ROHDE&SCHWARZ
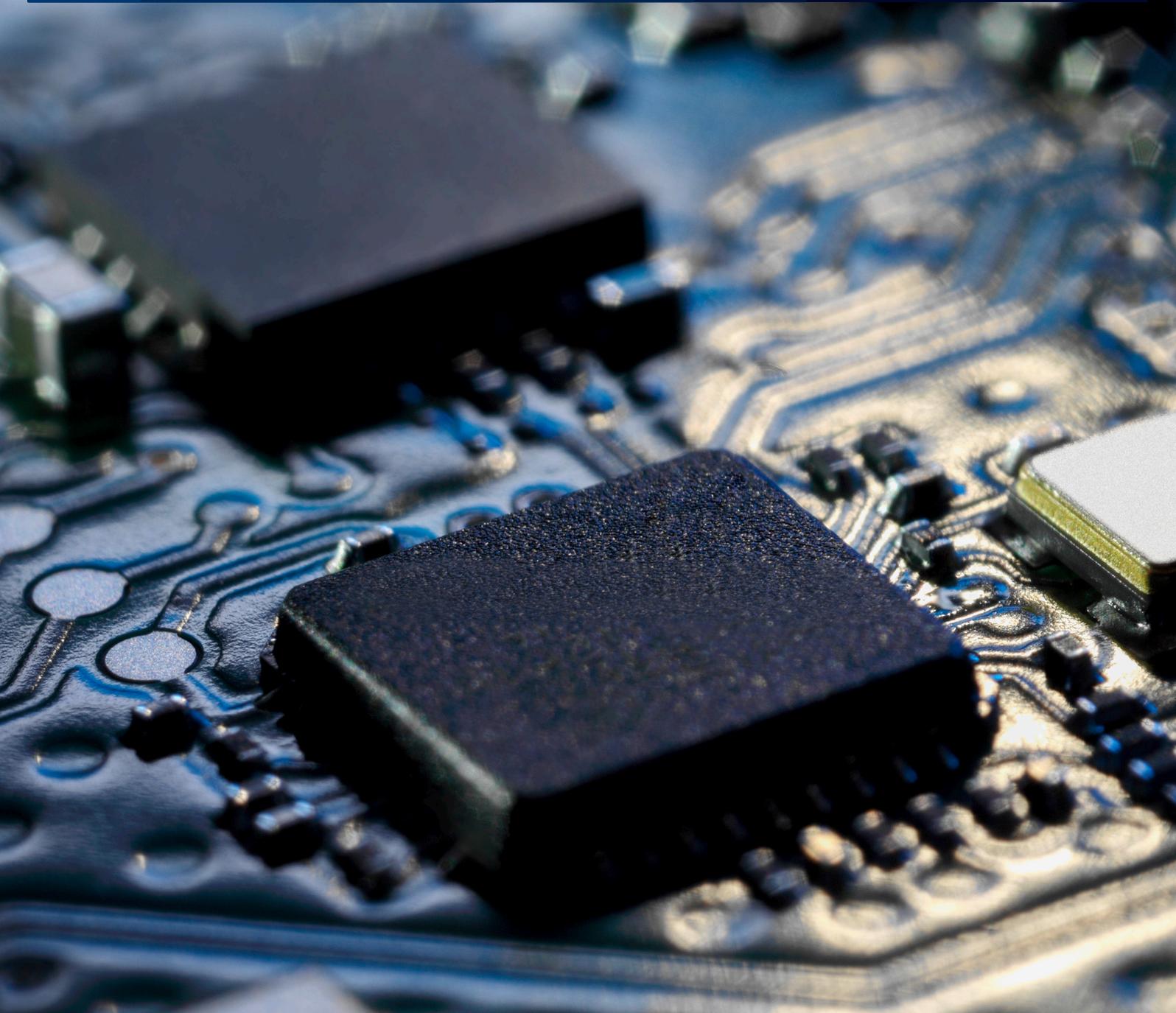
Make ideas real

R&S®TSVP
TEST SYSTEM VERSATILE PLATFORM

Open test platform for high-performance ATE applications

Product Brochure | Version 04.00

AT A GLANCE

In various industries, especially automotive (but also communications technology, IoT and A&D), all need production testing. Test departments must cope with increasingly complex electronic systems, all while keeping test times short, reducing costs and meeting ambitious reliability goals. Production testing identifies defects, while also examining complete electronic component integrity and verifying overall performance and functionality.

Application areas

The R&S®TSVP is mainly used together with sophisticated Rohde&Schwarz RF instruments in automotive manufacturing testing for telematics control units (TCU), car access (RKE/PEPS), zone control units (ZCU), high performance computers (HPC) or wireless battery management systems (w-BMS).

Open test platform based on PCI Express and PXI-1

The Rohde&Schwarz open test platform is ideal for high-performance automated test equipment (ATE). The architecture supports all relevant electrical test methods:
▶ Analog in-circuit test (ICT)
▶ Boundary scan test (BS)
▶ Functional test (FCT)

The R&S®TSVP chassis has a mechanical frame, digital backplane, analog backplane, mains switching and filtering, power supply and diagnostic extensions. One highlight is the analog bus for transferring measurement signals between different slots without additional external wiring. Three device versions are available:
▶ R&S®ExpressTSVP based on PXIe/PXI-1/cPCI bus for test and measurement tasks that require a flexible use of third-party PXIe modules
▶ R&S®CompactTSVP based on cPCI/PXI bus for general test and measurement tasks
▶ R&S®PowerTSVP based on CAN bus for dedicated high-power or switching applications

The R&S®ExpressTSVP can be combined with the R&S®PowerTSVP to create a larger system.

R&S®CompactTSVP with mass interconnect interface from Virginia Panel Corporation

KEY FACTS

- ▶ Comprehensive systematic approach
  - – System-oriented, compact basic unit and modular instruments for DC and LF signals
  - – Floating stimulus and measurement technology
  - – Optimized signal concept (analog measurement bus, rear I/O modules)
  - – Modules that handle up to 100 V and 50 A
  - – Modules that supply or load DUTs
  - – Highly reliable mass interconnect interface to quickly change application specific fixtures and adapters
  - – Systematic approach combines functional and in-circuit testing in a single chassis
  - – Wide range of functions in a compact system design, ideal for inline applications

- ▶ High test speed thanks to intelligent modules
- ▶ Standardized and powerful software components (R&S®GTSL, R&S®EGTSL) for instrument simulation while developing and tracing
- ▶ Integration of third-party cPCI/PXI/PXIe modules
- ▶ Integrated self-test to ensure the system is ready for use, and detailed diagnostics in the event of a system fault
- ▶ In-system calibration option for high system availability in mass production lines

PXI is a trademark of the PXI Systems Alliance.
PICMG and CompactPCI are trademarks of the PCI Industrial Computation Manufacturers Group.
PCI Express and PCIe are registered trademarks of PCI-SIG.

R&S®TSVP SYSTEM LAYOUTS

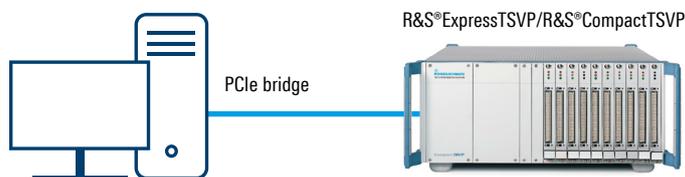### R&S®ExpressTSVP/R&S®CompactTSVP

The R&S®ExpressTSVP/R&S®CompactTSVP chassis with embedded computers are a more compact solution with unimpeded CPU usage. The 16 or 21 peripheral slots, ATE systems wtih medium pin counts and up to 990 channels are available in a single box solution.

R&S®ExpressTSVP/
R&S®CompactTSVP

R&S®ExpressTSVP/R&S®CompactTSVP with external PC

The R&S®ExpressTSVP/R&S®CompactTSVP can also be controlled by an external computer with a PCIe bridge for more flexibilty in selecting and configuring the control computer.

