



## DA1-100-10-FO: 1 MHz -100 MHz Wide Band, Fiber Optic / Coaxial Distribution Amplifier



### Key Features

- Combination of fiber optic and coaxial inputs and outputs. Designed to customers requirements.
- 1 -100 MHz Wideband Operation, or narrow bands such as 5 MHz, 10 MHz etc. Options to 200 MHz.
- 1U or 2U 19" rack mounted case depending upon number of outputs. Up to 40 outputs possible.

#### **Coaxial Inputs and Outputs**

- Each output can be independently set to 0 dBm to > +13 dBm (optional higher levels available)
- AGC Level Controlled. Output level remains stable to 0.02 dB even if input varies from +7 to +20 dBm.
- Alarm monitoring. All outputs have alarm monitoring. Indication by LEDS or rear panel DC outputs.
- Ultra low phase noise. Typically -134 dBc @ 1 Hz offset. Standard floor noise typically -165 dBc/Hz with options to -171 dBc/Hz (10 kHz offset).
- 90 dB channel isolation and 130 dB reverse isolation. Protects reference input and prevents cross-talk.
- 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.

#### **Fiber Optic Inputs and Outputs**

- Optical input: FC/APC connector
- Flexible number of outputs
- Transmission distances up to 50 km
- Wide range of gain options
- Laser type: DFB
- Optical Wavelength 1310 nm
- Optical power output 4.5 dBm nominal
- Optical Connector: FC/APC

### General Description

The DA1-100-10-FP is a wide band distribution amplifier combining optical and coaxial distribution amplifiers. The frequency bandwidth is wideband from 1 MHz to 100 MHz (usable to > 150 MHz), or narrow bands can be designed. It can be used to synchronize up to forty instruments to a frequency reference input. The reference input will typically be an OXCO, Rubidium, Cesium or Hydrogen Maser Frequency Standard. Typical frequencies are 5 and 10 MHz, but any frequency from 1 MHz to >100 MHz can be used.

The input can be coaxial or optical. For a coaxial input, either coaxial or optical outputs are available. For an optical input again the outputs can either be optical or coaxial.

The DA1-100-10-FO has features not found in any competitive unit. This makes the DA1-100-10-FO the industries leading distribution amplifier. The DA1-100-10-FO has outstanding phase noise on its coaxial inputs and outputs. Therefore the DA1-100-10-FO will not add any noise to the reference input.

The coaxial phase noise is typically  $<-134$  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-FO accepts coaxial inputs from +7 dBm to +20 dBm (-20 dBm to +30 dBm optional) and provides outputs from 0 dBm to  $>+13$  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.

### **Inputs and Outputs**

The number of outputs and the combination of optical or coaxial can be specified by the customer before the unit is manufactured. E.g a typical combination is one coaxial input and one optical input with five coaxial outputs and five optical outputs.

Each output is completely isolated from the input and each other. Therefore, the reference oscillator connected to the DA1-100-10-FO's input is protected against load variations, short circuits etc. that may be applied to the outputs.

