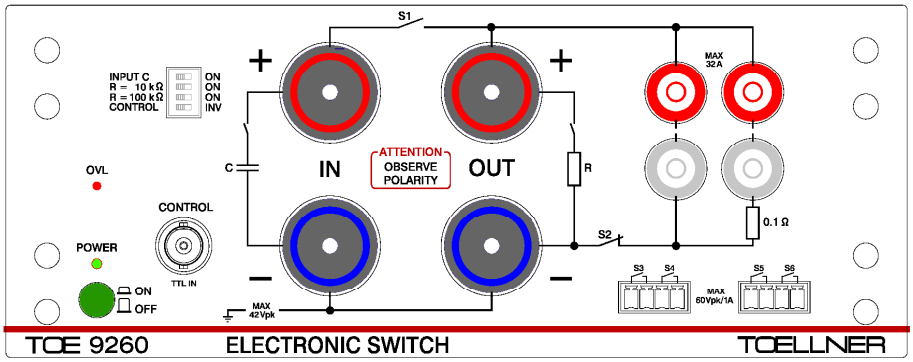
Instruction Manual

Electronic Switch

TOE 9260

9260E-Manual-Rev02.doc



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Contents **Page**

Warning

This device has been constructed and inspected in conformity with DIN EN 61010-1, "Safety requirements for electrical equipment for measurement, control and laboratory use", and left the plant in perfect condition with respect to safety technology and meets Safety Class I. To maintain this condition and ensure hazard-free operation, the user must observe the instructions and warnings contained in this manual.

When operating electronic equipment certain parts in these devices are necessarily under dangerous voltage. Non-observance of the warnings may therefore result in severe bodily injury or damage to the equipment.

Only suitably qualified personnel should perform work on these devices or in their vicinity. Flawless and safe operation of these devices presumes correct transport, proper storage, assembly as well as careful operation and maintenance.

Qualified personnel according to this manual are persons who are familiar with the assembly, startup and operation of the devices and who possess the corresponding qualifications for their work activity.

1. Introduction

Series **TOE 9260** electronic switches are examples of a generation of devices for time-based turning on and off of load and signal currents. These devices use an electronic, unidirectional power switch as well as four electronic bidirectional signal line switches. The power switch incorporates a selectable load-parallel crossover for selective discharging of buffered loads.

A digital input signal can be used to generate on- and off-durations of any time down to the microsecond range for both the power switch and the signal line switches.

Series **TOE 9260** switches are therefore ideal for use in test systems or any other applications where current paths from consumers or control devices need to be closed or interrupted for defined time intervals.

1.1 Features

1.1.1 General feature set

An essential feature of series **TOE 9260** electronic switches is the electronic power switch, which is constructed of a longitudinal and a branch path. Both paths can be used unidirectional, i.e. with a fixed, specified current direction.

The longitudinal path represents the actual switching travel over which the energy flow takes place from a feed source to the connected consumer.

The branch path is arranged parallel to the consumer and can be optionally engaged through a connector plug. It serves as needed to selectively discharge a buffered consumer or a buffered load during the turn-off phase of the longitudinal path. Two different plug positions are used to select between direct parallel wiring to the consumer or parallel wiring through a 0.1 Ω series resistor.

DIL switches are used to continually switch resistances of 10 kΩ or 100 kΩ to the output as high-impedance base loads, i.e. parallel to the consumer.

Another feature of the series **TOE 9260** electronic switches are the four electronic bidirectional signal line switches, which can be operated selectively in any direction. These signal line switches are used to switch low currents such as occur on control or data lines.

Control of the switching states as well as the power and signal line switches is accomplished as desired using a front panel or rear BNC input. A DIL switch can be used to internally invert the control signal.

The BNC inputs are compatible with TTL levels as well as CMOS 5 V and LVCMOS 3.3 V.

1.1.2 Overview of features

Basic functions

- Electronic power switch consisting of longitudinal and branch path, both paths unidirectional for specified current flow direction
- Branch path selectable inactive, active without series resistor or active with series resistor 0.1 Ω
- Capacitive buffering of input can be applied
- High-impedance loads of 10 kΩ or 100 kΩ can be continually applied
- Four electronic bidirectional signal line switches
- BNC control inputs front and rear
- Control signal can be internally inverted
- Control inputs compatible with TTL, CMOS 5 V, and LVCMOS 3.3 V
- Permissible switching frequency DC up to 100 kHz
- Protected against overcurrent / short-circuit, excessive temperature, excessive switching frequency

1.2 Model overview

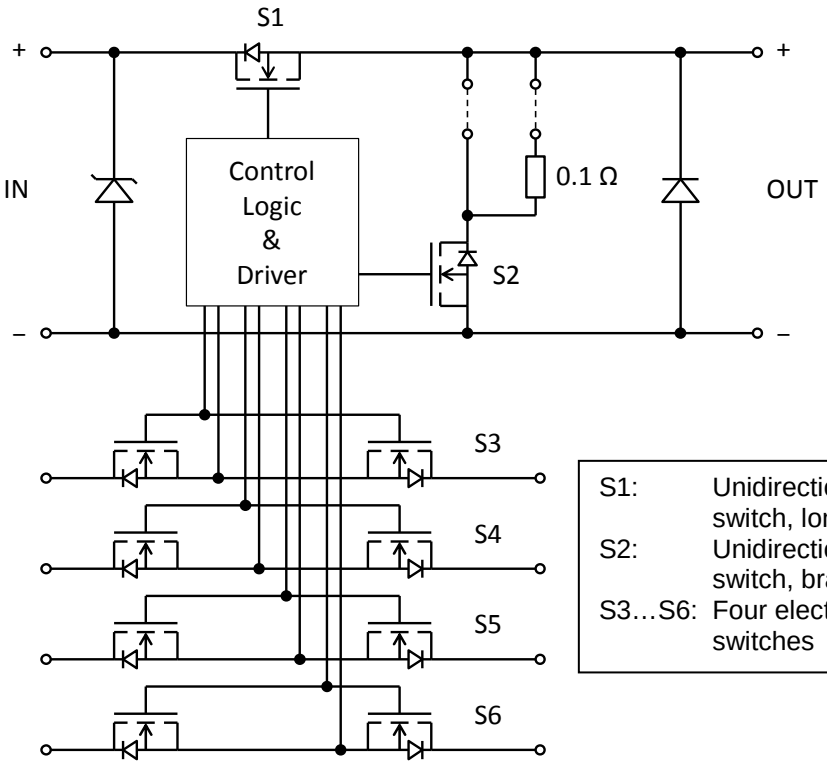
Series **TOE 9260** devices are available in models for various rated currents. The rated current of the power switch is indicated by a hyphenated number added to the basic part number.

