



D429 and D429L Communication Module

Data Sheet

The D429 module supports a set of communication interfaces: MVB, CAN, RS485, RS422, RS232.

For a specific application, the user chooses the required combination of interfaces.

A powerful ARM7 CPU enables custom specific communication protocols and applications.

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

Four dedicated input pins allow "geographic addressing", i.e. all modules for one project are identical in stock but perform different functions on the vehicle.

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



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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.

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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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Table of Contents

1. General Safety Summary.....	6
Introduction.....	7
1. Architecture.....	9
1.1 Hardware Structure.....	9
1.1.1 Basic Function Blocks.....	10
1.1.2 Memory.....	10
1.2 Software Structure.....	11
Physical Interfaces.....	12
MVB Interface (X1, X2).....	12
ESD+ Description.....	12
EMD Description.....	15
1.2.1 MVB Shielding Concept.....	18
MVB Cabling.....	19
CAN Interface (X3).....	20
1.2.1 Pin Definition.....	20
1.2.2 CAN Cabling.....	20
RS485-Interface (X5).....	21
RS422-Interface (X5).....	22
RS232-Interface (X4).....	23
Real Time Clock (RTC).....	24
1.1 Power Connector / Code Input (X3).....	25
1.1.1 Pin Definitions.....	25
1.1.2 Code Inputs.....	25
1.1.1 Operating Conditions (Power Supply).....	26
1. Software Protocols.....	27
1.1 MVB Software Protocols.....	27
1.2 CAN Software Protocols.....	28
CANpie Driver Software.....	28
CAN Communication Stacks.....	28
General Concepts.....	29
MVB Configuration.....	29
1.1 Several Identical D429 on One MVB.....	30
Communication Configuration.....	31
Device Status Word.....	32
Mechanical Data.....	34
1.1.1 Mechanical Dimensions and Weight.....	34
1.1.1 Cabling / Cable Locks.....	35
1.1.1 Mounting by four Screws.....	35
1.1.2 Mounting on Rail TH35.....	35
1.1.3 Convection Cooling.....	35
2. Environmental Data.....	36

3. Application Hints.....	37
3.1 Diagnostic by LEDs.....	37
3.1.1 General Status LEDs.....	37
3.1.1 CODE LEDs.....	38
3.1.1 Communication Interfaces.....	40
3.1 Reset Mechanism.....	41
3.1 Panic Recovery.....	41
3.1.1 JTAG Interface.....	41
3.1 EMI Considerations.....	42
Standards Reference.....	43
4. Links to other duagon Documents.....	46
D429 Order Information.....	47
5. Document History.....	51
6. Index.....	53
Appendix A: Document Numbering System.....	54
Appendix B: Software Licensing.....	55

1. 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 AG.

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 D429 is a powerful MVB CPU platform with the following communication interfaces:

- **MVB (X1 and X2)**
The MVB interface of the D429 is available for both the ESD+ and EMD physical layer. As an option, a full range MVB bus administrator is available. See pages 12 (HW) and 27 (SW). The D429CL and D429XL are equipped with a MDFULL Controller which allows for process data communication. The D429E, D429C and D429X are equipped with a SERVER Controller, which allows for process data and message data communication.
- **CAN (on X3)**
As an option the D429 supports virtually all CAN operating modes and baud rates: Version 2.0a and 2.0b, with up to 1 Mbaud. See pages 20 (HW) and 28 (SW).
- **RS485 (X5)**
The D429 supports one single RS485 line interface (RXTX+ and RXTX-) with custom specific protocol as an option. See page 21.
- **RS422 (X5)**
The D429 supports one single RS422 line interface (RX+, RX-, TX+ and TX-) with custom specific protocol optionally. See page 22.
- **RS232 (X4)**
A serial line interface may be used for application or diagnostic purposes. It supports the Tx- and Rx- line with or without two hardware handshake signals (RTS and CTS). See page 23.

Data can be routed between these buses according to an application specific definition of the gateway functionality.

The amount of data being transferred is mainly limited by the architectural limits of the respective bus system.

- **CPU**
A powerful ARM7 CPU runs application specific software. The D429 comes from Duagon with a boot loader, real time operating system (eCos), serial line support and MVB API driver software.
The user implements the application and communication driver software according to his own needs. The development environment relies on GNU-C.
The download of software takes place via RS232 on X4 or MVB. Please note that it is strongly recommended to choose for this purpose the RS232 option on X4.
- **64 MByte Flash memory (option)**
This amount of nonvolatile storage capacity is organized in a Flash file system and may be used to implement e.g. event recorders for diagnostic data collection.

The D429 is designed for the harsh traction environment and conforms to the EN50121 / EN50155 / EN61373 standards, e.g. by:

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

The device is integrated in a stainless steel housing.

How to Get Started

This data sheet describes the properties and functions of the D429.

The D429 is directly powered from the vehicle battery; supporting voltages like e.g. 24V or 110V.



WARNING. When using a high voltage D429 device (D429-HV), obey the safety precautions at the beginning of this data sheet.

Online Support

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

There you will find:

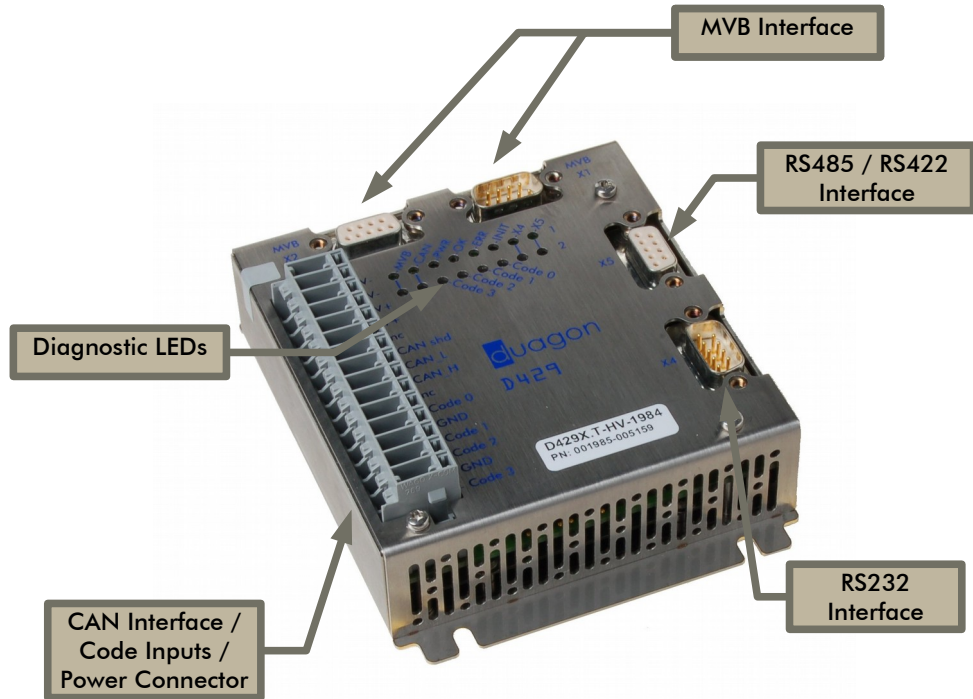
- up to date documents
- frequently asked questions
- description of new product versions

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

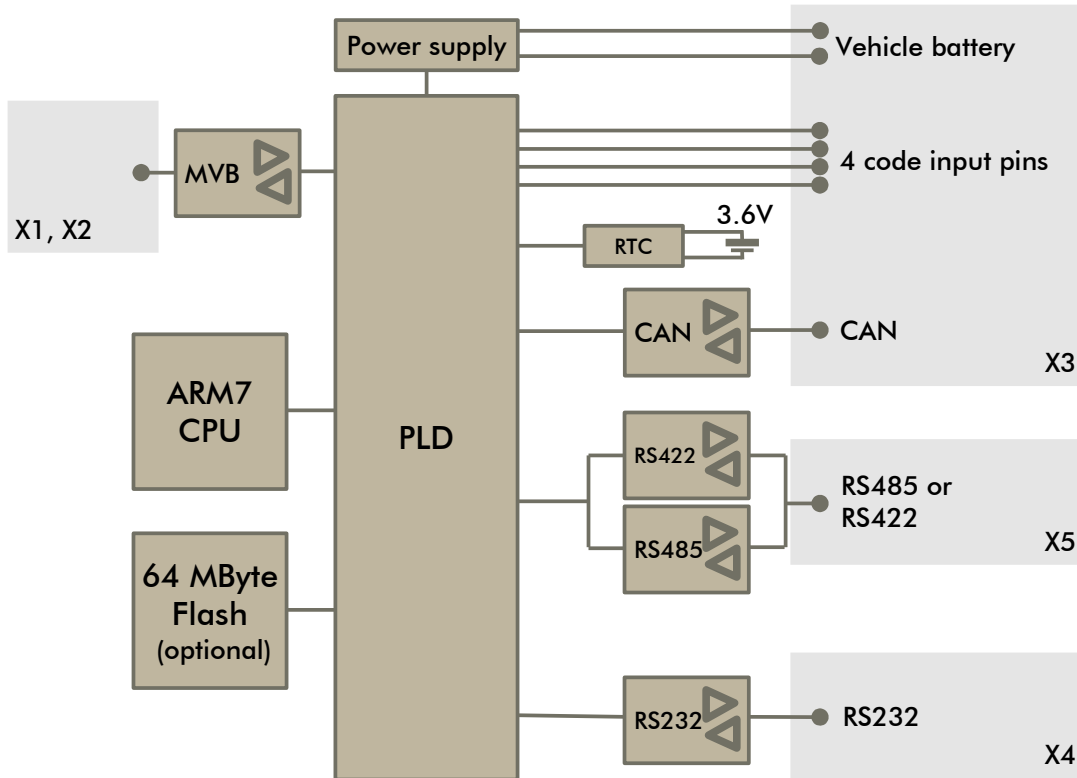
1. Architecture

1.1 Hardware Structure

The figure below shows the D429.



