4.2.12 External Event Blocks

These blocks report the state of the receiver applicable at the instant of a level transition on one of its “Event” pins. The receiver time is reported in the `ExtEvent` SBF block, and the receiver position is reported in the `ExtEventPVTCartesian` and the `ExtEventPVTGeodetic` blocks.

If enabled, upon detection of an event, these three blocks are output in the following order, with no other SBF blocks in between them:

1. `ExtEvent`;
2. `ExtEventPVTCartesian`;
3. `ExtEventPVTGeodetic`.

All blocks referring to the same event contain the same time stamp in the `TOW` and `WNc` fields.

ExtEvent	Number: 5924 "OnChange" interval: each time an event is detected

The ExtEvent block contains the time tag of a voltage transition on one of the "Event" input pins.

Parameter	Type	Units	Do-Not-Use	Description
Sync1	c1			Block Header, see 4.1.1
Sync2	c1			
CRC	u2			
ID	u2			
Length	u2	1 byte		
TOW	u4	0.001 s	4294967295	External time stamp, see 4.1.3
WNc	u2	1 week	65535	
Source	u1			Input pin where this external event has been detected. The following values are defined: 1: EventA 2: EventB
Polarity	u1			0: rising edge event 1: falling edge event
Offset	f4	1 s		Event time offset with respect to TOW, including the potential delay specified with the **setEventParameters** command. The time of week of the external event is given by: $t_{ext,rx}$ [s] = TOW/1000 + Offset $t_{ext,rx}$ refers to the receiver system time scale. Use the RxClkBias field to convert this time to the GNSS time scale.
RxClkBias	f8	1 s	$-2 \cdot 10^{10}$	Receiver clock bias at the time of event. The clock bias is relative to the time system of the last PVT computation (see the TimeSystem field of the PVTCartesian or PVTGeodetic blocks). To get the time of week of the external event in GNSS time, use: $t_{ext,GNSS}$ [s] = TOW/1000 + Offset - RxClkBias. The accuracy of the clock bias is dependent on the age of the last PVT solution. When the receiver has been unable to compute a PVT during the last 10 minutes, this field is set to its Do-Not-Use value.
PVTAge	u2	1 s		Age of the last PVT solution. If the PVT age is larger than 10 minutes (600s), this value is clipped to 600.
Padding	u1[..]			Padding bytes, see 4.1.5

Rev 1

ExtEventPVTCartesian	Number: 4037 "OnChange" interval: each time an external event is detected

This block contains the position, velocity and time (PVT) solution applicable at the time of an external event, in a Cartesian coordinate system.

This block has the same structure and description as the PVTCartesian block, except that the TOW and WNc fields refer to the time at which the electrical transition on the event pin has been detected (with a millisecond resolution), and that the position is computed at the event time, taking into account a possible user-defined delay set by the **setEventParameters** command.

A user needing the sub-millisecond part of the event time must refer to the Offset field of the corresponding ExtEvent block. The corresponding ExtEvent block is the last of the ExtEvent blocks having been output by the receiver.

Parameter	Type	Units	Do-Not-Use	Description
Sync1	c1			Block Header, see 4.1.1
Sync2	c1			
CRC	u2			
ID	u2			
Length	u2	1 byte		
TOW	u4	0.001 s	4294967295	External time stamp, see 4.1.3
WNc	u2	1 week	65535	
Mode	u1			Bit field indicating the GNSS PVT mode, as follows: Bits 0-3: type of PVT solution: 0: No GNSS PVT available (the Error field indicates the cause of the absence of the PVT solution) 1: Stand-Alone PVT 2: Differential PVT 3: Fixed location 4: RTK with fixed ambiguities 5: RTK with float ambiguities 6: SBAS aided PVT 7: moving-base RTK with fixed ambiguities 8: moving-base RTK with float ambiguities 10: Precise Point Positioning (PPP) 12: Reserved Bits 4-5: Reserved Bit 6: Set if the user has entered the command **setPVTMode,Static,auto** and the receiver is still in the process of determining its fixed position. Bit 7: 2D/3D flag: set in 2D mode (height assumed constant and not computed).
Error	u1			PVT error code. The following values are defined: 0: No Error 1: Not enough measurements 2: Not enough ephemerides available 3: DOP too large (larger than 15) 4: Sum of squared residuals too large 5: No convergence 6: Not enough measurements after outlier rejection 7: Position output prohibited due to export laws 8: Not enough differential corrections available 9: Base station coordinates unavailable 10: Ambiguities not fixed and user requested to only output RTK-fixed positions
X	f8	1 m	$-2 \cdot 10^{10}$	X coordinate in coordinate frame specified by Datum
Y	f8	1 m	$-2 \cdot 10^{10}$	Y coordinate in coordinate frame specified by Datum
Z	f8	1 m	$-2 \cdot 10^{10}$	Z coordinate in coordinate frame specified by Datum
Undulation	f4	1 m	$-2 \cdot 10^{10}$	Geoid undulation. See the **setGeoidUndulation** command.
Vx	f4	1 m / s	$-2 \cdot 10^{10}$	Not applicable
Vy	f4	1 m / s	$-2 \cdot 10^{10}$	Not applicable
Vz	f4	1 m / s	$-2 \cdot 10^{10}$	Not applicable

