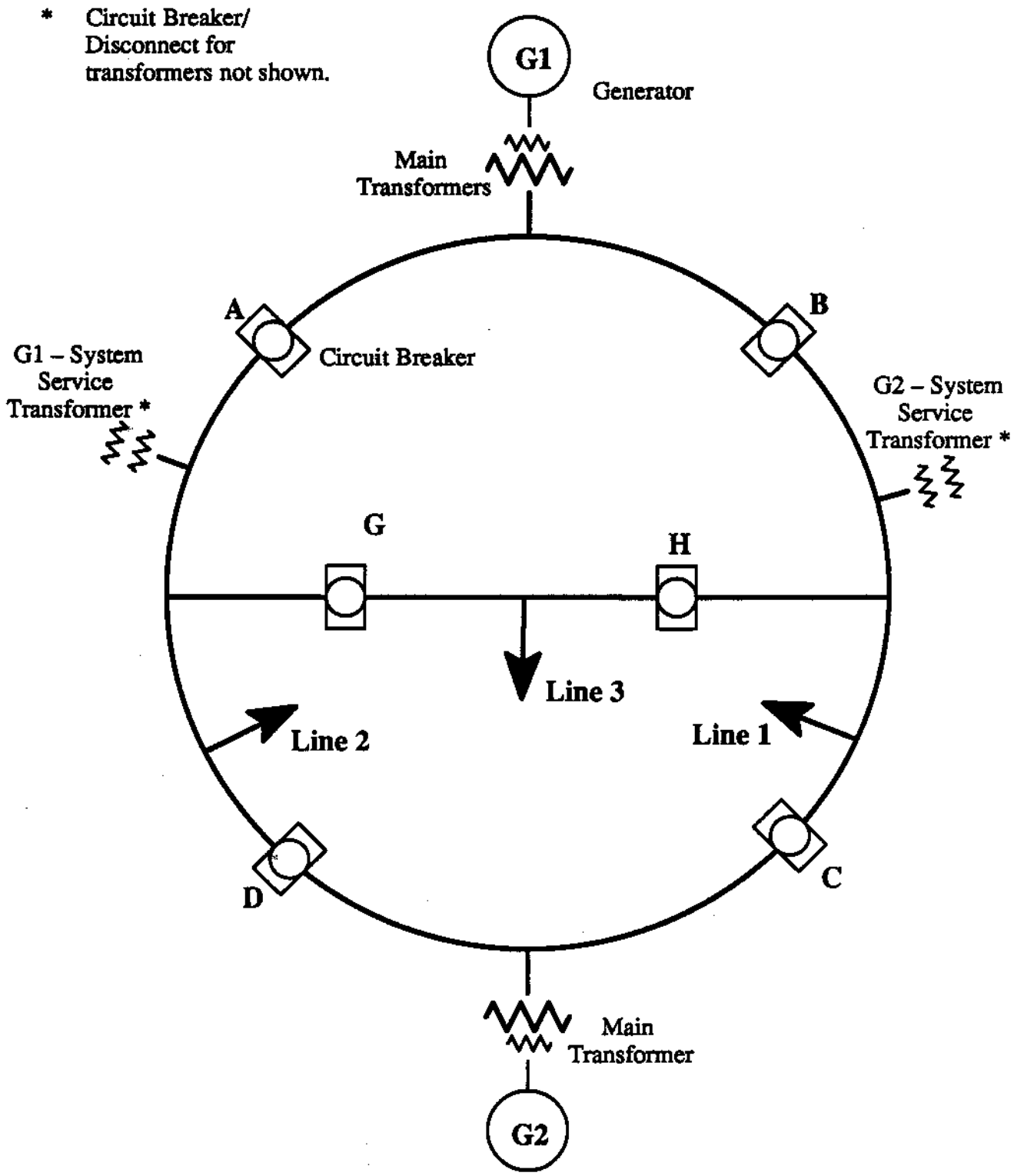


Figure 2.2 – Simplified 6 Breaker Ring Bus Configuration