



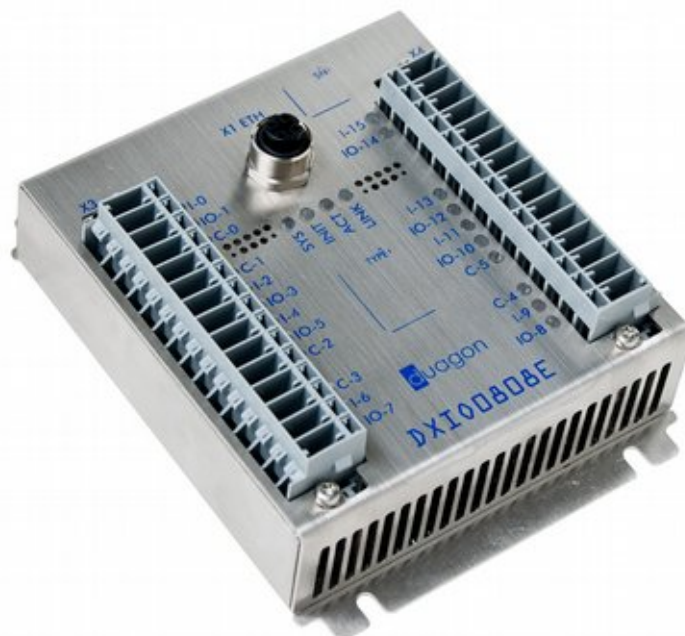
DXIO0808E

Ethernet Digital IO Module

Data Sheet

The DXIO0808E is an IO module with 8 digital inputs, 8 combined input/outputs and an Ethernet interface. The outputs do not conduct back driving voltages, which allows the use in redundant configuration. All channels have LED status indicators. Different module versions are intended to be used with nominal vehicle battery voltages from 24V to 110V.

The Ethernet interface is available with different communication stacks.



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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.

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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Table of Contents

- 1. General Safety Summary.....5**
- 2. Introduction.....6**
- 3. Architecture.....8**
 - 3.1 Hardware Structure..... 8
 - 3.1.1 Basic Function Blocs.....8
 - 3.1.2 IO – Connector Interface.....9
 - 3.1.3 Memory.....9
 - 3.2 Software Structure..... 10
- 4. Physical Interfaces.....11**
 - 4.1 Ethernet Interface ETH0 (X1)..... 11
 - 4.2 RS232 / JTAG Interface..... 12
 - 4.2.1 RS232 Interface (X6).....12
 - 4.2.2 JTAG Interface (X7).....13
 - 4.3 IO / Power / CODE Input Connectors (X3, X4)..... 14
 - 4.3.1 Pin Definitions.....14
 - 4.3.2 Cabling.....15
 - 4.3.3 Operating Conditions (Power Supply).....15
 - 4.4 Digital Outputs..... 16
 - 4.5 Digital Inputs..... 17
 - 4.6 Input/ Output Combination..... 19
- 5. Software Protocols.....20**
 - 5.1 Ethernet Software Protocols.....20
 - 5.1.1 Default Ethernet Services and Clients.....20
 - 5.2 CLI on Service Serial Line..... 20
- 6. General Concepts.....21**
 - 6.1 IPTCom Configuration..... 21
- 7. Mechanical Data.....22**
- 8. Thermal Management.....24**
 - 8.1 Maximum Output Power..... 24
 - 8.2 Overheating Protection and Indication.....24
- 9. Environmental Data.....25**
- 10. Application Hints.....26**
 - 10.1 Diagnostic by LEDs..... 26
 - 10.1.1 General Status LEDs.....26
 - 10.1.2 Ethernet.....27
 - 10.1.3 CODE Inputs.....27
 - 10.1.4 Input Channels.....27
 - 10.1 Reset Mechanism.....28
 - 10.1 EMI Considerations.....28

HTTP Server and FTP Server.....	28
11. Standards Reference.....	29
12. Links to other Duagon Documents.....	31
13. DXIO0808E Order Information.....	32
14. Document History.....	33
15. Index.....	34
Appendix A: Document Numbering System.....	35
Appendix B: Software Licensing.....	36

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.

2. Introduction

The DXIO0808E is an IO module with 8 digital inputs, 8 combined input/outputs and an Ethernet interface.

The Ethernet interface complies to IEEE802.3 and the internal logic is prepared for the future "Ethernet on traction vehicles" standard IEC61375-3-4. The DXIO0808E is designed for the harsh traction environment and conforms to the EN50121 / EN50155 / EN61373 standards, e.g. by:

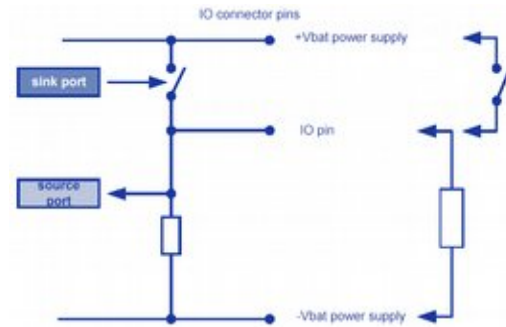
- -40 to +70°C operating temperature
- coating against humidity
- enhanced EMC and vibration robustness

The device is integrated in a stainless steel housing.

Innovative Digital IO

- 8 combined IO channels, each of them can be used as input, as output or in mixed IO mode.
- Redundant output configurations are supported without back- powering.
- 8 digital inputs
- LED status indicator

The DXIO0808 may be ordered for a battery voltage of 24V to 110V (two versions cover all nominal battery voltages as defined in EN50155).



On top of this functional definition, a lot of functions/ parameters may be adapted on customer's request.

Options

Since the main functionality is implemented in software and programmable logic, application specific changes can be introduced to the device without hardware change. This includes for example:

- Various Ethernet communication stacks supported
- Configuration of IO channels as a PWM output, enabling analogue output functions
- Inputs as frequency or event counter e.g. for speed sensors or PWM input detection
- Simple to complex software functions like a PLC
- Software- independent protection functions like end switches for servo motors

Please contact Duagon for more information about how your application problem may be solved.

Other Members of the DXIO0808 Product Family

The DXIO0808 Product Family covers modules with connections to the following vehicle bus systems:

- DXIO0808M: MVB
- DXIO0808E: Ethernet (this document)
- DXIO0808C: CAN

This Document

This document has a preliminary status. Therefore, several technical details are not finally defined, yet. These details are marked with "tbd", "to be defined". In a next version of this document, the "tbd" will be replaced by the final product properties.

How to Get Started?

This data sheet describes the properties and functions of the DXIO0808E Ethernet Digital IO Module.

Please ask Duagon for the DXIO0808E Development Kit Quick Start Guide for firmware development related documentation and source code.

The DXIO0808 is directly powered from the vehicle battery; supporting voltages like e.g. 24V or 110V.



