DA1-100-100MHz: Series of Narrowband or Wideband Distribution Amplifiers

Key Features

- 1-100 MHz wideband Operation. Other band frequencies from 100 kHz to 200 MHz are available
- AGC Level Controlled. Output level remains stable to 0.02 dB even if input varies
- AGC can be disabled if required. Amplifier then has fixed gain. Different gains can be made upon request
- 5 to 40 sinewave outputs. Each output can be <u>independently</u> set to 0 dBm to > +10 dBm (option +20 dBm)
- Alarm monitoring. <u>All outputs</u> have alarm monitoring. Indication by LEDS or rear panel DC outputs
- Ultra low phase noise. Typically, < -140 dBc @ 1 Hz offset. Floor noise to -171 dBc/Hz available.
- Excellent Allan Deviation. 2 x10^{-14} at 1 sec, 2 x10^{-17} at longer time intervals.
- >100 dB channel isolation and >140 dB reverse isolation. Protects reference input and prevents cross-talk.
- BNC Connectors standard. SMA or TNC or N type connectors optionally available.
- Optional second frequency "Back-up" input. Automatically switched in, if first input fails.
- Optional internal back-up oscillator. Automatically switched in, if external input fails.
- Optional Redundancy (two units with automatic switchover)
- Many other options and customized options. Bespoke design service available.

General Description

The DA1-100-10 series are a series of ultra-low noise distribution amplifiers. They cover 1-200 MHz either in a wideband unit (e.g. 1 -100 MHz), or narrowband versions (e.g. 5 MHz, 10 MHz). They can be used to synchronize from five to forty instruments to a frequency reference input. The reference input will typically be an OXCO, Rubidium, Caesium or Hydrogen Maser Frequency Standard.

The DA1-100-10 has features not found in any competitive unit. This makes the DA1-100-10 the industry's leading distribution amplifier.   The DA1-100-10 has outstanding low phase noise. Therefore, the DA1-100-10 will not add any noise to the reference input.

Phase noise is typically <-140 dBc @ 1 Hz. This low phase noise enables units to be cascaded for over 1000 outputs.

Amplifier with Gain and Automatic Gain Control (AGC)

Unlike most competitive units, the DA1-100-10 accepts inputs from +7 dBm to +20 dBm (-20 dBm to +30 dBm optional) and provides outputs from 0 dBm to > +10 dBm (up to +20 dBm optional).   The output will not vary with input variations.

This is very useful when long cable runs are being used or equipment has different input level requirements.   The AGC can be disabled, if required, making the unit a fixed gain amplifier. Different gains are available upon request.

