

APPLICATION NOTE #40 EXPANDABLE POWER

AR RF/Microwave Instrumentation has continued to develop and improve our product offerings to meet the needs of the market. This can be seen with our extensive list of product offerings. A major concern in the market is flexibility. Flexibility of the test equipment in the lab is always a concern.

Today many test labs are seeing a continued increase in RF test levels and increased test distances. Automotive, Military, and Aerospace have all seen an increase in RF test levels over the years. This usually would require bigger, more powerful amplifiers replacing the smaller now obsolete amplifiers. AR RF/Microwave Instrumentation has seen the need for upgradeability to add power instead of replacing power. In addition this high field strength will only be required for a small part of a test labs total testing, leaving this large amplifier under utilized for most of the time. The ability to separate out or split the amplifier for multiple uses would also be extremely beneficial to a test lab. AR RF/Microwave Instrumentation has responded to this need with a new offering of **Expandable Power**. As the world moves further and further into the digital and wireless age the need for flexibility of test equipment becomes a necessity.

Growing power when you need it:

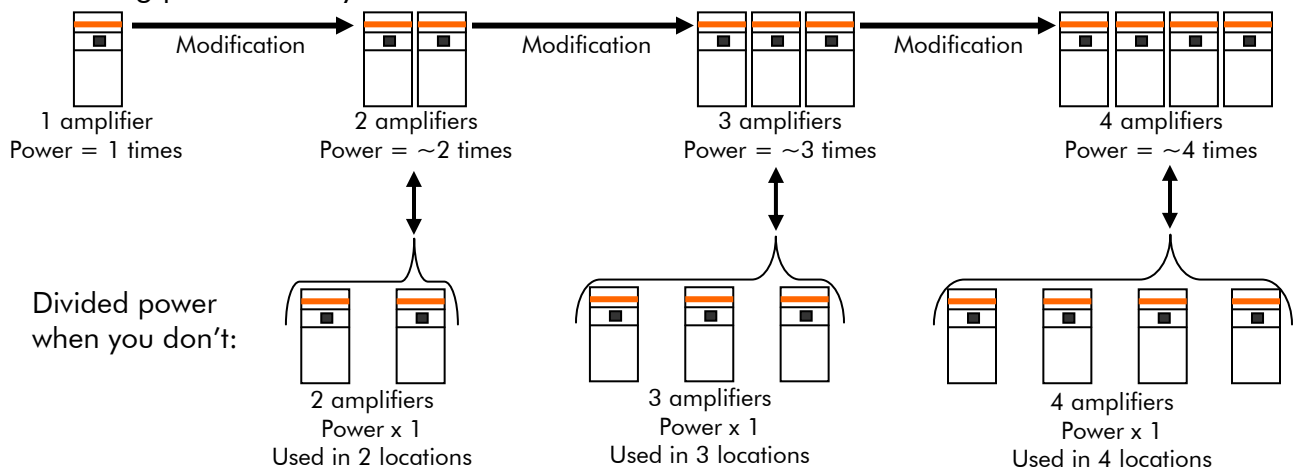


Figure 1: Diagram of Expandable Power

In order for these amplifiers to be controlled and to work in unison some considerations must be met. The amplifiers need to be combined and controlled by a central location, so the input and output come from one location called the controller. The RF input is pre-amplified and divided through the controller then *phase matched* cables run to each sub amplifier input. From the sub amplifier output *phase matched* cables return to the controller to be combined. If these RF cables and sub amplifiers are not *phase matched* power losses will occur and the system will lose efficiency.

The Controller

The controller is the heart of the expandable power technology. It is what enables AR RF/Microwave Instrumentation to increase the flexibility of the amplifiers. The controller consists of the following components:

Controller – The controller section takes control of all the separate amplifiers in the system and makes them act as one amplifier, providing monitoring and protection for the entire system.

Pre-amplifier and splitter – The pre-amplifier takes the input signal increases and splits the power to each sub amplifier; the drive level for each sub amplifier will be exactly the same.

Output Combiner – The combiner section now takes each sub amplifier's output power and combines the increased power to one output.

Power monitor – The power monitor meters and displays the forward and reverse power of the system.

Only one controller will need to be purchased. For example: If increasing from a 450S1G3 to a 600S1G3 a new controller will not be needed only a new output combiner. Modification is required to the controller, and a recalibration of the ALC (Automatic Level Control). In some cases this can be done on site.

The following AR RF/Microwave Instrumentation amplifiers can be used as the building blocks for Expandable Power:

Each one of these amplifiers can be combined with the same amplifier to increase the power. Up to 4 amplifiers can be combined.

1000W1000C 1000 Watts, 80 – 1000 MHz

2 x 1000W1000C + controller = 2000W1000A (2000 Watts Nominal)

3 x 1000W1000C + controller = 3000W1000 (3000 Watts Nominal)

4 x 1000W1000C + controller = 4000W1000 (4000 Watts Nominal)

200S1G4A 200 Watts, 0.8 – 4.2 GHz

2 x 200S1G4A + controller = 400S1G4 (400 Watts)

3 x 200S1G4A + controller = 540S1G4 (540 Watts)

4 x 200S1G4A + controller = 700S1G4 (700 Watts)

240S1G3A 240 Watts, 1 – 3 GHz

2 x 240S1G3A + controller = 450S1G3 (450 Watts)

3 x 240S1G3A + controller = 600S1G3 (600 Watts)

4 x 240S1G3A + controller = 800S1G3 (800 Watts)

Once combined each amplifier can still be used independently!

When combining the 1000W1000C amplifiers, the controller is housed in a separate cabinet.



Figure 2: 3000W1000

Both the 200S1G4A and 240S1G3A's controller is housed in one of the amplifiers.



Figure 3: 700S1G4

Example of expandable power:

A 200S1G4A (200 Watts 0.8-4.2 GHz) can be purchased today; then in the future when specs change and more power is needed another 200S1G4A (Phase and Amplitude Matched) can be purchased with a controller to make a 400S1G4 (400 Watts 0.8-4.2 GHz). The bonus is that each 200S1G4A can be separated and still function independently. The two 200S1G4As can be used in different locations in the lab and when the 400 watts is needed they can be brought together and used as one 400S1G4. This system can be upgraded even more with a total of 4 independent 200S1G4A to 700 Watts! The controller will need to be modified with a new output combiner, and a modification of the controller will be needed.

Example of divided power:

A 3000W1000 amplifier can be purchased to give the needed 3000 watts of power. But when 3000 watts may not be required each of the 3 1000W1000C independent amplifiers can function separately for 1000 watts at multiple locations. The user would have to disconnect the controller from the amplifier which is only 4 lines to each section, 2 RF cables (In & Out), Fiber optic RS232 and the serial communication. Now, the amplifier can function independently. Always make sure the phase matched RF cables remain in a safe place for when the amplifier is reconnected. The RF cables connecting the system are critical for maintaining max output, and always must be reconnected the same way with the same cables!!

Note: Each amplifier of a system can only be used as a complete system or as individual amplifiers. They can not be combined otherwise. Example: A 4000W1000 works as a 4000W1000 or as 4 independent 1000W1000C amplifiers **only**. It **will not** work as a 3000W1000 or 2000W1000.

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