OPERATING INSTRUCTIONS

ADS-431-403 Frequency Synthesizer
ADS-431-403A Quadrature Frequency Synthesizer

1. PRODUCT DESCRIPTION

The ADS-431-403 & ADS-431-403A direct digital synthesizers (DDS) use Silicon technology to operate from DC to 400 MHz with <0.75 Hz frequency resolution. A proprietary and custom Silicon gate array is used to achieve the combination of wide frequency bandwidth, fine resolution, and fast switching speed that is characteristic of the ADS series. Note that the actual upper frequency is restricted to one-quarter of the externally supplied DDS clock.

The "-403A" designator refers to the generic unit that contains a 500 MHz low pass filter to allow operation from a 1600 MHz clock — Lower clock speeds could result in aliased spurs that are higher than expected. Also quadrature is provided.

2. PERFORMANCE/SPECIFICATIONS

Output Frequency
- Range ..... DC to 400 MHz
- Resolution ..... <0.75 Hz
- Control ..... 30 parallel BINARY TTL bits (pos-true logic) with STROBE

Main Output
- Level ..... -4 dBm into 50?
- Accuracy/Flatness ..... ±2 dB

Auxiliary Output (ADS-431-403A)
- Level ..... -4 dBm into 50? (90° out of phase with main output)
- Accuracy/Flatness ..... ±2 dB
- Quadrature Accuracy ..... 90° ± 2°

Spectral Purity
- Harmonics ..... -20 dBc
- Spurious ..... -40 dBc, typical
- Phase Noise ..... <-105 dBc/Hz @ 100 Hz offset
  <-115 dBc/Hz @ 1 kHz offset
  <-130 dBc/Hz @ 10 kHz offset

Reference Frequency
- External ..... 1,600 MHz @ = +10 dBm

Frequency Switching
- Switching Speed ..... 40 clock cylces for change in LSB
  8 clock cylces for change in MSB

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2. PERFORMANCE/SPECIFICATIONS (continued)

Connectors
- RF Output (I) ..... SMA Female (J11) - ADS - 431-403A
- RF Output (Q)..... SMA Female (J10)
- Ext Ref Input..... SMA Female (J8)
- Frequency Control ..... 37-pin male subminiature D-connector (J7)
- Power ..... 9-pin subminiature male D-connector (J2)

Environmental
- Operating Temp ..... 0°C to +50°C

Power Supply (nominal) ..... -5.2V @ 1.1A; +5V @ 100 mA
Dimensions ..... 3.75"(W) x 4.78"(D) x 0.89"(T)
Weight..... <2 lb (0.9 kg), net; 4 lbs (1.4 kg), shipping

3. MECHANICAL CONFIGURATION

The ADS-431 is built according to best commercial practice.

Wherever an external RF signal is either required by the synthesizer or it is provided to the user, an SMA connector is provided. Refer to the section on Signal Connections for a listing of the possible connections.

4. INSTALLATION

The ADS-431 requires an external clock at 4 times the highest output frequency. The upper limit for this clock is 1,600 MHz thus producing an output of 400 MHz.

WARNING

Due to the static sensitivity of some of the synthesizer components, it is important that all the necessary precautions are taken to prevent static damage including but not limited to the use of ground straps and proper grounding techniques. Ground connections must be made first before connecting the frequency control mating connector to discharge any built-up static charge.

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5. POWER SUPPLY CONNECTIONS AND REQUIREMENTS

The -5.2V, and +5V DC power is supplied to the 9-pin subminiature D-connector (J2) as follows:

Power Supply	Current (A)	Pin #
-5.2V	1.2 A, (Max)	6
+5V	100 mA ± 10%	7
GND	----	8

IMPORTANT NOTE

The ADS-431 consumes approximately 6 watts of power. Heat sinks are employed to aid in heat dissipation but it is important that air be passed over the module in order to further reduce the heat build up.

6. SIGNAL CONNECTIONS

Several signals are connected to the ADS-431. The signals may be accessed according to the following table:

Output Signal	Female SMA Number
RF Sine Output (I) ADS-431-403A	J11
RF Sine Output (Q) MAIN SINE OUTPUT	J10

Input Signal	Female SMA Number
1,600 MHz Reference Input	J8

7. BINARY FREQUENCY CONTROL

A 30 bit, parallel, positive-true TTL logic is standard to the ADS-431. The phase accumulator within the unit allows for synchronizing a data transfer when a synchronizing signal (a strobe pulse) is supplied.

Note that the maximum allowable frequency is one-quarter of the clock. The MSB is the one-quarter clock frequency and if this bit is used with any other bit, an illegal frequency will result.

In addition to the frequency control, a separate TTL control line is provided to allow for very fast control of the output signal level. When this "phase reset" line (pin #36) is activated by setting it to a "HIGH" TTL level, the output of the synthesizer will be turned off. When this line is released (TTL "LOW"), the output of the

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synthesizer will begin at 0° phase when new data is clocked into the synthesizer.