WARNING. When using a high voltage DXIO0808 device (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:

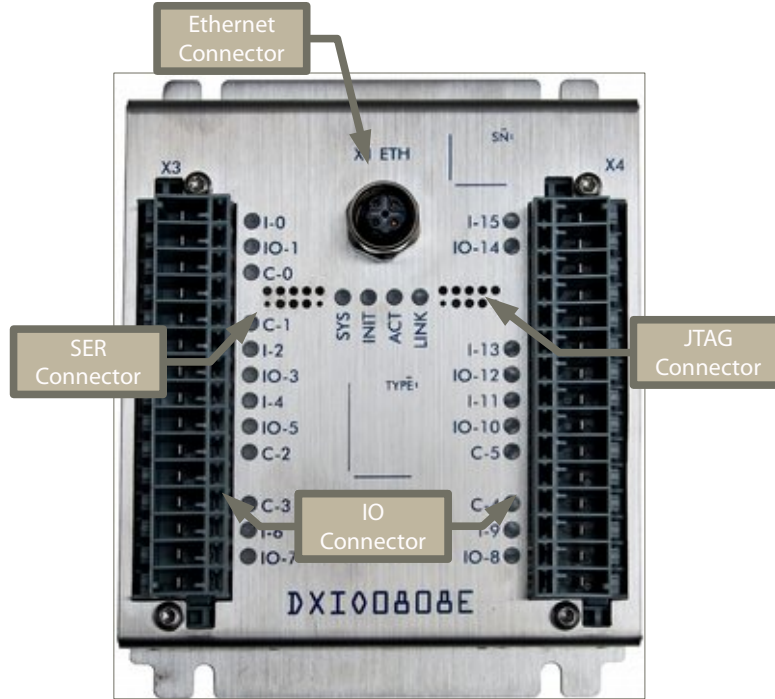
- Up to date documents
- Frequently asked questions
- Description of new product versions

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

3. Architecture

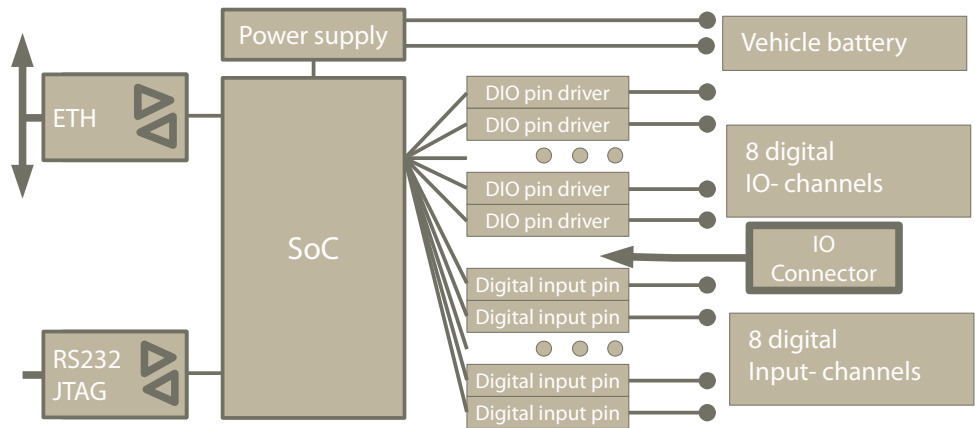
3.1 Hardware Structure

The figure below shows the DXIO0808E.



3.1.1 Basic Function Blocs

The basic function blocks within the DXIO0808E are shown in the drawing below:



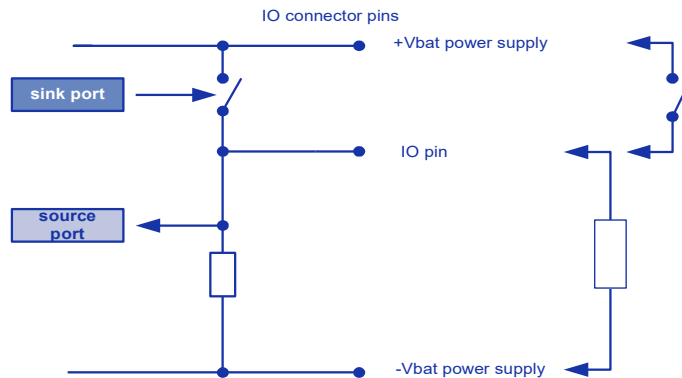
The **"System on a Chip SoC"** contains the local microprocessor and all relevant logic circuitry, like Ethernet MAC controller, memory controller, IO controller, etc. This component is implemented as a programmable logic device. This ensures the versatile change of e.g. controller specifications, bug fixes after hardware production and future portability to new silicon technologies.

The **digital inputs and outputs** interface to the external IO signals with their battery voltage levels.

Power is drawn from the battery supply. This includes the supply for the Ethernet transceivers as well as the internal logic and the output functions.

3.1.2 IO – Connector Interface

The architecture of a single IO pin driver is shown below:



On the outside, a load may be connected between the IO pin and V_{bat+} ; a switch to be read as a digital input is connected between V_{bat+} and the IO pin. The failsafe state of every output is "0" (off).

3.1.3 Memory

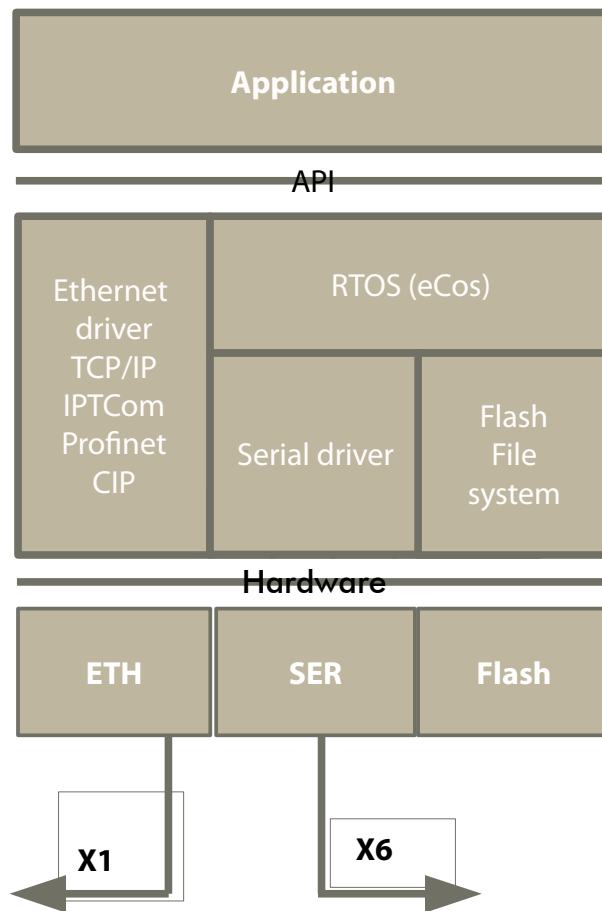
The DXIO0808 local microprocessor includes memory spaces as follows:

Memory Type	Size
Flash (volatile YAFFS flash file system (to store configuration and logging data))	6 MByte ¹⁾
SDRAM	32 MByte

Remarks:

- 1) This is the size of the flash file system available to the user. Extension to up to 30 MByte possible. Please call Duagon for more information.

