DDD1

General

The GPS display *DDD1* (= Driving Dynamics Display) shows either the values of an external HSx-Box, or the values of the integrated GPS receiver module. The DDD1 box can therefore be used as an external display for a HS16G. Some modes are dependent from the driving situation, and change the view automatically to the desired values. Following signals can be displayed: driving direction, total acceleration, altitude, curve radius, lean angle, traverse/lateral acceleration, longitudinal acceleration, speed and time.

Figure 1: *DDD1* Box.

Scope of Delivery

The scope of delivery of the DDD1 includes:

- *DDD1* box
- Connection cable for power supply with a plug for the cigar lighter
- GPS antenna for the *DDD1* box.
- USB connection cable (virtual COM port)
- Aluminum square to mount the DDD1 box
- Hook and loop fastener

Accessories

Not part of the scope of delivery are:

- Power adapter *PA*
- Mounting plate (25 mm x 30 mm) with ¼" thread

Display

The *DDD1* box is background lighted and has a contrasty 3.5-digit display with a digit height of 12.7 mm. The output text has the following meaning:

-	invalid GPS signal
--	GPS signal is outside the representable range
19.9|	(increasing) longitudinal acceleration
-19.9|	(decreasing) longitudinal accelerating
19.9_	traverse acceleration (to the right)
-19.9_	traverse acceleration (to the left)
19.9_|	Total acceleration

Average Rate Switch

The time window from 0 s to 1.5 s in 16 steps with a step width of 0.1 s is defined with the average rate switch. The switch position will be abbreviated in the following with *r* and goes from 0 to 15.

Signal Selection Switch

The signal selection switch defines the used mode. The mode will be abbreviated with *p* in the following.

p	Function
0	Driving direction in degree from 0° to 360° with a resolution of 1°.
1	Total acceleration (derived from longitudinal and lateral acceleration) with a resolution of 0.1 m/s² from 0 m/s² to 19.9 m/s².
2	Altitude with a resolution of 1 m from -500 m to 1999 m.
3	Curve radius with a resolution of 0.1 m from 0 m to 99.9 m, or with a resolution of 1 m from 100 m to 999 m.
4	Lean angle with a resolution of 0.1° from 0° to 63°, and with a step width of 0.25°.
5	Traverse/lateral acceleration with a resolution of 0.1 m/s² from -19.9 m/s² to 19.9 m/s².
6	Longitudinal acceleration with a resolution of 0.1 m/s² from -19.9 m/s² to 19.9 m/s².
7	Speed with a resolution of 0.1 km/h from 0 km/h to 199.9 km/h, or with a resolution of 1 km/h from 200 km/h to 655 km/h.
8	Dominant acceleration (= higher magnitude of longitudinal and traversal acceleration) with a resolution of 0.1 m/s² from -19.9 m/s² to 19.9 m/s².
9	Dominant acceleration (= higher magnitude of longitudinal and traversal acceleration) with a resolution of 0.1 m/s² from -19.9 m/s² to 19.9 m/s². The traverse acceleration is displayed as equivalent lean angle with a resolution of 1° from 0° to 63°.

