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CODE OF PRACTICE SEVEN

CODE OF PRACTICE FOR THE METERING OF ENERGY IMPORTS VIA LOW VOLTAGE CIRCUITS FUSED AT 100 AMPS OR LESS PER PHASE FOR SETTLEMENT PURPOSES

Issue 1

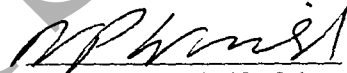### Version 3.00

DATE 13 February, 1996

Code of Practice Seven

CODE OF PRACTICE FOR THE METERING OF ENERGY IMPORTS VIA LOW VOLTAGE CIRCUITS FUSED AT 100 AMPS OR LESS PER PHASE FOR SETTLEMENT PURPOSES.
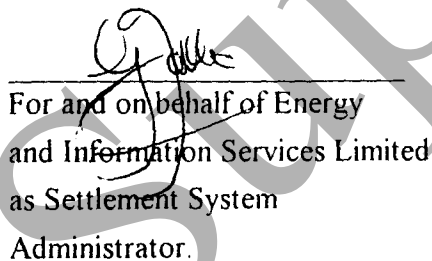
1. Reference is made to the Pooling and Settlement Agreement for the Electricity Industry in England and Wales dated 30th March 1990, and as amended and restated in 16th March 1995 and, in particular, to the definitions of "Code of Practice" and "Synopsis of Metering Codes" in clause 1.1 thereof.

2. Subject to Part 5 of Schedule 21 of the Pooling and Settlement Agreement, this Code of Practice shall apply to Metering Equipment comprising Metering Systems entered on to the Register on or after 1st April 1997.

3. This Code of Practice has been approved by the Executive Committee, the Settlement System Administrator and the Ancillary Service Provider.

For and on behalf of the
Executive Committee.

For and on behalf of the
Ancillary Service Provider.

For and on behalf of Energy
and Information Services Limited
as Settlement System
Administrator.

AMENDMENT RECORD

ISSUE	DATE	VERSION	CHANGES	AUTHOR	APPROVED
1	08/02/96	v 3.00	Approved by PEC	1998 MTF	PEC, 15/02/96

CODE OF PRACTICE FOR THE METERING OF ENERGY IMPORTS VIA LOW VOLTAGE CIRCUITS FUSED AT 100 AMPS OR LESS PER PHASE FOR SETTLEMENT PURPOSES.

CONTENTS

1. FOREWORD

This Code of Practice defines the minimum requirements for a Metering and Data Collection System (MDCS) required for the recording of electricity transfers at points of connection and/or supply VIA **LOW VOLTAGE CIRCUITS FUSED AT 100 AMPS OR LESS PER PHASE.**

Energy Settlements and Information Services Limited, as Settlement System Administrator ("SSA") shall retain copies of, inter alia, the Code of Practice together with copies of all documents referred to in them, in accordance with the provisions of the Pooling and Settlement Agreement ("P&SA").

2. SCOPE

This Code of Practice states the practices that shall be employed, and the facilities that shall be provided for the measurement, recording and collection of the quantities required for Settlement purposes.

This Code of Practice specifically applies to Metering and Data Collection Systems (MDCS) to be installed **FOR THE METERING OF ENERGY IMPORTS VIA LOW VOLTAGE CIRCUITS FUSED AT 100 AMPS OR LESS PER PHASE.**

Reactive energy measurement is not covered within this Code, where kVA and/or kvar is required Code of Practice 5 equipment shall be used.

It will be noted that this Code of Practice and Code of Practice 6 apply to the same circuit consumption. For clarity, the distinction is that Code of Practice 6 sets out the requirements for a Settlement Metering Equipment and Code of Practice 7 specifies the settlement requirements as part of a wider metering and data collection infrastructure providing data to the Data Processing interface. Code of Practice 7 does not require Code of Practice 6 Meters to be used. It would, however, be possible to construct a Code of Practice 7 system using Code of Practice 6 Metering.

It derives force from the metering provisions (Part XV) of the P&SA, to which reference should be made. It should also be read in conjunction with the relevant Agreed Procedures for, inter alia, operation of the data collection systems.

This Code of Practice does not contain the calibration, testing and commissioning requirements for Metering Equipment used for Settlement purposes. These requirements are detailed in Code of Practice Four - "Code of Practice for Calibration, Testing and Commissioning Requirements for Metering Equipment for Settlement Purposes".

Dispensations from the requirements of this Code of Practice may be sought in accordance with the P&SA and the relevant Agreed Procedure (AP32).

In the event of an inconsistency between the provisions of this Code of Practice and the P&SA, the provisions of the P&SA shall prevail.

3. REFERENCES

The following documents are referred to in the text:-

BS EN 61036	AC Static Watt-hour Meters for Active Energy (Classes 1 and 2).
BS EN 60521	Specification of Class 0.5, 1 and 2 Single-Phase and polyphase, single rate and Multi rate Watt hour meters.
SI 792	The Meters (Certification) Regulations 1990.
Electricity Act 1989	Schedule 7, as amended by the schedule 1, to the Competition and Services (Utilities) Act 1992.
BS EN 7799	Code of Practice for Information Security Management.
Pooling and Settlement Agreement	Definitions, part XV and Agreed Procedures.
Code of Practice 4	Code of Practice for Calibration, Testing and Commissioning Requirements for Metering Equipment for Settlement Purposes.
Code of Practice 5	Code of Practice for the Metering of Energy Transfers with a Maximum Demand of up to (and Including) 1MW Covered by the Pooling and Settlement Agreement.
Code of Practice 6	Code of Practice for Metering of Energy Imports via Low Voltage Circuits Fused at 100Amps or Less per Phase for Settlement Purposes.

4. DEFINITIONS AND INTERPRETATIONS

Save as otherwise expressly provided herein, words and expressions used in this Code of Practice shall have the meanings attributed to them in the P&SA.