Outputs

There are five to forty sinewave outputs depending upon what option is ordered. Each output is completely isolated from the input and each other. Therefore, the reference oscillator connected to the DA1-100-10's input is protected against load variations, short circuits etc. that may be applied to the outputs.
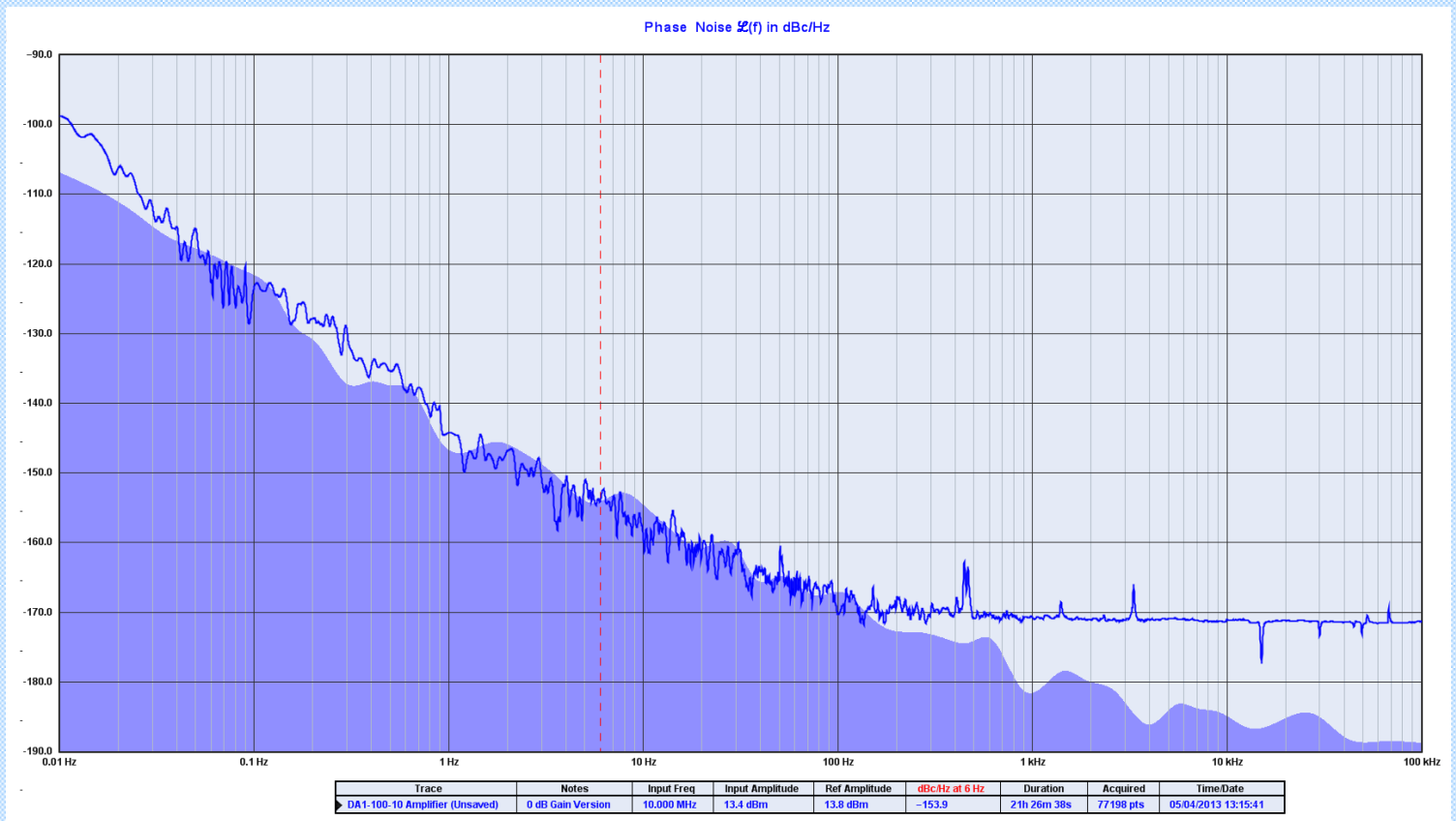
Channel to channel isolation is > 90 dB @ 10 MHz. Output to input isolation is > 130 dB @ 10 MHz

Each output port can be underlined_independently set to any level from 0 to > +10 dBm on the standard unit and outputs to +20 dBm are optional available. The ability to set every output to a different level is very useful when dealing with equipment that has different input level ranges. This is a unique feature of the DA1-100-10 not found on any other unit.

Phase Noise

The DA1-100-10 has very low phase noise and Allan deviation. This enables units to be connected in series without adding any appreciable noise to the reference input. Up to 1000 outputs can be derived from one input using multiple amplifiers, without the need of cascading more than three amplifiers at a time. This keeps the phase noise to a minimum.

A typical plot of phase noise at 10 MHz is shown below in blue. Note this is an amplifier with 0 dB gain. The standard DA1-100-10 has 3 to 6 dB of gain which raises the noise by a few dB.