p	Function
10	v at $\max(\lvert a\rvert;\lvert a_T\rvert) \le a_{thr}$ a at $\lvert a\rvert > \lvert a_T\rvert$ and $\lvert a\rvert > a_{thr}$ a_T bei $\lvert a_T\rvert > \lvert a\rvert$ and $\lvert a_T\rvert > a_{thr}$ with speed v, longitudinal acceleration a, traverse acceleration a_T, and threshold a_{thr}.
11	v at $\max(\lvert a\rvert;\lvert a_T\rvert) \le a_{thr}$ a at $\lvert a\rvert > \lvert a_T\rvert$ and $\lvert a\rvert > a_{thr}$ φ at $\lvert a_T\rvert > \lvert a\rvert$ and $\lvert a_T\rvert > a_{thr}$ with speed v, longitudinal acceleration a, traverse acceleration a_T, lean angle φ, and threshold a_{thr}.
12	Like $p = 10$, but the speed is displayed forcibly for an adjustable fraction of the cycle.
13	Like $p = 11$, but the speed is displayed forcibly for an adjustable fraction of the cycle.
14	Distance counter in meters as long as no decimal point is displayed, otherwise in km. To reset the distance counter at $p = 14$, the average rate switch must be turned to $r = 15$ until 0 is being displayed.
15	***r* = 0:** Distance slope in percent with a resolution of 0.1 %. ***r* = 7:** Time ***r* = 8:** LCD test with one visible segment but at an alternating position ***r* = 9:** Threshold a_{thr}. This value is set via the pot *THR*. ***r* = 10:** Number of used satellites ***r* = 11:** Max. HDOP value for a valid GPS signal ***r* = 12:** Counter of NMEA message VTG ***r* = 13:** Counter of NMEA message GGA ***r* = 14:** Firmware versions number ***r* = 15:** Firmware revision number

External Page-Button (optional)

The mode can be incremented by one with a short press of the page button, and decreased by one with a longer press. The modes are wrapped around. A longer than longer press changes the mode according to the signal selection switch.

Pin Assignment

The plugs of the *DDD1* box are of type Binder Series 719. The pins are numbered anti-clockwise, starting with the first pin after the notch.

LNA: The LNA connector is of type SMA, and connects the DDD1 box with an active GPS antenna. The LNA connector is temporarily short circuit protected. The active GPS antenna is supplied with 5 V DC. A GPS antenna must only be connected, if the integrated GPS receiver module is used. If the DDD1 is used as external display for a HSx box, a GPS antenna is not required.

POWER: This plug supplies the *DDD1* box with voltage, and offers additional connection possibilities.

Pin	Assignment
1	Supply voltage (6 V DC to 16 V DC; reverse polarity protected)
2	Ground
3	not connected
4	not connected

RS232/PROG: This plug connects the *DDD1* box with two serial interfaces.

Pin	Assignment
1	Serial transmitting wire to program the *DDD1* box.
2	Ground (connected internally with pin 2 of connector POWER)
3	Serial receiving wire to program the *DDD1* box.
4	Serial transmitting wire to program the configuration of the GPS receiver module. This pin is used for the NMEA output.
5	Serial receiving wire to program the configuration of the GPS receiver module. This pin can be used to overwrite the internal NMEA messages with an external HSx box.

Technical Data

Property	Description
Dimensions:	72 mm × 50 mm × 15 mm (+ 15 mm for turning switch)
Typical weight:	69 g
Power supply:	6 V DC to 16 V DC; reverse polarity protected
Typical current consumption:	110 mA
Typical power consumption:	0,7 W at 6 V DC 1,3 W at 12 V DC 1,8 W at 16 V DC

Additional technical data:

Property	Description
GPS update rate:	16⅔ Hz
GPS receiver module:	NEO-M8N (from u-blox)
Settings for GPS receiver module:	SBAS disabled; ≤ 9 satellites; *Portable* platform (speed ≤ 1116 km/h; altitude speed ≤ 180 km/h; altitude ≤ 12 km)
NMEA baud rate:	115200

GPS receiver module (according to u-blox):

Property	Description
Chip set:	u-blox NEO-M8N
Sensitivity:	Tracking & Navigation: -164 dBm Reacquisition: -159 dBm Cold Start: -147 dBm Hot Start: -156 dBm
Time to first fix:	1 s (in the worst case after 30 s)
Velocity accuracy:	0.05 m/s (50 % @ 30 m/s)
Heading accuracy:	0.3° (50 % @ 30 m/s)
Horizontal position accuracy:	2.5 m (CEP, 50 %, 24 hours static, -130 dBm, > 6 SVs)

See also
https://www.u-blox.com/en/product/neo-m8-series

Internet

Recent firmware and recent data sheet:
http://tellert.de/?product=ddd1

Recent device driver for the USB connection cable:
http://tellert.de/?product=usbser

Information about Binder Series 719:
http://tellert.de/?product=b719