SDG Technologies

WL232

A Wireless Radio Link for Remote RS232 Communication

<u>Contents</u>

1: Introduction

The SDG WL232 RS232 radio forms part of the SDG Technologies range of power metering, control and communication products, but it can be used as a sub-component in any application where a wireless RS232 link is required.

The unit is typically set up in a star network configuration as single radio-master with multiple radio-slaves, provided that the connected RS232 devices supports a master/slave protocol. The units are set up as radio 'master' or 'slave' with a single internal switch.

Cabling a whole building can be prohibitively expensive. For this reason modems were used in the past for meters or control devices placed remotely from the main modem. This causes extra monthly communication costs and reduces the reliability of the communication link between the AMR server and the remote meters or control devices.

For these applications, the WL232 RS232 radio was developed. It creates wireless RS232 links from the main modem to remote meters or control devices, saving wiring cost and reducing installation cost greatly.

The WL232 may be used as a generic RS232 link.

The WL232 works on a wireless frequency of 433MHz, which enables it to penetrate walls and floors. It has been tested in multi-storey buildings and providing reliable communications from the basement up to several storeys high. If a single link cannot provide the necessary range, links may be put in series.

2: Overview

RS232 Wireless Radio Link for the Elster A1140, AS230 and BMSRTU

- **Interconnect communication devices, meters and building management system remote terminal units (BMSRTUs) within the same building quickly with no wiring.**
- **Installation time drastically reduced.**
- **Single master, multiple slave configuration.**

- **433MHz free radio band travels big distances horizontally, or vertically through a multi-storey building.**
- **No external power supply needed - Gets its power from the Elster meter or BMSRTU.**
- **Unit is set up as master or slave with a single switch.**

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3: Specifications

Electrical and Radio

Antenna connector ....Standard Female 50Ω SMA Connector
RJ-12 connectors .... 2x in the usual Elster RS232 daisy-chain configuration, see diagram
The radio module used is a SIM20-433 from SIMCom. ... Please contact SDG for the complete data sheet

Serial interface

The units are factory programmed with a BAUD rate of 9600 and Frame 8N1. This is the communication parameters used as standard between die PNPScada AMR server and the meters and BMSRTUs.
(Elster meters use 9600 7E1, but the parity is taken care of by the server and all intermediate communications equipment set up for 9600 8N1)
Protocol... Transparent to all RS232 Protocol
Data Rates:..9600bps
Characters: .... 8 data bits
Parity .... none
Stop Bits 1

RS232 output

The unit utilises Special RS232 output compatible with any RS232 device, but modified so that it can be multidropped with Elster Electrical meters and BMSRTUs with a simple RJ12 splitter.

Two RJ12 connectors are provided, which are internally connected, so that the Elster daisy-chain may be continued without an extra RJ12 splitter.

Maximum number of (Special) RS232 devices per WL232 10
(Up to 100 special RS232 devices may be multidropped in the same room using the SDG EBUF driver)

Indicators

Power (green).. Power connected to the WL232 via meter or BMSRTU RJ12 plug
Rx (red) ....Receiving data on RS232
Tx (red)..Transmitting data on RS232

Programming

A single dip switch programs the WL232 as follows:

DIP switch position	WL function
Modem	**Single Modem/Etherpad-side WL232, radio master but RS232 slave**
Remote	**Multiple Meter/BMSRTU-side WL232, radio slave but RS232 master**

Power supply

Voltage input..6-16VDC
Consumption .... <100mA
Normally power is supplied by the RJ12 communication jack of the meter or BMSRTU, but power may be supplied via a special RJ12 to DB9 and power cable, in which case any 5-12V power supply may be used to power the WL232.

Physical Characteristics

Designed to enable mounting inside the BMSRTU chassis or underneath an A1140 meter cover

Size excluding the antenna and RJ12 connectors...72mmx50mmx25mm

4: Pin-out of RS232 Connectors

Two RJ12 connectors are provided. These are connected internally pin-for-pin and the two are identical. The reason for providing two RS12s is to eliminate the need for an extra RJ12 splitter. This enables the WL232 to fit underneath the cover of a A1140 meter. A short simple 1 to 1 flat cable would be used in this case between the WL232 and the A1140 and the remote comms flat cable would then be plugged into the 2nd port of the WL232 instead of directly into the A1140. In the case where no Elster or BMSRTU is available to power the WL232, a special cable can be supplied with RJ12 on the one side and DB9 on the other side, and a red and black wire fly-lead for power. (5v USB connector can be used from Laptop above 10degC.)

