ISKRAEMECO

MT174 Three-phase Electricity Meter
Technical Specification

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3.1 Scope

The MT174 is a poly-phase multi-function meter supporting measurement of active, active/reactive or active/reactive/apparent energy and demand in three-phase four- or three-wire networks. Meter variants are available for direct connection or indirect connection via current transformers. The meter is approved for use in single-phase two-wire networks. The MT174 complies with both European standards EN 50470-1 and EN 50470-3, international standards IEC 62052-11 and IEC 62053-21 and IEC 62052-23. The meter is designed and manufactured in compliance with ISO 9001 recommendations.

This document details all functional requirements and will be used to derive the final technical documentation for Production. All aspects of the firmware, hardware, communications and physical configuration are defined.

Throughout this technical specification, where additional customer clarification is necessary to completely define a functional requirement without ambiguity, the requirement is clearly marked.

3.2 References

The following documents are referenced throughout this paper:

1. *"IEC 62056-21: Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange",* International Electrotechnical Commission, May 2002

2. *"IEC 62056-61: Electricity metering – Data exchange for meter reading, tariff and load control – Part 61:* OBIS Object identification system"*,* International Electrotechnical Commission, November 2006

3. *"IEC 62052-11: Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment",* International Electrotechnical Commission, February 2003

4. *"IEC 62052-21: Electricity metering equipment (AC) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)",* International Electrotechnical Commission, January 2003

5. *"IEC 62052-21: Electricity metering equipment AC) - General requirements, tests and test conditions - Part 21: Tariff and load control equipment",* International Electrotechnical Commission, April 2005

6. *"IEC 62053-23: Electricity metering equipment (AC) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)",* International Electrotechnical Commission, January 2003

7. *"EN 50470-1:2006: Electricity metering equipment (AC). General requirements, tests and test conditions. Metering equipment (class indexes A, B and C)",* CENELEC, December 2006

8. *"EN 50470-3:2006: Electricity metering equipment (AC) -- Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)",* CENELEC, December 2006

9. *"UK Metering Forum Technical Recommendation M1/1 v1.34",* UK Metering Forum., February 2009

4.0 Electricity Meter Requirements

The MT174 electronic three-phase meters are designed for measurement and registration of active, reactive and apparent energy and demand in three-phase four-wire networks. They can be connected directly to the network. The metering and technical properties of the meters comply with the EN 50470-1 and -3 European standards for active energy meters, classes A and B, as well as with the IEC 62053-21 and IEC 62052-11 international standards for electronic meters of active energy for classes 1 and 2, and optionally with the IEC 62053-23 international standard for electronic meters of reactive energy for classes 2 and 3.
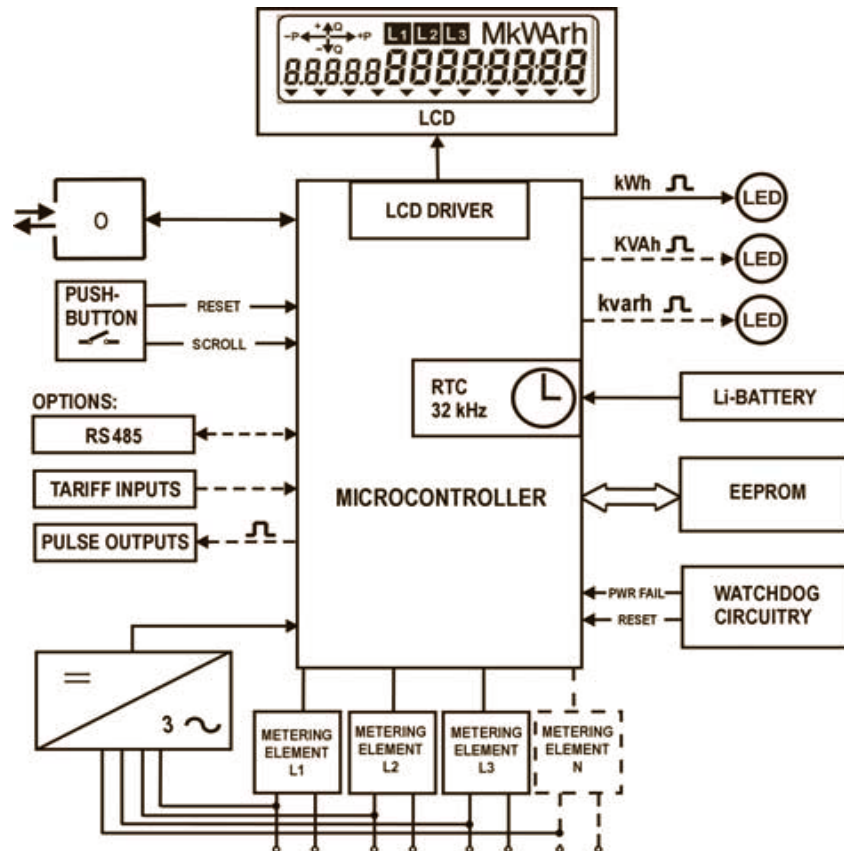
Figure 4-1 Functional architecture

A built-in time-switch complies with the IEC 62054-21 and IEC 62052-21 standards. It enables energy registration in up to four tariffs.

The meter software complies with WELMEC 7.2 Issue 1 Software Guide (Measuring Instruments Directive 2004/22/EC). The meters are designed and manufactured in compliance with the ISO 9001 (2000) standard.

The MT174 meters are designed for mechanical environment M1, electromagnetic environment E2 and climatic environment -40°C to +60°C, relative humidity 95% non-condensing, closed location. The meters can be installed in any position.

4.1 General Platform Features and Capabilities

The MT174 platform supports the following global functionality and capabilities. The specifics of the proposed configuration are detailed in successive chapters.

- Meter accuracy
    - Class A or B in compliance with EN 50470-3 (or 2 or 1 in compliance with IEC 62053-21) for active energy
    - Class 3 or 2 for reactive energy (option)
    - Class 3 or 2 for apparent energy (option)
    - Meter software in compliance with WELMEC 7.2 Issue 1

- Measured quantities
    - Energy (active, reactive and apparent)
    - Demand (active, reactive and apparent)
    - Reactive energy and demand by quadrants
    - Instantaneous power
    - Phase voltages (UL1, UL2, UL3)
    - Phase currents (IL1, IL2, IL3)
    - Phase power factors
    - Frequency

- Modes of energy measurement and registration
    - For one-way energy flow direction (import) with an electronic reverse running stop
    - For two energy flow directions (import, export)
    - For two-way energy flow direction, with always positive registration, i.e. energy flowing in the export direction is registered as it flows in import direction too (only for active energy)

- Connection
    - Direct whole-current
    - Indirect current transformer

- Networks
    - 3-phase 4-wire
    - 3-phase 3-wire
    - 1-phase 2-wire

- Meter quality
    - Due to high accuracy and long term stability of the metering elements no meter recalibration is required over its lifetime
    - Long meter lifetime and high meter reliability
    - High immunity to EMC

- Real-time Clock
    - Accuracy better than ±3 min/year at 23°C
    - RTC operation reserve 5 years
    - Back-up power supply Li-battery
    - Indication of low Li-battery (option)

- Time-of-use registration (up to 4 tariffs)
    - Tariffs change-over by internal real-time clock
    - Optional tariff inputs for external tariff change-over

- LCD-display:
    - Large LCD in compliance with the VDEW requirements
    - IEC 62056-61 OBIS code for data identification
    - LCD back-light (option)

- Data display modes:
    - Automatic cyclic data display (default display time 8 seconds)
    - Manual data display mode (by pressing the Scroll push-button)
    - Optional data display when the meter is in no-power state

- Indicators:
    - LCD:
        - valid tariff at the moment
        - meter status and alarms
        - energy flow direction
        - phase voltage presence and phase voltage sequence
        - reversed energy flow through a particular metering element

    - LEDs:
        - Imp/kWh

- - Imp/kvarh (at active and reactive energy meters)
  - Imp/kVAh

- Powerful load-profile recorder
  - Up to 8 channels
  - More than 790 days of registration at 1 channel (60min logging period)

- Communication channels
  - Infrared optical port in compliance with IEC 62056-21 for local programming and data down-loading
  - RS485 serial interface (option)
  - Protocol IEC 62056-21 mode C

