

TEST + Calibration

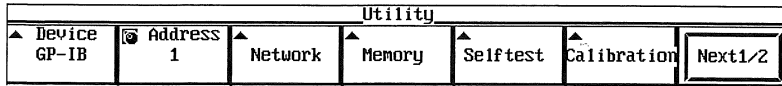
TA720
Time Interval Analyzer

14.4 Self Test

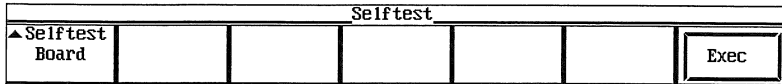
Procedure

Before taking the following steps, remove all the cables that are connected to the terminals on the front and rear panels, and stop the measurement.

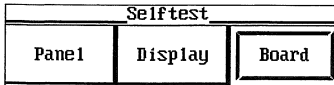
1. Press the **UTILITY** key to display the Utility menu.



2. Press the **Selftest** soft key to display the Selftest menu.



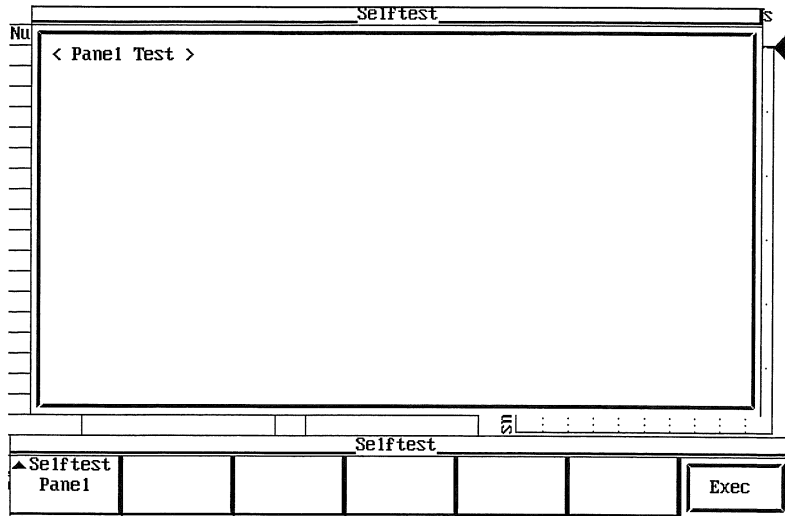
3. Press the **Selftest** soft key to display the Selftest selection menu.



- **Testing the Keys and Rotary Knob**

4. Press the **Panel** soft key.

A menu used to start the test and a window that indicates the test results are displayed.

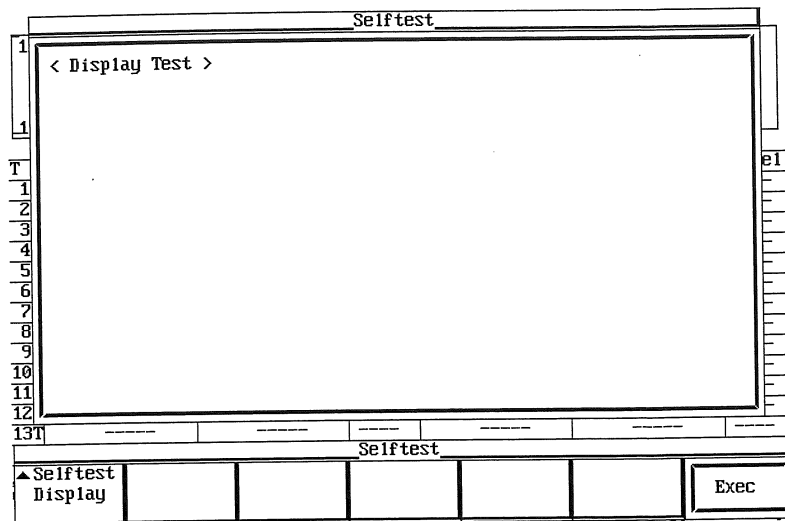


5. Press the **Exec** soft key to execute the test.
6. Press each key and check that the name of the key is displayed.
7. Turn the rotary knob to the left and right and check that the name of the direction is displayed correctly.
8. Press the ESC key twice to quit the test.

