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**SGM1430-B Smart Meter  
Polyphase User Manual - SMETS2**

Y20995-TUM  
Revision A  
[www.Aclara.com](http://www.Aclara.com)



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# COMPLIANCE WITH STANDARDS AND EUROPEAN DIRECTIVES



Meters are marked with the European CE mark in accordance with the Marking Directive 93/68/EEC to indicate compliance with the requirements of the EMC directive and Measuring Instruments Directive 2004/24/EC.

Safety requirements for meters are addressed in specific metering standards outlined below.

***BS EN 50470-1:2006***

General Requirements

***BS EN 50470-3:2006***

Active Energy Class A or Class B

***IEC 62052-11:2003***

General Requirements

***IEC 62053-21:2003***

Active Energy Class 1 or Class 2

***IEC 62053-22:2003***

Active Energy Class 1 or Class 2

***IEC 62053-23:2003***

Reactive Class 2 or Class 3

***BS 7856:2013***

BS Meter Dimension

***IEC 60529***



Ingress Protection

***IEC 62056-21:2002***

Hardware Description for local meter data exchange

The SGM1430-B smart meter complies with the general requirements of EN 50470 Parts 1 and Parts 3 and also complies with Class M2 Mechanical environment.

# WARNINGS AND CAUTIONS

|   |   |
|---|---|
|  |  <b>DANGER</b>  |
|   | <p><b>HAZARDOUS VOLTAGE</b></p> <p>Electrical equipment contains hazardous voltages and may cause death, serious personal injury, or equipment damage. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which will cause severe personal injury or equipment damage.</p> <p>Always de-energize and ground the equipment before maintenance. Maintenance should be performed only by qualified personnel. Follow all safety instructions contained herein.</p> |

## Important

The information contained herein is general and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Aclara reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawing or supplementary material or both, the latter shall take precedence.

The equipment in this manual must be operated only from the power source specified.

The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.

All electronic components within the meter are susceptible to damage from electrostatic discharge. To prevent damage when handling this product, use approved static control procedures.

Hazardous voltages can cause shock, burns, or death. To prevent exposure to hazardous voltages, disconnect and lock out all power sources before servicing and removing components.

If the meter is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

Unauthorized changes or modifications made to the unit could void the warranty.

## Qualified Personnel

For the purpose of this manual, a qualified person is one who is familiar with the installation, configuration, or operation of the equipment and the hazards involved. In addition, the person is:

- trained and authorized to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety procedures;
- trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices; and

- trained in rendering first aid.

Any work on or near energized meters, meter sockets, or other metering equipment presents the danger of electrical shock. All work on these products must be performed by qualified industrial electricians and metering specialists only. All work must be done in accordance with local utility safety practices and procedures.





# Table of Contents

|   |          |
|---|----------|
| <b>Chapter 1: Introduction</b>                      | <b>1</b> |
| Aclara Support . . . . .                            | 1        |
| <b>Chapter 2: Product Description</b>               | <b>3</b> |
| General Information . . . . .                       | 4        |
| Features . . . . .                                  | 5        |
| Models . . . . .                                    | 6        |
| Terminal Arrangements . . . . .                     | 7        |
| <b>Chapter 3: Physical Components</b>               | <b>9</b> |
| Enclosure and Covers . . . . .                      | 9        |
| Cover Seals . . . . .                               | 9        |
| Display . . . . .                                   | 10       |
| Descriptor, Numerical, and Unit Indicators. . . . . | 11       |
| Active Elements. . . . .                            | 13       |
| Current Status . . . . .                            | 14       |
| Reverse Run . . . . .                               | 14       |
| HAN Signal Status . . . . .                         | 15       |
| Contactors . . . . .                                | 15       |
| Load Control Relay . . . . .                        | 16       |
| Phase . . . . .                                     | 16       |
| Battery . . . . .                                   | 16       |
| Warning . . . . .                                   | 17       |
| Display Modes. . . . .                              | 17       |
| Display Configuration . . . . .                     | 17       |
| Auto-Scroll Duration . . . . .                      | 17       |
| Manual Operation Timeout . . . . .                  | 18       |
| Backlight Timeout . . . . .                         | 18       |
| Contrast Adjustment . . . . .                       | 18       |
| Display Item Configuration . . . . .                | 18       |
| OBIS Code . . . . .                                 | 18       |
| Interface Class. . . . .                            | 18       |
| Number of Digits. . . . .                           | 19       |
| Number of Decimal Places . . . . .                  | 19       |
| Additional Information . . . . .                    | 19       |
| Push Buttons . . . . .                              | 19       |
| Push Button A. . . . .                              | 19       |
| Push Button B - Sealable . . . . .                  | 20       |
| Push Buttons A and B . . . . .                      | 20       |
| Configuration . . . . .                             | 20       |
| Supply Reconnection . . . . .                       | 20       |
| Audible Indicators . . . . .                        | 20       |
| Optical Port. . . . .                               | 20       |
| LED Indicator . . . . .                             | 21       |
| Nameplate . . . . .                                 | 21       |
| CSP Communications Hub Interface . . . . .          | 22       |
| Contactors and Relay Terminals. . . . .             | 22       |
| Status Indicator . . . . .                          | 22       |
| Terminal Screws. . . . .                            | 22       |
| Lithium Battery . . . . .                           | 22       |
| Meter Security . . . . .                            | 22       |
| Magnetic Detection . . . . .                        | 23       |

|  |           |
|--|-----------|
| Memory . . . . .                                     | .23       |
| Firmware . . . . .                                   | .23       |
| Firmware Variants . . . . .                          | .23       |
| Firmware Components . . . . .                        | .24       |
| Firmware Specifications . . . . .                    | .25       |
| Metrology Firmware and Data . . . . .                | .25       |
| Firmware Release Notes Process . . . . .             | .26       |
| Firmware Upgrade . . . . .                           | .26       |
| Firmware Security . . . . .                          | .26       |
| Power Outages . . . . .                              | .27       |
| <b>Chapter 4: Communications</b>                     | <b>29</b> |
| Communication Interfaces . . . . .                   | .29       |
| ICHIS Interface . . . . .                            | .29       |
| 20-Pin Connector . . . . .                           | .30       |
| Optional AC Mains Connector . . . . .                | .30       |
| Home Area Network (HAN) . . . . .                    | .31       |
| Manufacturing Client . . . . .                       | .31       |
| Advanced Metering Infrastructure (AMI) . . . . .     | .31       |
| <b>Chapter 5: Metrology Functionality</b>            | <b>33</b> |
| Multipurpose Energy Metering . . . . .               | .33       |
| Instantaneous Measurements . . . . .                 | .33       |
| Frequency of Supply . . . . .                        | .34       |
| Cumulative Registers . . . . .                       | .34       |
| Power Quality Measurements . . . . .                 | .34       |
| Over Frequency and Under Frequency . . . . .         | .34       |
| Over Current . . . . .                               | .35       |
| Power Factor Threshold . . . . .                     | .35       |
| Voltage Quality Measurements . . . . .               | .35       |
| Average RMS Voltage for Phases 1, 2, and 3 . . . . . | .35       |
| Over Voltage Threshold . . . . .                     | .35       |
| Under Voltage Threshold . . . . .                    | .36       |
| RMS Extreme Over Voltage . . . . .                   | .36       |
| RMS extreme Under Voltage . . . . .                  | .36       |
| RMS Voltage Sag . . . . .                            | .36       |
| RMS Voltage Swell . . . . .                          | .36       |
| Supply Outage Reporting . . . . .                    | .37       |
| Profiles . . . . .                                   | .37       |
| Load Profile . . . . .                               | .37       |
| Interval Times . . . . .                             | .37       |
| Interval Time Changes . . . . .                      | .38       |
| Data Storage . . . . .                               | .38       |
| Load Profile . . . . .                               | .38       |
| Voltage Profile . . . . .                            | .38       |
| Memory Overwrite . . . . .                           | .38       |
| Power Outages . . . . .                              | .38       |
| Time-of-Use (TOU) . . . . .                          | .39       |
| Block Tariffs . . . . .                              | .39       |
| Maximum Demand . . . . .                             | .39       |
| Billing Data . . . . .                               | .39       |
| Daily Billing Data . . . . .                         | .39       |
| Monthly Billing Data . . . . .                       | .40       |
| Asynchronous Billing . . . . .                       | .41       |

|  |           |
|--|-----------|
| <b>Chapter 6: Advanced Features</b>              | <b>43</b> |
| Supply Disconnect and Reconnect . . . . .        | 43        |
| Supply Contactor Visual Status . . . . .         | 43        |
| Scheduled Disconnection/Reconnection . . . . .   | 43        |
| Automatic Disconnection/Reconnection . . . . .   | 43        |
| Load Limiting . . . . .                          | 44        |
| Under/Over Frequency . . . . .                   | 44        |
| Sag/Swell (Short Term) . . . . .                 | 44        |
| Under/Over Voltage (Long Term) . . . . .         | 44        |
| Over Current . . . . .                           | 44        |
| Power Factor . . . . .                           | 44        |
| Tamper Detection . . . . .                       | 45        |
| Arming and Disarming . . . . .                   | 45        |
| Auxiliary Load Relay . . . . .                   | 45        |
| Real-time Clock . . . . .                        | 45        |
| Event Logging and Errors/Alarms . . . . .        | 45        |
| Event Logs . . . . .                             | 46        |
| Prepayment Solution . . . . .                    | 46        |
| Overview . . . . .                               | 46        |
| Account Model . . . . .                          | 46        |
| Credit Object Types . . . . .                    | 47        |
| Charge Object Types . . . . .                    | 47        |
| Payment Modes . . . . .                          | 48        |
| Credit Mode . . . . .                            | 48        |
| Credits . . . . .                                | 48        |
| Charges . . . . .                                | 48        |
| Prepayment Mode . . . . .                        | 49        |
| Credits . . . . .                                | 49        |
| Charges . . . . .                                | 50        |
| Changing Payment Modes . . . . .                 | 51        |
| Changing to Credit Mode . . . . .                | 52        |
| Changing to Prepayment Mode . . . . .            | 52        |
| Non-Disablement . . . . .                        | 54        |
| Display Indication . . . . .                     | 54        |
| Non-Disablement Calendar . . . . .               | 54        |
| Days . . . . .                                   | 54        |
| Weeks . . . . .                                  | 55        |
| Seasons . . . . .                                | 55        |
| Special Days - Holidays . . . . .                | 55        |
| Disconnect Control Mode . . . . .                | 55        |
| Top-Ups . . . . .                                | 55        |
| UTRN (Token) Overview . . . . .                  | 55        |
| Prepayment Token Decimal (PPTD) . . . . .        | 56        |
| Prepayment Top-up Token (PTUT) . . . . .         | 56        |
| Class 5 Token . . . . .                          | 56        |
| Consumer UTRN Token – 20-Digit Decimal . . . . . | 57        |
| Check Digit – 20th Digit . . . . .               | 57        |
| UTRN Token - MAC . . . . .                       | 57        |
| Prepayment Key . . . . .                         | 58        |
| UTRN Counter Cache . . . . .                     | 58        |
| UTRN - Manual Entry . . . . .                    | 58        |
| UTRN Entry Responses . . . . .                   | 60        |
| UTRN Entry Accepted . . . . .                    | 60        |
| UTRN Entry Lockout . . . . .                     | 60        |

|   |           |
|---|-----------|
| Maximum Meter Balance . . . . .                           | .60       |
| Maximum Credit Threshold . . . . .                        | .61       |
| Debt to Clear . . . . .                                   | .61       |
| Order of Recovery of Debts . . . . .                      | .61       |
| Prepayment Events and Alerts . . . . .                    | .61       |
| Prepayment Logs . . . . .                                 | .63       |
| Prepayment Menu - Display. . . . .                        | .64       |
| Mandatory Prepayment Menu Items . . . . .                 | .65       |
| Prepayment Menu - Item Structure and Access . . . . .     | .66       |
| <b>Chapter 7: Installation</b>                            | <b>69</b> |
| Terminal Connections . . . . .                            | .69       |
| Terminal Block . . . . .                                  | .69       |
| Terminal Arrangements . . . . .                           | .69       |
| SGM1431-B Terminals . . . . .                             | .69       |
| SGM1432-B Terminals . . . . .                             | .69       |
| SGM1433-B Terminals . . . . .                             | .69       |
| Installation Procedures. . . . .                          | .69       |
| UK Installation . . . . .                                 | .69       |
| Installation Screwdrivers . . . . .                       | .71       |
| Backup Power Supply . . . . .                             | .72       |
| Mounting Template . . . . .                               | .72       |
| Connect SGM1430-B to the CSP Communications Hub . . . . . | .72       |
| Notifications to Installers and Utilities. . . . .        | .75       |
| <b>Chapter 8: Tests Procedures and Maintenance</b>        | <b>79</b> |
| Pulse Output LED . . . . .                                | .79       |
| Calibration . . . . .                                     | .79       |
| Test Display . . . . .                                    | .79       |
| Test Procedures . . . . .                                 | .80       |
| Field Accuracy Test . . . . .                             | .80       |
| Watt-hour Test . . . . .                                  | .80       |
| Maintenance and Repairs. . . . .                          | .81       |
| Cleaning . . . . .  | .81       |
| Disposal . . . . .  | .81       |
| Battery Disposal. . . . .                                 | .81       |
| <b>Chapter 9: Specifications</b>                          | <b>83</b> |
| Catalogue Codes. . . . .                                  | .85       |
| <b>Appendix A: Event Codes</b>                            | <b>87</b> |
| UK SMETS2 . . . . .                                       | .87       |
| <b>Index</b>  | <b>99</b> |

**CHAPTER****1**

# INTRODUCTION

The purpose of this document is to provide qualified metering personnel with product description; operating, maintenance, and upgrading instructions; site analysis guides; and diagrams for the SGM1430-B smart meter family. It is not intended to replace the extensive training necessary to install or remove meters from service. Any work on or near energized meters, meter sockets, or other metering equipment presents the danger of electrical shock. All work on these products must be performed by qualified industrial electricians and metering specialists only. All work must be done in accordance with local utility safety practices and procedures.

## Aclara Support

If you have questions, an issue, or would like to speak with Aclara's Support personnel, please contact Aclara using one of the following methods.

### Technical Support

Email [support@aclara.com](mailto:support@aclara.com) or call 1-800-892-9008 to speak with an Aclara representative.



**CHAPTER****2****PRODUCT DESCRIPTION**

The SGM1430-B meter from Aclara is an advanced modular designed family of products for small to medium enterprise and commercial installations. The SGM1430-B is available in a number of different polyphase variants, and it forms an integral part of a complete two-way, secure, end-to-end solution.



The SGM1430-B has been designed to offer flexibility and the choice of home area network (HAN) and wide area network (WAN) communications. As standard, the SGM1430-B supports different AMI technologies, including the UK CSP communications hub solution. The communications hub mechanically connects directly to the electricity meter. The hub communicates with the meter using the ZigBee communication protocol. A manufacturing option that provides direct communications via a hardwired interface is also available.

The on-board ZigBee RF interface uses industry standard Smart Energy Profile for HAN communications to the UK communications hub and in-home display (IHD) respectively.

The standard meter is supplied with an integrated 3 x 100 A switch for connect/disconnect of the consumer supply. Certain models of the SGM1430-B

meter offer an optional 2 A load control relay for control of other ancillary devices such as night storage heating, pumps, etc.

The meters also support a comprehensive tariff developed in association with the UK Great Britain Companion Specifications Standard as well as both seasonal time of day (STOD) and block tariffs.

Additionally, the meters offer storage for two years of load profile data and support independent profiling of voltage profile data, typically line voltage, current, frequency, etc. The SGM1430-B meter also provides, as standard, enhanced power quality features offering support of sag/swell and under/over voltage.

Designed with installation in mind, the SGM1430-B meter offers a means for a quick and secure deployment. A custom-designed LCD provides added value information. For example, when ZigBee is used, information such as HAN pairing progress, notification of pairing complete, local signal strengths for HAN, etc. is displayed to improve the installation experience. Refer to *Installation* on page 69 for more information on installing an SGM1430-B meter.

All SGM1430-B meters have a common layout for buttons, optical port, display, and pulse indicators. The communications hub interface is also standardized across all meter models. The SGM1430-B meter can be customized with optional variants and extras, including the following:

- Back-lit LCD
- Hardwired Communications Interface
- Magnetic Detection
- Removal of the HAN

## General Information

The key features of the SGM1430-B meters include:

- Product life of 20 years
- Polyphase direct connected (whole current)
- Optional one or two 2 A auxiliary relay
- A field-replaceable CSP communications hub that prevents disruption of service
- Comprehensive metrology – active, reactive, and apparent energy; import and export
- Extensive tariff capability – 48 x standard time of day TOU registers and 4 x 8 block tariff
- Two years of load profile data storage
- Three months voltage profile data



- Daily, weekly, and monthly billing data
- Voltage sag/swell, under and over voltage
- Over and Under Frequency
- Power Factor Threshold
- Comprehensive event logging with over 100 unique event codes, as well as Security, Power Event, Standard Event, and ALCS logs for event storage
- Enhanced physical and electronic security (tamper, password levels)
- HAN support of industry standard Smart Energy Profile
- GPRS wide area network for remote retrieval of data to a headend system via CSP communications hub
- DLMS COSEM compliant via the optical port
- Firmware over-the-air (FOTA) full upgrades
- Change of tenancy and supplier – CoT and CoS
- Dual firmware versions - Firmware rollback feature during firmware update
- Extensive data storage
- Simultaneous local and remote communication without performance loss
- Enhanced power quality monitoring including voltage, frequency, and power factor
- Control of external loads via auxiliary relay
- Short terminal cover
- Tariff Structure:
  - Active and Deferred Tariffs
  - 48 Time-of-Use Registers
  - 4 x 8 Block Tariffs
  - 4 Seasons
  - 5 Week Profiles
  - 16 Day Profiles
  - 50 Special Days
  - 200 Switching Times
  - 13 End of Month Billing Dates
  - 5 Weekly Billing Dates
  - 31 Daily Billing Sets

## Features

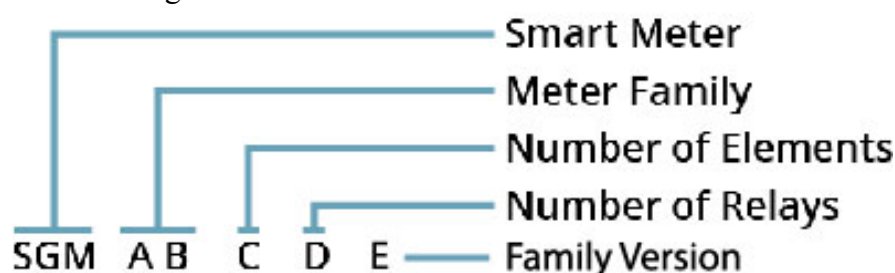
The SGM1430-B smart meter family has the following main features:

- Processor internal memory with 1.5 MB of flash memory for program and boot, plus 640 KB of internal RAM

- External serial flash memory with 16 MB for configuration and operational data as well as for firmware upgrade image storage
- Configurable display with auto and manual scroll lists and user-defined fields
- Independent communication ports: local optical port, AMI interface port (GPRS as standard), and ZigBee HAN port
- Configurable time-of-use (TOU) operation to support full flexibility tariffing
- Flexible calendar definition that supports up to 48 daily time periods, 16 day types, four week types, 50 designated holidays or special days, and four seasons
- Configurable measurement profile with independent measurements for each measuring element
- Select demand measurement for demand calculation, including selected measurement profile and selectable demand interval
- Prepayment mode of operation
- Field-replaceable CSP communications hub that provides flexibility for WAN communications
- Tamper detection for meter cover, terminal cover, and communications hub cover

## Models

The SGM1430-B smart meter family is made up of meters of common physical characteristics and functionality. The nomenclature of the meter models indicates the following:



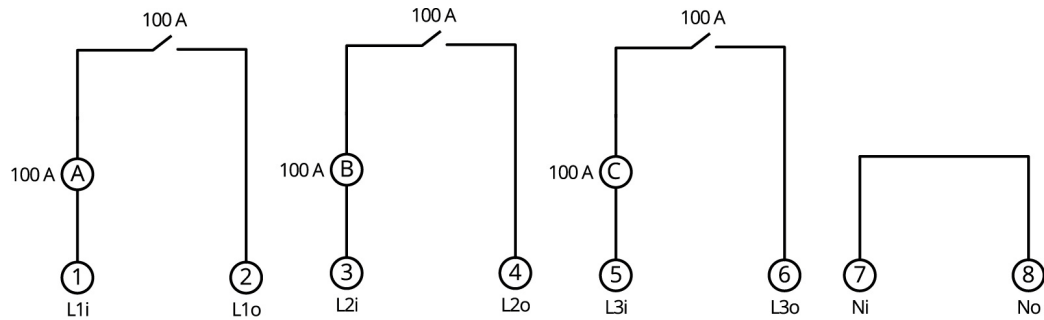
The following models are currently available in the SGM1430-B smart meter family:

| Model     | Connect Type | Phase | Current Elements | 3 x 100 A Contactor | 2 A Auxiliary Relay | Itr - Iref (Imax) |
|-----------|--------------|-------|------------------|---------------------|---------------------|-------------------|
| SGM1431-B | Direct       | Poly  | 3                | Yes                 | No                  | 0.5-10 (100 A)    |
| SGM1432-B | Direct       | Poly  | 3                | Yes                 | Yes x 1             | 0.5-10 (100 A)    |
| SGM1433-B | Direct       | Poly  | 3                | Yes                 | Yes x 2             | 0.5-10 (100 A)    |

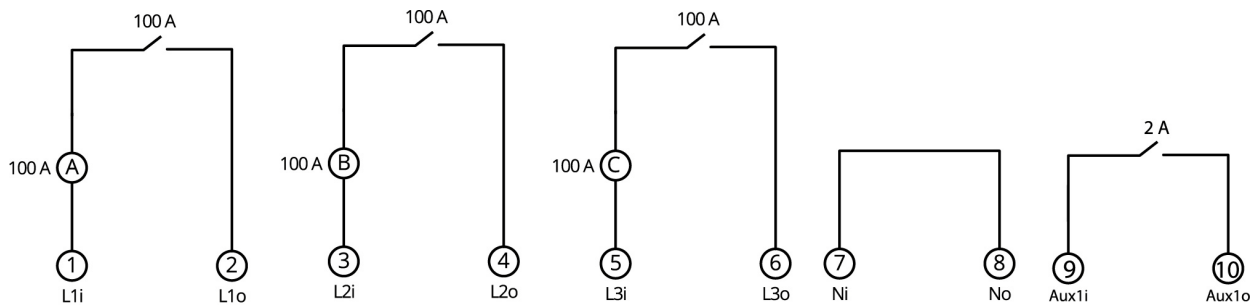
# Terminal Arrangements

The SGM1430-B polyphase meters conform to the British Standard Institute code of practice (BS 7856:2013).

