

Picture 1: Demo board XTR-8LR100

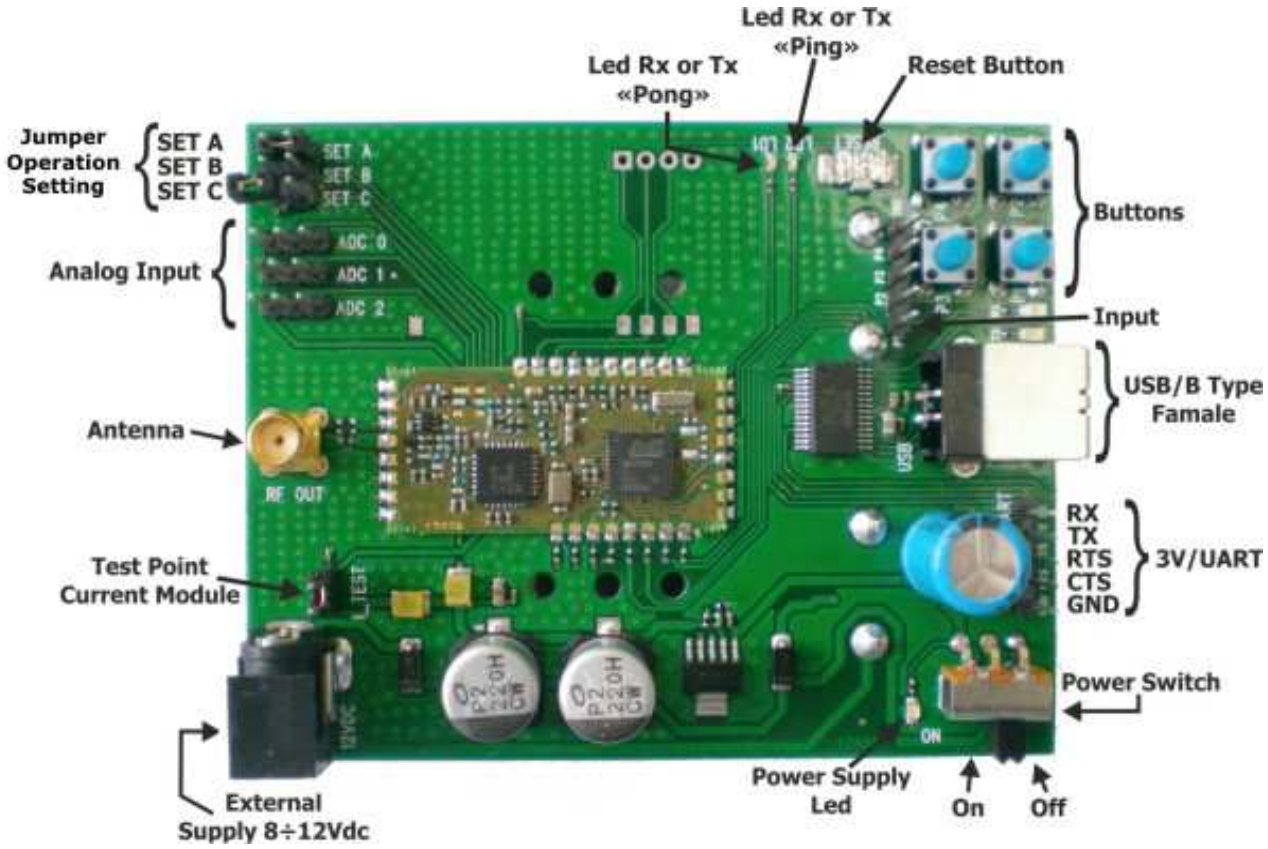


Picture 2: Demo board XTR-8LR10

DEMO-BOARD XTR-8LR100 (Picture 1) e DEMO-BOARD XTR-8LR10 (Picture 2) is an evaluation board of the transceiver module XTR-8LR100 and module XTR-8LR10 which can easily check functionality, power consumption, commands and performance of radio link. The difference between the two demo board is on the mounted module, XTR-8LR100 that have mode of operation, Normal, Rx ciclyc, Tx ADC value and XTR-8LR10 that is implemented the Normal mode operation.
For more detail about the operation mode refer to the user manual of the used module.
The device is able to work with external power supply or powered by four AA batteries, for tests in stand-alone. It is included a stylus antenna operating on the 868 MHz band connected to the SMA connector, thereby using the test mode through some diagnostic led, it is possible to realize radio links.
The DEMO-BOARD is equipped with a USB connector with COM port emulation realized with CI FTDI1235-C and an SMA input connector radio output for the RF connections measurement instruments.

The following table shows in detail the various elements included in the board, through commented image.

Le caratteristiche tecniche possono subire variazioni senza preavviso. AUR°EL S.p.A. non si assume la responsabilità di danni causati dall'uso improprio del dispositivo.



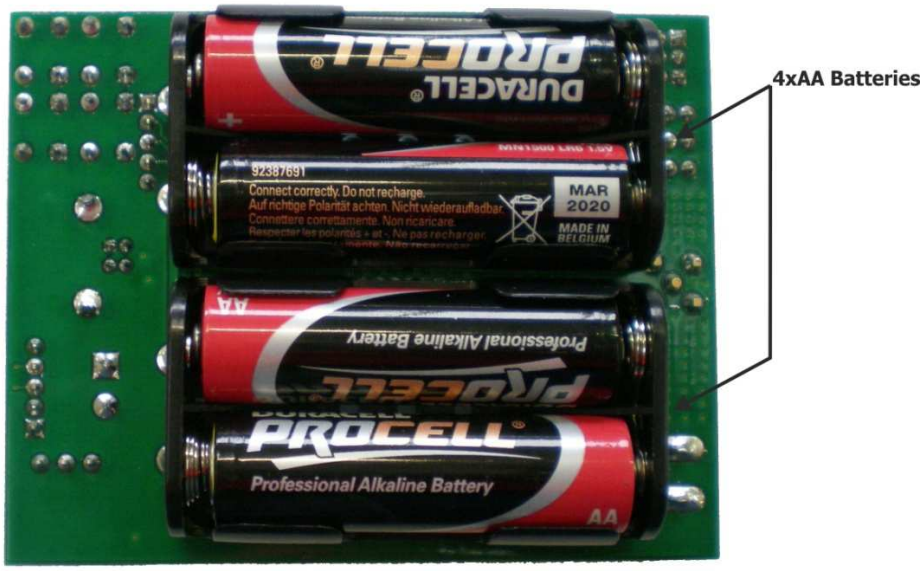
Picture 3: Description top side of demo XTR-8LR100/XTR-8LR10

