ROHDE&SCHWARZ

USER MANUAL

Power Switch Module

TS-PSM1

User Manual

for ROHDE & SCHWARZ Power Switch Module TS-PSM1

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Safety Instructions

Attention!
Electrostatic sensitive devices require special care

CERTIFICATE

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Deutsche Gesellschaft zur Zertifizierung von Managementsystemen

hereby certifies that the company

Rohde & Schwarz GmbH & Co. KG

Mühldorfstrasse 15
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with the production sites as listed in the annex

for the scope
Design and Development, Production, Sales, Services of Electronic-Measurement and Communication-Equipment and Systems

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An audit, documented in a report, has verified that this quality management system fulfills the requirements of the following standard:

DIN EN ISO 9001 : 2000

December 2000 edition

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This certificate is valid until	2008-01-23
Certificate Registration No.	001954 QM/ST
Frankfurt am Main	2005-01-24

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It was verified by the Notified Body that the supplementary requirements of the Annex V of the European Concil Directive 99/5/EC are fulfilled.

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Appendix to Certificate Registration No.: 001954 QM/ST

Rohde & Schwarz GmbH & Co. KG

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The international and German Road Traffic Law
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No.: 22 Electrical/Electronic Sub Assembly

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Annex to Certificate Registration No.: 001954 QM ST

Rohde & Schwarz GmbH & Co. KG

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Organizational unit/site	Scope
ROHDE & SCHWARZ GmbH & Co. KG Service Centre Cologne **ROHDE & SCHWARZ Systems GmbH** Graf-Zeppelin-Strasse 18 D-51147 Köln	Technical services in the field of measuring/communication techniques maintenance/repair calibration training technical documentation Development, production, systems
Rohde & Schwarz FTK GmbH Wendenschloßstrasse 168 D-12557 Berlin	Design and Development, Production and Sale of Communication Equipment, Installations and systems
Rohde & Schwarz GmbH & Co. KG Kaikenrieder Strasse 27 D-94244 Teisnach	Design and Development, Production, Sales, Services of Electronic-Measurement and Communication-Equipment and Systems
Rohde & Schwarz závod Vimperk s.r.o. Spidrova 49 CZE-38501 Vimperk Tschechische Republik	Design and Development, Production, Sales, Services of Electronic-Measurement and Communication-Equipment and Systems
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If you have any technical queries about this Rohde & Schwarz equipment, our Hotline at the Support Center of Rohde & Schwarz Sales-GmbH will be glad to help.

Our team will discuss your queries and look for solutions to your problems.

The Hotline is open Mondays to Fridays from 08.00 to 17.00 hrs.

For queries outside office hours, you can leave a message or send a note via fax or email. We will then get back to you as soon as possible.

ROHDE & SCHWARZ

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1 Usage

1.1 General

The ROHDE & SCHWARZ Power Switch Module TS-PSM1 is designed for interconnecting or distributing high voltages or current. Currents/voltages at all switching nodes can be measured or monitored with the analog bus. These functions are particularly important when the test component's current demand in both normal and standby mode has to be measured.

The TS-PSM1 can be used in the CompactTSVP and the PowerTSVP (TSVP = Test System Versatile Platform). It is fitted into the front of the TSVP chassis.

The front connector ends flush with the front panel of the TSVP chassis and is used for contacting the test products. An adapter frame can also be used if necessary.

At the back the TS-PSM1 is connected to the CAN/PXI bus and the analog bus of the TSVP chassis. The high power lines are taken to the rear of the TS-PSM1 via connection terminals and a 12-pin plug connector.

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1.2 Characteristics

Characteristics TS-PSM1
Power switching module for supplies and loads
Switching module for high voltages (max. 60 V)
8 high power channels (max. 16 A)
10 low power channels (max. 2 A)
4 high power MUX channels 4 : 1 (max. 16 A)
Indirect current measurement on high power channels with shunt
Direct current measurement on all channels by R&S analog bus and TS-PSAM plug-in module (<1 A)
Self-test of all relays by analog bus and TS-PSAM plug-in module
Control bus: CAN
For use in CompactTSVP and PowerTSVP

Table 1-1 Characteristics TS-PSM1

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2 View

Figure 2-1 shows a view of the TS-PSM1 .

Figure 2-1 View of the TS-PSM1

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3 Block Diagram

Figure 3-1 shows the block diagram of the TS-PSM1. A simplified view of the functional block can be seen in Figure 3-2 .

