Specification for a

system for communication and remote readout of meters V5.0

(SCR +)

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1 General

This paper describes a low cost **S**ystem for meter **C**ommunication and **R**eadout for powerless meters (**SCR**), in which the meter is powered by a interruptible or permanent communication connection for communication and remote readout.

2 Definitions

transmission unit:	unit which is connected to one meter, supplies power to the meter and transmits data from and to the meter
meter coil interface:	interface connected to one meter via two wires, usually containing a coil and a capacitor.
inductive readout terminal:	(Portable) equipment to readout a single meter using inductive coupling
BCC:	Block check character according to DIN 66219 / IEC 1155

3 Physical interface properties

3.1 General

The meter power supply and the meter communication connection can be either a DC or AC electrical connection, by a two wires, with arbitrary polarity.

3.2 DC Meter Interface with asynchronous transmission

The meter can be connected to a transmission unit which supplies a DC-Voltage V_{sup} to the meter.

The supplied DC voltage has the following requirements:

V_{sup} :	min.:	4.75 V_{DC}	
	nom.:	5.6 V_{DC}	
	max.:	6.5 V_{DC}	
	max.:	13.5 V_{DC}	(Absolute maximum for ATEX approved Gas meter applications)

When the supply voltage is applied, a current flows with the following properties:

I_{idle}:	min.:	0.5 mA	
	nom.:	2.5 mA	
	max.:	20 mA	(current limited in by transmission unit for ATEX approved Gas meter applications)
	max.:	30 mA	(Power on peak current)

The current I_{idle} is defined as the current into a meter waiting for a command from the communication link. It's minimum and nominal value are subject to individual meter specification.

The meter sends data to the transmission unit by switching the current between I_{Mark} and I_{Space} .

ΔI_{Mark}: <=: I_{idle} and
ΔI_{Mark}: <=: 4 mA

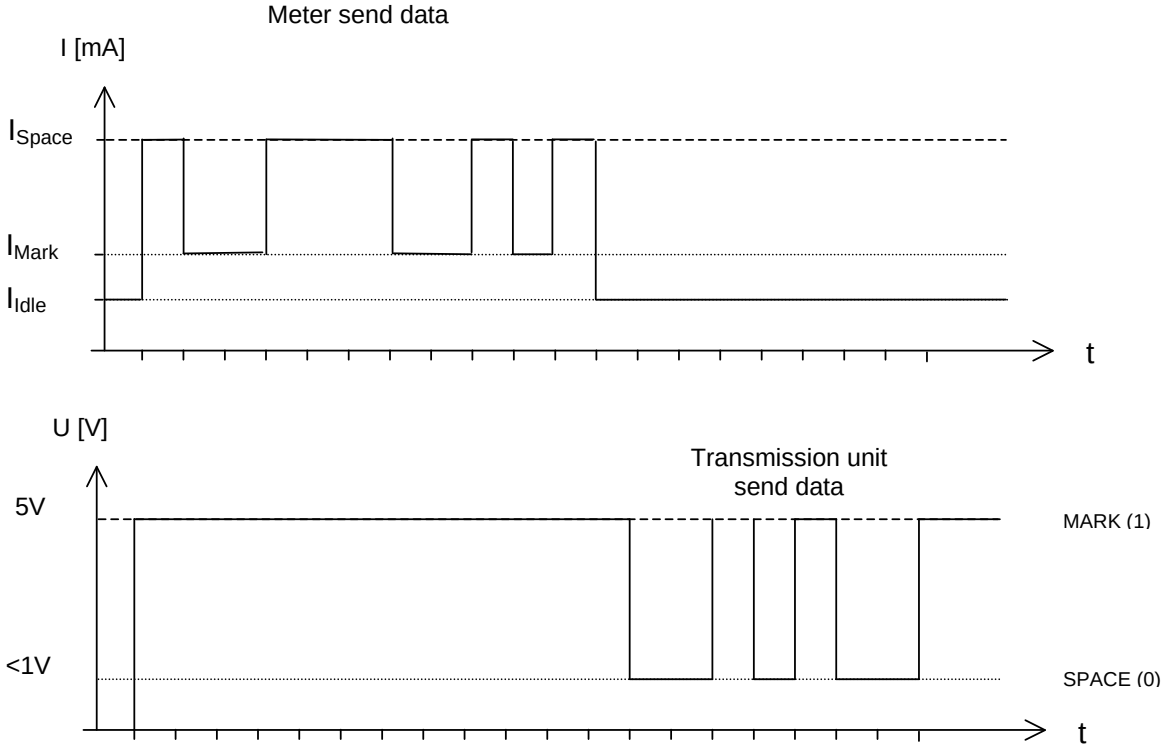
The current ΔI_{Mark} is defined as the maximum permitted increase of the current into the meter while some internal action is performed (such as sensor reading, memory reading an writing, supply recovery after bit transmission).

