

**Integrating Digiquartz<sup>®</sup> MET3 and MET3A  
Broadband Meteorological Systems  
with a Javad Navigation Systems (JNS) Receiver**



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“The standard by which other standards are measured”

## **Integrating Digiquartz<sup>®</sup> MET3 and MET3A Broadband Meteorological Systems with a Javad Navigation Systems (JNS) Receiver**

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### **Introduction**

Paroscientific is the leader in the high precision pressure measurement field where high resolution, accuracy, reliability, ruggedness, long-term stability, and low cost of ownership are important requirements. The high performance of Digiquartz<sup>®</sup> Instruments is a result of careful design, meticulous manufacturing, and extensive calibration and testing.

Paroscientific's MET3 and MET3A Broadband Meteorological Measurement Systems were specially designed for GPS-Meteorology and geophysical applications. For both of these applications, an intermediary goal is to calculate the amount of precipitable water vapor (PWV) in the atmosphere either to make very accurate position measurements or to forecast short-term weather very precisely. For these applications, precision, accuracy, reliability, and long-term stability of the MET stations correspond to low total cost of ownership in the long run. The broadband feature of these instruments also enables scientists to measure other atmospheric and geophysical signals with a network of GPS receivers co-located with Digiquartz<sup>®</sup> MET3 and MET3A Meteorological Measurement Systems.

Since surface pressure and temperature measurements are important parameters for PWV calculations, the data reliability and integrity from the MET stations are of paramount importance.

The MET3 and MET3A precision measurement instruments provide high accuracy data from barometric pressure, temperature, and relative humidity sensors. Pressure resolution is better than 1 microbar with a total accuracy of 0.08 hPa over the extended barometric range of 620 to 1100 hPa. Temperature resolution is 0.01 degree C. The fan-aspirated MET3A has a total temperature accuracy of 0.1 degree C over the full temperature range of -50 to +60 degrees C. Relative humidity performance is better than 2% at 25 degrees C, and humidity recovery time for the MET3A after 100% water saturation is less than 2 minutes.

These fully integrated systems are housed in environmental enclosures allowing stand-alone, indoor or outdoor mounting. Installation hardware and software are included, and optional interface cabling is available for easy system integration. The MET3 radiation shield protects the temperature and humidity sensors from precipitation and solar radiation. The MET3A utilizes a high performance, tuned barometric pressure port to reduce dynamic pressure errors caused by wind.

Microprocessor-based electronics provide fully temperature compensated and linearized outputs via a two-way RS-232 interface. The serial interface allows complete remote configuration and control of all operating parameters including resolution, sample rates, choice of engineering units, integration time, and sampling commands. Individual measurement parameters or a "unified" data word with all sensor outputs are easily interfaced with computer systems, GPS receivers, and data loggers.

The purpose of this document is to provide integration and diagnostics information, additional to the MET3 and MET3A Installation, Operation and Maintenance Guides to facilitate the integration of a MET station with a Javad Navigation Systems (JNS) Receiver. Once the MET stations are set up properly in the field, these instruments are designed to work under rugged environmental conditions for years without problems. The operating principle of a MET station with a GPS receiver is simple and relies on a few critical parameters. This technical paper elaborates on these critical parameters and provides a technical recipe to integrate a Javad Navigation Systems (JNS) Receiver with a MET station.

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## Operating Principle of MET Stations

MET stations include the world's most accurate, stable, and reliable **Digiquartz® Barometers**, packaged with a precision temperature and humidity probe. Integral electronics and packaging make installation and communication with these instruments an easy task.

In order for a MET station to work with a GPS receiver, regardless of the GPS receiver manufacturer, the following conditions must be met.

### 1. The MET instrument must be powered up.

MET stations are powered via pin 9 of its RS-232 connector. Please check the operating manual of your receiver to review if your receiver is capable of providing power to MET stations. If your GPS receiver is not capable of providing a voltage output of +7 to +16 VDC through pin 9 of its RS-232 connector, please contact Paroscientific Sales and Application engineers to get the power breakout/ supply kit (Part Number 1727-00X, X=1 for 110 VAC, for 220 VAC X=2). You may order this kit during your purchase of the MET station as well.

Note: MET stations shipped after ~8/02 have Power & Status LED's, which indicate the instrument is powered up and/or transmitting/receiving data.