Phase Noise $\mathcal{L}$(f) in dBc/Hz

Trace	Notes	Input Freq	Input Amplitude	Ref Amplitude	dBc/Hz at 6 Hz	Duration	Acquired	Time/Date
DA1-100-10 Amplifier (Unsaved)	0 dB Gain Version	10.000 MHz	13.4 dBm	13.8 dBm	−153.9	21h 26m 38s	77198 pts	05/04/2013 13:15:41

Allan Deviation Plot

The plot below shows the Allan deviation plot of the DA1-100-10. Allan Deviation is typically 1.8×10^{-14} for tau = 1 second with the noise floor less than 2×10^{-17}.
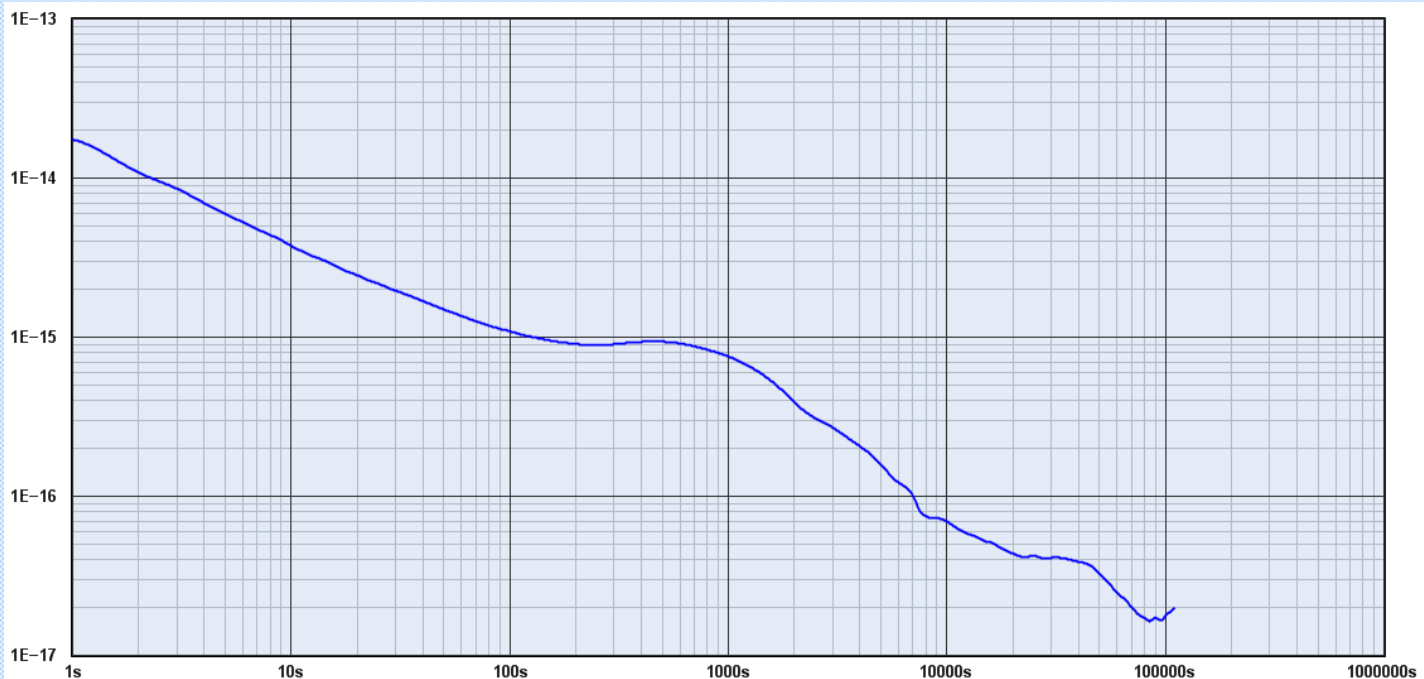
Phase Stable with matched outputs

The wide frequency bandwidth allows the outputs to have stable phase. The phase stability is typically 5 ps/°C. Also the delay match between outputs is better than 2.2 ns overall and typically less than 350 ps between groups of five outputs.

