Ortem Multiplexer

oMux 22x24S

Technical Document

Ortem Electronic A.Ş.

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WARNING!

Users with technical expertise can evaluate the product or system alternatives offered by Ortem Elektronik in this document and other materials.

In order to ensure that all performance, durability, maintenance, security, and alerting needs of the application are met, it is the user's responsibility to make the final selection of the system and components through its own study and testing.

The user must adhere to any applicable Industry Standards and shall abide by the information provided by Ortem Elektronik and authorized distributors as well as the information about the product in the most recent product catalog.

Contents

1 Table of Contents

2 Revision

The modifications made to this document are listed chronologically in the table that follows.

Schedule Code	Number of Updates	Date	Update cause

3 Safety

Do not follow the instructions in this document if you have no expertise managing electronic devices.

Contact the manufacturer if you are concerned or have any questions regarding this product, its use, or maintenance.

The term "manufacturer company" refers to "Ortem Elektronik A.Ş".

3.1 Safety Warning Icons

Follow the instructions attentively after seeing these symbols to proceed.

Danger! Risk of death or injury.

Warning! Risk of Signal Distortion or Damage to Equipment.

Follow the instructions attentively after seeing these symbols to proceed.

3.2 General Safety Regulations

Only individuals with a strong background in safety, mechanical, and control systems should deal with hydraulic control electronics.

When installing, repairing, maintaining, or altering this equipment, go by the guidelines advised by the manufacturer.
Accidents brought on by incorrect installation or maintenance are not the manufacturer's responsibility.
A system's improper use or improper programming that endangers its safety are not the manufacturer's responsibility.

If the electronics module, wiring, connectors, or control systems are faulty or malfunctioning, do not use this device.

Incorrect installations or specific circumstances when electronic control systems are subjected to intense electromagnetic interference fields might result in unwanted outcomes.

3.3 Performing welding after assembly

When possible, weld the vehicle's chassis before assembly if it needs to be done. If subsequent welding is required, refer to the steps below:

Avoid placing the welding machine's cords close to the control system's cables.

I. Cut all electrical connections between the system and any external equipment.
II. Unplug the battery's negative cable.
III. Unplug the battery's positive cable.
IV. The ground of the welder should be as close as possible to the welder as is practical.

3.4 Installation Rules

If the supply voltage of the Control system is interrupted, the vehicle must be provided with an emergency stop. The operator needs to have quick access to the Emergency Stop. If possible, the installation should take place after the operator is dismissed and the control system's supply voltage has been turned off.

3.4.1 Safety Precautions During Installation

Cabling that has been installed or put incorrectly might cause system malfunctions.
Potentially impacted by radio signals.

3.4.2 Safety Precautions During Operation

Danger! Risk of death or injury.

Before installing the control system and confirming its electrical operation, do not start the machine's engine.

3.5 Safety and Diagnostics During Maintenance

Ensure the following before working on the hydraulic control electronics:

- The machine is stable.
- Functions are positioned safely.
- The machine is not working.
- The hydraulic system has no pressure on it.
- The supply voltage of the control electronics is off.

4 Ortem Multiplexer 22x24S General Information

oMux 22x24S, a part of the Multiplexer product family, is a Body Control Unit that fulfills essential control functions such as door control, signaling, lamp operation, wiper motor control, air conditioner motor control, and window raising/lowering in vehicles. It can be installed in different parts of the vehicle and provide real time information via CAN-Bus communication interface.
Due to its capability to execute simultaneous operations, it provides the most cost-effective and economical solution for the vehicle. It can operate 15 oMux devices on the same CAN-Bus with identical software due to its master/slave operation capability. This allows seamless integration and efficient management of multiple oMux units within your vehicle system.

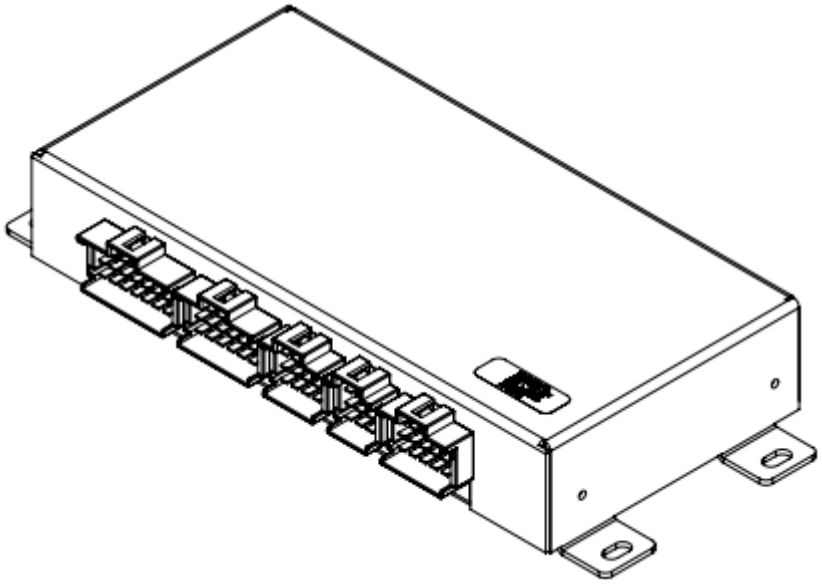


Figure 1: oMux 22x24S

oMux 22x24S has twenty-two inputs and twenty-four outputs.

Inputs:

- "Active-Low" Digital
- "Active-High" Digital
- Analog

Outputs:

- "Half-Bridge"
- "High-Side"

Two CAN communication ports for general communication and one for programming are available on oMux 22x24. The hardware components of oMux 22x24S are described in this manual. For more information on how to configure the software, follow the software manual or contact Ortem Elektronik AŞ.

4.1 Symbols used in diagrams.

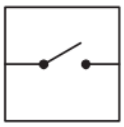
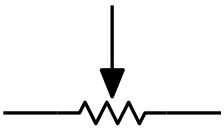
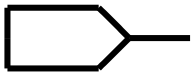
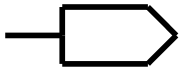
	Control Switch		Resistor
	Pull-Down Resistor		Zener Diode
	Pull-Up Resistor		Capacitor
	Voltage Source		Potentiometer
	GND (ground)		General Input
	Battery		General Output

Table 1: Symbol list

5 Get started.

This section offers detailed instructions on oMux 22x24S connections, as well as the required software programs and applications.

A detailed overview of the tasks involved in this area is provided below:

I. Collect the required materials.
II. Install the necessary software tools that Ortem Elektronik has provided.
III. Connect oMux 22x24S to a desktop development system and turn it on.

5.1 Required Materials

The following materials must be available to complete the procedures in this section:

- oMux 22x24S
- Multiplexer Testbench
- Computer (PC)
- USB-CAN converter

5.2 Required Software for Installation

Install the required software applications and install the following PC software tool before using oMux 22x24S.

- USB-CAN converter driver

The USB-CAN converter functions as an interface between the PC and oMux 22x24S.

5.2.1 Driver software installment

When connecting oMux 22x24S to a development system, a USB-CAN converter is necessary.

To install Ortem Elektronik USB-CAN converter drivers:

I. Plug the PC to the Ortem USB-CAN converter.
II. Windows will conduct an automatic installation of the driver program.
III. "FTDI Virtual COM Port" drivers are manually installed from ftdichip.com in case the automatic installation fails.

