Application Note

Anritsu envision : ensure

How To Create Scenarios

Network Master Pro MT1000A
Network Master Flex MT1100A
Scenario Edit Environment Kit (SEEK) MX100003A

Contents

1 Introduction

1.1 About This Note

This note describes the procedures and knowledge required for end users to create scenarios to automate tests using the MT1000A and MT1100A (Network Master hereafter). Readers with a good understanding of the contents will be able to create scenarios for controlling the Network Master.

This note explains the following:

- General procedures and knowledge to prepare for creating and maintaining scenarios
- Detailed explanations of sample scenarios

This note does not explain the following items; refer to the appended instruction manual for explanation of these items.

• How to operate network master	→ Refer to MT1000A or MT1100A instruction manual.
• SCPI command reference	→ Refer to remote scripting instruction manual.
• How to use MX100003A Scenario Editing Kit	→ Refer to MX100003A instruction manual.
• Scripts syntax and commands reference	→ Refer to MX100003A instruction manual.

1.2 Difficulty of Scenario Creation

The MX100003A Scenario Editing Kit (SEEK) is a tool to support automating tests. Implementing automatic testing using general measuring instruments without SEEK requires deep knowledge, skills, and experience in the following areas.

- Knowledge about command-line-based user interfaces called SCPI supported by measuring instruments
- Knowledge and experience of software programming using languages, such as C/C++, Visual Basic, Python, Ruby, etc.

Using these types of knowledge for programming automation objectives is a strength. Conversely, sections performing and managing testing must secure staff with the necessary software development skills.

The SEEK has been developed to implement automation using a drag and drop GUI without the need for the above-described knowledge and experience. The SEEK GUI is used to create scenarios on-screen based on operation sequences and pass/fail evaluation standards to be automated.

Scenario descriptions are simple to create using general GUI operations, but on the other hand, there may be limits to the descriptions. Descriptions created using programming languages have no limits, but on the other hand, can be extremely hard to use. SEEK eliminates this trade-off by introducing a unique scripting language in addition to GUI operations. It is easy to obtain this scripting language due to its small size. This combination of sequence description using a GUI and scripting language offers users the best balance of both methods.

The necessity to use scripting language when creating scenarios by the SEEK depends on what kind of pass/fail evaluation standards are used. The following table shows the relationship between pass/fail evaluation standards and the difficulty of scenario creation.

Table 1.2-1 Relationship between pass/fail evaluation standards and scenario creation difficulty

Pass/fail evaluation standards	Scenario creation difficulty
Network Master pass/fail evaluation (threshold setting)	No need to use scripting language Scenarios created easily using GUI operation only
Other than above	Requires programming using scripting language Difficulty of scenario creation depends on complexity of evaluation standards Simple example: The difference between the measured maximum and minimum throughput for a frame length of 64 bytes is evaluated as pass if it is 10% or less of the wire rate, but fail under other conditions. Complex example: If no frame loss is detected at a frame length of 64 bytes, it is evaluated as pass. If frame loss is detected, the frame length is set to 1500 bytes and measurement is performed over. If the frame loss rate result of the second measurement is improved by at least 50% compared to the first measurement, it is evaluated as pass. If this improvement is not achieved, it is evaluated as fail.

2 Considerations for Creating Scenarios

This section explains some general considerations and recommended procedures for creating scenarios.

2.1 Testing Manager and Testing Field Technician

There are two positions to consider when automating tests: the testing manager (in the office), and the field technician onsite. The testing manager (or office) creates the scenarios, while the field technician loads scenarios into the Network Master and runs the field tests. Technicians performing multiple tests can be based at different locations, and sometimes the testing manager and field technician may be the same person.

The role of the testing manager is to create the scenarios and distribute them to the field technicians. Sometimes, following distribution of the scenarios, it may be necessary to change these scenarios due to differences in the network operation policy, and testing environment. In this case, the testing manager must be able to change/revise scenarios and will also have to redistribute them so that field technicians will run the revised scenarios.

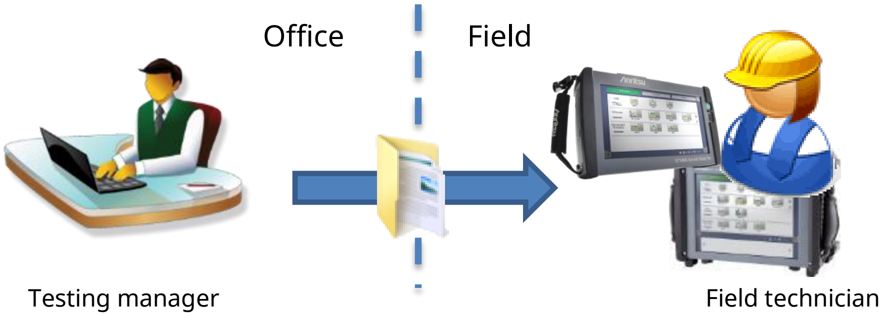


Fig. 2.1-1 Testing manager and field technician

This important work requires careful consideration of how the testing manager distributes the completed created test scenarios so that field technicians can perform operations and maintenance. If the testing manager and field technician are located at the same person, this is not a problem.

2.2 Preparing for Creating Scenarios

The first thing to do before creating scenarios is to clearly document the test procedure. For example, it is best to clarify the following four points.

2.2.1 Defining Network Master Initial Conditions at Test Start

To assure measurement repeatability, it is important to define the initial conditions. When the next test is performed under the some conditions which precious test made, if the measurement results change without changing anything about the device/network under the test, it indicates that a problem has occurred.

After defining the initial conditions, set and operate the Network Master under these conditions, which can be saved as a settings or configuration (.cfg) file defining the initial conditions of the Network Master. Loading this configuration file before the scenario assures testing under the same conditions every time. If no Network Master is available, this settings or configuration file can be created on a PC using the MX100001A software, which can be downloaded free-of-charge from the Anritsu website.

2.2.2 Examining Parameters

What settings cannot be determined at scenario creation? As an example, the IP address of the equipment to which the Network Master will be connected changes at each measurement site and cannot be determined until actual testing starts. Occasionally, a scenario may be created in which all measurement sites have a common fixed IP address, but this usage may change with time.

So how do we examine these variable parameters and clarify the reasons and changes at fault conditions? It is best to consider them from various viewpoints, such as changes with time, changes with location, changes due to unknown factors (accuracy), changes due to test frequency (quarterly measurements, etc.). It is also good to describe items that can change simultaneously.

2.2.3 Visualizing Test Procedure

Visualize the test procedure using a flowchart. It is best to start from powering-up the device to be tested (DUT) and the Network Master. It is important to be clear about manual operation procedures before and after connecting cables. When powering-up equipment before and after connecting cables, there may be differences in the obtained measurement results.

It is important to understand complex flow procedures when there are many alternative conditions. When describing these types of procedure using one scenario, the scenario can become extremely complex, making post-testing maintenance difficult. In these cases, it is better to re-examine the procedure and split the scenario into several scenarios.

2.2.4 Defining Pass/Fail Standards

This section explains the basics of a passing test.

The Network Master has a pass/fail evaluation function using standard counter items. This tutorial first explains use of this function, which simplifies scenario creation. Select “Summary” at the GUI and read section *3.4.7.8 Judge* of the MX100003A instruction manual for an explanation.

If the pass/fail evaluation is complex, consider whether it can be simplified.
For example, at evaluation when the threshold value is XX when there is a VLAN and YY when there is no VLAN, this scenario can be greatly simplified by splitting into two scenarios one with the VLAN, And one without the VLAN. Or in this case, it may be more efficient for the field technician to perform pass/fail evaluation by eye and omit automatic evaluation. In this latter case, create a scenario to display the message “Confirm XXX is YYY. OK/NG”.

In both these examples, although the scenarios are simple, the field technician has more work to do, increasing the risk of human error. When performing evaluations, it is important to consider the balance between the cost of creating and maintaining the scenario and the operation cost.

Like the previously described test parameters, there are cases where the pass/fail threshold values cannot be decided at scenario creation. In these cases, it is best to document the reasons for the variability and the range.

2.3 Handling Variable Parameters and Threshold Values

As explained previously, sometimes setting parameters and threshold values either cannot be decided at scenario creation, or may change in the future. There are two methods for dealing with these types of variable factors.

(1) Allocating Global Variables

Use the function explained in section *3.4.4 Global Variable* of the MX100003A instruction manual. Since, unlike local variables, the value of a global variable can be changed at a Network Master screen, this function makes it unnecessary to update and redistribute scenarios. The changed value is backed-up, so it is saved after restarting the Network Master. It can be locked with a password, preventing the field technician changing it in error.

Use of global variables is convenient when parameter settings change with test site. For example, when the parameter is different between sites A and B, two Network Master units are used—one at each site. In this case, the site-dependent parameters are set in each Network Master, supporting integrated testing at all sites.

There are some precautions regarding global variables; if the same scenarios are re-registered in a Network Master, when the scenario is updated, the values saved in the main frame are initialized. As a result, the last updated value is in error. It is necessary to manage conditions when changing global variables. Refer to section *2.4 Updating Scenarios* in this note for how to transfer global variables when updating scenarios.

(2) Questioning Field Technician Running Test Scenarios

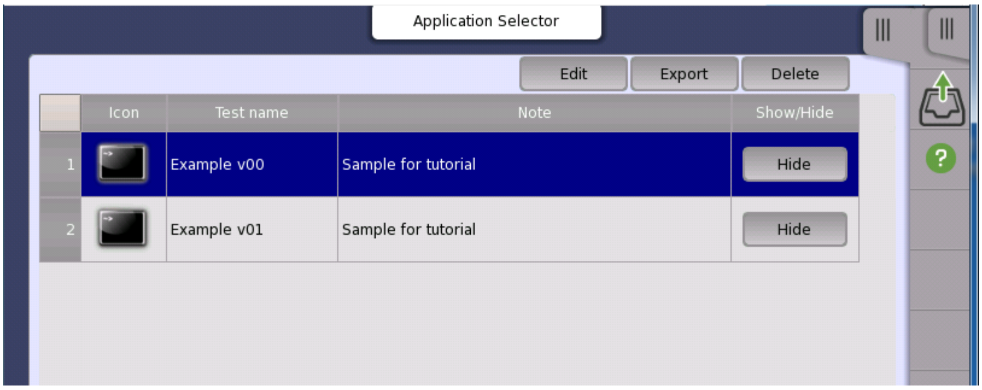
One scenario command is use of “Message”. Executing this command while executing a scenario, displays a dialog box on the Network Master screen requesting input by the field technician.

This is convenient if values cannot be decided before the test start date, or if there may be small changes in the values depending on circumstances. However, too many of these input messages increases the work of the field technician, which may increase the chance of operation errors. Consequently, it is better not to use too many Message questions for field technicians.

2.4 Updating Scenarios

Manage scenario updates by including the version number in the scenario name. For example, the first version of a scenario named “Example” would be “Example v00”; when this scenario is upgraded, change the name of the scenario to “Example v01”, and so on with each upgrade.

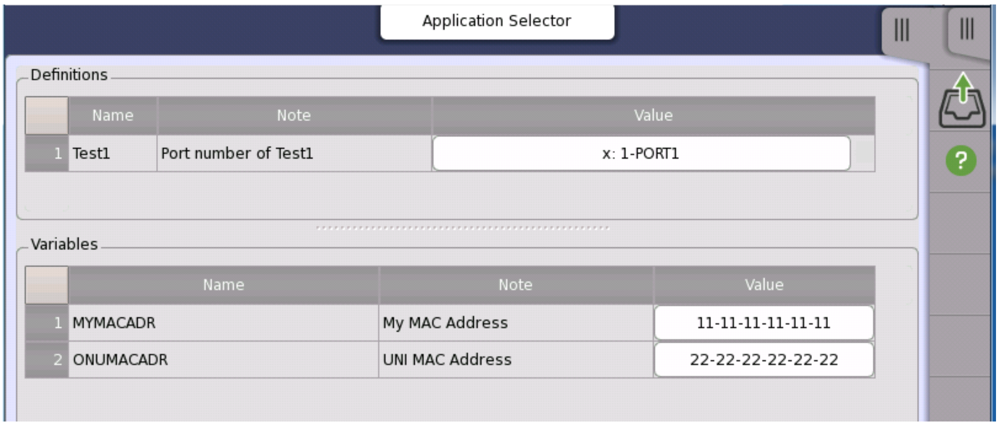
Register upgraded scenarios in the Network Master main frame. The following screen shows an example when both versions have been registered.