Alarms

Every output has alarm monitoring. Should the RF level drop on any output, an alarm will be raised. Also, front panel LED's show the status of the alarms. The alarm signals are also available on the rear panel as DC level outputs.

Applications

The DA1-100-10 Distribution Amplifier is ideal for use in calibration or standard laboratories, space research, satellite systems, communication systems or anywhere where ultimate performance is needed.

Miscellaneous Information

The DA1-100-10 is a highly reliable unit. The DA1-100-10 is housed in a fully screened 19" rack mount case and operates from a 100 to 240 VAC supply (usable 90 to 260 VAC). The DA1-100-10 is CE marked for sale within the EEC. It is guaranteed for three years.

Options and Other Amplifiers available from Precision Test Systems

- Fully DC isolated outputs. Useful in preventing ground loops on long cable runs.
- Squarewave outputs. Either at the same frequency as the input, or at different frequencies.
- Multiplied or divided outputs. E.g. 10 MHz, input with 5 MHz output. 10 MHz input with 100 MHz output. Any type of multiplication / division can be incorporated.
- Low pass filter on outputs. This reduces the harmonic output.
- Guaranteed phase noise specifications. Measured phase noise specifications supplied with unit.
- Higher output levels, up to +30 dBm.
- Different amplifier gains allowing different input levels from -20 dBm to +30 dBm to be accommodated.
- Additional outputs. Up to 20 outputs in a 1U case or 40 outputs in a 2U case.

- **External DC Power Input.** The DA1-100-10 can also have an external 12VDC input. This can be used to provide back up power. If AC power is lost, the DA1-100-10 will immediately switch to the DC supply.
- **Redundancy.** Two units operate together. If one unit fails, the outputs are automatically switched to the secondary unit.
- **Internal backup oscillator.** This oscillator is automatically enabled should the input signal fail.
- **Two or three reference inputs.** Each reference input with have five isolated outputs derived from it. So, the DA1-100-10 can operate at two or three different frequencies at the same time. E.g. 10 MHz and 5 MHz, 50 MHz, 10 MHz and 5 MHz. When there are three inputs, option 09 will need to be ordered at the same time.

DA1-100-10 Rear view (with option 04 TNC Connectors).

Precision Test Systems also manufacturers the PTS50 and DA1010 series of distribution amplifiers. These models are lower cost alternatives to the DA1-100-10 but still give very good performance.

DA1-100-10 SPECIFICATIONS

Specification Parameter	Specification	Comments
Input		
Frequency	1-200 MHz	See model list below for actual frequencies
Bandwidth (2-100 MHz)	± 3 dB	± 5 dB from 1 – 100 MHz
Impedance / Input VSWR	50 Ω / < 1.5:1 @ 10 MHz	Typically, < 1.2:1 @ 10 MHz
Input Level (standard unit)	+7 dBm to + 20 dBm	AGC Controlled. Optional -20 to +30 dBm
Gain (standard unit)	3 dB (optional -5 to +30 dB)	AGC controlled or fixed gain options.
Sinewave Outputs		
Output Waveform	Sinewave	50 Ω BNC Connector on rear panel
Output Frequency	Exactly the same as the input	
Output VSWR	< 1.15: 1 @ 10 MHz	
Output level (individually adjustable)	Adjustable 0 dBm to > +10 dBm	Outputs to +20 dBm optionally available
Output Level Stability	< 0.05 dB / °C	Typically, < 0.02 dB / °C
Harmonic Distortion (10 dBm input)	-20 dBc	Typically -25dBc (optional; -50 dBc)
Spurious Outputs (> 500 kHz)	-125 dBc	Typical
Channel to Channel Isolation	> 100 dB @ 10 MHz	Typically, > 106 dBm
Input to Output (Reverse) Isolation	> 140 dB @ 10 MHz	
Delay match between outputs	< 2.5 ns (<500 ps / 5)	< 500 ps within group of 5 outputs
Temperature Stability of delay	10 ps/°C	Typically 5 ps/°C
Slave Output		
Slave Output	Passive output derived from input	Level = input level - 7 dB.
Allan Deviation (typical @ 10 MHz)		
Allan Deviation	< 4 x 10^{-14} (1 sec)	< 2 x10^{-13} at 0.1 sec. Floor < 3 x 10^{-17}
Phase Noise for standard unit (typical @ 10 MHz)		

