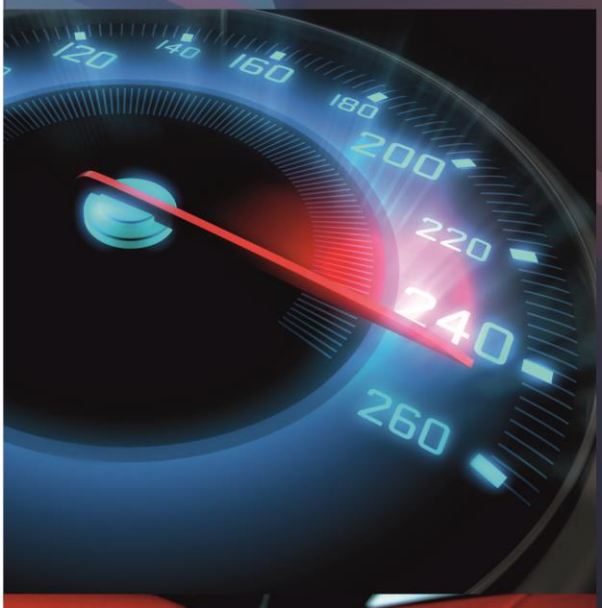
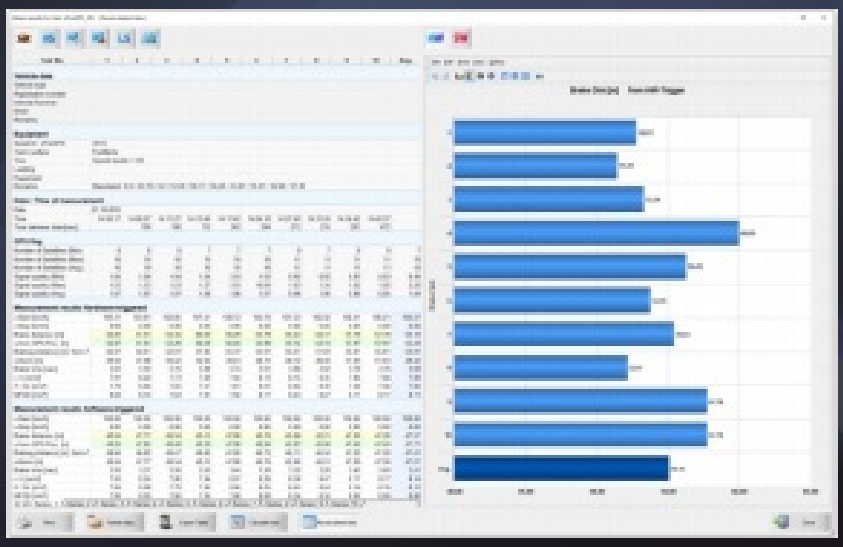
Suchy Data Systems

xProGPS_max2

Brake and Performance Test System





xpro®

High Performance Automotive Test Systems

KEY FEATURES OF THE SYSTEM

The Test system **xProGPS_max2** is an extremely powerful measurement system for performing brake and performance tests on any kind of vehicle.

Based on 100 Hz GPS speed data, acceleration and gyro data from the **xProINS / xProINS_mini** inertial sensor precise braking distances and braking times will be calculated. An easy to learn menu which is presented on the driver display **CANFAZ5** or alternatively **xProLCD** guides the driver through the brake test procedure

A brake pedal switch attached to the trigger input of the system delivers an exact trigger time stamp with a precision of 1 µs, which allows exact calculation of the start speed when pressing the brake pedal.

In alternative a brake load cell can be used for accurate braking force control and trigger

The system is delivered with **xProGPS** Windows software package, which creates sophisticated presentations, various graphics, bar charts and spreadsheets.

Very special features of xProGPS_max2

- 100 Hz GPS receiver for high dynamic processing
- 25 Hz Assist GPS receiver with high sensivity for data acquisition in areas with disturbances
- Corrects the pitching angle of the vehicle caused by pressing the brake
- Inertial sensor with 6 DOF increases precision of results
- Innovative complex calculation algorithm delivers most precise braking results
- Kalman integration with inertial sensor data helps to compensate GPS dropouts
- Alternatively a pulse sensor can be used in case GPS signals are weak
- High quality brake pedal switch with robust rubber sealed trigger sensor
- Up to 100 brake tests (10 series à 10 tests) in one job folder

BRAKE TEST SYSTEM

The Brake Test System **xProGPS_max2** consists of the following components:

- xProGPS_max2 main unit containing the GPS receiver

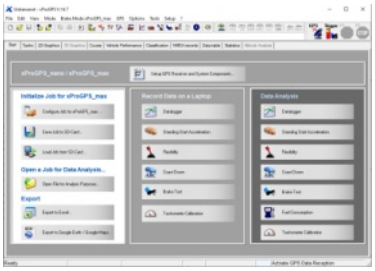
- CANFAZ5 or xProLCD Driver Display

- xProINS or xProINS_mini Inertial sensor

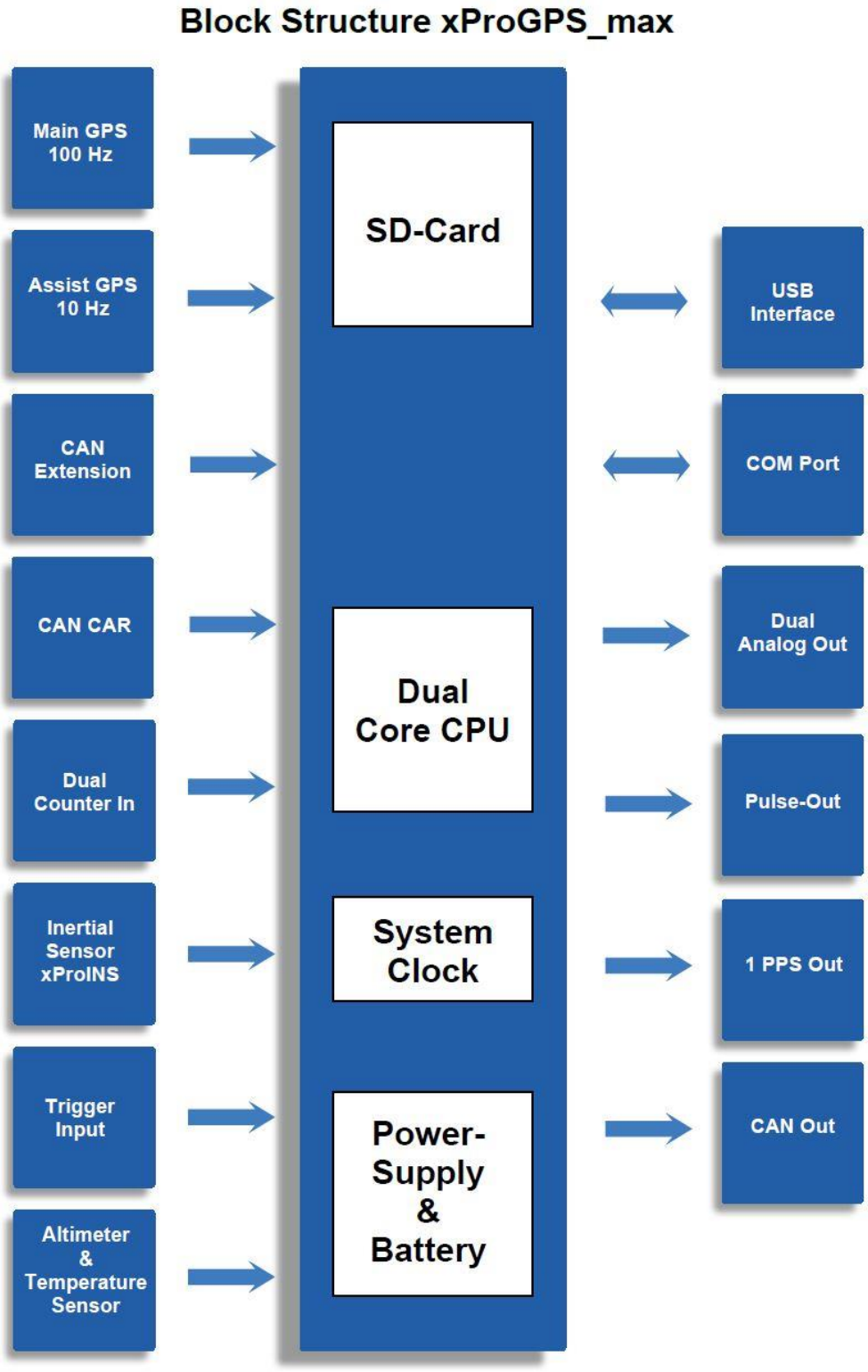
- Brake Pedal switch or Brake Force Sensor

