

AT600 Smart Trailer EBPMS / TPMS Device

User Guide



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Abbreviations

ADC	Analogue to Digital Converter
ASCII	American Standard Code for Information Interchange (computer character set)
BLE	Bluetooth Low Energy
CAN	Controller Area Network
DC	Direct Current
EBS	Electronic Braking System
EBPMS	Electronic Brake Performance Monitoring System
FET	Field Effect Transistor
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service (part of GSM)
GPS	Global Positioning System
GSM	Global System for Mobile communication
IP	Internet Protocol (part of TCP/IP)
LED	Light Emitting Diode
LPWAN	Low Power Wide Area Network
LTE	Long-Term Evolution (wireless mobile communication standard)
MEMS	Micro Electro-Mechanical System
NMEA	National Marine Electronics Association (defined a GPS output format)
OTA	Over the Air (remote configuration of devices)
FOTA	Firmware update Over The Air
PC	Personal Computer
PCB	Printed Circuit Board
PDU	Protocol Description Unit (describes a binary SMS format)
RBT	Roller Brake Test
RFID	Radio Frequency Identification
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSC	Short Message Service Centre
SV	Satellite Vehicle
TCP	Transmission Control Protocol (part of TCP/IP)
TPMS	Tyre Pressure Monitoring System
UDP	User Datagram Protocol
WGS84	World Geodetic System 1984 (global co-ordinate system used by GPS)

Product Overview

The AT600 Smart Trailer device is specifically designed for HGV semi-trailer applications, providing ongoing / live monitoring of safety-related aspects, in addition to typical location tracking features.

The primary feature of the AT600 Smart Trailer device is EBPMS (electronic brake performance monitoring), which assesses brake live performance of the trailer / tractor unit combo and reports operational efficiency to the platform, allowing alerts to be generated when significant deterioration is detected or levels below the usual RBT (roller brake test) threshold. All EBPMS calculations are done on the device, including compensation for road angle, and hence no post-processing is required on the platform.

The AT600 Smart Trailer incorporates a 433MHz receiver for direct reading of supported TPMS sensors. Additionally, BLE sensors are supported, as is reporting of tyre-related data that is present on the CANBus.

The AT600 Smart Trailer device benefits from a large 3500mAh back-up battery, which is good for at least 60 days whilst the trailer is parked (in hourly update mode). The back-up battery has a heater built-in, allowing charging in low ambient temperatures, avoiding the problem of parked trailers going offline during winter months.

Interconnect uses the trusted and ubiquitous HDSCS system device side, with AMP Din 7-way intermediate connections to be paired with one of our available cables to match the EBS manufacturer & model. The AT600 Smart Trailer device takes +24V power and CAN directly from the EBS unit, and hence installation is fast & simple.

Housed in a sturdy enclosure, with IP69K ingress protection, and M8 mounting, the AT600 is built to withstand the harsh conditions typically expected in semi-trailer applications.

Features

The main features of the AT600 are highlighted below:

- Robust construction with 2 x M8 mounting
- IP69K water-resistant
- Cortex M33 STM32U5 low-power family ARM Processor
- Multi-concurrent GNSS supporting all major constellations
- Quectel EG915N-EA 4G LTE Cat 1 + 2G GSM communications
- BLE 5.2
- Internal LTE and Bluetooth antennas - PIFA PCB trace, high-sensitivity
- Internal GNSS antenna, 15mm ceramic patch
- Low power consumption – well within the 1A max. supplied by the EBS
- 6 axis IMU (accelerometer + gyro)
- CANBus
- 2 digital inputs
- 2 digital outputs
- 1-wire / Dallas interface
- Auxiliary 3.3 for use with accessories
- 1 RS232 Port
- Heated back-up battery, lithium-ion, 3500mAh
- Fast & reliable FOTA

Technical Specifications

LTE / GSM Communication

Communications Module:	Quectel EG916N-EA
LTE FDD Frequency Bands:	B1/B3/B5/B7/B8/B20/B28
LTE TDD Frequency Bands:	B38/B40/B41
GSM Frequency Bands:	B3/B8
LTE Antenna:	Ceramic
Dual SIM:	Plastic nano SIM (4FF), push-push style with retainer MFF2 chip SIM

