Operator’s manual
REB 551-C4*2.3
Breaker terminal for 1 1/2 breaker configurations

About this manual:
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Chapter 1  Introduction

About this chapter
This chapter introduces you to the operator’s manual, it’s purpose and usage.
1 Introduction to the operator’s manual

1.1 About this manual

Use the operator’s manual to view instructions concerning how to perform common tasks during normal service.

The operator’s manual contains the following important chapters:

- The safety information chapter reviews warnings and notes in the manual of which you should be alert.
- The human machine interface chapter describes the local human-machine interface (HMI).
- The disturbance chapter describes how to retrieve disturbance information and reset alarms.
- The protection system status chapter describes how to read service values, function values and output signals.
- The terminal unit status chapter describes how to get information about the terminal status.

The manual does not contain any instructions for commissioning or testing.

1.2 Intended audience

1.2.1 General

The operator’s manual addresses the operator, who operates the terminal on a daily basis.

1.2.2 Requirements

The operator must be trained and possess a basic knowledge in how to operate protection equipment. The manual contains terms and expressions commonly used to describe this kind of equipment.

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1.3 Revisions

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Chapter 2  Safety information

About this chapter
This chapter lists warnings and cautions that must be followed when handling the terminal.
1 Warnings

Warning!
Do not touch circuitry during operation. Potentially lethal voltages and currents are present.

Warning!
Always connect the terminal to protective ground, regardless of the operating conditions. This also applies to special occasions such as bench testing, demonstrations and off-site configuration. Operating the terminal without proper grounding may damage both terminal and measuring circuitry, and may cause injuries in case of an accident.

Warning!
Never unmount the front or back cover from a powered terminal or from a terminal connected to powered circuitry. Potentially lethal voltages and currents are present.

Warning!
Always avoid to touch the circuitry when the cover is removed. The product contains electronic circuitries which can be damaged if exposed to static electricity (ESD). The electronic circuitries also contain high voltage which is lethal to humans.
Chapter 3  Overview

About this chapter
This chapter describes operations an operator may perform on a daily basis or when the need arises.
**Operator overview**

If a disturbance occurs the operator must document it and the fault that caused the disturbance has to be evaluated and documented for future reference. The operator must identify the disturbance and, for example, document the fault currents and voltages at the time of the fault. The operator is also responsible for retrieving data about the protected network, which will give further information when investigating a fault. This implies viewing the mean current, voltage, power and frequency or primary and secondary measured phasors. The operator is able to check the terminal status at any time.

In some cases the operator is responsible for changing the way the terminal operates. This could be changing the active setting group or a setting parameter value. This must be done in strict accordance with the company regulations due to that a none authorized change can cause severe damage to the protected object.
Chapter 4 Understand the human-machine interface

About this chapter
This chapter describes how the human-machine interface works from an operator’s view.
1 Human Machine Interface Overview

1.1 Application

The human machine interface is used to monitor and in certain aspects affect the way the product operates. The configuration designer can add functions for alerting in case of important events that needs special attention from you as an operator.

1.2 Design

The human-machine interface consists of:

- the human-machine interface (HMI) module.
- the LED module.

Figure 1: The figure shows the LED (upper) and the HMI (lower).
The number of buttons used on the HMI module is reduced to a minimum to allow a communication as simple as possible for the user. The buttons normally have more than one function, depending on actual dialogue.

Pressing any button in idle mode will activate the HMI display.

The C button has three main functions:
• **Cancel** any operation in a dialogue window.
• **Exit** the present level in the menu tree. This means, it cancels the present function or the present menu selection and moves one step higher (back) in the menu tree.
• **Clear** the LEDs when the start window is displayed.
• Bring the HMI display into idle mode if pressed when the idle window is displayed (Quit function).

The E button mainly provides an **Enter/Execute** function. It activates, for example, the selected menu tree branch. Further it is used to confirm settings and to acknowledge different actions.

The left and right arrow buttons have three functions:

• Position the cursor in a horizontal direction, for instance, to move between digits in a number during the parameter setting.
• Move between leafs within the same menu branch.
• Move between the confirmation alternatives (yes, no and cancel) in a command window.

The up and down arrow buttons have three functions:

• Move between selectable branches of the menu tree. This function also scrolls the menu tree when it contains more branches than shown on the display.
• Move between the confirmation alternatives in a command window.
• Change parameter values in a data window

The LED indication module is equipped with 18 LEDs, which can light or flash in either red, yellow or green color. A description text can be added for each of the LEDs.
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Human Machine Interface Overview

Chapter 4
Understand the human-machine interface

Understand the human-machine interface

Figure 3: The LED module

1 Three-color LEDs
2 Descriptive label, user exchangeable

1.3 Functionality

The HMI module is a bidirectional means of communicating. This means that:

- events may occur that activates for instance a LED, in purpose to draw your attention to something that has occurred and needs some sort of action.
- you as the operator may of own interest view a certain data.

Use menus to navigate through menu commands and to locate the data of interest.

The LED module is a unidirectional means of communicating. This means that events may occur that activates a LED, in purpose to draw your attention to something that has occurred and needs some sort of action.
2 HMI module LED indications

The LEDs above the LCD indicates the terminal’s status.

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<th>Means</th>
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<tr>
<td>Off (no LED is lit)</td>
<td>No power or defect terminal.</td>
</tr>
<tr>
<td>Steady green LED</td>
<td>The terminal is ready for operation.</td>
</tr>
<tr>
<td>Flashing green LED</td>
<td>Internal failure, startup is in progress</td>
</tr>
<tr>
<td>Flashing yellow LED</td>
<td>Terminal in test mode.</td>
</tr>
<tr>
<td>Steady yellow LED</td>
<td>Disturbance report trigged.</td>
</tr>
<tr>
<td>Steady red LED</td>
<td>A binary signal, normally a TRIP command, has been activated. Which binary signal(s) that are supposed to activate the red LED is defined in the disturbance report.</td>
</tr>
<tr>
<td>Flashing red LED</td>
<td>Terminal blocked or in configuration mode.</td>
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Figure 4: The LED indication module

Table 1: LED indications
Chapter 5  Understand the HMI tree

About this chapter
This chapter describes the different Menu trees.
Overview

This chapter presents the main layout of the menu tree for the local human-machine interface (HMI). The menu tree includes menus for:

- Disturbance report
- Service report
- Settings
- Terminal report
- Configuration
- Command
- Test

Use SMS or SCS to activate or deactivate menus on the local human-machine interface (HMI).

Note!

*It is possible to completely turn off parts of the menu tree!*
Figure 5: Menu tree for REx 5xx.
2 DisturbReport

Use this menu to display the information recorded by the REx 5xx terminal for the 10 latest disturbances, these commands are available:

- Display information of a disturbance.
- Calculate the distance to fault.
- Manually trigger the disturbance reporting unit.
- Clear the disturbance report memory.

To view the complete disturbance report, including the result of the event recorder and the disturbance recorder, use a front-connected PC or the SMS or SCS.

2.1 Disturbance

A disturbance instance will show:

- **The time of disturbance**, which is defined as the local terminal date and time when the first triggering signal started the disturbance recording.
- **The trig signal**, which started the recording.
- **Indications**, activated during the recorded disturbance. Indications to be recorded are selected during the terminal configuration procedure.

The fault locator will also report:

- **Fault location**, provides information about the distance to the fault and the fault loop used for the calculation.
- **Trip values**, are displayed as phasors (RMS value and phase angle) of the currents and voltages, before and during the fault.

