

Product Manual

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CANcockpit

New Generation 2009

Flexible instrumentation with CAN bus technology



Product Manual **CANcockpit**

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▼ = will follow

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1. Safety Instructions

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1. Safety Instructions

1.1 Installation

**No smoking!
No naked flames or lights!**



- The product is only designed for use in land-bound vehicles (except motorcycles).
- Make sure that the engine cannot be unintentionally started during installation.

Before installation

- Withdraw ignition key from ignition lock.
- Note down all data in temporary electronic memories.
- Before installation refer to the vehicle documents for details of vehicle type and any special features.
- Refer to the construction diagrams to find out the positions of the fuel/hydraulic/pneumatic and electrical lines.
- Take account of any modifications to the vehicle which have to be considered during installation.
- Failure to use the product correctly may cause harm to people, property and the environment. Therefore make sure you use our product correctly.
- Basic knowledge of vehicle electrics and mechanics is necessary for installation to prevent harm to people, property and the environment.
- The product has been developed, manufactured and tested in accordance with the basic safety requirements of EC directives and the acknowledged state of the art.
- **Short circuits**
Short circuits in the vehicle's wiring can cause cable fires, battery explosions and damage to other electronic systems. Therefore disconnect the minus pole of the vehicle battery before starting work.
If the vehicle has supplementary batteries, the minus poles of these batteries should also be disconnected.
- Modifying or tampering with the product may affect safety. Therefore it must not be modified or tampered with.
- When removing/installing seats, covers and the like, make sure that you do not damage lines or release plug connections.
- **Possible data loss**
When the batteries' minus poles are disconnected, all the temporary electronic memories lose their entered data. Therefore, note down all the relevant data for re-programming before disconnection.

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1. Safety Instructions

1.1 Installation

During installation

- During installation make sure that the product's components do not affect or restrict vehicle functions and are themselves not damaged.
- Only install undamaged parts in vehicles.
- During installation make sure that the product does not impair the field of vision and that the product is not positioned within the impact range of the driver's or passenger's heads.
- When selecting the installation location, make sure there is sufficient space behind the drilled holes and the installation opening.
- Take account of the routing of lines and cable leads.
- Do not select an installation location within the mechanical and electrical range of the airbag.
- Do not drill holes or cut openings in load-bearing or stabilizing struts or members.
- Err on the small side when predrilling installation apertures with cone-type cutters, compass or jig saws, or files, enlarge if necessary and complete. Deburr edges. Always follow the tool manufacturer's safety instructions.
- When working beneath the vehicle, secure the vehicle in accordance with the vehicle manufacturer's instructions.
- If any work is necessary while the engine is running, take special care. Only wear suitable working clothes because of the risk of injury due to pinching and burning. Long hair should be worn in a hair net.
- Only use the envisaged multimeters or diode-test lamps to measure wattages and currents in motor vehicles. The use of conventional test lamps can cause damage to control units and other electronic systems.

After installation

- Firmly connect the earth cable to the minus pole of the vehicle battery.
- (Re-)program the data in the temporary electronic memories.
- Test all(!) vehicle functions.
- CANcockpit components to be cleaned with clear water only.
Observe the IP-degrees of protection (DIN 40050).

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1. Safety Instructions

1.2 Electrical Connection

Connect the cables in accordance with the electrical connection diagram.



- Take account of the cable cross section
A reduction in the cable cross section results in a higher current density. This can cause the cable to heat up.
- When laying electric cables, use existing cable ducts and routes but without laying cables parallel to ignition cables or cables leading to high current consumers. Fix the cables with cable tape or adhesive tape.
- Do not route cables over mobile components. Do not fasten cables to the steering column.
- Make sure that the cables are not exposed to tensile, compressive or shear forces.
- If the cables are routed through drilled holes, protect them with rubber sleeves or the like.
- Strip cables only with a cable stripper. Adjust the stripper so that no strands are damaged or severed.
Solder new cable connections only with the soft soldering process or use standard crimp connectors.
- Crimp connections should only be made with a crimping tool. Follow the tool manufacturer's safety instructions.
- Insulate exposed strands so that no short circuiting can occur.
- Faulty wiring can cause short circuiting. Wire the cables only in accordance with the electrical connection diagram.

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1. Safety Instructions

1.3 Sensors

1.3.1 Pressure Sensor for Oil

- Sensor installation location: At the place provided by the engine manufacturer, equipment manufacturer or car manufacturer in the oil circulation system (most often in place of the oil pressure switch).
- Sensor installation only when engine is cold.
- When removing the oil pressure switch or the screw from the drilled hole for the oil pressure measuring system, collect the oil running out of the system in a proper container and dispose of it in accordance with legal regulations.
max.
- The values mentioned in the following table for the maximum tightening torque (Nm max.) refer exclusively to the load-bearing capacity of products. Prior to using the product, it is important to ask the manufacturer of the vehicle, equipment system or engine in each instance for the maximum torque (? Nm max.) value for the threaded hole into which the product is to be screwed. Non-observance of the maximum tightening torque specified for the threaded hole in each instance can result in damage to the vehicle, engine or equipment system.

M10 x 1	30 Nm
1/8 in. BSPF	30 Nm
1/8 - 27 NPTF	30 Nm
R 1/8 DIN 2999	30 Nm
M12 x 1,5	40 Nm
M12 x 1	50 Nm
M14 x 1,5	50 Nm
1/4 in. BSPF	60 Nm
1/4 - 18 NPTF	60 Nm
3/8 - 18 NPTF	60 Nm
M16 x 1,5	80 Nm
3/8 - 18 Dryseal NPTF	80 Nm
M18 x 1,5	100 Nm

- If the connection thread is cylindrical, a sealing washer or a sealing ring made of copper must be fitted.
- Following sensor installation, fill up the system with the required quantity of specified oil.

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1. Safety Instructions

1.3 Sensors

1.3.2 Temperature Sensor for Oil

- Sensor installation location: At the place provided by the engine manufacturer, equipment manufacturer or car manufacturer in the oil circulation system (e. g. oil drain plug).
- Sensor installation only when engine is cold.
- When removing the oil drain plug, collect the oil running out of the system in a proper container and dispose of it in accordance with legal regulations.
- The values mentioned in the following table for the maximum tightening torque (Nm max.) refer exclusively to the load-bearing capacity of products. Prior to using the product, it is important to ask the manufacturer of the vehicle, equipment system or engine in each instance for the maximum torque (? Nm max.) value for the threaded hole into which the product is to be screwed. Non-observance of the maximum tightening torque specified for the threaded hole in each instance can result in damage to the vehicle, engine or equipment system.

max.	
M10 x 1	10 Nm
M10 x 1.5	10 Nm
1/8 - 27 NPTF	10 Nm
M12 x 1.5	15 Nm
1/2 - 20 Gang	15 Nm
M14 x 1.25	20 Nm
M14 x 1.5	20 Nm
5/8 - 18 UNF - 3A	20 Nm
1/2 In. 20 Whit. S	20 Nm
1/4 - 18 NPTF	20 Nm
M16 x 1.5	30 Nm
M18 x 1.5	30 Nm
M20 x 1.5	30 Nm
M22 x 1.5	30 Nm
M24 x 1.5	30 Nm
M26 x 1.5	30 Nm
1/2 - 14 NPTF	30 Nm
3/8 - 18 NPTF	30 Nm
R 1/2	30 Nm
R 3/8	30 Nm
3/8 - 18 Dryseal NPTF	30 Nm
3/4 - 16 UNF-3A	30 Nm

- If the connection thread is cylindrical, a sealing washer or a sealing ring made of copper must be fitted.
- Following sensor installation, fill up the system with the required quantity of specified oil.

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1. Safety Instructions

1.3 Sensors

1.3.3 Temperature Sensor for Engine Coolant

- Sensor installation location: At the place provided by the engine manufacturer, equipment manufacturer or car manufacturer in the coolant circulation system (e.g. in place of the temperature warning switch) or in the coolant hose.
- Sensor installation only when engine is cold.
- Collect the coolant running out of the system in a proper container and dispose of it in accordance with legal regulations. max.
- The values mentioned in the following table for the maximum tightening torque (Nm max.) refer exclusively to the load-bearing capacity of products. Prior to using the product, it is important to ask the manufacturer of the vehicle, equipment system or engine in each instance for the maximum torque (? Nm max.) value for the threaded hole into which the product is to be screwed. Non-observance of the maximum tightening torque specified for the threaded hole in each instance can result in damage to the vehicle, engine or equipment system.

M10 x 1	10 Nm
M10 x 1.5	10 Nm
1/8 - 27 NPTF	10 Nm
M12 x 1.5	15 Nm
1/2 - 20 Gang	15 Nm
M14 x 1.25	20 Nm
M14 x 1.5	20 Nm
5/8 - 18 UNF - 3A	20 Nm
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1/4 - 18 NPTF	20 Nm
M16 x 1.5	30 Nm
M18 x 1.5	30 Nm
M20 x 1.5	30 Nm
M22 x 1.5	30 Nm
M24 x 1.5	30 Nm
M26 x 1.5	30 Nm
1/2 - 14 NPTF	30 Nm
3/8 - 18 NPTF	30 Nm
R 1/2	30 Nm
R 3/8	30 Nm
3/8 - 18 Dryseal NPTF	30 Nm
3/4 - 16 UNF-3A	30 Nm

- If the connection thread is cylindrical, a sealing washer or a sealing ring made of copper must be fitted.
- Following sensor installation, fill up the system with the required quantity of the compositon specified coolant.

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1.3 Sensors



1.3.4 Fuel Level Sensor (Lever Type Sensor/Tubular Type Sensor)

- An installation opening remaining to be made in the tank at a suitable point for supply level measurement or at an installation flange or installation opening already provided by the tank manufacturer.
- If an installation opening must be made, the tank must be completely drained first. Fill the fuel into an approved container.
-  Risk of explosion exists due to presence of residual gases in the tank! Make sure that the tank is aired sufficiently (approx. 10 minutes).
- Make a preliminary hole in the installation opening using a drill and then finish the hole using a compass saw or piercing saw. Comply with the safety instructions of the tool manufacturer. Clean the tank of residue from the drilling or sawing work.
- The safety instructions given by the welding equipment manufacturer and the working regulations applying to welding work must be respected when welding the tank flange.

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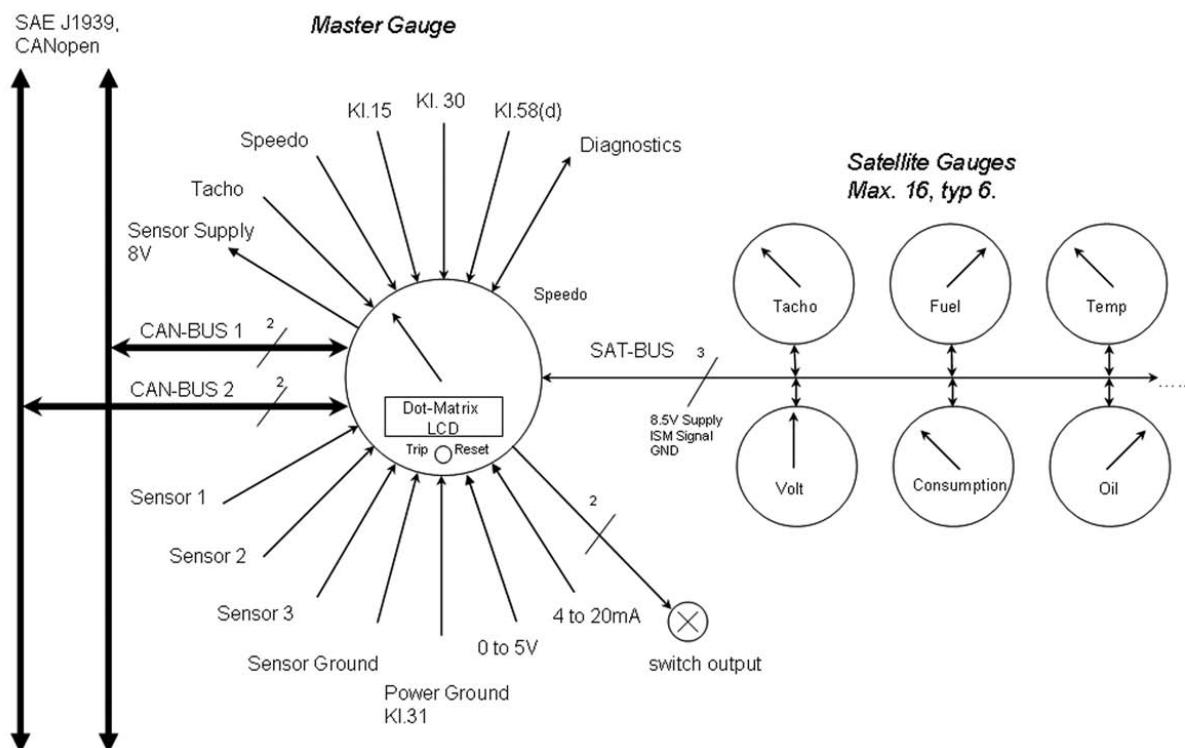
2. Functional Specification

1. System

1.1 Main Features

- Master-Slave relationship between Master gauge and other instruments
- Up to 16 Slave functions on one Master instrument or 32 with the use of two Master instruments
- CAN protocol flexibility (processing two protocols simultaneously)
- Modular "plug & play" as needed
- Analogue sensor compatible
- Frequency inputs
- Dot-matrix information display
- Switch outputs available
- Flexible to customer needs

1.1.1 Block Diagram CANcockpit



1.2 Mechanical Concept

The Masters are 80, 85 and 100 mm in diameter, the Satellite gauges dia. 52, 80 and 100 mm.

The dials are translucent backlit. The illumination of the gauges is realised with white LED's.

The backlighting of the LCD has a yellow LED. The warning lamp in the slave can have a red or yellow LED.

The housing and bezel are made of non-flammable plastic, the design is like a triangle with the black color RAL 9005. The bezel is clipable. The lens is flat and frosted. The pointer has a PC hub in black and the pointer arm is OL 5105 (white -coated on the underside). The pointer type is translucent illuminated.

The housings have an indent in the thread at 6 o'clock position, so that an optional key can be used according to SAE J1226 and SAE J 1399.

The movements are front-mounted stepper motors MW2000, only clockwise indication.

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1.3 Safety Concept

1.3.1 Sensors

Analog sensors can be checked for short and open circuit.

1.3.2 System Check

When the trip-reset button is pressed while ignition is being turned on, the system-check function is activated and clears the contents of the DTC List.

If there are any active service messages, they will be displayed on the Dot-Matrix Display starting with the first active service message. If the reset button is then pressed and held for 5 seconds or longer, this service message will be reset. The next active service message is displayed thereafter.

To proceed to the next active service message without resetting the displayed code, the button needs to be pressed shortly (<5 sec). If all active service codes have been displayed, the system check function is started as described below:

1. All warning lamps and illumination of all gauges are activated for 3 seconds.
2. The Master gauge initializes all configured satellite gauges and waits until they are ready or a Satbus timeout occurs.
3. During time.this, all LCD-Dots are turned on for about 1.5 sec, all pointers are moved to their end value
4. Then all LCD-Dots are turned off and the pointers move back to zero, for about 1.5 sec too, and all warning lamps and illumination will be turned off
5. Firmware version and Check sum of the EEPROM in hexadecimal format are displayed for about 10 sec.

The display format is as follows:

XX represents a hex-coded value

Small display line	Format	Description
2	hXX sXX.XX dd_mm_yyyy	hXX specifies the Hardware version relevant to the Firmware sXX.XX refers to the Firmware version, for example s12.A8 stands for V06 dd_mm-yyyy is the Firmware date in day, month and full-year format.
4	nXXXXwXXyXX cXXXXXX	nXXXX is the WINgauge serial number of the device as programmed into the EEPROM. wXXyXX displays the production week and year in short format. cXXXXXX shows the actual 3-byte Checksum of the EEPROM as calculated during the system check.

1.3.3 Satbus

After ignition for synchronisation the Master gets feedback from the satellites.

A timeout function can be programmed too. If more satellites are configured, the Master will not get feedback from all gauges. After a timeout of about 14 seconds, the Master will act as described before, when the Master gets feedback from all satellites.

During normal operation there is no feedback from the satellites.

1.3.4 WINgauge

A system diagnosis function for testing all in- and outputs is implemented in the WINgauge Software.

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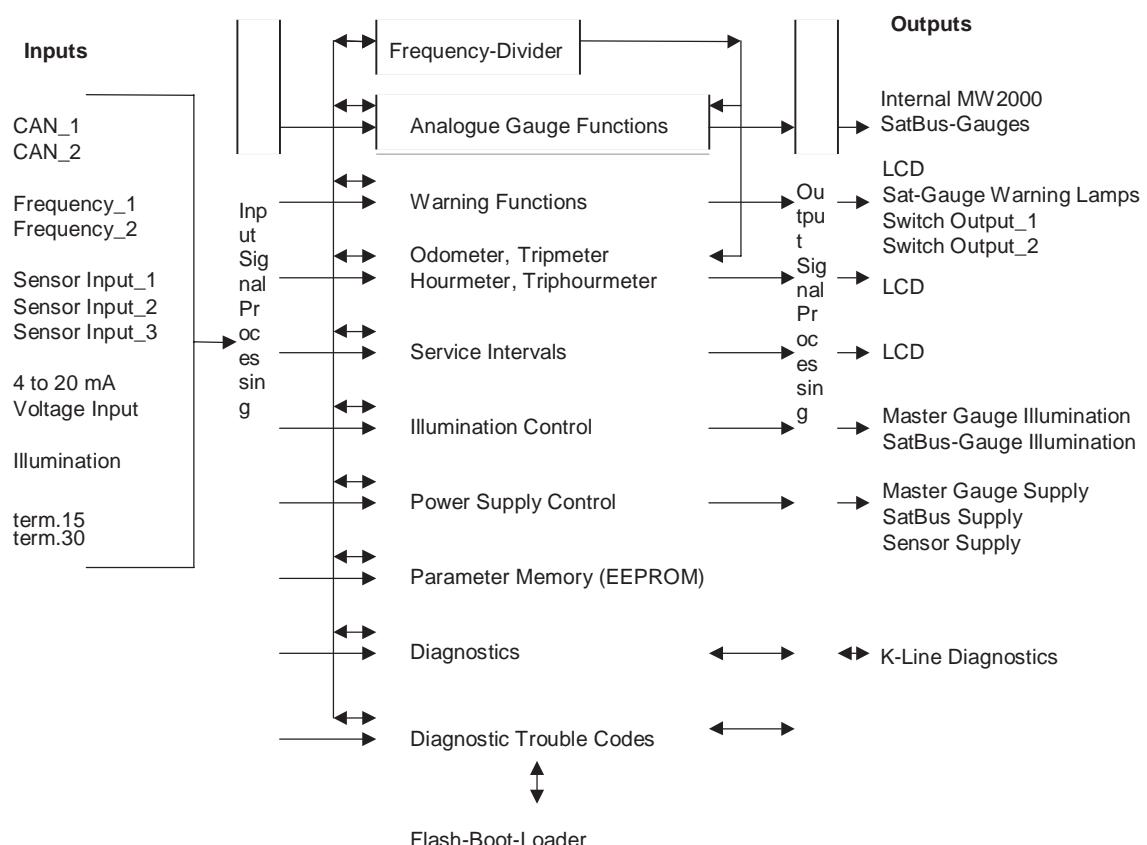
2. Master Gauges

2.1 General Features

The design concept for this design includes:

- 2x High-speed Full-CANbus interface V2.0B compatible.
- Half-duplex serial link to satellite gauges.
- VMC SCAL CDVV Microcontroller with identical firmware.
- Stepper motor MW2000 directly controlled by Microcontroller.
- Satellite gauges use SM2 stepper motor driven by ISM IC.
- LED illumination concept.
- 132 x 33 dots matrix LCD.
- Wide input voltage range switch mode power supply.
- Diagnostic Interface for configuration.

2.1.1 Main Functions



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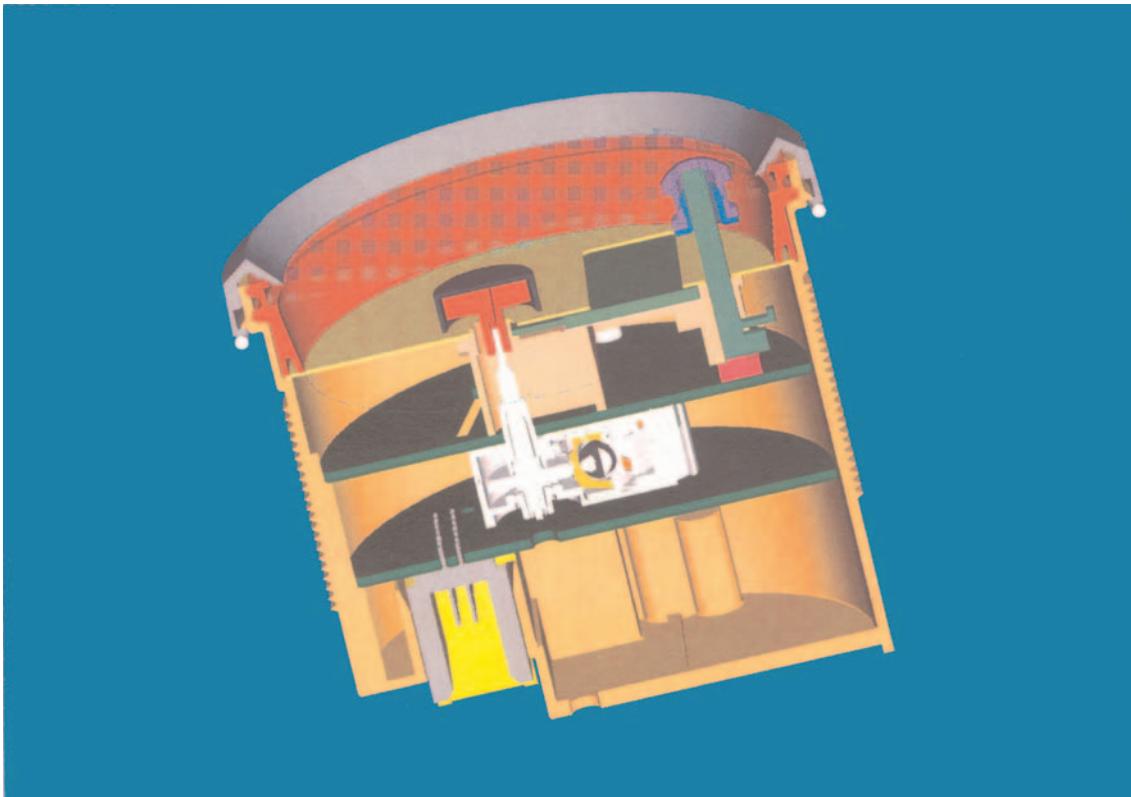
2.2 Mechanical Concept

As the same LCD is used for different Master gauge diameters the pointer position has different eccentricities and indication angles.

Gauge diameter [mm]	Eccentricity [mm]	Indication angle
80	7	210°
85	4.5	216°
100	0	206°

The connectors are 26-Pin MODU II-Connector and 4-Pin MATE-N-LOK from AMP.

2.2.1 Master dia. 80 mm



Two PCB's are necessary for this diameter. They are connected with a standard pin connector and two distance towers.

2.2.2 Master dia. 85 mm

The PCB assemblies and their corresponding parts of the Ø 80 mm and Ø 85 mm gauges are identical. The difference between the two gauges is the position of the stepper motor on the PCB so that the eccentricity of 7 mm in the Ø 80 mm gauge can be reduced to 4.5 mm in the Ø 85 mm gauge.

2.2.3 Master dia. 100 mm

For this size, only one PCB assembly is necessary. Input Signal Processing.

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2. Functional Specification

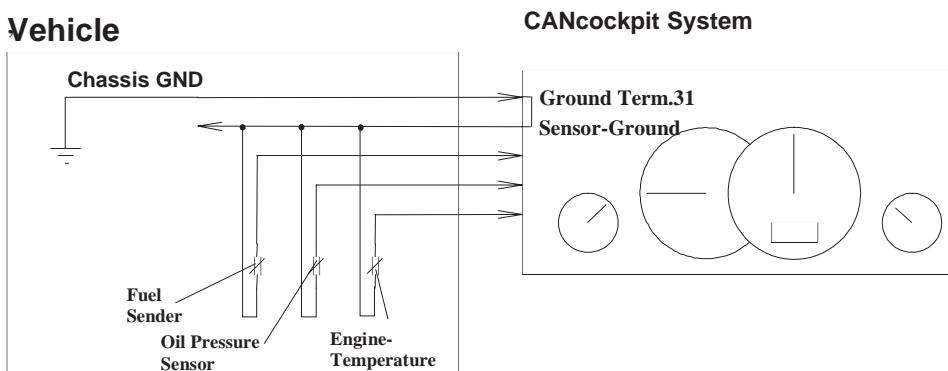
2.3 Input Signal Processing

2.3.1 Analog Inputs

All sensor characteristics can be defined with the WINgauge Software.

2.3.1.1 Grounding Concept

The Master gauge has two main ground lines. Ground term.31 is connected to the vehicle's body (negative battery terminal) and Sensor Ground is supplied from the instrument; insulated return sender are necessary. The Sensor Ground should not be connected to vehicle ground, which would result in a higher current flowing through this line and thus produce a signal noise and measurement error. Sensor Ground and Ground term.31 are joined together inside the Master Gauge. This grounding principle is necessary to accurately measure analog values. Ground shift on Sensor Ground is minimized by this concept.



2.3.1.2 Sensors

The static and dynamic voltage drop of the sensors should not exceed 0.5 V.

Pressure:	10 - 184 Ohms
Temperature:	10 - 700 Ohms
Fuel lever type:	3 - 180 Ohms
Fuel dip-pipe:	0.5 - 90 Ohms
Other sensors:	4 - 20 mA
Other sensors:	0 - 5 V

2.3.2 Input Signal Processing applied to the two frequency inputs

Frequency 1:

The standard modules can be changed to $500 < k < 400\,000$ pulses/km or miles for the Speedometer and 0.5 - 400 pulses/rev for the Tachometer.

Maximum frequency is 40 kHz (2 kHz via internal divider).

Frequency 2 as Hall Sensor / Terminal W:

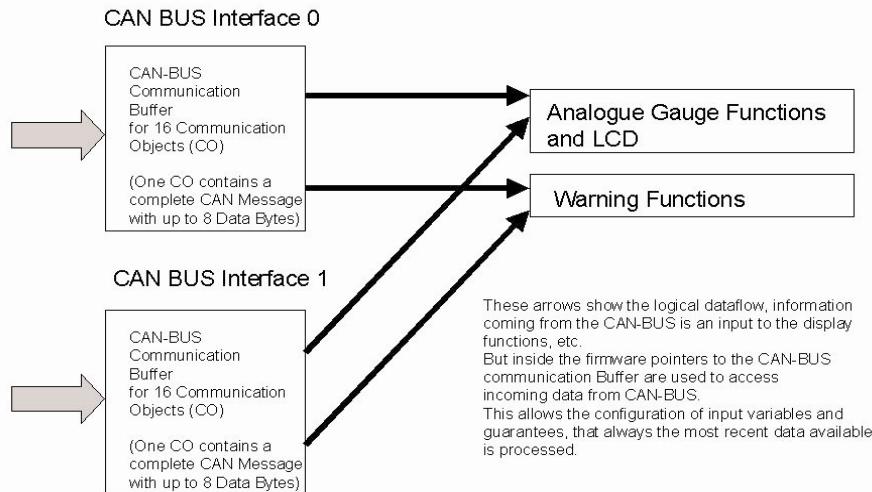
$500 < k < 65\,000$ pulses/km or miles for Speedometer and 0.5 - 65 pulses/rev for Tachometer.

Maximum frequency is 2 kHz.

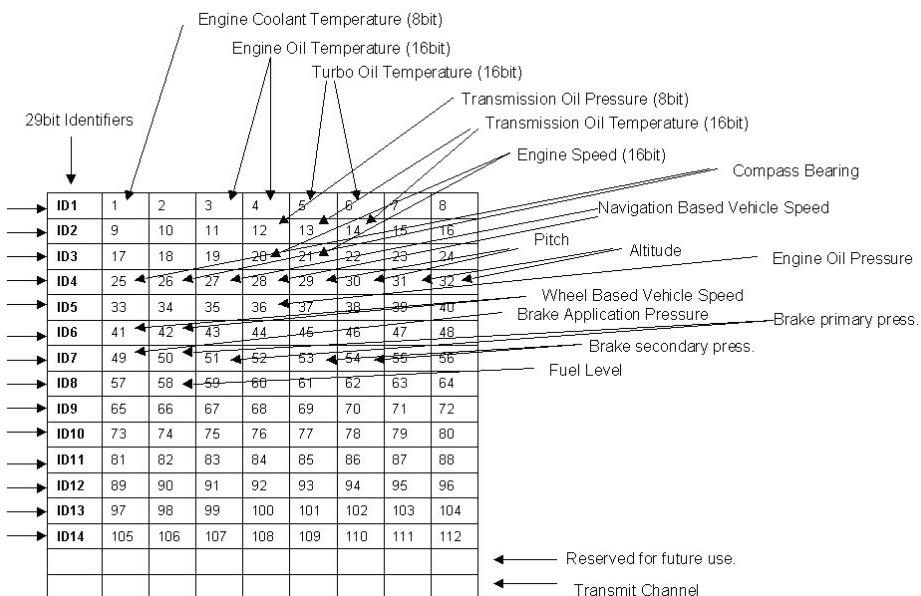
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2.3.3 Input Signal Processing for CANbus messages



Example of SAE J1939 Messages received on one of the two CANbus Interfaces.



The Master Gauge CANbus interface conforms to CAN 2.0B specification and supports extended (29Bit) identifiers. The Gauge acts as a "Standard ECU", which is non-configurable as defined in SAE J1939. The application layer is based on SAE J1939/71 Rev 2008-01.

Additional communication protocol is CAN Open
For this the different CANbus data bases will be provided by the WINgauge configuration.

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2.4 PIN Assignment Description

Master:

Pin	Description	Pin	Description
1	Power Supply (terminal 30)	14	+ 8 V DC for sensor supply
2	Ground (terminal 31)	15	0 - 5 V DC Input
3	CAN1 _High	16	Illumination (terminal 58 (d))
4	CAN1 _Low	17	Ignition (terminal 15)
5	CAN2 _High	18	Frequency Input 2 (0-2 kHz)
6	CAN2 _Low	19	Frequency Input 1 (0-40 kHz)
7	NC	20	Switch-Output_1
8	k-Line	21	Switch-Output_2
9	Analog Input 1 (0,5 - 200 Ω)	22	NC
10	Analog Input 2 (0,5 - 300 Ω)	23	NC
11	Analog Input 3 (10 - 700 Ω)	24	External Switch
12	4 - 20 mA Input	25	Analog GND
13	4 - 20 mA GND	26	Frequency GND

2.4.1 Technical Description

PIN 1: Power Supply (terminal 30)

V_{Batt} = + 10,5 V to + 32 V

The instrument is supplied with permanent power through this terminal. Current consumption varies depending on the instruments operating mode (standby or active) and number of Slaves.

PIN 2: Ground (terminal 31)

Power ground of the instrument.

PIN 3, 4: CANbus Interface 1

High-Speed Full CANbus V2.0B compatible (10, 20, 50, 125, 250, 500 kbit/s, 1 Mbit/sec.).

12 V and 24 V system compatible.

Cable: shielded, twisted pair with a drain.

Cable Impedance: nom. 120 Ω .

Topology: linear Bus

Trunk Length: max. 40 meters

Drop Length: max. 1 meter

Termination: 2 resistors 120 Ω at each end of the bus.

Related documents: ISO 11898, SAE J1939/11



A combination of 29 bit ID and 11 bit ID can't be processed!

PIN 5, 6: CANbus Interface 2

See on CANbus Interface 1.

PIN 7: Not connected

PIN 8: K-Line Diagnostic Interface

Programming of the EEPROM and the diagnostics carried out via serial diagnostic interface K-Line.

PIN 9, 25: Analog Input 1

Range: 0.5 - 200 Ω

Standard sensors: Tube-type Sensor: 0,5 Ω to 90 Ω

Lever-type Sensor: 3 Ω to 180 Ω .

Sensor has to be connected between thesee pins.

PIN 10, 25: Analog Input 2

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Range: 0.5 - 300 Ω

Standard sensors: Pressure sensor(10 - 184 Ω)

Sensor has to be connected between theese pins.

PIN 11, 25: Analog Input 3

Range: 10 - 700 Ω

Standard sensors: Temperature sensor (38 - 700 Ω)

Sensor has to be connected between theese pins.

PIN 12, 13: 4 to 20 mA Input

Range: 4 to 20 mA

A resistor converts the 4 - 20 mA current into proportional voltage. Results are sampled every 31.25 msec by the Microprocessor.

PIN 14: +8 V sensor power supply:

Voltage: +8 V - 0 %, +10 %

Max. current: 50 mA



This output can be used only at 24 V power supply.

PIN 15: 0 - 5 V Input :

Range: 0 - 5 V

Results are sampled every 31.25 msec by the Microprocessor.

PIN 16: Illumination Input (terminal 58 (d):

Range: 0 to $U_{\text{Bat.}}$ (battery voltage)

Dimming of Master gauge illumination and attached Satellite gauges is controlled by the voltage amplitude at the Illumination input.

PIN 17: Ignition (terminal 15)

Vign.= + 10,5 V to + 32 V

The Microprocessor senses the voltage at the input and turns it into active mode, if the ignition is turned on.

PIN 18, 26: Frequency Input 2

Hall Sensor and terminal W:

Max. Frequency: 2 kHz

U_{high} min.: 5 - 7 V according to the configurated pulses

Signal type: square, sinus

Max. offset: 0.5 V

Off current max.: 100 μ A

Duty cycle: 50 \pm 15 %

Pulse ratio: 500 - 65 000 pulses/km or miles

Pulse/rev: 0.5 - 65 pulses/revolution

The Instrument has a pull-up resistor at the ignition in the input circuit. Input can be either road speed or engine speed.

Selection by configuration.



Only one frequency input (either Input 1 or 2) can be defined as road speed input.

PIN 19, 26: Frequency Input 1

Universal Frequency Input

Max. Frequency: 40 kHz (2 kHz via internal divider, 1:1; 1:2; ... 1:20)

U_{high} min: 1.5 - 10 V according to the configurated pulses

Signal type: square, sinus

Max. offset: 0.5 V

Off current max.: 100 μ A

Duty cycle: 50 \pm 15%

Pulse ratio: 0.5 - 400 pulses/revolution

The instrument has a pull-up resistor at ignition in the input circuit. Input can be either road speed or engine speed. Selection

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by configuration. An adjustable frequency divider reduces input frequency, so that it can be processed by the Microprocessor.

 **Only one frequency input (either Input 1 or 2) can be defined as road speed input.**

PIN 20: Switch Output 1

Maximum voltage: 32 V

Maximum current: 0.5 A

Warning lamp to be connected between output and supply voltage (terminal 15 or terminal 30).

Switch output controlled by the Microprocessor. The pin turns the output either on or off (static). The output is an open drain and acts like a low switch to ground.

 **Save against high current with a Fuse 0.5 A!**

PIN 21: Switch Output 2

Identical with Switch output 1

PIN 22: Not connected

PIN 23: Not connected

PIN 24: External Switch

Switch has to be connected between this pin and GND

Satellite

Pin	Description	Pin	Description
1	-	3	GND
2	Satellite - Bus	4	Power Supply

PIN 1-3: Satellite Bus Interface (Satbus):

Bus signal levels: 5 V \pm 10%

Ground reference: \pm 100 mV

Max. Bus length: 10 m

Cable impedance: Standard cable

Connector: 4-Pin MATE-N-LOK AMP

Satbus is used in a Master-/ Slave-configuration and is bi-directional with half-duplex communication. When the system is active, a constant clock signal is produced on the bus by the Master gauge.

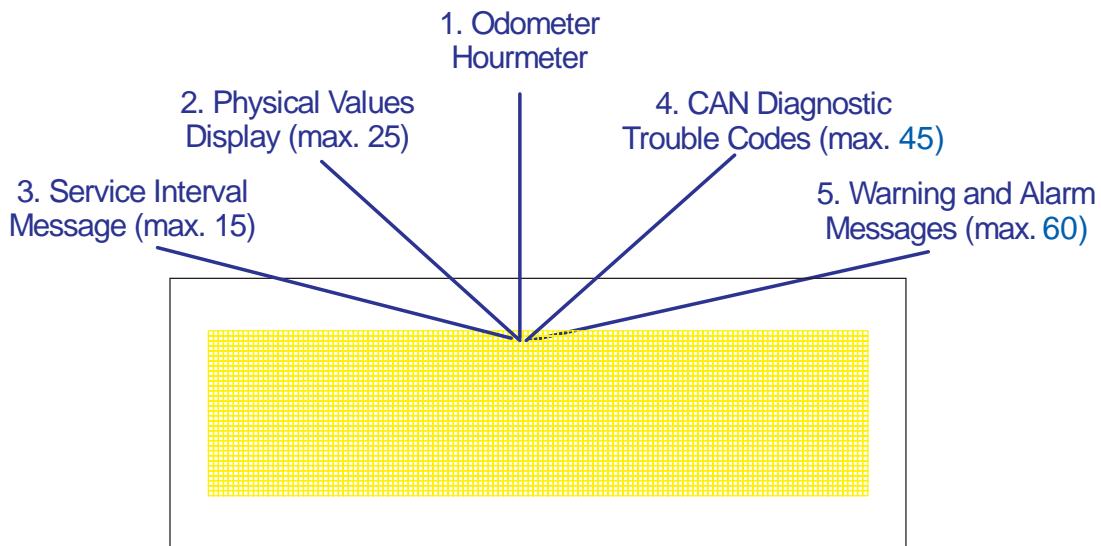
Bit-rate on Satbus = 31.25 kHz.

Product Manual CANcockpit

2. Functional Specification

2.5 Display Functions

Five main display functions have been specified for the Master gauge. (s. picture below) As the number of displays in each main function is configurable (except for odometer and hourmeter), the actual number of displays can be up to a maximum of 146.



A maximum of 30 Warnings and 30 Alarms can be set. The Physical Values of the defined Satellite gauges can be shown on the display (if configured). A total of 25 physical value Displays (PVD) are possible, including the physical values indicated by the Satellite gauges. Thus with increasing numbers of Slaves defined by WINgauge, the number of freely selectable physical values to be displayed on the dot-matrix decreases.

2.5.1 Navigation through Display

The order of the display groups is: Odometer / Hourmeter, Alarms, CAN DTCs, Service Messages, Physical Values, Warnings and then back to Odometer / Hourmeter. The Alarms, CAN-DTCs, Service Messages and Warnings are being monitored and appear only if they are activated. If the button is pressed more than 2 sec., the LCD shows the main display which is Odometer / Hourmeter.

2.5.2 Display Layout

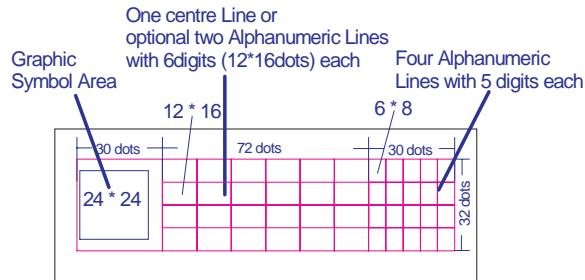
The Dot-matrix Display has 132 x 33 dots.

The following picture shows the proposed display layout. The outer line represents the LCD glass and the inside marks the active display area. The structure inside has only been drawn for illustration; it is not visible on the display itself

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2. Functional Specification

Dot Matrix Layout



The display is structured into three main areas:

1. Symbol Area

This 30 x 32 pixel area is reserved for graphic symbols. The symbols are left aligned to optically enlarge the appearance of the symbol.

2. Central Area

The centre of the display is organised as one or two lines with 6 digits each. Here it is possible to show alphanumeric ASCII characters using the large font (12 x 16 pixel). If only one line is displayed, then this line will be centred in vertical direction. Short text (up to 6 letters) can be used to provide identification for the value displayed. This area is best suited to communicate important numeric values to the user. Values will be shown in the second line on the right, where units appear on the left. One or two centre lines are configured via WINgauge as well as the description of the short text.

3. Physical Unit Area

The physical unit area is located right of the alphanumeric Centre Lines. In general the unit belonging to the value displayed on the centre lines is shown here as text. This area is organised as four lines of 5 characters of the small font. If the Unit can be displayed with less than three ASCII characters, then the large font is applied, else the small font is used. Units will not be wrapped into the next line.

If there are two Centre Lines, then there will also be two-unit Lines (small Line 2 and Line 4). In case only one Centre Line is displayed, then only one corresponding Unit Line will be visible (small Line 3).

It is therefore possible to show the following parameters and units to give a clear indication of the valid physical unit which can be chosen via WINgauge:

Parameter	Units
Revolution / rotation	1/min, rpm
Speed	km/h, mph, knots
Distances	km, m (Meter), mm, miles, mi, M, m (landmile = 1.609 km), nm (nautical mile = 1.852 km)
Power supply	Volt, V, A, mA
Time	h, hours, min, sec
Temperatures	°C, °F
Pressures	bar, psi, kPa, Mpa,
Level of liquids	%, l, gal (US-gallons)
Fuel consumption	l/h, gal/h, km/l, l/100, kg/h, km/kg
Weight	kg
Power	N, kN, Nm
Diverse	Ohm, Grad, deg, appl, Count, qm/h, Gear, Code, SPN, FMI

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2. Functional Specification

2.5.3 Display Functions

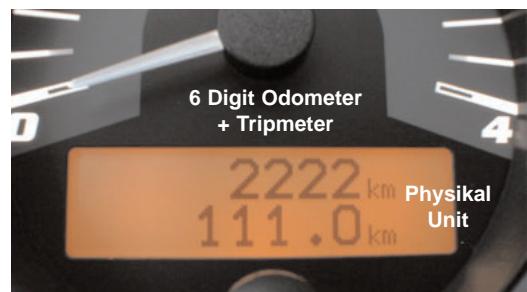
2.5.3.1 Main Display (Odometer, Hourmeter)

The display shows total and trip in two lines. Total has 6 digits and trip has 4 plus 1 digit. The figures roll over to 0.0 after a distance of 999.999 / 9.999 or 100.000 / 1.000 hours. Pressing the button longer than 2 seconds will reset trip odometer or hourmeter.

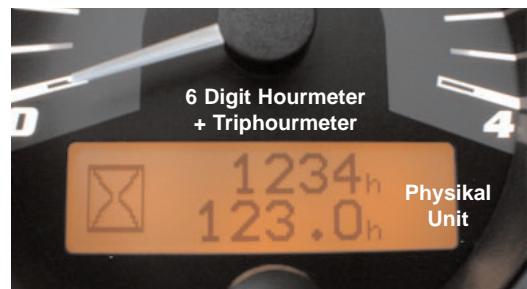
A part of the Display can be used to show the company logo as a start-up display configured by WINgauge



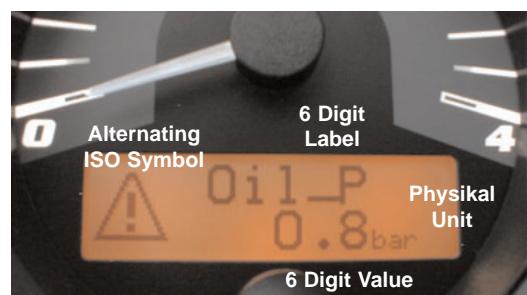
Main Display for Speedometer



Main Display for Tachometer



Alarm Display



Configuration Option:

- To provide additional information two Centre Lines can be programmed. The top line displays a label for identification.
- If no physical value should appear on the display, then a configuration allows a display, which only shows the alternating graphic symbol in the centre of the display.

This option is useful, if a digital input triggers an alarm.

2.5.3.2 Alarm Display

If an alarm is triggered the Alarm Display is shown. To alert the user, the General- Alarm-Symbol is flashing, alternating with the symbol that indicates the type of alarm.

The Central area of the display shows the actual physical value (6digits). The physical unit appears to the right.

When the customer quits the alarm longer two seconds the Display will change to the last displayed value (if no other Alarm and Warning is existing which weren't quitted). The General Alarm Symbol will remain in the graphic Symbol Area with a vertical line on the right side of the symbol to indicate that the Alarm doesn't correspond to the main display but to another Physical Value.

When different Alarms are present the highest priority will be shown. The priority of the alarms is defined with the WINgauge Software. If the Alarm is confirmed and the Alarm condition does not exist anymore then the Alarm is cleared in the list of active Alarms. If the Alarm is not confirmed but the Alarm condition does not exist anymore then the Alarm is still in the list of active Alarms.

To see the different Alarms in the Alarm display group the button has to be pressed shortly (>50 msec).

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2.5.3.3 CAN DTC Display

1 to 5 independent DTC channels can be configured. Every channel is able to receive the DTCs from one CAN device (Source Address). If DTCs are received from any of the configured CAN devices, they will be stored into a DTC receive buffer. The buffer will be able to hold a total of 40 DTCs and will be implemented as a ring buffer, so that old DTCs can be overwritten by newly received DTCs

CAN DTC Display



2.5.3.4 Warning Display

In the Warning display the Specific Graphic Symbol (ISO) is flashing at 1 Hz. There is no alternating.

The operator can acknowledge the Warning by pressing the button longer than two seconds. The Display will change to the Display, which was active before, if no other Alarms and Warnings are existing, which have not been acknowledged yet.

When different Warnings are present the highest priority will be shown. The priority of the Warnings is defined with the WINgauge Software.

Alarms have higher priorities than the Warnings. If the Warning condition vanishes also the Warning will vanish, if it has been acknowledged.

To see the different Warnings in the Warning display group the button has to be pressed longer than 50 msec.

Warning Display



Configuration Option:

- To provide additional information two Centre-Lines can be programmed. The top line displaying a label for identification.
- If no physical value should appear on the display, then a configuration allows a display, which only shows the flashing graphic symbol in the centre of the display.
- This option is useful, if a digital input triggers a warning.

Product Manual CANcockpit

2. Functional Specification

2.5.3.5 Service Message

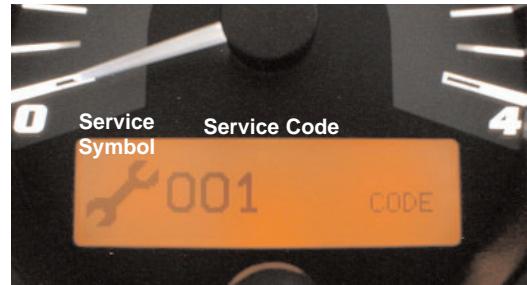
The Service Message indication is based on operating hours and odometer.

The Graphic Symbol Area displays the "Service Symbol" in case a Service Message becomes due.

The corresponding service code is shown on the centre line of the display centre. As a "unit" the word "CODE" appears to indicate, that the value is a code number.

To see the different active Service Messages in the Service Message display group the button has to be pressed longer than 50 msec.

Service Message



Configuration Option:

The Service Message indication can be configured as stand-alone or interval message.

2.5.3.6 Physical Value Display

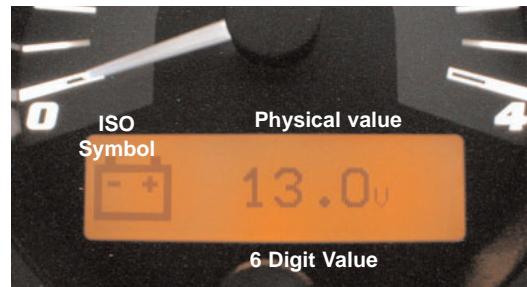
The graphic display area shows a symbol relating to the physical value displayed. The symbol can be selected via configuration from the defined symbols in ROM or EEPROM.

In the standard form the physical value is shown on a single Centre-Line, followed by the physical unit. This unit text can be selected from ROM during configuration.

If the value is outside of the configurated range, then "-----" is shown.

To see the different Physical Values in the Physical Value display group the button has to be pressed longer than 50 msec

Physical Value Display



Physical Value Display



Configuration Option:

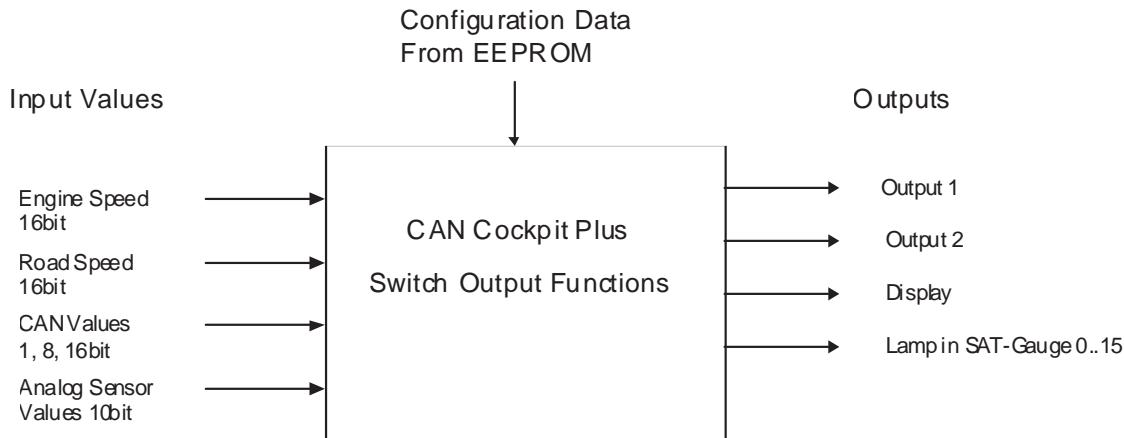
As an option a text label can provide identification for the value displayed. For example Battery one of two batteries, or Motor-2 of two motors. The text label can be configured via WINgauge with maximum 6 letters.

The physical value is displayed in the lower centre line.

Product Manual CANcockpit

2. Functional Specification

2.5.4 Alarm- and Warning Functions



The Alarms and Warnings are triggered by the input values. Configuration parameters in EEPROM select the input values. These variables can have a size of 1, 8 and 16 bit. Possible inputs are engine speed, road speed, data in CAN messages and analogue sensor values. Input values are then monitored and if the configured thresholds are exceeded, then an Alarm or Warning action is triggered, resulting in switch outputs being activated.

2.5.4.1 Description of the Outputs

Definitions:

Warning: Is a message to make the operator aware of a condition, which requires his attention.

Alarm: Is a message to alert the operator about a condition, which requires his attention and immediate action. The Alarm is more severe than a Warning.

The switch outputs are only controlled by the Alarm- and Warning Functions.