GNSS Location

GNSS Antenna:	Internal 15 x 15 x 4mm ceramic patch
GNSS Receiver:	ICOE CS101
Concurrent GNSS Receiver:	GPS L1 C/A: 1574.397–1576.443 MHz GALILEO E1: 1563.440–1587.696 MHz GLONASS L1: 1597.781–1605.656 MHz BeiDou B1 C/A: 1559.052–1563.144 MHz
Position Accuracy:	1.5m CEP
Receiver Sensitivity:	-167dBm (tracking & navigation)
TTFF: Cold start	27 sec (average) @ -130 dBm
Hot start	1 sec (average) @ -130 dBm

BLE 5.2

BLE Module:	ST BlueNRG-LP
TX Power:	+8dBm
Sensitivity:	-97dBm
Bluetooth Compliance:	5.2 and earlier

Power

External Voltage Source:	5 – 90 VDC
Internal Battery:	3.7V, 3500mAh, lithium-ion, with heater
Battery Heater:	5W
Battery Life:	48 hours continuous operation 60 days operation in low-power mode @ hourly update 120 days operation in low-power mode @ daily update
Current Consumption, max:	350mA @ 24 VDC (battery charging at max. rate)
Current consumption, average:	20mA @ 24 VDC
Current consumption, sleep:	< 100uA

Indicators

Status LEDs (externally visible):	Communications (BLUE) GNSS (GREEN) CANBus (RED)
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Interconnections

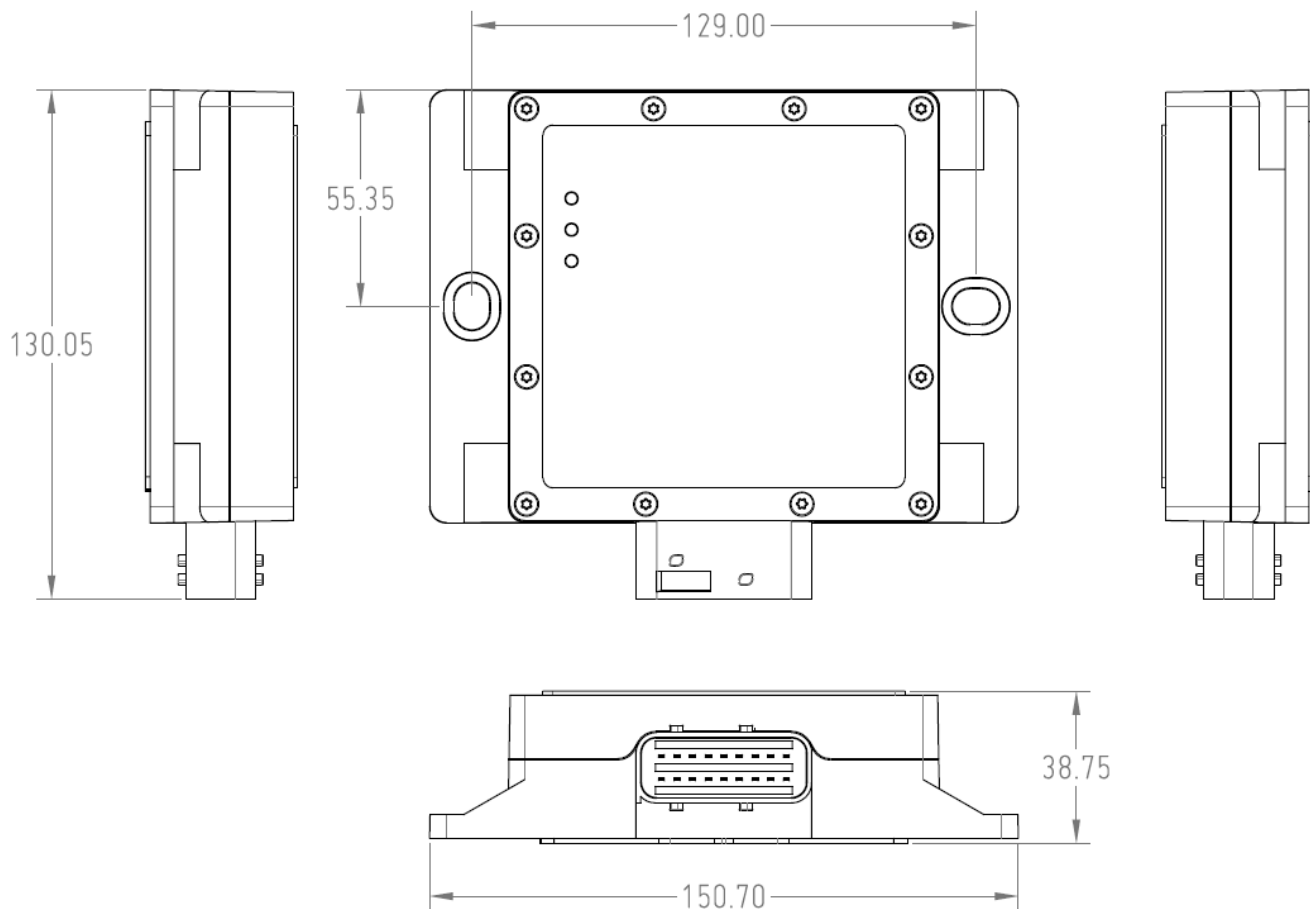
	2 digital pull-up inputs 5 digital outputs, 60V, 0.5A maximum, open drain (optional 3.3V drive) 1-wire (Dallas) CANBus RS232 serial port 3.3V Auxiliary Output
Dual SIM:	nano SIM 4FF + MFF2 chip SIM
POWER & DATA:	18-way HDSCS

