Communication

ELAD

ELAD FDM-DUOr

Dual Mode SDR Receiver

USER MANUAL

1 Index

2 FDM-DUOr Overview

2.1 Notice

Amateur radio regulations vary from country to country. Confirm your local amateur radio regulations and requirements before operating the ELAD FDM-DUOr.

2.2 Firmware versions

The features described in this manual refers the following firmware versions :

RX Demodulator	User Interface	USB Interface	FPGA
Ver: 1.08 Date: 12/19/2014	Ver: 4.17 Date: 12/18/2014	Ver: 4.08 Date: 09/18/2014	Ver: 2.00 Date: 07/30/2014

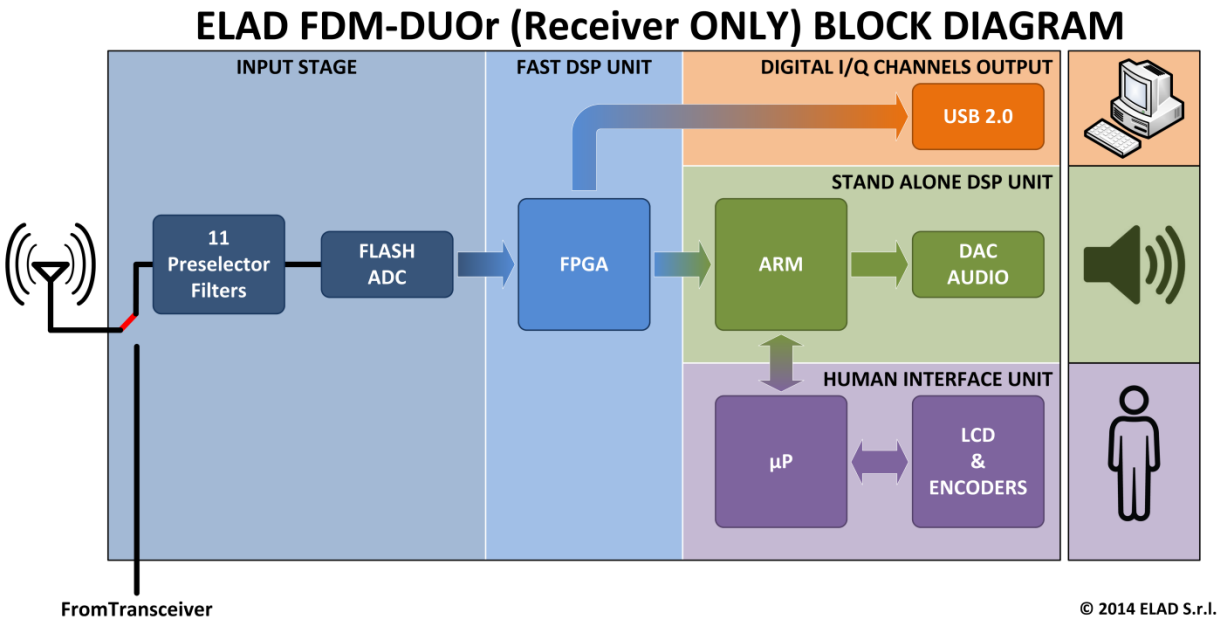
2.3 Introduction

Thank you for choosing the FDM-DUOr. It is an innovative dual mode SDR receiver covering the frequency range from 9kHz to 54MHz. The FDM-DUOr can be used like a standard receiver in stand-alone mode or connect to a PC to exploit the full potential of the ELAD FDM-SW2 software.

2.3.1 Main Features

- Frequency range: RX 9kHz to 54MHz direct sampling receiver
- Double antenna connectors (RX input and TX input)
- 11 slot for user selectable filters
- Operating Modes: CW LSB USB AM
- ADC Linear LTC2165,16bit @122.88MHz
- DDC FPGA Spartan 6 XC6SLX25 + Serial Flash for stand-alone mode
- Stand-alone RX demodulator with STM32F4 ARM floating point µController
- LPC1766 Cortex M3 for LCD & Keyboard control
- Clocking source Si5338 driven by 10MHz TCXO or External reference input
- CAT USB interface with FTDI controller

2.3.2 Block Diagram



2.4 Precautions

- Connect the receiver only to a power source described in this manual.
- Take care when plugging in cables, avoid applying sideways pressure that might damage the connectors.
- Avoid operating in wet conditions.
- For better performance and safety, connect the receiver to good earth ground using a short, heavy, braided cable.
- Ground all outdoor antennas for this receiver using approved methods. Grounding helps protect against voltage surges caused by lightning. It also reduces the chance of build-up of static charge.

3 Hardware Description

3.1 Front Panel Description

1 - LCD Display

See LCD.

2 - E1 Knob

Audio volume , AGC, noise reduction, noise blanker control. Knobs functions

3 - Main Knob

Main VFO and MEM control. See Knobs functions

4 - Speaker/Headphones Audio Output

The main FDM-DUOr audio output.

5 - Auxiliary Output

Auxiliary audio output.

6 - E2 Knob

Filter and pitch control. See Knobs functions

7 - MODE and MENU buttons

Change operating mode and enter the FDM-DUOr setup menu. See Keys functions

8 - VFO and MEM buttons

Basic VFO Memory operations. See Keys functions

3.2 Rear Panel Description

1 - USB Receiver Data Connector
USB 2.0 port to connect with the PC. Please use the supplied cable.

2 - Frequency Reference Input
SMA 50 Ohm 10MHz, 0 dBm frequency reference input.

3 – TX IN Connector
M-type TX Input 50 Ohm antenna connector.

4 - Antenna Connector
M-type RX 50 Ohm antenna connector.

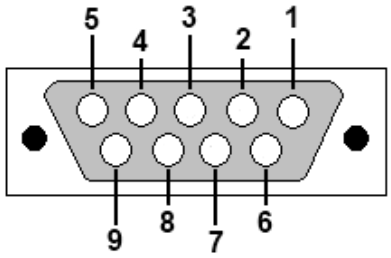
5 - PTT Input Connector
PTT Input to command the internal switch-box.

6 - CAT USB Serial Port
USB serial port for CAT communication.

7 - Power Switch
Turn On/Off the FDM-DUOr.

8 - Power supply
13.8V, 2.5A DC power supply connector.

9 - Expansion Port
DB9 connector for external hardware. **This is NOT a standard serial port.**

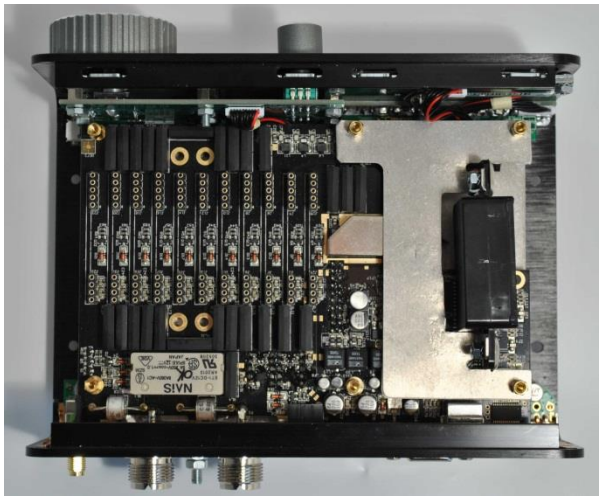


- Pin 1: SPI Latch
- Pin 2: I2C SCL
- Pin 3: SPI Clock
- Pin 4: I2C SDA
- Pin 5: Ground
- Pin 6: TX Duo
- Pin 7: RX Duo
- Pin 8: SPI Data
- Pin 9: +5V

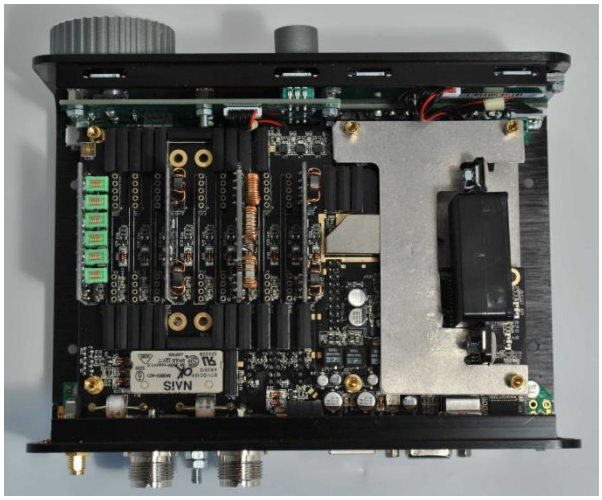
10 – Speaker/Headphones Audio Output
The main FDM-DUOr audio output

11 – Ground Connector
For better performance and safety, connect to an earth ground using a short, heavy cable.

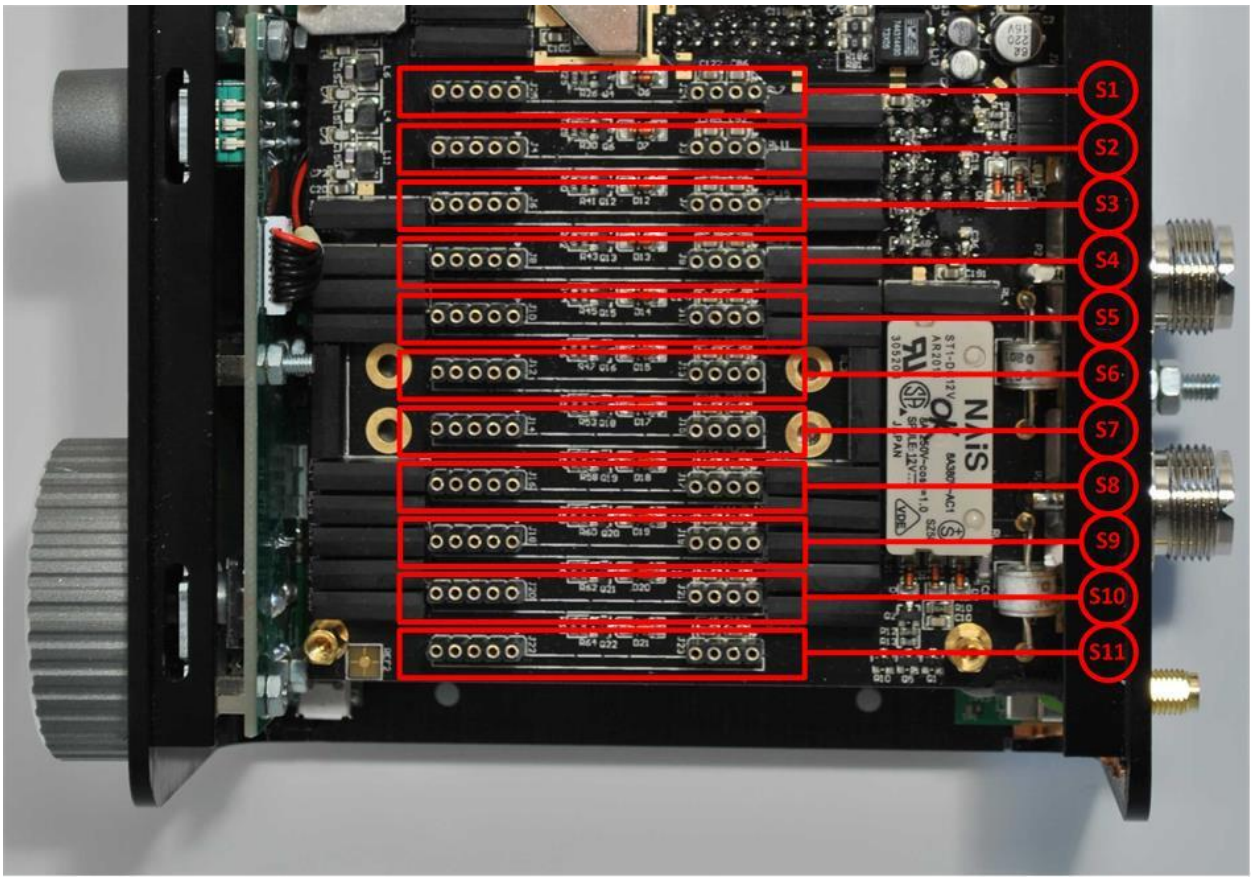
3.3 Internal Hardware Description



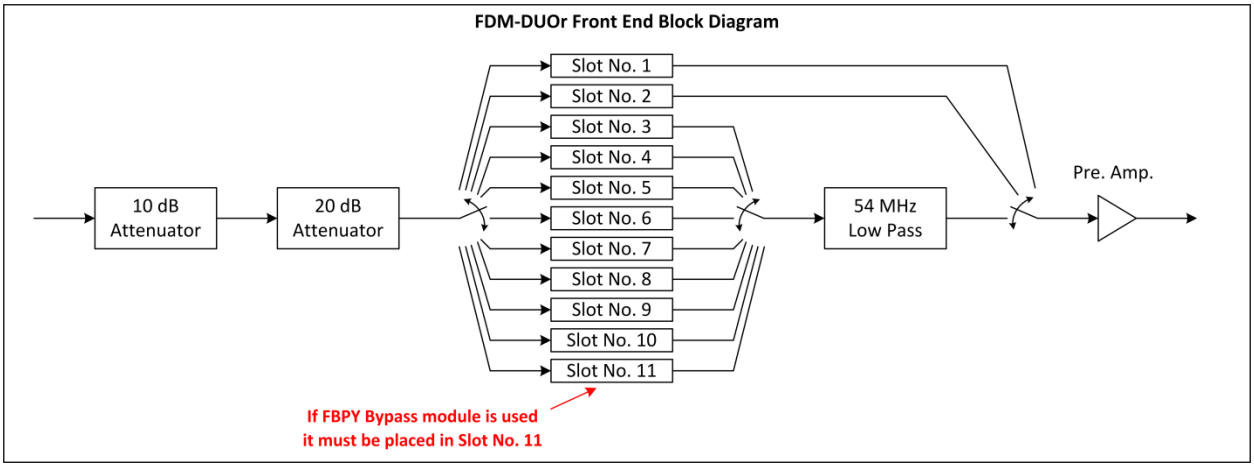
Empty FDM-DUOr board



FDM-DUOr board with 3 filter modules



S1 ÷ S11
Eleven slots for filter modules from 1 to 11.
N.B. If FBPY Bypass module is used, it must be placed in Slot No. 11.

