SIGMATEK

X-DIAS

Designguide

Instruction Manual

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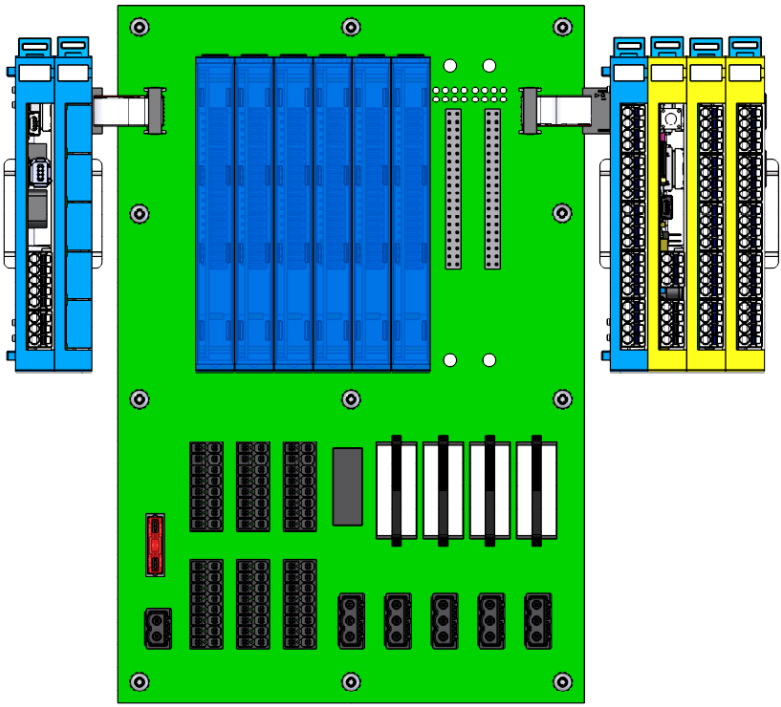
Publisher: SIGMATEK GmbH & Co KG
A-5112 Lamprechtshausen
Tel.: +43/6274/4321
Fax: +43/6274/4321-18
Email: office@sigmatek.at
WWW.SIGMATEK-AUTOMATION.COM

Translation of the Original Instructions

Designguide X-DIAS

The X-DIAS design guide defines the general rules for the integration of X-DIAS modules on a wiring board and their connection to an S-DIAS system.

Possible example of an X-DIAS wiring board with S-DIAS connection:



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1 Technical Requirements Wiring Board

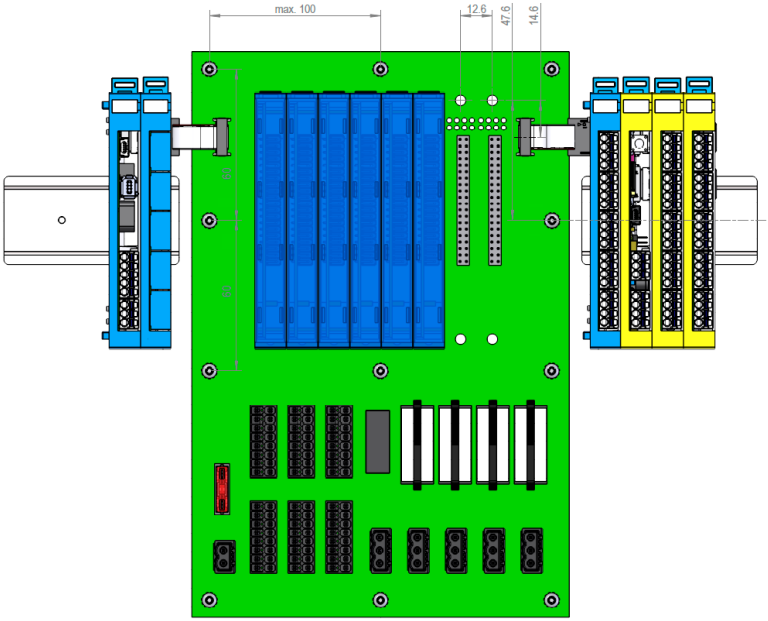
Circuit board design	multilayer printed circuit board (min. 4 layers)
Printed circuit board thickness	1.6 mm ±10 % 2 mm ±10 %
Distance between circuit board and control cabinet mounting plate	recommended 10 mm (min. 5 mm), see chapter 2.1.1 Mounting Distances
Distance between mounting holes	maximum 100 mm
16-pin printed circuit board connector for S-DIAS interface on wiring board	Tyco 464824-E or Harting 15 11 016 2601 000
40-pin socket strip for X-DIAS modules on wiring board	Samtec SSQ-120-01-L-D
Impedance of the S-DIAS bus	100 Ω
Functional grounding X-DIAS modules	via mounting screws of the circuit board on the grounded control cabinet mounting plate
Mounting position	vertical, see chapter 2.1.2 Mounting

2 Mechanical Design Specifications

2.1 Module Placement

It is recommended to place the X-DIAS modules on the top left of the wiring board so that there is a clean separation between the bus and I/Os. The power supply and bus connection for the X-DIAS modules is provided from the left via the S-DIAS adapter module and S-DIAS flat ribbon cable (40 mm). A 16-pin plug connector for the S-DIAS interface is required on the wiring board.

The supply and the bus are then routed accordingly on the wiring board from one X-DIAS module to the next, from left to right. The bus is ONLY looped through a plugged-in X-DIAS module, from left to right. After the last X-DIAS module, it is possible to connect further S-DIAS modules and X-DIAS modules to (one) additional wiring board(s) using S-DIAS flat ribbon cables (40 mm). The 16-pin connector on the wiring board for looping through the S-DIAS interface is the same type as that used for feeding the S-DIAS interface.