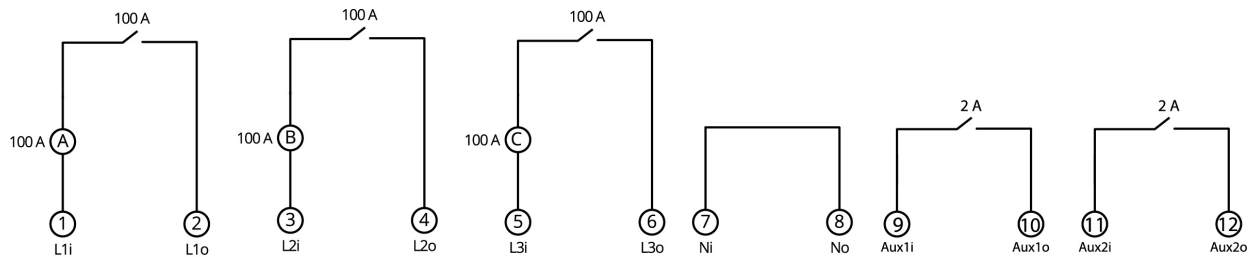
## SGM1431-B



## SGM1432-B



## SGM1433-B



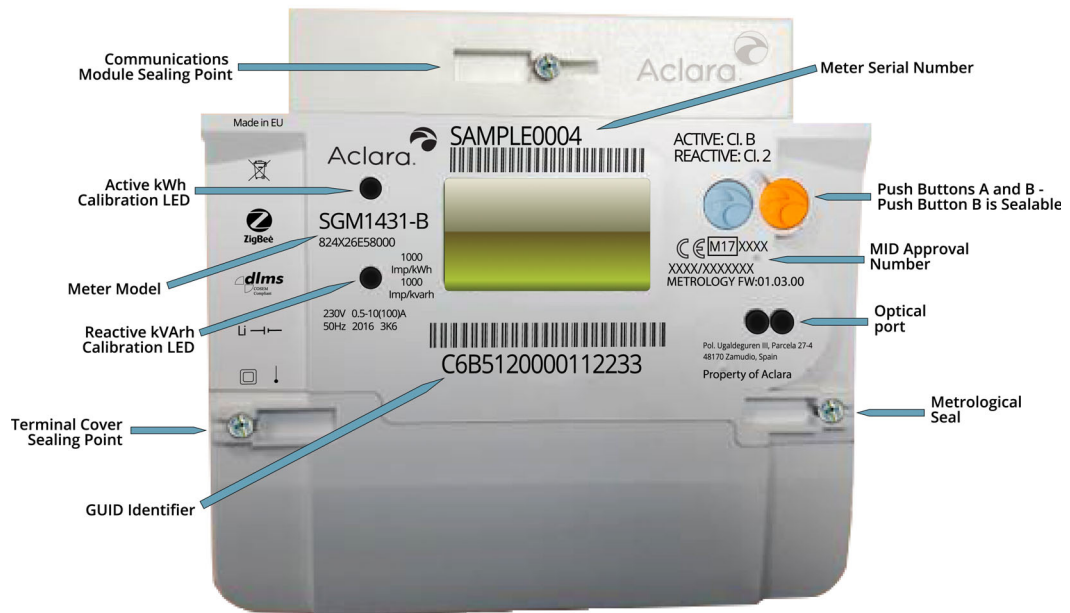


## CHAPTER

## 3

## PHYSICAL COMPONENTS

The SGM1430-B smart meter family comprises of a number of polyphase variants with and without 2 A aux relay outputs. The main physical features of a SGM1430-B meter are shown below.



## Enclosure and Covers

The SGM1430-B meters use a thermally stable, UV-protected polycarbonate enclosure that is double insulated to protective Class II. The enclosure provides an Ingress Protection Rating of IP54 in accordance with IEC 60529. The following cover segments are constructed of Polycarbonate 10% GF (Grade Lexan 503RS):

- **Meter cover** - When the meter is fully installed, the main cover cannot be removed while the terminal cover is fitted to the meter.
- **Terminal cover** - Protects the terminal screws from external contact. Inside the terminal cover is a diagram identifying the connections on the terminal block. This includes a schematic diagram and description of all physical elements on the terminal block, the arrangement of active and neutral terminals for the conductors, and an identifying number defining the specific variant of terminal.

## Cover Seals

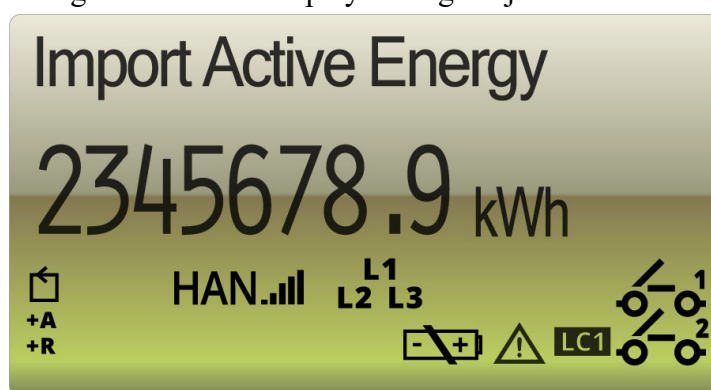
The meter cover and terminal cover are secured by standard single sealing screws. The torque value for the sealing screw is 0.6-0.9 Nm. The screw head has a recessed hole and slot to accommodate a 0.914 mm diameter thread wire seal. The

sealing wire is crimped close to the body of the meter using a tool with die indents.

As a manufacturing option, the meter can also be supplied with an ultrasonic permanent seal.

## Display

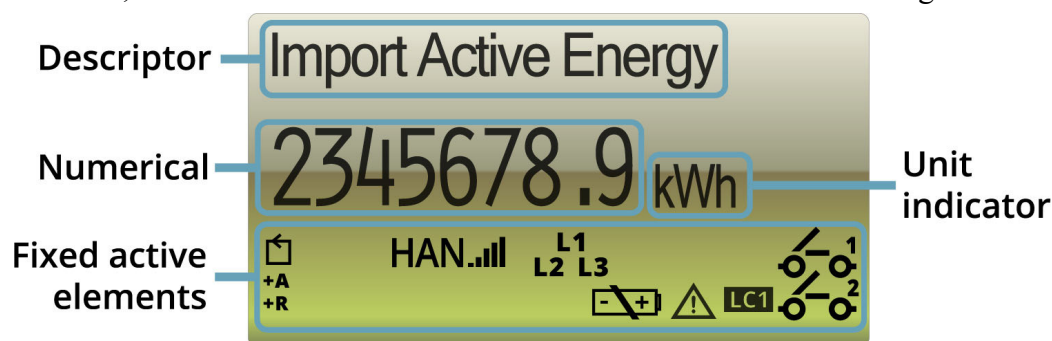
The SGM1430-B meter provides a backlit Liquid Crystal Display (LCD) located on the meter face. The display consists of graphical elements and segments. The graphical section displays the meter status in quantities up to eight digits, including the unit of measure. It can also display end user instructions to advise installation teams that commissioning is complete. The LCD backlight will illuminate the display when a button is pressed. The automatic scroll duration, manual scroll timeout, backlight duration, and contrast adjustment are configurable via the display settings object.



The display shows the following:

- Units of measure
- Constant display of the meter status
- State of the primary supply contactor
- State of the auxiliary control relay (applicable to SGM1432-B and SGM1433-B)
- Voltage state per phase
- Direction of current per phase
- Signal strength as reported by the HAN module
- Communication status of the HAN network
- Direction of energy (for example, flowing from the premise to the network)
- Battery status
- Various data values, meter status, and indications
- Current and historical energy and demand registers

There are four basic types of indicators on the display: descriptor, numerical, unit indicator, and fixed active elements. Each are described in the following sections.



## Descriptor, Numerical, and Unit Indicators

The top line descriptor supports 32 characters. The numerical line supports up to eight digits along with a decimal and other separators. The unit indicator is always to the right of the numerical line.

The following items are available for display on the SGM1430-B meter variants.

|                                 | SGM1430-B Variants - LCD Items Supported |
|---------------------------------|--|
| Description in SGM1430-B Manual | SGM1431-B / SGM1432-B / SGM1433-B        |
| Active Power Import             | X  |
| Active Power Import - Ph1       | X  |
| Active Power Import - Ph2       | X  |
| Active Power Import - Ph3       | X  |
| Active Power Export             | X  |
| Active Power Export - Ph1       | X  |
| Active Power Export - Ph2       | X  |
| Active Power Export - Ph3       | X  |
| Reactive Power Import           | X  |
| Reactive Power Import - Ph1     | X  |
| Reactive Power Import - Ph2     | X  |
| Reactive Power Import - Ph3     | X  |
| Reactive Power Export           | X  |
| Reactive Power Export - Ph1     | X  |
| Reactive Power Export - Ph2     | X  |
| Reactive Power Export - Ph3     | X  |
| Reactive Power Q1               | X  |
| Reactive Power Q2               | X  |
| Reactive Power Q3               | X  |
| Reactive Power Q4               | X  |
| Apparent Power Import           | X  |
| Apparent Power Export           | X  |

|                                      | SGM1430-B Variants - LCD Items Supported |
|--------------------------------------|--|
| Description in SGM1430-B Manual      | SGM1431-B / SGM1432-B / SGM1433-B        |
| Current (I) - Ph1                    | X  |
| Current (I) - Ph2                    | X  |
| Current (I) - Ph3                    | X  |
| Voltage (V) - Ph1                    | X  |
| Voltage (V) - Ph2                    | X  |
| Voltage (V) - Ph3                    | X  |
| Power Factor                         | X  |
| Supply Frequency - Hz                | X  |
| Active Energy Import                 | X  |
| Active Energy Import - Ph1           | X  |
| Active Energy Import - Ph2           | X  |
| Active Energy Import - Ph3           | X  |
| Active Energy Export                 | X  |
| Active Energy Export - Ph1           | X  |
| Active Energy Export - Ph2           | X  |
| Active Energy Export - Ph3           | X  |
| Reactive Energy Import               | X  |
| Reactive Energy Import - Ph1         | X  |
| Reactive Energy Import - Ph2         | X  |
| Reactive Energy Import - Ph3         | X  |
| Reactive Energy Export               | X  |
| Reactive Energy Export - Ph1         | X  |
| Reactive Energy Export - Ph2         | X  |
| Reactive Energy Export - Ph3         | X  |
| Reactive Energy (Q1)                 | X  |
| Reactive Energy (Q2)                 | X  |
| Reactive Energy (Q3)                 | X  |
| Reactive Energy (Q4)                 | X  |
| Apparent Energy Import               | X  |
| Apparent Energy Export               | X  |
| Max Demand Active Power Import kW    | X  |
| Max Demand Active Power Export kW    | X  |
| Tariff TOU(X) where X is Rate 1 - 48 | X  |
| Block Tariff (4 x 8)                 | X  |
| Time (hh:mm:ss)                      | X  |
| Date (dd/mm/yy)                      | X  |



|   | SGM1430-B Variants - LCD Items Supported |
|---|--|
| Description in SGM1430-B Manual                               | SGM1431-B / SGM1432-B / SGM1433-B        |
| Segment Test  | X  |
| Meter Serial Number (YYM1234567)                              | X  |
| Meter Balance (£)   | X  |
| Standing Charge (p)   | X  |
| MPAN  | X  |
| Customer Identification Number (CIN)                          | X  |
| Energy Supplier Contact Details:<br>name and telephone number | X  |
| Active Tariff Price   | X  |
| Set/Enable Privacy PIN  | X  |
| Disable Privacy PIN   | X  |
| Temp Disable Privacy Pin                                      | X  |
| Network Join  | X  |
| Supplier Message  | X  |
| <b>Event Logs:</b>  |  |
| Event Log   | X  |
| Power Event Log   | X  |
| Security Log  | X  |
| <b>Prepayment Displays:</b>                                   |  |
| Mode of Operation: Credit or Prepayment Mode                  | X  |
| Meter Balance (£)   | X  |
| Emergency Credit Menu   | X  |
| Last Five Credits   | X  |
| Standing Charge (p)   | X  |
| Accumulated Debt  | X  |
| Payment-based Debt  | X  |
| Time-based Debt   | X  |
| Available Credit  | X  |
| Debt to Clear   | X  |
| Aggregated Debt   | X  |
| Enter UTRN - Mandatory for Prepayment                         | X  |
| <b>Costs:</b>   |  |
| Cost of Instantaneous Active Power Import                     | X  |

## Active Elements


The active elements icons indicate status of current flow, network connection signal strength, contactor and load control relay status, low battery voltage, and other warnings. The function of each icon is described in the following sections.


## Current Status

The four arrows represent the current flow of the meter. The current flow of the meter is portrayed as follows:

### Horizontal Arrows


The horizontal arrows indicate the direction of the flow of active energy.


When  is illuminated, energy is being consumed from the grid.

When  is illuminated, energy is being generated at the premise and received by the network.

### Vertical Arrows

The vertical arrows indicate the presence of reactive energy.

When  is illuminated, there is a lagging condition.

When  is illuminated, there is a leading condition.

The possible states are described in the following table.

| Illuminated Icons      | Description            |
|------------------------|------------------------|
| <b>+R</b>              | Import Reactive Energy |
| <b>+A</b>              | Import Active Energy   |
| <b>-R</b>              | Export Reactive Energy |
| <b>-A</b>              | Export Active Energy   |
| <b>+A</b><br><b>+R</b> | First Quadrant         |
| <b>-A</b><br><b>+R</b> | Second Quadrant        |
| <b>-A</b><br><b>-A</b> | Third Quadrant         |
| <b>+A</b><br><b>-R</b> | Fourth Quadrant        |

## Reverse Run

If the meter is configured to measure import energy only and detects reverse (export) energy, the reverse run icon will appear until the event is cleared at the headend.



If the Reverse Run icon is visible, reverse energy has been detected. The reverse run indication can only be cleared by a command via one of the communications ports.

The reverse run icon is enabled by setting the appropriate bit in the COSEM error register filter; the status icon represents the current state of the reverse run bit in the error register, respectively.

## HAN Signal Status

AMI communication signal strength is portrayed through five bars.



From low to high, these signal strength indications are:

- No signal
- Very Low signal strength
- Low signal strength
- Medium Low signal strength
- Medium signal strength
- Medium High signal strength
- High signal strength


The connection status and signal strength for each connected device will be cycled. A solid device icon indicates the device is connected, while a flashing icon indicates a fault with the particular device. Only connected devices will be shown in the cycle.



## Contactors

The display indicates whether the primary (main supply) contactor is open or closed or whether the contactor is armed and ready for closing. The main supply open/close indicator is visible at all times.



The icon will indicate three possible states of the contactors.

| Icons   | Description        |
|---|--------------------|
|  | Contactor is open. |

| Icons  | Description          |
|--|----------------------|
|             | Contactor is closed. |
|  (Flashing) | Contactor is armed.  |

## Load Control Relay

The LC1 icon represents the state of the load control relay. When LC1 is illuminated, the load control relay is closed and the load is connected. If LC1 is not present on the display, the load control relay is open and the load is disconnected.

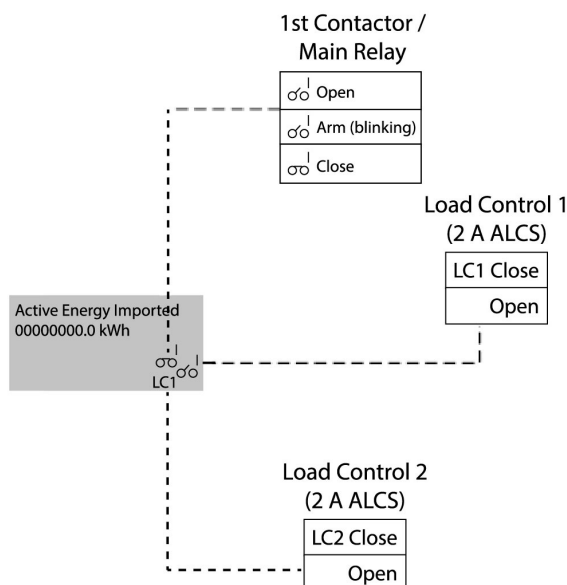
**LC1**

## Phase

The phase indicator L1 indicates the presence of phase voltage above a defined threshold. (The L2 and L3 indicators are unused in the polyphase SGM1430-B meter.)

**L1**

## SGM1432-B/SGM1433-B LCD Icons - Contactor and Aux Relay



## Battery

This icon indicates low backup battery voltage. When the voltage of the backup battery has fallen below a critical threshold, the icon will appear, and the meter will create an event log entry.



## Warning

The warning icon indicates a warning condition has been detected by the meter.



## Display Modes

The SGM1430-B meter supports eight different display modes for the UK:

- Primary
- Alternate 1
- Alternate 2
- Alternate 3 (prepayment menu)
- Engineering Menu
- HAN Signal Strength
- Active TOU
- Privacy PIN

The display also shows the status during HAN pairing and relay reconnection. Each display mode is configurable via the corresponding display configuration object list. Configuration involves programming the OBIS code, interface class, and formatting information into the list. Items appear on the screen in the same order as the list. The total number of display items in each user-configurable display mode is 50.

The display supports both automatic and manual scrolling through display items. The automatic scroll duration, manual scroll timeout, backlight duration, and contrast adjustment are configurable via the display settings. Please refer to *Push Buttons* on page 19 for more information on scrolling through display items.

## Display Configuration

The following aspects of the display may be configured by the utility.

### Auto-Scroll Duration

This setting defines the amount of time each display item will remain on the screen during an auto-scroll operation.

|         |            |
|---------|------------|
| Default | 20 seconds |
| Minimum | 5 seconds  |
| Maximum | 60 seconds |
| Disable | 0 seconds  |

## Manual Operation Timeout

This setting defines the inactivity period for the manual-scroll mode. While operating in manual-scroll mode, if no buttons are pressed, the display will revert back to auto-scroll mode.

|         |            |
|---------|------------|
| Default | 10 seconds |
| Minimum | 1 second   |
| Maximum | 60 seconds |

## Backlight Timeout

This setting defines the period of time the backlight will remain lit following an action which triggered the illumination. The following actions will trigger backlight illumination:

- Pressing of the pushbuttons
- Optical Port activity
- Insertion of a WAN device

|         |                         |
|---------|-------------------------|
| Default | 300 seconds (5 minutes) |
| Minimum | 1 second                |
| Maximum | 300 seconds             |

## Contrast Adjustment

This setting adjusts the contrast level of the display.

|         |              |
|---------|--------------|
| Default | 20           |
| Minimum | 0 (lightest) |
| Maximum | 63 (darkest) |

## Display Item Configuration

The following display items may be configured as described in the following sections.

### OBIS Code

The DLMS Object Identification System code for the display item.

### Interface Class

The DLMS Interface Class for the display item.

## Number of Digits

This specifies the number of digits to display when leading zeros are enabled.

|         |   |
|---------|---|
| Default | 0 |
| Minimum | 0 |
| Maximum | 8 |

## Number of Decimal Places

This specifies the number of decimal places to display,

|         |   |
|---------|---|
| Default | 0 |
| Minimum | 0 |
| Maximum | 2 |

## Additional Information

This specifies the additional information for the following unique display items.

- For prepayment data, this field is configured with the Attribute ID.
- For serial numbers, this field must be configured with:

|                           |   |
|---------------------------|---|
| Meter serial number       | 0 |
| COMM module serial number | 1 |
| All other display items   | 2 |

For details on Prepayment Attribute IDs, refer to the Meter Config Tool software.

## Push Buttons

Two push buttons (A and B) on the meter face grant the customer a means to restore supply and manual cycle through the display screens.

### Push Button A

Push button A is used to manually scroll through custom display items within the user-configurable display modes. Each button press manually advances to the next item in the display. The manual scroll mode will revert back to automatic scrolling after a number of seconds have elapsed without button A being pressed. This pre-set period of time is known as the manual scroll timeout. This button is also used to acknowledge successful, failed, or timed-out HAN join events when prompted by the LCD display.

## Push Button B - Sealable

Push button B, when not sealed, is used to navigate through the various display modes. Each press of this button will advance to the next display mode.

- |                                  |   |
|----------------------------------|---|
| 1. Primary                       | 5. Engineering Menu                           |
| 2. Alternate 1                   | 6. HAN Signal Strength                        |
| 3. Alternate 2                   | 7. Active TOU<br>(specific firmware versions) |
| 4. Alternate 3 (prepayment menu) | 8. Privacy PIN                                |

## Push Buttons A and B

Together, these buttons are used to restore the consumer supply. The end customer must press buttons A and B simultaneously for a configured number of seconds (the default is 5 seconds) when prompted by the LCD display.

## Configuration

The following sections describe the available options for the A and B push buttons.

### Supply Reconnection

This setting adjusts the amount of time the push buttons must be depressed (simultaneously) in order to reconnect the supply.

|         |            |
|---------|------------|
| Default | 5 seconds  |
| Minimum | 2 seconds  |
| Maximum | 10 seconds |

### Audible Indicators

This setting enables or disables audible indications when the push buttons are pressed.

|          |          |
|----------|----------|
| Default  | Disabled |
| Disabled | 0        |
| Enabled  | 1        |

## Optical Port

The SGM1430-B meter has an optical port for local communication. It supports the IEC 62056-21 optical communication interface standard with a baud rate of 9,600 bps. The optical port is disabled on meters deployed in field.



## LED Indicator

The LED indicator flashes when measuring the consumer's load. The LED as default will flash to indicate forward and reverse kWh but can be reconfigured to show kVArh.

## Nameplate

This section describes the various possible markings on the face of the meter.



