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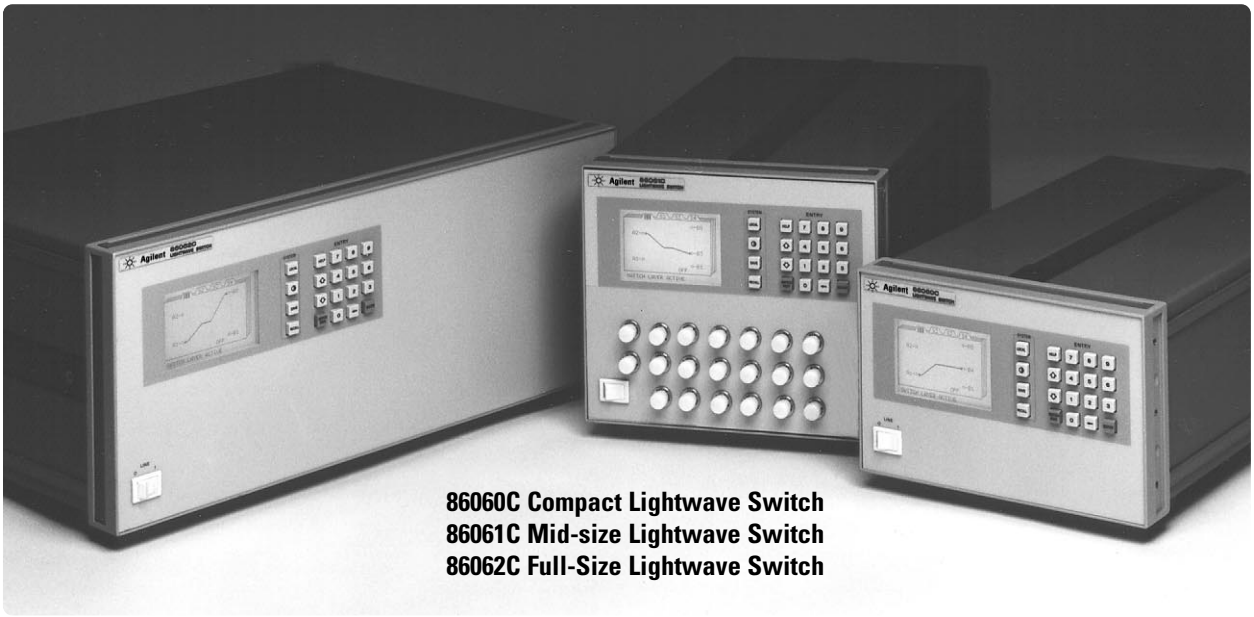
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Agilent 8606xC Series Lightwave Switches

Product Overview



86060C Compact Lightwave Switch
86061C Mid-size Lightwave Switch
86062C Full-Size Lightwave Switch

Agilent Technologies

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Lightwave Switching for Test Automation

- **Temperature stabilized performance with low insertion loss**
- **Easy-to-use manual interface with visual signal path display**
- **Repeatable switching with 10 million cycle minimum life**
- **SCPI-compatible remote commands via GPIB and RS-232**
- **Multilayer switches and other custom configurations available**

The Agilent 8606xC series of programmable lightwave switches cover a broad range of switching capacity and provide easy signal routing for accurate and repeatable measurement automation. These switches provide an important building block for implementing automated test systems in manufacturing. They are designed to be versatile and can be easily configured with several different options for automated test environments.

The 8606xC switch family features an easy-to-use manual interface and a visual signal routing display. The interface allows quick manual operation for initially setting up a measurement or for quick investigation of test device performance. Selected switch positions can be saved and recalled. The switches can be easily integrated into automated test systems using SCPI-compatible commands via GPIB or RS-232 interfaces.

Agilent 86060C Features and Benefits

The new "C" series of lightwave switches are now temperature stabilized and thus, offer excellent repeatability and insertion loss stability. They are designed for long reliable service with low insertion loss and low back reflections, for accurate lightwave measurements in automated test setups where the switch is an integral part of the measurement.