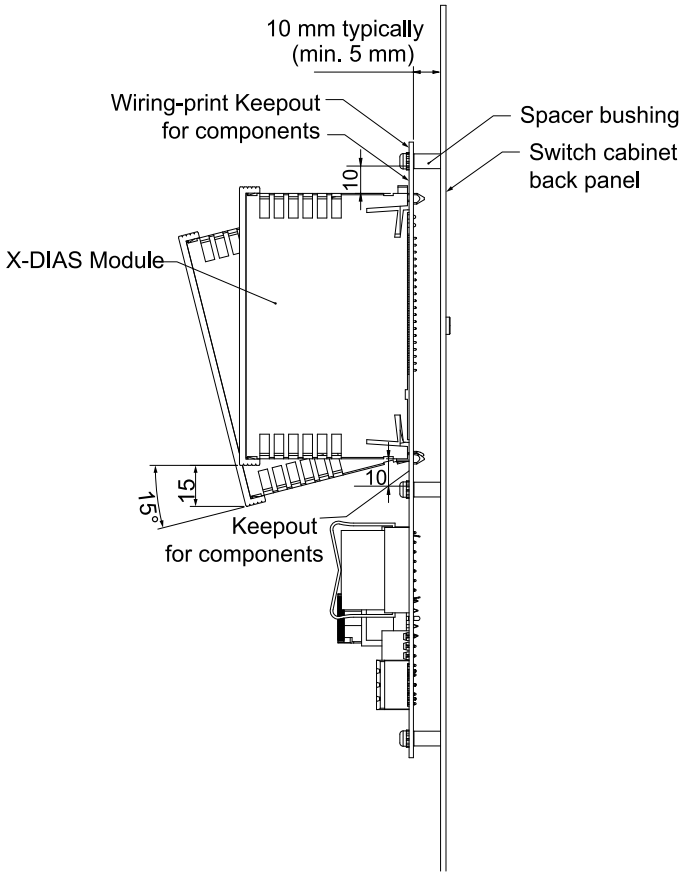
The limitation of the number of modules within an S-DIAS/X-DIAS system is only due to the supply limitation of the S-DIAS/X-DIAS supply module and the maximum available address space for S-DIAS/X-DIAS modules. A power boost module can be used to feed in new power within an S-DIAS/X-DIAS system, allowing up to 64 S-DIAS/X-DIAS subscribers to be operated in one S-DIAS/X-DIAS bus segment.

Each active S-DIAS or X-DIAS device on the bus occupies one of the 64 possible bus addresses. Any mix of S-DIAS and X-DIAS modules is possible in one system.

The wiring board must be sufficiently protected against compressive and tensile forces in the area of the X-DIAS modules with mechanical fastening elements for plugging and unplugging the modules. The distance between the fastening elements should be a maximum of 100 mm. A spacing of 12.6 mm is recommended for the X-DIAS modules; taking tolerances into account, there would therefore be no spacing between the modules. The spacing can also be chosen larger, resulting in visible gaps between the modules. To ensure that the X-DIAS modules are visually in line with the S-DIAS modules, the Y-distance from the drill hole of the upper snap-in hook of the X-DIAS module to the center of the top-hat rail of the S-DIAS modules must be 47.6 mm. Furthermore, the distance from the drill hole of the upper snap-in hook of the X-DIAS module to the center of the 16-pin connector for the S-DIAS interface must be 14.6 mm.

2.1.1 Mounting Distances

To ensure that the blue or yellow covers of the X-DIAS modules is at the same height as the covers of the S-DIAS modules, the following lengths are recommended for the spacer sockets for the control cabinet mounting plate with a printed circuit board thickness of 1.6 mm.



Board thickness 1.6 mm (±10 %) bzw. 2.0 mm (±10 %)

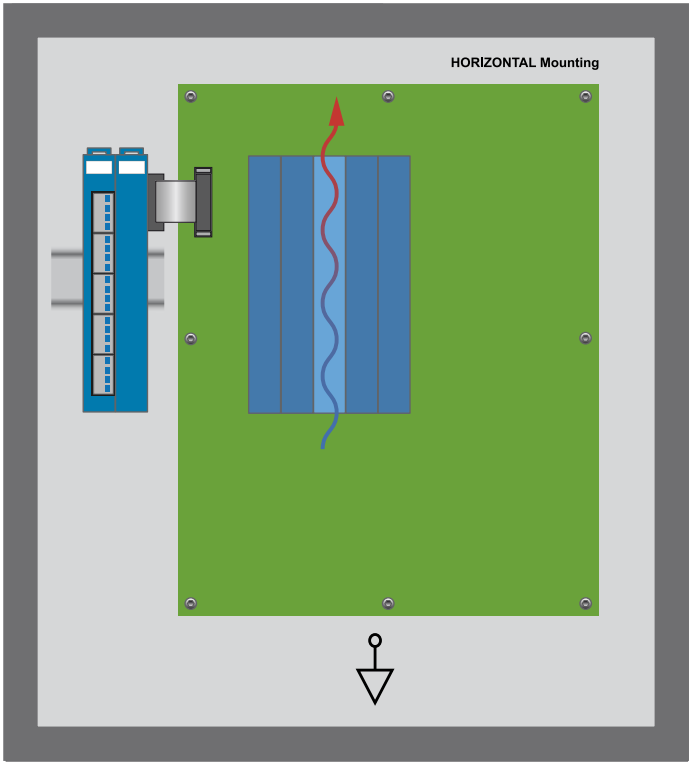
S-DIAS hat rail used in accordance with OVE EN 60715	Length of the spacer bush
TH 35-7,5	10 mm
TH 35-15	17.5 mm

Shorter spacer bolts may also be used, but not shorter than 5 mm.

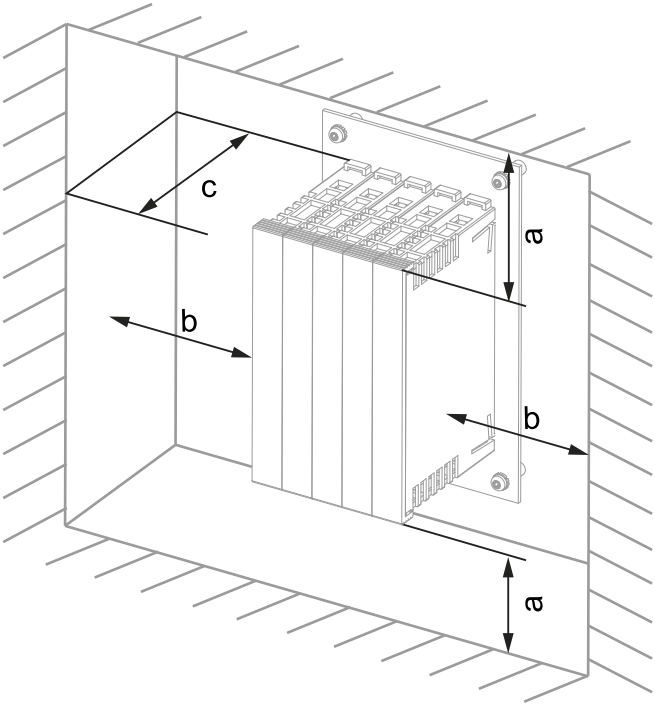
To ensure that the module can be connected and disconnected correctly, a minimum distance of 10 mm from the top must be maintained for components. A distance of 15 mm must be maintained at the bottom for the slight downward rotation of the module, so that there is sufficient space for high components when plugging and unplugging the module.