- Pulse outputs
  - Class A by IEC 62053-31 (option)
  - OptoMOS relay with make contact (option)

- Plastic meter case
  - Made of high-quality self-extinguishing UV stabilized material that can be recycled
  - Double insulation
  - IP54 protection against dust and water penetration (by IEC 60529)

- Mechanical environment: M1
- Electromagnetic environment: E2
- Potential links (whole-current)
  - sliding self-braking potential links enable quick disconnection of current and voltage circuitries
  - under terminal block or meter cover

- Antifraud functions:
  - Detectors (optional)
    - meter cover opening
    - terminal cover opening
    - reversed energy flow direction
    - external permanent magnetic field
  - Indicators (optional)
    - meter cover opening
    - terminal cover opening
    - reversed energy flow direction trough each of metering elements
    - external permanent magnetic field

- Fraud energy registers (optional)
  - consumption since the meter cover has been opened
  - consumption since the terminal cover has been opened
  - consumption since reversed energy flow has been detected
  - consumption since external permanent magnetic field has been detected

- Counters of events (optional)
  - meter cover opening
  - terminal cover opening
  - reversed energy flow direction
  - external permanent magnetic field

- Counters of elapsed time (optional)
  - since meter cover has been opened
  - since terminal cover has been opened
  - since reversed energy flow has been detected
  - since external permanent magnetic field has been detected
  - total energy registration
  - energy registration in a particular tariff

- Time-stamps (optional)
  - last meter cover opening
  - last terminal cover opening
  - last reversed energy flow detection
  - last external permanent magnetic field tampering

- Pushbuttons
  - Scroll button
  - Billing reset button

4.2 Measurement Platform

The measuring system can operate accurately over a wide voltage and temperature range. The current sensor is a single shunt resistor for single-phase and a system of three Rogowski coils for three-phase. The voltage sensor is a resistive voltage divider. The continuous analogue signals are converted to discrete digital pulses and input to the measurement processor for calculation of instantaneous power. Integrals are calculated, summed and further processed before being written to the relevant data model register objects.

The basic rating of the meter must be defined which will define the operation limits and overall accuracy. Additional technical clarification is indicated where required.

Requirement	Description	Value	Clarification	Notes
MP.01	Number of phases	3	No	
MP.02	Coupling method	Direct (whole-current)	No	
MP.03	Nominal voltage (U_n)	230V AC	No	
MP.04	Voltage range	$0.8\ U_n$ - $1.15\ U_n$	No	
MP.05	Reference current (I_{ref})	10 A	Yes	1
MP.06	Maximum current (I_{max})	120 A	No	
MP.07	Short-circuit current	30 I_{max}	No	
MP.08	Thermal current	1.2 I_{max}	No	
MP.09	Nominal frequency	50 Hz	No	
MP.10	Operating temperature range	$-40^{o}C$ to $+60^{o}C$	No	
MP.11	Extended temperature range	$-40^{o}C$ to $+70^{o}C$	No	
MP.12	Neutral current measurement	No	No	
MP.13	Voltage circuit burden	< 0.6W / < 10 VA (without RS-485) < 0.8W / < 10 VA (with RS-485)	No	
MP.14	Current circuit burden	< 0.16 VA	No	
MP.15	Active accuracy class (MID EN 50470-1)	B	Yes	2
MP.16	Reactive accuracy class (IEC 62053-21)	2	Yes	
MP.17	Apparent accuracy class (IEC 62053-21)	2	No	
MP.18	Measurement mode	Independent import and export measurement registers	No	3
MP.19	Demand period	30 minutes	No	4

Table 4-1 Measurement system configuration

Notes:
1. Clarification of reference (nominal) current rating required for final Production calibration.
2. All meters will be supplied with MID approval for Settlement.
3. Three modes of measurement operation; a) import only measurement, b) independent measurement of import and export, and c) absolute measurement of import and export (registered in single accumulator).
4. Demand period for current demand, demand in interval, maximum demand and cumulative maximum demand calculation.

In addition to the basic metrology ratings, metrology constants and terminal covers are required. However, selection will depend upon input/output configuration requirements, e.g. availability of inputs/outputs will affect output pulse constant and terminal cover selection.

Requirement	Description	Value	Clarification	Notes
MP.20	Meter/terminal cover removal detection	Yes	No	
MP.21	Terminal cover	Extended	No	4
MP.22	Active calibration (LED) constant	500 imp/kWh	No	5
MP.23	Reactive calibration (LED) constant	500 imp/kvarh	No	5
MP.24	Apparent calibration (LED) constant	500 imp/kVAh	No	
MP.25	Output pulse constant	250 imp/kWh	Yes	5
MP.26	Upper mounting hook	Yes, plastic	Yes	6

Table 4-2 Terminal block

Notes:
5. Two terminal cover variants are available for selection. The short cover exposes I/O terminals but does not restrict routing of current tails. The extended cover includes break-outs and prevents access to current and I/O terminals (see Figure 4-2).
6. The LED constants set the ratio between energy consumption and the red front-plate mounted calibration LED blink rates. The output pulse constant sets the equivalent ration between consumption and impulse output generation. The output constant is redundant if no physical impulse outputs are available. Output constant should be half of the meter constant.
7. Additional upper mounting hook options: plastic, short metal or long metal (DIN 43857).
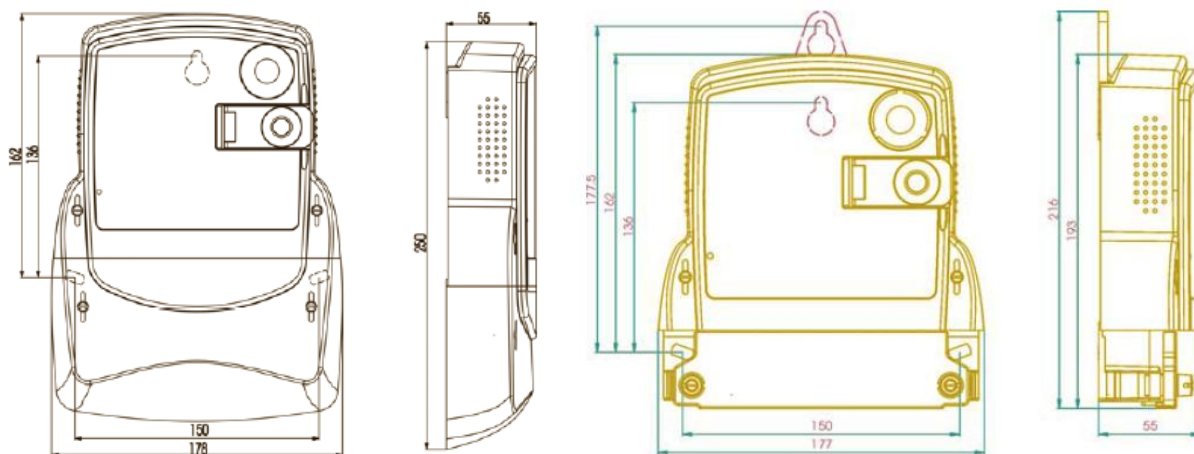
Figure 4-2 Terminal cover options

A connection diagram label including details of network connection, current terminals and I/O terminals is fixed to the underside of the all terminal covers.

4.3 Liquid Crystal Display

The seven-segment LCD display console is split into five sectors. The data value sector consists of eight characters each 8mm high. The data identification section displays the five digit OBIS (IEC 62056-61) identification code of the value currently being displayed in the data value sector in accordance with DIN 43863-3. The OBIS code digits are 5mm in high. A third sector indicates the energy registration quadrant schematic indicting power flow direction. The fourth sector contains the phase presence/failure flags (L1, L2 and L3 depending on snigle- or three-phase) and the data value units. Finally, the fifth sector shows up to eleven additional flags for general meter operation status.