Phase Noise (@ offset frequency) with +10 dBm input and +10 dBm output	@ 1	@10	@100	@1k	@10k	@100k	This is for a unit with ten outputs and a gain of 3 to 6 dB
	-135	-148	-157	-163	-165	-166	

Phase Noise (@ offset frequency) with +13 dBm input and +13 dBm output	@ 1	@10	@100	@1k	@10k	@100k	This is for a unit with five outputs and a gain of 0 dB
	-140	-157	-166	-170	-171	-171	

General		
Power (AC)	100 - 240 VAC (usable 90 - 260)	50 Watts max

Size and weight (5 to 20 outputs)	483 x 300 x 44 mm and 2.8 kg	Width x Depth x Height
Size and weight (20 to 40 outputs)	483 x 300 x 88 mm and 3.5 kg	Width x Depth x Height
Operating / Storage Temperature	-10 to +50 °C / -20 to +80 °C	Humidity < 90% non-condensing
Alarm Output	Alarm Outputs on rear panel	
Options (not all options can be fitted at the same time)		
Option 01	Dual changeover alarm relay	Activated in the event of an alarm
Option 02A / B	Ground Isolated Input / Outputs	
Option 03	Redundancy	Requires two units
Option 04 / 05 / 05B	TNC / SMA/ N type connectors	Replaces standard BNC connectors
Option 06	Guaranteed Phase Noise	Plots supplied with unit
Option 07	UKAS traceable certificate	
Option 08	Increased Output levels	Various options to +20 dBm available
Option 09, 09A, 09B, 09C, 09D	Additional sinewave outputs	20 o/p's in all in 1 U case. 40 outputs in 2U case. AGC range 10-19dBm
Option 10	Squarewave outputs	TTL/CMOS or ECL output levels
Option 11	Divided frequency output	E.g. 2.048 MHz, 1MHz, 10 MHz, 1 pps etc.
Option 12	Multiplied output	E.g. X2, X5, X10, X100.
Option 13	Low Pass filter on output	Improved harmonic rejection
Option 14	External DC input	Nominal 12V external DC.
Option 16-XXX	Internal backup oscillator	XXX = frequency in MHz.
Option 17-XXX	Different Gain Levels	Customer to advise gain requirement
Option 18	Delete five outputs	Negative option. Reduces price.
Option 19	Second External Input	Automatic switchover if 1st input is lost
Option 20 / 20B (opt 20B needs opt 09)	Two or three reference inputs	With two or three sets of five outputs
Option 22	Additional internal amplifier	Increases sensitivity to -20 dBm
Option 23	Bandwidth optimized	Specify actual frequency bandwidth
Option 25	2 inputs with 8 outputs each.	Customer special option
Option 26 / 26B	Fiber optic input and outputs	
Option 27	Ethernet interface for alarms	

DA1-100-10 series. Model numbering:

DA1-100-10:	Wideband 1 – 100 MHz.	DA1-100-10-10MHz:	Narrowband 10 MHz
DA1-100-10-100kHz:	Narrowband 100 kHz	DA1-100-10-13MHz:	Narrowband 13 MHz
DA1-100-10-1MHz:	Narrowband 1MHz	DA1-100-10-15MHz:	Narrowband 15 MHz
DA1-100-10-2048 kHz:	Narrowband 2048 kHz	DA1-100-10-150MHz:	Narrowband 150 MHz
DA1-100-10-5MHz:	Narrowband 5 MHz	DA1-100-10-160MHz:	Narrowband 160 MHz

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Full specifications available from www.ptsyst.com. Specifications and features subject to change without notice (101221)

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