The rated currents for the signal line switches as well as the rated voltages are shown in the following table.

Series **TOE 9260** electronic switches

Model	Power switch		Signal line switches	
	Current	Voltage	Current	Voltage
TOE 9260-50	0 - 50 A	0 - 60 V	0 - 1 A	0 - 60 V
TOE 9260-100	0 - 100 A	0 - 60 V	0 - 1 A	0 - 60 V

1.3 Schematic diagram for TOE 9260



S1: Unidirectional electronic power switch, longitudinal path
S2: Unidirectional electronic power switch, branch path
S3…S6: Four electronic signal line switches

2. Operation

2.1 Startup

Warning

Safe operation of these devices presumes that they have been placed in service properly by qualified personnel in compliance with the warnings in this manual.

In particular the general installation and safety regulations (e.g. DIN/EN and VDE) must be observed. Non-observance may result in death, serious personal injury or major damage to equipment.

These devices meet Protection Class I (protective earth connection) according to DIN EN61010-1. Before powering up, be sure that the mains voltage agrees with the permissible operating voltage of the device (→ 4.1 Technical Data for TOE 9260 and the rating plate). Except in areas with special protection measures, the mains plug must only be inserted in a socket having a PE contact. The protection effect must never be defeated through use of an extension cable not having a protective earth. The mains plug must be inserted in the socket before the device is turned on and the measuring and control circuits connected. Any interruption in the protective earth inside or outside the unit or removal of the protective earth connection may result in a hazardous condition for the device. No intentional interruption of the protective earth connection is permitted. Observe local regulations for earthing.

Ensure that only fuses of the specified type and specified current are used as replacements (→ 4.1 Technical Data for TOE 9260 and the rating plate). The use of repaired fuses or short circuiting the fuse holder is not permitted.

If it is apparent that non-hazardous operation is no longer possible, the devices must be taken out of service and secured against unintended operation.

2.1.1 Installation and ventilation

There are no problems associated with installation of these devices.

The devices include a thermostatically controlled fan which brings in air from the sides and below and blows it out to the rear. Provide sufficient ventilation distance so that the rear fan can work effectively. Otherwise it can happen that under high load conditions the unit will heat up to a point where it is automatically shut off (→ 2.4.4 Excessive temperature protection).

Series **TOE 9260** devices are designed so that they can be used either as tabletop units or in 19” rack systems. Appropriate adapters for 19” rack use are available as an option.

2.1.2 Preparations

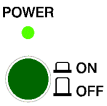
ON
OFF

After connecting the mains supply and pressing the POWER switch the device is ready. This is indicated by the green power LED above the mains switch.

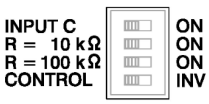
2.2 Description of the controls

At the end of the manual you will find the various operating and display elements for the series **TOE 9260** numbered with front panel and rear views. In the following the individual operating elements are explained in detail.

2.2.1 Front panel controls

[1] 

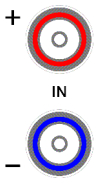
Mains switch for turning the power to the device on and off. When the unit is ON the green *POWER* LED will be illuminated.

[2] 

4x DIL switch. Assignments from top to bottom (Nos. 1 to 4):
1. Apply input buffer capacitor to input socket pair *IN*
2. Apply high-impedance base load 10 kΩ parallel to output socket pair *OUT*
3. Apply high-impedance base load 100 kΩ parallel to output socket pair *OUT*
4. Inversion of the control signal present at CONTROL

[3] 

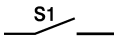
Selectable input buffer capacitor. This appears parallel to the input *IN*.

[4] 

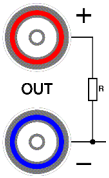
Input *IN* of the power switch. Here an appropriate voltage source is connected. Note polarity and voltage level, never more than the rated voltage of the **TOE 9260**.

[5] 

Polarity notice for Input IN and Output OUT of the power switch. Voltages must be connected only with the correct polarity.

[6] 

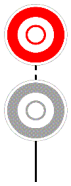
Longitudinal path switch *S1* of the power switch. Across this the connection between the socket pairs *IN* and *OUT* is applied.

[7] 

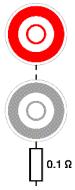
Output *OUT* of the power switch. Here the consumer to be operated is connected. A (possibly pre-loaded) buffered consumer may be connected only with the indicated polarity and with a voltage not greater than the rated voltage of the **TOE 9260**.

[8] 

Selectable base load 10 kΩ or 100 kΩ. This appears parallel to the output *OUT*.

[9] 

Socket pair for branch path 0 Ω. If the consumer connected on the output needs to be jumpered during a turn-off time (switch *S1* of the longitudinal path open), for example to discharge a buffer stage in the consumer as quickly as possible, this socket pair is jumpered using the provided connector plug (→ 2.3.2 Power switch operation, Use of the branch path).

[10] 

Socket pair for branch pair 1 Ω. The same information and guidelines apply here as for the “Socket pair for branch 0 Ω”, whereby here the consumer will be jumpered during the turn-off time using a 0.1 Ω resistor, e.g. for realisation of the test signal according to LV 124-E10, test case 3 (→ 2.3.2 Power switch operation, Use of the branch path).

