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This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.openssl.org/)

This product includes cryptographic software written/developed by: Eric Young (eay@cryptsoft.com) and Tim Hudson (tjh@cryptsoft.com).

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Warranty

Please inquire about the terms of warranty from your nearest ABB representative.

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Disclaimer

The data, examples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties. All persons responsible for applying the equipment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. In particular, any risks in applications where a system failure and/or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsibility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks.

This document has been carefully checked by ABB but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commitments, in no event shall ABB be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.
Conformity

This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95/EC). This conformity is the result of tests conducted by ABB in accordance with the product standards EN 50263 and EN 60255-26 for the EMC directive, and with the product standards EN 60255-1 and EN 60255-27 for the low voltage directive. The product is designed in accordance with the international standards of the IEC 60255 series and ANSI C37.90. The DNP protocol implementation in the IED conforms to "DNP3 Intelligent Electronic Device (IED) Certification Procedure Subset Level 2", available at www.dnp.org.
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Section 1  Introduction

1.1  This manual

The installation manual contains instructions on how to install the IED. The manual provides procedures for mechanical and electrical installation. The chapters are organized in the chronological order in which the IED should be installed.

1.2  Intended audience

This manual addresses the personnel responsible for installing the product hardware. The installation personnel must have basic knowledge of handling electronic equipment.

1.3  Product documentation

1.3.1  Product documentation set

Figure 1: The intended use of manuals throughout the product lifecycle
The engineering manual contains instructions on how to engineer the IEDs using the various tools available within the PCM600 software. The manual provides instructions on how to set up a PCM600 project and insert IEDs to the project structure. The manual also recommends a sequence for the engineering of protection and control functions, LHMI functions as well as communication engineering for IEC 60870-5-103, IEC 61850 and DNP 3.0.

The installation manual contains instructions on how to install the IED. The manual provides procedures for mechanical and electrical installation. The chapters are organized in the chronological order in which the IED should be installed.

The commissioning manual contains instructions on how to commission the IED. The manual can also be used by system engineers and maintenance personnel for assistance during the testing phase. The manual provides procedures for the checking of external circuitry and energizing the IED, parameter setting and configuration as well as verifying settings by secondary injection. The manual describes the process of testing an IED in a substation which is not in service. The chapters are organized in the chronological order in which the IED should be commissioned. The relevant procedures may be followed also during the service and maintenance activities.

The operation manual contains instructions on how to operate the IED once it has been commissioned. The manual provides instructions for the monitoring, controlling and setting of the IED. The manual also describes how to identify disturbances and how to view calculated and measured power grid data to determine the cause of a fault.

The application manual contains application descriptions and setting guidelines sorted per function. The manual can be used to find out when and for what purpose a typical protection function can be used. The manual can also provides assistance for calculating settings.

The technical manual contains application and functionality descriptions and lists function blocks, logic diagrams, input and output signals, setting parameters and technical data, sorted per function. The manual can be used as a technical reference during the engineering phase, installation and commissioning phase, and during normal service.

The communication protocol manual describes the communication protocols supported by the IED. The manual concentrates on the vendor-specific implementations.

The point list manual describes the outlook and properties of the data points specific to the IED. The manual should be used in conjunction with the corresponding communication protocol manual.

### 1.3.2 Document revision history

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<td>-/March 2013</td>
<td>First release</td>
</tr>
<tr>
<td>A/October 2016</td>
<td>Minor corrections made</td>
</tr>
<tr>
<td>B/November 2019</td>
<td>Maintenance release - Updated safety information and bug corrections</td>
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## 1.3.3 Related documents

### Documents related to REB650

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<td>Technical manual</td>
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</tr>
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<td>Commissioning manual</td>
<td>1MRK 505 289-UUS</td>
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<td>Product Guide, configured</td>
<td>1MRK 505 290-BUS</td>
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<td>Type test certificate</td>
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</tr>
<tr>
<td>Application notes for Circuit Breaker Control</td>
<td>1MRG006806</td>
</tr>
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1.4 Symbols and conventions

1.4.1 Symbols

The electrical warning icon indicates the presence of a hazard which could result in electrical shock.

The warning icon indicates the presence of a hazard which could result in personal injury.

The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.

The information icon alerts the reader of important facts and conditions.
The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although warning hazards are related to personal injury, it is necessary to understand that under certain operational conditions, operation of damaged equipment may result in degraded process performance leading to personal injury or death. It is important that the user fully complies with all warning and cautionary notices.

### 1.4.2 Document conventions

- Abbreviations and acronyms in this manual are spelled out in the glossary. The glossary also contains definitions of important terms.
- Push button navigation in the LHMI menu structure is presented by using the push button icons.
  
  For example, to navigate between the options, use 🔺 and 🔻.
- HMI menu paths are presented in bold.
  