	Icon	Test name	Note	Show/Hide
1		Example v00	Sample for tutorial	Hide
2		Example v01	Sample for tutorial	Hide

Fig. 2.4-1 Registering revised scenario

Before deleting an old version, it may sometimes be necessary to transfer global variables. Use the [Edit] button while the focus is on the old version as shown in the above figure.



Definitions

	Name	Note	Value
1	Test1	Port number of Test1	x: 1-PORT1

Variables

	Name	Note	Value
1	MYMACADR	My MAC Address	11-11-11-11-11-11
2	ONUMACADR	UNI MAC Address	22-22-22-22-22-22

Fig. 2.4-2 Transferring global variables

Make a note of the displayed global variables and input them to the new version. At this time, it is possible that the structure of the global variables will be different between the new and old versions. The test manager should consider transfer of global variables at scenario update and subsequently distribute the updated scenario.

When transfer of the required global variables is completed, use the [Delete] button to delete the old version. To keep the old version without it being visible, use the [Hide] button to hide it.

3 Sample Scenarios

This section shows the scenario creation process using sample scenarios. Scenario creation can be completed quickly by revising sequences to be automated using these samples as templates.

Sample scenarios can be downloaded from the Anritsu website at the following URL.

http://www.anritsu.com/en-au/test-measurement/support/downloads/software/dwl17512

These sample scenarios assume use of the MT1000A but can be easily changed for use by the MT1100A. Refer to section *3.4.1 Instrument Configuration* in the MX100003A instruction manual for how to use the MT1100A.

Table 3-1 List of sample scenarios

Title	Outline	Programming Skills
Error-free commissioning test	Confirms network communications. Checks for error-free transmission by looping-back traffic sent from tester at far end	Not required
Error insertion commissioning test	Confirms network communications. Loops-back traffic sent with inserted errors from tester at far end and confirms errors returned	Required (low difficulty level)
Automated long-term testing	Automates multiple long-term measurements as one processing sequence	Not required
Category 5 cable test	Confirms continuity of pulled Category 5 cables	Required (high difficulty level)

3.1 Error-free Communications Test

3.1.1 Test Objective

This test uses a 10-Gbps Ethernet network. The Network Master located at the user side sends traffic to the central exchange. When a specific IP address is specified as the destination, the traffic is looped-back by the central exchange.

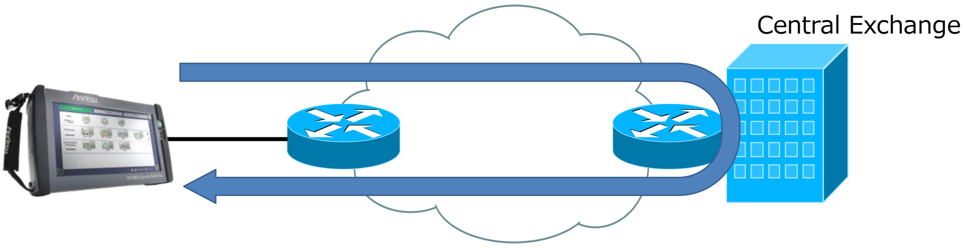


Fig. 3.1-1 Network configuration at sample scenario commissioning test

3.1.2 SCPI Commands

No SCPI commands are used.

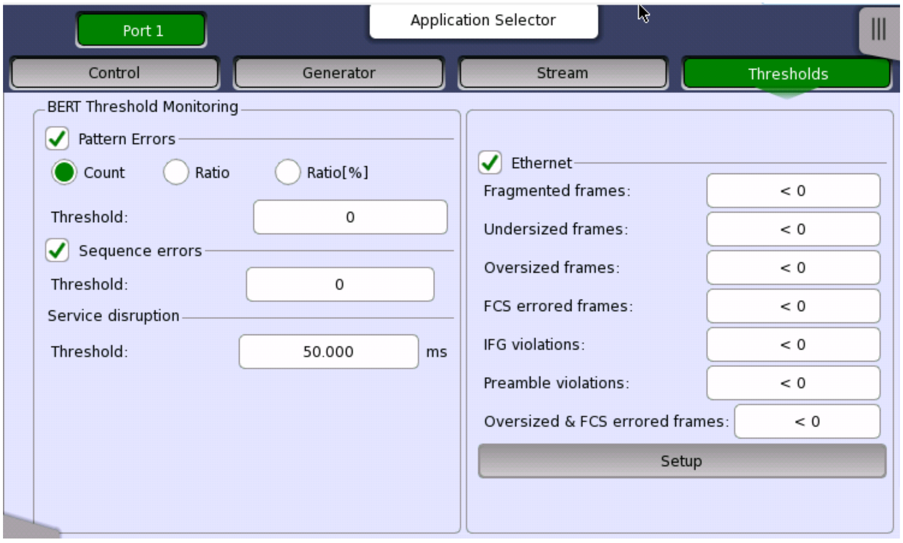
3.1.3 Test Specifications

Network Master Initial Conditions

This sample uses the Ethernet BERT application; after using [Restore Application Defaults] to set the initial conditions, the Ethernet BERT application is launched and the settings are changed as follows. Save the changed settings to a settings file.

Table 3.1-1 Changing setting contents

Screen	Setting	Setting
[Setting] – [Port]	Port	[Off] → [SFP+ 10 Gbps LAN]
[Setting] – [Stream]	[MAC] – [ARP]	No check → Check
	[MAC] – [Default]	No check → Check
[Test] – [Generator]	[Automatically start traffic generator when test started	No check → Check
[Test] – [Stream]	[Frame Size]	[Constant] → [Random]
	[End]	[64] →[1500]
[Test] – [Thresholds]	[Pattern Errors]	No check → Check
	[Sequence Errors]	No check → Check
	[Ethernet]	No check → Check
	Type (See Fig. 3.1-2.)	No check → Check



BERT Threshold Monitoring

☑ Pattern Errors

● Count ○ Ratio ○ Ratio[%]

Threshold: 0

☑ Sequence errors

Threshold: 0

Service disruption

Threshold: 50.000 ms

☑ Ethernet

Fragmented frames:	< 0
Undersized frames:	< 0
Oversized frames:	< 0
FCS errored frames:	< 0
IFG violations:	< 0
Preamble violations:	< 0
Oversized & FCS errored frames:	< 0

Fig. 3.1-2 Threshold settings screen

Pass/Fail Evaluation Standards

After completing measurement, a pass evaluation is awarded only when the values for all the following statistics are zero.

Pattern Error, Sequence Error, Fragmented Frames, Undersized Frames, Oversized Frames, FCS Errored Frames, Oversized&FCS Errored Frames, IFG Violations, Preamble Violations

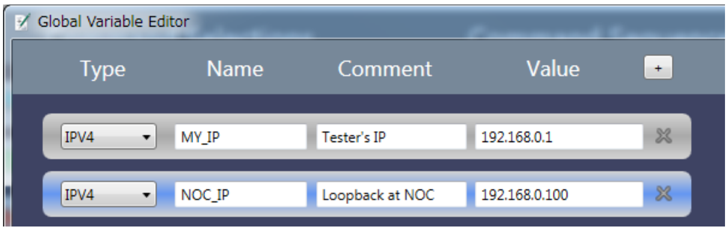
Parameters

The following table shows the parameters used by this sample.

Table 3.1-2 Parameters

Parameter	Class/Variable Name	Explanation
Src IPv4 Address	Global Variable MY_IP	Network Master IPv4 Address
Dest IPv4 Address	Global Variable NOC_IP	IP Address for looping-back by central exchange

The following global variables are defined at the MX100003A screen according to this table.

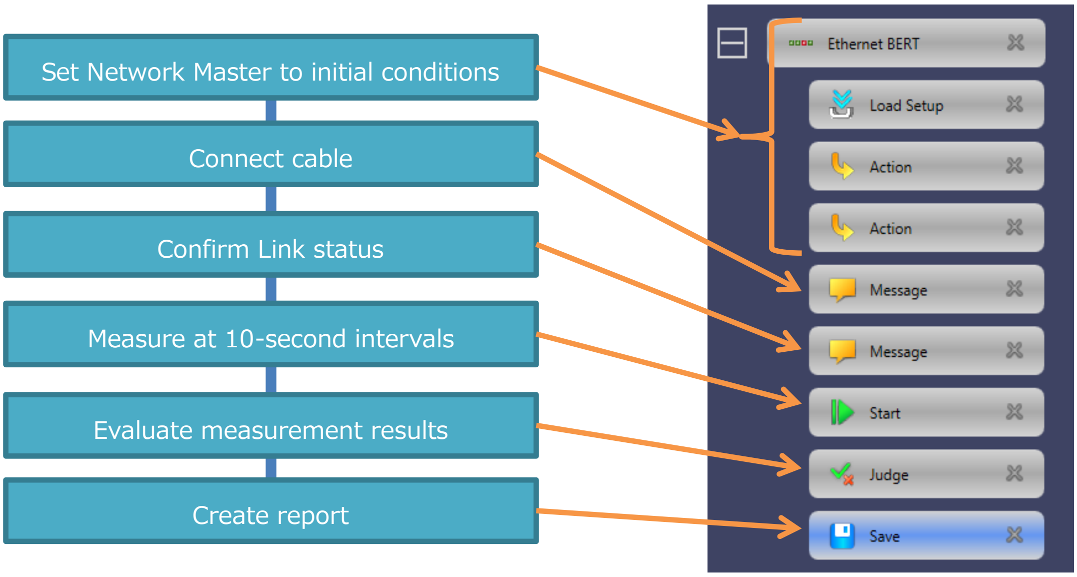


Type	Name	Comment	Value
IPV4	MY_IP	Tester's IP	192.168.0.1
IPV4	NOC_IP	Loopback at NOC	192.168.0.100

Fig. 3.1-3 Global setting changes

Test flowchart

The following shows the match between the test flowchart and the scenario command sequence.



Set Network Master to initial conditions

Connect cable

Confirm Link status

Measure at 10-second intervals

Evaluate measurement results

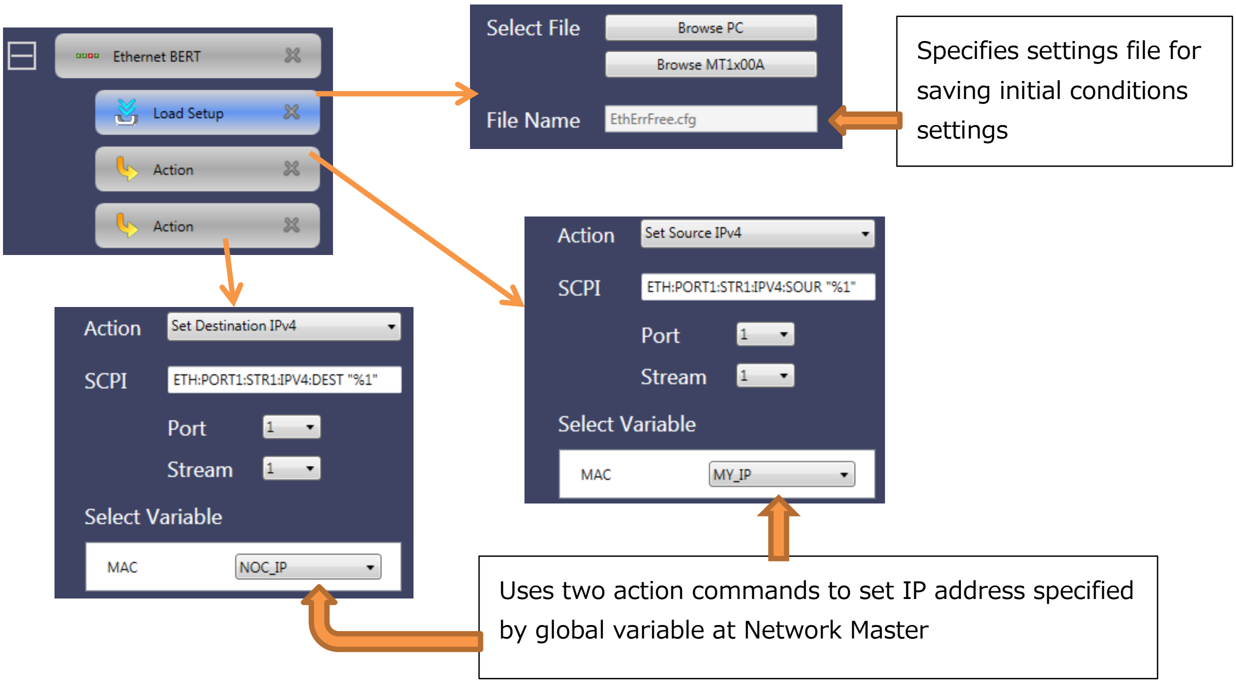
Create report

Fig. 3.1-4 Test flowchart

3.1.4 Explanation of Scenario

This section explains the setting contents of each command in line with the test flowchart.