[11] 

Red *OVL*-LED (Overload). Comes on when a shutdown has occurred due to one of the following fault conditions:

- Max. switching frequency of 100 kHz on the control input has been exceeded
- Overcurrent
- Excessive temperature

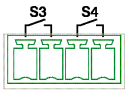
A reset following a switching frequency fault is done by reducing the frequency at the control input, or in case of overcurrent or excessive temperature by turning the unit off and on using the mains switch. The reason for the overcurrent must be identified and the cause removed. In case of excessive temperature the unit can be restarted only after a sufficient cooling down time (→ 2.4 Protection).

[12] 

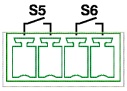
Front panel BNC input *CONTROL* for controlling the switching state both for the power switch and the signal line switches (→ 2.3.2 Power switch operation, Control and → 2.3.3 Operation of the signal line switches, Control).

[13] 

Branch path switch *S2* of the power switch. The function of this switch is described under [9] and [10] (→ 2.3.2 Power switch operation, Use of the branch path).

[14] 

Terminal block for signal line switches *S3* and *S4*. These can be used with suitable terminal block plugs (e.g. Phoenix MC 1,5 / 4-ST-3,81 = item no. 1803594 or Würth Elektronik WR-TBL Series 361 = item no. 691361300004).
The control and data lines to be switched are routed through the signal line switches indicated by the switch symbols *S3* and *S4*. The connections for unused signal line switches are left open.
The signal line switches are closed and opened synchronous with each other and synchronous with closing and opening of the longitudinal path *S1* of the power switch.

[15] 

The terminal block for the signal line switches *S5* and *S6*. The same explanations apply as for *S3* and *S4*.

[16] 

0.1 Ω series resistor for the branch path.

2.2.2 Rear panel controls

[20] Identifier

The identifier shows the current version and the installed options for the unit.

[21] Protective earth

This screw connects the housing to the protective earth.

<u>Attention</u>: This connection must never be removed!

[22] 

Rear-side BNC input *CONTROL* for controlling the switching state both for the power switch and the signal line switches (→ 2.3.2 Power switch operation, Control and → 2.3.3 Operation of the signal line switches, Control).

[23] Rating plate

The rating plate contains the following information: Company name, device series, serial number, supply voltage with mains fuse and current draw.

[24] Mains plug with mains fuse

This 3-pole standardized plug is used with the mains power cord. Integrated into the plug is the chamber for the device fuse with an additional compartment for a spare fuse.

2.3 General device functions

2.3.1 Operation

The **TOE 9260** is controlled from the front using a 4-position DIL switch and a variously positionable 19 mm connector plug.

Switching time settings are made on the clock source used (e.g. function generator), which may if desired be connected to the front- or rear-side BNC input *CONTROL* on the **TOE 9260**.

2.3.2 Power switch operation

Connection

To operate the power switch a DC voltage source (power supply, battery) is connected to the socket pair *IN.* The applied voltage must be no greater than the rated voltage for the **TOE 9260**. Overlaying with alternating current is permissible as long as the input buffer capacitor is not applied and the maximum momentary value of the total applied voltage does not exceed the rated voltage of the **TOE 9260** and the minimum momentary value is not negative. Setting a current limit at the source with a value appropriate to the consumer or providing protection against overcurrent is required.

Warning

It is imperative that the source be connected to the input *IN* with the **correct polarity**! Otherwise damage to the Electronic Switch may result.

A current limiter or overcurrent fuse for the feed source is absolutely required.

The current return path from the consumer to the voltage source must always be guided via the minus sockets of the output *OUT* and the input *IN* of the **TOE 9260**. These minus sockets must never be bypassed, because otherwise some protection mechanisms of the Electronic Switch are without effect, and damage to the Electronic Switch may result.

The consumer is connected to the socket pair *OUT*.

Depending on the requirement an impedance network, for example when operating or testing motor vehicle components an artificial network (AN) can be placed between the voltage source and the input *IN* or the output *OUT* and the consumer. In case of an artificial network (AN) between voltage source and input *IN* the input buffer capacitor should not be applied, because otherwise the artificial network (AN) will be without effect.

In all cases in which the built-in input buffer capacitor can be used (DC input voltage without overlaying of AC voltage, no artificial network between voltage source and input *IN*) and is applied by the DIL Switch INPUT C / ON, it causes an improvement of the switching times, especially a reduced rise time.

A digital switching signal for controlling the power switch can be selected as desired to the front panel or rear BNC *CONTROL* socket. A suitable clock source must be provided. This signal should be compatible with one of the logic standards CMOS 5 V, LVCMOS 3.3 V or TTL. Suitable devices include function generators in square wave or pulse mode as well as arbitrary waveform generators (AWG) with digital waveforms. Voltages above 5 V as well as negative voltages or voltages which extend into the negative range may not be used. The frequency of the switching signal must not exceed 100 kHz.

Control

The digital switching signal is used to control the state of the paths *S1* and *S2*. If the DIL switch CONTROL / INV is not set to INV, *S1* is conductive and *S2* is non-conductive during a High level of the switching signal.

If however the DIL switch CONTROL / INV is set to INV, *S1* is non-conductive and *S2* is conductive during a High level of the switching signal. This setting can be advantageous when a control pulse is needed to interrupt the supply to the consumer.

As long as the BNC input *CONTROL* does not see a High level and the DIL switch CONTROL / INV is not set to INV, the consumer is separated from the source, since the longitudinal path *S1* of the power switch is not conducting.

If the **TOE 9260** is turned on, the branch path *S2* is conducting in this state. If the 19 mm connector is plugged into one of the 4 mm socket pairs Red / Gray, any still charged buffer stage is discharged through *S2*.

Note

If the *CONTROL* input is left open or not driven, but left in high impedance state, setting the DIL switch CONTROL / INV to INV will cause that the longitudinal path *S1* of the power switch is continuously conducting and the branch path *S2* is non-conductive. This connects the consumer to the supplying voltage source.