- **Testing the Display**

4. Press the **Display** soft key.

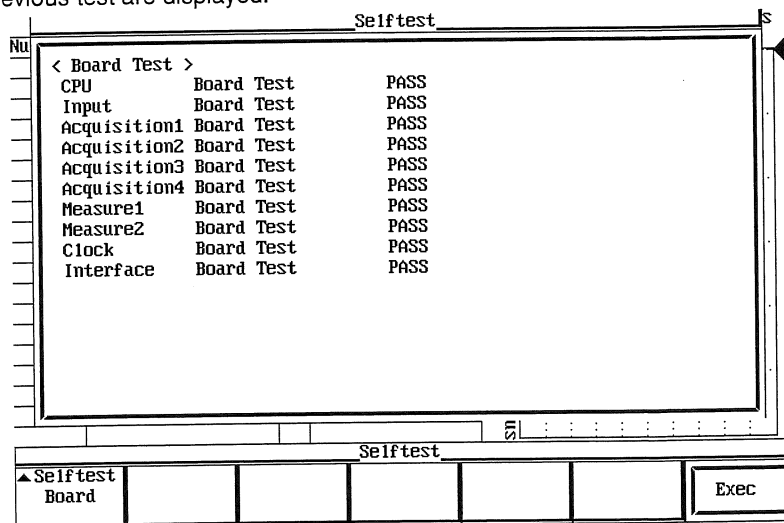
A menu used to start the test and a window containing the text "<Display Test>" are displayed.



5. Press the **Exec** soft key to start the test.
Text indicating the test items and test details is displayed.
6. Press the arrow keys to display the test item and the test details alternately and check that color dropout and other abnormalities are not present on the display.
7. Turn the rotary knob to check that the brightness of the LCD changes.
8. Press the ESC key to quit the test.

• Testing the Board

4. Press the **Board** soft key.
A menu used to start the test and a window that indicates the results of the previous test are displayed.



5. Press the **Exec** soft key to start the test.
The board test starts, and the results are displayed.
PASS should appear on all items.

Explanation

When a Failure Is Found from the Test

It is probably a malfunction. Please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

Text Indicating the Results of the Board Test

If a failure is found, FAIL or the following character string appears in place of PASS. In either case, servicing is required. Please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

- Low Battery: The lithium battery has reached the end of its service life.
 The battery must be replaced.
- Calibration Data Lost: The internal calibration value may have been lost.
 Recalibration is required.
- ROM Error/DRAM Error/: Error may have occurred in the internal memory.
 SRAM Error

Note

When executing a self test, leave the input terminals (CH A and CH B) open.

14.5 Adjusting the Time Base



CAUTION

- Do not apply a voltage exceeding the maximum input voltage to the input terminals of each instrument. This may cause damage to the input section.
- Do not apply external voltage to the output terminals of each instrument. This may cause damage to the internal circuitry.

Instruments Required

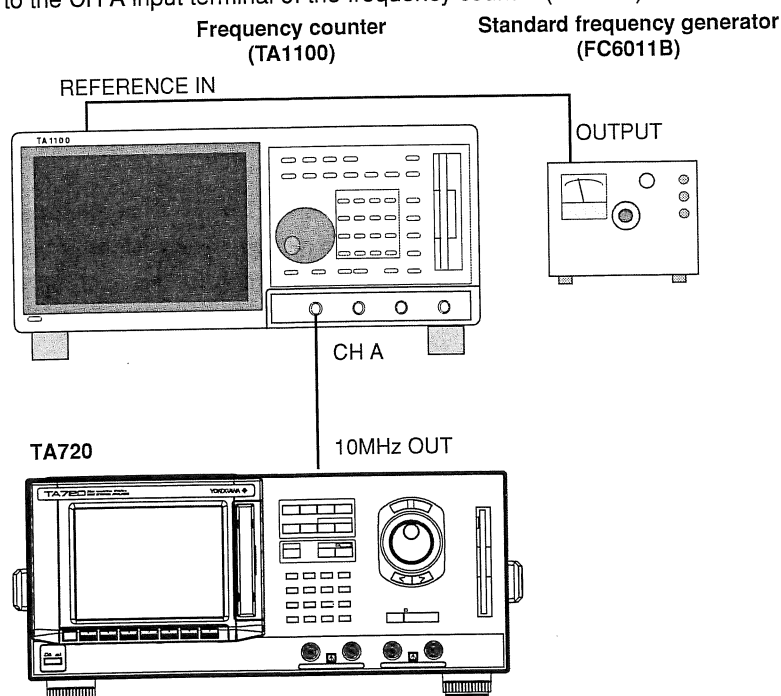
Prepare the following instruments.