2.2 CalcDistToFlt

Possible to recalculate the distance to fault with a different fault loop or with different fault locator setting parameters. The recalculation is enabled since trip values are available for each disturbance that caused a phase-selective trip of the distance protection function.

2.3 ManualTrig

Using the manual trigger creates an instant disturbance report. Use this function to get a snapshot of the monitored line.
2.4 ClearDistRep

The disturbance report has a dedicated storage memory, sufficient enough to save the ten latest disturbances. The memory operates by the first-in – first-out principle (FIFO). This means that when the memory is full, the oldest recorded disturbance will be deleted from memory when a new disturbance occurs. After clearing, the entire disturbance memory will be empty.
3 ServiceReport

The Service report menu displays the operating conditions of the terminal as well as measured and calculated values and internal signal status.

3.1 ServiceValues

Presents the average values of measured current, voltage, active and reactive power and frequency. Available when the transformer module option is installed.

3.2 Phasors

Presents the primary and secondary phasors of measured currents and voltages.

3.3 Functions

Presents the presently measured values and other information of the different parameters for included functions.

3.4 I/O

Displays present logical values of all binary inputs and outputs of all installed I/O modules in the REx 5xx terminal.

3.5 DisturbReport

Provides information about the below listed items concerning the disturbance recording.

- Available free memory for further disturbance recording.
- The sequence number for the next possibly recorded disturbance (can be viewed or set).

The present status of analogue triggers that can start the disturbance recorder.

3.6 ActiveGroup

The present setting of active groups can be viewed here.
3.7 Time

The current internal time for the REx 5xx terminal can be viewed here. The time is displayed in the form YYYY-MMM-DD and hh:mm:ss. All values but the month are presented with digits. The month is presented with the first three letters in current month.
4 Settings

Use this menu to select and set the different parameters for included protection and control functions in the REx 5xx terminal. There are four selectable and editable settings group, each independent of the other, to structure desired functions and applications.

4.1 DisturbReport

This menu includes all setting parameters for the disturbance report. The following features are available:

- **Sequence number** can be set for each recorded disturbance.
- **Sampling rate** is fixed at 1000 Hz.
- **Recording times** for pre-fault, post-fault and time limit shall be set.
- **Fault locator settings** shall be done here. It includes measurement duration and presentation of the result.

4.2 Functions

Settings of the parameters for the included protection and control functions are done here. Four separate setting groups are available. First select desired group and then desired function. One group can contain one or several functions.

4.3 ChangeActGrp

Select and change the active group setting. Each of the four groups can be set independently of each other.

4.4 Time

To set the internal time in the REx 5xx terminal. The time is set in the form of YYYY-MM-DD and hh:mm:ss. All values but the month are presented with digits. The month are presented with the first three letters in current month.
5 TerminalReport

Use this menu to display information of the self supervision, terminal identity, software version, modules and the analogue inputs.

5.1 SelfSuperv

The REx 5xx terminal has extensive built-in self-supervision functions to detect if internal faults occurs. If an error occurs, the green LED on the front panel will flash and a warning signal will be activated. Use the self-supervision report to get information about detected faults.

The self-supervision report can also be used to check the status of each installed module as well as CPU, memory and clock operation.

5.2 IdentityNo

The terminal identity feature contains information as serial number and the software version installed in the terminal.

5.3 Modules

This menu includes information about all included modules, such as I/O-modules and MPM-module (CPU).

5.4 AnalogInput

Includes information about the analogue inputs, voltage and current, concerning nominal and rated values.
6  **Configuration**

Use this menu to make a general configuration of the REx 5xx terminal. The CAP 531 configuration tool must be used to configure protection and control functions and the I/O modules.

6.1  **AnalogInput**

Use this menu to configure general analogue input settings, such as:

- general data about the power network, such as rated voltage, current, frequency and the position of the earthing point.
- CT and VT ratio.
- user-defined labels for the analogue inputs and for the measured voltage, current, active and reactive power and frequency.

6.2  **I/O-modules**

In this menu it is possible to:

- reconfigure added or replaced I/O modules.
- set the level for blocking of oscillating binary inputs.

6.3  **DiffFunction**

Use this menu to configure the differential protection functions as a part of networked terminal system. Possible to change:

- the differential synchronisation scheme
- the master terminal identity
- the remote (slave) terminal identity.

6.4  **TerminalCom**

Use this menu to configure the REx 5xx terminal communication buses, if any connected.

6.4.1  **SPA communication**

Use this menu to set the parameters for the front and rear ports used for SPA communication. Each communication channel must be set separately.
Slave number and baud rate (communication speed) must be set for both the ports. These settings must correspond with the settings in the used PC-program. For the rear port it is possible to set permission of changes between active setting groups, ActGrpRestrict, and the setting restrictions, SettingRestrict, as well.

6.4.2 IEC communication

Use this menu to set slave number and baud rate when to communicate on the IEC 870–5–103 communications bus, also known as Schnittstelle 6 or VDEW 6. The IEC bus uses the same rear optic port as the SPA bus, but the settings must be done separately.

6.4.3 LON communication

Use this menu to view node information as address and location, (set from the LON Network Tool), as well as the Neuron identity. Functions for address setting during installation (ServicePinMSG), LON configuration reset (LONDefault) and session timers are also available.

**Note!**

*Session timers are for advanced usage and should only be changed upon recommendation from ABB Automation Products AB.*

6.4.4 Remote terminal communication

Use this menu to configure the digital communication to remote terminal. This communication requires a certain digital communication module. The parameters to set are:

- the bit rate
- the fiber optics transmitter output power
- the terminal master/slave operation.

6.5 Time

The internal terminal time can be synchronised with an external unit connected to the SPA/IEC 870-5-103 port or the LON port. It is also possible to use a minute pulse synchronisation signal connected to a digital input.

6.6 DisturbReport

This menu includes all setting parameters for the disturbance report. The following feature is available:
• Clear the LEDs.

6.7 LocalHMI

Use this menu to block the possibility to change settings via remote communication.

6.8 Identifiers

Use the identifiers to define and specify the location of a terminal within the power system. All identifier names are typed as strings, maximum 16 characters, and the identity numbers are typed with digits. Typical usage are:

• name and number of the station.
• name and number of the bay or object.
• name and number of the actual REx 5xx terminal.
7 Command menu

Use this menu to manually select and execute any single or multiple signal command, as defined from the configuration menu or the CAP 531 configuration tool. The signal(s) can be connected to any internal function or to a binary output of the terminal. It is possible to assign a user-defined name to these binary signals.
8 Test menu

Use this menu to enable easier secondary injection tests of the REx 5xx terminal. It is possible to block functions to prevent trip of circuit breakers and activation of alarm signals etc. to the control room during the testing activities.

The selectable modes, from the HMI, is the TestMode and ConfigMode.

TestMode:

- Setting the terminal in test mode operation
- Blocking of one or several protection and control functions (selectable) during test operation.
- Blocking of one or several event functions (selectable) during test operation.
- Setting the disturbance report and the disturbance summary to On or Off during test operation.
- Special test mode to facilitate the testing of the line differential protection function. This Diff. TestMode disables the trip-out from the remote terminal and enables test from one end.

ConfigMode:

- Setting the terminal in configuration mode operation. This will automatically be done when down-loading a configuration from the CAP 531 configuration tool. When the down-loading is completed, the terminal automatically enters the normal mode.
Chapter 6 Handle the disturbances

About this chapter
This chapter describes how to handle disturbances.
1 Identify a disturbance

1.1 View the disturbance summary

View the disturbance summary when a disturbance occurrence is indicated by the lit yellow LED of the HMI module.