  For example, select **Main menu/Settings**.
- LHMI messages are shown in Courier font.
  
  For example, to save the changes in non-volatile memory, select Yes and press 🔄.
- Parameter names are shown in italics.
  
  For example, the function can be enabled and disabled with the *Operation* setting.
- Each function block symbol shows the available input/output signal.
  
  - the character ^ in front of an input/output signal name indicates that the signal name may be customized using the PCM600 software.
  - the character * after an input/output signal name indicates that the signal must be connected to another function block in the application configuration to achieve a valid application configuration.
- Dimensions are provided both in inches and mm. If it is not specifically mentioned then the dimension is in mm.
Section 2 Safety information

2.1 Symbols on the product

All warnings must be observed.

Read the entire manual before doing installation or any maintenance work on the product.

Class 1 Laser product. Take adequate measures to protect your eyes and do not view directly with optical instruments.

2.2 Warnings

Observe the warnings during all types of work related to the product.

Only electrically skilled persons with the proper authorization and knowledge of any safety hazards are allowed to carry out the electrical installation.

National and local electrical safety regulations must always be followed. Working in a high voltage environment requires serious approach to avoid human injuries and damage to equipment.

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

Always use suitable isolated test pins when measuring signals in open circuitry. Potentially lethal voltages and currents are present.
Never connect or disconnect a wire and/or a connector to or from an IED during normal operation. Hazardous voltages and currents are present that may be lethal. Operation may be disrupted and IED and measuring circuitry may be damaged.

Dangerous voltages can occur on the connectors, even though the auxiliary voltage has been disconnected.

Always connect the IED to protective ground, regardless of the operating conditions. This also applies to special occasions such as bench testing, demonstrations and off-site configuration. This is class 1 equipment that shall be grounded.

Never remove any screw from a powered IED or from a IED connected to powered circuitry. Potentially lethal voltages and currents are present.

Take adequate measures to protect the eyes. Never look into the laser beam.

### 2.3 Caution signs

Whenever changes are made in the IED, measures should be taken to avoid inadvertent tripping.

The IED contains components which are sensitive to electrostatic discharge. ESD precautions shall always be observed prior to touching components.

Always transport PCBs (modules) using certified conductive bags.

Do not connect live wires to the IED. Internal circuitry may be damaged.
Always use a conductive wrist strap connected to protective ground when replacing modules. Electrostatic discharge (ESD) may damage the module and IED circuitry.

Take care to avoid electrical shock during installation and commissioning.

Changing the active setting group will inevitably change the IEDs operation. Be careful and check regulations before making the change.

2.4 Note signs

Observe the maximum allowed continuous current for the different current transformer inputs of the IED. See technical data.
Section 3 Environmental aspects

3.1 Sustainable development

Sustainability has been taken into account from the beginning of the product design including the pro-environmental manufacturing process, long life time, operation reliability and disposing of the IED.

The choice of materials and the suppliers have been made according to the EU RoHS directive (2002/95/EC). This directive limits the use of hazardous substances which are the following:

Table 1: Maximum concentration values by weight per homogeneous material

<table>
<thead>
<tr>
<th>Substance</th>
<th>Proposed maximum concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead - Pb</td>
<td>0.1%</td>
</tr>
<tr>
<td>Mercury - Hg</td>
<td>0.1%</td>
</tr>
<tr>
<td>Cadmium - Cd</td>
<td>0.01%</td>
</tr>
<tr>
<td>Hexavalent Chromium Cr (VI)</td>
<td>0.1%</td>
</tr>
<tr>
<td>Polybrominated biphenyls - PBB</td>
<td>0.1%</td>
</tr>
<tr>
<td>Polybrominated diphenyl ethers - PBDE</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Operational reliability and long life time have been assured with extensive testing during the design and manufacturing processes. Moreover, long life time is supported by maintenance and repair services as well as by the availability of spare parts.

Design and manufacturing have been done under a certified environmental system. The effectiveness of the environmental system is constantly evaluated by an external auditing body. We follow environmental rules and regulations systematically to evaluate their effect on our products and processes.

3.2 Disposing of the IED

Definitions and regulations of hazardous materials are country-specific and change when the knowledge of materials increases. The materials used in this product are typical for electric and electronic devices.

All parts used in this product are recyclable. When disposing of an IED or its parts contact a local waste handler who is authorized and specialized in disposing electronic waste. These handlers can sort the material by using dedicated sorting processes and dispose of the product according to the local requirements.
### Table 2: Materials of the IED parts

<table>
<thead>
<tr>
<th>IED</th>
<th>Parts</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>Metallic plates, parts and screws</td>
<td>Steel</td>
</tr>
<tr>
<td></td>
<td>Plastic parts</td>
<td>PC(^1), LCP(^2)</td>
</tr>
<tr>
<td></td>
<td>LHMI display module</td>
<td>Various</td>
</tr>
<tr>
<td>Package</td>
<td>Box</td>
<td>Cardboard</td>
</tr>
<tr>
<td>Attached material</td>
<td>Manuals</td>
<td>Paper</td>
</tr>
</tbody>
</table>

1) Polycarbonate  
2) Liquid crystal polymer
Section 4 Unpacking, inspecting and storing

4.1 Removing transport packaging

IEDs require careful handling.

