Iskraemeco ECL Limited

P2G/W Functional Specification

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1 Scope

This document describes the functionality provided by the P2G and P2W data loggers. This document should be read in conjunction with the support documents listed in section 16.

2 Definitions and Abbreviations

The following table defines expressions and abbreviations used in this document.

Term	Description
AMR	Automatic Meter Reading
DST	Daylight Saving Time
GSM	Global System for Mobile
IEC	International Electrotechnical Commission
MSISDN	Mobile Subscriber International ISDN Number
RTC	Real Time Clock
SDDS	SMS Data Delivery Service
SMS	Short Message Service
SMP	SMS Meter Protocol

Table 2-1: Definitions and Abbreviations

3 Introduction

Figure 3-1: P2G Data Logger

P2G integrates a data logger, GSM module and safety isolations in a single unit. The internal GSM module provides a reliable means to communicate data as a part of an AMR, energy management or monitoring system for industrial gas, electricity and water metering. P2G belongs to a new generation of Iskraemeco professional communicators. The gas communicator is approved and manufactured in compliance with the BS EN 60079 and ISO 9001 and designed conform to Iskraemeco's own stringent internal standards derived from extensive field and manufacturing experience.

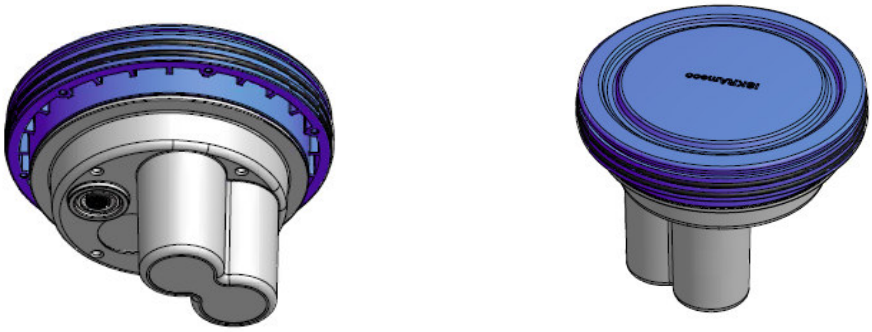

Figure 3-2: P2W Data Logger

P2W is a data logger for the water industry. Hardware and software are the exact same as the P2G. The only difference is the plastics are designed so that the unit can be installed in a water pit where the water meter is located. For the purpose of this document, the term P2G also refers to P2W.

4 P2G Features

Table 4-1 shows a summary of the features currently offered by the P2G.

Pulse Inputs	2 input ports
Pulse Outputs	2 output ports
Data Logging	Data logging at 5 min, 15 min, 30 min, 1 hour and 24 hour intervals
Temperature Monitoring	Current temperature (℃)
Temperature Logging	Logging at 5 min, 15 min, 30 min, 1 hour and 24 hour intervals
IEC 62056 Interface	Optical interface for local access
GSM Module	Communications via SMS for remote access
Data Delivery by SMS	Scheduled data delivery
RTC	Manages schedules and data logging, supports DST and network resynchronisation
Power Management	Monitors battery life use
Wakeup Window	Allows reconfiguration and data requests via SMS
Tamper detection	Alarm will be sent if a tamper has been detected on one of the pulse inputs
Input data threshold monitoring	The unit can be configured to monitor the input data over a period of time and to send an alarm message if the number of pulses is above or below a configured threshold value.

Table 4-1: Feature Summary

5 Configuration and Register Set

The P2G supports a number of registers that can be used to configure the device and to provide metering data. These registers are described in full in [3]. Section 5.3 below gives a brief description of the registers supported by P2G.

These registers can be read or written by one of two methods. The first is using the optical port on the front of the device. This supports the IEC 62056 protocol and can be accessed using either a HHU or laptop via an optical head connector. The second method is remotely via SMS. Configuration data can be sent via SMS using the SMP/SDDS format [1, 2, 3]. The P2G will receive an SMS if it is registered with the GSM network and can return any requested data to a trusted MSISDN.

Each of these methods is described in more detail below.

5.1 IEC 62056 Interface

All registers are accessible for reading and writing from the front optical port. This port conforms to IEC 62056-21 *[4]* and is commonly referred to as a FLAG *[5]* port. Register identification and formats are proprietary and defined by the SDDS specification *[3]*. Registers are organised in two categories, configuration (ISKRA-SYS) and data (ISKRA-DATA).

Configuration registers reside in the ISKRA-SYS group and describe the overall operation of the device including scheduling of data delivery and system management functions.

Measurement data registers are described in the ISKRA-DATA group and include logging profiles. Supplementary measurement channel configuration is contained within this group of registers.

Register access is protected by a hierarchy of security levels. Level 1 security provides privileged read access to all readable registers. Level 2 security access allows writing of time and date by a third-party without exposing other registers. Level 3 security provides read and write access to all registers. Additionally, every register has an associated read, write or read/write permission flag.

A number of macro functions may be executed with level 3 privilege to perform specific operations, such as resetting of registers and powering of the GSM module.

A brief description of functional requirements necessary for communication with the P2G via the FLAG port follows.

