# ETSI TS 104 001 V2.2.1 (2019-01)


**Open Smart Grid Protocol (OSGP);**
**Smart Metering/Smart Grid Communication Protocol**

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RTS/ATTM-0020010

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***ETSI***

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# Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

With more than 5 million OSGP compatible smart meters and other devices already installed in Europe and around the world, OSGP has become a defacto standard for smart meters and smart grid infrastructure communications in Europe. In addition, over 30 million more electricity meters already installed in Europe are using the same power line communications technology as used by OSGP.

Consistent with the general European objective to create European standards that will enable interoperability of smart grid devices including electricity meters, which can then improve the means by which customers' awareness of actual consumption can be raised in order to allow timely adaptation to their demands (commonly referred to as 'smart metering'), the OSGP Alliance, formerly known as Energy Services Network Association (ESNA), a non-profit corporation under Dutch law, is partnering with utilities, manufacturers, system integrators and other interested parties to obtain their support for the promotion and adoption of OSGP as a European specification for smart grid communications to benefit utilities, their customers, and suppliers.

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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# 1 Scope

The present document is a revision of ETSI TS 104 001. ETSI TS 104 001 was initially a revision of ETSI GS OSG 001 [i.5], which was originally created under the ETSI ISG OSG. The previous version of ETSI TS 104 001 was prepared by the TC PLT, but it now falls under the responsibilities of TC ATTM. This update is to ensure proper references to ANSI, IEEE and MC.

# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] BS EN 14908-1:2014: "Open data communication in building automation, controls and building management. Building network protocol. Protocol stack".

[2] BS EN 13757-2:2018: "Communication systems for meters. Wired M-Bus communication".

[3] BS EN 13757-3:201: "Communication systems for meters. Application protocols".

[4] ANSI C12.18/IEEE Std 1701™/MC12.18: Standard for Optical Port Communication Protocol to Complement the Utility Industry End Device Data Tables.

[5] ANSI C12.19/IEEE Std 1377™/MC12.19: Standard for Utility Industry Metering Communication Protocol Application Layer (End Device Data Tables).

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ISO/IEC 646:1991: "Information technology - ISO 7-bit coded character set for information interchange".

[i.2] ISO 8859/1 (or ECMA-94): "Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1".

[i.3] IEC 61000-4-7: "Electromagnetic compatibility (EMC) - Part 4-7: Testing and measurement techniques - General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto".

[i.4] Void.

[i.5] ETSI GS OSG 001: "Open Smart Grid Protocol (OSGP)".

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the following terms apply:

**active energy/power:** measure of active power expended over time (resistive load)

**AES:** symmetric 128-bitblock data encryption technique

**authentication:** process where data is validated to be current and to have come from the expected source

**Base Encryption Key (BEK):** 128 bit key derived from the OMA Key for the purpose of OSGP encryption

**Billing Interface Definition Number (BIDN):** identifier used to identify billing-related data in OSGP device logs

NOTE: See tables in clause D.33.

**bootrom:** part of the OSGP device firmware which is fixed and cannot be changed over the network

**broadcast:** message directed at all of the network population. In OSGP systems, only the data concentrator initiates broadcast messages

NOTE: OSGP devices may repeat a broadcast message.

**ciphertext:** output of encrypting plaintext

**clone domain:** domain where the most significant bit of the node number assigned to all nodes is set to zero

NOTE 1: This allows the node to receive messages that are sent by a node with the same domain, subnet and node number as the clone domain node. In BS EN 14908-1:2014 [1] addressing there can be up to 255 subnets and 127 nodes/subnet, so the high order bit of the node number byte is free for this special use.

NOTE 2: Normally, packets from the same domain, subnet and node as your own are rejected: in the Clone domain case, this is bypassed.

**cycle count:** cycle count is the maximum number of packet cycles to randomize access to the link over

NOTE: So, if the cycle count is 4, the responder generates a random number between 0 and 3, multiplies the result by the packet cycle width (see below in definitions) and then waits that long before responding to the message.

**Data Concentrator (DC):** server which supervises electrical utility OSGP devices and other devices

**device (or OSGP device):** device which implements the OSGP protocol

**Daylight Saving Time (DST):** adjustment from solar time to provide longer evenings during summer months

**digest:** 8-byte data block computed using the OSGP digest algorithm

NOTE: (see annex E) Along with the Open Media Authentication Key. The digest accounts for both message data and sequence number (Reference ID).

**dip:** measured quantity detected at a level below a defined threshold

**encryption:** process where data is converted to a format that can only be understood by someone sharing the key used by the source

**energy:** summation of power over time

**Fast Commission Message (FCM):** specific message type used for PLC traffic optimization during initial commissioning of an OSGP device

**group ID:** mechanism for selecting a subset of devices to process a broadcast message

**in phase:** phase angle between two sine waves is 0 degrees

**Interface Change Alarm (ICA):** modifying device tables or calling device procedures described in present document may cause the device's interface definition to change, the dimensions of some OSGP device tables may change and the Interface Change Alarm in BT03 will be logged

NOTE: Attempts to read or write some device tables will not succeed until the alarm has been cleared. Tables affected by the Interface Change Alarm in this manner are marked with the ICA NAK attribute throughout the present document. Tables and procedures that may cause the Interface Change Alarm to be triggered are marked with the ICA SRC attribute throughout the present document.

**load profile:** recording of one or more pieces of data at specified intervals

**M-Bus:** protocol developed for networking and remote reading of utility meters

NOTE: The M-Bus capabilities in the OSGP device according to the present document can discover and query up to four M-Bus devices, such as gas, water, or heat meters. The OSGP device stores the consumption data collected from the M-Bus devices along with any alarm or status messages.

**M-Bus Auto-discovery:** process by which the device polls the M-Bus network for new and previously commissioned devices

NOTE: Newly discovered devices are added to the commissioned device list for regular polling, up to a maximum of four devices.

**M-Bus Data Type (MDT):** mapping a of M-bus Data Record Header (DRH) definition to a 5-bit ordinal.

**Multipurpose Expansion Port (MEP):** physical interface through which further network devices can be added to the utility OSGP device

NOTE: A MEP device is a device that connects to the OSGP device using the MEP port to access OSGP device tables and run OSGP device procedures.

**multicast:** message directed at a subset of the network population

**Non-Volatile Memory (NVM):** generic term used to refer to memory that retains its values across power cycles and, in the present document, used to store device data

**Non-Volatile Memory size (NVM(s)):** number of bytes of non-volatile memory

NOTE: The total number of 1K blocks of NVM is available in ET04.

**Open Media Access Key (OMAK):** 96-bit key used for messages between meters and data concentrators having access to all procedures and tables unless limited during production to prevent access to features such as calibration data, manufacturer's identification information, etc.

NOTE: The default OSGP 128 key used for application level content protection and encryption is derived from OMAK, and may be changed using the key change procedure EP20.

**one-time-read:** method by which an electric OSGP device performs a snapshot of pertinent registers along with a timestamp

**packet cycle:** packet cycle is the time in milliseconds that it takes to transmit a packet of average length where average is for that network/messaging pattern

NOTE: Packet cycle width is usually expressed in tens of milliseconds, e.g. a packet cycle width of 20 means 200 ms.

**Pending Event Descriptor (PED):** Pending Event Descriptor contains the activation type and time of a pending table

NOTE: It is defined in BT04.

**phase alignment:** addition of inductance or capacitance to current or voltage measurement channels to reduce or eliminate phase angle errors and consequent power measurement errors

**Pending Event Description (PED):** description of the event that causes a pending table to be activated

**phase loss:** absence of an electrical phase or the reduction of an electrical phase below the declared voltage by predefined percentage

**plaintext:** non-encrypted data (ascii or binary) input to encryption algorithm to produce ciphertext

**Point to Point (P2P):** direct communication between two devices

**Power Line Communication (PLC):** communication using the existing power distribution network

**power factor:** active power divided by apparent power and lies within the range -1 to 1

**Program ID (PID):** identifier for a given interface version implemented by the OSGP device firmware

NOTE: A change of Program ID signals a potential interface definition change. The program ID needs to be universally unique per firmware version and per OSGP device interface.

**RC4:** stream encryption algorithm that uses XOR on the data stream

**reactive energy/power:** energy alternately stored and released by inductors and/or capacitors (reactive load)

**reverse (export) energy:** energy delivered by the customer to the utility and often considered a tamper condition if the user is not legitimately supplying energy (e.g. solar power) to the utility

**Real Time Clock (RTC):** device functionality that maintains a complete clock-calendar with one-second resolution

**self-read:** method by which a device performs a snapshot of pertinent registers along with a timestamp

**swell:** measured quantity detected at a level above a defined threshold

**tariff:** published list of rate schedules and terms and conditions, or the particular schedule in effect at a given time

**telegram:** single response message from a M-Bus slave device containing billing data and other information complete billing information from a single M-Bus slave device potentially requiring more than one telegram

**tier:** time at which at changes are made between tariffs

**tilt Switch:** gravity operated switch that opens or closes based on its attitude relative to the ground or by inertial movement

**Time-Of-Use metering (TOU):** metering that records metered quantities based on a time schedule (time of day, day of the week, month and season) allowing the utility to track energy usage over time as well as for billing purposes potentially including one or more tariffs

**Value Control Identifier (VCI):** identifier to indicate which entity has primary control over the value of a particular field including, for example, whether it is a fixed value, or that its value can be configured in the OSGP device

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

| | |
|---|---|
| ABO | Alarm read/Big read/One-time-read |
| AC | Alternating Current |
| ADC | Analog to Digital Conversion |
| ADD | Automated Device Discovery |
| AES | Advanced Encryption Standard |
| ANSI | American National Standards Institute |
| APDU | Application Protocol Data Unit |
| ASCII | American Standard Code for Information Interchange |

ATM Automated Topology Management
BCD Binary Code Decimal
BEK Base Encryption Key
BIDN Billing Interface Definition Number
BIT BInary digiT
BO Big read/One-time-read
BOOL BOOLean
BP Basic Procedure

NOTE: Same as ANSI C12.19/IEEE Std 1377/MC12.19 [5] Standard Procedure.

BPSK Binary Phase Shift Keyed
BRKI BReaK Interrupt
BS British Standard
BSN Broadcast Sequence Number
BT Basic Table

NOTE: Same as ANSI C12.19/IEEE Std 1377/MC12.19 [5] Standard Table.

CAUT CAUTion
CBA L3L2L1 Phase Rotation
CCM Counter with CBC-MAC
CECB Currently Executing Code Bank
CI Control Info
CMAC Cipher-based Message Authentication Code
CRC Cyclic Redundancy Check
CRC/ID Cyclic Redundancy Check/IDentification
CT Current Transformer
CT/VT Current Transformer/Voltage Transformer
DC Data Concentrator
DCM Data Concentrator/Meter
DCX Data Concentrator
DD Discovery Domain
DDM Delta Data Monitor
DIN Deutsche Industry Norm
DP Decimal Point
DR Demand Reset
DRH Data Record Header
DST Daylight Saving Time
ECMX Energy Communications Management eXchange
EEPROM Electrically Erasable Programmable Read-Only Memory
EL Event Log
ELON EcheLON
EMC Electro-Magnetic Compatibility
EN European Norm
EOI End Of Interval
EP Extended Procedure

NOTE: Same as ANSI C12.19/IEEE Std 1377/MC12.19 [5] Manufacturer Procedure.

ERR ERRor
ESNA Energy Services Network Association
ET Extended Table

NOTE: Same as ANSI C12.19/IEEE Std 1377/MC12.19 [5] Manufacturer Table.

FCM Fast Commission Message
FSL Fixed Section Length
FW FirmWare
GIC Group ID Count
GL Group Length
HD Host Direct
HI Host Indirect

| | |
|---|---|
| HW | HardWare |
| ICA | Interface Change Alarm |
| ICANAK | Interface Change Alarm Negative AcKnowledgement |
| ICASRC | Interface Change Alarm SouRCe |
| ICS | Interface Compatibility Settings |
| ID | IDentification |
| IDT | Interface DefiniTion |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IEM | Internal Expansion Module |
| IHD | In-Home Display |
| IO | Input/Output |
| IP | Internet Protocol |
| ISO | International Standards Organization |
| ISSS | Invalid Service Sequence State |
| ITHD | Current Total Harmonic Distortion |
| KYZ | Kilowatt Hour (KWH) pulse input |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| LLS | Log List Size |
| LP | Load Profile |
| LPO | Load Profile Options |
| LSB | Least Significant Byte |
| LSV | Load Side Voltage |
| MAC | Media Access Control |
| MB | M-Bus |
| MBR | M-Bus Billing Read |
| MC | Measurement Canada |
| MDT | M-Bus Data Type |
| MDTT | M-Bus Data Type Table |
| MEA | MEP Expansion Architecture |
| MEP | Multipurpose Expansion Port |
| MFG | ManuFacturinG |
| MP | MEP |
| MSB | Most Significant Byte |
| NA | Not Applicable |
| NAK | Negative ACKnowledgement |
| NES | Networked Energy Services |
| NI | Non-Integer |
| NID | Node IDentification |
| NIH | Node ID Hashes |
| NM | Network Management |
| NMI | Non-Maskable Interrupt |
| NTA | Netherland Technical Agreement |
| NV | Non-Volatile |
| NVM | Non-Volatile Memory |
| NVRAM | Non-Volatile Random Access Memory |
| OEM | Original Equipment Manufacturer |
| OMA | Open Media Access |
| OMAK | Open Media Access Key |
| OSGP | Open Smart Grid Protocol |
| OTR | One-Time-Read |
| PA | Phase Angle |
| PED | Pending Event Descriptor |
| PARAM | PARAMeter |
| PCBA | Printed Circuit BoArd |
| PED | Pending Event Description |
| PID | Program ID |
| PK | Provisioning Key |
| PLC | Power Line Communication |
| PQ | Power Quality |
| PROC | PROCedure identifier |

| | |
|---|---|
| PSN | Procedure Sequence Number |
| PT | Provisioning Tool |
| PXE | Pre-boot eXecution Environment |
| RAM | Random Access Memory |
| RCD | ReCorD |
| RDATE | Recurring DATE |
| RK | Read-only Key |
| RMS | Root Mean Square |
| ROM | Read-Only Memory |
| RTC | Real Time Clock |
| RX | Receive |
| SEQ | Request Sequence Number |
| SSI | Signal Strength Indicator |
| SR | Self-Read |
| SRC | SouRCe |
| SS | System Software |
| SSI | Signal Strength Indicator |
| SW | SoftWare |
| TE | Total Energy |
| THD | Total Harmonic Distortion |
| TOU | Time-Of-Use metering |
| TX | Transmit |
| UART | Universal Asynchronous Receiver/Transmitter |
| UN | Urgent and Non-urgent |
| UOM | Unit Of Measure |
| UTC | Universal Time Coordinated |
| VA | Apparent Power |
| VAR | Reactive Power |
| VATHD | Apparent Power Total Harmonic Distortion |
| VCI | Value Control Identifier |
| VDB | Variable Data Block |
| VT | Voltage Transformer |
| VTHD | Voltage Total Harmonic Distortion |
| WAN | Wide Area Network |
| XOR | eXclusive OR |
| XTAL | Crystal Oscillator |

# 4 OSGP operation overview

This clause illustrates how a data concentrator can leverage OSGP to read or write a value in an OSGP device.

In figure 1, a data concentrator issues a Table Read Request (see clause 9) targeted to a specific OSGP device, identified by its subnet/node or Unique Node ID. For a complete reference of available OSGP application primitives, including the Table Read Request see clause 9.

The Table Read Request is first sent to the optional proxy repeater layer, via the appropriate proxy source (Message 1). The proxy source is a standard BS EN 14908-1:2014 [1] node, identified by its own subnet and node ID, acting as BS EN 14908-1:2014 [1] router. The proxy source is the originator of the message and is responsible for encoding the optional proxy layer routing information into the packet. The encodings are a path of repeaters leading to the proxy agent who strips off the final path encoding and sends the packet to the final destination (the proxy target) as a standard BS EN 14908-1:2014 [1] message. The proxy source, using topology based routing tables internal to the routing layer, tunnels the read request to the appropriate next hop proxy (2a, 2b), until the Read Request reaches the designated proxy agent which will deliver the read request to the OSGP device using the OSGP protocol. Each proxy takes care of message retransmissions to the next hop.

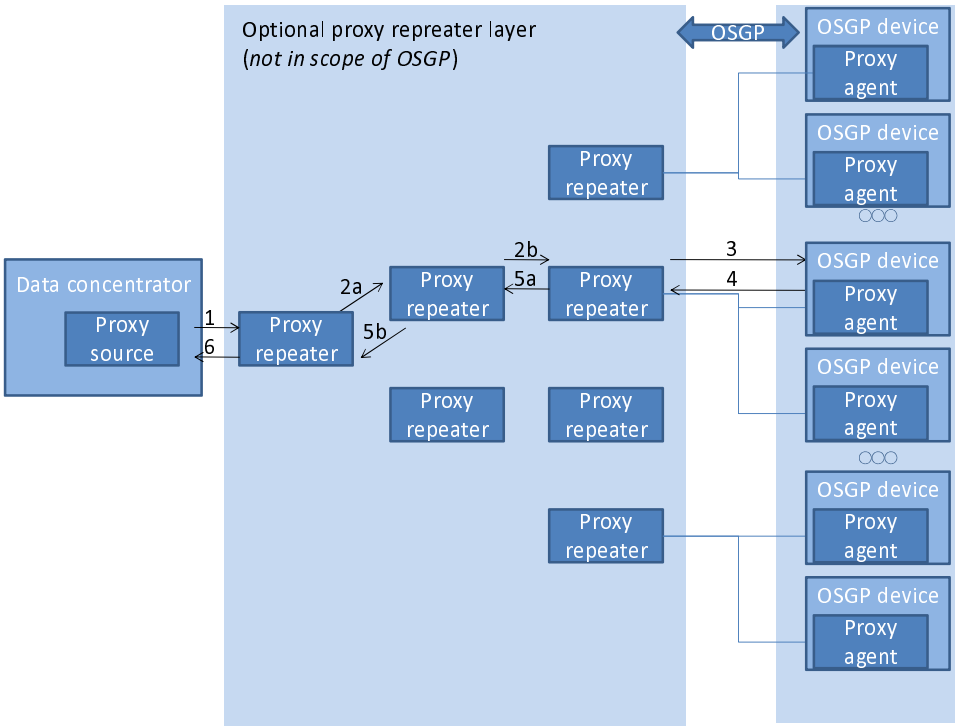


**Figure 1: OSGP operation overview**

Message 3 is delivered by the last hop proxy repeater to the OSGP device. Message 3 is a standard BS EN 14908-1:2014 [1] APDU, delivered to the target OSGP device identified by its Unique Node ID or subnet/node.

Compared to standard BS EN 14908-1:2014 [1] operation however, the OSGP protocol uses purely master/slave communications, always initiated, on any given channel, by a central point (typically the Data Concentrator). The meter may initiate a transaction only when first installed, if configured to perform DC discovery. The consequence is that all channels depicted in figure 1 are usually contention free when a single DC is used. When multiple DCs are used, the network remains contention free when using dedicated time slots for each DC, however, randomized access may also be used in which case contention may occur. OSGP deployments do not support peer to peer networking.

Note also how multicast unacknowledged communication, for instance, would be optimized by the optional proxy layer: each proxy would take care of message duplication to each next hop proxy, making it possible for the Data Concentrator to address a very large number of target OSGP devices with a single message.

OSGP resides at layer 7 (application layer) of BS EN 14908-1:2014 [1]. As such in inherits the transaction layer of BS EN 14908-1:2014 [1], the Request/response mechanism of the Session Layer.

The general structure of the BS EN 14908-1:2014 [1] application layer APDU is:

| Destin and Type (1 or 2 bytes) | Data (variable) |
|---|---|

OSGP uses type code 0x00 for ongoing operations messages, such as table reads. Type code 0x04 may also be used for backwards compatibility in some deployments. Additional message codes are defined for OSGP Automated Topology Management, which is documented in clause 5.

Here are some OSGP APDU examples:

- Request: Code: 0x00, Encrypted data: <15 bytes>

  Decrypted data: 0x30 00 03 8E 56 E4 21 D6 2F 43 91 0C 48 A3 CC

  Where: 0x30 is the OSGP command code (Full Read, see clause 9.3.1)

  0003 is the ID of the table to be read (table BT03, see annex A)

  8E 56 E4 21 is the OSGP sequence number of the request

D6 2F 43 91 0C 48 A3 CC is the OSGP digest (see annex E)

- Response : Code: 0x00, Encrypted data: <19 bytes>

  Decrypted data: 0x00 00 08 00 1C 58 00 01 81 40 58 4F FE B4 2F 7E 83 5D 1E

  Where: 00 is the OSGP <OK> response code

  0008 is the octet count of the data part of the OSGP response

  1C 58 00 01 81 40 58 : is the data part of the OSGP response

  4F FE B4 2F 7E 83 5D 1E is the OSGP digest of the response

Security details are not illustrated in this clause. In a typical OSGP deployment, security may be implemented at the BS EN 14908 level, at the discretion of the implementer. However, OSGP **does not rely on** BS EN 14908-1:2014 [1] **for security** and implements its own security model at the application layer, relying on shared keys between the Data Concentrator and the OSGP device: the OMA key (OMAK) and the Base Encryption Key.

For more details on security, see clause 7.

# 5 OSGP network formation and maintenance

## 5.0 Foreword

This clause defines the manner in which the OSGP network will automatically discover and maintain OSGP device topology. This capability is known as the Automated Topology Management (ATM) feature. The ATM feature includes the following capabilities:

- Automated association of a device to a DC at installation.
- Automated re-association of a device to a new DC when the old DC no longer can reach the device due to a topology change.
- Automated identification of test points.
- Mesh network bandwidth sharing via automatic identification of transmission slots.

In the following APDU definitions, all multiple word items are big endian.

## 5.1 Discovery Protocol

The basic mechanism used to make device associations is a discovery mechanism called Automated Device Discovery (ADD). ADD allows the DC to discover any device supporting ADD, including other DCs. The discovery can be made through repeaters whether or not those repeaters are not commissioned, commissioned in the DC's domain or commissioned in some other domain. They only need to be in a global discovery domain.

## 5.2 Discovery Domain

ATM ADD defines a global discovery domain (DD) using the following BS EN 14908-1:2014 [1] 6-byte domain: (0x7A3340F1BCD2). All devices will always be configured in the DD. The DD is configured as a Clone domain so that subnet/node conflicts are not an issue.

The key for the DD is the upper bytes of the OMA key (see clause 7). Each device will be capable of sending or receiving ADD messages on the DD.

## 5.3 ADD Proxy Message

Each ATM ADD message has a header that allows the message to be sent through repeaters, even if those repeaters are not commissioned. This allows a DC to discover devices without first commissioning intervening devices. As such, all addressing is based on physical (Unique Node ID and broadcast) addressing. Each message contains a repeat chain of Unique Node IDs. The entire repeat chain is passed all the way out and back so that no transaction tracking is required in the repeaters. This protocol does not support challenge BS EN 14908-1:2014 [1] authentication.

An ATM message contains N addresses, one for each device involved. So, a request from A through B to C will have 3 addresses. M is the instance in the address list for whom the message is intended. The message header is as follows:

- BS EN 14908-1:2014 [1] message code: 0x45 (outbound) or 0x4A (inbound).
- Address position (1 byte): The first 4 bits encode the position of the destination address in the list, while the last 4 bits encode the number of addresses in the list.
- Address list (N × 6 bytes): Unique Node ID list (all zeroes means broadcast). List includes initiator.
- Path mask ((N - 2)/8 + 1 bytes): One bit per hop (1 ≥ alt path).
- Transaction number (1 byte): Transaction number.
- Packet Cycle Width (1 byte): Cycle width (ms/10) (outbound broadcast only).
- Packet Cycle Count (1 byte): Number of cycles to randomize over (outbound broadcast only).

Note that the Packet Cycle Count is limited to the range of 0 to 127.

Forwarding rules:

- If M > N, the message is illegal and the message is discarded. The device then writes its NID into the address position indicated by M (for benefit of broadcasts).
- Then, if M == N (outbound)/M == 1 (inbound), then the message is for this device and the message data following the proxy header is processed as a normal BS EN 14908-1:2014 [1] APDU.
- If M < N, then M is incremented (outbound)/decremented (inbound) and the message is relayed on to address M. The transaction number is only meaningful to the DC.
- When receiving the last outbound message or the first inbound message (M == N-1), the device will read the signal strength indicator (SSI) corresponding to that message and append it to the APDU. These two SSI values are referred to as <SSIo> and <SSIi> respectively.

## 5.4 ATM Query ID

The ATM Query ID message is always sent using the ATM ADD mechanism, i.e. as payload preceded by the ADD header. This minimizes the different scenarios to one and it provides the target with the DC NID and the DC with the target NID.

The format of the ATM Query ID is as follows:

- BS EN 14908-1:2014 [1] message code: 0x49.
- Session# (1 byte).
- Unique Node ID hash lo (1 byte).
- Unique Node ID hash hi (1 byte).
- Min Comm Outage (2 bytes): Minimum minutes for flag 0x02 and 0x40.
- Flags (1 byte): [See option flags above].

NOTE 1: BS EN 14908-1:2014 [1] and Echelon LonTalk® define a query ID message and Respond to query message. The ATM query ID and ATM Respond to Query are different messages, defined at application level.

A device responds if it meets the following criteria of the request:

1) A matching Unique Node ID range. This criterion is a range of 8 bit Unique Node ID hashes (NIH), NIHlo through NIHhi. An NIH is the sum of all 6 bytes of the Unique Node ID. This can be used to limit the number of devices that respond to a request. Typically, a query ID would be done over a small range.

2) ATM Query ID responses are enabled, or the ATM Query ID message has the ignore disable option flag (0x01). A device can be disabled from sending query ID responses for a particular query session by request from the initiator. The device will not respond if it has received a "Respond To Query"/off message (with no subsequent /on message) for the current DC/session, unless the incoming ATM Query ID message has the ignore disable option flag. The device shall be able to keep up to 8 such DC/session pairs. For each session the device will keep a flag indicating whether to respond to additional queries and it will also store a repeat chain quality value for use in Query ID responses. This information should only be retained for 48 hours.

3) Out of communication option (0x02). A device only responds if it is out of communication. A device is out of communication if it has not received an application level message from the DC in N minutes.

4) Test Point option (0x04). A device only responds if it is a test point (more on this below).

5) Respond if commissioned option (0x08). A device responds only if it is commissioned.

6) Respond if not commissioned (0x10). A device responds only if it is not commissioned.

7) Respond only if principal DC (0x20). A device responds only if it is principal DC.

8) Indirect DC option (0x40). Only OSGP devices that have heard from a DC (securely or otherwise) in the last N minutes respond.

NOTE 2: Option value 0x20 is reserved.

The response to this message contains:

1) the Program ID (PID) of the device.

2) the best repeat chain quality value including the owning DC. A repeat chain with the smallest number of hops is the best quality. If there are two with the same number of hops to different DCs then the DC with the best signal strength is the tie-breaker. See clause 5.6.

An example of the timing of sending of the response is as follows. Assume the Packet cycle width is 20 (20 ms × 10 ms) and the Cycle count is 4. This means that the device would pick a random number in the range of 0 to 3 and multiply that number times 200 milliseconds. That would be the time to wait before sending the response.

The format of the ATM Query ID response is as follows:

- BS EN 14908-1:2014 [1] message code: 0x48.
- Program ID (8 bytes).
- Best DC NID (6 bytes).
- Chain Quality (2 bytes).

Note that the DC NID returned is that of the DC with the best chain quality (fewest hops or best signal strength/margin in the event of a tie, see clause 5.6) excluding the DC that is querying. This allows the querying DC to see if any other DC can reach it even if it is the DC with the best chain quality.

## 5.5 ATM Respond to Query

Tells a device to respond or not respond further to ATM Query ID messages for a given session. Also, this message will give the device a repeat chain quality value to store for this DC. It is sufficient for the end device to store only the Unique Node ID and quality value for the DC with the best quality. The repeat chain quality information is based on the number of hops and signal strength.

The format of the ATM Respond to Query message is as follows:

- BS EN 14908-1:2014 [1] message code: 0x47.
- Session# (1 byte).
- On/off (1 byte): 0 ≥ off; 1 ≥ on.
- Chain Quality (2 bytes): see above.

The format of the ATM Respond to Query response message is as follows:

- BS EN 14908-1:2014 [1] message code: 0x46.

## 5.6 Signal Strength Values

SSI is a single byte and has the following format:

- Margin value (bit 4..7).
- Signal strength as encoded by transceiver, divided by 2 (bit 1..3).
- One and only one bit (bit 0).

Chain Quality is a two byte value and has the following format:

- Hop count (1 byte): number of hops from the DC to the device.
- SSI (1 byte): reflects the worst of the outbound and inbound SSI values.

## 5.7 Examples

Assume the following Unique Node IDs:

- DC: N1.
- OSGP Device 1: N2.
- OSGP Device 2: N3.
- OSGP Device 3: N4.

The following APDUs would be used to send a request to Device 3 and have a response returned to the DC (values are in hex) using transaction number 01 and a path mask of 2 indicating that the second hop uses the alternate frequency:

1) <N1> -> <N2>: 45 24 <N1> <N2> <N3> <N4> 02 01 <Request>
2) <N2> -> <N3>: 45 34 <N1> <N2> <N3> <N4> 02 01 <Request>
3) <N3> -> <N4>: 45 44 <N1> <N2> <N3> <N4> 02 01 <Request>
4) <N4> -> <N3>: 4A 34 <N1> <N2> <N3> <N4> 02 01 <Response> <SSIo>
5) <N3> -> <N2>: 4A 24 <N1> <N2> <N3> <N4> 02 01 <Response> <SSIo> <SSIi>
6) <N2> -> <N1>: 4A 14 <N1> <N2> <N3> <N4> 02 01 <Response> <SSIo> <SSIi>

The following APDUs would be used to send a broadcast via Device 2 that is responded to by Device 3:

1) <N1> -> <N2>: 45 24 <N1> <N2> <N3> 00 00 00 00 00 00 02 01 20 04 <Request>
2) <N2> -> <N3>: 45 34 <N1> <N2> <N3> 00 00 00 00 00 00 02 01 20 04 <Request>
3) <N3> -> broadcast: 45 44 <N1> <N2> <N3> 00 00 00 00 00 00 02 01 20 04 <Request>
4) <N4> -> <N3>: 4A 34 <N1> <N2> <N3> <N4> 02 01 <Response> <SSIo>
5) <N3> -> <N2>: 4A 24 <N1> <N2> <N3> <N4> 02 01 <Response> <SSIo> <SSIi>
6) <N2> -> <N1>: 4A 14 <N1> <N2> <N3> <N4> 02 01 <Response> <SSIo> <SSIi>

# 5.8 Fast Commission Message (FCM)

## 5.8.1 Overview

Because of the number of individual PLC messages that are required to commission an OSGP device there is a lot of PLC traffic involved to achieve a single function: Commissioning of a meter. This clause describes an enhancement to the way OSGP devices can be commissioned through the use of a single message. This message is directed to the OSGP device, which is responsible to break up the individual components of the message into configuration messages.

## 5.8.2 FCM message and response description

The FCM uses a specific BS EN 14908-1:2014 [1] type code (0x05). The FCM message is always encrypted and authenticated using the meter's current or original OMAK key - both are accepted.

**Table 1**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| **<code>** | UINT8 | 0x05 | BS EN 14908-1:2014 [1] type code |
| <FCM> | LtFCM | | Fast Commission Message Structure |
| EN14908 sequence no. | UINT32 | | Big-endian |
| EN14908 Digest | Array[8] of UINT8 | | |

FCM message structure, expressed as a little-endian byte packed structure:

```
typedef struct {
    union
    {
        UInt8 Byte;                 // typically 00 for initial commission
        struct
        {
            // 0:FCM is rejected if OSGP device is not configured and authenticated
            // 1:FCM is always accepted
            UInt8 FCMAcceptance   : 1;   // LS bit


            UInt8 spares          : 7;   // MS bit
        } Bfld;
    } FcmFlags;
    struct
    {
        UInt8 NonGroupRXTimer     : 4;
        UInt8 DomainLength           : 2;
        UInt8 spares              : 2;
    } FcmHead;
    UInt8 DomainId[6];
    UInt8 Subnet;
    struct
    {
        UInt8 Node                : 7;
        UInt8 unused                 : 1;
```

```
    } NodeId;
    UInt8 DomainKey[12];
    UInt32 BroadcastSeqBase;     // Set to ET04
    UInt16 BroadcastSeqDelta;       // Set to ET04
    UInt8 CompatibilitySet[8];
} LtFCM;
```

**FCM response:**

The FCM will return a response similar to that of a standard OSGP request (see clause 9), which includes a response code (see clause 9.9) and a FCM response structure.

**Table 2**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| **<code>** | UINT8 | 0x05 | BS EN 14908-1:2014 [1] message type |
| <OSGP Response code> | UINT8 | | See clause 9 |
| <FCM Response> | LtFCMResp | | FCM Response |
| EN14908 Digest | Array[8] of UINT8 | | |

FCM Response Structure, expressed as a little-endian byte packed structure:

```
typedef struct {
    UInt8 ProgramId[8];      // from ET03
    UInt8 InactivePhases;    // from ET04
    UInt8 MepOccupancy;      // from ET14
    UInt8 TestPointFlags;    // from ET04
    UInt8 MT29Length;
    UInt8 MT29Record[68];    // from ET29, actual length: <MT29Length>
} LtFCMResp;
```

The field <LtFCMResp.MT29Length> will be up to 68 bytes in length. A value greater that 68 indicates that additional ET29 reads are needed.

Once the FCM message is received and validated the various components in the FCM message are applied by the OSGP device, which involves updating ET04, updating the EN14908 domain ID and node values.

Once complete, the <LtFCMResp> message is constructed as a response and sent.

Failure Responses: OSGP devices which do not support FCM will respond to the FCM with a EN14908 application code value of 0x3E.

If the <LtFCM. FcmFlags.FCMAcceptance> flag is 0, and the meter is not configured and authenticated, then the ISSS response is sent (see clause 9.9).

**Table 3**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <code> | UINT8 | 0x05 | BS EN 14908-1:2014 [1] application code |
| <OSGP Response code> | UINT8 | 0x0A | ISSS (see clause 9.9) |
| EN14908 Digest | Array[8] of UINT8 | | |

# 6 OSGP Device data representation

## 6.1 General overview

OSGP uses a representation oriented model of a smart-grid device.

The device data structures are presented and used in tabular form, and include binary encoded information elements. This data representation has been selected for its efficiency in terms of NVM requirements, as well as compactness for network data transfers. Data tables are also particularly adapted to the storage of measurement samples.

OSGP proxy agents and Data concentrators interact with the OSGP device by means of primitives enabling manipulation of the data tables, or by means of procedures which may impact various aspects of the OSGP device data representation: these services are presented in clause 9. Other systems may also interact with the data representation of the OSGP device, e.g. by means of optical ports, but these other interaction models are out of scope of OSGP.

Annexes A, B, C and D list and define the OSGP device data representation and interaction procedures.

Clause 6.2 provide definitions for the data types used in annexes A, B, C and D.

Clause 6.3 lists the value control identifier codes, which are used to specify the entity having control of the table values.

Clauses 6.5, 6.6 and 6.7 provide additional table naming conventions found in the basic and extended tables and procedures described in annexes A, B, C and D.

## 6.2 Data Types

This clause provides definitions for the data types used in the Application Layer protocol and referenced in the table definitions.

NOTE: All multiple-byte fields, such as UINT16, INT32, and FLOAT (excluding arrays) are ordered least significant byte (LSB) first.

**Table 4: Data Types**

| Type | Data Type Definition |
|---|---|
| INTx (x= 8, 16, 24, 32, 40, 48) | 8, 16, 24, 32, 40 or 48 bit signed integer, binary signed two's complement |
| UINTx (x= 8, 16, 32) | 8, 16, 32 bit unsigned integer |
| FILLx (x= 8, 16, 32) | 8, 16 or 32 bits of zeroes used as a space holder or filler |
| INT(x..y) | Signed integer not bounded by an 8 bit boundary. Starting bit position = x and ending bit position = y |
| UINT(x..y) | Unsigned integer not bounded by an 8 bit boundary. Starting bit position = x and ending bit position = y |
| BOOL(x) | A single bit variable (FALSE = 0, TRUE = 1) |
| SET(x) | A collection of 8x BOOL |
| FILL(x..y) | y-x+1 bits of zeros used as a space holder or filler |
| ARRAY[x] of Data Type | A contiguous block of the defined data type. Array indices are always zero-based |
| NI_FMAT1 | Non-integer format 1, defined to be INT32 for this OSGP device, as stated in Basic Table 00 (BT00) |
| NI_FMAT2 | Non-integer format 2, defined to be INT32 for this OSGP device, as stated in Basic Table 00 (BT00) |
| TIME | A structure of 3 - UINT8 fields where:<br>byte 0 = hour<br>byte 1 = minute<br>byte 2 = second |
| LTIME_DATE | A structure of 6 - UINT8 fields where:<br>byte 0 = 2-digit year (02 = 2002)<br>byte 1 = month (01 = January, 02 = February, etc.)<br>byte 2 = day<br>byte 3 = hour<br>byte 4 = minute<br>byte 5 = second |
| STIME_DATE | A structure of 5 - UINT8 fields where:<br>byte 0 = 2-digit year<br>byte 1 = month<br>byte 2 = day<br>byte 3 = hour<br>byte 4 = minute |
| PED | Pending Event Description, see BT04 |

| Type | Data Type Definition |
|---|---|
| RDATE | A structure defining a recurrent date that can be yearly, monthly, weekly, or daily.<br>Bit field of UINT16, where:<br>MONTH = UINT(0..3);<br>IF MONTH IS:<br>1..13: OFFSET = UINT(4..7);<br>WEEKDAY = UINT(8..10);<br>DAY = UINT(11..15);<br>14: FILLER1 = FILL(4..7);<br>WEEKDAY = UINT(8..10);<br>FILLER2 = FILL(11..15);<br>15: PERIOD = UINT(4..9);<br>DELTA = UINT(10..15);<br><br>**Identifier Value Definition**<br>MONTH 0 = Unassigned<br>1..12 = Month of year<br>13 = Action is repeated monthly<br>14 = Action is repeated weekly<br>15 = Action is repeated each PERIOD plus DELTA<br>OFFSET<br>0 = No offset<br>1 = Advance to WEEKDAY before MONTH, DAY entered<br>2 = Postpone to the first WEEKDAY on or after MONTH, DAY entered<br>3 = Postpone to the second WEEKDAY on or after MONTH, DAY entered<br>4 = Postpone to the third WEEKDAY on or after MONTH, DAY entered<br>5 = Postpone to the fourth WEEKDAY on or after MONTH, DAY entered<br>6 = Postpone to the last WEEKDAY of the MONTH on or after DAY entered<br>7 = Observe on MONTH, DAY entered as well as day following MONTH, DAY entered<br>8 = Postpone to Monday if Sunday<br>9 = Advance to Friday if Sunday<br>10 = Postpone to Monday if Saturday<br>11 = Advance to Friday if Saturday<br>12 = Postpone to Monday if Sunday or Saturday<br>13 = Advance to Friday if Sunday or Saturday<br>14 = Postpone to Monday if Sunday, advance to Friday if Saturday<br>15 = Do not observe MONTH, DAY entered. Observe on day following MONTH, DAY entered<br>WEEKDAY<br>0..6 = Sunday to Saturday<br>7 = Unassigned<br>DAY<br>0 = Invalid<br>1..31 = Day of the month<br>PERIOD<br>0..63 = This setting, along with DELTA, is used to schedule daily activities<br>DELTA<br>0..63 = This setting, along with PERIOD, is used to schedule daily activities |

## 6.3 Pending tables

Pending tables provide a way to synchronize configuration changes in multiple OSGP devices to a single moment in time. As a typical use case a utility may want to enact a new time-of-use calendar in all the meters in a particular region at precisely the same time, marking midnight of a new year or the day when a new law goes into effect. Given the unpredictability of power-line communications in terms of precise delivery time to all meters in the network, it is desirable to be able to download the new calendar to the meters well in advance to ensure the information gets there ahead of when it is needed but with an activation time in the future at which all meters will enact the new calendar simultaneously.

This "pending" new calendar sits in a reserved area of memory with a trigger date/time that is checked continuously. At the activation time, the pending calendar is transferred into the active calendar memory space and begins to take effect.

Only a few of the OSGP device tables have corresponding pending tables. These are BT4150, ET4143 and ET6204.

## 6.4 Value Control Identifiers (VCI)

The VCI (Value Control Identifier) table column in the annexes show which entity has primary control over the value. The definitions for the VCI column are:

- F = Fixed value.
- M = OSGP Device controls value. OSGP agents should not attempt to write, or do not have write access to this field.
- HD = Host Direct. OSPG agents can change values in tables marked HD via direct table writes.
- HI = Host Indirect. OSGP agents can change values in tables marked HI via a corresponding pending table

EXAMPLE: Measurement registers and statuses.

- H = OSGP agent or OSGP device reading/configuration software controls value. For example, configuration and customer identifiers.
- P = Program ID. These fields are fixed for a given program ID, but may change in the future due to a technology change, for example. It is recommended that all fields marked with this identifier on every communication with the OSGP device be read.

## 6.5 Value

This field specifies the hard-coded value for fields marked "F" or the non-zero value in effect when the OSGP device is shipped. Fields with no value identified here are initialized to 0, but may have been be changed with provisioning.

## 6.6 Register Naming Convention

Throughout the present document, the per-phase measurement registers are denoted as follows:

- A = Line 1 (for example 'A' Sag events).
- B = Line 2 (for example Phase 'B' Loss).
- C = Line 3 (for example RMS Current 'C').
- ABC = All phases in a polyphase OSGP device (for example Fwd Active Wh ABC).

## 6.7 Table and Procedure Naming Conventions

The following defines the letters preceding the table or procedure numbers in the present document. This naming convention is used in titles, and in references to tables/procedures in formulas and descriptions:

- BT = Basic Table. For example, BT00, BT01, etc.
- ET = Extended Table. For example, ET01, ET03, etc.
- BP = Basic Procedure. For example, BP05, BP06, etc.
- EP = Extended Procedure. For example, EP04, EP05, etc.

The meaning of a formula value, such as BT61.11, is Basic Table 61, offset 11. The meaning of a formula value, such as BT03.4.4, is Basic Table 3, offset 4, bit 4.

When performing a read or write for an Extended Table or procedure (see clause 9), the ID field is configured as 2 048 plus the Basic Table number.

EXAMPLE 1: To write to ET03, use the number 2 051 in the table ID field (2 048 + 3 = 2 051).

To execute EP04, issue a full write request to BT07 with the procedure ID of 2 052 (2 048 + 4 = 2 052). This number is included in each table or procedure heading in the present document. No offset is applied to the table ID field for Basic Tables (i.e. the table ID field for BT54 would be 54).

NOTE 1: When writing or reading a pending table, there is an additional offset of 4 096 applied to the table or procedure number.

EXAMPLE 2: Pending table BT54 is numbered (4 096 + 54 = 4 150), and pending table ET47 is numbered (4 096 + 2 048 + 47 = 6 191).

NOTE 2: Occasionally, references to OSGP device tables in the present document will contain an appended offset value to indicate that the reference is to a specific field in that table: the field located at that offset value.

EXAMPLE 3: "BT21.6" refers to the "Number of Occurrences" field in BT21, as that field is located at offset 6 of BT21.

## 6.8 Interface Change Alarm (ICA NAK)

Modifying some OSGP device data tables or calling some OSGP device procedures described in the present document may cause the OSGP device data representation to change. In this case, the dimensions of some OSGP device tables may change and the Interface Change Alarm in BT03 shall be logged. In addition, the Interface Definition Table (ET42) shall be updated to reflect the new state of affected device tables.

Attempts to read or write some OSGP device data tables shall be blocked until the alarm has been cleared. The clearing of the alarm signifies that the system acknowledges and understands the interface change and is ready to process data in the new representation. Tables affected by the Interface Change Alarm in this manner are marked with the ICA NAK attribute throughout the present document. Tables and procedures that may cause the Interface Change Alarm to be triggered are marked with the ICASRC attribute throughout the present document.

# 7 Security

## 7.0 Foreword

Measures are included to protect the privacy of consumers by restricting access to data and encrypting such data to prevent access by other than authorized bodies. Measures are also included to detect attempts to circumvent metering functions such as might result in unrecorded access to utility services.

The BS EN 14908-1:2014 [1] session layer provides authentication services. However, it does not provide data confidentiality services. OSGP complements the security framework defined in BS EN 14908-1:2014 [1] by its own application layer security, which provides authentication and confidentiality services at application layer.

The initial security suite standardized in OSGP is called OSGP-RC4-PSK. The OSGP-RC4-PSK suite provides a secure, mutually authenticated, two-way communication channel between a DC and a meter. The secure channel provides data confidentiality, integrity, authentication, and replay protection. A single key (OMAK) is shared between the Data Concentrator, and is used for both broadcast messages and unicast messages.

## 7.1 OMA Key (OMAK)

During the manufacturing process, OSGP devices are configured with a unique 96-bit OMA key. These keys are transmitted securely to the utility so they can be used by Data Concentrators. The original device-specific OMAK typically gets replaced by a shared OMAK by the Data Concentrator after is has discovered the new OSGP device using ATM (see clause 5), using BS EN 14908-1:2014 [1] 'increment key' network management message or FCM message.

The OMAK is used by BS EN 14908-1:2014 [1] authentication for the Phase Measurement message. It is also used for OSGP messages when used with the OSGP-RC4-PSK security suite.

The OMAK is used:

- By BS EN 14908-1:2014 [1] authentication for some messages (see clause 7.2).

- By application level OSGP authentication (see clause 7.2) as an input key of the digest algorithm of annex E.
- By application level OSGP encryption: a 128 bit Base Encryption Key (BEK) is first derived from the OMAK then XOR combined with the application level OSGP digest. The OSGP transaction (message APDU and response APDU) is encrypted using the RC4 algorithm with the resulting shared 128 bit key, as specified in clause 7.3.

## 7.2 OSGP-RC4-PSK Authentication

The OSGP data concentrator uses application level digest authentication to authenticate application level messages with the devices. This form of authentication requires half the packets that native BS EN 14908-1:2014 [1] authentication requires (no challenge). To avoid replay attacks, a sequence number is appended to the payload and digested. To avoid misdirection attacks, the subnet/node address of the device is factored into the digest.

Assuming the device expects a sequence number of N, a device rejects any message that does not have a sequence number of N-1 to N+M where M is 8. When a request with sequence number N-1 is received, the response originally sent, if any, for N-1 is resent. When the device first comes up it picks a starting sequence number at random. If the sequence number received in a request is out of range, the device will NAK the request with a reason of "invalid sequence number" and the response will be followed by the desired sequence number. It is up to the data concentrator at that point to begin using the new sequence number.

Requests have the following format (see also clause 4 for examples):

| | | |
|---|---|---|
| Request | Sequence (4 bytes) | Digest (8 bytes) |

The digest is computed over the following data using the digest algorithm included in annex E, using the 96 bit OMA key.

| | | | |
|---|---|---|---|
| Subnet (1 byte) | Node (1 byte) | Request | Sequence |

Responses have the following format:

| | |
|---|---|
| Response | Digest (8 bytes) |

The digest is computed over the following data:

| | | | | | |
|---|---|---|---|---|---|
| Subnet (1 byte) | Node (1 byte) | Request | Sequence | Response | Response Length (1 byte) |

Note for backward compatibility, devices that do not have bit 6 of the fifth byte of their program IDs set are assumed to not include the "Response Length" in the digest. For example, a device with program ID of 9000011583050F00 would not include the response length whereas one with a program ID of 90000115C3050F00 would include it.

Note that even NAK responses such as "invalid sequence number" are secured in this way.

The OSGP device can send the following types of NAKs (for a complete list, refer to clause 9.9):

- "Subnet" and "Node" in the above diagrams always refer to the subnet/node of the request target. That is, it is the same address in both directions. "Request" and "Sequence" always refer to the values in the original request message.

It is assumed that the device can retain its sequence number across power cycles or provide strong random number generation across power cycles. The data concentrator will not retain the device sequence numbers across its own power cycle. Thus, the first authenticated message after power up will require an extra exchange.

All critical device data is protected by OSGP application level digest authentication for both read and write operations. This includes:

- OSGP device configuration
- OSGP billing data and load profiles

- Load shed requests
- Time setting

The following are protected via BS EN 14908-1:2014 [1] challenge authentication. This authentication verification is the responsibility of the BS EN 14908-1:2014 [1] interface, and not of the OSGP device:

- BS EN 14908-1:2014 [1] logical addressing
- Authentication key modification
- Phase measurement
- Compatibility setting
- Node mode change
- Read/write memory

The following are not protected by authentication:

- BS EN 14908-1:2014 [1] status query
- Signal strength measurements

## 7.3 OSGP-RC4-PSK Encryption

The data concentrator shall support encryption of some application layer messages sent between utility meters and the data concentrators using the stream cipher RC4. It shall discover whether a device requires encryption at the end of commissioning and at the switchover stage of a download.

The Base Encryption Key (BEK) used by the data concentrator and OSGP device is derived from the OMA key (OMAK) by using the BS EN 14908-1:2014 [1] authentication encryption algorithm with the current OMA key to encrypt the following 64 bit data patterns:

- 81 3F 52 9A 7B E3 89 BA
- 72 B0 91 8D 44 05 AA 57

The encrypted results are concatenated to form the 128-bit PLC encryption key.

To ensure uniqueness of ciphertext, the request digest is XORed with the first 8 bytes of the BEK to build a key sequence. The key sequence is re-initialized for each request. The response is treated as part of the same RC4 stream as the request.

The encryption of frames uses RC4 stream cipher occurs by encrypting only the data after the BS EN 14908-1:2014 [1] message code and prior to the digest. Only frames with a message code of 0 or 4 (OSGP ongoing operations frame) are encrypted. An "invalid digest" response is never encrypted.

## 7.4 OSGP-AES-128-PSK Security Suite

As of this publication, OSGP supports two security suites: OSGP-RC4-PSK, which is the original suite used in OSGP v1, and OSGP-AES-128-PSK, which has been subsequently proposed. While both suites are supported by the meters, it is recommended that OSGP-AES-128-PSK be used.

The OSGP-AES-128-PSK security suite provides a secure, mutually authenticated, two-way communication channel between a DC and a meter. The secure channel provides data confidentiality, integrity, authentication, and replay protection and can be used for both broadcast messages and unicast messages.

This suite uses 128-bit pre-shared keys, AES-128 in CCM mode for authenticated encryption, and CMAC for authentication. The suite introduces significant changes to key management, unicast and broadcast messages, and commissioning when compared with OSGP-RC4-PSK, while maintaining compatibility and coexistence of the two suites. Full specification of the OSGP-AES-128-PSK suite will be provided in the future.

## 7.5 Hardware Lock

In addition to the OMAK key and other security features provided by OSGP-AES-128-PSK and OSGP-RC4-PSK, the OSGP device may employ a hardware-integrated security mechanism that supersedes the key access permissions. The hardware locks may be table and procedure specific, and may apply only to certain tables (or parts of tables) and procedures in the OSGP device. It may restrict write and read operations, as well as the execution of procedures. Attempts to access tables and procedures restricted by the hardware lock will result in the error message "Insufficient Security Clearance", despite OSGP level keys indicating the proper level of security clearance. The tables and procedures that may be restricted by the hardware lock are documented as such in the table/procedure listings in the present document. Note that the hardware lock settings, if any, may be different in different OSGP devices.

# 8 Device Functional Description for the case the OSGP device is an electric power metering device

## 8.1 General

Clauses 8.1 to 8.19 provide an overview of the primary functional areas of the device, and describe which tables and procedures should be used when configuring each functional area. This includes a number of which are at the manufacturer's or, where implemented by the device manufacturer, at the OSGP network operator's discretion. Where an optional function is implemented, it shall comply with the relevant clauses of the present document.

## 8.2 Time-Of Use Calendar (Optional)

### 8.2.0 Foreword

Time-Of-Use (TOU) is the term used to describe the partitioning of energy usage into different registers based on a schedule. The device may support up to four such registers, called tariffs (T1, T2, T3 and T4). The tariffs may be selected for different time periods within a day (midnight to midnight - local time). The time at which a tariff is changed is called a tier switch. Each 24-hour set of tier switches is called a day schedule. There may be different day schedules for weekdays, Saturday, Sunday, and holidays. Each year is identical with regard to season changes, holidays, and daylight saving time scheduling. This is called a perpetual calendar implementation. All measured energy values shall be stored as totals into the tariff registers based on the TOU schedule.

The available options of the perpetual TOU calendar are:

- Day schedules (per season):
  - 1 weekday schedule
  - 1 Saturday schedule
  - 1 Sunday schedule
  - 2 holiday schedules
- 4 seasons with programmable start dates
- 15 holidays per year
- 1 independent Self-read schedule per year
- 10 tier switches per day

1 date for DST on, 1 date for DST off, with programmable time and minutes adjustment. DST on and off can be set to occur at different times of the day.

The device, if it is a power OSGP device, shall store the following values, for each tariff:

- Active energy, forward and reverse.
- Active energy, forward + reverse.
- Active energy, forward - reverse.
- Reactive energy, import and export.

The calendar shall be programmed in BT53 and BT54. Invalid entries in BT54, such as activation of a season greater than 3, shall be ignored. If no seasons are programmed, the default active season shall be season 1. The results of all these assessments are reported in BT55, with some duplication in BT52.

### 8.2.1 Manual Override Options (optional)

The device may support the ability to override the currently active tariff and switch to another (user-specified) tariff manually. The tariff change can be configured to happen immediately as soon as the manual override occurs, or at a scheduled date/time at some point after the manual override is performed.

The tariff change caused by a manual overrides is cancelled when any of the following events occur:

- Another manual command is issued.
- The next TOU calendar-driven tariff switch occurs.
- After the interval specified for the manual override expires, or at a user-specified date/time. The duration of the manual override, or the date/time at which a manual override is to be cancelled and the standard TOU schedule is to resume, is user-configurable.

The default tariff to use in case of clock error can be selected. Any time a clock error occurs, the OSGP device will begin using this tariff until the error is corrected, at which point the OSGP device will resume using whichever tariff the TOU calendar calls for.

When manual tariff override is in effect, calendar controlled demand reset and self-read, season change are still evaluated, all BT55 fields except tariff and tariff drive are properly updated, and DST time, time zone are applied.

All combinations of activation and cancellation are supported via one or more of these configuration methods: procedure EP15, table ET47, and pending table ET47 (ET4143). EP15 can be used to enact an immediate activation with either a manual or next tier switch cancellation. Configurations written via EP15 are copied to ET47.

ET47 can be written directly to enact immediate overrides with any of the cancellation types. Pending table ET47 is used to schedule a future activation. The pending table activation can be cancelled at any time via BP14 and BP15. BT04 reflects up to two pending activations.

A clock error supersedes a manual override, so while a clock error is present, the configured clock error tier is in effect. A new activation enacted by any means while an override is in effect will immediately cancel the existing override and enact the new one. ET23 can be read to determine the presently active calendar ID.

### 8.2.2 Over Power Threshold Tariff (optional)

The Over Power Threshold Tariff can be enabled or disabled. When enabled, whenever instantaneous power exceeds a pre-set power threshold over a pre-set time threshold the active tariff is forced to a configured tariff. When this occurs, it supersedes any other tariff control including TOU tariff control, calendar override via EP15 or ET47 and clock error tariff. After the instantaneous power drops below the over power threshold, other tariff controls listed above would resume.

The instantaneous power value that is compared to the over power threshold can be chosen from forward power, forward+reverse power, or forward-reverse power. The three types of power sources are usually used to ignore generation and fraud, for fraud prevention, and for electricity generating users respectively.

When the over power threshold is exceeded for over the time threshold, an event is triggered to indicate this condition and when the power drops below the threshold, another event of the same kind will be set to indicate the condition is gone.

If power up power quality hold time is set to non-zero, every time after power up, the over power tariff control will restart. In this case after power up the tariff control would always goes back to other tier controls until the over power tier control restarts.

## 8.3 Clock Adjustment (mandatory)

### 8.3.1 Absolute Time Synch

BP10 is used to set the date and time of the device at the factory. When calling this procedure. UTC time shall be passed in as a parameter. The device will then directly overwrite the current clock and calendar setting with the input UTC time. Since adjusting the clock using BP10 may affect the Load Profile and TOU modules, it is NOT to be used during normal meter operation.

### 8.3.2 Clock Adjustment by Delta

The recommended method to modify the device's clock during normal operation is to use EP16. There are two ways to modify the device time through EP16. The first method is to send the time delta in seconds directly, which requires first reading the device clock and comparing to a reference clock. This procedure will accept the number of seconds to modify the clock (forward or reverse). The largest amount the clock may be modified by is plus or minus 600 seconds (10 minutes). The device should perform a gradual shift of the clock at the middle of every minute, by no more than 20 seconds, or the configured maximum delta increment, until the desired delta has been performed. The default 1-second per-adjustment limit ensures the clock adjustment will not affect the device's internal Load Profile and TOU schedules. The clock changes begin at the next even minute (for the first ever programmed clock change).

The second method by which to adjust the device clock via EP16 is to send the correct UTC time and the device will calculate the time delta by comparing it to the device's internal time. The same limit of plus or minus 600-second max adjustment applies. If the device calculates the delta of the input time and the device time to be greater than 600 seconds, the procedure will return an error code and not perform the adjustment.

The device issuing the EP16 command shall indicate which method is to be used.

## 8.4 Billing Functions

### 8.4.1 Self-Reads (mandatory)

"Self-read" is the term used to describe the automatic, periodic storage of measurement data to a separate area of memory that can be read for billing purposes. Self-reads provide a mechanism for all meters with the same self-read schedule to record billing data at the same time of day. An OSGP device shall be capable of performing a self-read at a predefined interval. All of the energy measurement data provided in the total and all four tier registers will be captured during a self-read event.

The TOU calendar in BT54 can be configured to perform a self-read daily, weekly, monthly, or some other period of days up to 63 days. The time of day the self-read should be performed is configured in ET04. The OSGP device holds by default 24 copies of self-read data before the oldest data is overwritten. The actual number of self-read data sets the OSGP device holds is configurable via EP06. The host system can then collect this information sometime after the OSGP device has performed the self-read action. An alarm bit will be set in BT03 whenever a new self-read has been recorded in the OSGP device. The Data Concentrator can use this to determine when new data is available, but shall clear the alarm flag upon reading the data. Whether or not the self-read data is read, the OSGP device will not interrupt the programmed schedule and old data will be overwritten with new data when the self-read is scheduled to occur.

If the OSGP device is powered down at the time a self-read was scheduled to occur, the self-read will be recorded at the subsequent power-up with the timestamp of the power-up event. If the OSGP device is powered down for more than 63 days, a self-read will be recorded on power-up, regardless if any were configured.

Additionally, a self-read can be triggered manually via EP12, which creates a new self-read record immediately. The same alarm in BT03 is triggered via manual self-read and the results are placed into BT26, overwriting the previous self-read regardless of whether that was from a manual or scheduled self-read.

The self-read information is stored in BT26, which contains a snapshot of all the registers in BT23 plus some status information.

### 8.4.2 Total Energy (optional)

The device may also store the day's consumption for all of the total energy measurements (excluding tariff registers). This storage occurs at UTC midnight and contains only the previous day's energy consumption. This snapshot of total energy may be used by a host system to determine total usage of the secondary side of a transformer. The total energy (or daily consumption), energy consumed during the previous 24 hours, is stored in ET12 and requires no configuration from the host system.

### 8.4.3 On-Demand Reads of Current Billing Register Values (mandatory)

BT23 can be read at any time to get the current billing register values. However, if BT23 is read using multiple partial reads, there is no guarantee of consistency of the data. Therefore, the transaction table (ET27) should be used to perform on-demand reads.

## 8.5 Load Profile (mandatory)

### 8.5.0 Foreword

Load profiling is the periodic storage of interval measurement(s). Load profile data and configuration can be found in BT61 "Actual Load Profile," BT62 "Load Profile Control," BT63 "Load Profile Status" and BT64 "Load Profile Data". All the pertinent configuration and dimension information required for interpreting load profile data also can be found in ET42 "Interface Definition Table". Instructions to follow when developing an application to read load profile data follow later in this clause.

Each OSGP device shall be capable of support a load profile data log that can be configured to record up to 16 different values at once. The load profile log is divided into groups of data called blocks, with a configurable number of intervals per block, as well as a configurable length of each interval.

The start time for the first load profile block shall also be configurable. Note that if the total block time (i.e. the interval duration multiplied by number of intervals per block) does not divide evenly into 24 hours or is not a integer multiple of 24 hours, then the actual start time for each subsequent block will not always match the start time for the first block. For example, with a block start time of 00:00 and a block duration of 18 hours, then the actual block start times will rotate through these times: 00:00, 18:00, 12:00, 06:00.

Up to 16 channels can be recorded on the same interval. The 16 channels are selected from the measured values, which are listed in BT16. All channels are stored as total values (no differential values). Load profile is configured via EP11 by indicating the number of channels to be logged, the interval duration, the number of intervals per block and which channels to log.

Certain status information in the load profile log is reported only once per block, including the timestamp and status of complete intervals. Other status information is contained in tables BT61, BT62, and BT63. For ease of use, all relevant geometry and status information for the present active load profile configuration is also contained in extended table ET21.

On power up the OSGP device software will determine if load profile records were missed through the power outage and will stuff missing intervals only on the power-off and power-on day. If the outage spans more than one block, the log will reflect a discontinuity in two successive blocks. Optionally, instantaneous values are stuffed with 0s and set the extended status to 4. This can be configured via controlled by ET04.71. Load profile statistics are always stuffed as zeroes except for the interval active at the time of the power down which gets the statistics in effect at that time.

Load profile data (BT64) reading can be disabled with the "Disable Optional Features" bit in ET55.

### 8.5.1 Use case: Reading Load Profile Data

To read the most recently recorded load profile data in the OSGP device, follow these steps:

1) Read and store BT61 or ET42 for the present load profile configuration, including the number of blocks (days) with available data, the number of intervals recorded in each block, the number of channels (registers) being logged, and the interval time. This information needs to be read only once per load profile reconfiguration.

2) Read and store BT62 or ET42 to note which registers (sources) have been logged. An OSGP device may be configured to log electric OSGP device data, M-Bus device data, and MEP data and all are stored in the same log. The source IDs listed in BT62 or ET42 define which data registers are logged in which load profile channels. This information needs to be read only once per load profile reconfiguration.

   If the interval source ID in BT62 is in the range of 112 to 163, this indicates it is a mapped source ID, or a key used to refer to an extended source id in ET66 "Load Profile Source ID Mapping Table". ET66 is described in more detail later in the present document.

3) Read the "Number of Valid Blocks" and "Last Block" fields in BT63 for information on where in BT64 the occupied blocks lie. Note that the "Last Block" field in BT63 is updated as soon as any single interval in the block is marked valid.

4) Read ET21 for the size of each block, the size of each interval, and the index of the most recently recorded interval. The values of parameters in ET21 change as load profile is being recorded so ET21 shall be re-read before each read of load profile data from the OSGP device.

5) To read the most recently recorded full block of load profile data, perform a partial read of BT64 with the following parameters:

   - Offset = ((BT63.3 - 1) modulo BT61.7) × ET21.8.
   - Count = BT21.8.

   To read the most recently recorded one interval of load profile data, perform a partial read of BT64 with the following parameters:

   - Offset = (BT63.3 × ET21.8) + ET21.12 + (ET21.20 × ET21.25).
   - Count = ET21.25.

   More intervals within the blocks as well as earlier recorded blocks can be read with appropriate calculations for the offset and count. Keep in mind that the load profile log is a circular buffer in the OSGP device's memory, so any calculations on offsets for earlier blocks should use modulo the number of total blocks in the load profile.

### 8.5.2 Use case: Parsing M-Bus Load Profile Data

#### 8.5.2.0 Foreword

The OSGP device load profile data can be parsed to extract and interpret M-Bus data:

- The device shall generate alerts when new M-Bus information is available for either control valve status or load profile if the "M-Bus Alerts" field in ET50 (ET50.30.2) is set to 1.
- For general information on M-Bus devices, see clause 8.18.

#### 8.5.2.1 M-Bus Data Types and ET57

The previous clause on reading load profile data describes how to determine which source IDs correspond to all the configured load profile channels. Typically, only a subset of the channels will correspond to M-Bus device data. M-Bus source IDs will all be extended source ids of the following format in ET42:

- Bits 15..12 = 4.

- Bits 11..8 = 0..4 corresponding to the ET13 index for the device to be polled for this data type.
- Bits 7..5 = Unused.
- Bits 4..0 = M-Bus Data Type (MDT) value.

An M-Bus Data Type (MDT) is a mapping of M-bus Data Record Header (DRH) definitions to simple 5-bit ordinals. These DRH definitions and mappings can be used to interpret the M-Bus load profile data that has been collected. One or more DRHs can be mapped to a single data type. Applying multiple DRHs to the same data type may be desirable, as it is possible that separate M-Bus devices will not always use the same DRH for a given type of reading. In that case, those DRHs (i.e. those that are all applicable to the same type of reading) can be applied to the same data type, and the OSGP device will act accordingly when that data type is encountered. That way, the OSGP device is able to effectively handle each type of M-Bus device. The only known case where this could occur is a OSGP device that might return temperature corrected values sometimes, and non-temperature corrected other times. A flag in the MDT mapping table is used to indicate whether temperature correction is on or off.

The MDT-to-DRH mappings are contained in ET57 "M-Bus/MEP Data Type Table". ET57 is optimized around an assumption that the typical DRH is 3 bytes or less. DRHs longer than 3 bytes are accommodated, just not as efficiently as shorter ones. Note that ET57 does not contain lengths for each DRH, because the DRH length can be deduced from the DRH itself. If a DRH is improperly formed, then either the MDT will not match (resulting in a "skipped" channel) or the MDT could match on the wrong DRH.

Each MDT entry in ET57 can be flagged as "special". Entries flagged as special are always given precedence. If the OSGP device matches on a non-special MDT but there is another entry for that MDT marked special, the OSGP device continues to search for that until it exhausted all the DRHs. This allows the load profile to record certain types of entries such as temperature corrected volume preferentially.

If the M-Bus read contains no data that matches the medium or MDT criterion, then the channel is marked as "skipped" (see the "Extended Status" field in BT64). If a match is found, then if the value is less than 4 bytes, the unused bytes are stored as zero in the load profile interval. If the value is more than 4 bytes, only the first 4 bytes are stored. The assumption here is that only Mode 1 (little-endian) is used by M-Bus devices.

Using the source ID information in ET42 and the MDT information in ET57, the user can learn where the M-Bus data is within the OSGP device's load profile and how to interpret it. Occasionally, some extra configuration and concerns arise that the user may need to be aware of. These are addressed in clauses 8.5.2.2 and 8.5.2.3.

### 8.5.2.2 Load Profile Poll Rate

The load profile poll rate is configured via ET34. This determines how often M-Bus devices will be read for load profile purposes. A value of 0 means there is no limit on the polling, and the poll rate is determined by the load profile interval duration. This is an approximation, as M-Bus reads may not occur at an exact interval and retries can vary the spacing. The reason for needing a separate poll rate for M-Bus devices (instead of using the load profile interval duration) is that reading them too frequently could be a drain on their batteries. For intervals that do not require a poll, the channel is stuffed with 0 and the extended status may be marked using a value of 4 ("Skipped") if the OSGP device is configured to use this status. Otherwise, the status is 0. Polls only occur when the number of minutes in the day modulo the poll rate is 0, or if it is the last interval of the day.

### 8.5.2.3 Time Stamping

There are two possible behaviours of the M-Bus device. One is that the device returns instantaneous values, and the other is that it returns an hourly read. In the latter case, the hourly read should be accompanied by a time stamp. If it is, then the OSGP device will check the time stamp to make sure it is current. The OSGP device will determine the time stamp definition using an MDT entry and bit offset definitions in ET34. For example, if the M-Bus device reports a time stamp in its self-read using the full date/time format, then ET57 would contain 06 6D as the DRH, the hour locator would be 17/5, and the minute locator would be 9/6. Note that if there is no time stamp in the self-read, the OSGP device will not manufacture one, even if there is a load profile source ID specifying time. The day and invalid time fields in the time stamp are ignored.

If the locator bit count is 0, then a default locator is used as follows:

- 4-byte value (hour: 9/5; minute: 1/6).
- 6-byte value (hour: 17/5; minute: 9/6).

For example, if the M-Bus device is slow and the hourly read is initiated at 9:00:00, then the M-Bus device could return an hourly read with a time stamp of 8:00:00, the same as an hour before. In this case, the OSGP device will repeat the read again every N (configurable) seconds until the time changes up to N (configurable) times. To reduce the chance of this occurring, the M-Bus device will not be read exactly on the hour but instead N (configurable) seconds after the hour. This should allow the M-Bus device to be ready for the read most of the time assuming time sync is configured for it.

If a "current" read cannot be made within the above parameters, then whatever value is last read is placed in the LP with an extended status of "not current". Note that if the OSGP device fails to respond on the last attempt, the value will be 0 and the status will be marked as 15.

### 8.5.3 Load Profile Unread Entries Alarm

An alarm defined in BT03 indicates that at least one complete unread block is available. Note that the device shall increment the unread count as soon as any valid intervals are placed into a block. The flag shall not be set until the block is complete (all intervals are set or the next block has been created, e.g. due to stuffing or other time change). This alarm shall be self-clearing. That is, the device shall clear the alarm as soon as there are no complete unread entries. Note that the unread count is decremented from oldest to newest. That is, if the unread count is 3 and there is one partial block and the unread count is decremented by 2, then that leaves the unread count at one with one partial block so the flag will clear.

## 8.6 Self-Test (Alarms, Error Codes) (optional)

The device may periodically perform self-tests and setflags to indicate when alarm conditions are detected. Self-tests will not clear any alarms if the alarm condition no longer persists. It is the responsibility of the Data Concentrator (or other mechanism e.g. optical reader) to clear the necessary alarms. BT03 contains flags for the possible alarm conditions, and ET22 defines which error codes will be shown on the display. Some self-tests are performed periodically (every second, minute, hour, daily or weekly), some self-tests are performed on power up only, while other self-tests are performed on request. BT03 documents the period at which alarms are checked.

## 8.7 Pulse Inputs (optional)

The device can collect pulse data from pulse output devices, such as gas and water meters, and transmit the collected data to the Data Concentrator. Tamper alarm monitoring for each pulse output device is also included. Pulse data collection is an optional item. Pulse input data collected from channel one and channel two will be stored in separate billing registers and incremented after a valid pulse has been detected. Both pulse count channels can be selected for load profiling. The pulse devices can be configured via ET06.

## 8.8 Power Quality (optional)

### 8.8.1 Functional Description

The device may monitor various parameters for power quality. All power quality recordings are stored in ET09 unless stated otherwise below. Power quality events can be read by the Data Concentrator, and can also be read directly from the OSGP device via the optical port. When a power quality event occurs, the status shall return to normal for at least 1 second for another power quality event to be recorded. The OSGP device provides power quality measurements for the following:

- **Voltage (RMS) dip (under voltage):** Records the number of voltage dip occurrences on any one phase. A voltage dip shall last continuously for the time set in the OSGP device Dip/Swell Duration Threshold to be recorded as an event. The threshold that determines if a voltage dip is recorded is configurable as a percentage below the factory-rated voltage. The threshold range is 1 % to 99 %. The lowest voltage that occurred during the most recent sag (after the duration threshold is met) is recorded, as well as the date and time that the lowest recorded voltage occurred.

  The user-configurable Sag/Swell Duration Threshold sets the number of seconds that a voltage sag or swell shall be sustained to be recorded as an event. A setting of 0 (zero) forces the recording of every detected event. The range is 0 seconds to 15,555 seconds.

- **Voltage (RMS) swell (over voltage):** Records the number of voltage swell occurrences on any one phase. A voltage swell shall last continuously for the time set in the OSGP device Sag/Swell Duration Threshold to be recorded as an event. The threshold that determines if a voltage swell is recorded is configurable as a percentage above the factory-rated voltage. The threshold range is 1 % to 99 %. The highest voltage that occurred during the most recent swell (after the duration threshold is met) is recorded, as well as the date and time that the highest recorded voltage occurred.