1.1.1 Basic Function Blocks



The PLD programmable logic includes several functions like the Duagon **MVB controller**, controllers for **RS485/RS422/RS232**, an interface to the **CAN** controller and several other peripheral digital functions. Depending on the application, it is compiled matching to the set of used hardware options.

The local **ARM7 microprocessor** controls the internal flow of information and can be widely adapted to application requirements. This part can be reprogrammed / redefined without hardware change. It contains 256 kByte SRAM and 2 MByte Flash.

Power is drawn from the vehicle battery supply. This includes the supply for the various communication transceivers as well as the internal logic.

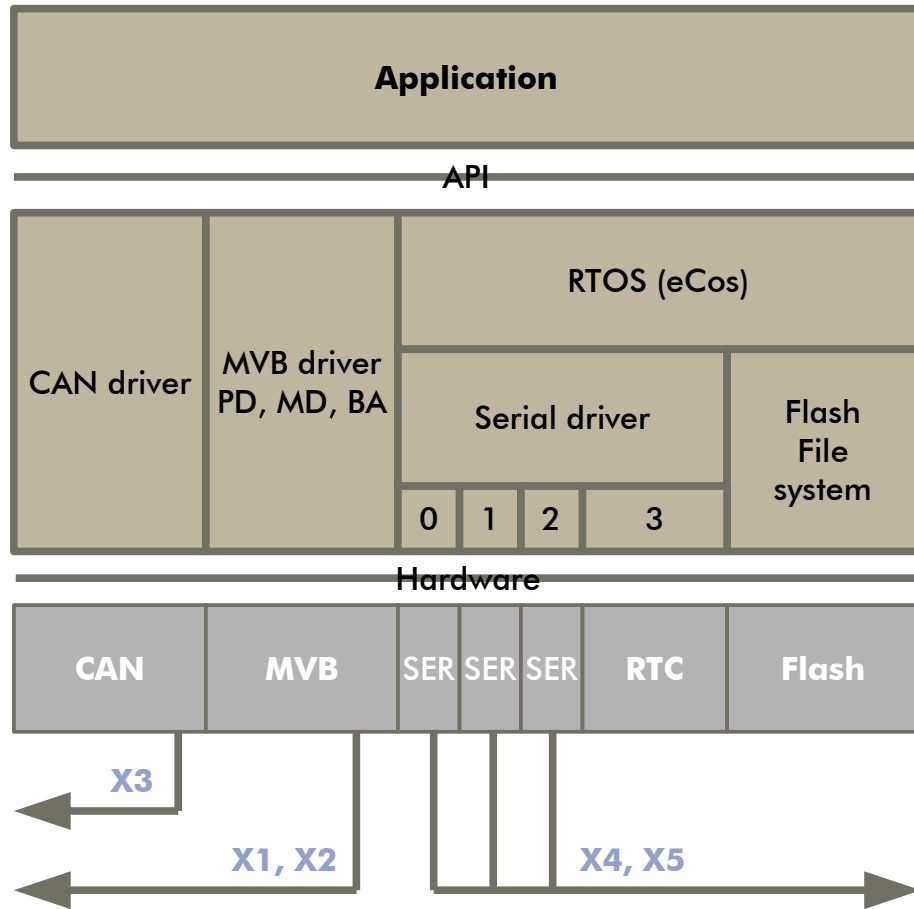
1.1.2 Memory

The D429 local microprocessor includes the following memory spaces:

Memory Type	Size
Flash	2 MByte
SRAM general memory	256 kByte+1024 kByte
SRAM traffic memory MVB	256 kByte

The **64 MByte Flash** Memory is intended for separate flash file system use and comes completely independent from the CPU internal flash memory, as an option.

1.2 Software Structure



Note: It is also possible that Duagon implements your application according to your specification. Please call Duagon for more information about software engineering projects.

Most of the driver and operating system software is accessible in sources.

- For the CAN, the simple driver may be sufficient, or it may be replaced with one of the CAN upper layer standards; according to the customer's needs.
- The MVB part supports all relevant libraries for Class 1 to 4 operation.
- The real time clock (RTC) and the Flash Memory are accessible through the operating system using standardized POSIX functions.

Physical Interfaces

MVB Interface (X1, X2)

The D429 is equipped with two 9-pin SUB-D connectors for MVB.

Other types of MVB connectors are available on request.

Independent from the type of physical interface (ESD+ or EMD), the D429 supports two redundant MVB lines A and B.

As an innovation to previous solutions, each line has its own decoder circuitry. Both redundant lines are monitored at the same time and the D429 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.

ESD+ Description

This paragraph applies to the D429-D versions, only.

Pin #	Pin shortcut	Input / Output as seen from the D429	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 D429 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.

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 D429 is available in both EMD and ESD+ version, the TxE signal is not required any more.

Terminator Supply ESD+

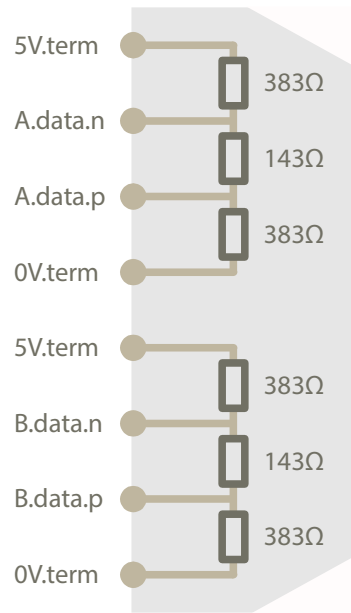
This paragraph applies to the D429-D version, only.

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 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 D429 (voltage specifications not guaranteed).

Terminators ESD+

The following terminator is recommended for the use with the D429 version for ESD+:



Line A
In case the D429 is the last of several MVB nodes, one of the D429- MVB connectors remains free. 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 120Ω.

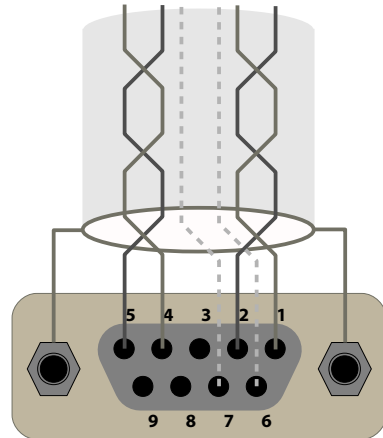
The terminator is not included within the D429. Call duagon for availability and supply information.

Line B

MVB Cable Attachment ESD+

The figure shows the recommended cable attachment.

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



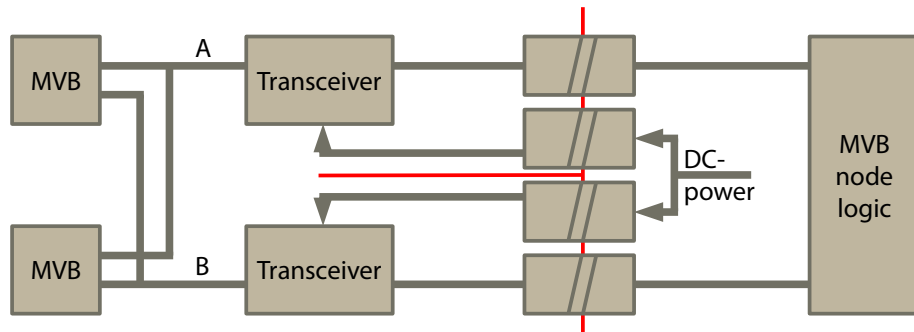
Important Note:



- 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 from the logic/IO and from each other.



EMD Description

This paragraph applies to the D429-T version, only.

Pin #	Pin Shortcut	Input / Output as seen from the D429	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 resistor	Termination resistor between two pins
8, 9	B.term		

Shell	Shield	-	Connection to shield resp. housing.
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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 D429 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 120Ω.

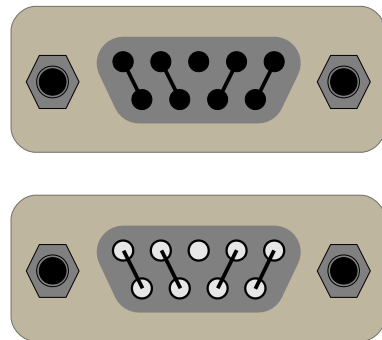
Note: If the D429 is equipped with two MVB connectors, both connectors have the same pinout, and all pins except pin "NC" are routed from one connector to the other.

Terminators EMD

The following terminator is recommended for the use with the D429-T:

The appropriate pins from the MVB line are connected to the local terminating resistor within the D429.