The following switch outputs are provided:

a. Output 1 and Output 2

These are two outputs, which act like two switches to ground. The switch output can control i.e. a warning lamp, a buzzer or a relay. It turns off, when the Alarm condition is not existing anymore, or if the Alarm has been acknowledged and it was configured. It stays on, if another Alarm condition also configured to turn on this output is still active.

b. Display

Every Alarm or Warning activates a display on the dot matrix. When the Alarm is triggered, then the associated display appears on the dot matrix, overwriting the previous display. The display combines a graphic symbol with a physical value (numerical value plus physical unit), describing the input value, which has caused the Alarm or Warning.

c. Warning Lamps in the Satellite Gauges

The Satellite Gauges include a warning lamp. This warning lamp can be turned on and off via the Sat-Bus. An Alarm or Warning could be configured to activate a warning lamp in each of the Satellite Gauges. The selected warning lamp in the Satellite Gauge remains on as long as the trigger condition remains, and turns off as soon as the trigger condition is not existing anymore. Flashing of the warning lamp can be configurated.

2.5.4.2 Switch Output Acknowledgement Function

The Acknowledgement Function provides a means to turn off some of the switch output action. This may be desired, if the Alarm activates a buzzer and the operator wants to turn the buzzer off.

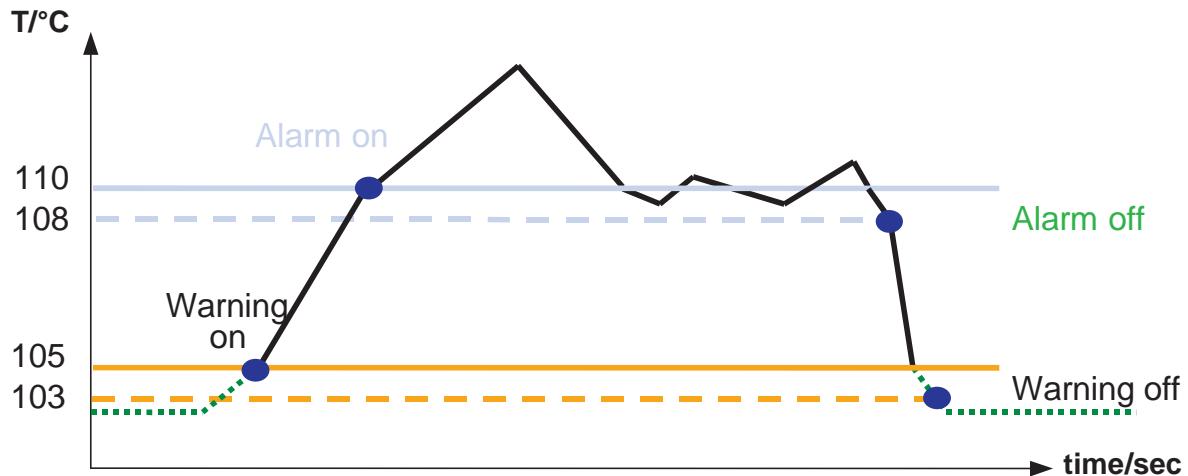
To acknowledge a switch output, the operator must press the button for more than 2 sec, while the Alarm or Warning is active.

When a Warning or Alarm has been acknowledged, then the Switch Outputs (1, 2) will be deactivated, if they have been configured to turn off these outputs.

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2. Functional Specification

2.5.4.3 Alarm and Warning Trigger Conditions



The diagram above illustrates the Alarm and Warning trigger conditions for the engine coolant temperature as an example. The Warning threshold is set at 105° C, where the Alarm threshold is reached at 110° C. To prevent repeated on/off cycles of the Warning or the Alarm an activation hysteresis is applied. Therefore in above example an Alarm is turned off, if the temperature falls below 108° C and the warning is cancelled at 103° C. The hysteresis is 2° C in this case and is the same for both Alarm- and Warning condition. In addition a turn-on delay from 1 sec to 4 minutes can be configured. The delay time starts, when the threshold is reached. If the input value falls below the threshold value, then the delay time restarts from this point in time.

It can be configured, that the Warning is triggered, if a value rises above a threshold (as in the case of the engine coolant temp.), or if the input value falls below a threshold (e.g. fuel level).

2.5.4.4 Alarm and Warning Trigger enabling with Engine running

Triggering of some Alarms and Warnings only makes sense, when the engine is actually running. Examples are engine oil pressure or hydraulic pressure. For these situations triggering an Alarm and Warning can be disabled until the engine is running. This conditional trigger enable is selectable for every Alarm and Warning (together) during configuration.

Engine running is detected, by exceeding a separately configurable threshold value: the Alarm and Warning enable engine speed threshold. The minimum threshold is 0 rpm and the maximum is 32.000 rpm.

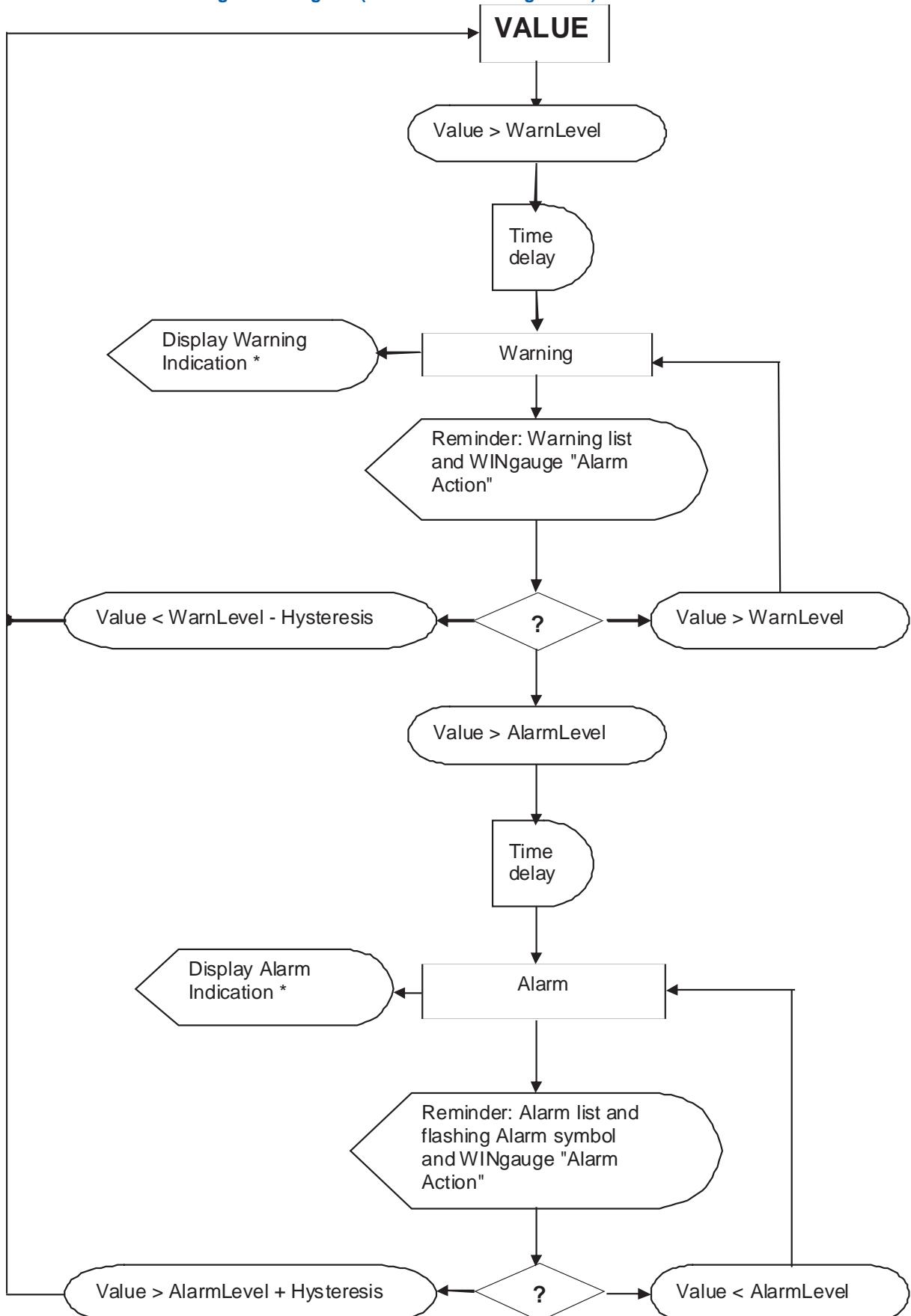
An additional trigger-enable time delay starting from engine running condition can be configured. This is helpfull in cases, where it takes a while until a pressure is built up.

This delay time is settable from 0 to 250 sec with a resolution of 1sec.

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2. Functional Specification

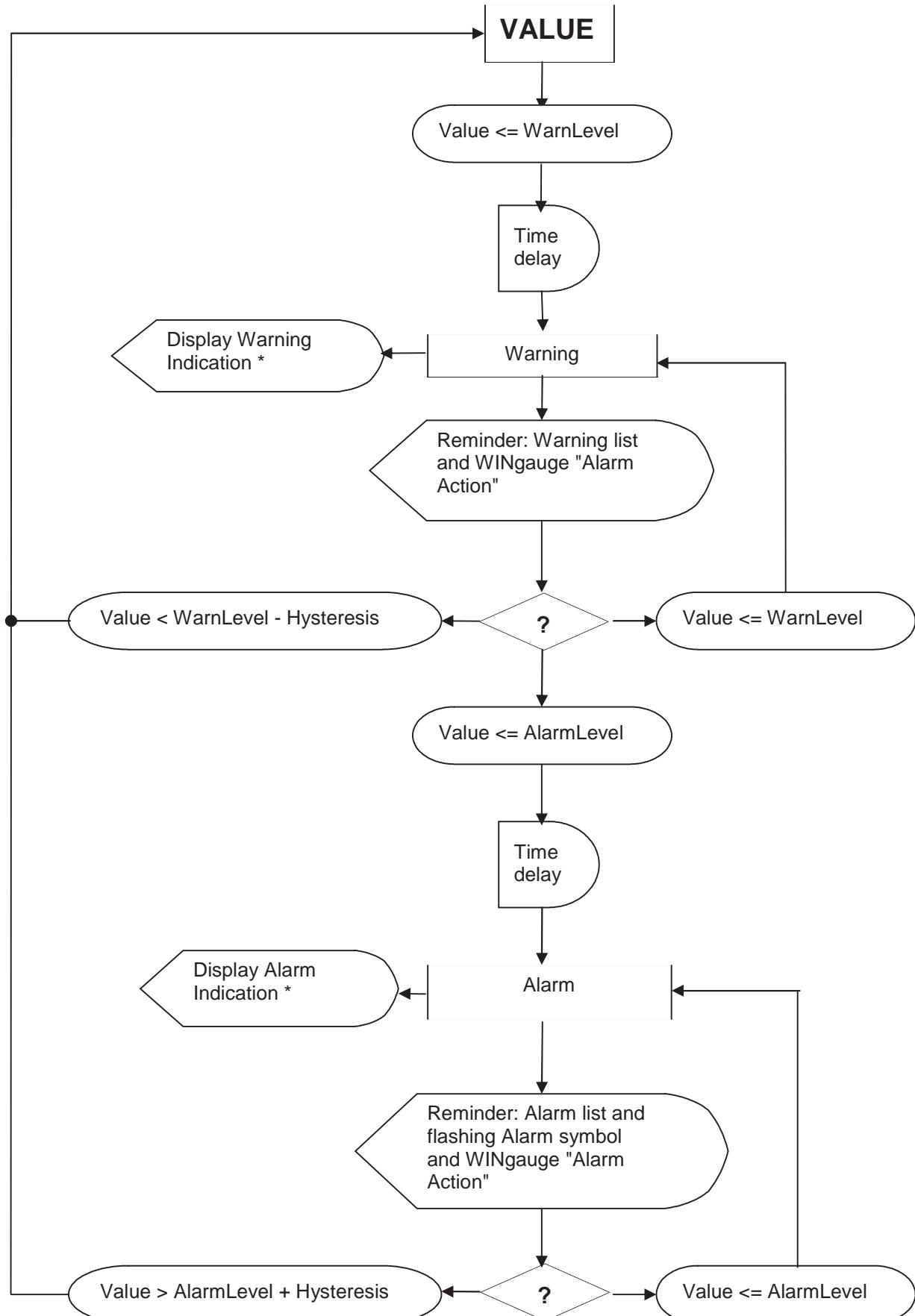
2.5.4.5 Alarm and Warning State Diagram (Maximum Value Algorithm)



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2. Functional Specification

Alarm and Warning State Diagram (Minimum Value Algorithm)



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2. Functional Specification

2.5.5 Service

The Service message is based on the Hourmeter or Odometer. The service message indication can be configured via WINgauge. There are 15 independent service messages with customer specific settings, which can be configured via WINgauge. The service messages are implemented as periodic intervals. A message which should be indicated only once, the quantity of intervals would then be 0. Configuration data is stored in EEPROM.

For each of the 15 Service messages following can be specified in a table:

1. Service code number: Range: 1 to 255. 0 needs to be entered to disable this service function.
2. First message after x hours: (1h <= x <= 65.000 h)
3. Periodic service time: Range: 1h to 4.095h. If 0h is selected, it means only once (not periodic).

If a Service message has expired, this service code is displayed as a decimal number together with the common service symbol on the dot-matrix display. The Service message display remains active until this service code is reseted.

2.5.5.1 Reset of Service messages

The reset of the service message function is possible first if it occurred and not before.

When a one-time service message will be reseted, then this Service message will be disabled by writing 0 into the service code field of the Service message table in EEPROM.

When a periodic interval will be reseted then the periodic service time will be added to the hours of the current hourmeter value. This will ensure, that even if a Service message is reseted later than required, the time to the next service indication will be the periodic interval time as specified.

Example: Service message No.: 12
Service code: 153
First service after: 300 h
Periodic service: 100 h

Event	Time (hourmeter)	Display
First service code displayed after	300 h	153
Reset of this service at	340 h	
Next service display at	440 h	153

The reset of the Service message is part of the system check function (part of safety check).

Procedure for resetting a Service message:

1. With ignition switched off, push the button and hold down while ignition is being turned on, then the system check function is activated and clears the contents of the DTC List.
2. If there are any service messages active, then they will be displayed on the Dot-Matrix Display starting with the first active service message. If the button is then pressed and held for 5 seconds or longer, then this Service message will be reseted. The next active Service message is displayed afterwards. To proceed to the next active service message without resetting the displayed code the button needs to be pressed shortly (<5 sec). If all active service codes have been displayed, then the system check function is started.

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2. Functional Specification

2.5.6 CAN (SAE J1939) DTC (Diagnostic Trouble Codes) messages

It will be required to know the CAN source address (SA) of the controller (ECU), which has sent a DTC message, so that the problem can be located.

The SAE J1939 specifies 13 different diagnostic modes (DM1 to DM13). But for CANcockpit only DM1 is relevant. In DM1 active DTCs are broadcast on the CAN-Bus. Active means, that these faults are existing at the moment, compared to faults, which existed sometime in the past.

2.5.6.1 CAN SAE J1939 Elements

DTCs consist of 4 elements defined in SAE J1939:

1. Suspect Parameter Number (SPN) 19 bits

In the DTC, the SPN identifies the faulty element, component, sensor or parameter of a device (ECU).

2. Failure Mode Indicator (FMI) 5bits

The FMI defines the type of failure detected. It provides additional information about the nature of the fault. There are 32 pre-defined FMIs.

Examples are:

"Out of calibration", "Data Valid but above normal operational range", "Mechanical System not responding or out of adjustment"....

3. Occurrence Count (OC) 7bits

Shows the number of times a fault was active

4. SPN Conversion Method (CM) 1bit

The February 1996 version of SAE J1939-73 contained inadequate definitions to assure consistent implementations.

Consequently the specification of the DTC format was changed. To indicate the new consistent format this bit must be set to 0. Also the old versions will be supported by CANcockpit.

The number of possible DTCs is very large, therefore efficient filtering is important for this function.

DTC			
Data Byte 3 8 least significant bits of SPN	Data Byte 4 8 medium significant bits of SPN	Data Byte 5 3 most significant bits of SPN plus 5 bit FMI	Data Byte 6 Conversion Method bit plus 7 bit Occurrence Count.

There are two main applications for DTCs (Diagnostic Trouble Codes):

- To inform the operator, that something is not as expected.
Depending on the DTC it can have the nature of an Alarm (most severe), Warning or only Information
- To provide diagnostic information for the workshop, so that system faults can be analyzed and repaired.

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2. Functional Specification

2.5.6.2 CAN DTC Information Display Requirements

1. Information for the operator needs to be brief and clear, so that action can be taken quickly, if required.

- Activate Warning Lamp
- Activate Switch-Output
- Display Short Text

2. For the workshop it is more important to get detailed information, so the cause can be found and fixed.

- DTC List with SPN, FMI and Occurrence Count

The DTC List can also be viewed by the operator, but requires detailed knowledge of the CAN devices reporting the DTCs. Also it can be expected, that the workshop will have other diagnostic tools, which can access even more Information than J1939 DM1.

2.5.6.3 CAN DTC Display Functions

2.5.6.3.1 DTC Reception

One to five independent DTC channels can be configured. Every channel is able to receive the DTCs from one CAN device (Source Address).

If DTCs are received from any of the configured CAN devices, they will be stored into a DTC receive buffer. The buffer will be able to hold a total of 40 DTCs and will be implemented as a ring buffer, so that old DTCs can be overwritten by newly received DTCs.

Every newly received DTC will be compared with latest DTC's in the ring buffer. If they are different it will be stored in the ring buffer. Thus avoid overflowing of the ring buffer by toggling transmitted DTC's.

2.5.6.3.2 DTC List

If the service personnel or the operator wants to check for received DTCs, he can step through the display list until coming to the DTC-Displays. There will be no automatic display, which comes up and must then be acknowledged. Therefore it is possible to prevent annoying displays coming up, if DTCs are received, which have no actual relevance.

The DTC List function will provide access to the DTCs inside the DTC receive buffer. One DTC Display will exist in the display list for every configured DTC channel (channel 1 to 5).

To see the received DTCs of one channel the operator presses and holds the button for longer than 2sec. At this time the processor will transfer the received DTCs from the DTC Receive Ring Buffer to the DTC List. Only the DTCs of the selected channel will appear in the DTC List. The most recent DTC will be shown first. Every short press will lead to earlier received DTCs, until all DTCs have been shown or the button is pressed and held for more than 2sec.

The DTC List will be cleared at ignition off/ on (configurable).

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2. Functional Specification

2.5.6.3.3 DTC List Display Format

One Graphic Symbol per DTC Channel (Source Address) can be configured and will be shown together with the DTC in the upper and lower level. It indicates, where the DTC message comes from.

Also the number of received DTC's on this channel (0-40) which are currently inside the DTC Ring Buffer will be displayed.

Examples:

Electronic Engine Controller (EEC) reports Pre-Filter Oil Pressure (SPN=1208) was 102 times (occurrence count) above normal operating range - most severe level (FMI=0).

Index 10 provides information about the position inside the Ring Buffer.



Electronic Engine Controller (EEC) reports System Diagnostic Code #1 (SPN=611), occurrence count information not available (OC=127) and Special Instructions (FMI=14).

Index 15 provides information about the position inside the Ring Buffer.



Electronic Transmission Controller (ETC) reports Clutch Actuator (SPN=788) was 2 times Out of Adjustment ((FMI=7))

Index 18 provides information about the position inside the Ring Buffer.



Hydraulic Controller reports Hydraulic Reservoir Temperature (SPN=1508) one time Above Normal (FMI=3)

Index 40 provides information about the position inside the Ring Buffer.



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2. Functional Specification

2.5.6.3.4 Diagnostic Lamp Status

The following diagnostic lamps are defined in SAE J1939:

1. Red Stop Lamp —> Stop Engine
2. Amber Warning Lamp
3. Protect Lamp
4. Malfunction Indicator Lamp

The status information of all configured DTC received channels are collected and the result will be stored in a 16bit status variable (Byte1 and Byte2). It is then possible to configure alarm or warning functions to react on the diagnostic lamp status. This also has the advantage that normal Alarm- or Warning-Functions are integrated with Alarms or Warnings (DTC Lamp Status) from the CAN Bus.

2.5.6.3.5 DTC Scan

When DTC's are received via interrupt, they are immediately stored into the DTC-receive ring buffer. This ring buffer will then be scanned for 8 specific DTC's. These DTC's can be configured via WINgauge with unique icons and labels. Alarm and/ or Warning Functions can then be configured to trigger on the status of certain bits inside the DTC scan result register.

2.5.6.4 Speedometer Master Gauge

2.5.6.4.1 Tolerance

The overall speedometer accuracy is within 0% to +4% of full scale reading for each indicated value over the operating range of the instrument.

This fulfills SAE J1226 for the American market and for the European market DIN 75521-2.

	SAE J1226		DIN 75 521 - 2	
	-4%	4%	0 <= v1-v2 <= v2/25 + 5km/h	
Actual speed	u. Tol.	o. Tol.	u. Tol.	o. Tol.
0	0	0		
10	9,6	10,4		
20	19,2	20,8		
30	28,8	31,2		
40	38,4	41,6	40	46,6
50	48	52	50	57
60	57,6	62,4	60	67,4
70	67,2	72,8	70	77,8
80	76,8	83,2	80	88,2
90	86,4	93,6	90	98,6
100	96	104	100	109
110	105,6	114,4	110	119,4
120	115,2	124,8	120	129,8

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2.5.6.4.2 Speedometer Gauge Operation

The Master gauge receives speed information either via CAN or via one of the frequency inputs. During configuration the source of the speed information has to be defined. The input signal is first converted into a physical speed value. The microcontroller calculates the deflection angle of the speedometer based on this physical speed value and gauge output characteristic.

Specification of odometer storage

The standard Speedometer version of the Master gauge contains an Odometer. It can be configured that also the Tachometer can have an Odometer instead of an Hourmeter. The Odometer consists of a total Odometer and a Tripodometer. Both can be displayed on the dot matrix LCD as two lines. Format is 6 digits for total km, landmiles, nautical miles or meter and 4 digits, decimal point and 1 digit for 1/10 kilometer, land mile or nautical mile. The resolution of meter is 1m.

a. Information comes from CAN-Bus Interfaces (one of two):

For the Odometer indication it must be ensured that a ECU is broadcasting this information on the CAN-Bus. If no signal is received only dashes will be indicated.

b. Total odometer information generated by master gauge:

The Odometer information will be written to EEPROM every 1km. A ring counter algorithm is applied to save and recover the information from EEPROM. The rest-distance is written to EEPROM 10 sec after ignition has been turned off.

A special 16-word-ring-counter algorithm is applied to recover the odometer in case the battery was disconnected. With nominal input frequency applied, the odometer shall indicate calculated mileage within $\pm 0.3\%$ [SAE J1226].

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2. Functional Specification

2.5.6.5 Tachometer Master Gauge

2.5.6.5.1 Tolerance

The Tachometer indication must be within $\pm 2\%$ of full scale with nominal voltage applied at temperature of $24 \pm 3^\circ \text{C}$. [SAE J1399].

2.5.6.5.2 Tachometer Gauge Operation

The Master gauge receives the engine speed information either via CAN-Bus or via one of two frequency inputs. During configuration the source of the engine speed information has to be defined. The input signal is first converted into a physical engine speed value. The micro-controller calculates the deflection angle of the Tachometer.

2.5.6.5.3 Specification of the hourmeter

The standard Tachometer version of the Master gauge contains an Hourmeter. It can be also configured with the WINgauge that also the Speedometer can contain an Hourmeter.



Legal demands are to fulfil!

a. Information comes from CAN-Bus Interfaces (one of two):

For the Hourmeter indication it must be ensured that a ECU is broadcasting this information on the CAN-Bus. If no signal is received only dashes will be indicated.

b. Total hours information generated by master gauge:

The Hourmeter counts the number of engine hours, when the engine speed exceeds a threshold value configurable via WINgauge (default value 300 rpm). If the engine speed is below the threshold value the hour counting stops (total and trip). The last value will be stored within 10 sec in EEPROM after the ignition is turned off, then counting stops, no matter if the engine is running or not.

The time indication is within ± 5 sec with nominal voltage supplied at 25 degrees C and within ± 10 sec with nominal voltage supplied over the full operating temperature range.

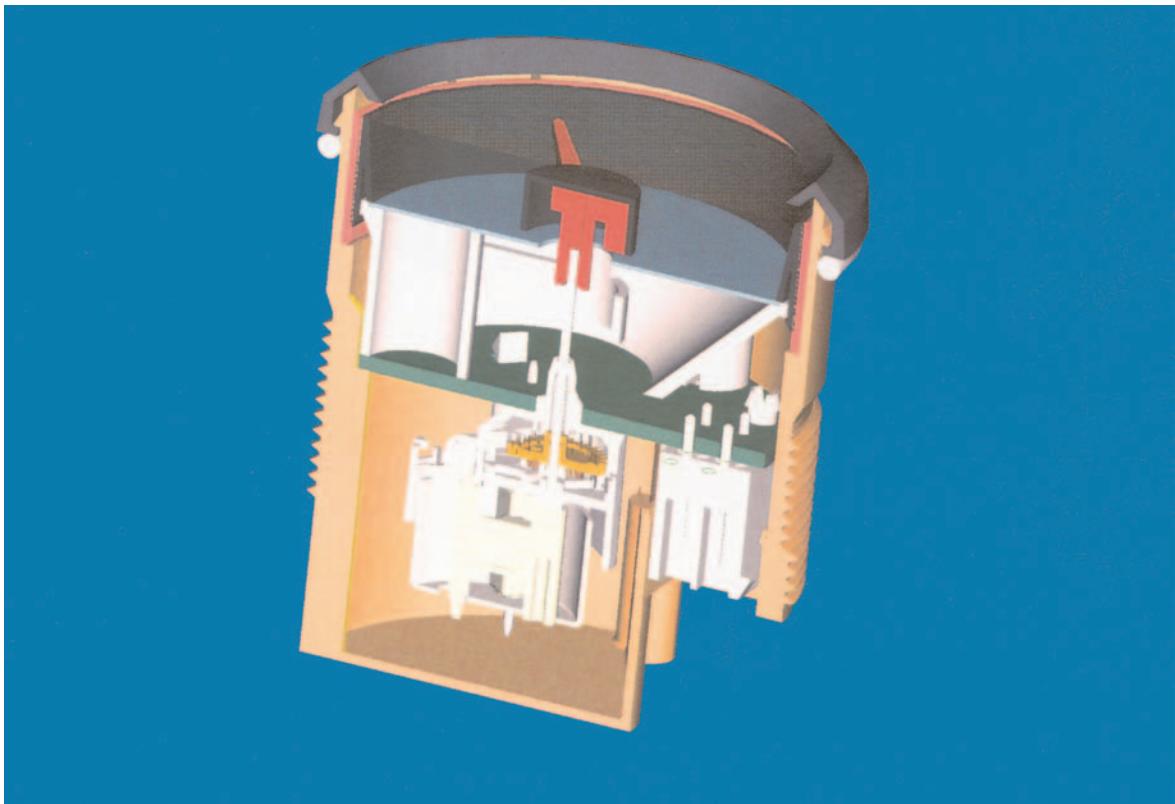
The total hour information is backed-up in EEPROM every 7.5 minutes. A special 16-word-ring-counter algorithm is applied to recover total hours in case battery had been disconnected.

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2. Functional Specification

3. Satellite Gauges

3.1 Mechanical concept



The movements are front mounted stepper motors SM2, only clockwise indication.

Connectors: AMP 6 Pin MATE-N-LOK

The dials have a 240° scale and a black panel effect for the warning lamps, so without activating of the warning lamp no sign is visible.

3.2 Fault modes

When ignition is off, the pointers are positioned 6° below the left side of the scales. With ignition on the pointers are moving to the scale start value. When the gauges receive wrong informations or the analog signals are out of range (configured by WINgauge), the pointers are moving 6° below the scale start value

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3.3 Satellite gauge address

Each Satellite has his fixed address. The address is defined with the Assy PCB.

The matrix of the combination of the gauge type and address:

Address Numbers of the Satellite gauges	
00	Speedo / Tacho 1
01	Pressure Engine Oil
02	Pressure Brake 1 / Rudder / Primary air
03	Pressure Transmission Oil
04	Pressure Turbocharger / Tacho 2
05	Temperature Engine Oil
06	Temperature Transmission Oil
07	Coolant Water Temperature
08	Temperature Hydraulics Oil
09	Temperature without Symbol / Gear Oil
10	Pyrometer / Pressure Brake 2 / Turbo / Exhaust
11	Level, Fuel level 1
12	Level, Fresh Water / Cylinder Head / Position Rear Wheel
13	Level, Waste Water / Fuel Level 2 / Pressure Brake 2 (250 bar) / AddBlue / Winch
14	Voltmeter
15	Hydraulic Pressure / Ammeter / Pressure Brake 1(250 bar)

 **Maximum 16 Satellite gauges can be connected per Master. To avoid grave system conflicts, on each address is only one gauge allowed.**

3.4 Warning Lamp inside the Satellite Gauge

All warning lamps are red except the amber level warning lamps. The WINgauge allows configuration of these warning lamps.

3.5 Tolerance

The Satellites have the pointer accuracy of $\pm 2.5\%$.

Product Manual CANcockpit

2. Functional Specification

A. Technical Data

Operating Temperature

Operating Temperature: -40°C to + 85°C (at nominal voltage)
Visible restrictions: for LCD outside -20°C and +70°C

Storage Temperature

Storage temperature: -40°C to +85°C
LCD Humidity resistance: +65°C ± 2°C
90% r.F. ⁺²₋₃ %

Supply Voltage

Nominal Voltage: + 12 V and + 24 V
Operating Voltage: + 10,5 V to + 32 V as standard
Test voltage: + 14 V and + 28 V
Total Supply Current: 200 mA ± 20% for Master and 110 mA per Satellite

Satellite supply: + 10,5V to + 32V, current consumption max. 2 A
Sensor supply: + 8 V ± 10% (8 V - 0%, +10% at 24 V), Imax: 50 mA

Ground is connected to the negative battery terminal.

Idle Current

The Ignition off current (stand by mode) is 4 mA for the System (Master and Satellites).

Ground shift

Ground shift on non-analogue inputs are assumed to be < ± 0.5 V.
i.e. all digital input have to work with an additional signal offset of ± 0.5 V

EMC Requirements

See enclosures

Overvoltage Protection

The Master can withstand a voltage of 56 V for 5 minutes without damage (SAE J1810).

I/O circuit protection

The gauges are protected against reversed battery polarity.

Cable requirement

To the Master:

Type cross section: 0,5 mm²

From Master To Satellite

Type cross section: 0,75 mm²
Max quantity of gauges: 16 Satellites



Max. cable length:

10 m from Master to the last daisy chained Satellite

Product Manual CANcockpit

2. Functional Specification

B. Applied Standards

Accompanying Documents. For reference only		
Document	Description	Version
SAE J1226	Electric speedometer specification	1983-02
SAE J1399	Electric tachometer specification	1984-06
SAE J1810	Electrical indicating system specification	1993-01
SAE J1939	Recommended practice for truck and bus control	2000-04
SAE J1939 / 11	Physical layer	1999-10
SAE J1939 / 21	Data link layer	2001-04
SAE J1939 / 31	Network layer	1997-12
SAE J1939 / 71	Vehicle application layer	2008-01
SAE J1939 / 81	Network management	2003-05
89/336/EWG	Applied Standards, Breakdown sending to the DIN/EN standards 50 081-1, 50 082-1, 50 082-2 (applied standards, disturbance acc to DIN/EN standards 50 081-1, 50 082-1, 50 082-2)	
95/54 EWG	Motor vehicle guideline EMV (vehicle guidance emc)	1995-10
DIN 40 839	Electromagnetic compatibility (emc) in road vehicles; disturbances conducted along supply lines in 12V and 24V onboard systems	1992-10
DIN 70 005 Teil 2	Graphische symbole, Grundlagen und Übersicht (graphic symbols, basis and overview)	1993-12
DIN 75 521 Teil 2	Speedometer instrument panel mounting for motor vehicles	1992-02
DIN-EN 50081-1	Electromagnetic compatibility - generic emission	1993-03
DIN-EN 50 081-2	Electromagnetic compatibility - industrial environment	1994-03
DIN-EN 50082-1	Electromagnetic compatibility - generic immunity emission	1997-11
DIN-EN 50082-2	Electromagnetic compatibility - generic immunity industrial environment	1996-02
IEC 60068-2-11	Corrosion resistance	1995-10
EN IEC 60 529	Schutzarten durch Gehäuse	1991-10
ISO 2575	Road vehicles - symbols for controls, indicators and telltales	2000-03
ISO 3767-1	Tractors, machinery for agricultural and forestry powered lawn and garden equipment - symbols for operator controls and other displays.	1998-12
ISO 6405-1	Earth-moving machinery - symbols for operator controls and other displays	1991-12
ISO 7000	Graphic symbols for use on equipment - index and synopsis	1989-11
ISO 7637-1-2	Road vehicles - electrical disturbance by conduction and coupling:	1990-06
UL 94	Part 1: passenger cars and light commercial vehicles with nominal 12V supply voltage - electrical transient conduction along supply lines only	1998-10
TPV	Part 2: commercial cars with nominal 24V supply voltage - electrical transient conduction along supply lines only	1998-10
ISM-Z	Test for flammability of plastic materials for parts in devices and appliances	2000-07
VDON 2.1954.001	Technical test specification for mechanical and electronic information systems in motor vehicles	1997-12
VDON 2.1955.070	Specification: customer specific integrated circuit in cmos technology for control of vdo-stepper motors (SM2/ MW2000)	1997-12
VDON 2.1958.001	Company sign VDO	2000-12

Product Manual **CANcockpit**

3. Installation Instructions

Enclosures

Installation instructions

TU00-0736-5107120

0609

(Page 1-8)

Montageanleitung | Installation Instructions

www.vdo.com

CANcockpit

Neue Generation | New Generation 2009

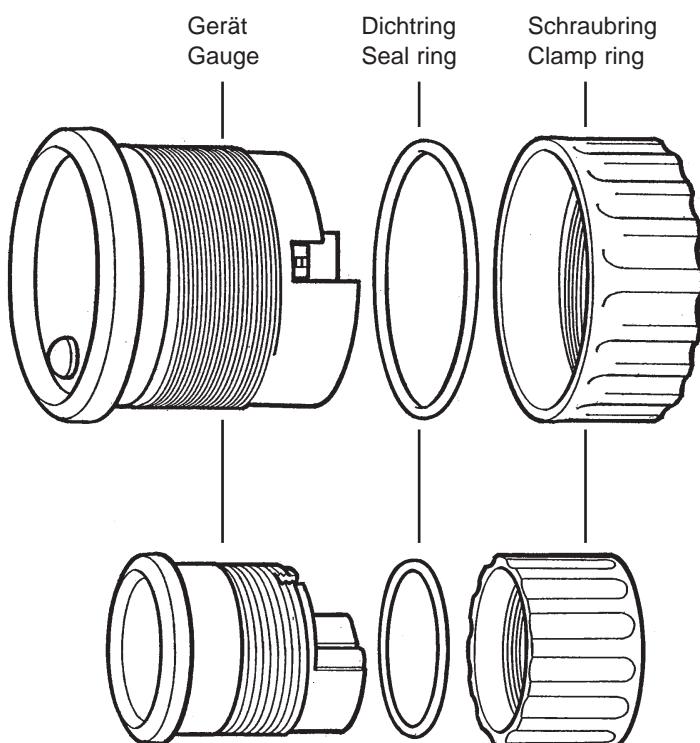


Montageanleitung Installation Instructions

CANcockpit

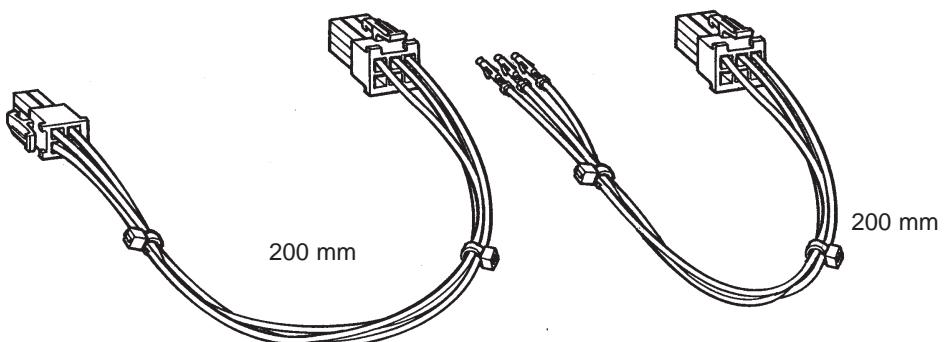
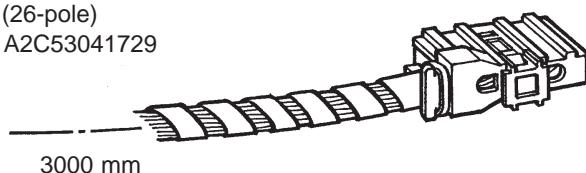
Systemkomponenten System components

Master-Gerät
(Gehäuse Ø 80mm)
Master gauge
(housing dia. 80mm)



Slave-Gerät (Gehäuse Ø 52mm)
Satellite gauge (housing dia. 52mm)

Kabelbaum Master (26polig),
Wiring harness master (26-pole)
Bestell-Nr. / Order No.: A2C53041729



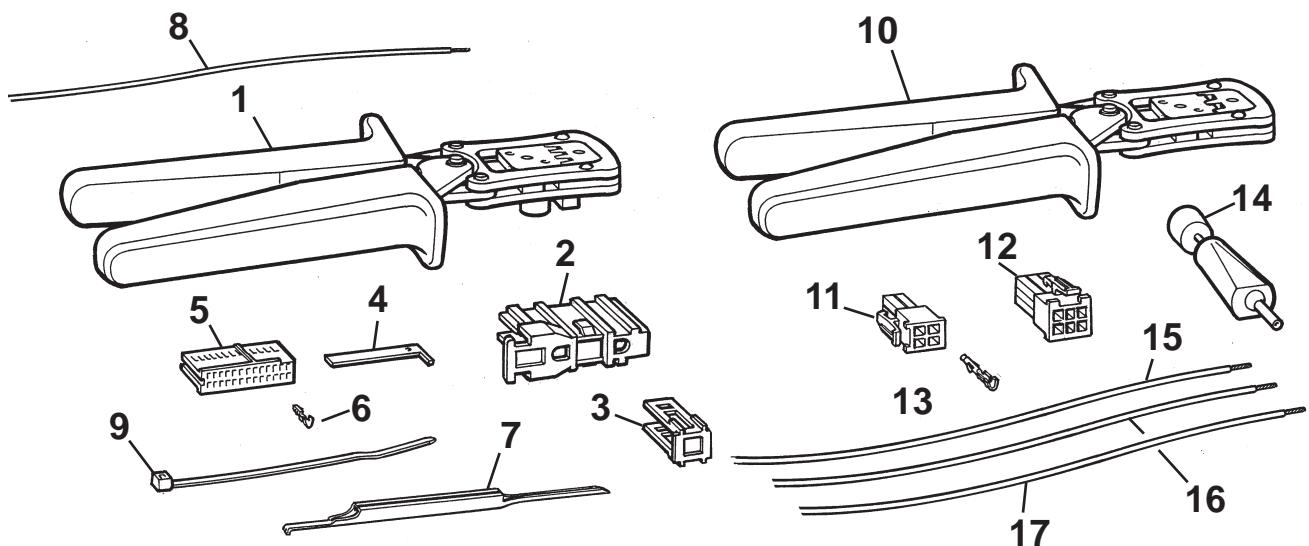
Kabelbaum Master - Slave
Wiring harness master - satellite
Bestell-Nr. / Order No.: A2C53344035

Kabelbaum Slave - Slave
Wiring harness satellite - satellite
Bestell-Nr. / Order No.: A2C53344036

Montageanleitung Installation Instructions

CANcockpit

Oder eigener Zusammenbau der Kabelbäume. Nur mit folgenden Teilen:
Or own installation of the wiring harnesses. With following parts only:



Anwendung / Application:

- A: für Kabelbaum Master (26polig) / for wiring harness master (26-pole)
- B: für Kabelbaum Master - Slave / for wiring harness master - satelite
- C: für Kabelbaum Slave - Slave / for wiring harness satelite - satelite

Pos. Pos.	Bezeichnung Designation	Anwendung Application	Verp.-Einheit Items / Package	Bestell-Nr. Order No.
1	Handzange / Hand tool	AMPMODU	A	(AMP-Nr./ No. 0-0169481-1)
2	Gehäuse /Housing	AMPMODU	A	700
3	Abzugsbügel / Draw-off bracket	AMPMODU	A	600
4	Kontaktsicherung / Contact seal	AMPMODU	A	2000
5	Kontaktgehäuse / Contact housing	AMPMODU	A	500
6	Kontakt (Master) / Contact (master)	AMPMODU	A	10000
7	Ausstoßwerkzeug / Push out tool	AMPMODU	A	2
8	Kabel 0,5mm ² / Wire 0.5mm ²		A	—
9	Kabelbinder / Cable strap		A, B, C	—
10	Handzange / Hand tool	MATE-N-LOK	B, C	(AMP-Nr./ No. 0-0734202-1)
11	Stecker, 4polig / Connector, 4-pole	MATE-N-LOK	B	500
12	Stecker, 6polig / Connector, 6-pole	MATE-N-LOK	B, C	1000
13	Kontakt / Pin	MATE-N-LOK	B, C	10000
14	Ausstoßwerkzeug / Push out tool	MATE-N-LOK	B, C	2
15	Kabel, gelb 0,75mm ² / Wire, yellow 0.75mm ²		B, C	—
16	Kabel, rot 0,75mm ² / Wire, red 0.75mm ²		B, C	—
17	Kabel, schwarz 0,75mm ² / Wire, black 0.75mm ²		B, C	—

Montageanleitung Installation Instructions

CANcockpit

A: für Kabelbaum Master (26polig) / for wiring harness master (26-pole)

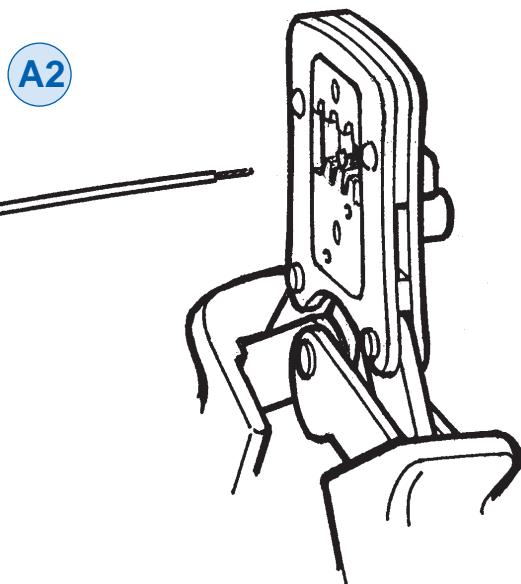
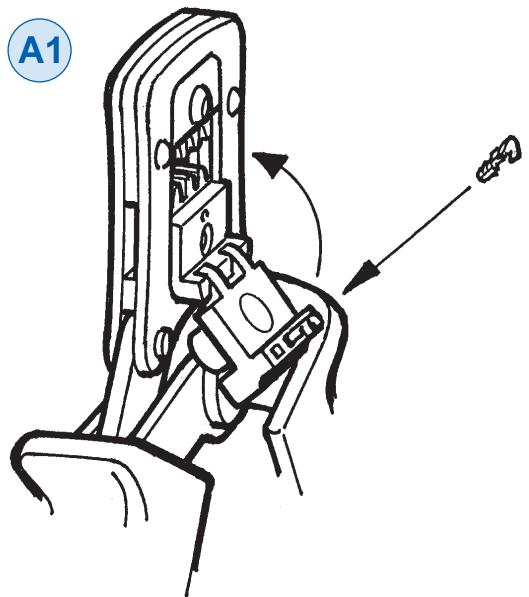
Mit den Kontakten (Pos. 6) und den entsprechenden Kabeln (Pos. 8) eine Crimpverbindung nach EN 60352-2/A1 Teil 2 herstellen.

Make a crimp connection per EN 60352-2/A1 Part 2 with the contacts (Pos. 6) and the corresponding cables (Pos. 8).

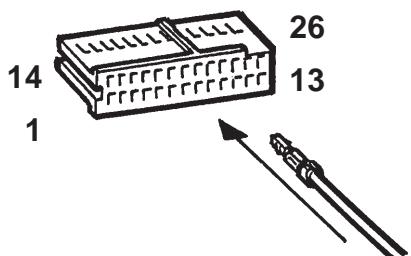
Dabei besonders darauf achten, dass alle Einzeldrähte des Kabels von der Crimphülse erfasst werden, denn sonst besteht Kurzschlussgefahr!

Take special care to contain all individual wires of the cable in the crimp socket to avoid the risk of a short-circuit!

Die Kabel je nach Belegung in das 26polige Kontaktgehäuse (Pos. 5) einstecken. Die Kontakte müssen hörbar einrasten. Insert the cables into the 26-pole contact housing (Pos. 5) according to connector pin allocation. The contacts must engage with an audible click.



A3



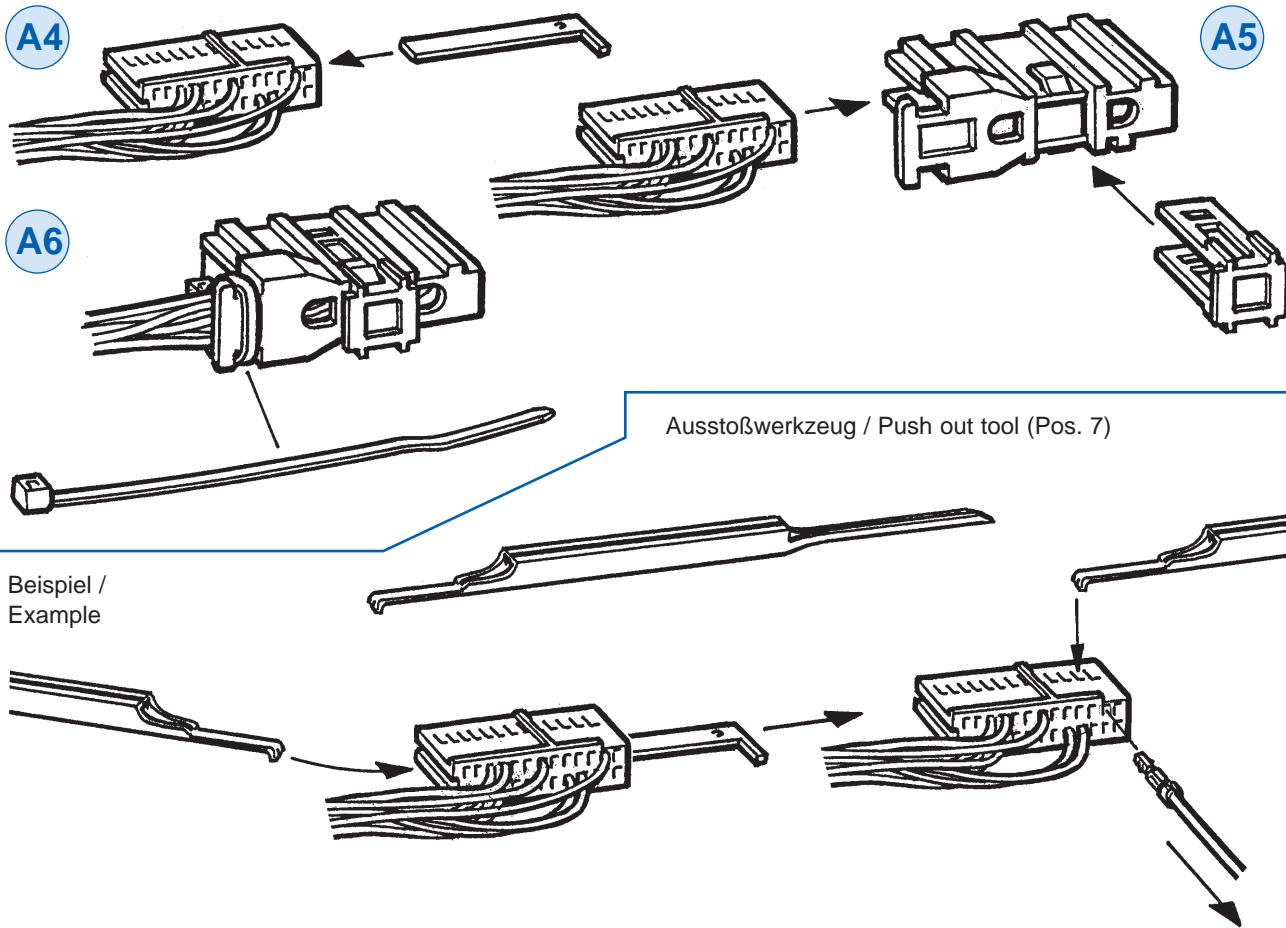
Pin-Belegung
Pin allocation

Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	KI. 30 / Power Supply (terminal 30)	14	+ 8 V DC für Geber / for Sensor supply
2	KI. 31 / GND (terminal 31)	15	0 - 5 V DC Eingang / Input
3	CAN1 _High	16	KI. 58 d / Illumination (terminal 58 d)
4	CAN1 _Low	17	KI. 15 / Ignition (terminal 15)
5	CAN2 _High	18	Frequenzeingang 2 / Frequency Input 2 (0-2 kHz)
6	CAN2 _Low	19	Frequenzeingang 1 / Frequency Input 1 (0-40 kHz)
7	nicht belegt / not connected	20	Schaltausgang 1 / Switch-Output 1
8	k - Line	21	Schaltausgang 2 / Switch-Output 2
9	Analog Eingang 1 / Input 1 (0,5-200 Ohm)	22	nicht belegt / not connected
10	Analog Eingang 2 / Input 2 (0,5-300 Ohm)	23	nicht belegt / not connected
11	Analog Eingang 3 / Input 3 (10 -700 Ohm)	24	Externer Schalter / External Switch
12	4 - 20 mA Eingang / Input	25	Masse Analog / Analog GND
13	4 - 20 mA Masse / GND	26	Masse Frequenz / Frequency GND

Montageanleitung Installation Instructions

CANcockpit

A: für Kabelbaum Master (26polig) / for wiring harness master (26-pole)



B: für Kabelbaum Master - Slave / for wiring harness master - satellite

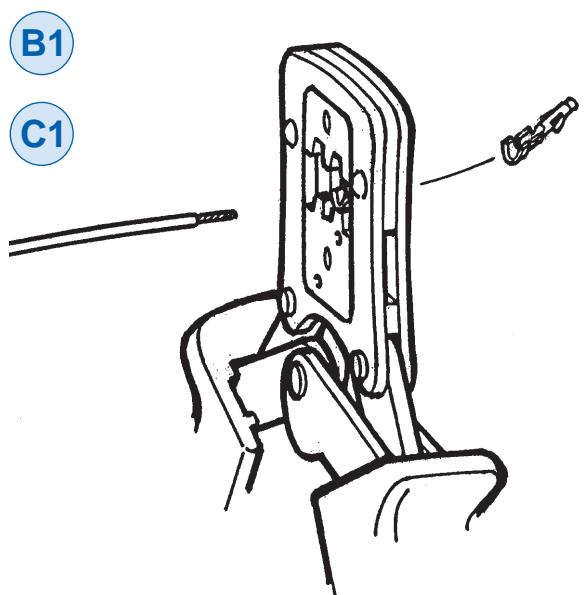
C: für Kabelbaum Slave - Slave / for wiring harness satellite - satellite

Mit den Kontakten (Pos. 13) und den entsprechenden Kabeln (Pos. 15, 16, 17) eine Crimpverbindung nach EN 60352-2/A1 Teil 2 herstellen.

