SIGMATEK

TO 161

S-DIAS Digital Output Module

Operating Manual

Date of creation: 30.07.2013 | Version date: 26.07.2023 | Article number: 20-007-161-E

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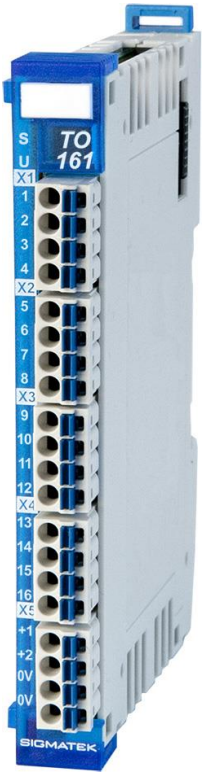
Translation of the Original Instructions

S-DIAS Digital Output Module TO 161

with 16 short-circuit proof digital outputs

The S-DIAS TO 161 digital output module has 16 short-circuit proof digital outputs in two groups (+24 V/0.5 A, short-circuit proof). The supply voltage for each group is monitored for low voltage.



Contents

1 Introduction

1.1 Target Group/Purpose of this Operating Manual

This operating manual contains all information required for the operation of the product.

This operating manual is intended for:

- Project planners
- Technicians
- Commissioning engineers
- Machine operators
- Maintenance/test technicians

General knowledge of automation technology is required.

Further help and training information, as well as the appropriate accessories can be found on our website www.sigmatek-automation.com.

Our support team is happily available to answer your questions.
Please see our website for our hotline number and business hours.

1.2 Important Reference Documentation

This and additional documents can be downloaded from our website or obtained through support.

1.3 Contents of Delivery

1x TO 161

2 Basic Safety Directives

2.1 Symbols Used

The following symbols are used in the operator documentation for warning and danger messages, as well as informational notes:

DANGER

Danger indicates that death or serious injury **will occur**, if the specified measures are not taken.

⇨ To avoid death or serious injuries, observe all guidelines.

Danger indique une situation dangereuse qui, faute de prendre les mesures adéquates, **entraînera** des blessures graves, voire mortelles.

⇨ Respectez toutes les consignes pour éviter des blessures graves, voire mortelles.

WARNING

Warning indicates that death or serious injury **can** occur, if the specified measures are not taken.

⇨ To avoid death or serious injuries, observe all guidelines.

Avertissement d'une situation dangereuse qui, faute de prendre les mesures adéquates, **entraînera** des blessures graves, voire mortelles.

⇨ Respectez toutes les consignes pour éviter des blessures graves, voire mortelles.

CAUTION

Caution indicates that moderate to slight injury **can** occur, if the specified measures are not taken.

⇨ To avoid moderate to slight injuries, observe all guidelines.

Attention indique une situation dangereuse qui, faute de prendre les mesures adéquates, **peut** entraîner des blessures assez graves ou légères.

⇨ Respectez toutes les consignes pour éviter des blessures graves, voire mortelles.

INFORMATION

Information

⇨ Provides important information on the product, handling or relevant sections of the documentation, which require attention.

2.2 Disclaimer

INFORMATION

The contents of this operating manual were prepared with the greatest care. However, deviations cannot be ruled out. This operating manual is regularly checked and required corrections are included in the subsequent versions. The machine manufacturer is responsible for the proper assembly, as well as device configuration. The machine operator is responsible for safe handling, as well as proper operation.

The current operating manual can be found on our website. If necessary, contact our support.

Subject to technical changes, which improve the performance of the devices. The following operating manual is purely a product description. It does not guarantee properties under the warranty.

Please thoroughly read the corresponding documents and this operating manual before handling a product.

SIGMATEK GmbH & Co KG is not liable for damages caused through, non-compliance with these instructions or applicable regulations.

2.3 General Safety Directives

The Safety Directives in the other sections of this operating manual must be observed. These instructions are visually emphasized by symbols.

INFORMATION

According to EU Directives, the operating manual is a component of a product.

This operating manual must therefore be accessible in the vicinity of the machine since it contains important instructions.

This operating manual should be included in the sale, rental or transfer of the product, or its online availability indicated.

Regarding the requirements for Safety and health connected to the use of machines, the manufacturer must perform a risk assessment in accordance with machine directives 2006/42/EG before introducing a machine to the market.

Operate the unit with devices and accessories approved by SIGMATEK only.

CAUTION

Handle the device with care and do not drop or let fall.

Prevent foreign bodies and fluids from entering the device.

The device must not be opened!

Manipulez l'appareil avec précaution et ne le laissez pas tomber.

Empêchez les corps étrangers et les liquides de pénétrer dans l'appareil.