In case the D429 is the last of several MVB nodes, one of the MVB connectors remains free. 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 D429. Call duagon for availability and supply information.

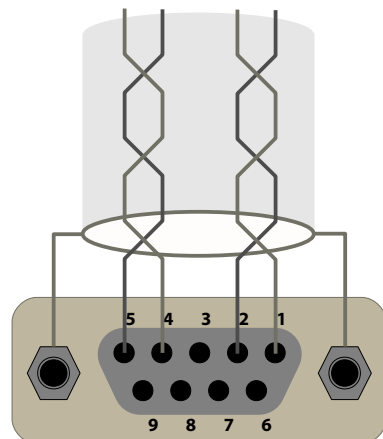
MVB Cable Attachment for EMD

The schematic shows the recommended cable attachment.

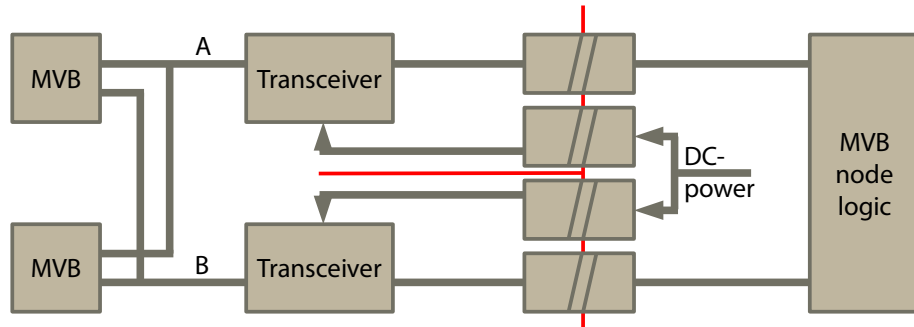


Important Note:

- 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



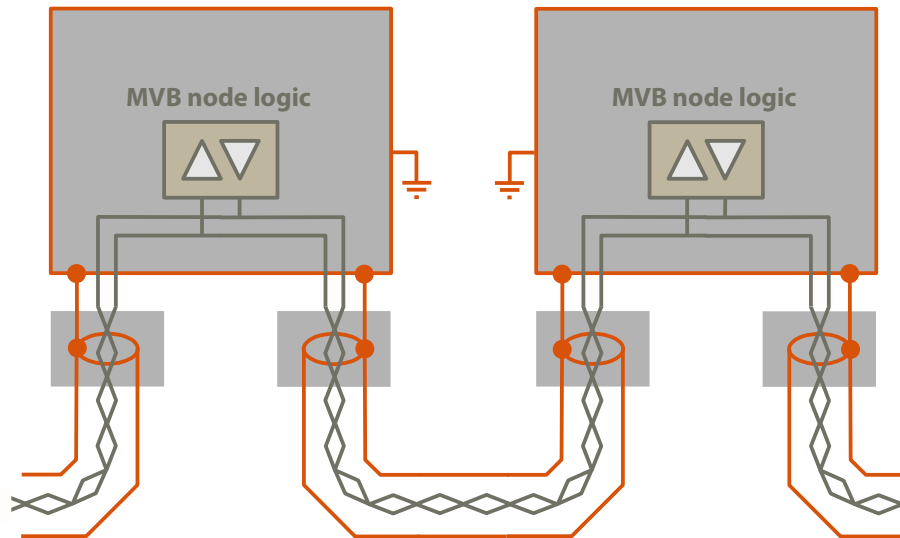
The two MVB lines A and B are galvanically insulated to the logic/IO and to each other.

1.2.1 MVB Shielding Concept

There are basically two different shielding concepts used in applications. The D429 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 the same connection to the device housing in all nodes



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. 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 issue:

- **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 D429.
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.

For more information, see also the document "Material and Components for Wiring – Technical Note", d-000842-nnnnnn.

Both MVB connectors 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!

CAN Interface (X3)

The D429 provides a CAN interface on connector X3.

It supports virtually all CAN operating modes and baud rates: Version 2.0a and 2.0b, with up to 1 Mbaud. The CAN controller is compatible to the Philips SJA1000 widely used in the industry.

For more information about the software running on the CAN interface, refer to page 28.

1.2.1 Pin Definition

The X3 connector provides a CAN interface on pin 6 to 8.

Pin #	Pin shortcut	Description
8	CAN_H	CAN signal lines
7	CAN_L	
6	CAN_shd	Recommended for higher baud rate applications or in high EMI environments.

Note:

All CAN pins (CAN_H, CAN_L, CAN_shd) are galvanically insulated from all digital logic. However, the CAN_shd pin has an RC-circuit (1M Ω parallel to 4.7nF) to the case surface (Shield).

1.2.2 CAN Cabling

The D429 is by default configured to 1MBaud operation. For this mode, shielded CAN cables are recommended in order to reduce trouble with emitted EMI.

RS485-Interface (X5)

The 9-pin female SUB-D connector X5 is alternatively used as an RS485 interface. When used for the RS485 interface, the pin out shown below is valid:

Pin #	Pin shortcut	Input / Output as seen from the D429	Description
1	RXTX+	bidirectional	non- inverted signal line, with RS485- level
2	RXTX-		inverted signal line, with RS485- level
3	NC	-	Not connected
4	n.u.	-	
5	n.u.	-	
6	LGND	power output	local ground, may be used as power equalization line
8	n.u.	-	
7	n.u.	-	
9	n.u.	-	
shell	Shield	-	Connection to shield resp. housing.

n.u. = not used in relation to RS485 operation. Do not connect any wire to it.

The RS485 interface is galvanically insulated to the digital logic. Please refer to the description of the insulation for the MVB/ESD+ interface.

Configuration Options RS485

This paragraph defines the user selectable options for the RS485 interface.

These hardware and firmware selectable options must be defined prior to manufacturing / delivery of the product:

Issue	Description	Option
Termination	Define the resistance of the terminator in Ω . (usual values are 120 Ω , 150 Ω)	e.g. 120 Ω , 150 Ω or no termination Default: 120 Ω
Bias	Defines, whether the terminator shall generate a "bias" offset voltage of approx. -0.75 Volt. This feature may be used to ensure a reliable idle level even during EMI disturbances.	yes or no Default: no bias
Protocol	Define the protocol to be used (e.g. UART)	e.g.: UART, 115200Baud, no parity, one stop bit

Notes:

- The combination 150 Ω termination and bias is not possible on the standard products.
- The filled in values are examples and may be adapted according to customer needs.

RS422-Interface (X5)

The 9-pin female SUB-D connector X5 is alternatively used as an RS422 interface. When used for the RS422 interface, the pin out shown below is valid:

Pin #	Pin shortcut	Input / Output as seen from the D429	Description
1	RX+	input	non- inverted signal line, with RS422- level
2	RX-		inverted signal line, with RS422- level
3	NC	-	Not connected
4	TX+	output	non- inverted signal line, with RS422- level
5	TX-		inverted signal line, with RS422- level
6	RXGND	power output	local ground, may be used as power equalization line
7	TXGND		
8	n.u.	-	
9	n.u.	-	
shell	Shield	-	Connection to shield resp. housing.

n.u. = not used in relation to RS422 operation. Do not connect any wire to it.

The RS422- interface is galvanically insulated to the digital logic. Please refer to the description of the insulation for the MVB/ESD+ interface.

Configuration Options RS422

This paragraph defines the user selectable options for the RS422 interface.

These hardware and firmware selectable options must be defined prior to manufacturing / delivery of the product:

Issue	Description	Option
Termination	Define the resistance of the terminator in Ω . (usual values are 120 Ω , 150 Ω)	e.g. 120 Ω , 150 Ω Default: 120 Ω
Bias	Defines, whether the terminator shall generate a "bias" offset voltage of approx. -0.75 Volt. This feature may be used to ensure a reliable idle level even during EMI disturbances.	yes or no Default: no bias
Protocol	Define the protocol to be used (e.g. UART)	e.g.: UART, 115200Baud, no parity, one stop bit

Notes:

- The combination 150 Ω termination and bias is not possible on the standard products.
- The filled in values are examples and may be adapted according to customer needs.

RS232-Interface (X4)

On X4 (9-pin male SUB-D), there is an RS232 interface with the following pin out:

Pin #	Pin shortcut	Input / Output as seen from the D429	Description
2	RxD	Input	Receive data input
3	TxD	Output	Transmit data output
7	RTS	Output	Request To Send or Second TxD
8	CTS	Input	Clear To Send or Second RxD
5	GND	(power line)	Reference potential.

All other pins are not connected.

The additional RTS, CTS pins may be used for hardware handshake or for a second pair of TxD and RxD. This can be defined by software configuration.

The RS232 interface is galvanically insulated to the digital logic. Please refer to the description of the insulation for the MVB/ESD+ interface.

Configuration Options RS232

This paragraph defines the user selectable options for the RS232 interface.

These firmware selectable options must be defined prior to delivery of the product.

Issue	Description	Option
Protocol	Transmission parameters	Default: UART, 115200Baud, 8N1, no hardware handshake

Real Time Clock (RTC)

The D429 can be ordered with a real time clock as an option. The accuracy of this RTC is better than ± 1 minute per month.