### 2. The MET station must be set to transmit pressure data in units of "bar" (UN=3).

The MET stations only respond to a GPS receiver when the pressure unit is set to "bar". Broadband MET3 and MET3A Meteorological Measurement Systems' pressure units are set to "bar" in the factory before shipment. This corresponds to UN parameter (set to) 3 in the configuration. If your instrument is set to a different pressure unit, you can use the Digiquartz® Interactive (DQI) software (provided with the MET station) to change the pressure unit as explained in the following section of this document. To download the most recent version of the DQI software, please visit <http://www.paroscientific.com>.

### 3. Correct cable type between the GPS receiver and MET station must be used.

Paroscientific provides (optionally available) GPS to MET interface cables. This cable connects the MET station directly to the GPS, or to another GPS interface cable provided by the GPS receiver manufacturer. If you are using a custom made cable or don't have the right GPS cable to interface with the MET cable, you may experience communication problems. If you are using a custom-made MET cable, please check MET manual to see the pin connections.

### 4. The GPS receiver must be configured to send a P9 command to the MET station.

Once the GPS receiver and MET station is connected and powered up, the MET station is ready to respond to a P9 command issued from the GPS receiver. The GPS receiver must be configured to send a P9 command to the MET station. The MET station returns the pressure, temperature and humidity in standard NMEA<sup>1</sup> format.

Please refer to the operating manual of your GPS receiver to configure your receiver to issue a P9 command every time position data is acquired. The P9 command must be in the following format.

**\*(Two-digit address of the MET Station)00P9 <cr><lf>**

In this format, (Two-digit address of the MET Station) corresponds to the address of your MET station. By default, it is "01". If you changed this address, please use the correct address in the format above. If you did not change the address of the MET station, \*0100P9<cr><lf> command should be issued by the GPS

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<sup>1</sup> The NMEA 0183 (National Marine Electronics Association) Standard for Interfacing Marine Electronics Devices is a voluntary industry standard, first released in March of 1983. The NMEA has become a standard protocol for interfacing navigational devices such as GPS and DGPS receivers. It defines electrical signal requirements, data transmission protocol, timing and specific sentence formats.

receiver to get a response from the MET station. The <cr> and <lf> correspond to carriage return (Character 13) and line feed (Character 11).

The MET station P9 command only works with a single device. It will not work in an RS-232 loop.

A typical response to a P9 command is as below.

\$WIXDR,P,<Pres Value>,B,<SN>,C,<Temp value>,C,<SN>,H,<Hum value>,P,<SN><CR><LF>

└──────────┬──────────┬──────────┘  
          Pressure      Temperature      Humidity

Transducer	Field	Units
Pressure	P	B=Bar
Temperature	C	C=Celsius
HumidityH	P=Percent	

<SN> = Transducer Serial Number (Typically - DQ#####)

This response will be parsed out by your GPS receiver and stored in RINEX format in your GPS receiver.

## Integration Procedure

Plug the interface cable into Serial C (Port) of the receiver using an appropriate DB-9 null modem/gender changer and the standard JNS serial cable. Unless a special JNS cable is used, the user must supply power using Paroscientific's power adapter module.

- Turn on the receiver.
- Run PCView and connect to the receiver.
- Go to menu File and select Manual mode.
- Send the command: set,dev/ser/c/rate,9600 to set the baud rate of serial port C.
- Send the command: set,dev/ser/c/ewrap,on.
- Send the command: set,dev/ser/c/imode,echo.
- Send the command: set,dev/ser/c/echo,/cur/log. (That command assumes that you are logging to data recording memory; if logging using PCView to serial port A then send the command: set,dev/ser/c/echo,/dev/ser/a instead).
- Send the command: set em,dev/ser/c/misc/MET3:600 to request data from the MET3 every 600 seconds (10 minutes). Other values can be specified, (the MET3 data will be collected at standardized epochs such as 00:10:00, 00:20:00, etc).
- Start data logging using one of the usual methods (PCView or MidPad).

Settings are retained through power cycles so it is not necessary to send manual commands again (unless you change the device on serial port C). (Commands dm,dev/ser/c/misc/MET3 and set,dev/ser/c/echo,/dev/null can be used to turn off the data acquisition).

**NOTE:** A temporary program which creates a RINEX MET file from a .jns file is available from DougHo@niceties.com . The Teqc program from UNAVCO is expected to support creating RINEX MET file from a .jns file in future release after mid-2003.

For more information or technical support on JNS receivers, visit <http://www.javad.com>.

## Technical Support

After performing your bench top test, if you are still having problems, please contact Paroscientific's Application Support Engineers either at (425) 883-8700 or send a description of your problem including the serial number of your instrument via e-mail to [support@paroscientific.com](mailto:support@paroscientific.com).