5.1.1 Wakeup Sequence

The P2G is battery powered and remains in a low-power state during normal operation. The host device must initiate an IEC 62056 session by first sending a NULL sequence (as detailed in *[4]* Annex B).

5.1.2 Device Identification

The P2G unit will identify itself during the sign-on sequence as follows,

HHU → /?!<CR><LF>

/ISK5***P2G***<CR><LF> ← P2G

The baud rate identification is specified by the SDDS register *FLAGRATE* which will default to 9600bps. Similarly, a P2W unit will identify itself as follows,

HHU → /?!<CR><LF>
/ISK5***P2W***<CR><LF> ← P2G

5.1.3 Register Format

P2G registers are organised into two classes, ISKRA-SYS and ISKRA-DATA. In order to identify a register the class must also be specified. For example, the following IEC 62056 write command will set current time,

<SOH>W1<STX>00*02.02.00(124500)<ETX><BCC>

The following read command will get the logging period for channel 3,

<SOH>R1<STX>06*03.04.04()<ETX><BCC>

The general register identification format is,

<*class*>**a.b.c*

where *class* is the data format value defined in the *SMP Data Format Definitions [2]* document expressed in ASCII-hexadecimal. Specifically, the register identification formats are,

ISKRA-SYS	00**a.b.c*
ISKRA-DATA	06**a.b.c*

5.2 SMS Interface

Data can be delivered by the P2G via SMS using SMP as a method of formatting an SMS. SMP can also be used to request data, send configuration data and reset the P2G.

The SMS are transmitted using 8 bit data which gives 140 octets of user data in the SMS. SMP implements a 14 octet header leaving 126 octets to transfer data. This is enough to transmit ½ hour logging for a single input plus a number of other registers in a single SMS.

The P2G is configured with a trusted MSISDN that it uses as a method of security. It will only send and process messages with this MSISDN. The SMP header also includes the device ID which adds an extra level of security since the P2G will only process messages with the correct device ID.

For a full description of the SMP message format please refer to *[1]*. Below is a brief description of the main features.

5.2.1 Security

The SMP protocol implements security on two levels. The first is to only accept SMS from a trusted MSISDN. Any message that is not from a trusted MSISDN will be ignored. If configured to do so, the P2G can send an alarm to the trusted MSISDN to indicate the condition. There can be up to two trusted MSISDN configured.

The second level of security is the DEVICEID field in the SMP header. The DEVICEID is an eight octet field which is unique to the P2G. When an SMS is received this field is compared to the DEVICEID configured on the unit. If they match the message is processed, otherwise an alarm can be set.

5.2.2 Configuration

The P2G can be configured via SMP using the METER-CONFIG message. This message can be used to configure all the registers as described in section 5.3. The Data part of the SMP message can contain one or more tuples of Register ID and Register Data.

When the P2G receives a METER-CONFIG it checks that all Register IDs and corresponding data are valid before applying the new configuration. If an error is detected at any stage then the complete message is ignored and an error may be sent to the trusted MSISDN.

It is possible to request an acknowledgement to a METER-CONFIG message. If the ACK_REQ bit is set in the Flags field of the SMP header, the P2G will send a METER-REPLY message if the configuration was valid and applied.

5.2.3 Alarms and Errors

The P2G can be configured to send alarm and error messages for various invalid conditions. The METER-ERROR message is sent to indicate that there was an error detected while the P2G was processing an incoming SMP message. The error message sent will contain the Message ID of the received message plus a two byte code indicating the error plus optional bytes containing further information. The METER-ALARM message is sent when the P2G has detected an invalid condition. The alarm message will contain a two byte code indicating the alarm condition plus optional bytes containing further information.

The P2G can be configured to enable or disable the sending of METER-ERROR and METER-ALARM messages as required.

5.2.4 Data Requests

The trusted MSISDN can request register data from the P2G by sending a METER-REQ message. This message can contain a list of one or more Register IDs that are being requested. The P2G will process the METER-REQ message and return the Register IDs plus the Register Data in an METER-REPLY message. The METER-REPLY message will contain the Message ID of the corresponding request to allow the trusted MSISDN to match requests to replies. If the data for the requested registers exceeds a single SMS then the data will be fragmented across multiple SMS. The P2G will always return the registers in the order requested. This allows the trusted MSISDN to collect all the fragments and order them by Message ID to concatenate and extract the required data.

5.2.5 Register Reset

The registers on the P2G can be reset using the METER-RESET message. The reset message is treated slightly different from other SMP messages in that there is no authentication based on the trusted MSISDN. Instead, the message includes a reset password within the message which is used to authenticate the validity of the message. The password in the message is compared against the L4PASSWD. If the password is valid the message is processed. The message also includes a single octet that contains a bit field which can be used to set the level of reset to perform. The bits of this octet correspond to the system executable macros (see Table 2-1) as described below.

5.3 Registers

As described above registers are arranged into ISKRA-SYS and ISKRA-DATA registers. A register from either of these groups must be one of the data types indicated in Table 5-1.