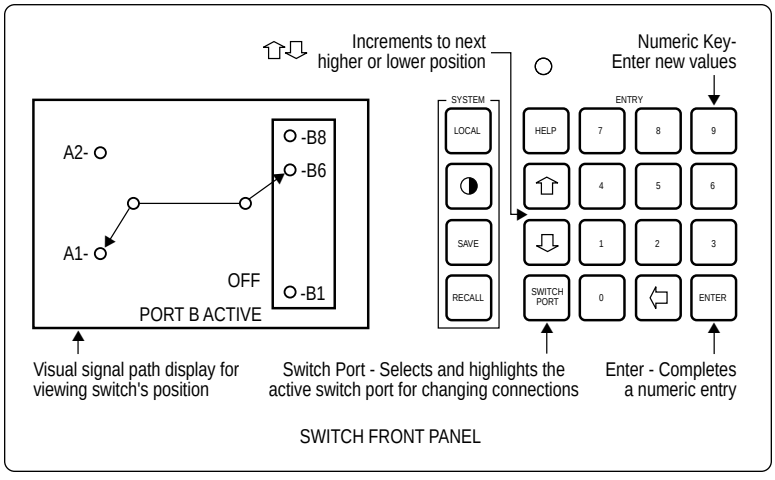


Figure 1. Agilent's manual interface and visual signal routing display (top diagram).

The 86060C is a compact switch available with four to eight output channels and one or two inputs. The switch is designed for easy configuration with Agilent optical attenuators, lightwave multimeters, OTDRs, and other lightwave test instrumentation for either benchtop or automated system applications.

New to the "C" series switch family is the 86061C—a mid-size switch in a half-width chassis, available with one or two input channels. It can accomodate from four to twelve output channels on the front panel and up to eighteen outputs on the rear panel.

The 86062C is a full-width instrument with 20 to 100 output channels. It is designed for automated production and evaluation testing of large numbers of devices.

The 8606xC Series Lightwave Switches are designed for 9/125 µm single-mode, as well as 62.5/125 and 50/125 µm multi-mode operation. Switching is bi-directional. The 1xN switching module is built around a precision stepper motor.

Standard configurations include fiber "pigtails" or FC, SC, or ST connectors. Other connector types including Diamond or angled physical contact are available on request. (Unlike most Agilent products, these connector types are not interchangeable.)

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Switching Operation

The basic 1xN switching design of the 8606xC is shown in Figure 2. It consists of a single input channel that is routed through a movable arm. The arm is controlled by the stepper motor to align the input to any output position[1]. Very low insertion loss and excellent repeatability are achieved using high quality optics and precise motor control.

A two input switch diagram is shown in Figure 3. In this configuration, the two input arms move together to connect either input channel to an output channel. The standard 8606xC design is called "non-blocking" since the unselected input channel is not blocked to the output. In this example, connecting A1 to B1 may also connect A2 to B2. "Blocking" type switches that only allow one of the input channels to be connected to the output can also be configured in the 8606xC family. These are available as special options at this time. For additional information about blocking switches, please refer to the custom switching configuration section of this document or contact your local Agilent field office.

Contiguous Switching Option

A variation on the two input switch as in Figure 3, this option allows both inputs to be connected to corresponding adjacent output channels. This is true both mechanically and programmatically. For example, when selecting Input A1 to Output B1 you will get an A1 to B1 port connection. In the case of the contiguous option, you will also get an A2 to B2 adjacent connection, even though these connections were not selected.

