Black Box protocol

Ver. 1.7.4

METREL®

List of modifications

Black Box protocol version	Modifications	Document version
1.7	Added command WAKE_UP Added command return message	Ver. 1.7.4 and up

1.6	Commands:
	  - Added section IS (Inspection)
	Command returns:
	  - MSG
	  - Added section IS (Inspection)
	Use Cases:
	  - Added Auto Sequence ® – Inspection example	

1.5	Command returns in Single Test:
	  - STREAM added
	  - EXTENDED_PARAMETERS added
	    MEASURING_STATUS_ON,
	    MEASURING_STATUS_OFF
	    ICON_ON
	    ICON_OFF
	  - ACTIONS added
	New option added under SEND_ST_INFO in START_AUTOTEST command
	Command returns in Auto Test:
	  - AT PAUSE added properties
	Extended settings in ENABLE command	

1.4	ACTION command Break added Touch pre-test replies added TOUCH_TEST = REQUEST TOUCH_TEST = PASSED TOUCH_TEST = FAILED Touch pre-test commands added TOUCH_TEST = ENABLE TOUCH_TEST = DISABLE	Ver. 1.4.3 and up
1.3	Extended parameters added X0 X1 (Support for A 1600) Added setting SEND_INFO in command START_SINGLETEST Added START_SINGLETEST command Added SEND_ST_INFO = INTERMEDIATE_RESULTS command in Auto Sequences Added RESET command and PASSWORD setting Added KEYBOARD and TEXT action command to reply on MSG HELP command added PROCEED command changed with ACTION and KEY Added DONE command return	Ver. 1.3.2 and up
1.2	First official version	Ver. 1.2

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1 About

Black Box protocol is used for controlling the instrument as a black box. All commands start with *BB;* prefix. In general a Black Box command looks like this:
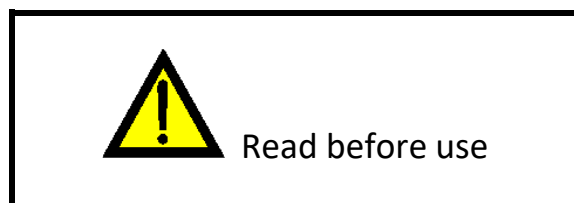
BB; X1; X2; ...; Xn

Xn – different parameters of the command that consist of a name, ID (optional), a value string (optional) and a comment string (optional) that is ignored by the parser.
NAME ID = value string "comment string"

Commands sent to the instrument are case sensitive and must end with a carriage return character (0x13).

1.1 Safety warnings

In order to reach high level of operator safety while carrying out various measurements using the Black Box protocol, as well as to keep the test equipment undamaged, it is necessary to consider the following warnings:

‣ **Consider all generally known precautions in order to avoid risk of electric shock. Hazardous tests, using Black Box protocol, can start automatically and it is programmer's responsibility to implement necessary safety measures.**

‣ **Read Instruction manual of test instrument carefully, otherwise use of the instrument may be dangerous for the operator, for the instrument or for the equipment under test!**

‣ **Consider warning markings on the instrument!**

‣ **If the test equipment is used in manner not specified in the Instruction manual the protection provided by the equipment may be impaired!**

‣ **Do not use the instrument and accessories if any damage is noticed!**

‣ **Some measurements require safety touch pre-test to check for the presence of dangerous voltage on PE test terminal. Disabling or ignoring this option by using Black Box protocol without additional safety measures can lead to hazardous situation.**

1.2 Definitions, acronyms, and abbreviations

Term	Definition
Auto Test	Auto Sequence® - pre-programmed test sequences

2 Commands

Section describes commands for instrument control.

2.1 ENABLE

BB; ENABLE = *#*; *{settings}*

Puts the instrument into Black Box mode in which other BB commands become available or exits Black Box mode. Instrument answers with DONE.

#
  – 1   Enters Black Box mode
  – 0   Exits Black Box mode

{settings} - optional settings (Multiple settings should be separated by "; ")
  – PASSWORD = *{password}*
      This setting is mandatory unless a password in the Account Manager is not set (empty).
      {password}   Black Box password that is set in Account Manager.
  – DEBUG_TEXTS
      Enables debug information to be sent (parameter and limit names for Single tests, …)
      Comment strings are ignored by the parser.
  – MEASURING_STATUSES
      Enables specific measuring statuses to be sent.
  – ICONS
      Enables measuring icons to be sent.
  – ACTIONS
      Enables available user actions to be sent.

Notice:
During execution of Single Test or Auto Sequence® this command is not available. Black Box mode can only be exited from idle state.

2.2 RESET

BB; RESET

Sets the instrument into default Black Box idle state. After instrument enters the idle state, it responds with DONE command.

Notice:
During the execution of this command, the instrument might send some results or status commands before sending the DONE command.

2.3 WAKE_UP

BB; WAKE_UP

When the instrument gets into the sleep mode (full charging screen) it can be awakened by this command.

2.4 STATUS

BB; STATUS

Verify the instrument about the Black Box status. Instrument replays with a command described in section *3.3*.

2.5 START_SINGLETEST

BB; START_SINGLETEST *{#id}*; *{parameters}*; *{limits}*; *{extended_parameters}*; *{settings}*

The command starts a Singletest with ID #id. Optional parameters should be in the order as shown above. IDs, parameters, limits and pre-defined values can be found in a software tool DataDisplay FrameWork Visualizer. See section 4 for details.