- **Over-current (RMS):** Records the number of over-current events on any one phase. The over-current condition shall last continuously for 10 seconds to be recorded as an event. The threshold that determines if an over-current condition is recorded is configurable as a percentage over reference current which defaults to the rated current of the OSGP device. The reference current is the OSGP device's maximum current by default, unless configured otherwise. The over-current analysis is designed to detect uses above a reference level or within reason above the maximum current rating of the OSGP device. It is not designed for detecting and recording instances of high amperage current surges.

- **Power outages:** Records the duration, power on date and time, and power off date/time of the last 10 long power outages, as well as a count of all short power outages. The voltage applied to the OSGP device shall be below the Power Outage Detection Threshold, and last longer than the time (in seconds) set in the user-configurable Long Power Outage Duration Threshold for a long power outage event to be recorded. The Power Outage Detection Threshold defaults to 72 % of the rated voltage (this value can be modified in factory). When the rated voltage being applied to the OSGP device drops below that value on all phases, it is considered a power outage.

  The range of the Long Power Outage Time Threshold is 0 seconds to 65 535 seconds. Power outages that are shorter than the Long Power Outage Time Threshold, but at least 250 ms (approximately), are counted as short power outages. If the Long Power Outage Duration Threshold is set to 0 (zero), then the duration and date/time of every power outage event longer than approximately 250 ms is recorded as a long power outage, with complete records for the last 10 long outages. In this case, the short outage count is never incremented.

- **Frequency:** The frequency is constantly monitored (except for the first 1 seconds to 2 seconds after power-up) and the maximum and minimum values, since last reset, are recorded along with the time of the event.

- **Phase loss:** Records the number of phase loss occurrences on any one phase as well as the date and time of the last occurrence. Voltage (RMS) drop on any phase below the internal phase loss level for a sustained duration of 10 seconds (by default) is considered a phase loss. The internal phase loss level is set to approximately 61 % of the rated voltage by default, although this figure is user-configurable via ET04.

  The duration that a phase loss shall last before it will be recorded in the event log is also user-configurable. This can be configured via ET55.

  Since this event may affect the accuracy of the OSGP device, energy accumulation is automatically reconfigured to exclude the lost phase. A phase loss error message can be shown on the display if configured by the user. Phase loss also causes a diagnostic code to be activated.

- **Total harmonic distortion (THD):** Records three types of total harmonic distortion: voltage total harmonic distortion (V-THD), current total harmonic distortion (I-THD) and apparent total harmonic distortion (VATHD). THD is a ratio of the voltage or current at harmonic frequencies to the voltage or current at the fundamental frequency for the OSGP device, expressed as a percentage.

  The OSGP device updates the THD values every 10 seconds. THD measurements can be recorded in the OSGP device event log. The duration that a THD condition shall exist for before it is recorded as a THD event in the event log and the percentage each THD level shall reach in order for it to be recorded as a THD event can be specified. The THD thresholds should be configured carefully to ensure that the event log contains only events of interest.

  If these settings have been configured (and the THD events have been enabled in the event log), the THD State Changed event will be logged whenever a THD value exceeds the specified threshold for the specified duration. Another THD State Changed event will be logged when THD falls below the threshold. Events containing the maximum THD value and the average THD value for that time period will also be logged (if they are enabled in the event log). The maximum THD value is the maximum over that period. The average THD is an average THD over that period and the period itself may vary.

  THD calculations can be performed using the standard defined in IEC 61000-4-7 [i.3], or using the RMS method. This is configurable via ET55.

# 8.9 Display (optional)

## 8.9.0 Foreword

Each device may contain display with several programmable features. A device with a display can display up to 30 numeric value items, which are chosen from data sources including the available total and tariff energy measurements, as well as time, date, and prepay energy credit remaining. The display scrolls through each item, with a programmable scroll-time for each item of 6 seconds to 15 seconds. The scroll-time is the time that the value is shown on the display before scrolling to the next item. Each item has a unique programmable 4-character ID code that is displayed along with the value item.

Clauses 8.9.1 to 8.9.9 describe the tables that can be used to configure the display.

## 8.9.1 Display Sources List (optional)

BT33 defines the items to be included in the present display list by source number and category. The 2-byte display list source number consists of a high byte and low byte. The high byte indicates the display list category. The low byte indicates the measurement source number.

The following is a list of categories (high byte of display list source #) and associated source IDs (low byte of display list source #) to define a display source item as it is entered into BT33.

**Table 5**

| Display List Category | High Byte Value Bits 3..7 | Bits 0..2 | Low byte value | Description and Location of low-byte measurement ID |
|---|---|---|---|---|
| Summation Totals and Tiers and Present Values | 0 | 0 | 0..BT10.7 | BT16 describes the list of items to display (Item 73 to 80 are not supported by display). |
| | 0 | 1 | 2..11 | Date/time of max demand 1, total and 4 tariffs:<br>2 = Date of total.<br>3 = Time of total.<br>4 = Date of tariff 0.<br>5 = Time of tariff 0. |
| | 0 | 1 | 12..21 | Date/time of max demand 2, total and 4 tariffs. |
| | 0 | 1 | 22..31 | Date/time of max demand 3, total and 4 tariffs. |
| | 0 | 1 | 32..41 | Date/time of max demand 4, total and 4 tariffs. |
| | 0 | 1 | 42..51 | Date/time of max demand 5, total and 4 tariffs. |
| | 0 | 1 | 52..61 | Date/time of max demand 6, total and 4 tariffs. |
| | 0 | 1 | 62..71 | Date/time of max demand 7, total and 4 tariffs. |
| | 0 | 1 | 72..81 | Date/time of max demand 8, total and 4 tariffs. |
| Self-Read Data | 1 | 0 | 0.. BT10.7 (BT23 values only) | Latest self-read data set. This includes monthly billing data, totals and tiers, no present values, no previous demand values. |
| | 1 | 1 | 0..1 | 0 = Latest self-read date.<br>1 = Latest self-read time. |
| | 1 | 1 | 2..11 | Date/time of max demand 1, total and 4 tariffs<br>2 = Date of total.<br>3 = Time of total.<br>4 = Date of tariff 0.<br>5 = Time of tariff 0. |
| | 1 | 1 | 12..21 | Date/time of max demand 2, total and 4 tariffs. |
| | 1 | 1 | 22..31 | Date/time of max demand 3, total and 4 tariffs. |
| | 1 | 1 | 32..41 | Date/time of max demand 4, total and 4 tariffs. |
| | 1 | 1 | 42..51 | Date/time of max demand 5, total and 4 tariffs. |
| | 1 | 1 | 52..61 | Date/time of max demand 6, total and 4 tariffs. |
| | 1 | 1 | 62..71 | Date/time of max demand 7, total and 4 tariffs. |
| | 1 | 1 | 72..81 | Date/time of max demand 8, total and 4 tariffs. |

| Display List Category | High Byte Value Bits 3..7 | Bits 0..2 | Low byte value | Description and Location of low-byte measurement ID |
|---|---|---|---|---|
| One Time Read Data | 1 | 2 | 0.. BT10.7 (BT23 values only) | Latest OSGP device one time read data set. This includes billing data, totals and tiers, no present values, and no previous demand values. |
| | 1 | 3 | 0..1 | 0 = Latest one time read date.<br>1 = Latest one time read time. |
| | 1 | 3 | 2..11 | Date/time of max demand 1, total and 4 tariffs:<br>2 = Date of total.<br>3 = Time of total.<br>4 = Date of tariff 0.<br>5 = Time of tariff 0. |
| | 1 | 3 | 12..21 | Date/time of max demand 2, total and 4 tariffs. |
| | 1 | 3 | 22..31 | Date/time of max demand 3, total and 4 tariffs. |
| | 1 | 3 | 32..41 | Date/time of max demand 4, total and 4 tariffs. |
| | 1 | 3 | 42..51 | Date/time of max demand 5, total and 4 tariffs. |
| | 1 | 3 | 52..61 | Date/time of max demand 6, total and 4 tariffs. |
| | 1 | 3 | 62..71 | Date/time of max demand 7, total and 4 tariffs. |
| | 1 | 3 | 72..81 | Date/time of max demand 8, total and 4 tariffs. |
| Historical Demand Reset Data | 1 | 4 | 0.. BT10.7 (BT23 values only) | Latest demand reset entry. This includes billing data, totals and tiers, no present values, no previous demand values. |
| | 1 | 5 | 0..1 | 0 = Latest demand reset date.<br>1 = Latest demand reset time. |
| | 1 | 5 | 2..11 | Date/time of max demand 1, total and 4 tariffs:<br>2 = Date of total.<br>3 = Time of total.<br>4 = Date of tariff 0.<br>5 = Time of tariff 0. |
| | 1 | 5 | 12..21 | Date/time of max demand 2, total and 4 tariffs. |
| | 1 | 5 | 22..31 | Date/time of max demand 3, total and 4 tariffs |
| | 1 | 5 | 32..41 | Date/time of max demand 4, total and 4 tariffs. |
| | 1 | 5 | 42..51 | Date/time of max demand 5, total and 4 tariffs. |
| | 1 | 5 | 52..61 | Date/time of max demand 6, total and 4 tariffs. |
| | 1 | 5 | 62..71 | Date/time of max demand 7, total and 4 tariffs. |
| | 1 | 5 | 72..81 | Date/time of max demand 8, total and 4 tariffs. |
| Date/Time | 4 | 0 | 0..1 | 0= Present local date, 1= present local time. |
| Miscellaneous | 5 | 0 | 0 | Prepay total credit remaining. |
| | 5 | 0 | 1 | Prepay emergency credit remaining. |
| | 5 | 0 | 2 | Disconnect active maximum power limit. This will use the primary or secondary maximum power threshold defined in ET05 (whichever is active at the moment). |
| | 5 | 0 | 3 | Disconnect active maximum power limit. This will use the primary or secondary maximum current threshold defined in ET05 (whichever is active at the moment). |
| | 5 | 1 | 0 | Current TOU calendar ID. |
| | 5 | 1 | 1 | CT ratio multiplier, which is the "Ratio F" field in BT15. |
| | 5 | 1 | 2 | CT ratio multiplier, which is the "Ratio P" field in BT15. |
| | 5 | 1 | 3 | Relay Control ID. |
| | 5 | 1 | 4 | CT ratio actual. This is the calculated ratio based on the configured transformer secondary rated current. |
| | 5 | 2 | 0 | Firmware version number. |
| | 5 | 3 | 0 | Number of demand resets. |
| | 5 | 3 | 1 | Demand sub-interval in minutes. |
| | 5 | 3 | 2 | Demand interval in minutes. |
| | 5 | 3 | 3 | Load profile interval time between log records in minutes. |
| Self-Read Data | 6..28 | 0 | 0.. BT10.7 (BT23 values only) | Earliest 23 self-read data sets:<br>6 = Most recent data set before the current one.<br>28 = Earliest. |
| | 6..28 | 1 | 0..1 | 0 = Date of corresponding self-read data set.<br>1 = Time of corresponding self-read data set. |
| OSGP device One Time Read Data | 6..28 | 2 | 0.. BT10.7 (BT23 values only) | Earliest 23 one time read data sets:<br>6 = Most recent data set before the current one.<br>28 = Earliest. |

| Display List Category | High Byte Value Bits 3..7 | Bits 0..2 | Low byte value | Description and Location of low-byte measurement ID |
|---|---|---|---|---|
| | 6..28 | 3 | 0..1 | 0 = Date of corresponding OSGP device one time read data set.<br>1 = Time of corresponding OSGP device one time read data set. |
| Historical Demand Reset Data | 6..16 | 4 | 0.. BT10.7 (BT23 values only) | Earliest 11 demand reset data sets:<br>6 = Most recent data set before the current one.<br>11 = Earliest. |
| | 6..16 | 5 | 0..1 | 0 = Date of corresponding demand reset entry<br>1 = Time of corresponding demand reset entry |
| | 6..16 | 5 | 2..11 | Date/time of max demand 1, total and 4 tariffs:<br>2 = Date of total.<br>3 = Time of total.<br>4 = Date of tariff 0.<br>5 = Time of tariff 0. |
| | 6..16 | 5 | 12..21 | Date/time of max demand 2, total and 4 tariffs. |
| | 6..16 | 5 | 22..31 | Date/time of max demand 3, total and 4 tariffs. |
| | 6..16 | 5 | 32..41 | Date/time of max demand 4, total and 4 tariffs. |
| | 6..16 | 5 | 42..51 | Date/time of max demand 5, total and 4 tariffs. |
| | 6..16 | 5 | 52..61 | Date/time of max demand 6, total and 4 tariffs. |
| | 6..16 | 5 | 62..71 | Date/time of max demand 7, total and 4 tariffs. |
| | 6..16 | 5 | 72..81 | Date/time of max demand 8, total and 4 tariffs. |

BT33 also controls the duration, in seconds, that each item in the display list will be shown on the display. It also is used to define the order in which items are to be displayed. The display list is a circular list with the end of the list being shown with all segments on the display lit. Each item in the display list will be displayed for 6 seconds to 15 seconds, as configured in BT33. Note that this display duration can also be set to 0, which will fixate the display on the item currently displaying until the OSGP device push button is pushed to advance to the next display list item.

### 8.9.2 Display Configuration (optional)

ET07 allows the user to define how the items in the display list will be displayed, including the ID code, the number of digits to display, whether leading zeros will be displayed or not, the active and inactive features indicated by the name plate, and the decimal point configuration associated with each item on the display list. The user may also set whether or not the all segments on is displayed after the display list has completed its cycle. The user may configure the display format for the OSGP device date format (DDMMYYYY, MMDDYYYY, YYYYMMDD, YYYYDDMM). Display of the OSGP device's firmware version can be enabled or disabled to present tariff from ET07.

### 8.9.3 Error Codes Configuration (optional)

ET22 allows the user to define which alarms may be configured as scrolling errors that will be displayed as the last item in the display list or locking errors that will lock the normal display regardless of position in display list and will display the errors in two screens with an error code for each screen (one for the locking error, one for scrolling errors).

### 8.9.4 Simulated Wheel Rotation Configuration (optional)

ET01 allows the user to configure the rate of rotation for optional simulated mechanical wheel on the display. The simulated wheel is an optional visual indicator for the relative rate of energy consumption measured by the OSGP device.

### 8.9.5 Disconnect Configuration (optional]

ET05 allows the user to configure text that will be displayed explaining why the load disconnect contactor was opened. The 4 digit ID code that will be displayed while the disconnect open text is shown is also configurable via ET05. The behaviour of the Disconnect Open icon is also configurable via ET05. The disconnect icon will turn on when there is no load side voltage (because the disconnect is open and there is no load side generator). A user can also configure the icon to flash, depending on whether the load disconnect contactor is locked open. The icon is not shown when the load disconnect contact is closed, or there is a load side generator.

### 8.9.6 CT and VT Ratios (optional)

BT15 allows the user to configure how the devices CT and VT ratios will be displayed. These ratios can be displayed as an industry standard method where a ratio X : Y is displayed representing the primary transformer rated current : the secondary transformer rated current, or as the multiplier value that the ratio corresponds to (e.g. a ratio of 40:5 would be displayed as 8.

### 8.9.7 Firmware Version on Power-Up (optional)

ET07 allows the use to configure the OSGP device to display the firmware version currently running in the OSGP device on power-up. The OSGP device can be configured to display its firmware version for 1 seconds to 15 seconds on power-up, if desired.

### 8.9.8 PLC signal quality Icons (optional)

The device may have indicators on its display to show PLC traffic detection and received-message quality. The signal strength thresholds that trigger these icons are specified via ET55.14 for non-ATM traffic. For ATM discovery queries, the initiator can specify the signal strength threshold via the query message. If this is not provided by the initiator, then the non-ATM value specified in ET55.14 is used.

### 8.9.9 Scheduled Display Messages (optional)

ET55 may be used to configure preset messages to be shown on the device's display. The "Scheduled Display Message Text" field defines this message, which can include up to 4 characters that will be shown on the display. The date/time can be configured which the preset message will be displayed, and the date/time at which the preset message will be removed from the display. If the configured start date/time is earlier than current time, the preset message will be displayed immediately. If the device is powered down at the date/time the preset message is scheduled to appear, and the end date/time has not passed when the devices powers back on, the preset message will be displayed until the end date/time has passed.

The scrolling display will be suspended while the message is on display, and will resume as soon as the message has been removed. However, the preset message can be configured so that a user can manually override the preset message (i.e. remove it from the display and resume the scrolling display schedule) by pressing the push button to the left of the OSGP device display. To ensure that the message is displayed for the configured amount of time, make sure to disable the manual override option.

## 8.10 Load Disconnect Contactor (optional)

### 8.10.0 Foreword

The device may contain up to two internal control outputs that can be used to control two independent devices. The primary control output shall be the load disconnect contactor used to control a circuit disconnect that controls the load to the customer. It can be programmed for use via several different automatic and manual applications:

- **Maximum Power and Current Level Thresholds:** The OSGP device contains a series of settings that establish a maximum power (or current) level threshold. When the OSGP device detects this level of power (or current), it indicates that the OSGP device has reached its trip point, and the OSGP device will automatically turn off (trip) the load disconnect contactor.

- **Prepaid Metering:** The OSGP device will automatically turn off the load disconnect contactor once the credit level in energy has gone to zero in a prepaid metering installation. The OSGP device reduces the amount of remaining credit based on energy usage and tariff level as time goes by.

  Once the prepay credit is exhausted (has reached zero), the OSGP device can either be configured to turn off the load disconnect or to switch into Maximum Power mode (to avoid complete power shutoff at the premises). When switching to Maximum Power mode is selected, the Power Threshold on Exhausted Credit value (in watts) setting is used to determine the active power level setting, in watts, at which the load disconnect turns off when prepay credit is exhausted (goes to 0). The Maximum Prepay Power Duration Threshold value programmed into the OSGP device is used to determine the number of minutes that the Power Threshold on Exhausted Credit setting shall be continuously met or exceeded for the load disconnect to turn off when prepay credit is exhausted. Normal operation resumes when the prepay credit value is increased to above zero.

- **Local Control:** Local manual control of the load disconnect contactor via the disconnect push button.

- **Remote Control:** Remote manual control of the load disconnect contactor.

Clauses 8.10.1 to 8.10.4 describe how each of these applications can be programmed. Most of these settings are configurable via ET05.

## 8.10.1 Maximum Power and Current Level Thresholds

### 8.10.1.0 Foreword

The device contains a series of settings that establish a maximum power level threshold. When the OSGP device detects this level of power on the line, it indicates that excessive power is in use and the OSGP device will automatically shut off (trip) the load disconnect contactor. After an excessive power condition trips the load disconnect contactor in this fashion, the load disconnect contactor can be manually reset.. If the power level threshold is still exceeded after manual re-latching, the load disconnect will shut off again within a minute. This feature is intended primarily to limit consumer power usage, and is not to be used as the system safety over-current protection.

The OSGP device can be configured to use current measurements, instead of power measurements, to determine when excessive power is in use and the OSGP device should shut off the load disconnect contactor. The OSGP device will use power measurements by default.

Clauses 8.10.1.1 to 8.10.1.3 describe how to configure the OSGP device's maximum power and current level thresholds.

### 8.10.1.1 Changing the Device's Maximum Power Level Threshold

In order to set the maximum power level threshold for the OSGP device, configure the following settings:

- **Maximum Power Level Thresholds:** The OSGP device may contain both a Primary Power Level Threshold and a Secondary Power Level Threshold value. The OSGP device can be programmed to use either value to determine when excessive power is in use and the load disconnect contactor should be shut off. The values of these fields can be configured via ET05 "Control Output Settings".

  Only one of the threshold values will be in use at any given time, and the OSGP device will use the Primary Maximum Power Level Threshold by default. However, the Secondary Maximum Power Level Threshold can be selected by calling EP22 "Switch Maximum Power or Current Level".

  The "Active Power or Current Level" field in ET30 "Maximum Power or Current Level Control" indicates whether the primary or secondary threshold is presently in use.

- **Maximum Power Duration Thresholds:** The OSGP device also contains both a Primary Maximum Power Duration Threshold and a Secondary Maximum Power Duration Threshold value. The Primary Maximum Power Duration Threshold is used when the Primary Power Level Threshold value is in use, and the Secondary Maximum Power Duration Threshold is used when the Secondary Power Level Threshold is in use.

These fields set the duration that the associated Maximum Power Level Threshold shall be continuously met or exceeded before the load disconnect contactor will be shut off. When the power drops below the power level threshold before this interval expires, the duration is reset and starts counting again from zero when the power exceeds the level threshold again. When the duration threshold is set to 0, the load disconnect contactor will turn off immediately when the maximum power level threshold is reached. The range is 0 to approximately 260 minutes. These fields can be configured via ET05.

- **Power Level to Measure:** It is possible to choose how the OSGP device will calculate the current power level when checking it against the maximum power level threshold:

  - Forward energy (Fwd Active [W] L1+L2+L3).
  - Forward + reverse energy (Fwd+Rev Active [W] L1+L2+L3).
  - Forward - reverse active energy (Fwd-Rev Active [W] L1+L2+L3).

  The calculation method to be used is set via EP42 "Control Output Settings".

#### 8.10.1.2 Changing the Device's Maximum Current Level Threshold

The settings below need to be configured for the OSGP device to use current measurements, instead of power measurements, to determine when excessive power is in use and the OSGP device should shut off the load disconnect contactor:

- **Maximum Current Level Thresholds:** The OSGP device contains both a Primary Current Level Threshold and a Secondary Current Level Threshold value, both of which shall be entered in Amperes. The OSGP device can be programmed to use either value to determine when excessive power is in use and the load disconnect contactor should be shut off. The values of these fields can be configured via ET05 "Control Output Settings".

  Only one of the threshold values will be in use at any given time, and the OSGP device will use the Primary Maximum Current Level Threshold by default. The device can switch to the Secondary Maximum Current Level Threshold (and back) by calling EP22 "Switch Maximum Power or Current Level".

  The "Active Power or Current Level" field in ET30 "Maximum Power or Current Level Control" indicates whether the primary or secondary threshold is presently in use.

- **Maximum Current Duration Thresholds:** The OSGP device also contains both a Primary Maximum Current Duration Threshold and a Secondary Maximum Current Duration Threshold value. The Primary Maximum Current Duration Threshold is used when the Primary Current Level Threshold value is in use, and the Secondary Maximum Current Duration Threshold is used when the Secondary Current Level Threshold is in use.

  These fields set the duration that the associated Maximum Current Level Threshold shall be continuously met or exceeded before the load disconnect contactor reaches its trip point and shuts off. When the current drops below the threshold before this interval expires, the duration is reset and starts counting again from zero when the current exceeds the level threshold again. When the duration threshold is set to 0, the load disconnect contactor will turn off immediately when the maximum current level threshold is reached. The range is any interval up to approximately 260 minutes. These fields can be configured via ET05.

- **Disconnect Trip Point Current Source:** The OSGP device can be specified for how it will measure the active current by specifying the source to use when measuring current (i.e. Forward Current, Forward + Reverse Current, Forward - Reverse Current), and whether the current should be measured per phase, or as a sum of all phases. Calling EP42 "Control Output Settings" establishes which calculation method will be used.

#### 8.10.1.3 Choosing Power or Current (optional)

By default, the OSGP device will use power measurements to determine when the load disconnect contactor has reached its trip point and should be shut off. EP42 "Control Output Settings" is used to switch from power measurements to current measurements, and vice versa.

NOTE: The "Disconnect Control Type" field in ET46 "Control Output Read-Only Data" may indicate whether the OSGP device is presently using power or current measurements to determine when the load disconnect contactor has reached its trip point.

### 8.10.2 Prepaid Metering (optional)

The device will automatically turn off the load disconnect contactor once the credit level in energy has gone to zero in a prepaid metering installation. The OSGP device reduces the amount of remaining credit based on energy usage and tariff level as time goes by.

Once the prepay credit is exhausted (has reached zero), the OSGP device can either be configured to turn off the load disconnect or to switch into Maximum Power mode (to avoid complete power shutoff at the premises). When switching to Maximum Power mode is selected, the Power Threshold on Exhausted Credit value (in watts) setting is used to determine the active power level setting, in watts, at which the load disconnect turns off when prepay credit is exhausted (goes to 0). The Maximum Prepay Power Duration Threshold value programmed into the OSGP device is used to determine the number of minutes that the Power Threshold on Exhausted Credit setting shall be continuously met or exceeded for the load disconnect to turn off when prepay credit is exhausted. Normal operation resumes when the prepay credit value is increased to above zero.

The prepay control settings can be configured via ET05:

- The prepay control settings can be enabled or disabled by writing the "Enable Prepay" field.
- The "Prepay Total Credit" field indicates the active energy credit (in Wh) remaining. The rate at which prepaid credit is deducted is determined by the "Prepay Tariff X Rate" fields in ET05, where X represents the tariff the field applies to (e.g. "Prepay Tariff 1 Rate" establishes the rate for tariff 1).
- When no credit is left, either or the emergency credit or maximum power (or both) will be checked based on configuration. The emergency credit and maximum power checks can be enabled or disabled by writing the "Enable Prepay Emergency Credit" and/or "Enable Prepay + Max Power Option" fields in ET05.

  If neither of these options is enabled, the load disconnect contactor will shall shut off immediately when prepaid credit runs out.
- If the maximum power check is enabled, the maximum power at which the load disconnect contactor will turn off after prepaid credit runs out can be established by writing the "Prepay Power Threshold" field. Note that the "Prepay Power Time Threshold" field in ET05 establishes a duration for which the threshold shall be met before the load disconnect contactor will be tripped.
- If enabled, emergency prepay credit can be added via EP21. The maximum emergency credit that can be added is dictated by the "Maximum Prepay Total Emergency Credit" field.

### 8.10.3 Local Manual Control (optional)

Manual opening of the load disconnect contactor can be enabled or disabled. When configured to be disabled, the OSGP device will not respond if the consumer attempts to open or close the load disconnect contactor manually. Manual operation of the load disconnect contactor can be enabled or disabled by writing the "Disable Manual Disconnect Open" field in ET05. Note that when the load disconnect contactor is manually opened or closed, the push button shall be pressed (or the lever held) for the duration indicated by the "Minimum Disconnect Switch Hold Time" in ET05 for the change to take effect.

### 8.10.4 Load Contactor Remote Control (optional)

EP23 can be used to close the load disconnect contactor remotely. Upon execution of this procedure, the load disconnect contactor will close immediately. There are several OSGP device fields that can be configured to prevent execution of EP23:

- The "Enable Remote Disconnect Closed" field in ET05 can be set to prevent remote closing of the load disconnect contactor.
- The "Reject EP23 If Manually Opened" field in ET05 can be set to prevent remote closing of the load disconnect contactor after it has been opened manually.
- The "Reject Disconnect Close LSV" field in ET05 can be set to prevent remote closing of the load disconnect contactor when load side voltage is present.

- The "HW Options" field in ET29 has a field that can be used to disable the load disconnect contactor. In this case, the OSGP device will operate as if no disconnect is present. All ET05 configurations will remain unchanged but the disconnect-related settings would no longer be processed. Manual disconnect operation will be ignored. Remote disconnect operation via EP02 as well as EP21 will return result code 3 (procedure conflicts with current device setup).

# 8.11 Control Relay (optional)

## 8.11.0 Foreword

One optional control relay can operate an external low current device, such as a contactor coil, which in turn can control a larger amperage device. The open or closed state of the control relay is determined by the present tariff level that is in effect. The tariff period that activates the relay is configurable.

## 8.11.1 Control Relay Randomization

The OSGP device includes a randomization option for control relay open and close operations. As part of this feature, the maximum number of seconds of randomization time to open or close the control relay for each control relay operation that is sent to a group of OSGP devices can be specified. The time the command is executed for each OSGP device in the group will vary randomly between 1 second and the maximum number of seconds set, allowing the actual implementation time for each OSGP device to vary. This is provided to reduce the possibility of spikes or sags on the power grid when multiple loads come online at roughly the same time. When the maximum number of seconds is set to 0, the relay will open or close immediately.

Randomization for control relay operations can be enabled or disabled by writing the "Randomization Enable" field in ET05. The maximum randomization interval to use can be set by writing the "Broadcast Max Random Time" and "Broadcast Max Random Minutes" fields in ET05.

## 8.11.2 Time-Based Control Relay Calendar

Each device can contain a calendar that specifies when the control relay should be opened or closed. The calendar supports the following types of schedules:

- Daily: The control relay calendar includes a separate schedule for each day of the week.
- Weekday/Weekend: The control relay has two schedules: one for weekdays, and one for weekends.
- Season: The control relay has four separate schedules: one for each season.
- Season Weekday/Weekend: The calendar has eight separate schedules: a weekday schedule and a weekend schedule for each season.

The type of calendar the device will use is specified by writing the "Time-Based Relay Control Mode" field in ET05. Each calendar can include up to 10 open or close operations per schedule. For example, a daily calendar includes a schedule for each day of the week, so up to 10 open or close operations per day when using a daily calendar can be specified. The Control Relay can be configured to change state based on the time of day. The schedules for opening and closing the relay are stored in ET61 "Time-Based Relay Control".

Each calendar can be assigned an ID, which can be displayed on the device's display.

This calendar is independent of the tariff-based control provided by the OSGP device's TOU calendar, and cannot be used at the same time as the tariff-based control provided by the TOU calendar. If both the control relay calendar described in this clause and the OSGP device's tariff-based control are enabled at the same time, the tariff-based control settings will take precedence. The state that the control relay should switch to when a clock error occurs and the OSGP device cannot determine which scheduled state to use can also be specified.

Note that if a remote command is issued to open the control relay, then the OSGP device will suspend all programmatic (i.e. time-based or tariff based) relay operations until another remote command is issued to close the relay. At that point, the OSGP device will resume using the time-based or tariff-based relay schedule programmed into the OSGP device.

### 8.11.3 Remote Control

EP02 is used to control both the control relay and the load disconnect contactor. If EP02 is used to force either output open, the automatic controls (such as the time-based relay control calendar) for that output are disabled. Automatic control is re-enabled when EP02 is invoked to close the output.

If EP02 is used to force the disconnect open, a parameter indicating the priority of the command needs to be set. If the parameter indicates a low priority, the procedure will be not be executed if OSGP device is configured with a high priority disconnect level. If the parameter indicates a high priority, the procedure will be executed disregard of which priority disconnect level the OSGP device is configured with.

## 8.12 History Log (optional)

### 8.12.0 Foreword

The event log holds a chronological time-stamped record of alarms and events that occur in the OSGP device. Event log data can be found in BT74 "History Log Data". Dimension information is in BT70 "Dimension Log" and BT71 "Actual Log". Proper interpretation of the offsets in BT74 relies on reading BT71 first to determine the presently configured dimensions of the event log.

BT74 is implemented as a circular queue of entries. The header fields (bytes 0...9) hold the information needed to read the queue. The "Number Of Valid Entries" field indicates how many entries in the queue contain data. "Last Entry Element" is the array element of the most recently recorded entry. The "Number Of Unread Entries" field stores the number of entries that have not been read through the system. This value may or may not pertain to the optical reader. It is recommended that the entire list is read, and that the "Last Entry Element" field is used to track the starting point of the entries listed in reverse chronological order.

The events and alarms that will be logged in the history log are configured via BT72 "Events Identification".

### 8.12.1 Critical Events (optional)

#### 8.12.1.0 Foreword

Any of the status and alarm events can be defined as critical events. Once an event has been designated as a critical event, the last 10 instances of that event will be retained in the event log at all times.

Critical events will be maintained in the event log along with all of the other events that have not been designated as critical. The event log stores up to 100 of the most recent events. When the event log is full, the oldest events are over-written. However, the oldest events will now be examined before they are overwritten. If one of the older events to be removed is identified as a critical event, and replacing it would cause its retention count to be less than the minimum of 10, then that event will be relocated within the log. The relocated event will replace either the earliest instance of a non-critical event, or the earliest instance of a critical event which no longer has to be retained due to its minimum retention count being exceeded (whichever it finds first starting from the oldest entry in the log). This means that the event log may not be in timestamp order, and some event log sequence numbers may no longer be in order, after the critical events have been defined.

**Caution:** When the critical event log settings on the OSGP device are re-configured, all critical events which occurred while the previous settings were in effect will no longer be marked as critical events (although they will remain in the event log as non-critical events). This applies even if a given alarm was classified as being a critical event both before and after the critical event log settings were modified. In this case, only the instances of the alarm which occurred after the settings were most recently configured will be classified as critical.

#### 8.12.1.1 Critical Event Categories

If multiple events have been classified as critical events, then they could consume a large portion of the event log. Therefore, up to 9 critical event categories can be specified in order to add flexibility to the critical events. A critical event category is a user-selected group of events which, taken as a whole, will have a retention count of 10. Each category may contain a single event, or multiple events. This allows the user to identify as many critical events as they wish by assigning them to categories.

EXAMPLE: An event log category could be created containing all alarms relevant to phase losses and power outages, or an event log category containing all alarms relevant to OSGP device tampering. The 10 most recent instances of the group of alarms assigned to each category would then be retained in the event log at all times. If it is desirable for the last 10 instances of a specific alarm to be retained in the event log at all times, ensure that the alarm is the only event assigned to its critical event log category.

The critical event categories can be configured via ET68, "Critical Events".

### 8.12.1.2 Critical Event Bitmasks

#### 8.12.1.2.0 Foreword

Many events return arguments that indicate what caused the event to occur. If it is desirable to designate a critical event based on the specific arguments returned, a bitmask and a value for each critical alarm that is designated as a critical alarm can be specified. The bitmask will identify which bits of the argument are relevant and mask out those which are not. The value will specify the values the relevant bits shall have.

Up to 10 bitmask/value sets per OSGP device can be defined, each of which is assigned to an event that has been defined as a critical event. Note that a particular event may have more than one bitmask associated with it. In addition, if an event designated as a critical event does not have a critical event bitmask configured for it, then all instances of that event will be considered critical events.

These bitmasks are set up in table ET69 "Critical Event Bitmasks".

#### 8.12.1.2.1 Example Critical Event Bitmask

This clause provides an example of defining a critical event bitmask. The following example describes how to create a critical event bitmask for the Load Disconnect State Changed event. As described in the last clause, the instances of this event that should be considered critical can be specified based on three criteria: the state of the load disconnect contactor after it changed, whether or not the operation was successful, and the reason for the change.

The low byte returned with the event argument indicates the new state of the load disconnect contactor:

- 1 = Closed.
- 2 = Opened.
- 3 = Locked Open.

Bit 4 indicates whether or not the change in state was successful:

- 0 = Successful.
- 1 = Failure.

The high byte indicates why the load disconnect contactor's state changed:

- 1 = EP02 operation.
- 2 = Maximum Power.
- 3 = Prepay.
- 4 = Prepay Power.
- = EP23 operation.
- = Manual operation.
- = Schedule.
- = EP30 invoked.

- = Disconnect resynchronization occurred.
- = Power-up resynchronization occurred.

As an example, to log events where the load disconnect contactor has been successfully closed via OSGP device procedure EP02, create a bitmask to search for instances of the event where the low byte has bit 0 set to 1, bit four is set to 0. This results in a value of 0x01. Mask out bits other than 0 and 4, since their values are not relevant in this case, and consider the event a match only if the resulting value is 0x01. The mask and value look like this:

- **Mask:** 0x0111 0000 0001 - 0001 0001
- **Value:** 0x0101 0000 0001 - 0000 0001

To only log events where the load disconnect contactor attempted to close unsuccessfully, create a bitmask to search for instances of the event where bit 4 of the low byte is set:

- **Mask:** 0x0111 0000 0001 - 0001 0001
- **Value:** 0x0111 0000 0001 - 0001 0001

To log all attempts to close the load disconnect contactor, regardless of whether or not they are successful, bit 4 of the low byte does not need to be checked, and would be masked out as well:

- **Mask:** 0x0101 0000 0001 - 0000 0001
- **Value:** 0x0101 0000 0001 - 0000 0001

To log opened events, but only if they're successful, create a bitmask to search for instances of the event where the low byte has bit 1 set, and bit four is clear:

- **Mask:** 0x0112 0000 0001 - 0001 0010
- **Value:** 0x0102 0000 0001 - 0000 0010

## 8.13 One-Time Reads (optional)

A One-time-read can be requested by calling EP24. One-time-reads do not occur multiple times in a scheduled pattern as Self-reads do. Each One-time-read is programmed to occur at a specific date and time, and occurs only once. Up to 3 separate One-time-reads in the OSGP device at once can be scheduled.

If the OSGP device is powered-down at the time a One-time-read is scheduled to occur, the One-time-read will be recorded the next time the OSGP device is powered-up, with a timestamp of when the actual reading occurred.

The OSGP device stores up to 2 sets of One-time-reads. Whenever a new One-time-read occurs, the oldest stored One-time-read data set is overwritten if 2 sets are already stored.

A snapshot of the following data is recorded during a One-time-read:

- Total and tariff-specific active and reactive energy values.
- Time, date, and season when data was captured.
- Total power outage minutes and counts that occurred since the OSGP device went into operation (or since all registers were reset to zero).
- Pulse counts from pulse output devices.
- Error counter (relevant to PTB/German and BEV/Austrian certifications).
- All maximum demand-related metering data, if configured.

One-time read OSGP device data is stored in ET31 "OSGP device One-time Read Log". One-time read M-Bus data is stored in ET32 "M-Bus One-time Read Log". The number of entries in these two log tables is recorded in ET11 and ET36.

# 8.14 Group Broadcasts (optional)

The OSGP device may be capable of sending group broadcast messages to multiple devices, in which group IDs are used to target broadcast messages to a subset of meters on the network.

ET33 holds a list of group IDs that pertain to different feature groups in the OSGP device. When a OSGP device receives a group broadcast, the OSGP device will process only those broadcasts that are directed to one or more of its groups. The group ID is hierarchical. The high byte is the group, and the low byte is the sub-group. A broadcast message directed to group ID x.255 will be processed by all sub-groups of group x. A broadcast with group ID 0xFFFF or 0xFFyy (where yy is any number) is directed to all sub-groups of all groups. On the other hand, if ET33 has a group ID x.255, the OSGP device accepts broadcast directed to any sub-groups of group x and if ET33 has a group ID 0xFFFF or oxFFyy, the OSGP device accepts broadcast directed to any subgroup of any group.

Group IDs can be added to (or removed from) a OSGP device by executing EP27.

# 8.15 Demand Metering (optional)

## 8.15.0 Foreword

The OSGP device may offer various types of demand calculations that can be performed to measure the peak active and reactive power being delivered to the system over a designated time period. Demand measurements are useful in that they provide information on peak usage as opposed to accumulation over time. In addition, by using averages instead of instantaneous maximum power values, they are not impacted by spikes and short surges.

The OSGP device's demand configuration can be read via BT13, BT21, and BT22, and configured via EP32, EP33, and ET40. There are two possible demand scenarios, depending on how these settings are configured:

- **Rolling demand:** Rolling demand uses the interval and sub-interval to create interlaced measurement periods. This provides a way to calculate the peak power usage for a set period of time, and the OSGP device continues to update the value as more time elapses to generate a rolling average. In this scenario, the sub-interval determines how frequently the value will be updated. The main interval determines the length of time for which demand measurements will be made.

  Each time a sub-interval elapses, the data for the oldest sub-interval is thrown out and replaced by the data for the most recent sub-interval, and the demand is measured again.

EXAMPLE: To measure the peak power usage for a OSGP device for 45-minute periods and receive an updated value to be reported every five minutes, use rolling demand. Set the sub-interval to 5 minutes in this case, and set the main interval to 45 minutes.

In this scenario, if the OSGP device begins calculating demand at 1:00, then the first main interval would elapse at 1:45. At 1:45 a demand record would be made for the first interval: the time period from 1:00-1:45. At 1:50, the end of the next sub-interval, a new demand record would be made for the time period from 1:05-1:50. At 1:55, a demand record would be made for the time period from 1:10-1:55. This would continue until the end of the demand billing cycle.

- **Block demand:** Block demand uses the interval setting to create independent measurement periods. Block demand is intended to measure the peak power usage for a specific time period, so that the values returned do not reflect rolling averages.

  To use block settings, set the main interval to the time period for which the peak power usage should be measured. For example, if the main interval is set to 60 minutes, demand values would be read and recorded once every hour, and would reflect peak power usage for the hour since the last reading only. So if demand calculations begin at 1:00, then the demand value at 2:00 would reflect peak power usage from 1:00 - 2:00. The demand value recorded at 3:00 would reflect peak power usage from 2:00 - 3:00, and so on.

The OSGP device offers various types of demand calculations and demand settings. The OSGP device is capable of measuring and recording the present demand, previous demand, maximum demand, cumulative demand, and continuous cumulative demand for forward, reverse, forward + reverse, and forward - reverse active power, as well as for reactive power for all 4 quadrants.

## 8.15.1 Demand Values (optional)

### 8.15.1.0 Foreword

Clauses 8.15.1.1 to 8.15.1.6 summarize the various demand values the OSGP device can calculate.

### 8.15.1.1 Present Demand

Present demand values are stored in BT28. Present demand is the demand value of the interval currently in progress. It is updated every second. There are two ways to calculate present demand, depending on the time value that is used to normalize the energy used in the interval. The first measures the accumulated energy since interval start based on the time expired since last end-of-interval, meaning that the demand value is calculated by dividing the accumulated energy by the amount of time that has passed since the current interval began. The second measures the accumulated energy since interval start based on the total interval time, meaning that the demand value is calculated by dividing the accumulated energy by the total length of the current interval (regardless of how much of that time has expired).

A switch to configure which type of calculation to use is provided in ET40. If energy usage decreases because of forward and reverse configuration, the present demand is calculated to be 0.

### 8.15.1.2 Previous Demand

Previous demand values are stored in ET39. These are the demand values for the last complete or partial interval. The previous demand is updated every sub interval and the following formula describes how previous demand is calculated. Previous demand is measured by dividing the accumulated energy for the main interval by the interval time.

### 8.15.1.3 Maximum (Peak) Demand

Maximum demand (in BT23) is the largest demand value since the last demand reset. At every sub-interval for rolling demand or main interval for block demand, the previous (present demand for the last interval) demand is compared with the maximum demand and if the previous demand is bigger than the maximum demand, the maximum demand is updated to be the value of the previous demand. In this way, the maximum demand is an average power calculation over the configured interval of time and is updated per sub-interval/main interval [Feature 2358]. The beginning and end of an interval are both synchronized to the top of the hour [Feature 2357]. This average mechanism avoids recording momentary spikes but catches general peaks in trends. At each demand reset, the maximum demand is reset to 0. Each maximum demand value is recorded with the corresponding date and time of occurrence.

### 8.15.1.4 Coincident Sources

The OSGP device can store up to two coincident values, chosen from the available measured and calculated values, along with each maximum demand value. When the maximum demand values are updated, the coincident values are also updated at the same time.

### 8.15.1.5 Cumulative Demand

Cumulative demand is the summation of all previous maximum demand values that were present at the time of their respective demand resets. At each demand reset, the cumulative demand is incremented with the value of the new maximum demand.

### 8.15.1.6 Continuous Cumulative Demand

Continuous cumulative demand is the summation of cumulative demand and the maximum demand value since the last demand reset. Continuous cumulative demand should be correctly calculated if cumulative demand is disabled and continuous cumulative demand is enabled.

### 8.15.1.7 Demand Reset

A demand reset marks the end of a demand billing cycle. The following tasks are performed for each demand reset:

- Update all calculations evaluated at demand reset.

- Save the current demand values to previous (latest) demand reset table and historical demand reset table. The OSGP device can hold one or more copies of demand reset data before the oldest data is overwritten. This figure is user-configurable. The data recorded when a demand reset is performed is the same as that which is recorded by a OSGP device Self-read. All records of demand data are stored in ET41.

- Reset current maximum demand and coincident values.

Demand resets can be scheduled into the OSGP device with via the TOU calendar in BT54. Resets can be configured to occur daily, weekly, monthly, or at any other daily interval up to once every 63 days (i.e. every second day, every third day, and so on). The exact time of the reset is configurable. If the OSGP device is powered down at the time a demand reset was scheduled to occur, the demand reset data will be recorded at the subsequent power-up with the timestamp of the power-up event. Automatic demand resets can also be triggered with EP34.

A demand reset lockout period can be configured into the OSGP device (measured in seconds). After a demand reset has been performed, no subsequent demand reset of the same type can occur for the programmed amount of time. The three types of demand reset are the push button reset, by command via the optical port or power line channel, and through the TOU calendar.

#### 8.15.1.8 Historical Demand Reset Log

The historical demand reset log is stored in ET41. This is an adjustable table that can be set to any number of entries up to the capacity of the optional feature memory space (48K with no adjustable logs configured). The number of current entries of ET41 is set via EP32, and is recorded in ET36. If the count is configured to be 0, the table still exists, but the header will reflect 0 entries. The header of BT25, which contains previous demand reset data, will contain data that is all zeros as an indication of an empty entry.

#### 8.15.1.9 Initializing Demand Metering

Demand metering is an optional feature. Therefore, initialization of demand consists of two steps: activation and configuration.

1) **Activation** is achieved by executing EP31 with the appropriate authentication parameters. Before demand is activated, BT21 reflects having no demand data or features enabled and the billing tables are presented accordingly. The historical demand reset log (ET41) exists but reports 0 entries. The same state holds as well after running EP31 and before configuring the demand settings via EP31.

2) **Configuration** shall be preceded by activation and consists of the following steps, which should be executed in this order:

   - Updating the TOU calendar in BT54 for inclusion of the automatic demand reset schedule.

   - Writing to ET40 for miscellaneous, non-interface related demand configurations.

   - Executing EP32 to allocate memory, configure parameters, and begin the calculations.

#### 8.15.1.10 Reconfiguration

Some demand parameters can be reconfigured without affecting table dimensions, but they do change the content of what is being recorded. This is done via EP33 "Billing Reconfiguration". No logs are reset when EP33 is executed. A demand reset is logged and a self-read can occur if requested. If any demand source is specified by a non-255 source ID, the cumulative and continuous cumulative demand for this source index will be cleared in BT23 after the demand reset and associated self read if configured.

## 8.16 Test Mode

Test mode is used to test the OSGP device accuracy without disturbing billing registers. Upon entering test mode, the OSGP device suspends standard energy accumulations, standard demand calculations, power quality analysis, tariff register calculations and storage in billing tables, automated control of the disconnect switch, and automated control of the control relay.

In addition, all standard operation demand calculations that were interrupted by test mode activation are considered completed and the values are calculated as if the full time of the demand interval had elapsed, and the non-elapsed time is considered to have had an energy accumulation of zero.

While in test mode, the OSGP device continues to allow communication and logs events that are not related to suspended functions. TOU calendar calculation will not be affected by test mode. The OSGP device also continues to perform data logging. However, this is only done to avoid gaps in the data log and test-mode-specific data will not be logged or otherwise affect the data log. During the test mode, the load profile record channel status is marked with "Interval contains test mode data". Although this record data does not really contain test mode data, it contains data that stopped accumulating due to test mode. The OSGP device will also continue to count input pulses as to not loose data from external devices.

Optical communications are allowed but invoking procedures that may have impact on OSGP device accuracy or cause inappropriate results will be disallowed during test mode. These procedures are:

- EP01: NV Memory Refresh.
- EP02: Control Output Command.
- EP08: Erase code memory.
- EP09: Download Code Packet.
- EP10: Switch Code Bank.
- EP14: Enable DC component calculation for all measurement channels.
- EP23: Remote Disconnect reconnect.
- EP30: Synchronize Disconnect Status.
- EP32: Billing Information Configuration.
- EP33: Billing Reconfiguration.
- EP36: Schedule Disconnect Lock Open.

The OSGP device activates test mode when BP06 is executed with the "Test Mode" flag set to True. When test mode is entered or exited, an event log entry is made (depending on event log configuration).

## 8.17 MEP Device Overview

### 8.17.0 Foreword

An OSGP device may contain two communication ports on the OSGP device's terminal block:

- An M-Bus port which allows connection of up to 4 M-Bus devices to the OSGP device.
- A bidirectional multipurpose expansion port (MEP), which may be implemented at the discretion of the OSGP manufacturer, e.g. as an isolated UART serial port. The optional MEP port may allow a connected smart device to access OSGP device data, run OSGP device procedures, and have limited write access to the OSGP device via protocols chosen by the OSGP manufacturer. This clause documents, however, the procedures enabling communication between an OSGP data concentrator and a MEP port.

The smart devices that connect to the OSGP device using the MEP port are referred to as *MEP devices*. This clause provides details on which OSGP device tables and procedures shall be used when accessing OSGP device data and running OSGP device procedures with a MEP device.

## 8.17.1 Downlink Data Transfer

### 8.17.1.0 Foreword

Communication from the OSGP device to the MEP device is implemented via two different mechanisms, depending on the urgency and need for acknowledgment of the data transfer. The mechanisms for urgent and non-urgent downlink data transfers are described in clauses 8.17.1.1 and 8.17.1.2.

### 8.17.1.1 Reading Non-Urgent Data

Non-urgent data to be transferred to the MEP device resides in a section of ET13 called "MEP Non-Urgent Data". The MEP device should read this area for new data every time it communicates with the OSGP device, or at some manageable periodic interval. This space is not managed or cleared by the OSGP device. Non-urgent data transfers to the MEP device are limited to 57 bytes. This capacity is not adjustable.

The following sequence diagram illustrates the steps that occur when the MEP device reads non-urgent data.

1) Up to 57 bytes of data is written to ET13.

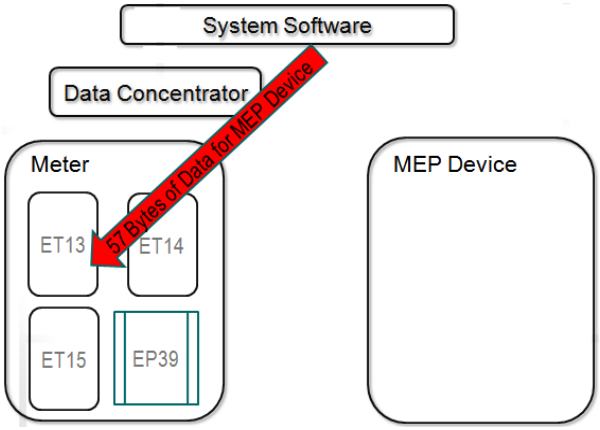


**Figure 2**

2) The MEP device reads ET13 and discovers the non-urgent data.

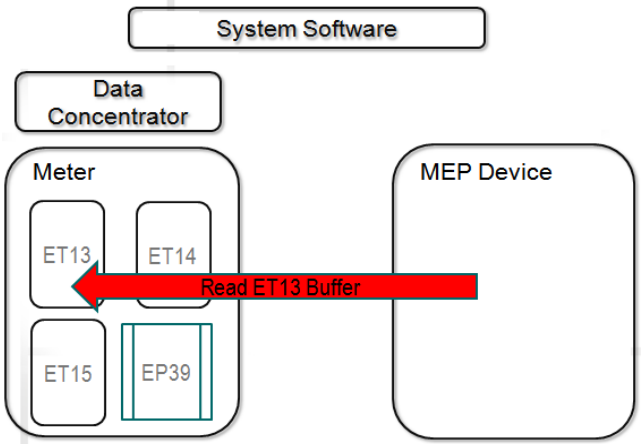


**Figure 3**

3) The MEP device reads the non-urgent data stored in ET13.

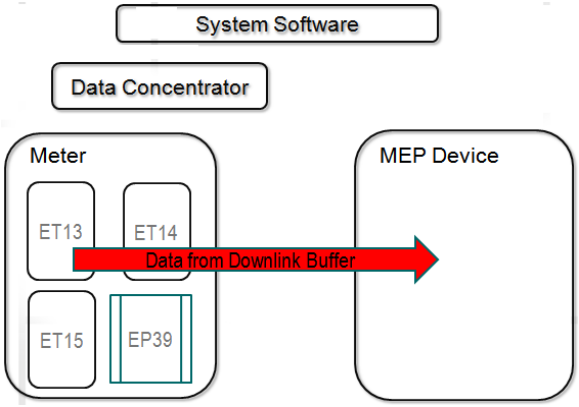


**Figure 4**

### 8.17.1.2 Reading and Processing On-Demand Requests

An urgent, or on-demand, data transfer is one that is to occur as soon as possible, usually with the expectation of an acknowledgment of the success or indication of failure of the transfer.

Urgent downlink data transfers, or on-demand write requests, to the MEP device are limited to 24 bytes (25 bytes, including the length byte). This capacity is not adjustable.

During an urgent downlink data transfer, the following steps occur:

1) The Data Concentrator posts data to the OSGP device via a procedure, and is presented in the next available entry of table ET15. ET15 is a circular queue of on-demand MEP and M-Bus requests. The status of the new request is initialized to 0 = "Request not yet completed".

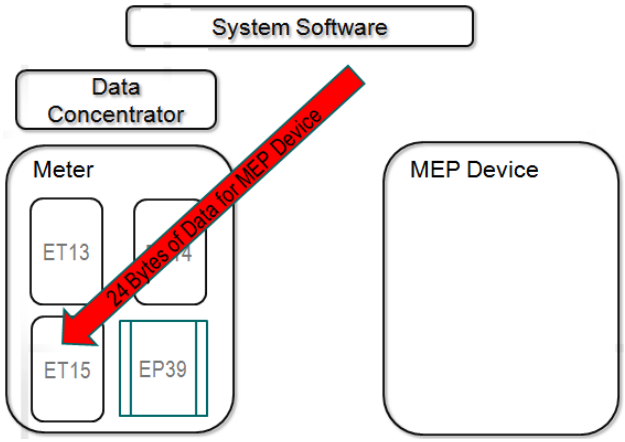


**Figure 5**

2) When the OSGP device posts a new queue entry for the MEP device, it sets the "On Demand Request" alert bit in ET13, and then begins emitting an alert sequence to notify the MEP device that a request is pending. It also starts an expiration timer for the request. If this timer, configured in ET51, expires before the request is processed, the entry status is set to "No Response From Device".

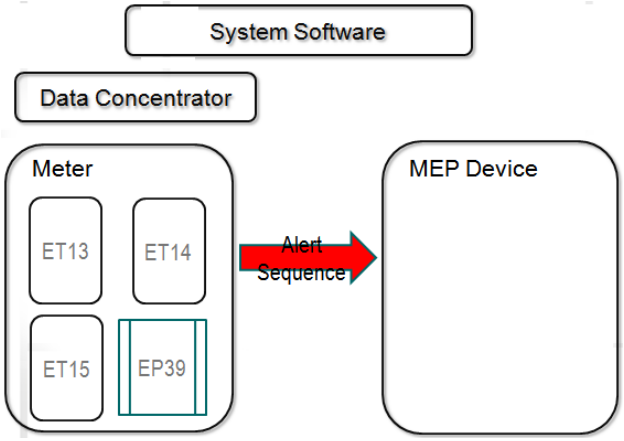


**Figure 6**

3) Upon detecting the alert sequence from the OSGP device, the MEP device polls the alert bits in ET13.

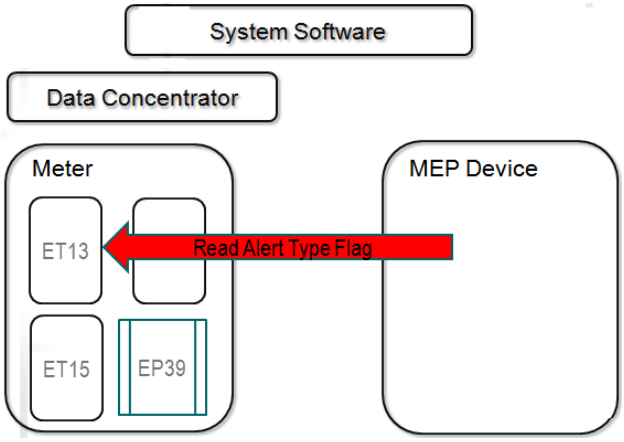


**Figure 7**

4) If the "On Demand Request in ET15" bit is set, the device shall then query ET15 for the details of the request. Use the "Read Pointer" as an index to locate the "Request Queue" entry, and check that the entry's "Device Handle" field is set to the correct MEP device handle and that its "Result" field is set "Request not yet completed". This will always be the case whenever the "On Demand Request" bit is set.

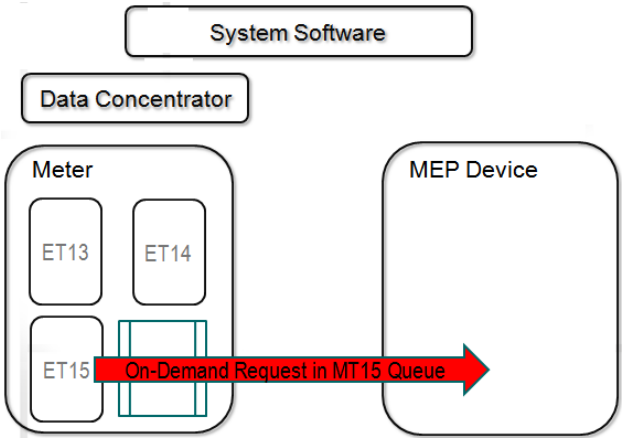


**Figure 8**

5) The "Request Queue" holds descriptive and status information for each entry. The downlink data attached to a given request is in a separate circular queue at the bottom of ET15. The index into the "Request Queue" pertaining to the entry of interest to the MEP device is the same index used to access the "Write Messages" area of ET15.

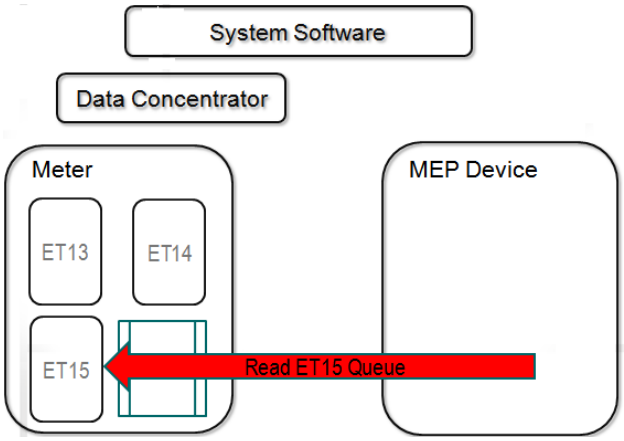


**Figure 9**

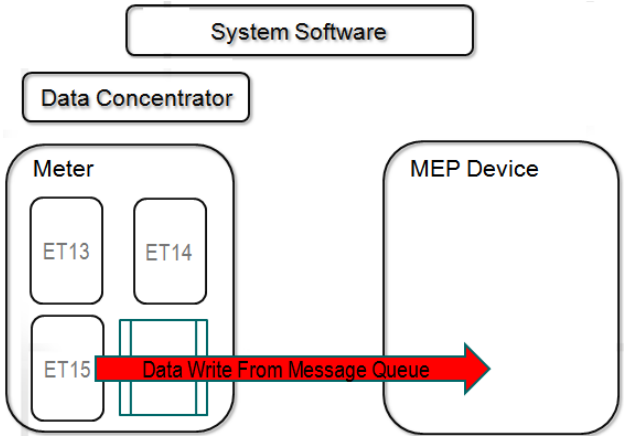


**Figure 10**

6) After the data has been read from ET15, the MEP device shall acknowledge receipt of it by executing EP39 with the parameter "Complete on-demand request".

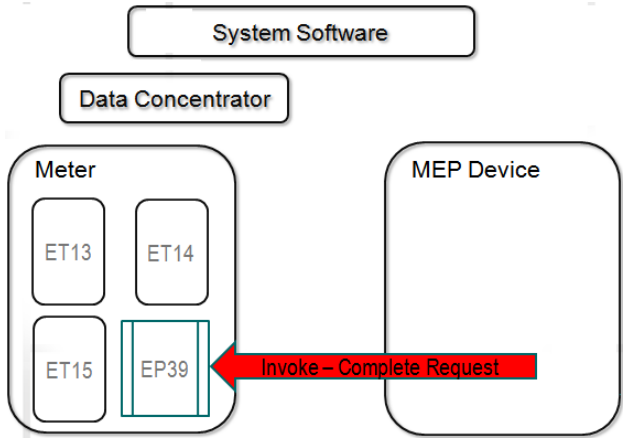


**Figure 11**

7) If uplink data needs to be returned, a separate invocation of EP39 is required, following the procedure for uplink data transfer described in clause 8.17.2.

8) Once the EP39 acknowledgment is received, the OSGP device marks the status of this request in ET15 as "Success" and ceases the alert sequence. The Data Concentrator polls ET15 for the new status either "No Response" or "Success".

## 8.17.2 Uplink Data Transfer

### 8.17.2.0 Foreword

Data flow from the MEP device to the OSGP device is also facilitated by one of several different mechanisms, depending on the source and type of the data transfer. All of the mechanisms for uplink data transfers are described in clauses 8.17.2.1 to 8.17.2.5.

### 8.17.2.1 Responding to a Scheduled Read Request (With and Without Alarms)

ET13, "MEP Device Configuration" can be provisioned to facilitate scheduled reads of MEP device data. The schedule can be set for hourly, daily, weekly, or monthly reads at specified times. Once a schedule is established, the following steps occur:

1) The scheduled read period elapses, and the OSGP device sets the "Scheduled Read Request" bit in ET13. This triggers the emission of an alert sequence.

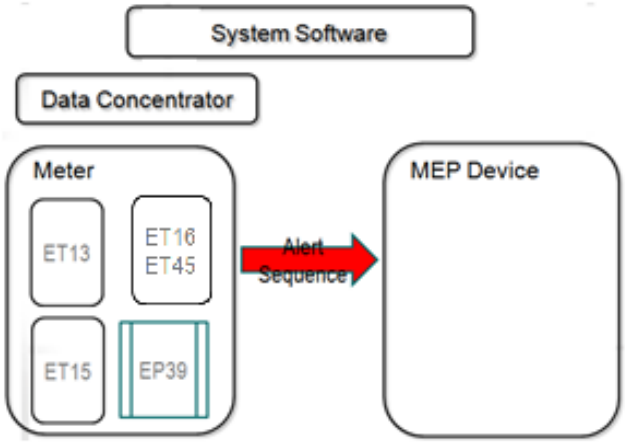


**Figure 12**

2) Upon sensing the alert sequence from the OSGP device, the MEP device reads the alert bits in ET13 and sees that a scheduled read is due.

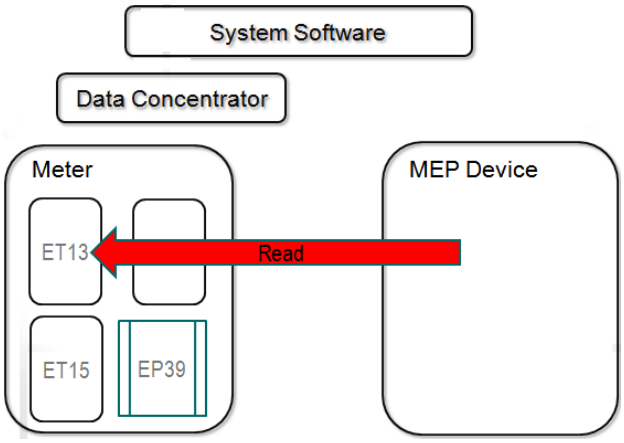


**Figure 13**

3) The MEP device posts the requested data to the OSGP device through procedure EP39 with the parameter "Non-urgent data only" or "Non-urgent data with alarms".

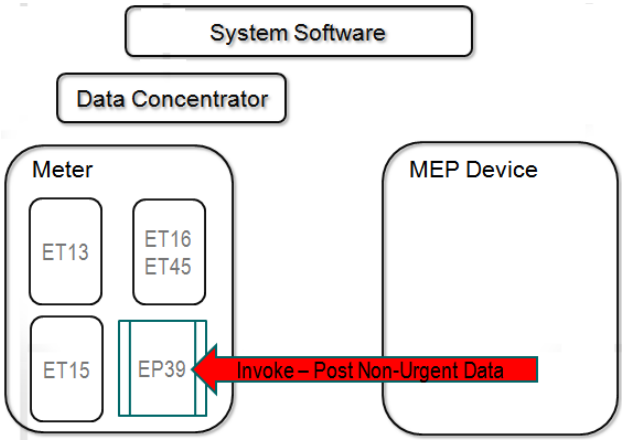


**Figure 14**

4) The OSGP device stores the posted data in a table that is then read by the Data Concentrator and ceases the alert sequence.

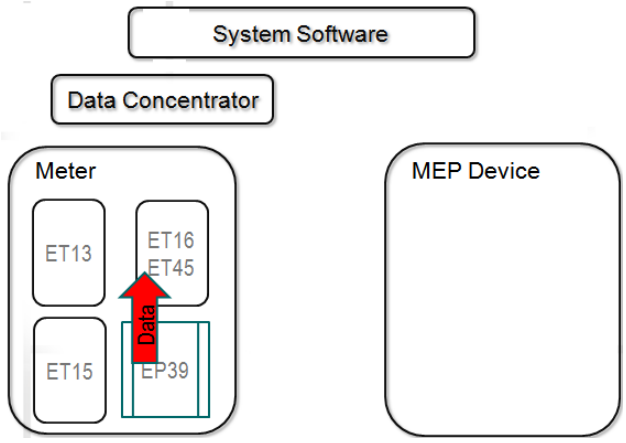


**Figure 15**

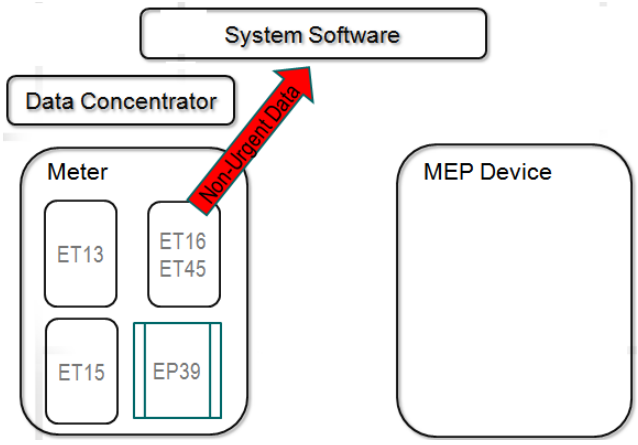


**Figure 16**

### 8.17.2.2 Responding to an On-Demand Read Request (With and Without Alarms)

Urgent uplink data may be posted to the OSGP device independently by the MEP device, or in response to an on-demand read request from NES. Alarms are considered as a special type of urgent uplink data. Both data and alarms are posted to the OSGP device in the same way, similar to the mechanism for posting non-urgent uplink data.

Posting a response to an on-demand request for data for a MEP device consists of the following steps:

1) The on-demand request is entered into and read from OSGP device table ET15 via the mechanism described in steps 1 to 4 of clause 8.17.1.2. The request type is "Billing Read".

2) The MEP device posts the requested data to the OSGP device through procedure EP39 with the parameter "Urgent Data Only" and the data. If alarms need to be posted with this data, the EP39 parameter "Urgent Data + Alarms" should be used and the alarm information included in the procedure.

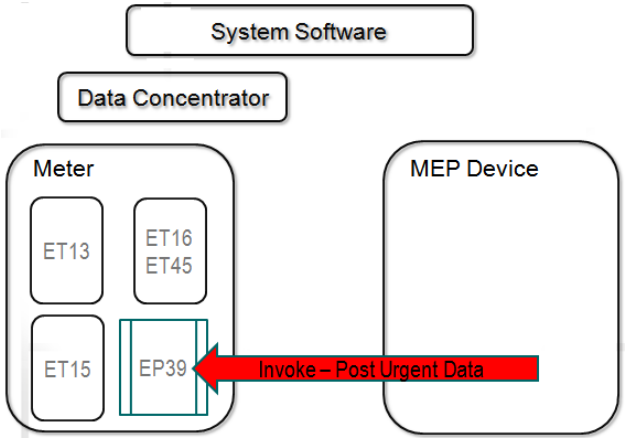


**Figure 17**

3) The MEP device then signals completion of the request by executing EP39 with the parameter "Complete On-demand Request".

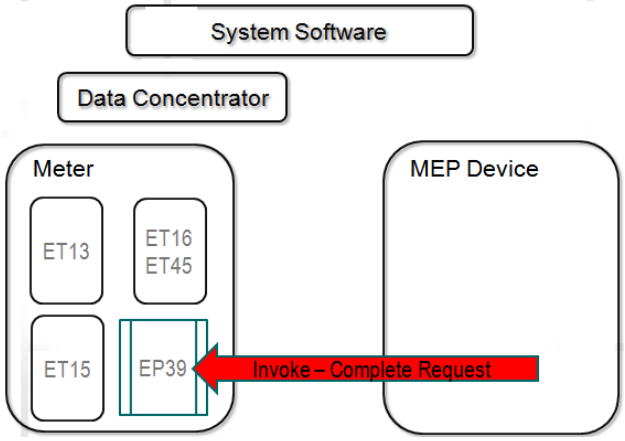


**Figure 18**

If the amount of time elapsed from seeing the on-demand request to posting EP39 for completing the on-demand request is larger than the on-demand timeout in ET51, the MEP device should not post the completion procedure, as the OSGP device will have already timed out the request. In this case, the request may be reattempted.

4) The OSGP device copies the posted data to a table that is read by the Data Concentrator.

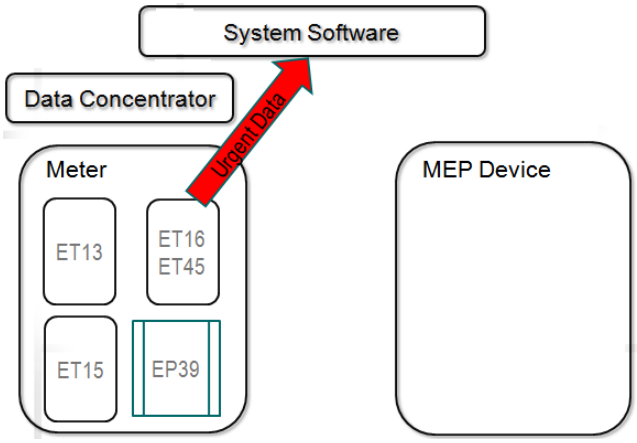


**Figure 19**

### 8.17.2.3 Posting Unsolicited Non-urgent Data (With and Without Alarms)

The MEP device can post non-urgent data on its own (i.e. not in response to a scheduled read or on-demand request) to the OSGP device for transfer upstream. This is done as follows:

1) The MEP device posts the requested data to the OSGP device through procedure EP39 with the parameter "Non-urgent data only" or "Non-urgent data with alarms".

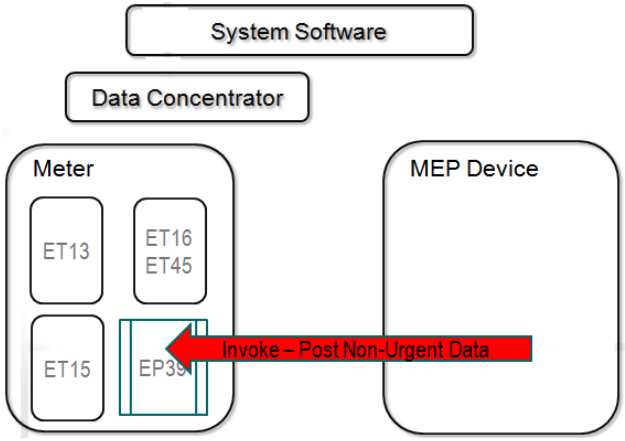


**Figure 20**

2) The OSGP device stores the posted data in a table that is then read by the Data Concentrator.