1. Setting Network Master Initial Conditions



Select File: Browse PC / Browse MT1x00A

File Name: EthErrFree.cfg

Specifies settings file for saving initial conditions settings

Action: Set Source IPv4

SCPI: ETH:PORT1:STR1:IPV4:SOUR "%1"

Port: 1

Stream: 1

Select Variable

MAC: MY_IP

Action: Set Destination IPv4

SCPI: ETH:PORT1:STR1:IPV4:DEST "%1"

Port: 1

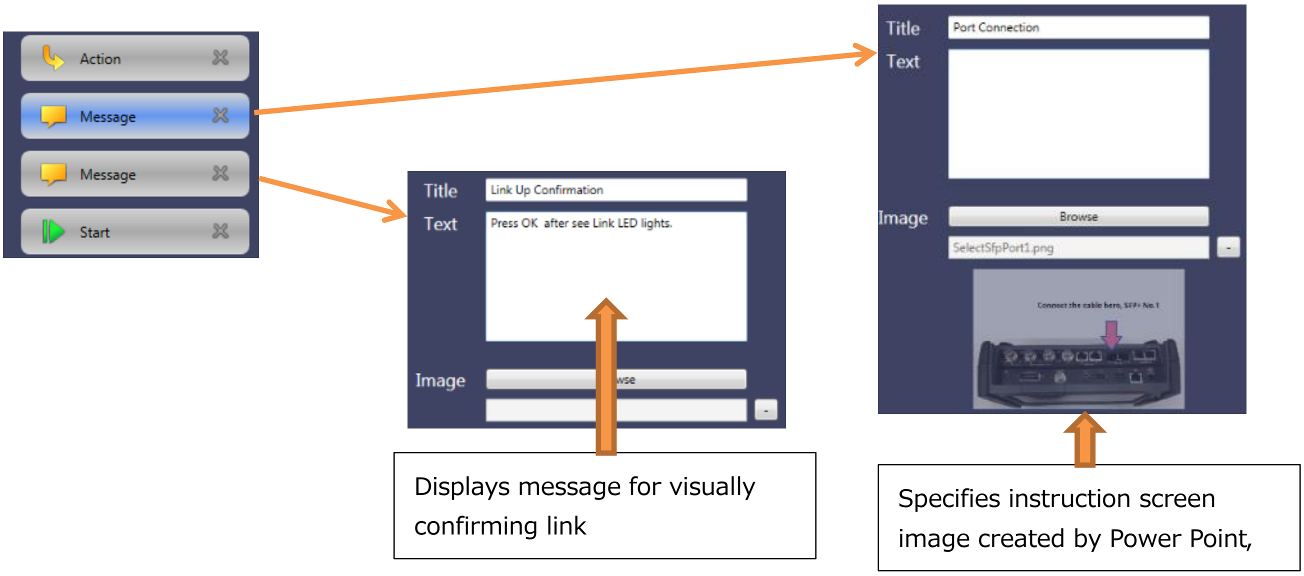
Stream: 1

Select Variable

MAC: NOC_IP

Uses two action commands to set IP address specified by global variable at Network Master

2. Connecting Cable and Confirming Link



Title: Link Up Confirmation

Text: Press OK after see Link LED lights.

Image

Title: Port Connection

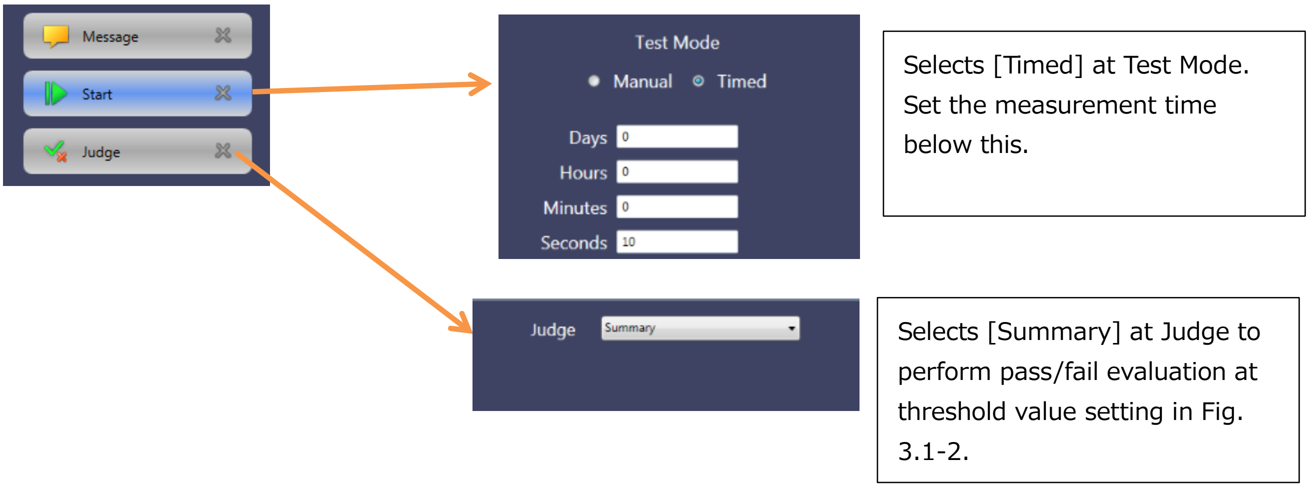
Text

Image: SelectSfpPort1.png

Displays message for visually confirming link

Specifies instruction screen image created by Power Point,

3. Measuring Every 10 Seconds and Evaluating Results



Test Mode

● Manual ◉ Timed

Days 0

Hours 0

Minutes 0

Seconds 10

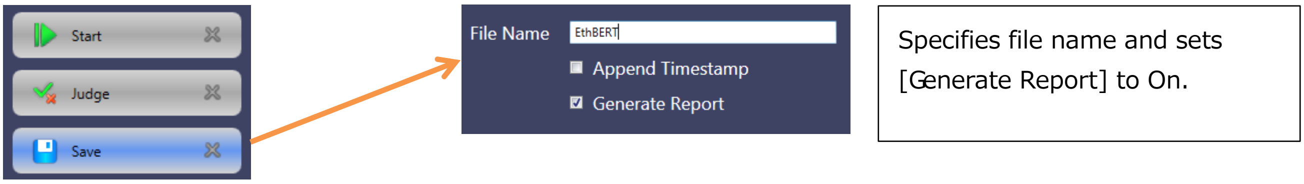
Judge: Summary

Selects [Timed] at Test Mode. Set the measurement time below this.

Selects [Summary] at Judge to perform pass/fail evaluation at threshold value setting in Fig. 3.1-2.

4. Creating Report

Using the Save command last saves the measurement results file (*.res) in the same way as saved by using normal screen operation. This measurement file is converted to a report (pdf, xml, csv) when the scenario is completed.



File Name: EthBERT

□ Append Timestamp

☑ Generate Report

Specifies file name and sets [Generate Report] to On.

When the test evaluation result is Fail, the *.res file file can provide useful clues; we recommend placing the Save command after evaluation for this reason.

3.2 Communications Test with Error Insertion

3.2.1 Test Objective

This test uses a 10-Gbps Ethernet network. The Network Master located at the user side sends traffic to the central exchange. When a specific IP address is specified as the destination, the traffic is looped-back by the central exchange. This sample scenario instructs the Network Master to insert packets including a user signal with bit errors into the traffic which is looped-back and checked for the same bit errors.

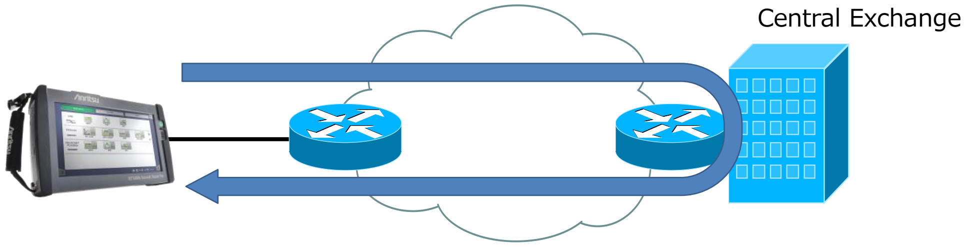


Fig. 3.2-1 Network configuration for sample scenario commissioning test

3.2.2 SCPI Commands

The following table lists the SCPI commands used by this sample scenario.

Table 3.2-1 SCPI Commands

Command	Explanation
ETHernet:PORT1:STIMuli:EBLength	Sets number of bit errors to insert
SYSTem:STIMuli:INSert	Inserts bit errors
ETHernet:PORT1:IFETch? (BPE)	Captures bit error measurement results

3.2.3 Test Specifications

Network Master Initial Conditions

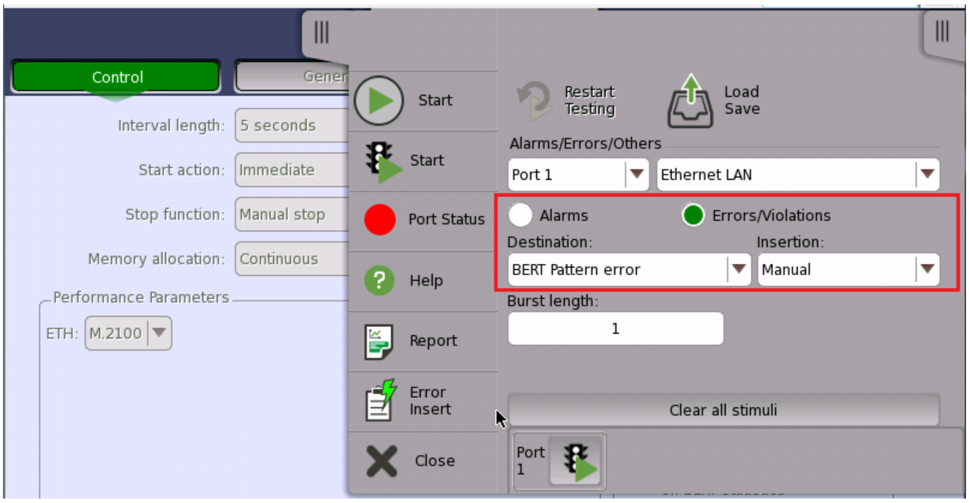
This sample uses the Ethernet BERT application; after initializing the settings using [Restore Application Defaults], the Ethernet BERT is launched and the following settings are changed. Save the changed settings to a settings file.

Table 3.2-2 Changing setting contents

Screen	Setting	Setting Value
[Setting] - [Port]	Port	[Off] → [SFP+ 10 Gbps LAN]
[Setting] - [Stream]	[MAC] - [ARP]	No check → Check
	[MAC] - [Default]	No check → Check
[Test] - [Stream]	[Frame Size]	[Constant] → [Random]
	[End]	[64] → [1500]

Fig. 3.2-2 Changing setting contents (continued)

Screen	Setting	Setting Value
[Test] - [Thresholds]	[Pattern Errors]	No check → Check
Alarms/Errors/Others	[Errors/Violations]	No check → Check
	[Destination]	[Off] → [Manual]
	[Insertion]	[No Error] → [BERT Pattern Error]



Interval length: 5 seconds
Start action: Immediate
Stop function: Manual stop
Memory allocation: Continuous
Performance Parameters
ETH: M.2100

Alarms/Errors/Others
Port 1 | Ethernet LAN
○ Alarms ● Errors/Violations
Destination: BERT Pattern error
Insertion: Manual
Burst length: 1

Fig. 3.2-2 Settings at Alarms/Errors/Others screen

Pass/Fail Evaluation Standards

After completing measurement, a pass evaluation is awarded only when the bit error count and detected bit error count match.

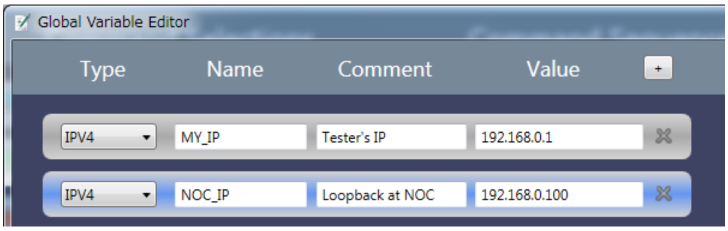
Parameters

The following table lists the parameters used by this sample scenario.

