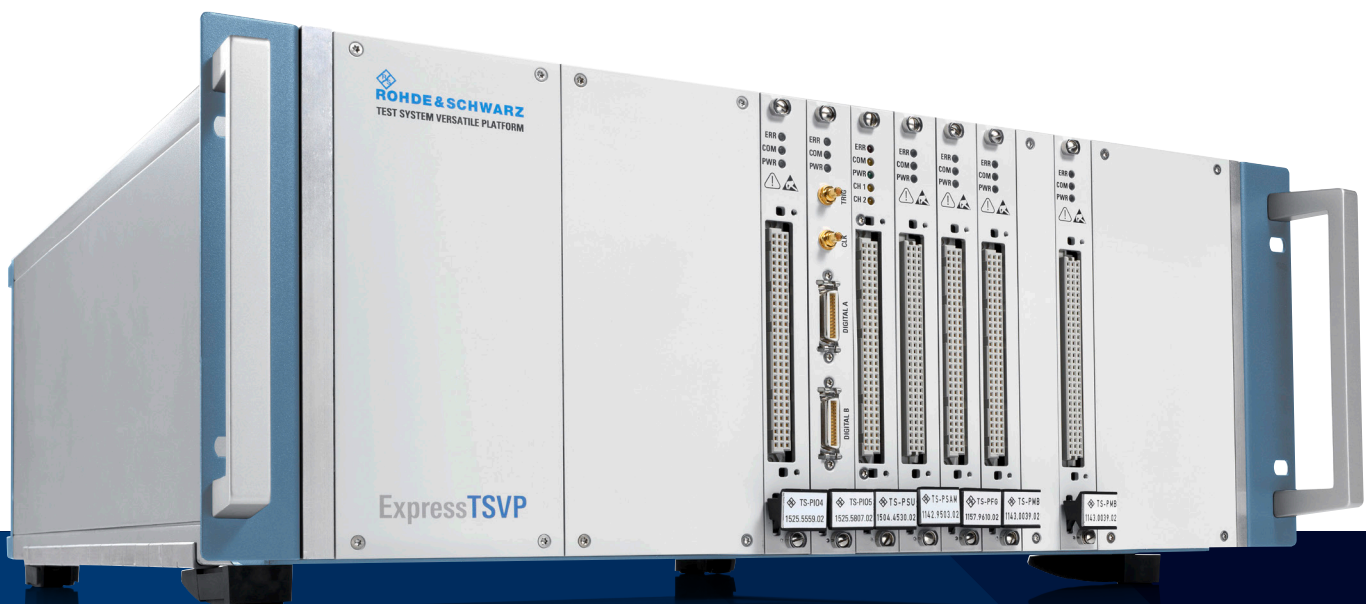# R&S®ExpressTSVP
UNIVERSAL TEST AND MEASUREMENT CHASSIS

Open test platform based on PXI Express™ and PXI

Product Brochure
Version 01.00

ROHDE&SCHWARZ

Make ideas real

AT A GLANCE

The R&S®ExpressTSVP concept represents true innovation in state-of-the-art PC based instrumentation while offering traditional capabilities found in high-performance ATE systems. The versatile platform accelerates the adoption of industry standard CompactPCI® Express and PXI Express™ as well as CompactPCI® and PXI-1 in all major fields of industrial test and measurement applications.

With its large number of cPCIe/PXIe/cPCI/PXI-1 slots and the tight integration of ATE functionality provided by Rohde & Schwarz instrumentation and switching modules, the R&S®ExpressTSVP is the universal platform for highly productive system engineering. Compact units are used to configure complex ATE functionality which can be interfaced to DUTs by the standardized test receiver concept that provides multiple application flexibility and easy handling on the factory floor. Unique data acquisition and stimulation modules provide floating potential measurements and DUT stimulation.

The R&S®ExpressTSVP open test platform is designed as an all-in-one solution for test and measurement applications in development, production and servicing of telecommunications and automotive electronics.

The R&S®ExpressTSVP product line is an industrial ATE platform featuring in-circuit test (ICT) as a modular hardware and software option for creating powerful and affordable manufacturing test systems.

Key facts
► 21-slot multi standard chassis
► 5 PXI express slots
► 13 R&S®PXI-1/cPCI/CAN slots with rear I/O
► 1 CAN slot with rear I/O
► 1 cPCI serial system slot (rear)
► 1 cPCI serial slot (rear)
► Compact 4U 19" design
► PXI express slots with up to PCIe® x4 link
► cPCI serial slot (rear) with PCIe® x8 link
► Sophisticated analog measurement bus subsystem
► Rear I/O support for easy system cabling
► Support of PXI trigger concept
► Simple and efficient module connection
► Easily expandable ATE switching
► Cost-effective peripheral control via CAN
► Compatible to R&S®CompactTSVP chassis, R&S®PowerTSVP chassis and Rohde & Schwarz T&M modules for R&S®TSVP
► Seamless test adaptation using standardized mass interconnect receivers together with interchangeable test adapters

R&S®ExpressTSVP MODULE FORMATS AND FEATURES

The main objective behind the R&S®ExpressTSVP is to offer an inherently flexible and cost-effective modular test and measurement platform. The performance, modularity and scalability of the product is addressed by the platform technology.