Register Type	SDDS Description	FLAG representation
MSISDN	*See SDDS specification [3]*	ASCII-hexadecimal
SEQUENCE	Decimal string (maximum 8 octets)	ASCII-hexadecimal (no length indicator)
STRING	Printable string (maximum 15 characters)	ASCII (no length indicator)
INT8	Unsigned 8-bit integer	ASCII-decimal
INT16	Unsigned 16-bit integer	ASCII-decimal
INT32	Unsigned 32-bit integer	ASCII-decimal
FLOAT	IEEE-754 single-precision floating point number	ASCII-decimal
INTERVAL	Schedule interval period specified in months and days	MM:DD
BOOLEAN	*zero* (FALSE) or *non-zero* (TRUE)	ASCII-decimal
DATE	Schedule date	MM:DD
TIME	Schedule time	hh:mm
SYSDATE	System date	YY:MM:DD
SYSTIME	System time	hh:mm:ss
TIMESTAMP	Time and date stamp	YY:MM:DD: hh:mm:ss
REGISTER	ISKRA-SYS or ISKRA-DATA register ID (3 octets) -- *dependent on DATATYPE register, see SDDS specification [3]*	ASCII-hexadecimal
IMID	Decimal digit string (exactly 15 characters)	ASCII-decimal
LP	Logging profile (always 32-bits)	ASCII-hexadecimal

Table 5-1: Register data types

Register data types are fully described in the SDDS Specification *[3]*, but require conversion to 7-bit ASCII-friendly versions for transmission over a FLAG session.

5.3.1 System Registers

The ISKRA-SYS class of registers is used to configure basic system functions and data message scheduling. Table 5-2 indicates the registers in this class with associated IDs, data types and permissions.

Field	Register	Type	R/W
00.00.00	MSISDN1	MSISDN	RW
00.00.01	MSISDN2	MSISDN	RW
00.00.02	L1PASSWD	STRING	W
00.00.03	L2PASSWD	STRING	W
00.00.04	L3PASSWD	STRING	W
00.00.05	L4PASSWD	STRING	W
00.00.06	MAXRETRY	INT8	RW
00.00.07	RTCSYNC	INTERVAL	RW
00.00.08	ALARMS	BOOLEAN	RW
00.00.09	ERRORS	BOOLEAN	RW
00.00.0B	AUTOID	BOOLEAN	RW
00.00.0C	WKPSTART	DATE	RW
00.00.0D	WKPSTOP	DATE	RW
00.00.0E	WKPTIME	TIME	RW
00.00.0F	WKPWAIT	INT8	RW
00.00.10	WKPINT	INTERVAL	RW
00.00.11	WKPACTIVE	BOOLEAN	R
00.00.12	WKPNEXT	TIMESTAMP	R
00.00.15	RSTWKPWAIT	INT8	R/W
00.x1.00	STARTDATE	DATE	RW
00.x1.01	STOPDATE	DATE	RW
00.x1.02	SENDTIME	TIME	RW
00.x1.03	INTERVAL	INTERVAL	RW
00.x1.04	DATATYPE	INT8	RW
00.x1.05	ACTIVE	BOOLEAN	R
00.x1.06	NEXT	TIMESTAMP	R
00.x2.nn	DATA	REGISTER	RW

Field	Register	Type	R/W
00.04.0D	LASTSENT	TIMESTAMP	R
00.04.0E	LASTRCVD	TIMESTAMP	R
01.00.00	DEVMSISDN	MSISDN	RW
01.01.00	GSMVER	STRING	R
01.01.01	RSSIMIN	INT8	R
01.01.02	RSSIMAX	INT8	R
01.01.03	BERMIN	INT8	R
01.01.04	BERMAX	INT8	R
01.01.05	CELLID	INT16	R
01.01.06	LAC	INT16	R
01.01.07	NETLOSS	INT16	R
01.01.08	IMEI	IMID	R
01.01.0A	COREVER	STRING	R
01.01.0B	LASTREG	TIMESTAMP	R
01.01.0C	GSMSTATUS	BOOLEAN	R
01.01.0D	NETSTATUS	BOOLEAN	R
02.00.00	DEVICEID	SEQUENCE	RW
02.00.01	DEVLOC	STRING	RW
02.00.02	DEVOP	STRING	RW
02.00.03	OPNOTE1	STRING	RW
02.00.04	OPNOTE2	STRING	RW
02.00.05	FLAGRATE	INT8	RW
02.01.00	L1PASSWD	STRING	W
02.01.01	L2PASSWD	STRING	W

00.x3.00	RETRIES_CH	INT16	R
00.x3.01	TXOK_CH	INT16	R
00.x3.02	TXFAIL_CH	INT16	R
00.x4.00	RETRIES_ALL	INT16	R
00.x4.01	TXOK_ALL	INT16	R
00.x4.02	TXFAIL_ALL	INT16	R
00.04.03	TXDATA	INT16	R
00.04.04	TXREPLY	INT16	R
00.04.05	TXTEST	INT16	R
00.04.06	TXALARM	INT16	R
00.04.07	TXERROR	INT16	R
00.04.08	RECVD	INT16	R
00.04.09	RXCONFIG	INT16	R
00.04.0A	RXRESET	INT16	R
00.04.0B	RXREQ	INT16	R
00.04.0C	RXTEST	INT16	R