The following definitions, which also apply, supplement or complement those in the P&SA and are included for the purpose of clarification.

4.1 Active Energy

Active Energy means the electrical energy produced, flowing or supplied by an electrical circuit during a time interval, and being the integral with respect to time of the instantaneous power measured in units of watt-hours or standard multiples thereof, that is;

1,000 Wh = 1 kWh
1,000 kWh = 1 MWh
1,000 MWh = 1 GWh
1,000 GWh = 1 TWh

4.2 Active Power

Active Power means the product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof, that is;

1,000 Watts = 1 kW
1,000 kW = 1 MW
1,000 MW = 1 GW
1,000 GW = 1 TW

4.3 Demand Period

Demand Period means the period over which Active Power is integrated to produce Demand Values. Each Demand Period shall be of 30 minutes duration, one of which shall finish at 24:00 hours.

4.4 Demand Values

Demand Values means, expressed in kW twice the value of kWh recorded during any Demand Period. The Demand Values are half hour demands and these are identified by the time of the end of the Demand Period.

4.5 Electricity

Electricity means Active Energy and Reactive Energy.

4.6 Energy Storage Device

A device to provide standby power to the Metering Equipment clock and calendar in the event of Mains failure e.g. battery or supercapacitor.

4.7 Full Load

Full Load means the product of the number of phases, maximum current (I_{max}), and rated voltage of the Meter at unity power factor.

4.8 Import

Import means, for the purposes of this Code of Practice, an electricity flow as specified within the P&SA.

4.9 Maximum Demand

Maximum Demand expressed in kW means twice the greatest number of kWh recorded during any Demand Period.

4.10 Meter

Means a device for measuring electrical energy.

4.11 Metering Clock

Metering clock means a clock or system used for assigning a metered value to a specific Demand Period .

4.12 Metering Equipment

Metering Equipment means Meters, measurement transformers (both voltage and current), metering protection equipment including alarms, circuitry and their associated data collection outstations and wiring which are part of the Active Energy measuring equipment at, or relating to, a Site.

4.13 Meter Register

Meter Register means a device, normally associated with a Meter, from which it is possible to obtain a reading of the amount of Active Energy that has been supplied by a circuit.

4.14 Metering and Data Collection System (MDCS)

This MDCS means all components of equipment, including Metering Equipment, between the point of supply and or connection and the Data Processing Interface used in order to satisfy the requirements of Code of Practice 7.

4.15 Data Processing Interface

Data Processing Interface means a computer based system receiving data on a routine basis from selected MDCS on behalf of Pool Members or by Agents of Pool Members.

4.16 UTC

Universal Time Clock means clocks that operate to this time, as distinct from GMT.

5. Electrical Interface Requirements

5.1 Measured Quantities

For each circuit the following energy measurements are required for Settlement purposes:
(i)   Import kWh.

5.2 Accuracy Requirements

The overall accuracy of the energy measurements shall at all times be within the limits of error specified in SI 792 Regulation 8 pertaining to Schedule 7 of the Electricity Act 1989.

Meters where certified shall be certified as set out in accordance with schedule 7 of the Electricity Act 1989.

Appropriate evidence to substantiate that these overall accuracy requirements are met shall be available for inspection to Pool Members or their agent(s).

5.3 Meters

For each circuit direct connected Active Energy Meters shall be used, which shall be in accordance with Schedule 7 of the Electricity Act 1989.

5.3.1 New Meters

New Meters shall comply with the requirements of either BS EN 61036 Class 2, for Indoor Meters or BS EN60521 Class 2. The rating for single phase Meters shall be 230 volts, 50Hz, 20 Amps basic or less and 100 Amps maximum and for polyphase Meters 230/400 volts, 50Hz, 40 Amps basic or less and 100 Amps maximum.

5.3.2 Existing Meters

Existing Meters may be used provided they were manufactured to the relevant British Standards. Ratings different to those quoted for new Meters may be utilised provided they are appropriate for the supply being metered.

5.4 Metering Equipment

All MDCS Metering Equipment (including Energy Storage Device) shall have a minimum design service life, without maintenance, of 10 years from date of manufacture.

Where separate items of equipment are provided they shall be individually protected against electrical overload.

Where Metering Equipment has a primary battery to provide back-up for the clock and calendar, this battery shall have a minimum standby service life of 3 years from the date of manufacture of the Metering Equipment i.e. supporting the clock for 3 years without mains power.

Where Energy Storage Devices other than primary batteries are used, the clock and calendar shall be supported for a period of 7 days without an external supply connected to cater for extended supply failure.

6. Supplier Interface Requirements

6.1 Displays and Facilities at a Site.

This section sets out the displays that shall be provided at the customers site. If such facilities are provided remote from the Meter the displays shall be updated on demand by the customer or at least once in any 24hr period.

The MDCS shall display as a minimum the following information:
- total Import cumulative kWh per circuit, 6 digit integer kWh value padded with leading zeroes where appropriate for polyphase and 5 digit integer kWh value padded with leading zeroes where appropriate for single phase Meters.

The MDCS shall store the following data for each Meter such that it can be readily displayed if required by the supplier. If this data is displayed it shall be made readily available to the supplier (see Section 7) :

(i)   For Polyphase Meters:
- Maximum Demand ("MD") 6 digit (4 integer and 2 decimal places) kW value padded with leading zeroes where appropriate for the current and historic programmable charging period, e.g. monthly or statistical review period;
- cumulative MD, 6 digit (4 integer and 2 decimal places) kW value padded with leading zeroes where appropriate;
- number of MD resets (up to 99);
- multi-rate display sequence as specified by the Supplier, with a minimum of 8 Registers selectable over the calendar year; and
- current UTC or clock time and date as specified by supplier.

(ii)   For single phase Meters:
- multi-rate display sequence as specified by Supplier, with a minimum of 4 Registers selectable over the calendar year; and
- current UTC or clock time and date as specified by supplier.