Use of the branch path

The switching state of the branch path *S2* is always complementary to the state of the longitudinal path *S1*. This means the consumer can be jumpered with *S2*, while *S1* is open (not conducting). This allows for example a buffer stage in the consumer to be discharged. To achieve the fastest possible discharge the provided 19 mm connector is plugged into the left-side 4 mm socket pair Red / Gray.

The 19 mm connector may only be plugged in de-energized state of the **TOE 9260**.

If on the other hand the right-side 4 mm socket pair Red / Gray is used, the discharge takes place through the series resistor of 0.1 Ω, e.g. for realisation of the test signal according to LV 124, version 2009, test E-10, test case 3.

If no discharging through *S2* is desired, the connector plug can be placed in a horizontal position, i.e. in both red or both gray 4 mm sockets, so that it can always be easily located. In this position it has no effect.

Note that with buffered consumers the rise and fall times are lengthened. High buffer capacities with low series resistance values can also result in triggering of the overcurrent fuse.

Note

To connect one of the two 4 mm socket pairs Red / Gray, only a connector plug having at least 32 A of continuous current capacity may be used. It must have pins with spring contact (similar to bunch or laboratory plugs), a pin diameter of 4 mm, and pin spacing of 19 mm. To achieve the lowest possible impedance and inductance connection, (laboratory) cables are not suitable here.
The 19 mm connector may only be plugged in de-energized state of the TOE 9260.

Warning

Feedback from the (buffered) load side to the *OUT* output of the power switch must have the indicated polarity and not exceed the rated voltage of the **TOE 9260**! A voltage inversion into the negative is only permissible after blocking *S1* by means of inductance-dependent, further flowing load current. Non-observance of this may result in damage to the Electronic Switch.

High-impedance base load

DIL Switches R = 10 kΩ / ON and R = 100 kΩ / ON can be used to permanently switch corresponding resistances to *OUT* as high-impedance base loads, i.e. independent of the switching state of paths *S1* and *S2*.

PWM operation of a consumer

Consumers which are suitable for use with pulse width modulation (PWM) can be used with the **TOE 9260**. The frequency of the digital switching signal which is sent to one of the *CONTROL* inputs corresponds to the frequency of the PWM signal; the pulse/pause ratio of the switching signal results in the duty cycle of the PWM.

The current which is drawn by the consumer during the turn-on phase of the PWM is allowed to have values up to the rated current of the **TOE 9260**. If the current draw is higher, the overcurrent protection on the **TOE 9260** may be triggered during the turn-on phase of the PWM.

The **TOE 9260** is in principle suitable for switching frequencies up to 100 kHz. Depending on the voltage and current requirement of the consumer as well as the cable inductance from the feeding source to the socket pair *IN*, this maximum frequency may however not be reached, but rather the **TOE 9260** will shut off at even a significantly lower frequency due to overload, which is indicated by the *OVL* LED. The reason for this overload in this case will be the inductive energy from the incoming line, which continues to flow into the **TOE 9260** for

each turn-off event in the longitudinal path and which is converted as a product factor of the switching frequency into power loss.

The following measures must be taken to increase the achievable switching frequency:

- Minimize the cable length to the sockets *IN*
- Parallel, closely adjacent routing of both cable conductors
- Use of a feed source with high output buffer capacity
- Applying the input buffer capacitor of the **TOE 9260** by setting the DIL Switch INPUT C / ON to ON. The built-in capacitor is thermally protected against too high ripple current load which may be caused by high consumer currents at high PWM switching frequencies.

Warning

Consumers which are not expressly approved for PWM operation may not be turned on and off at high switching frequencies, since otherwise buffer stages in the consumer, e.g. electrolytic capacitors, can overheat and be damaged by excessive ripple current loads!

2.3.3 Operation of the signal line switches

Connection

To switch signal lines, they are routed through the bidirectional switches *S3 – S6*. They are connected using the correspondingly labeled front panel connectors. Suitable terminal block plugs are for example Phoenix MC 1,5 / 4-ST-3,81 = item no. 1803594 or Würth Elektronik WR-TBL Series 361 = item no. 691361300004).

S3 – S6 provide four bidirectional signal line switches, for example to be able to turn on or interrupt a multi-pole signal connection simultaneously. The terminals for unneeded signal line switches are left unconnected.

The direction of current flow through the signal line switches *S3 – S6* can be selected as desired and independent of each other.

The upper limit of the applied signal levels is limited to the rated voltage of the **TOE 9260**. The electrical isolation between the signal line switches and to the CONTROL input is for up to 42 V_{peak}.

Control

Closing and opening the signal line switches *S3 – S6* takes place synchronous with each other as well as synchronous with closing and opening of the longitudinal path *S1* of the power switch.

The functions and possibilities for using the *CONTROL* input are the same as described for the power switch (→ 2.3.2 Power switch operation).

2.4 Protection

Series **TOE 9260** devices use various protective devices which serve to prevent serious damage to the units.

Warning

Make absolutely sure that the supplying voltage source is connected to *IN* with the proper polarity!

Feedback from the (buffered) load side to the *OUT* output of the power switch must have the indicated polarity and not exceed the rated voltage of the **TOE 9260**! A voltage inversion into the negative is only permissible after blocking *S1* by means of inductance-dependent, further flowing load current.

Non-observance of these instructions may result in damage to the Electronic Switch.

2.4.1 Overcurrent and short-circuit protection of the switching paths

The overcurrent and short-circuit protection of the switching paths is designed to guard the **TOE 9260** against overload from excessive currents. It extends through the longitudinal and branch paths of the power switch as well as through the signal line switches.

When the overcurrent and short-circuit protection is triggered, the internal driver stages are permanently turned off, i.e. the switching paths are no longer driven.

This fault status is indicated by the *OVL* LED.

A reset is accomplished by turning the unit off and on using the mains switch. The cause of the overcurrent or short-circuit must be identified and eliminated.

2.4.2 Input overcurrent protection

The input overcurrent protection guards the power switch against excessively high periodic supply of power which results from the inductance on the input cable at the moment the longitudinal path is turned off.