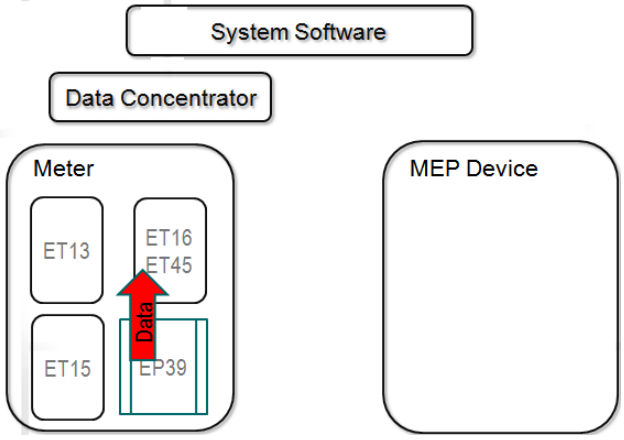


**Figure 21**

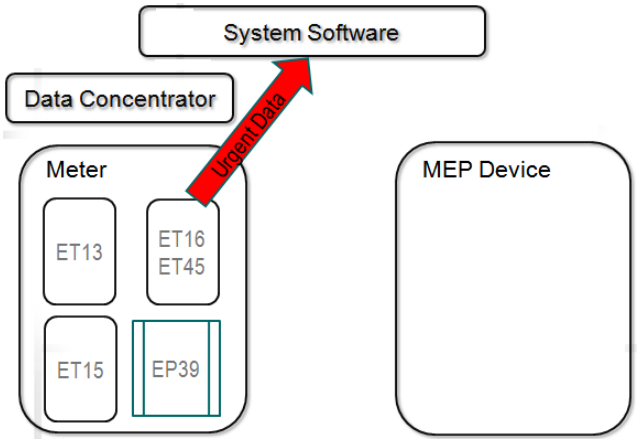


**Figure 22**

### 8.17.2.4 Posting Unsolicited Urgent Data

Posting urgent data independently, i.e. not in response to an on-demand request, consists of the following steps. Note that data posted through this mechanism does not consume the scheduled and non-urgent data buffer:

1) Post the data through procedure EP39 with the parameter "Unsolicited Urgent Data Only".

NOTE: If a previously posted urgent data record has not yet been read by the Data Concentrator, the OSGP device will reject the posting of any new urgent data that was posted in response to an on-demand request or that was posted independently. In this case, EP39 will return a result code of 4 (Timing Constraint). The MEP device should try to repost the urgent or on-demand data some time later. On-demand response data posted after the on-demand timeout has expired will not be accepted by the OSGP device. In this case, the MEP device should discontinue attempting to post the data, and the on-demand request will need to be retried from the system level.

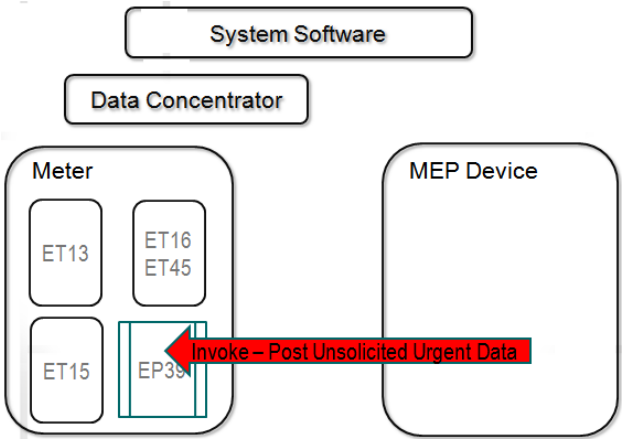


**Figure 23**

2) The OSGP device stores the posted data in a table that is then read by the Data Concentrator.

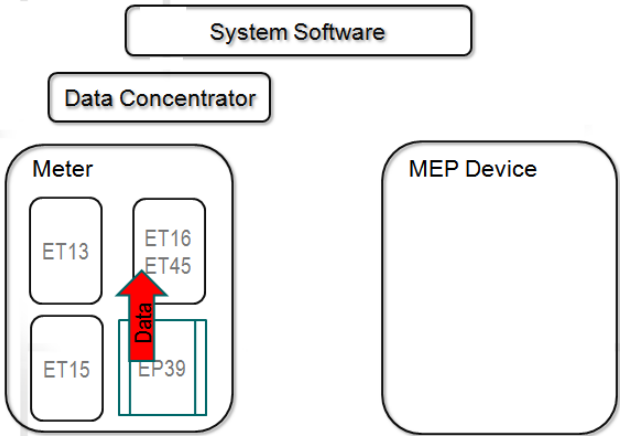


**Figure 24**

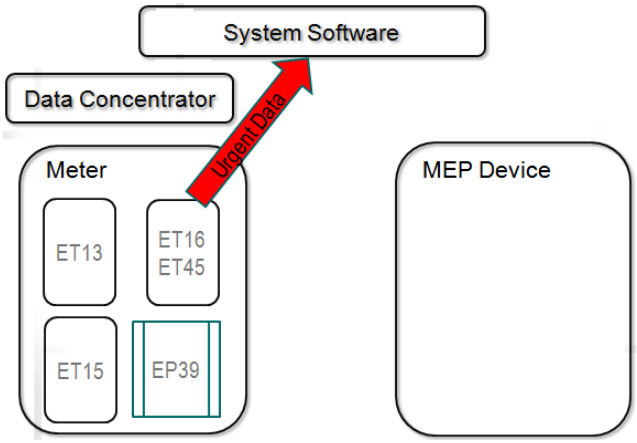


**Figure 25**

### 8.17.2.5 Posting Alarms Only

Posting alarms generated by the MEP device to the OSGP device consists of the following steps:

1) The MEP device should execute EP39 with the parameter "Alarms Only" and the single byte of alarms to be posted to the OSGP device.

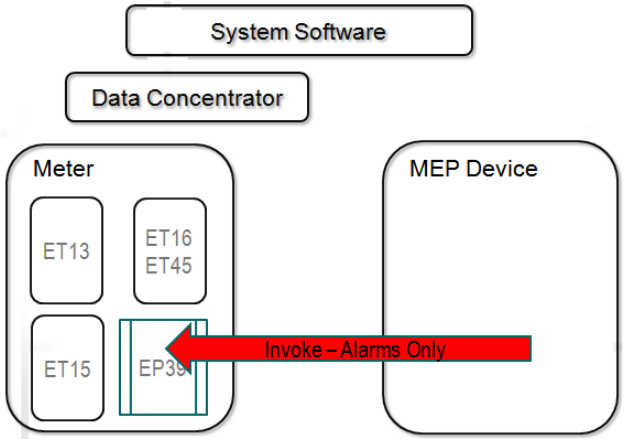


**Figure 26**

2) The OSGP device copies the alarms data to a table that is read by the Data Concentrator. Additionally, a OSGP device alarm is set to trigger immediate reading of the alarms on the next poll of the Data Concentrator. Note that the OSGP device passes on alarm data on an urgent basis only when a new bit has been set in the "Alarms" field. There is no provision to automatically clear MEP device alarms in the device itself. This is assumed to be managed at a layer above NES. Additionally, a bitmask can be configured in ET13 to govern which bits within the "Alarms" field the OSGP device checks for having been newly set.

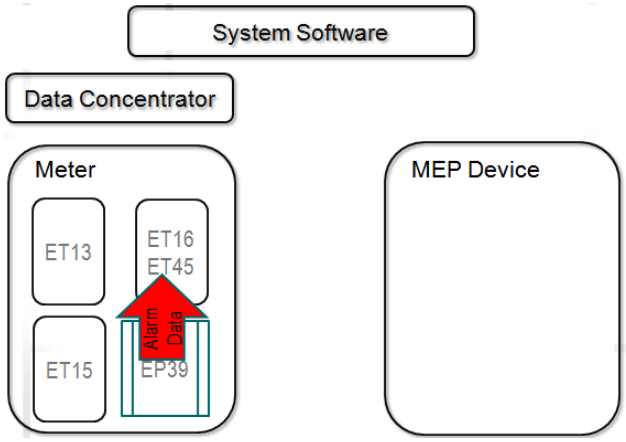


**Figure 27**

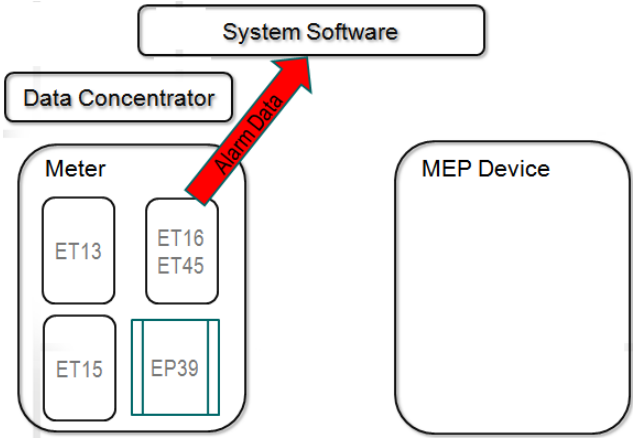


**Figure 28**

# 8.18 M-Bus Device support (optional)

## 8.18.0 Foreword

The optional M-Bus capabilities in the OSGP device can discover and query up to four M-Bus devices, such as gas, water, or heat meters. The OSGP device stores the consumption data collected from the M-Bus devices along with any alarm or status messages. The data and messages are sent to the utility central service centre through the network.

The OSGP device can perform the functionality of an M-Bus mini-master, meeting standards BS EN 13757-2 [2] and BS EN 13757-3 [3]. This clause provides an overview of the tables and procedures used to manage an M-Bus device.

## 8.18.1 Billing Data Collection

### 8.18.1.0 Foreword

Billing data can be collected during a scheduled polling of the M-Bus devices, or by an on-demand read request. These methods are described in clauses 8.18.1.1 to 8.18.1.4.

#### 8.18.1.1 On-Demand Reads for M-Bus Devices

An on-demand read can be performed at any time, and need not be scheduled in advance. The date and time of each reading is included with the collected data. Up to 525 bytes (mostly data, but including some overhead) can be stored for an M-Bus device on-demand read, and the OSGP device can store data for one on-demand read at a time per device.

Data collected from an M-Bus device is not interpreted or reformatted by the OSGP device, but is stored just as it was received from the M-Bus device. M-Bus on-demand reads can be scheduled via MP 19 "Post On-Demand M-Bus Request". After a request is made via this procedure, the request and its result can be tracked in the "Request Queue" area of ET15 "MEP/M-Bus On-demand Requests". The data retrieved from M-Bus on-demand reads is stored in ET16 "M-Bus/MEP Device Data".

The following describes how to use these tables and procedures to read on-demand M-Bus data:

1) Post an on-demand billing read via EP19. In order to do so, read the device handle of the desired M-Bus device from the "Device Handle" field of ET14.

   When calling EP19, make sure that the "Transaction Number" field is set to a value that in not presently in use in ET15. There is no defined range for these fields, and so it is recommended that a value be chosen that is far removed from the values currently used in ET15. Consult the description of EP19 later in the present document for further guidelines on the transaction number to be used with EP19.

   Generally, the "Request Type" should be set to 2 (Billing Read) when EP19 is called, as this corresponds to the standard M-Bus billing read.

NOTE 1: When EP19 is invoked, the data read from the M-Bus device is stored in ET16, as described in the remainder of this clause.

2) Poll ET15 every second to confirm that the on-demand read request has been posted and successfully completed. To do so, poll the request queue of on-demand requests until the entry assigned the transaction number used in step 1 is found, and confirm that the "Result" field is set to "Success".

3) Read data from the ET16 entry corresponding to the M-Bus device identified in step 1. The maximum size of each entry is controlled by the "M-Bus/MEP Data Entry Size" field in ET11. The exact size of the latest read is captured in the "Billing Read Length" field in ET14 (referenced in step 3). Use the device identification read from ET16 to track desired M-Bus devices by their device handle.

NOTE 2: Other applications may call EP19 to post an on-demand billing read request for an M-Bus device, in which case the previous set of on-demand data stored in ET16 for that device would be overwritten, as the OSGP device supports storing one set of on-demand read data per device at a time. Therefore, applications should be programmed to read ET16 immediately after invoking EP19.

#### 8.18.1.2 Scheduled Reads for M-Bus Devices

The OSGP device can be programmed to perform regularly scheduled reads of the M-Bus device. The time of day that a scheduled read occurs is configurable. Scheduled reads can be set to repeat daily, weekly, monthly, or yearly. The scheduled read schedule for each M-Bus devices is stored in the "Scheduled Billing Read Time" of ET13 "M-Bus/MEP Device Config".

If the OSGP device is powered-down at the time a scheduled read is to occur, the scheduled read will be recorded the next time the OSGP device is powered-up, with a timestamp of when the actual reading occurred.

The OSGP device will store one copy of the most recent scheduled read data, and up to 11 additional sets total of previous scheduled read data for all M-Bus devices combined. Each set of M-Bus scheduled read data set can contain up to 525 bytes, including overhead - any data beyond that is ignored. Whenever a new scheduled read occurs, the oldest stored data set is overwritten if 12 sets are already stored. The log is not partitioned by device, so it could be entirely full of reads from one device, or a mixture of some or all devices. The results of each scheduled read are stored in ET45 "M-Bus/MEP Recurring Read Log".

The following describes how to use these tables and procedures to read scheduled M-Bus data for a device:

1) Poll the "Device Occupancy" bits in ET14 approximately once per minute to learn when a new M-Bus device has been added to the OSGP device. The point at which polling for new devices should be stopped may depend on the application, or knowledge from outside NES. The "Device Occupancy" bit(s) set in ET14 corresponds to the assigned slot(s) in ET14 and ET16.

2) Read the "Device Handle" field in the ET14 slot corresponding to the newly added device. Save this information.

3) Poll the "Billing Data Collected" alarm bit in the appropriate ET14 entry approximately once every 10 seconds to see when the first read from the new device has been captured. If it is possible that the first read has already taken place, this bit may already have been cleared by NES, so limit the polling of this bit to approximately 10 minutes. To be sure an entry has been recorded, read the "Billing Read Length" field in the appropriate ET14 entry. It will be set to a non-zero value when data has been recorded.

4) Read the ET16 entry corresponding to the device of interest for the M-Bus device identification information. The maximum size of each entry is controlled by the "M-Bus/MEP Data Entry Size" field in ET11. The exact size of the latest read is captured in the "Billing Read Length" field in ET14 (referenced in step 3). Use the device identification read from ET16 to track desired M-Bus devices by their device handle.

   Subsequent scheduled reads posted to the OSGP device will be stored in ET45 "MEP/M-Bus Recurring Read Log" after this. The number and size of entries in this log are dimensionable OSGP device parameters that are documented in ET36. ET36 is a table that consists of a set of definitions for manufacturer's log tables, which include ET45. The dimension information for ET45 is in the fifth entry of ET36. In that record there are two fields that indicate the present configuration of ET45 and shall be read in order to navigate ET45. The "Entry Size" field indicates the size of each log entry in ET45, and the "Current Entries" field indicates how many total entries exist in ET45, regardless of whether they are populated with data.

   Once the device handles for devices of interest and the configuration of ET45 have been acquired, the following steps should be followed to learn of and read new data postings from M-Bus devices. First, an introduction to the structure of ET45 is needed. ET45 is implemented as a circular queue of entries. The header fields (bytes 0...5) hold the information needed to read the queue. The "Number Of Valid Entries" field indicates how many entries in the queue contain data. The "Last Entry Element" field is the array element of the most recently recorded entry. The "Number Of Unread Entries" field stores the number of entries that have not been read through the system. This value may or may not pertain to another reader. It is recommended that the entire list be read, and that the "Last Entry Element" field is used to track the starting point of the entries listed in reverse chronological order. The header fields should not be changed.

5) Periodically (once per minute or longer as appropriate) poll the header of ET45 (ET45.1..ET45.5) to determine if and where new entries have been posted.

6) Using the dimension information ascertained from ET36, read the "Length" and "Handle" fields of the new entry or entries. If the handle of the new entry corresponds to a device of interest, read the entire entry, using the length information to read only necessary bytes. The device may have posted fewer bytes than the size of the ET45 entry.

7) Store the index of the ET45 array element just read and use that as the starting point for future reads, keeping in mind the next read may have wrapped around to element 0.

#### 8.18.1.3 One-Time-Reads for M-Bus Devices

The OSGP device can be programmed to perform a scheduled One-time-read of an M-Bus device. One-time-reads may be useful if it is desirable schedule a billing read on a specific date and time, e.g. when a customer moves out of a residence. Up to 4 One-time-reads can be scheduled in the OSGP device at once. This can be 1 read scheduled for each of the 4 M-Bus devices, or 4 reads of one M-Bus device (or any combination between the 4 reads and the 5 devices). Data collected from an M-Bus One-time-read is not interpreted or reformatted by the OSGP device, and is stored just as it was received from the M-Bus device. One-time-reads can be scheduled by calling EP24 "Post One-time-read Request". One-time read M-Bus data is stored in ET32 "M-Bus One-time Read Log".

If the OSGP device is powered-down at the time a One-time-read is scheduled to occur, the One-time-read will be recorded the next time the OSGP device is powered-up, with a timestamp of when the actual reading occurred.

The OSGP device stores up to 8 sets of M-Bus One-time-read data. Each set of M-Bus One-time-read data can contain up to 525 bytes, including overhead - any data beyond that is ignored. Whenever a new One-time-read occurs, the oldest stored One-time-read data set is overwritten if 8 sets are already stored. The log is not partitioned by device, so it could be entirely full of reads from one device, or a mixture of some or all devices.

#### 8.18.1.4 Power Outage Data-Read Interruptions

If a scheduled or on-demand record is interrupted or missed entirely by a power outage, the read will be performed when the power is restored. Timestamps of the read will represent when the read was completed.

### 8.18.2 Auto-discovery

Auto-discovery is the process by which the OSGP device polls the M-Bus network for new and previously commissioned devices. Newly discovered devices are added to the commissioned device list for regular polling, up to a maximum of four devices. The auto-discovery mode status can be determined by reading the "Mode" field in ET14 "M-Bus/MEP Device Status". M-Bus auto-discovery can be disabled by writing the "Auto Discovery Disable" field in ET04 "System Information".

### 8.18.3 Device Removal

An M-Bus device can be logically removed from the OSGP device with EP17 "Remove M-Bus/MEP Device".

### 8.18.4 M-Bus Status and Alarms

M-Bus status information and alarms can be read at a configurable interval, on-demand, or at the same time that billing information is collected. The date and time of each reading is included. The OSGP device can recognize the standard M-Bus alarms and status messages for items such as the type of counter, power level, permanent and temporary errors, and others.

NOTE: The baud rate the M-Bus devices are using should be considered when setting the frequency at which M-Bus status reads are performed to make sure that the read requests do not overload the OSGP device.

EXAMPLE: If the OSGP device is connected to four M-Bus devices that are operating at 300 baud and is configured to perform M-Bus status reads every minute, the OSGP device will not be able to successfully complete the read for all four devices.

The OSGP device will generate an M-Bus alarm when any of the following actions occur. Note that the "M-Bus/MEP Alarm" bit in BT72 "Events Identification" shall be enabled for the alarm to be generated:

- Scheduled billing read: Scheduled billing read is completed and billing data is collected.
- Status read: Status read is completed and at least one new high priority device alarm is set in the status data collected from an M-Bus device.
- Overflow of billing data: More billing data was read from a device than could be stored in the OSGP device. Excess data is discarded.
- Communications failure: During read of a commissioned device, if communication fails due to no response or a bad checksum, this alarm bit is set. In addition, if communication fails due to no response, the device is marked as "down" in the device status table.
- Serial number mismatch: When a response is received from a commissioned M-Bus device, the serial number is checked against what has been previously stored for that device and an alarm is set if they do not match. The billing data is still stored.
- An additional separate alarm in BT72, "M-Bus Auto-Discovery Complete," indicates that the OSGP device has exited auto-discovery mode. This alarm indicates that a new device(s) may have been added to the OSGP device. As a security feature, this alarm is set when auto-discovery mode is exited whether or not a new device was just added.

## 8.19 Compatibility Settings (mandatory)

The OSGP device has a compatibility setting that is used to control behaviour when working with PLC clients such as Data Concentrators. The compatibility setting is readable via read-only tables ET42 and ET54. The compatibility setting bit mask has these bits that determine:

- ICS - ICA NAK bit - whether a OSGP device sends an ICA NAK (0x1F) when a PLC client is attempting certain operations. Specifically, a NAK is sent if the interface change alarm is on and the client attempts a read or write of a table or an invocation of a procedure that is changeable in form or meaning based on OSGP device M or P fields.
- ICS - Blg/LP Format 2 bit - if not set, OSGP device disallows procedures that will modify the OSGP device interface in ways that older PLC clients cannot handle. Procedures that are not allowed include:
    1) EP32.
    2) EP11 with the "LPO Options Flags" set to true.

In addition, if the compatibility setting is not set and the OSGP device either has demand configured or the "LP Options Flags" turned on, then an incompatible configuration NAK (0x1E) is returned on any operation attempted that would cause the ICA NAK as described above, regardless of the ICA NAK bit setting.

Compatibility Settings are set via this message:

- 0x01 <count of bytes to follow (8 bits)> <bit array of compatibility settings>

# 9 Basic OSGP services

## 9.0 Foreword

All fields in the following messages, except <data> fields, are in MSB format. A sequence number and digest is added by the OSGP security mechanism in all messages, see clause 7.

For pending tables, all <count> and <length> fields include the Pending Event Descriptor (<PED>), when present. Furthermore, the checksum is calculated over the <PED> as well as the <data>. Finally, for partial reads and writes, the offset is not affected by the presence of the <PED>. For example, to read 4 bytes from offset 3 of a pending table, the <count> would be 10 and the offset would be 3. The OSGP device knows by the table ID whether to expect the <PED> or not.

## 9.1 Matching of requests and responses

The OSGP protocol is master-slave to avoid collisions because the nodes may not be able to hear each other. Therefore, overlapping transactions cannot be supported. Procedures shall be executed strictly one at a time, waiting for a first procedure result before calling the next.

Each OSGP transaction request is carried by an BS EN 14908-1:2014 [1] session layer request, and the OSGP response is carried by an BS EN 14908-1:2014 [1] session layer response. If two procedures are invoked the result of the second procedure will always overwrite the result of the first procedure. Table writes will execute regardless of their response reaching the requester.

## 9.2 Buffer sizing restrictions

The following restrictions apply to buffer sizing:

a) The maximum length of explicit message (including OSGP commands) is 114 bytes.

b) The maximum number of table bytes requested on partial reads is 84 bytes.

c) The maximum number of table bytes sent on partial writes is 75 bytes.

# 9.3 Full Table Read service

## 9.3.1 Request

The OSGP Full Read Request command provides the capability to read the entire specified data table in the device.

| | | |
|---|---|---|
| <length> | 2 (MSB - Most Significant Byte first) | The number of bytes in the remainder of the message, not including the <length> field. |

To me it seems this item is part of the Lon transport layer (it is not in the APDU traces), so I did not include it.

**Full read request:** <command> <table ID>

The Full Read service request uses the following parameters.

**Table 6**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <command> | UINT8 | 0x30 | 0x30 identifies Full read request command |
| <tableID> | UINT16 | Table Identifier | 0 to 65 535, the target table ID |

## 9.3.2 Full Read Response

The Full read service response will contain the table data as specified in the read service request.

**Full read response:** <response> <count> <data>

When the read request targets a pending table, a six octet pending event description is added before the table data.

The Full Read service response uses the following parameters.

**Table 7**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <response> | UINT8 | <nok>\|<ok> | See response code for details |
| <count> | UINT16 | | Length of <PED> and <data> returned, in bytes |
| <PED> | PED | | The Pending Event descriptor is present for pending tables only, see BT 04 |
| <data> | | | Table data requested, in LSB format |
| NOTE: OSGP does not support segmentation. Partial reads and write may be used wisely with the maximum payload size of 84 bytes in mind. If the number of bytes requested exceeds the number available in the table, the extra bytes are returned as zeroes and no error is returned. | | | |

# 9.4 Full Table write service

## 9.4.1 Request

The Full Write Request command writes bytes to the entire specified data table in the device. If fewer bytes are provided than will fill the table, only those bytes provided are written and the remainder is left as is and no error is returned. If more bytes are provided than will fit in the table, the extra bytes are ignored and no error is returned.

**Full write request:** <command> <table ID> <count> <data>

The Full Write service request uses the following parameters.

**Table 8**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <command> | UINT8 | 0x40 | |
| <tableID> | UINT16 | Table Identifier | 0 to 65 535, the target table ID. |
| <count> | UINT16 | | Length of <PED> and table <data> to be written, in bytes. If this is set to a value that is larger than the actual data passed, then the additional data passed will be ignored. If this field is set to a value that is smaller than the size of the table being written to, then only <count> bytes will be written.<br>If this field is missing or less than 2 bytes, then the interpreted value will be indeterminate. No error will be returned in this case. |
| <PED> | PED | | The Pending Event descriptor is present for pending tables only, see BT 04. |
| <data> | | | Table data to be written, in LSB format. |

### 9.4.2 Response

Full write response: <response>

The Full Write service response uses the following parameters:

**Table 9**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <response> | UINT8 | <nok>\|<ok> | See response code for details |

## 9.5 Partial table read

### 9.5.1 Request

The Partial Read Request command reads the specified bytes in the specified data table in the device. If the number of bytes requested exceeds the number available in the table, the extra bytes are returned as zeroes and no error is returned.

**Partial read request:** <command> < table ID> <offset> <count>

The Partial Read service request uses the following parameters.

**Table 10**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <command> | UINT8 | 0x3F | 0x30 identifies Partial read request command |
| <tableID> | UINT16 | Table Identifier | 0 to 65 535, the target table ID |
| <offset> | UINT24 | | Byte offset into data table of where to begin reading |
| <count> | UINT16 | | Length of <PED> and table data requested, in bytes |

### 9.5.2 Response

Response is of the same format as the full read response.

# 9.6 Partial table write

## 9.6.1 Request

The Partial Write Request command writes the specified bytes into the specified data table in the device. If more bytes are provided than will fit in the table, the extra bytes are ignored and no error is returned.

**Partial write request:** <command> <table ID> <offset> <count> <data>

The Partial Write service request uses the following parameters:

**Table 11**

| Message field | Data type | Value | Comments |
|---|---|---|---|
| <command> | UINT8 | 0x4F | 0x30 identifies Partial read request command. |
| <tableID> | UINT16 | Table Identifier | 0 to 65 535, the target table ID. |
| <offset> | UINT24 | | Byte offset into data table of where to begin reading. |
| <count> | UINT16 | | Length of <PED> and table data requested, in bytes. If this is set to a value that is larger than the actual data passed, then the additional data passed will be ignored. If this field is set to a value that is smaller than the size of the table being written to, then only <count> bytes will be written.<br>If this field is missing or less than 2 bytes, then the interpreted value will be indeterminate. No error will be returned in this case. |
| <PED> | PED | | The Pending Event descriptor is present for pending tables only, see BT 04. |
| <data> | | | Table data to be written, in LSB format. |

## 9.6.2 Response

Response is of the same format as the full write response.

# 9.7 Request/Response sequencing

The BS EN 14908-1:2014 [1] sequence number is handled by the OSGP device as follows:

a) If incoming sequence number is N as expected, OSGP device fulfills request and responds appropriately.

b) If incoming sequence number is N-1 OSGP device does not re-perform the action requested, but sends the response that was sent for the previous request (this may be <ok> or <nok> depending on the validity of the request).

c) If incoming sequence number is N to N+8, OSGP device accepts the request as a valid new request and sets the expected sequence number to the number received plus 1.

d) If incoming sequence number is anything other than the cases described, OSGP device responds with error code <seq> and the correct sequence number.

e) (Partially secure broadcasts) If incoming sequence number is 0, broadcast or one-to-one, the message will be accepted, assuming the digest is correct.

f) (Secure broadcasts) If a message is a broadcast, and the sequence number is non-zero, then it shall fall into the secure sequence number range as defined by the secure broadcast protocol (see clause 9.11). The secure broadcast parameters are defined in ET04.

## 9.8 Request/Response OSGP APDU example

**Partial read request:**

- > 00:3F:0034:000000:0006:F52F5481:599DF7BCF192C236

OSGP APDU description:

| | |
|---|---|
| 00: | BS EN 14908-1:2014 [1] application code. |
| 3F: | OSGP service request code (partial table read). |
| 0034: | OSGP table ID (BT52). |
| 000000: | Table offset (0). |
| 0006: | Count (6). |
| F52F5481: | OSGP sequence number. |
| 599DF7BCF192C236: | OSGP digest calculated assuming the following inputs:<br>Key is 12 bytes of 0xDF.<br>digest input: 02 02 00 3f 00 34 00 00 00 00 06 F5 2F 54 81 where 02 03 is the subnet/node ID and remaining input is entire request message. |

**Response from OSGP device:**

- < 00:00:0006:0402100F3B37:303D9BBE3DA3A8B6

Packet description:

| | |
|---|---|
| 00: | BS EN 14908-1:2014 [1] application code. |
| 00: | OSGP <ok> response code. |
| 0006: | Count (6). |
| 0402100F3B37: | OSGP table data in LSB format. |
| 303D9BBE3DA3A8B6: | OSGP digest calculated assuming the following inputs:<br>Key is 12 bytes of 0xDF.<br>digest input: 02 02 00 3F 00 34 00 00 00 00 06 F5 2F 54 81 00 00 00 06 04 02 10 0F 3B 37 0A where 02 03 is the subnet/node ID, the remaining input is entire request and response messages and the response length (0x0A). |

## 9.9 Response error codes

The two types of response codes the OSGP device may return are <ok> and <nok>.

- <nok> indicates one of the following response codes:
  - <nok> = <sns> | <onp> | <iar> | <bsy> | <dig> | <seq> | <inc> | <ica>

**Table 12**

| Response code | Response value | Definition | Reason |
|---|---|---|---|
| <ok> | 0x00 | Acknowledge - No problems, request accepted. | Command accepted. |
| <err> | 0x01 | Error. | This error will be received when in response to a Security request when the password entered does not match any in the device, or if an unrecognized request is submitted. |
| <sns> | 0x02 | Service Not Supported - The error response will be sent to the device when the requested service is not supported. This error indicates that the message received was valid, but the request could not be honoured. | This error will be received in instances where an invalid or unsupported command is received (e.g. Terminate request over PLC), or if the BS EN 14908-1:2014 [1] app code received is not 0x00 or 0x04. |
| <isc> | 0x03 | Insufficient Security Clearance - This error indicates that the current authorization level (key plus control word setting) is insufficient to complete the request. | This error will be received when trying to access a secure table or procedure via the PLC. Example: Rd/Wr request to BT42. Other cases include using PK when PK is disabled, and using the wrong key on the wrong port. |
| <onp> | 0x04 | Operation Not Possible - This error will be sent to the device that requested an action that is not possible. This error indicates that the message was valid, but the message could not be processed. | This error will be received in instances where an invalid length, offset, or same procedure sequence number is received, if the layer 7 checksum is incorrect, or if an invalid baud rate is attempted in the Negotiate request. |
| <iar> | 0x05 | Inappropriate Action Requested - This error indicates the requested action was inappropriate. | This error will be received for actions such as a write request to a read only table, access to an invalid table/procedure ID, and partial read/write requests of BT07 and BT08. |
| <bsy> | 0x06 | Device Busy - This error indicates the requested action was not acted upon because the device was busy doing something else. | A remote device will receive this message if an optical port session is in progress. |
| <isss> | 0x0A | Invalid Service Sequence State - This error indicates the request is not accepted at the current service sequence state (n/a for PLC channel). | This error will be received for example when a login request is submitted when the user is already logged in, or a read request is submitted before login. |
| <dig> | 0x0B | Digest Error - This error indicates an error with the BS EN 14908-1:2014 [1] digest. | This error will be received when a BS EN 14908-1:2014 [1] message is sent to the device with an invalid or missing digest. |
| <seq> | 0x0C | Sequence Nbr Error - This error indicates an error with the BS EN 14908-1:2014 [1] sequence number. | This error will be received if an invalid sequence number is sent to the device. The device will respond with the correct sequence number. |
| <inc> | 0x1E | Incompatible Error - This error indicates the device is in an incompatible state for the client. | The OSGP device has data in formats that are incompatible with the client. |
| <ica> | 0x1F | Interface Change - This error indicates that the data will not be returned until the interface change alarm is cleared. | The OSGP device has dimension changes that the client may not know about. |

## 9.10 Transactions

The OSGP protocol supports a very limited message size. It is not possible to atomically read/write tables larger than a few dozen bytes. It is also not possible in OSGP to deliver multiple write commands and be sure that all will take effect. The transaction table provides an ability to safely execute complex interactions with the OSGP device using transactions. The semantics allow the Data concentrator to start a transaction, deliver a collection of OSGP commands and then commit the transaction. Either all the requests occur or none.

The transaction table actually consists of a transaction request table (ET27) and transaction response table (ET28). The Data Concentrator will write a series of OSGP commands to the transaction request table. Upon finishing the write, the OSGP device will execute them and put the results into the transaction response table.

The tables contain a series of requests or responses wrapped by a duplicated transaction number. The OSGP requests and responses do not include checksums. They do include pending table data as appropriate. Note that while OSGP requests and responses sent over BS EN 14908-1:2014 [1] PLC are preceded by a 00 byte, this is not true of OSGP requests and responses stored in the transaction tables. Including a transaction number at the beginning and end of the table allows the OSGP device to ensure that the data is consistent and fully applies to the same transaction. The rule for table readers/writers is that the data shall be read/written consecutively from first to last byte. It is up to the transaction originator to manage the transaction space and ensure that transaction numbers are unique.

Each step of a transaction is executed atomically but the entire transaction is not. To allow for the case of a power cycle between steps of a transaction, a transaction is re-executed on power up if it was interrupted. This means that a transaction shall be idempotent (capable of getting the same result if executed multiple times). This means no step of a transaction should consist of a non-idempotent procedure (such as BP05 or BP16) nor should the entire transaction be non-idempotent. An example of the latter would be a transaction that reads BT03 and then clears BT03. If this were re-executed on a power up, the second execution would always read a cleared BT03.

## 9.11 Secure Broadcasts

The sequence number of 0 shall be used during broadcasts to indicate that no sequence check is to be performed. Such broadcasts are not immune to replay attack. Consequently normal sequencing shall not use the sequence number 0 and therefore, secure broadcasts shall be sent using the secure broadcast sequence number as follows:

Each device shall have:

- A 32-bit secure broadcast sequence base number, B.
- An acceptable delta beyond B, called D.
- The most recently used broadcast sequence number, R.
- A device shall accept a broadcast with sequence number N if N is greater than R and less than B+D. B and D shall be set during commissioning. As R approaches B+D (range exhaustion), a new value for B shall be sent to each device. This shall occur when the range has fewer than 100 sequence numbers remaining or is within 10 % of exhaustion, whichever is the fewer. This is known as secure broadcast resynchronization. If a new value is set in the device, it shall reset R to B. The first number used to be used shall be B+1.

NOTE: Range exhaustion should be rare if D set to a large number such as 4 096.

- When a device is added or replaced, initial synchronization shall be done as part of the commissioning function. Resynchronization (for range exhaustion) is done by a separate function. If any device fails to resynchronize and later comes back up, the resynchronization shall be retried. During this time, the data concentrator shall continue to use the dual sequence numbers.
- The data concentrator shall always choose a value for B where B+D is greater than B, i.e. D is 1 or greater.

## 9.12 Downloading

Downloading shall use a broadcast sequence number allocated from the above range that shall be fixed for the duration of the download.

# 9.13 Procedure invocation

## 9.13.0 Foreword

Actions performed by the OSGP device are achieved through procedures. Procedures are initiated by writing into BT07 in the OSGP device and the response is read in BT08 "Procedure response Table", if configured. Writing to BT07 "Procedure Initiate Table" with the procedure number requested and any input parameters, the OSGP device shall perform the requested action and return the result in BP08, if configured. Reading BT08 before writing to BT07 may have unexpected results. The contents of BT08 are dependent on the last procedure written to BT07.

NOTE: Direct table writes, including those to BP07 for executing procedures, may be limited to an average of once every 15 minutes, so that the average number of table writes per day does not exceed 100.

Processing new alerts shall always supersede a non-alert procedure invocation.

The procedure number formats are BPxx for Basic Procedures and EPxx for Extended Procedures, for example, BP01 or EP04.

The OSGP agent willing to invoke a procedure shall write in BT07 table:

- The procedure identifier (PROC).
- The response handling code.
- The request sequence number (SEQ).

As listed in table 13, followed by the list of parameters for the procedure. Each procedure defines its own format for parameters.

These parameters are packed as a single record, starting with PROC and SEQ, followed by the packed parameter format as defined by the specific procedure (see annexes C and D).

**Table 13: Data written from DC to OSGP device BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Procedure number | UINT(0..11) | 0 | | H | Procedure to be executed in the OSGP device, range 0 to 2 065. |
| Response handling | UINT(12..15) | 0 | 0 | P | Response posted in BP08 upon procedure completion. |
| Procedure sequence number (PSN) | UINT8 | 2 | | H | Set by initiator and returned in BP08, used for coordination. First sequence number after login shall be other than 255. To differentiate the optical device from other possible sources, the sequence number shall be in the range of 0 to 4. Contiguous sequence numbers shall be different. If a sequence number is repeated, then the write to BP07 will result in a response code of 0x04. |

After executing the procedure, the OSGP device shall write the response in BT 08, as illustrated in table 14.

**Table 14: OSGP device procedure response written in BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Procedure number | UINT(0..11) | 0 | | M | Procedure last executed in the OSGP device. |
| Filler | FILL(12..15) | 0 | | | |
| Procedure sequence number (PSN) | UINT8 | 2 | | M | Procedure sequence number (from BP07) of procedure last executed. Use this field as a check that the result posted corresponds to the request that was submitted, as opposed to a request from the optical or power-line user. |
| Result code | UINT8 | 3 | | M | The following are the most commonly used procedure response codes. Certain procedures may use other codes. These are specified within the appropriate procedure as they have procedure-specific meaning:<br>0 = Procedure completed.<br>1 = Procedure accepted but not fully completed.<br>2 = Invalid parameter for known procedure, procedure ignored.<br>3 = Procedure conflicts with current device setup, procedure ignored.<br>4 = Timing constraint, procedure ignored.<br>5 = No authorization for requested procedure, procedure ignored.<br>6 = Unrecognized procedure, procedure ignored.<br>7 to 255: reserved. |

Note that this mechanism does not allow concurrent procedure execution. Procedures shall be executed strictly one at a time, waiting for a first procedure result before calling the next. If two procedures are invoked the result of the second procedure will always overwrite the result of the first procedure.

### 9.13.1 Procedure Timing

In general, procedures shall be executed synchronously. This means that the OSGP device shall receive the BP07 write, execute the procedure, and send the response to the BP07 write. As a result, by the time BP08 is read for the result, the procedure will have executed. However, in some cases the procedure may set the result code in BP08 to "incomplete" as an indicator that the procedure did not fully execute. In this case, it might be appropriate to continue to read BP08 waiting for the result code to change to something other than "incomplete". However, this may not always be appropriate because some procedures return "incomplete" as a final result, and not as an intermediate result. If "incomplete" is used to indicate incomplete execution, then that fact will be explicitly stated in the procedure result code description.

### 9.13.2 Slow and Non-Responsive Procedures

Another concern with synchronous execution is the duration of the procedure execution. For most procedures, the time to execute the function is very short and thus the execution time will not affect the timing of the BP07 write response. However, in some cases the delay in responding to the BP07 write may be significant. Also, some procedures will never respond to BP07 writes because they force the OSGP device to reset. Any procedure that has this concern will refer to this clause.

When a procedure has a long execution time or the procedure is non-responsive and the initiator is time sensitive (e.g. a PLC client), then it is recommended that the BP07 write should be sent unacknowledged (unacknowledged-repeat service preferred). The sender should then wait a while (10 seconds is a good number) and then poll BP08. If BP08 shows that the procedure has not executed (i.e. the procedure sequence number and procedure number do not match), then the sender shall assume the BP07 write was lost and resend it and repeat the wait process. This outer retry loop shall be repeated as necessary a reasonable number of times (e.g. 4) to allow for communication failures on the unacknowledged message.

# Annex A (normative): Basic Tables

## A.1 Basic Table 00 (BT00): General Configuration

This table describes the general configuration and layout of the remaining tables and procedures in the OSGP device and how to read their data. The symbols defined in table A.1 are used throughout the definition of BT00.

**Table A.1**

| Symbol | Value |
|---|---|
| A | BT00.13 |
| B | BT00.13 + BT00.14 |
| C | BT00.13+BT00.14+BT00.15 |
| D | BT00.13+BT00.14+BT00.15+BT00.16 |

- Read access: Open, password not required.
- Write access: None.

**Table A.2**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Data Order | UINT(0..0) | 0 | 0 | P | Order of bytes in multi-byte field communication transfer.<br>0 = Little endian or least significant byte (LSB) first.<br>1 = Big endian or most significant byte (MSB) first. |
| Char Format | UINT(1..3) | 0 | 1 | P | Format of char data type used throughout tables.<br>0 = Unassigned.<br>1 = ASCII per ISO/IEC 646:1991 [i.1].<br>2 = ISO 8859/1 or ECMA-94 [i.2] Latin 1<br>3..7 = Unassigned |
| Filler | FILL(4..7) | 0 | | | |
| Time Format | UINT(0..2) | 1 | 2 | F | Data type used for dates and times.<br>2 = UINT8 with discrete fields for year, month, day, hour, minute, second. |
| Data Access Method | UINT(3..4) | 1 | 1 | F | Method of partial table data transfer:<br>1 = Offset count method is supported. |
| Identification Format | UINT(5..5) | 1 | 1 | P | Format of OSGP device identifier fields in tables BT01,BT05, and BT06:<br>0 = CHAR string.<br>1 = BCD. |
| Integer Format | UINT(6..7) | 1 | 0 | F | Format of signed integer data types.<br>0 = Two's complement. |
| Non Integer Format 1 | UINT(0..3) | 2 | 8 | P | Data type used for table fields specified as NI_FMAT1. 8 = 4-byte signed integer format. |
| Non Integer Format 2 | UINT(4..7) | 2 | 8 | P | Data type used for table fields specified as NI_FMAT2. 8 = 4-byte signed integer format. |
| Manufacturer | ARRAY[4] Of CHAR | 3 | ELON | P | OSGP device manufacturer identification. |
| Nameplate Type | UINT8 | 7 | 2 | F | Type of OSGP device and nameplate information contained in these tables.<br>2 = Electric. |
| Default Set Used | UINT8 | 8 | 0 | F | This field is reserved for future use. |
| Procedure Parameter Length | UINT8 | 9 | 255 | P | Maximum length in bytes of parameters passed to procedures in BT07. |
| Response Data Length | UINT8 | 10 | 12 | P | Maximum length in bytes of parameters returned by procedures in BT08. |
| Standard Version | UINT8 | 11 | 1 | F | Device data table structure standard version number. |
| Standard Revision | UINT8 | 12 | 0 | P | Device data table structure standard revision number. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Dim Basic Tables Used | UINT8 | 13 | 10 | P | Number of bytes required to represent the set of Basic Tables used in the OSGP device, where each bit in the set represents a specific Basic Table. |
| Dim Extended Tables used | UINT8 | 14 | 13 | P | Number of bytes required to represent the set of Extended Tables used in the OSGP device, where each bit in the set represents a specific Extended Table. |
| Dim Basic Procedures Used | UINT8 | 15 | 2 | P | Number of bytes required to represent the set of Basic Procedures used in the OSGP device, where each bit in the set represents a specific Basic Procedure. |
| Dim Extended Procedures Used | UINT8 | 16 | 12 | P | Number of bytes required to represent the set of Extended Procedures used in the OSGP device, where each bit in the set represents a specific Extended Procedure. |
| Manufacturer Status Length | UINT8 | 17 | 4 | P | Number of bytes used for indicating manufacturer defined alarms and statuses. |
| Number of Pending Tables | UINT8 | 18 | 2 | P | Number of pending tables used in the OSGP device. |
| The following Value flags list the tables and procedures implemented in the OSGP device:<br>TRUE = The table/procedure is implemented.<br>FALSE = The table/procedure is NOT implemented.<br>In general, any table or procedure marked as not implemented and 'F' could be added in a future OSGP device release and this would be backward compatible. Tables marked 'P' below are deemed most likely to be added in the near future. | | | | | |
| STD_TBLS_USED: | SET(BT00.13) | | | | Bitmask of Basic Tables used in the OSGP device |
| BT00 used | BOOL(0) | 19 | TRUE | F | General Configuration |
| BT01 used | BOOL(1) | 19 | TRUE | F | General Manufacturer Identification |
| BT02 used | BOOL(2) | 19 | TRUE | F | Device Nameplate |
| BT03 used | BOOL(3) | 19 | TRUE | F | End Device Mode Status |
| BT04 used | BOOL(4) | 19 | TRUE | F | Pending Status |
| BT05 used | BOOL(5) | 19 | TRUE | F | Device Identification |
| BT06 used | BOOL(6) | 19 | TRUE | F | Utility Information |
| BT07 used | BOOL(7) | 19 | TRUE | F | Procedure Initiate |
| BT08 used | BOOL(0) | 20 | TRUE | F | Procedure Response |
| Filler | BOOL(1) | 20 | | | |
| BT10 used | BOOL(2) | 20 | TRUE | F | Dimension Sources Limiting |
| BT11 used | BOOL(3) | 20 | FALSE | P | Actual Sources |
| BT12 used | BOOL(4) | 20 | TRUE | F | Unit of Measure Entry |
| BT13 used | BOOL(5) | 20 | TRUE | F | Demand Control |
| BT14 used | BOOL(6) | 20 | FALSE | P | Data Control |
| BT15 used | BOOL(7) | 20 | TRUE | F | Constants |
| BT16 used | BOOL(0) | 21 | TRUE | F | Source Definition |
| Filler | BOOL(1) | 21 | | | |
| Filler | BOOL(2) | 21 | | | |
| Filler | BOOL(3) | 21 | | | |
| BT20 used | BOOL(4) | 21 | TRUE | F | Dimension Register |
| BT21 used | BOOL(5) | 21 | TRUE | F | Actual Register |
| BT22 used | BOOL(6) | 21 | TRUE | F | Data Selection |
| BT23 used | BOOL(7) | 21 | TRUE | F | Current Register Data |
| BT24 used | BOOL(0) | 22 | TRUE | F | Previous Season Data |
| BT25 used | BOOL(1) | 22 | TRUE | P | Previous Demand Reset |
| BT26 used | BOOL(2) | 22 | TRUE | F | Self Read Data |
| BT27 used | BOOL(3) | 22 | TRUE | F | Present Register Selection |
| BT28 used | BOOL(4) | 22 | TRUE | F | Present Register Data |
| Filler | BOOL(5) | 22 | | | |
| BT30 used | BOOL(6) | 22 | TRUE | F | Dimension Display |
| BT31 used | BOOL(7) | 22 | FALSE | P | Actual Display |
| BT32 used | BOOL(0) | 23 | FALSE | F | Display Source |
| BT33 used | BOOL(1) | 23 | TRUE | F | Primary Display List |
| BT34 used | BOOL(2) | 23 | FALSE | P | Secondary Display List |
| Filler | BOOL(3) | 23 | | | |
| Filler | BOOL(4) | 23 | | | |
| Filler | BOOL(5) | 23 | | | |
| Filler | BOOL(6) | 23 | | | |
| Filler | BOOL(7) | 23 | | | |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| BT40 used | BOOL(0) | 24 | TRUE | F | Dimension Security Limiting |
| BT41 used | BOOL(1) | 24 | FALSE | F | Actual Security |
| BT42 used | BOOL(2) | 24 | TRUE | F | Security |
| BT43 used | BOOL(3) | 24 | TRUE | F | Default Access Control |
| BT44 used | BOOL(4) | 24 | TRUE | F | Access Control |
| BT45 used | BOOL(5) | 24 | FALSE | F | Key |
| Filler | BOOL(6) | 24 | | | |
| Filler | BOOL(7) | 24 | | | |
| Filler | BOOL(0) | 25 | | | |
| Filler | BOOL(1) | 25 | | | |
| BT50 used | BOOL(2) | 25 | TRUE | F | Dimension Time and TOU |
| BT51 used | BOOL(3) | 25 | FALSE | P | Actual Time and TOU |
| BT52 used | BOOL(4) | 25 | TRUE | F | Clock |
| BT53 used | BOOL(5) | 25 | TRUE | F | Time Offset |
| BT54 used | BOOL(6) | 25 | TRUE | F | Calendar |
| BT55 used | BOOL(7) | 25 | TRUE | F | Clock State |
| BT56 used | BOOL(0) | 26 | FALSE | F | Time Remaining |
| Filler | BOOL(1) | 26 | | | |
| Filler | BOOL(2) | 26 | | | |
| Filler | BOOL(3) | 26 | | | |
| BT60 used | BOOL(4) | 26 | TRUE | F | Dimension Load Profile |
| BT61 used | BOOL(5) | 26 | TRUE | F | Actual Load Profile |
| BT62 used | BOOL(6) | 26 | TRUE | F | Load Profile Control |
| BT63 used | BOOL(7) | 26 | TRUE | F | Load Profile Status |
| BT64 used | BOOL(0) | 27 | TRUE | F | Load Profile Data Set 1 |
| BT65 used | BOOL(1) | 27 | FALSE | P | Load Profile Data Set 2 |
| BT66 used | BOOL(2) | 27 | FALSE | F | Load Profile Data Set 3 |
| BT67 used | BOOL(3) | 27 | FALSE | F | Load Profile Data Set 4 |
| Filler | BOOL(4) | 27 | | | |
| Filler | BOOL(5) | 27 | | | |
| BT70 used | BOOL(6) | 27 | TRUE | F | Dimension Log |
| BT71 used | BOOL(7) | 27 | TRUE | F | Actual Log |
| BT72 used | BOOL(0) | 28 | TRUE | F | Events Identification |
| BT73 used | BOOL(1) | 28 | TRUE | F | History Log Control |
| BT74 used | BOOL(2) | 28 | TRUE | F | History Log |
| BT75 used | BOOL(3) | 28 | FALSE | P | Event Log Control |
| BT76 used | BOOL(4) | 28 | FALSE | P | Event Log |
| Filler | BOOL(5) | 28 | | | |
| Filler | BOOL(6) | 28 | | | |
| Filler | BOOL(7) | 28 | | | |
| Filler | UINT8 | 29..19+A-1 | | | |
| MFG_TBLS_USED: | SET(BT00.14) | | | | Bitmask of Extended Tables used in the OSGP device |
| ET00 used | BOOL(0) | 19+A | TRUE | F | Calibration |
| ET01 used | BOOL(1) | 19+A | TRUE | F | LED/ KYZ Options |
| ET02 used | BOOL(2) | 19+A | TRUE | F | RTC Calibration |
| ET03 used | BOOL(3) | 19+A | TRUE | F | Utility Information |
| ET04 used | BOOL(4) | 19+A | TRUE | F | System Information |
| ET05 used | BOOL(5) | 19+A | TRUE | F | Control Output Settings |
| ET06 used | BOOL(6) | 19+A | TRUE | F | Pulse Inputs |
| ET07 used | BOOL(7) | 19+A | TRUE | F | Display Options |
| ET08 used | BOOL(0) | 20+A | TRUE | F | Measurement Data |
| ET09 used | BOOL(1) | 20+A | TRUE | F | Power Quality |
| ET10 used | BOOL(2) | 20+A | TRUE | F | Internal Power Outage |
| ET11 used | BOOL(3) | 20+A | TRUE | F | MFG Dimensions |
| ET12 used | BOOL(4) | 20+A | TRUE | F | Daily Consumption |
| ET13 used | BOOL(5) | 20+A | TRUE | F | MEP Device Config |
| ET14 used | BOOL(6) | 20+A | TRUE | F | MEP Device Status |
| ET15 used | BOOL(7) | 20+A | TRUE | F | MEP On-Demand Requests |
| ET16 used | BOOL(0) | 21+A | TRUE | F | MEP Device Data |
| ET17 used | BOOL(1) | 21+A | TRUE | F | SW Dnld Verification and Code Bank Information |
| ET18 used | BOOL(2) | 21+A | TRUE | F | DC Component |
| ET19 used | BOOL(3) | 21+A | TRUE | P | OSGP device One Time Read Queue |
| ET20 used | BOOL(4) | 21+A | TRUE | P | MEP One Time Read Queue |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| ET21 used | BOOL(5) | 21+A | TRUE | F | Load Profile Internal Configuration |
| ET22 used | BOOL(6) | 21+A | TRUE | F | Error Codes Configuration |
| ET23 used | BOOL(7) | 21+A | TRUE | F | Reserved - Internal use only |
| ET24 used | BOOL(0) | 22+A | FALSE | F | Internal use only |
| ET25 used | BOOL(1) | 22+A | FALSE | F | Internal use only |
| ET26 used | BOOL(2) | 22+A | FALSE | F | Internal use only |
| ET27 used | BOOL(3) | 22+A | TRUE | F | Transaction Request Table |
| ET28 used | BOOL(4) | 22+A | TRUE | F | Transaction Response Table |
| ET29 used | BOOL(5) | 22+A | TRUE | F | Hardware Configuration |
| ET30 used | BOOL(6) | 22+A | TRUE | F | Maximum Power Level Control |
| ET31 used | BOOL(7) | 22+A | TRUE | F | OSGP device One-Time Read Log |
| ET32 used | BOOL(0) | 23+A | TRUE | F | M-Bus One-Time Read Log |
| ET33 used | BOOL(1) | 23+A | TRUE | F | Group Configuration |
| ET34 used | BOOL(2) | 23+A | TRUE | P | MEP Device Config 2 |
| ET35 used | BOOL(3) | 23+A | TRUE | P | MFG test |
| ET36 used | BOOL(4) | 23+A | TRUE | P | Mfg Actual Dimensions |
| ET37 used | BOOL(5) | 23+A | TRUE | P | Build Info |
| ET38 used | BOOL(6) | 23+A | TRUE | P | Config ID Log |
| ET39 used | BOOL(7) | 23+A | TRUE | P | Previous Demands |
| ET40 used | BOOL(0) | 24+A | TRUE | P | Demand Configuration |
| ET41 used | BOOL(1) | 24+A | TRUE | P | Historical Demand Resets |
| ET42 used | BOOL(2) | 24+A | TRUE | P | Interface Definition |
| ET43 used | BOOL(3) | 24+A | TRUE | P | Test Mode Configuration |
| ET44 used | BOOL(4) | 24+A | TRUE | P | Test Mode Status |
| ET45 used | BOOL(5) | 24+A | TRUE | P | MEP Recurring Read Log |
| ET46 used | BOOL(6) | 24+A | TRUE | P | Ctrl Output Read Only Data |
| ET47 used | BOOL(7) | 24+A | TRUE | P | Calendar Override |
| ET48 used | BOOL(0) | 25+A | TRUE | P | Feature Activation |
| ET49 used | BOOL(1) | 25+A | TRUE | P | Display Output |
| ET50 used | BOOL(2) | 25+A | TRUE | P | MEP Inbound |
| ET51 used | BOOL(3) | 25+A | TRUE | P | MEP Device Config |
| ET52 used | BOOL(4) | 25+A | TRUE | P | MEP Transaction Request |
| ET53 used | BOOL(5) | 25+A | TRUE | P | MEP Transaction Response |
| ET54 used | BOOL(6) | 25+A | TRUE | P | OSGP device Status |
| ET55 used | BOOL(7) | 25+A | TRUE | P | OSGP device Config |
| ET56 used | BOOL(0) | 26+A | FALSE | P | Load-side calibration |
| ET57 used | BOOL(1) | 26+A | TRUE | P | MDTT |
| ET58 used | BOOL(2) | 26+A | TRUE | P | MEA Status Extension |
| ET59 used | BOOL(3) | 26+A | TRUE | P | MEP Proc Response |
| ET60 used | BOOL(4) | 26+A | TRUE | P | Configurable Energy Accumulator Settings |
| ET61 used | BOOL(5) | 26+A | TRUE | P | Time-Based Relay Control |
| ET62 used | BOOL(6) | 26+A | FALSE | P | |
| ET63 used | BOOL(7) | 26+A | FALSE | P | |
| ET64 used | BOOL(0) | 27+A | FALSE | P | |
| ET65 used | BOOL(1) | 27+A | FALSE | P | |
| ET66 used | BOOL(2) | 27+A | TRUE | P | LP Source Mapping Table |
| ET67 used | BOOL(3) | 27+A | TRUE | P | Display Source Mapping Table |
| ET68 used | BOOL(4) | 27+A | TRUE | P | Critical Events |
| ET69 used | BOOL(5) | 27+A | TRUE | P | Critical Event Bitmasks |
| ET70 used | BOOL(6) | 27+A | TRUE | P | RAM Only Status |
| ET71 used | BOOL(7) | 27+A | FALSE | P | |
| Filler | UINT8 | 28+A..19+B-1 | | | |
| STD_PROC_USED: | SET(BT00.15) | | | | Bitmask of Basic Procedures used in the OSGP device |
| BP00 used | BOOL(0) | 19+B | FALSE | F | Cold Start |
| BP01 used | BOOL(1) | 19+B | FALSE | F | Warm Start |
| BP02 used | BOOL(2) | 19+B | FALSE | F | Save Configuration |
| BP03 used | BOOL(3) | 19+B | FALSE | F | Clear Data |
| BP04 used | BOOL(4) | 19+B | TRUE | F | Reset List Pointers |
| BP05 used | BOOL(5) | 19+B | TRUE | F | Update Last Read Entry |
| BP06 used | BOOL(6) | 19+B | TRUE | P | Change End Device Mode |
| BP07 used | BOOL(7) | 19+B | FALSE | F | Clear Basic Status Flags |
| BP08 used | BOOL(0) | 19+B | FALSE | F | Clear Extended Status Flags |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| BP09 used | BOOL(1) | 20+B | FALSE | F | Remote Reset |
| BP10 used | BOOL(2) | 20+B | TRUE | F | Set Date and/or Time |
| BP11 used | BOOL(3) | 20+B | FALSE | F | Execute Diagnostics Procedure |
| BP12 used | BOOL(4) | 20+B | TRUE | F | Activate All Pending Tables |
| BP13 used | BOOL(5) | 20+B | TRUE | F | Activate Specific Pending Table |
| BP14 used | BOOL(6) | 20+B | TRUE | F | Clear All Pending Tables |
| BP15 used | BOOL(7) | 20+B | TRUE | F | Clear Specific Pending Table |
| MFG_PROC_USED | SET(BT00.16) | | | | Bitmask of Extended Procedures used in the OSGP device |
| EP00 used | BOOL(0) | 19+C | TRUE | F | Self-Calibration |
| EP01 used | BOOL(1) | 19+C | TRUE | F | NV Memory Refresh |
| EP02 used | BOOL(2) | 19+C | TRUE | F | Control Output Command |
| EP03 used | BOOL(3) | 19+C | TRUE | F | Clear Alarms |
| EP04 used | BOOL(4) | 19+C | TRUE | F | Write Control Word |
| EP05 used | BOOL(5) | 19+C | TRUE | F | Set Lock Options |
| EP06 used | BOOL(6) | 19+C | TRUE | F | Adjust Table Sizes |
| EP07 used | BOOL(7) | 19+C | TRUE | F | Dump NVM |
| EP08 used | BOOL(0) | 20+C | TRUE | F | Erase Code Bank |
| EP09 used | BOOL(1) | 20+C | TRUE | F | Download Software packet |
| EP10 used | BOOL(2) | 20+C | TRUE | F | Switch Code Bank |
| EP11 used | BOOL(3) | 20+C | TRUE | F | Configure/ Reset Load Profile Data Set |
| EP12 used | BOOL(4) | 20+C | TRUE | F | Record Self Read |
| EP13 used | BOOL(5) | 20+C | TRUE | F | Write Single Bit in Table |
| EP14 used | BOOL(6) | 20+C | TRUE | F | DC Component Elimination |
| EP15 used | BOOL(7) | 20+C | TRUE | F | Set Tariff |
| EP16 used | BOOL(0) | 21+C | TRUE | F | Request System Clock Change by Delta |
| EP17 used | BOOL(1) | 21+C | TRUE | F | Remove MEP Device |
| EP18 used | BOOL(2) | 21+C | TRUE | F | Clear MEP Alarms |
| EP19 used | BOOL(3) | 21+C | TRUE | F | Post On-demand MEP Request |
| EP20 used | BOOL(4) | 21+C | TRUE | F | Set encryption key |
| EP21 used | BOOL(5) | 21+C | TRUE | F | Add Prepay Credit |
| EP22 used | BOOL(6) | 21+C | TRUE | P | Switch Max Power Level |
| EP23 used | BOOL(7) | 21+C | TRUE | P | Remote Disconnect Reconnect |
| EP24 used | BOOL(0) | 22+C | TRUE | P | Post One Time Read Request |
| EP25 used | BOOL(1) | 22+C | TRUE | P | Reset Mfg Lists |
| EP26 used | BOOL(2) | 22+C | TRUE | P | Update Mfg Unread Entries |
| EP27 used | BOOL(3) | 22+C | TRUE | P | Add/Remove Group ID |
| EP28 used | BOOL(4) | 22+C | TRUE | P | Set Battery Enable |
| EP29 used | BOOL(5) | 22+C | TRUE | P | Set Clear OSGP device Diags |
| EP30 used | BOOL(6) | 22+C | TRUE | P | Sync Disconnect States |
| EP31 used | BOOL(7) | 22+C | TRUE | P | Activate Feature |
| EP32 used | BOOL(0) | 23+C | TRUE | P | Demand Config Source |
| EP33 used | BOOL(1) | 23+C | TRUE | P | Demand Reset Config |
| EP34 used | BOOL(2) | 23+C | TRUE | P | Demand Reset |
| EP35 used | BOOL(3) | 23+C | TRUE | P | Deactivate Feature |
| EP36 used | BOOL(4) | 23+C | TRUE | P | Schedule Disconnect Lock |
| EP37 used | BOOL(5) | 23+C | TRUE | P | NVM Advanced Config |
| EP38 used | BOOL(6) | 23+C | FALSE | P | |
| EP39 used | BOOL(7) | 23+C | TRUE | P | Post MEP Data |
| EP40 used | BOOL(0) | 24+C | FALSE | P | |
| EP41 used | BOOL(1) | 24+C | TRUE | P | MEP Download Initialize |
| EP42 used | BOOL(2) | 24+C | TRUE | P | Control Config Dependency Setting |
| EP43 used | BOOL(3) | 24+C | TRUE | P | ANSI Form Config |
| EP44 used | BOOL(4) | 24+C | TRUE | P | IO Control |
| EP45 used | BOOL(5) | 24+C | TRUE | P | Stuff Event |
| EP46 used | BOOL(6) | 24+C | TRUE | P | Health Check |
| EP47 used | BOOL(7) | 24+C | FALSE | P | |
| Filler | UINT8 | 24+C+1..19 +D-1 | FALSE | P | |
| The following value flags indicate the table write privileges:<br>TRUE = The table can be written to.<br>FALSE = The table can NOT be written to. | | | | | |
| STD_TBLS_WRITE: | SET(BT00.13) | | | | Bitmask of Basic Tables used in the OSGP device that are writable (before security considerations) |
| BT00 write | BOOL(0) | 19+D | FALSE | F | General Configuration |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| BT01 write | BOOL(1) | 19+D | TRUE | F | General Manufacturer Identification |
| BT02 write | BOOL(2) | 19+D | TRUE | F | Device Nameplate |
| BT03 write | BOOL(3) | 19+D | FALSE | F | End Device Mode Status |
| BT04 write | BOOL(4) | 19+D | FALSE | F | Pending Status |
| BT05 write | BOOL(5) | 19+D | TRUE | F | Device Identification |
| BT06 write | BOOL(6) | 19+D | TRUE | F | Utility Information |
| BT07 write | BOOL(7) | 19+D | TRUE | F | Procedure Initiate |
| BT08 write | BOOL(0) | 20+D | FALSE | F | Procedure Response |
| Filler | BOOL(1) | 20+D | | | |
| BT10 write | BOOL(2) | 20+D | FALSE | F | Dimension Sources Limiting |
| BT11 write | BOOL(3) | 20+D | FALSE | F | Actual Sources |
| BT12 write | BOOL(4) | 20+D | FALSE | F | Unit of Measure Entry |
| BT13 write | BOOL(5) | 20+D | FALSE | F | Demand Control |
| BT14 write | BOOL(6) | 20+D | FALSE | F | Data Control |
| BT15 write | BOOL(7) | 20+D | TRUE | F | Constants |
| BT16 write | BOOL(0) | 21+D | FALSE | F | Source Definition |
| Filler | BOOL(1) | 21+D | | | |
| Filler | BOOL(2) | 21+D | | | |
| Filler | BOOL(3) | 21+D | | | |
| BT20 write | BOOL(4) | 21+D | FALSE | F | Dimension Register |
| BT21 write | BOOL(5) | 21+D | FALSE | F | Actual Register |
| BT22 write | BOOL(6) | 21+D | FALSE | F | Data Selection |
| BT23 write | BOOL(7) | 21+D | TRUE | F | Current Register Data |
| BT24 write | BOOL(0) | 22+D | TRUE | F | Previous Season Data |
| BT25 write | BOOL(1) | 22+D | TRUE | P | Previous Demand Reset |
| BT26 write | BOOL(2) | 22+D | TRUE | F | Self Read Data |
| BT27 write | BOOL(3) | 22+D | FALSE | F | Present Register Selection |
| BT28 write | BOOL(4) | 22+D | FALSE | F | Present Register Data |
| Filler | BOOL(5) | 22+D | | | |
| BT30 write | BOOL(6) | 22+D | FALSE | F | Dimension Display |
| BT31 write | BOOL(7) | 22+D | FALSE | P | Actual Display |
| BT32 write | BOOL(0) | 23+D | FALSE | F | Display Source |
| BT33 write | BOOL(1) | 23+D | TRUE | F | Primary Display List |
| BT34 write | BOOL(2) | 23+D | FALSE | P | Secondary Display List |
| Filler | BOOL(3) | 23+D | | | |
| Filler | BOOL(4) | 23+D | | | |
| Filler | BOOL(5) | 23+D | | | |
| Filler | BOOL(6) | 23+D | | | |
| Filler | BOOL(7) | 23+D | | | |
| BT40 write | BOOL(0) | 24+D | FALSE | F | Dimension Security Limiting |
| BT41 write | BOOL(1) | 24+D | FALSE | F | Actual Security |
| BT42 write | BOOL(2) | 24+D | TRUE | F | Security |
| BT43 write | BOOL(3) | 24+D | FALSE | F | Default Access Control |
| BT44 write | BOOL(4) | 24+D | FALSE | F | Access Control |
| BT45 write | BOOL(5) | 24+D | FALSE | F | Key |
| Filler | BOOL(6) | 24+D | | | |
| Filler | BOOL(7) | 24+D | | | |
| Filler | BOOL(0) | 25+D | | | |
| Filler | BOOL(1) | 25+D | | | |
| BT50 write | BOOL(2) | 25+D | FALSE | F | Dimension Time and TOU |
| BT51 write | BOOL(3) | 25+D | FALSE | P | Actual Time and TOU |
| BT52 write | BOOL(4) | 25+D | FALSE | F | Clock |
| BT53 write | BOOL(5) | 25+D | TRUE | F | Time Offset |
| BT54 write | BOOL(6) | 25+D | TRUE | F | Calendar |
| BT55 write | BOOL(7) | 25+D | FALSE | F | Clock State |
| BT56 write | BOOL(0) | 26+D | FALSE | F | Time Remaining |
| Filler | BOOL(1) | 26+D | | | |
| Filler | BOOL(2) | 26+D | | | |
| Filler | BOOL(3) | 26+D | | | |
| BT60 write | BOOL(4) | 26+D | FALSE | F | Dimension Load Profile |
| BT61 write | BOOL(5) | 26+D | TRUE | F | Actual Load Profile |
| BT62 write | BOOL(6) | 26+D | TRUE | F | Load Profile Control |
| BT63 write | BOOL(7) | 26+D | TRUE | F | Load Profile Status |
| BT64 write | BOOL(0) | 27+D | TRUE | F | Load Profile Data Set 1 |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| BT65 write | BOOL(1) | 27+D | FALSE | F | Load Profile Data Set 2 |
| BT66 write | BOOL(2) | 27+D | FALSE | F | Load Profile Data Set 3 |
| BT67 write | BOOL(3) | 27+D | FALSE | F | Load Profile Data Set 4 |
| Filler | BOOL(4) | 27+D | | | |
| Filler | BOOL(5) | 27+D | | | |
| BT70 write | BOOL(6) | 27+D | FALSE | F | Dimension Log |
| BT71 write | BOOL(7) | 27+D | FALSE | F | Actual Log |
| BT72 write | BOOL(0) | 28+D | FALSE | F | Events Identification |
| BT73 write | BOOL(1) | 28+D | TRUE | F | History Log Control |
| BT74 write | BOOL(2) | 28+D | FALSE | F | History Log |
| BT75 write | BOOL(3) | 28+D | FALSE | F | Event Log Control |
| BT76 write | BOOL(4) | 28+D | FALSE | F | Event Log |
| Filler | BOOL(5) | 28+D | | | |
| Filler | BOOL(6) | 28+D | | | |
| Filler | BOOL(7) | 28+D | | | |
| MFG_TBLS_WRITE: | SET(BT00.14) | | | | Bitmask of Extended Tables used in the OSGP device that are writable (before security considerations) |
| ET00 write | BOOL(0) | 19+D+A | TRUE | F | Measurement Control |
| ET01 write | BOOL(1) | 19+D+A | TRUE | F | LED/ KYZ Options |
| ET02 write | BOOL(2) | 19+D+A | TRUE | F | RTC Calibration |
| ET03 write | BOOL(3) | 19+D+A | TRUE | F | Utility Information |
| ET04 write | BOOL(4) | 19+D+A | TRUE | F | System Information |
| ET05 write | BOOL(5) | 19+D+A | TRUE | F | Control Output Settings |
| ET06 write | BOOL(6) | 19+D+A | TRUE | F | Pulse Inputs |
| ET07 write | BOOL(7) | 19+D+A | TRUE | F | Display Options |
| ET08 write | BOOL(0) | 20+D+A | TRUE | F | Measurement Data |
| ET09 write | BOOL(1) | 20+D+A | TRUE | F | Power Quality |
| ET10 write | BOOL(2) | 20+D+A | TRUE | F | Internal Power Outage |
| ET11 write | BOOL(3) | 20+D+A | FALSE | F | MFG Dimensions |
| ET12 write | BOOL(4) | 20+D+A | TRUE | F | Daily Consumption |
| ET13 write | BOOL(5) | 20+D+A | TRUE | F | MEP Device Config |
| ET14 write | BOOL(6) | 20+D+A | TRUE | F | MEP Device Status |
| ET15 write | BOOL(7) | 20+D+A | TRUE | F | MEP On-Demand Requests |
| ET16 write | BOOL(0) | 21+D+A | TRUE | F | MEP Device Data |
| ET17 write | BOOL(1) | 21+D+A | FALSE | F | SW Dnld Verification and Code Bank Information |
| ET18 write | BOOL(2) | 21+D+A | FALSE | P | Reserved for future use |
| ET19 write | BOOL(3) | 21+D+A | FALSE | P | Reserved for future use |
| ET20 write | BOOL(4) | 21+D+A | FALSE | P | Reserved for future use |
| ET21 write | BOOL(5) | 21+D+A | TRUE | F | Load Profile Internal Configuration |
| ET22 write | BOOL(6) | 21+D+A | TRUE | F | Error Codes Configuration |
| ET23 write | BOOL(7) | 21+D+A | TRUE | F | Reserved - Internal use only |
| ET24 write | BOOL(0) | 22+D+A | FALSE | F | Reserved |
| ET25 write | BOOL(1) | 22+D+A | FALSE | F | Reserved |
| ET26 write | BOOL(2) | 22+D+A | FALSE | F | Reserved |
| ET27 write | BOOL(3) | 22+D+A | TRUE | F | Transaction Request Table |
| ET28 write | BOOL(4) | 22+D+A | FALSE | F | Transaction Response Table |
| ET29 write | BOOL(5) | 22+D+A | TRUE | F | Hardware Configuration |
| ET30 write | BOOL(6) | 22+D+A | FALSE | F | Maximum Power Level Control |
| ET31 write | BOOL(7) | 22+D+A | TRUE | F | OSGP device One-Time Read Log |
| ET32 write | BOOL(0) | 23+D+A | TRUE | F | M-Bus One-Time Read Log |
| ET33 write | BOOL(1) | 23+D+A | TRUE | F | Group Configuration |
| ET34 write | BOOL(2) | 23+D+A | TRUE | P | MEP Device Config 2 |
| ET35 write | BOOL(3) | 23+D+A | TRUE | P | MFG Test |
| ET36 write | BOOL(4) | 23+D+A | FALSE | P | Mfg Actual Dimensions |
| ET37 write | BOOL(5) | 23+D+A | FALSE | P | Build Info |
| ET38 write | BOOL(6) | 23+D+A | FALSE | P | Config ID Log |
| ET39 write | BOOL(7) | 23+D+A | FALSE | P | Previous Demands |
| ET40 write | BOOL(0) | 24+D+A | TRUE | P | Demand Configuration |
| ET41 write | BOOL(1) | 24+D+A | FALSE | P | Historical Demand Resets |
| ET42 write | BOOL(2) | 24+D+A | FALSE | P | Interface Definition |
| ET43 write | BOOL(3) | 24+D+A | TRUE | P | Test Mode Configuration |
| ET44 write | BOOL(4) | 24+D+A | FALSE | P | Test Mode Status |
| ET45 write | BOOL(5) | 24+D+A | FALSE | P | MEP Recurring Read Log |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| ET46 write | BOOL(6) | 24+D+A | FALSE | P | Ctrl Output Read Only Data |
| ET47 write | BOOL(7) | 24+D+A | TRUE | P | Calendar Override |
| ET48 write | BOOL(0) | 25+D+A | FALSE | P | Feature Activation |
| ET49 write | BOOL(1) | 25+D+A | FALSE | P | Display Output |
| ET50 write | BOOL(2) | 25+D+A | TRUE | P | MEP Inbound Data |
| ET51 write | BOOL(3) | 25+D+A | TRUE | P | MEP Device Configuration |
| ET52 write | BOOL(4) | 25+D+A | TRUE | P | MEP Transaction Request |
| ET53 write | BOOL(5) | 25+D+A | FALSE | P | MEP Transaction Response |
| ET54 write | BOOL(6) | 25+D+A | FALSE | P | OSGP device Status |
| ET55 write | BOOL(7) | 25+D+A | TRUE | P | OSGP device Config |
| ET56 write | BOOL(0) | 26+D+A | TRUE | P | Load-side calibration |
| ET57 write | BOOL(1) | 26+D+A | TRUE | P | MDTT |
| ET58 write | BOOL(2) | 26+D+A | FALSE | P | MEA Status Extension |
| ET59 write | BOOL(3) | 26+D+A | FALSE | P | MEP Proc Response |
| ET60 write | BOOL(4) | 26+D+A | TRUE | P | Configurable Energy Accumulator Settings |
| ET61 write | BOOL(5) | 26+D+A | TRUE | P | Time-Based Relay Control |
| ET62 write | BOOL(6) | 26+D+A | FALSE | P | |
| ET63 write | BOOL(7) | 26+D+A | FALSE | P | |
| ET64 write | BOOL(0) | 27+D+A | FALSE | P | |
| ET65 write | BOOL(1) | 27+D+A | FALSE | P | |
| ET66 write | BOOL(2) | 27+D+A | FALSE | P | LP Source Mapping Table |
| ET67 write | BOOL(3) | 27+D+A | TRUE | P | Display Source Mapping Table |
| ET68 write | BOOL(4) | 27+D+A | TRUE | P | Critical Events |
| ET69 write | BOOL(5) | 27+D+A | TRUE | P | Critical Event Bitmasks |
| ET70 write | BOOL(6) | 27+D+A | FALSE | P | |
| ET71 write | BOOL(7) | 27+D+A | FALSE | P | |
| Filler | UINT8 | 28+D+A..30 +D+A | FALSE | P | |

## A.2 Basic Table 01 (BT01): General Manufacturer Identification

This table contains manufacturer identification information. The hardware and software version and revision numbers are hard-coded in the legally relevant software image, and readable in BT01. Writing to BT01 does not change the hard-coded values. The convention for OSGP device version/revision numbers is to use format x.y.z where x and y represent major and minor release numbers, respectively, and z represents a build number within a release.

