Relion® 630 series

Load Shedding Controller
PML630
Product Guide
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1. Description

PML630 is a power management IED 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 IED is a member of ABB’s Relion® product family and a part of its 630 series characterized by their functional scalability and flexible configurability.

PML630 supports the IEC 61850 standard and offers seamless connectivity with other Relion series IEDs and COM600 Station Automation device to realise the load-shedding functionality. The IED uses GOOSE and MMS communication profiles for I/O data exchange with other Relion series IEDs and COM600 Station Automation device.

3. Application

PML630 provides system level protection to small or medium industrial systems from system disturbances. The IED supports three types of load-shedding functions:

- Fast load-shedding
- Slow load-shedding
- Manual load-shedding

The fast load-shedding function prevents the tripping of a grid transformer when the measured current exceeds the preset current limit for a defined time duration. The slow load-shedding function prevents the tripping of a grid transformer when the measured current exceeds the preset current limit for a defined time duration. The slow load-shedding function ensures power availability to critical process loads by tripping less process critical loads.

PMS solutions are suitable for medium or large industrial power networks during the following conditions:

- When the industrial power networks have grid connectivity characterised by poor stability and/or availability
- When the industrial plants are located in remote locations without power grid connectivity
- When the industrial power networks have substantial electrical load and critical loads
- When the industrial power networks work in parallel or isolation with grid
- When the industrial power networks have in-plant power generation work in parallel or isolation with grid
- When the industrial power systems have grid connectivity characterised by poor stability and/or availability

2. Power management systems

Power Management Systems (PMS) are essential for safe, efficient and reliable operation of a power system within an industrial complex. PMS functionality suite includes load-shedding, power sharing, network synchronization and power restoration.

PMS solutions protect and optimize the stability of industrial systems against disturbances by ensuring power sharing between generators when the industrial power system is islanded from the grid. These solutions also ensure that the generators meet the required power demand when the network is grid connected. Load-shedding functionality ensures power availability to critical process loads by tripping less process critical loads.

PMS solutions are suitable for medium or large industrial power networks during the following conditions:

- When the industrial power networks have grid connectivity characterised by poor stability and/or availability
- When the industrial plants are located in remote locations without power grid connectivity
- When the industrial power networks have substantial electrical load and critical loads
- When the industrial power networks work in parallel or isolation with grid
- When the industrial power networks have in-plant power generation work in parallel or isolation with grid
load-shedding function triggers the fast load-shedding function to initiate the load shed action.

The manual load-shedding function sheds multiple load feeders based on the defined load-shedding priorities.

PMS functionality suite is applicable in various industrial segments. Some of the industrial segments are Oil and Gas, Marine, Pulp and Paper, Metals, Minerals, and Building automation.

4. Communication

PML630 supports the IEC 61850 substation automation standard including horizontal GOOSE [1] and vertical MMS communication profiles.

PML630 is optimized to interoperate with RET615, REM615, REF615, RET630, REM630, REF630, REG670 and COM600 Station Automation device. All operational information and controls are available through the IEC 61850 communication profiles.

Disturbance files, available in a COMTRADE file format, can also be accessed using the IEC 61850 standard's MMS file transfer services or any standard protocol like FTP. The IED can send and receive binary and analog signals to other IEDs (horizontal communication) using the IEC 61850-8-1 GOOSE profile. PML630 meets the GOOSE performance requirements for tripping applications like load-shedding in distribution substations, as defined by the IEC 61850 standard. The IED can interoperate with other IEC 61850 compliant IEDs, tools and systems and simultaneously report events to five different clients on the IEC 61850 station bus. The IED is connected to Ethernet-based communication systems via the RJ-45 connector (10/100BASE-TX) or the fibre-optic multimode LC connector (100BASE-FX).

IEC 61850 GOOSE communication profile for load-shedding offers several advantages.

