

RELION® 630 SERIES

Power Management PML630/Compact Load-Shedding Solution Operation Manual





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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 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2014/35/EU). This conformity is the result of tests conducted by ABB in accordance with the product standard 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.

Safety information



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



Non-observance can result in death, personal injury or substantial property damage.



Only a competent electrician is allowed to carry out the electrical installation.



National and local electrical safety regulations must always be followed.



The frame of the device has to be carefully earthed.



The device contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.



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

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Section 1 Introduction

1.1 This manual

The operation manual contains instructions on how to operate the device once it has been commissioned. The manual provides instructions for monitoring, controlling and setting the device.

1.2 Intended audience

This manual addresses the operator, who operates the device on a need basis.

The operator must be trained in and have a basic knowledge of handling the load-shedding functionality. The manual contains terms and expressions commonly used to describe this functionality.

1.3 Product documentation

1.3.1 Product documentation set

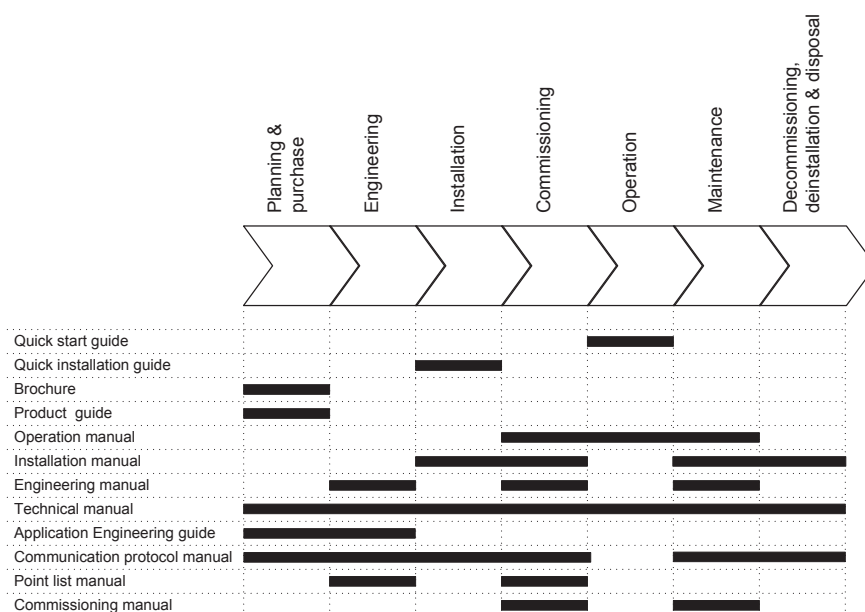


Figure 1: The intended use of documents during the product life cycle



See the 630 series documentation for installation and commissioning manuals. The PML630 documentation set includes only application engineering guide, engineering manual, IEC 61850 communication protocol manual, IEC 61850 point list manual, operation manual and technical manual.

1.3.2 Document revision history

Document revision/date	Product version	History
A/2011-05-04	1.1	First release
B/2011-11-03	1.1.1	Content updated to correspond to the product series version
C/2012-03-29	1.1.2	Content updated to correspond to the product series version
D/2013-10-14	1.2	Content updated to correspond to the product series version
E/2016-08-29	1.2.1	Content updated to correspond to the product series version
F/2019-08-12	1.2.1	Content updated

1.3.3 Related documentation

Name of the document	Document ID
Application Engineering Guide	1MRS757394
Engineering Manual	1MRS757184
IEC 61850 Communication Protocol Manual	1MRS757260
IEC 61850 Point List Manual	1MRS757261
Technical Manual	1MRS757256



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<http://www.abb.com/relion>.

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. Therefore, comply fully with all warning and caution notices.

1.4.2 Document conventions

A particular convention may not be used in this manual.

- Abbreviations and acronyms 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.
To navigate between the options, use  and .
- Menu paths are presented in bold.
Select **Main menu/Settings**.
- WHMI menu names are presented in bold.
Click **Information** in the WHMI menu structure.
- LHMI messages are shown in Courier font.
To save the changes in nonvolatile memory, select `Yes` and press .
- Parameter names are shown in italics.
The function can be enabled and disabled with the *Operation* setting.
- The ^ character in front of an input or output signal name in the function block symbol given for a function, indicates that the user can set an own signal name in PCM600.
- The * character after an input or output signal name in the function block symbol given for a function, indicates that the signal must be connected to another function block in the application configuration to achieve a valid application configuration.

1.4.3 Functions, codes and symbols

Table 1: *Functions included in the device*

Functionality	IEC 61850
Generic process I/O	
Single point control (8 signals)	SPC8GGIO ¹⁾
Double point indication	DPGGIO ¹⁾
Single point indication	SPGGIO ¹⁾
Generic measured value	MVGGIO ¹⁾
Event counter	CNTGGIO ¹⁾
Monitoring	
Measured value limit supervision	MVEXP ¹⁾
Station battery supervision	SPVNZBAT ¹⁾
Power management (load-shedding)	
Critical circuit breaker	NCBDCSWI
Table continues on next page	

Functionality	IEC 61850
Contingency based load-shedding core function	LSCACLS
Busbar-wise sheddable loads data	LDMMXU
Busbar-wise load feeders load-shedding command	LSPTRC
Power source	PSCSWI
Subnetwork supervision	SNWRCLS
Network power source	NPMMXU
Information exchange between peer PML630s	PPLSGGIO ²⁾
Disturbance recorder functions	
Analog channels 1-10 (samples)	A1RADR
Analog channel 11-20 (samples)	A2RADR
Analog channel 21-30 (samples)	A3RADR ¹⁾
Analog channel 31-40 (calc. val.)	A4RADR ¹⁾
Binary channel 1-16	B1RBDR
Binary channel 17-32	B2RBDR
Binary channel 33-48	B3RBDR
Binary channel 49-64	B4RBDR ¹⁾
Disturbance recorder	DRRDRE
Multipurpose functions	
Position evaluate	POS_EVAL ¹⁾
Double point indication	DPGGIO ¹⁾
Multipurpose analog protection	MAPGAPC ¹⁾
Station communication (GOOSE)	
Binary receive	GOOSEBINRCV
Double point receive	GOOSEDPRCV
Integer receive	GOOSEINTRCV
Measured value receive	GOOSEMVRCV
Single point receive	GOOSESRCV

- 1) The function is not used by default. However, it is kept enabled in the Application Configuration tool for instantiation in any additional logic other than features offered by the PML630 connectivity package.
- 2) The PPLSGGIO function block is instantiated only when the cPMS - LS Configuration B is selected in the configuration wizard of PML630.

Section 2 Environmental aspects

2.1 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 device.

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 2: *Maximum concentration values by weight per homogeneous material*

Substance	Proposed maximum concentration
Lead - Pb	0.1%
Mercury - Hg	0.1%
Cadmium - Cd	0.01%
Hexavalent Chromium Cr (VI)	0.1%
Polybrominated biphenyls - PBB	0.1%
Polybrominated diphenyl ethers - PBDE	0.1%

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.

2.2 Disposal of a device

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 a device or its parts contact a local waste handler who is authorized and specialized in disposing of electronic waste. These handlers can sort the material by using dedicated sorting processes and dispose of the product according to the local requirements.

Table 3: *Materials of the device parts*

Device	Parts	Material
Unit	Metallic plates, parts and screws	Steel
	Plastic parts	PC ¹⁾ , LCP ²⁾
	LHMI display module	Various
Package	Box	Cardboard
Attached material	Manuals	Paper

- 1) Polycarbonate
2) Liquid crystal polymer

Section 3 IED Overview

3.1 Overview

PML630 is a Power Management device that provides comprehensive load-shedding solution for the power network in an industrial plant. It protects the plant against blackouts and power source outages due to system disturbances. This device is a member of ABB's Relion® product family and a part of its 630 product series characterized by functional scalability and flexible configurability. PML630 is identical to the Relion 630 series protection relays and does not have any specific hardware modules. It is only the application functions pre-loaded in the device that differentiate it from the 630 series protection relays.

The device supports various modes of load-shedding.

- Fast load-shedding based on network contingencies
- Slow load-shedding based on transformer overloading or the maximum demand violation on the grid tie feeder
- Manual load-shedding based on operator-defined priorities or amount of loads to be shed in kW

PML630 complies to the IEC 61850 standard and offers seamless connectivity with other Relion 615/620/630 series protection relays, RIO600 IO units and COM600 to realize the load-shedding functionality. The device uses GOOSE and MMS communication profiles for I/O data exchange with Relion product family protection relays and COM600.

The PML630 load-shedding controller essentially handles load-shedding functionality for plant electrical network. This comprises of various components.

- 6 generators
- 2 external network connectivity (tie line or grid transformers) and 6 busbars
- 15 network breakers
- 60 load-shedding groups (10 loads/load groups per busbar)

This is referred as cPMS - LS configuration A (for load-shedding power management function).



All the six generators could also be configured as utility grid transformers.

When the power network configuration exceeds the limits defined for a PML630 in Configuration A, an additional PML630 device can be configured in a peer-to-peer

method thereby dividing the network into sectors called power network areas. Each PML630 is responsible for the load-shedding action in its respective area, based on the power source capabilities and inter-power network area connectivity status. The coordination of load-shedding actions between the PML630 IEDs is handled by suitable parameterization. This arrangement of multiple PML630 IEDs in a peer-to-peer method is called cPMS - LS configuration B.

The PML630 IEDs communicate with each other also using IEC 61850 GOOSE. Likewise, cPMS - LS configuration B is also a feature in PML630. The Configuration B is always built up over and above the Configuration A and hence the latter is a prerequisite.

The maximum recommended number of PML630 IEDs in a peer-to-peer mode in Configuration B is three.

The power network areas would be connected to each other through their grid 1 or grid 2 power source connection points.

3.2

Local HMI

The LHMI is used for setting, monitoring and controlling the device. The LHMI comprises the display, buttons, LED indicators and communication port.

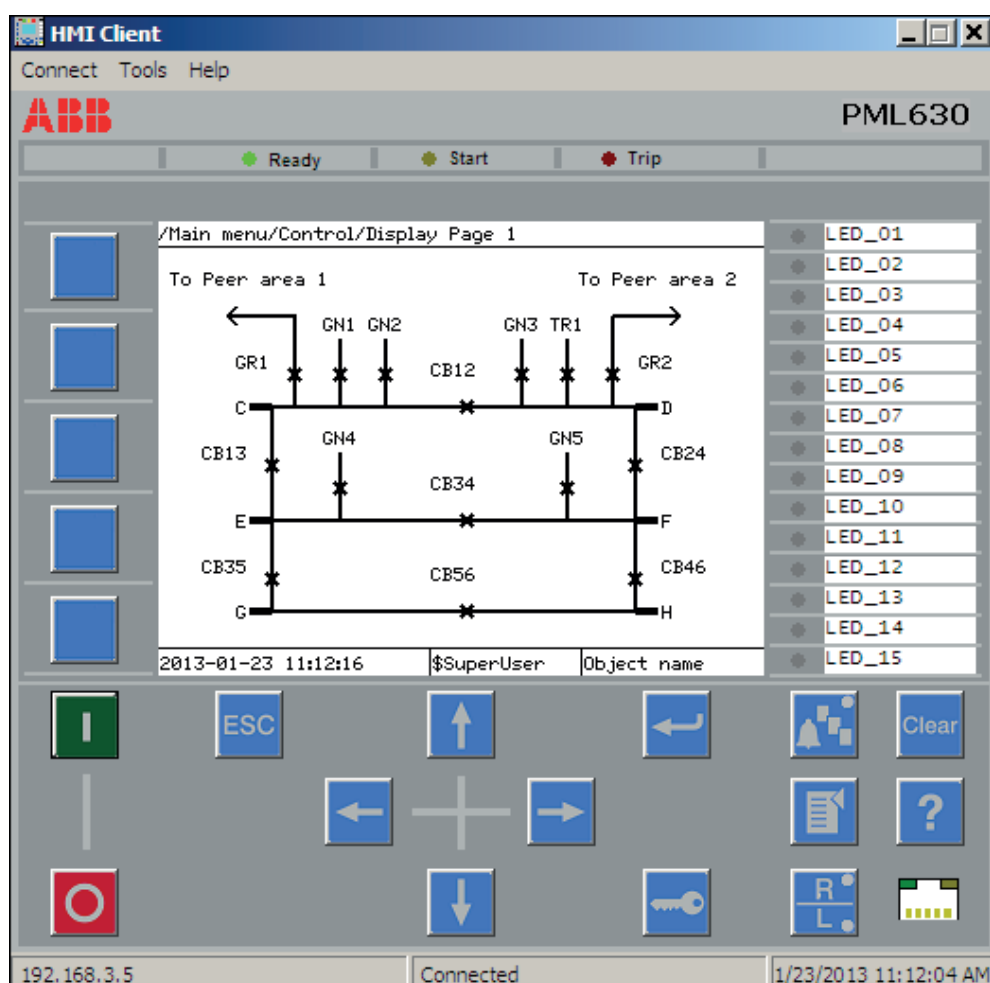


Figure 2: LHMI

3.2.1

Display

The LHMI includes a graphical monochrome display with a resolution of 320 x 240 pixels. The character size can vary. The amount of characters and rows fitting the view depends on the character size and the view that is shown.

The display view is divided into four basic areas.

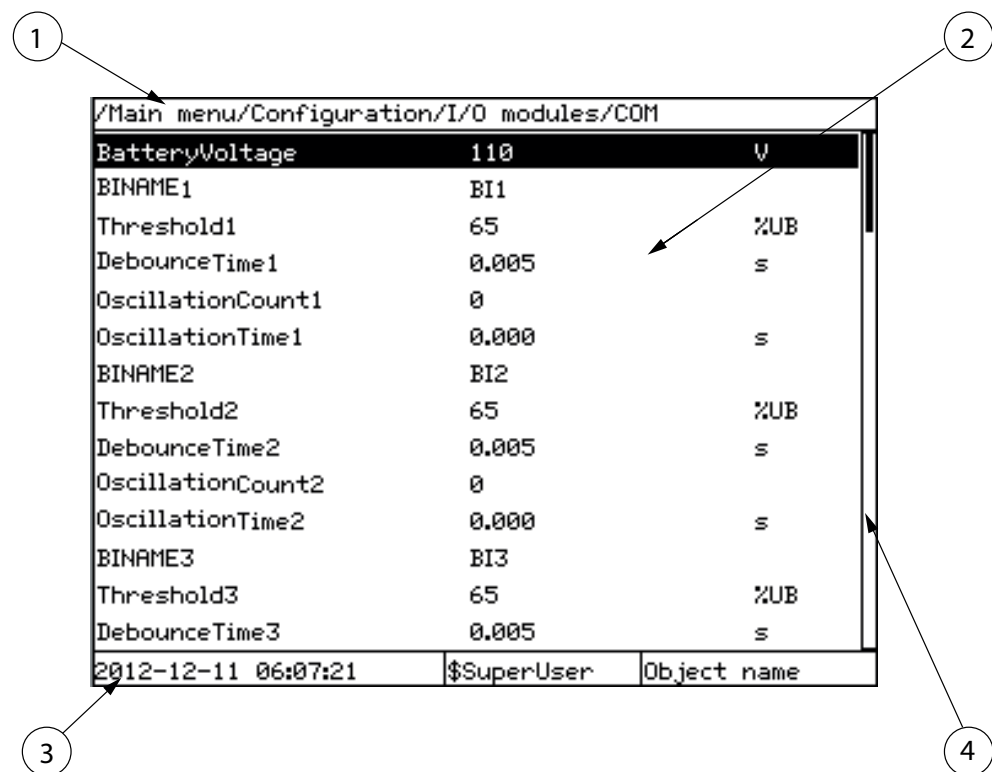


Figure 3: Display layout

- 1 Path
- 2 Content
- 3 Status
- 4 Scroll bar (appears when needed)

- The path shows the current location in the menu structure. If the path is too long to be shown, it is truncated from the beginning, and the truncation is indicated with three dots.
- The content area shows the menu content.
- The status area shows the current IED time, the user that is currently logged in and the object identification string which is settable via the LHMI or with PCM600.
- If text, pictures or other items do not fit in the display, a vertical scroll bar appears on the right. The text in content area is truncated from the beginning if it does not fit in the display horizontally. Truncation is indicated with three dots.

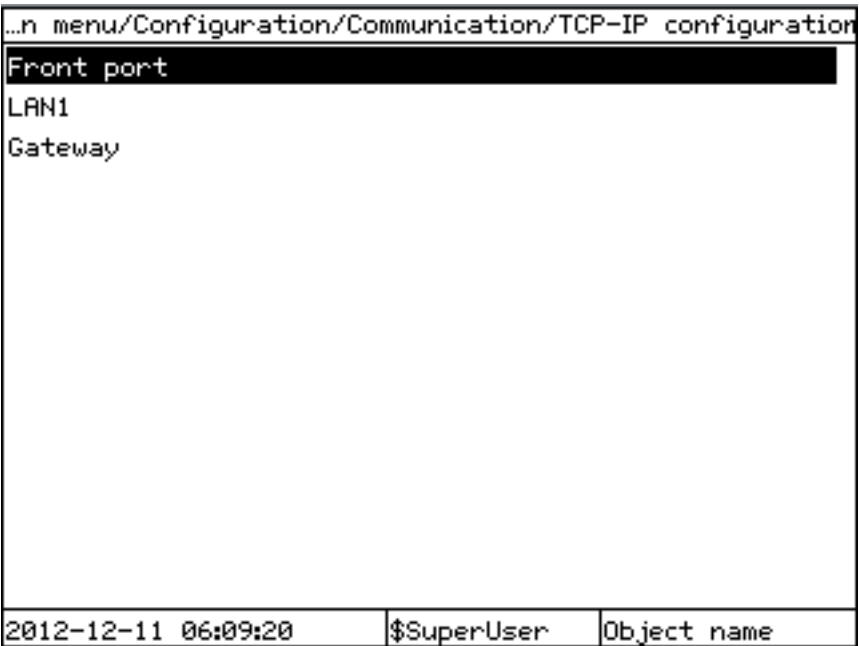


Figure 4: Truncated path

The function button panel shows on request what actions are possible with the function buttons. Each function button has a LED indication that can be used as a feedback signal for the function button control action. The LED is connected to the required signal with PCM600.

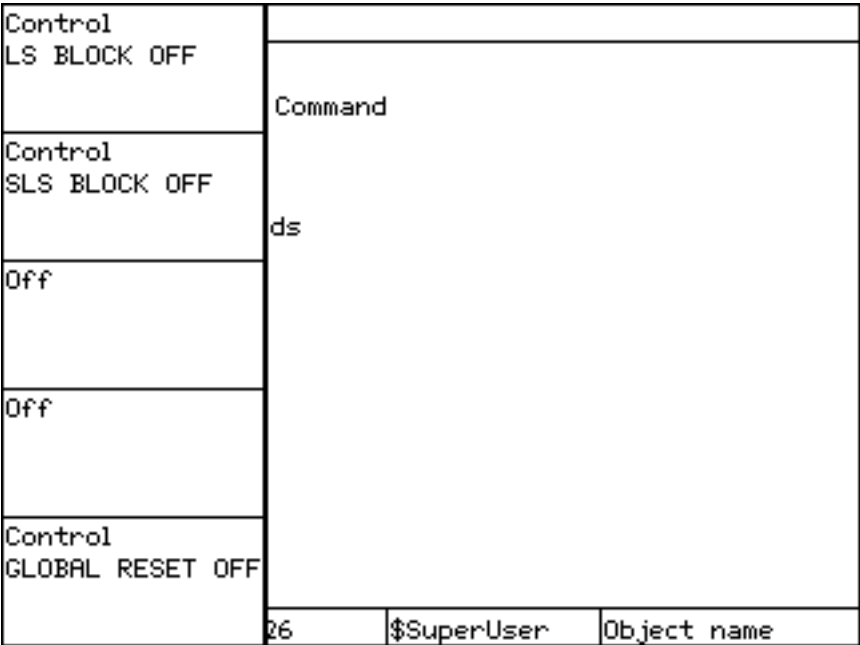


Figure 5: Function button panel

The alarm LED panel shows on request the alarm text labels for the alarm LEDs.

✓Main menu	1	Fast LS Status	●	LED_01
Control	2	Slow LS Status	●	LED_02
Manual Load Shed Command	3	G1L03_OFF	●	LED_03
Events		SN1 LS Blk Status	●	LED_04
Measurements		SN2 LS Blk Status	●	LED_05
Disturbance records		SN3 LS Blk Status	●	LED_06
Settings		SN4 LS Blk Status	●	LED_07
Configuration		SN1 SLS TrgInhSt	●	LED_08
Monitoring		SN2 SLS TrgInhSt	●	LED_09
Test		SN3 SLS TrgInhSt	●	LED_10
Information		SN4 SLS TrgInhSt	●	LED_11
Clear		SN1 LS Op Status	●	LED_12
Language		SN2 LS Op Status	●	LED_13
		SN3 LS Op Status	●	LED_14
		SN4 LS Op Status	●	LED_15
2012-12-11 06:11:49	\$SuperUse			

Figure 6: Alarm LED panel

The function button and alarm LED panels are not visible at the same time. Each panel is shown by pressing one of the function buttons or the Multipage button. Pressing the ESC button clears the panel from the display. Both the panels have dynamic width that depends on the label string length that the panel contains.

3.2.2

LEDs

The LHMI includes three indicators above the display: Ready, Start, and Trip. The load shed start (initiation of power balance calculation) and operate (initiation of load-shed commands) are mapped to LHMI Start and Trip LEDs respectively.

There are also 15 matrix programmable alarm LEDs in front of the LHMI. Each LED indicates three states with the colors: green, yellow and red. The alarm texts related to each three-color LED are divided into three pages and can be browsed with the Multipage button. Altogether, the 15 physical three-color LEDs can indicate 45 different alarms. The 15 physical three-color LEDs in one LED group can indicate 45 different signals. Altogether, 135 signals can be indicated since there are three LED groups. The LEDs can be configured with PCM600 and the operation mode can be selected with the LHMI or PCM600.

3.2.3

Keypad

The LHMI keypad contains push-buttons which are used to navigate in different views or menus. The push-buttons are used to acknowledge alarms, reset indications, provide help, make new settings and confirmations.

The keypad also contains programmable push-buttons that can be configured either as menu shortcut or control buttons.

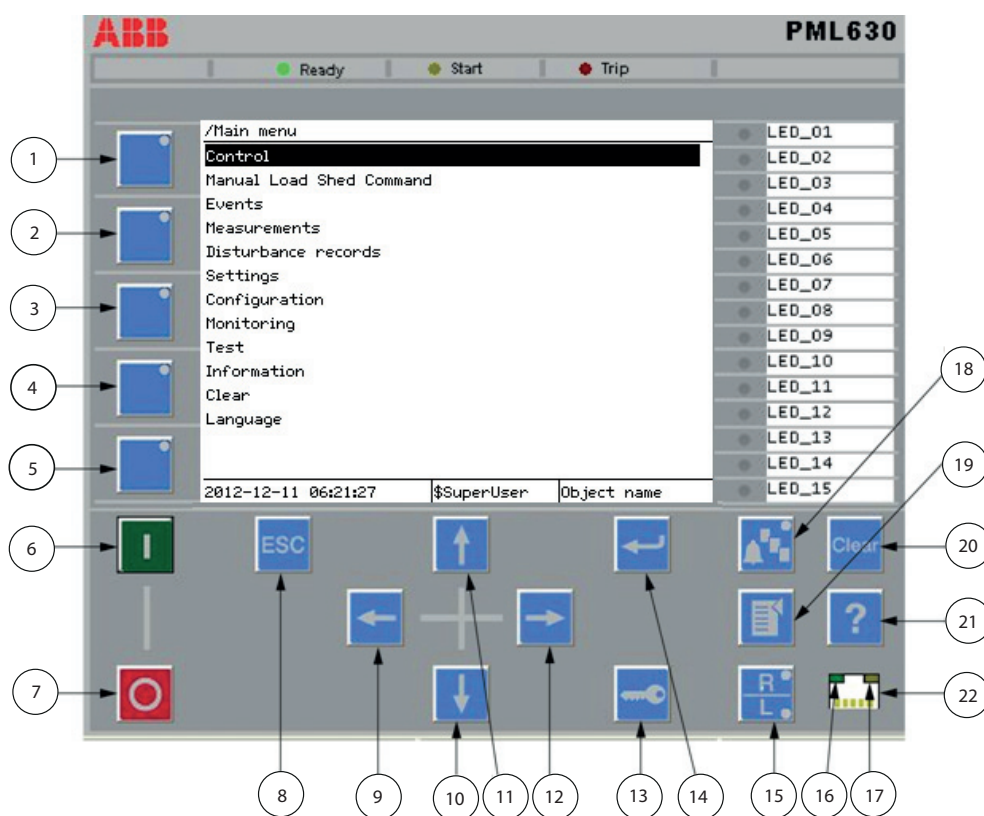
















Figure 7: LHCI keypad with object control, navigation and command push buttons and RJ-45 communication port

1...5	Function button	14	Enter
6	Disabled in PML630	15	Disabled in PML630
7	Disabled in PML630	16	Uplink LED
8	Escape	17	Not in use
9	Left	18	Multipage
10	Down	19	Menu
11	Up	20	Clear
12	Right	21	Help
13	Key	22	Communication port

Navigation





The arrow buttons are used for navigation. To scroll information, press the arrow button several times or keep it pressed down.

