IMS-GNM181

Product Highlights

- 184-channel multi-band, multi-GNSS clock module for optimum reception of GPS, Galileo, BeiDou, and GLONASS satellites
- Available as one-slot or two-slot wide models with support for formatted time string I/O and the Meinberg IMS-XHE^{Rb} Rubidium expansion unit
- Ease of configuration through web interface of base IMS unit
- Compliant with ITU-T G.8272 PRTC-A and PRTC-B specifications

Multi-Band, Multi-GNSS Clock with State-of-the-Art Security

The IMS-GNM181 clock module for Meinberg's IMS family of modular time servers represents the peak of Meinberg's tradition of GNSS-based timekeeping—a robust 184-channel clock module capable of acquiring GPS, Galileo, BeiDou, and GLONASS signals on multiple bands and using these to generate ultra-precise 10 MHz frequency signals, 1PPS clock signals as well as absolute time strings for high-accuracy timekeeping.

The support for all four of the main GNSS constellations and their various frequency bands reduces the effectiveness of GNSS spoofing & jamming attempts by broadening the range of possible operating frequencies and signal types and thus reducing the predictability of the vulnerable frequency.

* Models described as "two slots wide" or "two slots tall" in this data sheet only use two 'slots' of chassis space by virtue of their higher profile resulting from the size of the components on the printed circuit board and/or the need to accommodate more connectors. The faceplate of such high-profile modules is therefore two slots in width/height, which can prevent the use of adjacent interfaces in M500 and M1000(S) systems. Such modules do not require two physical interfaces in your IMS system.

Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9
31812 Bad Pyrmont

sales@meinberg.de
www.meinbergglobal.com

Phone: +49 5281 9309-0

Basic Specifications

Receiver Type	184-channel multi-band, multi-GNSS receiver
Compatible Antennas	Meinberg Multi-Band GNSS Antenna (recommended for best performance and full feature set) The PCTEL Multi-GNSS Antenna (available from Meinberg) also offers very limited compatibility (support limited to GPS L1, Galileo E1, BeiDou B1I, GLONASS L1OF bands)

Oscillator Options

The IMS-GNM181 is shipped as standard with a "**OCXO SQ**" type oscillator (oven-controlled crystal oscillator), which provides excellent holdover performance if your IMS system loses synchronization with its upstream references for any reason. The IMS-GNM181 may also be shipped on request with a more powerful holdover solution; the options available and their performance metrics are listed below:

Type	Short-Term Stability (τ = 1 second)	Holdover Temperature Drift	Holdover Performance (1 Day)[1]	Holdover Performance (1 Year)[1]
OCXO SQ	5×10^{-9}	$\pm 1 \times 10^{-7}$ (–10 to 70 °C)	± 220 µs	± 4.7 s
OCXO MQ	2×10^{-10}	$\pm 5 \times 10^{-8}$ (–20 to 70 °C)	± 65 µs	± 1.6 s
OCXO HQ	5×10^{-12}	$\pm 1 \times 10^{-8}$ (5 to 70 °C)	± 22 µs	± 788 ms
OCXO DHQ[2]	2×10^{-12}	$\pm 2 \times 10^{-10}$ (5 to 70 °C)	± 4.5 µs	± 158 ms
XHE^{Rb} Rubidium	2×10^{-11}	$\pm 6 \times 10^{-10}$ (–25 to 70 °C)	± 800 ns	± 8 ms

1 Full holdover performance requires the system to have been synchronized for 24 hours previously.

2 IMS-GNM181 modules with OCXO DHQ oscillators are only available in two-slot wide models due to the size of the oscillator.

Accessories Included

- A Meinberg Multi-Band GNSS Antenna for outdoor installation, a mounting kit containing all the accessories required to mount the antenna on a pole or wall, and a 20 m (65.6 ft) Belden H155 coaxial cable with pre-fitted connectors as standard*.
- XHE-SPI cable for connection with an external XHE^{Rb} Rubidium expansion unit (only with models featuring XHE-SPI connectivity).
- Optional: MBG-S-PRO surge protector for in-line installation between the antenna and your IMS-GNM181 module.

* Meinberg also offers customized antenna cables to accommodate your specific installation requirements. Please reach out to your Meinberg Sales Representative for more information

GNSS Signal Support

The IMS-GNM181 allows simultaneous reception of signals from the GNSS services listed below.