{#id}   unique ID of a measurement

{parameters}   single test's parameters

> Syntax:
> – P # = {value}
>
>> #   parameter ID
>> {value} parameter value

{limits}   single test's limits

> Syntax:
> – L # = {value}
>
>> #   limit ID
>> {value} limit value

Notice:
{parameters} and *{limits}* represent Single test's parameters and limits as seen in the instrument. All are optional and if not set the instrument default values are used.

{Extended_Parameters}   optional parameters used for specifying additional Single Test properties

> Syntax:
> – X # = {value}
>
>> #   extended parameter ID
>> {value} parameter value

See the example described in section *5.5.*

{settings}   represent optional settings that can be any of the following settings:

Syntax:
- HV_PASSWORD = {####}

    {####}   Up to four-digit password value for HV measurements

Enables High voltage measurements by typing the correct password as set in the instrument

Syntax:
- SEND_INFO = {flag#1},{flag#2},{flag#N}

    {flag#1}   Single flag supported

      - INTERMEDIATE_RESULTS Every result in continuous measurement is printed.

    {flag#2},{flag#N}   Not available.

Additional options to configure single test printing output.

Syntax:
- TOUCH_TEST = {option}

    {option}

                    - ENABLE   Safety touch pre-test is enabled
                    - DISABLE   Safety touch pre-test is disabled

Enables or disables safety touch pre-test in specific measurement. By default this option is enabled.

Notice:
See TOUCH_TEST example in section *5.6*

2.6 START_AUTOTEST

BB; START_AUTOTEST; NAME = {Auto Sequence® name}; {X1}; {X2}; {X3}

This command starts an Auto Sequence® (referred as AUTOTEST). Besides the *{Auto Sequence® name}* it has the following optional *{X1}*, *{X2}* and *{X3}* parameters:

{Auto Sequence® name}   Name of the Auto Sequence® available from Auto Sequences® menu.

{X1} {X2} {X3}   Optional parameters

    Syntax:
    - SEND_ST_INFO = {flag#1},{flag#2},{flag#N}

      {flag#1},{flag#2},{flag#N} Additional options to configure single test printing output.

            - INTERMEDIATE_RESULTS Every result in continuous measurement is printed.
            - AT_STEP_INFO   Every result is marked with step and count information (AT_STEP, COUNT) to which part of Auto Sequence® it belongs.

Enables sending of single test info – parameters, limits and results.

- SAVE_RESULT

Enables auto-saving results to instrument's Memory Organizer.

- HV_PASSWORD = {####}
  {####}   Up to four-digit password value for HV measurements

Enables High voltage measurements by typing the correct password as set in the instrument.

Notice:
{Auto Sequence® name} must be valid. (Auto Sequence® group should be selected and Auto Sequence® with same name present in the selected group). Workspace in Memory organizer should also be set.

2.7 IS (Inspection)

BB; IS; *{operation}*

Within the execution of Inspection, the user can set the Inspection status and Check box statuses.

{operation} - Operations that can be executed on Inspection content

- STATUS = *{status_value}*
  Setting the Inspection general status value
     {status_value}   status of inspection (pass, fail, empty, checked)

- CHECK_BOX; ID = *{check_box_id}*; STATUS = *{status_value}*
  Setting the Check Box status value.
     {check_box_id}   *ID of selected Check box*
     {status_value}   *Status of Check box (pass, fail, empty, checked)*

Notice:
Each status is set independently and has no influence on other statuses. Before setting these commands, the interdependence between statuses should be considered and implemented programmable.

2.8 ACTION

BB; ACTION = *{action_name}*

This command executes an action on the instrument. Currently supported actions are Control Panel buttons. Most common commands are displayed bellow:

{action_name}   *Names of Control panel buttons*

- Proceed   *(Command will execute* *)*

- Skip   *(Command will execute* *)*

- Repeat   *(Command will execute* *)*

- Retest   *(Command will execute* *)*

- End_loop   *(Command will execute* *)*

- End   *(Command will execute* *)*

- Stop_test   *(Command will execute* *)*

- Start_test   *(Command will execute* *)*

- Change_status *(Command will execute* *)*

- Break   *(Command will abort single test or autosequence* *)*

Notice:
To get the supported actions for each screen use HELP command. See section *2.11* for details*.*

2.9 MSG

BB; MSG #; *{action}*

With this command the user answers to MSG command sent by the instrument.

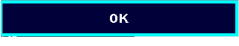**#**   ID of the message window

{action}
- TEXT = *{text}*

 {text}   Alphanumeric text (UTF-8 format) or numeric text
 Used with message type KEYBOARD to enter text.

- BUTTON = *{button_name}*
 Used to reply on messages with buttons.

 {button_name}   button that will be pressed
 - Ok   *(Command will execute* *)*
 - Yes   *(Command will execute* *)*
 - No   *(Command will execute* *)*

 Notice:
 Possible *{button_name}* depends on the message window itself.

2.10 KEY

BB; KEY = *{key_name}*

{key_name}
 - *enter*
 - *esc*
 - *option*

- *up*
- *down*
- *left*
- *right*

This command executes the equivalent of a keyboard button press. It operates in Single Test and Auto Sequence® menus.