An adapter cable (W3) is available for connecting to a standard female 9pin connector.
Cables for connection to other meters are also available.
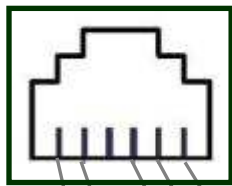
Pin no	BMSRTU
1	Rx, connected to pin 3
2	Tx, transmit data
3	Rx, receive data
4	NC (Not connected)
5	0V
6	6-16VDC

5: Application

Generally in a building, the communications device will be connected to a meter, via hardwired RS232. Elster meters can multidrop their RS232 communications. Multiple meters may be daisy-chained together using a simple RJ12 splitter.

However, often remote meters or control devices are too far from the communications device to be hardwired directly. One or more of the wires are therfore 'replaced by' a radio-link.
On the Modem/ Etherpad side the WL232 is configured as the Master (comms-side). The internal dip switch of this unit is switched to the "Modem" position, and there must be only one per building. This single WL232 is the radio master, although it is one of the RS232 daisy-chain 'slaves' listening to the RS232 daisy-chain master.

To install the WL232, simply take out the RJ12 cable from the Elster meter and plug it into one of the two RJ12 connectors of the WL232. Now connect the WL232 via the supplied cable to the Elster meter. The WL232 can now be covered by the Elster A1140 cover.

A flat 2dbi antenna is provided with each WL232.The antenna must be positioned in such a way that it is not obscured by any metal. The flat side of the antenna of the Remote WL232 must be pointed in the general direction of the Master WL232. One of the flat sides of the Master WL232 must be pointed in the general direction of the Remote WL232s.

If the modem or etherpad is not connected to an A1140, AS230 or BMSRTU, a special cable (W2 cable) and power supply is needed to power the WL232. The exception is if an epad1 or epad3 is used with factory option of providing power on the serial port. This must be specified when placing an order for the latter.

Any number of remote WL232s may now be connected to the Elster meters or BMSRTUs located in the same building, by plugging in the WL232 into the Elster meter daizy-chain, or directly into the communications port of the BMSRTU. The number of meters is limited by the time required for each meter to read in, as only one can read in to the modem at a time. For example, 130 meters will take 6h to read in on one modem daily.

Any number of sub networks can be created in a building if interference from privies installations accrues.

A bigger antenna can be installed at the Master WL232 side to accommodate multidirectional connections.

Local ("Modem") WL232
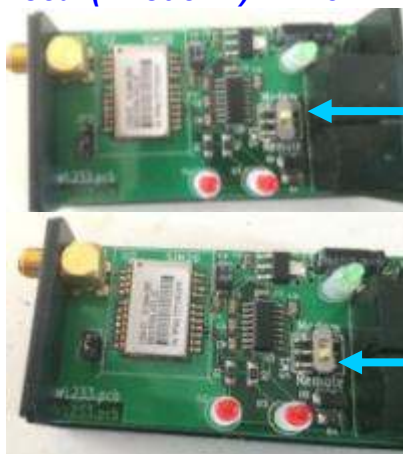
Switch the DIP switch to "Modem" for only one of the WL232s in the building - the one that is in the same daizy-chain as the modem or etherpad

Switch DIP switch to "Remote" for the rest of the System.

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6: Network Planning

The WL232 can be used in Multiple Network configurations.

a) First is the typical P2P or **Point to Point configuration** with one Master and one Slave device.
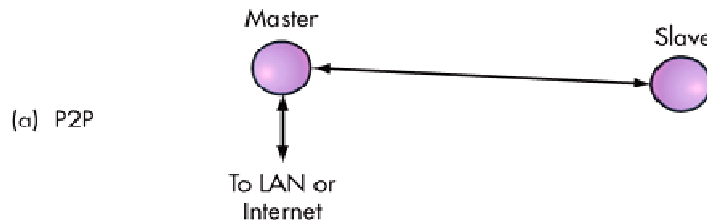
This is the most commonly used connection where a distribution box is remotely connected to one common Internet connection. (Modem or Etherpad)