02.01.02	L3PASSWD	STRING	W
02.02.00	TIME	SYSTIME	RW
02.02.01	DATE	SYSDATE	RW
02.02.02	DST	BOOLEAN	RW
02.02.03	UPTIME	TIMESTAMP	R
02.03.01	FWVER	STRING	R
02.03.02	AMBTMP	FLOAT	R
02.03.03	RSTCNT	INT16	R
02.03.04	BATTLIFE	INT16	R
02.03.05	BATTRST	INT16	R
02.03.06	STATUS	STRING	R
02.03.07	LASTFLAG	TIMESTAMP	R
02.03.08	BADFLAG	INT16	R
02.03.09	FLAGCNT	INT16	R
02.03.0A	LASTCFG	TIMESTAMP	R
02.03.0B	PRODUCTID	STRING	R
02.03.0C	IOCFG	STRING	R

Table 5-2: ISKRA-SYS registers

System registers are accessed by selecting the ISKRA-SYS data format *[6]* when addressed by SDDS/SMS or FLAG (see section 5.1).

5.3.2 Data Registers

ISKRA-DATA registers contain measurement and logged data accumulated by physical and logical data channels inputs. Table 5-3 indicates physical channel registers with associated IDs, data types and permissions.

Field	Register	Type	RW
xx.00.00	RAWACC	INT32	RW
xx.01.00	SCAACC	FLOAT	RW
xx.01.01	SCAINIT	FLOAT	RW
xx.02.nn	RAWLP*n*	*see [3]*	R
xx.04.00	METERID	SEQUENCE	RW
xx.04.01	CHINFO	STRING	RW
xx.04.02	SCALAR	INT16	RW
xx.04.03	ROLLOVER	FLOAT	RW
xx.04.04	LPPERIOD	INT8	RW
xx.04.05	LPMODE	BOOLEAN	RW
xx.04.06	LPINTEXT	BOOLEAN	RW
xx.04.07	LPCAP	INT8	R
xx.04.08	TAMPER	BOOLEAN	RW
xx.04.09	TAMPVAL	INT8	RW
xx.04.0A	CHTYPE	INT8	RW
xx.04.0B	IPORTNO	INT8	RW
xx.04.0C	OPORTNO	INT8	RW
xx.04.0D	THLMON	BOOLEAN	RW
xx.04.0E	THLTIME	TIME	RW
xx.04.0F	THLPERIOD	INT16	RW
xx.04.10	THLLEVEL	INT32	RW
xx.04.11	THHMON	BOOLEAN	RW
xx.04.12	THHTIME	TIME	RW
xx.04.13	THHPERIOD	INT16	RW
xx.04.14	THHLEVEL	INT32	RW
xx.04.15	NOTE1	STRING	RW
xx.04.16	NOTE2	STRING	RW

Table 5-3: ISKRA-DATA registers (physical)

Physical channels are mapped to the physical inputs. Physical outputs are mapped to physical inputs via the physical channels. A single logical channel is used for temperature logging (Table 5-4).

Field	Register	Type	RW
0x.02.nn	RAWLP*n*	*see [3]*	R
0x.04.00	METERID	SEQUENCE	RW
0x.04.01	CHINFO	STRING	RW
0x.04.04	LPPERIOD	INT8	RW
0x.04.07	LPCAP	INT8	R

Table 5-4: ISKRA-DATA registers (logical)

The temperature logging channel interval data is fixed at 4-byte FLOAT type. Only the logging period is configurable for this logical channel. The temperature logging channel number follows the physical channel numbers, i.e. channel number *02* for the 2-input logger unit and *04* for the 4-input logger unit.

5.3.3 Macro Execution

Macros provide more involved operations on registers than simple read and writes. Entire groups of registers can be cleared or reset to factory defaults.

Macro	Function	Description	MR bit
			DATA
0000	RESET ALL REGISTERS	All ISKRA-SYS and ISKRA-DATA registers are reset to factory defaults (see *[3]* Appendix 6.2). This includes all configuration and measurement data registers without exception.	0
0001	RESET ALL MEASUREMENT DATA	All ISKRA-DATA registers are reset to factory defaults (see [1] Appendix 6.2). This includes all measurement data and logged data registers. ISKRA-DATA CONFIG registers and ISKRA-SYS registers are not reset.	1
0002	RESET MEASUREMENT DATA	All ISKRA-DATA RAWACC and SCAACC registers are cleared to factory defaults (see *[3]* Appendix 6.2). The reset excludes profile RAWLP data registers. ISKRA-DATA CONFIG registers and ISKRA-SYS registers are not reset.	2
0003	RESET PROFILE DATA	All ISKRA-DATA logged profile registers are cleared to factory defaults (see *[3]* Appendix 6.2). The reset excludes RAWACC and SCAACC registers. ISKRA-DATA CONFIG registers and ISKRA-SYS registers are not reset.	3
0004	RESET NETWORK DATA	All ISKRA-SYS network performance informational registers are reset to factory default values (GSM::INFO registers).	4
0005	RESET SDDS DATA	All ISKRA-SYS SDDS statistical informational registers are reset to factory default values (SDDS::INFO registers).	5
			DEVICE
0100	CLEAR TAMPER OR THRESHOLD MONITOR CONDITION	Clear an active tamper or threshold monitor condition existing in the device. This macro will have no effect if a tamper or threshold monitor condition has not been detected.	6
0101	CLEAR DEVICE STATUS	Clear a non-default device operational status. ISKRA-SYS register STATUS is also reset to factory defaults.	7
			COMMUNICATION
0200	UPDATE NETWORK STATUS	SDDS includes several GSM network related performance and status registers which are updated when the GSM module is powered up from standby. The UPDATE NETWORK STATUS macro powers GSM module and updates GSM register data. The GSM module is allowed to timeout and power-down to standby automatically. Depending on the SIM boot sequence, the GSM registers may not be updated for certain period of time after execution of UPDATE NETWORK STATUS. During this period the IEC 62056 session remains active. *Note, this macro is executed implicitly during any scheduled power up.*	N/A
0201	GSM SIGNAL TEST	This macro switches on the GSM module and updates the GSM INFO registers every 5 seconds. It will remain in this mode until either: a) a new FLAG session is initiated, or b) the GSM times out and switches off.	N/A
0202	GSM POWER DOWN	Switch the GSM module off.	N/A
			SYSTEM
0300	SMS SELF TEST	Initiate and SMS test message.	N/A
			RESET
8000	SOFTWARE RESET	Perform a software reset.	N/A
8001	FACTORY RESET	Reset configuration to factory defaults and perform a software reset.	N/A

