60KW 500 MHZ Solid State Amplifier Design
Progress Report

M. Gaspar, M. Pedrozzi

Commissioning of 4KW Validation Prototype

PC Master Controller: Design Finished. 5 Pieces to be Ordered (Industry)

Power Supply Controller: Design Finished. 50 Pieces in Production (Industry)

Power Splitter: 2 8-Way Prototypes Working (PSI Design)

250W Amplifier Module: All Parts Available (Incl. Substrates). Assembly & Tests in House.

Cooling Bar: Use Soleil Design (Keep Compatibility) (Industry)

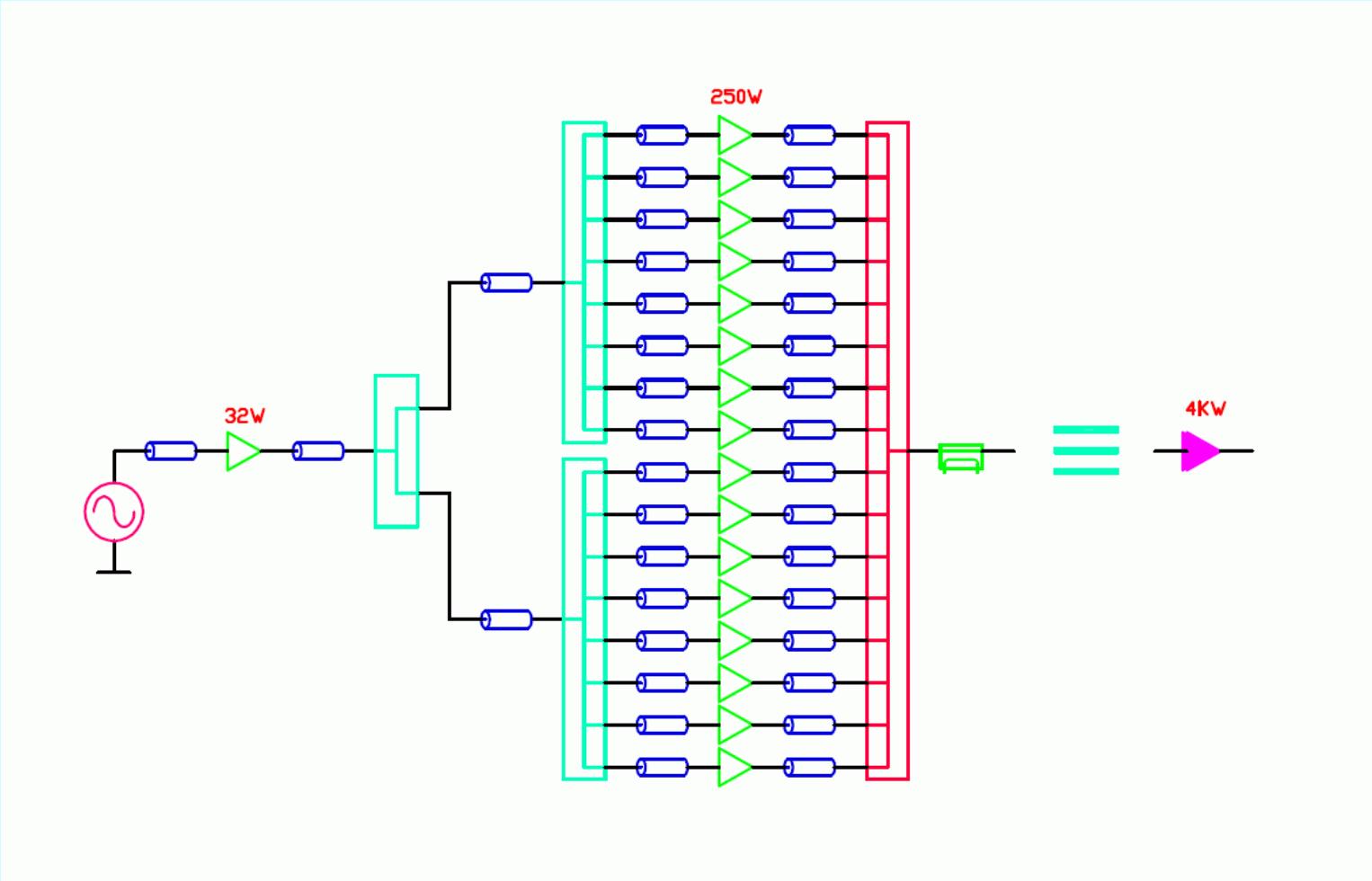
High Power Coupler: to be Purchased (Industry)