- **Standard frequency generator**
 - Frequency accuracy: 0.1 ppm or better
 - Recommended instrument: FC6011B Rb Atomic Oscillator (by Fujitsu), or HP5065A (by Agilent Technologies)
- **Frequency counter**
 - Frequency resolution: 1 Hz or better
 - Recommended instrument: TA1100 Time Interval Analyzer (by YOKOGAWA)

The procedure for adjusting the time base (reference clock) using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the standard frequency generator to the REFERENCE IN (rear panel) terminal of the frequency counter (TA1100) and measure using the external reference frequency.
- Using a BNC cable, connect the 10MHz OUT terminal on the rear panel of the TA720 to the CH A input terminal of the frequency counter (TA1100).



14.5 Adjusting the Time Base

Instrument Settings

- TA720: None
- TA1100:
 - Function: Frequency A
 - Gate time: 1 ms
 - Number of samples: 1
 - Sampling mode: FREE
 - Display: NUMERIC
 - Input Setting CH A: DC coupling, ATT=OFF, 50 Ω , trigger level = 0 V
 - REFERENCE: EXTERNAL
 - Rb atomic oscillator: None

Adjustment Procedure

- Adjust the TA720 after 30 minutes of warm-up.
- Turn the REFERENCE ADJUST on the rear panel of the TA720, and adjust it so that the read-out value of the frequency counter is within the following range.
9.999995 MHz to 10.000005 MHz (10 MHz \pm 5 Hz, within \pm 0.5 ppm)

14.6 Performance Test



CAUTION

- Do not apply a voltage exceeding the maximum input voltage to the input terminal of each instrument. This may cause damage to the input section.
- Do not apply external voltage to the output terminals of instruments. This may cause damage to the internal circuitry.

Testing the Trigger Voltage Accuracy

Instruments Required

Prepare the following instruments.

DC voltage generator

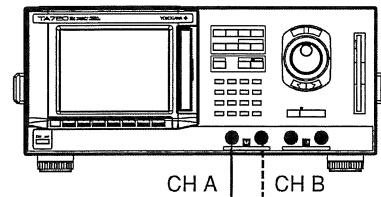
- Voltage accuracy: 1 mV or better
- Recommended instrument: 7651 programmable DC voltage/current source (by YOKOGAWA)

The procedure for testing the trigger voltage accuracy using the recommended instruments is described below.

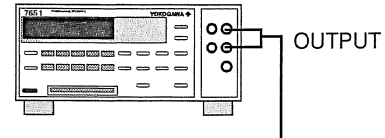
Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the DC voltage generator to the input terminal (CH A/CH B) of the TA720.

TA720



DC voltage generator (7651)



Instrument Settings

- TA720: Input settings: DC coupling, 1 M Ω , trigger level = 0 V
- 7651: Output level: 4.000 V, 0 V, -4.000 V

Test Method

- Calibrate the TA720 after 30 minutes of warm-up.
- This test compares the applied DC voltage to the trigger level (slice level) set by the TA720 and checks the error in the trigger level.
- The actual detection of the trigger level is done by monitoring the input indicator of the TA720.