Table 4: *Navigation push-buttons*

Name	Description
 ESC	<ul style="list-style-type: none"> Leaving setting mode without saving the values. Cancelling certain actions. Adjusting the display contrast in combination with  or . Changing the language in combination with  or . Running the display test in combination with . Deleting a character in combination with  when editing a string. Inserting a space in combination with  when editing a string.
 Enter	<ul style="list-style-type: none"> Entering parameter setting mode. Confirming a new value of a setting parameter. Confirming selection in dialogs and alarm panel.
 Up  Down	<ul style="list-style-type: none"> Moving up and down in menus. Moving selection in dialogs and alarm panel. Scrolling active digits of a parameter when entering a new setting value.
 Left  Right	<ul style="list-style-type: none"> Moving left and right in menus. Selecting pages in the SLD. Changing the active digit of a parameter when entering a new setting value.
 Key	<ul style="list-style-type: none"> Activating the authorization procedure, when the user is not logged in. Logging out, when the user is currently logged in.


Commands

Table 5: *Command push-buttons*

Name	Description
 Menu	<ul style="list-style-type: none"> Moving directly to Main menu, if currently in any other menu or view. Moving to the default view, if currently in Main menu.
 Clear	<ul style="list-style-type: none"> Activating the Clear/Reset view.
 Help	Showing the help menu.
 Multipage	Opening alarm panel and selecting alarm page from the view.

Function buttons

Table 6: *Function buttons*

Name	Description
 LCD function button	Executing the defined function: OFF, menu short cut or binary control.

3.2.4 Local HMI functionality

3.2.4.1 Protection and alarm indication

Protection indicators

The protection indicator LEDs are Ready, Start and Trip.



Configure the disturbance recorder to enable the Start and Trip LEDs.

Table 7: *Ready LED*

LED state	Description
Off	Auxiliary supply voltage is disconnected.
On	Normal operation.
Flashing	Internal fault has occurred.

Table 8: *Start LED*

LED state	Description
Off	Normal operation.
On	Power balance calculations have been initiated due to conditions satisfying the starting conditions for fast load shedding or slow load shedding.
Flashing	<p>The IED is in test mode and fast and slow load shed functions are blocked.</p> <ul style="list-style-type: none"> The indication disappears when the IED is no longer in test mode and blocking is removed.

Table 9: *Trip LED*

LED state	Description
Off	Normal operation.
On	A load-shedding function (fast load shedding or slow load shedding or manual load shedding or external trigger) has operated (load shed command issued).
Flashing	Internal fault has occurred

Alarm indicators

The 15 programmable three-color LEDs are used for alarm indication. The colors of the LEDs are defined by the configuration and they are independent of the LEDs' states.

Table 10: *Alarm indications*

LED state	Description
Off	Normal operation. All activation signals are off.
On	<ul style="list-style-type: none"> Follow-S sequence: The activation signal is on. LatchedColl-S sequence: The activation signal is on, or it is off but the indication has not been acknowledged. LatchedAck-F-S sequence: The indication has been acknowledged, but the activation signal is still on. LatchedAck-S-F sequence: The activation signal is on, or it is off but the indication has not been acknowledged. LatchedReset-S sequence: The activation signal is on, or it is off but the indication has not been acknowledged.
Flashing	<ul style="list-style-type: none"> Follow-F sequence: The activation signal is on. LatchedAck-F-S sequence: The activation signal is on, or it is off but the indication has not been acknowledged. LatchedAck-S-F sequence: The indication has been acknowledged, but the activation signal is still on.

The 13 programmable three-color LEDs are used for alarm indication. START/PICKUP yellow color LED indicates start signal of load shed. TRIP RED color LED indicates the operate signal of load shed.

Table 11: *Alarm indications*

LEDs	Operations
GRP1_LED 1	<ul style="list-style-type: none"> Fast load shed operated (Red indication) Fast load shed start (Yellow indication)
GRP1_LED 2	<ul style="list-style-type: none"> Slow load shed operated (Red indication) Slow load shed start (Yellow indication)
GRP1_LED 3	Spare
GRP1_LED 4	SubNetwork 1 load shed block (Red indication)
GRP1_LED 5	SubNetwork 2 load shed block (Red indication)
GRP1_LED 6	SubNetwork 3 load shed block (Red indication)
GRP1_LED 7	SubNetwork 4 load shed block (Red indication)
GRP1_LED 8	SubNetwork 1 slow load shed block/inhibited (Red indication)
GRP1_LED 9	SubNetwork 2 slow load shed block/inhibited (Red indication)
GRP1_LED 10	SubNetwork 3 slow load shed block/inhibited (Red indication)
GRP1_LED 11	SubNetwork 4 slow load shed block/inhibited (Red indication)
GRP1_LED 12	SubNetwork 1 load shed operated (Red indication)
GRP1_LED 13	SubNetwork 2 load shed operated (Red indication)
GRP1_LED 14	SubNetwork 3 load shed operated (Red indication)
GRP1_LED 15	SubNetwork 4 load shed operated (Red indication)
GRP2_LED 1	Grid 1 (GR1) connected peer electrical network area far-end CB Close (Green indication)
GRP2_LED 2	GR1 connected peer electrical network area data error (Red indication)
Table continues on next page	

LEDs	Operations
GRP2_LED 3	GR1 connected electrical network area SN LS block due to Remote CB (Red indication)
GRP2_LED 4	GR1 connected electrical network area SN LS block (Red indication)
GRP2_LED 5	GR2 connected electrical network area Remote CB Close (Green indication)
GRP2_LED 6	GR2 connected electrical network area data error (Red indication)
GRP2_LED 7	GR2 connected electrical network area SN LS block due to Remote CB (Red indication)
GRP2_LED 8	GR2 connected electrical network area SN LS block (Red indication)

3.2.4.2

Parameter management

The LHMI is used to access the device parameters. Three types of parameters can be read and written.

- Numerical values
- String values
- Enumerated values

Numerical values are presented either in integer or in decimal format with minimum and maximum values. Character strings can be edited character by character. Enumerated values have a predefined set of selectable values.

3.2.4.3

IED modes

The IED supports four operational modes.

- On
- Test
- Blocked
- Test+Blocked

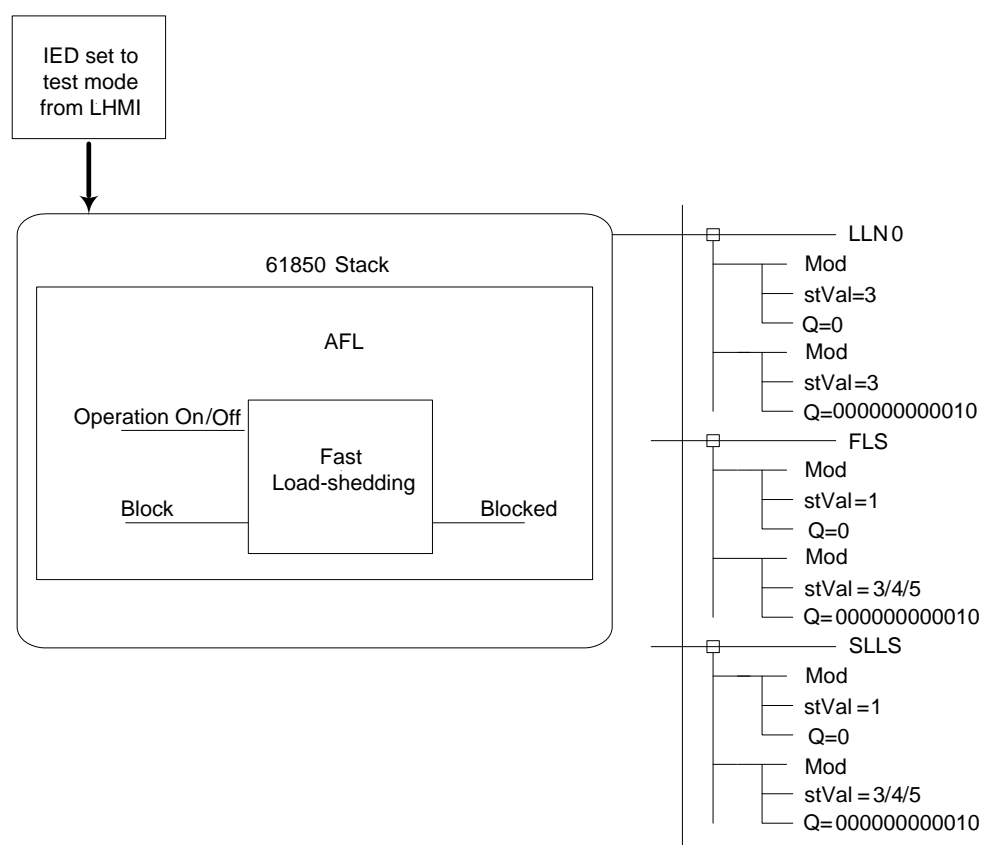


Figure 8: IED Test mode handling sequence

Table 12: Semantics of IED LN0 behaviour, based on modes

IED mode	Functionality mode (LSCACLS mode)	LNBeh	LNBeh value
On	On	On	1
Test	On	Test	3
Test	Blocked	Test+Blocked	4
Test	Off	Off	5

3.2.4.4

Load-shedding application modes

The IED supports different load-shedding application modes.

- On
- Off
- Blocked

The load shed AFL functions support the On, Off and Blocked modes for fast load-shedding and slow load-shedding. If the LSCACLS function block Operation is set to

OFF, load shed functionality cannot be active. Fast load shed functionality is active only if LSCACLS (core) function's Operation is set in ON mode.

If fast load-shedding is blocked, slow load-shedding is also blocked automatically. However, manual load-shedding is independent and can be operated even when fast and slow load-shedding modes are blocked.

Three out of the five functional keys in the LHMI can be configured (see the engineering manual).

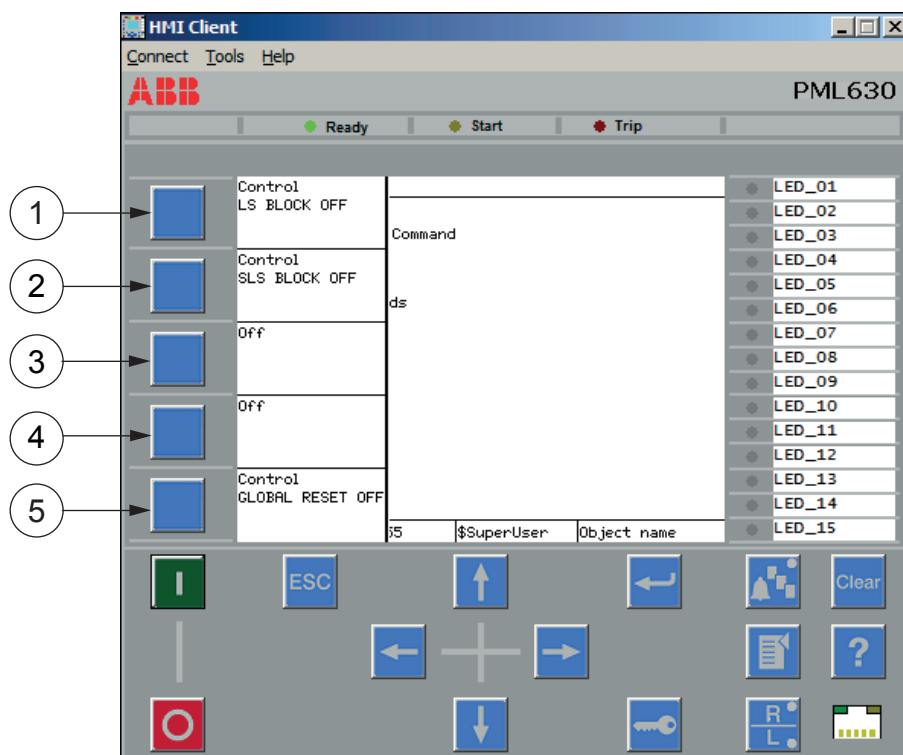


Figure 9: Load-shedding functional keys

- 1 Load-shedding blocked
- 2 Slow load-shedding blocked
- 3 Spare
- 4 Spare
- 5 Global load-shedding reset

3.2.4.5 Front communication

The RJ-45 port in the LHMI enables front communication.

- The green uplink LED on the left is lit when the cable is successfully connected to the port.

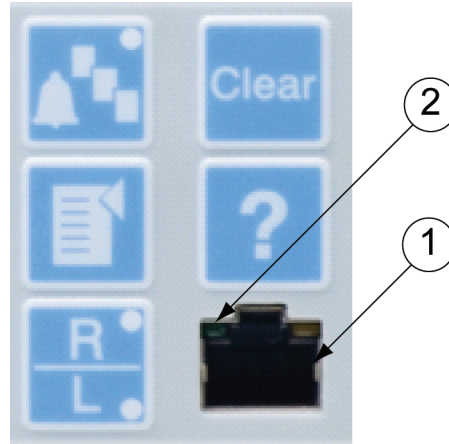


Figure 10: RJ-45 communication port and green indicator LED

- 1 RJ-45 connector
- 2 Green indicator LED

When a computer is connected to the IED front port, the IED's DHCP server for the front interface assigns an IP address to the computer. The default IP address for the front port is 192.168.0.254.



If the IED is ordered without an LHMI, the LAN1 port has to be used for configuration and setting purposes. The default IP address for the LAN1 port is 192.168.2.10. DHCP is not available from the LAN1 port.

3.2.4.6

Single-line diagram

The single-line diagram feature is used to display the key load-shedding network diagram. This comprises of the power sources, network and load circuit breaker indications, as ascertained by the load-shedding logic in the IED. Single-line diagram is used for understanding load-shedding operations. It shows a graphical presentation of the network connection which is configured with PCM600.

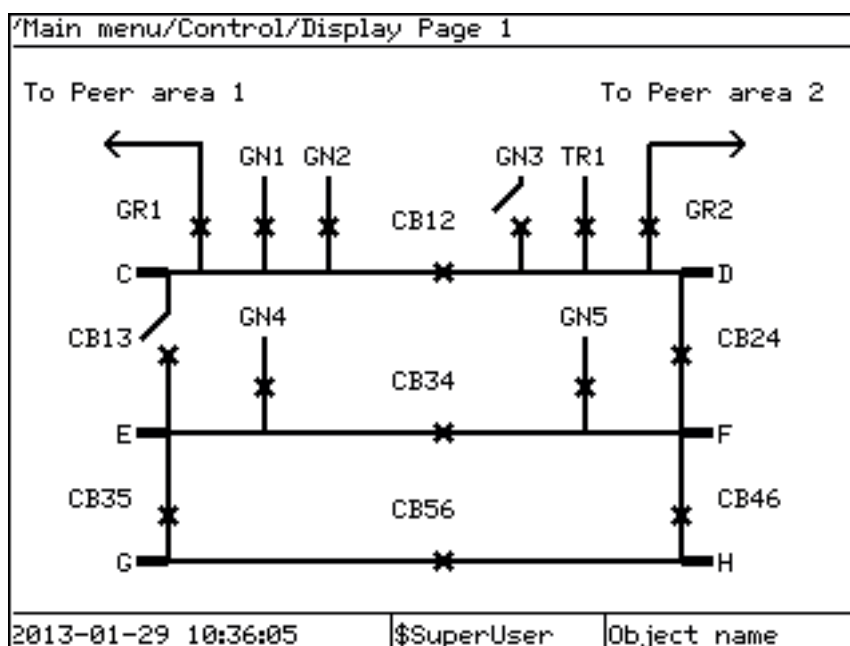


Figure 11: Single-line diagram

3.3 Web HMI

The WHMI enables the user to access the device via a web browser. The supported Web browser version is Internet Explorer 7.0 or later.



WHMI is disabled by default. To enable the WHMI, select **Main menu/Configuration/HMI/Web HMI/Operation** via the LHMI.

WHMI offers several functions.

- Alarm indications and event lists
- System supervision
- Parameter settings
- Measurement display
- Disturbance records

The menu tree structure on the WHMI is almost identical to the one on the LHMI.

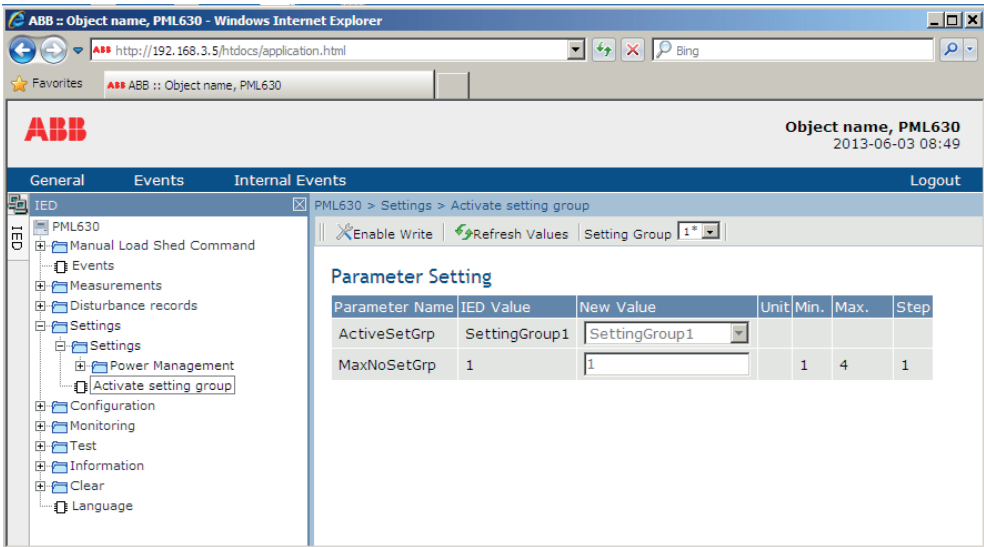


Figure 12: Example view of the WHMI

The WHMI can be accessed locally and remotely.

- Locally by connecting the user's computer to the device via the front communication port.
- Remotely over LAN/WAN.

Thus, the WHMI can be used remotely to set the device parameters and also other Relion series protection relays from a central operation workplace in the substation or the plant network.

3.3.1 Command buttons

Command buttons can be used to edit parameters and control information via the WHMI.

Table 13: Command buttons







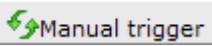
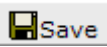
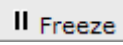
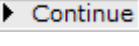

Name	Description
 Enable Write	Enabling parameter editing.
 Disable Write	Disabling parameter editing.
 Write to IED	Writing parameters to the device.
 Refresh Values	Refreshing parameter values.
 Commit	Committing changes to device's non-volatile flash memory.
 Reject	Rejecting changes.

Table continues on next page

Name	Description
 Manual trigger	Triggering the disturbance recorder manually.
 Save	Saving the disturbance recording.
 Freeze	Freezing the values so that updates are not displayed.
 Continue	Receiving continuous updates to the monitoring view.
 Delete	Deleting the disturbance record.

3.4 Authorization

The user categories are predefined for the LHMI and WHMI, each with different rights.

The IED users can be created, deleted and edited only with PCM600. One user can belong to one or several user categories.



At delivery, the IED user has full access as SuperUser until users are created with PCM600. Logging on is not required for the LHMI.

Table 14: *Predefined user categories*

Username	User rights
SystemOperator	Control from LHMI, no bypass
ProtectionEngineer	All settings
DesignEngineer	Application configuration
UserAdministrator	User and password administration



All changes in user management settings will cause an IED reboot.

3.5 Communication

The IED supports IEC 61850-8-1 standard for communication. This includes MMS communication profile for vertical communication and GOOSE communication profile for horizontal communication.

All operational information and controls are available through these profiles. The IED operator functionality is achieved through the MMS communication profile or through the WHMI client surface.

The IED exchanges load-shedding operational signals using the IEC 61850 GOOSE profile from feeder IEDs (REF/REM/RET615, REF/REM/RET620, REF/REG/REM/RET630 and Remote I/O Unit RIO600 1.2). The IED receives binary and analog signals from feeder IEDs for load-shedding input data processing.

- The data transfer from a generator or transformer IEDs (RET615, RET620, REG/RET630 and Remote I/O Unit RIO600 1.2) to the IED includes circuit breaker status, trip or critical alarms, power and current (for transformer feeder IEDs).
- The data transfer from the load feeder IEDs (REF/REM/RET615, REF/REM/RET620, REF/REM/RET630 and Remote I/O Unit RIO600 1.2) to the IED includes circuit breaker status and power.

The load-shedding information (binary signals) is sent to the load feeder IEDs using IEC 61850 GOOSE communication profile. The IED can also interoperate with other IEC 61850 compliant IEDs including Relion® 630 and 615 series of IED's and reports events to five different IEC 61850 clients (HMI/Gateways and so on) simultaneously using the MMS communication profile.

All communication connectors, except for the front port connector are placed on integrated communication modules.

The IED supports SNTP and IRIG-B time synchronization methods with a time-stamping resolution of 1 ms.

Ethernet based:

- SNTP (Simple Network Time Protocol)

With special time synchronization wiring:

- IRIG-B



PML630 Ver.1.2.1 supports ANSI/CN protection relays of the 615 and 620 series, REG615 and RIO600 Ver.1.2 or later in addition to the IEC protection relays mentioned in this section.

3.6

PCM600 tool

Protection and Control IED Manager PCM600 offers all the necessary functionality to work throughout all stages of the device's life cycle.

- Planning
- Engineering
- Commissioning
- Operation and disturbance handling
- Functional analysis

The whole substation configuration can be controlled and different tasks and functions can be performed with the individual tool components. PCM600 can operate with many different topologies, depending on the customer needs.



For more information, see the PCM600 documentation.

3.6.1

Connectivity packages

A connectivity package is a software component that consists of executable code and data which enables system tools to communicate with a device. Connectivity packages are used to create configuration structures in PCM600. The latest PCM600 and connectivity packages are backward compatible with older device versions.

A connectivity package includes all the data which is used to describe the device. For example, it contains a list of the existing parameters, data format used, units, setting range, access rights and visibility of the parameters. In addition, it contains code which allows software packages that use the connectivity package to properly communicate with the device. It also supports localization of text even when it is read from the device in a standard format such as COMTRADE.

Update Manager is a tool that helps in defining the right connectivity package versions for different system products and tools. Update Manager is included with the products that use connectivity packages.

3.6.2

PCM600 and IED connectivity package version

- Protection and Control IED Manager PCM600 Ver.2.5 or later
- ABB IED Connectivity Package PML630 Ver.1.2.1



Download connectivity packages from the ABB Web site
<http://www.abb.com/substationautomation>

Section 4 Using the HMI

4.1 Using the local HMI

At delivery, logging on is not required and the user has full access until users and passwords are created with PCM600 and written into the IED.

Commands, changing parameter values and resetting indications, for example, are actions requiring password when the password protection is activated. Reading information on the LHMI is always allowed without password.




HMI operations are possible only for authorized users.



Do not switch off the auxiliary power supply to the IED before changes, for example, setting parameter or local/remote control state changes are saved.

A mechanism for limiting the number of writings per time period is included in the IED to prevent the flash memory from wearing out due to too many writings caused by the application configuration. As a consequence, saving application function states may take up to an hour. If the auxiliary power is interrupted before the states are saved, that change is lost. Settings and configuration parameters are saved without delay.





4.1.1 Logging on

1. Press  to activate the logon procedure.
The logon is also activated when attempting a password-protected operation.
2. Select the user name from the list.

Log on	
User:	<input type="text" value="Admin"/>
Password:	*****
OK	Cancel

Figure 13: Selecting the user name

3. Enter the password when prompted digit by digit and select OK.

- Activate the digit to be entered with  and .
- Enter the character with  and .

Upper and lower case letters are also found by scrolling with the vertical arrows.

Log on	
User:	Admin
Password:	*****
OK	Cancel



Figure 14: Entering the password



Passwords are case sensitive.



Only characters A - Z, a - z and 0 - 9 should be used in user names and passwords.

4. Press  to confirm the logon or  to cancel the procedure.
If the logon fails, a message is displayed on the display.

Error
Incorrect password!

Figure 15: Error message indicating an incorrect password



The logon dialog will open if the attempted operation requires another level of user rights.





Once a user is created and written into the IED, logon is possible with the password assigned in the tool. If there is no user created, an attempt to log on causes the display to show a corresponding message.

Log on
No users defined
OK

Figure 16: No user defined

4.1.2 Logging off

The user is automatically logged off after the display timeout. The IED returns to a state where only reading is enabled. Manual logoff is also possible.

1. Press .
2. To confirm logoff, select Yes and press .

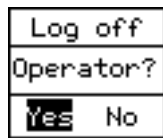



Figure 17: Logging off

- To cancel logoff, press .

4.1.3 Turning the display backlight on

The display backlight is normally off. It turns on at power up.

- To turn on the backlight manually, press any LHMI push button.
The backlight turns on and the panel is ready for further operations.

If the panel has not been used for a predefined timeout period, the backlight is switched off. The user is logged out from the current user level after the display backlight has turned off. The factory default for display timeout is 60 minutes.

The display returns to the default view and all unconfirmed operations, for example parameter editing and breaker selection are cancelled.



Change the backlight timeout period in **Main menu/Configuration/HMI/LHMI/DisplayTimeout**.

