SIEMENS

3WL circuit breaker software

Operating Manual

08/2011

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Note the following:

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

Introduction

Note

Information, rights and obligations

The software is used for documenting the results of tests performed with the function testing device. The data of the selected circuit breaker and the protection settings of the ETUs must be entered and are clearly documented. The program tests the validity of the inputs and specifies test values for testing the tripping values of the circuit breaker and the tolerance limits.

You can obtain further information from your local Siemens representative.

We would draw your attention to the fact that the contents of this Operating Manual are not part of an earlier or existing agreement, approval or legal relationship, or intended to modify such. All obligations on the part of Siemens result from the relevant purchase agreement that also contains the full and exclusively valid warranty ruling. These contractual warranty requirements are neither extended nor restricted by the implementation of this Operating Manual.

The 3WL air circuit breaker (ACB) is a device for protecting and switching important switchgear, cables, busbars and loads.

There is an industry-specific requirement for quantitative testing of the tripping characteristic of the electronic trip units (ETUs) of this circuit breaker. The tolerance limits of the response thresholds of the individual tripping functions and the tolerance limits of the delay times must be tested here.

Siemens offers a circuit breaker test device for this purpose:

- Order number: 3WL9111-0AT44-0AA0.

This measuring instrument can be purchased or hired.

The scope of delivery, technical data, cabling, operation and detailed description of the tests can be found in the Operating Instructions of the circuit breaker test device (order number 3ZX1812-0WL93-0AN0).

Siemens also provides a software tool for documenting the function test. This makes it possible to capture and clearly document the important data of the circuit breaker under test and the protection settings of the relevant ETU.

Based on the tests described in the Operating Instructions of the circuit breaker test device, the software tool specifies in the "Protocol" worksheet a testing sequence for all relevant protection areas. This is adapted to the selected ETU (15B, 25B, 27B, 45B, 55B or 76B) and the current protection settings.

The test currents are found in the "Protocol" sheet. These values are set on the device in accordance with the Operating Instructions of the circuit breaker test device. The calculated tripping times must be entered in the relevant cells and compared with the setpoint values.

The program offers the option of saving these results and then printing them out.

This software checks the validity of the inputs, especially the values of test currents and response thresholds of the subsequent protection ranges, and reports overlaps.

Important properties of the ETUs are described in the 3WL documentation (e.g. in the Configuration Manual"SENTRON air circuit breakers (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=35681108&caller=view)", 3WL Operating Instructions, Industry Mall).

Operating the program

2

2.1 Starting the program

Starting the program

The program is started by executing the relevant *.XLS file. At the start, the "Enable Macros" button in the "Security Warning" dialog window must be clicked .

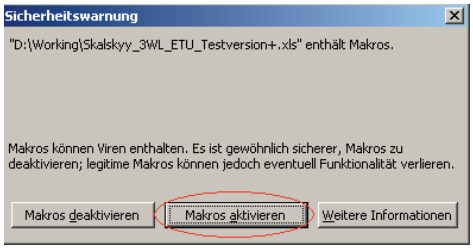

Figure 2-1 Security Warning - Enable Macros

The Excel security settings for executing macros must be set to the permissible level (in the Excel main menu via Tools → Options → Security → Macro Security → Medium).

Following this, you reach the main menu of the program, "Help" sheet. In this program step, execution of the program can be canceled and the program exited - "Program close" button.

Usually, you will continue to the selection of the ETU to be tested - via the "Test initiate →" button

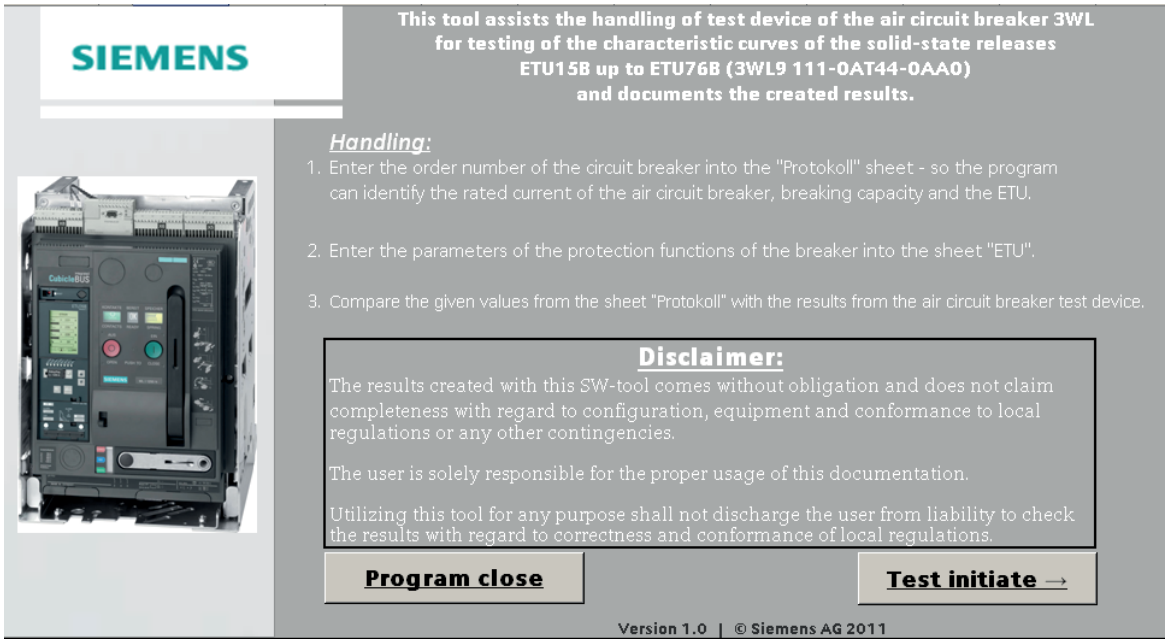

Figure 2-2 "Help" sheet - Test initiate

After clicking on the "Test initiate →" button, you reach the next selection menu where 6 ETUs (ETU15B to ETU76B) are suggested for selection. The specifications for the function test are accepted for the selected ETU, and the input algorithm is started.

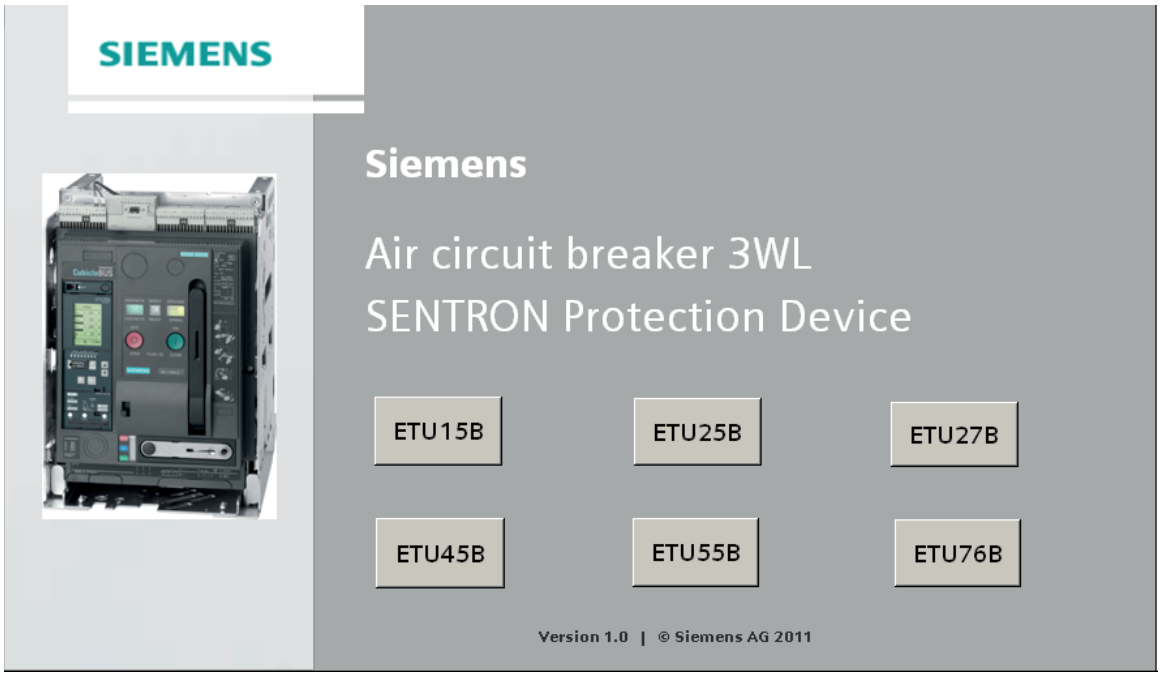

Figure 2-3 Device selection

You have the option of canceling and exiting the program at this point by changing to the "Help" sheet and clicking on the "Program close" button (as shown above in the "Help" sheet - Test initiate).

2.2 Selecting the breaker and the ETU

Selecting the breaker and the ETU

6 ETUs are available for selection for testing: ETU15B, ETU25B, ETU27B, ETU45B, ETU55B and ETU76B. The test-related differences between the ETUs are shown in the table below.