L'appareil ne doit pas être ouvert!

If the device does not function as intended or has damage that could pose a danger, it must be replaced!

En cas de fonctionnement non conforme ou de dommages pouvant entraîner des risques, l'appareil doit être remplacé!

The module complies with EN 61131-2.

In combination with a facility, the system integrator must comply with EN 60204-1 standards.

For your own safety and that of others, compliance with the environmental conditions is essential.

Le module est conforme à la norme EN 61131-2.

En combinaison avec une équipement, l'intégrateur de système doit respecter la norme EN 60204-1.

Pour votre propre sécurité et celle des autres, le respect des conditions environnementales est essential.

2.4 Software/Training

The application is created with the software LASAL CLASS 2 and LASAL SCREEN Editor.

Training for the LASAL development environment, with which the product can be configured, is provided. Information on our training schedule can be found on our website.

3 Standards and Directives

3.1 Directives

The product was constructed in compliance with the following European Union directives and tested for conformity.

3.1.1 EU Conformity Declaration

EU Declaration of Conformity

The product TO 161 conforms to the following European directives:

- **2014/35/EU** Low-voltage Directive
- **2014/30/EU** Electromagnetic Compatibility (EMC Directive)
- **2011/65/EU** “Restricted use of certain hazardous substances in electrical and electronic equipment” (RoHS Directive)

The EU Conformity Declarations are provided on the SIGMATEK website. See Products/Downloads or use the search function and the keyword “EU Declaration of Conformity”.

4 Type Plate

Exemplary nameplate (symbol image)

HW: Hardware version
SW: Software version

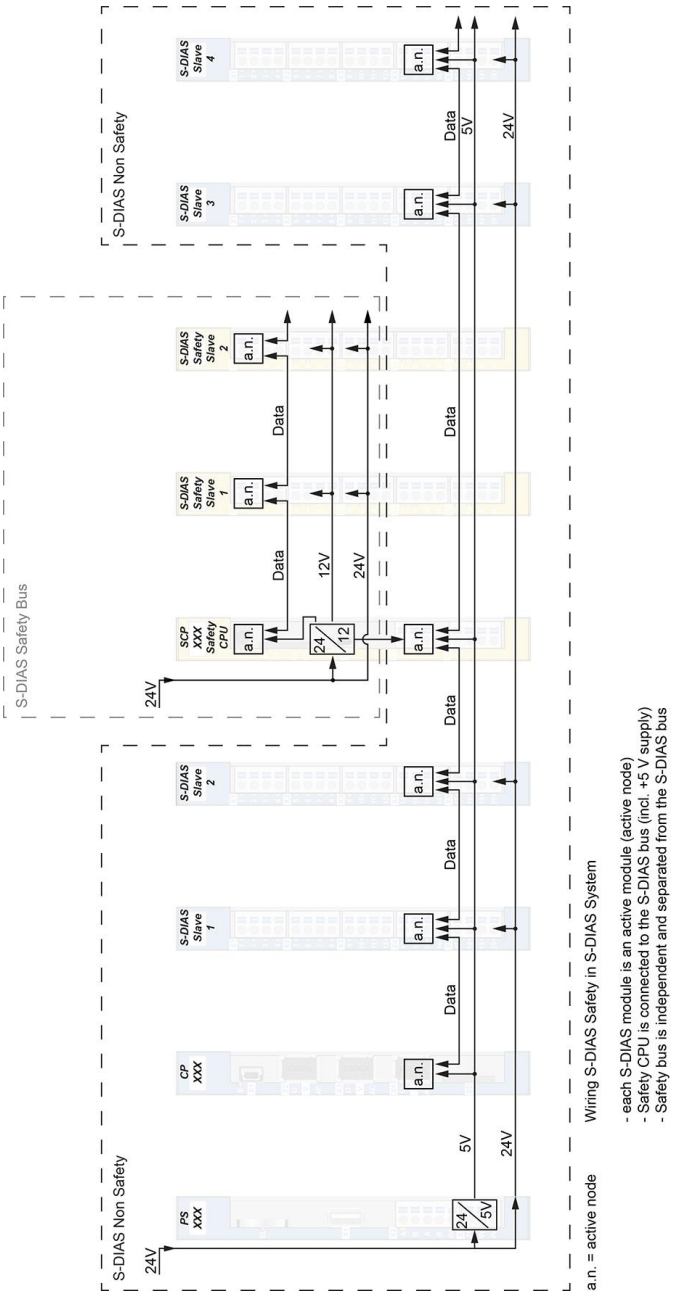
5 Technical Data

5.1 Digital Output Specifications

Number	16
Short-circuit proof	yes
Maximum continuous current load allowed per channel	0.5 A
Maximum total current (per 8-channel group)	4 A (100% of on-time)
Maximum total current (entire module)	8 A (100 % of on time)
Maximum braking energy of outputs (inductive load)	maximum 1 Joule/channel
Residual current (off)	≤ 10 µA
Turn-on delay	< 100 µs (up to HW version 6.XX) < 200 µs (starting with HW version 7.00)
Turn-off delay	< 100 µs (up to HW version 6.XX) < 200 µs (starting with HW version 7.00)