4.1.4 Identifying the device

The IED information includes detailed information about the device, such as revision and serial number.

1. Select **Main menu/Information/Product identifiers**.
2. Select a submenu with  and .

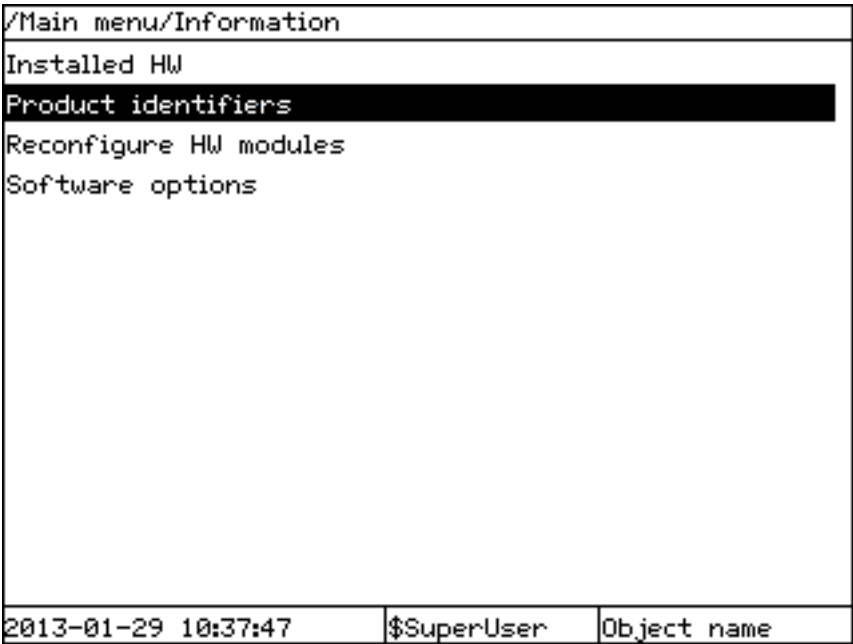





Figure 18: Selecting a submenu

- 3. Enter the submenu with .
- 4. Browse the information with  and .

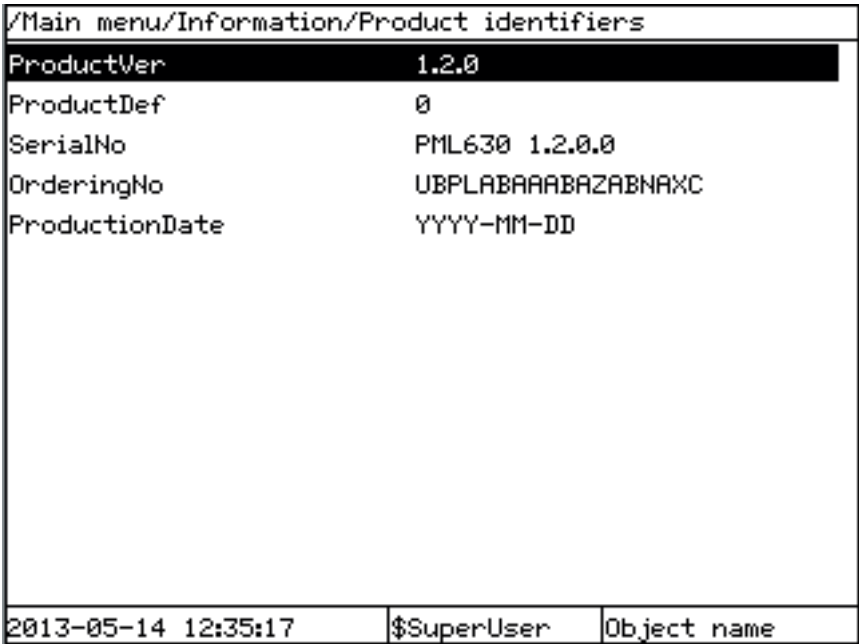


Figure 19: IED information

4.1.5 Adjusting the display contrast

Adjust the display contrast anywhere in the menu structure to obtain optimal readability.

- To increase the contrast, press simultaneously **ESC** and **↑**.
- To decrease the contrast, press simultaneously **ESC** and **↓**.



To store a selected contrast, change the *ContrastLevel* parameter via **Main menu/Configuration/HMI/LHMI**.

4.1.6 Changing the local HMI language

1. Select **Main menu/Language** and press **↵**.
2. Change the language using **↑** or **↓**.
3. Press **↵** to confirm the selection.
4. Commit the changes.










Only English language is supported.



Figure 20: Changing the LHMI language

4.1.7 Navigating in the menu

Navigate the menus and change the display views on the screen with the keypad.

- To move to the Main menu or default view, press .
- To move up or down in a menu, press  or .
- To move downwards in the menu tree, press .
- To move upwards in the menu tree, press .
- To enter setting mode, press .
- To leave setting mode without saving, press .

4.1.7.1 Menu structure

The Main menu contains main groups which are divided further into more detailed submenus.





- Control
- Manual load shed command
- Events
- Measurements
- Disturbance records
- Settings
- Configuration
- Monitoring
- Test
- Information
- Clear
- Language

4.1.7.2 Scrolling the display

If a menu contains more rows than the display can show at a time, a scroll bar is displayed on the right.

/Main menu/Configuration/I/O modules/COM		
BatteryVoltage	110	V
BINAME1	BI1	
Threshold1	65	%UB
DebounceTime1	0.005	s
OscillationCount1	0	
OscillationTime1	0.000	s
BINAME2	BI2	
Threshold2	65	%UB
DebounceTime2	0.005	s
OscillationCount2	0	
OscillationTime2	0.000	s
BINAME3	BI3	
Threshold3	65	%UB
DebounceTime3	0.005	s
2012-12-11 09:10:22	Guest	Object name





Figure 21: Scroll bar on the right

- To scroll the view upwards, press .
- To scroll the view downwards, press .
- To jump from the last row to the first row, press  again.
 - Press  to jump from the first row to the last row.

4.1.7.3

Changing the default view

The default view of the display is **Main menu** unless set otherwise.

1. Select **Main menu/Configuration/HMI/LHMI/DefaultScreen** and press .
2. Change the default view with  or .
3. Press  to confirm the selection.

4.1.8

Using function buttons

The function buttons can be configured either as menu shortcuts or control buttons. The buttons are functional only when the function button panel is visible.

1. Press any function button to open the function button panel.
On the first press of a button, the panel opens but no other action is taken.

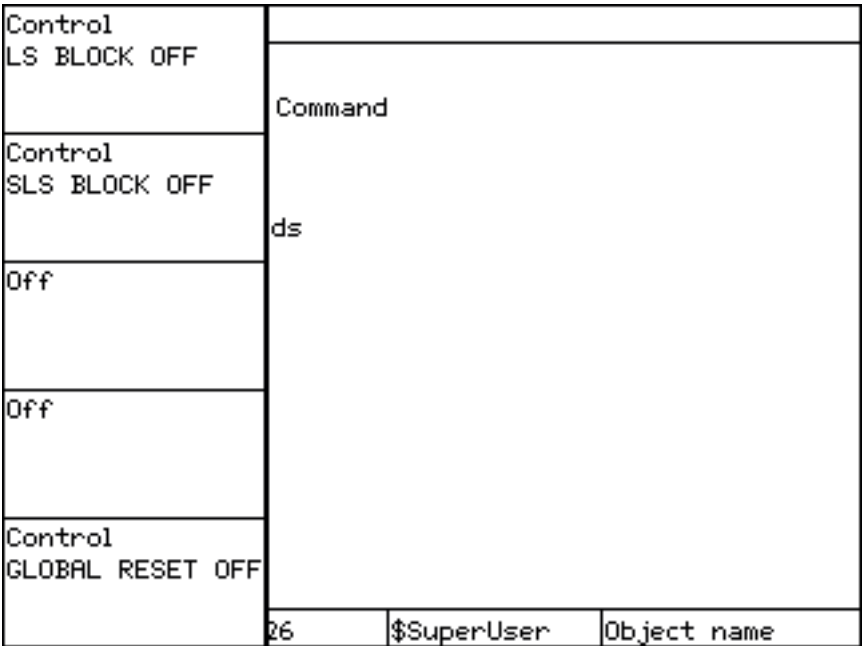


Figure 22: Function button panel

2. Press the wanted function button.
 - Press the wanted function button to jump to a certain menu item. The menu opens immediately upon pressing the button.
 - Press the wanted function button for at least 0.5 s to initiate a control signal. The action is taken once. To repeat the action, press the button again. If the button is pressed less than 0.5 s, no action is taken.
3. Press **ESC** to close the function button panel.

The panel is also closed after pressing a function button configured for a menu shortcut.

The function buttons are configured with PCM600.



For more information, see PCM600 documentation.

4.1.9 Using the single-line diagram

The single-line diagram is created with PCM600.

1. Select **Main menu/Control/Single line diagram**.

The single-line diagram view is displayed.

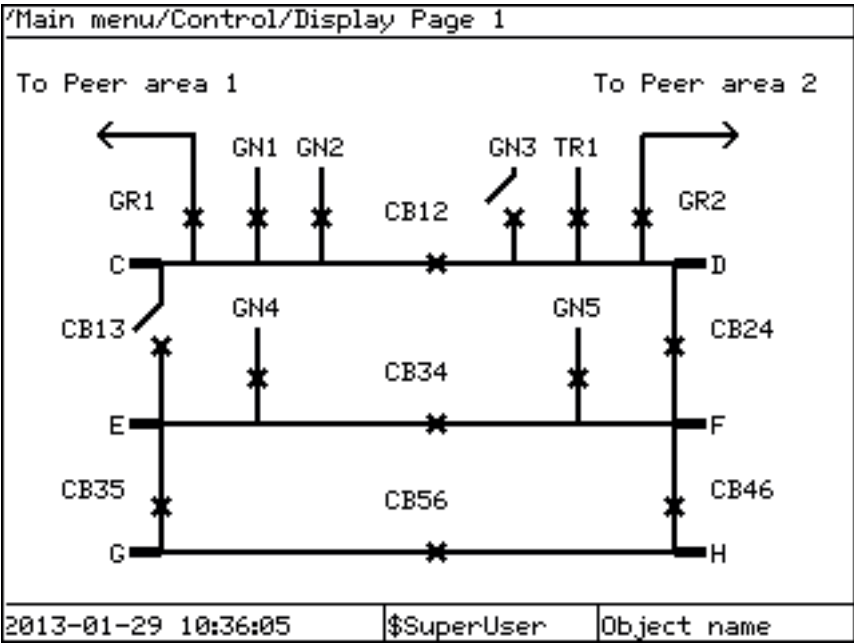


Figure 23: Example of a single-line diagram

- 2. To move between the single-line diagram pages, press or . This is required when the single-line diagram does not fit into a single display page and hence configured in multiple pages.



Select the single-line diagram for the default view in **Main menu/Configuration/HMI/LHMI/DefaultScreen**.

4.1.10 Browsing setting values

- 1. Select **Main menu/Settings/Settings** and press .
- 2. Press and then to activate the setting group number selection.

Edit setting group	
Setting group:	
Yes	No

Figure 24: Selecting the setting group number

- 3. Press to confirm the setting group selection and to return to the Edit setting group dialog.
- 4. Press to select Yes and to view the setting group values.
 - Press or to select No and to exit.

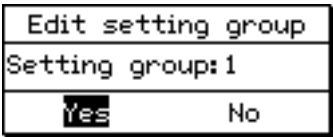






Figure 25: Selecting a setting group

5. To browse the settings, scroll the list with  and  and to select a setting press . To move back to the list, press .

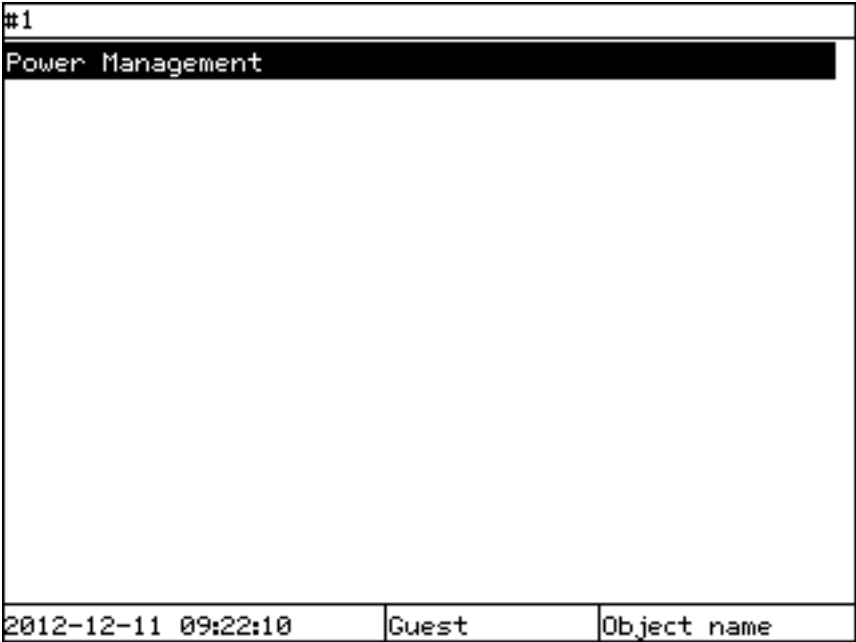


Figure 26: Setting alternatives in the selected setting group

The content of the list depends on the pre-configuration or on the functions configured with PCM600.



PML630 supports only one setting group.

4.1.11 Editing values

- To edit values, log in with the appropriate user rights.
If the user rights are not sufficient for editing values, the log on dialog opens.



Parallel editing is not possible. For example, if a value is edited via WHMI or PCM600, the same value cannot be edited via LHMI at the same time.

4.1.11.1

Editing numerical values

1. Select **Main menu/Settings** and then a setting.



The # character on the right indicates that the parameter belongs to a setting group.

The last digit of the value is active.



- When the symbol in front of the value is ↑, the active value can only be increased.
- When the symbol is ↓, the active value can only be decreased.
- When the symbol in front of the value is ↕, the active value can either be increased or decreased.

#1/Power Management/LSCACLS:1		
INSTNAME	LSCACLS	
Disable LS SubNetw	No	
Enable LS SubNetw1	Yes	
Enable LS SubNetw2	Yes	
Enable LS SubNetw3	Yes	
Enable LS SubNetw4	Yes	
SubNetw1 Man Prio	↑	5
SubNetw2 Man Prio	6	
SubNetw3 Man Prio	7	
SubNetw4 Man Prio	8	
SubNetw1 Man Pow	10000.0	kW
SubNetw2 Man Pow	10000.0	kW
SubNetw3 Man Pow	10000.0	kW
SubNetw4 Man Pow	10000.0	kW
2013-01-29 10:43:55	\$SuperUser	Object name

Figure 27: Last digit is active and it can be increased or decreased





/Main menu/Configuration/Monitoring/A4RADR(ACH4):1		
INSTNAME	A4RADR	
NAME31	SN1_EF_POWBAL	
Operation Ch 31	On	
Nominal value Ch 31	0.0	
Under trigger Ch 31	Off	
Under Trg Lev Ch 31	50	%
Over trigger Ch 31	Off	
Over Trg Lev Ch 31	200	%
NAME32	SN2_EF_POWBAL	
Operation Ch 32	On	
Nominal value Ch 32	0.0	
Under trigger Ch 32	Off	
Under Trg Lev Ch 32	50	%
Over trigger Ch 32	Off	
2013-06-03 08:54:01	\$SuperUser	Object name





Figure 28: Last digit is active and it can be increased or decreased

2. Press  to increase or  to decrease the value of an active digit. One press increases or decreases the value by a certain step. For integer values, the change is 1, 10, 100 or 1000 (...) depending on the active digit. For decimal values, the change can be fractions 0.1, 0.01, 0.001 (...) depending on the active digit.



For parameters with defined steps, digits smaller than the step value cannot be edited.

3. Press  or  to move the cursor to another digit.
4. To select the minimum or maximum value, select the arrow symbol in front of the value.
 - To set the value to the maximum, press .
 - To set the value to the minimum, press .



After pressing , the previous value can be restored by pressing  once, and vice versa. Another press of  or  sets the value to the lower or higher limit. The symbol in front of the value is \updownarrow , when the previous value is shown.

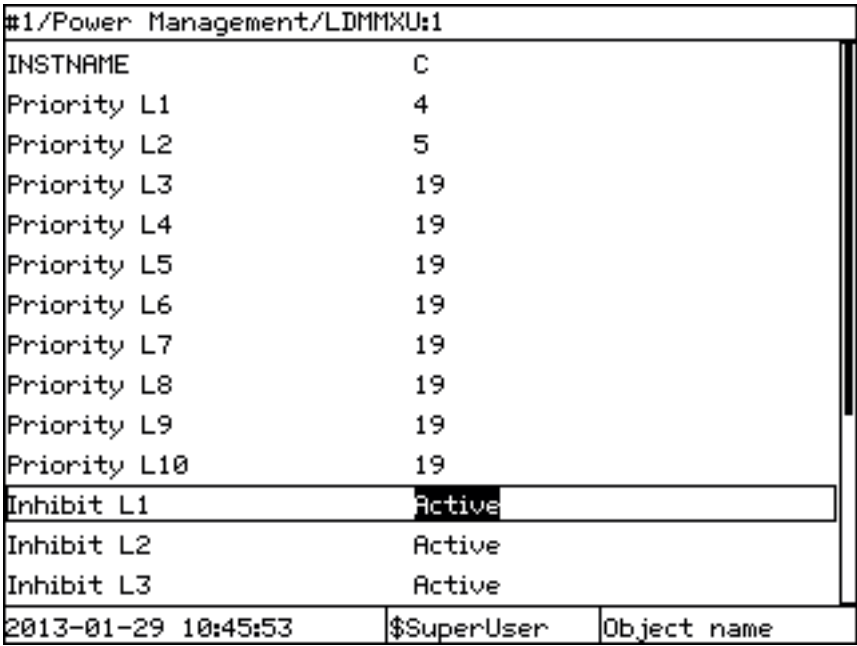
#1/Power Management/LSCACLS:1		
INSTNAME	LSCACLS	
Disable LS SubNetw	No	
Enable LS SubNetw1	Yes	
Enable LS SubNetw2	Yes	
Enable LS SubNetw3	Yes	
Enable LS SubNetw4	Yes	
SubNetw1 Man Prio	\$	3
SubNetw2 Man Prio	6	
SubNetw3 Man Prio	7	
SubNetw4 Man Prio	8	
SubNetw1 Man Pow	10000.0	kW
SubNetw2 Man Pow	10000.0	kW
SubNetw3 Man Pow	10000.0	kW
SubNetw4 Man Pow	10000.0	kW
2013-01-29 10:43:55	\$SuperUser	Object name

Figure 29: Restoring the previous value

4.1.11.2

Editing enumerated values

1. Activate the setting mode and select a setting.
When editing an enumerated value, the selected value is shown inverted.
2. Press  or  to change the value of an active enumerated value.
One press changes the enumerated value by one step in the parameter specific order.







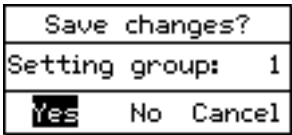
#1/Power Management/LDMMXU:1		
INSTNAME	C	
Priority L1	4	
Priority L2	5	
Priority L3	19	
Priority L4	19	
Priority L5	19	
Priority L6	19	
Priority L7	19	
Priority L8	19	
Priority L9	19	
Priority L10	19	
Inhibit L1	Active	
Inhibit L2	Active	
Inhibit L3	Active	
2013-01-29 10:45:53	\$SuperUser	Object name

Figure 30: Editing enumerated values

4.1.12 Saving settings



Editable values are stored in the non-volatile flash memory. Most of the parameter changes take effect immediately after storing, but some parameter changes require application restart. Values stored in the flash memory remain in effect after reboot as well.

1. Press  to confirm any changes.
2. Press  to move upwards in the menu tree or  to enter the Main Menu.
3. To save the changes in non-volatile memory, select Yes and press .



Save changes?		
Setting group:	1	
Yes	No	Cancel

Figure 31: Confirming settings

- To exit without saving changes, select No and press .
- To cancel saving settings, select Cancel and press .



Pressing Cancel in the Save changes dialog closes only the Save changes dialog box, but the IED remains in editing mode. All the changes applied to any setting are not lost and the user can continue to


change settings. To leave the change setting mode, select No or Yes in the Save changes dialog.



After changing the parameters marked with !, the IED restarts automatically for the changes to take effect.

4.1.13 Clearing and acknowledging

The Clear button is used to reset, acknowledge or clear all messages and indications, including LEDs and latched outputs as well as registers and recordings. Press the Clear button to activate a selection menu, and select the wanted clearance or reset function. Events and alarms assigned to alarm LEDs are cleared with the Clear button.

1. Press  to activate the Clear view.

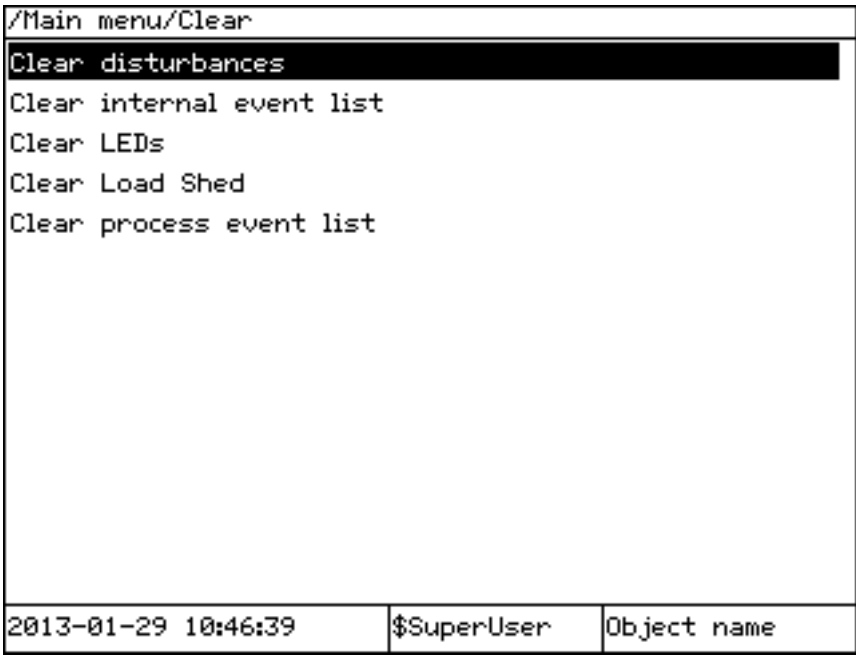










Figure 32: Clear view

The content of the Clear menu depends on the pre-configuration or on the functions configured with PCM600.

2. Select the item to be cleared with  or .
3. Press , select OK to confirm the selection or Cancel to cancel the selection, and press .
4. Repeat steps 2 and 3 to clear other items.


4.1.14 Using the local HMI help

1. Press  to open the help view.
2. Scroll the text with  or  if the help text exceeds the display area.
3. To close the help, press .
The help dialog is also closed when the display timeout expires.

4.1.15 Accessing IED settings using the local HMI



Only the parameters under the basic level in PCM600 are available via LHMI.

1. Select **Main menu/Settings** and Press .

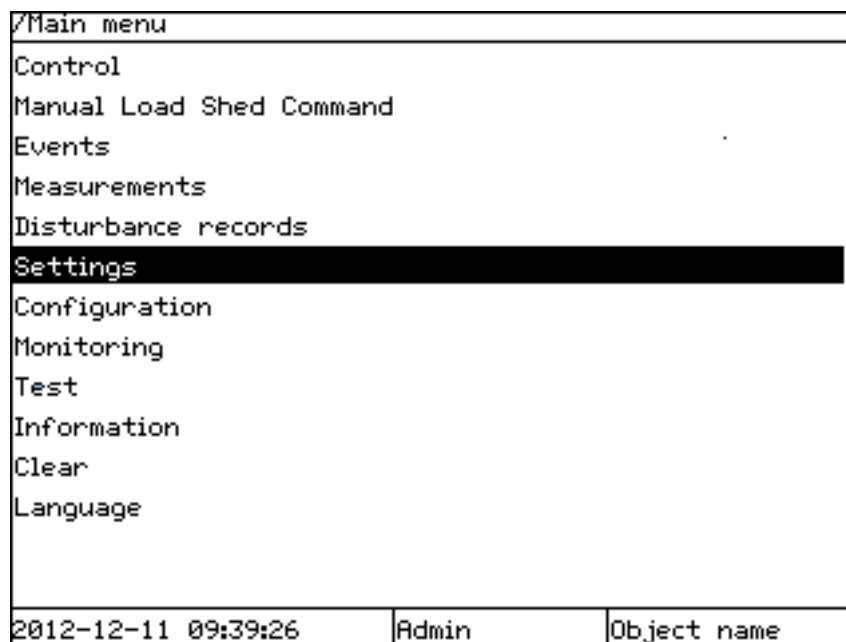







Figure 33: Main menu

2. Press  and then  to activate the setting group number selection.
 - 2.1. Press  to confirm the setting group selection and  to return to the **Edit setting group** dialog.
 - 2.2. Press  to select Yes and to view the setting group values.