b) Secondly is the **Star configuration** with one Master and multiple Slave devices.
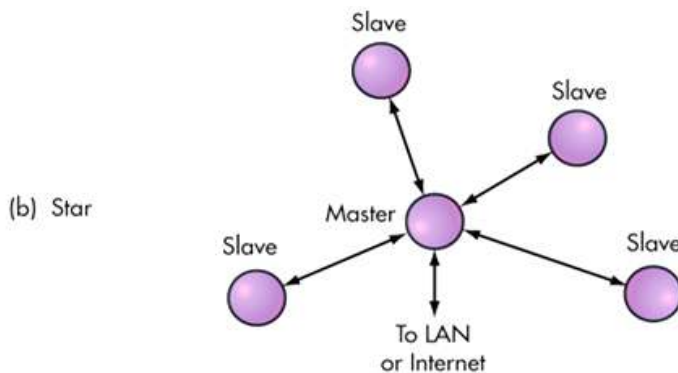
This configuration is commonly used where multiple distribution boxes are remotely connected to one common Internet connection. (Modem or Etherpad)

c) The same configuration can be used more than once in an installation by changing the NETIDs of the WL232s in the second network.

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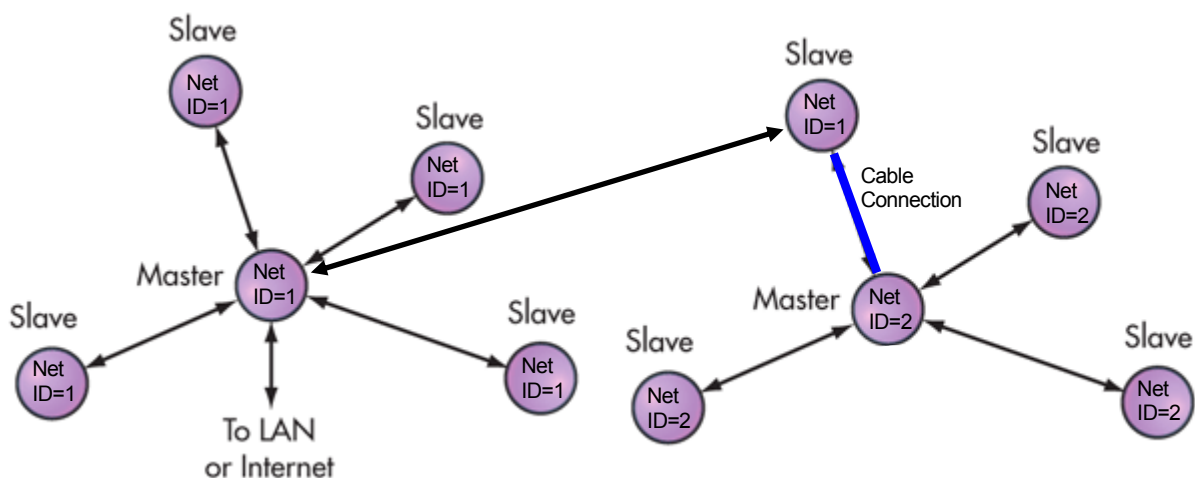
Sub Network Allocation.

1: Choosing an AIR Data Rate 0-7

The AIR Data Rate is the speed that the WL232 communicates at, with other WL232s
There is correlation between the AIR Data Rate and the RF Channels that are available.
If the default Baud rate setting of 9600 is used, there is the maximum of 4 RF Channels available.
The AIR Data Rate of 9600 was chosen because this is the default communications rate of most meters
and a faster speed is not required.

2: Choosing a RF Channel (RF CH) 0-3

The RF Channel is a frequency channel spaced within the Spatial Frequency of 433MHz– 434.79MHz
It is separate kHz blocks of bandwidth allocated within the total bandwidth of the frequency.
The default Spatial Frequency is set to1

The Graph shows a very simple example of this.


433MHz– 434.79MHz
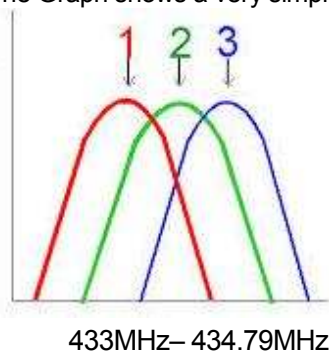
This can be used to separate 3 or 4 networks from each other by using different RF Channels, as per the example.
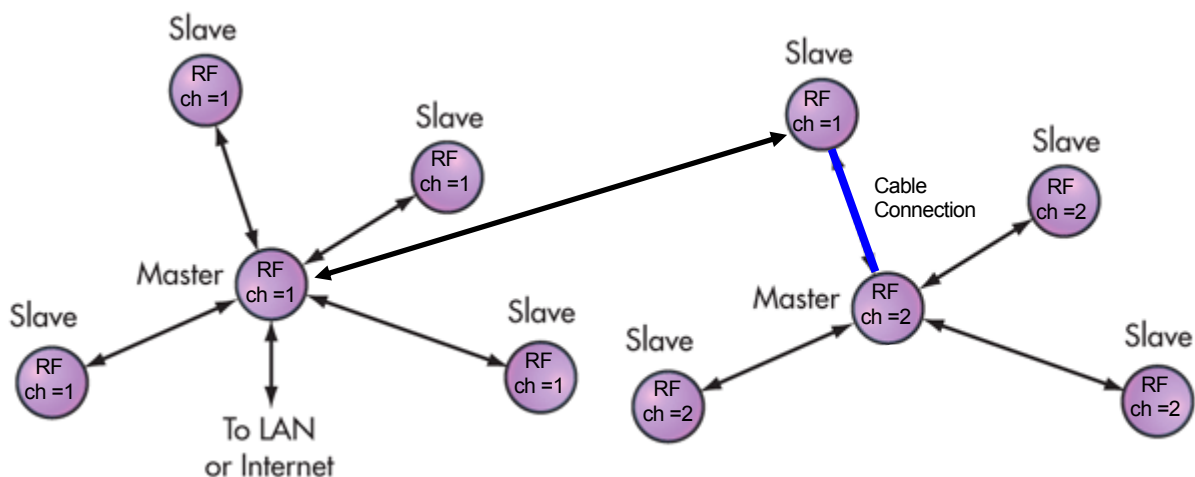
3: Choosing a Net ID or NETWORK ID (0-254)

The Net ID is a digital network allocation, splitting a RF Channel into 255 possible sub networks.
The default Net ID is set to 1 to make initial setup more convenient.
Digital sub netting opens the possibility of creating 1020 separate networks within the small frequency spacing of 1MHz.

This is the preferred method of separating the networks in order to extend the range of the WL232.
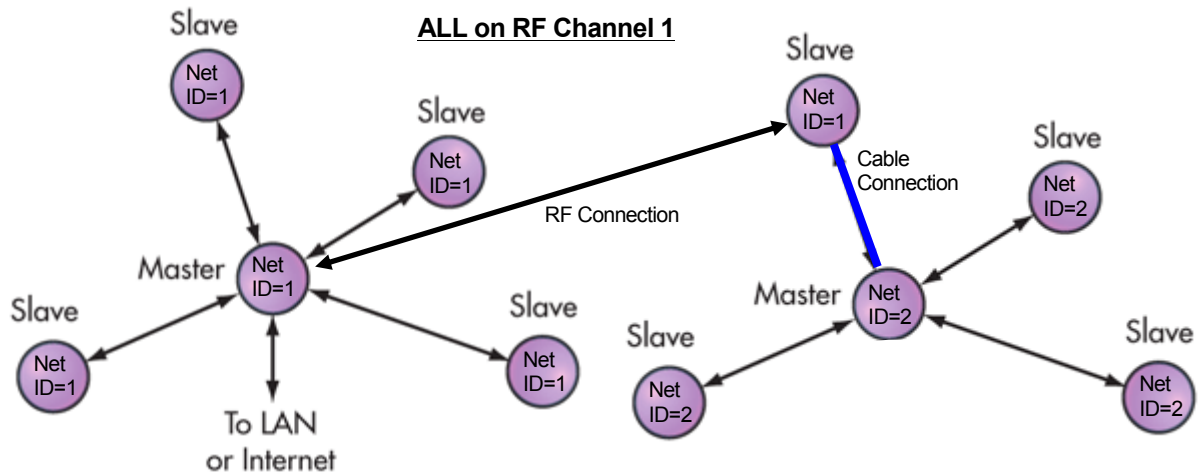
4: The SID or LOCAL ID of the WL232 (0-254)

The SID of the WL232 is its unique identifier in the digital RF network.
The default setting of the SID is as close to the last three numbers of the Radio Serial Number as possible.
If the radio S/No ends with 725 the SID will be 25 and if the S/No ends with 122 the SID will be 122.
The SID can be used to address the WL232 directly within a network without sending the data to all.