3.2 Software Structure



The application running on the DXIO0808 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.

Typical tasks of the application software are the routing of IO data to and from the Ethernet bus, serving fallback timers and the like.

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

- The Ethernet part provides access to the chosen Ethernet communication stack.
- The Flash Memory is accessible through the operating system using standardized POSIX functions.

For more information, see also Section "Software Protocols" on page 20.

4. Physical Interfaces

4.1 Ethernet Interface ETH0 (X1)

The DXIO0808E provides an Ethernet interfaces ETH0 (X1) with an M12 connector (with D coding). Other Ethernet connector types are available on request.

The following features are supported:

- 10 and 100Base-TX
- full duplex
- auto negotiation
- auto sensing
- auto polarity
- 100m cable length over CAT5e
- unique MAC address
- Termination is 100Ω

The Ethernet interface is galvanically insulated to the digital logic.

For more information about the software running on the Ethernet interface, refer to section "Ethernet Software Protocols" on page 20.

Connector Pin Definition

The pin out of the Ethernet connector is as follows:

Pin M12 (X1)	Signal Name
1	TX+
3	TX-
2	RX+
4	RX-

Insulation and Shielding Concept

Characteristics:

- The cable shield is connected *to the device housing*.
- The cable shield has the same connection to the device housing *in all nodes*.
- The signal lines are *galvanically insulated* to the DXIO0808 inner logic.

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.

Ethernet Cabling

For information about counterparts for X1, see also the document "Material and Components for Wiring – Technical Note", d-000842-nnnnnn.

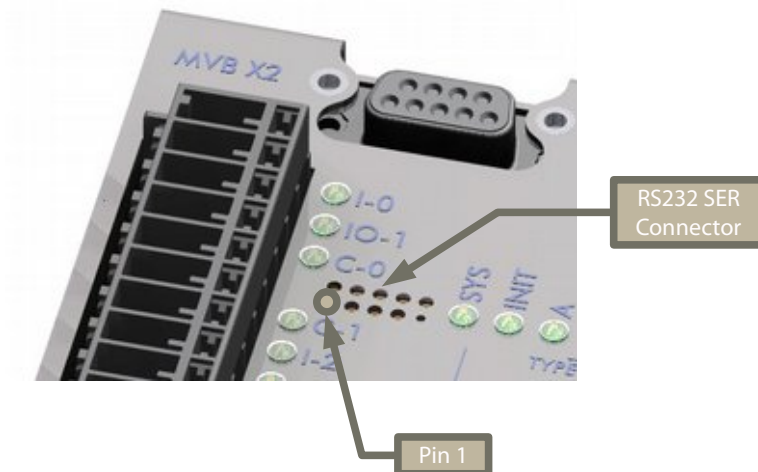
4.2 RS232 / JTAG Interface

There are two service interfaces for debugging and firmware update: RS232 and JTAG.



These interfaces are intended for service purpose only. They shall not be used for normal operation.

4.2.1 RS232 Interface (X6)



The RS232 Interface provides a Command Line Interface (see page 20) and it is intended for software debugging and firmware download. It is recommended to use this serial line for no other purposes.

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

Connector X6 is a female header connector.

Pin #	Signal Name	Input / Output as seen from the DXIO0808	Description
1	nc	-	Not connected
2	nc	-	
3	RxD	Input	Receive data input
4	RTS	Output	Request To Send (not used by default)
5	TxD	Output	Transmit data output
6	CTS	Input	Clear To Send (not used by default)
7	nc	-	Not connected
8	nc	-	
9	GND	(power line)	Reference potential
10	nc	-	Not connected

Configuration Options RS232

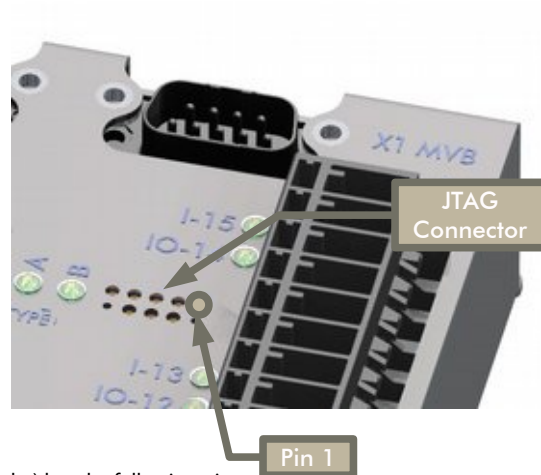
This paragraph defines the user selectable options for the RS232 interface.

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

4.2.2 JTAG Interface (X7)

The DXIO0808 provides a JTAG interface for developing the customer application (including debugging and loading the flash memory)



The JTAG connector X7 (female header) 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	Reserved, do not connected
9	TDI	JTAG signal line
10	GND	Local power reference

Remarks:

- The V_{cc} pins are connected to the internal 3.3V. Do not load the DXIO0808 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 -Vbat. Be sure, that any debugging tools (notebook? JTAG debugging box?) do not touch sensitive contact areas (even protective ground may damage the devices...).
- The pinout of the female header connector X7 is mirrored.

4.3 IO / Power / CODE Input Connectors (X3, X4)

4.3.1 Pin Definitions

Pin	Name		Pin	Name
X3 -1	I-channel 0		X4 -15	I-channel 15
X3 -2	IO-channel 1		X4 -14	IO-channel 14
X3 -3	Code Input 0		X4 -13	-V _{bat}
X3 -4	+V _{bat}		X4 -12	not connected
X3 -5	Code Input 1		X4 -11	not connected
X3 -6	I-channel 2		X4 -10	I-channel 13
X3 -7	IO-channel 3		X4 -9	IO-channel 12
X3 -8	I-channel 4		X4 -8	I-channel 11
X3 -9	IO-channel 5		X4 -7	IO-channel 10
X3 -10	Code Input 2		X4 -6	Code Input 5
X3 -11	+V _{bat}		X4 -5	+V _{bat}
X3 -12	Code Input 3		X4 -4	Code Input 4
X3 -13	I-channel 6		X4 -3	I-channel 9
X3 -14	IO-channel 7		X4 -2	IO-channel 8
X3 -15	-V _{bat}		X4 -1	-V _{bat}

Please note, that the two IO connectors are mounted "face- to- face", i.e. they have their "pin 1 direction" to the opposite side.

The respective pins for the battery lines are internally connected.

- Depending on the maximum current on the outputs, more than one of the +V_{bat}- lines must be connected.
- Even though there is not very much current on the -V_{bat}- line, we recommend to connect more than one -V_{bat}- pin.