Output Power Combiner: 18-Way Combiner in Production (PSI Workshop)

Cables: to be Purchased (Industry)

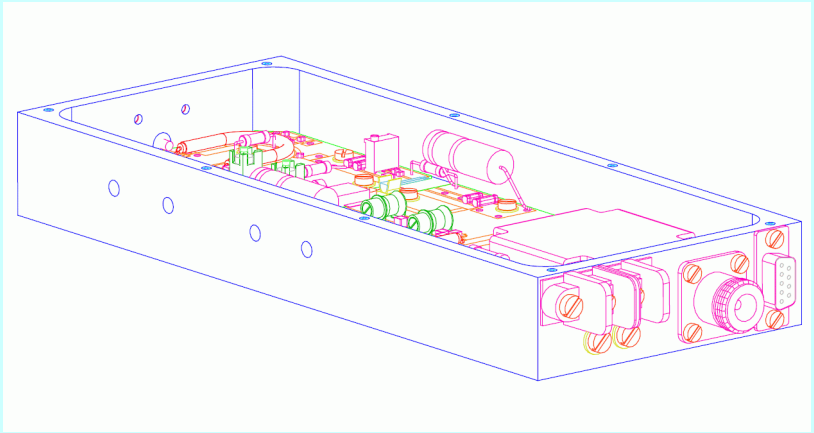
Water Cooled Load: to be Purchased (Industry)

