General

The protection relay REX 521 is designed for protection, control, measuring, and supervision in medium voltage networks. Typical applications include incoming and outgoing feeders as well as substation protection. The protection relay is provided with energizing inputs for conventional current and voltage transformers. Also a hardware version with inputs for current and voltage sensors is available.

Design

The protection relay is based on a multiprocessor environment. The human-machine interface (HMI)\(^1\) including an LCD display with different views makes the local use easy and informs the user via indication messages. Modern technology is applied both in hardware and software solutions.

The protection relay is part of the ABB Substation Automation system and extends the functionality and flexibility of the concept further.

---

1. HMI is referred to as MMI in the relay and in the Relay Setting Tool.
Features

Standard configuration B01:

• Three-phase non-directional overcurrent protection with three stages
• Non-directional earth-fault protection with three stages
• Phase discontinuity protection for three phases
• Three-phase thermal protection for cables
• Three-phase transformer inrush and motor start-up current detector
• Supervision function for the energizing current input circuit
• Current waveform distortion measurement
• Three-phase current measurement
• Neutral current measurement
• Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
• Transient disturbance recorder
• Trip-circuit supervision
• Delayed trip output for the circuit-breaker failure protection (CBFP) function
• Circuit breaker control with indication
• Lockout function
• Object indication
• Logic control position selector
• User-configurable I/Os
• Interlocking
• User-configurable alarm LEDs

Standard configuration B02:

• Three-phase non-directional overcurrent protection with three stages
• Three-phase transformer inrush and motor start-up current detector
• Non-directional earth-fault protection with three stages
• Phase discontinuity protection for three phases
• Three-phase thermal protection for cables
• Supervision function for the energizing current input circuit
• Current waveform distortion measurement
• Three-phase current measurement
• Neutral current measurement
• Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
• Transient disturbance recorder
• Trip-circuit supervision
• Delayed trip output for the circuit-breaker failure protection (CBFP) function
• Automatic reclosing 1...5 shots
• Circuit breaker control with indication
• Lockout function
• Object indication
• Logic control position selector
• User-configurable I/Os
• Interlocking
• User-configurable alarm LEDs

Fig. 1  Block diagram of B01

Fig. 2  Block diagram of B02
Features (cont’d)

**Standard configuration M01:**
- Three-phase non-directional overcurrent protection with three stages
- Three-phase transformer inrush and motor start-up current detector
- Directional earth-fault protection with three stages
- Phase discontinuity protection for three phases
- Three-phase thermal protection for cables
- Supervision function for the energizing current input circuit
- Current waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Residual voltage measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

![Fig. 3 Block diagram of M01](image)

**Standard configuration M02:**
- Three-phase non-directional overcurrent protection with three stages
- Three-phase transformer inrush and motor start-up current detector
- Directional earth-fault protection with three stages
- Phase discontinuity protection for three phases
- Three-phase thermal protection for cables
- Supervision function for the energizing current input circuit
- Current waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Residual voltage measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Automatic reclosing 1...5 shots
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

![Fig. 4 Block diagram of M02](image)
The main difference between the standard configurations B01/B02 and standard configurations M01/M02 is the directional earth-fault protection, which is included in the standard configurations M01 and M02. The difference between configurations B01 and B02, and likewise between M01 and M02, is the auto-reclosure function in B02 and M02.

**Standard configuration H01:**
- Three-phase directional overcurrent protection with two stages
- Three-phase non-directional overcurrent protection with one stage
- Three-phase transformer inrush and motor start-up current detector
- Directional earth-fault protection with three stages
- Phase discontinuity protection for three phases
- Three-phase thermal protection for cables
- Synchro-check/voltage-check function with one stage
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Three phase-to-earth voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Automatic reclosing 1...5 shots
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os

**Interlocking**
- User-configurable alarm LEDs

**Standard configuration H02:**
- Three-phase directional overcurrent protection with two stages
- Three-phase non-directional overcurrent protection with two stages
- Three-phase transformer inrush and motor start-up current detector
- Directional earth-fault protection with three stages
- Underfrequency or overfrequency protection with one stage
- Phase discontinuity protection for three phases
- Three-phase thermal protection for cables
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- System frequency measurement

*Note!* The standard configuration H01 is available only with the sensor HW version.
Features (cont’d)

- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Automatic reclosing 1...5 shots
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

- Synchro-check/voltage-check function with one stage
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Three phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Automatic reclosing 1...5 shots
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

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**Standard configuration H03:**

- Three-phase non-directional overcurrent protection with three stages
- Three-phase transformer inrush and motor start-up current detector
- Directional earth-fault protection with three stages
- Phase discontinuity protection for three phases
- Three-phase thermal protection for cable
Features (cont’d)

