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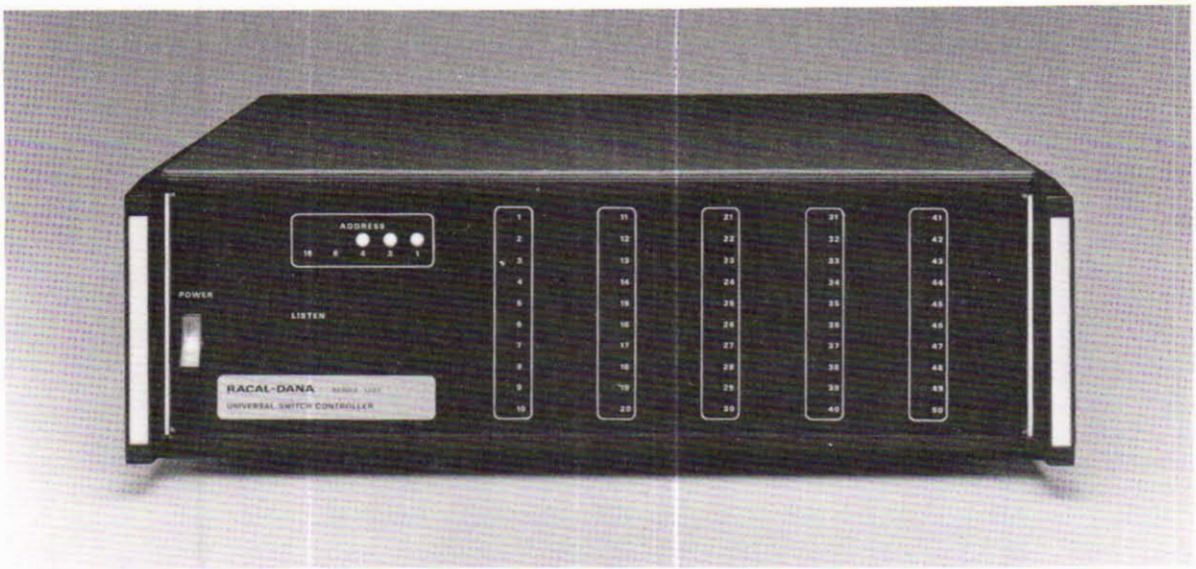
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Switching Systems General Information



Introduction

The development of a standard instrument interface and low-cost desktop computers has now made it practical to automate previously manual test benches. The era of "Rack and Stack" automated systems has created the need for instruments that can be used to switch the analog inputs and outputs between measuring instruments, sources, and the unit(s) under test. Racal-Dana switching systems are designed to meet this need for easily configured, highly flexible analog switching.

Easily Configured

The Racal-Dana switching systems allow a wide variety of configurations. Capable of switching levels from microvolts to 1000 volts, they may be connected to provide matrix switching, switching trees, scanning, isolated switching, multiplexing, fan-out switching, or a wide combination of the above to meet the exact needs of your system.

Models for Both "Rack and Stack" and Large ATE Systems

Racal-Dana offers two series of GPIB switching systems to satisfy the requirements of both the large-scale ATE system designer and the test engineer automating a previously manual test bench.

The Series 1200 offers the ultimate in flexibility and is the ideal solution for applications that require the switching of a wide variety of signal types.