R&S®ExpressTSVP/R&S®CompactTSVP

PCIe bridge

R&S®ExpressTSVP/R&S®CompactTSVP and R&S®PowerTSVP

The R&S®ExpressTSVP/R&S®CompactTSVP can be combined with the R&S®PowerTSVP for high-performance and high-pin-count ATE systems. The parts of a system with high current or high voltage signals up to 120 V can be separated to ensure a safe distance from the R&S®CompactTSVP so that it can be a dedicated measurement unit for high-power applications.

R&S®ExpressTSVP/
R&S®CompactTSVP

R&S®PowerTSVP

CAN

R&S®PowerTSVP

A medium-pin-count ATE with a standard external PC can use a CAN bus interface to control the R&S®PowerTSVP chassis. The CAN interface can use various standard interfaces such as USB to CAN. In this application scenario, appropriately dimensioned switching applications can be used for general purpose signals, high power load and power supply switching and analog and digital signal stimulus and acquisition with sample rates up to 5 ksample/s.

R&S®PowerTSVP

R&S®ExpressTSVP
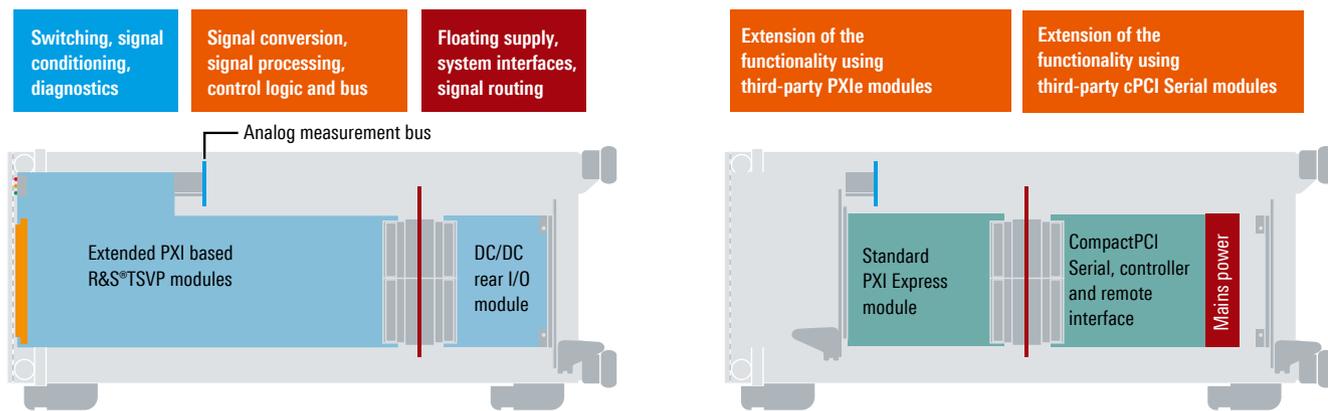## UNIVERSAL TEST AND MEASUREMENT CHASSIS
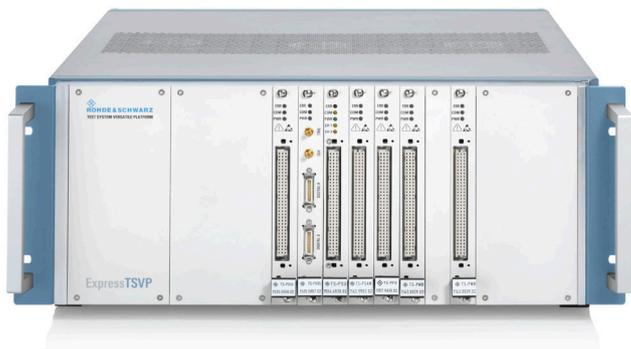
Open test platform based on PXI and PXI Express

The R&S®ExpressTSVP concept is a true innovation in state-of-the-art PC based instrumentation that still offers the traditional capabilities found in high-performance ATE systems. The versatile platform accelerates PXI and PXI Express (PXIe) usage in all major fields of automotive test and measurement applications. The additional PXIe standard enables the use of several third-party modules.

Key facts
▶ 21-slot multi-standard chassis
▶ 1 cPCI Serial system slot (rear)
▶ 1 cPCI Serial slot (rear)
▶ 5 PXI Express slots
▶ 13 PXI/cPCI/CAN slots with rear I/O
▶ 1 CAN bus slot with rear I/O
▶ Compact 4 HU 19" design
▶ PXI Express slots with up to PCIe x4 link
▶ cPCI Serial slot with PCIe x8 link
▶ Sophisticated analog measurement bus subsystem
▶ Compatible to R&S®CompactTSVP chassis, R&S®PowerTSVP chassis and Rohde & Schwarz T&M modules for R&S®TSVP

R&S®ExpressTSVP – PXIe and extended PXI system functionality

Switching, signal conditioning, diagnostics	Signal conversion, signal processing, control logic and bus	Floating supply, system interfaces, signal routing		Extension of the functionality using third-party PXIe modules	Extension of the functionality using third-party cPCI Serial modules

Analog measurement bus

Extended PXI based R&S®TSVP modules — DC/DC rear I/O module

Standard PXI Express module — CompactPCI Serial, controller and remote interface — Mains power

Analog measurement bus

The analog measurement bus offers short signal routing to measurement modules and electrical immunity to digital PCI backplanes.
The highly sophisticated analog signal handling led to the interconnection solution for the R&S®TSVP analog bus. The analog bus is directly above the front connector area with space for onboard signal conditioning and signal routing with coupling relays for the analog bus.
The eight lines of the system-wide analog measurement bus are available at extended PXI based R&S®TSVP module slots. They are used to temporarily connect DUT signals routed via switching modules and various measurement or stimulus modules that have access to the analog measurement bus.

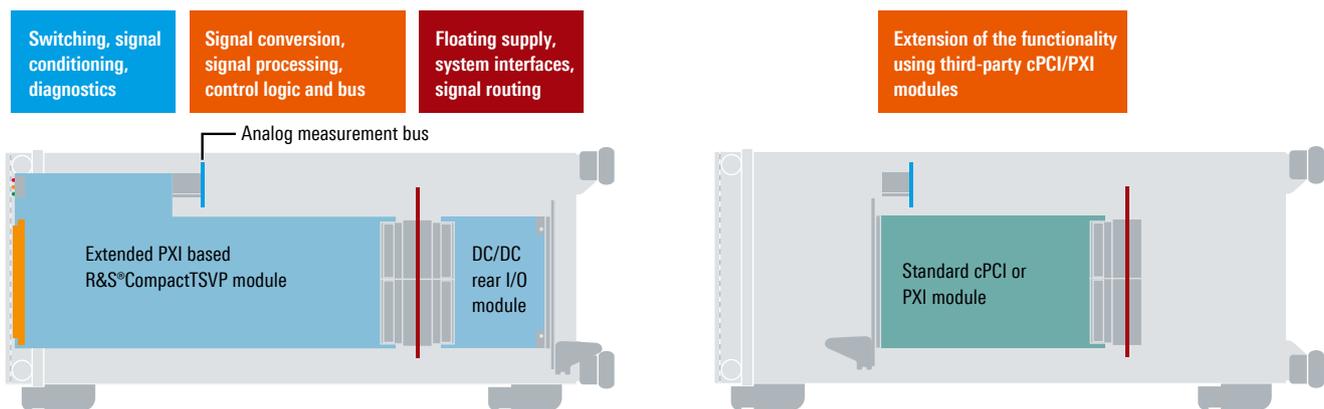# R&S®CompactTSVP
INDUSTRIAL TEST AND MEASUREMENT CHASSIS

Open test platform based on CompactPCI and PXI

The R&S®CompactTSVP concept is a true innovation in state-of-the-art PC based instrumentation that offers the traditional capabilities in high-performance ATE systems. The versatile platform accelerates CompactPCI and PXI adoption in all major industrial test and measurement application fields.