In order to reduce losses and to enhance noise rejection, it is a good design practice to connect all +V_{bat} and -V_{bat} lines.

The IO channels are described in dedicated chapters on pages 16ff, 17ff and 19ff.

Code Inputs

The CODE Inputs are used to generate an index, which can be used by the application for geographic addressing.

The basic way to control these functions is to strap an input to either +Vbat ("1") or leave it open ("0"):

Code Inputs generated Index
5	4	3	2	1	0	
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	1	0	2
. normal binary counting ...
1	1	1	1	1	0	62
1	1	1	1	1	1	63 (reserved for production tests)



Note: The recommended procedure to select Code Input combinations is by placing small jumpers on the cable connector (see the document "Material and Components for Wiring – Technical Note", d-000842-nnnnnn.).
The input current on these pins is less than for general input pins. Do not use long cables (more than 0.1m) for external strapping. If a pin should be open, do not connect any cables to it.

4.3.2 Cabling

The IO connectors X3 and X4 belong to the "XCOM"- family made by Wago; Matching counterparts and supplemental parts are described in the document "Material and Components for Wiring – Technical Note", d-000842-nnnnnn.



4.3.3 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 (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 -	-100		100	V	Survives erroneous polarity reversal.
V_{bat+} Version HV	Supply voltage with respect to V_{bat-} - operating -	28.8	48 72 96 110 ($\sqrt{3}U_n$)	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 -	-300		300	V	Survives erroneous polarity reversal.
-	Interruptions of voltage supply, Class "S2"		10		ms	5.1.1.2 Class S2
P_{idle}	Power drawn from V_{bat} with all communication interfaces operational, all other inputs and outputs off		3.5	7	W	
I_{ppin}	Maximum current drawn over a single V_{bat+} pin		4 ²⁾		A	
C_{start}	Capacity contributing to power-on current surge			tbd	μF	Very low current surge. Value is NOT increased by external capacitor!

Notes:

- 1) In extension to the standard reference, there is no limitation with respect to the duration.
- 2) Since there may be several power supply pins connected in parallel, this value is intended as a hint for average planning, only.

4.4 Digital Outputs

When the sink port switches dynamically “on” and “off”, then the IO pin is used as an output function. During this operation mode, reading the inputs (via the source port) may give some diagnostic functionality:

Pin used as OUTPUT		
Output state	Input read back	Description
On “1”	“1”	Normal operation.
	“0”	Error. Reason may be current drawn by load exceeds limitation; e.g. short to V_{bat-} , or thermal overload of switch. Reported as error by LED indicators.
Off “0”	“1”	Error. A pure output may never go to V_{bat+} by itself. A reason may be a short circuit to V_{bat-} . Not reported by LEDs, since this channel could also be used as input.
	“0”	Normal operation.



The failsafe state of every output is “0” (off). In case of a failure, the output is switched off by the IO controller logic (e.g. in case of a short circuit) or by the software application (e.g. in case of missing Ethernet frames).

Output Operating Conditions

Symbol	Parameter / Conditions		Min	Nom	Max	Unit
R_{on}	Output switch on resistance	Ver- sion LV		0.25	0.5	Ω
I_{oncont}	Nominal load current continuous		0 ¹⁾		3	A
$I_{ondecay}$	Short term overcurrent, decay with 120ms down to I_{oncont} ²⁾				20	A
$I_{onshort}$	Short circuit trigger current for 10 μs ³⁾		20		50	A
E_{AS}	Inductive load switch-off energy dissipation, single pulse			0.36		A
V_{clamp}	Output clamp voltage at inductive load switch off; with respect to V_{bat+}			59		J
V_{clamp}	Output clamp voltage during back-powering; with respect to V_{bat+} , V_{bat+}			59		V
T_{ssv}	Time until outputs are switched off after loss of sink port service ⁴⁾			2050		ms
R_{on}	Output switch on resistance	Ver- sion HV		0.53	1.07	Ω
I_{oncont}	Nominal load current continuous		0		1.5	A
$I_{ondecay}$	Short term overcurrent, decay with 120ms down to I_{oncont} ²⁾				8.0	A
$I_{onshort}$	Short circuit trigger current for 10 μs ³⁾				20	A
E_{AS}	Inductive load switch-off energy dissipation, single pulse		8.0		20	A
V_{clamp}	Output clamp voltage at inductive load switch off; with respect to V_{bat+}			0.38		J
V_{clamp}	Output clamp voltage during back-powering; with respect to V_{bat+} , V_{bat+}			172		V
T_{ssv}	Time until outputs are switched off after loss of sink port service ⁴⁾			172		V
			2050		ms	

Notes:

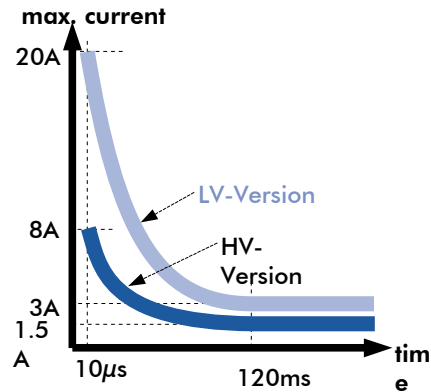
1) No negative current. The maximum value is defined by the internal current limitation. Do not try to use the device for a long time under these conditions, since this may harm the internal switch and/or the pin/cable connector.

2) Peak pulse currents are allowed to switch on for example cold light bulbs.

3) In case of a short circuit, the outputs are turned off after about 10 μ s. As a conclusion: Do not rely on the assumption, that a short circuit on an output will blow the wire protection fuse!
In case of a load current > 2A (HV) or >4A (LV) the output is switched off at the latest after 120ms.

4) T_{sv} "sink time supervision" the software parameter for the fallback time. It is configurable in the software; the default value is shown here, only.

Remark: Paralleling several outputs together in order to get higher switched currents is in principle possible. Care must be taken for the wiring (do not overload a single wire; typical current ratings for the combination pins – socket – cable are in the range 5 to 10 A) and for the control over Ethernet (be sure, that the two outputs always have the same state).



Polarity Reversal

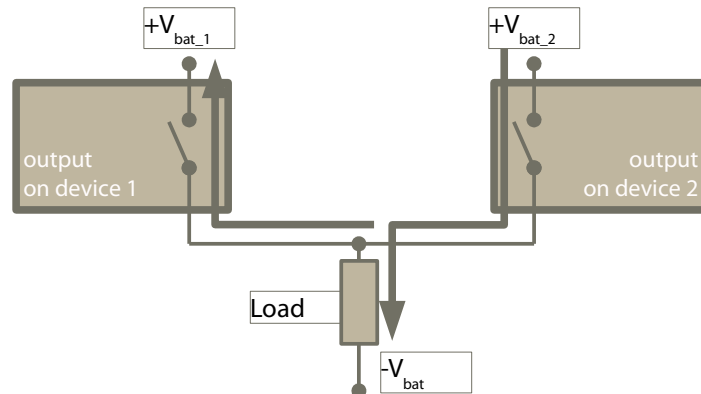
When the whole DXIO0808 module is powered with a reversed voltage, then this will not harm. Obviously, there is no control logic or Ethernet operation.