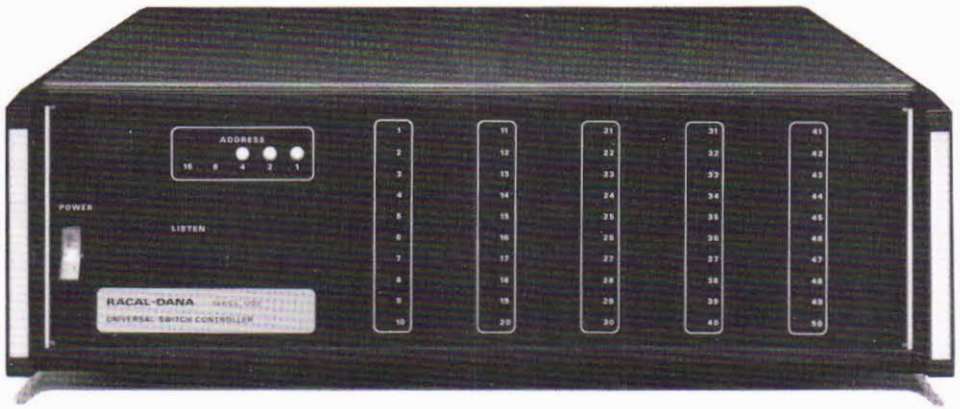
The Series 1240 should be considered for large-scale ATE systems that require a high-density matrix configuration. The 1240 is fully compatible to the U.S. Air Force MATE (Modular Automatic Test Equipment) program requirements and uses the high-level CIIL programming language.

GPIB Switching System Model Summary

Feature / Series	Configuration		Switching Type				
	Matrix Size (Maximum)	Scanning	High Voltage	Low Thermal	RF	General Purpose	Microwave
1200	150 Crosspoints	X	X	X	X	X	X
1240	23×60	—	X	—	X	X	—

X = Standard Feature

Switching Systems
Universal GPIB Switching System
Series 1200



A Solution to the Routing Problems of Analog Signals in GPIB Systems

The Series 1200 Universal Switching System is the world's first GPIB instrument designed specifically to switch signals ranging from microvolts to 750 volts, from DC to 18 GHz, and from picoamps to 30 amps.

The Series 1200 routes the analog output of signal sources and the input of measuring instruments, permitting control of the routing by a programmable calculator and simple, direct software.

Select the Modules to Satisfy Your Requirements

The Series 1200 virtually eliminates the need to design and debug a complex, custom-engineered switching system. By simple selection of an appropriate mix of standard switching modules, plugging them into the universal mainframe, and initiating a simple program string, the design is accomplished.

The Series 1200 is available with a selection of dedicated switching modules, which can be chosen to match your specific requirements.

This allows you to turn traditional manual connections and reconnections into a neat and simple automated system using your GPIB controller. It makes automated testing as simple as turning a switch.

The low cost of the Series 1200 means automatic testing is now affordable and extremely practical for short run production, prototype, and R&D testing. It gives you more time to review the results rather than manually taking data.

This system demonstrates the following measurable savings:

- Reduced measurement errors
- Reduced system design time
- Reduced test system cost
- Reduced manual set-up time
- AND, it permits you the opportunity to set up an ATE system for even short run production, engineering and Q.A. testing.

Capacity to Handle Your Largest System

Up to five modules, representing up to 50 channels, may be plugged into the microprocessor controlled master chassis of the Model 1202 which operates as a listener device on the bus.

For larger systems, a slave chassis is available. Model 1203 slave chassis allows expansion up to to 15 modules.

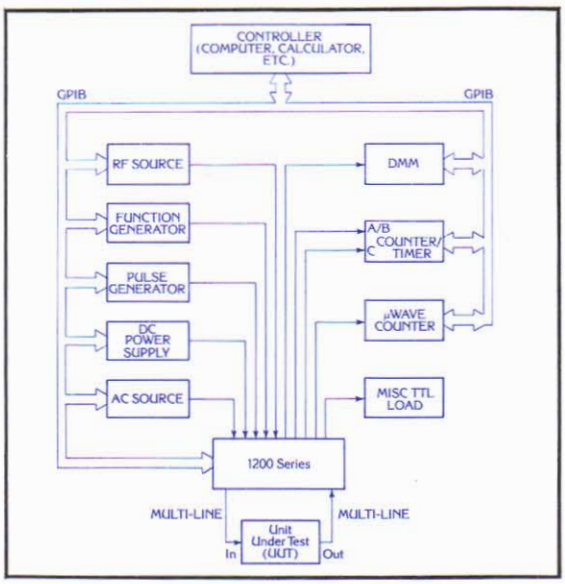


Figure 1 shows the block diagram of a typical system using the Series 1200.