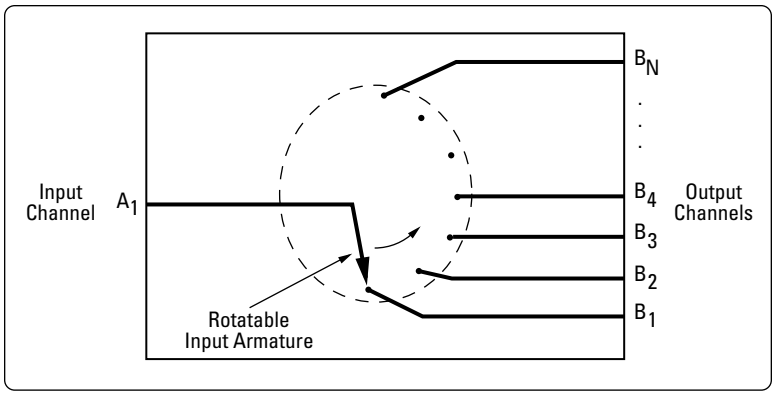


Figure 2. 1xN switching configuration

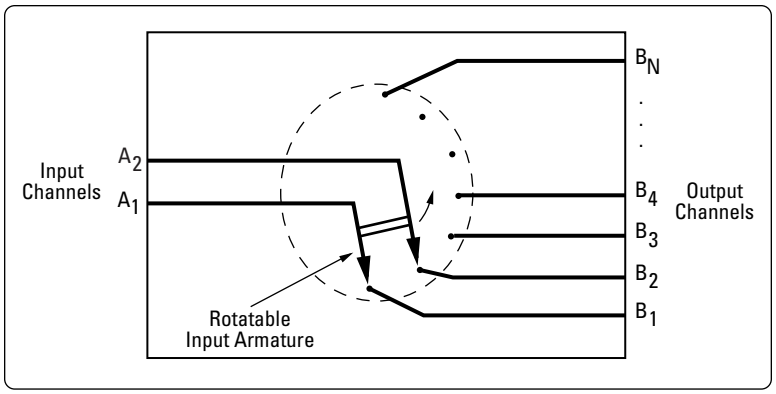


Figure 3. 2xN non-blocking configuration

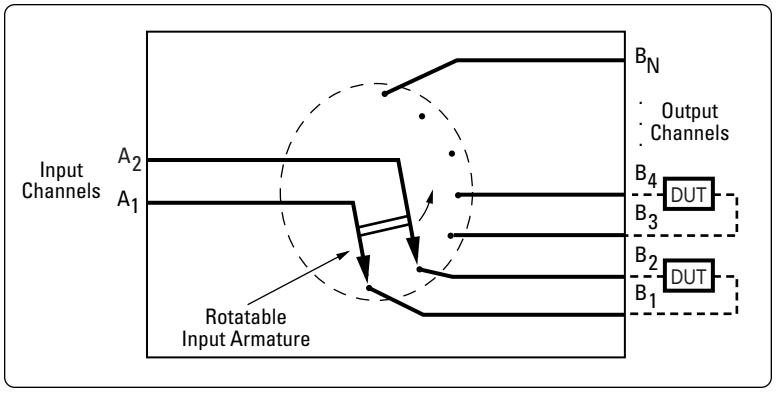


Figure 4. Contiguous switching option

The standard version does not guarantee that the non-selected input channel will be adjacent to the selected output channel.

Figure 4 demonstrates one application for this option in which multiple devices under test have their inputs connected to the odd output channels and their outputs connected to the adjacent even output channels. This enables multiple products to be connected and tested in parallel, which can dramatically reduce test times.

[1] The terms "input" and "output" denote one side of the switch versus the other. They do not imply that transmission can only occur in one direction. The 8606xC series switches are all bi-directional (i.e., signals can transmit in either direction).

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Custom configurations

In addition to the many standard options, Agilent offers a variety of custom configurations to tailor the optical switch for specific test applications. Some of the more important configurations are described here. For information on other types of custom switches, please contact your local Agilent field representative.

Multi-layered Switches

The 8606xC family offers multi-layered switch configurations in a single chassis. This provides added flexibility and functionality while minimizing rack or bench space. Integrated multi-layer software can control up to 4 separate switch layers in a single box. An example of a 4 layer switch is shown in Figure 5. It consists of two 1x2 switches on layers S1 and S2 and two 2x8 switches in layers S3 and S4 in a single chassis. The front panel display in Figure 6 shows the channel configuration in each of the four layers.