- Read access: Open, password not required.
- Write access: not through PLC.

**Table A.3**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Manufacturer | ARRAY[4] OF CHAR | 0 | | H | Name of OSGP device manufacturer. |
| Model | ARRAY[8] OF CHAR | 4 | | H | Identifier of the OSGP device model, left-justified. |
| Hardware version number | UINT8 | 12 | | M | These two fields are used as a combined 2-byte packed field (offset 12 is MSB) expressing the boot ROM version number in the format x.yyz according to the following formula:<br>Bits 15..12 = x, major version, range 0 to 9<br>Bits 11..5 = yy, minor version, range 0 to 99<br>Bits 4..0 = z, build, range 0 to 31<br>Examples:<br>3.10.21 = 0x3155 |
| Hardware revision number | UINT8 | 13 | | M | |
| Software version number | UINT8 | 14 | | M | These two fields are used as a combined 2-byte packed field (offset 14 is MSB) expressing the application (external flash) version number in the format x.yyz according to the following formula:<br>Bits 15..12 = x, major version, range 0 to 9<br>Bits 11..5 = yy, minor version, range 0 to 99<br>Bits 4..0 = z, build, range 0 to 31<br>Examples:<br>3.10.21 = 0x3155 |
| Software revision number | UINT8 | 15 | | M | |
| Manufacturer serial number | ARRAY[16] OF BCD | 16 | | H | Manufacturer's serial number. (Field is 8 bytes in length). |

# A.3 Basic Table 02 (BT02): Device Nameplate

This table contains information identifying the type of the OSGP device and what would be reflected on its nameplate. Values are set at factory as per customer order:

- Read access: OMAK.
- Write access: OMAK.

**Table A.4**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Electric device record: | | | | | See note. |
| Kh | ARRAY[6] OF CHAR | 0 | | M | Watt-hours per revolution of the display simulated wheel, (if this feature is implemented). |
| Kt | ARRAY[6] OF CHAR | 6 | | M | Watt-hours per pulse for the test LED outputs. |
| Input scalar | UINT8 | 12 | | M | Not supported. |
| Configuration | ARRAY[5] OF CHAR | 13 | | M | OSGP device form factor.<br>For example, 16S = Form 16S. |
| Frequency | UINT(0..2) | 18 | | M | Power frequency rating code.<br>2 = 50 Hz.<br>3 = 50 Hz or 60 Hz.<br>4 = 60 Hz. |
| Number of elements | UINT(3..5) | 18 | | M | Number of measuring elements in the OSGP device.<br>0 = None.<br>1 = 1.<br>2 = 2.<br>3 = 2,5.<br>4 = 3.<br>5 = 6.<br>6 = 1,5. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Base type | UINT(6..9) | 18 | | M | OSGP device base type.<br>0 = None.<br>1 = S-base (socket).<br>2 = A-base (ANSI bottom connected).<br>3 = K-base.<br>4 = IEC bottom connected.<br>5 = Switchboard.<br>6 = Rack mount.<br>7 = B-base.<br>8 = P-base. |
| Accuracy class | UINT(10..15) | 18 | | M | Reserved for future use. |
| OSGP device element voltage | UINT(0..3) | 20 | | M | OSGP device element voltage code.<br>0 = None.<br>1 = 69,3.<br>2 = 72.<br>3 = 120.<br>4 = 208.<br>5 = 240.<br>6 = 277.<br>7 = 480.<br>8 = 120 through 277.<br>9 = 120 through 480. |
| Supply voltage | UINT(4..7) | 20 | | M | External supply voltage code:<br>0 = Internal.<br>1 = 69,3 AC.<br>2 = 72 AC.<br>3 = 120 AC.<br>4 = 208 AC.<br>5 = 240 AC.<br>6 = 277 AC.<br>7 = 480 AC.<br>8 = 120 through 277 AC.<br>9 = 120 through 280 AC.<br>10 = 48 DC.<br>11 = 125 DC.<br>12 = 250 DC. |
| Maximum amperage | ARRAY[6] OF CHAR | 21 | | M | OSGP device class max current rating. |
| Test amperage | ARRAY[6] OF CHAR | 27 | | M | RMS current for main OSGP device tests. |
| NOTE: This entire table's content is dependent on the type of device being used, e.g. electric, gas, or water OSGP device. | | | | | |

# A.4 Basic Table 03 (BT03): End Device Mode Status

This table displays the presently active mode and all triggered alarms. If a value is set to 1, then that alarm is active in the OSGP device:

- Read access: OMAK.
- Write access: None.

**Table A.5**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Unused | BOOL(0) | 0 | 0 | F | Unused. |
| Test mode | BOOL(1) | 0 | 0 | P | True: Test mode is activated.<br>False: Test mode is deactivated. |
| Unused | BOOL(2) | 0 | 0 | F | Unused. |
| Filler | FILL(3..7) | 0 | | | |
| Unprogrammed | BOOL(0) | 1 | | M | Reserved for internal use. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Configuration error | BOOL(1) | 1 | | M | One internal initialization attempt failed. Retries may have succeeded. Alarm checked on power-up. |
| Self-check error [System Reset] | BOOL(2) | 1 | | M | Watch-dog reset occurred. May be due to momentary voltage interruption. Alarm occurs asynchronously. |
| RAM failure | BOOL(3) | 1 | | M | RAM power-up memory test failed Alarm occurs asynchronously. |
| ROM failure | BOOL(4) | 1 | | M | Bootrom CRC invalid or System Image CRC invalid. |
| Non-volatile memory failure | BOOL(5) | 1 | | M | Table failed power-up CRC verification or background CRC verification. Memory may have been corrupted. Alarm checked at power-up and periodically. |
| Clock error | BOOL(6) | 1 | | M | Clock functions have been suspended due to OSGP device running without a battery, or loss of memory containing clock info (internal only). Alarm checked on power-up. |
| Measurement error | BOOL(7) | 1 | | M | |
| Low battery | BOOL(8) | 1 | | M | RTC battery is below the configured voltage in ET02. Alarm checked daily and at power-up. |
| Low loss potential | BOOL(9) | 1 | | M | Not used. |
| Demand overload | BOOL(10) | 1 | | M | Not used. |
| Power failure | BOOL(11) | 1 | | M | Power failure occurred since this bit was last cleared. Alarm occurs asynchronously at time of power-down. |
| Tamper/Tilt detect [Cover Removed or Tilt detected] | BOOL(12) | 1 | | M | The OSGP device cover has been removed, or the OSGP device has been tilted. Alarm checked every second. Tilt may be qualified by the "Tilt Timer" field in ET04. If so the Tilt detection shall occur within this period prior to a power outage. |
| Reverse rotation [Reverse Energy] | BOOL(13) | 1 | | M | OSGP device has registered reverse power for 10 consecutive seconds. Alarm checked once per second. |
| Save-all aborted | BOOL(14) | 1 | | M | A table save-all procedure did not complete. This alarm checked on power-up. |
| Disconnect switch error | BOOL(15) | 1 | | M | Disconnect feedback disagrees with internal disconnect status variable. Disconnect operation not reliable. |
| Filler status 2 | FILL(0..7) | 3 | | M | |
| EXTSTATUS_RCD | SET(BT00.17) | | | | BItmask of extended alarms and statuses. |
| Extended status 0 [Load Profile Overflow] | BOOL(0) | 4 | | M | Load profile memory overflow occurred, unread records have been overwritten. Alarm checked every load-profile interval. |
| Extended status 1 [Self-Read Occurred] | BOOL(1) | 4 | | M | New self-read has been recorded. Alarm coincides with self-read schedule. |
| Extended status 2 [Disconnect Shut-Off] | BOOL(2) | 4 | | M | This alarm indicates that control output 1 has changed state (among closed, open and locked open). |
| Extended status 3 [Control Relay Activated] | BOOL(3) | 4 | | M | Control output 2 has been tripped. Alarm occurs asynchronously. |
| Extended status 4 [Phase Loss Detected] | BOOL(4) | 4 | | M | Phase loss detected on one or more phases. Alarm occurs asynchronously. |
| Extended status 5 [Phase Inversion Detected] | BOOL(5) | 4 | | M | Phase inversion detected by Data Concentrator and communicated to OSGP device. Alarm occurs asynchronously. |
| Extended status 6 [Comms Failure] | BOOL(6) | 4 | | M | Internal BS EN 14908-1:2014 [1] communications error (buffer overflow, buffer busy, invalid command or command length, init timer expired). Alarm occurs at power-up and asynchronously. |
| Extended status 7 (General Error) | BOOL(7) | 4 | | M | Reserved. |
| Extended status 8 [Invalid Password] | BOOL(0) | 5 | | M | An invalid password was entered during optical or 14908-1 communications, or the wrong password for the given port was used. Alarm occurs asynchronously. Note that this alarm can occur during commissioning if encryption is disabled. Also, if this alarm occurs over the 14908.1 port while an optical user is connected, the user ID will be that of the optical user, not the 14908.1 user ID. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Extended status 9 [Remote Communications Inactive] | BOOL(1) | 5 | | M | No explicit message was received over PLC for the last configured minutes. Only applies to meters that are commissioned. |
| Extended status 10 [Current Flow with No Voltage] | BOOL(2) | 5 | | M | Current flow detected (higher than 2A) on low-voltage phase (when phase loss is detected). Alarm occurs asynchronously. |
| Extended status 11 [Pulse Input Channel 1] | BOOL(3) | 5 | | M | Tamper condition detected on Pulse Input Channel 1. |
| Extended status 12 [Pulse Input Channel 2] | BOOL(4) | 5 | | M | Tamper condition detected on Pulse Input Channel 2. |
| Extended status 13 [Software Download Failure] | BOOL(5) | 5 | | M | CRC or Image ID error occurred during boot-up procedure. Alarm occurs asynchronously. |
| Extended status 14 [Code Bank Changed] | BOOL(6) | 5 | | M | New application image has been invoked. Alarm occurs asynchronously. |
| Extended status 15 [Profile Log Backfill Failed] | BOOL(7) | 5 | | M | Load profile was not filled at power-up because OSGP device was off for too long. Alarm occurs asynchronously. |
| Extended status 16 [MEP Installed or Removed] | BOOL(0) | 6 | | M | Installation or removal of the MEP card has occurred. Alarm occurs asynchronously. |
| Extended status 17 [M-Bus Alarm] | BOOL(1) | 6 | | M | A new alarm has been set for one or more of the paired M-Bus devices. Read the "M-Bus Device Status.Alarms" in ET14 to identify the device(s) and alarm(s) that has occurred.<br>Alarm occurs asynchronously. |
| Extended status 18 [M-Bus Auto-Discovery Complete] | BOOL(2) | 6 | | M | Auto-discovery mode has been exited. A device may have been added to the OSGP device. |
| Extended status 19 [Phase Rotation Changed] | BOOL(3) | 6 | | M | Phase rotation different from original setup. |
| Manufacturer status 20 [Prepay credit exhausted] | BOOL(4) | 6 | | M | Prepay total credits have run out. |
| Extended status 21 [Prepay warning acknowledged] | BOOL(5) | 6 | | M | User has acknowledged the fact that prepay credit is lower than the warning threshold, and cancelled the warning by pressing the push button to disable the buzzer. |
| Extended status 22 [Event Log Overflow] | BOOL(6) | 6 | | | Event log is within 10 % of full capacity of unread log entries. |
| Extended status 23 [Mfg Log Entry Available] | BOOL(7) | 6 | | M | Indicates there is 1 or more unread entries in one or more of the extended logs. This alarm is automatically cleared when the list pointers are updated to reflect 0 unread entries in all logs. See additional notes on reading extended logs in ET36. |
| Extended status 24 [Interface Change Alarm] | BOOL(0) | 7 | | M | Indicates a change occurred to dimension and/or semantic information and the IDT or program ID has been updated. |
| Extended status 25 [Magnetic Tamper] | BOOL(1) | 7 | | M | Magnetic tamper has been detected. |
| Extended status 26 [Access Lockout ]override | BOOL(2) | 7 | | M | The security control word override hardware has been activated. The event can indicate the control word being overridden or the override being removed; the alarm is only set when the override is on. |
| Extended status 27 [Power Quality Event Detected] | BOOL(3) | 7 | | M | Power quality event (sag/surge/over-current) detected on one or more phases. Alarm occurs only at change of arguments (when any new event is detected on any phase, when any event is gone on any phase). |
| Extended status 28 [Event Log Unread Entries] | BOOL(4) | 7 | | | One or more unread entries exist in the event log. This alarm is cleared automatically when the list pointer is updated to reflect 0 unread entries. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Extended status 29 [THD] | BOOL(5) | 7 | | M | THD event detected on one or more phases. Alarm occurs only at change of arguments (when any new event is detected on any phase, when any event is gone on any phase). |
| Extended status 30 [LP Unread Entries] | BOOL(6) | 7 | | M | One or more unread entries exist in the load profile log. This alarm is cleared automatically when the list pointer is updated to reflect 0 unread entries. |
| Extended status 301 [Load side voltage with open disconnect switch] | UINT(7) | 7 | | M | Load side voltage has been detected while the load disconnect contactor is in the open state. |

# A.5 Basic Table 04 (BT04): Pending Status

This table provides status of pending tables. Information within table A.6 includes table number and conditions upon which activation occurs:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table A.6**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Basic Pending | ARRAY[BT00.13] OF BOOL | 0 | | M | A bit map of booleans, one per bit Basic Table. Set if the table has a pending table. |
| Extended Pending | ARRAY[BT00.14] OF BOOL | BT00.13 | | M | A bit map of booleans, one per bit Extended Table. Set if the table has a pending table. |
| Last Activation Time | STIME_DATE | BT00.13+BT00.14 | | M | Time of the last activation. |
| Number of Pending Activations | UINT8 | BT00.13+BT00.14+5 | | M | Number of pending activations. |
| Pending Activations | ARRAY[BT00.18] OF 6-byte records: | | | M | An array of pending entry activation records, also called Pending Event Descriptors (PED) |
| Event Code | UINT(0..3) | BT00.13+BT00.14+6 | | M | The condition upon which the pending table becomes active as follows:<br>• 0: Based on absolute time in the "Event Storage" field later in BT04.<br>• 1: Based on relative time in the "Event Storage" field.<br>• 2: No meaning attached to the data so no auto activation (can be used in conjunction with BP13 and BP15 or to make all but the last partial write inert). |
| Self Read Flag | BOOL (4) | | | M | If True, the OSGP device will perform a self-read before a pending table is activated. |
| Demand Reset Flag | BOOL (5) | | | M | If True, the OSGP device will perform a demand reset before pending table is activated. |
| Event Storage | ARRAY[5] OF CHAR | BT00.13+BT00.14+7 | | M | If Event Code is 0, this is an STIME_DATE (UTC).<br>If Event Code is 1, this is weeks/days/hours/minutes/seconds.<br>If Event Code is 2, data is opaque. |
| Table | | BT00.13+BT00.14+12 | | | |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Table ID | UINT(0..11) | | | M | Table number 0..4 095 |
| Still Pending | UINT(12) | | | M | Flag indicating if table is still pending (1) or not (0) |

# A.6 Basic Table 05 (BT05): Device Identification

This table contains miscellaneous user-specified identification information:

- Read access: OMAK.
- Write access: OMAK.

**Table A.7**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Identification | ARRAY[20] OF BCD | 0 | | H | User-specified device identification. |

# A.7 Basic Table 06 (BT06): Utility Information

This table contains utility identification, location, and program information:

- Read access: OMAK.
- Write access: OMAK.

**Table A.8**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Owner name | ARRAY[20] OF CHAR | 0 | | H | Owner name. |
| Utility division | ARRAY[20] OF CHAR | 20 | | H | Utility division number. |
| Service point | ARRAY[20] OF BCD | 40 | | H | ID number attached to the service point. |
| Electrical address | ARRAY[20] OF BCD | 50 | | H | Electrical address for mapping purposes. |
| Device identification | ARRAY[20] OF BCD | 60 | | H | Device identification. |
| Utility serial number | ARRAY[20] OF BCD | 70 | | H | Utility-specified serial number. |
| Customer identification | ARRAY[20] OF BCD | 80 | | H | Customer identification. |
| Coordinate 1 | ARRAY[10] OF CHAR | 90 | | H | General mapping coordinate. |
| Coordinate 2 | ARRAY[10] OF CHAR | 100 | | H | General mapping coordinate. |
| Coordinate 3 | ARRAY[10] OF CHAR | 110 | | H | General mapping coordinate. |
| Tariff id | ARRAY[8] OF CHAR | 120 | | H | Identification of the billing tariff - not used by OSGP device. |
| Configuration software vendor | ARRAY[4] OF CHAR | 128 | | H | Manufacturer of configuration software. |
| Software version number | UINT8 | 132 | | H | Configuration software version number. |
| Software revision number | UINT8 | 133 | | H | Configuration software revision number. |
| Programmation software vendor | ARRAY[4] OF CHAR | 134 | | H | Manufacturer of programming software. |
| Software version number | UINT8 | 138 | | H | Programmation software version number. |
| Software revision number | UINT8 | 139 | | H | Programmation software revision number. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Programmer name | ARRAY[10] OF CHAR | 140 | | H | Name of most recent programmer. |
| Miscellaneous identification | ARRAY[30] OF CHAR | 150 | | H | Miscellaneous identification information. |

# A.8 Basic Table 07 (BT07): Procedure Initiate

This table describes the header fields that occur at the beginning of each procedure request. The remaining fields are different for each procedure, depending on the input and output parameters required. For more information on how BT07 is used with OSGP device procedures, see clause 9.13:

- Read access: OMAK.

NOTE: While OMAK read access is granted for BT07, restriction of full read operation for BT07 and BT08 may prevent PLC reads due to buffer overrun.

- Write access: OMAK.

**Table A.9**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Procedure number | UINT(0..11) | 0 | | H | Procedure to be executed. |
| Response handling | UINT(12..15) | 0 | 0 | H | "Post response on completion" is the only option currently supported. |
| Sequence number | UINT8 | 2 | | H | Controlled by host to prevent duplicate actions. |

# A.9 Basic Table 08 (BT08): Procedure Response

This table describes the header fields that occur at the beginning of each procedure response. The remaining fields are different for each procedure, depending on the input and output parameters required. For more information on how BT08 is used with OSGP device procedures, see clause 9.13:

- Read access: OMAK.

NOTE: While OMAK read access is granted for BT09, restriction of full read operation for BT07 and BT08 may prevent PLC reads due to buffer overrun.

- Write access: None.

**Table A.10**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Procedure number | UINT(0..11) | 0 | | M | Procedure last executed. |
| Filler | FILL(12..15) | 0 | | | |
| Sequence number | UINT8 | 2 | | M | Confirms sequence number sent in BT07. |
| Result code | UINT8 | 3 | | M | The result code returned. For more information, see clause 9.13. |
| … | | | | | Remaining fields (if any) are detailed in each procedure below. |

# A.10 Basic Table 10 (BT10): Dimension Sources Limiting

This table lists the dimensions of tables 12 through 16, used for describing measurement sources:

- Read access: OMAK.
- Write access: None.

**Table A.11**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Power fail exclusion | BOOL(0) | 0 | TRUE | P | Exclusion of demand calculations for some period of time immediately after a power failure is supported in the OSGP device. |
| Reset exclusion | BOOL(1) | 0 | TRUE | P | Demand reset is supported in the OSGP device. |
| Block demand | BOOL(2) | 0 | TRUE | P | Block demand is supported in the OSGP device. |
| Sliding demand | BOOL(3) | 0 | TRUE | P | Sliding demand is supported in the OSGP device. |
| Thermal demand | BOOL(4) | 0 | FALSE | F | Thermal demand is not supported in the OSGP device. |
| Set 1 constants | BOOL(5) | 0 | TRUE | F | One set of constants in BT15 is supported in the OSGP device. |
| Set 2 constants | BOOL(6) | 0 | FALSE | F | A second set of constants is not supported in the OSGP device. |
| Filler | FILL(7..7) | 0 | | F | |
| Number of UOM entries | UINT8 | 1 | 41 | P | Number of measurement entries. |
| Number of demand control entries | UINT8 | 2 | 8 | P | Number of demand control entries in BT13. |
| Data control length | UINT8 | 3 | 0 | F | Not supported. |
| Number of data control entries | UINT8 | 4 | 0 | F | Not supported. |
| Number of constants entries | UINT8 | 5 | 1 | P | Number of constant records. |
| Constants selector | UINT8 | 6 | 2 | F | Selector for record structure used in BT15:<br>2 = Electric constants. |
| Number of sources | UINT8 | 7 | 177 | P | Total number of data sources measured and calculated in the OSGP device, including the standard source IDs of BT16 (up to 255), the extended source IDs. |

# A.11 Basic Table 12 (BT12): Unit of Measure Entry

This table defines the attributes of the measurement sources in the device. For the complete list of measurement sources, see clause A.14.1 for complete list of display sources:

- Read access: OMAK.
- Write access: None.

**Table A.12**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Array[BT10.1] of UINT32: | | | | | |
| ID code | UINT(0..7) | 0 | | F | Identifies the physical quantity of interest. Note that because the unit of measure record includes a time base indicator, some of the units have an extra time factor that is cancelled out by the unit of measure record time base indicator.<br>Power:<br>0 = Active power - W.<br>1 = Reactive power - Var.<br>2 = Apparent power - VA.<br>3 = Phasor power - VA = sqrt(W2+Var2).<br>4 = Quantity power - Q(60). |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| | | | | | 5 = Quantity power - Q(45).<br>6 = Reserved.<br>7 = Reserved.<br>Voltage:<br>8 = RMS volts.<br>9 = Average volts.<br>10 = RMS volts squared (V2).<br>11 = Instantaneous volts.<br>Current:<br>12 = RMS amps.<br>13 = Average current.<br>14 = RMS amps squared (I2).<br>15 = Instantaneous current.<br>Percent total harmonic distortion:<br>16 = T.H.D. V (IEEE-Electrical Engineers).<br>17 = T.H.D. I (IEEE).<br>18 = T.H.D. V (IC-Industry Canada).<br>19 = T.H.D. I (IC-Industry Canada).<br>Event Codes:<br>50 = Power outages.<br>51 = Number of demand resets.<br>52 = Number of times programmed.<br>53 = Number of minutes on batter carryover.<br>Phase Angles:<br>20 = V-VA, voltage phase angle.<br>21 = Vx-Vy, where x and y are phases defined in phase selector.<br>22 = I-VA, current phase angle.<br>23 = Ix-Iy, where x and y are phases defined in phase selector.<br>24 = Power factor computed using apparent power, ID Code = 2.<br>25= Power factor computed using phasor power, ID Code = 3.<br>26 = Reserved.<br>27 = Reserved.<br>28 = Reserved.<br>Time:<br>29 = Time of day.<br>30 = Date.<br>31 = Time of day and date.<br>32 = Interval timer.<br>33 = Frequency.<br>34 = Counter.<br>35 = Sense input (T/F).<br>36..39 = Reserved.<br>40 = Voltage sag.<br>41 = Voltage swells.<br>42 = Power outage.<br>43 = Voltage excursion low.<br>44 = Voltage excursion high.<br>45 = Normal voltage level.<br>46 = Voltage unbalance.<br>47 = Voltage T.H.D. excess.<br>48 = Current T.H.D. excess.<br>49..63 Reserved. |
| Time base | UINT(8..10) | 0 | | F | Indicates the measurement method with respect to time:<br>0 = Quantity of commodity or usage rate, values have the units stated in the ID Code x Hour (energy units).<br>1 = Instantaneous (sampled).<br>2 = Period based (power, RMS).<br>3 = Sub-block average demand, most recent averaging demand sub-interval values (demand).<br>4 = Block average demand, with period greater than or equal to the Sub-block average demand period (demand).<br>5 = Net buOMAK quantity of commodity, integral of commodity usage rate over a specified period of, values have the units stated in the ID Code x Hour (energy).<br>6 = Thermal quantity (demand).<br>7 = Event quantity (number of occurrences of an event). |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Multiplier | UINT(11..13) | 0 | | F | Scaling value to apply to the value after reading from the OSGP device:<br>0 = 1<br>1 = 100<br>2 = 1 000<br>3 = 1 000 000<br>4 = 1 000 000 000<br>5 = 0,01<br>6 = 0,001<br>7 = 0,000001 |
| Q1 | BOOL(14) | 0 | | F | Indication that the value lies in quadrant 1. |
| Q2 | BOOL(15) | 0 | | F | Indication that the value lies in quadrant 2. |
| Q3 | BOOL(16) | 0 | | F | Indication that the value lies in quadrant 3. |
| Q4 | BOOL(17) | 0 | | F | Indication that the value lies in quadrant 4. |
| Net flow | BOOL(18) | 0 | | F | Identifies the manner in which the quadrants specified are being summed:<br>False = Quantity is added positively regardless of the direction of flow.<br>True = Net of delivered minus received, where watts are delivered in quadrants 1 and 4, received in quadrants 2 and 3; and Vars are delivered in quadrants 1 and 2, received in quadrants 3 and 4. |
| Segmentation | UINT(19..21) | 0 | | F | Phase measurement association:<br>0 = Not phase related or all phases present.<br>1 = Phase A to B.<br>2 = Phase B to C.<br>3 = Phase C to A.<br>4 = Neutral to ground, or no phase information.<br>5 = Phase A to Neutral.<br>6 = Phase B to Neutral.<br>7 = Phase C to Neutral. |
| Harmonic | UINT(22..22) | 0 | | F | 0 = Value is the entire signal unfiltered.<br>1 = Value is a harmonic component of an associated source. |
| Filler | FILL(23..30) | 0 | | F | |
| Not standard defined | BOOL(31) | 0 | | F | Indication that the value does not follow the standard definition in the manner outlined in BT12. |

## A.12 Basic Table 13 (BT13): Demand Control

This table lists the configured demand settings. For background information on demand metering, see clause 8.15:

- Read access: OMAK.
- Write access: None.

**Table A.13**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Reset Exclusion | UINT8 | 0 | | M | Demand reset exclusion in truncated minutes as configured by ET40. This affects sequential demand resets of the same type and affects each reset method individually. This is cancelled by power outages. |
| Power Fail Recognition time | UINT8 | 1 | | M | Not supported. |
| Power Fail Exclusion | UINT8 | 2 | | M | Demand calculation exclusion after power fail in truncated minutes as configured by ET40. |
| Cold_Load_Pick up | UINT8 | 3 | | M | Not supported. |
| Interval Value | Array[BT10.2] of 2 byte record: | | | | Demand sub-interval and interval multiplier for each demand interval. |
| Sub Interval | UINT8 | 4 | | M | Demand sub-interval in minutes as configured by ET40. This is always the same value for all configured demand registers. |
| Interval Multiplier | UINT8 | 5 | | M | Demand interval multiplier in minutes as configured by ET40; sub-interval × interval multiplier => demand interval. This always be the same value for all configured demand registers. |

# A.13 Basic Table 15 (BT15): Constants

This table lists the metering constants used and applied to data in the OSGP device:

- Read access: OMAK.
- Write access: OMAK.

**Table A.14**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Electric constants: | | | | | (see note) |
| Multiplier | NI_FMAT1 | 0 | | H | Value of multiplier adjustment applied to OSGP device data. |
| Offset | NI_FMAT1 | 4 | | H | Value of addition/subtraction adjustment applied to OSGP device data. |
| Applied | BOOL(0) | 8 | FALSE | H | Constants in the table are applied to OSGP device data. |
| Filler | FILL(1..7) | 8 | | | |
| Ratio F | NI_FMAT1 | 9 | | H | Current transformer (CT) ratio. |
| Ratio P | NI_FMAT1 | 13 | | H | Voltage transformer (VT) ratio. |
| NOTE: This entire table's content is dependent on the type of device being used, e.g. electric or gas OSGP device. | | | | | |

# A.14 Basic Table 16 (BT16): Source Definition

## A.14.0 Foreword

This table lists the general type of each measurement data source. BT16 defines all of the metrological data that is measured or calculated in the OSGP device, ordered by source ID (i.e. order of sources as they appear in BT 12, if Meas=false that record is skipped when matching BT16 with BT12). Tables and procedures containing settings and/or readings for the following functions reference this list of metering sources:

- Summations.
- Present Values.
- Load Profile, including all mapped sources.

- Display.

Additional sources, not listed here, can be configured for display. See clause A.14.1 for complete list of display sources.

Source IDs 112 to 163 inclusive in BT16 are called "mapped sources", see note 3 in table A.16 in clause A.14.1:

- Read access: OMAK.
- Write access: None.

Measurement Source Definition Record Description: Array[BT10.7] of UINT8.

**Table A.15**

| Field Name | Type | Offset | VCI | Description |
|---|---|---|---|---|
| Unit of measure (Meas) | BOOL(0) | 0 | F | True= A Unit of Measure entry exists in BT12 for this source, it is a measurement register.<br>FALSE = A Unit of Measure entry in BT12 does not exist for this source. |
| Demand control (DemCtrl) | BOOL(1) | 0 | P | Not supported. |
| Data control (DataCtrl) | BOOL(2) | 0 | F | Not supported. |
| Constants (Const) | BOOL(3) | 0 | F | True = The Constants (BT15) entry is associated with this source<br>FALSE = The Constants (BT15) entry is not associated with this source. |
| Pulse | BOOL(4) | 0 | F | TRUE = The source is in engineering units<br>FALSE = The source is in pulse units. |
| Applied | BOOL(5) | 0 | F | TRUE = The entry in the Constants table (BT15) has not been applied to the source.<br>FALSE = The entry in the Constants table (BT15) has been applied to the source. |
| Filler | FILL(6..7) | 0 | | |

## A.14.1 Measurement Source Definition Records

An A, B, C, or ABC in Source Name indicates a phase value. A Q1, Q2, Q3, or Q4 in Source Name is an energy quadrant indicator value.

Table A.16 assigns a number (source id) to all register values that can be selected for display, load profile, and other logging features.

EXAMPLE: In order to configure the OSGP device display to show Fwd Active energy and Export Reactive energy, one would configure BT33 (display config table) with source ids 0 and 3.

**Table A.16**

| Source # | Source Name | Meas | DemCtrl | DataCtrl | Const | Pulse | Applied | RefTable | RefTable Offset | Coin Select? |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Fwd Active Wh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 0 | Y |
| 1 | Rev Active Wh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 4 | Y |
| 2 | Import Reactive Varh ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 8 | Y |
| 3 | Export Reactive Varh ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 12 | Y |
| 4 | Power Off Minutes | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT23 | 16 | Y |
| 5 | Power Outage Qty | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT23 | 20 | Y |

| Source # | Source Name | Meas | DemCtrl | DataCtrl | Const | Pulse | Applied | RefTable | RefTable Offset | Coin Select? |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Fwd+Rev Active Wh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 24 | Y |
| 7 | Fwd-Rev Active Wh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 28 | Y |
| 8 | Fwd Active W ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 0 | Y |
| 9 | Rev Active W ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 4 | Y |
| 10 | Import Reactive Var ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 8 | Y |
| 11 | Export Reactive Var ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 12 | Y |
| 12 | RMS Current A | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 16 | Y |
| 13 | RMS Current B | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 20 | Y |
| 14 | RMS Current C | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 24 | Y |
| 15 | RMS Voltage A | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 28 | Y |
| 16 | RMS Voltage B | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 32 | Y |
| 17 | RMS Voltage C | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 36 | Y |
| 18 | Power Factor A | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 40 | Y |
| 19 | Frequency | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 44 | Y |
| 20 | VA Power ABC | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 48 | Y |
| 21 | Power Factor B | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 52 | Y |
| 22 | Power Factor C | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 56 | Y |
| 23 | Sin phase angle (A) | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 60 | Y |
| 24 | Sin phase angle (B) | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 64 | Y |
| 25 | Sin phase angle (C) | TRUE | FALSE | FALSE | FALSE | TRUE | FALSE | BT28 | BT11.2 × 4 + 68 | Y |
| 26 | Channel 0 pulse input | TRUE | FALSE | FALSE | FALSE | FALSE | TRUE | BT23 | 32 | Y |
| 27 | Channel 1 pulse input | TRUE | FALSE | FALSE | FALSE | FALSE | TRUE | BT23 | 36 | Y |
| 28 | Error Counter | TRUE | FALSE | FALSE | FALSE | TRUE | TRUE | BT23 | 40 | Y |
| 29 | T0 Fwd Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 44 | |
| 30 | T0 Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 48 | |
| 31 | T0 Import Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 52 | |
| 32 | T0 Export Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 56 | |
| 33 | T0 Power Off Minutes | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | 60 | |
| 34 | T0 Power Outage Qty | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | 64 | |
| 35 | T0 Fwd+Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 68 | |
| 36 | T0 Fwd-Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 72 | |

| Source # | Source Name | Meas | DemCtrl | DataCtrl | Const | Pulse | Applied | RefTable | RefTable Offset | Coin Select? |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | T0 Channel 0 pulse input | TRUE | FALSE | FALSE | FALSE | FALSE | TRUE | | 76 | |
| 38 | T0 Channel 1 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | 80 | |
| 39 | T0 Error Counter | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | | 84 | |
| 40 | T1 Fwd Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 88 | |
| 41 | T1 Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 92 | |
| 42 | T1 Import Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 96 | |
| 43 | T1 Export Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 100 | |
| 44 | T1 Power Off Minutes | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | | |
| 45 | T1 Power Outage Qty | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | | |
| 46 | T1 Fwd+Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 112 | |
| 47 | T1 Fwd-Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 116 | |
| 48 | T1 Channel 0 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | | |
| 49 | T1 Channel 1 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | | |
| 50 | T1 Error Counter | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | | | |
| 51 | T2 Fwd Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 132 | |
| 52 | T2 Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 136 | |
| 53 | T2 Import Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 140 | |
| 54 | T2 Export Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 144 | |
| 55 | T2 Power Off Minutes | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | | |
| 56 | T2 Power Outage Qty | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | | |
| 57 | T2 Fwd+Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 156 | |
| 58 | T2 Fwd-Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 160 | |
| 59 | T2 Channel 0 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | | |
| 60 | T2 Channel 1 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | | |
| 61 | T2 Error Counter | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | | | |
| 62 | T3 Fwd Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 176 | |
| 63 | T3 Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 180 | |
| 64 | T3 Import Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 184 | |
| 65 | T3 Export Reactive VArh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 188 | |

| Source # | Source Name | Meas | DemCtrl | DataCtrl | Const | Pulse | Applied | RefTable | RefTable Offset | Coin Select? |
|---|---|---|---|---|---|---|---|---|---|---|
| 66 | T3 Power Off Minutes | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | | |
| 67 | T3 Power Outage Qty | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | | | |
| 68 | T3 Fwd+Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 200 | |
| 69 | T3 Fwd-Rev Active Wh ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT23 | 204 | |
| 70 | T3 Channel 0 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | | |
| 71 | T3 Channel 1 pulse input | FALSE | FALSE | FALSE | FALSE | FALSE | TRUE | | | |
| 72 | T3 Error Counter | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | | | |
| 73 | MEP Dev 1 Counter 1 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 74 | MEP Dev 1 Counter 2 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 75 | MEP Dev 2 Counter 1 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 76 | MEP Dev 2 Counter 2 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 77 | MEP Dev 3 Counter 1 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 78 | MEP Dev 3 Counter 2 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 79 | MEP Dev 4 Counter 1 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 80 | MEP Dev 4 Counter 2 | FALSE | FALSE | FALSE | FALSE | TRUE | TRUE | N/A | | |
| 81 | Fwd Active W ABC post CT/VT ratio | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 72 | Y |
| 82 | Rev Active W ABC post CT/VT ratio | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 76 | Y |
| 83 | Import VAR ABC post CT/VT ratio | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 80 | Y |
| 84 | Export VAR ABC post CT/VT ratio | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 84 | Y |
| 85 | Unused | N/A | N/A | N/A | N/A | N/A | N/A | | | |
| 86 | Unused | N/A | N/A | N/A | N/A | N/A | N/A | | | |
| 87 | Unused | N/A | N/A | N/A | N/A | N/A | N/A | | | |
| 88 | Present Dmd 1 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 0 | |
| 89 | Present Dmd 2 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 4 | |
| 90 | Present Dmd 3 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 8 | |
| 91 | Present Dmd 4 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 12 | |
| 92 | Present Dmd 5 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 16 | |
| 93 | Present Dmd 6 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 20 | |
| 94 | Present Dmd 7 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 24 | |
| 95 | Present Dmd 8 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | 28 | |
| 96 | Previous Dmd 1 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 0 | Y |
| 97 | Previous Dmd 2 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 4 | Y |
| 98 | Previous Dmd 3 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 8 | Y |
| 99 | Previous Dmd 4 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 12 | Y |
| 100 | Previous Dmd 5 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 16 | Y |
| 101 | Previous Dmd 6 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 20 | Y |

| Source # | Source Name | Meas | DemCtrl | DataCtrl | Const | Pulse | Applied | RefTable | RefTable Offset | Coin Select? |
|---|---|---|---|---|---|---|---|---|---|---|
| 102 | Previous Dmd 7 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 24 | Y |
| 103 | Previous Dmd 8 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | ET39 | 28 | Y |
| 104 | Q1 Reactive VAr ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 88 | Y |
| 105 | Q2 Reactive VAr ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 92 | Y |
| 106 | Q3 Reactive VAr ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 96 | Y |
| 107 | Q4 Reactive VAr ABC | TRUE | FALSE | FALSE | TRUE | TRUE | FALSE | BT28 | BT11.2 × 4 + 100 | Y |
| 108 | Q1 Reactive VArh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 44 | Y |
| 109 | Q2 Reactive VArh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 48 | Y |
| 110 | Q3 Reactive VArh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 52 | Y |
| 111 | Q4 Reactive VArh ABC | TRUE | TRUE | FALSE | TRUE | TRUE | FALSE | BT23 | 56 | Y |
| 112..163 | Mapped Sources | N/A | N/A | N/A | N/A | N/A | N/A | See Below | | |
| 164 | Min Voltage A | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 165 | Min Voltage B | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 166 | Min Voltage C | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 167 | Max Voltage A | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 168 | Max Voltage B | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 169 | Max Voltage C | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 170 | Max Active Fwd Power ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 171 | Max Active Rev Power ABC | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 172 | Max Reactive Power Q1 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 173 | Max Reactive Power Q2 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 174 | Max Reactive Power Q3 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 175 | Max Reactive Power Q4 | FALSE | FALSE | FALSE | TRUE | TRUE | FALSE | N/A | | |
| 176 | Time Stamp Previous Source | FALSE | FALSE | FALSE | FALSE | TRUE | FALSE | N/A | | |

NOTE 1: The minimum voltage source will be 0 if there has been a power outage or brown out during the interval and the time stamp will be that of the first power down in the interval.

NOTE 2: The time stamp previous source is stored in the form DDHHMMSS. For example, if the minimum voltage occurred on the 13th of the month at 5:33:24, then the time stamp is stored as decimal value 13 053 324.

NOTE 3: Mapped sources are used to refer to an extended source ID in another table. The other table is dependent on the user of the source IDs. For Load Profile (LP), it is ET66. For the display, it is ET67. To determine which extended source ID to use, take the 8-bit source ID and subtract 112. So, for the display, a source ID of 113 would indicate index 1 of ET67.

## A.14.2 Extended Source IDs

Source IDs 112 to 163 are used for mapped source IDs. This mechanism is used to map additional sources that, if enumerated, would exceed the capacity of BT16. Source IDs 112..163 correspond to table entries 0..51 of ET66 and ET67, which specify additional two byte source IDs called 'extended source IDs'.

The extended source ID is encoded as follows:

Type 0 (Standard) Data: 4-bit sub-type, 8-bit data.

| | | |
|---|---|---|
| Type 1 (MEP) | Data: | 4-bit MEP index, 8-bit channel number. |
| Type 2 (Demand) | Data: | 2-bit sub-type, 6-bit qualifier, 4-bit index. |
| Type 3 (Misc) | Data: | 4-bit sub-type, 4-bit qualifier, 4-bit index. |
| Type 4 (MDT) | Data: | 4-bit MEA index, 3-bit spare, 5-bit MDT. |

Note that the bit definitions above are MSB to LSB for the 16-bit source ID. For example, a demand source ID with sub-type 1, qualifier 3 and index 15 would have the value 0x243F.

**Type 0 specifics:**

**Table A.17**

| Sub-type | Data |
|---|---|
| Standard Source ID (0) | The standard source ID. Cannot be a mapped source ID. |

**Type 2 specifics:**

**Table A.18**

| Sub-type | Qualifier | Index |
|---|---|---|
| Cumulative Demand (0) | Demand Register (0 based) | Tier |
| Continuous Cumulative Demand (1) | Demand Register (0 based) | Tier |
| Maximum Demand (2) | Demander Register (0 based) | Tier |

Note that a tier value of 0 means total of all tiers while a tier value of 1 means the first tier and so on.

**Type 3 specifics:**

**Table A.19**

| Sub-type | Qualifier | Index |
|---|---|---|
| Reactive Varh ABC (0) | Quadrant (0..3) | Tier |

## A.15 Basic Table 20 (BT20): Dimension Register

This table lists the maximum dimensions for the tables in this decade that contain the measured values registers:

- Read access: OMAK.
- Write access: None.

**Table A.20**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Season information field | BOOL(0) | 0 | TRUE | F | OSGP device reports the appropriate season in tables in this decade. |
| Date time field | BOOL(1) | 0 | TRUE | F | OSGP device reports date and time in tables in this decade. |
| Demand reset counter | BOOL(2) | 0 | TRUE | P | OSGP device reports the count of the number of demand resets that have occured since billing registers were last cleared. |
| Demand reset lockout | BOOL(3) | 0 | TRUE | P | OSGP device supports a configurable lockout period for sequential demand resets. |
| Cumulative demand | BOOL(4) | 0 | TRUE | P | Cumulative demand is supported. |
| Continuous cumulative demand | BOOL(5) | 0 | TRUE | P | Continuous cumulative demand is supported. |
| Time remaining | BOOL(6) | 0 | FALSE | P | Reporting time remaining in the demand interval. |
| Filler | FILL(7..7) | 0 | 0 | | |
| Self-read inhibit overflow | BOOL(0) | 1 | FALSE | F | OSGP device does not inhibit self-reads once a memory overflow occurs. |
| Self-read sequence number | BOOL(1) | 1 | TRUE | P | A 2-byte sequence number is maintained within BT26 after demand is configured. |
| Daily self-read | BOOL(2) | 1 | TRUE | F | Daily self-reads are supported, programmable via the TOU Calendar table, BT54. |
| Weekly self-read | BOOL(3) | 1 | TRUE | F | Weekly self-reads are supported, programmable via the TOU Calendar table, BT54. |
| Self-read demand reset | UINT(4..5) | 1 | 0 | P | OSGP device does not automatically perform either a self-read with every demand reset, or a demand reset with every self-read. |
| Filler | FILL(6..7) | 1 | 0 | F | |
| Number of self-reads | UINT8 | 2 | 253 | P | OSGP device supports up to this many self-read entries in BT26. |
| Number of summations | UINT8 | 3 | 15 | P | OSGP device records 11 accumulations in BT23. For more information, see tables BT22 and BT23. |
| Number of demands | UINT8 | 4 | 8 | P | Number of demand registers supported in the OSGP device. |
| Number of coincident values | UINT8 | 5 | 16 | P | Total number of coincident values supported. |
| Number of occurrences | UINT8 | 6 | 1 | P | Number of max demands reported for each demand register. |
| Number of tiers | UINT8 | 7 | 4 | P | OSGP device supports 4 TOU tiers (rates). |
| Number of present demands | UINT8 | 8 | 8 | P | Number of maximum present demands supported. |
| Number of present values | UINT8 | 9 | 26 | P | The number of instantaneous measurement values recorded in the OSGP device. For a description of the present values, see tables BT27 and BT28. |

## A.16 Basic Table 21 (BT21): Actual Register

This table lists the actual dimensions for the tables in this decade that contain the measured values registers:

- Read access: OMAK.
- Write access: None.

**Table A.21**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Season information field | BOOL(0) | 0 | TRUE | F | OSGP device reports the appropriate season in tables in this decade. |
| Date time field | BOOL(1) | 0 | TRUE | F | OSGP device reports date and time in tables in this decade. |
| Demand reset counter | BOOL(2) | 0 | | M | Count of the number of demand resets that have occured since billing registers were last cleared:<br>True if included in billing data.<br>False if not included in billing data. |
| Demand reset lock | BOOL(3) | 0 | | M | OSGP device supports a configurable lockout period for sequential demand resets. |
| Cumulative demand | BOOL(4) | 0 | | M | True if cumulative demand is configured, and False if not. |
| Continuous cumulative demand | BOOL(5) | 0 | | M | True if continuous cumulative demand is configured, and False if not. |
| Time remaining | BOOL(6) | 0 | False | P | Not currently implemented. |
| Filler | FILL(7..7) | 0 | 0 | | |
| Self-read inhibit overflow | BOOL(0) | 1 | False | F | OSGP device does not inhibit self-reads once a memory overflow occurs. |
| Self-read sequence number | BOOL(1) | 1 | False | P | OSGP device does not provide a 4-byte sequence number with self-reads. However, a 2-byte sequence number is maintained within BT26. |
| Daily self-read | BOOL(2) | 1 | True | F | Daily self-reads are supported, programmable via the TOU Calendar table, BT54. |
| Weekly self-read | BOOL(3) | 1 | True | F | Weekly self-reads are supported, programmable via the TOU Calendar table, BT54. |
| Self-read demand reset | UINT(4..5) | 1 | 0 | P | OSGP device does not automatically perform either a self-read with every demand reset, or a demand reset with every self-read. |
| Filler | FILL(6..7) | 1 | 0 | F | |
| Number of self-reads | UINT8 | 2 | 0..BT20.2 | M | Number of self-read entries presently configured (MFG default 12). |
| Number of summations | UINT8 | 3 | 11 or BT20.3 | M | Number of accumulations reported in BT23. Changeable by demand configuration For a description of the summations, see tables BT22 and BT23. |
| Number of demands | UINT8 | 4 | 0..BT20.4 | M | Number of demand registers presently configured. |
| Number of coincident values | UINT8 | 5 | 0..BT20.5 | M | Total number of coincident values presently configured. |
| Number of occurrences | UINT8 | 6 | 0..BT20.6 | M | Number of max demands reported for each demand register. |
| Number of tiers | UINT8 | 7 | BT20.7 | M | OSGP device supports 4 TOU tiers (rates). |
| Number of present demands | UINT8 | 8 | 0..BT20.8 | M | Number of present demands configured. |
| Number of present values | UINT8 | 9 | BT20.9 | M | The number of instantaneous measurement values recorded in the OSGP device. For a description of the present values, see tables BT27 and BT28. |

# A.17 Basic Table 22 (BT22): Data Selection

This table lists the measurement sources (by number) that are recorded in BT23:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table A.22**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Summation sources | ARRAY[BT21.3] of UINT8 | 0 | | M | List of source identification numbers for each summation. For a description of the summations, see BT23 "Current Register Data". |
| Demand Select | ARRAY[BT21.4] of UINT8 | BT21.3 | | M | List of source identification number for the demand sources. |
| Min Max Flags | SET((BT21..4 +7) /8) | BT21.3 + BT21.4 | | M | A set of bit flags corresponding to each demand source, indicating whether it is a minimum or maximum demand.<br>False = minimum<br>True = maximum |
| Coincident Select | ARRAY[BT21.5] of UINT8 | BT21.3 + BT21.4 + ((BT21.4 +7) /8) | | M | A list of sources that can be collected with each demand measurement. |
| Coincident Demand Assoc | ARRAY[BT21.5] of UINT8 | BT21.3 + BT21.4 + ((BT21.4 +7) /8) + BT21.5 | | M | An index into Demand Select identifying the demand with which this coincident value is associated. |

# A.18 Basic Table 23 (BT23): Current Register Data

This table contains the recorded energy accumulations for the totals and all 4 TOU tiers:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

NOTE 1: Proper interpretation of the registers and offsets in BT23 relies on reading BT21 first to determine the presently configured dimensions of BT23.

NOTE 2: NI_FMAT1 is defined in BT00.2.

**Table A.23**

| Symbol | Value |
|---|---|
| A | IF BT21.0.2 THEN 1<br>ELSE 0 |
| B | A + 4×BT21.3 |
| C | B + BT21.4×DmdRcd |
| D | C + BT21.5×CoinRcd |

**Table A.24**

| Number | Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|---|
| | IF BT21.0.2 THEN number Demand Resets | UINT8 | 0 | | M | The number of demand resets executed by the OSGP device. |
| Total Data Block: Summations, Demands, and Coincidents | | | | | | |
| Summations: Array[[BT20.3] of NI_FMAT1 | | | | | | Measurement accumulations for totals. These values are never reset in the field). |
| 0 | Fwd Active Wh ABC | NI_FMAT1 | A | | M | |
| 1 | Rev Active Wh ABC | NI_FMAT1 | A+4 | | M | |
| 2 | Import Reactive VArh ABC | NI_FMAT1 | A+8 | | M | |

| Number | Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|---|
| 3 | Export Reactive VArh ABC | NI_FMAT1 | A+12 | | M | |
| 4 | Power Outage Duration | NI_FMAT1 | A+16 | | M | The power outage duration in seconds. This field not populated in tier groups. |
| 5 | Power Outage Qty | NI_FMAT1 | A+20 | | M | This field not populated in tier groups. |
| 6 | Fwd+Rev Active Wh ABC | NI_FMAT1 | A+24 | | M | |
| 7 | Fwd-Rev Active Wh ABC | NI_FMAT1 | A+28 | | M | Result clamped at 0. |
| 8 | Pulse input 1 | NI_FMAT1 | A+32 | | M | |
| 9 | Pulse input 2 | NI_FMAT1 | A+36 | | M | |
| 10 | Error counter | NI_FMAT1 | A+40 | | M | The error counter increments by 1 every instance of one the following alarms:<br>RAM failure<br>Non-volatile memory failure<br>Clock error<br>Measurement error<br>Tamper detect<br>Save-all aborted. |
| 11 | Reactive VArh Q1 | NI_FMAT1 | A+44 | | M | Reactive energy for quadrant 1. |
| 12 | Reactive VArh Q2 | NI_FMAT1 | A+48 | | M | Reactive energy for quadrant 2. |
| 13 | Reactive VArh Q3 | NI_FMAT1 | A+52 | | M | Reactive energy for quadrant 3. |
| 14 | Reactive VArh Q4 | NI_FMAT1 | A+56 | | M | Reactive energy for quadrant 4. |
| Demands: ARRAY[BT21.4] of DmdRcd: | | | | | | |
| DmdRcd: | | | | | | |
| | IF BT21.0.1 THEN Event Time | ARRAY[BT21.6] of STIME_DATE | B | | M | Local time stamp of the demand measurement. |
| | IF BT21.0.4 THEN Cumulative Demand | NI_FMAT1 | B + 5×BT21.6 | | M | Cumulative demand measurement. |
| | IF BT21.0.5 THEN Contin Cum Demand | NI_FMAT1 | B + 5×BT21.6 + 4 | | M | Continuous cumulative demand measurement. |
| | Demand | ARRAY[BT21.6] of NI_FMAT2 | B + 5×BT21.6 +8 | | M | Demand measurements. |
| | | | | | | |
| Coincidents: ARRAY[BT21.5] of CoinRcd: | | | | | | |
| CoinRcd: | | | | | | |
| | Coincidents | ARRAY[BT21.6] of NI_FMAT2 | C | | M | The selected sources collected with the demand measurements. The order of coincidents matches the order of demand registers. |
| Tier Data Block: Array[BT21.7] Recordsets of BT23.TotalDataBlock | | | | | | |
| | Summations | | D | | M | |
| | Demands | | | | M | |
| | Coincidents | | | | M | |

# A.19 Basic Table 24 (BT24): Previous Season Data

This table is a snapshot of the current register data (BT23) taken at the time of the last season change:

NOTE: ET54.2 holds the BIDN in effect at the time BT24 was updated and may be read along BT24 in order to correctly interpret the contents.

- Read access: OMAK.

- Write access: OMAK.
- Attributes: ICANAK.

**Table A.25**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Time and date | STIME_DATE | 0 | | M | Time and date when this data was captured. |
| Season | UINT8 | 5 | | M | Season represented in this snapshot. |
| RegisterDataRcd = BT23 | | 6 | | | Snapshot of Total and Tier summations, demand. |

# A.20 Basic Table 25 (BT25): Previous Demand Reset Data

This table contains the previous demand data recorded at the last demand reset for the totals and all 4 TOU tiers:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

NOTE: The data in BT25 is a read only copy of the latest entry recorded in ET41 (Demand Reset History Log). When the latest demand reset data in ET41 is modified, the BT25 data will change along with that. When ET41 is reset, the header fields (time/date, season, and number of demand resets) of BT25 will appear reset (all zeros) as well.

**Table A.26**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Time and date | STIME_DATE | 0 | | M | Time and date when this data was captured. |
| Season | UINT8 | 5 | | M | Season represented in this snapshot. |
| RegisterDataRcd = BT23 | | 6 | | | Snapshot of Total and Tier summations, demand. |

# A.21 Basic Table 26 (BT26): Self Read Data

This table is a snapshot of the current register data (BT23) taken at programmed intervals of time. Self-read intervals are programmable via the TOU Calendar (BT54):

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table A.27**

| Number | Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|---|
| | Order | BOOL(0) | 0 | False | F | Self read records are transported in ascending order (N is older than N+1). |
| | Overflow | BOOL(1) | 0 | | M | This flag is set when the self-read memory has over flowed, causing old data to be overwritten. |
| | List type | BOOL(2) | 0 | True | F | The self-read list is a circular queue. Set to False if the maximum number of entries is 0) |
| | Inhibit overflow | BOOL(3) | 0 | False | F | The OSGP device does not inhibit new entries when overflow occurs. |
| | Filler | FILL(4..7) | 0 | | | |
| | Number of valid entries | UINT8 | 1 | | M | Number of self read records with valid data. Range is 0 to BT21.2 (i.e. the value of the "Number of Self-Reads" field in BT21. |
| | Last entry element | UINT8 | 2 | | M | Array element of the most recent valid self read entry. Range is 0 to BT21.2. |
| | Last entry sequence number | UINT16 | 3 | | M | Sequence number of the most recent self-read operation. This value is never reset. |
| | Number of unread entries | UINT8 | 5 | | M,H | Number of self read records that have not been read. This field is incremented by the OSGP device and decremented by the host as records are read. Range is 0 to BT21.2. |
| Self read entries: Array[BT21.2] of SelfReadDataRecord | | | | | | |
| SelfReadDataRecord: | | | | | | |
| | IF BT21.4 != 0 then Blg Iface Def number (BIDN) | UINT16 | 6 | | M | This field holds the BIDN for this entry. See clause D.33 for more information on BIDN. |
| | Time and date | STIME_DATE | 6 (+2) | | M | Time and date (BT55) when this data was captured. |
| | Season | UINT8 | 11 (+2) | | M | Season represented in this snapshot. |
| | RegisterDataRcd = BT23 | | 12 (+2) | | | Snapshots of Total and Tier summations and demand. |

# A.22 Basic Table 27 (BT27): Present Register Selection

This table lists the instantaneous measurement sources (by number) that are recorded in BT28:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table A.28**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Present demand sources | ARRAY[BT21.8] of UINT8 | 0 | | F | The list of source identifiers included in present demand measurements. |
| Present value sources | ARRAY[BT21.9] of UINT8 | BT21.8 | | F | The list of source identification numbers for each instantaneous measurement value. For a description of the present values, see clause A.23. |

# A.23 Basic Table 28 (BT28): Present Register Data

This table contains the recorded instantaneous measurement values:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

Note for computing offsets in BT28:

- If BT21.0.6 = True then A = 3 else A = 0.

**Table A.29**

| Number | Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|---|
| | Present Demands: ARRAY[BT21.8] of PresDmdRcd: | | | | | |
| | PresDmdRcd: | | | | | |
| | IF BT21.0.6 THEN Time Remaining | TIME | 0 | | M | Time remaining to the end of the present demand interval. |
| | Demand value | NI_FMAT2 | 3 | | M | The present demand value. (See note). |
| | | | | | | |
| | | | | | | |
| Present Value # | Present values: ARRAY[BT21.9] of NI_FMAT1 | | | | | |
| 0 | Fwd Active W ABC | NI_FMAT1 | (A+4) × BT21.8 | | M | |
| 1 | Rev Active W ABC | NI_FMAT1 | | | M | |
| 2 | Import Reactive VAr ABC | NI_FMAT1 | | | M | |
| 3 | Export Reactive VAr ABC | NI_FMAT1 | | | M | |
| 4 | RMS Current (mA) A | NI_FMAT1 | | | M | |
| 5 | RMS Current (mA) B | NI_FMAT1 | | | M | |
| 6 | RMS Current (mA) C | NI_FMAT1 | | | M | |
| 7 | RMS Voltage (mV) A | NI_FMAT1 | | | M | |
| 8 | RMS Voltage (mV) B | NI_FMAT1 | | | M | |
| 9 | RMS Voltage (mV) C | NI_FMAT1 | | | M | |
| 10 | Power Factor A (1/1000) | NI_FMAT1 | | | M | |
| 11 | Frequency (mHz) | NI_FMAT1 | | | M | |
| 12 | VA ABC | NI_FMAT1 | | | M | |
| 13 | Power Factor B (1/1000) | NI_FMAT1 | | | M | |
| 14 | Power Factor C (1/1000) | NI_FMAT1 | | | M | |
| 15 | Sin(PA) A (1/1000) | NI_FMAT1 | | | M | |
| 16 | Sin(PA) B (1/1000) | NI_FMAT1 | | | M | |
| 17 | Sin(PA) C (1/1000) | NI_FMAT1 | | | M | |
| 18 | Fwd Active W ABC multiply CT/VT ratio if enabled | NI_FMAT1 | | | M | |
| 19 | Rev Active W ABC multiply CT/VT ratio if enabled | NI_FMAT1 | | | M | |
| 20 | Import Reactive VAr ABC multiply CT/VT ratio if enabled | NI_FMAT1 | | | M | |
| 21 | Export Reactive VAr ABC multiply CT/VT ratio if enabled | NI_FMAT1 | | | M | |
| 22 | Q1 Reactive Var ABC | NI_FMAT1 | | | M | |
| 23 | Q2 Reactive Var ABC | NI_FMAT1 | | | M | |
| 24 | Q3 Reactive Var ABC | NI_FMAT1 | | | M | |
| 25 | Q4 Reactive Var ABC | NI_FMAT1 | | | M | |
| NOTE: For correct interpretation of this value, also read the preset demand calculation type in ET40.4.0. | | | | | | |

# A.24 Basic Table 30 (BT30): Dimension Display

This table lists the maximum dimensions of fields and tables in this decade that control the display:

- Read access: OMAK.
- Write access: None.

**Table A.30**

| Field Name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| On time | BOOL(0) | 0 | True | F | Programmable on-time is supported. |
| Off time | BOOL(1) | 0 | False | F | Programmable off-time is not supported. |
| Hold time | BOOL(2) | 0 | False | P | Programmable hold-time is not supported. |
| Filler | FILL(3..7) | 0 | | | |
| Number of display sources | UINT16 | 1 | 962 | P | The number of measurement sources that can be shown on the OSGP device display. |
| Width display sources | UINT8 | 3 | 2 | F | Number of display sources is described by 2 bytes. |
| Number of primary list items | UINT16 | 4 | 30 | P | The primary display list can contain 30 sources. |
| Number of primary lists | UINT8 | 6 | 1 | P | 1 normal list. |
| Number of secondary list item | UINT16 | 7 | 0 | P | Secondary display is not supported. |
| Number of secondary lists | UINT8 | 9 | 0 | P | Secondary display is not supported. |

# A.25 Basic Table 33 (BT33): Primary Display List

This table is used to configure what items show in what order and for how long on the OSGP device display:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table A.31**

| Field Name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Primary Display List | ARRAY[BT30.6] of DispListDescRcd | | | | |
| DispListDescRcd: | | | | | |
| On time | UINT(0..3) | 0 | 6 | H | The interval that each item is displayed, in seconds. This field has a range of 6 seconds to 15 seconds. Setting this field to zero disables the automatic display scrolling feature and requires the push button to advance to the next display list item. |
| Off time | UINT(4..7) | 0 | 0 | F | Not implemented. |
| Hold time | UINT(0..3) | 1 | 0 | P | Not implemented. |
| Default list | UINT(4..7) | 1 | 1 | F | First group of display sources listed below up to source BT33-2 -1 pertain to Normal mode. Value 1 = normal display. |
| Number list items | UINT8 | 2 | 3 | H | Number of items to display in normal mode. |
| Display sources: | ARRAY[BT30.4] OF UINT16 | 3 | 0x2000 0x2001 0x0000 | H | The high byte specifies list category and the low byte specifies data register to display. For details on how to set these bytes, see clause 8.9. |

# A.26 Basic Table 50 (BT50): Dimension Time and TOU

This table lists the dimensions of tables and parameters within tables BT50 through BT55:

- Read access: OMAK.
- Write Access: None.

**Table A.32**

| Field Name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| TOU self read | BOOL(0) | 0 | True | F | OSGP device supports scheduling of self-reads within TOU calendar. |
| Season self read | BOOL(1) | 0 | True | F | OSGP device supports scheduling of self-reads with season change. |
| Season demand reset | BOOL(2) | 0 | False | P | OSGP device does not support automatic demand reset with season change. |
| Season change armed | BOOL(3) | 0 | False | F | OSGP device does not support arming season change to coincide with the next demand reset. |
| Sort dates | BOOL(4) | 0 | False | F | OSGP device does not require the non-recurring dates to be pre-sorted when received. |
| Anchor date | BOOL(5) | 0 | False | F | OSGP device does not support the anchor date format of RDATE data type. |
| Filler | FILL(6..7) | 0 | | | |
| Daylight saving time auto | BOOL(0) | 1 | False | F | OSGP device does not support handling DST changes outside the scope of BT54. |
| Separate weekdays | BOOL(1) | 1 | False | P | OSGP device supports 1 weekday schedule. |
| Separate summation demands | BOOL(2) | 1 | False | F | OSGP device does not support switching tariff rates independently for summations and demands. |
| Sort tier switches | BOOL(3) | 1 | True | F | OSGP device requires tier switches in BT54 be pre-sorted when received. |
| Capable of time zone offset | BOOL(4) | 1 | True | F | OSGP device supports time zone offset. |
| Filler | FILL(5..7) | 1 | | | |
| Number of seasons | UINT(0..3) | 2 | 4 | P | Maximum number of seasons supported in the OSGP device. |
| Number of special schedules | UINT(4..7) | 2 | 2 | P | Maximum number of special (holiday) schedules per season supported in the OSGP device. |
| Number of non-recurring dates | UINT8 | 3 | 0 | P | Nonrecurring dates are not supported. |
| Number of recurring dates | UINT8 | 4 | 23 | P | Maximum number of recurring dates supported for entry in BT54. This includes: 1 for DST start date, 1 for DST end date, 4 for each of 4 season start dates, 15 holidays per year, 1 independent self-read schedule, 1 reserved for future use. |
| Number of tier switches | UINT16 | 5 | 200 | P | Maximum number of tier switches per day supported for entry in BT54. First switch of every day begins at midnight. |
| Calendar table size | UINT16 | 7 | 693 | P | Total size in bytes of BT54. |

# A.27 Basic Table 52 (BT52): Clock

This table reflects the OSGP device system date and time in UTC, non-DST adjusted, non-time-zone adjusted. BT52 is updated every second:

- Read access: OMAK.
- Write access: None.

**Table A.33**

| Field Name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Clock calendar | LTIME_DATE | 0 | Jan 1, 2004 00:00:00 | M | OSGP device system date and time in UTC. All OSGP device functions, except those scheduled from within BT54 "Calendar" are scheduled from this clock, including the load profile. |
| Day of week | UINT(0..2) | 6 | 4 | M | Present day of the week, updated every second: 0 = Sunday, 1 = Monday, etc. |
| Daylight saving time | BOOL(3) | 6 | | M | Present status of DST in effect. Even when this flag is True, the "Clock Calendar" field in BT52 does not reflect daylight savings time. Read BT55 for DST clock adjustments. |
| Greenwich mean time | BOOL(4) | 6 | True | F | OSGP device system date and time corresponds to Greenwich Mean Time (UTC). |
| Time zone applied | BOOL(5) | 6 | False | F | Time zone offset is not applied to the OSGP device system date and time in BT52. |
| DST applied | BOOL(6) | 6 | False | F | OSGP device system date and time in BT52 does not include daylight saving time adjustment. |
| Filler | FILL(7..7) | 6 | | | |

# A.28 Basic Table 53 (BT53): Time Offset

This table contains programmable Daylight Saving Time (DST) options:

- Read access: OMAK.
- Write access: OMAK.

**Table A.34**

| Field Name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Daylight saving time effective | TIME | 0 | | H | Time of day the OSGP device adjusts the TOU clock in BT55 to or from daylight savings, based on entries in BT54 "Calendar " and the "DST Delta" field in ET04. |
| Daylight saving time adjustment | UINT8 | 3 | | H | Daylight saving time adjustment, in minutes. When daylight saving time begins, the TOU clock in BT55 will adjust forward by this amount relative to the OSGP device system date and time in BT52. When daylight saving time ends, the TOU clock in BT55 will adjust back to the OSGP device system date and time. |
| Time Zone Offset | INT16 | 4 | | H | Time zone offset, in minutes, to be applied to the TOU clock in BT55. Range of -12 hours to +14 hours enforced by the OSGP device. |

# A.29 Basic Table 54 (BT54): Calendar

This table holds the Time of Use calendar that controls the scheduling of rate changes in the OSGP device. In addition, the OSGP device's self-reads are scheduled here. All events scheduled in BT54 are triggered by the TOU clock representing local time (BT55). For more information on self-reads and OSGP device billing, see clause 8.3:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table A.35**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Non-Recurring Dates | ARRAY[BT50.3] of NonRecurrDateRcd | | | | |
| NonRecurrDateRcd: | | | | | |
| Non-recurring date | DATE | 0 | | | |
| Action | CalendarActionBfld | | | | See below for definition of this bit field. |
| Recurring Dates: | ARRAYBT50.4] of RecurrDateRcd (3-byte records) | | | | |
| RecurrDateRcd: | | | | | |
| Recurring date | RDATE | BT50.3 × sizeof(NonRecurrDateRcd) | | H | Date of event or start date of season. Recurring dates are based on a perpetual calendar and can repeat on a daily, weekly, monthly, or yearly basis. Activation time is the start of the scheduled day at 00:00:00. |
| CalendarActionBfld: | | | | | |
| Action | UINT(0..4) | | | H | Action to perform on this recurring date:<br>0 = No action.<br>1 = Daylight savings time on.<br>2 = Daylight savings time off.<br>3 = Select season 0.<br>4 = Select season 1.<br>5 = Select season 2.<br>6 = Select season 3.<br>19 = Special schedule 0.<br>20 = Special schedule 1. |
| Demand Reset | BOOL(5) | | | H | 1 = Perform demand reset on this date.<br>0 = No demand reset. |
| Self read | BOOL(6) | | | H | 1 = Perform self read on this date.<br>0 = No self read. |
| Filler | FILL(7..7) | | | | |
| Tier Switches: | ARRAY[BT50.5]] of TIerSwitchRcd (3-byte records) | | | | |
| TierSwitchRcd: | | | | | |
| Tier | UINT(0..2) | BT50.3 × sizeof(NonRecurrDateRcd) + BT50.4 × sizeof(RecurrDateRcd) | | H | Rate that begins at this time. |
| Filler | FILL(3..4) | | | | |
| Hour | UINT(11..15) | | | H | Start hour of new rate. |
| Minute | UINT(5..10) | | | H | Start minute of new rate. |
| Schedule | UINT8 | | | H | Day schedule that this rate switch belongs to.<br>Value:<br>0 for first 10 switches.<br>1 for next 10 switches.<br>… 19 for last 10 switches. |
| Season Schedules: | ARRAY[BT50.2] of SeaSchedRcd (5-byte records) (see note) | | | | |
| SeaSchedRcd: | | | | | |
| Saturday | UINT8 | BT50.3 × sizeof(NonRecurrDateRcd) + BT50.4 × sizeof(RecurrDateRcd) + BT50.5 × sizeof(TierSwitchRcd) | | H | Day schedule to use on Saturday in this season. |
| Sunday | UINT8 | | | H | Day schedule to use on Sunday in this season. |
| Weekday | UINT8 | | | H | Day schedule to use on all weekdays in this season. |
| Special schedule 0 | UINT8 | | | H | First holiday day schedule for use in this season. |
| Special schedule 1 | UINT8 | | | H | Second holiday day schedule for use in this season. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Calendar ID | UINT32 | BT50.3 × sizeof(NonRecurrDateRcd) + BT50.4 × sizeof(RecurrDateRcd) + BT50.5 × sizeof(TierSwitchRcd) + BT50.2 × sizeof(SeaSchedRcd) | | H | Identifier for entire TOU calendar. |
| NOTE: If BT50.1.1 is True, this record is expanded by 4 to cover all 7 days of the week. | | | | | |

# A.30 Basic Table 55 (BT55): Clock state

This table reflects the local time, DST-adjusted TOU clock, updated every minute. All events scheduled in the TOU calendar table (BT54) are triggered by this clock:

- Read access: OMAK.
- Write access: None.