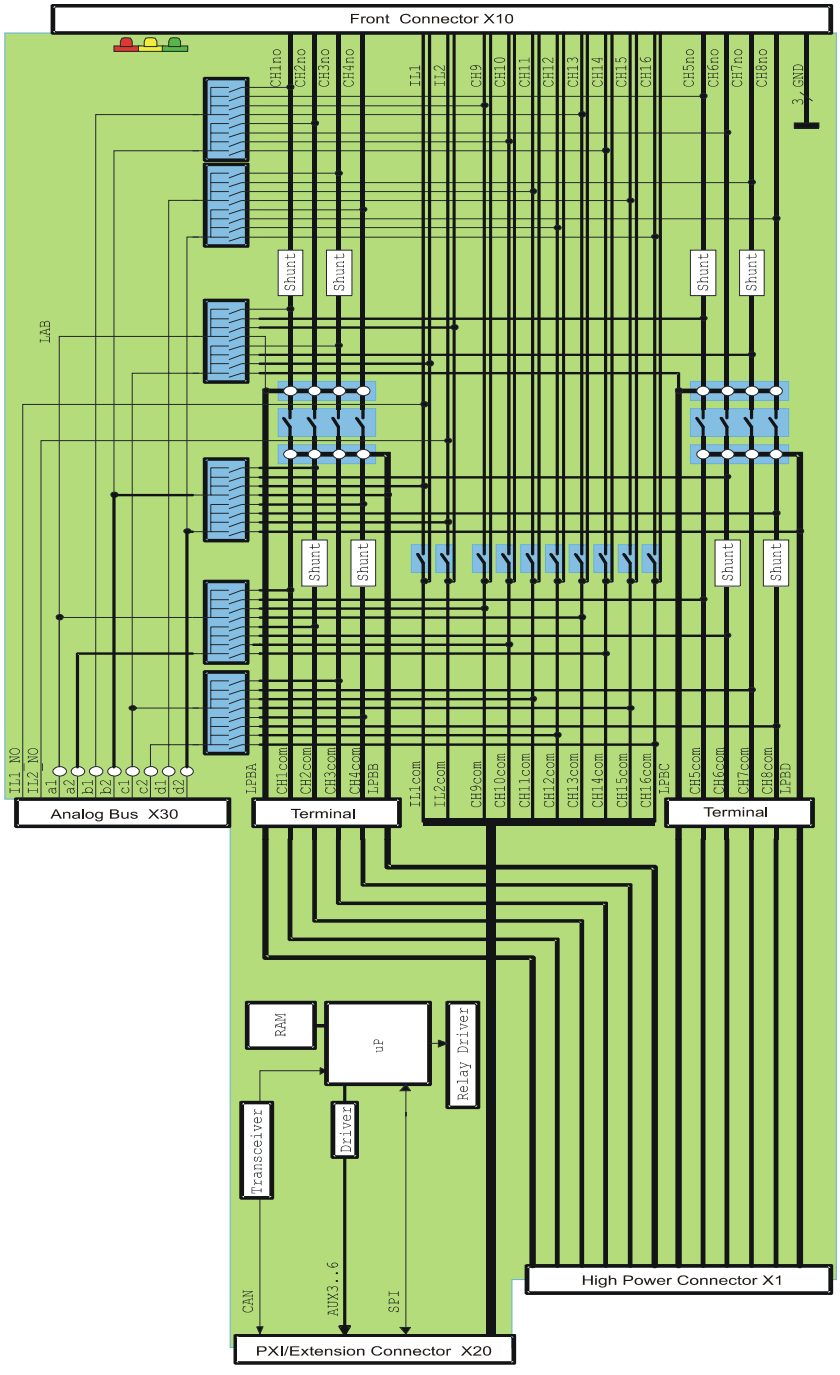

Figure 3-1 Block Diagram TS-PSM1

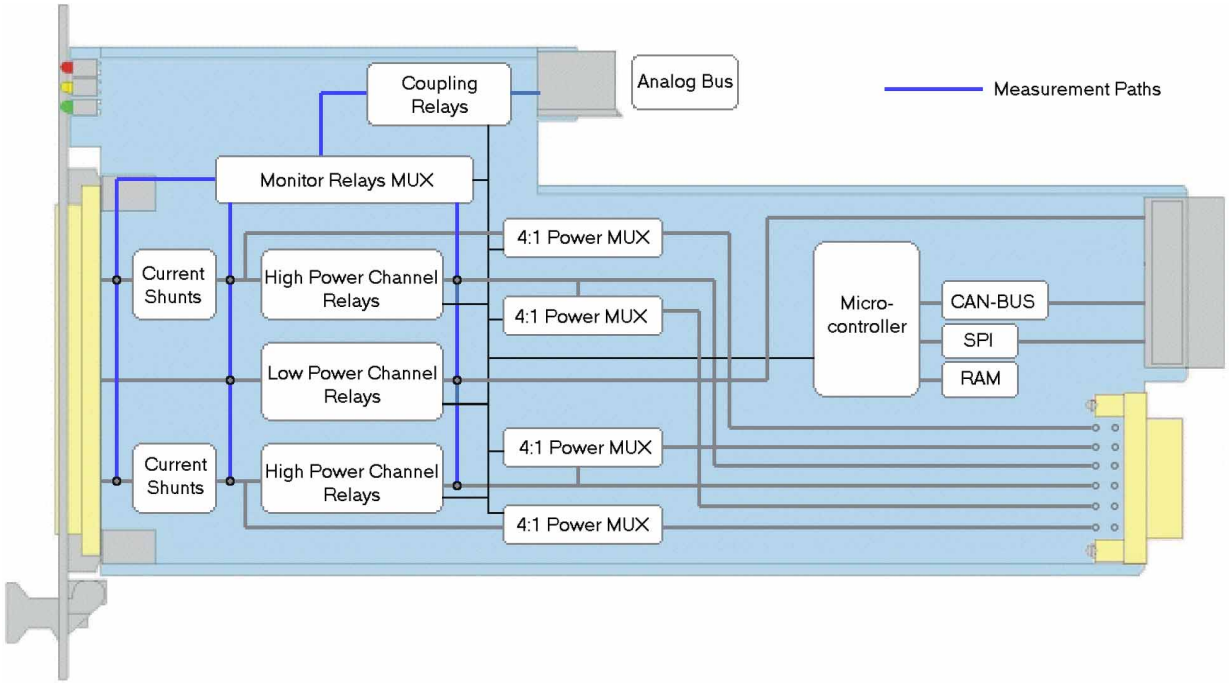

Figure 3-2 Functional Block Diagram TS-PSM1

4 Layout

4.1 Mechanical Layout

The TS-PSM1 is designed as a long plug-in board for front mounting in the TSVP chassis. The mounting depth is 300 mm, and the front panel is 4U in height.

Connector X20 is used to make the connections with the cPCI backplane / control backplane of the TSVP. Connector **X30** connects the TS-PSM1 with the analog bus backplane in the TSVP chassis. The high power connections are routed across the rear connector X1 and terminals X2, X3. Test products and peripherals are connected using front connector X10 .