When the input overcurrent protection is triggered, the internal driver stages are permanently turned off, i.e. the switching paths are no longer driven.

A fault condition is indicated by the *OVL* LED.

Reset by turning the unit off and on using the mains switch.

The following measures can be taken to prevent too high periodic supply of inductive energy and thereby an undesired triggering of the input overcurrent protection:

- Minimize the cable length to the sockets *IN*
- Parallel, closely adjacent routing of both cable conductors
- Use of a feed source with high output buffer capacity
- Apply the built-in input buffer capacitor

2.4.3 Protection against exceeding of the maximum switching frequency

To protect against excessive switching losses and against excessive driver output, the maximum switching frequency is limited.

Applying a higher frequency at the *CONTROL* input results in shutting off of the internal driver stages, i.e. the switching paths are no longer driven.

This fault condition is indicated by the *OVL* LED.

The fault condition remains as long as the non-permitted switching frequency is present. If the frequency is first reduced significantly below the permissible limit (taking into account a hysteresis), the device automatically clears the fault condition and the switching paths are again driven. The permissible switching frequency range is then again available.

2.4.4 Excessive temperature protection

The excessive temperature protection responds to excessive component temperatures in the unit. This protection is provided in two stages. For continuous operation at high voltage, high current and high switching frequency, the fan speed is first increased.

If the component temperatures continue to rise, the internal driver stages are shut off, i.e. the switching paths are no longer driven.

This fault condition is indicated by the *OVL* LED.

After an appropriate cool-down time the unit can be reset by turning it off and on using the mains switch.

3. Configuring for 19” rack mount

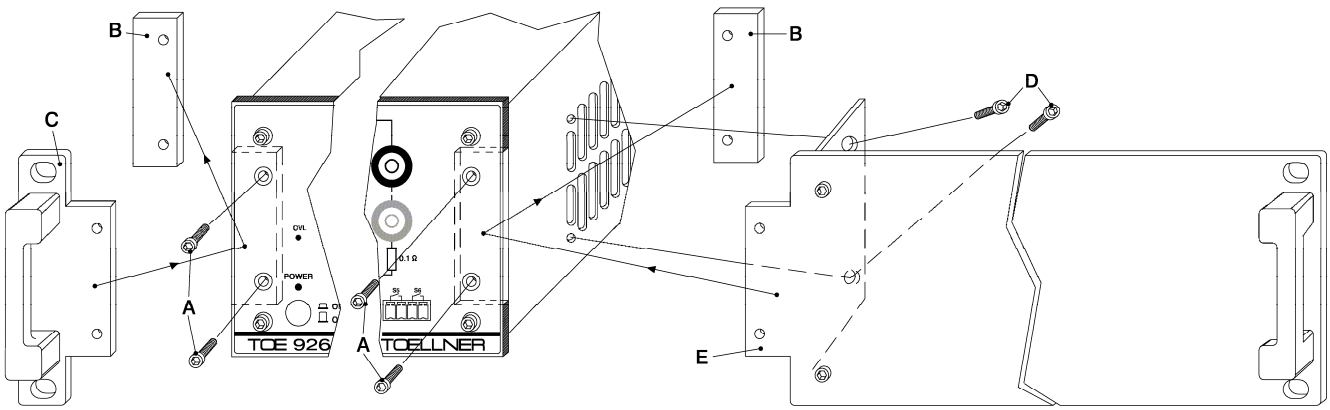
3.1 19" adapter set (2HU) for 1x TOE 9260 (Option)

The series **TOE 9260** Electronic Switches are 19” rack-capable tabletop devices. By using the optional **TOE 9521** one **TOE 9260** can be easily converted for 19” 2 HU rack mount.

The optional 19” adapter set **TOE 9521** includes a 19” adapter piece with handle and a 19” compensation panel with handle as well as the necessary installation materials.

Reconfiguring from 1x TOE 9260 to 19" rack mount

1. Use the included TX 20 screwdriver to remove the feet from the Electronic Switch. First remove the rubber inserts on the front feet.
2. Use the included Allen wrench to remove the two inner screws (A) on the left and right side of the front panel of the Electronic Switch.
3. Pull the two fill strips (B) from the side and replace them on the left or right side with the 19” adapter piece with handle (C) and on the other side with the 19” compensation panel with handle (E).
4. Screw the 19” adapter piece (C) on to the front panel using the hex head screws (A). Likewise use the hex head screws (A) to attach the 19” compensation panel (E) to the front panel and use the TX 20 Torx screwdriver to thread the Torx screws (D) into the side holes provided as shown in the diagram.



A: M3x10 hex head screw
B: Fill strip
C: 19" adapter piece 2 HU with handle
D: M4x6 self-threading Torx screw
E: 19" compensation panel 2 HU with handle

Installing in the 19” rack

The 19” unit must be located on the device side on a slide rail. This slide rail as well as the fasteners needed for attaching the unit in the 19” rack is not included in the scope of delivery for this option.

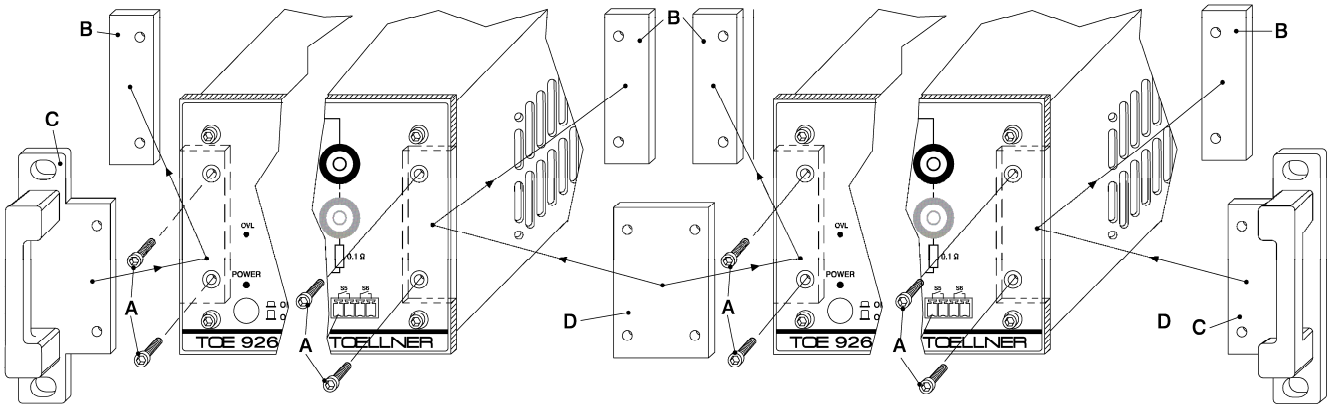
3.2 19" adapter set (2HU) for two Toellner Instruments ½ 19” (Option)