**Table A.36**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Clock calendar | LTIME_DATE | 0 | | M | DST and time-zone-adjusted OSGP device date and time. This field is updated every minute, and on every table write. When daylight saving time begins, this clock will adjust forward by the DST adjustment programmed in BT53, relative to the OSGP device system date and time in BT52. When daylight saving time ends, this clock echoes the OSGP device system date and time. |
| Day of week | UINT(0..2) | 6 | | M | DST-adjusted day of the week, updated every minute: 0 = Sunday, 1 = Monday, etc. |
| Daylight saving time | BOOL(3) | 6 | | M | Present status of DST in effect, updated every minute. |
| Greenwich mean time | BOOL(4) | 6 | False | F | The TOU clock in BT55 does not necessarily correspond to Greenwich Mean Time. |
| Time zone applied | BOOL(5) | 6 | True | F | Time zone offset has been applied to the TOU clock in BT55. |
| DST applied | BOOL(6) | 6 | True | F | The TOU clock in BT55 includes daylight saving time adjustment. |
| Filler | FILL(7..7) | 6 | 0 | | |
| Current tier | UINT(0..2) | 7 | | M | Current active tier (rate) in the OSGP device. The range is 0 to 3, per the configuration in BT54. |
| Filler | FILL(3..5) | 7 | 0 | | |
| Tier drive | UINT(6..7) | 7 | | M | 0 = Tier (rate) selection is programmed and managed through BT54 "Calendar".<br>1 = Override ended by tier switch in effect.<br>2 = Indefinite override in effect.<br>3 = Time-based override in effect (either duration or absolute time) or over power threshold tier forced See ET54.Tier Drive for clarification. |
| Special schedule active | UINT(8..11) | 7 | | M | Current active special (holiday) schedule. The range is 0 to 1, per the configuration in BT54. |
| Season | UINT(12..15) | 7 | | M | Current active season. The range is 0 to 3, per configuration in BT54. |

# A.31 Basic Table 60 (BT60): Dimension Load Profile

This table lists the maximum dimensions of the remaining tables in this decade, which contain the load profile configuration and records. The parameters in BT60 reflect the maximum possible setting for each individual field given that the other fields are configured appropriately:

- Read access: OMAK.
- Write access: None.

**Table A.37**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Memory length | UINT32 | 0 | NVM(s) - 24576 - Overhead | M | Total number of bytes used for load profile log sets 1 and set 2. "Overhead" is equal to 2 bytes for every 128 of data. For 128K NVM size, this is 104,832. |
| Set 1 inhibit overflow | BOOL(0) | 4 | False | F | Set 1 load profiling is not capable of being inhibited once a memory overflow occurs. |
| Set 2 inhibit overflow | BOOL(1) | 4 | False | P | Set 2 not supported. |
| Set 3 inhibit overflow | BOOL(2) | 4 | False | F | Set 3 not supported. |
| Set 4 inhibit overflow | BOOL(3) | 4 | False | F | Set 4 not supported. |
| End reading supported | BOOL(4) | 4 | False | P | End readings are not supported. |
| End pulse supported | BOOL(5) | 4 | False | F | End pulses are not supported. |
| Set 1 scalar divisor enable | BOOL(6) | 4 | False | P | Scalars and divisors are not supported for Set 1. |
| Set 2 scalar divisor enable | BOOL(7) | 4 | False | P | Set 2 not supported. |
| Set 3 scalar divisor enable | BOOL(8) | 4 | False | F | Set 3 not supported. |
| Set 4 scalar divisor enable | BOOL(9) | 4 | False | F | Set 4 not supported. |
| Extended interval status | BOOL(10) | 4 | True | F | Extended interval status is supported, and provides information about power failures and clock changes sustained in each interval. |
| Simple interval status | BOOL(11) | 4 | True | F | Simple interval status is supported, and provides information about which intervals in the block have been recorded. |
| Filler | UINT(12..15) | 4 | | F | Not Used |
| UINT8 supported | BOOL(0) | 6 | False | F | This interval data format is not supported. |
| UINT16 supported | BOOL(1) | 6 | False | F | This interval data format is not supported. |
| UINT32 supported | BOOL(2) | 6 | False | F | This interval data format is not supported. |
| INT8 supported | BOOL(3) | 6 | False | F | This interval data format is not supported. |
| INT16 supported | BOOL(4) | 6 | False | P | This interval data format is not supported. |
| INT32 supported | BOOL(5) | 6 | True | F | INT32 interval data format is supported. |
| NI FMAT1 supported | BOOL(6) | 6 | False | F | This interval data format is not supported. |
| NI FMAT2 supported | BOOL(7) | 6 | False | F | This interval data format is not supported. |
| Number of blocks in set 1 | UINT16 | 7 | 9 530 | P | The maximum number of blocks that set 1 can hold (minimal configuration assumed). |
| Number of intervals set 1 | UINT16 | 9 | 1 440 | F | The maximum number of intervals per block that set 1 can hold (one-minute interval time assumed). |
| Number of channels set 1 | UINT8 | 11 | 16 | P | The maximum number of channels per interval that can be configured in set 1. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Maximum interval time set 1 | UINT8 | 12 | 255 | F | The maximum time duration between two consecutive intervals that can be configured for set 1. |

# A.32 Basic Table 61 (BT61): Actual Load Profile

This table lists the presently running configuration of the load profile in the OSGP device. Note that the load profile is configured via EP11. For background information on the load profile, see clause 8.5:

- Read access: OMAK.
- Write access: None.

**Table A.38**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Memory length | UINT32 | 0 | 0..BT60.0 | M | Total number of bytes used for load profile log sets 1 and set 2. |
| Set 1 inhibit overflow | BOOL(0) | 4 | False | F | Set 1 load profiling is not inhibited once a memory overflow occurs. |
| Set 2 inhibit overflow | BOOL(1) | 4 | False | P | Set 2 is not supported. |
| Set 3 inhibit overflow | BOOL(2) | 4 | False | F | Set 3 is not supported. |
| Set 4 inhibit overflow | BOOL(3) | 4 | False | F | Set 4 is not supported. |
| End reading supported | BOOL(4) | 4 | False | P | End Readings are not supported. |
| End pulse supported | BOOL(5) | 4 | False | F | End Pulses are not supported. |
| Set 1 scalar divisor enable | BOOL(6) | 4 | False | P | Scalars and divisors are not supported for set 1. |
| Set 2 scalar divisor enable | BOOL(7) | 4 | False | P | Set 2 is not supported. |
| Set 3 scalar divisor enable | BOOL(8) | 4 | False | F | Set 3 is not supported. |
| Set 4 scalar divisor enable | BOOL(9) | 4 | False | F | Set 4 is not supported. |
| Extended interval status | BOOL(10) | 4 | True | F | Extended interval status is supported, and provides information about power failures and clock changes sustained in each interval. |
| Simple interval status | BOOL(11) | 4 | True | F | Simple interval status is supported, and provides information about which intervals in the block have been recorded. |
| Filler | UINT(12..15) | 4 | | F | Not Used. |
| UINT8 supported | BOOL(0) | 6 | False | F | This interval data format is not supported. |
| UINT16 supported | BOOL(1) | 6 | False | F | This interval data format is not supported. |
| UINT32 supported | BOOL(2) | 6 | False | F | This interval data format is not supported. |
| INT8 supported | BOOL(3) | 6 | False | F | This interval data format is not supported. |
| INT16 supported | BOOL(4) | 6 | False | P | This interval data format is not supported. |
| INT32 supported | BOOL(5) | 6 | True | F | INT32 interval data format can be configured in set 1. |
| NI FMAT1 supported | BOOL(6) | 6 | False | F | This interval data format is not supported. |
| NI FMAT2 supported | BOOL(7) | 6 | False | F | This interval data format is not supported. |
| Number of blocks set 1 | UINT16 | 7 | | M | The number of blocks that set 1 can hold for the present set 1 configuration This is equivalent to the days of storage since one block always represents one calendar day. |
| Number of intervals set 1 | UINT16 | 9 | | M | The number of intervals per block for the present set 1 configuration. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Number of channels set 1 | UINT8 | 11 | | H | The number of channels per interval for the present set 1 configuration, configured via procedure. |
| Maximum interval time set 1 | UINT8 | 12 | | H | The time duration for two consecutive intervals for the present set 1 configuration. A value of 1-60 indicates a duration in minutes, and a value of 84 indicates a duration of 24 hours. |

# A.33 Basic Table 62 (BT62): Load Profile Control

This table lists some of the current load profile configuration settings. For background information on the load profile, see clause 8.5:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table A.39**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| See note. | | | | | |
| Channel Settings: | Array[BT61.11] of 3-byte records: | | | | |
| End reading (Channel x) | BOOL(0) | 0 | 0 | P | End readings are not supported. |
| Interval source (Channel x) | UINT8 | 1 | | H | Interval data source for the present configuration for channel x, chosen from sources listed in BT16. Configured via procedure. |
| End reading source (Channel x) | UINT8 | 2 | 0 | P | End readings are not supported. |
| | | | | | |
| Format | UINT8 | BT61.11 × 3 | 32 | P | Interval data format for the present configuration. The INT32 format implies interval data is in snapshot mode (the exact register value is logged in the load profile). |
| IF BT60.4.6 THEN: | | | | | |
| Scalars | ARRAY[BT60.11] of UINT16 | BT61.11 × 3 + 1 | | H | Scalars applied to interval data before being recorded. |
| Divisors | ARRAY[BT60.11] of UINT16 | BT61.11 × 3 + 1 + 2×BT60.11 | | H | Divisors applied to interval data before being recorded. |
| NOTE: This represents one data set's worth of data. If more data sets are enabled and configured, this info is duplicated for each data set. | | | | | |

# A.34 Basic Table 63 (BT63): Load Profile Status

This table lists the present status of valid blocks and intervals in the load profile data set, and the arrangement of the log records in BT64. For background information on the load profile, see clause 8.5:

- Read access: OMAK.
- Write access: None.

**Table A.40**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| See note. | | | | | |
| Block order | UINT(0..0) | 0 | Ascending order (N is older than N+1) | F | Describes the order of blocks as listed in BT64 and as transported.<br>0 = Ascending order. |
| Overflow | BOOL(1) | 0 | | M | When True, indicates an interval was entered in a new block such that the number of unread blocks exceeded the actual number of possible blocks in the data set. This flag, once triggered, will be cleared upon execution of EP11, BP04, or BP05 with appropriate parameters. It is not cleared automatically by the OSGP device. Extended alarm 0 is also triggered when this overflow flag is triggered, and stays set until cleared by the host. |
| List type | UINT(2..2) | 0 | Circular list | F | Describes the method of block generation in OSGP device memory.<br>0 = First in first out (reads this if max entries is 0)<br>1 = Circular queue |
| Block inhibit overflow | BOOL(3) | 0 | False | F | Describes the status of inhibiting load profile when memory overflow occurs. Load profiling is never inhibited once a memory overflow occurs. |
| Interval order | UINT(4..4) | 0 | Ascending order (N is older than N+1) | F | Describes the order of intervals within a block as listed in BT64, and as transported.<br>0 = Ascending order. |
| Active mode | BOOL(5) | 0 | | M | Describes the current state of the data set.<br>True = set is presently collecting data.<br>False = set is not presently collecting data or is disabled. |
| Test mode | BOOL(6) | 0 | False | P | Test mode is not supported. |
| Number valid blocks | UINT16 | 1 | | M | Number of valid blocks in the data set. A block is considered valid when at least one interval is recorded. Range is 0 to BT61.7. |
| Last block | UINT16 | 3 | | M | Array index of the most recent valid block in the data set. Range is 0 to BT61.7 minus 1. |
| Last block sequence number | UINT32 | 5 | | M | The sequence number of the most recent valid block in the data set. Increments by one for each new block entered.<br>Range is 0 to 4 294 967 295. |
| Number unread blocks | UINT16 | 9 | | H | Number of valid blocks in the data set that have not been read. This number is incremented by the OSGP device and decremented by the host via procedure.<br>Range is 0 to BT61.7. |
| Number valid intervals | UINT16 | 11 | | M | Number of valid intervals in the most recent valid block in the set. Range is 0 to BT61.9. |
| NOTE: This represents one data set's worth of data. If more data sets are enabled and configured, this info is duplicated for each data set. | | | | | |

# A.35 Basic Table 64 (BT64): Load Profile Data

This table contains the entire set of load profile records. For background information on the load profile, see clause 8.5:

- Read access: OMAK.
- Write access: None.

**Table A.41**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Block data: | Array[BT61.7] OF (End Time + End Readings + Simple Status + Intervals) records: | | | | |
| End time | STIME_DATE | 0 | | M | Timestamp of the most recently recorded interval in the block. When the block is complete, this represents the end time of the block. |
| | | | | | |
| IF BT61.4.4 THEN: End Readings | ARRAY[BT61.11] of NI_FMAT1 | 5 | | | Snapshots of each channel taken at the end of the block. |
| Simple Status | SET((BT61.9+7)/8) | 5 + 4 × BT61.11 | | M | Simple status for this block. One bit for each interval in the block. If the bit = 1, then the interval has been processed. If the bit = 0, then the interval has not been processed. For incomplete blocks, this field can be used to determine how many and which intervals in the block to read. |
| Intervals: | Array[BT61.9] of (((BT61.11 /2) +1) + 4 × BT61.11)-byte records | | | | This array contains the load profile interval data with extended status per interval for all intervals in the block. Intervals that are marked invalid by Simple Status may contain nonzero data. This data should be ignored. |
| Extended Status | Array[(BT61.11 /2) +1] of Byte | 5 + 4 × BT61.11 + SET ((BT61.9 + 7)/8) | | M | Extended status for each interval. The highest nibble (byte 0 is high nibble) is status common to all channels. The contents of this nibble are bit flags representing the following (more than one flag could be set at a time):<br>0 = Daylight savings time is in effect during or at start of interval; Load profiling is not affected by DST clock adjustments. Load profiling is scheduled by the OSGP device system clock which is always in standard time.<br>1 = Power fail within interval.<br>2 = Clock reset forward during interval.<br>3 = Clock reset backward during interval.<br>The remaining nibbles represent the status of the channels, one nibble per channel:<br>Byte 0 low nibble represents channel 0.<br>Byte 1 high nibble represents channel 1.<br>Byte 1 low nibble represents channel 2, etc.<br>Each of these nibbles is a binary value. The parenthetical number indicates relative precedence (if multiple apply, the status with the higher precedence number is used). The meaning of channel status nibble is defined as:<br>0(0) = No status flag.<br>1(9) = Overflow (not implemented).<br>2(4) = Partial interval due to common state.<br>3(3) = Long interval due to common state.<br>4(10×) = Skipped due to stuffing or other reasons (see below and "LP use skipped").<br>5(1) = Interval contains test mode data<br>8(7) = MEP decryption failure<br>9(2) = Clock error<br>10(5) = MEP device missing<br>11(6) = Not current (MDT time stamp invalid)<br>15(10) = M-Bus channel placeholder in effect (M-Bus device data not yet retrieved or was never retrieved). |
| Interval Channel data: | Array[BT61.11] of 4-byte records | | | | |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Interval channel x value | INT32 | 5 + 4 × BT61.11 + SET((BT61.9 +7)/8) + (BT61.11/2 + 1) | | M | End of Interval (EOI) value for channel x. |

# A.36 Basic Table 70 (BT70): Dimension Log

This table lists the maximum dimensions of the remaining tables in this decade which contain the History and Event logs. For more information on the History Log, see clause 8.12:

- Read access: OMAK.
- Write access: None.

**Table A.42**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Event number | BOOL(0) | 0 | False | F | A common event number is maintained in both logs when an event occurs that is configured for both logs. |
| History date time | BOOL(1) | 0 | True | F | Date/time stamps are maintained in both logs. |
| History sequence number | BOOL(2) | 0 | True | F | Sequence numbers are maintained in both logs. |
| History inhibit overflow | BOOL(3) | 0 | False | F | OSGP device does not inhibit History Log entries once a memory overflow occurs. |
| Event inhibit overflow | BOOL(4) | 0 | False | F | OSGP device does not inhibit Event Log entries once a memory overflow occurs. |
| Filler | FILL(5..7) | 0 | | F | |
| Number of basic events | UINT8 | 1 | 8 | F | Up to 64 basic events are supported (8 × 8 bytes of bit flags) See BT72 for a list of the supported standard events. |
| Number of extended events | UINT8 | 2 | 13 | P | Up to 104 extended events are supported (13 × 8 bytes of bit flags) See BT72 for a list of the supported events. |
| History data length | UINT8 | 3 | 2 | P | Two bytes of arguments are supported in the History Log. |
| Event data length | UINT8 | 4 | 2 | P | Two bytes of arguments are supported in the Event Log. |
| Number of history entries | UINT16 | 5 | 7487 | P | Up to this many entries can be stored in the History Log. |
| Number of event entries | UINT16 | 7 | 0 | P | Up to 0 entries can be stored in the Event Log. |

# A.37 Basic Table 71 (BT71): Actual Log

This table lists the maximum dimensions of the remaining tables in this decade which contain the History and Event logs. For more information on the History Log, see clause 8.12:

- Read access: OMAK.
- Write access: None.

**Table A.43**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Event number | BOOL(0) | 0 | False | P | A common event number is maintained in both logs when an event occurs that is configured for both logs. |
| History date time | BOOL(1) | 0 | True | P | Date/time stamps are maintained in both logs. |
| History sequence number | BOOL(2) | 0 | True | P | Sequence numbers are maintained in both logs. |
| History inhibit overflow | BOOL(3) | 0 | False | P | OSGP device does not inhibit History Log entries once a memory overflow occurs. |
| Event inhibit overflow | BOOL(4) | 0 | False | P | OSGP device does not inhibit Event Log entries once a memory overflow occurs. |
| Filler | FILL(5..7) | 0 | | F | |
| Number of basic events | UINT8 | 1 | 8 | F | Up to 64 basic events are supported (8×8 bytes of bit flags) See BT72 for supported a list of basic events. |
| Number of extended events | UINT8 | 2 | 13 | P | Up to 104 extended events are supported (13×8 bytes of bit flags) See BT72 for a list of supported events. |
| History data length | UINT8 | 3 | 2 | P | Two bytes of arguments are supported in the History Log. |
| Event data length | UINT8 | 4 | 2 | P | Two bytes of arguments are supported in the Event Log. |
| Number of history entries | UINT16 | 5 | 0..BT70.5 | M | Number of entries stored in the History Log (MFG default: 100) |
| Number of event entries | UINT16 | 7 | 0 | F | Up to 0 entries can be stored in the Event Log. |

## A.38 Basic Table 72 (BT72): Events Identification

This table lists which events, both basic and extended, are supported in the OSGP device. Any of these can be configured to be logged in the Event Log. The argument is a 2-byte value providing additional descriptive information about the event. The total size of BT72 is BT71.1 + BT71.2.

The "event code" as used in BT74 is actually just an index into BT72. To correctly map an event code to an entry in BT72, it is necessary to first access BT70 to get the number of basic events in order to see where the extended events start. For example, given a "Number of Basic Events" of 8 in BT70, then the event with Category Extended and Number 4 would have "event code" 68. The "Number of Basic Events" is fixed at 8:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table A.44**

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| No Event | Std. | 0 | BOOL(0) | 0 | True | F | |
| Primary Power Down | Std. | 1 | BOOL(1) | 0 | True | F | |
| Primary Power Up | Std. | 2 | BOOL(2) | 0 | True | F | Reset cause. See ET10 for more details. |
| Time Changed (old time - no arg) | Std. | 3 | BOOL(3) | 0 | True | F | Delta value (0 for absolute). |
| Time Changed (new time - no arg) | Std. | 4 | BOOL(4) | 0 | True | F | |
| Time Changed (old time) | Std. | 5 | BOOL(5) | 0 | False | F | |
| Time Changed (new time) | Std. | 6 | BOOL(6) | 0 | False | F | |
| End Device Accessed for Read | Std. | 7 | BOOL(7) | 0 | True | F | Table number of table that was read. |
| End Device Accessed for Write | Std. | 8 | BOOL(0) | 1 | True | F | Table number of table that was written. |
| Procedure Invoked | Std. | 9 | BOOL(1) | 1 | True | F | Procedure number. Shall be enabled along with the specific procedure(s) to be logged. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Table Written To | Std. | 10 | BOOL(2) | 1 | True | F | Table number. Shall be enabled along with the specific table(s) to be logged. |
| End Device Programmed | Std. | 11 | BOOL(3) | 1 | False | F | |
| Communication Terminated Normally | Std. | 12 | BOOL(4) | 1 | True | F | |
| Communication Terminated Abnormally | Std. | 13 | BOOL(5) | 1 | True | F | |
| Reset List Pointers | Std. | 14 | BOOL(6) | 1 | True | F | List that was reset. See BP04 for more information. |
| Update List Pointers | Std. | 15 | BOOL(7) | 1 | True | F | List that was updated. See BP05 for more information. |
| History Log Cleared | Std. | 16 | BOOL(0) | 2 | True | F | |
| History Log Pointers Updated | Std. | 17 | BOOL(1) | 2 | True | F | Value by which log pointer was updated. |
| Event Log Cleared | Std. | 18 | BOOL(2) | 2 | False | P | |
| Event Log Pointers Updated | Std. | 19 | BOOL(3) | 2 | False | P | Value by which log pointer was updated. |
| Demand Reset Occurred | Std. | 20 | BOOL(4) | 2 | False | P | |
| Self-Read Occurred | Std. | 21 | BOOL(5) | 2 | True | F | |
| Daylight Savings Time On | Std. | 22 | BOOL(6) | 2 | True | F | |
| Daylight Savings Time Off | Std. | 23 | BOOL(7) | 2 | True | F | |
| Season Change | Std. | 24 | BOOL(0) | 3 | True | F | New season number. |
| Rate Change | Std. | 25 | BOOL(1) | 3 | False | F | |
| Special Schedule Activation | Std. | 26 | BOOL(2) | 3 | True | F | New special schedule. |
| Tier Switch Change | Std. | 27 | BOOL(3) | 3 | True | F | New current tier. |
| Pending Table Activation | Std. | 28 | BOOL(4) | 3 | True | F | Table number. |
| Pending Table Clear | Std. | 29 | BOOL(5) | 3 | True | F | Table number. |
| Metering Mode Started | Std. | 30 | BOOL(6) | 3 | False | F | |
| Metering Mode Stopped | Std. | 31 | BOOL(7) | 3 | False | F | |
| Test Mode Started | Std. | 32 | BOOL(0) | 4 | True | F | |
| Test Mode Stopped | Std. | 33 | BOOL(1) | 4 | True | F | |
| OSGP device Shop Mode Started | Std. | 34 | BOOL(2) | 4 | False | F | |
| OSGP device Shop Mode Stopped | Std. | 35 | BOOL(3) | 4 | False | F | |
| OSGP device Reprogrammed | Std. | 36 | BOOL(4) | 4 | True | F | |
| Configuration Error Detected | Std. | 37 | BOOL(5) | 4 | True | F | 0x0000 = Internal Initialization Timeout. |
| Self Check error Detected | Std. | 38 | BOOL(6) | 4 | True | F | 0 = Watch-dog timeout<br>2 = Abnormal Vdet4 power interrupt<br>3 = Stack overflow<br>100 - Miscellaneous exception. |
| RAM Failure Detected | Std. | 39 | BOOL(7) | 4 | True | F | 1 = Reserved<br>3 = Reserved<br>4 = RAM memory test error<br>5 = Reserved<br>6 = NVRAM alarm variable corrupted. |
| ROM Failure Detected | Std. | 40 | BOOL(0) | 5 | True | F | 0 = Bootrom invalid CRC<br>1 = System image invalid CRC. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Non-volatile Memory Failure Detected | Std. | 41 | BOOL(1) | 5 | True | F | Table number (65 535 for all)<br>65 534 = bootrom NVM CRC/signature invalid<br>65 533 = bootrom NVM write error<br>For table numbers, if the 0x8000 bit is set then the failure was detected during read-before-write. If the 0x4000 bit is set then failure was detected during read-after-write. If neither bit is set then failure was detected in background checks. |
| Clock Error Detected | Std. | 42 | BOOL(2) | 5 | True | F | 0 = Memory initialization or BT52 corruption.<br>1..6 = Reserved. |
| Measurement Error Detected | Std. | 43 | BOOL(3) | 5 | True | F | |
| Low Battery Detected | Std. | 44 | BOOL(4) | 5 | True | F | |
| Low Loss Potential Detected | Std. | 45 | BOOL(5) | 5 | False | F | |
| Demand Overload Detected | Std. | 46 | BOOL(6) | 5 | False | P | |
| Tamper Detected | Std. | 47 | BOOL(7) | 5 | True | F | Bits indicate which tampers are present:<br>Bit 0: 1 = OSGP device cover removed.<br>Bit 1: 1 = Feature Removed: Pulse channel 1 tamper.<br>Bit 2: 1 = Feature Removed: Pulse channel 2 tamper.<br>Bit 3: 1 = Tilt tamper. |
| Reverse Rotation Detected | Std. | 48 | BOOL(0) | 6 | True | F | Bit 0: 1 = Phase A reversed.<br>Bit 1: 1 = Phase B reversed.<br>Bit 2: 1 = Phase C reversed.<br>Bit 3: 1 = Phase Total, used only for Delta OSGP device. |
| Aborted Save All | Std. | 49 | BOOL(1) | 6 | True | F | |
| Disconnect Switch Error Detected | Std. | 50 | BOOL(2) | 6 | True | F | The Disconnect Switch Error event has several different arguments that contain information about why the event was logged and the state of the OSGP device at that time. In summary, an argument value of 0x0054 or 0x005C means that load side generation was detected, and any other argument is indicative of an unexpected fault related to the load disconnect contactor. Below is more detail on the argument encoding.<br>The argument type is identified by the lowest 3 bits of the argument itself. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| | | | | | | | **Argument Format 2:**<br>If Bits [2..0] are binary xx1 (where x can be either 0 or 1), then bits 1..3 represent the current status of the load disconnect contactor and the remaining bits are reserved for internal use. This argument is included every time the Disconnect Switch Error event is logged:<br>- Bits1..2: Internal State<br>1 = closed<br>2 = opened<br>3 = locked open<br>- Bit 3: External State<br>0 = open<br>1 = closed<br>**Argument Format 3:**<br>If Bits [2..0] are set to binary x10, then it is a new occurrence of the condition. The rest of the argument information is reserved for internal use, but the Disconnect Switch Error event with argument format 2 will also be logged in this case and should provide some information as to the current state of the load disconnect contactor.<br>**Argument Format 4:**<br>If Bits [2..0] are set to 4 (binary 100), then the event has been logged because the disconnect feedback is unreliable or because the OSGP device has detected load side generation when the disconnect is open. In this case, bits 3-6 indicate the following status, and the remaining bits are reserved for internal use.<br>- Bits 3..4: Internal State<br>1 = closed<br>2 = opened<br>3 = locked open<br>- Bit 5: External State<br>0 = open<br>1 = closed<br>- Bit 6: Load side voltage status<br>0 = none<br>1 = present<br>Bits 7..15: Instantaneous Power Level<br>o Sum of first four registers in BT28 (0 implies no power consumption measured in last 50 cycles) (see note). |
| Reserved | Std. | 51 | BOOL(3) | 6 | False | F | |
| Reserved | Std. | 52 | BOOL(4) | 6 | False | F | |
| Reserved | Std. | 53 | BOOL(5) | 6 | False | F | |
| Reserved | Std. | 54 | BOOL(6) | 6 | False | F | |
| Reserved | Std. | 55 | BOOL(7) | 6 | False | F | |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Reserved | Std. | 56 | BOOL(0) | 7 | False | F | |
| Reserved | Std. | 57 | BOOL(1) | 7 | False | F | |
| Reserved | Std. | 58 | BOOL(2) | 7 | False | F | |
| Filler | Std. | 59 | BOOL(3) | 7 | False | F | |
| Filler | Std. | 60 | BOOL(4) | 7 | False | F | |
| Filler | Std. | 61 | BOOL(5) | 7 | False | F | |
| Filler | Std. | 62 | BOOL(6) | 7 | False | F | |
| Filler | Std. | 63 | BOOL(7) | 7 | False | F | |
| Mfg Events: | SET(BT70.2) | | | | | | |
| Load Profile Memory Overflow | Mfg. | 0 | BOOL(0) | 8 | True | F | |
| Self Read Recorded | Mfg. | 1 | BOOL(1) | 8 | False | F | |
| Control Output 1 Tripped | Mfg. | 2 | BOOL(2) | 8 | True | F | Bits 0..3 indicate the current state:<br>1 = closed<br>2 = opened<br>3 = locked open<br>Bit 4 indicates whether or not the change in state was successful:<br>0 = successful<br>1 = failure<br>Bits 5 is reserved for future use.<br>Bit 6: Previous internal status (EP30 and power-up resynchronizations only)<br>0 = open,<br>1 = closed<br>Bit 7: Previous external status (EP30 and power-up resynchronizations only)<br>0 = open<br>1 = closed<br>High byte indicates the reason the state has changed:<br>1 = EP02 operation<br>2 = Maximum Power<br>3 = Prepay<br>4 = Prepay Power<br>5 = EP23 operation<br>6 = Manual operation<br>7 = Schedule<br>8 = EP30 invoked<br>9 = Disconnect resynchronization occurred<br>10 = Power-up resynchronization occurred. |
| Control Output 2 Tripped | Mfg. | 3 | BOOL(3) | 8 | True | F | Low byte indicates the current state of the control relay:<br>1 = closed<br>2 = opened<br>High byte indicates the reason the state has changed:<br>1 = EP02 operation<br>2 = Tariff-Based<br>3 = Time-Based. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Phase Loss | Mfg. | 4 | BOOL(4) | 8 | True | F | 1 = Line 1 Phase Lost (L1)<br>2 = Line 2 Phase Lost (L2)<br>3 = L1 & L2<br>4 = Line 3 Phase Lost (L3)<br>5 = L1 & L3<br>6 = L2 & L3<br>7 = L1 & L2 & L3 |
| Phase Inversion | Mfg. | 5 | BOOL(5) | 8 | True | F | Inverted phase:<br>4 = Plus 180° Inverted<br>6 = Minus 120° Inverted<br>2 = Plus 120° Inverted. |
| Serial Port Error | Mfg. | 6 | BOOL(6) | 8 | True | F | 0x0000 = Optical port failed to put the OSGP device's power line transceiver into nascent state.<br>0x0001 = A message failed between the OSGP device and the its power line transceiver (does not include PLC messages).<br>0x4000 = Invalid command length received.<br>0x8000 = Invalid command received.<br>0xC000 = PLC driver unable to receive message (rx buffer = full).<br>0xE000 = PLC driver length received will overflow Rx buffer. |
| General Error | Mfg. | 7 | BOOL(7) | 8 | True | F | 0 ..1 = Reserved |
| Invalid Password | Mfg. | 8 | BOOL(0) | 9 | True | F | Channel ID:<br>0 = Opticalport<br>1 = 14908.1 network port. |
| Remote Comm Inactive | Mfg. | 9 | BOOL(1) | 9 | True | F | |
| Current on Low Voltage | Mfg. | 10 | BOOL(2) | 9 | True | F | Phase bit mask (bit 0:A, bit 1:B, bit 2:C). |
| Pulse 1 Tamper | Mfg. | 11 | BOOL(3) | 9 | True | F | |
| Pulse 2 Tamper | Mfg. | 12 | BOOL(4) | 9 | True | F | |
| CRC or Image ID Error | Mfg. | 13 | BOOL(5) | 9 | True | F | 0 = CRC/ID failure<br>1 = Digest failure. |
| Code Bank Change | Mfg. | 14 | BOOL(6) | 9 | True | F | 0 = Application image changed successfully as commanded<br>1 = Unexpected application image changed detected. |
| Load Profile Not Stuffed | Mfg. | 15 | BOOL(7) | 9 | True | F | |
| MEP Installed or Removed | Mfg. | 16 | BOOL(0) | 10 | True | F | 0 = MEP card installed<br>1 = MEP card removed |
| M-Bus/MEP Alarm | Mfg. | 17 | BOOL(1) | 10 | True | F | 8 192 = Device 1 billing read completed, data collected<br>8 193 = Device 1 billing read completed, application errors<br>8 194 = Device 1 status read completed, new device alarm<br>8 195 = Device 1 billing data overflow<br>8 196 = Device 1 communication failure |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| | | | | | | | 8 197 = Device 1 serial number mismatch on billing read<br>16 384 = Device 2 billing read completed, data collected<br>16 385 = Device 2 billing read completed, application errors<br>16 386 = Device 2 status read completed, new device alarm<br>16 387 = Device 2 billing data overflow<br>16 388 = Device 2 communication failure<br>16 389 = Device 2 serial number mismatch on billing read<br>24 576 = Device 3 billing read completed, data collected<br>24 577 = Device 3 billing read completed, application errors<br>24 578 = Device 3 status read completed, new device alarm<br>24 579 = Device 3 billing data overflow<br>24 580 = Device 3 communication failure<br>24 581 = Device 3 serial number mismatch on billing read<br>32 768 = Device 4 billing read completed, data collected<br>32 769 = Device 4 billing read completed, application errors<br>32 770 = Device 4 status read completed, new device alarm<br>32 771 = Device 4 billing data overflow<br>32 772 = Device 4 communication failure<br>32 773 = Device 4 serial number mismatch on billing read<br>40 960 = MEP device billing read completed, data collected<br>40 961 = MEP device billing read completed, application errors<br>40 962 = MEP device status read completed, new device alarm<br>40 962 = MEP device billing data overflow<br>40 964 = MEP device communication failure<br>40 965 = MEP device serial number mismatch on billing read. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| MEP Auto-Discovery Complete | Mfg. | 18 | BOOL(2) | 10 | True | F | |
| Phase Rotation Changed | Mfg. | 19 | BOOL(3) | 10 | True | F | The LSB of the argument indicates current phase rotation status:<br>0 = L1L2L3<br>1 = L3L2L1<br>2 = Rotation Unknown |
| Prepay Credit Exhausted | Mfg. | 20 | BOOL(4) | 10 | True | F | |
| Prepay Warning Acknowledged | Mfg. | 21 | BOOL(5) | 10 | True | F | |
| History Log Overflow Pending | Mfg | 22 | BOOL(6) | 10 | True | F | |
| Mfg Log Reads Available | Mfg | 23 | BOOL(7) | 10 | True | F | Bitmask of manufacturing logs:<br>Bit 0 = OSGP device OTR<br>Bit 1 = M_Bus OTR<br>Bit 2 = Conifg ID |
| Interface Change | Mfg | 24 | BOOL(0) | 11 | True | F | 0000 = Initial OSGP device load.<br>0001 = EP06 invocation.<br>0002 = Interface Compatibility Setting changed during commissioning.<br>0003 - Interface Compatibility was changed via a table write.<br>0xxx where xxx is the number of the procedure invoking the change. |
| Magnetic Tamper | Mfg | 25 | BOOL(1) | 11 | True | F | |
| Access Lockout override | Mfg | 26 | BOOL(2) | 11 | True | F | The security control word override is detected:<br>1 = Override detected.<br>0 = Override condition gone. |
| Power Quality Event Detected | Mfg | 27 | BOOL(3) | 11 | True | F | Power quality event (sag/surge/over-current) detected, bit mask, bit value 1 means event detected, value 0 means event gone<br>Bit 0 = phase A sag<br>Bit 1 = phase B sag<br>Bit 2 = phase C sag<br>Bit 3 = phase A surge<br>Bit 4 = phase B surge<br>Bit 5 = phase C surge<br>Bit 6 = phase A over-current<br>Bit 7 = phase B over-current<br>Bit 8 = phase C over-current |
| Event Log Unread Entries | Mfg | 28 | BOOL(4) | 11 | True | F | |
| THD Event Detected | Mfg | 29 | BOOL(5) | 11 | True | F | THD event detected, bit mask, bit value 1 means event detected, value 0 means event gone<br>Bit 0 = phase A V-THD<br>Bit 1 = phase B V-THD<br>Bit 2 = phase C V-THD<br>Bit 3 = phase A I-THD<br>Bit 4 = phase B I-THD<br>Bit 5 = phase C -ITHD<br>Bit 6 = phase A VATHD<br>Bit 7 = phase B VATHD<br>Bit 8 = phase C VATHD |
| LP Unread Entries | Mfg | 30 | BOOL(6) | 11 | True | F | |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Load Side Voltage Detected on Disconnect Open | Mfg | 31 | BOOL(7) | 11 | True | F | Reserved. |
| MEP status event | Mfg | 32 | BOOL(0) | 12 | True | F | 8 192 = M-Bus Device 1 registered<br>8 193 = M-Bus Device 1 failed to register, no available position<br>8 194 = M-Bus Device 1 failed to register, lost communication<br>8 195 = M-Bus Device 1 baud rate changed<br>8 196 = M-Bus Device 1 removed logically from OSGP device<br>16 384 = M-Bus Device 2 registered<br>16 385 = M-Bus Device 2 failed to register, no available position<br>16 386 = M-Bus Device 2 failed to register, lost communication<br>16 387 = M-Bus Device 2 baud rate changed<br>16 388 = M-Bus Device 2 removed logically from OSGP device<br>24 576 = M-Bus Device 3 registered<br>24 577 = M-Bus Device 3 failed to register, no available position<br>24 578 = M-Bus Device 3 failed to register, lost communication<br>24 579 = M-Bus Device 3 baud rate changed<br>24 580 = M-Bus Device 3 removed logically from OSGP device<br>32 768 = M-Bus Device 4 registered<br>32 769 = M-Bus Device 4 failed to register, no available position<br>32 770 = M-Bus Device 4 failed to register, lost communication<br>32 771 = M-Bus Device 4 baud rate changed<br>32 772 = M-Bus Device 4 removed logically from OSGP device<br>40 961 = MEP device failed to register (no available position)<br>40 962 = MEP device failed to register (lost communication)<br>40 963 = MEP device baud rate changed<br>40 964 = MEP device removed logically from OSGP device<br>5 = MEP device registered |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Max Power Level Changed | Mfg | 33 | BOOL(1) | 12 | True | F | Maximum power level has changed:<br>0 = Maximum power level changed from primary to secondary.<br>1 = Maximum power level changed from secondary to primary. Event is not generated if switch is attempted when OSGP device is already in primary mode. |
| Last Dip Event Lowest Voltage | Mfg | 34 | BOOL(2) | 12 | True | F | Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the voltage value in volts. Divide the argument value by 4 to get the voltage value. |
| Last Surge Event Highest Voltage | Mfg | 35 | BOOL(3) | 12 | True | F | Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C.<br>The remaining bits are used for the voltage value, in volts. Divide the argument value by 4 to get the voltage value. |
| Maximum value for Voltage THD Event | Mfg | 36 | BOOL(4) | 12 | True | F | Maximum THD of last finished V-THD event, for the period of VTHD goes beyond the threshold, and drops below of the threshold.<br>Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the VTHD value. Divide the argument value by 4 to get the THD value. |
| Maximum value for Current THD Event | Mfg | 37 | BOOL(5) | 12 | True | F | Maximum THD of last finished I-THD event, for the period of ITHD goes beyond the threshold, and drops below of the threshold.<br>Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the I-THD value. Divide the argument value by 4 to get the THD value. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Maximum value for apparent power THD Event | Mfg | 38 | BOOL(6) | 12 | True | F | Max THD of last finished VATHD event, for the period of VATHD goes beyond the threshold, and drops below of the threshold.<br>Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the VATHD value. Divide the argument value by 4 to get the THD value. |
| Average value for Voltage THD Event | Mfg | 39 | BOOL(7) | 12 | True | F | Average THD of last finished V-THD event, for the period of VTHD goes beyond the threshold, and drops below of the threshold.<br>Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the VTHD value. Divide the argument value by 4 to get the THD value. |
| Average value for Current THD Event | Mfg | 40 | BOOL(0) | 13 | True | F | Average THD of last finished I-THD event, for the period of ITHD goes beyond the threshold, and drops below of the threshold.<br>Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the ITHD value. Divide the argument value by 4 to get the THD value. |
| Average value for apparent power THD Event | Mfg | 41 | BOOL(1) | 13 | True | F | Average THD of last finished VATHD event, for the period of VATHD goes beyond the threshold, and drops below of the threshold.<br>Bits 0-1 of the argument is used to indicate the phase:<br>0 = phase A<br>1 = phase B<br>2 = phase C<br>The remaining bits are used for the VATHD value. Divide the argument value by 4 to get the THD value. |

| Field Name | Category | Number | Type | Offset | Default Value | VCI | Argument (if any) |
|---|---|---|---|---|---|---|---|
| Disconnect Pulsed | Mfg | 42 | BOOL(2) | 13 | True | F | This event is primarily for diagnostic purposes.<br>High byte nonzero: Argument format 1<br>Bit 0 = desired external state (0 = open, 1 = closed)<br>Bit 1 = power down pending (0 => not pending)<br>Bit 2..15 = low 16 bits of the program counter of the calling routine<br>divided by 4<br>High byte all 0s: Argument format 2<br>Bits 0..7 = disconnect pulse count. |
| M-Bus Command Matched | Mfg | 43 | BOOL(3) | 13 | True | F | Bits 15..13 = M-Bus Device #<br>000 = M-Bus device 0<br>001 = M-Bus device 1<br>010 = M-Bus device 2<br>011 = M-Bus device 3<br>100 = MEP device<br>Bits 7..0 = Data byte following MDT match. |
| M-Bus Device Alarm | Mfg | 44 | BOOL(4) | 13 | True | F | Bits 15..13 = M-Bus Device #<br>000 = M-Bus device 0<br>001 = M-Bus device 1<br>010 = M-Bus device 2<br>011 = M-Bus device 3<br>100 = MEP device<br>Bits 7..0 = Alarm data byte. |
| M-Bus Alarm Match | Mfg | 45 | BOOL(5) | 13 | True | F | Bits 15..13 = M-Bus Device #<br>000 = M-Bus device 0<br>001 = M-Bus device 1<br>010 = M-Bus device 2<br>011 = M-Bus device 3<br>100 = MEP device<br>Bits 7..0 = Alarm data byte. |
| Over Power Threshold Exceeded | Mfg | 46 | BOOL(6) | 13 | True | F | 0 = Power threshold has been exceeded, and the OSGP device has forced a switch to the consumption-based tariff.<br>1 = Power has dropped below the power threshold, and the OSGP device has switched back to the active tier specified by the TOU calendar. |
| Reserved | Mfg | 47 | BOOL(7) | 13 | True | F | |
| NOTE: If a device is configured to use the Load Side Voltage Detected event to indicate when load side voltage is present, the values listed above for Argument Format 4 will not occur. | | | | | | | |

# A.39 Basic Table 73 (BT73): History Log Control

This first part of BT73 is identical in layout to BT72. However, it is writable and each bit is used to indicate whether the event is to be logged, rather than whether the event can be logged. Requests to log events in BT73 which are marked as not applicable to be logged in BT72 will be ignored. The initial state of BT73 is that all bits are set (all loggable events are logged), with these exceptions:

- Device Accessed for Read.
- Device Accessed for Write.
- Procedure Invoked.
- Table Written to.
- History Log Overflow Pending.
- Event Log Unread Entries.

BT73 reverts to that same state when BT73 is corrupted (bad CRC) or a global, unrecoverable NV memory error occurs. Note that turning off "no event" has no effect on event log clearing.

Following the portion of BT73 which matches BT72 (i.e. at offset (BT71.1 + BT71.2) × 8), there are also bits that control the logging of "Table Written to" events per table and "Procedure Invoked" events per procedure (these bits have the same format as the bits starting at offset 19 of BT00 and have length "D" as defined in the BT00 legend). For this purpose, pending table writes are assumed to be governed by the same entry as for the base table. The starting offset of these bit arrays is (BT71.1 + BT71.2) × 8.

For more information on the History Log, see clause 8.12:

- Read access: OMAK.
- Write access: OMAK.

# A.40 Basic Table (BT74): History Log Data

This table holds the History Log and pointer information required for reading it. For more information on the History Log, see clause 8.12:

- Read access: OMAK.
- Write access: None.

**Table A.45**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Order | UINT(0..0) | 0 | 0 | F | Describes the order of log entries as listed in BT74 and as transported:<br>0 = Ascending order (N is older than N+1). |
| Overflow | BOOL(1) | 0 | | M | When True, indicates an entry was entered such that the number of unread entries exceeded the actual number of possible entries in the log. This is cleared by BP04 and BP05. |
| List type | UINT(2..2) | 0 | 1 | F | Describes the method of log entry generation in OSGP device memory.<br>0 = First in first out (reads this if the maximum number of entries is 0)<br>1 = circular queue. |
| Inhibit overflow | BOOL(3) | 0 | False | F | New History Log entries are never inhibited once a memory overflow occurs. |
| Filler | FILL(4..7) | 0 | | | |
| Number valid entries | UINT16 | 1 | | M | Number of valid History Log entries in BT74. The range is 0 to BT71.5. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Last entry element | UINT16 | 3 | | M | Array index of the last valid log entry in BT74. The range is 0 to BT71.5. |
| Last entry sequence number | UINT32 | 5 | | M | The 4-byte sequence number of the last log entry in BT74. This number is never reset by the OSGP device. |
| Number unread entries | UINT16 | 9 | | M/H | Number of valid log entries in BT74 set that have not been read. This number is incremented by the OSGP device and decremented by the host via procedure. The range is 0 to BT71.5. |
| History record: | ARRAY[BT71.5] of ((BT71.0.1×6 + BT71.0.0×2 + BT71.0.2×2 + 4 + BT71.3)-byte records: | | | | |
| Time | LTIME_DATE | 11 | | M | Date and time of the History Log entry (UTC). |
| Sequence number | UINT16 | 17 | | M | 2-byte sequence number associated with the History Log only. This number is the low 2 bytes of the field in BT74.5 |
| User ID | UINT16 | 19 | | M | ID of the user that was logged in to the OSGP device when the event occurred. If no user was logged in, the value of this field is 0xFFFF. If a PLC message is being processed at the time, this field is 0xFFFE. |
| Event | UINT(0..11) | 21 | | M | Event code logged. See BT72 for a description of the event codes. |
| Filler | FILL(12..15) | 21 | | | |
| Argument | ARRAY[BT71.3] OF UINT8 | 23 | | M | Argument associated with a log. See BT72 for a description of the argument associated with each event code. |

# A.41 Basic Table 4150 (BT4150): Pending TOU Calendar

Use BT4150 to create a pending TOU calendar that will be activated at a future date and time. The format and content of BT4150 is identical to BT54, which is described in clause A.29. The content of this pending table will be copied to BT54 and the pending TOU calendar will be activated when the PED added to BT4150 indicates that it is time to do so:

- Read access: OMAK.
- Write access: OMAK.

NOTE: A Pending Event Description (PED) may precede the Basic Table contents in any full or partial read or write of the pending table. The format of the PED is described below.

**Table A.46: Pending Event Description**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Event Code | UINT(0..3) | 0 | | H | Specify the condition upon which the pending table should be activated:<br>0: Based on an absolute time specified in the "Event Storage" field.<br>1: Based on a relative time specified in the "Event Storage" field. The time is relative to when the table write is received by the OSGP device.<br>2: No meaning attached to the data, so no automatic activation will be performed. The pending table defined in BT4150 can still be activated using BP12 or BP13 when this value is chosen. |
| Self Read Flag | BOOL (4) | 0 | | H | If True, the OSGP device will perform a Self-read before pending table is activated. |
| Demand Reset Flag | BOOL (5) | 0 | | H | If True, the OSGP device will perform a demand reset before pending table is activated. |
| Event Storage | ARRAY[5] OF CHAR | 1 | | H | If Event Code is 0, this is an STIME_DATE. (in UTC). If STIME_DATE is all zeroes, this indicates an empty PED.<br>If Event Code is 1, these 5 bytes are in the order of weeks/days/hours/minutes/secs.<br>If Event Code is 2, data is opaque. |

# Annex B (normative): Extended Tables

## B.1 Extended Table 00 (ET00) (2048): Manufacturer Specific

Reserved for later use.

## B.2 Extended Table 01 (ET01) (2049): Manufacturer Specific

Reserved for later use.

## B.3 Extended Table 02 (ET02) (2050): RTC calibration

This table provides the interface to calibrate the OSGP device's RTC (real time clock):

- Read access: OMAK.
- Write access: OMAK.

**Table B.1**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Reserved | | 0..10 | | | |
| Battery Voltage | UINT16 | 11 | | M | Voltage level of cpu battery, in units of 1/100 V. Updated once a day and on each OSGP device power-up. |
| Battery Alarm Config | UINT16 | 13 | 230 | H | Level below which low battery alarm will be set, in units of 1/100 V. |
| Flags | UINT8 | | | | |
| Battery enable state | BOOL(0) | 15 | | M | 0 = Battery is presently disabled.<br>1 = Battery is presently enabled. |
| RTC Source | BOOL(1) | 15 | 0 | H | RTC time base source. Choices are:<br>0 = 32 KHz XTAL clock always.<br>1 = Line frequency & 32 KHz XTAL. |
| RTC Current Source | UINT(2..3) | 15 | | M | Current RTC Source Indicator:<br>0 = 32 KHz XTAL.<br>1 = Phase L1.<br>2 = Phase L2.<br>3 = Phase L3. |
| Unused | BOOL(4..7) | 15 | | | Reserved for future use. |

## B.4 Extended Table 03 (ET03) (2051): Utility Information

This table is for the utility to use to enter utility-specific information, such as a utility serial number, program information, and battery change information:

- Read access: Open, password not required.
- Write access: OMAK.

**Table B.2**

| Field Name | Type | Offset | VCI | Description |
|---|---|---|---|---|
| Utility Serial Number | ARRAY[30] OF CHAR | 0 | H | String containing the customer's serial number. This field can be locked by control word bit 2. |
| ProgramGUID | ARRAY[20] OF CHAR | 30 | H | Program globally-unique identifier. This is set to match user's program as a means to identify the current configuration of the OSGP device. This variable is also set on the manufacturing line using the customer's requested program. |
| ProgramNumber | ARRAY[10] OF CHAR | 50 | H | User-configured number (not used by the OSGP device). The minimum value is zero and the maximum value is 99 999 999. |
| Program Date Time-Year | UINT16 | 60 | H | Date/timestamp of last OSGP device programming. |
| Program Date Time-Month | UINT8 | 62 | H | |
| Program Date Time-Day | UINT8 | 63 | H | |
| Program Date Time-Hour | UINT8 | 64 | H | |
| Program Date Time-Minute | UINT8 | 65 | H | |
| Program Date Time-Second | UINT8 | 66 | H | |
| Number Times Pgmd | UINT32 | 67 | H | Number of sessions in which OSGP device was programmed. |
| Battery Change Date-Year | UINT16 | 71 | H | Date/timestamp of the OSGP device's last battery replacement. |
| Battery Change Date-Month | UINT8 | 73 | H | |
| Battery Change Date-Day | UINT8 | 74 | H | |
| Battery Change Date-Hour | UINT8 | 75 | H | |
| NVM version | ARRAY[2] of UINT8 | 76 | H | These two bytes are used as a combined 2-byte packed field (offset 76 is MSB) expressing the NVM version number in the format x.yyz according to the following formula:<br>Bits 15..12 = x. Range 0 to 9<br>Bits 11..5 = yy. Range 0 to 99<br>Bits 4..0 = z. Range 0 to 26, where 1 to 26 represent a letter from a to z for test releases.<br>Examples:<br>0,08 = 0x0100<br>1,10 = 0x1140<br>1,20 = 0x1280<br>1,50 = 0x1640<br>9,99z = 0x9C7A |
| Point Of Delivery ID | ARRAY[50] OF CHAR | 78 | H | Point of Delivery ID (PODID). |
| HW version number | UINT8 | 128 | H | The hardware version number. |
| Program ID (read only) | ARRAY[8] of UINT8 | 129 | M | Read only copy of the 14908.1 program ID stored in ET04. |

## B.5 Extended Table 04 (ET04) (2052): System Information

This table holds information needed by other components of the system:

- Read access: OMAK.
- Write access: OMAK.

**Table B.3**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Sequence Number | UINT32 | 0 | | M | The current 1409.1 message sequence number. This field is updated with each new OSGP device read/write operation request over the 14908.1 network port. |
| Transceiver ID | ARRAY'[6] of UINT8 | 4 | | M | ID of the device's transceiver connected to the 14908.1 network port. |
| Subnet ID | UINT8 | 10 | | H/M | Used in addressing the OSGP device over PLC. The OSGP device may reset this value to zero upon request. |
| Node ID | UINT8 | 11 | | H/M | Used in addressing the OSGP device over PLC. The OSGP device may reset this value to zero upon request. |
| Explicit Message Received | BOOL(0) | 12 | | M | 1 = Explicit Message Received.<br>Updated with each new OSGP device read/write operation request over PLC. |
| Force Cnfg | BOOL(1) | 12 | | H/M | 1 = Force manufacturing configuration process of the OSGP device's power line transceiver. This is cleared by OSGP device after the configuration is complete (typically 4 seconds). This also forces encryption key back to default. This field will not be cleared if the config process fails (timeout = 30 seconds). |
| Request Transceiver State | BOOL(2) | 12 | | H/M | 1 = Starts process of requesting the OSGP device's smart transceiver's state. This is cleared when state is received.<br>The state is written to "Transceiver State" field below. This field will not be cleared if the request fails (timeout = 4 seconds). |
| Disable PLC Encryption | BOOL(3) | 12 | | H | 1 = Disabled PLC encryption. |
| Disable EEPROM Lock | BOOL(4) | 12 | | H | 1 = Disable the OSGP device's EEPROM lock feature. |
| Transceiver Phase | BOOL(5..7) | 12 | | M | Most recent phase information reported by the OSGP device's power line transceiver to the OSGP device:<br>0 = No phase inversion present<br>1 =In Phase normal<br>2 = Plus 120° inverted<br>3 = Minus 120° normal<br>4 = Phase 180° inverted<br>5 = Plus 120° normal<br>6 = Minus 120° inverted<br>7 = N/A<br>This field is updated each time the transceiver detects a phase change. |
| Rated Frequency | UINT8 | 13 | | H | Value of rated frequency (in Hz) for this OSGP device type, set during the manufacturing process. This field can be locked by control word bit 2. |
| Program ID | ARRAY[8] of UINT8 | 14 | | M | The device's 14908.1 program ID. |
| Self-Identification | ARRAY[30] of UINT8 | 22 | | M | The device's 14908.1 self-identification string. |
| PK Access | UINT8 | 52 | | H | 0 = Access enabled.<br>1 = access disabled. |
| Max Power Outages Recorded | UINT8 | 53 | 10 | P | The number of power outages recorded in tables ET09 and ET10 before events are lost. Queues are first in, first out. |
| Unused | UINT8 | 54 | 4 | F | Unused. |
| Max number of TE Registers | UINT8 | 55 | 4 | P | The number of registers recorded for Total Energy (or Daily Consumption) in table ET12. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Registration Current | UINT16 | 56 | 10 | H | The value of the starting current (in mA) for this OSGP device type, set during the manufacturing process. This field can be locked by control word bit 2. |
| Max Current | UINT16 | 58 | 100 | H | The value of the maximum current (in A) for this OSGP device type. This field is set during the manufacturing process, and is used for over-current detection. |
| Rated Voltage | UINT16 | 60 | 120 | H | Value of rated voltage (in V) for this OSGP device type. This field is set during the manufacturing process, and can be locked by control word bit 2. |
| Inactive Phases | | | | | Bit field to set active phases in the current OSGP device service configuration. This field is used to tell the OSGP device to ignore phase loss and sags on non-installed phases. It can be locked by control word bit 10.<br>0 = Phase is present<br>1 = Phase is not present<br>The OSGP device will set this field to 2 (Phase L1 and L3 on, L2 off) when it is running in form 2S and form 12S. |
| Phase A | BOOL(0) | 62 | | H | Disable phase A. |
| Phase B | BOOL(1) | 62 | | H | Disable phase B. |
| Phase C | BOOL(2) | 62 | | H | Disable phase C. |
| DST off time delta | INT16 | 63 | | H | Delta minutes of DST off time from DST on time (practical range -720 to 719 representing +/-12 hours). |
| Self-Read Time | | | | | Time of day to perform self-read to BT26. |
| Hour | UINT8 | 65 | | H | Range 0 to 23. |
| Minute | UINT8 | 66 | | H | Range 0 to 59. |
| Stop Mode Config | UINT8 | 67 | | H | The number of days the OSGP device will continue to operate in Wait mode before Stop Mode (and discontinuation of the RTC) is invoked.<br>0 = Never go to stop mode.<br>255 = Immediately go to stop mode. |
| Reserved | | | | | |
| Reserved | UINT8 | 68 | | H | |
| Reserved | UINT8 | 69 | | H | |
| Reserved | UINT8 | 70 | | H | |
| RK BP10 + EP16 Access | BOOL[0] | 71 | 1 | H | 0 = Access enabled.<br>1 = Access disabled. |
| Test Point | BOOL(1) | 71 | | H | 0 = Not a test point.<br>1 = Is a test point. |
| Test Point Confirmed | BOOL(2) | 71 | | H | For internal use. |
| LP Use Skipped | BOOL(3) | 71 | | H | If this field is set to 1, then any of the following operations will result in the extended status of a load profile channel being set to 4 ("skipped") and the channel value being set to 0.<br>1. Stuffing an instantaneous value<br>2. A channel is designated for an M-Bus device and no such device is configured, or the interval was skipped due to the value of the "LP Poll Rate" field in ET34.<br>3. A channel is for a MEP device and no such device is registered. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Transceiver State | UINT8 | 72 | | M | Last received state of the OSGP device's power line transceiver:<br>0,1: Invalid states.<br>2: Has application, unconfigured.<br>3: Applicationless, unconfigured.<br>4: Configured, online.<br>5: Invalid state.<br>6: Hard offline.<br>7: Invalid state.<br>12: Configured, soft offline.<br>140: Configured, in bypass mode.<br>255: No reply when status requested.<br>This field is updated on each OSGP device power-up, each re-synch request from the Data Concentrator, and each transceiver reset. |
| Phase Rotation Changed | UINT8 | 73 | | M | 0: Phase rotation unknown<br>1: L1L2L3 or ABC<br>2: L3L2L1 or CBA<br>This field is updated once a second. |
| PLC Comm Inactive Time Threshold | UINT16 | 74 | | H | This field sets a time threshold, in minutes. If no PLC packet addressed to this OSGP device received for more than this time threshold, the PLC Comm Inactive alarm will be set.<br>Set this field to 0 to disable this threshold and no alarm will be set no matter for how long the PLC communication remains inactive. This field has a range of 1 minutes to 65,535 minutes. |
| Broadcast Receipt | LTIME_DATE | 76 | | M | Time stamp (UTC) of last successful secure broadcast receipt. |
| Broadcast Base | UINT32 | 82 | | H | Secure broadcast base value (B) |
| Broadcast Delta | UINT16 | 86 | | H | Secure broadcast delta value (D) |
| Reverse Rotation Alarm Current Threshold | UINT16 | 88 | 1000 | F | The current threshold, in mA. The OSGP device uses this threshold and rated voltage to calculate active power threshold, then compares it against the measured reverse active power. The reverse rotation alarm will be set if the measured reverse active power is higher than the active power threshold for more than 10 seconds. |
| PLC Signal Quality Status | UINT8 | 90 | | M | The PLC Signal Quality Status:<br>0: No PLC traffic detected.<br>1: PLC traffic detected, but no traffic addressed to this OSGP device.<br>2: A packet addressed to this OSGP device has been received. The signal margin is less than or equal to 9 dB.<br>3: A packet addressed to this OSGP device has been received. The signal margin is at 12 dB or 15 dB<br>4: A packet addressed to this OSGP device has been received. The signal margin is greater than or equal to 18 dB.<br>5..7: These values correspond to values 2..4, and indicate the OSGP device is commissioned but has not received a PLC message within the duration specified by the "PLC Active Timeout" field in ET55. For example, value 5 indicates that the OSGP device has been commissioned with no activity within the specified duration, and the last activity was less than or equal to 9 dB. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Auto Discovery Ta | UINT16 | 91 | 670 | H | Extension of turn-around time. In bit-times; this value is added to the nominal value of 330, and used only for address 0 during auto-discovery. Once a OSGP device has been commissioned, the values in ET13 override these. |
| Auto Discovery To | UINT16 | 93 | 250 | H | Extension of turn-around time. In ms; this value is added to the nominal value of 50, and is used only for address 0 during auto-discovery, Once a OSGP device has been commissioned, the values in ET13 override these. |
| Auto Discovery Disable | UINT8 | 95 | | H | A nonzero value in this field disables MEP auto-discovery. |
| Reserved | INT16 | 96 | | H | |
| Events Outage Threshold | UINT16 | 98 | | H | The Event Outage Threshold field defaults to zero, and represents the interval (seconds) that the power shall be off before a Power Down event followed by a Power Up event is added to BT74. |
| NVM Size | UINT16 | 100 | | F | The number of 1K blocks of NVM available. |
| Safe Image Locked | UINT8 | 102 | | H | 1=>Safe image cannot be activated. Default: 0 |
| MEP Seq Nbr | UINT32 | 103 | | | |
| Unused | UINT16 | 107 | | H | Unused |
| Premise power generation | UINT8 | 109 | | H | 0 = Power generation off.<br>1 = Power generation on. |
| Power outage threshold | UINT8 | 110 | 72 | H | A percentage of the rated voltage. This field can be locked by control word bit. Also saved in critical init data section. A new threshold will only take effect after OSGP device reset. |
| Phase loss threshold | UINT8 | 111 | 61 | H | A percentage of the rated voltage. |
| Reserved | UINT8 | 112 | | M, H | |
| Clock Error Tier | UINT8 | 113 | 0 | H | Tier to use on a clock error. Range is 0 to 3. |
| Unused | UINT16 | 114 | | H | Reserved for future use. |
| IDT Version | UINT8 | 116 | | M | This field provides a quick way of determining when any of the contents of the IDT (Interface Definition) have changed. This number increments by 1 (and wraps) whenever any of the following procedures are executed: EP11,EP32, EP33, EP06, EP37. It also can increment one or two times on an upgrade due to program ID or other changes. |
| Tilt Timer | UINT8 | 117 | 30 | H | The number of seconds before a power outage that can elapse before a tilt switch input event will be ignored. If set to 255, then tilt is never ignored. |

# B.6 Extended Table 05 (ET05) (2053): Control Output Settings

This table is used to set the threshold and criteria that determine when the control outputs should be set open or closed. The primary control output (Load Disconnect Contactor) can be controlled in three ways: via maximum power settings and in a prepay configuration (described here), and manually via procedure EP02.

For more information on the control outputs affected by ET05, see clauses 8.10 and 8.11:

- Read access: OMAK.
- Write access: OMAK.