5.3 oMux 22x24S Connection to a development system

The connection between oMux 22x24S and a development system is shown in Figure 2 below:

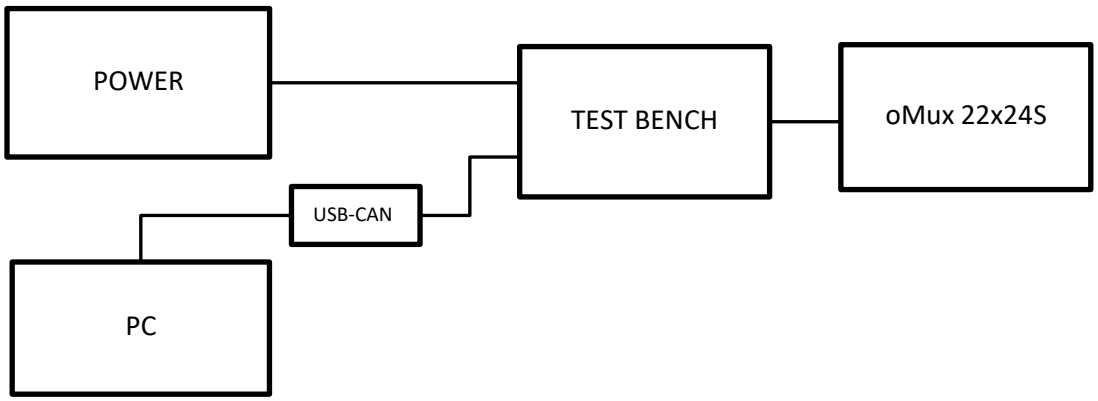


Figure 2: Connection diagram

Follow these steps to connect oMux 22x24S to a development system:

i. Plug the Testbench and oMux 22x24S connectors.
ii. Connect the Testbench to an appropriate power supply.
iii. Connect Ortem's CAN-USB converter to your computer and the Testbench.

6 *Connectors and Pin Outputs*

There are five connectors on the Ortem Multiplexer 22x24S:

- Connector 1 (P1) 964567-6
- Connector 2 (P2) 964567-1
- Connector 3 (P3) 964567-3
- Connector 4 (P4) 964567-4
- Connector 5 (P5) 964567-2

To prevent mismatching with the car electrical harness, the connectors are given separate types.

Figure 3: oMux 22x24S Appearance

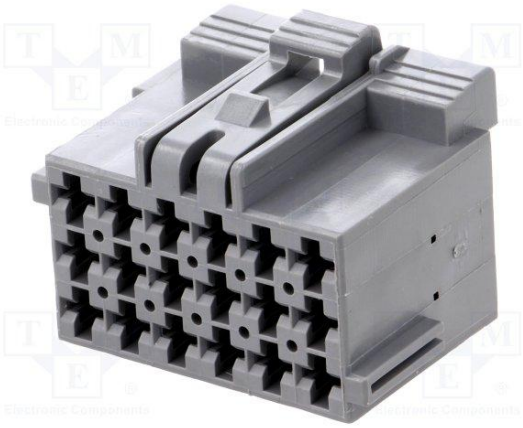
Connector 1 equivalency:

Tyco 1-967625-1

Material: PBT-GF10

Combination Material: Tin

Figure 4: 1-967625-1



Connector 2 equivalency:

Tyco 1-967624-1

Material: PBT-GF10

Combination Material: Tin

Figure 5: 1-967624-1

Connector 3 equivalency:

Tyco 1-967622-1

Material: PBT-GF30

Combination Material: Tin

Figure 6: 1-967622-1

Connector 4 equivalency:

Tyco 1-967621-1

Material: PBT-GF10

Combination Material: Tin

Figure 7: 1-967621-1

Connector 5 equivalency:

Tyco 1-967623-1

Material: PBT-GF10

Combination Material: Tin

Figure 8: 1-967623-1

6.1 Pin Outputs

The interface between oMux 22x24S's internal circuitry and the car wiring harness is provided by the pins, which connects all inputs, outputs, and communication channels.

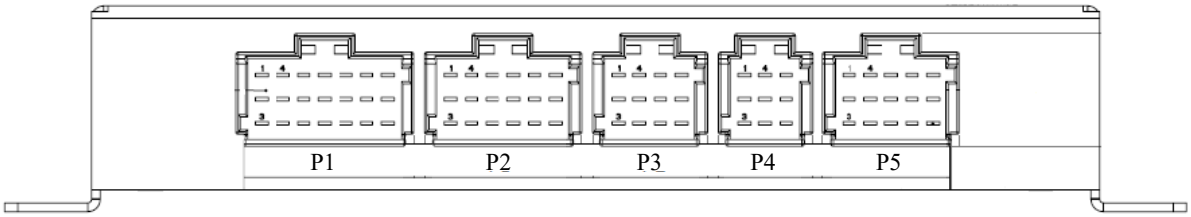
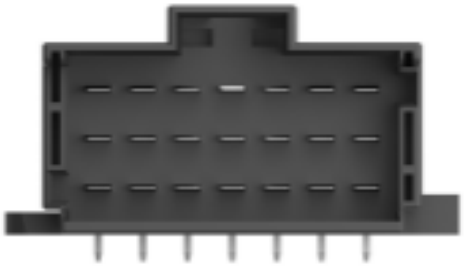
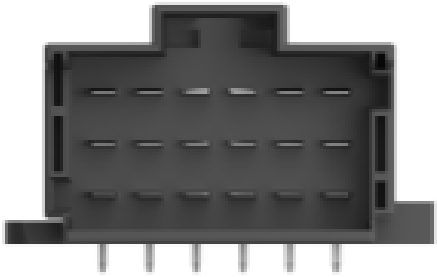


Figure 9: Connector Appearance

The tables below show all Pin outputs and Pin functions.



Connector 1 (P1)



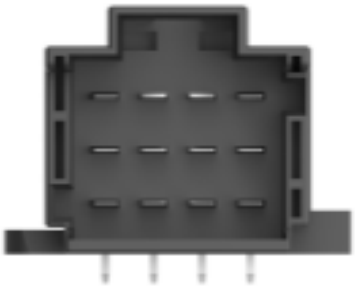
Connector 2 (P2)

P1 (964567-6)		
Pin	**I/O**	**Function**
1	Output 21	Half Bridge (10A)
2	Output 22	Half Bridge (10A)
3	Input 02	Low Active
4	Output 24	Half Bridge (10A)
5	Input 22	Low Active
6	Input 21	Low Active
7	Input 16	Analog
8	PWR	GND
9	Input 20	Low Active
10	Output 23	High Side (10A)
11	CAN 2	High
12	Input 19	High Active
13	Output 20	High Side (10A)
14	CAN 2	Shield
15	CAN 2	Low
16	Output 19	High Side (10A)
17	12V Out	300 mA max.
18	Input 17	Low Active
19	5V Out	500 mA max.
20	PWR	Vbb_G4
21	PWR	Vbb_G4

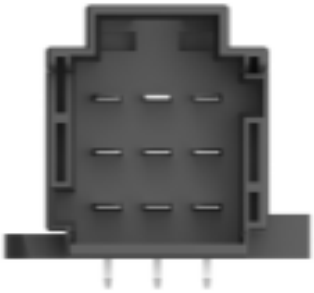
Table 2: Connector 1 pin list

P2 (964567-1)		
Pin	**I/O**	**Function**
1	Output 18	High Side (10A)
2	Input 14	Analog
3	Input 15	Analog
4	Output 17	High Side (10A)
5	CAN 1	High
6	CAN 1	Shield
7	Output 14	High Side (10A)
8	PWR	GND
9	CAN 1	Low
10	Output 13	High Side (10A)
11	Input 12	Analog
12	Input 11	Analog
13	Output 16	High Side (10A)
14	Input 10	Analog
15	Input 13	Analog
16	Output 15	High Side (10A)
17	PWR	Vbb_G3
18	PWR	Vbb_G3

Table 3: Connector 2 pin list



Connector 3 (P3)



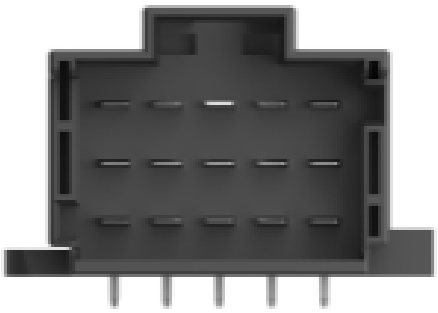
Connector 4(P4)