Key facts
▶ Modular instrument chassis for CompactPCI and PXI modules
▶ Standard 19" 4 HU rackmount enclosure for 3 HU CompactPCI modules
▶ CompactPCI backplane conforming to PICMG 2.0 Rev. 3.0 specification
▶ Rear I/O support for easy system cabling (IEEE 1101.11-1998)
▶ Sophisticated analog measurement bus subsystem
▶ Support of PXI trigger concept
▶ 14 peripheral slots for versatile instrumentation
▶ Mass interconnect interface in different sizes (optional)
▶ High pin count switching expansion by cascading an R&S®PowerTSVP chassis
▶ Rohde & Schwarz commitment to industrial standards

R&S®CompactTSVP – Extended cPCI/PXI system functionality

Switching, signal conditioning, diagnostics	Signal conversion, signal processing, control logic and bus	Floating supply, system interfaces, signal routing

Analog measurement bus

Extended PXI based R&S®CompactTSVP module

DC/DC rear I/O module

Extension of the functionality using third-party cPCI/PXI modules

Standard cPCI or PXI module

Analog measurement bus

The analog measurement bus offers short signal routing to measurement modules and electrical immunity to digital PCI backplanes. The highly sophisticated analog signal handling led to the interconnection solution for the analog bus of the R&S®CompactTSVP and R&S®PowerTSVP. 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 at all peripheral 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. It is implemented on a physically dedicated backplane located 160 mm from the digital CompactPCI/PXI backplane.

R&S®PowerTSVP

INDUSTRIAL HIGH-POWER AND SWITCHING APPLICATION CHASSIS


Open test platform based on CAN bus

The R&S®PowerTSVP chassis was created as a cost-efficient subsystem for high-power and switching applications. It can be used to build systems ranging from dedicated switching instruments to more complex switching applications in test and measurement systems. The chassis contains a mechanical frame, digital backplane, analog measurement bus, mains switching and filtering, power supply and diagnostic extensions controlled via CAN bus.

Key facts

▶ Modular switching instrument chassis
▶ Chassis extension for R&S®CompactTSVP or standalone
▶ Standard 19" rackmount 4 HU enclosure
▶ 16 peripheral slots for switching instrumentation and further dedicated instrumentation
▶ Rear I/O support for easy system cabling (IEEE 1101.11-1998)
▶ Sophisticated analog measurement bus subsystem
▶ Support of system-wide trigger concept
▶ Easily expandable ATE instrumentation and switching
▶ High pin count switching applications, e.g. for in-circuit test (ICT)
▶ High-power switching

General concept of the R&S®PowerTSVP module format

For example: R&S®RTB2004 oscilloscope

For example: R&S®NGP800 power supply series
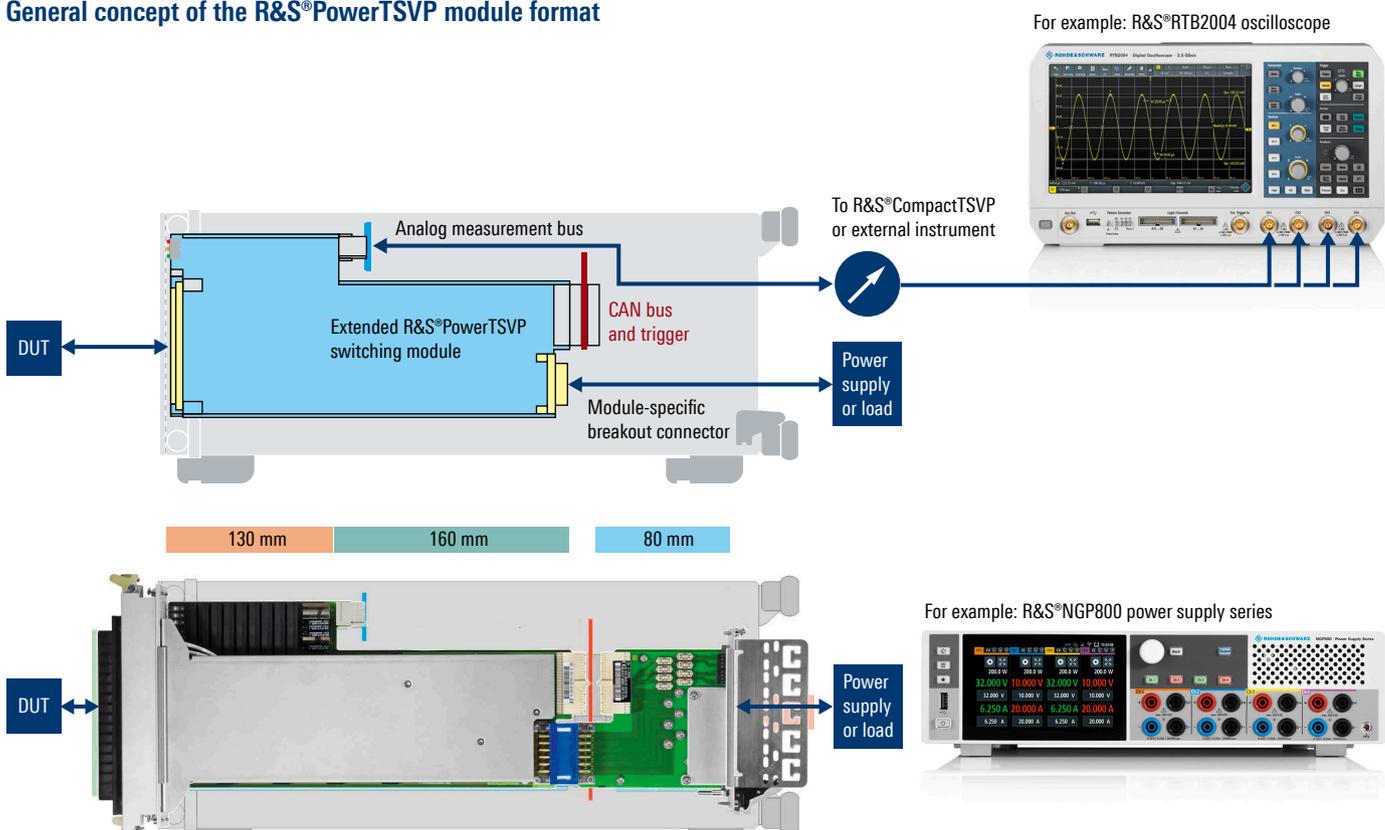
R&S®TSVP MODULES AND ACCESSORY PRODUCTS

SYSTEM CONTROLLER, BRIDGES AND EXTENSIONS

R&S®TS-PSCE1x system controller

CompactPCI Serial embedded system controller for R&S®ExpressTSVP

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.

Key facts
- ▶ Intel Xeon E3 1505MV6 processor
- ▶ 512 Gbyte SSD (R&S®TS-PSCE1S)
- ▶ Windows 10 operating system (R&S®TS-PSCE1W)

Specifications in brief
- ▶ Packaging: 3 HU single-slot CompactPCI Serial CPU board
- ▶ Processor: Intel Xeon E3 1505MV6 3.0 GHz/4.0 GHz
- ▶ RAM: 16 Gbyte DDR4 ECC
- ▶ SSD: M.2 2280, 512 Gbyte, SATA
- ▶ Computer interfaces
  - 2 × USB type C 3.1 Gen. 1
  - 2 × USB 3.0
  - 2 × 1 Gbit Ethernet
  - 2 × DisplayPort
- ▶ Operating system: Windows 10

R&S®TS-PSC7x system controller

CompactPCI embedded system controller for R&S®CompactTSVP

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.