1. Examine the delivered products to ensure that they have not been damaged during the transport.
2. Remove the transport packing carefully without force.

   The cardboard packaging material is 100% recyclable.

4.2 Inspecting the product

4.2.1 Identifying the product

1. Locate the IED's order number from the label attached to the IED's case.
2. Compare the IED's order number with the ordering information to verify that the received product is correct.

4.2.2 Checking delivery items

Check that all items are included in the delivery in accordance with the delivery documents.

4.2.3 Inspecting the IED

IEDs require careful handling before installation on site.

- Check the IED to see if any damage occurred during transportation.

If the IED has damaged during transportation, make a claim against the transport contractor, and notify the local ABB representative.

4.2.4 Returning an IED damaged in transit

If damage has occurred during transport, appropriate actions must be taken against the latest carrier. Please inform the nearest ABB office or representative. Notify ABB immediately if there are any discrepancies in relation to the delivery documents.
4.3 Storing

If the IED is stored before installation, it must be done in the original transport casing in a dry and dust free place in accordance with ANSI C37.90.0. Observe the environmental requirements stated in the technical manual.
Section 5 Mounting

5.1 Required tools

Use Torx TX10 and TX15 screwdrivers when attaching the mounting kits to the IED.

5.2 Checking environmental conditions and mounting space

The mechanical and electrical environmental conditions at the installation site must be within the limits described in the technical manual.

- Avoid installation in dusty, damp places.
  Avoid places susceptible to rapid temperature variations, powerful vibrations and shocks, surge voltages of high amplitude and fast rise time, strong induced magnetic fields or similar extreme conditions.
- Check that sufficient space is available.
  Sufficient space is needed at the front and rear of the IED to allow access to wires and optical fibers and to enable maintenance and future modifications.
- Ensure that IED is installed in an area that is accessible only by electrically skilled person or electrically instructed person with proper authorization and knowledge of safety hazards.

5.3 Mounting the IED

5.3.1 Rack mounting the IED

5.3.1.1 Rack mounting a single 3U IED

1. Attach the mounting brackets to both ends of the IED using the required screws.
Figure 2: Mounting the brackets

1. Mounting brackets
2. Screws

2. Tighten the screws.
3. Mount the IED with the rack mounting panels to the 19" rack.
4. Tighten the screws.

Figure 3: Rack mounted 3U IED

A 8.82 inches (224 mm) + 0.47 inches (12 mm) with ring-lug connector
B 1 inch (25.5 mm)
C 19 inches (482 mm)
D 5.20 inches, 3U (132 mm)
Check the allowed minimum bending radius from the optical cable manufacturer.

5.3.2 Arranging ventilation

Ventholes are located at the bottom and on the back plate of the IED. Reserve sufficient space round the IED to ensure adequate ventilation.

- Reserve at least 2U below and above the unit.
- Reserve for rack mount approximately 10 cm behind the unit, measured from the surface of the cover.
- Ensure sufficient space for the wiring and the installation of cable ducts.
Section 6 Connecting

6.1 Required tools

Only use a screwdriver and insert bits for slotted 9/64 inch (Nr.1 / 3.5 mm) blade when handling CT/VT terminals of screw-compression type and slotted 3/16 inch (4.5 mm) blade when handling CT/VT terminals of ring-lug type.

6.2 Connecting wires

All connections are made on the rear of the case. No soldering is needed.

1. Connect each signal connector terminal with one 14 or 16 AWG wire. Use 12 or 14 Gauge wire for CB trip circuit.
2. Connect each ring-lug terminal for CTs/VTs with one 12 AWG wire.
3. Connect terminals on the communication module for IRIG-B with one 28–18 AWG wire.
4. Connect terminals on the communication module for EIA-485 with one 28–18 AWG wire.

See the technical manual for product-specific terminal diagrams.

6.2.1 Connecting screw-compression type wires

Terminal blocks of screw-compression type are used for electrical connections.

1. Open the screw terminal before inserting a wire into it for the first time. To open the screw terminal, turn the fixing screw anti-clockwise until the terminal hole is wide open (the inside of the terminal hole is surrounded by metal).
2. Insert the wire and turn the fixing screw clockwise until the wire is firmly fixed.