The disturbance summary is automatically displayed and scrolled on the display. No manual intervention is necessary.

1.2 The disturbance summary

The disturbance summary lists data about the two most recent disturbances:

- The date and time of occurrence.
- The indications list.
- The fault loop and distance to fault.

The summaries of the two most recent disturbances are automatically scrolled on the display in the following manner:

1. The most recent disturbance is summarized. The heading DistSummary1 is displayed. The heading remains on the second display row while related data are displayed.
2. The date and time the disturbance occurred are displayed.
3. The indications list is automatically scrolled signal by signal.
4. The fault loop and distance to fault are displayed.
5. The second most recent sequence disturbance is summarized according to steps 2-4 above. The heading DistSummary2 is displayed. The heading remains on the second display row while related data are displayed.
6. The most recent disturbance summary is repeated.
7. The second most recent disturbance summary is repeated.
2 View the disturbance indications

2.1 Navigate the menus

1. Only one disturbance can be viewed at the time. Select the one to be viewed.

2. View the indications list.

Navigate the menus to:

DisturbReport
  Disturbances
    Disturbances
    Indications

\( n \) is the disturbance order of occurrence, \( n=1 \) meaning the most recent and \( n=10 \) the least.

3. Scroll through the available signal indications.

Signals activated during the fault time of the disturbance recording are listed.
3 View the prefault and fault voltages and currents

3.1 Navigate the menus

This procedure describes how to navigate the menus to view prefault and fault analog values.

View prefault values
1. Only one disturbance can be viewed at the time. Select the one to be viewed.
2. View prefault values.
   Navigate the menus to:
   - DisturbReport
     - Disturbances
       - Disturbance\textsubscript{n}
         - TripValues
           - PreFault

   \( n \) is the disturbance order of occurrence, \( n=1 \) meaning the most recent and \( n=10 \) the least.

3. Scroll through the available voltages and currents.
   Use the Left and/or Right arrow buttons to scroll between values.

Viewing fault current
1. Only one disturbance can be viewed at the time. Select the one to be viewed.
2. View fault current.
   Navigate the menus to:
   - DisturbReport
     - Disturbances
       - Disturbance\textsubscript{n}
         - TripValues
           - Fault

   \( n \) is the disturbance order of occurrence, \( n=1 \) meaning the most recent and \( n=10 \) the least.
3. **Scroll through the available voltages and currents.**

   Use the **Left** and/or **Right** arrow buttons to scroll between values.
4 View disturbance trigger levels

4.1 Navigate the menus

This procedure describes how to view the disturbance trigger levels.

1. View the list of trigger levels.

Navigate the menus to:

   ServiceReport
   DisturbReport
   AnalogTrigStat

2. Scroll the list.

Use the Left and Right arrow buttons to scroll the list of trigger levels.

Table 2: Disturbance triggering levels

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Description of trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1&gt;</td>
<td>Overvoltage trigger level in voltage input U1</td>
</tr>
<tr>
<td>U1&lt;</td>
<td>Undervoltage trigger level in voltage input U1</td>
</tr>
<tr>
<td>U2&gt;</td>
<td>Overvoltage trigger level in voltage input U2</td>
</tr>
<tr>
<td>U2&lt;</td>
<td>Undervoltage trigger level in voltage input U2</td>
</tr>
<tr>
<td>U3&gt;</td>
<td>Overvoltage trigger level in voltage input U3</td>
</tr>
<tr>
<td>U3&lt;</td>
<td>Undervoltage trigger level in voltage input U3</td>
</tr>
<tr>
<td>U4&gt;</td>
<td>Overvoltage trigger level in voltage input U4</td>
</tr>
<tr>
<td>U4&lt;</td>
<td>Undervoltage trigger level in voltage input U4</td>
</tr>
<tr>
<td>U5&gt;</td>
<td>Overvoltage trigger level in voltage input U5</td>
</tr>
<tr>
<td>U5&lt;</td>
<td>Undervoltage trigger level in voltage input U5</td>
</tr>
<tr>
<td>I1&gt;</td>
<td>Overcurrent trigger level in voltage input I1</td>
</tr>
<tr>
<td>I1&lt;</td>
<td>Undercurrent trigger level in voltage input I1</td>
</tr>
<tr>
<td>I2&gt;</td>
<td>Overcurrent trigger level in voltage input I2</td>
</tr>
<tr>
<td>I2&lt;</td>
<td>Undercurrent trigger level in voltage input I2</td>
</tr>
<tr>
<td>Viewed data (default labels used, data is example values)</td>
<td>Description of trigger</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>I3&gt;</td>
<td>Overcurrent trigger level in voltage input I3</td>
</tr>
<tr>
<td>I3&lt;</td>
<td>Undercurrent trigger level in voltage input I3</td>
</tr>
<tr>
<td>I4&gt;</td>
<td>Overcurrent trigger level in voltage input I4</td>
</tr>
<tr>
<td>I4&lt;</td>
<td>Undercurrent trigger level in voltage input I4</td>
</tr>
<tr>
<td>I5&gt;</td>
<td>Overcurrent trigger level in voltage input I5</td>
</tr>
<tr>
<td>I5&lt;</td>
<td>Undercurrent trigger level in voltage input I5</td>
</tr>
</tbody>
</table>
5 View disturbance sequence number

5.1 Navigate the menus

This procedure describes how to view in consecutive order disturbance sequence number.

1. View the sequence number.
   Navigate the menus to:

   ServiceReport
   - DisturbReport
   - SequenceNo
6 Calculate the distance to fault

6.1 Navigate the menus

1. Only one disturbance can be viewed at the time. Select the one to be viewed.
2. View the distance to fault calculation menu.

Navigate the menus to:

```
DisturbanceReport
CalcDistToFlt
Disturbance
```

\( n \) is the disturbance order of occurrence, \( n=1 \) meaning the most recent and \( n=10 \) the least.

3. Select a fault loop.
4. Press the E button to calculate.

The fault loop and distance to fault are displayed.

6.2 How the distance to fault is displayed

The calculated distance to fault is displayed in the following manner either in the disturbance summary or when the distance is manually recalculated:

```
FltLoop=<Loop>
Dist=<Qualifier1><Qualifier2><Distance value><Unit>
```

The first row identifies the fault loop used for calculation.

The second row qualifies the calculated data and shows the distance using the selected unit, percent (%), kilometers (km) or english miles (mi).

<table>
<thead>
<tr>
<th>Table 3: Qualifier1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
</tr>
<tr>
<td>Blank (no symbol)</td>
</tr>
<tr>
<td>“&gt;”</td>
</tr>
<tr>
<td>Symbol</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Blank (no symbol)</td>
</tr>
<tr>
<td>&quot;*&quot;</td>
</tr>
<tr>
<td>&quot;E&quot;</td>
</tr>
</tbody>
</table>
7 Manually trigger the disturbance report

7.1 Navigate the menus

This procedure describes how to manually trigger the disturbance recording.

1. Display the manual trigger dialog.

   Navigate the menus to:

   DisturbReport
   ManualTrig

2. Confirm the manual trigger.

   Select Yes by using the Left and/or Right arrow buttons, of not already highlighted. Press the E button to assert the manual trigger.