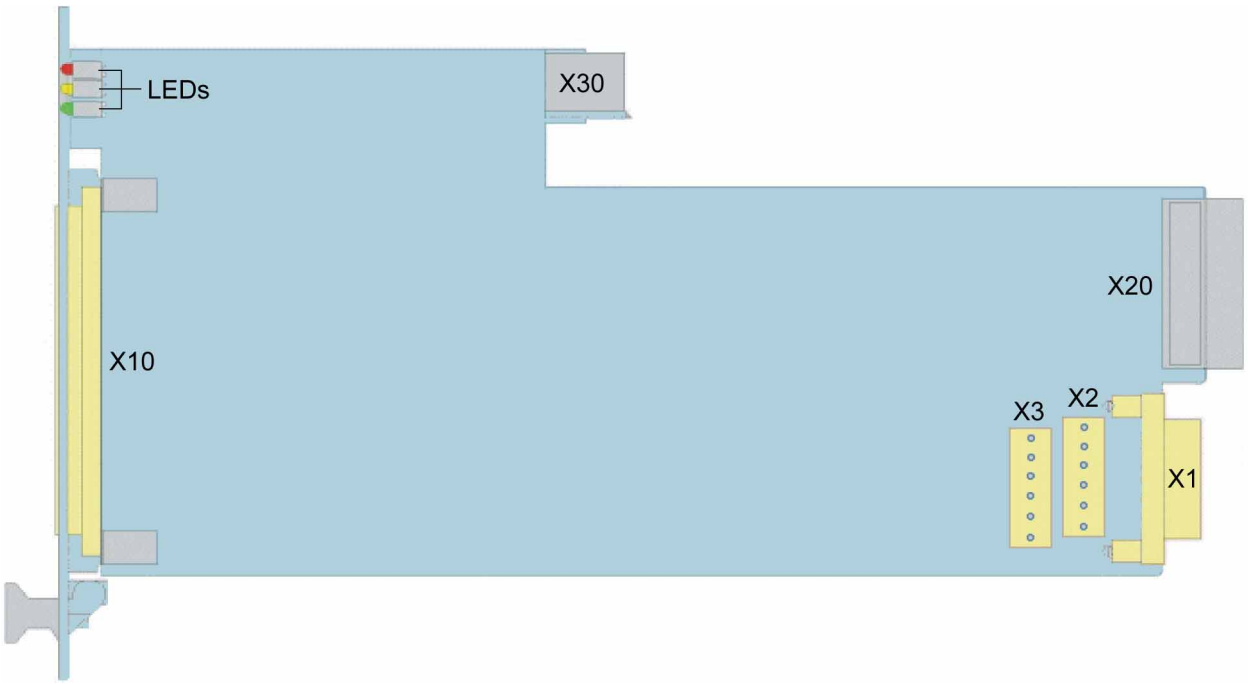

Figure 4-1 Layout of Connectors and LED's

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Symbol	Use
X1	High Power Connector
X2	High Power Terminal
X3	High Power Terminal
X10	Front Connector
X20	PXI/Extension Connector
X30	Analog Bus Connector

Table 4-1 Connectors on the TS-PSM1

4.2 Display Elements

(see Figure 4-1)

The front panel of the TS-PSM1 contains three light-emitting diodes (LED's) with the following functions:

LED	Description
ERR (red)	Fault condition: Lights up when a fault is detected on the TS-PSM1 in the power-on test after the supply voltage is switched on.
COM (yellow)	Communication: Lights up briefly when the TS-PSM1 is accessed via the interface.
PWR (green)	Power: Lights up when all supply voltages are present.

Table 4-2 Display elements on the TS-PSM1

LED Test:

When voltage is powered up all three LED's light up for around 1 second. This ensures that the 5 V supply is present and that the LED's and power-on test are functioning.

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5 Function Description

(see Section 3, Block Diagram and Functional Block Diagram)

5.1 Signal Concept

The special design of the TS-PSM1 guarantees the ideal guiding of supply and load paths through the test system. Both “Force” channels with high currents and “Sense“ channels of voltage/current sources are guided across the TS-PSM1 to the components on test. In the opposite direction, test components can be injected with loads with one or a number of poles. With the High Power Multiplexers it is possible to select different load simulations that can be integrated in the TSVP chassis.

The currents and voltages can be measured and monitored at all switching nodes with additional relays on the TS-PSM1 and the analog bus (high currents with shunts).

5.2 System Functions

The system functions are implemented by a local processor with internal flash. An external SRAM is also provided. Communication with the system controller in the CompactTSVP is conducted on the CAN bus.

The functions of the TS-PSM1 can be summarized as follows:

- Analog function test
- Connection of voltage/current sources
- Connection of test component loads (original loads, simulated/ electronic loads)
- Power Multiplexer
- Switch simulation

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5.3 Flexibility

The construction of the TS-PSM1 and its wide range of voltages and currents ensure a high level of flexibility and a broad range of applications. As well as being used in the ROHDE & SCHWARZ Compact-TSVP and PowerTSVP, the TS-PSM1 can also be operated remotely in the UUT adapter or in a load box.

Even complex, yet flexible load systems can be implemented with original loads and/or electronic loads by the multiple module-internal connection of power channels to form a high current bus in the Power-TSVP.

The high-power sources or loads are fed thru connector X1 to the UUT. The preferred slot in the CompavctTSVP is slot 16. If single high power switches are needed, the terminals X2 and X3 can be used to reconnect the second pole to the front connector. Application specific cable and additional front panel are necessary. In the CompactTSVP, only slot 16 allows usage of connector X1 to pass thru the signals from/to the back.

5.4 Compact Design

The space-saving design of the TS-PSM1 (1 slot) with voltage/current monitoring and self-test on the analog bus allows the creation of very powerful and compact measurement and load systems with up to 12 modules in the CompactTSVP and 16 modules in the PowerTSVP. These can be incorporated directly and hence very cost-effectively in production cells.

5.5 Noise Immunity

Optimum response to electrical interference or rises in temperature is achieved by the controller on the serial differential CAN bus (Controller Area Network).

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6 Commissioning

6.1 Installing the Plug-In Module

The install the TS-PSM1 plug-in module, proceed as follows:

- Run down and power off the TSVP
- Select a suitable front slot (preferred slot 16 in CompactTSVP).
- Remove the front panel from the TSVP chassis by slackening off the screws.

WARNING!

Check the backplane connectors for bent pins! Any bent pins must be straightened!
Failure to do this may permanently damage the backplane!

- Push in the plug-in module using moderate pressure
- The top snap pin on the module must locate in the right-hand and the bottom pin in the left-hand hole on the TSVP chassis

WARNING!