Figure 4-3 LCD console layout

The nomenclature and meaning of the meter status flags and OBIS identification codes may be delineated on the front-plate area reserved for customer definable legends (see section 4.11 Serialisation and Markings). The status event flag markings layout on the front-plate is shown in Figure 4-4 below (see MT174 Technical Description for details).
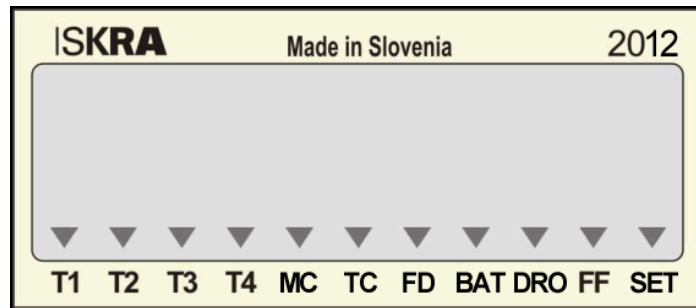
T1	T2	T3	T4	MC	TC	FD	REV	BAT	PD	DRO	FF	SET
X	X	X	X	X	X	X		X		X	X	X

Figure 4-4 Event status flags

Requirement	Description	Value	Clarification	Notes
LCD.01	Energy consumption data format	7 significant digits + 1 decimal place	Yes	6, 7
LCD.02	Demand data format	6 significant digits + 3 decimal places	Yes	6, 7
LCD.03	Auto-scroll sequence	1-0:1.7.0 Instant active import kW 1-0:1.8.0 Total active import kWh 1-0:2.7.0 Instant active export kW 1-0:2.8.0 Total active export kWh 1-0:15.8.0 Absolute total active kWh	Yes	8

LCD.04	Manual-scroll sequence	0-0:C.1.0	Device ID	Yes	9
		0-0:0.2.0	Firmware version		
		0-0:C.1.6	Firmware checksum		
		0-0:0.9.1	Time		
		0-0:0.9.2	Date		
		1-0:1.8.0	Total active import kWh		
		1-0:1.8.1	Rate 1 active import kWh		
		1-0:1.8.2	Rate 2 active import kWh		
		1-0:2.8.0	Total active export kWh		
		1-0:31.7.0	Instantaneous current L1		
		1-0:51.7.0	Instantaneous current L2		
		1-0:71.7.0	Instantaneous current L3		
		1-0:32.7.0	Instantaneous voltage L1		
		1-0:52.7.0	Instantaneous voltage L2		
		1-0:72.7.0	Instantaneous voltage L3		
		1-0:31.6.0	Instantaneous current L1		
		1-0:51.6.0	Instantaneous current L2		
		1-0:71.6.0	Instantaneous current L3		
		1-0:1.7.0	Instant active import kW		
		1-0:1.8.0	Total active import kWh		
		1-0:2.7.0	Instant active export kW		
		1-0:2.8.0	Total active export kWh		
		1-0:15.8.0	Absolute total active kWh		
		F.F.0	Fatal error		
		-	Display test		
LCD.05	Data readout (DRO) sequence	0-0:C.1.0	Device ID	Yes	10
		0-0:0.2.0	Firmware version		
		0-0:C.1.6	Firmware checksum		
		0-0:0.9.1	Time		
		0-0:0.9.2	Date		
		0-0:C.51.1	Terminal cover access count		
		0-0:C.51.2	Time of terminal cover access		
		0-0:C.51.2*x	Timestamps of terminal access		
		0-0:C.51.3	Meter cover access count		
		0-0:C.51.4	Time of meter cover access		
		0-0:C.51.4*x	Times of meter cover access		
		0-0:C.51.5	Magnetic field detection count		
		0-0:C.51.6	Magnetic field detection time		
		0-0:C.51.6*x	Magnetic field detection times		
		1-0:5.8.0	Ind. react. import total (R1) kvarh		
		1-0:6.8.0	Cap. react.import total (R2) kvarh		
		1-0:7.8.0	Ind. react. export total (R3) kvarh		
		1-0:8.8.0	Cap. react. export total (R4) kvarh		
		1-0:9.8.0	Apparent import total kVAh		
		1-0:1.8.0	Total active import kWh		
		1-0:1.8.1	Rate 1 active import kWh		
		1-0:1.8.2	Rate 2 active import kWh		
		1-0:2.8.0	Total active export kWh		
		1-0:31.7.0	Instantaneous current L1		
		1-0:51.7.0	Instantaneous current L2		
		1-0:71.7.0	Instantaneous current L3		
		1-0:32.7.0	Instantaneous voltage L1		
		1-0:52.7.0	Instantaneous voltage L2		
		1-0:72.7.0	Instantaneous voltage L3		
		1-0:31.6.0	Instantaneous current L1		
		1-0:51.6.0	Instantaneous current L2		
		1-0:71.6.0	Instantaneous current L3		
		1-0:1.7.0	Instant active import kW		
		1-0:1.8.0	Total active import kWh		
		1-0:2.7.0	Instant active export kW		
		1-0:2.8.0	Total active export kWh		
		1-0:15.8.0	Absolute total active kWh		
		F.F.0	Fatal error		

LCD.06	Event flags	T1 - T4 Current tariff rate MC Meter cover open TC Terminal cover open FD Permanent magnetic influence BAT Low battery DRO Data read-out active FF Fatal error SET Parameter setting access	**Yes**	11
LCD.07	Backlight	No	No	
LCD.08	No-power reading	No	No	
LCD.09	Reset button	Yes	No	
LCD.10	Test mode at start up	No	No	
LCD.11	Test mode accuracy	8 significant digits + 1 decimal place	No	

Table 4-3 LCD display configuration

Notes:
8. The proposed maximum displayable consumption value is 999999.9 kWh or kvarh and the maximum demand value 999.99 kW or kvar.
9. Units displayed will be kW, kvar, kWh or kvarh depending on current data value being displayed.
10. The auto-scroll object list defines the cyclic sequence of data objects that is displayed on the LCD during normal idle operation. A maximum of 30 registers can be displayed in the sequence. The sequence updates every 8 seconds by default. The end of the sequence is marked by END (optional).
11. The manual-scroll object list defines the cyclic sequence of data objects displayed when the Standard Data manual console mode is entered via the blue front panel scroll button (see MT174 Technical Description for details of blue/orange button menu system). A maximum of 50 registers can be displayed in the sequence.
12. The DRO object list defines the predefined list of objects that may be read during communication using IEC 62056-21 mode C (local or remote) or D (local only). A maximum of 120 registers can be displayed in the sequence.
13. Any of the indicated event flags can be omitted from the LCD display and front-plate legends if required.

4.4 Inputs/Outputs

The meter can be equipped with a selection of auxiliary input and output terminals for tariff rate control, external measurement logging and communications. The following auxiliary terminals are available:

- Tariff inputs (2)
- Tariff outputs or impulse outputs (2)
- Serial communication channel (RS-485)

Auxiliary terminals are located to the far right of the current terminals in the terminal block. See
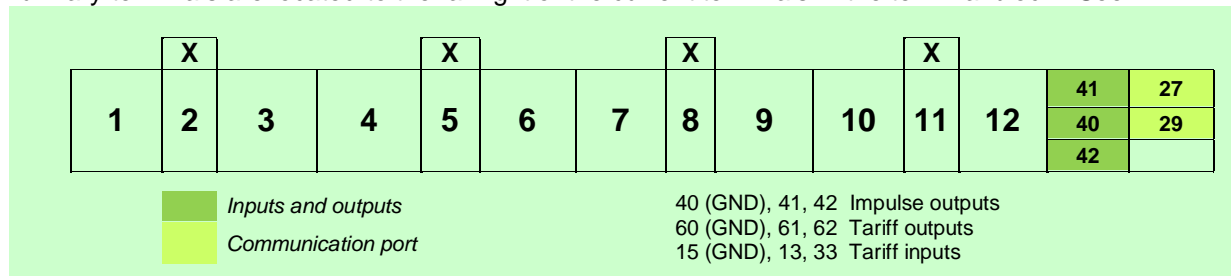
Figure 4-5 below for a schematic layout.