Test Procedure

1. Connect the output of the 7651 to TA720 CH A.
2. Set the output level of the 7651 to 4.000 V.
3. Set the trigger level of the TA720 to 4.100 V.
4. Set the TA720 in the measurement start condition.
5. Decrease the trigger level of the TA720 in 5-mV steps. Gradually decrease the trigger level and record the voltage at which the input indicator illuminates as VL.
6. Set the trigger level of the TA720 to 3.900 V.

14.6 Performance Test

7. Increase the trigger level of the TA720 in 5-mV steps. Gradually increase the trigger level and record the voltage at which the input indicator illuminates as V_H .
8. The trigger voltage is derived by taking the average of V_L and V_H . Confirm that this voltage is within the allowable range.
$$V_{TRIG} = (V_L + V_H)/2$$
9. Perform similar tests by setting the output of the DC voltage generator to 0.000 V and -4.000 V.
10. Repeat steps 1 to 9 for CH B.

Test Result

- CH A

Voltage of the 7651	VL	VH	VTRIG	Allowable Range
4.000 V				3.950 V to 4.050 V
0.000 V				-0.010 V to 0.010 V
-4.000 V				-4.050 V to -3.950 V

- CH B

Voltage of the 7651	VL	VH	VTRIG	Allowable Range
4.000 V				3.950 V to 4.050 V
0.000 V				-0.010 V to 0.010 V
-4.000 V				-4.050 V to -3.950 V

Note

If noise is present due to the influence from the outside environment, connect a 1- μ F capacitor between the signal line and ground.

Testing the Input Sensitivity

Instruments Required

Prepare the following instruments.

Synthesized signal generator

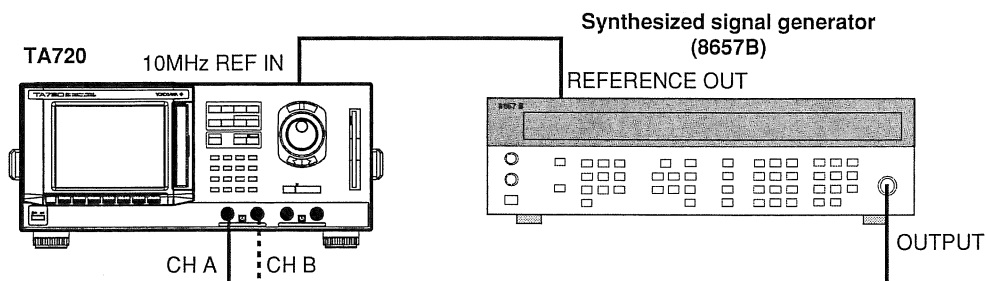
- Frequency range: 10 MHz to 170 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 0.15 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)

The procedure for testing the input sensitivity using the recommended instruments is described below.

When using the recommended instruments, calibrate the instruments so that the output level accuracy is 0.15 dB or better.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: Period A, B
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:

Input Frequency	X Center	X Span
10 MHz	100 ns	15 ns
166.6 MHz	6 ns	15 ns

- Y High: 10^6
- 8657B
 - Frequency: 10 MHz, 166.6 MHz
 - Level: 35 mV_{rms}

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the period measurement function on the TA720. Perform the same test on both CH A and CH B.

14.6 Performance Test

Test Result

- CH A↑

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			99.7 ns to 100.3 ns		280 ps or less
166.6 MHz			5.7 ns to 6.3 ns		120 ps or less

- CH A↓

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			99.7 ns to 100.3 ns		280 ps or less
166.6 MHz			5.7 ns to 6.3 ns		120 ps or less

- CH B↑

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			99.7 ns to 100.3 ns		280 ps or less
166.6 MHz			5.7 ns to 6.3 ns		120 ps or less

- CH B↓

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			99.7 ns to 100.3 ns		280 ps or less
166.6 MHz			5.7 ns to 6.3 ns		120 ps or less

When the results of all the tests above are within the allowable range, the input sensitivity is taken to be 100 mVpp.

Testing the Frequency Measurement

Instruments Required

Prepare the following instruments.