4KW Amplifier Configuration

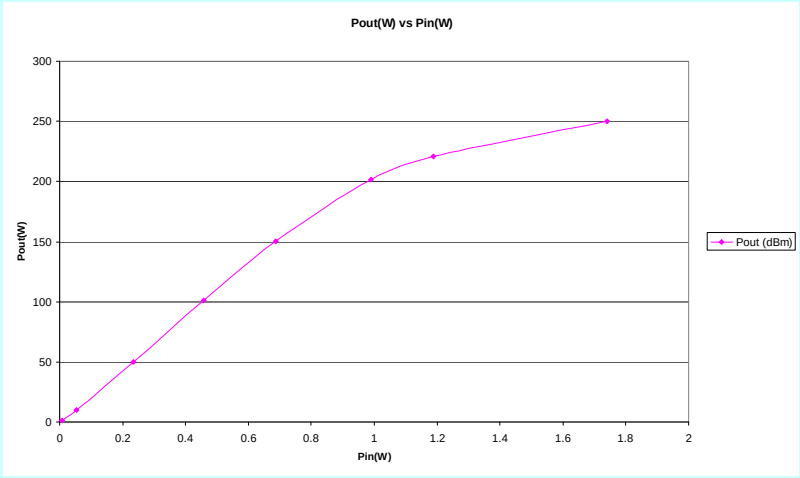


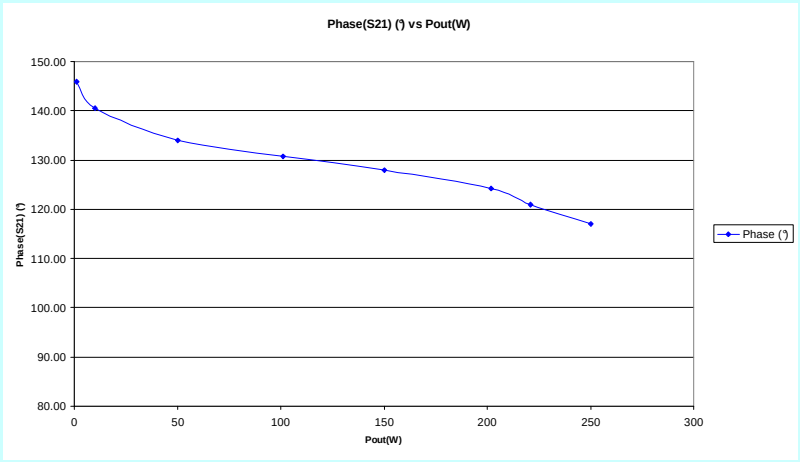
250W Amplifier Module

New Design using LDMOS MRF6P3300



3D-View of 500MHz Amplifier Module

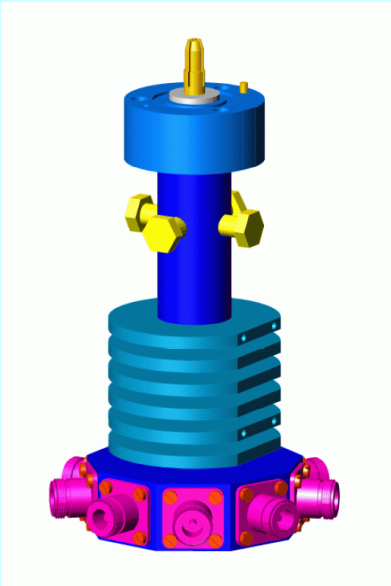


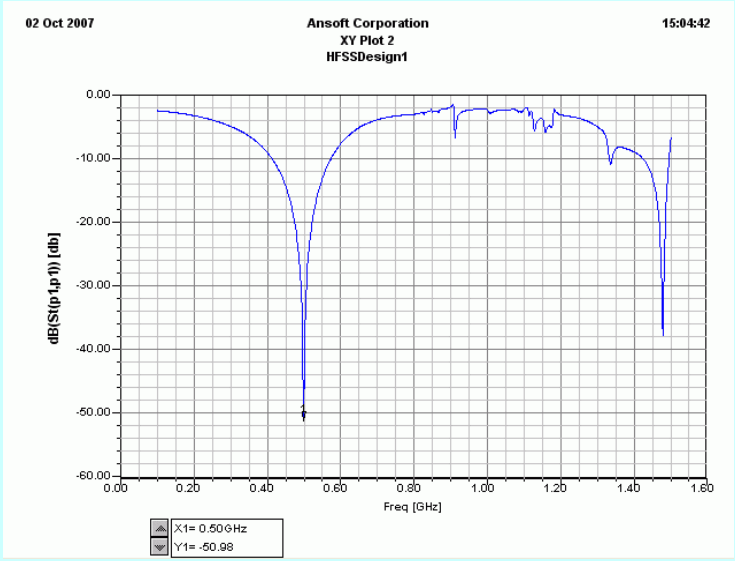


Key Performance Parameters

	Operation	Max
Output Power (with Circulator)	250W	280W
Gain	22dB	20dB
Efficiency	~ 54%	~ 50%