P3 (964567-3)		
Pin	**I/O**	**Function**
1	PWR	Vbb_Logic
2	Input 01	Low Active
3	Address 1	High Active
4	Address 2	High Active
5	Address 3	High Active
6	Address 4	High Active
7	CAN 3	High
8	CAN 3	Shield 1
9	PWR	GND
10	CAN 3	Shield 2
11	CAN 3	Low
12	Input 18	High Active

Table 4: Connector 3 pin list

P4 (964567-4)		
Pin	**I/O**	**Function**
1	Output 1	High Side (10A)
2	Output 2	High Side (10A)
3	PWR	Vbb_G1
4	Output 4	High Side (10A)
5	PWR	GND
6	PWR	Vbb_G1
7	Output 3	High Side (10A)
8	Output 6	High Side (10A)
9	Output 5	High Side (10A)

Table 5: Connector 4 pin list



Connector 5 (P5)

P5 (964567-2)		
Pin	**I/O**	**Function**
1	Output 10	High Side (10A)
2	PWR	Vbb_G2
3	PWR	Vbb_G2
4	Output 09	High Side (10A)
5	Input 6	Low Active
6	Input 7	Low Active
7	Input 4	Low Active
8	Input 3	Low Active
9	Input 9	Analog
10	Output 12	High Side (10A)
11	Input 5	Low Active
12	Input 8	Low Active
13	Output 11	High Side (10A)
14	Output 08	High Side (10A)
15	Output 07	High Side (10A)

Table 6: Connector 5 pin list

Abbreviation	Definition
Vbb	Battery Voltage
GND	Battery Ground
HS	High Side Output
HB	Half Bridge
AIN	Analog Input (0-Vbb)
FIN	Frequency Input
INT	Interrupt Input
V-Out	Voltage Output
NC	No Connect
Com	Communication
PWM	Pulse Width Modulation
PWR	Power
5V-Out	Max. 500mA
12V-Out	Max. 300mA

Table 7: Abbreviations

7 Supply

The vehicle's battery provides electricity to Ortem Multiplexer 22x24, It may run on a 12 V or 24 V system (9 V to 36 V) and can operate with protection against 36 V Overvoltage.

7.1 Supply Characteristics

Vbb_Logic, Vbb_G1, Vbb_G2, Vbb_G3 and Vbb_G4 pins must be connected to the positive (+) pole of the vehicle battery, and the GND pins to the negative (-) pole of the vehicle battery.

Supply Characteristics				
	Minimum	Nominal	Maximum	Unit
Input Voltage Range	9		36	V
Overvoltage			36	V
Current (9 V Operation Mode)			300	mA
Current (32 V Operation Mode)			50	mA
Current (32 V Sleep Mode)		4	6	mA
Overvoltage (5 minutes)			36	V
Vbb_Logic Current (For every connector)		0,05	1	A
Vbb_G1 Current (For every connector)			15	A
Vbb_G2 Current (For every connector)			15	A
Vbb_G3 Current (For every connector)			15	A
Vbb_G4 Current (For every connector)			15	A

Table 8: oMux 22x24S Supply characteristics

oMux 22x24, connector P1's pin 17 has 12Vand pin 19 has 5V output.

WARNING!

Do not draw a total current exceeding the specified limits through these pins. By doing this, the output will reduce its voltage, causing it to protect itself.

7.1.1 5V Supply Characteristics

5V Supply Characteristics				
	Minimum	Nominal	Maximum	Unit
Input Voltage Range (5 V Output)	9		36	
Overvoltage			36	V
Output Voltage Range (5 V Output)	4.74	5.02	5.30	V
Output Voltage Accuracy			6	%
Output Current	0		500	mA

Table 9: oMux 22x24S Sensor Supply Outputs

7.1.2 5V Supply Fault Responses

"5V Supply" is designed to endure instances when the battery or ground experience short circuit or overcurrent. In case that these circumstances arise, the circuit will recover as shown in the table below:

Sensor Supply Fault Responses	
Situation	**Response**
Battery Short Circuit (Sensor Supply =Battery Voltage)	When the short circuit is over, the Sensor Supply Voltage returns.
Ground Short Circuit (Sensor Supply =Ground)	When the short circuit is over, the Sensor Supply Voltage returns.
Overcurrent (Sensor Supply =Ground)	When the overcurrent condition is over, the Sensor Supply Voltage returns.

Table 10: oMux 22x24S Fault Responses

7.1.3 12V Supply Characteristics

12V Supply Characteristics				
	Minimum	Nominal	Maximum	Unit
Input Voltage Range (12 V Output)	16		36	
Overvoltage			36	V
Output Voltage Range (12 V Output)	11.28	12	12.72	V
Output Voltage Accuracy			6	%
Output Current	0		300	mA

Table 11: oMux 22x24S Sensor Supply Outputs

WARNING!

12V supply may not work stably with supply voltage under 16V. In order for it to work stably supply voltage must be above 16V.

7.1.4 12V Supply Fault Responses

"12V Supply " is designed to endure instances when the battery or ground experience short circuit or overcurrent. In case that these circumstances arise, the circuit will recover as shown in the table below:

Sensor Supply Fault Responses	
Situation	**Response**
Battery Short Circuit (Sensor Supply =Battery Voltage)	When the short circuit is over, the Sensor Supply Voltage returns.
Ground Short Circuit (Sensor Supply =Ground)	When the short circuit is over, the Sensor Supply Voltage returns.
Overcurrent (Sensor Supply =Ground)	When the overcurrent condition is over, the Sensor Supply Voltage returns.

Table 12: oMux 22x24S Fault Responses

8 Inputs

oMux 22x24S has digital and analog inputs.

EQUIPMENT DAMAGE!

Equipment that could produce high peak voltages of more than 36V shouldn't be connected to the inputs; if it needs to be, a protection diode or a transistor should be used.

8.1 Digital Inputs

Digital inputs are typically used with on or off switches individually.

oMux 22x24S has two types of inputs:

- Digital Inputs
- Address Inputs

oMux 22x24S has a total of 14 digital inputs:

- 2 “Active-High”
- 12 “Active-Low”

8.1.1 Digital Input Characteristics

Digital Input Characteristics				
	Minimum	**Nominal**	**Maximum**	**Unit**
Input Voltage Range	0		32	V
Overvoltage			36	V
Inductive Load Protection		Available		
Pull-up/down Resistor	-%5	47	+%5	KΩ
Pin’s Capacitance		0.1		µF
Pull-up/down (When Active)	10			mS

Table 13: Digital Input Characteristics

8.1.2 Digital Input Configuration

By using pull-up or pull-down resistors inside the module, digital inputs are set up as "Active-High" or "Active-Low."

8.1.3 Digital Input Connections

An on/off switch is often used to connect a digital input.

"Active-High" Input

"Active-High" input must be connected to the battery's (+) supply when input status changes.

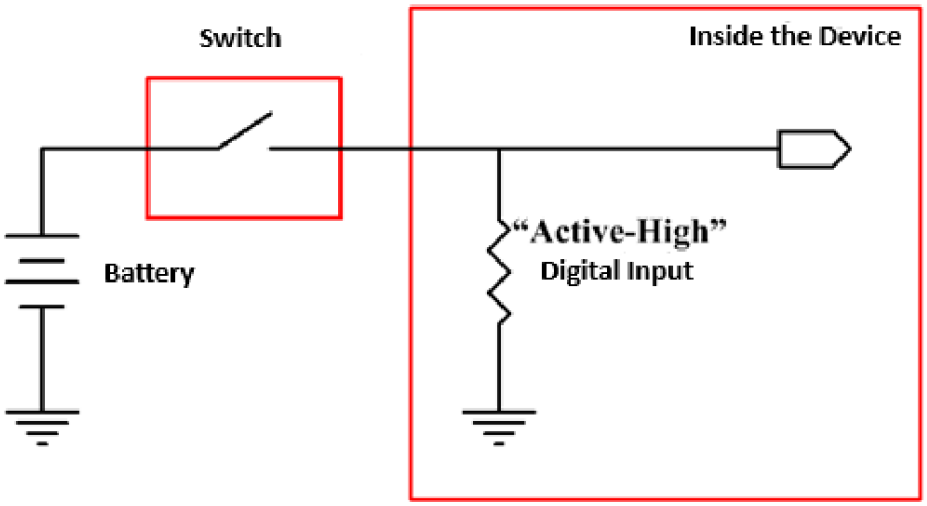


Figure 10: Active-High Digital Input

"Active Low" Input

During switching, the Active-Low input must be connected to a ground.