5.2 Electrical Requirements

Supply voltage +24 V /1-2	18-30 V DC	
Current consumption of voltage supply +24 V /1-2	corresponds to the load on the digital outputs	
Voltage supply from S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V supply) for TO 161 HW1.x to HW5.x	typically 45 mA	maximum 50 mA
Current consumption on the S-DIAS bus (+5 V supply) for TO 161 HW6.x, HW7.x	typically 62 mA	maximum 67 mA
Current consumption on the S-DIAS bus (+5 V supply) for TO 161-E HW1.x to HW5.x	typically 45 mA	maximum 50 mA
Current consumption on the S-DIAS bus (+5 V supply) for TO 161-E HW6.x, HW7.x	typically 62 mA	maximum 67 mA


S-DIAS Non Safety
S-DIAS Safety Bus
S-DIAS Non Safety
24V
PS XXX
CP XXX
S-DIAS Slave 1
S-DIAS Slave 2
SCP XXX Safety CPU
S-DIAS Safety Slave 1
S-DIAS Safety Slave 2
S-DIAS Slave 3
S-DIAS Slave 4
a.n.
Data
5V
12V
24V
24/5V
24/12
a.n. = active node
Wiring S-DIAS Safety in S-DIAS System
- each S-DIAS module is an active module (active node)
- Safety CPU is connected to the S-DIAS bus (incl. +5 V supply)
- Safety bus is independent and separated from the S-DIAS bus

5.3 Voltage Monitor

Supply voltage +24 V /1-2	supply voltage > 18 V (corresponding DC OK-LED lights green)

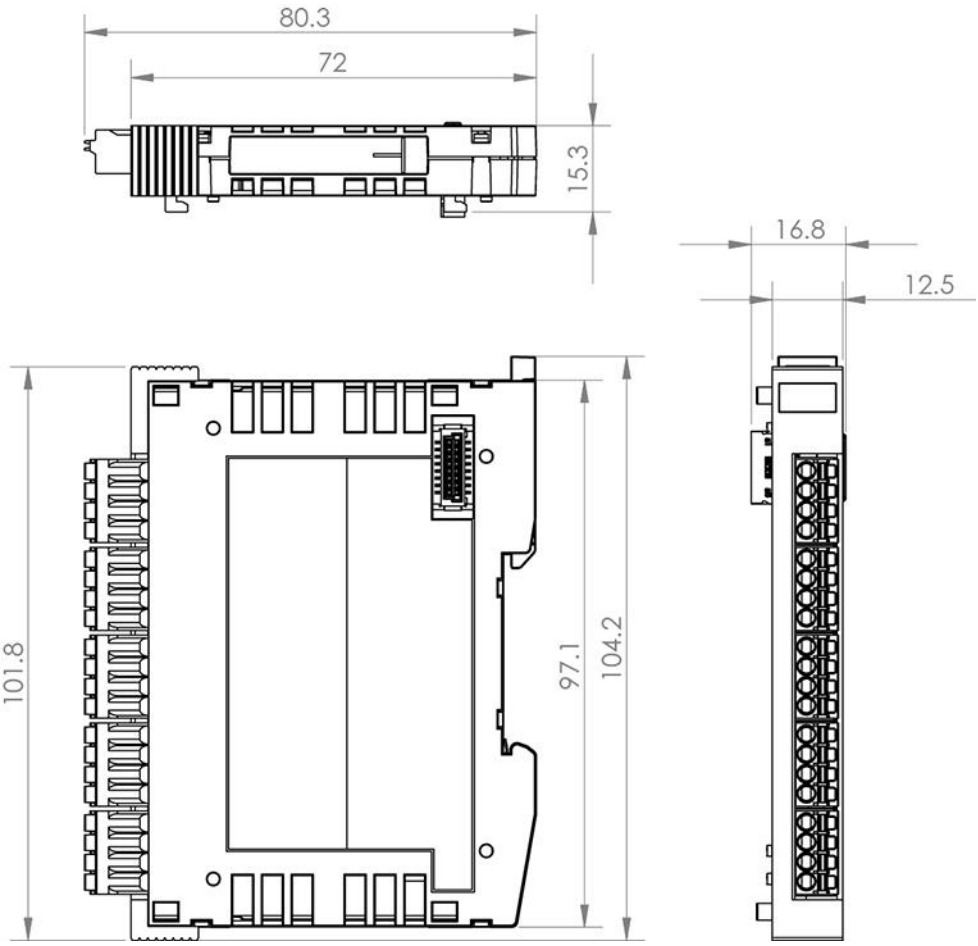
5.4 Miscellaneous

Article number	20-007-161 20-007-161-X (polymer coated printed circuit board)
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE, UKCA