  (Hardware trigger)

- xProGPS windows software package for setup and data analysis



SYSTEM ARCHITECTURE



BRAKE TEST SYSTEM

Driver Display

Inertial Sensor xProINS

BRAKE FORCE

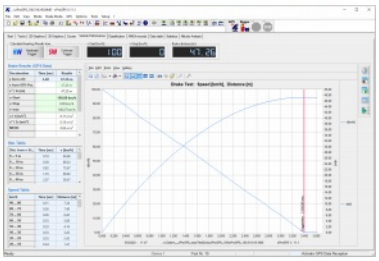
Brake Pedal Switch
Trigger Input

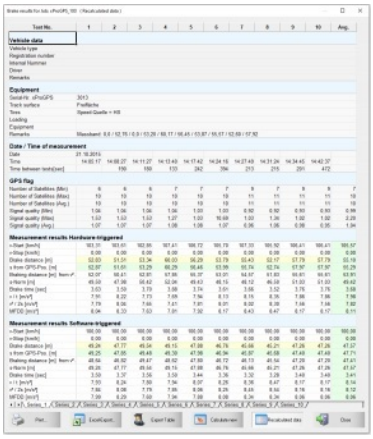
Optical / Wheel Speed Sensor
(Optional - Pulse Input)

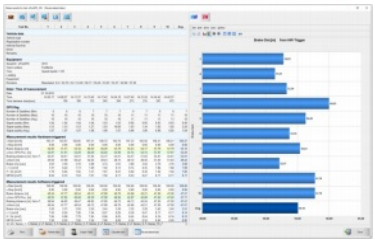
GPS
Receiver

Assist
Receiver

Results







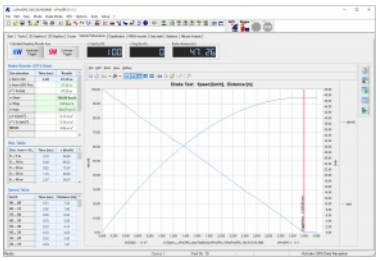
PERFORMANCE TEST SYSTEM

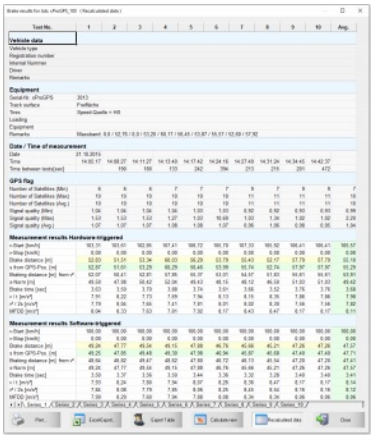
Driver Display

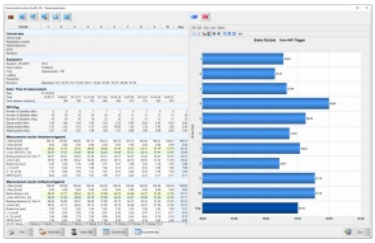
GPS Receiver

Assist Receiver

Results







Optical / Wheel Speed Sensor
(Optional - Pulse Input)

FUEL CONSUMPTION TEST SYSTEM

Driver Display

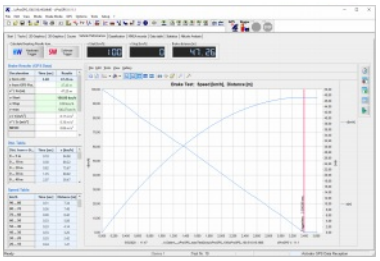
FUEL CONSUMPTION METER

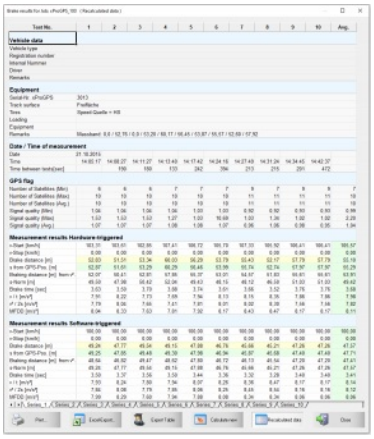
Optical / Wheel Speed Sensor
(Optional - Pulse Input)