- Data transfer based on reliable and proven Ethernet technology
- Substation LAN infrastructure for binary and analog data exchange between the IEDs
- Eliminated hard-wired I/Os
- Faster performance than hard-wired I/Os and hence a distinct advantage for load-shedding application
- Easy implementation of change(s) in substation configuration
- Supervised data transfer using IEC 61850 quality definitions

5. Network architecture

The load-shedding network architecture consists of IEDs, their functional organization and their inter-communication.

PML630 performs load-shedding actions based on the binary and measurement data it receives from the IEDs associated with generator feeders, grid transformer feeders, motor or load feeders, bus coupler feeders and bus tie feeders. After making a decision to take load shedding action, the PML630 sends shed commands to motor or load feeders through their respective IEDs. Data flow between the IEDs and PML630 is realized over IEC 61850 GOOSE.

COM600 Station Automation device monitors and controls the load-shedding operation and substation processes. This is realized over IEC 61850 MMS communication between COM600 and PML630 or feeder IEDs.

The integrated system of PML630, feeder IEDs and COM600 Station Automation device to realize load-shedding power management solution is known as cPMS [1]. cPMS is an

[1] Generic Object Oriented Substation Event
integrated solution as well as a software feature in PML630.

Figure 1. cPMS architecture
Figure 2: cPMS functionality overview
6. Terminology in cPMS

- Six generators
- Two grid transformers
- Six single busbars
- Four subnetworks with power sources

The six generators and two grid transformers can be connected to four busbars, while load feeders can be connected to all six busbars. The busbars can be spaced in three levels.

7. Power network configuration support in cPMS

The IED can support power networks with the following configurations.
In a redundant configuration, two PML630s can execute the load-shedding functionality independently. All feeder IEDs are configured to communicate simultaneously with both PML630s over IEC 61850 GOOSE. Each PML630 is connected to its own COM600 Station Automation device.
9. System protection and control functions

Fast load-shedding

The fast load shedding function protects the network during a power deficit. A network power deficit occurs when a generator, a grid transformer, a bus coupler, or a bus tie feeder circuit breaker trips. The fast load-shedding function can monitor a maximum of four independent power networks. During a power deficit in one of the networks, the IED performs power balance calculations and arrives at a sheddable load priority. The IED issues shed commands to loads with priority less than or equal to the calculated priority.

The fast load-shedding functionality is explained here using an example.

In this substation configuration example, when AB, AC, BD and CD connections are open, four subnetworks or power networks are formed. The fast load-shedding function monitors available power from power sources based on their capability against the power consumption and performs power balance calculation for each subnetwork using the equation:

\[
(\Sigma P_{\text{generator}} + \Sigma P_{\text{spinning reserve}}) + \\
(\Sigma P_{\text{gridtransformer}} + \Sigma P_{\text{grid additional drawal capacity}}) \\
\geq (\Sigma P_{\text{Load}} + \Sigma P_{\text{load inhibit (system or manually inhibited)}})
\]

Available power from generator = \(\Sigma P_{\text{generator}} + \Sigma P_{\text{spinning reserve}}\)

Available power from grid transformer = \(\Sigma P_{\text{gridtransformer}} + \Sigma P_{\text{grid additional drawal capacity}}\)

- \(\Sigma P_{\text{generator}}\) is the total power generated by the generator(s) in the subnetwork.
- \(\Sigma P_{\text{spinning reserve}}\) is the total reserve capacity of all generator(s) in the subnetwork. This depends on the ambient temperature, capability of a generator and its working mode.
- \(\Sigma P_{\text{gridtransformer}}\) is the total power flow from grid transformer(s) in the subnetwork.
- \(\Sigma P_{\text{grid additional drawal capacity}}\) is the total additional power that can be taken from the grid.
- \(\Sigma P_{\text{Load}}\) is the total power consumption of all load feeders in the subnetwork.
- \(\Sigma P_{\text{load inhibit}}\) is the total power consumption from load feeders that do not participate in load-shedding and/or the resultant power due to power balance mismatch caused by measurement inaccuracies.

The fast load-shedding function performs the following actions in a power network.