If this option is chosen, there is also a Lithium Thionyl Chlorid battery (which is well suited with a temperature range from -40°C to $+85^{\circ}\text{C}$) with the size of $\frac{1}{2}\text{AA}$ mounted on the board. For the lifetime of the battery see chapter "Useful Life".

If the RTC loses data, please contact Duagon to exchange the battery.

This battery must be mechanically fixed.



Warnings:

- **Never apply an excessive force to the positive terminal. Never drop. Never deform or disassemble the battery.**
- **Never charge, short-circuit or forcibly discharge the battery.**
- **Never heat or expose to open flames.**
- **Never allow liquid leaking from the battery to get in your eyes or mouth.**
- **Never touch the battery electrodes.**
- Disposal:
As electric capacity is left in a discarded battery and it comes into contact with other metals, it could lead to distortion, leakage, overheating, or explosion, so make sure to cover the (+) and (-) terminals with friction tape or some other insulator before disposal.



Explanation:

Because the positive terminal of the battery is sealed by a glass, subjecting this area to sudden jolts and excessive force (over 19.6 N) could destroy the glass seal leading to leakage.

All other warnings could generate gas inside the battery and leading to distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases. Because this liquid could cause serious damage, if it does come in contact with your eyes, flush them immediately with plenty of water and consult a physician. Do not allow the battery electrodes to come in contact with your skin or fingers. Otherwise, the moisture from your skin could cause a discharge of the battery, which could produce certain chemical substances causing you to receive a chemical burn.



Caution: Handling

Please have the installation, removal, and disposal of this battery performed by a technician with a thorough understanding of the Warnings and Cautions on handling.

Caution: Storage

Avoiding storing the battery in direct sunlight, or in excessively hot and humid locations, and store it out of the way of rainwater and other adverse environmental elements.

1.1 Power Connector / Code Input (X3)

The D429 is powered directly from the vehicle battery via connector X3. In addition, connector X3 contains four Code Inputs and the CAN interface described on page 20.

1.1.1 Pin Definitions

Pin #	Pin shortcut	Description
1	$-V_{bat}$	Negative power supply
2	$-V_{bat}$	
3	$+V_{bat}$	Positive power supply
4	$+V_{bat}$	
5	nc	Not connected
6	CAN_shield	Recommended for higher baud rate applications or in high EMI environments.
7	CAN_H	
8	CAN_L	CAN signal lines
9	nc	Not connected
10	Code 0	Code Input Line 0
11	GND	Power reference
12	Code 1	Code Input Line 1
13	Code 2	Code Input Line 2
14	GND	Power reference
15	Code 3	Code Input Line 3

Note:

The respective pins for the battery lines are internally connected. Since the device requires minor power, it is OK to connect only one of the V_{bat} lines, but do not connect other devices on the empty V_{bat} line.

1.1.2 Code Inputs

On X3 there are four CODE Input lines. These are read by a start up script, which distinguishes from the state of the CODE Inputs which application to start (see also Section "Several Identical D429 on One MVB" on page 30).

The basic way to control the CODE Inputs is, to strap them either to GND, or leave them open.

Important Remarks:



- Setting all CODE Inputs to GND is reserved for production purposes. This CODE is used during production e.g. for burn-in stress generation. Never use this configuration during normal operation, since this configuration may switch outputs on spontaneously.
- The recommended procedure to select CODE Input combinations is by placing small jumpers on the cable connector. The input current on these pins is very low. Do not use long cables (more than 0.1m) for external strapping. When a pin should be open, do not connect any cables to it.

1.1.1 Operating Conditions (Power Supply)

Symbol	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 ($\cong U_n$)	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 ($\cong U_n$)	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 all communication interfaces operational, all other inputs and outputs off		3.5	7	W	

Note:

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

1. Software Protocols

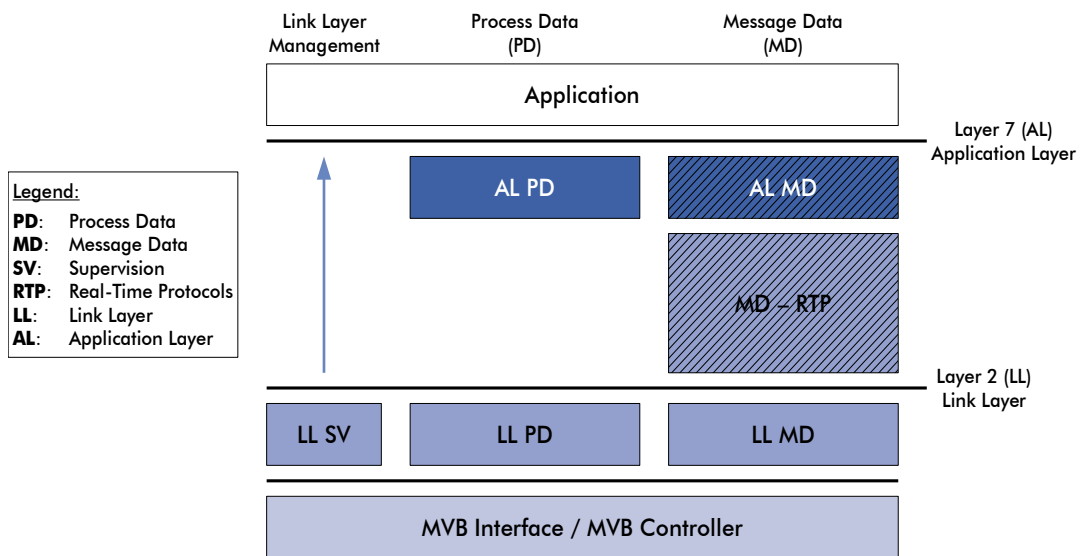
The D429 controller application is usually implemented on customer's side. Duagon delivers a small "demonstrator" software, being an example for testing and implementation concepts.

Note: It is also possible that Duagon implements your application according to your specification. Please call Duagon for more information about software engineering projects.

1.1 MVB Software Protocols

The MVB Driver provides an easy way to implement the communication between the customer's application and the MVB.

The following figure shows the structure of the TCN driver:



The TCN Driver Software for D429 supports process data and message data up to application layer (AL PD and AL MD).

The driver software is available as preconfigured binary library for the standard RTOS "eCos", which have to be linked with the application code.

For further development the ANSI C source files are also available.

For more information, please refer to the D429 Driver Kit, d-001211-nnnnnnn

MVB Bus Administrator

The D429 can act as a full featured MVB Bus Administrator. The Duagon tool D2000 may be used to administrate an MVB network and to generate the bus administrator configuration file.

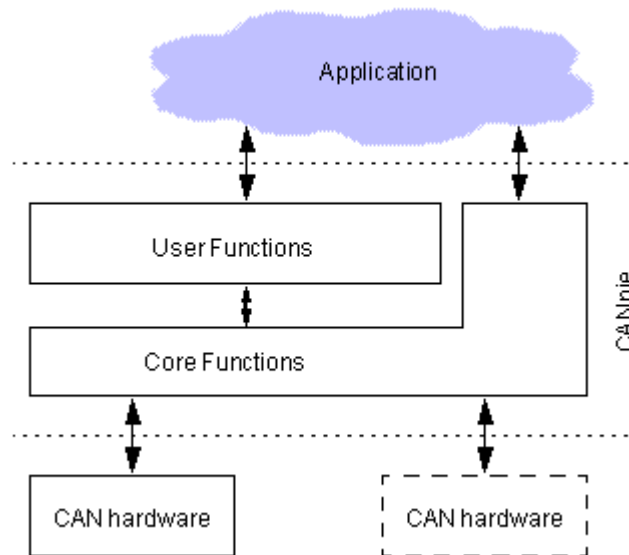
For more information about Bus Administrator configuration call Duagon or see our web page.

1.2 CAN Software Protocols

CANpie Driver Software

The D429 is delivered with the CANpie Driver Software package. The CANpie Driver Software provides a low-level API to the CAN Controller of the D429.

Note: CANpie can be replaced by any other CAN communication stack.



CANpie provides a two-level API, consisting of core functions and user functions.

User Functions

The user functions always call the core functions, they never access the hardware directly. That means the user functions do not have to be modified when implementing the CANpie on existing hardware. A typical user function is the writing of a CAN message to the FIFO buffer.

Core Functions

The core functions access the hardware directly, so an adaptation is necessary when implementing for a new piece of hardware. Core functions may also be called by the application (in that case the application engineer must have a good knowledge about the CAN hardware). A typical core function is reading from a CAN controller register.

CAN Communication Stacks

The D429 can run arbitrary CAN communication stacks, such as **CANopen**, **J1939**, etc.

Please contact Duagon for further information.

General Concepts

MVB Configuration

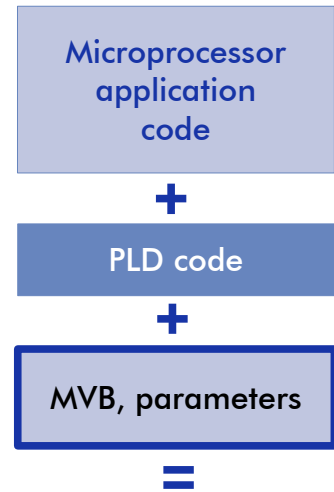
In order to see the D429 module on the MVB at the correct address, it must be configured:

- The preferred way of configuration is the direct access over MVB into the D429s local file system. This requires for example the d412 diagnostic tool, some files released by Duagon, and a simple text editor for the MVB configuration.
- As a second solution, a serial line (RS232) can be used. However, this interface may already be allocated to an application (or may not be available on a given hardware selection).