This is possible when using the DID or Destination ID.

5: The DID or Destination ID of the WL232 (0-254)

The DID of the WL232 is an identifier that can be set to communicate to a single WL232 directly.
The default setting is 255 as this allows all the WL232s in the digital sub network to receive the communication

As in the example of the SID, if the SID of the remote WL232 (which is the destination WL232) is set to 122 and the local WL232's DID is set to 122, the local WL232 will only communicate to that specific WL232 with the SID of 122.

7: Programming

Conventions and abbreviations

In the AT Command set for the WL232 modules, the Conventions and abbreviations are:

In this document, the WL232 modules are referred to as following term:
1) ME (Mobile Equipment);
2) MS (Mobile Station);
3) TA (Terminal Adapter);
4) DCE (Data Communication Equipment) or facsimile DCE (FAX modem, FAX board);
5) TE (Terminal Equipment);
6) DTE (Data Terminal Equipment) or plainly "the application" which is running on an embedded system;

Data Mode and Command Mode

WL232 has two modes: Data mode and Command mode, which can be switched via inserting the Jumper (JP3) and switching SW1 on Modem

The default status of WL232 is in data mode after Power On.
Therfore, when the Jumper is NOT inserted the WL232 will work in data mode.
When the Jumper IS inserted the WL232 will switch to command mode.

Under data mode WL232 will carry out transparent data transfer, i.e. send out the data directly that is inputted to the RS232 port;
but under command mode, the WL232 will respond to AT commands.

Note: In command mode, the command line must be terminated by entering <CR> or (Enter) Do not add <LF>

AT Command syntax

The "AT" or "at" prefix must be set at the beginning of each Command line.

To terminate a Command line use Enter <CR>.

Commands are usually followed by a response.

All these AT commands can operate in several modes, as indicated in the following table:

Test Command	AT+<x>=?	The WL232 module returns the list of parameters and value ranges set with the corresponding Write Command or by internal processes.
Read Command	AT+<x>?	This command returns the currently set value of the Parameter or parameters.
Write Command	AT+<x>=<...>	This command sets the user-definable parameter Values.

AT Commands for the WL232

Description

Command	Description
AT+SRDFIRM	GET WL232 FIRMWARE INFORMATION
AT+SRDSN	GET WL232 SERIAL NUMBER
AT+SRDCHA	GET/SET WL232 RF CHANNEL = 1
AT+SRDDATAR	GET/SET WL232 AIR INTERFACE DATA RATE = 2 (9200)
AT+SRDCID	GET/SET WL232 NETWORK ID = 1 (0-254)
AT+SRDSID	GET/SET LOCAL WL232 ID = SN (0-254)
AT+SRDDID	GET/SET DESTINATION WL232 ID = 255 ALL (0-254 Direct)
AT+SRDFORWARD	ENABLE/DISABLE FORWARD
AT+SRDPARAM	GET/SET WL232 PARAMETERS
AT+SRDSLEEP	GET/SET WL232 SLEEP TIME IN POWER SAVE MODE
AT+SRDEPS	GET/SET WL232 POWER SAVE MODE
AT+ SRDCONREMOTE	ENABLE/DISABLE CONFIGURE REMOTE WL232
AT+SRDRESET	RESET WL232
AT+SRDSEND	SEND DATA TO DEDICATED TARGET

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Detailed Descriptions of Commands

AT+SRDFIRM   Get WL232 Firmware Information

AT+SRDFIRM Get WL232 Firmware Information	
Read command **AT+SRDFIRM?**	Response **(Firm Information)** **OK**
	Parameter
Reference	Note ● Support remote read

AT+SRDSN   Get WL232 SN

AT+ SRDSN Get/Set WL232 SN	
Read command **AT+SRDSN?**	Response **<sn>** **OK**
Reference	Note ● Support remote read