COG	f4	1 degree	$-2 \cdot 10^{10}$	Course over ground: this is defined as the angle of the vehicle with respect to the local level North, ranging from 0 to 360, and increasing towards east. Set to the Do-Not-Use value when the speed is lower than 0.1m/s.
RxClkBias	f8	1 ms	$-2 \cdot 10^{10}$	Receiver clock bias relative to the GNSS system time reported in the TimeSystem field. Positive when the receiver time is ahead of the system time. To transfer the receiver time to the system time, use: $t_{GPS/GST} = t_{rx}$ - RxClkBias
RxClkDrift	f4	1 ppm	$-2 \cdot 10^{10}$	Receiver clock drift relative to the GNSS system time (relative frequency error). Positive when the receiver clock runs faster than the system time.
TimeSystem	u1		255	Time system of which the offset is provided in this sub-block: 0: GPS time 1: Galileo time 3: GLONASS time 4: BeiDou time 5: QZSS time
Datum	u1		255	This field defines in which datum the coordinates are expressed: 0: WGS84/ITRS 19: Datum equal to that used by the DGNSS/RTK base station 30: ETRS89 (ETRF2000 realization) 31: NAD83(2011), North American Datum (2011) 32: NAD83(PA11), North American Datum, Pacific plate (2011) 33: NAD83(MA11), North American Datum, Marianas plate (2011) 34: GDA94(2010), Geocentric Datum of Australia (2010) 35: GDA2020, Geocentric Datum of Australia 2020 250: First user-defined datum 251: Second user-defined datum
NrSV	u1		255	Total number of satellites used in the PVT computation.
WACorrInfo	u1		0	Bit field providing information about which wide area corrections have been applied: Bit 0: set if orbit and satellite clock correction information is used Bit 1: set if range correction information is used Bit 2: set if ionospheric information is used Bit 3: set if orbit accuracy information is used (UERE/SISA) Bit 4: set if DO229 Precision Approach mode is active Bits 5-7: Reserved
ReferenceID	u2		65535	This field indicates the reference ID of the differential information used. In case of DGPS or RTK operation, this field is to be interpreted as the base station identifier. In SBAS operation, this field is to be interpreted as the PRN of the geostationary satellite used (from 120 to 158). If multiple base stations or multiple geostationary satellites are used the value is set to 65534.
MeanCorrAge	u2	0.01 s	65535	In case of DGPS or RTK, this field is the mean age of the differential corrections. In case of SBAS operation, this field is the mean age of the 'fast corrections' provided by the SBAS satellites.
SignalInfo	u4		0	Bit field indicating the type of GNSS signals having been used in the PVT computations. If a bit *i* is set, the signal type having index *i* has been used. The signal numbers are listed in section 4.1.10. Bit 0 (GPS-C/A) is the LSB of SignalInfo.

