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The SCR+ Communication Interface

AE02:03.01:01.01
AE02.03.01:02.01
AE02:03.01.03.01

Specification

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Contents

1. Introduction

This specification describes a low cost **S**ystem for meter **C**ommunication and **R**eadout for powerless meters (SCR), in which the meter is powered by an interruptible or permanent connection for communication and remote readout.
The meter power supply and the meter communication interface can be either a DC or AC electrical connection, by two wires, with arbitrary polarity.

2. DC Meter Interface with asynchronous transmission

2.1 Physical interface

The meter can be connected to a transmission unit which supplies a DC Voltage with the following requirements:

- V_{min} : 4.5 V DC
- V_{nom}: 4.75 V DC
- V_{max}: 6.5 V DC

- I_{min} : 0.5 mA (idle mode. The Meter waits for a command)
- I_{nom} : 4 mA (while the Meter reads out the mechanical rollers)
- I_{max} : 30 mA (inrush current. See also chapter 2.1.2)

2.1.1 Modulation

Each direction uses another modulation. If the Meter sends data to the Transmission unit, a current modulation is used. If the Transmission unit sends data to the Meter a voltage modulation is used. Figure 1 shows the current or voltage level for Idle, Mark and Space state.

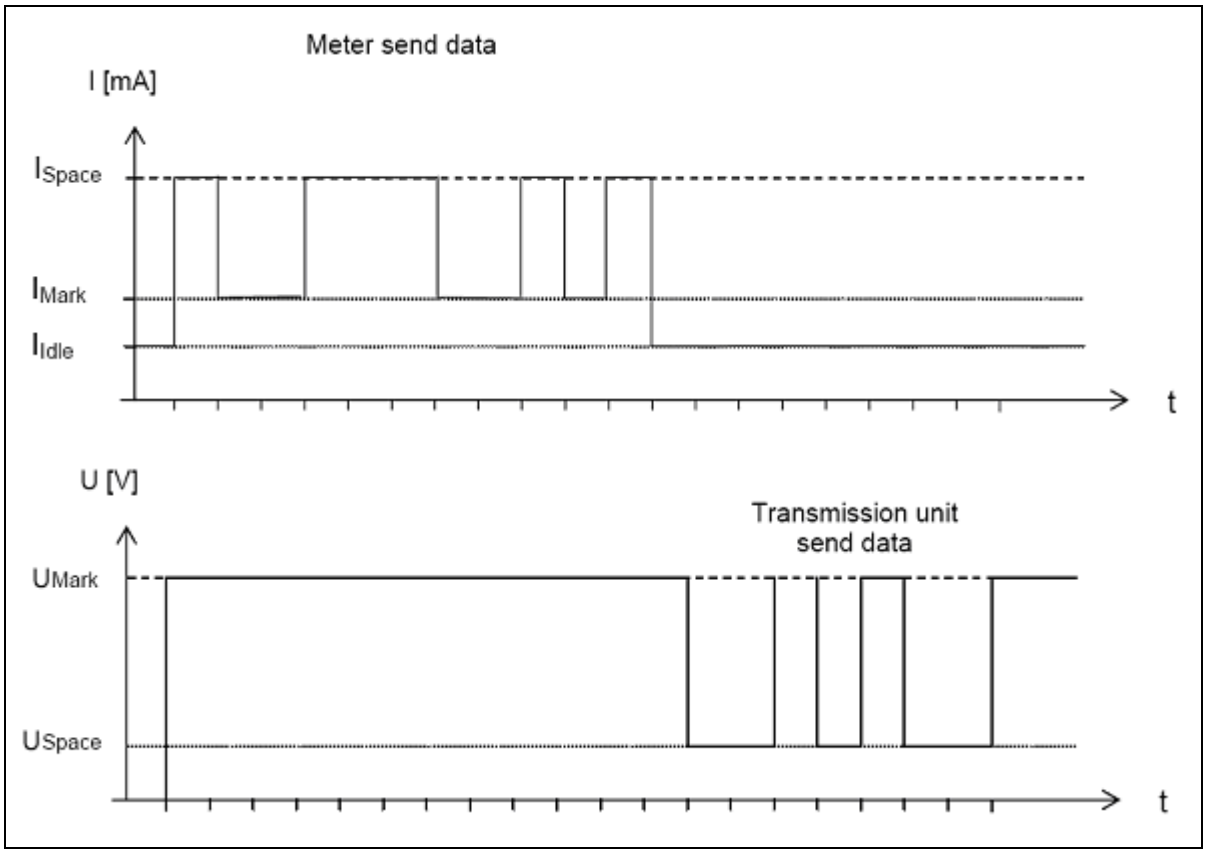


Figure 1: Diagram for current modulation (Meter send data) and voltage modulation (Transmission unit send data)

The following limits are specified:

State	Direction	Limits
Mark	Meter -> Transmission unit	4 mA ≤ I_{Mark} ≤ 5 mA
Space	Meter -> Transmission unit	8 mA ≤ I_{Mark} ≤ 9 mA
Idle	No communication	I_{Idle} ≤ 0.5 mA
Mark	Transmission unit -> Meter	4.5 V ≤ U_{Mark} ≤ 6.5 V
Space	Transmission unit -> Meter	0 V ≤ U_{Space} ≤ 1 V

2.1.2 Inrush current

After supplying the Meter an inrush current flows to charge an internal capacitor for buffering the power supply. While the Transmission unit sends data to the Meter (in this case the power supply is pulsed) the power supply is buffered by the capacitor. Figure 2 shows a typical current profile during power on. The Meter is supplied with the preferred voltage of 4.75 V.

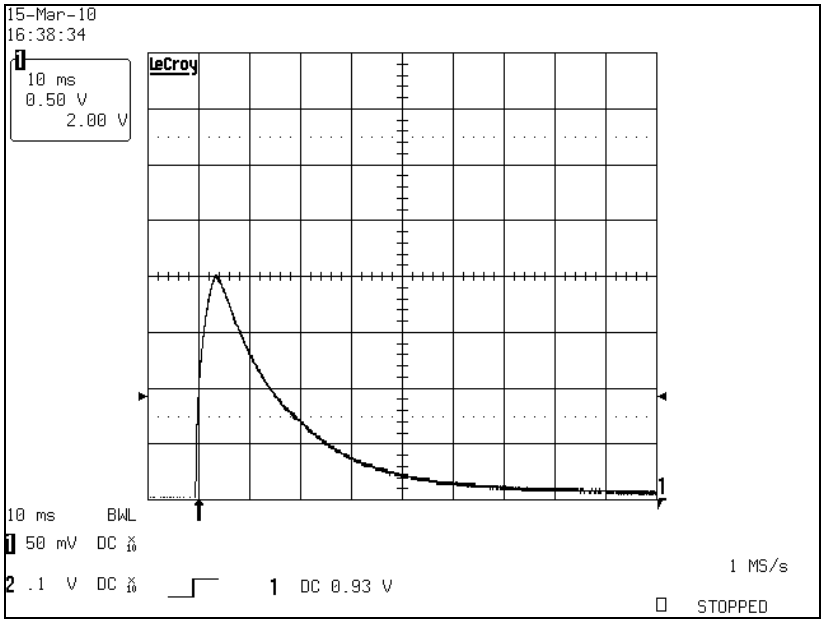


Figure 2: Typical inrush current after power on (U_{Supply}=4.75 V).

It is essential: $I = \frac{U}{V \cdot R}$; V=11, R=10 Ω

The typical peak current is: I_{peak}= 18.2 mA

2.2 Asynchronous communication

Bit 0 is transmitted by signaling SPACE state for period determined by the transmission baud rate of 300 baud.
For transmission to the meter, the duty cycle of bit 0 for any combination of more than 10 successive bits shall be less than 50%. (This can be achieved by interbyte gaps e.g.). Otherwise, the meter might interpret the transmission as a power down (and subsequent power up).A NUL string according to IEC 62056-21, Annex B e.g. is interpreted as power down / disconnect.
The Characters are transmitted with 7 bits, 1 or 2 stop bits, even parity. For transmission to the meter, 2 stop bits are recommended.