	Test options of the relevant protection functions				
ETU	**L** Overload protection	**N** Neutral conductor protection	**S** Short-time delayed short-circuit protection	**I** Instantaneous short-circuit protection	**G** Ground fault protection
ETU15B	Yes	No	No	Yes	No
ETU25B	Yes	No	Yes	Yes	No
ETU27B	Yes	Yes	Yes	Yes	Yes
ETU45B	Yes *	Yes	Yes *	Yes	Yes * (optional)
ETU55B	Yes *	Yes	Yes *	Yes	Yes * (optional)
ETU76B	Yes *	Yes	Yes *	Yes	Yes * (optional)

(* Can be switched between standard and alternative function:

- For L range: I^2t_R = const / I^4t_R = const;
- For S range: t_{sd} = const / I^2t_{sd} = const;
- For G range: t_g = const / I^2t_g = const;).

You can find a detailed description of the functionalities of the relevant ETUs in the Configuration Manual "SENTRON Air Circuit Breakers (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=35681108&caller=view)".

2.3 Transfer of the protection settings to the "ETU" sheet

Transfer of the protection settings to the "ETU" sheet

After selecting the ETU to be tested, the "Protocol" sheet is first called up. The structure of this sheet is always identical for all ETUs.

Note

Input rules

The following rules apply in general for the entire program:

- Only the fields set against a white background are used for data input.
- The grayed-out fields must not be changed.
- The fields marked with an asterisk (*) are mandatory – that is, they must not be left empty.

The "Protocol" sheet is completed in 3 steps:

1. All customer-specific information, and the details of the inspector, location, date, etc., are specified in Step 1:

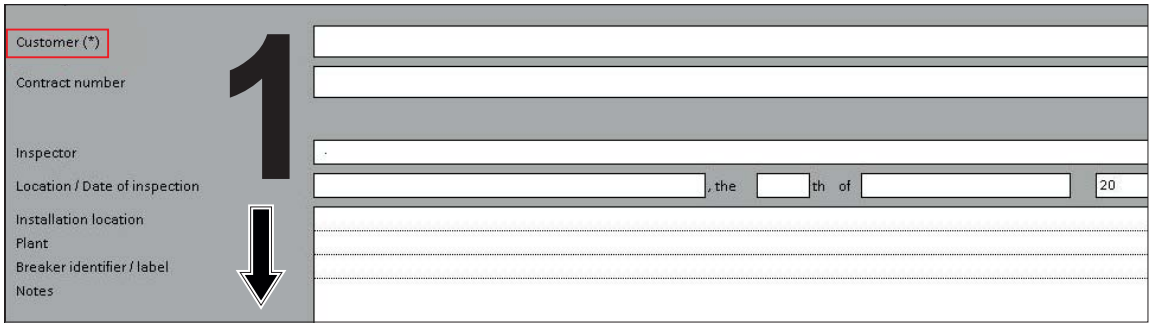

Figure 2-4 "Protocol" sheet with customer-specific information

2. The order number of the 3WL breaker is entered in Step 2. Input of each alphanumeric character must be terminated with the "ENTER" button. To reach Step 3, input of the order number must be confirmed with the "Submit" button. (The order number to be entered is taken from the rating plate of the circuit breaker to be tested):

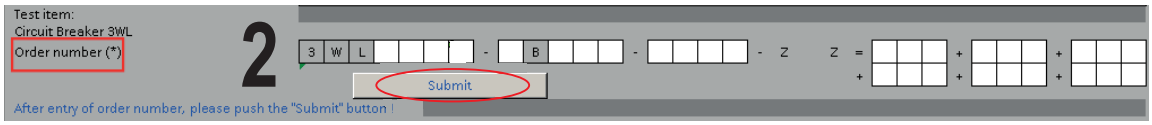

Figure 2-5 Entering the order number of the 3WL breaker

The inputs are thus checked for technical correctness. In the case of inadmissible specification of the order number of the breaker, the cells with the incorrect values are colored red, a message "False values for this size !" appears, and the operator is not taken further in the program until the valid values are entered. (The technical validity of the entered order number can also be checked with the help of the current Siemens Catalog).

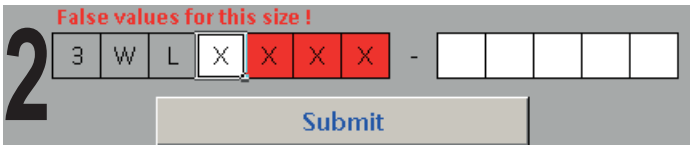

Figure 2-6 Confirm input of the order number (MLFB)

3. In Step 3, the current of the rated current module is to be entered with the help of the selection
menu. The value of this is taken from the ETU to be tested:

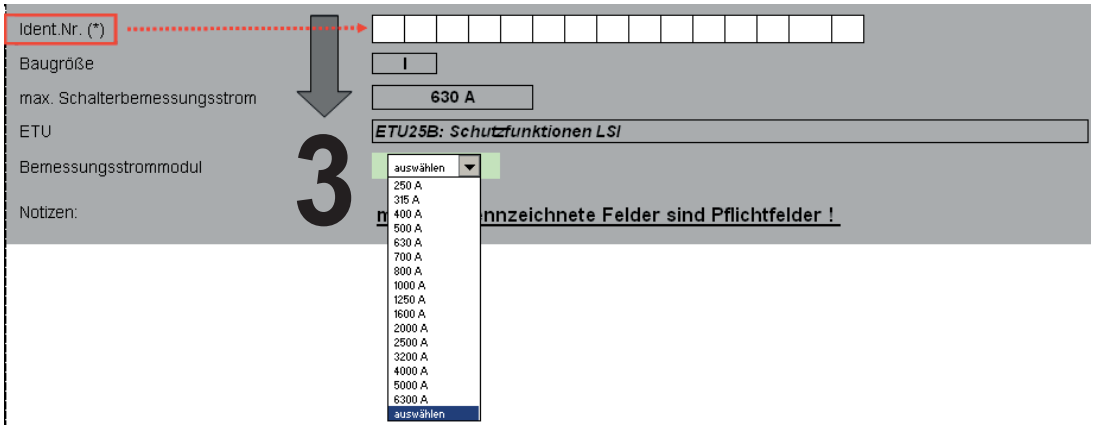

Figure 2-7 Selecting the rated current module

The value is automatically checked for technical correctness. If an incorrect entry is made, the message "False input !" appears.

Note

Permissible value specification for rated current module

After entering a permissible value for the rated current module, it is possible to change to the "ETU" sheet.

Figure 2-8 Entering the rated current (reference value for the protection settings)

Note

Protection setting

The ETU15B contains no rated current module. Change to the "ETU" sheet is automatic after clicking on the "Submit" button (see Step 2)! The reference value for the protection settings in this case is the maximum breaker rated current (I_n = I_n max).

2.4 Transfer of the ETU settings to the "Protocol" sheet

Transfer of the ETU settings to the "Protocol" sheet

To reach the "Protocol" sheet, the "Go to sheet Protocol →" button must be clicked after entering the protection parameters in the "ETU" sheet.

Figure 2-9 Go to sheet "Protocol"

This causes all the protection settings in the "ETU" sheet to be transferred to the "Protocol" sheet, as well as the test currents to be set on the 3WL circuit breaker test device for the individual protection functions, and the the tripping times to be measured. The user can carry out the suggested tests (test sequence) with the circuit breaker test device. The procedure is described in detail in the Operating Instructions of the circuit breaker test device. The tripping times thus calculated can be entered in the "Protocol" sheet in the "Result" column of the relevant test.

(To modify the protection parameters in the meantime, you can return to the "ETU" sheet by activating the "Change ETU settings" button in the "Protocol" sheet).

2.5 Settings in the "ETU" sheet

Settings in the "ETU" sheet

The structure of the "ETU" sheet contains the specific settings of the relevant ETUs and differs from type to type. The operating currents for ETUs 15B to 45B are set via the selection menu (with which a factor is selected from a permissible range), and the absolute values of the operating currents for ETUs 55B and 76B are entered direct.

Note

Changing to the Protocol sheet

If you are in the "ETU" sheet, you can only return to the "Protocol" sheet via the "Go to sheet Protocol →" button! This button is located in each specific "ETU" sheet at the bottom after the lines relevant to input (see Figure: ETU15B selection menu).

The "Go to sheet Protocol →" must only be activated after all protection parameters have been fully entered in the "ETU" sheet!

In all specific "ETU" sheets, as well as all "Protocol" sheets, only the cells colored white are intended for entering parameters! The gray cells are used only as information windows and must not be modified!