The Software Parts...

The data within the module's file system consists of two types of "code" and several parameters:

- First, the microprocessors application specific code. Typical tasks are the routing of communication data to and from the MVB, make decisions about redundant sink ports, serve fallback timers and the like. Customer specific extensions are implemented by some additional C-code.
- Second, the PLD code is loaded into a programmable logic device. This device then behaves as a piece of hardware and includes the interface into various directions.
- Third, the MVB configuration and general purpose parameter-set. This includes information like device addresses, PD port addresses, type of MVB physical layer, etc.



...make a Code Set

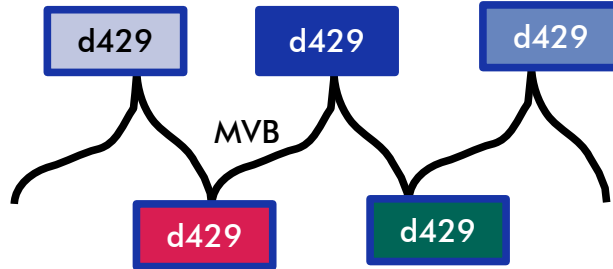
A "code set" includes all programmable information required for a specific application.



If the user wants to have some specific functions programmed into the device at delivery time, he will get an identification number of this customized version from Duagon.

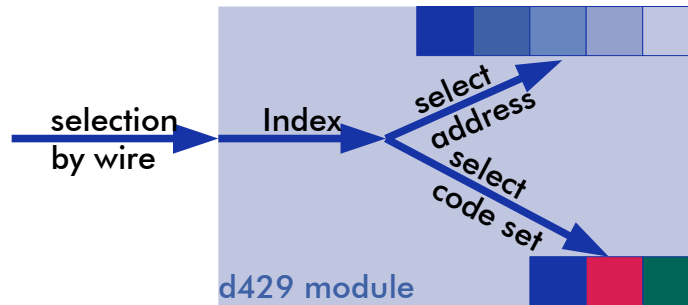
1.1 Several Identical D429 on One MVB

When there are several D429 modules in one MVB system, their MVB addresses must be somehow different.

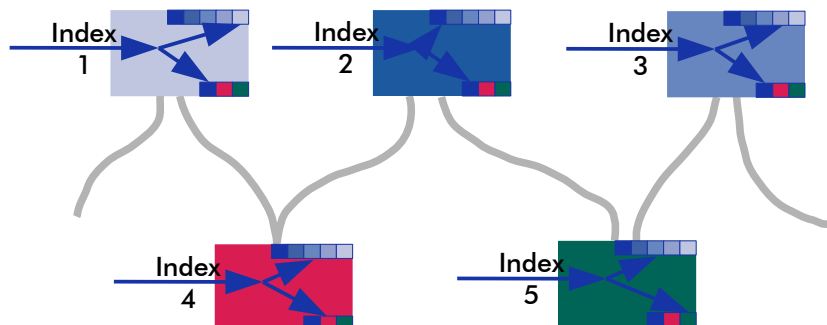


However, it is very useful to have only one type of module within a vehicle; i.e. all modules can be exchanged with each other and the correct function remains at the right place:

- Each module must "know", where it is (i.e. which function is to be performed).
The external wiring on the "code" pins tells the device which "**index**" it has (see page 25 for more information). The index has a direct influence on the MVB addresses.
This is the preferred way to support multiple D429 modules.
- In addition, the index may select one of several **code sets**. This would be the case, if e.g. one of the D429 modules has a specific PLD or application software which the others do not have. The number of different code sets is restricted by the capacity of the internal file system, only.
This way of geographic differentiation is required for customer specific versions, only.
- All used "code sets" must be included in all modules.



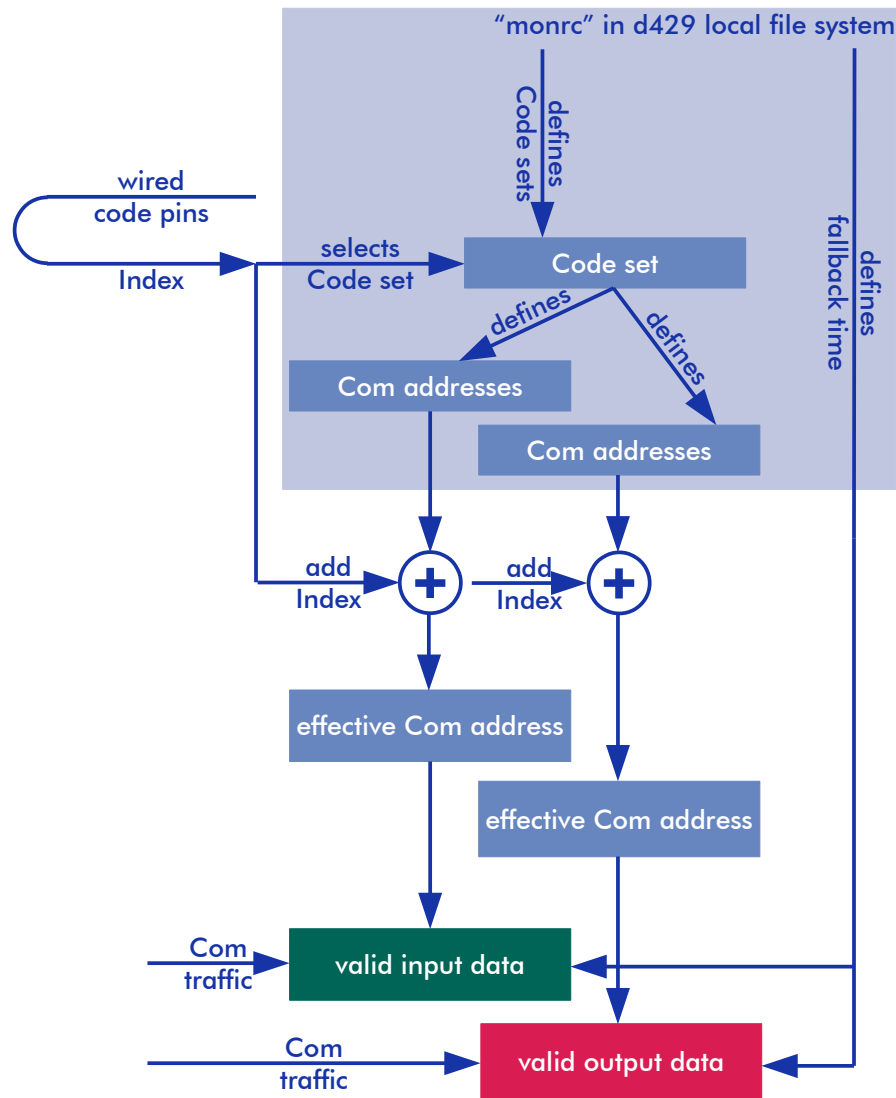
When exchanging modules from one location to the other, the wiring remains at the right place and selects the correct functionality:



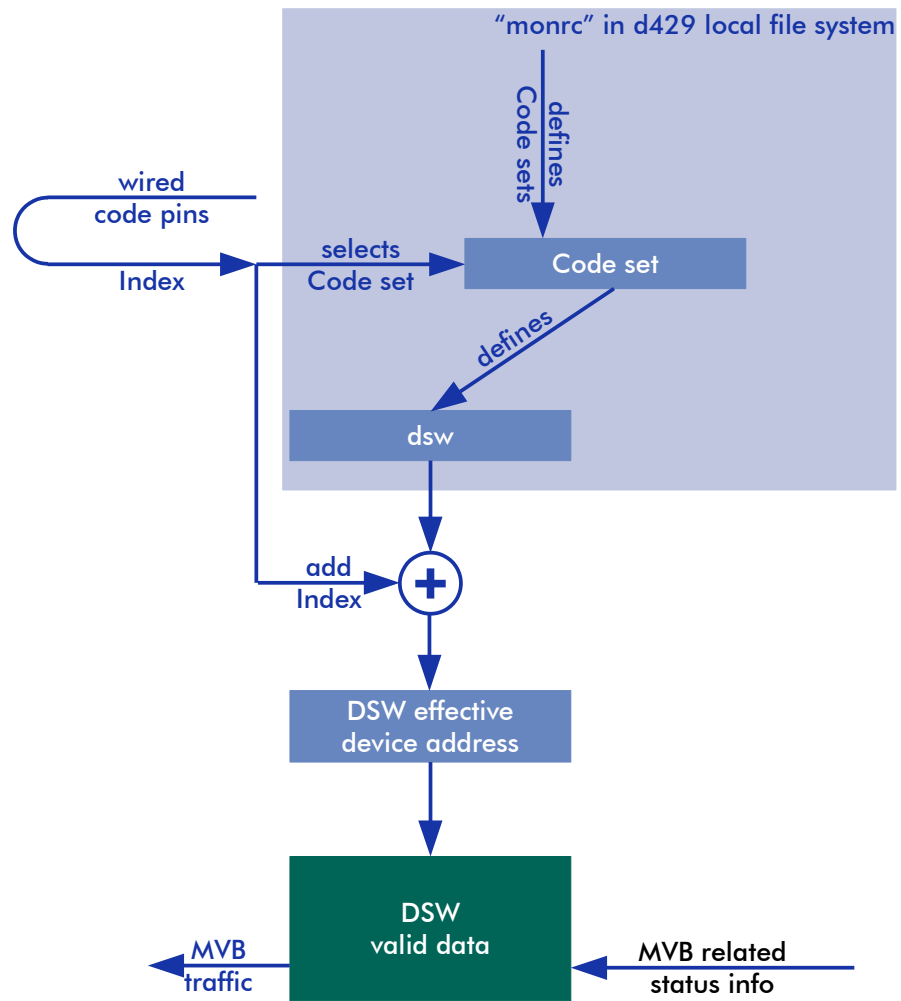
Communication Configuration

The configuration has to be done according to application specific requirements. In case, the D429 occurs just once in a vehicle, no precautions are required for the application engineering.