6.2.2 Connecting ring-lug type wires

Ring-lug type insulated terminal can be used for signal connectors and I/O connectors. The maximum outside diameter for the M4 ring-lug type terminals is 9 mm. The maximum outside diameter for the M3 ring-lug type signal terminals is 8 mm. Select ring-lugs suitable to wiring dimension and size of terminal point.
6.3  Connecting protective grounding

Connect the IED to ground using a 6 Gauge flat copper cable. Use an ground lead maximum 59.06 inches (1500 mm). Notice that extra length is required for door mounting.

1. Loosen the nut from the protective ground pin to connect a separate ground protection lead.

   ![Figure 4: The protective ground pin is located to the left of connector X101 on the 3U full 19" case](image)

   Ground IED must have its own ground lead connected to the ground circuit connector.

2. Connect the ground lead to the ground bar.
3. Thread the copper cable on the protective ground pin.
4. Tighten the nut on the protective ground pin.
5. Support the ground lead so that it cannot break or weaken. Observe the situations for mechanical, chemical or electrochemical conditions.

6.4  Connecting analog signals

A connection diagram is needed to connect the analog signals.

Use the compression type for CT/VT terminals.

The wires for the analog signals can be connected to the CT/VT terminals before the connector is connected to the IED.

The connector features an automatic short-circuit mechanism for the current terminals. Therefore, detaching the connector from the unit will not open the secondary circuit of the CT which otherwise could cause dangerously high voltages.

To avoid a mismatch between CT and VT connections the connectors are ‘pre-coded’.
6.4.1 Connecting current and voltage inputs

Connect the wires from the CTs to the correct device according to the phase order and the connection diagram. Each terminal for CTs is dimensioned for one 10 Gauge wire or for two wires of maximum 12 Gauge.

To help connecting the current and voltage inputs, the connector pair is marked with symbols. For a current input, the connector pair forms a circle. But in the case of a voltage input, the connector pair forms two half-circles.
Figure 7: CTVT connector symbols

1 VT symbol
2 CT symbol

Table 3: Analog input modules TRM

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<tr>
<th>Terminal</th>
<th>TRM 6I + 4U</th>
<th>TRM 8I + 2U</th>
<th>TRM 4I + 1I + 5U</th>
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<td>1/5A</td>
<td>100/220V</td>
<td>100/220V</td>
</tr>
<tr>
<td>X102-3, 4</td>
<td>100/220V</td>
<td>1/5A</td>
<td>100/220V</td>
<td>100/220V</td>
</tr>
<tr>
<td>X102-5, 6</td>
<td>100/220V</td>
<td>1/5A</td>
<td>100/220V</td>
<td>100/220V</td>
</tr>
<tr>
<td>X102-7, 8</td>
<td>100/220V</td>
<td>100/220V</td>
<td>100/220V</td>
<td>100/220V</td>
</tr>
<tr>
<td>X102-9, 10</td>
<td>100/220V</td>
<td>100/220V</td>
<td>100/220V</td>
<td>100/220V</td>
</tr>
</tbody>
</table>

Table 4: Analog input modules AIM

<table>
<thead>
<tr>
<th>Terminal</th>
<th>AIM 6I + 4U</th>
<th>AIM 4I + 1I + 5U</th>
</tr>
</thead>
<tbody>
<tr>
<td>X103-1, 2</td>
<td>1/5A</td>
<td>1/5A</td>
</tr>
<tr>
<td>X103-3, 4</td>
<td>1/5A</td>
<td>1/5A</td>
</tr>
<tr>
<td>X103-5, 6</td>
<td>1/5A</td>
<td>1/5A</td>
</tr>
<tr>
<td>X103-7, 8</td>
<td>1/5A</td>
<td>1/5A</td>
</tr>
<tr>
<td>X103-9, 10</td>
<td>1/5A</td>
<td>0.1/0.5A</td>
</tr>
<tr>
<td>X104-1, 2</td>
<td>1/5A</td>
<td>100/220V</td>
</tr>
<tr>
<td>X104-3, 4</td>
<td>100/220V</td>
<td>100/220V</td>
</tr>
</tbody>
</table>

Table continues on next page
See the connection diagrams for information on the analog input module variant included in a particular configured IED. The primary and secondary rated values of the primary VT’s and CT’s are set for the analog inputs of the IED.

6.4.2 Connecting IED with a test switch

- When the IED is used with a test switch, connect the current and voltage transformers directly to the switch.

6.5 Connecting power supply

When using power supply 110-250 VDC or 100-240 VAC, connect the IED’s auxiliary voltage to terminals X420-1 and X420-3. When using a DC supply, connect the positive lead to terminal X420-3.

When using power supply 48-125 VDC, the IED’s auxiliary voltage is connected to terminals X420-1 and X420-2 with the positive lead connected to terminal X420-2.

When using power supply 24-30 VDC, connect the IED’s auxiliary voltage to terminals X420-2 and X420-3.

Branch circuit protection must be provided in the power supply wiring to the IED, and if necessary it must be possible to disconnect manually from the power supply.