Since the resolution of the synthesizer is "limited" to a non standard step size, some frequency values may not be available. Any frequency, however, will be settable to an accuracy of less than the smallest step size.

8. SYNCHRONOUS PROGRAMMING

In order to perform a synchronous frequency change (i.e., all digits change simultaneously), the STROBE line must be held at a "LOW" TTL level (0V to 0.8V). Pull any of the 30 frequency control lines to a "HIGH" TTL level (2.4V to 5.5V) in order to produce the desired output frequency (refer to the section containing the listing of the programming control lines).

When the STROBE line is held at a "LOW" TTL level, changes in any of the frequency control lines will not result in a change in the output frequency until the STROBE line (pin#17) is pulled to a HIGH TTL level. Data must be valid 5 nsec prior to the change in the STROBE line and data will STROBEd into the accumulator on the LOW to HIGH transition. The update rate for the synthesizer is “limited” to 40 clock cycles plus filter delay or less than 50 nsec.

9. ASYNCHRONOUS PROGRAMMING

In some cases, it may be desirable to simply change a small number of digits and it is not important whether or not all digits change simultaneously. This may be accomplished very easily by holding the STROBE line (pin #17) to a "HIGH" TTL logic level. When this method is used, any change in the level of any of the frequency control lines will be immediately reflected in a change of the output signal.

NOTE: The data is not stored within the synthesizer when the STROBE line is held "HIGH". If any of the frequency control lines are removed or changed, the output signal will be updated immediately.

10. RESET

The digital ON/OFF switch (phase reset) is controlled through pin #36 on the 37-pin subminiature D-connector. If the control line is pulled "HIGH", the output is turned off with over 100 dB of attenuation (although there may be leakage of the clock at the output). When the line is grounded (i.e., "LOW"), the output signal will begin at 0° phase (when new data is clocked into the synthesizer).

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11. PROGRAMMING CONTROL LINES (J7)

Frequency (Hz)	Bit#	Pin#
400 MHz	F30	35
200 MHz	F29	16
100 MHz	F28	34
50 MHz	F27	15
25 MHz	F26	33
12.5 MHz	F25	14
6.25 MHz	F24	32
3.125 MHz	F23	13
1.5625 MHz	F22	31
781.25 kHz	F21	12
390.625 kHz	F20	30
195.3125 kHz	F19	11
97.65625 kHz	F18	29
48.828125 kHz	F17	10
24.4140625 kHz	F16	28
12.20703125 kHz	F15	09
6.103515625 kHz	F14	27
3.0517578125 kHz	F13	08
1.52587890… kHz	F12	26
762.939453… Hz	F11	07
381.469726… Hz	F10	25
190.734863… Hz	F09	06
95.3674316… Hz	F08	24
47.6837158… Hz	F07	05
23.8418579… Hz	F06	23
11.9209289… Hz	F05	04
5.96046447… Hz	F04	22
2.98023223… Hz	F03	03
1.49011611… Hz	F02	21
0.74505805… Hz	F01	02
Not Connected	---	20,18, 37
FREQ. STROBE	---	17
GROUND ---	01,19	
RESET ---	36	

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12. FREQUENCY PROGRAMMING EXAMPLES

Several examples will be shown to illustrate the logic involved in programming the ADS-431-403A:

DESIRED FREQUENCY	ACTIVE ("HIGH") PINS
96.000 MHz	Pins 15, 33, 14, 32, 31, 30, 11, 29, 8, 7, 5, 23, 4, 22, 21 & 2 (errror < 100 mHz)
160.0 MHz	Pins 34, 15, 32, 13, 30, 11, 28, 9, 26, 7, 24, 5, 22, 3 & 2 (error < 120 mHz)
126.241968 MHz	Pins 34, 33, 12, 30, 10, 9, 27, 26, 7, 25, 6, 5, 23, 4, 22, 3 & 2 (error < 100 mHz)
336.000 MHz	Pins 16, 34, 33, 32, 13, 31, 10, 9, 7, 25, 6, 24, 23, 22, 3 & 21 (error < 10 mHz)

13. WARRANTY

All Meret products are warranted against defects in material and workmanship for a period of one year after initial shipment. Meret will repair or replace any circuit or component that is found to be defective during this period if in Meret's sole opinion the product is deemed defective.

Any modifications or options performed by Meret during the initial one year period shall be included under the initial warranty, and such secondary warranties shall terminate one year after the initial shipment. Shipment of the product to Meret (San Diego, CA) shall be made prepaid and shall not be made without prior authorization by Meret.

This warranty is voided if the product is abused or if unauthorized modifications are made by the user.

This warranty is in lieu of all other warranties, expressed or implied, and no person is authorized to represent or assume for Meret any liability in connection with the sales of our products other than stated within this warranty.

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Serial Number

QC by _____ Date: _____

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