

# GAHM

## Ground Active Hydrogen MASER



### HIGH PERFORMANCE & ROBUST PRODUCT

- High-performance frequency stability atomic clock from 1 second to 1 day
- 100% Designed and Manufactured in-house
- High-level operational sites : extreme environmental sites, high level of maintainability
- 40 years of experience with near-to 200 units deployed and maintained on 6 continents
- Designed for a LifeTime over 20 years
- Maintenance-free package offers

### KEY FEATURES

- Frequency Stability @ 1s :  $9E-14$  / @1d :  $<1.5E-15$
- Phase noise @1Hz :  $<-130$  dBc/Hz (5 MHz)
- Cavity technology for high gain performance
- Teflon & bulb coating technology over 20 years lifetime
- Low Sensitivity technology for higher stability performance :  $<1E-15/^{\circ}C$
- Warranty : 2 years
- Low Magnetic sensitivity: insensitive to fluctuations in the Earth's magnetic field fluctuation
- Catalog of maintenance contracts
- Lifetime : 20 years

### KEY APPLICATIONS

- Space applications - ground segment: VLBI, DeepSpace tracking, SLR/LLR, DORIS
- Precise Time Station/Facility: GNSS, Defense & Industrial autonomous Time Scales
- National Metrology Institute
- R&D Test Facilities
- Quantum applications

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## FREQUENCY STABILITY

| t [s] | ADEV          |         |
|-------|---------------|---------|
|       | Specification | Typical |
| 1     | 1,5E-13       | 9E-14   |
| 10    | 3E-14         | 2E-14   |
| 100   | 1E-14         | 5E-15   |
| 1000  | 3E-15         | 2E-15   |
| 10000 | 2,5E-15       | 1,5E-15 |

## FREQUENCY ACCURACY, CONTROL, DRIFT & SENSITIVITY

| Frequency                     | Standard | Option      |
|-------------------------------|----------|-------------|
| Control - Range               | >±1E-10  |             |
| Control – Resolution          | <1E-16   |             |
| Drift [/day]                  | <2E-15   |             |
| Temperature sensitivity [/°C] | <5E-15   | 1E-15 [HCB] |

## PHASE NOISE

| Offset from carrier [Hz] | Phase Noise [dBc/Hz] |        |         |
|--------------------------|----------------------|--------|---------|
|                          | 5 MHz                | 10 MHz | 100 MHz |
| 1                        | -130                 | -124   | -102    |
| 10                       | -143                 | -137   | -116    |
| 100                      | -152                 | -146   | -126    |
| 1000                     | -152                 | -146   | -145    |
| 10000                    | -152                 | -146   | -155    |

## RF OUTPUTS

| RF outputs            |           |        |         |
|-----------------------|-----------|--------|---------|
| Interfaces            | 5 MHz     | 10 MHz | 100 MHz |
| Standard              | 2         | -      | 2       |
| O2                    |           | 2      |         |
| O4                    |           | 4      |         |
| Signal                |           |        |         |
| Termination [Ω]       | 50        |        |         |
| Level [dBm]           | 12,5 ±1,5 |        |         |
| Spectral purity [dBc] |           |        |         |
| Harmonics : 1st & 2nd | -45       |        |         |
| Spurious Wide-band    | -70       |        |         |

## 1PPS

| 1 PPS             |                        |              |
|-------------------|------------------------|--------------|
| Interfaces        | Output                 | Input (Sync) |
| Standard          | 1                      | 1            |
| PPS2              | 2                      |              |
| PPS4              | 4                      |              |
| Signal            | Output                 | Input (Sync) |
| Termination [Ω]   | 50                     |              |
| Level [V]         | (Option PPS4 >2.5V) 2V |              |
| Pulse width [μs]  | 100                    | >0.1         |
| Rise time [ns]    | <5                     |              |
| Jitter            | <40 ps                 | <1μs         |
| Setting [ns/step] | -                      | 40           |

## POWER SUPPLY

| Power supply            |                 |
|-------------------------|-----------------|
| AC                      |                 |
| 90-250V 50/60 Hz        |                 |
| DC                      |                 |
| 22-30V                  |                 |
| Power consumption       |                 |
| Stand-by mode [W]       | 100             |
| Nominal mode [W]        | 140             |
| Warm-up mode [W]        | 210             |
| Battery Pack            |                 |
| BAT1 : Battery Pack     | 24 V - 12 hours |
| BAT2 : 2x Battery Packs | 24 V - 24 hours |

## PACKAGE

| Package - size & weight  |                             |
|--------------------------|-----------------------------|
| Unit                     |                             |
| W x D x H [cm]           | 60 x 80 x 90                |
| [kg]                     | 144                         |
| HCB option               |                             |
| W x D x H [cm] (chiller) | 85 x 127 x 120 (43x40x27.2) |
| [kg]                     | 166 (31)                    |
| BATx option              |                             |
| W x D x H [cm]           | 27x43x43                    |
| BAT1 [kg]                | 41                          |
| BAT2 [kg]                | 82                          |

## REMOTE

- **Remote Ethernet monitoring:** LAN HTTP, FTP
- **Distance Control service**

## CE MARKING

## WARRANTY, MAINTENANCE & LIFETIME

- **Warranty :** 2 years (start at the end of FAT)
- **Self-diagnostics**
- **Catalog of maintenance contracts :**
  - ✓ **Platinum**
  - ✓ **Gold**
  - ✓ **Silver**
  - ✓ **Bronze**
  - ✓ **Basic Monitoring**
- **Lifetime :** 20 years

## ORDERING INFORMATION

- **Instructions :** GAHM/xx/xx/xx/xx/..
- **OPTIONS :**
  - ✓ **HCB :** active Heater-Cooler Box (climatic chamber)
  - ✓ **O2 :** 2x 10 MHz Outputs
  - ✓ **O4 :** 4x 10 MHz Outputs
  - ✓ **PPS2 :** 2x 1PPS Outputs
  - ✓ **PPS4 :** 4x 1PPS Outputs >2.5V (TTL)
  - ✓ **BATx :** Battery Packs (IATA approved)
    - ✓ **BAT1 :** one Battery Pack
    - ✓ **BAT2 :** Two Battery Packs
  - ✓ **FAT :** Factory Acceptance Test
  - ✓ **DEL :** Delivery according to incoterms 2020
  - ✓ **INS :** on Site Installation
  - ✓ **SAT :** on Site Acceptance Test\*
  - ✓ **TRAx :** Dedicated on Site or remote training
    - ✓ **TRA-B :** Basic training
    - ✓ **TRA-C :** Complete basic training
    - ✓ **TRA-D :** Detailed training
    - ✓ **TRA-E :** Expert training

\*Minimum of one performance equivalence of frequency reference on Site

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