The series **TOE 9260** Electronic Switches are 19” rack-compatible tabletop devices. By using the optional **TOE 9522** two Toellner Instruments ½ 19” (2HU) of equal length can be easily converted for 19” 2 HU rack mount.

The optional 19” adapter set **TOE 9522** includes two 19” adapter pieces with handle, a front joining strip and a rear bracket as well as the necessary installation materials.

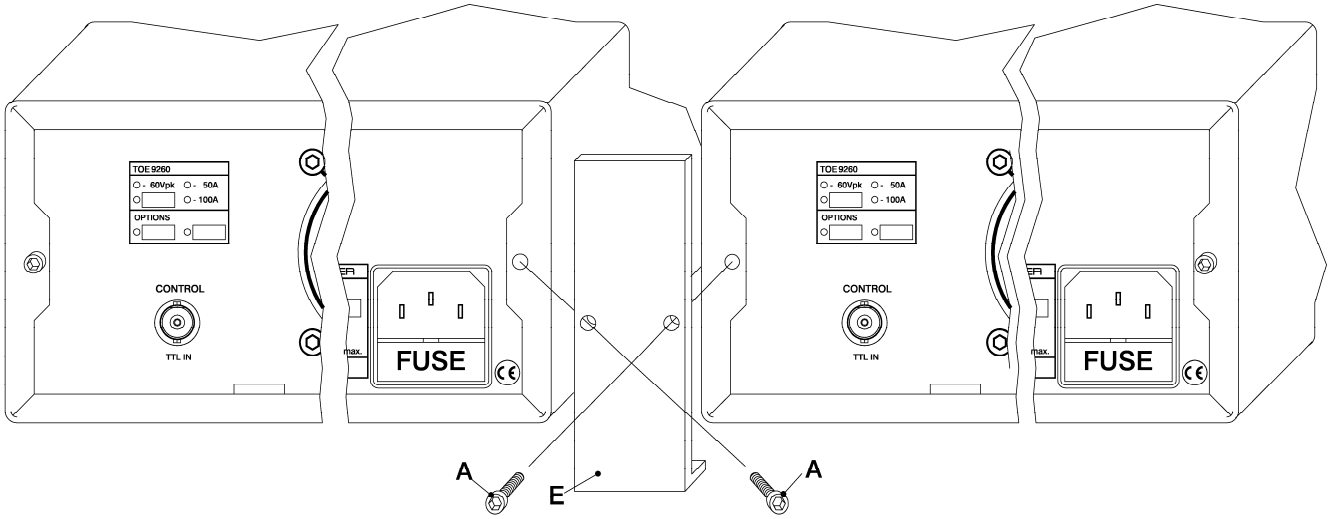
Reconfiguring from two Toellner Instruments ½ 19” to 19” rack mount

1. Use the included TX 20 screwdriver to remove the feet from the Electronic Switch. First remove the rubber inserts on the front feet.
2. Use the included Allen wrench to remove the two inner screws (A) on the left and right side of the front panel of the Electronic Switch.
3. Pull the four fill strips (B) from the side and replace them on each side with a 19” adapter piece with handle (C) and in the center with the front joining strips (D).
4. Use the hex head screws (A) to attach the new parts to the front panel as shown in the diagram.



A: M3x10 hex head screw
B: Fill strip
C: 19" adapter panel 2 HU with handle
D: Front joining strip

5. Use the Allen wrench to remove the inner mounting screw (A) of the housing at the rear of the two Electronic Switches.
6. Fasten the two Electronic Switches together using the rear bracket (E) using the previously removed screws (A).



A: M3x10 hex head screw
E: Rear bracket

Installing in a 19" rack

The 19” unit must be located on both sides on slide rails. These slide rails as well as the fasteners needed for attaching the unit in the 19” rack are not included in the scope of delivery for this option.

4. Technical Data

Remark The technical data are based on a warm-up time of at least 30 minutes under constant conditions and a reference temperature of 23°C ±1°C.

4.1 Technical Data TOE 9260

Model	TOE 9260-50	TOE 9260-100
Input voltage		
Power switch	**0 - 60 V**	**0 - 60 V**
Signal line switches	**0 - 60 V**	**0 - 60 V**
Load current		
Power switch, longitudinal path		
Continuous current	**0 - 50 A**	**0 - 100 A**
Peak current	**300 A**	**300 A**
Power switch, branch path		
Continuous current	**0 - 32 A**	**0 - 32 A**
Peak current	**300 A**	**300 A**
Signal line switches	**0 - 1 A**	**0 - 1 A**
Voltage drop		
Power switch, longitudinal path	**< 0.3 V** at 50 A	**< 0.4 V** at 100 A
Power switch, branch path	**< 0.3 V** at 32 A	**< 0.3 V** at 32 A
Signal line switches	**< 0.2 V** at 1 A	
Switching frequency f_{MAX}	**100 kHz**	
Power switch switching times		
Rise time t_r	**< 1.0 µs** measured at the device output sockets with 1 Ω load, V_{IN} = 10 V … 40 V, applied built-in input buffer capacitor or measured at the device output sockets with 1 Ω load, V_{IN} = 10 V … 40 V, not applied input buffer capacitor but buffered feed source, inductance of the incoming cable to the input sockets max. 250 nH (input cable length reduced to 300 mm, twisted laying of cables)	
Fall time t_f	**< 0.6 µs** measured at the device output sockets with 1 Ω load, V_{IN} = 10 V … 40 V	
Switching times for signal line switches		
Rise time t_r	**< 0.1 µs** measured with 100 Ω load, V_{IN} = 10 V … 40 V **< 0.1 µs** measured with 1 kΩ load, V_{IN} = 10 V … 40 V	
Fall time t_f	**< 0.5 µs** measured with 100 Ω load, V_{IN} = 10 V … 40 V **< 0.5 µs** measured with 1 kΩ load, V_{IN} = 10 V … 40 V	
PWM operation of power switch		
Operating duration	No limitation	Load current ≤ 50 A: No limitation Load Current > 50 … 100 A: 5 min
14 V input voltage	**DC up to 100 kHz** at duty cycle 50 % when using the optional available connection cable (length 0.50 m, cross-section 16 mm^2) on the in- and output	