Weight

340g

Dimensions

151 x 130 x 39 mm



Hardware Description

AT600 Pin Applications and Colour Code

Pin Number	Application	CB601 Wire Colour
1	Digital Input #1	White
2	Digital Input #2	Brown
3	+24V	Red
4	+24V (for loop-back)	N/A
5	CANL	Green / Yellow
6	CANH	Red / White
7	RS232-TXD	Green
8	Digital Output #1	Yellow
9	Digital Output #2	Pink
10	1-Wire	Grey
11	GND	Black
12	3.3V Aux Out	Orange
13	GND	Black
14	CANL (for loop-back)	N/A
15	CANH (for loop-back)	N/A
16	RS232-RXD	Blue
17	SWDIO	N/A
18	SWCLK	N/A

Cable Overview

CB601	Fully-populated cable, as per the above table, terminated in astra standard plug & play connectors for easy use with accessories, for the purposes of bench testing
CB600RA	For trailer installations, this cable mates with the AT600 18-way HDSCS, With 5m length, terminated in a 7-way DIN, to be matched with one of the cables below, according to the EBS model
CB601	for use with Haldex Gen3 EBS
CB602	for use with Wabco TEBS-E EBS
CB603	for use with Knorr-Bremse TEBS G2.x
CB604	for use with Haldex Gen4 EBS

Preparation – First Steps

AT600 devices are always powered-on, and are typically shipped in despatch mode, in permanent sleep, until connected to a power source.

Devices come with an astra MFF2 chip SIM as standard, and that's our recommended option, as the most robust solution considering the shock & vibration. Users have the option to fit a 4FF (nano) size plastic SIM in the holder, to be retained using a PCB post, as shown below:



The back-up battery is connected beneath the PCB, which is a press-fit onto the 18-way connector contacts. We recommend not to remove the PCB from the enclosure, to avoid damage.