Make a crimp connection per EN 60352-2/A1 Part 2 with the contacts (Pos. 13) and the corresponding cables (Pos. 15, 16, 17).

 Dabei besonders darauf achten, dass alle Einzeldrähte des Kabels von der Crimphülse erfasst werden, denn sonst besteht Kurzschlussgefahr!

Take special care to contain all individual wires of the cable in the crimp socket to avoid the risk of a short-circuit!



Montageanleitung Installation Instructions

CANcockpit

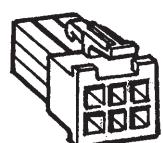
B: für Kabelbaum Master - Slave / for wiring harness master - satelitte
C: für Kabelbaum Slave - Slave / for wiring harness satelitte - satelitte

Die Kabel (Pos. 15, 16, 17) je nach Belegung in den 4poligen (Pos. 11) / 6poligen Stecker (Pos. 12) einstecken. Die Kontakte müssen hörbar einrasten.

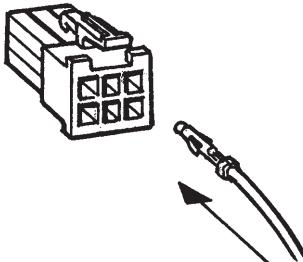
Insert the cables (Pos. 15, 16, 17) into the 4-pole (Pos. 11) / 6-pole connector (Pos. 12) according to connector pin allocation. The pins must engage with an audible click.

rot red schwarz black gelb yellow

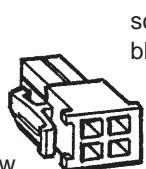
B2



C2



B3



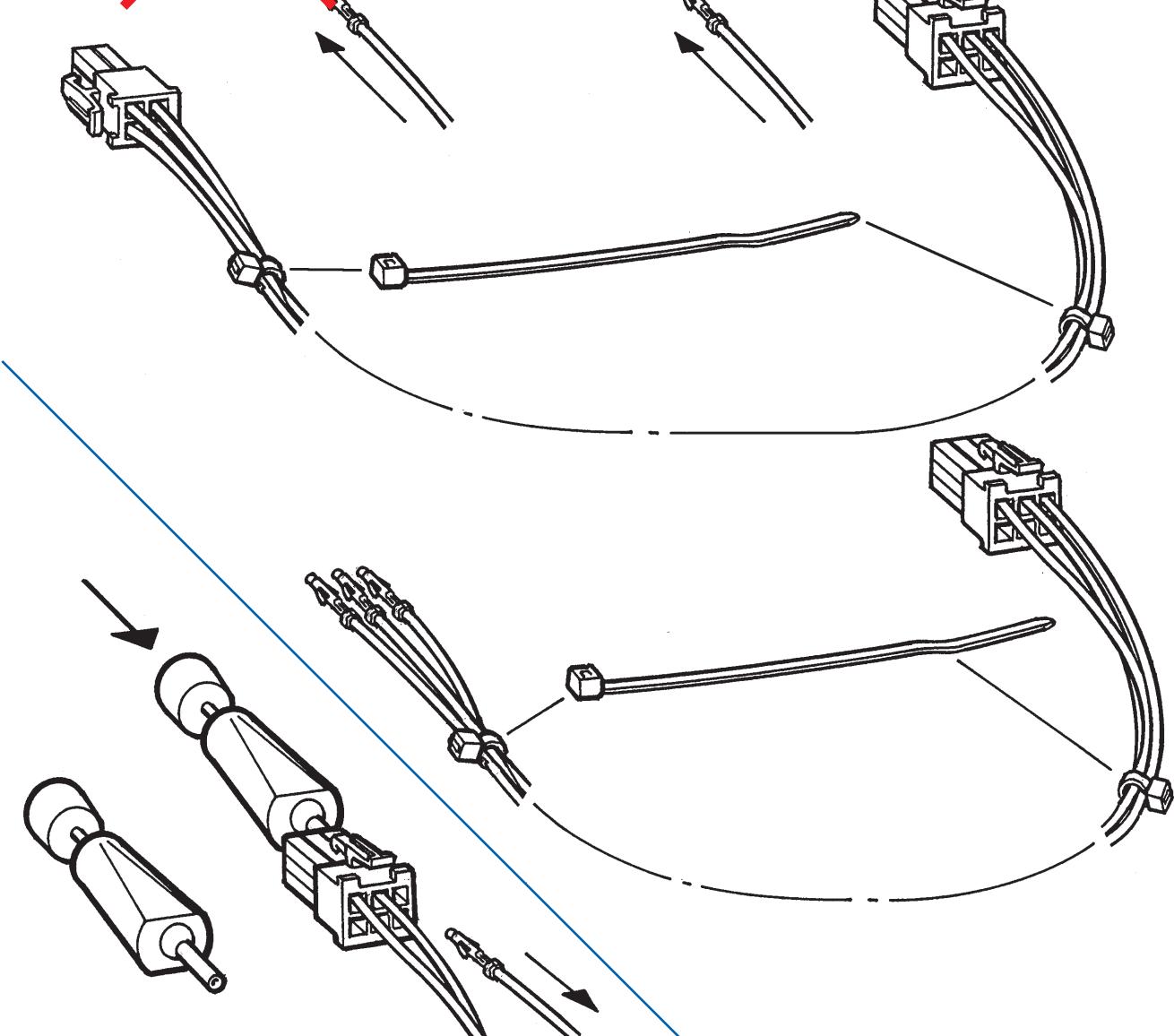
rot
red



rot
red

schwarz
black

gelb
yellow

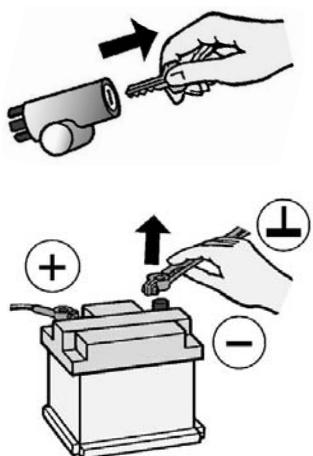


Ausstoßwerkzeug (Pos. 14)
Push out tool

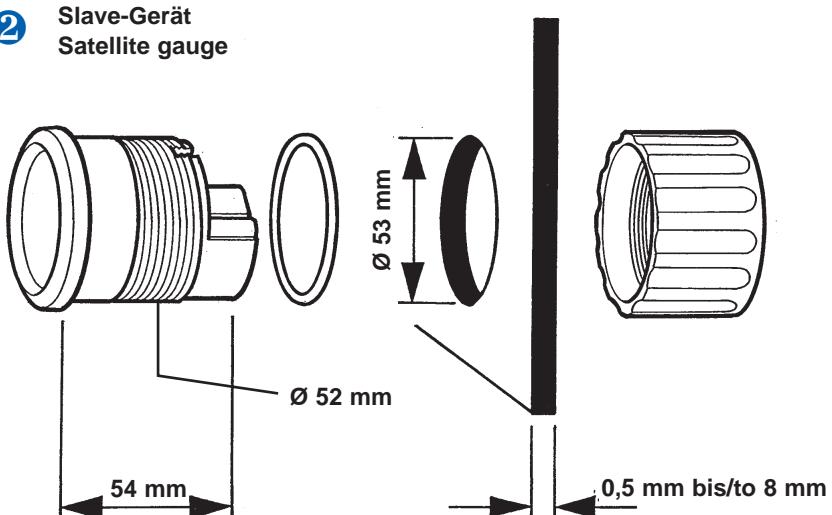
Montageanleitung Installation Instructions

CANcockpit

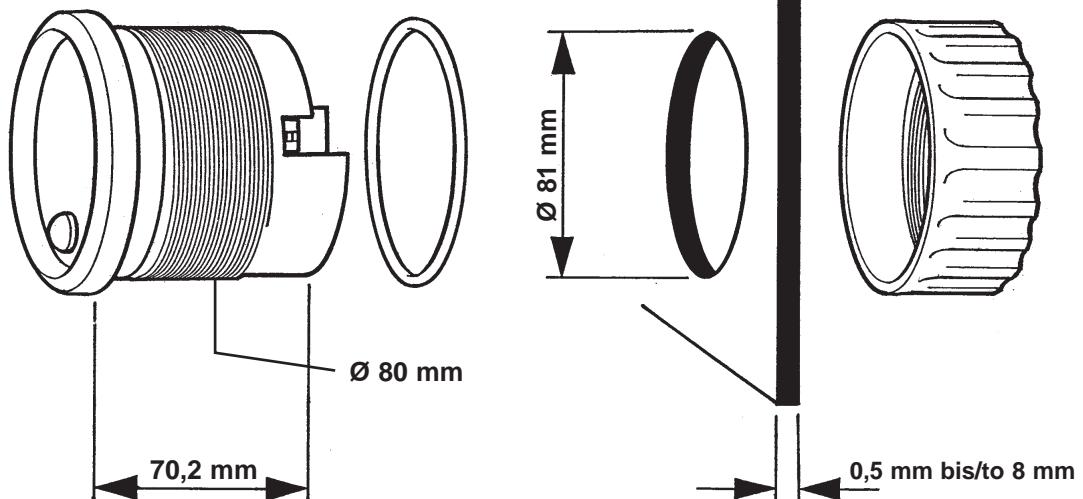
1



2 Slave-Gerät
Satellite gauge

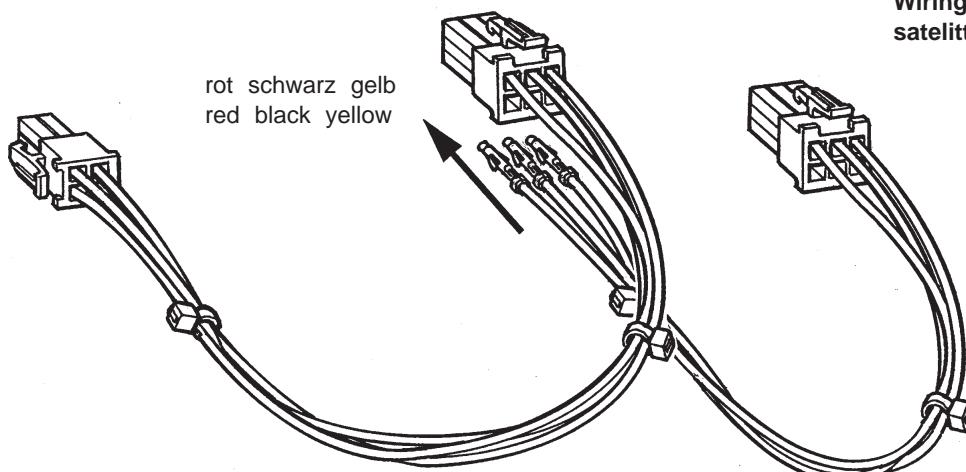


Master-Gerät
Master gauge



3

Kabelbaum Master - Slave
Wiring harness master - satellite

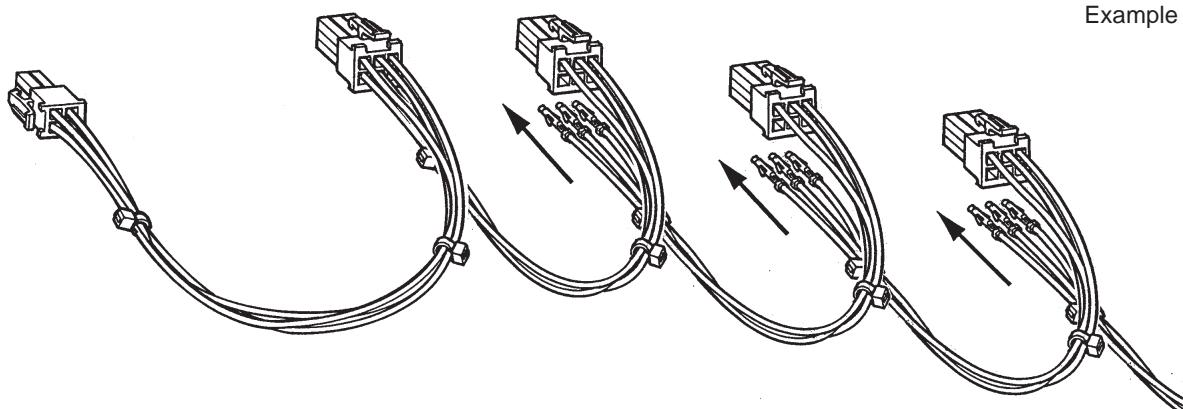


Kabelbaum
Slave - Slave
Wiring harness
satellite - satellite

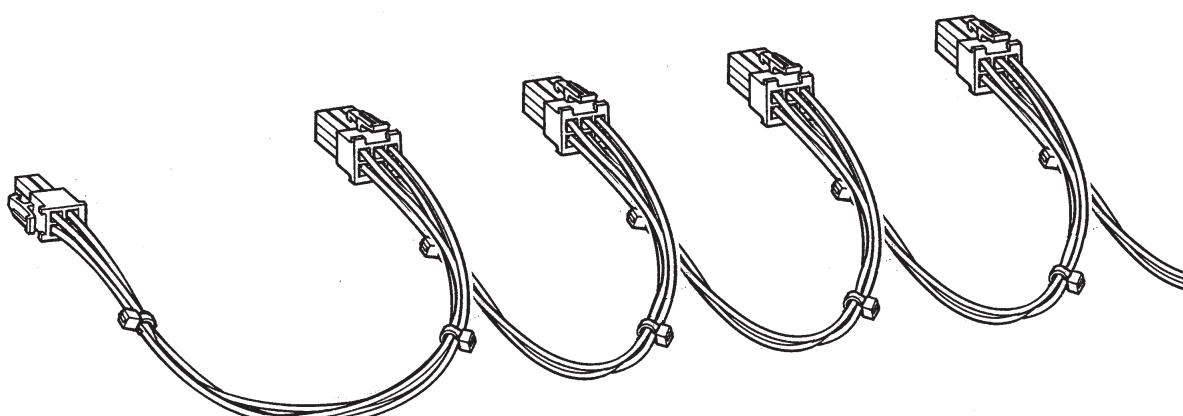
Montageanleitung Installation Instructions

CANcockpit

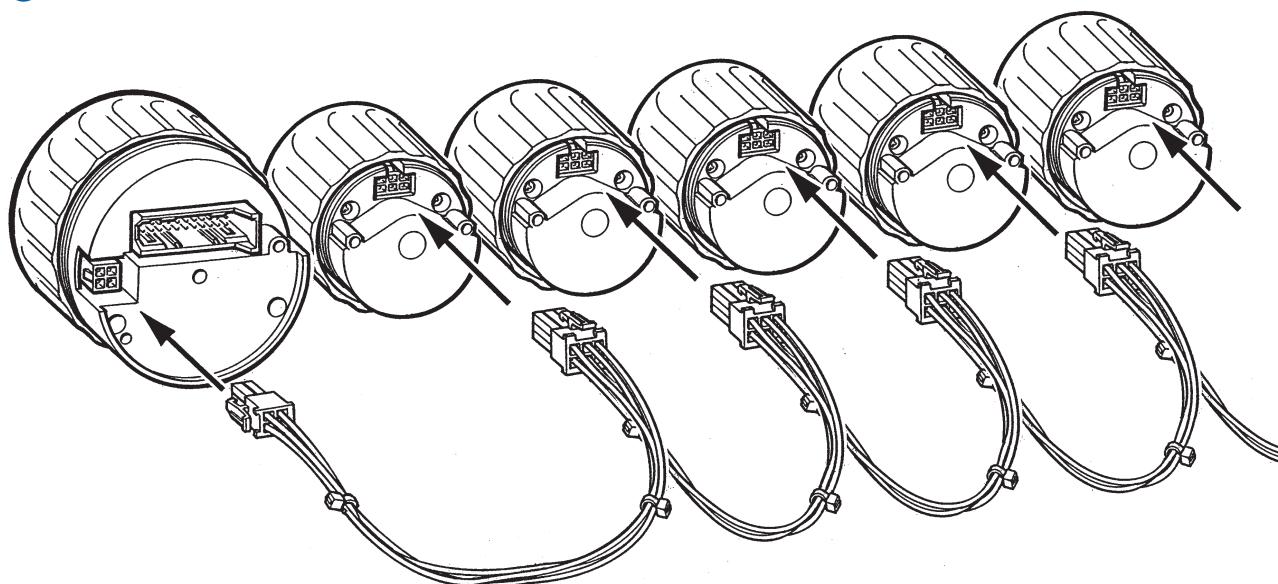
4



5



6

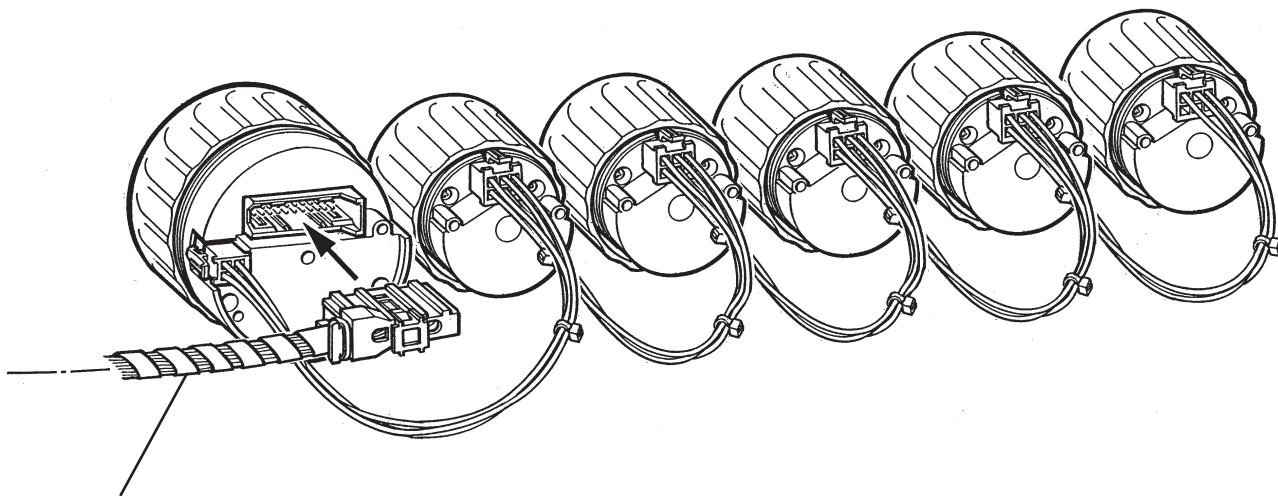


Montageanleitung Installation Instructions

CANcockpit

7

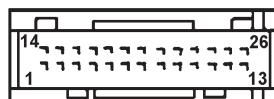
Beispiel /
Example



Kabelbaum Master
Wiring harness master

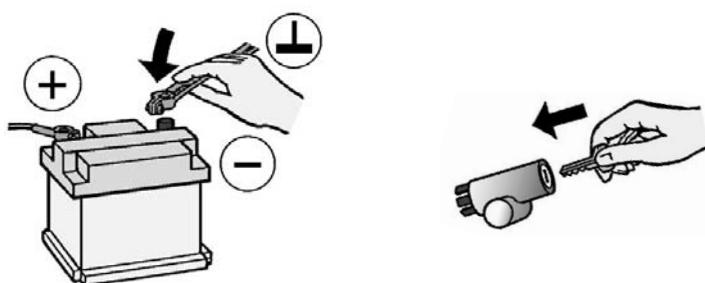
Kabel-Belegung
cable allocation

Geräteanschluss
Gauge connection



Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	KI. 30 / Power Supply (terminal 30)	14	+ 8 V DC für Geber / for Sensor supply
2	KI. 31 / GND (terminal 31)	15	0 - 5 V DC Eingang / Input
3	CAN1 _High	16	KI. 58 d / Illumination (terminal 58 d)
4	CAN1 _Low	17	KI. 15 / Ignition (terminal 15)
5	CAN2 _High	18	Frequenzeingang 2 / Frequency Input 2 (0-2 kHz)
6	CAN2 _Low	19	Frequenzeingang 1 / Frequency Input 1 (0-40 kHz)
7	nicht belegt / not connected	20	Schaltausgang 1 / Switch-Output 1
8	k - Line	21	Schaltausgang 2 / Switch-Output 2
9	Analog Eingang 1 / Input 1 (0,5-200 Ohm)	22	nicht belegt / not connected
10	Analog Eingang 2 / Input 2 (0,5-300 Ohm)	23	nicht belegt / not connected
11	Analog Eingang 3 / Input 3 (10 -700 Ohm)	24	Externer Schalter / External Switch
12	4 - 20 mA Eingang / Input	25	Masse Analog / Analog GND
13	4 - 20 mA Masse / GND	26	Masse Frequenz / Frequency GND

8



Product Manual **CANcockpit**

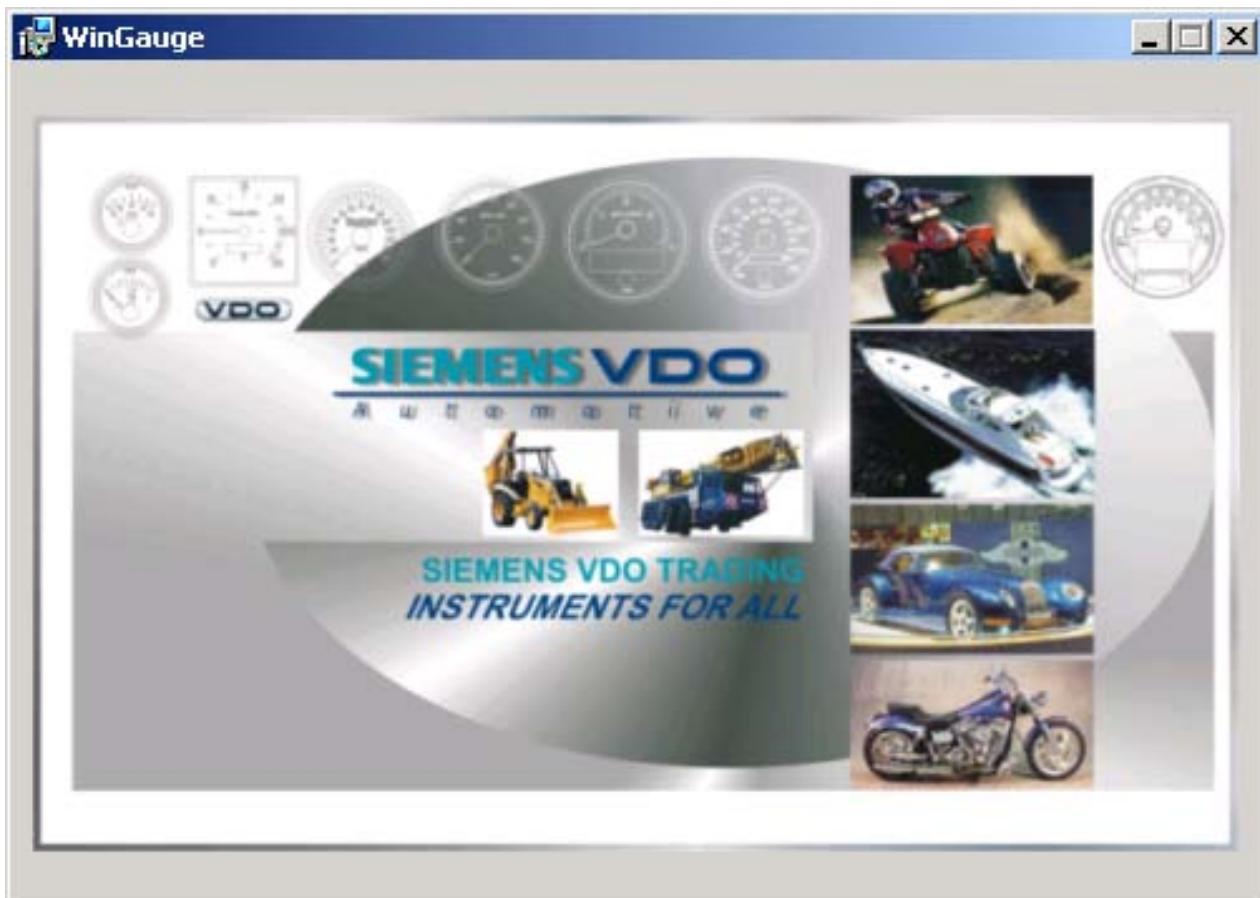
5. Software Description

Enclosures

WinGauge Software

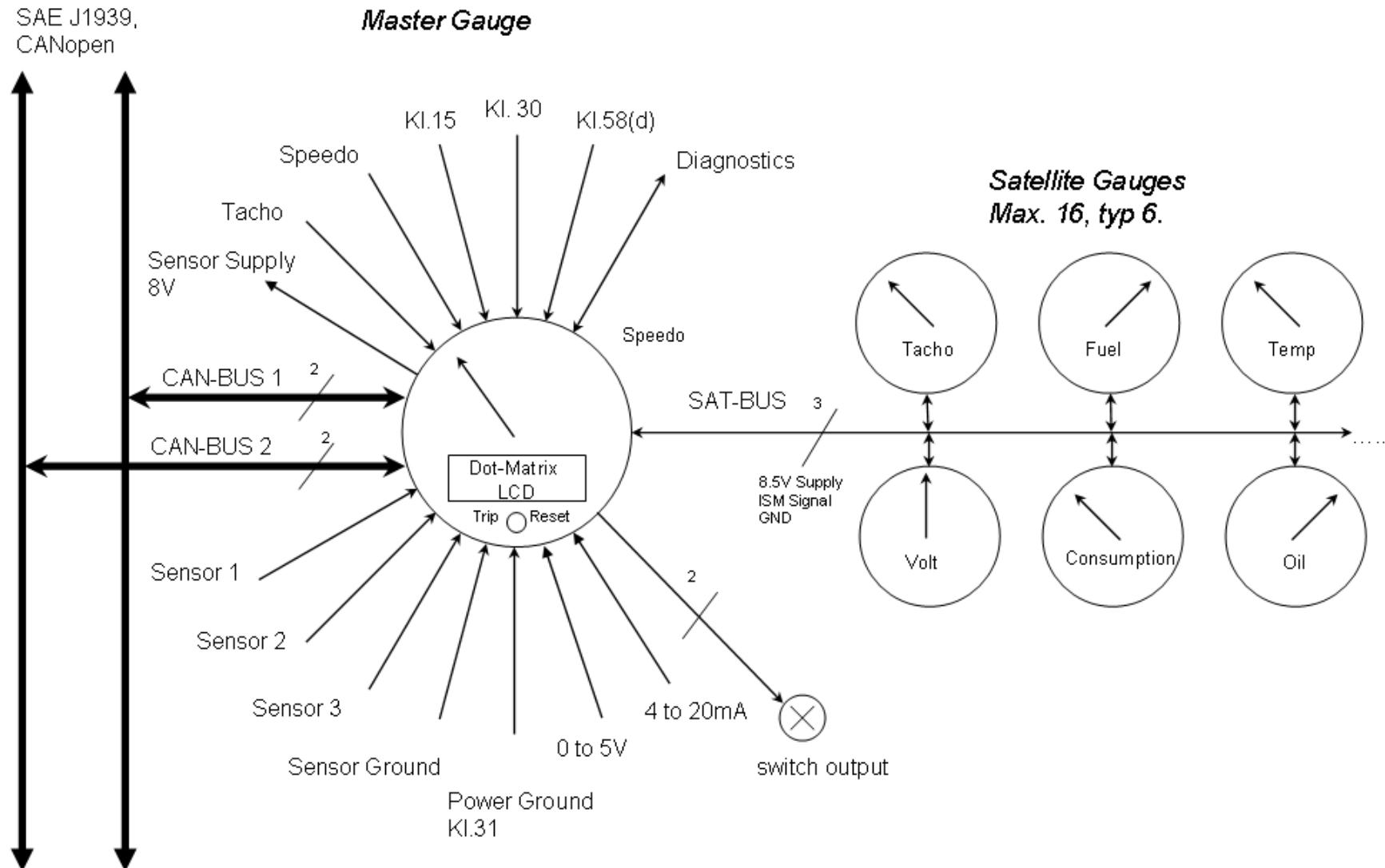
0303

(Page 1-53)



Components and Concept

SAE J1939,
CANopen



Example of a fully configured Instrumentation

Overview

- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- Speed - 0-60 km/h
- Engine speed - 0-4500
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -

Master: CAN 1



Part No.: A2C53024779
Type: High Line - Tacho Ø 80
Prim. Range: 0-3000 1/min
CAN 1

Slave - (Adr.: 11)  0.5-200 Ω 1 Part No.: A2C53024552 Level - Fuel Prim. Range: 0-100 % Sensor Input 1 [0.5-200 Ohm]	Slave - (Adr.: 7)  CAN 1 Part No.: A2C53024529 Temperature - Cooling water Prim. Range: 40-120 °C CAN 1	Slave - (Adr.: 14)  CAN 1 Part No.: A2C53024533 Voltage (V) - Battery Prim. Range: 8-16 V CAN 1	Display speed 0-40 kHz F1 Part No.: A2C53042287 Speedometer - Speed Prim. Range: 0-60 km/h Frequency 1 (0-40 kHz)
Display 0-2kHz F2 Part No.: A2C53042286 Tachometer - Engine speed	Display CAN 1 Part No.: A2C53024536 Pressure - Engine oil	Display 10-7000 3 Part No.: A2C53024531 Temperature - Hydraulics oil	Display CAN 1 Part No.: Pressure - Fuel Rate

Example of a fully configured Instrumentation cont.

Overview		Display 0-2kHz F2	Display CAN 1	Display 10-700Ω 3	Display CAN 1
High Line Tacho - 0-3000 1/min					
Fuel - 0-100 %					
Cooling water - 40-120 °C					
Battery - 8-16 V					
speed	Speed - 0-60 km/h	Part No.: A2C53042286 Tachometer - Engine speed Prim. Range: 0-4500 Frequency 2 (0-2 kHz)	Part No.: A2C53024536 Pressure - Engine oil Prim. Range: - bar CAN 1	Part No.: A2C53024531 Temperature - Hydraulics oil Prim. Range: - °C Sensor Input 3 [10-700 Ohm]	Part No.: Pressure - Fuel Rate Prim. Range: - l/h CAN 1
	Engine speed - 0-4500				
	Engine oil - - bar				
	Hydraulics oil - - °C				
	Fuel Rate - - l/h				
	Fuel Temperature - - °C				
	Intake Manifold Temperature - - °C				
	Percent Load - - %				
	Hydraulic Oil Filter Switch - -				
	Air Filter Switch - -				
	Brake Switch - -				
Part No.: Pressure - Fuel Temperature Prim. Range: - °C CAN 1		Display CAN 1	Display CAN 1	Display CAN 1	Display 0-5 V
Part No.: Pressure - Intake Manifold Temperature Prim. Range: - °C CAN 1					
Part No.: Pressure - Percent Load Prim. Range: - % CAN 1					
Part No.: Pressure - Hydraulic Oil Filter Switch Prim. Range: - Voltage inp. [0-5 V]					
Part No.: Pressure - Air Filter Switch Prim. Range: - Sensor Input 2 [0.5-300 Ohm]		Display 0.5-300Ω 2	Display 4-20 mA A		
Part No.: Pressure - Brake Switch Prim. Range: - Current inp. [4-20 mA]					

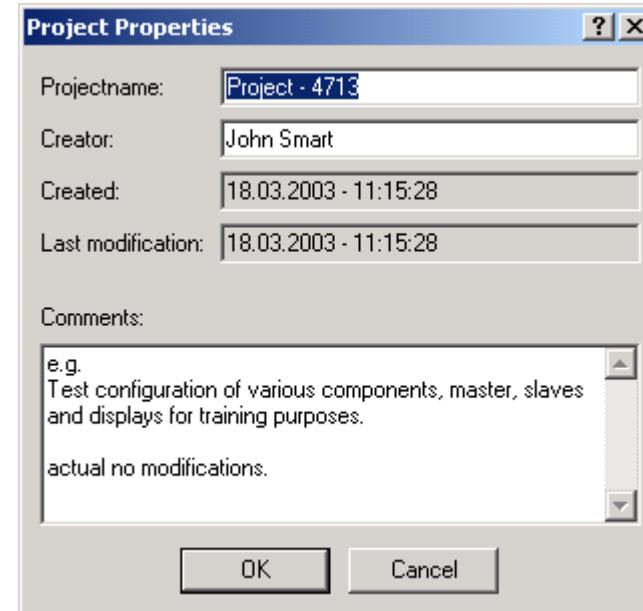
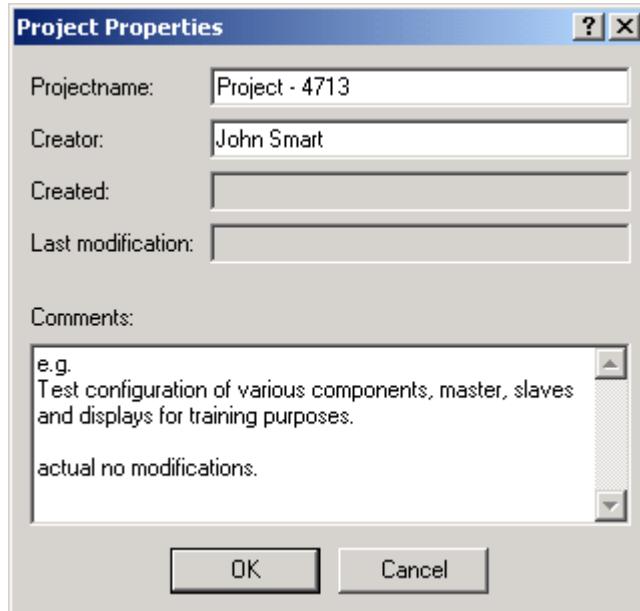


.....
.....
..... Overview

Basic Steps to build a new Configuration:

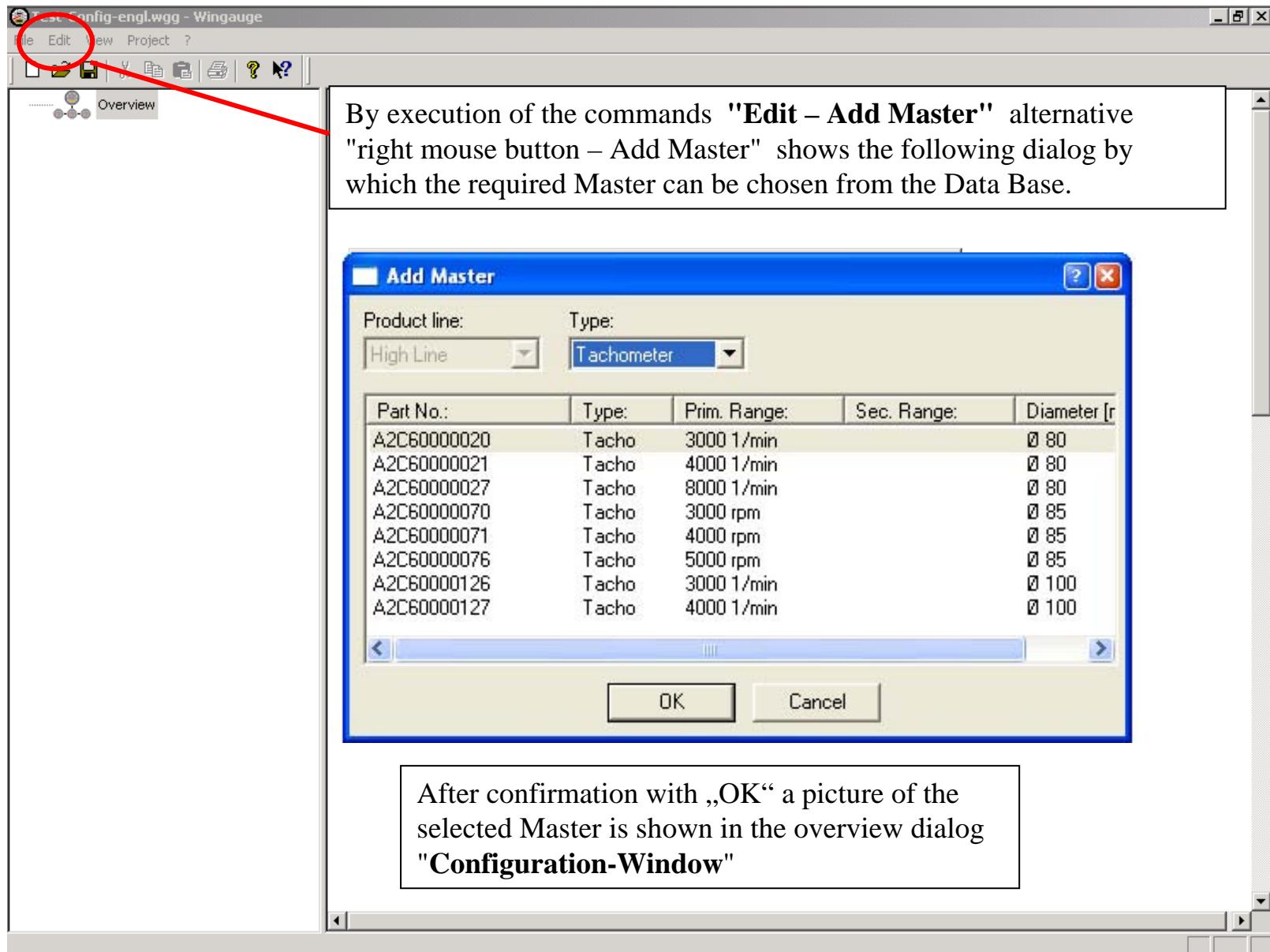
1. Definition of Project Properties
2. Adding a Master Instrument
3. Adding the required Slaves or Displays
4. Configuration of Master, Slave- and Display Instruments.
5. Save Configuration
6. Test / Diagnose the new Configuration.

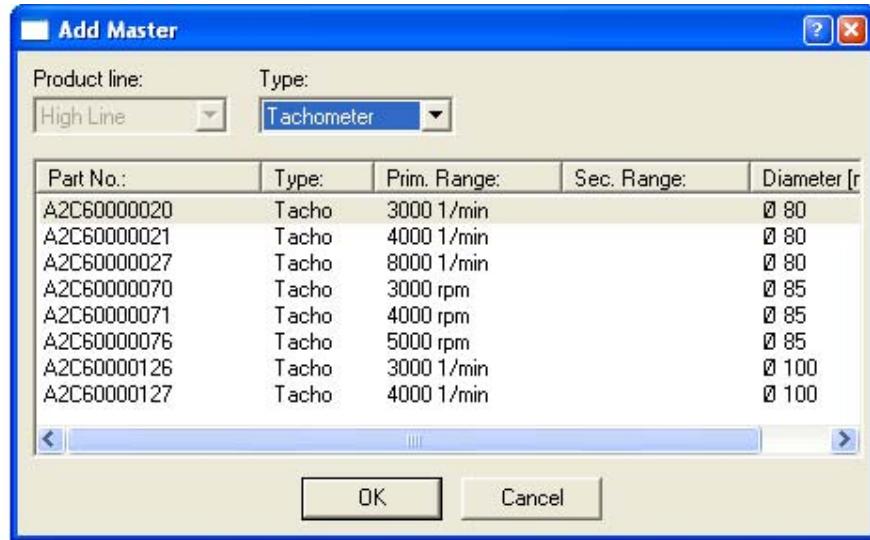
Definition of Project Properties



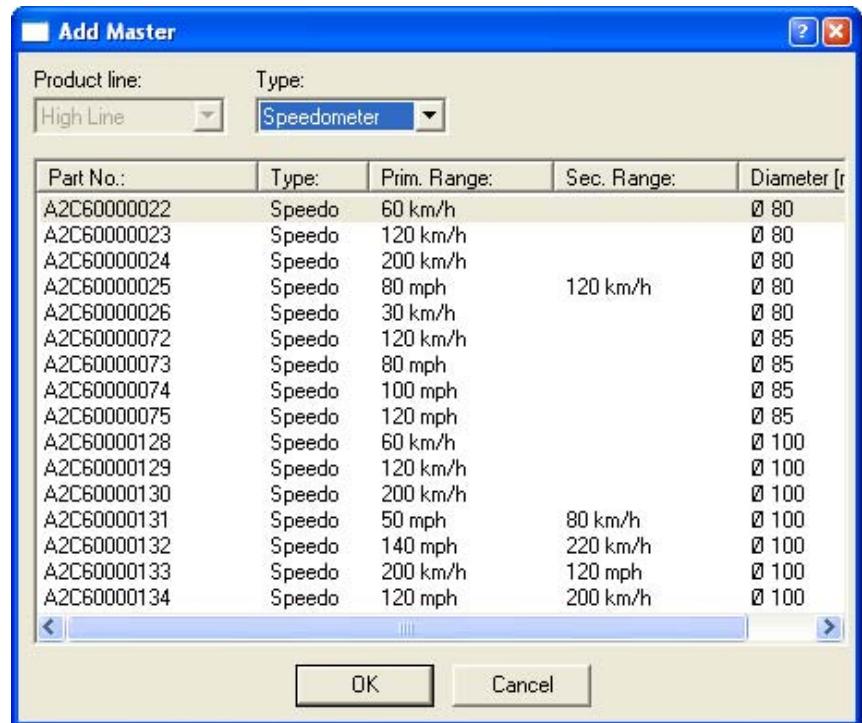
Date and Time will be added to the „Created / Last modification“ fields, after the configuration has been saved the first time. The „Last modification“ field receives an update every time changes are made to the project.

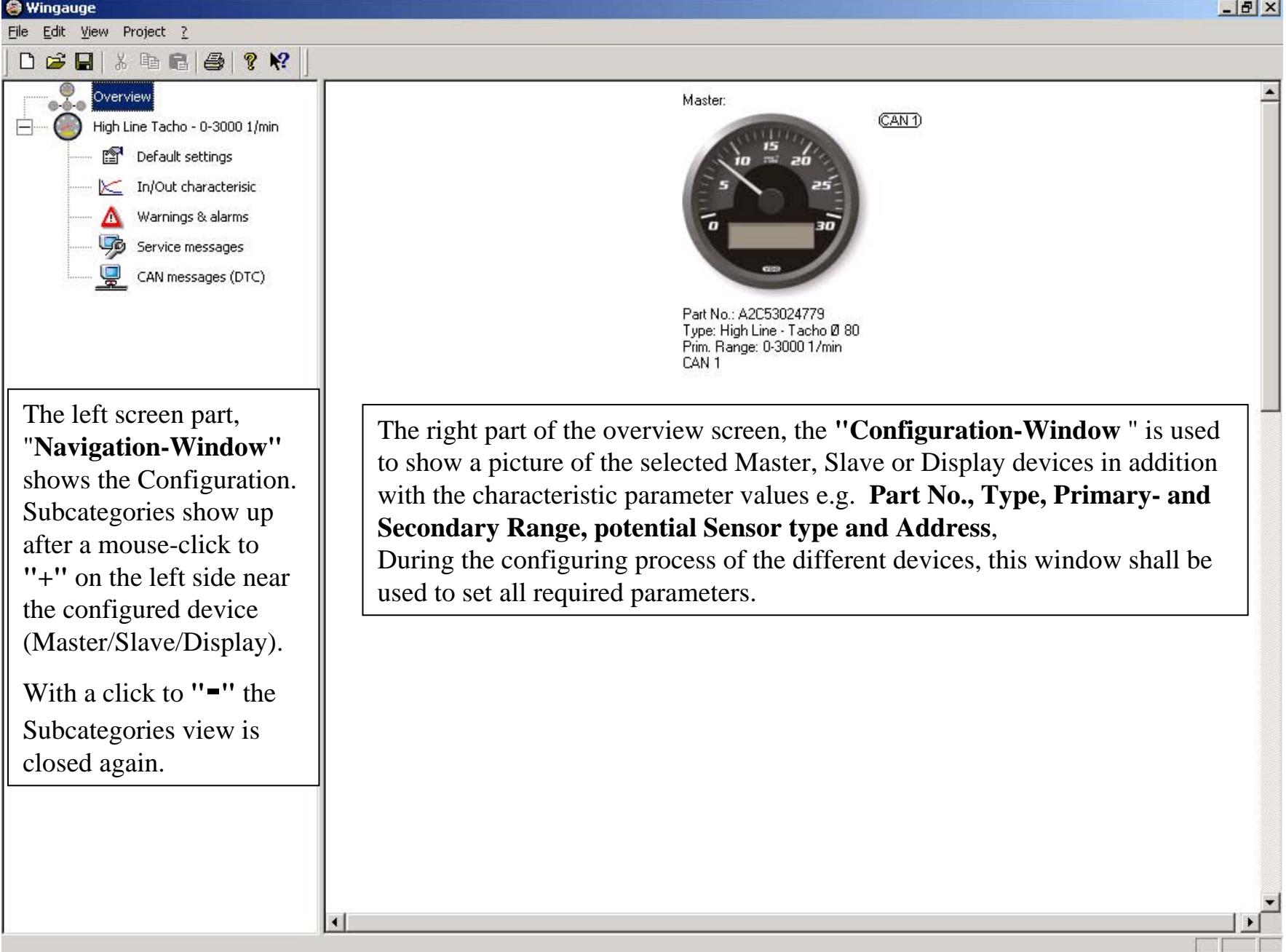
2.) Adding a Master Instrument



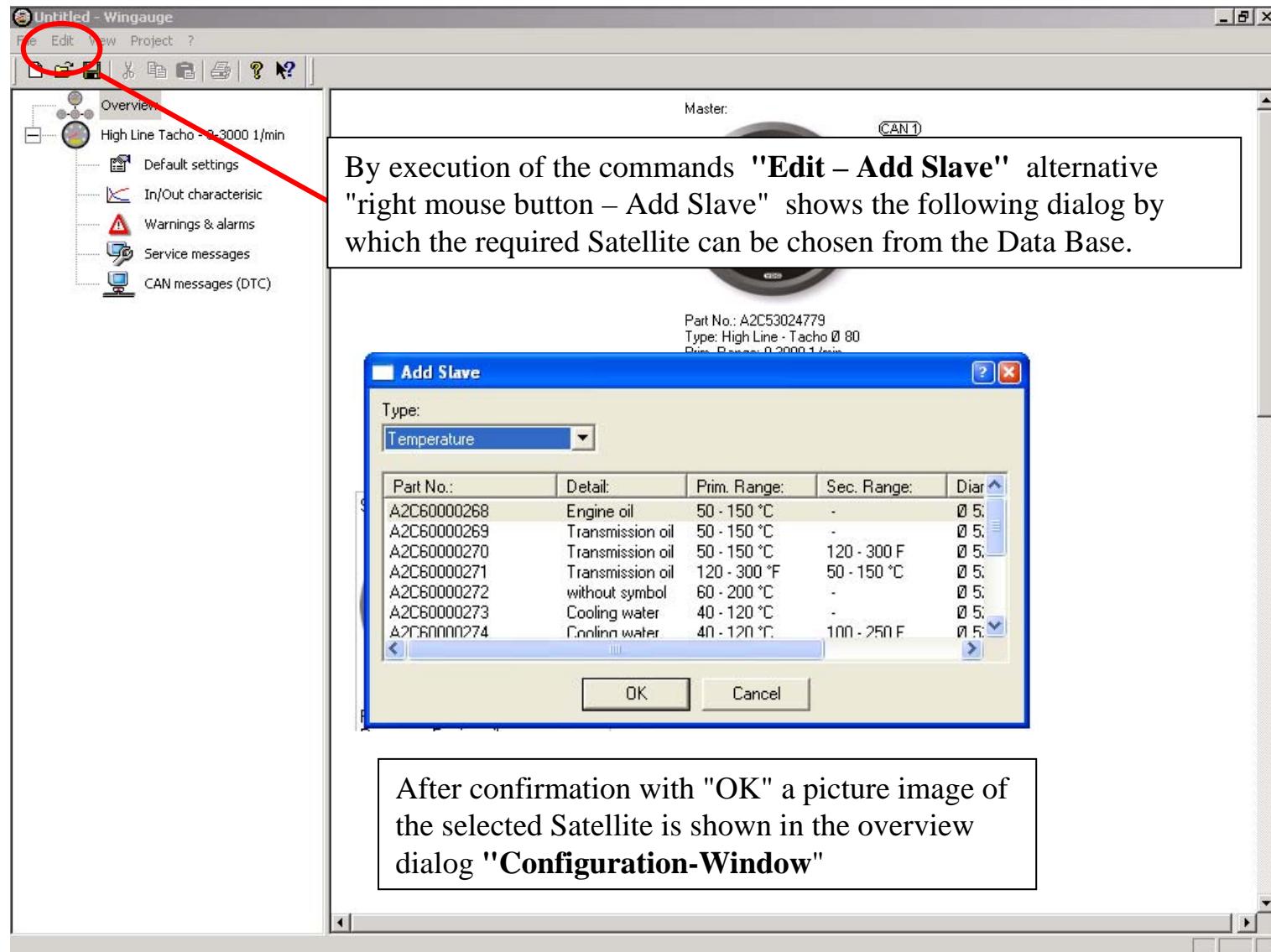


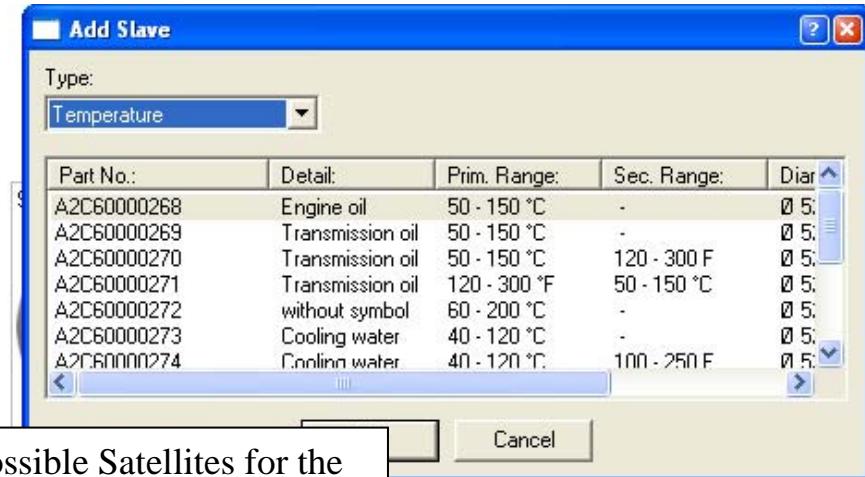
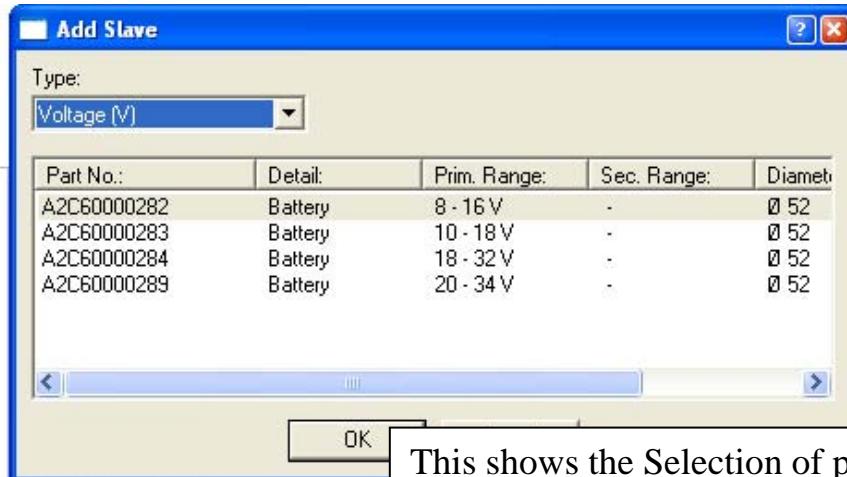
TACHO and SPEEDO Instruments can be chosen from a broad variety of instruments.



