Production Test Platform TSVP

Test System Versatile Platform

- Integration of external and internal devices in line with test department requirements
- Standardized fixture interface
- Optional exchangeable fixture head
- Maximum configuration with 31 slots
- Conforming to PICMG 2.0 Rev. 2.1 Specification (CompactPCI)
- PXI backplane to PXI Specification Rev. 1.0
- Internal analog and trigger bus
- Integrated selftest concept, self-monitoring
- Full support of LabWindows/CVI and TestStand

ROHDE & SCHWARZ

TSVP highlights

- Standardized interface
- Optional exchangeable fixture head
- System monitoring functions (e.g. system temperature, power supplies)
- Extensive integrated selftest concept
- Signal bus system (analog bus, trigger bus)
- Simple signal routing concept for integration of external devices

Introduction

TSVP is a standardized modular platform for the adaptation and electrical testing of subassemblies and units in production environments. The high-performance system accommodated in a compact 19" enclosure (4 HU) has a maximum configuration of 31 modules to the CompactPCI (CPCI) or PXI standard.

TSVP's main purpose is to standardize all the switching functions and basic measurement functions used by practically all T&M systems in facilities producing electronic subassemblies and units. TSVP was designed mainly with modularity, flexibility of configuration and scalability in mind, so as to offer tailor-made solutions for a wide variety of applications. This does away with expensive hardware and software overheads.

A unique feature of TSVP is the exclusive use of industry standards available worldwide (hardware: CPCI/PXI, software: LabWindows/CVI and TestStand), which were given a wider scope exclusively for production testing. It has thus become possible to use the industry standards where stringent production requirements have to be met.

TSVP is the first single platform to provide a cost-effective system kernel for practically all test applications, and so cuts the high costs that would be involved in using many different systems. TSVP is an economical choice even for development labs, as it features open system architecture and flexibility at a favourable price. This opens up entirely new vistas because test segments as well as laboratory-generated test sequences can be used both in the lab and in production, thus reducing overall production time.

Moreover, compatibility of laboratory and production test equipment produces synergies that save both time and money:

- Test specifications can be generated on a compatible system
- Verification of test sequences in production is, for the most part, not required
- Test problems encountered in production can be reproduced in the lab

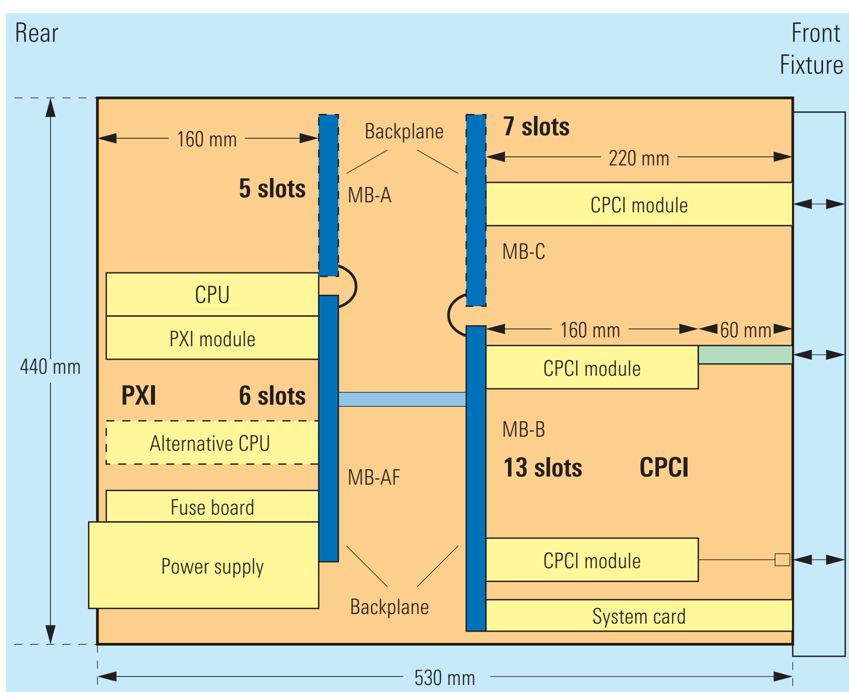


Fig. 1: Top view of TSVP

System concept

TSVP provides all the required hardware functions such as system controller and AF and RF signal routing. The optional software comprises a standardized user interface (LabWindows/CVI, National Instruments) and standardized test sequence control (TestStand, National Instruments). The straightforward internal signal routing concept for external extensions (patented) allows fast module replacement during servicing. A standardized exchangeable fixture head can be attached to the frame as an option. The system, cabling and plug-in modules are checked by a built-in selftest.