(Technical Data, cont.)

40 V input voltage	**DC up to typ. 20 kHz** when using the optional available connection cable (length 0.50 m, cross-section 16 mm^2) on the in- and output The achievable PWM frequency depends on the buffering of the feed source or applying the built-in input buffer capacitor and on the inductance of the incoming cable to the input sockets. At too high a frequency feed of inductive energy into the device the input overcurrent protection function will be triggered. An actually achievable higher frequency is permitted for use up to the max. switching frequency of 100 kHz.
Protection functions	
Overcurrent or short-circuit of the switching paths	Monitors continuous current and peak current. Driver stage turned off when limits are exceeded, display OVL. Reset by turning the unit off and on using the mains switch.
Input current	Monitors the inductive energy fed at the switching frequency on the cable from the feed source to the input sockets. Turns off the driver stage when value is exceeded, display OVL. Reset by turning off and on using the mains switch. *Note: The incoming energy can be minimised by a short cable, arranged for low-inductance.*
Max. switching frequency exceeded	Turns off the driver stage, display OVL. Reset by lowering the switching frequency below the permissible value, at first also reduced by a hysteresis of typ. 8 kHz.
Excessive temperature	2-stage protection against excessively high component temperatures. Stage 1: Fan speed increased Stage 2: Driver stage turned off, display OVL. Reset after a sufficient cool-down time by turning the unit off and on using the mains switch.
Power switch is <u>not</u> reverse polarity protected! Reverse polarity voltage applied to the input or output can damage the unit from excess current or thermal overload.	
Connections	
Mains voltage	Wide range input voltage 90…264 V AC, 47-63 Hz, I_{max} = 0.36 A, rear mounted non-heating device input socket with T1AL fuse per IEC 127-2/III, DIN 41662
Control input	Control signal with amplitude 2…7 V. Compatible with CMOS 5V, LVCMOS 3.3V and TTL. Protected up to ± 20 V. Impedance 1 MΩ. 1x BNC, non-earthed, front side, protection circuit with self-resetting fuse 1x BNC, non-earthed, rear side, protection circuit with self-resetting fuse The Control input controls the switching states of the power switch and signal line switches. The signal line switches are controlled synchronous with control of the longitudinal path of the power switch.
Power switch	
IN	High-current socket pair 6 mm Red / Blue, with touch protection
OUT	High-current socket pair 6 mm Red / Blue, with touch protection
Branch path selector	2x socket pair 4 mm Red / Gray with touch protection for inserting a 19 mm plug

(Technical Data, cont.)

Signal line switches	
In-/outputs	Front side connector for connecting screw terminal blocks with 3.81mm spacing Suitable screw terminal blocks include Phoenix MC 1,5 / 4-ST-3,81 = item no. 1803594 or Würth Elektronik WR-TBL system, Series 361 = item no. 691361300004
Electrical isolation	Between power switch, signal line switches, Control input and PE, max. 42 V_{peak} each.
General	
Power consumption, mains side	Max. approx. 35 VA
Protection	Protection Class I accord. to DIN EN 61010-1
Operating temperature	0 - 40°C
Storage temperature	−20 - 70°C
Reference temperature	23°C ±1°C
Cooling	2-stage thermostatically controlled fan
Dimensions (W x H x D)	224 x 88 x 405 mm; with feet 224 x 103 x 405 mm
19"-System	Compatible with ½ 19", 2 HU
Weight	Approx. 4 kg
Housing	Aluminium/steel