Further details on the multi rate register switching scheme are given in Appendix 4.
Where a multi-rate display sequence is enabled associated with a Meter, the default display shall be the cumulative kWh register of the active rate and the rate identifier. The initial operation of the display selector, if fitted, shall display the test display and the next operation shall display the total Import cumulative kWh. Subsequent operation of the display selector shall display register values in a sequence specified by the supplier.

7. Pool Requirements for the Data Processing Interface

The MDCS and its operator shall comply with BS7799 particularly sections 6,7,8, and 9.

7.1 Data Provision requirements

For each Meter, one Data Collection Agency shall be responsible for data collection.

The MDCS shall provide information in the formats specified in Appendix 1A, 1B and 2A. Open electronic data interchange standards shall be used.

7.1.1 Data Requirements

Data at the Data Processing Interface shall be provided for each Meter as follows and is further defined in Appendix 1:

(i) For each data exchange of the MDCS with Data Processing and for each metered data stream:
- kWh cumulative total Meter Register value for each Meter to 6 digit integer kWh value padded with leading zeroes where appropriate (see section 7.7 on the conversion algorithm);
- The date and time of the recording of the cumulative register reading [YYMMDDhhmmss];
- The Meter identifier; 12 characters alphanumeric as defined in Appendix 1b,
- For polyphase metering, Maximum Demand (MD), 6 digit (4 integer and 2 decimal places) kW value padded with leading zeroes where appropriate, for the current and previous programmable charging period e.g. monthly statistical review period as specified by the Supplier;
- multi-rate cumulative Active Energy registers as specified by Supplier;
- date of last MD reset if appropriate [YYMMDD]; and
- number of days data returned from Meter.

(ii) The MDCS shall provide the following data for each Day or partial Day where available, for each metered data stream:
- kWh cumulative total Meter Register value for each Meter to 6 digit integer kWh value padded with leading zeroes where appropriate;
- Where a battery is fitted supporting a Metering Clock, a battery change maintenance flag shall be provided based on the standby battery service life;
- An indication should a Metering Clock failure occur;
- the number of successful password accesses (i.e. any access that changes static or dynamic data) made on that day to a maximum of 7;
- MD reset flag as appropriate;
- The Settlement Day Date [YYMMDD]; and
- A flag to indicate any power outage for the whole of a Settlement Day.

(iii) For each Demand Period the MDCS shall provide, for each metered data stream:

- A flag to indicate if net reverse energy flow has taken place;
- Truncated absolute cumulative Meter Register reading in the range 10's of kWh, kWh, 1/10 kWh and 1/100 kWh;
- A flag to indicate successful password access (i.e. any access that changes static or dynamic data); and
- a flag to indicate that any power outage has occurred.

Where billing information is displayed in accordance with section 6.1, it shall be provided to the supplier via the interface.

7.1.2 Command Requirements

The MDCS shall permit the following data request functions as a minimum:

- Read complete 30 minute database;
- Last 'n' days of data, where 'n' is the number of days (n = 0 is the current day); and
- Read selected Meters (if appropriate).

7.2 Data Accuracy

Any discrepancy between the measured value of Active Energy at each individual metering point and the equivalent data presented at the Data Processing Interface for the same metering point shall not exceed +/-0.5% of full load at that metering point.

The value of energy measured in a Demand Period but not stored in that Demand Period shall be carried forward to the next Demand Period.

7.3 Time Keeping

The MDCS and all its elements shall be referenced to the Universal Time Clock (UTC). No switching between UTC and British Summer Time (BST) shall occur for settlements data storage requirements.

(i)   For Unsynchronised Metering Clocks the limits of error for the time keeping shall be:

- The completion of each Demand Period to be at a time which is within ± 6 minutes of UTC; and
- The duration of each Demand Period to be within ± 2%, except where time synchronisation has occurred in a Demand Period.

(ii)   Where synchronised Metering Clocks are used for the measurement of Demand Periods for Meter Registers then the overall system timing accuracy shall be:

- The completion of each Demand Period at a time to be within ± 30 seconds of UTC; and
- the duration of each Demand Period to be within ± 1%.

7.4 Security Requirements

7.4.1 Data Security

The MDCS shall include appropriate controls to provide reasonable assurance that all data held within it, and any related processing carried out by it, is complete, accurate, timely, and comes from an authorised source.

The MDCS shall contain an appropriate means of uniquely authenticating that the data presented to the Data Processing Interface has been correctly attributed to the correct Meter. The preferred approach is specified as set out in Appendix 3 (section 11).

7.4.2 Access to system

Access to modify, insert or delete dynamic or standing data in the MDCS shall be defined. Parties shall be granted sufficient access to data and other aspects of the MDCS to accomplish assigned tasks, but no more. Access to the MDCS to re-configure or reprogram any module or element shall be restricted by password. Access shall be only by authorised individuals.

The MDCS shall use a protected mechanism to authenticate the user's identity. The MDCS shall protect authorisation data so that it cannot be accessed by any unauthorised user. The MDCS shall be able to enforce individual or group accountability by providing the capability to uniquely identify each MDCS user, and associate this identity with all auditable actions taken by that individual (see section 7.7 on what actions are auditable).

7.4.3 Sealing

All Metering Equipment shall be capable of being sealed in accordance with the relevant Pool Agreed Procedures, the Meter Operator Codes of Practice, Certification Regulations and other relevant standards.

If the Metering Equipment uses a manual Maximum Demand (MD) reset button then this shall be sealable.

7.5 Performance

The MDCS shall be capable of demonstrating that it is able to technically and operationally meet these requirements before being accepted as a Code of Practice 7 System. MDCS performance will be measured against the following parameters over a Calendar Month:
- Each Calendar month accurate (see section 5.2, 7.2 & 7.3) data shall be provided for at least 99% of Meters for at least 99% of the Demand Periods; and

- If, due to unforeseen circumstances, the data cannot be delivered the MDCS shall be able to recover enough Metered Register Data within 7 working days to meet the performance requirements stated above.