The system comprises several CPCI or PXI segments (scalability), which may be combined to form a system or can operate as independent single or combined subsystems. This means that requirements of the future – like parallel testing – can be met today.

Fig. 2: Integration of standard CPCI modules

System configurations

The modular and scalable design of TSVP allows many basic system configurations which can be divided into two main categories:

- Measurement-oriented system configurations: basic version PCA 4
- Multi-CPU system configurations: basic version PCA 5

Different configurations are implemented by adding or removing individual segments. The segments are interconnected by means of bridges.

Fig. 1 is a block diagram of a fully configured TSVP (31 slots) with a variety of CPCI/PXI segments. The system CPU can be fitted on the right or left of TSVP as it is detected automatically.

The front segments are CPCI backplanes with direct access to the fixture interface. TSVP is an extra 60 mm deep (compared with commercial CPCI module frames) so that the module-specific connections can be adapted to the standardized interface using a set of special cables (Fig. 2). Twenty CPCI slots are then available at the front.

The fuse board (Fig. 3) provides additional internal monitoring functions, e.g. system temperature and supply-voltage monitoring. Thanks to an alarm service, this information can be processed further in the system controller. A system card also provides functions for in-depth selftesting of the system.

The optional system card is therefore strongly recommended for all measurement-oriented configurations.

The rear segments are PXI backplanes with a total of 11 slots. Not only PXI but also CPCI modules can be installed. The outstanding feature of TSVP is its backplane architecture offering up to 31 CPCI/PXI slots. The modular concept permits a wide variety of system configurations to be realized, even multiprocessor systems with up to five CPUs.

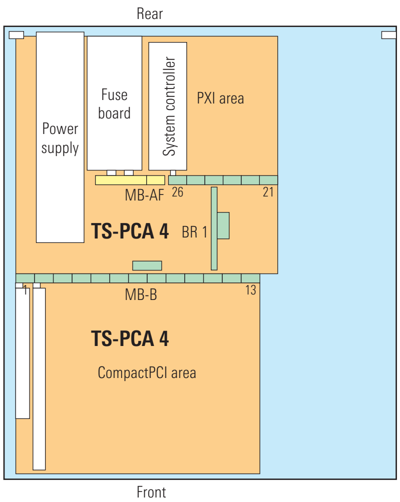
The main configurations of TSVP are presented in the following.

Fig. 3: Fuse board

Measurement-oriented system configurations

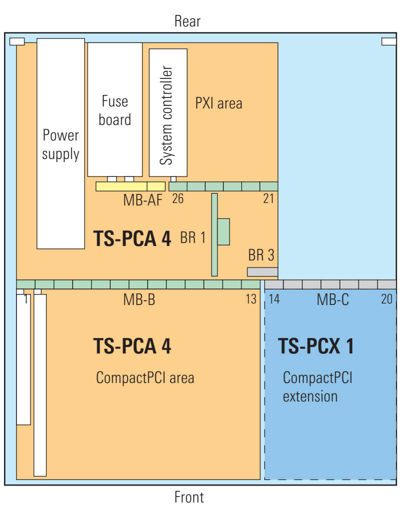
Basic version PCA4

- 13 CPCI slots
- 6 PXI slots

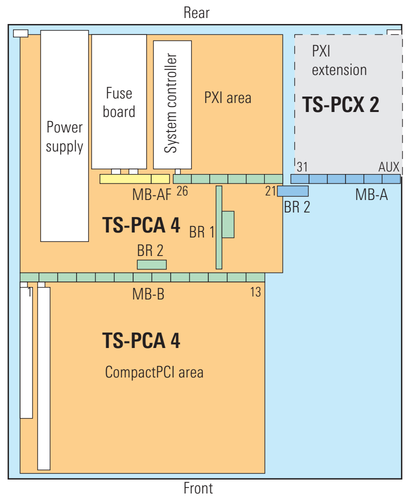


1-subsystem versions

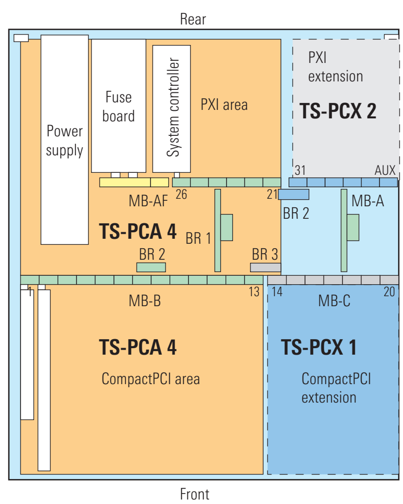
- Scanner extension PCX1
  - 20 CPCI slots
  - 6 PXI slots