	AlertFlag	u1		0	Bit field indicating integrity related information: Bits 0-1: RAIM integrity flag: 0: RAIM not active (integrity not monitored) 1: RAIM integrity test successful 2: RAIM integrity test failed 3: Reserved Bit 2: set if integrity has failed as per Galileo HPCA (HMI Probability Computation Algorithm) Bit 3: set if Galileo ionospheric storm flag is active Bit 4: Reserved Bits 5-7: Reserved
Rev 1	NrBases	u1		0	Number of base stations used in the PVT computation.
Rev 1	PPPInfo	u2	1 s	0	Bit field containing PPP-related information: Bits 0-11: Age of the last seed, in seconds. The age is clipped to 4091s. This field must be ignored when the seed type is 0 (see bits 13-15 below). Bit 12: Reserved Bits 13-15: Type of last seed: 0: Not seeded or not in PPP positioning mode 1: Manual seed 2: Seeded from DGPS 3: Seeded from RTKFixed
Rev 2	Latency	u2	0.0001 s	65535	Time elapsed between the time of applicability of the position fix and the generation of this SBF block by the receiver. This time includes the receiver processing time, but not the communication latency.
Rev 2	HAccuracy	u2	0.01 m	65535	2DRMS horizontal accuracy: twice the root-mean-square of the horizontal distance error. The horizontal distance between the true position and the computed position is expected to be lower than HAccuracy with a probability of at least 95%. The value is clipped to 65534 =655.34m
Rev 2	VAccuracy	u2	0.01 m	65535	2-sigma vertical accuracy. The vertical distance between the true position and the computed position is expected to be lower than VAccuracy with a probability of at least 95%. The value is clipped to 65534 =655.34m.
Rev 2	Misc	u1			Bit field containing miscellaneous flags: Bit 0: In DGNSS or RTK mode, set if the baseline points to the base station ARP. Unset if it points to the antenna phase center, or if unknown. Bit 1: Set if the phase center offset is compensated for at the rover, unset if not or unknown. Bit 2: Proprietary. Bit 3: Proprietary. Bits 4-5: Proprietary. Bits 6-7: Flag indicating whether the marker position reported in this block is also the ARP position (i.e. whether the ARP-to-marker offset provided with the **setAntennaOffset** command is zero or not) 0: Unknown 1: The ARP-to-marker offset is zero 2: The ARP-to-marker offset is not zero
	Padding	u1[..]			Padding bytes, see 4.1.5

ExtEventPVTGeodetic	Number: 4038 "OnChange" interval: each time an external event is detected

This block contains the position, velocity and time (PVT) solution applicable at the time of an external event, in an ellipsoidal coordinate system.

This block has the same structure and description as the PVTGeodetic block, except that the TOW and WNc fields refer to the time at which the electrical transition on the event pin has been detected (with a millisecond resolution), and that the position is computed at the event time, taking into account a possible user-defined delay set by the **setEventParameters** command.

A user needing the sub-millisecond part of the event time must refer to the Offset field of the corresponding ExtEvent block. The corresponding ExtEvent block is the last of the ExtEvent blocks having been output by the receiver.

Parameter	Type	Units	Do-Not-Use	Description
Sync1	c1			Block Header, see 4.1.1
Sync2	c1			
CRC	u2			
ID	u2			
Length	u2	1 byte		
TOW	u4	0.001 s	4294967295	External time stamp, see 4.1.3
WNc	u2	1 week	65535	
Mode	u1			Bit field indicating the GNSS PVT mode, as follows: Bits 0-3: type of PVT solution: 0: No GNSS PVT available (the Error field indicates the cause of the absence of the PVT solution) 1: Stand-Alone PVT 2: Differential PVT 3: Fixed location 4: RTK with fixed ambiguities 5: RTK with float ambiguities 6: SBAS aided PVT 7: moving-base RTK with fixed ambiguities 8: moving-base RTK with float ambiguities 10: Precise Point Positioning (PPP) 12: Reserved Bits 4-5: Reserved Bit 6: Set if the user has entered the command **setPVTMode,Static,auto** and the receiver is still in the process of determining its fixed position. Bit 7: 2D/3D flag: set in 2D mode (height assumed constant and not computed).
Error	u1			PVT error code. The following values are defined: 0: No Error 1: Not enough measurements 2: Not enough ephemerides available 3: DOP too large (larger than 15) 4: Sum of squared residuals too large 5: No convergence 6: Not enough measurements after outlier rejection 7: Position output prohibited due to export laws 8: Not enough differential corrections available 9: Base station coordinates unavailable 10: Ambiguities not fixed and user requested to only output RTK-fixed positions
Latitude	f8	1 rad	$-2\cdot10^{10}$	Latitude, from $-\pi/2$ to $+\pi/2$, positive North of Equator
Longitude	f8	1 rad	$-2\cdot10^{10}$	Longitude, from $-\pi$ to $+\pi$, positive East of Greenwich
Height	f8	1 m	$-2\cdot10^{10}$	Ellipsoidal height (with respect to the ellipsoid specified by Datum)
Undulation	f4	1 m	$-2\cdot10^{10}$	Geoid undulation. See the **setGeoidUndulation** command.
Vn	f4	1 m / s	$-2\cdot10^{10}$	Not applicable
Ve	f4	1 m / s	$-2\cdot10^{10}$	Not applicable
Vu	f4	1 m / s	$-2\cdot10^{10}$	Not applicable