7.6 Resilience and Reliability

7.6.1 Data integrity

The MDCS shall:
- provide information to permit resolution of inconsistent data;
- provide information to permit verification of the accuracy of data;
- permit the adaptation of data structures and dependent processes to meet changes demanded by regulatory and other appointed organisations;
- facilitate a comprehensive and reliable recovery process;
- provide protection from unauthorised access;
- facilitate the effective operation of any data warehousing, database gateway, message warehouse, or message gateway initiatives where required; and
- facilitate the effective operation of any other data consistency management programme.

7.6.2 Physical integrity

The MDCS shall permit detection and rectification of any failure that leads to a break of the performance requirements set out in section 7.5 and 7.2, on a timely basis.

The MDCS shall be capable of detecting when communication links are disabled, and be able to take appropriate measures to ensure that no data is lost, corrupted or duplicated.

7.6.3 Backup and system continuity

Adequate MDCS continuity procedures shall exist (e.g. backup, or prevention of loss of data in the event of mains power loss to any component of the MDCS, including the Meter itself and communication links).

No one component or module of the MDCS shall store, without duplication, more than 1GWh's of metered data at any time that has not yet been successfully transmitted and receipt acknowledged by the Data Processing interface. Where duplication is undertaken all reasonable precautions shall be taken and demonstrated to avoid common mode failure and faults.

7.7 Audit

This section defines the audit requirements over and above those requirements of the business, to ensure the proper operation of the MDCS.

Pool authorised agents shall be able to evaluate MDCS security and accountability by a secure means, within a reasonable time, and without undue difficulty.

The MDCS shall permit direct read access to any data stored in any part of the MDCS for audit purposes.

There shall be an adequate audit trail which is sufficient to allow tracing of individual Meter readings back to the Meter.

All access to the MDCS for reprogramming or re-configuration of any element of the MDCS shall be supported by an adequate (see below) audit trail. The audit trail system design shall be subject to the approval of the Pool auditor. Audit trails may be archived but shall be available for inspection to the Pool auditor. The audit data shall be protected by the system so that read access to it is limited to those who are authorised for audit data. The system shall be able to record the following events:

1. failed use of authentication mechanisms;
2. introduction , deletions or modifications of standing or dynamic data into the system;
3. Programming or reconfiguration of any element of the system recorded for each meter affected; and
4. other security relevant events.

The audit record shall identify: date and time of the event, user, type of event, and success or failure of the event. For identification/authentication events the origin of request (e.g. terminal ID) shall be included in the audit record. For changes made to the MDCS, the audit record shall identify the change. The system administrator shall be able to selectively audit the actions of any one or more users based on individual identity.

The algorithms performing the conversion to kWh shall be documented and approved.

The Pool Auditor will be asked to approve all MDCS''s prior to their operation to ensure that the appropriate controls have been incorporated within it to achieve the above mentioned control objectives.

7.8 Communications with Data Processing Interface

The Outline Data Structure for the information required in 7.1.1 is detailed in Appendix 1a.

The Data Structure and Format for the data items specified in section 7.1.1 are detailed in Appendix 1b.

The Data Definitions and Descriptions are detailed in Appendix 2a.

7.9 Archiving

Audit trail archives shall be maintained for 6 years.

8. Third Party Interface Requirements

8.1 Access To Data

Access to metering data shall be in accordance with the provisions of the P&SA and the Agreed Procedures referred to therein. Such access shall not interfere with or endanger the security of the data or the collection process for Settlement purposes.

8.2 Additional Features

Additional features may be incorporated within or associated with the Metering Equipment provided but these shall not interfere with or endanger the operation of the Settlement process.

9. Appendix 1 Outline Data Structure and Formats

9.1 Appendix 1a: Outline Data Structure

The outline data structure described in Appendix 1a is expanded in Appendix 1b to provide more detail of the precise data structures and formats. Appendix 2a contains the data definitions and descriptions. The data authentication process is outlined in Appendix 3.

9.2 Appendix 1b: Data Structure and Formats

OUTLINE DATA STRUCTURE

"TAG" DATA HEADER BLOCK	Meter Identifier - MID Date/Time of reading kWh Cumulative Reading MD & Multi-rate Info. No. of days data in message
DAILY HEADER BLOCK 0 **CURRENT DAY**	Date kWh Cumulative Reading Security Data/Flags
DATA BLOCK **CURRENT DAY**	Data array of 48 fields Each field containing the kWh Value - XX.XX Security Flag
DAILY HEADER BLOCK 1 **PREVIOUS DAY**	Date kWh Cumulative Reading Security Data/Flags
DATA BLOCK **PREVIOUS DAY**	Data array of 48 fields Each field containing the kWh Value - XX.XX Security Flag arrays
DAILY HEADER BLOCK n-1 **CURRENT DAY - (n-1)**	Date kWh Cumulative Reading Security Data/Flags
DATA BLOCK **CURRENT DAY - (n-1)**	Data array of 48 fields Each field containing the kWh Value - XX.XX Security Flag arrays
DIGITAL SIGNATURE	Data authentication block

Elapsed Time

9.2.1 "TAG" Data Header Block

9.2.1.1 Meter Identifier-MID

<u>Character Mapping</u>

P P P   M Y Y   X X X X X X

- 6 digit alpha-numeric
- Last 2 digits of year of manufacture
- Manufacturers Code
- Free format data field
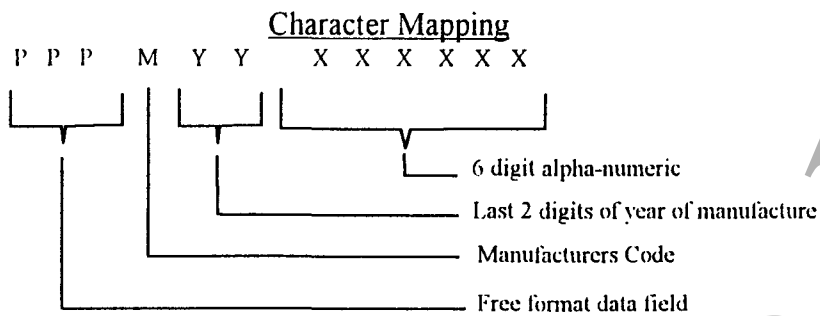
Field	Character	Type	Range	Field Padding	Allowed Case
PPP	P	Alpha-numeric	A-Z. 0-9	Leading Zeroes	Upper or Lower Case
M	M	Alpha	A-Z	-	Upper Case Only
YY	Y	Numeric	0-9	-	-
XXXXXX	X	Alpha-numeric	A-Z. 0-9	Leading Zeroes	Upper Case Only

9.2.1.2 Date and Time of Reading of Meter

Y Y   M M   D D   h h   m m   s s

- Seconds
- Minutes
- Hours
- Day
- Month
- Year

9.2.1.3 kWh Cumulative Reading

The absolute value of the cumulative meter register at the time of the interrogation. Expressed as :- 6 digit integer kWh value, padded with leading zeroes where appropriate.

1	2	3	4	5	6
Hundred Thousand	Ten Thousand	Thousands	Hundreds	Tens	Units

9.2.1.4 Maximum Demands - MDs

MD register data block consisting of 6 digit (4 integer and two decimal places) kW values with an implied decimal place, padded with leading zeroes where appropriate.

i)   MD in kW in current charging period

ii)   MD in kW in previous charging period

iii)   Cumulative Maximum Demand

Register ID	1000's	100's	Tens	Units	1/10ths	1/100ths
Current kW MD	1	2	3	4	5	6
Previous kW MD	1	2	3	4	5	6
Cumulative MD	1	2	3	4	5	6

9.2.1.5 Date of Last MD Reset

Date of the last MD reset consisting of :-

```
   Y Y    M M   D D
   └─┬─┘  └─┬─┘ └─┬─┘
     │      │     │
     │      │     └──────── Day
     │      └────────────── Month
     └───────────────────── Year
```
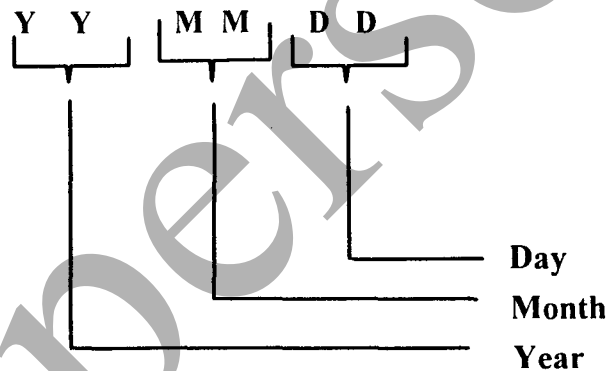
9.2.1.6 Number of Maximum Demand Resets

The numerical value representing the number of Maximum Demand Resets, maximum value NN = 99.

No. of MD Resets	N	N

9.2.1.7 Multi-rate Energy Registers

Multi-rate energy registers at time of data read out consisting of 6 digit integer kWh values, padded with leading zeroes where appropriate.

Register ID	100k's	10k's	1000's	100's	Tens	Units
Rate 1	1	2	3	4	5	6
Rate 2	1	2	3	4	5	6
Rate 3	1	2	3	4	5	6
Rate 4	1	2	3	4	5	6
Rate 5	1	2	3	4	5	6
Rate 6	1	2	3	4	5	6
Rate 7	1	2	3	4	5	6
Rate 8	1	2	3	4	5	6

This data block should always be of the same size. All data items should be transmitted, even if never initialised or used e.g. MD register on single phase meter, 8 rate register block even if 4 rate single phase meter, or if rate currently inactive e.g.due to tariff change.

9.2.1.8 Number of Days Data in Message

The numerical value representing the number of days of data to be transmitted by   the system in response to a request for a data output.

No. of days of data in message	N	N	N

9.2.2 Daily Header Block

9.2.2.1 Day Identifier

Day identifier for the 24 hour period to which the 30 minute data relates.
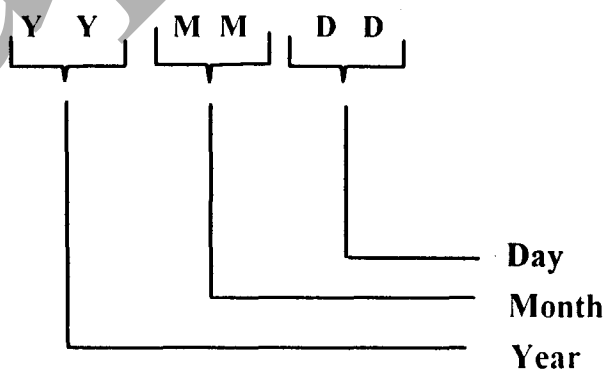
9.2.2.2 Start of Day kWh Cumulative Reading

The absolute value of the cumulative meter (channel) register at 00:00 hours, at the start of the 24 hour period, to which the 48 periods of information relate.

Expressed as :- 6 digit integer kWh value, padded with leading zeroes where appropriate.

1	2	3	4	5	6
Hundred Thousand	Ten Thousand	Thousands	Hundreds	Tens	Units

9.2.2.3 Security Data and Flags

The normal status of each flag is logic zero and the presence or occurrence of an identified event is signalled by setting the flag to logic 1.

i)   NNN - No. of successful level 2 accesses (maximum count = 7);

ii)   BM - Battery Maintenance Flag;

iii)   CF - Clock Failure;

iv)   MD - MD reset flag, set for the day on which the MD was reset; and

v)   PO - 24 hour continuous power outage of the system.