- Test module extension PCX2
  - 13 CPCI slots
  - 11 PXI slots

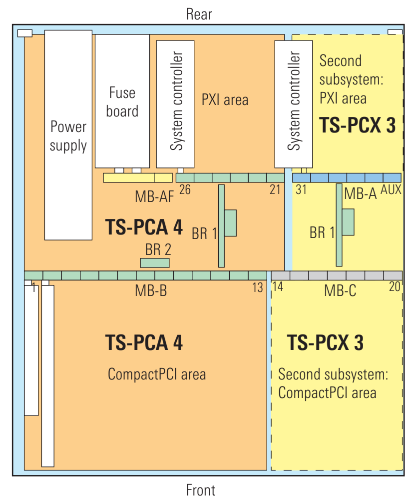


- Maximum configuration with PCX1 and PCX2
  - 20 CPCI slots
  - 11 PXI slots



2-subsystem version PCA4 + PCX3

- Subsystem 1
  - 13 CPCI slots
  - 6 PXI slots
- Subsystem 2
  - 7 CPCI slots
  - 5 PXI slots



Note:
The subsystems have separate CPUs and so can be thought of as separate systems. This means that tests on two UUTs can be performed simultaneously and independently.
For this configuration, a second system card (one for each subsystem) is strongly recommended to provide full selftest capability for subsystem 2 as well.

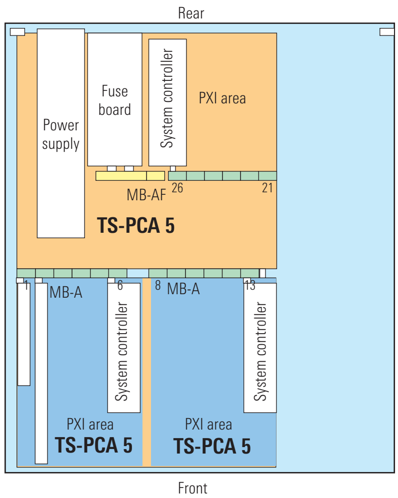
Certified Quality System
ISO 9001
DQS REG. NO 1954

Certified Environmental System
ISO 14001
REG. NO 1954

Multi-CPU system configurations

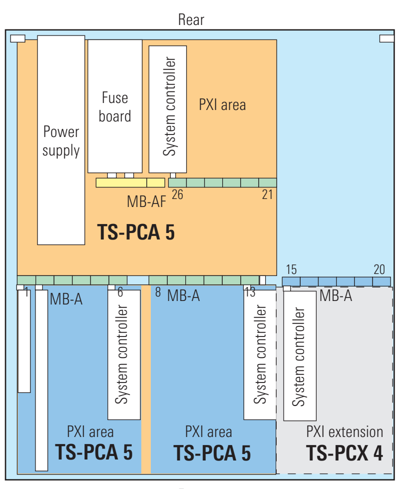
Basic version PCA5 (3 CPUs)

- CPU subsystem 1: 6 PXI slots
- CPU subsystem 2: 6 PXI slots
- CPU subsystem 3: 6 PXI slots



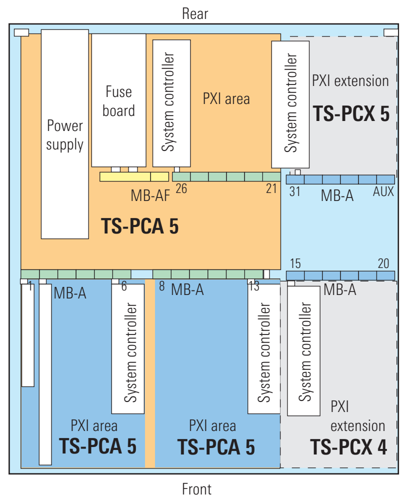
Extension 1 (4 CPUs) PCX4

- CPU subsystem 1: 6 PXI slots
- CPU subsystem 2: 6 PXI slots
- CPU subsystem 3: 6 PXI slots
- CPU subsystem 4: 6 PXI slots



Extension 2 (5 CPUs) PCX5

- CPU subsystem 1: 6 PXI slots
- CPU subsystem 2: 6 PXI slots
- CPU subsystem 3: 6 PXI slots
- CPU subsystem 4: 6 PXI slots
- CPU subsystem 5: 5 PXI slots



Signal routing concept

Featuring a special arrangement of backplanes within the overall system (Rohde&Schwarz patent), TSVP is the first system to avoid the service-unfriendly cross wiring typical of commercial plug-in card systems (e.g. VXI).