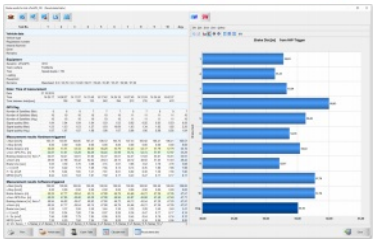
GPS Receiver

Assist Receiver

Results







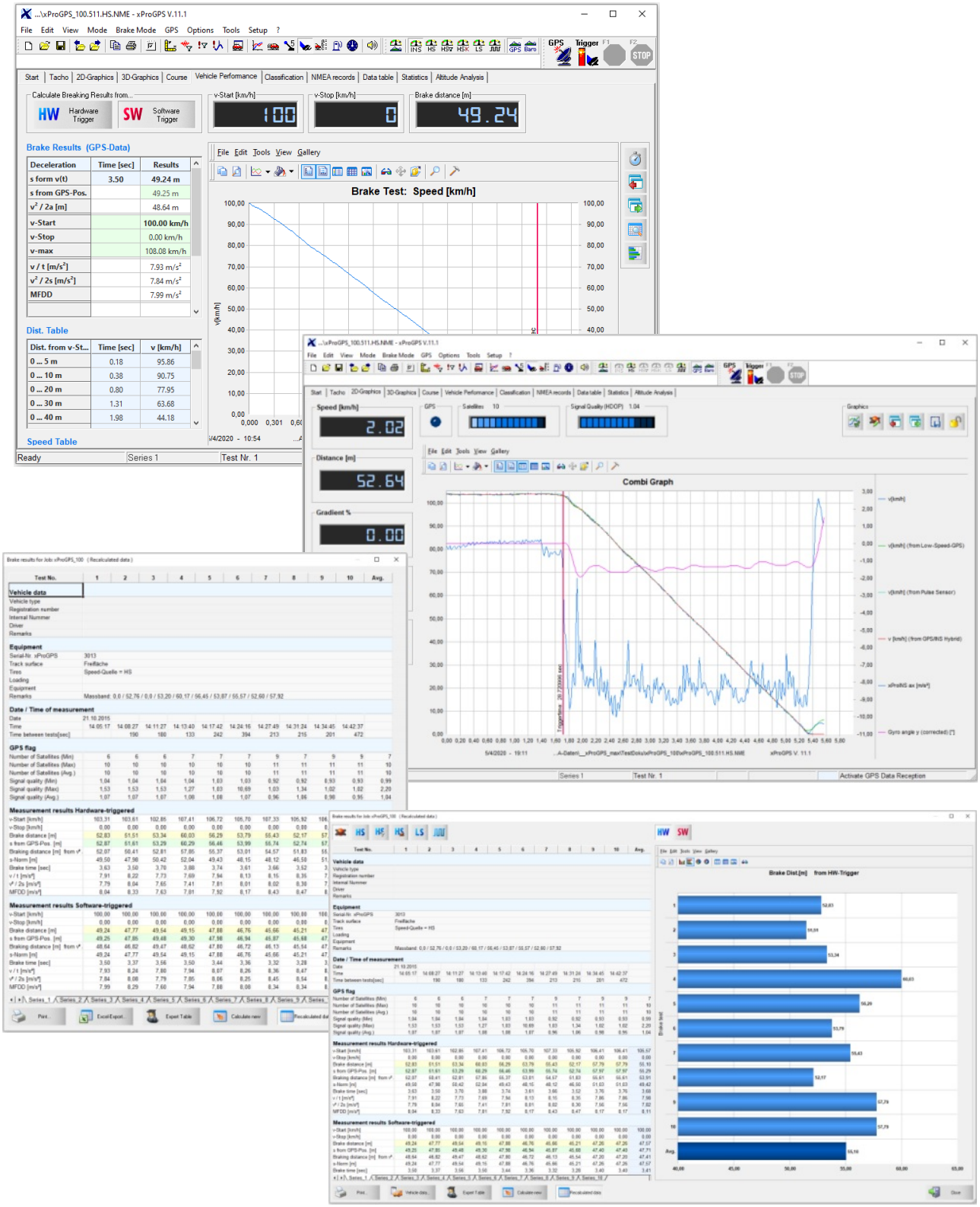
On the xProLCD or xProOLED driver displays the relevant values and instructions are shown

On a CANFAZ driver display the trigger speed is marked in the bar graph with an LED. The scaling of the bar graph is done automatically, showing the trigger speed plus the defined hysteresis.

These displays are small and bright, so the driver will have al the required parameters clearly shown during the whole test

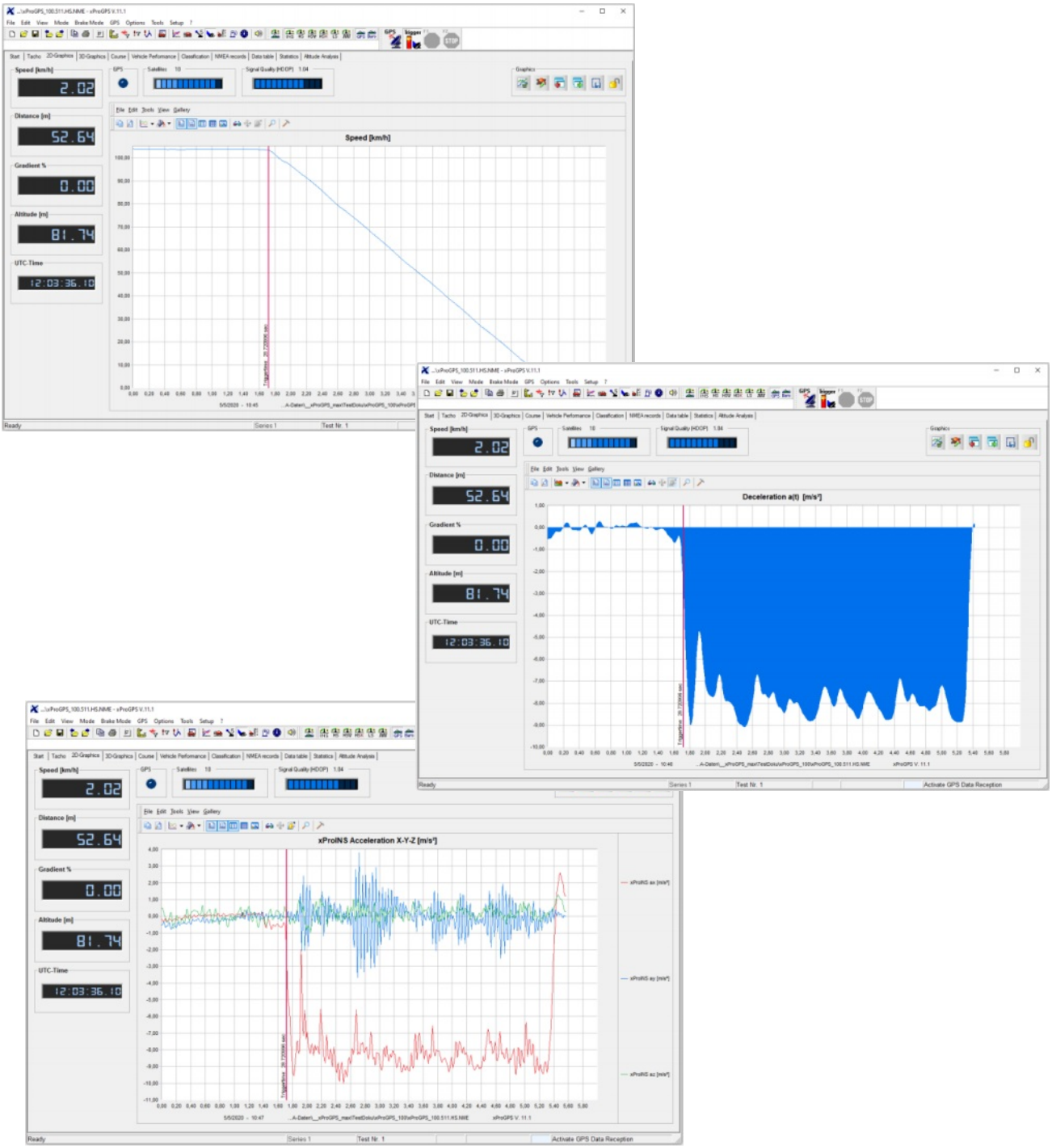
SHOW GRAPHICS, SPREADSHEETS AND BAR GRAPHS WITH XPROGPS WINDOWS SOFTWARE

xProGPS will calculate the results of the recorded data and display the corresponding graph and results in dedicated spreadsheets, menus and pages.