Table 5-5: Executable Macros

Macros may be executed via FLAG or implicitly by processing of a valid METER-RESET message. Table 5-5 describes each macro and the reset mode bit number in the METER-RESET message (MR bit). All macros which reset registers above do so with the exception the following registers,

- DEVICEID
- TIME
- DATE
- DST
- UPTIME
- FWVER
- RSTCNT
- BATTLIFE
- BATTRST
- LASTCFG
- PRODUCTID
- IOCFG
- RAWACC
- SCAACC
- ROLLOVER

These registers are initialised the first time the unit is powered only. They're values are explicitly modifiable by FLAG or SDDS.

5.4 Security

The system and data registers are protected by three levels of password and a fourth level reserved for the SMP METER-RESET message. The first three levels are accessible in the DEVICE group of ISKRA-SYS registers and all four levels are accessible from the SDDS group. Both register groups refer to the same objects.

Level	Access
1	Read any readable register
2	Write time and date registers
3	Read any readable register Write any writable register Execute any macro
4	METER-RESET execution

Table 5-6: Security Levels

All passwords are writable with level 3 access privilege, none are readable. Level 2 allows writing of the system time and date (registers TIME and DATE). This level does not inherit level 1 privileges.

Level 4 is used for matching against a password challenge supplied in a METER-RESET message. The Level 4 password is only accessible via the local optical interface. It cannot be set, cleared or read via SMS.

NOTE:

The DEVICEID register can be accessed via the local optical interface without any password protection.

6 Pulse Counting and Data Logging

The P2G can be connected to any device that provides a switch closure output and will count and log the number of pulses. It will also replicate any input pulses on one of its outputs to allow further pulse counting equipment to be connected.

The P2G can also monitor ambient temperature and log temperature values.

The P2G supports configuration of pulse counting and data logging via the ISKRA-DATA set of registers. There are three data channels supported. The first two channels are used to count/log pulse inputs. The third channel is used to log temperature data.

6.1 Pulse Inputs

The P2G can support two physical pulse input ports. It can count pulses on both input ports at rates of up to 10Hz. The physical input port can be configured using the IPORTNO register.

6.2 Pulse Outputs

The P2G can replicate a pulse input on one of its pulse output ports. The mapping of pulse input ports to pulse output ports is configurable via the OPORTNO register. It is also possible to configure this register to map the first input port to all of the output ports.

6.3 Scaled Counters

The P2G can store a scaled value which is the equivalent of the raw pulse count divided or multiplied by a scaling factor. This can be used to represent the unit value of the connected device. The scaling factor is configurable via the SCALAR register.

6.4 Counter Rollover

The P2G can be configured to reset the raw pulse count and the scaled value when the scaled value reaches a certain value. This allows the P2G rollover to match the connected device. The rollover value is set via the ROLLOVER register.

6.5 Pulse Logging

The P2G logs the raw pulse count value at a configurable interval selectable from a number of different logging periods. The data that is logged can be an accumulated value or a differential value. The data value count may be forced to a 16-bit or 32-bit integer value depending on the range required.

Each log profile register will contain a full day of intervals, the number of intervals depending on the configured logging period. Future intervals within a register yet to be written are initialised to zero. Logging data is accessed through the RAWLP registers. Consecutive days of logged data will be maintained up to the maximum capacity (indicated by register LPCAP). Thereafter, logged days will be overwritten, oldest first.

6.5.1 Period

The logging period is configured via the LPPERIOD register. The logging periods supported are:

LPPERIOD	Interval size	Number of intervals
0	5 mins	288
1	15 mins	96
2	30 mins	48
3	60 mins	24
4	24 hours	1

5 – 255	UNDEFINED	UNDEFINED

Table 6-1: LPPERIOD Values

The time that the data is logged is a multiple of the interval size. For example, if the logging period is 2 and the current RTC is 13:43:00, then the first log will occur at 14:00:00 and the next at 14:30:00, etc. If the period was 4 then the log would occur at 00:00:00.