Use both hands to guide the module and carefully plug it into the backplane connectors

- The module is correctly located when a distinct 'stop' can be felt
- Tighten the top and bottom screws on the front panel of the plug-in module

6.2 Initializing the Plug-In Module

Once the system has been powered up, the TS-PSM1 is initialized. Signals GA0 ... GA5 on the cPCI bus are used for slot detection.

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7 Software

7.1 Driver Software

A LabWindows CVI driver is provided for the TS-PSM1 . This driver satisfies the IVI Switch specification. The driver is part of the ROHDE & SCHWARZ GTSL software. All the functions of the driver are described fully in the on-line help and in the LabWindows CVI Function Panel.

The following software modules are installed during driver installation:

Module	Path	Remarks
rspsm1.dll	<GTSL Directory>\Bin	Driver
rspsm1.hlp	<GTSL Directory>\Bin	Help file
rspsm1.fp	<GTSL Directory>\Bin	LabWindows CVI Function Panel file, Function Panels for CVI development environment
rspsm1.sub	<GTSL Directory>\Bin	LabWindows CVI attribute file. This files is needed by some „Function Panels“.
rspsm1.sub	<GTSL Directory>\Bin	Import library
rspsm1.h	<GTSL Directory>\Include	Header file for the driver

Table 7-1 Driver Installation TS-PSM1

NOTE:

The IVI and VISA libraries of National Instruments are needed to run the driver.

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7.2 Softpanel

The software package of the TS-PSM1 includes a so-called softpanel (see example in Figure 7-1). The softpanel enables the user to execute the functions of the TS-PSM1 listed in the menu with on-screen mouse clicks.