In case, there are several D429 within one vehicle, we recommend to include this generic information flow for configuration of all communication interfaces:



Device Status Word



DSW data without BA

The device status word is presented to the MVB during a device status request.

bit positions															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Capabilities				specific				common flags							
PD	BA	GW	MD	AX1	AX0	ACT	MAS	LAT	RLD	SSD	SDD	ERD	FRC	DNR	SER
0	0	0	1	0	0	0	0	x	x	0	0	0	0	x	0

The meaning of the various bits is as follows:

- **Capabilities:** The **MD** capability is set in any case; as well as the **PD** capability (meaning here: 0=set).
- The **LAT** "Line A trusted" and **RLD** "Redundant line disturbed" are set according to the activities found on MVB.
- The **SSD** "some system disturbance", **SDD** "some device disturbance", **ERD** "extended reply delay", **FRC** "Forcing" and **SER** "system reserved" bits are not used and set to constant "0".
- The **DNR** "device not ready" is set, when there is a heavy hardware error or when the outputs are switched off due to lack of output data.

Bus Administrator Operation

With the bus administrator enabled, the device status word is enhanced by the BA-related bits:

bit positions															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Capabilities				specific				common flags							
PD	BA	GW	MD	AX1	AX0	ACT	MAS	LAT	RLD	SSD	SDD	ERD	FRC	DNR	SER
0	1	0	1	x	x	1	x	x	x	0	0	0	0	x	0

In addition to the common flags (described in previous paragraph):

- **Capabilities:** The **BA** bus administrator capability (bit 14) is now set.
- **ACT** is always set to 1 (declares the BA being configured).
- **MAS** is set, when the internal BA is the current BA. This bit is reset, when another BA controls the MVB.
- **AX1, AX0** are automatically set by the D429. The original function of these bits is replaced by an automatic mechanism, that will always pass the BA bus mastership to any other valid BA and will always get BA mastership due to a dynamically adapted AX1,0- value.

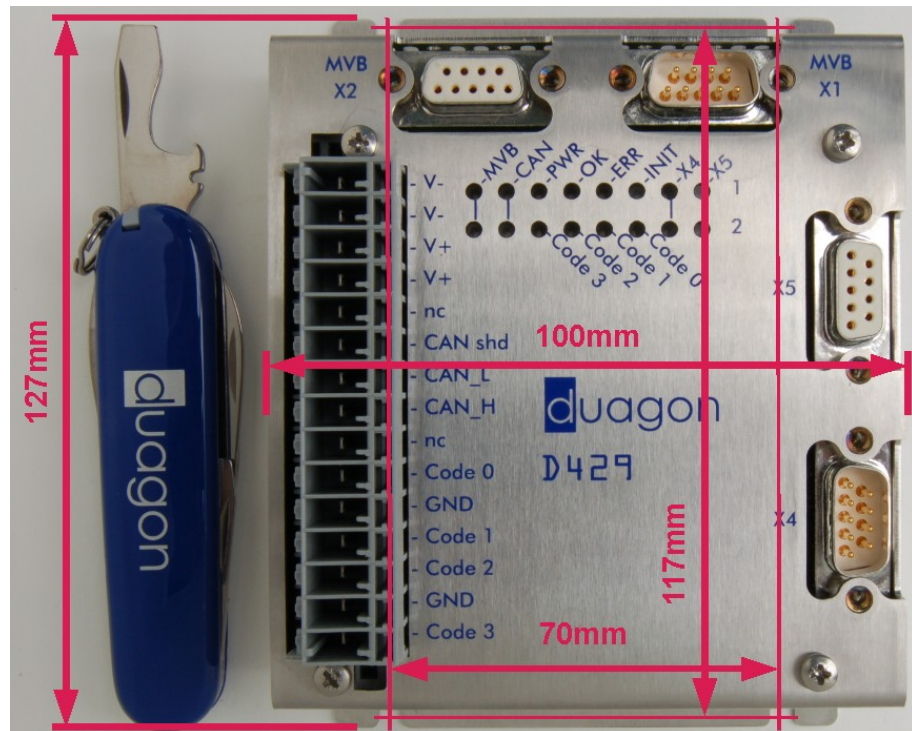
Mechanical Data

1.1.1 Mechanical Dimensions and Weight

The weight of the complete D429 is approx. 415g.

The weight of the housing only is approx. 290g.

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



(all measures are mm)

The picture below shows the "height" of the D429 case without connectors.



(all measures are in mm)

Important Notes:

- 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.

1.1.1 Cabling / Cable Locks

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

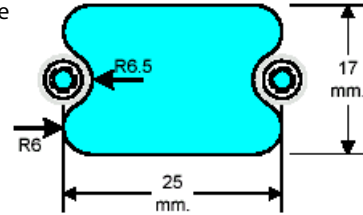
Be sure not to apply the UNC4-40 thread; it will damage the thread.



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

Important Notes

- The hood must not interfere with the D429 housing. Therefore, the connector's flanges should lie flat on the D429 surface
- The drawing on the right side shows the dimensions of the cutout on the D429. This is the area where the connector hood will dive below the D429 surface.



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

1.1.1 Mounting by four Screws

The D429 is recommended to be mounted with four M4 screws. The picture above shows the dimensions for the fixture holes.

1.1.2 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 D429 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 the 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:

1.1.3 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.



2. Environmental Data

Issue	min.	typ.	max.	Unit	EN50155:2007
Operational temperature range, "internal cubicle temperature", i.e. outside of D429 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	

3. Application Hints

3.1 Diagnostic by LEDs

3.1.1 General Status LEDs

Four status LEDs display the general state of the D429 module:



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

"OK" green LED	meaning
ON	MVB is configured, D429 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 hardware error

"ERR" red LED	meaning
short-short-short-short	Missing MVB writes to sink ports at all. When there is no MVB write to sink ports any more, the D429 module will shut off to interpret MVB data after a certain time. This state should be considered the "fail safe state". The application around the D429 module should be built in a way, that no unwanted or even dangerous effects occur when all activity is stopped. This error condition is reported in the device status report over the MVB: The "DNR" bit is set.
long-short-short-short	Missing MVB traffic (no writes to sink port) on one of the two redundant MVB lines. Missing MVB traffic on one channel (Line A or Line B) is a legal situation and all IO channels are working as intended. However, the MVB cable should be checked for faults. If not checked, the next occurring fault will stop all activity. This error condition is reported in the device status report over the MVB (with the common flags RLD and LAT being involved).
short-long-short-short	Missing MVB writes to one of several sink ports or Bus Administrator error: This may still be a legal situation, when only one of two configured sink ports is served or the own BA is never used. All IO channels are working as intended. However, the situation should be checked for faults. If not checked, the next occurring fault on the redundant device will stop all activity.
short-short-long-short	Diagnostic error on CAN interface.
short-short-short-long	Bus Administrator error: Local configured and running BA was not used within a certain time limit.

"ERR" red LED	meaning
Combination	The previously described errors may occur in combination. Watch the "long" pulse and locate the related error in the paragraphs above.

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

The diagnostic codes use the currently measured "MVB traffic".

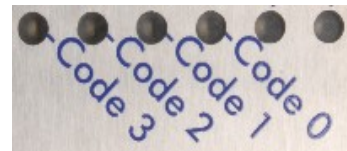
Note:

- only the MVB writes to the own sink ports are measured. Traffic related to other devices is not checked.

3.1.1 CODE LEDs

The CODE LEDs display the actual configured code input pins of the D429 module:

For more information about the CODE Inputs see pages 25 and 30.



"CODE" LED				CODE inputs and generated index
3	2	1	0	
0	0	0	0	0 ¹⁾
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Important Remark:

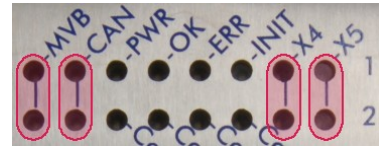


- 1) This state is reserved for production purposes. It is used during production e.g. for burn-in stress generation. Never use this configuration during

normal operation, since this configuration may switch outputs on spontaneously.

3.1.1 Communication Interfaces

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



MVB

Row "1" (TX) LEDs	Meaning
ON	The interface is sending data on line A and B.
OFF	The interface is not sending data on line A and B.

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

RS232, RS422, RS485, CAN

Row "1" (TX) LEDs	Meaning
ON	The interface is transmitting data.
OFF	The interface is not transmitting data.