COG	f4	1 degree	$-2 \cdot 10^{10}$	Course over ground: this is defined as the angle of the vehicle with respect to the local level North, ranging from 0 to 360, and increasing towards east. Set to the Do-Not-Use value when the speed is lower than 0.1m/s.
RxClkBias	f8	1 ms	$-2 \cdot 10^{10}$	Receiver clock bias relative to the GNSS system time reported in the TimeSystem field. Positive when the receiver time is ahead of the system time. To transfer the receiver time to the system time, use: $t_{GPS/GST} = t_{rx}$ - RxClkBias
RxClkDrift	f4	1 ppm	$-2 \cdot 10^{10}$	Receiver clock drift relative to the GNSS system time (relative frequency error). Positive when the receiver clock runs faster than the system time.
TimeSystem	u1		255	Time system of which the offset is provided in this sub-block: 0: GPS time 1: Galileo time 3: GLONASS time 4: BeiDou time 5: QZSS time
Datum	u1		255	This field defines in which datum the coordinates are expressed: 0: WGS84/ITRS 19: Datum equal to that used by the DGNSS/RTK base station 30: ETRS89 (ETRF2000 realization) 31: NAD83(2011), North American Datum (2011) 32: NAD83(PA11), North American Datum, Pacific plate (2011) 33: NAD83(MA11), North American Datum, Marianas plate (2011) 34: GDA94(2010), Geocentric Datum of Australia (2010) 35: GDA2020, Geocentric Datum of Australia 2020 250: First user-defined datum 251: Second user-defined datum
NrSV	u1		255	Total number of satellites used in the PVT computation.
WACorrInfo	u1		0	Bit field providing information about which wide area corrections have been applied: Bit 0: set if orbit and satellite clock correction information is used Bit 1: set if range correction information is used Bit 2: set if ionospheric information is used Bit 3: set if orbit accuracy information is used (UERE/SISA) Bit 4: set if DO229 Precision Approach mode is active Bits 5-7: Reserved
ReferenceID	u2		65535	This field indicates the reference ID of the differential information used. In case of DGPS or RTK operation, this field is to be interpreted as the base station identifier. In SBAS operation, this field is to be interpreted as the PRN of the geostationary satellite used (from 120 to 158). If multiple base stations or multiple geostationary satellites are used the value is set to 65534.
MeanCorrAge	u2	0.01 s	65535	In case of DGPS or RTK, this field is the mean age of the differential corrections. In case of SBAS operation, this field is the mean age of the 'fast corrections' provided by the SBAS satellites.
SignalInfo	u4		0	Bit field indicating the type of GNSS signals having been used in the PVT computations. If a bit *i* is set, the signal type having index *i* has been used. The signal numbers are listed in section 4.1.10. Bit 0 (GPS-C/A) is the LSB of SignalInfo.

