duagon

Data Sheet

D429R MVB Repeater

The MVB Repeater connects two MVB segments to each other. Communication traffic from both sides is exchanged with the other side.

As an option, three MVB segments can be connected together (“star coupler”).

Different module versions are intended to be used with nominal vehicle battery voltages from 24V to 110V.

The module supports the MVB ESD+ or EMD with redundant lines.

Duagon Data Sheet Preamble

On having purchased products described in this data sheet, the customer acquires the right to use the products according to its specified purpose and in accordance with all operation, service and maintenance instructions. All other rights to the product, Duagon's intangible assets rights in particular, belong solely to Duagon and may not be deemed to have been assigned along with the sale of the products.

All product properties are fully described in the data sheet under express exclusion of any warranty for other properties. Of decisive relevance is the data sheet valid at the time of the order being placed. Duagon provides a warranty that the product properties are retained during the period of warranty. Evidence that the properties of the product have been retained will be brought, always and exclusively, on Duagon premises by means of a test construction pursuant to the type test.

The customer is obliged to inspect whether the products themselves are suitable for the application intended. In particular, that inspection must include the integration of the products into the intended system configuration and a check on whether the properties as per data sheet can be fulfilled once integrated into the system configuration as planned by the customer. Since the products are not certificated for operation with security applications, the customer must take appropriate measures to ensure that any malfunctions that may occur in a system configuration with other products will be absorbed by supplementary security measures.

The period of warranty for the products is 24 months and it begins on the date the products are shipped from the factory.

The warranty that Duagon assumes for the products will, at Duagon's discretion, be limited either to the repair of or the replacement of the products at the Duagon factory. The warranty solely covers the products or parts thereof which, despite professional handling, have become defective or unusable and which arrive at the Duagon factories for repair or replacement during the period of warranty. The extent of Duagon's warranty is fully set out in this data sheet. Duagon cannot be held liable for consequential damage caused by a defect or for indirect damage or for consequential damage of any kind. Therefore the customer bears all and any costs that occur due to production downtime, for example, or due to the installation or dismantling of products or due to their transportation to Duagon and back.

Duagon's liability and warranty do not obtain if evidence cannot be brought that the products were being operated according to its specified purpose and in accordance with all operation, service and maintenance instructions as issued by Duagon.

These provisions form an integrated part of the product properties. Duagon products cannot be acquired with other or more extensive degrees of warranty and liability on the part of Duagon.

This data sheet is to be evaluated in accordance with **Swiss** law. The court of jurisdiction is the **seat of the vendor**. The applicability of the UN agreement as to international sales of goods (also known as "Viennese Purchasing Convention") is herewith expressly excluded.

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Document history

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1	Dec. 17th 2007	Rogenmoser	See chapter "Document History"	d-001893-004961
2	April 3rd, 2008	Klauser		d-001893-005476
3	Aug. 20th, 2009	Milani		d-001893-007465
4	Sept. 6th, 2010	Klauser		d-001893-008873
5	Mar. 3rd, 2011	Kovács		d-001893-010123
6				
7				
8				

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or those connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform installation, maintenance and service procedures

To avoid fire or personal injury

Connect and disconnect properly. This data sheet contains all relevant information for connecting the device.

Power On only with all connections made. All connectors on the device must be connected (unused connections should be covered with a dummy connector).

Ground the product. Ground connection is located on the device.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult this data sheet before making connections to the product.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Do not operate with suspected failures. If you suspect there is a damage to this product, have it inspected by qualified service personnel, or return it to Duagon GmbH.

Safety Terms and Symbols

Terms in this data sheet. These terms may appear in this data sheet.

WARNING. Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.

Service Safety Summary

Only qualified personnel should perform installation, maintenance and service procedures

Do not service with Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Introduction

The D429R connects different MVB segments to each other. All MVB segments may either be EMD or ESD+. If they are of different type (EMD and ESD+ mixed), then all relevant timing differences between the segments are automatically corrected.

The transferred telegrams are refreshed with respect to their magnitude, jitter, frame timing and general plausibility.

The MVB Repeater is completely transparent to all kind of bus traffic (layer 1 device).

The internal logic function is completely automatic and there is no configuration needed for MVB device addresses, PD traffic- or Bus Administrator lists and the like.

The D429R is designed for the harsh traction environment and conforms to the EN-50121 / EN-50155 / EN61373 standards, e.g. by:

- -40 to +70°C operating temperature
- coating against humidity
- enhanced EMI and vibration robustness

The repeater is integrated in a stainless steel housing.

The D429R is directly powered from the vehicle battery; supporting voltages like e.g. 24V or 110V.

WARNING. When using a high voltage D429R device (D429R-HV), obey the safety precautions at the beginning of this data sheet.

How to Get Started

The D429R does not need any configuration. Just plug in the MVB and power cables.

Online Support

For additional information, please visit our home page www.duagon.com.

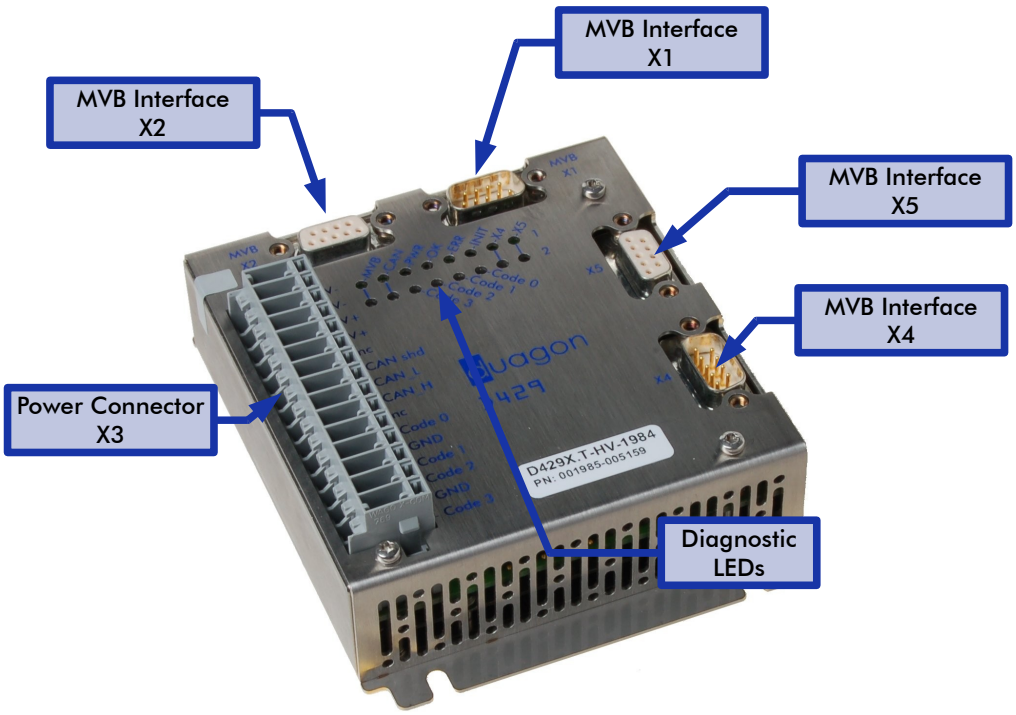
There you will find:

- up to date documents
- frequently asked questions
- description of new product versions

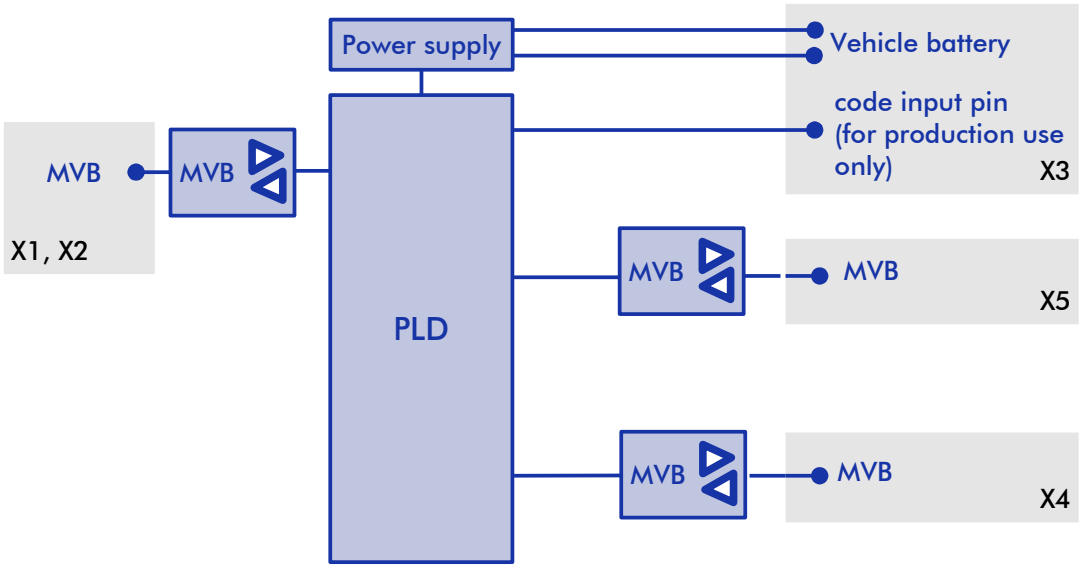
On our web page it is also possible to subscribe to an email news service providing notifications about all kind of news.

Architecture

Hardware Structure



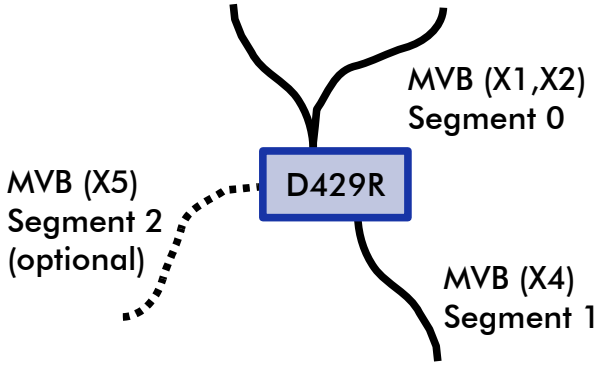
The figure below shows the D429R.
Basic Function Blocks



The PLD programmable logic includes several functions like the Duagon **MVB controller** and several other peripheral digital functions. Depending on the application, it is compiled matching to the set of used hardware options. **Power** is drawn from the vehicle battery supply. This includes the supply for the various communication transceivers as well as the internal logic.

D429R Repeater Structure

The D429R is intended to connect two different MVB segments together.



As an alternate option the D429R can be used to connect three MVB segments together (star coupler). The segments 1 and 2 are connected at the end of the line or via a T-stub to X4 and X5, respectively.

Physical Interfaces

MVB Interfaces (X1, X2, X4, X5)

Independent from the type of physical interface (ESD+ or EMD), the D429R supports two redundant lines A and B.

As an innovation to previous solutions, each line has its own decoder circuitry, i.e. both redundant lines are monitored at the same time and the D429R decides dynamically which line is the better one.

By this way, the application gains optimal stability in "less than perfect" environments: noise, crosstalk and cable effects are reduced to a minimum.

On the D429R there are at minimum 2, and up to 3 MVB- interfaces available:

Conn.	Intention	Cabling	Options	Notes
X1, X2	Main MVB interface, always present, with traffic memory	as usual	ESD+, EMD	Signal continuity between X1 and X2
X4	MVB interface for bus repeater function	at the end of the line; D429R includes terminator	ESD+, EMD	-
X5	Optional MVB interface for bus repeater function	at the end of the line; D429R includes terminator	ESD+, EMD	-

Remarks:

- For the three buses (X1, X2), (X4) and (X5) each combination of ESD+ and EMD can be ordered. For more information see order information on page 27.

ESD+ Description for X1,X2

This paragraph applies to the D429R.D versions, only.

Pin #	Pin shortcut	Input / Output as seen from the D429R	Description
1	A.data.P	bidirectional	non- inverted MVB bus line, with RS485- level
2	A.data.N		inverted MVB bus line, with RS485- level
3	NC	-	Not connected
4	B.data.P	bidirectional	non- inverted MVB bus line, with RS485- level
5	B.data.N		inverted MVB bus line, with RS485- level
6	A.0V.term	power output	power supply from D429R to external terminator
8	A.5V.term		
7	B.0V.term		
9	B.5V.term		
shell	Shield	-	Connection to shield resp. housing.