The permitted auxiliary voltage range is found from the IED sticker.

Connect the power supply to connector X420. Since connectors X420 and X319 are the same size; do not accidentally connect the power supply to connectors X319.

Insert only the corresponding male connector to the female connector. Inserting anything else (such as a measurement probe) may violate the female connector and prevent a proper electrical contact between the printed circuit board and the external wiring connected to the screw terminal block.
Connect the terminals on the auxiliary voltage connector correctly. Different power supplies use different terminals.

Damage may occur to the IED if the plug is accidentally inserted 180 degrees turned (upside down)
Before connecting communication channels, check that the HW module has the correct communication interfaces.

The optical fibres are very sensitive to handling. Do not bend them too sharply. The minimum curvature radius is 250 mm for the glass fibre cables. If cable straps are used to fix the cables, apply with loose fit.

Always hold the connector, never the cable, when connecting or disconnecting optical fibres. Do not twist, pull or bend the fibre. Invisible damage may increase the fibre attenuation of the optic signal deteriorating the communication quality. Strictly follow the instructions from the manufacturer for each type of optical cables/connectors.

See the technical manual for product-specific communication interfaces.

6.6 Connecting the communication channels

Figure 10: Connecting the auxiliary voltage connector
Section 7 Checking installation

7.1 Identifying hardware and software version

The information of hardware and software versions of the IED are available on the label attached on the case of the IED. There are also module labels that can be used to identify the different modules inside the IED (such as input-output cards and so on).

7.2 Checking mounting

Check that all fixing screws are tight and that all cables are connected.

7.3 Energizing the IED

Before connecting the auxiliary power, check that the terminal strip is wired and placed correctly. Remove the protective film from the top side of the unit. Check that there is no debris visible in the ventilation holes.

During the IED start-up all the LEDs are lit for a short period. After that it will be observed that:

• The Green Normal LED starts to flash
• The LCD lights up and starting... is displayed
• The main menu is displayed. A final steady green Normal LED indicates a successful start-up of the device.

If the self supervision of the IED detects a diagnostic error during the start-up process, the green Normal LED flashes and the internal fault code is displayed on the LCD screen. Note down the displayed code to be used as reference when contacting ABB technical support.

<table>
<thead>
<tr>
<th>Battery Supervision BATS</th>
<th>Logic</th>
<th>Led Battery</th>
<th>VS+ (output voltage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Battery</td>
<td>Output Ready</td>
<td>VS+ Supervision</td>
<td>VS+ Output</td>
</tr>
<tr>
<td>Active</td>
<td>Active 1</td>
<td>On &gt; 15.1 V</td>
<td>&gt; 33.5 V</td>
</tr>
<tr>
<td>Active</td>
<td>Off 0</td>
<td>&lt; 14.6 V</td>
<td>&lt; 33.5 V</td>
</tr>
<tr>
<td>Active</td>
<td>On 0</td>
<td>&gt; 15.1 V</td>
<td>&lt; 32.9 V</td>
</tr>
<tr>
<td>Active</td>
<td>Off 0</td>
<td>&lt; 14.6 V</td>
<td>&lt; 32.9 V</td>
</tr>
</tbody>
</table>
Section 8  Removing, repairing and exchanging

8.1  Product lifecycle

At some point of the product lifecycle, the IED will be upgraded to a next generation unit. When selecting the original product, already consider the upgrading and extension possibilities that the specific product offers for its whole lifecycle.

8.2  Checking IED information

The IED information includes detailed information about the device, such as version and serial number. To find the information navigate through the LHMI menus as indicated below:

1. Select Main Menu/Diagnostics/IED status.
2. Select a submenu with and .
3. Enter the selected submenu with .
4. Browse the information with and .

The Product identifiers submenu contains product related information including product type, serial number, order number, production date and SW version.

The Installed HW submenu contains information about the HW modules.

8.3  Removing the IED

Before removing the IED, make sure that auxiliary power is turned off and all wiring is disconnected.

For upgrade purposes the IED does not need to be removed. Before removing the IED check with your local ABB office if the IED can be upgraded.

8.4  Sending the IED for repair

In case of product problems, contact the nearest ABB office or representative for consultation and instructions.

8.5  Exchanging the IED

To exchange the IED with another identical unit, remove the IED and install the new one. Contact your local ABB for information about exchangeable units.
Check with your local ABB if the IED can be upgraded.
Section 9  Technical data

9.1  Case and HMI display variants

9.1.1  Front side of the IED

The LHMI includes a monochrome LCD of 320x240 pixels.

