Automatic Passenger Counting

## IRMA – Infrared Motion Analyzer
## 5th generation

# IRMA-Gateway-3-J1708
## Data sheet

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# Document Information

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# Validity

Gateway types covered by this document:

| Short name | Name of product | Type designation |
|---|---|---|
| IRMA-Gateway-3-J1708 | IRMA-Gateway-3-J1708 | C-3-J-141.1.2.-16.261300.210100 |
| | | C8-3-J-141.1.2.-16.261300.211100 |
| | | C8-3-J-141.1.2.-16.261300.210100 |
| | | C8-3-J-141.1.2.-16.261300.211100 |

# Content

# 1 General

## 1.1 Trade names

Unless otherwise indicated, all brand and product names in this document are the registered trade names of the respective owners.

## 1.2 Disclaimer

The information contained in this document is based on product data resulting from the development and approval phases as well as the production of initial samples. These specifications do not claim to be error-free and will need to be updated or corrected. Such modifications may be made by iris GmbH without notice. Characteristic or typical values given are based on our experience and are approximate values to be expected; they are by no means guaranteed by iris-GmbH.

## 1.3 Symbols / abbreviations used

"Please note"

"Worth knowing"

"Caution! - Can result in defects."

"Information"

"See Annex"

"See document on our website"

"Instructions"

"Please note down"

"Please contact iris-GmbH"

"Download"

## 1.4 On this document

The following data sheet describes the analyzer variant 'Gateway' for IRMA MATRIX and the communication protocol J1708. Gateways in this context are evaluation units of the "IRMA" people counting system. Gateway and IRMA Gateway-3-J1708 are synonymous. This data sheet does not describe the function or installation of the gateway in its entirety (sensors, cables, data interface, etc.), but displays the technical data.

The analyzer and gateway are identical in hardware, only the software is different for both devices. To distinguish the functionality, the analyzer has been renamed gateway. Electrical and mechanical properties have remained the same. Documents for type testing are therefore only available for the analyzer. (Table 2, “Standard compliance”)