- Initiates power balance calculation in a power network on activation of a critical signal
- Calculates the sheddable load according to the priorities using the actual measured power value from all feeders and user

Figure 6. cPMS supported subnetworks
defined priority value from PCM600 engineering station or from the IED front panel user interface (Local HMI or LHMI)

- Issues load shed commands to load(s) with priority less than or equal to the calculated shed priority and discards loads that are inhibited for load shedding (manually or by system because of measurement inaccuracies)
- Uses PML630's IEC 61850 communication interface module to issue load shed command information over GOOSE to load feeder IEDs
- Builds subnetwork-wise dynamic load tables and power network information for display in COM600 Station Automation device

PML630 identifies certain events as critical signals for initiating the power balance calculation.

- Opening of generator feeder or grid transformer feeder circuit breaker
- Opening of bus coupler feeder or a tie line (network) circuit breaker
- Protection-lockout function operation of feeder protection functions
- Lockout function operation of a generator turbine

**Slow load-shedding**

The slow load-shedding function reduces the overload on grid transformers and/or reduces maximum demand to an acceptable level based on the parameters settings. These settings can be defined from PCM600.

This function is activated when a grid transformer experiences an over load condition. The overload detection is performed based on the IDMT principle, similar to the one implemented for transformer overload protection.

PML630 requires adequate coordination with grid transformer feeder IEDs for early over load detection and effective activation of the load-shedding functionality.

Another form of overload detection implemented is based on maximum demand exceeding beyond a certain time limit. Both the power threshold and time duration parameters are specified using PCM600.

Both the above overload detection methods generate a trigger that is passed onto the fast load-shedding module. It then generates shed commands to loads, by considering the acceptable reserve value parameter for power balance after trigger is generated.

**Manual load-shedding**

The manual load-shedding function in the IED is activated based on the subnetwork level. The IED LHMI is used for entering the priority. This function issues shed commands to feeder IEDs with priorities less than or equal to the user defined priority.

**Load-shedding blocking**

The load-shedding blocking feature can be used to block load-shedding functionality. This prevents the fast and slow load-shedding functions from initiating actions when provided with incorrect data. Load-shedding blocking can be achieved automatically or manually.

**Automatic blocking**

The load-shedding functions are blocked automatically during certain subnetwork conditions.

- During a communication failure between PML630 grid transformer IED
- When the data from grid transformer IED has bad IEC 61850 quality
- When grid transformer IED is in test mode
- When the generator or grid transformer circuit breaker is in intermediate position for a time duration longer than 200 ms or in an undefined state

The load shedding functionality is blocked in all subnetworks when the communication between the bus coupler or bus tie feeder IED and PML630 fails or when the bus coupler or the bus tie feeder is in an undefined state.
Manual load shedding will not be active in a subnetwork, if the fast or slow load-shedding in that subnetwork is blocked.

**User initiated blocking**
User can block fast and slow load-shedding functions in a subnetwork from PCM600 or from the LHMI of the IED.

**Load feeder inhibition**
Load feeder inhibition feature is used to prevent load-shedding functions from initiating open commands to the inhibited load feeder. Load feeder inhibition can be achieved automatically or manually.

**Automatic load feeder inhibition**
Automatic load feeder inhibition is performed during the following subnetwork conditions.

- When the load feeder IED's communication with PML630 fails
- When the data from the load feeder has bad IEC 61850 quality
- When the load feeder IED is in test mode, which in turn is reflected also in the IEC 61850 quality
- When the load feeder circuit breaker is not in close condition

**User initiated load feeder inhibition**
The user initiated load feeder inhibition can be performed from PCM600 or from the LHMI of the IED.

10. Inputs and outputs

**GOOSE communication**
The fast and slow load-shedding functions in the IED require a fixed set of data from the feeder IEDs. This data is sent via IEC 61850 GOOSE.

- Generator feeder IED provides real power, circuit breaker status, circuit breaker service position and protection lock out operation data.
- Grid transformer feeder IED provides real power, current, circuit breaker status, circuit breaker service position and protection lock out operation data.
- Network circuit breaker feeder IED provides real power, circuit breaker status, circuit breaker service position and protection lock out operation data.
- Load feeder IED provides real power and circuit breaker status data.