This is done by cabling the rear CPCI or PXI measurement cards or external devices through the system (Fig. 4, item 6 and item 1) either right to the fixture interface or to a Rohde&Schwarz module that takes the signals to the interface or, via the internal analog and trigger bus, to the extended CPCI backplane (Fig. 4, item 5).

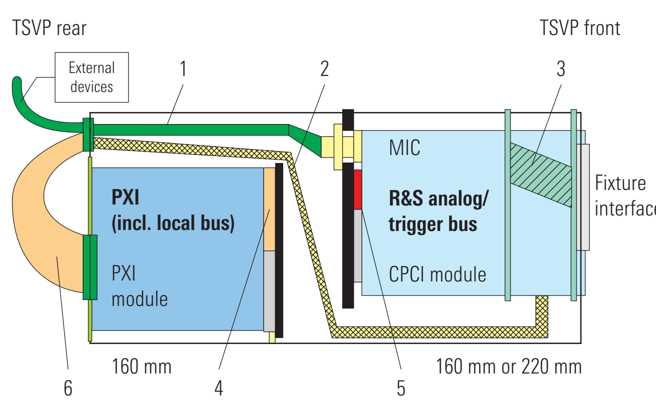
Any further cabling is avoided through the use of the analog and trigger bus. As TSVP has no cross-wiring whatsoever, every module can be inserted or removed without undoing any cables – this makes TSVP considerably more service-friendly than any other plug-in card systems. Plus, it is practically impossible to make a mistake when replacing modules, and downtimes (MTTR) are reduced.

The adapter system (APC = application connector) (Fig. 4, yellow) is likewise very flexible, so that a wide variety of signals can be handled. The APC connectors can be configured separately for each slot for:

- up to 9 RF signals (2 GHz) or
- 1 RF signal (18 GHz) or
- up to 6 power signals (10 A) or
- 1 power signal >>10 A or
- 32 AF/digital signals

For high-current applications, a local power bus can be set up in a simple way by interconnecting neighbouring APCs, so providing a flexible means of connecting additional external power supplies or loads, for example, across the system to the UUT.

Power (10 A) and RF signals (up to 18 GHz) can be routed via application-specific CPCI modules. The internal analog bus approach makes the programmable combination of test signals possible.



1	Cable from TSVP rear panel to module (or directly to fixture interface)
2	Feed of external signals to standard CPCI modules
3	Cable set for connecting standard CPCI modules to fixture interface
4	PXI local bus
5	Rohde&Schwarz analog and trigger bus
6	Cable for connecting PXI test module with CPCI scanner module

Fig. 4: TSVP cabling concept

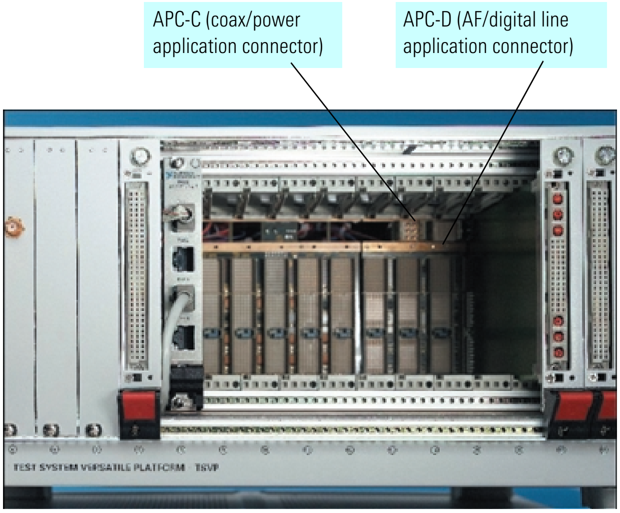


Fig. 5: Front view of CPCI backplane

Signal buses/trigger buses

The PXI specification (PXI Rev. 1.0), analogous to VXI and VME, provides for a PCI bus, plus a bus for test and stimulus signals (13 lines) and a trigger bus (8 lines + 1 star trigger).

The PXI bus system is used on the TSVP's rear backplane. As PXI offers extended functionality compared with CPCI, not only PXI but also CPCI modules can be used.

The front backplane features a PCI bus to CPCI standard extended by a 12-wire analog bus and an 8-wire trigger bus. In addition, two trigger channels of the PXI trigger bus are connected to two trigger channels of the front backplane via unidirectional driver stages. This gateway links the two trigger bus systems, so that trigger signals from both subsystems (PXI area at the rear and CPCI area at the front) can be distributed and used across the whole system.