Table 3.2-3 Parameters

Parameter	Type/Variable Name	Explanation
Src IPv4 Address	Global variable MY_IP	Network Master IPv4 Address
Dest IPv4 Address	Global variable NOC_IP	IP Address for looping-back by central exchange

The following global variables are defined at the MX100003A screen according to this table.


Global Variable Editor

Type	Name	Comment	Value
IPV4	MY_IP	Tester's IP	192.168.0.1
IPV4	NOC_IP	Loopback at NOC	192.168.0.100

Fig. 3.2-3 Global variable settings

Test Flowchart

The following shows the match between the test flowchart and the scenario command sequence。

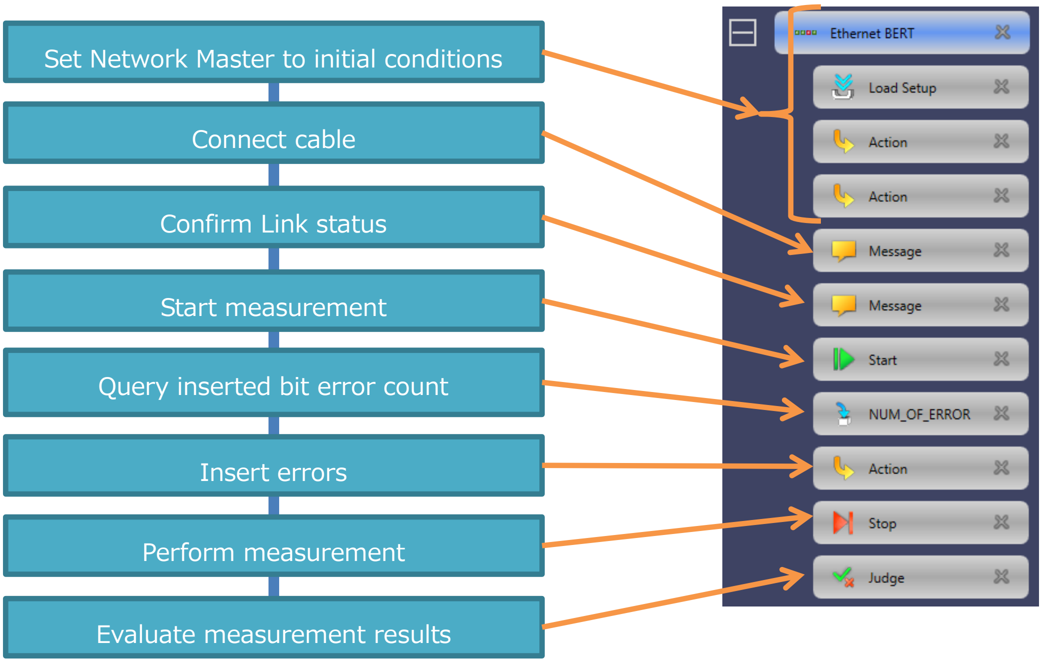
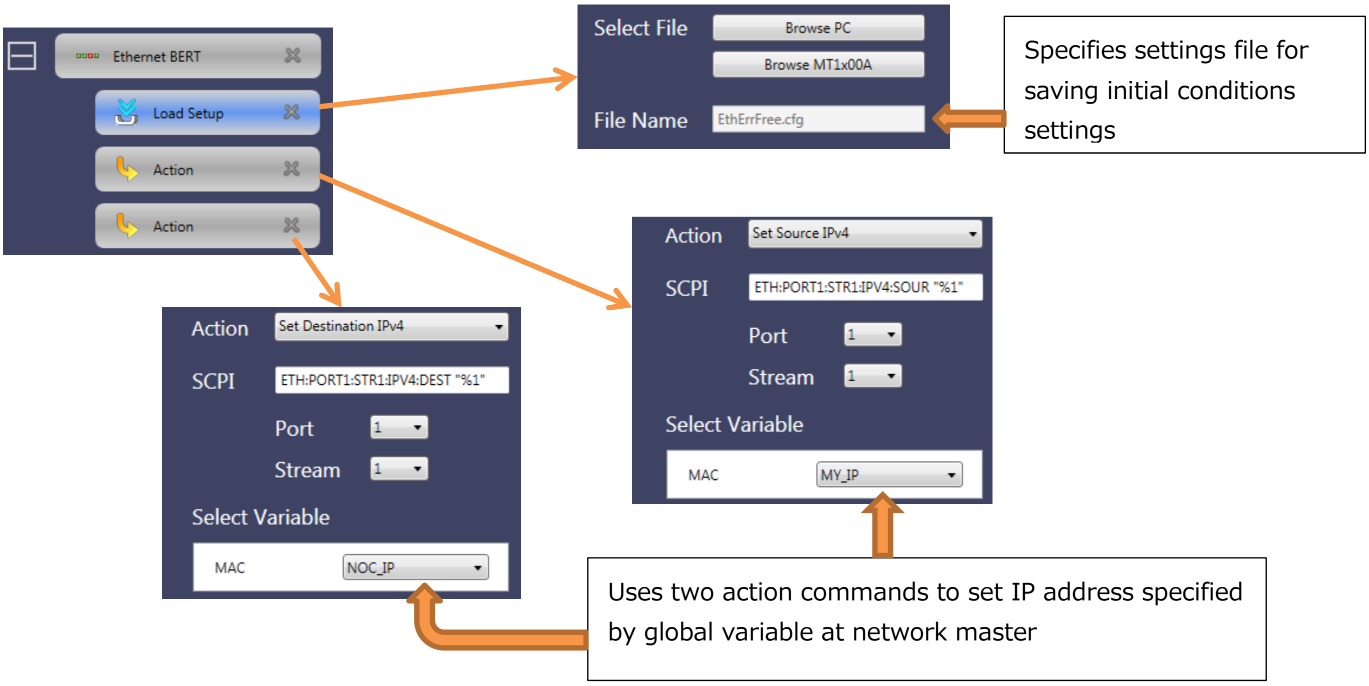


Fig. 3.2-4 Test flowchart

3.2.4 Explanation of Scenario

This section explains the setting contents of each command in line with the test flowchart.

1. Setting Network Master Initial Conditions。



File Name: EthErrFree.cfg

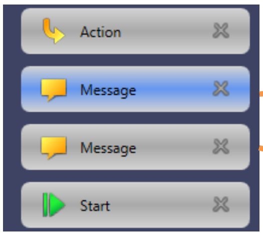
Specifies settings file for saving initial conditions settings

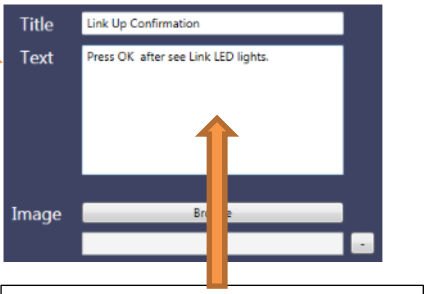
Action: Set Source IPv4
SCPI: ETH:PORT1:STR1:IPV4:SOUR "%1"
Port: 1
Stream: 1
Select Variable
MAC: MY_IP

Action: Set Destination IPv4
SCPI: ETH:PORT1:STR1:IPV4:DEST "%1"
Port: 1
Stream: 1
Select Variable
MAC: NOC_IP

Uses two action commands to set IP address specified by global variable at network master

2. Connecting Cable and Confirming Link

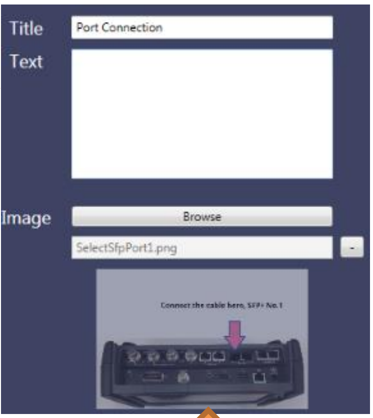




Title: Link Up Confirmation

Text: Press OK after see Link LED lights.

Displays message for visually confirming link



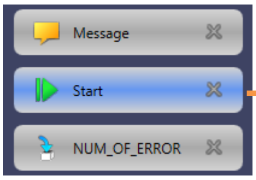
Title: Port Connection

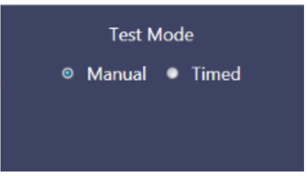
Text:

Image: SelectSfpPort1.png

Specifies instruction screen image created by Power Point,

3. Starting Measurement



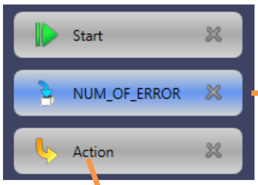


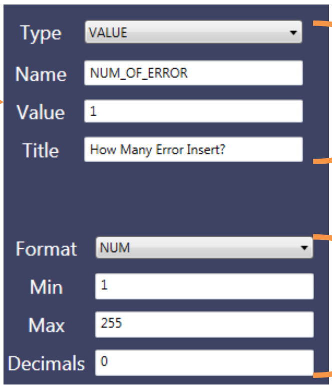
Test Mode

● Manual ○ Timed

Sets Test Mode to [Manual] and continues measurement until " Measurement Stop" command executed

4. Queries Inserted Bit Error Count and Inserts Errors for That Count





Type: VALUE

Name: NUM_OF_ERROR

Value: 1

Title: How Many Error Insert?

Format: NUM

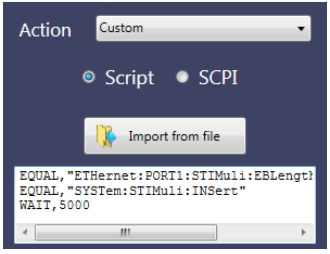
Min: 1

Max: 255

Decimals: 0

Defines NUM_OF_ERROR variable to substitute for queried user value and assumes initial condition of 1 for Value

Since decimal integer, Format is [NUM] and Decimals is 0 with setting range of 1 ~ 255



Action: Custom

● Script ○ SCPI

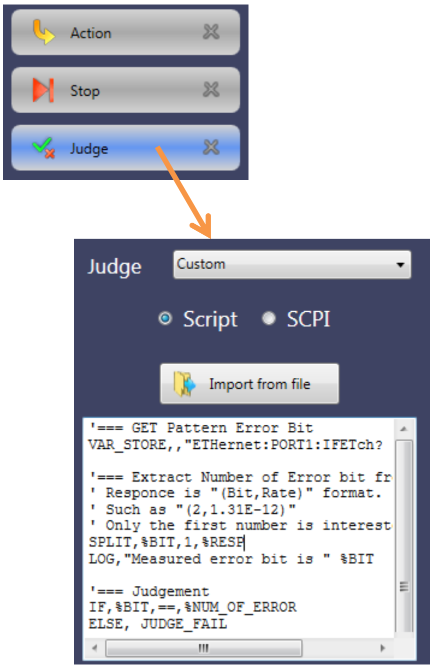
```
EQUAL,"ETHernet:PORT1:STIMuli:EBLengtl
EQUAL,"SYSTem:STIMuli:INSert"
WAIT,5000
```

Selects [Custom] at Action and describes following script:

```
001: EQUAL,"ETHernet:PORT1:STIMuli:EBLength "%NUM_OF_ERROR
002: EQUAL,"SYSTem:STIMuli:INSert"
003: WAIT,5000
```

Wait processing is required at line 3 of this sample scenario setting to wait for 5 seconds to capture the first measurement result.

5. Stopping Measurement and Evaluating Measurement Result



Judge: Custom

● Script ○ SCPI

```
'=== GET Pattern Error Bit
VAR_STORE,,"ETHernet:PORT1:IFETch?

'=== Extract Number of Error bit fr
' Responce is "(Bit,Rate)" format.
' Such as "(2,1.31E-12)"
' Only the first number is interest
SPLIT,%BIT,1,%RESP
LOG,"Measured error bit is " %BIT

'=== Judgement
IF,%BIT,==,%NUM_OF_ERROR
ELSE, JUDGE_FAIL
```

Selects [Custom] at Judge and describes following script

```
001:'=== GET Pattern Error Bit
002:VAR_STORE,,"ETHernet:PORT1:IFETch? (BPE)",%RESP

003:'=== Extract Number of Error bit from Response
004:' Response is "(Bit,Rate)” format.
005:' Such as "(2,1.31E-12)"
006:' Only the first number is interested,
007:SPLIT,%BIT,1,%RESP
008:LOG,"Measured error bit is " %BIT
009:
010:'=== Judgement
011:IF,%BIT,==,%NUM_OF_ERROR
012:ELSE, JUDGE_FAIL
```

Line 002
First, saves measurement results to local variable RESP.