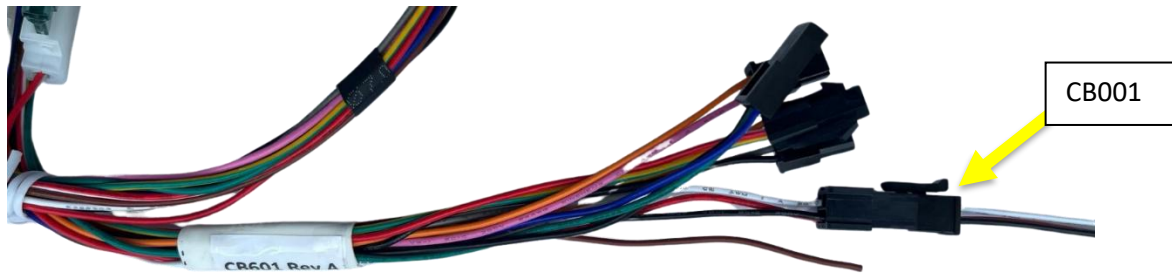
Now you are ready to wake the device from despatch mode, by connecting a DC power source (we suggest from 9-30V DC, 1.0A min. current capability). Do this by attaching the CB601 test & development cable to the main 18-way HDSCS connector:



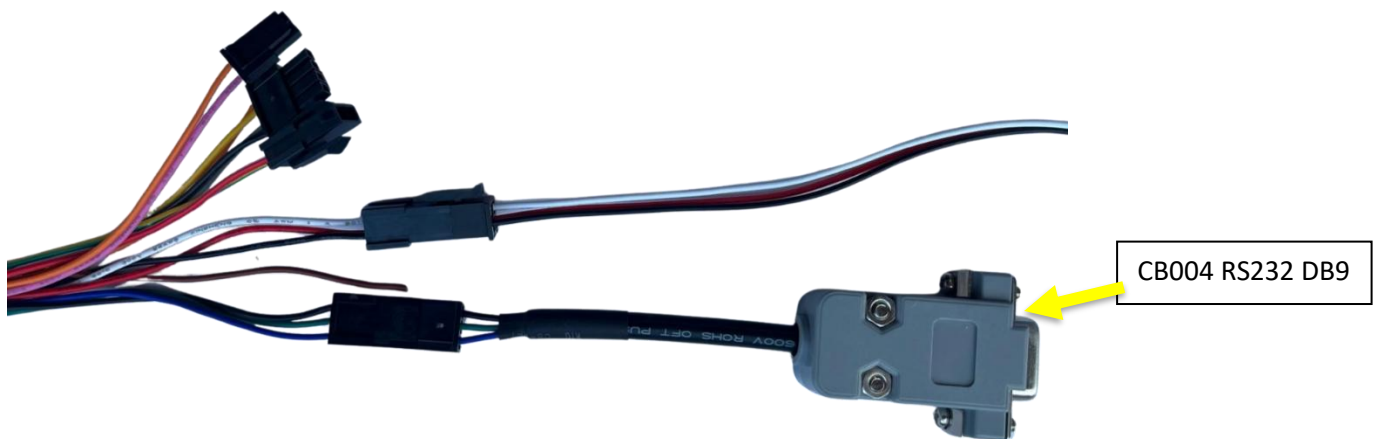
And push in the yellow clip to secure the connector fully into position:



A convenient way to connect DC power is via the 4-way (2x2) connector on the other end of the CB601 cable, which mates with our standard CB001 power & ignition cable:



Also attach the CB004 RS232 adapter to the 3-way (3x1) header:



Connect the DB9 end of the CB004 adapter to an RS232 port of a PC (probably using a USB-RS232 adapter)

Open any ASCII terminal application and set the COM port to the one assigned to the AT600 connection, and BAUD rate to 115200. All other RS232 settings can be left at their default values.

Apply DC power (anything from 9-30V is convenient, although the supported range of the AT600 is 6-90VDC) to the red & black wires of the CB001 as below:

RED +VE
BLACK GND

The AT600 should wake-up and you will see something like this in your ASCII terminal:

```
Voltage regulator ON
IGN ON event
CAN enabled, interface type: 6
Wakeup: 0x09 DIG1 EXT_PWR
PWR_DOWN_STATE_CHANGE -> WAITING_TO_RESUME
PWR_DOWN_EXIT: canbus
CANBus wake
PWR_DOWN_EXIT: monitor
PWR_DOWN_EXIT: ebpm
EBPMS wake
PWR_DOWN_EXIT: event
Event wake
REPORT REASON(S):
  TIMED
  I/O CHANGE
  EXTPWR
  JNY START
STATUS:
  IGN ON
  GPS INVALID
Sending Report to comm_task
  msn: 45
  jtime: 1475316049
  time: 10:00:49
  date: 06:10:2026
  lat: 53.472334
  lon: -2.329034
  head: 186.7 degrees
  spd: 0.0 kmh
  sats: 31
  hdop: 0.47
  est. err: 0 m
  accel: X:0 Y:0 Z:0 m/s/s * 10
  decel: X:0 Y:0 Z:0 m/s/s * 10
PWR_DOWN_STATE_CHANGE -> IDLE
CAN enabled, interface type: 6
Ext Volts: 12.55V
Batt: 4.18V / 100%, Charging, 20.0C, Heater OFF
CAN enabled, interface type: 6
First good GPS...
```

The device is now in operational mode, and will remain in this state.

Now is a convenient time to review the device configuration and make any necessary changes. Please refer to Astra Telematics Command Reference for details of configuration commands. You can find that document right at the top of our downloads page:

<https://astratelematics.com/astra-telematics-download-product-manuals/>

Below are some of the primary configurations that you may wish to change:

Server Communication:	\$IPAD, \$PORT, \$PROT, \$MODE, \$TCPT
CANBus Options:	\$CANC (define EBS type or auto-detect)
Reporting Intervals:	\$STIM, \$JSEC, \$HEAD, \$DIST

Journey Detection: \$IGNM (we recommend mode 5)

The AT600 Smart Trailer device communicates with the platform server using our Modular Communication Protocol Y. This modular protocol includes optional modules which can be enabled or disabled, according to the application and user preferences. For HGV semi-trailer applications, the relevant module contains the following data fields:

Module Byte Count (n)	integer	count	1	
CAN event date / time	uint32	julian seconds	4	
Flags	uint16	bitfield	2	
Current EBS Supply Pressure	uint8	kPa / 5	1	
Total Axle Load	uint16	kg / 2	2	
Current wheel-based speed	uint16	kph * 256	2	
Road Angle	int8	degrees * 10	1	0x80 / -128 when unavailable
Deceleration	uint8	m/s ² * 20	1	0xFF when unavailable/not a valid brake event
Service Brake Demand Pressure	uint16	kPa * 52	2	
Parking Brake Demand	uint8	% / 0.4	1	0xFF when unavailable
Braking Efficiency Raw	uint8	%	1	0xFF when unavailable/not a valid brake event
Braking Efficiency Compensated	uint8	%	1	0xFF when unavailable/not a valid brake event
Wheel Count	uint8	Count	1	
Wheel Position	uint8	encoded	1	
Tyre Pressure	uint8	Bar * 10	1	0xFF when unavailable
Brake Temperature	uint8	degrees C / 10	1	0xFF when unavailable
Brake Lining Wear	uint8	% / 0.4	1	0xFF when unavailable
Axle 1 Left brake pressure	uint8	kPa / 5	1	0xFF when unavailable
Axle 1 Right brake pressure	uint8	kPa / 5	1	0xFF when unavailable
Axle 2 Left brake pressure	uint8	kPa / 5	1	0xFF when unavailable
Axle 2 Right brake pressure	uint8	kPa / 5	1	0xFF when unavailable
Axle 3 Left brake pressure	uint8	kPa / 5	1	0xFF when unavailable
Axle 3 Right brake pressure	uint8	kPa / 5	1	0xFF when unavailable
		module total:	variable	

Please contact support@astratelematics.com for a copy of our documentation for Modular Communication Protocol Y.