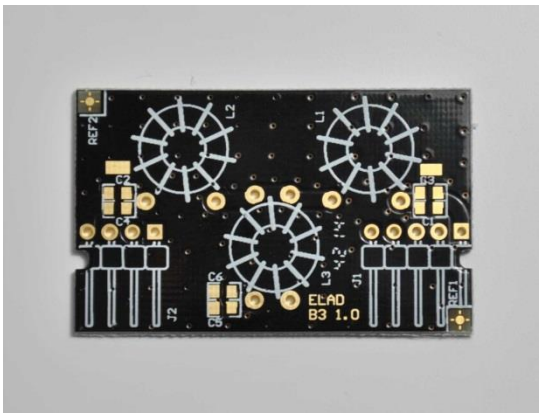


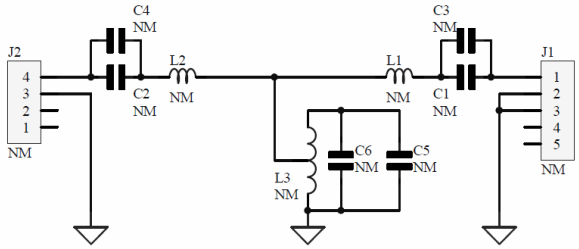
3.3.1 ELAD Filter Module Family

Actual SFP-08 available filter modules (*)			
Module Code	**Module Description**	**Module Code**	**Module Description**
FHP05M-1	High Pass 500 kHz	FBP17-1	Band Pass 17 m
FHP1M7-1	High Pass 1700 kHz	FBP15-1	Band Pass 15 m
FBP160-1	Band Pass 160 m	FBP12-1	Band Pass 12 m
FBP80-1	Band Pass 80 m	FBPY	Bypass module (**)
FBP40-1	Band Pass 40 m	FPCB-B3	Empty module for self-made filters
FBP30-1	Band Pass 30 m	FPCB-H5	Empty module for self-made filters
FBP20-1	Band Pass 20 m		

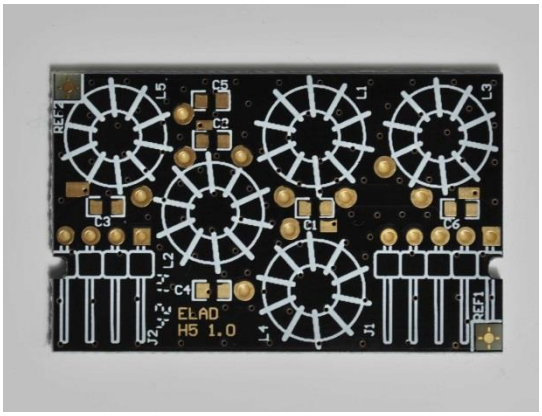
(*) Please refer to ELAD website for updated list of filter modules.
(**) Bypass module is included with the FDM-DUOr.

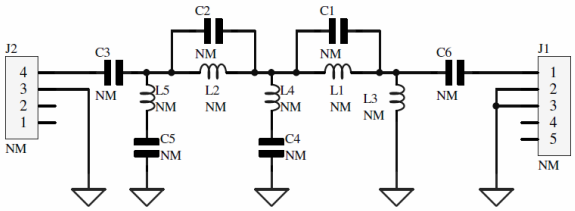
3.3.2 FPCB-B3 Module Schematic



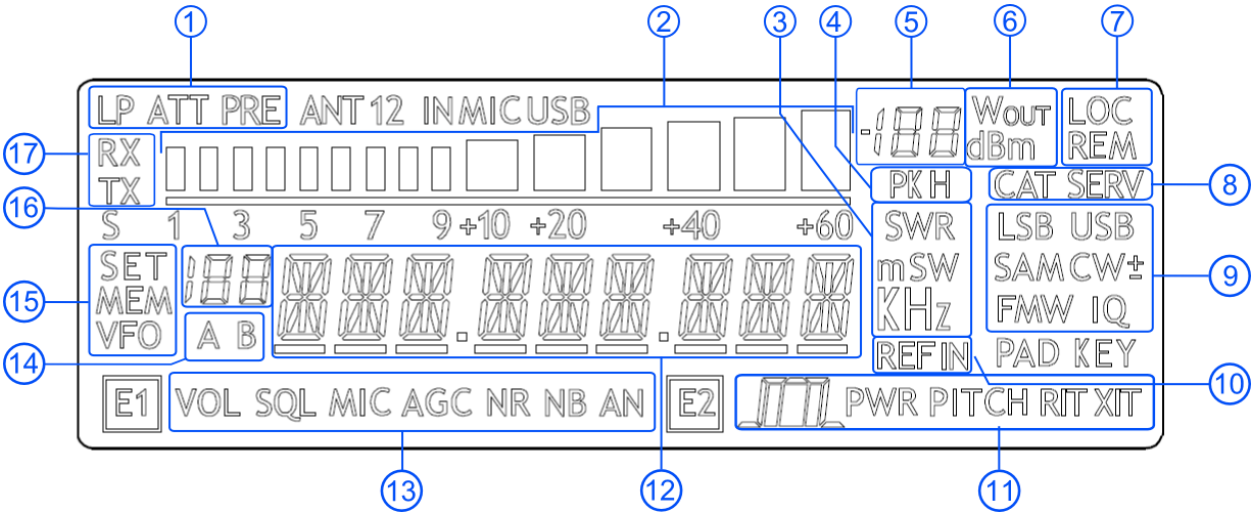


3.3.3 FPCB-H5 Module Schematic





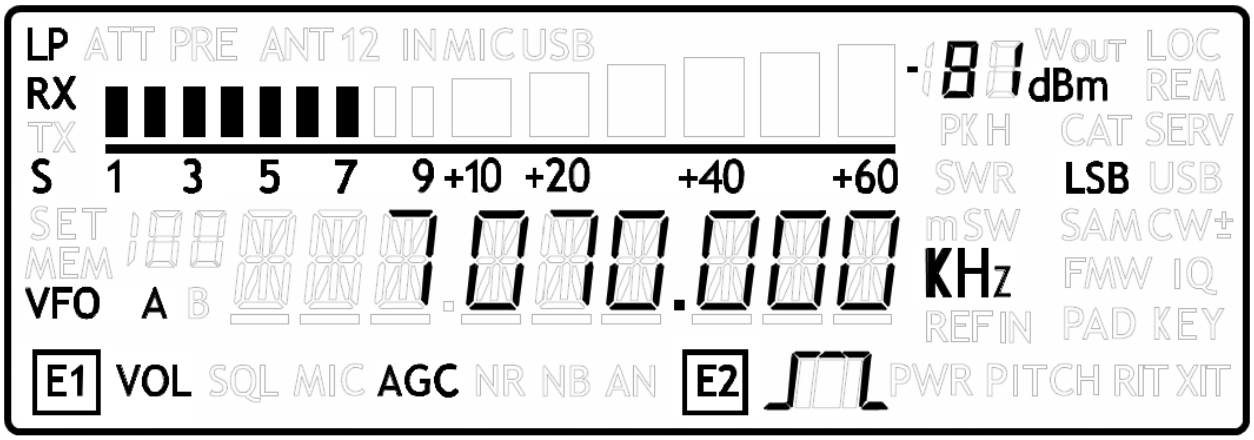
4 LCD



1. LP: Low pass input filter active. ATT: input attenuation active.
2. Bar meter: in receiver mode displays the signal strength in S-units, in transmission mode displays the forward power transmitted.
3. Measurements unit for the main display. The “S” of SWR is also used to indicate the “QuickStep” function.
4. PK: blinks if the case of internal ADC overload.
5. Secondary display that displays the signal strength.
6. Measurement unit for the secondary display.
7. LOC: on when the Main Knob is locked.
8. CAT: on when a CAT command is received, SERV: Service mode enabled.
9. Operating mode.
10. External frequency reference present.
11. E2 Selected function. PITCH: CW pitch frequency, :Demodulation filter bandwidth.
12. Main display.
13. E1 Selected function. VOL: main volume, AGC: automatic gain control settings, NR: noise reduction, NB: noise blanker.
14. Display the selected VFO.
15. SET: settings menu mode, MEM: memory mode, VFO: VFO mode
16. In memory mode, displays the selected memory index, in settings mode display the menu number.
17. RX: receive, TX: internal switch box activated.

5 Quick Start

These instructions are intended only for a quick guide, detailed instructions are given later in this manual

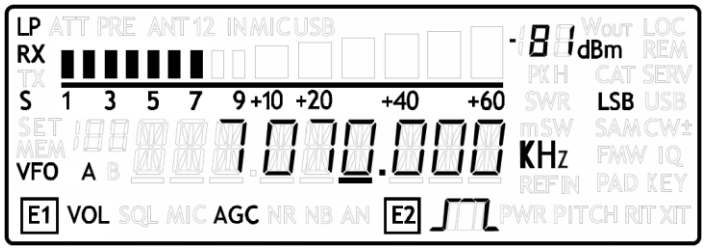


- Turn on the FDM-DUOr using the rear panel switch. The receiver start in VFO mode with the VFO-A selected.
- Turn the E1 knob until you hear a suitable level of noise.
- Use the Main knob to tune a frequency.
- Press MODE F3 to select the desired communication mode.
- Use the E2 to set the demodulation filter.

6 User Interface

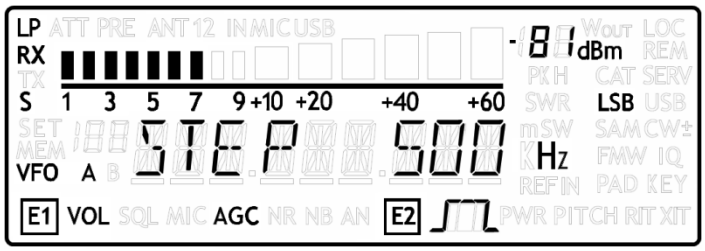
6.1 VFO Mode

The VFO mode is the default mode of FDM-DUOr. Each VFO memorize the tuning frequency, mode and tuning step



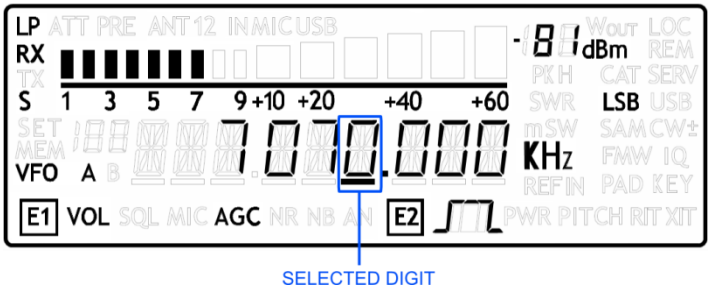
6.1.1 Tuning

In this mode, use the Main Knob to tune a frequency.
A short pressure on the main knob enter the frequency step menu



Use the main knob to modify the tuning step, then with a short pressure return in the VFO menu.

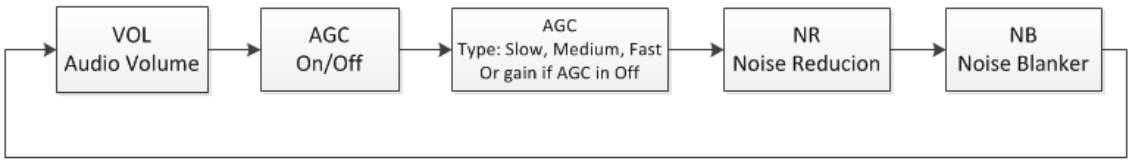
With a long pressure over the main knob, the Digit by Digit Frequency tuning mode is activated



In this mode use the main knob to modify the selected digit and E1 or E2 to change witch digit you want to modify. Apply a short pressure on main knob to return in the standard tuning mode.

6.1.2 E1 Receiver Settings

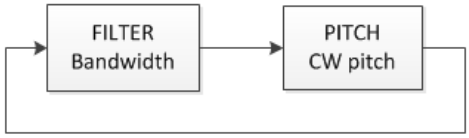
Apply a short pressure on the E1 knob to change the E1 selected parameter, the selected parameter icon is turned on in the LCD. Turn until one click the E1 knob to display the parameter value, then turn again E1 to modify the parameter value.



AGC: if the AGC is turned OFF (manual gain mode), the AGC icon blinks.
NR and NB: if the Noise Reducer or the Noise Blanker is turned on the relative NR or NB icon blinks.

6.1.3 E2 Receiver Settings

Apply a short pressure on the E2 knob to change the E2 selected parameter, turn until one click the E1 knob to display the parameter value, then turn again E1 to modify the parameter value.

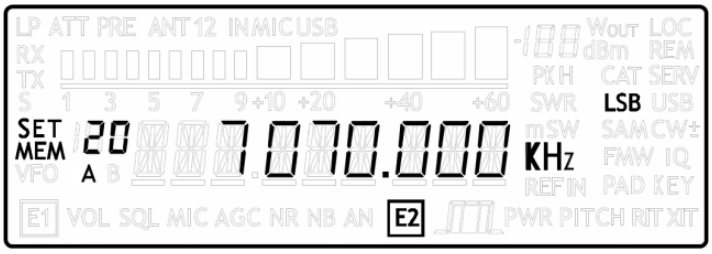


6.1.4 Switch VFO

Use the A/B M button to switch VFO-A/B.