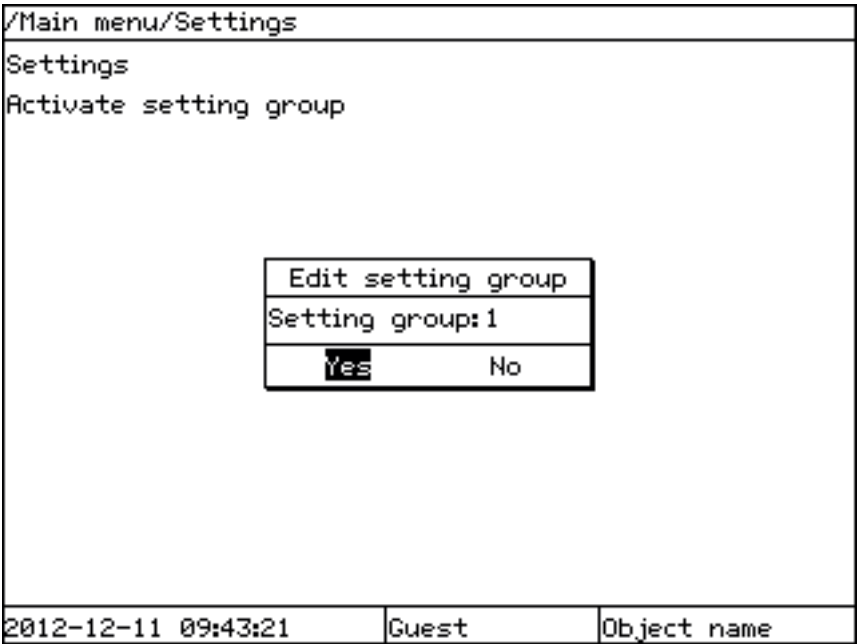






Figure 34: Settings menu

- 2.3. To browse the settings, scroll the list with  and  and to select a setting press . To move back to the list, press . The **Power Management** menu appears.

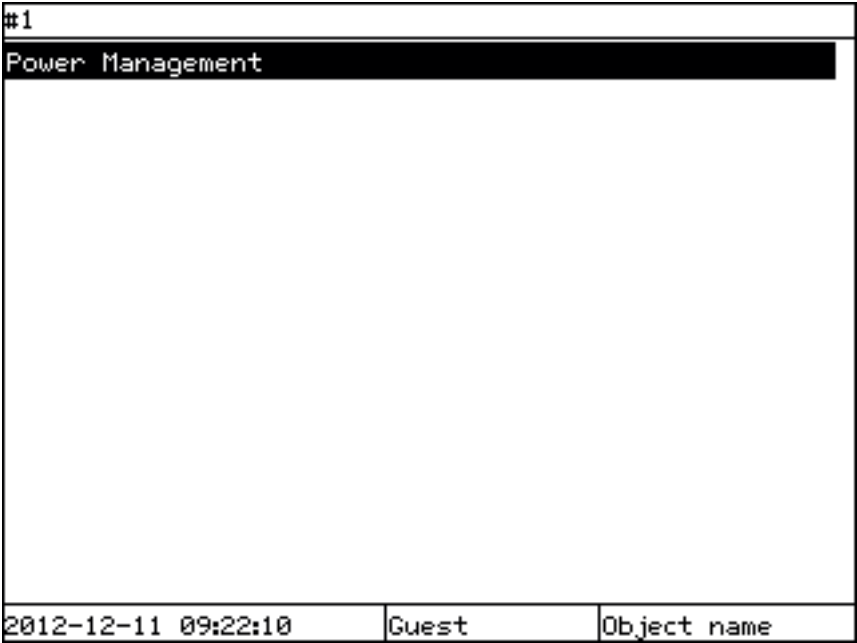


Figure 35: Power Management menu

3. Press  to browse the **Power Management** settings.

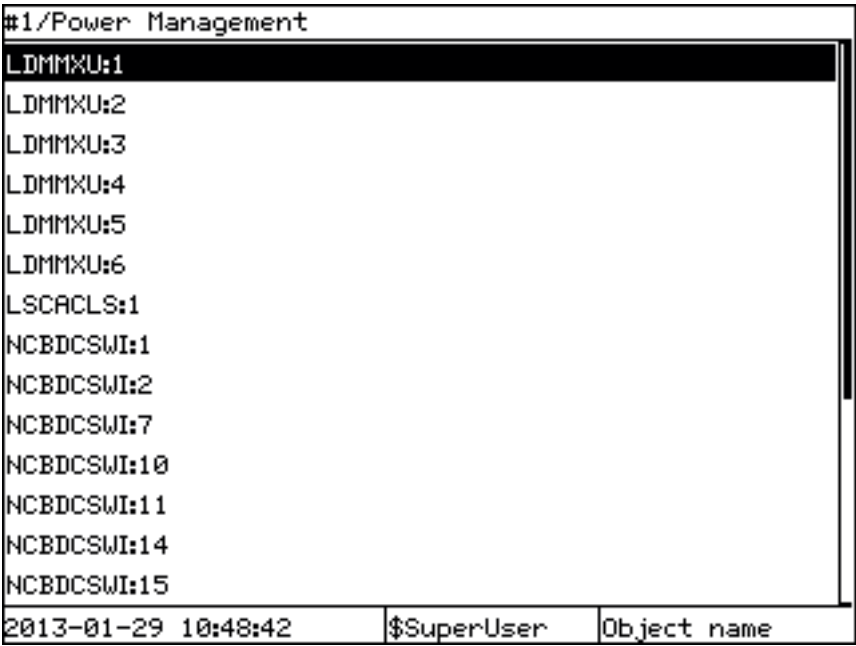


Figure 36: Power management settings menu

The menu lists various settings.

Table 15: Parameter settings applicable for Power Management function blocks

Function	Description
LDMMXU	1 to 6 instances for 6 load busbars
NCBDCSWI	1 to 15 instances for 15 network circuit breakers
PSCSWI	1 to 8 instances for 8 power sources
LSCACLS	1 instance for load shed core



For more information about the setting parameters of power management functions, see the technical manual.


4. Press  to browse the detailed settings of the individual entity.

Table 16: LDMMXU load busbar settings

Settings	Value	Description
Priority L1...L10	1...19	Priority setting of the sheddable loads
Inhibit L1...L10	Active/Inactive	Manual Inhibition of the sheddable loads

#1/Power Management/LDMMXU:1		
INSTNAME	C	
Priority L1	4	
Priority L2	5	
Priority L3	19	
Priority L4	19	
Priority L5	19	
Priority L6	19	
Priority L7	19	
Priority L8	19	
Priority L9	19	
Priority L10	19	
Inhibit L1	Active	
Inhibit L2	Active	
Inhibit L3	Active	
2013-01-29 10:45:53	\$SuperUser	Object name

Figure 37: Load busbar settings

LSCACLS: Fast load shed core function settings.

Table 17: LSCACLS Fast load shed core function settings

Settings	Value	Description
Disable LS SubNetw	Yes/No	Global load-shedding (Disables load-shedding for all subnetworks)
Enable LS SubNetw1...4	Yes/No	Individual subnetwork load-shedding
SubNetw1...4 Man Prio	1...19	Manual load-shedding based on priority
SubNetw1...4 Man Pow	limits	Manual load-shedding based on power value in kW

#1/Power Management/LSCACLS:1		
INSTNAME	LSCACLS	
Disable LS SubNetw	No	
Enable LS SubNetw1	Yes	
Enable LS SubNetw2	Yes	
Enable LS SubNetw3	Yes	
Enable LS SubNetw4	Yes	
SubNetw1 Man Prio	19	
SubNetw2 Man Prio	19	
SubNetw3 Man Prio	19	
SubNetw4 Man Prio	19	
SubNetw1 Man Pow	200000.0	kW
SubNetw2 Man Pow	200000.0	kW
SubNetw3 Man Pow	200000.0	kW
SubNetw4 Man Pow	200000.0	kW
2012-12-11 09:49:41	Guest	Object name

Figure 38: Load shed core settings

NCBDCSWI: Network circuit breakers, bus coupler and tie breakers settings.

- Block Override to bypass load shed block: Block override (**No/IED in test/Quality bad CB close/Quality bad CB Open/CB Position/All Yes**)



The default setting for the parameter 'Block override' is 'No', so the load shed function is blocked when network circuit breaker IED is in test mode or quality of data is bad or if circuit breaker position is intermediate or invalid.

The parameter setting 'All Yes' bypasses the load shed function blocking irrespective of blocking condition.

#1/Power Management/NCBDCSWI:1		
INSTNAME		CB12
Block override		No
2012-12-11 09:50:37		Guest
		Object name

Figure 39: Network circuit breakers bus coupler and tie breakers settings

PSCSWI: Power sources (generator, and external source – either transformer or grid connected with peer network area) settings.

Table 18: PSCSWI: Power source settings

Settings	Value	Description
Block override	No IED in test Quality bad CB close Quality bad CB Open CB Position All Yes	Block override to bypass load shed block
Maximum Ava power	0...999999.9 kW	Maximum power
Governor mode	Droop MW ISO PControl Optimize Base load Peak load	Governor mode of the generator
Slow load shed mode	Disable OC & Ext Trg Max Dmd Trg OC, Max Dmd, Ext Trg	Slow load shed mode selection
Maximum power SLS	0...999999.9kW	Maximum power after slow load shed trigger
Maximum demand	0...999999.9kW	Maximum demand setting

Table continues on next page

Settings	Value	Description
Start value	0.8...10 pu	Start value for over current based slow load shed operation.
Start value Mult	0.05...5	Start value multiplier for over current based slow load shed operation
Time multiplier	limits to be entered	Time multiplier
Operating curve type	ANSI Ext. inv. ANSI Very inv. ANSI Norm. inv. ANSI Mod. inv. ANSI Def. Time L.T.E. inv. L.T.V. inv. L.T. inv. IEC Norm. inv. IEC Very inv. IEC inv. IEC Ext. inv. IEC S.T. inv. IEC L.T. inv. IEC Def. Time Programmable RI type RD type	Operating curve type selection
Operate delay time	0.04 - 200.00	Operate delay time for definite time operation



Governor mode setting is applicable only for Generator and has no consequence for other power sources, though the setting is visible and enabled for all types of power sources.



In case of cPMS - LS configuration B, if the *Block override* parameter setting is done for the interconnected grid power source circuit breaker at any one area, the other interconnected area always considers the far end circuit breaker position as “Close”. “Close” to “Open” change in circuit breaker position is not communicated to the other interconnected area.

#1/Power Management/PSCSWI:1			
INSTNAME		GRID1	
Block override	No		
Maximum Ava power	22000.0	kW	
Governor mode	ISO		
Slow load shed mode	OC & Ext Trg		
Maximum power SLS	0.0	kW	
Maximum demand	0.0	kW	
Start value	0.05	pu	#
Start value Mult	1.0		#
Time multiplier	1.00		#
Operating curve type	IEC Def. Time		#
Operate delay time	0.04	s	#
2013-05-14 12:53:26		\$SuperUser	Object name

Figure 40: Power sources



For more information about the different settings and their significance, see the technical manual.

4.1.16 Using the Clear menu

1. Select **Main menu/Clear**.




/Main menu		
Control		
Manual Load Shed Command		
Events		
Measurements		
Disturbance records		
Settings		
Configuration		
Monitoring		
Test		
Information		
Clear		
Language		
2012-12-11 09:54:42	Guest	Object name

Figure 41: Clear menu

- Press  to activate the **Clear** view.

/Main menu/Clear		
Clear disturbances		
Clear internal event list		
Clear LEDs		
Clear Load Shed		
Clear process event list		
2012-12-11 09:55:58	Guest	Object name

Figure 42: Clear load shed

- Clear disturbances: to erase disturbance records captured by the IED
 - Clear internal event list: to erase internal events captured by the IED
 - Clear LEDs: to clear all the LEDs signals by the IED
 - Clear load shed: to reset load shed
 - Clear process event list: to erase event list captured by the IED
- 2.1. Select the item to be cleared with  or .
- 2.2. Press  in the **Clear Load Shed** menu.

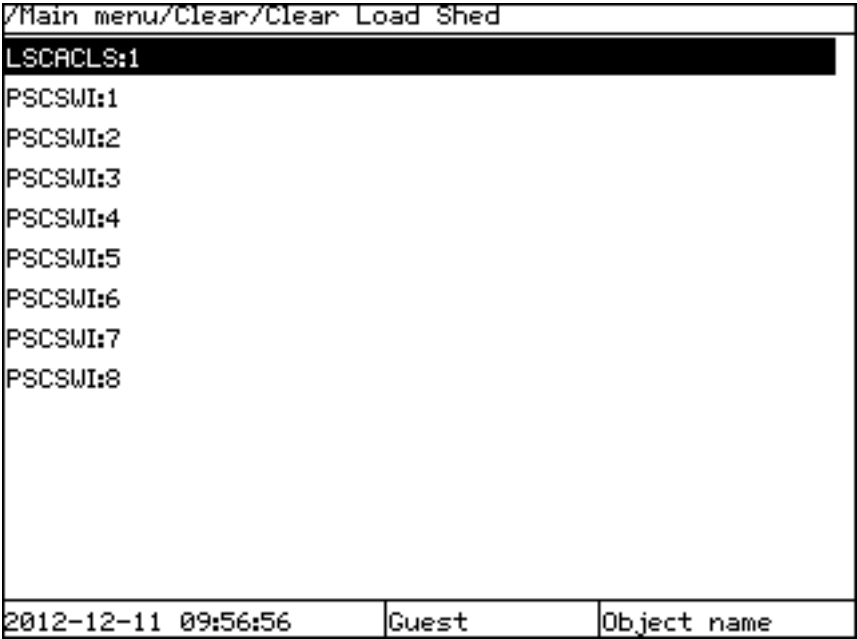



Figure 43: Clear Load Shed Menu

- 2.3. Press  for fast load shed clear from LSCACLS.

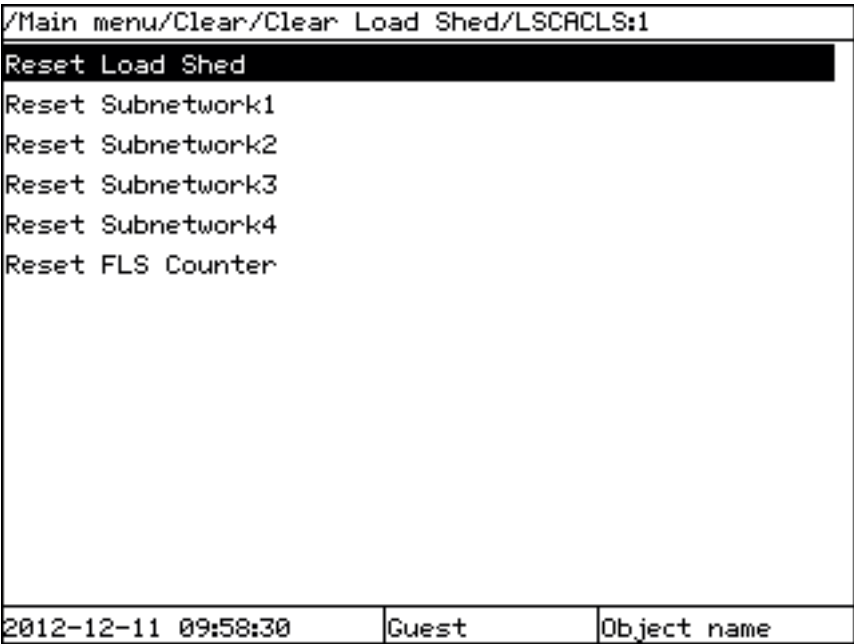




Figure 44: Fast load shed clear

- 2.4. Press , select OK to confirm the selection or Cancel to cancel the selection, and press .

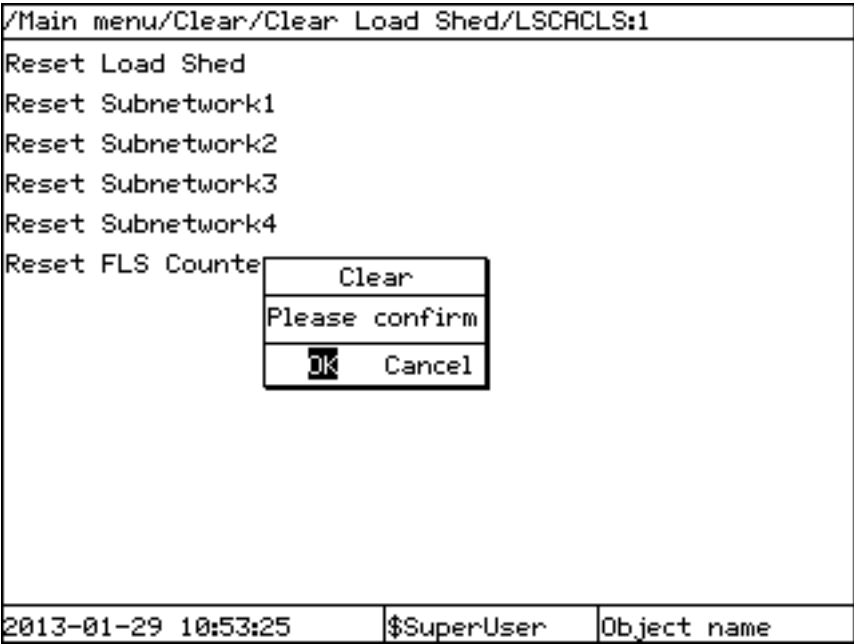



Figure 45: Fast load shed clear from LSCACLS

Table 19: Fast load shed clear from LSCACLS

Command	Description
Reset Load Shed	Resets load shed activation in all subnetworks
Reset Subnetwork1	Resets load shed activation in subnetwork 1
Reset Subnetwork2	Resets load shed activation in subnetwork 2
Reset Subnetwork3	Resets load shed activation in subnetwork 3
Reset Subnetwork4	Resets load shed activation in subnetwork 4
Reset FLS Counter	Resets fast load shed counter to 0

- 2.5. Press  for slow load shed clear from PSCSWI.

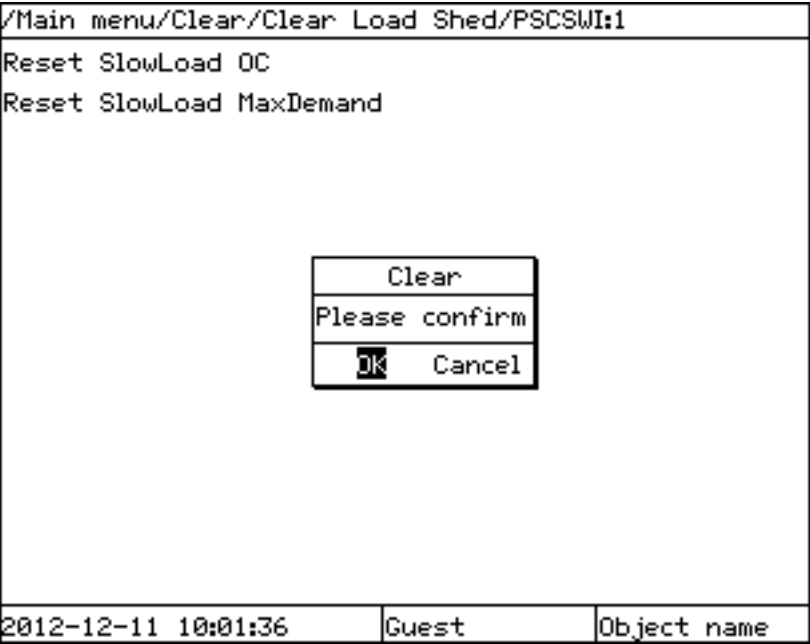


Figure 46: Slow load shed clear

Table 20: Slow load shed clear from PSCSWI

Command	Description
Reset SlowLoad OC	Resets overcurrent-based slow load-shedding
Reset SlowLoad MaxDemand	Resets maximum demand based slow load shed

4.1.17 Executing the manual load shed command from the LHMI

1. Select **Main menu/Manual Load Shed Command**.

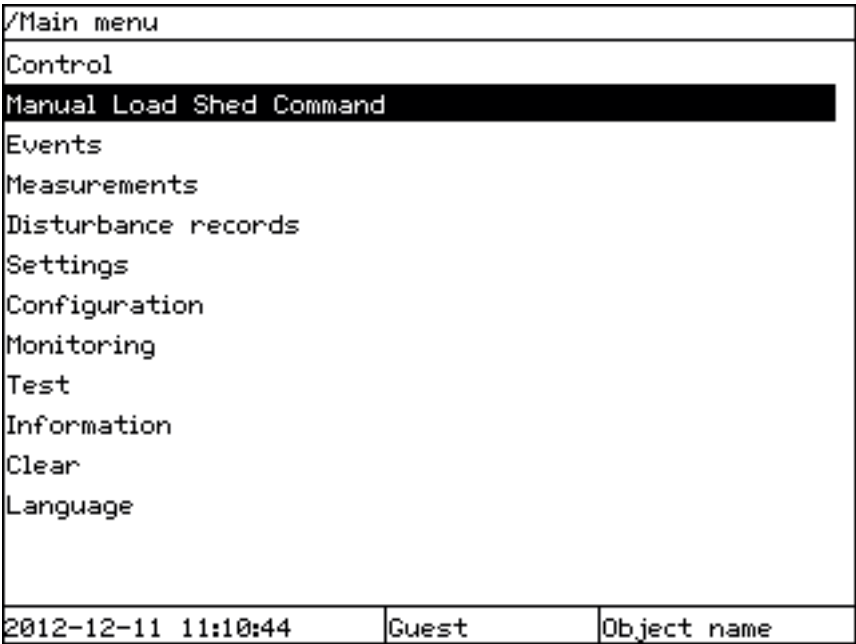



Figure 47: Manual load shed command

2. Press  for the execution.
Manual load shed command can be executed for any of the four subnetworks.

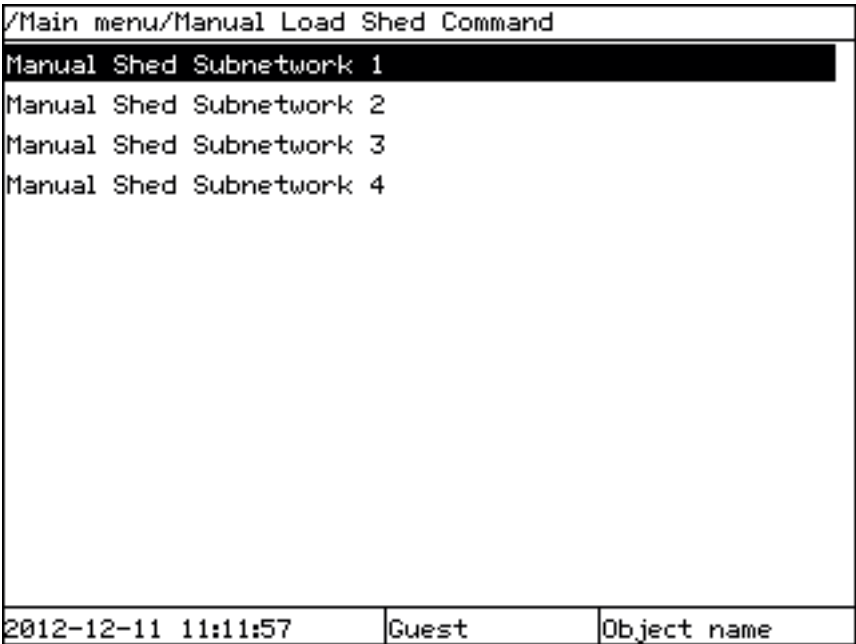




Figure 48: Manual load shed selection for subnetwork

3. Press  and OK to execute the manual load shed command, or  and Cancel to cancel the operation.

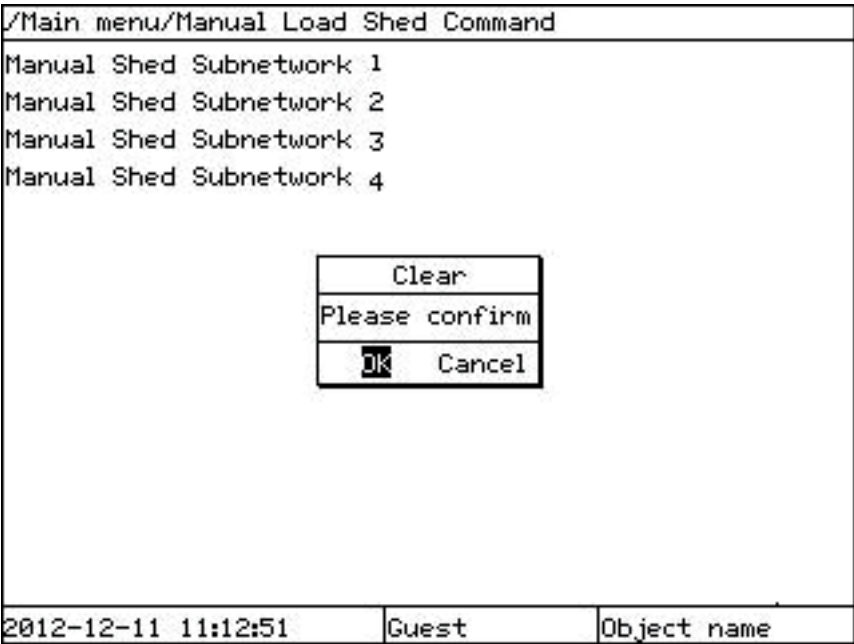


Figure 49: Manual load shed confirmation

Table 21: Manual load shed commands

Command	Description
Manual Shed Subnetwork 1	Manual load shed command for subnetwork 1
Manual Shed Subnetwork 2	Manual load shed command for subnetwork 2
Manual Shed Subnetwork 3	Manual load shed command for subnetwork 3
Manual Shed Subnetwork 4	Manual load shed command for subnetwork 4



Selection of priority or power for manual load-shedding action of each subnetworks is based on the parameter setting in the IED or communicated input data (from COM600). See the application engineering guide for more details.