Redundant Output Use

Two DXIO0808 modules may be operated in a redundant configuration to each other.

Example:

Assumed, a short circuit on V_{bat_1} inhibits the left DXIO0808 to work correctly. Then the DXIO0808 on the right side takes over this job and controls the load. There is no back powering current to the left side.



4.5 Digital Inputs

When the output is never switched on, then the IO pin is operated in the "digital input mode". In this case, the source port directly reflects the state of the IO pin.

All channels have LED status indicators.

Input Operating Conditions

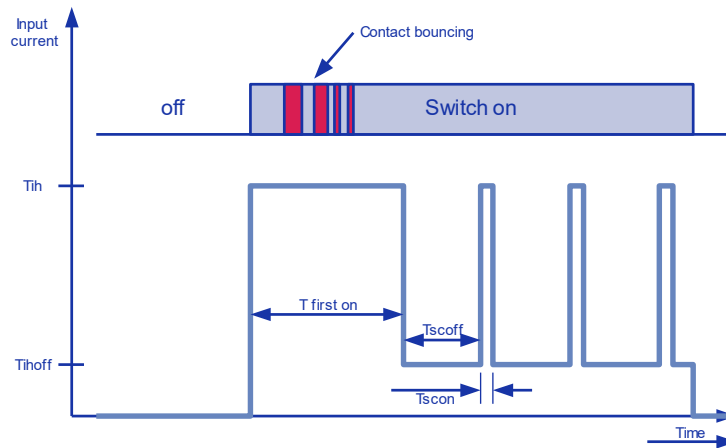
Symbol	Parameter / Conditions		Min	Nom	Max	Unit
I_{ih}	High level input current	Version LV	8	10	15	mA
I_{ihoff}	High level input current during scan idle times		0.014	0.023 @24V	0.1	mA
V_{ih}	Input voltage, high recognized		$V_{bat+} * 0.3$		V_{bat+}	V
V_{il}	Input voltage, low recognized		0		$V_{bat+} * 0.17$	V
I_{ih}	High level input current	Version HV	8	10	15	mA
I_{ihoff}	High level input current during scan idle times		0.03	0.1 @110V	0.2	mA
V_{ih}	Input voltage, high recognized		$V_{bat+} * 0.3$		V_{bat+}	V
V_{il}	Input voltage, low recognized		0		$V_{bat+} * 0.17$	V

Input Current Characteristic

When an input is switched on, the input current drawn by the device will be I_{ih} . This current leads to a significant power dissipation; 16 channels at worst case conditions would dissipate 12 Watts (LV Version) and 37 Watts (HV Version), respectively. This would be too much for two reasons:

- A small device like the DXIO0808 would become very hot on the surface
- It is not economical for the battery power.

In order to reduce the power consumption, the inputs are scanned repetitively every 16ms:



- For T_{scon} prior to a scan, the input current is raised to the nominal I_{ih} to ensure a safe state recognition.
- During the remaining T_{scoff} of the scan cycle, the input current is reduced to I_{ihoff} .

By this procedure, the average current is significantly reduced. This lowers the power dissipation to acceptable levels.

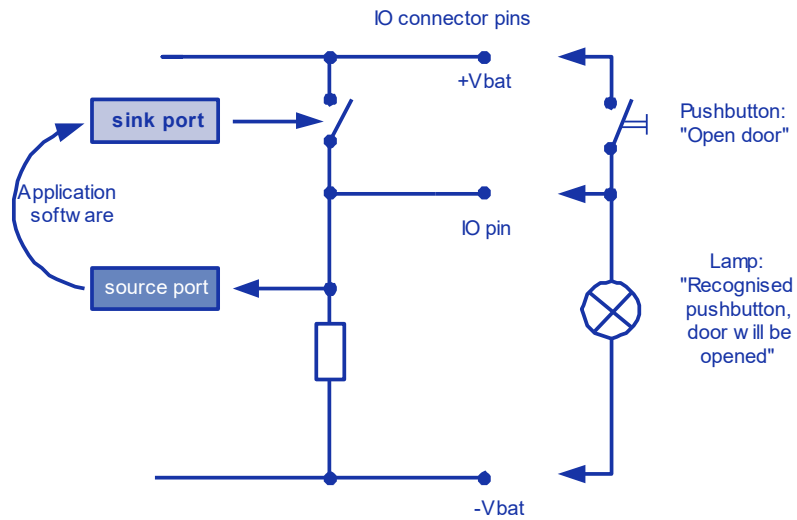
Some mechanical switches require a high current during the process of contact closing. An intelligent logic within the DXIO0808 ensures, that during the contact process the current will be for sure on the high level. The high current will be kept for at least T_{first_on} in order to catch up with any contact bouncing. After this time, the input current is reduced.

Symbol	Parameter / Conditions	Min	Nom	Max	Unit
--------	------------------------	-----	-----	-----	------

$T_{\text{first on}}$	Duration of high input current (I_{in}) after first contact close	15			ms
T_{scoff}	Duration of low input current during scan idle times	14	15.5	24	ms
$T_{\text{sc on}}$	Duration of high input current during scan times		0.5		ms

4.6 Input/ Output Combination

Both operating modes may be combined to achieve a latch:



Example:

At the beginning, the sink port is switched off. When the pushbutton is pressed, the source port reports a "1" to the application, and the lamp is lit. The application will now recognize the request and switch the output on, which will keep the outside lamp "on". When the pushbutton is released now, the lamp will be latched in the ON state. At a later time, the lamp may be switched off by application software.

Note

When the output is switched on, the corresponding input will draw the reduced input current (I_{inoff}). This reduces overall heat dissipation. When the output is switched off, the input current will show the normal scan activities with alternating I_{in} and I_{inoff} .

5. Software Protocols

The Ethernet IO controller application running on the DXIO0808 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.

Typical tasks of the application software are the routing of IO data to and from the Ethernet bus, serving fallback timers and the like.

5.1 Ethernet Software Protocols

A standard Ipv4 stack supporting TCP and UDP transport is integrated in the DXIO0808E.

Customer specific Ethernet communication stacks such as IPTCom, Profinet RT, CIP, etc. are available as an option.

IPTCom

The DXIO0808E supports as an option IPTCom Process Data, IPTCom Message Data and IPTDir service. Other IPTCom functions are available on request.

EtherNet/IP - CIP

The DXIO0808E provides as an option Common Industrial Protocol (CIP) adapter class functionality. For information about the availability of Ethernet/IP on the DXIO0808E, please call Duagon.