The system and bus architecture of TSVP allows signals from the internal PXI modules at the rear of the system or from external devices to be taken, via APC connectors, to a scanner module in the front CPCI area. From the scanner module, signals can be applied to an analog or trigger bus and are then available throughout the system, i.e. they can be tapped by any other module directly at the analog or trigger bus.

If mainly scanner relay cards are used in the front (CPCI) of TSVP, a switching matrix with extremely flexible connecting and trigger facilities can be configured.

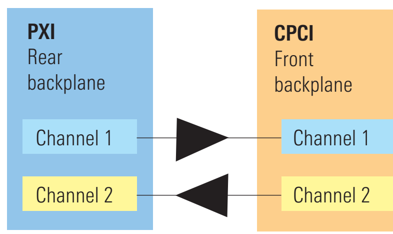


Fig. 7: Inter-backplane triggering

Cooling concept

Despite its highly compact design, TSVP meets the stringent temperature requirements for test systems in harsh industrial environments. This is achieved by means of an elaborate and effective cooling concept.

The front and rear rows of slots are cooled by separate fan assemblies. The fans are arranged so that they cover a large area, so ensuring uniform distribution of the cooling air over all modules (Fig. 9).

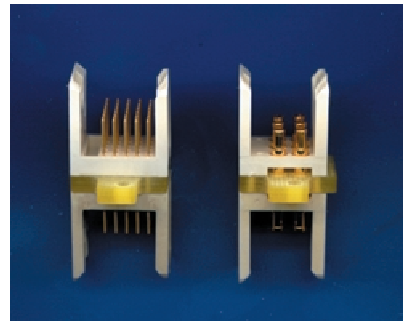


Fig. 6: APC-D and APC-C connectors

This results in a wide operating temperature range. Temperature grids are used to average the temperature over the whole air flow at the front and the rear of the system. Sensors measure the temperatures, and the sensor signals are fed to the fuse board. This prevents extreme temperatures at some modules giving rise to erroneous temperature readings.

The measured temperatures can be output for further processing via the rear service connector or in the controller via a Windows NT service. The temperature sensors are also used to regulate the fan assemblies. Any overtemperature condition that may occur in case of a fault is indicated by an LED on the rear of the fuse board (Fig. 11, HtmpR and HtmpF).

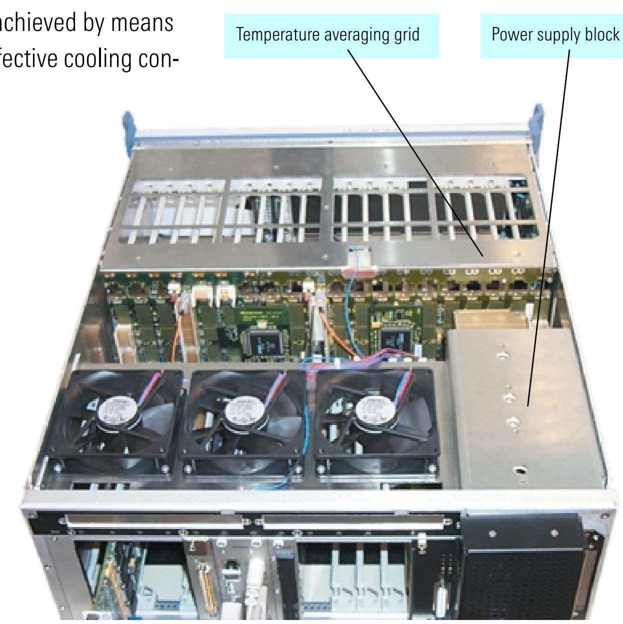


Fig. 8: Rear fan assembly of TSVP

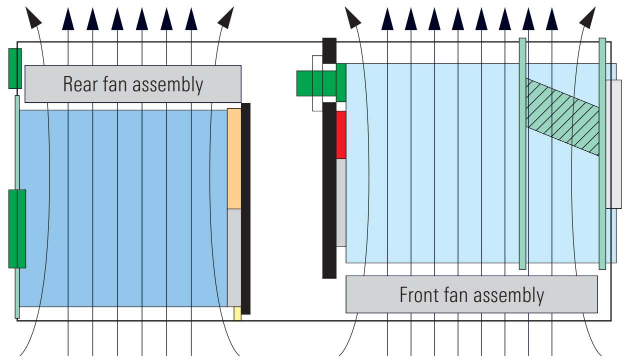


Fig. 9: Cooling air flow in TSVP

Power supply

The plug-in 350 W power supply provides the voltages required by CPCI as well as a 24 V supply voltage. The supply voltages present at the service connector are indicated by LEDs.

The power supply block incorporates the fuse board, which forms an easy-to-replace unit together with the power supply. This is particularly important in servicing, since no cables have to be undone and no mistakes can be made.