Notice:
The command should be used only in situations where the instrument cannot be handled using ACTION 2.7 or MSG 2.9 commands.

2.11 HELP

BB; HELP; *{command}*

Prints help for certain commands. Currently supported commands:

{command}
- ACTION   Prints available actions in the current screen.
- KEY   Prints supported key.

Notice:
Multiple results are separated by comma.

3 Command returns

3.1 ERROR MESSAGES

BB; ERROR # "*{Error description}*"

This message with relevant error code and description will be returned from the instrument if command cannot be executed.

Error code

{Error description}   Description of the identified error (see table below)

#	*{Error description}*
1	BlackBox mode is not enabled
2	Command unavailable or invalid
3	Wrong password
4	Autotest group not selected
5	Autotest not found
6	Wrong HV password
7	Workspace error
8	Wrong communication port
9	Unsupported parameters or limits (obsolete)
10	P # or L # # ID of parameter or limit with unsupported attributes (Multiple unsupported attributes are separated by comma.)
11	Extended parameters wrong configuration
15	Instrument in sleep mode, command unavailable or invalid (This state can be awakened by WAKE_UP command.)

3.2 DONE

BB; DONE

With this command return the instrument signals that it has finished processing the last command.

3.3 STATUS

BB; STATUS; *{property}*

With this command return instrument displays the status of the Black Box properties.

{property}
- ENABLE = #   Defines the Black Box mode.

              #
-     1   Black Box is enabled.
-     0   Black Box is disabled.

Example:
BB; STATUS; ENABLE = 1   // Black Box is enabled

3.4 MSG

BB; MSG #; {*Message type $*}; NAME = {*caption*}

With this command the instrument tells the user that there is a message on the screen waiting for user input.

ID of the message window.

This ID is used in the answer to the message, to identify the message the user is answering (in case there is more than one active on the screen). ID equals 0 if single message is displayed.

{*Message type $*}
- NOTIFICATION $

This message appears during measurements if some pretest has failed. Notification normally has single OK button.

     $ ID of the message content that uniquely identifies the message's content.

- ASK $

This message appears during measurements if some pretest has failed and needs the user to decide if it should proceed with single test. Ask message normally has two buttons, YES and NO.

     $ ID of the message content that uniquely identifies the message's content.

- KEYBOARD $

Keyboard is on screen and is awaiting text.

     $ Keyboard type (requested text)

         1   Alphanumeric text (UTF-8 format)

         2   Numeric text

- CUSTOM

This message is not related to single tests and appears if any other error is detected.

{*caption*}
Description of message content.

Notice:
See MSG example in section 5.8.

3.5 ST (Single Test)

Instrument reports data about the active single test. During Auto Sequence® execution ST (Single test) will only appear if SEND_ST INFO command is previously set.

BB; ST; *{Data type}* # = *{value}* *"comment"*

{Data type}   Single test can report the following *Data types*:

- START

    START *# "comment"*

    Instrument reports that a single test has been started.

#	ID of the single test
comment	Name (Caption) of the single test – Visible only if DEBUG_TEXTS command is set.

- END

    Instrument report that the active single test has finished.

- RESULT

    RESULT # = *{value}* *"comment"*
    RESULT # = *{value}* *"comment"*; STATUS = *{status_type}*

    Result of the single test.

#	ID of the result or sub-result
{value}	Result value – includes numeric value, space character and a unit
comment	Result name (Caption) – visible only if DEBUG_TEXTS command is set
{status_type}	Status of the result (if applicable)

    - pass   ✅ status

    - fail   ❌ status

    - cancel   🚫 status of a test canceled by a user / instrument

    - abort   🚫 status of a test aborted by the instrument

- STREAM

    STREAM #; POS = *{position}*; *{type} {id}* = *{value}*; *…*

    Stream of the single test.

#	ID of the stream
{position}	Data position inside the stream (optional)
{type}	*Stream axis type:*
	- *R* *Result*
	- *L* *Limit*
	- *P* *Parameter*
{id}	*Stream axis id for specific {type}*
{value}	*Value for stream axis at {type} {id}*
…	*Array of stream axis {type} {id} = {value}*

Notice:
Data Position POS = *{position}* is optional. It depends on the stream type.
See STREAM example in section 5.7 .

- EXTENDED_PARAMETER

  EXTENDED_PARAMETER *#* = *{value}*

  Extended parameter of the single test.

#	ID of the extended parameter
{value}	Extended parameter value

- PARAMETER

  PARAMETER *#* = *{value}* *"comment"*

  Parameter of the single test.

#	ID of the parameter
{value}	Parameter value
comment	Parameter name (Caption)

- LIMIT

  LIMIT *#* = *{value}* *"comment"*

  Limit of the single test.

#	ID of the limit
{value}	Limit value
comment	Limit name (Caption)

- STATUS

  STATUS = *{value}*

{value}	Status of the single test
- pass	✔ status
- fail	✖ status
- none	limits not set – no status
- empty	status not applicable
- cancel	🚫 status of a test canceled by a user / instrument
- abort	🚫 status of a test aborted by the instrument

- MEASURING_STATUS_ON

  MEASURING_STATUS_ON *#* = *{value}*

  Measuring specific status of the single test was set.

ID of the measuring status. List of IDs and more information is in the Appendix document.

{value}   Measuring status value.

- MEASURING_STATUS_OFF

MEASURING_STATUS_OFF *#*

Measuring specific status of the single test was removed.

ID of the measuring status.

- ICON_ON

ICON_ON *# = {value}*

Measuring specific icon of the single test was set.

ID of the measuring icon. List of IDs and more information is in the Appendix document.

{value}   Measuring icon value.

- ICON_OFF

ICON_OFF *#*

Measuring specific icon of the single test was removed.

ID of the measuring icon.

- ACTIONS

ACTIONS = *{list_of_actions}*

Currently available user actions.

{list_of_actions}   List of available actions. See section 2.8 for more information.

- TOUCH_TEST

TOUCH_TEST = *{message}*

Safety touch pre-test notifications.

{message}
- REQUIRED   This message appears during measurement if safety touch pre-test has to be executed by user. The user should **press** the Touch test button (Run key) on the measuring instrument.

- PASSED   This message appears if touch pre-test passed and it was safe to proceed with the measurement.

- FAILED   This message appears if touch pre-test failed.

3.6 IS (Inspection)

Instrument reports data about the active inspection.

BB; IS; *{Data type}*

{Data type}   Inspection can report the following *Data types*:

- START

  START; ID = *{inspection_id}*

  Instrument reports that an inspection has been started.

  > *{inspection_id}* Unique id of inspection

- END

  Instrument reports that the active inspection has finished.

- NAME

  NAME = *{name}*; STATUS_VALUES = *{status_values}*

  > *{name}*   Name of the inspection
  > *{status_values}*   List of all possible status values for this inspection
  > > - *pass*
  > > - *fail*
  > > - empty
  > > - checked

- CHECK_BOX

  CHECK_BOX; CAPTION = *{text}*; STATUS_VALUES = *{status_values}*; ID = *{id}*;
  PARENT_ID = *{parent_id}*

  Result of the single test.

  > *{text}*   Check box caption text
  > *{status_values}*   List of all possible status values for this Check box
  > *{id}*   Check box ID
  > *{parent_id}*   *Check box parent ID*

- END_DEFINITION

  Instrument reports that the inspection definition sending has been finished.

3.7 AT (Auto Sequence®)

Instrument reports data about the active Auto Sequence® (AT).

BB; AT; *{Data type}*

{Data type}   Auto Sequence® can report the following *Data types*:

- START

    Instrument reports that the Auto Sequence® has started.

- END

    Instrument reports that the active Auto Sequence® has ended.

- STATUS

    STATUS = *{value}*

    {value}   Status of the active Auto Sequence®

- pass	✔	status
- fail	✖	status
- none	▬	no status
- empty	▬	status not applicable
- abort	🚫	status of an Auto Sequence® with aborted single test(s)

- PAUSE

    Instrument reports that the Auto Sequence® has stopped in an PAUSE flow command.

    PAUSE; TYPE = *{type}*; DURATION = *{duration}*; TEXT = *{text}*; IMAGE = *{image}*

    TYPE = {type}

         {type}   Pause type

           - TEXT
           - TEXT_AND_ WARNING
           - IMAGE

    DURATION = {duration}

         {duration}   Pause duration. The "inf" value stands for infinite pause.

    TEXT = {text}

         {text}   Text shown in pause.

    IMAGE = {image}

         {image}   Image path and name.

- STEP_END_DECISION

    Instrument reports that the Auto Sequence® has stopped in the "Operation after end of single test" screen.

- APPLIANCE_INFO

    APPLIANCE_INFO; ID = *{id}*; NAME = *{name}*; RETEST_PERIOD = *#*

    Instrument reports appliance info from the flow command Appliance Info.

    ID = {id}
    {id}   Appliance / equipment ID number or text

    NAME = {name}
   *{name}*   Appliance / equipment name

    RETEST_PERIOD = #
    #   Appliance /equipment retest period in months

4   DataDisplay FrameWork Visualizer SW

DataDisplay FrameWork Visualizer is a SW tool required to be used with Black Box protocol, especially when using single test Black Box commands.

4.1   View ID of the single test measurement

Every single test measurement has its own unique ID. By using **START_SINGLETEST** command, ID of the selected measurement is required. This ID can be identified in DataDisplay FrameWork Visualizer SW – tab Measurements.
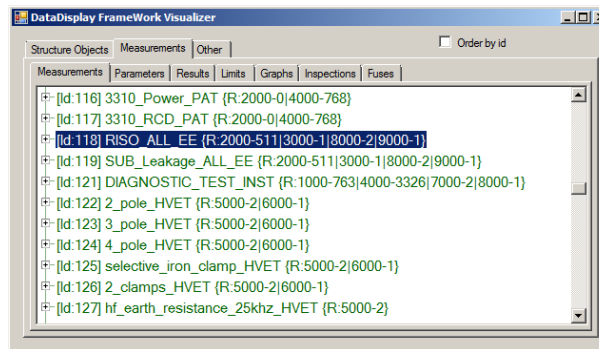