   Select No and press the E button to avoid asserting a manual trigger.
8 View the used disturbance memory size

8.1 Navigate the menus

This procedure describes how to read the used disturbance memory size.

1. View the size.

   Navigate the menus to:

   ServiceReport
   DisturbReport
   MemoryUsed
Reset the LED alarms

9.1 Navigate the menus

This procedure describes how to reset LED’s after evaluating the reasons of an alarm in order to prepare for new alarms.

1. **Make sure the basic terminal dialog is displayed.**
   
   You may need to press the C button repeatedly to return to the basic terminal dialog from the displayed menu branch or leaf.

2. **Press the C button to reset LED alarms.**
   
   All LED’s are reset.
10 Test the LEDs of the LED module

10.1 Navigate the menus

This procedure describes how to test the LEDs of the LED module.

1. Display the Test menu
   Navigate the menus to:
   
   Test
   Mode
   HMI LED

2. Press the OK button to enter test selection

3. Select test mode
   Use the Up or Down arrow button to select Yes to prepare for the test to start.

4. Confirm test mode
   Press the E button to confirm the selection.

5. Save test mode changes and start test
   The Save test mode dialog is displayed. Save the change by selecting Yes and press the E button again. The LED test is started.

Stop the HMI LED test

1. Display the Test menu
   Navigate the menus to:
   
   Test
   Mode
   HMI LED

2. Press the OK button to enter test selection

3. Select test mode
   Use the Up or Down arrow button to select No to prepare for the test to stop.
4. **Confirm test mode**
   Press the E button to confirm the selection.

5. **Save test mode changes and stop test**
   The Save test mode dialog is displayed. Save the change by selecting Yes and press the E button again. The LED test is stopped.
Test the LEDs of the LED module

Chapter 6
Handle the disturbances
Chapter 7  View the protection system status

About this chapter
This chapter describes operations an operator may perform on a daily basis or when the need arises.
1 View the service values

1.1 Navigate the menus

This procedure describes how to navigate the menus to view line voltage, phase current, neg. seq. current, active power, reactive power and frequency. Such values are called service values.

1. Display the Service values menu.
   Navigate the menus to:

   ServiceReport
   ServiceValues

2. Scroll the available service values to read mean values.
   Use the Left and/or Right arrow buttons to scroll between values.

1.2 Available HMI service values

Each service value may be displayed using custom labels.

Table 5: Available service values

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Service value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U = 0.000 kV</td>
<td>Mean RMS voltage of voltage input channels 1-3</td>
</tr>
<tr>
<td>I = 0.000 A</td>
<td>Mean RMS current of current input channels 1-3</td>
</tr>
<tr>
<td>P = 0.000 MW</td>
<td>Mean active power of voltage and current channels 1-3</td>
</tr>
<tr>
<td>Q = 0.000 MVAr</td>
<td>Mean reactive power of voltage and current channels 1-3</td>
</tr>
<tr>
<td>f = 50.00 Hz</td>
<td>Mean frequency of voltage input channels 1-3</td>
</tr>
<tr>
<td>INegSeq = 0.000 A</td>
<td>Mean RMS negative sequence current of current input channels 1-3</td>
</tr>
</tbody>
</table>
2 View the primary and secondary phasors

2.1 Navigate the menus

This procedure describes how to navigate the menus to view primary and secondary measured analog values. Such values are called *phasors*.

View the primary phasors

1. Display the primary phasors menu.
   
   Navigate the menus to:

   ServRep
   Phasors
   Primary

2. Scroll through the available values to read phasors.

   Use the **Left** and/or **Right** arrow buttons to scroll between values.

View the secondary phasors

1. Display the secondary phasors menu.

   Navigate the menus to:

   ServRep
   Phasors
   Secondary

2. Scroll the available values to read phasors.

   Use the **Left** and/or **Right** arrow buttons to scroll between values.

2.2 Available primary and secondary phasors

Primary and secondary phasors are available for all voltage and current input channels, as well as the primary phasors for phase-to-phase voltages between voltage channels 1 and 2, 2 and 3 or 3 and 1.

Each phasor may be displayed using custom labels. Consult the station documentation to find the configured labels.
Table 6: Example of primary phasor (explanation of viewed data)

<table>
<thead>
<tr>
<th>Viewed data (default labels are used, data is example values)</th>
<th>Phasor</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1 =</td>
<td>Measured analogue quantity (phasor)</td>
</tr>
<tr>
<td>0.000 kV</td>
<td>Magnitude of a measured phasor</td>
</tr>
<tr>
<td>0.0 deg</td>
<td>Phase angle of a measured phasor</td>
</tr>
<tr>
<td></td>
<td>Phasor U2 and U3 utilize phasor U1 as reference</td>
</tr>
</tbody>
</table>
3 View the function block variables and output signals

3.1 Navigate the menus

This procedure describes how to navigate the menus to view function output signals.

View the status of function block binary outputs:
1. **Identify the function block to view.**
   Use table of the following section to find the function block to view.

2. **Display the list of outputs.**
   Navigate the menus to:
   
   Service Report
   Functions
   <name of function block>
   FuncOutputs

3. **Scroll the output values.**
   Use the **Left** and/or **Right** arrow buttons to scroll between values.

View the values of function block variables:
1. **Identify the function block and variable to view.**
   Use table of the following section to find the function block and variable to view.

2. **Display the list of outputs.**
   Navigate the menus to:
   
   Service Report
   Functions
   <name of function block>
   <function block variable>

3. **Scroll the output values.**
   Use the **Left** and/or **Right** arrow buttons to scroll between values.
### 3.2 Contents of the Functions menu related to function outputs

Please note that the **Functions** menu contains more than what is described here. Other functions such as clearing of counters and calculated function data are also part of the service report, but described separately.