9 Way Combiner - 500MHz





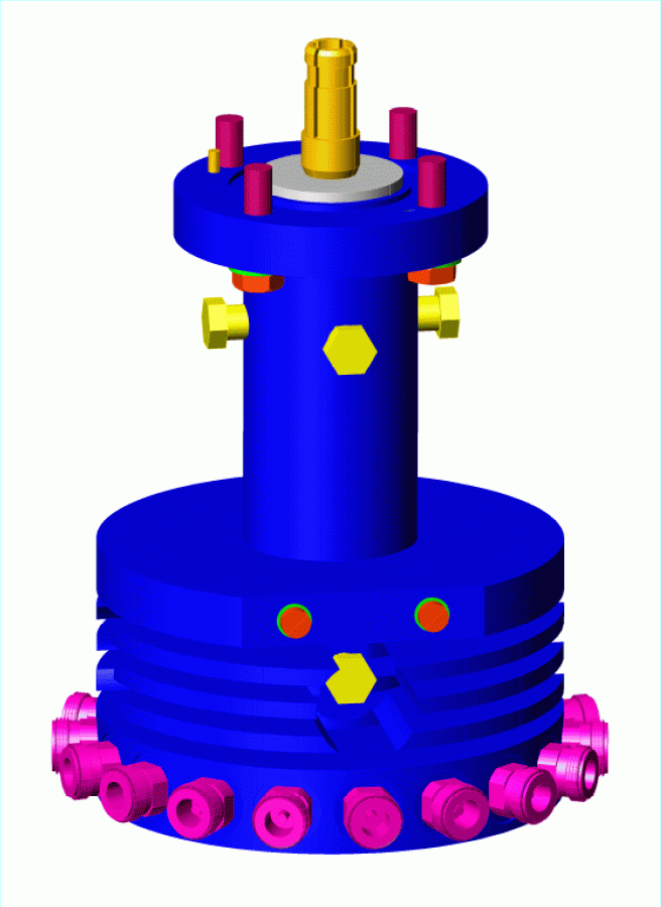
Status

All Parts Available

Not Yet Assembled

Tests in Preparation

18/16 Way Combiner – 500MHz



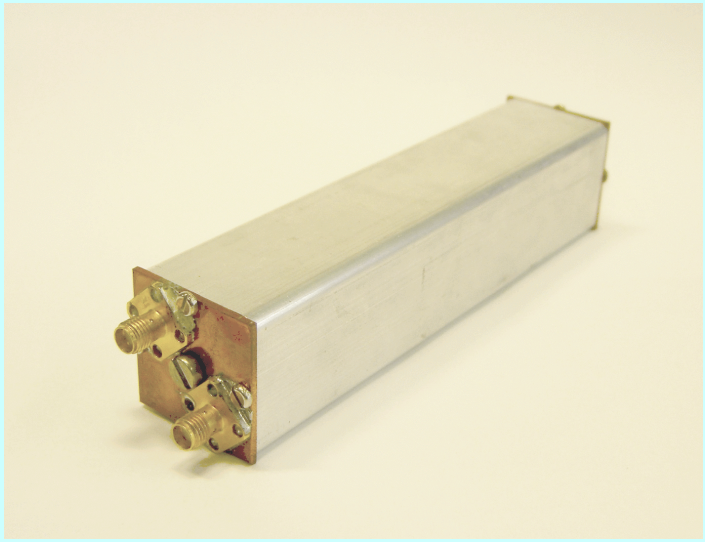
Status

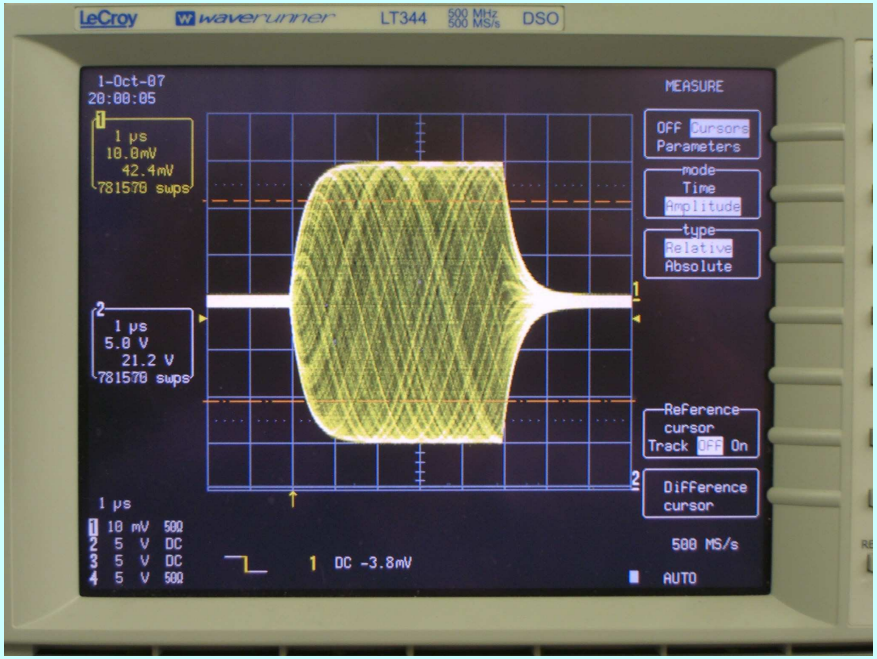
Mechanical Parts in Production Now

Precision Required for 18 Ways will be Realized with no Extra Costs

Tests in Preparation

500MHz Tunable Cavity Resonator





Main Features

Tuning Range: +/- 20%

Center Frequency: 500MHz