ΔI_{Space}: >=: I_{Mark} and
ΔI_{Space}: >=: 4 mA

The current ΔI_{Space} is defined as the minimum increase of the current into the meter for a „Space" bit transmission form the meter.

The transmission unit signals SPACE state by decreasing the supplied voltage to less than 1V.

V_{Space}: max.: 1 V
min.: 0 V



3.3 DC Meter Interface with synchronous transmission

A transmission unit which supplies power according to 3.2 and which starts clocking the power not later that 100 mS after power on establishes a synchronous link according to 5.

3.4 AC Meter Interface

The meter can be wired to a AC transmission device, which supplies the meter with AC with a nominal frequency of 10 kHz. The AC supply must have a inner resistance high enough to detect the voltage modulation when the meter modifies its internal resistance to send data.

The supplied AC voltage has the following requirements:

$V_{\text{no load}}$:	min.:	5.70	V_{RMS}
	nom.:	8.4	V_{RMS}
	max.:	11.40	V_{RMS}
$V_{\text{load 2k}\Omega}$:	min.:	5.0	V_{RMS}
	nom.:	7.5	V_{RMS}
	max.:	8.60	V_{RMS}

Data transmission to and from the meter is done by modulation of the AC voltage. The meter signals SPACE state by decreasing its resistance by switching 470Ω or less in parallel to its connections.

3.5 Asynchronous Bit transmission

Bit 0 is transmitted by signaling SPACE state for period determined by the transmission baud rate. The latter may be 300, 1200 or 2400 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.

3.6 Asynchronous Character transmission

Character transmission is with 7 bits, 1 or 2 stopbits, even parity. For transmission to the meter, 2 stopbits are recommended. (For Firmware V4 or lower, 2 stopbit or interbyte gaps are required).

4 Data Link

4.1 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.

4.2 Reading the meter

To read the meter, the transmission unit starts communication with a Sign on either

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

To a Sign on a), b), or c), the meter replies with a Data Readout according to 6 or 7, a Sign on d) starts the Synchronous Link mode (see 5, 8)

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
3) Sign up type b) and Application protocol with OBIS 2005can be used from Firmware Release V5.1 and later only.

5 Synchronous Link

5.1 General

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, available with Firmware V5.1 and later. The transmission unit does so by switching the supplied DC voltage with a nominal frequency of 2 kHz and listening to an echo when the DC voltage is off.

5.2 Power Clock

To activate the synchronous links, transmission unit starts clocking the power at nominal 100mS after Power on, with a nominal frequency of 2 kHz and a duty cycle > 50%.

