

Effective: August 2021
Supersedes:



UTS-ID User Manual

Universal Tilt Sensor for Impact Detection



ENGINEERING YOUR SUCCESS.

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Publication History

The following table provides an overview of the changes made to this document over the course of its publication history

Revision	Description of Change
Rev. 001	First release of this document

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1 Safety


Do not perform the procedures in this manual unless you are experienced in the handling of electronic equipment.


Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.

The term "manufacturer" refers to Parker Hannifin Corporation.

Safety Symbols

The following symbols are used in this document to indicate potentially hazardous situations:


 *Danger! Risk of death or injury.*


 *Warning! Risk of damage to equipment or degradation of signal.*


When you see these symbols, follow the instructions carefully and proceed with caution.


General Safety Regulations

Work on the hydraulics control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine, and its safety regulations.

 Follow the manufacturer's regulations when mounting, modifying, repairing, and maintaining equipment. The manufacturer assumes no responsibility for any accidents caused by incorrectly mounted or incorrectly maintained equipment. The manufacturer assumes no responsibility for the system being incorrectly applied, or the system being programmed in a manner that jeopardizes safety.

 Do not use the product if electronic modules, cabling, or connectors are damaged or if the control system shows error functions.


 Electronic control systems in an inappropriate installation and in combination with strong electromagnetic interference fields can, in extreme cases, cause an unintentional change of speed of the output function

 This product can expose you to chemicals including **ANTIMONY TRIOXIDE, CARBON BLACK (AIRBORNE, UNBOUND PARTICLES OF RESPIRABLE SIZE)** which is known to the State of California to cause cancer and **4,4'-(PROPANE-2,2-DIYL) DIPHENOL, BPA, P,P'-ISOPROPYLIDENEBISPHENOL**, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

Welding After Installation

If welding is required for installation, complete as much as possible of the welding work before the installation of the system. If welding must be done afterwards, proceed as follows:


 Do not place the welding unit cables near the electrical wires of the control system

-  If sensor has been installed and additional welding is required, remove the 4-pin connector from the sensor to avoid possible electrical damage to the unit. Disconnect the electrical connections between the system and external equipment
- Disconnect the negative cable from the battery
- Disconnect the positive cable from the battery
- Connect the welder's ground wire as close as possible to the place of the welding


Construction Regulations

The vehicle must be equipped with an emergency stop which disconnects the supply voltage to the control system's electrical units. The emergency stop must be easily accessible to the operator. If possible, the machine must be built so that the supply voltage to the control system's electrical units is disconnected when the operator leaves the operator's station.

Safety During Installation

 Incorrectly positioned or mounted cabling can be influenced by radio signals, which can interfere with the functions of the system.






Safety During Start-Up

 ***Danger! Risk of death or injury.*** Do not start the machine's engine before the control system is mounted and its electrical functions have been verified.

Do not start the machine if anyone is near the machine.

Safety During Maintenance and Fault Diagnosis

Before performing any work on the hydraulics control electronics, ensure that

-  The machine cannot start moving
-  Functions are positioned safely
-  The machine is turned off
-  The hydraulic system is relieved from any pressure
-  Supply voltage to the control electronics is disconnected

2 Document Introduction

2.1 Scope

The purpose of this document is to detail installation recommendations and define CAN messages for the Universal Tilt Sensor ID (Impact Detection) and its integration with IoT systems. These instructions/guidelines are to be used as a reference tool for the manufacturer's design, production, and service personnel. The user of this manual should have basic knowledge in the handling of electronic equipment.

2.2 Terminology

The abbreviations and acronyms used in this manual are defined in the following table.

Table 2.2.1: Abbreviation List

Abbreviation	Explanation
UTS-ID	Universal Tilt Sensor – Impact Detection
CAN	Controller Area Network
EMI	Electromagnetic Interference
SAE	Society of Automotive Engineers
PGN	Parameter Group Number
MEMS	Micro Electro-Mechanical Systems
FIR	Finite Impulse Response
IIR	Infinite Impulse Response

3 Datasheet

3.1 Characteristics

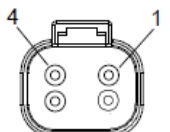
Table 3.1.1: Physical and Electrical Characteristics

General	Purchasing Part Number	167427ECD	
	Weight	0.14 kg	
	Temperature (operating)	-40°C to 85°C	
	Temperature (storage)	-40°C to 105°C	
	Number of axes	3	
	Acceleration Range	±16 g	
	Angular range	±2000 dps	
	Mounting	Tripod	
Mechanical Characteristics	Mounting bolt	1/4"-20 UNC or M6x1.0	
	Mounting torque	135 in-lb max	
	Mounting surface flatness	.010"	
	Connector	Deutsch DT06-4P	
Communication	CAN protocol	SAEJ1939	
	CAN messages	see part drawing	
	CAN bus speed	250 kbps	Default
	Data broadcast rate	0.1 Hz	
	CAN source address	0xE4	
Electrical Specifications	Operating voltage	6.5 - 36 Vdc	
	Reverse polarity	-48 Vdc	
	Short circuit protection	+58 Vdc or ground	
	Current draw	16.5 mA (12 V); 14.0 mA (24 V)	
	Accuracy	±3.15%	
	Resolution	0.488 mG/bit	
Environmental Protection	EMI	ISO 11452-2	100 V/m
		ISO 7637-2 and -3	transients
	ESD	ISO 10605:2008	±15 kV
	Mechanical	Shock	1m drop
		Vibration	40 Gs
	Climate	Sealing	IP68/IP69K (with rear connector protection)
Chemical	Liquids (resistance)	standard automotive	

4 Installation Quick Sheets

4.1 UTS Quicksheet

Connector DT04-4P

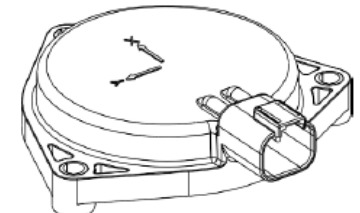


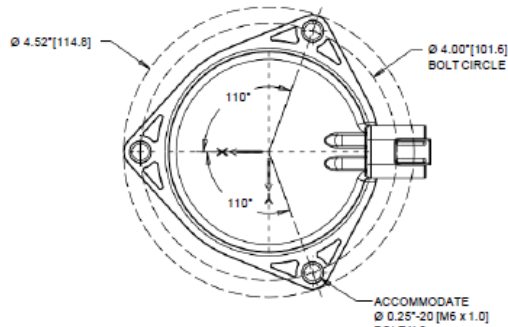
1. + Voltage Supply
2. - Voltage Supply
3. CAN-L
4. CAN-H

Mating connector: DT06-4S
W4S
1062-16-0144

Notes:

1. Recommended mounting bolt diameter 1/4" or M6.
2. Do not exceed specified torque limit, 135 in-lbs [15.3 Nm].





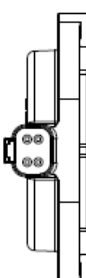
Ø 4.52" [114.8]

Ø 4.00" [101.6] BOLT CIRCLE

110°

110°

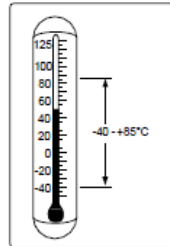
ACCOMMODATE Ø 0.25"-20 [M6 x 1.0] BOLT X 3




NOTICE

Sensor communicates over CAN bus using SAE J1939 protocol.

- CAN bus speed 250 kbps
- CAN source address 0xE4
- Data broadcast rate 0.1 Hz
- Refer to part drawing for CAN message specification



-40 +85°C




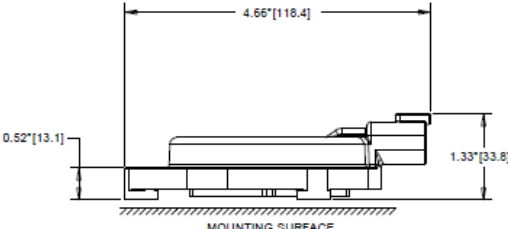
WARNING

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4.66" [118.4]

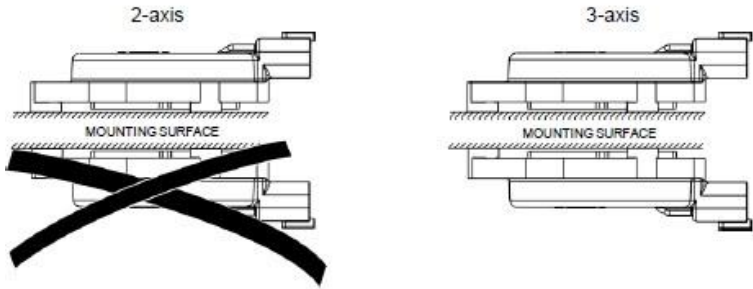
0.52" [13.1]

1.33" [33.8]

MOUNTING SURFACE

Figure 4.1.1: UTS Quick Sheet Page 1

! NOTICE
 Sensor should be mounted on a flat surface (\square . 010" max).
 • 2-axis sensors must be mounted 'right side up'
 • 3-axis sensors may be mounted 'right side up' or 'upside down'