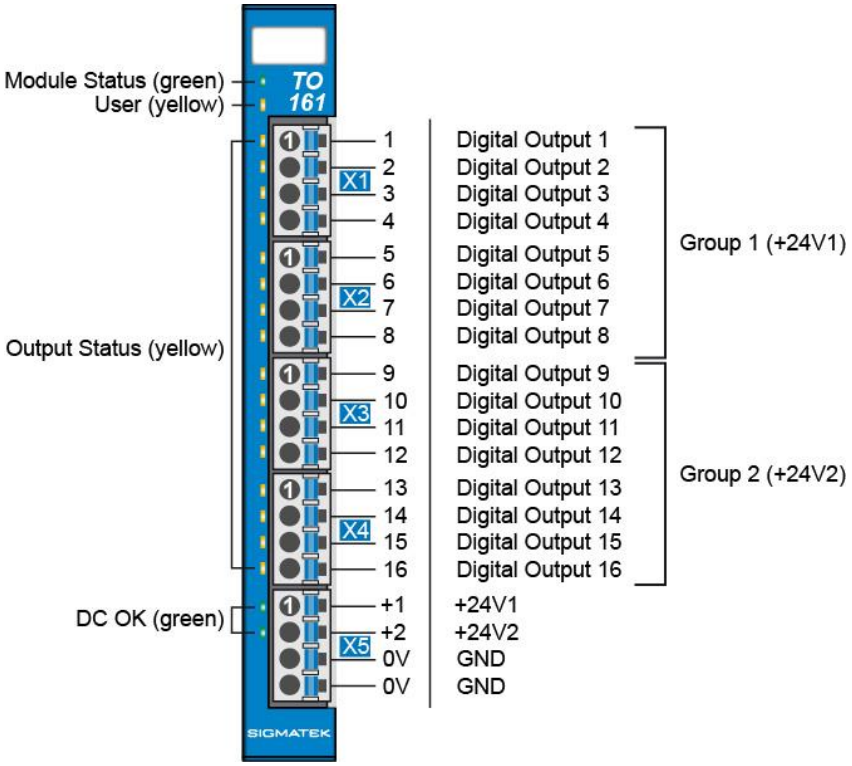
5.5 Environmental Conditions

Storage temperature	-20 ... +85 °C	
Environmental temperature	0 ... +60 °C	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without derating > 2000 m up to a maximum of 5000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	pollution degree 2	
EMC resistance	in accordance with EN 61000-6-2 (industrial area)	
EMC noise generation	in accordance with EN 61000-6-4 (industrial area)	
Vibration resistance	EN 60068-2-6	3.5 mm from 5-8.4 Hz 1 g from 8.4-150 Hz
Shock resistance	EN 60068-2-27	15 g
Protection type	EN 60529	IP20

6 Mechanical Dimensions



7 Connector Layout



INFORMATION

The GND supply (X5: Pin 3 and Pin 4) is internally bridged. Only one GND pin (pin 3 or pin 4) is required to power the module. The bridged connections may be used for further looping of the +24 V supply and the GND supply. However, it must be taken into account that a total current of 6 A per connection is not exceeded by the forward looping!

7.1 Status LEDs

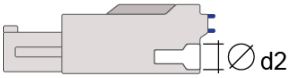
Module Status	green	ON	module active
		OFF	no supply available
		BLINKING (5 Hz)	no communication
User	yellow	ON	can be set from the application (e.g. the module LED can be set to blinking through the visualization so that the module is easily found in the control cabinet)
		OFF	
		BLINKING (2 Hz)	
		BLINKING (4 Hz)	
Output Status	yellow	ON	output ON
		OFF	output OFF
DC OK	green	ON	the respective output group is powered

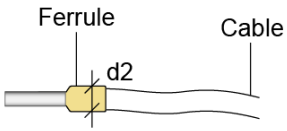
7.2 Applicable Connectors

Connectors:
X1-X5: Connectors with spring terminals (included in delivery)
The spring terminals are suitable connecting ultrasonically compacted (ultrasonically welded) strands.