GPS	L1 C/A code signal (GPS L1 band, 1575.42 MHz) (CDMA) L2C code signal (GPS L2 band, 1227.60 MHz) (CDMA)
QZSS	L1 C/A code signal (GPS L1 band, 1575.42 MHz) (CDMA) L2C signal (GPS L2 band, 1227.60 MHz) (CDMA)
Galileo	E1 OS B/C (1575.42 MHz, CDMA) E5b (1207.14 MHz, CDMA) E6-B/C (1278.75 MHz, CDMA)
BeiDou	B1I (1561.098 MHz, CDMA) B2I (1207.14 MHz, CDMA)
GLONASS	L1OF (1602 MHz + *k**562.5 kHz) (FDMA) L2OF (1246 MHz + *k**437.5 kHz) (FDMA) *k* represents the channel (between -7 and +6) within the corresponding GLONASS frequency band

MRS Synchronization Options

The MRS (Multi-Reference Source) functionality of the IMS-GNM181 allows the clock to be synchronized not only on the basis of a GNSS reference (GPS, Galileo, BeiDou, or GLONASS) but also alternatively or redundantly by any of the following reference sources:

Source	Synchronization Types	Additional Input Module Required
External NTP server	Time of day only	None[1]
External PTP master	Time of day, phase, frequency	IMS-HPS100 module
Synchronous Ethernet	Frequency only	IMS-HPS100 module
Pulse-per-second + time string (models with COM port only)	Time of day, phase	None
External frequency signal	Frequency only	Any IMS module with a frequency input (e.g., IMS-ESI, IMS-MRI); supported frequencies dependent on module
Black burst with VITC[2] (Pro AV/Broadcasting)	Time of day, phase, frequency	IMS-VSI module
Black burst without VITC (Pro AV/Broadcasting)	Frequency only	IMS-VSI module
LTC[2] (Pro AV/Broadcasting)	Time of day, phase	IMS-VSI module
DARS/word clock (Pro AV/Broadcasting)	Frequency only	IMS-VSI module
Framed E1 bitstream (2048 kbps) (Telecom)	Frequency only	IMS-ESI module
IMS-XHE^{Rb} rubidium clock (models with IMS-XHE^{Rb} port only)	Frequency only	None

1 IMS-LNE module may be necessary for additional network connectivity.

2 Time-of-day synchronization requires SMPTE 309, SMPTE 309 MJD, or ITU-R BR.1353 VITC. Standard SMPTE 12M time code is not suitable for time-of-day synchronization.

Integrated Resilience & Security Mechanisms

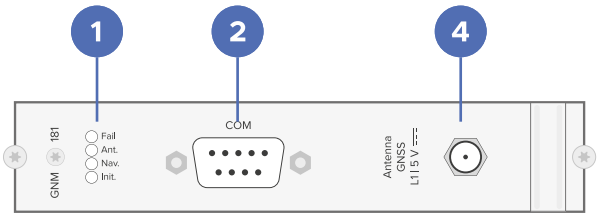
The IMS-GNM181 module is specifically engineered for use in mission-critical applications and therefore places considerable focus on protecting your timing & synchronization infrastructure by mitigating the risks of a variety of security threats, including jamming, spoofing, and electrical sabotage:

Intelligent Reference Selection Algorithm (IRSA)	The unique IRSA functionality—a part of Meinberg's bespoke LANTIME OS operating system—continuously reviews all configured reference sources to verify their plausibility against trusted sources and automatically disregards specific sources if there are indications that the incoming feed has been manipulated. For example, a GNSS signal might be compared against a rubidium clock to identify suspicious timing changes in the satellite signal, and if an alarm is raised, the IMS-GNM181 switches to the next configured source.
Multi-band navigation message reception	The IMS-GNM181 supports a wide variety of GNSS services from all four constallations on a wide range of frequency bands. The diversity of frequency bands and signal modulation techniques impedes jamming and spoofing efforts due to the need for the adversary to know which frequency bands are being used, which navigation message format is being used, and which modulation technique is being used. Only the server operator can definitively know which signals are being used at any given time, and so 'insider knowledge' or wideband jamming is required to disrupt the signal.

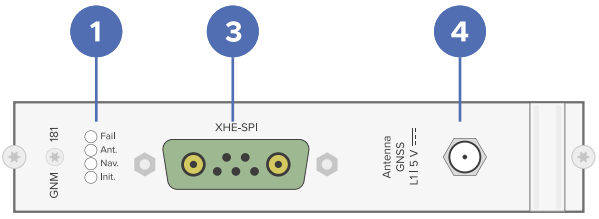
Connectors and Variants

The IMS-GNM181 models featuring a COM port allow the clock to output time strings and also to receive time strings for synchronization with an external time string source.