4.2   View Parameters / Limits of the selected single test measurement

Parameters / Limits also consist of IDs and values (attributes). See figures below where to locate parameter or limit ID.
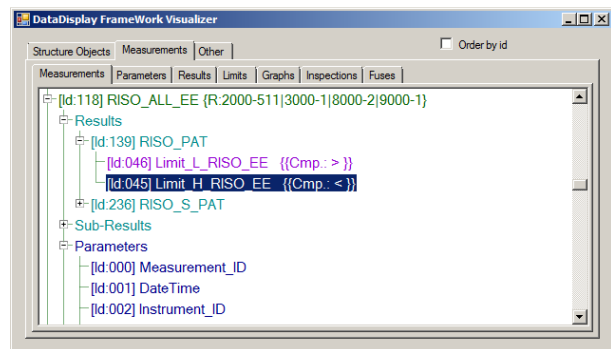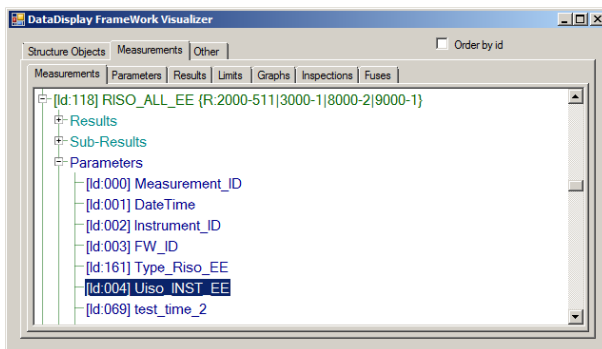
4.3   View Parameter / Limit attributes

After Parameter / Limit ID is identified select Parameters or Limits tab, search by ID and open Attribute Values. List of all supported values (attributes) of the selected Parameter or Limit can be found.
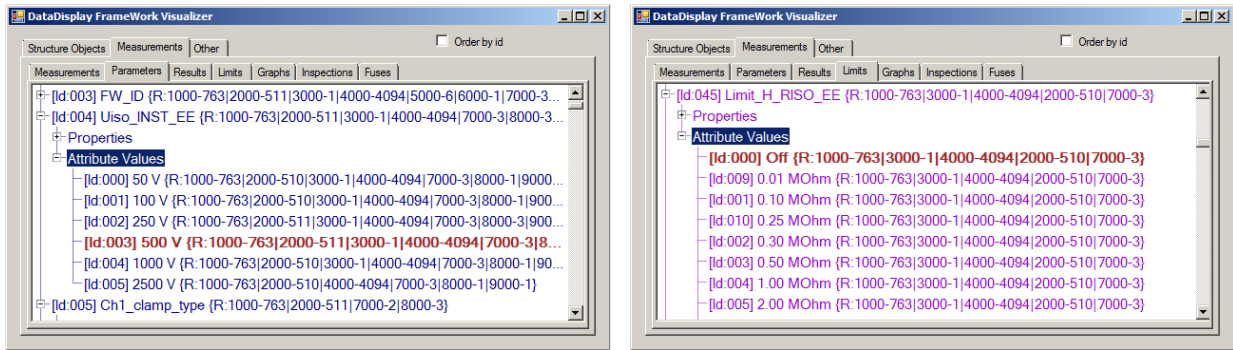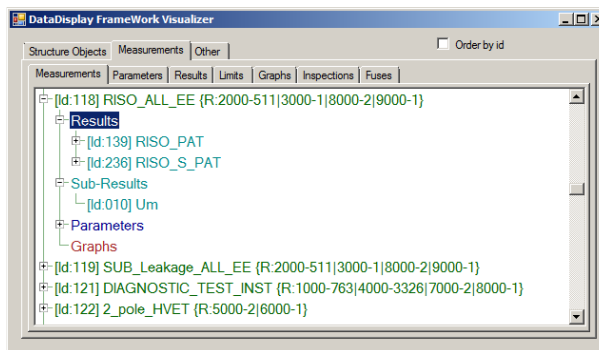
Parameter ID 004 values in example above: 50 V, 100 V, 250 V, 500 V, 1000 V, 2500 V

Limit ID 045 values in example above: Off, 0.01 MOhm, 0.10 MOhm, 0.25 MOhm, 0.30 MOhm, 0.50 MOhm,…

Notice:
The line that contains default Parameter / Limit attribute value is coloured red.

4.4　Results and Sub-results

Available IDs of results and Sub-results for the selected single test are not required by the Black Box protocol, but can be useful for parsing result data.

5   Use Cases

In this section "blue" colour presents Black Box commands while "red" colour presents Black Box command returns.

Before applying any of following commands to the instrument you should first put the instrument into the Black Box mode. Basic example is below. See section **2.1 ENABLE** for advanced options.