Profinet RT

The DXIO0808E provides as an option Profinet RT IO Device functionality. For information about the availability of Profinet RT on the DXIO0808E, please call Duagon.

Further Ethernet Communication Stacks

Customer specific Ethernet communication stacks are available on request. Please contact Duagon for further information.

5.1.1 Default Ethernet Services and Clients

The following clients and services are available:

- HTTP server (see also application hint on page 28)
- FTP server (see also application hint on page 28)
- simple telnet server (see also "Command Line Interface – Data Sheet" d-002357-nnnnnn)
- RFC862 echo server (UDP, TCP only 1 connection)
- Dynamic IP address allocation by DHCP client or static IP address configuration
- SNTP client
- DNS client
- ARP
- ICMP
- IGMP
- Quality of Service / ToS

5.2 CLI on Service Serial Line

X6 provides a serial line interface (see page 12). This serial line provides a Command Line Interface (CLI) for diagnostics, debugging and maintenance. The following functions are available:

- Access to the local flash file system
- Download and Upload of product firmware using Xmodem protocol
- Start user defined applications

Default serial line transmission parameters are 115kBaud, no parity, one stop bit, no hardware handshake.

For more information about the CLI, please refer to the "Command Line Interface – Data Sheet", d-002357-nnnnnn.

6. General Concepts

6.1 IPTCom Configuration

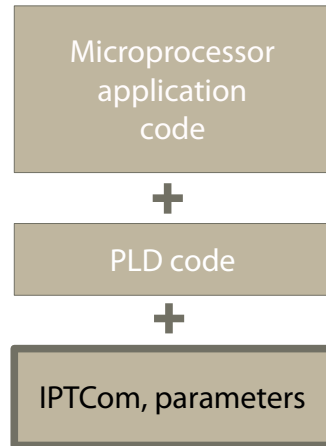
In order to see the DXIO0808 module on the Ethernet at the correct addresses, it must be configured. Although the predefined configuration will fit in most applications, changing parameters is not difficult.

- The preferred way of configuration is the direct access over serial line or JTAG into the DXIO0808 local file system.
- The DXIO0808 also provides a serial interface for the upload of the device configuration file (device.cfg). Each DXIO0808 requires a configuration file. Each DXIO0808 is shipped with default configuration.
- The Ethernet IP address is also defined in configuration file, default address is 192.168.1.20.

The Software Parts...

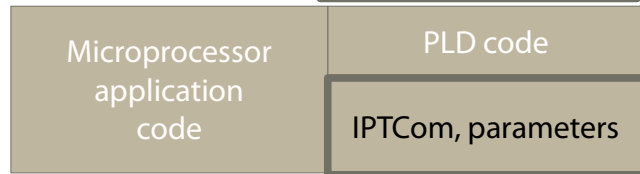
The data within the module's file system consists of two types of "code" and several parameters:

- The microprocessor executes application specific code. Typical tasks are the routing of IO data to and from the IPTCom link, serving fallback timers and the like. Of course, customer specific extensions are possible and require usually some additional C-code.
- The PLD code is loaded into a programmable logic device. This device then behaves as a piece of hardware and includes the Soft-CPU, the IO register interface and optionally customer specific macro cells.
- The IPTCom configuration and general purpose parameter set includes information like device addresses, ComIDs, etc.



...make a Code Set

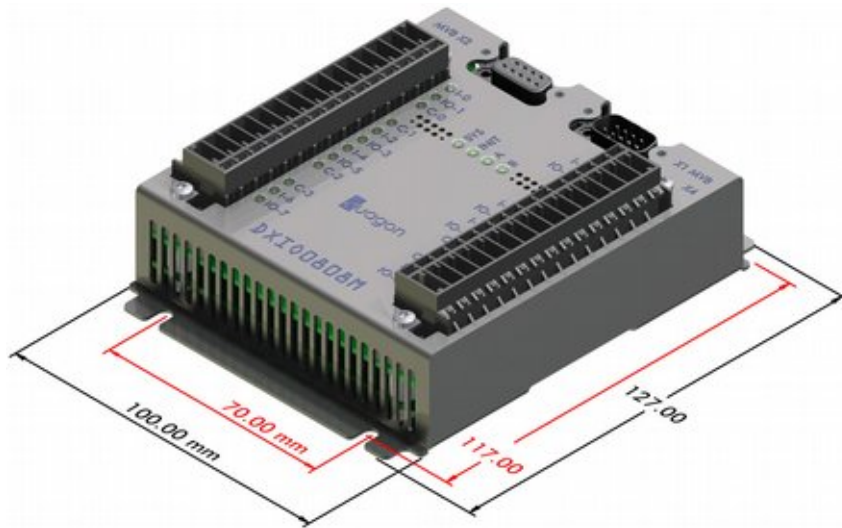
- The "default code set" refers to the IO functionality as it is described within this document: 8+8 IO channels with mixed input and output capabilities.
- If the user wants to have some more complex functions (PWM, counters and the like), he will get a customized version of e.g. PLD code from Duagon. Please refer also to the chapter "DXIO0808 Order information" on page Fehler: Referenz nicht gefunden.



7. Mechanical Data

The weight of the complete DXIO0808 is approx. 405g.
The weight of the housing only is approx. 265g .

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



Mounting by four Screws

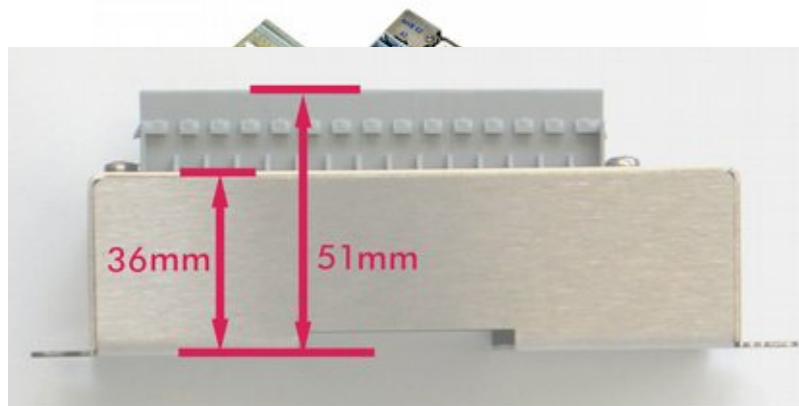
The DXIO0808 is proposed to be mounted with four M4 screws. The picture above shows the dimensions for the fixture holes.

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 DXIO0808 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.