Lines 003 ~ 008
Represent measurement results as character string like "(2,1.31E-12)". Extract part indicating bit error count and save to local variable BIT. For confirmation, displays obtained bit error count on screen.

Lines 010 ~ 012
Compare obtained bit error count with the one input by field technician and evaluate as fail if different before finally terminating scenario.

3.3 Automating Long-Term Continuous Measurement

3.3.1 Test Objective

When long-term test taking 8 hours for example has many test runs under different conditions, procedures are required to save measurements, and change the conditions and restart measurement every 8 hours. This sample scenario automates this continuing process to obtain three sets of test results each 24 hours (every 8 hours) without manual intervention. Each test is conducted with different frame size, 64 bytes, 256 bytes and 1518 bytes.

3.3.2 SCPI Commands

No SCPI commands are used.

3.3.3 Test Specifications

Initial Network Master Condition

This sample scenario uses the Ethernet BERT application. After first using [Restore Application Defaults] to set the initial conditions, the Ethernet BERT application is launched and the settings are changed as follows.

Table 3.3-1 Changing setting contents (1/3)

Screen	Setting	Setting Value
[Setting] - [Port]	Port	[Off] → [SFP+ 10 Gbps LAN]
[Setting] - [Stream]	[MAC] - [ARP]	No check → Check
	[MAC] - [Default]	No check → Check
[Test] - [Generator]	[Automatically start traffic generator when test started]	No check → Check

After making the above changes, save the settings file as file name Longrun64.cfg and then make the following setting changes.

Table 3.3-1 Changing setting contents (2/3)

Screen	Setting	Setting Value
[Test] - [Stream]	[Start]	[64] → [256]

After making the above changes, save the settings file as file name Longrun256.cfg and then make the following setting changes.

Table 3.3-1 Changing setting contents (3/3)

Screen	Setting	Setting Value
[Test] - [Stream]	[Start]	[256] → [1518]

After making the above changes, save the settings file as file name Longrun1518.cfg and then make the following setting changes.

Pass/Fail Evaluation Standards

Only the measurement results are required and there is no pass/fail evaluation; the result is always pass.

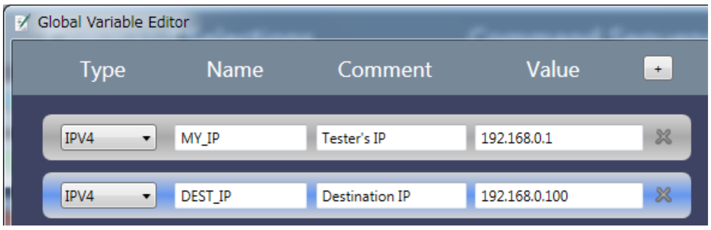
Parameters

The following table shows the parameters used by this sample scenario.

Table 3.3-2 Parameters

Parameters	Type/Variable Name	Explanation
Src IPv4 Address	Global Variable MY_IP	Network Master IPv4 Address
Dest IPv4 Address	Global Variable DEST_IP	IPv4 address of traffic destination

The following global variables are defined at the MX100003A screen according to this table.

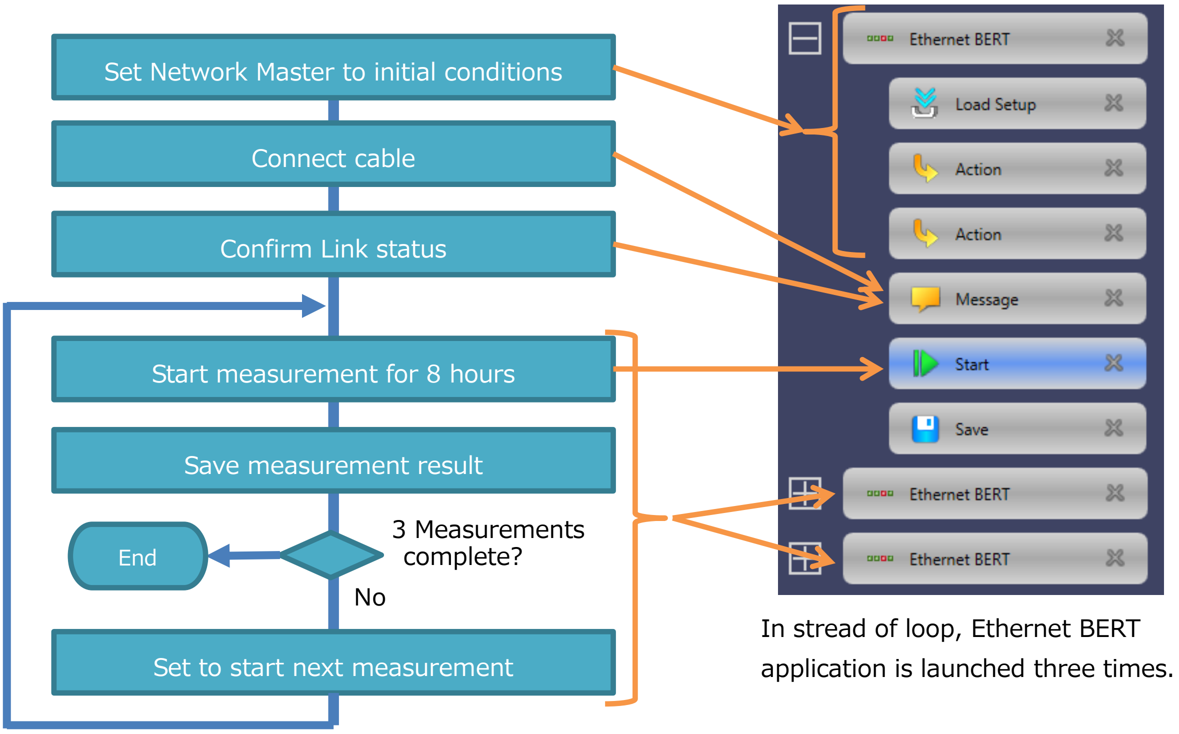


Type	Name	Comment	Value
IPV4	MY_IP	Tester's IP	192.168.0.1
IPV4	DEST_IP	Destination IP	192.168.0.100

Fig. 3.3-1 Global Variable Settings

Test Flowchart

The following shows the match between the test flowchart and the scenario command sequence.



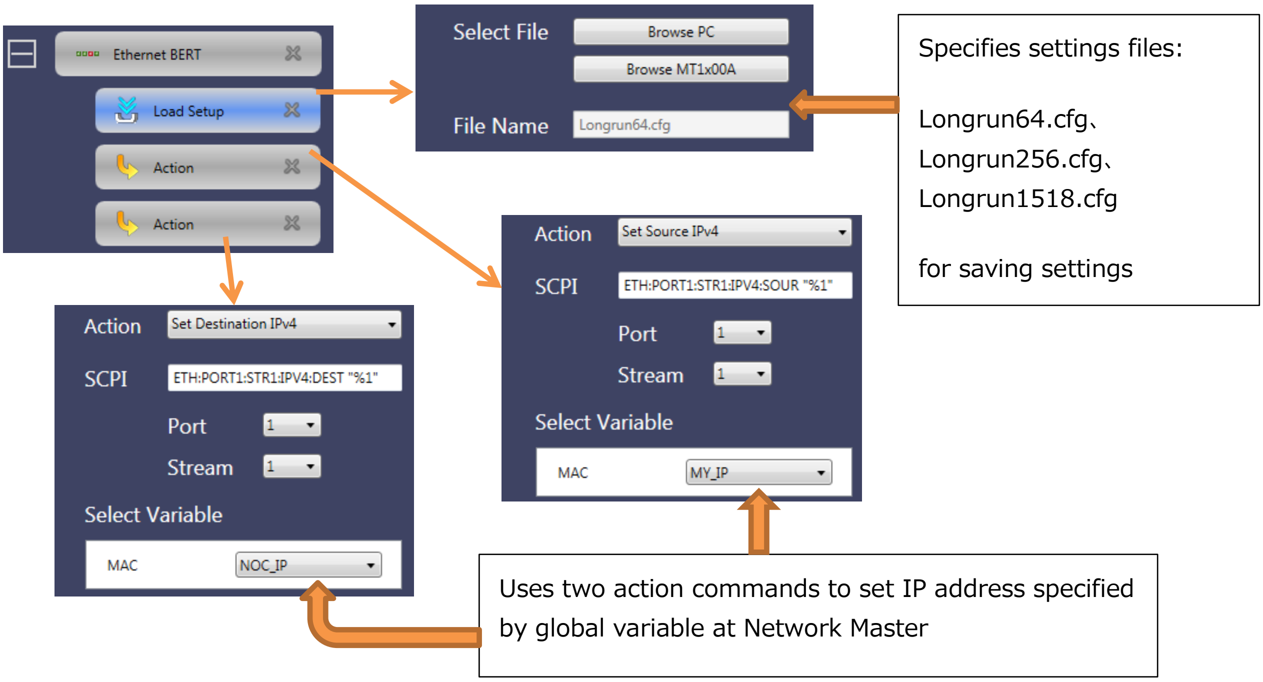
In stread of loop, Ethernet BERT application is launched three times.

Fig. 3.3-1 Test flowchart

3.3.4 Explanation of Scenario

This section explains the setting contents of each command in line with the test flowchart.

1. Setting Network Master Initial Conditions



Select File: Browse PC / Browse MT1x00A

File Name: Longrun64.cfg

Action: Set Source IPv4

SCPI: ETH:PORT1:STR1:IPV4:SOUR "%1"

Port: 1

Stream: 1

Select Variable

MAC: MY_IP

Action: Set Destination IPv4

SCPI: ETH:PORT1:STR1:IPV4:DEST "%1"

Port: 1

Stream: 1

Select Variable

MAC: NOC_IP

Specifies settings files:

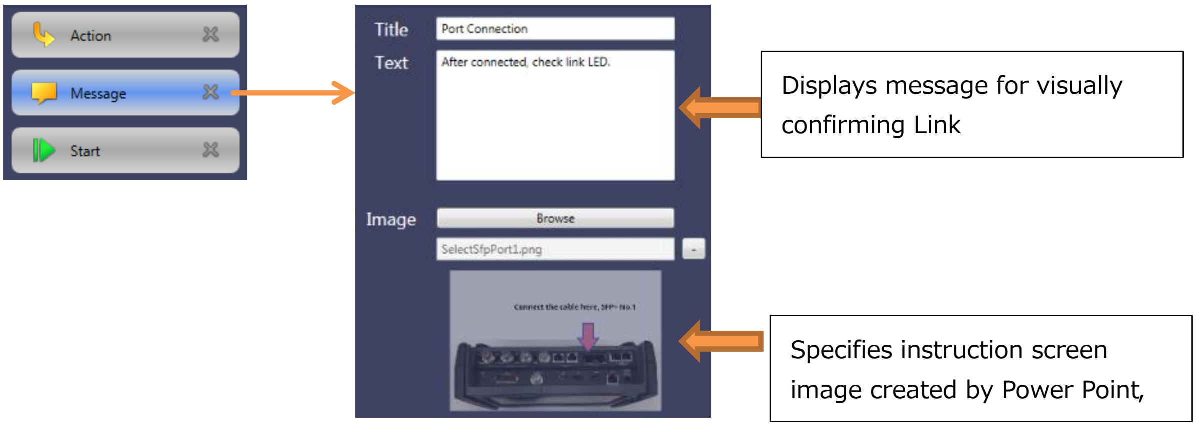
Longrun64.cfg、
Longrun256.cfg、
Longrun1518.cfg

for saving settings

Uses two action commands to set IP address specified by global variable at Network Master

2. Connecting Cable and Confirming Link

This command is placed only in the Ethernet BERT applications started first.



Title: Port Connection

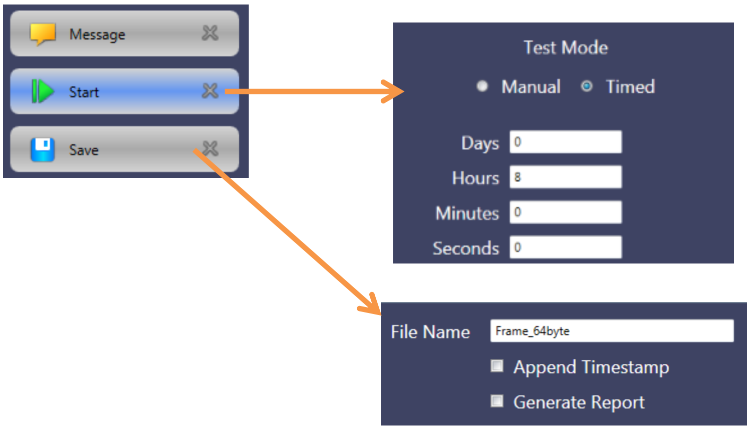
Text: After connected, check link LED.