The Series 1200 is Virtually Invisible

Pre-engineered compensation factors within each of the Series 1200 plug-in modules eliminate a host of serious measurement errors.

These permit measurement, for instance, with less than 1 microvolt thermal EMF uncertainty and extremely low contact resistance, even at low current levels. To prevent degradation in resistance and current measurements, contact resistance is held to milliohms in those channels intended for such measurements.

Resistance is added, however, for high voltage switching to suppress transients caused by parasitic capacitance and in-rush currents.

Other modules guarantee dynamic performance up to 18 GHz, 10 A, 100 MHz, etc. When used in combinations, they can provide channel groups configured as scanners, matrices, trees, or individual isolated switches. This facilitates distribution, convergence, and scanning of a wide variety of signals.

Plug-in personality connectors on Models 1211 through 1214 make connecting these switching modules easy. By pre-wiring these connectors for your specific test requirements, you can quickly change from one "custom" setup to the next.

Series 1200 Switching Module Summary

Model Number	Modules	Maximum Input Level Per Channel	Frequency Range	Lines Per Channel	Channels Per Module	Configuration
1210	BCD driver	N/A	N/A	1-wire per channel (common ground)	64	64 TTL sinks (16 decades BCD)
1211	TTL switching	N/A	N/A	1-wire per channel (common ground)	10	Independent TTL sinks
1212	Power switching	270 V rms, 150 VA 10 AMPS at 5 volts	DC to 400 Hz	2-wire per channel	10	Independent channels
1213	Low level switching	50 volts DC or rms AC	DC to 1 MHz	3-wire per channel	10	2 each, 1 × 5, 3-wire
1214	High voltage switching	5-channels— 750 VDC or 200 V rms 5-channels— 100 VDC or Peak AC	DC to 1 MHz	3-wire per channel	10	2 each, 1 × 5, 3-wire
1215	RF switching	250 V DC or Peak AC	DC to 100 MHz	1-wire per channel (common ground)	10	2 each, 1 × 5 matrix
1216	Microwave switching	100 W at 100 MHz 7.5 W at 18 GHz	DC to 18 GHz	Single pole/ double throw (common ground)	2	Independent channels
1217	Microwave switching	100 W at 100 MHz 7.5 W at 18 GHz	DC to 18 GHz	Single pole/ double throw (common ground)	4	Independent channels

Specifications

Universal Switch Controller—Model 1202

Description: The 1202 provides microprocessor control logic, GPIB interface, relay power supply, and front panel status annunciators

Channel Capacity: 5 switching modules

External Trigger: Rear panel BNC connector, TTL level

Cooling: Fan

GPIB Interface: Programming of switch conditions, closure modes, trigger modes, and self-test

Modes: Listen only and addressable listener

Front Panel Indicators: Power on/off
50 LED channel status annunciators
GPIB address LED annunciators
Listen LED

Temperature Range

Operating: 0°C to +50°C

Storage: −20°C to +70°C

Humidity: ≤75% RH, 0°C to +40°C
≤50% RH, +40°C to +50°C

Power Requirements

Voltage: 100, 120, 220, or 240 VAC ±10%

Frequency: 50 or 60 Hz

Consumption: 85 watt maximum

Dimensions: 133 H × 425 W × 498 D mm
(5.5 H × 16.75 W × 19.6 D inches)

Weight: 9.1 kg (20 lb)

Switching Systems
Universal GPIB Switching System
Series 1200

Slave Chassis—Model 1203

Description: Identical to the 1202 except the GPIB interface and microprocessor control logic are not included

BCD Switching Module—Model 1210

Description: Designed to allow interface with BCD programmable instruments, the 1210 provides 64 lines of TTL level control. It is ideal for use in converting from GPIB to BCD for controlling non-GPIB compatible devices

TTL Module—Model 1211

Description: Designed as a general purpose device, the TTL switching module may be used to program BCD or parallel controlled devices. In addition, external relays, lamps, alarms, etc. may be controlled by this module. Front panel indicators in the chosen slot may be used for system annunciation when this module is installed.