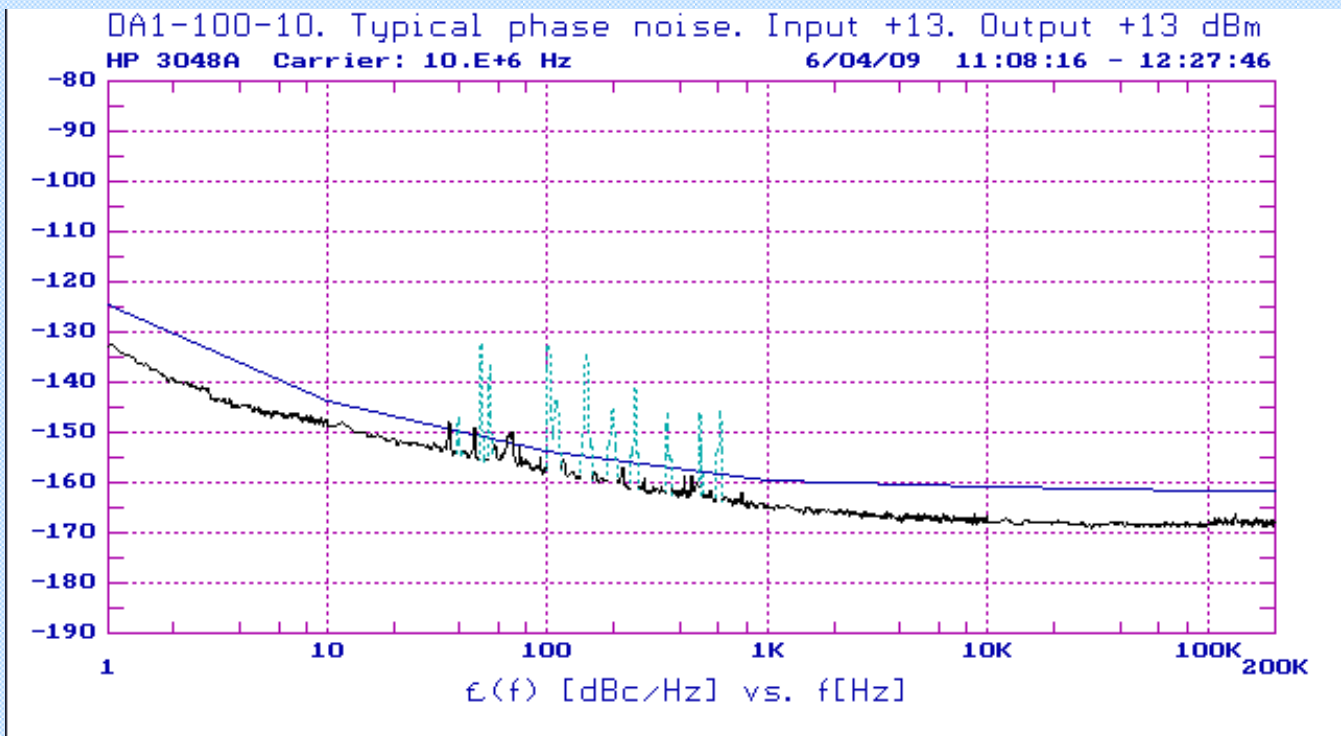
Channel to channel isolation is  $> 90$  dB at 10 MHz and  $> 65$  dB at 100 MHz. Output to input isolation is  $> 130$  dB at 10 MHz and  $> 100$  dB at 100 MHz.

Each coaxial output port can be independently set to any level from 0 to  $> +13$  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. Over 1000 outputs can be obtained without any significant increase in close-in noise.

### **Phase Noise**

The DA1-100-10-FO has very low phase noise. This enables units to be connected in series without adding any appreciable noise to the reference input. With only three DA1-100-10's in series, up to 1000 outputs can be derived from one input.

A typical plot of phase noise for the coaxial inputs and outputs is shown below. The blue line is the DA1-100-10-FO's specifications. The light blue lines are line related, spurious outputs. These spurs (50 or 60 Hz) are present in any equipment connected to the AC 115 or 230 VAC supply. The black line is the actual phase noise. The far out noise (offsets  $> 1$  kHz) can even be improved upon by careful selection of the output level and amplifier gain. Floor noise to -171 dBc/Hz is achievable.



### 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 shows the status of the alarms. The alarm signals are also available on the rear panel.

### Applications

The DA1-100-10-FO 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-FO is a highly reliable unit. The DA1-100-10-FO 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-FO is CE marked for sale within the EEC.

### Options and Other Amplifiers available from Precision Test Systems

- Fully DC isolated inputs and 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 +20 dBm.
- Different amplifier gains allowing different input levels from -20 dBm to +30 dBm to be accommodated.
- Various numbers of outputs from 5 to 40. Taylor made to suit your application.
- External DC Power Input. The DA1-100-10 can also have an external 12VDC input (12 - 15 VDC). This can be used to provide back up power. If AC power is lost, the DA1-100-10 will immediately switch to the 12VDC supply.
- Redundancy. Two units operate together. If one unit fails, the outputs are automatically switched to the secondary unit. Also redundant AC supplies can be incorporated with dual AC connectors.
- Internal backup oscillator. This oscillator is automatically enabled should the input signal fail. The oscillator can be specified in any frequency from 1 to 100 MHz.
- Two reference inputs. Each reference input will have five isolated outputs derived from it. So the DA1-100-10 can operate at two different frequencies at the same time. E.g. 1 MHz and 5 MHz, 5 MHz and 10 MHz.



DA1-100-10 Rear view (with option 04 TNC Connectors). 1U case type. 2U case is double the height.