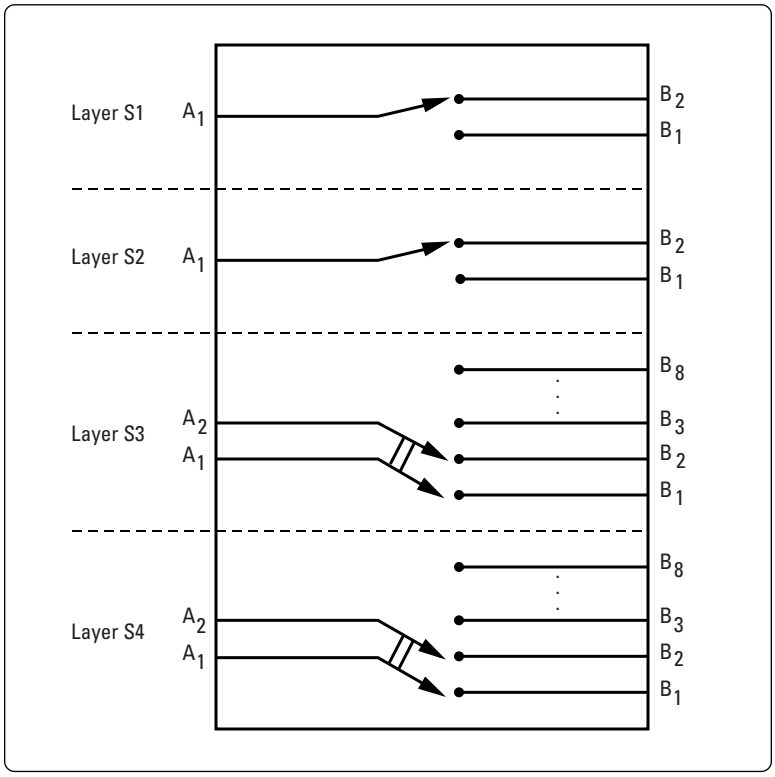


Figure 5. Multi-layered switch example

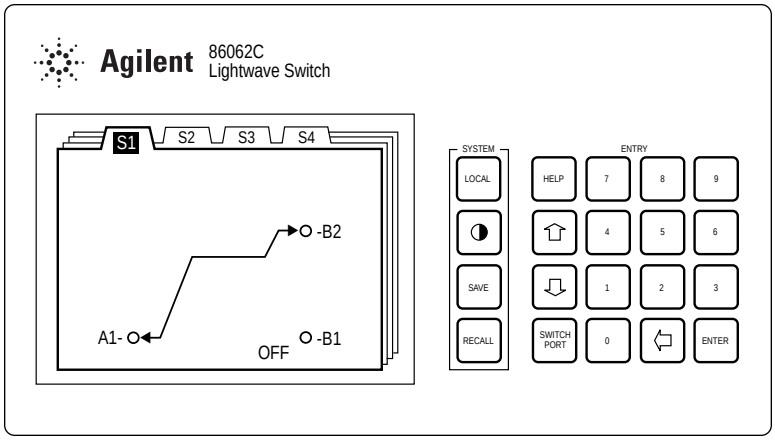


Figure 6. Layer S1 showing input side of automated testbed shown in Figure 2

Blocking Switches

In addition to the standard "non-blocking" design, the 8606xC series switches can be specified in a "blocking" configuration (i.e., only one input channel can be connected to the output). This is achieved in two ways.

The first type of blocking solution is where every other output channel position is utilized (see Figure 7). In this configuration only one input channel can be connected to an output channel, while the other input is not aligned to any connecting port. The advantage to this design is that low insertion loss can be maintained. However, the total number of available output channels is reduced by half. For the 8606xC family, the limit would be 50 output channels in this blocking configuration.

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If more than fifty channels are required, another blocking solution is available in the "C" version by adding an Mx1 switching element in front of a 1xN armature switch (See Figure 8). The implication of this design is that there is slightly higher insertion loss than the standard "C" specification, and the input/output channels are controlled on two separate layers via front panel keys or remote control. When programming the switch, two SCPI commands are needed to connect a one of the input channels to a desired output channel.

More Than Two Input Channels

The 8606xC family of switches can be configured to have more than 2 input channels. Up to 4 input channels can be accomodated. Figure 9 depicts a 4xN configuration. In this design, the four input arms move together to connect any input channel to any output channel.

For other types of special configurations (such as angled connector contacts, enhanced specifications, special fiber type, etc.), please contact your local Agilent field representative or regional customer call center.