**Table 7: Functions that may be viewed directly (in order of occurrence)**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMI LED</td>
<td>HLED</td>
<td>LED indication function</td>
</tr>
<tr>
<td>InstantOC</td>
<td>IOC</td>
<td>Instantaneous overcurrent protection</td>
</tr>
<tr>
<td>TimeDelayOC</td>
<td>TOC</td>
<td>Time delayed overcurrent protection</td>
</tr>
<tr>
<td>CapUnbalance</td>
<td>TOCC</td>
<td>Unbalance protection for capacitor banks</td>
</tr>
<tr>
<td>InvTimeDelayOC</td>
<td>TOC2</td>
<td>Two step time delayed phase overcurrent protection</td>
</tr>
<tr>
<td>DirInvTDelayOC</td>
<td>TOC3</td>
<td>Two step time delayed residual overcurrent protection</td>
</tr>
<tr>
<td>OverLoad</td>
<td>OVLD</td>
<td>Overload supervision</td>
</tr>
<tr>
<td>ThermOverLoad</td>
<td>THOL</td>
<td>Thermal phase overload</td>
</tr>
<tr>
<td>Stub</td>
<td>STUB</td>
<td>Stub protection</td>
</tr>
<tr>
<td>PoleDiscord</td>
<td>PD</td>
<td>Pole discordance</td>
</tr>
<tr>
<td>BreakerFailure</td>
<td>BFP</td>
<td>Breaker failure protection</td>
</tr>
<tr>
<td>TimeDelayUV</td>
<td>TUV</td>
<td>Time delayed under voltage protection</td>
</tr>
<tr>
<td>TimeDelayOV</td>
<td>TOV</td>
<td>Time delayed over voltage protection</td>
</tr>
<tr>
<td>IntCircBridge</td>
<td>TOVI</td>
<td>Inter circuit bridging</td>
</tr>
<tr>
<td>LossOfVoltage</td>
<td>LOV</td>
<td>Loss of voltage check</td>
</tr>
<tr>
<td>DeadLineDet</td>
<td>DLD</td>
<td>Dead line detection</td>
</tr>
<tr>
<td>BrokenConduct</td>
<td>BRC</td>
<td>Broken conductor check</td>
</tr>
<tr>
<td>CTSupervision</td>
<td>CTSU</td>
<td>Current circuit supervision</td>
</tr>
<tr>
<td>FuseFailure</td>
<td>FUSE</td>
<td>Fuse failure</td>
</tr>
<tr>
<td>Trip</td>
<td>TR</td>
<td>Trip logic</td>
</tr>
<tr>
<td>CommunicCHL</td>
<td>CCHL</td>
<td>Communication channel logic</td>
</tr>
<tr>
<td>RadialFeederP</td>
<td>PAP</td>
<td>Radial feeder protection</td>
</tr>
<tr>
<td>VoltageTransfS</td>
<td>TCT</td>
<td>Voltage transformer supervision</td>
</tr>
<tr>
<td>ComChanTest</td>
<td>CCHT</td>
<td>Communication channel test logic</td>
</tr>
<tr>
<td>FaultLocator</td>
<td>FLOC</td>
<td>Fault locator</td>
</tr>
</tbody>
</table>
Table 8: The Impedance group (Group designation: Impedance)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GenFltCriteria</td>
<td>GFC</td>
<td>General fault criteria</td>
</tr>
<tr>
<td>PhaseSelection</td>
<td>PSL</td>
<td>Phase selection logic</td>
</tr>
<tr>
<td>HighSpeed</td>
<td>HS</td>
<td>High speed protection</td>
</tr>
<tr>
<td>HighSpeedBO</td>
<td>HSBO</td>
<td>High speed binary output</td>
</tr>
<tr>
<td>Zone1</td>
<td>ZM1</td>
<td>Distance protection zone 1</td>
</tr>
<tr>
<td>Zone2</td>
<td>ZM2</td>
<td>Distance protection zone 2</td>
</tr>
<tr>
<td>Zone3</td>
<td>ZM3</td>
<td>Distance protection zone 3</td>
</tr>
<tr>
<td>Zone4</td>
<td>ZM4</td>
<td>Distance protection zone 4</td>
</tr>
<tr>
<td>Zone5</td>
<td>ZM5</td>
<td>Distance protection zone 5</td>
</tr>
<tr>
<td>ComLocal</td>
<td>ZCLC</td>
<td>Local acceleration logic</td>
</tr>
<tr>
<td>ZCommunication</td>
<td>ZCOM</td>
<td>Scheme communication logic</td>
</tr>
<tr>
<td>Com1P</td>
<td>ZC1P</td>
<td>Phase segregated scheme communication logic</td>
</tr>
<tr>
<td>Com1RevWEI</td>
<td>ZCAL</td>
<td>Current reversal and weak end infeed logic</td>
</tr>
<tr>
<td>PowerSwingDet</td>
<td>PSD</td>
<td>Power swing detection</td>
</tr>
<tr>
<td>PowerSwingLog</td>
<td>PSL</td>
<td>Additional logic for power swing detection</td>
</tr>
<tr>
<td>PoleSlipProt</td>
<td>PSP</td>
<td>Pole slip protection</td>
</tr>
<tr>
<td>SwitchOntoFlt</td>
<td>SOTF</td>
<td>Automatic switch onto fault</td>
</tr>
</tbody>
</table>
Table 9: The Earth Fault group (Group designation: Earth Fault)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TimeDelayEF</td>
<td>TEF</td>
<td>Time delayed earth fault protection</td>
</tr>
<tr>
<td>4stepEF</td>
<td>EF4</td>
<td>4 step earth fault protection</td>
</tr>
<tr>
<td>WattmetrEF1</td>
<td>WEF1</td>
<td>Sensetive residual overcurrent protection</td>
</tr>
<tr>
<td>WattmetrEF2</td>
<td>WEF2</td>
<td>Sensetive residual overcurrent protection</td>
</tr>
<tr>
<td>EFC</td>
<td>EFC</td>
<td>Scheme communication logic</td>
</tr>
<tr>
<td>ComIRevWei</td>
<td>EFCA</td>
<td>Current reversal and weak end infeed logic</td>
</tr>
</tbody>
</table>

Table 10: System control and protection group (Group designation: System Protec)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SuddenChangeC</td>
<td>SCC1</td>
<td>Sudden change in phase current</td>
</tr>
<tr>
<td>SuddenChangeRC</td>
<td>SCRC</td>
<td>Sudden change in residual current</td>
</tr>
<tr>
<td>SuddenChangeV</td>
<td>SCV</td>
<td>Sudden change in voltage</td>
</tr>
<tr>
<td>OverCurrentP</td>
<td>OCP</td>
<td>Phase overcurrent protection</td>
</tr>
<tr>
<td>UnderCurrentP</td>
<td>UCP</td>
<td>Phase undercurrent protection</td>
</tr>
<tr>
<td>ResidOverCP</td>
<td>ROCP</td>
<td>Residual overcurrent protection</td>
</tr>
<tr>
<td>OverVoltageP</td>
<td>OVP</td>
<td>Over voltage protection</td>
</tr>
<tr>
<td>LowActivePP</td>
<td>LAPP</td>
<td>Low active power protection</td>
</tr>
<tr>
<td>LowActiveRP</td>
<td>LARP</td>
<td>Low active and reactive protection</td>
</tr>
<tr>
<td>HighActivePP</td>
<td>HAPP</td>
<td>High active power protection</td>
</tr>
<tr>
<td>HighActiveRP</td>
<td>HARP</td>
<td>High active and reactive power protec</td>
</tr>
</tbody>
</table>

Table 11: The Autorecloser group (Group designation: Auto Recloser)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoRecloser 1</td>
<td>AR01</td>
<td>AutoRecloser</td>
</tr>
<tr>
<td>AutoRecloser 2</td>
<td>AR02</td>
<td></td>
</tr>
<tr>
<td>AutoRecloser 3</td>
<td>AR03</td>
<td></td>
</tr>
</tbody>
</table>
### View the function block variables and output signals