## 1.5 Position of the gateway within the analyzer family

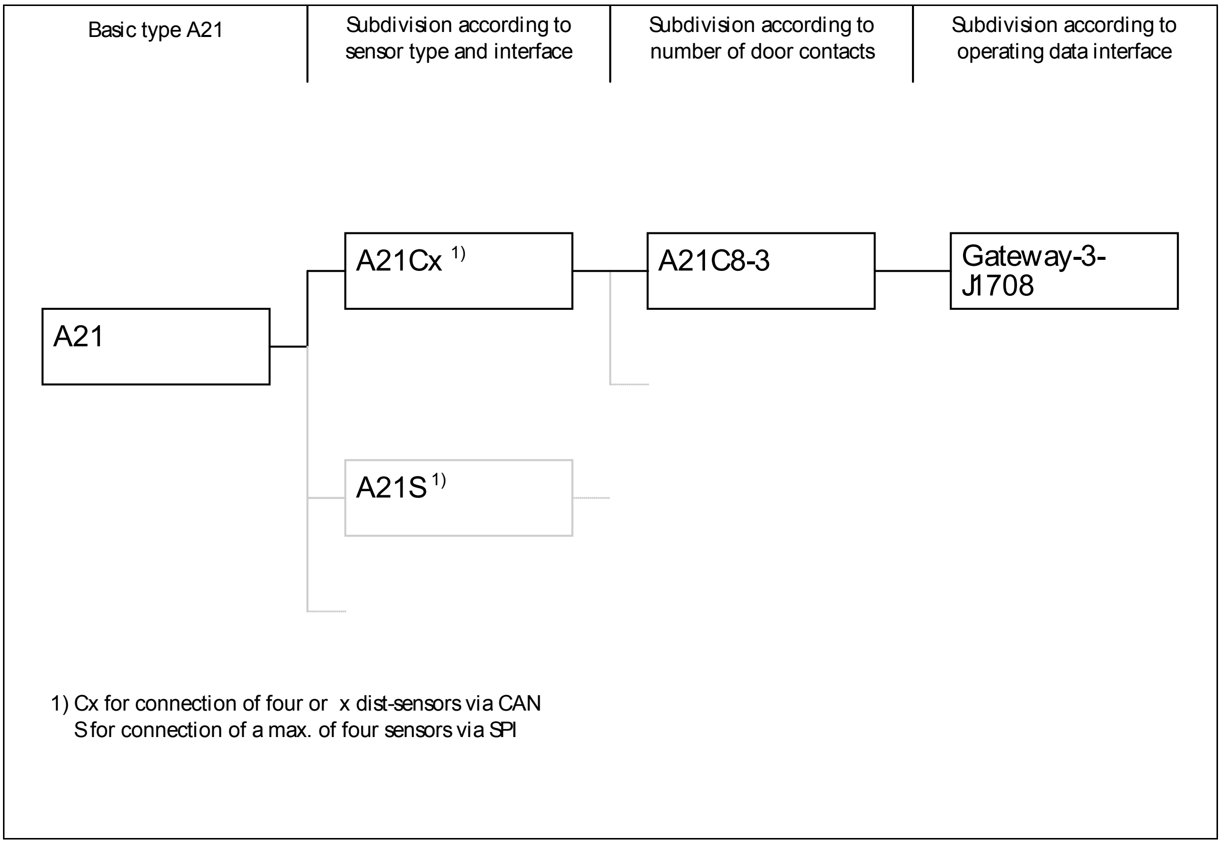


**Fig. 1: Position of the gateway within the analyzer family (excerpt)**

## 1.6 Views on the device, photographs (example)

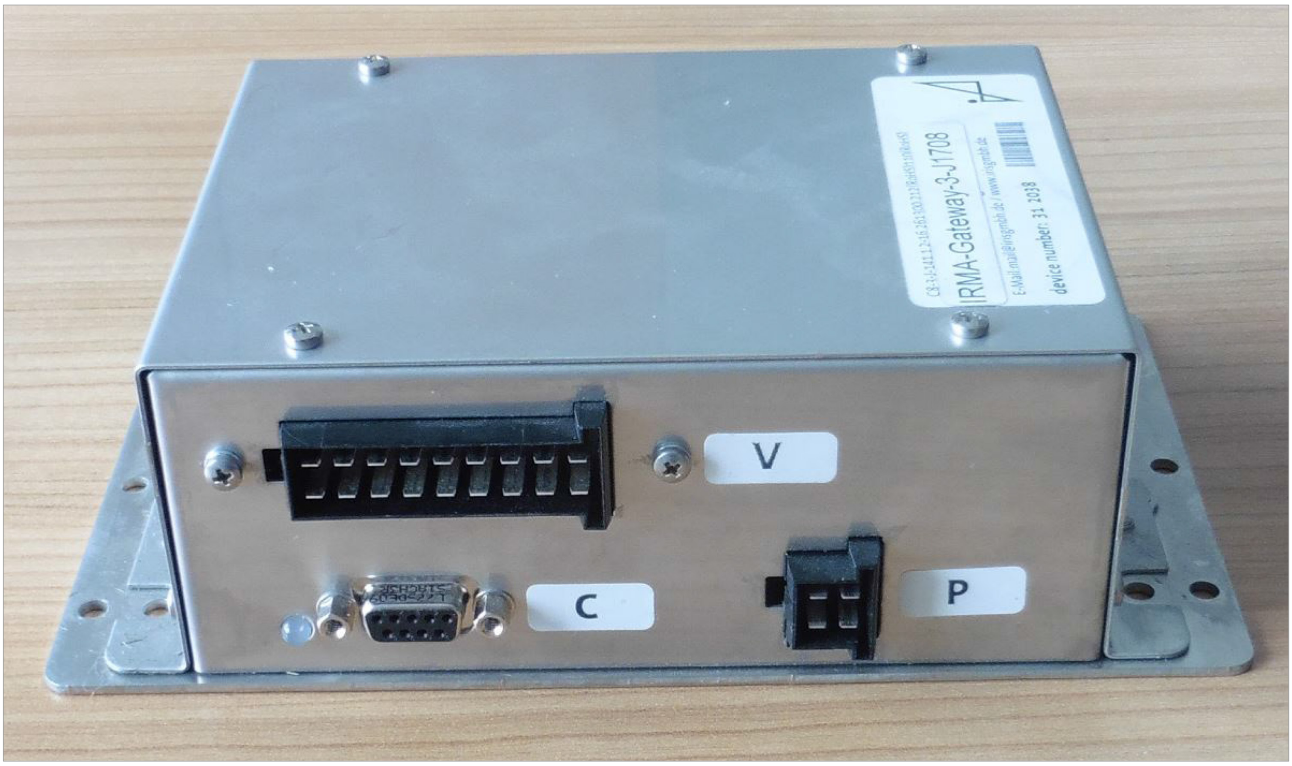


**Fig. 2: View on IRMA-Gateway-3-J1708 operating interfaces and name plate**


**Fig. 3:** **View on IRMA-Gateway-3-J1708 CAN connector**

## 1.7 Name plate (example)

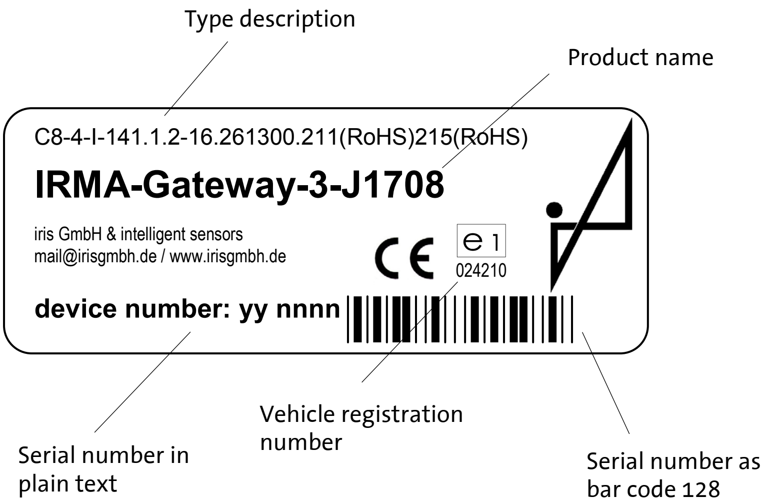


**Fig. 4:** **Name plate (example)**

### 1.7.1 Formation of type descriptions (excerpt)

a(a)-3-J-ccc.1.2-16.2613rr.210100

| | | | |
|---|---|---|---|
| a(a) | = | C: | A21C for a maximum of four sensors |
| | = | C8: | A21C8 for a maximum of eight sensors |
| 3 | = | 3 door inputs | |
| J | = | J1708 | |
| ccc | = 141: | Housing version 1.41, four-part, IP30, base plate V1.41 | |
| rr | = 00: | no logger memory, without real time clock | |
| bbb | = 210: | PCB „LPBG-A21C210“ | |
| | = 211: | PCB “LPBG-A21C211” | |
| 100 | = | Interface module „LPBG-A21-J100“ | |

e.g. **C-3-J-141.1.2-16.261300.211100**

# 2 Brief description

The gateway IRMA-Gateway-3-J1708 is a central component of the “IRMA” passenger counting system. It is used in public transport such as in busses or trains. Exiting and entering passengers are detected by means of sensors mounted at each door and their numbers are summed up for each stop or station. The counting data is sent via CAN from IRMA MATRIX to the gateway. Data query by the on-board computer takes place via J1708.

Depending on the type of device, up to 8 sensors of type IRMA MATRIX may be connected. They are mounted either singly or in pairs on small or wide doors. All sensors are connected to the gateway via a common shielded cable. Exchange of data complies with the CAN standard (Controller Area Network). A linear wiring scheme is used, with the sensors being hooked up via distributors and short branch lines.

The length of the electric BUS may be 30m, with length depending on the type of cable used, number of sensors and the bit rate (specification during project design). The “CAN” connector then provides for connection to the analyzer. (Sensor interface “CAN“, p. 23)

Detection of door states (counting start/stop) is achieved with three galvanically separated switching inputs (interface “V”). These may be connected to an external source of control voltage, specific to the on-board power supply, or to potential-free switches – in such cases making use of auxiliary voltage provided by the device (the so-called door voltage). Connection is made using unshielded single wires.

For transmission of counter data to the on-board computer a galvanically separated data interface is available (also via the “V” interface) – in this case of type „J1708“. Connection is made via unshielded wiring, the individual wires being stranded in pairs. Shielded wires may also be used if appropriate. (Operating interface, connector „V“, p. 16)

The separate “P” connector serves as connection to the on-board network. A DC-DC-transformer with galvanic separation from the on-board supply provides the complete system with the electric power required. It generates internal logic voltage as well as sensor supply voltage.

In addition, a RS232 service interface “C”, which is not galvanically separated, is also available. It is not active in normal operations and is used for configuration and software download as required. (Service interface, connector „C“, p. 20)

A two-color light emitting diode (LED) is used to signal the various operating states. (LED State Indication, p. 26)

The gateway and its components are of modular design and has a certain PCB interface module specific to its type. All components are mounted in a stainless-steel housing.

The PCB is provided with a central power supply, a processing kernel, consisting of a micro controller and memory, the CAN line driver, and the RS232 service interface.

The interface module contains the J1708 operating data interface to the on-board computer and 3 potential-free signal inputs. It moreover generates the door voltage.

A firmware controls the interaction of the individual components. PC software tools facilitating configuration and visualization are available. (Firmware, Software, p. 26)