The security data and flags shall be coded into a single byte as follows:

Bit	7	6	5	4	3	2	1	0
Type	-	PO	MD	CF	BM	N	N	N

(Bit 7 is reserved for future use).

9.2.3 Data Block

The truncated absolute value of the cumulative meter (channel) register at the end of the 30 minute period, to which the value relates.

Expressed as :- 4 digit kWh value, comprising two integers and two decimal digits, with an implied decimal place.

1	2	3	4
Tens	Units	Tenths	Hundredths

Appended for each 30 minute record are three security flags:

i)   Reverse running indication;

ii)   Successful level 2 password access; and

iii)   Power Failure.

The normal status of these flags is logic zero and the presence or occurrence of an identified event is signalled by setting the flag to logic 1.

The data block will consist of a contiguous data array of 48, 4 digit values representing the value (truncated kWh cumulative register) for each respective demand period of the day e.g.

```
2220 2221 2222 2223 2224 2225 2226 2227
2228 2229 2230 2231 2232 2233 2234 2235
2236 2237 2238 2239 2240 2241 2242 2243
2244 2245 2246 2247 2248 2249 2250 2252
2252 2253 2254 2255 2256 2257 2258 2259
2260 2262 2262 2263 2264 2265 2266 2267
```

The data flags shall be presented as individual bit arrays with a flag for each demand period of the day in the array (48 bits per day). The sequence and location of individual bits within the data flag array corresponds directly to the demand period number of the respective 30 minute data value. i.e. bit 1 associated with demand period 1 (00:00 to 00:30) bit 48 associated with demand period 48 (23:00 to 24:00).

Data that has not yet been generated for the individual 30 minute demand periods i.e. in current day block for times following the time of data readout, shall be represented by FFFF. All flags for these associated periods shall be set to logic 0.

9.2.4 Data Authenticator

The data authenticator is appended to each data block associated with every data read process. The data authenticator is detailed in Appendix 3.

10. Appendix 2A Data Definitions and Descriptions

10.1 Data Block

10.1.1 General Definition

Complete set of data for one communications session

10.1.2 Data Definition

```
Identifier ::= NamedVariableList
{
        variable list name       0
        scope of access          VAA-specific
        VAA name                 7
        scope may change         FALSE
        life time                VDE
        list of named variables 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96
}
```

10.2 Meter Identifier - MID

10.2.1 General Definition

12 characters representing the Meter Identifier - MID

10.2.2 Data Definition

```
Identifier ::= NamedVariableObject
{
        variable name            8
        scope of access          VAA-specific
        VAA name                 7
        scope may change         FALSE
        life time                VDE
        type description         visible-string(SIZE(12))
        read-write flag          READ-ONLY
        available                TRUE
}
```

10.3 Date and Time of Reading Meter

10.3.1 General Definition

12 characters representing the date and time

10.3.2 Data Definition

```
DateAndTime ::= NamedVariableObject
{
        variable name          16
        scope of access        VAA-specific
        VAA name               7
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(12))
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.4 kWh Cumulative Reading

10.4.1 General Definition

6 characters representing the total cumulative kWh in kWh

10.4.2 Data Definition

```
CumulativekWh ::= NamedVariableObject
{
        variable name          24                            .
        scope of access        VAA-specific
        VAA name               7                    -- VAABilling
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(6))    -- Format as above
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.5 Current kW Maximum Demand

10.5.1 General Definition

6 characters representing the current kW MD in 1/100s of a kW.

10.5.2 Data Definition

```
CurrentkWMD ::= NamedVariableObject
{
        variable name          32
        scope of access        VAA-specific
        VAA name               7                        -- VAABilling
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(6))  -- Format as above
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.6 Previous kW Maximum Demand

10.6.1 General Definition

6 characters representing the previous kW MD in 1/100s of a kW.

10.6.2 Data Definition

```
PreviouskWMD ::= NamedVariableObject
{
        variable name          40                       •
        scope of access        VAA-specific
        VAA name               7                        -- VAABilling
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(6))  -- Format as above
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.7 Cumulative Maximum Demand

10.7.1 General Definition

6 characters representing the cumulative MD in 1/100s of a kW.

10.7.2 Data Definition

```
CumulativeMD ::= NamedVariableObject
{
        variable name          48
        scope of access        VAA-specific
        VAA name               7                      -- VAABilling
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(6))    -- Format as above
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.8 Date Of Last MD Reset

10.8.1 General Definition

6 characters representing the date of the last maximum demand reset.

10.8.2 Data Definition

```
MDResetDate :: = NamedVariableObject
{
        variable name          56                         •
        scope of access        VAA-specific
        VAA name               7                      -- VAABilling
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(6))    -- Format as above
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.9 Number Of Maximum Demand Resets

10.9.1 General Definition

2 characters representing the number of maximum demand resets, 00 - 99.

10.9.2 Data Definition

NumMaxDemandResets :: = NamedVariableObject
{
variable name	64
scope of access	VAA-specific
VAA name	7 -- VAABilling
scope may change	FALSE
life time	VDE
type description	numeric-string(SIZE(2)) -- Format as above
read-write flag	READ-ONLY
available	TRUE

}

10.10 Multi-rate Energy Registers

10.10.1 General Definition

Eight registers containing the multi-rate kWh energy in kWh.

10.10.2 Data Definition

MultiRatekWh ::= NamedVariableObject
{
variable name	72
scope of access	VAA-specific
VAA name	7 -- VAABilling
scope may change	FALSE
life time	VDE
type description	compact-array(SIZE(8)) OF numeric-string(SIZE(6))
read-write flag	READ-ONLY
available	TRUE

}

10.11 Number of Days Data in Message

10.11.1 General Definition

Three characters representing the number of days of data to be transmitted.