**Chapter 7**

**View the protection system status**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoRecloser 4</td>
<td>AR04</td>
<td></td>
</tr>
<tr>
<td>AutoRecloser 5</td>
<td>AR05</td>
<td></td>
</tr>
<tr>
<td>AutoRecloser 6</td>
<td>AR06</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 12: The Syncrocheck group (Group designation: SynchroCheck)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SynchroCheck1</td>
<td>SYN1</td>
<td>SynchroCheck</td>
</tr>
<tr>
<td>SynchroCheck2</td>
<td>SYN2</td>
<td></td>
</tr>
<tr>
<td>SynchroCheck3</td>
<td>SYN3</td>
<td></td>
</tr>
<tr>
<td>SynchroCheck4</td>
<td>SYN4</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 13: The DC monitor group (Group designation: DC monitor)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI11-Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI21-Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI31-Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI41-Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI51-Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI61-Error</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 14: The Command function group (Group designation: Command function)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD01</td>
<td></td>
<td>Single command function (16 signals)</td>
</tr>
<tr>
<td>CD02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 15: Basic logic group (Group designation: Basic logic)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND1A</td>
<td>Annn</td>
<td>AND gates part 1</td>
</tr>
<tr>
<td>AND1B</td>
<td>Annn</td>
<td>AND gates part 2</td>
</tr>
<tr>
<td>OR1A</td>
<td>Onnn</td>
<td>OR gates part 1</td>
</tr>
<tr>
<td>OR2A</td>
<td>Onnn</td>
<td>OR gates part 2</td>
</tr>
<tr>
<td>XOR1</td>
<td>XOnn</td>
<td>Exclusive OR gates</td>
</tr>
<tr>
<td>INV</td>
<td>IVnn</td>
<td>Inverters</td>
</tr>
<tr>
<td>SR</td>
<td>SRnn</td>
<td>Set-reset flip-flops</td>
</tr>
<tr>
<td>Timer</td>
<td>TMnn</td>
<td>Timers</td>
</tr>
<tr>
<td>TimerLong</td>
<td>TLnn</td>
<td>Timers, long delay</td>
</tr>
<tr>
<td>Pulse</td>
<td>TPnn</td>
<td>Pulse generators, part 1</td>
</tr>
<tr>
<td>Pulse2</td>
<td>TPnn</td>
<td>Pulse generators, part 2</td>
</tr>
<tr>
<td>PulseLong1</td>
<td>TQnn</td>
<td>Pulse generators, long pulse, part 1</td>
</tr>
<tr>
<td>PulseLong2</td>
<td>TQnn</td>
<td>Pulse generators, long pulse, part 2</td>
</tr>
<tr>
<td>ContrGates1</td>
<td>GTnn</td>
<td>Controllable gates</td>
</tr>
<tr>
<td>TimerSet1</td>
<td>TSnn</td>
<td>Settable timers</td>
</tr>
<tr>
<td>SRWithMem1</td>
<td>SMnn</td>
<td>Set-reset flip-flops with memory</td>
</tr>
</tbody>
</table>
4 Read the measured and calculated function values

4.1 View the calculated impedances

This procedure describes how to read calculated impedance data.

1. **View the available impedance data.**
   
   Navigate the menus to:
   
   ServiceReport
   Functions
   Impedance
   General
   ImpValues

2. **Scroll the list to view each impedance value.**
   
   Use the Left and/or Right arrow buttons to scroll between values.

4.2 Calculated impedance values

Table 16: Calculated impedance values

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Impedance value</th>
</tr>
</thead>
<tbody>
<tr>
<td>XL1= 144 Ohm/phase</td>
<td>Positive sequence reactance measured in phase L1 (L2, L3).</td>
</tr>
<tr>
<td>RL1= 193 Ohm/phase</td>
<td>Positive sequence resistance measured in phase L1 (L2, L3).</td>
</tr>
<tr>
<td>XL2= 142 Ohm/phase</td>
<td>Positive sequence resistance measured in phase L1 (L2, L3).</td>
</tr>
<tr>
<td>RL2= 192 Ohm/phase</td>
<td>Positive sequence resistance measured in phase L1 (L2, L3).</td>
</tr>
<tr>
<td>XL3= 143 Ohm/phase</td>
<td>Positive sequence resistance measured in phase L1 (L2, L3).</td>
</tr>
<tr>
<td>RL3= 194 Ohm/phase</td>
<td>Positive sequence resistance measured in phase L1 (L2, L3).</td>
</tr>
</tbody>
</table>
4.3 View the calculated direction

This procedure describes how to read calculated direction.

1. View the available direction.
   Navigate the menus to:
   
   ServiceReport
   Functions
   Impedance
   General
   ImpDirection

2. Scroll the list to view direction for each phase.
   Use the Left and/or Right arrow buttons to scroll between values.

4.4 Calculated direction

Table 17: Calculated direction

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Direction value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1= None</td>
<td>Displays the direction of measured impedance in each respective phase loop. Values may be forward for forward direction, reverse for reverse direction and none, when it is not possible to define the correct direction.</td>
</tr>
<tr>
<td>L2= Reverse</td>
<td></td>
</tr>
<tr>
<td>L3=L1 Forward</td>
<td></td>
</tr>
</tbody>
</table>

4.5 View the calculated differential values

This procedure describes how to read calculated differential data.

1. View the list of available differential data.
   Navigate the menus to:
Read the measured and calculated function values

Chapter 7

View the protection system status

ServiceReport
  Functions
    Differential
      DiffValues

2. Scroll the list to view each value.
   Use the Left and/or Right arrow buttons to scroll between values.

4.6 Calculated differential values

Table 18: Calculated differential values

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Differential value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDiffL1= 0.003 A</td>
<td>Measured actual value of differential current in phase L1</td>
</tr>
<tr>
<td>IBiasL1= 0.734 A</td>
<td>The highest value of Bias currents in phase L1 or 1/2 of Bias current in L2 or 1/2 of Bias current in L3 max [(I_{bias}L1 or 0.5xI_{bias}L2 or 0.5I_{bias}L3)]</td>
</tr>
<tr>
<td>IDiffL2= 0.004 A</td>
<td>Measured actual value of differential current in phase L2</td>
</tr>
<tr>
<td>IBiasL2= 0.733 A</td>
<td>The highest value of Bias currents in phase L2 or 1/2 of Bias current in L1 or 1/2 of Bias current in L3 max [(I_{bias}L2 or 0.5xI_{bias}L1 or 0.5I_{bias}L3)]</td>
</tr>
<tr>
<td>IDiffL3= 0.002 A</td>
<td>Measured actual value of differential current in phase L3</td>
</tr>
<tr>
<td>IBiasL3= 0.735 A</td>
<td>The highest value of Bias currents in phase L3 or 1/2 of Bias current in L2 or 1/2 of Bias current in L1 max [(I_{bias}L3 or 0.5xI_{bias}L2 or 0.5I_{bias}L1)]</td>
</tr>
</tbody>
</table>

4.7 View the differential communication values

This procedure describes how to read differential communication values.
1. View the list of available communication data.

Navigate the menus to:

ServiceReport
  Functions
    Differential
      DiffCom

2. Scroll the list to view each value.

Use the Left and/or Right arrow buttons to scroll between values.

4.8 Differential communication values

Table 19: Differential communication values

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Communication values</th>
</tr>
</thead>
<tbody>
<tr>
<td>TransmDelay= 0.345 ms</td>
<td>One half of measured loop time delay in transmission of communication telegram</td>
</tr>
<tr>
<td>NoOfShInterr= 199</td>
<td>Recorded number of short interruptions in communication to the remote terminal (20 - 50)ms</td>
</tr>
<tr>
<td>NoOfMedInterr= 12</td>
<td>Recorded number of medium interruptions in communication to the remote terminal (50 - 200)ms</td>
</tr>
<tr>
<td>NoOfLongInterr= 2</td>
<td>Recorded number of long interruptions in communication to the remote terminal &gt;200ms</td>
</tr>
<tr>
<td>CommStatus= OK</td>
<td>Status of communication link</td>
</tr>
<tr>
<td>NoOfTXD= 37 %</td>
<td>Percentage of theoretically possible transmitted telegrams</td>
</tr>
<tr>
<td>NoOfRXD= 41 %</td>
<td>Percentage of received transmitted telegrams</td>
</tr>
<tr>
<td>SyncError= 5 us</td>
<td>Synchronization error between two terminals</td>
</tr>
</tbody>
</table>
4.9 **View the thermal overload temperatures**
This procedure describes how to read thermal overload temperatures.