2.3 Transmission timing

When changing direction of communication:
After any transmission from the meter, a delay of at least 150 ms shall be observed before sending data to the meter. After any transmission to the meter, a delay of at least 150 ms will be observed before sending data from the meter.

2.4 Reading the meter

To read the meter, the transmission unit starts communication with a Sign on either (all characters are ASCII coded)

a) /?!<CR><LF>
b) /? MeterNumber!<CR><LF>
c) continuous Power up
d) clocked Power up

To a Sign on a), b), or c), the meter replies with a Data Readout according to chapter 2.5
A Sign on d) starts the Synchronous Link mode (see chapter 3)

Notes:

1. The Sign on "/?!<CR><LF>" or "/?Meternumber!<CR><LF>" must observe the timing requirements of IEC 62056-21.
2. Continuous Power up is treated as a Sign On without meter address (/?!<CR><LF>)
3. A minimum power down time of 2 sec must be observed before Power up Sign on
4. When reading the protocol with power on, depending on the hardware used, some extra characters may be present before the leading /. These should simply be skipped.

2.5 Answer of the meter

There are 3 possibilities for the answer frame. The programmed protocol type is printed to the index plain (under the meter number as Protocol key):

Protocol key (see index plate)	Protocol type	Chapter
AE02:03.01:01.01	EDIS 1995	2.5.1
AE02:03.01:02.01	OBIS 2005	2.5.2
AE02:03.01:03.01	OMS Issue 2.0.0 / 2009-07-20	2.5.3

2.5.1 Application protocol EDIS 1995

This protocol is according to IEC 1107 Mode A
A Data Readout is as follows:

/Manuf_Id Medium Version<CR><LF>
7.0(Reading*m3)<CR><LF>
0.09(ManufDate)<CR><LF>
0.00(MeterNumber)<CR>LF>
0.01(NominaSize)<CR><LF>
!<CR><LF>
<ETX><BCC>

Note:

- Between “Manuf_Id” and “Medium” is a space character
- Between “Medium” and “Version” is a space character

Protocol Element	EDIS-Code	Description
Manuf_ID	Not available	The Manuf_Id is a three Uppercase letter ID according to www.dlms.com/flag/
Medium	Not available	The Medium String is a clear text with uppercase or upper and lowercase characters describing the Medium. “Gas” is used for gas meter.
Version	Not available	This element descripts the protocol version. It starts with ‘V’, followed by the fist digit (major version), a dot and a second digit (minor version).
Reading	7.0	The Reading is a String with up to 10 digits and decimal separator ‘.’ or ‘,’ if appropriate. In case of Register errors, the Reading String contains ‘?’ in place of one or more digits (Roller error) or ‘?’ in place of all digits (Register error)
ManufDate	0.09	This element descripts the Date of Manufacturing or calibration (format dd-mmyy).
MeterNumber	0.00	The forth line contains the Meter Number. Most models limit the Meter Number to a string which contains only up to 8 digits. The maximal number of digits is 20
NominalSize	0.01	This is the meter size. The element is a string which may start and end with non digit characters, but it always contains a numeric part, eventually with decimal separator ‘.’ or ‘,’ (e.g. ‘G4’)
<BCC>	Not available	The Protocol ends with the Block check character (BCC) according to DIN 66219 / IEC 1155

2.5.2 Application protocol with OBIS designators (2005)

This protocol is according to IEC 62056-21 Mode A
A Data Readout is as follows:

/Manuf_Id Medium Version<CR><LF>
<STX>7-1:1.0(Reading*m3)<CR><LF>
96.2.1(ManufDate)<CR><LF>
0.0.1(MeterNumber)<CR>LF>
0.0.0(NominaSize)<CR><LF>
!<CR><LF>
<ETX><BCC>