# 3 Block Diagrams

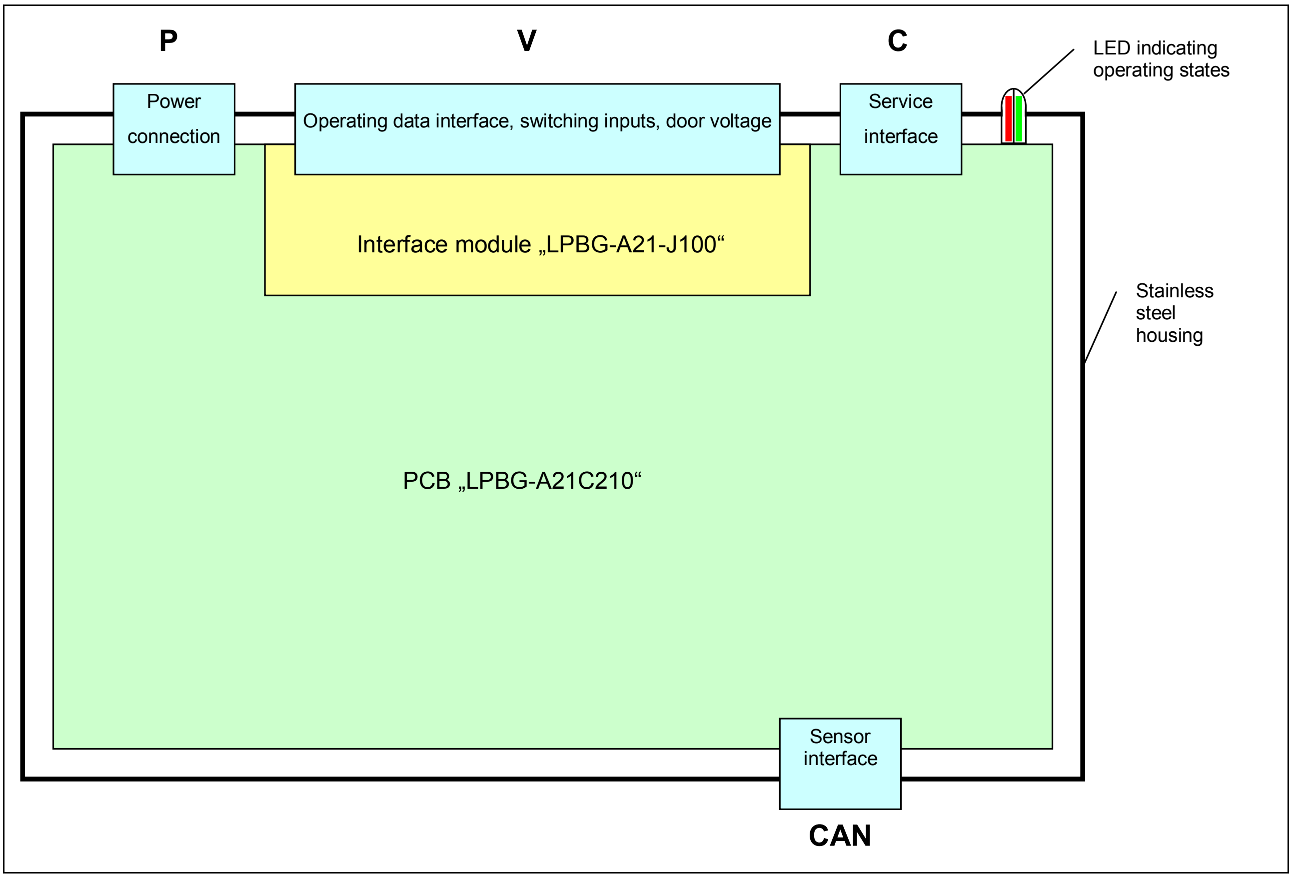


**Fig. 5: Overview of interfaces**

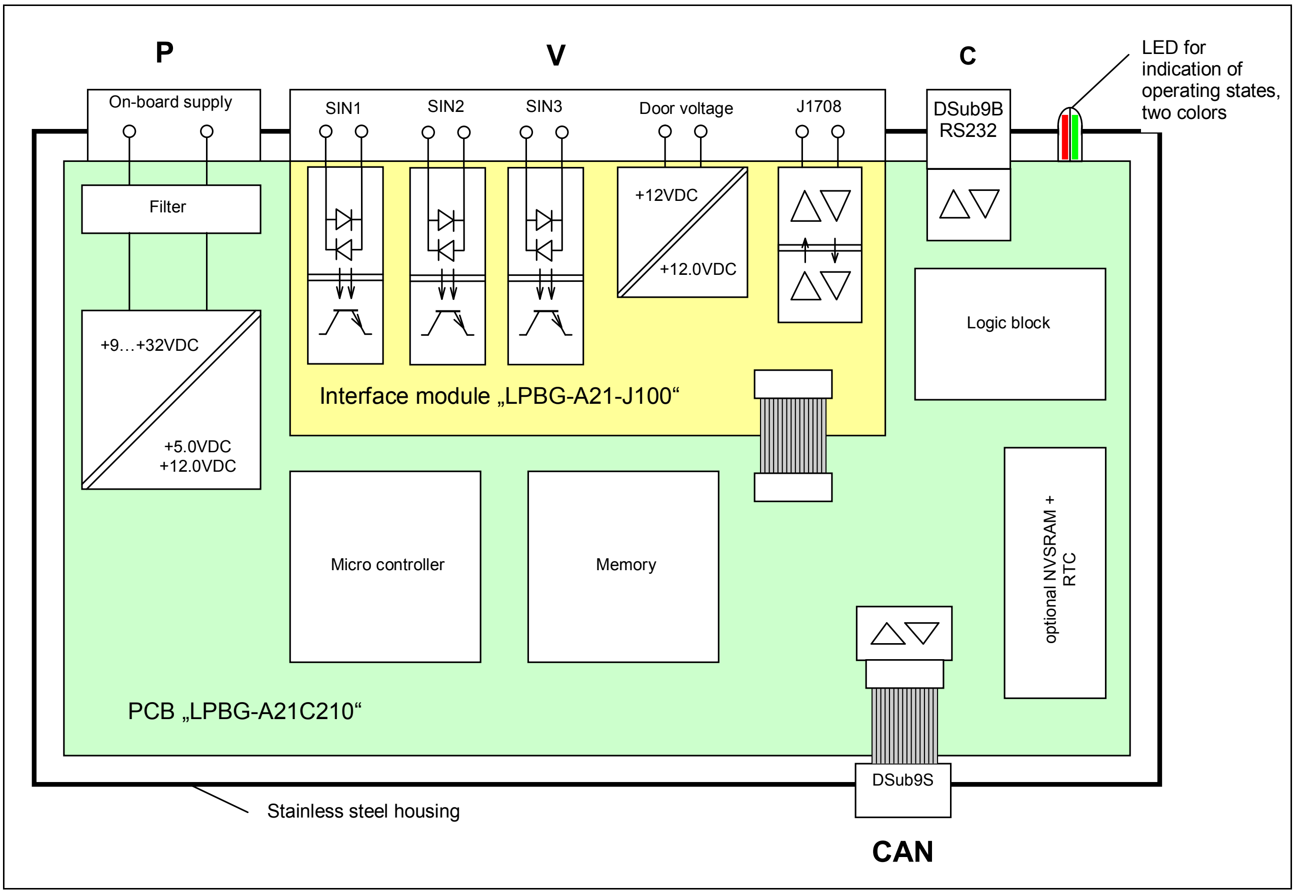


**Fig. 6:** **Internal components**

# 4 General Technical Data, Operational Parameters

**Table 1:** **General Technical Data, Summary**

| **Parameter** | **Symbol** | **Value** | **Notes** |
|---|---|---|---|
| **Operational conditions** | | | |
| Supply voltage | $U_{VP}$ in VDC | 9…32 | 12V- or 24V-car battery, galvanic separation allowable voltage fluctuation acc. to car guideline 2004/104EC, Load dump protection acc. to SAE J1455 Aug.94 |

| | | | |
|---|---|---|---|
| Permissible voltage fluctuation according to motor vehicle standard 2004/104EG | | | |
| Load-dump protection according to SAE J1455 Aug.94 | | | |
| Insulation voltage endurance | $V_{iso}$ in kVAC | 1.0 | Guaranteed minimum value for all galvanic separations |
| Operating temperature range | $T_A$ in °C | -25 ... +70 | Non condensing |
| Relative humidity | RLF in % | ≤ 95 | Non condensing |
| **Protection class** | | | |
| MTBF | h | ≥300,000 | At 25°C ambient temperature |
| **Storage, transportation** | | | |
| Temperature range | $T_A$ in °C | -40 ... +85 | |
| Relative humidity | RLF in % | ≤95 | Non condensing |
| **General information** | | | |
| Weight | in g | 950...1000 | Depending on installed features |
| Overall dimensions | LxWxH in mm | 198 x 125 x 60 | Over all |
| Housing material | | Stainless steel 1.4301 | Casing 1mm sheet steel, base plate 2mm sheet steel |

# 5 Standard compliance

**Table 2: Standard Compliance**

| **Standard compliance, device tests** | | | |
|---|---|---|---|
| **Area** | **Standard, classification** | **Notes** | **Test report** 1) |
| Railways | DIN EN50121-3-2 | EMC | |
| | DIN EN50155 | Operating conditions | |
| | DIN EN 61373: 2011-04, category 1, class A | Vibrations, shocks | |
| Cars | Motor car guideline 2006/28/EC | EMC | |
| | J1455 | Load dump | |

| | | | |
|---|---|---|---|
| | | transients protection on power line | |
| | EN60721-3-5, Klasse 5M2 | Vibrations, shocks | |
| 1) Without indication of a test report, any references to technical standards must be considered design objectives, and their confirmation by pertinent reviews is still pending (as of: 10.03.2008). | | | |

**Table 3: Certification marks**

| **Mark** | **Approval number** |
|---|---|
| open | open |

# 6 Interfaces

## 6.1 Power supply, “P” connector

The device IRMA-Gateway-3-J1708 has been designed for use with the 12- or 24V on-board voltage of railways or motor car systems. The on-board voltage is being conditioned by means of peak voltage filter, polarity protection, and uninterruptible power supply features. A DC-DC-transformer is used for the supply of any required voltage levels under galvanic separation. The DC-DC-transformer itself is fitted with an input power limiter and thermal overload protection. A time-lag fuse safeguards the input in the event of the transformer being defect.

The on-board supply connection is made using a four-pole knife-blade connector “P” (Power). The internal bridging between two respective contacts allows for forwarding.

## 6.1.1 Connector

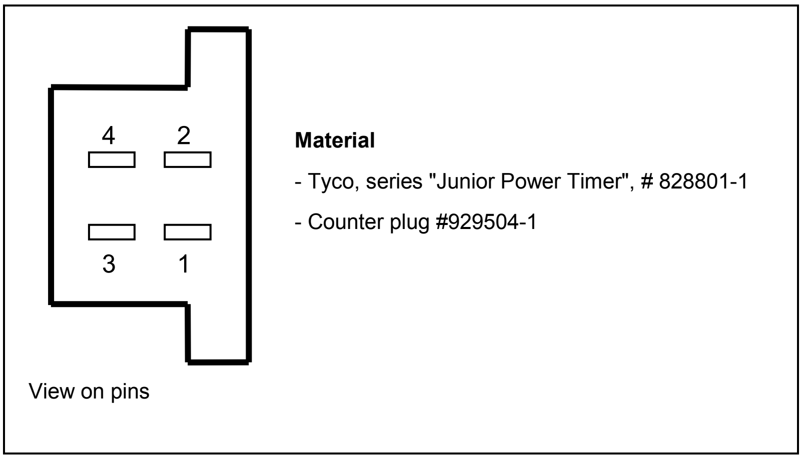


**Fig. 7:** **"P" connector**

**Table 4:** **Connector assignment, power connector “P”**

| Pin | Signal name | Type | Application | Notes |
|---|---|---|---|---|
| 1, 3 | VP | Input | Power supply, positive pole | Galvanic separation from housing and electronic components |
| 2, 4 | GNDVP | Input | Power supply, negative pole | |

## 6.1.2 Pin description, signal names

**Supply voltage input "VP, GNDVP"**

The supply voltage to be connected to input "VP" against "GNDVP" (**V**oltage**P**ower or **G**rou**ndV**oltage**P**ower) powers a galvanically separated DC-DC-transformer.
The protection against transient currents is implemented by means of a varistor and an electronic peak voltage cut-off system.
The input is provided with polarity protection.