For various application requirements, such as additional test and measurement modules, the R&S®ExpressTSVP is interoperable with commercially available 3 HU PXI Express™, CompactPCI®, PXI-1 and CPCI® serial modules.
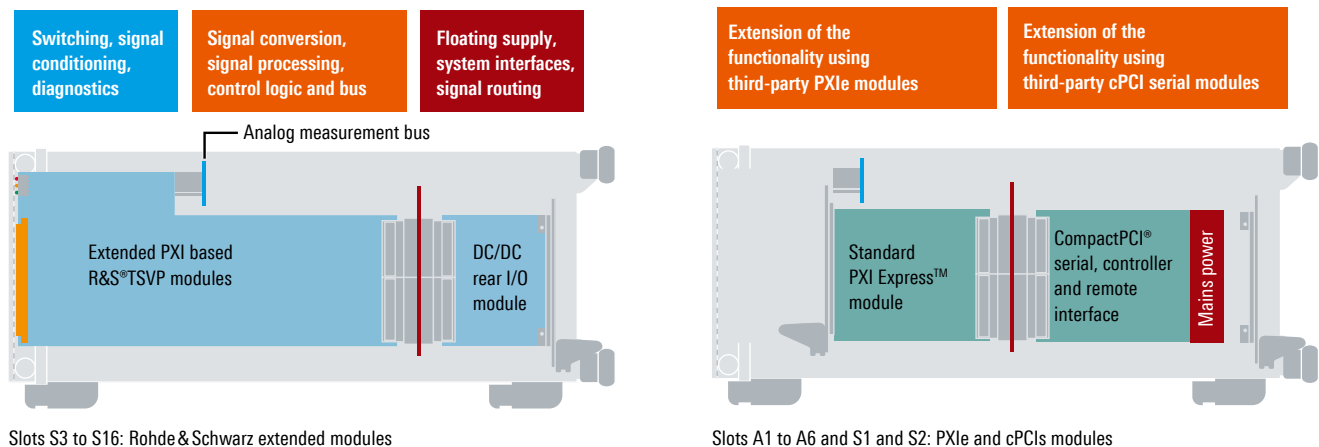
This allows users to benefit from technology advances in the mainstream industrial PC applications as well as imaging, communications and test and measurement products for dedicated application requirements. PXI modular instrumentation can be used, including features that provide advanced timing and triggering capabilities.

Although tight integration and electronics miniaturization help when building powerful equipment with smaller footprints, available board space is still a major issue. The board space of 3 HU PXI Express™, CompactPCI®, PXI-1 and CPCI® serial modules is the same as the Eurocard mechanical packaging measuring 160 mm × 100 mm (length × height). The R&S®TSVP module format is extended by 130 mm in length to bring unique additional features like primary switching and signal conditioning on board.

Core functionalities such as A/D conversion, storage and computing are combined into a comprehensive environment. The R&S®TS-PDC isolated power supply, a DC/DC conversion module that uses the space of the CompactPCI® standardized rear transmission module (RTM) section, is used for the analog and digital frontends of dedicated floating measurement and stimulus units. The advantage of this concept is double board space when compared with PXI 1-slot Eurocard modules.
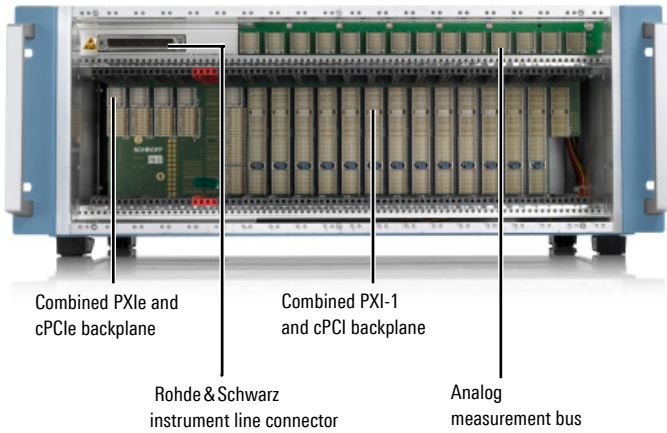
The isolated R&S®TS-PDC DC/DC supply modules are placed behind the backplane, which serves as a thermal barrier to prevent the measurement modules from heating up. It provides high thermal stability of measurements over the full temperature range. The module is included at no extra cost in every measurement module that requires a floating DC/DC supply.

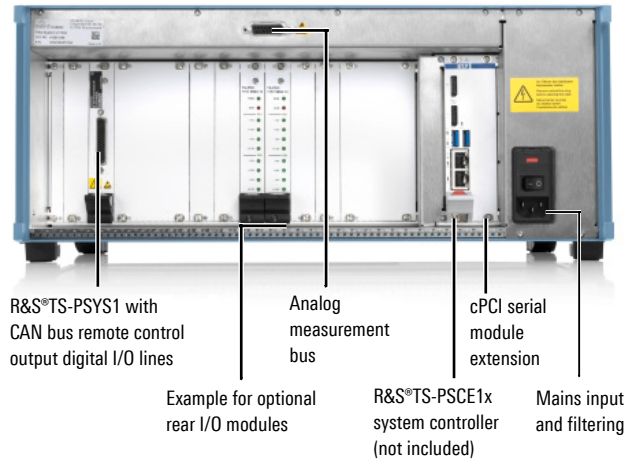## R&S®ExpressTSVP side view of extended PXI and PXIe configuration

Slots S3 to S16: Rohde & Schwarz extended modules

Slots A1 to A6 and S1 and S2: PXIe and cPCIs modules

R&S®ExpressTSVP COMPONENTS

R&S®ExpressTSVP front view

Combined PXIe and cPCIe backplane

Rohde & Schwarz instrument line connector

Combined PXI-1 and cPCI backplane

Analog measurement bus

R&S®ExpressTSVP rear view

R&S®TS-PSYS1 with CAN bus remote control output digital I/O lines

Example for optional rear I/O modules

Analog measurement bus

R&S®TS-PSCE1x system controller (not included)

cPCI serial module extension

Mains input and filtering

Versatile backplane architecture

The R&S®ExpressTSVP test and measurement chassis includes the control backplane with a total of 21 peripheral slots.