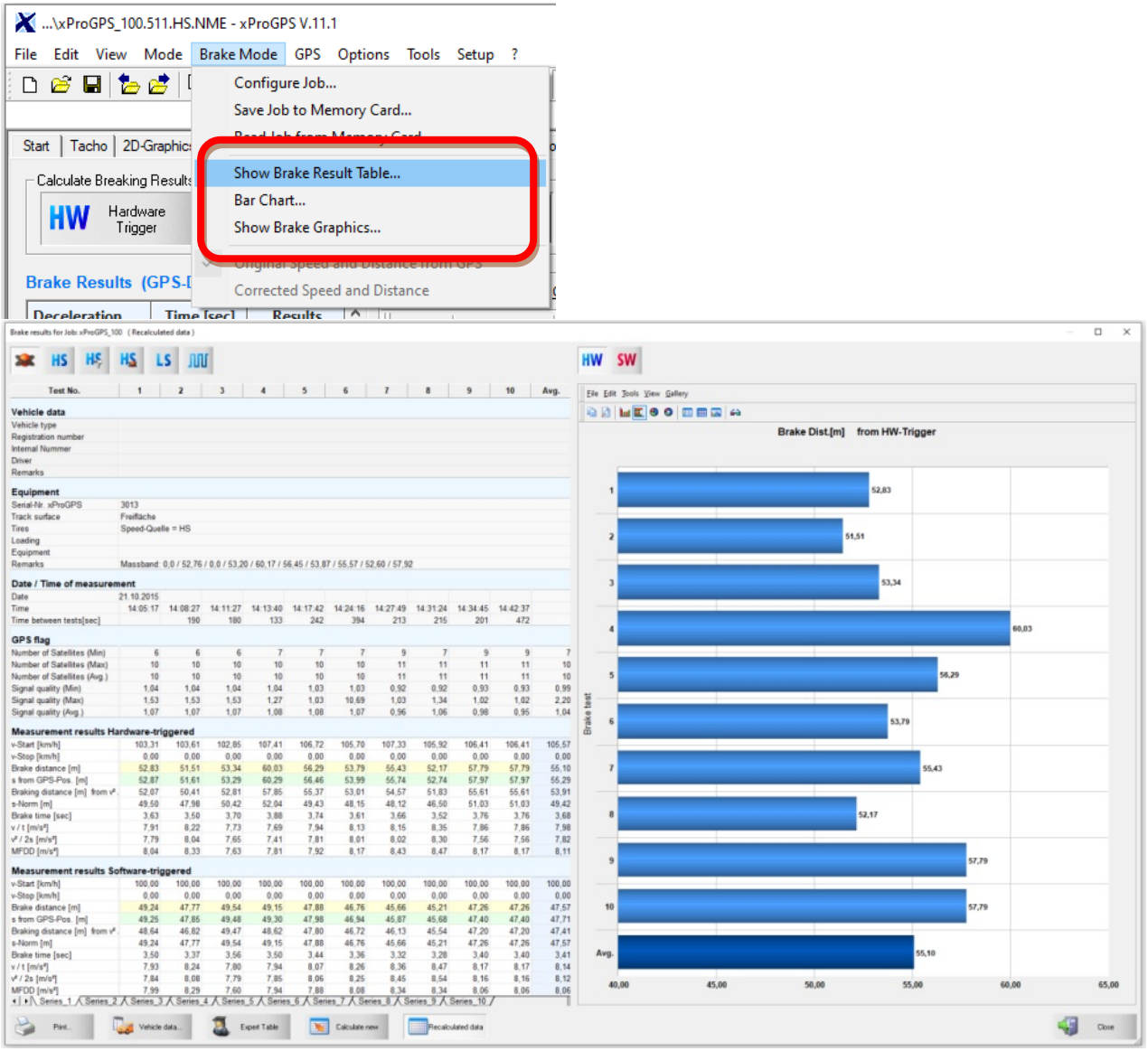
2D GRAPHICS PAGE

Several predefined graphic pages are available on 2D Graphics page.



SPECIAL BRAKE TEST RESULTS

For further brake test data analysis additional functions are available :



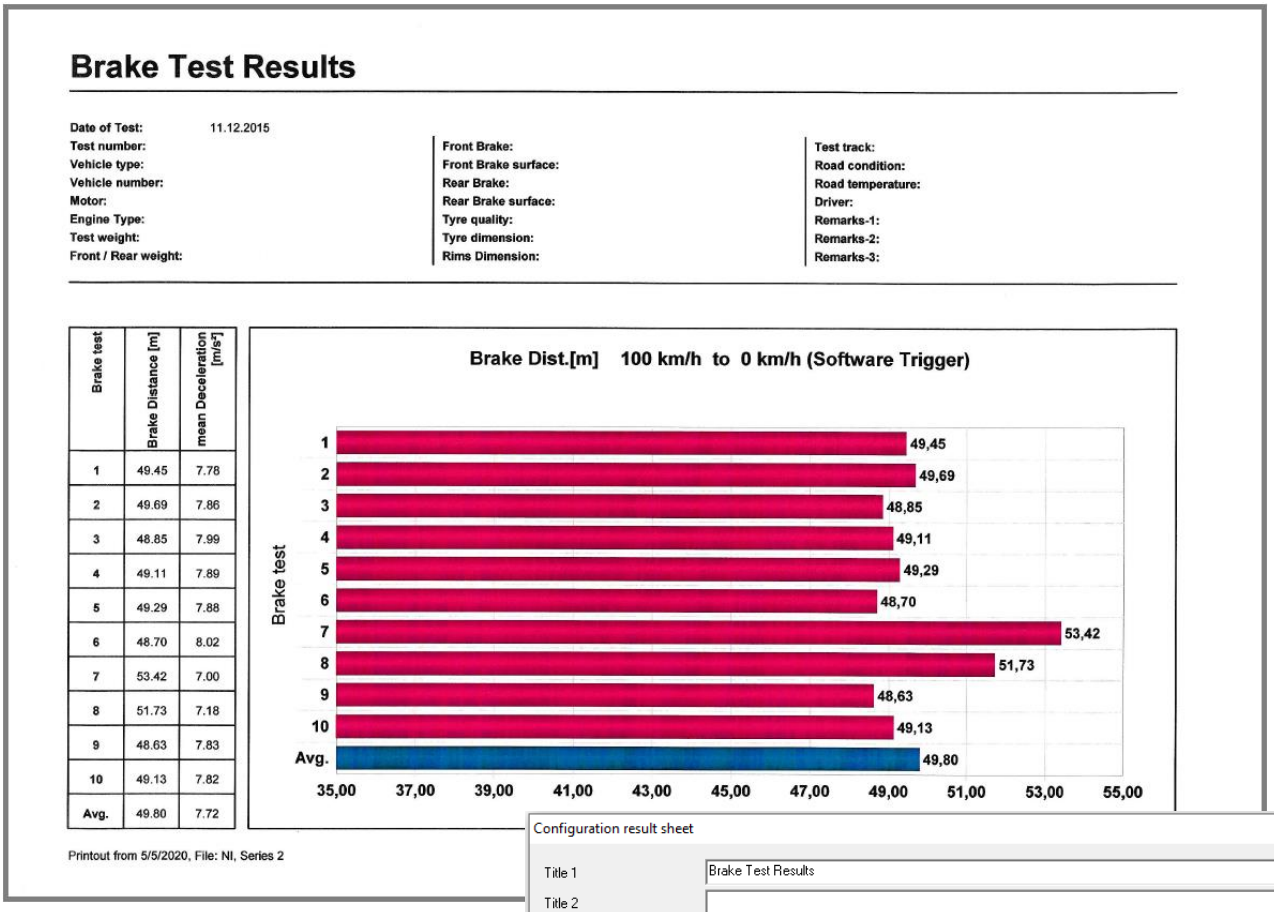
SELECTABLE SPEED SOURCE

For better results, xProGPS_max analysis software allow to switch between the results of the various speed sources

xProGPS_max2 calculates up to 6 different speeds and corresponding results for the brake tests:

INS (Hybrid speed)	Calculated speed for brake test mode. This speed is generated from the GPS-HS speed and data from the inertial system. The calculation of this speed is a highly integrated procedure developed by Suchy Data Systems GmbH only. It uses complex formulas and filtering procedures and delivers the most precise results for brake tests
HS (GPS **H**igh **S**peed)	Unmodified speed from GPS-Main 100 Hz Receiver
HS filtered	Smoothed speed from GPS-Main 100 Hz Receiver with special smoothing algorithm
HS Kalman	This speed is generated from the GPS-Main 100 Hz speed and data from the inertial system. The speed is calculated using the so called “Kalman” filter algorithm
LS (GPS **L**ow **S**peed)	Speed from Assist Receiver (Low Speed signal). This 100 Hz LS speed signal is derived from the original 10 Hz signal by Interpolation. Additionally the signal is shifted by a known time offset of the belated low speed signal
Pulse speed	Calculated speed from the speed pulse input – if recorded. This speed is generated using the pulse count input and the speed pulse factor, which has to be supplied for the speed-in-signal. A smoothing filter is already included in the calculation algorithm.

Test report printouts :



Brake Test Results

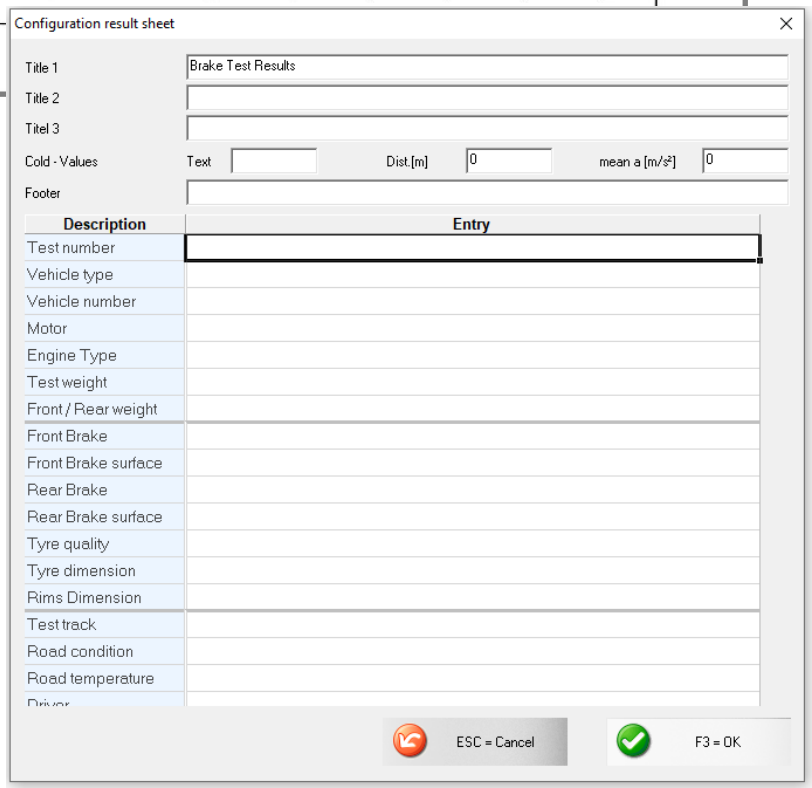
Date of Test: 11.12.2015
Test number:
Vehicle type:
Vehicle number:
Motor:
Engine Type:
Test weight:
Front / Rear weight:

Front Brake:
Front Brake surface:
Rear Brake:
Rear Brake surface:
Tyre quality:
Tyre dimension:
Rims Dimension:

Test track:
Road condition:
Road temperature:
Driver:
Remarks-1:
Remarks-2:
Remarks-3:

Brake test	Brake Distance [m]	mean Deceleration [m/s²]
1	49.45	7.78
2	49.69	7.86
3	48.85	7.99
4	49.11	7.89
5	49.29	7.88
6	48.70	8.02
7	53.42	7.00
8	51.73	7.18
9	48.63	7.83
10	49.13	7.82
Avg.	49.80	7.72

Printout from 5/5/2020, File: NI, Series 2

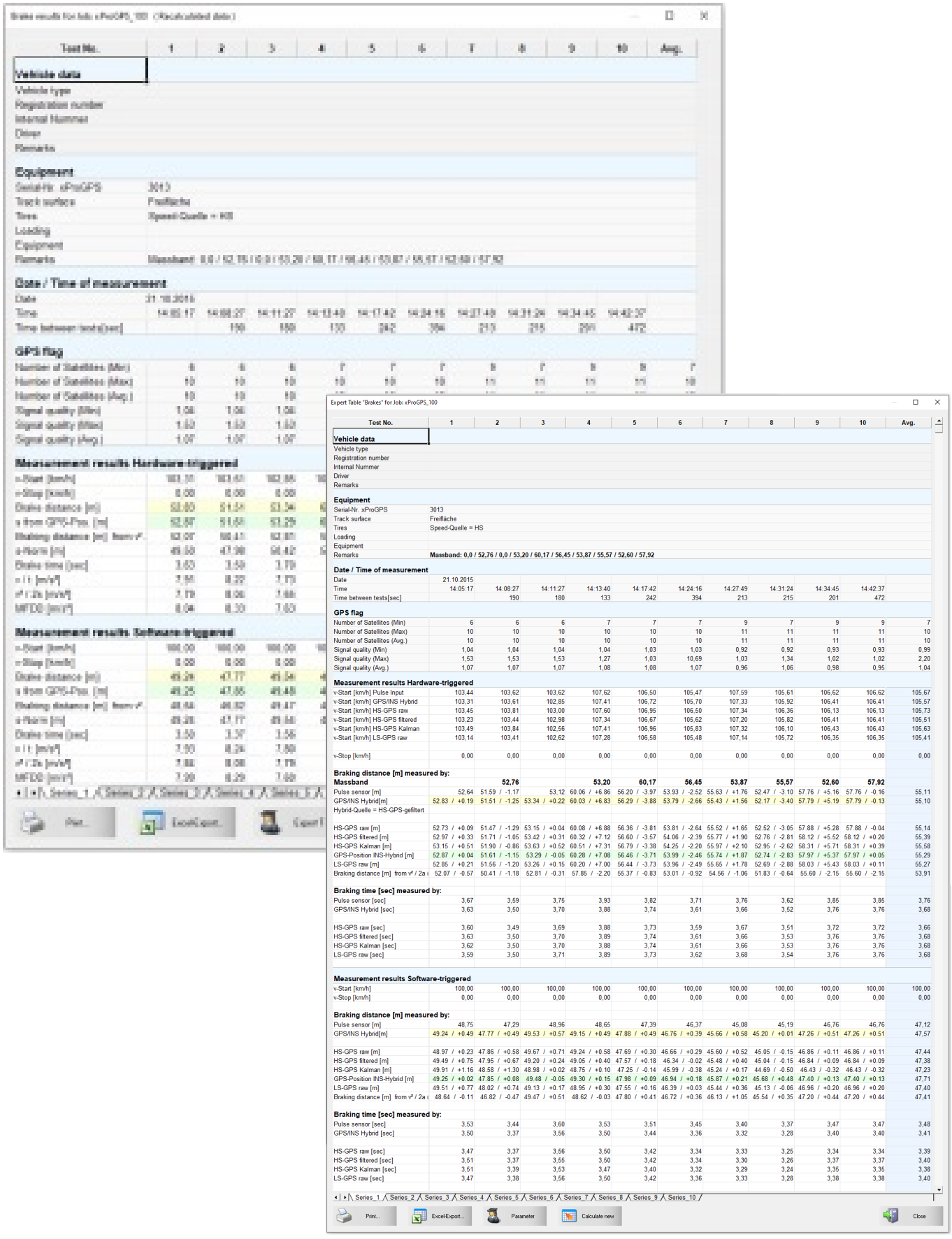


Configuration result sheet

Title 1: Brake Test Results
Title 2:
Titel 3:
Cold - Values — Text: — Dist.[m]: 0 — mean a [m/s²]: 0
Footer:

