

# NOVATECH INSTRUMENTS, INC.

## Models 2960AR and 2965AR

### Disciplined Rubidium Frequency Standards



The 2960AR and 2965AR Rubidium Frequency Standards provide sinewave outputs of 10MHz and 5MHz, along with a 50MHz synthesized output (2965AR only) in a small bench-top case. 1pps IN and OUT signals are available on the rear panel. Featuring an auto-adaptive 1pps disciplining algorithm, these models provide Stratum 1 performance from long-term stable 1pps sources such as GPS. When not disciplined to 1pps, they provide holdover of better than  $\pm 1\mu\text{s}$  for 24 hours and a long term stability of  $\pm 5 \times 10^{-11}$ . The synthesized output, internally locked to the Rb Oscillator, generates any frequency from 100Hz to 50MHz with a resolution of  $1\mu\text{Hz}$ . Combined with the GPS1 smart antenna, they provide a complete frequency standard for ground stations or the calibration laboratory.

### Specifications:

#### FREQUENCY STABILITY

|   |                           |   |
|---|---------------------------|---|
| Short Term:                                 | $\tau=1\text{s}$          | $<3 \times 10^{-11}$  |
|   | $\tau=10\text{s}$         | $<1 \times 10^{-11}$  |
|   | $\tau=100\text{s}$        | $<3 \times 10^{-12}$  |
| Aging:                                      | Monthly                   | $<\pm 5 \times 10^{-11}$ after 1 month  |
|   | Yearly                    | $<\pm 5 \times 10^{-10}$ after 3 months   |
| Holdover (24 Hours, $\pm 2^\circ\text{C}$ ) |                           | $<\pm 1 \times 10^{-11}$ ( $<\pm 1\mu\text{s}$ after $>10 \times$<br>1pps tracking time constant) |
| Temperature:                                | +5 to $+45^\circ\text{C}$ | $<\pm 1 \times 10^{-10}$  |
| Line Voltage:                               | $\pm 10\%$                | $<\pm 5 \times 10^{-12}$  |

#### FREQUENCY ACCURACY

|              |  |
|--------------|--|
| At shipment: | $<\pm 5 \times 10^{-11}$ at $20^\circ\text{C}$ .   |
| Retrace:     | $<\pm 5 \times 10^{-11}$ from last frequency after 1hr ON<br>and 24hrs OFF (constant environment). |

#### FIXED SINEWAVE OUTPUTS

10MHz and 5MHz,  $1V_{\text{RMS}} \pm 0.25V_{\text{RMS}}$  into  $50\Omega$ . (10MHz, 10MHz and 5MHz for 2960AR)

#### SYNTHESIZED SINEWAVE OUTPUT (2965AR only)

Programmable from 100Hz to 50MHz in  $1\mu\text{Hz}$  steps. Amplitude:  $1V_{\text{RMS}} \pm 0.25V_{\text{RMS}}$  at 5MHz into  $50\Omega$  ( $\pm 3\text{dB}$  from 100Hz to 50MHz, referenced to 10MHz). Phase Noise:  $<-140\text{dBc}$ , 10kHz offset, 1MHz out. Harmonics:  $<-45\text{dBc}$ , spurious:  $<-55\text{dBc}$ .

#### SPECTRAL PURITY (10MHz outputs)

Harmonic  $<-25\text{dBc}$ , Spurious/Non-Harmonic/Sub-Harmonic:  $<-45\text{dBc}$ .

#### PHASE NOISE (Typical, 10MHz output, $50\Omega$ load)

| Frequency Offset | dBc  |
|------------------|------|
| 1Hz              | -70  |
| 10Hz             | -90  |
| 100Hz            | -120 |
| 1kHz             | -140 |
| 10kHz            | -140 |

#### 1pps IN and OUT

1pps IN, DC-coupled, accepts TTL. 1pps OUT TTL,  $133\mu\text{s}$  negative pulse width.

#### ENVIRONMENTAL

Temperature:  $+0^\circ\text{C}$  to  $+50^\circ\text{C}$  operating.

Humidity: 80% to  $31^\circ\text{C}$ , decreasing linearly to 50% at  $40^\circ\text{C}$ .

#### SIZE

6.4cm H, 18.5cm W, 24.1cm L, excluding bail and feet.

#### CONNECTORS

BNCs on front panel for sine outputs. BNCs on rear panel for 1pps I/O. DE9 on rear panel for synthesizer RS232.

#### LINE POWER

$120/240\text{VAC} \pm 10\%$ , 50/60Hz. 30VA (50VA max during warm up  $<20$ minutes).

#### FRONT PANEL INDICATORS

POWER OK: AC power is applied and on.

RUBIDIUM LOCK: Green: Oscillator is locked. Red: Warm-up.

1PPS LOCK: Locked to and tracking a 1pps input.

#### ACCESSORY

GPS1: Matching GPS smart antenna system.

24-Mar-2004



Model 2960AR Disciplined Rb Standard

The Model 2960AR is the same as the 2965AR, except that it deletes the synthesized output and provides three fixed frequency outputs of 10MHz, 10MHz and 5MHz. The 2960AR is the best choice where a synthesized output is not required. The 2960AR and 2965AR share all the other specifications in common.



Model GPS1 Smart Antenna

The Model GPS1 is a complete Smart GPS Antenna which requires no user intervention or setup beyond installation with a clear view of the sky (up to 120 meters from the 2960AR or 2965AR) to provide a stable 1pps to the 2960AR or 2965AR Disciplined Rubidium Standards. The GPS1 automatically self-surveys and switches to an over-determined timing mode. The internal GPS receiver is equipped with TRAIM, so the GPS1 qualifies its received signals, discarding data from noisy or non-functional satellites ensuring a stable 1pps output (typically  $\pm 50$ ns). The 1pps LOCK LED on the 2960AR and the 2965AR is illuminated green when a stable 1pps is available and being tracked. Complete with cables, power supply and interface module.

### 2965AR Synthesizer Serial Commands

| Serial Command        | Function  |
|-----------------------|---|
| F xx . xxxxxxxxxxxxxx | Set Frequency in MHz to nearest 1 $\mu$ Hz. Decimal point required.   |
| E x                   | Serial Echo Control. x=D for Echo <b>D</b> isable, x=E for Echo <b>E</b> nabled. Default is <b>E</b> nabled.  |
| S                     | Save current state into EEPROM and sets valid flag. State saved is used as default upon next power up or reset.   |
| R                     | Reset. This command resets the synthesizer. EEPROM data is preserved and, if valid, it is used upon restart.  |
| C                     | Clear. This command clears the EEPROM valid flag and restores all factory default values (5MHz output).   |
| Qr                    | Query the volatile (RAM) memory storage. These are the values currently output by the synthesizer. These will equal the stored values in the EEPROM after an 'R' or power up only if no changes have been made in the settings. |
| Qe                    | Query the non-volatile memory (EEPROM) storage.   |

#### Available Models:

**2960AR** ..... Disciplined Rubidium Standard, 10MHz, 10MHz and 5MHz.

**2965AR** ..... Disciplined Rubidium Standard, 10MHz, 5MHz, and 50MHz Synthesized, RS232 control.

**GPS1** ..... Smart GPS Antenna, 30M RS422 I/F cable, 1pps BNC cable, power source and interface module.

Consult Novatech Instruments, Inc. for other available options.