ANTARES
engineering with answers

AAI Training Session
Session 1

Introduction to product overview and Basic Physics

Electrical engineering solutions for specialist vehicles and remote locations

ANTARES
AUTHORISED
INSTALLER

Welcome to Antares

Welcome to Antares from All of the Antares Engineering Team

We are:

Graham Young – Engineering Director

Brian Moulson – Control Systems Manager

Ben Salter – Senior Applications Engineer

Andrew Reid – Applications Engineer

What are we going to cover

- Session 1 – Introduction and system basics
- Session 2 – General Product Overview part 1
- Session 3 – General Product Overview part 2
- Session 4 – System Design Techniques and Round Up Session

ANTARES engineering with answers

Session 1

- This session is designed to set the scene
- It is a loose collection of useful concepts
- It is either far too basic for some and…
- Too detailed for others

ANTARES AUTHORISED INSTALLER

The four elements

Creation of Power	Storage of Power	Conversion of Power	Management of Power
Alternators	GEL batteries	AC DC Battery Chargers	DC Power Management
Diesel Gensets	AGM batteries	DC DC Converters	AC Power Management
Drivetrain AC generators	Lithium Ion	DC AC Static Inverters	Task/Signal management (CANbus, LinBus, RS232)
Fuel cells	Fuel	Frequency Converters	
Solar Panels	Flywheel		
Grid connection	Capacitors		

ANTARES AUTHORISED INSTALLER

The wall

Think of a system as a building a wall

- Standard bricks
- Modified Bricks
- Special Bricks

- And the **engineering** is glue/mortar to hold it together!

ANTARES engineering with answers

Electrical engineering solutions for specialist vehicles and remote locations

ANTARES AUTHORISED INSTALLER

Comprehensive offering

- The next two presentations are aiming to provide a broad brushed overview of the Antares offering.
- Antares have brought together a comprehensive range of components suitable for professional markets.
- Before we start we would like to take you through some of the basics

ANTARES engineering with answers

Electrical engineering solutions for specialist vehicles and remote locations

ANTARES AUTHORISED INSTALLER

Basics

Before we move on to the products we wish to cover some basic physics and terminology the we use in Antares

Electrical Parameters

Parameter	Symbol	Unit of Measurement	Unit Abbreviated	
Voltage	V (U)	Volts	V	Electrical Force
Current	I	Amps	A	Electrical Flow
Power	P	Watts	W	Electrical Power
Charge	Q	Coulombs Amp-hours	Ah	Amps x Seconds Amps x Hours
Energy	E	Joules Watt-hours	J Wh	Watts x Seconds Watts x Hours
Resistance	R	Ohms	Ω	Volt drop per Amp
Frequency	Hz	Hertz	Hz	Cycles Per Second
Decibel	dB	Decibel	dB	Measurement of Sound Power
Battery Capacity	Ah	Ampere Hour	Ah	

Key Formulas we use

V=IR

Voltage = Current x Resistance

Example: 100A though a cable with 5mΩ resistance will give a volt drop of 0.5V. Voltage change=100A x 0.005Ω = 0.5V

P=VI

Power = Voltage x Current

Example: 100A load at 24V is 2400Watts, P=VI, P=24V x 100A =2400W

Combining the above provides

$P=I^2R$, Power = Current squared x resistance

$P=V^2/R$, Power = Voltage squared / resistance

Working with Large Values

Within the Electronics industry and Mathematics larger values will typically be referred to using prefixes.

Common examples of these are:

Micro	10^{-6}	μA	Micro Amp
Milli	10^{-3}	mA	Milliamp
Kilo	10^{3}	kW	Kilo Watt
Mega	10^{6}	MW	Mega Watt

For example 1000W is equal to 1kilo Watt (1kW)

0.001A is equal to 1milli amp (1mA)

Basic Concept

1. Conventionally current flows within a circuit from +ve to –ve.
2. Voltage is the driving force that allows current to flow.
3. Current flows within a circuit. Current is neither lost or gained. It essentially flows around a circuit returning to its original source.

The water analogy

Some non electrical engineers find it easier to visualise electrical systems in reference to water

Cables are pipes!

Batteries are tanks of water!

Loads are turbines!

Switches are taps and valves

Whilst extremely helpful these visualisations can cause to misleading thinking

Question: If you connect a full battery with an empty battery will any current flow? If so, how much?

ANTARES engineering with answers

Voltage

- Voltage is the potential difference between two points within an electrical circuit
  - Example: 12V between a battery positive and battery negative
- Voltage can be best thought of as the driving force that allows current to flow. Without a potential difference no current will flow
- The term “nominal” is used when defining a voltage. Measured voltage can be substantially different and may also vary
- The term is used as a shorthand

Resistance

- Where voltage is the driving force that allows current to flow within a circuit, the resistance is the opposing force that prevents current from flowing.
- **Different materials** have different resistance and therefore some materials conduct electricity whilst others insulate.
- **Conductors** are used within electrical circuits to allow current flow.
- **Insulators** have high resistance and are used primarily to provide protection and prevent current flow.