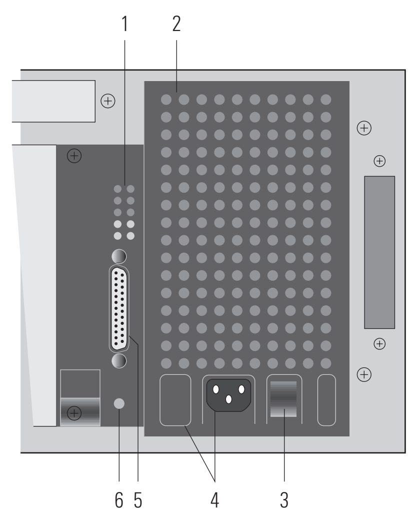


Fig. 10: Rear view of power supply block

1	Display panel
2	Switching power supply
3	On/off switch
4	Low-power connector with power fuse
5	Service connector
6	Fuse board

Selftest and diagnosis

The TSVP system concept is strongly orientated towards applications in electronics production testing. This applies in particular to TSVP's selftest and diagnosis capabilities, which are by far superior to anything offered by commercial CPCI, PXI or even VXI systems.

For example, each slot of the CPCI area is assigned a readable code by means of which the position of each card in the system can be determined. This facilitates selftesting and is a valuable aid for configuring appropriate fixture wiring.

Together with the system card, Rohde & Schwarz modules can be tested down to relay level and commercial modules diagnosed down to their basic functionality.

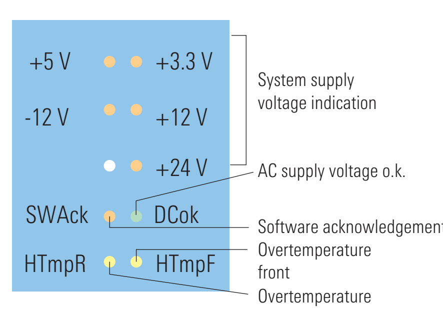


Fig. 11: Fuse-board display panel

Apart from the TSVP proper, the system selftest even covers the fitted modules as well as external devices and their cabling. This is possible because the TSVP selftest software has been designed for modularity and extendability.

The Rohde & Schwarz modules have extensive built-in selftest capability. For example, in the case of relay modules (scanner cards), all relay switching states can be read by an onboard logic. Usually, switchable access to the analog bus is also provided which, in conjunction with the system card, gives TSVP its very high integrated diagnostic depth. And this can be significantly enhanced for the individual modules by using simple selftest adapter plugs. Using suitable test loops, for example, modules can be diagnosed through to the fixture interface; the selftest adapter plugs are module-specific.

A Windows NT service continuously monitors system temperatures and supply voltages during the test. The current values can be evaluated by the test or sequence control program.

Selftest functions of system card

- Voltage measurement (DC/AC)
- Current measurement (DC/AC)
- Resistance measurement (2/4 wires)
- Access to analog bus (12 buses)
- I^2C bus
- One-wire bus
- Monitoring of supply voltages
- Internal temperature monitoring, TSVP chassis
- External temperature monitoring, system rack

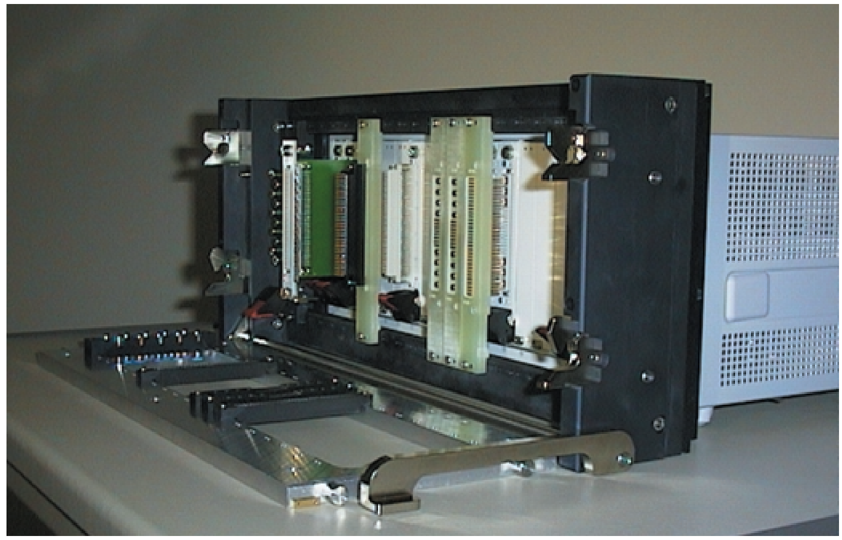


Fig. 12: TSVP with exchangeable fixture head

Exchangeable fixture interface

In modern electronics production, it is now standard to use exchangeable fixture interfaces on automatic testers with an average to high number of pins, no matter whether a large or a small number of items has to be tested.