Load-shedding functions generate load shed command data, which is sent by IEC 61850 GOOSE messaging. This information, after reaching a load feeder IED, initiates the opening of the corresponding circuit breaker. Power source, bus coupler, inter bus tie feeders and load feeder IEDs send data to PML630 over IEC 61850 GOOSE. While analog values are sent with a slower GOOSE time cycle of 1000 ms, binary values are sent as spontaneous GOOSE messages with minimum time of 4 ms.

**MMS communication**
The IED uses IEC 61850 MMS communication profile to send load-shedding operational data to COM600. This data is displayed in load-shedding displays, alarm or event lists and substation single-line diagrams. Using the MMS profile, the IED also receives load-shedding control actions, manual load shed command and load-shedding reset commands from COM600.

The IED sends the following load-shedding operational data to COM600.

- Fast load-shedding function sends load shed operation status (after the initiation of power balance and load shed priority calculations)
- Slow load-shedding function sends grid transformers (1 or 2) overload, maximum demand violation, operation status and IDMT or maximum demand based overload data
- Manual load-shedding function sends subnetwork-wise status
• Overall load-shedding function sends also a combined load-shed operation status
• Power network load-shedding data - power balance calculation data, load-shedding block status, sources, busbar and load network assignment data, active status of subnetwork 1/2/3/4
• Sources data - generator circuit breaker status and power, grid transformer circuit breaker status and power load data
• Network circuit breakers (bus couplers and interbus tie feeders) data - circuit breaker status, power data
• Load data - accumulated load per priority per busbar, load feeder circuit breaker status and power, load feeder priority and load shed inhibit status

COM600 provides the following load-shedding control actions to PML630.
• Fast load-shedding - overall and individual subnetwork load shed reset command
• Slow load-shedding - IDMT based reset command
• Manual load-shedding - subnetwork-wise command

**Hardwired I/Os**

The IED hardwire I/O consists of an analog board of four current transformer channels and five voltage transformer channels. There are 14 binary inputs and nine binary outputs as part of the communication board and power supply module respectively. Since the IED receives and sends all data over IEC 61850 GOOSE, the load-shedding application does not use the hardwire analog or binary I/Os. While the analog board is essential for the functioning of the IED, the binary I/Os are idle by default. However, they can be configured and used as required.

**Table 1. Analog input options**

<table>
<thead>
<tr>
<th>Analog input configuration</th>
<th>CT (1/5 A)</th>
<th>CT sensitive (0.1/0.5 A)</th>
<th>VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>4</td>
<td>-</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 2. Binary input/output options for 4U variants**

<table>
<thead>
<tr>
<th>Binary input configuration</th>
<th>BI</th>
<th>BO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>14</td>
<td>9</td>
</tr>
</tbody>
</table>

11. **Disturbance recording**

The disturbance recording function includes collecting information when a load shed trigger occurs. The numerical disturbance report can be accessed via the local HMI. A more comprehensive disturbance report with waveforms is available using PCM600. The IED is equipped with a disturbance recorder with 10 analog signal channels. Out of the 10 analog channels, eight channels can be set to record the waveform of the load-shedding data.

- Subnetwork 1 Available Power
- Subnetwork 1 Load
- Subnetwork 2 Available Power
- Subnetwork 2 Load
- Subnetwork 3 Available Power
- Subnetwork 3 Load
- Subnetwork 4 Available Power
- Subnetwork 4 Load

A power source outage or opening of a network circuit breaker generates an internally generated binary event that is mapped in the IEC 61850 model of the IED as load-shed start signal. The recording from the analog signal channels of disturbance recorder is triggered by the load-shed start signal. This indicates the initiation of power balance calculations.

Initiation of power balance calculations do not imply the operation of the fast or slow load-shedding function, since it depends on the available power in the subnetwork. A negative power deficit due to a power source...
outage in the power network or opening of a network circuit breaker activates PML630 to issue load-shedding commands.

The disturbance recorder function provides the value of available power and load in each subnetwork before and after the load shed calculation initiation. This is helpful in ascertaining the power situation in the subnetworks before and after a load shed start event.