10.11.2 Data Definition

```
NumberOfDays ::= NamedVariableObject
{
        variable name          80
        scope of access        VAA-specific
        VAA name               7                    -- VAABilling
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(3))
        read-write flag        READ-ONLY
        available              TRUE
}
```

10.12 Profile Data

10.12.1 General Definition

Daily data block comprising header data and profile data.

10.12.2 Data Definition

DailyData ::= NamedVariableObject
{

variable name	88
scope of access	VAA-specific
VAA name	7 -- VAABilling
scope may change	FALSE
life time	VDE
type description	compact-array OF DailyDataType SIZE(N+1)
read-write flag	READ-ONLY
available	TRUE

}

Where N = 20, 100, 250 or 450

DailyDataType :: = structure
{

DayIdentifier	numeric-string(SIZE(6))
StartCumulativekWh	numeric-string(size(6))
DailyFlags	bit-string(SIZE(8))
HalfHourData	compact-array(SIZE(48)) OF numeric-string (SIZE(4))
ReverseRunning	bit-string(SIZE(48))
Level2	bit-string(SIZE(48))
PowerFail	bit-string(SIZE(48))

}

10.13 Authenticator

10.13.1 General Definition

Eight byte string calculated using an authentication algorithm, an internal 8 byte authentication key and the preceding data.

10.13.2 Data Definition

Authenticator ::= NamedVariableObject
{

variable name	96	
scope of access	VAA-specific	
VAA name	7	-- VAABilling
scope may change	FALSE	
life time	VDE	
type description	octet-string(SIZE(8))	
read-write flag	READ-ONLY	
available	TRUE	

}

10.14 Authentication Key

10.14.1 General Definition

Eight byte string used by the authentication algorithm when calculating the authenticator.

10.14.2 Data Definition

AuthenticationKey ::= NamedVariableObject
{

variable name	104	
scope of access	VAA-specific	
VAA name	39	-- VAAManagement
scope may change	FALSE	
life time	VDE	
type description	octet-string(SIZE(8))	
read-write flag	WRITE-ONLY	
available	TRUE	

}

10.15 Password

10.15.1 General Definition

Six character string consisting of case insensitive alpha characters (A to Z), digits (0 to 9) or the underscore character (_).

10.15.2 Data Definition

```
Level2Password ::= NamedVariableObject
{
        variable name          112
        scope of access        VAA-specific
        VAA name               39                      -- VAAManagement
        scope may change       FALSE
        life time              VDE
        type description       visible-string(SIZE(6))
        read-write flag        WRITE-ONLY
        available              TRUE
}
```

10.16 Date and Time Set

10.16.1 General Definition

12 characters representing the date and time

10.16.2 Data Definition

```
DateAndTimeSet ::= NamedVariableObject
{
        variable name          120
        scope of access        VAA-specific
        VAA name               39                      -- VAAManagement
        scope may change       FALSE
        life time              VDE
        type description       numeric-string(SIZE(12))
        read-write flag        READ-WRITE
        available              TRUE
}
```

10.17 Time Adjust

10.17.1 General Definition

Signed integer representing the number of seconds by which to adjust the time. The maximum permissible value is ± 900 seconds.

10.17.2 Data Definition

```
DateAndTimeSet ::= NamedVariableObject
{
        variable name          128
        scope of access        VAA-specific
        VAA name               39                          -- VAAManagement
        scope may change       FALSE
        life time              VDE
        type description       integer
        read-write flag        WRITE-ONLY
        available              TRUE
}
```

10.18 Maximum Demand Reset

10.18.1 General Definition

Boolean which when written to will initiate a maximum demand reset.

10.18.2 Data Definition

```
MDReset ::= NamedVariableObject
{
        variable name          136
        scope of access        VAA-specific
        VAA name               39                   -- VAAManagement
        scope may change       FALSE
        life time              VDE
        type description       integer
        read-write flag        WRITE-ONLY
        available              TRUE
}
```

11. Appendix 3 Authentication

11.1 Authentication Overview

The requirement for authentication in is to ensure that the receiver of the information can be confident that the contents of the message have not been altered since it left the sender and that the identity of the sender is not misrepresented. On one hand the sender is the system as it generates the metering profile information and on the other hand the system is the receiver as it obtains requests for reprogramming data or setting of the clock.

The data authentication process utilises a system whereby Authentication Keys will be loaded into systems by authorised parties. These Keys, along with all the data to be communicated, will then be used to form a Digital Signature. The same Keys will be provided to the authenticating parties. This will ensure that all authorised holders of the Keys will be able to validate the authenticity of the information being transferred, provided of course that they also have knowledge of the appropriate Digital Signature algorithm.

The Authentication Keys programmed into systems and other validation equipment can be changed should the authentication system be compromised. A Key management system is required to ensure secure creation, storage and transport of the Keys to all parties concerned.

11.2 Authentication Process

The data block described in Appendix 1(a) will be signed by a Digital Signature to provide authentication of the source and validation of the data. This allows the content of messages to be sent in plain text and still validated and authenticated by authorised parties only. There are two inputs to the Digital Signature function :-
i)   A Hash Function - a representation of all the data in the data block
ii)   A Private Authentication Key.
The Private Authentication Key is an 8 byte (64 bit) binary number that is kept secret. It is placed in all devices that need to either generate an authenticated Digital Signature, or check that the Digital Signature received is valid.

The Hash function is used to create a smaller representation of the transmitted data. The total data block, consisting of all data inclusive of the Tag Header Block through to the last full days data block being transmitted is included into the Hash calculation. As the data block is of variable length the Hash Function must allow for variable length messages.

These two items are then operated on by the Digital Signature function to provide an 8 byte (64 bit) Digital Signature, which is appended to the end of the data block. The details of the Hash Function and the Digital Signature are defined in a controlled document, available on request to authorised parties from the Electricity Pool of England and Wales.