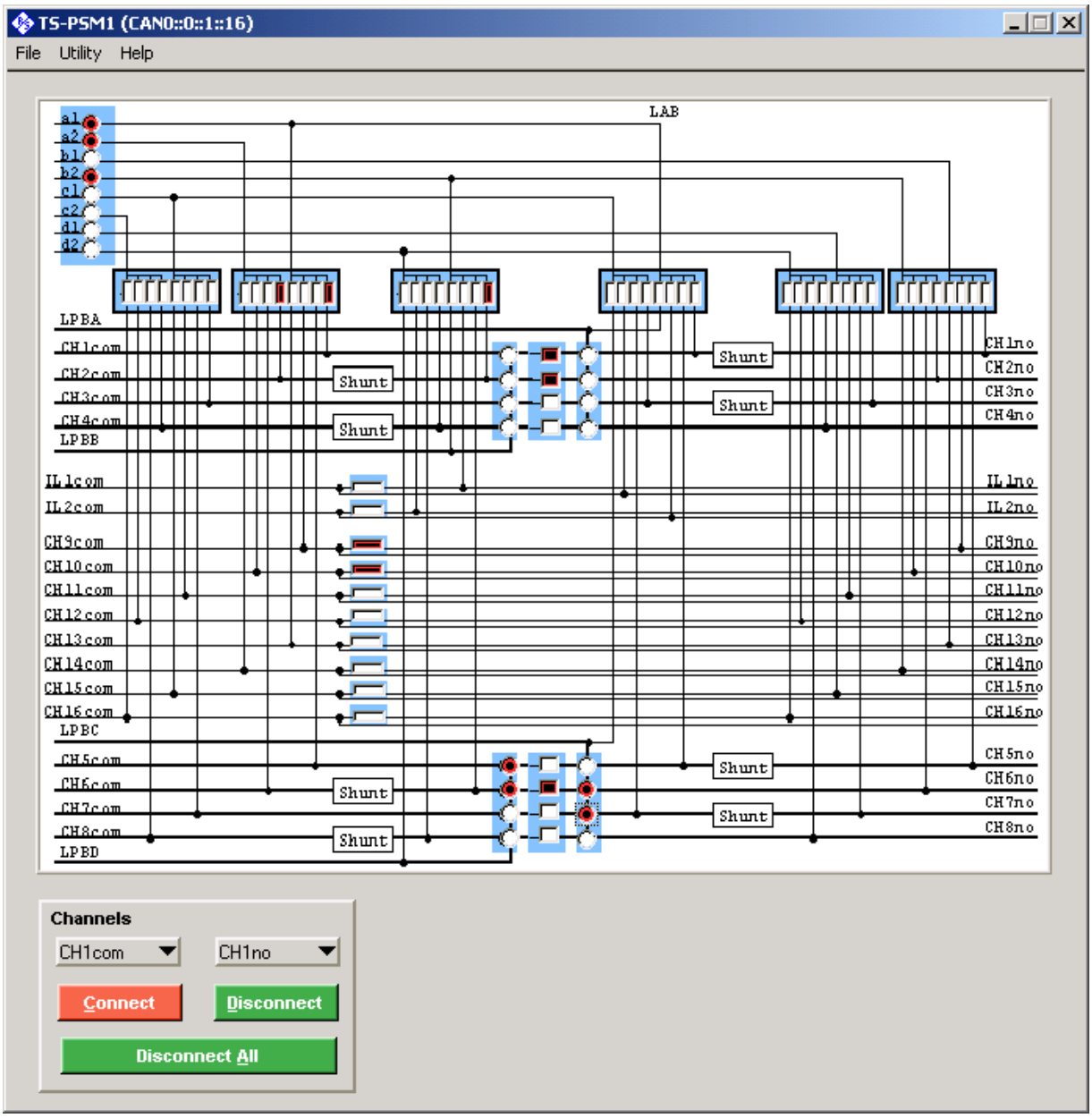

Figure 7-1 Softpanel TS-PSM1 (example)

7.3 TS-PSM1 Program Example

```
/*
    Simple connection between ABa1 and ABb1 with TS-PSM1 in Slot 16

    The coding rules of a GTSL software like
    allocating and locking the resource, or error handling
    are not considered in this example.
    It´s just to show the function calls to get the connection.
*/

#include "rspsm1.h"  /* rspsm1 ivi-driver header file  */

static ViStatus  s_status;

main()
{

    /*
      Creates a new IVI instrument driver and optionally sets the initial
       state of the session attributes.

      "CAN0::0::1::16": CAN board 0, Bus Controller 0, Frame 1, Slot 16
    */

    s_status = rspsm1_InitWithOptions ("CAN0::0::1::16", VI_TRUE,
VI_TRUE,
"", & handle);

    /*
       This function creates a path between channel ABa1 and LABa1.
      The driver calculates the shortest path between the two channels.
    */
    s_status = rspsm1_Connect (handle, "ABa1", "LABa1");

    s_status = rspsm1_Connect (handle, "ABb1", "LABb1");

    s_status = rspsm1_Connect (handle, "CH1com", "LABa1");
    s_status = rspsm1_Connect (handle, "CH1no", "LABb1");

    s_status = rspsm1_Connect (handle, "CH1com", "CH1no");

    /*
       Connection between ABa1 and ABb1 exists.
    */


    /*
       Opens the path between Channel ABa1 and LABa1.
    */

    s_status = rspsm1_Disconnect (handle, "CH1com", "CH1no");
```

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```
        s_status = rspsm1_Disconnect (handle, "CH1com", "LABa1");
        s_status = rspsm1_Disconnect (handle, "CH1no", "LABb1");

        s_status = rspsm1_Disconnect (handle, "ABa1", "LABa1");
        s_status = rspsm1_Disconnect (handle, "ABb1", "LABb1");