4.2 Using the Web HMI

WHMI is disabled by default.

1. To enable the WHMI, select **Main menu/Configuration/HMI/Web HMI/Operation** via the LHMI.
2. To enable writing through the WHMI, select **Main menu/Configuration/HMI/Web HMI/Write mode** via the LHMI.
3. To open the WHMI, write the IED IP address to the address bar of the browser.



Do not use favorites in the web browser. If the user is unauthorized and selects a favorite pointing to a WHMI page, the action can redirect the user to the log in page. With authorization the user is redirected to the startup page.



Only the parameters under the basic level in PCM600 are available via the WHMI.

4.2.1

Logging in

If no users have been created with PCM600, both the default user ID and password is SuperUser.

1. Enter the username.
2. Enter the password.
3. Click **OK**.

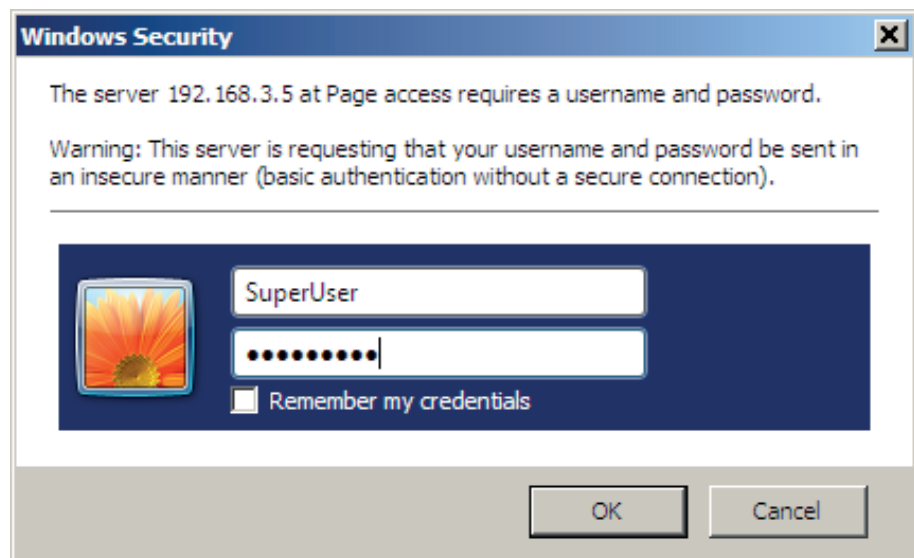


Figure 50: Entering username and password to use the WHMI

4.2.2

Logging out

The user is logged out after a session time-out.

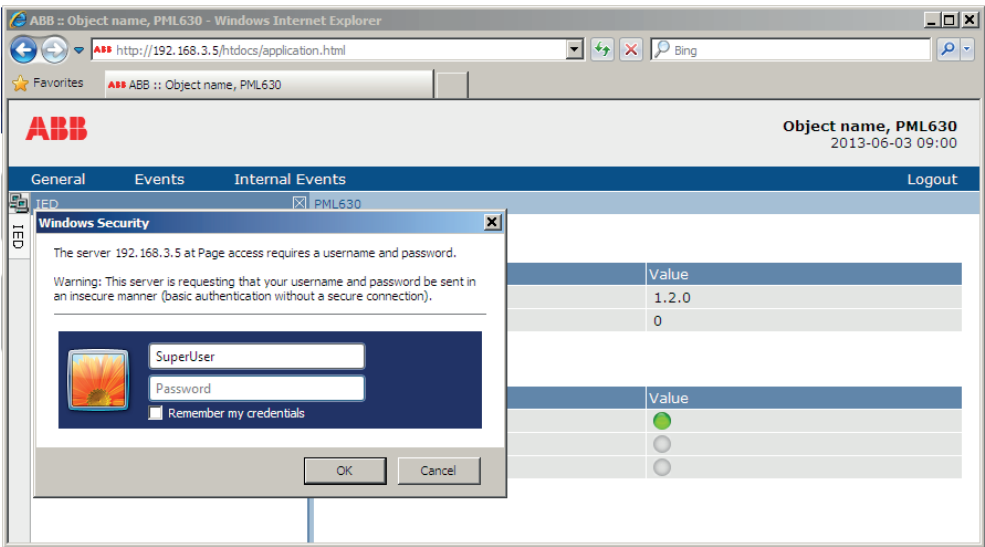


Figure 51: Session time-out

- To log out manually, click **Logout** on the menu bar.

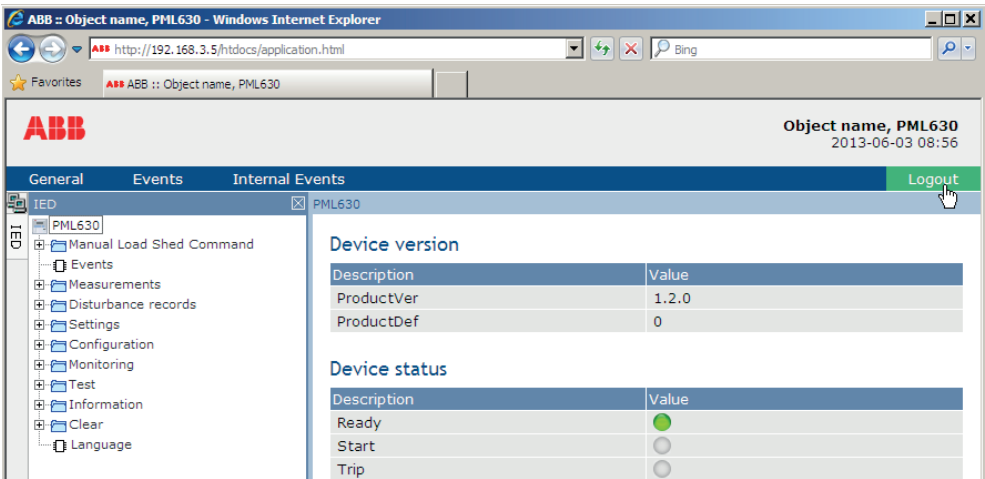


Figure 52: WHMI logout

If the WHMI is closed without properly logging out, the WHMI does not reconnect until the set session time-out.

4.2.3 Identifying the device

The IED information includes detailed information about the device, for example, revision and serial number.

1. Click **Information** in the WHMI menu structure.
2. Click a submenu to see the data.

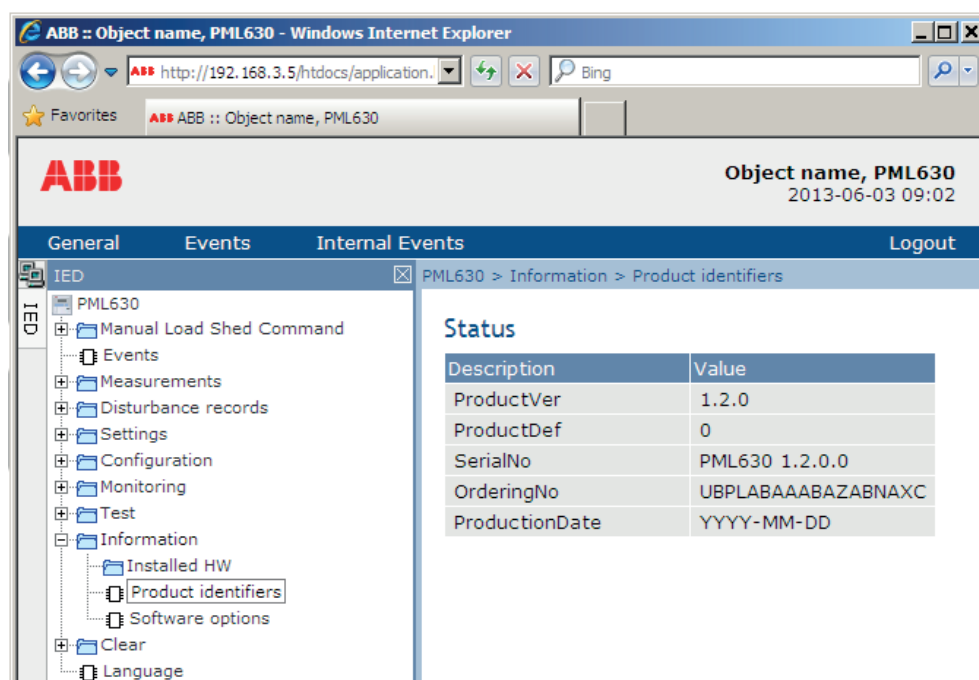


Figure 53: Device information

4.2.4 Navigating in the menu

The menu tree structure on the WHMI is almost identical to the one on the LHMI. Use the menu bar to access different views.

- The **General** view shows the IED version and status.
- The **Events** view contains a list of events produced by the application configuration.
- **Logout** ends the session.

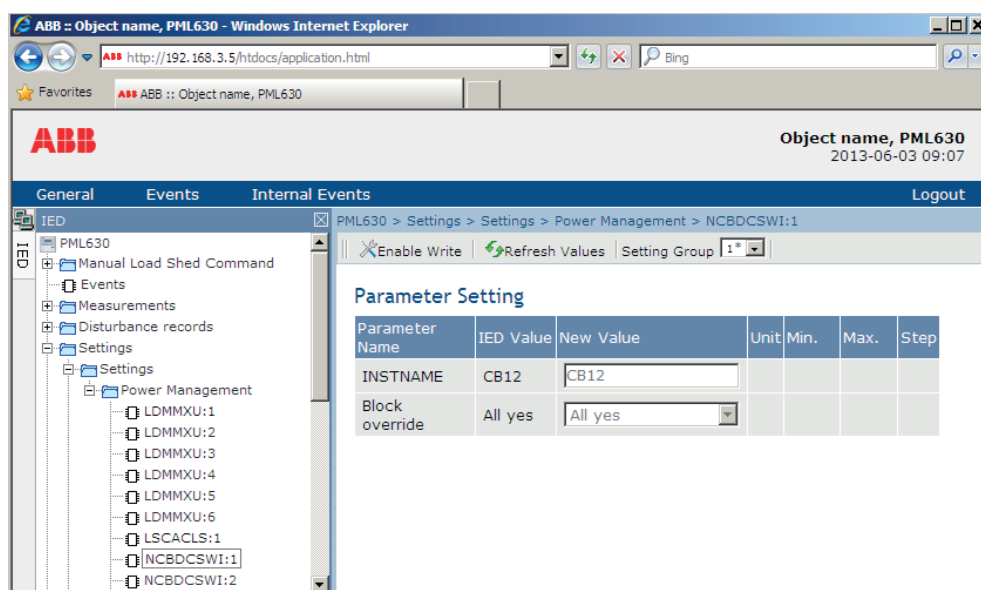


Figure 54: Navigating in the WHMI menus

4.2.4.1

Menu structure

The Main menu contains main groups which are divided further into more detailed submenus.

- Manual load shed command
- Measurements
- Disturbance records
- Settings
- Configuration
- Monitoring
- Test
- Information
- Clear
- Language

4.2.5

Setting parameters in Web HMI



It is recommended that advanced parameter settings are done by the Protection and Control engineer using the Parameter Setting tool. The WHMI and the LHMI setting capability can be assigned to the Operator level. The PCM600 is not an operational tool and hence WHMI or LHMI have to be used to set essential parameters during normal IED operation.

LDMMXU (Load busbar settings)

Settings related to priority and load-shedding inhibition of the individual loads can be changed from WHMI.

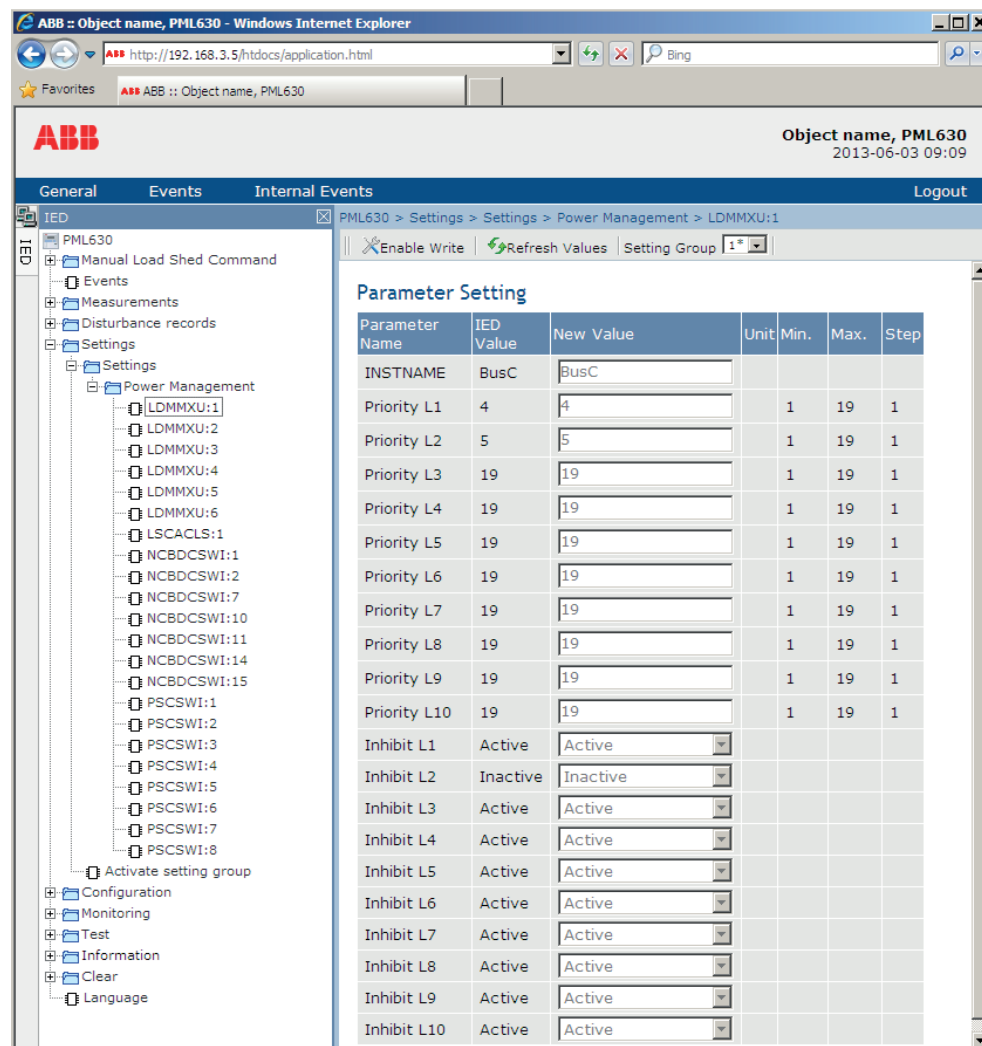


Figure 55: LDMMXU parameter setting

LSCACLS (Contingency based load-shedding)

LSCACLS is a core load-shedding function which can be used from WHMI for various operations.

- Enable or disable load-shedding of the individual subnetwork
- Enable or disable load-shedding of all subnetworks together
- Manual load shed priority setting for subnetwork1 - subnetwork4
- Manual load shed power setting for subnetwork1 - subnetwork4

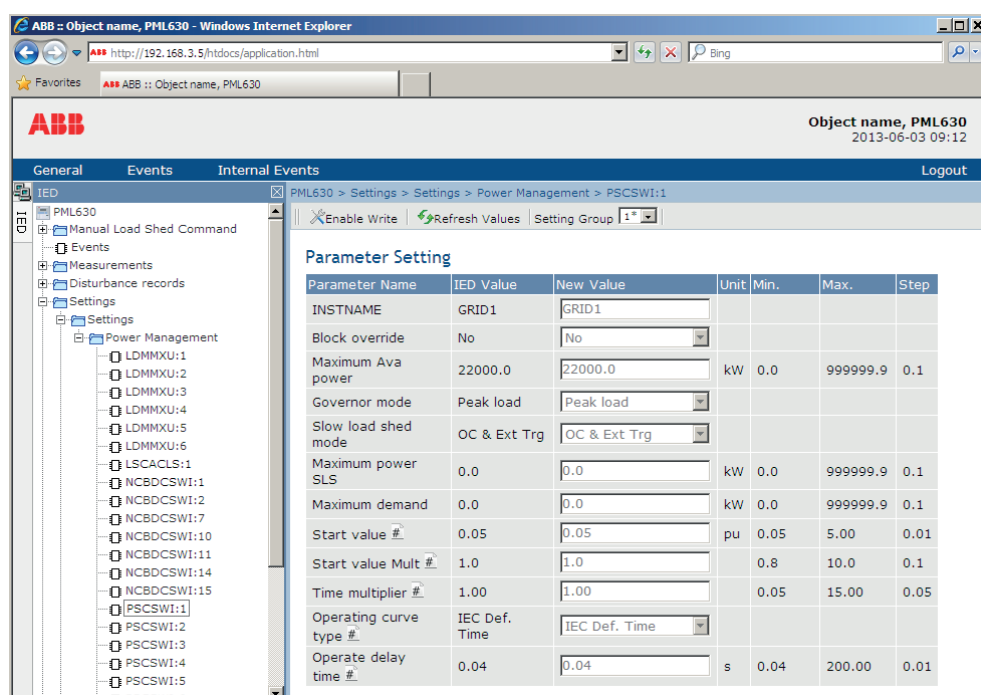


Figure 56: LSCACLS parameter setting

PSCSWI (Power sources)

Setting of power sources such as generators, transformers or grid transformers can be done from WHMI.

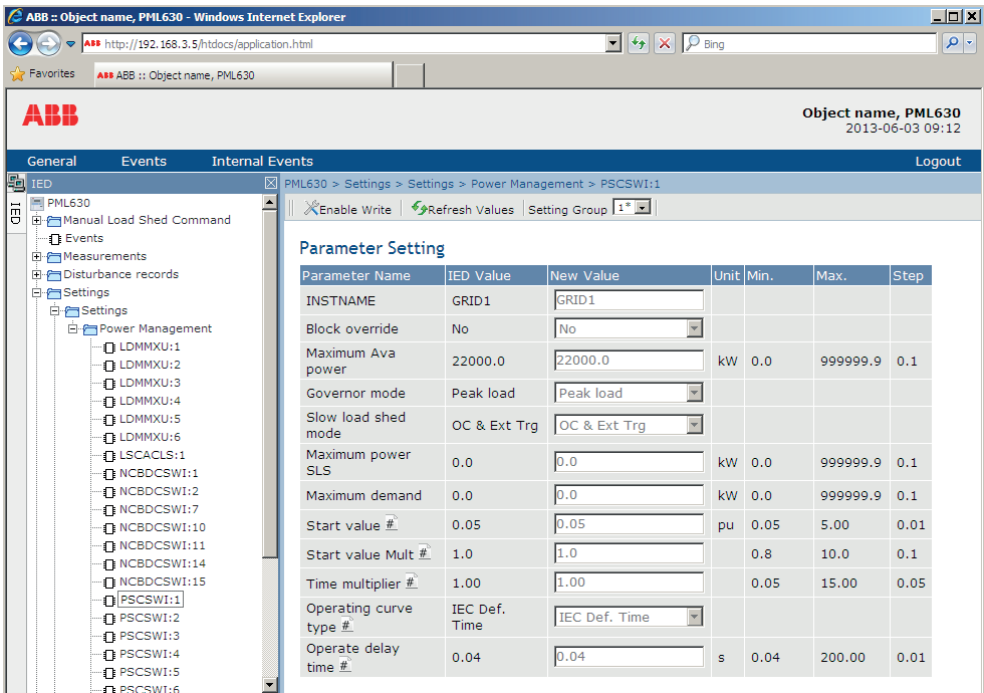


Figure 57: Power source (any) web page



Start value, Start value Mult, Time multiplier, Operating curve type and Operate delay time settings are related to overcurrent-based slow load shed mode setting.

NCBDCSWI (Network circuit breaker)

Network breaker can be bus coupler or tie feeder.

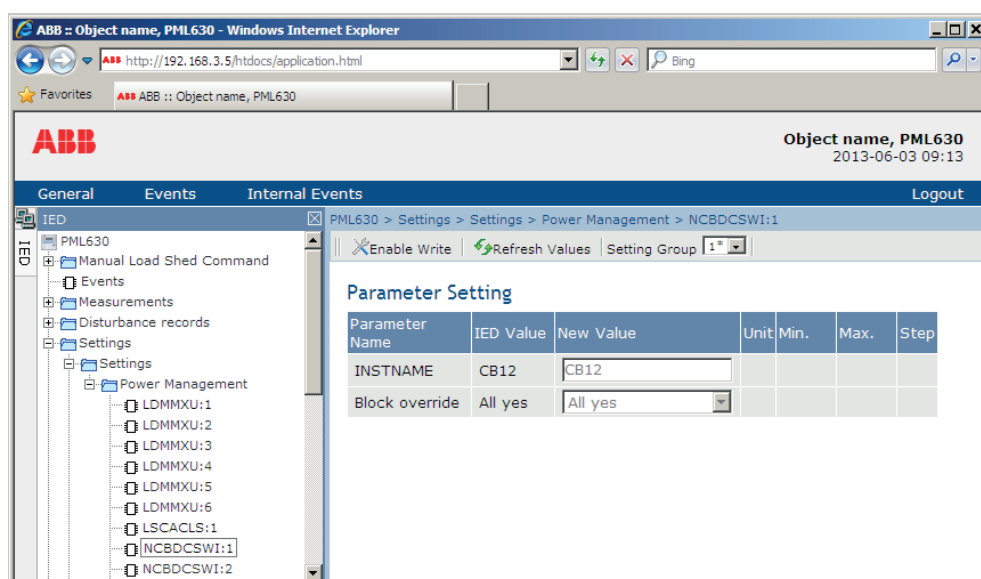


Figure 58: Network circuit breaker settings



For details of the setting parameters for Power Management functions, see the technical manual.

Time synchronization settings

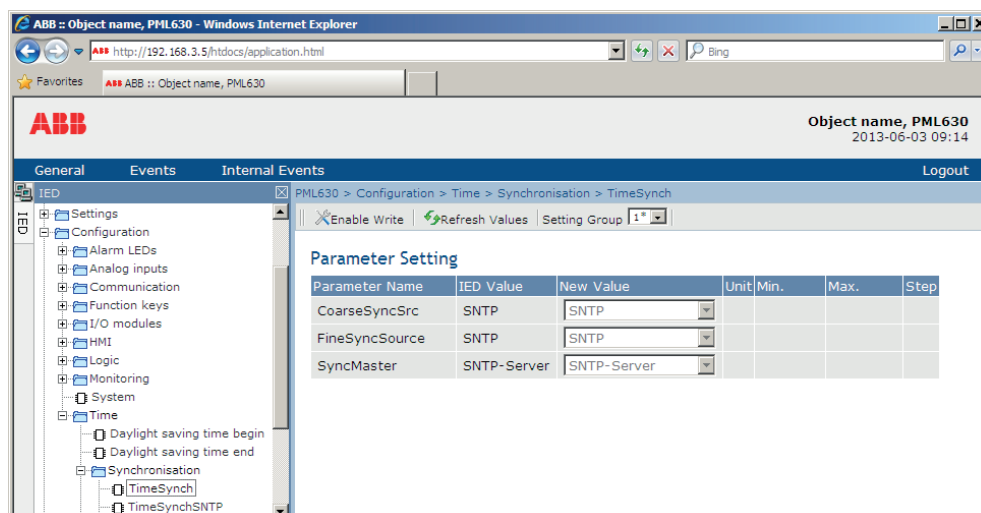


Figure 59: Time synchronization settings

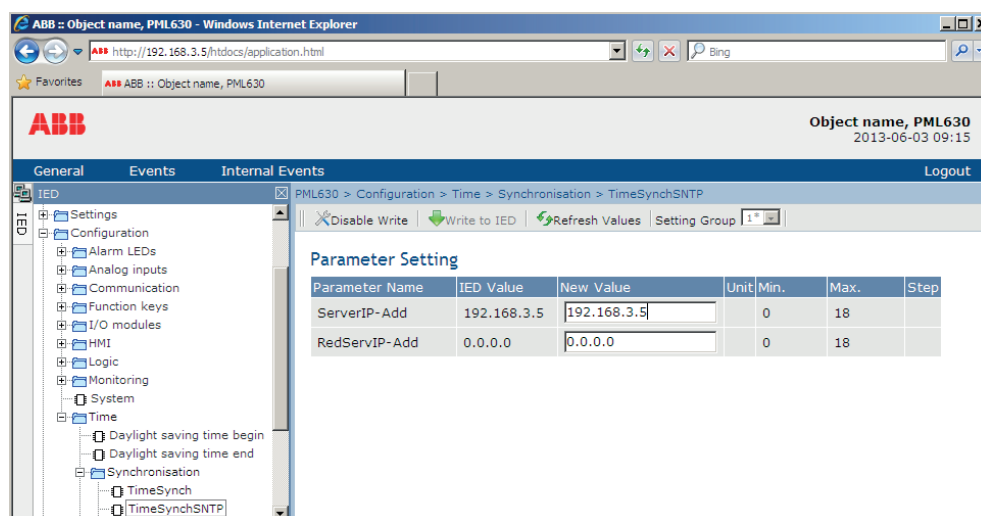


Figure 60: Time synchronization settings

4.2.6

Editing values

1. Click the menu in the WHMI tree.
2. Click the submenu to see function blocks.
3. Click a function block to see the setting values.
4. Click **Enable Write**.