Both connectors have the same pinout, and all pins except pin "NC" are routed from one connector to the other one.
According to the TCN standard, NC (pin 3) may optionally be used for a "TxE signal". This signal is intended for controlling bus couplers (for example interface from ESD+ to EMD). Since the D429R is available in both EMD and ESD+ version, the TxE signal is not required any more.

ESD+ Description for X4 and X5

This paragraph applies for ESD+ option of the connectors X4 and/or X5 only.

Pin #	Pin shortcut	Input / Output as seen from the D429R	Description
1	A.data.P	bidirectional	non- inverted MVB bus line, with RS485- level
2	A.data.N		inverted MVB bus line, with RS485- level
3	NC	-	Not connected
4	B.data.P	bidirectional	non- inverted MVB bus line, with RS485- level
5	B.data.N		inverted MVB bus line, with RS485- level
6	GND_MVBA	power output	power equalization line
7	GND_MVBB		
8	NC	-	Not connected
9	NC	-	Not connected
shell	Shield	-	Connection to shield resp. housing.

Terminator Supply ESD+ for X1,X2 only

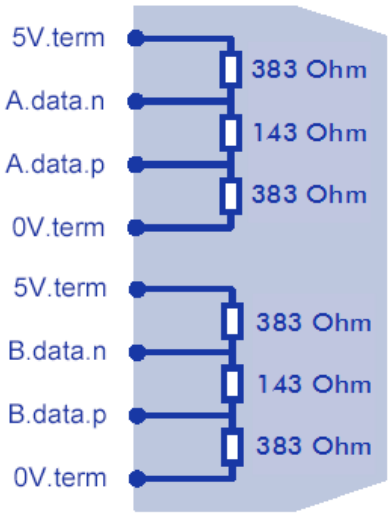
This paragraph applies to the D429R.D version, only.

Item	Value	Unit	Remarks
Output voltage	5	V	+/-5% tolerance
Short circuit current limitation	300	mA	The terminator supply delivers for a short amount of time a higher current of up to 0.87A. After a short time period the current is limited at approx. 0.3A.
Maximum output current	70	mA	when terminator is driven "active"

The output power is sufficient for one terminator. Mounting two terminators makes no sense; but this at least does not cause harm to the D429R (voltage specifications not guaranteed).

Terminators ESD+ for X1,X2 only

The following terminator is recommended for the use with the D429R version for ESD+:



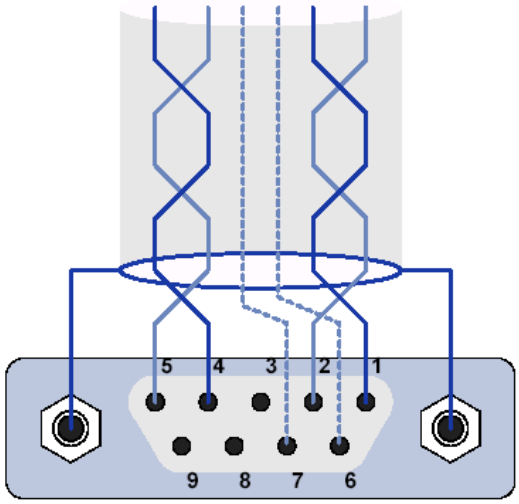
In case the D429R is the last of several MVB nodes, one of the D429R- MVB connectors remains open. The terminator is mounted on this connector and delivers the correct line termination.

The resistors inside will offset an „idle" line when not driven by a node transmitter. The effective line termination matches the recommended cable impedance of 120 Ohms.
The terminator is not included within the D429R. Call Duagon for availability and supply information.

MVB Cable Attachment ESD+

The figure shows the recommended cable attachment.

The dotted lines are the "potential equalization lines". They have the intention to connect all MVB nodes together.

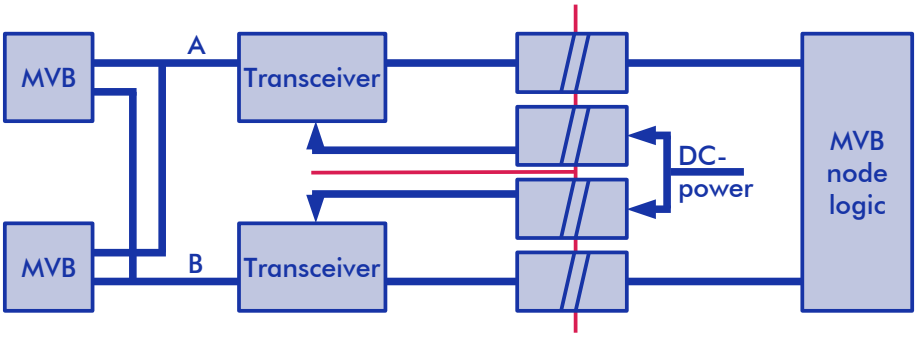


Important Remark:

- Pin 3, 8 and 9 are not connected on the outside. Do not use cables where all pins are connected, this may impair proper functionality or even damage devices!

Insulation ESD+

The two MVB lines A and B are galvanically insulated to the logic/IO and to each other.



EMD Description for X1, X2

This paragraph applies to the D429R.T version, only.

Pin #	Pin short-cut	Input / Out-put as seen from the D429R	Description
1	A.data.P	bidirectional	non- inverted MVB bus line
2	A.data. N		inverted MVB bus line
3	NC	-	Not connected
4	B.data.P	bidirectional	non- inverted MVB bus line
5	B.data. N		inverted MVB bus line
6, 7	A.term	Passive resist-or	Termination resistor between two pins.
8, 9	B.term		
Shell	Shield	-	Connection to shield resp. housing.

Both connectors have the same pinout, and all pins are routed from one connector to the other one except NC.
According to the TCN standard, NC (pin 3) may optionally be used for a "TxE signal". This signal is intended for controlling bus couplers (for example interface from ESD+ to EMD). Since the D429R is available in both EMD and ESD+ version, the TxE signal is not required any more.
The effective line termination matches the recommended cable impedance of 120 Ω.