        s_status = rspsm1_close (handle);
    }
```

8 Self-Test

The TS-PSM1 has a built-in self-test capability. The following tests are possible:

- LED Test:
- Power-on test
- TSVP Self-Test

8.1 LED Test

After power-on, all three LED's light up for around one second to indicate that the 5 V supply is present, all LED's are working and the power-on test was successful. The following statements can be made about the different LED statuses:

LED	Description
One LED does not light up	Hardware problem on the module
No LED's light up	No +5V supply

Table 8-1 Statements about the LED Test

8.2 Power-On Test

The power-on test runs at the same time as the LED test. The red LED lights up if a fault is found on the module. This is just a test of the firmware of the TS-PSM1 .

8.3 TSVP Self-Test

The TSVP self-test runs an in-depth test on the module and generates a detailed log.

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The TS-PSAM modules is used as a measuring unit of R&S modules in the TSVP. The correct operation of the modules is ensured by measurements on the analog bus.

NOTE:

You will find information about starting the self-test and on the sequence of necessary steps in the Service Manual.

9 Interface description

9.1 Connector X1

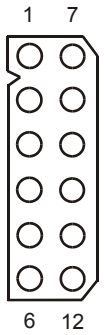

Figure 9-1 Connector X1 (mating side)

Pin	Signal	Pin	Signal
1	LPBA	7	CH1 COM
2	CH2 COM	8	CH6 COM
3	CH3 COM	9	CH4 COM
4	LPBB	10	LPBD
5	CH5 COM	11	CH7 COM
6	CH8 COM	12	LPBC

Table 9-1 X1 Pinning Assignment

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9.2 Terminal X2

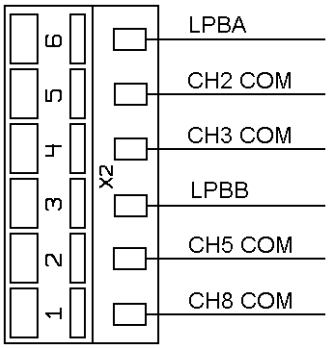

Figure 9-2 Terminal X2

9.3 Terminal X3

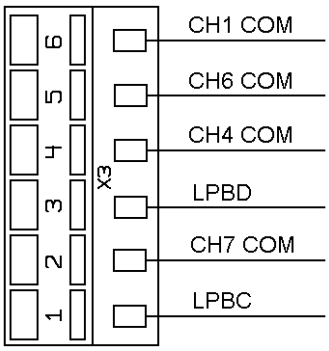

Figure 9-3 Terminal X3

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9.4 Connector X10

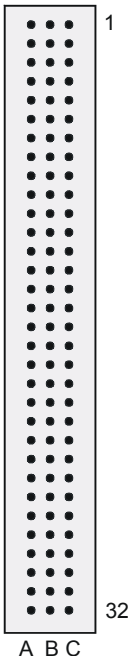

Figure 9-4 Connector X10 (mating side)

Pin	A	B	C
1	**CH1_NO**	**CH1_NO**	**CH1_NO**
2	**CH1_NO**	**CH1_NO**	**CH1_NO**
3	**CH1_NO**	**CH1_NO**	**CH1_NO**
4	**CH2_NO**	**CH2_NO**	**CH2_NO**
5	**CH2_NO**	**CH2_NO**	**CH2_NO**
6	**CH2_NO**	**CH2_NO**	**CH2_NO**
7	CH9_NO	CH10_NO	CH11_NO
8	CH9_COM	CH10_COM	CH11_COM
9	**CH3_NO**	**CH3_NO**	**CH3_NO**
10	**CH3_NO**	**CH3_NO**	**CH3_NO**
11	**CH3_NO**	**CH3_NO**	**CH3_NO**
12	**CH4_NO**	**CH4_NO**	**CH4_NO**

Table 9-2 X10 Pinning Assignment

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Pin	A	B	C
13	**CH4_NO**	**CH4_NO**	**CH4_NO**
14	**CH4_NO**	**CH4_NO**	**CH4_NO**
15	CH12_NO	CH13_NO	CH14_NO
16	CH12_COM	CH13_COM	CH14_COM
17	**CH5_NO**	**CH5_NO**	**CH5_NO**
18	**CH5_NO**	**CH5_NO**	**CH5_NO**
19	**CH5_NO**	**CH5_NO**	**CH5_NO**
20	**CH6_NO**	**CH6_NO**	**CH6_NO**
21	**CH6_NO**	**CH6_NO**	**CH6_NO**
22	**CH5_NO**	**CH6_NO**	**CH6_NO**
23	CH15_NO	CH16_NO	GND
24	CH15_COM	CH16_COM	GND
25	**CH7_NO**	**CH7_NO**	**CH7_NO**
26	**CH7_NO**	**CH7_NO**	**CH7_NO**
27	**CH7_NO**	**CH7_NO**	**CH7_NO**
28	**CH8_NO**	**CH8_NO**	**CH8_NO**
29	**CH8_NO**	**CH8_NO**	**CH8_NO**
30	**CH8_NO**	**CH8_NO**	**CH8_NO**
31	IL1_NO	IL2_NO	GND
32	IL1_COM	IL2_COM	CHA-GND

Table 9-2 X10 Pinning Assignment

Note:
Signals in bold print are High Power

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9.5 Connector X20

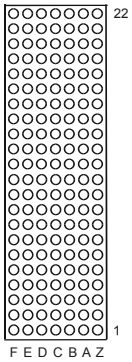

Figure 9-5 Connector X20 (mating side)

NC = not connected, NP = not populated

Pin	F	E	D	C	B	A	Z	
22	GND	GA0	GA1	GA2	GA3	GA4	GND	
21	GND	PXI_LBR3	PXI_LBR2	PXI_LBR1	GA5	PXI_LBR0	GND	
20	GND	PXI_LBL1	GND	PXI_LBL0	AUX1	AUX2	GND	