$\pm 90^\circ$ 2 axis sensor outputs at various orientations

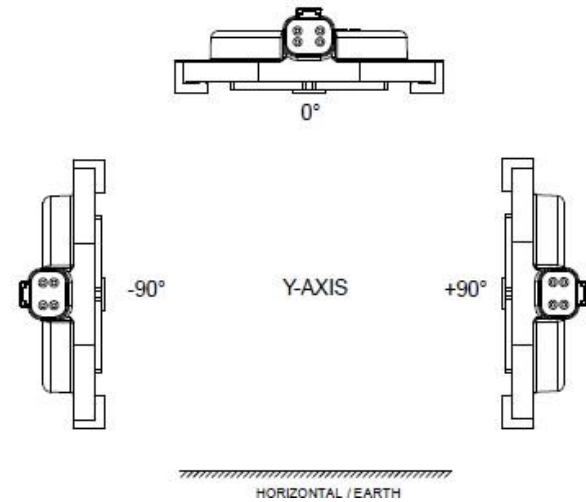
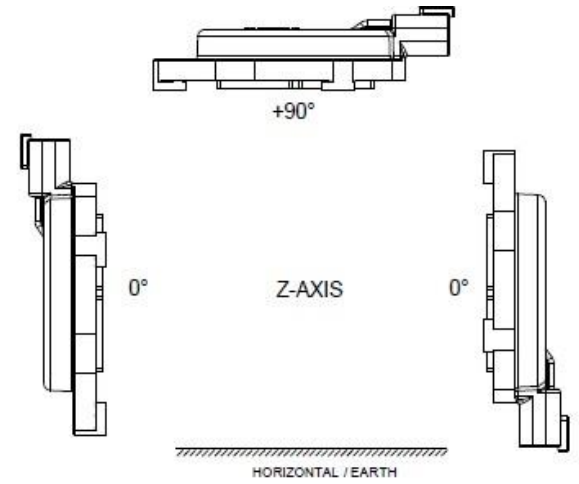
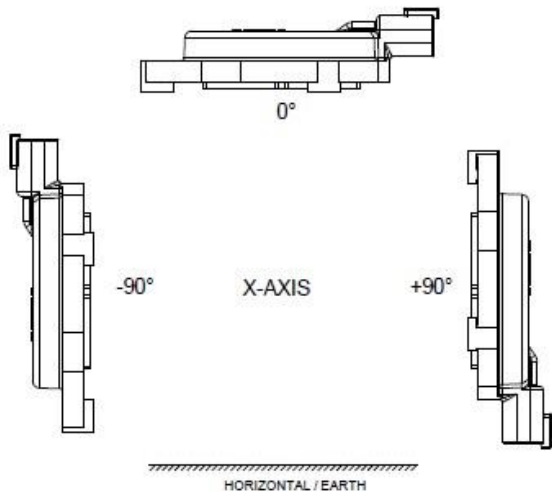


Figure 4.1.2: UTS Quick Sheet Page 2

5 Product Introduction

5.1 Overview

Application

The UTS-ID uses MEMS technology to provide a multi-axis acceleration sensor optimized for mobile hydraulic applications. The UTS-ID accelerometers are used to calculate changes in orientation with respect to gravity to compute and communicate impact events. The sensor communicates over CAN bus using SAE J1939 protocol and has an integral Deutsch connector. UTS-ID is IoT ready and can be integrated with Parker Mobile IoT solutions.

Reliability

The UTS-ID has a glass-filled, hybrid plastic construction for sturdiness and corrosion resistance. The sensor is very robust and able to withstand rugged applications. For moisture protection the enclosure is sealed against harsh environments using spin-weld technology. These features give the sensor IP69k protection for exposed outdoor applications when mounted right side up and an IP68 rating when mounted up-side down. Additionally, the UTS-ID design has a high level of EMI protection.

Installation

The UTS-ID comes standard with 3-axis acceleration detection and advanced algorithm to determine impact events. It has three mounting holes in a tripod pattern to facilitate level installation and a 4-pin sealed Deutsch DT connector type designed for automotive use. These features provide for easy installation and removal, even in field conditions.

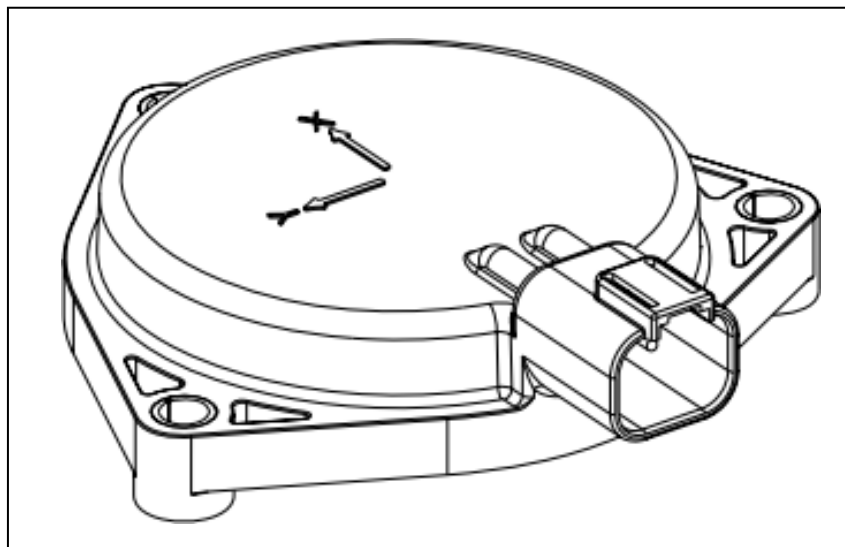


Figure 5.1.1: UTS-ID with Deutsch DT04-4P Connector

5.2 UTS Filtering Description

The UTS-ID has a two stage filtering operation – where the user has some customization opportunity in the second stage.

Stage 1 – Kalman Filter

The first stage, a Kalman Filter, is responsible for tracking the orientation of the sensor by combining the accelerometer and gyro readings. The filter tracks a unit vector that represents gravity, giving the orientation of the sensor in Roll and Pitch. During the update cycle, a prediction of the orientation is made using the previous position and the rotation rate as measured by the gyro. Additionally, the acceleration is measured and used to create a second prediction of the orientation. The two predictions are averaged with a weight given to each prediction based on the following:

- Acceleration variance: Gravity is always 1g in a specific direction. Variance in the acceleration vector represents high rotation or a noisy signal. In either case more weight is given to gyro-based prediction.
- Acceleration not equal to 1g: If the measured value of acceleration is much greater or less than 1g then the system is accelerating and the measurement cannot be used to accurately gauge the orientation. In this case more weight is given to the gyro-based prediction.

Stage 2 – User Configurable Exponential Low Pass Filter

The low pass filter is used to smooth the potentially noisy accelerometer signal and measure a moving average and moving variance. The low pass filter uses an exponential moving average algorithm. Note: Refer to [Section 8.6](#) for examples on how to adjust this filter.

The variance of the filter is used by the Kalman filter while the smoothed average is an input to the impact detection algorithm.

$$y[n] = [1 - e^{-\lambda*dt}] * x(n) + (e^{-\lambda*dt}) * y(n - 1)$$

Lambda (λ) is the customizable parameter (**Low Pass Filter Decay Rate**), 0.01 / bit,

Parameter value = 1000

Realized value = 10.

x(n) is the current input.

y(n) is the current output.

y(n-1) is the previous output.

dt is the time difference between samples – 4.8 ms. (variable is in seconds, so use 0.0048 s for calculations.)

Characteristically, the larger the value of Lambda, the less aggressive the filter. Similarly, the lower value selected for Lambda, the longer it will take to response.

Plotting Stage 2 Filter Responses

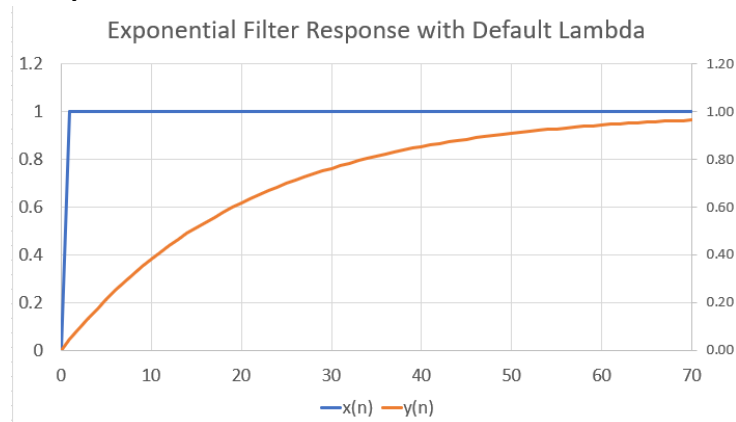


Figure 1: Step Response of Stage 2 IIR Filter with Default Settings

It should be noted that:

The left Y axis label represents the $x(n)$ signal (step function) magnitude.

The right Y axis label represents the $y(n)$ signal response after passing through the filter.

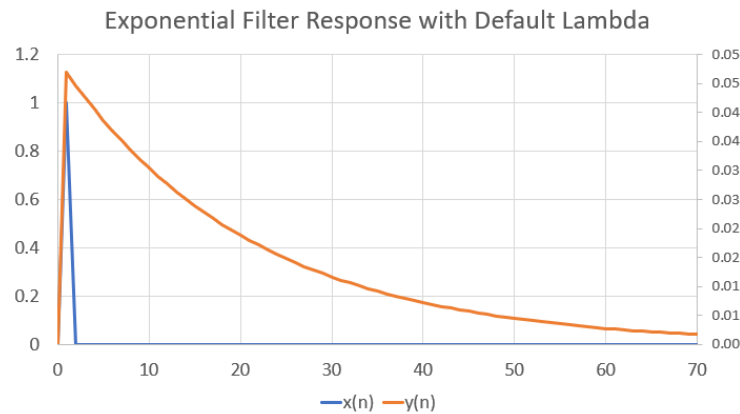


Figure 2: Impulse Response of Stage 2 IIR Filter with Default Settings

It should be noted that:

The left Y axis label represents the $x(n)$ signal (impulse function) magnitude.