Key facts
- ▶ Intel Core i5-8400H processor
- ▶ Includes rear I/O module
- ▶ 256 Gbyte SSD (R&S®TS-PSC7S)
- ▶ Windows 10 operating system (R&S®TS-PSC7W)

Specifications in brief
- ▶ Packaging: 3 HU dual-slot CompactPCI CPU board
- ▶ Processor: Intel Core i5-8400H 2.5 GHz
- ▶ RAM: 16 Gbyte DDRL SDRAM
- ▶ SSD: 2.5", 256 Gbyte, SATA
- ▶ Computer interfaces
  - 2 × USB 2.0
  - 1 × USB 3.0
  - 3 × 1 Gbit Ethernet
  - 1 × RS-232
  - 2 × DisplayPort
  - 1 × VG
- ▶ Operating system: Windows 10
- ▶ Suitable for R&S®CompactTSVP

Accessories

R&S®TSVP accessory products
See supplement order number 5040.7266.02

Mass interconnect receiver for the R&S®TSVP family
See user manual order number 5046.4023.02

R&S®TSVP MODULES AND ACCESSORY PRODUCTS

R&S®TS-PSC08 PCIe-to-cPCI bridge

Remote control via PCIe bridge
Desktop and industrial PCs equipped with
PCI Express extension slots can also be used as
a system controller for the R&S®ExpressTSVP/
R&S®CompactTSVP chassis.

The transparent downstream PCIe cable inter-
face is ready to run without software driver
installation and provides outstanding system
performance.

Specifications in brief
► Remote interface: PCI Express
► External host PC: PCI Express bus
► Implementation: transparent PCIe bridge
► Interface location: rear panel of
  R&S®ExpressTSVP/R&S®CompactTSVP
  chassis, controller slot 1

R&S®TS-PXB2 backplane extension module

R&S®TS-PXB2

**Flexible expansion of the R&S®CompactTSVP and
R&S®PowerTSVP with two additional CAN bus
slots**
The R&S®TS-PXB2 is a backplane extension
module for slots A1 and A2.

As a result, PXI slots can be kept free so that
they can be equipped with measurement mod-
ules. The cabling kit for the backplane option
also includes a breakout of the system CAN bus
on rear I/O slot 4 for controlling remote modules
directly in the test fixture.

Furthermore, the R&S®TS-PXB2 option can have
24 signals routed to the backplane of the instru-
ment, to the digital I/O ports 5, 6 and 7 of the
R&S®TS-PIO3B option.

Specifications in brief
► Expansion by means of two CAN bus slots at
  slots A1, A2 without linkup to the analog bus
► Breakout of the CAN bus to the rear panel
► Breakout of each of the 24 digital I/O
  channels of slots A1 and A2 on the
  rear panel
► Suitable for R&S®CompactTSVP and
  R&S®PowerTSVP

INSTRUMENTATION

R&S®TS-PSAM analog source and measurement module

Scanning multimeter and data acquisition unit
► Floating measurement of voltage, current
  (AC/DC) and resistance in 2 and 4 wire mode
► Analog in-circuit test with short, contact and
  continuity test
► Test of resistors, diodes, bipolar transistors,
  jumpers/switches and discharge of
  capacitors
► Measurement synchronization via PXI clock
  and trigger

Specifications in brief
► Voltage measurements
  – DC: up to ±120 V
  – AC: up to 50 V (RMS)
► Current ranges
  – DC: up to ±1 A
  – AC: up to 1 A (RMS)
► Resistance ranges: 1 Ω to 10 MΩ
► Sample rate: 0.01 sample/s to 200 ksample/s
► DC source: ±5 V, 100 mA, 4-quadrant
► Discharge unit: max. 120 V DC, 400 mA
► Suitable for R&S®ExpressTSVP/
  R&S®CompactTSVP
► Includes R&S®TS-PDC DC/DC converter
  RTM module

R&S®TS-PICT in-circuit test extension
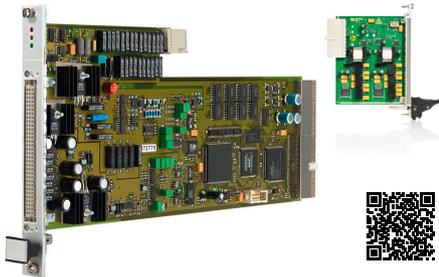
Analog ICT in conjunction with the R&S®TS-PSAM

▶ Testing of R, L, C, diodes, transistors, parallel R-C
▶ For guarded measurements in 3, 4 and 6 wire technology
▶ Measurement of inductors, capacitors and impedances

Specifications in brief

▶ AC source: referenced to GND
▶ Voltage: 0.1 V, 0.2 V, 1.0 V
▶ Voltage offset: off, pos., neg.
▶ Impedance: 1 Ω, 10 Ω, 1 kΩ, 10 kΩ
▶ Frequency: DC, 100 Hz, 1 kHz, 10 kHz
▶ Measurement unit: referenced to GND
▶ Current ranges: 1 µA to 200 mA
▶ Sample rate: max. 200 ksample/s
▶ Working voltage: max. 60 V DC
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP
▶ Includes R&S®TS-PDC DC/DC converter RTM module

R&S®TS-PIO2 analog and digital I/O module

Analog and digital 16-channel stimulus and measurement unit for mixed signal DUT testing

▶ Analog and digital signal acquisition with high measurement resolution of 24 bit for level ranges up to ±27 V
▶ Sampling rate of up to 5 ksample/s for inputs and outputs
▶ Autocorrection feature for all input and output channels
▶ Analog and digital stimulus outputs, offering static and dynamic signal outputs
▶ 16 bit resolution, high output level up to ±27 V
▶ Versatile signal switching and DUT interconnection
▶ Stimulus and acquisition channels providing floating operation

Specifications in brief

▶ Output channels: 16, in 4 groups, floating high/low voltage: ±27 V/±27 V (L per group)
▶ Current/channel: 12 × 15 mA, 4 × 100 mA
▶ Modes: analog, digital, frequency
▶ Input channels: 16, in 4 groups, floating
▶ High/low threshold: ±27 V/±27 V (both per group)
▶ Data buffer: 4 × 5 ksample (A_{out}/D_{out}/A_{in}/D_{in})
▶ Sample rate: 0.01 sample/s to 5 ksample/s
▶ Suitable for R&S®CompactTSVP and R&S®PowerTSVP
▶ Includes R&S®TS-PDC DC/DC converter RTM module

R&S®TS-PIO3B digital I/O module and R&S®TS-PTRF signal port and transmission module

Digital control and coil driver with power outputs

The R&S®TS-PIO3B is a versatile digital I/O module with 64 (model .02) or 40 (model .04) channels. It offers eight ports with eight digital I/O lines each that have MOSFET output drivers. The circuitry is designed to drive RF relays with all common control voltages. The high current-carrying capacity makes the module a universal coil driver. An SPI interface allows users to control external SPI modules.

Transmission to the R&S®TS-PTRF front module is designed to either route digital signals to the front connector or distribute digital ports to control auxiliary modules, e.g. R&S®TS-PXM1.