6.5.2 Mode

Logging can be configured to be accumulated or differential data. Accumulated data logs the current raw pulse count accumulator (RAWACC). Differential data logs the number of pulses between logging periods. The logging mode can be configured via the LPMODE register.

6.5.3 Data Size

The logging data can be configured to be 16 bit integer or 32 bit integer data. This can be configured to provide the required resolution of data. The data size will affect the load profiling capacity and number of SMS required to transmit data. The data size is set to 16 bit by default. The LPINTEXT register can be used to configure 32 bit data.

6.5.4 Capacity

The P2G can store many days of logging data per data channel. The maximum number of days is calculated by the P2G and can be read from the LPCAP register. The value of the LPCAP register is calculated using LPPERIOD, LPMODE and LPINTEXT for physical pulse logging and LPPERIOD for temperature logging.

6.5.5 Configuration

All logged data for a data channel will be cleared to zero if any one of the following registers change,

- LPPERIOD
- LPMODE
- LPINTEXT

This is required to recalculate LPCAP and to internally re-organise memory. Logging will continue using the new LPPERIOD value.

6.6 Temperature

A logical data channel is used to log ambient temperature. The temperature sensor can monitor temperature to an accuracy of 0.125℃.

6.6.1 Monitor

The temperature monitor provides the current temperature of the P2G. The current temperature of the device can be accessed via the AMBTMP register and is returned as a 32-bit IEEE floating-point number.

6.6.2 Logging

At the end of an interval, according to the configured logging period, the current ambient temperature is logged. Temperature logging has a fixed interval size and fixed mode, i.e. each interval is represented by a 32-bit IEEE floating-point number. Only the logging period may be configured.

7 Real Time Clock

The P2G has a real time clock (RTC) which is used to schedule all logging and SMS events. The RTC supports local or remote configuration, daylight saving time (DST) and automatic resynchronisation with the GSM network.

7.1 Updating the RTC

The RTC can be updated via the SMS interface or IEC 62056 interface. However, updating the RTC via SMS can introduce some inaccuracy due to the unpredictable delivery time of the SMS by the GSM network. The date and time are stored independently in the registers DATE and TIME respectively.

7.2 RTC Dependencies

The RTC is used by the P2G to schedule logging events and to schedule data delivery via SMS. Updating either the date or time can have an effect on either of these functions. If the time is changed then this can have an effect on logging data. If the time is shifted backwards then logging data will be aggregated for the relevant periods. If shifted forward then the load profile will contain zero data for the relevant periods. Updating the date will affect the logging data. If the date is moved backwards then any logged data for those days will be reset and logging will restart at the new date. If the date is moved forward then the current logging day is moved forward to this new date.

7.3 Daylight Saving Time

The RTC supports daylight saving time (DST). If DST is enabled via the DST register then the P2G will adjust its RTC by one hour on the last Sunday in March and October. On the last Sunday in March the P2G will adjust the RTC by one hour forward at 01:00am. On the last Sunday in October it will adjust the RTC by one hour backward at 02:00am.

7.4 Network Resynchronisation

The P2G can update the RTC by synchronising with the GSM network. The time used within the GSM network is extremely accurate and can be used to update the RTC to avoid drifting. The RTC resynchronisation function can be configured to occur at daily, weekly or monthly periods.

8 SMS Data Delivery

The P2G can deliver any of its registers to the primary MSISDN using SMS. The SMS interface supports the SMP [1] protocol and register representation as defined by the SDDS [3] specification. The date, time and frequency of the data delivery can be configured for up to 5 different schedule channels. Each schedule can deliver up to 32 separate registers.

Registers can also be requested on an adhoc basis by sending a request to the P2G via SMS. The P2G will receive the SMS and reply with the register data the next time it registers with the GSM network.

8.1 Scheduled Delivery

8.1.1 Description

A schedule can transmit one or more registers on a specific date and at a specific time. The data is sent in on or more SMS to the configured primary MSISDN. The SMS are formatted according to the SMP/SDDS specifications. If the data cannot be accommodated by a single SMS then the data is fragmented across multiple messages. A single register can be split across SMS.

8.1.2 Configuration

A schedule can be configured to start on a specific date and time via the STARTDATE and SENDTIME registers. The STARTDATE can be configured as an absolute day and month, or it can be configured as relative offset to the device's RTC. The schedule can be configured to send the register data periodically for a configured number of days and months via the INTERVAL register. The schedule will then be delivered at this frequency indefinitely. If a schedule should only be delivered for a set period then a stop date can be configured via the STOPDATE register. The P2G will then stop sending data once this date has been reached. The data format for the registers being delivered is configurable via the DATAFORMAT register. A schedule can deliver either ISKRA-SYS or ISKRA-DATA registers. Up to a maximum of 32 registers can be configured per schedule via the DATA registers.

8.2 Requested Data

Registers can be requested via SMS on an adhoc basis by sending a request to the P2G. Any SMS sent to the P2G will remain within the GSM network until the GSM is switched on and registered. This will happen either when it switches on the GSM to send scheduled data or when it switches the GSM on for a configured wakeup window (refer to section 12 for a description of wakeup windows). Once the GSM is registered the network will deliver the SMS to the P2G. The P2G will then send a reply with the requested registers.