## 6.1.3 Electrical parameters

**Table 5: Power supply “P”, limiting values / power rating**

| **Limiting values / power rating ($T_A$ = 25°C, if not stated otherwise)** | | | | |
|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **max** | **Conditions / notes** |
| Supply voltage | $V_{VP}$ in VDC | -36 | +36 | t ≤1min, $R_{Source}$ = 0Ω |
| | | -50 | +50 | t ≤10s, $R_{Source}$ = 0Ω |
| | | -150 | +150 | Pulse shaped, τ = 0.4s, $R_{Source}$ = 0.8Ω 1) |
| Transients absorption capacity | $W_{max}$ in J | | 20 | Varistor in the DC-SV input cut-off at 200V @ 50A, 2ms |
| Insulation voltage endurance | $V_{iso}$ in kVAC | | 1.0 | All potentials/single wires against chassis or against the other interfaces |
| Burst, all contacts | $V_s$ in kV | -2.0 | +2.0 | 5/50ns, 5kHz, strand-strand, strand-chassis |
| Surge, all contacts | Vs in kV | -2.0 | +2.0 | 5/50µs,100Ω, strand-strand, strand-chassis |
| ESD, all contacts | Vs in kV | -4/-8 | +4/+8 | Contact/air, 150pf, 330Ω, repeat time ≥ 1s |
| 1) Load dump impulse acc. to SAE-J1455 | | | | |

**Table 6: Power supply “P”, electrical operating parameters**

| **Specification / operating parameters ($T_A$ = 25°C, if not stated otherwise)** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **Type** | **max** | **Conditions / notes** |
| Insulation resistance | in MΩ | 100 | | | All potentials, single strands against chassis |
| Insulation capacity | in nF | | 4.7 | | Strand against chassis |
| | | | | | |
| **Supply voltage** | | | | | |
| Full load range | $V_{VP}$ in V | 9.0 | | 32.0 | $P_{out,DCDC,total}$ ≥ 9W 1), $T_{Analyzer\ housing}$ ≤70°C |
| Peak load range | | 18.0 | | 32.0 | $P_{out,DCDC,total}$ ≥ 14W, without heat dispersion Lp-base plate with time limit |
| Start-up range | | 8.5 | | 33.0 | Start-up voltage |
| Holding range | | 7.0 | | | At partial load 4 sensors, input current limiter active |
| | | | | 50.0 | with time limit provided by thermal cut-off depending on load |

| | | | | | |
|---|---|---|---|---|---|
| Outage compensation time | $t_{ü}$ in ms | 10<br>20 | | | C210: $P_{out,DCDC,total}$ = 9W, VVP = 24V<br>C211: $P_{out,DCDC,total}$ = 9W, VVP = 24V |
| Power consumption | $I_{VP}$ in A | | 0.5 | | $V_{VP}$ = 12V, 4 sensors 1W each, no |
| | | | 0.25 | | $V_{VP}$ = 24V, 4 sensors 1W each, no |
| | | | 0.5 | | $V_{VP}$ = 24V, 8 sensors 1W each, no |
| | | | 1.4 | | $P_{out,DCDC,max}$ = 9W, $V_{VP}$ = 9V |
| | | | 1.0 | | $P_{out,DCDC,max}$ = 10W, $V_{VP}$ = 12V |
| | | | 0.5 | | $P_{out,DCDC,max}$ = 10W, $V_{VP}$ = 24V |
| Permanent residual current | | | | 5.0 | In case of a defect for $t \rightarrow \infty$, internal time-lag fuse |
| Inrush current | | | 8.0 | 10.0 | t < 10ms, current limiter activated |
| **1)** $P_{out,DCDC,max}$ is the maximum permanent output power of the DC-DC-transformer. The energy provided is divided up between the micro controller kernel (approx. 1W), the interface module (approx. 1W) and the sensors. | | | | | |

## 6.2 Operating interface, „V“ connector

The signals for registration of door states and the connection to the on-board computer are realized via the connector “V” (vehicle). Connection is made chiefly by means of unshielded cables – single strands for the door signals and stranded and sheathed pairs of wire for the J1708 data interface (for details refer to “Installation", p. 30).

### 6.2.1 Connector

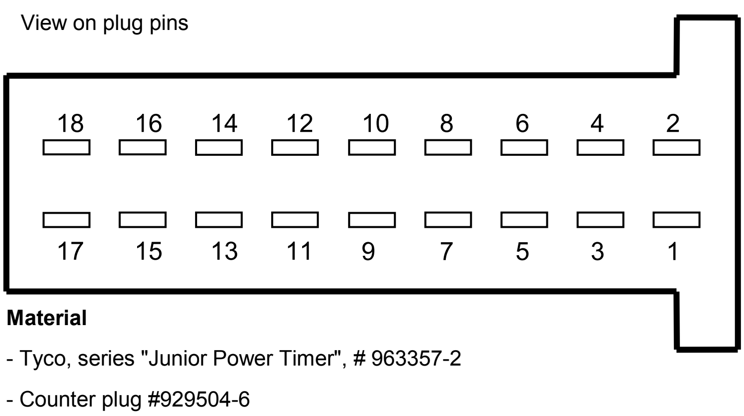


**Fig. 8:** **"V" connector**

## 6.2.2 Pin description, signal names

**Table 7: Operating interface "V", signals and names**

| Pin | Name | Type | Application | Notes |
|---|---|---|---|---|
| 1 | | | not connected | |
| 2 | CHGND | | Mass | Vehicle potential |
| 3 | J1708+ | I/O | Data, positive pole | With potential separation |
| 4 | J1708- | I/O | Data, negative pole | |
| 5, 6 | GNDISO | | Reference potential J1708 | |
| 7, 11, 15 | GNDVD | Output | Door voltage, negative pole | Auxiliary voltage output with potential separation 12V, R≥100Ω, short-circuit proof |
| 9, 13, 17 | VD | Output | Door voltage, positive pole | |
| 8 | SIN3b | Input | Switching input 3, contact "b" | With potential separation, independent of polarity |
| 10 | SIN3a | Input | Switching input 3, contact "a" | |
| 12 | SIN2b | Input | Switching input 2, contact "b" | With potential separation, independent of polarity |
| 14 | SIN2a | Input | Switching input 2, contact "a" | |
| 16 | SIN1b | Input | Switching input 1, contact "b" | With potential separation, independent of polarity |
| 18 | SIN1a | Input | Switching input 1, contact "a" | |

**Door voltage "VD, GNDVD"**

The device supplies an auxiliary voltage, which is short-circuit proof and galvanically separated, for control of the switching inputs when potential-free contacts are being used. It is resilient to inadvertent connection to the on-board voltage.

It must be noted that when the door voltage is used for one or more switching inputs, the potential separation between them is cancelled.

**Switching inputs "SINx"**

The switching inputs "SINx" (SSM input) are potential-free, optically separated, digital control units. They are regularly used as door signal inputs. The polarity of the control voltage is of no importance, i.e. the input operates independent of current direction. The additional designation as “a” or “b” is for organizational purposes only.

The input resistance is achieved by connecting in parallel one 22kΩ resistor and a current sink. In a voltage-less state, the ohmic resistance serves as basic load (for “ringing out” the line) and the current sink acts as voltage dependent resistor. The input resistance increases with rising control voltage. In this manner, rising power losses at high control voltages are avoided. On the other side, a certain minimum current flows, when control voltage is low, in order e.g. to safeguard proper functioning of the line break monitoring (R≤1.7kΩ @ 4.6V).

**Data lines "J1708+, J1708-, GNDISO"**

A 2-wire port is provided for serial communication with the on-board computer. The hardware pin out, level, timing, etc. comply with the standard J1708.

The interface is designed with potential separation, short-circuit proof and protected against inadvertent connection to on-board voltage.

The connection via "J1708+" and "J1708-" is sufficient for the communication. Additional connection of reference mass „GNDISO“ is not required. The advantages and disadvantages of connection must be specifically reviewed for each application.

**Potential "CHGND"**

When shielded cables are used (not strictly required), the shield may be connected to the pin "CHGND", which is internally connected to the housing.

In order to avoid ground loops a single-sided connection of the shield may be more favorable. This must be reviewed for each application.