Some parameters, for example, the IED test mode, cannot be set via the WHMI.

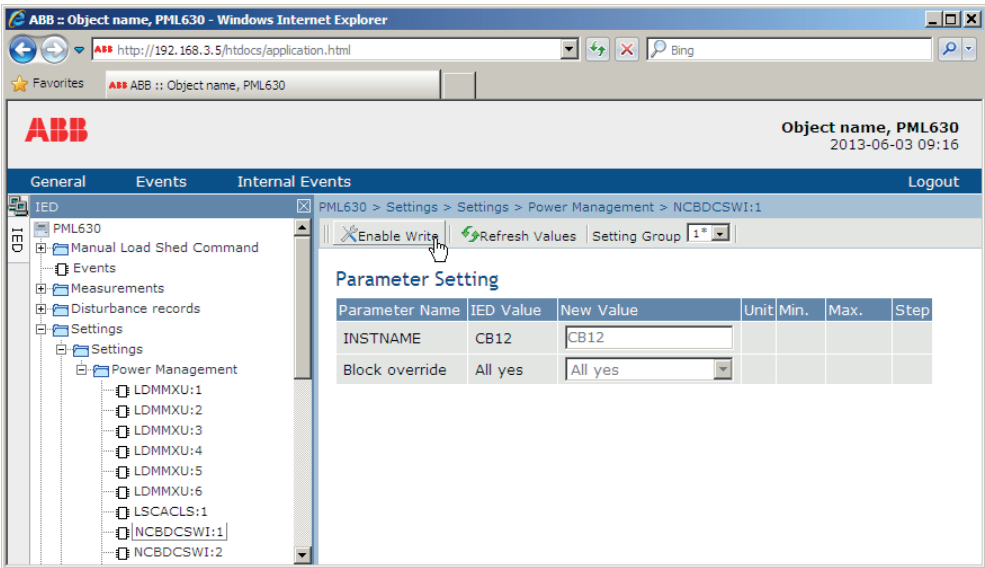


Figure 61: Enable writing to edit a value

The selected setting group is shown in the Setting Group drop-down list. The active setting group is indicated with an asterisk *.

5. Edit the value.
- The minimum, maximum and step values for a parameter are shown in the Min., Max. and Step columns.
 - Setting group values are indicated with #.

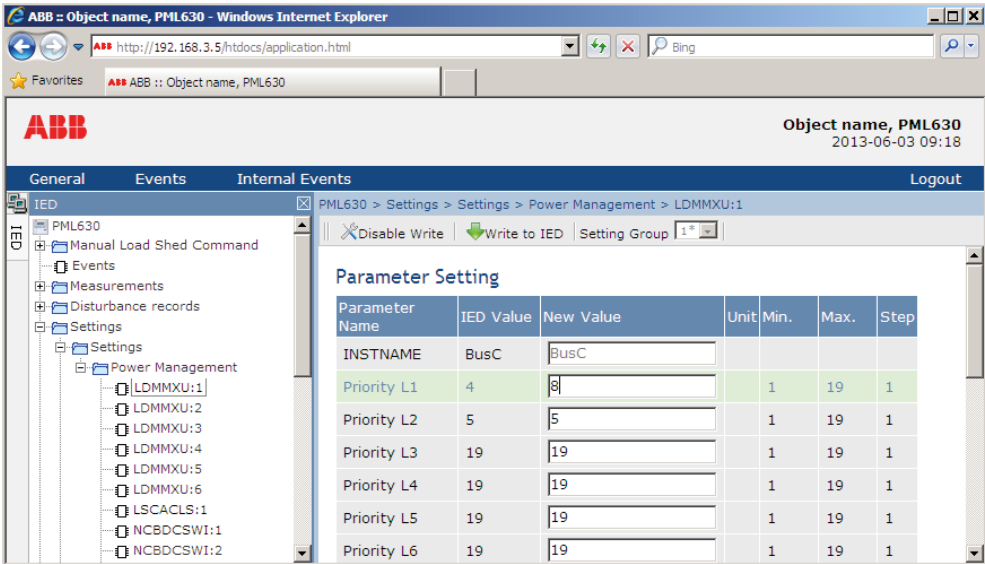


Figure 62: Editing a value

- If the entered value is within the accepted value range, the selection is highlighted in green. If the value is out of range, the row is highlighted in red and a warning dialog box is displayed.
- If writing values fails, a warning dialog box is displayed.

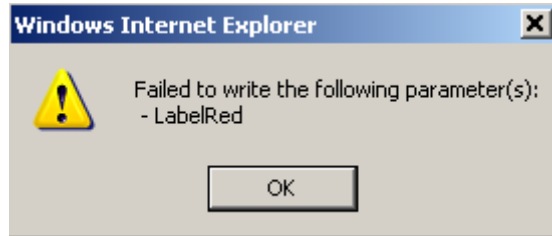


Figure 63: Warning indicating that the values were not written to the IED

If writing is enabled accidentally, click **Disable Write**. **Disable Write** cannot be selected, when a value has already been written to the IED. After clicking **Write to IED**, click either **Commit** or **Reject**.

4.2.7

Committing values

Editable values are stored in the non-volatile flash memory. Values stored in the flash memory are in effect also after reboot.

1. Edit setting values.
2. Click **Write to IED**.
The values are written into the IED, but not taken into use.

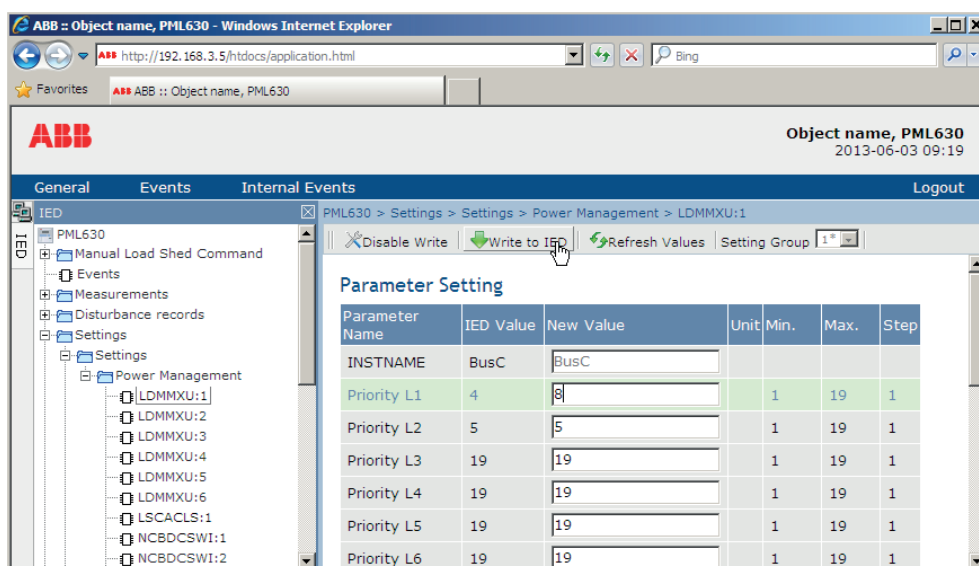


Figure 64: Writing values to the IED

3. Commit or reject new values.
 - Click **Commit** to save the values.
The new values are saved in the non-volatile memory and taken into use.
 - Click **Reject** to cancel saving the settings.

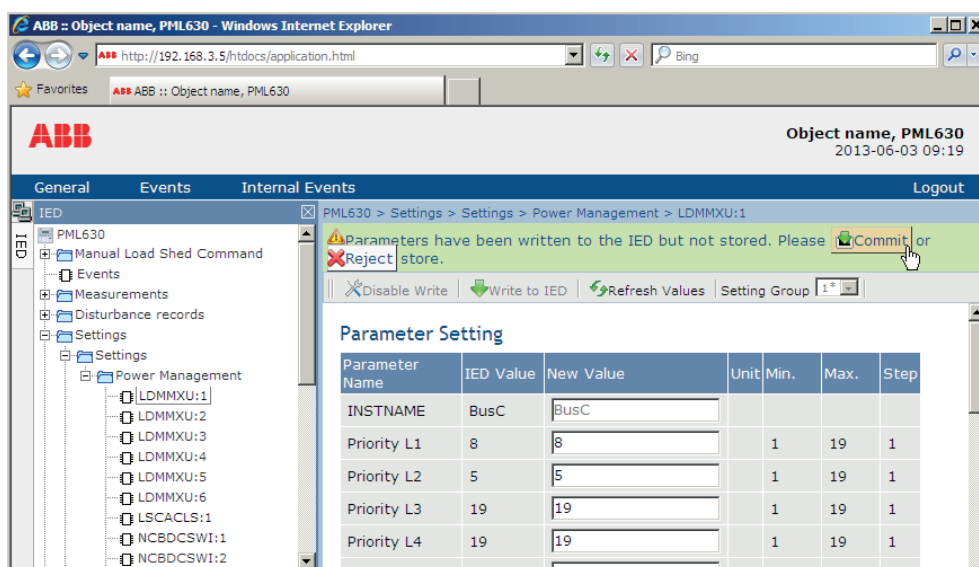


Figure 65: Committing changes



Committing values takes a few seconds.



If the values are not committed, they are not taken into use and they are lost after a reboot.



During system operation, if settings are changed in the IED using WHMI, then the entire set of changed parameters need to be read into PCM600. This is to maintain a backup of the last changed parameters in the IED. Failing to do so or inadvertent changing of parameters from PCM600 could result in loss of changes done from the Web HMI.

4.2.8

Accessing IED settings using Web HMI

WHMI is used to monitor and set read/write operations of the IED load management.

To access the IED, use the Internet or Web browser.

1. In the address bar, enter the IP address of the IED.
2. Enter the user name and password to connect to the IED.

The IED subtree appears.

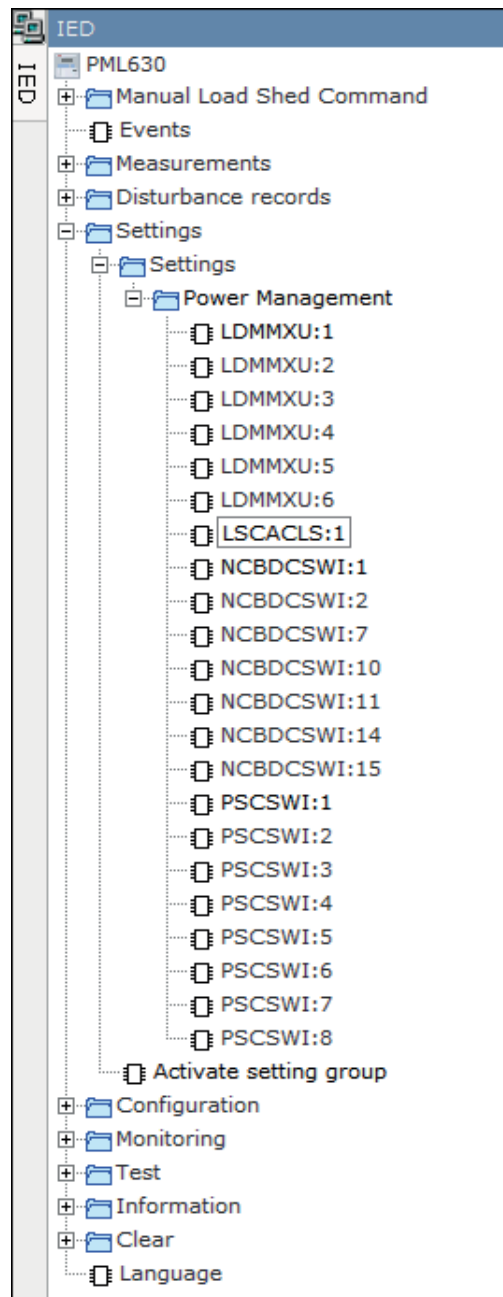


Figure 66: Subtree of power management functions

The subtree shows various subfolders which contain the monitoring and settings of individual parameters.

- Manual Load Shed Command
- Disturbance records
- Settings
- Configuration
- Monitoring

4.2.8.1 **Monitoring the device status on IED**

The device data provides the product version and product definition of the IED, and the three LED indications show the status of the IED.

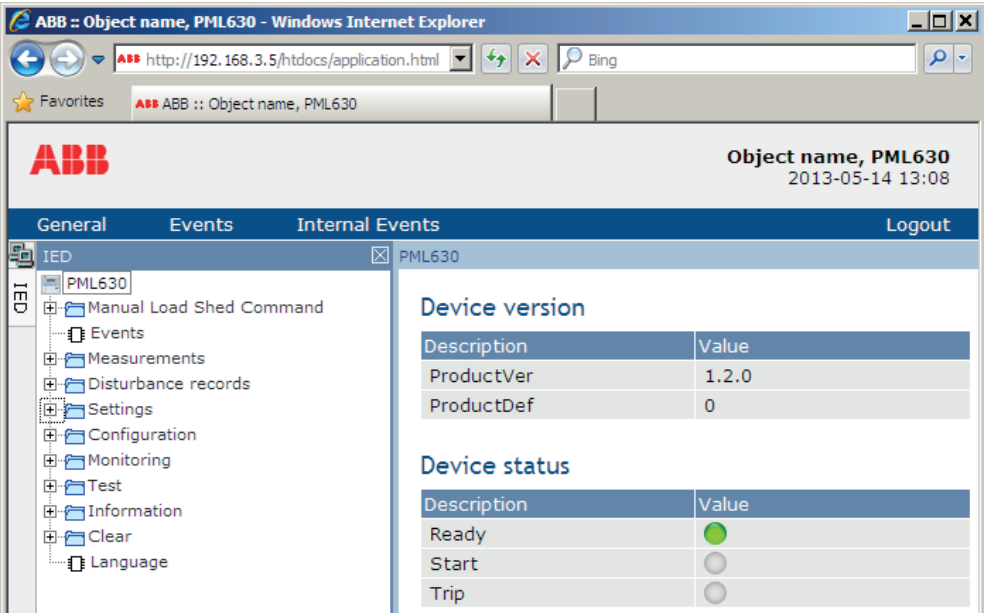


Figure 67: *Device status*

4.2.8.2 **Clear menu**

The Clear menu provides options for clearing LEDs, disturbances, process events, fast load shed (LSCACLS) and slow load shed (PSCSWI).

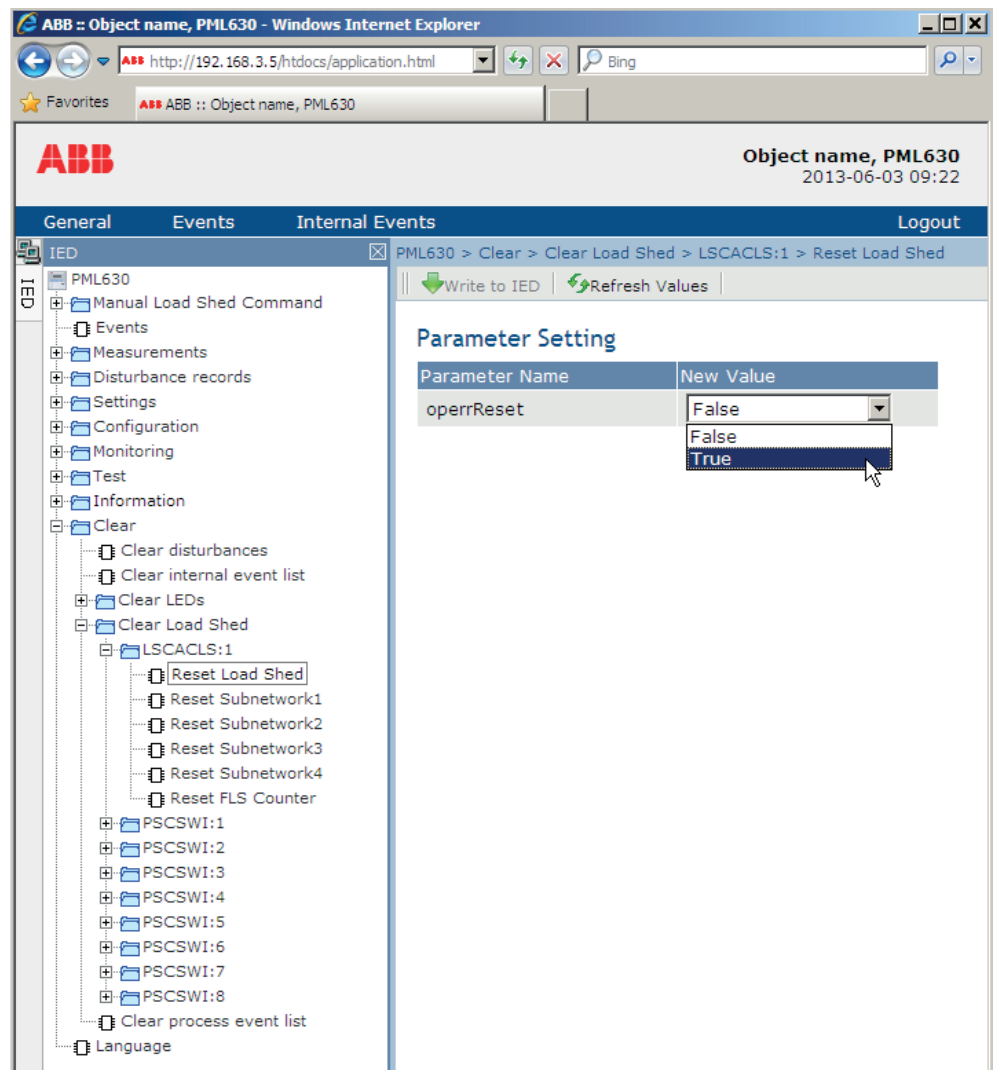


Figure 68: Clear menu

4.2.8.3

Executing manual load-shedding commands

1. Select **Manual Load Shed Command**.
2. Select the subnetwork in which loads are to be shed.
For example, **Manual Shed Subnetwork 1**.
3. Select **True** from the drop-down list and click **Write to IED**.

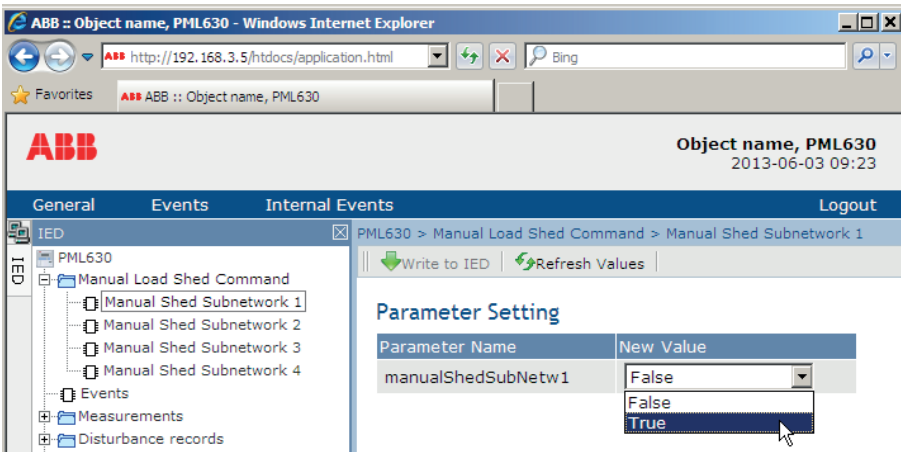


Figure 69: Manual load-shedding command

4.2.9 Selecting the event view

The event view contains a list of events produced by the application configuration. The default view shows the latest events. The event list is updated if the event count changes while the user is viewing the latest events. If the user is viewing older events while the event count changes, only the drop-down list is updated.

1. Click **Events** on the menu bar.
Each event view page shows 100 events.

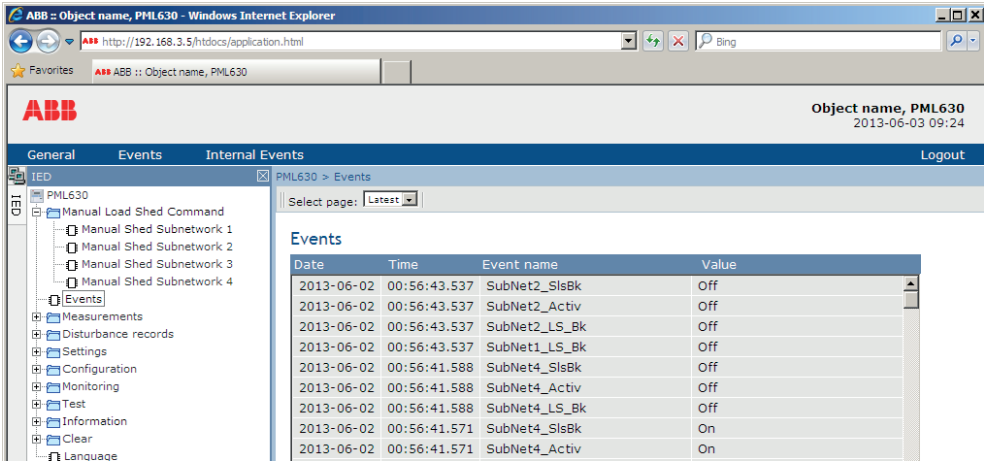


Figure 70: Monitoring events

2. To view older events, select the event range from the drop-down menu on the toolbar.

4.3 COM600 operational aspects for load-shedding

- 1. Enter the user name and password in the COM600 login screen and click **Login**.



Figure 71: COM600 login screen

Once the user successfully logs into the COM600 using valid credentials (user name and password), the screen appears showing the substation structure and the product version information.

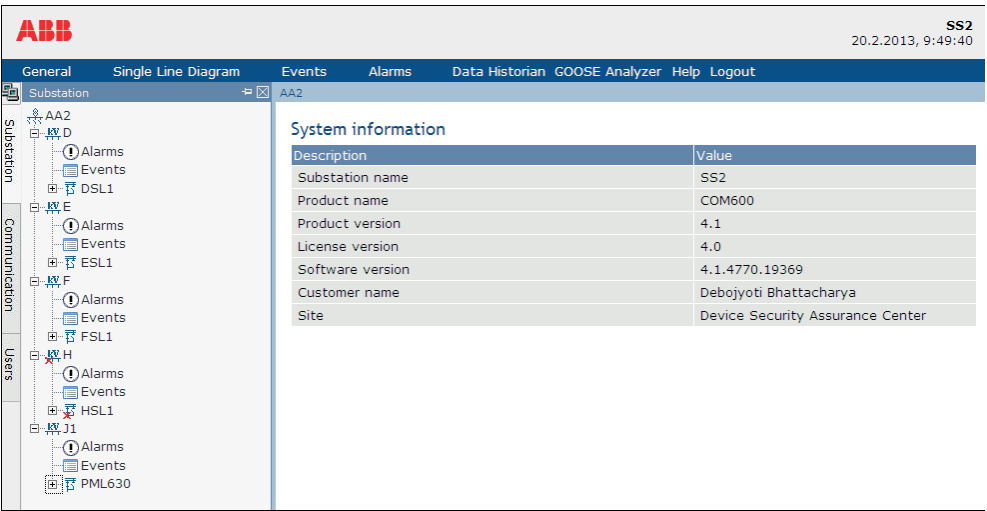


Figure 72: Substation structure

- 2. Click the appropriate IED object corresponding to PML630, for example, Voltage level J1/Bay PML630.
The list of subnetworks and GR1, GR2 – Peer PML Data Exchange related to the IED, which are automatically configured using the PCM600 and connectivity package, is shown.



GR1, GR2 – Peer PML Data Exchange are applicable only if the corresponding IED is configured as cPMS - LS Configuration B

and if GR1 and GR2 power sources are configured for grid connectivity with the adjacent electrical network (area).



For more information, see the engineering manual.

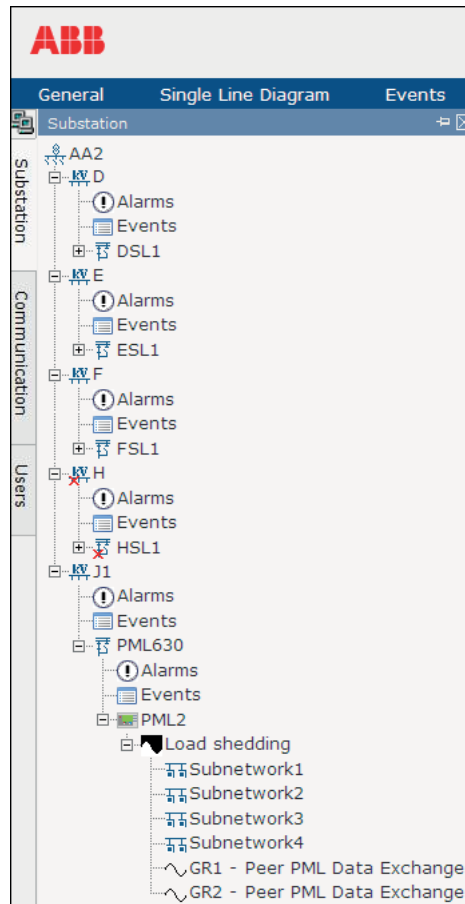


Figure 73: Substation structure

3. Click any one of the subnetworks under **Load shedding** under the IED in the substation structure to view the corresponding subnetwork display.
 - In cPMS - LS Configuration A, there is no adjacent electrical network (area) and hence Subnetwork 1...4 have identical displays.
 - In cPMS - LS Configuration B, where interconnected adjacent electrical network (area) is present and monitored by the respective IEDs, Subnetwork 1 and 2 displays are identical and contain additional information related to the peer station (area) *Power balance* and *Must be shed* power. However, Subnetwork 3 and 4 displays do not show this additional information.

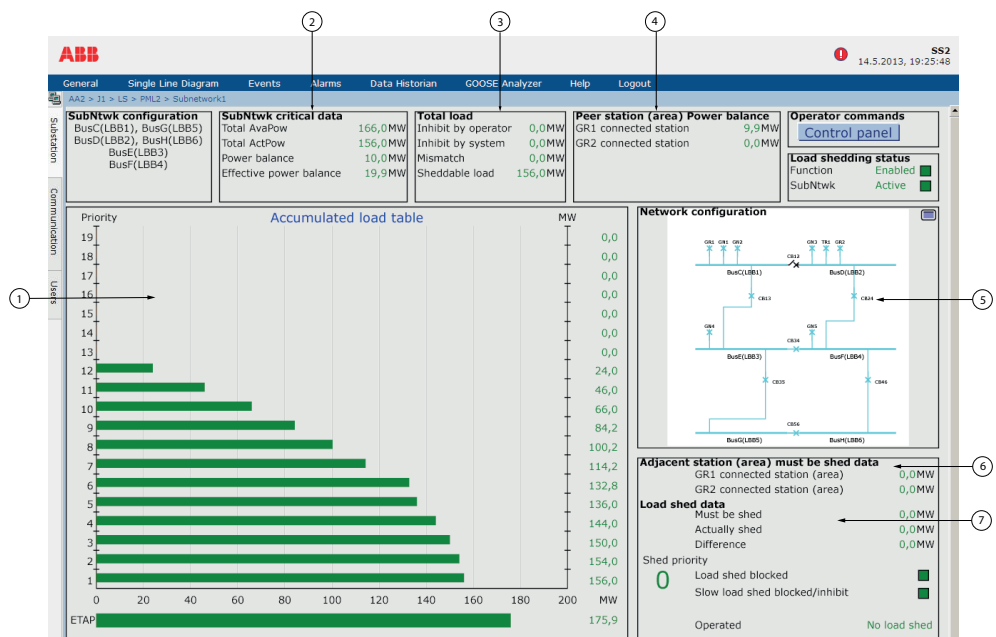


Figure 74: Subnetwork load-shedding information for cPMS – LS Configuration B

- 1 Accumulated load table
- 2 Subnetwork power data
- 3 Load inhibition
- 4 Peer station (area) Power balance
- 5 Key SLD
- 6 Adjacent station (area) must be shed data
- 7 Load shedding action data/status



Parts 1, 2, 3, 5 and 7 mentioned above are same irrespective of cPMS - LS Configuration A or B.

Parts 4 and 6 are applicable for cPMS - LS Configuration B only.

4. Click on GR1- Peer PML630 data exchange and GR2- Peer PML630 data exchange to view the peer station (area) far-end data.

GR1 - Peer PML Data Exchange	
GR1 connected peer station (area) far-end data	Status/Value
Far-end CB position	Closed
Adjacent station (area) PML630 data error	Not active
Far-end SubNtwk LS block due to far-end side CB	Not blocked
Adjacent station (area) subNtwk LS block	Not blocked
Adjacent station (area) connected SubNtwk PowBa	3,00 MW
Must be shed Pow from adjacent station (area)	0,00 MW

Figure 75: Grid connected peer station (area) far-end data

On operation of a circuit breaker associated with a power source, fast load-shedding module is initiated and results in load-shedding due to a shortage of power in Subnetwork1.

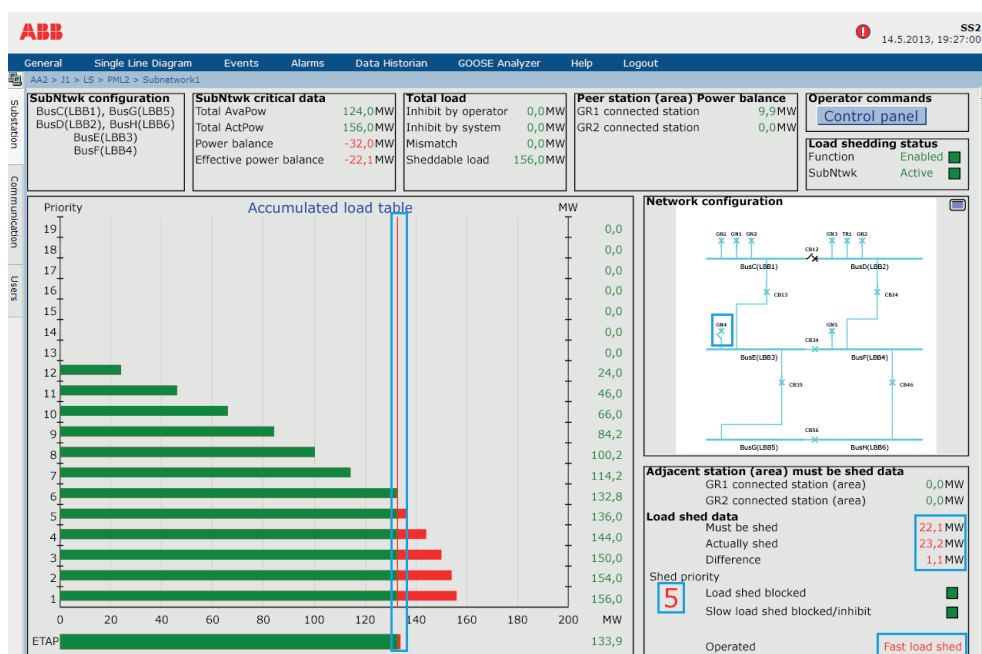


Figure 76: Power shortage

- Click **Control Panel** to open the **Manual LS/LS command reset control** dialog box which gives the status of the load-shedding action.

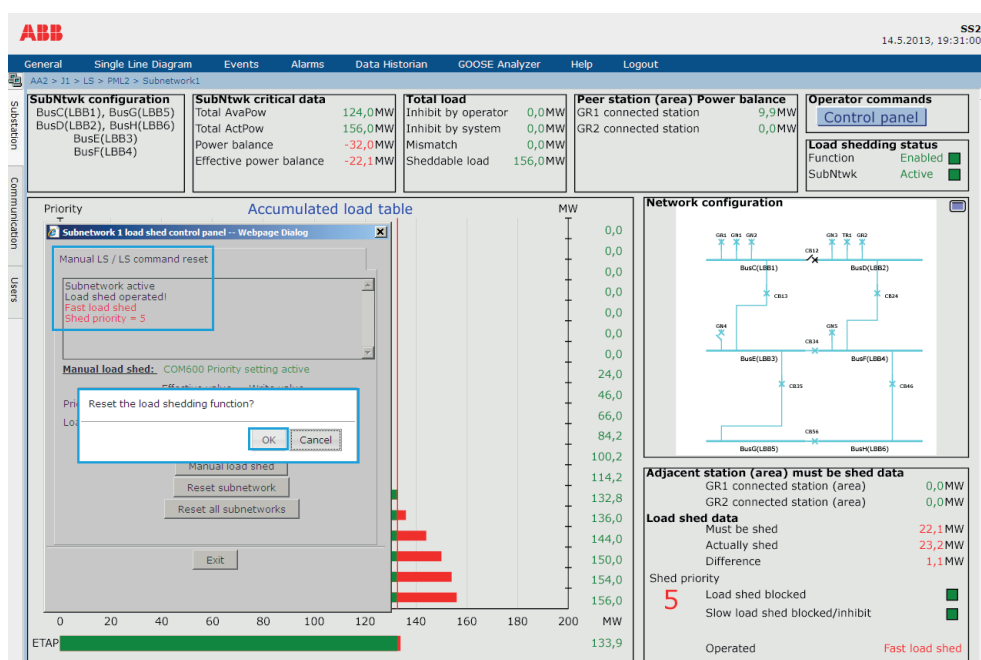


Figure 77: Load shed status

6. Click the **Reset subnetwork** button.
Another dialog box opens.
 - Click **Ok** to reset load-shedding. Reset of the load-shedding action is done to disable the commands after the load shed action.



All alarms and events can be checked in the **Alarms and Events** page, after required event treatment configuration in SAB600.

7. Define manual load-shedding from the **Subnetwork load shed control** dialog box.

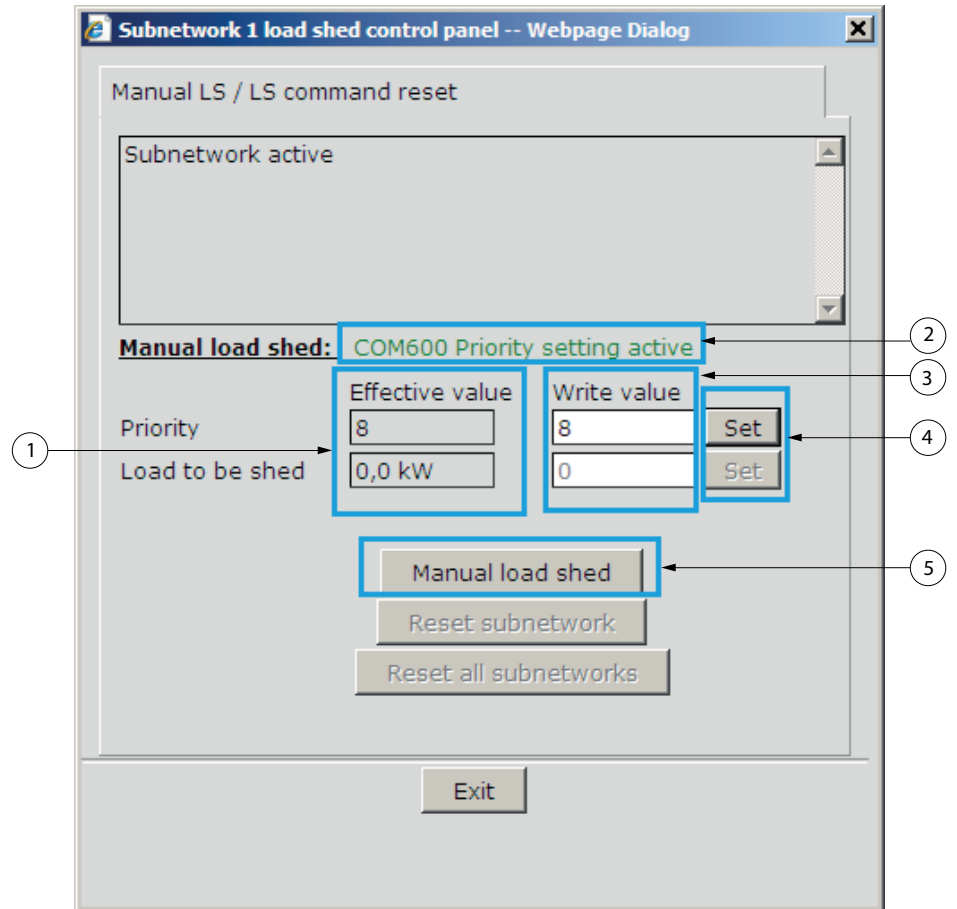


Figure 78: Load shed control panel for manual load-shedding

- 1 Effective Value display shows the 'Priority' or 'Load to be shed' values for manual load-shedding.
- 2 Active manual load shed setting display.
 - Manual LS is disabled
 - PML630 Priority setting active
 - PML630 kW setting active
 - COM600 Priority setting active
 - COM600 kW setting active
 - PML630 Priority setting active, COM600 quality bad
 - PML630 kW setting active, COM600 quality bad



The last two options are valid when the manual load shed setting is set to 'SN Man Prio input' and 'SN Man Pow input' respectively.

- 3 Write value text box is enabled when the Manual load shed mode setting is set to 'SN Man Prio input' or 'SN Man Pow input' and input data quality is 'Good'.

- 4 Set command button is used to set the values entered in the 'Write value' text box.
 - 5 Manual load shed command button initiates the manual load-shedding action.
8. Click the button adjacent to the grid transformers in the substation SLD to view the slow load-shedding dialog box.

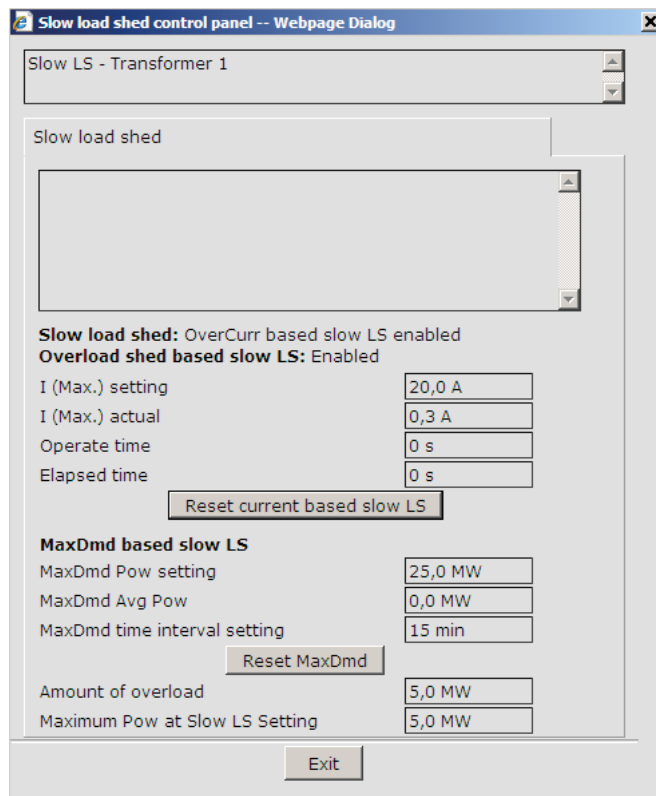


Figure 79: Slow load shed control

The slow load shed control box shows various details.

- Display of active slow load shed mode setting.
- Information related to overcurrent-based slow load-shedding setting and actual values, like *Overload shed based slow LS mode* enable/disable, *I (Max.) setting* (maximum current setting), *I (Max.) actual* (maximum of three phase current value), *Operate time* and *Elapsed time*.
- Maximum demand parameters like *MaxDmd Pow* setting (maximum power setting), *MaxDmd Avg Pow* (maximum demand average power), *MaxDmd time interval setting* (time interval setting for maximum demand) as set from PST (and read over IEC 61850 MMS).
- *Amount of overload display* and *Maximum Pow at Slow LS Setting* as set from PST.
- The **Reset current based slow LS** and **Reset MaxDmd** command buttons are used to reset the overcurrent and max demand operation.

Whenever there is an extended load-shedding trigger from any adjacent electrical network (area), the same can be viewed in the display.

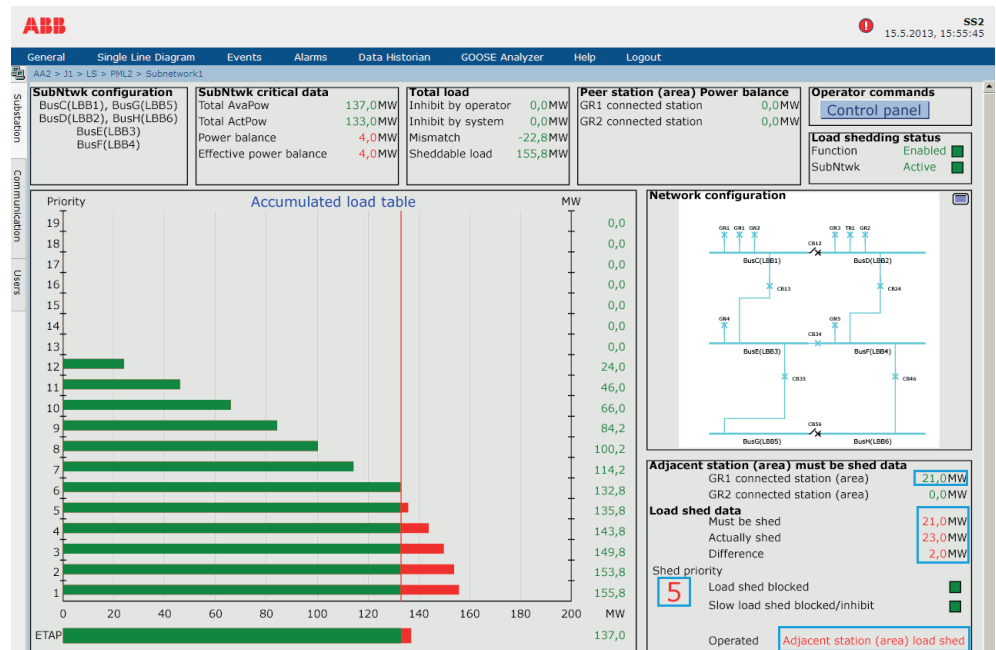


Figure 80: Extended load shed display

Adjacent station (area) must be shed data and Peer station (area) power balance show the extended load shed operation details from the GR1, GR2 connected peer station (area). The cause of load-shedding appears as **Operated Adjacent station (area) load shed**.

The subsequent priority of the loads up to which shedding is done and the load-shedding status are also indicated.

9. Click the **Single Line Diagram** link to open the substation SLD display.



The SLD shown below is representational only and the main purpose is to explain the PML630 specific information in the general SLD display.

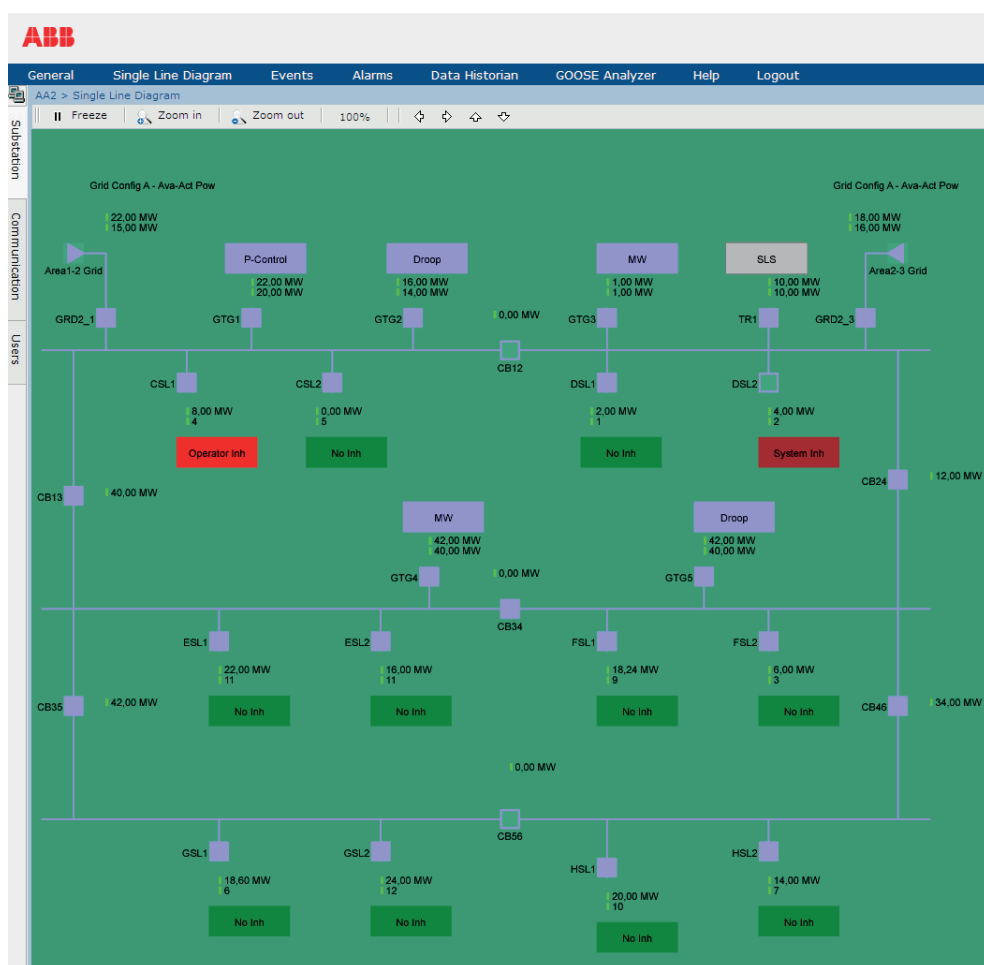


Figure 81: Substation SLD display

Section 5 IED operation

5.1 Normal operation

In a normal device use situation, the basic operation includes monitoring and checking procedures.

- Monitoring measured values
- Checking object states
- Checking function setting parameters
- Checking events and alarms

All basic operations can be performed via the LHMI, WHMI or with PCM600.



For more information, see the PCM600 documentation.

5.2 IED parametrization

IED parameters are set via the LHMI or PCM600.

Setting parameters need to be ascertained according to the electrical network operating conditions and configuration. The IED's settings need to be verified before the IED is connected to a system.



Document all changes to parameter settings.



For more information, see the PCM600 documentation.



Do not switch off the auxiliary power supply to the IED before changes, for example, setting parameter or local/remote control state changes are saved.

5.2.1

Settings for device functionality

Function settings can be edited one by one by navigating to the individual setting values, for example via the LHMI. The values in other setting groups should be known before editing a certain setting value.

After completing the editing of setting group values, the new values are activated. The user can either commit the edited values or discard them.

5.2.2

Settings for different operating conditions

Device settings can be designed for various operation conditions by defining different setting values to different setting groups. The active setting group can be changed by the device application or manually via the LHMI, WHMI or PCM600.



The device contains only one setting group by default. The number of setting groups can be selected from 1 to 4. Setting groups are applicable only to the overcurrent protection functionality supported by the PSCSWI function.

Section 6 Operating procedures



6.1 Monitoring

6.1.1 Indications

The operation of the IED can be monitored via three different indications on the LHMI.




- Three indicator LEDs with fixed functionality: Ready, Start and Trip
- 15 programmable three-color alarm LEDs which can present 45 virtual LED states
 - Texts which are shown on the alarm view can be programmed for each LED colour and off state. Programming can be done with PCM600, via WHMI and LHMI. These texts are displayed on the LHMI.
- An auto-indicating message on the display.

6.1.1.1 Using auto-indication messages

Auto-indication messages are shown in a dialog box that is displayed when the disturbance recorder is triggered. The indication dialog box shows a list of current disturbance recordings one by one. To scroll the dialog, use  and .








To activate the auto-indication message function, the disturbance recorder function has to be activated and properly configured.

1. Read the auto-indication message in the dialog box.
The message contains the same information that is available for disturbance recordings.
2. Press  to see more detailed information.
3. Press  to close the auto-indication message without clearing it or press  to activate the Clear view and to clear messages.

6.1.1.2 Monitoring alarm data

Active alarms are indicated by the alarm LEDs and the LED in the Multipage button. The alarms are configured with PCM600. The alarm type and information depend on the application configuration.

1. Press  to open the alarm view.
2. Press  or  to move between active alarms in the page, or press  to switch between the three alarm pages.
3. Press  to open a dialog box that shows more detailed information about the selected alarm.

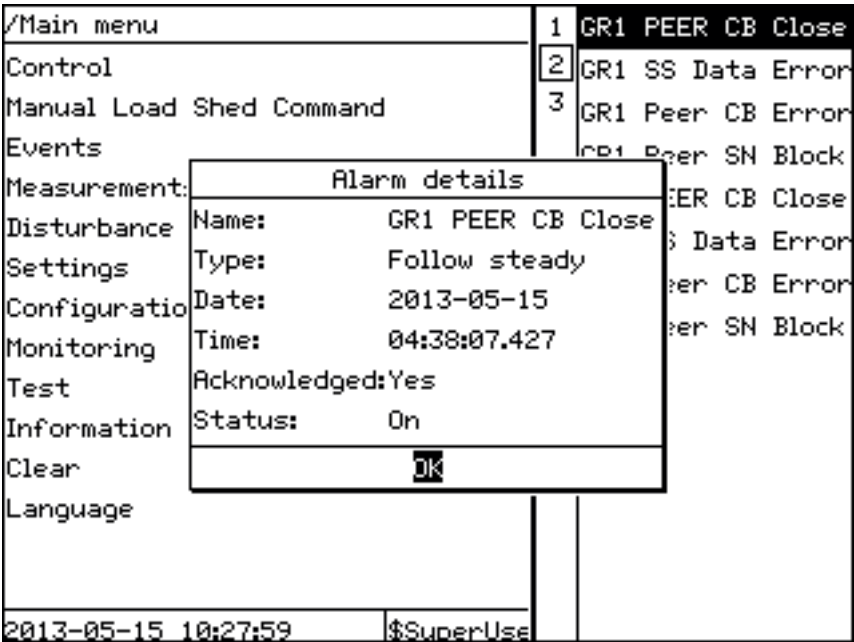








Figure 82: Alarm details

- Press  or  to close the dialog box.
4. Press  to close the alarm view.
 5. Press  to activate the Clear view and to clear alarms.