6.1.5 Store VFO to memory

Use the V-M F1 key to store the current VFO settings into a memory



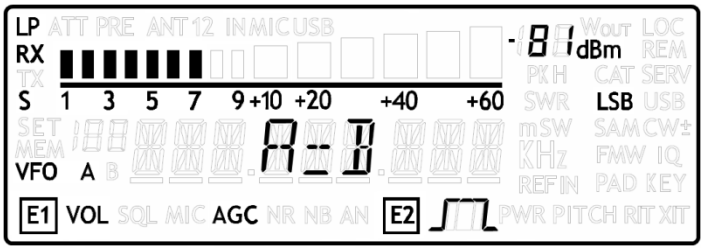
Use E2 knob or main knob to select the destination memory and confirm with a short pressure on E2.

6.1.6 "QuickMem" mode

Keep pressed the V►M F1 key to enter the "QuickMem" mode.
The memory channels 180 to 199 are reserved for the "QuickMem" selection. Keep pressed the V►M F1 key until the desired frequency appears on the LCD display, then release the key and the current VFO is set to the frequency and mode saved in the memory channel.
You can use the "FDM-DUOr Manager" feature in the ELAD FDM-SW2 software to customize the memory channels.

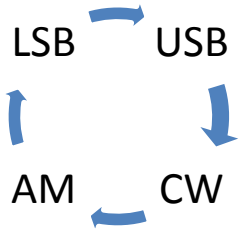
6.1.7 VFO-A = VFO-B

With long pressure on M►V F2 key you get VFO-A = VFO-B



6.1.8 Change Operating Mode

With a short pressure on the MODE F3 button, you can change the receiver mode between the available modes:

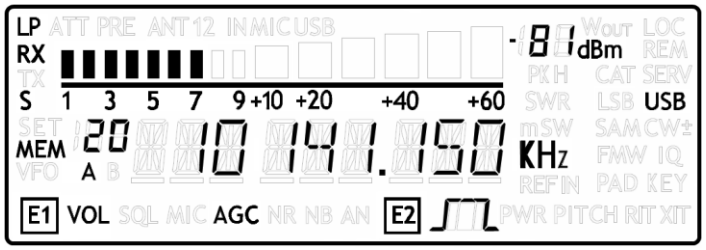


6.1.9 "QuickStep"

With a short pressure on the S F4 key, the "QuickStep" function is activated. This function quickly sets the frequency step preset selected in the "QuickStep" setting menu, press again the S F4 key to set the previous frequency step.

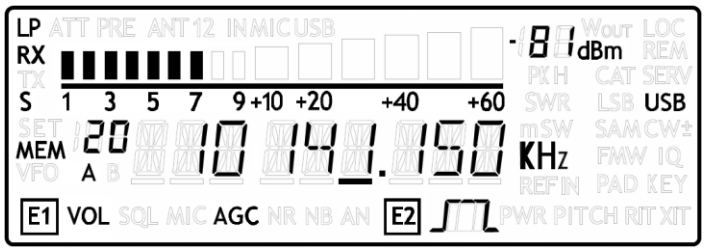
6.2 MEM Mode

To activate the memory mode, apply a long pressure on A/B M.



6.2.1 Select and edit a memory

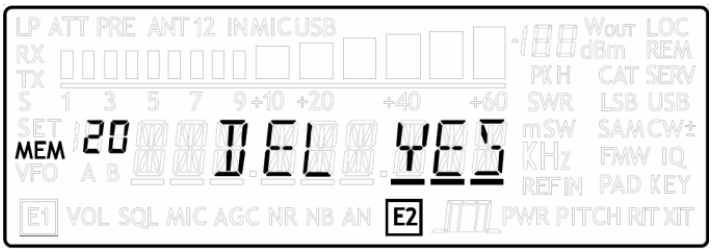
Use the main knob to select a memory. Apply a long pressure on the main encoder to enter the edit memory menu. In this menu it is possible to modify the selected memory frequency in digit by digit mode.



Use the A/B M button to select the VFO-A/B. This is useful if you want to set the memory settings to a specific VFO.

6.2.2 Delete a memory

Apply a long pressure to the V►M F1 key to enter the delete menu



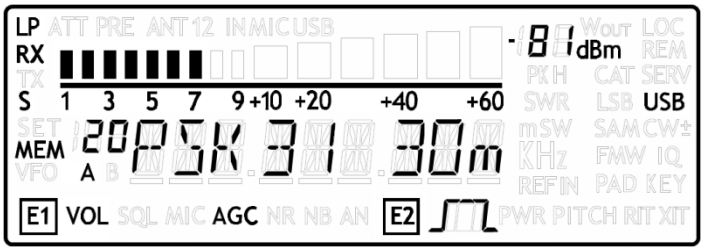
Use the E2 knob to set yes or no and make a short pressure on E2 to confirm.

6.2.3 Set memory to VFO

Use the M►V F2 key to set the selected VFO to the selected memory frequency and mode. When this function is used, the FDM-DUOr automatically switches to the VFO mode.

6.2.4 Change the memory display mode

Apply a short pressure on the S F4 key to show the memory label in the LCD main display. Press shortly again S F4 to return to display the memory frequency.



You can use the "FDM-DUOr Manager" feature in the ELAD FDM-SW2 software to customize the memory channels.

6.3 Knobs functions

The following table describes the knob functions for some user interface menu :

Menu	Action	Main Knob	E1 Knob	E2 Knob
VFO	Value modified	Change selected VFO frequency	Enter E1 selection parameter	Enter E2 selection parameter
	Short Pressure	Enter STEP menu	Change E1 selected parameter	Change E2 selected parameter
	Long Pressure	Switch to DIGIT by DIGIT tuning mode	(2)	(2)
STEP	Value modified	Change tuning step value		
	Short Pressure	Exit from STEP Menu		
	Long Pressure	Switch to DIGIT by DIGIT tuning mode	(2)	(2)
MEM	Value modified	Select next/previous memory	Enter E1 selection parameter	Enter E2 selection parameter
	Short Pressure		Change E1 selected parameter	Change E2 selected parameter
	Long Pressure	Switch to DIGIT by DIGIT tuning mode	(2)	(2)
E1 Selection: VOL - AGC-NR - NB	Value modified	Back to VFO or MEM menu	Modify E1 selected parameter value	Modify E2 selected parameter value
	Short Pressure	Back to VFO or MEM menu	Change E1 selected parameter	Change E2 selected parameter
	Long Press	Switch to DIGIT by DIGIT tuning mode	(2)	(2)
E2 Selection: FILTER - PITCH	Value modified	Back to VFO or MEM menu	Modify E1 selected parameter value	Modify E2 selected parameter value
	Short Pressure	Back to VFO or MEM menu	Change E1 selected parameter	Change E2 selected parameter
	Long Pressure	Switch to DIGIT by DIGIT tuning mode	(2)	(2)
VFO > MEM	Value modified	Change the destination memory		Change the destination memory
	Short Press			Save VFO in the selected memory
	Long Pressure		(2)	(2)
Delete MEM	Value modified			Change Yes/No
	Short Pressure			Confirm Yes/No
	Long Pressure			
SETUP - PARAMETER CHOICE (MENU button)	Value modified			Change parameter selection
	Short Press			Enter parameter setup menu
	Long Pressure			

Menu	Action	Main Knob	E1 Knob	E2 Knob
SETUP - PARAMETER MODIFICATION	Value modified	Parameter coarse variation (1)	Parameter coarse variation (1)	Parameter fine variation
	Short Press			Save and exit
	Long Pressure			
DIGIT by DIGIT Tuning	Value modified	Modify the current digit value	Change digit selection	Change digit selection
	Short Pressure	Switch to standard tuning mode	Switch to standard tuning mode	Switch to standard tuning mode
	Long Pressure		(2)	(2)

(1) Available only for certain menu.
(2) Press simultaneously E1 and E2 to lock/unlock all the keys and knobs.

6.4 Keys functions

The following table describes the keys functions :

Mode	Pressure	A/B M	V►M F1	M►V F2	MODE F3	S F4	MENU F5
VFO	Short	Switch VFO	Enter VFO to MEM menu	-	Change selected VFO operating mode	Enable/disable Quickstep function	Enter settings menu
	Long	Switch to MEM mode	Enter "QuickMem" menu	VFO A = B	-	-	Lock/Unlock Main Knob
MEM	Short	Switch VFO	-	Selected memory to VFO	Change selected memory operating mode	Change memory display frequency/label	Enter settings menu
	Long	Switch to VFO mode	Enter delete memory menu	-	-	-	Lock/Unlock Main Knob

6.5 Settings Menu List

The following table describes the FDM-DUOr settings menu list. To enter the settings menu mode, press the MENU F5 key. Use E2 to select the menu, then apply a short pressure on E2 to display the current menu setting, if you want to change the setting use the E2 knob and confirm the setting with a short pressure on E2. In some menu you can also use the main knob to change the setting more quickly. To turn back or exit the menu just press MENU F5.

Menu	Title	Description	Available Settings	Default
1	RX ATT	Receiver input attenuation	OFF or ON	OFF
3	SNAP	Round to step	OFF or ON	ON
4	AGC TH	AGC Threshold	From 0 to 10	4
6	AUX VOL	Auxiliary output volume	From 0 to 100	50
7	QUICKSTEP	Step selected for the "QuickStep" mode	1Hz, 5Hz, 10Hz, 25Hz, 50Hz, 100Hz, 250Hz, 500Hz, 1kHz, 2kHz, 3kHz, 4.5kHz, 5kHz, 7.5kHz, 9kHz, 10kHz, 12.5kHz, 25kHz, 50kHz, 100kHz, 125kHz, 250kHz, 500kHz, 1MHz	1kHz
8	CW MUTE	Set mute status during CW transmission	OFF or ON	OFF
9	xSB MUTE	Set mute status during AM or SSB transmission	OFF or ON	ON
60	FR OFFSET	Enable / Disable the frequency offset for the visualization	OFF or ON	OFF
61	OFS VALUE	Frequency offset value for the visualization	+/- 99.999999999 GHz. See *	0Hz
70	CAT BAUD	CAT serial port baud rate	9600, 38400, 57600, 115200	38400
71	HOLD TIME	Hold time to detect a long pressure	From 500 to 2500ms	1000ms
72	REPT TIME	Repetition time when a key is pressed	From 100 to 1500ms	600ms
80	SERVICE	Enable Service mode	ON or OFF	OFF
81	DEFAULT	Restore default parameters	YES or NO	NO
82	UI UPDATE	If Service mode is active, enable the firmware update mode	YES or NO	NO
83	VIEW SN	Display the FDM-DUOr serial number		
84	VIEW FW	Display the FDM-DUOr firmware versions	Firmware	UI
85	CLK ADJ	Sets the internal clock correction value. It is used to have a fine frequency setting. In case of "Ref In" utilization, this parameter is not relevant.	±50000 dots (not Hz)	-

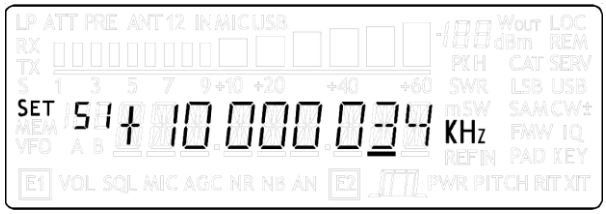
6.5.1 Frequency visualization offset menu

The frequency visualization offset is helpful when using a transverter. The Frequency offset set in digit by digit mode with some improvements to set a signed 10 digit offset in a 9 digit display.

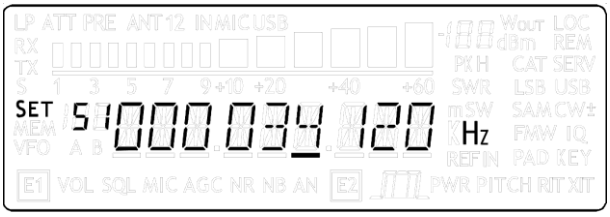
- E2: Select the digit to modify
- Main encoder: modify the selected digit value
- E1: change the visualization
  - kHz: the 8 most significant digit of the frequency offset are displayed
  - Hz: the 8 least significant digit of the frequency offset are displayed
- E1 or Main encoder short pressure: change the sign of the offset (+/-)
- E2 short pressure: save the setting

EXAMPLES:
Frequency offset value: +10,000,034,120 Hz

- kHz Display mode



- Hz Display mode



7 CAT Remote Control

7.1 Introduction

The FDM-DUOr receiver uses a full-duplex, asynchronous, USB serial interface for communicating through the USB CAT port. Each data is constructed with 1 start bit, 8 data bits, 1 stop bit, no parity is used (8N1). The baud rate is selectable in the [70] CAT BAUD menu. Available values are 9600, 38400, 57600, 115200 bps.
The FDM-DUO implements proprietary commands and also a subset of the Kenwood TS-480 command set. Some of those commands have a dummy implementation for compatibility issues with Ham Radio Deluxe.

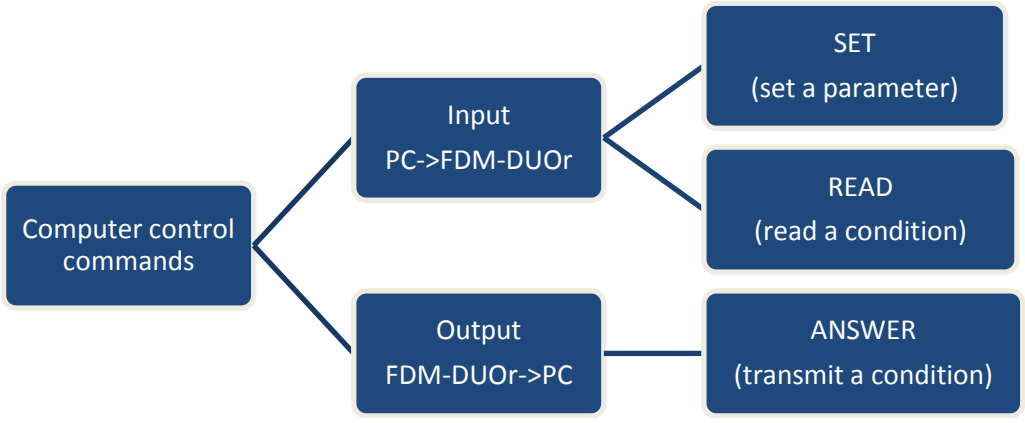
7.2 Computer control commands

A computer control command is composed of an alphabetical command, various parameters, and the terminator that signals the of the command.
For example to set the VFO-A to 14MHz the command is:

FA00014000000;

- "FA": alphabetical command
- "00014000000000": parameter
- ";": terminator

Computer control commands can be classified as shown below:



EXAMPLE

- To set the VFO-A to 14MHz the PC sends: "FA00014000000000;" **SET command**
- To read the VFO-A frequency the PC sends: "FA;" **READ command**
- When this command has been sent, the following message is returned to the PC: "FA00014000000000;" **ANSWER**

7.3 CAT Commands List

7.3.1 Active commands list

COMMAND	FUNCTION	SET	READ	ANS.
AT/RA	RF ATTENUATOR	YES	YES	YES
DT	DUO TYPE	-	YES	YES
FA	VFO-A FREQUENCY	YES	YES	YES
FB	VFO-B FREQUENCY	YES	YES	YES
FI	INTERNAL FILTER MODULES	YES	YES	YES
FR	VFO/MEM MODE	YES	YES	YES
GC	GAIN CONTROL	YES	YES	YES
GS	GAIN SETTINGS	YES	YES	YES
IF	INFORMATION	-	YES	YES
LB	LCD BACKLIGHT	YES	YES	YES
LP	LOW PASS	YES	YES	YES
MC	MEMORY CHANNEL	YES	YES	YES
MD	MODE	YES	YES	YES
MR	MEMORY READ	-	YES	YES
MT	MUTE IN TRANSMISSION	YES	YES	YES
MW	MEMORY WRITE	YES	-	-
NB	NOISE BLANKER STATUS	-	YES	YES
NC	NOISE REDUCTION	YES	YES	YES
NK	NOISE BLANKER	YES	YES	YES
NR	NOISE REDUCTION STATUS	-	YES	YES
OS	FVO STATE	YES	YES	YES
OV	FVO VALUE	YES	YES	YES
PI	PITCH	YES	YES	YES
RF	RECEPTION FILTERS	YES	YES	YES
SE	SERVICE	YES	YES	YES
SM	S METER	-	YES	YES
SN	SERIAL NUMBER	-	YES	YES
VA	AUX VOLUME	YES	YES	YES
VM	MAIN VOLUME	YES	YES	YES
VS	FIRMWARE VERSION	-	YES	YES

7.3.2 Active commands tables

AT	Reads or sets the input attenuator status										Parameters: P1 '0': 0dB '1': 10dB '2': 20dB '3': 30dB
Set	1	2	3	4	5	6	7	8	9	10	
	A	T	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	A	T	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	A	T	P1	;							

DT	Reads the FDM-DUO type										Parameters: P1 Always 002
Set											
Read	1	2	3	4	5	6	7	8	9	10	
	D	T	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	D	T	P1	P1	P1	;					

FA	Reads or sets the VFO A frequency *Set* not available during power transmission										Parameters: P1 Frequency in Hz (11 digit)
Set	1	2	3	4	5	6	7	8	9	10	
	F	A	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	P1	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	F	A	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	F	A	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	P1	P1	;							

FB	Reads or sets the VFO B frequency *Set* not available during power transmission										Parameters: P1 Frequency in Hz (11 digit)
Set	1	2	3	4	5	6	7	8	9	10	
	F	B	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	P1	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	F	B	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	F	B	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	P1	P1	;							

FI	Reads or sets the internal filter modules settings									
Set	1	2	3	4	5	6	7	8	9	10
	F	I	P1	P1	P2	P3	P3	P3	P3	P3
	11	12	13	14	15	16	17	18	19	20
	P3	P3	P3	P3	P3	P3	P4	P4	P4	P4
	21	22	23	24	25	26	27	28		
	P4	P4	P4	P4	P4	P4	P4	;		
Read	1	2	3	4	5	6	7	8	9	10
	F	I	P1	P1	;					
Answer	1	2	3	4	5	6	7	8	9	10
	F	I	P1	P1	P2	P3	P3	P3	P3	P3
	11	12	13	14	15	16	17	18	19	20
	P3	P3	P3	P3	P3	P3	P4	P4	P4	P4
	21	22	23	24	25	26	27	28		
	P4	P4	P4	P4	P4	P4	P4	;		

Parameters:
P1 module index, from '0' to '10'

P2 module state;
'0' not used
'1' used

P3 module low frequency

P4 module high frequency

FR	Reads or sets the VFO or M.CH mode *Set* not available during transmission									
Set	1	2	3	4	5	6	7	8	9	10
	F	R	P1	;						
Read	1	2	3	4	5	6	7	8	9	10
	F	R	;							
Answer	1	2	3	4	5	6	7	8	9	10
	F	R	P1	;						

Parameters:
P1
0: VFO-A
1: VFO-B
2: M.CH

GC	Reads or sets the active gain control									
Set	1	2	3	4	5	6	7	8	9	10
	G	C	P1	;						
Read	1	2	3	4	5	6	7	8	9	10
	G	C	;							
Answer	1	2	3	4	5	6	7	8	9	10
	G	C	P1	;						

Parameters:
P1
0: auto (AGC)
1: manual

GS	Reads or sets the control gain settings									
Set	1	2	3	4	5	6	7	8	9	10
	G	S	P1	P2	P2	P2	;			
Read	1	2	3	4	5	6	7	8	9	10
	G	S	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	G	S	P1	P2	P2	P2	;			

Parameters:
P1
0: auto (AGC)
1: manual

P2 for P1='0'
0 : slow
1 : medium
2 : fast

P2 for P1='1'
0 : OFF
1 a 10 : active

IF	Retrieves the transceiver status									
Set										
Read	1	2	3	4	5	6	7	8	9	10
	I	F	;							
Answer	1	2	3	4	5	6	7	8	9	10
	I	F	P1	P1	P1	P1	P1	P1	P1	P1
	11	12	13	14	15	16	17	18	19	20
	P1	P1	P1	P2	P2	P2	P2	P2	P3	P3
	21	22	23	24	25	26	27	28	29	30
	P3	P3	P3	P4	P5	P6	P7	P7	P8	P9
	31	32	33	34	35	36	37	38	39	40
	P10	P11	P12	P13	P14	P14	P15	;		

Parameters:
P1: Frequency 11 digit
P2: 5 spaces
P3: Always 0
P4: Always 0
P5: Always 0
P6/P7: Memory ch. Number 0-199
P8: 0:Rx 1:Tx
P9: Operating Mode (See MD)
P10: See FR
P11: Always 0
P12: Always 0
P13: Always 0
P14: Always 0
P15: Space

LB	Sets/Reads the LCD backlight parameters									
Set	1	2	3	4	5	6	7	8	9	10
	L	B	P1	P3	P3	P3	P4	P4	P4	P5
	11	12	13	14	15	16	17	18	19	20
	P5	P5	;							
Read	1	2	3	4	5	6	7	8	9	10
	L	B	P2	;						
Answer	1	2	3	4	5	6	7	8	9	10
	L	B	P2	P3	P3	P3	P4	P4	P4	P5
	11	12	13	14	15	16	17	18	19	20
	P5	P5	;							

Parameters:
P1 mode
0 : temporary set
1 : Rx Stand Alone
2 : Rx Remote (PC Controlled)
3 : Tx

P2 mode selection
1 : Rx Stand Alone
2 : Rx Remote (PC Controlled)
3 : Tx

P3 : RED component (0 to 100)
P4 : GREEN component (0 to 100)
P5 : BLUE component (0 to 100)

LP	Reads the Low-Pass Filter Status									
Read	1	2	3	4	5	6	7	8	9	10
	L	P	;							
Answer	1	2	3	4	5	6	7	8	9	10
	L	P	P1	;						

Parameters:
P1
0: not active
1: active

MC	Recalls or reads the Memory channel									
Set	1	2	3	4	5	6	7	8	9	10
	M	C	P1	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10
	M	C	;							
Answer	1	2	3	4	5	6	7	8	9	10
	M	C	P1	P2	P2	;				

Parameters:
P1: 0 or 1
P2: 00 to 99

MD	Recalls or reads the operating mode status									
Set	1	2	3	4	5	6	7	8	9	10
	M	D	P1	;						
Read	1	2	3	4	5	6	7	8	9	10
	M	D	;							
Answer	1	2	3	4	5	6	7	8	9	10
	M	D	P1	;						

Parameters:
P1:
1: LSB
2: USB
3: CW
5: AM

MR	Reads the Memory channel data									
Set										
Read	1	2	3	4	5	6	7	8	9	10
	M	R	P1	P2	P3	P3				
Answer	1	2	3	4	5	6	7	8	9	10
	M	R	P1	P2	P3	P3	P4	P4	P4	P4
	11	12	13	14	15	16	17	18	19	20
	P4	P4	P4	P4	P4	P4	P4	P5	P6	P7
	21	22	23	24	25	26	27	28	29	30
	P8	P8	P9	P9	P10	P10	P10	P10	P10	P10
	31	32	33	34	35	36	37	38	39	40
	P10	P10	P10	P10	P10	P10	P10	P10	P11	P12
	41	42	43	44	45	46	47	48	49	50
	P15	P16	P16	P16	P16	P16	P16	P16	P16	;

Parameters:
P1: 0
P2/3: 000 to 199 Memory No.
P4: Frequency (11 digit)
P5: Mode (see MD command)
P6: Always 0
P7: Always 0
P8: Always 0
P9: Always 0
P10 to P13: Memory label, last 14 chars
P14: 00
P15: Memory status
B: used
F: free
P16: Memory label, first 8 chars

MT	Reads or sets the mutes status during transmission *Set* not available during transmission									
Set	1	2	3	4	5	6	7	8	9	10
	M	T	P1	P2	;					
Read	1	2	3	4	5	6	7	8	9	10
	M	T	;							
Answer	1	2	3	4	5	6	7	8	9	10
	M	T	P1	P2	;					

Parameters:
P1 CW MUTE
0: not active
1: active

P2 SSB MUTE
0: not active
1: active

MW	Store the data to the Memory channel									
Set	1	2	3	4	5	6	7	8	9	10
	M	W	P1	P2	P3	P3	P4	P4	P4	P4
	11	12	13	14	15	16	17	18	19	20
	P4	P4	P4	P4	P4	P4	P4	P5	P6	P7
	21	22	23	24	25	26	27	28	29	30
	P8	P8	P9	P6	P10	P10	P10	P10	P10	P10
	31	32	33	34	35	36	37	38	39	40
	P10	P10	P10	P10	P10	P10	P10	P10	P11	P12
	41	42	43	44	45	46	47	48	49	50
	P15	P16	P16	P16	P16	P16	P16	P16	P16	;
Read										
Answer										

Parameters:
P1:0
P2/3: 000 to 199 Memory No.
P4: Frequency (11 digit)
P5: Mode (see MD command)
P6: Always 0
P7: Always 0
P8: Always 0
P9: Always 0
P10 to P13: Memory label, last 14 chars
P14: 00
P15: Memory status
B: used
F: free
P16: Memory label, first 8 chars

NB	Reads the noise blanker function status									
Set										
Read	1	2	3	4	5	6	7	8	9	10
	N	B	;							
Answer	1	2	3	4	5	6	7	8	9	10
	N	B	P1	;						

Parameters:
P1
0: Noise Blanker OFF
1: Noise Blanker ON

NC	Reads or sets the noise reduction value									
Set	1	2	3	4	5	6	7	8	9	10
	N	C	P1	P2	P2	P2	;			
Read	1	2	3	4	5	6	7	8	9	10
	N	C	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	N	C	P1	P2	P2	P2	;			

Parameters:
P1 always 0

P2 noise reduction value
0: OFF
01 ~ 10 (active)

NK	Reads or sets the noise blanker value									
Set	1	2	3	4	5	6	7	8	9	10
	N	K	P1	P2	P2	P2	;			
Read	1	2	3	4	5	6	7	8	9	10
	N	K	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	N	K	P1	P2	P2	P2	;			

Parameters:
P1 always 0

P2 noise blanker value
0: OFF
01 ~ 10 (active)

NR	Reads the noise reduction function status									
Set										
Read	1	2	3	4	5	6	7	8	9	10
	N	R	;							
Answer	1	2	3	4	5	6	7	8	9	10
	N	R	P1	;						

Parameters:
P1
0: Noise Reduction OFF
1: Noise Reduction ON

OS	Sets/Reads the Frequency view offset status *Set* not available during transmission									
Set	1	2	3	4	5	6	7	8	9	10
	O	S	P1	;						
Read	1	2	3	4	5	6	7	8	9	10
	O	S	;							
Answer	1	2	3	4	5	6	7	8	9	10
	O	S	P1	;						

Parameters:
P1
0: not active
1: active

OV	Sets/Reads the Frequency view offset value *Set* not available during transmission									
Set	1	2	3	4	5	6	7	8	9	10
	O	V	P1	P2	P3	P3	P3	P3	P3	P3
	11	12	13	14	15	16	17	18	19	20
	P3	P3	P3	P3	P3	P3	P3	P3	P3	;
Read	1	2	3	4	5	6	7	8	9	10
	O	V	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	O	V	P1	P2	P3	P3	P3	P3	P3	P3
	11	12	13	14	15	16	17	18	19	20
	P3	P3	P3	P3	P3	P3	P3	P3	P3	;

Parameters:
P1
Always '0'
P2
Offset sign'+' /'-'
P3
Absolute value in Hz

PI	Reads or sets the pitch value									
Set	1	2	3	4	5	6	7	8	9	10
	P	I	P1	P1	P1	P1	;			
Read	1	2	3	4	5	6	7	8	9	10
	P	I	;							
Answer	1	2	3	4	5	6	7	8	9	10
	P	I	P1	P1	P1	P1	;			

Parameters:
P1 pitch value in Hz
0000 ~ 1000 in 10Hz step

RA	Reads or sets the attenuator function status									
Set	1	2	3	4	5	6	7	8	9	10
	R	A	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10
	R	A	;							
Answer	1	2	3	4	5	6	7	8	9	10
	R	A	P1	P1	P2	P2	;			

Parameters:
P1
00: ATT OFF
01: ATT ON (20dB)
P2: always 00

RF	Reads or sets the reception filters values									
Set	1	2	3	4	5	6	7	8	9	10
	R	F	P1	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10
	R	F	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	R	F	P1	P2	P2	;				

Parameters:
P1 (like MD command)
1: LSB
2: USB
3: CW
5: AM

P2: see parameter details section

SE	Reads or sets the service mode status *Set* not available during transmission									
Set	1	2	3	4	5	6	7	8	9	10
	S	E	P1	;						
Read	1	2	3	4	5	6	7	8	9	10
	S	E	;							
Answer	1	2	3	4	5	6	7	8	9	10
	S	E	P2	;						

Parameters:
P1 always '1'. Force the service mode

P2 always '0'. If in service mode this CAT protocol is not available

SM	Reads the S-meter status									
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	S	M	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	S	M	P1	P2	P2	P2	P2	;		

Parameters:
P1: Always 0
P2: Meter Read
0000: S0
0002: S1
0003: S2
0004: S3
0005: S4
0006: S5
0008: S6
0009: S7
0010: S8
0011: S9
0012: S9+10
0014: S9+20
0016: S9+30
0018: S9+40
0020: S9+50
0022: S9+60

SN	Reads the receiver serial number									
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	S	N	;							
Answer	1	2	3	4	5	6	7	8	9	10
	S	N	P1	P1	P1	P1	P1	P1	P1	P1
	11	12	13	14	15	16	17	18	19	20
	P1	P1	P1	P2	P2	P2	;			

Parameters:
P1
Serial number

VA	Reads or sets the auxiliary volume										Parameters: P1 000 ~ 100
Set	1	2	3	4	5	6	7	8	9	10	
	V	A	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	V	A	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	V	A	P1	P1	P1	;					

VM	Reads or sets the main volume										Parameters: P1 000 ~ 005 010 ~ 100 in 5 dots step
Set	1	2	3	4	5	6	7	8	9	10	
	V	M	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	V	M	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	V	M	P1	P1	P1	;					

VS	Reads the FDM-DUO firmware versions.										Parameters: P1 firmware version to read I: User Interface F: FPGA U: USB audio R: Rx Demodulator P2 firmware version “xx.yy”
Set											
Read	1	2	3	4	5	6	7	8	9	10	
	V	S	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	V	S	P1	P2	P2	P2	P2	P2	;		

7.3.3 Parameters details

7.3.3.1 RF command – P2 parameter

P2	MODE		
	LSB/USB	CW	AM
0	1600Hz	-	2500Hz
1	1700Hz	-	3000Hz
2	1800Hz	-	3500Hz
3	1900Hz	-	4000Hz
4	2000Hz	-	4500Hz
5	2100Hz	-	5000Hz
6	2200Hz	-	5500Hz
7	2300Hz	100Hz & 4	6000Hz
8	2400Hz	100Hz & 3	-
9	2500Hz	100Hz & 2	-
10	2600Hz	100Hz & 1	-
11	2700Hz	100Hz	-
12	2800Hz	300Hz	-
13	2900Hz	500Hz	-
14	3000Hz	1000Hz	-
15	3100Hz	1500Hz	-
16	4000Hz	2600Hz	-
17	5000Hz	-	-
18	6000Hz	-	-

7.3.4 Dummy commands tables

The following commands have a dummy implementation.

AC	Sets or reads the internal antenna tuner status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00 P2: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	A	C	;							
Answer	1	2	3	4	5	6	7	8	9	10
	A	C	P1	P1	P2	;				

AG	Sets or reads the AF gain ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0 P2: Always 000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	A	G	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	A	G	P1	P2	P2	P2 ;				

AI	Sets or reads the Auto Information (AI) function ON/ OFF ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	A	I	P1	;						
Answer	1	2	3	4	5	6	7	8	9	10
	A	I	P1	;						

AN	Selects the antenna connector ANT1/ ANT2 ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 1
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	A	N	;							
Answer	1	2	3	4	5	6	7	8	9	10
	A	N	P1	;						

BC	Sets or reads the Beat Canceller function status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	B	C	;							
Answer	1	2	3	4	5	6	7	8	9	10
	B	C	P1	;						

BY	Reads the busy signal status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0 P2: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	B	Y	;							
Answer	1	2	3	4	5	6	7	8	9	10
	B	Y	P1	P2	;					

CA	Sets and reads the CW Auto Zero-beat function status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	C	A	;							
Answer	1	2	3	4	5	6	7	8	9	10
	C	A	P1	;						

CN	Sets and reads the CTCSS tone number ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	C	N	;							
Answer	1	2	3	4	5	6	7	8	9	10
	C	A	P1	P1	;					

CT	Sets and reads the CTCSS function status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	C	T	;							
Answer	1	2	3	4	5	6	7	8	9	10
	C	T	P1	;						

DL	Sets and reads the Digital Noise Limiter (DNL) function status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0 P2: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	D	L	;							
Answer	1	2	3	4	5	6	7	8	9	10
	D	L	P1	P2	P2	;				

EX	Sets or reads the Extension Menu ***DUMMY IMPLEMENTATION***									Parameters: P1: 000 - 060: Menu No. P2: Always 00 P3: Always 0 P4: Always 0 P5: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	E	X	P1	P1	P1	P2	P2	P3	P4	;
Answer	1	2	3	4	5	6	7	8	9	10
	E	X	P1	P1	P1	P2	P2	P3	P4	P5
	11	12	13	14	15	16	17	18	19	20
	P5	;								

FS	Selects or reads the Fine Tuning function status ***DUMMY IMPLEMENTATION***									Parameters: P1 Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	F	S	;							
Answer	1	2	3	4	5	6	7	8	9	10
	F	S	P1	;						

FW	Selects or reads the DSP filtering bandwidth ***DUMMY IMPLEMENTATION***									Parameters: P1 Always 0000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	F	W	;							
Answer	1	2	3	4	5	6	7	8	9	10
	F	W	P1	P1	P1	P1	;			

GT	Selects or reads the AGC constant status ***DUMMY IMPLEMENTATION***									Parameters: P1 Always 000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	G	T	;							
Answer	1	2	3	4	5	6	7	8	9	10
	G	T	P1	P1	P1	;				

ID	Reads the transceiver ID number ***DUMMY IMPLEMENTATION***									Parameters: P1: 020
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	I	D	;							
Answer	1	2	3	4	5	6	7	8	9	10
	I	D	P1	P1	P1	;				

IS	Sets and reads the IF SHIFT function status ***DUMMY IMPLEMENTATION***									Parameters: P1: "+" P2: Always 0000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	I	S	;							
Answer	1	2	3	4	5	6	7	8	9	10
	I	S	P1	P2	P2	P2	P2	;		

KS	Sets and reads the CW electric keyer's keying speed ***DUMMY IMPLEMENTATION***									Parameters: P1: 010
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	K	S	;							
Answer	1	2	3	4	5	6	7	8	9	10
	K	S	P1	P1	P1	;				

MF	Sets or reads Menu A or B ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	M	F	;							
Answer	1	2	3	4	5	6	7	8	9	10
	M	F	P1	;						

MG	Sets or reads the Microphone gain status ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 000
Set	1	2	3	4	5	6	7	8	9	10	
Read	1	2	3	4	5	6	7	8	9	10	
	M	**G**	**;**								
Answer	1	2	3	4	5	6	7	8	9	10	
	M	**G**	**P1**	**P1**	**P1**	**;**					

NL	Set or reads the NB (Noise Blanker) level ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 000
Set	1	2	3	4	5	6	7	8	9	10	
Read	1	2	3	4	5	6	7	8	9	10	
	N	**L**	**;**								
Answer	1	2	3	4	5	6	7	8	9	10	
	N	**L**	**P1**	**P1**	**P1**	**;**					

PA	Sets or reads the pre-amplifier function status ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 0 P2: Always 0
Set	1	2	3	4	5	6	7	8	9	10	
Read	1	2	3	4	5	6	7	8	9	10	
	P	**A**	**;**								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	**A**	**P1**	**P2**	**;**						

PC	Sets or reads the output power ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 005
Set	1	2	3	4	5	6	7	8	9	10	
Read	1	2	3	4	5	6	7	8	9	10	
	P	**C**	**;**								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	**C**	**P1**	**P1**	**P1**	**;**					

PR	Sets or reads the Speech Processor function ON/ OFF ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10	
Read	1	2	3	4	5	6	7	8	9	10	
	P	**R**	**;**								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	**R**	**P1**	**;**							

PS	Sets or reads the Power ON/ OFF status ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 1
Set	1	2	3	4	5	6	7	8	9	10	
Read	1	2	3	4	5	6	7	8	9	10	
	P	**S**	**;**								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	**S**	**P1**	**;**							

QR	Sets or reads the Quick Memory channel data ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0 P2: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	Q	R	;							
Answer	1	2	3	4	5	6	7	8	9	10
	Q	R	P1	P2	;					

RA	Sets or reads the Attenuator function status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00 P2: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	R	A	;							
Answer	1	2	3	4	5	6	7	8	9	10
	R	A	P1	P1	P2	P2	;			

RG	Sets or read the RF gain status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	R	G	;							
Answer	1	2	3	4	5	6	7	8	9	10
	R	G	P1	P1	P1	;				

RL	Sets or reads the Noise Reduction level ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	R	L	;							
Answer	1	2	3	4	5	6	7	8	9	10
	R	L	P1	P1	;					

RM	Sets or reads the Meter function ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 1 P2: Always 0001
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	R	M	;							
Answer	1	2	3	4	5	6	7	8	9	10
	R	M	P1	P2	P2	P2	P2	;		

SD	Sets or reads the CW Break-in time delay ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	S	D	;							
Answer	1	2	3	4	5	6	7	8	9	10
	S	D	P1	P1	P1	P1	;			

SH	Sets or reads the DSP filter settings ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	S	**H**	**;**							
Answer	1	2	3	4	5	6	7	8	9	10
	S	**H**	**P1**	**P1**	**;**					

SL	Sets or reads the DSP filter settings ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	S	**H**	**;**							
Answer	1	2	3	4	5	6	7	8	9	10
	S	**H**	**P1**	**P1**	**;**					

SQ	Sets and reads the squelch level ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0 P2: Always 000
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	S	**Q**	**P1**	**;**						
Answer	1	2	3	4	5	6	7	8	9	10
	S	**Q**	**P1**	**P2**	**P2**	**P2**	**;**			

TN	Sets or reads the Tone frequency number ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 00
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	T	**N**	**;**							
Answer	1	2	3	4	5	6	7	8	9	10
	T	**N**	**P1**	**P1**	**;**					

TO	Sets or reads the Tone function ON/ OFF ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	T	**O**	**;**							
Answer	1	2	3	4	5	6	7	8	9	10
	T	**O**	**P1**	**;**						

TS	Sets or reads the TF-SET function status ***DUMMY IMPLEMENTATION***									Parameters: P1: Always 0
Set	1	2	3	4	5	6	7	8	9	10
Read	1	2	3	4	5	6	7	8	9	10
	T	**S**	**;**							
Answer	1	2	3	4	5	6	7	8	9	10
	T	**S**	**P1**	**;**						

VD	Sets or reads the VOX delay time ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 0000
Set	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
Read	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
	V	**D**	**;**								
Answer	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
	V	**D**	**P1**	**P1**	**P1**	**P1**	**;**				

VG	Sets or reads the VOX GAIN ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 000
Set	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
Read	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
	V	**G**	**;**								
Answer	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
	V	**G**	**P1**	**P1**	**P1**	**;**					

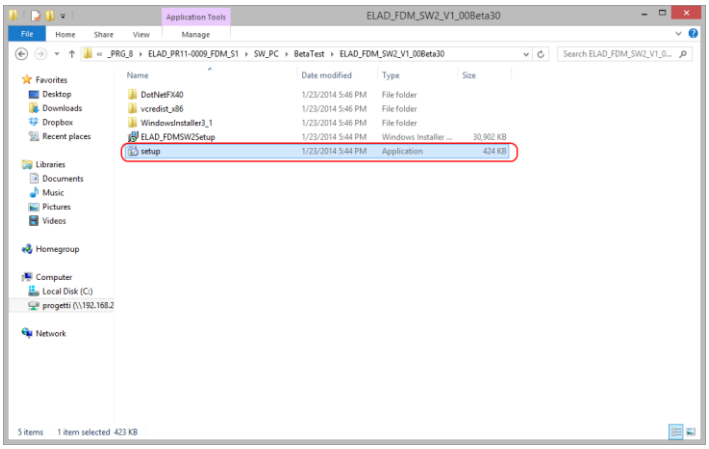
VX	Sets or reads the VOX function status ***DUMMY IMPLEMENTATION***										Parameters: P1: Always 0
Set	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
Read	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
	V	**X**	**;**								
Answer	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	
	V	**X**	**P1**	**;**							

8 Software & Driver Installation

8.1 Software installation

8.1.1 First-time install in Windows 8 and Windows 7

Double-click the file “setup.exe” in the CD .

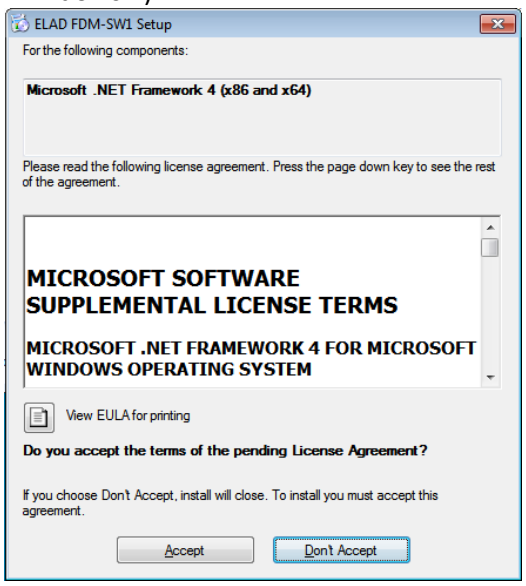


The windows installer first installs the prerequisites:

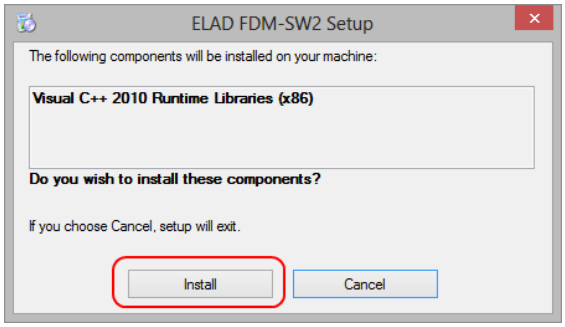
- Microsoft VC++ 2010 Runtime libraries
- Microsoft .NET Framework 4.0 (Only for Windows 7)

and then the FDM-SW2 software.

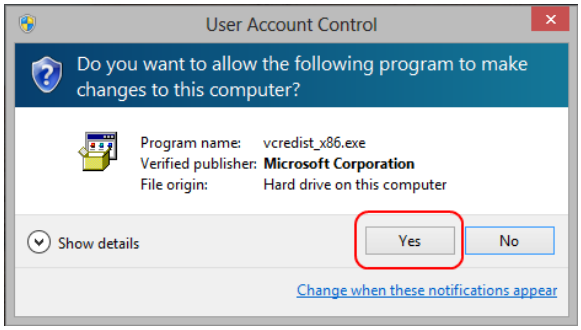
- Click on “Accept” (Only for Windows 7)



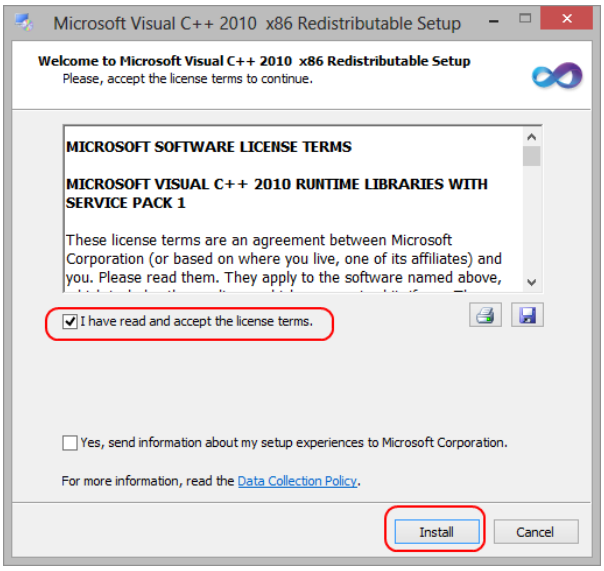
Click on “Install”



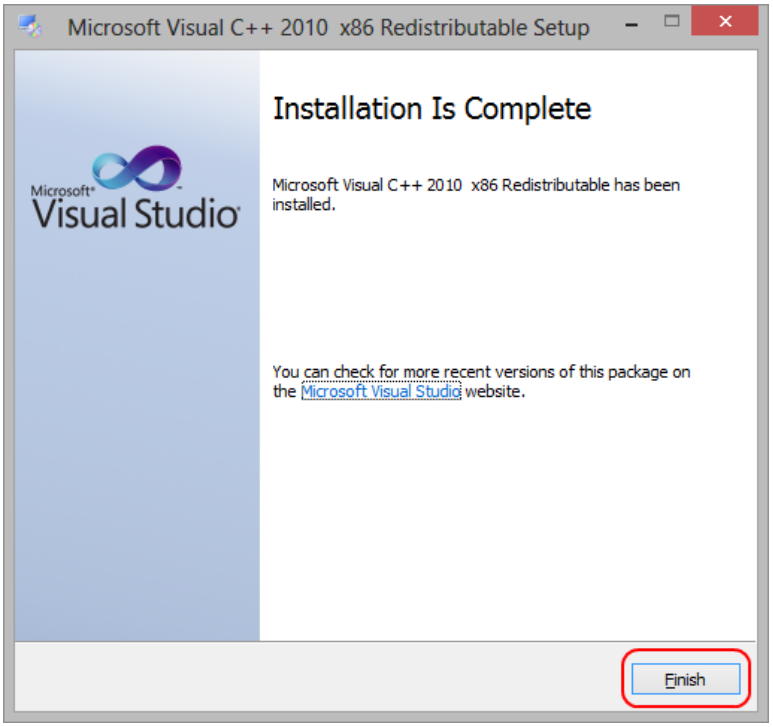
Click on “Yes”



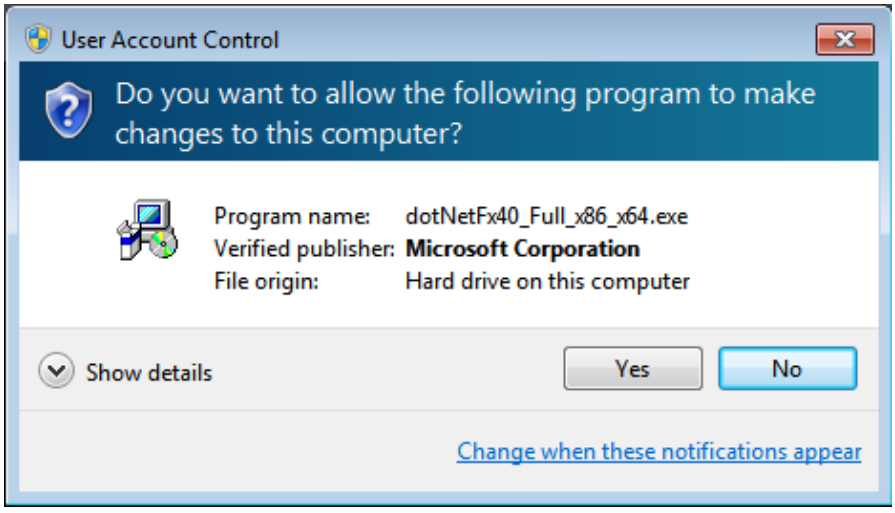
Click on Install



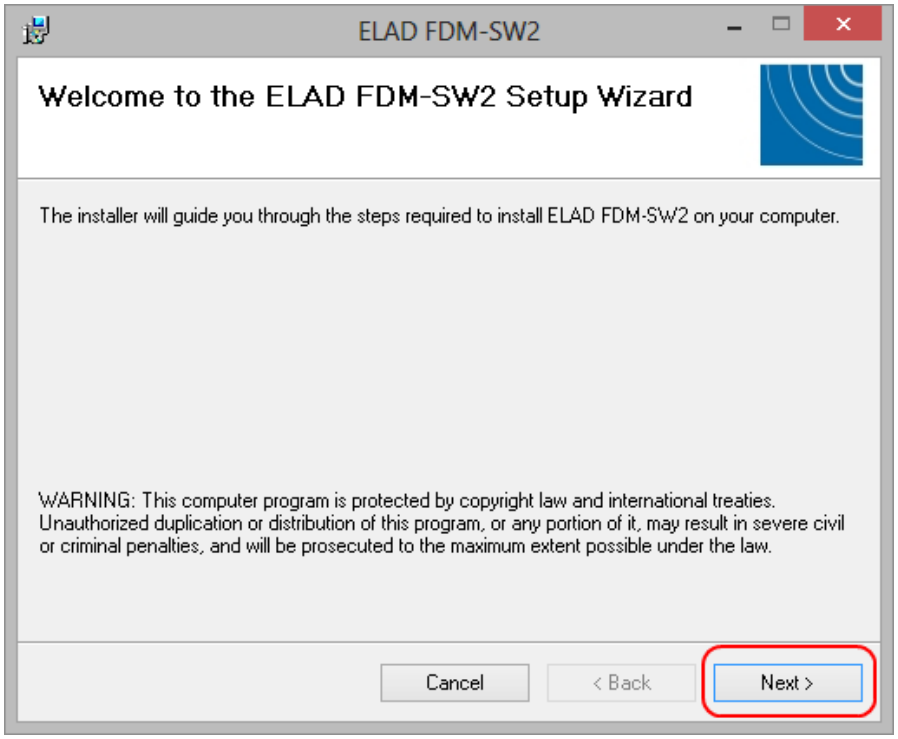
Microsoft Visual C++ 2010 x86 Redistributable installation is complete, click on “Finish”



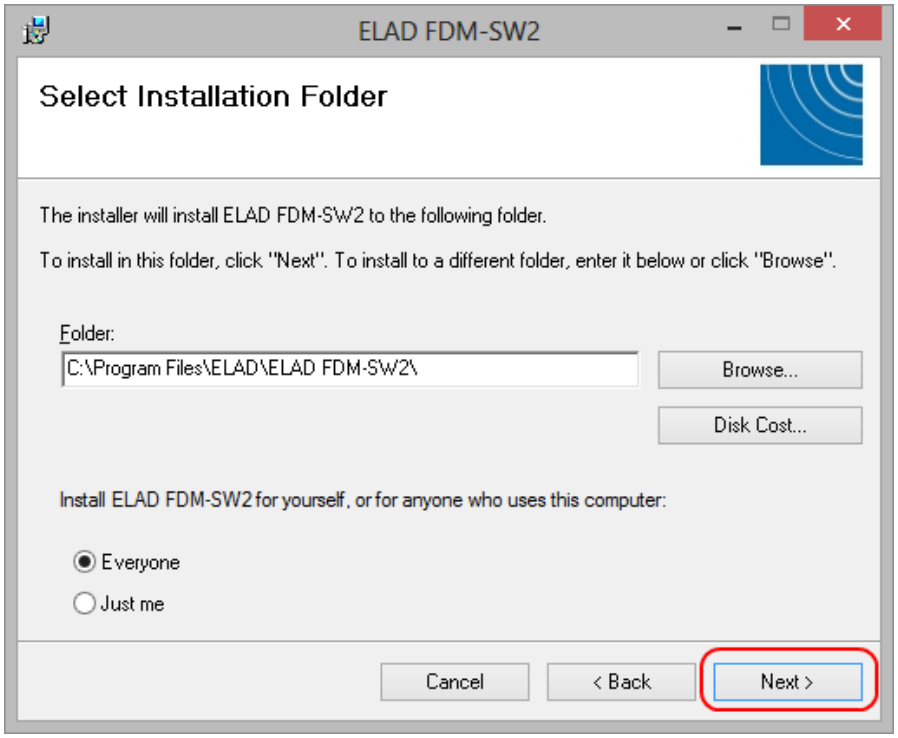
Click on “Yes” to start the installation of the .Net Framework 4.0 (Only for Windows 7)



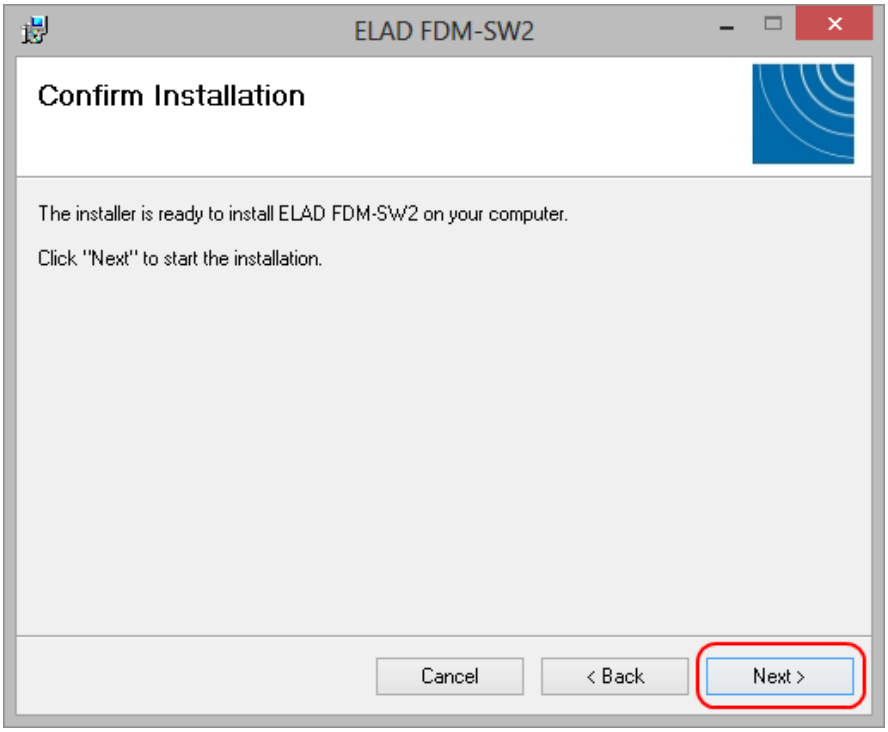
Click to “Next” to start the FDM-SW2 software installation



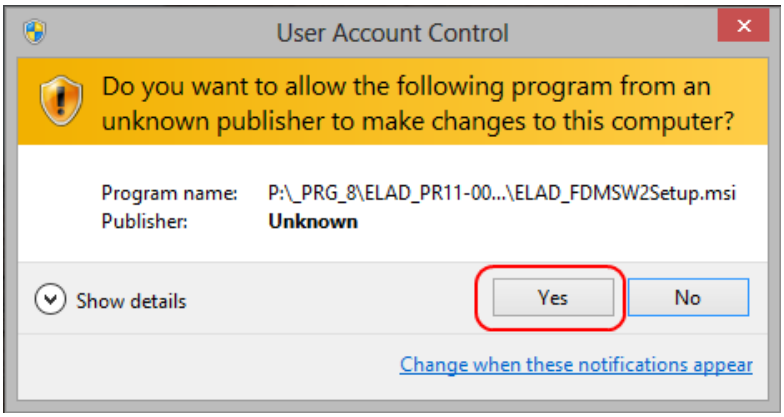
Chose the installation folder, then click on “Next”