Configurations: Model 1211 provides 10 independently controlled power sinks, 10 complementary TTL level outputs and 10 access lines to the front panel channel annunciators. Power is also provided for TTL and relay sourcing.

Power Sinks: Up to 30 mA per line with clamp diodes for inductive overswing protection. 50 V maximum input.

Power Output: Nominal 24 V DC unregulated at 300 mA maximum
Nominal 5 V DC regulated at 80 mA maximum

Complementary TTL Logic Outputs: 8 mA maximum at 0.5 V sink (sourcing requires external pull-up resistors)

Annunciator Access Lines: Driving to ground through a minimum of 1 kilohm will cause the associated front panel LED to illuminate.

Input/Output Connector: 40 pin, KULKA Type 2597A-10 terminal blocks.

Power Switching Module—Model 1212

Description: This is designed to provide switching for AC line (mains) power, DC power supplies, and AC or DC current sources. Other voltage or current levels may be switched with this module when thermal offsets and series (contact) resistance are not critical. This module contains 10 independent two-wire channels.

Frequency Range: DC to 400 Hz

Series Resistance (per wire): ≤150 milliohm at 5 amps DC

Open Switch Isolation (per wire): ≥10,000 megohm

Thermal Offset: ≤10 μV per channel (differential)

Isolation Resistance: $\geq 10^{10}$ ohms between any two terminals or between any terminal and case with switches open

Maximum Switching Voltage: 270 V rms, 50 to 400 Hz, 200 VDC

Maximum Common Mode Voltage

Channel to Channel: 380 VDC or peak AC

Terminal to ground: 500 VDC or Peak AC

Maximum Switchable Current

Per Wire: 5 A rms AC, 5 A DC

Per Channel: 10 A rms AC, 10 A DC

Per Module: 30 A rms AC, 50 to 400 Hz, & DC (with wires paralleled)

Maximum Switchable Power

Per Wire: 100 VA rms AC, 125 VA DC

Per Channel: 150 VA rms AC, 200 VA DC

Switching Time: ≤35 mSec

Input/Output Connector: 40 pin, KULKA Type 2597A-10 terminal blocks

Low Level Switching Module—Model 1213

Description: This module is designed for switching inputs to high impedance instruments such as digital multimeters, true rms voltmeters, high speed digitizing voltmeters, A/D converters and phase angle-voltmeters. Featuring low thermal offsets, excellent dry switching characteristics and low series contact resistance, it is ideal for most low level switching applications. It contains 10 three-wire channels organized as two 1 x 5 matrices.

Frequency Range: DC to 1.0 MHz

Thermal Offset: ≤1 μV differential per channel (Hi/Lo terminals).

Series Resistance (per channel): ≤200 milliohm at 2 A DC

Open Switch Isolation: ≥10,000 megohms

Isolation Resistance: $\geq 10^{10}$ ohms between any two terminals or between any terminal and case with switches open. .

Switching Time: ≤35 mSec

Cross-Talk Isolation*: ≥100 dB at 500 VDC
≥100 dB at 50/60 Hz
≥60 dB at 20 kHz
≥50 dB at 1 MHz

Maximum Switching Voltage*: 50 V rms, DC to 100 kHz
6 V rms, 100 kHz to 1 MHz

Maximum Common Mode Voltage*

High or Low to Case: 500 VDC or peak AC to 400 Hz

Low to Guard: 200 VDC or peak AC to 400 Hz

Guard to Case: 500 VDC or peak AC to 400 Hz

*With common channels connected to Racal-Dana Series 6000 Digital Multimeter or equivalent load.