Image: SelectSfpPort1.png

Displays message for visually confirming Link

Specifies instruction screen image created by Power Point,

3. Measuring for 8 hours and Saving Measurement Results



Test Mode

● Manual ◉ Timed

Days 0

Hours 8

Minutes 0

Seconds 0

File Name Frame_64byte

□ Append Timestamp

□ Generate Report

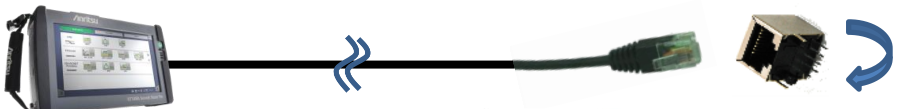
Selects [Timed] at Test Mode and measurement for 8 hours

Specifies each of Frame_64Byte, Frame_256Byte, and Frame_1518Byte as name of file for saving measurement results

3.4 Testing Category 5 Cable

3.4.1 Test Objective

This test confirms the continuity of Category 5 cable pulls in facilities such as data centers. The Network Master is connected to one end of the cable and a RJ-45 loop-back jack is connected to the other end to loop-back the test signal.



Connect	Pin 1 (orange-white)	to	Pin 3 (green-white)
	Pin 2 (orange)	to	Pin 6 (green)
	Pin 4 (blue)	to	Pin 7 (brown-white)
	Pin 5 (blue-white)	to	Pin 8 (brown)

Fig. 3.4-1 Network configuration for sample scenario commissioning test

The main test procedure flow is outlined below.

1. Measure the cable length using the Cable Test application with the far end open.
2. Measure the cable length again using the Cable Test application with the loop-back jack connected to the far end to loop-back the test signal.
3. Measure the bit error rate with the loop-back jack connected to the far end to loop-back the test signal.

3.4.2 SCPI Commands

The following table lists the SCPI commands used by this sample scenario.

Table 3.4-1 SCPI Commands

Command	Explanation
ETHernet:CABLe:RESults:PAIR<Pr>?	Queries Cable Test Application measurement results
ETH:STAT:PORT1:LINK?	Queries Ethernet Link status
ETHernet:PORT1:STReam:PAYLoad	Sets Ethernet sent traffic pattern

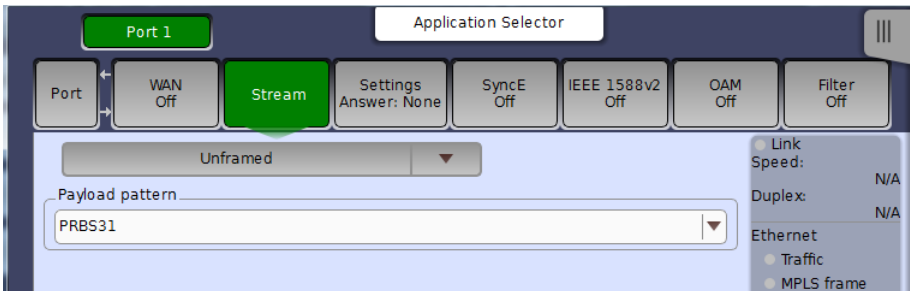
3.4.3 Test Specifications

Initial Network Master Condition

This sample scenario uses the Cable Test and Ethernet BERT applications. Since the Cable Test Application has no setting items, it is not necessary to define the initial conditions. After setting the initial condition using [Restore Application Defaults], the Ethernet BERT application is started and the settings are changed as follows. Save the settings to a file after completing the settings.

Table 3.4-2 Changing setting contents

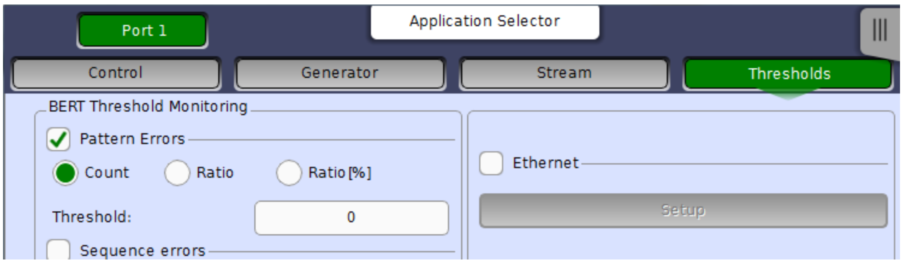
Screen	Setting	Setting Value
[Setting] - [Port]	[Port Setup] - [Interface Type]	Off → [Electrical]
	[Port Setup] - [Port Mode]	[Autonegotiate]
	Auto Negotiation Advertisement	1000M FDX only Off; all others On
[Setting] - [Stream]	Layer 2 (See Fig. 3.4-2.)	[Unframed]
	Payload Pattern	[PRBS31]
[TEST] - [Threshold]	[Pattern Errors]	Off → On
	[Pattern Errors] - [Threshold]	[0]



Unframed

Payload pattern: PRBS31

Fig. 3.4-2 Settings at Setup-Stream screen



BERT Threshold Monitoring

☑ Pattern Errors

● Count ○ Ratio ○ Ratio [%]

Threshold: 0

□ Sequence errors

□ Ethernet

Fig. 3.4-3 Settings at Setup-Stream screen

Pass/Fail Evaluation Standards

The test is evaluated as pass only when all the following conditions are satisfied.

1. The measurement results for the four cable pairs are sufficiently similar when the cable length is measured while the far end is open.
2. The measurement results for the same cable pairs are sufficiently similar when the cable length is measured while the far end is open and when shorted by the far-end loop-back jack.
3. The bit-error measurement results are error-free when measured for 1 minute.

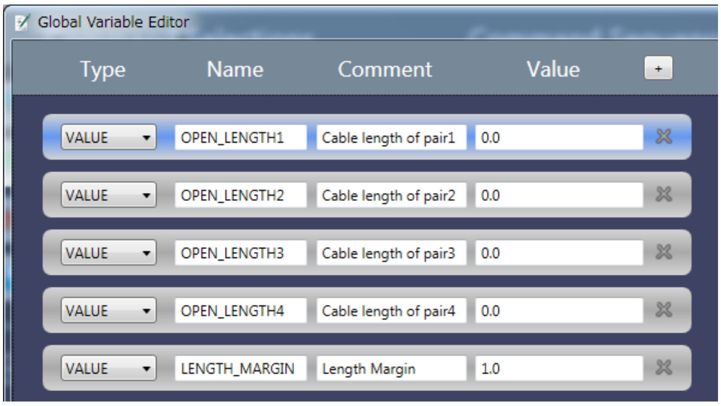
Parameters

The following table shows the parameters used by this sample scenario.

Table 3.4-3 Parameters

Parameter	Type/Variable Name		Explanation
N/A	Global variable	OPEN_LENGTH1 OPEN_LENGTH2 OPEN_LENGTH3 OPEN_LENGTH4	Variables for measurements result saves In this sample scenario, the Cable Test application is launched twice. In these circumstances, it is best to use global variables to transfer data between applications.
Threshold value	Global variable	LENGTH_MARGIN	Pass/Fail evaluation margins The results for the lengths of the four cable pairs are evaluated based on the average ± LENGTH_MARGIN.

The global variables are defined as follows at the MX100003A screen according to this table.



Type	Name	Comment	Value
VALUE	OPEN_LENGTH1	Cable length of pair1	0.0
VALUE	OPEN_LENGTH2	Cable length of pair2	0.0
VALUE	OPEN_LENGTH3	Cable length of pair3	0.0
VALUE	OPEN_LENGTH4	Cable length of pair4	0.0
VALUE	LENGTH_MARGIN	Length Margin	1.0

Fig. 3.4-4 Global variable settings

Test Flowchart

The following shows the match between the test flowchart and the scenario.

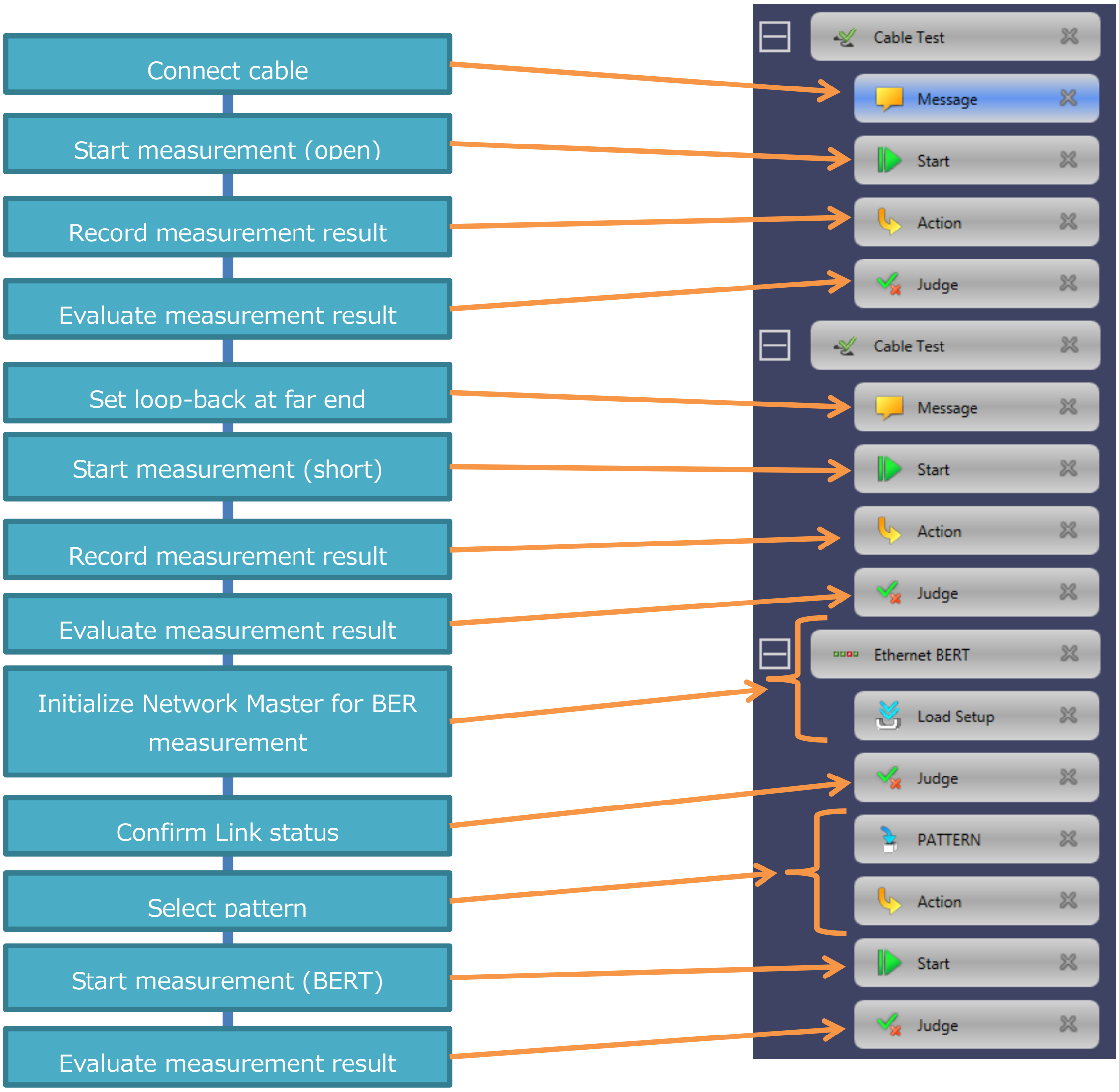
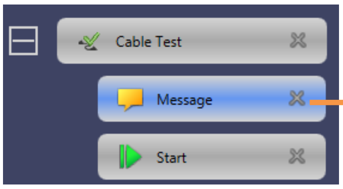


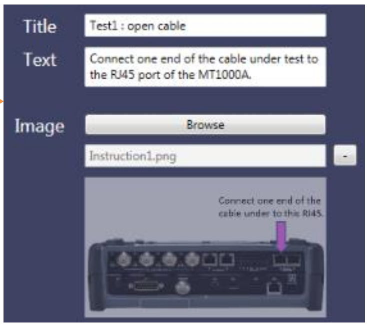
Fig. 3.4-5 Test flowchart

3.4.4 Explanation of Scenario

This section explains the setting contents of each command in line with the test flowchart.

1. Connecting Cable





Title: Test1 : open cable

Text: Connect one end of the cable under test to the RJ45 port of the MT1000A.