Example parser code can be found on our NPM page:

<https://npm.io/package/astra-protocol-y-parser>

Hardware Application Information

Status LEDs

GNSS Status:	Constant ON Double Flash @ 1Hz Slow Flash @ 0.2Hz Fast Flash (<2Hz)	Searching for initial fix GPS 3D navigation Lost GPS navigation Test mode – contact astra
COMM Status:	200 ms ON / 1800 ms OFF 1800 ms ON / 200 ms OFF Constant OFF	ON / SEARCHING registered on network Modem OFF
CANBus Status:	OFF Flashing	No CANBus data is being received CANBus data is being received

Digital Inputs

Digital inputs 1 and 2 are suitable for use in 'power-take-off' applications and can be connected directly to 12/24V vehicle circuits. Maximum tolerated voltage on these inputs is 32.0V.

Digital Outputs

The AT600 is capable of switching 2 external loads of up to 60V, 0.5A using MOSFET Low Side Switches (open drain), which must be used to switch the GND side of the load. The digital output switches are protected by internal self-resetting fuses, rated at 0.63A. An external fuse, rated at 0.5A will avoid any risk of internal damage that may occur.

CANBus

The AT600 has integrated CANBus, which is typically connected directly to the EBS, using cables supplied by Astra. For any other applications, please note:

IMPORTANT NOTE: The CANBus pins are ESD protected to 15kV, but can only withstand a continuous voltage of 12V maximum. These pins must not be used for any other application to avoid damage to the device.

Integrated Accelerometer

The AT600 has a built in 6 axis MEMS accelerometer / gyro, which is used to measure road angle for EBPMS purposes and motion detection for wake from sleep. For options to define the sensitivity of the wake from sleep function, please refer to the \$MEMS parameter.

1-wire / iButton (Dallas Key) Interface

This can be used with iButton devices for the purpose of driver ID, or with DS18B20 temperature probes. Please refer to the appropriate application notes for more details of how to use these features.

3.3V Auxilliary Power Output

This are reserved for use with external devices. The 3.3V regulated output can be used with certain astra accessories, or client-specific applications. This output is fused at 150mA, maximum recommended current drain is 100mA.

Enclosure Sealing

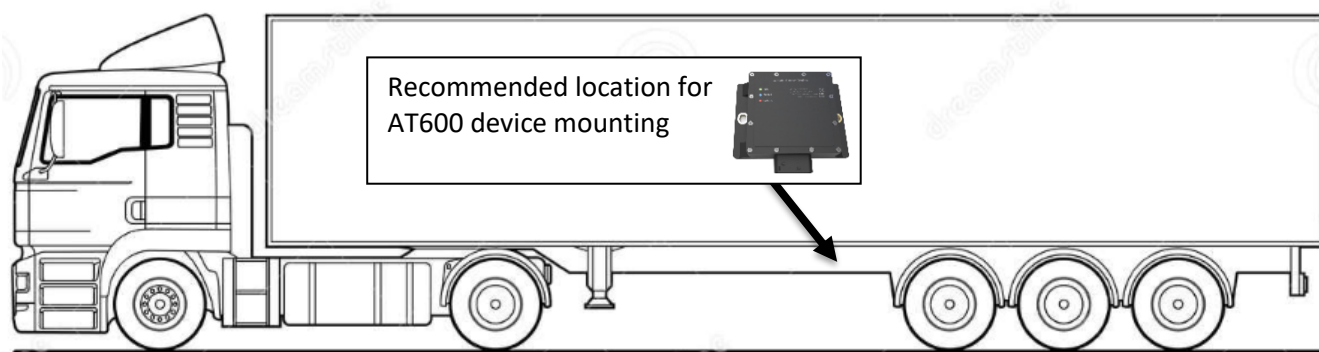
When fitting the enclosure cover, please insert all 12 screws and torque to 60cNm to guarantee IP69K sealing.

Installation

Mounting the Device

We recommend mounting the AT600 to the outside face of either of the trailer I beams. A convenient spot is typically just forward of the front axle. The device should be mounted to the I

beam with 2 x M8 bolts (supplied) with plain washers and nyloc nuts, with the 18-way HDSCS connector facing down:



Connections to the EBS ECU

For all trailers, the starting point is the CB600RA cable, which should be connected to the AT600 Smart Trailer device, and secured by pressing the yellow clip.