EMD Description for X4 and X5

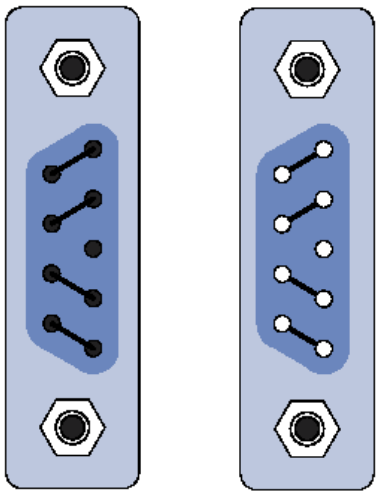
This paragraph applies for EMD option of the connectors X4 and/or X5 only.

Pin #	Pin shortcut	Input / Out-put as seen from the D429R	Description
1	A.data.P	bidirectional	non- inverted MVB bus line
2	A.data.N		inverted MVB bus line
3	NC	-	Not connected
4	B.data.P	bidirectional	non- inverted MVB bus line
5	B.data.N		inverted MVB bus line
6	NC	-	Not connected
7	NC	-	Not connected
8	NC	-	Not connected
9	NC	-	Not connected
Shell	Shield	-	Connection to shield resp. housing.

Both connectors have the same pinout.

Terminators EMD for X1,X2 only

This paragraph applies to the D429R.T version, only. The following terminator is recommended for the use with the D429R.T:



The appropriate pins from the MVB line are connected to the local terminating resistor within the D429R.

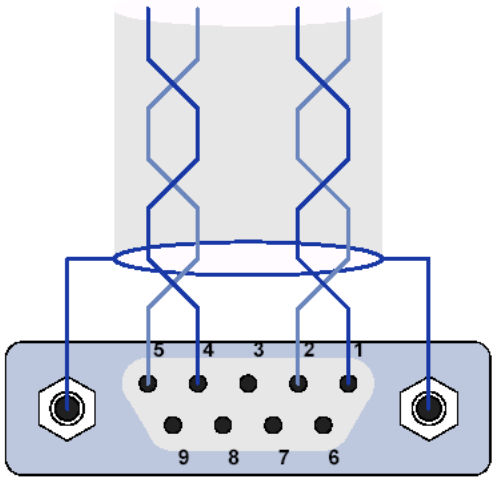
Assumed, the D429R is the last of several MVB nodes, one of the MVB connectors remains open. The terminator is mounted on this connector and delivers the correct line termination.

Please note:

- depending on the cabling concept, it is typically required to have two types of terminators: one with a male SUB-D connector and one with a female connector.
- The terminator is not included within the D429R. Call Duagon for availability and supply information.

MVB Cable Attachment EMD

The schematic shows the recommended cable attachment.

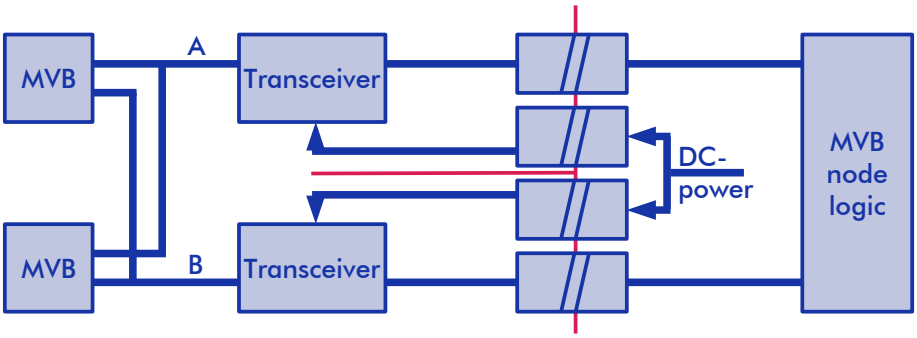


Important Remark:

- Pin 3 and 6 to 9 are not connected on the outside. Do not use cables where all pins are connected, this may impair proper functionality or even damage devices!

Insulation EMD

The two MVB lines A and B are galvanically insulated to the logic/IO and to each other.

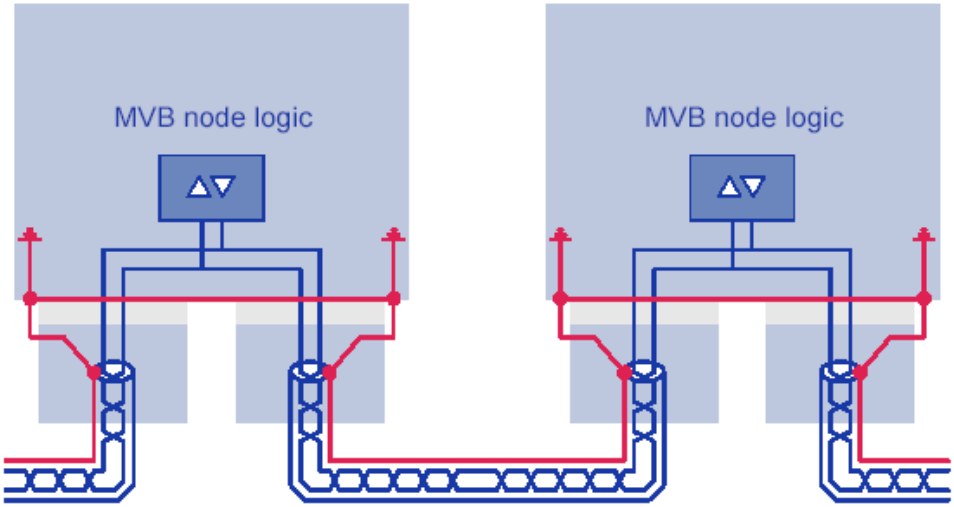


MVB Shielding Concept

There are basically two different shielding concepts used in applications. The D429R is optimized to use the concept described below; therefore we recommend to use this concept.

The main properties of the used concept are:

- The cable shield is connected *to the device housing*.
- The cable shield has *in all nodes* the same connection to the device housing.