**Standard configuration H04:**
- Three-phase non-directional overcurrent protection with three stages
- Three-phase directional overcurrent protection with one stage
- Underfrequency or overfrequency protection with one stage
- Three-phase transformer inrush and motor start-up current detector
- Directional earth-fault protection with three stages
- Non-directional earth-fault protection with three stages
- Phase discontinuity protection for three phases
- Three-phase thermal protection for cable
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Three phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Automatic reclosing 1...5 shots
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

**Standard configuration H05:**
- Three-phase non-directional overcurrent protection with three stages
- Non-directional earth-fault protection with three stages
- Three-phase overvoltage protection with two stages
- Three-phase undervoltage protection with two stages
- Residual overvoltage protection with three stages
- Three-phase transformer inrush and motor start-up current detector
- Three-phase thermal overload protection for devices
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Three phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
Feeder Protection Relay

REX 521
1MRS752177-MBG

Features (cont’d)

- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

Standard configuration H06:

- Three-phase non-directional overcurrent protection with two stages
- Three-phase overvoltage protection with two stages
- Three-phase undervoltage protection with two stages
- Residual overvoltage protection with three stages
- Underfrequency or overfrequency protection with two stages

- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Three phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs
Features (cont’d)

**Standard configuration H07:**
- Three-phase non-directional overcurrent protection with three stages
- Non-directional earth-fault protection with two stages
- Directional earth-fault protection with two stages
- Three-phase overvoltage protection with two stages
- Three-phase undervoltage protection with two stages
- Underfrequency or overfrequency protection with one stage
- Negative phase sequence (NPS) protection with two stages
- Three-phase motor start-up supervision
- Three-phase thermal overload protection for devices
- Phase reversal protection
- Phase sequence voltage protection
- Fuse failure protection
- Three-phase non-directional undervoltage protection with one stage
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Neutral current measurement
- Three-phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit breaker failure protection (CBFP) function
- Circuit breaker control with indication
- Operation time counter
- Lockout function
- Object indication

**Standard configuration H08:**
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

![Fig. 11 Block diagram of H07](image-url)
Features (cont’d)

- Three-phase current measurement
- Neutral current measurement
- Three phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

Standard configuration H09:

- Three-phase non-directional overcurrent protection with three stages
- Non-directional earth-fault protection with three stages
- Three-phase overvoltage protection with two stages
- Three-phase undervoltage protection with two stages
- Residual overvoltage protection with three stages
- Three-phase transformer inrush and motor start-up current detector
- Underfrequency or overfrequency protection with two stages
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement
- Three-phase current measurement
- Automatic reclosing 1…5 shots
- Neutral current measurement
- Three phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

Note! The standard configuration H08 is available only with the voltage transformer (VT) HW version. VTs are used to measure phase-to-earth voltages.
Features (cont’d)

- Three-phase current measurement
- Neutral current measurement
- Three-phase voltage measurements
- Residual voltage measurement
- System frequency measurement
- Three-phase power and energy measurement
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB)
- Transient disturbance recorder
- Trip-circuit supervision
- Delayed trip output for the circuit-breaker failure protection (CBFP) function
- Automatic reclosing 1...5 shots
- Circuit breaker control with indication
- Lockout function
- Object indication
- Logic control position selector
- User-configurable I/Os
- Interlocking
- User-configurable alarm LEDs

Note! The standard configuration H09 is available only with the voltage transformer (VT) HW version. VTs are used to measure phase-to-earth voltages.

Standard configuration H50:
- Three-phase non-directional overcurrent protection with three stages.
- Three-phase directional overcurrent protection with two stages
- Directional earth-fault protection with two stages
- Non-directional earth-fault protection with two stages
- Three-phase overvoltage protection with two stages
- Three-phase undervoltage protection with two stages
- Residual overvoltage protection with two stages
- Three-phase transformer inrush and motor start-up current detector
- Underfrequency or overfrequency protection with two stages
- Phase-sequence voltage protection
- Supervision function for energizing current input circuit
- Supervision function for energizing voltage input circuit
- Current waveform distortion measurement
- Voltage waveform distortion measurement

Note! The standard configuration H50 is available only with the voltage transformer (VT).
Features (cont’d)  

**Standard configuration H51:**

- Three-phase non-directional overcurrent protection with three stages.
- Three-phase directional overcurrent protection with one stage.
- Non-directional earth-fault protection with two stages.
- Directional earth-fault protection with two stages.
- Three-phase overvoltage protection with one stage.
- Three-phase undervoltage protection with one stage.
- Underfrequency or overfrequency protection with two stages.
- Negative phase-sequence (NPS) protection with one stage.
- Three-phase motor start-up supervision.
- Three-phase thermal overload protection for devices.
- Residual overvoltage protection with one stage.
- Phase-sequence voltage protection.
- Fuse-failure protection.
- Three-phase non-directional undervoltage protection with one stage.
- Supervision function for energizing current input circuit.
- Supervision function for energizing voltage input circuit.
- Current waveform distortion measurement.
- Voltage waveform distortion measurement.
- Three-phase current measurement.
- Neutral current measurement.
- Three-phase voltage measurements.
- Residual voltage measurement.
- System frequency measurement.
- Three-phase power and energy measurement.
- Calculation of the accumulated electric breaker wear of the circuit breaker (CB).
- Transient disturbance recorder.
- Trip-circuit supervision.
- Delayed trip output for the circuit breaker failure protection (CBFP) function.
- Circuit breaker control with indication.
- Operation time counter.
- Lockout function.
- Object indication.
- Logic control position selector.
- User-configurable I/Os.
- Interlocking.
- User-configurable alarm LEDs.