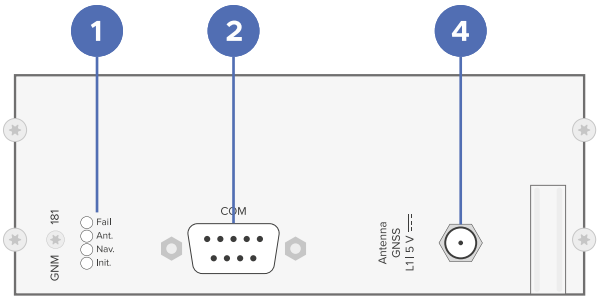
The models featuring an IMS-XHE^{Rb} port allow the clock to be synchronized via an external Meinberg IMS-XHE^{Rb} Rubidium clock for high accuracy in holdover conditions.



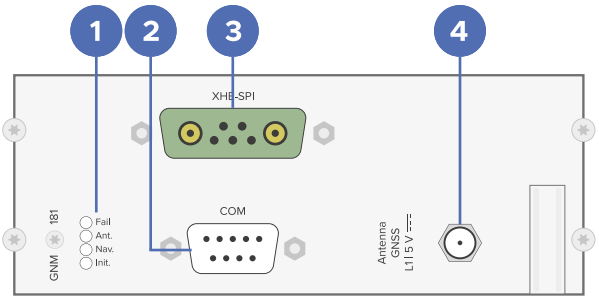
One-slot COM Port Model



One-slot IMS-XHE^{Rb} Connector Model



Two-slot COM Port Model (OCXO DHQ)



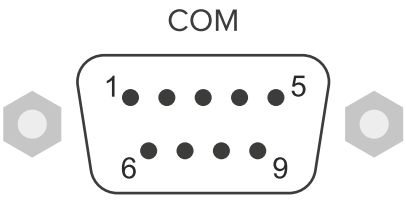
Two-slot IMS-XHE^{Rb} Connector and COM Model

1 LED Status Indicators

"Fail" LED System Status	"Ant." LED Reference Signal Status	"Nav." LED Geolocation Status	"Init." LED Initialization Status
Indicates that the clock is running in free-run mode off the onboard oscillator	Indicates whether the antenna is correctly connected and functional and whether a signal has been received	Indicates whether the GNM181 module has been able to complete geolocation by locating at least four satellites	Indicates initialization by the on-board firmware and the host operating system and the warm-up state of the onboard oscillator

2 RS-232 COM Serial Time String Output

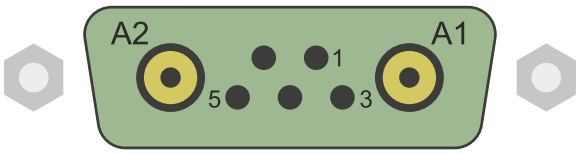
Pin	Function
1	PPS In
2	RxD (Receive)
3	TxD (Transmit)
5	GND (Ground)



Connector Type	D-Sub 9-pin Male
Supported Time Strings	Meinberg Standard *(Default)*, Meinberg Capture, Meinberg GPS, SAT, NMEA RMC, NMEA GGA, NMEA ZDA, NMEA RMC GGA *(RMC followed by GGA),* NMEA GGA ZDA *(GGA followed by ZDA),* Uni Erlangen, Computime, Sysplex 1, SPA, RACAL, ION, ION Blanked, IRIG-J-1, 6021, Freelance
Baud Rates	300, 600, 1200, 2400, 4800, 9600, 19200 *(Default)*
Framing Options	7N2, 7E1, 7E2, 8N1 (Default), 8N2, 8E1, 7O1, 7O2, 8O1, 8E2

3 XHE-SPI Connector

Pin	Function
A1	PPS In
A2	PPS Out
1	SCL_Out (SPI Clock)
2	CS (Chip Select)
3	MOSI (Master Out, Slave In)
4	MISO (Master In, Slave Out)
5	Ground (GND)



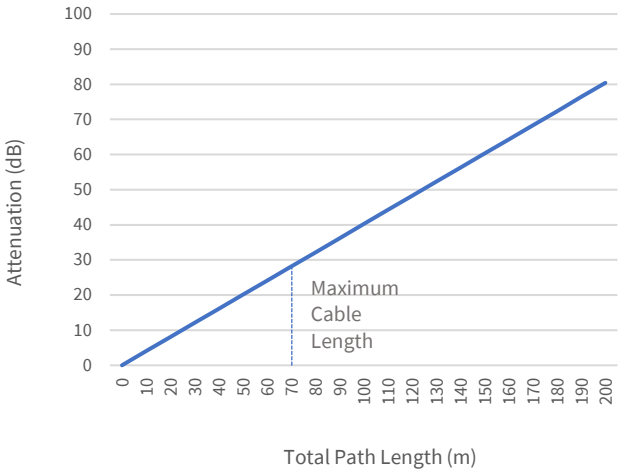
Connector Type	XHE-SPI Female (for connection of external Meinberg IMS-XHE^{Rb} Rubidium expansion unit)