9.1.2  Rear side of the IED

Figure 11:  Front view of 3U full 19” IED

Figure 12:  Rear view of 3U full 19” with ring lug terminals COM05

Figure 13:  Rear view of 3U full 19” with screw compression terminals with COM05
9.2 Dimensions

Table 6: Dimensions of the IED - 3U full 19" rack

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>17.48 inches (444 mm)</td>
</tr>
<tr>
<td>Height</td>
<td>5.20 inches (132 mm), 3U</td>
</tr>
<tr>
<td>Depth</td>
<td>9.82 inches (249.5 mm)</td>
</tr>
<tr>
<td>Weight box</td>
<td>&lt;22.04 lbs (10 kg)</td>
</tr>
</tbody>
</table>

9.3 Enclosure class

9.3.1 Ingress protection

Table 7: Ingress protection

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IED front</td>
<td>IP 54</td>
</tr>
<tr>
<td>IED rear</td>
<td>IP 20</td>
</tr>
<tr>
<td>IED sides</td>
<td>IP 40</td>
</tr>
<tr>
<td>IED top</td>
<td>IP 40</td>
</tr>
<tr>
<td>IED bottom</td>
<td>IP 20</td>
</tr>
</tbody>
</table>
Section 10   Accessories and ordering data

10.1   Mounting kits

10.1.1   Rack mounting kit for a single IED

- Mounting brackets
- Screws

Figure 15: 19" rack mounting panels for 3U housing

Table 8: Mounting kit

<table>
<thead>
<tr>
<th>Items</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>19&quot; rack mounting kit for one 3U full 19&quot; housing IED</td>
<td>1KHL400352R0001</td>
</tr>
</tbody>
</table>
## Section 11   Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating current</td>
</tr>
<tr>
<td>ACC</td>
<td>Actual channel</td>
</tr>
<tr>
<td>ACT</td>
<td>Application configuration tool within PCM600</td>
</tr>
<tr>
<td>A/D converter</td>
<td>Analog-to-digital converter</td>
</tr>
<tr>
<td>ADBS</td>
<td>Amplitude deadband supervision</td>
</tr>
<tr>
<td>AI</td>
<td>Analog input</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AR</td>
<td>Autoreclosing</td>
</tr>
<tr>
<td>ASCT</td>
<td>Auxiliary summation current transformer</td>
</tr>
<tr>
<td>ASD</td>
<td>Adaptive signal detection</td>
</tr>
<tr>
<td>ASDU</td>
<td>Application service data unit</td>
</tr>
<tr>
<td>AWG</td>
<td>American Wire Gauge standard</td>
</tr>
<tr>
<td>BBP</td>
<td>Busbar protection</td>
</tr>
<tr>
<td>BFOC/2,5</td>
<td>Bayonet fibre optic connector</td>
</tr>
<tr>
<td>BFP</td>
<td>Breaker failure protection</td>
</tr>
<tr>
<td>BI</td>
<td>Binary input</td>
</tr>
<tr>
<td>BOS</td>
<td>Binary outputs status</td>
</tr>
<tr>
<td>BR</td>
<td>External bistable relay</td>
</tr>
<tr>
<td>BS</td>
<td>British Standards</td>
</tr>
<tr>
<td>CB</td>
<td>Circuit breaker</td>
</tr>
<tr>
<td>CCVT</td>
<td>Capacitive Coupled Voltage Transformer</td>
</tr>
<tr>
<td>Class C</td>
<td>Protection Current Transformer class as per IEEE/ ANSI</td>
</tr>
<tr>
<td>CMPPS</td>
<td>Combined megapulses per second</td>
</tr>
<tr>
<td>CMT</td>
<td>Communication Management tool in PCM600</td>
</tr>
<tr>
<td>CO cycle</td>
<td>Close-open cycle</td>
</tr>
<tr>
<td>COMTRADE</td>
<td>Standard Common Format for Transient Data Exchange format for Disturbance recorder according to IEEE/ANSI C37.111, 1999 / IEC60255-24</td>
</tr>
<tr>
<td>COT</td>
<td>Cause of transmission</td>
</tr>
<tr>
<td>CPU</td>
<td>Central processing unit</td>
</tr>
<tr>
<td>CR</td>
<td>Carrier receive</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic redundancy check</td>
</tr>
<tr>
<td>CROB</td>
<td>Control relay output block</td>
</tr>
</tbody>
</table>
CS  Carrier send
CT  Current transformer
CU  Communication unit
CVT or CCVT  Capacitive voltage transformer
DAR  Delayed autoreclosing
DARPA  Defense Advanced Research Projects Agency (The US developer of the TCP/IP protocol etc.)
DBDL  Dead bus dead line
DBLL  Dead bus live line
DC  Direct current
DFC  Data flow control
DFT  Discrete Fourier transform
DHCP  Dynamic Host Configuration Protocol
DI  Digital input
DLLB  Dead line live bus
DNP  Distributed Network Protocol as per IEEE Std 1815-2012
DR  Disturbance recorder
DRAM  Dynamic random access memory
DRH  Disturbance report handler
DTT  Direct transfer trip scheme
EHV network  Extra high voltage network
EIA  Electronic Industries Association
EMC  Electromagnetic compatibility
EMF  Electromotive force
EMI  Electromagnetic interference
EnFP  End fault protection
EPA  Enhanced performance architecture
ESD  Electrostatic discharge
F-SMA  Type of optical fibre connector
FAN  Fault number
FCB  Flow control bit; Frame count bit
FOX 20  Modular 20 channel telecommunication system for speech, data and protection signals
FOX 512/515  Access multiplexer
FOX 6Plus  Compact time-division multiplexer for the transmission of up to seven duplex channels of digital data over optical fibers
FTP  File Transfer Protocol
FUN  Function type
GCM  Communication interface module with carrier of GPS receiver module
GDE  Graphical display editor within PCM600
GI   General interrogation command
GIS  Gas-insulated switchgear
GOOSE Generic object-oriented substation event
GPS  Global positioning system
GSAL Generic security application
GSE  Generic substation event
HDLC protocol  High-level data link control, protocol based on the HDLC standard
HFB connector type Plastic fiber connector
HMI  Human-machine interface
HSAR High speed autoreclosing
HV   High-voltage
HVDC High-voltage direct current
IDBS Integrating deadband supervision
IEC  International Electrical Committee
IEC 61869-2 IEC Standard, Instrument transformers
IEC 60870-5-103 Communication standard for protective equipment. A serial master/slave protocol for point-to-point communication
IEC 61850 Substation automation communication standard
IEC 61850–8–1 Communication protocol standard
IEEE Institute of Electrical and Electronics Engineers
IEEE 802.12 A network technology standard that provides 100 Mbits/s on twisted-pair or optical fiber cable
IEEE P1386.1 PCI Mezzanine Card (PMC) standard for local bus modules. References the CMC (IEEE P1386, also known as Common Mezzanine Card) standard for the mechanics and the PCI specifications from the PCI SIG (Special Interest Group) for the electrical EMF (Electromotive force).
IEEE 1686 Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities
IED Intelligent electronic device
I-GIS Intelligent gas-insulated switchgear
Instance When several occurrences of the same function are available in the IED, they are referred to as instances of that function. One instance of a function is identical to another of the same kind but has a different number in the IED user interfaces. The word "instance" is sometimes defined as an item of information that is representative of a type. In the same way an instance of a function in the IED is representative of a type of function.
IP  1. Internet protocol. The network layer for the TCP/IP protocol suite widely used on Ethernet networks. IP is a connectionless, best-effort packet-switching protocol. It provides packet routing, fragmentation and reassembly through the data link layer.
2. Ingression protection, according to IEC standard