*Note! The standard configuration H51 is available only with the voltage transformer (VT).*
Several standard configurations are available for the protection relay. Refer to the REX 521 "Technical Reference Manual, Standard Configurations" for more detailed information.

The B01 standard configuration for REX 521 is designed to be used in single busbar systems using one circuit breaker for selective short-circuit, time overcurrent and earth-fault protection of radial isolated neutral networks, solidly earthed networks, resistant earthed networks and resonant earthed networks.

The B02 standard configuration is designed to be used in single busbar systems using one circuit breaker for selective short-circuit protection, time-overcurrent protection, earth-fault protection and automatic reclosing. The configuration can be used in different types of networks such as radial isolated neutral networks, solidly earthed networks, resistant earthed networks and resonant earthed networks.

The M01 standard configuration is designed to be used in single busbar systems using one circuit breaker for selective short-circuit, time overcurrent and directional earth-fault protection of radial isolated neutral networks, solidly earthed networks, resistant earthed networks and resonant earthed networks.

The M02 standard configuration is designed to be used in single busbar systems using one circuit breaker for selective short-circuit protection, time-overcurrent protection, directional earth-fault protection and automatic reclosing. The configuration can be used in different types of networks such as of radial isolated neutral networks, solidly earthed networks, resistant earthed networks and resonant earthed networks.

The H01 standard configuration is designed to be used in single busbar systems using one circuit breaker for selective directional and non-directional short-circuit protection, directional time-overcurrent protection, directional earth-fault protection and automatic reclosing with syncro- and voltage-check functionality.

The H02 standard configuration is designed to be used in single busbar systems using one circuit breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, non-directional earth-fault protection and automatic reclosing.

The H03 standard configuration is designed to be used in single busbar systems using one circuit breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, directional earth-fault protection and automatic reclosing with syncro- and voltage-check functionality.

The H04 standard configuration is designed to be used in single busbar systems using one circuit-breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, directional and non-directional earth-fault protection and automatic reclosing.

The H05 standard configuration is designed to be used in single busbar systems using one circuit-breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, non-directional earth-fault protection, overvoltage protection, undervoltage protection, residual overvoltage protection and thermal overload protection for devices.

The H06 standard configuration is designed to be used in single busbar systems using one circuit-breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, overvoltage protection, undervoltage protection, residual overvoltage protection, underfrequency protection and overfrequency protection.

The H07 standard configuration is designed for protection of large or medium-size three-phase AC motors in circuit-breaker controlled motor drives. Due to the large number of protective functions integrated, the relay provides a complete protection against motor damage caused by electrical faults. The H07 configuration can also be applied to other objects needing thermal overload protection, such as power transformers. It can also be used in applications requiring overcurrent protection, under or overvoltage protection and/or directional or non-directional earth-fault protection.

The H08 standard configuration is designed to be used in single busbar systems using one circuit-breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, non-directional earth-fault protection, overvoltage protection, undervoltage protection, residual overvoltage protection and thermal overload protection for devices. The protection is based on...
phase-to-earth voltages. In addition, phase-to-phase voltages are available in the measurement view.

The H09 standard configuration for REX 521 is designed to be used in single busbar systems using one circuit breaker for selective non-directional short-circuit protection, non-directional time-overcurrent protection, non-directional earth-fault protection, overvoltage protection, undervoltage protection, residual overvoltage protection, underfrequency protection, overfrequency protection and automatic reclosing.

The H50 standard configuration for REX 521 is designed to be used in single busbar systems by using one circuit breaker for selective non-directional short-circuit protection, directional and non-directional time-overcurrent protection, directional and/or non-directional earth-fault protection, overvoltage protection, undervoltage protection, residual overvoltage protection, overvoltage protection, underfrequency protection and/or overfrequency protection.

The H51 standard configuration for REX 521 is designed for protection of large or medium-size three-phase AC motors in circuit breaker controlled motor drives. Due to the large number of protective functions integrated, the relay provides a complete protection against motor damage caused by electrical faults.

The H51 configuration can be applied to other objects that need the thermal overload protection (such as power transformers). It can also be used in applications requiring overcurrent protection, directional overcurrent protection, under/overvoltage protection, directional or non-directional earth-fault protection, underfrequency protection and/or overfrequency protection.
**Design, hardware**

Different hardware versions of REX 521 are shown in the table below.