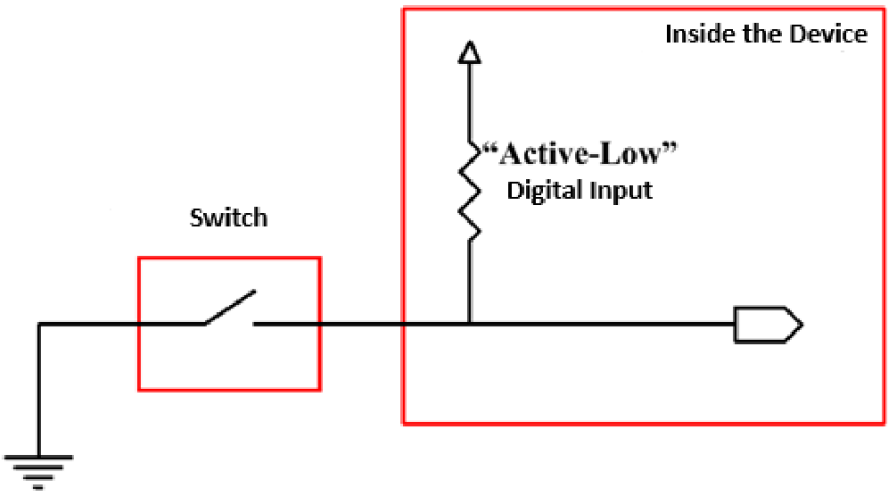


Figure 11: Active-Low Digital Input.

WARNING!
The upper trigger limit for active-low inputs is 2.9 volts. The lower trigger limit for active-low inputs is 5.9 volts.

8.1.4 Digital Addressing Inputs

ADR1, ADR2, ADR3, and ADR4 are the names given to the digital inputs as address inputs. The system address is set using these inputs to distinguish modules. The maximum devices that may be used with oMux 22x24S is 15. These inputs have pull-down resistors built-in and are "Active-High" inputs.

Before turning on oMux, the state of these inputs should be known, and it is advised that they be permanently connected to the car's harness.

Table 9 below illustrates the addressing configuration.

oMux 22x24S System Addressing Inputs				
ADR4	**ADR3**	**ADR2**	**ADR1**	**oMux Addresses**
0	0	0	0	Reserved
0	0	0	1	oMux1
0	0	1	0	oMux2
0	0	1	1	oMux3
0	1	0	0	oMux4
0	1	0	1	oMux5
0	1	1	0	oMux6
0	1	1	1	oMux7
1	0	0	0	oMux8
1	0	0	1	oMux9
1	0	1	0	oMux10
1	0	1	1	oMux11
1	1	0	0	oMux12
1	1	0	1	oMux13
1	1	1	0	oMux14
1	1	1	1	oMux15

Table 14: oMux 22x24S System Addressing Inputs

Note: Address 0 (0000) is reserved and can’t be used.

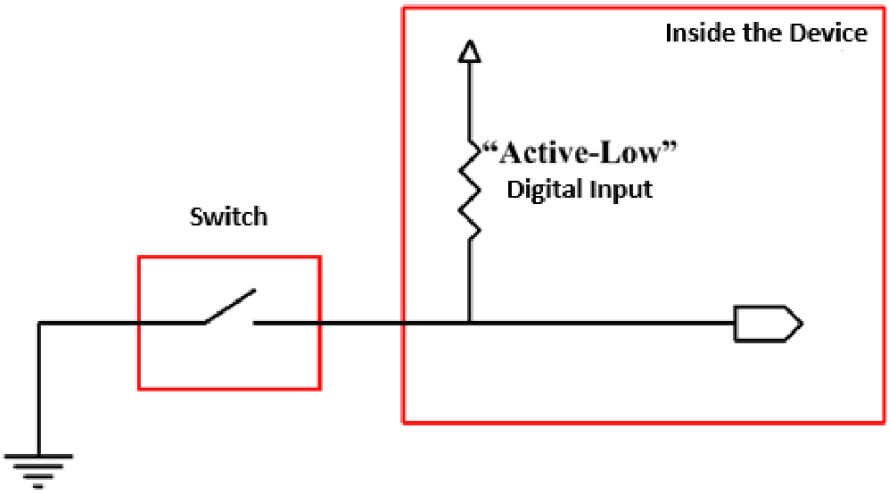


Figure 12: "Active-High" Address Input

8.2 Analog Inputs

oMux 22x24S has eight analog inputs:
Analog inputs can be used as NTC (0-70 KΩ), Resistance reading 0-500 Ω, Voltage Reading 0-3.9V (VA) 0-5.4V (VB) or as a digital input. Control pins in the input circuit are programmed by the software to switch between various modes. These pins are Pull-down, Pull-up, and Resistor control terminals. As hardware, analog inputs come in two different varieties. Only the calculation for the voltage reading mode is different.

- Type-1 : Input_9/10/11/12/13
- Type-2 : Input_14/15/16

8.2.1 Analog Inputs Modes

8.2.1.1 NTC Mode

The control pins must be set up in the following way in order to enable this mode.

Pull-Down:	**Off**
Pull-Up:	**Off**
Resistor:	**Off**

Temperature calculation formula:

V_r	Calculated raw voltage.
V_s	Internal supply voltage (12V ±0.5) inside the I/O module
ADC_{Raw}	Raw ADC value (Analog Mess)
R_{NTC}	Calculated NTC resistance.
B	NTC constant
R_0	NTC resistance value at 25°C

$V_r = ADC_{Raw}\ x\ 0{,}0117$ $R_{NTC} = \frac{68\times\left(\frac{100\times V_r}{V_S - V_r}\right)}{68-\left(\frac{100\times V_r}{V_S - V_r}\right)}$ $°C = \frac{B}{\frac{B}{298{,}15}+\ln\left(\frac{R_{NTC}}{R_0}\right)} - 273{,}15$

8.2.1.2 Resistance Reading Mode

The control pins must be set up in the following way in order to enable this mode.

Pull-Down:	**Off**
Pull-Up:	**On**
Resistor:	**Off**

Resistance calculation formula:

$Read$ Raw value read.
R Resistance value.

$$R = \frac{(Read\times 0{,}0117)\times 1478}{11{,}4-(Read\times 0{,}0117)}$$

WARNING!

While analog inputs operate in resistance and NTC measurement modes, the loading effect on the cable can cause deviations in the readings. To prevent this, the sensor GND must be tied to the connector GND.

8.2.1.3 Voltage Reading Mode

The control pins must be set up in the following way in order to enable this mode.

Pull-Down:	**On**
Pull-Up:	**Off**
Resistor:	**On**

Current calculation formula:

Version A.

$Read$ Raw value read.
V Voltage value.

Type-1(0-3,93V)

$$V = (Read \times 0{,}015415)$$

Type-2(0-3,88V)

$$V = (Read \times 0{,}015225)$$

Version B.

$Read$ Raw value read.

V Voltage value.