As a result, all housings are connected together. Within the vehicle concept it must be ensured, that there are no ground potential differences that may harm the cable shield or the connectors.

The connection between the cable shield and the device housing is done via the cable connector housing and the fixing screw / cable lock (as required by the TCN standard).

Note: The other shielding concept (with the shield being insulated from the housing) can be supported on customer's request, too. However, this concept requires some production changes and is therefore more expensive.

MVB Cabling

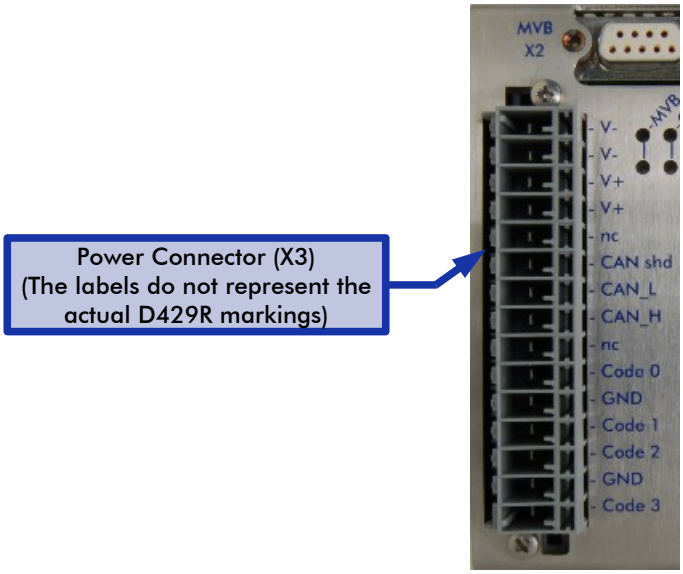
There is a wide variety of different manufacturers for "SUB-D" cable connectors. For the cable connector itself, the user may choose a supplier to his own requirements: the various versions are selected according to obvious quality level versus cost considerations.

For the connector hoods, Duagon recommends to thoroughly check the following issues:

- **Shield continuity**: The MVB requires to have a shield being routed through the nodes. Therefore the user has to make sure, that the connector has a good conducting path between the cable shield and the connector shell on D429R.
  In this sense, a metallic hood is the best solution. Plastic hoods with metallization are less than perfect; pure plastic is recommended for special purposes, only (e.g. in-rack cabling, lab use).
  Some connectors have "dimples" with the intention to install a conductive path between the two metal shells. These are of benefit, but it is good design practice, not to rely completely on these contacts (almost never, they are specified with e.g. contact resistance). Always consider the screw cable locks as the main shield contact.

Power Connector (X3)

The D429R is powered directly from the vehicle battery via connector X3.



Pin Definitions

Pin	Signal name	Description
X3 –1	$-V_{bat}$	Negative power supply
X3 –2	$-V_{bat}$	
X3 –3	$+V_{bat}$	Positive power supply
X3 –4	$+V_{bat}$	
X3 –5	nc	not connected
X3 –6	nc	not connected
X3 –7	nc	not connected
X3 –8	nc	not connected
X3 –9	nc	not connected
X3 –10	nc	not connected
X3 –11	GND	
X3 –12	nc	not connected
X3 –13	nc	not connected
X3 –14	GND	
X3 –15	Code 0	Code Input (for production use only, leave open)

Remarks:

- The respective pins for the +Vbat- battery line are internally connected. Since the internal device requires minor power, it is OK to connect only one pin of the Vbat- line, but do not connect other devices on the empty Vbat pins.

Operating Conditions (Power Supply)

Sym-bol	Parameter / Conditions	Min	Nom	Max	Unit	EN50155:2007
V_{bat+}	Variations, supply change over, supply related surge	0.6 [1]	1	1.4 [1]	* U_n	5.1.1 5.1.3 (Class C1) 5.2
V_{bat+} **Version LV**	Supply voltage with respect to V_{bat-} - operating -	14.4	24 36 (≙ U_n)	50.4	V	Nominal value according to 5.1.1; outer limits include the "variations", "supply change over" and "supply related surge"
	Supply voltage with respect to V_{bat-} - non-operating -	-50.4		50.4	V	Survives erroneous polarity reversal.
V_{bat+} **Version HV**	Supply voltage with respect to V_{bat-} - operating -	28.8	48 72 96 110 (≙ U_n)	154	V	Nominal value according to 5.1.1; outer limits include the "variations", "supply change over" and "supply related surge"
	Supply voltage with respect to V_{bat-} - non-operating -	-154		154	V	Survives erroneous polarity reversal.
-	Interruptions of voltage supply		-			5.1.1.2 Class S1
P_{idle}	Power drawn from V_{bat} with MVB operational		3.5	7	W	

Notes

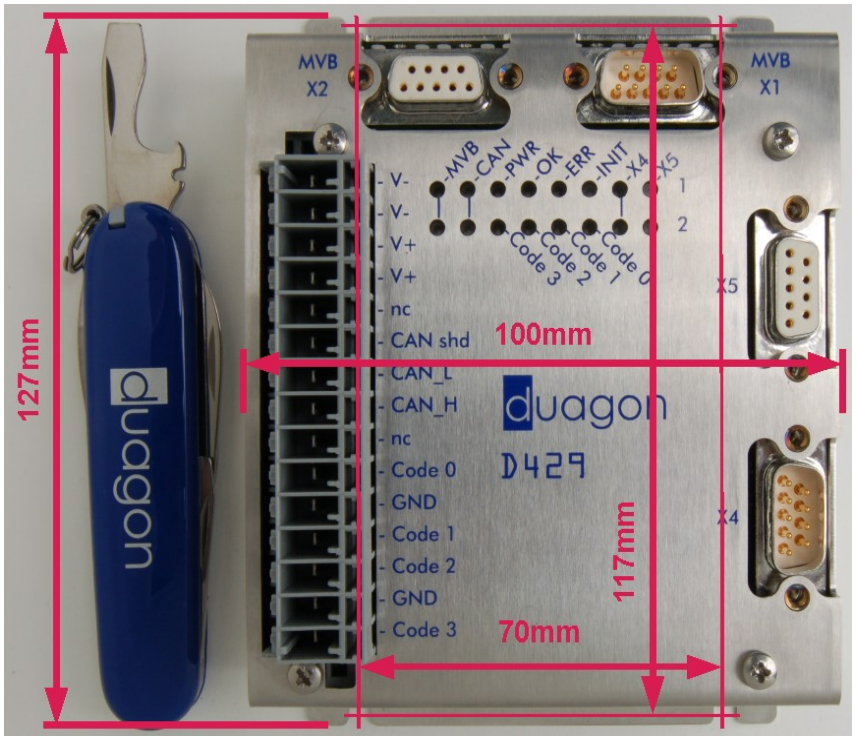
1) In extension to the standard reference, there is no limitation with respect to the duration.