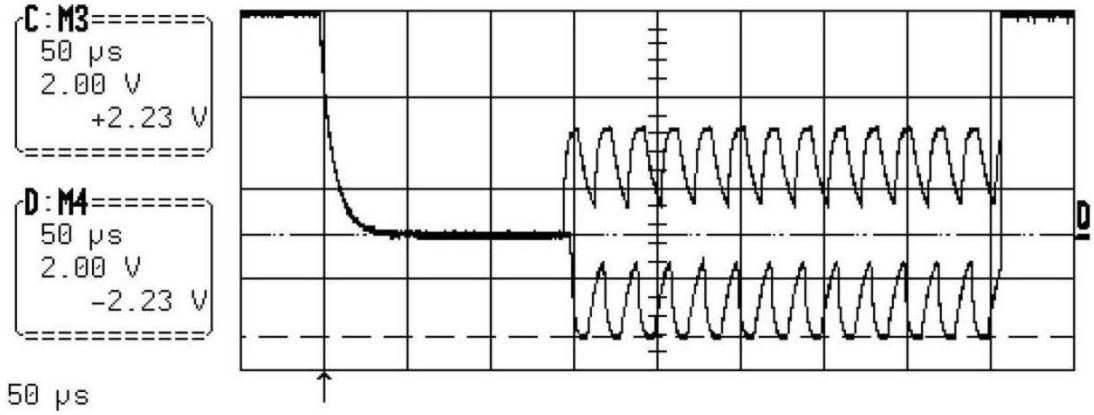
5.3 Echo Specification

As soon as the required data is available, the meter starts sending bits by sending a AC Burst echo during the power off clock of cycles to signal a Space state.
Transmission is 7 bits, 1 stopbit, even parity.
Maximum Load for the Burst is 22k, 330 pF

5.4 Synchronous Link Interface Specification

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

5.5 Burst Example



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

6 Application protocol EDIS 1995

This protocol is according to IEC 1107 Mode A

6.1 Protocol Structure

A Data Readout set is as follows:

/Manuf_Id Medium Version<CR><LF>
8.0(Reading*m3)<CR><LF>
0.09(ManufDate)<CR><LF>
0.00(SerialNumber)<CR>LF>
0.01(NominaSize)<CR><LF>
!<CR><LF>

6.2 Protocol Elements

The Manuf_Id is a three Uppercase letter ID according to www.dlms.com/flag/
The Medium String is a clear text with uppercase or upper and lowercase characters describing the Medium. If it contains “Wasser” or “Water”, the Medium is Water, if it contains “Gas”, the Medium is Gas, if it contains “Heiss” or “Hot”, the Medium is Hot Water (overrides detection of water).
The first line ends with ‘V’, a fist digit, a dot, a second digit and <CR><LF>.
If the Version information contains a dot and a character from ‘A’ .. ‘Z’ or ‘a’ .. ‘z’, the Application protocol is not according to EDIS 1995, see 7.
The first line has max 23 characters

The second line starts with the designator for Water, 8.0. Some Gas meters have a designator of 7.0, some Hot Water meters have a designator of 9.0.
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 (Rollererror) or ‘?’ in place of all digits (Registererror)
The second line has max. 23 characters

The third line contains the Date of Manufacturing or calibration, format dd-mm-yy . The third line has max. 16 characters.

The forth line contains the Serial Number. Most models limit the Serial Number to a string which contains only up to 8 digits. In that case, the forth line has max. 16 characters

The fifth line contains the meter size. This is a String which may start and end with non digit characters, but it always contains a numeric part, eventually with decimal separator ‘.’ or ‘,’ indicating the meter size. The fifth line has max. 15 characters.

The total protocol length is max. 96 characters. 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.

