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External Timing of Table Mode on DDS9m and 409B-AC.

AN002

Beginning with Revision 1.3 of the DDS9m firmware, external timing of the Table Mode has been added. Each pair of output values as defined in the DDS9m manual can be stepped either by a new serial command, `'TS'` (Table Step) or via an external control pin. This allows customer provided timing to be independent from the on-board timing, including "single-stepping" of table values.

To use this feature, table values are stored as defined in the manual, except all dwell times are set to `'ff'`, which forces the table to stop at that pair. There are then two ways to move to the next table pair:

1) via serial port: `TS` ;jumps to the next table pair

2) negative edge on Pin 10 of P1.

Pin 10 of P1 is a 3V CMOS compatible signal. This pin is pulled-up on board by a 3.3kΩ resistor to 3.3V. Only the negative edge will trigger the next output. Edges occurring sooner than approximately 100µs will be ignored. There is no upper limit on the timing. Detection of this negative edge is affected by the current state of the processing.

The last table pair in the record must be set to dwell times of `'00'`, to signal the end of the record. At this point the table will return to the beginning of the record. This last record will be output for 100µs.

Should your system require a "handshake" signal, the IOUD (I/O update) signal on pin 14 of P1 can be used. The positive edge of this signal indicates an update of the internal DDS generator. The latency from this edge to an output is less than 100ns. This signal is 3V CMOS compatible.

This example starts with 10MHz, zero phase and full scale amplitude, steps to 5MHz, zero phase, half scale amplitude and then repeats:

```
m 0
t0 0000 05f5e100,0000,03ff,ff
t1 0000 05f5e100,0000,03ff,ff
t0 0001 02faf080,0000,0200,ff
t1 0001 02faf080,0000,0200,ff
t0 0002 02faf080,0000,0200,00
t1 0002 02faf080,0000,0200,00
m t
ts
ts
```

The last record, with `'00'` for dwell is executed for 100µs before returning to the first record. Each `'ts'` moves to the next record point from the last executed record with an `'ff'` as a dwell time.

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External Synchronization

Beginning with Rev 1.9 of the DDS9m firmware, a special command has been added to allow pin 14 to be used to synchronize the frequency updates in the external table mode. This is also available as a modified version of the Model 409B table-top synthesizer. This is the Model 409B-AC, which supplies two SMA connectors on the rear panel for IOUD and TS.

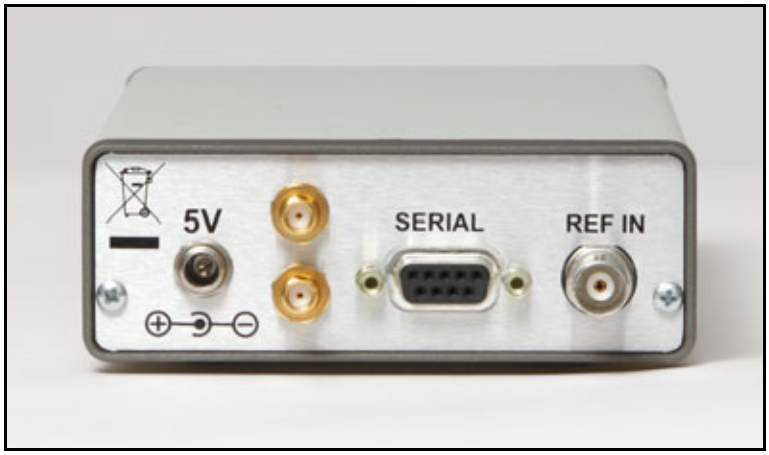
When TS or a negative edge on pin 10 is used, the granularity of the processing speed causes a timing jitter on the actual presentation of the new output. Pin 14 (IOUD connector on the 490B-AC), normally used as an output to synchronize external hardware, is the I/O update signal used internally to trigger a new setting. A new command `"I e"` has been added, which converts this pin to an input with a weak pull-up. This allows customer supplied external hardware to pulse a positive edge to update the output. This is 3.3V logic signal and should not have 5V applied to it.

This pulse must be low for a minimum of 10ns, and pulse high (can remain high) for a minimum of 10ns. The output setting will have a pipeline delay of less than 100ns from this positive edge. Due to on-chip re-timing of this edge, there may be up to ±8ns of ambiguity when using the default internal clock.

This positive edge must be issued after a `"TS"` command or a pin 10 (TS connector on 490B-AC) edge has finished processing, which may be as long as 100µs. Anomalous performance could otherwise result.

Please note that internal to the instrument, this same control signal is used to set the default values upon power up or following a customer reset. If held steady by your logic during initialization, no output will be present until there is a positive edge. It is suggested that this pin be used with an "open-collector" type drive, or tri-stated from your logic, to allow initialization. The state of `"I e"` is stored in EEPROM with the `"S"` command.

This line can also be used without using the table mode. It is especially useful when synchronizing the DDS9m or 409B-AC to an external event or customer supplied hardware. If it is desired that each new output is phase aligned, the `"M a"` command should be used before setting the `"I e"` command.



409B-AC Rear Panel

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