Slots A1 to A4 and A6 have a combined PXI Express™/CompactPCI® express interface. Slot A5 can have a 2-slot module.

Slots S3 to S16 contain a PXI-1/CompactPCI® interface in combination with a CAN, analog bus and rear I/O connection known from the R&S®CompactTSVP. Slot S16 is limited to CAN and analog bus connections only.

A cPCI serial system slot reserved for the controller and one free cPCI serial slot are positioned in the rear.

The rear cabling is convenient with the 19" rackmountable standard test adapter available for the R&S®ExpressTSVP as a set of off-the-shelf products ready for use in production testing.

The backplane concept offers maximum flexibility when integrating the ATE instrumentation modules into the R&S®TSVP product line or commonly used off-the-shelf cPCIe/cPCI based products.
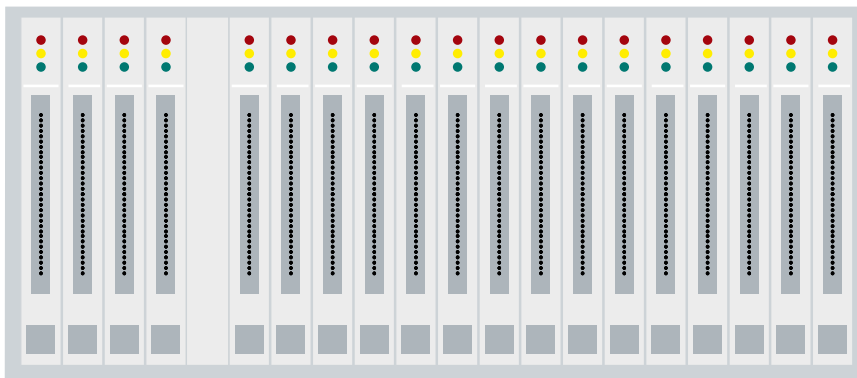
Front	A1	A2	A3	A4	A5	A6	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
PXIe/cPCIe	■	■	■	■		■														
PXI-1/cPCI							■	■	■	■	■	■	■	■	■	■	■	■	1)	
CAN							■	■	■	■	■	■	■	■	■	■	■	■	1)	■
Analog bus							■	■	■	■	■	■	■	■	■	■	■	■	■	■
Rear					S2	S1	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
Rear I/O							■	■	■	■	■	■	■	■	■	■	■	■		■
cPCI serial					■	CPU														
Power supplies	■	■	■	■																

1) Only for Rohde & Schwarz modules or CompactPCI® modules equipped only with J1 connector.

System backplane architecture for the R&S®ExpressTSVP

Analog measurement bus

The analog measurement bus offers short routing of signals to the measurement modules and electrical immunity to the digital PCI backplane.

The highly sophisticated handling of analog signals led to the interconnection solution for the analog bus of the R&S®TSVP. The analog bus is located directly above the front connector area where space is provided for onboard signal conditioning and signal routing using coupling relays for the analog bus. The eight lines of the system-wide analog measurement bus are available on all extended R&S®TSVP module slots. They are used to temporarily interconnect DUT signals routed via switching modules and various measurement or stimulus modules that have access to the analog measurement bus.

Serial system control module with CAN bus

To allow the use of relay based switching modules offered as part of the R&S®TSVP product family, the backplane is also equipped with a controller area network (CAN) serial communications bus at slots S3 to S16. The low-noise and interference-resistant CAN bus ensures high reliability and high signal quality.

In addition, the interfaces for switching modules have been simplified significantly while still providing sufficient performance for setting up switching paths using mechanical relays.

In line with Rohde&Schwarz overall commitment to industrial standards, various reliable and high-performance serial communications standards are available to choose from.

One straightforward approach is the deployment of a CAN bus, which has been used successfully in automotive electronics for many years.

The interface is physically implemented as a CompactPCI® based R&S®TS-PSYS1 RTM module, located at the rear of slot S15. The module is part of the chassis and contains additional system administration functions such as internal voltage and temperature monitoring and digital I/O lines to interface automation devices with 24 V digital I/O levels.

The R&S®TS-PSYS1 is used to configure and control the internal R&S®ExpressTSVP modules that are based on the CAN bus and all modules of the R&S®PowerTSVP extension chassis (which is based solely on the cost-efficient CAN bus).