Mechanical Data

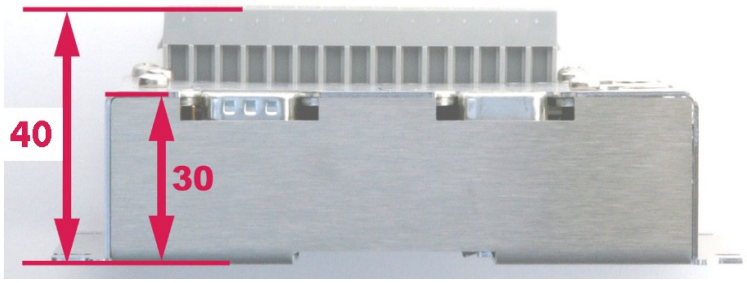
Mechanical Dimensions and Weight

The weight of the complete D429R is approx. 415g.
The mass of the housing is approx. 290g.

The material of the housing shell is stainless steel. The thickness of the sheet metal is 1mm.



The picture below shows the "height" of the D429R case without connectors (all dimensions in mm).



Important Note

- When calculating the required "height" of the module, be aware that the cables will require space (additional 60 – 70mm should be sufficient).
- Add an extra 16mm if you want to plug and unplug the cable without unmounting the device.

Cabling / Cable Locks

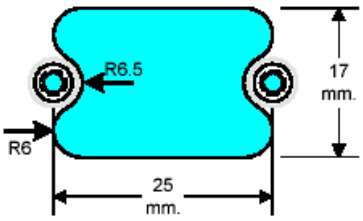
Connectors X1,X2, X4 and X5 use M3 thread for the cable locks.

Be sure not to apply the UNC4-40 thread; it will damage the thread.

The maximum torque for the screw locks is 40cNm. A higher torque may destroy the thread!

Important Note

- The hood must not interfere with the D429R housing. Therefore, the connector's flanges should lie flat on the D429R surface
- The drawing on the right side shows the dimensions of the cutout on the D429R. This is the area where the connector hood will dive below the D429R surface.



For more information about connectors and cables for wiring see the "Material and Components for wiring – Technical Note", d-000842-nnnnnn.

Mounting by Four Screws

The D429R is proposed to be mounted with four M4 screws. The picture above shows the dimensions for the fixture holes.

Mounting on Rail TH35

The mounting rail TH35 is available in two different thicknesses, the TH35-7.5 and TH35-15. We recommend the more stable TH35-15, due to the omnipresent vibrations on railway vehicles. However, the D429R will also fit on the lighter mounting rail.

Note:

- Be sure to have approximately 5mm headroom on both sides in addition to the 127mm in picture above: it is required for placement on TS35 – DIN-rail.
- For good EMI (electromagnetic interference) behavior it is essential to properly connect the device case to protective earth.

Convection Cooling

Leave the space next to the ventilation holes on both sides empty.

The module does not need active ventilation by a fan, but natural passive convection must be possible.

Environmental Data

Issue	min.	typ.	max.	Unit	EN50155:2007
Operational temperature range, "internal cubicle temperature", i.e. outside of D429R housing	-40	+25	+70	°C	4.1.2 Class TX.
Air temperature surrounding the PCB	-40	+25	+85	°C	4.1.2 For information, only.
Altitude above sea level			1800	m	4.1.1 For derating of maximum temperature with respect to altitude levels in excess please call Duagon.
Relative humidity		<75 %	95%		Typical value for yearly average, max value for 30 consecutive days per year. Short term moisture condensation without malfunction (DIN EN 60068-2-30:2006-05)
Vibration			2 50	mm m/s^2	12.2.11 for 5-25 Hz for 25- 150 Hz
Shock			50	m/s^2	Duration 50ms
RFI susceptibility from 0.15 to 2000 MHz.	20			V/m	

Application Hints

Diagnostic by LEDs

General Status LEDs

Four status LEDs display the general state of the D429R module:

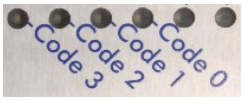
"PWR" green LED	Meaning
ON	Power is on.
OFF	No power.

"OK" green LED	Meaning
ON	MVB is configured, D429R is OK and performing MVB traffic.
OFF	Error condition: see red error LED (ERR). If the red LED is off too: Loss of power, heavy hard-ware error

"ERR" red LED	Meaning
ON	PLD error. Send module back to Duagon.

"INIT" yellow LED	Meaning
ON	Initialization completed.
OFF	Initialization in progress.

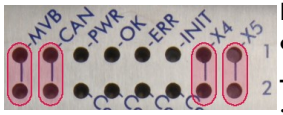
CODE LEDs



The CODE LEDs specify the actual product:

"CODE" LED				
3	2	1	0	Product
0	0	0	0	D429R.D-LV-DD / D429R.D-HV-DD
0	0	0	1	D429R.T-LV-DD / D429R.T-HV-DD
0	0	1	0	D429R.D-LV-TD / D429R.D-HV-TD
0	0	1	1	D429R.T-LV-TD / D429R.T-HV-TD
0	1	0	0	D429R.D-LV-DT / D429R.D-HV-DT
0	1	0	1	D429R.T-LV-DT / D429R.T-HV-DT
0	1	1	0	D429R.D-LV-TT / D429R.D-HV-TT
0	1	1	1	D429R.T-LV-TT / D429R.T-HV-TT
1	0	0	0	Production use only
1	0	0	1	Production use only
1	0	1	0	Production use only
1	0	1	1	Production use only
1	1	0	0	Production use only
1	1	0	1	Production use only
1	1	1	0	Production use only
1	1	1	1	Production use only

Communication Interfaces



For every communication interface, a set of LEDs is used to indicate activity on the bus:

The first row (indicated by 1) represents activity on line A of the corresponding interface, the second row (indicated by 2) represents line B.