2.1.2 Mounting

The X-DIAS modules are designed for mounting on a wiring board in the control cabinet. The functional grounding of the X-DIAS modules is carried out via their GND connection on the wiring board. The wiring board must be connected to the grounded switch cabinet mounting plate with low resistance via the mounting screws. The single X-DIAS modules are snapped onto the wiring board and fixed to it using the snap-in hooks on the modules. The modules must be mounted horizontally (module label up) with sufficient clearance between the ventilation slots of the X-DIAS modules blocks and nearby components and/or the control cabinet wall. This is necessary for optimal cooling and air circulation to ensure proper function up to the maximum ambient temperature.



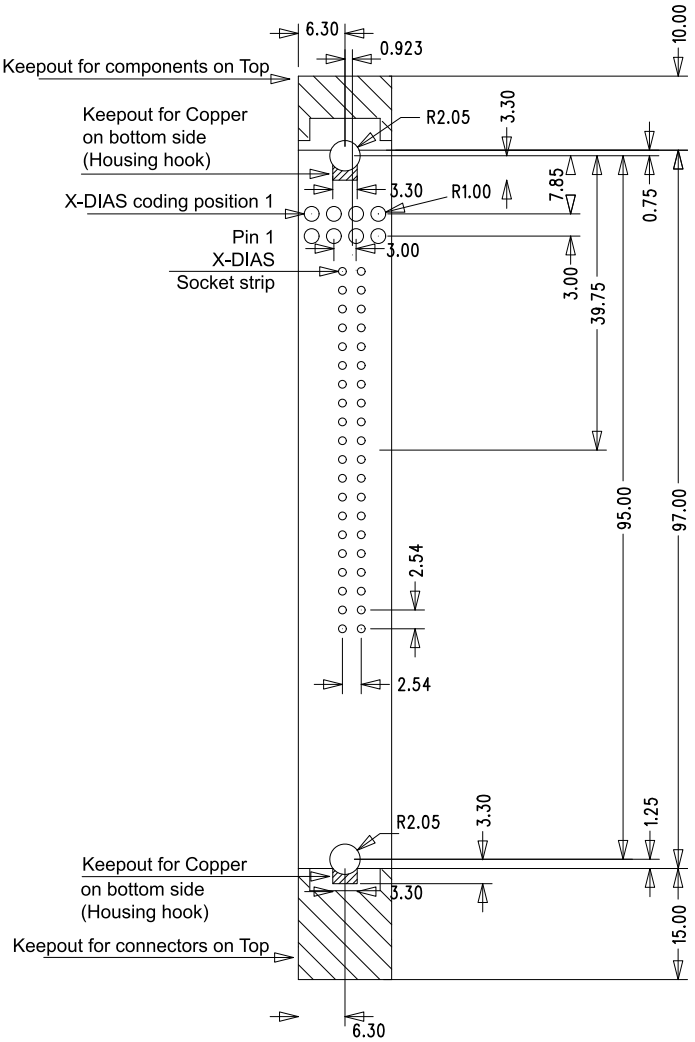
Recommended minimum distances between the X-DIAS modules and the surrounding components or control cabinet wall:



a	b	c
30 mm (1.18″)	**30 mm** (1.18″)	**90 mm** (3.54″)

a, b, c … distances in mm (inches)

2.1.3 Footprint



INFORMATION

The footprint is available as a DXF file.

2.2 Coding

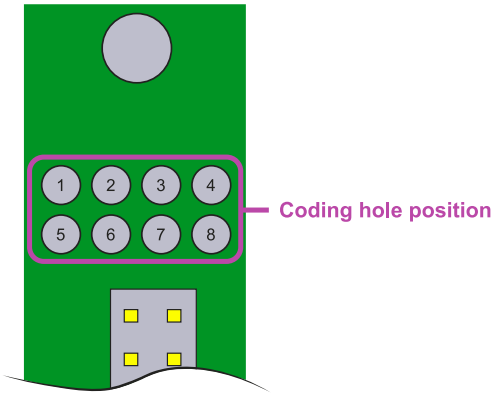
X-DIAS modules have module coding by means of coding pins on the module housing. In combination with coding holes on the wiring board, a mismating protection can be realized, e.g. module coding XDM 161:

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8
X	X	X	O	X	O	O	O

X … Coding pin present on the module -> there must be a coding hole on the wiring board

O ... No coding pin present on the module -> there must be no coding hole on the wiring board