The disturbance recorder can store up to 100 recordings in the non-volatile memory. These recordings can be uploaded for subsequent fault analysis. The number of recordings depend on the length of the recording and the number of incorporated signals.

The disturbance recorder and the Start LED on the front-panel IED user interface are both activated by the load-shed start signal. The load-shedding function start signal at state 1 is configured to activate the Start LED.

12. Event log

The IED features an event log which enables logging of event information. The event log can be configured to log information according to user pre-defined criteria including IED signals. To collect sequence-of-events (SoE) information, the IED incorporates a non-volatile memory with a capacity of storing 1000 events with associated time stamps and user definable event texts. The non-volatile memory retains its data also in case the IED temporarily loses its auxiliary supply. The event log facilitates detailed pre- and post-fault analyses of faults and disturbances.

The SoE information can be accessed locally via the user interface on the IED front panel or remotely via the communication interface of the IED. The information can further be accessed, either locally or remotely, using the web-browser based user interface.

13. Self-supervision

The IED's built-in self-supervision system continuously monitors the state of the IED hardware and the operation of the IED software. Any fault or malfunction detected is used for alerting the operator.

Self-supervision events are saved into an internal event list which can be accessed locally via the user interface on the IED front panel. The event list can also be accessed using the web-browser based user interface or PCM600.

14. Access control

To protect the IED from unauthorized access and to maintain information integrity, the IED is provided with an authentication system including user management. Using the IED User Management tool in the Protection and Control IED Manager PCM600, an individual password is assigned to each user by the administrator. Further, the user name is associated to one or more of the four available user groups: System Operator, Protection Engineer, Design Engineer and User Administrator. The user group association for each individual user enables the use of the IED according to the profile of the user group.
15. Time synchronization

The IED supports Ethernet based SNTP\textsuperscript{[1]} and IRIG-B\textsuperscript{[2]} based time synchronization methods with a time-stamping resolution of 1 ms. This information can be accessed in COM600 Station Automation device alarms and event display pages.

\textsuperscript{[1]} Simple Network Time Protocol
\textsuperscript{[2]} Inter-Range Instrumentation Group - Time Code Format B with special time synchronization wiring
16. Technical data

Table 3. Dimensions

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>Half 19&quot;</td>
<td>220 mm</td>
</tr>
<tr>
<td>Height</td>
<td>Half 19&quot;</td>
<td>177 mm (4U)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>265.9 mm (6U)</td>
</tr>
<tr>
<td>Depth</td>
<td>Half 19&quot;</td>
<td>249.5 mm</td>
</tr>
<tr>
<td>Weight box</td>
<td>Half 19&quot; box</td>
<td>6.2 kg (4U)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5 kg (6U)</td>
</tr>
<tr>
<td>Weight LHMI</td>
<td>Half 19&quot; LHMI</td>
<td>1.0 kg (4U)</td>
</tr>
</tbody>
</table>

Table 4. Power supply

<table>
<thead>
<tr>
<th>Description</th>
<th>600PSM02</th>
<th>600PSM03</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{auxnominal}$</td>
<td>100, 110, 120, 220, 240 V AC, 50 and 60 Hz</td>
<td>48, 60, 110, 125 V DC</td>
</tr>
<tr>
<td></td>
<td>110, 125, 220, 250 V DC</td>
<td></td>
</tr>
<tr>
<td>$U_{auxvariation}$</td>
<td>85...110% of $U_n$ (85...264 V AC)</td>
<td>80...120% of $U_n$ (38.4...150 V DC)</td>
</tr>
<tr>
<td></td>
<td>80...120% of $U_n$ (88...300 V DC)</td>
<td></td>
</tr>
<tr>
<td>Maximum load of auxiliary voltage supply</td>
<td>35 W</td>
<td></td>
</tr>
<tr>
<td>Ripple in the DC auxiliary voltage</td>
<td>Max 15% of the DC value (at frequency of 100 Hz)</td>
<td></td>
</tr>
<tr>
<td>Maximum interruption time in the auxiliary DC voltage without resetting the IED</td>
<td>50 ms at $U_{aux}$</td>
<td></td>
</tr>
<tr>
<td>Power supply input must be protected by an external miniature circuit breaker</td>
<td>For example, type S282 UC-K. The rated maximum load of aux voltage which is given as 35 watts. Depending on the voltage used, select a suitable MCB based on the respective current. Type S282 UC-K has a rated current of 0.75 A at 400 V AC.</td>
<td></td>
</tr>
</tbody>
</table>
17. Front panel user interface