Specifications in brief

▶ Digital I/O channels
  – 64, in 8 groups (model .02)
  – 40, in 5 groups (model .04)
▶ Voltage: 0 V to 35 V
▶ Current output: max. 200 mA per bit, 1 A per port
▶ Analog inputs: 8
▶ Level range : 0 V to 5 V
▶ Resolution: 10 bit
▶ Accuracy: ±(100 mV + 5 %)
▶ SPI interface: SPI SCLK
  MOSI 5 V TTL output with 300 Ω series
  MISO 5 V TTL input
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP

Easy deployment by sophisticated software

▶ Self-test software
▶ Soft front panels for immediate use
▶ LabWindows/CVI device driver support
▶ Test software library R&S®GTSL in DLL format

R&S®TSVP MODULES AND ACCESSORY PRODUCTS

R&S®TS-PIO4 32-channel programmable digital I/O module
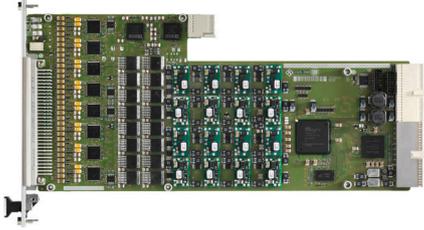
Flexibly programmable 32 bit digital inputs and 32 bit digital outputs that are able to acquire and generate static or dynamic digital patterns
▶ 32 digital input and 32 digital output channels
▶ 40 MHz sample rate, depending on levels and number of channels
▶ FPGA based flexibility and real-time task execution independent of operating system
▶ 8 groups of 4 channels each: –6 V to +10 V
▶ Tristate control for every output channel in dynamic mode
▶ Programmable DIO level (high and low) per group with 14 bit resolution
▶ Two programmable input threshold levels per group for hysteresis or level monitoring
▶ High output current with 150 mA per channel
▶ Synchronization/triggering (bidirectional) via PXI trigger bus or XTI (TTL)
▶ External clock input via EXT_CLK input pin (TTL)

Specifications in brief
▶ Output channels: 32, in 8 groups of 4 bit
▶ Voltage/group: –6 V to +10 V, tristate
▶ High output current with 150 mA per channel
▶ Input channels: 32, in 8 groups of 4 bit
▶ Threshold/group: –6.0 V to 7.1 V
▶ Sample rate: 0.01 sample/s to 40 Msample/s
▶ Resolution: 12.5 ns
▶ Data buffer: 2 Msample at 32 bit
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP

Easy deployment by sophisticated software
▶ Self-test software
▶ Soft front panels for immediate use
▶ LabWindows/CVI device driver support
▶ Test software library R&S®GTSL in DLL format

R&S®TS-PIO5 LVDS digital functional test module
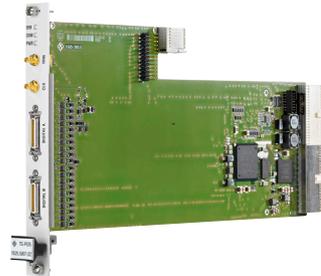
Very flexibly programmable bidirectional LVDS channels to acquire and generate static or dynamic digital patterns
▶ Two MDR connectors with 10 LVDS channels each (8 × data, 1 × general purpose, 1 × clock); bidirectional LVDM with fixed termination (100 Ω) onboard
▶ Two single-ended control lines per connector
▶ 10 RS-485 (RS-422) compatible I/O channels with interface connector onboard
▶ Stimulation with digital real-time data streams with 2 Mpattern (32 bit) memory onboard
▶ Acquisition of real-time digital data streams
▶ LVDS transceivers with internal ESD protection
▶ FPGA based flexibility and simultaneous task operation independent of the operating system

Specifications in brief
▶ 5 V/max. 0.30 A power supply available at each digital connector, protected by a diode and fuse
▶ Pattern rate up to 200 Mbit, 5 ns resolution
▶ Triggering (bidirectional) via PXI trigger bus; resolution based on PXI or external clock, ≥ 10 ns
▶ Synchronization via
   – TTL external clock input (SMB plug)
   – LVDS clock lines (MDR connector)
   – PXI clock 10 MHz
▶ Jitter and signal delay compensation in steps of typically 2.5 ns, 180° phase shift or delay of numerous clock cycles (combination possible)
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP

Easy deployment by sophisticated software
▶ Self-test software
▶ Software front panels for immediate use
▶ LabWindows/CVI device driver support
▶ Test software library R&S®GTSL in DLL format

R&S®TS-PFG function generator module

Dual-channel arbitrary waveform generator with isolated outputs

- ▶ Arbitrary waveform generator module with two floating signal outputs and independent channel isolation
- ▶ High output level range up to 40 V (V_{pp})
- ▶ High sampling rate of 25 Msample/s per channel
- ▶ Output of standard waveforms up to 1 MHz sine, square, triangle, arbitrary waveform
- ▶ Sequencing of multiple memory sections and multiple repetitions

Specifications in brief

- ▶ Channels: 2, fully independent, floating, cascadable
- ▶ Voltage ranges: ±1 V, ±5 V, ±10 V, ±20 V
- ▶ Voltage resolution: 16 bit
- ▶ Output current: max. 250 mA
- ▶ Data buffer: 1 Msample per channel
- ▶ Sample rate: 0.01 sample/s to 25 Msample/s
- ▶ Standard waveforms: sine wave, triangle, square wave (1 Hz to 1 MHz), DC static
- ▶ Pulse: min. 500 ns (1 % to 99 %)
- ▶ Output ranges: ±1 V to ±20 V, max. 40 V (V_{pp})
- ▶ Output current: max. ±250 mA
- ▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP
- ▶ Includes R&S®TS-PDC DC/DC converter RTM module

R&S®TS-PAM signal analyzer module

Eight-channel digitizer and waveform analyzer

- ▶ Digitizer module featuring two fully independent, floating acquisition units
- ▶ Acquisition modes with up to eight single-ended or four differential channels
- ▶ High sampling rate of 20 Msample/s for each acquisition unit
- ▶ Multichannel signal recording for up to eight channels at 5 Msample/s
- ▶ Synchronous acquisition of eight programmable comparator signals and PXI trigger
- ▶ Wide dynamic range with 14 bit resolution

Specifications in brief

- ▶ Acquisition units: 2, fully independent and floating
- ▶ Data buffer: 1 Msample per acquisition unit
- ▶ Channels per unit: 4
- ▶ Voltage ranges: ±0.2 V to 100 V (per channel)
- ▶ Resolution: 14 bit
- ▶ Sample rate: 0.02 sample/s to 20 Msample/s
- ▶ Relay multiplexer: 3:1 per channel
- ▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP
- ▶ Includes R&S®TS-PDC DC/DC converter RTM module

R&S®TSVP MODULES AND ACCESSORY PRODUCTS

R&S®TS-PSU power supply and load module

Four-quadrant source with integrated measurement unit
- Two independent, floating channels of four-quadrant sources with separate sensing per channel
- Programmable current and voltage limiting
- Integrated voltage and current measurement unit per channel
- Electronic load simulation of 20 W per channel
- Output and recording of voltage and current profiles
- Protection against overvoltage, overcurrent, overtemperature and short circuits
- 4-to-1 relay multiplexer for force and sense lines of each channel

Specifications in brief
- Output channels: 2, floating, fully independent, 4 quadrants, cascadable
- Voltage ranges: ±15 V, ±50 V (16 bit)
- Current ranges: 10 mA, 100 mA, 3 A (16 bit)
- Data buffer: 2 × 10 ksample (V_{out}/I_{out})
- Measurement unit: voltage or current
- Data buffer: 10 ksample
- Sample rate: 0.01 sample/s to 10 ksample/s
- Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP
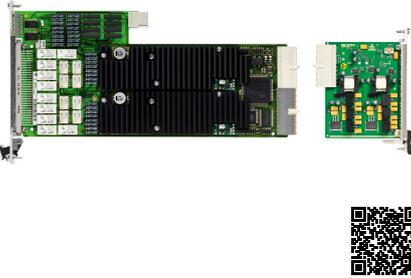
R&S®TS-PSU12 power supply and load module

Four-quadrant source with integrated measurement unit
- Two independent, floating channels of four-quadrant sources with separate sensing per channel
- Programmable current and voltage limiting
- Same feature set as the R&S®TS-PSU but with R&S®TS-PDC internal primary power supply

Specifications in brief
- Output channels: 2, floating, fully independent, 4 quadrants, cascadable
- Voltage ranges: ±12 V (16 bit)
- Current ranges: 10/100/500 mA (16 bit)
- Data buffer: 2 × 10 ksample (V_{out}/I_{out})
- Measurement unit: voltage or current
- Data buffer: 10 ksample
- Sample rate: 0.01 sample/s to 10 ksample/s
- Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP
- Includes R&S®TS-PDC DC/DC converter RTM module

SIGNAL ROUTING AND SWITCHING

R&S®TS-PMB switch matrix module

High-density, 90-channel, full matrix relay-multiplexer module
The R&S®TS-PMB sets up test channels for functional and in-circuit tests. It provides all signal routing between DUT and measurement modules via the analog bus.