2.2.1 Coding hole positions on wiring board (TOP view)

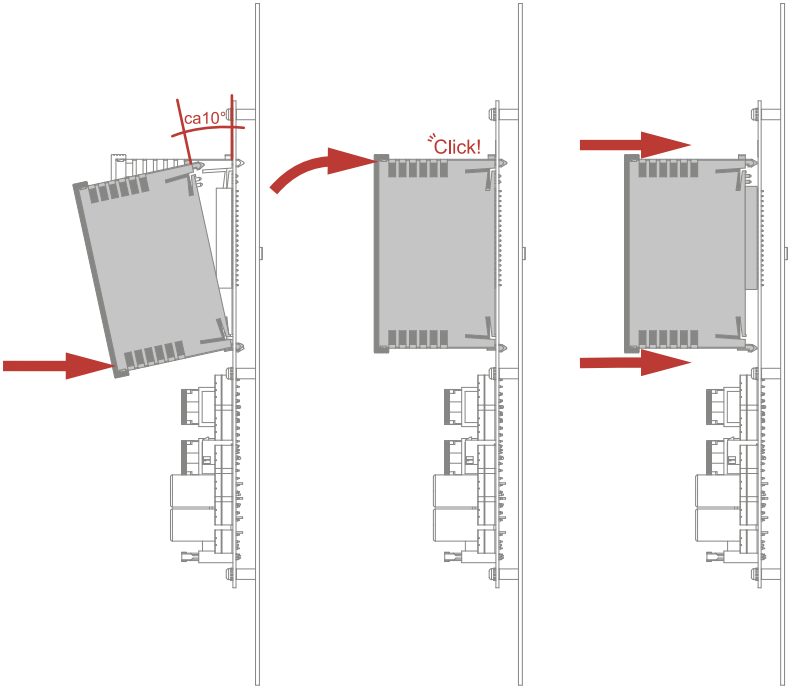


INFORMATION

The individual coding of the modules can be found in the respective documentation.

2.2.2 Connect Module

When connecting the X-DIAS modules, they must first be hooked in with the lower snap-in hook and then pushed upwards in a slight twisting motion until the upper snap-in hook engages.

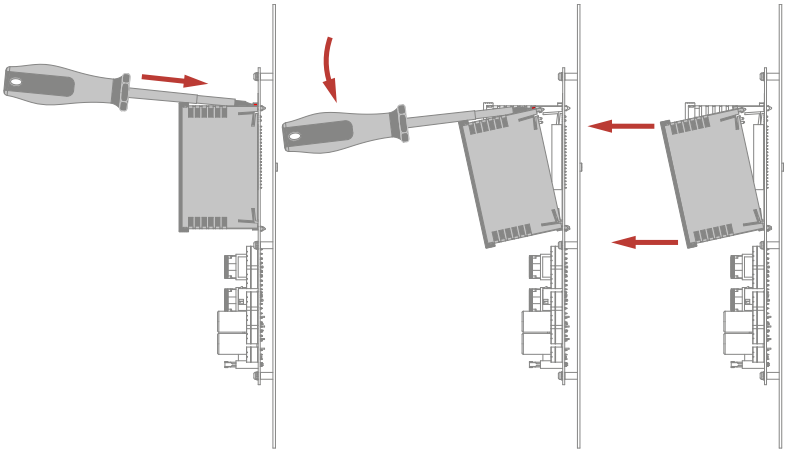


INFORMATION

The modules may only be connected and disconnected when they are de-energized. Failure to do so may result in damage to the modules.

2.2.3 Disconnect Module

A slotted screwdriver is required to disconnect the modules. This must be inserted into the tab parallel to the module. By exerting controlled downward pressure on the handle of the screwdriver, the module is unlocked at the top and can then be removed with a slight downward turning movement.



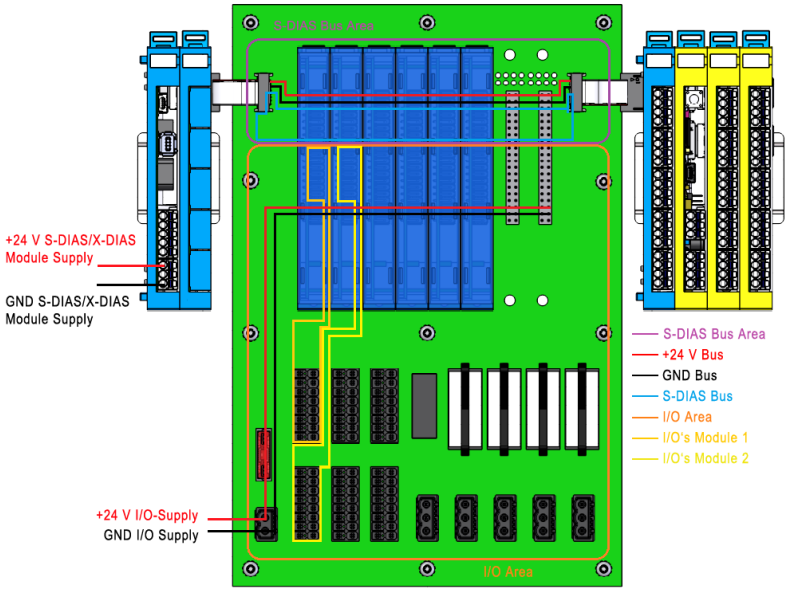
3 Electrical Design Specifications

3.1 Area Allocation

The wiring board is divided into 2 areas:

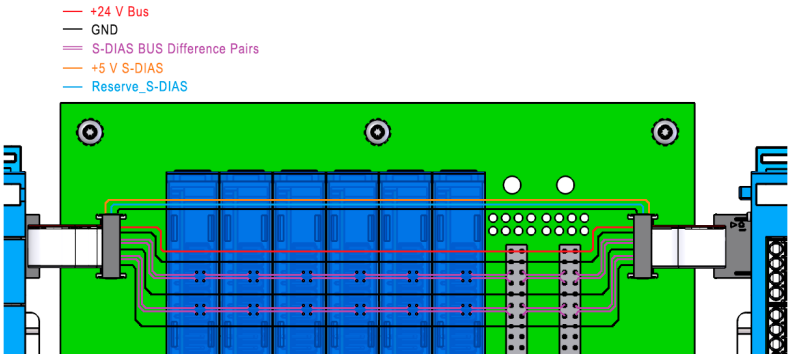
- The routing of the S-DIAS bus supply and the S-DIAS bus takes place in the S-DIAS bus area.
- The routing of the I/O supply and the routing of the I/Os takes place in the I/O area.