**Table 1: REX 521 hardware versions**

<table>
<thead>
<tr>
<th>Relay type</th>
<th>REX 521</th>
</tr>
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<tbody>
<tr>
<td>Version name</td>
<td>Basic</td>
</tr>
<tr>
<td>REX521xBxxx</td>
<td>1</td>
</tr>
<tr>
<td>REX521xMxxx</td>
<td>4</td>
</tr>
<tr>
<td>REX521xHxxx</td>
<td>1</td>
</tr>
<tr>
<td>REX521xSxxx</td>
<td>1</td>
</tr>
</tbody>
</table>

**Transformer modules (MIM)**

- 1

**Transformers**

- Current transformers 1/5 A
  - 4
- Current transformers 0.2/1 A
  - 1
- Voltage transformers 100 V
  - 1

**Sensor channels**

- Current sensor inputs
  - 3
- Voltage sensor inputs
  - 3

**Main CPU modules**

- 1

**CPU_SP (SPA/ IEC plastic)**

**CPU_SG (SPA/ IEC glass)**

**CPU_LP (SPA/ IEC/ LON plastic)**

**CPU_LG (SPA/ IEC/ LON glass)**

**Power supply modules**

- 1

**PS_87H (Dltresh.=80 VDC)**

**PS_87L (Dltresh.=18 VDC)**

**Display module**

- 1

- 1

- 1

- 1

**Digital inputs**

- 9

**High-speed power outputs**

- 1

**Power outputs (PO)**

- 3

**Signalling outputs (SO)**

- 2

**IRF outputs**

- 1

**Trip-circuit supervision (TCS)**

- 1
**Design, software**

Functionality is available as part of the standard configurations B01, B02, M01, M02, H01, H02, H03, H04, H05, H06, H07, H08, H09, H50 and H51.

Functions available for use in the different standard configurations are listed below.

**Table 2: Standard configurations for REX 521**

<table>
<thead>
<tr>
<th>HW versions</th>
<th>Standard configurations</th>
<th>Basic</th>
<th>Medium</th>
<th>High/Sensor</th>
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</thead>
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<td>B02</td>
<td>M01</td>
<td>M02</td>
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<td>ANSI device number</td>
<td>FB name (CD-ROM)</td>
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<td>x</td>
</tr>
<tr>
<td>f1</td>
<td>81-1</td>
<td>Freq1St1</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>f2</td>
<td>81-2</td>
<td>Freq1St2</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>SYNC1</td>
<td>25-1</td>
<td>SCVCSt1</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ls2t n&lt;</td>
<td>48</td>
<td>MotStart</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3I()</td>
<td>46R</td>
<td>PREV3</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>i2&gt;</td>
<td>46-1</td>
<td>NPS3Low</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>i2&gt;&gt;</td>
<td>46-2</td>
<td>NPS3High</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3I&lt;</td>
<td>37-1</td>
<td>NUC3St1</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>FUSEF</td>
<td>60</td>
<td>FuseFail</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3ithdev&gt;</td>
<td>49M/G/T</td>
<td>Tol3Dev</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>U1U2&lt;&gt;1</td>
<td>47-1</td>
<td>PSV3St1</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**Control functions**

| I<->O CB1 | COCB1 | COCB1 | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| I<->O IND1 | COIND1 | COIND1 | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| I<->O IND2 | COIND2 | COIND2 | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
### Table 2: Standard configurations for REX 521 (continued)

<table>
<thead>
<tr>
<th>HW versions</th>
<th>Basic</th>
<th>Medium</th>
<th>High/Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard configurations</td>
<td>B01</td>
<td>B02</td>
<td>M01</td>
</tr>
<tr>
<td>IEC symbol</td>
<td>ANSI device number</td>
<td>FB name (CD-ROM)</td>
<td></td>
</tr>
<tr>
<td>I&lt;-&gt;O 3IND3</td>
<td>COIND3</td>
<td>COIND3</td>
<td>x&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>I&lt;-&gt;O POS</td>
<td>COLOCAT</td>
<td>COLOCAT</td>
<td>x</td>
</tr>
<tr>
<td>ALARM1-8</td>
<td>ALARM1-8</td>
<td>MMIALAR1-8</td>
<td>x</td>
</tr>
</tbody>
</table>

**Measurement**

- 3I: MECU3A
- Io: MECU1A
- Uo: MEVO1A
- DREC: MEDREC
- 3U: MEVO3A
- 3U_B: MEVO3B
- PQ: MEPE7
- AI1: MEAI1

**Condition monitoring**

- CB wear1: CMBWEAR1
- TCS1: CMTC51
- MCS 3I: CMCU3
- MCS 3U: CMVO3
- TIME1: CMTIME1

**Power quality monitoring**

- PQ 3Inf: PQCU3H
- PQ 3Unf: PQVO3H

**Standard**

- SWGRP | SWGRP | SWGRP | x | x | x | x | x | x | x | x | x | x | x | x | x |

<sup>1</sup>H01 available only as sensor version

<sup>2</sup>Available only as VT version

<sup>3</sup>VTs are used to measure phase-to-earth voltages, calculated phase-to-phase voltages are shown by 3U_B