Next, select the appropriate cable, according to the EBS ECU fitted to the trailer in question:

CB601	for use with Haldex Gen3 EBS
CB602	for use with Wabco TEBS-E EBS
CB603	for use with Knorr-Bremse TEBS G2.x
CB604	for use with Haldex Gen4 EBS

Join the 2 cables via the 7-way DIN connectors, and carefully route along the inside of the I beam, using cable ties to secure the cable to existing ones.

At the EBS ECU side, connect to the appropriate port, according to the EBS type:

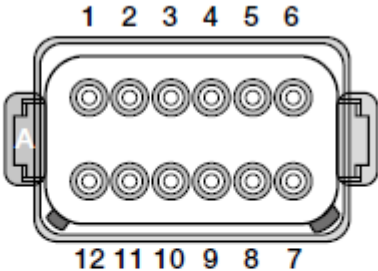
Haldex Gen3 Remove the blanking plug from any of the 2 DIAG ports and push in the CB601 cable, until the locking tab clicks into position

Haldex Gen4 Remove the blanking plug from any of the 2 DIAG ports and push in the CB604 cable, until the locking tab clicks into position

Wabco TEBS-E Remove the blanking plug from the Subsystem port and push in the CB602 cable, until the locking tab clicks into position

Knorr-Bremse TEBS G2.x Remove the Deutsch DT-06 connector from the In-Out ports and insert the pins of the CB603 cable as below:

In-Out Pin#	CB603 Wire Colour
7	Red
8	Black
9	Yellow
10	White

In - Out Connector	
	
Pin Number	Function
1	AUXIO 1
2	AUXIO 2
3	AUXIO 3
4	Sensor Ground
5	Sensor Input 1 [SENS_IN1] (Tri-state Input)
6	Sensor Supply [SENS_SUP] (Tri-state Input)
7	Stop Lamp Supply (+) → RED
8	Stop Lamp Ground (-) → BLACK
9	J1939 CAN (5 V) Low → WHITE
10	J1939 CAN (5 V) High → YELLOW
11	AuxRet 3
12	AuxRet 12 (Return for AUXIO 1 & 2)

Electrical Parameters

Operating Conditions

Parameter	Min	Max	Units
Power Supply Input Voltage	+6	+60	V
Digital Input High Voltage Threshold	+5.0	-	V
Digital Input Low Voltage Threshold	-	+2.0	V
Digital Output Maximum Voltage	-	+60.0	V
Digital Output Maximum Current	-	0.5	A

Absolute Maximum Ratings

Parameter	Min	Max	Units
Power Supply Input Voltage	-32	+100	V
Voltage on Digital Inputs 1-2	-32	+32	V
Voltage on Digital Outputs 1-2	-32	+60	V
Current on Digital Outputs 1-2	0	0.5	A
Voltage on RS232 RX	-25	+25	V
Voltage on RS232 TX	-13	+13	V
Voltage on iButton/Dallas Interface	-5	+5	V
Storage Temperature	-40	+85	°C
Operating Temperature (w/o battery heater)	0	+60	°C
Operating Temperature (with battery heater)	-20	+60	°C

Typical Power Consumption

Operating Mode	Current @ 13.8V	Current @ 27.6V	Power Consumption
Fully Operational	25mA	14mA	< 400mW
Battery charging	500mA	275mA	< 7W
Sleep (no battery)	0.5mA	0.3mA	7mW
Sleep (with battery)	< 10uA	< 10uA	0.1mW

Environmental Specifications

Parameter	Specification
Storage temperature	-40 to +85 °C
Operating temperature (no battery)	-20 to +60 °C
Operating temperature (with battery)	0 to +45 °C (note: no charging below 0°C)
Ingress Protection	IP69K
Vibration, broadband random	Complies with IEC60068-2-64
Shock	Complies with IEC60068-2-64
Humidity	IP69K

Appendix A - Cable info

CB600RA 18-way HDSCS to 7-way DIN male



CB601 Haldex Gen 3 to 7-way DIN female



CB603 Wabco Subsystems to 7-way DIN female



CB604 Haldex Gen 4 to 7-way DIN female