Requirement	Description	Value	Clarification	Notes
IO.01	Tariff inputs	No	No	1
IO.02	Impulse outputs	2	**Yes**	2
IO.03	Impulse output width	80 ms	**Yes**	3
IO.04	Tariff outputs	No	No	4

IO.05	RS-485 communication port	Yes	Yes	
IO.06	Potential Links	Terminal block	No	
IO.07	Meter terminal cover	Long	Yes	5

Table 4-4 Auxiliary terminals

Notes:
1. Line to neutral voltage control of active tariff rate. Tariff inputs combine to control rate 1 to 4 activation. Tariff input 2 may be omitted if not required (2-rate tariff only).
2. Pulse outputs are not available if tariff outputs are selected. Pulse outputs can be line voltage optoMOS relays (rated 25W, 100mA @ 250V) or opto-isolated open-collector low voltage outputs according to IEC 62053-31 (S0). IEC 62053-31 pulses can be transmitted 0.5 metres and optoMOS relays can be transmitted up to 1km (depending on cabling).
3. Pulse width may be 10 to 100 ms in 10 ms increments. Relay pulse outputs should typically use longer pulse durations and lower pulse constants.
4. Tariff inputs are not available if tariff outputs are selected.
5. Meter cover options are short, long and long with internal current terminal fence.
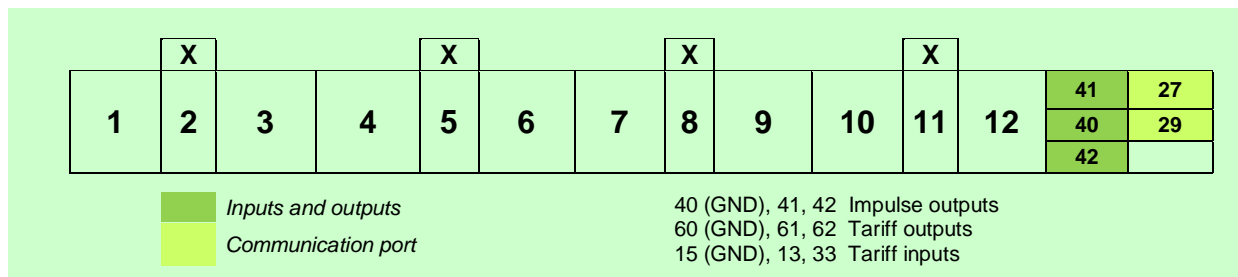
Figure 4-5 Current and auxiliary terminal layout

4.5 Security

Security management features include multi-level password authentication and physical tamper detection. Unauthorised access is protected by three passwords:

- · read access to meter data
- · write access to meter parameters
- · modification of time and date

Passwords can be a maximum of 12 characters in length. Repeat password attack is protected by temporary local communication channel disablement on incorrect entry of a password three times. An appropriate entry is also entered in the meter log book, the incorrect password entry counter incremented and the incorrect password entry timestamp updated.

Requirement	Description	Value	Clarification	Notes
SM.01	Authentication password 1	READ	Yes	
SM.02	Authentication password 2	PARAM	Yes	
SM.03	Authentication password 3	SET	Yes	
SM.04	Meter cover tamper switch	Yes	No	
SM.05	Terminal cover tamper switch	Yes	No	
SM.06	External magnetic field detection	Yes	No	
SM.07	Reverse flow	No	No	

Table 4-5 Security Management

Physical fraud protection includes optional meter cover and terminal cover micro-switches which will generate log book events, counter increments and timestamps. An optional external magnetic field influence detector can be fitted and energy consumption during the tamper state can be registered into a dedicated register.

Lastly, a set of registers monitor the elapsed time since the start of particular event. Monitored events include:
- · duration of meter energisation
- · measurement in a particular tariff
- · start of magnetic field influence
- · start of reverse flow
- · duration without voltage (power down)

4.6 Data Profiling

The load profile recorder supports a maximum of eight measurement channels.   Energy or demand can be registered and recorded in each load profile channel. Interval data is marked with a time stamp (date and time of the end of a logging interval), a meter status field for the interval and a check sum.

Number of channels	Load Profile Capacity (days)		
	60 min	30 min	15 min
1	793	396	198
2	476	238	149
3	340	170	85
4	261	130	65
5	214	107	53
6	182	91	46
7	158	79	40
8	140	70	35

Table 4-6 Load Profile Capacity

The capacity of the load profile recorder depends on the logging interval and the number of registered capture objects (channels) as shown in Table 4-6. If maximum demand is to be measured, the load profile capture interval and demand period should be of the same value.

Requirement	Description	Value		Clarification	Notes
DP.01	Load profile capture interval	30 minutes		No	1
DP.02	Number of load profile channels	2		Yes	
DP.03	Measurement registration	Energy		Yes	2
DP.04	Channel registered measurement	A+	Total import active kWh or kW	Yes	3
		A-	Total export active kWh or kW	Yes	
		IAI	Absolute active kWh or kW	-	
		R+	Total import reactive kvarh or kvar	-	
		R-	Total export reactive kvarh or kvar	-	
		R1	Reactive kvarh or kvar in 1st quadrant	-	
		R2	Reactive kvarh or kvar in 2nd quadrant	-	
		R3	Reactive kvarh or kvar in 3rd quadrant	-	
		R4	Reactive kvarh or kvar in 4th quadrant	-	
		S	Total import apparent kVAh	-	

Table 4-7 Load profile function configuration

Notes:
1. Modifications to a load profile channel capture interval will cause load profile storage to be cleared permanently. The capture interval can be to 5, 15, 30 or 60 minutes.
2. The load profile recorder can log either energy or demand measurement data.
3. Measurement registration data according to *DP.02 number of channels* and *DP.03 measurement registration*.

4.7 Billing Management

The billing management functionality supports scheduled or manual capture of billing data (consumption and demand) to historical billing registers. Billing reset events also clear the current maximum demand for the current billing period. Scheduled capture is performed according to the defined billing period (e.g. a calendar month) and manual capture is performed via the orange front panel button. A maximum of 15 billing period records can be stored in first in, first out basis. Up to 9 historical billing periods can be displayed on the LCD.

Scheduled billing resets can be performed either:

- *once a year on a specified date and time*
- *every month on specified day in the month and time*
- *every month on a specified day in the week with a specified day in the month offset*
- *every week on a specified day in the week and time, or*
- *every day*

Manual billing resets are activated by pressing the orange Billing Reset button or locally/remotely via one of the serial interfaces. Billing resets are aligned to the end of the current demand period, i.e. 30 minutes.

Requirement	Description	Value	Clarification	Notes
BM.01	Number of billing periods (via LCD)	9	No	1
BM.02	Number of billing periods (via serial port)	15	No	1
BM.03	Billing reset blockade period	60 minutes	No	2
BM.04	Billing period schedule	Monthly on 1st @ 00:00hrs	Yes	3

Table 4-8 Billing profile configuration

Notes:
1. The maximum number of billing periods accessible via either the serial communications channels or the local optical port.
2. Blockade period prevents further billing resets after initial reset.
3. Permitted relative billing periods can be daily, weekly, monthly or yearly. Any time of the day can be set but the reset will be aligned to the end of the current demand period.

4.8 Clock and Calendar

The real-time clock function supports Daylight Saving Time and configurable time-zone. The clock function drives all scheduled activity in the meter including profiling and tariff management. The clock is maintained during power outages by either a built-in lithium battery or super capacitor. A battery offers backup for 5 years during operation and a 20 year shelf-life, but cannot be exchanged on-site. A super-capacitor provides backup for short periods (up to 7 days depending on charge), but does not have a defined lifetime.

Requirement	Description	Value	Clarification	Notes
CM.01	Time-zone	GMT + 0 hrs	No	1
CM.02	Daylight Saving Time enabled	No	Yes	2

CM.03	DST start time	01:00hrs last Sunday in March	No	
CM.04	DST end time	02:00hrs last Sunday in March	No	
CM.05	RTC backup	Lithium battery	No	

Table 4-9 Clock management

Notes:
 1. *The time-zone should be fixed to GMT + 0hrs for the UK.*
 2. *All calendar functions will operate in GMT mode if DST is disabled.*

4.9 Tariff Management

The primary purpose of the tariff management function is to manage the times at which different tariff rates are active. When a particular rate is active registered energy consumption and demand will advance in the appropriate measurement register objects.