9 Tamper Condition Detection

The P2G data logger incorporates a number of security devices to prevent against unauthorised access to configuration and measurement data, and to detect unexpected interference with the physical inputs. Remote and local access protection is discussed fully in section 5.4.

The P2G data logger includes physical connection tap ports, each associated with exactly one pulse input port. When the pulse cables are correctly installed, the unit will monitor the continued presence of these connections.

9.1 Monitor

Presence of a physical connection is indicated by ISKRA-DATA information register IPCONN. This register will always show the presence or absence of individual physical input connections. This function in itself does not provide pre-emptive detection.

9.2 Alarming

A tamper condition constitutes a continuous loss of physical connection (detected by the connection tap port monitor) on a particular data channel for a specific duration. If this duration is exceeded a tamper condition is raised and an alarm SMS message (METER-ALARM) sent to the central system (trusted MSISDN). The alarm message will contain the channel number which caused the tamper condition.

ISKRA-DATA configuration registers TAMPER and TAMPVAL control the tamper detector state (enabled or disabled) and the tamper condition validation duration (in minutes), respectively. If a suspected tamper condition is interrupted at any time by a return of connection the tamper detector is reset.

If a tamper condition is detected by exceeding the tamper validation time, ISKRA-DATA informational register TAMPSTAT is asserted, register TAMPCNT incremented and the current time and date entered in register TAMPTIME.

A tamper condition must be cleared by execution of the CLEAR TAMPER CONDITION macro. Note, if this macro is executed during potential tamper condition the tamper detector is reset. The only other means of clearing a tamper condition is by execution of the RESET ALL REGISTERS macro.

10 Input Data Monitoring

The P2G can be configured to monitor the pulse input data on all physical channels. It can be configured to send an alarm message if the number of pulses counted over a period is above or below a threshold value. This is of particular use to monitor for leakage upstream or downstream of the meter.

10.1 Configuration

Pulse input monitoring can be configured on a per channel basis. Each channel can be configured to monitor independently a high threshold value and a low threshold value. The high threshold is enabled by the THHMON register. It will start monitoring at a specific time, which can be configured via the THHTIME register. The monitoring will then count the number of pulses over a given period, which can be set between 1 and 1440 minutes. This is configured via the THHPERIOD register. The number of pulses to compare against is configured using the THHLEVEL register. If the number of pulses counted over the period is greater than the configured threshold level, then the event is logged and an METER-ALARM message is sent.

A separate set of registers can also be configured for low threshold monitoring. The registers THLMON, THLTIME, THLPERIOD and THLLEVEL can be used to generate an alarm if the input data falls below a set threshold for a given period at a given time.

The data input monitoring will occur at the set time on a daily basis while enabled. The maximum period can be set to 1440 minutes, which is equal to 24 hours to allow constant monitoring if required.

10.2 Status Registers

When the data monitoring detects an alarm condition it stores the status in a number of INFO registers. If the pulse count goes above a set level then the THHSTATUS register is set, the THHCOUNT register is incremented and the THHLAST register is set to the timestamp of the event. The THLSTATUS, THLCOUNT and THLLAST registers are updated when the low level monitor is detected. The status conditions will remain active until cleared by the 0100 macro execution. Monitoring is not re-enabled until the status condition is cleared.

10.3 Alarms

The unit will send an METER-ALARM message when a threshold monitoring condition is detected. The METER-ALARM message will contain the number of pulses that were counted during the monitoring period.

11 Battery Management

The P2G maximises battery life by implementing a power management strategy. When the P2G is running normally counting and logging data then it operates in a low power mode. In low power mode the GSM device is switched off to save power. The GSM device is only switched on when required. The GSM will be switched on when there is scheduled data to be transmitted or if a wakeup window is configured.

11.1 Monitoring

The P2G continually monitors operating mode and calculates the remaining life of the battery. The battery life is accessed via the BATTLIFE register. The P2G continually updates this register based on the current operating mode.

11.2 Battery Replacement

If the battery is replaced in the P2G then the BATTLIFE register can be reset by pressing the RESET switch. The RESET switch is located internally and can only be accessed by removing the cover of the P2G. This should only be carried out when the battery is replaced by a qualified engineer as part of routine maintenance.

12 Wakeup Window & Reconfiguration

12.1 Description

The P2G can be reconfigured via SMS. An SMS can be sent to the P2G and will remain in the network until the next time the P2G switches on its GSM and registers with the network. The P2G can be configured with a wakeup window that allows the P2G to switch on the GSM at a specific time for a set number of minutes. After this period it will switch off the GSM. By configuring a wakeup window the P2G can be contacted via SMS as required.

12.2 Configuration

The wakeup window is configured similarly to a schedule, except it does not send any data. The wakeup window can be configured to start on a specific date and at a specific time via the WKPSTART and WKPTIME registers. The wakeup window can be configured via the WKPWAIT register to stay on for 1-60 minutes before switching off the GSM. The wakeup window can also be configured to wakeup periodically for a configured number of days and months via the WKPINT register. The wakeup will then occur at this frequency indefinitely. If the wakeup should only happen for a set period then a stop date can be configured via the WKPSTOP register.