### 6.2.3 Electrical parameters

**Table 8: Operating interface “V”, limiting value / power rating**

| **Limiting values / power rating ($T_A$ = 25°C, if not stated otherwise)** | | | | |
|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **max** | **Conditions / notes** |
| **all connections** | | | | |
| Burst, all contacts | Vs in kV | -2.0 | +2.0 | 5/50ns, 5kHz, strand-strand, strand-chassis |
| Surge, all contacts | Vs in kV | -2.0 | +2.0 | 5/50µs,100Ω, strand-strand, strand-chassis |
| ESD, all contacts | Vs in kV | -4/-8 | +4/+8 | Contact/air, 150pf, 330Ω, repeat time ≥ 1s |
| Insulation voltage endurance | $V_{iso}$ in kVAC | | 1.0 | Potential against any other potential |
| **Switching inputs "SINxa, b"** | | | | |
| Electric surge strength | $V_{max,SIN}$ in VDC | -48 | +48 | t →∞, $R_{Source}$ = 0Ω |
| | | -54 | +54 | t ≤1min, $R_{Source}$ = 0Ω |
| | | tested with SINa against SINb | | |
| **Door voltage "VD-GNDVD"** | | | | |

| | | | | |
|---|---|---|---|---|
| Electric surge strength | $V_{max,VD}$ in VDC | -32 | +48 | t →∞, $R_{Source}$ = 0Ω |
| | | -32 | +54 | t ≤1min, $R_{Source}$ = 0Ω |
| | | tested with VD against GNDVD | | |
| Transients absorption capacity | $W_{max}$ in J | | 1.2 | 48V-Transguard, 1210 |
| **J1708-Interface "J1708+, -"** | | | | |
| Electric surge strength | $V_{max,J1708}$ in VDC | -0.4 | +30 | t →∞, $R_{Source}$ = 0Ω |
| | | -0.4 | +36 | t ≤1min, $R_{Source}$ = 0Ω, strand against strand, strand against GNDISO |
| | | tested with strand against strand and strand against GNDISO | | |
| Transients absorption capacity | $W_{max}$ in J | | 0.1 | 30V-Transguard, 0805 |
| Note: The values shown have been specified by design. However, they were not always subjected to review, since they are not in all cases subject to normative testing. | | | | |

**Table 9: Operating interface “V”, electrical operating parameters**

| **Specification / operating parameters ($T_A$ = 25°C, if not stated otherwise)** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **Type** | **max** | **Conditions / notes** |
| Insulation resistance | $R_{iso}$ in MΩ | 100 | | | Between separate potentials |
| Insulation capacity | $C_{iso}$ in nF | | 4.7 | | Between separate potentials |
| | | | | | |
| **Switching inputs "SINxa,b"** | | | | | |
| Switching voltages | $V_{in}$ in V | -6.5 | | +6.5 | For logical L, for P2.0x ≥ 4.5V |
| | | | ±7.5 | | Turning point, for P2.0x ≈ 2.5V |
| | | -32.0 | | -8.5 | For logical H, for P2.0x ≤ 0.5V |
| | | +8.5 | | +32.0 | |
| | | the transition area between H and L and vice versa is undefined and is considered as “out of limits” area (switching input) | | | |
| Max Switching frequency | $f_{sw}$ in kHz | | | 1.0 | |
| Input resistance | $R_{in}$ in kΩ | | 22 | | $V_{in}$ = 0V |
| | | | 1.2 | | $V_{in}$ = 4.6V |
| | | | | 1.7 | $V_{in}$ = 4.6V and $T_A$=-25...85°C |
| | | | 1.1 | | $V_{in}$ = 6.5V |
| | | | 1.3 | | $V_{in}$ = 8.5V |
| | | | 1.8 | | $V_{in}$ = 12.0V |

| | | | | | |
|---|---|---|---|---|---|
| | | | 2.9 | | $V_{in}$ = 24.0V |
| | | | 3.3 | | $V_{in}$ = 32V |
| **Auxiliary voltage output / door voltage "VD-GNDVD"** | | | | | |
| Output voltage | $V_{VD}$ in V | | 25.0 | 32.0 | Idle |
| | | | 14.0 | | $R_{Load}$ = 3 switching inputs |
| | | | 9.5 | | $R_{Load}$ = 220Ω |
| Short-circuit current | $I_{max,VD}$ in mA | | | 150 | Permanent, protection by PTC |
| **Data interface "J1708+, -"** | | | | | |
| Output voltage H [1)] | $V_{J1708+}$ in V | | 4.85 | | Against GNDISO |
| | $V_{J1708+}$ in V | | 0.1 | | Against GNDISO |
| Output voltage L [1)] | $V_{J1708+}$ in V | | 0.7 | | Against GNDISO, bus lines open |
| | $V_{J1708+}$ in V | | 4.2 | | Against GNDISO, bus lines open |
| Baud rate | Baud | | | 9600 | According to J1708 standard |
| 1) measured at MAX3442 | | | | | |

## 6.3 Service interface, “C” connector

The service interface is a serial communications interface to the PC according to the RS232 standard. It is used mainly in start-up, configuration, and maintenance of the device. The interface is not galvanically separated.
An auxiliary voltage output (pin_6) is available for current supply to e.g. interface converter devices.

PC connection is implemented using a shielded 1:1-line (straight-through-extension, iris delivery no.: K-A21-C-RS232-01).

### 6.3.1 Connector

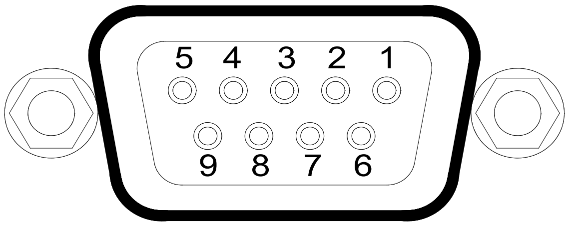


**Fig. 9: DSub9-socket, view on pin out**

**Table 10: Service interface “C”, pin out**

| Socket | Signal name | Type | Application | Notes |
|---|---|---|---|---|
| 1 | | | | Not connected |
| 2 | RD | Output | Read Data Line | |
| 3 | TD | Input | Transmit Data Line | |
| 4 | DTR | Input | Data Terminal Ready | Selection of service/mode of operation |
| 5 | GND | | | |
| 6 | +12V | Output | Auxiliary voltage output | Max 100mA |
| 7 | RTS | Input | Request To Send | |
| 8 | CTS | Output | Clear To Send | |
| 9 | | | | Not connected |
| Housing | GND | | Chassis | Shield |

### 6.3.2 Pin description, signal names

**Data lines "RD" and "TD"**

As a minimum, the lines “RD” (PC reading) and “TD” (PC sending) are required for data communications.

### Handshake lines "RTS" and "CTS"

Both of these lines signal to the opposite device the request (RTS) and the readiness (CTS) to send.

### Control line "DTR"

The control input “DTR” is used for signalling and switching between modes of operation.

| | |
|---|---|
| Counter mode (normal operations) | $U_{DTR}$ = L or open |
| Boot mode (configuration) | $U_{DTR}$ = H |

### Auxiliary voltage output +12V

The interface converters directly connected to the RS232 interface are powered through a line protected against over-current.

**Table 11: Service interface “C”, limiting values / power rating**

| Limiting values / power rating ($T_A$ = 25°C, if not stated otherwise) | | | | |
|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **max** | **Conditions / notes** |
| **Signal lines** | | | | |
| Max Voltage at the outputs RD, CTS | $V_{max}$ in V | -13.2 | +13.2 | |
| Max Voltages at the inputs TD, RTS, DTR | $V_{max}$ in V | -25.0 | +25.0 | |
| **Auxiliary voltage output** | | | | |
| Max Voltage | $V_{max}$ in V | -0.4 | +30.0 | t→ ∞, due to varistor and polarity protection diode |
| **Shield** | | | | |
| Burst | $V_s$ in kV | -2.0 | +2.0 | 5/50ns, 5kHz |
| Surge | $V_s$ in kV | -2.0 | +2.0 | 5/50µs, 100Ω |
| **all pins and shield** | | | | |
| ESD | $V_s$ in kV | -4/-8 | +4/+8 | Contact/air, 150pf, 330Ω, repeat time ≥ 1s |
| Notes:<br>- Further information regarding limiting values is provided in the Maxim data sheet "MAX3223E" and the standard EIA/TIA-232-F.<br>- The RS232 signals are not or only conditionally resilient to permanent connection of the 12/24V on-board supply.<br>- The values shown have been specified by design. However, they were not always subjected to review, since | | | | |

they are not in all cases subject to normative testing.

**Table 12: Service interface “C”, electrical parameters**

| **Specification / operating parameters ($T_A$ = 25°C, if not stated otherwise)** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **Type** | **max** | **Conditions / notes** |
| Baud rate | Baud | 300 | | 34800 | All standard baud rates within range |
| **Data lines** | | | | | |
| Sender output voltage RD, CTS | $V_o$ in V | 5.0 | 5.4 | | |
| Input voltage range, recipient, TD, RTS, DTR | $V_{in}$ in V | -25 | | +25 | |
| Trigger threshold, recipient TD, RTS, DTR | $V_{in}$ in V | 0.8 | 1.5 | | Or open for logical L |
| | | | 1.8 | 2.4 | For logical H |
| | | Type 300mV hysteresis for switch-over, typ. 5kΩ input resistance | | | |
| **Auxiliary voltage output** | | | | | |
| Output voltage | $V_{+12V}$ in V | 11.0 | | 12.25 | |
| Output current | $I_{+12V}$ in mA | | | 100 | Via polyswitch 200mA |

For selection of the boot mode, the DTR level must be kept to H level at the time of voltage connection. During normal operation the pin remains open or it must be connected to L (ground).

## 6.4 Sensor interface "CAN"

For connection of 1 to 8 distance sensors (depending on the type of gateway) a four-wire shielded CAN BUS system is used (2 x signal, 2 x power). The maximum supported number of sensors depends on the available power i.e. the power requirements of the sensors themselves and the system features.