The heart of the tariff management is the calendar function which holds a hierarchically organised structure of season, week and day profiles. In terms of the UK's regulated Market Domain Data, the tariff calendar structure models a Standard Settlement Configuration (SSC) scheme. The tariff programme can accommodate complex Time-of-Use tariffs:

 · *10 seasons per year (weekly tariff programs)*
 · *10 daily profile definitions*
 · *10 switching times per daily profile definition*
 · *46 holidays (exceptional tariff program definition)*

The tariff programme calendar consists of two schemes, one active and one passive. The passive calendar scheme can be used in one of two ways. Firstly, the passive scheme can be used to model a separate tariff scheme for demand, i.e. separate tariffs for energy and demand whereby energy and demand registers are switched independently. Secondly, the active scheme switches both energy consumption and demand registers and the passive scheme holds a standby tariff scheme to be activated at a future date. This mechanism allows for efficient distribution of new tariff schemes to take affect at a particular time and date to groups of meters.

Alternatively, tariff rate switching can be prompted by signaling to the optional tariff inputs. In this mode, both energy and demand registers are switched in the active calendar scheme. Up to four rates can be switched with both tariff inputs (or two rates with a single tariff input).

The Season Table defines one or more Week Programmes each starting on a particular date in the year. A Week Programme associates one or more Day Profiles Tables with each day of the week. For example, a tariff program may run a certain daily switching scheme on weekdays but may revert to a different daily scheme at the weekend.

Season/start	Program	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Hol
1. 1. 0:00	1	1	1	1	1	1	1	1	1
1. 4. 0:00	2	1	1	1	1	1	1	2	2

Figure 4-6 Season Table example

The Day Profile Table consists of a set of scheduled actions (e.g. in UK Market Domain Data terms, a Time Pattern Regime switching time) throughout a 24 hour period from mid-night to mid-night. A maximum of 10 scheduled times can be defined for each Day Profile. At each scheduled time the associated script from the Tariff Script Table. Note, an active Day Profile must have a mandatory entry for 00:00hrs.
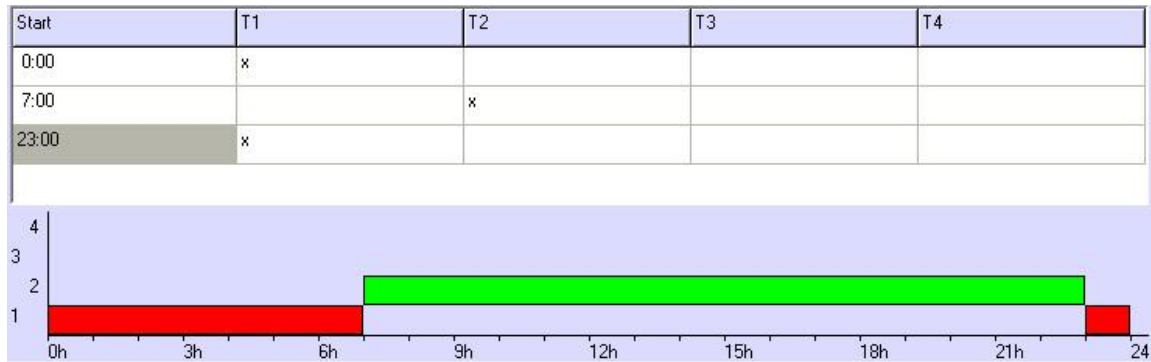
Figure 4-7 Day Profile example

The Holiday Table contains entries for holidays and other special days which provide an override of the regular Day Profile Table for a particular day of the week. For example, an energy supplier may provide the consumer with a flat weekend rate on Bank Holiday days.

Requirement	Description	Value	Clarification	Notes
TM.01	Tariff switching mode	Internal	No	1
TM.02	Passive tariff scheme	No	Yes	2
TM.03	Passive scheme switch-over	n/a	Yes	3
TM.04	Tariff programme version identifier	-	Yes	
Active Scheme				
TM.05	Active scheme season 1	01 Jan @ 00:00 hrs, week profile 0	Yes	4
TM.06	Active scheme season 2	-	Yes	4
TM.07	Active scheme season 3	-	Yes	4
TM.08	Active scheme season 4	-	Yes	4
TM.09	Active scheme season 5	-	Yes	4
TM.10	Active scheme season 6	-	Yes	4
TM.11	Active scheme season 7	-	Yes	4
TM.12	Active scheme season 8	-	Yes	4
TM.13	Active scheme season 9	-	Yes	4
TM.14	Active scheme season 10	-	Yes	4
TM.15	Active scheme Week Profile 1	Mon - Sun, day profile 0	Yes	5
TM.16	Active scheme Week Profile 2	-	Yes	5
TM.17	Active scheme Week Profile 3	-	Yes	5
TM.18	Active scheme Week Profile 4	-	Yes	5
TM.19	Active scheme Week Profile 5	-	Yes	5
TM.20	Active scheme Week Profile 6	-	Yes	5
TM.21	Active scheme Week Profile 7	-	Yes	5
TM.22	Active scheme Week Profile 8	-	Yes	5
TM.23	Active scheme Week Profile 9	-	Yes	5
TM.24	Active scheme Week Profile 10	-	Yes	5
TM.25	Active scheme Day Profile 1	Rate 1: 00:00hrs	Yes	6

Requirement	Description	Value	Clarification	Notes
TM.26	Active scheme Day Profile 2	-	Yes	6
TM.27	Active scheme Day Profile 3	-	Yes	6
TM.28	Active scheme Day Profile 4	-	Yes	6
TM.29	Active scheme Day Profile 5	-	Yes	6
TM.30	Active scheme Day Profile 6	-	Yes	6
TM.31	Active scheme Day Profile 7	-	Yes	6
TM.32	Active scheme Day Profile 8	-	Yes	6
TM.33	Active scheme Day Profile 9	-	Yes	6
TM.34	Active scheme Day Profile 10	-	Yes	6
Passive Scheme				
TM.35	Active scheme season 1	-	Yes	4
TM.36	Active scheme season 2	-	Yes	4
TM.37	Active scheme season 3	-	Yes	4
TM.38	Active scheme season 4	-	Yes	4
TM.39	Active scheme season 5	-	Yes	4
TM.40	Active scheme season 6	-	Yes	4
TM.41	Active scheme season 7	-	Yes	4
TM.42	Active scheme season 8	-	Yes	4
TM.43	Active scheme season 9	-	Yes	4
TM.44	Active scheme season 10	-	Yes	4
TM.45	Active scheme week profile 1	-	Yes	5
TM.46	Active scheme week profile 2	-	Yes	5
TM.47	Active scheme week profile 3	-	Yes	5
TM.48	Active scheme week profile 4	-	Yes	5
TM.49	Active scheme week profile 5	-	Yes	5
TM.50	Active scheme week profile 6	-	Yes	5
TM.51	Active scheme week profile 7	-	Yes	5
TM.52	Active scheme week profile 8	-	Yes	5
TM.53	Active scheme week profile 9	-	Yes	5
TM.54	Active scheme week profile 10	-	Yes	5
TM.55	Active scheme day profile 1	-	Yes	6
TM.56	Active scheme day profile 2	-	Yes	6
TM.57	Active scheme day profile 3	-	Yes	6
TM.58	Active scheme day profile 4	-	Yes	6
TM.59	Active scheme day profile 5	-	Yes	6
TM.60	Active scheme day profile 6	-	Yes	6
TM.61	Active scheme day profile 7	-	Yes	6
TM.62	Active scheme day profile 8	-	Yes	6
TM.63	Active scheme day profile 9	-	Yes	6
TM.64	Active scheme day profile 10	-	Yes	6
TM.65	Special day 1	-	Yes	7
TM.66	Special day 2	-	Yes	7
TM.67	Special day 3	-	Yes	7
TM.68	Special day 4	-	Yes	7
TM.69	Special day 5	-	Yes	7
TM.70	Special day 6	-	Yes	7
TM.71	Special day 7	-	Yes	7
TM.72	Special day 8	-	Yes	7
TM.73	Special day 9	-	Yes	7

Requirement	Description	Value	Clarification	Notes
TM.74	Special day 10	-	Yes	7

Table 4-10 Tariff management configuration

Notes:
1. The tariff switching mode controls whether rate switching is internal according to the defined Tariff Programme or externally via the auxiliary tariff inputs. External switching allows the use of an external clock source or a telemeter with a switched neutral voltage. When external switching is selected Tariff Programme switching is disabled.
2. The active tariff scheme cannot be modified, however the meter can be supplied with a specified active scheme and a different passive scheme ready for activation at some time after commissioning or on-demand. Passive scheme options are none (no passive scheme), inactive (passive scheme with switch-over date and time) or demand (separate tariff programme for demand).
3. Switch-over date and time defines when the passive scheme will be replace the active scheme.
4. The default season is active all year around using week profile 0. Note, season 0 must start on 01 January at 00:00hrs.
5. By default, Week Profile 1 uses Day Profile 0 every day of the week, Monday to Sunday.
6. By default, Day Profile 1 contains a single entry for 00:00hrs, i.e. rate 1 active all day. Note, an active Day Profile must have a mandatory entry for 00:00hrs.
7. A maximum of 48 special days (holidays) can be defined. Each special day entry specifies the start date, recurrence (e.g. every year) and the overriding Day Profile number.