See also

"SENTRON air circuit breakers" configuration manual (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=35681108&caller=view)

2.6 ETU15B electronic trip unit

ETU15B

The "ETU15B" sheet contains two setting parameters that can each be modified via the selection menus (marked with small red circles):

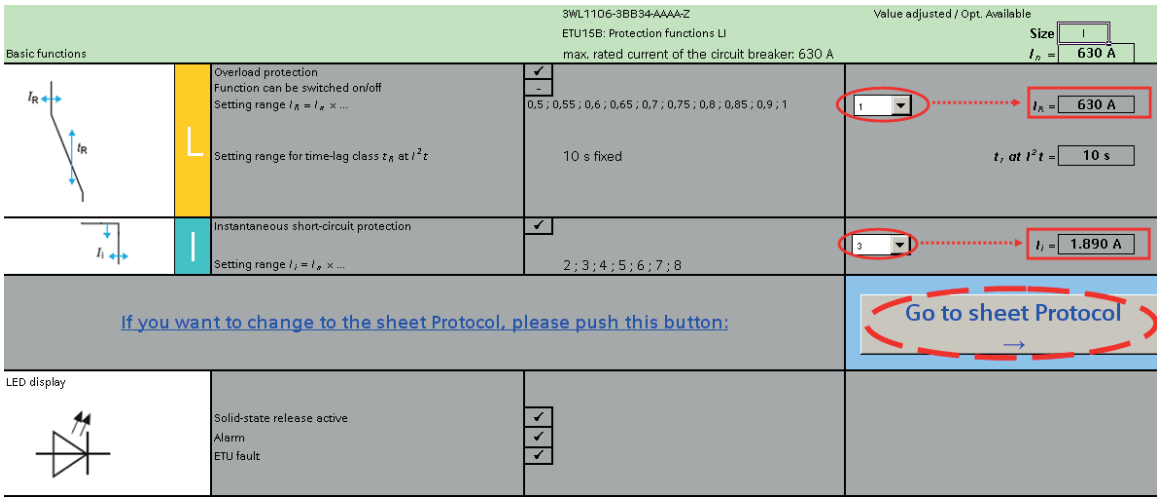

Figure 2-10 ETU15B selection menu

After entering the protection parameters and activating the "Go to sheet Protocol →" button, you jump back to the "Protocol" sheet. (The procedure for using the "Protocol" sheet is described in the next chapter).

The program makes it possible to change from the "Protocol" sheet to the "ETU" sheet as often as desired by activating the "Change ETU settings" button in the "Protocol" sheet:

This applies for all ETU types!

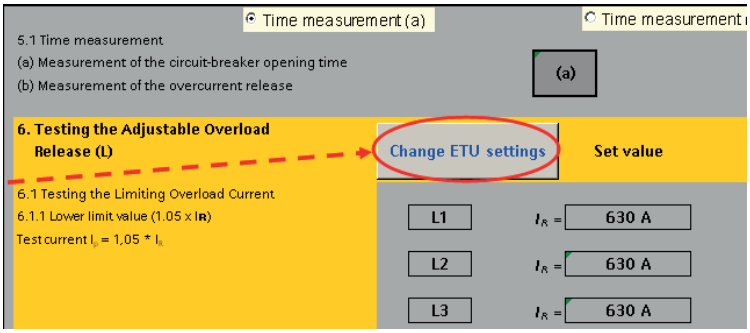

Figure 2-11 Changing ETU15B settings

When selecting the operating current I_i an automatic check is made at the program level in which the operating current of the instantaneous short-circuit release (I) is compared with the overload range (L).

Two options are taken into account:

1. If the selected test current of the overload release (I_p) is less than the set operating current of the instantaneous short-circuit release (I_i), the two values are within the permissible range (that is, a test actually takes place in the L range), and program execution can continue.
2. However, if the envisaged test current of the overload release (I_p) is not less than the set operating current of the instantaneous short-circuit release (I_i) (in this case, the test current would already lie within the I range), the cells to be corrected will be colored red, and the error message "Change / Read an instruction!" will appear.

To remove the error message, the procedure is similar to that described for correcting the S range for the ETU25B (similarly to the figure for the ETU25B: test current for the overload characteristic curve I_p and ETU25B: entering the test current). The procedure is described in the next section.

2.7 ETU25B electronic trip unit

ETU25B

The "ETU25B" sheet differs from the "ETU15B" sheet in only 2 points:

- The values of the setting current of the instantaneous protection function (I) can no longer be selected via the selection menu, but instead are automatically determined depending on the rated current of the 3WL circuit breaker.
- In addition, the ETU25B module contains the range of the delayed short-circuit release whose settings can be made via the selection menus:

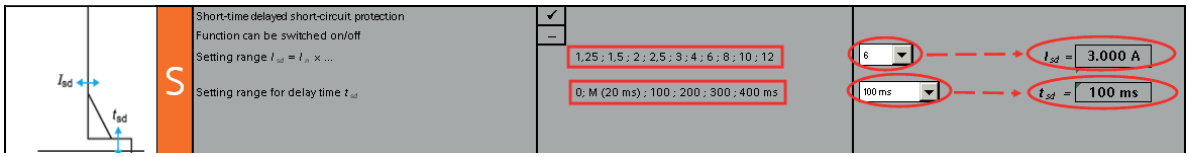

Figure 2-12 ETU25B selection menu

When selecting the operating current I_{sd} an automatic check is made at the program level in which the operating current of the delayed short-circuit release (S) is compared with the overload range (L). 2 options must be taken into account here:

1. If the selected test current (I_p) of the overload release (I_p) is less than the set operating current of the delayed short-circuit release (I_{sd}), the two values are within the permissible range (that is, a test actually takes place in the L range), and program execution is continued.
2. However, if the envisaged test current of the overload release (I_p) is not less than the set operating current of the instantaneous short-circuit release (I_{sd}) (in this case, the test current would already lie within the S range), the cells to be corrected will be colored red, and the error message "Change / Read an instruction!" will appear.

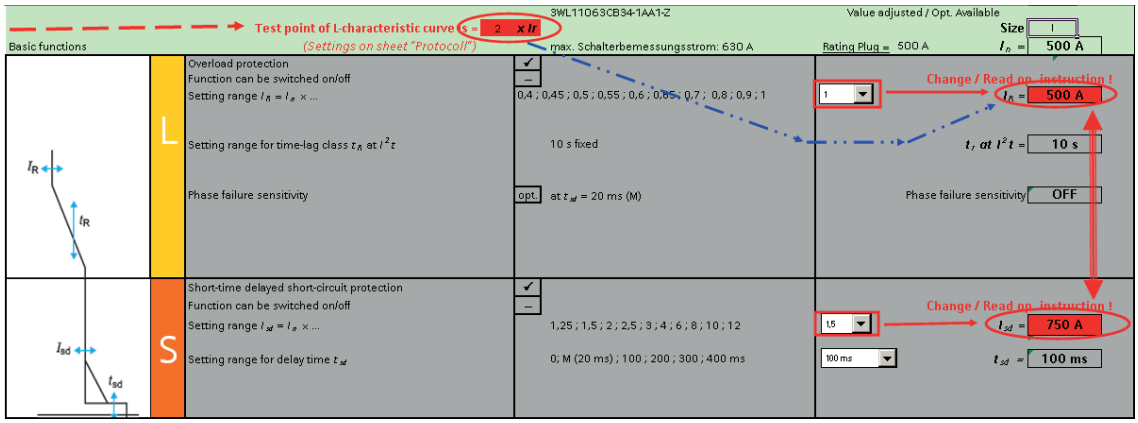

Figure 2-13 ETU25B: Test current for the overload characteristic curve I_p

The value of the test current for the overload characteristic curve (I_p) can be modified direct (see blue broken line in the ETU25B figure: Test current for the overload characteristic curve I_p and ETU25B figure: Entering the test current, value range 2 and 8 x I_R). The following rules apply:

I_p = (test point of L characteristic curve) * (I_R)

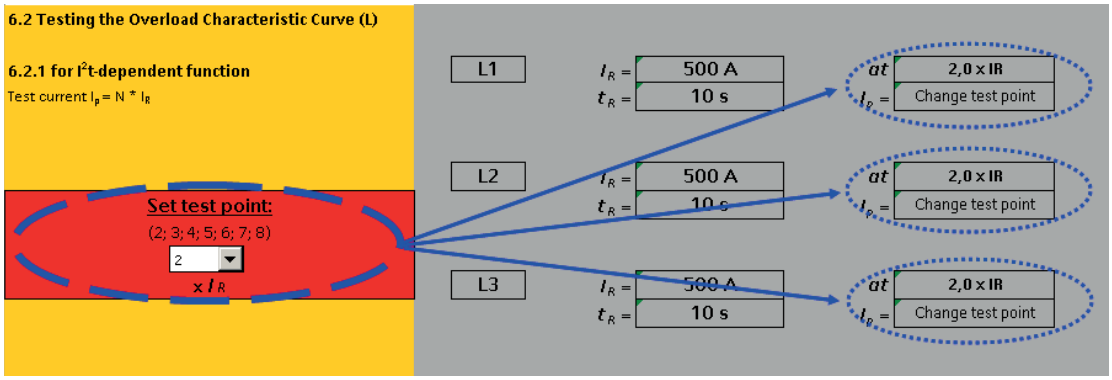

Figure 2-14 ETU25B: Entering the test current

The value of the "test point of L characteristic curve" must be set in the "Protocol" sheet in Section 6.2 "Testing the Overload Characteristic Curve (L)" (see the ETU25B figure: Entering the test current).

A further method of reducing the value of the test current is to reduce the response threshold of the overload release itself (I_R):

I_p = (test point L characteristic curve) * X * (I_n), X = [0.4 … 1].