BB; ENABLE = 1

Instrument should respond with:

BB; DONE

5.1   Single Test – R iso

BB;START_SINGLETEST 118; P4 = 500 V; P161 = Riso-S; P69 = 2 s

BB; ST; START 118
BB; ST; PARAMETER 161 = Riso-S
BB; ST; PARAMETER 4 = 500 V
BB; ST; PARAMETER 69 = 2 s
BB; ST; PARAMETER 249
BB; ST; PARAMETER 250
BB; ST; LIMIT 48 = Off
BB; ST; LIMIT 47 = Off

BB; ST; RESULT 236 = >199.9 MOhm
BB; ST; RESULT 10 = 525 V
BB; ST; STATUS = none

BB; ST; END

5.2   Single Test – Intermediate results

BB; START_SINGLETEST 80; P 119 = 4 wire; P 66 = 4 A; P 69 = 10 s; SEND_INFO = INTERMEDIATE_RESULTS

BB; ST; START 80
BB; ST; PARAMETER 119 = 4 wire
BB; ST; PARAMETER 66 = 4 A
BB; ST; PARAMETER 69 = 10 s
BB; ST; PARAMETER 249
BB; ST; PARAMETER 250
BB; ST; LIMIT 43 = Off
BB; ST; LIMIT 44 = Off
BB; ST; RESULT 135; STATUS 135 = empty
BB; ST; STATUS = empty

BB; ST; RESULT 135; STATUS 135 = empty
BB; ST; STATUS = empty

BB; ST; RESULT 135; STATUS 135 = empty
BB; ST; STATUS = none

BB; ST; RESULT 135; STATUS 135 = empty
BB; ST; STATUS = empty

BB; ST; RESULT 135 = >999 Ohm
BB; ST; STATUS = none

BB; ST; RESULT 135 = >999 Ohm
BB; ST; STATUS = none
...
BB; ST; RESULT 135 = >999 Ohm
BB; ST; STATUS = none

BB; ST; END

5.3 Single Test – Limits configuration

BB; START_SINGLETEST 80; P 119 = 4 wire; P 66 = 4 A; P 69 = 5 s; L 43 = 0.1 Ohm; L 44 = 5 Ohm

BB; ST; START 80
BB; ST; PARAMETER 119 = 4 wire
BB; ST; PARAMETER 66 = 4 A
BB; ST; PARAMETER 69 = 5 s
BB; ST; PARAMETER 249
BB; ST; PARAMETER 250
BB; ST; LIMIT 43 = 0.1 Ohm
BB; ST; LIMIT 44 = 5 Ohm
BB; ST; RESULT 135 = >999 Ohm; STATUS 135 = fail
BB; ST; STATUS = fail

BB; ST; END

5.4 Single Test – High Voltage

Running High voltage test requires use of HV_PASSWORD command:

BB; START_SINGLETEST 96; P 102 = 1000 V; HV_PASSWORD = 0000

BB; ST; START 96
BB; ST; PARAMETER 102 = 1000 V
BB; ST; PARAMETER 105 = 5 s
BB; ST; PARAMETER 249
BB; ST; PARAMETER 250
BB; ST; LIMIT 64 = Off
BB; ST; LIMIT 65 = 1.0 mA

BB; ST; RESULT 189 = 1025 V
BB; ST; RESULT 190 = 0.1 mA; STATUS 190 = pass
BB; ST; RESULT 191 = 0.1 mA

BB; ST; RESULT 192 = 0.0 mA
BB; ST; STATUS = pass

BB; ST; END

5.5 Single Test – Extended parameters

This example demonstrates execution of High Voltage using A 1600 switch adapter on channels 1 and 2:

BB; START_SINGLETEST 97; P94 = 3000 V; L67 = 10.0 mA; X0 = A1600; X1 = 1,2; HV_PASSWORD = 0000

BB; ST; START 97
BB; ST; PARAMETER 94 = 3000 V
BB; ST; PARAMETER 105 = 5 s
BB; ST; PARAMETER 249
BB; ST; PARAMETER 250
BB; ST; EXTENDED_PARAMETER 0 = A1600
BB; ST; EXTENDED_PARAMETER 1 = 1,2
BB; ST; LIMIT 66 = Off
BB; ST; LIMIT 67 = 10.0 mA
BB; ST; RESULT 185 = 3.12 kV
BB; ST; RESULT 186 = 0.00 mA; STATUS 186 = pass
BB; ST; STATUS = pass

BB; ST; END

5.6 Single Test – Touch pre-test

This example demonstrates execution of single test with safety touch pre-test which passed:

BB; START_SINGLETEST 16; TOUCH_TEST = ENABLE

BB; ST; START 16
BB; ST; PARAMETER 260 = TN rcd
BB; ST; PARAMETER 108 = C
BB; ST; PARAMETER 28 = 0.5 A
BB; ST; PARAMETER 29 = 0.035 s
BB; ST; PARAMETER 31 = 1
BB; ST; PARAMETER 233 = -
BB; ST; PARAMETER 234 = Off
BB; ST; PARAMETER 236 = Standard
BB; ST; LIMIT 13 = 5 A
BB; ST; LIMIT 6 = 50 V
BB; ST; TOUCH_TEST = REQUIRED

Press "RUN" key for touch pre-test.

BB; ST; TOUCH_TEST = PASSED
BB; ST; RESULT 34 = 56.4 A; STATUS 34 = pass
BB; ST; RESULT 205 = 4.08 Ohm
BB; ST; RESULT 2 = 220 V
BB; ST; RESULT 37 = 0.54 Ohm
BB; ST; RESULT 38 = 4.04 Ohm
BB; ST; STATUS = pass

BB; ST; END

This example demonstrates execution of single test with safety touch pre-test which failed:

BB; START_SINGLETEST 16; TOUCH_TEST = ENABLE

BB; ST; START 16
BB; ST; PARAMETER 260 = TN rcd
BB; ST; PARAMETER 108 = C
BB; ST; PARAMETER 28 = 0.5 A
BB; ST; PARAMETER 29 = 0.035 s
BB; ST; PARAMETER 31 = 1
BB; ST; PARAMETER 233 = -
BB; ST; PARAMETER 234 = Off
BB; ST; PARAMETER 236 = Standard
BB; ST; LIMIT 13 = 5 A
BB; ST; LIMIT 6 = 50 V
BB; ST; TOUCH_TEST = REQUIRED

   Press "RUN" key for touch pre-test.