AT+SRDCHA   Get/Set WL232 RF Channel

AT+ SRDCHA Get/Set WL232 RF Channel	
Test command **AT+SRDCHA=?**	Response **+SRDCHA: (list of supported <channel>s)** **OK**
	Parameter see Write command
Write command **AT+SRDCHA=** **<channel>**	Response **OK** **ERROR**
	Parameter **<channel>** An integer parameter to indicate WL232 RF channel, the default value is 1.
Read command **AT+SRDCHA?**	Response **+SRDCHA:<channel>** **OK**
	Parameter see Write command
Reference	Note ● The total RF channel numbers is determined by to data rate and RF band ● WL232 modules should communicate with the same RF channel. Support power off save ● Support remote read/write

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Set RF channel number

The RF channel numbers, start frequency and frequency step size are different according to the frequency band and data rate. The number of available frequencies depends on the data rate (for higher data rates, the required bandwidth is higher; thus, less frequency channel can be allocated).

The actual center frequency is defined by three parameters: the start frequency, the frequency step, and the frequency ID. These parameters are different for different data rates and frequency bands. The actual frequency is calculated as follows:

center_frequency = start_frequency +   (Fx * frequency_step)

Where Fx is the frequency ID. The first channel is identified with Fx = 0 (e.g. if the maximum number of the channels is 14. The valid range for the frequency ID is 0 to13.

The detail frequency assignment for different frequency bands is as the tables below.

Table 2: Frequency Assignment for WL232-A 434 MHz module

DATAR	Data Rate [bps]	Start Frequency [MHz]	Frequency Step Size [kHz]	Number of Available Channels
0	2,400	433.33	330	4
1	4,800	433.33	330	4
2	9,600	433.33	330	4
3	10,000	433.33	330	4
4	20,000	433.53	390	3
5	50,000	433.61	360	2
6	100,000	433.91	0	1
7	128,000	433.91	0	1

AT+SRDDATAR   **Get/Set WL232 Air Interface Data Rate**

AT+SRDDATAR Get/Set WL232 Air Interface Date Rate	
Test command **AT+SRDDATAR=?**	Response **+SRDDATAR: (list of supported <rate>s)** **OK**
	Parameter see Write command
Write command **AT+SRDDATAR=** **<rate>**	Response **OK** **ERROR**

	Parameter
	<rate> Parameter to indicate WL232 air interface date rate.
	          0---2400 bps
	          1---4800 bps
	          2---9600 bps (default value)
	          3---10000 bps
	          4---20000 bps
	          5---50000 bps
	          6---100000 bps
	          7---128000 bps

Read command **AT+SRDDATAR?**	Response **+SRDDDATAR:<rate>** **OK**
	Parameter see Write command
Reference	Note ● WL232 modules should communicate with the same air interface data rate ● Support power off save ● Support remote read/write

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AT+SRDCID   Get/Set WL232 Network ID

AT+ SRDCID Get/Set WL232 Network ID	
Test command **AT+SRDCID=?**	Response **+SRDCID: (list of supported <cid>s)** **OK**
Write command **AT+SRDCID=<cid>**	Response **OK** **ERROR**
	Parameter **<cid >** An integer number 0-255 to identify a WL232 sub network. The default value is 1.
Read command **AT+SRDCID?**	Response **+SRDCID:<cid>** **OK**
	Parameter see Write command
Reference	Note ● WL232 modules should communicate with the same network ID ● Support power off save ● Support remote read/write

AT+SRDSID   Get/Set Local WL232 ID

AT+ SRDSID Get/Set Local WL232 ID	
Test command **AT+SRDSID=?**	Response **+SRDSID: (list of supported <sid>s)** **OK**
Write command **AT+SRDSID=<sid >**	Response **OK** **ERROR**

	Parameter
	<sid> An integer number 0-254 to identify a unique WL232 in
	          a
	          sub network. The default value is close
	          to the SN.