6.1.1.3 Monitoring an internal IED fault

The flashing green LED indicates an internal IED fault. The fault messages are found in the LHMI menu.

1. Select **Main menu/Monitoring/Internal events** or **Main menu/Monitoring/IED status** to monitor the latest fault indication.
2. Press  or  to scroll the view.

/Main menu/Monitoring/IED status		
Item	Status	
Internal fail	Off	
Internal warning	Off	
Time synch	Ready	
Real time clock	Ready	
Application	Ready	
Runtime execution	Ready	
IEC61850	Ready	
DNP3	Ready	
COM1	Ready	
PSM1	Ready	
TRM2	Ready	
Battery 1	Ready	
2013-02-08 06:32:44	\$SuperUser	Object name



Figure 83: Fault indication



The internal event list is not updated dynamically. To update the list, leave the **Internal events** menu and then select it again.

6.1.1.4

Monitoring condition monitoring data

1. Select **Main menu/Monitoring/I/O status/Monitoring**.
2. Press  or  to scroll the view.

With PCM600 the user can map output signals from condition monitoring related function blocks to the appropriate destinations.

6.1.1.5

Monitoring the IED using the local HMI

1. Select **Main menu/Monitoring** and press .

/Main menu		
Control		
Manual Load Shed Command		
Events		
Measurements		
Disturbance records		
Settings		
Configuration		
Monitoring		
Test		
Information		
Clear		
Language		
2013-01-29 10:55:54	\$SuperUser	Object name

Figure 84: Main menu

2. Press  to browse the I/O status.

/Main menu/Monitoring		
IED status		
I/O status		
Internal events		
Ethernet		
2013-01-29 10:54:46	\$SuperUser	Object name

Figure 85: I/O status menu

3. Press  to browse the **Power Management** menu.

/Main menu/Monitoring/I/O status		
Alarm LEDs		
Binary input modules		
Binary output modules		
Monitoring		
Power Management		
PSM		
2012-12-13 06:45:35	\$SuperUser	Object name

Figure 86: Power Management load-shedding menu






The binary input and output menus are not used for load shedding applications in the IED.

/Main menu/Monitoring/I/O status/Power Management		
LDMMXU:1		
LDMMXU:2		
LDMMXU:3		
LDMMXU:4		
LDMMXU:5		
LDMMXU:6		
LSPTRC:1		
LSPTRC:2		
LSPTRC:3		
LSPTRC:4		
LSPTRC:5		
LSPTRC:6		
LSCACLS:1		
NCBDCSWI:1		
2013-01-29 10:57:53	\$SuperUser	Object name

Figure 87: Power Management menu

The menu lists the monitoring status of inputs and outputs of the function blocks.

- LDMMXU (Busbar-wise sheddable loads data)
 - LSPTRC (Busbar-wise load feeders load-shedding command)
 - LSCACLS (Contingency based load-shedding core function)
 - NCBDCSWI (Network circuit breaker)
 - NPMMXU (Network power source)
 - PSCSWI (Power source)
 - PPLSGGIO (Information exchange between peer PML630s of their network areas)
 - SNWRCLS (Subnetwork supervision)
4. Press  for navigating into monitoring of all the above functions from the **Power Management** menu.
 - 4.1. Press  and  to scroll the list.

6.2 Controlling

The power management load-shedding functionality can be controlled through the LHMI using various controls.


- Command to manually shed loads (based on priority and power)
- Command to reset individual subnetwork
- Command to reset all subnetworks
- Command to reset slow load-shedding
- Command to reset fast load-shedding counter

When a load-shedding command is sent to the sheddable loads, the outputs are latched. These latched output signals can be reset through the operator command inputs. The commands can also be reset using WHMI feature.

6.3 Resetting the IED

6.3.1 Clearing and acknowledging via the local HMI

Use the Clear button to reset, acknowledge or clear all messages and indications, including LEDs and latched outputs as well as registers and recordings. Pressing the Clear button activates a view for selecting the reset function. Events and alarms assigned to alarm LEDs can also be cleared with the Clear button.

1. Press  to activate the Clear view.
All the items that can be cleared are shown.

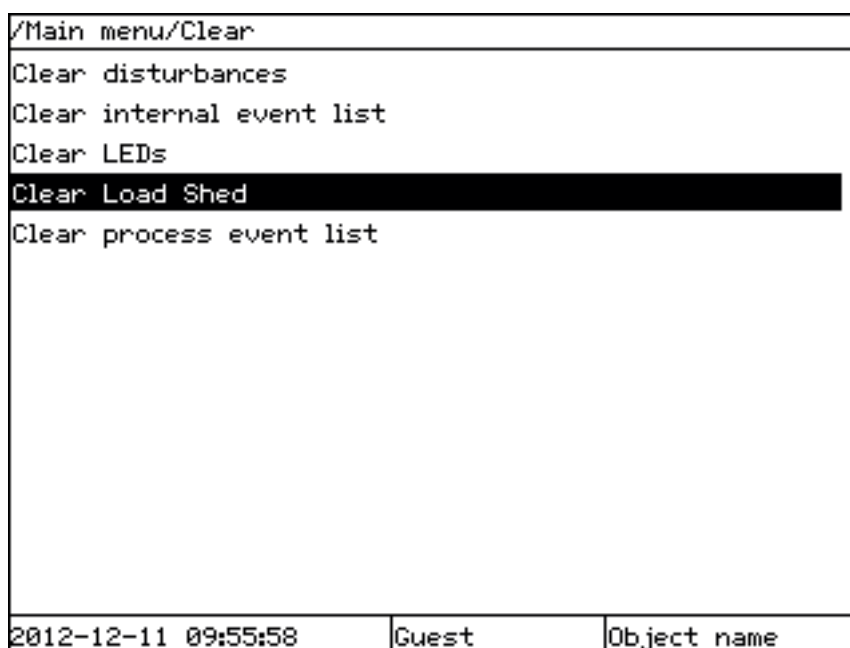





Figure 88: Clear view

2. Select the item to be cleared with  or .
3. Press , select OK to confirm the selection or Cancel to cancel the selection.
4. To clear other items, repeat the steps.

6.4 Changing the IED functionality or behaviour

6.4.1 Setting the IED into test mode

Initially the IED is in **ON** mode.

Figure 89: IED test mode menu

- | | | |
|--|-------------|-------------|
| /Main menu/Test/Function test modes/Power Management | | |
| LSCACLS:1 | | |
| 2013-05-15 10:29:11 | \$SuperUser | Object name |

By default, when the IED is in operation mode (ON), load shed functions are not blocked.

Figure 93: Load shed core functionality blocked

Monitoring/I/O status/Power Management/SNWRCLS:1/Outputs			
INSTNAME	SNWRCLS1		
DISABLE_LS	FALSE		
SN_ACTIVE	TRUE		
LS_BLOCK	TRUE		
SLS_TRG_INH	FALSE		
NEG_POW_BAL	FALSE		
LS_RESET	FALSE		
MAN_LS_TRG	FALSE		
LS_OPERATE	FALSE		
LS_OPR_STS	No Load shed		
AVA_POWER	144000.000		kW
RUNNING_LOAD	133000.000		kW
SHDABL_LOAD	155839.688		kW
POWER_BAL	11000.000		kW
2013-05-15 10:35:18	\$SuperUser	Object name	

Figure 94: Blocked status of load shed functionality

- 100

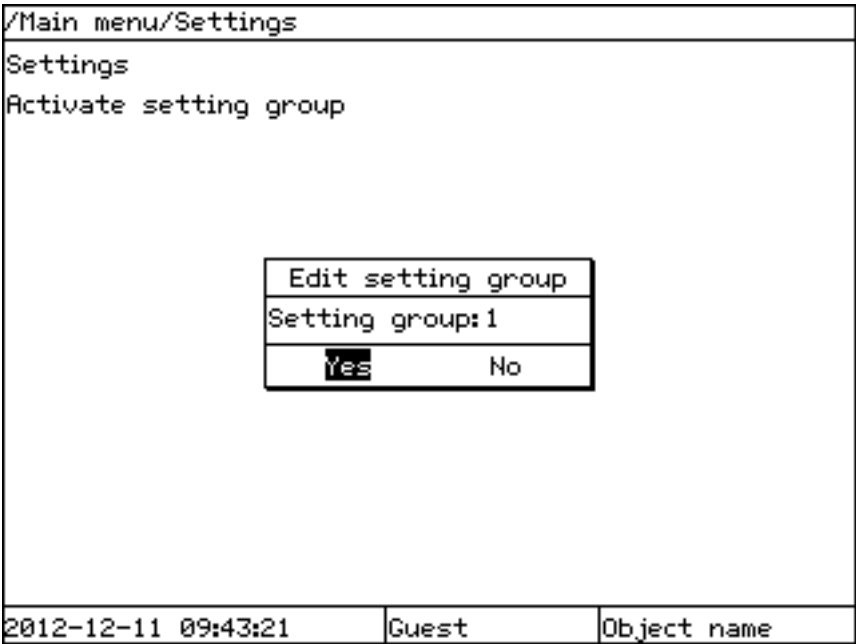






Figure 96: Selecting a setting group for editing

2. Press  on the Setting group line in the dialog box to activate selection mode.
3. Select the wanted setting group with  or  and press .

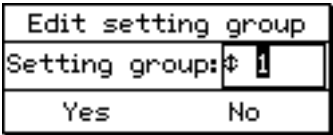






Figure 97: Changing the setting group

4. Select Yes in the dialog, and press  to continue.
The current setting group is displayed on the left in the header.
5. Select the application function category in the list with  or , and press  to see the function blocks in that category.
Categories available in the list depend on the pre-configuration or on the functions configured with PCM600.

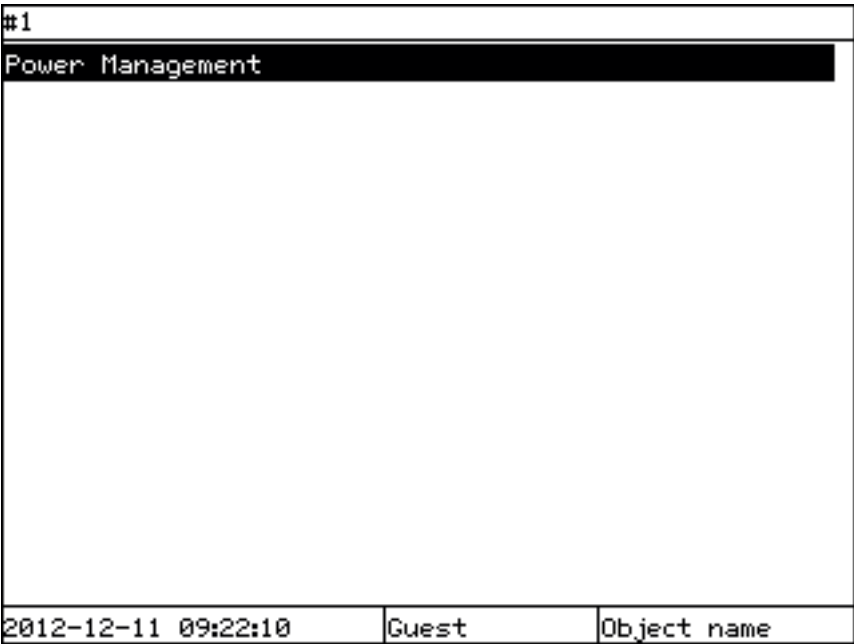



Figure 98: Selecting the function category

6. To navigate to the function blocks available under power management, press .

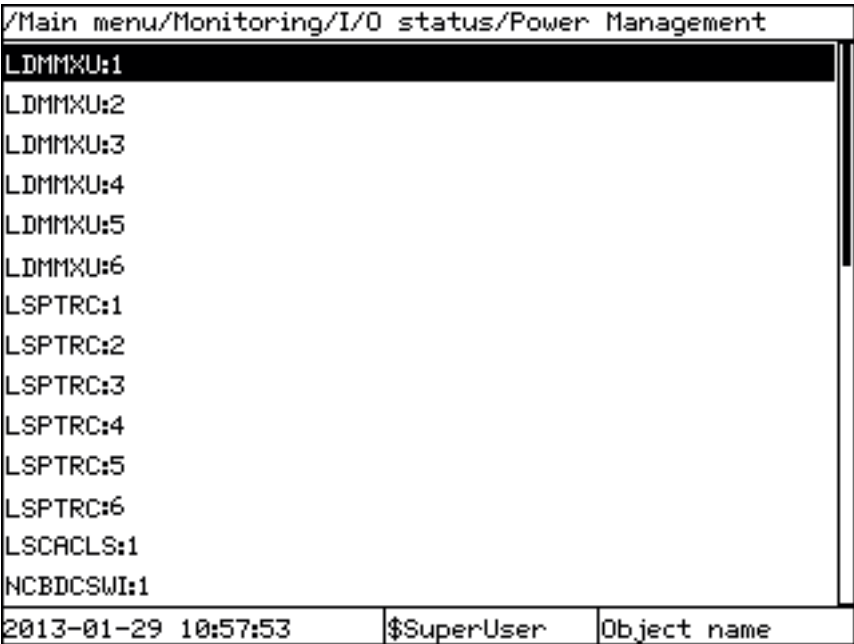








Figure 99: Function block settings

7. To select a function block, press .




#1/Power Management/LSCACLS:1		
INSTNAME	LSCACLS	
Disable LS SubNetw	No	
Enable LS SubNetw1	Yes	
Enable LS SubNetw2	Yes	
Enable LS SubNetw3	Yes	
Enable LS SubNetw4	Yes	
SubNetw1 Man Prio	19	
SubNetw2 Man Prio	19	
SubNetw3 Man Prio	19	
SubNetw4 Man Prio	19	
SubNetw1 Man Pow	200000.0	kW
SubNetw2 Man Pow	200000.0	kW
SubNetw3 Man Pow	200000.0	kW
SubNetw4 Man Pow	200000.0	kW
2012-12-11 09:49:41	Guest	Object name

Figure 100: Function block settings

8. To browse the function blocks, scroll the list with  and . Function blocks available depend on the application configuration. To move back to the list, press .
9. To select a function block, press . The # character on the right indicates that the parameter belongs to a setting group.
10. To edit the selected setting, press .
 - In case of a parameter that is not part of a setting group, the parameter is activated for editing.
 - In case of a setting group parameter, the editing dialog shows the value of the setting in all available setting groups, but the user can edit only the value in the selected setting group. The active setting group is marked with an asterisk *.

#1/Power Management/LSCACLS:1		
INSTNAME	LSCACLS	
Disable LS SubNetw	No	
Enable LS SubNetw1	Yes	
Enable LS SubNetw2	Yes	
Enable LS SubNetw3	Yes	
Enable LS SubNetw4	Yes	
SubNetw1 Man Prio	\$	3
SubNetw2 Man Prio	6	
SubNetw3 Man Prio	7	
SubNetw4 Man Prio	8	
SubNetw1 Man Pow	10000.0	kW
SubNetw2 Man Pow	10000.0	kW
SubNetw3 Man Pow	10000.0	kW
SubNetw4 Man Pow	10000.0	kW
2013-01-29 10:43:55	\$SuperUser	Object name

Figure 101: Changing the setting value

11. Press  or  to change the value.
12. Confirm the change with .

6.4.3

Activating LEDs

To activate the LEDs, they must be configured with PCM600.

1. Select **Main Menu/Configuration/Alarm LEDs** and press .

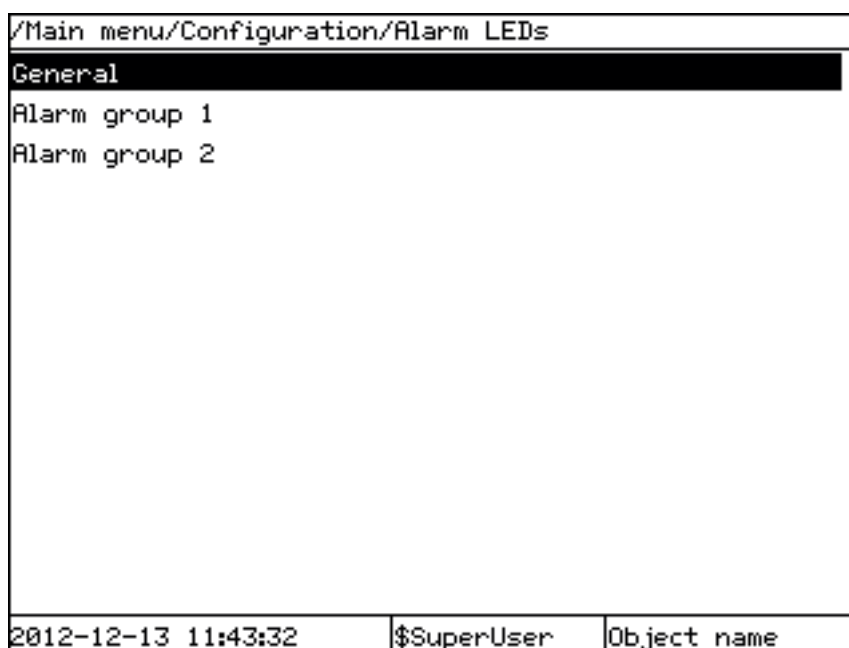











Figure 102: Alarm groups

2. Select an alarm group with  or  and press .
3. Select an Alarm LED with  or .
4. Press  to confirm the selection and to change the Alarm LED mode.
5. Press  or  to change the value and  to confirm the selection.



For more information, see the PCM600 documentation.

Section 7 Troubleshooting

7.1 Fault tracing

7.1.1 Identifying hardware errors

1. Check the module with an error.
 - Check the general IED status in **Main menu/Monitoring/IED status** for a faulty hardware module.
 - Check the history of changes in internal event list in **Main menu/Monitoring/Internal events**.
2. Inspect the IED visually.
 - Inspect the IED visually to find any physical error causes.
 - If you can find some obvious physical damage, contact ABB for repair or replacement actions.
3. Check whether the error is external or internal.
 - Check that the error is not caused by external origins.
 - Remove the wiring from the IED and test the input and output operation with an external test device.
 - If the problem remains, contact ABB for repair or replacement actions.

7.1.2 Identifying runtime errors

1. Check the error origin from IED's internal event list **Main menu/Monitoring/Internal events**.
2. Reboot the IED and recheck the supervision events to see if the fault has cleared.
3. In case of persistent faults, contact ABB for corrective actions.

7.1.3 Identifying communication errors

Communication errors are normally communication interruptions or synchronization message errors due to communication link breakdown.

- Check the IEC61850 communication status in internal event list in **Main menu/Monitoring/Internal events**.
- In case of persistent faults originating from IED's internal faults such as component breakdown, contact ABB for repair or replacement actions.

7.1.3.1

Checking the communication link operation

There are several different communication links on the product. First check that all communication ports that are used for communication are turned on.

1. Check the front communication port RJ-45.
 - 1.1. Check that the uplink LED is lit with a steady green light.
The uplink LED is located on the LHMI above the RJ-45 communication port on the left. The port is used for direct electrical communication to a PC connected via a crossed-over Ethernet cable.
 - 1.2. Check the communication status of the front port via the LHMI in **Main menu/Monitoring/Ethernet/Front port**.
Check that the "LINKUP" value is 1, that is, the communication is working. When the value is 0, there is no communication link.
2. Check the communication status of the rear port X0 via the LHMI in **Main menu/Monitoring/Ethernet/LAN1**.
The X0 communication port on the rear side of the IED is for electrical communication to a PC connected via a crossed-over Ethernet cable. This communication port is an alternative to the front communication port.
 - Check that the "LINKUP" value is 1, that is, the communication is working. When the value is 0, there is no communication link.
3. Check the communication status of the rear port X1 via the LHMI in **Main menu/Monitoring/Ethernet/LAN1**.
The X1 communication port on the rear side of the IED is for optical Ethernet via LC connector or electrical via RJ-45 connector of the IEC 61850-8-1 station bus communication.
 - Check that the "LINKUP" value is 1, that is, the communication is working. When the value is 0, there is no communication link.

7.1.3.2

Checking the time synchronization

- Select **Main menu/Monitoring/IED status** and check the status of the time synchronization on **Time Synch**.
The *Time synch* value is "Ready" when the synchronization is in order.






Activate the time synchronization source. Otherwise, the value is always "Ready".

7.1.4

Running the display test

To run the display test, either use the push buttons or start the test via the menu.

- Select **Main menu/Test/LED test**.
- Press  or simultaneously  and .

All the LEDs are tested by turning them on simultaneously. The display shows a set of patterns so that all the pixels are activated. After the test, the display returns to normal state.

7.2 Indication messages

7.2.1 Internal faults

When the Ready LED indicates an internal fault by flashing, the message associated with the fault is found in the internal event list in the LHMI menu **Main menu/Monitoring/Internal events**. The message includes the date, time, description and signal state for the fault. The internal event list is not updated dynamically. The list is updated by leaving the **Internal events** menu and then selecting it again. The current status of the internal fault signals can also be checked via the LHMI in **Main menu/Monitoring/IED status**.

The ABB logo together with the IED FAILURE message appear on the screen after a five minutes' communication break between the LHMI and the IED. The LHMI panel displays the message due to a communication failure or a severe functional error in the IED. The protection functionality of the device can be ensured by testing the IRF contact status.

Different actions are taken depending on the severity of the fault. If the fault is found to be permanent, the IED stays in internal fault mode. The IED continues to perform internal tests during the fault situation.

When a fault appears, the fault indication message is to be recorded and stated when requesting support or service.

Table 22: *Internal fault indications*

Fault indication	Additional information
Internal Fault Real Time Clock Error	Hardware error with the real time clock.
Internal Fault Runtime Exec. Error	One or more of the application threads are not working properly.
Internal Fault SW Watchdog Error	This signal will be activated when the terminal has been under too heavy load for at least 5 minutes.
Internal Fault Runtime App Error	One or more of the application threads are not in an expected state.
Internal Fault File System Error	A file system error has occurred.
Internal Fault TRM-Error	A TRM card error has occurred. The instance number is displayed at the end of the fault indication.
Internal Fault COM-Error	A COM card error has occurred. The instance number is displayed at the end of the fault indication.
Internal Fault PSM-Error	A PSM card error has occurred. The instance number is displayed at the end of the fault indication.

7.2.2

Warnings

The warning message associated with the fault is found in the internal event list in the LHMI menu **Main menu/Monitoring/Internal events**. The message includes the date, time, description and signal state for the fault. The current status of the internal fault signals can also be checked via the LHMI in **Main menu/Monitoring/IED status**.

When a fault appears, record the fault indication message and state it when ordering service.

Table 23: *Warning indications*

Warning indication	Additional information
Warning IEC 61850 Error	IEC 61850 has not succeeded in some actions such as reading the configuration file, startup etc.

7.2.3

Additional indications

The additional indication messages do not activate internal fault or warning.

The messages are listed in the LHMI menu under the event list. The signal status data is found under the IED status and in the internal event list.

Table 24: *Additional indications*

Warning indication	Additional information
Time Synch Error	Source of the time synchronization is lost or time system has made a time reset.
BATTERY1 Error	Auxiliary power is disconnected.
Settings Changed	Settings have been changed.
Setting Groups Changed	Setting group has been changed.

7.3

Correction procedures

7.3.1

Factory settings restoration

In case of configuration data loss or error that prevents the IED from working properly, the configuration can be restored to the original factory state. All default settings and configuration files stored in the factory are restored.

For further information on restoring factory settings, contact customer support.

7.3.2

Changing and setting the password

The password can only be set with PCM600.



For more information, see the PCM600 documentation.

7.3.3 Identifying IED application problems

Navigate to the appropriate menu in the LHMI to identify possible problems.

- Check that the function is on.
- Check that the correct setting group (1 to 4) is activated.
- Check the blocking.
- Check the mode.
- Check the measurement value.
- Check the connection to trip and disturbance recorder functions.
- Check the channel settings.

Section 8 Glossary

COMTRADE	Common format for transient data exchange for power systems. Defined by the IEEE Standard.
cPMS	Compact power management solution
DHCP	Dynamic Host Configuration Protocol
EMC	Electromagnetic compatibility
HMI	Human-machine interface
IEC	International Electrotechnical Commission
IEC 61850	International standard for substation communication and modeling
IEC 61850-8-1	A communication protocol based on the IEC 61850 standard series
IED	Intelligent electronic device
IP	Internet protocol
IP address	A set of four numbers between 0 and 255, separated by periods. Each server connected to the Internet is assigned a unique IP address that specifies the location for the TCP/IP protocol.
IRF	1. Internal fault 2. Internal relay fault
IRIG-B	Inter-Range Instrumentation Group's time code format B
LAN	Local area network
LC	Connector type for glass fiber cable, IEC 61754-20
LCP	Liquid crystal polymer
LED	Light-emitting diode
LHMI	Local human-machine interface
MMS	1. Manufacturing message specification 2. Metering management system
PC	1. Personal computer 2. Polycarbonate
PCM600	Protection and Control IED Manager
RJ-45	Galvanic connector type
RoHS	Restriction of hazardous substances

SNTP	Simple Network Time Protocol
WAN	Wide area network
WHMI	Web human-machine interface



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