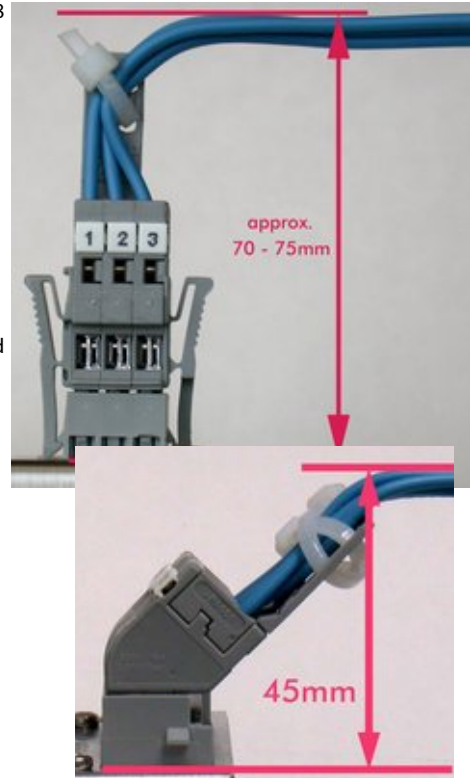


Thickness

The picture shows the “height” of the DXIO0808 case with and without connectors.

Please note:

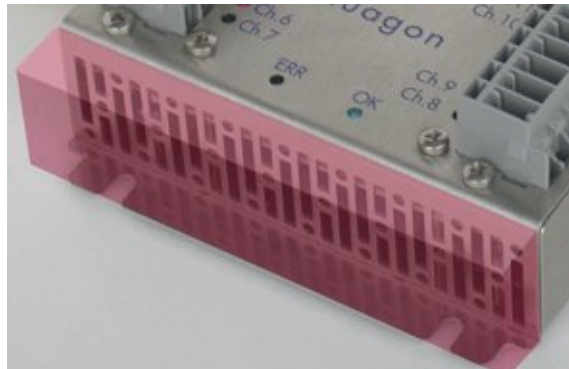
- When calculating the required “height” of the module, be aware that the cables will require space (additional 70 – 75mm from the box surface should be OK, see picture on the right side).
- This 70mm should be usually sufficient for the M12 connectors, too.
- Add an extra 16mm if you want to plug and unplug the cable.
- Bended connectors require less space. Be aware of the M12 connectors, they may be higher.



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.



Grounding Bolt option

Optionally the DXIO0808E/M/C is available with a grounding bolt X5. Please see the order table to choose this order option.



8. Thermal Management

8.1 Maximum Output Power

The DXIO0808 is a high-power device, delivering up to 1000 Watt continuous output power even at a constant environment temperature of 70°C.

Maximum Output Power High-Voltage (-HV) Devices

Mounting	Maximum Total Output Current [A]	Maximum Environment Temp. [°C]
Vertical	12 ¹⁾	70
Horizontal	12 ¹⁾	55
Horizontal	8.8	70 ²⁾
Horizontal	7.2	70

Remarks:

- 1) Limited by the over-current-protection.
- 2) Non-standard product, please call Duagon for more information.

Maximum Output Power Low-Voltage (-LV) Devices

Mounting	Maximum Total Output Current [A]	Maximum Environment Temp. [°C]
Vertical	24 ¹⁾	70
Horizontal	24 ¹⁾	55
Horizontal	24 ¹⁾	70 ²⁾
Horizontal	16	70

Remarks:

- 1) Limited by the over-current-protection.
- 2) Non-standard product, please call Duagon for more information.

8.2 Overheating Protection and Indication

The DXIO0808 has a built-in overheating protection, this prevents the DXIO0808 from taking permanent damage. The overheating protection is activated if the DXIO0808 is used above the recommended operating conditions.

If the overheating protection is active, most of the indication LEDs and all digital inputs and outputs are switched off. The overheating is indicated with the red SYSTEM-LED, please refer to "General Status LEDs" on page 26 for more information.

Furthermore, the overheating protection activity is indicated on the device status port, please ask for DXIO0808E Application Development Library and Documentation, d-005293-nnnnnn" on page 31 for more information.

9. Environmental Data

Issue	min.	typ.	max.	Unit	EN50155:2007
Operational temperature range, "internal cubicle temperature", i.e. outside of DXIO0808 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	

10. Application Hints

10.1 Diagnostic by LEDs

10.1.1 General Status LEDs

The status LEDs "SYSTEM" and "INIT" display the general state of the DXIO0808 module:

"INIT" Yellow LED	Meaning
ON	Initialization or firmware update ongoing: Not the full functionality available
OFF	normal operation mode

"SYSTEM" Bicolor LED Red/Green	Meaning
Green ON	Power on, no error
Red ON	An error occurred (see below)
OFF	device not powered

red "SYSTEM" LED Blinking Pattern ¹⁾	Meaning
0-0-0-0	Network Error or IPTcom communications error
1-0-0-0	waiting for IPTcom --> connect a network cable
0-1-0-0	Only for PWM boards: Present DATA_OUT but missing PWM info sent via IPTcom
0-0-1-0	IO error (short circuit or overload).
1-0-0-0-0	Onboard temperature sensor detects >70°C
Fast blinking	Onboard temperature sensor detects >85°C

¹⁾ Blinking pattern: "1" indicates a long and "0" indicates a short blinking time.

10.1.2 Ethernet

Two LEDs display the signal activity of the Ethernet link:

"LINK" Green LED	Meaning
ON	An Ethernet link is available on ETH0
OFF	There is no Ethernet link available on ETH0

"ACT" Yellow LED	Meaning
ON	The interface ETH0 is sending or receiving data
OFF	No activity on the interface ETH0

10.1.3 CODE Inputs

The status of all CODE inputs is indicated by LEDs.

10.1.4 Input Channels

All channels have LED status indicators.

10.1 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 DXIO0808 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 DXIO0808 will need a certain time to power up. This procedure takes in typical 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“.

10.1 EMI Considerations

We assume the following integration for the DXIO0808:

- The DXIO0808 signal lines (Ethernet) have no connection with unshielded cables to the outside.
- Unshielded cables can be used for the digital IO channels.
- The device case is properly connected to protective earth.

HTTP Server and FTP Server

The DXIO0808E is delivered with an easy to use HTTP server and a FTP server. The HTTP web server provides a number of predefined web pages that can be displayed with a web browser:

- Diagnostics information: Device status, traffic statistics, traffic memory viewer, etc
- Configuration front-end: Define device specific parameters, communication parameters, etc
- Access to the DXIO0808 local file system
- Firmware Update

The FTP server provides direct access to the DXIO0808 local file system.

Note:

- The web pages can be adapted to customer specific requirements

For more information about the web server, please refer to the "Duagon HTTP Web Server – Data Sheet", d-001787-nnnnnn. For more information about the FTP server, please refer to the "Duagon FTP Server – Data Sheet", d-004105-nnnnnn.

11. Standards Reference

The "DXIO0808" complies to the standards EN50155, EN50121-3-2 and IEEE802.3 in general. For exceptions, not applicable subclauses etc. please refer to the following paragraphs and, in more detail, to the "Type Test Report" (see page 31).