19	GND	AUX1	AUX2	PXI_LBL3	GND	PXI_LBL2	GND	
18	GND	PXI_TRIG6	GND	PXI_TRIG5	PXI_TRIG4	PXI_TRIG3	GND	X20
17	GND	PXI_CLK10	AUX4	AUX3	GND	PXI_TRIG2	GND	
16	GND	PXI_TRIG7	GND	AUX5	PXI_TRIG0	PXI_TRIG1	GND	
15	GND	+5V	+5V	AUX6	GND		GND	
14	NC						NC	C
13	NC						NC	O
12	NP	CH9_COM				CH13_COM	NP	N
11	NP			IL1_COM			NP	N
10	NC	CH10_COM				CH14_COM	NC	E
9	NC						NC	C
8	NC	CH11_COM				CH15_COM	NC	T
7	NC			IL2_COM			NC	O
6	NC	CH12_COM				CH16_COM	NC	R
5	NC						NC	
4	NC						NC	
3	GND	RSA0	RRST#	+12V	GND	RSDO	GND	
2	GND	+12V	RSDI	RSA1	+5V	RSCLK	GND	
1	GND	+5V	CAN_L	CAN_H	GND	RCS#	GND	

Rear I/O	Rear I/O incompatible PXI	PXI Signals
	R&S Rear IO control (SPI)	
GA3..0 at GND or N.C.	GA5..4 at jumper field. GA5 only TS-PWA3	

Table 9-3 X20 Pinning Assignment

9.6 Connector X30

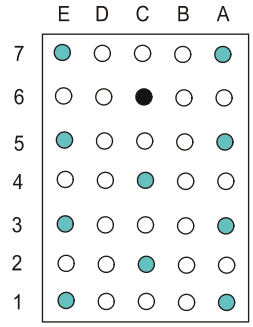

Figure 9-6 Connector X30 (mating side)

Pin	E	D	C	B	A
7	IL2_x				IL1_x
6			GND		
5	ABc1				ABa1
4			ABb1		
3	ABc2				ABb2
2			ABa2		
1	ABd2				ABd1

Table 9-4 X30 Pinning Assignment

Note:
IL1_x = IL1 of the slot

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10 Specifications

NOTE:

In the event of any discrepancies between data in this manual and the technical data in the data sheet, the data sheet takes precedence.

Interfaces

Control Bus	CAN 2.0b (1 Mbit/s)
UUT Connector (Front)	DIN41612, 96 pins
Rear I/O connector	cPCI, 110 pins

High Power Switching Channels

Number/Relay Type	8 / Zettler AZ764
Contacts	8 x SPST
Max. switching voltage	60 VDC / 42 VAC
Max. switching current	12 A rms (continuously), 16 A pulsed max. 60 s (duty cycle: 1 period *on* / 3 periods *off*)
Max. switching capacity	480 W
On-time (typ.)	10 ms
Off-time (typ.)	3 ms
Switching cycles (mech.)	3×10^7
Current measurement (indirect)	8 x shunt, 10 mOhm
Current measurement (direct)	max. 1A / 10W with analog bus and TS-PSAM

High Power Multiplexer

Number/Relay Type	16 / Zettler AZ764
Contacts	4 x 4-to-1
Max. switching voltage	60 VDC / 42 VAC
Max. switching current	12 A rms (continuously), 16 A pulsed max. 60 s (duty cycle: 1 period *on* / 3 periods *off*)

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Max. switching capacity	480 W

Low Power Interface

Number/Relay Type	10 / Zettler AZ832
Contacts	10 x SPST
Max. switching voltage	60 VDC / 42 VAC
Max. switching current	2 A
Max. switching capacity	150 W
On-time (typ.)	3 ms
Off-time (typ.)	2 ms
Switching cycles (mech.)	2×10^7
Current measurement (direct)	max. 1A / 10W with analog bus and TS-PSAM

Monitor Switching Channels

Number/Relay Type	6 / Meder RM-05
Contacts	12 x 4-to-1
Max. switching voltage	60 VDC / 42 VAC
Max. switching current	1 A (1.5 A load rating)
Max. switching capacity	10 W
On-time (typ.)	0.5 ms
Off-time (typ.)	0.2 ms
Switching cycles (mech.)	1×10^9

Environmental conditions

EMC	according to EMC Directive 89/336/EEC and Standard EN61326
Safety	CE, EN61010 Part 1
Shock	40 g, MIL-STD-810, MIL-T-28800, class 3 and class 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

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Noise	
10 Hz to 300 Hz	1.2 g
Humidity	+25 °C / +40 °C, 95% humidity

General Data

Dimensions	316 x 174 x 20 mm
Weight	780 g
Nominal temperature range	+5 °C to +40 °C
Operating temperature range	0 to +50°C
Storage temperature range	-40 °C to +70 °C
Power consumption	22.5 W max.

Order number

Power Switching Module TS-PSM1	1143.0139.02

Software

GTSL basic software, CVI driver

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