The 630 series IEDs can be ordered with an integrated or detached front-panel user interface (HMI). The local HMI includes a large graphical monochrome LCD with a resolution of 320 x 240 pixels (width x height). The amount of characters and rows fitting the view depends on the character size as the characters' width and height may vary. The local HMI includes dedicated open and close operating button that are not used in the IED. It also includes five programmable function buttons with LED indicators.

The 15 programmable alarm LEDs can indicate 45 alarms. The local HMI offers full front-panel user interface functionality with menu navigation, menu views and operational data. In addition, the local HMI is configured automatically using PCM600 (as a part of the IED configuration steps) to display the key load shedding single-line diagram. The single-line diagram view displays the status of the critical circuit breakers like generator, grid transformer circuit breakers, network circuit breakers (bus couplers and equivalent tie feeder representation) and busbar arrangements. Additional representation like load feeders, generator and grid transformer can also be configured over and above the key load shedding single-line diagram.

![Local user interface](image)

Figure 7. Local user interface

18. Mounting methods

By the help of appropriate mounting accessories the standard IED case for the 630 series IEDs can be flush mounted, semi-flush mounted or wall mounted. Detachable HMI is intended for optimized mounting in medium voltage metal-clad switchgear, thus reducing wiring between the low-voltage compartment and the panel door.

Mounting methods:

- Flush mounting, where the cPMS is offered as a control and relay panel based solution offering.
- Door mounting of the local HMI. The IED case mounted in the low-voltage compartment of the switchgear, where the cPMS is offered as a switchgear-based solution offering.

For further information regarding cut-outs and templates for different mounting options, refer to the 630 series Installation Manual 1MRS755958.
19. Selection and ordering data

The IED type and serial number label identifies the load-shedding controller IED. The label is placed on the side of the IED case. The IED labels include a set of smaller size labels, one label for each module in the IED. The module labels state the type and serial number of each module.

The order number consists of a string of codes generated from the hardware and software modules of the IED. Use the ordering key information in tables, to generate the order number when ordering PML630.

Figure 8. Flush mounting

Figure 9. Detached LHMI
<table>
<thead>
<tr>
<th>#</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IED</td>
</tr>
<tr>
<td></td>
<td>630 series IED, 4U half 19” housing with connector set</td>
</tr>
<tr>
<td>2</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>IEC</td>
</tr>
<tr>
<td>3</td>
<td>Main application</td>
</tr>
<tr>
<td></td>
<td>Power management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Functional application, preconfigurations</td>
</tr>
<tr>
<td></td>
<td>Load shedding</td>
</tr>
<tr>
<td>5-6</td>
<td>Available analog inputs options</td>
</tr>
<tr>
<td></td>
<td>4 I (I, 1/5 A) + 5 U</td>
</tr>
<tr>
<td>7-8</td>
<td>Available binary inputs/output options</td>
</tr>
<tr>
<td></td>
<td>14 BI + 9 BO</td>
</tr>
<tr>
<td>9</td>
<td>Communication serial</td>
</tr>
<tr>
<td></td>
<td>Glass fibre (ST connector)</td>
</tr>
<tr>
<td>10</td>
<td>Communication Ethernet</td>
</tr>
<tr>
<td></td>
<td>Ethernet 100BaseFX (LC)</td>
</tr>
<tr>
<td></td>
<td>Ethernet 100BaseTX (RJ-45)</td>
</tr>
<tr>
<td>11</td>
<td>Communication protocol</td>
</tr>
<tr>
<td></td>
<td>IEC 61850</td>
</tr>
<tr>
<td>12</td>
<td>Language</td>
</tr>
<tr>
<td></td>
<td>English</td>
</tr>
<tr>
<td>13</td>
<td>Front panel</td>
</tr>
<tr>
<td></td>
<td>Integrated local HMI</td>
</tr>
<tr>
<td></td>
<td>Detached local HMI, 5 m cable</td>
</tr>
</tbody>
</table>