Row "1" (Line A) LEDs	Meaning
ON	The interface is receiving data on line A.
OFF	The interface is not receiving data on line A.

Row "2" (Line B) LEDs	Meaning
ON	The interface is receiving data on line B.
OFF	The interface is not receiving data on line B.

Reset Mechanism

The device will reset itself after power-up or when the power supply voltage drops below a certain level and comes back again.

Please note: Since the D429R device also operates with very low voltages (-LV: far below 14V), the device may be still "up and running", even if other devices have already fallen out of operation.

Power Up

As with all electronic equipment, the D429R will need a certain time to start up. This procedure takes in typical MVB systems up to approx. 0.5 to 4 seconds (depending on version) and is automatically performed. However, the device is completely passive to the outside during this time.

EMI Considerations

We assume the following integration for the D429R.

- The D429R signal lines have no connection with unshielded cables to the outside.
- The device case is properly connected to protective earth.

Standards Reference

The "D429R" complies to the standards EN50155, EN50121-3-2 and IEC61375 in general. For exceptions, not applicable subclauses etc. please refer to the "D429R Type Test – Report" with the document number d-001569-nnnnnn:

Immunity

The D429R has no vehicle battery related inputs or outputs; just the power supply connection itself. Consequently, there are no specs for "indirect transients".

EN50121-3-2:2006 7.1 Battery referenced ports: Conducted radio frequency EN61000-4-6, 10V_{rms} (carrier voltage), 150kHz – 80MHz, 1kHz, 80% AM, Source impedance 150Ω

EN50121-3-2:2006 7.2 Battery referenced ports: Fast transients bursts according to EN61000-4-4, ±2kV 5/50ns t_r/t_h, 5kHz repetition frequency.

EN50121-3-2:2006 7.3 Battery referenced ports: Surges according to EN-61000-4-5, waveform 1.2/50µs, wire vs grounding ±2kV 42Ω 0.5uF, wire vs wire ±1kV 42Ω 0.5uF

EN50121-3-2:2006 8.1 Signal I/O: Conducted radio frequency EN61000-4-6 10V_{rms} (carrier voltage) 150kHz – 80MHz, 1kHz, 80% AM, Source impedance 150Ω

EN50121-3-2:2006 8.2 Signal I/O: Fast transients bursts according to EN-61000-4-4, 2kV ±5/50ns t_r/t_h, 5kHz repetition frequency

EN50121-3-2:2006 9.1 Enclosure port: Radio frequency EN61000-4-3, 20V/m (rms carrier voltage) 80MHz – 1GHz, 1kHz 80% AM.

EN50121-3-2:2006 9.2 Enclosure port: Radio frequency EN61000-4-3, 20V/m (rms carrier voltage) 800MHz – 1GHz, 1kHz 80% AM; 10V/m (rms carrier voltage) 1.4GHz – 2.1GHz, 1kHz 80% AM; 5V/m (rms carrier voltage) 2.1GHz – 2.5GHz, 1kHz 80% AM;

EN50121-3-2:2006 9.3 Enclosure port: Electrostatic discharge EN61000-4-2, 6kV contact discharge, 8kV air discharge.

Emission

EN50121-3-2:2006 4.1 and 5.1 Battery referenced ports, process measurement and control ports: EN55011, 150kHz – 500 kHz 99dBµV/m quasipeak; 500kHz – 30MHz 93 dBµV/m quasipeak.

EN50121-3-2:2006 6.1 Enclosure port: EN55011, 30MHz – 230 MHz 40dBµV/m quasipeak measured at 10m; 230MHz – 1GHz 47 dBµV/m quasipeak measured at 10m distance.

Insulation

IEC61375:2007 MVB physical layer, applied to EMD and ESD in the same way, according to IEC60571, 707V_{rms}, 1MΩ for 1 minute. Routine testing is done with the higher voltages defined in EN50155 (see below).

EN50155:2007 12.2.9: Insulation measurement test / Voltage withstand test. 1000V_{rms}, 1MΩ for 1 minute. During routine testing, the testing is optionally changed to sinusoidal 1500Vrms rms, 1MΩ for 10sec. Each individual device is tested prior to shipment (routine testing).

Useful Life

EN50155:2007 6.2: There are component with a limited useful life in the D429R:

- Reprogrammable components (Flash Memory). These are specified from the manufacturer with 20 years data retention at 125° Celsius, which fits clause 6.2. The actual "useful life" can be extended by reprogramming these devices.

Particularly, there are no electrolytic capacitors, which typically introduce a limitation to useful life.

Polarity Reversal

EN50155:2007 7.2.6: Polarity reversal. The D429R is protected against polarity reversal of the vehicle battery.

Components

EN50155:2007 8.1.5 and 8.1.7: There may be specialized components/ single source components included in the product. Contact Duagon for more information about repair and long term shipment procedures.

Shock and Vibration

EN61373:1999: There is no specific definition of the mounting direction in the vehicle, i.e. the highest requirement is to be applied to all directions of the D429R. The D429R applies to mounting location "Category 1, Class B".

MVB

IEC61375-1:2007, International Electrotechnical Commission, "Electric Railway Equipment, Train bus, Train Communication Network": Clause 3 describes the MVB "Multifunction Vehicle Bus".

Fire and Smoke

EN45545-2:2010: The D429 falls in the category of "not-listed" products. There are no special requirements for products with a mass lower than 100g (interior location) and 400g (exterior location).
The relevant mass of the D429, i.e. excluding the steel housing (290g, "functional necessity" EN45545-2:4.6) and the PCB (35g, "functional necessity" EN45545-2:4.6) is approximately 90g.

NF F16-102:1992: According to the French standard NF F16-102 no requirements are necessary for electrical systems with a mass lower than 300g, which are situated in a technical compartment, in the open air, a box, a cabinet or as a block equipment. The mass of the D429R without the steel housing is approximately 125g.