**IP 20**
Ingression protection, according to IEC standard, level IP20—Protected against solid foreign objects of 12.5mm diameter and greater.

**IP 40**
Ingression protection, according to IEC standard, level IP40—Protected against solid foreign objects of 1mm diameter and greater.

**IP 54**
Ingression protection, according to IEC standard, level IP54—Dust-protected, protected against splashing water.

**IRF**
Internal failure signal

**IRIG-B:**
InterRange Instrumentation Group Time code format B, standard 200

**ITU**
International Telecommunications Union

**LAN**
Local area network

**LCD**
Liquid crystal display

**LDD**
Local detection device

**LED**
Light-emitting diode

**LNT**
LON network tool

**MCB**
Miniature circuit breaker

**MVAL**
Value of measurement

**NCC**
National Control Centre

**NOF**
Number of grid faults

**NUM**
Numerical module

**OCO cycle**
Open-close-open cycle

**OCP**
Overcurrent protection

**OLTC**
On-load tap changer

**OTEV**
Disturbance data recording initiated by other event than start/pick-up

**OV**
Over-voltage

**Overreach**
A term used to describe how the relay behaves during a fault condition. For example, a distance relay is overreaching when the impedance presented to it is smaller than the apparent impedance to the fault applied to the balance point, that is, the set reach. The relay “sees” the fault but perhaps it should not have seen it.

**PCI**
Peripheral component interconnect, a local data bus

**PCM600**
Protection and control IED manager

**PC-MIP**
Mezzanine card standard

**POR**
Permissive overreach

**POTT**
Permissive overreach transfer trip

**Process bus**
Bus or LAN used at the process level, that is, in near proximity to the measured and/or controlled components