Click on “Next”

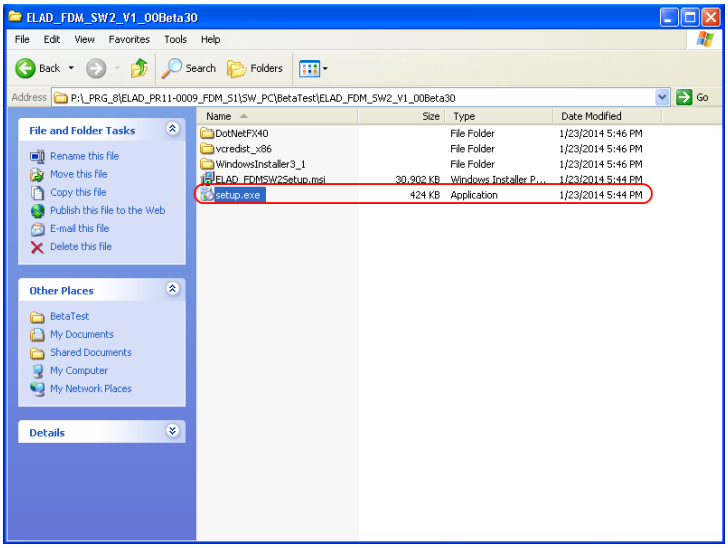


Click on “Yes”

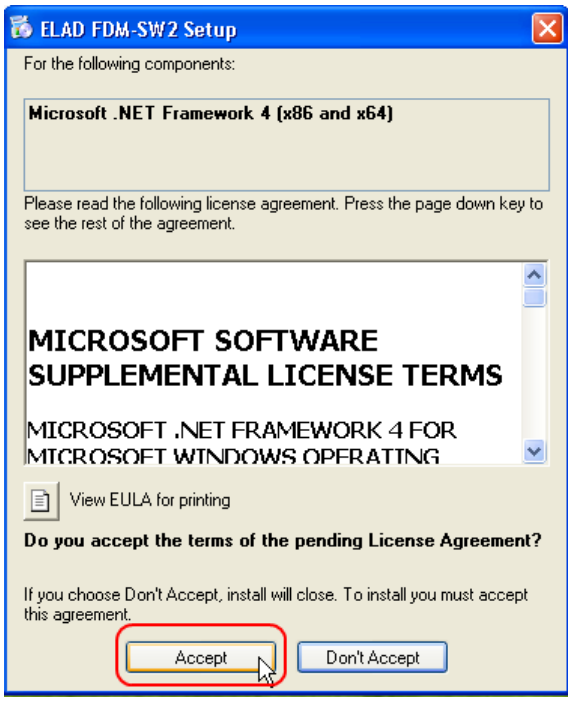


8.1.2 First-time install in Windows XP

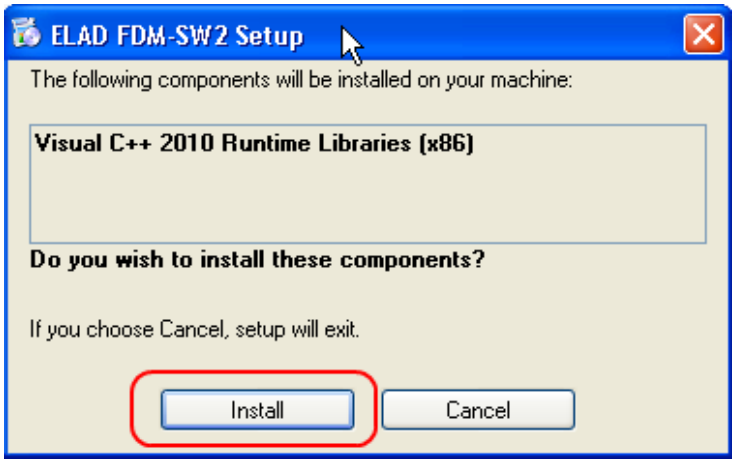
Double-click the file “setup.exe” in the installation folder.



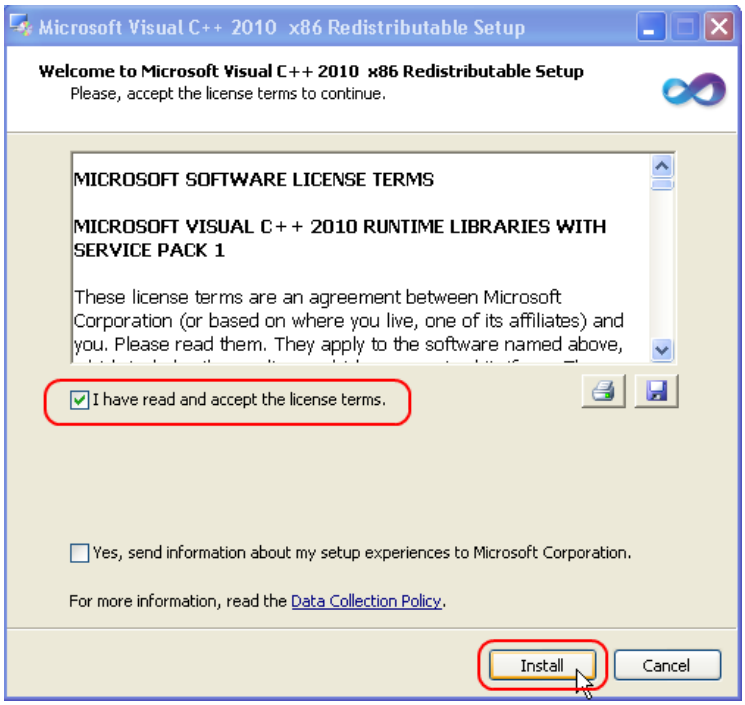
Click on “Accept”



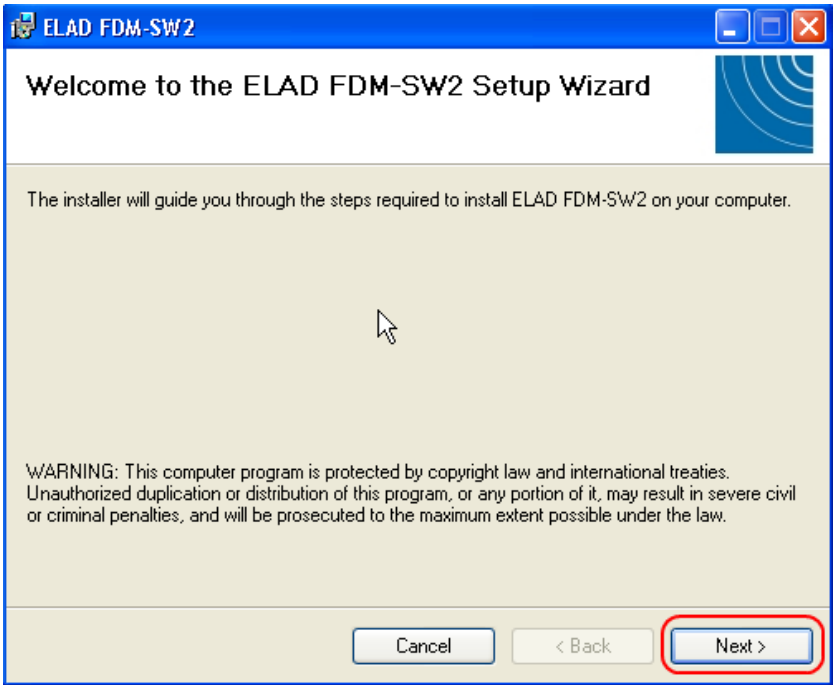
Click on “Install”



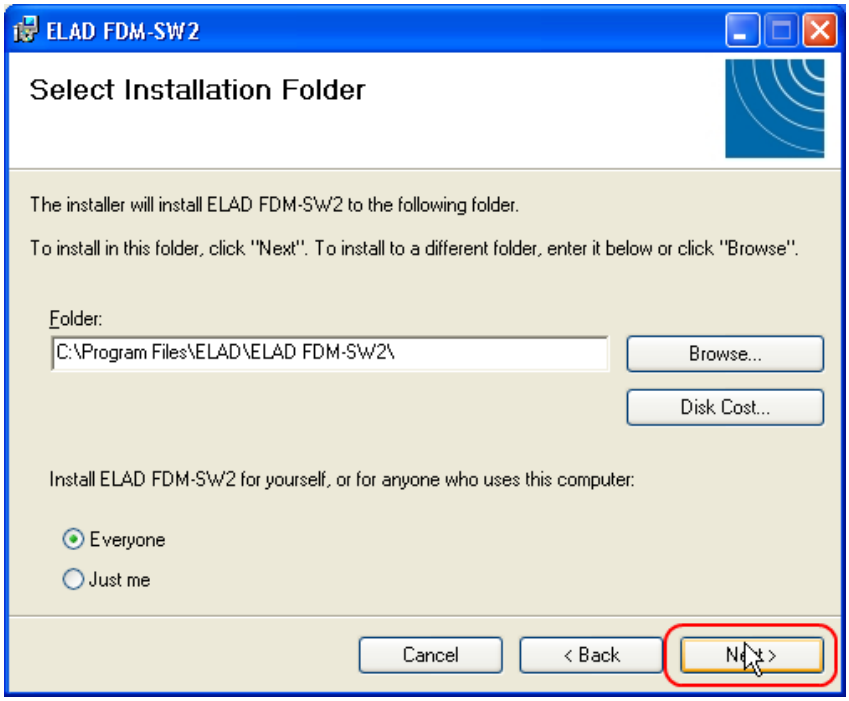
Click on “Install”



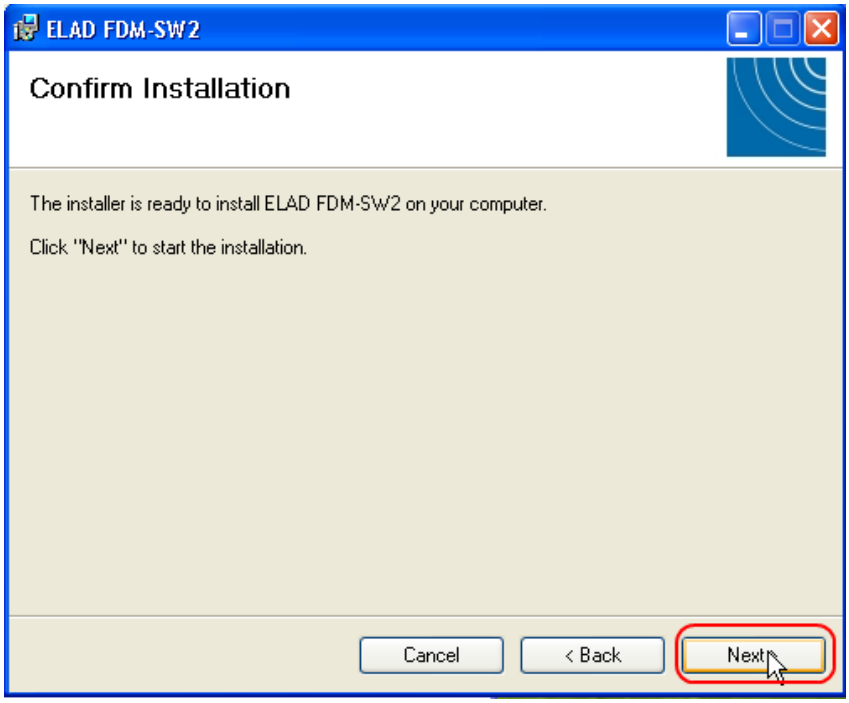
Click on Next to install the FDM-SW2 software



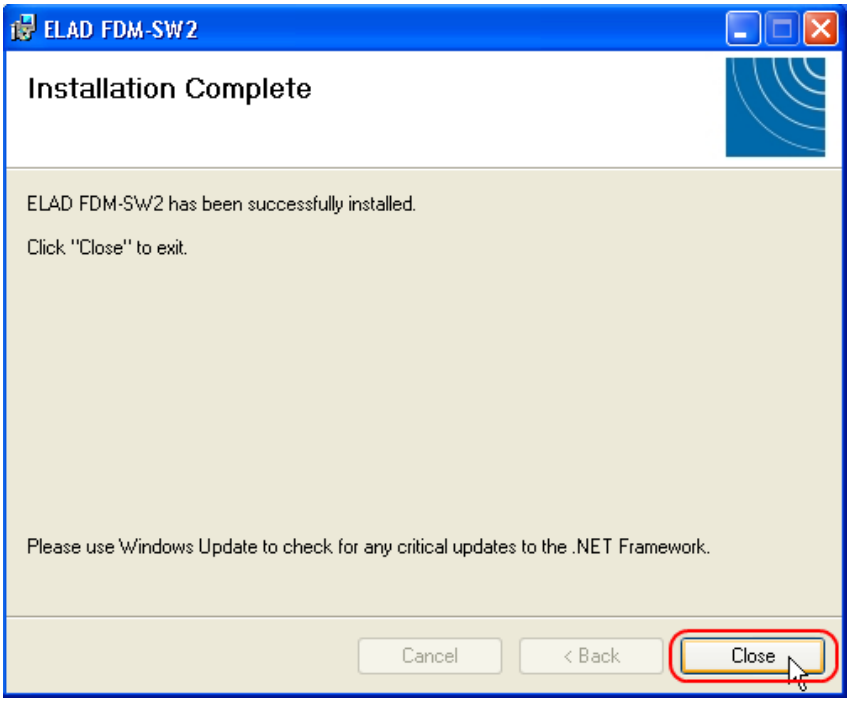
Select the installation folder, then click on “Next”



Click on “Next”



The FDM-SW2 Software installation is completed



8.1.3 Update an existing software version

Double click on file ELAD_FDM_SW2_V_x.xx.msi included in the update and follow the instructions.