The right Y axis label represents the $y(n)$ signal response of $x(n)$ after passing through the filter.

6 Installation Guidelines

6.1 Operating Conditions

The UTS should not be submerged under any liquid without added protection. The operating temperatures for the sensor are -40 to +85°C.

6.2 CAN

The UTS uses CAN messages to report its impact events. All messages are SAE J1939 Proprietary B PGN's except the address claim request and response which are SAE J1939 standards. The UTS is compatible with a 250kbps CAN baud rate, qualifying it as a “High-Speed” CAN sensor. Per ISO 11898-2, the linear bus must be terminated with two 120 Ω resistors at the ends of the transmission lines. Termination resistors are not provided with the system. External CAN termination is required. Be sure to follow SAE J1939 standards when creating the harness that the sensor connects to.

For a list of the default settings of the UTS refer to Table 7.4.1.

6.3 Power Supply Requirements

Table 6.3.1 shows the power supply requirements for the UTS-ID. The UTS-ID operates in 12V or 24V systems and can operate from 6 V to 36 V with a regulated voltage supply.

Table 6.3.1: UTS Power Supply Requirements

Parameter	Value	
Operating Voltage	+6 to +36 Vdc	
Input Current	16.5 mA at 12V typical 14 mA at 24V typical	
Circuit Protection	Reverse Polarity	-48 Vdc
	All Pins - Short to +V _{BAT}	+58 Vdc MAX
	Transients	See ISO 7637-2, -3

6.4 Connector

The UTS uses the Deutsch DT series connector type. Technical details are listed below.

Mating Connector: DT06-4S
W4S
1062-16-0144

Figure 6.4.1: UTS Mating Connector

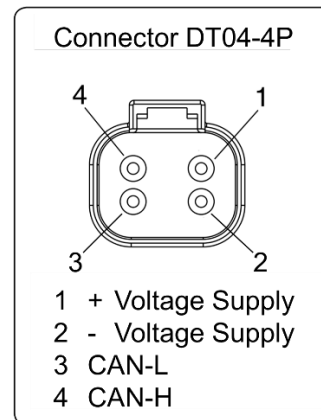


Figure 6.4.2: UTS Connector Diagram

6.5 Mounting Requirements


Mounting Torque


It is important to tighten the mounting fasteners enough to prevent vibration and loosening. Do not exceed 135 in-lbs (15.3 Nm).

 Do not use an impact wrench as this type of device could damage the unit.

Mounting Surface

It is important for the mounting surface to be flat, clean, and clear of any imperfections that may cause false angle readings.

 Do not mount to metal with surface flatness greater than .010" (.254mm).

 Avoid mounting to metal less than 1/8" (3.175mm) thick as this can cause excess vibration.

Mounting Orientation

The sensor output is agnostic to mounting orientation. Mount the sensor with regards to the desired sealing capacity noted in [Section 5.1 – Reliability](#).

7 CAN Information

7.1 SAE J1939

The J1939 standards come from the international Society of Automotive Engineers (SAE) and were developed to provide a standard architecture by which multiple electronic systems on a vehicle can communicate. J1939 has been implemented in a broad range of vehicles and transportation systems and provides a reliable communication protocol over a high-speed CAN network.

The UTS-ID uses this protocol to transmit its condition as a predefined set of outputs. All messages are SAE J1939 Proprietary B PGN's except the address claim request and response.

7.2 Identifier Description

The J1939 protocol uses a 29-bit identifier. The 29-bit identifier is built up as follows:

- Bit 1-8 is Source Address (**SA**)
- Bit 9-24 is Parameter Group Number (**PGN**)
- Bit 25 is Data Page (**DP**)
- Bit 26 is Reserved (**R**)
- Bit 27-29 is Priority (**P**)

Table 7.2.1: J1939 CAN Identifier Structure

29-bit IDENTIFIER																														
Priority		R	DP	Parameter Group Number																Source Address										
				PDU Format								PDU Specific																		
CAN 29 Bit ID Position	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

Each identifier has an associated 8-byte data field. The data field is built up as shown in Table 7.2.2.

Table 7.2.2: The Data Field Structure

DATA FIELD																															
BYTE 1								BYTE 2								BYTE 3-7								BYTE 8							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	...	1	0	7	6	5	4	3	2	1	0			

The Data Field is structured as Little Endian within the bytes, and Big Endian for the Data Field. This is visualized in Table 7.2.2 above.

7.3 UTS Communications

The UTS uses two communication message types: Global and Specific Address.

- **Global Message:** This is the operational “Broadcast mode” message for all the axis accelerometer information on the sensor. In these messages the unit broadcasts the outgoing data (status of each axis) on the J1939 bus.
- **Specific Address Message:** This is the “Service mode” message for the sensor. In these messages the UTS-ID receives write and query messages to its node address from the J1939 bus.

 Ensure there is no loss of power while making programming changes with the UTS.

7.4 Protocol Defaults

The default UTS settings are adjustable. The table below lists the default settings the sensor ships with. Please refer to Section 8 for examples on how to adjust these parameters. Refer to the tables in Section 7.5 for CAN message details

Table 7.4.1: Default Product Messages and Setup

Impact Event Notification						Default Status: Enabled
Default PGN 0xFFAA (65450)		SA 0xE4 (default)	Parameter Group Definition Proprietary B		Default Priority 6	Broadcast Interval On impact (1)
Data Byte	Length	Parameter Name	Format	Resolution	Offset	Description
1	2 bytes	Impact Magnitude	Unsigned 16-bit Int	2.44244e-4 g/bit	0	Maximum Magnitude Detected
3	2 bytes	Direction X (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	Normalized Direction x-axis
5	2 bytes	Direction Y (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	Normalized Direction y-axis
7	2 bytes	Direction Z (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	Normalized Direction z-axis
Debounce Stopped						Default Status: Enabled
Default PGN 0xFFAA (65450)		SA 0xE4 (default)	Parameter Group Definition Proprietary B		Default Priority 6	Default Broadcast Interval 2.000 s after impact event
Data Byte	Length	Parameter Name	Format	Resolution	Offset	Value
1	2 bytes	Impact Magnitude	Unsigned 16-bit Int	3.05180e-5 unit/bit	0	0
3	2 bytes	Direction X (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	0x7FFF
5	2 bytes	Direction Y (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	0x7FFF
7	2 bytes	Direction Z (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	0x7FFF

- 1) Once an impact is detected no further impacts messages will be sent out until the debounce time has passed (2.000 seconds by default).

Table 7.4.2: Data Broadcast Message (Orientation and Acceleration)

Sensor Orientation						Default Status: Enabled
Default PGN 0xFFAB (65451)		SA 0xE4 (default)	Parameter Group Definition Proprietary B		Default Priority 6	Default Broadcast Interval 10.000 s
Data Byte	Length	Parameter Name	Format	Resolution	Offset	Description
1	2 bytes	Direction X (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	Gravity unit vector for the x-axis
3	2 bytes	Direction Y (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	Gravity unit vector for the y-axis
5	2 bytes	Direction Z (Unit Vector)	Unsigned 16-bit Int	3.05180e-5 unit/bit	-1	Gravity unit vector for the z-axis
Net Acceleration						Default Status: Enabled
Default PGN 0xFFAC (65452)		SA 0xE4 (default)	Parameter Group Definition Proprietary B		Default Priority 6	Default Broadcast Interval 10.000 s
Data Byte	Length	Parameter Name	Format	Resolution	Offset	Description
1	2 bytes	Magnitude	Unsigned 16-bit Int	2.44144e-4 g/bit	0	Three axis Magnitude vector
3	2 bytes	Acceleration X	Unsigned 16-bit Int	4.88289e-4 g/bit	-16	Measured x-axis acceleration
5	2 bytes	Acceleration Y	Unsigned 16-bit Int	4.88289e-4 g/bit	-16	Measured y-axis acceleration
7	2 bytes	Acceleration Z	Unsigned 16-bit Int	4.88289e-4 g/bit	-16	Measured z-axis acceleration

Table 7.4.3: SAE J1939 Standard Messages Received by UTS-ID

Request Message (PGN 59904) for Address Claimed (PGN 60928 - AC)					
PGN		PF	PS	SA	Parameter Group Definition
0xEA00 (59904)		234	DA	SA	PDU1 Format
Data Byte	Length	Parameter Name		Format	
1	1 byte	PGN (PS)		0x00	
2	1 byte	PGN (PF)		0xEE PGN 60928 (0x00EE00)	
3	1 byte	PGN (MSB)		0x00	
Commanded Address – CA					
PGN		PF	PS	SA	Parameter Group Definition
0xFED8 (65240)		254	216	SA	PDU2 Format
Data Byte	Length	Parameter Name		Format	
1	8 bytes	NAME		SPN 2849, NAME of component to receive the CA message	
9	1 byte	Address Assignment		SPN 2847, valid range: 0 to 253, new Source Address of the component receiving the CA message	

- 2) The request message may be sent to a specific address (0-253) or the global destination address (255)
- 3) The UTS-ID will respond to a request message for Address Claimed (directed to its Source Address or the global address) with a successful Address Claimed(AC) message before resuming other transmissions; otherwise, the Cannot Claim Address message will be sent and the UTS-ID will remain silent
- 4) The Commanded Address message is sent using the transport protocol BAM
- 5) The UTS-ID will respond to a Commanded Address message containing its NAME with a successful Address Claimed (AC) message before resuming other transmissions; otherwise, the UTS-ID will retain its previous Source Address