Maximum Switchable Current per Channel: 2 A rms, DC to 100 kHz
1 A rms at 1 MHz

Maximum Switchable Power per Channel: 2 VA DC or peak AC

Maximum Instantaneously Switched Power: 2 VA per module

Input/Output Connector: 40 pin, KULKA Type 2597A-10 terminal blocks

High Voltage/Low Thermal Switching Module—Model 1214

Description: This is designed for switching inputs to instruments such as digital multimeters, true rms AC voltmeters, high speed digitizing voltmeters, A/D converters and phase angle voltmeters. The high switching voltage capability allows measurements to be made that previously required a hard-wired configuration. Voltages up to 750 volts may be scanned or switched. After switches are positioned, differential voltages up to 1000 volts may be applied.

The combination of this high voltage capability and low thermal offsets makes the Model 1214 an ideal switching system for automatic DVM calibration systems. It may also be used for high voltage power supply testing.

Frequency Range: DC to 1.0 MHz

Thermal Offset: ≤1 μV differential per channel (Hi/Lo terminals).

Series Resistance (Per Channel)
Group 1 Channels: 540Ω ± 5%
Group 2 Channels: ≤200 milliohm at 2 A DC.

Open Switch Isolation: ≥10,000 megohms

Isolation Resistance: $\geq 10^{10}$ ohms between any two terminals or between any terminal and case with switches open.

Switching Time: ≤35 mSec

Cross-Talk Isolation*: ≥100 dB at 500 VDC
≥100 dB at 50/60 Hz
≥60 dB at 20 kHz
≥50 dB at 1 MHz

Maximum Switching Voltage*
Group 1 Channels: 750 VDC
200 V rms to 1 kHz
125 V rms at 10 kHz
100 V rms at 100 kHz
20 V rms at 1 MHz
Group 2 Channels: 100 VDC or peak AC to 100 kHz

Maximum Common Mode Voltage*
Hi or Low to Case: 1000 VDC or peak AC to 400 Hz
Low to Guard: 300 VDC or peak AC to 400 Hz

Maximum Switchable Current per Channel
Group 1 Channels: 25 mA DC or rms AC
Group 2 Channels: 2 A rms, DC to 100 kHz

Maximum Instantaneously Switched Power: 2 VA per module

Input/Output Connector: 40 pin, KULKA Type 2597A-10 terminal blocks

*With common channels connected to Racal-Dana Series 6000 Digital Multimeter or equivalent load.

RF Switching Module—Model 1215

Description: The 1215 is designed to switch the input of such high frequency devices as frequency counters, oscilloscopes, true rms voltmeters, and RF voltmeters. It is ideal also for switching outputs from function generators, signal generators, frequency synthesizers and other RF devices.

Because of the wide bandwidth, the 1215 is suitable for routing and switching TTL and other logic signals.

It contains 10 single wire channels configured as two 1×5 matrices.

Frequency Range: DC to 100 MHz

Thermal Offset: ≤175 μV

Insertion Loss: ≤0.5 dB at 100 MHz with 50 ohm termination

Switching Time: ≤2 mSec

Input/Output Connector: BNC

Shunt Capacitance: ≤60 pF added as measured at common terminal

Open Switch Isolation: ≥120 dB at 250 VDC
≥36 dB at 100 MHz
Common to any branch with 50 ohm termination

Maximum Switching Voltage: 250 VDC or peak AC

Maximum Common Mode Voltage Between Channels: 350 VDC or peak AC

Maximum Switching Current: 200 mA DC or peak AC per channel

Maximum Switching Power: 20 VA DC or peak AC to 100 kHz maximum sum of all channels derating by 5 VA per decade above 100 kHz to 5 VA at 100 MHz

Connectors: BNC

Microwave Switching Modules—Models 1216 & 1217

Description: These modules are designed for switching in a 50 ohm system. The DC to 18 GHz frequency range makes them ideal for switching inputs to such devices as microwave counters, power meters, RF millivoltmeters, modulation meters and network analyzers. They are also well suited for switching fast risetime signals.