An additional method of placing the test current within the L range (and removing the error message), is to increase the response threshold I_{sd} of the delayed short-circuit release as far as possible, until the following applies: $I_p < I_{sd}$.

All messages or the further settings of the "Protocol" sheet are described in more detail in the following chapters.

2.8 ETU27B electronic trip unit

ETU27B

The structure of the "ETU27B" sheet is similar to that of the "ETU25B" sheet but it contains two further protection functions:

1. N conductor protection function (see next figure): with the buttons marked in white, the additional neutral conductor protection function can be switched off (OFF setting) or switched on (ON setting), with the operating current of the protection device (I_N) corresponding to the rated current (I_n).

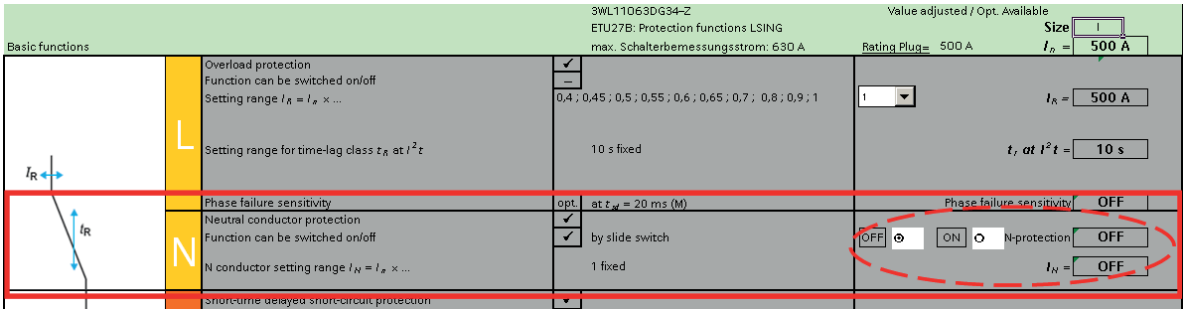

Figure 2-15 ETU27B: N conductor protection

2. Ground fault protection function (see next figure): the values of the operating current I_g are not entered here in the usual way using factors,

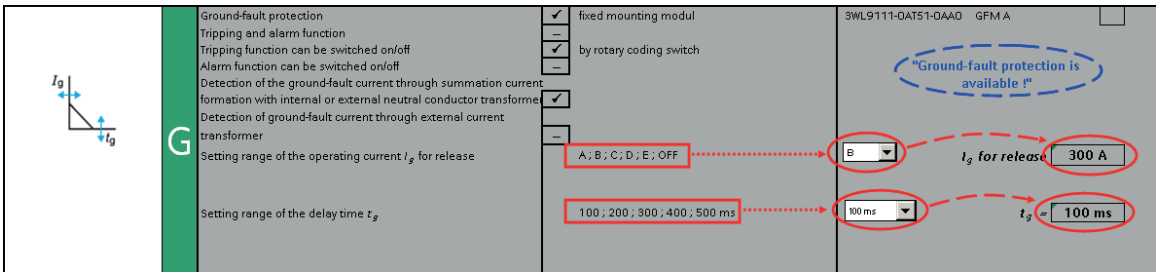

Figure 2-16 ETU27B: ground fault protection function

but instead encoded by means of letters and taken from the following table depending on the relevant
size

Set values for Ig *		
	Size	
	I / II	III
A	100 A	400 A
B	300 A	600 A
C	600 A	800 A
D	900 A	1000 A
E	1200 A	1200 A
OFF	OFF	OFF

* For ETU45B to ETU76B - the values A to E of the operating current I_g can only be set if the ground fault protection module is actually installed in the relevant ETU. This can be seen from the order number. In the "ETU" sheet, information colored blue appears to indicate whether or not the ground fault protection module is available – see ETU27B figure: Ground fault protection function (blue circle top right). If no ground fault protection module is available, selection of the values A to E does not modify the response threshold for the ground fault protection range and this range remains switched off.

Note

Ground fault protection module

This information is only relevant for the ETU45B, ETU55B and ETU76B since the ETU15B and ETU25B cannot contain a ground fault protection module, and the ETU27B is only supplied with a permanently installed ground fault protection module.

2.9 ETU45B electronic trip unit

ETU45B

From the ETU45B, the overload range (L), the range of the delayed short-circuit release (S), and the ground fault protection range (G), include an option for switching the characteristic curve between standard and alternative function, as follows:

for the L range: I^2t_R = const / I^4t_R = const: for the S range: t_{sd} = const / I^2t_{sd} = const:

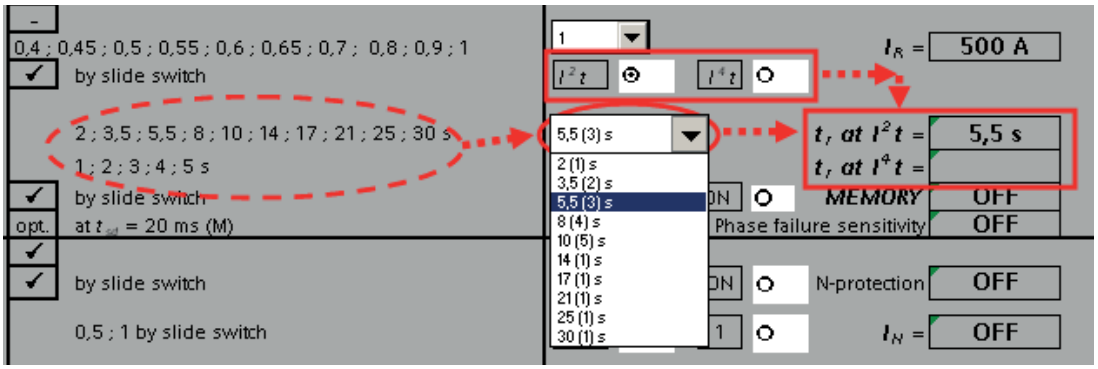

Figure 2-17 ETU45B: Switching option for the characteristic curve (L range)

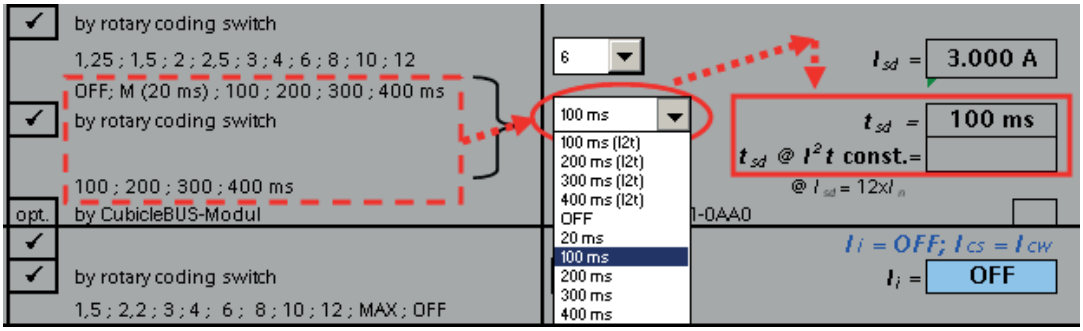

Figure 2-18 ETU45B: Switching option for the characteristic curve (S range)

for the G range: t_g = const / I^2t_g = const:

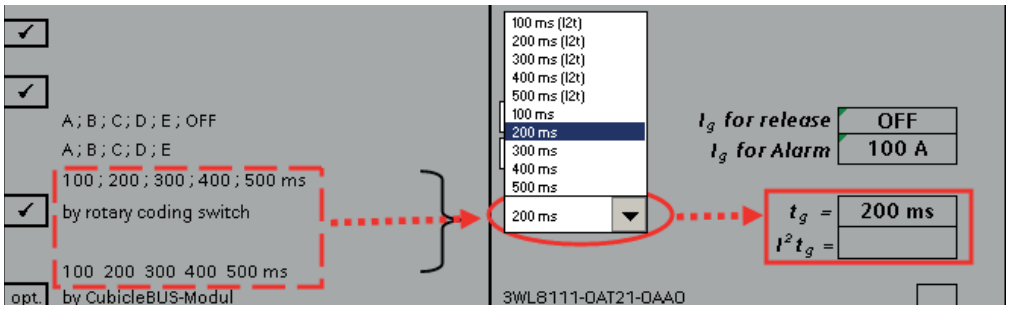

Figure 2-19 ETU45B: Switching option for the characteristic curve (G range)

Similarly to setting the ETUs using rotary encoding switches and slide switches, switchover takes place separately in the L range (ETU slide switch, software buttons), and in contrast, switchover in the S and G range is implemented simultaneously with the time selection (ETU double function of the rotary encoding switch, software time setting via the scroll menu).

In addition, the ETU45B differs from the previously described ETUs in three points:

1. In the L range, the thermal memory can be switched on or off (if the thermal memory is switched on, the delay time at the second tripping operation is reduced by 5%);
2. In the N conductor protection range, you can choose between the response thresholds **0.5 x I_n** or **1 x I_n** :

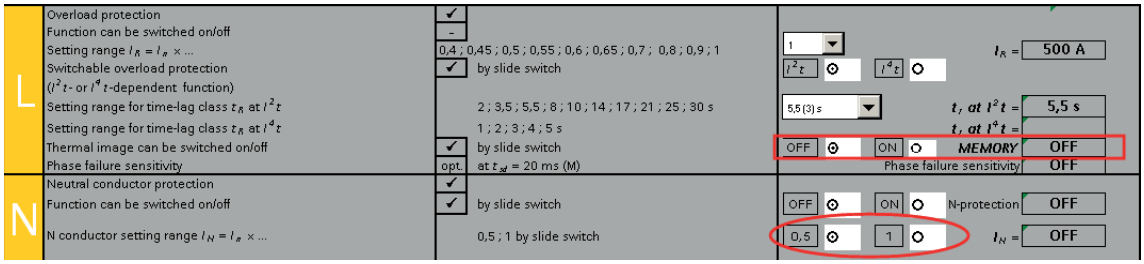

Figure 2-20 ETU45B: N conductor protection - response thresholds

3. The response threshold of the instantaneous short-circuit protection is no longer fixed, but instead can be modified via the selection menu.

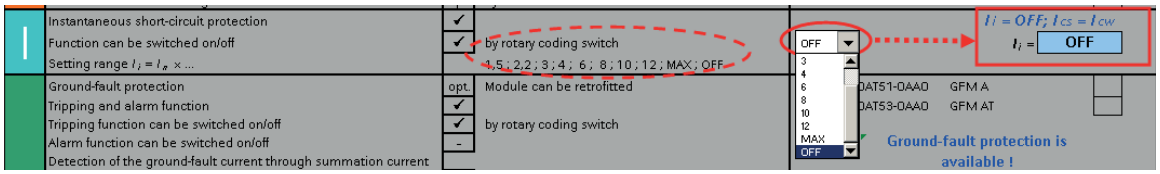

Figure 2-21 ETU45B: Response threshold of the instantaneous short-circuit protection

The I release and the S release can be switched off, and no test of the relevant range can thus take place in the switched-off state.

The delayed and instantaneous short-circuit protection must **not** be set to "OFF" simultaneously – at least one of the two must be switched on. This is checked by the program, and an appropriate message appears ("Change / Read an instruction"). Only when a correction has been made do you continue to the "Protocol" sheet.

The precise meaning and effect of the settings "OFF" and "MAX" of the instantaneous short-circuit release (I range) can be found in the Operating Instructions (page 9-27).

2.10 ETU55B/ETU76B electronic trip unit

ETU55B / ETU76B

The ETU55B and ETU76B contain the same functions as the ETU45B, but they differ in the following details:

1. All values are no longer set via the selection menu but by entering numbers (absolute values of the operating currents and the delay times) direct in the relevant (white) cells. This simulates parameterization of these ETUs via the menu locally or via communication.
2. In the N conductor range, the operating current can now be selected in the value range 0.2 x I_n to 2 x I_n.
3. With both ETU55B and ETU76B, the L protection function can also be switched off in addition to the S, I, G and N range. In this case, testing is not specified for either in the overload range.
4. The difference between the ETU55B and the ETU76B is only in the interface area of the relevant ETU. The ETU55B can only be parameterized via the interface with communicative components (BDA, Software Switch ES Power). The ETU76B also offers the option of making the protection settings locally using pushbuttons/ETU display. Completion of the relevant "ETU" sheet, and the procedure when entering the protection parameters in the program are identical for both ETU55B and ETU76B.
5. With ETUs 55B and 76B, a time delay t_{sd} to 4 s can be set in the delayed short-circuit range. For setting values t_{sd} > 4 s, a reduction of the maximum possible set value I_{sd} takes place in the ETU depending on the size (see Operating Instructions, page 9-26, footnote [2]). When entering values in the program, this function is also carried out automatically and information is displayed.

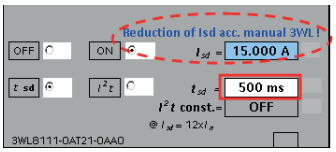

Figure 2-22 ETU55B/ETU76B: Time delay

Note

Confirm the input of all values with ENTER

For the ETU55B and ETU76B, input of all values (except OFF/ON settings) must be terminated every time in every cell with "ENTER". The program thus guides the user automatically to the next cell to be filled. If the value is entered incorrectly (outside the setting range), the user is prompted to enter values within the setting ranges of the individual protection functions, and the error message "Not in setting range!" appears. The cell with the wrong value is colored red.

At the same time, the values are also checked for the permissible step width. If this is incorrect the message "Wrong step width!" appears.

(The permissible step widths can be found in the configuration manual "SENTRON air circuit breakers (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=35681108&caller=view)").

2.11 Test sequence

Test sequence

Note

Measuring methods

The circuit breaker test device and thus also the program always offer a selection of two measuring methods:

a) Measurement of the protective tripping of the circuit breaker (complete mechanical chain of effect), trip signal comes from the auxiliary switch of the main contacts;

b) Measurement of the trip signal direct at the ETU (socket X22).

Different tripping times are calculated for the S, I and G range, depending on the measuring method. The tables and calculation formulas can be found in the Operating Instructions of the circuit breaker test device.

The corresponding setting is made in Chapter 5.1 of the "Protocol" sheet:

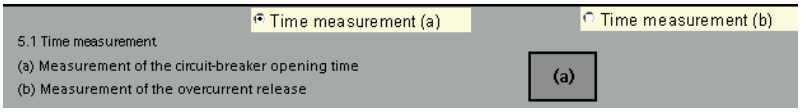

Figure 2-23 Different time measurement methods

The "Protocol" sheet comprises the following sections (depending on the relevant ETU) and it is adjusted automatically.

2.12 Testing the adjustable overload release (L)

Testing the adjustable overload release (L)

1. Testing the limit current (available on all ETUs):

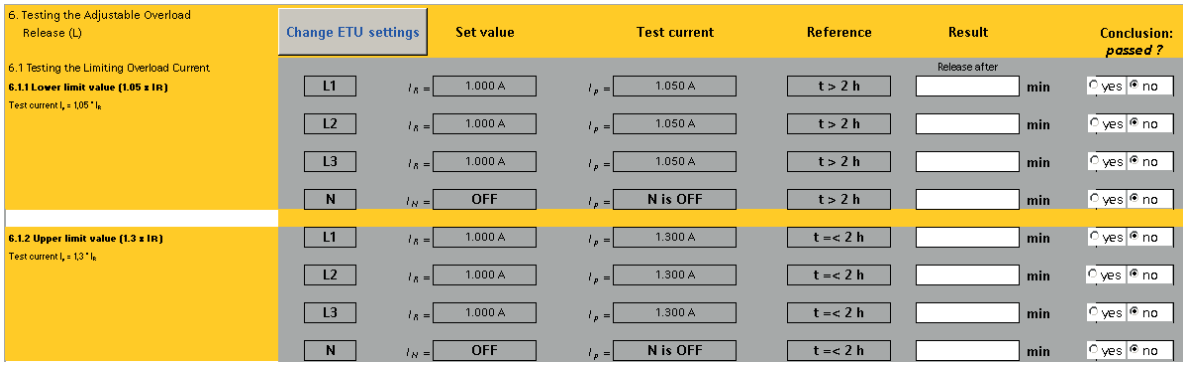

Figure 2-24 Testing the limit current

If a vectorial ground fault protection function is available, you are recommended to switch this off before testing since otherwise the ground fault protection release frequently responds more sensitively than the overload release in the case of unbalanced current infeed with the circuit breaker test device. In this case, a G tripping would thus take place instead of the expected L tripping.

In this test sequence, the low test current (+ 5%) and the high test current (+ 30%) are specified in accordance with IEC for the relevant phase L1, L2 and L3. The N conductor protection can be tested independently of phases L1 to L3 (but this is only possible from the ETU27B and higher).

This test is very time-consuming since approximately 4 hours are required for each part of the test. For this reason, the program suggests further tests in the L range that require significantly less time (described in the following chapters).

2. Test of the overload characteristic curve with adjustable test point on the curve (available on all ETUs):

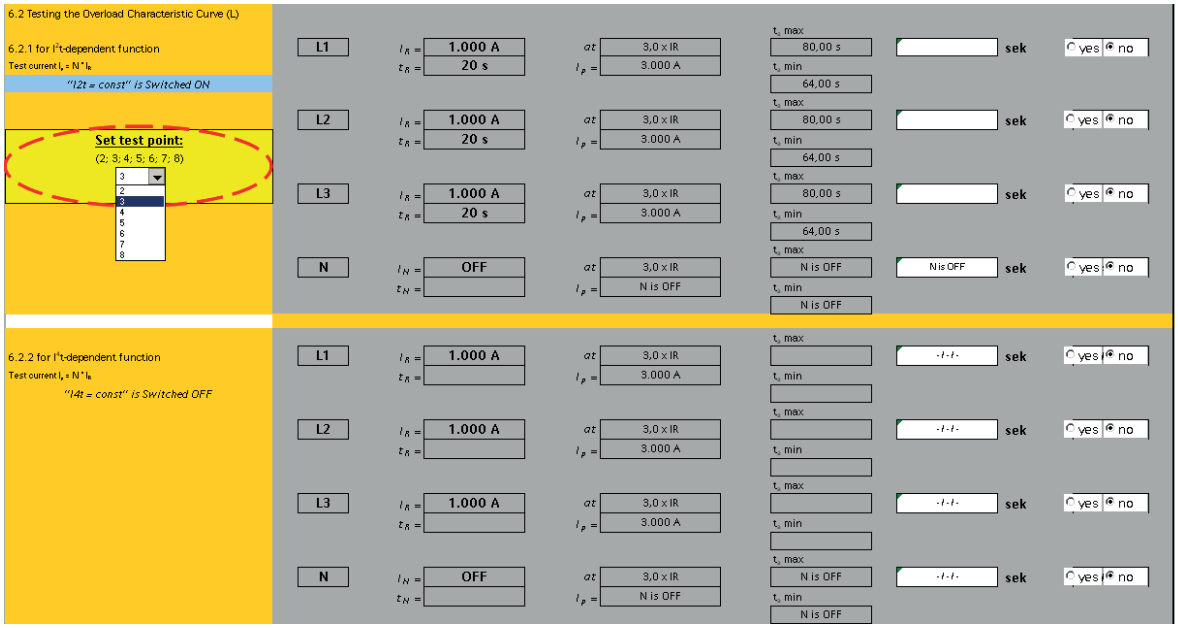

Figure 2-25 Testing the overload characteristic curve

There is always the option of using the program to test two points on the L curve in the set L release range:

– One test point is freely adjustable 2 ... 8 x I_R. The setting is made via the selection menu in the "Protocol" sheet (see the figure above, red circle).

– Alternatively, one further test point (reference point for t_R) is fixed. The setting value is always 6 x I_R (this case is described below in the following chapter "Testing the time-lag class with fixed test point on the characteristic curve").

For the selected test current I_p = N x I_R, the program calculates the associated tripping time (tolerance band t_a min, t_a max). The test (specification of the values of the test currents and the tripping times) is only suggested for the selected curve characteristic. The values for the inactive function in each case are not specified (cells are disabled by means of " - / - / - "). Likewise, the function I^2t_R = const or I^4t_R = const that is currently active, is colored blue.

If the value of the selected test point is above the lower limit value of the delayed (S) or instantaneous (I) short-circuit release, the user is informed via the messages "S/I release" and "No L range". In addition, the "Result" column is freely selected for entering the values. This part of the test is thus not possible.

Note

Function I^2t_R and I^4t_R

On ETUs 15B to 27B, only the function I^2t_R = const is available (t_R is fixed at 10 s internally); on ETUs 45B to 76B, you can choose freely between I^2t_R = const and I^4t_R = const. With both settings, the delay times can also be selected according to the specification for both settings.

3. Test of the time-lag class with fixed test point (reference point) on the curve (available on all ETUs):

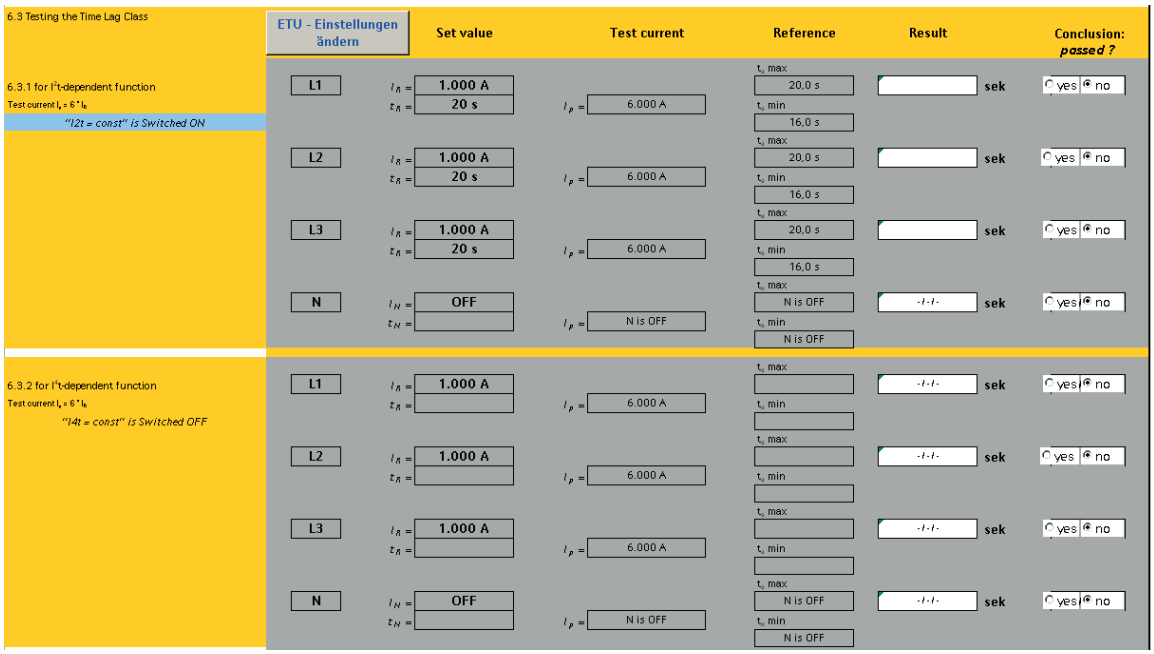

Figure 2-26 Test of the time-lag class

The reference point (a fixed point on the L curve) is specified at the level of 6 x I_R here. For this point, you receive the setting value of t_R as the upper tolerance value of the tripping time.

If the value of the reference point is above the lower limit value of the delayed (S) or instantaneous (I) short-circuit release, the user is informed via the messages "S/I release" and "No L range". In addition, the "Result" column is blocked for entering the values. This part of the test is thus not possible.

4. Testing the thermal memory (available from ETU45B and higher):

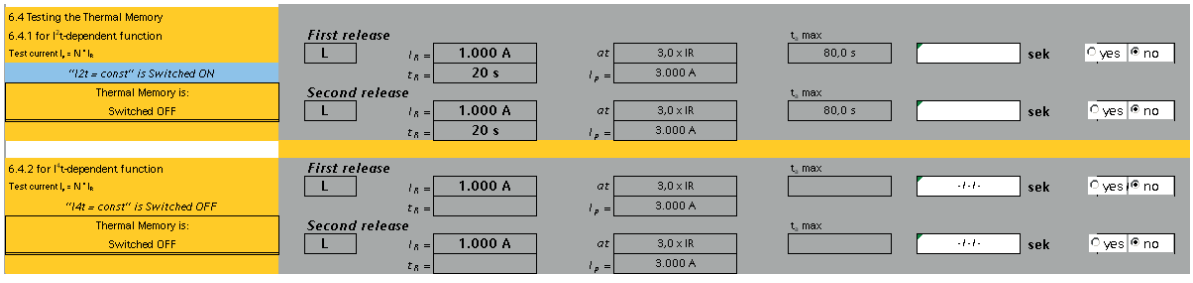

Figure 2-27 Testing the thermal memory

If the thermal memory is switched on, the measuring time of the closely following second tripping is 5% lower than the measuring time of the first tripping.

If the thermal memory is switched off, the measuring times of the first and second tripping are identical.

2.13 Testing the delayed short-circuit release (S)

Testing the delayed short-circuit release (S)

1. Testing the operating current (available from ETU25B and higher):

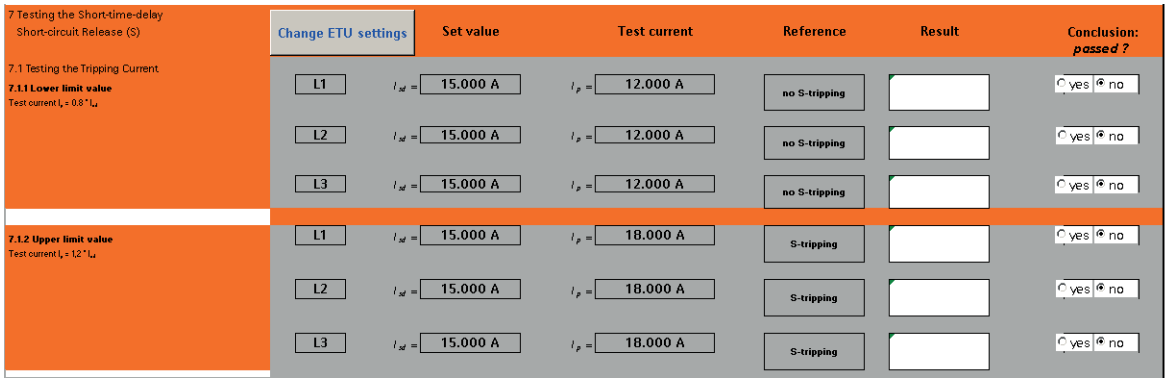

Figure 2-28 Testing the operating current (from ETU25B and higher)

The lower limit value / lower tolerance band (- 20%) or the upper limit value / upper tolerance band (+ 20%) of the operating current are calculated here for the relevant phase L1, L2 and L3. This test takes place in accordance with IEC specifications.