Description	Entry
Test number	
Vehicle type	
Vehicle number	
Motor	
Engine Type	
Test weight	
Front / Rear weight	
Front Brake	
Front Brake surface	
Rear Brake	
Rear Brake surface	
Tyre quality	
Tyre dimension	
Rims Dimension	
Test track	
Road condition	
Road temperature	
Driver	

ESC = Cancel F3 = OK



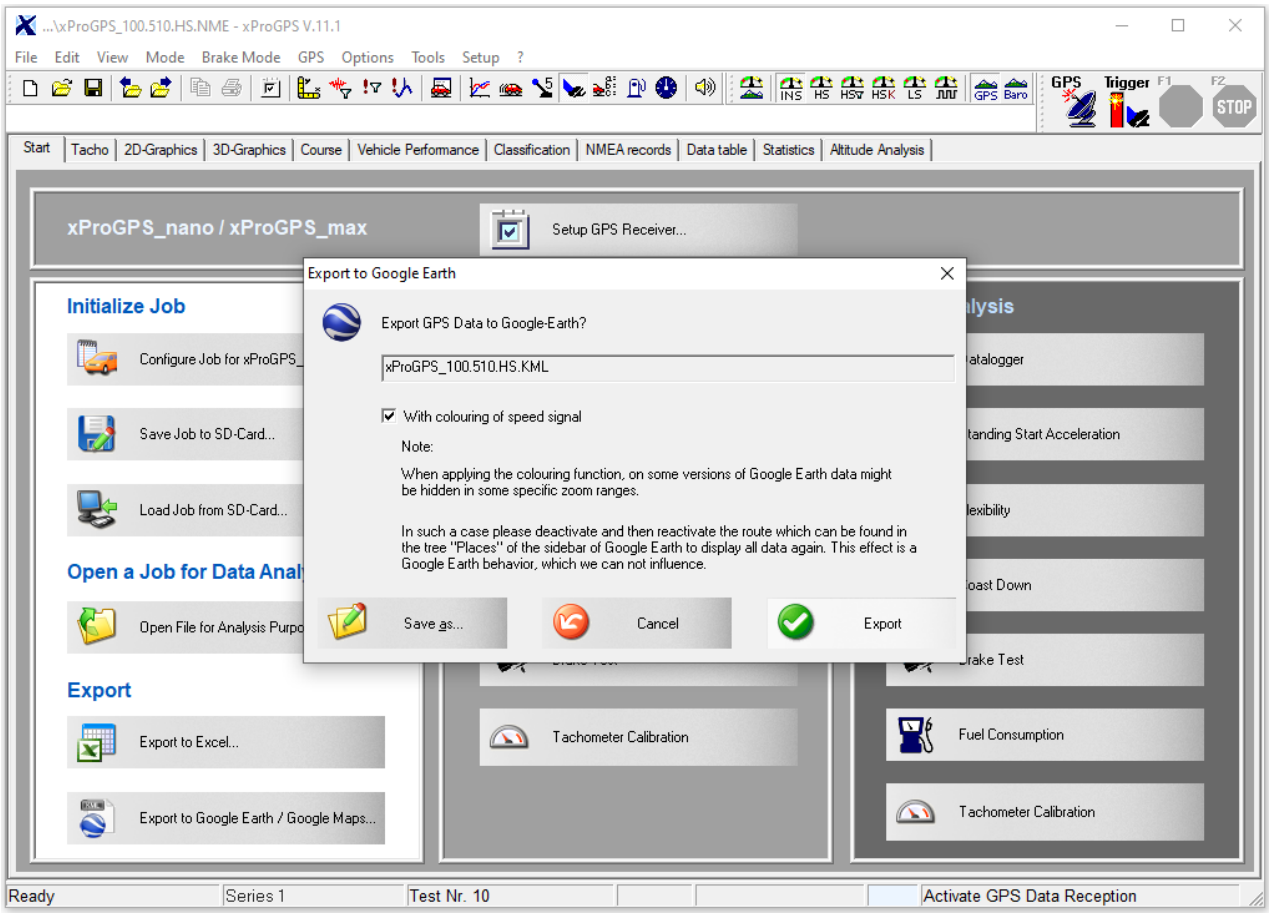
Expert Table "Brakes" for Job: xProGPS_100