External Supply 8÷12Vdc	Plug input male general supply 8÷12Vdc 300mA
Power Switch	General switch power board. ON= board switched on OFF= board switched off
Power Supply Led	Red led power indicator. Switched on with Power Switch in ON position.
Antenna	SMA female socket 3,5 mm. Connected directly to antenna pin of XTR-8LR100/8LR10
USB/B Type Female	USB socket type B. Connect to computer via USB cable. The USB port uses an internal shifter for serial port FTDI1235-C. It is not possible to power supply the board with this port.
3V/UART	Connections RX/ TX/ RTS/ CTS of UART port. They are signals from relative pins of the module XTR-8LR100/8LR10, with logic levels 0V e + Vcc.
SET A	Close the jumper to activate the NORMAL mode
SET B	Close the jumper to activate the “TX Cyclic” mode (2) Or closed together with SET_A actives mode "RX Cyclic" (2) Close the jumper to activate TEST mode for DEMO XTR-8LR10
SET C (1)	Close the jumper to activate TEST mode Or closed together with SET_A actives mode " Tx ADC Cyclic" (2)

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LED RX or TX "PONG"	Led 1 green used in the TEST mode On when it sends or receives the message "PONG", or in the other modes it indicates the transmission status
LED RX or TX "PING"	Led 2 green used in the TEST mode On when it receives or sends the message "PING" In the other modes it indicates the reception status
Analog Input	Analog input 0,05 ÷ 4,3V with resolution 12bits
Buttons	No functionality associated
Reset Button	Press (0.5 sec) and release to reset the uC of the XTR-8LR100/8LR10
Test Point Current	Open jumper and insert an ammeter to check the consumption of the radio module

(1): No function for Demo Board XTR-8LR10
(2): Only for Demo Board XTR-8LR100



Picture 4: Description bottom side of demo XTR 8LR100/XTR-8LR10

4xAA Batteries: Batteries for working in stand-alone.
Insert on the battery holder, 4 x AA non-rechargeable 1.5V batteries, paying attention to the direction indicated on the bottom of the same.

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Installing procedure

To start using the DEMO XTR-8LR100/8LR10 follow the steps below:

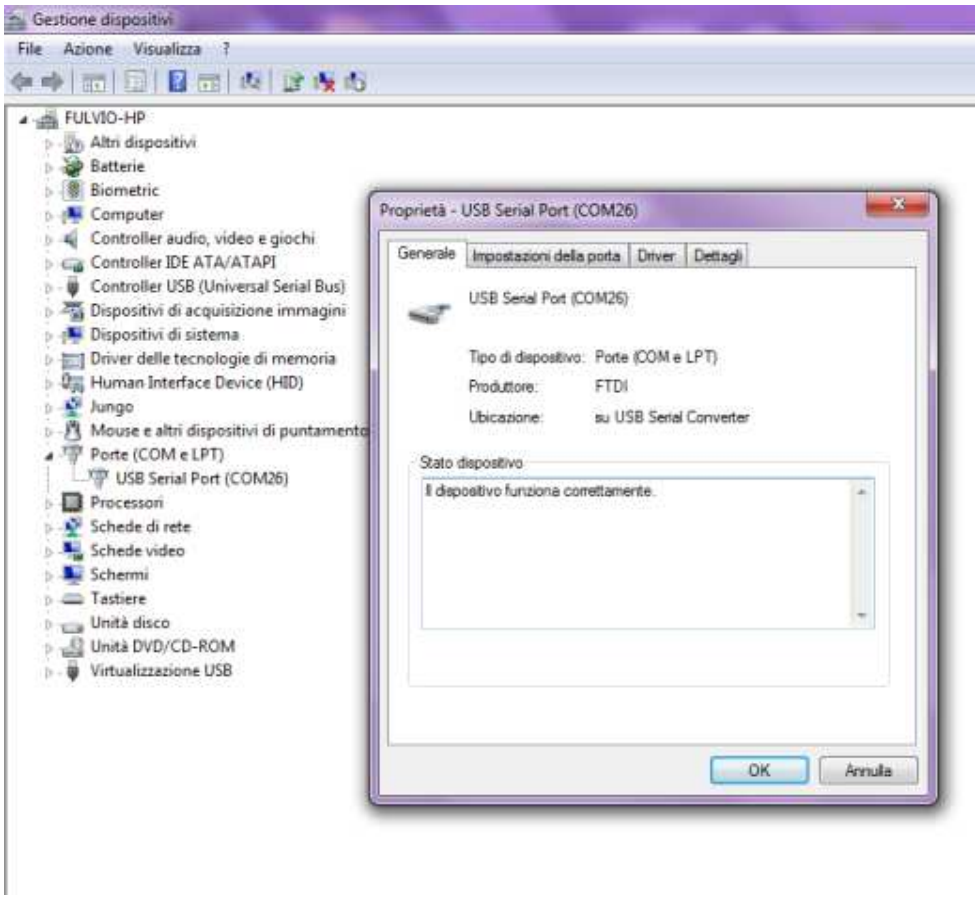
1. Insert the 4 AA batteries as shown in Picture 4.
   Power supply DEMO XTR-8LR100/8LR10 placing the **Power Switch** in ON position and be sure the 3 jumpers Set_A, SET_B and SET_C are open.

2. Install on the computer drivers for the USB port, for this purpose use the following link http://www.ftdichip.com/Drivers/D2XX.htm taking care to identify the proper drivers for the operating system from the PC.

3. Connect the USB cable to the demo and the PC: the computer should report the identification of USB, communicate the outcome of the installation of the drivers and the number of the COM used. If this is not reported, then you should open the page Windows about device control, click on the menu "Ports (COM & LPT)", click the right button on USB / Port installed, and from the properties of each of them, try the COM associated to FTDI driver.