If the lower limit value is set, there must be no tripping in the S range (that is, tripping takes place in the L range). If the test current is set to the upper limit value, an S trip must take place in every case (the delay time t_{sd} is measured in accordance with the table or formulas).

A safe and easy way of determining whether the ETU has tripped in the L range (0.8 x I_{sd}) or the S range (1.2 x I_{sd}) is provided by the QUERY key of the ETU ("Query trip cause" key) (see 3WL Operating Instructions, page 9-24). You are also recommended to set the curve characteristic to t_{sd} = const in this test, then at 0.8 x I_{sd} you will obtain a tripping time >> t_{sd} and at 1.2 x I_{sd}, the breaker or the ETU trips in the tolerance band to t_{sd} + 50 ms.

2. Testing the delay time
(ETU15B does not contain this function; for ETUs 25B and 27B, only the function t_{sd} = const is available; for ETUs 45B to 76B, the curve characteristic is freely selectable between t_{sd} = const and I^2t_{sd} = const):

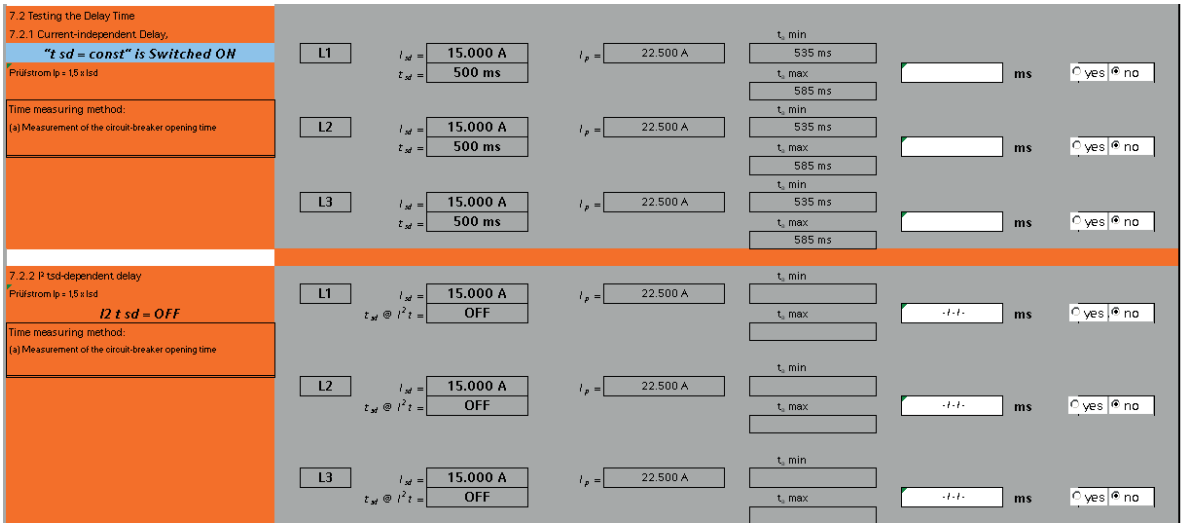

Figure 2-29 Testing the delay time

Either the current-independent delay or the I²tsd-dependent delay are calculated here. The values of the current-independent (constant) delay are calculated in accordance with a fixed defined table (see Operating Instructions of the circuit breaker test device, page 7-2). With these values, a distinction is made between both measuring methods, assuming the ETU is not activated until the start of the measurement.

With ETUs 45B to 76B, a supply voltage can also be connected before measuring. This results here in time measurement values up to 15 ms lower (both measuring methods). The program does not take account of this case.

The times for the I^2t_{sd}-dependent delay are calculated according to a formula (see Operating Instructions of circuit breaker test device, page 7-2), and above the reference point 12 x I_n, the program takes the tripping times in turn from the table (since the tripping curve enters its constant section from this point).

The tripping time is tested for a representative test current 1.5 x I_{sd}.

If I_{sd} is so great that the test current would be higher than I_{cw}, the test current suggested by the program is automatically reduced to this limit.

If the value of this test current (test point) is above the lower limit value of the instantaneous short-circuit release (I), the user is informed via the messages "I release" and "No S range". In addition, the "Result" column is blocked for entering the values.

2.14 Testing the instantaneous short-circuit release (I)

Testing the instantaneous short-circuit release (I)

1. Testing the operating current (available on all ETUs):

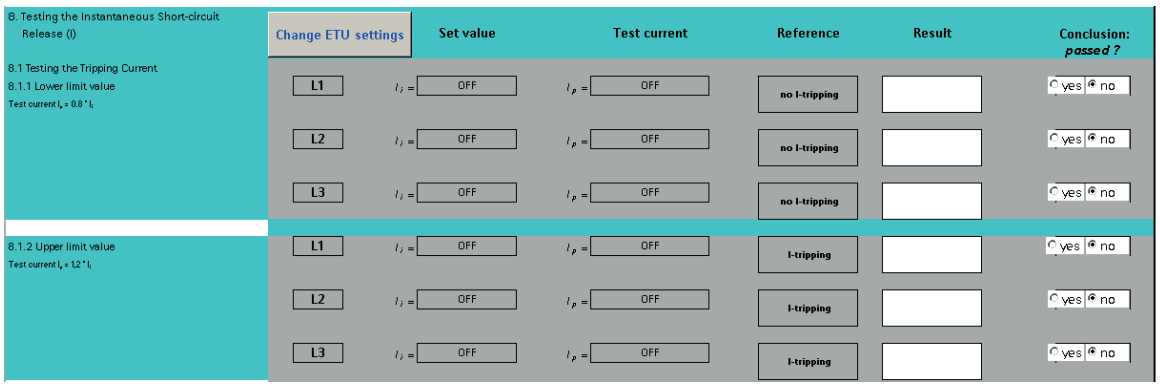

Figure 2-30 Testing the operating current (all ETUs)

The lower limit value / lower tolerance band (- 20%) or the upper limit value / upper tolerance band (+ 20%) of the operating current are calculated here for the relevant phase L1, L2 and L3. This test takes place in accordance with IEC specifications.

If the lower limit value is set, there must be no tripping in the I range (that is, tripping takes place in the S range, and times greater than 85 ms are measured, except when t_{sd} is set to 20 ms – special function "Motor protection"). If the test current is set to the upper limit value, an I trip must take place in every case, and the tripping times are measured in accordance with the table in the Operating Instructions. These times are also specified in the following chapter.

It is also possible here to check the cause of the trip with the "QUERY" key of the ETU, as described in the chapter "Testing the delayed short-circuit release (S)".

2. Testing the tripping time (available on all ETUs):

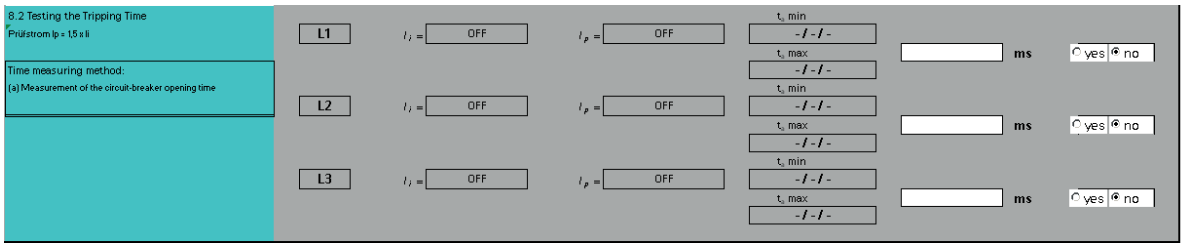

Figure 2-31 Testing the tripping time

As in the S range, a reference test point is also calculated here at the level of $I_p = 1.5 \times I_i$ and specified for the test.

If the set value I_i is so great that the test current calculated in this way would be higher than I_{cs}, the test current is automatically reduced to this limit.

2.15 Testing the ground fault release (G)

Testing the ground fault release (G)

Note

Testing the ground fault release

The program offers a choice of two measuring methods for testing the ground fault release (from ETU45B and higher):

– Vectorial current measurement

– Current measurement with external transformer

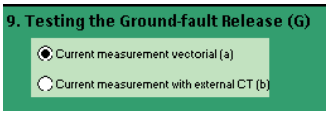

Figure 2-32 Testing the ground fault release (G)

The test execution of these two measuring methods is described in the relevant chapter of the Operating Instructions of the circuit breaker test device.

The measuring method (see above) is changed on the ETU45B using a slide switch on the ground fault module, and on the ETU55B and ETU76B it is changed in the relevant menu.

When simulating the secondary current of the external transformer with a transformation ratio of 1200 A / 1 A, you must take into account that this setting is made with the "external GF CT Current" button (see Operating Instructions of the circuit breaker test device, page 4-1).

The transformer secondary current to be set when measuring with the external transformer is calculated automatically by the program from the primary test current and additionally specified.