4 GNSS Antenna Input

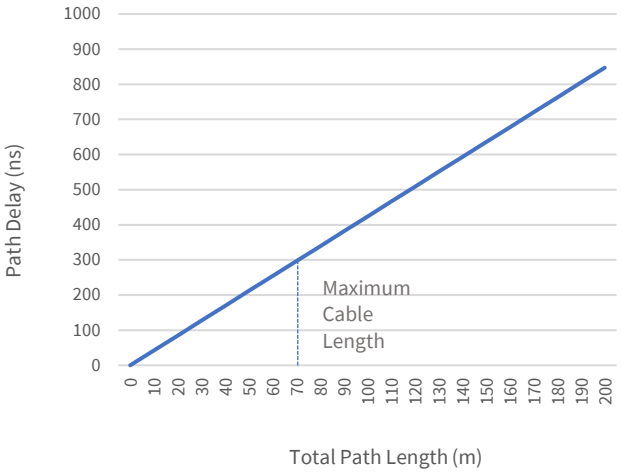
Connector Type	Subminiature Type-A (SMA) connector for coaxial cable
Power Supply	5 V, 100 mA to antenna via antenna cable
Supported Cable Length	Max. 70 m (Belden H155) Max. 150 m (H2010 Ultraflex)

Coaxial Cable Options: Signal Transmission Performance

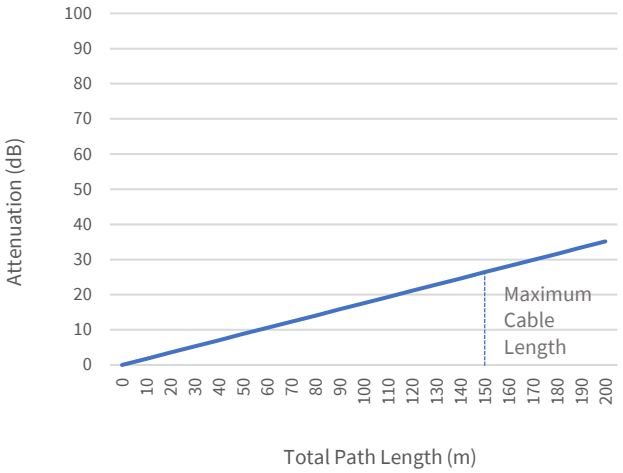
Signal Attenuation: Belden H155 Cable at 1575 MHz*



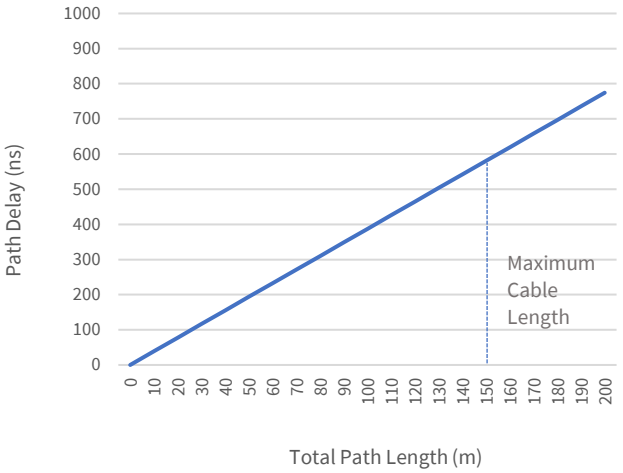
Signal Path Delay: Belden H155 Cable at 1575 MHz*



Signal Attenuation: H2010 Ultraflex Cable at 1575 MHz*



Signal Path Delay: H2010 Ultraflex Cable at 1575 MHz*



* **Test conditions**: Propagation time and signal attenuation measured on 50 m of Belden H155 and 150 m of H2010 Ultraflex coaxial cable. Graph calculated based on the known assumptions that (a) if cable specifications and frequency are constant, path attenuation has a linear relationship to path length and (b) if cable specifications are constant, path delay has a linear relationship to path length.

1575 MHz was selected as the representative frequency due to its use as the widely used GPS L1 and Galileo E1 bands. When using lower-frequency bands such as GPS L5 or Galileo E6, signal attenuation will be accordingly lower, allowing for longer cables.