7 Application protocol with OBIS 2005designators

This protocol is according to IEC 62056-21 Mode A, with our without BCC

7.1 Example

/ELS Gas V5.0.A<CR><LF>
<STX>7-1:1.0(12345,67*m3)<CR><LF>
0.0.1(1234567890abcdefghij)<CR><LF>
0.0.0(G2,5)<CR><LF>
96.2.1(19-03-05)<CR><LF>
!<CR><LF>
<ETX><BCC>

7.2 Lines description

7.2.1 Header Line

The Header Line contains the three uppercase letter Manufacturer ID according to www.dlms.com/flag/, a clear text Medium description and Hardware and Protocol Version information.
Existing medium Strings are Gas, Wasser, Water, Heisswasser, Hotwater, some medium Strings may contain space character.
Version Information starts with the character V, followed by a single digit (major hardware version), followed by a dot (.), followed by a single digit (minor hardware version), followed by a dot (.), followed by a single character for the protocol version. We recommend to scan the version information by reading backwards until ‘V’ from the end of the line and then reading forward.
There is one Space character between the Manufacturer ID and the Medium description and at least one space character between the Medium and the Version information.
Maximum length of the header line including <CR><LF> is 26 characters.

7.2.2 Reading Line

The Reading Line starts with a OBIS Code, followed by the reading and units in brackets. The first digit of the OBIS Code stands for the media and might be 8 (for water), 7 (for Gas) or 9 (for Hot Water).
The last digit of the OBIS Code for Gas can be 0 (for volume at measuring conditions) or 2 (for volume at base conditions).
The reading is a String with up to 10 digits and a 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)
The reading is followed by a unit designator, which may be *m3, *ft3, *cuft, *usg
Maximum length of the reading line including <CR><LF> is 24 characters.

7.2.3 Number Line

The Number Line contains a meter number of up to 20 characters.
Maximum length of the number line including <CR><LF> is 29 characters.

7.2.4 Metertype Line

The Metertype Line with OBIS Code 0.0.0 contains a String which contains a number indicative of the meter size, eventually with ‘,’ or ‘.’ as decimal separator.
Maximum length of the metertype line including <CR><LF> is 18 characters.

7.2.5 Date Line

The Date Line contains a date formatted as dd-mm-yy. You cannot assume that the date really exists (e.g. Feb. 31 could be possible)
Maximum length of the date line including <CR><LF> is 18 characters.

7.2.6 Block Check Character

The Protocol may be with or without BCC (Block check character). In case where no BCC is used, there is no <STX> and no <ETX>

7.3 General Rules

The order of the lines is not guaranteed.
Maximum length of the whole Protocol is 121 characters
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.

8 Short protocol for Synchronous Link

The short protocol 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.

The short protocol reading is:

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

with

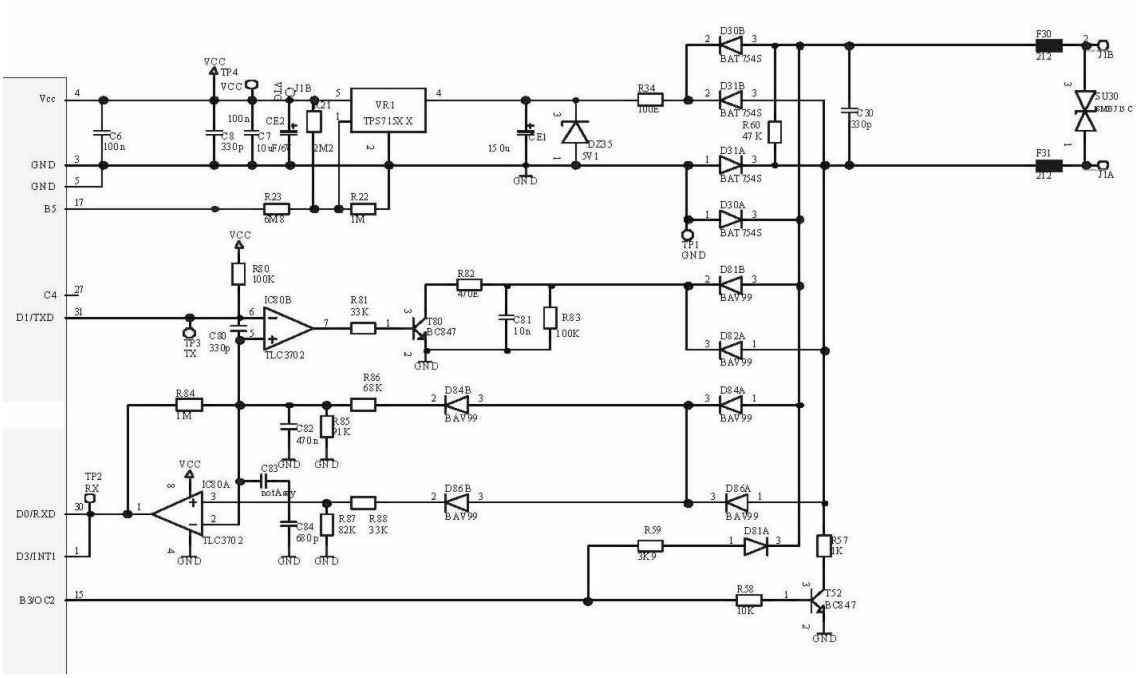
A:	Protocol Type. Currently, only A is used, other characters are reserves for future use.
Reading:	String with up to 10 digits and a eventual decimal separator ‘.’ or ‘,’. Internal errors are indicated in the reading by a character ‘?’ in place of a digit (Roller error) or in place of all digits (Register error)
Units:	A unit designator, which may be *m3, *ft3, *cuft, *usg