Connections:

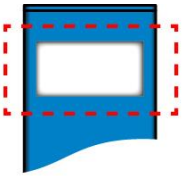
Stripping length/Sleeve length:	10 mm
Plug-in direction:	parallel to conductor axis or to PCB
Conductor cross section, rigid:	0.2-1.5 mm^2
Conductor cross section, flexible:	0.2-1.5 mm^2
Conductor cross section, ultrasonically compacted:	0.2-1.5 mm^2
Conductor cross section AWG/kcmil:	24-16
Conductor cross section flexible, with ferrule without plastic sleeve:	0.25-1.5 mm^2
Conductor cross section flexible, with ferrule with plastic sleeve:	0.25-0.75 mm^2 (ground for reducing d2 of the ferrule)





d2 = max. 2.8 mm

7.3 Label Field



Manufacturer	Weidmüller
Type	MF 10/5 CABUR MC NE WS
Weidmüller article number	1854510000
Compatible printer	Weidmüller
Type	Printjet Advanced 230V
Weidmüller article number	1324380000

8 Wiring

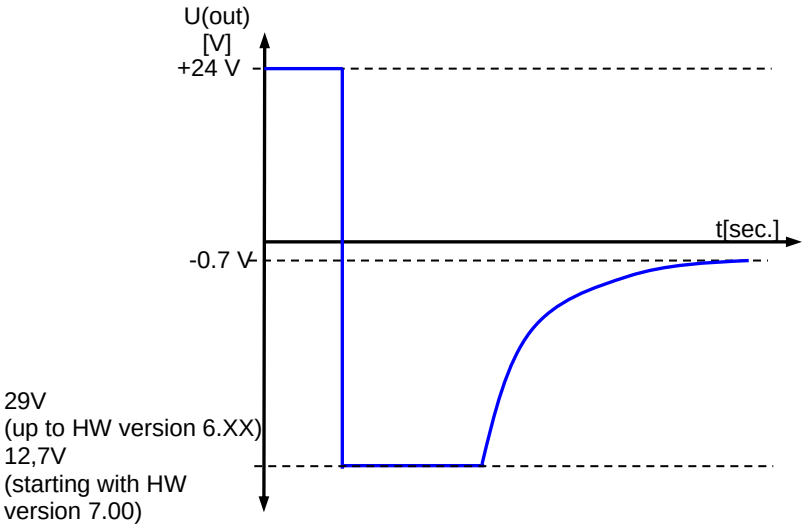
8.1 General Information on the Digital Outputs

The cross sectional area of the +24 V supply must be designed for the maximum output current drawn by a group.

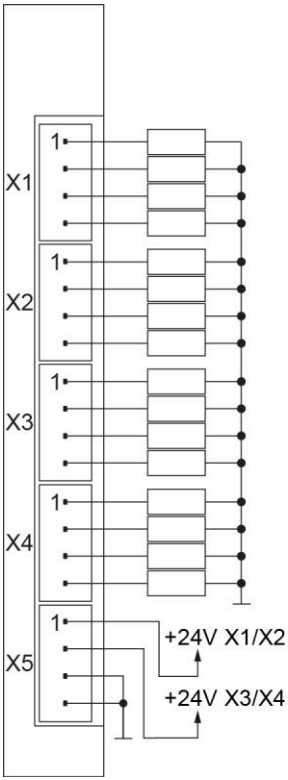
The outputs can be turned off by disconnecting the +24 V supply voltage.

Applying power to an output whose supply voltage exceeds 0.7 V is not allowed.

The outputs are electrically protected against +24 V. Braking of inductive loads is limited to -29 V (up to HW version 6.XX) / -12.7 V (from HW version 7.00) as shown in the graph below. However, an additional protection circuit directly on inductive loads is recommended (freewheeling diode) to avoid a system failure caused by voltage spikes (cross talk on analog lines). However, this results in the internal voltage limit being effective up to -0.7 V only.



8.2 Wiring Example

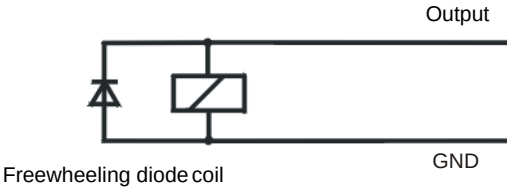


8.3 Note

The following guidelines should be observed:

- Avoid parallel wiring between input lines and load-bearing circuits.
- Protective circuits for all relays (RC networks or free-wheeling diodes)
- Correct wiring to mass

Connecting Inductive Loads:



INFORMATION

The ground bus should be connected to the control cabinet when possible!

The S-DIAS module CANNOT be connected or disconnected while voltage is applied!

9 Assembly/Installation

9.1 Check Contents of Delivery

Ensure that the contents of the delivery are complete and intact. See chapter 1.3 Contents of Delivery.