Table 7.4.4: SAE J1939 Standard Messages transmitted by UTS-ID

Address Claimed – AC					
PGN		PF	P S	SA	Parameter Group Definition
0xEE00 (60928)		238	25 5	SA	PDU1 Format
Data Byte	Len gth	Parameter Name			Format
1	21 bits	Identity Number			SPN 2837, Manufacturer serial number, set in Group 0 parameter number 18 in Table 5
3.6	11 bits	Manufacturer Code			SPN 2838, 71 – Vansco, cannot be changed
5.1	3 bits	ECU Instance			SPN 2840, set in Group 0, parameter number 19 in Table 7.4.7
5.4	5 bits	Function Instance			SPN 2839, set in Group 0, parameter number 20 in Table 7.4.7
6	1 byt e	Function			SPN 2841, UTS-ID function for industry group and vehicle system set in Group 0 parameter number 21 in Table 7.4.7
7.1	1 bit	Reserved			
7.2	7 bits	Vehicle System			SPN 2842, set in Group 0, parameter number 22 in Table 7.4.7
8.1	4 bits	Vehicle System Instance			SPN 2843, set in Group 0, parameter number 23 in Table 7.4.7
8.5	3 bits	Industry Group			SPN 2846, set in Group 0, parameter number 24 in Table 7.4.7
8.8	1 bit	Arbitrary Address Capable			SPN 2844, 0 – UTS-ID is not set to perform Address Arbitration, cannot be changed

Cannot Claim Address					
PGN		PF	PS	SA	Parameter Group Definition
0xEE00 (60928)		238	255	254	PDU1 Format
Data Byte	Length	Parameter Name		Format	
1	21 bits	Identity Number		SPN 2837, Manufacturer serial number, set in Group 0 parameter number 18 in Table 7.4.7	
3.6	11 bits	Manufacturer Code		SPN 2838, 71 – Vansco, cannot be changed	
5.1	3 bits	ECU Instance		SPN 2840, set in Group 0, parameter number 19 in Table 7.4.7	
5.4	5 bits	Function Instance		SPN 2839, set in Group 0, parameter number 20 in Table 7.4.7	
6	1 byte	Function		SPN 2841, UTS-ID function for industry group and vehicle system set in Group 0 parameter number 21 in Table 7.4.7	
7.1	1 bit	Reserved			
7.2	7 bits	Vehicle System		SPN 2842, set in Group 0, parameter number 22 in Table 7.4.7	
8.1	4 bits	Vehicle System Instance		SPN 2843, set in Group 0, parameter number 23 in Table 7.4.7	
8.5	3 bits	Industry Group		SPN 2846, set in Group 0, parameter number 24 in Table 7.4.7	
8.8	1 bit	Arbitrary Address Capable		SPN 2844, 0 – UTS-ID is not set to perform Address Arbitration, cannot be changed	

- 6) Upon power-up, only the Cannot Claim Address message can be transmitted until an address is successfully claimed with the Address Claimed message
- 7) Transmitted once at startup.
- 8) Transmitted once at boot up and on request.

Table 7.4.5: Configuration Messages (Parameter Change)

Configuration Request Message ⁽¹⁰⁾				
PG N	PF	PS	SA	Parameter Group Definition
0xEF00 (61184)	239	0	SA	PDU2 Format
Data Byte	Length	Parameter Name		Valid Range
1	1 byte	Command Byte		0xC0
2	1 byte	Read or Write		0 = Read, 1 = Write
3	1 byte	Parameter Group Number		0-255
4	1 byte	Parameter ID Number		0-255
5	4 bytes	Parameter Value		32-bits, byte 5 is the LSB, byte 8 is the MSB
Configuration Response Message ⁽¹¹⁾				
PG N	PF	PS	SA	Parameter Group Definition
0xEF00 (61184)	239	0	SA	PDU2 Format
Data Byte	Length	Parameter Name		Format
1	1 byte	Command Byte		0xC0
2	1 byte	Read/write response or invalidrequest		2 = Read response, 3 = Write response, 255 = invalid request
3	1 byte	Parameter Group Number		0-255
4	1 byte	Parameter ID Number		0-255
5	4 bytes	Parameter Value		32-bits, byte 5 is the LSB, byte 8 is the MSB

9) Received by the UTS-ID Application for reading and changing configuration parameters.

10) Transmitted by the UTS-ID Application in response to a read/write request.

11) After receiving a valid read message, the UTS-ID will send a response message with the DestinationAddress (DA) set to the Source Address of the requestor

Example (read Impact Threshold):Requestor (SA = 0xF9):

18EFE4F9 C0 00 02 05 00 00 00 00UTS-ID (SA = 0xE4):

18EFF9E4 C0 02 02 05 07 00 00 00

Table 7.4.6: Configuration Messages (Save)

Save Configuration Changes Message					
P G N		PF		S A	Parameter Group Definition
0xEF00 (61184)		239	0	S A	PDU2 Format
Data Byte	Length	Parameter Name		Format	
1	1 byte	Command Byte		0xC1	
2	7 bytes	Unused Bytes		0xFFFFFFFF	

Table 7.4.7: Configuration Parameter Numbers (Group 0)

General Parameters – Group 0						
Group Number	Parameter Number	UTS-ID Configuration Parameter	R/W Capable	Length	Format	Default
0	00 (0x00)	Revision Number	R	4 bytes	Unsigned Integer	4
0	01 (0x01)	Platform Software Number	R	4 bytes	Unsigned Integer	953610
0	02 (0x02)	Platform Software Version	R	4 bytes	Unsigned Integer	215
0	03 (0x03)	Platform Software Build Number	R	4 bytes	Unsigned Integer	28
0	04 (0x04)	SAP Part Number	R	4 bytes	Unsigned Integer	0xFFFF FFFF
0	05 (0x05)	Serial Number	R	4 bytes	Unsigned Integer	0xFFFF FFFF
0	16 (0x10)	CAN Bit Rate	R/Wm	4 bytes	Unsigned Integer, valid range: [250, 500]	250 kbps
0	17 (0x11)	J1939 Source Address (0xE4)	R/Wm	1 byte	Unsigned integer, valid range: 0 to 253, 254 = NULL, 255 = global	228
0	18 (0x12)	J1939 Manufacturer Code	R/Wm	21 bits	Unsigned Long	0
0	19 (0x13)	J1939 ECU Instance	R/Wm	3 bits	Unsigned Long	0
0	20 (0x14)	J1939 Function Instance	R/Wm	5 bits	Unsigned Long	0
0	21 (0x15)	J1939 Function	R/Wm	8 bits	Unsigned Long	136
0	22 (0x16)	J1939 Vehicle System	R/Wm	7 bits	Unsigned Long	0
0	23 (0x17)	J1939 Vehicle System Instance	R/Wm	4 bits	Unsigned Long	0
0	24 (0x18)	J1939 Industry Group	R/Wm	3 bits	Unsigned Long	3
0	25 (0x19)	J1939 Manufacturer Code	R/Wm	11 bits	Unsigned Long	71
0	32 (0x20)	CANopen Status	R/W	4 bytes	Unsigned Integer, valid range 1 to 3. 1 = J1939 Mode 2 = CANopen Mode 3 = J1939 and CANopen mode	1
0	33 (0x21)	CANopen Node ID	R/W	1 byte	Unsigned Integer	0x0A

- 12)** If the Source Address is changed with a write message, the UTS-ID must respond with a successful Address Claimed (AC) message before resuming other transmissions; otherwise, the Cannot Claim Address message must be sent and the UTS-ID must remain silent
- 13)** The Source Address can only be written in broadcast mode by using the J1939 Commanded Address (CA) message
- 14)** Access levels vary from Read Only (R), Read and Write Once (R/Wo), and Read and Write Many (R/Wm)

Table 7.4.7: Configuration Parameter Numbers (Group 0, continued)

IMU Parameters – Group 0						
Group Number	Parameter Number	UTS-ID Configuration Parameter	R/W Capable	Length	Format	Default
0	48 (0x30)	Sample Rate (1 to 8)	R/Wm	4 bytes	1 = 13 Hz 2 = 26 Hz 3 = 52 Hz 4 = 104 Hz 5 = 208 Hz 6 = 416 Hz 7 = 833 Hz 8 = 1660 Hz (default)	5
0	49 (0x31)	Accelerometer Full Scale (0 to 3)	R/Wm	4 bytes	0 = +/- 2G (default) 1 = +/- 4 G 2 = +/- 8 G 3 = +/- 16 G	0
0	50 (0x32)	Gyro Full Scale (0 to 3)	R/Wm	4 bytes	0 = +/- 250 dps 1 = +/- 500 dps 2 = +/- 1000 dps 3 = +/- 2000 dps	3

Table 7.4.8: Configuration Parameter Numbers (Group 1)

This table has to do with the production process and is purposely left blank.