Bandwidth: 1MHz

Rise Time/Fall Time: 1us

Loaded Quality Factor: 500

Attenuation: 0.5

Fully Passive: No Problem due to Power Failure

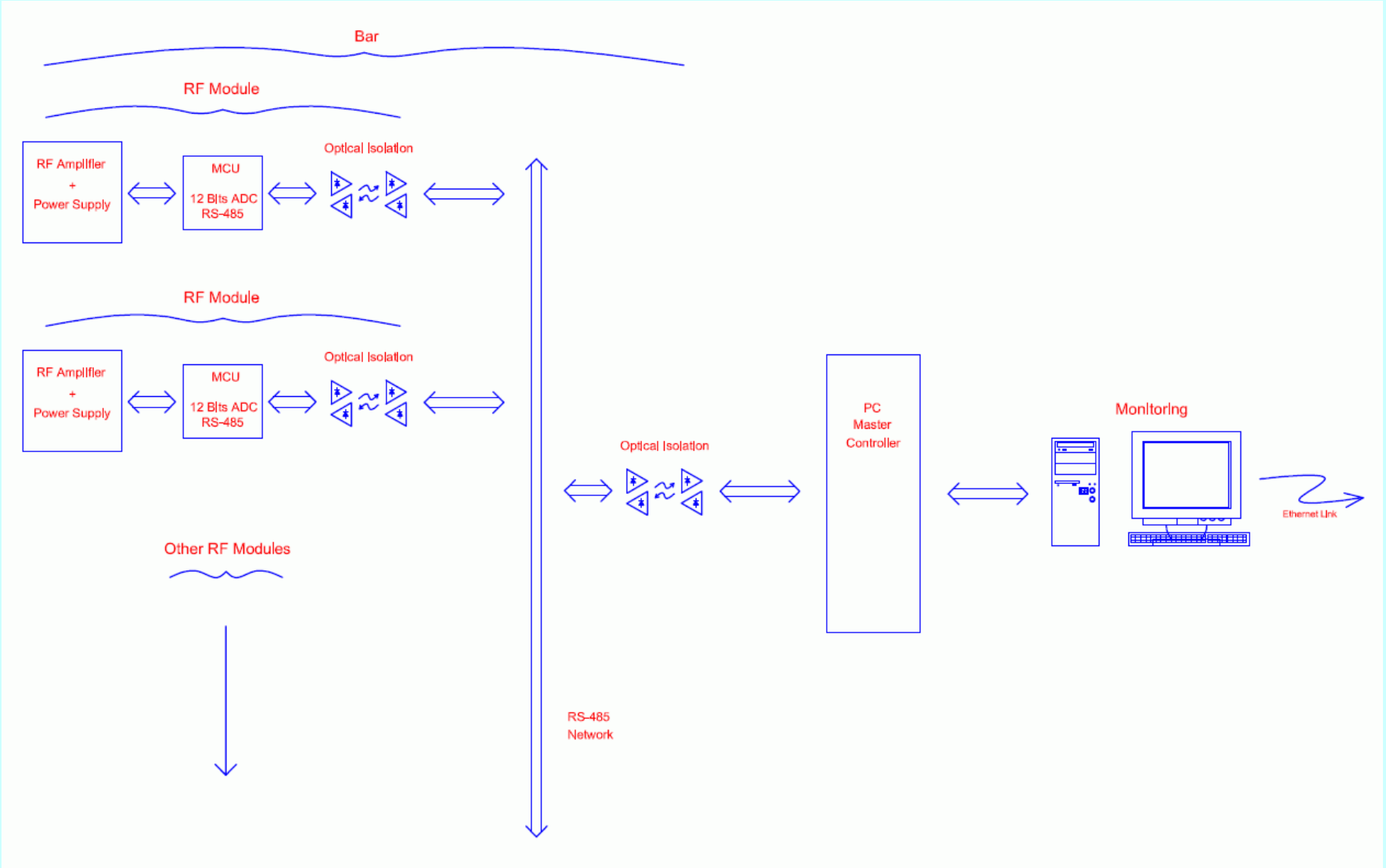
Main Application

Provides Limitation of RF Rise and Fall Times

Allow Safe Pulsed Operation Preventing MOSFETs from being Damaged due to too High RF dV/dt Transient Conditions

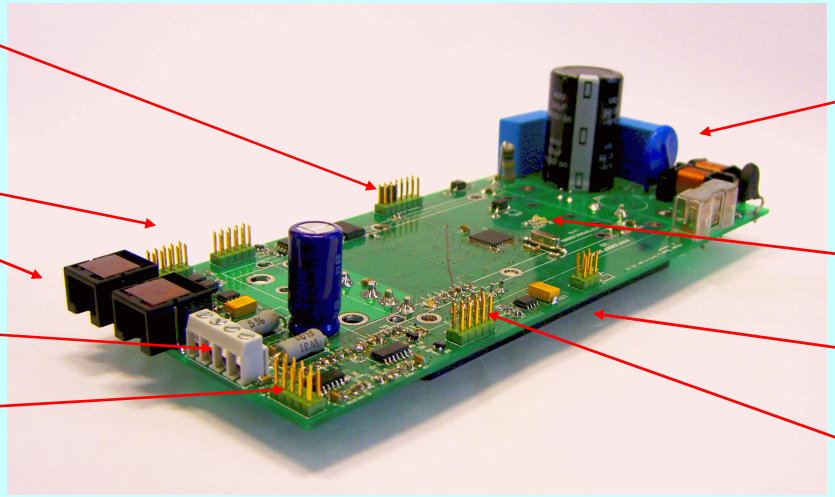
Supervision and Monitoring

4KW Amplifier



Power Supply Controller

(and Complete Monitoring System)