1. **View the list of available temperatures.**
   Navigate the menus to:
   
   ServiceReport
   Functions
   ThermOverLoad
   Temperature

2. **Scroll the list to view each value.**
   Use the Left and/or Right arrow buttons to scroll between values.

4.10 **Thermal overload temperatures**

Table 20: Thermal overload temperatures THOL (THOL-)

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>T Line</td>
<td>Actual line temperature</td>
</tr>
<tr>
<td>T Amb</td>
<td>Ambient temperature</td>
</tr>
</tbody>
</table>

4.11 **View the automatic recloser counters**
This procedure describes how to read automatic recloser counters.

1. **View the available counter data.**
   Navigate the menus to:
   
   ServiceReport
   Functions
   Autorecloser
   AutoRecloser
   Counters

   where $n$ is the instance to be viewed, numbers 1-6.
2. **Scroll the list to view each counter value.**
   Use the **Left** and/or **Right** arrow buttons to scroll between values.

### 4.12 Autorecloser counter values

**Table 21: Autorecloser counter values AR (AR---)**

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Counter value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ph-Shot1= 12</td>
<td>Recorded number of first single pole reclosing attempts</td>
</tr>
<tr>
<td>3ph-Shot1= 331</td>
<td>Recorded number of first three-pole reclosing attempts</td>
</tr>
<tr>
<td>3ph-Shot2= 124</td>
<td>Recorded number of second three-pole reclosing attempts</td>
</tr>
<tr>
<td>3ph-Shot3= 55</td>
<td>Recorded number of third three-pole reclosing attempts</td>
</tr>
<tr>
<td>3ph-Shot4= 12</td>
<td>Recorded number of fourth three-pole reclosing attempts</td>
</tr>
<tr>
<td>NoOfReclosings= 534</td>
<td>Recorded number of all reclosing attempts</td>
</tr>
</tbody>
</table>

### 4.13 View the synchrocheck values

This procedure describes how to read synchrocheck values.

1. **View the available synchrocheck values.**
   Navigate the menus to:

   - **ServiceReport**
   - **Functions**
   - **SynchroCheck**
   - **SynchroCheck\_n**
   - **SyncValues**

   where \( n \) is the instance to be viewed, numbers 1-4.
2. Scroll the list to view each value.

Use the **Left** and/or **Right** arrow buttons to scroll between values.

### 4.14 Synchrocheck values

**Table 22: Synchrocheck values**

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Synchrocheck data</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDiff= 0.3455 %ofU1b</td>
<td>Measured voltage difference between measured and reference voltage</td>
</tr>
<tr>
<td>FreqDiff= 0.0231 Hz</td>
<td>Measured frequency difference between measured and reference voltage</td>
</tr>
<tr>
<td>PhaseDiff= 0.0215 deg</td>
<td>Measured phase difference between measured and reference voltage</td>
</tr>
</tbody>
</table>

### 4.15 View the event counter values

This procedure describes how to read pulse counter values.

1. **View the available counter data.**

   Navigate the menus to:

   ServiceReport
   
   Functions
   
   Counters
   
   Count
   
   Counters

2. **Scroll the list to view each counter value.**

   Use the **Left** and/or **Right** arrow buttons to scroll between values.
### Event counter values

#### Table 23: Event counter values

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Counter value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter1= 23</td>
<td>Recorded number of pulses by counter no.1</td>
</tr>
<tr>
<td>Counter2= 456</td>
<td>Recorded number of pulses by counter no.2</td>
</tr>
<tr>
<td>Counter3= 12</td>
<td>Recorded number of pulses by counter no.3</td>
</tr>
<tr>
<td>Counter4= 7456</td>
<td>Recorded number of pulses by counter no.4</td>
</tr>
<tr>
<td>Counter5= 0</td>
<td>Recorded number of pulses by counter no.5</td>
</tr>
<tr>
<td>Counter6= 0</td>
<td>Recorded number of pulses by counter no.6</td>
</tr>
</tbody>
</table>
5 View the I/O function block signals

5.1 View the I/O module signals
This procedure describes how to navigate the menus to view binary I/O signals.

1. Identify the slot and module to view.
   Use table of the following section to find the slot and module to view.

2. Display the list of signals.
   Navigate the menus to:

   ServiceReport
   I/O
   <Slot and module name>
   FuncOutputs

3. Scroll the list to view each individual signal.
   Use the Left and/or Right arrow buttons to scroll between values.

5.2 I/O modules
I/O modules are always addressed by references to the slot in which the module resides, the module type and its order number, that is, which one of several modules of the same kind is to be addressed. The name are constructed in the following way:

   Slot <Slot number>-<Module type><Designation number>

For the first binary input module mounted in slot 14 the name will be:

   Slot14-BIM1

Consequently, for the second BIM module mounted in slot 16 the name will be:

   Slot16-BIM2
View the I/O function block signals

Table 24: Module shorthands

<table>
<thead>
<tr>
<th>Module</th>
<th>Module shorthand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary input module</td>
<td>BIM</td>
</tr>
<tr>
<td>Binary output module</td>
<td>BOM</td>
</tr>
<tr>
<td>Binary I/O module</td>
<td>IOM</td>
</tr>
<tr>
<td>Milliampere module</td>
<td>MIM</td>
</tr>
</tbody>
</table>

Chapter 7
View the protection system status

5.3 View the remote terminal communication data

This procedure describes how to navigate the menus to view remote terminal communication signals.

1. **Display the list of signals.**
   To view signals of function block RTC1, navigate the menus to:
   
   ServiceReport
   I/O
   RemTermCom1
   FuncOutputs

   To view signals of function block RTC2, navigate the menus to:
   
   ServiceReport
   I/O
   RemTermCom2
   FuncOutputs

2. **Scroll between the signals.**
   Use the Left and/or Right arrow buttons to scroll between signals.

5.4 Available signals

Table 25: Output signals for the binary signal transfer to remote end function
<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC01-REC16</td>
<td>Binary signals received from remote terminal, outputs 01-16</td>
</tr>
<tr>
<td>COMFAIL</td>
<td>Communication failure</td>
</tr>
</tbody>
</table>
6 Determine the active setting group

6.1 Navigate the menus

This procedure describes how to determine the active setting group.

1. Determine the active group.

   Navigate the menus to:

   ServiceReport
   ActiveGroup
7 Clear the autorecloser counters

7.1 Navigate the menus

This procedure describes how to clear the automatic reclosing counters.

1. Display the clear counters dialog.

Navigate the menus to:

ServiceReport
  Functions
    AutoRecloser
      AutoReclosern
        Counters
          ClearCounters

where \( n \) is the instance to be viewed, numbers 1-6.

2. Confirm clearing the counters.

Select Yes by using the Left and/or Right arrow buttons, of not already highlighted. Press the E button to confirm. Counters are cleared.

Select No and press the E button to leave the counters at their present value.
8 Clear the differential communication counters

8.1 Navigate the menus

This procedure describes how to clear the differential communication counters.

1. Display the clear counters dialog.

Navigate the menus to:

ServiceReport
Functions
Differential
DiffCom
ClearCounters

2. Confirm clearing the counters.

Select Yes by using the Left and/or Right arrow buttons, of not already highlighted. Press the E button to confirm. Counters are cleared.

Select No and press the E button to leave the counters at their present value.
Clear the event counters

9.1 Navigate the menus

This procedure describes how to clear the event counters.