BB; ST; TOUCH_TEST = FAILED
BB; ACTION = Break
BB; ST; STATUS = empty

BB; ST; END

5.7 Single Test – Patient Leakage (to earth)

This example demonstrates execution of single test with stream results:

BB; START_SINGLETEST 215; SEND_INFO = INTERMEDIATE_RESULTS

BB; ST; START 215
BB; ST; PARAMETER 346 = All
BB; ST; PARAMETER 347 = All
BB; ST; PARAMETER 351 = All
BB; ST; PARAMETER 352 = All
BB; ST; PARAMETER 350 = All
BB; ST; PARAMETER 355 = All

BB; ST; PARAMETER 353 = All
BB; ST; PARAMETER 69 = Off
BB; ST; PARAMETER 376 = Mains
BB; ST; LIMIT 134 = 100 uA

BB; ST; STREAM 124; P 346 = Normal; P 347 = NC; P 351 = Earthed; P 350 = Earthed; P 352 = Earthed; P 353 = 1; P 355 = TRMS; R 497 = 0.013 mA; R 498 = none
BB; ST; STREAM 124; P 346 = Normal; P 347 = NC; P 351 = Earthed; P 350 = Earthed; P 352 = Earthed; P 353 = 1; P 355 = AC; R 497 = 0.001 mA; L 221 = 10 uA; R 498 = pass
BB; ST; STREAM 124; P 346 = Normal; P 347 = NC; P 351 = Earthed; P 350 = Earthed; P 352 = Earthed; P 353 = 1; P 355 = DC; R 497 = 0.013 mA; L 221 = 10 uA; R 498 = fail

BB; ST; STATUS = fail

BB; ST; END

5.8 Message Box notification handling

Following examples demonstrates message box notification handling.

At some point the instrument triggers Message Box:
BB; MSG 0; ASK 0; NAME = Resistance L-N is too high(>30 kOhm). Check fuse / switch.%0DWould you like to proceed?
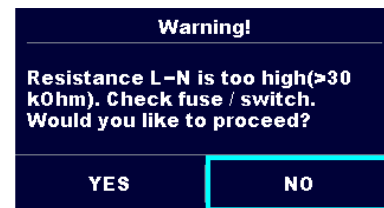
Special characters	Text string
\r	%0D
\n	%0A
;	%3B
%	%25

To close Message Box with Yes command, following command should be sent to instrument:
BB; MSG 0; BUTTON = Yes

At some point the instrument triggers Message Box:
BB; MSG 0; NOTIFICATION 33; NAME = Active polarity pretest failed!
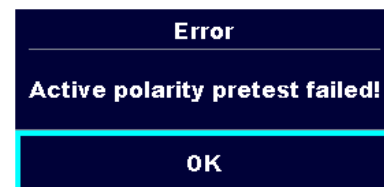
To close Message Box with Ok command, following command should be sent to instrument:
BB; MSG 0; BUTTON = Ok

At some point the instrument triggers keyboard entry:
BB; MSG 0; KEYBOARD 1; NAME = Name

To enter text and close keyboard screen, following command should be sent to instrument:
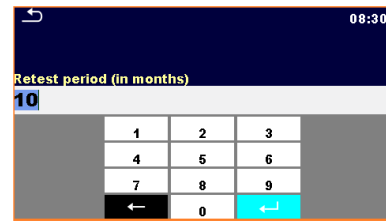BB; MSG 0; TEXT = text
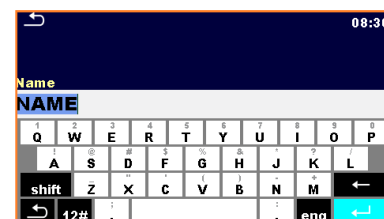
At some point the instrument triggers numeric keyboard entry:

BB; MSG 0; KEYBOARD 2; NAME = Retest period (in months)

To enter value and close keyboard screen, following command should be sent to instrument:
BB; MSG 0; TEXT = 12

5.9 Auto Sequence® – full

BB; START_AUTOTEST; NAME = BB demo(HV); SEND_ST_INFO; SAVE_RESULT; HV_PASSWORD = 0000

BB; AT; START
BB; ST; START 96 "HV AC"
BB; ST; PARAMETER 102 = 1000 V "U test"
BB; ST; PARAMETER 105 = 5 s "t end"
BB; ST; LIMIT 64 = Off "L limit"
BB; ST; LIMIT 65 = 1.0 mA "H limit"
BB; ST; RESULT 189 = 1024 V "U"
BB; ST; RESULT 190 = 0.1 mA "I"; STATUS 190 = pass
BB; ST; RESULT 191 = 0.1 mA "Ic"
BB; ST; RESULT 192 = 0.1 mA "Ir"
BB; ST; STATUS = pass
BB; ST; END
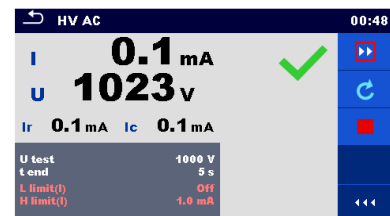
BB; AT; STEP_END_DECISION
BB; ACTION = Proceed