The BUS system is of linear structure, and the sensors are connected via short branch lines (30cm max.) and distributing connectors. 120Ω termination must be provided on both outmost system line ends between CAN_H and CAN_L. Alternatively, in the case of a fixed installation, wiring boxes can be used instead of distribution connectors ; the stubs can then be extended by using the six-wire technique.

The achievable electrical BUS length depends on the bit rate, a typical value is 30m with 1MBits-1, 4 sensors and 0.25mm² wire cross-section. The physically attainable BUS length is shorter than the electrical BUS length, here it is necessary to take the length of the stubs into account (they are doubled).

The achievable distance can be almost doubled by reducing the bit rate and using cables with a larger core cross-section.

### 6.4.1 Connector

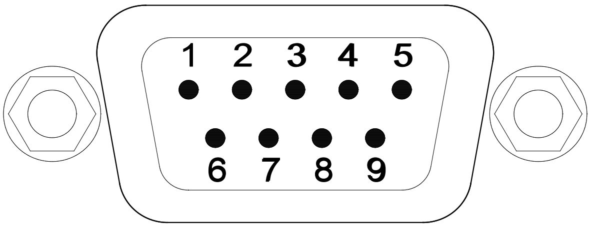


**Fig. 10:** **Sketch of the sensor interface "CAN"**

**Table 13:** **Sensor interface "CAN", pin out**

| Pin | Signal name | Type | Application |
|---|---|---|---|
| 1 | NC | | not connected |
| 2 | CAN_L | IO | CAN signal L |
| 3 | CAN_GND | | Ground |
| 4 | NC | | Not connected |
| 5 | NC | | Not connected |
| 6 | CAN_GND | | Ground |
| 7 | CAN_H | IO | CAN signal H |
| 8 | NC | | Not connected |
| 9 | CAN_V+ | Power | Power supply, sensors |
| 10 | NC | | Not connected |

## 6.4.2 Electrical parameters

**Table 14: Sensor interface “CAN”, limiting values / power rating**

| Specification / operating parameters ($T_A$ = 25°C, if not stated otherwise) | | | | |
|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **max** | **Conditions / notes** |
| **Sensor power supply CAN_V+** | | | | |
| Sensor supply voltage | $V_{CAN\_V+}$ in VDC | -0.6 | +30 | t → ∞, $R_{Source}$ = 0Ω, max. permanent voltage , varistor |
| | | -0.6 | +35 | t ≤1min, $R_{Source}$ = 0Ω, limitation by varistor |
| Transients absorption capacity | $W_{max}$ in J | | 0.1 | Capping by varistor at 65V @ 2A |
| **Data "CAN_H" and "CAN_L"** | | | | |
| Electric strength | $V_{CAN\_H,}$ $V_{CAN\_L,}$ in VDC | -27 | +30 | t → ∞, $R_{Source}$ = 0Ω, max. permanent voltage, varistor |
| | | -27 | +35 | t ≤1min, $R_{Source}$ = 0Ω, limitation by varistor |
| Transients absorption capacity | $W_{max}$ in J | | 0.1 | 30V-Transguard, 0805 |
| **Shield** | | | | |
| Burst | $V_s$ in kV | -2.0 | +2.0 | 5/50ns, 5kHz |
| Surge | $V_s$ in kV | -2.0 | +2.0 | 5/50µs, 100Ω |
| **all pins and shield** | | | | |
| ESD | $V_s$ in kV | -4/-8 | +4/+8 | Contact/air, 150pf, 330Ω |
| Notes: The values shown have been specified by design. However, they were not always subjected to review, since they are not in all cases subject to normative testing. | | | | |

**Table 15: Service interface “CAN”, electrical parameters**

| Specification / operating parameters ($T_A$ = 25°C, if not stated otherwise) | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **min** | **Type** | **max** | **Conditions / notes** |
| **Sensor power supply CAN_V+** | | | | | |
| Sensor supply voltage | $V_{CAN\_V+}$ in V | 12.0 | 13.5 | 14.0 | At least one sensor (1W) as load |
| | | 12.0 | 13.3 | | 8 sensors as load |
| | | | | 17.8 | Idle |
| Device drive current | $I_{CAN\_V+}$ in A | | | 0.71 | $T_i$ = 70°C, (polyswitch 1.1A) |

| | | | | | |
|---|---|---|---|---|---|
| **Data "CAN_H" and "CAN_L"** | | | | | |
| Capacity CAN_L, CAN_H against CAN_GND | C in pF | | 100 | | Provided by transguards |
| Line connection CAN_L against CAN_H | Z in kΩ | | 3.0 | | T-network 2x 1.5kΩ in series, center point with 100nF against CAN_GND |
| Signal voltages | Vo in V | 0 | | 5.25 | Refer to Philips data sheet TJA1040 |
| Baud rate | in kBaud | | | 1000 | |

# 7 LED State Indication

The following operating states are identified by means of light color:

**Table 16:** **LED indication, colors and states**

| **Color** | **Operating state** |
|---|---|
| Off | Nonworking |
| Red | Reset during voltage connection, initialization |
| Yellow | Configuration mode (initial boot mode) |
| Green | Operational readiness, counting method |

# 8 Firmware, Software

The firmware (software on the gateway) controls the interaction of the individual components.

The IRMA MATRIX sensor generates the passenger count data itself (it has a firmware and all necessary configurations). IRMA MATRIX transmits these counting results via CAN to the gateway, which converts the counting results into another protocol (IBIS) and sends them to the on-board computer via the VDV 300 interface. Here, the count data can be processed further.
This firmware is already loaded on delivery, but can be loaded or overwritten at any time via the "C" interface.

Firmware examples:

- GDIST500_AA21C_CU1-6.00-20130528.HEX
- GDIST500_AA21C_CU2-6.00-20130528.HEX

- GDIST500_AA21C_CU3-6.00-20130528.HEX
- GDIST500_AA21C_CU4-6.00-20130528.HEX

For software loading and configuration, software tools are provided for the PC - downloadable as a "IRMA-Setup_Release_5.1.9_User" package from: https://www.irisgmbh.de/technischedokumente/service-software / .

# 9 Device Drawings

Note: The drawings are not to scale; Figures indicate millimeters.

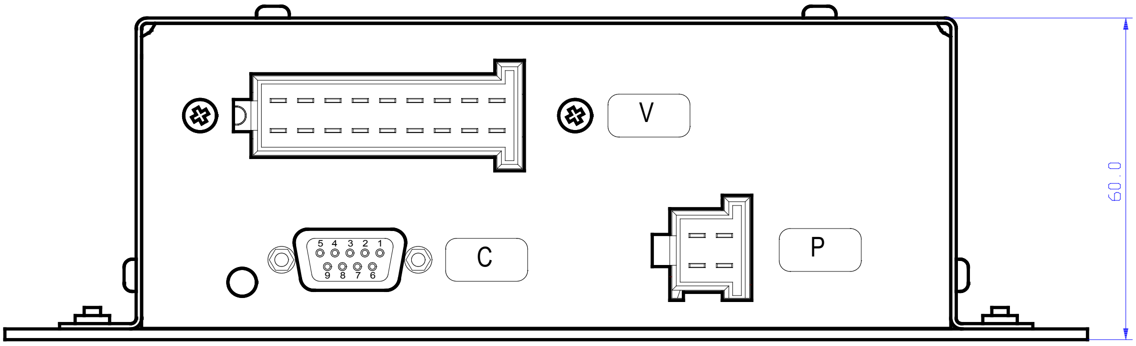


**Fig. 11: View on connector, operating interface IRMA-IRMA-3-J1708**

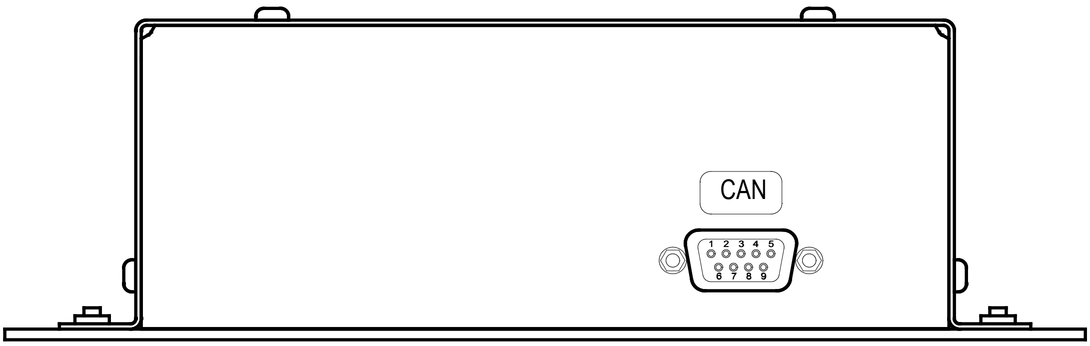


**Fig. 12: Back view IRMA-IRMA-3-J1708**

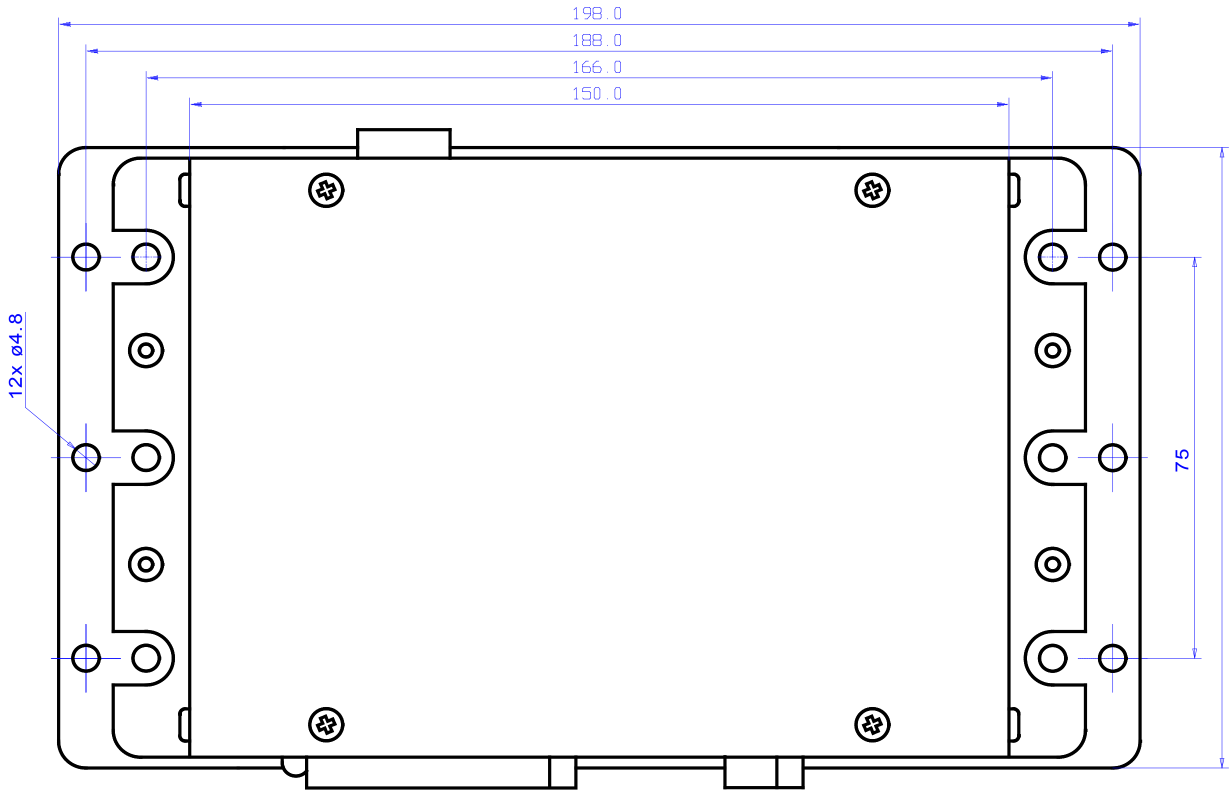


**Fig. 13:** **Top view IRMA-IRMA-3-J1708, mounting holes**

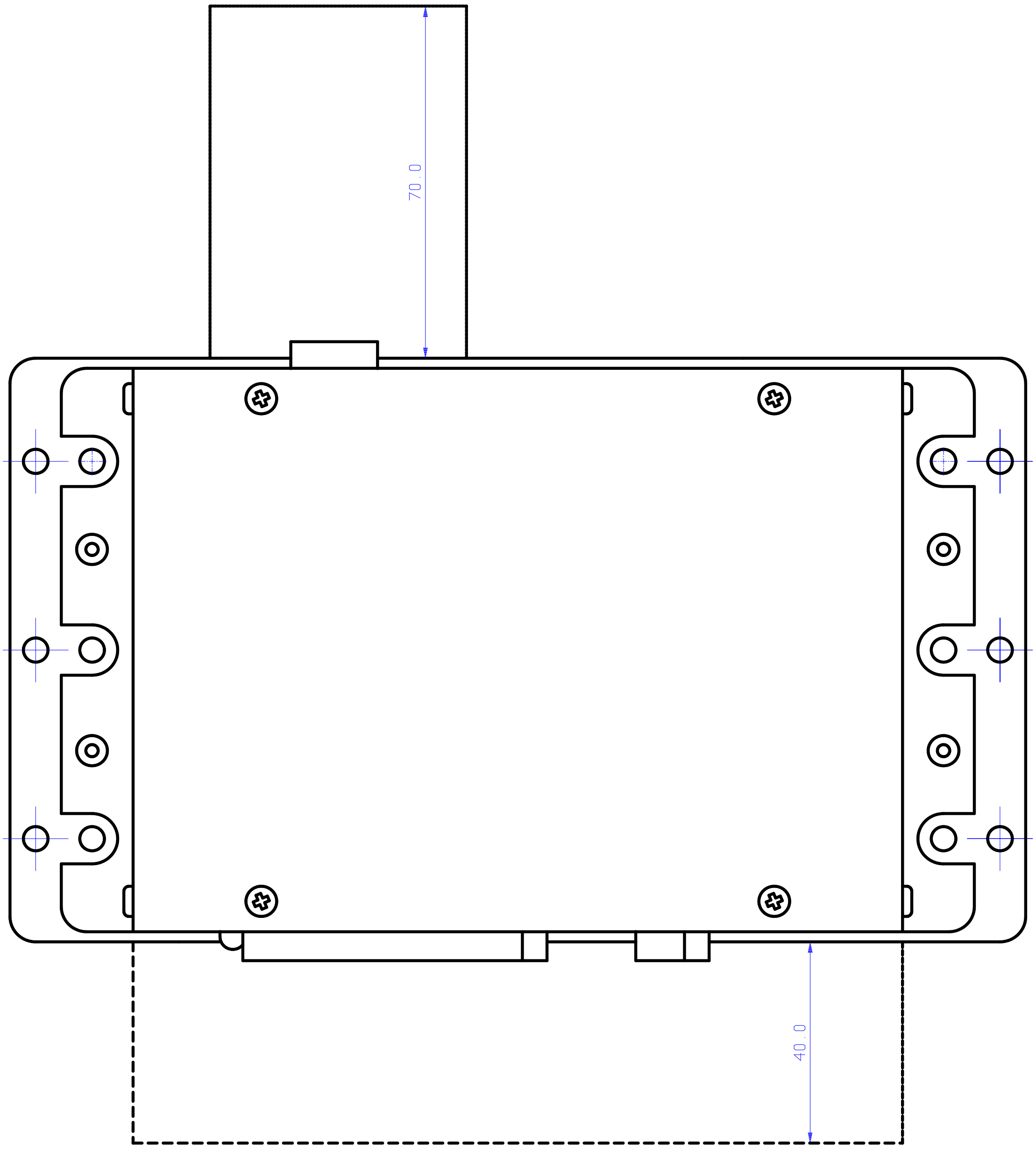


**Fig. 14:** **Space required for mounting**

# 10 Installation

## 10.1 Choice of the mounting location

The device must be positioned inside of the vehicle in such a manner that the following conditions are met:

- Maintenance of the allowable operating temperature range at all times, i.e.
  - do not mount on the body shell with direct exposure to sunlight
  - do not mount in areas where pent-up heat may occur

- do not mount in areas where dust or abrasive particles may accumulate, such as system of rods, belt drives or waste air ducts

- do not mount in air streams, which may encourage condensation due to their temperature or humidity

- do not mount on vibrating components or on components subject to shock.

In addition, care must be taken, when mounting the device, that a reliable, low-ohmic, corrosion protected grounding connection is established to the vehicle chassis. For this purpose, clear of paint at least one mounting hole on the chassis, and use a serrated lock washer, as required. In the event of insulated mounting, one additional grounding cable, strip or stranded wires of at least 10mm² and 30cm in maximum length, must be used.

## 10.2 Wiring diagram, overview diagrams

The wiring of door signals may be either of two principle types:

- Use of potential-free contacts (use door voltage of the device)

- Use of external control voltages.

The door signal detection function is independent of polarities, i.e. the polarity of the control voltage is of no consequence.

In general, the wiring for door signals must be of the two-wire type. This means that both poles of the door signal input must be connected through to the source. In this instance, the individual wires should be located as close as possible to each other – ideally they should be stranded. This type of wiring provides an optimum of immunity against EMC.

Pre-fabricated cables are recommended for wiring purposes. Such cables are available in various grades (fire protection class, free of halogens yes/no).
When ordering cables, the required length must also be specified (variables x, y, z, a).