Test No.	1	2	3	4	5	6	7	8	9	10	Avg.
Vehicle data											
Vehicle type											
Registration number											
Internal Nummer											
Driver											
Remarks											
Equipment											
Serial-Nr. xProGPS	3013										
Track surface	Freifläche										
Tires	Speed-Quelle = HS										
Loading											
Equipment											
Remarks	**Massband: 0,0 / 52,76 / 0,0 / 53,20 / 60,17 / 56,45 / 53,87 / 55,57 / 52,60 / 57,92**										
Date / Time of measurement											
Date	21.10.2015										
Time	14:05:17	14:08:27	14:11:27	14:13:40	14:17:42	14:24:16	14:27:49	14:31:24	14:34:45	14:42:37	
Time between tests[sec]		190	180	133	242	394	213	215	201	472	
GPS flag											
Number of Satellites (Min)	6	6	6	7	7	7	9	7	9	9	7
Number of Satellites (Max)	10	10	10	10	10	10	11	11	11	11	10
Number of Satellites (Avg.)	10	10	10	10	10	10	11	11	11	11	10
Signal quality (Min)	1,04	1,04	1,04	1,04	1,03	1,03	0,92	0,92	0,93	0,93	0,99
Signal quality (Max)	1,53	1,53	1,53	1,27	1,03	10,69	1,03	1,34	1,02	1,02	2,20
Signal quality (Avg.)	1,07	1,07	1,07	1,08	1,08	1,07	0,96	1,06	0,98	0,95	1,04
Measurement results Hardware-triggered											
v-Start [km/h] Pulse Input	103,44	103,62	103,62	107,62	106,50	105,47	107,59	105,61	106,62	106,62	105,67
v-Start [km/h] GPS/INS Hybrid	103,31	103,61	102,85	107,41	106,72	105,70	107,33	105,92	106,41	106,41	105,57
v-Start [km/h] HS-GPS raw	103,45	103,81	103,00	107,60	106,95	106,50	107,34	106,36	106,13	106,13	105,73
v-Start [km/h] HS-GPS filtered	103,23	103,44	102,98	107,34	106,67	105,62	107,20	105,82	106,41	106,41	105,51
v-Start [km/h] HS-GPS Kalman	103,49	103,84	102,56	107,41	106,96	105,83	107,32	106,10	106,43	106,43	105,63
v-Start [km/h] LS-GPS raw	103,14	103,41	102,62	107,28	106,58	105,48	107,14	105,72	106,35	106,35	105,41
v-Stop [km/h]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Braking distance [m] measured by:											
Massband		**52,76**		**53,20**	**60,17**	**56,45**	**53,87**	**55,57**	**52,60**	**57,92**	
Pulse sensor [m]	52,64	51,59 / -1,17	53,12	60,06 / +6,86	56,20 / -3,97	53,93 / -2,52	55,63 / +1,76	52,47 / -3,10	57,76 / +5,16	57,76 / -0,16	55,11
GPS/INS Hybrid[m]	52,83 / +0,19	51,51 / -1,25	53,34 / +0,22	60,03 / +6,83	56,29 / -3,88	53,79 / -2,66	55,43 / +1,56	52,17 / -3,40	57,79 / +5,19	57,79 / -0,13	55,10
Hybrid-Quelle = HS-GPS-gefiltert											
HS-GPS raw [m]	52,73 / +0,09	51,47 / -1,29	53,15 / +0,04	60,08 / +6,88	56,36 / -3,81	53,81 / -2,64	55,52 / +1,65	52,52 / -3,05	57,88 / +5,28	57,88 / -0,04	55,14
HS-GPS filtered [m]	52,97 / +0,33	51,71 / -1,05	53,42 / +0,31	60,32 / +7,12	56,60 / -3,57	54,06 / -2,39	55,77 / +1,90	52,76 / -2,81	58,12 / +5,52	58,12 / +0,20	55,39
HS-GPS Kalman [m]	53,15 / +0,51	51,90 / -0,86	53,63 / +0,52	60,61 / +7,31	56,79 / -3,38	54,25 / -2,20	55,97 / +2,10	52,95 / -2,62	58,31 / +5,71	58,31 / +0,39	55,58
GPS-Position INS-Hybrid [m]	52,87 / +0,04	51,61 / -1,15	53,29 / -0,05	60,28 / +7,08	56,46 / -3,71	53,99 / -2,46	55,74 / +1,87	52,74 / -2,83	57,97 / +5,37	57,97 / +0,05	55,29
LS-GPS raw [m]	52,85 / +0,21	51,56 / -1,20	53,26 / +0,15	60,20 / +7,00	56,44 / -3,73	53,96 / -2,49	55,65 / +1,78	52,69 / -2,88	58,03 / +5,43	58,03 / +0,11	55,27
Braking distance [m] from v² / 2a	52,07 / -0,57	50,41 / -1,18	52,81 / -0,31	57,85 / -2,20	55,37 / -0,83	53,01 / -0,92	54,56 / -1,06	51,83 / -0,64	55,60 / -2,15	55,60 / -2,15	53,91
Braking time [sec] measured by:											
Pulse sensor [sec]	3,67	3,59	3,75	3,93	3,82	3,71	3,76	3,62	3,85	3,85	3,76
GPS/INS Hybrid [sec]	3,63	3,50	3,70	3,88	3,74	3,61	3,66	3,52	3,76	3,76	3,68
HS-GPS raw [sec]	3,60	3,49	3,69	3,88	3,73	3,59	3,67	3,51	3,72	3,72	3,66
HS-GPS filtered [sec]	3,63	3,50	3,70	3,89	3,74	3,61	3,66	3,53	3,76	3,76	3,68
HS-GPS Kalman [sec]	3,62	3,50	3,70	3,88	3,74	3,61	3,66	3,53	3,76	3,76	3,68
LS-GPS raw [sec]	3,59	3,50	3,71	3,89	3,73	3,62	3,68	3,54	3,76	3,76	3,68
Measurement results Software-triggered											
v-Start [km/h]	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
v-Stop [km/h]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Braking distance [m] measured by:											
Pulse sensor [m]	48,75	47,29	48,96	48,65	47,39	46,37	45,08	45,19	46,76	46,76	47,12
GPS/INS Hybrid[m]	49,24 / +0,49	47,77 / +0,49	49,53 / +0,57	49,15 / +0,49	47,88 / +0,49	46,76 / +0,39	45,66 / +0,58	45,20 / +0,01	47,26 / +0,51	47,26 / +0,51	47,57
HS-GPS raw [m]	48,97 / +0,23	47,86 / +0,58	49,67 / +0,71	49,24 / +0,58	47,69 / +0,30	46,66 / +0,29	45,60 / +0,52	45,05 / -0,15	46,86 / +0,11	46,86 / +0,11	47,44
HS-GPS filtered [m]	49,49 / +0,75	47,95 / +0,67	49,20 / +0,24	49,05 / +0,40	47,57 / +0,18	46,34 / -0,02	45,48 / +0,40	45,04 / -0,15	46,84 / +0,09	46,84 / +0,09	47,38
HS-GPS Kalman [m]	49,91 / +1,16	48,58 / +1,30	48,98 / +0,02	48,75 / +0,10	47,25 / -0,14	45,99 / -0,38	45,24 / +0,17	44,69 / -0,50	46,43 / -0,32	46,43 / -0,32	47,23
GPS-Position INS-Hybrid [m]	49,25 / +0,02	47,85 / +0,08	49,48 / -0,05	49,30 / +0,15	47,98 / +0,09	46,94 / +0,18	45,87 / +0,21	45,68 / +0,48	47,40 / +0,13	47,40 / +0,13	47,71
LS-GPS raw [m]	49,51 / +0,77	48,02 / +0,74	49,13 / +0,17	48,95 / +0,30	47,55 / +0,16	46,39 / +0,03	45,44 / +0,36	45,13 / -0,06	46,96 / +0,20	46,96 / +0,20	47,40
Braking distance [m] from v² / 2a	48,64 / -0,11	46,82 / -0,47	49,47 / +0,51	48,62 / -0,03	47,80 / +0,41	46,72 / +0,36	46,13 / +1,05	45,54 / +0,35	47,20 / +0,44	47,20 / +0,44	47,41
Braking time [sec] measured by:											
Pulse sensor [sec]	3,53	3,44	3,60	3,53	3,51	3,45	3,40	3,37	3,47	3,47	3,48
GPS/INS Hybrid [sec]	3,50	3,37	3,56	3,50	3,44	3,36	3,32	3,28	3,40	3,40	3,41
HS-GPS raw [sec]	3,47	3,37	3,56	3,50	3,42	3,34	3,33	3,25	3,34	3,34	3,39
HS-GPS filtered [sec]	3,51	3,37	3,55	3,50	3,42	3,34	3,30	3,26	3,37	3,37	3,40
HS-GPS Kalman [sec]	3,51	3,39	3,53	3,47	3,40	3,32	3,29	3,24	3,35	3,35	3,38
LS-GPS raw [sec]	3,47	3,38	3,56	3,50	3,42	3,36	3,33	3,28	3,38	3,38	3,40

Series_1 | Series_2 | Series_3 | Series_4 | Series_5 | Series_6 | Series_7 | Series_8 | Series_9 | Series_10

Print... | ExcelExport... | Parameter | Calculate new | Close

GOOGLE EARTH EXPORT



HARDWARE FEATURES - xPRO_GPS_MAX 2

xProGPS_max2 represents another major step forward in applying and providing GPS-technology in the field of vehicle testing.

xProGPS_max2 is a stand-alone complex logging system, which comes with a wide variety of interfaces and delivers a native GPS data rate of 100 Hz in superb quality.