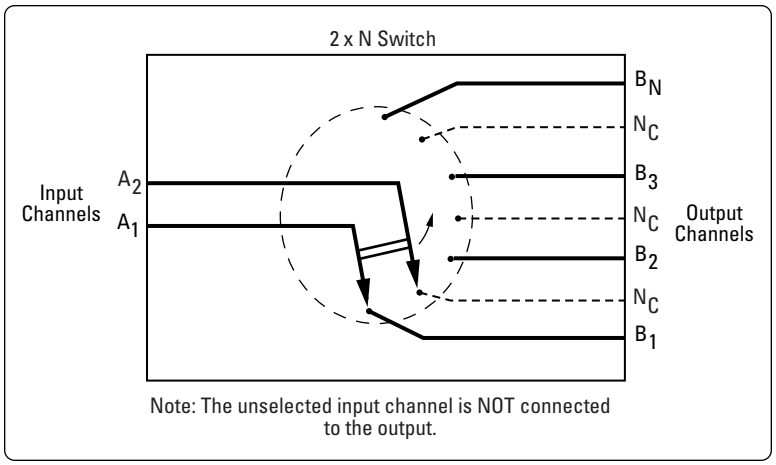


Figure 7. Agilent 8606xC blocking switch configuration 1

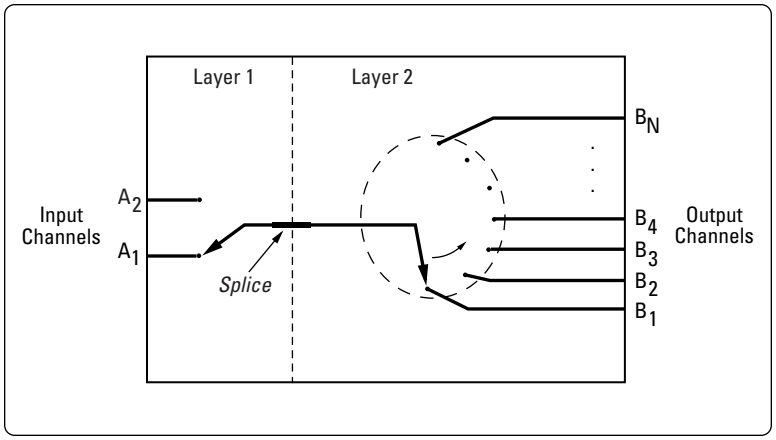


Figure 8. Agilent 8606xC blocking switch configuration 2

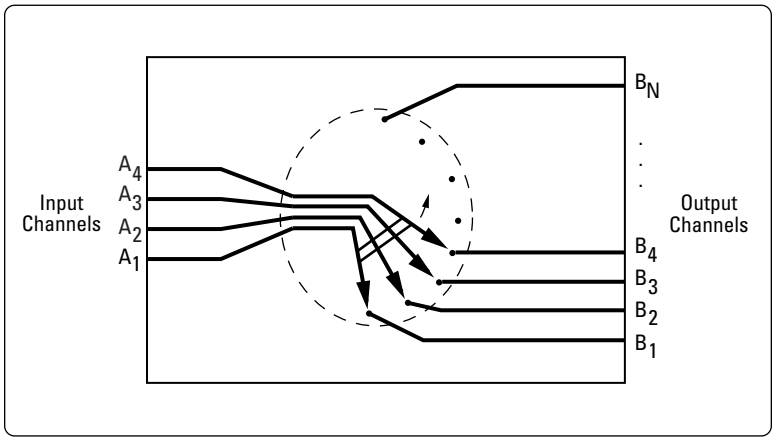


Figure 9. 4xN switch configuration

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Applications

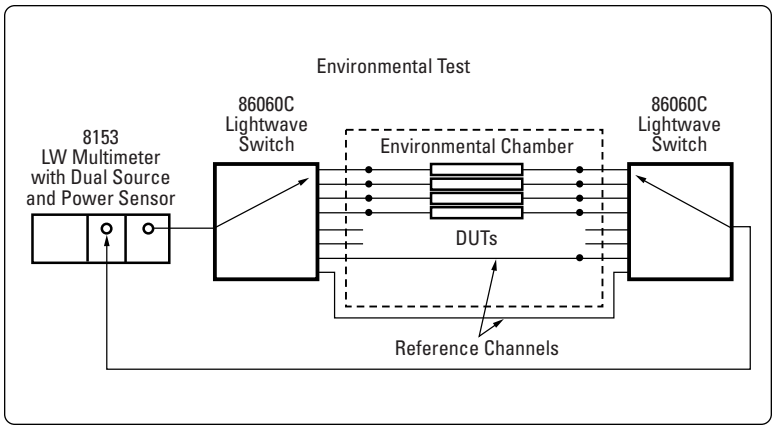


Figure 10. Insertion loss as a function of temperature

A well-implemented automated test system can help reduce manufacturing costs. A wide range of measurements can be performed and recorded much more rapidly, eliminating the need to manually reset operating conditions. Automated systems can be implemented to reduce the necessary operator skill level and amount of training required. They can also reduce the time spent recording, recovering, and publishing test results.

Increasing measurement throughput by greatly reducing time per test, a single automated test system can do the work of several manual stations, thereby reducing both cost per test and the total capital investment required for the test.

Qualification testing can be very expensive, with the additional cost of operating an environmental chamber on top of tying up lots of test equipment for long periods to test multiple devices. Figure 10 shows an automated environmental test system using two 86060C Lightwave Switches and an 8153 Lightwave Multimeter with the 81554SM Dual Laser Source module and the 81532A Power Sensor module.

Multiple devices are connected for the test (for example, isolators, patchcords, or attenuators). Insertion loss is measured versus temperature. Reference channels are used for system calibration and to compensate for system drift. This system could be expanded to test return loss versus temperature with the addition of a coupler and a reflectance standard. This test system can also be set up using a single 86062C switch with two layers.