Type-1(0-5,4V)

$$V = (Read \times 0{,}021176)$$

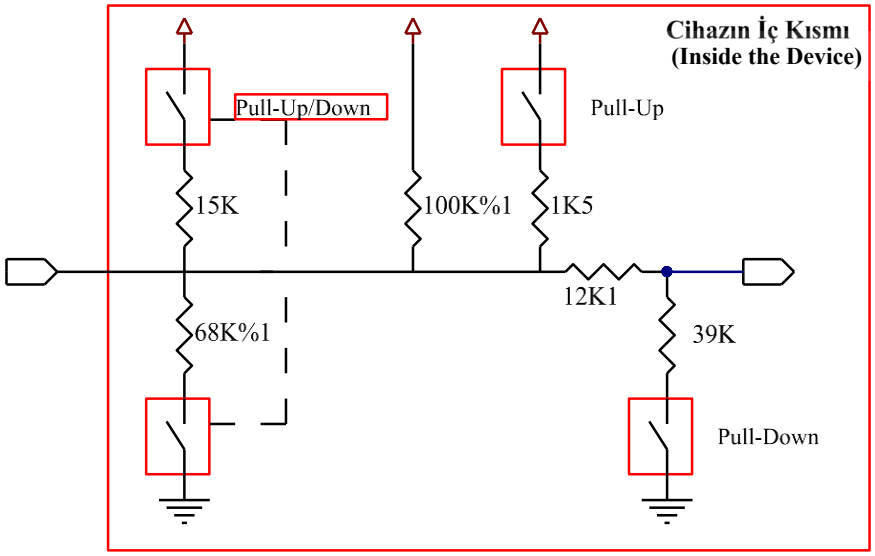
Type-2(0-5,4V)

$$V = (Read \times 0{,}021176)$$

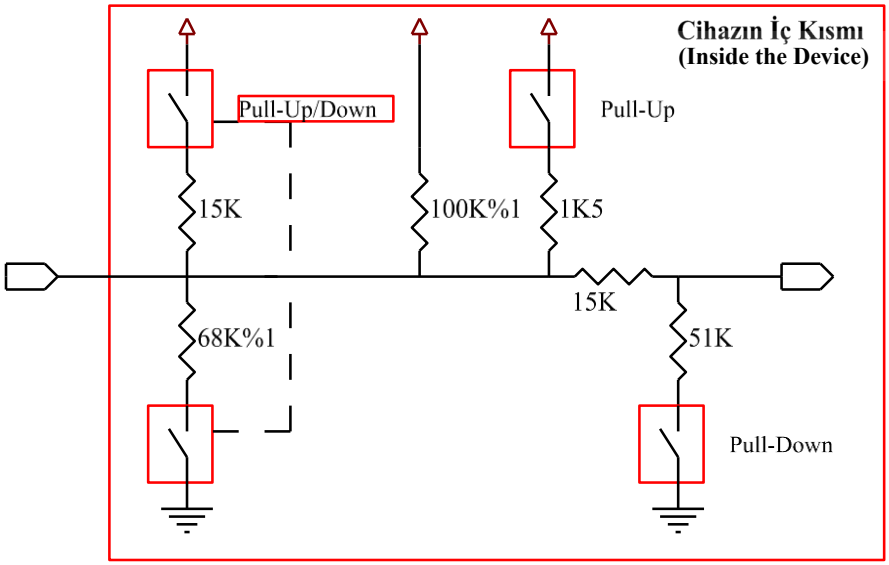
Analog Inputs Characteristics				
	Minimum	**Nominal**	**Maximum**	**Unit**
Input Voltage Range	0		Vbat	V
Over Voltage			36	V
Inductive load Protection		Available		
Capacitance on Pin		0.1		µF
Stability			8	Bit

Table 15: oMux 22x24S Analog Inputs Characteristics

8.2.2 Analog Inputs Configurations



Type-1



Type-2

Figure 13: oMux 22x24S Analog Inputs Configuration

9 Outputs

There are 24 "Semi-conductor" outputs on oMux 22x24. Each output can manage maximum a draw of 10 Amperes.
oMux 22x24S offers two different output types.

- "High-Side" outputs (All "High-Side" outputs are current measured)
- Half-Bridge outputs (Internally composed by a combination of "Low-Side" output with a "High-Side" output)

9.1 "High-Side" Outputs

There are 21 "High-Side" outputs.
On/off or PWM are used in "High-Side" outputs.

Outputs Current Measurement for 10A:

- OUTPUT 1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/23 (PWM)

- Output current reading lower limit for OUTPUT 1/2/3/4/5/6/9/10/11/12/13/14/15/16/17/18/19/20 is 100mA; for OUTPUT 7/8/23 is 15 mA.

9.1.1 10A "High-Side" Output Features with Current Measurement

10A "High-Side" Output Features with Current Measurement				
	Minimum	**Nominal**	**Maximum**	**Unit**
Switchable Voltage Range	9		36	V
Output Current	0		10	A
ON state Output Resistance		16		mΩ
Over Voltage			36	V
PWM Frequency			100	Hz
PWM Resolution		0.1		%
Internal Flyback Diode		Available*		-
Inductive Impact Protection			750	V (Peak)

* : Half-Bridge outputs are not included.

Table 16: oMux 22x24S 10A "High-Side" Output with Current Measurement

Output Protection:

The following protection mechanisms are present in the outputs:

- Software Overcurrent - When the threshold set by the software is surpassed, the driver IC's "Sense" current disables the output, additionally the software also controls the reset mechanism.

- Overheating - The output will be turned off if the driver IC's temperature reaches the thermal limit. When the drive temperature decreases to a safe level, the output will turn back on.
- Overcurrent - The output is disabled when the current drawn from the drive IC reaches the limit point. When the current falls below a suitable level, the output will be triggered once more.

9.1.2 "High-Side" Output Connections

Recall the following while connecting "High-Side" outputs:

- The "High-Side" output supply are organized into six Vbb Gx groups. The Vbb Gx pins are normally fused independently and connected to a 12 V or 24 V system supply. Each socket has two Vbb Gx pins with six outputs, and the maximum current allowed through a group is 15A. A total of 60 A of load can be passed through the gadget.

Follow the practices below when connecting "High-Side" outputs:

- Never connect "High-Side" outputs to loads that can consume more current than the maximum continuous current or peak current.
- Connect the load ground physically closest to the power ground.

A typical "High-Side" 10 A output connection is shown below:

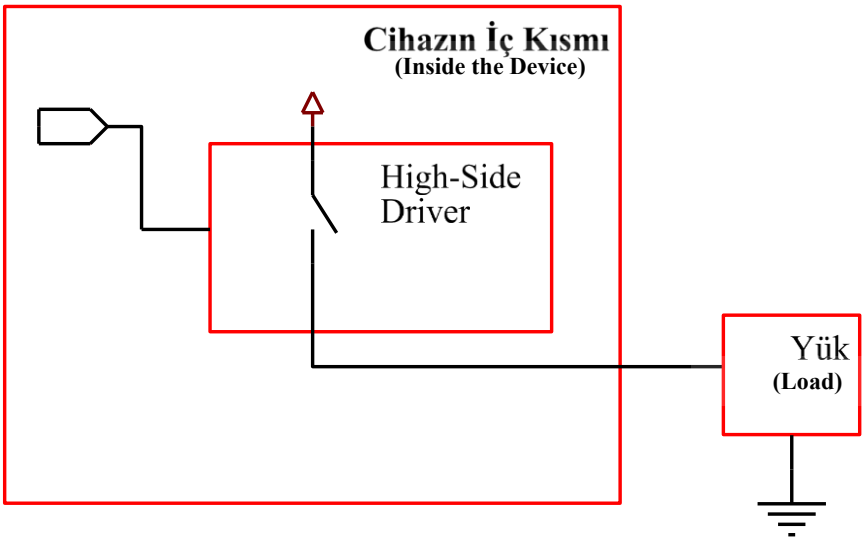


Figure14: Typical "High-Side" Outlet Mounting connection.

9.2 *"Half-Bridge" Outputs*

There are a total of 3 "Half-Bridge" outputs on oMux 22x24. The "Low-Side" and "High-Side" outputs are combined to form these outputs.

When needed, outputs can be set up as High-Side, Low-Side, or Half-Bridge.