The general-purpose switch matrix module can handle input signals up to 1 A. It provides self-test capability and fast switching of signal paths.

Specifications in brief
- Switching: relay, full matrix
- Configuration: 90 channels to 2 × 4 buses
- Deployed as
  - Single matrix: 90 pins to 4 bus lines
  - Single matrix: 45 pins to 8 bus lines
  - Dual matrix: 45 pins to 4 bus lines
- Analog measurement bus access to 8 bus lines
- Voltage: max. 120 V DC
- Current: max. 1 A
- Power: max. 10 W
- Switch time: 0.5 ms (incl. bouncing)
- Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP
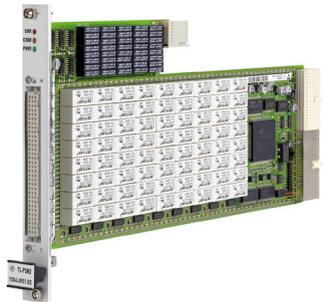
R&S®TS-PSM1 power switching module

High-power multiplexer and multiple DUT power switching module
▶ Power switching module for supplies and loads
▶ Can handle voltages up to 70 V with
  – 8 high-power channels with max. 16 A
  – 10 power channels with max. 2 A
  – 4 high-power 4-to-1 multiplexer channels with max. 16 A
▶ Indirect high-current measurements on high-power channels via shunt resistors; routing of corresponding voltage via analog measurement bus
▶ Self-test of all relays via analog measurement bus and R&S®TS-PSAM

Specifications in brief
▶ Switching: high-power (HP) and medium-power (MP) relays
▶ Configuration MP
  – 10 × SPST front – front/rear
▶ Configuration HP
  – 8 × SPST rear – front, shunt
  – 2 × SP 4:1 MUX front – front
  – 2 × SP 4:1 MUX rear – rear
▶ Voltage: max. 60 V DC
▶ Current MP/HP: max. 2 A/16 A
▶ Power MP/HP: max. 150 W/480 W
▶ Switch time MP: 5 ms (incl. bouncing)
▶ Switch time HP: 10 ms (incl. bouncing)
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP

R&S®TS-PSM2 multiplex and switch module

Medium-power multiplexer and switching module
▶ Medium-power switching module for voltages up to 2 A
▶ Eight independent groups of 3 SPST/1 SPDT relay channels or 4-to-1 DPST relay multiplexers
▶ Relay multiplexers can be cascaded via local power buses
▶ Indirect current measurements on each SPxT channel via shunt resistors
▶ Direct current measurements up to 1 A on all channels via the analog measurement bus and R&S®TS-PSAM

Specifications in brief
Switching: 8 independent relay groups
▶ Configuration
  – 3 × SPST + SPDT, shunt or
  – DP 4:1 MUX
▶ Voltage: max. 120 V DC
▶ Current: max. 2 A
▶ Power: max. 60 W
▶ Switch time: 5 ms (incl. bouncing)
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP

R&S®TS-PSM3 high-power switching module

Automotive DUT supply and load switching up to 30 A
▶ 8 high-power channels for currents up to 30 A
▶ 8 medium-power channels for currents up to 2 A
▶ Integrated current measurement via current sensors and analog bus coupling
▶ Rear I/O access to the power signals for unique flexibility during system integration and seamless adaptation to power supplies and loads within a system paradigm based on R&S®PowerTSVP
▶ Unique comprehensive self-test and measurement of relay contact resistance

Specifications in brief
▶ Maximum operating voltage
  – Channel to channel, max. 87 V DC
  – Channel to GND, max. 63 V DC
▶ High-power channels
  – Switching current: max. 30 A
  – Switching power: max. DC: 900 W
  – Operate/release time: typ. < 8 ms
▶ Medium-power channels
  – Switching current: max. 2 A
  – Switching power: max. DC: 60 W
  – Operate/release time: typ. < 6 ms
▶ Adaptation to R&S®TS-PRIO3 rear I/O module
▶ All high-power and medium-power channels
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP

R&S®TSVP MODULES AND ACCESSORY PRODUCTS

R&S®TS-PSM4 multiplex and switch module

Power multiplexer and DUT power switching module
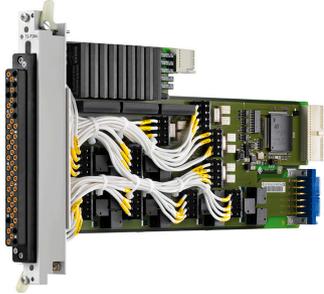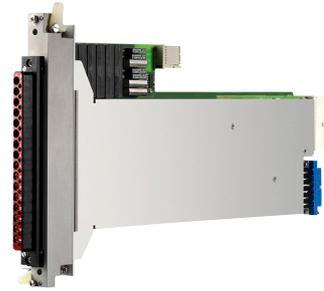
▶ 12 high-power channels for currents up to 16 A
▶ 8 medium-power channels for currents up to 2 A
▶ Integrated current measurement via shunt resistors and analog bus coupling
▶ Rear I/O access to the power signals for unique flexibility during system integration and seamless adaptation to power supplies and loads within a system paradigm based on R&S®PowerTSVP
▶ Unique comprehensive self-test and measurement of relay contact resistance

Specifications in brief

▶ Maximum operating voltage
  – Channel to channel, max. 117 V DC
  – Channel to GND, max. 105 V DC
▶ High-power channels
  – Switching current, max. 16 A
  – Switching power: max. DC: 480 W
  – Operate/release time: typ. < 4 ms
▶ Medium-power channels
  – Switching current: max. 2 A
  – Switching power: max. DC: 60 W
  – Operate/release time: typ. < 6 ms
▶ Adaptation to R&S®TS-PRIO2 rear I/O module
  – All high-power and medium-power channels

R&S®TS-PSM5 high-power switching module

Automotive DUT supply and load switching up to 50 A

▶ 4 high-power channels for currents up to 50 A
▶ 4 medium-power channels for currents up to 2 A
▶ Integrated current measurement via current sensors and analog bus coupling
▶ Rear I/O access to the power signals for unique flexibility during system integration and seamless adaptation to power supplies and loads within a system paradigm based on R&S®PowerTSVP
▶ Unique comprehensive self-test and measurement of relay contact resistance

Specifications in brief

▶ Maximum operating voltage
  – Channel to channel, max. 87 V DC
  – Channel to GND, max. 63 V DC
▶ High-power channels
  – Switching current: max. 50 A
  – Switching power: max. DC: 1120 W
  – Operate/release time: typ. < 14 ms
▶ Medium-power channels
  – Switching current: max. 2 A
  – Switching power: max. DC: 60 W
  – Operate/release time: typ. < 6 ms
▶ Adaptation to R&S®TS-PRIO5 rear I/O module
  – All high-power and medium-power channels

R&S®TS-PXM1 switching extension module

General-purpose switching extension of the R&S®TS-PIO3B digital I/O module

▶ Breakout and routing of internal signals from adjacent PXI modules, e.g. boundary scan lines
▶ Discrete wiring of DUTs with auxiliary voltages in the functional test
▶ Connection of load resistances to DUT outputs
▶ Simple control via one R&S®TS-PIO3B control port each for up to eight R&S®TS-PXM1 switching extension modules
▶ Can be used on slots A1 to A4, which in the past were ordinarily not used for DUT connections and in front of controller slots 1 and 2; if needed, PXI slots can be kept free for additional measurement modules

Specifications in brief

▶ Relay organization: 8 × 4PDT
▶ Switching voltage: max. 30 V DC
▶ Switching current: max. 2 A
▶ Switching power: max. 60 W
▶ Relay control: 8 bit, low active
▶ Suitable for R&S®ExpressTSVP/ R&S®CompactTSVP and R&S®PowerTSVP

REAR I/O INSTRUMENT EXTENSIONS

R&S®TS-PRIOx rear I/O instrument extensions

R&S®TS-PRIO4, rear I/O transmission module
for R&S®TS-PIO3B and R&S®TS-PMB

R&S®TS-PRIO3, rear I/O module for R&S®TS-PSM3

The R&S®TS-PRIOx modules are a ruggedized implementation of modular rear I/O switching module extensions to make high-current switching an intrinsic part of the test system.