Row "1" (RX) LEDs	Meaning
ON	The interface is receiving data.
OFF	The interface is not receiving data.

3.1 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 D429 device operates also from very low voltages (-LV: far below 14V), the device may be still "up and running", even if other devices have fallen out of operation already.

Power up

As with all electronic equipment, the D429 will need a certain time to power 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 during this time, „as if nothing is plugged in“.

3.1 Panic Recovery

The D429 supports a workaround solution, when the usual download via MVB or serial line does not work any more. This could be the case, when the download procedure is stopped too early (i.e. power cut off during flash programming) or when the downloaded application does not work properly.



For low level programming, the module has to be removed from the mounting location and has to be opened up. **It is not allowed for the customer to open up the housing! Warranty is void!**



In any case, an open housing will present contact areas with potential electrical shock hazard.

3.1.1 JTAG Interface

The D429 uses the JTAG interface for debugging and loading the flash memory in a virgin state after production.

The JTAG connector has the following pin out:

Pin #	Signal Name	Description
1	TCK	JTAG signal line
2	GND	Local power reference
3	TDO	JTAG signal line
4	+3.3V	Local power line
5	TMS	JTAG signal line
6	+3.3V	Local power line
7	NC	Not connected
8	reserved	For Duagon internal test purposes, only
9	TDI	JTAG signal line
10	GND	Local power reference

Remarks:

- The pin number 1 has a "square" pad, all other pins have a round pad. The pin 1 corresponds to the red stripe of the flat cable connector.

- The V_{cc} pins are connected to the internal 3.3V. Do not load the D429 internal 3.3V power supply with excessive current; use a separate power supply for the external debugging devices.
- Since the JTAG connector is not equipped with a galvanic insulation against the vehicle battery, a problem may arise even with non-dangerous battery voltages: the local digital ground is connected to $-V_{bat}$. Be sure, that any debugging tools (notebook? JTAG debugging box?) do not touch sensitive contact areas (even protective ground may damage the devices...).

3.1 EMI Considerations

We assume the following integration for the D429:

- The D429 signal lines have no connection with unshielded cables to the outside.
- The device case is properly connected to protective earth.

Standards Reference

The "D429" complies to the standards EN50155, EN50121-3-2 and IEC61375 in general. For exceptions, not applicable subclauses etc. please refer to the following paragraphs and, in more detail, to the "D429 Type Test – Report" with the document number d-000962-nnnnnn:

Immunity

The D429 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_f, 5kHz repetition frequency.

EN50121-3-2:2006 7.3 Battery referenced ports: Surges according to EN61000-4-5, waveform 1.2/50us, 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 EN61000-4-4, 2kV ±5/50ns t_r/t_f, 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 D429:

- 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.

- The Lithium battery (used for the real time option, only) should last for more than twenty years at +25°C environment temperature, which is reduced to about ten years at +60°C.

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

Polarity Reversal

EN50155:2007 7.2.6: Polarity reversal. The D429 is protected against polarity reversal of the vehicle battery. Also the RTC battery is protected against polarity reversal and short circuit on the D429 if the option event recorder or vehicle controller is chosen.

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 D429. The D429 applies to mounting location "**Category 1, Class B**".

MVB

IEC61375-1:2007: IEC International Electrotechnical Commission, "Electric Railway Equipment, Train bus, Part 1, Train communication network". Especially Clause 3: Multifunction Vehicle Bus.

CAN

ISO11898-2:2006: Controller Area Network (CAN): The D429 complies to the standard in general.

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.

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 D429 without the steel housing is approximately 125g.

DIN 5510-2:2009: The PCB and the female plug fulfill the UL94-V-0 (according to DIN EN 60695) flammability standard requirement. The other small parts/components are not required for further consideration.

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.

4. 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.

D429 Type Test – Report, d-000962-nnnnnn

This document covers the type testing performed with the D429 device.

CONTROLLER Driver Kit for D429, d-001211-nnnnnn

The Driver Kit provides an easy way to implement your application on the D429 controller. The Driver Kit contains the needed documents and software (e.g. real-time OS, development tools, ANSI C source code of driver, driver porting guide, API interface description, as well as board specific firmware with documentation how to download).

MVB System User's Guide, d-000656-nnnnnn

This document includes a lot of background knowledge for the work with MVB. It also includes hints for practical solutions, like finding & fixing of failures.

Labeling and Packaging – Specification, d-000778-nnnnnn

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-nnnnnn

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-nnnnnn

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

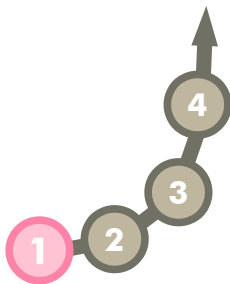
This document is intended for engineers to help them select the right MVB components.

D429 Order Information

The basic architecture of the D429 allows a huge number of different options. In order to find out the right option profile for your application, follow these four steps:

- Step 1:** Select a D429- family member. This is usually defined by your application.
- Step 2:** Select the hardware options. The hardware options are required to be specified prior to manufacturing (normally at order time). These options have an influence on pricing. Any changes at a later date may cause significant trouble with respect to cost and / or delivery time.
- Step 3:** Code set options. These options are downloadable to the hardware, and come readily programmed with the shipped devices. Their selection is required prior to delivery of boards, i.e. possibly after hardware manufacturing.
- Step 4:** Your personal selection of all options may not be "handy enough" to repeat it for each order. Duagon will issue a unique identification number for your selections, and this is well suited for the commercial ordering process.

Step 1: Select your Family Member



Duagon selected a few predefined D429 option profiles. These are:

D429E An **Event recorder** with MVB bus (X1 and X2), a Real Time Clock (RTC), 64MBytes Flash, 1MByte SRAM, RS485 (X5) and RS232 interface (X4).

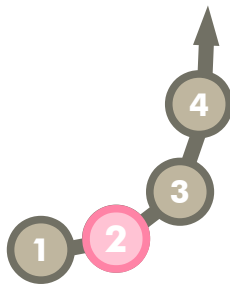
D429C A **CAN to MVB Gateway** with MVB bus (X1 and X2), and CAN (X3), RS232 on X4, 1MByte SRAM.

Each of these family members have some additional options to choose from – see the "step 2" for the family member in question.

In case, you do not find an option profile perfectly fitting your application, you may select all the features by yourself:

D429X A custom specific "**X**" **controller** with a combination of all features to choose from. Of course, this approach makes most sense, where a high volume has to be optimized for cost and performance. See the "Step 2: D429X" and make your choice.

Step 2: D429E Hardware Options (Event Recorder)



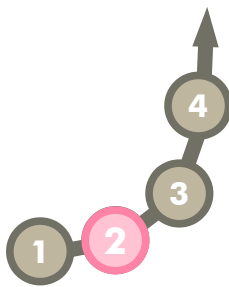
Since the connectors X3, X4 and X5 are predefined in their function, there are not this many choices:

D429E	.T	-HV
Product Type: D429E		
MVB Type (X1, X2): EMD ESD+	-T -D	
Power Supply: Nominal battery voltage: 24V, 36V Nominal battery voltage: 48V, 72V, 96V, 110V		-LV -HV

Some fixed features for the D429E in general:

- X3 = CAN, X4= RS232, X5= RS485
- The RS232 interface on X4 is used for software download and debugging.

Step 2: D429C and D429CL Hardware Options (CAN to MVB Gateway)

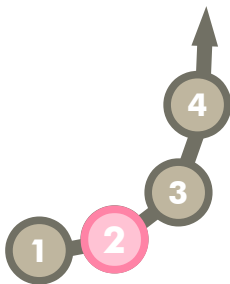


D429C	L	.T	-HV
Product Type: D429C			
Functionality: SERVER + BA MDFULL without BA	<empty> L		
MVB Type (X1, X2): EMD ESD+		-T -D	
Power Supply: Nominal battery voltage: 24V, 36V Nominal battery voltage: 48V, 72V, 96V, 110V			-LV -HV

Some fixed features for the D429C in general:

- X3 = CAN, X4 = RS232, X5 = no function
- The RS232 interface on X4 is used for software download and debugging.

Step 2: D429XL Hardware Options (RS485 to MVB Gateway)

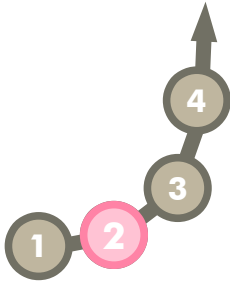


D429XL	.T	-HV
Product Type: D429XL incl. MDFULL		
MVB Type (X1, X2): EMD ESD+	-T -D	
Power Supply: Nominal battery voltage: 24V, 36V Nominal battery voltage: 48V, 72V, 96V, 110V		-LV -HV

Some fixed features for the D429XL in general:

- MVB with MDFULL, no Server, no Bus Administrator
- X3 = without CAN, X4 = RS232, X5 = RS485
- The RS232 interface on X4 is used for software download and debugging.

Step 2: D429X Hardware Options (Custom Defined)



As you can see in the table below, there are a lot of decisions to be taken! In order not to get lost in confusion, we have added to the table the option profiles for the standard products D429E and D429C.