Advantages of exchangeable fixture interface

- Exchange of fixture within seconds
- No extra cabling (mistakes are prevented)
- Easy exchange of fixtures for different systems
- Simplification of fixture design (standardization)
- Higher contact stability than with plug-and-socket connections
- Lower susceptibility to faults than with plug-and-socket connections

TSVP features an optional exchangeable fixture head, which can also be simply retrofitted. The exchangeable fixture head comes with stable single-lever pull-in mechanics, which is designed so that canting is prevented when the fixture is closed.

The extremely robust contact blocks from Virginia Panel™ not only offer high mechanical and electrical endurance but are also available worldwide.

Another highlight of the TSVP exchangeable fixture head is that the contact blocks as well as the CPCI modules behind them can be separately removed and inserted through the fixture head. So, modules can be replaced during servicing within seconds with the exchangeable fixture head fitted. The contact blocks of the exchangeable fixture head are just as easy to replace.

Software

TSVP software

The software is based on C, LabWindows/CVI and TestStand and runs under Windows NT.

Basic software GTSL

The TSVP basic software GTSL (generic test software library) offers various test case libraries which can be combined fast and easily with TestStand to give ready-to-run test programs.

TSVP software	
Operating system	Windows NT 4.0 or higher
User interface	LabWindows/CVI
Programming language	C
Sequencer	TestStand (NI), development or runtime environment
Parallel test panel	x2 parallel, runtime sequencer
Selftest	for modules, system and customer-specific extensions
Resource manager	management of connected devices, modules and relay matrix
Relay matrix management	instruments and pin names
CVI device driver and function panels for TSVP modules	Visa, IVI

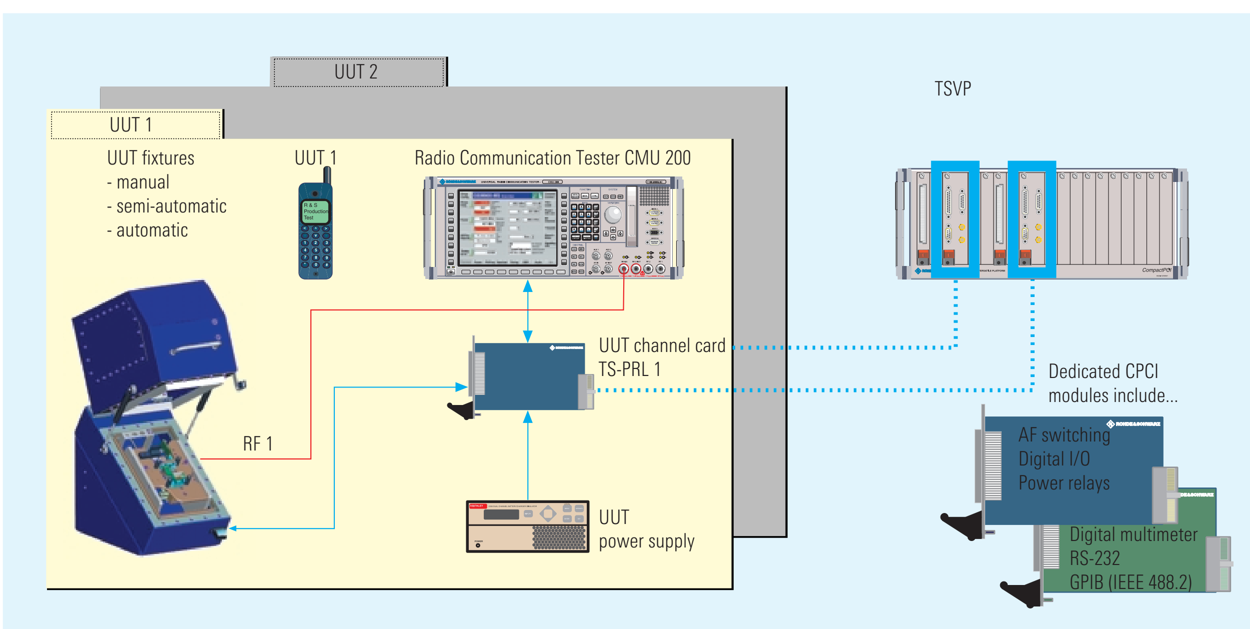
Customer-specific libraries can be created and integrated on the basis of programming examples in the C source code.