	AlertFlag	u1		0	Bit field indicating integrity related information: Bits 0-1: RAIM integrity flag: 0: RAIM not active (integrity not monitored) 1: RAIM integrity test successful 2: RAIM integrity test failed 3: Reserved Bit 2: set if integrity has failed as per Galileo HPCA (HMI Probability Computation Algorithm) Bit 3: set if Galileo ionospheric storm flag is active Bit 4: Reserved Bits 5-7: Reserved
Rev 1	NrBases	u1		0	Number of base stations used in the PVT computation.
Rev 1	PPPInfo	u2	1 s	0	Bit field containing PPP-related information: Bits 0-11: Age of the last seed, in seconds. The age is clipped to 4091s. This field must be ignored when the seed type is 0 (see bits 13-15 below). Bit 12: Reserved Bits 13-15: Type of last seed: 0: Not seeded or not in PPP positioning mode 1: Manual seed 2: Seeded from DGPS 3: Seeded from RTKFixed
Rev 2	Latency	u2	0.0001 s	65535	Time elapsed between the time of applicability of the position fix and the generation of this SBF block by the receiver. This time includes the receiver processing time, but not the communication latency.
Rev 2	HAccuracy	u2	0.01 m	65535	2DRMS horizontal accuracy: twice the root-mean-square of the horizontal distance error. The horizontal distance between the true position and the computed position is expected to be lower than HAccuracy with a probability of at least 95%. The value is clipped to 65534 =655.34m
Rev 2	VAccuracy	u2	0.01 m	65535	2-sigma vertical accuracy. The vertical distance between the true position and the computed position is expected to be lower than VAccuracy with a probability of at least 95%. The value is clipped to 65534 =655.34m.
Rev 2	Misc	u1			Bit field containing miscellaneous flags: Bit 0: In DGNSS or RTK mode, set if the baseline points to the base station ARP. Unset if it points to the antenna phase center, or if unknown. Bit 1: Set if the phase center offset is compensated for at the rover, unset if not or unknown. Bit 2: Proprietary. Bit 3: Proprietary. Bits 4-5: Proprietary. Bits 6-7: Flag indicating whether the marker position reported in this block is also the ARP position (i.e. whether the ARP-to-marker offset provided with the **setAntennaOffset** command is zero or not) 0: Unknown 1: The ARP-to-marker offset is zero 2: The ARP-to-marker offset is not zero
	Padding	u1[..]			Padding bytes, see 4.1.5

ExtEventBaseVectGeod	Number: 4217 "OnChange" interval: each time an external event is detected

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Parameter	Type	Units	Do-Not-Use	Description
Sync1	c1			Block Header, see 4.1.1
Sync2	c1			
CRC	u2			
ID	u2			
Length	u2	1 byte		
TOW	u4	0.001 s	4294967295	External time stamp, see 4.1.3
WNc	u2	1 week	65535	
N	u1			Number of baselines for which relative position, velocity and direction are provided in this SBF block, i.e. number of ExtEventVectorInfoGeod sub-blocks. If N is 0, there are no baseline available for this epoch.
SBLength	u1	1 byte		Length of one sub-block
ExtEventVectorInfoGeod	...	...		*A succession of N ExtEventVectorInfoGeod sub-blocks, see definition below*
Padding	u1[..]			Padding bytes, see 4.1.5

`ExtEventVectorInfoGeod` sub-block definition:

Parameter	Type	Units	Do-Not-Use	Description
`NrSV`	u1			Number of satellites for which corrections are available from the base station identified by the `ReferenceID` field.
`Error`	u1			PVT error code. The following values are defined: 0: No Error 1: Not enough measurements 2: Not enough ephemerides available 3: DOP too large (larger than 15) 4: Sum of squared residuals too large 5: No convergence 6: Not enough measurements after outlier rejection 7: Position output prohibited due to export laws 8: Not enough differential corrections available 9: Base station coordinates unavailable 10: Ambiguities not fixed and user requested to only output RTK-fixed positions
`Mode`	u1			Bit field indicating the GNSS PVT mode, as follows: Bits 0-3: type of PVT solution: 0: No GNSS PVT available (the `Error` field indicates the cause of the absence of the PVT solution) 1: Stand-Alone PVT 2: Differential PVT 3: Fixed location 4: RTK with fixed ambiguities 5: RTK with float ambiguities 6: SBAS aided PVT 7: moving-base RTK with fixed ambiguities 8: moving-base RTK with float ambiguities 10: Precise Point Positioning (PPP) 12: Reserved Bits 4-5: Reserved Bit 6: Set if the user has entered the command **`setPVTMode,Static,auto`** and the receiver is still in the process of determining its fixed position. Bit 7: 2D/3D flag: set in 2D mode (height assumed constant and not computed).
`Misc`	u1			Bit field containing miscellaneous flags: Bit 0: Set if the baseline points to the base station ARP. Unset if it points to the antenna phase center, or if unknown. Bit 1: Set if the phase center offset is compensated for at the rover (i.e. the baseline starts from the antenna ARP), unset if not or unknown. Bit 2: Proprietary. Bit 3: Proprietary. Bits 4-5: Proprietary. Bits 6-7: Reserved
`DeltaEast`	f8	1 m	$-2\cdot10^{10}$	East baseline component (from rover to base)
`DeltaNorth`	f8	1 m	$-2\cdot10^{10}$	North baseline component (from rover to base)
`DeltaUp`	f8	1 m	$-2\cdot10^{10}$	Up baseline component (from rover to base)