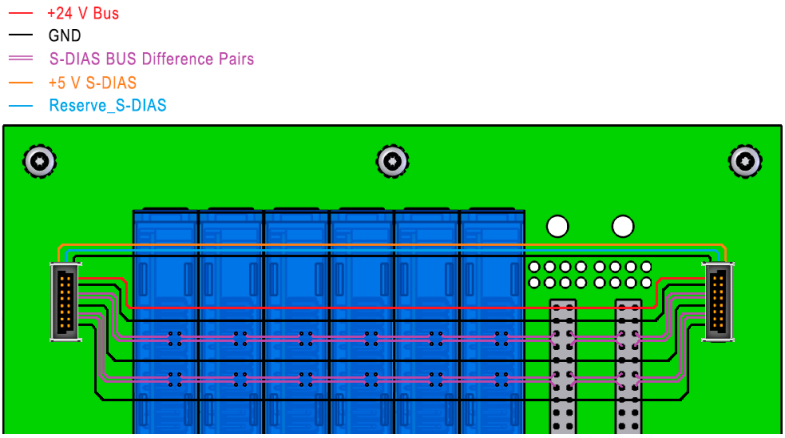
It is recommended to separate these areas in the printed circuit board design as shown above. The modules are functionally grounded via their GND connection. The GND of the X-DIAS modules must be routed electrically with low resistance via the wiring board and the mechanical fastening elements to the rear wall of the control cabinet and connected to ground.



3.2 S-DIAS Bus

The X-DIAS modules are supplied with +24 V bus/GND from the S-DIAS bus. The bus itself consists of a differential Tx and Rx bus on LVDS physics with 100 Mbits/s data rate. If the S-DIAS bus is continued on the last X-DIAS module to connect further S-DIAS modules, the S-DIAS-specific +5 V supply and the S-DIAS reserve signal must also be routed from the incoming S-DIAS interface connector to the outgoing S-DIAS interface connector via the wiring board.

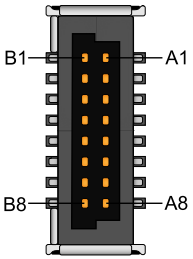




3.2.1 Connector Layout Bus

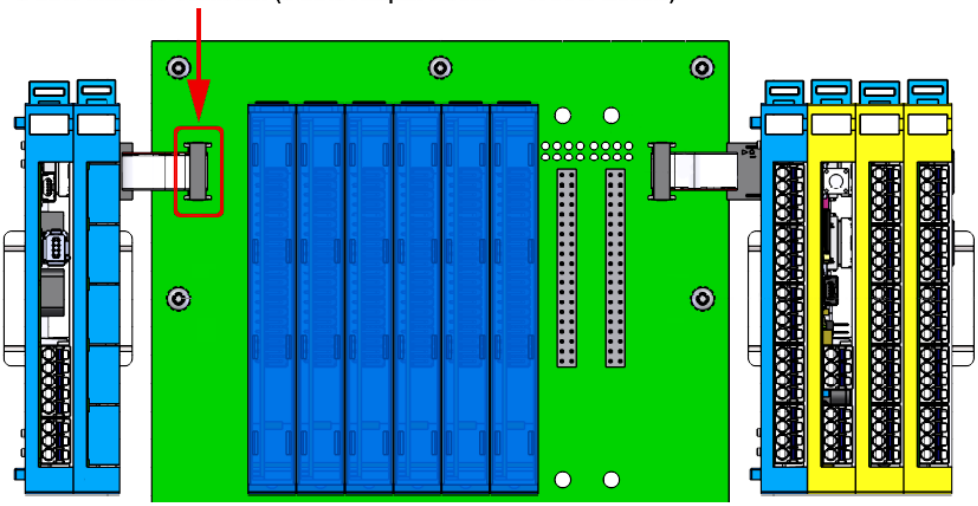
3.2.1.1 S-DIAS Interface Connector (S-DIAS Adapter Module => X-DIAS Module)

Pin assignment for the S-DIAS interface connector incoming from the S-DIAS adapter module to the X-DIAS wiring board to the first X-DIAS module for connection via S-DIAS ribbon cable (40 mm).



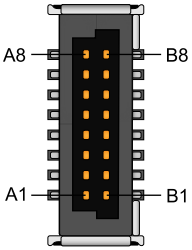
Pin		Signal		Description
B1	A1	+24 V bus	+24 V bus	S-DIAS bus signals
B2	A2	GND	GND	
B3	A3	+5V S-DIAS	+5V S-DIAS	
B4	A4	GND	GND	
B5	A5	RxD- IN	Reserve S-DIAS	
B6	A6	RxD+ IN	GND	
B7	A7	TxD- OUT	GND	
B8	A8	TxD+ OUT	GND	

S-DIAS Interface Connector (S-DIAS Adapter Module => X-DIAS Module)



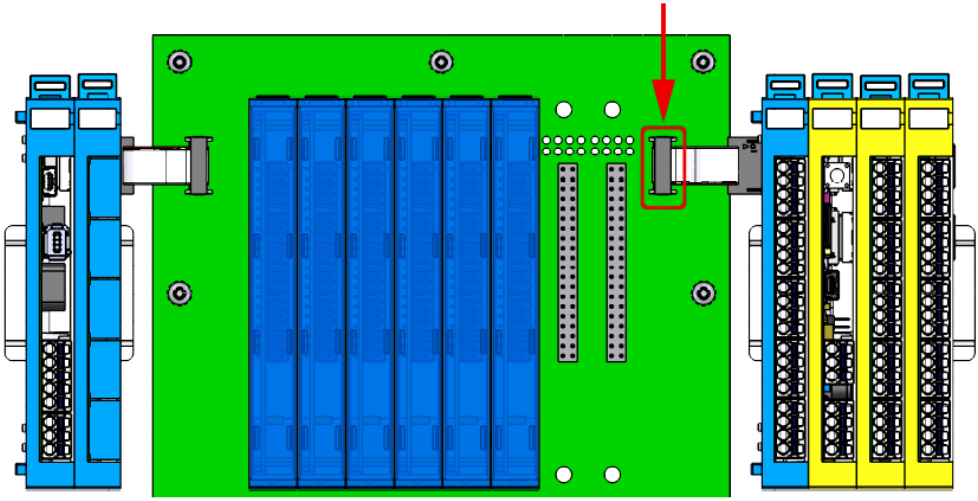
3.2.1.2 S-DIAS Interface Connector (X-DIAS Module => S-DIAS Module)

Pin assignment for the S-DIAS interface connector leading from the X-DIAS wiring board of the last X-DIAS module to an S-DIAS module for connection using an S-DIAS ribbon cable (40 mm).