<sup>4</sup>Configured fixedly to the Io (1/5 A) channel or Ios if selected

<sup>5</sup>Can be used as Io>, Io>>> or Uo>, Uo>>> and Uo>>> function block with some limitations

<sup>6</sup>3I>>> and 3I>>>> cannot be set to operate as 3I>, 3I>> or 3I>>> for more information, see REX 521 Technical Reference Manual, Standard Configurations.

Note: Calculated Uo (Uos) is used in the Sensor versions of H01 and H03 configurations. Calculated Io (IoS) is available in H01-H05, H08, H09 and H50 configurations.
## Technical data

### Table 3: Energizing inputs

<table>
<thead>
<tr>
<th>Rated frequency</th>
<th>50.0/60.0 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current inputs</strong></td>
<td></td>
</tr>
<tr>
<td>rated current</td>
<td>0.2 A/1 A/5 A</td>
</tr>
<tr>
<td><strong>Thermal withstand capability</strong></td>
<td></td>
</tr>
<tr>
<td>continuously</td>
<td>1.5 A/4 A/20 A</td>
</tr>
<tr>
<td>for 1 s</td>
<td>20 A/100 A/500 A</td>
</tr>
<tr>
<td>dynamic current withstand, half-wave value</td>
<td>50 A/250 A/1250 A</td>
</tr>
<tr>
<td>input impedance</td>
<td>&lt;750 mΩ/100 mΩ/20 mΩ</td>
</tr>
<tr>
<td><strong>Voltage inputs</strong></td>
<td></td>
</tr>
<tr>
<td>rated voltage</td>
<td>100 V/110 V/115 V/120 V (parametrization)</td>
</tr>
<tr>
<td>voltage withstand, continuous</td>
<td>2 x U_n (240 V)</td>
</tr>
<tr>
<td>burden at rated voltage</td>
<td>&lt;0.5 VA</td>
</tr>
<tr>
<td><strong>Sensor inputs</strong></td>
<td></td>
</tr>
<tr>
<td>voltage range RMS</td>
<td>9.4 V RMS</td>
</tr>
<tr>
<td>voltage range peak</td>
<td>± 12 V</td>
</tr>
<tr>
<td>input impedance</td>
<td>&gt;4.7 MΩ</td>
</tr>
<tr>
<td>input capacitance</td>
<td>&lt;1 nF</td>
</tr>
</tbody>
</table>

### Table 4: Auxiliary power supplies

<table>
<thead>
<tr>
<th>Type</th>
<th>PS_87H (REX521xxHxx)</th>
<th>PS_87L (REX521xxLxx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage, AC</td>
<td>110/120/220/240 V</td>
<td>-</td>
</tr>
<tr>
<td>Input voltage, DC</td>
<td>110/125/220 V</td>
<td>24/48/60 V</td>
</tr>
<tr>
<td>Voltage variation</td>
<td>AC 85…110%, DC 80…120% of rated value</td>
<td>DC 80…120% of rated value</td>
</tr>
<tr>
<td>Burden</td>
<td>&lt;20 W</td>
<td></td>
</tr>
<tr>
<td>Ripple in DC auxiliary voltage</td>
<td>max. 12% of the rated DC value (IEC 60255-11)</td>
<td></td>
</tr>
<tr>
<td>Interruption time in auxiliary DC voltage without resetting</td>
<td>&lt;40 ms, 110 V</td>
<td>&lt;15 ms, 24 V</td>
</tr>
<tr>
<td></td>
<td>&lt;100 ms, 200 V</td>
<td>&lt;50 ms, 48 V</td>
</tr>
<tr>
<td>Interruption time in auxiliary DC voltage without resetting</td>
<td>&lt;40 ms, 110 V</td>
<td>&lt;15 ms, 24 V</td>
</tr>
<tr>
<td></td>
<td>&lt;100 ms, 200 V</td>
<td>&lt;50 ms, 48 V</td>
</tr>
<tr>
<td>Internal overtemperature indication</td>
<td>+78°C (+75…+83°C)</td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Digital inputs

<table>
<thead>
<tr>
<th>Type</th>
<th>PS_87H (REX521xxHxx)</th>
<th>PS_87L (REX521xxLxx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating range, DC</td>
<td>80…265 V DC (for DI9 18…265 V)</td>
<td>18…265 V</td>
</tr>
<tr>
<td>Input voltage, DC</td>
<td>110/125/220 V (for DI9 also 24/48/60 V)</td>
<td>24/48/60/110/125/220 V</td>
</tr>
<tr>
<td>Current drain</td>
<td>~2…25 mA</td>
<td>&lt;0.8 W</td>
</tr>
<tr>
<td>Power consumption/input</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Signal outputs