1. **Display the clear counters dialog.**
   Navigate the menus to:
   
   ServiceReport
   Functions
   Counters
   Count
   ClearCounters

2. **Confirm clearing the counters.**
   Select Yes by using the Left and/or Right arrow buttons, of not already highlighted. Press the E button to confirm. Counters are cleared.

   Select No and press the E button to leave the counters at their present value.
Clear the event counters

Chapter 7
View the protection system status
Chapter 8 View the terminal unit status

About this chapter
This chapter describes operations an operator may perform on a daily basis or when the need arises.
1 Find the reason of an internal failure

1.1 Navigate the menus

This procedure describes how to navigate the menus in order to find the reason of an internal failure when indicated by the flashing green LED of the HMI module.

1. Display the self supervision menu.
   Navigate the menus to:

   TerminalReport
   SelfSuperv

2. Scroll the supervision values to identify the reason of the failure.
   Use the Left and/or Right arrow buttons to scroll between values.

1.2 Self supervision HMI data

Table 26: Output signals for the self supervision function

<table>
<thead>
<tr>
<th>Indicated result</th>
<th>Reason</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>InternFail = OK</td>
<td>No problem detected.</td>
<td>None.</td>
</tr>
<tr>
<td>InternFail = Fail</td>
<td>A failure has occurred.</td>
<td>Check the rest of the indicated results to find the fault.</td>
</tr>
<tr>
<td>InternWarning = OK</td>
<td>No problem detected.</td>
<td>None.</td>
</tr>
<tr>
<td>InternWarning = Warning</td>
<td>A warning has been issued.</td>
<td>Check the rest of the indicated results to find the fault.</td>
</tr>
<tr>
<td>MPM-modFail = OK</td>
<td>No problem detected.</td>
<td>None.</td>
</tr>
<tr>
<td>MPM-modFail = Fail</td>
<td>The main processing module has failed.</td>
<td>Contact your ABB representative for service.</td>
</tr>
<tr>
<td>MPM-modWarning = OK</td>
<td>No problem detected.</td>
<td>None.</td>
</tr>
</tbody>
</table>
### Chapter 8

View the terminal unit status

#### Find the reason of an internal failure

<table>
<thead>
<tr>
<th>Indicated result</th>
<th>Reason</th>
<th>Action</th>
</tr>
</thead>
</table>
| MPM-modWarning = Warning | There is a problem with:  
  - the real time clock.  
  - the time synchronization. | Set the clock.  
If the problem persists, contact your ABB representative for service. |
| ADC-module = OK | No problem detected. | None. |
| ADC-module = Fail | The A/D conversion module has failed. | Contact your ABB representative for service. |
| Slot04BIM1 = Fail (Example data, se following section for details) | I/O module communication has failed. | Check that the I/O module has been configured and connected to the IOP1- block.  
If the problem persists, contact your ABB representative for service. |
| RealTimeClock = OK | No problem detected. | None. |
| RealTimeClock = Warning | The real time clock has been reset. | Set the clock. |
| TimeSync = OK | No problem detected. | None. |
| TimeSync = Warning | No time synchronization. | Check the synchronization source for problems.  
If the problem persists, contact your ABB representative for service. |
2 Identify the terminal

2.1 Navigate the menus

2.1.1 Retrieve the terminal’s serial number

1. View the serial number from the terminal report.
   Navigate the menus to:
   
   TerminalReport
   IdentityNo

2.1.2 Retrieve the terminal’s identity

1. View the identifiers from the configuration menu.
   Navigate the menus to:
   
   Configuration
   Identifiers

2. Scroll the available identifiers.
   Use the Left and/or Right arrow buttons to scroll between values.

2.2 Available identifiers

Table 27: Set parameters for the general terminal parameters function

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Name</td>
<td>-</td>
<td>“Station Name”</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Station No</td>
<td>0-99999</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Object Name</td>
<td>-</td>
<td>“Object Name”</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Object No</td>
<td>0-99999</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Unit Name</td>
<td>-</td>
<td>“Unit Name”</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Unit No</td>
<td>0-99999</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
3 Read the terminal time

3.1 Navigate the menus

This procedure describes how to read the terminal time.

1. View the date and time.

   Navigate the menus to:

   ServiceReport
   Time
4  Retrieve the version of installed firmware

4.1  Navigate the menus

1.  View the firmware version from the terminal report.

   Navigate the menus to:

   TerminalReport
   IdentityNo
5 Determine the installed modules

5.1 Navigate the menus

This procedure describes how to determine which modules are installed.

1. View the list of modules.
   Navigate the menus to:
   
   TerminalReport
   Modules

2. Scroll the list of installed modules to view what is installed in each slot.
   Use the Left and/or Right arrow buttons to scroll the list.

5.2 I/O modules

I/O modules are always addressed by references to the slot in which the module resides, the module type and its order number, that is, which one of several modules of the same kind is to be addressed. The name are constructed in the following way:

Slot<Slot number>-<Module type><Designation number>=<Article number>

For the first binary input module mounted in slot 14 the name will be:

Slot14-BIM1=1MRK000508-xx

Consequently, for the second BIM module mounted in slot 16 the name will be:

Slot16-BIM2=1MRK000508-xx

Table 28: Module shorthands

<table>
<thead>
<tr>
<th>Module</th>
<th>Module shorthand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary input module</td>
<td>BIM</td>
</tr>
<tr>
<td>Binary output module</td>
<td>BOM</td>
</tr>
<tr>
<td>Binary I/O module</td>
<td>IOM</td>
</tr>
<tr>
<td>Milliampere module</td>
<td>MIM</td>
</tr>
</tbody>
</table>
6 Retrieve the nominal and rated values of analog inputs

6.1 Navigate the menus

This procedure describes how to determine the nominal and rated values of analog inputs.

1. View the list of available analog input values.

   Navigate the menus to:

   TerminalReport
   AnalogInputs

2. Scroll the list to view values.

   Use the **Left** and/or **Right** arrow buttons to scroll between values.

<table>
<thead>
<tr>
<th>Viewed data (default labels used, data is example values)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ur= 110.000 V</td>
<td>Rated AC voltage of a terminal</td>
</tr>
<tr>
<td>Ir= 5.0000 A</td>
<td>Rated AC current of a terminal</td>
</tr>
<tr>
<td>U1r= 63.509 V</td>
<td>Rated phase voltage of a channel U1</td>
</tr>
<tr>
<td>U2r= 63.509 V</td>
<td>Rated phase voltage of a channel U2</td>
</tr>
<tr>
<td>U3r= 63.509 V</td>
<td>Rated phase voltage of a channel U3</td>
</tr>
<tr>
<td>U4r= 63.509 V</td>
<td>Rated phase voltage of a channel U4</td>
</tr>
<tr>
<td>U5r= 63.509 V</td>
<td>Rated phase voltage of a channel U5</td>
</tr>
</tbody>
</table>
Retrieve the nominal and rated values of analog inputs

Chapter 8
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<tr>
<th>Viewed data (default labels used, data is example values)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>I1r= 5.0000 A</td>
<td>Rated phase current of a channel I1</td>
</tr>
<tr>
<td>I2r= 5.0000 A</td>
<td>Rated phase current of a channel I2</td>
</tr>
<tr>
<td>I3r= 5.0000 A</td>
<td>Rated phase current of a channel I3</td>
</tr>
<tr>
<td>I4r= 5.0000 A</td>
<td>Rated phase current of a channel I4</td>
</tr>
<tr>
<td>I5r= 5.0000 A</td>
<td>Rated phase current of a channel I5</td>
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