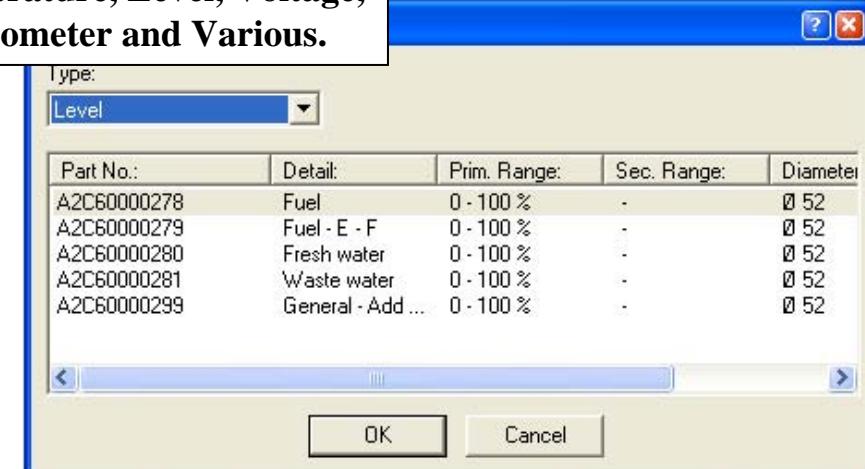
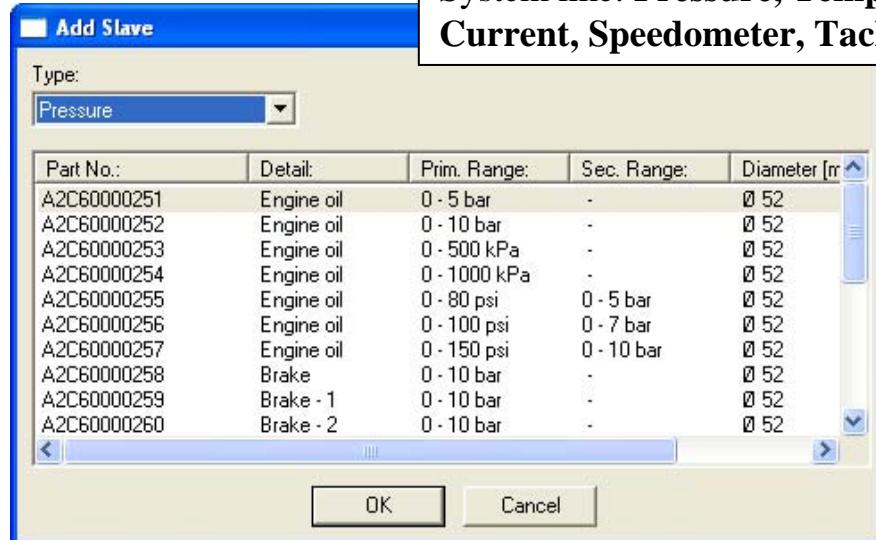


3.) Adding the required Satellites





This shows the Selection of possible Satellites for the System like: **Pressure, Temperature, Level, Voltage, Current, Speedometer, Tachometer and Various.**



3.) Adding the required Satellites

This shows the Selection of possible Sensors for the various Satellite types like: **Pressure, Temperature, Level, Voltage, Current, Speedometer, Various and Tachometer.**

The image displays three overlapping dialog boxes from the WinGauge software. The top-left box is for 'Pressure' sensors, listing various oil types with their primary and secondary ranges and addresses. The top-right box is for 'Level' sensors, listing fuel, water, and waste water levels. The bottom-left box is for 'Voltage (V)' sensors, listing battery types. Each box has an 'OK' and 'Cancel' button at the bottom.

Part No.	Detail:	Prim. Range:	Sec. Range:	Address:
A2C53024538	Engine oil	0 - 5 bar	-	1
A2C53024539	Engine oil	0 - 10 bar	-	1
A2C53024541	Engine oil	0 - 500 kPa	-	1
A2C53024542	Engine oil	0 - 1000 kPa	-	1
A2C53024543	Engine oil	0 - 80 psi	0 - 5 bar	1
A2C53024545	Engine oil	0 - 150 psi	0 - 10 bar	1
A2C53024546	Brake	0 - 10 bar	-	2
A2C53024547	Brake	0 - 150 psi	0 - 10 bar	2
A2C53024548	Brake	0 - 16 bar	-	2
A2C53024549	Transmission	0 - 28 bar	-	3
A2C53024549	Transmission	0 - 406 psi	0 - 28 bar	3
A2C53024549	Turbo charger	0 - 28 bar	-	3

Part No.:	Detail:	Prim. Range:	Sec. Range:	Address:
A2C53024552	Fuel	0 - 100 %	-	11
A2C53042280	Fuel	0 - 100 %	-	11
A2C53042281	Fresh water	0 - 100 %	-	12
A2C53042282	Waste water	0 - 100 %	-	13

Part No.:	Detail:	Prim. Range:	Sec. Range:	Address:
A2C53024524	Engine oil	50 - 150 °C	-	5
A2C53024526	Transmission oil	50 - 150 °C	-	6
A2C53024527	Transmission oil	50 - 150 °C	120 - 300 F	6
A2C53024528	without symbol	60 - 200 °C	-	9
A2C53024529	Cooling water	40 - 120 °C	-	7
A2C53024530	Cooling water	40 - 120 °C	100 - 250 F	7
A2C53024531	Hydraulics oil	20 - 120 °C	-	8
A2C53024532	Pyrometer	100 - 900 °C	-	10
A2C53042278	Engine oil	120 - 300 F	50 - 150 °C	5
A2C53042279	Cooling water	100 - 280 F	40 - 140 °C	7



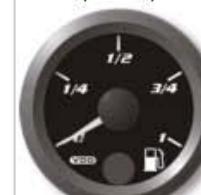
- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
 - In/Out characteristic
 - Warnings & alarms

Master:



Part No.: A2C53024779
Type: High Line - Tacho Ø 80
Prim. Range: 0-3000 1/min
CAN 1

Slave - (Adr.: 11)



Part No.: A2C53024552
Level - Fuel
Prim. Range: 0-100 %
CAN 1

The first two Instruments for the requested configuration are added now.
Parallel to the last steps the system can be expanded with additional Satellite instruments



- Overview
- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C

Master:

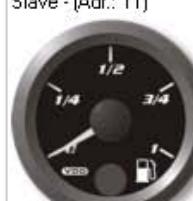


CAN 1

Part No.: A2C53024779
Type: High Line - Tacho Ø 80
Prim. Range: 0-3000 1/min
CAN 1

Slave - (Adr.: 11)

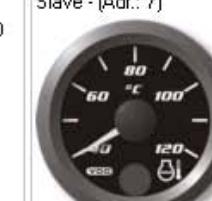
CAN 1



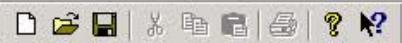
Part No.: A2C53024552
Level - Fuel
Prim. Range: 0-100 %
CAN 1

Slave - (Adr.: 7)

CAN 1



Part No.: A2C53024529
Temperature - Cooling water
Prim. Range: 40-120 °C
CAN 1



- Overview
- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V

Master:



CAN 1

Part No.: A2C53024779
Type: High Line - Tacho Ø 80
Prim. Range: 0-3000 1/min
CAN 1

Slave - (Adr.: 11)

CAN 1



Part No.: A2C53024552
Level - Fuel
Prim. Range: 0-100 %
CAN 1

Slave - (Adr.: 7)

CAN 1



Part No.: A2C53024529
Temperature - Cooling water
Prim. Range: 40-120 °C
CAN 1

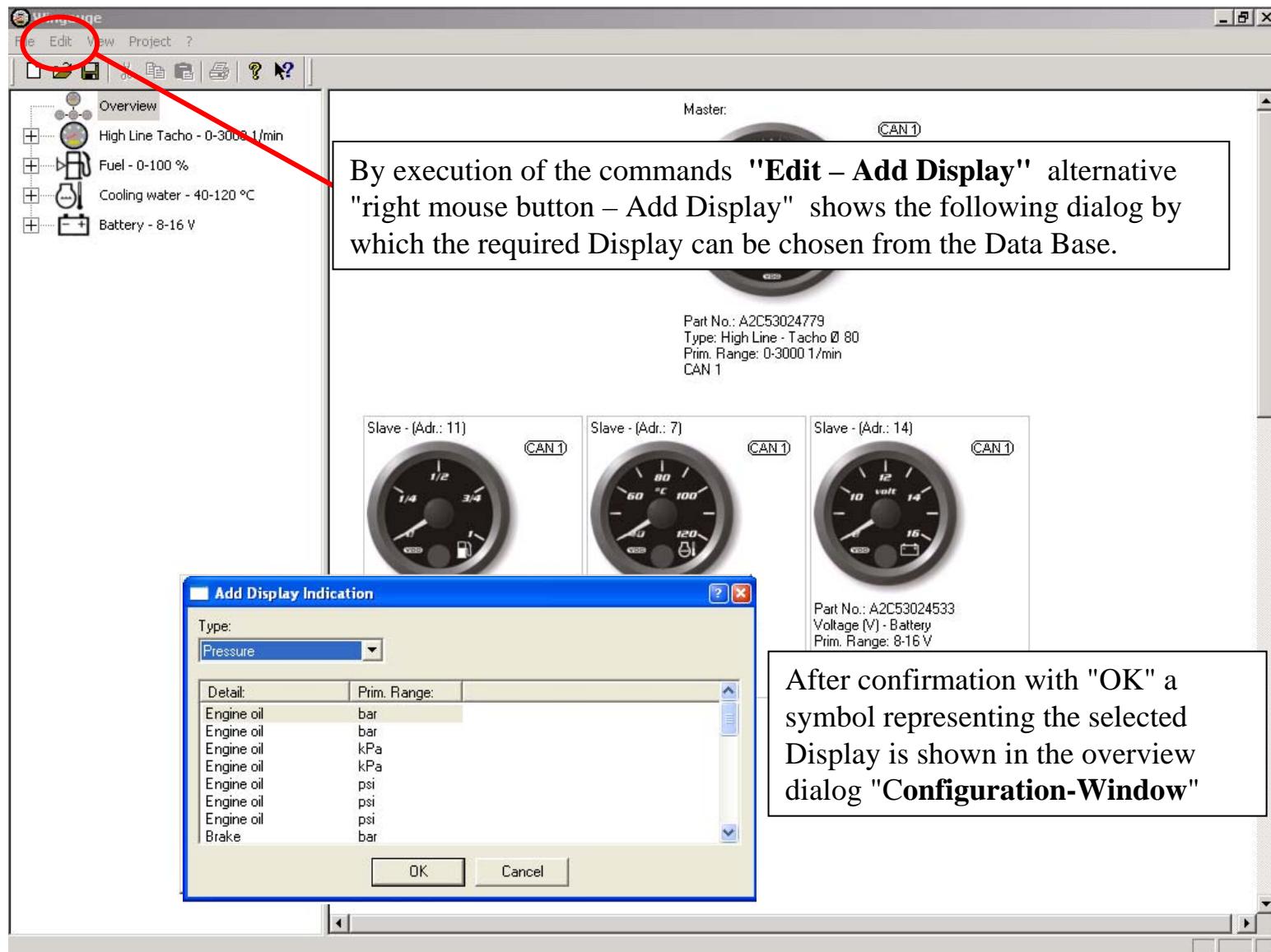
Slave - (Adr.: 14)

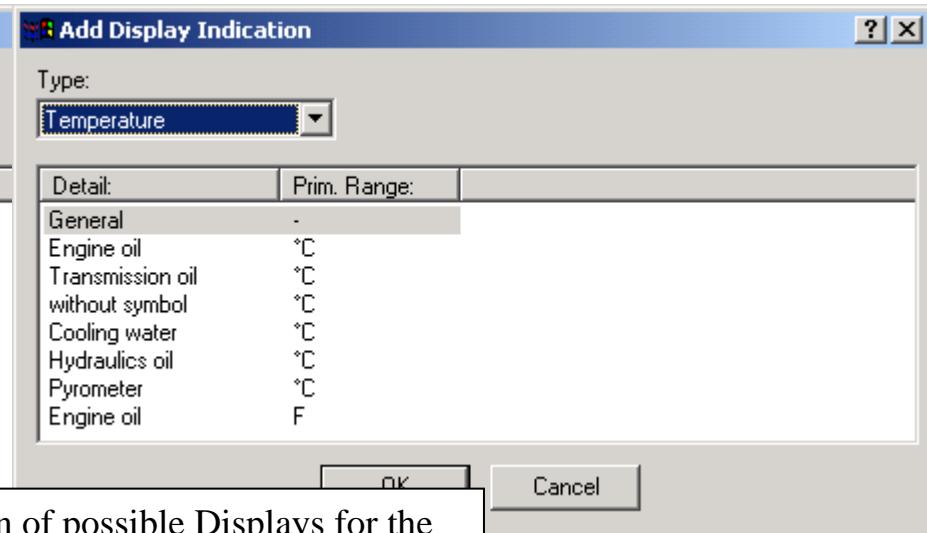
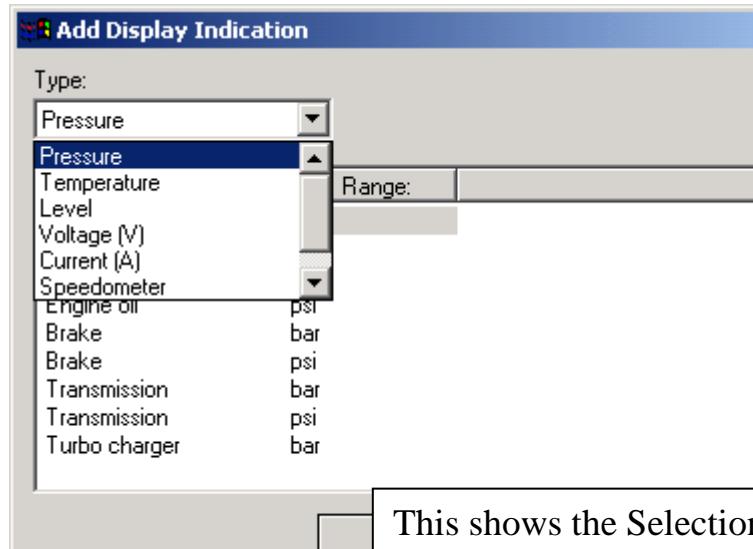
CAN 1



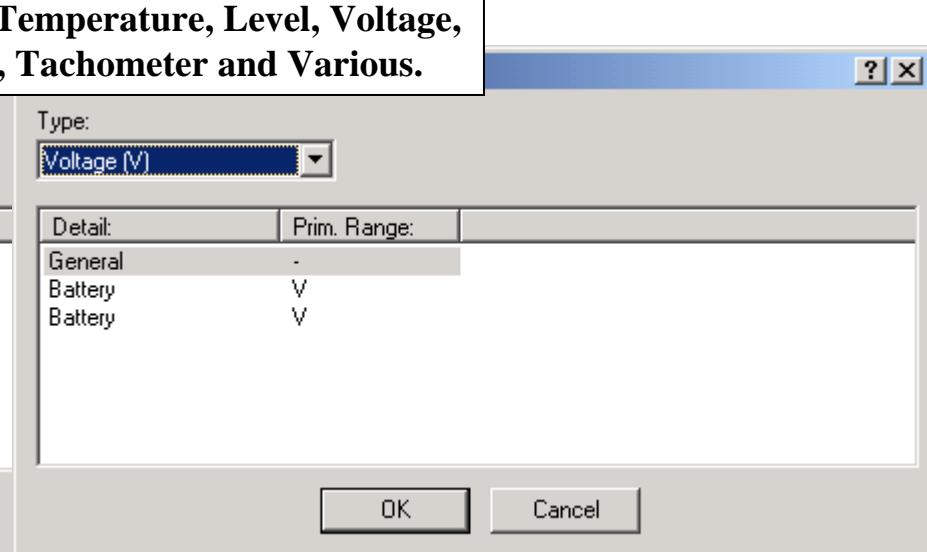
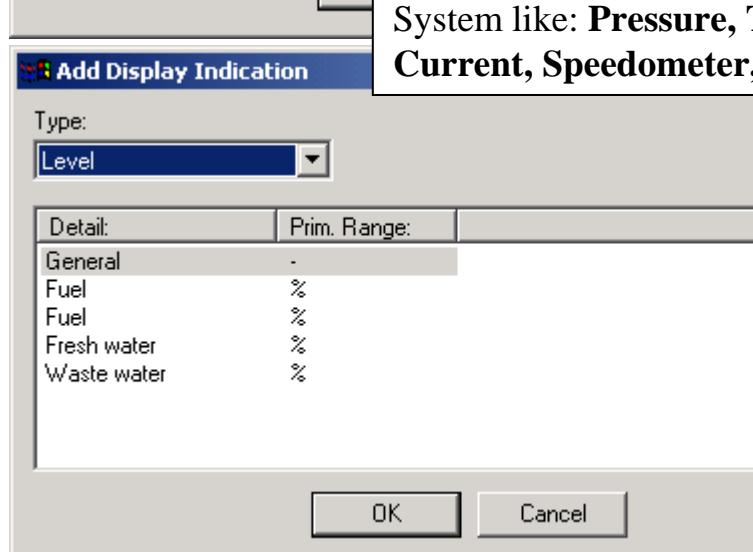
Part No.: A2C53024533
Voltage (V) - Battery
Prim. Range: 8-16 V
CAN 1

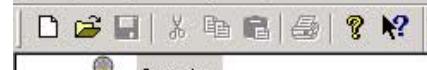
3.) Adding the required Displays





This shows the Selection of possible Displays for the System like: **Pressure, Temperature, Level, Voltage, Current, Speedometer, Tachometer and Various.**





- Overview
- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed Speed - km/h

Master:

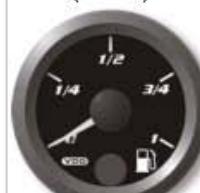


CAN 1

Part No.: A2C53024779
Type: High Line - Tacho Ø 80
Prim. Range: 0-3000 1/min
CAN 1

Slave - (Adr.: 11)

CAN 1



Part No.: A2C53024552
Level - Fuel
Prim. Range: 0-100 %
CAN 1

Slave - (Adr.: 7)

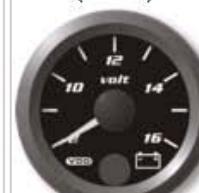
CAN 1



Part No.: A2C53024529
Temperature - Cooling water
Prim. Range: 40-120 °C
CAN 1

Slave - (Adr.: 14)

CAN 1



Part No.: A2C53024533
Voltage (V) - Battery
Prim. Range: 8-16 V
CAN 1

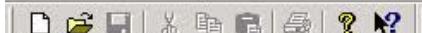
Display
speed
---->

CAN 1



Part No.: A2C53042287
Speedometer - Speed
Prim. Range: - km/h
CAN 1

This shows now the Basic System - Configuration including the essential blocks like: Master, three Satellites and one Display. However, the parameter Settings are only standard and don't match the required functions. This must be adopted later. Before the configuration of the details for this system can be started, it's required to add the other missing components.



Overview

- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed
- Speed - km/h
- Engine speed - 1/min
- Engine oil - bar
- Hydraulics oil - °C

In the "Navigation-Window" it can be followed, how the whole System builds up to completion. Certainly this shows also which parts of the detailed configuration need to be performed next. Remarkable are the missing symbols and the commonly used name – General –

Master:

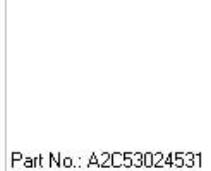
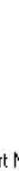


Part No.: A2C53024779
Type: High Line - Tacho
Prim. Range: 0-3000 1/min
CAN 1

Due to the size of this very complex Configuration it's necessary to understand that part of the configuration continues in the invisible part of the "Configuration-Window".

Using the roll-bar on the right side of the window may help to pull the non visible part up.



CAN 1  Part No.: A2C53024529 Temperature - Cooling water Prim. Range: 40-120 °C CAN 1	CAN 1  Part No.: A2C53024533 Voltage (V) - Battery Prim. Range: 8-16 V CAN 1	CAN 1  Part No.: A2C53042287 Speedometer - Speed Prim. Range: - km/h CAN 1
CAN 1  Part No.: A2C53042286 Tachometer - Engine speed	CAN 1  Part No.: A2C53024536 Pressure - Engine oil	CAN 1  Part No.: A2C53024531 Temperature - Hydraulics oil

Overview

- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed Speed - - km/h
- Engine speed - - 1/min
- Engine oil - - bar
- Hydraulics oil - - °C
- General - -

Display  CAN 1	Display  CAN 1	Display  CAN 1	Display CAN 1
Part No.: A2C53042286 Tachometer - Engine speed Prim. Range: - 1/min CAN 1	Part No.: A2C53024536 Pressure - Engine oil Prim. Range: - bar CAN 1	Part No.: A2C53024531 Temperature - Hydraulics oil Prim. Range: - °C CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1
Display CAN 1	Display CAN 1	Display CAN 1	Display CAN 1
Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1
Display CAN 1	Display CAN 1	<p>Rolling the screen up, the other configured Displays inclusive their characteristic values defined up to this point are visible. With the next step the basic Configuration shall be completed in a way that it matches the requested layout.</p>	
Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1		





Overview

- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed Speed - km/h
- Engine speed - - 1/min
- Engine oil - bar
- Hydraulics oil - - °C
- General - -

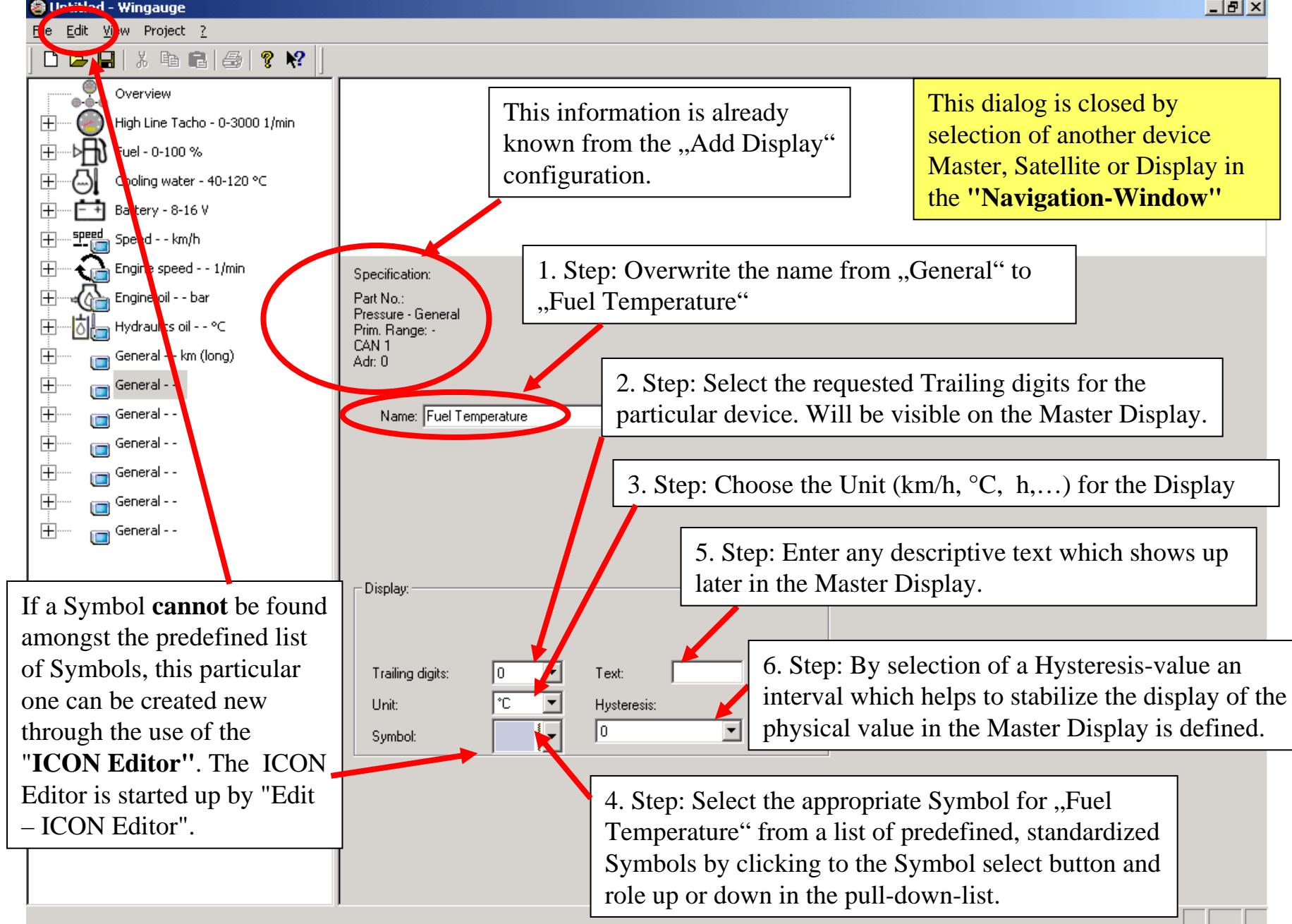
Display CAN 1	Display CAN 1	Display CAN 1	Display CAN 1
Part No.: A2C53042286 Tachometer - Engine speed Prim. Range: - 1/min CAN 1	Part No.: A2C53024536 Pressure - Engine oil Prim. Range: - bar CAN 1	Part No.: A2C53024531 Temperature - Hydraulics oil Prim. Range: - °C CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1
Display CAN 1	Display CAN 1	Display CAN 1	Display CAN 1
Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1	Part No.: Pressure - General Prim. Range: - CAN 1
Display CAN 1	Display CAN 1		

Two red arrows point from the 'General - -' items in the navigation window to the 'Pressure - General' items in the display table, indicating a one-to-one correspondence between the two.

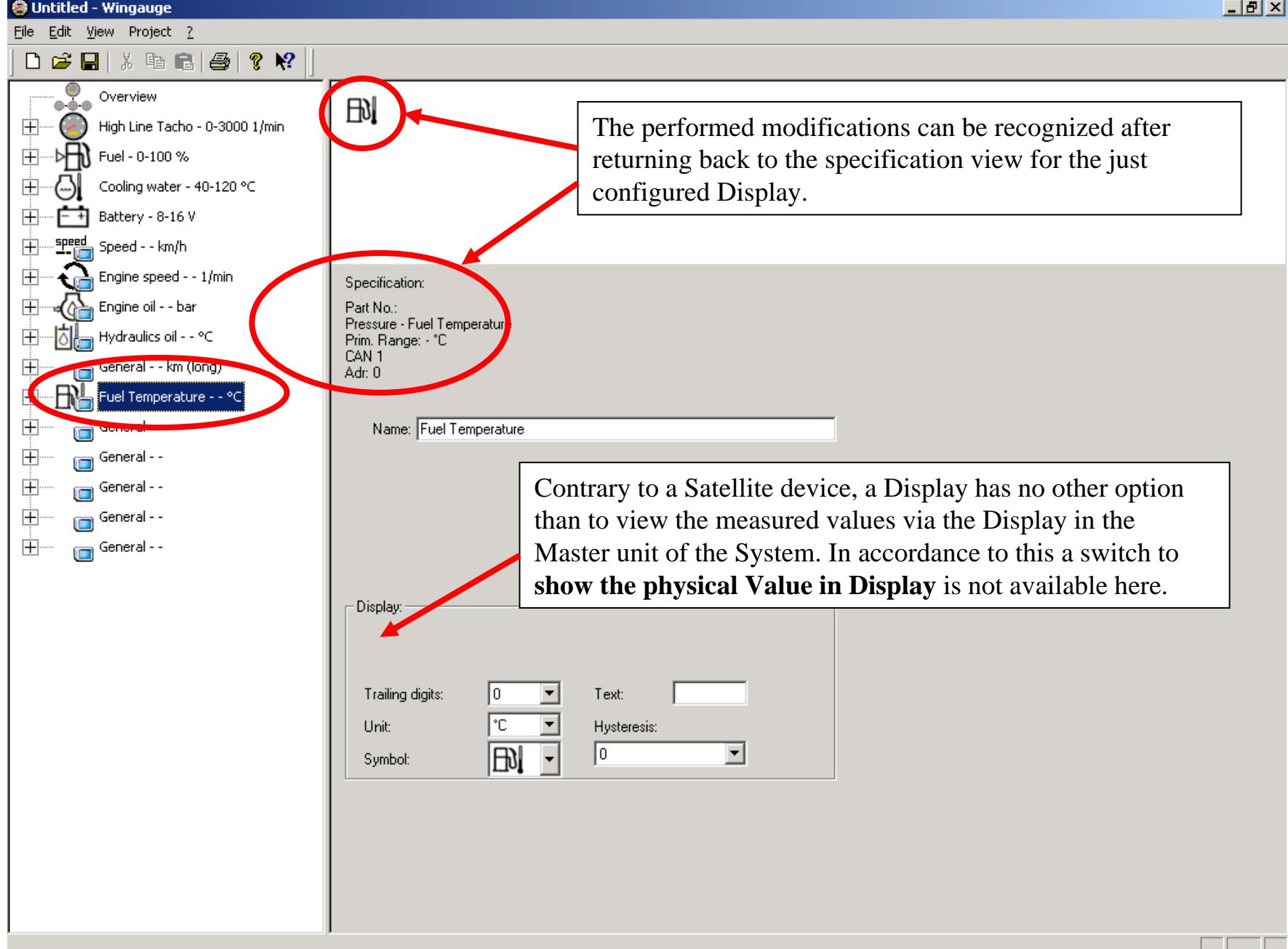
Exemplary for the other Displays the necessary modifications shall be implemented for one unit. The two arrows show the pair of views belonging to one Display unit. By clicking to the chosen Display in the **"Navigation-Window"** a new dialog window opens up in the **"Configuration-Window"**.

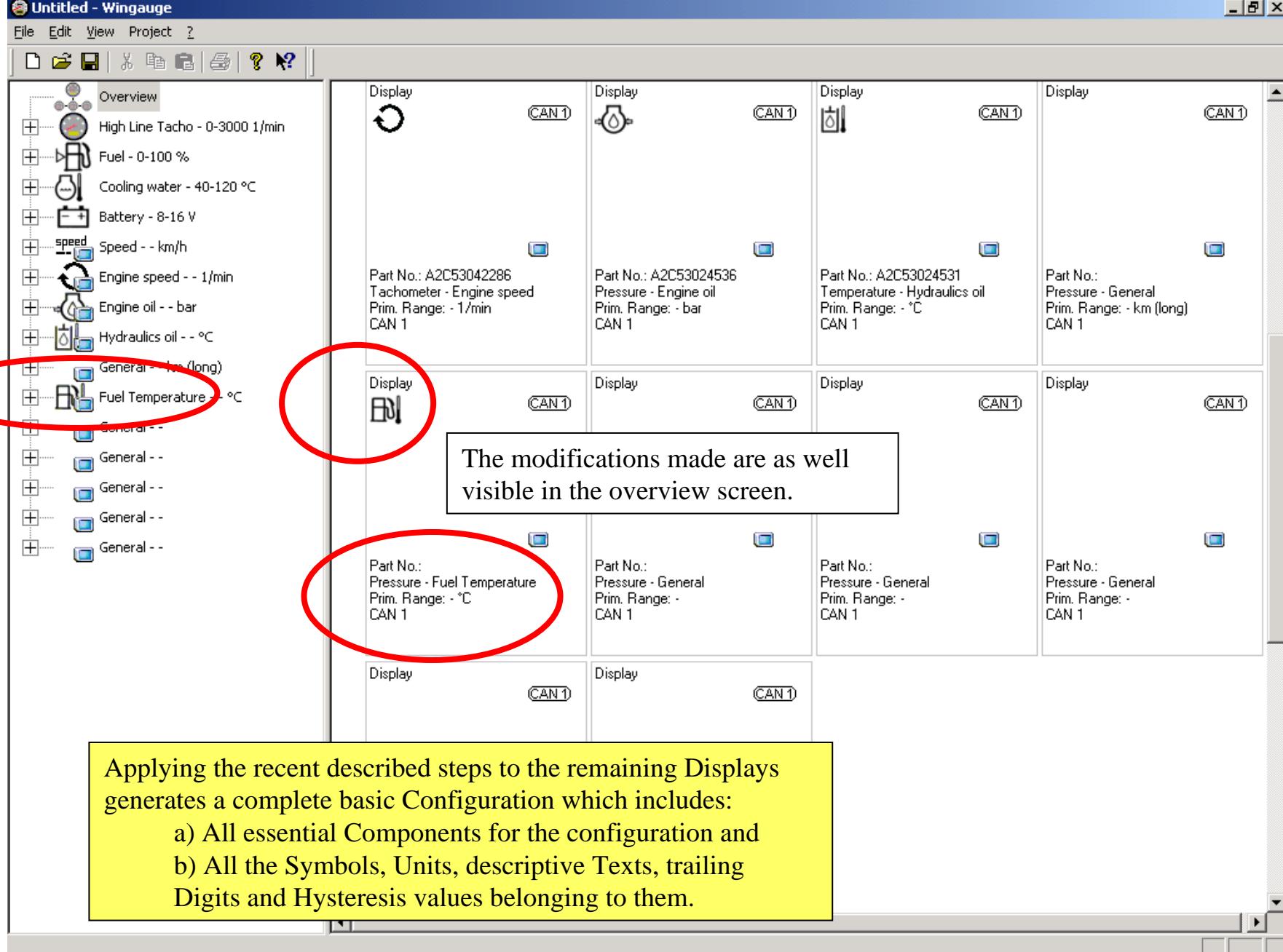
Part No.:
Pressure - General
Prim. Range: -
CAN 1

Part No.:
Pressure - General
Prim. Range: -
CAN 1



If a Symbol **cannot** be found amongst the predefined list of Symbols, this particular one can be created new through the use of the **"ICON Editor"**. The ICON Editor is started up by "Edit – ICON Editor".





Applying the recent described steps to the remaining Displays generates a complete basic Configuration which includes:

- a) All essential Components for the configuration and
- b) All the Symbols, Units, descriptive Texts, trailing Digits and Hysteresis values belonging to them.

Up to now basic configuration values like **Name, Symbol, Unit, trailing Digits and Hysteresis values** have been defined. This parameter setting is dedicated to present the individual device values in the Master Display. After creation of the missing Symbols plus the assignment to the correct device the next step is to define the In/Out characteristics for each device. Doing this implies that for each device, Master, Satellite or Display, the right Sensor is assigned and configured.

At this point it's easy to realize which Satellites still have not the right Symbols assigned. By use of the **ICON Editor** these Symbols are now created and can be assigned to the appropriate device.

Part No.: Pressure - Fuel Temperature
Prim. Range: - °C
CAN 1

Part No.: Pressure - Intake Manifold Temperature
Prim. Range: - °C
CAN 1

Part No.: Pressure - Percent Load
Prim. Range: - %
CAN 1

CAN 1
extended format (29 Bit): 1
use MID filter: 1
SAE J 1939 PGN: 0
Com. Mode: 64
Priority: 0
PDU - Format: 0
PDU - Specification: 0
Data length (DLC): 0
Source Address: 0
Data length: 1
Data Address: 1
Resolution: 1.000000
CAN-Offset: 0.000000

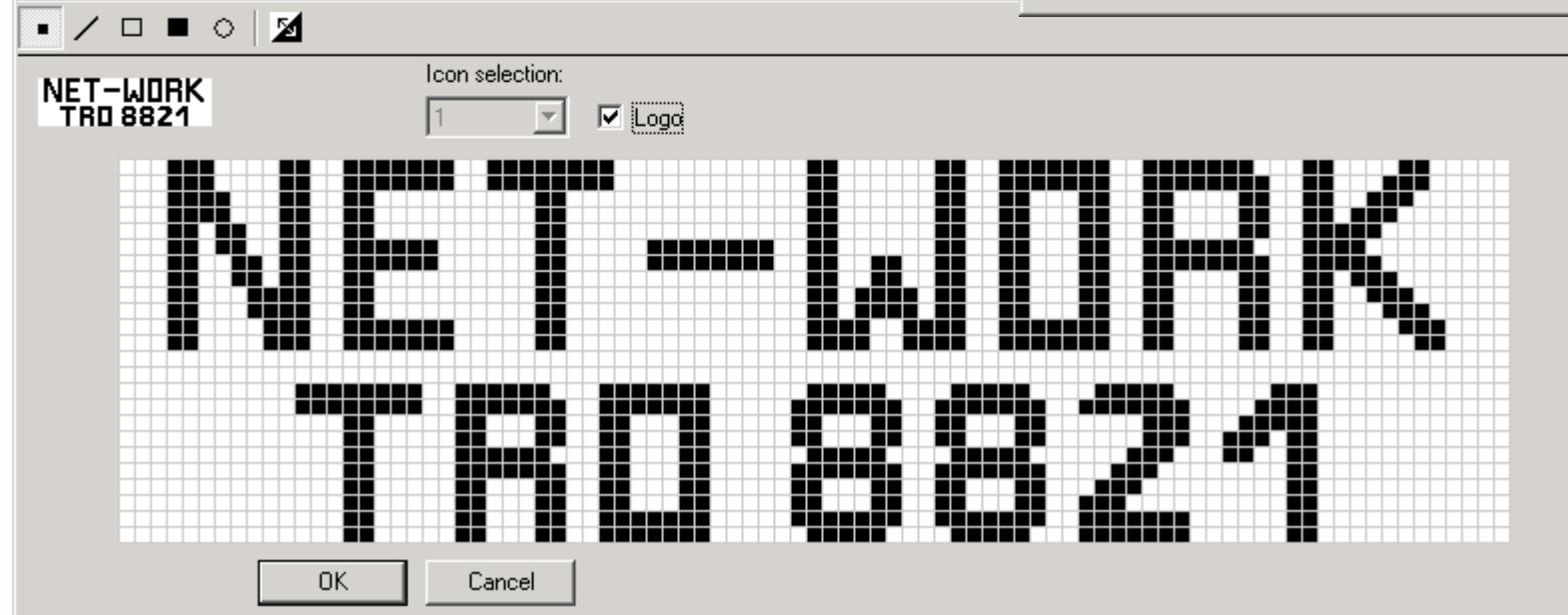
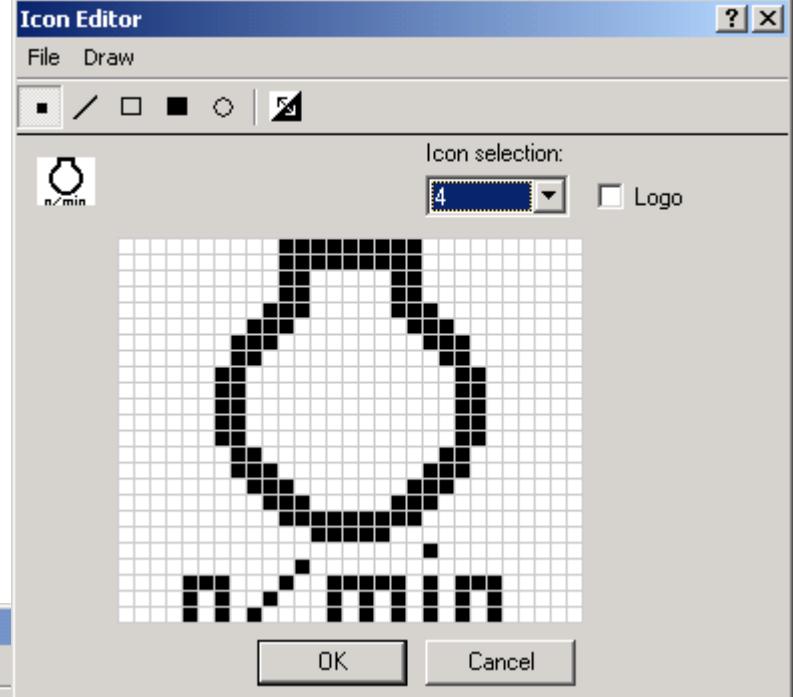
Display CAN 1 Display CAN 1 Display CAN 1 Display CAN 1 Display CAN 1

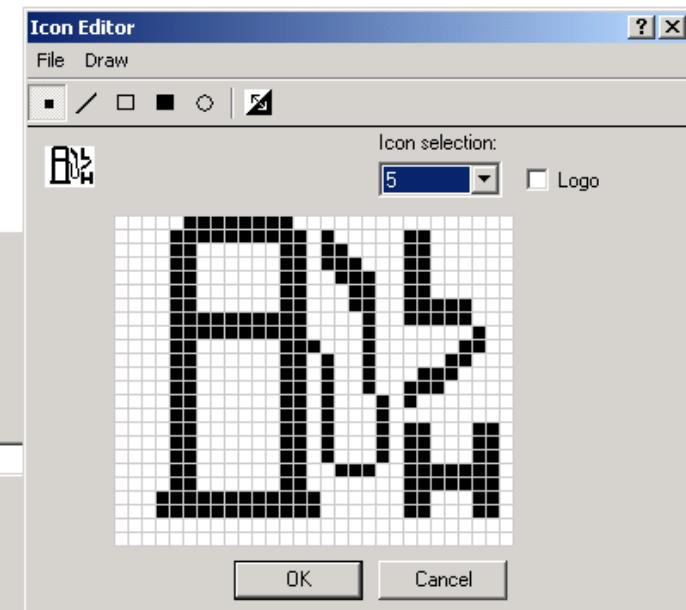
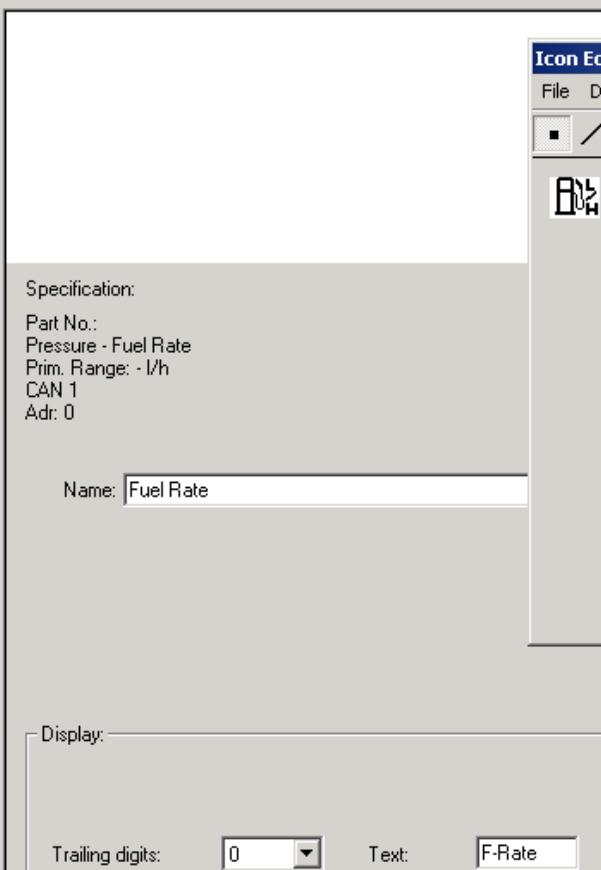
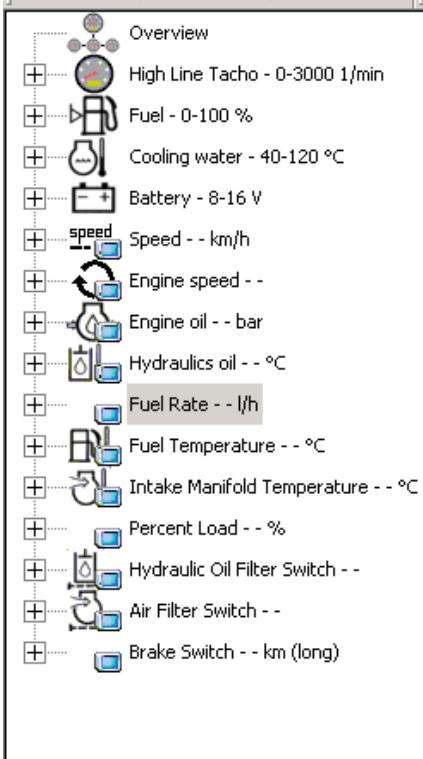
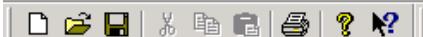
Searching for Satellites or Displays which haven't received the full configuration is made easier when pointing with the mouse pointer to the "CAN 1" sign on the upper right corner of each device in the **"Configuration-Window"**. This opens up a window with all the CAN Parameter settings. A device is not configured when essential parameters are preset by "0".

ICON Editor

The ICON Editor is accessible via the function "Edit – ICON Editor".

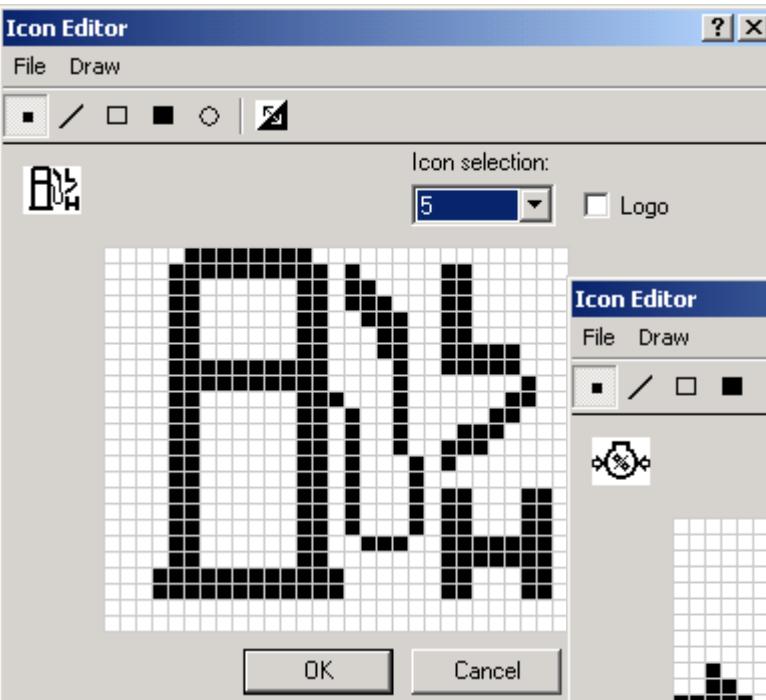
This routine is used to define nonexistent new Symbols or any kind of Logo. While the Symbols are represented in a square of 24 x 24 pixel, the Logo is defined in a rectangle of 24 x 87 pixel. Any new defined Symbol / Logo will be automatically added to the existent Symbol-list and is saved together with the project information. New defined Logos and Symbols can be saved to disc too.