► Distribution of one power supply to multiple DUTs
► Flexible distribution of power supplies to DUTs including sense lines via medium-power relays
► Connection of test loads, original loads or simulated and electronic actuators in automotive test scenarios
► Multiplexing of power supplies and electronic loads

Specifications in brief
► Feedthrough from rear panel to switching module
► All switching lines typically supported
► In conjunction with power switch modules, both force and sense lines are supported
► High-power rear I/O provides mounting brackets for ground terminals

Switching modules	Suitable rear I/O	Suitable rear I/O for PXI based R&S®TSVP models
R&S®TS-PIO3B, R&S®TS-PTR	R&S®TS-PRIO4	R&S®TS-PRIO4
R&S®TS-PMB, R&S®TS-PSM2	R&S®TS-PRIO	R&S®TS-PRIO
R&S®TS-PSM3	R&S®TS-PRIO3	R&S®TS-PRIO4 (mandatory for slots 5/6 to 13/14)
R&S®TS-PSM4	R&S®TS-PRIO2	R&S®TS-PRIO4 (mandatory for slots 5 to 14)
R&S®TS-PSM5	R&S®TS-PRIO5	R&S®TS-PRIO4 (mandatory for slots 5/6 to 13/14)

IN-SYSTEM CALIBRATION

R&S®TS-ISC in-system calibration kit

On-site calibration solution for the R&S®CompactTSVP
The R&S®TS-ISC in-system calibration kit contains the basic tools needed to calibrate any of the modular instruments in the R&S®TSVP product family. The most important benefit for factory systems being able to calibrate while the modules remain in the instrument chassis slots. A dedicated, highly accurate multimeter is also needed for corresponding measuring accuracy during calibration.

Specifications in brief
The R&S®TS-ISC in-system calibration kit includes the following:
► R&S®TS-PCAL2 calibration module
► Calibration adapters
  – R&S®TS-PCALA
  – R&S®TS-PCALB
  – R&S®TS-PCALC
► R&S®TS-PKL cable for connecting the adapters to the external multimeter

R&S®TS-PCAL2 calibration module

On-site calibration module for chassis rear I/O
The R&S®TS-PCAL2 calibration module provides traceable calibration signals and can be integrated into multiple chassis on the factory floor so that each R&S®CompactTSVP can be calibrated on site without changing the module configuration.

An onboard relay multiplexer connects components to analog bus lines on an R&S®TS-PMB module installed in front of the R&S®TS-PCAL2 module.

Specifications in brief
The R&S®TS-PCAL2 has the following functions:
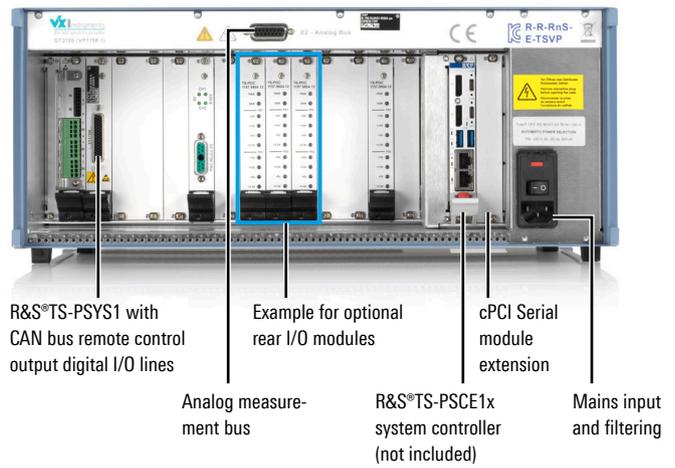► Floating 5 V reference source
► Three reference resistors for resistance measurements
► Ground-referenced current source, adjustable up to 1 A current measurements
► Floating signal generator for dynamic measurements of
  – DC: −40 V to +40 V
  – AC, sinusoidal:
    2 V to 80 V (V_{pp}), from 20 Hz to 50 kHz;
    0.2 V to 2 V (V_{pp}), from 50 kHz to 1 MHz

SLOTS AND ARCHITECTURE

R&S®ExpressTSVP front view

Combined PXIe and cPCIe backplane

Rohde & Schwarz instrument line connector

Combined PXI-1 and cPCI backplane

Analog measurement bus
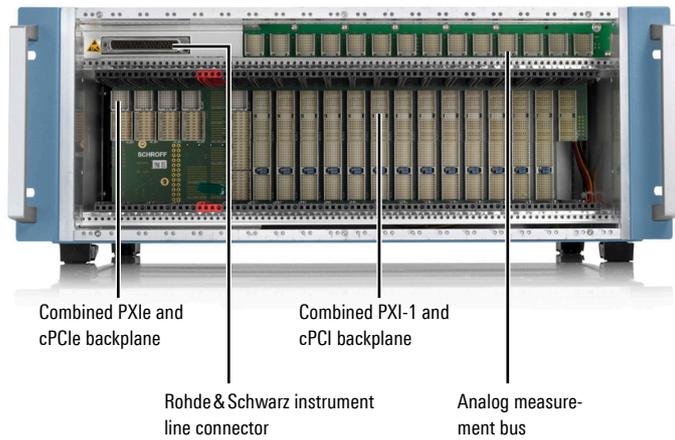
R&S®ExpressTSVP rear view

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

Analog measurement bus

Example for optional rear I/O modules

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, while slot A5 can have a 2-slot module.

Slots S3 to S16 contain a PXI-1/CompactPCI interface in combination with a CAN bus, analog bus and rear I/O connection known from the R&S®CompactTSVP, while slot S16 is limited to CAN and analog bus interfaces 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 very helpful 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 in the R&S®TSVP product line or commonly used off-the-shelf cPCIe/cPCI based products.
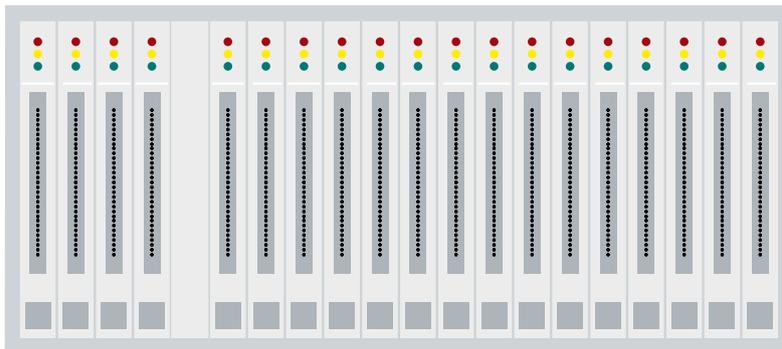
Front	A1	A2	A3	A4	A5	A6	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
PXIe	███	███	███	███		███														
cPCI							███	███	███	███	███	███	███	███	███	███	███	███		
PXI							███	███	███	███	███	███	███	███	███	███	███	███		
CAN							███	███	███	███	███	███	███	███	███	███	███	███	███	
Analog 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	███	███	███	███																

System backplane architecture for the R&S®ExpressTSVP

SLOTS AND ARCHITECTURE

R&S®CompactTSVP front view

R&S®TS-PCPA optional power supply extension kit

R&S®TS-PSP1 included with chassis

R&S®TS-PSC7x system controller (not included)

Combined cPCI and PXI backplane

Analog measurement bus

Dedicated slot for switching module (slot 16)