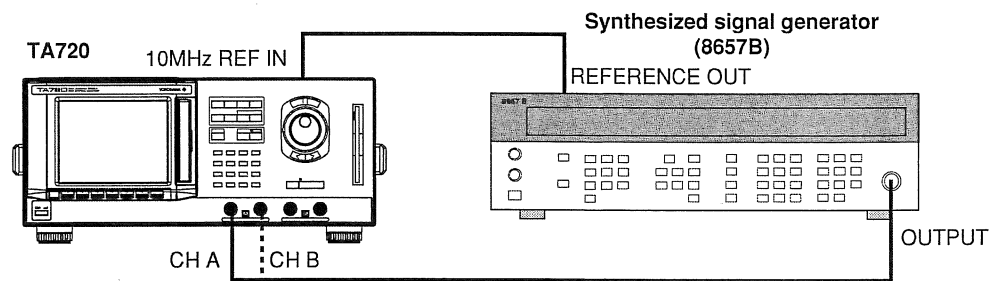
Synthesized signal generator

- Frequency range: 10 MHz to 170 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 1.5 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)

The procedure for testing the frequency measurement using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: Period A, B
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:

Input Frequency	X Center	X Span
10 MHz	100 ns	15 ns
166.6 MHz	6 ns	15 ns

- Y High: 10^6
- 8657B
 - Frequency: 10 MHz, 166.6 MHz
 - Level: 360 mV_{rms}

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the period measurement function on the TA720. Perform the same test on both CH A and CH B.

14.6 Performance Test

Test Result

- CH A↑

Synthesized Signal		Average		Standard Deviation	
Generator Frequency	Measured Value	Allowable Range	Measured value	Allowable Range	
10 MHz		99.7 ns to 100.3 ns		120 ps or less	
166.6 MHz		5.7 ns to 6.3 ns		100 ps or less	

- CH A↓

Synthesized Signal		Average		Standard Deviation	
Generator Frequency	Measured Value	Allowable Range	Measured value	Allowable Range	
10 MHz		99.7 ns to 100.3 ns		120 ps or less	
166.6 MHz		5.7 ns to 6.3 ns		100 ps or less	

- CH B↑

Synthesized Signal		Average		Standard Deviation	
Generator Frequency	Measured Value	Allowable Range	Measured value	Allowable Range	
10 MHz		99.7 ns to 100.3 ns		120 ps or less	
166.6 MHz		5.7 ns to 6.3 ns		100 ps or less	

- CH B↓

Synthesized Signal		Average		Standard Deviation	
Generator Frequency	Measured Value	Allowable Range	Measured value	Allowable Range	
10 MHz		99.7 ns to 100.3 ns		120 ps or less	
166.6 MHz		5.7 ns to 6.3 ns		100 ps or less	

Testing the Pulse Width Measurement

Instruments Required

Prepare the following instruments.

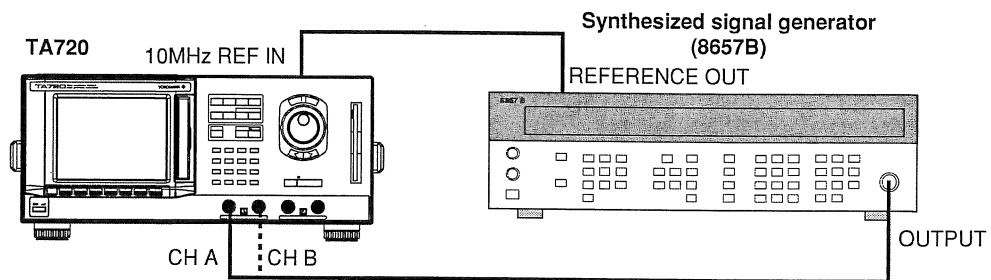
Synthesized signal generator

- Frequency range: 10 MHz to 90 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 1.5 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)

The procedure for testing the pulse width measurement using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: Pulse width A, B
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:

Input Frequency	X Center	X Span
10 MHz	50 ns	15 ns
83.3 MHz	6 ns	15 ns

- Y High: 10^6
- 8657B
 - Frequency: 10 MHz, 83.3 MHz
 - Level: 360 mV_{rms}

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the pulse width measurement function on the TA720. Perform the same test on both CH A and CH B.