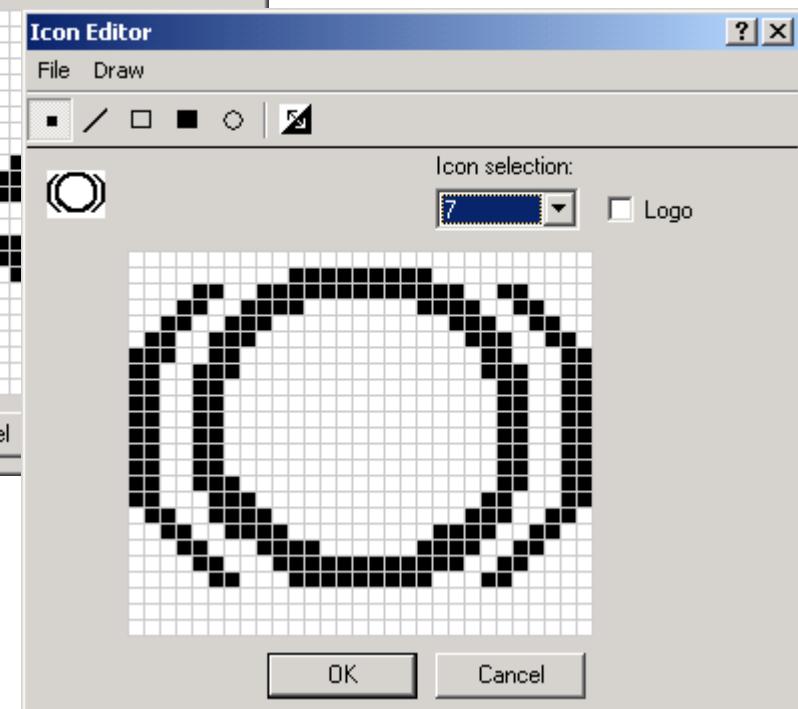
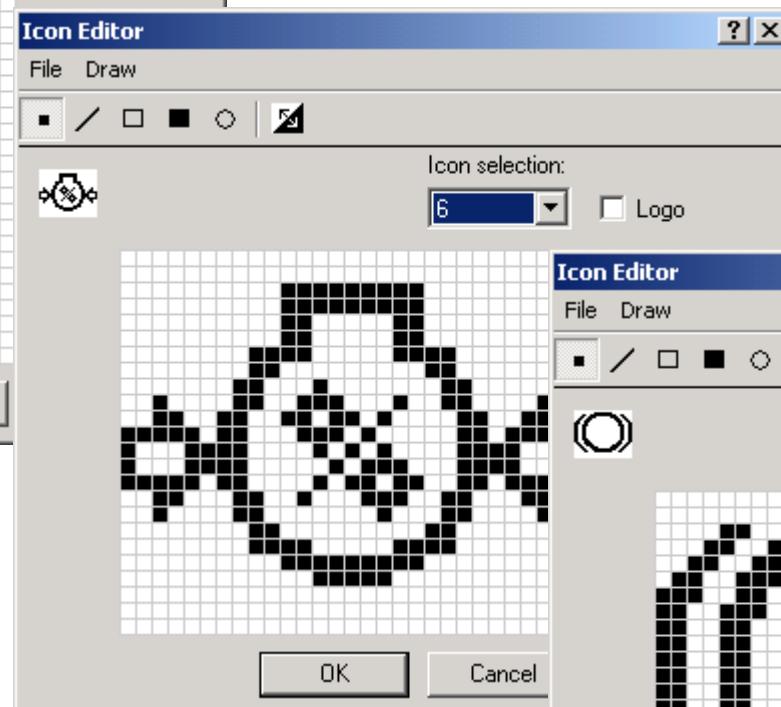


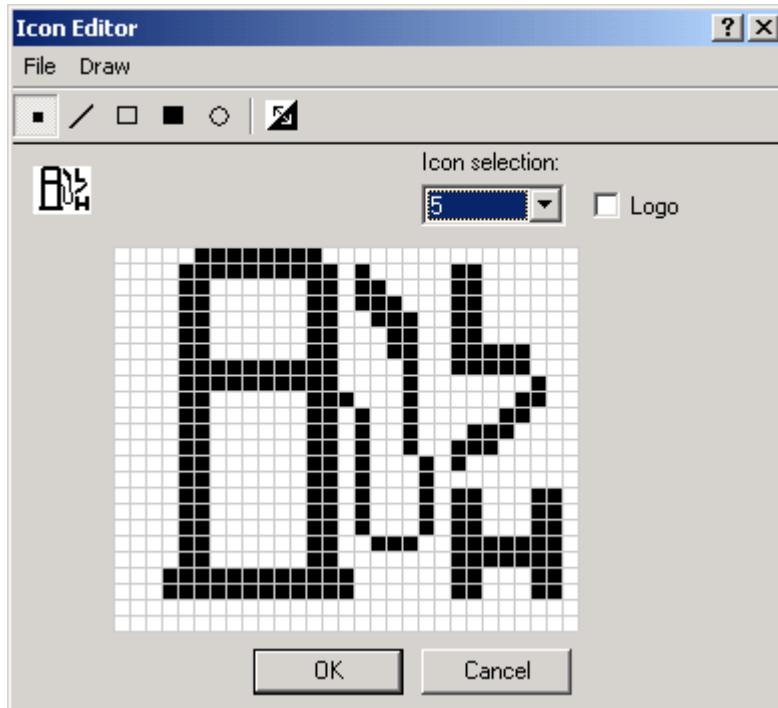
The new created logo plus all the new defined Symbols are added sequentially to the Symbol table. The **Logo** however **must be** defined as **Icon selection number 1**. It requires the equivalent space of 3 Symbols. Logo and Symbols are immediately visible after creation and confirmation with "OK" in the Symbol list and can be selected for the appropriate device.

To help design a new Symbol / Logo the ICON Editor provides small utility tools on the top part of the window. The small white square shows the designed Symbols in the later size. Icon selection is used to define the position for the Symbols in the memory of the Icon Editor as well as for later reference. The checkbox for the Logo opens up a larger, rectangular pixel window.



Examples of new defined Symbols.





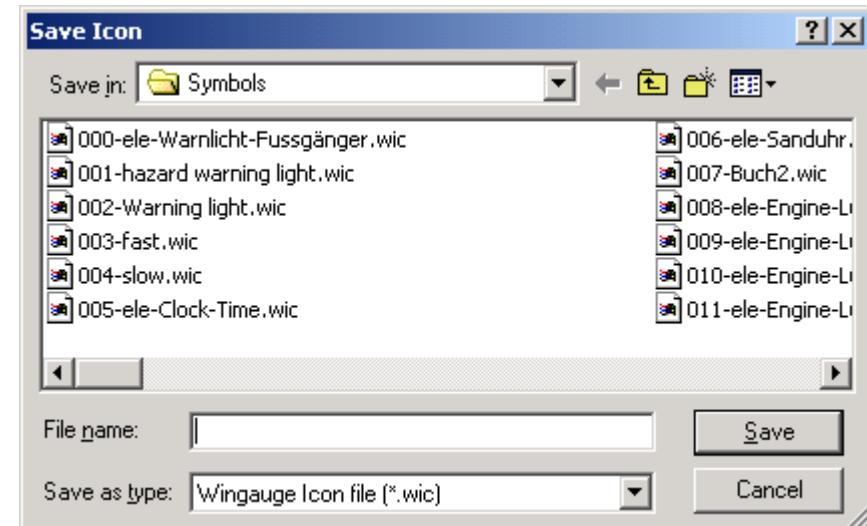
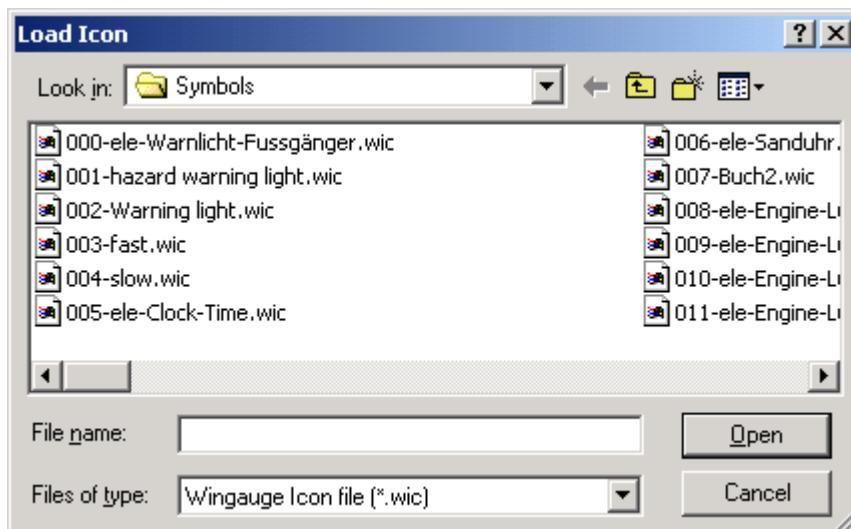
New created Symbols may be saved in a file for later use by the function:

"File – Save Icon".

In the same way the function

"File – Load Icon"

may be used to load a Symbol which has been defined at an earlier state. It is important to watch if the checkbox for Logo is checked or not. If it's checked, a Logo is expected to be loaded. This differentiation is necessary because a Logo occupies the space for 3 Symbols and requires different treatment.





- Overview
- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- Speed - km/h
- Engine speed - -
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -



Specification:

Part No.:
Pressure - Brake Switch
Prim. Range: -
CAN 1
Adr: 0

Name: Brake Switch

Display:

Trailing digits:	0	Text:	Switch
Unit:		Hysteresis:	0
Symbol:			

Now Master, Satellites and Displays are completed with the correct and required Symbols.

The assignment of the new defined Symbols works as described in the previous steps.

- 1.) Select the Device without Symbol or with Symbol to be exchanged.
- 2.) Pick the new created Symbol from the Symbol list.
- 3.) Close this step by selecting another Device of choice.



- Overview
- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed
 - In/Out characteristic
 - Warnings & alarms
- Engine speed --
- Engine oil -- bar
- Hydraulics oil -- °C
- Fuel Rate -- l/h
- Fuel Temperature -- °C
- Intake Manifold Temperature -- °C
- Percent Load -- %
- Hydraulic Oil Filter Switch --
- Air Filter Switch --
- Brake Switch --

Master:

Part No.: A2C53024779
Type: High Line - Tacho Ø 80
Prim. Range: 0-3000 1/min
CAN 1

Slave - (Adr.: 11)	Slave - (Adr.: 7)	Slave - (Adr.: 1)	speed
<p>Part No.: A2C53024552 Level - Fuel Prim. Range: 0-100 % CAN 1</p>	<p>Part No.: A2C53024529 Temperature - Cooling water Prim. Range: 40-120 °C CAN 1</p>	<p>Part No.: A2C53024533 Voltage (V) - Battery Prim. Range: 8-16 V CAN 1</p>	<p>Part No.: A2C53042287 Speedometer - Speed Prim. Range: - km/h CAN 1</p>
<p>Display</p>	<p>Display</p>	<p>Display</p>	<p>Display</p>
<p>Part No.: A2C53042286 Tachometer - Engine speed</p>	<p>Part No.: A2C53024536 Pressure - Engine oil</p>	<p>Part No.: A2C53024531 Temperature - Hydraulic oil</p>	<p>Part No.: A2C53042288 Pressure - Fuel Rate</p>

The next task to perform is:
Definition of the In/Out Characteristics

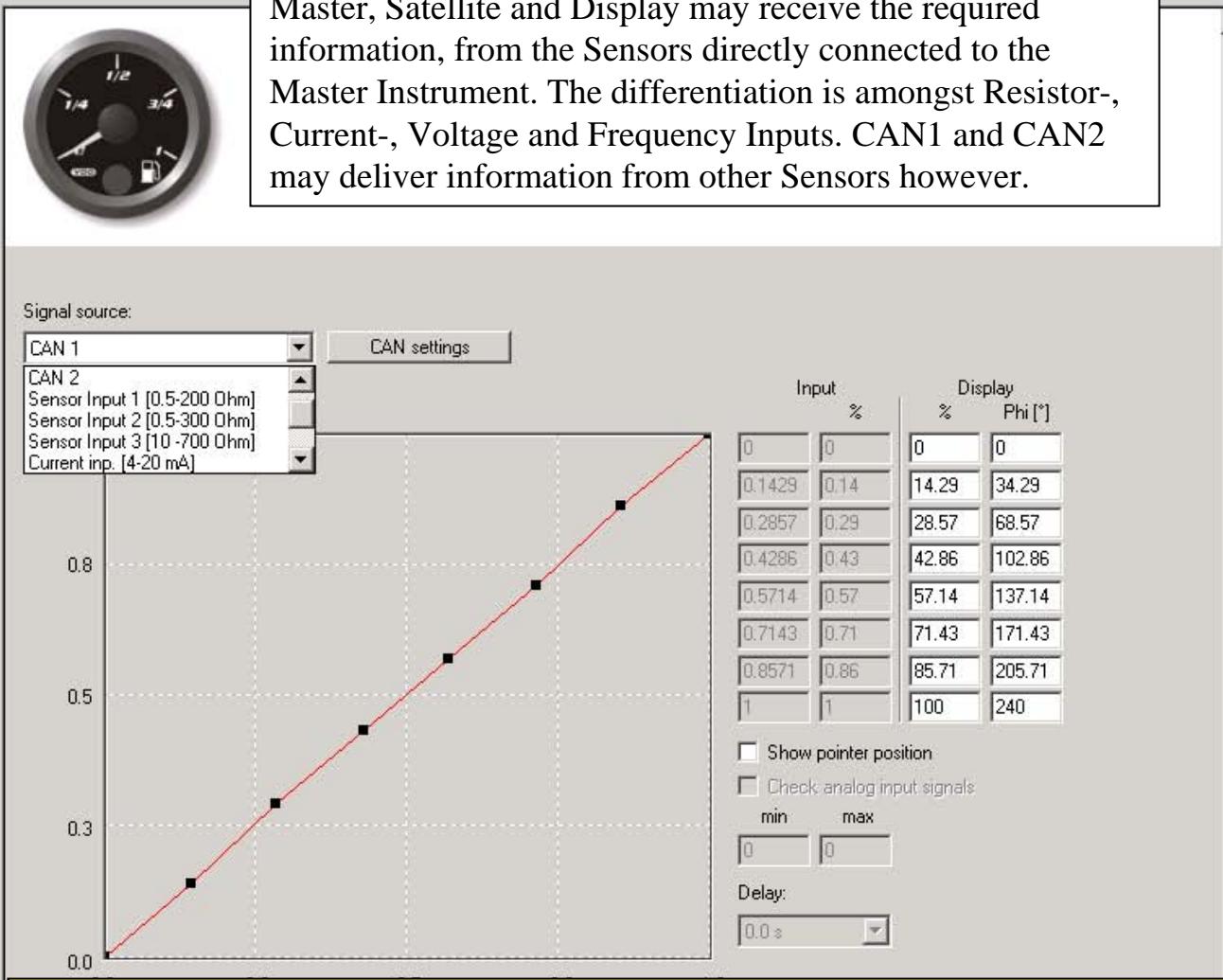
By a click to the "+" sign on the left of the Satellite in the **"Navigation-Window"** two more sub categories pop up:

- In / Out characteristics and
- Warnings & Alarms

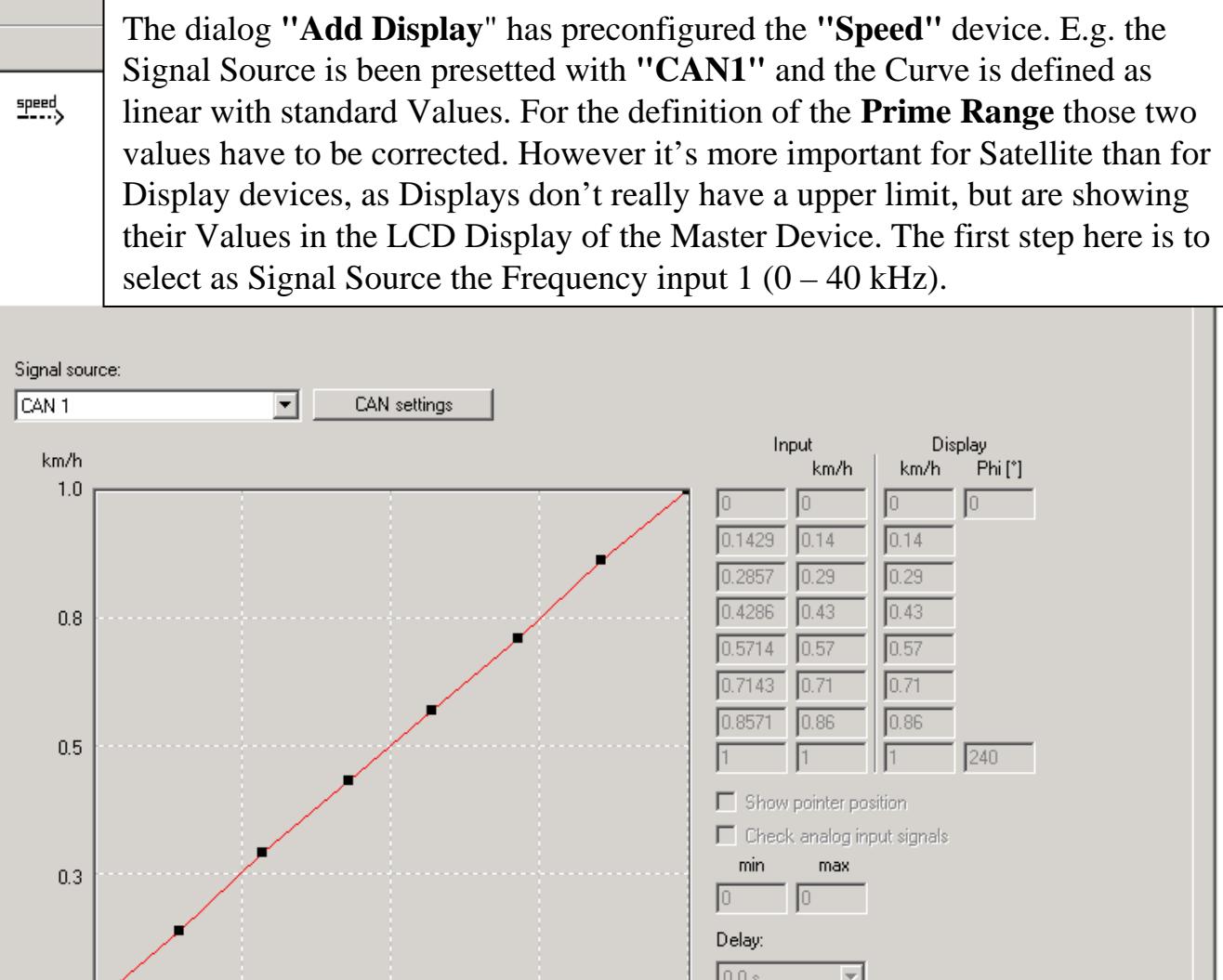
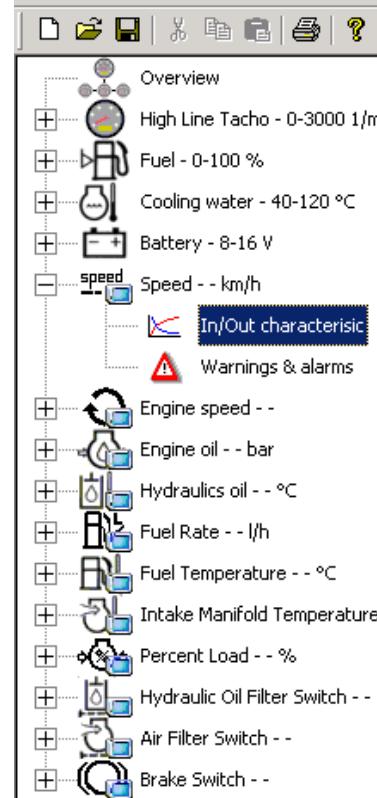
As a matter of fact, these two new categories are available for all Satellites, Master and Displays.



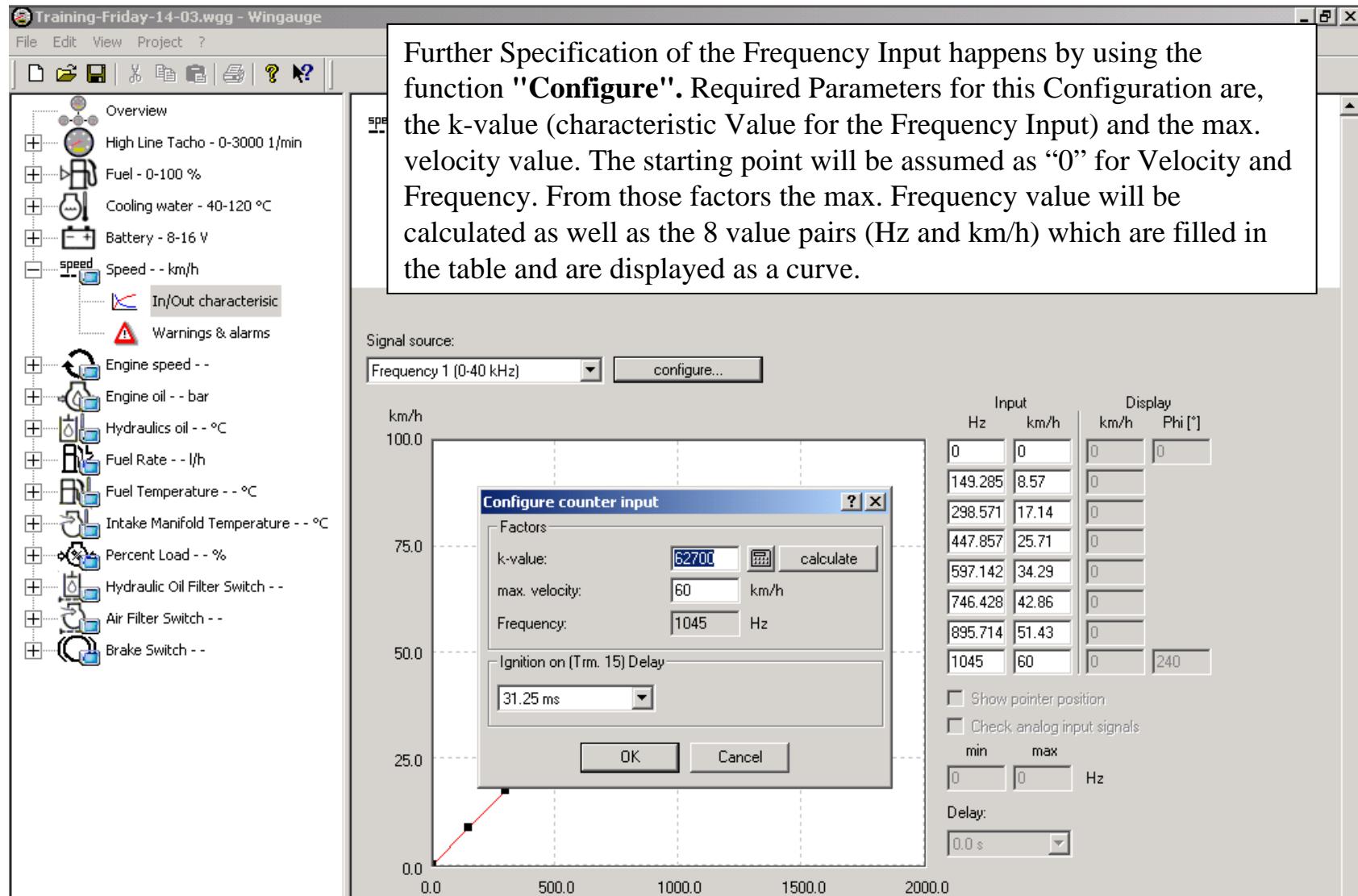
- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
 - In/Out characteristic
 - Warnings & alarms
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed Speed - - km/h
- Engine speed - -
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -



All Satellites, Master or Display being upsetted in the previous configuration process have in their configuration "CAN1" defined as the preferred Signal Source. The next steps will show how to connect the right Sensors to the correct Satellite.



Typically the required Parameters for this part of the Configuration are predefined as they depend very much on the physical Instruments like Signal Source, Switches, Sensors... which are connected in the System. Those Parameters may be taken from the Hardware Configuration. It is recommended to have these Characteristic Values of the Sensors available before the Software Configuration via WinGauge is started.



The k-value is a very sensor specific defined value. It can however be determined by the "Calculate" - function. To execute this function is only meaningful if it can be done in a vehicle.



- Overview
- High Line Tacho - 0-3000 1/min
- Fuel - 0-100 %
- Cooling water - 40-120 °C
- Battery - 8-16 V
- speed** **Speed - - km/h**
- In/Out characteristic
- Warnings & alarms
- Engine speed - -
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -

speed
---->

Specification:

Part No.: A2C53042287
Speedometer - Speed
Prim. Range: 0-60 km/h
Frequency 1 (0-40 kHz)
Adr: 0

Name: Speed

Display:

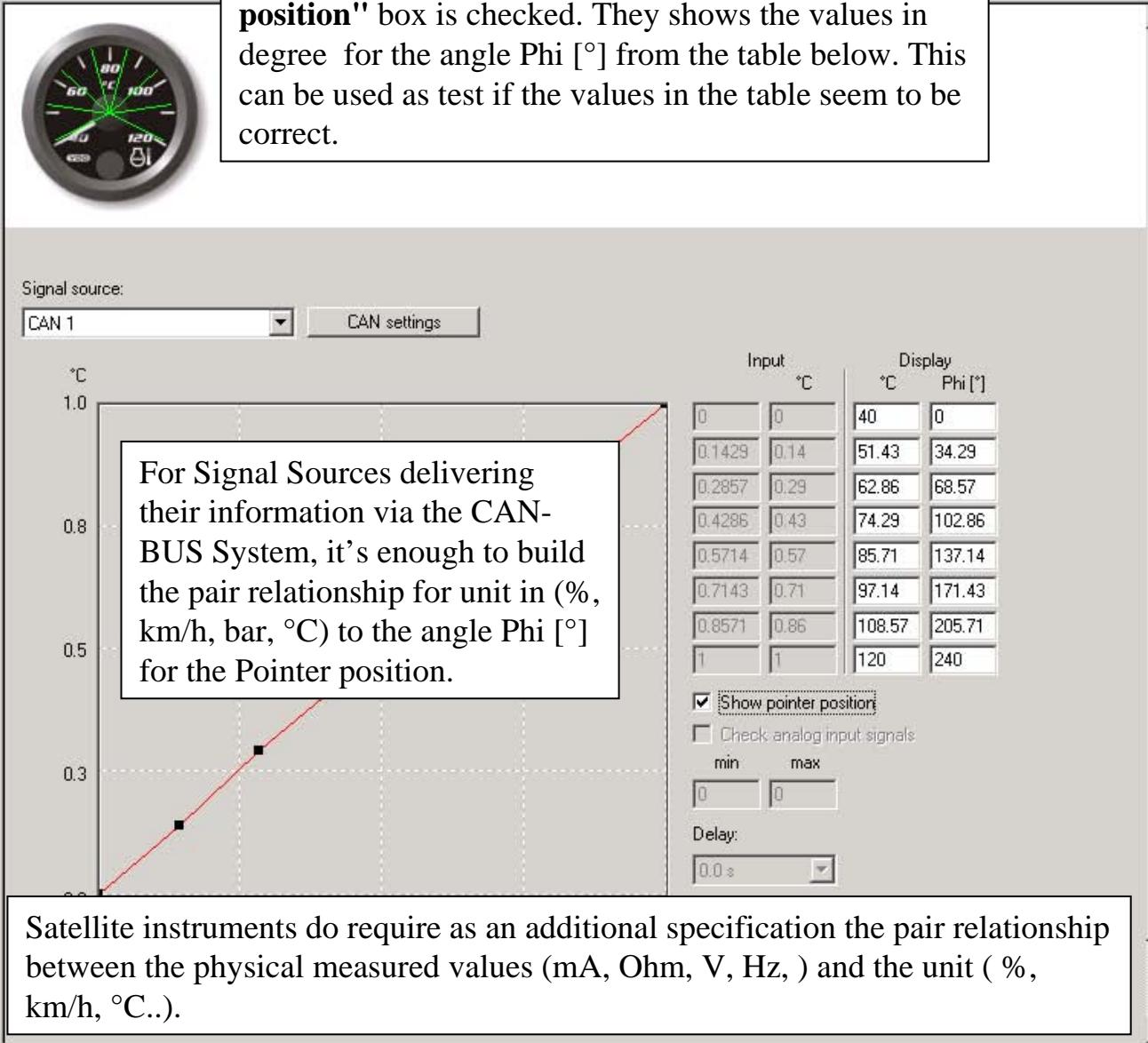
Trailing digits:	<input type="button" value="1"/>	Text:	<input type="text"/>
Unit:	<input type="button" value="km/h"/>	Hysteresis:	<input type="text"/>
Symbol:	<input type="button" value="speed
---->"/>	5	<input type="button" value="5"/>

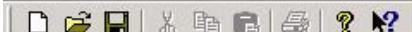
On exit of the Configuration for the "Speed – Display" the last configured values will be activated and displayed.

For the other Displays with Frequency Input the same steps have to be performed again.

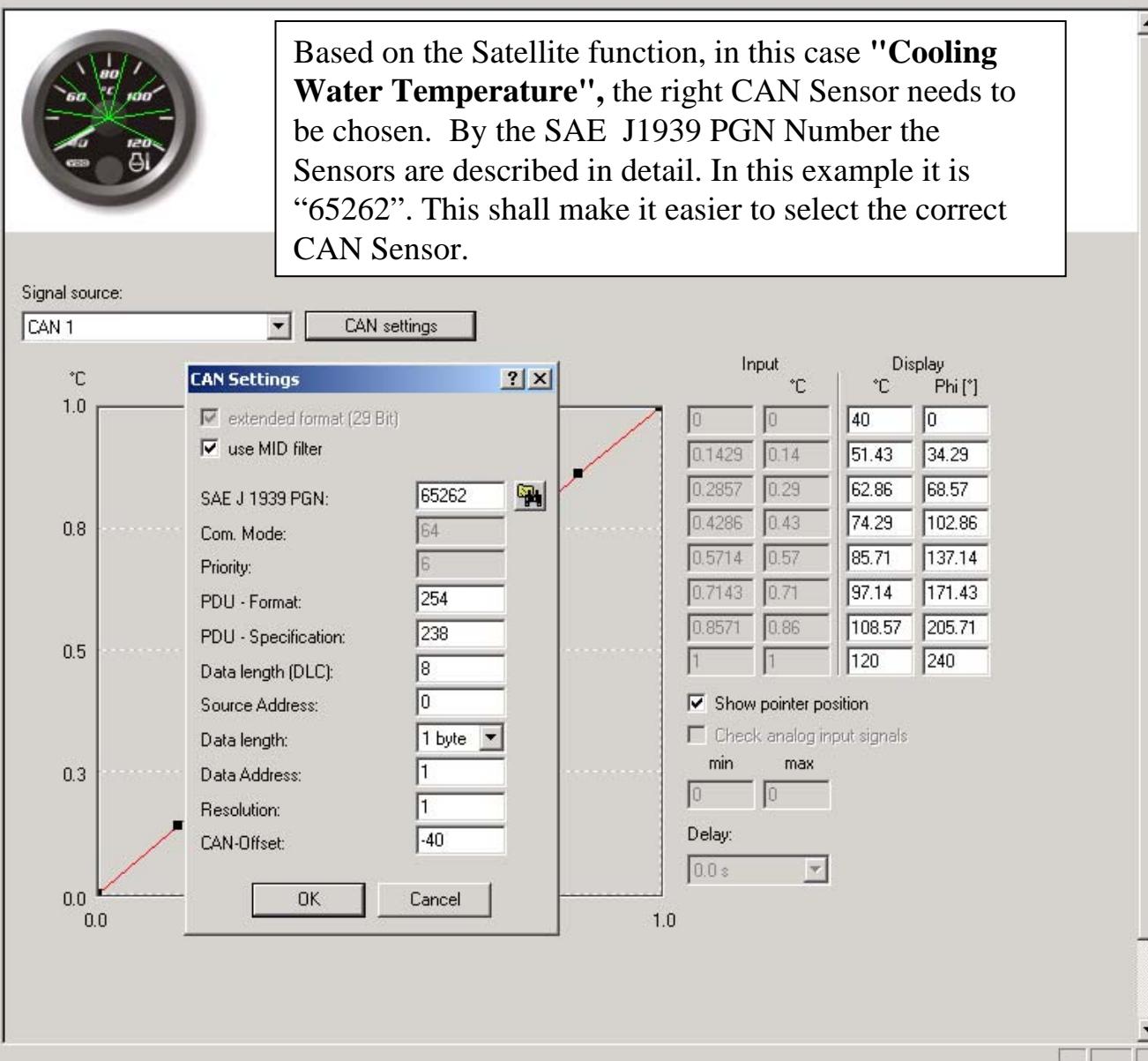


- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- speed Speed - 0-60 km/h
- Engine speed --
- Engine oil -- bar
- Hydraulics oil -- °C
- Fuel Rate -- l/h
- Fuel Temperature -- °C
- Intake Manifold Temperature -- °C
- Percent Load -- %
 - In/Out characteristic
 - Warnings & alarms
- Hydraulic Oil Filter Switch --
- Air Filter Switch --
- Brake Switch --



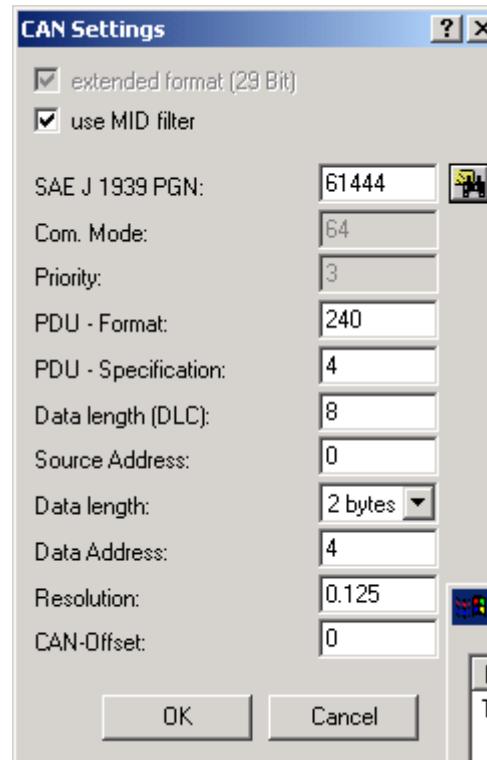


- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- speed Speed - 0-60 km/h
- Engine speed --
- Engine oil -- bar
- Hydraulics oil -- °C
- Fuel Rate -- l/h
- Fuel Temperature -- °C
- Intake Manifold Temperature -- °C
- Percent Load -- %
 - In/Out characteristic
 - Warnings & alarms
- Hydraulic Oil Filter Switch --
- Air Filter Switch --
- Brake Switch --



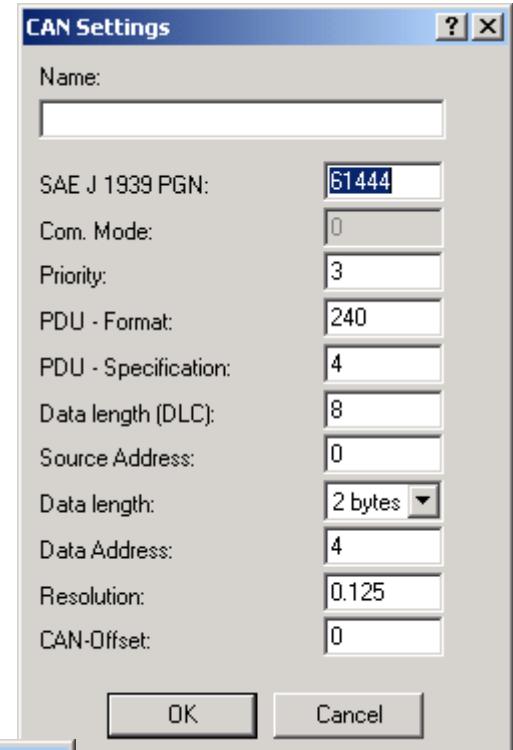
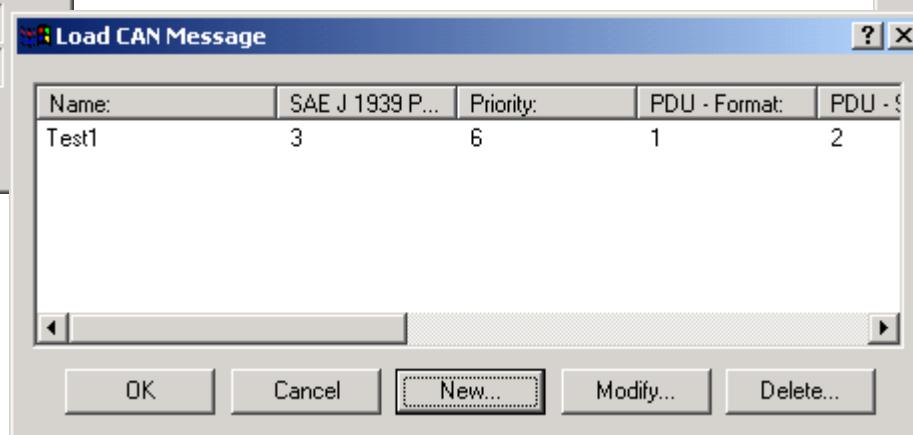
Based on the Satellite function, in this case "**Cooling Water Temperature**", the right CAN Sensor needs to be chosen. By the SAE J1939 PGN Number the Sensors are described in detail. In this example it is "65262". This shall make it easier to select the correct CAN Sensor.

CAN settings, Load CAN Message and define new CAN Sensor.



The function "CAN Settings" shows up in various dialogs. This other dialogs can be opened to get into a more detailed specification mode for the CAN Sensors. To configure those Sensors however, very detailed and specific knowledge about the Sensors, the environment where they are used as well as the specific parameters are required.

Note: Changes to the predefined Parameters shall only be made, if the adequate level of knowledge is avail.





A "Level-lever-type-sensor" with a resistor range of 3-180 Ohm has been selected for the Fuel Display. When choosing a predefined Sensor, all table values "Input" and "Display" are automatically presetted, as soon as the selection is confirmed with "OK". At the same time the adequate curve is displayed beside.

- + Overview
- + High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- + Fuel - 0-100 %
- + Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- + Battery - 8-16 V
- + speed Speed - 0-60 km/h
- + Engine speed - -
- + Engine oil - - bar
- + Hydraulics oil - - °C
- + Fuel Rate - - l/h
- + Fuel Temperature - -
- + Intake Manifold Ten
- + Percent Load - - %
 - In/Out characteristic
 - Warnings & alarms
- + Hydraulic Oil Filter S
- + Air Filter Switch - -
- + Brake Switch - -

Signal source:

Sensor Input 1 [0.5-200 Ohm]

Sensor selection...

user defined Part No.: 0-1,0-1

°C

200.0



Load sensor data

Type:

Level levertypesensor

New...

Part No.:	Group:	Name:	Range:
221-824-054-049	Level levertypesensor		0 - 100 %, 3 - 180 Ohm
221-824-054-050	Level levertypesensor		0 - 100 %, 3 - 180 Ohm
221-824-054-051	Level levertypesensor		0 - 100 %, 3 - 180 Ohm
221-824-054-052	Level levertypesensor		0 - 100 %, 3 - 180 Ohm
221-824-054-053	Level levertypesensor		0 - 100 %, 3 - 180 Ohm
221-824-054-054	Level levertypesensor		0 - 100 %, 3 - 180 Ohm
221-824-054-055	Level levertypesensor		0 - 100 %, 3 - 180 Ohm

OK

Cancel

Input Ohm	Display °C	Display Phi [']
0.5	40	40 0
29	51.43	51.43 34.29
57.5	62.86	62.86 68.57
86	74.29	74.29 102.86
114.5	85.71	85.71 137.14
143	97.14	97.14 171.43
171.5	108.57	108.57 205.71
200	120	120 240

 Show pointer position Check analog input signals

min max

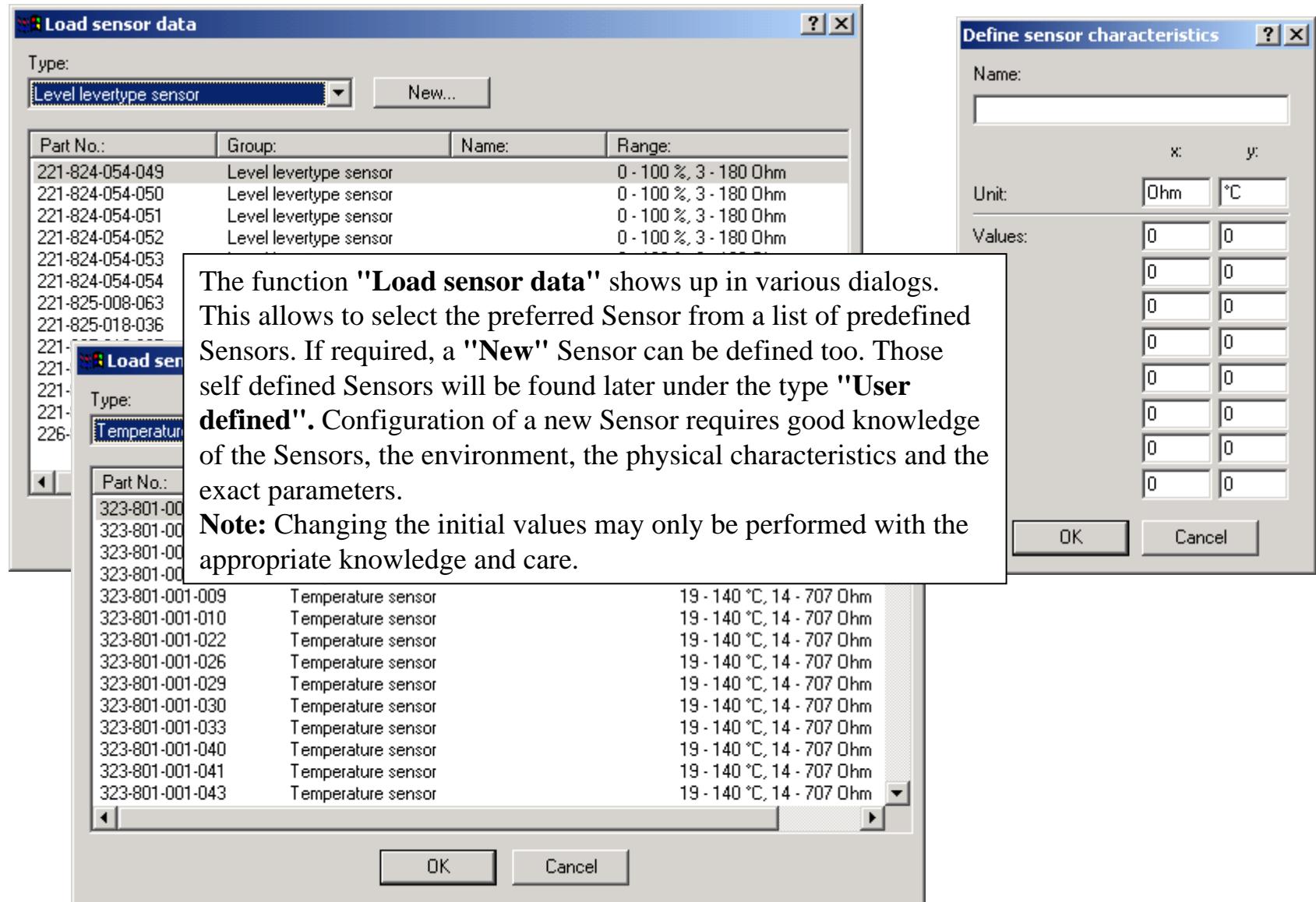
0 0 Ohm

Delay:

0.0 s

Adjustments to the table values can be made as easy as just override the presented value in the table above. Be aware of later impact of this change.

Add Sensor Data / Define Sensor Characteristics



The function "**Check analog input signals**" is activated by a click on the checkbox and verifies continuously if the Signal source operates correct. The test operates within a given min/max. range of values. A Sensor defect Signal will be triggered in case the Signal values are outside the defined min/max. range for more than a time specified in the delay field. This Sensor defect Signal is visualized in the Satellite through moving the pointer to the left down (0) position. For Displays, the Sensor Symbol is shown together with a row of "-----" in the Master Display.

The checking function should be activated for every Sensor!

The left and right side of the white field marks the min. / max. values of the range to check the analog input signals.

Equivalent to the previous steps the Configuration for the remaining Master, Satellite and Display devices has to be performed. After that the specification process for the input side of the Configuration is essentially completed.

0hm	%	%	Phi [°]
3	0	0	0
29.55	14.29	14.29	34.29
51.675	28.57	28.57	68.57
78.225	42.86	42.86	102.86
104.212	57.14	57.14	137.14
131.325	71.43	71.43	171.43
153.45	85.71	85.71	205.71
180	100	100	240

Show pointer position
 Check analog input signals
 min max
 20 180 0hm
 Delay:
 0.0 s

Overview

- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- Speed - 0-60 km/h
- Engine speed - 0-4500
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
 - In/Out characteristic
 - Warnings & alarms
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -



Warnings and alarms:

minimum engine start time:

15

s

Flash interval:

700

rpm

0.00

s

rpm threshold:

Warning:

Priority:

1

Symbol:

off

threshold:

0

1/min

Action:

Action

threshold:

0

1/min

Action:

Action

Delay:

0

s

Algorithm:

Maximum, with RPM

0

Hysteresis:

0

Alarm:

Priority:

off

Symbol:

off

threshold:

0

1/min

Action:

Action

threshold:

0

1/min

Action:

Action

Delay:

0

s

Algorithm:

Minimum, with RPM

0

Hysteresis:

0

By use of the **Algorithm** the Threshold value is defined as upper/lower limit. The value in the **Hysteresis** field specifies the difference value after which the Warning / Alarm can be vanished.

Overview:

Priority:	Source:	Warning:	Alarm:	Delay:	Algorithm:	Hysteresis:
5	Cooling water - 40-120 °C	0.0 °C -	103.0 °C - Switch...	3.0 s	Maximum, with R...	3.0 °C
6	Engine oil - - bar	0.0 bar -	1.0 bar - Show l...	3.0 s	Minimum, with R...	0.2 bar
7	Hydraulics oil - - °C	0.0 °C -	96.0 °C - Show l...	5.0 s	Maximum, with R...	3.0 °C
10	Hydraulic Oil Fil...	0.0 --	1.0 -- Switch on...	5.0 s	Maximum, with R...	0.0 -
11	Air Filter Switch - -	0.0 --	1.0 -- Switch on...	5.0 s	Maximum, with R...	0.0 -
12	Brake Switch - -	0.0 --	1.0 -- Switch on...	5.0 s	Maximum, with R...	0.0 -

This overview field is only available for the Master Instrument. Here are the Warning / Alarm conditions for all instruments listed which have such conditions set.

Overview

- High Line Tacho - 0-3000 1/mi
- + Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - Gear indication
- + CAN messages (DTC)
- + CAN Request Messages
- + Fuel - 0-100 %
- + Cooling water - 40-120 °C
- + Battery - 8-16 V
- + speed Speed - 0-60 km/h
- + Vibration Frequency - 0-75
- + Engine oil - - bar
- + Hydraulics oil - - °C
- + Fuel Rate - - l/h
- + Fuel Temperature - - °C
- + Intake Manifold Temperature -
- + Percent Load - - %
- + Air Filter Switch - -
- + Brake Switch - -



Activation of configured Satellites warning lamps check at "Ignition on". No function indicates a possible external wiring fault!

Activation of Master switch output check at "Ignition on". No function indicates a possible external wiring fault!

Warnings and alarms:

minimum engine start time:

15

s

Warn LED

Flash interval:

0.50

s

rpm threshold:

700

rpm

ext. warnlamps test

RPM reference:

CAN 1

master outputs test

Priority:	Symbol:	Warning:		Alarm:		Delay:	Algorithm:	Hysteresis:
		threshold:	Action:	threshold:	Action:			
1		0	1/min	0	1/min	3	Minimum, with RPM-	2
off		0	1/min	0	1/min	0	Minimum, with RPM-	0

Overview:

Priority:	Source:	Warning:	Alarm:	Delay:	Algorithm:	Hysteresis:
1	DTC Lampstatus...	Switch on outpu...				
2	DTC Lampstatus...	Switch on outpu...				
3	DTC Scan 1					
7	Fuel - 0-100 %	5.0 % - Switch o...	-	10.0 s	Minimum, withou...	3.0 %
5	Cooling water - 4...	-	103.0 °C - Switc...	3.0 s	Maximum, with ...	3.0 °C
8	Battery - 8-16 V	-	11.0 V - Switch ...	3.0 s	Minimum, with R...	0.5 V
8	Battery - 8-16 V	-	15.0 V - Switch ...	3.0 s	Maximum, with ...	0.5 V
6	Engine oil - - bar	-	1.0 bar - Show l...	3.0 s	Minimum, with R...	0.2 bar
7	Underdriven oil - -	Underdriven oil - -	Show l...	5.0 s	Maximum, with ...	2.0 °C



- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- Speed - 0-60 km/h
- Engine speed - 0-4500
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
 - In/Out characteristic
 - Warnings & alarms
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -



Warnings and alarms:

minimum engine start time:

15 s

rpm threshold:

700 rpm

Warn LED

Flash interval:

0.00 s

Warning:			Alarm:			Delay:	Algorithm:	Hysteresis:
Priority:	Symbol:	threshold:	Action:	threshold:	Action:			
1		0 1/min	Action	0 1/min	Action	0 s	Maximum, with RPM	0
off		0 1/min	Action	0 1/min	Action	0 s	Minimum, with RPM-threshold	

Selection for the **"Maximum / Minimum"** limit means that the value shall not grow larger or fall lower than the threshold. The selection for **"with / without RPM"** means that the values shall not be valid for Warning / Alarm signaling before the RPM threshold, defined for the whole configuration, is reached.

5	Cooling water - 4...	0.0 °C -	103.0 °C - Switch...	3.0 s	Maximum, with ...	3.0 °C
6	Engine oil - - bar	0.0 bar -	1.0 bar - Show l...	3.0 s	Minimum, with R...	0.2 bar
7	Hydraulics oil - - °C	0.0 °C -	96.0 °C - Show l...	5.0 s	Maximum, with ...	3.0 °C
10	Hydraulic Oil Fil...	0.0 --	1.0 -- Switch on...	5.0 s	Maximum, with ...	0.0 -
11	Air Filter Switch - -	0.0 --	1.0 -- Switch on...	5.0 s	Maximum, with ...	0.0 -
12	Brake Switch - -	0.0 --	1.0 -- Switch on...	5.0 s	Maximum, with ...	0.0 -



- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- Speed - 0-60 km/h
- Engine speed - 0-4500
- Engine oil -
- Hydraulics -
- Fuel Rate -
- Fuel Temp -
- Intake Mani -
- Percent Load
 - In/Out
 - Warnings & alarms
- Hydraulic Oil
- Air Filter Sw
- Brake Switch

Warnings and alarms:

minimum engine start time: s

rpm threshold: rpm

Warn LED

Flash interval:

Priority:	Symbol:	Warning:		Alarm:		Delay:	Algorithm:	Hysteresis:
		threshold:	Action:	threshold:	Action:			
5		0 °C	Action	103 °C	Action	3 s	Maximum, with RPM	3
			Action			0 s	Minimum, with RPM	0

Action

Switch on output 1

Switch on output 2

Switch off output 1 after confirmation

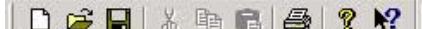
Switch off output 2 after confirmation

Switch on SAT warn lamp

Show Icon and phys. Value in display

Show Icon in display

Example: It's defined with a priority 5, that Alarm shall be initiated as soon as the Cooling Water Temperature has been reached above 103°C for longer than the delay time of 3 sec. Switching on Output1 and the Warning Lamp in the Cooling Water Satellite the Alarm is visualized. At the same time the Symbol for Cooling Water Temp. together with the actual physical value will be shown in the Master Display. Cooling down by more than 3°C to below 100°C the Warning Lamp in the Satellite together with the Output1 Signal is switched off again. The Warning message in the Master Display disappears after manual confirmation by pushing the button on the Master Instrument. These actions, to take back the Warning / Alarm are implicitly defined by setting the value for the Hysteresis.



- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- + Fuel - 0-100 %
- + Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- + Battery - 8-16 V
- + speed Speed - 0-60 km/h
- + Engine speed - 0-4500
- + Engine oil - - bar
- + Hydraulics oil - - °C
- + Fuel Rate - - l/h
- + Fuel Temperature - - °C
- + Intake Manifold Temperature - - °C
- + Percent Load - - %
 - In/Out characteristic
 - Warnings & alarms
- + Hydraulic Oil Filter Switch - -
- + Air Filter Switch - -
- + Brake Switch - -



A picture image of the selected instrument is only available for Master and Slave Devices, not for Displays.

Only a few special specifications which are only valid for the Master Instrument are left to be set before the Configuration will be completed. These specifications are: Default settings, Service Messages and CAN messages (DTC). Those three will be shown on the following pages.

Show startup logo on ignition on

To bring up a Logo in the Master Display with "Ignition on", this check box has to be activated.

Display:

show phys. value in display

Trailing digits:

0

Type:

Text:

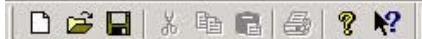
Unit:

1/min

Hysteresis:

Symbol:

50



- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- Speed - 0-60 km/h
- Engine speed - 0-4500
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
 - In/Out characteristic
 - Warnings & alarms
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -



Default settings:

Description:

Part No.: A2C53024779
 Name: High Line - Tacho
 Primary display range: 0 - 3000 1/min
 Secondary display range: -
 Diameter: Ø 80

 ODO-Meter

 Hourmeter

Actual ODO meter values:

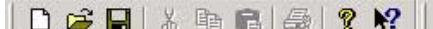
Source: CAN 1
 vel. source: Frequency 1 [0-4]
 Unit: km
 Total distance (ODO): 0 km

Actual hourmeter values:

Hour meter source: Master
 RPM source: CAN 1
 RPM threshold: 700 1/min.
 Total hours: 0

The listed Parameters in the description frame are already known from the "Add-Master dialog". This information will be enhanced with information about the selected Sensor / Signal source for the Hourmeter respective the ODO-Meter. In essence the selection process is the same as for the In/Out Characteristics. But here no curve will be shown.

It's required to define for either the ODO-Meter or Hourmeter which the Signal Sources are. Is it a CAN device or a Sensor connected directly to the Master device. Further the parameters for Unit, RPM threshold, Total Distance/Hours or Trip Distance /Hours need to be defined / selected. The selected Symbol will be the Symbol for the Master device showing the values of the respective Sensor, Hours or ODO.



- Overview
- High Line Tacho - 0-3000 1/min
 - Default settings
 - In/Out characteristic
 - Warnings & alarms
 - Service messages
 - CAN messages (DTC)
- Fuel - 0-100 %
- Cooling water - 40-120 °C
 - In/Out characteristic
 - Warnings & alarms
- Battery - 8-16 V
- speed Speed - 0-60 km/h
- Engine speed - 0-4500
- Engine oil - - bar
- Hydraulics oil - - °C
- Fuel Rate - - l/h
- Fuel Temperature - - °C
- Intake Manifold Temperature - - °C
- Percent Load - - %
 - In/Out characteristic
 - Warnings & alarms
- Hydraulic Oil Filter Switch - -
- Air Filter Switch - -
- Brake Switch - -

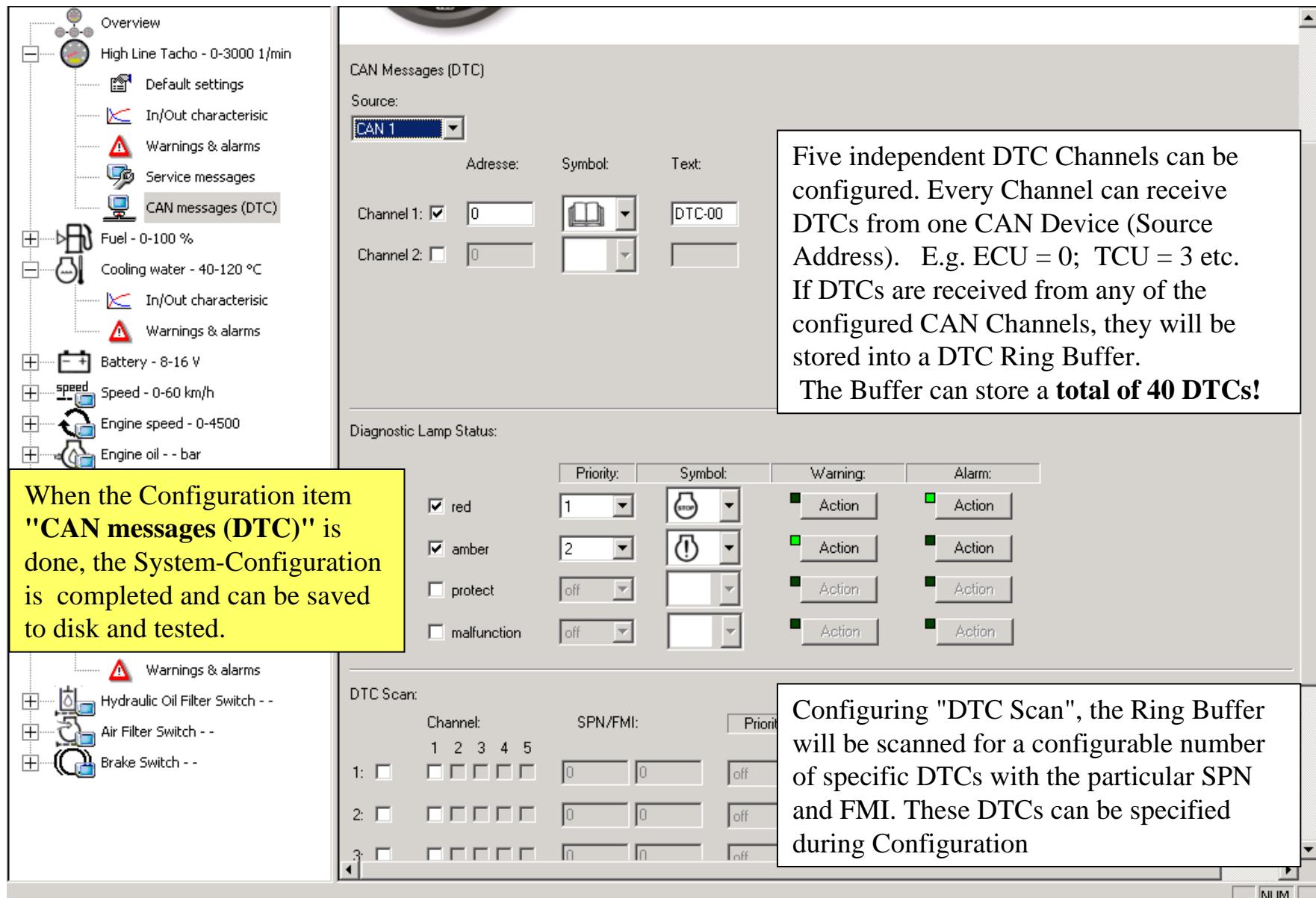


Display:

No.:	Code:	First notification after:	Interval:
1:	1	150	h
2:	5	500	h
3:	10	250	h
4:	off	0	h
5:	off	0	h
6:	off	0	h
7:	off	0	h
8:	off	0	h
9:	off	0	h
10:	off	0	h
11:	off	0	h
12:	off	0	h
13:	off	0	h
14:	off	0	h
15:	off	0	h

This dialog is used to configure the Display of Service-Message numbers after a predefined interval (h / km depending if the Master is defined as Hourmeter or ODOMeter), to allow maintenance tasks to be performed in time. Depending on the Service Codes there may be different intervals set for the first notification and the following intervals. In this example Service-Message no. 1 is shown after 150 h and then with a frequency of 150 h again. Service-Message no. 5 shall be repeated after all 500 operating hours. The meaning of the Service-Message numbers needs to be predefined by the manufacturer and should be described in the documentation joining the vehicle.

Configuration of DTC Messages



When the Configuration item "CAN messages (DTC)" is done, the System-Configuration is completed and can be saved to disk and tested.

CAN Messages (DTC)

Source: CAN 1

Adresse: Symbol: Text:

Channel 1: 0  DTC-00

Channel 2: 0  

Diagnostic Lamp Status:

Priority:	Symbol:	Warning:	Alarm:
<input checked="" type="checkbox"/> red	1 	<input checked="" type="checkbox"/> Action	<input checked="" type="checkbox"/> Action
<input checked="" type="checkbox"/> amber	2 	<input checked="" type="checkbox"/> Action	<input checked="" type="checkbox"/> Action
<input type="checkbox"/> protect	off 	<input checked="" type="checkbox"/> Action	<input checked="" type="checkbox"/> Action
<input type="checkbox"/> malfunction	off 	<input checked="" type="checkbox"/> Action	<input checked="" type="checkbox"/> Action

DTC Scan:

	Channel:	SPN/FMI:	Priority:
1:	1 2 3 4 5	0 0	off
2:	1 2 3 4 5	0 0	off
3:	1 2 3 4 5	In In	off

Five independent DTC Channels can be configured. Every Channel can receive DTCs from one CAN Device (Source Address). E.g. ECU = 0; TCU = 3 etc. If DTCs are received from any of the configured CAN Channels, they will be stored into a DTC Ring Buffer. The Buffer can store a **total of 40 DTCs!**

Configuring "DTC Scan", the Ring Buffer will be scanned for a configurable number of specific DTCs with the particular SPN and FMI. These DTCs can be specified during Configuration

The Configuration now can be **Saved** by the use of :
"File – Save as" or
"File – Save"
 In case the file has been already existing and has already a valid filename.

After Saving, the Configuration may now be transferred to the connected physical units and executed there by use of the function:
"Project - Write Master settings"

File Edit View Project ?

Master: CAN 1

Part No.: A2C53024779
 Type: High Line - Tacho Ø 80
 Prim. Range: 0-3000 1/min
 CAN 1

Slave - (Adr.: 11) CAN 1

Part No.: A2C53024552
 Level - Fuel
 Prim. Range: 0-100 %
 Sensor Input 1 [0.5-200 Ohm]

Slave - (Adr.: 7) CAN 1

Slave - (Adr.: 14) CAN 1

Display speed → 0-40 kHz F1

Part No.: A2C53042287
 Speedometer - Speed
 Prim. Range: 0-60 km/h
 Frequency 1 (0-40 kHz)

Display → 0-2kHz F2

Part No.: A2C53042286
 Tachometer - Engine speed

Display → CAN 1

Part No.: A2C53024536
 Pressure - Engine oil

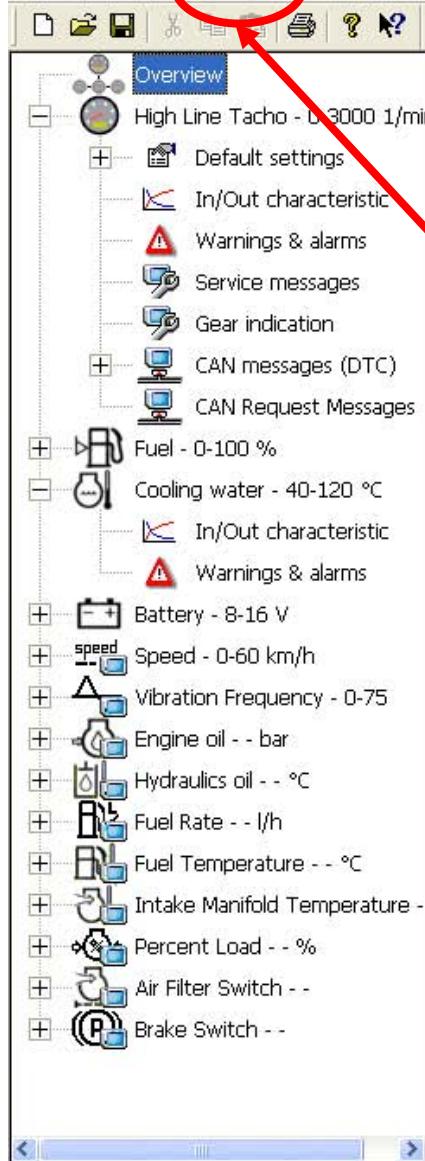
Display → CAN 1

Part No.: A2C53024531
 Temperature - Hydraulic oil

Display → CAN 1

Part No.: Pressure - Fuel Data

NUM

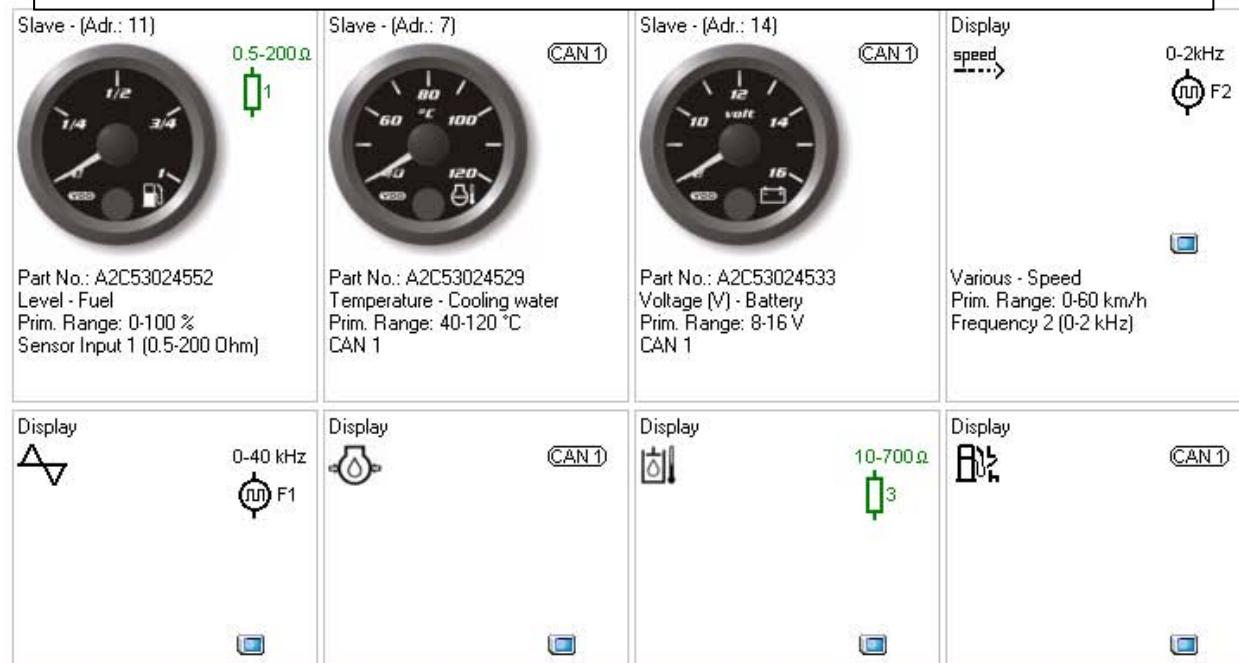


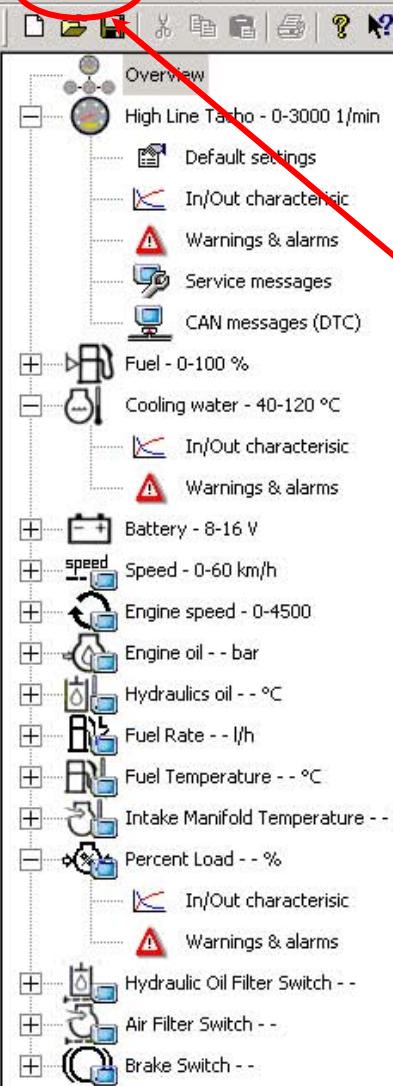
The next two functions serve the EEPROM side of the Master device. They can be used to read out the EEPROM and save it to disc, or to load a new/modified EEPROM configuration into the Master device:

"Project - Hardcopy - Read Master settings"
"Project - Hardcopy - Write Master settings"

Using **"Project - Options"** following options can be selected:

- **Language**
- **Database**
- **User Database**

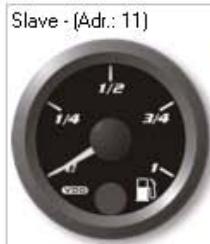




Two more Functions:
 • **Diagnostics** and
 • **Recorder**
 can be found below the function "**Edit**".
 A description is available in the following pages.



Part No.: A2C53024779
 Type: High Line - Tacho Ø 80
 Prim. Range: 0-3000 1/min
 CAN 1



Part No.: A2C53024552
 Level - Fuel
 Prim. Range: 0-100 %
 Sensor Input 1 [0.5-200 Ohm]

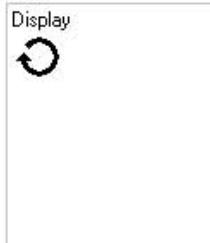


Part No.: A2C53024529
 Temperature - Cooling water
 Prim. Range: 40-120 °C
 CAN 1

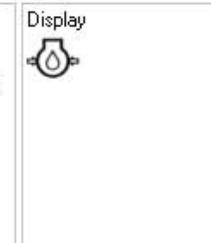


Part No.: A2C53024533
 Voltage (V) - Battery
 Prim. Range: 8-16 V
 CAN 1

0-40 kHz
 F1



Part No.: A2C53042286
 Tachometer - Engine speed



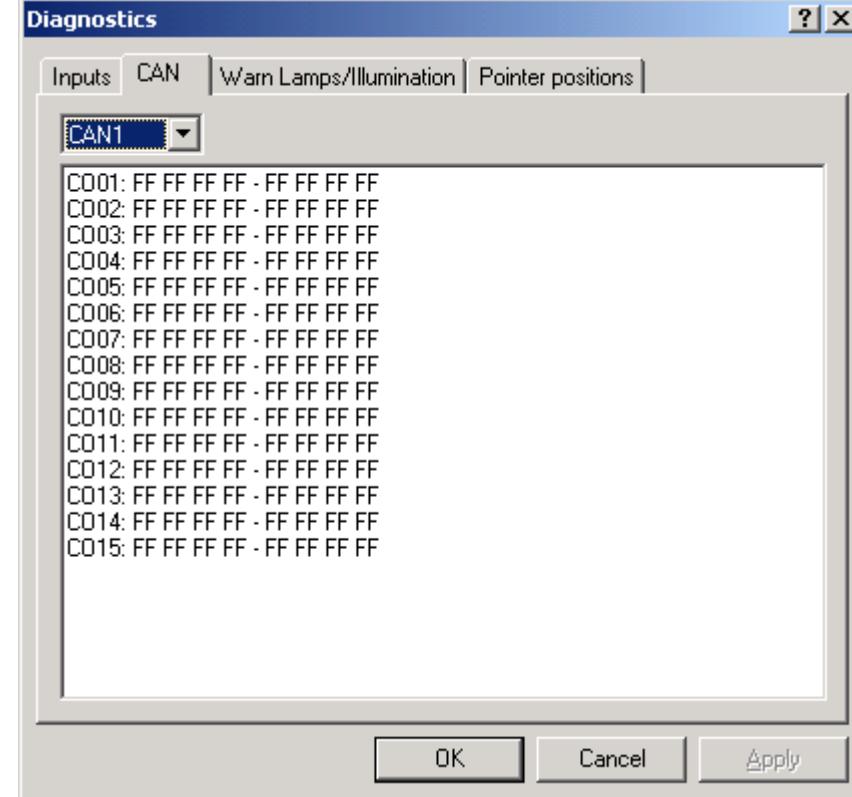
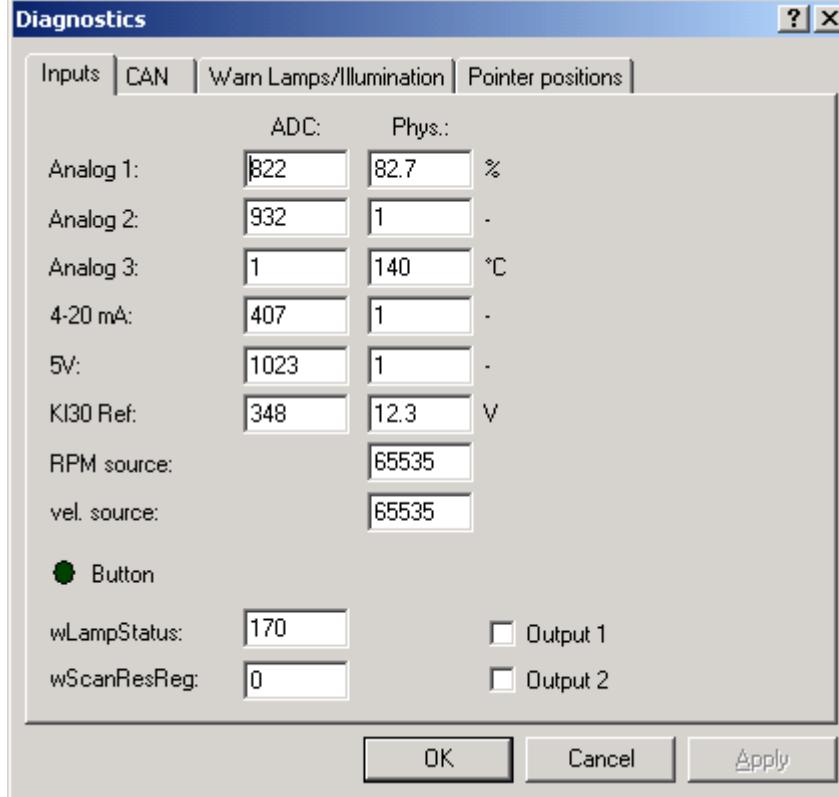
Part No.: A2C53024536
 Pressure - Engine oil



Part No.: A2C53024531
 Temperature - Hydraulic oil

CAN 1

CAN 1



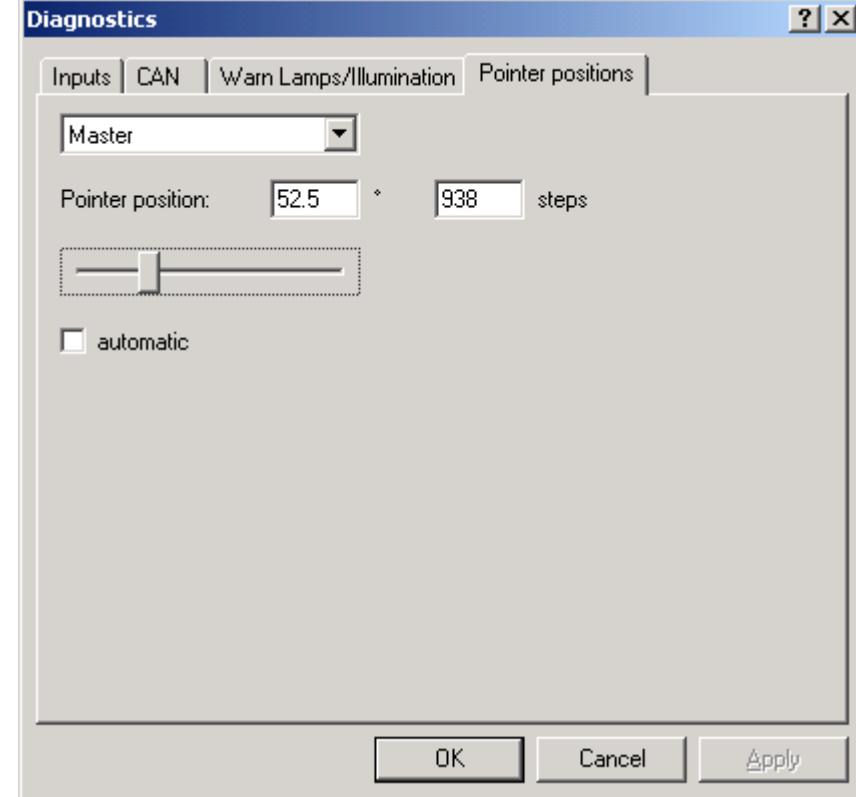
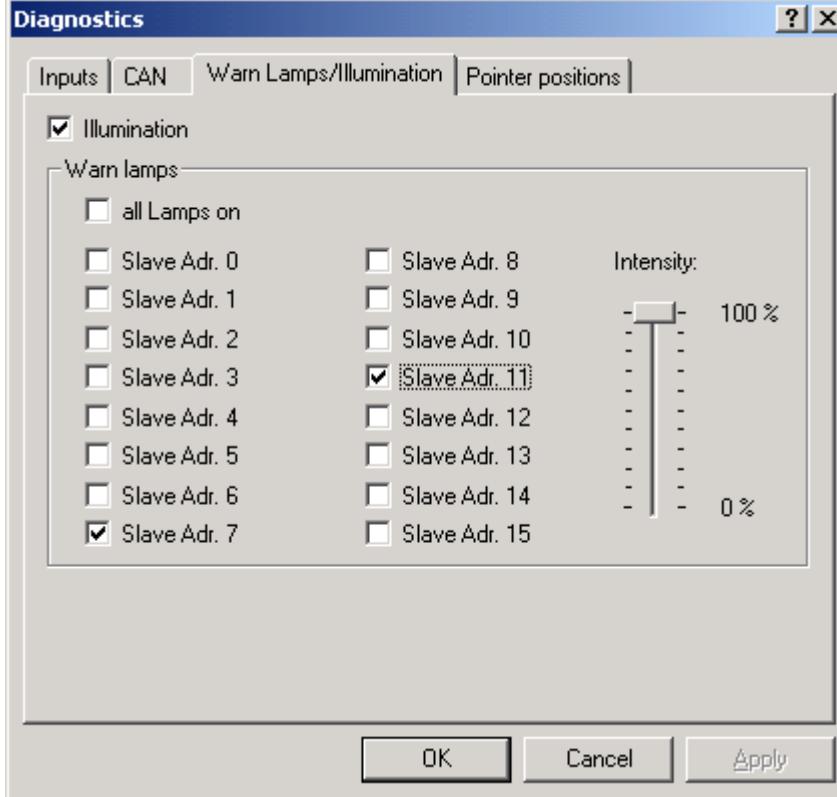
The **Diagnostics** function covers four important areas:

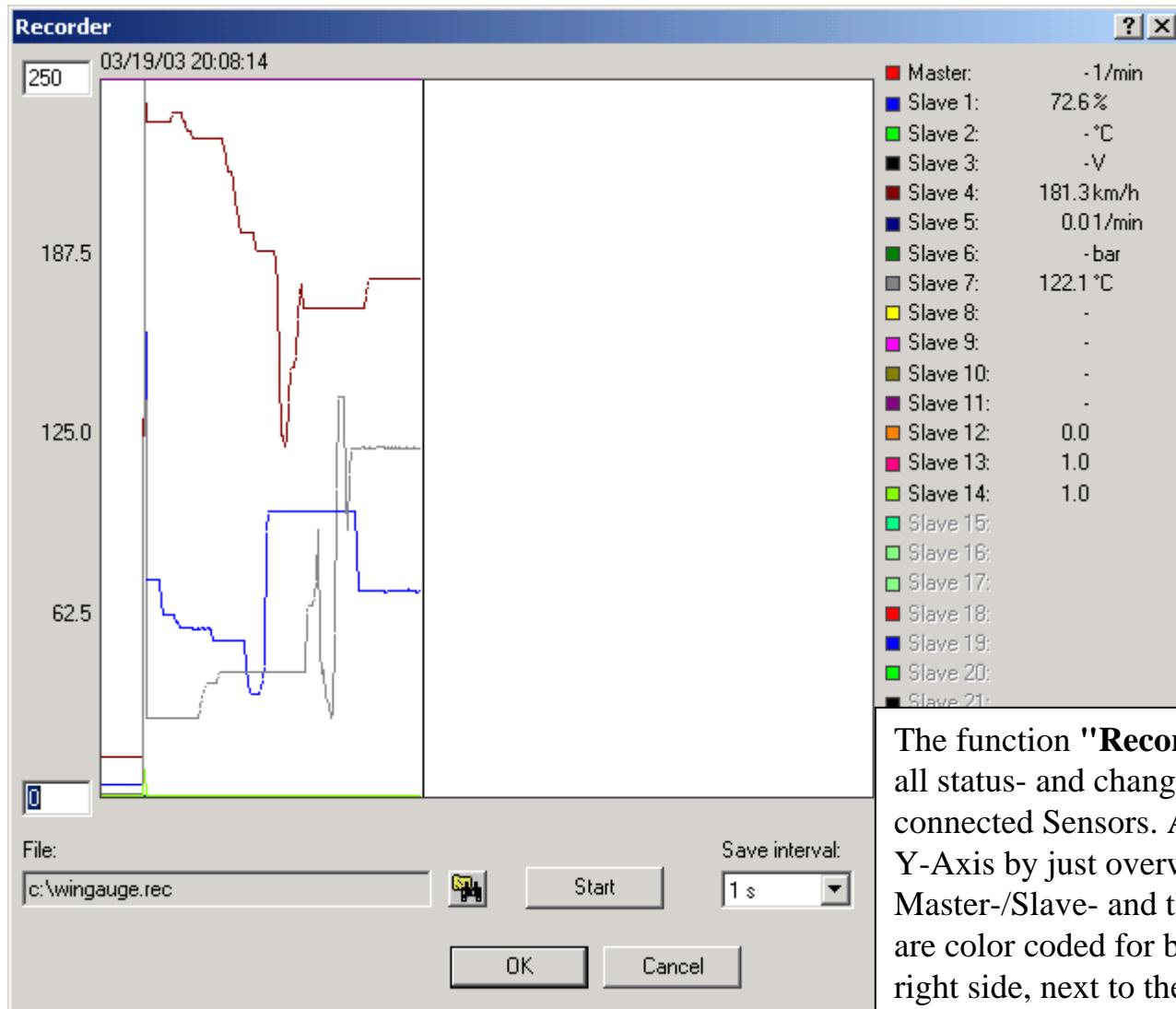
- **Inputs**
- **CAN**
- **Warn Lamps/Illumination**
- **Pointer positions**

with their support it is possible to diagnose an existing and connected configuration.

Inputs means to show all physical values generated by the connected Instruments configuration analogous to the programmed Sensor inputs on the Master device:
 Analog 1-3 (Resistor-sensors), Current-, Voltage- und Frequency-Sensors, Output 1 and 2 , Button-function... The physical unit plus an Analog-Digital-Converted value is presented.

CAN shows the data content of 15 x 8 Bytes on the CAN-BUS. Those represent the information coming from the different CAN Objects.





The function "**Recorder**" allows to log and track all status- and changing Signals of all the connected Sensors. Adjustable is the range of the Y-Axis by just overwrite the min./max. values. Master-/Slave- and the different display curves are color coded for better recognition. On the right side, next to the legend, the measured values are shown together with the units they are measured in. It's possible to save the logged Excel file permanent to disc.

Product Information

www.vdo.com

CANcockpit

CANopen-Specification for **CANcockpit**



Product Manual CANcockpit

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5.2.1 Summary of Features

NMT:	Slave
Error Control:	Heartbeat
Node ID:	Configurable in EEPROM with WINgauge
No. of PDOs:	7 x RPDOs and 3 x TPDOs
PDO modes:	Manufacturer specific time-triggered with one configurable interval for each TPDO with WINgauge.
PDO linking:	No, (PDO COB-Ids can be configured with WINgauge)
PDO mapping:	Static
No. of SDOs:	One server SDO
Emergency message:	Yes
CANopen version:	DS 301 V4.02
Framework:	No
Certified:	Yes, or documented.
Device Profile:	DS 401 V2.1

5.2.2 Expressions

COB	Communication Object
COB-ID	CAN identifier of Communication Object
Device Profile	A standardised CANopen device profile specifies the CANopen characteristics of a type of device, for example an I/O module. Some of the features are mandatory and others are optional. A standardised CANopen device profile provides a basis for the development of a CANopen device and creates a degree of exchangeability between different suppliers.
Framework	CANopen frameworks are specific extensions of the Application Layer and the standardised communication profile. Examples are the framework for programmable CANopen devices (SPS), framework for safety relevant applications.
EDS	Electronic Data Sheet describes the functionality of a CANopen device in a standardized manner.
NMT	Network Management in CANopen
Node-ID	Address of CAN node (device)
Object Directory	Directory inside the CANopen device containing all CANopen objects.
PDO	Process Data Object is a CANopen communication object handling real-time data. PDO communication and mapping parameters define it.
RPDO	Receiving PDO
SDO	Service Data Objects enable access to the CANopen object directory. An SDO consists of at least two CAN messages with different identifiers. SDOs are always confirmed point-to-point communication services.
TBD	To Be Defined -> is not yet specified
TPDO	Transmitting PDO

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5.2.3 Hardware Requirements

CANopen Baud Rates and Sample Points for CANcockpit

Standard CAN Bus Baud Rates on the CDVV controller at 10MHz crystal frequency						
Standard Baud Rate	Baudrate Prescaler	Time Quantum	Bit Time	Nominal Bit Time	Sample Point	Comment
	BPR	tQ				
[kHz]		[usec]	[tQ]	usec	[tQ]	
1000	0	0.100	10	1	8	some restrictions due to message processing
500	0	0.100	20	2	17	as above
250	1	0.200	20	4	17	SAE J1939
125	2	0.400	20	8	17	
50	9	1.000	20	20	17	
20	24	2.500	20	50	17	
10	49	5.000	20	100	17	

The 800 kHz baud rate is not possible, because the bit time is 1.25usec, whereas the time quantum at 10MHz is 0.1usec.

Galvanic isolation

There is no galvanic isolation required for CANopen. However it is recommended to apply it, if the bus length exceeds 200m.

11bit Identifiers

CANopen is based on 11bit IDs. 29bit IDs cannot be used together with 11bit IDs.

5.2.4 Firmware Requirements

CAN Interfaces

CAN I to be selectable for CANopen or J1939 (both with full functionality)

CAN II to be selectable for J1939 (full functionality) or CANopen (only additional PDO in)

Master or Slave?

In a CANopen network there is only one NMT-master, which controls all devices on the bus. The master is able to set the operational state of the connected slave devices.

CANcockpit acts as a slave on the CANopen network.

However it is desirable that CANcockpit would also have minimum CANopen NMT-Master capabilities in case there is no other CANopen Master. An example for this situation is a system with 4 Slave-Sensor-Devices connected to the CANopen interface of the CANcockpit Main-Gauge.

In a small system without NMT-master CANcockpit can be configured to move automatically from pre-operational to operational state. This allows it to send and receive PDOs without an NMT-master. The IDs for the RPDOs and TPDOs can also be configured via EEPROM settings to match the requirements of the application.

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Operational States

Initialisation

The initialisation starts after ignition (KI15) is turned on for the CANcockpit Gauge. Here the gauge application-programme and CAN hardware is initialised and then it transits to the Pre-Operational state automatically.

Boot-Up Message

The Boot-Up Message is transmitted, when CANcockpit performs the transition from "Initialising" to "Pre-Operational". The Boot-Up Message is part of the Heartbeat-Protocol and uses the same COB-ID (1792+own Node-ID). This allows one to retrieve the sending node directly from the used COB-ID.

Pre-Operational

In this state communication via CANopen SDOs is possible, but PDOs are still disabled. "Digital outputs" are switched to the defined state, which is given by object 6206h and 6207h. The state of the digital outputs can be modified via SDO and the state will be retained throughout NMT state transitions, if the corresponding "Error mode bit" is 0. "Analogue outputs" (Gauges, PVDs) will move to their "invalid data" indication. The gauge also sends emergency messages during this state.

Heartbeat

Yes, as producer. Heartbeat time is configurable via WINgauge in increments 1msec with an effective resolution of 31.25msec. If this parameter is 0, then no heartbeat message will be sent.

Lifeguarding

No.

The draft standard DS-401 V2.1 highly recommends supporting the Heartbeat functionality. To support the old lifeguarding function as well is not required, because CANcockpit is an indication system and its operation should not be critical to any process.

Operational

If the gauge is in CANopen Operational state, it communicates via PDOs. Emergency messages are sent, if necessary. SDO communication is possible. Because PDO communication is active, write access via SOD to some objects must be rejected. An example is to write to EEPROM or to change the state of the digital outputs.

Stopped

When the gauge is in this state, it does not communicate over the CANopen interface (no SDOs and no PDOs). However it is possible to activate the communication with a command from the CANopen master. "Digital outputs" are switched to the defined state, which is given by object 6206h and 6207h. "Analogue outputs" (Gauges, PVDs) will move to their "invalid data" indication.

States and Communication Objects

The table below is based on DS-301 V4.02 and shows in which states CANcockpit will support the listed objects.

	INITIALISING	PRE-OP.	OPERATIONAL	STOPPED
PDO			X	
SDO		X	X	
Sync. Object				
Time Stamp Object				
Emergency Object		X	X	
Boot-Up Object	X			
NMT Objects incl. Heartbeat		X	X	X

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Error handling

Emergency messages shall be triggered by internal errors in the device and they are assigned the highest possible priority to ensure that they get access to the bus without latency. The Emergency messages shall contain the error field with pre-defined error numbers and additional information.

Error behaviour

If a serious device failure is detected the module shall enter autonomously the Pre-operational state.

Device failures should include the following communication errors:

- Bus-off conditions of the CAN interface

Severe device errors also may be caused by device internal failures, in which case CANcockpit may perform an internal reset -for example triggered by the watchdog- and then after the initialisation move to Pre-operational state.

Emergency Messages

Supported Emergency Error Codes:

Error Code (hex)	Meaning
0000	Error Reset or No Error
1000	Generic Error
3015	KI15 off
63EE	Data Set, EEPROM checksum error

The following conditions will cause an emergency message being sent:

1. When CANcockpit is in pre-operational or operational state and the KI15 input is turned from on to off, the following emergency message will be sent once. In this case CANcockpit will still remain in its current CANopen (NMT) state for at least 5 seconds. However after this delay time it will switch off without further notice.

Byte	0	1	2	3	4	5	6	7
Value	0x15	0x30	xx	0x00	0x00	0x00	0x00	0x00
Content	Emergency Error Code	Error register	Manufacturer specific Error Field					

2. On the transition from "Reset Communication" to "Pre-Operational" an emergency message will be sent, if an EEPROM checksum was error detected.

Byte	0	1	2	3	4	5	6	7
Value	0xEE	0x63	xx	0x00	0x00	0x00	0x00	0x00
Content	Emergency Error Code	Error register	Manufacturer specific Error Field					

Simple J1939 <-> CANopen Gateway

If possible, translation from J1939 and CC analogue / frequency inputs to CANopen limited to display of D'MAC or data recorder. This function must be configurable via WINgauge.

2 messages from CANopen to J1939 configurable in increments of 1.5msec interval.

To limit the processing time required for this function variable will be transferred without further scaling or formatting.

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Minimum Capabilities

To enable devices, which do not support the complete DBT- (Distributor) and NMT (Network Management) Slave functionality, to co-operate with full capability devices, the following minimal capabilities are required:

- Module-ID,
- Object dictionary, depending on the device functionality,
- One SDO, supporting the mandatory entries (read only),
- Support of the following services as NMT Slave:
 - Reset_Node,
 - Enter_Pre-Operational_State,
 - Start_Remote_Node,
 - Stop_Remote_Node,
 - Reset_Communication

Default profile ID-allocation scheme

Minimum capability devices enter the Pre-Operational state directly after finishing the device initialisation. ID-allocation is via WINgauge. Then the nodes can be switched directly into the Operational state. By switching a device into the stopped state it is forced to stop the communication altogether (except node guarding, if active). Furthermore, this state can be used to achieve certain application behaviour. The definition of this behaviour falls into the scope of device profiles.

EEPROM Option for transition from pre-operational to operational state after KL.15 on.

It is possible to enable an option via EEPROM configuration, which lets CANcockpit move from pre-operational state to operational state automatically after KL.15 is turned on. Also, if CANcockpit performs a reset, the operational state will be entered without requiring an NMT-command. A reset for example can be caused by a low voltage condition or a watchdog trigger.

However when an NMT-command is received to move from operational to another state, CANcockpit will perform the requested transition without automatically re-entering the operational mode.

If the pre-operational state is entered, because of an error condition requiring this, then CANcockpit will remain in the pre-operational state without automatically moving to operational state again.

Static allocation of the communication object identifiers (COB-ID's)

Static distribution means that the identifiers are fixed by the module suppliers and may be changed by the system integrator through module specific means such as configuration with WINgauge.

Restore Defaults

If parameters in EEPROM can be changed via CANopen interface, then this option should be implemented.

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Device Profile

Standard "Human Machine Interface" or Custom device profile?

Based on Device Profile for Generic I/O Modules DS 401 V2.1.

Reason: The Human Machine Interface profile DSP-403 has been withdrawn by CiA. Another alternative would have been to use DSP-407 "Application profile for Passenger Information", but this Draft Proposal is marked "not recommended for implementation" and also exceeds the target functionality by far. Therefore the best solution is to apply the very popular Generic I/O Modules DS401 in its current version V2.1 and add more functionality as required for CANcockpit.

The CANcockpit instrumentation system consists of up to 17 gauges (1xmain gauge plus 0 to 16 satellite gauges). It shall be possible to set the indication of these gauges via the CANopen interface. In addition up to 25 physical value displays (PVD) can be defined, where the first PVDs show the values defined for the gauges. For the remaining PVDs the indication variable can be freely configured. The generic I/O device profile provides three RPDOs for analogue outputs, each PDO consisting of four analogue 16bit output values. Hence the number of gauges or PVDs would be limited to 12. However the CANopen standard allows to implement additional PDOs, but the IDs of these PDOs exceed the pre-defined connection set and must therefore be uniquely by the system designer.

If the CANopen interface is configured, then up to 24 PVDs can be configured to display CANopen signal values. The remaining PVDs can be used to show some other physical values, for example from the J1939 interface.

CANopen Text and Icon Display

As a special feature CANcockpit is able to display alphanumeric text received via CANopen interface together with a graphic icon. Text can be shown as 2 Lines with 8 large characters or 4 Lines with 16 small characters. In addition it is possible to select one of the graphic symbols (from ROM or EEPROM) to be shown on the left display area.

CANopen Display Format with 2x8 large characters

<i>Graphic Symbol Area</i>							

CANopen Display Format with 4x16 characters (small font)

This CANopen display uses one of the Alarm- and Warning-Functions and appears as a pop-up display as soon as it is activated, if it has the highest priority of all active Alarms. The priority of the CANopen display can be configured. Configuration also allows selecting, if the display disappears as soon as the trigger condition is not met anymore or only after it has been acknowledged.

The display is accessible through the SDO channel.

Wish is to have one Warning and one Alarm Display for CANopen. However, if this uses too much RAM, then the CANopen display should be configurable with WINgauge to be either a Warning Display or an Alarm Display.

Solution:

A 4x16 character buffer is provided, which can be written to via SDO communication. The display in 4x16 format can be configured to be an Alarm- or Warning-Display, but not both at the same time because there is only one 4x16 character buffer. However it is possible to configure an Alarm and a Warning-Display in the format 2x8 characters, so that both two different Text-Messages can be shown (one as Alarm and one as Warning).

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Pre-Defined Connection Set

In order to reduce configuration effort for simple networks a mandatory default identifier allocation scheme is defined. These identifiers are available in the PRE-OPERATIONAL state directly after initialization (if no modifications have been stored). The default profile ID-allocation scheme consists of a functional part, which determines the object priority and a Node-ID-part, which allows distinguishing between devices of the same functionality. This allows a peer-to-peer communication between a single master device and up to 127 slave devices. It also supports the broadcasting of non-confirmed NMT-objects. Broadcasting is indicated by a Node-ID of zero.

The pre-defined connection set supports one emergency object, one SDO, maximum 4 Receive-PDOs (RPDO) and 4 Transmit-PDOs (TPDO) and the NMT objects.

COB ID Structure of pre-defined Connection Set

Bit	10	9	8	7	6	5	4	3	2	1	0
	F	F	F	F	N	N	N	N	N	N	N
	Function Code										Node ID

The following table outlines the CO allocation for the CAN controller.

CO	Function	Comment	ID
1	TPDO1	64 Digital Inputs	0x0180+own Node ID
2	TPDO2	4 analogue Inputs (ADC_wANI1Phy, ADC_wANI2Phy, ADC_wANI3Phy, ADC_w20mAPhy)	0x0280+own Node ID
3	TPDO3	4 analogue Inputs (ADC_w5VPhy, ADC_wKI58, VN_wRevolution, VN_wVelocity)	0x0380+own Node ID
4	Emergency	Emergency Message and reserved for TNMT2025	0x0080+own Node ID
5	Heartbeat	Heartbeat, also used for boot-up message.	0x0700+own Node ID
6	TSDO	Send SDO responses	0x0580+own Node ID
7	RNMT0	Receive NMT commands with ID=0. This CO will be serviced via interrupt.	0x0000
8	Reserved for RNMT2026	Disabled until required.	
9	RSDO	Receive SDO messages	0x0600+own Node ID
10	RPDO1	64 Digital Outputs	0x0200+own Node ID
11	RPDO2	4 analogue Outputs (Main Gauge + 3Sat Gauges)	0x0300+own Node ID
12	RPDO3	4 analogue Outputs (4 Sat Gauges)	0x0400+own Node ID
13	RPDO4	4 analogue Outputs (4 Sat Gauges)	0x0500+own Node ID
14	RPDO5	4 analogue Outputs (4 Sat Gauges). This PDO is not part of the pre-defined connection set. The system designer must allocate a unique ID with WINgauge.	Configurable with WINgauge
15	RPDO6	4 analogue Outputs (4 Sat Gauges). This PDO is not part of the pre-defined connection set. The system designer must allocate a unique ID with WINgauge.	Configurable with WINgauge
16	RPDO7	4 analogue Outputs (4 Sat Gauges). This PDO is not part of the pre-defined connection set. The system designer must allocate a unique ID with WINgauge.	Configurable with WINgauge

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Object Dictionary

Administrative Messages

(Layer Management, Network Management and Identifier Distribution Messages)

By means of **Administrative Messages** the setting up of layer specific parameters (Layer Management services), the initialisation, configuration and supervision of the network is performed. Services and protocols of these functions are according to the LMT (Layer Management), NMT (Network Management) and DBT (Distributor) service entities of the CAL specification.

Service Data Messages

Service Data Messages are used for read and write access to all entries of the object dictionary of a device. The main usage of this facility is device configuration.

CANcockpit must support multiplexed domain access protocol and expedited transfer (<5bytes) has to be supported for SDOs.

The block transfer protocol is for the transfer of larger amounts of data, which is not required for CANcockpit, because configuration and flash programming is done via K-Line.

Note: Block transfer protocol puts a high demand on resources of RAM for buffering data and also interrupt response time must be small not to lose any information.

The following services are supported:

- SDO Download, which can be split up into
 - Initiate SDO Download
 - Download SDO Segment
- SDO Upload, which can be split up into
 - Initiate SDO Upload
 - Upload SDO Segment
- Abort SDO Transfer

Process Data Messages

Process data messages perform the real-time data transfer.

Transmission:

CANcockpit supports asynchronous time-triggered PDOs. The PDOs are transmitted no matter if the values have changed or not. The event time (interval time) can be configured via WINgauge (K-Line) with a resolution of 31.25msec.

Remote request (provide mode) data transfer is also supported, in which case the update time interval value can be configured (WINgauge) with the same resolution as for asynchronous time-triggered PDOs. The CM of the CO must be set to Communication Mode: "Provide" (EEPROM parameter)

Reception:

The producer of the PDOs should normally put the information onto the CANopen network cyclical (synchronous or asynchronous). This information is then received in the corresponding CO of the CANcockpit CAN controller and processed once every 31.25msec.

However sometimes a device does not send the information cyclical. In this case it should be possible to configure CANcockpit so that the information is accessed applying remote request. This remote request will then be sent at a configurable (WINgauge) interval with a resolution of 31.25msec.

The PDO mapping is static.

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Triggering Modes

The CANopen Communication Profile distinguishes two message-triggering modes:

Event Driven

Message transmission is triggered by the occurrence of an object specific event. In case of the CANcockpit the event triggering is time-based.

Remotely requested

The transmission of asynchronous PDOs may be initiated on receipt of a remote request initiated by another device.

Pre-defined Messages

(Synchronisation-, Time Stamp-, Emergency Messages)

By means of Pre-defined Messages node synchronisation, time stamping and emergency notification is supported optionally. Of these options the CANcockpit supports the emergency message.

Entries in Object Directory

Communication Profile Area

Device type (1000h)

The object at index 1000h describes the type of device and its functionality. The 32bit unsigned value is stored in ROM (read only) and indicates the device profile, here "401=0191h" for generic I/O module supporting digital in- and outputs as well as analogue I/O.

Value: 000F 0191

Error registers (1001h)

This object is an error register for CANcockpit. This entry is mandatory for all devices. It is a part of an Emergency object.

The error register is 8bit wide and coded as follows:

Bit	M/O	Meaning	CANcockpit
0	M	generic error	Yes
1	O	Current	N/A
2	O	Voltage	N/A
3	O	Temperature	N/A
4	O	communication error (overrun, error state)	Automatic timeout function -> not required.
5	O	device profile specific	Reserved for future use (DS401)
6	O	Reserved (always 0)	0
7	O	manufacturer specific	EEPROM checksum error

If a bit is set to 1 the specified error has occurred. The only mandatory error that has to be signaled is the generic error. The generic error is signaled at any error situation.

Manufacturer Device Name Object (1008h)

Contains the manufacturer device name. It returns the visible string "CANcockpit".

OBJECT DESCRIPTION

Index	1008h
Name	Manufacturer device name
Object Code	VAR
Data Type	Visible String
Category	Optional

ENTRY DESCRIPTION

Access	const
PDO Mapping	No
Value Range	No
Default Value	No

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Manufacturer Firmware Version (100Ah)

Contains the manufacturer firmware version description. For CANcockpit this is the firmware date, because this is relevant for the configuration with WINgauge and is required to be checked before a new EEPROM configuration may be written into the EEPROM via CANopen. Only, if the firmware version matches the firmware version included in the Intel-hex file, is it allowed to write the configuration to EEPROM.

Example of the format: 31_12_2004

OBJECT DESCRIPTION

INEDX	100Ah
Name	Manufacturer firmware version
Object Code	VAR
Data Type	Visible String
Category	Optional

ENTRY DESCRIPTION

Access	const
PDO Mapping	No
Value Range	No
Default Value	No

Note: The CANopen standard refers to this object as the "Manufacturer Software Version" however to be consistent with the terminology applied for CANcockpit this entry has been named "Manufacturer Firmware Version". For CANcockpit the software is defined to be WINgauge, which is the configuration software running on a personal computer.