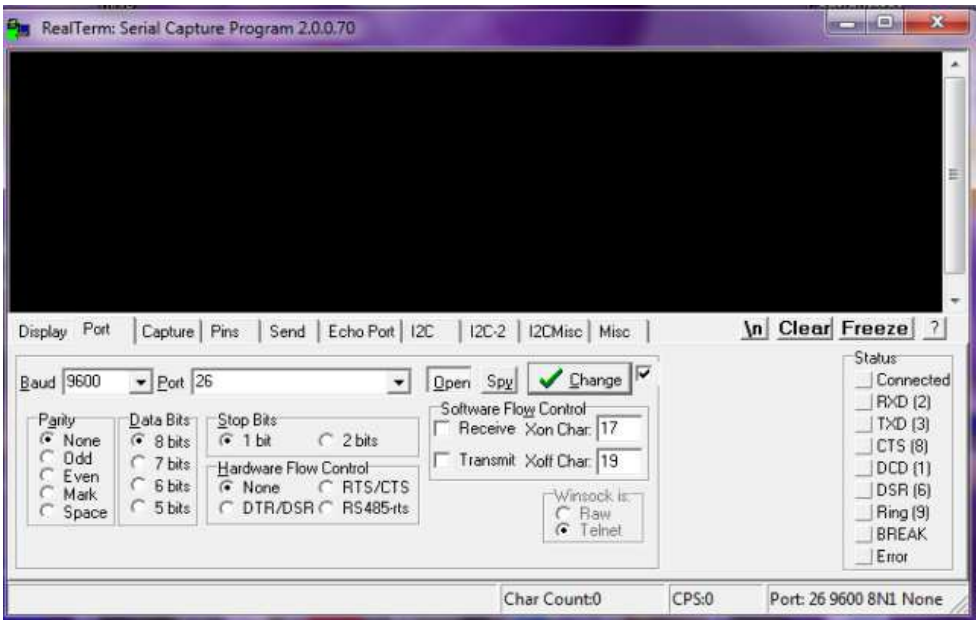
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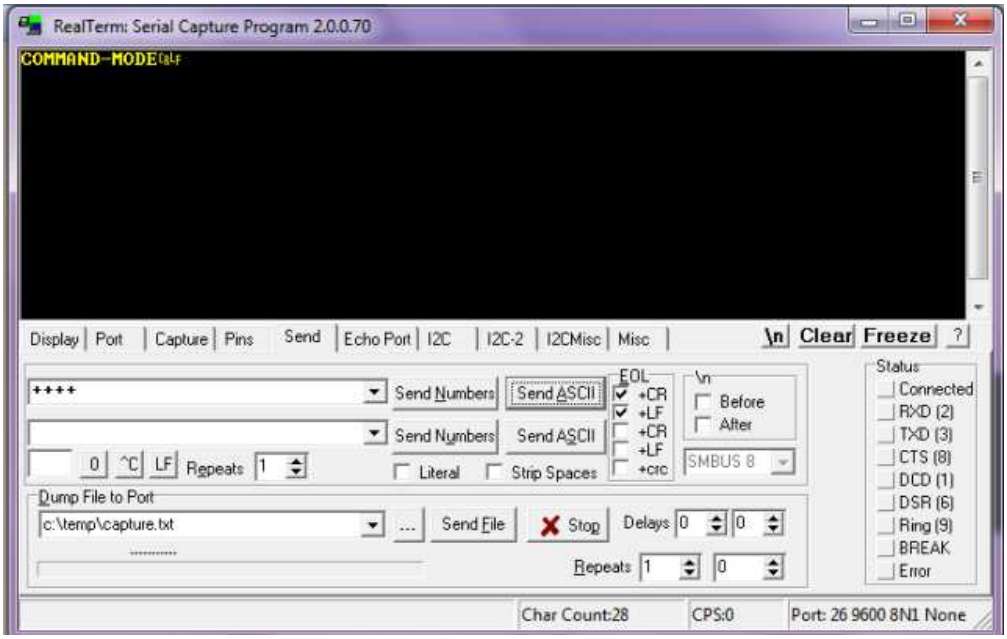
4. Open a communication software for serial ports, it is recommended RealTerm free download on the following link: http://sourceforge.net/projects/realterm/files/Realterm/
All the examples mentioned in this manual have been performed with Realterm.
Several programs of communication are available for serial ports suitable for this purpose, however, in order to exclude errors introduced by them and to get adequate support by the supplier, it is recommended to perform the experiments described below using Realterm, at least until it reaches an appropriate level of confidence with XTR-8LR100 o XTR-8LR10.

5. Start the program and set the communication parameters as follows:
communication speed 9600bps, a START bit, 8 data bits and STOP bits, no parity. In this case, select the menu item "Port 26", used in this example as associated port to DEMO XTR-8LR100.
After each change of the working parameters of the serial port, remember to click the "Change" button to Realterm, the set values are visible at any time in the small square at the bottom right of the screen Realterm.

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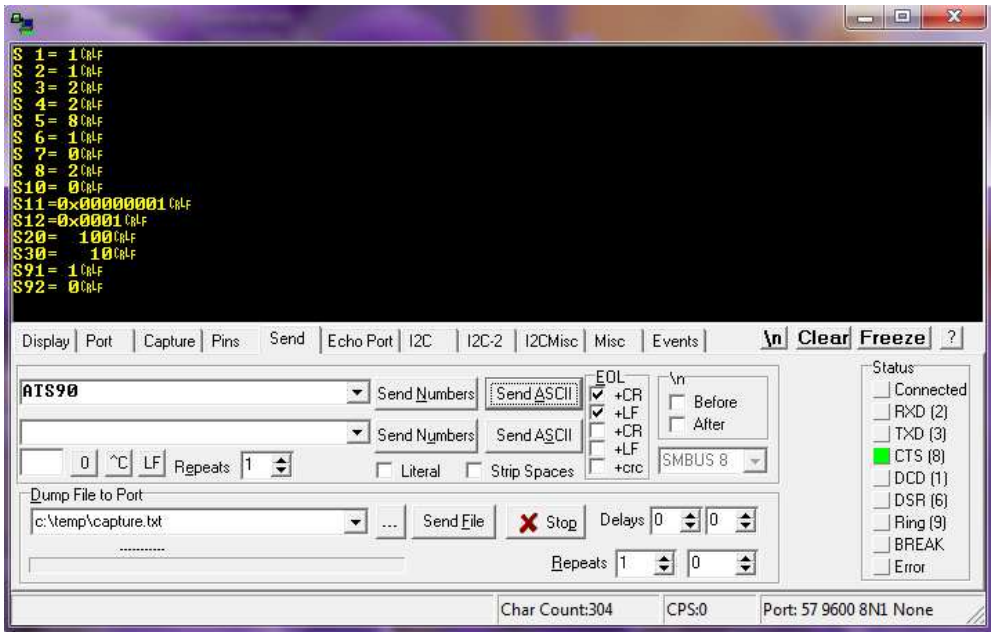