IMS System Bus Connector Specifications

Connector Type	96-pin IEC 60603-2 (DIN 41612) connector IMS clock pin layout standard

Pin No.	Row A	Row B	Row C
1	V_{cc} in (+5V)	V_{cc} in (+5V)	V_{cc} in (+5V)
2	V_{cc} in (+12V)	V_{cc} in (+12V)	V_{cc} in (+12V)
3	V_{DD} in (TCXO/OCXO)	V_{DD} in (TCXO/OCXO)	V_{DD} in (TCXO/OCXO)
4	Reserved (FreqAdjust Out)	PPS IMS Out	Prog. Pulse 3 Out
5	Fixed Frequency Out	GND	10 MHz IMS In
6	PPS IMS In	Custom	PPS Out
7	DCLS Time Code IMS In	GND	PPS 2 In
8	External Clock In / PPS XHE In	Not connected	PPM Out
9	10 MHz Sine Out	Not connected	PPS XHE Out
10	100 kHz TTL out	Custom	Prog. Pulse 0 Out
11	1 MHz TTL out	Custom	Prog. Pulse 1 Out
12	10 MHz TTL out	Not connected	Prog. Pulse 2 Out
13	DCLS Time Code Out	Not connected	Not connected
14	AM Time Code Out	GND	COM4 RxD In
15	COM2 RxD In	Not connected	Custom
16	COM2 TxD Out	Not connected	Custom
17	COM3 RxD In	Not connected	DCF77 Mark Out
18	COM3 TxD Out	Not connected	Reserved
19	GND	Not connected	Timesync Out
20	GND	GND	Custom
21	GND	Not connected	Freq. Synth TTL Out
22	GND	GND	Freq. Synth OD Out
23	GND	Not connected	Freq. Synth Sine Out
24	GND	Not connected	COM1 TxD Out
25	GND	Slot ID 0	COM4 TxD Out
26	GND	Slot ID 1	COM0 TxD Out
27	GND	Slot ID 2	CAP1 In
28	GND	Slot ID 3	CAP0 In
29	GND	+USB	COM1 RxD In
30	GND	-USB	COM0 RxD In
31	GND	GND	GND
32	GND	GND	GND

IMS System Compatibility

Compatible Base Chassis Types	All IMS LANTIME systems (M500[1], M1000(S)[2], 2000S, M3000(S), M4000)
Compatible Slots	CLK (Clock)
LANTIME OS Requirements	Requires LANTIME OS Version 7.08 for full feature support

1 While the IMS-GNM181 is fully compatible with the IMS LANTIME M500, please note that two slot-wide modules featuring a DHQ oscillator and/or both a COM output and IMS-XHE^{Rb} connector will occupy the space otherwise used for the MRI slot; as such, it will not be possible to insert another module into this MRI slot.

2 While the IMS-GNM181 is fully compatible with the standard IMS LANTIME M1000 and M1000S systems, please note that two slot-tall modules featuring a DHQ oscillator and/or both a COM output and IMS-XHE^{Rb} connector will occupy the space otherwise used for the IO2 slot; as such, it will not be possible to insert another module into this slot. In M1000 models with clock redundancy, the use of a two slot-tall IMS-GNM181 will make it impossible to install a redundant clock module.

Miscellaneous Technical Information

Card Type	Eurocard format
Power Consumption (Typical)	5.5 W to 7.0 W (depending on oscillator option)
Current Draw (Typical)	1.1 A to 1.4 A (depending on oscillator option)
Operating Voltage	5 V
Supported Operating Temp.	0 to 50 °C (32 to 122 °F)
Supported Storage Temp.	-20 to 70 °C (-4 to 158 °F)
Supported Humidity Conditions	Max. 85 % (non-condensing) at 40 °C

Miscellaneous Support & Compliance Information

Technical Support	Free lifetime support via telephone and email, including firmware updates
Warranty	Three-year warranty, extendable upon request
Firmware Updates	Firmware is field-upgradeable; updates can be installed directly from the unit or via a remote network connection. Software updates are provided free of charge for the lifetime of your Meinberg product.
RoHS Compliance	The product is fully RoHS-compliant.
WEEE Status	The purchase of this product is considered to be a “B2B” transaction (non-household product) for the purposes of the European Union Waste of Electrical and Electronic Equipment Directive; the product falls under Category 6, “Small IT and Telecommunications Equipment”. For disposal, it must be returned to the manufacturer to ensure WEEE compliance. Any transportation expenses for returning this product (at end-of-life) must be covered by the end user, while Meinberg will cover the costs for the waste disposal itself.