BCC: Block check character

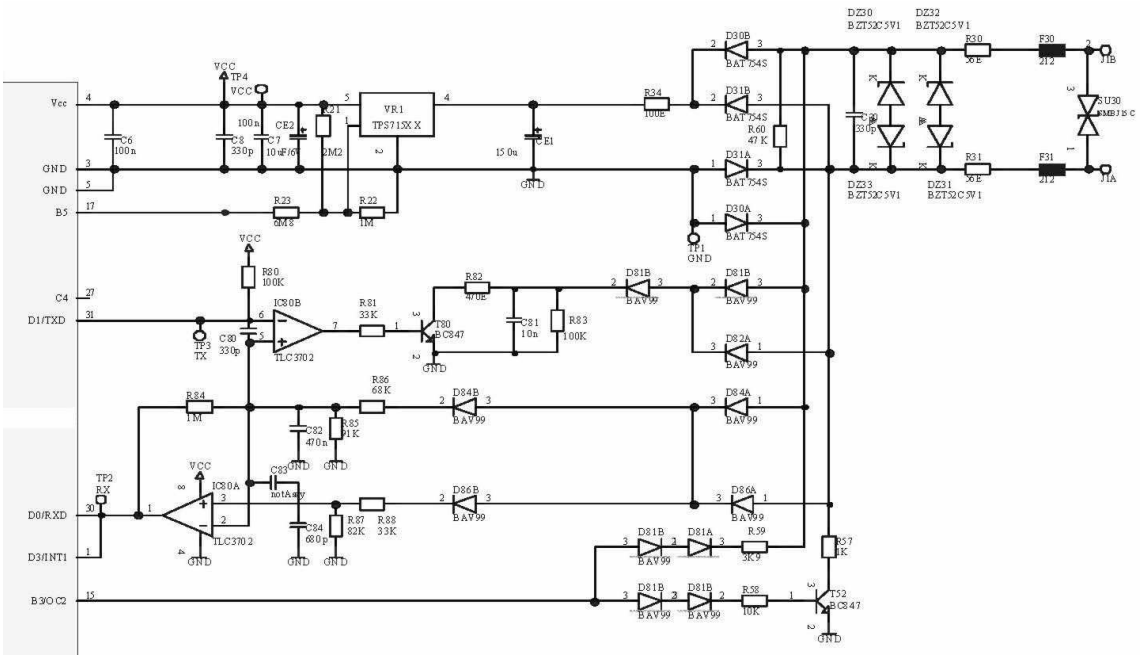
The short protocol is repeated typically four times, the idea is that the transmission units switches power off when she could interpret one reading.