Cooling considerations for reliable operation

The CompactPCI® slot area is equipped with three radial fans. The fans are mounted above the slot area and deliver consistent airflow from bottom to top. The fans are temperature-controlled, and the temperature inside the R&S®ExpressTSVP chassis is measured at four locations.
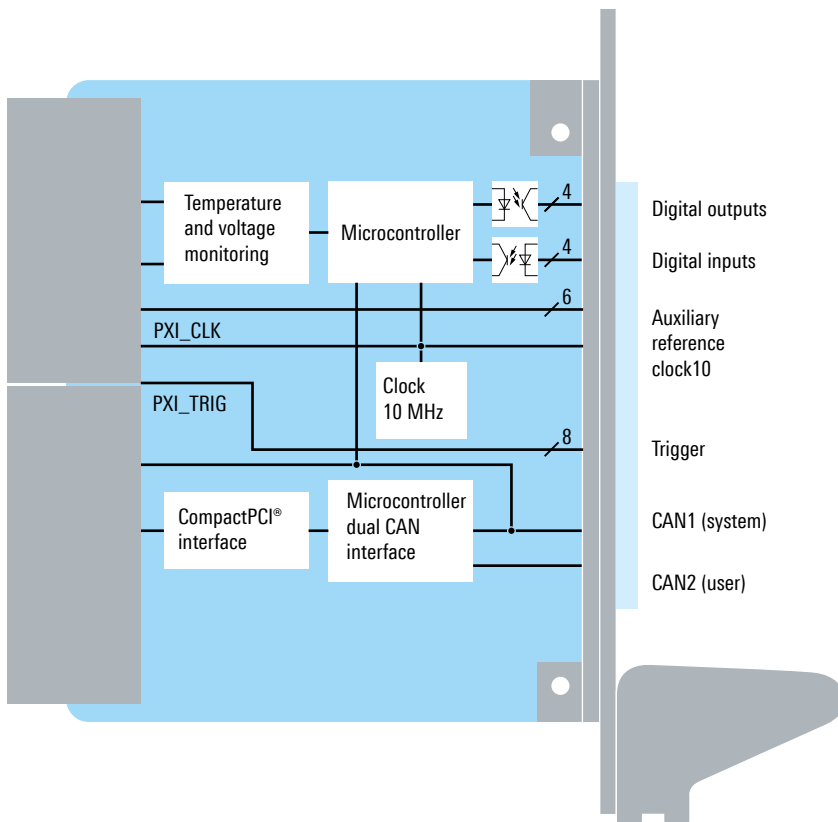
Block diagram of the R&S®TS-PSYS1 CAN bus system control module

Test adapter accessories

To quickly and cost-effectively incorporate the R&S®ExpressTSVP into production test environments, an entire set of mass interconnect support products is available.

Mass interconnect solutions in general act as quickly changeable connector interfaces between the R&S®TSVP and its instrumentation and devices/units under test (DUT/UUT) in test applications. Used in defense, aerospace, automotive, manufacturing and other applications, mass interconnect systems are available in multiple sizes and configurations to accommodate the hardware of any testing requirement.

Mass interconnect systems are flexible, reconfigurable and modular by design. Modular and scalable mass interconnect solutions like the R&S®TS-PAD4 and R&S®TS-PAD5 mass interconnect receivers are a cost-efficient way to obtain the highest signal quality and reliability.

The R&S®TSVP modular instruments are usually equipped with a standardized DIN 41612 front connector.

Due to wear between the instruments' DIN front connectors and the receiver frame, signal modules are available in different quality levels – for instance, the R&S®PFPAX4, which is compatible with Virginia Panel Corporation (VPC) QuadraPaddle signal modules on the fixture side.

Because some of the R&S®TSVP high-power instruments already use VPC Micro Power or TriPaddle signal modules, additional signal modules are obsolete.

The modules can be mixed if each insertion slot is equipped with the same kind of signal module at both the receiver and fixture end. With their wide range of standardized high-quality connectors, VPC solutions enable rapid and easy connection of the R&S®TSVP to the fixture.

R&S®TS-PAD4 mass interconnect receiver
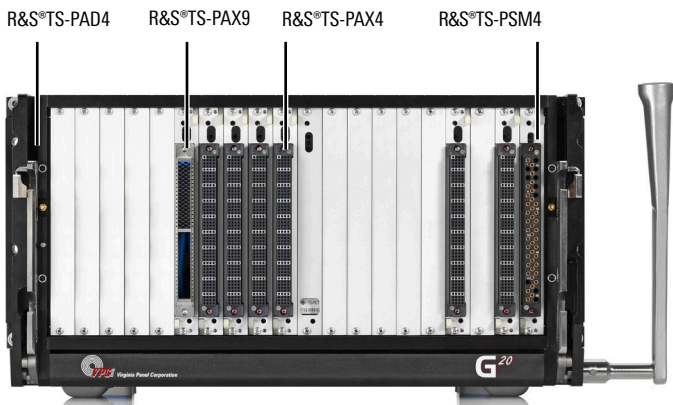
R&S®TS-PAD5 mass interconnect receiver
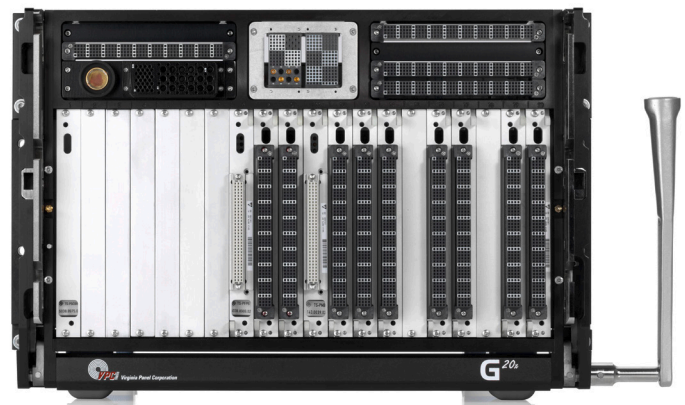
R&S®PowerTSVP FOR SWITCHING APPLICATIONS

The R&S®PowerTSVP chassis was created as a cost-efficient subsystem for switching applications. It can be used to build systems ranging from dedicated switching instruments to complex switching applications inside test and measurement systems.