14.6 Performance Test


Test Result

- CH A 


Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			48.4 ns to 51.6 ns		120 ps or less
83.3 MHz			5.0 ns to 7.0 ns		100 ps or less

- CH A 

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			48.4 ns to 51.6 ns		120 ps or less
83.3 MHz			5.0 ns to 7.0 ns		100 ps or less

- CH B 

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			48.4 ns to 51.6 ns		120 ps or less
83.3 MHz			5.0 ns to 7.0 ns		100 ps or less

- CH B 

Synthesized Signal		Average		Standard Deviation	
Generator Frequency		Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz			48.4 ns to 51.6 ns		120 ps or less
83.3 MHz			5.0 ns to 7.0 ns		100 ps or less

Testing the A-to-B Time Interval Measurement

Instruments Required

Prepare the following instruments.

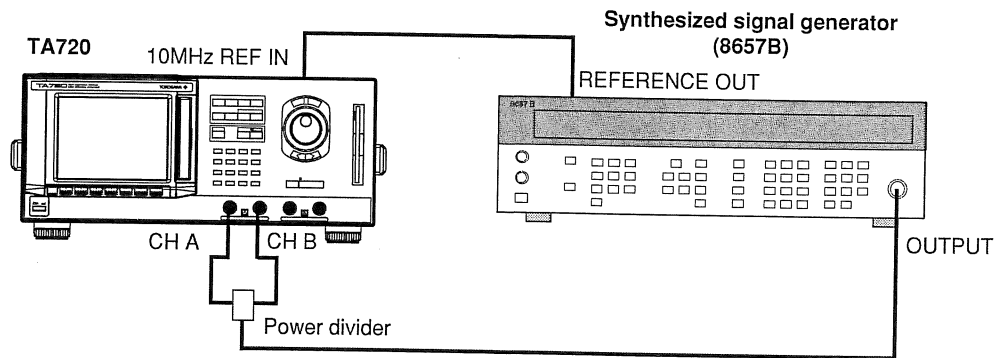
Synthesized signal generator

- Frequency range: 10 MHz to 170 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 1.5 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)
- Power divider
 - Characteristic impedance: 50 Ω
 - Recommended instrument: 70-0966 Power Divider (by YOKOGAWA)

The procedure for testing the A-to-B time interval measurement using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: A-to-B time interval
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:
 - A↑B↑ or A↓B↓ with CH B delay of 2.5 ns

Input Frequency	X Center	X Span
10 MHz	2 ns	15 ns
166.6 MHz	2 ns	15 ns

- A↑B↓ or A↓B↑ with CH B delay of 0 ns

Input Frequency	X Center	X Span
10 MHz	50 ns	15 ns
166.6 MHz	3 ns	15 ns

- Y High: 10⁶
- 8657B
 - Frequency: 10 MHz, 166.6 MHz
 - Level: 720 mV_{rms}

14.6 Performance Test

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the A-to-B time interval measurement function on the TA720.

Test Result

- A↑B↑

Synthesized Signal Generator Frequency	Average		Standard Deviation	
	Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz		0.9 ns to 4.1 ns		120 ps or less
166.6 MHz		1.5 ns to 3.5 ns		100 ps or less

- A↓B↓

Synthesized Signal Generator Frequency	Average		Standard Deviation	
	Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz		0.9 ns to 4.1 ns		120 ps or less
166.6 MHz		1.5 ns to 3.5 ns		100 ps or less

- A↑B↓

Synthesized Signal Generator Frequency	Average		Standard Deviation	
	Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz		48.4 ns to 51.6 ns		120 ps or less
166.6 MHz		2.0 ns to 4.0 ns		100 ps or less

- A↓B↑

Synthesized Signal Generator Frequency	Average		Standard Deviation	
	Measured Value	Allowable Range	Measured value	Allowable Range
10 MHz		48.4 ns to 51.6 ns		120 ps or less
166.6 MHz		2.0 ns to 4.0 ns		100 ps or less