COB-ID Emergency Object (1014h)

Index 1014h defines the COB-ID of the Emergency Object (EMCY) as an unsigned 32bit value.

The value is read only and the COB-ID is fixed at 128+own Node ID.

OBJECT DESCRIPTION

Index	1014h
Name	COB-ID Emergency message
Object Code	VAR
Data Type	UNSIGNED32
Category	Conditional: Mandatory, if Emergency is supported.

ENTRY DESCRIPTION

Access	ro
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	80h + Node-ID

Consumer Heartbeat (1016h)

CANcockpit is a slave device on the CANopen network and therefore does not monitor the heartbeat of other devices. Hence this object is not part of the CANcockpit object directory. However RPDO messages required for the gauges and displays are continuously monitored with a configurable timeout function. If a message is not received within its configured timeout limit, then this will be communicated to the operator. Affected gauge pointers will move to the error indication position and PVD will show "-----".

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Producer Heartbeat Time (1017h)

The producer heartbeat time defines the cycle time of the heartbeat. The producer heartbeat time is 0, if it is not used. The unsigned 16bit value has to be a multiple of 1ms.

OBJECT DESCRIPTION

Index	1017h
Name	Producer Heartbeat Time
Object Code	VAR
Data Type	UNSIGNED16
Category	Conditional: Mandatory, if guarding not supported.

ENTRY DESCRIPTION

Access	rw
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	As configured in EEPROM (WINgauge)

Identity Object (1018h)

The object at index 1018h contains general information about the device. The Vendor ID (sub-index 1h) contains a unique value allocated to each manufacturer. The manufacturer-specific Product code (sub-index 2h) identifies a specific device version.

The manufacturer-specific revision number (sub-index 3h) consists of a major revision number and a minor revision number. The major revision number identifies a specific CANopen behavior and is administered by VDO. If the CANopen functionality is expanded, the major revision has to be incremented.

The minor revision number identifies different versions with the same CANopen behavior. The administration of the minor revision number is the responsibility of the party, who administers the configuration data for a given application (VDO or OEM).

Rational:

The CANcockpit system of gauges is very flexible and can be adapted to many applications and requirements. The number and kind of gauges connected will vary from application to application and therefore the mapping and interpretation of PDO data will be different from configuration to configuration. A simple mechanism is required to prevent that a CANcockpit system with an inadequate configuration is connected to the CANopen network.

Solution:

The minor revision number will be utilized to distinguish between different CANcockpit configurations. The number will only be different, if the characteristics are different, which are relevant as seen from the CANopen perspective. For example, if the configuration of the J1939 interface is changed, then this does not require a new minor revision number. However the minor revision number needs to be changed, if another slave gauge is added, which is driven from CANopen data.

This way it is possible for the CANopen master to check, if the connected CANcockpit system has the correct configuration or belongs to a list of compatible configurations.

All information here is read only, but the minor revision number (EED_stCCopen.wMiRevNo) and the low byte of the major revision number (EED_stCCopen.bMjRevNo) (only VDO) can be set with WINgauge during configuration. The high byte of the major revision number is stored in ROM and therefore fixed for a given firmware. For more detail for example the sub-indices, please refer to DS301 V4.02.

OBJECT DESCRIPTION

Index	1018h
Name	Identity Object
Object Code	RECORD
Data Type	Identity
Category	Mandatory

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ENTRY DESCRIPTION

Sub-Index	0h
Description	Number of entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value	4
Default Value	4
Sub-Index	1h
Description	Vendor ID
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	UNSIGNED32 (Actual value 0x09000053)
Default Value	No
Sub-Index	2h
Description	Product code
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	UNSIGNED32 (Actual value TBA.)
Default Value	No
Sub-Index	3h
Description	Revision number
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	UNSIGNED32 (Actual value see above)
Default Value	No
Sub-Index	4h
Description	Serial number
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	UNSIGNED32 (Actual value: Low word = Series Number High word = Production Week, Year as stored in EEPROM)
Default Value	0xFFFF0000

Receive PDO communication parameters (1400h to 1406h)

These RPDO receive asynchronously the values of maximum 32 digital outputs plus the analogue outputs (gauge indications). The transmission type is 254. The sub-index 0h contains the number of valid entries within the communication record. Its value is set to 2. All parameters are "read only".

OBJECT DESCRIPTION

Index	1400h to 1406h
Name	Receive PDO parameter
Object Code	RECORD
Data Type	PDO CommPar
Category	Mandatory for each supported PDO

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ENTRY DESCRIPTION

Sub-Index	0h
Description	Largest sub-index supported
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value	2
Default Value	2

Sub-Index	1h
Description	COB-ID used by PDO
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value	<p>UNSIGNED32</p> <p>The actual COB-ID is configurable with WINgauge for each of the 7 RPDOs. The COB-Ids of the first 4 RPDOs should be configured based on the definitions for the predefined connection set. The COB-Ids of the remaining 3 RPDOs must be chosen so that no ID conflict for a given network will result.</p> <p>COB-Ids must be 11bit-ID (standard identifiers)!</p>
Default Value	No

Sub-Index	2h
Description	Transmission type
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value	<p>UNSIGNED8</p> <p>255</p>
Default Value	No

Note:

After power-on and application reset the values of the mapped outputs are as the default values.

Receive PDO mapping parameters (1600h to 1606h)

Contains the mapping for the PDOs the device is able to receive. The sub-index 0h contains the number of valid entries within the mapping record. This number of entries is also the number of the application variables, which shall be transmitted/received with the corresponding PDO.

The sub-indices from 1h to number of entries contain the information about the mapped application variables. These entries describe the PDO contents by their index, sub-index and length (see table below for the format). All three values are hexadecimal coded and read only.

The structure of the entries from sub-index 1h is as follows:

Byte: MSB		LSB
Index (16bit)	Sub-index (8bit)	Object length in bits (8bit)

OBJECT DESCRIPTION

Index	1600h to 1606h
Name	Receive PDO mapping
Object Code	RECORD
Data Type	PDO Mapping
Category	Mandatory for each supported PDO

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ENTRY DESCRIPTION

1st RPDO: 8x8 Digital outputs:

Index	Sub-Index	Comment	Value/ hex
1600h	0	Number of mapped objects	8
	1	Write Digital Output 1 to 8	6200 01 08
	2	Write Digital Output 9 to 16	6200 02 08
	3	Write Digital Output 17 to 24	6200 03 08
	4	Write Digital Output 25 to 32	6200 04 08
	5	Write Digital Output 33 to 40	6200 05 08
	6	Write Digital Output 41 to 48	6200 06 08
	7	Write Digital Output 49 to 56	6200 07 08
	8	Write Digital Output 57 to 64	6200 08 08

2nd RPDO: 4 Analogue Outputs

Index	Sub-Index	Comment	Value/ hex
1601h	0	Number of mapped objects	4
	1	Write Analogue Output 1	6411 01 10
	2	Write Analogue Output 2	6411 02 10
	3	Write Analogue Output 3	6411 03 10
	4	Write Analogue Output 4	6411 04 10

3rd RPDO: 4 Analogue Outputs

Index	Sub-Index	Comment	Value/ hex
1602h	0	Number of mapped objects	4
	1	Write Analogue Output 5	6411 05 10
	2	Write Analogue Output 6	6411 06 10
	3	Write Analogue Output 7	6411 07 10
	4	Write Analogue Output 8	6411 08 10

4th RPDO: 4 Analogue Outputs

Index	Sub-Index	Comment	Value/ hex
1603h	0	Number of mapped objects	4
	1	Write Analogue Output 9	6411 09 10
	2	Write Analogue Output 10	6411 0A 10
	3	Write Analogue Output 11	6411 0B 10
	4	Write Analogue Output 12	6411 0C 10

5th RPDO: 4 Analogue Outputs

Index	Sub-Index	Comment	Value/ hex
1604h	0	Number of mapped objects	4
	1	Write Analogue Output 13	6411 0D 10
	2	Write Analogue Output 14	6411 0E 10
	3	Write Analogue Output 15	6411 0F 10
	4	Write Analogue Output 16	6411 10 10

6th RPDO: 4 Analogue Outputs

Index	Sub-Index	Comment	Value/ hex
1605h	0	Number of mapped objects	4
	1	Write Analogue Output 17	6411 11 10
	2	Write Analogue Output 18	6411 12 10
	3	Write Analogue Output 19	6411 13 10
	4	Write Analogue Output 20	6411 14 10

7th RPDO: 4 Analogue Outputs

Index	Sub-Index	Comment	Value/ hex
1606h	0	Number of mapped objects	4
	1	Write Analogue Output 21	6411 15 10
	2	Write Analogue Output 22	6411 16 10
	3	Write Analogue Output 23	6411 17 10
	4	Write Analogue Output 24	6411 18 10

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Transmit PDO communication parameters (1800h to 1802h)

Contains the communication parameters for the PDOs the device is able to transmit. The parameters are read only.

OBJECT DESCRIPTION

Index	1800h to 1802h
Name	Transmit PDO parameter
Object Code	RECORD
Data Type	PDO CommPar
Category	Mandatory for each supported PDO

ENTRY DESCRIPTION

Index	Sub-Index	Comment	Value
1800h	0	Largest sub-index supported	2
	1	COB-ID used by PDO	Configurable with WINgauge
	2	Transmission type	254 Manufacturer specific: Asynchron time-based with the option to configure (WINgauge) for remote request operation. Transmission interval time can be configured with WINgauge.

ENTRY DESCRIPTION

Index	Sub-Index	Comment	Value
1801h	0	Largest sub-index supported	2
	1	COB-ID used by PDO	Configurable with WINgauge
	2	Transmission type	254 Manufacturer specific: Asynchron time-based with the option to configure (WINgauge) for remote request operation. Transmission interval time can be configured with WINgauge.

ENTRY DESCRIPTION

Index	Sub-Index	Comment	Value
1802h	0	Largest sub-index supported	2
	1	COB-ID used by PDO	Configurable with WINgauge
	2	Transmission type	254 Manufacturer specific: Asynchron time-based with the option to configure (WINgauge) for remote request operation. Transmission interval time can be configured with WINgauge.

Transmit PDO mapping parameter (1A00h to 1A02h)

Contains the read only mapping for the PDOs the device is able to transmit.

1st TPDO: 8x8 Digital Inputs:

Index	Sub-Index	Comment	Value/ hex
1A00h	0	Number of mapped objects	8
	1	Read Digital Input 1 to 8	6000 01 08
	2	Read Digital Input 9 to 16	6000 02 08
	3	Read Digital Input 17 to 24	6000 03 08
	4	Read Digital Input 25 to 32	6000 04 08
	5	Read Digital Input 33 to 40	6000 05 08
	6	Read Digital Input 41 to 48	6000 06 08
	7	Read Digital Input 49 to 56	6000 07 08
	8	Read Digital Input 57 to 64	6000 08 08

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2nd TPDO: 4 Analogue Inputs

Index	Sub-Index	Comment	Value/ hex
1A01h	0	Number of mapped objects	4
	1	Read Analogue Input 1	6401 01 10
	2	Read Analogue Input 2	6401 02 10
	3	Read Analogue Input 3	6401 03 10
	4	Read Analogue Input 4	6401 04 10

3rd TPDO: 4 Analogue Inputs

Index	Sub-Index	Comment	Value/ hex
1A02h	0	Number of mapped objects	4
	1	Read Analogue Input 5	6401 05 10
	2	Read Analogue Input 6	6401 06 10
	3	Read Analogue Input 7	6401 07 10
	4	Read Analogue Input 8	6401 08 10

Manufacturer Specific Profile Area

CANopen Display

Write display mode (2000h)

This variable controls the CANopen Display.

The following description is in a format based on CiA DS301: CANopen Application Layer and Communication Profile, Version 4.02

OBJECT DESCRIPTION

Index	2000h
Name	Write display mode
Object Code	VAR
Data Type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Access	wo
PDO Mapping	No
Value Range	Coding and Value Range see below.
Default Value	0

Writing onto the LCD of the CANcockpit main gauge involves the following steps:

1. Write the desired texts via SDO as strings into the objects 2001h to 2003h. Keep in mind that the object 2003h addresses the same internal memory as the objects 2001h and 2002h, but in a different format.
2. Activate the desired display by writing the display mode object. This also selects the corresponding graphic symbols.

As with all Alarms and Warnings the display can be configured to remain until it has been acknowledged or disappear as soon as the relevant Bit-Signal (A) or (W) as described below becomes 0.

The UNSIGNED32 variable is defined as follows:

MSB			LSB
Byte3	Byte2	Byte1	Byte0
See below for coding	Reserved, set to 0.	Index to Graphic Symbol for Alarm	Index to Graphic Symbol for Warning

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MSB = Byte3

Bit	7	6	5	4	3	2	1	0
	F	R	R	R	R	R	A	W

F: Format Bit

1-> 4lines x 16character (only Alarm or Warning)
 0 -> 2lines x 8character (Alarm and/ or Warning)

R: Reserved Bit, set to 0.

A: Alarm Bit

1-> Alarm Display is activated (if configured)
 0 -> Alarm Display is not activated.

W: Warning Bit

1-> Warning Display is activated (if configured)
 0 -> Warning Display is not activated.

Note:

1. If the Format Bit (F) is 1, then only either the Alarm Bit (A) or the Warning Bit (W) may be 1. In case (F), (A) and (W) are 1, the same 4lines x 16 characters will appear as Alarm and Warning Display.
2. CANcockpit handles this variable as a structure with the name: Copen_stDispMode. The address of this 4byte structure is available in the ROM symbol table, so that a Warning or Alarm can be configured based on the value of the Warning or Alarm Bit (A or W) in byte 3 (address = & Copen_stDispMode + 3bytes).

Write Alarm display data 2Lines x 8characters (2001h)

This visible string object provides the text for the CANopen Alarm display. It has a length of 16bytes. The character set is the large font (12x16pixel) CANcockpit character set as specified in the EEPROM specification. This object should not be written to, if the 4lines x 16character format is selected.

OBJECT DESCRIPTION

Index	2001h
Name	Write Alarm display data
Object Code	VAR
Data Type	VISIBLE_STRING
Category	Optional

ENTRY DESCRIPTION

Access	wo
PDO Mapping	No
Value Range	20h to 7Fh
Default Value	" "

Write Warning display data 2Lines x 8characters (2002h)

This visible string object provides the text to be displayed on the CANopen Warning Display. It has a length of 16bytes. The character set is the large font (12x16pixel) CANcockpit character set as specified in the EEPROM specification. This object should not be written to, if the 4lines x 16character format is selected.

OBJECT DESCRIPTION

Index	2002h
Name	Write Warning display data
Object Code	VAR
Data Type	VISIBLE_STRING
Category	Optional

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ENTRY DESCRIPTION

Access	wo
PDO Mapping	No
Value Range	20h to 7Fh
Default Value	" "

Write Alarm or (but not and) Warning Display 4x16 (2003h)

This visible string object provides the text to be displayed on the CANopen Alarm or Warning Display (only one of the two). It has a length of 64bytes. The character set is the small font (6x8pixel) CANcockpit character set as specified in the EEPROM specification. This object should not be written to, if the 2lines x 8character format is selected.

OBJECT DESCRIPTION

Index	2003h
Name	Write Alarm or Warning display data
Object Code	VAR
Data Type	VISIBLE_STRING
Category	Optional

ENTRY DESCRIPTION

Access	wo
PDO Mapping	No
Value Range	20h to 7Fh
Default Value	" "

Trigger Hardware Reset (2004h)

This variable allows triggering a complete hardware reset of the CANcockpit system. The function can be activated after a new configuration has been written to EEPROM, so that it will not be necessary to disconnect power from CANcockpit to activate the new settings.

Caution: This reset does not only affect the CANopen interface of CANcockpit. When this function is activated CANcockpit enters a loop and stops serving the watchdog. This will trigger a watchdog reset after a short delay.

To prevent accidental activation of this function, it will only operate, if the special security code will be written to this object in pre-operational state. All other data will be ignored.

OBJECT DESCRIPTION

Index	2004h
Name	Trigger Hardware Reset
Object Code	VAR
Data Type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Access	wo
PDO Mapping	No
Value Range	0xCE560A1F
Default Value	No

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Read and Write an EEPROM Data Record from and to EEPROM access buffer (2005h).

This object is required to transfer data records to and from CANcockpit via the CANopen interface. The data is contained in Data Records as specified below. One record contains 16 or less data bytes and only one record is transferred at any time. This way the SDO client can access the complete EEPROM data record for record.

OBJECT DESCRIPTION

Index	2005h
Name	Read and Write EEPROM Data Record
Object Code	VAR
Data Type	OCTET_STRING
Category	Optional

ENTRY DESCRIPTION

Access	Rw
PDO Mapping	No
Value Range	0x00 to 0xFF
Default Value	N/A

EEPROM Data Record Format for CANopen interface of CANcockpit:

Description	Data	16bit-Address	Number of valid data bytes	Reserved	Checksum
Size/ bytes	16	2	1	1	1
Symbol	D[16]	LH	N	R	C

Symbol	Description
D[16]	16 data bytes are transferred in this field.
LH	Here the target address as a 16bit hexadecimal value is entered. The first byte represents the low byte of this address. The following byte is the high byte of the address. The address is a byte address, but because the EEPROM is organised in 16bit words, this address (LH) must always be an even number.
N	This byte indicates the number of valid data bytes contained from the beginning of D[16]. This byte must always be set to 16. Other values will result in an error.
R	Reserved, please set to 0.
C	Each record ends with an 8bit Checksum field, which contains the two's complement of the 8bit sum of all bytes starting from "D[0]" to and including "R". Therefore, adding this sum and the value contained in the Checksum field (8bit addition) must result in zero.

Read Data Record from EEPROM

To read EEPROM data the object 2006h has to be read first to check, if the EEPROM is not busy, then a read command including the byte address of the requested data can be written into object 2006h. Next object 2006h has to be polled until the Rdy-Bit is 1, indicating that the requested data is available in object 2005h or until the Err-Bit becomes 1, indicating an error. In case of an error no data can be read, otherwise the EEPROM Data Record in object 2005h contains the requested data and can now be read.

Note: EEPROM read/ write access should not be performed during normal system operation. A hardware reset is required to make EEPROM changes active after successfully writing to EEPROM. EEPROM block checksums have to be correct.

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Write EEPROM Data Record to EEPROM

Writing a data record to EEPROM involves the following steps:

1. Check object 2006h and if the EEPROM is not busy, write one Record as specified above into this object of CANcockpit.
2. If this transfer was successful, activate the EEPROM write procedure using the control word described under object "Read/Write access EEPROM (2006h)". Note that the address given in object 2005h must be equal to the address in object 2006h, otherwise the write operation will be rejected.
3. Read object 2006h to check for general errors until the EEPROM is not busy anymore.
4. When all data has been written, verify the EEPROM data using record read operation.

Read/ Write access EEPROM (2006h)

This object controls the access to the CANcockpit parameter memory (EEPROM).

OBJECT DESCRIPTION

Index	2006h
Name	Read and Write access EEPROM
Object Code	VAR
Data Type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Access	Rw
PDO Mapping	No
Value Range	As defined below.
Default Value	N/A

The UNSIGNED32 variable is defined as follows:

MSB		LSB
Byte3	Byte2	Byte1
See below for coding	Check Byte	High byte of address

Byte3 contains the command and status bits for the EEPROM read and write operation.

MSB = Byte3

Bit	7	6	5	4	3	2	1	0
	Rdy	Err	Bsy	0	0	0	Rd	Wr

Rdy:

This bit should always be set to 0, if the object is written to. CANcockpit will set it to 1, when the read has been finished successfully. In case of a read operation, the requested data will then be available in the EEPROM Data Record object.

Err:

This bit should always be set to 0, if the object is written to. CANcockpit will set this bit in case the requested operation produced an error. If Err will be 1, then Rdy will not become 1.

Bsy:

This bit must be checked and must be 0, before an EEPROM Data Record may be written to object 2005h and before an EEPROM read or write command may be written to object 2006h. If this bit is 1, it indicates, that the EEPROM is busy and cannot be accessed now. When an EEPROM write operation has been started, CANcockpit will set this bit to 1 and automatically clear it after the EEPROM write has finished.

Rd = 1 -> Read EEPROM contents command starting at the address (Byte1 and Byte0) into EEPROM Data Record. The Check Byte (Byte2) must be set to 0xAA, otherwise an error will be returned. If Rd=1, Wr must be 0.

Wr = 1 -> Write data in EEPROM Data Record (object 2005h) into EEPROM. The Check Byte (Byte2) must be set to 0x55, otherwise an error will be returned and no write operation will be performed. If Wr=1, Rd must be 0.

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Standardised Device Profile Area

Read 64 digital Inputs byte wise (6000h)

This object shall read groups of 8 input lines as 8-bit information. Up to eight 8-Bit inputs are addressable in CANcockpit.

The CANcockpit main gauge has no hardware digital inputs. However it is possible to select internal variables via configuration, for example the status of the 16 SAT- and 16 external warning lamps, plus the switch outputs as digital input signals to be transmitted to the CANopen bus. The selected byte variables are polarity processed (object 6002h) before they are made available in an internal result array "Copen_b6000DI1[8]".

OBJECT DESCRIPTION

Index	6000h
Name	Read Input 8 Bit
Object Code	Array
Data Type	UNSIGNED8
Category	Conditional: Device with digital inputs

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Inputs 8-Bit
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8

Sub-Index	1
Description	Read Input 1 to 8
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	2
Description	Read Input 9 to 16
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	3
Description	Read Input 17 to 24
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	4
Description	Read Input 25 to 32
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

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Sub-Index	5
Description	Read Input 33 to 40
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	6
Description	Read Input 41 to 48
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	7
Description	Read Input 49 to 56
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	8
Description	Read Input 57 to 64
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Polarity of 64 digital Inputs (6002h)

This object shall define the polarity of a group of 8 input lines. Input polarity can be inverted individually.
1 =input inverted, 0 =input not inverted

From CANopen this object is read only, but it can be configured with WINgauge to the requirements of the application.

OBJECT DESCRIPTION

Index	6002h
Name	Polarity Input 8-Bit
Object Code	Array
Data Type	UNSIGNED8
Category	Optional

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Inputs 8-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8

Sub-Index	1
Description	Polarity Input 1 to 8
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

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Sub-Index	2
Description	Polarity Input 9 to 16
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	3
Description	Polarity Input 17 to 24
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	4
Description	Polarity Input 25 to 32
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	5
Description	Polarity Input 33 to 40
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	6
Description	Polarity Input 41 to 48
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	7
Description	Polarity Input 49 to 56
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	8
Description	Polarity Input 57 to 64
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

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Write 64 digital Outputs byte wise (6200h)

Values written via SDO will overwrite PDO values and vice versa.

Digital outputs of the CANopen network are actually digital inputs for CANcockpit. The result of the polarity processing (object 6202h) and timeout control (object 6206h and object 6207h) is available in the result array "Copen_abDO[8]". Warning or Alarm conditions can be directed to the contents of these signals, hence making it possible to trigger an Alarm or Warning based on information coming in via CANopen (RPDO1).

Writing to this object via SDO will be rejected in operational state (NMT) to prevent access conflicts. Writing in preoperational state is possible and values will be retained, if the corresponding error mode bit is 0. If this bit is 1, then the output state will be according to the configured error value when no PDOs are received (including timeout condition and transitions to initialisation, stop or preoperational).

Reading this object via SDO will return the following:

Condition	Read Result
Preoperational	0xFF for all bytes
Operational no RPDO1 timeout condition	Valid bytes as received in RPDO1
Operational, but RPDO1 timeout condition	0xFF for all bytes

OBJECT DESCRIPTION

Index	6200h
Name	Write Output 8-Bit
Object Code	Array
Data Type	UNSIGNED8
Category	Conditional: Device with digital outputs

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Outputs 8-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8

Sub-Index	1
Description	Write Output 1 to 8
Access	rw
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	2
Description	Write Output 9 to 16
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	3
Description	Write Output 17 to 24
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Sub-Index	4
Description	Write Output 25 to 32
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

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Sub-Index	5
Description	Write Output 33 to 40
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No
Sub-Index	6
Description	Write Output 41 to 48
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No
Sub-Index	7
Description	Write Output 49 to 56
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No
Sub-Index	8
Description	Write Output 57 to 64
Access	rw
Entry Category	Optional
PDO Mapping	Default
Value Range	Unsigned8
Default Value	No

Change Polarity Output 8-Bit (6202h)

This object shall define the polarity of a group of 8 output lines. Output polarity can be inverted individually.
1 =output inverted 0 =output not inverted

OBJECT DESCRIPTION

Index	6202h
Name	Change Polarity Output 8-Bit
Object Code	Array
Data Type	UNSIGNED8
Category	Optional

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Outputs 8-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8
Sub-Index	1
Description	Polarity Output 1 to 8
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

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Sub-Index	2
Description	Polarity Output 9 to 16
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	3
Description	Polarity Output 17 to 24
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	4
Description	Polarity Output 25 to 32
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	5
Description	Polarity Output 33 to 40
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	6
Description	Polarity Output 41 to 48
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	7
Description	Polarity Output 49 to 56
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	8
Description	Polarity Output 57 to 64
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

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Error Mode Output 8-Bit (6206h)

This object indicates, whether an output is set to a pre-defined error value (see 6207h object) in case of a message time out.
 1 = output value shall take the pre-defined condition specified in 6207h object
 0 = output value shall be kept if an error occurs

Actual values can be configured with WINgauge (EEPROM parameters).

OBJECT DESCRIPTION

Index	6206h
Name	Error Mode Output 8-Bit
Object Code	Array
Data Type	UNSIGNED8
Category	Optional

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Outputs 8-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8

Sub-Index	1
Description	Error Mode Output 1 to 8
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Sub-Index	2
Description	Error Mode Output 9 to 16
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Sub-Index	3
Description	Error Mode Output 17 to 24
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Sub-Index	4
Description	Error Mode Output 25 to 32
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Sub-Index	5
Description	Error Mode Output 33 to 40
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

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Sub-Index	6
Description	Error Mode Output 41 to 48
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	7
Description	Error Mode Output 49 to 56
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	8
Description	Error Mode Output 57 to 64
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Error Value Output 8-Bit (6207h)

On condition that the corresponding Error Mode is active, device failures shall set the outputs to the value configured by this object.

0 = Output shall be set to '0' in case of fault, if 6206h object is enabled

1 = Output shall be set to '1' in case of fault, if 6206h object is enabled

Actual values can be configured with WINgauge (EEPROM parameters).

OBJECT DESCRIPTION

Index	6207h
Name	Error Value Output 8-Bit
Object Code	Array
Data Type	UNSIGNED8
Category	Optional

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Outputs 8-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8

Sub-Index	1
Description	Error Value Output 1 to 8
Access	Ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Sub-Index	2
Description	Error Value Output 9 to 16
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

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Sub-Index	3
Description	Error Value Output 17 to 24
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	4
Description	Error Value Output 25 to 32
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	5
Description	Error Value Output 33 to 40
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	6
Description	Error Value Output 41 to 48
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	7
Description	Error Value Output 49 to 56
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No
Sub-Index	8
Description	Error Value Output 57 to 64
Access	Ro
Entry Category	Optional
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

Read analogue Inputs word wise (6401h)

This object shall read the value of the input channel 'n'. Value is 16-Bit wide or less. The value shall be always left adjusted. The remaining bits at the right side of the LSB shall be set to zero.

Note: This object always refers to 16bit values (word). The CANcockpit firmware can also handle 8bit data to be assembled into a TPDO. This can be configured, however an SDO read access to this object will only return the same data as in the TPDO, if no 8bit values were selected.

OBJECT DESCRIPTION

Index	6401h
Name	Read Analogue Input 16-Bit
Object Code	Array
Data Type	Integer16 (or unsigned16, depending on actual configuration data)
Category	Conditional: Device with analog input

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ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Analogue Inputs 16-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	8
Default Value	8
Sub-Index	1
Description	Analogue Input 1
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	2
Description	Analogue Input 2
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	3
Description	Analogue Input 3
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	4
Description	Analogue Input 4
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	5
Description	Analogue Input 5
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	6
Description	Analogue Input 6
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	7
Description	Analogue Input 7
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

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Sub-Index	8
Description	Analogue Input 8
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

Write analogue Outputs word wise (6411h)

This object shall write an Integer16 value to the output channel 'n'. The value shall be always left adjusted.

Here the variables represent physical values (process values), before the output characteristic of the gauges or the conversion for a PVD. Access is directly to the CAN receive buffer objects. When values are entered the corresponding timeout counter is to be reset. When the timeout expires data will become invalid, which means that data has to be "refreshed" within the configured timeout period.

SDO entries will overwrite PDO values and vice versa.

Reading the object will return 0xFFFF in case of a timeout condition.

OBJECT DESCRIPTION

Index	6411h
Name	Write Analogue Output 16-Bit
Object Code	Array
Data Type	Integer16 (or unsigned16, depending on actual configuration data)
Category	Conditional: Device with analogue outut

ENTRY DESCRIPTION

Sub-Index	0
Description	Number of Analogue Outputs 16-Bit
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value	24
Default Value	24

Sub-Index	1
Description	Analogue Output 1
Access	Ro
Entry Category	Mandatory
PDO Mapping	Default
Value Range	Integer16
Default Value	No
Sub-Index	2
Description	Analogue Output 2
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

Sub-Index	3
Description	Analogue Output 3
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

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Sub-Index	4
Description	Analogue Output 4
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

Sub-Index	5
Description	Analogue Output 5
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

Sub-Index	6
Description	Analogue Output 6
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

Sub-Index	7
Description	Analogue Output 7
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

Sub-Index	8
Description	Analogue Output 8
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

to

Sub-Index	24
Description	Analogue Output 24
Access	Ro
Entry Category	Optional
PDO Mapping	Default
Value Range	Integer16
Default Value	No

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5.2.5 Appendix

Literature

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2 Embedded Networking with CAN and CANopen, Olaf Pfeiffer, Andrew Ayre and Christian Keydel, 2003 RTC Books, San Clemente CA USA, ISBN 0-929392-78-7

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[2] CiA DS401: Device Profile for Generic I/O Modules, Version 2.1 17.05.2002

[3] CiA DS201: CAN in the OSI Reference Model, February 1996

[4] CiA DS202-1: CMS Service Specification, February 1996

[5] CiA DS202-2: CMS Protocol Specification, February 1996

[6] CiA DS202-2: CMS Data Types and Encoding Rules, February 1996

[7] CiA DS203-1: NMT Service Specification, February 1996

[8] CiA DS203-2: NMT Protocol Specification, February 1996

[9] CiA DS206: Recommended Standard CAL Module Data Sheet, February 1996

[10] CiA DS207: Application Layer Naming Conventions, February 1996

[11] Intel Hexadecimal Object File Format Specification Revision A, 1/6/88

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6. System Components, Spare Parts and Accessories

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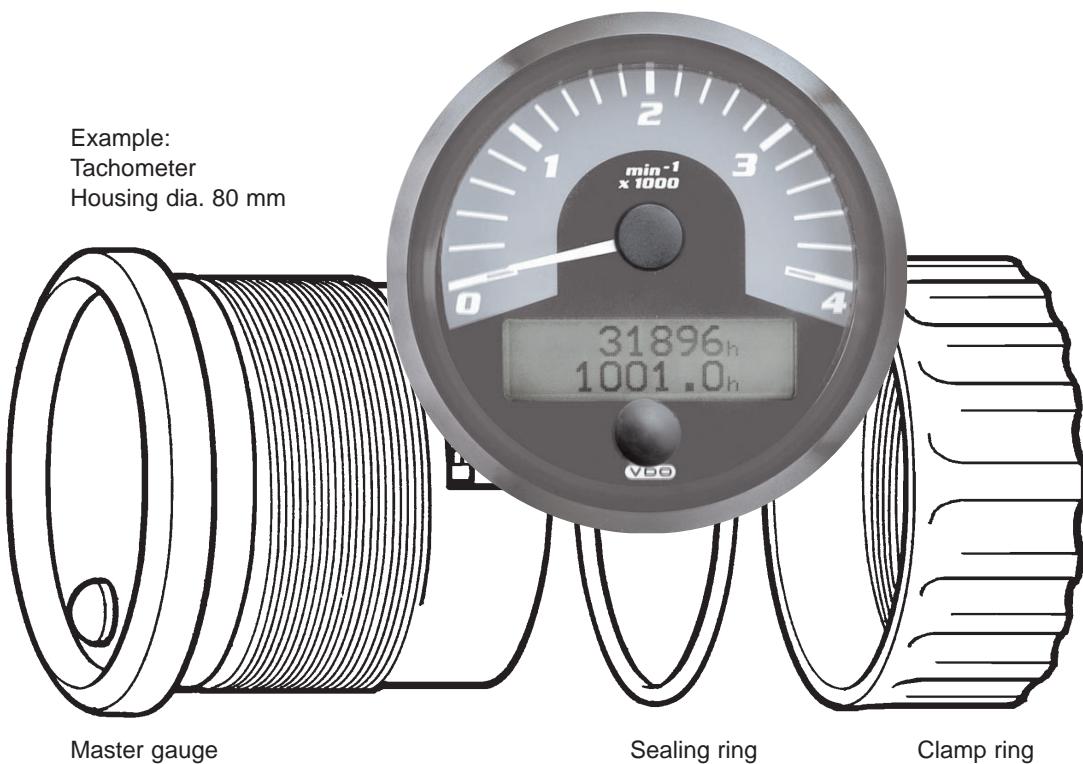
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6. System Components, Spare Parts and Accessories

6.1 System Components

6.1.1 Master Gauges



Partnumber	MOQ	Description
Master 80 mm		
A2C60000020	10	CCM 80 Tacho 0-3*1000/min S tb
A2C60000021	10	CCM 80 Tacho 0-4*1000/min S tb
A2C60000022	10	CCM 80 Speedo 0-60km/h S tb
A2C60000023	10	CCM 80 Speedo 0-120km/h S tb
A2C60000024	10	CCM 80 Speedo 0-200km/h S tb
A2C60000025	10	CCM 80 Speedo 0-80mph D tb
A2C60000026	10	CCM 80 Speedo 0-30km/h S tb
A2C60000027	10	CCM 80 Tacho 0-8*1000/min S tb
Master 85 mm		
A2C60000070	10	CCM 85 Tacho 0-3*1000rpm S tb
A2C60000071	10	CCM 85 Tacho 0-4*1000rpm S tb
A2C60000072	10	CCM 85 Speedo 0-120km/h S tb
A2C60000073	10	CCM 85 Speedo 0-80mph S tb
A2C60000074	10	CCM 85 Speedo 0-100mph S tb
A2C60000075	10	CCM 85 Speedo 0-120mph S tb
A2C60000076	10	CCM 85 Tacho 0-5*1000rpm S tb
Master 100 mm		
A2C60000126	10	CCM 100 Tacho 0-30*100/min S tb
A2C60000127	10	CCM 100 Tacho 0-40*100/min S tb
A2C60000128	10	CCM 100 Speedo 0-60km/h S tb
A2C60000129	10	CCM 100 Speedo 0-120km/h S tb
A2C60000130	10	CCM 100 Speedo 0-200km/h S tb
A2C60000131	10	CCM 100 Speedo 0-50mph D tb
A2C60000132	10	CCM 100 Speedo 0-140mph D tb
A2C60000133	10	CCM 100 Speedo 0-200km/h D tb
A2C60000134	10	CCM 100 Speedo 0-120mph D tb

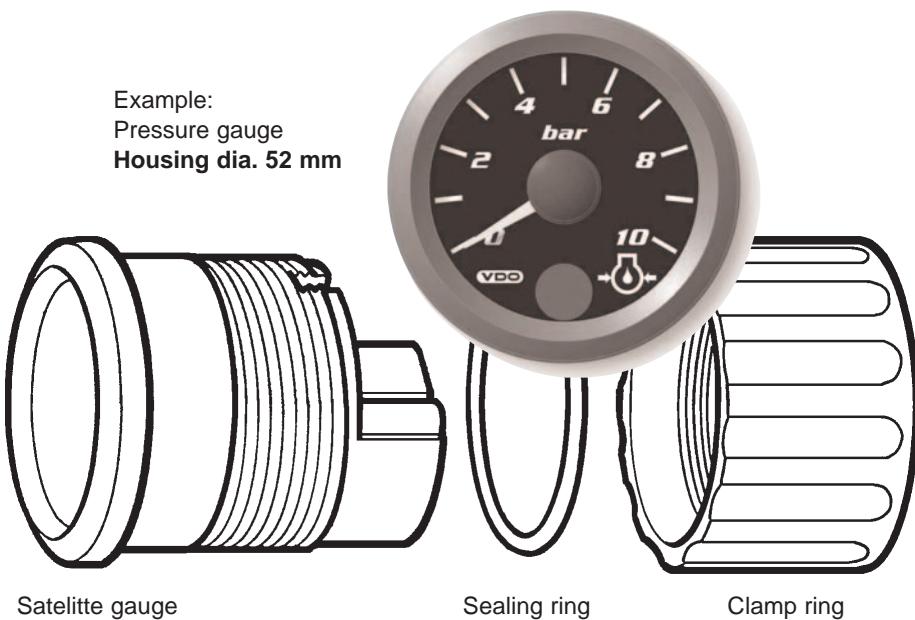
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6. System Components, Spare Parts and Accessories

6.1 System Components

6.1.2 Satelite Gauges

Example:
Pressure gauge
Housing dia. 52 mm



Partnumber	MOQ	Description
Slave 52 mm		
A2C60000251	10	CCS 52 PressOil 0-5bar S tb
A2C60000252	10	CCS 52 PressOil 0-10bar S tb
A2C60000253	10	CCS 52 PressOil 0-500kPa S tb
A2C60000254	10	CCS 52 PressOil 0-1000kPa S tb
A2C60000255	10	CCS 52 PressOil 0-80psi D tb
A2C60000256	10	CCS 52 PressOil 0-100psi D tb
A2C60000257	10	CCS 52 PressOil 0-150psi D tb
A2C60000258	10	CCS 52 PressBr 0-10bar S tb
A2C60000259	10	CCS 52 PressBr1 0-10bar S tb
A2C60000260	10	CCS 52 PressBr2 0-10bar S tb
A2C60000261	10	CCS 52 Press1 0-250bar S wo tb
A2C60000262	10	CCS 52 Press2 0-250bar S wo tb
A2C60000263	10	CCS 52 PressBr 0-150psi D tb
A2C60000264	10	CCS 52 PressBr 0-16bar S tb
A2C60000265	10	CCS 52 PressTr 0-28bar S tb
A2C60000266	10	CCS 52 PressTr 0-400psi D tb
A2C60000267	10	CCS 52 PressTu 0-2bar S tb
A2C60000268	10	CCS 52 TempOil 50-150C S tb
A2C60000269	10	CCS 52 TempTr 50-150C S tb
A2C60000270	10	CCS 52 TempTr 50-150C D tb
A2C60000271	10	CCS 52 TempTr 120-300F D tb
A2C60000272	10	CCS 52 Temp 60-200C S wo tb
A2C60000273	10	CCS 52 TempWa 40-120C S tb
A2C60000274	10	CCS 52 TempWa 40-120C D tb
A2C60000275	10	CCS 52 TempWa 100-280F D tb
A2C60000276	10	CCS 52 TempHy 20-120C S tb
A2C60000277	10	CCS 52 TempPyro 100-900C S tb

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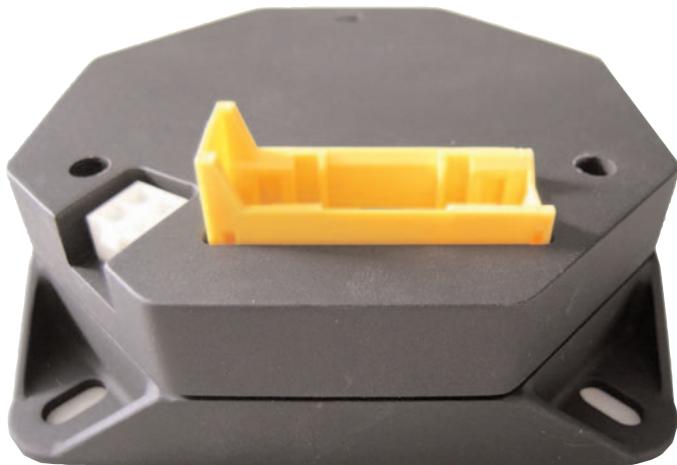
6. System Components, Spare Parts and Accessories

6.1 System Components

6.1.2 Satelite Gauges

Partnumber	MOQ	Description
Slave 52 mm		
A2C60000278	10	CCS 52 LevelFuel 0-1 S tb
A2C60000279	10	CCS 52 LevelFuel E-F S tb
A2C60000280	10	CCS 52 LevelFw 0-1 S tb
A2C60000281	10	CCS 52 LevelWw 0-1 S tb
A2C60000282	10	CCS 52 Volt 8-16V S tb
A2C60000283	10	CCS 52 Volt 10-18V S tb
A2C60000284	10	CCS 52 Volt 18-32V S tb
A2C60000285	10	CCS 52 Am -125/+125A S tb
A2C60000286	10	CCS 52 Tacho 0-3*1000/min S tb
A2C60000287	10	CCS 52 Speedo 0-60km/h S tb
A2C60000288	10	CCS 52 TempOil 120-300F D tb
A2C60000289	10	CCS 52 Volt 20-34V S tb
A2C60000354	10	CCS 52 PressOil 0-10bar S on tb
A2C60000355	10	CCS 52 TempWa 40-120C S on tb
Big Slave 85 mm		
A2C60000356	10	CCS 80 Tacho 0-3*1000/min S tb
A2C60000357	10	CCS 80 Speedo 0-60km/h S tb
A2C60000358	10	CCS 80 Speedo 0-80mph D tb
A2C60000359	10	CCS 80 Speedo 0-60km/h D tb
Big Slave 100 mm		
A2C60000360	10	CCS 100 Tacho 0-3*1000/min S tb
A2C60000361	10	CCS 100 Speedo 0-120km/h S tb

6.1.3 Master Black Box



Partnumber	MOQ	Description
Master Black Box		
A2C60500641	10	CCM Black Box

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6. System Components, Spare Parts and Accessories

6.1 System Components

6.1.4 Article description

CCS 52 PressOil 0-5bar S on tb ABCDE

1 2 3 4 5 6 7 8 9

1 Device type

CANcockpit BlackBox - CCB
CANcockpit Master - CCM
CANcockpit Slave - CCS
CANcockpit Harness - CCH

2 Diameter

52 mm - 52
80 mm - 80
85 mm - 85
100 mm - 100

5 Main scale

min. "-" max. unit

6 Dial scale

Single scale - S
Double scale - D

3 Gauge

Ammeter	- Am	Speedometer	- Speedo
Level	- Level	Tachometer	- Tacho
Pressure	- Press	Temperature	- Temp
Pyrometer	- Pyro	Voltmeter	- Volt
Rear Wheel	- RearW		

7 ISO symbol

Off-road - "none"
On-road - on
Without - wo

8 Bezel

Triangle black - tb
Triangle chrome - tc

9 Customer

optional

4 Reference

AdBlue	- AdBlue	Hydraulics	- Hy
Air	- Air	Transmission	- Tr
Brake	- Br	Turbo	- Tu
Engine Oil	- Oil	Water	- Wa
Freshwater	- Fw	Wastewater	- Ww
Fuel	- Fuel		

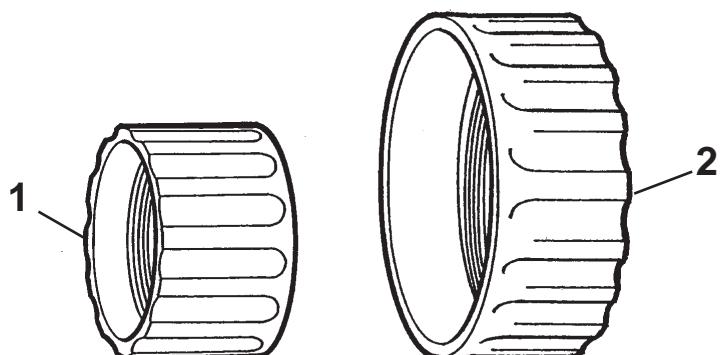
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6. System Components, Spare Parts and Accessories

6.2 Spare Parts and Accessories

6.2.1 Spare Parts

Clamp rings



for gauges dia. 52 mm / dia. 80 mm

Pos.	Designation	Items / Package	Order No.
1	Clamp ring dia. 52 mm	1	800-005-015G
2	Clamp ring dia. 80 mm	1	800-005-005G

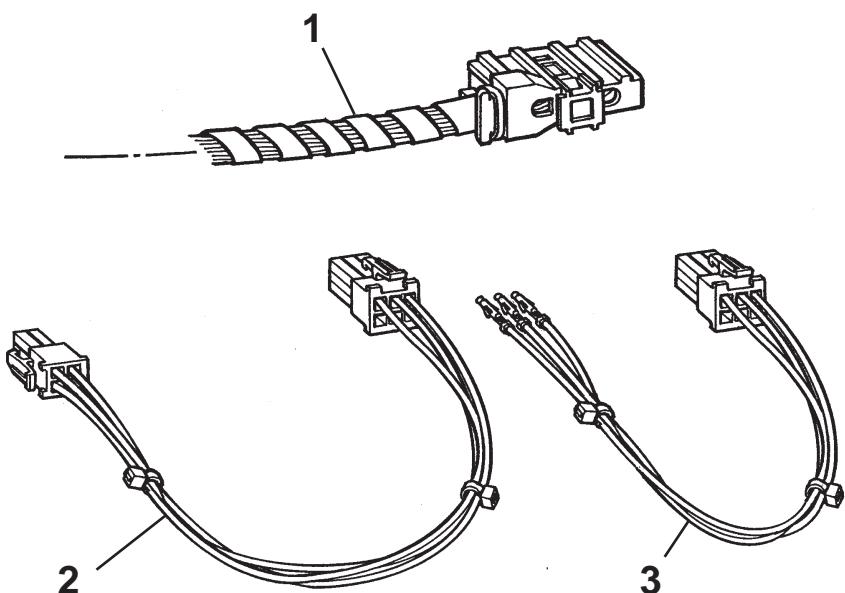
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6. System Components, Spare Parts and Accessories

6.2 Spare Parts and Accessories

6.2.2 Accessories

Wiring harnesses



Pos.	Designation	Items / Package	Order No.
1	Wiring harness master (26-pole), 3000 mm long	10	A2C53041729
2	Wiring harness master-satellite, 200 mm long	10	A2C53344035
3	Wiring harness satellite-satellite, 200 mm long	10	A2C53344036

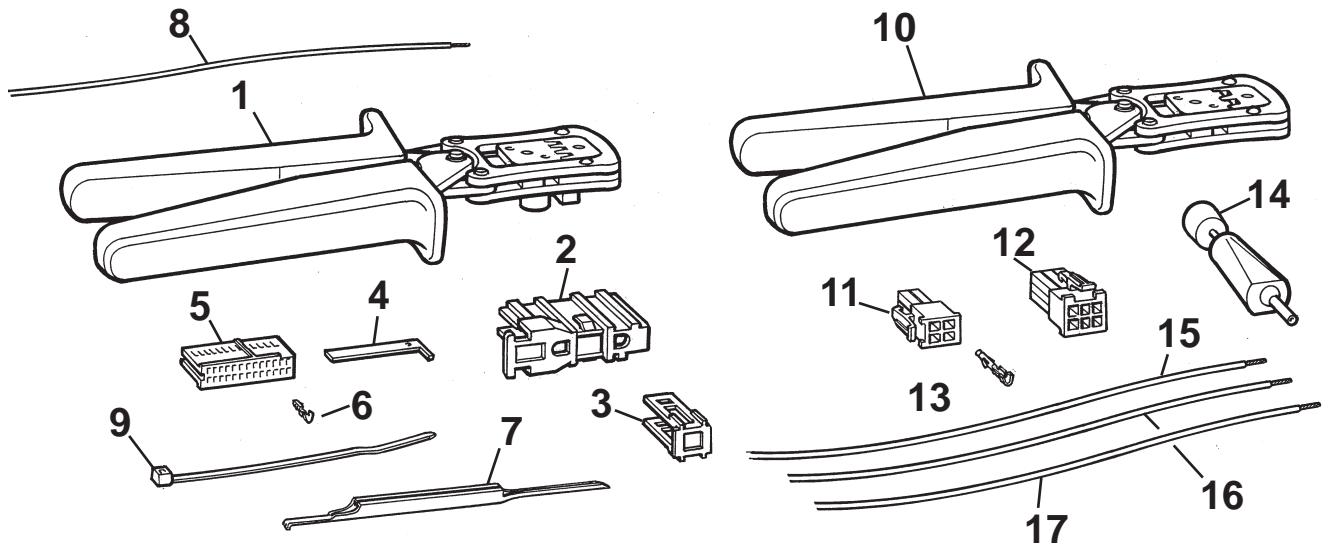
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6. System Components, Spare Parts and Accessories

6.2 Spare Parts and Accessories

6.2.2 Accessories

Parts for own installation of the wiring harnesses



Pos.	Designation	Items / Package	Order No.
1	Hand tool AMPMODU (AMP-Nr. 0-0169481-1)	—	—
2	Housing AMPMODU	100	X11-602-000-002
3	Draw-off bracket AMPMODU	100	X11-602-000-005
4	Contact seal AMPMODU	100	X11-602-000-004
5	Contact housing AMPMODU	100	X11-602-000-001
6	Contact (master) AMPMODU	200	X11-602-000-003
7	Push out tool AMPMODU (AMP-No. 0-0091084-1)	—	—
8	Wire 0.5mm ²	—	—
9	Cable strap	—	—
10	Hand tool MATE-N-LOCK (AMP-No. 0-0734202-1)	—	—
11	Connector, 4-pole MATE-N-LOCK	100	X11-602-000-006
12	Connector, 6-pole MATE-N-LOCK	100	X11-602-000-008
13	Pin MATE-N-LOCK	1000	A2C59512862
14	Push out tool MATE-N-LOCK (AMP-No. 0-0189727-1)	—	—
15	Wire, yellow 0.75mm ²	—	—
16	Wire, red 0.75mm ²	—	—
17	Wire, black 0.75mm ²	—	—

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6. System Components, Spare Parts and Accessories

6.2 Spare Parts and Accessories

6.2.2 Accessories

Software Accessories



Pos.	Designation	Items / Package	Order No.
1	CANcockpit Interface (Wingauge CMD Line)	1	X11-602-000-009
2	CANcockpit Interface (Wingauge)	1	X11-602-000-010
3	CANcockpit Demo Case	1	X10-110-397-006

Demo Case



Datenblätter | Data Sheets

www.vdo.com

CANcockpit

Neue Generation | New Generation 2009



Datenblätter | Data Sheets **CANcockpit**

Produkt Product	Doku-Nr. Documentation No.	Seiten Pages
<input type="checkbox"/> Master-Geräte CANcockpit Master Gauges	TU00-0736-5104620 0509	1 - 4
<input type="checkbox"/> Slave-Geräte CANcockpit Satellite Gauges	TU00-0736-5304620 0509	1 - 4
<input type="checkbox"/> Master Black Box	TU00-0736-5404620 0509	1 - 3

Master-Geräte

Systemkomponenten

CANcockpit

Tachometer oder Drehzahlmesser
(Gehäuse Ø 80 / 85 / 100 mm)

Beispiel: Gehäuse Ø 80 mm



Drehzahlmesser / Tachometer

Master Gauges

System Components

CANcockpit

Speedometer or Tachometer
(Housing dia. 80 / 85 / 100 mm)

Example: housing dia. 80 mm



Tachometer / Speedometer

Beschreibung:

Analoge Anzeige der Geschwindigkeit oder Drehzahl.