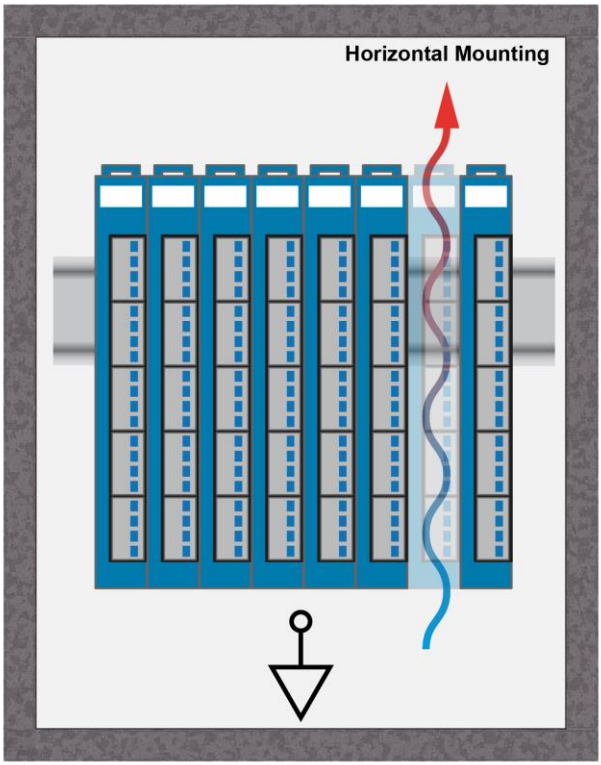
INFORMATION

On receipt and before initial use, check the device for damage. If the device is damaged, contact our customer service and do not install the device in your system.

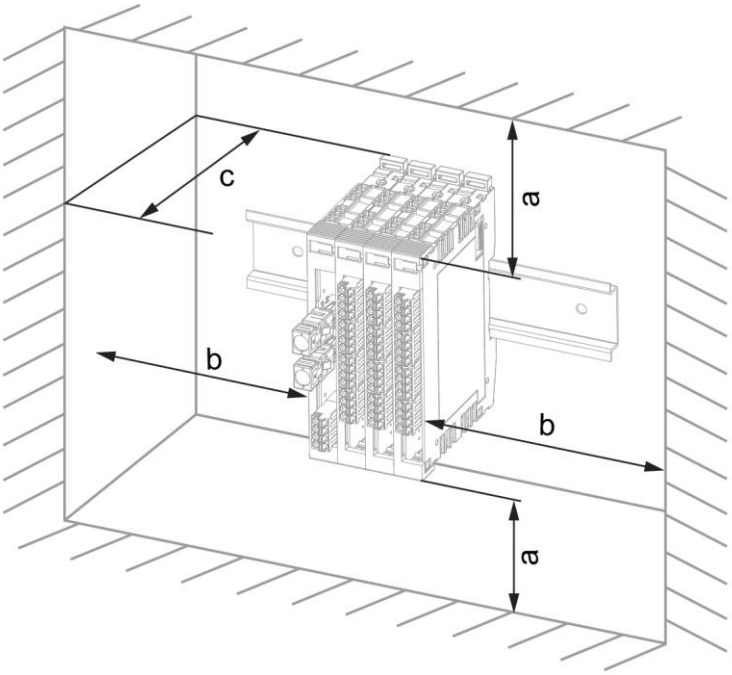
Damaged components can disrupt or damage the system.

9.2 Mounting

The S-DIAS modules are designed for installation into the control cabinet. To mount the modules a DIN-rail is required. The DIN rail must establish a conductive connection with the back wall of the control cabinet. The individual S-DIAS modules are mounted on the DIN rail as a block and secured with latches. The functional ground connection from the module to the DIN rail is made via the grounding clamp on the back of the S-DIAS modules. The modules must be mounted horizontally (module label up) with sufficient clearance between the ventilation slots of the S-DIAS module blocks and nearby components and/or the control cabinet wall. This is necessary for optimal cooling and air circulation, so that proper function up to the maximum operating temperature is ensured.



Recommended minimum distances of the S-DIAS modules to the surrounding components or control cabinet wall:



a	b	c
30 mm (1.18″)	**30 mm** (1.18″)	**100 mm** (3.94″)

a, b, c … distances in mm (inches)

10 Transport/Storage

INFORMATION

This device contains sensitive electronics. During transport and storage, high mechanical stress must therefore be avoided.

For storage and transport, the same values for humidity and vibration as for operation must be maintained!

Temperature and humidity fluctuations may occur during transport. Ensure that no moisture condenses in or on the device, by allowing the device to acclimate to the room temperature while turned off.

When sent, the device should be transported in the original packaging if possible. Otherwise, packaging should be selected that sufficiently protects the product from external mechanical influences. Such as cardboard filled with air cushioning.

11 Storage

INFORMATION

When not in use, store the operating panel according to the storage conditions. See chapter 10.

During storage, ensure that all protective covers (if available) are placed correctly, so that no contamination, foreign bodies or fluids enter the device.

12 Maintenance

INFORMATION

During maintenance as well as servicing, observe the safety instructions from chapter 2 Basic Safety Directives.

12.1 Service

This product was constructed for low-maintenance operation.

12.2 Repair

INFORMATION

In the event of a defect/repair, send the device with a detailed error description to the address listed at the beginning of this document.

For transport conditions, see chapter 10 Transport/Storage.

13 Disposal

INFORMATION

Should you need to dispose of the device, the national regulations for disposal must be followed.

The device appliance must not be disposed of as household waste.

14 Addressing

Address (hex)	Size (bytes)	Access Type	Description	Reset value
Memory				
0000	2	w	Output Register Bit 0 Output 1 Bit 1 Output 2 … Bit 15 Output 16	0000
0002	2	r	24 V status Bit 0 DC 24V OK 1 Bit 1 DC 24V OK 2 Bit 2-15 reserved	0000

15 Supported Cycle Times

15.1 Cycle Times below 1 ms (in µs)

50	100	125	200	250	500
x	x	x	x	x	x

x= supported

15.2 Cycle Times equal to or higher than 1 ms (in ms)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

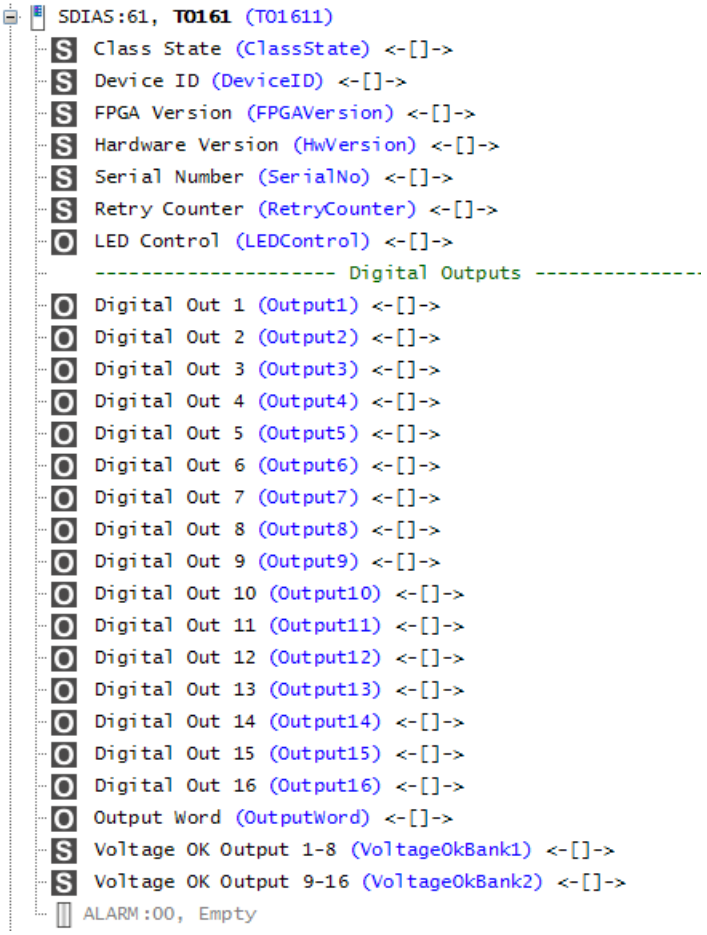
x= supported

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

x= supported

16 Hardware Class TO161

Hardware Class TO161 for the S-DIAS TO161 digital module



This hardware class is used to control the TO 161 hardware module with 16 digital outputs. More information on the hardware can be found in the module documentation.

16.1 Interfaces

16.1.1 Clients

SdiasIn	The client must be connected to an S-DIAS port, an "SdiasOut"_[x]" server.
Place	The physical location of the hardware module is entered in this client. Up to 64 modules, 0 to 63, can be assigned.
Required	This client is active by default, which means that the S-DIAS hardware module at this position is mandatory for the system and can under no circumstances be disconnected or return an error. Otherwise, the entire hardware deactivated. If the hardware module is missing or removed, an S-DIAS error is triggered. If his client is initialized with 0, the hardware module located in this position is not mandatory. This means that it can be inserted or removed at any time. However, which components identified as "not required" should be selected with regard to the safety of the system.