**Table 17: Recommended cable types**

| Wiring | Cable type, order code | Notes |
|---|---|---|
| of potential-free contacts and J1708 interface | K-A21-V-J1708-02-x-y-z-am | LiY, 0.75mm² + HK-SO-LIH, 2xAWG14, 2AWG18 |
| External control voltage and J1708 interface | K-A21-V-J1708-01-x-y-z-am | LiY, 0.75mm² + HK-SO-LIH, 2xAWG14, 2AWG18 |
| Power | K-A21-P-01-xm- | LiY, 1mm² |
| | K-A21-P-02-xm- | Sabix A 146 FRNC, 1mm² |
| | K-A21-P-03-xm- | Helutherm 145, 1mm² |

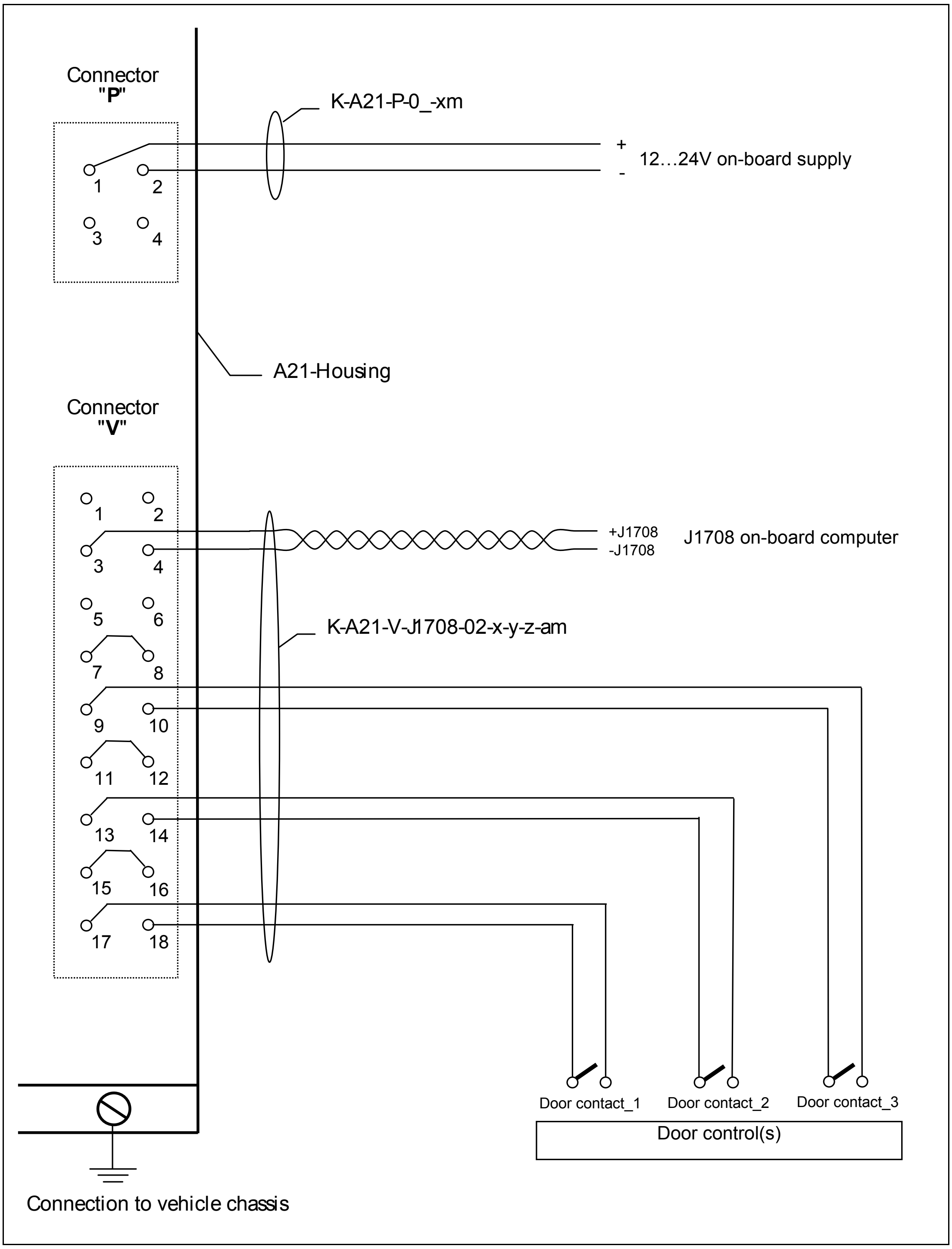


**Fig. 15:** **Overview diagram, door signals by means of potential-free contacts**

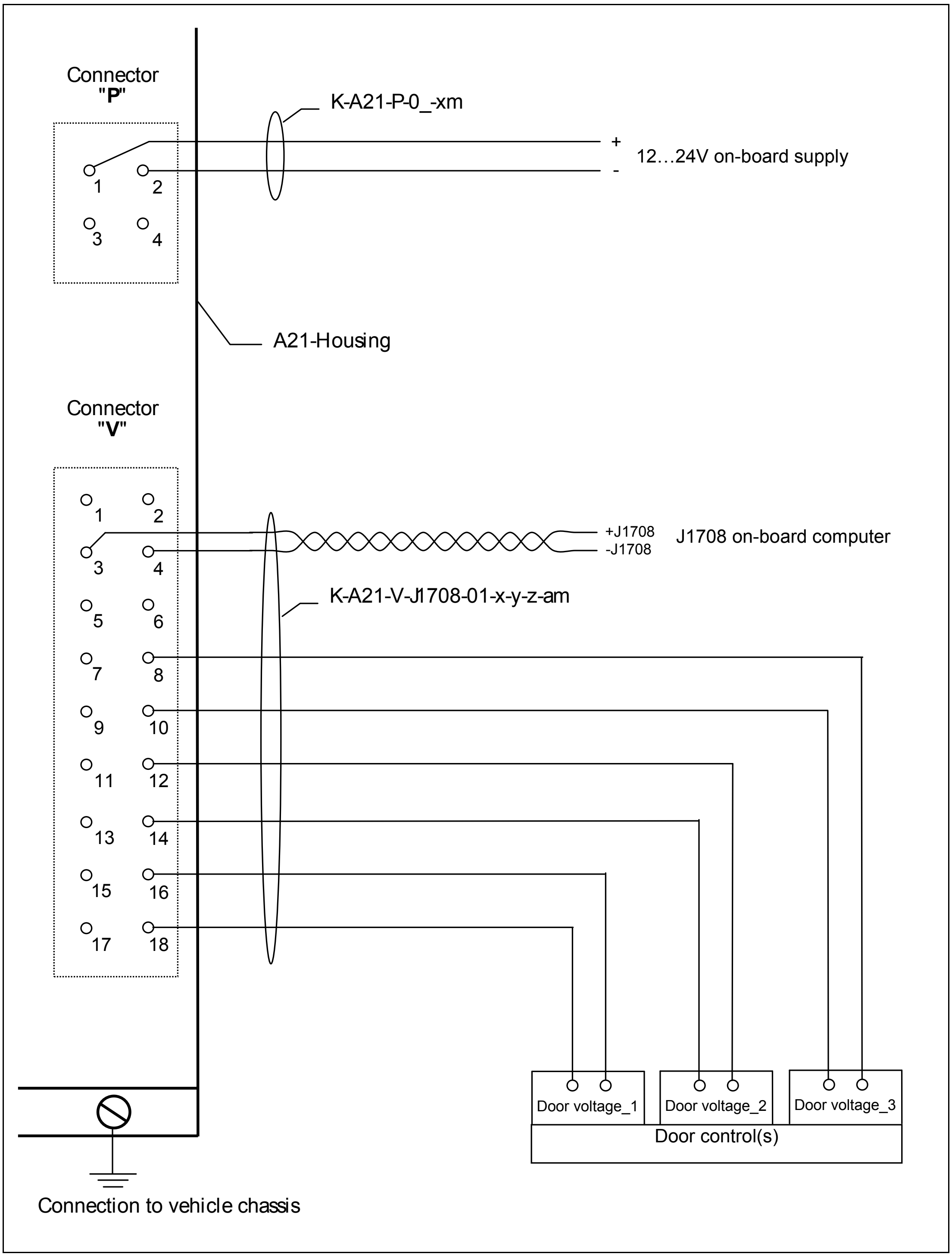


**Fig. 16:** **Overview drawing, door signals by means of external control voltage (polarity of no consequence)**

# 11 Abbreviations, definitions

| | |
|---|---|
| APC | Automatic Passenger Counting |
| CAN | Controller Area Network |
| DC | Direct current |
| ESD | Electro-static discharge |
| EMC | Electromagnetic compatibility |
| IRMA | Infrared Motion Analyzer |
| NVSRAM | Non Volatile Static Random Access Memory |
| OBC | On Board Computer |
| potential-free | same meaning as “galvanically separated” |
| SSI | Serial Synchronous Interconnection |
| SV | Power supply |