4.10 Communications

The meter includes a local optical interface and an optional RS-485 interface conforming to IEC 62056-21 and IEC 62056-61 public standards [1, 2].

4.10.1 Local Optical Interface

The local optical interface supports IEC 62056-21 mode C for data reading and parameterisation. Information exchange uses IEC 62056-61 OBIS addressing. The meter will respond to a data readout request after receiving the appropriate acknowledgement message.   The subsequent transmitted registers are specified by the DRO sequence as defined in Table 4-3 LCD display configuration.
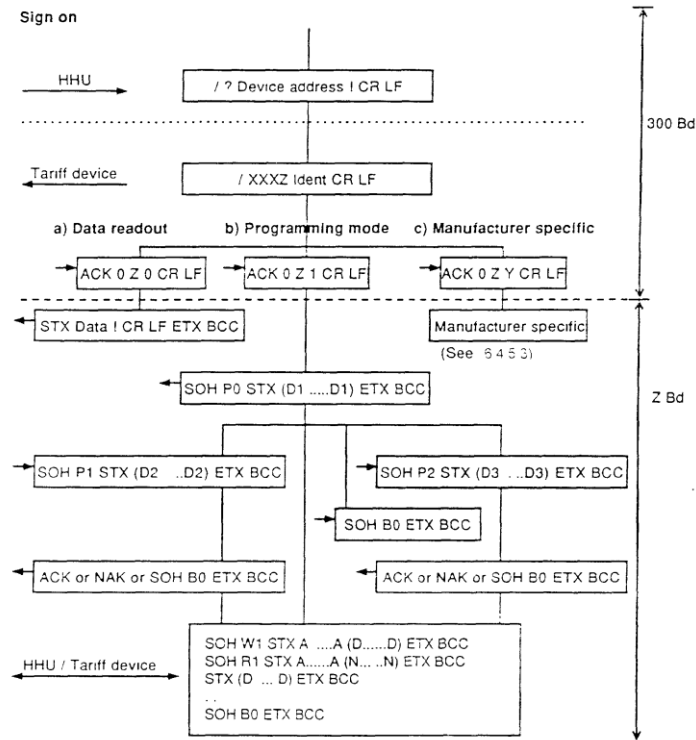
Figure 4-8 IEC 62056-21 mode C

The optical interface handshake starts at 300bps regardless of the setting defined in Table 4-12 Communications Interfaces.

4.10.2 RS-485 Interface

The optional RS-485 interface also conforms to IEC 62056-21 and IEC 62056-61 and enables connection of up to 31 MT174 meters to a single concentrator, e.g. the P2CC communicator. The network is a master/slave architecture. The communicator acts as the master and the MT174 meter is the slave device.

The maximum distance between the meters and the communicator is 1200 metres. IEC 62056-21 mode C must be used for data exchange and the data transmission rate is fixed. The default is 9600bps but may be configured between 300 and 19200bps depending on the master's capability and configuration. The RS-485 interface is located in the auxiliary terminals on the right side of the terminal block.

Terminal	Path
27	RS-485 A
29	RS-485 A

Table 4-11 RS-485 terminal functions

Note: the meter address may be a maximum of 20 characters, stored in Device Address 1 (register 0.0.0) and must be unique. If not specified by the client, the default meter address will be the meter serial number.

Requirement	Description	Value	Clarification	Notes
OP.01	Device address 1	<meter serial>	Yes	1
OP.02	Optical interface baud rate	9600 bps	No	

Requirement	Description	Value	Clarification	Notes
OP.03	RS-485 baud rate	9600 bps	No	

<p align="center">**Table 4-12 Communications Interfaces**</p>

Notes:
1. Customised device serial numbers may be specified for RS-485 slave addressing.
2. Possible values for communications interface baud rate are 300bps,

4.11   Serialisation and Markings

Customisation of the meter front-plate and electronic serialisation can be specified for preparation in production. The meter supports a number of user definable data objects for storage of supplier specific serial numbering and other site information, e.g. consumer ID or Standard Settlement Configuration code.

Requirement	Description	Value	Clarification	Notes
ID.01	Device address 1	<manufacturer serial number>	Yes	1
ID.02	Device address 2	Null	Yes	
ID.03	Parameter Scheme ID	Null	Yes	

<p align="center">**Table 4-13 Device identifier configuration**</p>

Notes:
1. Device address 1 is also the RS-485 slave address and should not be defined if already specified in Table 4-12 Communications Interfaces.

The meter front-plate data and layout is principally dictated by Measuring Instruments Directive (MID) requirements for electronic meters, however limited customisation of the design is provided for customer specific information including logos and barcode encoding and formats.

The unique manufacturer serial number (also encoded electronically in Device Address 1 and the Meter Serial ID registers by default) is used during the production process and for traceability in the event of customer queries or audit requests. It is recommended to maintain the serial number and barcode (code 39 interleaved 2 of 5) for these purposes.

The user definable area is reserved for customer specific information. The bar code can be encoded with up to 18 characters of information, e.g. a UKMF compliant serial number.
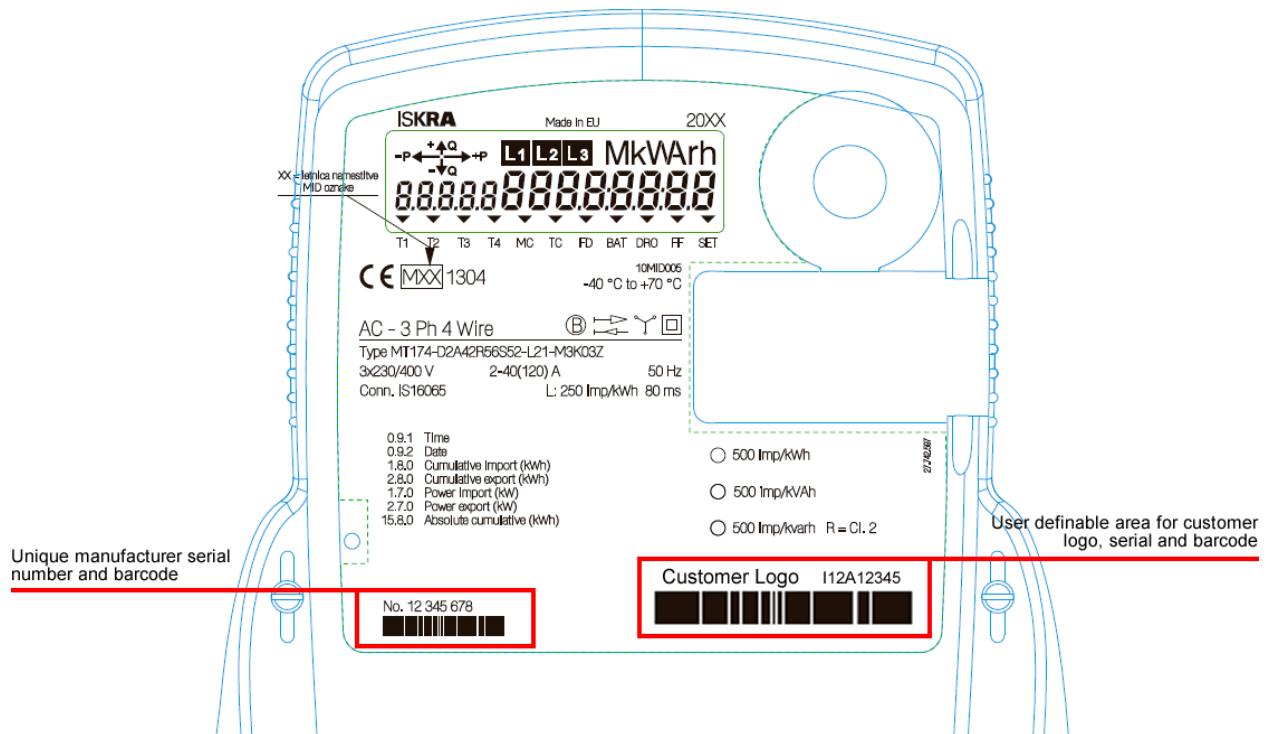
Figure 4-9 Sample MID meter plate layout

The current UK Metering Forum (administered by Gemserv Ltd) specified supplier serial number format according to Technical Recommendation M-1/1 [9] is due to be replaced by Technical Recommendation M-2 in 01 January 2013 with a format capable of handling the expected annual volumes resulting from smart metering rollouts. Note, Meter Asset Providers are free to use the new format before this date. A recent consultation has also been conducted to update the manufacturer identifier codes, however, the changes do not affect Iskraemeco.