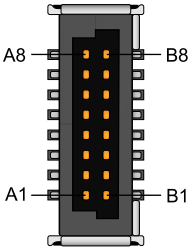
Pin		Signal		Description
A8	B8	+24 V bus	+24 V bus	S-DIAS bus signals
A7	B7	GND	GND	
A6	B6	+5V S-DIAS	+5V S-DIAS	
A5	B5	GND	GND	
A4	B4	Reserve S-DIAS	RxD- IN	
A3	B3	GND	RxD+ IN	
A2	B2	GND	TxD- OUT	
A1	B1	GND	TxD+ OUT	

S-DIAS Interface Connector (X-DIAS Module => S-DIAS Module)

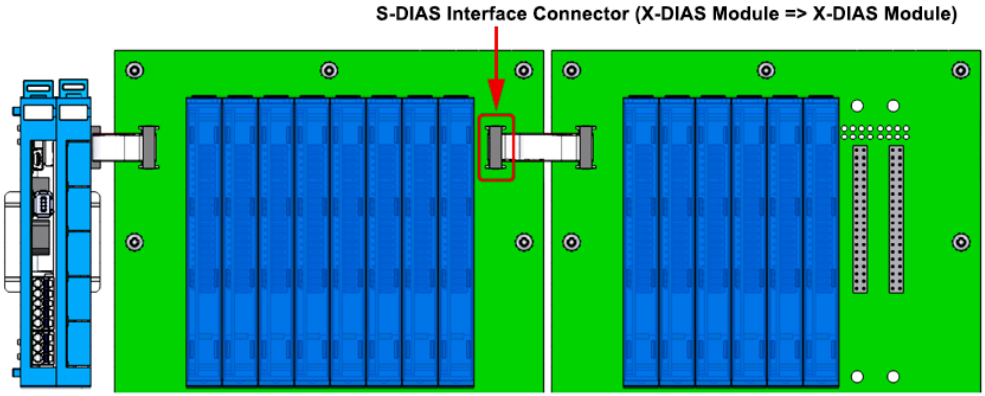


3.2.1.3 S-DIAS Interface Connector (X-DIAS Module => X-DIAS Module)

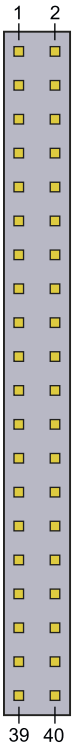
Pin assignment for the S-DIAS interface connector leading from the X-DIAS wiring board of the last X-DIAS module to another X-DIAS wiring board to the first X-DIAS module for connection using an S-DIAS ribbon cable (40 mm).



Pin		Signal		Description
B1	A1	+24 V bus	+24 V bus	S-DIAS bus signals
B2	A2	GND	GND	
B3	A3	+5V S-DIAS	+5V S-DIAS	
B4	A4	GND	GND	
B5	A5	RxD- IN	Reserve S-DIAS	
B6	A6	RxD+ IN	GND	
B7	A7	TxD- OUT	GND	
B8	A8	TxD+ OUT	GND	



3.2.1.4 X-DIAS Connector



Pin		Signal		Description
1	2	+24 V bus	+24 V bus	S-DIAS bus signals
3	4	GND	GND	
5	6	RxD- OUT	RxD- IN	
7	8	RxD+ OUT	RxD+ IN	
9	10	GND	GND	
11	12	TxD- IN	TxD- OUT	
13	14	TxD+ IN	TxD+ OUT	
15	16	GND	GND	
17	18	-	-	I/O signals: modul-specific connector layout
19	20	-	-	
21	22	-	-	
23	24	-	-	
25	26	-	-	
27	28	-	-	
29	30	-	-	
31	32	-	-	
33	34	-	-	
35	36	-	-	
37	38	-	-	
39	40	-	-	

3.2.2 Bus Routing

The TxD Out+ signal of the module must be connected to the TxD In+ signal of the subsequent module. The TxD Out- signal of the module must be connected to the TxD In- signal of the subsequent module.

The RxD Out+ signal of the module must be connected to the RxD In+ signal of the previous module. The RxD Out- signal of the module must be connected to the RxD In- signal of the previous module.

The following points must be taken into account for bus routing:

- the differential impedance of the S-DIAS bus LVDS signals must be 100 Ω
- the width and spacing of the signals of the differential pair depends on the printed circuit board structure and must be calculated accordingly
- the differential signals should be routed next to each other (edge coupled)
- the distance between the differential pairs to each other or to other networks must be at least 3x greater than the distance between the signals of a differential pair
- to achieve the required impedance, there must be no GND area between the signals of the differential pair
- if possible, differential pairs should be routed without vias to avoid impedance jumps
- the LVDS lines should be routed as short as possible. The individual LVDS cable pairs must be as short as possible from plug to plug and must not exceed a length of 40 mm.

3.2.3 +24 V Bus Supply

The X-DIAS modules are supplied with +24 V bus via the S-DIAS bus. If an X-DIAS module requires a +24 V I/O supply, this must be provided separately. Supplying the I/O side of the X-DIAS modules with +24 V bus is not permitted.

The voltage drop of the +24 V bus supply must not exceed 100 mV with a maximum current load of 1.6 A for the S-DIAS/X-DIAS modules. This must be taken into account when dimensioning the conductor tracks.

3.2.4 +5 V S-DIAS Bus Supply

Compared to the S-DIAS modules, the X-DIAS modules do not require a 5 V S-DIAS bus supply. If the S-DIAS bus is continued on the last X-DIAS module to connect further S-DIAS modules, the S-DIAS-specific +5 V supply must also be routed from the incoming S-DIAS interface connector to the outgoing S-DIAS interface connector via the wiring board. The +5 V supply is intended exclusively for supplying the S-DIAS modules and must not be used for other purposes.

The voltage drop of the +5 V S-DIAS bus supply must not exceed 50 mV with a maximum current load of 1.6 A on the S-DIAS modules. This must be taken into account when dimensioning the conductor tracks.