16.1.2 Servers

ClassState	This server shows the actual status of the hardware class.
DeviceID	The device ID of the hardware module is shown in this server.
FPGAVersion	FPGA version of the module in 16#XY (e.g. 16#10 = version 1.0).
SerialNo	The serial number of the hardware module is shown in this server.
RetryCounter	This server increments when a transfer fails.
LEDControl	With this server, the application LED of the S-DIAS module can be activated to find the module in the network more quickly. The following statuses are possible: 0 LED off 1 LED on 2 blinks slowly 3 blinks rapidly
Output[1-16]	Output 1-16; output set over write()
OutputWord	In this server, the digital outputs are shown in a 16-bit field. Bits 0 to 15 in this word are allocated to Outputs 1 to 16. A write() instruction to this server writes the bit pattern to these outputs.
VoltageOkBank[1-2]	0 supply error 1 supply is OK Bank1: for outputs1-8 Bank2: for outputs 9-16

16.1.3 Communication Interfaces

ALARM	Downlink	With this downlink the corresponding alarm class can be placed via the hardware editor.

16.2 Example


HwControl
HwControl1
RtDebug
SafetyDomainTimeout
Control
State
_ClassOk
DiasMaster
SafetyState
DomainNr
VaranManager_2
VaranManager_21
To_HwControl
VaranManagerTime
VaranManagerNr
PreventManagerError
IsoStartPoint
RQTaskTime
IsAlsoClient
SuperiorSystemTime
SafetyIsoMemRead
SafetyIsoMemWrite
SafetyAsyMemRead
SafetyAsyMemWrite
ManagerOk
Release
RetryCounter
IsoVaranTime
AsyVaranTime
Act_RtTime
Min_RtTime
Max_RtTime
Act_RtCallTime
Min_RtCallTime
Max_RtCallTime
SuperiorSystemOk
VaranOut_1
VaranOut_2
SafetyMemState
SafetyIsoRdMemUs...
SafetyIsoWrMemUs...
SafetyAsyRdMemU...
SafetyAsyWrMemU...
VI021
VI0211
VaranIn
Required
UserAction
SerNoValidation
Transparent
Online
DeviceAddress
VendorID
DeviceID
SerialNo
ValidateSerNo
FirmwareVersion
SdiasState
SdiasRetryCounter
SdiasOut_1
VaranOut_1
TO161
TO1611
SdiasIn
Place
ClassState
DeviceID
FPGAVersion
SerialNo
LEDControl
Output1
Output2
Output3
Output4
Output5
Output6
Output7
Output8
Output9
Output10
Output11
Output12
Output13
Output14
Output15
Output16
OutputWord
VoltageOkBank1
VoltageOkBank2

Documentation Changes

Change date	Affected page(s)	Chapter	Note
24.10.2013	4	1.5	Added Vibration resistance
23.12.2013	6 9	3 Connector Layout 4.2 Wiring Example	Changed image Added wiring example
11.02.2014	6 7	3 Connector Layout 3.2 Applicable Connectors	Changed image Connection capacity added French notes added
01.04.2014	4 11	1.4 Miscellaneous 5 Mounting	UL added Text updated
18.07.2014	6	3 Connector Layout	Added wiring notice
30.01.2015	10	4.3 Note	Added note concerning connecting the S-DIAS module while voltage is applied
26.03.2015	7	3.2 Applicable Connectors	Added connections
28.04.2016	13	5 Mounting	Graphics distances
17.08.2017	5 8	1.5 Environmental Conditions 3.2 Applicable Connectors	Added operating conditions Added sleeve length Added info regarding ultrasonically welded strands
18.10.2017	9 14	3.3 Label Field 5 Mounting	Added chapter Graphic replaced
20.09.2018		3 Connector Layout	Note added
14.11.2019	17	7 Supported Cycle Times	Chapter added
28.02.2020	17	7 Supported Cycle Times	Text adapted
08.09.2020	18	8 Hardware Class TO161	Chapter added
04.11.2020	14	5 Mounting	Expansion functional ground connection
04.05.2021	6	1.4 Miscellaneous	Article number -X added
13.09.2021	4	1.2 Electrical Requirements	Current consumption changed
05.10.2021	4	1.2 Electrical Requirements	HW-Version -E changed

22.12.2021	4	1.1 Digital Output Specifications	Delay values changed
	12	4.1 General Information on the Digital Outputs	Outputs adjusted
20.05.2022	5	1.2 Electrical Requirements	HW-Version added
06.12.2022	6	1.3 Miscellaneous	UKCA conformity
26.07.2023		Document	General chapters added, design