The outputs are used as on/off switches when using Low-Side. PWM and current measuring features are absent.

Outputs for 10A with Current Measurement:

- OUTPUT 21/22/24 (HB) (PWM)
- Output current reading lower limits are 15 mA for OUTPUT 21/22/24.

9.2.1 2.5A/10A "Half-Bridge" Output Characteristics

2.5A/10A "Half-Bridge" Output Characteristics				
	Minimum	**Nominal**	**Maximum**	**Unit**
Switchable Voltage Range	9		36	V
Output Current	-2.5		10	A
"High-Side" Output ON Resistor		16		mΩ
"Low-Side" Output ON Resistance		50		mΩ
Over Voltage			36	V
PWM Frequency			100	Hz
PWM Resolution		0.1		%
Internal Flyback Diode		Unavailable		-
Inductive Impact Protection			750	V (Peak)

Table 17: oMux 22x24S 10/2.5 A "Half-Bridge" Outputs

Output Protection:
The outputs are protected by the following systems:

- Software Overcurrent - When the threshold set by the software is surpassed, the driver IC's "Sense" current disables the output, additionally the software also controls the reset mechanism.

- Overheating - The output will be turned off if the driver IC's temperature reaches the thermal limit. When the drive temperature decreases to a safe level, the output will turn back on.

- Overcurrent - The output is disabled when the current drawn from the drive IC reaches the limit point. When the driving current falls below a suitable level, the output will be triggered once more.

9.2.2 “Half-Bridge” Output Connection

A typical "High-Side" 10A/2.5 A output connection is shown below:

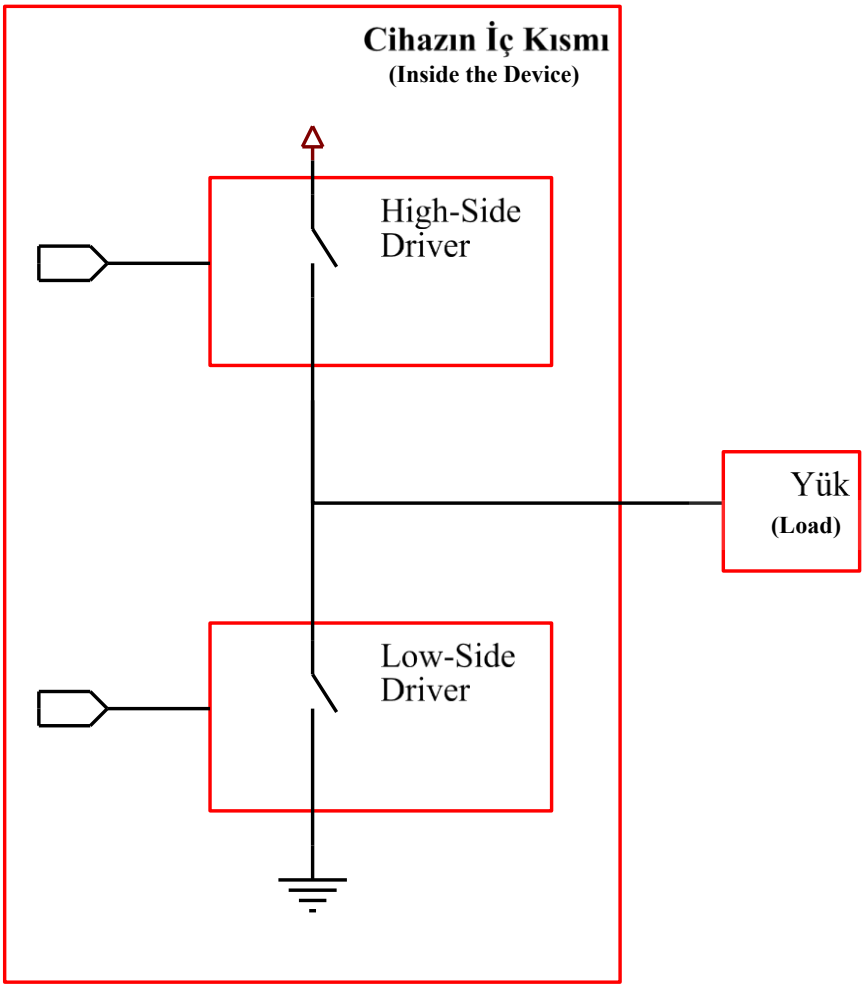


Figure 15: Typical “Half-Bridge” Output Mount connection

10 Communication

When interacting with other vehicle modules or a personal computer, oMux 22x24S uses Controller Area Network (CAN) connection.

10.1 CAN controller area network

CAN 2.B communication is supported by oMux 22x24S hardware, and CAN-based protocols can be implemented using software.

Three CAN lines are available on the device; CAN1 and CAN2 are used by setting the device in accordance with the requested scenario. CAN3 is reserved and assigned for oMux system, which is used for purposes such as diagnostics or software updates.

CAN1/2 Tx Limits			
	Extended ID	Standard ID	Summary
CAN 1	50	12	62
CAN 2	29	01	30

10.1.1 CAN Characteristics

CAN, up to 1Mbps.

CAN characteristics are shown below:

CAN Characteristics				
	MIN	**NOM**	**MAX**	**Unit**
Overvoltage protection	-58	-	58	V
Bit Speed	50	-	1000	kbps
J1939 Compatibility	-	Available	-	
Internal Termination Resistor (120)	-	Available	-	

Table 18: CAN Characteristics

An example CAN connection utilizing SAE J1939 standard is shown below.:

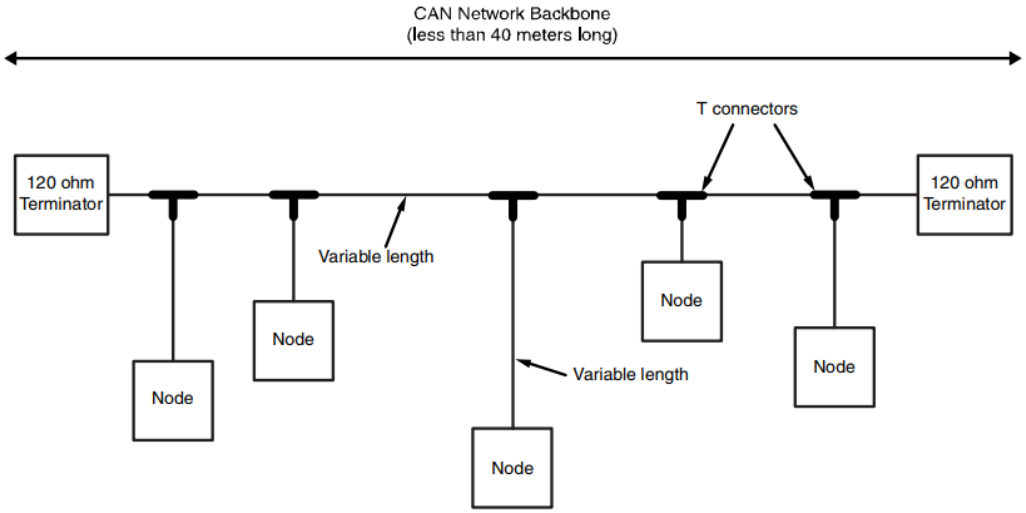


Figure 16: CAN connection

11 Setup

Given that every assembly is different, and each system is distinct, it is impossible to provide thorough assembly instructions that will work for every assembly. As a result, this section only offers basic instructions for setting oMux 22x24.

> The process for installing oMux 22x24S in the car during manufacture must be established by the vehicle manufacturer.

11.1 Mechanical Installation Guide

To install oMux into the vehicle please follow the instructions below.

11.1.1 oMux 22x24S Dimensions

The following figure shows the dimensions of oMux 22x24S: 281,71 x 133,96 x 46,90mm.