R&S®CompactTSVP rear view

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

Example for optional rear I/O modules

System controller rear I/O module

Analog measurement bus

Mains input and filtering
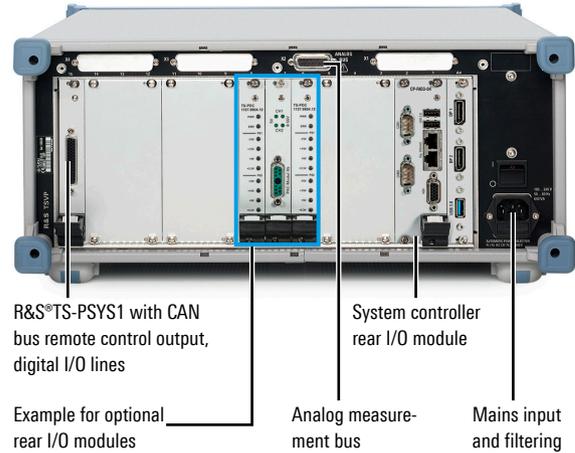
Versatile backplane architecture

The R&S®CompactTSVP test and measurement chassis forms the control backplane with 14 peripheral slots in line with the CompactPCI specification PICMG 2.0 rev. 3.0 with CompactPCI rear I/O support for RTM modules.

Eleven slots also support special PXI features (PCI eXtensions for Instrumentation).

The CompactPCI standard 32 bit design makes it possible to route module-specific signals via the RTM concept to the rear of the test platform without special cabling. Slots 3 and 4 support the RTM feature instead of PXI, making

the feature possible. The rear side cabling is a big help when using a 19" rackmountable standard test adapter, available for the R&S®CompactTSVP as a set of off-the-shelf products, ready for use in production testing. Slots 5 to 15 have PXI triggering features and a high-precision 10 MHz system clock for synchronization.

The backplane concept is very flexible when integrating either the ATE instrumentation modules in the R&S®CompactTSVP product line or common off-the-shelf CompactPCI based products.
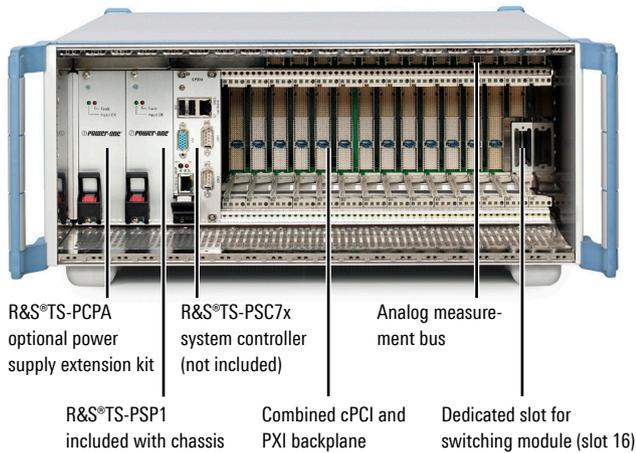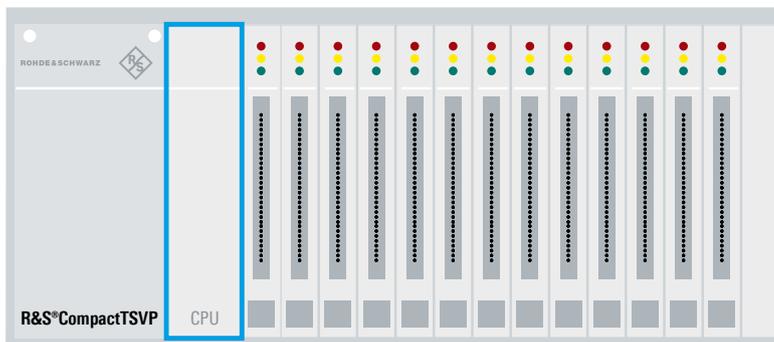

Bus \ Slot	A1	A2	A3	A4	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CompactPCI					█		█	█	█	█	█	█	█	█	█	█	█	█	█	
PXI					█				█	█	█	█	█	█	█	█	█	█	█	
CAN bus									█	█	█	█	█	█	█	█	█	█	█	
Analog bus					█		█	█	█	█	█	█	█	█	█	█	█	█	█	
Rear I/O					█	█														
DC/DC rear I/O									█	█	█	█	█	█	█	█	█	█	█	
Power supplies	█	█	█	█																

System backplane architecture for the R&S®CompactTSVP

ORDERING INFORMATION

Designation	Type	Order No.
Modular instrument chassis		
R&S®ExpressTSVP universal test and measurement chassis	R&S®ExpressTSVP	1158.1542K02
R&S®CompactTSVP industrial test and measurement chassis	R&S®CompactTSVP	1152.2518.02
R&S®PowerTSVP industrial high-power and switching application chassis	R&S®PowerTSVP	1157.8043.02
System controller and extension		
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	1544.7701.04
System controller, for R&S®ExpressTSVP with SSD and Windows 10 IoT	R&S®TS-PSCE1W	1544.7701.06
System controller, for R&S®CompactTSVP	R&S®TS-PSC7	1512.4771.02
System controller, for R&S®CompactTSVP with SSD	R&S®TS-PSC7S	1512.4771.04
System controller, for R&S®CompactTSVP with SSD and Windows 10 IoT	R&S®TS-PSC7W	1512.4771.06
Backplane extension module, for R&S®CompactTSVP and R&S®PowerTSVP	R&S®TS-PXB2	1512.3600.02
USB-to-CAN interface, for R&S®PowerTSVP	–	2099.2961.00
PCIe-to-cPCI bridge		
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
cPCI remote controller, for R&S®CompactTSVP	R&S®TS-PSC08-B	1512.4759.22
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
Instrumentation		
Analog source and measurement module	R&S®TS-PSAM	1142.9503.02
In-circuit test extension	R&S®TS-PICT	1158.0000.02
Analog and digital I/O module	R&S®TS-PIO2	1504.4801.02
Digital I/O module	R&S®TS-PIO3B	1512.4407.02
Signal port and transmission module	R&S®TS-PTRF	1512.3800.02
Signal transmission module	R&S®TS-PTR	1512.4407.03
32-channel programmable digital I/O module	R&S®TS-PIO4	1525.5559.02
LVDS digital functional test module	R&S®TS-PIO5	1525.5807.02
Function generator module	R&S®TS-PFG	1157.9610.02
Signal analyzer module	R&S®TS-PAM	1157.9410.02
Power supply and load module	R&S®TS-PSU	1504.4530.02
Power supply and load module	R&S®TS-PSU12	1504.4530.03
Signal routing and switching		
Switch matrix module	R&S®TS-PMB	1143.0039.02
Power switching module	R&S®TS-PSM1	1143.0139.02
Multiplex and switch module	R&S®TS-PSM2	1504.4901.02
High-power switching module	R&S®TS-PSM3	1519.2516.03
Multiplex and switch module	R&S®TS-PSM4	1519.2622.03
High-power switching module	R&S®TS-PSM5	1519.2768.03
Switching extension module	R&S®TS-PXM1	1512.4007.02

Designation	Type	Order No.
Rear I/O instrument extensions		
Rear I/O instrument extension, for R&S®TS-PIO3B, R&S®TS-PTR	R&S®TS-PRIO4	1510.8005.04
Rear I/O instrument extension, for R&S®TS-PMB, R&S®TS-PSM2	R&S®TS-PRIO	1510.8005.02
Rear I/O instrument extension, for R&S®TS-PSM3	R&S®TS-PRIO3	1519.2845.02
Rear I/O instrument extension, for R&S®TS-PSM4	R&S®TS-PRIO2	1519.3070.02
Rear I/O instrument extension, for R&S®TS-PSM5	R&S®TS-PRIO5	1519.3112.02
In-system calibration		
In-system calibration kit	R&S®TS-ISC	1505.2502.02
Calibration module	R&S®TS-PCAL2	1505.2519.02

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