Multi-port device testing can complicate manufacturing test. Flexible lightwave switch configurations provide a versatile building block for test systems design. Figure 11 shows an eight channel WDM/router test setup which uses a multi-layered 86062C switch with three switching modules. The Agilent 11896A Polarization Controller allows the devices under test to be tested for amplitude and wavelength

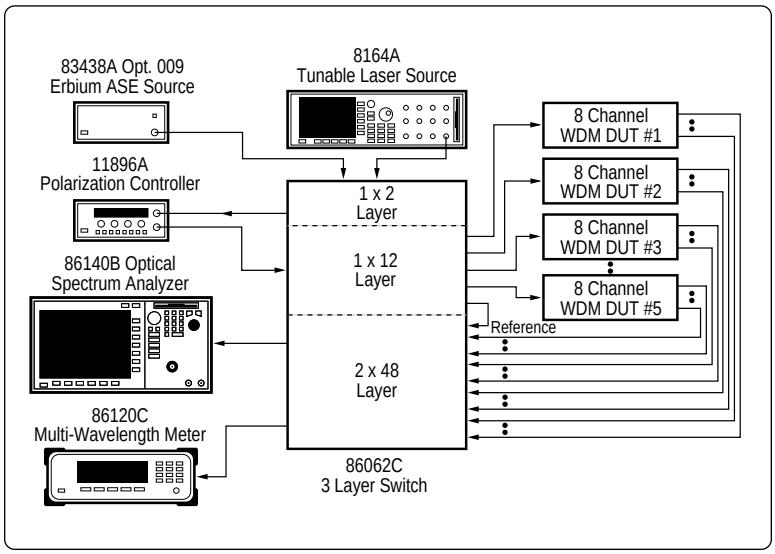


Figure 11. Eight channel WDM/router test setup

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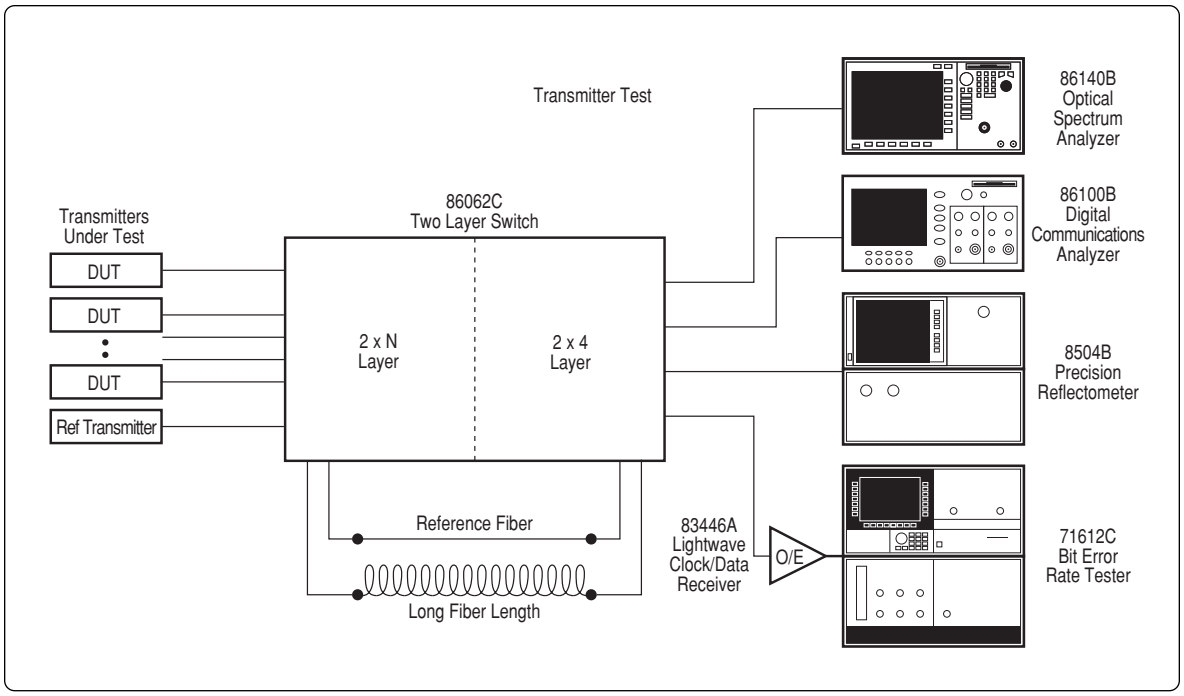


Figure 12. Automated transmitter test system

polarization dependency. The Agilent 86140B Optical Spectrum Analyzer provides spectral characteristics such as free spectral range, channel bandwidth, and isolation/crosstalk. The Agilent 86120C Multi-Wavelength Meter is used to make extremely accurate channel wavelength and channel spacing measurements. The switch configuration provides for an 8 x 8 or multiple 1 x 8 test device configurations.