INFORMATION

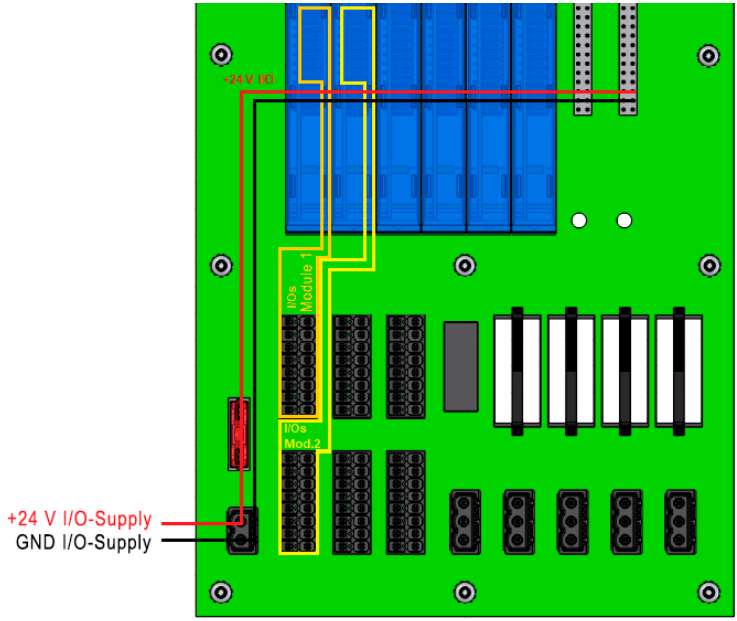
If X-DIAS modules are used on an S-DIAS supply module with several S-DIAS and X-DIAS modules, the total currents of the S-DIAS and X-DIAS modules used must be determined and checked. The total current of the +24 V and +5 V supply must not exceed 1.6 A in each case! The specification for the current can be found in the module-specific documentation under "Electrical Requirements".

3.2.5 Miscellaneous

The "Reserve S-DIAS" signal is only required for the S-DIAS modules. If the S-DIAS bus is continued on the last X-DIAS module to connect further S-DIAS modules, the "Reserve S-DIAS" signal must be routed from the incoming S-DIAS interface connector to the outgoing S-DIAS interface connector via the wiring board.

3.3 Routing I/O Area

The I/O supply of the X-DIAS modules must be provided by a +24 V SELV/PELV power supply unit. The pin assignment for the +24 V I/O supply of the X-DIAS modules can be found in the respective module documentation. The maximum possible current load must be taken into account when dimensioning the conductor track thicknesses or areas for the +24 V I/O supply. When dimensioning the conductor track thicknesses of the I/O signals, the maximum possible current load must also be taken into account. It is generally recommended to route analog signals and digital signals separately in order to avoid crosstalk between the digital signals and sensitive analog signals.



3.4 GND Concept

It is recommended to design the GND on the wiring board as a surface on one layer of the multi-layer board. As the bus and the I/O area are not electrically isolated from each other, a common GND area should be created for both areas.

It is also recommended that the GND of the wiring board is connected directly to the grounded switch cabinet mounting plate with low resistance via all fastening elements. It is important to establish an electrically low-impedance ground connection of the S-DIAS modules via the top-hat rail to the same grounded control cabinet mounting plate.

Both measures are necessary for the modules to function properly.

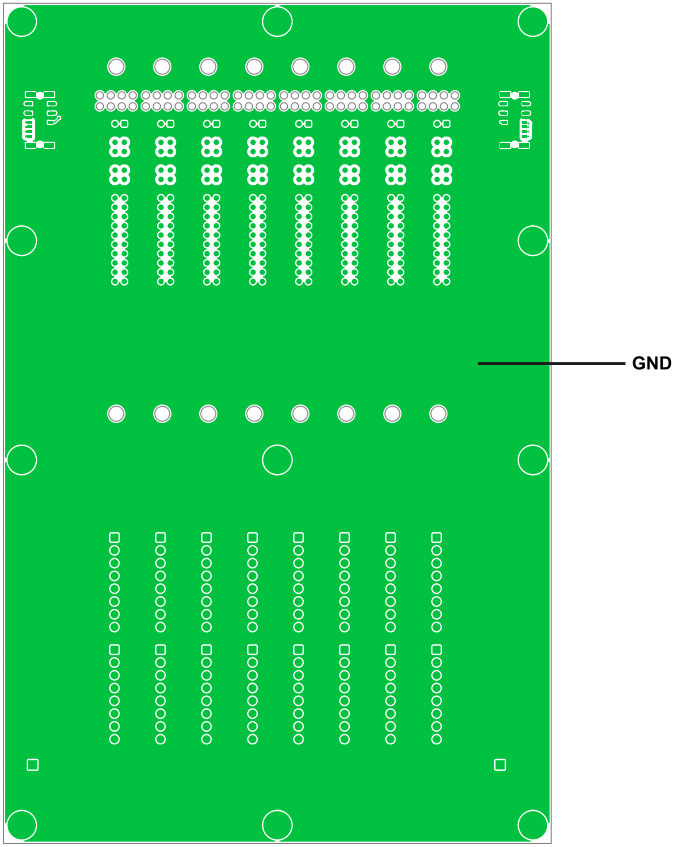
3.5 Circuit Board Design

A multilayer printed circuit board with a thickness of 1.6 mm ±10 % or 2 mm ±10 % with at least 4 layers is recommended for the wiring board.