Main Features

Output Power: 600W

Output Voltage Range: 16.7V to 33.5V

Input Voltage Range: 200V to 400V

Efficiency: ~ 90%

Can be Remotely Programmed and Monitored

Extra Analog and Digital I/Os

Multi-tasking Script Operating System (SOS)

Interlock Reaction Time: ~ 1uS

Full Monitoring Loop Time: ~ 150mS

Design Finished

50 Pieces in Production Now

SOS (Save Our Souls)

(Originally: Script Operating System*)

Main Features

Runs ASCII Scripts: No Need for Previous Compilation

Available Commands for Analog and Digital I/O

Simplified IBM BSC Protocol implementation for Network Applications

Can also be used in Autonomous Applications (No Network)

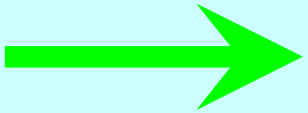
Optimized for Data Acquisition

Multi-tasking Environment: Allows Monitoring and Data Taking Simultaneously

Precise Time-Base for Timing Applications: 1mS

Almost all Code Portable to other Microcontrollers

Designed in House: No Commercial Licen$e Needed

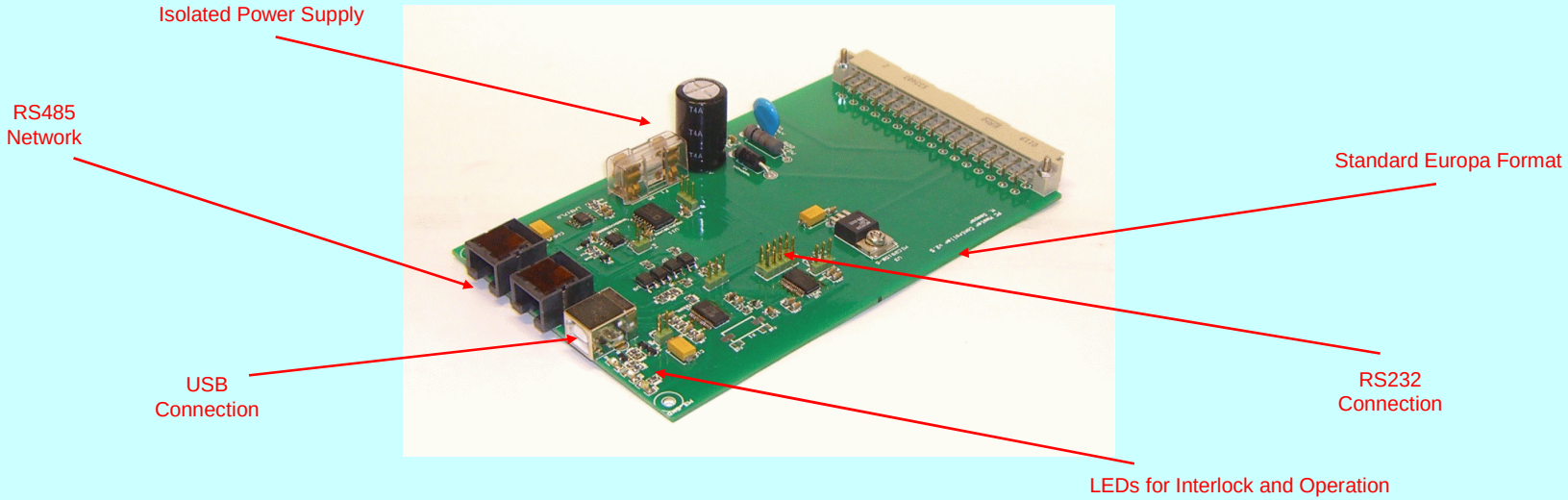


Actual Version: SOS v2.96.26

Will be Programmed in All New Power Supply Controllers in Production Now

* Original name was “Script Operating System”. New Name “Save Our Souls” was Kindly Proposed by our Colleague Pal Trivan