4.2 General data

Ordering options

0-50 A, 0-60 V.....TOE 9260-50
0-100 A, 0-60 V.....TOE 9260-100

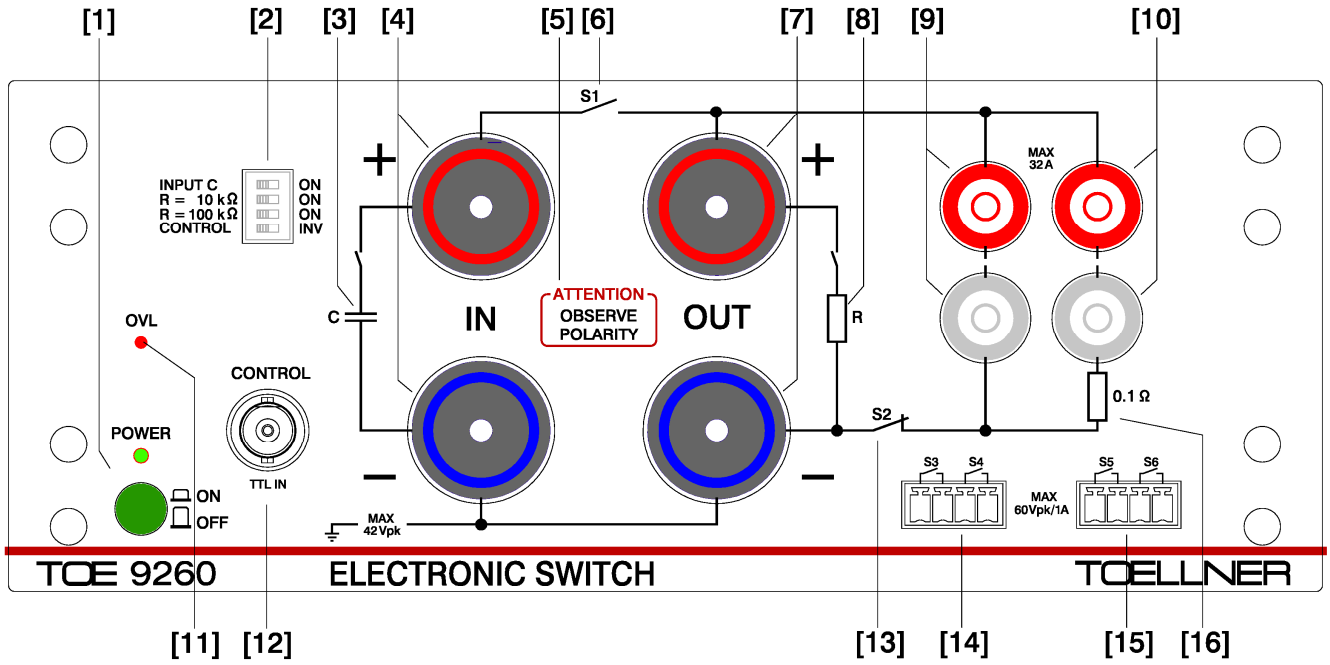
Included accessories

1 mains cable
1 connector plug 19 mm
2 terminal blocks for signal line switches
1 Instruction Manual

Optional accessories

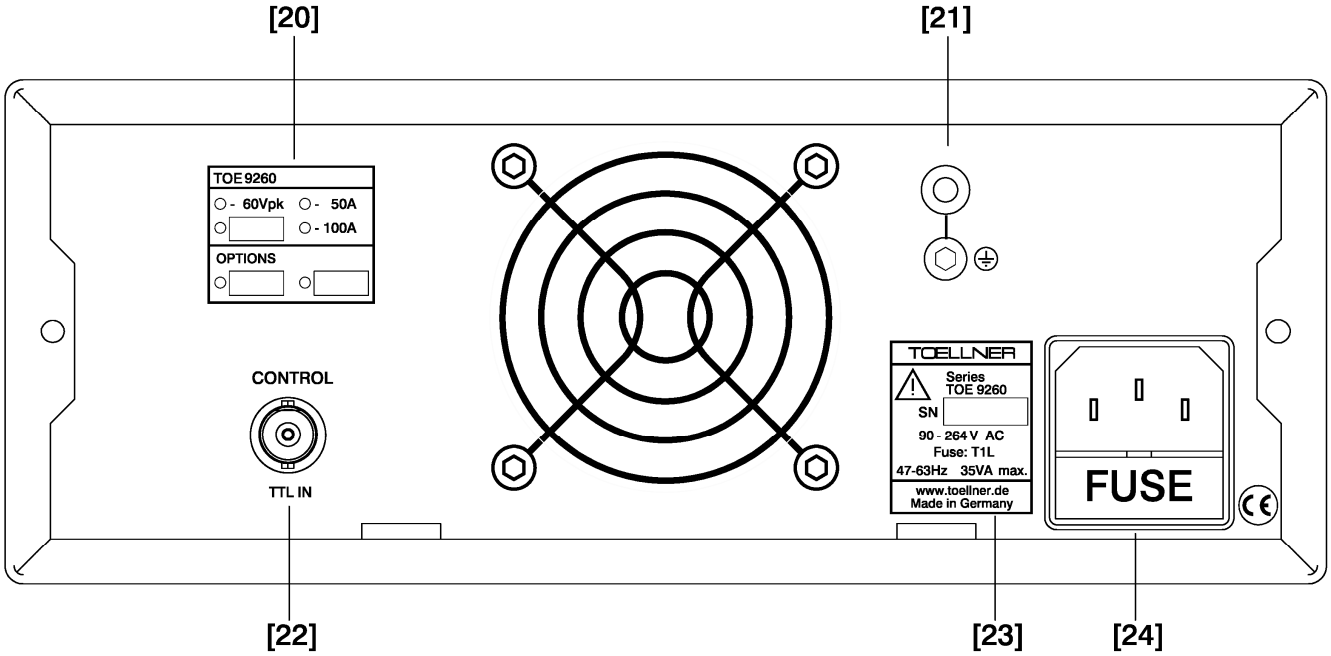
0.50 m connection cable with 1 safety socket, red ..... TOE 9260/22
0.50 m connection cable with 1 safety socket, blue ..... TOE 9260/23
1.20 m connection cable with 1 safety socket, red ..... TOE 9260/24
1.20 m connection cable with 1 safety socket, blue ..... TOE 9260/25
19" adapter set 2 HU (asymmetrical) for 1x TOE 9260 ..... TOE 9521
19" adapter set 2 HU (parallel connector) for 2 Toellner Instruments ½ 19" .... TOE 9522

5. Views



Front panel view of the **TOE 9260**

[1] Mains switch with green *POWER*-LED
[2] 4x DIL switch
[3] Selectable input buffer capacitor
[4] Power switch input
[5] Polarity reminder
[6] Power switch, longitudinal path
[7] Power switch output
[8] Selectable base load 10 kΩ or 100 kΩ
[9] Socket pair for branch path 0 Ω
[10] Socket pair for branch path 0.1 Ω
[11] Red *OVL* LED (overload)
[12] Front BNC control input
[13] Power switch, branch path
[14] Connections for signal line switches S3 and S4
[15] Connections for signal line switches S5 and S6
[16] 0.1 Ω-series resistor for branch path



Rear view of the **TOE 9260**

[20] Identifier
[21] Protection earth
Do not unscrew!
[22] Rear BNC control input
[23] Rating plate
[24] Mains panel plug, with fuse