Degree of Protection

EN60529:2000: The degree of protection is IP 30C.

Manufacturing

The manufacturing of the PCB assembly is done according to **IPC-A-610D:2005 level 2.**

The product complies to the European Union directive **EC/2002/95** (**RoHS** compliance).

REACH

Concerning the European Union directive **EC/1907/2006** (**REACH** compliance), Duagon does not need to register any substance. Duagon's products do not use quantities of more than 1 ton of a certain substance and the substances are not released under normal conditions of use. For a registration, both criteria would have to be fulfilled.

Humidity

EN60068-2-30:2006: Provides a composite test procedure, primarily intended for component type specimens, to determine, in an accelerated manner, the resistance of specimens to the deteriorative effects of high temperature/humidity and cold conditions.

Links to other Duagon Documents

In general, most of the documents are located on www.duagon.com, and may be downloaded from there in the most up to date version.

D429R Type Test – Report, d-001569-nnnnnn

This document covers the type testing performed with the D429R device.

Labeling and Packaging – Specification, d-000778-nnnnnnn

This document describes all product labels (e.g. serial number label) used in relation with customers. It describes furthermore how Duagon packs the products for shipment.

Quality Plan for Duagon Products – Specification, d-000796-nnnnnnn

This document is a specification about test procedures for series testing of Duagon products. It is valid for all Duagon products in general. For each specific product an applicable subset of the described tests is selected; according to the procedures specified here.

Life Cycle of Duagon's Products – Technical Note, d-000526-nnnnnnn

Opens up some MTBF and Life Cycle considerations. In a very general way, the "Life Cycle"- document may be used for planning the life time repair stock in order to ensure long support times

Material and Components for wiring – Technical Note, d-000842-nnnnnn

This document is intended for engineers to help them select the right MVB components.

D429R Order Information

The D429R allows a number of different options. The repeater may be used as a MVB bus- or star-coupler for two or three different MVB bus types (ESD+ or EMD). In order to get the desired functionality for your application, the following options must be specified for interface type and power supply:

D429R	.T	-HV	-DD
Product Type: 429R			
MVB Type (X1,X2):			
EMD	-T		
ESD+	-D		
Power Supply:			
Battery supply: 14.4V to 50.4V		-LV	
Battery supply: 28.8V to 154V		-HV	
MVB Type (X5 and X4)			
EMD, EMD			-TT
ESD+, ESD+			-DD
EMD, ESD+			-TD
ESD+, EMD			-DT

Remark:

- All three bus segments are understood to have redundant lines (Line A/B). If a bus segment has to be treated "non-redundant", call Duagon for a "software option".

How does the identification look like?

This **example** demonstrates the format of the identification:

Generic product family	Common identification of hard-wired and downloadable options
D429R.D-LV-DD -	d001234-123456

During the life time of a product and its application, new versions may become necessary. Appendix A gives some general hints how this issue is handled within Duagon.

Preferred Option Set Combinations

The functionality as described can be identified with the following document number:

Intended for hardware...	Document number downloadable options (also known as "OP")	Description
D429R	d-002056-nnnnnn	MVB repeater functionality as described in this data sheet.

Document History

d-001893-010123

- Options on X1,X2 corrected

d-001893-008873

- REACH statement added
- Update ESD Terminator value recommendation
- company address and phone number updated
- Various minor changes, mainly editorial

d-001893-007465

standardization and actualization

- regrouping of chapters
- editorial changes
- EMI hints added
- General Safety Summary added
- removed connector descriptions
- new Humidity standard
- added Fire and Smoke in section "Standards Reference"

d-001893-005476

- Correction in Chapter "Order Information" (page 29): X4 and X5 exchanged
  Order code "-DT" means ESD+ on X5 and EMD on X4
  Order code "-TD" means EMD on X5 and ESD+ on X4

  Note: The CODE pin description on page 7 was already correct in earlier document version.

d-001893-004961

- New Housing
- new LED “INIT”
- D429R splitting off from document d-000891-004378.

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Appendix A: Document Numbering System

All Duagon documents have a unique identification number. The identification number has a certain internal structure in order to ease the tracking of different documents. In general, there are two parts:

Prefix	Document number	Filing number
d	-000310	-001952
Always constant	Specifies a certain purpose of a document with the intention to link several documents with different filing number. Please note, that the purpose of the document number is not stored for each document number, but can be derived from the document title, which is stored for each Filing number. The format is either 6 digits or not available.	Unique number, that identifies a particular document. Released in sequential manner as the documents are filed in the archive. A Duagon- internal data base contains exactly one document title text for each filing number. Always 6 digits.

Examples for identification numbers

Identification number	Document Title / Remarks
d-000310-001606	„DXIO data sheet Rev 2.2"
d-000310-001952	„DXIO data sheet Rev 2.3" A document, that is updated from time to time: the document number has the purpose to link several versions of the „DXIO data sheet" together. The filing number distinguishes between different versions. Please note, that the document number part is kept the same, as long as the basic intention of the early versions is still kept, for example during revisions due to debugging or manufacturing updates. In case a significant change happens, another document number would be applied.
d-000719	„Notes from prototype meeting ..." A document, that is obviously not updated after release. The „document number" part is missing and the filing number remains the only used part for identification.

Recommendation:
In your order, you may specify for example "d-000584-nnnnnn" in order to get the "newest" version of a specific product. When you do not want to follow the sequence of newer versions, i.e. you want to stick to a specific version, then specify the full identification number like "d-000584-002043".

Appendix B: Software Licensing

The software components used on D429R are subject to specific license agreements. The following sections describe the relevant issues in a generalized form for Duagon products:

MicroMonitor

The "MicroMonitor for D429R" is based on the Original MicroMonitor software as it was released by Bell Labs as open source software under the terms of the LUCENT PUBLIC LICENSE.

The Original MicroMonitor Software and its license agreement are available for public download on Lucent Technologies' Research Software Distribution Web Site (http://www.umonfw.com/).

Duagon distributes the Object Code as well as the modified Source Code of the "MicroMonitor for D429R" under the terms of the same LUCENT PUBLIC LICENSE.

Please contact Duagon to get a copy of the Source Code.