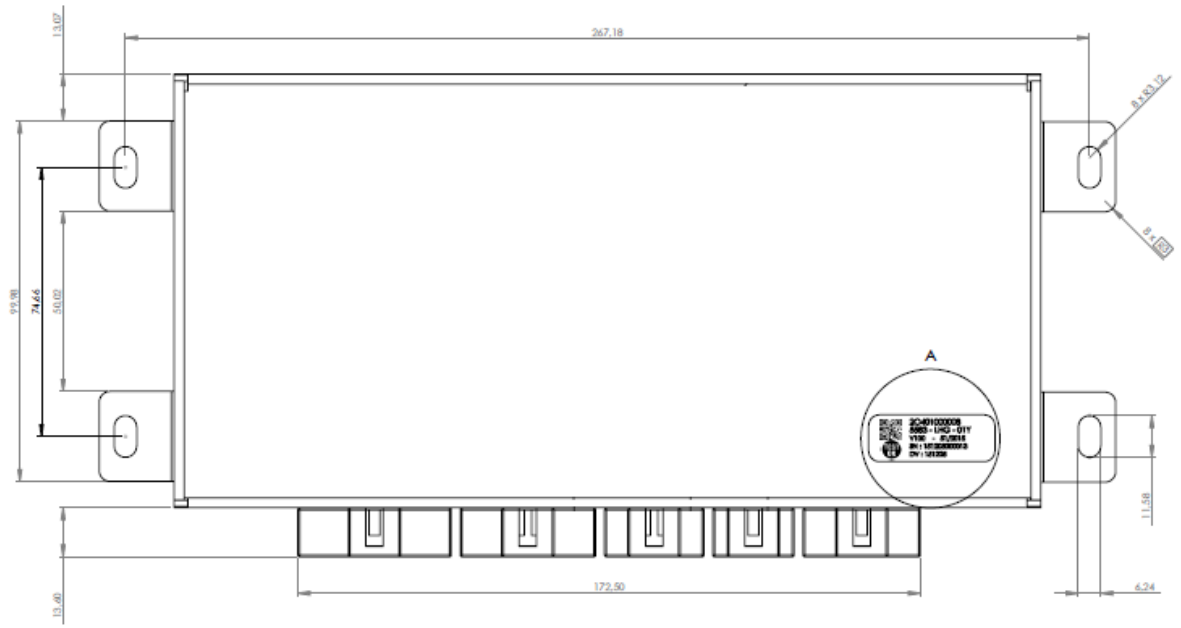


Figure 17: 22x24S oMux Technical Drawing Image

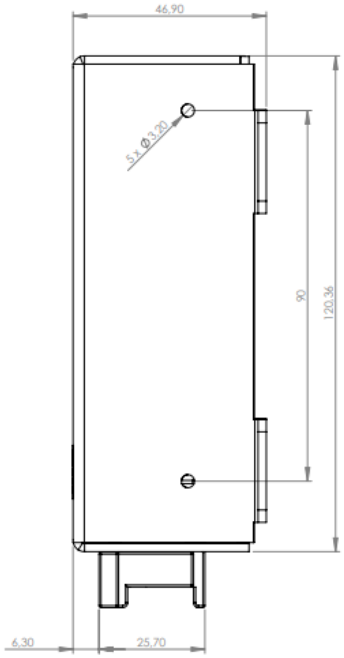


Figure 18: 22x24S oMux Technical Drawing Image

11.1.2 Location of Installation

oMux 22x24S can be installed on the chassis or in the cab of the vehicle.

Before installing oMux 22x24S, consider the following mechanical and environmental criteria.

Note: oMux 22x24S can be used with a turbo, exhaust manifold, etc. Install it away from any significant heat source, as an example oMux 22x24S should not be installed close to any drivetrain components, such as an engine or transmission.

11.1.3Mechanical Requirements

Prior to deciding on a mounting location for oMux 22x24, review the following mechanical specifications:

- oMux 22x24S should be installed so that water or moisture doesn't build up on it.
- The device and the cable harness must be secured in such a way that water from the cable harness cannot flow into the device, but only in the opposite direction.
- Hard impacts must be prevented from damaging the harness.
- It must be simple to attach and disconnect the wiring harness from the connector.
- The location of oMux 22x24S should be convenient for service.

11.1.4 Environmental Conditions

oMux 22x24's guarantee does not cover harm brought on by environmental circumstances that are greater than the device's design tolerances.

1. Install oMux 22x24S in an environment with a temperature range of -40°C to +85°C.

WARNING!

Equipment damage: oMux 22x24S box, during maintenance or repair procedures, the vehicle should not be in any way in contact with water, and the device shouldn't get wet.

11.1.5 Design and Connection of Vehicle's harness

A vehicle harness that fits with oMux 22x24S connections must be created by the car manufacturer.

Designing a vehicle's harness requires:

- Layout of oMux 22x24S's inputs, outputs, communication, and power pins.
- Other parts of the car and their exact locations; and other information.
- Harness line of circulation.

The vehicle harness can be attached once it has been created by simply clicking it into the connector port on oMux 22x24.

11.1.6 Attaching oMux 22x24S to the Vehicle

Fix oMux 22x24S to vehicle using four fasteners.