<table>
<thead>
<tr>
<th>Max system voltage</th>
<th>250 V AC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous carry</td>
<td>5 A</td>
</tr>
<tr>
<td>Make and carry for 0.5 s</td>
<td>10 A</td>
</tr>
<tr>
<td>Make and carry for 3 s</td>
<td>8 A</td>
</tr>
<tr>
<td>Breaking capacity when control circuit time-constant L/R &lt;40 ms, at 48/110/220 V DC</td>
<td>1 A/0.25 A/0.15 A</td>
</tr>
</tbody>
</table>

Table 7: Power outputs

<table>
<thead>
<tr>
<th>Max system voltage</th>
<th>250 V AC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous carry</td>
<td>5 A</td>
</tr>
<tr>
<td>Make and carry for 0.5 s</td>
<td>30 A</td>
</tr>
<tr>
<td>Make and carry for 3 s</td>
<td>15 A</td>
</tr>
<tr>
<td>Breaking capacity when control circuit time-constant L/R &lt;40 ms, at 48/110/220 V DC</td>
<td>5 A/3 A/1 A</td>
</tr>
<tr>
<td>Minimum contact load</td>
<td>100 mA, 24 V AC/DC (2.4 VA)</td>
</tr>
<tr>
<td>TCS (Trip-circuit supervision)</td>
<td>Control voltage range</td>
</tr>
<tr>
<td></td>
<td>Current drain through the supervision circuit</td>
</tr>
<tr>
<td></td>
<td>Minimum voltage (threshold) over a contact</td>
</tr>
</tbody>
</table>
## Table 8: Environmental conditions

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specified service temperature range</td>
<td>-10…+55°C</td>
</tr>
<tr>
<td>Transport and storage temperature range</td>
<td>-40…+70°C</td>
</tr>
<tr>
<td>Enclosure class</td>
<td></td>
</tr>
<tr>
<td>Front side, flush-mounted</td>
<td>IP 54</td>
</tr>
<tr>
<td>Rear side, connection terminals</td>
<td>IP 20</td>
</tr>
<tr>
<td>Dry heat test</td>
<td>according to IEC 60068-2-2</td>
</tr>
<tr>
<td>Dry cold test</td>
<td>according to IEC 60068-2-1</td>
</tr>
<tr>
<td>Damp heat test, cyclic</td>
<td>according to IEC 60068-2-30, r.h. &gt;93%, T = 25…55°C</td>
</tr>
<tr>
<td>Storage temperature tests</td>
<td>according to IEC 60068-2-48</td>
</tr>
</tbody>
</table>

## Table 9: Standard tests

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Description</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation tests</td>
<td>Dielectric test</td>
<td>IEC 60255-5</td>
</tr>
<tr>
<td></td>
<td>Test voltage</td>
<td>2 kV, 50 Hz, 1 min.</td>
</tr>
<tr>
<td></td>
<td>Impulse voltage test</td>
<td>IEC 60255-5</td>
</tr>
<tr>
<td></td>
<td>Test voltage</td>
<td>5 kV, unipolar impulses, waveform 1.2/50 μs, source energy 0.5 J</td>
</tr>
<tr>
<td></td>
<td>Insulation resistance measurements</td>
<td>IEC 60255-5</td>
</tr>
<tr>
<td></td>
<td>Insulation resistance</td>
<td>&gt; 100 MΩ, 500 V DC</td>
</tr>
<tr>
<td>Mechanical tests</td>
<td>Vibration tests (sinusoidal)</td>
<td>IEC 60255-21-1, class I</td>
</tr>
<tr>
<td></td>
<td>Shock and bump test</td>
<td>IEC 60255-21-2, class I</td>
</tr>
<tr>
<td></td>
<td>Seismic test</td>
<td>IEC 60255-21-3, class 2</td>
</tr>
</tbody>
</table>
### Table 10: Electromagnetic compatibility tests

The EMC immunity test level fulfills the requirements listed below:

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Description</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MHz burst disturbance test, class III</td>
<td>common mode</td>
<td>2.5 kV</td>
</tr>
<tr>
<td></td>
<td>differential mode</td>
<td>1.0 kV</td>
</tr>
<tr>
<td>Electrostatic discharge test, class III</td>
<td>for contact discharge</td>
<td>6 kV</td>
</tr>
<tr>
<td></td>
<td>for air discharge</td>
<td>8 kV</td>
</tr>
<tr>
<td>Radio frequency interference test</td>
<td>conducted, common mode</td>
<td>10 V (rms), f = 150 kHz...80 MHz</td>
</tr>
<tr>
<td></td>
<td>radiated, amplitude-modulated</td>
<td>10 V/m (rms), f = 80...1000 MHz</td>
</tr>
<tr>
<td></td>
<td>radiated, pulse-modulated</td>
<td>10 V/m, f = 900 MHz</td>
</tr>
<tr>
<td>Fast transient disturbance test</td>
<td>power supply</td>
<td>4 kV</td>
</tr>
<tr>
<td></td>
<td>I/O ports</td>
<td>2 kV</td>
</tr>
<tr>
<td>Surge immunity test</td>
<td>power supply</td>
<td>2 kV, common mode</td>
</tr>
<tr>
<td></td>
<td>I/O ports</td>
<td>1 kV, differential mode</td>
</tr>
<tr>
<td>Power frequency (50 Hz) magnetic field</td>
<td>100 A/m continuous</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 A/m 1 to 3 s</td>
<td></td>
</tr>
<tr>
<td>Voltage dips and short interruptions</td>
<td>30%, 10 ms; 60%, 100 ms; 60%, 1000 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;90%, 5000 ms</td>
<td></td>
</tr>
<tr>
<td>Electromagnetic emission tests</td>
<td>conducted RF emission (mains terminal)</td>
<td>EN 55011, class A, EN 60255-25</td>
</tr>
<tr>
<td></td>
<td>radiated RF emission</td>
<td>EN 55011, class A EN 60255-25</td>
</tr>
<tr>
<td>CE approval</td>
<td>Complies with the EMC directive 89/336/EEC and the LV directive 73/23/EEC.</td>
<td>EN 50263 EN 50081-2 EN 61000-6-2 EN 60255-6</td>
</tr>
</tbody>
</table>
Table 11: Data communication

<table>
<thead>
<tr>
<th>Rear interface, connector X3.2 and X3.3</th>
<th>Fibre-optic interface</th>
</tr>
</thead>
</table>
| protocol                               | SPA, IEC_103, Modbus, DNP 3.0  
Also LON in the REX 521 xxxxL versions. |
| protocols                              | IEC 61850 and SPA TCP/IP |

Using SPA-ZC 402 SPA/Ethernet adapter:

<table>
<thead>
<tr>
<th>Rear interface, connector X3.1:9,10</th>
<th>RS-485 connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>protocols</td>
<td>SPA, Modbus, DNP 3.0</td>
</tr>
</tbody>
</table>

Using SPA-ZC 302 Profibus-DPV1/SPA Gateway:

<table>
<thead>
<tr>
<th>Front panel</th>
<th>optical RS 232 connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>protocol</td>
<td>SPA</td>
</tr>
<tr>
<td>communication cable</td>
<td>1MCK 950001-2</td>
</tr>
</tbody>
</table>

SPA protocol

<table>
<thead>
<tr>
<th>baud rates</th>
<th>4.8/9.6/19.2 kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>start bits</td>
<td>1</td>
</tr>
<tr>
<td>data bits</td>
<td>7</td>
</tr>
<tr>
<td>parity</td>
<td>even</td>
</tr>
<tr>
<td>stop bits</td>
<td>1</td>
</tr>
</tbody>
</table>

IEC_103 protocol

<table>
<thead>
<tr>
<th>baud rates</th>
<th>9.6/19.2 kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>data bits</td>
<td>8</td>
</tr>
<tr>
<td>parity</td>
<td>even</td>
</tr>
<tr>
<td>stop bits</td>
<td>1</td>
</tr>
</tbody>
</table>

Modbus protocol

<table>
<thead>
<tr>
<th>baud rates</th>
<th>0.6/1.2/2.4/4.8/9.6/19.2 kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>data bits</td>
<td>7/8 (ASCII/RTU)</td>
</tr>
<tr>
<td>parity</td>
<td>no parity/odd/even</td>
</tr>
<tr>
<td>stop bits</td>
<td>1/2</td>
</tr>
<tr>
<td>Modbus modes</td>
<td>ASCII, RTU</td>
</tr>
</tbody>
</table>

DNP 3.0 protocol

<table>
<thead>
<tr>
<th>baud rates</th>
<th>0.3/0.6/1.2/2.4/4.8/9.6/19.2 kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>data bits</td>
<td>8</td>
</tr>
<tr>
<td>parity</td>
<td>no parity/odd/even</td>
</tr>
<tr>
<td>stop bits</td>
<td>1/2</td>
</tr>
</tbody>
</table>

LON protocol

<table>
<thead>
<tr>
<th>bit rates</th>
<th>78.0 kbps/1.25 Mbps</th>
</tr>
</thead>
</table>
### Technical data (cont’d)