Feature	Options included in standard product:		Custom specific selection for D429X	
	D429E	D429C	Possible options	Fill in your choice
Supply voltage	-HV, -LV	-HV, -LV	-HV, -LV	
MVB type on X1, X2	ESD+, EMD	ESD+, EMD	ESD+, EMD	
CAN available on X3	yes	yes	yes, no	
Function on X4	RS232	RS232	RS232	
Function on X5	RS485	-	RS485 RS422	
Real time clock with Lithium battery	yes	no	yes, no	
64MByte Flash file system	yes	no	yes, no	
1Mbyte SRAM	yes	yes	yes, no	

Remarks:

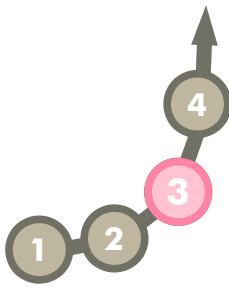
- default values for RS485, RS422 and RS232 as specified on pages 21,22 and 23. These parameters can be customized.

Confirmation



When you have finished your selections, contact Duagon and get a confirmation about the feasibility, a custom specific data sheet version and an identification number (as described in Step 4).

Step 3: Code Set Options



The "Code Set Options" consist of software defined features. Due to the inherent flexibility of software, it is not possible to resume this wide potential into a reasonable number of "order codes". As a result from this, we propose to the customer -

- to specify all relevant properties required for the application,
- to implement your own software functions and test the behavior of the device in the application with "engineering samples"

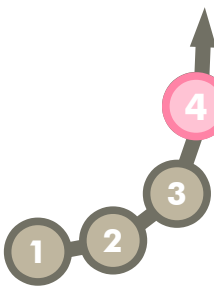
Some customers prefer to order a "virgin" device and download any software themselves. Also possible: Write your code, test it, and then submit it to Duagon in order to get it programmed on the shipped devices.

Examples for the details within the "Code Set Options" are:

- Baud rate and transmission parameters of the serial lines
- MVB parameters like "redundant lines", bus administrator arbitration list, device address, etc.
- Software modules submitted from the customer.
- Definition of behavior dependent upon the code pin settings

If you are not sure, how to start and how to refine your selections for the final solution, get in contact with Duagon and discuss your application with our engineers.

Step 4: Identification of custom specific selections



The selection of all options may become a rather complex process. This process should not be repeated for each commercial order! Therefore, all application specific features are concluded within a single identification number.

How to get such an identification?

- Make your selections and submit all information to Duagon, e.g. by email.
- Duagon will archive this information and release an identification number for it.
- The customer introduces this number into his commercial ordering system; any future orders will refer to this identification.

The first two points are usually dealt with by engineers, the third point usually by the purchasing department.

How does the identification look like?

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

Generic product family	Common identification of hardwired and downloadable options
D429C.D-LV-	d-001234-123456

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.

5. Document History

d-013160-025228

- Spelling corrections

d-013160-022227

- Added D429XL and D429CL

d-000891-023108

- Update to new layout

d-000897-012948

- Only RS232 as order option on connector X4.
- Removed "Preferred OP combination" table. Information about existing OP-combinations not relevant for data-sheet.

d-000897-009484

- Added DIN 5510-2 Fire and Smoke Statement

d-000897-008869

- D429C always with 1MByte SRAM equipped
- Update ESD Terminator value recommendation
- REACH statement added
- company address and phone number updated
- various minor changes, mainly editorial

d-000897-007482

- Standardization and actualization
- regrouping of chapters
- editorial changes
- General Safety Summary added
- 1Mbyte SRAM (fixed instead of optional)
- removed connector descriptions
- EMI hints added
- removed RS422/RS485 capability on connector X4
- added Software Protocols
- MVB
- CAN
- POSIX
- new Humidity norm added
- added Fire and Smoke in section "Standards Reference"

d-000897-004378

- RS232 interface added to default configuration of D429C
- Additional information about mounting of the device
- Hint software download preferably on X4 with RS232
- D429R now in new document d-001893-004961
- New Housing

- new LED "INIT"
- Update of EN50155 standard references (EN50155:2001 to EN50155:2007)
- Update of EN50121-3-2 standard references (EN50121-3-2:2000 to EN50121-3-2:2007)
- Chapter "Links to other Duagon Documents" added
- Multiple minor changes, mainly editorial

d-000891-003730

- Release of "Data Sheet D429 Rev 2"
- Update of EN50155 standard references (EN50155:1999 to EN50155:2001)
- Update of the EMD insulation concept (now the same as for ESD+)
- Multiple minor changes, mainly editorial.

d-000891-003310

- Multiple minor changes, mainly editorial.

d-000891-003294

- Multiple minor changes, mainly editorial.

d-000891-003069

- Multiple minor changes, mainly editorial.

d-000891-002844

- Multiple minor changes, mainly editorial.

d-000891-002643

- Release of "Preliminary Data Sheet"; some technical data is marked "to be defined".

6. Index

B					
Bus Administrator		33		M4 screws	35
C				Manufacturing	47
Cable		15, 16		Mechanical Data	34
Cable impedance		14, 16		Memory	10
CAN				Missing MVB traffic	37
CAN Controller		28		Mounting	35
CANpie		28		MVB interface	12
CTS		23		N	
D				NF F16-102	44
Device housing		18		O	
Device status		37		Order information	47
Device status word		33		P	
DNR		33		Packaging	46
E				Power	26
EMDB		16		Q	
EN50121		43		Quality Plan	46
EN50155		43		R	
ERD		33		Resistor	14
F				RFI	36
Fail safe state		37		RLD	33, 37
Fixture holes		35		RTS	23
FRC		33		RxD	23
G				S	
GND		23		SDD	33
Ground potential differences		18		SER	33
H				Shield	12, 16, 18
Hardware options		47		Shield continuity	19
Home page		8		Shielding concept	18
Hood		19		Software Licensing	55
Humidity		36		SSD	33
I				Sub-D Connector	19
IEC61375		43		Supply voltage	26
J				T	
J1939		28		Temperature range	36
L				Terminator	13
Labeling		46		Terminators EMD	16
LAT		33, 37		Terminators ESD+	14
LED		37, 38		TxD	23
Life Cycle		46		TxE signal	12, 16
M				U	
M3 thread		19, 35		UNC4-40	19, 35
				W	
				Wiring	30

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	<p>Specifies a certain purpose of a document with the intention to link several documents with different filing number.</p> <p>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.</p> <p>The format is either 6 digits or not available.</p>	<p>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.</p> <p>Always 6 digits.</p>

Examples for identification numbers

Identification number	Document Title / Remarks
d-000310-001606	„DXIO data sheet Rev 2.2“
d-000310-001952	<p>„DXIO data sheet Rev 2.3“</p> <p>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.</p> <p>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.</p> <p>In case a significant change happens, another document number would be applied.</p>
d-000719	<p>„Notes from prototype meeting ...“</p> <p>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.</p>

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 D429 are subject to specific license agreements. The following sections describe the relevant issues in a generalized form for Duagon products:

MicroMonitor

The "MicroMonitor for D429" 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 D429" under the terms of the same LUCENT PUBLIC LICENSE

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

eCos - RTOS Real-Time Operating System

The RTOS eCos is a registered trademark of Red Hat, Inc. The eCos source code and the "eCos license" agreement are available for public download on Sourceware Web Site (<http://ecos.sourceware.org/>).

The packages below are delivered under the terms of the "eCos license":

- The eCos Package Distribution "AT91DUAGON" is available for registered download on Duagon's Web Site (<http://www.duagon.com/>) as part of the Product specific Driver Kit.
- The "eCos Library for D429" is based on a public available eCos release and Duagon's eCos Package Distribution "AT91DUAGON" both configured using eCos template "duagon_D429".

TCN Driver Software

The TCN Driver Software is released under the terms of the DUAGON SOFTWARE LICENSE

The TCN Driver Software (source code and binary) and its license agreement are available for registered download on Duagon's Web Site (<http://www.duagon.com/>) as part of the product specific Driver Kit.

Note: The "JDP MD-stack Software" (if needed for the product at all) is delivered as binary, only.

DUAGON SOFTWARE LICENSE

Duagon cedes the present software to the customer in source code and/or binary form exclusively in order that the customer may modify or test it for running on the customer's system containing the Duagon products.

The binary form of the software or the modified software, regardless of whether the modifications to the software were made by the customer or by Duagon, is ceded to the customer to be used exclusively under a run time license

All rights, especially the intangible property rights to the software and the modified software shall belong exclusively to Duagon regardless of whether the modifications to the software were made by the customer or by Duagon. Also the rights to the modified software shall belong exclusively to Duagon.

The customer may not, either in source code or binary form - transmit the software or the modified software to third parties, or - use the software or the modified software for purposes other than those specifically mentioned above.

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CANpie Driver Software

The "CANpie Driver Software for D429" is released under the terms of the GNU Lesser General Public License. See the GNU Lesser General Public License for more details (<http://www.gnu.org/>).

The CANpie Driver Software (source code and binary) are available for registered download on Duagon's Web Site (<http://www.duagon.com/>) as part of the Product specific Driver Kit.

Note: The Original CANpie Software is available for public download on MicroControl's Web Site (<http://canpie.sourceforge.net/>).

YAFFS Flash File System

YAFFS is distributed under the terms of the license between Duagon GmbH (<http://www.duagon.com>) and Aleph One Ltd (<http://www.yaffs.net/>).

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