6. Click on the menu Send and select CR and LF, press the "Reset Button" of DEMO XTR-8LR100/8LR10, then type on the empty field “++++” and then press button "Send ASCII".
If communication is successful you will receive in response the following screen:

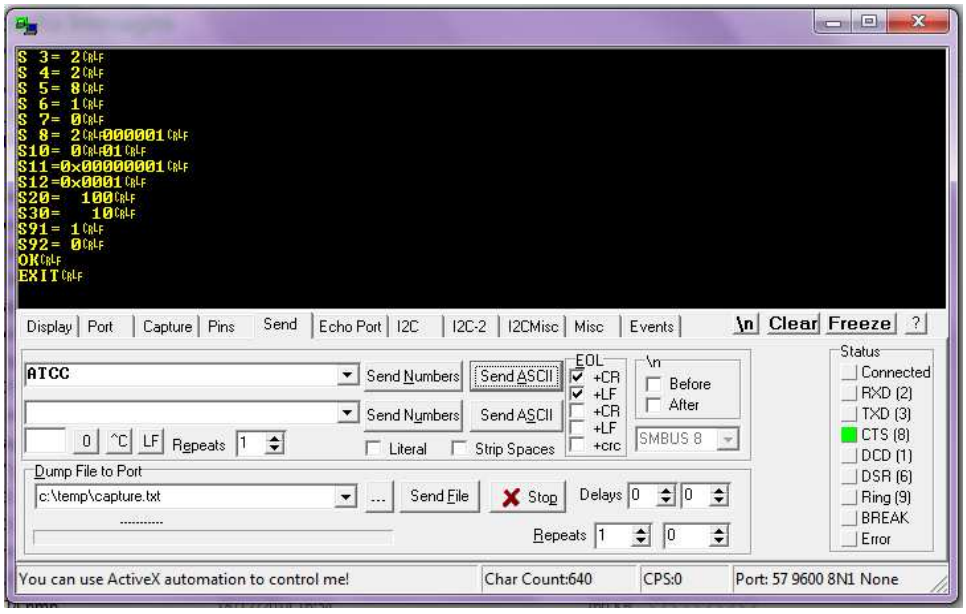


7. By now, you can send AT commands to the demo-board.
Send the command ATS90 as below, you will receive in response the state of all registers.
In the case of board never used, it will respond with the default settings.

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8. Change the desired parameters, type the command ATCC to get out of the command mode, or ATWR to save the new parameters on Eprom and exit from command mode, as confirming the demo-board answer with OK EXIT (see below).



TEST procedure of demo board:

The test mode allows you to test the working of the demo-board boards, and assess the performance of radio range.

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The application consists in a set up of radio connection between a pair of DEMO XTR-8LR100/8LR10 respectively called Master and Slave, the first transmits autonomously the message "PING", the second receives the packet answering with the message "PONG".
Diagnostics is managed by LED1, active when the unit receives Master or unit Slave transmits a "PONG" and LED2, active when the Master unit transmits or unit Slave receives a "PING".

Test mode procedure:
Connect the demo-board, 1 to serial PC, open the jumpers SET_A, SET_B, SET_C, set the parameters as in step 5 and then perform the command sequence as follows:

Command by PC → DEMO XTR-8LR100/ 8LR10	Answer by DEMO XTR-8LR100/ 8LR10 → PC	Description
++++	COMMAND-MODE	Command mode enter
ATS92=1	OK	It activates the module as Master in test mode
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode

Connect the demo-board 2 to PC serial, open jumpers SET_A, SET_B, SET_C, set the parameters as in step 5 and then perform the command sequence as follows:

Comando da PC → DEMO XTR-8LR100/ 8LR10	Risposta da DEMO XTR-8LR100/ 8LR10 → PC	Descrizione
++++	COMMAND-MODE	Command mode enter
ATS92=2	OK	It activates the module as Slave in test mode
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode

On both demo-boards - DEMO XTR-8LR100 - close the jumper SET_C, if your using DEMO XTR-8LR10 – close the jumper SET_B, the demo will start a sequence of PING-PONG, the LD1 and LD2 led will signal transmission and reception of each packet.
If communication does not start then you should press the reset button on both boards.
From command mode it is possible to modify the parameters of canalization, spreading factor and bandwidth, each time repeating the cycles of testing to verify performance. Finished the tests in Test-Mode before returning to work in other working modes, it is essential to disable the functionality of Test-Mode with the command ATS92 = 0.

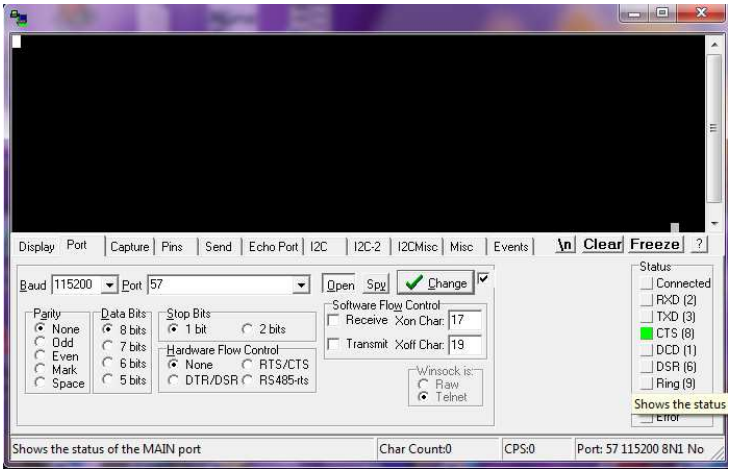
Test mode NORMAL and NORMAL with addressing:

NORMAL mode lets you transfer data packets (from 1 to 255 byte) through a serial port.
It is activated by closing the jumper SET_A and leaving open jumper SET_B and SET_C, the status of NORMAL mode is signaled by LED2 on and LED1 off (reception), LED1 on LED2 turned off (transmission).

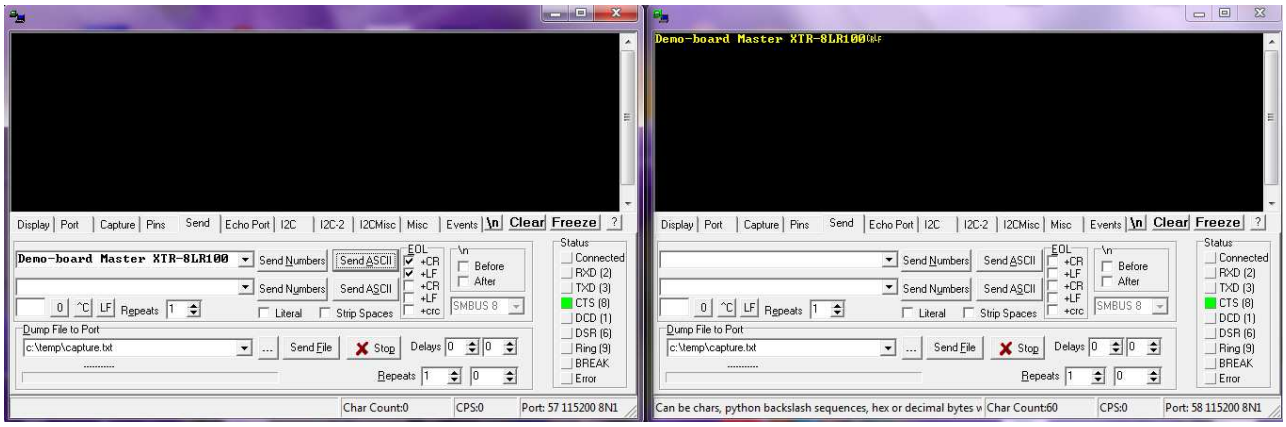
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Data transfer procedure in NORMAL:

In the default configuration, the demo-boards do not require any parameterization.
You should connect the demo boards to the serial port of the PC at speed of 115,2kbps.
Using Realterm set communication speed to 115,2kbps, a START bit, 8 data bits, a bit of STOP, no parity.
Select from the menu “Port 57”, used in this example as associated port to DEMO XTR-8LR100, then press the "Open" button.



From the "Send" menu of “Realterm" type a sequence of characters then press “Send ASCII”, LED2 turns off and LED1 turns on, during transmission time.
Unit 2 will receive the message and forward it on the own serial port.



Port 57: message sent from unit 1, see the field Send ASCII. ⇒ Port 58: message received from the unit 2, displayed.

Operation is reciprocal, so it can be transmitted from the 2 to the 1.
NORMAL mode does not use unique identifiers of the various terminals, those in listening, working on the same frequency and with the same settings radio, will receive the same message.

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Where it is required a connection point multi-point with exclusive connection between two units or one unit and *n* units, it is possible to activate the NORMAL mode with addressing.
You should operate as follows:

NORMAL mode with addressing:

The setting as described below also apply to the DEMO XTR-8LR10.
From sleep mode of unit 1, send the following commands:

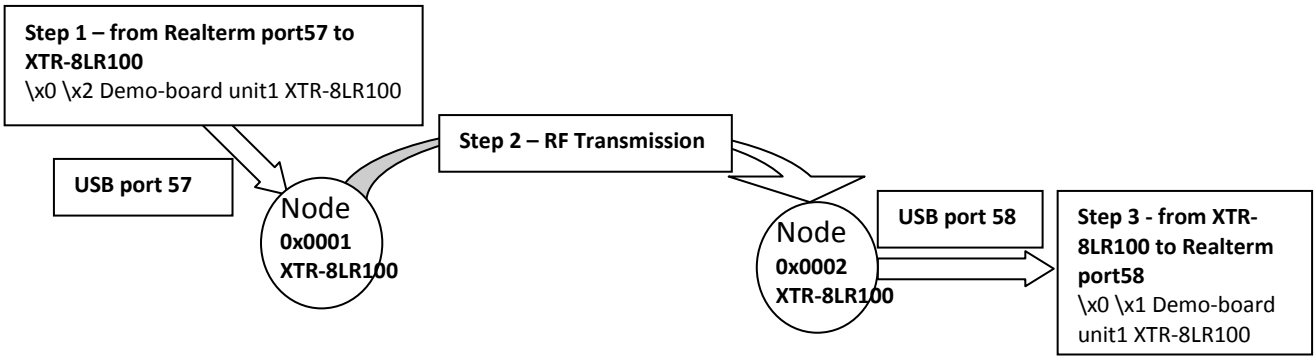
Command from PC → DEMO XTR-8LR100/ 8LR10	Answer from DEMO XTR-8LR100/ 8LR10 → PC	Description
++++	COMMAND-MODE	Command mode enter
ATS10=1	OK	It actives the network mode
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode

Unit 1 has been programmed to operate in "NORMAL mode with addressing", the network address (S11) and source address (S12) are active with the default parameter = 1.

From sleep mode of the unit 2, send the following commands:

Command from PC → DB_XTR-8LR100/ 8LR10	Answer from DB_XTR-8LR100/ 8LR10 → PC	Description
++++	COMMAND-MODE	Command mode enter
ATS10=1	OK	It actives the network mode
ATS12=0002	OK	Set to 2 to the unique sender address for the unit 2
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode.