Note:

- Between “Manuf_Id” and “Medium” is a space character
- Between “Medium” and “Version” is a space character

Protocol Element	OBIS-Code	Description
Manuf_ID	Not available	The Manuf_Id is a three Uppercase letter ID according to www.dlms.com/flag/
Medium	Not available	The Medium String is a clear text with uppercase or upper and lowercase characters describing the Medium. “Gas” is used for gas meter.
Version	Not available	This element descripts the protocol version. It starts with ‘V’, followed by the fist digit (major version), a dot and a second digit (minor version).
Reading	7-1:1.0	The Reading is a String with up to 10 digits and decimal separator ‘.’ or ‘,’ if appropriate. In case of Register errors, the Reading String contains ‘?’ in place of one or more digits (Roller error) or ‘?’ in place of all digits (Register error)
ManufDate	96.2.1	This element descripts the Date of Manufacturing or calibration (format dd-mmyy).
MeterNumber	0.0.1	The forth line contains the Meter Number. Most models limit the Meter Number to a string which contains only up to 8 digits. The maximal number of digits is 20
NominalSize	0.0.0	This is the meter size. The element is a string which may start and end with non digit characters, but it always contains a numeric part, eventually with decimal separator ‘.’ or ‘,’ (e.g. ‘G4’)
<BCC>	Not available	The Protocol ends with the Block check character (BCC) according to DIN 66219 / IEC 1155

2.5.3 Application protocol with OBIS codes according to OMS

The OBIS designators of this protocol are according to OMS, Issue 2.0.0 / 2009-07-20

A Data Readout (unconverted volume) is as follows:

/Manuf_Id Medium Version<CR><LF>
<STX>7-0:3.0.0(Reading*m3)<CR><LF>
96.2.1(ManufDate)<CR><LF>
0-0:96.1.0(MeterNumber)<CR>LF>
0.0.0(NominaSize)<CR><LF>
!<CR><LF>
<ETX><BCC>

A Data Readout (temperature converted volume) is as follows:

/Manuf_Id Medium Version<CR><LF>
<STX>7-0:3.1.0(Reading*m3)<CR><LF>
96.2.1(ManufDate)<CR><LF>
0-0:96.1.0(MeterNumber)<CR>LF>
0.0.0(NominaSize)<CR><LF>
!<CR><LF>
<ETX><BCC>

Note:

- Between “Manuf_Id” and “Medium” is a space character
- Between “Medium” and “Version” is a space character

Protocol Element	OBIS-Code	Description
Manuf_ID	Not available	The Manuf_Id is a three Uppercase letter ID according to www.dlms.com/flag/
Medium	Not available	The Medium String is a clear text with uppercase or upper and lowercase characters describing the Medium. “Gas” is used for gas meter.
Version	Not available	This element descripts the protocol version. It starts with ‘V’, followed by the fist digit (major version), a dot and a second digit (minor version).
Reading	7-0:3.0.0 (unconverted) 7-0:3.1.0 (converted)	The Reading is a String with up to 10 digits and decimal separator ‘.’ or ‘,’ if appropriate. In case of Register errors, the Reading String contains ‘?’ in place of one or more digits (Roller error) or ‘?’ in place of all digits (Register error)
ManufDate	96.2.1	This element descripts the Date of Manufacturing or calibration (format dd-mmyy).
MeterNumber	0-0:96.1.0	The forth line contains the Meter Number. Most models limit the Meter Number to a string which contains only up to 8 digits. The maximal number of digits is 20
NominalSize	0.0.0	This is the meter size. The element is a string which may start and end with non digit characters, but it always contains a numeric part, eventually with decimal separator ‘.’ or ‘,’ (e.g. ‘G4’)
<BCC>	Not available	The Protocol ends with the Block check character (BCC) according to DIN 66219 / IEC 1155

3. DC Meter Interface with synchronous transmission

Also it is possible to communicate via a synchronous communication. A transmission unit with the requirement of a frequent reading of a limited set of data from the meter with low power consumption may use the synchronous link to read the meter. The transmission unit does so by switching the supplied DC voltage with a maximum frequency of 2 kHz and listening to an echo when the DC voltage is off.