PC Master Controller



Main Features

Output Isolated Power: 15V 1A

Maximum Data Rate: 200Kbps

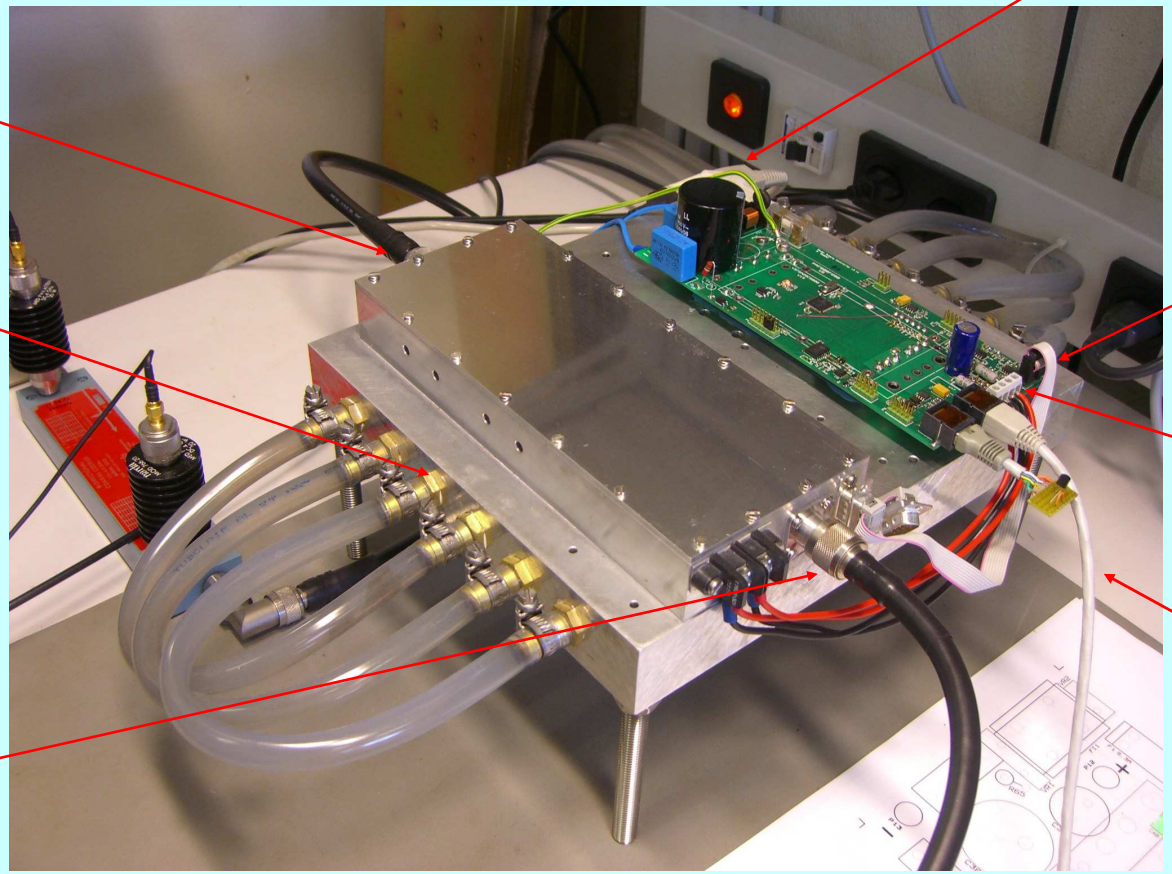
External Connections: USB and RS232

Interlock Monitoring through Signaling Lines

Design Finished

5 Pieces to be Ordered

Power Supply Controller and Monitoring System Tests



Conclusions

Physics Law

$$P = W / T$$

RF Design Law

$$P = (W*t*N*M*p)* e^{-T/K} + 2\pi S + H + L^{C} - G$$

Definitions:

P = Output Power

p = Input Power

W = A lot of Work

t = Lots of Extra Hours

T = Time

L = Passion for RF Design and Electronics

S = Personal Satisfaction

H = Proud of Making a High Quality and Interesting Work

M = Solid-State Device, Mosfet

N = Multiplication Number

G = Girlfriend‘s Unhappiness Correction Factor

K = Designer Dependent Constant

C = Designer‘s Competence and Knowledge