Precision Test Systems also manufactures 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
<b>Input</b>		
Frequency	1 MHz to 100 MHz	Wideband Frequency Input
Bandwidth (2 MHz - 100 MHz)	± 1.5 dB (typically ± 1 dB)	(±3 dB from 1 to 150 MHz)
Impedance	50 Ω	
Input VSWR	< 1.50	Slave output terminated in 50 Ω
Input Level (coaxial)	+7 dBm to + 20 dBm	AGC Controlled. Optional -20 to +30 dBm
<b>Sinewave Outputs</b>		
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	<1.8:1 @ 100 MHz
Output level (individually adjustable)	Adjustable 0 dBm to > +10 dBm	0 dBm to +13 dBm with > +10 dBm input
Output Level Stability	< 0.05 dB / °C	Typically < 0.02 dB / °C
Harmonic Distortion (10 dBm input)	-25 dBc	Typically -35 dBc @ 10 MHz
Spurious Outputs (> 500 kHz)	-125 dBc	Typical
Channel to Channel Isolation	> 90 dB @ 10 MHz.	> 60 dB @ 100 MHz
Input to Output Isolation	> 130 dB @ 10 MHz	> 105 dB @ 100 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
<b>Slave Output</b>		
Slave Output	Passive output derived from input	Level = input level - 7 dB.
<b>Allan Deviation</b>		
Allan Deviation	< 5 x 10 <sup>-14</sup> (1 sec)	Calculated from phase noise
<b>Phase Noise (coaxial inputs and outputs)</b>		

Phase Noise (dBc/Hz). Standard unit with five or ten outputs.	-125 / -144 / -154 / -160 / -161 / -162	1 /10 / 100 /1k /10k/100k Hz offsets
Phase Noise (dBc/Hz) typical with +13 dB Input and +13 dBm Output	-134 / -148 / -157 / -165 / -167 / -167	1 /10 / 100 /1k /10k/100k Hz offsets. Options to -171 dBc available.
<b>Fiber Optic</b>		
Frequency Range - Link Gain	1 to 100 MHz - 0 dB	
Gain Stability	± 3 dB over temperature range	
Carrier to Noise Ratio (CNR)	110 dB	
Spurious-free dynamic range (SFDR)	109 dB/Hz	
Laser type - Optical Wavelength	DFB - 1310 nm ± 20 nm	
Optical Power Output	4.5 dBm (nominal) 3mW	
Optical Connector	FC/APC socket	
<b>General</b>		
Power (AC)	100 - 240 VAC (usable 90 - 260)	50 Watts max
Size and weight 1U case	483 x 300 x 44 mm and 2.8 kg	Width x Depth x Height
Size and weight 2U case	483 x 300 x 88 mm and 3.4 kg	Width x Depth x Height
Ambient Operating Temperature	-10°C to +40 °C	
Alarm Output	Alarm Outputs on rear panel	
<b>Options (not all options can be fitted at the same time)</b>		
Option 01	Dual changeover alarm relay	Activated in the event of an alarm
Option 02A, 02B	Ground Isolated Input or Outputs	
Option 03, 03A, 03B, 03C, 03D, 03E	Redundancy Options inc. AC	Requires two units
Options 04 and 05, 05B	TNC, SMA or N type connectors	
Options 06 and 07	Phase Noise / UKAS certificates	
Option 08, 08A, 08B, 08C, 08D	Increased Outputs to +20 dBm	
Option 09A, 09B, 09C, 09D or 09E	Additional sinewave outputs	From 5 to 40 outputs available
Option 10, 10B, 10C	Squarewave outputs	TTL/CMOS or ECL output levels
Option 10D	Programmable DDS Output	0-80 MHz in 1 µHz steps. RS232 setting
Option 11 to option 11F	Divided frequency output	E.g. 2.048 MHz, 1MHz, 5 MHz, 1 pps etc.
Option 12, 12A, 12B	Multiplied output	E.g. X2, X5, X10, X100.
Option 13, 13A	Low Pass filter on output	Improved harmonic rejection
Option 14, 14A	External DC input	Operates from 12.0 to 13 or 8 to 15 VDC
Option 16-XXX	Internal backup oscillator	XXX = frequency in MHz.
Option 17-XXX	Different Gain Levels	Customer to advise gain requirement
Option 19 / 20	Second External Input's	Automatic switchover if 1 <sup>st</sup> input is lost
Option 22	Extra Internal Amplifier	
Option 23	Optimized Bandwidth	E.g. 100 to 120 MHz
Option 27	Ethernet Interface for Alarms	

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Specifications subject to change without notice (141016)