Digitale Anzeige der Wegstrecke, Betriebsstunden, physikalische Messwerte, ISO-Symbole, Warnungen und Alarme.

High-speed Full-CAN Bus interface V2.0B kompatibel.

Verarbeitung von zwei unterschiedlichen CAN Protokollen (J 1939, CANopen).

Programmierung über Diagnose-Schnittstelle (k-Line).

Anschlussmöglichkeit bis zu 16 Slave-Geräte.

Description:

Analog indication of road speed or engine speed.

Digital indication of distance, operating hours, physical measured values, ISO symbols, warnings and alarms.

High-speed Full-CAN Bus interface V2.0B compatible.

Processing of two different CAN protocols (J 1939, CANopen).

Programming with diagnosis interface (k-line).

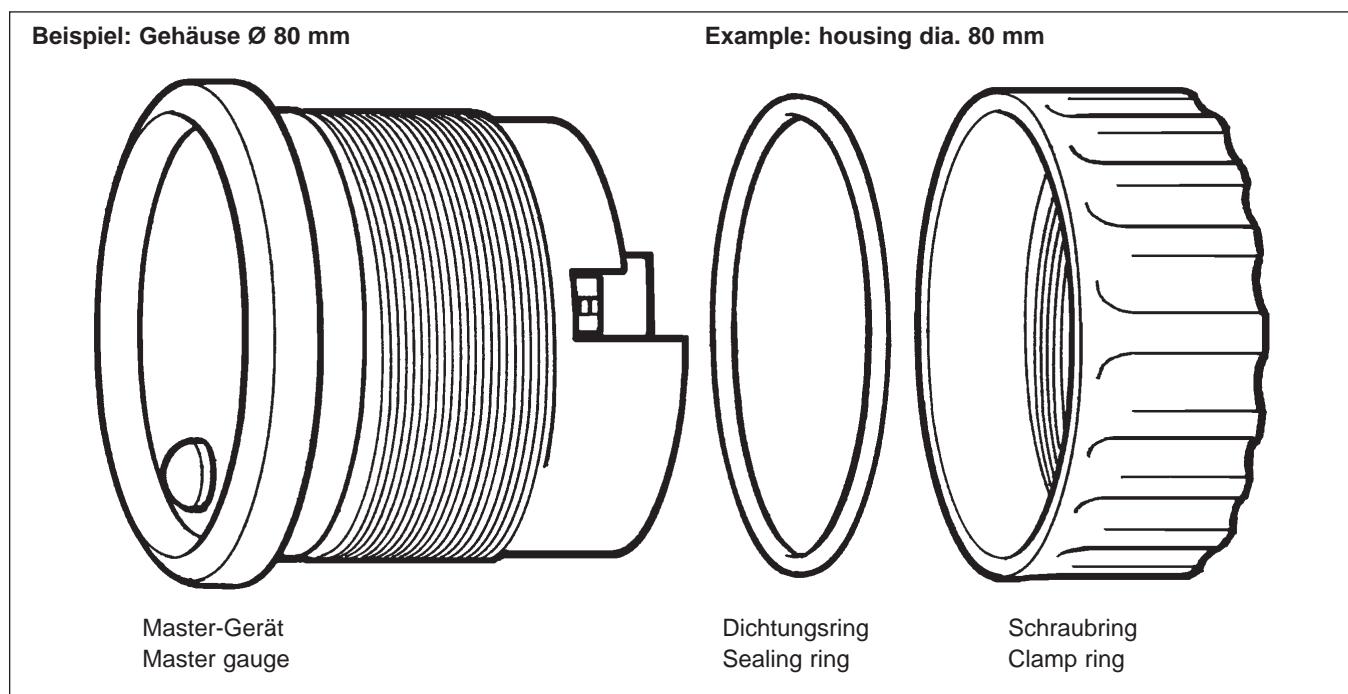
Possible connection of 16 satellite gauges.

Master-Geräte

Systemkomponenten

CANcockpit

Tachometer oder Drehzahlmesser
(Gehäuse Ø 80 / 85 / 100 mm)



Ausführung:

Frontring:	Kunststoff, schwarz, Dreikantausführung
Deckglas:	kratzfest, entspiegelt
Einlegering:	schwarz
Zifferblatt:	Durchlicht
Aufdruck:	Grund schwarz Skala, Ziffern und Symbol weiß
Zeiger:	Durchlicht, weiß
Display:	LCD, Dot Matrix Anzeige mit 132 x 33 pixel, monochrom, gelbe Hintergrundbeleuchtung
Gehäuse:	Kunststoff, flammhemmend
Befestigung:	Schraubring, Kunststoff
Beleuchtung:	weiß
Anschlussart:	AMP 26 Pins MODU II, MATE-N-LOK 4 Pins
Einbaurage:	beliebig
Eingänge:	2 CAN-Eingänge, 2x Frequenz, 3x Widerstand, 1x 4-20 mA, 1x 0-5 V
Ausgänge:	bis zu 16 Anzeigegeräte (Slaves), 2x Schaltausgang (GND 0,5A)

Design:

Bezel:	plastic, black, triangular version
Lens:	scratch resistant, nonreflective
Deflector:	black
Dial:	backlight
Dialgraphics:	black background with white characters
Pointer:	translucent backlighting, white
Display:	LCD, Dot Matrix display with 132 x 33 dots, monochrome, yellow backlighting
Housing:	plastic, flame retardant
Mounting:	clamp ring, plastic
Illumination:	white
Type of connection:	AMP 26 pins MODU II, MATE-N-LOK 4 pins
Nominal position:	optional
Inputs:	2 CAN inputs, 2x frequency, 3x resistance, 1x 4-20 mA, 1x 0-5 V
Outputs:	up to 16 satellite gauges, 2x switch outputs (GND 0.5A)

Master-Geräte

Systemkomponenten

CANcockpit

Tachometer oder Drehzahlmesser (Gehäuse Ø 80 / 85 / 100 mm)

Technische Daten:

Nennspannung:	12V und 24V DC
Betriebsspannung:	10,5V bis 32V DC
Stromaufnahme:	200mA ± 20%
EMV:	2006/28/EC (2004/104/EC), ISO 7637-1-2, SAEJ 1810
Schwingungsfestigkeit:	2g, 8-300 Hz, 1 oct./min.
Dauerschock:	25g, 1 Hz, 6 ms,
Schutzart:	IP65, IEC 60529 vorne IP30, IEC 60529 hinten
Betriebstemperatur:	– 40°C bis + 85 °C
Lagertemperatur:	– 40°C bis + 85 °C
LCD Feuchtebeständigkeit:	+ 65°C ± 2 °C 90% r.F.
Betriebstemperatur LCD Anzeige:	– 20°C bis + 70 °C

Anschlussbelegung / Terminal connection:

AMP 26 Pins MODU II

Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	Kl. 30 / Power Supply (terminal 30)	14	+ 8 V DC für Geber / for Sensor supply
2	Kl. 31 / GND (terminal 31)	15	0 - 5 V DC Eingang / Input
3	CAN1 _High	16	Kl. 58 d / Illumination (terminal 58 d)
4	CAN1 _Low	17	Kl. 15 / Ignition (terminal 15)
5	CAN2 _High	18	Frequenzeingang 2 / Frequency Input 2 (0-2 kHz)
6	CAN2 _Low	19	Frequenzeingang 1 / Frequency Input 1 (0-40 kHz)
7	nicht belegt / not connected	20	Schaltausgang 1 / Switch-Output 1
8	k - Line	21	Schaltausgang 2 / Switch-Output 2
9	Analog Eingang 1 / Input 1 (0,5-200 Ohm)	22	nicht belegt / not connected
10	Analog Eingang 2 / Input 2 (0,5-300 Ohm)	23	nicht belegt / not connected
11	Analog Eingang 3 / Input 3 (10 -700 Ohm)	24	Externer Schalter / External Switch
12	4 - 20 mA Eingang / Input	25	Masse Analog / Analog GND
13	4 - 20 mA Masse / GND	26	Masse Frequenz / Frequency GND

Master Gauges

System Components

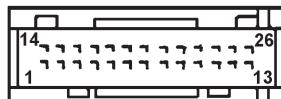
CANcockpit

Speedometer or Tachometer (Housing dia. 80 / 85 / 100 mm)

Technical Data:

Rated voltage:	12V and 24V DC
Operating voltage:	10.5V to 32V DC
Current consumption:	200mA ± 20%
EMC:	2006/28/EC (2004/104/EC), ISO 7637-1-2, SAEJ 1810
Vibration resistance:	2g, 8-300 Hz, 1 oct./min.
Physical shock:	25g, 1 Hz, 6 ms,
Protection:	IP65, IEC 60529 front side IP30, IEC 60529 backside
Operating temperature:	– 40°C to + 85 °C
Storage temperature:	– 40°C to + 85 °C
LCD Humidity resistance:	+ 65°C ± 2 °C 90% r.F.
Operating temperature light crystal display:	– 20°C to + 70 °C

Geräteanschluss
Gauge connection



4 Pin MATE-N-LOCK

Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	nicht belegt / not connected	3	Masse / GND
2	Sat - Bus	4	Versorgungsspannung Slave / Supply Satellite

1 3
Geräteanschluss
Gauge connection
2 4

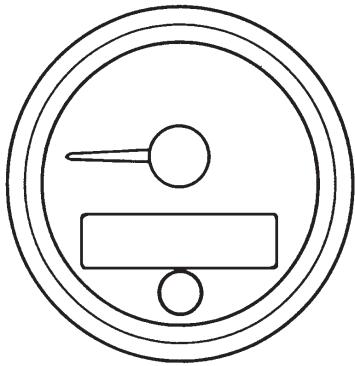
Master-Geräte

Systemkomponenten

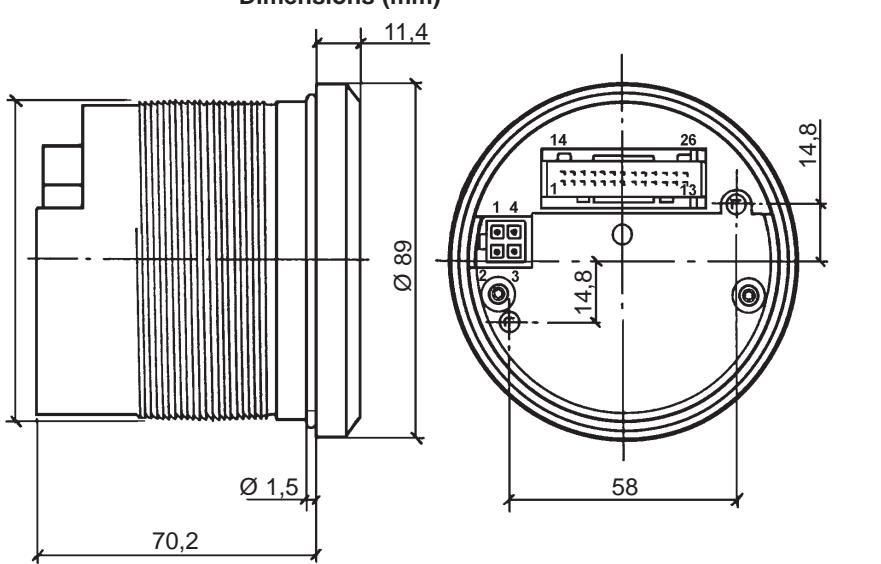
CANcockpit

Tachometer oder Drehzahlmesser (Gehäuse Ø 80 / 85 / 100 mm)

Beispiel: Gehäuse Ø 80 mm
Abmaße (mm)



Gewinde für Schraubring
Thread for clamp ring



Partnumber	MOQ	Description
Master 80 mm		
A2C60000020	10	CCM 80 Tacho 0-3*1000/min S tb
A2C60000021	10	CCM 80 Tacho 0-4*1000/min S tb
A2C60000022	10	CCM 80 Speedo 0-60km/h S tb
A2C60000023	10	CCM 80 Speedo 0-120km/h S tb
A2C60000024	10	CCM 80 Speedo 0-200km/h S tb
A2C60000025	10	CCM 80 Speedo 0-80mph D tb
A2C60000026	10	CCM 80 Speedo 0-30km/h S tb
A2C60000027	10	CCM 80 Tacho 0-8*1000/min S tb
Master 85 mm		
A2C60000070	10	CCM 85 Tacho 0-3*1000rpm S tb
A2C60000071	10	CCM 85 Tacho 0-4*1000rpm S tb
A2C60000072	10	CCM 85 Speedo 0-120km/h S tb
A2C60000073	10	CCM 85 Speedo 0-80mph S tb
A2C60000074	10	CCM 85 Speedo 0-100mph S tb
A2C60000075	10	CCM 85 Speedo 0-120mph S tb
A2C60000076	10	CCM 85 Tacho 0-5*1000rpm S tb
Master 100 mm		
A2C60000126	10	CCM 100 Tacho 0-30*100/min S tb
A2C60000127	10	CCM 100 Tacho 0-40*100/min S tb
A2C60000128	10	CCM 100 Speedo 0-60km/h S tb
A2C60000129	10	CCM 100 Speedo 0-120km/h S tb
A2C60000130	10	CCM 100 Speedo 0-200km/h S tb
A2C60000131	10	CCM 100 Speedo 0-50mph D tb
A2C60000132	10	CCM 100 Speedo 0-140mph D tb
A2C60000133	10	CCM 100 Speedo 0-200km/h D tb
A2C60000134	10	CCM 100 Speedo 0-120mph D tb

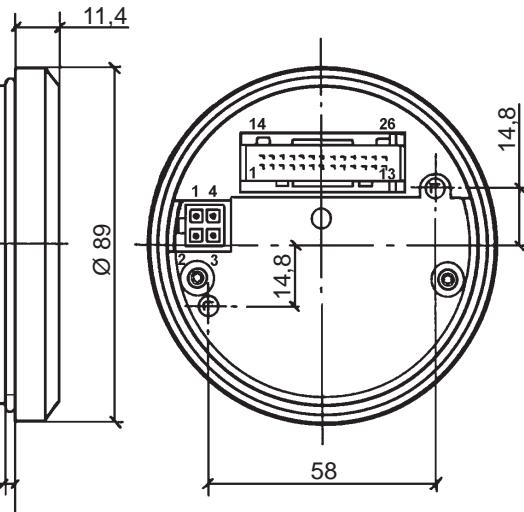
Master Gauges

System Components

CANcockpit

Speedometer or Tachometer (Housing dia. 80 / 85 / 100 mm)

Exemple: housing dia. 80 mm
Dimensions (mm)



Slave-Geräte

Systemkomponenten

CANcockpit

Analoge Anzeigegeräte
in verschiedenen Versionen
(Gehäuse Ø 52 / 80 / 100 mm)

Beispiel / Examples:



Druckanzeiger / Pressure gauge



Temperaturanzeiger /
Temperature gauge



Vorratsanzeiger / Fuel level gauge

Beschreibung:

Analoge Anzeige von Druck, Temperatur, Vorrat, Batteriespannung, Ampere, Geschwindigkeit, Drehzahl.

Programmierung über Diagnose-Schnittstelle (k-Line).

Satellite Gauges

System Components

CANcockpit

Various versions of
analog indication gauges
(Housing dia. 52 / 80 / 100 mm)

Description:

Analog indication of pressure, temperature, fuel, battery, ampere, speed, engine speed.

Programming with diagnosis interface (k-line).

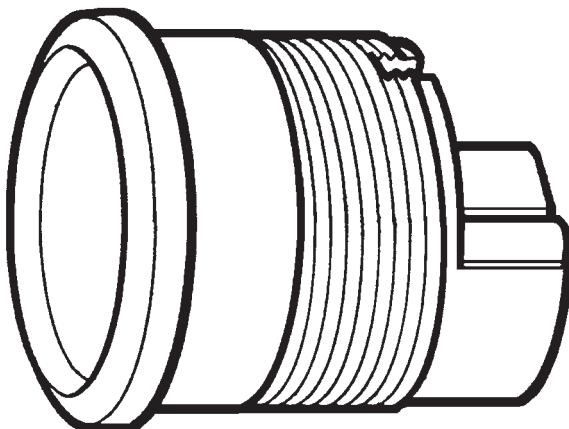
Slave-Geräte

Systemkomponenten

CANcockpit

Analoge Anzeigegeräte
in verschiedenen Versionen
(Gehäuse Ø 52 / 80 / 100 mm)

Beispiel: Gehäuse Ø 52 mm



Slave-Gerät
Satellite gauge

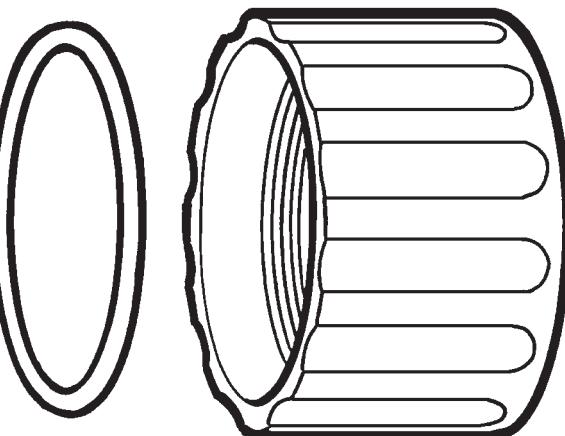
Satellite Gauges

System Components

CANcockpit

Various versions of
analog indication gauges
(Housing dia. 52 / 80 / 100 mm)

Example: housing dia. 52 mm



Dichtungsring
Sealing ring

Schraubring
Clamp ring

Ausführung:

Frontring:	Kunststoff, schwarz, Dreikantausführung
Deckglas:	kratzfest, entspiegelt
Einlegering:	schwarz
Zifferblatt:	Durchlicht
Aufdruck:	Grund schwarz Skala, Ziffern und Symbol weiß
Zeiger:	Durchlicht, weiß
Gehäuse:	Kunststoff, flammhemmend
Befestigung:	Schraubring, Kunststoff
Beleuchtung:	weiß
Anschlussart:	AMP MATE-N-LOK 6 Pins
Einbaulage:	0 - 85° Winkel

Design:

Bezel:	plastic, black, triangular version
Lens:	scratch resistant, nonreflective
Deflector :	black
Dial:	backlight
Dialgraphics:	black background with white characters
Pointer:	translucent backlighting, white
Housing:	plastic, flame retardant
Mounting:	clamp ring, plastic
Illumination:	white
Type of connection:	AMP MATE-N-LOK 6 pins
Nominal position:	0 - 85° angle

Slave-Geräte

Systemkomponenten

CANcockpit

Analoge Anzeigegeräte in verschiedenen Versionen (Gehäuse Ø 52 / 80 / 100 mm)

Technische Daten:

Versorgungsspannung: 10,5 - 32V DC von Master
Stromaufnahme: 60mA ± 10%

EMV: 2006/28/EC (2004/104/EC),
ISO 7637-1-2, SAEJ 1810

Schwingungsfestigkeit: 2g, 8-300 Hz, 1 oct./min
Dauerschock: 25g, 1 Hz, 6 ms
Schutzart: IP65, IEC 60529 vorne
IP30, IEC 60529 hinten

Betriebstemperatur: – 40°C bis + 85 °C
Lagertemperatur: – 40°C bis + 85 °C

Satellite Gauges

System Components

CANcockpit

Various versions of analog indication gauges (Housing dia. 52 / 80 / 100 mm)

Technical Data:

Power supply: 10.5 - 32V DC from Master
Current consumption: 60mA ± 10%

EMC: 2006/28/EC (2004/104/EC),
ISO 7637-1-2, SAEJ 1810

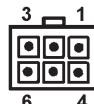
Vibration resistance: 2g, 8-300 Hz, 1 oct./min
Physical shock: 25g, 1 Hz, 6 ms
Protection: IP65, IEC 60529 front side
IP30, IEC 60529 backside

Operating temperature: – 40°C to + 85 °C
Storage temperature: – 40°C to + 85 °C

Anschlussbelegung / Terminal connection:

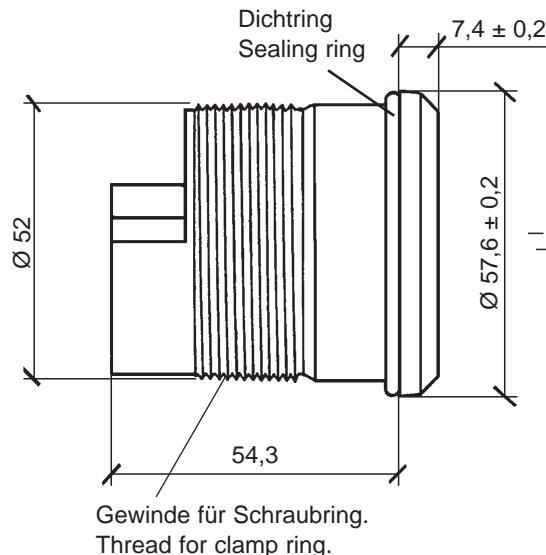
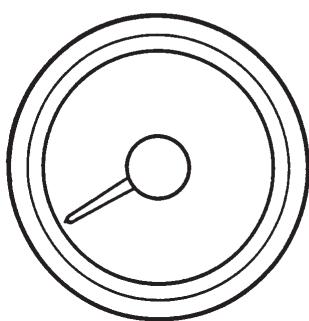
AMP MATE-N-LOCK 6 Pins

Geräteanschluss
Gauge connection

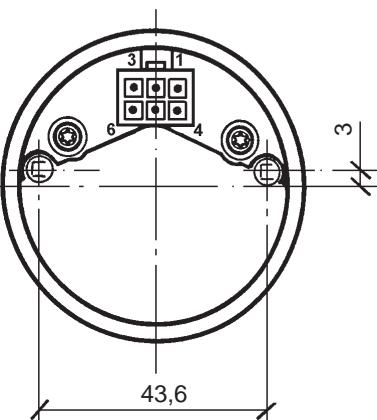


Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	Data	4	Data
2	Masse / GND	5	Masse / GND
3	Versorgungsspannung Slave / Supply Satellite	6	Versorgungsspannung Slave / Supply Satellite

Beispiel: Gehäuse Ø 52 mm Abmaße (mm)



Exemple: housing dia. 52 mm Dimensions (mm)



Slave-Geräte

Systemkomponenten

CANcockpit

Analoge Anzeigegeräte
in verschiedenen Versionen
Gehäuse Ø 52 mm

Partnumber	MOQ	Description
Slave 52 mm		
A2C60000251	10	CCS 52 PressOil 0-5bar S tb
A2C60000252	10	CCS 52 PressOil 0-10bar S tb
A2C60000253	10	CCS 52 PressOil 0-500kPa S tb
A2C60000254	10	CCS 52 PressOil 0-1000kPa S tb
A2C60000255	10	CCS 52 PressOil 0-80psi D tb
A2C60000256	10	CCS 52 PressOil 0-100psi D tb
A2C60000257	10	CCS 52 PressOil 0-150psi D tb
A2C60000258	10	CCS 52 PressBr 0-10bar S tb
A2C60000259	10	CCS 52 PressBr1 0-10bar S tb
A2C60000260	10	CCS 52 PressBr2 0-10bar S tb
A2C60000261	10	CCS 52 Press1 0-250bar S wo tb
A2C60000262	10	CCS 52 Press2 0-250bar S wo tb
A2C60000263	10	CCS 52 PressBr 0-150psi D tb
A2C60000264	10	CCS 52 PressBr 0-16bar S tb
A2C60000265	10	CCS 52 PressTr 0-28bar S tb
A2C60000266	10	CCS 52 PressTr 0-400psi D tb
A2C60000267	10	CCS 52 PressTu 0-2bar S tb
A2C60000268	10	CCS 52 TempOil 50-150C S tb
A2C60000269	10	CCS 52 TempTr 50-150C S tb
A2C60000270	10	CCS 52 TempTr 50-150C D tb
A2C60000271	10	CCS 52 TempTr 120-300F D tb
A2C60000272	10	CCS 52 Temp 60-200C S wo tb
A2C60000273	10	CCS 52 TempWa 40-120C S tb
A2C60000274	10	CCS 52 TempWa 40-120C D tb
A2C60000275	10	CCS 52 TempWa 100-280F D tb
A2C60000276	10	CCS 52 TempHy 20-120C S tb
A2C60000277	10	CCS 52 TempPyro 100-900C S tb
A2C60000278	10	CCS 52 LevelFuel 0-1 S tb
A2C60000279	10	CCS 52 LevelFuel E-F S tb
A2C60000280	10	CCS 52 LevelFw 0-1 S tb
A2C60000281	10	CCS 52 LevelWw 0-1 S tb
A2C60000282	10	CCS 52 Volt 8-16V S tb
A2C60000283	10	CCS 52 Volt 10-18V S tb
A2C60000284	10	CCS 52 Volt 18-32V S tb
A2C60000285	10	CCS 52 Am -125/+125A S tb
A2C60000286	10	CCS 52 Tacho 0-3*1000/min S tb
A2C60000287	10	CCS 52 Speedo 0-60km/h S tb
A2C60000288	10	CCS 52 TempOil 120-300F D tb
A2C60000289	10	CCS 52 Volt 20-34V S tb
A2C60000354	10	CCS 52 PressOil 0-10bar S on tb
A2C60000355	10	CCS 52 TempWa 40-120C S on tb
Big Slave 85 mm		
A2C60000356	10	CCS 80 Tacho 0-3*1000/min S tb
A2C60000357	10	CCS 80 Speedo 0-60km/h S tb
A2C60000358	10	CCS 80 Speedo 0-80mph D tb
A2C60000359	10	CCS 80 Speedo 0-60km/h D tb
Big Slave 100 mm		
A2C60000360	10	CCS 100 Tacho 0-3*1000/min S tb
A2C60000361	10	CCS 100 Speedo 0-120km/h S tb

Satellite Gauges

System Components

CANcockpit

Various versions of
analog indication gauges
Housing dia. 52 mm

Master Black Box

Systemkomponenten

CANcockpit

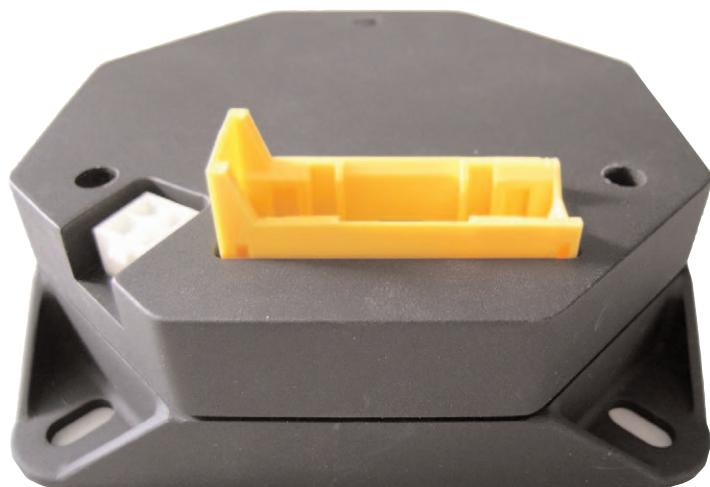
Gehäuse 100 x 100 x 41,3 mm

Master Black Box

System Components

CANcockpit

Housing 100 x 100 x 41,3 mm



Beschreibung:

Empfang und Verarbeitung sowohl von CANbus-Daten (SAE J1939 / CANopen) als auch von analogen Signalen zur Anzeige in Slave Instrumenten über SATbus.

High-speed Full-CANbus interface V2.0B kompatibel.

Verarbeitung von zwei unterschiedlichen CAN Protokollen (J1939, CANopen).

Programmierung als Tachometer oder Drehzahlmesser über Diagnose-Schnittstelle (k-Line).

Anschlussmöglichkeit bis zu 16 Slave-Geräte.

Description:

Reception and processing of both CANbus-data (SAE J1939 / CANopen) and analog signals for indication on slave instruments via SATbus

High-speed Full-CANbus interface V2.0B compatible.

Processing of two different CAN protocols (J1939, CANopen).

Programming as Speedometer or Tachometer with Diagnosis interface (k-line).

Possible connection of 16 satellite gauges.

Master Black Box

Systemkomponenten

CANcockpit

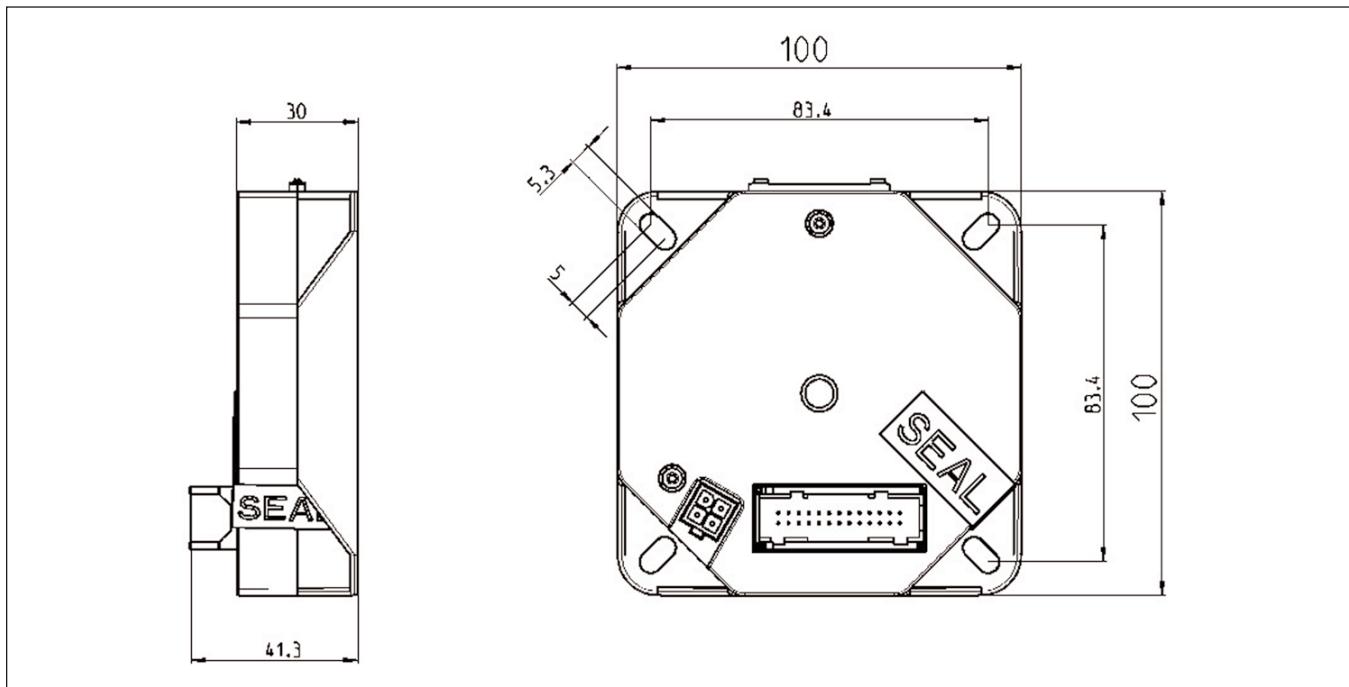
Gehäuse 100 x 100 x 41,3 mm

Master Black Box

System Components

CANcockpit

Housing 100 x 100 x 41,3 mm



Ausführung:

Gehäuse: Kunststoff, flammhemmend
 Befestigung: 4 Schrauben
 Anschlussart: AMP 26 Pins MODU II,
 MATE-N-LOK 4 Pins
 Eingänge: 2 CAN-Eingänge, 2x Frequenz,
 3x Widerstand, 1x 4-20 mA, 1x 0-5 V
 Ausgänge: über SATbus bis zu 16 Anzeigegeräte
 (Slaves),
 2x Schaltausgang (GND 0,5A)

Design:

Housing: plastic, flame retardant
 Mounting: 4 screws
 Type of connection: AMP 26 pins MODU II,
 MATE-N-LOK 4 pins
 Inputs: 2 CAN inputs, 2x frequency,
 3x resistance, 1x 4-20 mA, 1x 0-5 V
 Outputs: via SATbus up to 16 satellite gauges,
 2x switch outputs (GND 0.5A)

Partnumber	MOQ	Description
Master Black Box		
A2C60500641	10	CCM Black Box

Master Black Box

Systemkomponenten

CANcockpit

Gehäuse 100 x 100 x 41,3 mm

Technische Daten:

Nennspannung:	12V und 24V DC
Betriebsspannung:	10,5V bis 32V DC
Stromaufnahme:	70mA ± 10%
EMV:	2006/28/EC (2004/104/EC), ISO 7637-1-2, SAEJ 1810
Schwingungsfestigkeit:	2g, 8-300 Hz, 1 oct./min.
Dauerschock:	25g, 1 Hz, 6 ms,
Schutzart:	IP30, IEC 60529
Betriebs- und Lagertemperatur:	– 40°C bis + 85 °C

Master Black Box

System Components

CANcockpit

Housing 100 x 100 x 41,3 mm

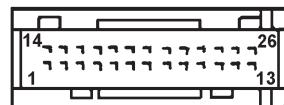
Technical Data:

Rated voltage:	12V and 24V DC
Operating voltage:	10,5V to 32V DC
Current consumption:	70mA ± 10%
EMC:	2006/28/EC (2004/104/EC), ISO 7637-1-2, SAEJ 1810
Vibration resistance:	2g, 8-300 Hz, 1 oct./min.
Physical shock:	25g, 1 Hz, 6 ms,
Protection:	IP30, IEC 60529
Operating- and Storage temperature:	– 40°C to + 85 °C

Anschlussbelegung / Terminal connection:

AMP 26 Pins MODU II

Geräteanschluss
Gauge connection



Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	Kl. 30 / Power Supply (terminal 30)	14	+ 8 V DC für Geber / for Sensor supply
2	Kl. 31 / GND (terminal 31)	15	0 - 5 V DC Eingang / Input
3	CAN1 _High	16	Kl. 58 d / Illumination (terminal 58 d)
4	CAN1 _Low	17	Kl. 15 / Ignition (terminal 15)
5	CAN2 _High	18	Frequenzeingang 2 / Frequency Input 2 (0-2 kHz)
6	CAN2 _Low	19	Frequenzeingang 1 / Frequency Input 1 (0-40 kHz)
7	nicht belegt / not connected	20	Schaltausgang 1 / Switch-Output 1
8	k - Line	21	Schaltausgang 2 / Switch-Output 2
9	Analog Eingang 1 / Input 1 (0,5-200 Ohm)	22	nicht belegt / not connected
10	Analog Eingang 2 / Input 2 (0,5-300 Ohm)	23	nicht belegt / not connected
11	Analog Eingang 3 / Input 3 (10 -700 Ohm)	24	Externer Schalter / External Switch
12	4 - 20 mA Eingang / Input	25	Masse Analog / Analog GND
13	4 - 20 mA Masse / GND	26	Masse Frequenz / Frequency GND

4 Pin MATE-N-LOCK



Pin	Beschreibung / Description	Pin	Beschreibung / Description
1	nicht belegt / not connected	3	Masse / GND
2	Sat - Bus	4	Versorgungsspannung Slave / Supply Satellite



CCS 52 PressOil 0-5bar S on tb ABCDE

1 2 3 4 5 6 7 8 9

1 Device type

CANcockpit BlackBox - CCB
CANcockpit Master - CCM
CANcockpit Slave - CCS
CANcockpit Harness - CCH

2 Diameter

52 mm - 52
80 mm - 80
85 mm - 85
100 mm - 100

5 Main scale

min. "-" max. unit

6 Dial scale

Single scale - S
Double scale - D

3 Gauge

Ammeter	- Am	Speedometer	- Speedo
Level	- Level	Tachometer	- Tacho
Pressure	- Press	Temperature	- Temp
Pyrometer	- Pyro	Voltmeter	- Volt
Rear Wheel	- RearW		

7 ISO symbol

Off-road - "none"
On-road - on
Without - wo

8 Bezel

Triangle black - tb
Triangle chrome - tc

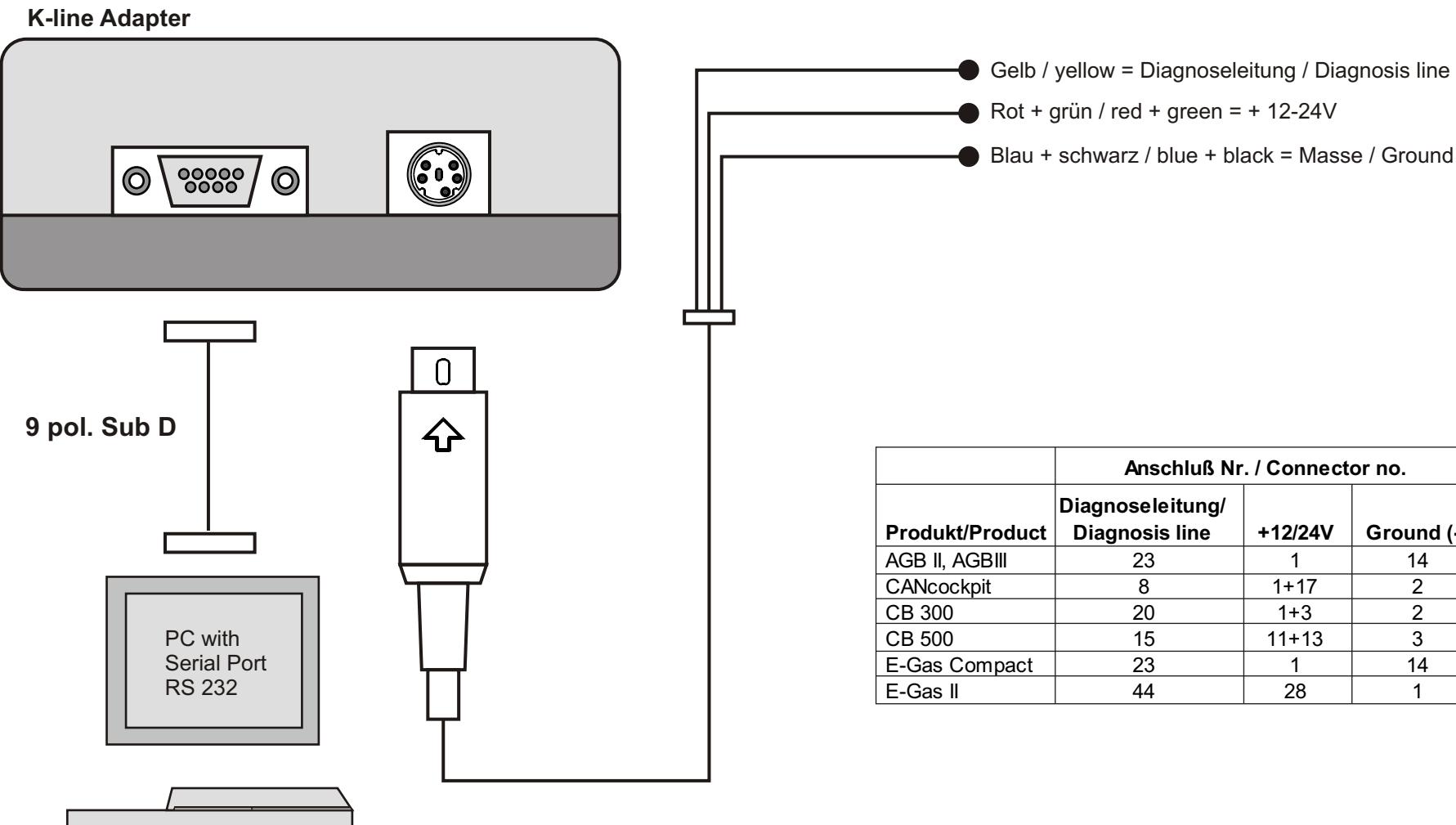
9 Customer

optional

4 Reference

AdBlue	- AdBlue	Hydraulics	- Hy
Air	- Air	Transmission	- Tr
Brake	- Br	Turbo	- Tu
Engine Oil	- Oil	Water	- Wa
Freshwater	- Fw	Wastewater	- Ww
Fuel	- Fuel		

K-line Adapter	X12-397-041-601, X12-397-041-001, X12-397-046-001, X11-602-000-009, X11-602-000-010	TU00-0777-5107120	03/09	1
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	Anschluß Nr. / Connector no.		
Produkt/Product	Diagnoseleitung/ Diagnosis line	+12/24V	Ground (-)
AGB II, AGB III	23	1	14
CANcockpit	8	1+17	2
CB 300	20	1+3	2
CB 500	15	11+13	3
E-Gas Compact	23	1	14
E-Gas II	44	28	1

Declaration of Compliance

We declare that the following products conform to EU Directive 2000/53/EC of the Parliament and of the Council on end-of-life vehicles.

Name of the product :

Types	Packed gauge no.	Unpacked gauge no.
1. CAN Cockpit Master D100mm	Diverse	Diverse
2. CAN Cockpit Master D80mm - (please note that the D85 is electrically the same as the D80mm but in a slightly bigger housing)	Diverse	Diverse
3. CAN Cockpit Slave 52mm	Diverse	Diverse
4. CAN Cockpit Big Satellite D100mm	Diverse	Diverse
5. CAN Cockpit Big Satellite D80mm	Diverse	Diverse

Utilization area : Automotive and Agricultural vehicles

Year of assembly : 2009

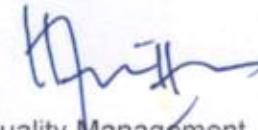
Manufacturer : Continental Automotive Instruments Malaysia Sdn. Bhd.
Continental Automotive Components Malaysia Sdn. Bhd.
2455, Mk.1, Tingkat Perusahaan 2A,
Prai Industrial Estate,
13600 Prai, Penang,
Malaysia.

Place and date of issue : Penang, 18 February 2009

Signature :
Position
Name



HOD - Product Development
Thomas Martin



Quality Management
Haszani B. Harun



EC-Declaration of Conformity

according to the guidelines of the European Community of electromagnetic compatibility (72/245/EEC) as amended by 2006/28/EC CANCOCKPIT system.

We declare that the following products conform with the protection requirements of Council Directive 72/245/EEC-2006/28/EC Annexes II B, relating to the electromagnetic compatibility.

This declaration will lose its validity with improper usage or resale and modifications, which are not approved by the manufacturer and supplier.

Name of the product :

Types	Packed gauge no.	Unpacked gauge no.
1. CAN Cockpit Master D100mm	Diverse	Diverse
2. CAN Cockpit Master D80mm - (please note that the D85 is electrically the same as the D80mm but in a slightly bigger housing)	Diverse	Diverse
3. CAN Cockpit Slave 52mm	Diverse	Diverse
4. CAN Cockpit Big Satellite D100mm	Diverse	Diverse
5. CAN Cockpit Big Satellite D80mm	Diverse	Diverse
6. CAN Cockpit Master D100 Black Box	Diverse	Diverse

Utilization area : Automotive and Agricultural vehicles

Year of assembly : 2009

This device has been designed and produced according to the following official standard :

Emission of interference : 2004/104/EC

Immunity to interference : 2004/104/EC

Manufacturer : Continental Automotive Instruments Malaysia Sdn. Bhd.
Continental Automotive Components Malaysia Sdn. Bhd.
2455, Mk.1, Tingkat Perusahaan 2A,
Prai Industrial Estate,
13600 Prai, Penang,
Malaysia.

Place and date of issue : Penang, 28 May 2009

Signature :
Position
Name


HOD - Product Development
Thomas Martin


Quality Management
Haszani B. Harun



VCA Headquarters
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Eastgate Road
Bristol, BS5 6XX
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Email: enquiries@vca.gov.uk
Web: www.vca.gov.uk

THE UNITED KINGDOM VEHICLE APPROVAL AUTHORITY

COMMUNICATION CONCERNING THE APPLICATION OF THE COUNCIL DIRECTIVE OF 20 JUNE 1972 ON THE APPROXIMATION OF THE LAWS OF THE MEMBER STATES RELATING TO A TYPE OF COMPONENT WITH REGARD TO RADIO INTERFERENCE SUPPRESSION (72/245/EEC) AS LAST AMENDED BY 2006/28/EC .

Type Approval No: e11*72/245*2006/28*4935*00

EC type-approval mark to be affixed on ESA: e11 03 4935

Reason for Extension: Not applicable

SECTION I

0.1 Make (trade name of manufacturer): Continental Automotive Malaysia

0.2 Type: D80 mm

0.3 Means of identification of type, if marked on the component: marked with label

0.3.1 Location of that marking: Label affixed to side of component

0.5 Name and address of manufacturer:
Continental Automotive Instruments Malaysia Sdn. Bhd.
Continental Automotive Components Malaysia Sdn. Bhd.
2455, Mk.1, Tingkat Perusahaan 2A, Prai Industrial Estate, 13600 Prai, Penang, Malaysia.

Name and address of authorised representative, if any: Dirk Plaga, Continental Trading
GmbH, Ludwig-Erhard-Strasse 28, 65760 Eschborn, Germany

0.7 In the case of components and separate technical units, location and method of affixing of the
EC type-approval mark: printed on a foil label and will be affixed on the CANCockpit

0.8 Address(es) of assembly plant(s): 2455, Mk.1, Tingkat Perusahaan 2A, Prai Industrial
Estate, 13600 Prai, Penang, Malaysia.



SECTION II

1. Additional information (where applicable): Not applicable
2. Technical service responsible for carrying out the tests: Vehicle Certification Agency
3. Date of test report: 7 June 2009
4. Number of test report: OSJ194266 (4935)
5. Remarks (if any): None
6. Place: BRISTOL
7. Date: 8 JUNE 2009
8. Signature:
The signature is handwritten in black ink, appearing to read "Michael J. Mulvane".
9. The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

OSJ194266





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THE UNITED KINGDOM VEHICLE APPROVAL AUTHORITY

COMMUNICATION CONCERNING THE APPLICATION OF THE COUNCIL DIRECTIVE OF 20 JUNE 1972 ON THE APPROXIMATION OF THE LAWS OF THE MEMBER STATES RELATING TO A TYPE OF COMPONENT WITH REGARD TO RADIO INTERFERENCE SUPPRESSION (72/245/EEC) AS LAST AMENDED BY 2006/28/EC .

Type Approval No: e11*72/245*2006/28*4936*00

EC type-approval mark to be affixed on ESA: e11 03 4936

Reason for Extension: Not applicable

SECTION I

0.1 Make (trade name of manufacturer): Continental Automotive Malaysia

0.2 Type: D100 mm

0.3 Means of identification of type, if marked on the component: marked with label

0.3.1 Location of that marking: Label affixed to side of component

0.5 Name and address of manufacturer:
Continental Automotive Instruments Malaysia Sdn. Bhd.
Continental Automotive Components Malaysia Sdn. Bhd.
2455, Mk.1, Tingkat Perusahaan 2A, Prai Industrial Estate, 13600 Prai, Penang,
Malaysia.

Name and address of authorised representative, if any: Dirk Plaga, Continental Trading
GmbH, Ludwig-Erhard-Strasse 28, 65760 Eschborn, Germany

0.7 In the case of components and separate technical units, location and method of affixing of the
EC type-approval mark: printed on a foil label and will be affixed on the CANCockpit

0.8 Address(es) of assembly plant(s): 2455, Mk.1, Tingkat Perusahaan 2A, Prai Industrial
Estate, 13600 Prai, Penang, Malaysia.



SECTION II

1. Additional information (where applicable): Not applicable
2. Technical service responsible for carrying out the tests: Vehicle Certification Agency
3. Date of test report: 7 June 2009
4. Number of test report: OSJ194266 (4936)
5. Remarks (if any): None
6. Place: BRISTOL
7. Date: 8 JUNE 2009
8. Signature:  M. J. MULVANEY
9. The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

OSJ194266





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THE UNITED KINGDOM VEHICLE APPROVAL AUTHORITY

COMMUNICATION CONCERNING THE APPLICATION OF THE COUNCIL DIRECTIVE OF 20 JUNE 1972 ON THE APPROXIMATION OF THE LAWS OF THE MEMBER STATES RELATING TO A TYPE OF COMPONENT WITH REGARD TO RADIO INTERFERENCE SUPPRESSION (72/245/EEC) AS LAST AMENDED BY 2006/28/EC .

Type Approval No: e11*72/245*2006/28*4937*00

EC type-approval mark to be affixed on ESA: e11 03 4937

Reason for Extension: Not applicable

SECTION I

0.1 Make (trade name of manufacturer): Continental Automotive Malaysia

0.2 Type: Black Box

0.3 Means of identification of type, if marked on the component: marked with label

0.3.1 Location of that marking: Label affixed to side of component

0.5 Name and address of manufacturer:
Continental Automotive Instruments Malaysia Sdn. Bhd.,
Continental Automotive Components Malaysia Sdn. Bhd.
2455, Mk.1, Tingkat Perusahaan 2A, Prai Industrial Estate, 13600 Prai, Penang, Malaysia.

Name and address of authorised representative, if any: Dirk Plaga, Continental Trading
GmbH, Ludwig-Erhard-Strasse 28, 65760 Eschborn, Germany

0.7 In the case of components and separate technical units, location and method of affixing of the
EC type-approval mark: printed on a foil label and will be affixed on the CANCockpit

0.8 Address(es) of assembly plant(s): 2455, Mk.1, Tingkat Perusahaan 2A, Prai Industrial
Estate, 13600 Prai, Penang, Malaysia.



SECTION II

1. Additional information (where applicable): Not applicable
2. Technical service responsible for carrying out the tests: Vehicle Certification Agency
3. Date of test report: 7 June 2009
4. Number of test report: OSJ194266 (4937)
5. Remarks (if any): None
6. Place: BRISTOL
7. Date: 8 JUNE 2009
8. Signature:  M. J. MULVANEY
9. The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

OSJ194266