3.5.1 Example 4-layer circuit board (multilayer)

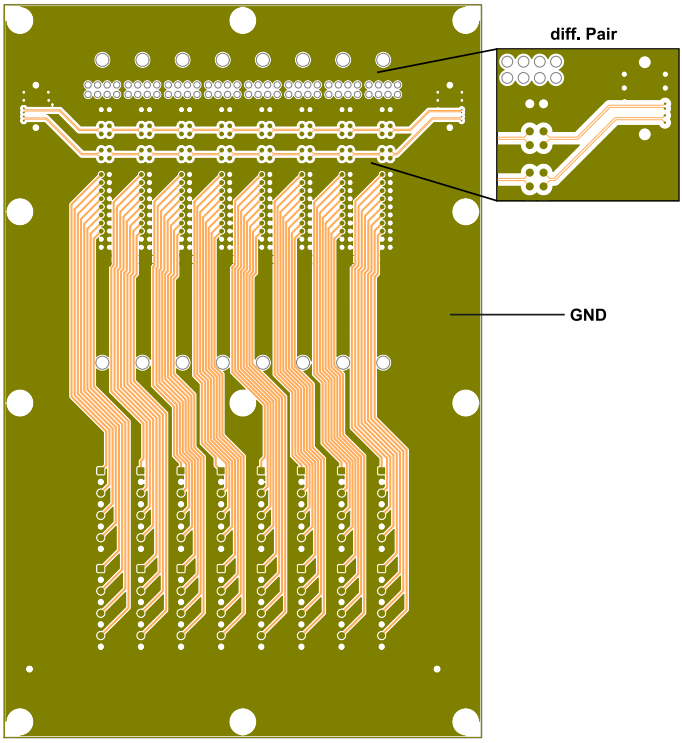
3.5.1.1 Top Layer

It is recommended to use the top layer as the surface for the GND. This embeds the bus on inner layer 1 and the signal lines on inner layers 1 & 2 in GND in order to improve the susceptibility to EMC interference. It is also recommended to remove the contact surfaces for the mounting holes on the top layer from the solder resist and connect them to GND so that an electrically low-resistance earth connection is established via the fastening elements.



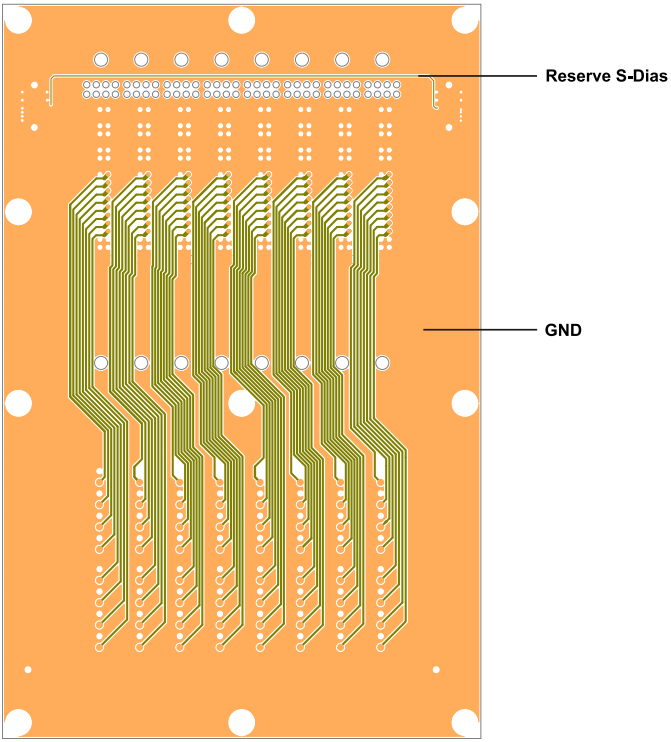
3.5.1.2 Inner Layer 1

It is recommended to use inner layer 1 as the routing layer for the bus. Inner layer 1 is also used to unbundle the signal lines in the I/O area. Furthermore, it is recommended to route sensitive analog signals on inner layer 1 in order to make the best possible use of the TOP layer with GND as a reference layer and shield. Unused areas for routing should be flooded with GND.



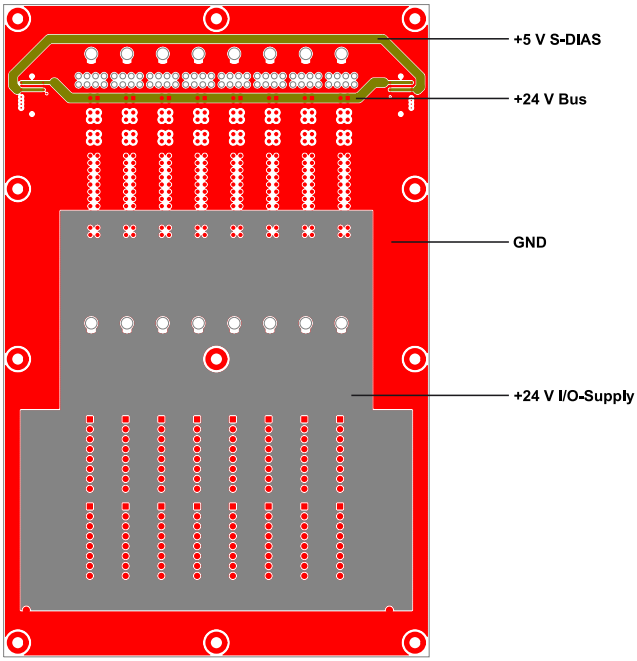
3.5.1.3 Inner Layer 2

In areas where no cables run or areas not used for routing should still be filled (flooded) with copper. These copper surfaces are connected to ground potential (0 V). It is recommended to flood the inner layer 2 in the bus area with GND so that the BUS is completely embedded in GND. Inner layer 2 is also used to unbundle the signal lines in the I/O area.



3.5.1.4 Bottom Layer

It is recommended to use the bottom layer for the +24 V I/O supply of the modules. Unused areas for the +24 V I/O supply should be flooded with GND.



3.5.1.5 Further Layers

Additional inner layers can be added if required for signal routing. Unused areas for routing should be flooded with GND. The area of the bus must be flooded with GND and the correct impedance must be observed. In addition, a screen printing layer can be added for the TOP layer for labeling the wiring board (position point designation, etc.), the plugs, fuses, relays, etc. Alternatively, marking or labeling of the wiring board can also be implemented by means of solder-stop release for the TOP layer.

Changes Chart

Change date	Affected page(s)	Chapter	Note
10.06.2024	11	2.1.3 Footprint	Changed graphic
	16	S-DIAS bus	S-DIAS connector on the right-hand side rotated by 180° (second diagram)
	17	3.2.1 Connector Layout Bus	Interface connector X-DIAS => S-DIAS rotated by 180° and table adapted accordingly
	25	3.5.1 Example 4-layer circuit board (multilayer)	Graphics changed
17.10.2024	15	3.1 Area Allocation	Graphics changed
	25	3.5.1 Example 4-layer circuit board (multilayer)	
03.02.2025		Document	Layout changes
03.09.2025	5	2.1 Module Placement	Extension text
23.10.2025	17	3.2.1 Connector Layout Bus	Extension image and text
	25	3.5.1 Example 4-layer circuit board (multilayer)	New images