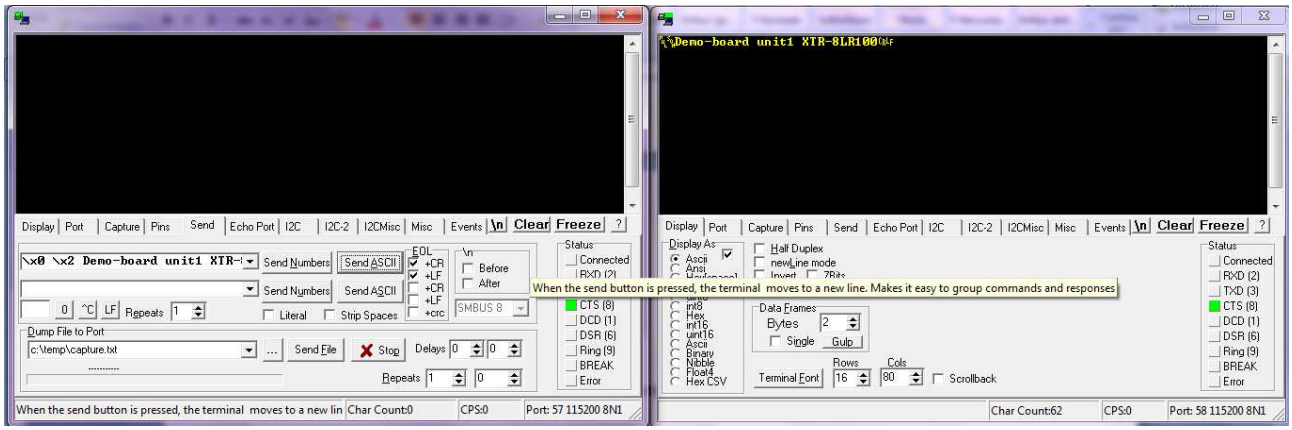
We have realized a network composed of two devices called 1 and 2 with network address 1.
From sleep mode close the jumper SET_A and modify the speed of the serial port of Realterm to 115200bps, of both units.
Below it is schematized the mechanism of transfer of message "Demo-board unit1 XTR-8LR100" from the unit 1 to the 2 realized with Realterm.



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In the following screens of Realterm, the transmission of unit 1 to 2 is displayed, of the string "Demo-board unit1 XTR-8LR100", the hexadecimal characters (0x0001) of the sender address are not displayed by Realterm for incompatibility of contemporary display to ASCI characters and HEX (screen on the right).

Note the string-field "Send ASCII" (screen on the left) formatting the message before the addressee address "\ x0 \ x2" followed by payload "Demo-board unit1 XTR-8LR100".

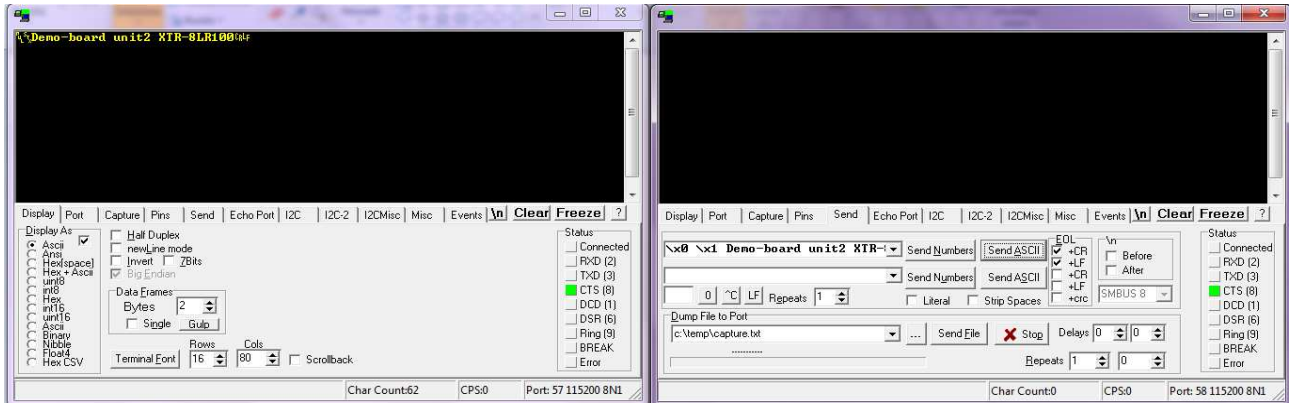


Unità1 port57 sends to unit 2
\x0 \x2 Demo-board unit1 XTR-8LR100

⇨

Unità2 port58 receives from unit 1
\x0 \x1 Demo-board unit1 XTR-8LR100

Screens displayed by Realterm for the message "Demo-board unit2 XTR-8LR100" sent from unit 2 to 1



Unit 1 port57 receives from unit 2
\x0 \x2 Demo-board unit2 XTR-8LR100

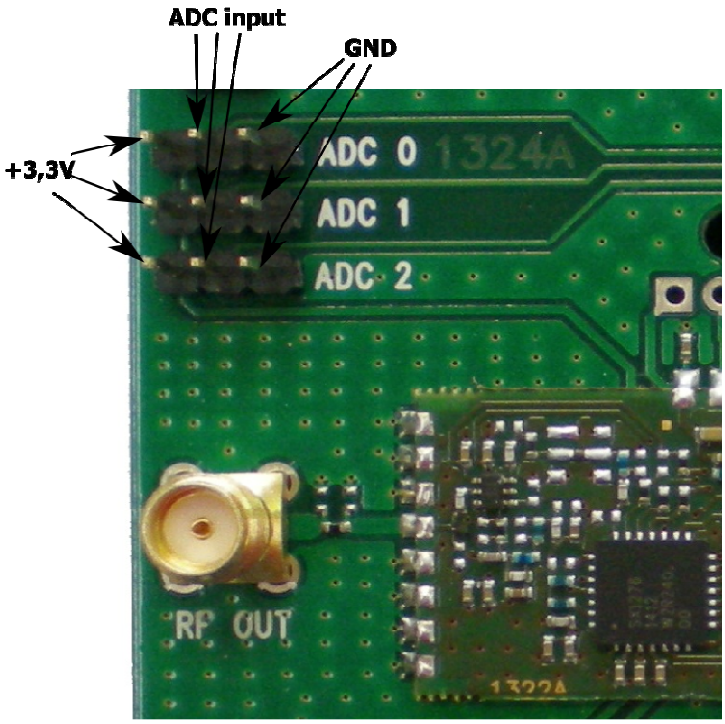
⇦

Unit 2 port58 sends to unit 1
\x0 \x1 Demo-board unit2 XTR-8LR100

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Transmission mode ADC cyclical (Available only for DEMO XTR-8LR100):

The following application realized with the DEMO XTR-8LR100 allows to transmit the value of three analog inputs: AN0 (pin4), AN1 (pin 5) and AN3 (pin6) of XTR-8LR100 module, independently and through programmed cycles.
They accept analog signals from 0mV to +4.3V ± 5% with 12bit resolution and input impedance of 3Kohm.
The device is normally in sleep and wakes up cyclically with an adjustable time via the command **ATS30 = X** (where **X** in seconds from 1 to 65536), reads the voltage of the analog input and transmits the value, returns to sleep and reiterates the cycle.
The device operates exclusively in network mode with address of the addressee Broadcast (all FFFF), receivers in listening belonging to the same network (same network ID) will forward to UART the value of the ADC (2 bytes each one) preceded by the address SOURCE ADDRESS, unique identifier of the node of origin of the message.