**Table B.4**

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Primary Control Output (Load Disconnect) Settings: | | | | | |
| Primary Power Threshold | UINT32 | 0 | | H | Primary active power level (in W) at which primary control (Load Disconnect) output will be tripped. |
| Prepay Total Credit | UINT32 | 4 | | H | Active energy credit (in Wh) remaining. If no credit is left, either or both the emergency credit or maximum power will be checked based on configuration. The load disconnect contactor will be opened if neither of the two checks is enabled. |
| Prepay Tariff 1 Rate | UINT32 | 8 | | H | Conversion rate for Tariff 1 (in Wh per kWh consumed) by which Prepay Total Credit register is reduced while OSGP device is operating in tariff 1. Maximum value 1 000 000. |
| Prepay Tariff 2 Rate | UINT32 | 12 | | H | Conversion rate for Tariff 2 (in Wh per kWh consumed) by which Prepay Total Credit register is reduced while OSGP device is operating in tariff 2. Maximum value 1 000 000. |
| Prepay Tariff 3 Rate | UINT32 | 16 | | H | Conversion rate for Tariff 3 (in Wh per kWh consumed) by which Prepay Total Credit register is reduced while OSGP device is operating in tariff 3. Maximum value 1 000 000. |
| Prepay Tariff 4 Rate | UINT32 | 20 | | H | Conversion rate for Tariff 4 (in Wh per kWh consumed) by which Prepay Total Credit register is reduced while OSGP device is operating in tariff 4. Maximum value 1 000 000. |
| Primary Maximum Power/Current Duration Threshold | UINT8 | 24 | | H | Specify the minimum time (in minutes) that the Primary Maximum Power Level Threshold (or Primary Maximum Current Level Threshold) shall be met before the load disconnect contactor will be tripped.<br>The "Disconnect Control Type" field in ET46 indicates whether this applies to the Primary Maximum Power Level Threshold or the Primary Maximum Current Level Threshold.<br>The range 0 to 255. A value of 0 indicates that the load disconnect contactor should open immediately when the power or current threshold is met. (see note 1). |
| Control Output Setting | | | | | Bitfields for enabling and disabling condition checks that affect the load disconnect contactor:<br>0 = Disable this condition check.<br>1 = Enable this condition check. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Enable Max Power or Current | BOOL(0) | 25 | 0 | H | Indicates whether maximum power or current measurements should be monitored to trip the load disconnect contactor. ET46.11 decides whether power or current measurements will be used. |
| Enable Prepay | BOOL(1) | 25 | 0 | H | Primary control (Load Disconnect) prepay condition. |
| Enable Tariff | BOOL(2) | 25 | 0 | H | Secondary control (Control Relay) tariff status condition. |
| Enable Reverse Deduction | BOOL(3) | 25 | 0 | H | 1= Reverse energy deducts prepay credit.<br>0 = Reverse energy ignored in deduction of prepay credit. |
| Enable Prepay + Max Power option | BOOL(4) | 25 | 0 | H | If set to 1, then the prepay condition is enabled with the maximum power option, as long as the "Enable Prepay" field is set to 1. |
| Disconnect switch position Inverted | BOOL(5) | 25 | 0 | H | 0 = Push disconnect switch up to close the disconnect.<br>1 = Push disconnect switch up to open the disconnect. |
| Disconnect LED Disabled | BOOL(6) | 25 | 0 | H | 0 = Disconnect blue LED not disabled.<br>1 = Disconnect blue LED disabled. |
| Enable Prepay Emergency Credit | BOOL(7) | 25 | 0 | H | Enable the emergency prepay credit condition. |
| Secondary Control Output (Control Relay) Settings: | | | | | |
| Tariff 1 - status | BOOL(0) | 26 | | H | 0 = Control output open.<br>1 = Control output closed. |
| Tariff 2 - status | BOOL(1) | 26 | | H | 0 = Control output open.<br>1 = Control output closed. |
| Tariff 3 - status | BOOL(2) | 26 | | H | 0 = Control output open.<br>1 = Control output closed. |
| Tariff 4 - status | BOOL(3) | 26 | | H | 0 = Control output open.<br>1 = Control output closed. |
| Prepay Credit Low Level Warning Threshold | UINT32 | 27 | | H | Send warning signal when prepay total credit is lower than this threshold. |
| Reserved for future | UINT16 | 31 | | H | Reserved. |
| Control Output Setting Continued | | | | | |
| Disconnect High Priority | BOOL(0) | 33 | | H | 0 = Low priority level.<br>1 = High priority level. |
| Disable Buzzer | BOOL(1) | 33 | | H | 0 = Buzzer not disabled.<br>1 = Buzzer disabled. |
| Disable Manual Disconnect Open | BOOL(2) | 33 | | H | 0 = Manual Disconnect open enabled.<br>1 = Manual Disconnect open disabled. |
| Enable Remote Disconnect Closed | BOOL(3) | 33 | | H | 0 = Remote disconnect close (reconnect) operations disabled.<br>1 = Remote disconnect close (reconnect) operations enabled. |
| Reject EP23 If Manually Opened | BOOL(4) | 33 | | H | 0 = Allow remote disconnect reconnect if disconnect is opened manually.<br>1 = Reject remote disconnect reconnect if disconnect is opened manually. |
| Disconnect Resync Control | UINT(5..6) | 33 | | H | 0 = Auto resync enabled if commissioned.<br>1 = Auto resync disabled.<br>2 = Auto resync enabled. |
| Reject Disconnect Close LSV | BOOL(7) | 33 | | H | 0 = Allow disconnect reconnect if there is load side voltage.<br>1 = Reject disconnect reconnect if there is load side voltage. |
| Prepay Power Threshold | UINT32 | 34 | | H | Active power level (in W) at which primary control output will be tripped after prepay is 0. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Control Status | | | | | Bitfield to indicate the present status of the control outputs:<br>0 = Control Output Status open.<br>1 = Control Output Status close. |
| Load Side Voltage | BOOL(0) | 38 | | M | 0 = Load side voltage not present.<br>1 = Load side voltage present. |
| Control Relay | BOOL(1) | 38 | | M | Present status of relay 1. |
| Disconnect Feedback Status | UINT(2..3) | 38 | | | This field indicates a composite "feedback state" of the load disconnect contactor.<br>0 = Open.<br>1 = Closed.<br>2 = Ambiguous (load side voltage detected, but no power flowing).<br>3 = Error (instantaneous power, load side voltage and disconnect state inconsistent). |
| Disconnect Locked Open | BOOL(4) | 38 | | M | This indicates whether or not the load disconnect contactor is locked open:<br>0 = Load disconnect contactor is closed or open, but not locked open.<br>1 = Load disconnect contactor is locked open. |
| Disconnect Sensor | BOOL(5) | 38 | | | This indicates whether or not the load disconnect contactor is open or closed.<br>0 = Load disconnect contactor open or not supported.<br>1 = Load disconnect contactor closed. |
| | UINT(6..7) | 38 | | | Reserved for future use |
| Maximum Prepay Total Emergency Credit | UINT32 | 39 | | H | The maximum emergency credit allowed when adding credit via EP21. |
| Prepay Total Emergency Credit | UINT32 | 43 | | H,M | The active emergency energy credit (in Wh) remaining. If no credit is left, the load disconnect contactor will be opened. |
| Broadcast Max Random Time | UINT8 | 47 | | H | The maximum random time, in seconds, to be applied after a broadcast command is sent to close the control relay. (see note 2)<br>A value of 0 indicates that the command will be executed immediately without random application. Values other than 0 indicate that the command will be executed after a random time that is generated between 1 second and the combined value of this field and the "Broadcast Max Random Minutes" field. |
| LED Options | | | | | The following 3 fields set the blue LED behaviour for different disconnect statuses:<br>0 = LED off.<br>1 = LED on all the time.<br>2 = LED flashes 1 second on and 1 second off. |
| LED Disconnect Closed | UINT8 | 48 | 1 | H | Blue LED behaviour when the load disconnect contactor is closed. |
| LED Disconnect opened | UINT8 | 49 | 2 | H | Blue LED behaviour when the load disconnect contactor is open. |
| LED Disconnect locked opened | UINT8 | 50 | 2 | H | Blue LED behaviour while the load disconnector is locked in the open state and cannot be manually closed. |
| Minimum Disconnect Switch Hold Time | UINT8 | 51 | 0 | H | Minimum time (in units of10 ms)that the disconnect switch lever shall be held up or down before the state of the load disconnect contactor will change. |
| Secondary Power Threshold | UINT32 | 52 | | H | The secondary active power level (in W) at which the load disconnect contactor will be tripped. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Secondary Power or CurrentTime Threshold | UINT8 | 56 | | H | Specify the minimum time (in minutes) that the Secondary Maximum Power Level Threshold (or Secondary Maximum Current Level Threshold) shall be met before the load disconnect contactor will be tripped.<br>The range 0 to 255. A value of 0 indicates that the load disconnect contactor should open immediately when power threshold is met. (See note 3). |
| Prepay Power Time Threshold | UINT8 | 57 | | H | Used for exhausted prepay maximum power control. This sets the minimum time (in minutes) that the power threshold shall be met before the load disconnect contactor will be tripped. The range is 0 to 255. A value of 0 indicates that the load disconnect contactor should trip immediately when power threshold is met. |
| Disconnect Config | | | | | |
| Disconnect Icon | BOOL(0) | 58 | | H | Controls the flashing polarity of the disconnect display icon when it is open or locked open. Here "disconnect open" means the disconnect is open and there is no load side generator.<br>0 = Disconnect is open (flashing icon). Disconnect is locked open (icon is constantly on).<br>1 = Disconnect is open (icon is constantly on). Disconnect is locked open (flashing icon). |
| Disconnect Open Text Enable | BOOL(1) | 58 | | H | Enables an eight character text value to be displayed explaining the reason that the disconnect is open.<br>0 = Do not display reason why the disconnect is open.<br>1 = Display user defined text indicating the reason why the disconnect is open.<br>The text value can be set using the "Disconnect Open Text" field described later in ET05. |
| Reject disconnect reconnect with load sensed | BOOL(2) | 58 | | H | 0 = Allow disconnect reconnect if load is sensed.<br>1 = Reject disconnect reconnect if load is sensed. |
| Separate disconnect and LSV icon | BOOL(3) | 58 | | H | 0 = Use disconnect icon to indicate LSV.<br>1 = Use load side voltage icon (F4 icon before it changes shape) for load side voltage and disconnect icon for sensor state. |
| Use LSV alarm | BOOL(4) | 58 | | H | 0 = Use disconnect switch error to indicate that load side voltage has been detected while the disconnect is open.<br>1 = Use a separate alarm to indicate that load side voltage has been detected while the disconnect is open. |
| Reserved | UINT(5..7) | 58 | | | Reserved for future use. |
| Disconnect Open ID | Array [4] of UINT8 | 59 | | H | Text to display in 4 left most characters on the display (ID code location).<br>Array element 0 = Left-most ID filed on the display<br>Array element 3 = Right-most ID field on the display. |
| Disconnect Open Text | | User defined text to explaining the reason why the disconnect is open | | | |
| EP02 executed | Array [8] of UINT8 | 63 | | H | EP02 executed. |
| Max Pwr and Duration exceeded | Array [8] of UINT8 | 71 | | H | Max power and duration exceeded. |
| Pre-Pay credit = 0 | Array [8] of UINT8 | 79 | | H | Pre-pay credit used. |
| Pre-Pay credit = 0 and max pwr exceeded | Array [8] of UINT8 | 87 | | H | Pre-pay credit used and max power exceeded. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| EP23 executed | Array [8] of UINT8 | 95 | | H | EP23 executed. |
| Manual operation | Array [8] of UINT8 | 103 | | H | Manual operation. |
| Scheduled Open | Array [8] of UINT8 | 111 | | H | OSGP device configured schedule. |
| Reserved | Array [8] of UINT8 | 119 | | H | Reserved for future use. |
| Reserved | Array [8] of UINT8 | 127 | | H | Reserved for future use. |
| Reserved | Array [8] of UINT8 | 135 | | H | Reserved for future use. |
| Reserved | Array [8] of UINT8 | 143 | | H | Reserved for future use. |
| Failed Disconnect Manual Operation ID | Array [4] of UINT8 | 151 | "VOLT" | H | Text to display in 4 left most characters on the display (ID code location).<br>Array element 0 = Left-most ID filed on the display<br>Array element 3 = Right-most ID field on the display. |
| Failed Disconnect Manual Operation Text | Array [8] of UINT8 | 155 | "ERROR " | H | User defined text indicating that a manual disconnect operation attempt failed due to low voltage. |
| Reliable Disconnect Operation Voltage | UINT16 | 163 | | H | This fixed voltage should be used to as a threshold where as long as 1 phase is greater than or equal to this value, the disconnect can be operated reliably. |
| Load Side State Validity Time | UINT8 | 165 | 5 | | Number of seconds the load side state shall have the same value to be considered valid. The minimum value is 1 second. |
| Load Side State transition duration interval | UINT8 | 166 | 20 | | The number of seconds the load side state can be set as in transition, after which any change of state puts it to indeterminate state. The minimum value is 2 seconds. |
| Failed Disconnect Close ID - Wait for LSV Update | Array [4] of UINT8 | 167 | "PUSH | H | Text to display in 4 left most characters on the display (ID code location).<br>Array element 0 = Left-most ID filed on the display<br>Array element 3 = Right-most ID field on the display. |
| Failed Disconnect Close Text - Wait for LSV Update | Array [8] of UINT8 | 171 | "AGAIN" | H | User defined text to indicate that a close disconnect operation attempt failed due to load side voltage detection values not being updated. |
| Failed Disconnect Close ID - LSV Present | Array [4] of UINT8 | 179 | "LSV | H | Text to display in 4 left most characters on the display (ID code location).<br>Array element 0 = Left-most ID filed on the display<br>Array element 3 = Right-most ID field on the display. |
| Failed Disconnect Close Text - LSV Present | Array [8] of UINT8 | 183 | "ON" | H | User defined text to indicate that a close disconnect operation attempt failed due to load side voltage being detected. |
| Failed Disconnect Close ID - Load Sensed | Array [4] of UINT8 | 191 | "LOAD | H | Text to display in 4 left most characters on the display (ID code location).<br>Array element 0 = Left-most ID filed on the display<br>Array element 3 = Right-most ID field on the display. |
| Failed Disconnect Close Text - Load Sensed | Array [8] of UINT8 | 195 | "ON" | H | User defined text to indicate that a close disconnect operation attempt failed due to load being sensed. |
| Primary Current Threshold | UINT32 | 203 | | H | The primary active current level (in Amperes) at which the load disconnect contactor will be tripped. |
| Secondary Current Threshold | UINT32 | 207 | | H | The secondary active current level (in Amperes) at which the load disconnect contactor will be tripped. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Primary Power or Current Time Threshold Second Part | UINT8 | 211 | | H | Specify a value in seconds that should be added to the Primary Maximum Power/Current Duration Threshold field to determine the minimum time that the Primary Maximum Power Level Threshold (or Primary Maximum Current Level Threshold) shall be met before the load disconnect contactor will be tripped.<br>For example, if the Primary Maximum Power/Current Duration Threshold field is set to 3 minutes and this field is set to 45 seconds, then the Primary Maximum Power Level Threshold (or Primary Maximum Current Level Threshold) shall be met for 3 minutes and 45 seconds before the load disconnect contactor will be tripped.<br>If the Primary Maximum Power/Current Duration Threshold is set to 0, this field is not applicable. |
| Secondary Power or Current Time Threshold Second Part | UINT8 | 212 | | H | Specify a value in seconds that should be added to the Secondary Maximum Power/Current Duration Threshold field to determine the minimum time that the Secondary Maximum Power Level Threshold (or Secondary Maximum Current Level Threshold) shall be met before the load disconnect contactor will be tripped.<br>For example, if the Secondary Maximum Power/Current Duration Threshold field is set to 10 minutes and this field is set to 20 seconds, then the Secondary Maximum Power Level Threshold (or Secondary Maximum Current Level Threshold) shall be met for 10 minutes and 20 seconds before the load disconnect contactor will be tripped.<br>If the Secondary Maximum Power/Current Duration Threshold field is set to 0, this field is not applicable. |
| Prepay Power Time Threshold Second Part | UINT8 | 213 | | H | The threshold, in seconds, for exhausted prepay maximum power control. This is always added to the value of the "Prepay Power Time Threshold (in minutes)" field. For example. If the "Prepay Power Time Threshold" is set to 3 minutes and this second part is set to 70 seconds, then the actual threshold used is 4 minutes 10 seconds. |
| Power Up Resync Options | UINT8 | 214 | | H | This field sets the resynchronization options to use on power up if the internal state of the load disconnect contactor differs from the sensor state.<br>0 = No synchronization.<br>1 = Synchronize to internal state.<br>2 = Synchronize to external state. |
| Randomization Enable | UINT16 | | | | Indicates whether randomization is enabled for control commands:<br>0 = Disabled<br>1 = Enabled |
| Relay EP02 unicast | BOOL(0) | 215 | | H | Relay EP02 open/close, unicast command. |
| Relay EP02 broadcast | BOOL(1) | 215 | | H | Relay EP02 open/close, PLC broadcast command. |
| Relay tariff control | BOOL(2) | 215 | | H | Relay tariff open/close control. |
| Relay time-based control | BOOL(3) | 215 | | H | Relay time-based open/close control. |
| Relay Control ID | UINT32 | 217 | 0 | H | User-assigned ID for the current relay control scheme. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Time-Based Relay Control Mode | UINT8 | 221 | 0 | H | Current mode of the Time-Based Relay Control calendar defined in ET61:<br>0 = Disabled<br>1 = Daily (7 active days)<br>2 = Weekday/Weekend (2 active days)<br>3 = Season (4 active days)<br>4 = Season Weekday/Weekend (8 active days). |
| Time-Based Relay Clock Error State | UINT8 | 222 | 0 | H | The state the relay is switched to if there is a clock error:<br>0 = Open<br>1 = Closed. |
| Broadcast Max Random Minutes | UINT8 | 223 | 0 | H | The maximum random time, in minutes, to be applied after a broadcast command is sent to close the control output. (see note 4)<br>A value of 0 indicates that the command will be executed immediately without random application. Values other than 0 indicate that the command will be executed after a random time that is generated between 1 second and the combined value of the two fields. |

NOTE 1: Use the "Primary Power/Current Duration Threshold Second Part" field to specify an additional value (in seconds) that should be added to this field's value to determine the minimum time.
NOTE 2: This field is combined with the "Broadcast Max Random Minutes" field, which appears later in ET05. The descriptions of the values in the “Broadcast Max Random Time” field definition refer to the combined value of the two fields.
NOTE 3: Use the "Secondary Power/Current Duration Threshold Second Part" field to specify an additional value (in seconds) that should be added to this field's value to determine the minimum time.
NOTE 4: This field is combined with "Broadcast Max Random Time" field, which is described earlier in ET05. The descriptions of values in the “Broadcast Max Random Minutes” definition refers to the combined value of the two fields.

## B.7 Extended Table 06 (ET06) (2054): Pulse Inputs

This table is used to configure and evaluate the pulse input channels.

Any changes to the pulse input idle state (ET06.0) shall be made with the pulse input channel set to inactive in order to prevent false pulse detection during the change:

- Read access: OMAK.
- Write Access: OMAK.

**Table B.5**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| | | | | | |
| Channel Status record: | ARRAY[2] of 7-byte record: | | | | Channel 1 and Channel 2 pulse input information |
| Ch. Status | | | | | Pulse input status/control flags |
| | BOOL(0) | 0 | 0 | H | 0 = Pulse input channel inactive.<br>1 = Pulse input channel active. |
| | BOOL(1) | 0 | 0 | H | 0 = Pulse input idle state is low (normally closed).<br>1 = Pulse input idle state is high (normally open). |
| | BOOL(2) | 0 | 0 | H | Reserved. Do not use this bit. |
| | BOOL(3) | 0 | 0 | H | 0 = Pulse input tamper is not a regular alarm.<br>1 = Pulse input tamper is a regular alarm. |
| | UNINT(4..7) | 0 | 0 | H | Reserved for future use. |
| | | | | | |
| Ch. Min Pulse Width | UINT16 | 1 | 20 | H | Minimum pulse width in ms. The maximum value is 45 000 ms. |
| Ch. ADC High Limit | UINT16 | 3 | 600 | H | ADC limit for tamper detection. |
| Ch. ADC Low Limit | UINT16 | 5 | 320 | H | ADC limit for pulse detection. |
| Pulse Input Raw Adc Reading | ARRAY[2] of 2 byte record | | | | Channel 1 and Channel 2 pulse input raw ADC reading. This read-only value used for debugging purposes. |
| Ch. Raw ADC Reading | UINT16 | 14 | | M | Internal Use Only. Updated once a second. |

# B.8 Extended Table 07 (ET07) (2055): Display Configuration

This table is used to configure the format and ID codes of displayable registers on the device's display. The 1st display list entry in BT33 will have the ID Code and format defined within ET07 as the 1st entry. The length of the array in ET07 is based on the parameter in BT30.4.

For background information on the device's display, see clause 8.9:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table B.6**

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Code Word: | Array[BT30.4] of 6-byte records: | 0 | | | |
| ID Format: | | 4-character ID code, entered here in ASCII format. | | | |
| ID Code | Array [4] of UINT8 | 0 | "DATE"<br>"TIME"<br>" " | H | Text to display in 4 left most characters on the display (ID code location).<br>Array element 0 = Left-most ID filed on the display.<br>Array element 3 = Right-most ID field on the display. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| ID DP State | UINT8 | 4 | | H | 4 bits that indicate state of decimal point with associated ID character:<br>1 = ON<br>0 = OFF<br>Bit 0 = right-most decimal point.<br>Bit 3 = left-most decimal point. |
| Data Format: | UINT8 | 5 | | | |
| Fields After DP | UINT(0..2) | 5 | | H | The number of fields after the decimal point to be shown on the display. The range of this field is 0..3, and the value of this field and the "Fields Before DP" field cannot combine to be greater than 8. |
| Fields Before DP | UINT(3..6) | 5 | | H | Number of fields before the decimal point to be shown on the display, per source, ordered by BT16 source number. The range of this field is 1..8. |
| Zero Suppression | BOOL(7) | 5 | | H | True = Hides leading zeros; Zero Suppression.<br>False = Shows all leading zeros up to the number of digits configured in ET07.4. |
| Accumulator Rollover | UINT8 | BT30.4 × 6 | 9 | H | Number of decimal digits of range of energy accumulators before rollover, in Wh. For example, 6 = rollover at 999 999 Wh.<br>The range of this field is 5..9. |
| Flags: | UINT8 | (BT30.4 × 6) + 1 | | | |
| Disable all-segments-lit | BOOL(0) | | 0 | H | 0 = Enable all-segments-lit cycle at the beginning of the display sequence.<br>1 = Disable all-segments-lit cycle. |
| Date display format | UINT(1..2) | | 0 | H | Display format for any date field:<br>0 = DDMMYYYY<br>1 = MMDDYYYY<br>2 = YYYYDDMM<br>3 = YYYYMMDD |
| FW Version on Pwr Up Config | UINT(3..6) | | 2 | H | Configures the amount of time, in seconds, the OSGP device's version number is to be displayed on power-up. A value of zero disables this feature. |
| Disable Tier/Tariff Icon | BOOL(7) | | 0 | H | Setting this field to True will disable the displaying of the tier icons (T1,T2,T3,T4). The icons will be shown when all display segments are lit. |
| Name Plate Icon Control | UINT16 | | | | Bitfield indicates which name plate icons are active.<br>0 = Name plate icon off<br>1 = Name plate icon on. |
| Name Plate Icon 0 | BOOL(0) | (BT30.4 × 6) + 2 | | H | Name plate icon F0. |
| | BOOL(1) | (BT30.4 × 6) + 2 | | H | Name plate icon F1. |
| | BOOL(2) | (BT30.4 × 6) + 2 | | H | Name plate icon F2. |
| | BOOL(3) | (BT30.4 × 6) + 2 | | H | Name plate icon F3 |
| | UINT(4..15) | (BT30.4 × 6) + 2 | | H | Reserved for future use |
| Display config ID | UINT32 | (BT30.4 × 6) + 4 | | H | Identifier representing the present display configuration in BT33 and ET07, not controlled by the OSGP device as being linked to any change in ET07 or BT33. |

| Field Name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Display auto revert seconds | UINT8 | (BT30.4 × 6) + 8 | | H | Seconds a scrolling display item can display until the display automatically reverts back to the first display item. A value of 0 means the automatic reversion is disabled.<br>This field is only applicable if the "On Time" field BT33 is set to 0. |

## B.9 Extended Table 08 (ET08) (2056): Measurement Data

This table contains the measurement data registers required for OSGP device debugging purposes:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table B.7**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Q1 Reactive VArh ABC | NI_FMAT1 | 0 | | M | |
| Q2 Reactive VArh ABC | NI_FMAT1 | 4 | | M | |
| Q3 Reactive VArh ABC | NI_FMAT1 | 8 | | M | |
| Q4 Reactive VArh ABC | NI_FMAT1 | 12 | | M | |
| Phase Measurement Data | ARRAY[3] of ET11.12 byte records: | | | M | |
| Active Forward Wh | NI_FMAT1 | 16 | | M | |
| Active Reverse Wh | NI_FMAT1 | 20 | | M | |
| Reactive Forward Varh | NI_FMAT1 | 24 | | M | |
| Reactive Reverse Varh | NI_FMAT1 | 28 | | M | |
| Harmonics Magnitude | ARRAY[3][ET11.19] OF UINT16 | 3×ET11.12 | | M | |
| Harmonics Phase | ARRAY[3][ET11.19] OF UINT16 | (3×ET11.12) × 3 | | M | |
| Voltage THD | ARRAY[3] OF UINT16 | (3×ET11.12) ×5 | | M | V-THD for each phase. The values is 10 000 times that of the actual THD. For example, a value of 100 means a V-THD level of 1 %. |
| Current THD | ARRAY[3] OF UINT16 | (3×ET11.12) × 5 + 6 | | M | I-THD for each phase. The values is 10 000 times that of the actual THD. For example, a value of 100 means a I-THD level of 1 %.<br>I-THD calculations will be disabled when the current is lower than 200 mA, because the current wave form will be distorted under these circumstances and the I-THD calculation will be invalid. |
| Apparent Power THD | ARRAY[3] OF UINT16 | (3×ET11.12) × 5 + 12 | | M | VATHD for each phase. The values is 10 000 times that of the actual THD. For example, a value of 100 means a VATHD level of 1 %. |

# B.10 Extended Table 09 (ET09) (2057): Power Quality

This table contains configurations and statistics related to power quality and power measurements. For more information on the power quality measurements made by the OSGP device, see clause 8.8:

- Read access: OMAK
- Write Access: OMAK
- Attributes: ICANAK

**Table B.8**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Outage Time Threshold | UINT16 | 0 | | H | Threshold, in seconds, for recording power outages. A value of 0 indicates every event should be recorded. The range of this field is 0 to 65,535. |
| Sag/Surge Time Threshold | UINT8 | 2 | | H | Threshold, in minutes, for recording voltage sags and surges. A value of 0 indicates that events should be recorded using instantaneous values. The range of this field is 0 to 255. |
| Sag Threshold | UINT8 | 3 | | H | Threshold, in percent under rated voltage, for recording a voltage sag event. |
| Surge Threshold | UINT8 | 4 | | H | Threshold, in percent over rated voltage, for recording a voltage surge event. |
| Over-Current Threshold | UINT8 | 5 | | H | Threshold, in percent over reference current, for recording an over-current event. |
| **Power outage record:** | ARRAY[ET04. 53] of 18-byte record: | | | | Reverse-chronological list of the ET04. 53 most recent power cycle events. Updated every OSGP device power-up or brownout. |
| Power-on Date/Time | LTIME_DATE | 6 | | M | Power on date time. |
| Reset Cause | UINT8 | 12 | | M | Reason for this reset/power on event. All other reset causes will not show up in ET08, only in ET10.<br>3 - Power failure.<br>8 - Brown-out. |
| Reserved for internal use | UINT8 | 13 | | M | |
| Power-off Date/Time | LTIME_DATE | 14 | | M | Power off date time (Should be earlier than ET9.4). |
| Power Off Duration | UINT32 | 20 | | M | Power off duration in seconds. If duration is less than 1 second, power off duration = 0. Rounds down for power-off seconds. |
| A Most recent sag event | LTIME_DATE | ET04. 53 × 18 + 6 | | M | Date time of the most recent sag event on phase A. |
| A Sag events | UINT16 | ET04. 53 × 18 + 12 | | M | Number of sag events measured by OSGP device on phase A since statistics were reset. A sag event is defined as the voltage on a single phase dipping below some percentage of the rated voltage for Outage Time Threshold. |
| B Most recent sag event | LTIME_DATE | ET04. 53 × 18 + 14 | | M | Date time of the most recent sag event on phase B. |
| B Sag events | UINT16 | ET04. 53 × 18 + 20 | | M | Number of sag events measured by OSGP device on phase B since statistics were reset. A sag event is defined as the voltage on a single phase dipping below some percentage of the rated voltage for Outage Time Threshold. |
| C Most recent sag event | LTIME_DATE | ET04. 53 × 18 + 22 | | M | Date time of the most recent sag event on phase C. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| C Sag events | UINT16 | ET04. 53 × 18 + 28 | | M | Number of sag events measured by OSGP device on phase C since statistics were reset. A sag event is defined as the voltage on a single phase dipping below some percentage of the rated voltage for Outage Time Threshold. |
| A Most recent surge event | LTIME_DATE | ET04. 53 × 18 + 30 | | M | Date time of the most recent surge event on phase A. |
| A Surge events | UINT16 | ET04. 53 × 18 + 36 | | M | Number of surge events measured by OSGP device on phase A since statistics were reset. A surge event is defined as the voltage on a single phase going above some percentage of the rated voltage for Outage Time Threshold. |
| B Most recent surge event | LTIME_DATE | ET04. 53 × 18 + 38 | | M | Date time of the most recent surge event on phase B. |
| B Surge events | UINT16 | ET04. 53 × 18 + 44 | | M | Number of surge events measured by OSGP device on phase B since statistics were reset. A surge event is defined as the voltage on a single phase going above some percentage of the rated voltage for Outage Time Threshold. |
| C Most recent surge event | LTIME_DATE | ET04. 53 × 18 + 46 | | M | Date time of the most recent surge event on phase C. |
| C Surge events | UINT16 | ET04. 53 × 18 + 52 | | M | Number of surge events measured by OSGP device on phase C since statistics were reset. A surge event is defined as the voltage on a single phase going above some percentage of the rated voltage for Outage Time Threshold. |
| Min Frequency | INT32 | ET04. 53 × 18 + 54 | | M | Minimum frequency (in 1/1 000 Hz) measured by the device since statistics were reset. |
| Min Freq Date/Time | LTIME_DATE | ET04. 53 × 18 + 58 | | M | Date time of the minimum frequency measurement. |
| Max Frequency | INT32 | ET04. 53 × 18 + 64 | | M | Maximum frequency (in 1/1 000 Hz) measured by the OSGP device since statistics were reset. |
| Max Freq Date/Time | LTIME_DATE | ET04. 53 × 18 + 68 | | M | Date time of the maximum frequency measurement. |
| A Over-current events | UINT32 | ET04. 53 × 18 + 74 | | M | Number of over-current events measured by the OSGP device on phase A since statistics were reset. Over-current defined as some percentage over OSGP device's max current rating, specified by ET09.3, for at least 10 seconds. |
| B Over-current events | UINT32 | ET04. 53 × 18 + 78 | | M | Number of over-current events measured by the OSGP device on phase B since statistics were reset. Over-current defined as some percentage over OSGP device's max current rating, specified by ET09.3, for at least 10 seconds. |
| C Over-current events | UINT32 | ET04. 53 × 18 + 82 | | M | Number of over-current events measured by the OSGP device on phase C since statistics were reset. Over-current defined as some percentage over OSGP device's max current rating, specified by ET09.3, for at least 10 seconds. |
| Phase A Loss | BOOL(0) | ET04. 53 × 18 + 86 | | M | Indication of phase loss on phase A, 1 = phase loss, 0 = phase present. Phase loss is defined as voltage on this phase that is less than 140 × Rated Voltage/230 Volt for at least 10 seconds. |
| Phase B Loss | BOOL(1) | ET04. 53 × 18 + 86 | | M | Indication of phase loss on phase B, 1 = phase loss, 0 = phase present. Phase loss is defined as voltage on this phase that is less 140 × Rated Voltage/230 Volt for at least 10 seconds. |
| Phase C Loss | BOOL(2) | ET04. 53 × 18 + 86 | | M | Indication of phase loss on phase C, 1 = phase loss, 0 = phase present. Phase loss is defined as voltage on this phase that is less than 140 × Rated Voltage/230 Volt for at least 10 seconds. |
| A Most Recent Phase Loss Event | LTIME_DATE | ET04. 53 × 18 + 87 | | M | Timestamp of the most recent phase loss event on phase A. |
| A Phase Loss Events | UINT16 | ET04. 53 × 18 + 93 | | M | Number of phase loss events on phase A since statistics were reset. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| B Most Recent Phase Loss Event | LTIME_DATE | ET04. 53 × 18 + 95 | | M | Timestamp of the most recent phase loss event on phase B. |
| B Phase Loss Events | UINT16 | ET04. 53 × 18 + 101 | | M | Number of phase loss events on phase B since statistics were reset. |
| C Most Recent Phase Loss Event | LTIME_DATE | ET04. 53 × 18 + 103 | | M | Timestamp of the most recent phase loss event on phase C. |
| C Phase Loss Events | UINT16 | ET04. 53 × 18 + 109 | | M | Number of phase loss events on phase C since statistics were reset. |
| A Most Recent Sag Voltage | NI_FMAT1 | ET04. 53 × 18 + 111 | | M | Lowest voltage (mV) detected during the most recent sag event on phase A. |
| B Most Recent Sag Voltage | NI_FMAT1 | ET04. 53 × 18 + 115 | | M | Lowest voltage (mV) detected during the most recent sag event on phase B. |
| C Most Recent Sag Voltage | NI_FMAT1 | ET04. 53 × 18 + 119 | | M | Lowest voltage (mV) detected during the most recent sag event on phase C. |
| A Most Recent Surge Voltage | NI_FMAT1 | ET04. 53 × 18 + 123 | | M | Highest voltage (mV) detected during the most recent surge event on phase A. |
| B Most Recent Surge Voltage | NI_FMAT1 | ET04. 53 × 18 + 127 | | M | Highest voltage (mV) detected during the most recent surge event on phase B. |
| C Most Recent Surge Voltage | NI_FMAT1 | ET04. 53 × 18 + 131 | | M | Highest voltage (mV) detected during the most recent surge event on phase C. |
| Short Outage Count | UINT32 | ET04. 53 × 18 + 135 | | M | Number of short outages experienced by the OSGP device. Short outages are defined as outages lasting less than the Outage Time Threshold. |
| PQ Configuration ID | UINT32 | ET04. 53 × 18 + 139 | | H | Identifier representing the present power quality threshold configuration, not controlled by the OSGP device as being linked to any change in ET08. |
| Sag/Surge Threshold Seconds | UINT8 | ET04.53 × 18 + 143 | | H | Value, in seconds, to be added to the minutes threshold above for the total time threshold for sag and surge events |
| Power Up Quality Hold Time | UINT8 | ET04. 53 × 18 + 144 | | H | The amount of time, in seconds, that the OSGP device will wait after powering up to begin recording power quality information. This prevents the OSGP device from recording power quality information while the voltage is not stable. |
| Over Current Time Threshold | UINT16 | T04. 53 × 18 + 145 | | H | The threshold, in seconds, for recording over current events. A value of 0 indicates that every record will be recorded. Range is 0 to 65 000. |
| THD record | ARRAY[3] of 70-byte record | | | | An array of records for THD events. The OSGP device records three types of total harmonic distortion: voltage total harmonic distortion (VTHD), current total harmonic distortion (ITHD) and VA (volts-amperes) total harmonic distortion (VATHD). THD is a ratio of the voltage or current at harmonic frequencies to the voltage or current at the fundamental frequency for the OSGP device, expressed as a percentage. |
| THD time threshold | UINT16 | ET04. 53 × 18 + 147 | | H | The time threshold for recording THD events, with a resolution of 10 seconds. A value of 0 indicates that every record will be recorded. Range is 0 to 65 000. The minimum value is 10 seconds. This field should not be set to a value less than 10 seconds. |
| THD threshold | UINT16 | ET04. 53 × 18 + 149 | | H | The percentage threshold for recording THD events. Range is 0 to 10 000, in 1/100 of a percent. For example, a value of 10 000 means 100 %. A value of 0 means that no THD events will be recorded. |
| THD event record | ARRAY[3] of 22-byte record | | | | One record for each phase: |
| Event count | UINT16 | ET04. 53 × 18 + 151 | | M | The number of THD events. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Event timestamp | LTIME_DATE | ET04. 53 × 18 + 153 | | M | Date/time of the last THD event. |
| Max THD | UINT16 | ET04. 53 × 18 + 159 | | M | Maximum THD of last event. |
| Max THD timestamp | LTIME_DATE | ET04. 53 × 18 + 161 | | M | Date/time stamp of the Max THD. |
| Average THD | UINT16 | ET04. 53 × 18 + 167 | | M | Average THD of last event. |
| Reserved | UINT32 | ET04. 53 × 18 + 169 | | | |

## B.11 Extended Table 10 (ET10) (2058): Internal Power Outages

This table is used for internal metering functions when any reset (including power outage) occurs:

- Read access: OMAK.
- Write Access: OMAK.

**Table B.9**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Power outage record: | ARRAY[ET04.Power Outages Recorded] of 18-byte record: | | | | Reverse-chronological list of the most recent power cycle events. |
| Power-on Date/Time | LTIME_DATE | 0 | | M | Power on date/time, in UTC. |
| Reset Cause | UINT8 | 6 | | M | Reason for this reset/power on event:<br>0..2 - Unused<br>3 - Power failure<br>4 - Watchdog reset<br>5 - Switchover event<br>6 - Flash Refresh<br>7 - Unknown reset cause<br>8 - Brown-out<br>9 - ID code set<br>10 - Measurement error, reset called to re-synch<br>11- Boot ROM Switchover<br>12 - Bad Stack<br>13 - NVM Locked<br>14 - Clock error correction<br>15 - User stack or interrupt stack corruption<br>100 - Miscellaneous exception<br>101 - UDI exception<br>102 - Overflow exception<br>103 - BRKI exception<br>104 - Address match exception<br>105 - Single step exception<br>106 - DBC exception<br>107 - NMI exception. |
| Reserved for future use | UINT8 | 7 | | M | |
| Power-off Date/Time | LTIME_DATE | 8 | | M | Power off date/time, in UTC. |
| Power Off Duration | UINT32 | 14 | | M | Power off duration in seconds. If duration is less than 1 second, a value of 0 will be returned. This field rounds down (i.e. a power off of 2,5 seconds will be reported as 2 seconds). |

# B.12 Extended Table 11 (ET11) (2059): MFG Dimension

This table contains the dimensions of the remaining MEP/M-Bus-related and other Extended Tables:

- Read access: OMAK.
- Write access: None.

**Table B.10**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Number of Devices | UINT8 | 0 | 5 | P | Maximum number of MEP devices supported. |
| Config Entry Size | UINT8 | 1 | 66 | P | Size in bytes of a MEP configuration table entry for M-Bus ET13. |
| Status Entry Size | UINT8 | 2 | 36 | P | Size in bytes of a MEP status table entry for M-Bus ET14. |
| On-demand Request Queue Size | UINT8 | 3 | 5 | P | Maximum number of entries in the MEP on-demand request queue. |
| On-demand Request Entry Size | UINT8 | 4 | 6 | P | Size in bytes of a MEP on-demand request table entry for M-Bus ET15. |
| Data Entry Size | UINT16 | 5 | 517 | P | Size in bytes of a MEP device data table entry for M-Bus ET16. |
| Transaction Request Length | UINT16 | 7 | 769 | P | Transaction Request Table length in bytes. |
| Transaction Response Length | UINT16 | 9 | 1 785 | P | Transaction Response Table length in bytes. |
| On-demand Write Entry Size | UINT8 | 11 | 25 | P | Maximum length of the MEP on-demand write entry (length + msg), per device. |
| Phase Measurement Data Size | UINT8 | 12 | 16 | P | Size in bytes of per phase measurement data for measurement ET08. |
| Config Entry 2 Size | UINT8 | 13 | 22 | P | Size in bytes of a MEP configuration table 2 entry for M-Bus ET34. |
| OSGP device one-time read queue size | UINT8 | 14 | 3 | P | Maximum number of entries in the OSGP device one-time read request queue. |
| M-Bus one-time read queue size | UINT8 | 15 | 4 | P | Maximum number of entries in the M-Bus one-time read request queue. |
| OSGP device one-time read request entry size | UINT8 | 16 | 17 | P | Size in bytes of a OSGP device one-time read request queue entry in ET19. |
| M-Bus one-time read request entry size | UINT8 | 17 | 17 | P | Size in bytes of an M-Bus one-time read request queue entry in ET20. |
| Number of Group IDs | UINT8 | 18 | 10 | P | Maximum number of group IDs that can be assigned to the OSGP device. |
| Number of Harmonics | UINT8 | 19 | 10 | P | Number of the harmonics are calculated: currently the 1st to 10th harmonic are calculated. Reflects the dimensions of the harmonics magnitude and phase arrays in ET08. |
| M-Bus Multicast Message Length | UINT8 | 20 | 65 | P | Max length in bytes of an M-Bus multicast message (length + C field + CI field + User Data). |
| ET22 Alarm Size | UINT8 | 21 | 120 | P | The number of bytes in first ET22 array. |
| MEP Data Sources | UINT8 | 22 | 6 | P | The number of MEP data sources in ET50. |
| ET48 Entry Count | UINT8 | 23 | 10 | P | The maximum number of entries in ET48. |
| Maximum Critical Event Bitmaps | UINT8 | 24 | 10 | P | The maximum number of bitmasks available for critical events. |
| ET57 Entry Count | UINT8 | 25 | 16 | P | The maximum number of M-Bus Data Types that can be created. |
| Time-based Relay Switches | UINT8 | 26 | 80 | P | Total number of relay switches in the OSGP device's time-based relay calendar. |

# B.13 Extended Table 12 (ET12) (2060): Daily Consumption

This table contains the consumption of total active and reactive energy for the last day, measured at UTC midnight:

- Read access: OMAK.
- Write Access: None.
- Attributes: ICANAK.

**Table B.11**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Last Day's Consumption: | ARRAY[ET04.55] of NI_FMAT1 | | | | Previous day's consumption for each register, recorded at UTC midnight. |
| Active Forward | NI_FMAT1 | 0 | | M | |
| Active Reverse | NI_FMAT1 | 4 | | M | |
| Reactive Import | NI_FMAT1 | 8 | | M | |
| Reactive Export | NI_FMAT1 | 12 | | M | |
| Today's Consumption: | ARRAY[ET04.55] of NI_FMAT1 | | | | Present day's consumption for each register, registers is updated at least once a second. At UTC midnight, the "Last Day's Consumption" values are overwritten with the "Today's Consumption" values. |
| Active Forward | NI_FMAT1 | 4×ET04.55 | | M | |
| Active Reverse | NI_FMAT1 | 4×ET04.55 +4 | | M | |
| Reactive Import | NI_FMAT1 | 4×ET04.55 +8 | | M | |
| Reactive Export | NI_FMAT1 | 4×ET04.55 +12 | | M | |

# B.14 Extended Table 13 (ET13): M-Bus/MEP Device Config

This table contains the programmable configuration information for each of the M-Bus and MEP connected devices. The first four entries are for M-Bus devices. The 5$^{th}$ entry has a different structure than the first 4. This entry is used for conveyance of downlink non-urgent MEP data and the MEP Alert flags.

ET13 is used when passing data between M-Bus and MEP devices, and utility meters. For an overview of how this works, see clauses 8.17 and 8.18:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table B.12**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Device Config | ARRAY [ET11.0] of ET11.1-byte structure | | | | Configuration information for each MEP device. |
| Scheduled Billing Read Time | ARRAY[3] of UINT8 | | | | Date/time for the regularly scheduled billing read for this device, referenced to local time. A value of all 0's represents the first day of the month at midnight. |
| Day | | 0 | | H | 1..28 = day of the month, 0 equals the first day of the month (Hour and Minute fields still apply)<br>For weekly scheduled reads:<br>32 = Sunday<br>33 = Monday<br>34 = Tuesday<br>35 = Wednesday<br>36 = Thursday<br>37 = Friday<br>38 = Saturday<br>(see note 1) |
| Hour | | 1 | | H | 0..23 |
| Minute | | 2 | | H | 0..59 |
| Scheduled Billing Read Frequency | UINT8 | 3 | | H | 0 = hourly; day, hour fields of timestamp ignored<br>1 = daily; day fields of timestamp ignored<br>2 = weekly<br>3 = monthly<br>(see note 2). |
| Scheduled Status Read Frequency (M-Bus only) | UINT16 | 4 | | H | Frequency of status read in minutes, synchronized to the last status read. A value of 0 means only read status with billing reads, separate status reads are not performed. |
| Baud Rate | UINT8 | 6 | | H | Desired baud rate for each device:<br>0 = 9 600 (MEP default)<br>1 = 300<br>2 = 600<br>3 = 1 200<br>4 = 2 400 (M-Bus default)<br>5 = 4 800<br>6 = 9 600<br>7 = 14 400 (not supported in M-Busor MEP protocol)<br>8 = 19 200 (not supported in M-Bus or MEP protocol)<br>9 = 28 800 (not supported in M-Bus or MEP protocol)<br>10 = 57 600 (not supported in M-Bus or MEP protocol)<br>11 = 38 400 (not supported in M-Bus or MEP protocol)<br>12..255 = Reserved for future use. |
| Device Alarm Bitmask | UINT8 | 7 | | H | Controls which device alarms are deemed urgent and trigger MEP device alarm to be set. |
| M-Bus device entries have the following format for the remainder of the table: | | | | | |
| Customer ID | ARRAY[20] of CHAR | 8 | | H | Customer identification of MEP device. |
| App Reset Parameter | UINT8 | 28 | | H | Parameter to be used with the application reset command, specifies which data telegrams are to be output in billing read requests. |
| Security Key Length | UINT8 | 29 | | H | Number of bytes in the security key (7 or smaller => no key). |
| Security Key | ARRAY[32] of UINT8 | 30 | | H | The security key. For key protection the first 8 bytes are write-only and will be read back as zeros. |
| Ta | UINT16 | 62 | | H | Extension of turn-around time. In bit-times; this value is added to the nominal value of 330. |
| To | UINT16 | 64 | | H | Extension of turn-around time, In ms. This value is added to the nominal value of 50. |
| MEP device entry has the following format for the remainder of the table: | | | | | |
| Alert Flags: | UINT8: | 8 | | M | Flags modified by the OSGP device for notification to the MEP device. |
| Scheduled Read Request Alert | BOOL(0) | 8 | 0 | M | Set by the OSGP device when a scheduled billing read period has elapsed. Cleared by the OSGP device when a non-urgent data write completes. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| On-demand Request in ET15 | BOOL(1) | 8 | 0 | M | Set by the OSGP device when a MEP on-demand request is pending in ET15. Cleared by the OSGP device when request is completed. |
| One-Time Read Request | BOOL(2) | 8 | 0 | M | Set by the OSGP device when a scheduled one-time read is due to be recorded. Cleared by the OSGP device when the data has been posted in the OSGP device. |
| M-Bus Change | BOOL(3) | 8 | 0 | M | Set by the OSGP device when an M-Bus control value has changed, or when new M-Bus load profile data is available. |
| Unused | BOOL(4..7) | 8 | | | Reserved. |
| MEP Non-urgent data | Array[ET11.1 - 9] of UINT8 | 9 | | H | Opaque data to be read by MEP device. This area of the table is used to store non-urgent downlink data. |
| NOTE 1: To disable scheduled billing reads, set this field to 39, and set the "Scheduled Billing Read Frequency" field to 2.<br>NOTE 2: To disable scheduled billing reads, set this field to 2 and set the "Day" field to 39. | | | | | |

## B.15 Extended Table 14 (ET14): M-Bus/MEP Device Status

This table contains the status information and alarms for each of the M-Bus and MEP connected devices. For more information on M-Bus and MEP devices, see clauses 8.17 and 8.18:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table B.13**

| Field Name | Type | Offset | VCI | Description | Updated on Urgent (U), Non-Urgent (N) or both (UN) reads | Type of Read That Updates This Field:<br>MB= M-Bus<br>MP = MEP<br>A = Alarm Read<br>B = Blg Read<br>O = OTR<br>Pre = Updated At Request Time<br>Post = Updated On Response Completion or Timeout |
|---|---|---|---|---|---|---|
| Mode | UINT8 | 0 | M | Bit 0 : 0 = Normal polling mode<br>1 = Auto-discovery mode. | | |
| Unused | UINT32 | 1 | M | Unused. | | |
| Device Occupancy | UINT8 | 5 | M | Bitmask of occupied device slots, 0= empty slot, 1= occupied:<br>Bit 0 - device 1<br>Bit 1 - device 2<br>Bit 2 - device 3<br>Bit 3 - device 4. | | |
| MEP Status: | ARRAY[ET11.0] of ET11.2-byte structure | | | | | |
| Device Handle | UINT16 | 6 | M | Unique identifier for this device. The handle ranges are divided by device type as follows:<br>1..999 : M-Bus devices<br>1 000..1 999 : MEP device. | | |

| Field Name | Type | Offset | VCI | Description | Updated on Urgent (U), Non-Urgent (N) or both (UN) reads | Type of Read That Updates This Field:<br>MB= M-Bus<br>MP = MEP<br>A = Alarm Read<br>B = Blg Read<br>O = OTR<br>Pre = Updated At Request Time<br>Post = Updated On Response Completion or Timeout |
|---|---|---|---|---|---|---|
| Device Status | UINT8 | 8 | M | 0 = Empty slot<br>1 = Device active ("Up")<br>2 = Device down (Lost communications)<br>3 = MEP Device active ("Up")<br>4 = MEP Device down (lost communications)<br>Note that this field is only applicable when the "Monitor MEP Health" field in ET51 is set to True, and the device handle is set to a non-zero value. | UN | MB, MP<br>Post ABO |
| Baud Rate | UINT8 | 9 | M | Current operating baud rate for this device:<br>0 = 9 600<br>1 = 300<br>2 = 600<br>3 = 1 200<br>4 = 2 400<br>5 = 4 800<br>6 = 9 600<br>7 = 14 400 (not supported in M-Bus protocol)<br>8 = 19 200 (not supported in M-Bus or MEP protocol)<br>9 = 28 800 (not supported in M-Bus or MEP protocol)<br>10 = 57 600 (not supported in M-Bus or MEP protocol)<br>11 = 38 400 (not supported in M-Bus or MEP protocol)<br>12..255 = Reserved for future use. | | |
| Billing Read Length | UINT16 | 10 | M | Length in bytes of the latest billing read in the MEP Device Data table ET16 (includes timestamp, header fields, and 0 terminator byte). | UN | MB, MP<br>Post B<br>×Applies to ET16 updates only |
| Read Attempts | UINT32 | 12 | M | Number of attempted communications to the device for any type of request. | UN | MB, MP<br>Pre BO |
| Read Answers | UINT32 | 16 | M | Number of successful answers to a (demand or scheduled) billing or status read (does not indicate alarm response versus data response, merely that comms were successful). | UN | MB, MP<br>Post BO |
| OSGP device MEP Alarms | UINT16 | 20 | M | OSGP device-detected MEP alarms. Bits in this field are latched until cleared via EP18. A new bit latched here triggers MEP Alarm in BT03 to be set. | | |
| Billing Data Collected | BOOL(0) | | M | Scheduled billing read completed for this device - billing data collected in ET16. (See note). | N to ET16 only | MB, MP<br>Post B |
| App Error Response Rcvd | BOOL(1) | | M | Not supported. | | |

| Field Name | Type | Offset | VCI | Description | Updated on Urgent (U), Non-Urgent (N) or both (UN) reads | Type of Read That Updates This Field: MB= M-Bus MP = MEP A = Alarm Read B = Blg Read O = OTR Pre = Updated At Request Time Post = Updated On Response Completion or Timeout |
|---|---|---|---|---|---|---|
| New Device Alarm | BOOL(2) | | M | Status read (scheduled or on-demand) completed for this device and at least one new device alarm exists. See [ET14.M-Bus status read] for device alarms. | n/a | MB, MP<br>Post A |
| Billing Read Overflow | BOOL(3) | | M | Billing read overflow occurred, all device data could not be stored in the table | UN | MB, MP<br>Post B |
| Failed Comms On Read | BOOL(4) | | M | Failed comms on read | | MB - on request timeout;<br>MP - on health monitor timeout |
| Serial Number Mismatch | BOOL(5) | | M | Serial number mismatch on billing read (billing data stored with new serial number) | N | MB only<br>Post B<br>N/A for MP |
| MEP Firmware Switchover Success | BOOL(6) | 20 | M | MEP firmware switchover succeeded | N/A | N/A |
| MEP Firmware Switchover Failure | BOOL(7) | 20 | M | MEP firmware switchover failed | N/A | N/A |
| Reserved | BOOL(8…15) | | | Reserved for future use | | |
| M-Bus Application Errors | UINT8 | 22 | M | Not supported. | | |
| App Errors Timestamp | LTIME_DATE | 23 | M | Time that application error message reported above was received. | | |
| MEP Device Alarms | UINT8 | 29 | M | Device alarms (in header of billing data response) received from scheduled or on-demand status read. Individual bits are latched until cleared via EP18. | | MB, MP<br>Post A |
| Status Read Timestamp | LTIME_DATE | 30 | M | Timestamp of last successful status read (demand or scheduled) | | MB, MP<br>Post A |
| Last Read Attempt | LTIME_DATE | 36 | M | Timestamp of the last attempted billing read (demand or scheduled) | UN | MB, MP<br>Pre BO |
| NOTE: This alarm pertains to ET16 only. If ET45 is configured and the compatibility setting indicates the DCX can read ET45, this alarm will not be posted for reads going to ET45 only (another alarm bit for mfg log entries available covers this). | | | | | | |

# B.16 Extended Table 15 (ET15): MEP On-demand Requests

This table contains a circular queue of on-demand transaction requests. As ET15 is read-only, the entries are made through a procedure, EP19. The results of these requests are read here as well.

ET15 is used when passing data between M-Bus and MEP devices, and utility meters. For an overview of how this works, see clauses 8.17 and 8.18:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table B.14**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Pointers | UINT8 | | | | |
| | UINT(0..3) | 0 | | M | Write pointer, points to where the next entry will be posted in the queue. |
| | UINT(4..7) | 0 | | M | Read pointer, points to the next entry to be processed by the OSGP device. |
| Request Queue | ARRAY[ET11.3] of ET11.4-byte structure | | | | Queue of on-demand requests and their results. The MEP device should query this area of ET15 when reading and processing urgent data on the OSGP device. |
| Transaction Nbr | UINT16 | 1 | | M | Transaction number for each request, used to keep track of requests/results on the server. |
| Device Handle or Group Mask | UINT16 | 3 | | M | Handle of the device to be queried. For request type 6 0xFFFF signifies all commissioned devices, else group mask. |
| Request type | UINT8 | 5 | | M | 0 = No entry.<br>1 = M-Bus application reset. Not applicable to MEP.<br>2 = Billing read (data requested).<br>3 = Status read (data requested). Not applicable to MEP.<br>4 = Write data (see below for type of data being written). This indicates there is data to be read by MEP and response data may or may not be required.<br>5 = Time sync (no write data required). Not applicable to MEP.<br>6 = Multicast/Broadcast to specified devices. The list of specified devices is configured in ET34 (see below for type of data being written). Not applicable to MEP.<br>7 = MEP download start (created internally as a result of EP41) (no write data required). This (and request types 8 and 9) is used in conjunction with the MEP firmware download process.<br>8 = MEP download code packet (created internally as a result of EP09, write data stored in multicast data area below).<br>9 = MEP download switchover (no write data required). |
| Result | UINT8 | 6 | | M | 0 = Request not yet completed<br>1 = Success<br>2 = No response from device<br>3 = Request failed. |
| Write Messages: | ARRAY[ET11.3] of ET11.11 byte structure | | | | User data to be written as-is to the MEP device. |
| Write Data Length | UINT8 | ET11.3 × ET11.4 + 1 | | M | Length in bytes of user data to be written to the MEP device. |
| Write Data | ARRAY[ET11.11 - 1] of UINT8 | ET11.3 × ET11.4 + 2 | | M | Data to be written as-is to the MEP device. This data comprises the User Data portion of the SND_UD telegram for M-Bus requests. For MEP devices, this data is to be read as-is by the device for Request Type 4. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Multicast Data Length | UINT8 | ET11.3 × (ET11.4 + ET11.11 ) + 1 | | M | Length in bytes to be written to the MEP device. Includes control fields plus user data for M-Bus requests. |
| Multicast Data Message: | ARRAY[ET11.20 - 1] of UINT8 | ET11.3 × (ET11.4 + ET11.11 ) + 2 | | M | Multicast data to be written as-is to the MEP devices.<br>For M-Bus devices, this data comprises the 'C' control field, followed by the 'CI' control field, followed by the User Data portion of the telegram,<br>For MEP devices, this data includes the Packet Number and Code Packet fields described below for download requests. |
| Packet Number | UINT16 | | | M | Download code packet number. |
| Code Packet | ARRAY[ET11.20 - 5] of UINT8 | | | M | Download code packet written to ET15, Multicast Data Message. |

# B.17 Extended Table 17 (ET17) (2065): Code Bank Info

This table holds status and diagnostic information about the most recent download attempt and the current status of executing code.

**Table B.15**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Bitmap size | UINT16 | 0 | | M | Number of bytes in the verification bitmap; updated indirectly via MP08 or MP41; default = 288 with code pkt size of 57 for MP08, and always = 512 for MP41 |
| Code packet size | UINT8 | 2 | 57 | M | Number of bytes in each code packet; updated via MP08; fixed at 57 bytes for this meter |
| Received packets | UINT16 | 3 | | M | Number of code packets received by the meter, regardless of successful write to flash code bank |
| First missed packet | UINT16 | 5 | | M | Ordinal number of the first missed packet in the image, range 0 to max number of packets -1 |
| BSN | UINT32 | 7 | | M | LonTalk broadcast sequence number, programmed via MP08 |
| Start time | LTIME_DATE | 11 | | M | Time and date (UTC) when this version started executing on the meter; set upon execution of MP10 before bank switch |
| Download status | Bit field of UINT32 | 17 | | M | Status of most recent download attempt |
| CRC and imageID of CECB OK | BOOL(0) | | | M | Set internally; initialized by MP08; reset on boot-up |
| CRC and imageID of !CECB OK | BOOL(1) | | | M | Set internally; initialized by MP08; reset on boot-up |
| CRC of CECB not OK | BOOL(2) | | | M | Set internally; initialized by MP08; reset on boot-up |
| ImageID of CECB not OK | BOOL(3) | | | M | Set internally; initialized by MP08; reset on boot-up |
| CRC of !CECB not OK | BOOL(4) | | | M | Set internally; initialized by MP08; reset on boot-up |
| ImageID of !CECB not OK | BOOL(5) | | | M | Set internally; initialized by MP08; reset on boot-up |
| Invalid bank value detected | BOOL(6) | | | M | Set internally; initialized by MP08 |
| MEP code packet active | BOOL(7) | | | M | Set internally, initialized by MP41 |
| Invalid code packet size | BOOL(8) | | | M | Set by MP08; initialized by MP08 |
| NVM downgrade req'd | BOOL(9) | | | M | Set internally; initialized by MP10 |
| Erase flash sector error | BOOL(10) | | | M | Set by MP08; initialized by MP08 |

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Duplicate packet nbr error | BOOL(11) | | | M | Set by MP09; initialized by MP08 |
| Invalid flash address | BOOL(12) | | | M | Set by MP09; initialized by MP08 |
| Write flash byte error | BOOL(13) | | | M | Set by MP09; initialized by MP08 |
| Executing code bank has changed | BOOL(14) | | | M | Set internally; initialized by MP08 |
| Invalid switch state | BOOL(15) | | | | Set by MP10 |
| Last executing code bank (0= bank 1, 1= bank 2) | BOOL(16) | | | M | Diagnostic set internally |
| | BOOL(17) | | | M | Reserved for future use |
| Recoverable flash error | BOOL(18) | | | | Set when a corrupted system image is recovered from a compressed image |
| | BOOL(19) | | | | Reserved for future use |
| Bootrom NVM CRC/signature failure | BOOL(20) | | | | Set when the bootrom NVM data CRC/signature is invalid |
| Bootrom refresh flash error | BOOL(21) | | | | Bootrom failed to refresh flash as commanded |
| Bootrom stop mode due to Vdet4 test failure | BOOL(22) | | | | Meter went to stop mode early in bootrom mode |
| Bootrom NVRAM error | BOOL(23) | | | | RTC code in NVRAM is not valid |
| Bootrom CRC failure | BOOL(24) | | | | Bootrom CRC is invalid |
| Bootrom NVRAM var error | BOOL(25) | | | | Bootrom NVRAM variable signature is invalid |
| Bootrom Power stable | BOOL(26) | | | | Bootrom power is stable |
| Bootrom Vdet4 after power stable | BOOL(27) | | | | Unexpected Vdet4 happened after power is stable |
| Bootrom stop mode due to exceptions while in watch mode | BOOL(28) | | | | Meter went to stop mode due to exceptions while in watch mode |
| Compressed Code Bank Not Ok | BOOL(29) | | | | True if the compressed bank is not ok. True after MP08 and until switchover succeeds |
| Reserved | UINT(30..31) | | | | Reserved for future use |
| Executing code bank | UINT8 | 21 | | M | Code bank currently being executed.<br>0 = code bank 1<br>1 = code bank 2 |
| Verification bitmap | ARRAY[512] of UINT8 | 22 | | M | Bitmap of code packets sectors successfully downloaded with new software image. Bit 0 corresponds to packet 0, bit 1 to packet 1, etc.<br>1 = packet received, 0 = packet not received |
| Switchover Count | UINT8 | 534 | | M | Number of switchover attempts remaining |

## B.18 Extended Table 18 (ET18) (2066): Manufacturer Specific

Reserved for later use.

## B.19 Extended Table 19 (ET19) (2067): Meter One-Time Read Queue

This table is the queue of posted one-time reads for meter billing. One-time reads are requested via MP24 "Post One-Time Read Request":

- Read access: OMAK.
- Write access: None.

- Attributes: ICANAK.

**Table B.16**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Request Queue: | ARRAY[ET11.14] of ET11.16-byte structure | | | | Queue of one-time requests and their results |
| Transaction Nbr | UINT16 | 0 | | M | Transaction number for each request, used to keep track of requests/results on the server |
| Date/Time | STIME_DATE | 2 | | M | Date/Time of when the read is to occur |
| Device Handle | UINT16 | 7 | | M | Always 0 |
| Spare | ARRAY[6] of UINT8 | 9 | | | Reserved for future use |
| Execution Status | UINT8 | 15 | | M | 0 = Normal<br>1 = Late arrival (arrived at meter after scheduled time)<br>2 = Delayed (arrived ahead of scheduled time but was executed late, probably due to a power failure) |
| Result | UINT8 | 16 | | M | 0 = Empty slot<br>1 = Request not yet completed<br>(2 = Request rejected) - N/A<br>3 = In progress<br>4 = Success<br>(5 = No response) - N/A<br>(6 = Failed) - N/A |

## B.20 Extended Table 20 (ET20) (2068): M-Bus One-Time Read Queue

This table is the queue of posted one-time reads for M-Bus billing. One-time reads are requested via MP24 "Post One-Time Read Request":

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table B.17**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Request Queue: | ARRAY[ET11.15] of ET11.17-byte structure | | | | Queue of one-time requests and their results |
| Transaction Nbr | UINT16 | 0 | | M | Transaction number for each request, used to keep track of requests/results on the server |
| Date/Time | STIME_DATE | 2 | | M | Timestamp of the request |
| Device Handle | UINT16 | 7 | | M | Handle of the device to be read |
| Spare | ARRAY[6] of UINT8 | 9 | | | Reserved for future use |
| Execution Status | UINT8 | 15 | | M | 0 = Normal<br>1 = Late arrival (arrived at meter after scheduled time)<br>2 = Delayed (arrived ahead of scheduled time but was executed late, probably due to a power failure) |
| Result | UINT8 | 16 | | M | 0 = Empty slot<br>1 = Request not yet completed<br>2 = Request rejected<br>3 = In progress<br>4 = Success<br>5 = No response<br>6 = Failed |

## B.21 Extended Table 21 (ET21) (2069): Load Profile Internal Configuration

This table holds extra information on the load profile configuration and status. It is not necessary to read ET21 on a regular basis:

- Read access: OMAK.
- Write access: None.

**Table B.18**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Current Block Address | UINT32 | 0 | | M | Physical address of the current block |
| Current Interval Address | UINT32 | 4 | | M | Physical address of the current interval |
| Block Size | UINT32 | 8 | | M | Size in bytes of the block |
| Block Header Size | UINT16 | 12 | | M | Size in bytes of the block header including end time, end readings, and simple status |
| Number of Valid Blocks | UINT16 | 14 | | M | Number of blocks in the data set with valid data |
| Number of Valid Intervals | UINT16 | 16 | | M | Number of intervals in the current block stored to Non-Volatile memory |
| Last Block Index | UINT16 | 18 | | M | Array index of the most recent block with new data |
| Last Interval Number | UINT16 | 20 | | M | Array index of the most recent interval recorded in the block |
| Simple Status Offset from Block | UINT8 | 22 | | M | Byte offset of the simple status from the start of the block |
| Simple Status Size | UINT8 | 23 | | M | Size in bytes of simple status |
| Interval 0 Offset from Block | UINT8 | 24 | | M | Byte offset of the first interval from the start of the block |
| Interval Size | UINT8 | 25 | | M | Size in bytes of one log interval |
| Channel 0 Offset from Interval | UINT8 | 26 | | M | Byte offset of the first channel's data from the start of the interval record |
| Extended Status Common | UINT8 | 27 | | M | Current extended status to be recorded in next interval record |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Number of Channels | UINT8 | 28 | | M | Number of channels being logged in the present configuration |
| Interval Time | UINT8 | 29 | | M | Logging interval in the present configuration |
| Sources | ARRAY[8] of UINT8 | 30 | | M | Source ids of the channels being logged in the present configuration, up to the first 8 sources. See BT16 for the list of possible sources. See ET21.70 for the expanded source list |
| Placeholders | ARRAY[8] of INT32 | 38 | | M | Used only for M-Bus channels, holds the value of the most recently posted interval data for each channel |
| Sources expansion | ARRAY[8] of UINT8 | 70 | | M | The list of sources from source 8 through 16 |
| LP config ID | UINT32 | 78 | | M | Identifier representing the present load profile configuration. This field is updated when MP11 is executed. See MP11 |
| MEP Billing Start Channel | UINT8 | 82 | | M | Channel number where MEP billing data starts (0-based) |
| Block Start Time | LTIME_DATE | 83 | | M | Time (UTC) when the current block started |
| Block Start Hour | UINT8 | 89 | | M | UTC Hour of requested start time. Not necessarily the start time of the current first block, which may be offset from the requested start time, depending on how interval length and number of intervals are configured |
| Block Start Minute | UINT8 | 90 | | M | UTC Minute of requested start time. Not necessarily the start time of the current first block, which may be offset from the requested start time, depending on how interval length and number of intervals are configured |
| Interval In Progress | UINT16 | 91 | | M | 0 if no interval pending. Non-zero is current interval number in process of closing (i.e. waiting for MEP data to be returned) |
| LP Options | UINT8 | 93 | | M | See MP11 LP Options field for details |
| Interval End Time (UTC) | LTIME_DATE | 94 | | M | End time of last interval in UTC |
| Interval End Time (local) | LTIME_DATE | 101 | | M | End time of last interval in local time |

## B.22 Extended Table 22 (ET22) (2070): Error Codes Configuration

This table is used to configure the format of error codes to be shown on the LCD. Each type of alarm can be formatted independently. See BT03 for a description of the supported alarms. Note that display control is sized based on ET11.21 rather than BT00.17 to all for future expansion without shifting of table data:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table B.19**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Display Control | ARRAY[ET11.21] OF UINT8 | | | | |
| Control | UINT(0..1) | 0 | 1 for NVM | H | When this alarm is triggered:<br>0 = Ignore alarm for display.<br>1 = Scroll alarm on display as a caution code.<br>2 = Lock display as an error code. |
| ERR/Caution ID | ARRAY[[(BT00.17 + 3 +3)/4]] of 12 byte record | | | | |
| Caution ID Code | 6-byte record | Text to be displayed in the ID field when cautions are being shown on the LCD. | | | |
| **ID Format:** | | 4-character ID code, entered here in ASCII format. | | | |
| ID Code | Array [4] of UINT8 | ET11.21 | "CAUT" | H | Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD. |
| ID DP State | UINT8 | ET11.21 + 4 | | H | 4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP..bit 3 = left-most DP. |
| **Reserved** | UINT8 | ET11.21 + 5 | | | Not used. |
| Error ID Code | 6-byte record | Text to be displayed in the ID field when errors are being shown on the LCD. | | | |
| **ID Format:** | | 4-character ID code, entered here in ASCII format. | | | |
| ID Code | Array [4] of UINT8 | ET11.21 + 6 | "ERR" | H | Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD. |
| ID DP State | UINT8 | ET11.21 + 10 | | H | 4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP..bit 3 = left-most DP. |
| **Reserved** | UINT8 | ET11.21 + 11 | | | Not used. |

## B.23 Extended Table 23 (ET23) (2071): Meter Internal Use Only

This table is contains miscellaneous information, mostly for internal debugging purposes:

- Read access: OMAK.
- Write access: OMAK.

**Table B.20**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Exception Log [0] | | | | | |
| Messages Received | UINT32 | 0 | | M | # of non-validated explicit messages received. Updated on occurrence. |
| Messages Validated | UINT32 | 4 | | M | # of validated (digest check) explicit messages received. Updated on occurrence. |
| Unused | ARRAY[4] of UINT8 | 8 | | M | Unused. |
| MEP Duration | UINT16 | 12 | | M | Duration in milliseconds of the last on-demand MEP operation, from start to finish. |
| Reserved | UINT8 | 14 | | H | |
| Reserved | UINT8 | 15 | | H | |
| Exception Log [1] | | | | | |
| Invalid App Code | UINT16 | 16 | | M | # of received messages with an invalid application code. Updated on occurrence. |
| Invalid Digest | UINT16 | 18 | | M | # of received messages that failed the digest check. Updated on occurrence. |
| Invalid Sequence | UINT16 | 20 | | M | # of received messages with an invalid sequence #. Updated on occurrence. |

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Duplicate Received | UINT16 | 22 | | M | # of received messages with a sequence that differs by 1 from the meter's expected sequence #. Updated on occurrence. |
| Timestamp | LTIME_DATE | 24 | | M | |
| Reserved | UINT8 | 30 | | H | |
| Reserved | UINT8 | 31 | | H | |
| Exception Log [2] | | | | | |
| Transmit Timeout | UINT16 | 32 | | M | # of PLC low level driver Tx timeouts. Updated on occurrence. |
| Receive Timeout | UINT16 | 34 | | M | # of PLC low level driver Rx timeouts. Updated on occurrence. |
| Nascent State | UINT16 | 36 | | M | # of times the meter determined that it shall put the Neuron into the nascent state. Updated on occurrence. |
| Buffer Overflow | UINT16 | 38 | | M | # of PLC Rx buffer overflow errors. Updated on occurrence. |
| Timestamp | LTIME_DATE | 40 | | M | |
| Reserved | UINT8 | 46 | | H | |
| Reserved | UINT8 | 47 | | H | |
| Exception Log [3] | | | | | |
| No Receive Buffer | UINT16 | 48 | | M | # of times the Neuron transmitted data to the Neuron but the receive buffer was not available. Updated on occurrence. |
| Frequency Invalid | UINT16 | 50 | | M | # of times the Neuron reported to the meter an invalid frequency. Updated on occurrence. |
| Local NM Failure | UINT16 | 52 | | M | # of local NM failures. Updated on occurrence |
| Transmit No Data | UINT16 | 54 | | M | # of times the meter attempted to transmit data to the Neuron but the meter tx buffer was empty. Updated on occurrence. |
| Timestamp | LTIME_DATE | 56 | | M | |
| Reserved | UINT8 | 62 | | H | |
| Reserved | UINT8 | 63 | | H | |
| Flash writes | UINT32 | 64 | | M | Number of words written to flash during flash refresh, downloads and locking operations. Updated on power-up and each flash write procedure invoked via PLC or optical. |
| CRC error | UINT16 | 68 | | M | Table id of most recent crc error; -1 indicates an error that caused simultaneous loss of more than one table. Updated when an NVMerror occurs in a meter table. |
| Temperature ADC values | ARRAY[10] of UINT16 | 70 | | M | Raw ADC values of last 10 temperature readings. Updated every 10 ms. |
| Control Word | ARRAY[2] of UINT16 | 90 | | M | Current values of control words (see format in MP04); this field is effectively read-only. Updated on each meter table read/write via PLC or optical. |
| Disconnect Internal Status | UINT8 | 94 | | M | Current values of disconnect internal (FW command) status; this field is effectively read-only. Updated every time through the meter's main loop.<br>0 = closed<br>1 = closing (Temporary state during pulsing)<br>2 = opened<br>3 = opening (Temporary state during pulsing). |
| Active TOU ID | UINT32 | 95 | | M | Currently active TOU calendar ID. Updated on every power-up, every minute and every meter table write request via PLC or optical. |
| Secure Broadcast Current | UINT32 | 99 | | M | Current secure broadcast sequence number. Updated during the secure broadcast process. |
| M-Bus Success count | UINT32 | 103 | | M | # of successful M-Bus layer 2 messages sent with valid response received from an M-Bus device. Updated upon occurrence. |
| M-Bus Retry count | UINT32 | 107 | | M | # of M-Bus layer 2 messages that required a retry. A maximum of 3 retries are attempted per message. Updated upon occurrence. |

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| F4 icon lit | UINT(0..0) | 111 | | M | 0 = F4 icon should not be lit<br>1 = F4 icon should be lit<br>Updated every second. |
| Flash Key Lock Set | UINT(1..1) | 111 | | M | 1 if meter's flash lock key was set to something other than all zeroes or all ones via MP05. |
| Release Lock Set | UINT(2..2) | 111 | | M | 1 if meter's release lock has been set via MP05. |
| Unexpected PLC Command Count | UINT16 | 112 | | M | Number of times an unexpected command was received on the PLC interface. Caps at 0xFFFF. Updated upon occurrence. |
| Maximum Critical Time | UINT16 | 114 | | M | Maximum duration of a power safe critical section (in hundredths of a second). Updated every time through the meter's main loop. See Max Critical Source, which appears later in ET23, for the address of the critical section. |
| NVM failure address | UINT32 | 116 | | H | Sets an address which the NVM routine will cause a CRC error for when read. If NVM failure table is non-zero, then this is used as an offset. Most tables start with a 6-byte header and then the table data. Adjustable logs only contain data. (TEST_BUILD only). |
| NVM failure times | UINT16 | 120 | | H | Sets the count for the number of consecutive times the failure address above will fail. Each time it fails this count is decremented. (TEST_BUILD only). |
| NVM failure table | UINT16 | 122 | | H | Sets a table number that is used to compute an address. The table number address is added to the address field and then this field is zeroed out. (TEST_BUILD_only). |
| Neuron Diagnostic Counters | | | | | Contains a copy of the 12 internal diagnostic counters stored in the Neuron. These values are updated upon request via MP29. |
| Transmission errors | UINT16 | 124 | | M | # of CRC errors detected during packet reception. These may be due to collisions or to noise on the transceiver input. |
| Transmit tx failures | UINT16 | 126 | | M | # of times that the node failed to receive expected acknowledgments or responses after retrying the configured number of times. These may be due to destination nodes being inaccessible on the network, to transmission failures because of noise on the channel, or they may occur if any destination node has insufficient buffers or receive transaction records. |
| Receive tx full | UINT16 | 128 | | M | # of times that an incoming packet was discarded because there was no room in the transaction database. These errors may be due to excessively long receive timers, or to inadequate size of the transaction database. |
| Lost messages | UINT16 | 130 | | M | # of times that an incoming packet was discarded because there was no application buffer available. |
| Missed messages | UINT16 | 132 | | M | # of times that an incoming packet was discarded because there was no network buffer available. |
| Layer2 received | UINT16 | 134 | | M | # of LonTalk messages received by the MAC layer with valid CRC. |
| Layer3 received | UINT16 | 136 | | M | # of LonTalk messages received by the MAC layer with valid CRC addressed specifically to this node. |
| Layer3 transmitted | UINT16 | 138 | | M | # of messages sent onto the network by this node. |
| Transmit tx retries | UINT16 | 140 | | M | # of times a retry was required because of a failure to receive an ack or response. |
| Backlog overflows | UINT16 | 142 | | M | # of times the MAC layer predictive backlog counter overflowed. |

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Late acks | UINT16 | 144 | | M | # of times an ack or response was received for a transaction that had already completed. Typically due to too short transaction timer values or network congestion. |
| Reserved | UINT16 | 146 | | M | |
| Various Status | UINT8 | | | | |
| Access lockout override | BOOL(0) | 148 | | M | Indicates if the security control word is overrule by hardware jumper/screw<br>0 = security control word effective<br>1 = security control word overruled. |
| Disconnect correction done | BOOL(1) | 148 | | M | TRUE when the power up disconnect resync is performed (3.0 and above). |
| TOU Override End Time in UTC | BOOL(2) | 148 | | M | The override end time specified in ET23 is in UTC if TRUE, or local time if FALSE. |
| Elapsed Dmd Interval Secs | UINT32 | 149 | | | Seconds that have elapsed in the preset demand interval. |
| BIDN | UINT16 | 153 | | H | Presently active BIDN. |
| Last Enforced BIDN | UINT16 | 155 | | H | Last BIDN entered by a non-PLC user post-mfg. |
| BT23 Total Sewn Len | UINT16 | 157 | | M | Length of BT23 under present configuration. |
| TOU Override End Time | LTIME_DATE | 159 | | M | End time of a time-based calendar override (see ET23.149 for additional context for this field). |
| Last Good Power Down | LTIME_DATE | 165 | | M | Last power down time without a clock error in effect; used for determining actual outage duration when the clock error is cleared. |
| Clock Error On-Time | UINT32 | 171 | | M | Seconds of powered-on operation while a clock error is in effect; used for determining actual outage duration when the clock error is cleared. |
| Tou Stuff Start Time | LTIME_DATE | 175 | | M | The power down time to start stuffing from. |
| Primary DC voltage | UINT16 | 181 | | M | Instant reading of the primary DC voltage for DCM. |
| Max Critical Source | UINT16 | 183 | | M | Address of the longest duration power safe critical section.<br>See Maximum Critical Time, which appears earlier in ET23, for the duration of the critical section.<br>(See note). |
| PLC Test Rate | UINT8 | 185 | 0 | H | Rate at which the meter transmits a service pin message in the range of 1 to 6 per second. 0 disables this feature. The value is clamped to 6. This feature is not available once the meter leaves manufacturing mode. |
| NOTE: Max Critical Source shall be multiplied by 4, and then SYSIMG_Entry shall be added (typically 0xC0000) to obtain the actual address. This can then be looked up in the map file. | | | | | |

## B.24 Extended Table 27 (ET27) (2075): Transaction Request Table

This table contains transaction requests (see clause 9.1). ET27 is a total of 769 bytes:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table B.21**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Transaction size (B) | UINT16 | 0 | | H | Total byte count including self. |
| Transaction type | UINT8 | 2 | | H | 0 = Requests<br>1 = Responses<br>2 = Responses - partial (not all responses could fit or premature termination due to invalid lengths)<br>3 = Group broadcast request; Meters not supporting group id requests will ignore this transaction<br>4 = Group broadcast request denied. The meter does not belong to any group in the request. |
| Transaction number | UINT16 | 3 | | H | Used for synchronization with responses and table content verification. |
| *For Transaction type 3 only, the following two fields are inserted before the Record List. The length of these two fields is represented as GL = (GIC × 2) + 1. For transaction types 0..2 and 4, GL = 0.* | | | | | |
| Group ID count | UINT8 | 5 | | H | Number of group IDs in the Group ID list |
| Group ID list | ARRAY[ET27.5] of UINT16 | 6 | | H | List of group IDs that should process this transaction;<br>0xYYFF = All sub-groups of group YY should process this transaction<br>0xFFYY or 0xFFFF = All groups and all sub-groups should process this transaction<br>0x0000 is not a valid group ID and should not be used in this message. |
| Record List: | Array[variable length] of Records | | | | |
| Record 0: | | | | | |
| Length (L0) | UINT16 | GL + 5 | | H | Length in bytes of Message field. Note that a length of 0 is considered invalid and will result in a "transaction type" of 2 (partial responses) in ET28. |
| Message | Array[L0] of UINT8 | GL + 7 | | H | C12 request/response. |
| Record 1: | | | | | |
| Length (L1) | UINT16 | GL + 5 + L0 +2 | | H | Length in bytes of Message field. |
| Message | Array[L1] of UINT8 | GL + 7 + L0+2 | | H | C12 request/response. |
| … | | | | | |
| Record n: | | | | | |
| Length (Ln) | UINT16 | GL + 5 + L0+L1+ …+Ln-1 + (n×2) | | H | Length in bytes of Message field. |
| Message | Array[Ln] of UINT8 | GL + 7 + L0+L1+ …+Ln-1 + (n×2) | | H | C12 request/response. |
| Transaction number | UINT16 | B-2 | | H | Repeated for table content verification. |

# B.25 Extended Table 28 (ET28) (2076): Transaction Response Table

ET28 contains transaction responses (see clause 9.1). ET28 has the same format as ET27 and thus is not duplicated here. ET28 is a total of 1 785 bytes:

- Read access: OMAK.
- Write access: None.