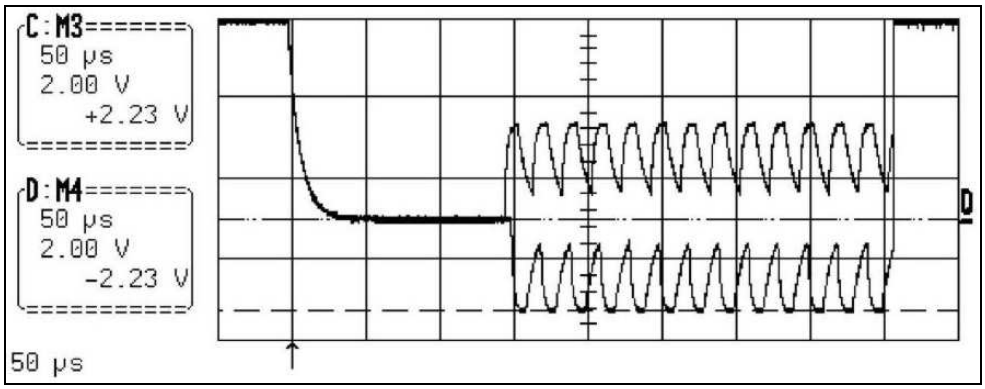
3.1 Power Clock

The transmission unit supplies the meter according to chapter 2.1. To activate the synchronous links, the transmission unit starts clocking the power at nominal 100 ms after Power on, with a nominal frequency of 830 Hz and a duty cycle > 50%.

3.2 Echo Specification

As soon as the required data is available, the meter starts sending bits by sending an AC Burst echo during the power off clock cycles to signal a Space state.
Transmission is 7 bits, even parity, 1 stop bit.
The Power has to be switched on again when a Burst has been detected or after TCL (see next table)

3.2.1 Burst Example



This example shows both a positive voltage and a negative voltage burst example in the same Chart.

3.3 Synchronous Link Interface Specification

	Description	Min.	Max.	Units
	Power/Clock Voltage High	$V_{sup\ min}$	$V_{sup\ max}$	V
	Power/Clock Voltage Low	$V_{Space\ min}$	$V_{Space\ max}$	V
	Power/Clock current	$I_{idle\ min}$	$I_{idle\ max}$	A
	Burst Voltage Hight (Space)	+/- 1.5	+/- (V_{sup} –0.3)	V
	Burst Voltage Low (Mark)	0	+/- 0.3	V
	Burst Frequency	40	60	kHz
TPOR[1]	Power On to Register Ready	100	1000	ms
TCL	Power/Clock low time	250 or Burst	1000	µs
	Power Clock low time jitter		±25	%
TCH	Power/Clock high time	500	2000	µs
	Power Clock Duty Cycle $\frac{TCH}{TCH + TCL}$	50		%
TDC	Delay, Clock to Data Out		250	µs
TRC	Reset Command. Time for Power/Clock low to force register reset		2000	ms

Note 1: A Synchronous Link capable device responds more than 99% of requests within TPOR max.

3.4 Short protocol for Synchronous Link

The synchronous communication is intended for transmission units with the requirement of frequently reading the meter using low power and without the need to read the full meter information at every reading. For this reason a short data protocol is used.

The short protocol reading is:

<STX>A(ReadingUnits)<ETX>BCC<CR><LF>

Symbol	Description
A	Protocol Type. Currently, only A is used, other characters are reserves for future use.
Reading	String with up to 10 digits and an eventual decimal separator '.' or ','. Internal errors are indicated in the reading by a character '?' in place of a digit (Roller error) or in place of all digits (Register error)
Units	A unit designator, which may be *m3
BCC	Block check character

The short protocol is repeated typically four times, the idea is that the transmission units switches power off when it could interpret one reading.