Input ADC available on DEMO XTR-8LR100

The analog source must be connected to the points shown in the drawing as "ADC input" in the lateral test-point of the left and right are respectively available the positive of power supply module (3.3V) and ground (GND).

For the settings in TX ADC cyclical mode, follow the steps below.
From sleep mode unit 1, send the following commands:

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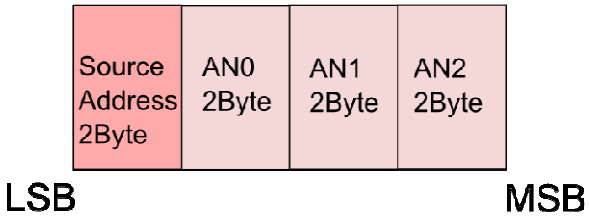
Command from PC → DEMO XTR-8LR100	Answer from DEMO XTR-8LR100 → PC	Description
++++	COMMAND-MODE	Command mode enter
ATS10=1	OK	It activates network mode
ATS30=1	OK	Set the time of cyclic transmission of the status of ADC to 1sec
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode

Close jumper SET_A and SET_C of unit 1, press and release the reset button on the demo board.
The cycle starts, at intervals of one second, ADC value will be transmitted.
The transmission is signaled by the blink of LD1.

From sleep mode unit 2, send the following commands:

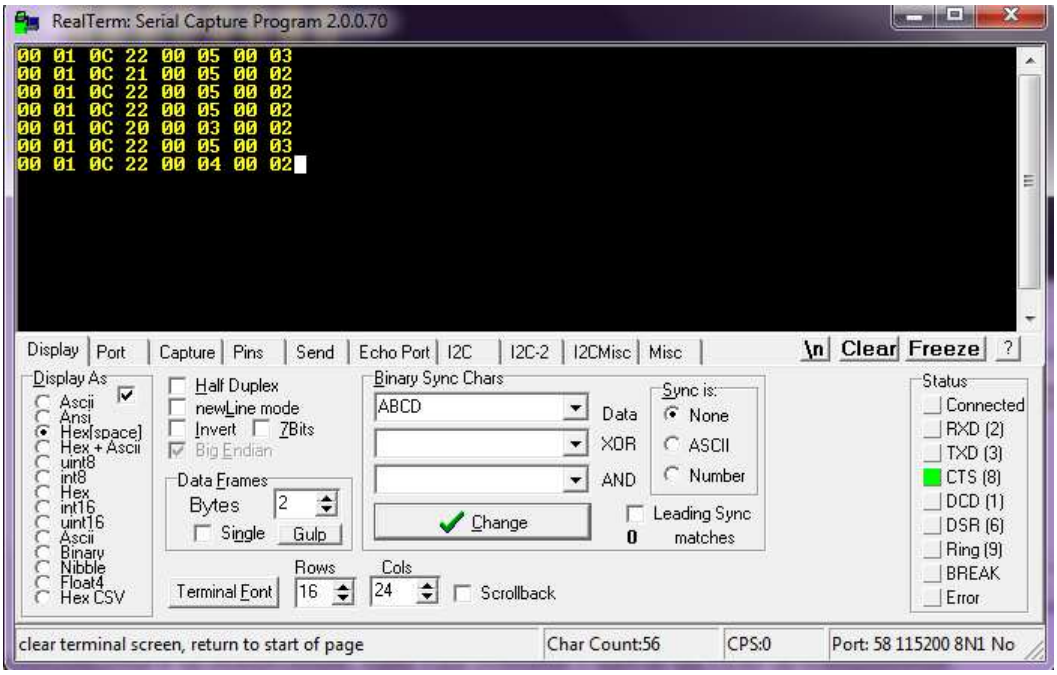
Command from PC → DEMO XTR-8LR100	Answer from DEMO XTR-8LR100 → PC	Description
++++	COMMAND-MODE	Command mode enter
ATS10=1	OK	It activates network mode
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode.

From sleep mode, close the jumper SET_A and set the speed of the serial port of Realterm to 115200bps.
At intervals of 1 second the unit 2 starts to receive packets structured in the following way:



Below, an example of the message received by a node in "TX ADC cyclical" displayed by Realterm connected all'unità2:

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The visualization is in hexadecimal, each line contains the data of a transmission cycle.
From the first line from left to right "00 01" represents source address (2 bytes in hex), "0C 22" is the value (hex) of input ADC_0 (in our application connected to + 3.3V), "00 05 "is the value (hex) of input ADC_1 (left open connected internally from 1k to GND)," 00 03 "is the value (hex) of input ADC_2, (left open connected internally from 1k to GND).
Each step of the ADC corresponds to 0,00105 Volts of the analog input which multiplied by the number of steps returned by the ADC, provides the voltage value in Volts applied to the ADC.
Applying the calculation to ADC_1 (0x0005 decimal 5) and ADC_2 (0x0003 decimal 3) results:

5 x 0.00105 = 0,00525Volts (ADC_1)
3 x 0.00105 = 0,00315Volts (ADC_2)

The inputs are connected to GND and should have returned a value close to 0, actually there is always an offset variable in the different production lot, which must be subtracted from the ADC.
Accepting a tolerance of 3÷5mV on the value of voltage read, for ADC_0 is possible to apply the following calculation:

0x0C22 in decimal 3106 x 0.00105 = 3,2613V

for an accurate measure of the analog input it must be performed a reading before with ADC connected to GND and then connecting to the input ADC the analog source to be measured.
In that case, use the following calculation formula:

(ADC – ADC_noise) x 0,00105 = ADC_Volts

where:
ADC is the value obtained by reading an analog input
ADC_noise is the value obtained from the analog input connected to GND
0.00105 is the value in Volts of a single step

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ADC_Volts is the value in Volts of analog input excluding noise
By applying the new computing to ADC_0 of the example, it results as follows:

(3106 - 4) x 0.00105 = 3,257Volts (voltage value read on input ADC_0 without offset)

where:
3106: corresponding decimal to 0x0C22 returned from reading ADC_0
4: it is the offset in decimal port ADC_0 connected to GND

Transmission mode TX and RX cyclical (Available only for DEMO XTR-8LR100):

TX and RX Cyclic are modes suitable for low power applications, where a automatic waking up mechanism of RX at fixed times by the S20 register, allows to choose cycle on/off more suitable to the application and to the would consumption. The setting is workable from the command **ATS20 = X** (where **X** is expressed in ms from 10 to 6000 in steps of 1 ms).
The device in cyclic **RX mode** is normally in sleep mode with average consumption of 1 uA, when the time set on the register S20 ends, it enters into reception, searching a valid preamble, in that case it complete the reception of the whole package and then return in sleep and repeat the cycle.
If the receiver does not find a valid preamble, it remains in reception for a term of three symbols, after that it returns to sleep.
The device in **TX cyclical** mode is normally in reception, when a packet is forwarded from Realterm towards XTR-8LR100, the package is sent by radio preceded by a preamble long as defined by the register S20 (from 10 to 6000ms).
In order to allow devices in "TX cyclic" mode to properly communicate with others in "RX cyclic" mode, it is essential to program the register S20 with identical value, only in this case the preamble transmitted will have adequate length to be intercepted from the receiver.

Below it is shown an example realized with two DEMO XTR-8LR100 respectively in RX and TX cyclic, with switching off cycle of 5 seconds, in network mode with address (source address) of the receiver "1" and the transmitter "2"; for the details of the times T/on, T/off and their timeout, you should refer to the information of the chapter RX cyclical described on user manual of "XTR-8LR100".

From sleep mode unit 1, send the following commands:

Command from PC → DEMO XTR-8LR100	Answer from DEMO XTR-8LR100 → PC	Description
++++	COMMAND-MODE	Command mode enter
ATS20=5000	OK	Set the cyclic restart time of the transmitter every 5 seconds
ATS10=1	OK	It activates network mode
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode.

Close the jumpers SET_A and SET_B leaving open jumper SET_C, set the speed of the serial port of Realterm to 115200bps.
LD1 ed LD2 are off.

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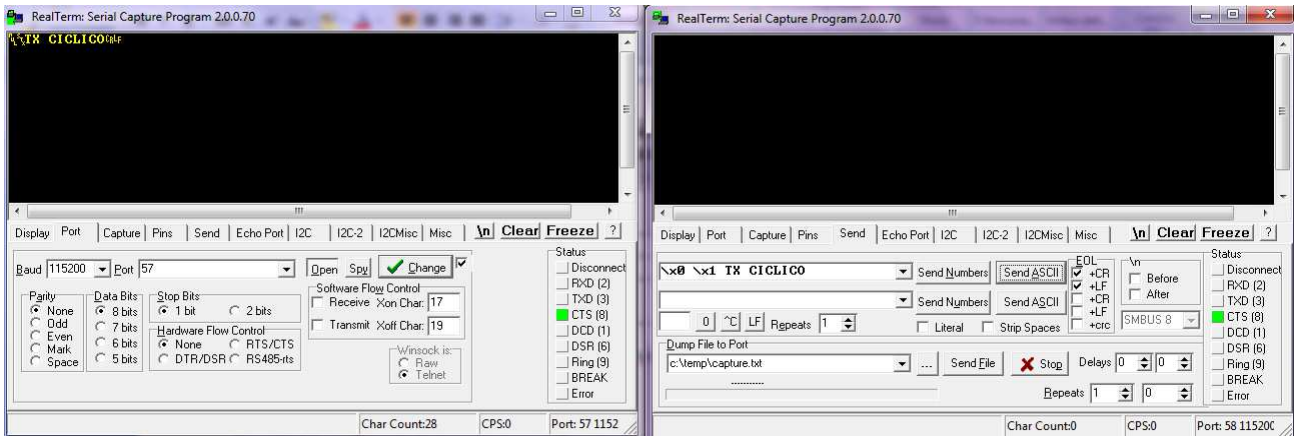
From sleep mode unit 2, send the following commands:

Command from PC → DEMO XTR-8LR100	Answer from DEMO XTR-8LR100 → PC	Description
++++	COMMAND-MODE	Input in Command mode
ATS20=5000	OK	Set the cyclic restart time of the transmitter every 5 seconds
ATS10=1	OK	It activates network mode
ATS12=0002	OK	Insert the address source address = 2
ATWR	OK EXIT	It saves the new settings on Eprom and exits from command mode.

Close the jumper SET_B and leave open jumper SET_A e SET_C, set the speed of the serial port of Realterm to 115200bps.
LD2 is on.

The unit 2 is configured in cyclic transmission, waiting for Realterm sends a string of characters.
Unit 1 is in receipt cyclic completely off with consumption of 1uA for 5 seconds and on for a short time to search a valid preamble.
When the unit first is in reception, intercepts a valid preamble, switches on LD1 and stays on until the forwarding of the message to Realterm

Screens displayed by Realterm for unit 1 (RX cyclic) and unit 2 (TX cyclic):



Unit 1 port 57 receives from unit 2
\x0 \x2 TX CICLICO

Unit 2 port 58 sends to unit 1 the message
\x0 \x1 TX CICLICO

Le caratteristiche tecniche possono subire variazioni senza preavviso. AUR°EL S.p.A. non si assume la responsabilità di danni causati dall'uso improprio del dispositivo.

Errata:

Release date	Revision user manual	Firmware correspondent	Changements from the previous revision
	1.0	0100	First release
18/06/2015	2.0	0110	Insert TEST, NORMAL, NORMAL mode with addressing, TX ADC cyclic.
24/09/2015	2.1	0110	Modifiche foto demo, inserimento demo XTR-8LR10
17/05/2016	2.2	0112	Aggiornata tabella iniziale e modalità test

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