# B.26 Extended Table 29 (ET29) (2077): Hardware Configurations

This table contains hardware configuration setup:

- Read access: OMAK.
- Write access: None.

**Table B.22**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| HW Options | Array[3] of UINT8 | 0 | | F | Bitmask of stuffed HW features on the meter where a 1 indicates the feature is present, 0 not present:<br>Bit 0: SO/KYZ<br>Bit 1: Pulse input 1<br>Bit 2: Pulse input 2<br>Bit 3: Relay 1 (Line 1)<br>Bit 4: Relay 2 (Line 1)<br>Bit 5: Disconnect and Buzzer<br>Bit 6: Relay 1 (Dry)<br>Bit 7: Relay 2 (Dry)<br><br>Bit 8: M-Bus module (enables M-Bus SW interface)<br>Bit 9: External Tamper<br>Bit 10: IEM module (enables MEP SW interface)<br>Bit 11: Disconnect sensor<br>Bit 12: Magnetic Tamper<br>Bit 13: Dimmer Fix (Disables software dimmer effect detection and fix if set)<br>Bit 14: Two line disconnect (separate open/close line)<br>Bit 15: Reserved<br><br>Bit 16-23: Reserved |
| HW Setup | UINT16 | 3 | | F | Bitmask of HW setup on the meter where 1 indicates setup apply and 0 not apply:<br><br>Bit 0: Single-phase<br>Bit 1: Poly-phase<br>Bit 2: CT<br>Bit 3: PCBA only (OEM)<br>Bit 4: DIN<br>Bit 5: BS<br>Bit 6: ANSI<br>Bit 7: DCM<br>Bit 8: Delta<br>Bit 9: P2P (Enable IEC IP meter features)<br><br>Bit 10-15: Reserved |

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| HW Internal Configuration | UINT8 | 5 | | F | Bitmask of stuffed HW features on the meter where a 1 indicates the feature is present, 0 not present:<br>Bit 0: Demand P/B<br>Bit 1-7: Reserved |
| IEM identification | | | | | |
| IEM ID[[0] | UINT8 | 6 | 1 | H | MFG identifier<br>0 = no MEP installed at factory<br>1 = Echelon M-Bus<br>2 …255 = Reserved for future use |
| IEM ID[1] | UINT8 | 7 | | H | HW type:<br>0 = M-Bus only or nothing if HW Options indicate M-Bus is not available<br>1 = Unpowered MEP<br>2 = Powered MEP (pMEP)<br>3 = ZigBee® IEM MEP<br>4..255 = Reserved for future use |
| IEM ID[2..5] | ARRAY[4] of UINT8 | 8 | 0 | H | MFG unique serial # |
| IEM ID[6] | UINT8 | 12 | 0 | H | Reserved for future use |
| IEM ID[7] | UINT8 | 13 | 0 | H | Reserved for future rse |
| IEM ID[8..9] | ARRAY[2] of UINT8 | 14 | 0x8001 | H | MEP SW Comms Definition |
| SW ID hi | | 14 | | | Bit 7 = 1 → remaining MEP ID bits define MEP bitmask functions supported<br>Bit 7 = 0 → remaining MEP Id bits define MEP functions supported (not as a bitmask) |
| SW ID lo | | 15 | | | When MEP ID hi Bit 7 → 1 :<br>Bit 0: supports M-Bus protocol<br>Bit 1: supports MEP bi-directional<br>Bit 2: supports P1 unidirectional<br>Bit 3: supports 802.15.4 (ZigBee®)<br>Bit 4: supports 802.15.4 (6LoWPAN)<br>Bit 5-7: Reserved |
| Image ID | UINT16 | 16 | | M | Determines compatible download images.<br>2.01 = 0x0001<br>2.10 = 0x0001 (yes, the same as 2.01)<br>3.01 = 0x0003<br>For 3.10 forward, hgh byte indicates memory size; low byte indicates compatible image, as:<br>3.10 256K = 0x0003<br>3.10 384K = 0x0103<br>3.10 512K = 0x0203 |
| ANSI Form Config Disabled | UINT8 | 18 | | H | Can be locked by control word bit 10 (disable phase config)<br>0: Default, allow changing the meter form (via MP43)<br>1: Disallow |
| NOTE: ZigBee is an example of a suitable product(s) available commercially. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of this (these) product(s). | | | | | |

# B.27 Extended Table 30 (ET30) (2078): Maximum power or current level control

This table contains the configuration information (programmed via MP22) and status of the maximum power or current level control:

- Read access: OMAK.
- Write access: None.

**Table B.23**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Primary to secondary switch time | LTIME_DATE | 0 | | M/H | Date time (UTC) to switch (or switched) active maximum power or current level from the primary to secondary level.<br>0 = there is no effective or pending primary to secondary switch command |
| Secondary level duration | UNT16 | 6 | | M/H | Duration in minutes to stay at the secondary level before switching back to the primary level.<br>0 = indefinitely stay in the secondary level until a secondary to primary switch command is sent via MP22 |
| Active power or current level | UINT8 | 8 | | M | Indicates the currently active power or current level<br>0 = none active, max power or control is disabled<br>1 = primary level active2 = secondary level active<br>ET46.11 decides whether this field applies for power or current |

## B.28 Extended Table 31 (ET31) (2079): Meter One-Time Read Log

This table is a log of snapshots of the current register data (BT23) taken at user-specified dates/times. ET31 is identical in structure to BT26. The size may be different. One-time reads are requested via MP24 "Post One-Time Read Request":

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table B.24**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Order | BOOL(0) | 0 | FALSE | F | One-time read records are transported in ascending order (N is older than N+1). |
| Overflow | BOOL(1) | 0 | | M | This flag is set when the one-time read memory has over flowed, causing old data to be overwritten. |
| List type | BOOL(2) | 0 | TRUE | F | The log is a circular queue. (Reads FALSE if max entries is 0). |
| Inhibit overflow | BOOL(3) | 0 | FALSE | F | The meter does not inhibit new entries when overflow occurs. |
| Filler | FILL(4..7) | 0 | | | |
| Number of valid entries | UINT8 | 1 | | M | Number of records with valid data. Range is 0 to ET11.15. |
| Last entry element | UINT8 | 2 | 0 | F | Array element of the most recent valid entry. Range is 0 to ET11.15 -1. |
| Last entry sequence number | UINT16 | 3 | | M | Sequence number of the most recent operation. This value is never reset. |
| Number of unread entries | UINT8 | 5 | | M,H | Number of records that have not been read. This field is incremented by the meter and decremented by the host as records are read. Range is 0 to ET11.15. |
| One-time read entries | Array of the following: | | | | Size of this array is found in ET36 |
| Length | UINT16 | 6 | | M | Number of bytes of billing read information (the entire entry space is still reserved if unused). |
| Transaction number | UINT16 | 8 | | M | From request queue. |
| Execution status | UINT8 | 10 | | M | 0 = Normal<br>1 = Late arrival (arrived at meter after scheduled time)<br>2 = Delayed (arrived ahead of scheduled time but was executed late, probably due to a power failure). |
| Result | UINT8 | 11 | | M | (0 = Empty slot) - N/A<br>(1 = Request not yet completed) - N/A<br>(2 = Request rejected) - N/A<br>(3 = In progress) - N/A<br>4 = Success<br>(5 = No response) - N/A<br>(6 = Failed) - N/A. |
| Billing read | SelfReadDataRecord | 12 | | M | See BT26. |

## B.29 Extended Table 32 (ET32) (2080): MEP One-Time Read Log

This table is a log of MEP billing data read at user-specified dates/times. ET32 has a list header structure identical structure to BT26, and log entry structure identical to ET16. One-time reads are requested via MP24 "Post One-Time Read Request":

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table B.25**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Order | BOOL(0) | 0 | FALSE | F | One-time read records are transported in ascending order (N is older than N+1). |
| Overflow | BOOL(1) | 0 | | M | This flag is set when the one-time read memory has over flowed, causing old data to be overwritten. |
| List type | BOOL(2) | 0 | TRUE | F | The log is a circular queue. (Reads FALSE if max entries is 0). |
| Inhibit overflow | BOOL(3) | 0 | FALSE | F | The meter does not inhibit new entries when overflow occurs. |
| Filler | FILL(4..7) | 0 | | | |
| Number of valid entries | UINT8 | 1 | | M | Number of records with valid data. Range is 0 to ET11.16.. |
| Last entry element | UINT8 | 2 | 0 | F | Array element of the most recent valid entry. Range is 0 to ET11.16 -1. |
| Last entry sequence number | UINT16 | 3 | | M | Sequence number of the most recent operation. This value is never reset. |
| Number of unread entries | UINT8 | 5 | | M,H | Number of records that have not been read. This field is incremented by the meter and decremented by the host as records are read. Range is 0 to ET11.16. |
| One-time read entries: | Array of the following: | | | | The size of this array is found in ET36. |
| Length | UINT16 | 6 | | M | Number of bytes of relevant information including the 0 terminator byte and all header fields except this length field (the entire entry space is still reserved if unused). |
| Transaction number | UINT16 | 8 | | M | From request queue. |
| Handle | UINT16 | 10 | | M | Handle of the device represented by this entry. |
| Execution status | UINT8 | 12 | | M | 0 = Normal<br>1 = Late arrival (arrived at meter after scheduled time)<br>2 = Delayed (arrived ahead of scheduled time but was executed late, probably due to a power failure). |
| Result | UINT8 | 13 | | M | (0 = Empty slot) - N/A<br>(1 = Request not yet completed) - N/A<br>2 = Request rejected<br>(3 = In progress) - N/A<br>4 = Success<br>5 = No response<br>6 = Failed. |
| Billing read | MBR | 14 | | M | MBR = M-Bus Billing Read<br>For M-Bus entries, see ET16 for definition of records posted here).<br>For MEP entries, the definition of records posted here are different from those posted in ET16 and ET45, and is as defined by the following three fields (Timestamp, Reserved and Data fields). |
| Timestamp | LTIME_DATE | 14 | | M | Timestamp of last successful read |
| Reserved | UINT8 | 20 | | | Field reserved; used by M-Bus entries only |
| Data | ARRAY[ET36.ET32EntrySize - 15] of UINT8 | | | | Data passed in by MEP device |

# B.30 Extended Table 33 (ET33) (2081): Group Configuration

This table contains the group configuration. Each meter can be assigned one or more group IDs for different purposes. Group broadcasts are processed only on meters with an ID in ET33 corresponding to an ID in the broadcast request. See MP27 and clause 8.14 for more information:

- Read access: OMAK.
- Write access: OMAK.

**Table B.26**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Group ID List | ARRAY[ET11.18] OF UINT16 | 0 | | H | List of group IDs assigned to this meter. By definition, a group ID of 0 is not a group |

# B.31 Extended Table 34 (ET34) (2082): MEP Device Configuration 2

This table holds additional MEP device configuration parameters:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICANAK.

**Table B.27**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Device Config | ARRAY [ET11.0] of ET11.13-byte structure | | | | Additional configuration information for each M-Bus device |
| Time sync format | UINT8 | 0 | | H | Time to be used in all time sync requests:<br>0 = Local (default)<br>1 = UTC |
| Time sync period | UINT8 | 1 | 24 | H | Number of hours between periodic time syncs to the device:<br>0 = disable periodic time sync<br>24 = (default) |
| Group Mask | UINT8 | 2 | 0 | H | Any bit location can be set to a 1 to include this MEP device in one of 8 possible groups for receiving multicast messages |
| Event Log Trigger Mask | UINT8 | 3 | | H | Mask to be compared to data in MEA alarm to determine if an event should be logged. Any bit set will trigger the event |
| LP Poll Rate | UINT16 | 4 | 60 | H | Maximum poll rate of the device for LP purposes in minutes |
| Control MDT | UINT8 | 6 | 0 | H | MDT defining a control status field (0 means none). This field corresponds to the MDT field in ET57 |
| Command Monitor MDT | UINT8 | 7 | 0 | H | MDT defining a command to monitor (0 means none). This field corresponds to the MDT field in ET57 |
| Time Stamp MDT | UINT8 | 8 | 0 | H | MDT defining the DRH of the time stamp in the VDB (0 means none). This field corresponds to the MDT field in ET57 |
| Hour Locator | UINT(0..4) | 9 | 0 | H | Starting bit # (1 based) of the hours in the time stamp |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| | UINT(5..7) | 9 | 0 | H | Bit count for the hours field in the time stamp |
| Minute Locator | UINT(0..4) | 10 | 0 | H | Starting bit # (1 based) of the minutes in the time stamp |
| | UINT(5..7) | 10 | 0 | H | Bit count for the minutes field in the time stamp |
| LP poll wait | UINT8 | 11 | 0 | H | Seconds to wait before first poll after end of LP interval |
| LP poll retries | UINT8 | 12 | 0 | H | Max times to retry before giving up getting a synchronized read during end of interval polling (0..254) |
| LP poll retry wait | UINT8 | 13 | 0 | H | Seconds to wait after each LP poll before retrying. Time shall be long enough to allow for previous attempt to complete otherwise retry may not occur |
| M-Bus Medium | UINT8 | 14 | 0 | H | Directs auto-discovered M-Bus devices to this index based on the device "medium" |
| Unused | ARRAY[7] of UINT8 | | | | Spare reserved for future use |

## B.32 Extended Table 35 (ET35) (2083): Manufacturer Specific

Reserved for later use.

## B.33 Extended Table 36 (ET36) (2084): Mfg Actual Dimensions

This table holds the actual configuration dimensions of the mfg tables that are adjustable. It is updated only via MP06 or MP37.

ET36 defines MFG logs will the following properties:

1) They use a standard header (same as BT26).

2) They post an alarm when there are unread entries (BT03::Mfg Log Entry Available).

3) Their unread entries can be decremented via MP26.

4) The posted alarm is automatically cleared after using MP26 if all logs report 0 unread entries.

Note that care shall be taken to read the entries "safely". In particular, the entries shall be read in a way that ensures they did not change while they were being read. This could be done by using a transaction or by reading the header after reading the entries and ensuring that the read entries were not overwritten due to wrap around (by using the sequence number and the last element index).

It is sufficient to read the P fields in ET36 once for a given program ID. Most M fields in ET36 can also be found in the IDT (ET42). Note that it is not necessary to read the "current entries" field from ET36 to read a log as, the "number of valid entries" field as found in the standard header can be read instead:

- Read access: OMAK.
- Write access: None.

**Table B.28**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Count | UINT8 | 0 | 5 | P | Number of mfg tables described in this list |
| Actual Dimension List: | ARRAY[Count] of 17-byte records | | | | |
| Table | TABLE_IDC | 1 | | F | Table ID |
| Tbl_Proc_Nbr | UINT(0..10) | | | F | Table number of log |
| Basic_vs_Ext_Flag | BOOL(11) | | | F | 0 = Basic table; 1 = Extended table |
| Procedure Flag | BOOL(12) | | | F | N/A |
| Flags | UINT(13..15) | | | F | Reserved for future use |
| Entry size | UINT16 | 3 | | P for ET38, M for ET31, ET32, ET41, ET45 | Size in bytes of an entry in the specified table, not including the list header<br>ET31: 232 (Default before demand is configured)<br>ET32: adjustable, configured via MP37, default is 525 (509 bytes of actual device data)<br>ET38: 35<br>ET41: variable, current configured value will be copied here based on MP32<br>ET45: adjustable, configured via MP37, default is 525 (509 bytes of actual device data) |
| Max entries | UINT16 | 5 | | P for ET38, M for ET31, ET32, ET41, ET45 | Maximum number of entries for this list.<br>ET31: 253<br>ET32: 253 (assuming smallest meaningful entry size)<br>ET38: 253<br>ET41: 253 (assuming smallest nonzero dmd config<br>ET45: 253 (assuming smallest meaningful entry size) |
| Current entries | UINT16 | 7 | | M | Number of list entries currently configured (via MP06, MP37, or MP32, as appropriate) The mfg defaults are:<br>ET31: 2<br>ET32: 8<br>ET38: 10<br>ET41: 0 (configured only via MP32)<br>ET45: 0 |
| Flags: | UINT8 | 9 | | | |
| Length Included | BOOL(0) | | | P | TRUE indicates a 2-byte length precedes each log entry. The length is the number of bytes of meaningful data in this read, and is less than Entry Size |
| Unused | UINT(1..7) | | | M | Reserved for future use |
| Spare | ARRAY[8] of UINT8 | 10 | | | Reserved for future use |
| Unread Entries Bitmap | ARRAY[(Count/8) + 1] of UINT8 | (Count × 10) + 1 | | M | This bitmap has a 1 set for each log that has unread entries. The order of the bits is the same as the order of the logs that precede it in ET36, with the first table being the LSB |

# B.34 Extended Table 37 (ET37) (2085): Build Information

This table holds some build information:

- Read access: OMAK.
- Write access: None.

**Table B.29**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Build Time | ARRAY[21] of CHAR | 0 | | M | Date and time this version is build |
| Build Type | UINT8 | | | | |
| Debug Build | BOOL(0) | 21 | | M | 0 = This is release build<br>1 = This is debug build |
| Test Build | BOOL(1) | 21 | | M | 0 = This is a normal build<br>1 = This is a test build |

# B.35 Extended Table 38 (ET38) (2086): Manufacturer Specific

Reserved for later use.

# B.36 Extended Table 39 (ET39) (2087): Previous Demand

This table contains the demand values calculated at the end of the last demand sub-interval for each of the configured demand registers. It is values are zeros before demand is activated and configured:

- Read access: OMAK.
- Write Access: None.
- Attributes: ICANAK.

**Table B.30**

| Field name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Previous demands | ARRAY[BT21.4] of NI_FMAT1 | | | M | In the order listed in BT22. |
| Reserved | ARRAY[BT20.4 - BT21.4] of NI_FMAT1 | 4 × BT21.4 | 0 | M | Reserved for the up to 8 total demands, if less than 8 are presently configured. |

# B.37 Extended Table 40 (ET40) (2088): Demand Configuration

This table contains some configuration for demand and demand reset. Changing the demand reset time of day in ET40 at an inappropriate time could cause a reset cycle to be missed. The recommendation is for System Software to apply an expiration to requests to change ET40:

- Read access: OMAK.
- Write Access: OMAK.

**Table B.31**

| Field name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| LCD EOI duration | UINT8 | 0 | | H | Duration of the LCD icon indicating demand end of interval (in seconds) |
| HW EOI duration | UINT8 | 1 | | H | Duration the selected hardware pin will be pulled high when indicating demand end of interval (in seconds) |
| Demand Reset Time | | | | | Local time of day to perform TOU controlled demand reset (provisioner should take care to not schedule demand reset around the DST switch times) |
| Hour | UINT8 | 2 | | H | Range 0 to 23 |
| Minute | UINT8 | 3 | | H | Range 0 to 59 |
| Option Flags: | | 4 | | | |
| Present Dmd Calculation | BOOL(0) | 4 | | H | The method by which present demand is calculated for BT28:<br>0 = Time value is time since last EOI<br>1 = Time value is entire interval length |
| Unused | UINT(1..7) | 4 | | | Reserved for future use |
| Reset Exclusion | UINT16 | 5 | | H | Seconds between sequential demand resets of the same type; this value in truncated minutes is copied to BT13.<br><br>PT and System software should not write value over 15 300 (255 minutes) to this field |
| Power Fail Exclusion | UINT16 | 7 | | H | Number of seconds after a valid power fail occurs to suspend demand calculations; this value in truncated minutes is copied to BT13<br><br>PT and System software should not write value over<br>15 300 (255 minutes) to this field |
| EOI Hardware Selection | UINT16 | 9 | | H | Choose hardware pin used for EOI indication<br>0 = No hardware available<br>1 = Use S0 pin for EOI indication<br>(see note). |
| NOTE: When using S0 for EOI, normal S0 pulsing is stopped. Start S0 test by setting ET01 S0 pulse width to 0xFFFF would override this setting. | | | | | |

# B.38 Extended Table 41 (ET41) (2089): Historical Demand Reset Log

This table is an adjustable log of previous demand reset data, including the latest demand reset data. The latest entry recorded here is also copied to BT25:

- Read access: OMAK.
- Write Access: None.
- Attributes: ICANAK.

**Table B.32**

| Field name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Order | BOOL(0) | 0 | FALSE | F | Demand reset records are transported in ascending order (N is older than N+1). |
| Overflow | BOOL(1) | 0 | | M | This flag is set when the demand reset memory has over flowed, causing old data to be overwritten. |
| List type | BOOL(2) | 0 | TRUE | F | The demand reset list is a circular queue. (Reads FALSE if max entries is 0). |
| Inhibit overflow | BOOL(3) | 0 | FALSE | F | The meter does not inhibit new entries when overflow occurs. |
| Filler | FILL(4..7) | 0 | | | |
| Number of valid entries | UINT8 | 1 | | M | Number of demand reset records with valid data. Range is 0 to ET36.ET41CurrentEntries. |
| Last entry element | UINT8 | 2 | 0 | F | Array element of the most recent valid demand reset entry. Range is 0 to ET36.ET41CurrentEntries. |
| Last entry sequence number | UINT16 | 3 | | M | Sequence number of the most recent demand reset operation. This value is never reset. |
| Number of unread entries | UINT8 | 5 | | M,H | Number of demand reset records that have not been read. This field is incremented by the meter and decremented by the host as records are read. Range is 0 to ET36. ET41CurrentEntries. |
| Demand reset entries: Array[ET36. ET41CurrentEntries] of: | | | | | Previous demand reset data. |
| Length | UINT16 | 6 | | M | Length of the entry, in bytes. |
| Reset reason | UINT8 | 8 | | M | The instigator for this reset record:<br>0 = Scheduled<br>1 = Procedural (MP33, MP34 executed)<br>2 = Push button<br>3 = Pending table activation. |
| BIDN | UINT16 | 9 | | M | BIDN for this entry. |
| BT25 | | 11 | | M | |

# B.39 Extended Table 42 (ET42) (2090): Interface Definition

This table holds the meter-specific interface definition. Only and all parameters which are changeable in the meter and affect the dimension and/or semantics of readable data are reflected here, i.e. program-id specific parameters and hardware configuration are not included.

Any time any information in ET42 changes, whether by an explicit SS or PT reconfiguration or as the result of a firmware upgrade, the interface change alarm in BT03 will be set.

**Warning:** Because of incorrect assumptions by version 2.21.06 and earlier DCs about the fixed portion of the IDT, it is recommended not to extend the fixed section of the IDT until all such older DCs are known to have been upgraded:

- Read access: OMAK.
- Write Access: None.

**Table B.33**

| Field name | Type | Offset | Represented by BIDN | Root Tbl Field (if app.) | Description |
|---|---|---|---|---|---|
| Table Length | UINT16 | 0 | | | Size of ET42, in bytes, including this field. |
| Fixed section length (FSL) | UINT8 | 2 | | | Size in bytes of the "fixed" part of ET42, up to Adjustable Log Info (including this length byte and the full Table Length field), used for determining if fields have been added to the "fixed" section. This field can also be used as an offset to the Adjustable Log Info. The adj log list is self-defining and new logs will be added to the end of the log list. The Sources list is defined by parameters in the fixed part of ET42. New source lists will be added to the end of the Sources section. See WARNING above. |
| Log list size (LLS) | UINT8 | 3 | | ET36.0 | Number of logs included in the Log List array below. |
| Interface Compatibility Setting | UINT16 | 4 | | ET54.0 | See ET54 field of same name for details. |
| C12.19 Compliance | UINT16 | 6 | | ET04.114 | See ET04 field of same name for details. |
| **Billing Interface Info:** | | | | | |
| Billing Interface Definition Nbr (BIDN) | UINT16 | 8 | Yes | | An identifier set by the calling device to identify billing related data in logs as pertaining to this configuration. This number is recorded in each entry of BT26 and ET31. (See note). |
| Flags: | UINT8 | 10 | | | |
| Dmd reset counter | BOOL(0) | | Yes | BT21.0.2 | TRUE if the number of demand resets is included with billing data, FALSE if not. |
| Cumulative dmd | BOOL(1) | | Yes | BT21.0.4 | TRUE if cumulative demand is configured and FALSE if not. |
| Continuous cum dmd | BOOL(2) | | Yes | BT21.0.5 | TRUE if continuous cumulative demand is configured and FALSE if not. |
| Demand configured | BOOL(3) | | Yes | ET48 | TRUE if demand feature has been configured, i.e. MP32 has been executed, at least once in this meter; FALSE if not. |
| Unread Log Entries Bitmap Enabled | BOOL(4) | | No | NA | TRUE if ET36.Unread Entries Bitmap is available in the current firmware. Cannot be enabled or disabled. |
| Number of self-reads | UINT8 | 11 | | BT21.2 | Number of self-read entries presently configured (MFG default 12). |
| Number of summations | UINT8 | 12 | Yes | BT21.3 | Number of accumulators reported in BT23. For a description of the summations, see tables BT22 and BT23. |

| Field name | Type | Offset | Represented by BIDN | Root Tbl Field (if app.) | Description |
|---|---|---|---|---|---|
| Number of demands | UINT8 | 13 | Yes | BT21.4 | Number of demand registers presently configured. |
| Number of coincident values | UINT8 | 14 | Yes | BT21.5 | Total number of coincident values presently configured. |
| Number of occurrences | UINT8 | 15 | Yes | BT21.6 | Number of max demands reported for each demand register. |
| Number of tiers | UINT8 | 16 | Yes | BT21.7 | Number of TOU tiers (rates) presently configured (default = 4). |
| Number of present demands | UINT8 | 17 | Yes | BT21.8 | Number of present demands reported in BT28. |
| Number of present values | UINT8 | 18 | Yes | BT21.9 | The number of instantaneous measurement values recorded in BT28. For a description of the present values, see tables BT27 and BT28. |
| Demand sub-interval | UINT8 | 19 | Yes | BT13.4 | Demand sub-interval in minutes as configured by MP32/33; will always be the same value for all configured demand registers. |
| Demand multiplier | UINT8 | 20 | Yes | BT13.5 | Demand interval multiplier in minutes as configured by MP32/33; sub-interval × interval multiplier => demand interval; will always be the same value for all configured demand registers. |
| Tier size | UINT16 | 21 | Yes | | Size in bytes of all the fields in a single tier in BT23. |
| **Load Profile Info:** | | | | | |
| Block Size | UINT32 | 23 | | ET21.8 | Block size in bytes of the currently running LP configuration. |
| Nbr of Blocks | UINT16 | 27 | | BT61.7 | Total number of blocks available for LP in the current configuration. |
| Number of channels | UINT8 | 29 | | BT61.11 and ET21.28 | The number of channels per interval for the present LP configuration. |
| Interval duration | UINT8 | 30 | | BT61.12 and ET21.29 | The time duration for two consecutive intervals for the present LP configuration. |
| Interval size | UINT8 | 31 | | ET21.25 | Size in bytes of one LP interval for the present configuration. |
| Options | UINT8 | 32 | | ET21.93 | Indicators of various LP features enabled. These features affect both the dimension and semantics of the LP data. See Root Table field for details. |
| Intervals per block | UINT16 | 33 | | BT61.9 | Number of intervals per block. |
| Block Start Hour | UINT8 | 35 | | ET21.89 | Start hour for block. |
| Block Start Minute | UINT8 | 36 | | ET21.90 | Start minute for block. |
| **History Log Info:** | | | | | |
| History log flags: | UINT8 | 37 | | BT71.0 | Flags denoting the presence or absence of optional fields. |
| Event Number | BOOL(0) | | | | |
| Date Time | BOOL(1) | | | | |
| Sequence Nbr | BOOL(2) | | | | |
| Inhibit Overflow | BOOL(3) | | | | |
| EL Inhibit Overflow | BOOL(4) | | | | |
| History log count | UINT16 | 38 | | BT71.5 | Number of entries stored in the History Log. |
| History log entry size | UINT8 | 40 | | BT71.3 | Size of the argument field in the History Log, in bytes. |

| Field name | Type | Offset | Represented by BIDN | Root Tbl Field (if app.) | Description |
|---|---|---|---|---|---|
| **Miscellaneous Info:** | | | | | |
| **** See WARNING above **** | | | | | |
| **Adjustable Log Info:** | | | | | |
| Log list: | ARRAY[LLS] of UINT24 | ET42.FSL | | | |
| Meter OTR log count | UINT8 | ET42.FSL | | ET36.7 | Number of list entries currently configured. |
| Meter OTR entry size | UINT16 | ET42.FSL + 1 | | ET36.3 | Max entry size currently configured. |
| M-Bus OTR log count | UINT8 | ET42.FSL + 3 | | ET36.24 | Number of list entries currently configured. |
| M-Bus OTR entry size | UINT16 | ET42.FSL + 4 | | ET36.20 | Max entry size currently configured. |
| Config ID log count | UINT8 | ET42.FSL + 6 | | ET36.41 | Number of list entries currently configured. |
| Config ID entry size | UINT16 | ET42.FSL + 7 | | ET36.37 | Max entry size currently configured. |
| Demand Reset log count | UINT8 | ET42.FSL + 9 | | ET36.58 | Number of list entries currently configured. |
| Demand Reset entry size | UINT16 | ET42.FSL + 10 | | ET36.54 | Max entry size currently configured. |
| M-Bus Recurr log count | UINT8 | ET42.FSL + 12 | | ET36.75 | Number of list entries currently configured. |
| M-Bus Recurr entry size | UINT16 | ET42.FSL + 13 | | ET36.71 | Max entry size currently configured. |
| **Sources**: | | | | | For various features. |
| Demand sources | ARRAY[ET42.NbrDmdSrcs] of UINT8 | ET42.FSL + 3 × ET42.LLS | Yes | BT22.[ET42.NbrSumms] | List of source identification numbers for each demand. For a description of the demands, see BT23. |
| Coincident sources | ARRAY[ET42.NbrCoinValsof UINT8 | ET42.FSL + 3 × ET42.LLS + ET42.NbrDmdSrcs | Yes | BT22.[ET42.NbrSumms + ET42.NbrDmdSrcs +1] | A list of sources that are collected with each demand measurement. Coincident sources are entered in the same order as the demand sources, i.e. coincidents 1 and 2 are associated with demand 1, coincidents 3 and 4 are associated with demand 2. |
| LP extended sources | ARRAY[ET42.NbrChans] of UINT16 | ET42.FSL + 3× ET42.LLS + ET42.NbrDmdSrcs + ET42.NbrCoinVals | | BT62 and ET21.30-37, ET21.70-77 | Extended source IDs for the channels selected for logging. Note that if ET04.107.1 is set to 0, then the extended source IDs will be limited to the 8-bit values from ET21 and will not be mapped to any extended source ID values from ET66. |
| MDTT current entries | UINT8 | ET42.FSL + 3 × ET42.LLS + ET42.NbrDmdSrcs + ET42.NbrCoinVals + 2 × ET42.NbrChans | No | ET57 | Number of ET57 non-zero entries added to the IDT. |

| Field name | Type | Offset | Represented by BIDN | Root Tbl Field (if app.) | Description |
|---|---|---|---|---|---|
| MDTT entries | ARRAY[ET42.MdttEntries] of MdtEntry (4 bytes each, see ET57) | ET42.FSL + 3× ET42.LLS + ET42.NbrDmdSrcs + ET42.NbrCoinVals + 2×ET42.NbrChans + 1 | No | ET57 | MDT Entries from ET57 with non-zero MDT values. |
| NOTE: The unique correlation of this nbr to a specific configuration is not enforced or guaranteed by the meter. | | | | | |

# B.40 Extended Table 43 (ET43) (2091): Test Mode Configuration

This table holds the configurations needed for test mode.

- Read access: OMAK.
- Write access: OMAK.

**Table B.34**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Test mode duration | UINT8 | 0 | 15 | H | The number of minutes that test mode will be activated |
| Test mode demand interval | UINT8 | 1 | 5 | H | The interval in minutes the demand is calculated |
| Active demand source | UNIT8 | 2 | 3 | H | 0: Forward<br>1: Reverse<br>2: Fwd + Rev<br>3: Fwd - Rev (default) |
| Reactive demand source | UINT8 | 3 | 0 | H | 0: Import (default)<br>1: Export |
| Enable test mode | UINT8 | 4 | 0 | H | 0: Test mode disabled<br>1: Test mode enabled |
| NOTE: This field can be write protected by the first bit of control word. | | | | | |

# B.41 Extended Table 44 (ET44) (2092): Test Mode Status

This table holds test mode status:

- Read access: OMAK.
- Write access: None.

**Table B.35**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Present active demand | INT32 | 0 | | M | Unit: W |
| Present reactive demand | INT32 | 4 | | M | Unit: var |
| Previous active demand | INT32 | 8 | | M | Unit: W |
| Previous reactive demand | INT32 | 12 | | M | Unit: var |
| Current interval active energy | INT32 | 16 | | | Active energy accumulated since the start of current interval, Wh |
| Current interval reactive energy | INT32 | 20 | | | Active energy accumulated since the start of current interval, varh |
| Time remaining - total | INT16 | 24 | | M | In seconds |
| Time remaining - interval | INT16 | 26 | | M | In seconds |

## B.42 Extended Table 45 (ET45) (2093): MEP Recurring Read Log

ET45 is a log of MEP billing data. ET45 has a list header structure identical structure to BT26, log entry structure identical to ET16, plus some additional fields. Scheduled (non-urgent) reads only are recorded to ET45. Entries are filled as much as the capacity permits, unrelated to the capacity of ET16. See ET14 for information on which statuses are updated there corresponding to entries logged in ET45:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

**Table B.36**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Order | BOOL(0) | 0 | FALSE | F | Log records are transported in ascending order (N is older than N+1). |
| Overflow | BOOL(1) | 0 | | M | This flag is set when the log memory has over flowed, causing old data to be overwritten. |
| List type | BOOL(2) | 0 | TRUE | F | The log is a circular queue. (Reads FALSE if max entries is 0). |
| Inhibit overflow | BOOL(3) | 0 | FALSE | F | The meter does not inhibit new entries when overflow occurs. |
| Filler | FILL(4..7) | 0 | | | |
| Number of valid entries | UINT8 | 1 | | M | Number of records with valid data. Range is 0 to ET36.ET45_CurrentEntries. |
| Last entry element | UINT8 | 2 | 0 | F | Array element of the most recent valid entry. Range is 0 to ET36.ET43_CurrentEntries-1. |
| Last entry sequence number | UINT16 | 3 | | M | Sequence number of the most recent operation. This value is never reset. |
| Number of unread entries | UINT8 | 5 | | M,H | Number of records that have not been read. This field is incremented by the meter and decremented by the host as records are read. Range is 0 to ET36.ET45_CurrentEntries. |
| Log entries: | Array of the following: | | | | The size of this array is found in ET36. |
| Length | UINT16 | 6 | | M | Number of bytes of billing read information including the handle and 0 terminator byte (M-Bus only), but not the length field (the entire entry space is still reserved if unused). |
| filler | UINT16 | 8 | | M | Reserved for future use. |

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Handle | UINT16 | 10 | | M | Handle of the device represented by this entry. |
| Execution status | UINT8 | 12 | | M | 0 = Normal<br>2 = Delayed (entry is a power-up backfill). |
| Result | UINT8 | 13 | | M | 4 = Success |
| Data | MBR | 14 | | M | MBR = MEP Read (see ET16 for definition). |

# B.43 Extended Table 46 (ET46) (2094): Control Output Read Only Data

This table contains control output data that are read only. Including the configuration information (programmed via MP22) and status of the maximum power level control:

- Read access: OMAK.
- Write access: None.

**Table B.37**

| Field name | Type | Offset | Value | F/M/H | Description | Rell # |
|---|---|---|---|---|---|---|
| Disconnect lock open time | LTIME_DATE | 0 | | M/H | Date time (UTC) to lock open the Disconnect<br>0 = there is no scheduled lock open request. | |
| Disconnect lock open Duration | UNT32 | 6 | | M/H | Duration in seconds for Disconnect to stay at the locked open state.<br>0 = indefinitely stay locked open until this schedule is override, cancelled or another schedule is requested. | |
| Disconnect trip value select | UINT8 | 10 | | M/H | Value used for disconnect max power<br>0 = forward + reverse power<br>1 = forward power<br>2 = forward - reverse power<br>(see note). | |
| Disconnect control type | UINT8 | 11 | | M/H | Value used for disconnect control type<br>0 = max power control<br>1 = max current control. | 3.30 |
| Current control type | UINT8 | 12 | | M/H | Value used for current control type: Look at per-phase current in BT28 or use calculated all phase current<br>0 = single phase<br>1 = all active phases. | 3.30 |

# B.44 Extended Table 47 (ET47) (2095): Calendar Override Settings

This table holds additional TOU calendar-related settings. If a type 2 cancellation is in effect, a rewrite of ET47 for a type 2 cancellation with the same or different tariff will restart the duration timer. All writes are evaluated appropriately:

- Read access: OMAK.
- Write access: OMAK.

**Table B.38**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Scheduled manual override properties: | | | | | |
| Tariff | UINT8 | 0 | 255 | HD, HI | Tariff to set<br>Tariff = 255 cancels any override presently in effect. |
| Cancellation | UINT8 | 1 | | HD, HI | 0 = At next calendar-driven tier switch<br>1 = Indefinite<br>2 = After the configured duration<br>3 = At the specified absolute local time (below). |
| Override Duration | UINT32 | 2 | | HD, HI | Duration of the override, in seconds. A value of 0 results in no switch. |
| Cancellation time | LTIME_DATE | 6 | | HD, HI | Local date/time (UTC)the override is to be cancelled. |
| Calendar ID | UINT32 | 12 | | HD, HI | Identifier in effect while override is in effect, does not overwrite BT54 value. |

# B.45 Extended Table 48 (ET48) (2096): Feature Activation Table

This table contains the optional features that have been activated, in the order activated:

- Read access: OMAK.
- Write access: None.

**Table B.39**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Activated feature count | UINT16 | 0 | | M | The number of features that have been activated. If there are N features, then the active features will be at indices 0..N-1 |
| Activations | ARRAY[ET11.23] OF 8-byte records: | 2 | | M | An array of activation records; all records may not be populated but they are reserved for expansion |
| Feature | UINT16 | 2 | | M | Feature Number as follows:<br>0 = demand |
| Activation Time | STIME_DATE | 4 | | M | Time the activation occurred (UTC) |
| Activation State | BOOL(0) | 9 | | M | 1 => Activated when release locked |
| Activation Key Valid | BOOL(1) | 9 | | M | 1 => Activation key was authorized (should always be 1 if previous bit is 1) |
| Configured | BOOL(2) | 9 | | M | 1 => Feature has been configured (e.g. for Demand, MP32 has been executed) |
| | FILL(3..7) | 9 | | M | |

# B.46 Extended Table 49 (ET49) (2097): LCD Output Table

This table contains the current contents of the display. ET49 can be locked so that an arbitrary pattern can be forced onto the display. The lock option is expected to be used in manufacturing or by internal test groups when the meter is not in release mode (and thus ET49 can be written):

- Read access: OMAK.
- Write access: None.

**Table B.40**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| Flags | UINT8 | 0 | | H | |
| Lock LCD | BOOL(0) | 0 | TRUE | H | If set, locks the display to match the display buffer below. |
| Unused | BOOL(1..7) | 0 | | | Reserved for future use. |
| Display buffer | ARRAY[32] of UINT8 | 1 | TRUE | H | The contents of the display as defined by the LCD segment map as documented in clause 8.9.1. |

# B.47 Extended Table 50 (ET50) (2098): MEP Inbound Data Space

This table holds status and controls relevant to the MEP device and is normally only modified by the MEP device:

- Read Access: OMAK.
- Write Access: OMAK.
- Attributes: ICANAK.

**Table B.41**

| Field Name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Identification String | Array[30] of BCD | 0 | 0 | M | MEP Self-identification |
| MEP Flags | UINT8: | 30 | | M | Flags modified by MEP device |
| MEP Device Registered | BOOL(0) | 30 | 0 | M | Set by the MEP device as a means to indicate its presence |
| ET59 Response | BOOL(1) | 30 | 0 | M | Set by the MEP to indicate responses go in ET59 |
| M-Bus alerts | BOOL(2) | 30 | 0 | M | Set by the MEP to indicate it wants M-Bus alerts, specifically, ET13.8(3) |
| Delta Data alerts | BOOL(3) | 30 | 0 | M | Set by the MEP to enable Delta Data Alerts |
| Unused | BOOL(4..7) | 30 | | | Reserved |
| Data Sources Icon Display Control | Array[ET11.22] of UINT16 | 31 | | M | Bitmap controls which icons are displayed when the associated data source is displayed. Values may be ORed together:<br>0: None<br>1: Euro<br>2: Dollar<br>4: Date<br>8: Time<br>16: kvarh<br>32: kWh<br>64: kvar<br>128: kW<br>256: negative (-) |
| Data Sources | Array[ET11.22] of NI_FMAT1 | 31 + 2 × ET11.22 | | M | Array of Data Sources, referenced by source number as listed in BT16 to be used for load profile and display |
| MEP icon display control | | | | | Controls how each MEP communication icon should be displayed<br>0 = OFF<br>1 = ON<br>2 = FLASH one second on and one second off |
| House icon | UINT(0..3) | 31 + 6 × ET11.22 | 0 | M | House icon |
| Short bar | UINT(4..7) | 31 + 6 × ET11.22 | 0 | M | Short bar icon |

| Field Name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Medium bar | UINT(0..3) | 32 × 6 × ET11.22 | 0 | M | Medium bar icon |
| long bar | UINT(4..7) | 32 + 6 × ET11.22 | 0 | M | Long bar icon |

# B.48 Extended Table 51 (ET51) (2099): MEP Device Configuration

This table holds configuration parameters for the MEP device that control how the meter treats the MEP interface:

- Read access: OMAK.
- Write access: OMAK.

**Table B.42**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| MEP Flags | UINT8 | 0 | | H | MEP Configuration flags. |
| Enable Optical D.O.S. timer | BOOL(0) | 0 | TRUE | H | True: Enforce Optical Denial-of-service (D.O.S.) timers.<br>False: Do not enforce D.O.S. timers. |
| Monitor MEP Health | BOOL(1) | 0 | 0 | H | True: Enable monitoring of the MEP serial port requests for device status purposes. |
| Reset Device Down MEP | BOOL(2) | 0 | 0 | H | True: Asserts MEP_RESETN when MEP Health Timeout period has elapsed. |
| Unused | BOOL(3..6) | 0 | | H | |
| Disable MEP | BOOL(7) | 0 | FALSE | H | When set to TRUE disables all MEP operations in the meter. |
| MEP Health Timeout | UINT16 | 1 | 60 | H | Number of seconds of MEP inactivity before the device is flagged as "down" in ET14. |
| On-demand Timeout | UINT8 | 3 | 30 | H | Number of seconds before an on-demand queue entry in ET15 is considered expired and marked with "No Response". |
| Optical Session Timeout | UINT16 | 4 | 600 | H | Number of seconds before an optical session is terminated for Denial of Service protection. |
| Optical Session Hold-Off | UINT16 | 6 | 300 | H | Number of seconds that the optical session is held off (disallowed) after a session timeout. |
| MEP Down Reset Duration | UINT8 | 8 | 1 | H | Number of seconds to assert MEP_RESETN when asserted. A value of 0 translates to 1. |

# B.49 Extended Table 52 (ET52) (2100): MEP Transaction Request Table

This table contains transaction requests from the MEP device and is identical in structure to ET27 and is not duplicated here. Access levels of the operations within this transaction table are controlled by the access level at which the table is written to:

- Read access: OMAK.
- Write access: None.
- Attributes: ICANAK.

# B.50 Extended Table 53 (ET53) (2101): MEP Transaction Response Table

This table contains transaction responses for the transactions requested in ET52 and is identical in structure to ET28 and is not duplicated here:

- Read access: OMAK.
- Write access: None.

# B.51 Extended Table 54 (ET54) (2102): Meter Status

This table holds information needed by other components of the system. It is similar to ET04 in this regard however it is read only and thus contains information that is for status only:

- Read access: OMAK.
- Write access: None.
- Attributes: ICASRC (due to change to Interface Compatibility Settings via commission process).

**Table B.43**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Interface Compatibility Settings | UINT16 | 0 | | H | Interface Compatibility Settings |
| ICS - ICA NAK | BOOL(0) | 0 | | H | 1 = Turn on ICA NAK; turn off MEP recurring reads going to ET16 |
| ICS - Blg/LP format 2 | BOOL(1) | 0 | | H | 1 = DC can handle billing data and LP data in all 3.1 formats |
| ICS - Unused | BOOL(2..15) | 0 | | H | |
| BT24 BIDN | UINT16 | 2 | | M | The BIDN in effect at the time of recording of BT24. This field shall be read with BT24 in order to correctly interpret its contents |
| Current meter form configuration | UINT8 | 4 | 1 | M | Shows the current configuration of meter form<br>0 = None ANSI meter (default)<br>1 = Auto detect the current form<br>2 = Force meter use Form 2S<br>3 = Force meter use Form 12S |
| Load side state | UINT16 | 5 | | M | For 3.1 ANSI meter. Detected LSV and load side state from ADC<br>Bit 0..2: LSV status<br>0: in transition (just changed state or powered up)<br>1: present but phase cannot be determined<br>2: present on phases indicated by next 3 bits (If all 3 bits are 0 then this condition is not present)<br>3: indeterminate (cannot be determined in current conditions)<br>4: out of range (in a unknown band)<br><br>Bit 3..5: per phase (A to C) LSV indicators<br>0: not present on this phase<br>1 : present on this phase<br>Bit 6..7 reserved<br><br>Bit 8..10: load sensing status |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| | | | | | 0: : in transition (just changed state or powered up) 1: present but phase cannot be determined<br>2: present on phases indicated by next 3 bits (If all 3 bits are 0 then this condition is not present)<br>3: : indeterminate (cannot be determined in current conditions)<br>4: out of range (in a unknown band)<br>Bit 11..13: per phase (A to C) load sensing indicators<br>0: not present on this phase<br>1 : present on this phase<br>Bit 14..15 reserved |
| DC Time | LTIME_DATE | 7 | | M | The RTC value of the DC (DCM only) |
| DC Power Down Time | LTIME_DATE | 13 | | M | The time of the last power down in DC time (DCM only) |
| Misc Flags | UINT16 | 19 | | M | Miscellaneous Flags (unused) |
| DC Neuron ID | ARRAY'[6] of UINT8 | 21 | | M | Neuron of local DC (DCM only) |
| | | | | | |
| DCM icon state | UINT16 | 27 | | M | Bit 0&1 Arrows, bit 2&3 WAN, bit4&5 WAN_B1, bit6&7 WAN_B2, bit8&9 WAN_B3<br>0 =off, 1 = on, 2 = flash |
| DCM DC processor reset disable | UINT8 | 29 | | M | 0 = DC processor will be reset by meter processor for given conditions<br>1 = DC processor will not be reset by meter processor |
| DC reset cause | UINT8 | 30 | | M | 0 = "RESET_CAUSE_POWERUP",<br>1 = "RESET_CAUSE_PANIC",<br>2 = "RESET_CAUSE_CACHE_FLUSH_FAILURE",<br>3 = "RESET_CAUSE_CLOCK_WRAPAROUND",<br>4 = "RESET_CAUSE_EXTERNAL_REQUEST",<br>5 = "RESET_CAUSE_LOCAL_REQUEST",<br>6 = "RESET_CAUSE_BOOT_API",<br>7 = "RESET_CAUSE_NO_MEMORY",<br>8 = "RESET_CAUSE_WATCHDOG",<br>9 = "RESET_CAUSE_UNKNOWN",<br>10 = "RESET_CAUSE_MODEM_DOWN",<br>11 = "RESET_CAUSE_UNKNOWN_EXCEPTION",<br>12 = "RESET_CAUSE_TAMPER",<br>13 = "RESET_CAUSE_BUFFER_EXHAUSTION",<br>14 = "RESET_CAUSE_WAN_INACTIVE",<br>15 = "RESET_CAUSE_MEMORY_LIMIT_EXCEEDED",<br>16 = "RESET_CAUSE_SERIAL_ERROR",<br>17 = "RESET_CAUSE_LON<br><br>Only reset cause 0, 8, 11, 17 are used by meter |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Short stack version number | UINT8 | 31 | | M | |
| Auto Offsets | ARRAY[6] OF INT16 | 32 | | M | Auto offset calculation results, these numbers will be use by the meter internally to calibrate out offsets |
| Tier Drives | UINT8 | 44 | | M | Miscellaneous Tier Drives. If BT55.Tier Drive = 3 check this field for actual reason. If all these fields = 0 then override is effect |
| Over Power Threshold Exceeded | BOOL(0) | 44 | FALSE | M | 1: Over power threshold being exceeded for over the power threshold time |
| Waveform buffer ADC highest value | UINT16 | 45 | | M | Highest ADC value (average of 1 cycle samples not scaled) of the last waveform detection time |
| Waveform buffer ADC lowest value | UINT16 | 47 | | M | Lowest ADC value (average of 1 cycle samples not scaled) of the last waveform detection time |
| PLC mode | UINT8 | 49 | | H | The following P2P meter related fields reflects the settings of Manufacturer Procedure - P2P configure |
| Immediate PLC mode transition | UINT8 | 50 | | H | |
| synchronized transition timeout | UINT16 | 51 | | H | |
| Auto mode duration | UINT16 | 53 | | H | |
| WAN adaptor off during external mode | UINT8 | 55 | | H | |
| IHD communication time out | UINT8 | 56 | | H | The above P2P meter related fields reflects the settings of Manufacturer Procedure - P2P configure |
| Disconnect random op pending | UINT8 | 57 | | M | Reserved for future use |
| Disconnect random duration | UINT16 | 58 | | M | Reserved for future use |
| Disconnect random start duration | UINT16 | 60 | | M | Reserved for future use |
| Relay random op pending | UINT8 | 62 | | M | 0 = No pending relay random operation<br>1 = Relay random operation pending |
| Relay random duration | UINT16 | 63 | | M | In Seconds. Remaining Random duration of pending relay operation. This value decreases by 1 every second |
| Relay random start duration | UINT16 | 65 | | M | In Seconds. Random duration of pending relay operation calculated in the beginning of each pending request. If relay random op pending is 0 then this indicates the duration of the last pending operation |
| PLC attenuation overwrite setting | UINT8 | 67 | | M | Reflects configuration set by MP49. See MP49 for detail |

## B.52 Extended Table 55 (ET55) (2103): Meter Configuration

This table holds various configurations for the meter:

- Read access: OMAK.

- Write access: OMAK.

**Table B.44**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| THD config | UINT8 | 0 | 0 | H | 0: VTHD and ITHD are calculated using Method 1<br>1: VTHD and ITHD are calculated using Method 2<br>See Total harmonic distortion (THD) information in clause 8.8 for detail. |
| Form 2S config | UINT8 | 1 | 0 | H | 0: Single phase mode. Energy, voltage and current of two measurement element are reported on phase L1.<br>1: Two phase mode. Line voltage are event distributed to phase L1 and L3. |
| Delta Clock Event Minimum Seconds | UINT8 | 2 | 0 | H | Minimum seconds of adjustment required to log a clock adjustment event (event codes 3 and 4 resulting from MP16). 0 means log all. |
| Flags | UINT8 | 3 | | | |
| Suppress Phase Inversion Alarm | BOOL(0) | 3 | FALSE | H | 1: Suppress Phase Inversion Alarm. |
| DC Discovery | BOOL(1) | 3 | TRUE | H | 1: Enabled DC Discovery. |
| Enable volt lo display | BOOL(2) | 3 | FALSE | H` | 1: Enable volt lo display at power off, only apply to DCM. |
| Enable over power threshold | BOOL(3) | 3 | FALSE | H | 1: Enable over power threshold monitor and tier forcing. |
| A/C-Band RX/TX interlock enable | BOOL(4) | 3 | FALSE | H | 1: A/C-Band interlock is enabled. This option is not implemented. |
| Delta Time Adjustment Increment | UINT8 | 4 | 1 | H | The seconds increment of the clock change within a single minute for a delta time adjustment; range 1 to 20; upper limit is enforced by the meter |
| Disable Optional Features | UINT32 | 5 | 0 | H | Bitfields for disabling optional features by rejecting the feature activation via MP31. From the lowest bit to the highest bit they map features 0 - 31 for MP31<br><br>For each bit/feature<br>0: MP31 Feature Activation for this feature is enabled<br>1: MP31 Feature Activation for this feature (or more) is disabled<br><br>Also refer to the following bit list for other features disabled by each bit<br>(see note 1). |
| | BOOL(0) | 5 | FALSE | | 1: MP31 activation for demand feature, MP32 and MP33 access denied. |
| DC PXE enable | UINT8 | 9 | 0 | H | Enable/disable DC PXE, will be locked by control word mfg access. |
| DC Discovery Wait | UINT16 | 10 | 10 | H | Seconds to wait after power up processing complete before initiating the active search phase (sending ATM messages) of DC discovery. Range 0 to 600. |
| DC Discovery Spacing | UINT16 | 12 | 16 | H | Number of DCMs or meters assumed to be present that could respond to a general discovery request. |
| DC Discovery Threshold | INT8 | 14 | -84dB | H | Messages with signal strength less than this are ignored during DC discovery and for PLC icon update purposes. (-84 dB means accept all). |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| PLC Active Timeout | UINT16 | 15 | 60 | H | Minutes of PLC inactivity before clearing the PLC icon and stopping responses to ATM "in comm. with DC" queries. |
| DC reset buzzer disable | UINT8 | 17 | TRUE | H | Enable/disable beep when meter resets DC, and get the PXE message from DC. |
| DCM Out Of Gas threshold | UINT16 | 18 | 0 | H | If the primary DC voltage is below this threshold, DC processor will be turned off immediately, Will be locked by control word mfg access. |
| DCM Primary DC Volt thresholds | ARRAY[15] OF UINT16 | 20 | 0 | H | Thresholds that meter check against after Earlier Power Fail is detected, if the Primary DC voltage at different time is below the corresponding thresholds, the DC Processor will be turned off. Will be locked by control word mfg access. |
| Disable Table Read Write Control | UINT8 | 50 | 0 | H | Bitfields for disabling read or write or both access of part or whole of 1 or more tables.<br>For each bit<br>0: This bit does not control read/write access of any table<br>1: This bit disables read/write access of tables as specified in the following bit list (see note 2). |
| | BOOL(0) | 50 | FALSE | | 1: Disables BT64 read. |
| | BOOL(1) | 50 | | | 1: Disables the write access of ET55->Disable measurement correct for dimmer effect. |
| | BOOL(2) | 50 | | | 1: Block MP11 execution by returning error code 3 - conflict with current setup. |
| | BOOL(3) | 50 | | | 1: Disables the write access of ET40 EOI configurations, including EOI LCD duration, EOI hardware duration and EOI hardware selection. |
| DC reset time out threshold | UINT8 | 51 | 10 | H | In minute, the threshold will be limited to [3, 30] minute. If a number smaller than 3 and bigger than 30 is written to this filed, the table will accepted it, but force the limit to [3, 30] internally. |
| Scheduled LCD Message ID | Array [4] of UINT8 | 52 | | H | Text to display in 4 left most characters on the LCD |
| Scheduled LCD Message ID DP State | UINT8 | 56 | | H | 4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP, bit 3 = left-most DP. |
| Scheduled LCD Message text | Array [8] of UINT8 | 57 | | M | Text to display in 8 right side. |
| Scheduled LCD Message Display Start Time | LTIME_DATE | 65 | 1 | M | Date time (UTC) to start displaying the message ID and text. |
| Scheduled LCD Message Display End Time | LTIME_DATE | 71 | 1 | M | Date time (UTC) to end displaying the message ID and text. |
| Message override control | | | | | |
| Disable Message Override | BOOL(0) | 77 | | H | Whether LCD push button action can override the message.<br>0 = Enable message override<br>1 = Disable message override. |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Message Overridden | BOOL(1) | 77 | | M,H | This flag is set if message is overridden by LCD push button or if user wants to cancel the schedule or stop the message displaying<br>0 = Message still active and not overridden<br>1 = Message inactive and overridden. |
| Phase Loss Threshold Seconds | UINT16 | 78 | 10 | H | Threshold, in seconds, for generating phase loss event. |
| Billing Register Control | UINT8 | 80 | | | This byte can be write protected by the control word bit 0 DISAB_BILL_REG. |
| Disable Energy Accumulator configuration | BOOL(0) | 80 | TRUE | | 1 (TRUE): Disables ET60 write. |
| Disable consumption based tariff | BOOL(1) | 80 | FALSE | | 1 (TRUE): Disables over power (or consumption based) threshold monitoring and consumption based tariff control. Only when this bit is FALSE and ET55.3.3 enable over power threshold is TRUE will the over power (or consumption based) threshold monitoring and consumption based tariff control be in effect. |
| Disable calendar override | BOOL(2) | 80 | FALSE | | 1 (TRUE): Disables write access to ET47 calendar override and ETP47 pending calendar override write. Disables MP15 set tariff by retuning a conflict error code 3. |
| Over power threshold | UINT32 | 81 | 0 | H | Power level (in W) the selected over power source is compared with. |
| Over power time threshold | UIN16 | 85 | 0 | H | Threshold, in second, for over power threshold tier control. |
| Over power threshold tier | UINT8 | 87 | 0 | H | Tier to force when over power threshold is exceeded. Range is 0 to BT20.7 - 1. |
| Over power source | UINT8 | 88 | 0 | H | Instantaneous value used for over power evaluation<br>0 = forward + reverse power<br>1 = forward power<br>2 = forward - reverse power<br>(see note 3). |
| Reserved | UINT8 | 89 | FALSE | H | |
| Reserved | UINT8 | 90 | TRUE | H | |
| Reserved | UINT8 | 91 | 48 | H | |
| Reserved | UINT8 | 92 | 40 | H | |
| Transformer secondary rated current | UINT8 | 93 | 1 | H | The current rating on the secondary side of the external current transformer. |
| Clock Error Calendar ID | UINT32 | 94 | 0 | H | Calendar ID to be used when there is a Clock Error. Note that Over Power takes precedence over Clock Error. |
| Over Power Calendar ID | UINT32 | 98 | 0 | H | Calendar ID to be used when over power tariff is in effect. Note that Over Power takes precedence over Clock Error. |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| P2P PLC attenuation level | UINT8 | 99 | 0 | H | 0 = Attenuate 6 dB<br>1 = Attenuate 12 dB<br>2 = Attenuate 18 dB<br>3 = Attenuate 24 dB<br>4 = Attenuate 30 dB<br>5 = Attenuate 36 dB<br>6 = Attenuate 42 dB<br>7 = Attenuate 48 dB<br>255 = No attenuation<br>After changing this attenuation level, the meter needs to be power cycled TWICE for the new level to take effect. Allow the meter to be powered on at least 5 seconds after the first power cycle to ensure the new setting is correctly written to the Neuron. First power cycle causes the new setting to be written to Neuron's NVM, second power cycle causes the new setting be read out of NVM to RAM for it to take effect. |
| Cover Tamper Duration | UINT16 | 100 | 10 | H | Duration in seconds for which a cover tamper shall be TRUE before recording the alarm. A value of 0 disables cover tamper alarms in this mode. |
| Cover Tamper Power Quality Duration | UINT16 | 102 | 10 | H | Duration in seconds affecting qualification of power quality + tamper events. A value of 0 disables cover tamper alarms in this mode. |
| Cover Tamper Power Quality Events Mask | UINT16 | 104 | 0 | H | Any one or all of the following PQ events can be configured to qualify the tamper event. |
| Phase loss | BOOL(0) | | 0 | H | A coincident new unqualified phase loss event. |
| Current on no voltage | BOOL(1) | | 0 | H | A coincident new unqualified current on no voltage event. |
| Subsequent power outage | BOOL(2) | | 0 | H | A subsequent power outage. |
| Preceding or coincident power outage | BOOL(3) | | 0 | H | A preceding or coincident power outage. |
| | BOOL(4..15) | | | | Reserved for future use. |
| NOTE 1 This field can be write protected by the third bit (calibration data control) of control word.<br>NOTE 2: This field can be write protected by the third bit (calibration data control) of control word.<br>NOTE 3: Meter uses Ferraris method for instantaneous power calculation so forward power equals forward - reverse power. | | | | | |

## B.53 Extended Table 56 (ET56) (2104): Load side state calibration

This table is used to calibrate and detect some load side states related to load side voltage and load sensing:

- Read access: OMAK.
- Write access: None.

**Table B.45**

| Field name | Type | Offset | Value | F/M/H | Description |
|---|---|---|---|---|---|
| … | | | | | |
| Raw ADC average value | UINT16 | 0 | | M | In ADC digits. Average value of load side state ADC raw data over the last 10 seconds. 0 - 1 023<br>Setting this field to 0xFFFF starts the averaging calculation and the average value will first get updated to 0xFFFE after that and then updated to the real average 10 seconds later. |
| Load side state band drip range | UINT8 | 2 | 75 | M | In ADC digits. Each band base value plus or minus this range to get the upper or lower edge of this band. |
| **Band base value**: | ARRAY[11] of UINT16 | | | | Each band's calibrated base value, ET11.24 specifies the current used bands |
| Base value | UINT16 | 3 | | F | Calibrated base value, MFG should copy the raw average value to this field for each setup. Here is the mapping of array index to actual connection. Note that setting any base value to over 1 023 disables the band check<br>0 - No LSV and no load sensed<br>1 - Load On Unknown Phase (no LSV)<br>2 - Load On All Phases; (no LSV) for ANSI meters phases A and C; for IEC meters phases A, B and C<br>3 - Load On A only (no LSV)<br>4 - Load On B only (no LSV)<br>5 - Load On C only (no LSV)<br>6 - LSV On Unknown Phase<br>7 - LSV On All Phases; for ANSI meters phases A and C; for IEC meters phases A, B and C<br>8 - LSV On A only<br>9 - LSV On B only<br>10 - LSV On C only<br><br>Default values:<br><br>95, 315, 890, 65 535, 65 535, 690, 65 535, 535,1 060, 65 535, 65 535. |
| Waveform peak to peak threshold | UINT16 | 25 | 40 | F | Reserved not used. |
| Waveform detection time | UINT8 | 27 | 20 | H | Reserved not used. |
| Rolling time | UINT8 | 28 | 40 | H | Reserved not used. |
| Temperature compensation | UINT16 | 29 | 43 | F | Reserved not used. |

## B.54 Extended Table 57 (ET57)(2105): M-Bus Data Type Table

This table holds an array of mappings of M-Bus DRH to M-Bus Data Type index.

Each entry contains a 3 byte DRH. If 3 bytes is not sufficient, then subsequent entries can be set as "extension" entries. In this case, the 3 bytes of DRH in the extension are concatenated onto those from the previous entry(s).

Note that when the Type is MEP Base Entry, the DRH field will be interpreted as follows:

- Byte 0: Offset into message.
- Byte 1: Length to compare.
- Byte 2: Command byte(s) to compare (possibly continued into next block, depending on length).

ET57 is an ICA NAK table. It will return a NAK if an interface change alarm is pending.

The default settings for ET57 will be defined in a way that is likely to provide the correct values needed for NTA. These values are TBD:

- Read access: OMAK.
- Write access: OMAK.
- Attributes: ICASRC, ICANAK.

**Table B.46**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Array[ET11.25] of MdtEntry | | | | H | MDT Entry Array |
| MdtEntry | | | | | |
| Entry Type | UINT(0..1) | 0 | 0 | | Entry Type:<br>0: Empty<br>1: M-Bus Base entry<br>2: MEP Base entry<br>3: Extension of previous entry |
| MDT | UINT(2..6) | 0 | | | M-Bus Data Type (ignored for extensions) |
| Special | UINT(7) | 0 | | H | Entry has "special" meaning for LP (ignored for extensions) |
| DRH | Array[3] of UINT8 | 1 | | H | 3 bytes of DRH |

## B.55 Extended Table 58 (ET58)(2106): MEA Status Extension

This table holds an array of MEA status by index:

- Read access: OMAK.
- Write access: None.

**Table B.47**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Device Status | ARRAY [ET11.0] of MeaStatus | | | | Status for each MEA device |
| Control Status | UINT8 | 0 | | M | Latest status value. Value is defined by control MDT in ET34 |
| Unused | ARRAY[19] of UINT8 | | | | Spare reserved for future use |

## B.56 Extended Table 59 (ET59)(2107): MEP Procedure Response

This table is a duplicate of table BT08. Depending on the setting of ET50.30.1 procedure responses are posted to either BT08 or ET59. The use of ET59 eliminates conflicts with PLC procedures responses. The structure of ET59 s identical to BT08 and is not documented here:

- Read access: OMAK.
- Write access: None.

# B.57 Extended Table 60 (ET60) (2108): Configurable Energy Accumulator Settings

This table holds various configurations for the meter:

- Read access: OMAK.
- Write access: OMAK.

**Table B.48**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Use Ferraris method | BOOL(0) | 0 | 0 | H | 0: per-phase method<br>1: Ferraris method<br>When a meter is configure as Delta meter, per-phase method is not applicable. Delta meter will always use Ferraris method regardless. So this field should be set to Ferraris method and locked disable when the meter is configured as Delta meter to avoid confusing. |
| Disable negative energy values | BOOL(1) | 0 | 0 | H | 0: Allow negative values<br>1: Disallow. |

# B.58 Extended Table 61 (ET61)(2109): Time-Based Relay Control

This table contains the calendar for Time-Based Relay Control. There are ten switches per day, and the meaning of each block of ten depends on the current mode. See the field "Time-Based Relay Control Mode" in ET05: Control Output Settings:

- Read access: OMAK.
- Write access: OMAK.

**Table B.49**

| Field name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Relay Switches | ARRAY[ET11.26] of RelayControlRcd | | | | |
| RelayControlRcd: | | | | | |
| Relay State | UINT(0) | 0 | | H | Relay state that begins at this time:<br>0 = open<br>1 = closed |
| Filler | FILL(1..4) | 0 | | | |
| Minute | UINT(5..10) | 0 | | H | Start minute of new state |
| Hour | UINT(11..15) | 0 | | H | Start hour of new state |

NOTE 1: Operation of Time-Based Relay Control is controlled by fields in ET05: Control Output Settings.

NOTE 2: The initial value of all switches is zero.

NOTE 3: A switch time of zero indicates the end of the list of switches for a particular day with the exception of the first switch in each day, which is midnight, as in the TOU calendar.

NOTE 4: The order of schedules in the table is as follows, depending on the mode:

Weekday:

0 - Sunday
1 - Monday
2 - Tuesday
3 - Wednesday
4 - Thursday
5 - Friday
6 - Saturday

Weekday/Weekend:

0 - Weekday
1 - Weekend

Season:

0 - Season 0
1 - Season 1
2 - Season 2
3 - Season 3

Season Weekday/Weekend:

0 - Season 0 Weekday
1 - Season 0 Weekend
2 - Season 1 Weekday
3 - Season 1 Weekend
4 - Season 2 Weekday
5 - Season 2 Weekend
6 - Season 3 Weekday
7 - Season 3 Weekend

- When "Time-Based Relay Control Mode" in ET05: Control Output Settings is "Season" or "Season Weekday/Weekend", the season functionality of BT54: Calendar will be used.

## B.59 Extended Table 62 (ET62) (2110): Load Profile Display Configuration

This table holds format and ID codes of 16 load profile channels when load profile is displaying on the LCD:

- Read access: OMAK.
- Write access: OMAK.

**Table B.50**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| **Flags** | UINT8 | | | | |
| Display local time | BOOL(0) | 0 | FALSE | H | 0: Display load profile data in UTC time<br>1: Display load profile data in local time. |
| Use All Channel ID chars | BOOL(1) | 0 | FALSE | H | 0: Use first 2 chars of extended status ID code followed by displaying channel number (01 - 16)<br>1: Use all 4 chars of extended status ID code. |

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Disable Load Profile Display | BOOL(2) | 0 | FALSE | H | 0: Allow load profile display<br>1: Disable load profile display. LP list name can be displayed but date and interval level cannot be entered |
| Load profile list ID Code | Array [4] of UINT8 | 1 | "P01" | H | ID for load profile list name display<br>Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD |
| Load profile list ID DP State | UINT8 | 5 | 4 | H | DP state for load profile list name display<br>4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP, bit 3 = left-most DP |
| Load profile date ID Code | Array [4] of UINT8 | 6 | "DATE" | H | ID for load profile date display<br>Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD |
| Load profile date ID DP State | UINT8 | 10 | | H | DP state for load profile date display<br>4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP, bit 3 = left-most DP |
| Interval Time ID Code | Array [4] of UINT8 | 11 | "TIME" | H | ID for load profile interval time display<br>Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD |
| Interval Time ID DP State | UINT8 | 15 | | H | DP state for load profile interval time display<br>4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP, bit 3 = left-most DP |
| Extended status ID Code | Array [4] of UINT8 | 16 | "STAT" | H | ID for extended status display<br>Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD |
| Extended status ID DP State | UINT8 | 20 | | H | DP state for extended status display<br>4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP, bit 3 = left-most DP |
| **Code Word:** | Array[BT60.11] of 6-byte records: | 21 | | | |
| **ID Format:** | | 4-character ID code, entered here in ASCII format. | | | |
| ID Code | Array [4] of UINT8 | 21 | CH01" - "CH16" | H | Array element 0 = left-most id filed on LCD, array element 3 = right-most id field on LCD |
| ID DP State | UINT8 | 25 | | H | 4 bits that indicate state of DP with associated ID character. 1 = ON, 0 = OFF, bit 0 = right-most DP, bit 3 = left-most DP |
| **Data Format:** | UINT8 | 26 | | | |
| Fields After DP | UINT(0..2) | 26 | | H | Number of fields after the decimal point to be shown on the LCD display, range 0 to 3, together with next field not greater than 8 |
| Fields Before DP | UINT(3..6) | 26 | | H | Number of fields before the decimal point to be shown on the display, per source, ordered by BT16 source number. range1 to 8, together with previous field not greater than 8 |
| Zero Suppression | BOOL(7) | 26 | | H | Zero Suppression = TRUE hides leading zeros; Zero Suppression = FALSE shows all leading zeros up to the number of digits configured in Fields Before DP. |

# B.60 Extended Table 66 (ET66) (2114): Load Profile Source ID Mapping Table

This table contains a mapping of mapped source IDs to extended source IDs. The mapped source IDs are standard source ID values 112 through 163. The first entry in ET66 contains the extended source ID for standard source ID 112, the second for 113, etc. ET66 is changed only via MP11:

- Read access: OMAK.
- Write Access: None.
- Attributes: ICANAK.

**Table B.51**

| Field name | Type | Value | F/M/H | Description |
|---|---|---|---|---|
| Extended Source IDs | ARRAY[BT60.11] of UINT16 | | H | An extended source ID for a mapped source ID of value N where N is the 112 + "table offset"/2. For example, a mapped source of 114 is at offset 4. Extended source IDs are defined in clause A.14. |

# B.61 Extended Table 67 (ET67) (2115): Display Source ID Mapping Table

This table contains a mapping of mapped source IDs to extended source IDs. The mapped source IDs are standard source ID values 112 through 163. The first entry in ET67 contains the extended source ID for standard source ID 112, the second for 113, etc.:

- Read access: OMAK.
- Write Access: OMAK.
- Attributes: ICANAK.

**Table B.52**

| Field name | Type | Value | F/M/H | Description |
|---|---|---|---|---|
| Extended Source IDs | ARRAY[BT30.4] of UINT16 | | H | An extended source ID for a mapped source ID of value N where N is 112 + "table offset"/2. Extended source IDs are defined in clause A.14. |

# B.62 Extended Table 68 (ET68)(2116): Critical Events

This table is similar to BT72, in that the order of events is the same, so the table can be indexed by event number. However, in place of a simple Boolean that determines whether the event is logged or not, the user enters the critical event category to which an event belongs, with 0 meaning none. The number of critical event categories is fixed at ten, but the user need not utilize all ten categories.

For more information, see clause 8.12.1.1:

- Read access: OMAK.
- Write access: OMAK.