Production process – Group 1						
Group Number	Parameter Number	UTS-ID Configuration Parameter	R/W Capable	Length	Format	Default
-	-	-	-	-	-	-

Table 7.4.9: Configuration Parameter Numbers (Group 2)

General Parameters – Group 2						
Group Number	Parameter Number	UTS-ID Configuration Parameter	R/W Capable	Length	Format	Default
2	00 (0x00)	Revision	R	4 bytes	Unsigned Long	1
2	01 (0x01)	Calibrated Accel PGN	R/Wm	4 bytes	Unsigned Long	0xFFAC
2	02 (0x02)	Calibrated Accel Transmission Interval	R/Wm	4 bytes	Unsigned Long	10,000,000 (10 s)
2	03 (0x03)	Impact Debounce Time	R/Wm	4 bytes	Unsigned Long	2,000,000 (2 s)
2	04 (0x04)	Event Timeout	R/Wm	4 bytes	Unsigned Long	1,000,000 (1 s)
2	05 (0x05)	Impact Threshold	R/Wm	4 bytes	Unsigned Long	7 (0.1 g/bit)
2	06 (0x06)	Impact PGN	R/Wm	4 bytes	Unsigned Long	0xFFAA
2	07 (0x07)	Low Pass Filter Decay Rate	R/Wm	4 bytes	Unsigned Long	10 (0.01 / bit)
2	08 (0x08)	Orientation PGN	R/Wm	4 bytes	Unsigned Long	0xFFAB
2	09 (0x09)	Orientation Transmission Interval	R/Wm	4 bytes	Unsigned Long	10,000,000 (10 s)
2	10 (0x0A)	Transmit Debounce end	R/Wm	4 bytes	Unsigned Long	1 (TRUE)
2	11 (0x0B)	Variance Threshold	R/Wm	4 bytes	Unsigned Long	70 (0.001 g/bit)
2	12 (0x0C)	Gyros PGN	R/Wm	4 bytes	Unsigned Long	0xFFAD
2	13 (0x0D)	Gyros Transmission Interval	R/Wm	4 bytes	Unsigned Long	0xFFFF FFFF
2	14 (0x0E)	Raw Accel PGN	R/Wm	4 bytes	Unsigned Long	0xFFAE
2	15 (0x0F)	Raw Accel Transmission Interval	R/Wm	4 bytes	Unsigned Long	0xFFFF FFFF

8 Application Examples/How Do I...

8.1 Direct broadcast messages

These messages are directly sent out by the impact sensor in every 10 sec. These images include

Impact messages

The sensor provides the event notification that includes

- Impact magnitude detected
- Direction of the impact (X, Y, Z vector)

The information sent out is: PGN: **0xFFAA (65450)** and the raw data may look like this

PGN	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0xFFAA	90	1E	92	EC	7C	C1	7F	91

Where

Bytes	Raw value	Description	Value	Resolution	Offset	Final Value
1,2	1E90	Impact Magnitude	7824	2.44244e-4 g/bit	0	1.91 g
3,4	EC92	Direction of X (unit vector)	60562	3.05180e-5 unit/bit	-1	0.8482
5,6	C17C	Direction of Y (unit vector)	49532	3.05180e-5 unit/bit	-1	0.5116
7,8	917F	Direction of Z (unit vector)	37247	3.05180e-5 unit/bit	-1	0.1367

Note: It's an impact calculation of: $(x^2+y^2+z^2) = v\text{unit}$

Orientation message

These messages are enabled by default. The sensor provides the orientation that includes

- Direction of orientation (X, Y, Z vector)

The information sent out is: PGN: **0xFFAB (65451)** and the raw data may look like this

The data looks like

PGN	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
0xFFAB	04	82	28	7D	F2	FF

Where

Bytes 1, 2 = 8D 86 = Direction of X (unit vector)

Bytes 3, 4 = E1 80 = Direction of X (unit vector)

Bytes 5, 6 = D3 FF = Direction of X (unit vector)

Bytes	Raw value	Description	Value	Resolution	Offset	Final Value
1,2	8204	Direction of X (unit vector)	33284	3.05180e-5 unit/bit	-1	0.01576
3,4	7D28	Direction of Y (unit vector)	32040	3.05180e-5 unit/bit	-1	-0.022203
5,6	FFF2	Direction of Z (unit vector)	65522	3.05180e-5 unit/bit	-1	0.9996

Net Acceleration message

These messages are enabled by default. The sensor provides the magnitude of acceleration and the direction. It includes

- Magnitude
- Direction of acceleration (X, Y, Z vector)

The information sent out is: **PGN: 0xFFAC (65452)** and the raw data may look like this

The data looks like

PGN	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0xFFAC	47	00	FF	7F	00	80	23	80

Bytes	Raw value	Description	Value	Resolution	Offset	Final Value
1,2	0047	Magnitude	71	2.44144e-4 g/bit	0	0.017334
3,4	7FFF	Acceleration X	32767	4.88289e-4 g/bit	-16	-0.000234
5,6	8000	Acceleration Y	32768	4.88289e-4 g/bit	-16	0.000253
7,8	8023	Acceleration Z	32803	4.88289e-4 g/bit	-16	0.017344

8.2 Configuration messages

Use shall be able to read/write configuration parameters

Here is the sample request (**PGN 0X00EF00 – 61184**) for reading a configuration message

Request:

Configuration Request Message				
PF	PS	SA	Parameter Group Definition	
239	0	SA	18EFSAF9	Sample request to read the first parameter from group '0' table
Parameter Name		Valid Range		
Command Byte		0xC0	1 bit	0xC0
Read or Write		0 = Read, 1 = Write	2 bit	0x00 (Read)
Parameter Group Number		0-255	3 bit	0x00
Parameter ID Number		0-255	4 bit	0x00
Parameter Value		32-bits, byte 5 is the LSB, byte 8 is the MSB	5- 8 bits	0x00 0x00 0x00 0x00

The

expected response as below with a (**PGN 0X00EF00 – 61184**) with the requested parameter

Configuration Response Message					
PGN		PF	PS	SA	Parameter Group Definition
0xEF00 (61184)		239	0	SA	
Data Byte	Length	Parameter Name			Response retrieved from the sensor
1	1 byte	Command Byte			0xC0
2	1 byte	Read/write response or invalid request			0x02 (Read Response)
3	1 byte	Parameter Group Number			0x00
4	1 byte	Parameter ID Number			0x00
5	4 bytes	Parameter Value			0x04 0x00 0x00 0x00 (Returns "Revision Number" from the Group 0 – configuration set)

On demand messages

Users can request a data related to a particular sensor. for example: PGN-60928

Request Message (PGN 59904) for Address Claimed (PGN 60928 - AC)						
PGN		PF	PS	SA	Parameter Group Definition	
0xEA00 (59904)		234	DA	SA	PDU1 Format (Raw message sent)	
Data Byte	Length	Parameter Name			Format	
1	1 byte	PGN (PS)			0x00	
2	1 byte	PGN (PF)			0xEE	PGN 60928 (0x00EE00)
3	1 byte	PGN (MSB)			0x00	

Here is the sample response message received

Address Claimed – AC							
PGN		PF	PS	SA	Parameter Group Definition		
0xEE00 (60928)		238	255	SA	PDU1 Format	Response retrieved from the sensor	
Data Byte	Length	Parameter Name			Format	Raw data received	Value
1	21 bits	Identity Number			SPN 2837, Manufacturer serial number, set in Group 0 parameter number 18 in Table 7.4.7	1 Byte: 0x00	28 (21 bits)
3.6	11 bits	Manufacturer Code			SPN 2838, 71 – Vansco, cannot be changed	2 Byte: 0x00	8 (11 bits)
5.1	3 bits	ECU Instance			SPN 2840, set in Group 0, parameter number 19 in Table 7.4.7	3 Byte: 0xE0	0 (3 bits)
5.4	5 bits	Function Instance			SPN 2839, set in Group 0, parameter number 20 in Table 7.4.7	4 Byte: 0x08	0 (5 bits)
6	1 byte	Function			SPN 2841, UTS-ID function for industry group and vehicle system set in Group 0 parameter number 21 in Table 7.4.7	5 Byte: 0x00	136 (8 bits)
7.1	1 bit	Reserved				6 Byte: 0x88	0 (1 bit)
7.2	7 bits	Vehicle System			SPN 2842, set in Group 0, parameter number 22 in Table 7.4.7	7 Byte: 0x00	0 (7 bits)
8.1	4 bits	Vehicle System Instance			SPN 2843, set in Group 0, parameter number 23 in Table 7.4.7	8 Byte: 0x30	3 (4 bits)
8.5	3 bits	Industry Group			SPN 2846, set in Group 0, parameter number 24 in Table 7.4.7		0 (3 bits)
8.8	1 bit	Arbitrary Address Capable			SPN 2844, 0 – UTS-ID is not set to perform Address Arbitration, cannot be changed		0 (1 bit)

8.3 Transmitting a Command

If the user is broadcasting messages through a tool, then it is possible that the entire 29-bit identifier needs to be set. In a case like this, the typical CAN extended (29-bit) identifier is broken down below

Table 8.1.1: CAN Extended Identifier Example

P/R/DP	PGN	SA
18	EFE4	F9

- **P/R/DP:** Priority, Reserved, Data Page – A value of **18** is typical for a broadcast message.
- **PGN:** Parameter Group Number – This section changes based on the command sent to the sensor.
- **SA:** Source Address – This section, set to **F9**, can be set to anything. F9 was used as it is the SA of the tool used.

Using an Identifier of 18xxxxF9, with the x's replaced by the PGN specified in the examples can be used for the following examples.

8.4 Change the UTS-ID source address

Instructions

1. Write to the Group and ID controlling the source address.
2. Send a "Save Configuration" message.
Done – the device will address claim the new source address and begin using it.

EXAMPLE - CHANGE THE UTS SOURCE ADDRESS FROM 0XE2 TO 0XE3

1. Send ID 0x18EFE2F9, Writing to group 0 and parameter ID 17 –
Data bytes: C0 01 00 11 E3 00 00 00
UTS responds with ID 0x18EFF9E2
Data bytes: C0 03 00 11 FF FF FF FF
2. Send ID 0x18EFE2F9, Send Save config message –
Data bytes: C1 00 00 00 00 00 00 00
UTS responds with ID 0x18EFF9E2 (acknowledge) –
Data bytes: 01 C1 01 00 FF FF FF FF
Address Claim:
18EEFFE3 00 00 E0 08 00 88 00 30
Note: Regular message start broadcasting at this time.