Volt Drop

- We often hear the term volt drop referred to in discussions.
- Volt drop is the reduction in potential difference (voltage) along a circuit.
- Volt drop is caused by the current flow and resistance of a circuit. **No flow = no volt drop!**
- High volt drop is caused by increased resistance within a circuit. Poorly maintained or designed connections, incorrect cable sizing for required length, too many connections
- Why does volt drop matter?

Problems with volt drop

- **Batteries cannot charge** if the applied voltage is too low
- **Voltage sensitive loads will cut out** or be damaged by low voltage.
- **Protection devices will operate prematurely** such as split charges, isolators.

ANTARES engineering with answers

Electrical engineering solutions for specialist vehicles and remote locations

ANTARES AUTHORISED INSTALLER

Variety of solutions to alleviate volt drop

- Use thicker or shorter cable
- Avoid diodes, shunts and multiple joins
- Use chassis return where appropriate
- Use an “active” voltage conversion device
- Raise the source voltage such as charger or alternator output (but beware!)
- Remote sense voltage where possible

Efficiency

- Electrical losses are the losses of power within certain components in the system.
- Inefficiency causes generation of heat. Using up scarce power resource or at worst causes fire
- Chargers for example are between 65% and 90% efficient. A serious waste of power. Inverters likewise
- DC Alternators, diodes packs, belts, pulleys and hydraulics also add in inefficiencies

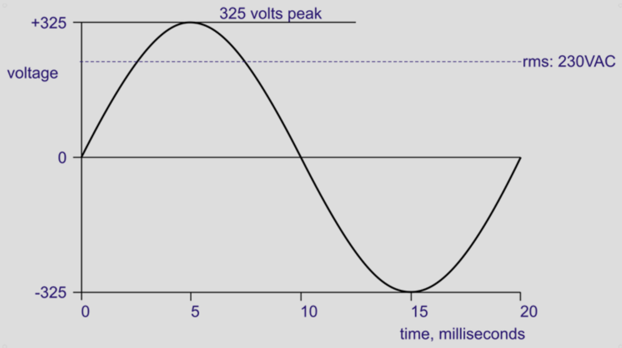
Types of Electricity

- **DC – Direct Current**

Constant steady voltage such as a battery.

- **AC – Alternating Current**

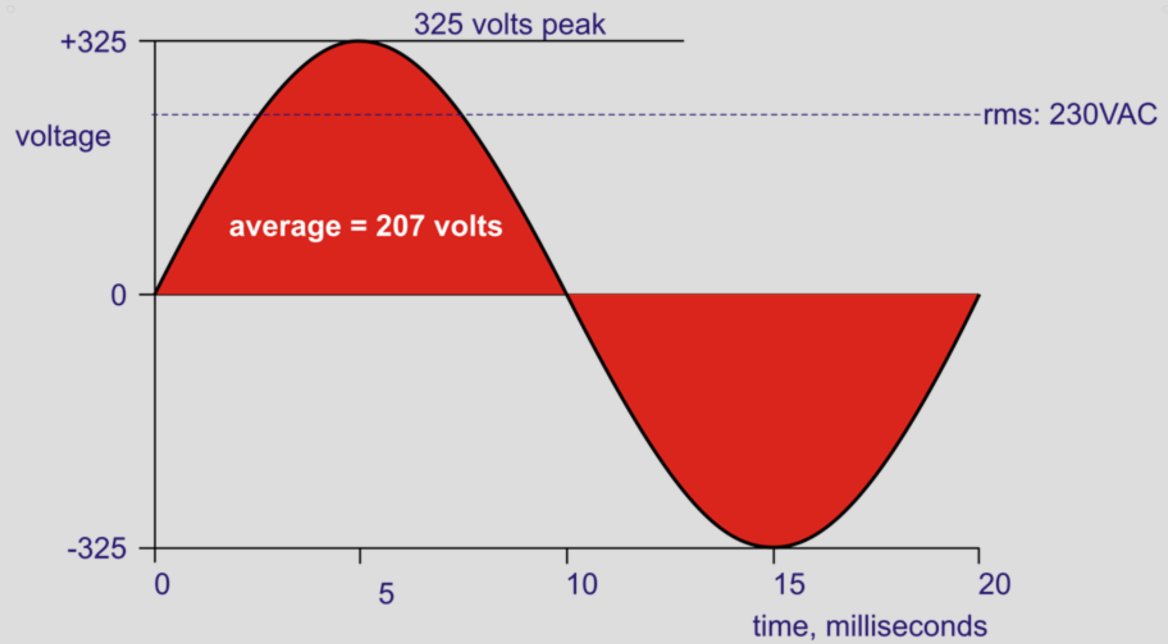
Voltage varying with time. Alternating positive and then negative.