The analog measurement bus routes general purpose signals from switching modules to various measurement and stimulus instruments integrated into the R&S®ExpressTSVP.

The analog bus lines from an R&S®ExpressTSVP chassis are connected to an R&S®PowerTSVP extension chassis for switching by means of the R&S®TS-PK01 cable.

The R&S®PowerTSVP is an industrial chassis including one power supply with space for an additional power supply for adherence to the identical concept for the R&S®ExpressTSVP. The serial control backplane provides 16 slots for CAN based R&S®TSVP modules and includes PXI trigger support.

The CAN bus remote control is implemented as the R&S®TS-PSYS2 interface module, which is part of the R&S®PowerTSVP.

The only requirement for cascading an R&S®PowerTSVP extension chassis to an R&S®ExpressTSVP chassis is a connection between the R&S®TS-PSYS2 CAN bus secondary interface and the R&S®TS-PSYS1 CAN bus primary interface inside the R&S®ExpressTSVP. This remote connection is also provided as an accessory (R&S®TS-PK02, cable from R&S®TS-PSYS1 to R&S®TS-PSYS2).

Power switching and the interconnection of external power supplies and electronic loads to DUTs are provided via the optional CAN based power switching modules.

Power signal handling is usually not possible inside laboratory equipment. With a remote power-switching unit, such as the R&S®PowerTSVP, it is possible to prepare test adapters close to the DUT power signals or adjacent to power supplies and loads.

Software front panel of the R&S®TS-PSYS1 system control module.
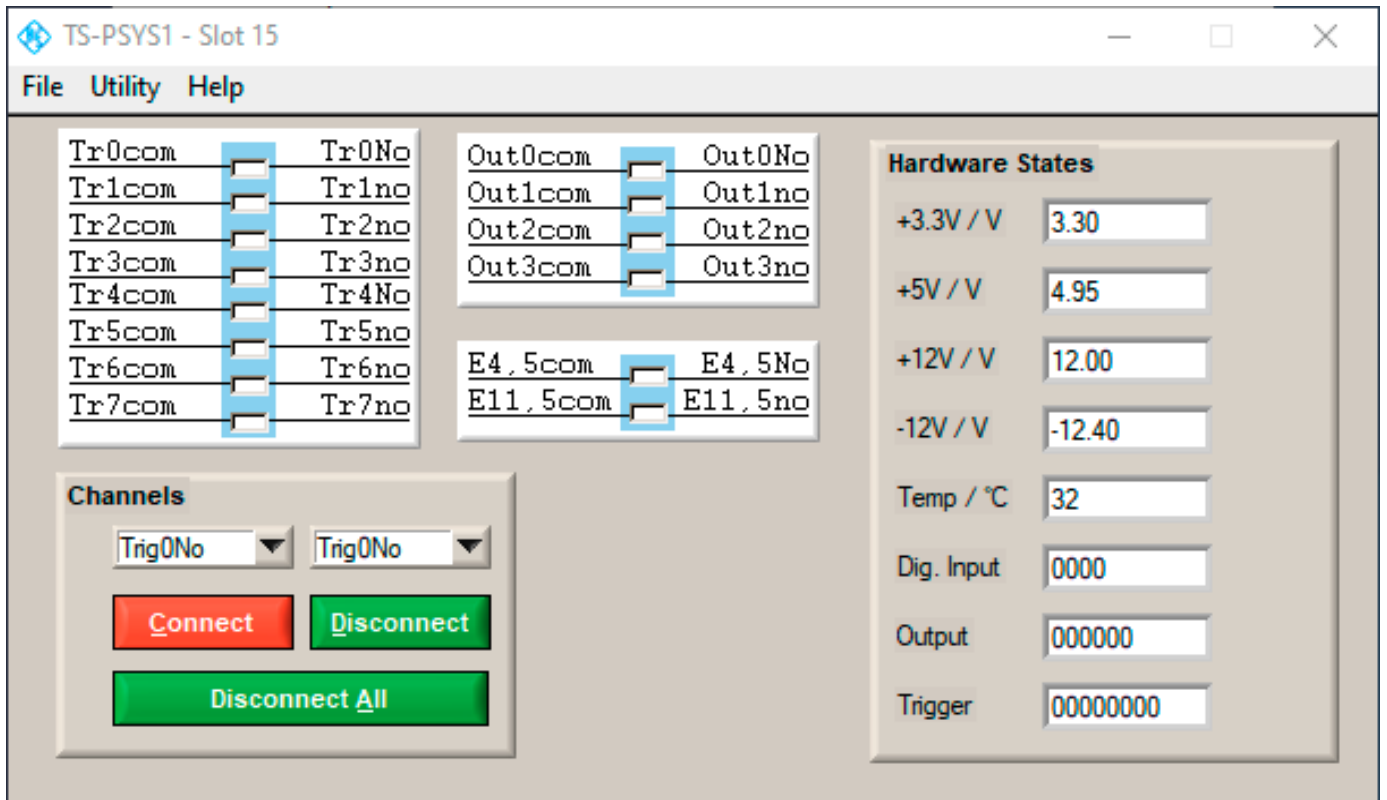
SOFTWARE SUPPORT

The R&S®TS-PSYS1 system control module is configured and controlled by a device driver DLL. Function panels and online help are available as common features for the LabWindows/CVI driver software.