1. Testing the operating current (available from ETU27B and higher):

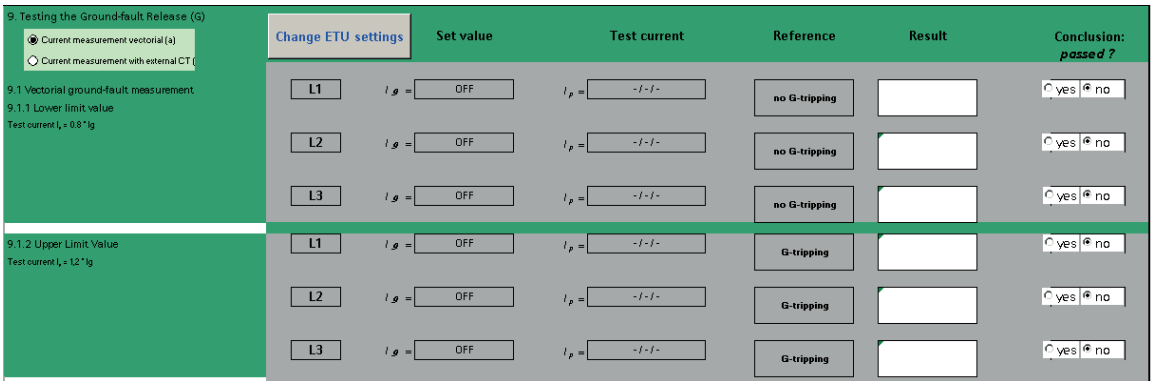

Figure 2-33 Testing the operating current (from ETU27B and higher)

The lower limit value / lower tolerance band (- 20%) or the upper limit value / upper tolerance band (+ 20%) of the operating current are calculated here for the relevant phase L1, L2 and L3. This test takes place in accordance with IEC specifications. If the lower limit value is set, there must be no tripping, but if the upper limit value is set, a ground fault release must take place in every case.

It is also possible here to check the cause of the trip as described in the chapter "Testing the delayed short-circuit release (S)".

2. Testing the delay time
(available from ETU27B and higher; for the ETU27B , only the function t_g = const is available; for ETUs 45B to 76B, the curve characteristic is freely selectable between t_g = const and I^2t_g = const):

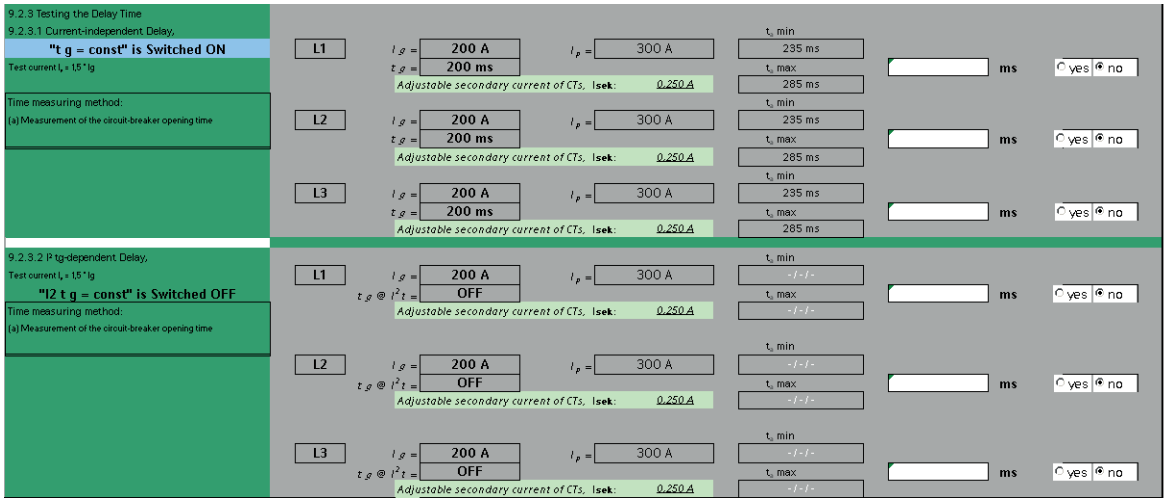

Figure 2-34 Testing the delay time (from ETU27B and higher)

Either the current-independent delay or the I^2t_{sd}-dependent delay are calculated here. The values of the current-independent (constant) delay are calculated in accordance with a fixed defined table (see Operating Instructions of the circuit breaker test device, page 7-2). With these values, a distinction is made between both basic measuring methods of the circuit breaker test device (socket X22 of the ETU or complete measurement via auxiliary switches on the main contacts), assuming the ETU is not activated until the start of the measurement.

The values of the I^2t_{sd}-dependent delay are calculated in accordance with a formula (see Operating Instructions of the circuit breaker test device, page 9-4).

Precisely as with the S range, a reference test point is also defined here at the level of I_p = 1.5 x I_g to be set on the circuit breaker test device.

2.16 Saving the results and exiting the program

Saving the results and exiting the program

In the lower section of the "Protocol" sheet (at the end) a choice of two buttons is offered:

Figure 2-35 Terminating the "Protocol" sheet

- **Save and exit**
  - After clicking on this button, the user is prompted to enter a filename in a separate window, and to save the test result.

  Note

  Entering a valid filename

  This separate window remains open until a name is entered. It is not possible to exit the window without entering a valid filename.

After saving the result, the program is closed automatically.

- **Abort**
  - After clicking on this button, the program is closed without saving the result. All settings in the "ETU" and "Protocol" sheets are thus lost!

Frequently asked questions (FAQs) 3

Frequently asked questions (FAQs)

- How can program execution be aborted if it is in the "ETU" sheet?
  - You must first change to the "Protocol" sheet (Transfer of the ETU settings to the "Protocol" sheet (Page 12) , Figure 2-9 Go to sheet "Protocol" (Page 12) and then click on the "Abort" button (Saving the results and exiting the program (Page 31) , Figure 2-35 Terminating the "Protocol" sheet (Page 31)).
- How can the test result be printed out?
  - You must first save your result (Saving the results and exiting the program (Page 31) , Figure 2-35 Terminating the "Protocol" sheet (Page 31)), then re-open the saved file, and print out the result in Excel using the main menu File → Print.
- The error message "Type mismatch" appears:
  - Not all values have been entered in the "Protocol" sheet! Click on "Exit", close the entire Excel application, and start the program again.
    Following this, you fill all fields completely, as described in Chapters Transfer of the protection settings to the "ETU" sheet (Page 10) to Transfer of the ETU settings to the "Protocol" sheet (Page 12).

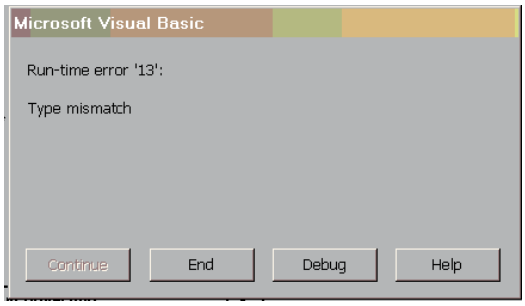

Figure 3-1 Error message "Type mismatch"

- What does the message in the "Protocol" sheet "False value for this size!" mean?
  - An incorrect breaker order number has been entered (see Chapter Transfer of the protection settings to the "ETU" sheet (Page 10) , Figure 2-6 Confirm input of the order number (MLFB) (Page 11)).
- Why does the message "False input" appear when selecting the value of the rated current module in the "Protocol" sheet?
  - The value of the rated current module is outside the permissible range for the entered size. In particular, the value of the rated current module must not be higher than the maximum breaker rated current (see Chapter Transfer of the protection settings to the "ETU" sheet (Page 10) , Figure 2-7 Selecting the rated current module (Page 11) and Figure 2-8 Entering the rated current (reference value for the protection settings) (Page 11)).

- How can another test for a new ETU be carried out?
  - First, the current test run must be terminated. Then you restart the program and select a new ETU.

- Why do the cells of I_R and I_{sd} or I_i color red and the message "Change / Read an instruction" appear?
  - If you want to test a range with a test current greater than the selected response threshold of a subsequent range (S range or I range), you will be informed of this with the message "Change / Read an instruction". Likewise, you receive this message if the response threshold of the I release is less than the response threshold of the S release. In this case, the I range and the S range overlap.
    The red cells indicate implausible ranges.

- Why does the message "False step width!" appear with the ETUs 55B and 76B and what does it mean?
  - When entering the values in the "ETU" sheet for ETU55B and ETU76B, the user is prompted to accept the step width for the operating currents and delay times from a table. This is specified in the configuration manual "SENTRON air circuit breakers (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=35681108&caller=view)". These step widths are identical to the actually parameterized step widths for the relevant ETU being tested by the user.
    For example: If you want to enter the value of the parameter between 100 and 500, the permissible step width is "5". This means in this case:
    The values 105, 110, 115, 120, …., 275, 280, 285, … , 495, 500 – are permissible;
    The values 101, 106, 117, … , 220.5, 221.3, … , 499 – are not permissible.
    (See also Chapter Settings in the "ETU" sheet (Page 13) , ETU55B / ETU76B).

Note

Error messages

To avoid such error messages, transfer the precise values that you also programmed in the ETU!