12. Appendix 4 Multi-rate Register Switching Regime

Multi-rate registers shall be programmable to provide the following minimum seasonal time of use tariff switching regime as described below and in the following diagrams;

- A minimum of 24 stored register switching times for a single phase and 48 for polyphase Meter systems at any one time.
- A minimum of 8 day types, each of which has an individual set of register switching times.
- A sequential day of the week number to allow register switching to take place on any day of the week or combinations of days of the week. Monday shall be day 1.
- A minimum of 8 seasons. Different weekday or combinations of weekdays register switching time registers can apply to each season.
- In addition to switching times a minimum of 13 MD Reset dates, commencing at the start of the settlement day, for the start of the seasons.
- A minimum of 2 daylight clock time changes, indicated by date and month during which a time shift of 1 or 2 hours will be implemented at 02:00 (time advance) or 03:00 (time retard). This shall not effect the UTC clock.
- A minimum of 12 exclusion dates during which any day's register switching times, indicated by day type, can be implemented for each exclusion date.
- Where Maximum Demand (MD) metering is being operated the MD shall be programmable to reset automatically as defined by 13 MD reset dates.

Where load switching is provided it shall comply with the appropriate standards.
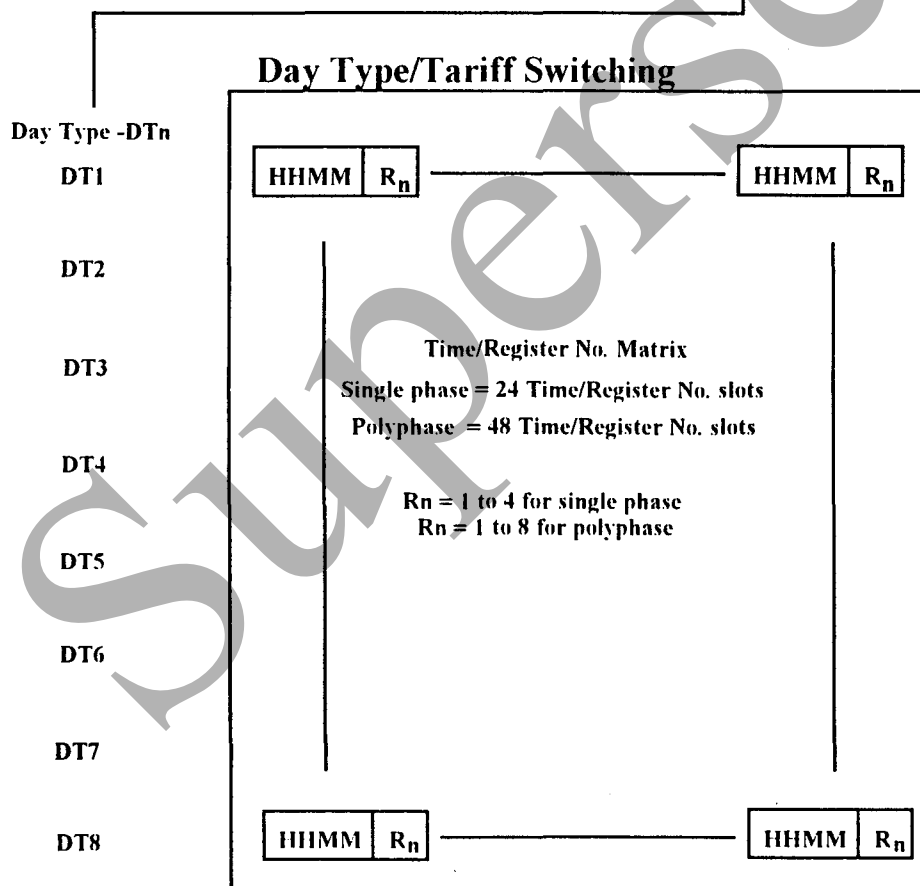
Trigger Dates For Start of Seasons

Season Definitions

1	DDMM	Sn
2	DDMM	Sn
3	DDMM	Sn
4	DDMM	Sn
5	DDMM	Sn
6	DDMM	Sn
7	DDMM	Sn
8	DDMM	Sn
9	DDMM	Sn
10	DDMM	Sn
11	DDMM	Sn
12	DDMM	Sn
13	DDMM	Sn

Sn = 1 to 8

Season No. Sn

Day of Week/Day Type - DT

	M	Tu	W	Th	F	S	Su
S1	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S2	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S3	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S4	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S5	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S6	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S7	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n
S8	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n	DT_n

DTn = 1 to 8

Day Type/Tariff Switching

Day Type -DTn

DT1

DT2

DT3

DT4

DT5

DT6

DT7

DT8

| HHMM | R_n | ———————— | HHMM | R_n |

Time/Register No. Matrix

Single phase = 24 Time/Register No. slots

Polyphase = 48 Time/Register No. slots

Rn = 1 to 4 for single phase
Rn = 1 to 8 for polyphase

| HHMM | R_n | ———————— | HHMM | R_n |

Exclusion Dates   Date of MD Reset

1	DDMM	DT		1	DDMM
2	DDMM	DT		2	DDMM
3	DDMM	DT		3	DDMM
4	DDMM	DT		4	DDMM
5	DDMM	DT		5	DDMM
6	DDMM	DT		6	DDMM
7	DDMM	DT		7	DDMM
8	DDMM	DT		8	DDMM
9	DDMM	DT		9	DDMM
10	DDMM	DT		10	DDMM
11	DDMM	DT		11	DDMM
12	DDMM	DT		12	DDMM
				13	DDMM

Daylight Saving Clock Changes

DDMM	+H	Advance Tariff Clock at 2:00am by 'H' hours on date specified

DDMM	-H	Retard Tariff Clock at 3:00am by 'H' hours on date specified

Note - Valid range of 'H' is either 1 or 2