Tools like the selftest function or the user interface, which can be adapted as required, are likewise GTSL components.

Example of an application: Production Tester TS7100

Production Tester TS7100 is an extremely compact, all-in-one solution for mobile-radio testing. Even though it is just 80 cm high in the low-profile configuration, for example, the system includes all essential components for parallel testing of two mobile phones. Essential components of a two-channel system are two Radio Communication Testers CMU200, two special power supplies for the mobile phones and a TSVP with various plug-in cards.

Fig. 13: TSVP-based Cellular Phone Production Test Platform TS7100



Specifications

Power supply

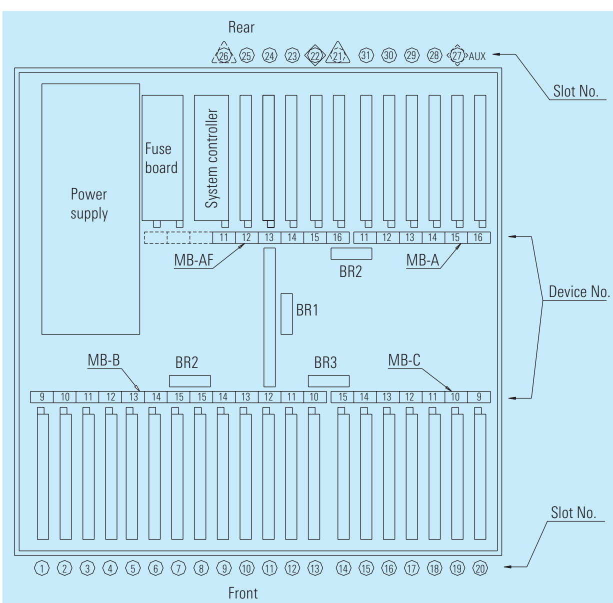
Power consumption/output power	500 W/350 W
Input voltage AC	100 V to 240 V, 50 Hz to 60 Hz
DC	150 V to 300 V
Output voltages	3.3 V, 20 A 5 V, 50 A +12 V, 12 A –12 V, 6 A 24 V to 27 V, 3 A

System interface

VG female connector strips	96 standard, 8 coax or 8 power contacts
Optional: exchangeable fixture head	single-lever pull-in mechanism, spring contact pins (Virginia Panel™), VG spacing

Modular backplane architecture

CPCI slots (front)	20
PXI slots (rear)	11
Plug-in modules 5 V, 3 HU	PICMG 2.0 Rev. 2.1 CPCI, PXI Specification Rev. 1.0
External signal feed	at rear, 30 standard plus 6 coax or 6 power signals per slot
Analog buses	12 (system-wide)
Trigger buses	8 (system-wide)



General data

Weight (without modules)	12 kg
Dimensions (H x W x D) in mm	178 (4 HU) x 48.26 (19") x 530
Ventilation	
Cooling capacity	350 W
Monitoring	two sensors, software-supported temperature measurement
Nominal temperature range	+5°C to +40°C
Operating temperature range	0°C to +50°C
Storage temperature range	–40°C to +70°C
Damp heat	+25°C/+40°C, 95% rel. humidity
Safety standards	CE, UL 1950 applied for, EN 61010 Part 1
EMC	EN 50081-1, EN 50082-2
Shock	40 g, MIL-STD-810, MIL-T-28800D, classes 3 and 5
Sinusoidal vibration	
5 Hz to 55 Hz	2 g, MIL-T-28800D, class 5
55 Hz to 150 Hz	0.5 g, MIL-T-28800D, class 5
Noise	
10 Hz to 300 Hz	1.2 g

PXI compatibility list (measurement-oriented configurations)

Slot		System controller in slot	
Number	Backplane segment	21	26
21	MB-AF	system controller	o.k.2)
22	MB-AF	o.k.*	o.k.*
23	MB-AF	o.k.	o.k.
24	MB-AF	o.k.	o.k.
25	MB-AF	o.k.1)	o.k.1)
26	MB-AF	o.k.2)	system controller
AUX	MB-A3)	reserved	reserved
27	MB-A3)	o.k.*	o.k.*
28	MB-A3)	o.k.	o.k.
29	MB-A3)	o.k.	o.k.
30	MB-A3)	o.k.1)	o.k.1)
31	MB-A3)	o.k.2)	o.k.2)

o.k.= fully compatible
o.k.*= must be star trigger slot in segments concerned
1) = fully compatible, PXI local bus signals only to left neighbouring slot
2) = fully compatible, but no access to PXI local bus
3) = only with TS-PCX2 chassis extension

Note:
Slot rows 21 to 26 and 27 to 31 are not interconnected by local bus or star trigger.

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