**Table B.53**

| Field name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Category | UINT8 | 0 | | H | Critical event category the event belongs to. There is a 1-byte entry for each event BT72.<br>Range 1 to 10 |

NOTE: When ET68 is written, no events currently in the event log will be considered critical, since the definition has changed and the log cannot be rescanned. All new events will obey the new critical event definitions.

# B.63 Extended Table 69 (ET69)(2117): Critical Event Bitmasks

This table allows the user to set up bitmasks to select a subset of a given event Id by evaluating its argument. The argument is evaluated as follows when an event Id is found in the table:

(EventArgument & ET69.Mask) == ET69.Value

If the above is true, the event is considered critical. If the above is false, the event may still be considered critical based on another bitmask in table B.54.

If the event Id is found in the table, and no bitmasks match, the event is not considered critical.

For more information see clause 8.12.1.1:

- Read access: OMAK.
- Write access: OMAK.

**Table B.54**

| Field name | Type | Offset | Default Value | VCI | Description |
|---|---|---|---|---|---|
| Array[10] of BitmaskInfo | | | | H | |
| BitmaskInfo | | | | | |
| Event ID | UINT16 | 0 | | H | ID of the event the bitmask applies to |
| Mask | UINT16 | 2 | | H | Mask of bits to be compared (to eliminate Do not Care bits) |
| Value | UINT16 | 4 | | H | Comparison value (shall be exact match) |

NOTE 1: ET69 is dimensioned by the new field Max Critical Event Bitmasks in ET11: MFG Dimension, which currently has the value of 10.

NOTE 2: Because of the Event ID field, multiple bitmasks can be defined for a particular event.

NOTE 3: Event ID 0 is defined as "No Event". This value will be used to indicate that a bitmask slot is not in use.

NOTE 4: It is assumed that there are no holes in the table. Searching will begin with the first entry, and when an Event ID of 0 is encountered, it will be assumed that the remainder of the table does not contain valid entries, and the search will be terminated.

NOTE 5: When ET69 is written, no events currently in the event log will be considered critical, since the definition has changed and the log cannot be rescanned. All new events will obey the new critical event definitions.

# B.64 Extended Table 70 (ET70)(2118): RAM only status

This table contains status variables that is stored in RAM only and would get reset to 0 upon power cycle:

- Read access: OMAK.
- Write Access: None.

**Table B.55**

| Field name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Current Display Index | UINT8 | 0 | | M | The current display index:<br><br>0-29: Normal display item<br>0-4: Mbus discovery mode display item<br>0-5: Test mode display item<br><br>249: Disconnect open text<br>250: Disconnect operation failure text<br>251: Caution code screen 1<br>252: Caution code screen 2<br>253: Error code screen 1<br>254: Error code screen 2<br>255: All segments lit |
| Second level display mode | UINT8 | 1 | | M | |
| Second level display on | BOOL(0) | 1 | | M | 1 = second level display on |
| Displaying second level list | UINT(1..4) | 1 | | M | 0 = all segment lit<br>1 = load profile display list<br>255 = End |
| Displaying second level Depth | UINT(5..7) | 1 | | M | 0 = list name<br>For list 1<br>1 = date<br>2 = interval |
| Displaying LP block number | UINT16 | 2 | | M | The currently displaying load profile data block index |
| Displaying LP interval number | UINT16 | 4 | | M | Array index of the displaying interval in the block<br>0xFFFF = not displaying interval or displaying "End" in the interval level |
| Displaying LP date | STime_Date | 6 | | M | Currently displaying load profile data date<br>All FF = not displaying LP date or interval in that date or displaying "End" in the date level |
| Displaying LP interval data type | UINT8 | 11 | | M | The currently displaying load profile interval data type<br>0 = Time<br>1 = Extended status<br>2 = Channel data |
| Displaying LP interval channel number | UINT8 | 12 | | M | The currently displaying load profile channel index (0 based) |
| Short stack application version number | ARRAY[3] OF UINT8 | 13 | | M | |
| Short stack core version number | ARRAY[3] OF UINT8 | 16 | | | |

# B.65 Extended Table 71 (ET71) (2119): MEP Delta Data and Config

This table contains the control and status for the MEP Delta Data Alert feature. It is stored in RAM only and will be reset to the listed default values upon power cycle:

- Read Access: OMAK.
- Write Access: OMAK.
- Attributes: ICANAK.

**Table B.56**

| Field Name | Type | Offset | Default Value | F/M/H | Description |
|---|---|---|---|---|---|
| Array[ET11.27] of Delta Data and Config | | | | M,H | |
| Delta Data and Config | | | | | |
| Delta Data Monitor Source | UINT16 | 0 | 255 | H | Extended Source ID of this monitor source, or 255 for "Not in Use" |
| Configured Delta | UINT16 | 2 | 0 | H | Delta comparison value for this Monitor Source. Set by MEP. A value of zero implies that delta data alerts are disabled for this monitor point |
| Comparison Value | NI_FMAT1 | 4 | 0 | M, H | Current comparison value for delta monitoring of this data source. Set by meter when delta is reached and Alert is set. Also can be set by MEP |
| Sampled Data Value | NI_FMAT1 | 8 | 0 | M | Current value of the data source. Overwritten by the meter once per second |
| Status | UINT8: | 12 | 0 | M, H | DDM Status Flags |
| Source ID Invalid | BOOL(0) | 12 | 0 | M | Set by meter when Delta Data Monitor Source ID is invalid |
| Alert State | BOOL(1) | 12 | 0 | M | Set by meter when this source has resulted in an Alert state |
| Spares | UINT(2..7) | 12 | 0 | M | Unused |

The extended sources IDs that can be used for this feature are:

- Standard (type 0): Sub-type 0 - All standard source IDs are allowed except for "mapped" IDs.
- MEP (type 1): All are allowed. For MEP (index 4) if the device is not registered the ID is invalid.
- Demand (type 2): Sub-types 0,1, and 2. The ID is considered invalid if Demand is not activated and configured.
- Types 3 (misc) and 4 (MDT) are not supported.

# B.66 Extended Table 1038 (ET1038) (3086): Manufacturer Specific

Reserved for later use.

# B.67 Extended Table 4143 (ET4143) (6191): Calendar Override Settings

ET4143 is the pending table for ET47, to be activated at some future date/time. The format and content of ET4143 is identical to ET47, The content of ET4143 is copied to ET47 when the Pending Event Description (PED) indicates that it is time to do so. See BT04 for a description of the PED:

NOTE: A Pending Event Description (PED) may precede any read (full or partial) or write (full or partial) of ET4143. The PED does not affect the offset used to access table entries. See clause 8.2.1 for a use case realization of reading and writing ET4143.

- Read access: OMAK.
- Write access: OMAK.

# B.68 Extended Table 4156 (ET4156) (6204): Configurable Energy Accumulator Settings

ET4156 is the pending table for ET60, to be activated at some future date/time. The format and content of ET4156 is identical to ET60, The content of ET4156 is copied to ET60 when the Pending Event Description (PED) indicates that it is time to do so. See BT04 for a description of the PED:

NOTE: A Pending Event Description (PED) may precede any read (full or partial) or write (full or partial) of ET4156. The PED does not affect the offset used to access table entries. See clause 8.2.1 for a use case realization of reading and writing ET4156.

- Read access: OMAK.
- Write access: OMAK.

# Annex C (normative): Basic Procedures

## C.1 Basic Procedure 04 (BP04): Reset List Pointers

BP04 is used to reset list control variables to their initial state, reflecting no entries or blocks read. The self-read alarm in table BT03 is not affected by calls to this procedure:

- Execution access: OMAK.

**Table C.1: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| List | UINT8 | 3 | | H | 2 = Self read data (BT 26)<br>3 = Load profile data set 1 (BT 64)<br>7 = All LP data sets<br>8 = History Log (BT74)<br>255 = All lists |

**Table C.2: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.3: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | Procedure not completed. Used with All lists option. Procedure is partially done because the control words disable writing to the self-read data. |
| 2 | Invalid List parameter. |
| 5 | No authorization. Used with self-read data option. Procedure cannot be executed because the control words disables writing to the self-read data. |

## C.2 Basic Procedure 05 (BP05): Update Last Read Entry

This procedure updates the number of entries read by the host for a specific log in the OSGP device. This procedure is the only available mechanism to record in the OSGP device how many entries or blocks have been read. The host system should invoke this procedure after every log read. The self-read alarm in table BT03 will be auto-cleared if there are no more unread entries as a result of calling this procedure:

- Execution access: OMAK.

**Table C.4: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| List | UINT8 | 3 | | H | 2 = Self read data (BT 26)<br>3 = Load profile data set 1 (BT 64)<br>7 = All LP data sets<br>8 = History Log (BT74)<br>255 = All lists |
| Entries Read | UINT16 | 4 | | H | Number of entries or blocks read by a host for the list selected above. |

**Table C.5: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.6: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid List parameter |

# C.3 Basic Procedure 06 (BP06): Change Mode

BP06 is used to put the OSGP device in to and out of stop mode. This procedure can only be executed via the optical port:

- Execution access: None.

**Table C.7: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Metering mode | BOOL(0) | 0 | 0 | F | This bit is not used in the OSGP device. |
| Test mode | BOOL(1) | 0 | 0 | H | True: Start test mode.<br>False: Stop test mode. |
| OSGP device shop mode | BOOL(2) | 0 | 0 | F | OSGP device shop mode is not supported. |
| Filler | FILL(3..7) | 0 | | | |

**Table C.8: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.9: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 3 | ET43 does not have a valid test mode configuration or test mode disabled |

# C.4 Basic Procedure 10 (BP10): Set Date and Time

This procedure sets the OSGP device system (non-DST) clock and calendar immediately to a specified time. This procedure expects UTC time entered as the input parameter. The time zone offset, written before this procedure is called, is applied within the OSGP device. It is strongly recommended that this procedure NOT be used after the OSGP device is installed. See procedure EP16 for an alternate method to adjust the OSGP device system clock:

- Execution access: OMAK.

**Table C.10: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Set time | BOOL(0) | 3 | | H | 0 = Do not set time.<br>1 = Set time. |
| Set date | BOOL(1) | 3 | | H | 0 = Do not set date.<br>1 = Set date. |
| Set time date qualifier | BOOL(2) | 3 | False | F | N/A. The OSGP device recalculates all calendar qualifiers based on the new time and date entered. |
| Filler | FILL(3..7) | 3 | | | |
| Date time | LTIME_DATE | 4 | | H | New date and time in UTC. |
| Day of week | UINT(0..2) | 10 | | F | N/A. The OSGP device recalculates all calendar qualifiers based on the new time and date entered. |
| Daylight savings time | BOOL(3) | 10 | False | F | N/A. The OSGP device recalculates all calendar qualifiers based on the new time and date entered. |
| Greenwich mean time | BOOL(4) | 10 | False | F | N/A. The OSGP device recalculates all calendar qualifiers based on the new time and date entered. |
| Time zone applied | BOOL(5) | 10 | False | F | N/A. The OSGP device recalculates all calendar qualifiers based on the new time and date entered. |
| DST applied | BOOL(6) | 10 | False | F | N/A. The OSGP device recalculates all calendar qualifiers based on the new time and date entered. |
| Filler | FILL(7..7) | 10 | | | |

**Table C.11: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Date and time before | LTIME_DATE | 4 | | M | System date and time in the OSGP device just before this procedure was executed. |
| Date and time after | LTIME_DATE | 10 | | M | System date and time in the OSGP device just after this procedure was executed. |

**Table C.12: Error Result Codes**

| Code Returned | Reason |
|---|---|
| (None) | |

## C.5 Basic Procedure 12 (BP12): Activate All Pending Tables

This procedure immediately activates all pending tables, regardless of the activation date specified within their PED. There is no data in the request or response for this procedure:

- Execution access: OMAK.

**Table C.13: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.14: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.15: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | No pending table was found that matched the request. |
| 3 | An internal conflict occurred when attempting to process the request. |

# C.6 Basic Procedure 13 (BP13): Activate Specific Pending Tables

This procedure immediately activates the any pending table with a matching PED. The request contains a PED. There is no response data for this procedure:

- Execution access: OMAK.

**Table C.16: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| PED | | 3 | | | See BT04 |

The format of the "PED" field is shown below.

**Table C.17: Pending Event Description**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Event Code | UINT(0..3) | 0 | | H | Specify the condition upon which the pending table should be activated:<br>0: Based on an absolute time specified in the "Event Storage" field.<br>1: Based on a relative time specified in the "Event Storage" field. The time is relative to when the table write is received by the OSGP device.<br>2: No meaning attached to the data, so no automatic activation will be performed. The pending table defined in BT4150 can still be activated using BP12 or BP13 when this value is chosen. |
| Self Read Flag | BOOL (4) | 0 | | H | If True, the OSGP device will perform a Self-read before pending table is activated. |
| Demand Reset Flag | BOOL (5) | 0 | | H | If True, the OSGP device will perform a demand reset before pending table is activated. |
| Event Storage | ARRAY[5] OF CHAR | 1 | | H | If Event Code is 0, this is an STIME_DATE. (in UTC). If STIME_DATE is all zeroes, this indicates an empty PED.<br>If Event Code is 1, these 5 bytes are in the order of weeks/days/hours/minutes/seconds.<br>If Event Code is 2, data is opaque. |

**Table C.18: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.19: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | No pending table was found that matched the request. |
| 3 | An internal conflict occurred when attempting to process the request. |

# C.7 Basic Procedure 14 (BP14): Clear All Pending Tables

This procedure clears the pending state of all pending tables. The data in the pending tables is not modified. There is no data in the request or response for this procedure:

- Execution access: OMAK.

**Table C.20: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.21: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.22: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | No pending table was found that matched the request. |
| 3 | An internal conflict occurred when attempting to process the request. |

# C.8 Basic Procedure 15 (BP15): Clear Specific Pending Tables

This procedure clears the pending state of any pending table with a matching PED. The data in the affected pending tables is not modified. The request contains a PED. The format of the "PED" field is shown below.

**Table C.23: Pending Event Description**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Event Code | UINT(0..3) | 0 | | H | Specify the condition upon which the pending table should be activated:<br>0: Based on an absolute time specified in the "Event Storage" field.<br>1: Based on a relative time specified in the "Event Storage" field. The time is relative to when the table write is received by the OSGP device.<br>2: No meaning attached to the data, so no automatic activation will be performed. The pending table defined in BT4150 can still be activated using BP12 or BP13 when this value is chosen. |
| Self Read Flag | BOOL (4) | 0 | | H | If True, the OSGP device will perform a Self-read before pending table is activated. |
| Demand Reset Flag | BOOL (5) | 0 | | H | If True, the OSGP device will perform a demand reset before pending table is activated. |
| Event Storage | ARRAY[5] OF CHAR | 1 | | H | If Event Code is 0, this is an STIME_DATE. (in UTC). If STIME_DATE is all zeroes, this indicates an empty PED.<br>If Event Code is 1, these 5 bytes are in the order of weeks/days/hours/minutes/secs.<br>If Event Code is 2, data is opaque. |

There is no response data for this procedure:

- Execution access: OMAK.

**Table C.24: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| PED | | 3 | | | See BT04. |

**Table C.25: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table C.26: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | No pending table was found that matched the request. |
| 3 | An internal conflict occurred when attempting to process the request. |

# Annex D (normative): Extended Procedures

## D.1 Extended Procedure 00 (EP00) (2048): Manufacturer Specific

Reserved for later use.

## D.2 Extended Procedure 01 (EP01) (2049): NV Memory Refresh

This procedure is used to refresh the device's non-volatile memory.

This procedure is non-responsive:

- Execution access: OMAK.

**Table D.1: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.2: OSGP device response from BT08:**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.3: Error Result Codes:**

| Code Returned | Reason |
|---|---|
| 2 | This error code is returned if the "Compressed Code Bank Not Ok" bit (ET17.17(29)) is set. |
| 3 | OSGP device is in test mode. |

## D.3 Extended Procedure 02 (EP02) (2050): Control Output Command

This procedure is used to change the state of each control output immediately. When this procedure is used to open the load disconnect contactor, the load disconnect contactor will be locked open and cannot be closed. When this procedure is used to close the load disconnect contactor, it will unlock the disconnect without physically closing it. A manual close disconnect operation can physically close the load disconnect contactor when it is in the unlocked state.

When this procedure is used to open or close the relay, the relay is physically opened or closed immediately:

- Execution access: OMAK.

**Table D.4: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Control output number | UINT(0..1) | 3 | | H | 0 = Control output 0 (load disconnect contactor)<br>1 = Control output 1 (control relay)<br>2,3 = Reserved for future use |
| Control output state | BOOL(2) | 3 | | H | 0 = Open control output<br>1 = Close control output |
| Disconnect High Priority Command | BOOL(3) | 3 | | H | Only effective if command is used to open control output 0<br>0 = Low priority level<br>1 = High priority level |
| Filler | FILL(4..7) | 3 | | | |

**Table D.5: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.6: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | This code is set when the procedure is invoked to close the control relay, and the automatic control is set to open the control relay. |
| 2 | Invalid control output number entered. |
| 3 | Low priority open disconnect command sent to OSGP device configured as high priority, or disconnect command sent to OSGP device configured as non-disconnect OSGP device or OSGP device is in test mode. |
| 4 | Procedure requested while output is in the process of opening or closing. |

## D.4 Extended Procedure 03 (EP03) (2051): Clear Alarms

This procedure is used to clear some or all of the OSGP device alarms. The host can clear only some of the alarms by sending back exactly the alarms that were read, the OSGP device will use this field as a bitmask to clear only those alarms:

- Execution access: OMAK.

**Table D.7: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Basic Alarms to Clear | UINT16 | 3 | | H | Basic alarms contained in BT03 to be cleared, based on a previous read. |
| Filler Status 2 | UINT8 | 5 | 0 | F | Reserved for future use. |
| Extended Alarms to Clear | ARRAY[2] of UINT8 | 6 | | H | First 2 bytes of extended alarms contained in BT03 to be cleared, based on a previous read. |
| Clear Method | UINT8 | 8 | | H | 0 = Clear all basic and extended alarms.<br>1 = Clear alarms using bitmask of read alarms. |
| More Extended Alarms to Clear | ARRAY[BT00.17 - 2] of UINT8 | 9 | | H | Rest of extended alarms contained in BT03 to be cleared, based on a previous read. |

**Table D.8: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.9: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid Clear Method specified. |

# D.5 Extended Procedure 04 (EP04) (2052): Manufacturer Specific

Reserved for later use.

# D.6 Extended Procedure 05 (EP05) (2053): Manufacturer Specific

Reserved for later use.

# D.7 Extended Procedure 06 (EP06) (2054): NVM Config

This procedure is used to set the sizes of various OSGP device tables. If the amount of memory required to satisfy the request is not available, the request will fail and no changes will be made. If the request can be satisfied, then the table's memory will be reconfigured. All adjustable tables (whether re-sized or not) are cleared just as if BP04 had been run on them. Values in BT61, BT62 and BT63 will be recomputed just as if EP11 had been run.

Any count can be set to all bits to one and that will indicate that the existing value is to be retained.

This procedure is non-responsive:

- Execution access: OMAK.
- Attributes: ICA SRC.

**Table D.10: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Trial | UINT(0..0) | 3 | | H | 0 = Normal<br>1 = Validate but do not execute |
| Filler | UINT(1..7) | 3 | | H | Shall be zero. |
| BT26 count | UINT8 | 4 | | H | Sets the number of self-reads in BT26. |
| BT64 count | UINT32 | 5 | | H | Sets the number of bytes of load profile data in BT64. |
| BT74 count | UINT16 | 9 | | H | Sets the number of event log entries in BT74. |
| ET31 count | UINT16 | 11 | | H | Sets the number of one-time-reads in ET31. |
| ET32 count | UINT16 | 13 | | H | Sets the number of one-time-reads in ET32. |
| ET38 count | UINT16 | 15 | | H | Sets the number of configuration ID entries in ET38. |
| ET45 count | UINT16 | 17 | | H | Sets the number of MEP recurring read entries in ET45. |

**Table D.11: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Remaining | INT32 | 4 | | M | Amount of remaining memory in adjustable log area after applying new counts. If the "Trial" bit is set, the value indicates the amount of memory that would be left had the values actually been applied. If this field is negative, it indicates the amount by which the request (all tables counted) exceeded the available space. |

**Table D.12: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Not enough memory to accommodate request (if space remaining < 0), or max dimension(s) exceeded (if space remaining = 0). |
| 3 | Not allowed on this platform. |
| 5 | Insufficient clearance (no reset privilege on BT26 and/or ET31). |

# D.8 Extended Procedure 07 (EP07) (2055): Manufacturer Specific

Reserved for later use.

# D.9 Extended Procedure 08 (EP08) (2056): Erase code memory

This procedure is for OSGP device software upgrades, and to erase the entire code bank into which the new software will be downloaded. Code bank management is performed internally in the OSGP device. The host need not know which bank is executing, downloading, or being erased. Upon successful execution of this procedure, the device will clear/initialize all appropriate status indicators in ET17. This includes setting ET17.17(29), which indicates the standby bank is no longer valid.

Wait 10 seconds after issuing this procedure before issuing any subsequent command to the OSGP device:

- Execution access: OMAK.

**Table D.13: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Broadcast Sequence Number | UINT32 | 3 | | H | The broadcast sequence number to be used for the next software download. |
| Code Packet Size | UINT8 | 7 | | H | The size, in bytes, of code packets downloaded in EP09. This number shall be even. |

**Table D.14: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.15: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | Several reasons - shall read ET17_Dnld_Stat for more info. |
| 3 | OSGP device is in test mode. |

# D.10 Extended Procedure 09 (EP09) (2057): Download Code Packet

This procedure is the mechanism for downloading a new software image to the OSGP device. The new image is written via several calls to this procedure, which write individual packets first to RAM, then to the unused code bank in external memory. Verification is performed by reading ET17:

- Execution access: OMAK.

**Table D.16: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Packet Number | UINT16 | 3 | | H | Order of this packet in the 64 K image. The range of this field is 0 to 1 150. |
| Code Image Packet | ARRAY[255] OF UINT8 | 5 | | H | The binary formatted code bytes to be written to the new memory bank. |

**Table D.17: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.18: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | Several reasons - shall read the "Download Status" field of ET17 for more info. |
| 3 | OSGP device is in test mode. |

# D.11 Extended Procedure 10 (EP10) (2058): Switch Code Bank

Calling this procedure will set the program counter immediately to execute code from the code bank not presently being used. The host device will not be able to read BT08 for verification of this procedure's execution. The host should read BT01 or ET17 to verify the OSGP device code is running from the new image.

The user shall wait 20 seconds after issuing this procedure before issuing any subsequent command to the OSGP device.

Before switching over, EP10 validates that the compressed code bank contains a valid CRC and valid digest. During the switchover, the image ID and compression signature are validated as well. If any of these fail, an image CRC/ID failure alarm is recorded and ET17 status bit are updated. If the OSGP device successfully performs a switchover, then ET17.17(29) will be set to mark the standby bank is valid:

- Execution access: OMAK.
- Attributes: ICA SRC (if program ID changes).

**Table D.19: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

OSGP device response from BT08: Not applicable.

**Table D.20: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 3 | OSGP device is in test mode |

# D.12 Extended Procedure 11 (EP11) (2059): Configure/Reset Load Profile Data Set

This procedure is used to configure the load profile data set. When a valid configuration is entered via this procedure, the new parameters take effect immediately and logging begins at the next appropriate interval (synchronized on the hour).

NOTE: Single-block load profile configurations are not supported in the OSGP device. For other than stand-alone use, it is recommended to choose settings in this procedure for Interval and Channels that equate to at least 2 blocks of storage in the OSGP device.

The load profile data set cannot be disabled, only reconfigured. When the load profile data set is reconfigured, the data from the pre-existing configuration is no longer readable in the OSGP device. The host should download all existing data before reconfiguring the load profile data set.

Note that if the "Load Profile Options Flags" field in EP11 is set, then the interval size used in EP11 (and therefore in BT61) will be interpreted as being in minutes only. In this case, the following mapping will be used for some current extended status fields used by the load profile log.

**Table D.21**

| Extended Status Value | Current Meaning | New Value |
|---|---|---|
| 8 | MEP Decryption Failure | 4 ("skipped") |
| 9 | Clock Error | 0 |
| 10 | Special | 0 |
| 11 | Not Current | 4 |
| 15 | MEP busy or inoperable | 4 |

For more information on load profiling, see clause 8.5:

- Execution access: OMAK.
- Attributes: ICA SRC, ICANAK.

**Table D.22: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Interval | UINT8 | 3 | | H | Interval between log records in minutes. If ET04.113(0) is not set, then values above 60 are treated as hours (less 60). For example, a value of 84 is equivalent to 24-hour intervals. |
| Channels | UINT8 | 4 | | H | The number of channels to be logged in this set. |
| Source select: | ARRAY[BT60.11] OF UINT8 | | | | |
| Interval source | UINT8 | 5 | | H | The source number of the channel to be logged, chosen from the Measurement Source Definition Records listed in BT16. See clause A.14.1 for more information. |
| LP config ID | UINT32 | 5+ BT60.11 | | | The identifier representing the present load profile configuration. This field is echoed in ET21. |
| Interval Count | UINT16 | 9 + BT60.11 | | H | The number of intervals per block. The maximum value is 1 440. |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| LP block start hour | UINT8 | 11 + BT60.11 | | H | UTC hour to start first block on after EP11 is called. |
| LP block start minute | UINT8 | 12 + BT60.11 | | H | UTC minute to start first block on after EP11 is called. |
| LP Options | UINT8 | 13 + BT60.11 | | H | Load Profile Options. Each bit (End Readings, Scalar Divisor, Data Reference) sets a load profile option. |
| LPO - End Readings | BOOL(0) | 13 + BT60.11 | | H | Shall be zero. |
| LPO - Scalar Divisor | BOOL(1) | 13 + BT60.11 | | H | Shall be zero. |
| LPO - Data Reference | BOOL(2) | 13 + BT60.11 | | H | Shall be zero. |
| LP Options Flags | BOOL(3) | 13 + BT60.11 | | H | If this bit is set, it means:<br>a) Log intervals in minutes only.<br>b) Only basic statuses are used.<br>c) Resets do not count as power cycles in common status. |
| Extended sources: | ARRAY[BT60.11] OF UINT16 | | | | |
| Interval extended source | UINT16 | 14 + BT60.11 | | H | Extended source number of the channel to be logged. |

**Table D.23: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.24: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid parameters. This error will be returned if the "Channels" parameter is set to 0, or a value greater than the maximum number of channels, or if the "Interval" parameter is set to 0. This error could also be returned if the requested configuration does not fit into the available OSGP device memory space. |
| 3 | Source ID not valid, or EP11 disabled. |
| 5 | Option not allowed. |

## D.13 Extended Procedure 12 (EP12) (2060): Record Self-Read

This procedure is used to perform an instantaneous (on-demand) self-read. Data is recorded to the same table as during a scheduled self-read. The self-read schedule is not altered with execution of this procedure. For more information on self-reads, see clause 8.4:

- Execution access: OMAK.

**Table D.25: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.26: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.27: Error Result Codes**

| Code Returned | Reason |
|---|---|
| (None) | |

# D.14 Extended Procedure 13 (EP13) (2061): Write Single Bit in Table

This procedure is used to modify a single bit in a single byte in a table. The user shall have access to the desired table. No other checking is performed by the OSGP device:

- Execution access: OMAK.
- Attributes: ICANAK (if being used to write to an ICANAK table; the response to the BT07 write request is what is NAK'ed in this case).

**Table D.28: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Table | UINT16 | 3 | | H | The table to be modified. |
| Offset | UINT16 | 5 | | H | Byte offset, from 0, of the byte to be modified. |
| And Mask | UINT8 | 7 | | H | Bits "and"ed with the current value prior to being "or"ed with the "Or Mask". |
| Or Mask | UINT8 | 8 | | H | Bits "or"ed with the result of the "and" operation above to make the new table value. |

**Table D.29: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.30: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 5 | User does not have permission to modify specified table |

# D.15 Extended Procedure 14 (EP14) (2062): Manufacturer Specific

Reserved for later use.

# D.16 Extended Procedure 15 (EP15) (2063): Set Tariff

This procedure is used to configure a manual tariff override of the TOU calendar. Several options exist for both activation and cancellation of the override, and can be set via ET47. This procedure covers only immediate activation and manual or next tier switch cancellation. Settings programmed via this procedure are copied into ET47.

A clock error (and its configured tariff setting) supersedes any tariff override. In the event of a power cycle while a hold type 0 is in progress, the hold will be released on power up if the current tariff is not equal to the tariff existing prior to the hold invocation:

For more information on the TOU calendar, see clause 8.2.

- Execution access: OMAK.

**Table D.31: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Tariff | UINT8 | 3 | | H | Tariff to set. A value of 255 indicates that the OSGP device should revert to the tariff set in BT54. |
| .Hold | UINT8: | 4 | | H | |
| | BOOL(0) | 4 | | H | 0: Hold until changed by BT54<br>1: Hold indefinitely. |
| Calendar ID | UINT32 | 5 | | H | Identifier in effect while EP15 hold is in effect. This does not overwrite the value used in BT54. |

**Table D.32: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.33: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid tariff parameter entered. |

# D.17 Extended Procedure 16 (EP16) (2064): Change System Clock by Delta

This procedure is used to perform a gradual clock adjustment to the OSGP device system clock (BT52). A controlled gradual adjustment is used to avoid skipping scheduled events and load profile records. The delta seconds option is checked first and if nonzero, this will be the method used.

The BT52 clock always represents UTC time (not adjusted for Daylight Saving Time [DST]). The "DST_Flag" in BT52 indicates whether or not DST is in effect. If required, the OSGP device-reading device shall apply the offset information in BT53 for DST and for time zone to the system clock to ascertain the local DST-adjusted time of day.

Note that it could take up to 40 minutes to adjust the system clock by the desired amount. During this time, additional clock adjustment requests will be rejected:

- Execution access: OMAK.

**Table D.34: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Date Time | LTIME_DATE | 3 | | H | The OSGP device will calculate time delta based on this field (a value of 0 indicates that this method is not requested). If both fields are set to 0, no time adjustment is performed. |
| Delta Seconds | INT16 | 9 | | H | The number of seconds by which to change the OSGP device system clock. The range is -600 seconds to +600 seconds. A value of 0 indicates that this method is not requested. |

**Table D.35: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.36: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | Both input fields = 0. |
| 2 | Input time or calculated adjustment is greater than the allowable limit. |
| 4 | Timing constraint: clock adjust is already in progress. |

## D.18 Extended Procedure 17 (EP17) (2065): Remove M-Bus/MEP Device

This procedure will remove the requested M-Bus or MEP device from the OSGP device. Removing a device constitutes no longer polling it and clearing the device status from the associated OSGP device tables, including the device occupancy flag and device handle in ET14.

Removing a MEP device sets the device baud rate in ET14 back to the default of 9 600 and clears all bits in ET50, "MEP Flags". All other fields in ET50 are left unchanged:

- Execution access: OMAK.

**Table D.37: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Action | UINT8 | 3 | | H | 0 = Remove device and re-assign primary address to 0.<br>1 = Remove device and re-assign primary address to 250. |
| Device handle | UINT16 | 4 | | H | Handle of the device to be removed. Use a value of 0xFFFF to remove all devices. When this option is used, the primary addresses of the devices are not changed. This option is intended for provisioning use only. |

**Table D.38: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.39: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid action specified. |
| 3 | Requested device handle to remove does not match an installed device in the OSGP device. |
| 4 | A remove request is already in progress. |

# D.19 Extended Procedure 18 (EP18) (2066): Clear MEP Alarms

This procedure clears the OSGP device detected and device alarms located in table ET14. Once all OSGP device-detected alarms for all M-Bus/MEP devices are cleared the "Manufacturer status 17, M-Bus Alarm" bit in BT03 will be cleared by the OSGP device:

- Execution access: OMAK.

**Table D.40: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Device Handle | UINT16 | 3 | | H | Handle of the device to be cleared. A value of 0xFFFF indicates that all devices should be cleared. |
| Device alarms | UINT8 | 5 | | H | Bitmask of device alarms to clear. This corresponds to the definition of device alarms. |
| OSGP device alarms | UINT16 | 6 | | H | Bitmask of OSGP device-detected alarms to clear. This corresponds exactly to the bitmask of alarms documented in ET14. |

**Table D.41: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.42: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 3 | Requested device handle to remove does not match an installed device in the OSGP device. |

# D.20 Extended Procedure 19 (EP19) (2067): Post On-demand M-Bus Request

This procedure is used to post an on-demand M-Bus request. After the request is made via this procedure, the request and its result can be tracked in the "Request Queue" area of ET15 "MEP/M-Bus On-demand Requests". For background information on M-Bus devices, see clause 8.18:

- Execution access: OMAK.

**Table D.43: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Transaction Number | UINT16 | 3 | | H | The transaction number for each request. This used to keep track of requests/results on the server. The following ranges for transaction numbers are recommended, to avoid using duplicate values:<br>0..0x3FF : Optical port applications<br>0x400..0x4FF : MEP applications<br>0xFF00..0xFFFF : Data Concentrator application. |
| Device Handle or Group Mask | UINT16 | 5 | | H | The handle of the device to be queried. For request type 6, a value of **0xFFFF** signifies that the multicast should be sent to all commissioned devices. Otherwise, this field signifies the group mask. |
| Request Type | UINT8 | 7 | | H | 0 = Reserved for OSGP device internal use<br>1 = M-Bus application reset<br>2 = Billing read<br>3 = Status read<br>4 = Write user data<br>5 = Time sync (no write data required)<br>6 = Multicast to specified devices (list of specified devices elsewhere). |
| Write Request: | | | | | |
| Write Data Length | UINT8 | 8 | | H | The length, in bytes of the user data to be written to the device. Used for request types 4 and 6. For request type 4, this length shall less than or equal to (ET11.11 -1). |
| Write Data | ARRAY[ET11.20 -1] of UINT8 | 9 | | H | The user data/multicast data to be written (as-is) to the devices. For user data, this is data to be written as-is to the device and is comprised of the SND_UD telegram. For multicast data, this is comprised of the 'C' control field, followed by the 'CI' control field, followed by the user data portion of the telegram. |

**Table D.44: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Entry index | UINT8 | 4 | | M | Index into on-demand request queue in ET15 of this entry. |

**Table D.45: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid request type entered. |
| 3 | Device handle entered does not match any of the installed devices. |
| 7 | On-demand queue is full, request denied. |

## D.21 Extended Procedure 20 (EP20) (2068): Change OMA Encryption Key

This procedure is used to modify the encryption key value used for communications over the BS EN 14908-1:2014 [1] network port. The key value is encrypted using RC4 with the key being the OMA Key defined in BT42:

- Execution access: OMAK.

**Table D.46: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Key Length | UINT8 | 3 | | H | Key length. |
| Key | ARRAY[32] of UINT8 | 4 | | H | Encrypted key value. |

**Table D.47: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.48: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Key length is larger than the maximum length allowed |

# D.22 Extended Procedure 21 (EP21) (2069): Add prepay credit

This procedure is used to add prepay total credit and/or prepay emergency credit. The user can choose the option of adding emergency credit from total credit:

- Execution access: OMAK.

**Table D.49: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Sequence Nbr | UINT8 | 3 | | H | The sequence number for adding prepay credit. This field is controlled by host to prevent duplicate actions. |
| Total Credits to Add | UINT32 | 4 | | H | Credits to be added to the total credit field. If the "Add Together" field is set to 1, part of this value is added to the emergency credit. |
| Emergency Credits to Add | UINT32 | 8 | | H | Credits to be added to the total emergency credit field. |
| Add Options | UINT8 | 12 | | H | Options to apply when add credit. |
| Add Together | BOOL(0) | 12 | | H | 0 = Use the above two parameters separately.<br>1 = Use the "Total Credits to Add" for both total and emergency credits. |
| Ignore Sequence Nbr | BOOL(1) | 12 | | H | 0 = Apply sequence number check.<br>1 = Ignore sequence number check. |

**Table D.50: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Total Credits Overflow | UINT32 | 4 | | M | Remaining of total credits that cannot be added. |
| Emergency Credits Overflow | UINT32 | 8 | | M | Remaining of emergency credits that cannot be added. |

**Table D.51: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid Parameter: sequence number duplicate with the last used sequence number. |
| 3 | Conflict with OSGP device setup. The OSGP device is configured as a non-disconnect OSGP device. |

# D.23 Extended Procedure 22 (EP22) (2070): Switch maximum power or current level

Use EP22 to switch from the Primary Maximum Power Level Threshold to the Secondary Power Level Threshold when the OSGP device is using power measurements to determine if the load disconnect contactor has reached its trip point. Use it to switch from the Primary Maximum Current Level Threshold to the Secondary Current Level Threshold when the OSGP device is using current measurements to make that determination. The OSGP device will use the appropriate primary threshold by default.

If the switch action is from the appropriate primary threshold to the secondary threshold, date/time when the switch will occur and the duration for which the switch will remain in effect shall be specified. The active maximum power (or current) level will remain at the secondary threshold for the configured duration and automatically switch back to the primary threshold after the duration expires, unless it is switched again via EP22 before the duration expires.

If the switch action is from the secondary threshold back to the primary threshold, it will take effect immediately and the primary power level will remain in effect until EP22 is called again.

Use EP42 to specify whether the OSGP device should use power measurements or current measurements to determine when the load disconnect contactor has reached its trip point. For an overview of how the OSGP device uses the maximum power and current levels, see clause 8.10:

- Execution access: OMAK.

**Table D.52: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Switch Action | UINT8 | 3 | | H | 0 = Primary to secondary switch.<br>1 = Secondary to primary switch. |
| Primary to secondary switch time | LTIME_DATE | 4 | | H | If the switch is from the primary threshold to the secondary threshold, use this field to specify the date/time to perform the switch. This parameter is ignored if the "Switch Action" field is not set to 0. If the date/time specified is earlier than the current OSGP device date/time, the switch will take place immediately. |
| Secondary level Duration | UINT16 | 10 | | H | If the switch is from the primary threshold to the secondary threshold, use this field to specify the duration, in minutes, to stay at the secondary threshold before switching back to the primary threshold. This parameter is ignored if the "Switch Action" field is not set to 0.<br>Enter a value of 0 to disable the automatic switch back to the primary threshold, and continue using the secondary threshold indefinitely, until EP22 is called again. |

**Table D.53: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.54: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid Action specified. |
| 3 | Conflict with current setup. Maximum power control is disabled in ET05. |

# D.24 Extended Procedure 23 (EP23) (2071): Remote Disconnect Reconnect

Upon execution of this procedure, the load disconnect contactor will close immediately. No manual close operation will be necessary. This procedure will be executed only if the "Enable Remote Disconnect Closed" field in ET05 is enabled:

- Execution access: OMAK.

**Table D.55: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.56: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.57: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 1 | Cannot close the load disconnect contactor due to exhausted prepay credit. |
| 3 | The command was rejected because ET05 is configured to disable remote disconnect, the OSGP device is in test mode, or the load disconnect contactor was manually opened. |

# D.25 Extended Procedure 24 (EP24) (2072): Post One-Time Read Request

This procedure is used to post a one-time read request for either OSGP device or MEP/M-Bus billing data to the appropriate queue. Successfully queued entries and their execution status are posted to ET19 and ET20. For more information on one-time reads, see clause 8.13:

- Execution access: OMAK.

**Table D.58: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Transaction Nbr | UINT16 | 3 | | H | Transaction number for each request. This is used to keep track of requests/results on the server. |
| Date/Time | STIME_DATE | 5 | | H | Local date/time stamp of when one-time read is to be executed. |
| Device Handle | UINT16 | 10 | | H | Device on which to perform the one-time read; only one device may be specified per request:<br>0 = OSGP device<br>1...0xFFFE = MEP/M-Bus device with this handle. |
| Spare | ARRAY[6] of UINT8 | 12 | | | Reserved for future use. |

**Table D.59: OSGP device response from BT08:**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Entry index | UINT8 | 4 | | M | Index into one-time read request queue in ET19 or ET20 of this entry. |

**Table D.60: Error Result Codes:**

| Code Returned | Reason |
|---|---|
| 3 | Device handle entered does not match any of the installed devices. |
| 7 | Request denied: on-demand queue is full. |

# D.26 Extended Procedure 25 (EP25) (2073): Reset Extended Table Logs and Queues

This procedure is used to reset or clear one or all of the manufacturer-defined logs, queues, and lists. This procedure can be used to clear all entries in a log, or to clear only one entry, in a request queue. Whether the request is already completed or not, the entry will be deleted without error. If the request does not exist, the procedure will still return a successful result:

- Execution access: OMAK.

**Table D.61: Data written from host: OSGP device table 7**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Table | TABLE_IDB_ BFLD: BIT FIELD of UINT16 | 3 | | H | Log, queue, or list to be cleared, identified by table number. For example: ET19, ET20, ET31, or ET32. Note that ET15 is not appropriate here as its entries are processed immediately, and there is no need for clearing the queue. |
| Tbl_Proc_Nbr | UINT(0..10) | | | H | Table number of log, list, or queue to be cleared. |
| Basic_vs_Extended_Flag | BOOL(11) | | | H | Should always be set to 1. |
| Selector | UINT(12..15) | | | H | 0 = Clear only the table identified.<br>1 = Clear all logs, lists, and queues.<br>2 = Clear only the entry specified. |
| Request Timestamp | STIME_DATE | 5 | | H | Exact timestamp of the request to be deleted. |

**Table D.62: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (None) | | | | | |

**Table D.63: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid table number entered. |

# D.27 Extended Procedure 26 (EP26) (2074): Update Mfg Lists Unread Entries

This procedure is used to update the list header field "Number of Unread Entries" for all the manufacturing logs and lists. It is analogous to BP05 for Extended Tables, and shall be used every time a list is read in order to prevent re-triggering of the BT03 alarm bit indicating unread entries exist. The alarm bit is cleared automatically by the OSGP device when all logs' unread entries have been acknowledged:

- Execution access: OMAK.

**Table D.64: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Table | TABLE_IDB_BFLD: BIT FIELD of UINT16 | 3 | | H | Log, queue, or list to be cleared, identified by table number. For example: ET19, ET20, ET31, or ET32. |
| Tbl_Proc_Nbr | UINT(0..10) | | | H | Table number of log, list, or queue to be cleared. |
| Std_vs_Mfg_Flag | BOOL(11) | | | H | Should always be set to 1 for this procedure. |
| Selector | UINT(12..15) | | | H | Reserved for future use. |
| Entries Read | UINT16 | 5 | | H | Number of entries read by a host for the list selected above. |

**Table D.65: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (None) | | | | | |

**Table D.66: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid table number entered. |

# D.28 Extended Procedure 27 (EP27) (2075): Add/Remove Group ID

This procedure is used to either add or remove the OSGP device from a specific broadcast group:

- Execution access: OMAK.

**Table D.67: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Action | UINT8 | 3 | | H | 0 = Add OSGP device to group.<br>1 = Remove OSGP device from group.<br>2 = Remove OSGP device from all groups. |
| Count | UINT8 | 4 | | H | Number of group IDs in the group ID list to which to apply the specified action. |
| Group ID list | ARRAY[ET11.19] of UINT16 | 5 | | H | The group IDs to either add or remove from the OSGP device's group ID list If the "Action" field is set to 2, this list will not be used.<br>Duplicate group IDs will not be added to the group ID list, if the same group ID is specified twice or if the ID of a group the OSGP device already belongs to is specified. This is to avoid wasting slots in the group ID list table. |

**Table D.68: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Empty Slot | UINT8 | 4 | | M | Available empty group ID slots in ET33 after the procedure is executed. |

**Table D.69: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 3 | The group ID list is full, add action cannot be performed. |

# D.29 Extended Procedure 28 (EP28) (2076): Enable/Disable Battery

This procedure is used to either enable or disable the battery circuit within the OSGP device hardware. When the battery is disabled, the OSGP device will enter stop mode whenever the power-down process completes. The battery will be enabled as part of the manufacturing process:

- Execution access: OMAK.

**Table D.70: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Action | UINT8 | 3 | | H | 0 = Disable Battery<br>1 = Enable Battery |

**Table D.71: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.72: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid Action specified. |

# D.30 Extended Procedure 29 (EP29) (2077): Read/Write Diagnostic Counters

This procedure is used to either read or clear the OSGP device's internal diagnostic counters. A copy of the OSGP device's counters are stored in ET23. This will also clear the diagnostic counters stored in ET23:

- Execution access: OMAK.

**Table D.73: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Read | BOOL(0) | 3 | | H | True = Read transceiver diagnostic counters and store in ET23.<br>False = No action. |
| Clear | BOOL(1) | 3 | | H | True = Clear the diagnostic counters.<br>False = No action. |

**Table D.74: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.75: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid Action specified. |

# D.31 Extended Procedure 30 (EP30) (2078): Synchronize Disconnect Status

Use this procedure to rectify a disconnect hardware failure that has caused the physical state of the disconnect to become out-of-sync with the commanded state. In addition, the disconnect can be switched either open or closed in this procedure pursuant to the resynchronization.

NOTE: To avoid overriding the internal commanded state, the disconnect should be synchronized to the correct internal state. If unknown, the internal state can be read from ET23.94 before executing this procedure.

Execution access:

- Hardware lock restriction: None.

**Table D.76: Data written from Host to OSGP device table 7**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Desired disconnect state | BOOL(0) | 3 | | H | 0 = Open<br>1 = Close |

**Table D.77: OSGP device Response from table 8**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.78: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid parameters. |
| 3 | This error code could indicate that:<br>The physical state of the OSGP device is ambiguous or in error and the resynchronization cannot be performed.<br>The requested resynchronization would cause the disconnect to be closed, and ET05 is configured to disable remote disconnect when load side voltage is present, and load side voltage has been detected.<br>The disconnect has been disabled, or the OSGP device is in test mode. |
| 4 | Procedure requested while disconnect status detection is not stable yet. |

# D.32 Extended Procedure 31 (EP31) (2079): Activate Feature

This procedure activates optional OSGP device features, such as demand metering. If the selected feature is already configured (in ET48), the request will be ignored, although the OSGP device will respond that the procedure was executed successfully. If not configured, the request will be treated like a new, and any old attributes in ET48 will be replaced with the new attributes:

- Execution access: OMAK.

**Table D.79: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Feature | UINT16 | 3 | | H | Feature number. Valid feature numbers can be found in ET48.02. |
| Challenge | ARRAY[8] of UINT8 | 5 | | H | Authentication challenge. This is a random 8-byte number. |
| Reply | ARRAY[8] of UINT8 | 13 | | H | Authentication reply. The reply is a function of the feature number, the challenge, the OSGP device's serial number and the OSGP device's Transceiver ID. The reply need not be correct unless the OSGP device is in release mode. |

**Table D.80: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.81: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | The feature number was not valid. |
| 3 | No more room in ET48, or this feature is disabled. |
| 5 | The OSGP device was in release mode and the reply was not valid. |

## D.33 Extended Procedure 32 (EP32) (2080): Billing Dimension Configuration

This procedure is used to configure items that affect the dimensions of the OSGP device's billing-related tables, including how many demand types are supported, the data source for each demand, whether each demand has cumulative and/or continuous cumulative demand, and the presence of coincident values. All demand related information added to existing tables is zeroed. All logs containing only demand information are reset. Logs with both demand and non-demand data are maintained. Demand shall be activated via EP31 prior to executing this procedure.

In setting this configuration information, the memory allocation in the optional feature area is also set for demand. If the specified configuration does not fit in the optional memory space the procedure will fail with an appropriate result code. If, after a successful configuration, this procedure is run again with a configuration that results in a larger or smaller memory allocation, thereby changing the location of tables for optional features activated after demand, these features' tables will be reset along with the demand tables.

For background information on demand metering, see clause 8.15.

This procedure is non-responsive:

- Execution access: OMAK.
- Attributes: ICA SRC, ICANAK.

**Table D.82: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Trial | UINT(0..0) | 3 | | H | 0 = Normal<br>1 = Validate, but do not execute. |
| Filler | UINT(1..7) | 3 | | H | Shall be zero. |
| Billing Interface Definition number (BIDN) | UINT16 | 4 | | H | An identifier set by the calling device to identify billing related data in logs as pertaining to this configuration. This number is recorded in each entry of BT26, ET31, and ET41.The unique correlation of this number to a |

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| | | | | | specific configuration is not enforced or guaranteed by the OSGP device.<br>RECOMMENDATION to help identify the source of configuration changes:<br>0 = Denotes asynchronous DR/SR error case - do not use<br>1.. 16,424: Non-PLC users.<br>16,425..32,849: Manufacturer-assigned numbers.<br>32,850..65,499: PLC users.<br>65,500..65,535 = Reserved for future use. |
| Number of Demands | UINT8 | 6 | | H | The number of demand types to support. The range of this field is 0 to BT20.4 If 0 demands are configured, remaining configuration is not validated. |
| Number of Historical Demand Reset Entries | UINT8 | 7 | | H | Number of current entries in ET41. ET36 is updated with this information. |
| Other demand data config | | | | | |
| Enable Cumulative Demand | BOOL(0) | 8 | | H | 0 = Disable cumulative demand calculation.<br>1 = Enable cumulative demand calculation. |
| Enable Continuous Cumulative Demand | BOOL(1) | 8 | | H | 0 = Disable continuous cumulative demand calculation.<br>1 = Enable continuous cumulative demand calculation. |
| Enable Coincident values | BOOL(2) | 8 | | H | 0 = Disable coincident values.<br>1 = Enable 2 (quantity fixed) coincident values for each supported demand register. |
| Sub Interval | UINT8 | 9 | | H | Demand sub-interval in minutes. |
| Interval Multiplier | UINT8 | 10 | | H | Demand interval multiplier. |
| Demand Source Select | ARRAY[BT20.4] of UINT8 | 11 | | H | Source number of the demand type, chosen from the following sources defined in BT16: 0,1,6,7,108 to 111 |
| Coincident Select | ARRAY[BT20.5] of UINT8 | 11+ BT2.04 | | H | Source numbers of the coincident values, chosen from the following BT16 sources include all summation total, present values and previous demand: 0 - 28, 81 - 84, 96 -111<br>Coincident sources shall be entered in the same order as the demand sources, i.e. coincidents 1 and 2 are associated with demand 1, coincidents 3 and 4 are associated with demand 2, etc.<br>(See note). |
| NOTE: Tier values are automatically the coincident sources for a tier max demand value. For example, if the coincident source is Q4 reactive energy, then a T2 max. demand value stores the coincident T2 Q4 reactive energy value not the total Q4 reactive energy value. | | | | | |

**Table D.83: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Space Remaining | INT32 | 4 | | M | Amount of unused memory after applying this configuration. If Trial bit is set, the value indicates the amount of memory that would be left had the values actually been applied. If this field is negative, it indicates the amount by which the requested config exceeded the available space. |

**Table D.84: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid number of demand type, demand source select, sub-interval, interval multiplier or coincident source entered, or number of demand reset log entries exceeds max allowable, or not enough memory to accommodate request; or if ICS - Blg/LP format 2 is False (see ET54). |
| 3 | The BIDN specified already exists in ET42 presently (historical log entries are not checked), or is out of range (checked for release-mode optical user only). The absence of this error does NOT guarantee the BIDN has never been used before or that it is unique to the associated configuration.<br>OSGP device is in test mode or demand optional feature is disabled in ET55 |
| 5 | Feature is not activated. |

# D.34 Extended Procedure 33 (EP33) (2081): Billing Reconfiguration

This procedure is used to reconfigure parameters affecting OSGP device billing tables. Only parameters that do not affect the memory allocation (i.e. dimensions) are changeable here. The new parameters take effect immediately, and a demand reset occurs at the end of procedure execution. To avoid having self-read records with mixed demand configuration data, this procedure can optionally also trigger a self-read concurrent with the demand reset.

Changing billing configuration via this procedure does not cause any historical logs to be reset, so the billing interface definition number shall be used to correlate historical reads with the proper configuration.

For background information on demand metering, see clause 8.15:

- Execution access: OMAK.
- Attributes: ICA SRC, ICANAK.

**Table D.85: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Billing Interface Definition Number (BIDN) | UINT16 | 3 | | H | An identifier set by the calling device to identify billing related data in logs as pertaining to this configuration. This number is recorded in each entry of BT26, ET31, and ET41.<br>(see note)<br>See EP32 for recommended and/or enforced ranges to be used by different parties. |
| Flags: | | | | | |
| Perform SR | BOOL(0) | 5 | | H | 1= Perform a self-read concurrent with the demand reset caused by this procedure.<br>0 = Self-read is not performed |
| Reserved | BOOL(1..7) | 5 | | H | Reserved for future use. |
| Sub Interval | UINT8 | 6 | | H | The demand sub-interval in minutes. A value of 255 indicates that the sub-interval is not being reprogrammed, and the existing source is to be used |
| Interval Multiplier | UINT8 | 7 | | H | The demand interval multiplier. A value of 255 indicates that the interval multiplier is not being reprogrammed, and the existing source is to be used |
| Demand Source Select | ARRAY[BT20.4] of UINT8 | 8 | | H | Source number of the demand type, chosen from the following sources 0,1,6,7,108 - 111.<br>A value of 255 indicates that this source is not being reprogrammed, and existing source is to be used. |
| Coincident Select | ARRAY[BT20.5] of UINT8 | 8+ BT20 .4 | | H | The source number of the coincident value. See EP32 for valid source list. A value of 255 indicates that this source is not being reprogrammed, and the existing source is to be used |
| NOTE: The unique correlation of this number to a specific configuration is not enforced or guaranteed by the OSGP device. | | | | | |

**Table D.86: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.87: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid sub-interval, interval multiplier, demand source or coincident source entered. |
| 3 | The BIDN specified already exists in the OSGP device presently, or is out of range. The absence of this error does NOT guarantee the BIDN has never been used before or that it is unique to the associated configuration.<br>OSGP device is in test mode, or the demand feature is disabled in ET55. |
| 5 | Feature is not activated, not configured or configured with summations only. |

# D.35 Extended Procedure 34 (EP34) (2082): Demand Reset

This procedure is used to trigger an immediate demand reset. For background information on demand metering, see clause 8.15:

- Execution access: OMAK.

**Table D.88: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (None) | | | | | |

**Table D.89: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.90: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 4 | Demand reset lockout is in effect. |
| 5 | Feature is not activated, not configured or configured with summations only. |

# D.36 Extended Procedure 36 (EP36) (2084): Schedule Disconnect Lock Open

This procedure is used to schedule the load disconnect contactor to be locked in the open state. A date/time and duration for the lock is provided in the procedure. The load disconnect contactor will be locked open at the scheduled date/time and stay at that state until the configured duration has passed. This procedure can also be used to cancel a lock that has already been scheduled.

If the OSGP device is powered down at the preset date/time specified, the load disconnect contactor will be locked open after power up until the time passes scheduled date/time + the duration. The scheduled date time and duration will be cleared to 0 if the duration expires before the OSGP device is powered back on. If the disconnect is locked open by a schedule, sending another schedule via this procedure would override the existing one. The disconnect status change event log will log the status change reason to be 'scheduled' in the argument:

- Execution access: OMAK.

**Table D.91: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Action | UINT8 | 3 | | H | 0 = Schedule the load disconnect contactor to be locked in the open state.<br>1 = Cancel the existing schedule. |
| Disconnect lock open time | LTIME_DATE | 4 | | H | Date/time to lock open the load disconnect contactor. This parameter is ignored if the "Action" field is set to 1. |
| Disconnect lock open Duration | UINT32 | 10 | | H | The duration, in seconds, for the load disconnect contactor to be locked open. This parameter is ignored if the "Action" field is set to 1.<br>If the duration is configured to 0 the OSGP device stays locked open indefinitely until another schedule is commanded or this schedule gets cancelled. |

**Table D.92: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

**Table D.93: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Invalid action specified, or expired schedule. |
| 3 | Disconnect is disabled, or the OSGP device is in test mode. |

# D.37 Extended Procedure 37 (EP37) (2085): NVM Config

This procedure is used to set the sizes of various tables in the adjustable table area. If the amount of memory required to satisfy the request is not available, the request will fail and no changes will be made. If the request can be satisfied, the tables to be resized all have permission to be adjusted, and they can be resized without affecting any locked tables, then the memory will be reconfigured and the resized tables will be cleared. Values in BT61, BT62 and BT63 will be recomputed just as if EP11 had been run.

BT26, ET31, and ET45 may be locked by the control word. If this is the case, the sizes for these logs, as well as all logs that exist before and between them, shall be set at 0xFF and 0xFFFF, respectively, in order to reconfigure the remaining logs. This procedure will fail if an attempt is made to change one or more of the locked logs.

The order of the logs in physical memory is: BT26, ET31, BT64, BT74, ET32, ET38, ET45.

Any count or entry size can be set to all bits to one and that will indicate that the existing value is to be retained.

This procedure is non-responsive:

- Execution access: OMAK.
- Attributes: ICA SRC.

**Table D.94: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Trial | UINT(0..0) | 3 | | H | 0 = Normal<br>1 = Validate but do not execute |
| Filler | UINT(1..7) | 3 | | H | Shall be zero. |
| Log count | UINT8 | 4 | | H | The number of logs to be sized in this procedure, starting with BT26 and progressing sequentially (no skips). |
| BT26 count | UINT8 | 5 | | H | Number of self-reads in BT26. |
| BT64 count | UINT32 | 6 | | H | Number of bytes of load profile data in BT64. |
| BT74 count | UINT16 | 10 | | H | Number of event log entries in BT74. |
| ET31 max entry size | UINT16 | 12 | | H | Not applicable. This field is ignored. |
| ET31 count | UINT16 | 14 | | H | Number of one time reads in ET31. |
| ET32 max entry size | UINT16 | 16 | | H | Maximum number of bytes dedicated to each entry in this log. The actual space used within the record may be less. |
| ET32 count | UINT16 | 18 | | H | Number of one time reads in ET32 |
| ET38 max entry size | UINT16 | 20 | | H | Not applicable. This field is ignored. |
| ET38 count | UINT16 | 22 | | H | Number of config ID entries in ET38. |
| ET45 max entry size | UINT16 | 24 | | H | The maximum number of bytes dedicated to each entry in this log. The actual space used within the record may be less. A practical limit of 509 bytes should be adhered to by user. |
| ET45 count | UINT16 | 26 | | H | The number of M-Bus recurring reads in ET45. |

**Table D.95: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Remaining | INT32 | 4 | | M | The amount of remaining memory in adjustable log area after applying new configuration. If the "Trial" bit is set to 1, this value indicates the amount of memory that would be left had the values actually been applied. If this field is negative, it indicates the amount by which the request exceeded the available space. |

**Table D.96: Error Result Codes**

| Code Returned | Reason |
|---|---|
| 2 | Not enough memory to accommodate request, if space remaining is less than 0, or maximum dimension have been exceeded, if space remaining is 0. |
| 3 | Not allowed on this platform. |
| 5 | Insufficient clearance (no reset privilege on BT26, ET31 and/or ET45). |

# D.38 Extended Procedure 39 (EP39) (2087): Post MEP Data (Urgent or Non-Urgent)

Use this procedure to assist the posting of scheduled, on-demand, or unsolicited data to the OSGP device from the MEP device. MEP alarm information and firmware switchover status can also be posted using this procedure. For an overview of how EP39 should be used in each of these processes, see clause 8.17.

The amount of MEP data posted when this procedure is called is constrained by several factors. If the procedure is invoked by writing to BT07, then it is limited to 194 bytes. If the procedure is invoked by creating a BT07 table write entry in the new MEP Transaction Request Table (ET52), then that data will be transferred directly from ET52 and is limited in size by the space in ET52 (which is ET11.7 - 19 bytes, or 750 bytes). Finally, the data size is limited by the destination table in the OSGP device. If any of these sizes is exceeded, the posted data is truncated and an overflow alarm set. If the "MEP Data Size" field set to a value that is larger than the actual data passed in the "MEP Data" field, then the additional data transferred will be indeterminate.

NOTE: Where applicable, the description of the "Data Type" field indicates the ET15 request types that correspond to each MEP data type.

For information on when the appropriate statuses are updated for the various types of data and alarm postings, see the description of ET14 earlier in this clause.

When posting unsolicited urgent data, the "Billing Data Collected" alarm bit in ET14 for the MEP device shall be False. If it is not then the procedure will fail with an error code of T08_TIMING_BAD. This is to avoid overwriting of previous unsolicited urgent data or on-demand response data that has not yet been retrieved.

For Data Types 5 and 6 (firmware switchover), the pass or fail status is set in ET14 (MEP Firmware Switchover Success | Failure), and the request queue in ET15 is marked with the result and the queue is advanced.

For Data Type 9, (Complete on-demand request), this procedure is used to complete an on-demand request to the MEP device. The request queue in ET15 is marked with the result value passed and the queue is advanced. The On Demand Request alert flag for the MEP device in ET13 is cleared. EP39 will fail if there is no pending on-demand request in the queue that contains the handle of the MEP device.

This procedure may optionally include the request transaction number from the queue entry being processed by the MEP device. In this form, the "MEP Data Size" field is set to 2, and the transaction number is stored in the first two bytes of the "MEP Data" field as a little-endian unsigned integer. The purpose of using this form is to assure that the MEP is completing the correct on-demand request from the queue in ET15:

- Execution access: OMAK.

The data written from host to BT07 is described below.

**Table D.97**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Data Type | UINT8 | 3 | | H | 0 - Alarms only (values after Alarms field ignored)<br>1 - On-demand data only. This corresponds to the "Request Type" field in ET15 being set to "Billing Read (Data Requested".<br>2 - On-demand + Alarms. This corresponds to the "Request Type" field in ET15 being set to "Billing Read (Data Requested".<br>3 - Non-urgent data only. This is for posting scheduled read data, or unsolicited non-urgent data.<br>4 - Non-urgent data + Alarms. This is for posting scheduled read data, or unsolicited non-urgent data.<br>5 - Firmware switchover success. This corresponds to the "Request Type" field in ET15 being set to "MEP Download Switchover".<br>6 - Firmware switchover failure. This corresponds to the "Request Type" field in ET15 being set to "MEP Download Switchover".<br>7 - Reserved<br>8 - Reserved<br>9 - Complete on-demand request. This should be used after EP39 is called with Data Types 1 or 2 to post on-demand read data.<br>10 - Clear M-Bus alert (all other fields ignored). This should be used after all alert-driven processing is complete.<br>11 - Unsolicited urgent data only |
| Alarms/Result | UINT8 | 4 | | H | 8-bit MEP alarms for Data Type 0, 2, 4, 8.<br>Completion result value for Data Type 9:<br>1 = Success<br>2 = No response from device<br>3 = Request failed |
| MEP Data Size | UINT16 | 5 | | H | Size in bytes of this data transfer |
| MEP Data | ARRAY[BT00.9 - 4] of UINT8 | 7 | | H | MEP data |

The OSGP device response from ET59 is described below.

**Table D.98**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

The error codes that could be returned when EP39 is called are described below.

**Table D.99**

| Code Returned | Reason |
|---|---|
| T08_LIST_FULL (7) | No space in the OSGP device table. |
| T08_CONFLICT (3) | Invalid Data Type (out of range), or if there is no device registered for all data types, or unexpected firmware switchover status for data types (5,6) occurs, or no matching MEP request is found in ET15 for data type (9). |
| T08_TIMING_BAD (4) | Urgent data is being posted while the "Billing Data Collected" alarm bit in ET14 is still set to True. |

# D.39 Extended Procedure 41 (EP41) (2089): MEP Download Initialize

This procedure is used to initiate firmware downloads to a MEP device. When this procedure completes, a new on-demand queue entry will be created in ET15 that will be used to notify the MEP device that a firmware download is starting. If the MEP device needs to reject the start of the firmware download, it can do so by calling EP39 with the "Data Type" field set to "Complete On-Demand Request" and the value of the "Result" field set to 3 (failed):

- Execution access: OMAK.

The data written from host to BT07 is described below.

**Table D.100**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Broadcast Sequence Number | UINT32 | 3 | | H | Broadcast sequence number to be used for the next software download. |
| Code Packet Size | UINT8 | 7 | | H | The size, in bytes, of code packets downloaded in EP09. This number shall be less than or equal to the value of the "M-Bus Multicast Message Length" field in ET11. |
| Device Indices Bitmap | UINT8 | 8 | | H | A bitmap representing which MEP devices will be receiving code packets. 0x01 implies device index 0, 0x02 device index 1, etc. |

The OSGP device response from ET59 is described below.

**Table D.101**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

The error codes that could be returned when EP39 is called are described below.

**Table D.102**

| Code Returned | Reason |
|---|---|
| T08_CONFLICT (3) | Invalid Data Type (out of range), or if there is no device registered for all data types, or unexpected firmware switchover status for data types (5,6) occurs, or no matching MEP request is found in ET15 for data type (9). |

# D.40 Extended Procedure 42 (EP42) (2090): Control Output Settings

Use EP42 to specify whether the OSGP device should use power measurements or current measurements to determine when the load disconnect contactor has reached its trip point.

When using power measurements, the method the OSGP device will use to calculate the power level when checking it against the maximum power level threshold with EP42 can be specified:

- Forward energy (Fwd Active [W] L1+L2+L3).
- Forward + reverse energy (Fwd+Rev Active [W] L1+L2+L3).
- Forward - reverse active energy (Fwd-Rev Active [W] L1+L2+L3).

When using current measurements, indicate how the OSGP device will measure the active current by specifying the source to use (i.e. Forward Current, Forward + Reverse Current, Forward - Reverse Current), and whether the current should be measured per phase, or as a sum of all phases. The following choices are available when single phase measurements are selected:

- If Forward current is selected, the OSGP device will check if any active phase with Forward current is above the Maximum Current Level Threshold in use.
- If Forward + Reverse current is selected, the OSGP device will check if the current for any active phase is above the Maximum Current Level Threshold in use.
- Forward - Reverse current is not a valid choice when single phase measurements are in use.

The following choices are available when the current is to be measured as the sum of all phases:

- If Forward current is selected, the OSGP device will check if the sum of the Forward current on all active phases is above the Maximum Current Level Threshold in use.
- If Forward + Reverse current is selected, the OSGP device will check if the combined current for all phases exceeds the Maximum Current Level Threshold in use.
- If Forward - Reverse current is selected, the OSGP device will check if the sum of the Forward current on all active phases minus the sum of the Reverse current on all active phases exceeds the Maximum Current Level Threshold in use. Note that the load disconnect contactor will not be shut off if Reverse current exceeds Forward current in this case.
- Execution access: OMAK.

The data written from host to BT07 is described below.

**Table D.103**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| Disconnect Trip Value | UINT8 | 3 | | H | Specify how the OSGP device will calculate the power (or current) level when checking it against the maximum power (or current) level threshold:<br>0 = Forward + Reverse Power (Fwd+Rev Active [W] L1+L2+L3)<br>OR Forward + Reverse Current<br>1 = Forward Power (Fwd Active [W] L1+L2+L3) OR Forward Current<br>2 = Forward - Reverse Power (Fwd-Rev Active [W] L1+L2+L3)<br>OR Forward - Reverse Current |
| Disconnect Control Type Select | UINT8 | 4 | | H | Specify how the OSGP device will determine when the load disconnect contactor has reached its trip point:<br>0 = Use power measurements<br>1 = Use current measurements |
| Disconnect Control Type Select | UINT8 | 5 | | H | If the "Disconnect Control Type Select" field is set to 1, this field determines whether the current should be measured per phase, or as a sum of all phases:<br>0 = Per phase<br>1 = Sum of all phases |

The OSGP device response from ET59 is described below.

**Table D.104**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| (No parameters) | | | | | |

The error codes that could be returned when EP42 is called are described below.

**Table D.105**

| Code Returned | Reason |
|---|---|
| T08_INVALID_PARAM (2) | Invalid parameter specified. For example, this would occur if both "Fwd - Reverse Power" for the "Disconnect Trip Value" field and "Per Phase" for the "Disconnect Control Type Select" field are specified. |

# D.41 Extended Procedure 44 (EP44) (2092): IO Control

This procedure can be used to change the polarity of a given I/O that has been configured as an output. This procedure can be locked by the control word:

- Execution access: OMAK.

**Table D.106: Data written from host to BT07**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| IO Address | UINT16 | 3 | | H | The address of the I/O. |
| IO number | UINT8 | 5 | | H | The pin number of the I/O. |
| Output level | UINT8 | 6 | | H | 0:Output low<br>1:Output high |
| Operation | UINT8 | 7 | | H | 0: No write or read<br>1: Write only<br>2: Read only<br>3: Write then read |

**Table D.107: OSGP device response from BT08**

| Field Name | Type | Offset | Value | VCI | Description |
|---|---|---|---|---|---|
| IO state bit | INT8 | 4 | | M | The state of the bit specified by the address and pin number. |
| IO state byte | INT8 | 5 | | M | The state of the byte specified by the address. |

# D.42 Extended Procedure 45 (EP45) (2093): Manufacturer Specific

Reserved for later use.

# D.43 Extended Procedure 46 (EP46) (2094): Manufacturer Specific

Reserved for later use.

# D.44 Extended Procedure 47 (EP47) (2095): Manufacturer Specific

Reserved for later use.

## D.45 Extended Procedure 48 (EP48) (2096): Manufacturer Specific

Reserved for later use.

## D.46 Extended Procedure 49 (MP49) (2097): Manufacturer Specific

Reserved for later use.

# Annex E (normative): OSGP OMA Digest Algorithm

This is the digest algorithm code expressed in C.

```
/*****************************************************************
Function:  Digest
Parameters: apduBytes -> bytes of apduSize
    key -> 12 bytes of key value. 96 bits.
    digestValueOut -> 8 bytes of key result.
        Zero before first call.
    pState -> 2 bytes of state value. Zero to start.
Returns:   None
Purpose:   To compute the digest based on the authorization key.
Comments:  This routine works segment by segment for long messages.
*****************************************************************/
/* user not aware of content of state
 */
typedef struct _Dstate
{
    byte    i;
    byte    j;
} DState;

void Digest(byte *apduBytes, short apduSize,
             byte*key, byte* digestValueOut, short* pState, byte bEnd )
{
   int k;
   int idx = 0;
   byte m, n;
   DState*  st = (DState*)pState;
   do
   {
       /* for each byte of the key
        */
      do /* for (i = 0; i < 18; i++) */
      {
          /* for each bit of the key byte
           */
         do /* for (j = 7; j >= 0; j--) */
         {
            k = (7 - st->j + 1) % 8;
            /* zero pad the message to use up any left over key bits
             */
            if (apduSize > 0)
            {
                /* use bytes in address order, not reverse
                 */
               m = apduBytes[idx++];
               apduSize--;
            }
            else
            {
                if ( bEnd )
                {   /* if this is the end, finish the key bits */
                    m = 0;
                }
                else
                {   /* if this is not the end, then return leaving state */
                    return;
                }
            }
            n = ~(digestValueOut[7-st->j] + (7-st->j) );
            if (key[st->i%12] &
                (1 << (st->j)) )
            {
               digestValueOut[7-st->j] =
                  digestValueOut[k] + m + ((n << 1) + (n >> 7));
            }
            else
            {
               digestValueOut[7-st->j] =
                  digestValueOut[k] + m - ((n >> 1) + (n << 7));
            }
            st->j++;
```

```
         } while ( st->j < 8 );
         st->j = 0;
         st->i++;
      } while ( st->i < 18 );
      st->i = 0;   } while (apduSize > 0);
}
```

# Annex F (informative): Void

# Annex G (informative): Bibliography


- BS EN 14908-3:2006: "Open data communication in building automation, controls and building management. Control network protocol. Power line channel specification".
- BS EN 50065-1:2001: "Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz. General requirements, frequency bands and electromagnetic disturbances".
- ETSI TS 103 908: "PowerLine Telecommunications (PLT); BPSK Narrow Band Power Line Channel for Smart Metering Applications [CEN EN 14908-3:2006, modified]".

# Annex H (informative): Change History

The following changes have been made to the present document.

| Date | Version | Information about changes |
|---|---|---|
| January 2012 | 1.1.1 | Publication of ETSI GS OSG 001 (ETSI ISG OSG) |
| November 2016 | 2.1.1 | Revision of ETSI GS OSG 001 into ETSI TS 104 001 (ETSI TC PLT) |
| January 2019 | 2.2.1 | Update to the ANSI, IEEE and MC references. |

# History

| Document history | | |
|---|---|---|
| V1.1.1 | January 2012 | Publication as ETSI GS OSG 001 |
| V2.1.1 | December 2016 | Publication |
| V2.2.1 | January 2019 | Publication |
| | | |
| | | |