As with every modular instrumentation product in the R&S®TSVP family, a software front panel is provided.

CONFIDENCE THROUGH SELF-TEST AND DIAGNOSTICS

The built-in self-test capability of the R&S®TS-PSYS1 system control module includes automated evaluation of module functionality.

The system-level self-test of the R&S®ExpressTSVP is performed using the R&S®TS-PSAM digital multimeter module as the measurement unit to test other modules and components in the chassis. The comprehensive self-test software concept provides ready-to-run self-test sequences for every R&S®TSVP platform product.

A comprehensive self-test program is provided for the R&S®TS-PSYS1 module.
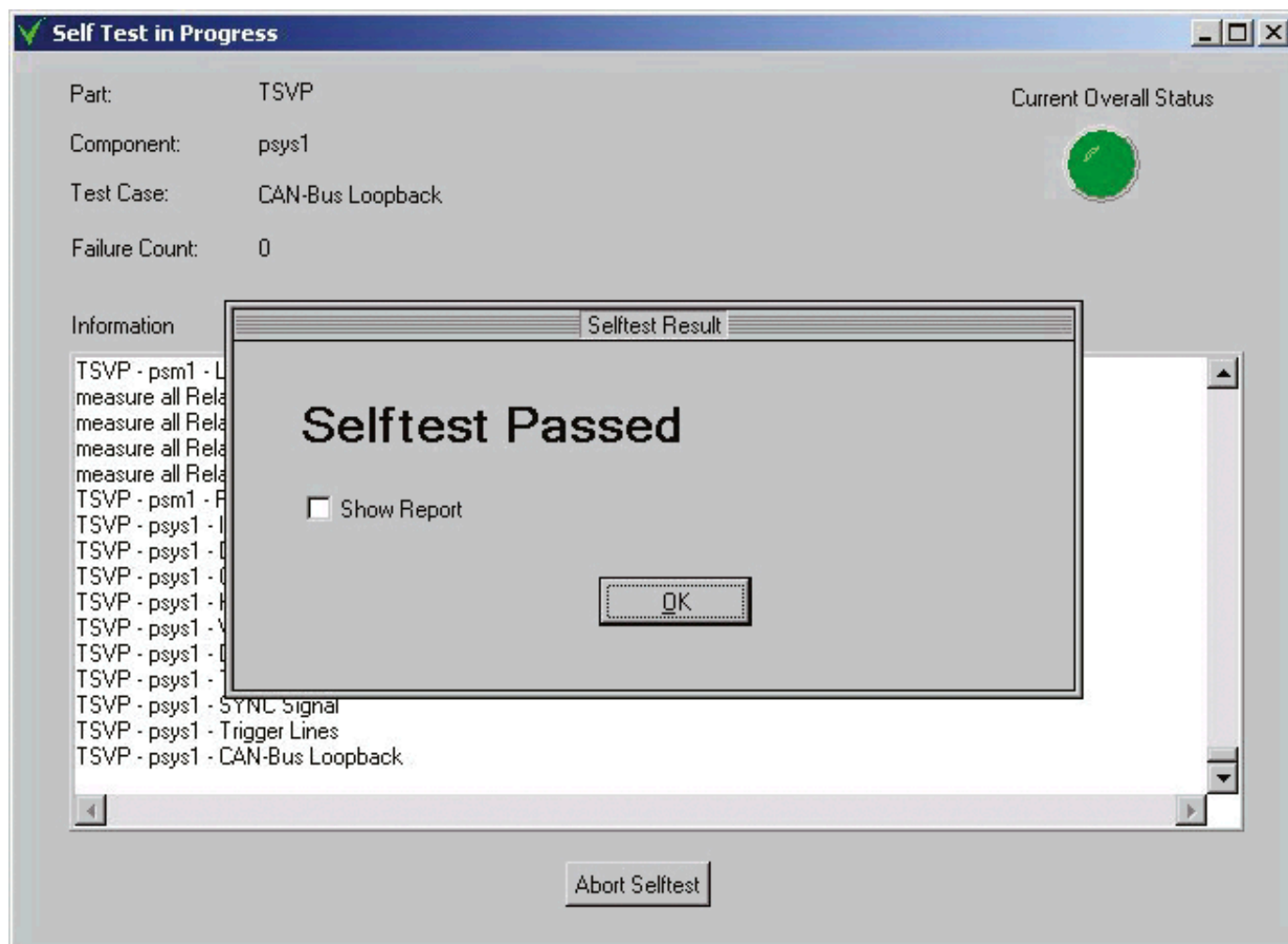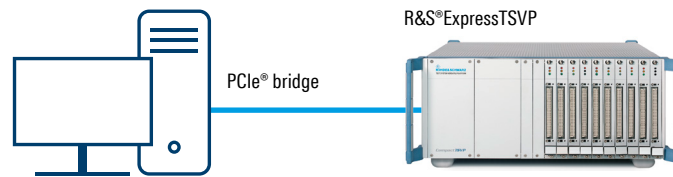
SYSTEM LAYOUT

R&S®ExpressTSVP

The R&S®ExpressTSVP chassis with an embedded computer enables a more compact solution with unimpeded use of the CPU. With its 14 peripheral slots, medium pin count ATE systems with up to 990 channels can be built as a one-box approach.