Immunity

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 150

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

EN50121-3-2:2006 7.3 Battery referenced ports: Surges according to EN61000-4-5, waveform 1.2/50s, wire vs grounding ±2kV 42 0.5uF, wire vs wire ±1kV 42 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 150

EN50121-3-2:2006 8.2 Signal I/O: Fast transients bursts according to EN61000-4-4, 2kV ±5/50ns t_r/t_{tr}, 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

IEEE802.3:2005 12.10.1: Insulation measurement test / Voltage withstand test. Ethernet physical layer, 1500V_{rms} or 2250V_{DC} 1MΩ for 1 minute. Each individual device is tested prior to shipment (routine testing).

EN50155:2007 12.2.9: Insulation measurement test / Voltage withstand test. Routine testing is done with the higher voltages defined in IEEE802.3 (see above).

Useful Life

EN50155:2007 6.2: There are component with a limited useful life in the DXIO0808:

- 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 DXIO0808 is protected against polarity reversal with the restriction, that current limitation for the output pins is done on the outside of the module. This is typically the case by the normal load, which is operated with inverted voltage in this case. In order to keep this feature, do not use loads, which enter short- circuit when powered with the wrong polarity (Example: "free wheeling diodes" over relays coils).

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 DXIO0808. The DXIO0808 applies to mounting location "**Category 1, Class B**".

Ethernet

IEEE802.3:2005: The following features are defined here: 10 and 100Base-TX, full duplex, auto negotiation, auto sensing, auto polarity, 100m cable length over CAT5e, unique MAC addresses.

Ethernet Connectors

IEC61076-2-101-am1:2003: Connectors for electronic equipment - Part 2-101: Circular connectors - Detail specification for circular connectors M8 with screw- or snap-locking, M12 with screw-locking for low voltage applications; Amendment 1 - Connectors for electronic equipment: Definition of the "M12 connector with D- coding".

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 DXIO0808 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 DXIO0808, i.e. excluding the steel housing (265g (tbd), "functional necessity" EN45545-2:4.6) and the PCB (50g (tbd), "functional necessity" EN45545-2:4.6) is approximately 90g (tbd).

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 DXIO0808 without the steel housing is approximately 140g (tbd).

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.

12. 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.

DXIO0808E Type Test – Report, d-005016-nnnnnn

Includes the results from type testing.

DXIO0808E Development Kit Quick Start Guide, d-005742-nnnnnn

This document is the starter user guide for DXIO0808E firmware development development

DXIO0808E Application Development Library and Documentation, d-005293-nnnnnn

This software kit includes the real time OS "eCos", a flash file system, the Ethernet library and a lot of additional information.

Duagon HTTP Web Server – Data Sheet, d-001787-nnnnnn

The HTTP web server running on Duagon products provides a wide range of functionality including firmware upload, configuration and diagnostics.

Duagon FTP Server – Data Sheet, d-004105-nnnnnn

The Duagon FTP server provides a save access to the local file system of Duagon Ethernet products.

Command Line Interface – Data Sheet, d-002357-nnnnnn

This document describes the Command Line Interface of the service serial line and the telnet server of Duagon products.

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 connectors, etc.

13. DXIO0808E Order Information

DXIO0808E	-B	-LV	-G
Ethernet Type:			
TCP / UDP Sockets	-I		
IPTCom	-B		
TRDP	-TR		
PROFINET	-R		
EtherNet/IP – CIP	-C		
Power Supply:			
Nominal battery voltage: 24V, 36V		-LV	
Nominal battery voltage: 48V, 72V, 96V, 110V		-HV	
Grounding Bolt:			
none			<empty>
with M5 grounding bolt			-G

14. Document History

d-003691-027258

- Order option for grounding bolt added
- Layout update

d-003691-009593

- Thermal Management changed
- Order code Interruption Class S2-option removed – now always Interruption Class S2
- Mechanical Data Changed
- Company GmbH to AG

d-003691-008092

- First preliminary version of this document.

15. Index

1		LED.....	17, 26f.
10 and 100Base-TX.....	11, 30	Life Cycle.....	31
C		Load current.....	16
CIP.....	20	M	
CODE Inputs.....	14	M4 screws.....	22
Command Line Interface.....	20	Mechanical Data.....	22
Contact bouncing.....	18	Mechanical switches.....	18
CTS.....	12	Memory.....	9
Current limitation.....	17	Mounting.....	22
D		N	
Diagnostic.....	16	NF F16-102.....	30
Duagon Software Licence.....	36	O	
DXIO0808 Product Family.....	7	Operating conditions.....	
E		Input.....	18
EN50121.....	29	Output.....	16
EN50155.....	29	Order information.....	32
ETH0.....	11	Output.....	16
Ethernet.....	11	P	
EtherNet/IP.....	20	Packaging.....	31
F		Paralleling outputs.....	17
Failsafe state.....	9, 16	Pin description.....	
Fallback time.....	17	Ethernet.....	11
Fixture holes.....	22	IO- connector.....	14
FTP Server.....	28	Serial line connector.....	12
Function blocks.....	8	Power.....	15
G		Profinet RT.....	20
GND.....	12	Q	
H		Quality Plan.....	31
Home page.....	7	R	
HTTP Server.....	28	RFI.....	25
Humidity.....	25	RTS.....	12
I		RxD.....	12
Identification Number.....	35	S	
IEC61076-2-101-am1.....	30	Scanning.....	18
IEEE802.3.....	6, 30	Shield.....	11
Input.....	17	Software Licensing.....	36
Input current.....	18	Supply voltage.....	15
IO pin driver.....	9	T	
IPC-A-610C.....	30	Telnet.....	20
IPTCom.....	20	Temperature range.....	25
L		TxD.....	12
Labeling.....	31	Y	
Latch.....	19	YAFFS flash file system.....	9

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 identical	<p>Specifies a certain purpose of a document with the intention to link several documents with different filing numbers.</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 (revision). 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	"DXIO data sheet Rev 2.3"
	<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 kept, for example during revisions due to debugging or manufacturing updates.</p> <p>In case a significant change happens, another document number will be applied.</p>
d-000719	"Notes from prototype meeting ..."
	<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 the D015 are subject to specific license agreements. The following sections describe the relevant issues in a generalized form for Duagon products:

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 Library for D015" is based on a public available eCos release and Duagon's eCos Package Distribution "NIO2DUAGON" both configured using eCos template "duagon_D015".

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/>).

Please contact Duagon GmbH for more information about this license.

Internal Altera Drivers

Altera driver and headers:

Copyright (c) 2003 Altera Corporation, San Jose, California, USA.
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This agreement shall be governed in all respects by the laws of the State of California and by the laws of the United States of America.

Host Server, Client Driver, Demo Applications

The following software is released under the terms of the DUAGON SOFTWARE LICENSE:

- Host Interface drivers (server and client)
- Demo Applications

These software packages (source code and/or binary) and their license agreement are available on request.

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