Electrical engineering solutions for specialist vehicles and remote locations

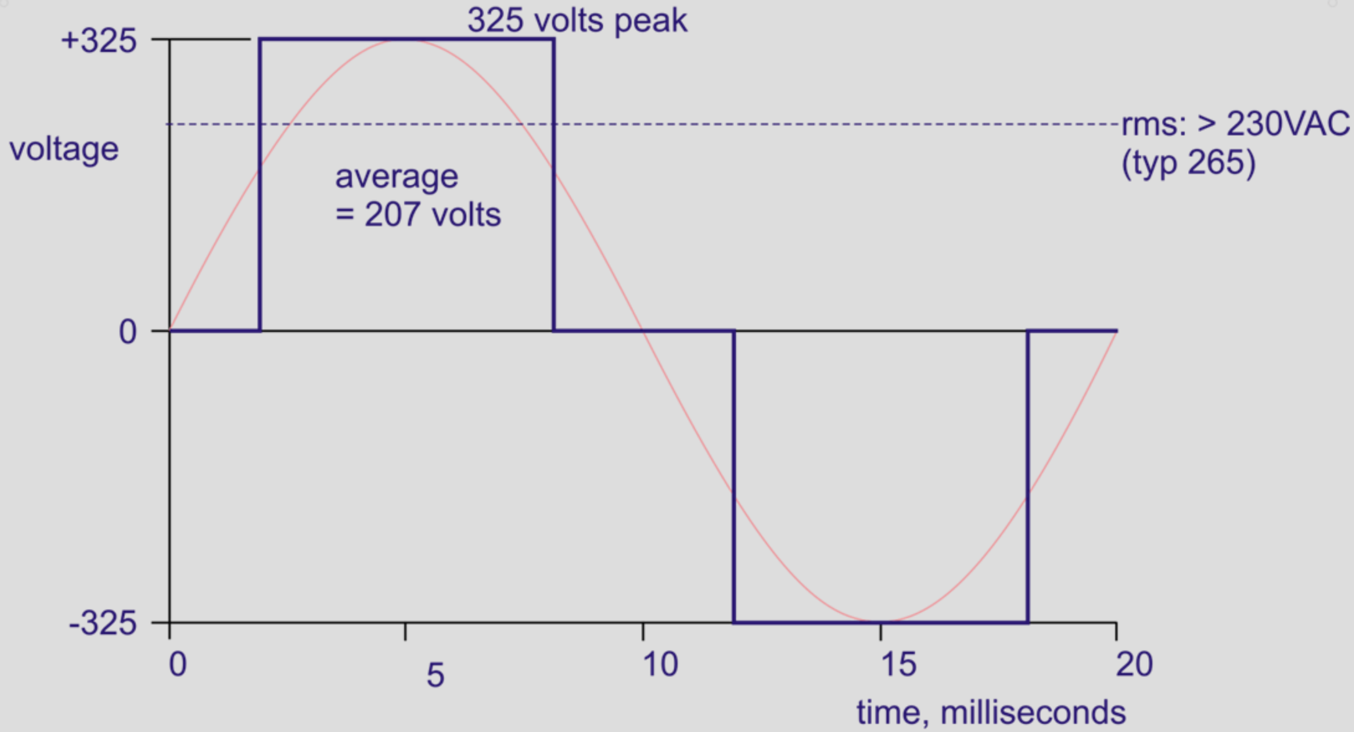
ANTARES AUTHORISED INSTALLER

Sine Wave parameters



Fours key parameters: RMS Voltage, Average voltage, Peak Voltage, Frequency

Modified Sine Wave



Meter Types

Care needs to be taken when measuring AC with different Meter Types

- Low Cost Meter

Average responding but the meter is calibrated for RMS sine wave so is only valid for measuring sine waves.

- True RMS Meter

Measures and computes the RMS value and readout shows the true RMS value. Can be used on any waveform.

AC pros and cons

PROS

1. Can use Transformers to raise or lower the voltage or to provide isolation
2. Higher voltages mean lower currents, greater efficiency or put another way higher powers
3. No choice - the most efficient loads or cost effective loads are AC due to their common applications being within the household/industry

CONS

1. Safety concerns
2. Cannot store AC directly

ANTARES
engineering with answers

Question or Comments?

Electrical engineering solutions for specialist vehicles and remote locations

ANTARES AUTHORISED INSTALLER