R&S®ExpressTSVP

R&S®ExpressTSVP and R&S®PowerTSVP

The combination of the R&S®ExpressTSVP and the R&S®PowerTSVP stands for high performance and high pin count ATE systems. For high-power applications, the parts of a system that handle signals with high currents or high voltages can be separated to ensure a safe distance from the R&S®ExpressTSVP as a dedicated measurement unit.

R&S®ExpressTSVP

R&S®PowerTSVP

CAN

R&S®ExpressTSVP with external PC

Alternatively, the R&S®ExpressTSVP can also be controlled by means of an external computer using a PCIe® bridge. This allows more flexible selection of the control computer and its configuration.

PCIe® bridge

R&S®ExpressTSVP
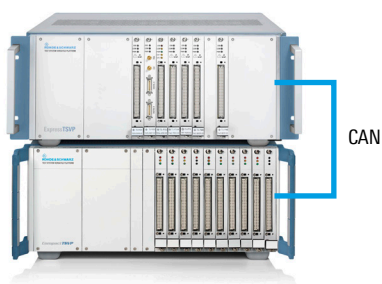
R&S®PowerTSVP

Medium pin count ATE with an external standard PC using a CAN bus interface to control the R&S®PowerTSVP chassis. The CAN interface can be based on various standard interfaces such as USB to CAN. With this scenario, correctly dimensioned switching applications can be used for various requirements ranging from general purpose signals, high power load and power supply switching.

R&S®PowerTSVP

SYSTEM CONTROLLER AND BRIDGES

R&S®TS-PSCE1x system controller

Users can configure the system by choosing the hardware, operating system and software that meets their specific requirements. The configuration can be extended at any time.

R&S®TS-PSCE1

The R&S®TS-PSCE1 base model is equipped with a server grade CPU board. The R&S®ExpressTSVP is connected via a CompactPCI® serial interface. It does not include a solid-state drive (SSD) or operating system.

R&S®TS-PSCE1S

The R&S®TS-PSCE1S model is equipped with a server grade CPU board and solid-state drive (SSD). The R&S®ExpressTSVP is connected via a CompactPCI® serial interface. It does not include an operating system.

R&S®TS-PSCE1W

The R&S®TS-PSCE1W model is fully equipped with a server grade CPU board and solid-state drive (SSD) with the Windows 10 operating system installed and the latest R&S®GTSL software. The R&S®ExpressTSVP is connected via a CompactPCI® serial interface.

R&S®TS-PSC08-E remote controller

Desktop and industrial PCs equipped with PCI Express® extension slots can also be used as a system controller for the R&S®ExpressTSVP chassis.

The transparent downstream PCIe® cable interface is ready to run without software driver installation and provides outstanding system performance.

R&S®TS-PSCE1x system controller
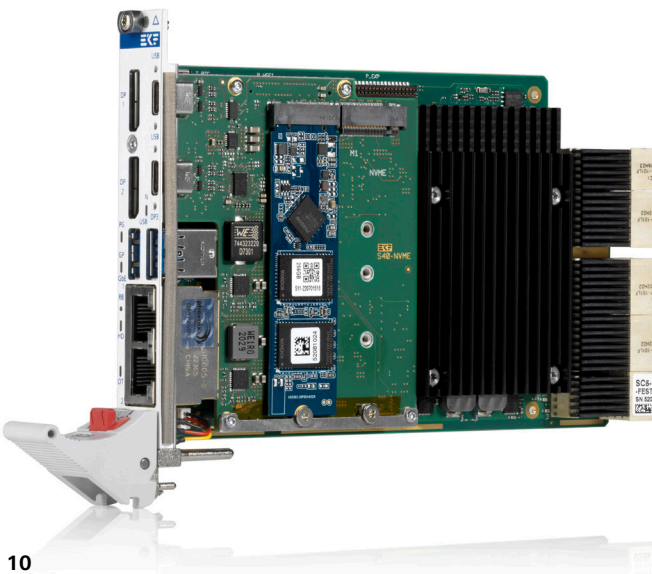
R&S®TS-PSC08-E remote controller
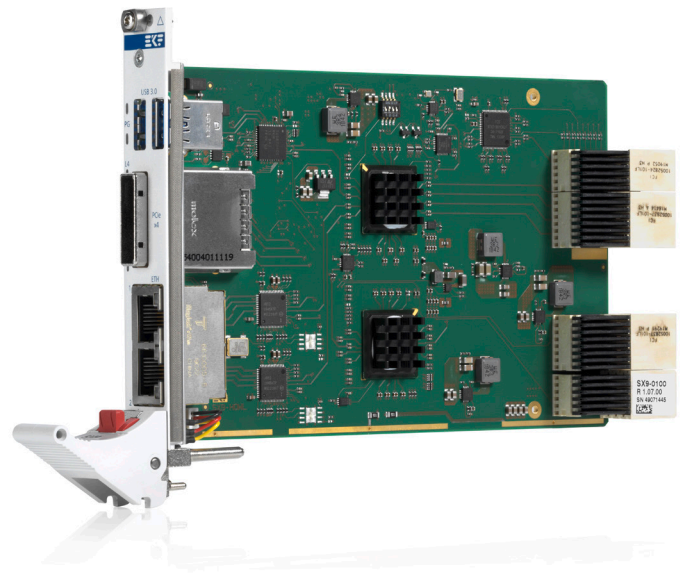
SPECIFICATIONS