- |   |  |
|---|--|
| 1) Country of manufacture               | 9) Class II (double-insulated)                         |
| 2) WEEE compliance                      | 10) Internal lithium battery                           |
| 3) Meter model                          | 11) Meter specifications                               |
| 4) ZigBee Smart Energy interoperability | 12) Global Unique Identifier (GUID) number and barcode |
| 5) Meter catalog number                 | 13) Ownership  |
| 6) DLSMS/COSEM compliance               | 14) MID approval number                                |

7) Active/Reactive energy metering constants

15) Accuracy class

8) Polyphase, two-wire

16) Customer serial number & barcode

## CSP Communications Hub Interface

The SGM1430-B meter has been designed to be compliant with the DCC intimate communications hub standard. The standard covers both the mechanical and electrical interface for support of a CSP communications hub.

## Contactors and Relay Terminals

The SGM1430-B meters are available in a variety of supply disconnect contactor and auxiliary relay configurations. The primary supply disconnect/reconnect contactor has a maximum rated current of 100 A.

The SGM1432-B and SGM1433-B models may be customized with a 2 A relay for management of an external supply contactor. The 2 A relay is voltage-free and electrically isolated from the meter's line and neutral. The torque value for the 2 A terminal screws is 0.2-0.3 Nm.

### Status Indicator

The LCD also provides icons that show whether the main and secondary supply contactors are open, closed, or armed and ready for closing. The status of the auxiliary load control relay is indicated by the LCD.

### Terminal Screws

The specifications of SGM1430-B terminal screws are as follows:

#### Contactor Terminals

Contactor terminal screws are M6 slotted / Phillips combination head screws with a bore diameter of 8.2 mm.

#### Relay Terminals

Relay terminal screws are M2.5 slotted head screws with a bore diameter of 3 mm.

## Lithium Battery

The SGM1430-B meter includes a lithium battery backup with sufficient capacity to maintain the meter's real-time clock for up to two years. The battery has a 20 year lifespan that is designed in line with the product life.

## Meter Security

Along with hardware seals, the SGM1430-B firmware will also detect and record the following tamper incidents:

- When the terminal cover is removed from the meter (Event)

- When the terminal cover is replaced (Event)
- When the meter cover is removed from the meter (Event)
- When the meter cover is replaced (Error)
- When the communications hub cover is removed from the meter (Event)
- When the communications hub cover is replaced (Event)

When a tamper is detected, the corresponding Event Code will be entered into the Fraud Detection Log. For more information on how to access this log, refer to *Event Logging and Errors/Alarms* on page 45.

## Magnetic Detection

The SGM1430-B meter supports a mechanism to detect external DC magnets of 300 Gauss near the load side terminals. The Fraud Detection log will report a Strong Magnetic Field followed by a Strong Magnetic Field Not Longer (Event) when the magnetic field ceases. For more information on how to access this log, refer to *Event Logging and Errors/Alarms* on page 45. Refer to the *Catalogue Codes* on page 85 for details on ordering this variant.

## Memory

### Processor Internal Memory

The SGM1430-B meters have 1.5 MB of flash memory for program and boot as well as 640 KB of internal RAM.

### External Serial Flash Memory

The SGM1430-B meters have 16 MB of external serial flash memory for configuration and operational data as well as for firmware upgrade image storage.

## Firmware

The firmware is the critical portion of the system that sits between the headend system, the metrological sensors, and the devices on the HAN.

### Firmware Variants

The SGM1430-B meter has a separate firmware module for the metrology processor and for the application processor.

A single metrology firmware build is used for the single-phase (SGM1411-B and SGM1412-B), five-terminal (SGM1415-B, SGM1416-B, and SGM1422-B), and polyphase (SGM1431-B, SGM1432-B, and SGM1433-B) meter variants.

The following table summarizes the firmware resident on the various meter models.

| Model     | Phase | Connect | Element | 100 amp | 2 amp |
|-----------|-------|---------|---------|---------|-------|
| SGM1411-B | 1     | Direct  | 1       | 1       | —     |
| SGM1412-B | 1     | Direct  | 1       | 1       | 1     |
| SGM1415-B | 1     | Direct  | 1       | 2       | —     |
| SGM1416-B | 1     | Direct  | 1       | 2       | 1     |
| SGM1422-B | 1     | Direct  | 2       | 2       | —     |
| SGM1431-B | 3     | Direct  | 3       | 3       | 0     |
| SGM1432-B | 3     | Direct  | 3       | 3       | 1     |
| SGM1433-B | 3     | Direct  | 3       | 3       | 2     |

## Firmware Components

All firmware source code is securely stored in a standard repository and subject to common practices of configuration management, version control, and release management.

All firmware is identified by version number. Firmware version numbers are defined in DLMS as an octet-string[7], or seven bytes. Release versions use three bytes as represented below:

[Major Version] . [Minor Revision] . [Build Number].

- Major Version indicates a significant update from the previous release.
- Minor Revision indicates a new sub-system or other minor release for integration.
- Build Number increments with each release to Aclara Product Validation on a given series.

The SGM1430-B meter is made up of the firmware components outlined below.

## **Metrology**

One area in the repository contains this firmware, isolated from the application code, and does not change after certification.

## **Bootloader**

The Bootloader firmware is integral to the application, but, like metrology, it does not change once it is released.

## **Application**

The meter firmware application can be upgraded via firmware over-the-air.

# **Firmware Specifications**

The SGM1430-B meters have two main processors: the metrology processor and the application processor.

The metrology processor provides the real-time clock and the measurement and calculation of energy values. The application processor provides functionality such as load profile and time-of-use, relay control, communications support, and Smart Energy Profile.

The meter performs both cyclic redundancy check (CRC) validation and cryptographic signature validation for the firmware running on the SGM1430-B. This ensures storage to the meter hardware and that the firmware is an authentic released image and has not been tampered with in transport.

The SGM1430-B meter provides customers with the majority of the above specified functionality, regardless of whether a communications module is installed or not. The core of this functionality resides on the metrology and application processors.

The meter maintains and verifies the checksum of data (such as billing data, load profile data, TOU data, event log data, etc.) stored in non-volatile memory. The meter also ensures continuous operation of firmware by means of a watchdog timer. The meter checks the proper operation of the measurement chip periodically and takes necessary action to recover from an error condition.

The meter maintains the checksum for calibration and configuration data and checks its integrity after power returns. During the manufacturing process, Aclara stores the resultant calibration data for each meter. For MID certification, calibrated meters were provided to the approved test house for accuracy and other tests as required.

# **Metrology Firmware and Data**

In accordance with the Guide for Measuring Instruments Directive 2004/22/EC and WELMEC 7.2, the core metrology firmware and data of the meter are explicitly isolated from the applications firmware to ensure that the metrology can in no way be updated or changed.

The meter is designed, constructed, tested, and certified as a European Union MID approved product. Test reports prepared for submission to, or received from, the relevant certifying bodies as part of the MID certification process will be made available to customers upon request.

The meters include the metrology suffix after the CE mark per the requirements listed in the MID.

## Firmware Release Notes Process

Firmware release notes will be provided to the customer. The release note details are generated from the Aclara software configuration management (SCM) system. All defects and enhancements are tracked and documented through the Aclara SCM system.

The customer release notes will include the following information:

- Description of all changes, listed by ID
- Compatibility information for firmware versions across the solution (e.g., electricity meter, gas meter, and in-home displays (IHDs)) including details on supported firmware upgrade paths
- Known issues and other relevant information

## Firmware Upgrade

The SGM1430-B meters support application firmware upgrades through the local communication port and through the AMI communication interface. The metrology firmware cannot be upgraded. The meter supports firmware upgrades via DLMS/COSEM and follows WELMEC guidelines.

All metering components that are capable of firmware upgrades will have the ability to do so remotely and independently of each other, activating a new image immediately or at a future date.

In the event of a failure to upgrade, the firmware will revert to the previous version automatically.

Following a firmware upgrade, the meter will:

- automatically restart without the need for a site visit,
- confirm the status to the headend system at configurable points throughout the process, and
- confirm correct operation to the headend system.

## Firmware Security

In order to maintain integrity and assurance of the firmware, Aclara cryptographically signs the firmware image with an Aclara-controlled private key as part of the Aclara release process and configuration management.

Prior to image activation, the system will perform a signature validation to ensure the firmware image to be activated has not been tampered with.

If the cryptographic signature fails to verify, the meter reverts to the last verified firmware (held in the actively running bank), and the new firmware will not be allowed to boot into the off-line bank.

After power returns to the meter, the bootloader, which is kept in immutable user boot flash space, will also perform a cryptographic signature check of the image. If it matches, the bootloader will continue to boot that image. If it fails, the bootloader will perform a cryptographic signature check of the off-line image in order to revert back to it.

The logical devices within the SGM1430-B meter will allow specific roles to upgrade specific network elements. For example, Electricity Meter Firmware Update Client may upgrade the E-Meter Firmware.

There are unique unicast encryption and authentication keys provided for each role of each logical device, including the Firmware Update Client, when connecting to each logical device within the meter. Each stakeholder for each logical device may independently and privately access the Firmware Upgrade client for their interested logical device. Each logical device is managed by its own master key. Master keys can encrypt new lower-level keys for each role securely and independently of the other logical devices.

## Power Outages

The SGM1430-B meter has a configurable timer (t1) which is programmed to distinguish the time between a long and normal power outage (the default value for a long power outage is three minutes or greater).

Upon re-energization of the meter, t1 will determine if the power outage period was greater than the value associated with a normal power outage. If it was, the meter will update the Power Failure Event Log with Event ID long power outage.

For a standard power outage, the Power Failure Event Log will be updated with Event ID.

The long power outage feature can be enabled and disabled through configuration. If disabled, the meter will only update the normal power outage event.

### Example 1

9:01:00 a.m. Power Down (477) Event

9:01:45 a.m. Power Up (478) Event (short off time)

The meter will update the Power Failure Event Log.

### Example 2

9:01:00 a.m. Power Down (477) Event

9:05:45 a.m. Power Up (478) Event (long off time)

The meter will update the Long Power Failure Event Log.





**CHAPTER****4**

## COMMUNICATIONS

The SGM1430-B meter has been designed to support the industry standard DCC Intimate Communications Hub Interface Specification (ICHIS), which defines the hardware interface for connectivity to CSP sourced communications hubs and the supply levels to provide power to any mating communications hub.

The meter also supports a home area network (HAN) that establishes ZigBee protocol connections between two devices, notably an in-home display (IHD) and the communications hub. The HAN is established on digital radios compliant with the IEEE802.15.4 standard.

The SGM1430-B establishes secure HAN links to the:

- CSP communications hub,
- in-home display, and
- prepayment meter interface device (PPMID).

The meter also supports a bi-directions IEC 62056-21 optical communications port which is used during manufacture and for warranty purposes. Please note, per NCSC requirements, the optical port is disabled for meters deployed in field installations.

Any communications from the headend system will require support of a CSP communications hub which will be intimately connected to the electricity meter.

Communications between the headend system and meter will be based on the UK GB companion specification supporting remote party messages.

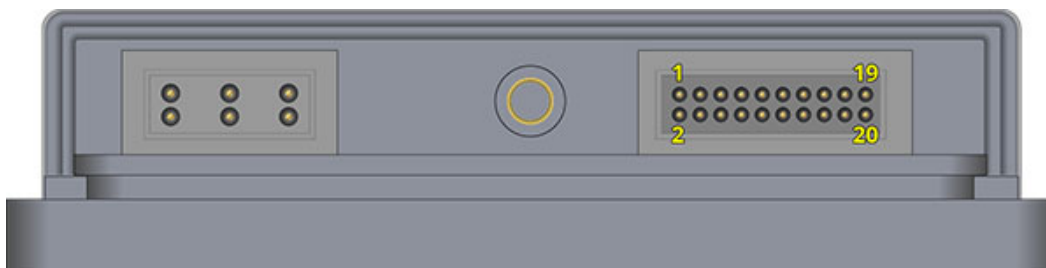
## Communication Interfaces

The following sections describe the available communication interfaces of the SGM1430-B meter.

### ICHIS Interface

The ICHIS interface includes a 20-pin connector and an optional AC mains connector.

## 20-Pin Connector



| Pin | Name               | Symbol | Input/<br>Output | Pull-up | Function                                |
|-----|--------------------|--------|------------------|---------|---|
| 1   | +12 V              | +12 V  | –                | –       | 12 V DC power supply rail               |
| 2   | +12 V              | +12 V  | –                | –       | 12 V DC power supply rail               |
| 3   | Common             | COM    | –                | –       | Common DC power supply rail             |
| 4   | Common             | COM    | –                | –       | Common DC power supply rail             |
| 5   | Device Present     | CH_PR  | Input            | Y       | Active low (communications hub present) |
| 6   | Host Present       | MT_PR  | Output           | Y       | Active low (host present)               |
| 7   | Transmit Data (Tx) | TX_MT  | Output           | Y       | Serial NRZ line code, logic 0 = high    |
| 8   | Receive Data (Rx)  | RX_MT  | Input            | Y       | Serial NRZ line code, logic 0 = high    |
| 9   | AC Lost            | AC LO  | Output           | Y       | Active high (No AC present)             |
| 10  | Reserved           | CSP_A  | NC               | N       | For use by CSP                          |
| 11  | Reserved           | CSP_B  | NC               | N       | For use by CSP                          |
| 12  | Reserved           | CSP_C  | NC               | N       | For use by CSP                          |
| 13  | Reserved           | RMM_B  | NC               | N       | For future use by ESME manufacturer     |
| 14  | Reserved           | RMM_C  | NC               | N       | For future use by ESME manufacturer     |
| 15  | Reserved           | RMM_D  | NC               | N       | For future use by ESME manufacturer     |
| 16  | Reserved           | RMM_E  | NC               | N       | For future use by ESME manufacturer     |
| 17  | Reserved           | RMM_F  | NC               | N       | For future use by ESME manufacturer     |
| 18  | Reserved           | CSP_D  | NC               | N       | For use by CSP                          |
| 19  | Reserved           | CSP_E  | NC               | N       | For use by CSP                          |
| 20  | Reserved           | CSP_F  | NC               | N       | For use by CSP                          |

## Optional AC Mains Connector



**L<sub>supply</sub>**

This connection provides line voltage (i.e., 230 V) directly from the un-metered, live supply connection terminal.

**N - N<sub>supply</sub>**

This connects directly to the neutral connection terminal.

**L<sub>load</sub>**

This connects directly to the live load main connection of the electricity meter for the use of PLC HAN when a site is disconnected.

Care should be taken when the meter is powered up and the communications module removed from the meter.

**NOTE** The AC pins are no longer populated on the SGM1430-B family of products. This is specifically attributed to meters that are deemed RF noise compliant against the latest version of ICHIS V2.1.

## Home Area Network (HAN)

The SGM1430-B meter provides HAN functionality for two-way secure communication to other peripheral products such as IHDs, PPMIDs, etc. The HAN supports the ZigBee 2.4 GHz RF interface and Smart Energy Profile. The HAN interface is located on board the SGM1430-B and communicates via the ZigBee communication protocol with the CSP communications hub.

## Manufacturing Client

The Manufacturing Client is used for reading and programming factory objects. Access with a password or authentication and/or encryption keys is required.

## Advanced Metering Infrastructure (AMI)

The SGM1430-B meters have an AMI communication interface containing two independent communication ports.

The SGM1430-B meters support a modular communications architecture that offers customers a choice of AMI communication modules. The meters have the capability to integrate with many different technologies.

The meters provide the means to configure selected errors, cautions, diagnostics, and events for reporting through the AMI interface.



**CHAPTER****5****METROLOGY FUNCTIONALITY**

The SGM1430-B meter supports an extensive feature set comprising metrology related functions, support of tariffs, load profile, power quality data, etc. The meter is similar to a complete energy meter (not just an electricity meter) when coupled with appropriate ZigBee communication devices for metering gas.

**Multipurpose Energy Metering**

The SGM1430-B meter supports the storage and operation of multiple energy types that are measured directly by the meter. Electrical observables are measured directly by the meter.

Preferred measurements can be selected to be defined and stored independently for each storage operation. These measurements include:

- demand calculations,
- time-of-use storage, and
- load profile storage.

**Instantaneous Measurements**

The SGM1430-B meter supports measurement of multiple electrical parameters. The following instantaneous measurements are available for each measuring element. These instantaneous data values are calculated and updated every momentary interval (approximately one second).

| Number | Instantaneous Measurement                  |
|--------|--|
| 1      | Total Active Power – kW                    |
| 2      | Import Active Power – kW                   |
| 3      | Export Active Power – kW                   |
| 4      | Total Import Reactive Power (Q1+Q2) – kVAr |
| 5      | Total Export Reactive Power (Q3+Q4) – kVAr |
| 6      | Reactive Power in Quadrant 1 (Q1) – kVAr   |
| 7      | Reactive Power in Quadrant 2 (Q2) – kVAr   |
| 8      | Reactive Power in Quadrant 3 (Q3) – kVAr   |
| 9      | Reactive Power in Quadrant 4 (Q4) – kVAr   |
| 10     | RMS Voltage                                |
| 11     | RMS Current                                |
| 12     | Frequency                                  |

| Number | Instantaneous Measurement |
|--------|---------------------------|
| 13     | Power Factor              |
| 14     | Phase Angle               |

## Frequency of Supply

The SGM1430-B meter supports measurement of the frequency of the main supply.

## Cumulative Registers

The SGM1430-B meter supports the following cumulative observables for each measuring element as well as total. The data is internally stored in milliunits.

| Number | Cumulative Register                          |
|--------|--|
| 1      | Total Active Energy – kWh                    |
| 2      | Import Active Energy – kWh                   |
| 3      | Export Active Energy – kWh                   |
| 4      | Total Reactive Energy – kVarh                |
| 5      | Total Import Reactive Energy (Q1+Q2) – kVarh |
| 6      | Total Export Reactive Energy (Q3+Q4) – kVarh |
| 7      | Reactive Energy in Quadrant 1 (Q1) – kVarh   |
| 8      | Reactive Energy in Quadrant 2 (Q2) – kVarh   |
| 9      | Reactive Energy in Quadrant 3 (Q3) – kVarh   |
| 10     | Reactive Energy in Quadrant 4 (Q4) – kVarh   |

## Power Quality Measurements

The SGM1430-B meters are capable of supporting power quality events and functionality including over/under voltage, sags or swells, over/under frequency, over current, and power factor. The meter may be configured to perform the following when the threshold parameters are met for over/under voltage, sags or swells, over/under frequency, and over current events:

- Update the event log
- Open the load switch
- Send an alert to the headend

For power factor events, the meter may be configured to update the event log or send an alert to the headend when the threshold parameters are met.

The configuration of these power quality events are described in more detail in the following sections.

## Over Frequency and Under Frequency

The SGM1430-B meters have configurable over frequency and under frequency thresholds and durations. The thresholds can be configured as follows:

- Over frequency threshold
- Duration (in seconds) that triggers an over frequency event/alarm
- Under frequency threshold
- Duration (in seconds) that triggers an under frequency event/alarm

The event log will record the time and date stamp for the start and end of the event and the total number of events.

## Over Current

The SGM1430-B meter has a configurable over current threshold and duration (in seconds) to activate the event. The event log will record the time and date stamp for the start and end of the event and the total number of events.

## Power Factor Threshold

The SGM1430-B meters have a configurable power factor threshold and duration (in seconds) to activate the event. The meter may be configured to update the event log or send an alert to the headend when the threshold parameters for a power factor event are met. The event log shall record the time and date stamp for the start and end of the event and the total number of events.

**NOTE** Power factor monitoring on polyphase installations is not recommended due to the significant number of alerts generated.

## Voltage Quality Measurements

The SGM1430-B meters may be configured to support Average RMS Over/Under Voltage, RMS Extreme Over/Under Voltage, RMS Voltage Sag, RMS Voltage Swell, and Supply Outage quality measurements.

### Average RMS Voltage for Phases 1, 2, and 3

The SGM1430-B polyphase meter has the ability to calculate the average RMS voltage for phases 1, 2, and 3 over a configurable period as defined in the Phase [n] Average RMS Voltage Measurement Period.

The values are calculated and stored at the end of the period in the Phase [n] Average RMS Voltage Profile Data Log.

### Over Voltage Threshold

Upon detecting that the value calculated for phase [n] is above the Phase [n] Average RMS Over Voltage Threshold, the meter will increment the Phase [n] Average RMS Overvoltage counter, update the Power Event Log, and send an alert via its HAN interface

Upon detecting that the value calculated for phase [n] is below the Phase [n] Average RMS Over Voltage Threshold and the value calculated in the prior configurable period was above the Phase [n] Average RMS Over Voltage

Threshold, the meter generates an event in the Power Event Log and also sends an alert via the HAN.

## **Under Voltage Threshold**

Upon detecting that the value calculated for phase [n] is below the Phase [n] Average RMS Under Voltage Threshold, the meter will increment the Phase [n] Average RMS Under Voltage Counter, update the Power Event Log, and send an alert via the HAN.

Upon detecting that the value calculated for phase [n] is above the Phase [n] Average RMS Over Voltage Threshold and the value calculated in the prior configurable period was above the Phase [n] Average RMS Under Voltage Threshold, the meter generates an event in the Power Event Log and also sends an alert via the HAN.

## **RMS Extreme Over Voltage**

If the RMS voltage for Phase [n] rises above the RMS Extreme Over Voltage Threshold for a duration longer than specified in the RMS Extreme Over Voltage Measurement Period, the meter will generate a corresponding entry in the Power Event Log and send an alert to the HAN interface.

If the RMS voltage returns to a value below the RMS Extreme Over Voltage Threshold longer than the configured measurement period, the meter will generate a corresponding entry in the Power Event Log and send an alert to the HAN interface.

## **RMS extreme Under Voltage**

If the RMS voltage for Phase [n] falls below the RMS Extreme Under Voltage Threshold for a duration longer than specified in the RMS Extreme Under Voltage Measurement Period, the meter will generate a corresponding log entry and send an alert to the HAN interface.

When the RMS voltage returns to a value above the RMS Extreme Under Voltage Threshold for a duration longer than the configured measurement period, the meter will generate a corresponding log entry and send an alert to the HAN interface.

## **RMS Voltage Sag**

If the RMS voltage for Phase [n] falls below the RMS Voltage Sag Threshold for a duration longer than specified in the RMS Voltage Sag Measurement Period, the meter will generate a corresponding entry in the Power Event Log and send an alert to the HAN Interface.

When the RMS voltage returns to a value above the RMS Voltage Sag Threshold for a duration longer than the configured measurement period, the meter will generate a corresponding log entry and send an alert to the HAN interface.

## **RMS Voltage Swell**

If the RMS voltage for Phase [n] rises above the RMS Voltage Swell Threshold for a duration longer than specified in the RMS Voltage Swell Measurement



Period, the meter will generate a corresponding entry and send an alert to the HAN interface.

When the RMS voltage returns to a value below the RMS Voltage Swell Threshold for a duration longer than the configured measurement period, the meter will generate a corresponding log entry and send an alert to the HAN interface.

## Supply Outage Reporting

The meter may be configured to record the date and UTC when the supply via Phase [n] is interrupted and when it is restored. Once configured, the meter will generate a corresponding entry in the Power Event Log. Once the supply has been restored, the meter will send an alert to the HAN interface that includes the date and UTC of both the interruption and restoration.

Following restoration of the supply via Phase [n], if the time difference between the supply being interrupted and then restored is greater than or equal to three minutes, an alert to that effect will be generated and sent via the HAN Interface containing details of the UTC date and time of interruption and restoration.

## Profiles

The SGM1430-B meter supports non-volatile recording of two profiles of a number of quantities (channels) at discrete time intervals (periods).

These two profiles are: load profile (profile 1) and voltage profile (profile 2). These profiles are usually defined by the quantity type captured in each profile: demand quantities for load profile (LP) and average voltage quantities for voltage profile.

### Load Profile

Load profile is traditionally configured to record a number of demand quantities (channels) at discrete time intervals (periods).

Four load profile channels are supported and are defaulted to the following:

- Import Active Energy
- Export Active Energy
- Import Reactive Energy
- Export Reactive Energy

These channels can be easily expanded (or contracted); however, the modification will be detrimental to the overall storage capacity.

When reconfiguring the channels, the energy supplier must retrieve all load profile data prior to the change, as changes will initiate a reset of the profiles.

### Interval Times

The following time intervals, as a minimum, are supported for both load and voltage profiles and are independent of each other:

- 60 minute
- 30 minute (default for standard load profile data)
- 15 minute
- 10 minute (default for voltage profile data)
- 5 minute
- 1 minute

## Interval Time Changes

In the event of a change of profile interval time, the energy supplier must retrieve all load profile data prior to the change, as changes will initiate a reset of the profiles.

This eliminates the possibility of the headend system reading across different profile periods, where the system assumes homogeneous buffer entries (all entries have the same size and structure).

## Data Storage

The SGM1430-B meter's data storage includes load profile, voltage profile, time-of-use, and block tariff metering.

### Load Profile

By default, the SGM1430-B meter can store a minimum of four channels of load profile demand data, at an interval of 30 minutes, for a period of 24 months.

The number of channels is reconfigurable. For example, the meter memory can store ten channels of load profile energy data, at an interval of 30 minutes, but only for a maximum period of 210 days (7 months).

### Voltage Profile

By default, the SGM1430-B meters can store a minimum of four channels of load profile demand data, at an interval of thirty 30 minutes, for a period of 3 months.

### Memory Overwrite

The meter will overwrite the oldest load profile data first in the event that all memory allocated to the profiles is consumed. It is the responsibility of the energy supplier to ensure that all data is retrieved punctually.

### Power Outages

Flags set in the status data of profile interval periods around power outages determine where power outages have occurred. The energy supplier will need to reconstruct the data based on these flags and time stamp data. No holes are left in the data where these outages have occurred.

## Time-of-Use (TOU)

The meters support multiple TOU registers. The minimum quantity of TOU registers are as follows:

- 48 rates (for Import Active Energy only), 8 elsewhere
- 6 day types per week
- 16 day profiles
- 5 week profiles
- 4 season profiles
- 50 special day profiles

## Block Tariffs

There are four block thresholds for each of the eight TOU rates, resulting in a 4x8 price matrix.

## Maximum Demand

The SGM1430-B meter provides four maximum demand (MD) registers. The meter also records the time and date stamp of the MD. The MD is recorded as the largest demand during the current billing period.

## Billing Data

The SGM1430-B supports daily, monthly and asynchronous billing. The daily and monthly billing is accessible via any of the communications ports present on the meter, and the data is overwritten based on the first in/first out method.

### Daily Billing Data

The SGM1430-B meter stores 31 daily billing data sets before overwriting occurs.

The snapshot will automatically occur on the crossover of the midnight boundary.

The daily billing data includes the following:

- Tariff TOU Register Matrix
- Tariff Block Counter Matrix
- Total Active Import Register
- Time and date stamp in the Daily Read Log
- Total Active Export Register

If the meter is in prepayment mode, the data below will be captured at the end of each billing period:

- Meter Balance

- Emergency Credit Balance
- Accumulated Debt Register
- TBC1 - 2 and PB Debt Payments:
  - Last Collection Time
  - Last Collection Amount
  - Total Amount Remaining
- Emergency Credit Status
- Disconnect Switch Status
  - Primary Element

Each daily data set includes a time and date stamp for when the snapshot occurred.

In the event of a power outage over the midnight boundary, the meter will perform the daily billing snapshot once power returns after the midnight boundary. The Daily Billing Snapshot feature can be enabled or disabled through configuration.

## Monthly Billing Data

The SGM1430-B meter stores 13 end-of-billing data sets before overwriting occurs.

The billing period is specified monthly. The end-of-month billing date can be specified as the last day of the month or a date specified for each month. In the case of a specified date, each month can be configured with a different date.

At the end of each billing period, the meter will store copies of the current cumulative/consumption registers into non-volatile memory.

The data includes the following:

- Tariff TOU Register Matrix
- Tariff Block Counter Matrix
- Total Active Import Register
- Total Active Export Register
- Cost of the Consumption

If the meter is in prepayment mode, the data below will be captured at the end of each billing period:

- Meter Balance
- Emergency Credit Balance
- Accumulated Debt Register
- TBC1 - 2 and PB Debt Payments:
  - Last Collection Time

- Last Collection Amount
- Total Amount Remaining
- Emergency Credit Status
- Disconnect Switch Status
- Primary Element

Each set of historical data contains a time and date stamp when the billing reset occurred.

The meter will record the source that activated the end of billing period, such as automatic end of month, forced billing reset from the headend system, etc.

## Asynchronous Billing

Asynchronous billings typically occur in the following situations:

- Automatic billing reset via pre-configured dates
- Ad-hoc on demand via headend system - This may update either of the sets.

These are managed by the predefined or programmable actions associated with change of tenancy/supplier or by direct execution of scripts from the headend system.

**NOTE** The invocation of billing scripts is not automatic within the meter and is subject to the correct configuration of the schedules and scripts.



**CHAPTER****6**

## ADVANCED FEATURES

This chapter provides information on the advanced features of the SGM1430-B, such as supply connection and disconnection, auxiliary load relay, clock, and event and error logging.

### Supply Disconnect and Reconnect

All SGM1430-B meters have supply disconnection and reconnection (SDR) functionality. This provides the means to disconnect the load-side terminals from the line-side terminals by actuating a contactor that is controlled by the meter. The contactor may be controlled directly by commands or through applications such as supply limiting and prepayment. The meter will generate an event log entry when the supply is manually disconnected.

The configuration parameters for the supply disconnect/reconnect meter relay are stored in non-volatile memory. All configuration options for the supply disconnect/reconnect relay can be configured locally via the optical port or remotely via the AMI interface. This section contains the firmware functional specifications related to the supply disconnect/reconnect functionality. The contactor and relay options are shown in the *Models* table on page 6.

### Supply Contactor Visual Status

The LCD segment will remain on when the supply disconnect/reconnect contactor is in the connected state, and it will remain off when the supply disconnect/reconnect contactor is in the disconnected state.

The LCD segment will flash with a 50% duty cycle during periods when the meter is armed. When the LCD segment is blinking, the contactor is physically in the open state until the reconnection is activated.

### Scheduled Disconnection/Reconnection

The SGM1430-B meters support disconnection and reconnection of all contactors and relays on a schedule. A common approach to schedule management applies to the supply disconnect/reconnect functionality and to the auxiliary load control functionality.

The SGM1430-B meters support a definition of a series of relay state change instructions for changing the state of any of the meter relays on a schedule.

### Automatic Disconnection/Reconnection

The SGM1430-B meters support multiple methods by which the supply relay can be automatically disconnected and subsequently reconnected.

## Load Limiting

The SGM1430-B meters support automatic disconnection of supply if the delivered power from the network to the customer exceeds a predefined average threshold over a predefined period of time.

When this functionality is enabled, the service will be disconnected for a defined period of time if the average consumption over the configured period of time exceeds the configured threshold.

## Under/Over Frequency

The SGM1430-B meters support disconnection of service if the supply frequency goes above an upper limit or below a lower limit.

When this functionality is enabled, the contactor will be disconnected for a defined period of time if the average frequency over a configured period of time exceeds either of the configured thresholds.

## Sag/Swell (Short Term)

The SGM1430-B meters support disconnection of service if the supply voltage goes above an upper limit or below a lower limit.

When this functionality is enabled, the contactor will be disconnected for a defined period of time if the average voltage over a configured period of time exceeds either of the configured thresholds.

## Under/Over Voltage (Long Term)

The SGM1430-B meters support disconnection of service if the supply voltage goes above an upper limit or below a lower limit for an extended period.

When this functionality is enabled, the contactor will be disconnected for a defined period of time if the average voltage over a configured period of time exceeds either of the configured thresholds.

## Over Current

The SGM1430-B meters support automatic disconnection of supply if the measured current exceeds a predefined average threshold over a predefined period of time.

When this functionality is enabled, the service will be disconnected for a defined period of time if the average current over the configured period of time exceeds the configured threshold.

## Power Factor

The SGM1430-B meters support automatic disconnection of supply if the calculated power factor goes below a predefined average threshold over a predefined period of time.

When this functionality is enabled, the service will be disconnected for a configured period of time if the average consumption over the configured period of time is less than the configured threshold.



## Tamper Detection

The SGM1430-B meter has the capability to open the load switch when detecting a tamper condition.

## Arming and Disarming

The SGM1430-B meters support a supply arming function to provide a safer means of reconnecting supply to a premise, especially when activating supply remotely. The meter can be armed or disarmed locally or remotely; however, supply will not be connected to the premise until the reconnection button is physically pressed on the meter. An end user can access the physical reconnection button without requiring an authorized technician.

When the meter is in the armed state, the LCD icon for the particular contactor will blink indicating that the contactor is open but armed. When the reconnection button is pressed on the meter, the main supply contactor will close for supply to be reconnected to the premise. The arming state can be canceled locally via the optical port or remotely via the AMI interface.

## Auxiliary Load Relay

The SGM1432-B and SGM1433-B meters contain a 2 A voltage-free contact relay to allow switching of an external contactor. The 2 A relay can be controlled remotely or scheduled to open or close at specific times of the day to control auxiliary loads such as water or under-floor heating. An LCD segment indicates if the 2 A relay is connected (see *Display* on page 10).

## Real-time Clock

All SGM1430-B meters have an internal clock mechanism to maintain the time and date. There are two time base options: line frequency based time and crystal oscillator based time.

**NOTE** Time accuracy will not be affected by high or low voltage operation, regardless of whether the time is being maintained by line frequency or crystal oscillator.

The crystal oscillator-based time mechanism is based on an internal 32.768 kHz crystal oscillator. The crystal oscillator is used to maintain the meter time when the supply voltage is not present or when the meter is configured to use oscillator-based time.

If the meter is configured to use the line frequency-based synchronization, the meter will switch to crystal-based time when the main supply is unavailable (i.e., the meter is powered down). The time keeping method will revert to line synchronization upon the supply being re-energized.

## Event Logging and Errors/Alarms

The SGM1430-B meters continually monitor for conditions that have been configured to be recorded upon occurrence. These events, errors, and alarms can

be read locally via the optical port and a supported handheld/laptop device. They can also be read remotely over the AMI system back to the headend or other allowable remote devices.

Events, errors, and alarms are comprised of a variety of different conditions, including the following:

- Serious error conditions (e.g., battery failure)
- Exceptional operational conditions (e.g., Power Up / Power Down)
- Normal configuration (e.g., clock time set)
- Normal billing events (e.g., asynchronous billing)
- Control of meter state (e.g., manual connection of SDR relay)
- Tamper conditions (e.g., meter cover removal)

Refer to *Event Codes* on page 87 for a complete list.

## Event Logs

As events are raised, they are filtered into a series of event logs based on the configuration of the meter. The SGM1430-B meter supports the following event logs:

| Log             | Description  |
|-----------------|--|
| Event Log       | This is used to log standard or general events.  |
| Security Log    | This log is specifically for events that may be evidence of attempts to commit fraud or theft by tampering with the meter. This includes removal of the meter cover, removal of the battery cover, use of an incorrect High Level Security Key, etc. |
| Power Event Log | This log deals with any event that has been triggered by the power quality functionality on the meter.   |
| ALCS Log        | This log records the status of the auxiliary load control switch and the device to which it relates.   |

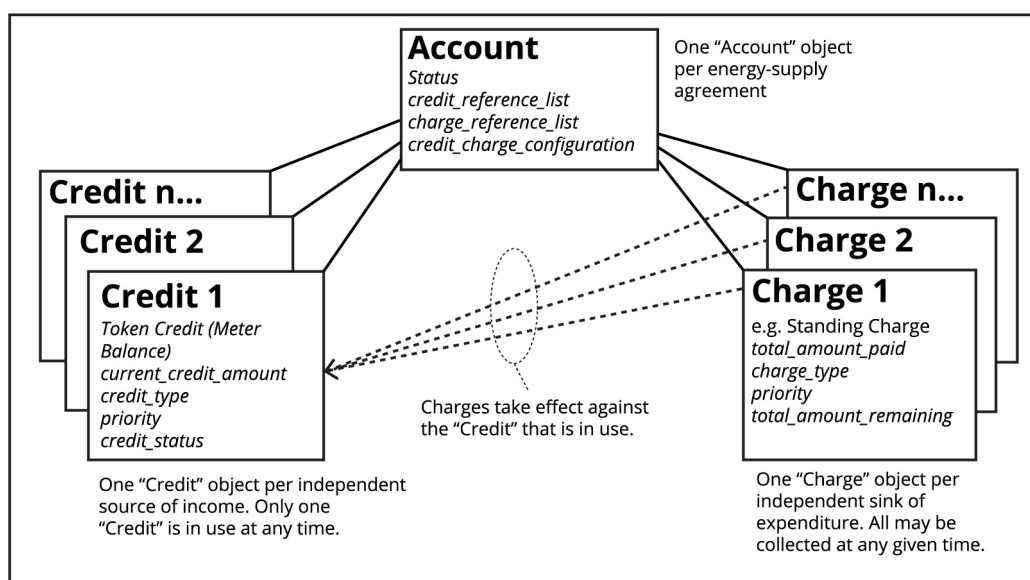
# Prepayment Solution

## Overview

The SGM1430-B meter family supports SMETS2 prepayment functionality in firmware version 7.6.0. SMETS2 prepayment adopts the account model as defined in the *DLMS Blue Book (12th Edition)*.

## Account Model

The account contains the summary information relating to the credits and charges that are pertinent to a given consumer.



The SGM1430-B meter family supports a single account for electricity import.

## Credit Object Types

A SGM1430-B meter account may include a combination of the following credit object types, depending on the payment mode of operation (Credit or Prepayment):

- **Token Credit Object (Meter Balance):** Credit object controlling the amount of credit either owed by the consumer (Credit mode; a negative amount) or credit which is transferred to the payment meter, normally in the form of UTRNs, or tokens, after deductions (Prepayment mode; a positive amount when in credit, a negative amount when owing monies).
- **Emergency Credit Object (EMC):** Credit object which is released when available and other types of credit are exhausted. The amount of emergency credit used is recovered from subsequently purchased credit tokens. A positive amount indicating the amount of emergency credit remaining. Emergency credit object is used in Prepayment mode only.
- **Accumulated Debt Object:** Credit object specifically for accumulating debt incurred when emergency credit is in use and suspension of debt collection is configured. This will always be a negative amount when accruing. Accumulated debt object is used in Prepayment mode only.

## Charge Object Types

The SGM1430-B meter account may include a combination of the following charge types:

- **Time-based Charge Object:** Describes charges collected regularly according to the passage of time, independent of consumption in that period. For example, standing charges and/or debt charges to be paid off over a period of time (e.g., daily).
- **Payment-based Charge Object:** Describes charges that are collected from every top-up (credit payment via UTRN) and put towards debts in

repayment. This is a percentage-based charge, where a set portion of the total amount of top-up credit received is taken to pay off that debt (i.e., with every payment, 20% of the payment is applied to the debt amount, thus reducing the amount of debt in this charge). Payment-based charge object is used in Prepayment mode only.

- **Consumption-based Charge Object:** Describes charges that are collected according to the amount of energy consumption which has occurred either in a time-of-use tariff (time-based tariff charge) or a block tariff (consumption-based tariff charge). A price per unit is assigned to each subdivision of the consumed energy register.

## Payment Modes

The SGM1430-B meter family can operate in one of the two following payment modes:

- Credit Mode
- Prepayment Mode

### Credit Mode

In Credit mode, the SGM1430-B meters utilize the credits and charges detailed below.

#### Credits

1. **Token Credit Object (Meter Balance)**
  - In Credit mode, meter balance represents the amount of monies the consumer owes.
  - Initially at zero (after a billing period reset or change from Prepayment mode), this amount goes negative internally as energy is consumed and charges are imposed. Outwardly, this is represented as a positive amount on the display.

#### Charges

1. **Consumption Charge Object**
  - A charge calculated and collected every second.
  - The charge is determined upon energy consumption within a given TOU period and its associated unit price.
  - Unit prices are configurable.
2. **Standing Charge Object**
  - A singular charge imposed periodically - daily by default.
  - This is a particular configuration of a time-based charge object (a continuous charge that does not terminate).
  - The charge amount is configurable.

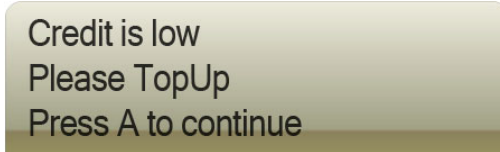
## Prepayment Mode

In Prepayment mode, the SGM1430-B meters utilize the credits and charges detailed below.

### Credits

#### 1. Token Credit Object (Meter Balance)

- In Prepayment mode, the meter balance represents the amount of credit the consumer either currently has available (positive amount) or currently owes (negative amount).
- Normally, when in credit, this amount will be positive and will reduce as energy is consumed and charges are imposed.
- The meter balance is exhausted when the amount falls below the Disablement Threshold, where the supply will be disconnected except under the following circumstances:
  - 1 Emergency credit is selected by the consumer.
  - 2 A non-disconnect (friendly disconnect) period is in force.
- A Low Credit Warning message will be displayed when the meter balance falls below the Low Credit Threshold, informing the consumer that they should top-up. The Low Credit Warning Threshold for meter balance is £2 by default, but it is configurable.

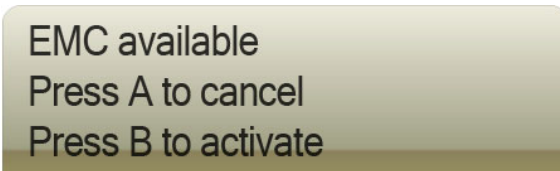


Credit is low  
Please TopUp  
Press A to continue

- When top-ups are applied, this credit (meter balance) will increase, but the amount will depend on any debts recovered first (i.e., any amount of emergency credit used, accumulated debt accrued, and payment-based debt, where configured).

#### 2. Emergency Credit Object

- The emergency credit (a configurable amount) is made available when the meter balance falls below the configurable Emergency Credit Threshold. The consumer may activate the emergency credit at that point OR at any time after that (via the Prepayment Menu or Prepayment Interface Device (PPMID), if available).



EMC available  
Press A to cancel  
Press B to activate

- When activated, the emergency credit becomes 'In-Use' immediately after the meter balance is exhausted.
- A Low Credit Warning message will be displayed to inform the consumer that they should top-up when the emergency credit runs low. The threshold used is the same as that configured for the meter balance.
- The emergency credit becomes exhausted when the value reaches zero. Thereafter, consumption and charges will recommence being levied off the

meter balance. If the value is, or falls, below the Disablement Threshold, the supply will be disconnected except under the circumstance that a non-disconnect (friendly disconnect) period is in force.

- When top-ups are applied, any emergency credit used will be taken from the payment. The remainder will be added to the meter balance, but the amount will depend on any debts recovered first (i.e., any accumulated debt accrued and payment-based debt, where configured).

### **3. Accumulated Debt Object**

- In this payment mode, the accumulated debt represents the amount of debt accrued (collection of standing charge and time-based debts, where configured) only when suspend debt emergency is configured. For example, debts are suspended from being collected from the emergency credit but accrued in the accumulated debt.
- Initially at zero, this amount goes negative internally as charges are imposed. Outwardly, this is represented as a positive amount on the display.
- When top-ups are applied, any accumulated debt accrued will be taken from the payment after any payment-based debt collection but before any is used to pay off any emergency credit used. The remainder will be added to the meter balance.

## **Charges**

### **1. Consumption Charge Object**

- A charge calculated and collected every second.
- The charge is determined upon energy consumption within a given TOU period and its associated unit price.
- Unit prices are configurable.

### **2. Standing Charge Object**

- A singular charge imposed periodically - daily by default.
- A particular configuration of a time-based charge object - a continuous charge that does not terminate.
- The charge amount is configurable.

### **3. Time-based Charge Object #1 - *optional***

- A singular charge imposed periodically.
- Debt recovery period is configurable.
- Charges collected for this debt will terminate once the debt has been paid off.
- Initial debt and debt recovery rate (amount collected each period) are configurable.
- The debt, debt recovery rate, and debt recovery period can be updated at any time.

### **4. Time-based Charge Object #2 - *optional***

- A singular charge imposed periodically.
- Debt recovery period is configurable.

- Charges collected for this debt will terminate once the debt has been paid off.
- Initial debt and debt recovery rate (amount collected each period) are configurable.
- The debt, debt recovery rate, and debt recovery period can be updated at any time.

#### 5. **Payment-based Charge Object - *optional***

- A charge imposed per top-up.
- A configurable percentage of the top-up.
- Charges collected for this debt will terminate once the debt has been paid off.
- Initial debt is configurable.
- The debt and top-up percentage recovery can be updated at any time.
- The absolute maximum payment provision (cap) imposed over a provision period is configurable. The provision period is also configurable - typically one week defined as Monday to Sunday.

For example:

- 1 The percentage of a payment is set to 10%.
- 2 Payment Max Provision (cap) is set to £5.
- 3 Provision Period is set to 1 week (typical).
- 4 The consumer makes £10 payments every day of the week.

Monday through Friday, £1 is taken off each payment towards the payment-based debt, totaling £5. Only £9, on these days, goes towards paying off:

- the consumer's accumulated debt,
- any meter balance less than the disablement threshold,
- any emergency credit used,
- and the remainder added to the meter balance.

On Saturday and Sunday, after the £5 cap is reached, no percentage of the payment is taken. The full £10 goes towards paying off:

- the consumer's accumulated debt,
- any meter balance less than the disablement threshold,
- any emergency credit used,
- and the remainder added to the meter balance.

## **Changing Payment Modes**

SGM1430-B meters with firmware 7.6.0 and later will be supplied with a default of Credit mode. Also, consumption charges (tariff prices) or standing charges will not be set up - they will contain zero charge values. The headend system must set up these charges as part of the initial installation and commissioning process.

Changing modes requires a sequence of commands that are governed by a request of the supplier.

During a change of mode, the previously configured tariff prices and standing charge will be maintained, but they can optionally be updated before or after the change of mode.

When prompted to change the payment mode, the electricity smart metering solution (ESME) records a snapshot (maximum of 12 entries that rollover on a first in, first out basis) of the following data that can be read by the headend system:

- Timestamp of Snapshot
- Active Import (A+) Energy Register
- Tariff TOU Register Matrix A+ [1 to 48]
- Block 1 Register Matrix [1 to 8]
- Block 2 Register Matrix [1 to 8]
- Block 3 Register Matrix [1 to 8]
- Block 4 Register Matrix [1 to 8]
- Emergency Credit Balance
- Meter Balance
- Payment-based Debt Register
- Time-based Debt Register 1
- Time-based Debt Register 2
- Accumulated Debt Register

## **Changing to Credit Mode**

The headend system will send one simple command to change the payment mode to Credit. Upon activation (determined by an activation date in the command), the following is actioned:

- Snapshot of billing data, as laid out above
- Reset of the meter balance
- Any debts are cleared
- The non-disablement calendar configuration is cleared
- Suspend debt configuration is cleared

## **Changing to Prepayment Mode**

The headend system will send the commands listed below to change the payment mode to Prepayment.

### **1. Update Prepayment Configuration**

This command configures the following for use in Prepayment mode:



- *Non-disablement Calendar* – Up to 5 day profiles.
- *Non-disablement Special Days* – Maximum of 20 specific dates where non-disablement is active all day (e.g., Xmas Day and Boxing Day).
- *Maximum Meter Balance* – A parameter to limit the maximum amount of credit allowed on the ESME; defined in milli-pence.
- *Maximum Credit Threshold* – A parameter to limit the applied credit to the ESME in a single top-up; defined in milli-pence.
- *Debt Recovery Cap* – Defined in whole currency (e.g., GBP).
- *Debt Recovery Cap period* – Defined in seconds, but set to a week.
- *Low Credit Threshold* – Applicable to meter balance and emergency credit balance; defined in milli-pence.
- *Emergency Credit Limit* – A parameter that determines the initial emergency credit available to the consumer when activated; defined in milli-pence.
- *Emergency Credit Threshold* – A parameter that determines when emergency credit becomes available; defined in milli-pence.
- *Activation date* – A parameter to determine when the above parameters can be activated.

This command can be used at any time to update the above parameters, even when already in Prepayment mode.

## 2. Switch to Prepayment Mode

This command switches the ESME to Prepayment mode, where the above parameters come into force and the following are configured:

- *Suspend Debt Disabled* – When configured, this will optionally suspend the collection of debts (standing charge and time-based debts) from being collected when the supply is disabled.
- *Suspend Debt Emergency* – When configured, this will optionally suspend the collection of debts (standing charge and time-based debts) from being collected off the emergency credit (when in use). This will accrue these debts in the accumulated debt register.
- *Disablement Threshold* – A parameter to determine when the supply will be disabled due to insufficient credit; defined in milli-pence.
- *Activation date* – A parameter to determine when the switch will be activated.

Upon activation (determined by an activation date in the command), the following is actioned:

- Snapshot of the billing data, as laid out above
- Reset of the meter balance
- Activation of emergency credit with amount (emergency credit limit) as set in the Update Prepayment Configuration command

## 3. Manage Debt on the ESME – optional

This command is optional and configures the debts and their collection parameters. This command can only be executed once the ESME is in

Prepayment mode, and it is used to update the imposed debts on the consumer as determined by the supplier.

This command can be used to update the following parameters:

- *Time-based Debt 1*
  - Debt recovery amount and scalar with respect to whole currency (e.g., GBP). For example, -2 implies pence.
  - Debt recovery period, defined in seconds.
  - Debt amount remaining (can add or subtract); defined in milli-pence.
- *Time-based Debt 2*
  - Debt recovery amount and scalar with respect to whole currency (e.g., GBP). For example, -2 implies pence.
  - Debt recovery period, defined in seconds.
  - Debt amount remaining (can add or subtract); defined in milli-pence.
- *Payment-based Debt*
  - Percentage of top-up (e.g., 10% – defined as 1000).
  - Debt amount remaining (can add or subtract); defined in milli-pence.

## Non-Disablement

In Prepayment mode, the ESME supports the non-disablement calendar. This calendar allows the supplier to define periods of the day and/or special days for non-disablement of the supply switch. If the credit were to become exhausted during these periods, the supply switch would not disconnect. It must be noted, however, that if the credit status still exists (i.e., exhausted) upon exit of a non-disablement period, the supply switch will disconnect. These periods are often termed 'friendly credit.'

### Display Indication

If the credit becomes exhausted while in the non-disablement period and would normally disconnect, an inverted 'ND' symbol will be shown on the display.



### Non-Disablement Calendar

The periods of non-disablement within the calendar are specified below.

#### Days

Up to five days can be individually configured to have non-disablement and disablement periods. One is specifically used to define a profile for special days (non-disablement all day), and the other four are used for the week profiles. Only two days which are configured to have non-disablement/disablement periods may be used each week.

## Weeks

Two week profiles are available, and each of these can be configured using two day profiles.

## Seasons

Three seasons can be configured as specified by date ranges, where each season can have two week profiles.

## Special Days - Holidays

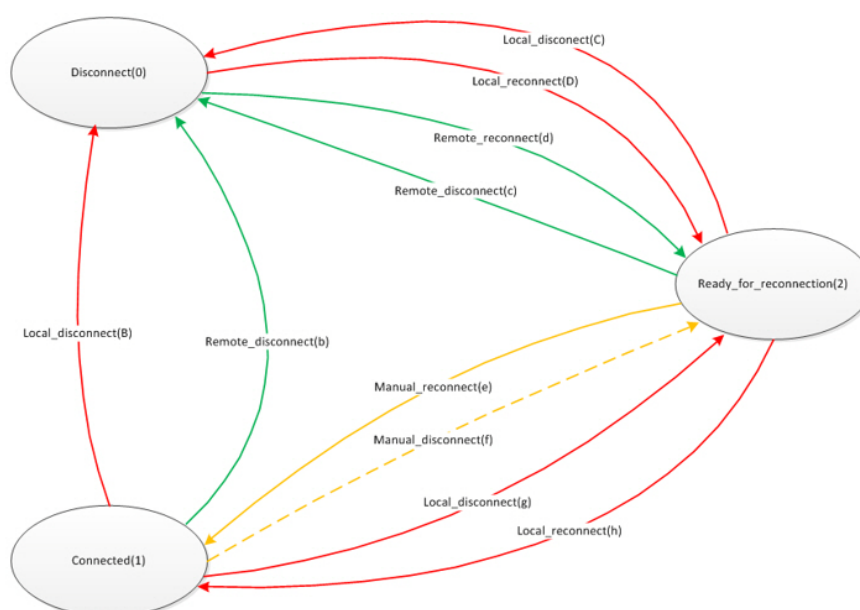
As well as the periods defined in the previous section, whole days can be specified as friendly credit holidays – special days. Up to 20 individual dates can be specified (e.g., Xmas Day and Boxing Day).

Special days override any period configuration specified by the days within the week.

## Disconnecter Control Mode

For the prepayment function to operate the disconnect switch effectively, the Disconnecter Control mode is defaulted to Mode 200.

This allows for internal disconnection (in the event of credit exhaustion) and re-arming where sufficient credit has been added to the meter to allow re-connection. The illustration below depicts Mode 200 state transitions.



## Top-Ups

Credit top-ups are applied to a consumer account using a unique transaction number (UTRN), sometimes referred to as a ‘token.’

## UTRN (Token) Overview

The UTRN is constructed from the 19-digit Prepayment Token Decimal (PPTD) appended with a further Check Digit, resulting in a 20-digit UTRN.

## Prepayment Token Decimal (PPTD)

The Prepayment Token Decimal (PPTD) is a 19-digit decimal integer.

The most significant two digits of the PPTD are between 73 and 96, this being the result of the addition of 7,394,156,990,786,306,048 (the K-Class 5 Offset) to the decimal representation of the binary Prepayment Top-up Token (PTUT) to distinguish it from other standard transfer specification (STS) defined tokens.

## Prepayment Top-up Token (PTUT)

In binary form, the PTUT is an unsigned 64-bit integer (8 octets), constructed as shown in the table below.

| PTUT Format - Bit Assignments     |   |       |  |
|-----------------------------------|---|-------|--|
| PTUT Component                    | Value   | Bits  | Note   |
| PTUT Lead                         | 0B00  | 63–61 | Fixed value  |
| PTUT Sub Class                    | 0B000   | 60–57 | Fixed value  |
| PTUT Truncated Originator Counter | Bits 41-32 of the Originator Counter  | 56–47 | Used for anti-replay purposes  |
| PTUT Value Class                  | <b>0B0</b> if PTUT Value is to be interpreted as multiples of 1/100 of currency unit<br>OR<br><b>0B1</b> if PTUT Value is to be interpreted as multiples of currency unit | 46–45 | If currency unit is set to GB pounds on the ESME or GSME:<br><b>0B0</b> means PTUT Value will be interpreted as GB pennies;<br><b>0B1</b> means PTUT Value will be interpreted as GB pounds. |
| PTUT Value                        | The quantum of the PTUT expressed as an unsigned binary number of 13 bits in length, so with leading binary zeros where required  | 44–32 | Thus, the maximum value is either:<br><b>£81.91</b> if PTUT Value Class = 0B0;<br>OR<br><b>£8,191.00</b> if PTUT Value Class = 0B1.  |
| PTUT Supplier MAC                 | See next slide  | 31–0  |  |

## Class 5 Token

This format does not overlap with the framework provided by the existing STS specification and indeed is a new domain of operation outside that of STS token classes 0, 1, 2, and 3.

| Token K Classes             |                            |                         |                                     |
|-----------------------------|----------------------------|-------------------------|-------------------------------------|
| Constant                    | Value - Decimal            | Value - Hex             | Purpose                             |
| K_Class 0_1_2_3_MIN         | 00 000 000 000 000 000 000 | 0x0 0000 0000 0000 0000 | MIN Class 0, 1, 2, 3 token value    |
| K_Class 0_1_2_3_MAX         | 73 786 976 294 838 206 463 | 0x3 FFFF FFFF FFFF FFFF | MAX Class 0, 1, 2, 3 token value    |
| K_Class_4_MIN               | 73 786 976 294 838 206 470 | 0x4 0000 0000 0000 0006 | MIN Class 4 token value             |
| K_Class_4_MAX               | 73 941 569 907 863 060 479 | 0x4 0225 3A12 6CE3 FFFF | MAX Class 4 token value             |
| K_Class 5_OFFSET (19 digit) | 7 394 156 990 786 306 048  | 0x669D 529B 714A 0000   | Constant to add on to Class 5 token |
| K_Class_5_MIN               | 73 941 569 907 863 060 480 | 0x4 0225 3A12 6CE4 0000 | MIN Class 5 token value             |

| Token K Classes |                            |                         |                         |
|-----------------|----------------------------|-------------------------|-------------------------|
| Constant        | Value - Decimal            | Value - Hex             | Purpose                 |
| K_Class_5_MAX   | 96 999 999 999 999 999 999 | 0x5 4225 3A12 6CE3 FFFF | MAX Class 5 token value |
| K_Class_6_MIN   | 97 000 000 000 000 000 000 | 0x5 4225 3A12 6CE4 0000 | MIN Class 6 token value |
| K_Class_6_MAX   | 99 999 999 999 999 999 999 | 0x5 6BC7 5E2D 630F FFFF | MAX Class 6 token value |

There are a number of departures from the currently specified IEC 62055-41 that are required for the Class 5 Token, which are mainly the ability to have an unencrypted token and secondly the ability to have a built-in MAC for token authentication.

### Consumer UTRN Token — 20-Digit Decimal

Under normal circumstances, the consumer will provide the ESME ID and purchase credit for their meter. A UTRN token is generated, and the request is sent to the ESME over the WAN communications to the communications hub and then on to the ESME over the HAN.

Should the WAN communications channel be off-line, the consumer must manually enter the UTRN token via the ESME UI or, if available, the PPMID UI.

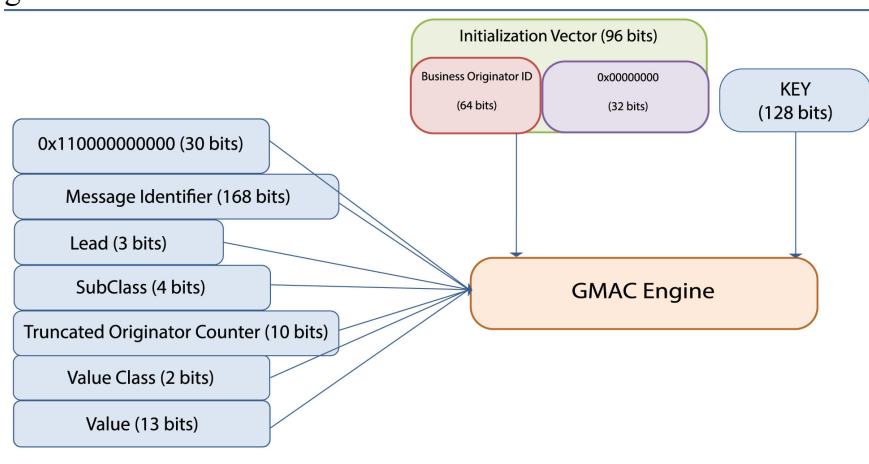
### Check Digit — 20th Digit

The Check Digit is used to verify the correct entry of the preceding 19-digit PPTD in instances where it is entered manually. This verifies accuracy of the entry, reducing human error.

The Check Digit adopts the Verhoeff algorithm. Erroneous entries detected by the Verhoeff algorithm aren't penalized as invalid entries - the lockout counter isn't incremented (see *UTRN Entry Lockout* on page 60).

### UTRN Token – MAC

The message authentication code (MAC) is GMAC based on a 128-bit symmetric key (prepayment key) that is derived each time a UTRN token is generated. The following diagram gives an overview of the data elements involved in that generation.



## Prepayment Key

The secret 128-bit prepayment key used in the MAC generation and UTRN validation is written to the ESME under the control of the headend system when the Update Security Credentials command is sent.

Upon a successful execution of this command, the ESME will reset its internal UTRN counter cache.

## UTRN Counter Cache

The ESME holds and maintains a UTRN counter cache to prevent 'replay' of previously processed UTRNs. The UTRN counter cache can hold 100 processed UTRNs (first in, first out order) and contains entries of the 32 most significant bits of the originator counter (64 bits) of successfully processed UTRNs.

The ESME checks that the UTRN counter is strictly numerically greater than the lowest numerical value in the UTRN counter cache and is not equal to any value in the UTRN counter cache. If the UTRN counter was **not** numerically greater than the lowest numerical value in the UTRN counter cache, it would be considered to be old. If the UTRN counter **was** equal to any value in the UTRN counter cache, it would be considered to be a duplicate.

The UTRN counter cache updates under the following conditions:

- UTRN is successfully processed by the ESME; as such, a new entry is added
- Reset upon Update of Security Credentials command

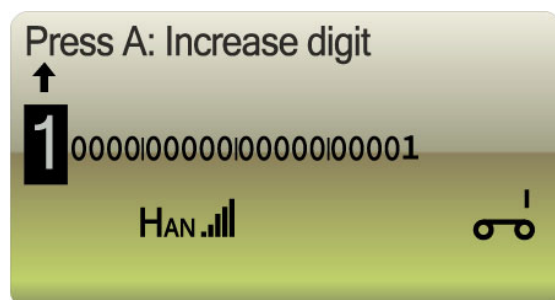
## UTRN - Manual Entry

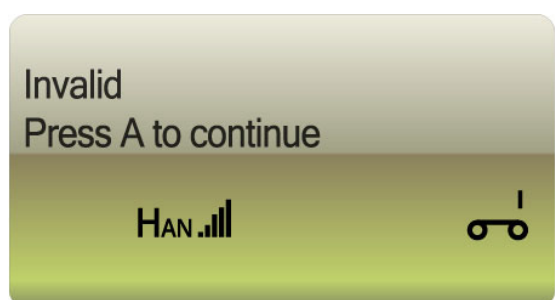
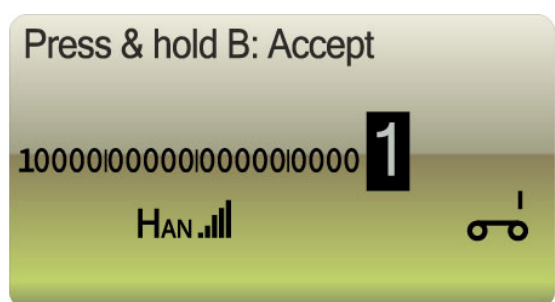
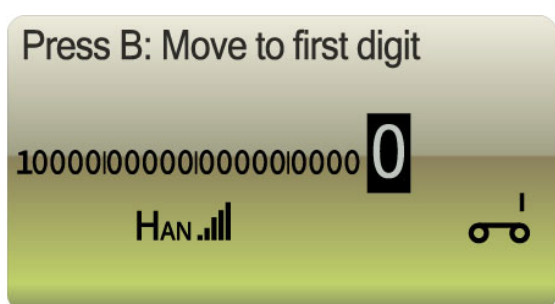
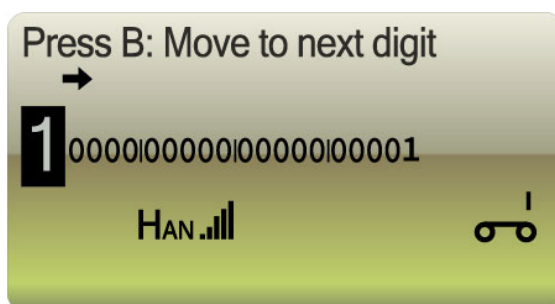
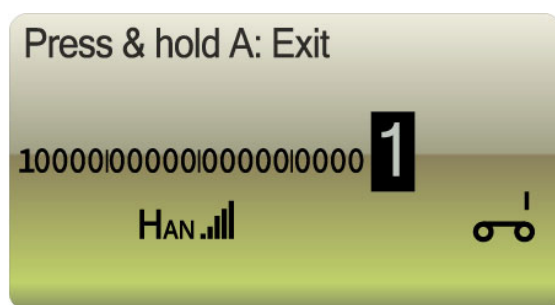
Manual entry of a UTRN can only be done via the Prepayment menu by pressing Button A until the **Enter Top-up Code** item is shown.

Press and hold Button A to enter the UTRN Top-up screen, where the following can be used to enter the top-up code:

| Enter UTRN Menu Options |  |
|-------------------------|--|
| Button                  | Action   |
| A Button Press          | Increases the value of the digit selected by the cursor by one |
| A Button Hold           | Exits the Enter UTRN display                                   |
| B Button Press          | Moves the cursor to the next digit                             |
| B Button Hold           | Accepts the current 20-digit UTRN for validation               |

See the images below for display examples.





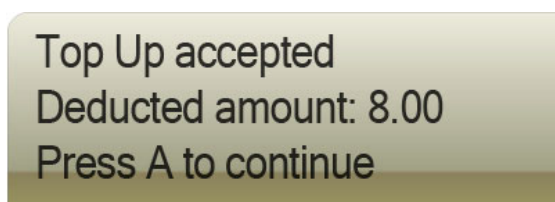
## UTRN Entry Responses

Every entry of a UTRN token will generate a response, whether accepted or rejected, which in turn is logged within the ESME. These responses will either be alerts or events; see *Prepayment Events and Alerts* on page 61. Successful UTRNs and their top-up amounts are logged in the following billing logs:

- **Payment-based Debt Payments** (log of what payment has been made towards the payment-based debt)
- **Prepayment Credits** (log of what credit has been accepted – full top-up amount)

### UTRN Entry Accepted

When the ESME successfully processes a UTRN (top-up), a message will appear on the ESME display to indicate that a top-up was accepted. This message will also indicate how much has been deducted.



### UTRN Entry Lockout

The ESME supports a UTRN lockout feature where certain responses to UTRN entries will be regarded as fraudulent/invalid attempts to enter a UTRN and will be penalized by a count towards a potential lockout.

The rules for the lockout feature are detailed in the following table.

| UTRN Token Lockout Conditions |   |               |
|-------------------------------|---|---------------|
| Lockout Counter               | Reason  | Lockout State |
| Increments, but still < 10    | Invalid UTRN entry received.  | OFF           |
| Resets (= 0)                  | Lockout State is OFF and a valid UTRN entry is received<br>OR top-of-the-hour is crossed. | OFF           |
| = 10                          | Ten consecutive invalid UTRN entries are received within the current clock hour.          | ON            |
| Resets (= 0)                  | Lockout State is ON and top-of-the-hour is crossed.                                       | OFF           |

When a lockout state is ON, no further UTRN entries are allowed. Any such entries will be rejected until the next top-of-the-hour is crossed.

## Maximum Meter Balance

The maximum meter balance is the absolute maximum amount of credit that is allowed to be credited to the meter balance.

If a top-up via a UTRN takes the credit above this threshold, the UTRN token will be rejected, but the consumer will be able to apply that UTRN again when the meter balance has sufficiently dropped to allow that top-up.



## Maximum Credit Threshold

The maximum credit threshold is the absolute maximum amount of credit from a single transaction that is allowed to be added to the meter.

If a top-up via a UTRN exceeds this vend amount, an invalid response will be generated, and the UTRN token will be rejected.