BB; ST; START 118 "R iso"
BB; ST; PARAMETER 161 = Riso, Riso-S "Type"
BB; ST; PARAMETER 4 = 500 V "Uiso"
BB; ST; PARAMETER 69 = 5 s "Duration"
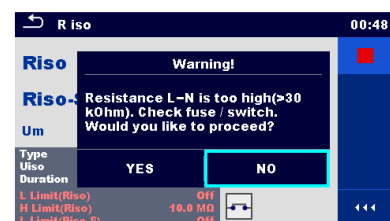BB; ST; LIMIT 46 = Off "L Limit"
BB; ST; LIMIT 45 = 10.0 MOhm "H Limit"
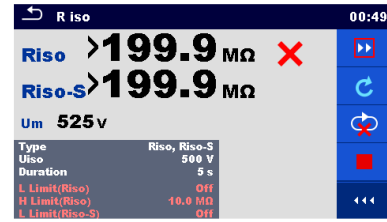BB; ST; LIMIT 48 = Off "L Limit"
BB; ST; LIMIT 47 = Off "H Limit"

BB; MSG 0; ASK 0 "Resistance L-N is too high(..."
BB; MSG 0; BUTTON = Yes

BB; ST; RESULT 139 = >199.9 MOhm "Riso"; STATUS 139 = fail
BB; ST; RESULT 236 = >199.9 MOhm "Riso-S"
BB; ST; RESULT 10 = 525 V "Um"
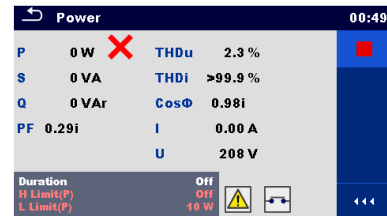BB; ST; STATUS = fail
BB; ST; END

BB; AT; STEP_END_DECISION
BB; ACTION = End_loop

BB; ST; START 88 "Power"
BB; ST; PARAMETER 69 = Off "Duration"
BB; ST; LIMIT 52 = Off "H Limit"
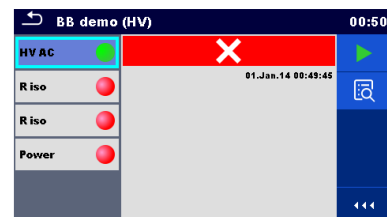BB; ST; LIMIT 51 = 10 W "L Limit"

BB; ACTION = End

BB; ST; RESULT 78 = 0 W "P"; STATUS 78 = fail
BB; ST; RESULT 79 = 1 VA "S"
BB; ST; RESULT 80 = 0 var "Q"
BB; ST; RESULT 81 = 0.31i "PF"
BB; ST; RESULT 82 = 2.8 Percent "THDu"
BB; ST; RESULT 85 = >99.9 Percent "THDi"
BB; ST; RESULT 241 = 0.99i "CosÎ¦"
BB; ST; RESULT 158 = 207 V "U"
BB; ST; RESULT 159 = 0.00 A "I"
BB; ST; STATUS = fail
BB; ST; END

BB; AT; STEP_END_DECISION
BB; ACTION = Proceed
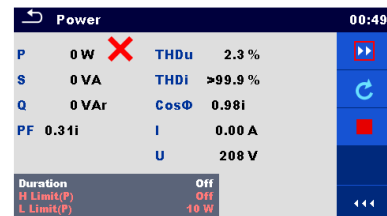
BB; AT; STATUS = fail
BB; AT; END

5.10 Auto Sequence® – Inspection

This example demonstrates execution of Inspections:

BB; START_AUTOTEST; NAME = demo_visualTest
BB; AT; START
…
BB; IS; START; ID = S632c51aa02a44328b9a9256a9b8c5c85
BB; IS; NAME = Visual"; STATUS_VALUES = pass,fail,empty
BB; IS; CHECK_BOX; CAPTION = wiring connection points; STATUS_VALUES = pass,fail,empty; ID = 30; PARENT_ID = -1
BB; IS; CHECK_BOX; CAPTION = cables; STATUS_VALUES = pass,fail,empty; ID = 31; PARENT_ID = -1
BB; IS; CHECK_BOX; CAPTION = covers, housing; STATUS_VALUES = pass,fail,empty; ID = 32; PARENT_ID = -1
BB; IS; CHECK_BOX; CAPTION = inscriptions and markings; STATUS_VALUES = pass,fail,empty; ID = 33; PARENT_ID = -1
BB; IS; END_DEFINITION

BB; IS; CHECK_BOX; ID=30; STATUS = pass
BB; IS; CHECK_BOX; ID=31; STATUS = pass
BB; IS; CHECK_BOX; ID=32; STATUS = pass
BB; IS; CHECK_BOX; ID=33; STATUS = pass
BB; IS; STATUS = pass

BB; ACTION = Stop_test

BB; IS; END
BB; AT; STEP_END_DECISION

BB; ACTION = Proceed

BB; AT; STATUS = fail
BB; AT; END