12.3 Reconfiguration via SMS

To reconfigure the P2G then the wakeup window should be configured as required. For example, it could be configured to wakeup at 12:00pm every day for 5 minutes. The P2G can then be reconfigured by sending one or more SMS to the device prior to this time, e.g. at 11:45am. When the GSM is powered on and registers with the GSM network, the network will push the SMS that are undelivered in the network down to the P2G. The P2G will then process them and send an acknowledgement or error message as required. After the wakeup time expires the GSM will be switched off and any undelivered SMS for it will remain in the network until the next time it's registered.

12.4 Configuration Reset

The configuration can be reset to factory defaults via the METER-RESET message. This message must contain the configured Level 4 password for the message to be accepted and processed. The METER-RESET message is processes slightly differently from other SMS as the trusted MSISDN is not checked. This allows anyone to reset the configuration as long as they know the reset password.

On receipt of the METER-RESET message the device resets the period of time the unit will remain awake. This time period can be configured via the RSTWKPWAIT register. This register can be used to configure an extended wakeup period so that it gives more time for the unit to be reconfigured.

A number of registers are retained after a METER-RESET message. These registers are:

ISKRA-SYS	ISKRA-DATA
DEVICEID	RAWACC
TIME	SCAACC
DATE	ROLLOVER
DST	
UPTIME	
FWVER	
RSTCNT	
BATTLIFE	
BATTRESET	
LASTCFG	
PRODUCTID	

IOCFG	

Table 12-1: Retained Registers

13 Network Information

The P2G provides network specific performance information gathering from the communication module. These registers are updated each time the communication module is powered and registers with the network. Table 13-1shows the network information supported by the P2G.

Signal Quality	Minimum measured Received Signal Strength Indication (RXLEV)
	Maximum measured Received Signal Strength Indication (RXLEV)
	Minimum measured channel Bit Error Rate (RXQUAL)
	Maximum measured channel Bit Error Rate (RXQUAL)
Service Location	Current cell identifier
	Current location area code
Serialisation	Modules International Mobile Equipment Identity
Revisions	GSM application software version string
	Core GSM software version string
Statistical	Number of de-registrations from the network while module powered
	Timestamp of last network registration
Status	If the GSM module is currently switched On or OFF.
	If the GSM module is currently registered on the network or not.

Table 13-1:Network Information

14 Device Information

The P2G provides a number of registers that can be used to program the unit and provide informational data. Table 14-1shows a selection of device registers.

Identification	Unique device identifier
	Device location identifier
	Device operator identifier
	Operator proprietary identifier 1
	Operator proprietary identifier 2
Security	Level 1 access password
	Level 2 access password
	Level 3 access password
Real-time Clock	Current RTC time
	Current RTC date
	Europe Daylight Saving Time mode
	Total system uptime in seconds
Revision	P2G firmware version string
System Status	Current ambient temperature (℃)
	Battery life remaining (mAh)
	Battery reset count
	System operational status
Statistical	Count of system resets
	Timestamp of last FLAG session
	FLAG session authentication fail count
	FLAG session count
	Timestamp of last configuration
Product Info	Product type identification string
	Port configuration – number of pulse inputs, tamper inputs and pulse outputs

Table 14-1: Device registers

15 Supported Products

The table below describes the currently supported P2G and P2W products.

Product	Type Designation	Pulse Inputs	Tamper Inputs	Pulse Outputs
P2G	P2G-K17V03I00	2	2	2
P2G-4	P2G-K17V03I01	4	0	4
P2W	P2W-K17V02	2	0	0

Table 15-1: Supported Products

16 References

1. “Iskraemeco SMS Message Protocol (SMP)”, Iskraemeco ECL Ltd
2. “SMP Data Format Definitions”, Iskraemeco ECL Ltd
3. “SMS Data Delivery Service Specification”, Iskraemeco ECL Ltd
4. “IEC 62056-21: ELECTRICITY METERING – DATA EXCHANGE FOR METER READING; TARIFF AND LOAD CONTROL (Part 21: Direct local data exchange)”, International Electrotechnical Commission (1st Draft, May 2003)
5. “FLAG Protocol”, FLAG Association Ltd / DLMS User Association
6. “SMP Data Format Specification”, Iskraemeco ECL Ltd
7. “P2G Software Version 1.03.00”, Iskraemeco ECL Ltd

17 Document Management

Version	Comment	Author	Date
1.0	Initial version of document	Fraser Moore	22 Jun 2005
1.0a	Added IEC 62056 description and supported register set description. Added discussion of security measures.	David Spalding	05 Aug 2005
1.0b	Added additional register descriptions and executable macros. Added extra sections detailing pulse logging, temperature logging and tamper condition detection. General clean-up and tightening of system descriptions.	David Spalding	12 Sep 2005
1.1	Added pulse input monitoring functionality	Fraser Moore	04/11/05
1.2	Added descriptions of PRODUCTID and IOCFG registers. Added description of the 0201 macro. Added Section 15 to describe the currently supported products.	Fraser Moore	11/01/06
1.3	Added updates for software version 1.03.00 support	Fraser Moore	22/11/2006

Table 17-1: Document Management