1) For future use
**Example code:** U B P L A A A A A A A A A Z N A X B

**Your ordering code:**

<table>
<thead>
<tr>
<th>Digit (#)</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Figure 10. Ordering key for PML630

Eight sets of order codes are possible for the IED.

<table>
<thead>
<tr>
<th>Order code</th>
<th>Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U B P L A A A A A A A A Z A A N A X B</td>
</tr>
<tr>
<td>2</td>
<td>U B P L A A A A A A A B A Z A A N A X B</td>
</tr>
<tr>
<td>3</td>
<td>U B P L A A A A A A A A A Z A A N A X B</td>
</tr>
<tr>
<td>4</td>
<td>U B P L A A A A A A A B A Z F A N A X B</td>
</tr>
<tr>
<td>5</td>
<td>U B P L A A A A A A A A Z A A N B X B</td>
</tr>
<tr>
<td>6</td>
<td>U B P L A A A A A A A A Z F A N B X B</td>
</tr>
<tr>
<td>7</td>
<td>U B P L A A A A A A B A Z F A N B X B</td>
</tr>
<tr>
<td>8</td>
<td>U B P L A A A A A B A Z A A N B X B</td>
</tr>
</tbody>
</table>
20. Accessories

Table 5. Mounting accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush mounting kit for one 4U half 19” housing IED</td>
<td>1KHL400040R0001</td>
</tr>
<tr>
<td>Wall-mounting kit (cabling to the front) for one 4U half 19” housing IED</td>
<td>1KHL400039R0001</td>
</tr>
</tbody>
</table>

Table 6. Connector sets

<table>
<thead>
<tr>
<th>Item</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector set for one 4U half 19” housing IED including analog input variant 4I + 5U (Io 1/5A), 5I + 4U (Io 0.1/0.5A) or 4I + 5U (Io 0.1/0.5A)</td>
<td>2RCA021735</td>
</tr>
</tbody>
</table>

21. Tools

PML630 is delivered without factory made pre-configuration. The default parameter setting values can be changed from the front-panel user interface, the web-browser based user interface (WebHMI) or the PCM600 tool in combination with the IED specific connectivity package.

PCM600 offers extensive IED configuration functions such as IED application configuration, signal configuration, DNP3 communication configuration and IEC 61850 communication configuration including horizontal communication, GOOSE.

When the web-browser based user interface is used, the IED can be accessed either locally or remotely using a web browser (IE 7.0 or later). For security reasons, the web-browser based user interface is disabled by default. The interface can be enabled with the PCM600 tool or from the front panel user interface. The functionality of the interface is by default limited to read-only, but can be configured to enable read and write access by means of PCM600 or the local HMI.

The IED connectivity package is a collection of software and specific IED information, which enable system products and tools to connect and interact with the IED. The connectivity packages reduce the risk of errors in system integration, minimizing device configuration and set-up times.

The configurability of the IED ensures easy adaptation of load-shedding functionality to your industrial power network, thus fulfilling the specific requirements of the present application. PCM600, which is used to configure the feeder IEDs is also used to engineer PML630. An efficient and effortless engineering procedure eliminates the re-entering of power network data and ensures that the following engineering steps are completed automatically.
• Instantiation of function blocks and their interconnections
• Generation of the load shedding single-line diagram for local HMI
• IEC 61850 engineering and GOOSE signal mapping, specific to the IED
• Load-shedding display configuration for COM600 HMI

PML630 Connectivity Package offers several additional features for engineering a cPMS solution conveniently. These features include load feeder templates for load shed command handling, standard parameter set and a sample reference project.