Read command **AT+SRDSID?**	Response **+SRDSID:<sid>** **OK**
	Parameter see Write command
Reference	Note ● Support power off save ● Support remote read/write

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AT+SRDDID   **Get/Set Destination WL232 ID**

AT+ SRDDID	Get/Set Destination WL232 ID
Test command **AT+SRDDID=?**	Response **+SRDDID: (list of supported <did>s)** **OK**
Write command **AT+SRDDID=<did>**	Response **OK** **ERROR**
	Parameter **<did>** An integer number 0-255 to identify the destination WL232,0-254 to identify a unique destination WL232, 255 is the broadcast address. The default value is 255.
Read command **AT+SRDDID?**	Response **+SRDDID:<did>** **OK**
	Parameter see Write command
Reference	Note ● Support power off save ● Support remote read/write

AT+SRDPARAM   **Get/Set WL232 Parameters**

AT+ SRDPARAM	Get/Set WL232 Parameters	
Write command **AT+SRDPARAM=** **<cha>,<cid>,<sid>,<** **did>,<datar>,<txpwr** **>,<forward>**	Response **OK** **ERROR**	
	Parameter **<cha>** RF channel **<cid>** Network ID **<sid>** Local WL232 ID **<did>** Destination WL232 ID **<datar>** WL232 air interface data rate	
Read Command **AT+SRDPARAM?**	Response **+SRDPARAM:** **<cha>,<cid>,<sid>,<did>,<datar>** **OK**	
Reference	Note ● Support power off save ● Support remote read/write	

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AT+SRDSLEEP **Get/Set WL232 Sleep Time In Power Save Mode**

AT+ SRDSLEEP Get/Set WL232 Sleep Time In Power Save Mode	
Test Command **AT+SRDSLEEP=?**	Response **+SRDSLEEP:(1-255, 0-2)** **OK**
	Parameter see Write command
Write Command **AT+SRDSLEEP=** **<time>,<unit>**	Response **OK** **ERROR**
	Parameter The default value is 3,0 **<time>** An integer number 1-255(Unit: according to <unit>) to set WL232 sleep time in power save mode **<unit>** An integer number 0-2 to identify the unit 0---represent second 1---represent minute 2---represent hour, with this unit the <time> value should not exceed 48.
Read Command **AT+SRDSLEEP?**	Response **+SRDSLEEP:<time>,<unit>** **OK**
	Parameter see Write command
Reference	Note • The set timer value will take effect at the 2nd cycle. • Support power off save • Support remote read/write

AT+SRDEPS   **Get/Set WL232 Power Save Mode**

AT+ SRDEPS Get/Set WL232 Power Save Mode	
Test command **AT+SRDEPS=?**	Response **+SRDEPS: (list of supported <mode>s)** **OK**
	Parameter see Write command
Write command **AT+SRDEPS=** **<mode>**	Response **OK** **ERROR**

	Parameter
	<mode> 0---normal (default value)
	           1---enable power save, wake up by UART
	           2---enable power save, wake up by timer
	           3---enable power save, wake up by timer or UART
	           5---enable power save, wake up by UART and send self
	               SID when wake up
	           6---enable power save, wake up by timer and send self
	               SID when wake up
	           7---enable power save, wake up by timer or UART, and
	               send self SID when wake up

Read command **AT+SRDEPS?**	Response **+SRDEPS:<mdoe>** **OK**
	Parameter see Write command
Reference	Note • The timer is set by AT+SRDSLEEP command • After enable power save mode and no UART & RF data need to deal with, WL232 module will enter power save mode in about • 2100 millisecond and output <NUL> via UART port at the same time • When WL232 wake up will output "MCU WakeUp" via UART port • After enable EPS=1/3/5/7, to input any ASCII character will wake up the WL232 module via UART port • Support power off save • Support remote read/write

AT+SRDCONREMOTE   Enable/Disable Configure Remote WL232

AT+ SRDCONREMOTE Enable/Disable Configure Remote WL232	
Write command **AT+SRDCONREM** **OTE=<param>**	Response **OK** **ERROR**
	Parameter **<param>** 0---disable configure remote WL232(default value) 1---enable configure remote WL232
Read Command **AT+** **SRDCONREMOTE?**	Response **+ SRDCONREMOTE: <param>** **OK**
	Parameter see Write command
Reference	Note

Configure Remote WL232

After you have enabled the Configure Remote function, the AT command that supports the remote read/write will execute at the remote WL232 side, and it will feedback the response information to the local WL232 side.