Frequency Range: DC to 18 GHz

Insertion Loss: ≤0.5 dB to 18 GHz

Open Channel Isolation: >60 dB to 18 GHz

VSWR: 1.25:1, DC to 6 GHz
1.40:1, 6 to 12 GHz
1.50:1, 12 to 18 GHz

Connectors: SMA

Switching Systems
Universal GPIB Switching System
Series 1200

Ordering Information

Model 1202: Universal Switch Controller
Model 1203: Slave Expansion Chassis
Model 1210: BCD Switching Module
Model 1211: TTL Switching Module
Model 1212: Power Switching Module
Model 1213: Low Level Switching Module
Model 1214: High Voltage Switching Module
Model 1215: RF Switching Module
Model 1216: 2 Channel Microwave Switching Module
Model 1217: 4 Channel Microwave Switching Module

Options

04: 50 Hz operation
71: 220/240 VAC operation

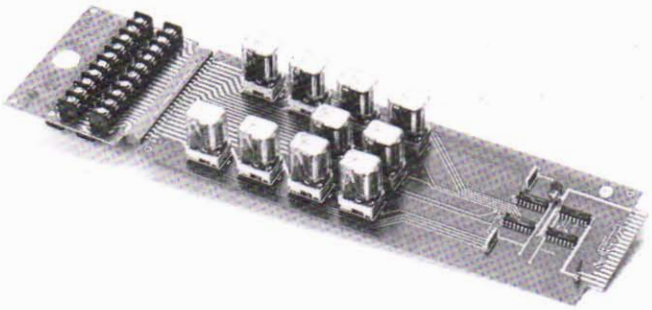
Accessories

See GPIB Instrument Section

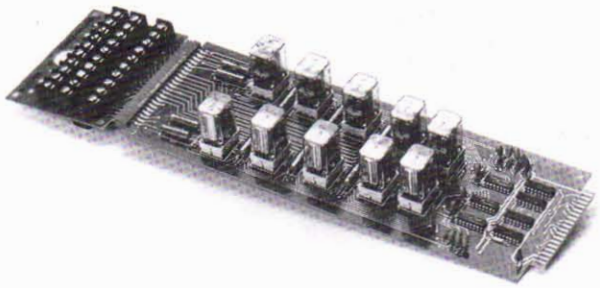
New

Model 1235: 100 MHz 2 x 4 RF Switching Module
Model 1236: 1 GHz Tree or 5 Individual Coax Switches

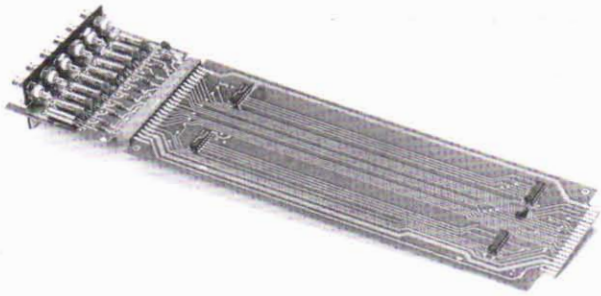
Please refer to Catalog Supplement for full specifications.



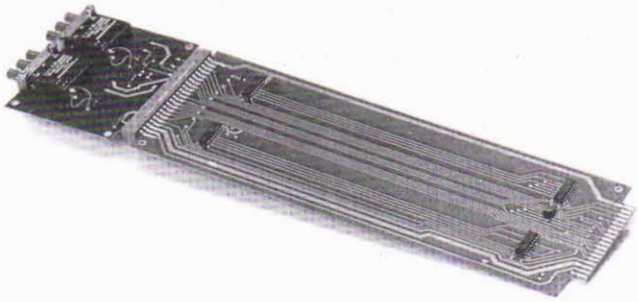
Model 1212 — Power Switching Module



Model 1213 — Low Thermal Switching Module



Model 1215 — RF Switching Module



Model 1216 — Microwave Switching Module

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