**PSM**
Power supply module

**PST**
Parameter setting tool within PCM600
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT ratio</td>
<td>Potential transformer or voltage transformer ratio</td>
</tr>
<tr>
<td>PUTT</td>
<td>Permissive underreach transfer trip</td>
</tr>
<tr>
<td>RCA</td>
<td>Relay characteristic angle</td>
</tr>
<tr>
<td>RISC</td>
<td>Reduced instruction set computer</td>
</tr>
<tr>
<td>RMS value</td>
<td>Root mean square value</td>
</tr>
<tr>
<td>RS422</td>
<td>A balanced serial interface for the transmission of digital data in point-to-point connections</td>
</tr>
<tr>
<td>RS485</td>
<td>Serial link according to EIA standard RS485</td>
</tr>
<tr>
<td>RTC</td>
<td>Real-time clock</td>
</tr>
<tr>
<td>RTU</td>
<td>Remote terminal unit</td>
</tr>
<tr>
<td>SA</td>
<td>Substation Automation</td>
</tr>
<tr>
<td>SBO</td>
<td>Select-before-operate</td>
</tr>
<tr>
<td>SC</td>
<td>Switch or push button to close</td>
</tr>
<tr>
<td>SCL</td>
<td>Short circuit location</td>
</tr>
<tr>
<td>SCS</td>
<td>Station control system</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervision, control and data acquisition</td>
</tr>
<tr>
<td>SCT</td>
<td>System configuration tool according to standard IEC 61850</td>
</tr>
<tr>
<td>SDU</td>
<td>Service data unit</td>
</tr>
<tr>
<td>SMA connector</td>
<td>Subminiature version A, A threaded connector with constant impedance.</td>
</tr>
<tr>
<td>SMT</td>
<td>Signal matrix tool within PCM600</td>
</tr>
<tr>
<td>SMS</td>
<td>Station monitoring system</td>
</tr>
<tr>
<td>SNTP</td>
<td>Simple network time protocol – is used to synchronize computer clocks on local area networks. This reduces the requirement to have accurate hardware clocks in every embedded system in a network. Each embedded node can instead synchronize with a remote clock, providing the required accuracy.</td>
</tr>
<tr>
<td>SOF</td>
<td>Status of fault</td>
</tr>
<tr>
<td>SPA</td>
<td>Strömberg protection acquisition, a serial master/slave protocol for point-to-point communication</td>
</tr>
<tr>
<td>SRY</td>
<td>Switch for CB ready condition</td>
</tr>
<tr>
<td>ST</td>
<td>Switch or push button to trip</td>
</tr>
<tr>
<td>Starpoint</td>
<td>Neutral/Wye point of transformer or generator</td>
</tr>
<tr>
<td>SVC</td>
<td>Static VAr compensation</td>
</tr>
<tr>
<td>TC</td>
<td>Trip coil</td>
</tr>
<tr>
<td>TCS</td>
<td>Trip circuit supervision</td>
</tr>
<tr>
<td>TCP</td>
<td>Transmission control protocol. The most common transport layer protocol used on Ethernet and the Internet.</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Transmission control protocol over Internet Protocol. The de facto standard Ethernet protocols incorporated into 4.2BSD Unix. TCP/IP was developed by DARPA for Internet working and encompasses both network layer and transport layer protocols. While TCP and IP specify two protocols</td>
</tr>
</tbody>
</table>
at specific protocol layers, TCP/IP is often used to refer to the entire US Department of Defense protocol suite based upon these, including Telnet, FTP, UDP and RDP.

**TEF**  
Time delayed ground-fault protection function

**TLS**  
Transport Layer Security

**TM**  
Transmit (disturbance data)

**TNC connector**  
Threaded Neill-Concelman, a threaded constant impedance version of a BNC connector

**TP**  
Trip (recorded fault)

**TPZ, TPY, TPX, TPS**  
Current transformer class according to IEC

**TRM**  
Transformer Module. This module transforms currents and voltages taken from the process into levels suitable for further signal processing.

**TYP**  
Type identification

**UMT**  
User management tool

**Underreach**  
A term used to describe how the relay behaves during a fault condition. For example, a distance relay is underreaching when the impedance presented to it is greater than the apparent impedance to the fault applied to the balance point, that is, the set reach. The relay does not “see” the fault but perhaps it should have seen it. See also Overreach.

**UTC**  
Coordinated Universal Time. A coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM), which forms the basis of a coordinated dissemination of standard frequencies and time signals. UTC is derived from International Atomic Time (TAI) by the addition of a whole number of “leap seconds” to synchronize it with Universal Time 1 (UT1), thus allowing for the eccentricity of the Earth’s orbit, the rotational axis tilt (23.5 degrees), but still showing the Earth’s irregular rotation, on which UT1 is based. The Coordinated Universal Time is expressed using a 24-hour clock, and uses the Gregorian calendar. It is used for aeroplane and ship navigation, where it is also sometimes known by the military name, “Zulu time.” “Zulu” in the phonetic alphabet stands for “Z”, which stands for longitude zero.

**UV**  
Undervoltage

**WEI**  
Weak end infeed logic

**VT**  
Voltage transformer

**3I_{0}**  
Three times zero-sequence current. Often referred to as the residual or the ground-fault current

**3V_{0}**  
Three times the zero sequence voltage. Often referred to as the residual voltage or the neutral point voltage