The UKMF Technical Recommendation applies to non-half hourly electricity meters for domestic and small commercial customers and is intended,

- for the guidance of parties responsible for specifying the serial numbers of meters which they procure

- to assist parties in the identification of certain meter characteristics, particularly the original procurer

The meter serial number format is comprised of the following fields:

- A code letter signifying the manufacturer

- Two figures to indicate the year of delivery

- A code letter or letters signifying the purchasing company (MAP)

- An optional gap, a full stop or an additional reference letter or number

- A serial number sequence of five digits, beginning with 00001 for each year, each manufacturer and each purchasing company

- A code letter signifying meter use (optional) or an additional serial number digit

The allocated manufacturer code letters are indicated in Table 4-14. The letters and numbers must be indelibly marked therefore have to be stencilled onto the front-plate during production. The sequence of serial numbers should be allocated by the manufacturer. Manufacturers are permitted to continue to use their own serial number systems in addition, but this should be placed inconspicuously on interior parts of the meter.

ID	Manufacturer
A	Landis + Gyr
C	CEWE
E	EDMI
F	Siemens Metering Ltd
G	-
H	Horstmann Timers and Controls
I	Iskraemeco UK
J	Jinling (Shanghai Electricity)
K	Elster
L	Landis + Gyr
M	General Electric
P	Secure
R	Sagem
S	Itron

Table 4-14 New UKMF manufacturer codes

The Meter Asset Provider purchaser codes are show in Table 4-15. Some MAPs have additional codes which are accommodated by the additional reference letter in the format.

Meter Asset Provider	Purchaser code	Additional code
Accuread	Z	
BGlobal Metering	BM	
Central Networks East (now Western Power Distribution)	F	a - z
Central Networks West (now Western Power Distribution)	G	a - z
E.ON Energy Services	W	a - z
EDF Energy CFS	V	
EDF Energy Networks (ex Eastern Electricity)	E	A - Z
EDF Energy Networks (ex London Electricity)	A	
EDF Energy Networks (ex SeeBoard)	B	
EDF Energy Services	A	
IMServ Europe Ltd	U	
Independent Power Networks		
Lowri Beck Services Ltd	LB	
Northern Electric Distribution Ltd	L	
Npower Ltd	K	
Npower Yorkshire Ltd (Meter Plus)	K	
OnStream	X	
PRI Ltd	Y	
Scottish and Southern Energy (ex Hydro Electric)	R	a - z
Scottish and Southern Energy (ex Southern Electric)	C	a - z
Scottish Power Distribution Ltd	P	
Scottish Power Manweb	J	
Siemens Energy Services	S	A - Z
Siemens Energy Services	T	A - Z
United Utilities Networks Ltd	N	a - z
United Utilities NW (ex Norweb)	M	a - z
Utility Energy Solutions Ltd		

Meter Asset Provider	Purchaser code	Additional code
Utility Partnership Ltd	UP	
Western Power Distribution	D	0 - 9
Western Power Distribution (South Wales)	H	0 - 9
Western Power Distribution (South Wales)	H	0 - 9
Western Power Distribution (South West)	D	0 - 9
Western Power Distribution (South West)	D	0 - 9
Yorkshire Electricity Distribution plc	K	

Table 4-15 UKMF Non-half Hourly MAP codes

The new format as defined by the forthcoming Technical Recommendation M-2 uses the existing Meter Asset Provider and manufacturer codes with an extended range sequence number, e.g.:

12K1234567

where,

12 is year of manufacture

K is the manufacturer code

1234567 is the sequential serial number

Serial ranges should be defined and specified during production with repeat orders confirming the new serial sequence range. If a new Meter Asset Provider business is to be purchasing the meters production will require notification of the new purchaser identifier.

Requirement	Description	Value		Clarification	Notes
ID.05	Serial sequence range	0000000 - nnnnnnn		Yes	1, 2
ID.06	Manufacturer ID	I		Yes	
ID.07	Meter Asset Provider ID	Purchaser	Additional	Yes	
		-			
ID.08	Format	12Innnnnnn		Yes	3

Table 4-16 Customer serial numbering

Notes:
1. It is assumed the new serial number format specified by Technical Recommendation M-2 will be facilitated for all production in 2012.
2. One of the user definable Device ID interface class objects may be used to electronically encode a UKMF compliant serial number for access over the WAN interface.
3. The serial format for production of meters in 2012.

Requirement	Description	Value	Clarification	Notes
ID.09	Customer logo	No	Yes	1
ID.10	Customer defined text	-	Yes	2
ID.11	Customer defined serial number	No	Yes	3
ID.12	Customer defined bar code	No	Yes	3, 4
ID.13	Customer defined bar code content	-	Yes	4
ID.14	Customer defined bar code encoding	Code 39, interleaved 2 of 5	Yes	4
ID.15	LCD legend (register identification)	Yes	Yes	5

Table 4-17 Customer logo and barcode

Notes:

1. A customer logo should be supplied as a high contrast EPS, JPG, TIFF or GIF file of at least 150dpi at time of order, if possible. The logo will be scaled to accommodate any additional text and/or serial number.
2. A short customer defined line of text may be specified (<20 characters), real-estate permitting.
3. A customer defined serial number may be specified for printing on the face-plate and/or encoding in a user defined bar code.
4. The customer defined bar code can encode up to 18 characters dependent on encoding format. Recommended formats are Code 39 or 128, interleaved 2 of 5. Users should verify their preferred bar code reader support before specifying a bar code.
5. Registers displayed on the LCD console are identified by their IEC 62056-61 OBIS codes [2]. An optional legend with the OBIS code identifier and a description may be defined.

4.12 Type Designation Code

The meter type designation code is stencilled on the front-plate and identifies the major hardware and software features.

<div align="center">MT174-D2A42R56S52-L21-M3K03Z</div>

Code	Description
MT	Three-phase three-system electronic meter
174	With maximum demand and RTC
-	-
D1	Terminal block: Imax=85A (DIN 43857)
D2	Terminal block: Imax=120A (DIN 43857)
D3	Terminal block: Imax=100A (BS 5685)
T1	Terminal block up to 6 A
A4	Active energy measurement, accuracy class 1
A5	Active energy measurement, accuracy class 2
1	Energy measurement in one direction
2	Energy measurement in two directions
4	Absolute measurement IAI
R5	Reactive energy measurement, accuracy class 2
R6	Reactive energy measurement, accuracy class 3
1	Energy measurement in one direction
2	Energy measurement in two directions
4	Absolute measurement IRI
6	Reactive energy in four quadrants (Q1, Q2, Q3, Q4, +Q, -Q)
-	-
S52	Apparent energy, accuracy class 2
-	
V	Low voltage passive input
2	Number of inputs
2	Control voltage is 24V DC
G	Low voltage output
n	Number of outputs
2	Transistor output
L	High voltage output (zero volt)
2	Number of relay pulse outputs
1	Pulse output (make contact)
-	-
M	Internal clock
2	Back-up power supply (super capacitor)
3	Back-up power supply (lithium battery)
K	Communication interface
0	Optical interface (IEC62056-21)
3	RS485 communication interface
Z	Load profile