Notes:

- The UTS source address is changed immediately after receiving the save configuration message.
-

8.5 Change the PGN of the Impact PGN

Instructions

1. Write to the Group and ID controlling the PGN of the impact PGN.
 2. Send a “Save Configuration” message.
Done – the device will use the new PGN when an impact is detected.
-

EXAMPLE - CHANGE THE PGN OF THE IMPACT DATA FRAME TO 0xFF05 (UTS-ID SOURCE ADDRESS = 0xE4)

1. Send ID 0x18EFE4F9, Writing to group 2 and parameter ID 6 –
Data bytes: C0 01 02 06 05 FF 00 00
UTS responds with ID 0x18EFF9E4
Data bytes: C0 03 02 06 FF FF FF FF
2. Send ID 0x18EFE4F9, Send Save config message –
Data bytes: C1 00 00 00 00 00 00 00
UTS responds with ID 0x18EFF9E4 (acknowledge) –
Data bytes: 01 C1 01 00 FF FF FF FF

Notes:

- Valid values for the PGN of the output data frame are 0x0000 to 0xFFFF
 - When an impact is triggered the sensor would broadcast a message with the id: 0x18FF05E4
-

8.6 Adjust the internal filtering of the UTS-ID

Process Steps

1. Calculate how aggressive to make the filter.
2. Adjust the parameter to the closest filter setting desired (must be between 0 and 1)
3. Save configuration settings.

EXAMPLE – ADJUSTING EXPONENTIAL DECAY FILTER (UTS SOURCE ADDRESS = 0XE4)

1. Calculate how aggressive to make the filter.
Using the formula from [5.2](#), we can plot the responses of the filter to an impulse response and a step response over a 0.25 second response (52 samples of accelerometer data)

And lets say we have a signal that looks like the following..

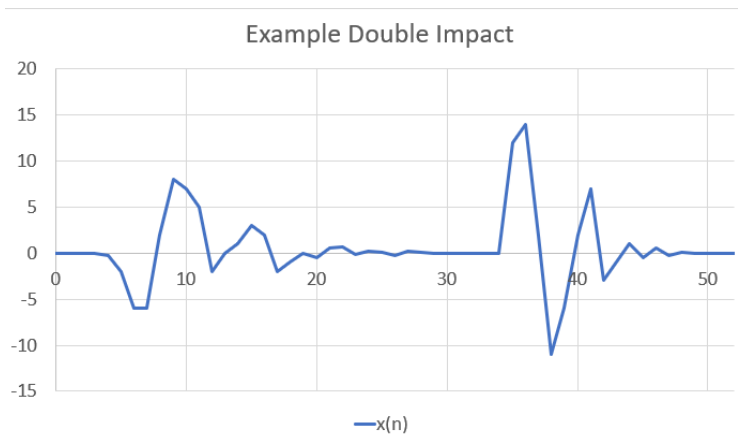


Figure 3: Example Double Impact Example One Axis

The first impact observed in Fig. 3 has a lower peak acceleration and a longer settling time. The second impact observed has a higher peak acceleration detected and a shorter settling time. Lets say we want to have a detection of the second impact but not the first, how do we go about this? First an understanding must be reached about how the parameters impact the detection algorithm.

The developer has the ability to set:

- Debounce time
- Event Timeout
- Low Pass Filter Decay Rate
- The Impact Threshold
- Variance threshold

Visually these features can be represented in Figure 4.



Figure 4: Visualization of Debounce Time

The debounce time is the amount of time that the filter will wait after an initial impact to send a message. In this example, it would be set to 38 ms. This would mean that if the -5 G passed the filter, then it would trigger an impact message and conclusion message. All the residual 'humps' that pass the filter would send notifications. This would be ill advised and is here as an example. The default setting is 2.0 seconds, which would be 416 samples. Four times longer than the X axis shows here.

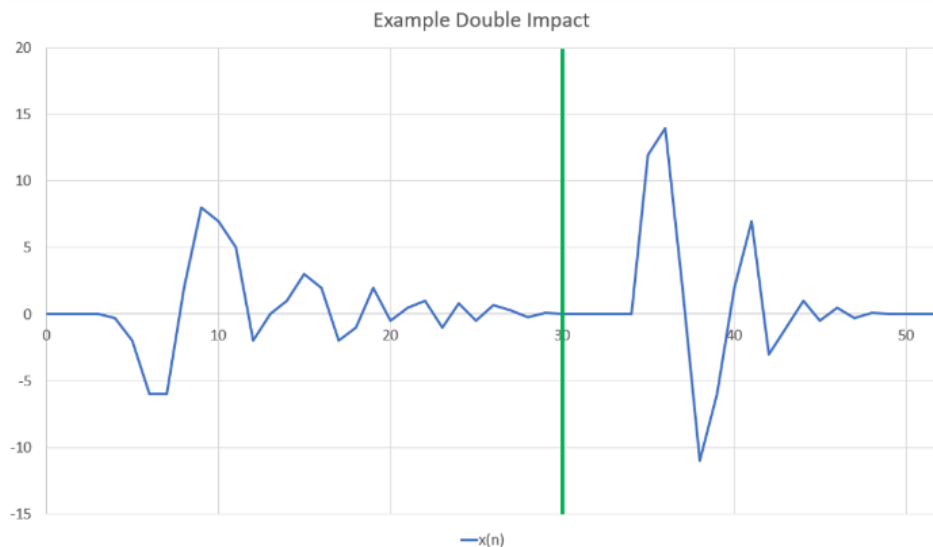


Figure 5: Visualization of Event Timeout

Figure 5 shows an example of what an Event Timeout could be. The Event timeout is the amount of time that the software will wait before it concludes that an impact has occurred. It accumulates the data locally and after the period set in Event Timeout and makes a decision if an impact has been created based on the settings that directly affect the input into the evaluation logic. This will impact the response time of the sensor.

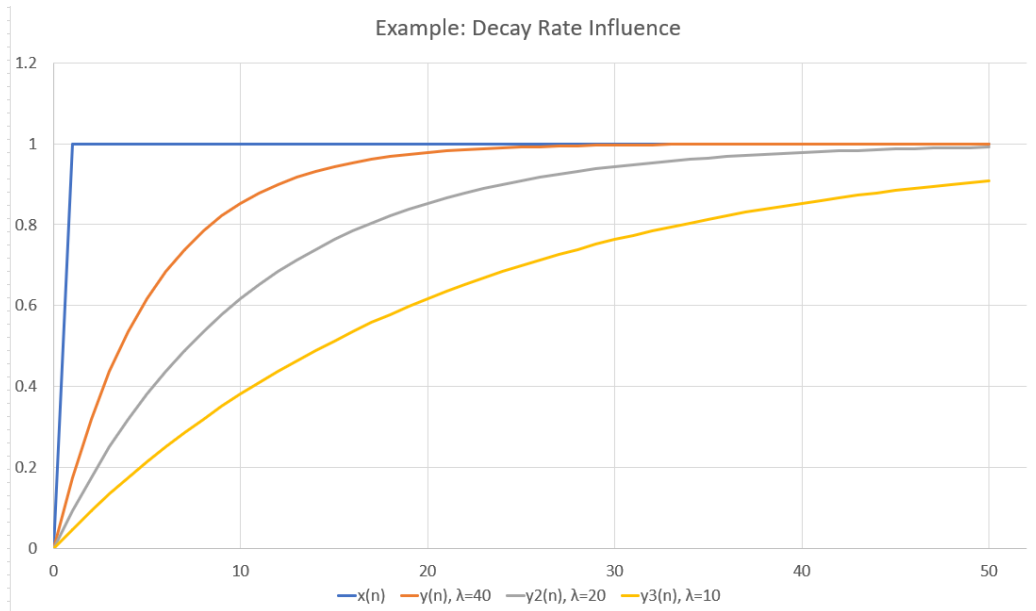


Figure 6: Impact of Lambda on the Decay Rate of the Filter.

Fig. 6 shows an example of what the affect of Lambda is on the exponential moving average IIR filter. Shows are Lambda values of 40, 20, and 10. Note that this is a zoomed in portion of the plot, and this Step function input $x(n)$ is approximatley 0.25 seconds. Having a filter response with these values will make the filter influence weaker – which is desirable for a more rective system.

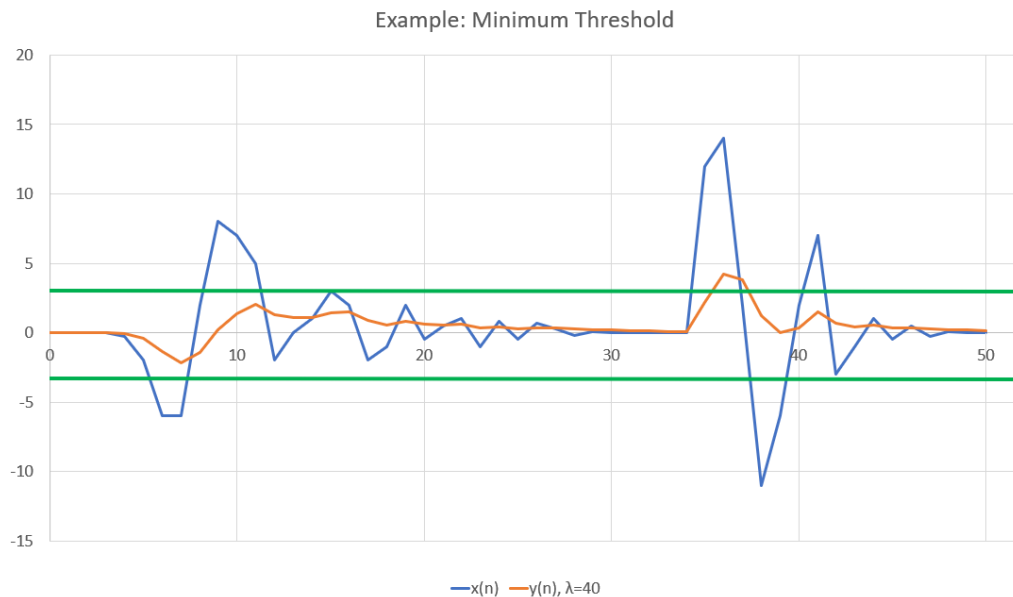


Figure 7: Visualization of Minimum Threshold

Fig. 7 shows what the Impact Threshold does to detect an algorithm. Note that $x(n)$ is the original signal being detected, and $y(n)$ is the filter response inside the UTS-ID. This shows what would be deemed an acceptable filter setting if the minimum threshold was 3 g. As you can see with the Filter decay rate, the first impact would not trigger, but the second impact with the higher magnitude would trigger a response from the sensor.

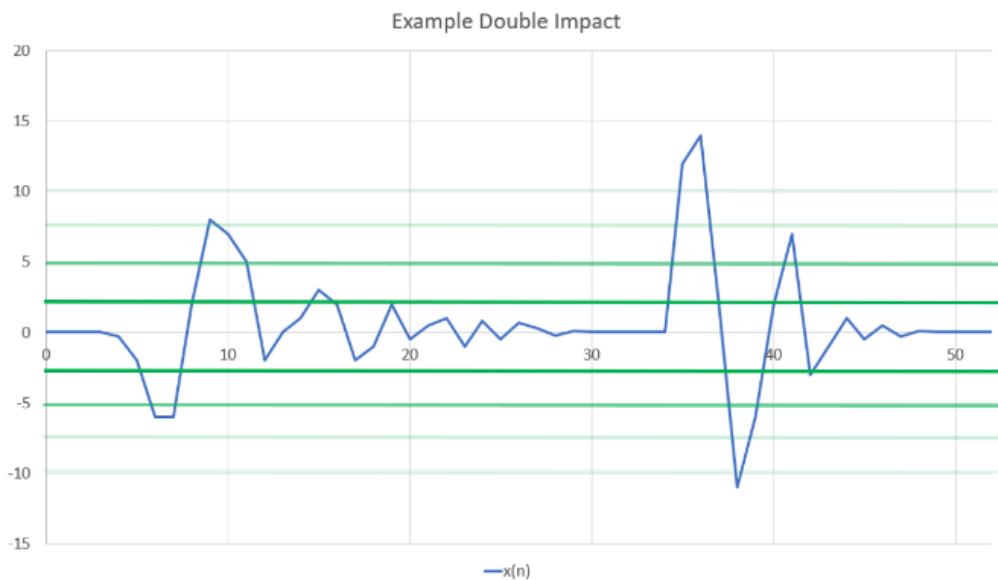


Figure 8: How variance is Visualized

The UTS-ID includes an option to change the tolerable variance of the signal. Variance is different from standard deviation in that Variance is the average of the squared differences from the mean, while standard deviation is the square root of the variance. Visually, the smaller the variance, the closer to 0 you are setting the parameter as what is tolerable. The larger the variance, the larger window. In this case, if the filtered signal exceeds the variance Threshold then it will trigger an event.

So how do we combine all this information? Taking the example signal above I have plotted the input, filtered value, and variance. We can use this information to figure out what we want.

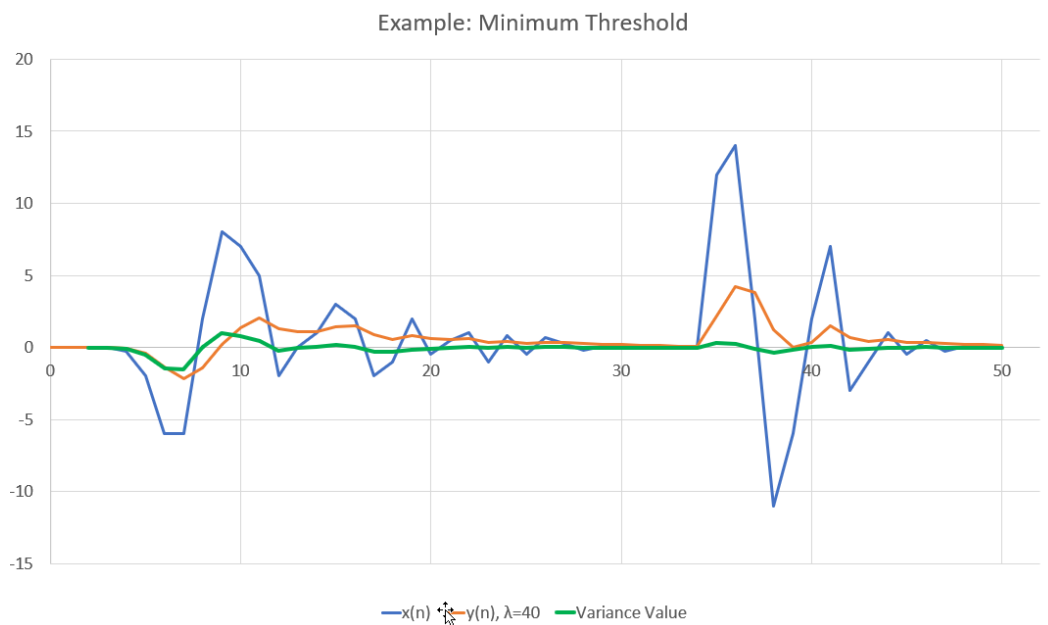


Figure 9: Putting it Together - Filtering with the UTS-ID

Fig. 9 shows a few things; $x(n)$, $y(n)$, and Variance Value (VV). Some of the numbers look like they would be close so the data has been converted to a table as well.

If we want to create a filter that responds to the second impact, but not the first, then we should have the following parameters:

- Debounce time: 2.0 seconds (default, won't affect the initial detection)
- Event Timeout: 1.0 seconds (default, won't affect the initial detection)
- Low Pass Filter Decay Rate: 40 (parameter value, 4000, 0xFA0)
- The Impact Threshold: 3.5 g (parameter value, 35, 0x23)
- Variance threshold: 0.25 g (parameter value, 25, 0x19)

After the table there are examples of how to set these parameters.

Table i: Table of graphic data

Sample	x(n)	y(n), $\lambda=40$	Variance Value
0	0	0.00	0.00
1	0	0.00	0.00
2	0	0.00	0.00
3	0	0.00	0.00
4	-0.3	-0.05	-0.10
5	-2	-0.39	-0.54
6	-6	-1.37	-1.48
7	-6	-2.18	-1.53
8	2	-1.45	0.02
9	8	0.20	0.98
10	7	1.39	0.77
11	5	2.02	0.45
12	-2	1.32	-0.21
13	0	1.09	-0.02
14	1	1.07	0.05
15	3	1.41	0.16
16	2	1.51	0.03
17	-2	0.90	-0.29
18	-1	0.57	-0.32
19	2	0.82	-0.13
20	-0.5	0.59	-0.12
21	0.5	0.57	0.00
22	1	0.65	0.04
23	-1	0.36	-0.05
24	0.8	0.44	0.02
25	-0.5	0.27	-0.03
26	0.7	0.35	0.03
27	0.3	0.34	0.01
28	-0.2	0.24	-0.01
29	0.1	0.22	0.00
30	0	0.18	0.00
31	0	0.15	0.00
32	0	0.12	0.00
33	0	0.10	0.00
34	0	0.08	0.00
35	12	2.17	0.32
36	14	4.23	0.23
37	2	3.84	-0.13
38	-11	1.25	-0.36
39	-6	-0.02	-0.18
40	2	0.34	0.02
41	7	1.50	0.09
42	-3	0.71	-0.13
43	-1	0.41	-0.07
44	1	0.52	-0.03
45	-0.5	0.34	-0.06
46	0.5	0.37	0.01
47	-0.3	0.25	-0.02
48	0.1	0.22	-0.02
49	0	0.19	0.00
50	0	0.15	-0.01

Instructions

1. Write to the Group and ID controlling the parameter of the Low Pass Filter Decay Rate.
2. Send a “Save Configuration” message.
3. Write to the Group and ID controlling the parameter of the Minimum Threshold
4. Send a “Save Configuration” message.
5. Write to the Group and ID controlling the parameter of the Variance Threshold
6. Send a “Save Configuration” message.

1. Send ID 0x18EFE4F9, Writing to group 2 and parameter ID 7 – Low Pass Filter Decay Rate.

Data bytes: C0 01 02 07 A0 0F 00 00

UTS responds with ID 0x18EFF9E4

Data bytes: C0 03 02 07 FF FF FF FF

2. Send ID 0x18EFE4F9, Send Save config message –

Data bytes: C1 00 00 00 00 00 00 00

UTS responds with ID 0x18EFF9E4 (acknowledge)–

Data bytes: 01 C1 01 00 FF FF FF FF

3. Send ID 0x18EFE4F9, Writing to group 2 and parameter ID 5 – Impact Threshold.

Data bytes: C0 01 02 05 23 00 00 00

UTS responds with ID 0x18EFF9E4

Data bytes: C0 03 02 05 FF FF FF FF

4. Send ID 0x18EFE4F9, Send Save config message –

Data bytes: C1 00 00 00 00 00 00 00

UTS responds with ID 0x18EFF9E4 (acknowledge)–

Data bytes: 01 C1 01 00 FF FF FF FF

5. Send ID 0x18EFE4F9, Writing to group 2 and parameter ID 5 – Variance Threshold.

Data bytes: C0 01 02 0B 19 00 00 00

UTS responds with ID 0x18EFF9E4

Data bytes: C0 03 02 0B FF FF FF FF

6. Send ID 0x18EFE4F9, Send Save config message –

Data bytes: C1 00 00 00 00 00 00 00

UTS responds with ID 0x18EFF9E4 (acknowledge)–

Data bytes: 01 C1 01 00 FF FF FF FF

9 Performance Considerations

The UTS is an angle sensor that uses an accelerometer to calculate changes in orientation. There are a few factors that may influence the operation.

Vibrations

Due to the use of high-resolution accelerometers, vibrations can cause interference in certain applications. Once the device is installed, it is recommended to operate all functions that may cause sudden vibrations/shock across the vehicle to ensure regular operation is as expected. This is also an opportunity to test what the desired threshold and attenuation for the impact detection is.

Using multiple sensors on the same CAN bus system

Each UTS will need to have a unique source address.

10 UTS – ID integration with Parker IOT

10.1 UTS-ID Sensor integration with IoT solutions

UTS-ID impact sensor can be integrated as an option to the Parker Mobile IoT solution. The impact sensor Canbus data can be configured to integrate data with controller or Parker Mobile IoT gateway.

UTS-ID
Impact Thresholds
Noise Settings
Intensity Setup



- Set sensitivity of axis forces
- Set intensity thresholds to identify severity of impact
- Set minimum noise threshold to avoid unnecessary events

Impact Detection
Impact Force
Orientation
Time
Location



- Impact Signal template configuration
- Impact Signals Real Time Overview
- Asset overview Widget Configurations

Alerts
Alert History
Email/SMS



- Configurable multi-severity threshold alerts
- Impact alerts history
- Configurable Email and SMS Notifications

Impact Reports
Events
Heat Map
Trends



- Interactive Impact Dashboard including impact location, top assets impacted, impact severity trends
- Impact event logs with date, time and impact magnitude

10.2 Setup Impact Signals

Impact signals can be configured at the controller or gateway level. Configure impact signals at gateway level using the Parker Mobile IoT template service and follow the CAN specifications in section 7 of this user manual

Parker Impact Template

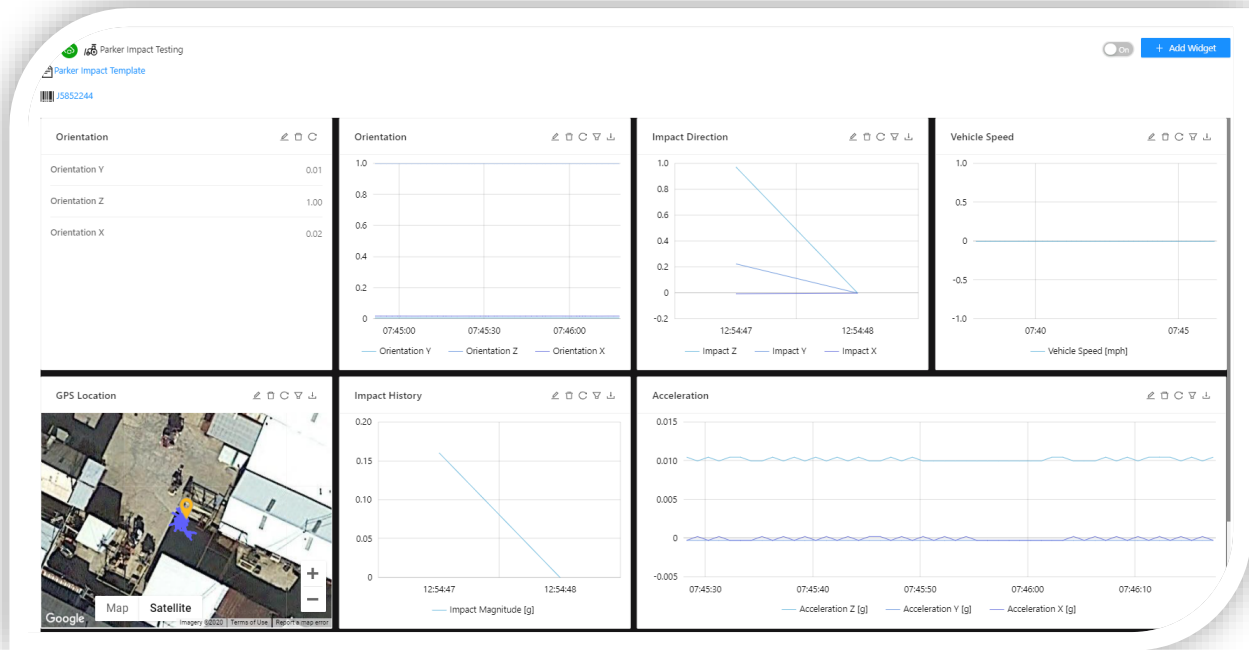
Signal Collections DM1 Faults

Search by name

Collection Name	Capture Interval	Type	Signals	Actions
Acceleration	100ms	Generic	4	...
GPS	10s	GPS	2	...
Impact	1ms	Generic	4	...
Orientation	1s	Generic	3	...
Report Signal Collection	10s	Generic	2	...

10.3 Signal Visualization

Impact signals including impact magnitude, impact acceleration and orientation can be visualized through the Parker Mobile IoT widgets that will include Line, Bar, Text and other widget types.



10.4 Impact Alerting and Notifications

Parker Mobile IoT user can setup alert and notification thresholds in different states including critical, warning or just for information. Use the impact signals from the sensor like magnitude, acceleration or orientation and set specific values to trigger alerts.

Signal Name: **Impact Magnitude** 🗑️ ✎️

PGN	65450	PGN Name	
SPN		SPN Name	
Bit Length	16	First Bit	0
Offset	0	Scaling	0.00042287042015232146
Unit	g	Source	can1.j1939
Source Address		J1939 Error Checking	<input type="checkbox"/>
CAN Header			

Alarm **Impact Detected**
Critical + **Warning** when Impact Magnitude is
3 greater than 5 greater than

10.5 Impact Reports

Impact reports are obtained from the Parker Mobile IoT portal. Impact reports populated based on impact events gathered from the sensor, along with location and time data. Impact reports include

Impact Dashboard

Summary statistics with impact location, top impacted assets, impact event counts, average Impact magnitude, impact severities



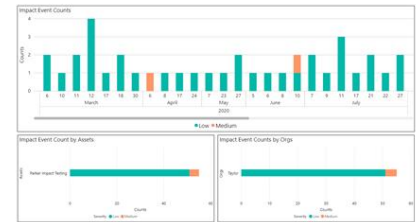
Impact Events

Impact event log including asset name, organization, date and time, magnitude, severity and location

Asset Name	Org Name	Date Time	Impact Magnitude (g)	Severity	Latitude	Longitude
Parker Impact Testing	Parker	7/2/2019 12:13:40 AM	1.37	Low	33.13	-89.06
Parker Impact Testing	Parker	6/28/2019 6:11:41 AM	1.33	Low	33.14	-89.07
Parker Impact Testing	Parker	6/4/2019 2:19:36 AM	1.37	Low	33.14	-89.06
Parker Impact Testing	Parker	6/15/2019 7:46:06 AM	1.37	Low	33.14	-89.06
Parker Impact Testing	Parker	6/27/2019 3:11:29 PM	1.40	Low	33.14	-89.06
Parker Impact Testing	Parker	7/8/2019 10:59:53 AM	1.84	Low	33.14	-89.06
Parker Impact Testing	Parker	6/28/2019 11:26:24 AM	1.37	Low	33.14	-89.06
Parker Impact Testing	Parker	7/18/2019 10:18:01 PM	2.29	Low	33.14	-89.06
Parker Impact Testing	Parker	6/21/2019 10:03:49 PM	1.32	Low	33.14	-89.06
Parker Impact Testing	Parker	6/11/2019 11:41:08 PM	1.31	Low	33.14	-89.06
Parker Impact Testing	Parker	6/26/2019 10:50:07 AM	1.36	Low	33.14	-89.06
Parker Impact Testing	Parker	7/1/2019 8:27:33 AM	1.33	Low	33.14	-89.06
Parker Impact Testing	Parker	6/20/2019 11:14:49 AM	1.41	Low	33.14	-89.06
Parker Impact Testing	Parker	7/8/2019 8:42:42 AM	1.34	Low	33.14	-89.06
Parker Impact Testing	Parker	7/5/2019 1:58:54 PM	1.43	Low	33.14	-89.06
Parker Impact Testing	Parker	6/29/2019 8:13:58 AM	1.38	Low	33.14	-89.06
Parker Impact Testing	Parker	6/14/2019 8:14:53 AM	1.40	Low	33.14	-89.06
Parker Impact Testing	Parker	6/27/2019 11:15:28 AM	1.35	Low	33.14	-89.06
Parker Impact Testing	Parker	6/7/2019 10:28:10 PM	1.35	Low	33.14	-89.06
Parker Impact Testing	Parker	6/11/2019 10:00:04 PM	1.39	Low	33.14	-89.06
Parker Impact Testing	Parker	6/14/2019 1:35:46 PM	1.39	Low	33.14	-89.06
Parker Impact Testing	Parker	6/28/2019 10:23:39 AM	1.38	Low	33.14	-89.06

Impact History

Impact event trends and comparison by assets and organizations, discover which assets are more impacted and their condition



11 FAQ

The FAQ for UTS can be found at <http://blog.parker.com/faqs> for additional product support

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