22. Supported ABB solutions

The cPMS solution seamlessly integrates the Power Management and Substation Automation functionality using the load-shedding network architecture.

To facilitate and streamline the system engineering, the IEDs are supplied with connectivity packages containing a compilation of software and IED-specific information including single-line diagram templates, a full IED data model including event and parameter lists. By utilising the connectivity packages the IEDs can be readily configured via the PCM600 Protection and Control IED Manager and integrated with the COM600 Station Automation device.

Compared with traditional hard-wired inter-device signaling, peer-to-peer communication over a switched Ethernet LAN offers an advanced and versatile platform for power system protection. Fast software-based communication, continuous supervision of the protection and communication system, and inherent flexibility for reconfiguration and upgradation are among the distinctive features of the protection and automation system approach.
23. Terminal diagrams

Figure 11. PML630 terminal diagram

Terminal sets 1, 2, 3, 4 and 5 are not used.
24. References

The www.abb.com/substationautomation portal offers you information about the distribution automation product and service range.

The download area on the right hand side of the web page contains the latest product documentation, such as technical reference manual, installation manual, operators manual, etc. The selection tool on the web page helps you find the documents by the document category and language.

The Features and Application tabs contain product related information in a compact format.
## 25. Functions, codes and symbols

### Table 7. Functions included in PML630

<table>
<thead>
<tr>
<th>Functionality</th>
<th>IEC 61850</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control</strong></td>
<td></td>
</tr>
<tr>
<td>Double point indication</td>
<td>DPGGIO(^1)</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
</tr>
<tr>
<td>Station battery supervision</td>
<td>SPVNZBAT(^1)</td>
</tr>
<tr>
<td>Generic measured values</td>
<td>MVGGIO(^1)</td>
</tr>
<tr>
<td>Single point indication</td>
<td>SPGGIO(^1)</td>
</tr>
<tr>
<td><strong>Power management</strong></td>
<td></td>
</tr>
<tr>
<td>Critical circuit breaker</td>
<td>NCBDCSWI</td>
</tr>
<tr>
<td>Contingency based fast load shed</td>
<td>LSCACLS</td>
</tr>
<tr>
<td>Sheddable load trip</td>
<td>LSPTRC</td>
</tr>
<tr>
<td>Busbar with sheddable load</td>
<td>LDMMXU</td>
</tr>
<tr>
<td>Network power source</td>
<td>PWSMMXU</td>
</tr>
<tr>
<td>Subnetwork output</td>
<td>SNWRCLS</td>
</tr>
<tr>
<td><strong>Disturbance recorder function</strong></td>
<td></td>
</tr>
<tr>
<td>Disturbance recorder</td>
<td>DRRDRE(^1)</td>
</tr>
<tr>
<td>Analog channels 1-10 (samples)</td>
<td>A1RADR(^1)</td>
</tr>
<tr>
<td>Analog channel 11-20 (samples)</td>
<td>A2RADR(^1)</td>
</tr>
<tr>
<td>Analog channel 21-30 (samples)</td>
<td>A3RADR(^1)</td>
</tr>
<tr>
<td>Analog channel 31-40 (calc. val.)</td>
<td>A4RADR</td>
</tr>
<tr>
<td>Binary channel 1-16</td>
<td>B1RBDR</td>
</tr>
<tr>
<td>Binary channel 17-32</td>
<td>B2RBDR</td>
</tr>
<tr>
<td>Binary channel 33-48</td>
<td>B3RBDR(^1)</td>
</tr>
<tr>
<td>Binary channel 49-64</td>
<td>B4RBDR(^1)</td>
</tr>
</tbody>
</table>

\(^1\) The function is not used by default. However, it is kept enabled in the Application Configuration tool for instantiation in any additional user defined logic other than the features offered by the IED Connectivity Package.
# 26. Document revision history

<table>
<thead>
<tr>
<th>Document revision/ date</th>
<th>Product version</th>
<th>History</th>
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<td>A/2011-05-04</td>
<td>1.1</td>
<td>First release</td>
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