11.1.6.1 Recommended Mounting Orientation

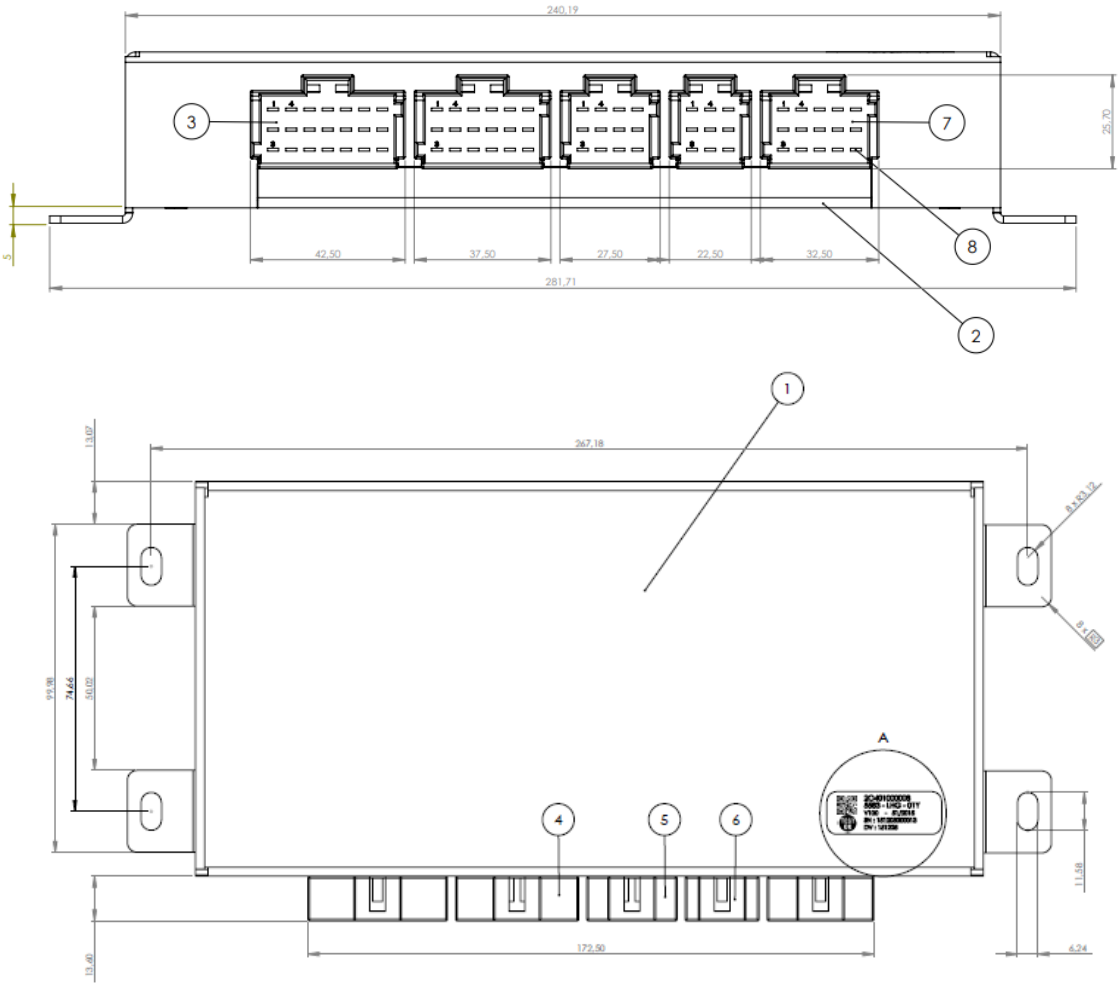


Figure 19: oMux 22x24S dimensions for mounting

Number	Quantity	Item Name	Material
8	75	Pin	Tin (Sn) Contacts 28mm x 0,8mm
7	1	TE 966140-2	PA66 - GF13
6	1	TE 966140-4	PA66 - GF13
5	1	TE 966140-3	PA66 - GF13
4	1	TE 966140-1	PA66 - GF13
3	1	TE 966140-6	PA66 - GF13
2	1	Bottom Cover	Aluminum 5454 - O
1	1	Top Cover	Aluminum 5454 - O

Table 19: Item names and material information

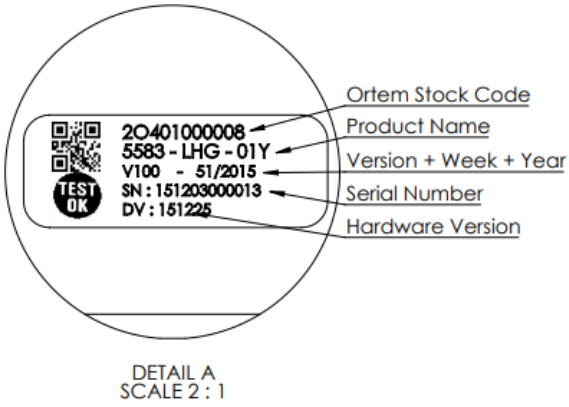


Figure 20: Sticker

11.2 Electrical Installation Guide

Follow these recommendations while installing oMux 22x24S in a car.

11.2.1 Connecting Vehicle Harness to oMux 22x24

Connector on oMux 22x24S receives vehicle harness connections.

11.2.2 Power Connections

Before giving oMux 22x24S supply voltage notice that:

- Power connections are made using Vbb_G1, Vbb_G2, Vbb_G3, Vbb_G4, Vbb_Logic and GND pins.

Note: In case of reverse supply, oMux 22x24S device contains an integrated semiconductor protection circuit.

Select fuse sizes by multiplying the maximum continuous current at normal operating time by 1.333.

- In order to protect the vehicle wiring harness, all power connections to oMux 22x24S must be fused.

7. Dictionary

Active-High

An active high input functions when the battery voltage level is detected, on the other hand it turns off when it is grounded.

Active-Low

An active low input functions when its grounded, on the other hand it turns off when the battery voltage is detected.

Analog input

An analog input converts and allows a voltage level to be read in a microprocessor as a digital value.

Weakening

An incremental decrease in current that may develop naturally or through the use of an attenuator.

CAN Bus

CAN bus (Controller Area Network) is a message-based protocol typically used in industrial and automotive applications which allows ECUs to communicate with each other.

CAN High

CAN high is the positive cable of the shielded twisted pair which develops a complete integrated signal when connected to the other negative cable.

CAN Low

CAN low is the negative cable of the shielded twisted pair which develops a complete integrated signal when connected to the other positive cable.

CAN Shield

CAN shield is applied around the cables CAN high and CAN low to protect it from damage.

Controller Area Network

The protocol was developed by Robert Bosch in 1986 to help further the development of electronic communications in the automobile industry. The multiplex design enables signals to be integrated and transferred over the whole network on a single line, ensuring that each electronic module in the vehicle receives data from sensors and actuators in real time. CAN bus has features such as low-cost, built-in error detection, speed and flexibility.

I/O controller board

A development product which allows the user to assess a programmed circuit board before it is mounted on a vehicle.

Controller module

Allows the user to control and check the functions of inputs and outputs of any module related to embedded software.

Feedback current

A closed-loop setup where the feedback error signal takes the form of a current.

Feedback current control

It adjusts an output's duty cycle so that the output delivers the required amount of current to the load.

Current sensor

A device that detects electrical current in a wire and produces a proportional signal accordingly.

Data link adapter (DLA)

A programming and diagnostics tool that links the CAN bus to a computer and allows them to exchange data through a USB or RS232 interface so that programming and testing can be done before the product is installed in a car.

DC-Coupled

Direct current (DC) coupling covers the whole frequency range. The signal to be read by this circuit must be within the input's defined detection threshold range.

De-Rating

lowering the rated output current level to an amount below the proper level. De-rating is typically conducted to prevent overheating of a product.

Digital input

An input that is often controlled by an external switch that triggers the entry as active or passive.

Driver (hardware)

A device that sends power or ground to an external load. A driver is a critical component in all output circuits.

Driver (software)

A software component that allows access to various hardware components.

Duty Cycle

Duty cycle is the ratio or percentage in which a device is active or functioning.

Flyback

A voltage spike created by an inductor when its power supply is removed abruptly.

Frequency input

An input that enables the frequency value of an oscillating input signal to be read.

Earning

Increasing the input signal's voltage level in order to maximize input resolution.

Half-Bridge

It supplies an output voltage either higher or lower than the input voltage by connecting them to its high side or lower side.

High-Side output

An output that allows the loads voltage to be displayed.

Inductive load

A charge that produces a magnetic field when energized. Inductors are electrical components that retain energy, and they are defined by the equation:

$$E_{\text{stored}} = \frac{1}{2}LI^2$$

Inrush Current

An open electrical device's initial instantaneous peak input current.

Keyed

Notches, slots, or other mechanical devices attached to connectors.

Current leakage

The flowing current when the ideal current becomes zero.

Load

A component that absorbs current from a module and is turned on and off, typically with outputs.

Logic Power

Power pins for Microprocessor and Logic peripherals.

Low-Side output

An output that displays ground as a result.

Open Load

A load is deactivated, most likely due to a faulty or corroded wire or connector pin.

Overcurrent

When a load consumes higher current from the output than the specified value, an error condition arises. A condition in which the circuit voltage exceeds the overvoltage upper design limit.

Power control input

A digital input that is used to turn the product on. While the entry is "Active," the product will boot and operate normally; when the input is disabled, the product's power drops, and it will not work.

Proportional-Integral-Differential (PID) Controller

A system or device controller that offers constant feedback on the desired and current states changes made on the inputs accordingly. A typical example of such a controller is one that prevents a vehicle from exceeding a predetermined speed regardless of the amount of pressure applied to the accelerator pedal.

Pull-down resistor

A pull-Down resistor is connected to a circuit’s ground, it makes the default state of a digital pin as Active-Low.

Pull-up resistor

A Pull-up resistor is connected to a reference voltage, it is used to make the default state of a digital pin as Active-High.

Pulse width modulation (PWM)

A digital logic circuit or duty cycle that has been programmed to generate a pulse with the desired duration. It is a method of controlling variable speed motors.

Sensor power

A product-dependent voltage output that is regulated and provides a constant voltage level for analog sensors.

Shielded Twisted-Pair Cable

A twisted cable (CAN High and CAN Low) used for CAN communication that consists of two wires. These wires are shielded with a material that boosts the cable's resistance to electrical noise (CAN shield).

Short-to-Battery

When an input or output pin is connected to the battery, a fault condition may occur, resulting in a potentially high current flow of power.

Short-to-Ground

When an input or output pin is connected to a system, a fault condition may occur, potentially resulting in significant current flow to ground.

Trip Time

The time it takes for the circuit to defend itself when a fault has occurred.

Ortem Multiplexer oMux Module

22x24S Technical Document