A powerful software package supports xProGPS_max2. We have modules for high-precision Brake Testing, Performance test including Coast Down, Fuel Consumption and more.

Above all xProGPS_max2 is based on the very latest GPS receiver technology, thus offering a so far unknown level of low-noise especially for the speed signal. By accessing multiple different Satellite systems, such as GLONASS, GALILEO etc., xProGPS_max2 delivers extraordinary results even when trees, buildings and further obstacles partially block view to the sky. To improve positioning into centimeter grade xProGPS_max2 is extendable via RTK / differential GPS.

In addition, xProGPS_max2 improves speed signal quality by built-in SENSOR-FUSION Technology. Sensor Fusion combines the GPS speed signal with data of the built-in or an external Inertial Sensor. We provide Sensor Fusion basically to compensate short-time signal drop-outs, i.e. when driving under a bridge. Furthermore, Sensor Fusion adds the possibility for additional signal smoothing of the speed signal.

Besides its outstanding GPS performance, xProGPS_max2 is also an outstanding CAN-Bus datalogger. Included as a standard are 4 independent CAN-Busses capable of logging up to 500 channels @ 100 Hz on each bus, totalizing in an amazing number of 2000 channels @ 100 Hz.

All CAN-interfaces of xProGPS_max2 are CAN-FD ready – specify the protocol you need and we can create a specific driver for it.

xProGPS_max2 includes several standard interfaces plus further process I/Os such as counters, 2 programmable analogue outputs, 4 wide range 24-bit analogue inputs plus digital interfaces.

Firmware Upgrades can be loaded via USB. A variety of different SUCHY driver displays can be attached via COM-Port.

Summary of the outstanding features of xProGPS_max2

- Extremely low noise in speed signal even at full 100 Hz native GPS data rate
- Low sensitivity to obstacles such as trees, buildings etc.
- Dual GPS-Receiver solution: 100 Hz main receiver plus 25 Hz backup-receiver for plausibility control
- RTK Interface to improve precision of positioning down to centimeter range
- Sensor Fusion algorithm with internal / external Inertial Sensor to compensate short-time drop-outs
- Kalman based Sensor Fusion to reduce signal noise even further
- Internal MEMS sensors for Accelerometer, Gyro, Altimeter and Temperature
- 4 CAN-FD with galvanic Isolation and programable Termination Resistor
- Standard USB 2.0 Full Speed Communication Interface for Firmware-Update
- Standard COM Interface as Display Communication Port
- Data-Interfaces: external Trigger plus Push-Button, dual Analogue-Out 16 Bit, programmable PLL (Frequency out), programmable Switch, Dual Counter-Input 32 Bit for Fuel Sensor or incremental Encoders
- Additional precision Real-Time-Clock
- Extendable by choice of modules -> i.e. 4 channel analogue module +/-20V range, 24-Bit resolution
- Data Storage to SD-card (Mega Byte / sec, long Filenames, 32 GByte Cards supported, max. 4 GByte per File
- Real-Time storage to SD-Card
- 32 Megabyte Data-RAM for lightning-fast on-line processing of incoming data
- Multi-Processor-System based on powerful 32-Bit-CPUs with high-speed inter-processor communication
- Interface for variety of SUCHY display units
- Power-Supply: 9-32 VDC @ appx. 3 Watt only with full galvanic Isolation
- Battery free protection against power-loss by SuperCaps
- Full metal housing milled from a single block of alloy
- Highest Quality industrial Lemosa sockets
- Compact size 175 * 124 * 25 mm only, weight appx. 300 g

INTERFACING CONNECTORS AND PINOUT

CONNECTORS ON THE FRONT-PANEL

All sockets include a blue Status LED and provide an individually fused Power Outlet derived from the Power-In socket.

- Power supply input 9 … 32 VDC fused with 1.85 electronic fuse
- Interface for Driver Display (COM-Port plus additional CAN-FD-Bus)
- Trigger input with galvanic isolation (1 channel positive Trigger, 1 channel negative Trigger)
- Extension CAN-FD 0 (preferred Interface for CAN output or to adapt to vehicle CAN)
- Extension CAN-FD 1 (Interface for SUCHY Inertial Sensor xProINS_mini)
- GPS Antenna SMA socket for Main Receiver (100 Hz)
- GPS Antenna SMA socket for Assist Receiver (25 Hz)
- USB-B Type B socket for Firmware upgrade and Parameter setting
- SD-Card Slot supporting SD-Cards up to 32 GByte
- Calibration-Button (black) for internal IMU (calibrate position angle)
- Start / Stop Button (red) to release / interrupt a measurement in stand-alone mode

TECHNICAL DATA

Name of Product	**xProGPS_max2**
Type of Product / intended Use	GPS based Datalogger for Vehicle Testing
Size	175 * 123 * 25 mm
Weight	appx. 550 g
Operating Temperature Range	-40 to +80 Celsius,
Humidity	5 … 80%, non-condensing
Power Supply	appx. 9 … 32 VDC, appx. 3 Watt, 7 Watt when charging

Precision of Internal Sensors and Interfaces

Inertial Sensor

Accelerometer

Range	2 g …. 16 g
Resolution	16 Bit
Sensitivity Error	appx. 0.5 %
Zero g-Offset	appx. 20 mg
Noise	appx. 0.18 mg / Sqrt(Hz) depending on range
Cross axis Sensitivity	appx. 1%

Gyro

Range	125 … 2000 dps depending on firmware pre-sets
Resolution	16 Bit
Sensitivity Error	appx. 2 %
Zero-rate Offset	appx. 0.5 dps
Noise	appx. 0.007 dps / Sqrt (Hz)

Altimeter

Operating Range	300… 1250 hPa
Absolute Accuracy	appx. 0.5 hPa
Relative Accuracy	appx. 0.3 hPa 0
Noise	.02 Pa

Analogue Inputs (Piggy Pack)

Resolution	24 Bit
Input Range	+/- 20 V
Accuracy	appx. 0.07 %
Input Impedance	1 MOhm
Offset Error	appx. 1.5 mV
Gain Error	appx. 0.05 % of Full Scale

Dual Analogue Outputs

Resolution	16 Bit
Output Voltage Range	0 … 2.5 V
Offset Error	appx. 1.5 mV
Gain Error	appx. 0.05 % of Full Scale

Frequency Synthesizer

Resolution	28 Bit
Usable f_max in System	appx. 4 MHz
Signal form	rectangular
Output Voltage	3.3 V CMOS level

Programmable Switch

Max. Switch Voltage	60 VDC
Max. Current	0.5 A
Switch Resistance	0.2 Ohm

Technical Data GPS Receivers

GPS 100 Hz Receiver

Accuracy of Position Stand-alone Mode	appx. 1.3 m CEP
Accuracy of Position RTK mode	appx. 1 cm
Accuracy of Speed	appx. 0.03 m / sec

GPS 25 Hz Receiver

Accuracy of Position	appx. 2.0 m CEP
Accuracy of Speed	appx. 0.05 m / sec