## Debt to Clear

The ESME will display the minimum amount of monies required to clear the current debt to achieve the following two goals:

1. Allow the consumer to get back on supply if previously disconnected
2. Allow the consumer to have EMC available again if previously used

**NOTE** Consumers can ‘live’ in EMC.

The determination of the debt to clear is as follows:

Debt to Clear = ((Disablement Threshold – Meter Balance) + EMC Used + |Accumulated Debt|) \* 100/(100%)

**NOTE** % is the payment recovery off a top-up.

However, the amount of payment recovery is also limited by the following (whichever is the smallest):

- Amount of payment debt remaining
- Weekly cap amount remaining

## Order of Recovery of Debts

When a top-up is applied, any outstanding debts are recovered prior to adding any remaining monies to the meter balance.

The order of debt recovery has the following priority (highest first):

1. Payment-based charge (if applicable),
2. Accumulated debt,
3. Payback of any negative meter balance up to the disablement threshold,
4. Emergency credit used,
5. and any remaining credit is added to the meter balance.

## Prepayment Events and Alerts

Below is a list of events and alerts pertinent to the prepayment function of the ESME.

$MB \geq$  Meter Balance,  $EMB \geq$  Emergency Credit Balance. UTRN-related events and alerts are highlighted.

| Prepayment Events and Alerts |  |   |            |                         |                    |
|------------------------------|--|---|------------|-------------------------|--------------------|
| ID (hex)                     | Description  | When Triggered                                | Alert Sent | HAN Device Notification | Logged             |
| 810D                         | Combined Credit below Low Credit Threshold                                 | $MB + EMB <$ Threshold                        | Yes        | Yes                     | No                 |
| 810E                         | Credit added locally   | UTRN entered via UI                           | Yes        | No                      | No                 |
| 8119                         | Emergency Credit has become available                                      | $MB <$ EMC Threshold                          | Yes        | Yes                     | No                 |
| 8168                         | Supply Disabled then Armed – Activate Emergency Credit triggered           | EMC Activated after Supply is Disabled        | Yes        | Yes                     | No                 |
| 81A7                         | Debt Collection Completed – Time Debt 1                                    | Time Debt 1 is Paid Off                       | Yes        | No                      | Yes – Event Log    |
| 81A8                         | Debt Collection Completed – Time Debt 2                                    | Time Debt 2 is Paid Off                       | Yes        | No                      | Yes – Event Log    |
| 81A9                         | Debt Collection Completed – Payment Debt                                   | Payment Debt is Paid Off                      | Yes        | No                      | Yes – Event Log    |
| 81AA                         | Emergency Credit Exhausted   | EMC is Used Up                                | Yes        | Yes                     | Yes – Event Log    |
| 81AB                         | Emergency Credit Activated   | Activation of EMC                             | Yes        | Yes                     | Yes – Event Log    |
| 81C4                         | UTRN Manual Entry Suspended  | 10 Invalid UTRN entries within Current Hour   | Yes        | Yes                     | Yes – Event Log    |
| 81C5                         | UTRN Rejected as Locked Out  | After Suspension until next top-of-hour       | Yes        | No                      | Yes – Event Log    |
| 8F0F                         | Combined Credit Below Disablement Threshold                                | $MB + EMB <$ Threshold                        | Yes        | No                      | No                 |
| 8F47                         | Credit would cause Meter Balance to exceed Maximum Meter Balance Threshold | Top-up would result in $MB >$ MB Threshold    | No         | No                      | Yes – Security Log |
| 8F51                         | Duplicate UTRN Entered   | Previously used UTRN Entered                  | No         | No                      | Yes – Security Log |
| 8F5B                         | UTRN exceeds Maximum Credit Threshold                                      | Top-up is $>$ Max Credit Threshold            | No         | No                      | Yes – Security Log |
| 8F63                         | UTRN not Authentic   | Invalid UTRN (e.g., MAC incorrect)            | No         | No                      | Yes – Security Log |
| 8F64                         | UTRN not for this Device   | Invalid UTRN (e.g., wrong Business Target ID) | No         | No                      | Yes – Security Log |

| Prepayment Events and Alerts |   |  |            |                         |                    |
|------------------------------|---|--|------------|-------------------------|--------------------|
| ID (hex)                     | Description   | When Triggered   | Alert Sent | HAN Device Notification | Logged             |
| 8F32                         | Supply Armed  | Credit is now > Disablement Threshold or ECS44             | Yes        | Yes                     | No                 |
| 8F70                         | Update Security Credentials   | Update Security Credentials command Successfully Processed | Yes        | No                      | Yes – Security Log |
| 8F83                         | Disablement of Supply due to Insufficient Credit – has been Suspended | Credit Exhausted while in ND Period                        | Yes        | No                      | No                 |

## Prepayment Logs

The following logs are recorded in the ESME and available for the headend system to retrieve:

### 1. Prepayment Daily Read Log

- Data:
  - Timestamp of when log recorded
  - Emergency Credit Balance
  - Meter Balance
  - Payment Debt Register – amount remaining
  - Time-based Debt Registers 1 and 2 – amounts remaining
  - Accumulated Debt Register
- Recorded daily at the end of each day
- Depth = 31

### 2. Billing Data – Change of Mode Triggered

- Data:
  - Timestamp of snapshot
  - Active Import (A+) Energy Register
  - Tariff TOU Register Matrix A+ [1 to 48]
  - Block 1 Register Matrix [1 to 8]
  - Block 2 Register Matrix [1 to 8]
  - Block 3 Register Matrix [1 to 8]
  - Block 4 Register Matrix [1 to 8]
  - Emergency Credit Balance
  - Meter Balance
  - Payment-based Debt Register
  - Time-based Debt Register 1

- Time-based Debt Register 2
- Accumulated Debt Register
- Recorded upon change of mode
- Depth = 12

### 3. Billing Data – Debt Payments

- Data:
  - Timestamp of snapshot
  - Payment made towards debt recovery
- Recorded upon every successful payment (processing of UTRN) where some debt has been repaid
- Depth = 10





### 4. Billing Data - Prepayment Credits





- Data:
  - Timestamp of snapshot
  - Credit Amount (before deductions)
- Recorded upon every successful payment (processing of UTRN)
- Depth = 5

## Prepayment Menu – Display

In Prepayment mode, the ESME displays a Prepayment menu. This menu allows the consumer to access various prepayment-related quantities such as meter balance, emergency credit balance, etc.

Pressing Button B will cycle the display through the various menus, but an additional menu is available in Prepayment mode, as highlighted in the table below.

| Sequencing  | Configurable         | Comments                        |
|---|----------------------|---------------------------------|
| Prepayment Menu (Alt3)  | Yes – up to 50 items | Only visible in Prepayment mode |
|  |                      |                                 |
| Primary Menu  | Yes – up to 50 items | Always visible                  |
|  |                      |                                 |
| Alt1 Menu   | Yes – up to 50 items | Visible when > 0 entries        |
|  |                      |                                 |
| Alt2 Menu   | Yes – up to 50 items | Visible when > 0 entries        |
|  |                      |                                 |
| Engineering Menu  | Yes – up to 50 items | Always visible                  |

| Sequencing  | Configurable                      | Comments                 |
|---|-----------------------------------|--------------------------|
|  |                                   |                          |
| Alt4 Menu   | Yes – up to 50 items              | Visible when > 0 entries |
|  |                                   |                          |
| Signal Strength   | No (signal strength of HAN (dBm)) | Always visible           |
|  |                                   |                          |
| Active TOU  | No (currently active TOU rate)    | Always visible           |
|  |                                   |                          |
| Privacy PIN Menu  | No (controls PIN access)          | Always visible           |

Once in the Prepayment menu, pressing Button A will give the consumer access to the supplier-defined (as defined in the customer configuration card) list under the Prepayment menu. The supplier can define and reorder the list items outlined below during meter configuration (when thresholds, profiles, events and alarms, etc. are programmed).

| Typical Prepayment Menu Structure |                          |
|-----------------------------------|--------------------------|
| ID                                | Item                     |
| 0                                 | Meter Balance            |
| 1                                 | Emergency Credit Balance |
| 2                                 | Emergency Credit Status  |
| 3                                 | Last Five Credits        |
| 4                                 | Accumulated Debt         |
| 5                                 | Prepayment-based Debt    |
| 6                                 | Time-based Debt          |
| 7                                 | Available Credit         |
| 8                                 | Debt to Clear            |
| 9                                 | Aggregated Debt          |
| 10                                | Enter UTRN               |
| 11                                | Audible Alert Settings   |

## Mandatory Prepayment Menu Items

Although the Prepayment Item List may be customised by the supplier, the following line items cannot be removed from the list for functionality purposes:

- Emergency Credit Status – to allow for Emergency Credit activation
- Enter UTRN – to allow for manual entry of a UTRN

## Prepayment Menu – Item Structure and Access

The table below outlines the features and navigation of the Prepayment menu.

| Prepayment Menu Operations                  |  |  |   |
|---|--|--|---|
| Item  | Upon Selecting   | Press Button A   | Press Button B  |
| <b>Meter Balance</b>                        | Balance Value  | Next Prepayment Item   | Exits Prepayment Menu   |
| <b>Emergency Credit Balance</b>             | Emergency Credit Balance<br>Remaining Balance (In-use<br>or Selected), 0 if not<br>available | Next Prepayment Item   | Exits Prepayment Menu   |
| <b>Emergency Credit Status</b>              | Emergency Credit: In-use<br>Remaining Balance  | Next Prepayment Item   | Exits Prepayment Menu   |
|   | Emergency Credit: Invoked<br>Remaining Balance   | Next Prepayment Item   | Exits Prepayment Menu   |
|   | EMC Available<br>Press A to cancel<br>Press B to activate                                    | Rejects Emergency Credit<br>– returns to Next<br>Prepayment Item | Emergency Credit is<br>Successfully Selected<br><i>Activated</i>  |
|   | Emergency Credit is<br>Exhausted   | Next Prepayment Item   | Exits Prepayment Menu   |
|   | Emergency Credit is not<br>Available   | Next Prepayment Item   | Exits Prepayment Menu   |
| <b>Last Five Credits</b>                    | Press A and hold to Enter  | HOLD A – Enters Credit<br>History                                | Exits Prepayment Menu   |
| <b>Last Five Credits –<br/>once entered</b> | <i>Credit 1 Amount</i>   | <i>Exits Last Five Credits</i>                                   | <i>Repeated presses cycle<br/>around the following<br/>(x = 1 to 5):</i> <ul style="list-style-type: none"> <li>• <i>Credit x Amount</i></li> <li>• <i>Credit x Date</i></li> <li>• <i>Credit x Time</i></li> <li>• <i>Credit x UTRN</i></li> </ul>         |
| <b>Accumulated Debt</b>                     | Accumulated Debt Amount  | Next Prepayment Item   | Exits Prepayment Menu   |
| <b>Prepayment-based Debt</b>                | Press A and hold to Enter  | HOLD A – Enters<br>Payment Debt                                  | Exits Prepayment Menu   |
| <b>Prepayment-based Debt – once entered</b> | <i>Payment-based Debt –<br/>Amount Remaining</i>   | <i>Exits Payment Debt</i>  | <i>Repeated presses cycle<br/>around the following:</i> <ul style="list-style-type: none"> <li>• <i>Payment-based Debt<br/>– Amount Remaining</i></li> <li>• <i>Payment-based<br/>Percent</i></li> </ul>  |
| <b>Time-based Debt</b>                      | Press A and hold to Enter  | HOLD A – Enters<br>Time-based Debt                               | Exits Prepayment Menu   |
| <b>Time-based Debt –<br/>once entered</b>   | <i>Time-based Debt 1 –<br/>Amount Remaining</i>  | <i>Exits Time-based Debt</i>                                     | <i>Repeated presses cycle<br/>around the following<br/>(x = 1 to 2):</i> <ul style="list-style-type: none"> <li>• <i>Time-based Debt x –<br/>Amount Remaining</i></li> <li>• <i>Recovery Rate x</i></li> <li>• <i>Collection<br/>Frequency x</i></li> </ul> |

| Prepayment Menu Operations                                  |   |  |  |
|---|---|--|--|
| Item  | Upon Selecting  | Press Button A   | Press Button B   |
| <b>Available Credit</b>                                     | Available Credit on Meter:<br>Meter Balance + Emergency<br>Credit Balance (if activated)                                      | Next Prepayment Item                                     | Exits Prepayment Menu                                      |
| <b>Debt to Clear</b>  | The Minimum Amount to<br>pay to Clear the Debt<br>accrued on the ESME -<br>Exclusive of Time-based<br>and Payment-based Debts | Next Prepayment Item                                     | Exits Prepayment Menu                                      |
| <b>Aggregated Debt</b>                                      | Sum of Debts Remaining<br>(Time-based and<br>Payment-based)   | Next Prepayment Item                                     | Exits Prepayment Menu                                      |
| <b>Enter UTRN</b>   | Press A and hold to Enter   | See <i>UTRN - Manual<br/>Entry</i> on page 58.           | Exits Prepayment Menu                                      |
| <b>Audible Alert<br/>Settings</b>                           | Press A and hold to Enter   | HOLD A – Enters<br>Audible Alert Options                 | Exits Prepayment Menu                                      |
| <b><i>Audible Alert<br/>Settings – once<br/>entered</i></b> | <i>Press A: Mute Alerts<br/>Press B: Unmute Alerts</i>  | <i>Mutes Alerts and Exits<br/>Audible Alert Settings</i> | <i>Unmutes Alerts and Exits<br/>Audible Alert Settings</i> |





**CHAPTER****7****INSTALLATION**

The following sections provide basic information for installing a SGM1430-B meter by a qualified individual.

**Terminal Connections**

The following sections describe and illustrate the terminal connections of each meter in the SGM1430-B meter family.

**Terminal Block**

The SGM1430-B meters have several terminal block configurations. The terminal block can be accessed by removing the terminal cover. Meter terminal configurations are shown in the *Models* table on page 6.

**Terminal Arrangements**

The SGM1430-B polyphase meters conform to British Standard Institute (BS 7856:2017). Please refer to the images in the *Terminal Arrangements* section on page 7 for more information.

**SGM1431-B Terminals**

The SGM1431-B meter has six line and two neutral terminals. The terminals align horizontally when viewing the meter terminal block at the bottom of the meter.

**SGM1432-B Terminals**

The SGM1432-B meter has six line terminals, two neutral terminals, and two auxiliary relay terminals (1 x 2 A relay). The 2 A relay terminals are located on the right side of the meter above the main terminals.

**SGM1433-B Terminals**

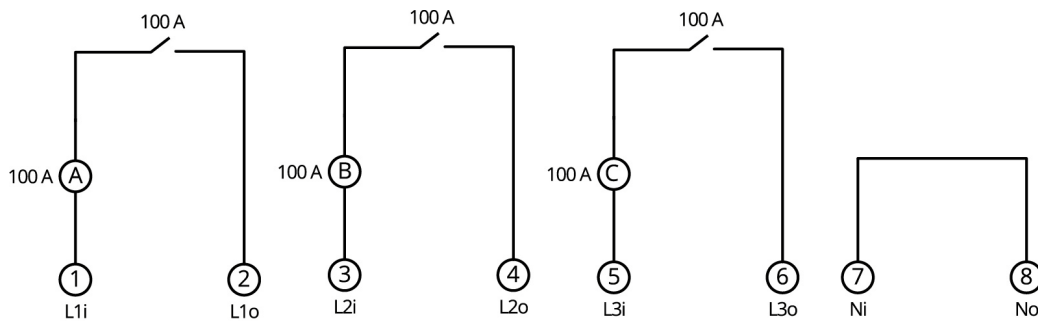
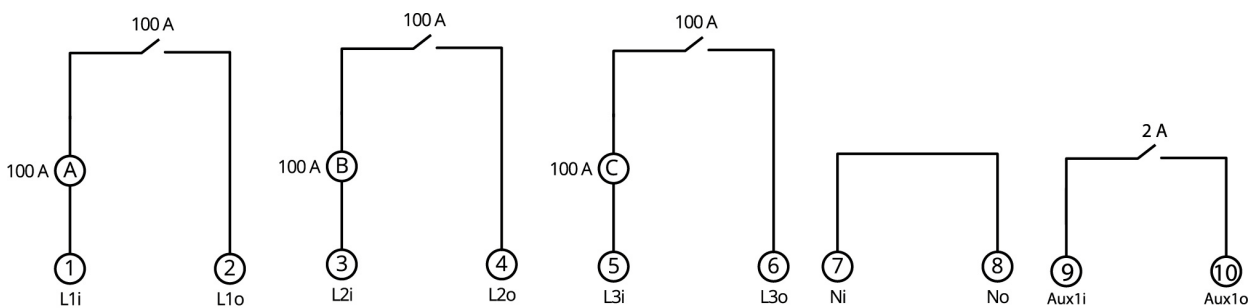
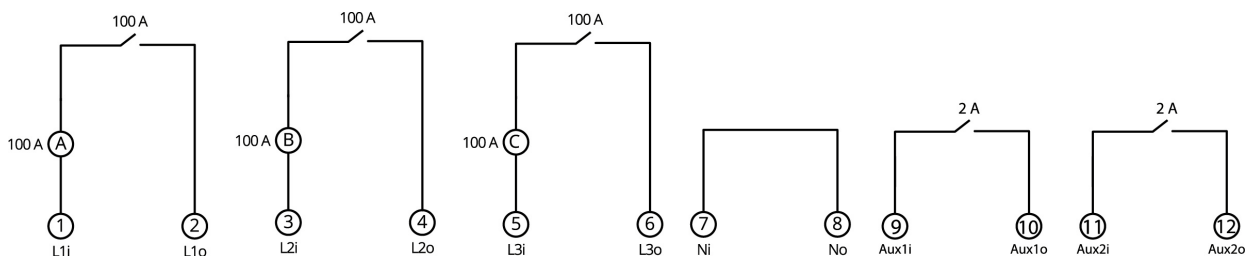
The SGM1433-B meter has six line terminals, two neutral terminals, and four auxiliary relay terminals (2 x 2 A relays). The 2 A relay terminals are located on the right side of the meter above the main terminals.

**Installation Procedures****UK Installation**

To install the SGM1430-B meters, make sure that the following minimum installation steps are performed:

1. Perform specific safety and work area analysis.

2. Take the last meter read on the existing meter and de-energize all live meter circuits.
3. Remove the old meter for recycling.
4. Assess wall or panel space available for the SGM1430-B meter.
5. Prepare all incoming wire cables for connection to the meter. Take care to specifically identify neutral conductors and check the integrity of conductors.
6. Take the following steps to install the SGM1430-B meter.
  - Position and affix the meter to the space identified. It is recommended that you use hard plastic screws to avoid the accidental exposure of a live screw head.
  - Connect wiring to meter terminals as specified below. The torque value is 2.5-3.5 Nm.

**SGM1431-B****SGM1432-B****SGM1433-B**

- Attach the terminal cover to the meter and attach seal. The torque value is 0.6-0.9 Nm.

**NOTE** Do not over-tighten the screw.

7. Remove the communications blanking plate and fix the CSP supplied communications module to the meter communications interface.
8. Ensure all sealing screws and meter equipment is sealed.
9. Upon completing both the installation of the meter and the completion of safety checks, re-energize the supply circuits.

## Installation Screwdrivers

To install the SGM1430-B meters, consideration must be given to the type of screw that was defined as part of the meter configuration for manufacturing.

Aclara offers support for the following types of screws:

- Phillips cross-recessed combination type metal screw



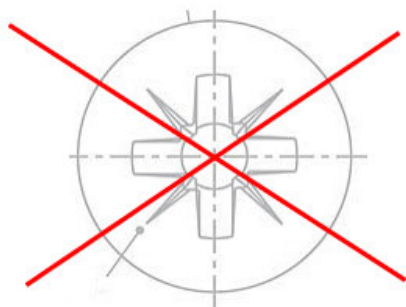
- Slotted head type metal screw



Due to the nature of those screws, installers must use the correct screwdriver in order to generate sufficient torque and not cause damage to the head of the screws. PH2 screwdrivers are recommended for use with the combination screws. Slotted head screwdrivers are also adequate for this purpose, but it is important to use the correct size during installation. Only the following blade widths are recommended:

- (7.0 mm)
- (5.5 mm)
- (4.0 mm)

PZ2 screwdrivers are **not** recommended for this purpose because damage is likely to be caused to the screw head.



## Backup Power Supply

The SGM1430-B meters have an internal backup power battery that is not replaceable in the field. It is designed for a 20-year lifetime.

## Mounting Template

The SGM1430-B meters support a three-screw mounting arrangement that is typically used on IEC energy meters. The meter meets all dimensional requirements of BS 7856:2013.

The meter mounting holes support screws with a thread diameter of up to 5.2 mm, and the two lower mounting holes are oval shaped to allow for some flexibility when mounting to an existing installation.

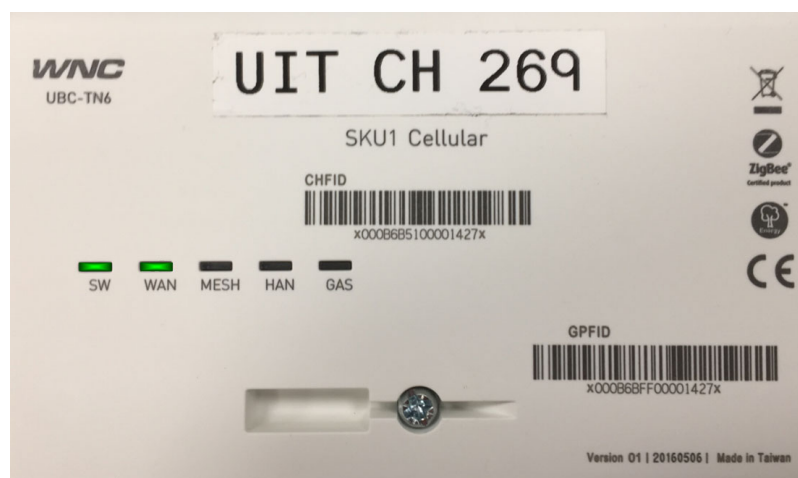
The top mounting hole is not accessible when the meter is mounted. The lower two mounting holes are located beneath and sealed by the terminal cover.

## Connect SGM1430-B to the CSP Communications Hub

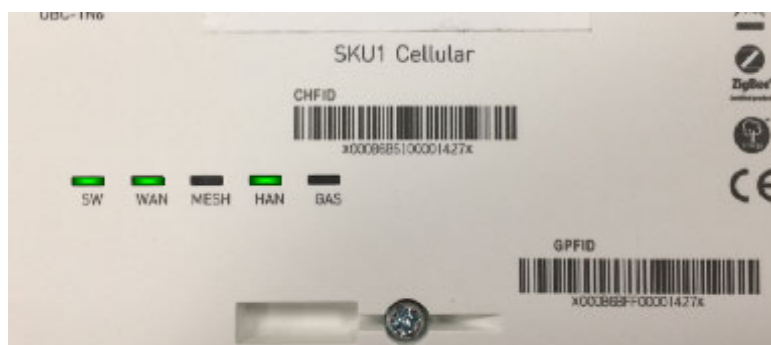
Use the following procedure to pair the SGM1430-B ZigBee communication protocol radio with the CSP-supplied communication hub.

1. Remove the communications cover plate and physically connect the communications hub CH to the SGM1430-B electricity meter.
2. Power up the SGM1430-B electricity meter.

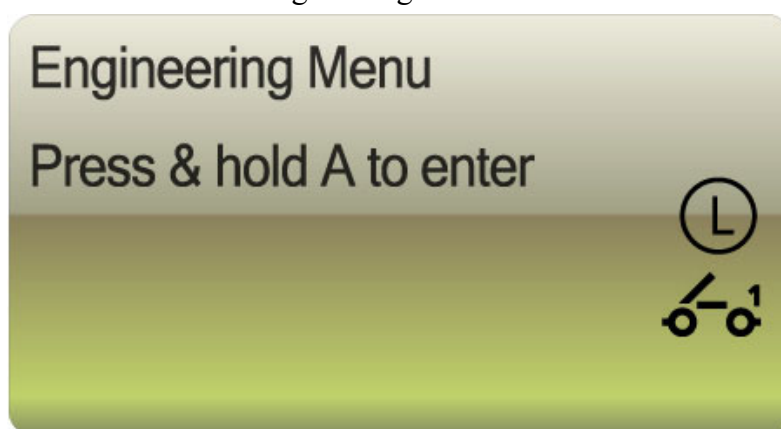
3. After several minutes, the communications hub will connect its wide area network (WAN) to the cellular network. The SW and WAN LEDs will flash every five seconds.



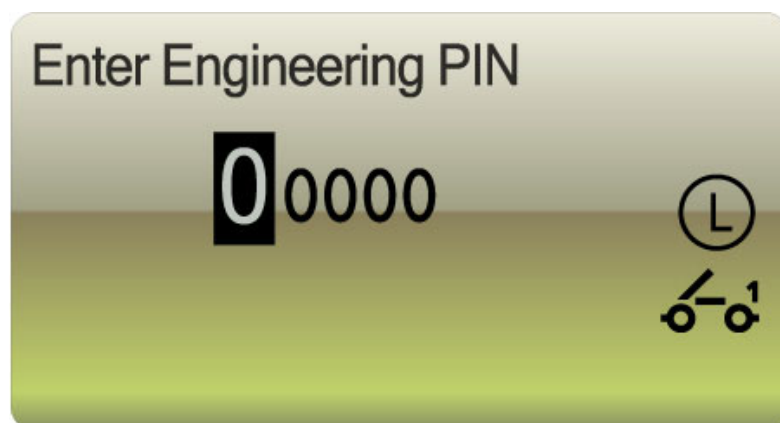
4. The installer initiates a process to pair (connect) the SGM1430-B meter to the communications hub.
5. The DSP sends the SGM1430-B meter credentials to the communications hub, and the HAN LED will flash every 5 seconds when the credentials have been added to the device log.



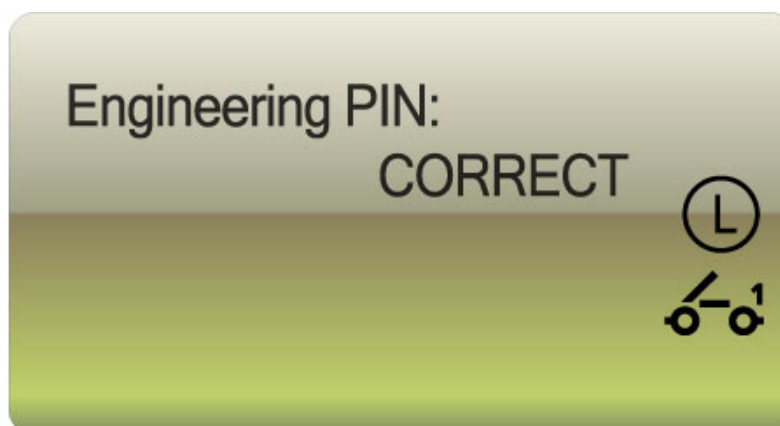
6. When the HAN LED is flashing on the communications hub, navigate to the Engineering Menu on the SGM1430-B meter. Press and hold the A button to enter the Engineering Menu.



7. Use the **A** and **B** buttons to enter the correct PIN.



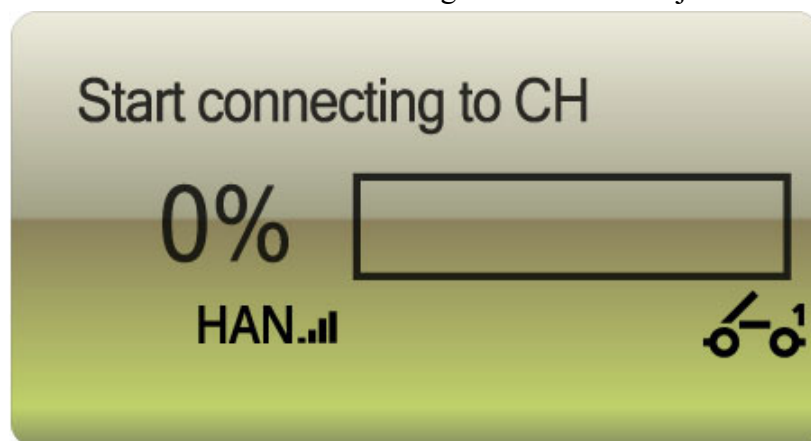
8. Press and hold the **B** button to submit the PIN.



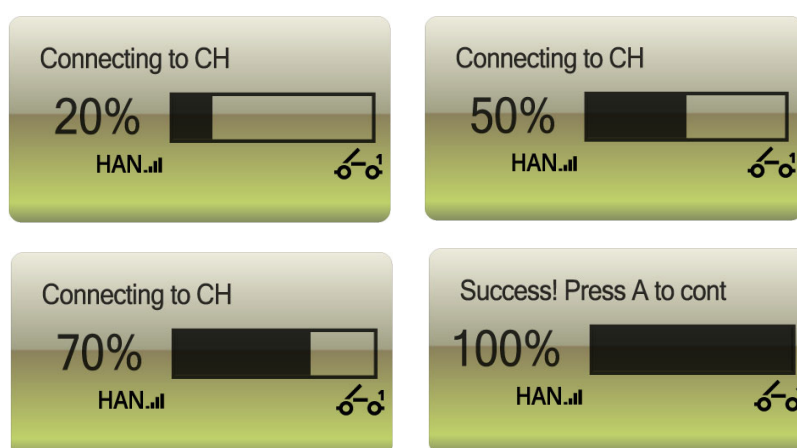
9. Press and hold the **A** button to Join Network.



10. The meter will now start searching for a network to join.



11. The connection progress will be displayed during the process.



12. Once the meter has successfully joined the communications hub, press the **A** button to continue.

The remaining commands in the installation and commissioning process will be sent to the SGM1430-B meter. Typically, the meter will be configured using the Electricity Meter Commissioning Service Requests. The exact order and sequence of the service requests is dependent on the individual energy supplier.

## Notifications to Installers and Utilities

**WARNING** Although the clock in the electricity meter is set at manufacturing, the user (utility) must ensure that the SET CLOCK command (ECS70) is sent to the meter as soon as possible after registration, and certainly before the first time-based command is sent. Until this command is successfully completed, the meter will record unsynchronized data.

**WARNING** The security log has only 100 entries. After this, it will overwrite the oldest item (i.e., it is a circular buffer). The user (utility) must read the security log frequently enough to prevent the loss of data.

It is advised that the user (utility) ensures that they use appropriate checks on the data they receive from the meters to ensure that messages/responses are consistent with the expected data. For example, responses should correlate with commands which were known to have been sent, and the meter cumulative registers should never go backward (i.e., reduce).

It is advised that the user (utility) includes in their customer guidance literature and training the following:

*If the meter is situated such that other people can easily read the meter, then the user should change the privacy PIN from the default of "0000" to their own 4-digit code.*

*When entering the code, the customer should always take care to shield their entry from the view of others.*

*The chosen 4-digit code should not be easily guessable, so it should not be part of the meter serial number or be the same digit repeated.*

We would like to remind the user (utility) that although the meters are delivered with security credentials already installed, it is the user's obligation to ensure these are changed according to the DCC terms (within the time set in the requirements) using the Update Device Certificates on Device Command. The utility must issue an Issue Security Credentials command to ensure the meter generates new key pairs.

**WARNING** The meter will perform checks to ensure: 1) Repeat UTRNs are not accepted. 2) Multiple retries are not attempted - the meter will block entry for a period of 1 hour to prevent this. 3) Wrongly formatted UTRNs are not accepted.

However, it is the user (utility) that must reconcile the issued UTRNs with the used UTRNs and is responsible for the security on UTRN issuing, etc.

## **Tamper Seals**

The meter has two tamper evident seals, one located on the meter terminal cover and one on the CSP communications module. Installers and maintenance engineers should inspect the seals for integrity and report any sign of tampering. Additionally, there is an MID certification seal. Any evidence of this being broken or tampered with should be reported.

## **Confidential Data Security**

It is the responsibility of the utility to protect the confidential data for its end customers. Aclara recommends the following:

1. Before removing a meter, the utility should always perform a change of tenancy (CoT), which will restrict the confidential data.
  - For meters returned to the factory, Aclara can remove all of the confidential data (e.g., if it was impossible to perform a CoT before the meter was removed from the premise).
2. The utility should always issue a CoT after the departure of a tenant to ensure that access to personal data for a previous tenant is restricted.
3. The utility should ensure that all sensitive data is removed prior to meter installation.
4. The utility should ensure that procedures are in place for the secure disposal of meters that are not to be re-installed or are deemed end of life.
  - For end of life meters that are returned to the factory, Aclara can remove all data.



## Security Credentials

Please note, there are no security credentials on the meter that will allow access to any other devices. This meter only contains its own security credentials.

## Connection to other Devices

The meter will only connect to other devices on the HAN. There are no other channels to allow connection. For any other device to be present on the HAN, they will have to have the correct addresses and signatures.

## Non-operational Interfaces

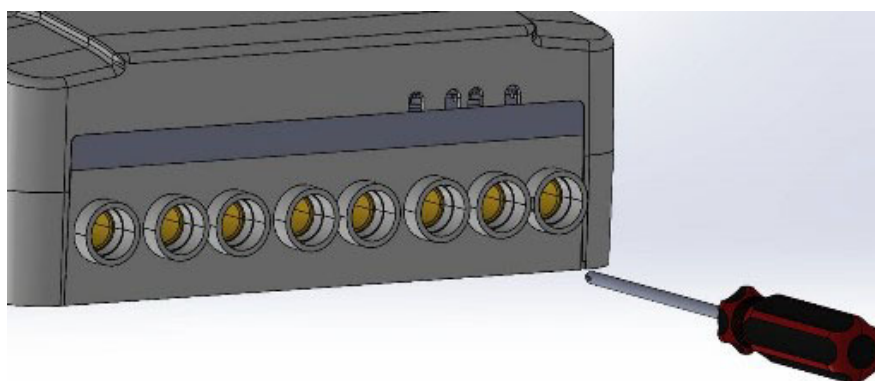
In accordance with UK SMETS2 Security requirements, all non-operational interfaces are disabled prior to shipment from the manufacturing plant. There is no expectation on the utility or the installers to disable any non-operational interface.

## Engineering PIN

If required, the meter can be supplied with an Engineering PIN that is used to protect the data of specific interest to installation engineers only. If required, the PIN is defined by the utility and is set during the manufacturing process. The PIN is static and cannot be changed once the meter leaves the manufacturing environment. Please note, if enabled, it is the responsibility of the utility to ensure that installation teams are aware of the PIN.

## Removal of the Terminal Cover

In some versions of the SGM1430-B, the meter terminal cover contains a retention clip that helps to secure the terminal cover in place. To remove the terminal cover, first remove the terminal cover seal and loosen the terminal sealing screw. Next, use a small flat blade screwdriver to gently unhook the retention clip from the meter base. This can be done by inserting the screwdriver into the notch on the front facia (located on the lower right-hand side of the terminal cover) and moving the blade to the 90 degree position. The terminal cover can then be removed unaided. Please see the diagram below to locate the position required to unhook the retention clip.





**CHAPTER****8**

# TESTS PROCEDURES AND MAINTENANCE

SGM1430-B meters are equipped with two pulse output LEDs as well as test indicators on the display.

## Pulse Output LED

The SGM1430-B meters are equipped with LED indicators for absolute active and reactive energy.

In reactive energy mode, the LED will pulse for reactive (kVArh) energy (for all four quadrants) and remain illuminated to indicate reactive energy anti-creep mode. Anti-creep is defined as when no current is flowing through the meter or when the current is less than the defined starting current of the meter.

The uniformity of the indicator is sufficient to allow verification of calibration. It is possible through a suitable number of pulse values to check the accuracy of the meter over the entire current range.

The indicator is configurable to provide support for both active and reactive functionality by use of an appropriate command through any of the communication ports.

The pulse rate is fixed at 1,000 pulses per kWh/kVArh.

The LED indicator reverts to active energy functionality when a cancel command is received or after a configurable period has elapsed. Note that cycling power alone will not cause the LED indicator to revert to active energy.

## Calibration

The pulse output LED emits calibration pulses. The LED pulses at the rate denoted on the meter cover and is directly proportional to the current active power (W) or reactive power (var). The duration of each output pulse is approximately 25 milliseconds.

The default unit for the calibration pulses is active energy, or watt hours (Wh). The meter may be switched to reactive energy or var hour (varh) calibration pulses via the optical port.

## Test Display

The LCD has annunciators for quadrant and energy flow indication. The annunciators provide valuable information during the testing process. Please refer to the *Display* section on page 10 for more information.

# Test Procedures

The following sections describe the requirements and steps for performing various tests.

## Field Accuracy Test

Test mode allows the meter to be tested for accuracy in the field without disturbing any billing data. In order to check the accuracy of the meter in the field, a portable standard and a phantom load generator is required.

Connect to voltages of the source, the reference meter, and the test meter in parallel. Connect the current of each in series.

1. Verify that the parameters/ranges in the reference meter are set separately from the test meter.
2. Apply voltage in accordance with the meter's nameplate marking to the reference meter, test the meter through phantom load, and warm up for 20 minutes.
3. Enter the meter constant in the reference meter (for example, 1000 imp/kWh).
4. Apply current to the meter (e.g., 10 amps) and unity power factor (UPF) for direct connected meters rated to 100 amps.
5. Set or hold the optical sensor connected to the reference meter on the calibration LED/pulse LED of the test meter.
6. Take accuracy for pulses calculated for 25 seconds for  $I_{ref}$  (10 A for direct connect meters).
7. Take accuracy for pulses calculated for 120 seconds for below  $I_{ref}$  (10 A for direct connect meters) loads and configure the reference meter for 120 seconds.
8. Start an accuracy check on the reference meter.
9. After the configured test duration, the reference meter will show the accuracy of the meter.

If a meter fails to yield the desired accuracy, it may need to be recalibrated or replaced.

## Watt-hour Test

1. Note the meter test constant value listed on the nameplate.
2. Select the desired voltage (in accordance with the meter's nameplate marking) and current level(s) on the test equipment.
3. Install the meter in a test panel that is wired and configured for the meter.
4. Begin testing according to standard test procedures. Allow 15 seconds of settling time after applying voltage before making accuracy measurements.

Check the meter calibration under three load conditions:

- full load
- light load
- full load with lagging power factor

A minimum test time of 30 seconds is needed to reduce test uncertainty. (Check the instruction book for your test board or standard to determine the actual minimum test time. Heavily filtered inputs may require longer test times.)

## Maintenance and Repairs

The SGM1430-B meters are factory calibrated and routine maintenance is not required. Because of the high component density of the PC boards and the integrated design, any repairs should be performed by Aclara. Please contact *Aclara Support* to schedule and return meters for repairs.

### Cleaning

Use the following guidelines when cleaning an SGM1430-B meter:

- Take care during cleaning not to damage or contaminate any gold-plated contacts of the connectors.
- If necessary, use compressed air to remove any accumulated dust.
- Do not immerse the meter in any liquid.
- Do not use abrasive cleaners on the covers.
- Do not use chlorinated hydrocarbon or ketone solvents on the covers.
- Wipe the enclosure with a damp cloth and a nonabrasive cleaning solution.

## Disposal

The lithium battery must be removed before meter disposal. Disposal of a SGM1430-B meter and its remaining components must be done in accordance with the waste electrical and electronic equipment directive (WEEE Directive).

### Battery Disposal

The lithium battery is internal and not replaceable in the field. Contact your local meter supplier to obtain a material safety data sheet (MSDS) or for recycling information.

In accordance with the European Directive 2006/66/EC, batteries and accumulators are marked with the crossed out wheeled bin, which indicates that they cannot be disposed of as unsorted municipal waste in the European Union.

The marking may also include a chemical symbol (e.g., Pb for Lead, Hg for Mercury, etc.) indicating that the battery contains substances classified as hazardous by the European Commission. Users of batteries must use the collection points available to customers for the return, recycling, and treatment of batteries.

- When discarding batteries, insulate the + and – terminals with insulation tape. Without insulation, lithium batteries may short, causing them to become hot, burst, or ignite.
- This product cannot be disposed of as unsorted municipal waste in the European Union.



## CHAPTER

## 9

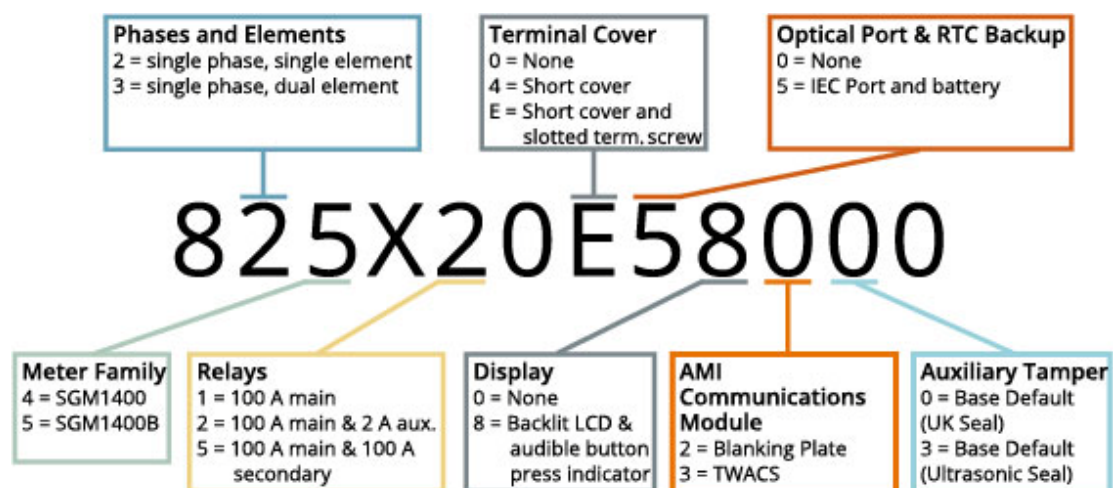
## SPECIFICATIONS

| Parameter                                | Specification  |
|--|--|
| Model                                    | SGM1431-B, SGM1432-B, and SGM1433-B  |
| Phase / Connection                       | Polyphase, 3 phase 4 wire direct connect   |
| Current ( $I_{tr} - I_{ref} (I_{max})$ ) | 0.5–10 A (100 A)   |
| Voltage Rating                           | -20% to +15%   |
| Starting Current                         | 40 mA  |
| Frequency                                | 50 Hz $\pm$ 2%   |
| Accuracy (active / reactive)             | Class A or B active energy=BS EN50470-1/3<br>Class 2 or 3 reactive energy = IEC 62053-23   |
| Power Consumption                        | 2 W / 4 VA (with intimate comm. hub in idle state)   |
| Relays                                   | <b>SGM1431-B</b> = 100 A main contactor<br><b>SGM1432-B</b> = 100 A main contactor and 2 A aux relay<br><b>SGM1433-B</b> = 100 A main contactor and 2 x 2 A aux relay  |
| Display                                  | 128 x 32 backlit LCD ( $\leq$ 8 digits plus decimal point)   |
| Ports                                    | AMI interface  |
| Terminals                                | <b>SMG1431-B</b> = 8 primary<br><b>SGM1432-B</b> = 8 primary and 2 voltage free<br><b>SGM1433-B</b> = 8 primary and 4 voltage free   |
| Protocols                                | DLMS / COSEM   |
| Optical Port                             | IEC 62056-21 (physical)  |
| HAN                                      | 2.4 GHz ZigBee communication protocol / Smart Energy 1.4<br><b>Class ID:</b> Class 1 radio equipment<br><b>Frequency Range:</b> 2405 MHz—2480 MHz<br><b>UIT Channels:</b> 11—26<br><b>TX Output Power:</b> <10 dBm (10 mW) maximum |
| TOU Rates                                | Primary element - 48 TOU and 4 x 8 block tariff  |
| Load Profile                             | <4 channel, configurable interval<br>(memory stores more than 2 years of 4 channel 30 minute interval data)  |
| Data Storage                             | 16 MB external serial flash memory   |
| Firmware Size                            | Dual image (700 kB + 700 kB)   |
| Operating Temperature                    | -20°C to +70°C<br><b>With ZigBee:</b> -20°C to +55°C   |
| Storage Temperature                      | -25°C to +70°C   |

| Parameter                    | Specification   |
|------------------------------|---|
| Operating & Storage Humidity | 95% non-condensing  |
| Enclosure Ingress Protection | IP54 (IEC 60529)  |
| Insulation Class             | Protective Class II   |
| Dimensions                   | 161 mm H x 170 mm W x 65 mm D   |
| Weight                       | <b>SMG1431-B</b> = 1240 grams<br><b>SMG1432-B</b> = 1255 grams<br><b>SMG1433-B</b> = 1265 grams   |
| Agency Approval              | MID approved<br>RED compliant   |
| Vibration and Shock          | Class M1 (as defined by Guide for Measuring Instruments Directive 2004/22/EC)   |
| Electromagnetic              | Class E2 (as defined by Guide for Measuring Instruments Directive 2004/22/EC)   |
| <b>Metrology Standards:</b>  |   |
| General                      | BS EN 50470 - 1<br>BS EN 50470 - 3 Class B<br>BS EN / IEC 62053-21 Class 1<br>IEC 62053-23 Class 2 varh   |
| RTC                          | BS EN / IEC 62054-21  |
| Load Control                 | BS EN / IEC 62052-21  |
| Optical Port (physical)      | IEC 62056-21  |
| Pulse Output                 | IEC 62053-31  |
| <b>Metering Standards:</b>   |   |
| General                      | IEC 62052-11<br>IEC 62053-21 Class 1 kWh<br>IEC 62053-23 Class 2 kVArh<br>IEC 62054-21  |
| Optical Port                 | IEC 62056-21  |
| Communication                | DLMS and ZigBee certified   |
| Regulatory                   | RoHS, WEEE  |
| Radio Frequency              | ETSI EN 301 489-1<br>ETSI EN 301 489-17<br>ETSI EN 300 328<br>EN 62368-1<br>EN 62479<br>Council Recommendation 1999/519/EC (low power equipment <20 mW) |