Note: The information in this paragraph is preliminary.

9 Appendix A: Sample Meter Interface Section

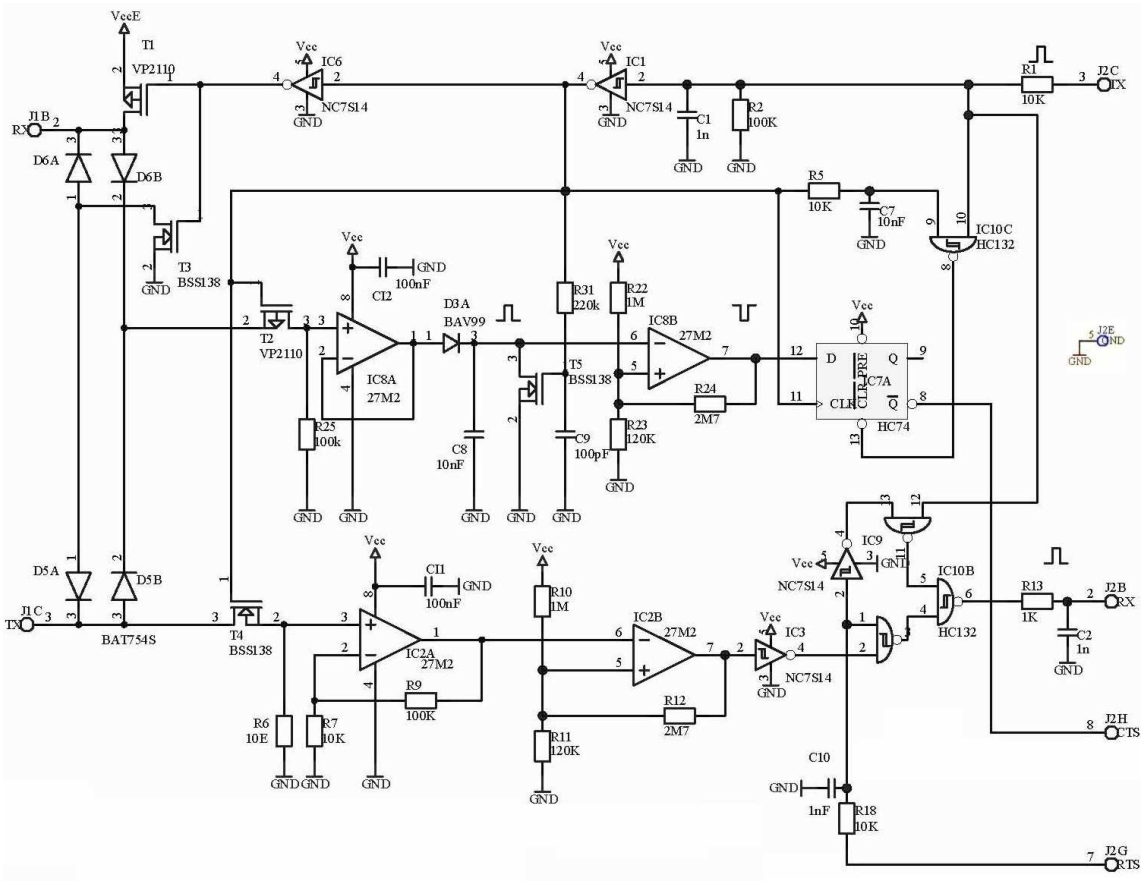


Sample Meter Interface for SCR +



Sample Meter Interface for SCR + for ATEX approval

10 Appendix B: Sample Meter to RS232 Interface



This example shows how a meter can be connected to a RS232 interface. To read the Standard SCR Protocol, the transmission unit with the RS232 simply switches RTS to high and Power on (not shown).
To read the synchronous protocol, the transmission unit clocks its data output e.g. by sending ‘p’ with a baudrate of e.g. 19200 baud and checks its CTS input for incoming bits.