



## DG16 and DG14 Sensors

### ADVANCED, HIGH-PRECISION GPS TECHNOLOGY FOR HIGH-DEMAND APPLICATIONS

The DG16™ from Thales is a low cost, new generation, sub-meter GPS+Beacon+SBAS receiver. DG16 is the perfect solution for high-end integration. In addition to 12 GPS L1 Code and carrier channels, it incorporates free of charge signals from Satellite Based Augmentation Systems (SBAS), such as WAAS, EGNOS & MSAS, and an embedded dual-channel DGPS beacon receiver to provide sub-meter differential positioning — the two SBAS channels can be configured as two additional GPS channels offering a total of 14 GPS channels.

DG16 can provide up to 20 Hz precise three-dimensional position and raw data for real-time guidance and navigation. DG16 can also output SBAS ranging, ephemeris and differential corrections as well as beacon corrections through the serial port. While DG16 offers three standard RS232 ports, it is capable of single port operation; one serial port can do it all. In addition, DG16 comes standard with User Defined Messages (UDM) software, a feature that enables the user to create custom messages.

DG16 has better signal tracking and offers Edge™ and Strobe Correlator™ technologies for multipath mitigation and better accuracy in shady environment. DG16 incorporates Receiver Autonomous Integrity Monitoring (RAIM) that allows the receiver to detect and correct errors in the satellite signals. In addition, the DG16 features Horizontal Protection Level (HPL) output for aviation applications such as Automatic Dependent Surveillance Broadcast (ADS-B) stations. It also features improved in-band and out-of-band interference rejection capabilities. For best performance, DG16 can be configured to use a Kalman filter with adaptive dynamic mode or user can select dynamic modes such as walking, ship, aircraft, etc. to match the operating conditions.

#### WADGPS PROCESSING WITH [M] OPTION

The DG16 WADGPS algorithm has been developed by Thales to provide a position solution using corrections coming from a network of up to 24 base stations. The DG16 WADGPS algorithm has been extensively tested in operational conditions in various



environments: North-Sea, Equatorial region and Southern Hemisphere, and has shown excellent results over medium (1500 km) network, even during ionospherically active days.

#### INTEGRATED DIFFERENTIAL OPTIMIZATION (IDO)

With the IDO, you can choose either a single or multiple sources of corrections from up to seven sources/channels of corrections (serial port, SBAS, and beacon). Sources are selected in order of preference through a Primary-Secondary scenario mode or combined using a Multi-Base processing, automatically or manually.

#### MULTIPATH MITIGATION

Multipath is the single largest cause of differential GPS position errors. The Strobe Correlator (patent pending) is a digital signal processing technique implemented in the hardware and software of the DG16 and DG14™ receivers that removes multipath errors almost entirely for reflected signals with delays of 37 m or more. This represents the best DGPS multipath mitigation available today in GPS receivers and means improved accuracy and greater reliability.

# DG16 AND DG14 SENSORS

## COMPATIBILITY

DG16 and DG14 from Thales are backward compatible with G12 in both hardware and software. They both have the same RF connector and the same 25-pin I/O connector location and pin-out as the G12. They also use the same standard Thales serial interface; allowing for easy and smooth upgrades. In addition, the DG16 and DG14 receivers consume less power than their predecessor, the G12™ receiver, and can be programmed for low power/sleep mode operation.

## DG14 RECEIVER

The DG14 from Thales is a 14-Channel receiver with 12 GPS L1 Code and carrier channels and 2 SBAS channels. While the DG14 is identical to the DG16 in performance, it does not have an on-board beacon receiver. All Other features are common to both DG16 and DG14 receiver.

## TECHNICAL SPECIFICATIONS

### Real-Time Position Accuracy<sup>1</sup>

#### Autonomous

CEP: 3.0 m (9.843 ft)  
95%: 5.0 m (16.4 ft)

#### Differential<sup>2</sup>

##### Local Base Station

CEP: 40 cm (1.31 ft)  
95%: 90 cm (2.95 ft)

##### Beacon

CEP: 70 cm (2.30 ft)  
95%: 1.6 m (5.25 ft)

##### SBAS

CEP: 1.0 m (3.28 ft)  
95%: 3.0 m (9.84 ft)

### Velocity Accuracy<sup>1</sup> (knots)

0.1 (95%)

### Time To First Fix<sup>1</sup>

Re-acquisition	3 sec
Hot start	11 sec
Warm start	35 sec
Cold start	90 sec

## DG16/DG14 Features

- 14 Channels
- 12 GPS code and carrier
- 2 SBAS (WAAS/EGNOS/MSAS)
- Standard NMEA-0183 V3.0 output
- Selectable position and raw data rates up to 20 Hz
- Position latency output
- Raw data output (code and carrier)
- 1 PPS (5V TTL)
- Precision: 200 ns (stand-alone)  
50 ns (differential)

- Edge and Strobe Correlator
- Differential base and remote RTCM V2.3, message types 1,2,3,6,9,16,18,19
- 20 g tracking capability
- Kalman filter
- Event marker
- Session programming
- Integrated Differential Optimization™
- Low power sleep mode
- Wide array of coordinate transformation options
- 3 bi-directional RS-232 serial ports, up to 115,000 bps
- External LED drivers
- Multi-base Differential processing with WADGPS (optional)
- User Defined Messages (UDM)
- On-board 2 Channel Beacon Receiver (DG16 only)
- Receiver Autonomous Integrity Monitoring (RAIM)
- Horizontal Protection Level (HPL) Output
- Speed (max)<sup>2</sup>: 514 m/sec (1,000 knots)
- Altitude (max)<sup>2</sup>: 18287 m (60,000 feet)

## Environmental & Physical

- Operating Temp: -30°C to 60°C (-22°F to 140°F)
- Storage Temp: -40°C to 85°C (-40°F to 185°F)
- Power Consumption: 1.3 W (GPS only)  
1.7 W (GPS + Beacon)  
0.3 W (antenna)
- Input Voltage: 9-36 VDC Unregulated
- Size: 95 mm x 42 mm x 168 mm (3.74 in x 1.65 in x 6.62 in)
- Connector: DB-25
- Weight: 540 gr (19 oz)
- Vibration:
  - MILSPEC 810E / Category 10
  - "Minimum Integrity Test - General"
- Shock: ±40 g Operational  
±75 g Non-Operational
- Acceleration: 20 g
- Humidity: 95% non-condensing

## EVALUATION SOFTWARE

Evaluate™ software is available with the DG16 and provides visual displays of satellite information (e.g., SNR), receiver position and velocity as well as data logging and analysis. It also allows direct communication with the receiver. Compatible with all of our receivers, the software runs on Windows® version 3.x Windows 95/98, NT, 2000, and XP platforms.

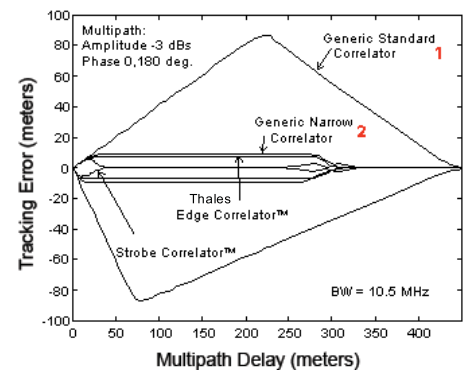
## DG16 DEVELOPMENT KIT

The DG16 Development Kit includes a DG16 GPS receiver, GPS+Beacon antenna, power supply, cables, manuals and the Evaluate and Mission Planning™ Software. The kit is loaded with all the firmware options available.

## Multipath Error Envelopes

1. Generic Standard Correlator Spacing, 1 chip
2. Generic Narrow Correlator Spacing, 0.1 chip

This figure shows the errors induced by a multipath signal half the strength of the direct signal.



The horizontal axis of the plot shows the multipath delay, this is the extra distance that the reflected signal travels compared to the direct signal. The vertical axis shows the induced range error caused by a multipath signal with the indicated delay.

From this plot you can see that typical narrow correlator performance and Edge Correlator performance is similar, while Strobe Correlator performance is much better, almost totally cancelling any multipath with a delay of more than 37 m.

<sup>1</sup> Accuracy and TTFB specifications based on tests conducted in Santa Clara and Moscow. Tests at different locations under different conditions may produce different results. Beacon tests based on 40 km baseline. Position accuracy may degrade with longer baselines.

Position accuracy specifications are for horizontal positioning. Vertical error is typically <2 times horizontal error.

<sup>2</sup> Altitude and speed limitless versions available in HDMA board configuration under validated export license.



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# THALES