## Catalogue Codes





**APPENDIX****A****EVENT CODES****UK SMETS2**

The event codes supported by the SGM1430-B are described in the tables on the following pages. The only distinction between an event and an error/alarm is whether it is filtered to the event log or the error/alarm register. The logs in which a code appears is determined by the filter configuration for each log. Each event has a unique counter of occurrences independent of the event log/error/alarm registers. (Please refer to *Event Logging and Errors/Alarms* on page 45 for more information on event logs, errors, and alarms.)

| Event Alert / Code | Event Alert/Code Description  | Critical / Non-Critical | Mandated / Enable or Disable | Alert WAN (Alert Type) | Alert HAN | Security Log | Event Log | Power Event Log | ALCS Event Log | Contains Sensitive Data | ESME / GSME Alert Always On | Remote Party Role |
|--------------------|---|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-----------------|----------------|-------------------------|-----------------------------|-------------------|
| 0x8F01             | Active power import above load limit threshold                          | Critical                | Mandated                     | Y <sup>1</sup>         | Y         | N            | Y         | N               | N              | N                       | Y                           | Supplier          |
| 0x8002             | Average RMS voltage above average RMS over voltage threshold            | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8003             | Average RMS voltage above average RMS over voltage threshold on Phase 1 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       |                             | Network Operator  |
| 0x8004             | Average RMS Voltage above Average RMS Over Voltage Threshold on Phase 2 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       |                             | Network Operator  |
| 0x8005             | Average RMS Voltage above Average RMS Over Voltage Threshold on Phase 3 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       |                             | Network Operator  |

| Event Alert / Code | Event Alert/Code Description  | Critical / Non-Critical | Mandated / Enable or Disable | Alert WAN (Alert Type) | Alert HAN | Security Log | Event Log | Power Event Log | ALCS Event Log | Contains Sensitive Data | ESME / GSME Alert Always On | Remote Party Role                                |
|--------------------|---|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-----------------|----------------|-------------------------|-----------------------------|--|
| 0x8006             | Average RMS Voltage below Average RMS Under Voltage Threshold (current value below threshold; previous value above threshold) | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operation                                |
| 0x8007             | Average RMS Voltage < Average RMS Under Voltage Threshold on Phase 1  | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       |                             | Network Operator                                 |
| 0x8008             | Average RMS Voltage < Average RMS Under Voltage Threshold on Phase 2  | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       |                             | Network Operator                                 |
| 0x8009             | Average RMS Voltage < Average RMS Under Voltage Threshold on Phase 3  | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       |                             | Network Operator                                 |
| 0x8F0A             | Billing Data Log Updated  | Critical                | Mandated                     | Y <sup>2</sup>         | N         | N            | N         | N               | N              | Y                       | Y                           | Supplier   |
| 0x8F0C             | Clock not adjusted (adjustment greater than 10 seconds)   | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier   |
| 0x810D             | Combined Credit Below Low Credit Threshold (prepayment mode)  | Non-Critical            | Mandated                     | Y <sup>1</sup>         | Y         | N            | N         | N               | N              | N                       | N                           | Supplier   |
| 0x810E             | Credit Added Locally  | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N                       | N                           | Supplier   |
| 0x8F0F             | Credit Below Disablement Threshold (prepayment mode)  | Critical                | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N                       | Y                           | Supplier   |
| 0x8119             | Emergency Credit Has Become Available (prepayment mode)   | Non-Critical            | Mandated                     | Y <sup>1</sup>         | Y         | N            | N         | N               | N              | N                       | N                           | Supplier   |
| 0x811A             | Failure in changing or maintaining HCALCS or ALCS state   | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | N               | Y              | N/A                     | N/A                         | Supplier   |
| 0x8F1C             | Firmware Verification Failed  | Critical                | Mandated                     | Y <sup>2</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier   |
| 0x8F1E             | Integrity check of content or format of command failed  | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | WAN Provider, Access Control Broker, or Supplier |
| 0x8020             | RMS Voltage above Extreme Over Voltage Threshold*   | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator                                 |

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| 0x8021             | RMS Voltage above Extreme Over Voltage Threshold on Phase 1 * | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8022             | RMS Voltage above Extreme Over Voltage Threshold on Phase 2 * | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8023             | RMS Voltage above Extreme Over Voltage Threshold on Phase 3 * | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8024             | RMS Voltage above Voltage Swell Threshold *                   | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8025             | RMS Voltage above Voltage Swell Threshold on Phase 1 *        | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8026             | RMS Voltage above Voltage Swell Threshold on Phase 2 *        | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8027             | RMS Voltage above Voltage Swell Threshold on Phase 3 *        | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8028             | RMS Voltage < Extreme Under Voltage Threshold *               | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8029             | RMS Voltage < Extreme Under Voltage Threshold on Phase 1 *    | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x802A             | RMS Voltage < Extreme Under Voltage Threshold on Phase 2 *    | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x802B             | RMS Voltage < Extreme Under Voltage Threshold on Phase 3 *    | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x802C             | RMS Voltage < Voltage Sag Threshold *                         | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x802D             | RMS Voltage < Voltage Sag Threshold on Phase 1 *              | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x802E             | RMS Voltage < Voltage Sag Threshold on Phase 2 *              | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |

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|--------------------|--|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-----------------|----------------|-------------------------|-----------------------------|--|
| 0x802F             | RMS Voltage < Voltage Sag Threshold on Phase 3 *                 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator                                 |
| 0x8F30             | Source Does not have Authority for Command                       | Critical                | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N                       | Y                           | WAN Provider, Access Control Broker, or Supplier |
| 0x8131             | Success in changing or maintaining HCALCS or ALCS state          | Non-Critical            | Mandated                     | N                      | N         | N            | N         | N               | Y              | N/A                     | N/A                         | N/A  |
| 0x8F32             | Supply Armed   | Critical                | Mandated                     | Y <sup>1</sup>         | Y         | N            | N         | N               | N              | N                       | Y                           | Supplier and Network Operator                    |
| 0x8F33             | Supply Disabled then Armed - Load Limit triggered                | Critical                | Mandated                     | Y <sup>1</sup>         | Y         | N            | N         | N               | N              | N                       | Y                           | Supplier and Network Operator                    |
| 0x8F34             | Supply Enabled after Load Limit                                  | Critical                | Mandated                     | Y <sup>1</sup>         | Y         | N            | N         | N               | N              | N                       | Y                           | Supplier and Network Operator                    |
| 0x8F35             | Supply Outage Restored   | Critical                | Mandated                     | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |
| 0x8F36             | Supply Outage Restored - Outage >= 3 minutes                     | Critical                | Mandated                     | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |
| 0x8F38             | Supply Outage Restored on Phase 1 Restored - Outage >= 3 minutes | Critical                | Placeholder                  | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |
| 0x8F39             | Supply Outage Restored on Phase 2 Restored                       | Critical                | Placeholder                  | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |
| 0x8F3A             | Supply Outage Restored on Phase 2 Restored - Outage >= 3 minutes | Critical                | Placeholder                  | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |
| 0x8F3B             | Supply Outage Restored on Phase 3 Restored                       | Critical                | Placeholder                  | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |

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|--------------------|--|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-----------------|----------------|-------------------------|-----------------------------|--|
| 0x8F3C             | Supply Outage Restored on Phase 3 Restored - Outage >= 3 minutes           | Critical                | Placeholder                  | Y <sup>2</sup>         | N         | N            | N         | Y               | N              | N                       | Y                           | Network Operator                                 |
| 0x8F3D             | Trusted Source Authentication Failure                                      | Critical                | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N                       | Y                           | WAN Provider, Access Control Broker, or Supplier |
| 0x8F3E             | Unauthorized Communication Access attempted                                | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | WAN Provider, Access Control Broker, or Supplier |
| 0x8F3F             | Unauthorised Physical Access Tamper Detected                               | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | WAN Provider, Access Control Broker, or Supplier |
| 0x8F43             | Change in the executing Firmware version                                   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8145             | Clock adjusted (within tolerance)  | N/A                     | Mandated                     | N                      | N         | N            | Y         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F47             | Credit would cause meter balance to exceed maximum meter balance threshold | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F48             | Device joining failed  | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F49             | Device joining succeeded   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F4A             | Device Unjoining failed  | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F4B             | Device Unjoining succeeded   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F4C             | Device Digital Signing Certificate replacement failed                      | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |
| 0x8F4D             | Device Digital Signing Certificate replacement succeeded                   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A  |

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|--------------------|--|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-----------------|----------------|-------------------------|-----------------------------|--------------------------|
| 0x8F4E             | Device Key Agreement Certificate replacement failed                        | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F4F             | Device Key Agreement Certificate replacement succeeded                     | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F51             | Duplicate UTRN entered   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F52             | Event Log Cleared  | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F53             | Failed Authentication or Authorisation not covered by other codes          | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8154             | Immediate HAN Interface Command Received and Successfully Actioned         | N/A                     | Mandated                     | N                      | N         | N            | Y         | N               | N              | N/A                     | N/A                         | Supplier                 |
| 0x8155             | Immediate HAN Interface Command Received but not Successfully Actioned     | N/A                     | Mandated                     | N                      | N         | N            | Y         | N               | N              | N/A                     | N/A                         | Supplier                 |
| 0x8157             | Supply interrupted   | N/A                     | Mandated                     | N                      | N         | N            | N         | Y               | N              | N/A                     | N/A                         | Supplier                 |
| 0x8F5B             | UTRN exceeds Maximum Credit Threshold                                      | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F60             | Unusual numbers of malformed, out-of-order or unexpected Commands received | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8161             | User Interface Command Input and Successfully Actioned                     | N/A                     | Mandated                     | N                      | N         | N            | Y (Boost) | N               | N              | N/A                     | N/A                         | Supplier                 |
| 0x8162             | User Interface Command Input but not Successfully Actioned                 | N/A                     | Mandated                     | N                      | N         | N            | Y (Boost) | N               | N              | N/A                     | N/A                         | Supplier                 |
| 0x8F63             | UTRN not Authentic   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F64             | UTRN not for this Device   | N/A                     | Mandated                     | N                      | N         | Y            | N         | N               | N              | N/A                     | N/A                         | N/A                      |
| 0x8F66             | Future - date HAN Interface Command Successfully Actioned                  | Critical                | Mandated                     | Y <sup>2</sup>         | N         | N            | N         | N               | N              | N                       | Y                           | Supplier or WAN Provider |



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| 0x8F67             | Future - date HAN Interface Command not Successfully Actioned    | Critical                | Mandated                     | Y <sup>2</sup>         | N         | N            | N         | N               | N              | N                       | Y                           | Supplier or WAN Provider   |
| 0x8168             | Supply Disabled then Armed - Activate Emergency Credit triggered | Non-Critical            | Mandated                     | N                      | N         | N            | N         | N               | N              | N                       | Y                           | N/A  |
| 0x8F69             | Device commissioned  | Critical                | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N                       | Y                           | Supplier   |
| 0x8F70             | Update Security Credentials                                      | Critical                | Mandated                     | N                      | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier   |
| 0x8F72             | Firmware Verification Successful                                 | Critical                | Mandated                     | Y <sup>2</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier   |
| 0x8F74             | Unauthorised Physical Access - Meter Cover Removed               | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier or Supplier and Network Operator                          |
| 0x8F75             | Unauthorised Physical Access - Strong Magnetic field             | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | WAN Provider or Supplier and Network Operator                      |
| 0x8F76             | Unauthorised Physical Access - Terminal Cover Removed            | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier and Network Operator                                      |
| 0x8F78             | Unauthorised Physical Access - Other                             | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Access Control Broker, WAN Provider, Network Operator, or Supplier |
| 0x8183             | Device joined SMHAN  | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier   |
| 0x8085             | Average RMS Voltage below Over Voltage Threshold                 | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator   |
| 0x8086             | Average RMS Voltage below Over Voltage Threshold on Phase 1      | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator   |
| 0x8087             | Average RMS Voltage below Over Voltage Threshold on Phase 2      | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator   |
| 0x8088             | Average RMS Voltage below Over Voltage Threshold on Phase 3      | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator   |

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| 0x8089             | Average RMS Voltage above Under Voltage Threshold                        | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x808A             | Average RMS Voltage above Average RMS Under Voltage Threshold on Phase 1 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x808B             | Average RMS Voltage above Average RMS Under Voltage Threshold on Phase 2 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x808C             | Average RMS Voltage above Average RMS Under Voltage Threshold on Phase 3 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x808D             | RMS Voltage above Extreme Over Voltage Threshold                         | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x808E             | RMS Voltage above Extreme Over Voltage Threshold on Phase 1              | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x808F             | RMS Voltage above Extreme Over Voltage Threshold on Phase 2              | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8090             | RMS Voltage above Extreme Over Voltage Threshold on Phase 3              | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8091             | RMS Voltage above Voltage Swell Threshold                                | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8092             | RMS Voltage above Voltage Swell Threshold on Phase 1                     | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8093             | RMS Voltage above Voltage Swell Threshold on Phase 2                     | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8094             | RMS Voltage above Voltage Swell Threshold on Phase 3                     | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8095             | RMS Voltage below Extreme Under Voltage Threshold                        | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |

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| 0x8097             | RMS Voltage below Extreme Under Voltage Threshold on Phase 2 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator        |
| 0x8098             | RMS Voltage below Extreme Under Voltage Threshold on Phase 3 | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator        |
| 0x8099             | RMS Voltage below Voltage Sag Threshold                      | Non-Critical            | Mandated                     | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator        |
| 0x809A             | RMS Voltage below Voltage Sag Threshold on Phase 1           | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator        |
| 0x809B             | RMS Voltage below Voltage Sag Threshold on Phase 2           | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator        |
| 0x809C             | RMS Voltage below Voltage Sag Threshold on Phase 3           | Non-Critical            | Placeholder                  | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator        |
| 0x8F1B             | Firmware Verification Failed At Power On                     | Critical                | Mandated                     | Y <sup>1</sup>         | N         | Y            | N         | N               | N              | N                       | Y                           | Supplier / WAN Provider |
| 0x81A2             | CH Connected to ESME   | N/A                     | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N/A                     | N/A                         | N/A                     |
| 0x81A3             | CH Disconnected from ESME                                    | N/A                     | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N/A                     | N/A                         | N/A                     |
| 0x81A4             | Close Tunnel Command Rejected                                | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier                |
| 0x81A5             | Communication From Local Port (e.g. Optical)                 | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier                |
| 0x81A6             | Customer Acknowledged Message on HAN Device                  | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier                |
| 0x81A7             | Debt Collection Completed - Time Debt 1                      | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier                |
| 0x81A8             | Debt Collection Completed - Time Debt 2                      | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier                |

| Event Alert / Code | Event Alert/Code Description                  | Critical / Non-Critical | Mandated / Enable or Disable | Alert WAN (Alert Type) | Alert HAN | Security Log | Event Log | Power Event Log | ALCS Event Log | Contains Sensitive Data | ESME / GSME Alert Always On | Remote Party Role |
|--------------------|---|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-----------------|----------------|-------------------------|-----------------------------|-------------------|
| 0x81A9             | Debt Collection Completed - Payment Debt      | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81AA             | Emergency Credit Exhausted                    | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | Y         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81AB             | Emergency Credit Activated                    | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | Y         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81AC             | Error Measurement Fault                       | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81AD             | Error Metrology Firmware Verification Failure | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81AE             | Error Non-Volatile Memory                     | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81B2             | Error Unexpected Hardware Reset               | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81B3             | Error Watchdog                                | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N               | N              | N                       | N                           | Supplier          |
| 0x81B8             | Incorrect Polarity                            | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Supplier          |
| 0x81B9             | Meter Cover Closed                            | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | N               | N              | N                       | N                           | Supplier          |
| 0x8010             | Over Current                                  | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8011             | Over Current L2                               | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8013             | Over Current L3                               | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |
| 0x8014             | Power Factor Threshold Below                  | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y               | N              | N                       | N                           | Network Operator  |

| Event Alert / Code | Event Alert/Code Description  | Critical / Non-Critical | Mandated / Enable or Disable | Alert WAN (Alert Type) | Alert HAN | Security Log | Event Log | Power Event Log               | ALCS Event Log | Contains Sensitive Data | ESME / GSME Alert Always On | Remote Party Role |
|--------------------|---|-------------------------|------------------------------|------------------------|-----------|--------------|-----------|-------------------------------|----------------|-------------------------|-----------------------------|-------------------|
| 0x8015             | Power Factor Threshold OK   | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y                             | N              | N                       | N                           | Network Operator  |
| 0x8016             | Over Current L2   | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y                             | N              | N                       | N                           | Network Operator  |
| 0x81BA             | Request Tunnel Command Rejected                                     | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x81BB             | Reverse Current   | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | N         | Y                             | N              | N                       | N                           | Supplier          |
| 0x81BC             | Strong Magnetic Field Removed                                       | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x81BE             | Supply Disabled Then Locked - Supply Tamper State Cause             | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x81C1             | Terminal Cover Closed   | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x81C4             | UTRN Manual Entry Suspended   | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | Y         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x81C5             | UTRN rejected as locked out   | Non-Critical            | Enable or Disable            | Y <sup>1</sup>         | N         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x8F83             | Disablement of supply due to insufficient credit has been suspended | Critical                | Enable                       | Y <sup>1</sup>         | N         | N            | N         | N                             | N              | N                       | Y                           | Supplier          |
| 0x81A0             | Smart Meter Integrity Issue – Warning                               | Non-Critical            | Enable                       | Y <sup>2</sup>         | N         | N            | Y         | N                             | N              | N                       | N                           | Supplier          |
| 0x8F57             | Supply Interrupted  | N/A                     | Enable                       | N                      | N         | N            | N         | Y (for CH, the CHF Event Log) | N              | N/A                     | N/A                         | N/A               |



# Index

## A

### active

- energy 14, 22, 37, 39, 79, 83
- high 30
- low 30
- power 33, 79, 87
- tariff 5
- terminal 9
- time-of-use (TOU) 17, 20

### alarm 87

### alarms 45

### auxiliary relay 5, 6, 10, 22, 43, 45, 69

## B

### billing 5, 39, 40, 88

### button 73

### buttons 10, 19, 74

## C

### clock 22, 25, 43, 45, 46, 75, 88, 91

### communication 25, 26, 39, 91, 95

#### AMI 31

#### HAN 3, 6, 10

#### hub 3, 5, 22, 23, 29, 31, 72, 73, 75, 83

#### interface 29

#### optical 20

### configuration 17

#### buttons 20

#### disconnect/reconnect 43

#### display 17

#### terminals 69

### contactor 6, 22, 43–45

#### status 10, 13, 15, 22

#### terminals 22

### credentials 76, 77, 93

## D

### data 5, 10, 25, 34, 38, 75

#### billing 5, 25, 39, 40, 88

#### interval 83

#### load profile 4, 25, 38

#### logs 35

#### power quality 33

#### prepayment 19

#### receive 30

#### security 76

#### transmit 30

### demand 6, 10, 33, 37, 38, 39

### disconnect/reconnect 3, 16, 22, 31, 43, 44

#### switch status 40, 41

### display 4, 6, 10, 15, 16, 19, 79, 83

### configuration 17, 19

### modes 17

## E

### energy 25, 33, 38

#### active 14, 22, 34, 37, 39, 79, 83

#### apparent 4

#### direction 10, 14, 79

#### reactive 14, 22, 34, 37, 79, 83

## F

### firmware 22–26, 83, 88, 91, 93, 95, 96

#### update 5, 26

## H

### HAN 10, 15, 29, 31, 36, 73, 77, 83

## I

### IHD 29, 31

## K

### kVA<sub>rh</sub> 21, 34, 79

### kW 33

### kWh 21, 34, 79, 80

## L

### load control 4, 13, 16, 22, 43, 46, 84

### load profile 4, 25, 33, 37, 38, 83

### log 5, 16, 23, 25, 27, 34, 35, 36, 39, 43, 46, 73, 75, 87

## M

### memory 5, 25, 38, 40, 43, 96

## N

### network 10, 13, 14, 27, 44, 75

## P

### PIN 76, 77

### power quality 33

### prepayment 19

## R

### reactive, see energy

### relay 4, 5, 13, 16, 17, 22, 25, 43, 45–69, 83

### reverse 14, 21, 97

## S

### screw

#### cover seal 9

#### terminal 9, 22

### Smart Energy Profile 3, 5, 25, 31

## **T**

terminal 23, 31, 43, 69, 83

- block 9, 69

- contactor 22

- cover 5, 9, 22, 23, 72, 76, 93, 97

- relay 22, 69

- screw 9, 22

terminal layout 70

## **V**

voltage 5, 45, 80, 83

- battery 13, 16

- over 4, 5, 34–35, 44, 87, 88, 93, 94

- RMS 35, 87

- sag 4, 5, 34–36, 44, 89, 95

- swell 4, 5, 34–36, 44, 89, 94

- under 4, 5, 34–35, 44, 87, 89, 93–95

## **W**

WAN 3, 6, 18, 73

## **Z**

ZigBee 3, 6, 29, 31, 33, 72, 83