Table 4-18 Type designation code

4.13   Faceplate Layout

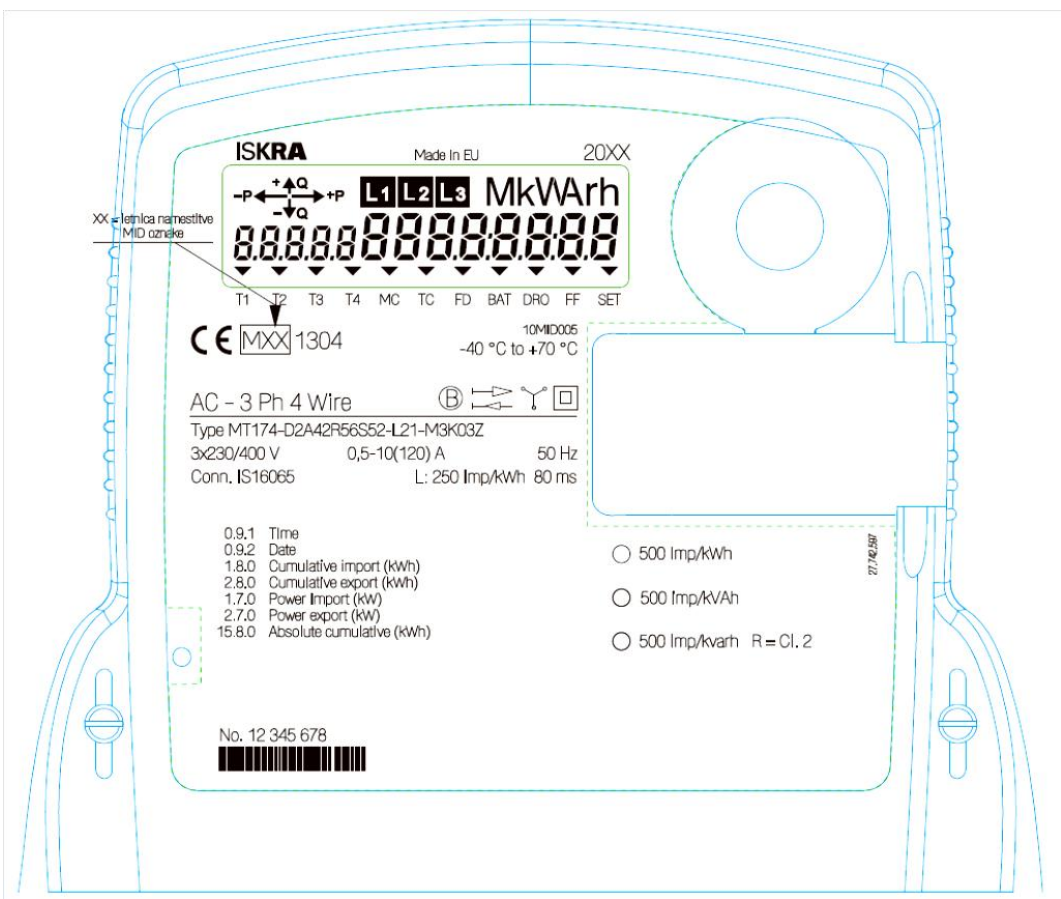The layout according to MID requirements as shown in Figure 4-10 shall be adopted for all Settlement meters.

Figure 4-10 Faceplate Layout

5.0 Requirements Checklist

Key		Description
No colour		Requirement clear, no further clarification necessary
Green		Further explanation or clarity required
Orange		Requirement modified

Table 5-1 Requirement status

The following key is used to track changes to requirements between document releases. Requirement status is classed as:

- i. accepted and requiring no further explanation
- ii. requiring further clarification or explanation
- iii. confirmed with/without content modification

Confirmation of all technical functional requirements is mandatory to permit the necessary technical documentation to be prepared for production.

Requirement	Description	Clarification
Measurement Platform		
MP.01	Number of phases	No
MP.02	Coupling method	No
MP.03	Nominal voltage (U_n)	No
MP.04	Voltage range	No
MP.05	Reference current (I_{ref})	Yes
MP.06	Maximum current (I_{max})	No
MP.07	Short-circuit current	No
MP.08	Thermal current	No
MP.09	Nominal frequency	No
MP.10	Operating temperature range	No
MP.11	Extended temperature range	No
MP.12	Neutral current measurement	No
MP.13	Voltage circuit burden	No
MP.14	Current circuit burden	No
MP.15	Active accuracy class (MID EN 50470-1)	Yes
MP.15	Reactive accuracy class (IEC 62053-21)	Yes
MP.16	Apparent accuracy class (IEC 62053-21)	No
MP.17	Measurement mode	No
MP.18	Demand period	No
MP.19	Number of phases	No
MP.20	Coupling method	No
MP.21	Nominal voltage (U_n)	No
MP.22	Voltage range	No
MP.23	Reference current (I_{ref})	No
MP.24	Maximum current (I_{max})	No
MP.25	Short-circuit current	Yes
MP.26	Thermal current	Yes
Display Console		
LCD.01	Energy consumption data format	Yes
LCD.02	Demand data format	Yes
LCD.03	Auto-scroll sequence	Yes

Requirement	Description	Clarification
LCD.04	Manual-scroll sequence	Yes
LCD.05	Data readout (DRO) sequence	Yes
LCD.06	Event flags	Yes
LCD.07	Backlight	No
LCD.08	No-power reading	No
LCD.09	Reset button	No
LCD.10	Test mode at start up	No
LCD.11	Test mode accuracy	No
Inputs and Outputs		
IO.01	Tariff inputs	No
IO.02	Impulse outputs	Yes
IO.03	Impulse output width	Yes
IO.04	Tariff outputs	No
IO.05	RS-485 communication port	Yes
IO.06	Potential Links	No
IO.07	Meter terminal cover	Yes
Security Management		
SM.01	Authentication password 1	Yes
SM.02	Authentication password 2	Yes
SM.03	Authentication password 3	Yes
SM.04	Meter cover tamper switch	No
SM.05	Terminal cover tamper switch	No
SM.06	External magnetic field detection	No
SM.07	Reverse flow	No
Data Profiling		
DP.01	Load profile capture interval	No
DP.02	Number of load profile channels	Yes
DP.03	Measurement registration	Yes
DP.04	Channel registered measurement	Yes
Billing Management		
BM.01	Number of billing periods (via LCD)	No
BM.02	Number of billing periods (via serial port)	No
BM.03	Billing reset blockade period	No
BM.04	Billing period schedule	Yes
Clock		
CM.01	Time-zone	No
CM.02	Daylight Saving Time enabled	Yes
CM.03	DST start time	No
CM.04	DST end time	No
CM.05	RTC backup	No
Tariff Management		
TM.01	Tariff switching mode	No
TM.02	Passive tariff scheme	Yes
TM.03	Passive scheme switch-over	Yes
TM.04	Tariff programme version identifier	Yes
TM.05 – 34	Active tariff scheme	Yes
TM.35 – 64	Passive tariff scheme	Yes
TM.65 – 74	Special days	Yes
Local Optical interface		
OP.01	Device address 1	Yes
OP.02	Optical interface baud rate	No
OP.03	RS-485 baud rate	No
Serialisation and Identification		
ID.01	Device address 1	Yes
ID.02	Device address 2	Yes

Requirement	Description	Clarification
ID.03	Parameter Scheme ID	Yes

Table 5-2 Requirements Summary Table

6.0 Document Management

Modifications to the document content are described below in Table 6-1 and approved revisions documented in the Section 7.0 Document Approval.

Version	Comment	Author	Date
0.1 draft	Draft release for review	David Spalding	05 Oct 2012
0.2	Removed misleading reference to available voltage ranges	David Spalding	23 Oct 2012

Table 6-1 Document management

7.0 Document Approval

Client approval is required to approve the technical specifications before production technical documentation can be generated. It is imperative the requirements captured within this document are accurate to ensure the production of equipment fit for purpose and meeting the Client's expectations.

For Client Use:

Revision	Name	Role	Signature	Date

Client comments:

For Iskraemeco Use:

Revision	Name	Role	Signature	Date

Iskraemeco comments: