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Filter Initialization

Upon start-up or after a filter reset command is issued, the Navigation Filter will require valid initial conditions to be provided before it will run. The running mode of the filter, and the available outputs, depend on the initialization conditions selected to initialize the filter. See **Filter States** for more information regarding initial conditions and filter mode.

Filter initialization is configured through a single command: **Initialization Configuration (0x0D,0x52)** command. The following discussion explains how to use each parameter in this command.

WARNING: In instances where the 3DM-CV7-GNSS/INS may experience large time jumps after the Navigation Filter has been initialized (i.e. acquiring a PPS fix), filter instabilities may occur. It is recommended that a **Reset Navigation Filter (0x0D,0x01)** command is performed if a large system time jump is experienced after filter initialization. To check the PPS status, monitor the **Time Sync Status (0xA0, 0x02)** and verify the Time Sync Boolean is true.

Wait for Run

The user may elect to have the Navigation Filter begin running as soon as the selected initial conditions are available or remain idle until a run command is issued. This option is set through the **Wait For Run Command** parameter.

Initial Condition Source

The initial conditions include an initial attitude (pitch, roll, and heading), initial velocity, and an initial position estimate. The user may elect to have some of these values provided automatically by the 3DM-CV7's on-board sensors, or they may choose to provide some or all of them manually or from external aiding measurements. The sources of these initial conditions – manual

(user supplied) or automatic (from internal measurements) – are set through the **Initial Cond Src** parameter.

Sources for Auto-Initialized Conditions

The following describes the auto-initialization sources for the initial conditions:

Pitch/Roll

If pitch/roll is set to auto-initialize, the 3DM-CV7 will use its own accelerometer measurements for pitch/roll initialization.

Tip: For best performance, initialize pitch and roll while the device is stationary. Linear acceleration will introduce errors into this attitude measurement.

Auto-Heading Alignment Selector

If a user would like to auto-initialize heading, they have two sources. A user can opt to use one source, or two sources through the **Auto Heading Alignment Selector:**. The sources are: GNSS kinematic alignment, and magnetometer alignment. Each auto-heading source is described in more detail in the following section.

Heading

The sources for auto-initialization of heading are:

- **Dual antenna heading:** Heading is initialized from a GPS compass measurement from the dual antenna heading system. This method does not make any assumptions about vehicle dynamics, but does require proper setup and installation of the dual antenna system. See **Installation** for more information.

- **Kinematic alignment**: Heading is initialized from the GNSS velocity vector. Once the vehicle reaches a velocity threshold of 2 m/s, heading is initialized in the direction of travel. This method makes the assumption that the vehicle's direction of travel is in the positive X direction of the vehicle frame, and is **violated by moving in reverse**.Special care must be taken to accelerate in the X direction only until the velocity threshold is reached especially when using this alignment method on vehicles that have the ability to move perpendicular to the vehicle X axis.

- **Magnetometer:** Heading is initialized from a magnetometer measurement. Special care must be taken if this method is to be used. See **Magnetometer Warning** for details.

- **External Heading:** Heading is initialized from an external heading input provided once at least every 5 seconds (preferably more often).

Position/Velocity

If set to auto-initialize, the external GNSS position and velocity is used for initialization.

Manually Initialized Conditions

Manual estimates of the **Initial Heading**, **Initial Pitch**, **Initial Roll**, **Initial Position**, and **Initial Velocity** can be entered in their respective fields in the **Initialization Configuration (0x0D,0x52)** command. If a user is providing manual position/velocity estimates, they need to specify the reference frame in the **Reference Frame Selector**.

NMEA over GPIO Initialization

See **NMEA Input** page for instructions on initialization with NMEA.