DeltaVe	f4	1 m / s	$-2 \cdot 10^{10}$	East velocity of base with respect to rover
DeltaVn	f4	1 m / s	$-2 \cdot 10^{10}$	North velocity of base with respect to rover
DeltaVu	f4	1 m / s	$-2 \cdot 10^{10}$	Up velocity of base with respect to rover
Azimuth	u2	0.01 degrees	65535	Azimuth of the base station (from 0 to 360°, increasing towards east)
Elevation	i2	0.01 degrees	−32768	Elevation of the base station (from -90° to 90°)
ReferenceID	u2			Base station ID
CorrAge	u2	0.01 s	65535	Age of the oldest differential correction used for this baseline computation.
SignalInfo	u4		0	Bit field indicating the GNSS signals for which differential corrections are available from the base station identified by ReferenceID. If bit *i* is set, corrections for the signal type having index *i* are available. The signal numbers are listed in section 4.1.10. Bit 0 (GPS-C/A) is the LSB of SignalInfo.
Padding	u1[..]			Padding bytes, see 4.1.5

ExtEventAttEuler	Number: 4237 "OnChange" interval: each time an external event is detected

This block contains the Euler angles (pitch, roll and heading) applicable at the time of an external event.

This block has the same structure and description as the AttEuler block, except that the TOW and WNc fields refer to the time at which the electrical transition on the event pin has been detected (with a millisecond resolution), and that the position is computed at the event time, taking into account a possible user-defined delay set by the **setEventParameters** command.

A user needing the sub-millisecond part of the event time must refer to the Offset field of the corresponding ExtEvent block. The corresponding ExtEvent block is the last of the ExtEvent blocks having been output by the receiver.

Parameter	Type	Units	Do-Not-Use	Description
Sync1	c1			Block Header, see 4.1.1
Sync2	c1			
CRC	u2			
ID	u2			
Length	u2	1 byte		
TOW	u4	0.001 s	4294967295	External time stamp, see 4.1.3
WNc	u2	1 week	65535	
NrSV	u1		255	The average over all antennas of the number of satellites currently included in the attitude calculations.
Error	u1			Bit field providing error information. For each antenna baseline, two bits are used to provide error information: Bits 0-1: Error code for Main-Aux1 baseline: 0: No error 1: Not enough measurements 2: Reserved 3: Reserved Bits 2-3: Error code for Main-Aux2 baseline, same definition as bit 0-1. Bits 4-6: Reserved Bit 7: Set when GNSS-based attitude not requested by user. In that case, the other bits are all zero.
Mode	u2			Attitude mode code: 0: No attitude 1: Heading, pitch (roll = 0), aux antenna positions obtained with float ambiguities 2: Heading, pitch (roll = 0), aux antenna positions obtained with fixed ambiguities 3: Heading, pitch, roll, aux antenna positions obtained with float ambiguities 4: Heading, pitch, roll, aux antenna positions obtained with fixed ambiguities
Reserved	u2			Reserved for future use, to be ignored by decoding software
Heading	f4	1 degree	$-2\cdot10^{10}$	Heading
Pitch	f4	1 degree	$-2\cdot10^{10}$	Pitch
Roll	f4	1 degree	$-2\cdot10^{10}$	Roll
PitchDot	f4	1 degree / s	$-2\cdot10^{10}$	Not applicable

RollDot	f4	1 degree / s	$-2 \cdot 10^{10}$	Not applicable
HeadingDot	f4	1 degree / s	$-2 \cdot 10^{10}$	Not applicable
Padding	u1[..]			Padding bytes, see 4.1.5