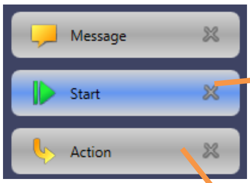
Image: Browse

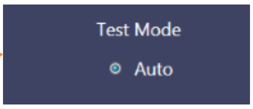
Instruction1.png

Displays message for visually confirming Link

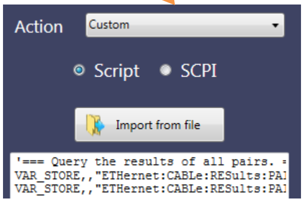
Specifies instruction screen image created by Power Point, etc.

2. Starting Measurement (Open) and Recording Measurement Results




Test Mode
● Auto

Only Auto can be selected at Cable Test


Action: Custom
● Script ○ SCPI

```
'=== Query the results of all pairs. =
VAR_STORE,,"ETHernet:CABLe:RESults:PAI
VAR_STORE,,"ETHernet:CABLe:RESults:PAI
```

Selects [Custom] at Action and describes following script.

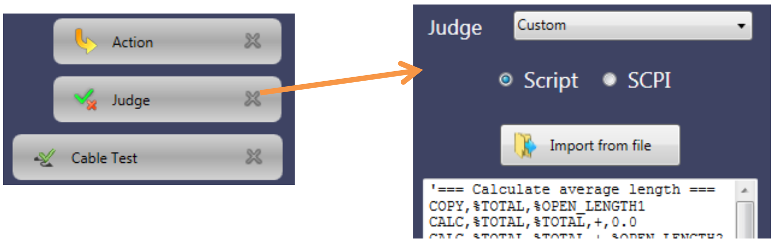
```
001:'=== Query the results of all pairs. ===
002:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR1?",%RESP1
003:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR2?",%RESP2
004:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR3?",%RESP3
005:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR4?",%RESP4
006:
007:'=== Substitute all results into variables ===
008:SPLIT,%STATUS1,1,%RESP1
009:SPLIT,%OPEN_LENGTH1,2,%RESP1
010:SPLIT,%STATUS2,1,%RESP2
011:SPLIT,%OPEN_LENGTH2,2,%RESP2
012:SPLIT,%STATUS3,1,%RESP3
013:SPLIT,%OPEN_LENGTH3,2,%RESP3
014:SPLIT,%STATUS4,1,%RESP4
015:SPLIT,%OPEN_LENGTH4,2,%RESP4
016:
017:LOG,"Status: Pair1=" %STATUS1 " Pair2=" %STATUS2 "
Pair3=" %STATUS3 " Pair4=" %STATUS4
018:LOG,"Length: Pair1=" %OPEN_LENGTH1" Pair2=" %OPEN_LENGTH2"
Pair3=" %OPEN_LENGTH4 " Pair4=" %OPEN_LENGTH4
```

Lines 001 ~ 005
Use ETHernet:CABLe:RESults:PAIR<Pr>? query and save obtained measurement results (lengths for four cable pairs) to each of four local variables %RESP1, %RESP2, %RESP3, and %RESP4, respectively. Pay attention to the blank second column of the VAR_STORE command.

Lines 007 ~ 015
Analyze response string to ETHernet:CABLe:RESults:PAIR1<Pr>? query to obtain cable lengths and status, and store them in appropriate variables. Response string to ETHernet:CABLe:RESults:PAIR<Pr>? query composed of three comma- separated measurement values for <status>, <distance>, and <amplitude> in form of ”SHRT,20.6,-0.6”. Specific measurement values obtained using SPLIT command.

Lines 017 ~ 18
Output log for measurement results to screen using LOG command.

3. Evaluating Measurement Results



```
'=== Calculate average length ===
COPY,%TOTAL,%OPEN_LENGTH1
CALC,%TOTAL,%TOTAL,+,0.0
CALC,%TOTAL,%TOTAL,+,%OPEN_LENGTH2
```

Selects [Custom] at Judge and describes following script.

```
'=== Calculate average length ===
COPY,%TOTAL,%OPEN_LENGTH1
CALC,%TOTAL,%TOTAL,+,0.0000
CALC,%TOTAL,%TOTAL,+,%OPEN_LENGTH2
CALC,%TOTAL,%TOTAL,+,%OPEN_LENGTH3
CALC,%TOTAL,%TOTAL,+,%OPEN_LENGTH4
CALC,%AVERAGE,%TOTAL,/,4.000
LOG,"Average Length= " %AVERAGE

'=== Decide thredold ===
CALC,%THRESHOLD_L,%AVERAGE,-,%LENGTH_MARGIN
CALC,%THRESHOLD_H,%AVERAGE,+,%LENGTH_MARGIN

'==== Status Check ===
COPY,%OK_COUNT_S,0
IF,%STATUS1,==,"OPEN"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1
IF,%STATUS2,==,"OPEN"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1
IF,%STATUS3,==,"OPEN"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1
IF,%STATUS4,==,"OPEN"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1

IF,%OK_COUNT_S,==,4
THEN,LOG,"All of Statuses are OPEN -> OK", "GREEN"
ELSE,LOG,"All of Statuses are not OPEN -> NG", "RED"

'==== Length Check ===
COPY,%OK_COUNT_L,0
IF_EX,"(%OPEN_LENGTH1>=%THRESHOLD_L)&&(%OPEN_LENGTH1<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
IF_EX,"(%OPEN_LENGTH2>=%THRESHOLD_L)&&(%OPEN_LENGTH2<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
IF_EX,"(%OPEN_LENGTH3>=%THRESHOLD_L)&&(%OPEN_LENGTH3<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
IF_EX,"(%OPEN_LENGTH4>=%THRESHOLD_L)&&(%OPEN_LENGTH4<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1

IF,%OK_COUNT_L,==,4
THEN,LOG,"All of length are within margin -> OK", "GREEN"
ELSE,LOG,"All of length are out of margin -> NG", "RED"

'==== Total Judgement ====
IF_EX,"(%OK_COUNT_S == 4) && (%OK_COUNT_L == 4)"
```

The average values are used to evaluate whether the lengths of the four cable pairs are sufficiently similar. Evaluation is performed by examining whether the difference between the average and length of each cable pair is within or outside the permissible margin.

Lines 001 ~ 008
Find average lengths of four cable pairs

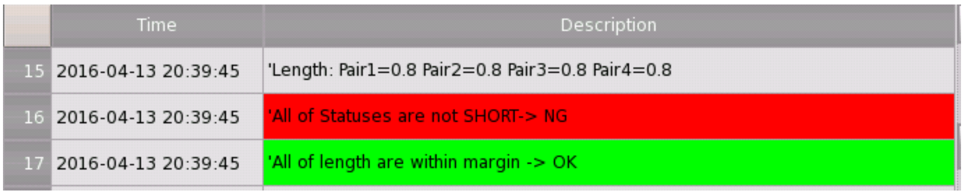
Lines 010 ~ 012
Use found average lengths and %LENGTH_MARGIN global variable to calculate pass/fail evaluation high and low limits

Lines 014 ~ 027
Evaluate whether status of four cable pairs is all "OPEN". Although can Use JUDGE_FAIL command here to confirm pass/fail evaluation, in this case, subsequent evaluation processing not performed. In order to perform next evaluation irrespective of whether status pass or fail, evaluation result is counted in %OK_COUNT_S variable (pass when value is 4).

Lines 029 ~ 042
Evaluate whether lengths of four cable pairs within pass range

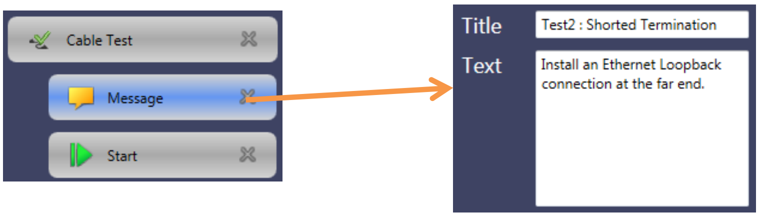
Lines 044 ~ 046
Overall evaluation

The following color-coded screen is output using the LOG command.



	Time	Description
15	2016-04-13 20:39:45	'Length: Pair1=0.8 Pair2=0.8 Pair3=0.8 Pair4=0.8
16	2016-04-13 20:39:45	'All of Statuses are not SHORT-> NG
17	2016-04-13 20:39:45	'All of length are within margin -> OK

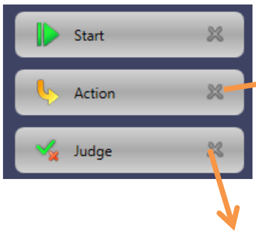
4. Looping-back Far End

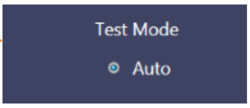


Title: Test2 : Shorted Termination
Text: Install an Ethernet Loopback connection at the far end.

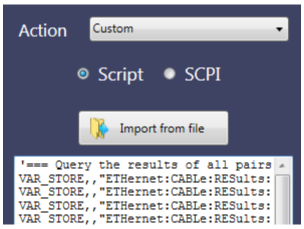
Displays message requesting connection of loop-back jack at far end

5. Starting Measurement (Short) and Obtaining Measurement Result





Only Auto can be selected at Cable Test



```
'=== Query the results of all pairs
VAR_STORE,,"ETHernet:CABLe:RESults:
VAR_STORE,,"ETHernet:CABLe:RESults:
VAR_STORE,,"ETHernet:CABLe:RESults:
VAR_STORE,,"ETHernet:CABLe:RESults:
```

Selects [Custom] at Action and describes following script.

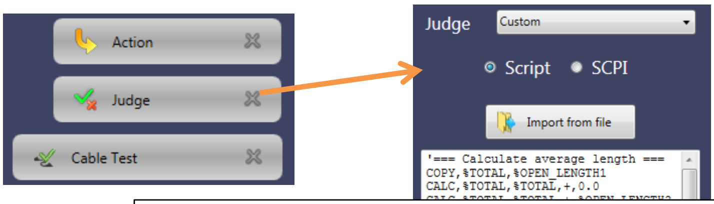
```
001:'=== Query the results of all pairs. ===
002:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR1?",%RESP1
003:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR2?",%RESP2
004:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR3?",%RESP3
005:VAR_STORE,,"ETHernet:CABLe:RESults:PAIR4?",%RESP4
006:
007:'=== Substitute all results into variables ===
008:SPLIT,%STATUS1,1,%RESP1
009:SPLIT,%LENGTH1,2,%RESP1
010:SPLIT,%STATUS2,1,%RESP2
011:SPLIT,%LENGTH2,2,%RESP2
012:SPLIT,%STATUS3,1,%RESP3
013:SPLIT,%LENGTH3,2,%RESP3
014:SPLIT,%STATUS4,1,%RESP4
015:SPLIT,%LENGTH4,2,%RESP4
016:
017:LOG,"Status: Pair1=" %STATUS1 " Pair2=" %STATUS2 "
Pair3=" %STATUS3 " Pair4=" %STATUS4
018:LOG,"Length: Pair1=" %LENGTH1 " Pair2=" %LENGTH2 "
Pair3=" %LENGTH3 " Pair4=" %LENGTH4
```

Lines 001 ~ 005
Use ETHernet:CABLe:RESults:PAIR<Pr>? query and save obtained measurement results (lengths for four cable pairs) to each of four local variables %RESP1, %RESP2, %RESP3, and %RESP4, respectively. Pay attention to the blank second column of the VAR_STORE command.

Lines 007 ~ 015
Analyze response string to ETHernet:CABLe:RESults:PAIR<Pr>? query to obtain cable lengths and status, and store them in appropriate variables. Response string to ETHernet:CABLe:RESults:PAIR<Pr>? query composed of three comma- separated measurement values for <status>, <distance>, and <amplitude> in form of "SHRT,20.6,-0.6". Specific measurement values obtained using SPLIT command.

Lines 017 ~ 018
Output log for measurement results to screen using LOG command.