Products aimed at new telecommunications systems require extensive testing to industry standards such as ITU-TS (formerly CCITT) G.957 for the Synchronous Digital Hierarchy, and other standards for SONET and ATM. Increasingly, the performance of products for these markets must be well documented and supplied with the product. Manufacturers continue to strive to use testing as one tool to improve process performance and yields. Potential suppliers are carefully evaluated to insure that their products and components will meet overall system performance requirements. Environmental tests are frequently necessary to be certain that designs are robust compared to the operating conditions that must be met.

Figure 12 shows a system for performing extensive parametric measurements, such as those required for SDH and SONET, on multiple transmitters. The system provides for testing the spectral characteristics with the Agilent 86140B Optical Spectrum Analyzer. The system performs eye-diagram measurements using the Agilent 86100B Digital Communications Analyzer (DCA). The Agilent 8504B Precision Reflectometer is calibrated to remove the path length to the transmitters, and provides detailed measurement of the different sources of reflection in the transmitter. The Agilent 71612C Bit Error Rate Tester, together with the Agilent 83446A Lightwave Clock/Data Receiver, is used to monitor bit error rate performance.

The system can be expanded to construct a transceiver test system. Additional channels would be needed on the right hand switch. Microwave switching can be added in front of the Agilent 71612C BERT to sequentially measure the bit error rate performance of the receivers.

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Specifications and Characteristics

Specifications describe the instrument's warranted performance (including measurement uncertainty) over the +5°C to +40°C temperature range, with RH from 0 to 80%, except where noted. **Characteristics** provide information about non-warranted instrument performance in the form of nominal values. Characteristics are at room temperature.

	Characteristic	Specification
Insertion Loss[1]		
Single-mode Switches	0.7 dB	1.0 dB
Multi-mode Switches	0.6 dB	0.8 dB
Insertion Loss Stability[2]	±0.025 dB	±0.03 dB
Repeatability[3]		
Sequential Switching	±0.005 dB	±0.008 dB
Random Switching	±0.01 dB	±0.025 dB
Optical Return Loss[4]		
Single-mode Switches	62 dB	58 dB
Multimode Switches	25 dB	20 dB
Polarization Dependent Loss[5]	0.02 dB	0.05 dB
Isolation	–100 dB	–80 dB
Typical Switching Life	10 million cycles	
Switching Time		
Between Adjacent Channels	330 msec	
Each Additional Channel	50 msec	

[1] Insertion loss does not include connectors. Include an additional 0.25 dB (characteristic) or 0.5 dB (hard spec) for each connector.
[2] Drift of any channel relative to one assigned reference channel at ±3°C for 7 days.
[3] Repeatability measured after four hours warmup and with an one second pause between movements.
[4] Excludes external pigtail backscatter and connector reflections.
[5] Polarization Dependent Loss only applies to single-mode switches and is measured at 1550 nm.

General Specifications

Temperature Range:
Operational: 0 to +55°C
Storage: –40 to +70°C

Power Requirements:
100/115/230/240 V (range 90 to 254 vac).
Power Consumption: up to 80 VA (characteristic)

Weight: (dependent on the number of channels)
Agilent 86060C: 3.76 to 4.1 Kg (8.4 to 9.2 lbs)
Agilent 86061C: 4.0 to 6.18 kg (8.8 to 13.6 lbs)
Agilent 86062C: 7.72 to 13.74 Kg (17.25 to 30.7 lbs)

Dimensions: (H x W x D)
Agilent 86060C: 132.6 x 213 x 345.4 mm
(5.25 x 8.39 x 14 in.)
Agilent 86061C: 177 x 213 x 345.4 mm
(7 x 8.39 x 14 in.)
Agilent 86062C: 177 x 425 x 345.4 mm
(7 x 16.75 x 14 in.)

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Ordering Information

Switch Configuration

Chassis Size (choose one)

86060C	Compact lightwave switch
86061C	Mid-size lightwave switch
86062C	Full-size lightwave switch

The following options are avilable for all models.