For the remote reading command, the response information may be as below:
a)   Incorrect AT command or parameters is wrong
      ERROR
b)   The AT command execute successfully at the local WL232 side but fail at remote side.
      OK RM(SID):Fail
c)   The AT command execute successfully at the local and remote WL232 side.
      OK
      RM(SID):result

For the remote write command, the response information may be as below:
a)   Incorrect AT command or parameters is wrong
      ERROR
 b)   The AT command execute successfully at the local WL232 side but fail at remote side.
      OK RM(SID):Fail
 c)   The AT command execute successfully at the local and remote WL232 side.
      OK
      RM(SID):Success

Note:
1) **AT+SRDCONREMOTE/AT+SRDCONF and all test command (AT+<x>=?) execute at the local side, whether Configure Remote function is enabled or disabled.**
2) **If Configure Remote function is enabled, AT+SRDSEND/AT+SRDUART command will return "Not support remote configure".**
3) **Local WL232 identify remote WL232 by its SID in a sub network, the remote WL232 could be in either command mode or data mode.**

Remote AT commands supported for read or write

Commands	Support remote read	Support remote write
AT+SRDFIRM	Yes	No
AT+SRDSN	Yes	No
AT+SRDRSSI	Yes	No
AT+SRDCHA	Yes	Yes
AT+SRDDATAR	Yes	Yes
AT+SRDCID	Yes	Yes
AT+SRDSID	Yes	Yes
AT+SRDDID	Yes	Yes
AT+SRDFORWARD	Yes	Yes
AT+SRDPARAM	Yes	Yes
AT+SRDSLEEP	Yes	Yes
AT+SRDEPS	Yes	Yes
AT+SRDRESET	No	Yes

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8: Quick Setup

1: Set the WL232 to Command Mode

WL232 has two modes: Data mode and Command mode,
Insert Jumper (JP3) <u>and</u> Switch (SW1) to Modem.

2: Connect the WL232 with a W1 Cable to program.

3: We use the software obtainable form the following link as a Terminal emulator.

 https://sites.google.com/site/terminalbpp/Terminal20140110.zip?attredirects=0

   This software is convenient to set up some Macros.

4: Open Set Macros and select Load Macro Settings (WL232_Programming.tmf). This file is available from wiki.pnpscada.com or with the programming cable and software supplied by SDG Technologies.

5: Change to the correct Communication port 8N1 and Connect

6: Send the (SN) Command to receive the Module Serial Number. SN

7: Set the RF Channel Number to 1 (CH=1). CH=0

8: Set the NetID or Network ID to 1 as Default.(0-254)

9: Set the SID (Station ID) or Multidrop to the Last two or three characters of the Module SN (0 - 255).

11: Set the DID or Destination ID to 255 as Default. (DID=255)

12: Remove Jumper (JP3) for normal operation.

NOTE:

Use NetID? to check the NetID setting

Use SID?   to check the SID setting

Use DID?   to check the DID setting

To reset to factory settings Use RESET. This is not the preset settings as sent to the client from SDG.

9: ICASA Approval

ICASA

Independent Communications Authority of South Africa
Pinmill Farm, 164 Katherine Street, Sandton
Private Bag X10002, Sandton, 2146

Radio Equipment Type Approval Certificate

Radio Equipment Type Approval Number

TA-2014/195

The Authority, in the exercise of the power conferred upon it by section 35 (1) of the Electronic Communications Act, 2005 (Act No. 36 of 2005), the applicable radio regulations which currently remain in force in terms of section 95 (2) of the Electronic Communication Act and subject to the terms and conditions set out in this document (see overleaf), hereby issues a radio type approval certificate to the company whose name and particulars are listed below.

Company Particulars

Name	:	SDG Technologies CC
Street Address	:	14 Partridge Avenue, Kempton Park
Telephone Number	:	010 003 1015
Facsimile Number	:	086 606 5312
Registration Number	:	1994/014035/23

Description of Apparatus

Category	:	RS232 Wireless Radio Link
Model	:	WL232
Frequency Range	:	433.05 – 434.79 MHz
ITU Emission Code	:	50K0F1D
Modulation	:	GFSK
Power Output	:	8.60 dBm
Channel Spacing	:	330 - 360 kHz
Features	:	

Only the original or a certified copy of the radio equipment type approval certificate shall be considered valid.

Philemon Molefe
Philemon Molefe
Senior Manager: Engineering & Technology

2014 -05- 1 9

Dr SS Mncube (Chairperson) NA Batyi, WH Currie, JM Leboea, MR Mohlaloga, N Ndhlovu, KGB Pillay, Dr MM Socikwa, WF Zwane, (Counsellors), PK Pengwana (CEO)

Plug and Play
SCADA