#### Table 12: General

<table>
<thead>
<tr>
<th>Toolboxes</th>
<th>CAP 501, CAP 505, LIB 510, SMS 510</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>All events are recorded in higher level syntax: reason, time, date are in clear text format in the selected language. The last 50 events are recorded.</td>
</tr>
<tr>
<td>Data recording</td>
<td>Records operate values</td>
</tr>
<tr>
<td>Mechanical dimensions</td>
<td>Width: 148.8 mm (1/3 of a 19” rack) Height, frame: 265.9 mm (6U) Height, box: 249.8 mm Depth: 235 mm For dimension drawings, refer to Installation Manual (see “References” on page 32).</td>
</tr>
<tr>
<td>Weight of the unit</td>
<td>&lt;5 kg</td>
</tr>
</tbody>
</table>
Terminal diagram of the REX 521: Basic

*) Power flow direction
**:) The jumper is not assembled by default when the protection relay is delivered
Terminal diagram of the REX 521: Medium

*) Power flow direction
***) The jumper is not assembled by default when the protection relay is delivered
Terminal diagram of the REX 521: High, excluding H08 and H09

*) Power flow direction

**) Connected to U12b in H03

***) The jumper is not assembled by default when the protection relay is delivered
Terminal diagram of the REX 521: High, H08 and H09

*) Power flow direction
**) The jumper is not assembled by default when the protection relay is delivered
Terminal diagram of the REX 521: Sensor

*) Connected to U12b in H01S and H03S
**) The jumper is not assembled by default when the protection relay is delivered
Ordering information

When ordering REX 521 protection relays, specify the following:

- order number
- quantity
- additional language
- optional Chinese front panel (Order No: 2RC025000A0001)

Each protection relay has a specific order number that identifies the protection relay type as well as the hardware and the software as described in the figure below. The order number is labelled on the marking strip on the front panel of the relay delivered, for example, Order No: REX521GMHPMSM01G.

When ordering the additional language must be defined according to the table:

<table>
<thead>
<tr>
<th>Code</th>
<th>Language combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>FI</td>
<td>English-Finnish</td>
</tr>
<tr>
<td>SE</td>
<td>English-Swedish</td>
</tr>
<tr>
<td>DE</td>
<td>English-German</td>
</tr>
<tr>
<td>ES</td>
<td>English-Spanish</td>
</tr>
<tr>
<td>FR</td>
<td>English-French</td>
</tr>
<tr>
<td>PT</td>
<td>English-Portuguese</td>
</tr>
<tr>
<td>PL</td>
<td>English-Polish</td>
</tr>
<tr>
<td>ZH</td>
<td>English-Chinese</td>
</tr>
</tbody>
</table>

Accessories

Semi-flush mounting kit 1MRS050254
Wall mounting kit 1MRS050240

Rack mounting kits:

<table>
<thead>
<tr>
<th>Enclosure size (x 19’):</th>
<th>Mounting kit order number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 + 1/3</td>
<td>1MRS050241 and 1MRS050238</td>
</tr>
<tr>
<td>1/3</td>
<td>1MRS050258</td>
</tr>
<tr>
<td>1/3 + 1/3</td>
<td>1MRS050241 and 1MRS050377</td>
</tr>
<tr>
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<td>1MRS050241 (2 pcs) and 1MRS050381</td>
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<td>1MRS050609 and 1MRS050241</td>
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Connection cable for front panel connector 1MKC950001-2
**Configuration, setting and SA system tools**

The following tool versions are needed to support the new functions and features of Release Q1/2006 revisions of REX 521:

- CAP 501 Relay Configuration Tool; CAP 501 v.2.4.0 or later
- CAP 505 Relay Configuration Tool; CAP 505 v.2.4.0 or later
- LIB 500 Library for MicroSCADA Pro; LIB 500 v.4.2-1 or later
- LIB 510 Library for MicroSCADA Pro; LIB 510 v.4.2-1 or later
- SMS 510 v.1.3.0 or later
### References

**Manuals for REX 521**

- Installation Manual 1MRS750526-MUM
- Operator’s Manual 1MRS751107-MUM
- Technical Reference manual, General 1MRS751108-MUM
- Technical Descriptions of Functions (CD-ROM v. 2.10 or later) 1MRS750889-MCD
- Modbus Remote Communication Protocol for REX 521, Technical Description 1MRS755017
- DNP 3.0 Remote Communication Protocol for REF 54_, RET 54_ and REX 521, Technical Description 1MRS755260

**Parameter and event lists for REX 521**

- Parameter List for REX 521 1MRS751999-RTI
- Event List for REX 521 1MRS752000-RTI
- General Parameters for REX 521 1MRS752156-RTI
- Interoperability List for REX 521 1MRS752157-RTI

**Tool-specific manuals**

- CAP505 Installation and Commissioning Manual 1MRS751901-MEN
- CAP505 User’s Guide 1MRS752292-MEN
- CAP505 Protocol Mapping Tool Operator’s Manual 1MRS755277
- CAP501 Installation and Commissioning Manual 1MRS751899-MEN
- CAP501 User’s Guide 1MRS751900-MUM
- Tools for Relays and Terminals, User’s Guide 1MRS752008-MUM

For more information, see:
http://www.abb.com/substationautomation