Number of Input Channels (choose one)

8606xC-001	Single input channel
8606xC-002	Two input channels

Wavelength and Fiber Type (choose one)

8606xC-109	1280–1650 nm, 9/125 µm single-mode fiber
8606xC-163	750–1350 nm, 62.5/125 µm multimode fiber
8606xC-H51	750–1350 nm, 50/125 µm multimode fiber (special order)

Channel Location (choose one)

8606xC-050	Connectors on front panel (86060C maximum 4 output channels, 86061C maximum 16 output channels)
8606xC-051	Connectors on rear panel (for connectorized outputs only)
8606xC-052	3 meter fiber out the rear panel (for connectorized outputs, connector is at the end of the 3 meter fiber)

Output Channels (choose one)

8606xC-2xx	Where xx is the number of connectorized output channels selected from the table below.
8606xC-3xx	Where xx is the # of non-connectorized output channels selected from the table below. This option is used in conjunction with the 8606xC-052 only.

86060C Compact Lightwave Switch	86061C Mid-Size Lightwave Switch	86062C Full-Size Lightwave Switch
Number of Output Channels		
04	04	20
06	08	24
08	12	28
	16	32
		40
		48
		56
		64
		72
		80
		00 (100 ouput channels)

Optical Connectors (choose one)

8606xC-012	FC connector
8606xC-014	ST connector
8606xC-017	SC connector
Special Order	FC/APC or SC/APC connectors

Accessories (choose one)

8606xC-1CM	Rackmount flange kit
8606xC-1CN	Front handle kit
8606xC-1CP	Rackmount flange kit with handles

Documentation

8606xC-ABJ	User's manual in Japanese
8606xC-UK6	Commercial calibration certification with test data

Special Orders

Contact your local Agilent Technologies representative.

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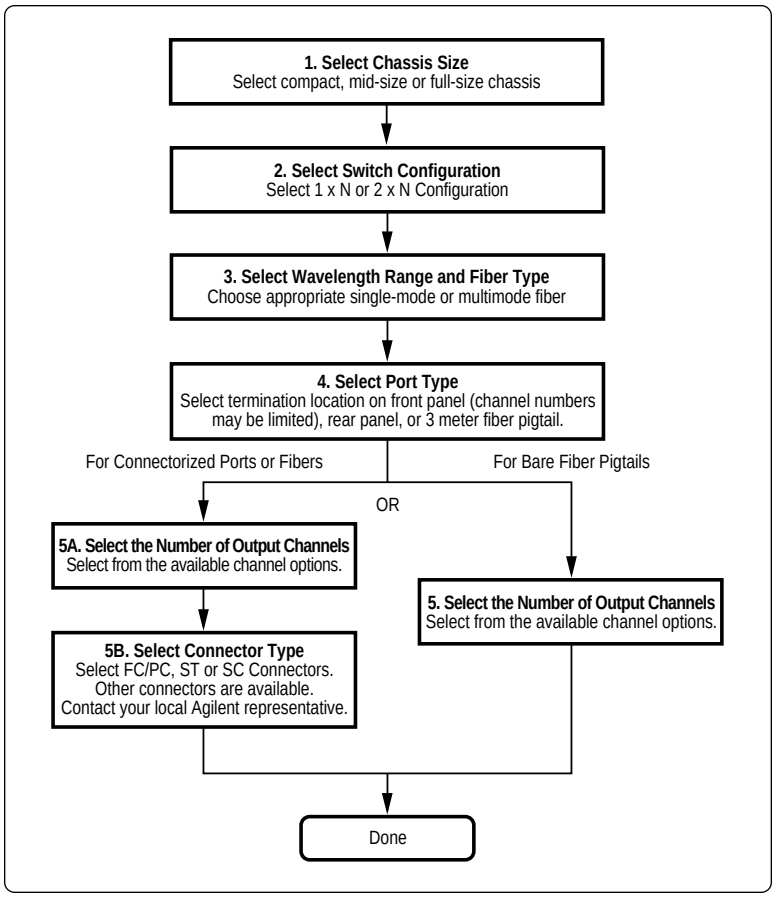


Figure 13. Configuration flowchart

Configuration Examples

Agilent 86060C Compact Lightwave Switch

86060C-001	One input channel
86060C-109	1280 to 1650 nm, 9/125 µm single-mode fiber
86060C-051	Connectors on rear panel
86060C-208	8 connectorized outputs
86060C-017	SC connectors

Agilent 86062C Full-Size Lightwave Switch

86062C-002	Two input channels
86062C-163	750 to 1350 nm, 9/125 µm single-mode fiber
86062C-052	3 meter fiber pigtails out the rear panel
86062C-264	64 outputs
86062C-012	FC connectors

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