R&S®ExpressTSVP		
Control backplane		
cPCI serial		PCIe® Gen. 2, x8
PXIe		PCIe® Gen. 2, x4
cPCI/PXI		32 bit, 33 MHz
CAN		2.0b, 1 Mbit
PXI clocks		PXIe_CLK100, PXI: CLK10: ±(1.5 ppm + 1 ppm/year)
PXI sync		PXIe_SYNC100
PXI trigger		PXI_TRIG[0 to 7]
PXI local bus		slots A1 to A4, A6
Slots		
S1	system slot (rear side)	cPCI serial
S2	periphery slot (rear side)	cPCI serial
A1 to A4		PXIe
A6		PXIe, S1 rear I/O
S3 to S15	with rear I/O	cPCI, PXI, CAN
S16	with rear I/O	CAN
System control module		
R&S®TS-PSYS1		rear I/O interface for CompactPCI® to CAN bus (CAN 2.0b)
		4 outputs, PhotoMOS relay, 42 V, 200 mA
		4 inputs, optocoupler, 2.4 V to 42 V, 5 mA
		2 switchable external supply voltages: ▶ X30.20: 5.0 V ▶ X30.21: 12.0 V
		8 switchable external trigger inputs/outputs
		5 monitoring lines: temperature, 3.3 V, 5 V, +12 V, –12 V
Analog measurement bus backplane		
Analog bus lines	breakout connector at rear side	8
Voltage	DC	120 V (max.)
	AC	50 V (RMS)
Current		1 A (max.)
Cooling		
Cooling mode		temperature controlled, full speed
Cooling principle		3 × PWM 12 V cooling fans
Power rating		
AC input	rated voltage	100 V to 230 V AC
	rated frequency	50 Hz to 60 Hz
	rated power	560 VA
DC output	+3.3 V	25 A
	+5 V	50 A
	+12 V	15 A
	–12 V	2 A
	+5 V AUX	1 A
General data		
Temperature	operating temperature range	0 °C to +55 °C
Damp heat		85 % (max.) at +35 °C
Dimensions	W × H × D	485 mm × 615 mm × 191 mm (19.09 in × 24.21 in × 7.52 in)
Weight		12.5 kg (27.56 lb)

R&S®TS-PSCE1x system controller

Control computer

Processor	Intel® Xeon® E3 1505MV6	3.0 GHz/4.0 GHz, 8M, 4C/8T
Random access memory (RAM)	DDR4 ECC	16 Gbyte at 2400 MT/s
Solid-state disc (SSD)	R&S®TS-PSCE1S/TS-PSCE1W	M.2 2280, 512 Gbyte, SATA
Interfaces		
USB	USB type C 3.1 Gen. 1	2
	USB 3.0	2
Ethernet	1 Gbit	2
Graphics	DisplayPort, 4096 × 2304 pixel at 60 Hz	2
Security		TPM 2.0
Operating system	R&S®TS-PSCE1W	Windows 10 IoT Enterprise LTSC High End 2021

General data

Interface standard		PICMG® CompactPCI® serial (CPCI-S.0), 2 PCI Express® Gen. 2 x8 (fat pipe)
Dimensions	single size Eurocard (W × H)	100 mm × 160 mm (3.94 in × 6.30 in)

R&S®TS-PSC08-E remote controller

Control computer

Interfaces		
USB	USB 3.0	2
Ethernet	1 Gbit	2
PCIe® x4		external cabling specification PCIe® x4 connector 38-pos.

General data

Interface standard	backplane side	PICMG® CompactPCI® serial (CPCI-S.0)
		PCI Express® Gen2 x4
Dimensions	single size Eurocard (W × H)	100 mm × 160 mm (3.94 in × 6.30 in)

ORDERING INFORMATION

Designation	Type	Order No.
Modular instrument chassis		
Universal test and measurement chassis	R&S®ExpressTSVP	1158.1542K02
System controllers and extensions		
System controller, for R&S®ExpressTSVP	R&S®TS-PSCE1	1544.7701.02
System controller, for R&S®ExpressTSVP, with SSD	R&S®TS-PSCE1S	1512.5010.04
System controller, for R&S®ExpressTSVP, with SSD and Windows 10 IoT	R&S®TS-PSCE1W	1512.5010.06
PCIe®-to-cPCI bridges		
PCIe® interface card, for PC	R&S®TS-PSC08-A	1512.4759.12
cPCI remote controller, for R&S®ExpressTSVP	R&S®TS-PSC08-E	1544.7699.02
PCIe® X4 cable, length: 1 m	R&S®TS-PSC08-C	3660.2110.10
PCIe® X4 cable, length: 2 m	R&S®TS-PSC08-C	3660.2110.20

Rohde & Schwarz

The Rohde & Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks & cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

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Sustainable product design

► Environmental compatibility and eco-footprint
► Energy efficiency and low emissions
► Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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