6. Evaluating Measurement results



```
'=== Calculate average length ===
COPY,%TOTAL,%OPEN_LENGTH1
CALC,%TOTAL,%TOTAL,+,0.0
```

Selects [Custom] at Judge and describes following script.

```
'==== Status Check ===
COPY,%OK_COUNT_S,0
IF,%STATUS1,==,"SHRT"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1
IF,%STATUS2,==,"SHRT"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1
IF,%STATUS3,==,"SHRT"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1
IF,%STATUS4,==,"SHRT"
THEN,CALC,%OK_COUNT_S,%OK_COUNT_S,+,1

IF,%OK_COUNT_S,==,4
THEN,LOG,"All of Statuses are SHORT-> OK", "GREEN"
ELSE,LOG,"All of Statuses are not SHORT-> NG", "RED"

'==== Length Check ===
COPY,%OK_COUNT_L,0

'-- pair 1 ---
COPY,%OK_COUNT_L,0.0
COPY,%OK_COUNT_H,0.0
CALC,%THRESHOLD_L,%OPEN_LENGTH1,-,%LENGTH_MARGIN
CALC,%THRESHOLD_H,%OPEN_LENGTH1,+,%LENGTH_MARGIN
IF_EX,"(%LENGTH1>=%THRESHOLD_L)&&(%LENGTH1<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
LOG,"Threshold1 Low=" %THRESHOLD_L" High=" %THRESHOLD_H

'-- pair 2 ---
CALC,%THRESHOLD_L,%OPEN_LENGTH2,-,%LENGTH_MARGIN
CALC,%THRESHOLD_H,%OPEN_LENGTH2,+,%LENGTH_MARGIN
IF_EX,"(%LENGTH2>=%THRESHOLD_L)&&(%LENGTH2<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
LOG,"Threshold2 Low=" %THRESHOLD_L" High=" %THRESHOLD_H

'-- pair 3 ---
CALC,%THRESHOLD_L,%OPEN_LENGTH3,-,%LENGTH_MARGIN
CALC,%THRESHOLD_H,%OPEN_LENGTH3,+,%LENGTH_MARGIN
IF_EX,"(%LENGTH3>=%THRESHOLD_L)&&(%LENGTH3<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
LOG,"Threshold3 Low=" %THRESHOLD_L" High=" %THRESHOLD_H

'-- pair 4 ---
CALC,%THRESHOLD_L,%OPEN_LENGTH4,-,%LENGTH_MARGIN
CALC,%THRESHOLD_H,%OPEN_LENGTH4,+,%LENGTH_MARGIN
IF_EX,"(%LENGTH4>=%THRESHOLD_L)&&(%LENGTH4<=%THRESHOLD_H)"
THEN,CALC,%OK_COUNT_L,%OK_COUNT_L,+,1
LOG,"Threshold4 Low=" %THRESHOLD_L" High=" %THRESHOLD_H
LOG,"OK Count=" %OK_COUNT_L

IF,%OK_COUNT_L,==,4
THEN,LOG,"All of length are within margin -> OK", "GREEN"
ELSE,LOG,"All of length are out of margin -> NG", "RED"

'==== Total Judgement ====
IF_EX,"( %OK_COUNT_S == 4) && (%OK_COUNT_L == 4)"
ELSE, JUDGE_FAIL
```

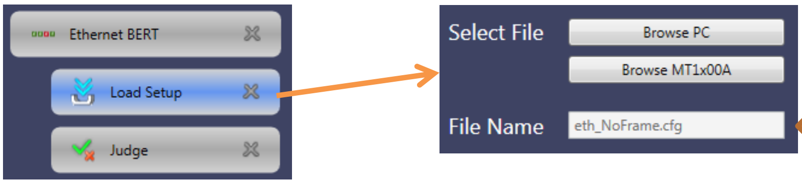
The length values recorded in the global variables as the previous measurement (open) are used to evaluate whether the lengths of the four cable pairs are sufficiently similar when the far end is shorted by the loop-back jack and when it is open. Evaluation is performed by examining whether the difference between the opened and the shorted lengths is within or outside the permissible margin.

Lines 001 ~ 014
Evaluate whether status of four cable pairs is all “SHRT”. Although can Use JUDGE_FAIL command here to confirm pass/fail evaluation, in this case, subsequent evaluation processing not performed. In order to perform next evaluation irrespective of whether status pass or fail, evaluation result is counted in %OK_COUNT_S variable (pass when value is 4).

Lines 016 ~ 052
Evaluate whether lengths of four cable pairs within pass range

Lines 054 ~ 056
Overall evaluation

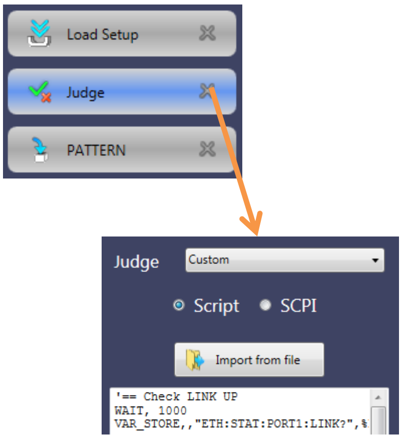
7. Setting Network Master Initial Condition for BER Measurement



File Name: eth_NoFrame.cfg

Specifies settings file for saving initial conditions shown in Table 3.4-2

8. Confirming Link Status



Judge: Custom

◉ Script ○ SCPI

```
'== Check LINK UP
WAIT, 1000
VAR_STORE,,"ETH:STAT:PORT1:LINK?",%
```

Selects [Custom] at Judge and describes following script.

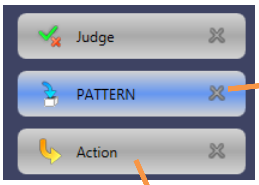
```
001:'== Check LINK UP
002:WAIT, 1000
003:VAR_STORE,,"ETH:STAT:PORT1:LINK?",%RESP
004:
005:IF, %RESP, ==, 1
006:THEN, LOG, "ETH [link] OK ("%RESP")","GREEN"
007:ELSE, LOG, "ETH [link] NG ("%RESP")","RED"
008:ELSE, MESSAGE, "Link up fail! ¥nCheck cable connection"
009:ELSE, JUDGE_FAIL
010:ELSE, END
011:ENDIF
```

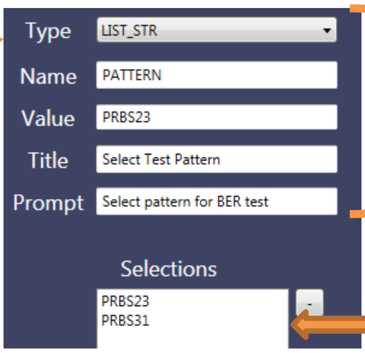
Line 002
Waits until Link established after completing preceding Load Setup

Line 002
Saves response to ETH:STAT:PORT1:LINK? query in local variable %RESP

Lines 005 ~ 011
Perform evaluation. If no Link established, evaluate as fail and terminate processing

9. Selecting Pattern





Type: LIST_STR

Name: PATTERN

Value: PRBS23

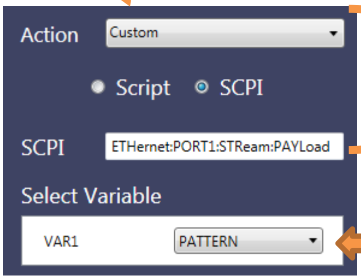
Title: Select Test Pattern

Prompt: Select pattern for BER test

Selections:
PRBS23
PRBS31

Displays dialog to select two choices of user pattern: PRBS23 and PRBS31. Consequently specifies [LIST_STR] at Type. Inputs name change for saving user results at Name. This example uses “ PATTERN” for name change.

Input selection list here.



Action: Custom

○ Script ● SCPI

SCPI: ETHernet:PORT1:STReam:PAYLoad

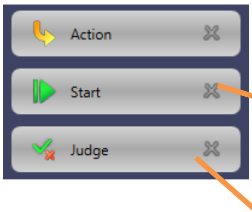
Select Variable

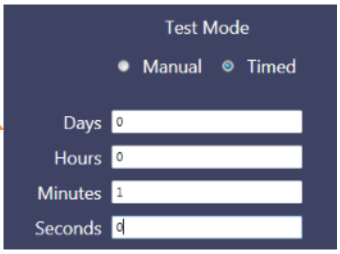
VAR1: PATTERN

Selects [CUSTOM] at Action.
Inputs [ETHernet:PORT1:STReam:PAYLoad %1] at SCPI.
Select Variable list box appears at [%1] type.

VAR1 list box displays candidate variables. Selects PATTERN variable.

10. Starting Measurement and Evaluating Measurement Results





Test Mode

○ Manual ● Timed

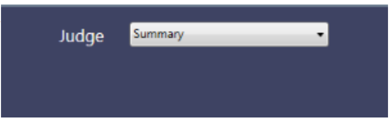
Days: 0

Hours: 0

Minutes: 1

Seconds: 0

Selects [Timed] at Test Mode.
Sets measurement time below.



Judge: Summary

Selects [Summary] at Judge to perform pass/fail evaluation at [Threshold] setting set as shown in Fig. 3.4-3.

Anritsu envision : ensure

Specifications are subject to change without notice.

● United States
Anritsu Company
1155 East Collins Blvd., Suite 100, Richardson,
TX 75081, U.S.A.
Toll Free: 1-800-267-4878
Phone: +1-972-644-1777
Fax: +1-972-671-1877

● Canada
Anritsu Electronics Ltd.
700 Silver Seven Road, Suite 120, Kanata,
Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

● Brazil
Anritsu Eletronica Ltda.
Praça Amadeu Amaral, 27 - 1 Andar
01327-010 - Bela Vista - Sao Paulo - SP
Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

● Mexico
Anritsu Company, S.A. de C.V.
Av. Ejército Nacional No. 579 Piso 9, Col. Granada
11520 México, D.F., México
Phone: +52-55-1101-2370
Fax: +52-55-5254-3147

● United Kingdom
Anritsu EMEA Ltd.
200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K.
Phone: +44-1582-433200
Fax: +44-1582-731303

● France
Anritsu S.A.
12 avenue du Québec, Bâtiment Iris 1- Silic 612,
91140 VILLEBON SUR YVETTE, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

● Germany
Anritsu GmbH
Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49-89-442308-0
Fax: +49-89-442308-55

● Italy
Anritsu S.r.l.
Via Elio Vittorini 129, 00144 Roma, Italy
Phone: +39-6-509-9711
Fax: +39-6-502-2425

● Sweden
Anritsu AB
Kistagången 20B, 164 40 KISTA, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

● Finland
Anritsu AB
Teknobulevardi 3-5, FI-01530 VANTAA, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

● Denmark
Anritsu A/S
Kay Fiskers Plads 9, 2300 Copenhagen S, Denmark
Phone: +45-7211-2200
Fax: +45-7211-2210

● Russia
Anritsu EMEA Ltd.
Representation Office in Russia
Tverskaya str. 16/2, bld. 1, 7th floor.
Moscow, 125009, Russia
Phone: +7-495-363-1694
Fax: +7-495-935-8962

● Spain
Anritsu EMEA Ltd.
Representation Office in Spain
Edificio Cuzco IV, Po. de la Castellana, 141, Pta. 8
28046, Madrid, Spain
Phone: +34-915-726-761
Fax: +34-915-726-621

● United Arab Emirates
Anritsu EMEA Ltd.
Dubai Liaison Office
902, Aurora Tower,
P O Box: 500311- Dubai Internet City
Dubai, United Arab Emirates
Phone: +971-4-3758479
Fax: +971-4-4249036

● India
Anritsu India Private Limited
2nd & 3rd Floor, #837/1, Binnamangla 1st Stage,
Indiranagar, 100ft Road, Bangalore - 560038, India
Phone: +91-80-4058-1300
Fax: +91-80-4058-1301

● Singapore
Anritsu Pte. Ltd.
11 Chang Charn Road, #04-01, Shriro House
Singapore 159640
Phone: +65-6282-2400
Fax: +65-6282-2533

● P.R. China (Shanghai)
Anritsu (China) Co., Ltd.
Room 2701-2705, Tower A,
New Caohejing International Business Center
No. 391 Gui Ping Road Shanghai, 200233, P.R. China
Phone: +86-21-6237-0898
Fax: +86-21-6237-0899

● P.R. China (Hong Kong)
Anritsu Company Ltd.
Unit 1006-7, 10/F., Greenfield Tower, Concordia Plaza,
No. 1 Science Museum Road, Tsim Sha Tsui East,
Kowloon, Hong Kong, P.R. China
Phone: +852-2301-4980
Fax: +852-2301-3545

● Japan
Anritsu Corporation
8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016 Japan
Phone: +81-46-296-6509
Fax: +81-46-225-8359

● Korea
Anritsu Corporation, Ltd.
5FL, 235 Pangyoyeok-ro, Bundang-gu, Seongnam-si,
Gyeonggi-do, 13494 Korea
Phone: +82-31-696-7750
Fax: +82-31-696-7751

● Australia
Anritsu Pty. Ltd.
Unit 20, 21-35 Ricketts Road,
Mount Waverley, Victoria 3149, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

● Taiwan
Anritsu Company Inc.
7F, No. 316, Sec. 1, NeiHu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

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