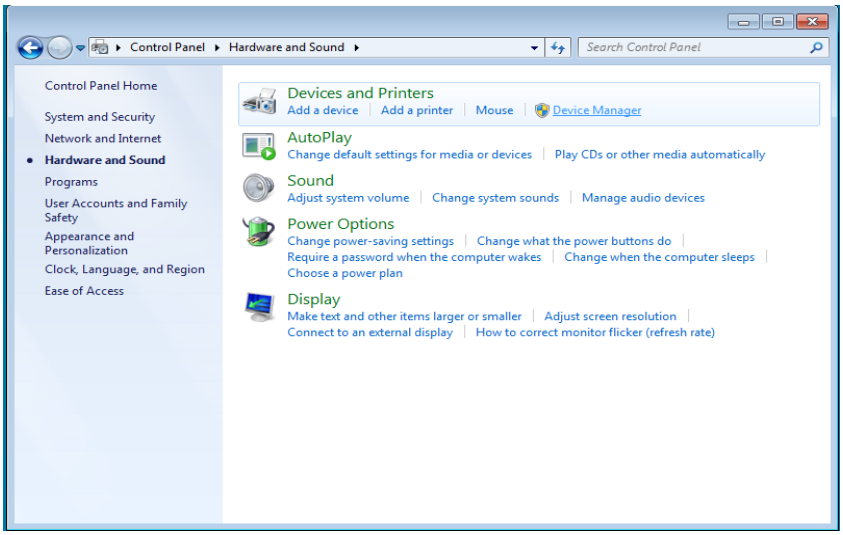
8.2 USB driver

8.2.1 USB driver installation in Windows 8 and Windows 7

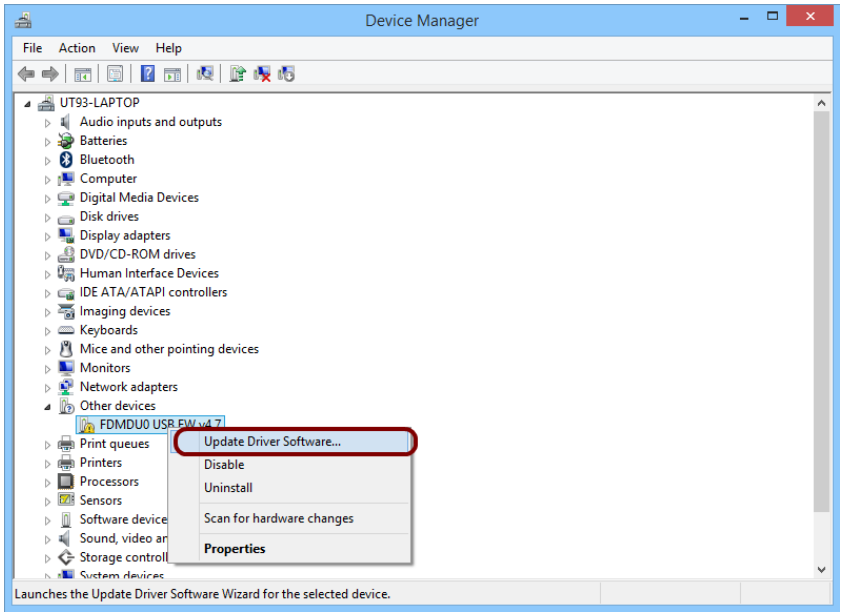
8.2.1.1 *First driver installation*

To install ELAD FDM-DUOr driver, connect the FDM-DUOr USB RX port to a USB 2.0 socket on PC end power on the device. When Windows detects the new hardware, follow the steps listed below to install driver correctly:

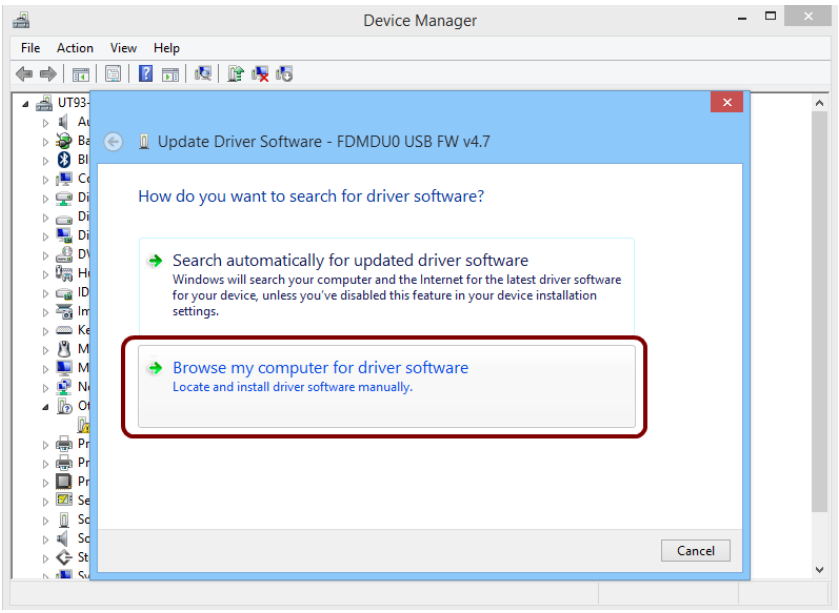
Open **Control Panel** from **Start** menu, select "System" and "Device Manager". Expand "Other Devices" node: FDM-DUO.



Select FDM-DUO, right click on it and execute "Update driver software".



When Windows starts the installation procedure, select the option “Browse my computer for driver software**”** (the second option).

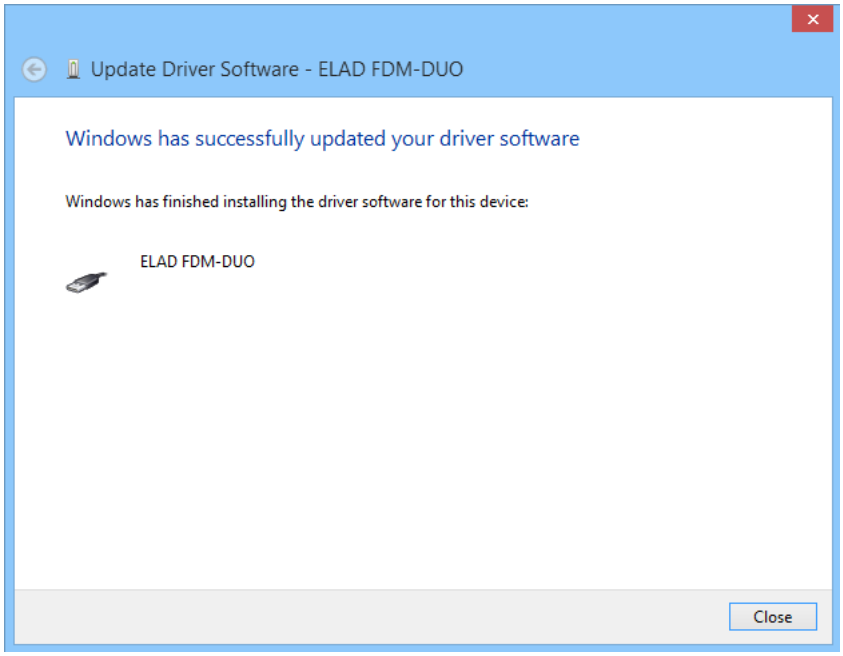


In the next dialog-box, insert the driver folder location using “Browse” button and check the option “Include subfolders”. In this way manual driver search is enabled

For 32 bit system select the folder: **C:\Program Files\ELAD\ELAD FDM-SW2\ELAD_FDM_Driver**
For 64 bit system select the folder: **C:\Program Files (x86)\ ELAD\ELAD FDM-SW2\ELAD_FDM_Driver**
Then click “Next”.

Click Install.

Let the hardware installation automatically completes and, at the procedure ending, click on “Close”; then disconnect and connect FDM-DUOr device on the same USB socket.



Now ELAD FDM-DUOr USB driver is installed on your PC.

8.2.2 USB driver installation in Windows XP

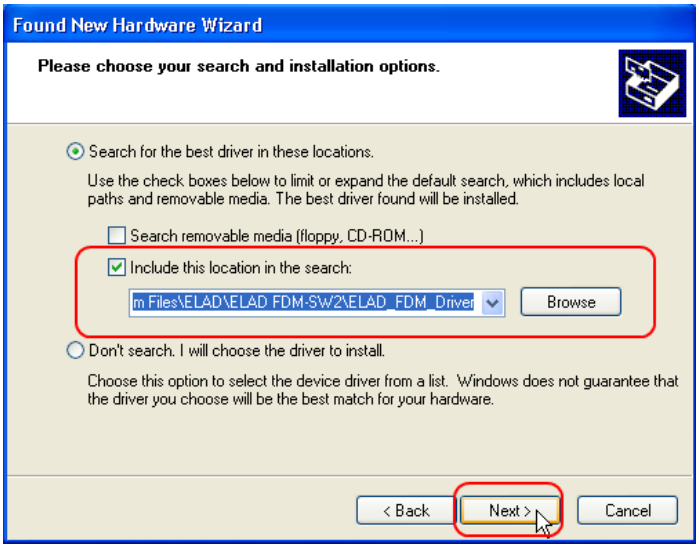
8.2.2.1 *First driver installation*

To install ELAD FDM-DUOr driver, connect the FDM-DUOr USB RX port to a USB 2.0 socket on PC and power on the device. Windows XP detects the new hardware and starts the hardware installation wizard. Then, next steps to install FDM-DUOr driver are listed below:

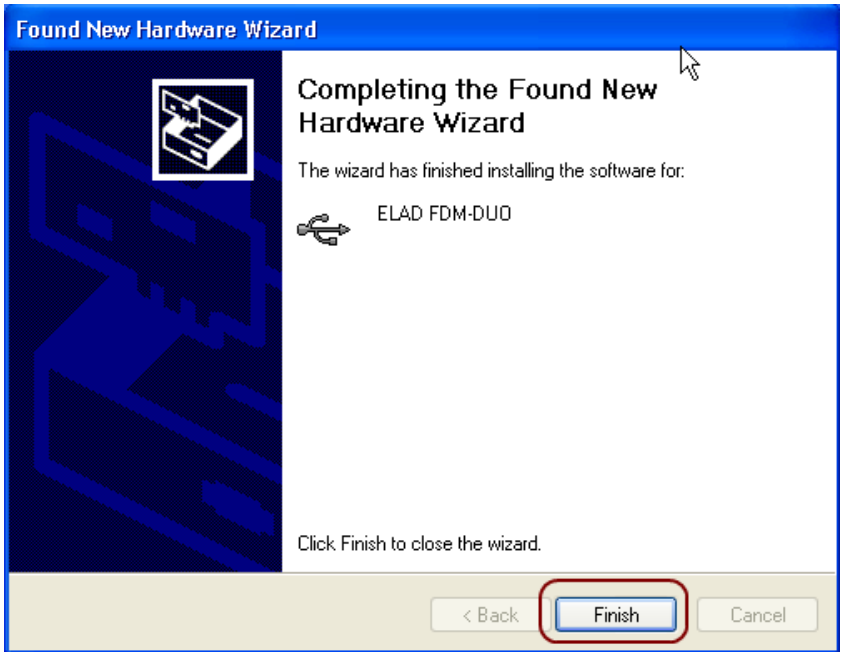
At the first dialog box, select the last option “No, not this time” and “Next”.

Select “Install from a list or specific location (Advanced)” and “Next”.

In the next dialog-box, check the options “Search for the best driver in these location” and “Include this location in the search” to enable manual driver search. Clicking on “Browse”, select the path where the driver folder is located: **Local Drive (C:) \Programs\ELAD\ELAD FDM-SW2\ELAD_FDM_Driver**. Then click “Next”.



Let the hardware installation automatically completes and click on “Finish”; then disconnect and connect FDM- DUOr device on the same USB socket.

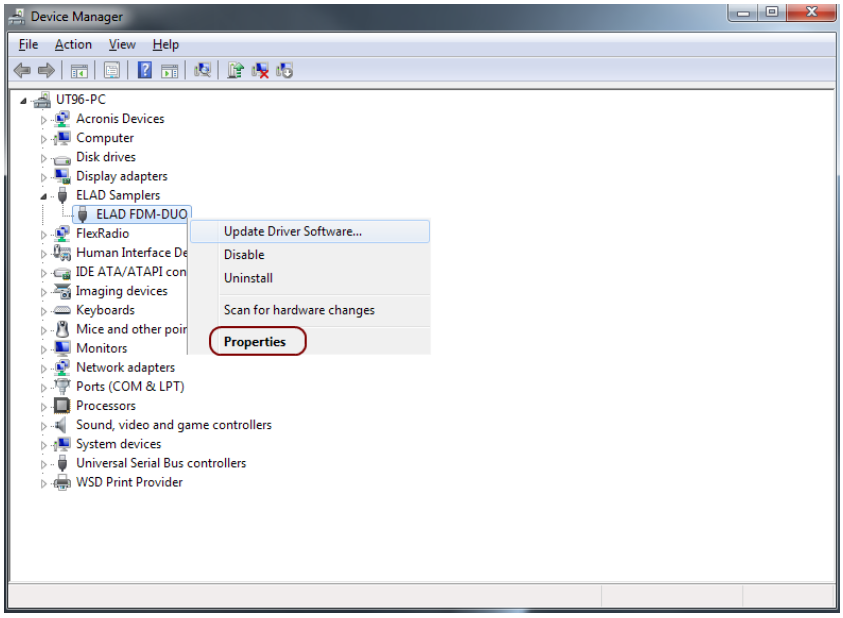


Now ELAD FDM- DUOr driver is installed on your PC.

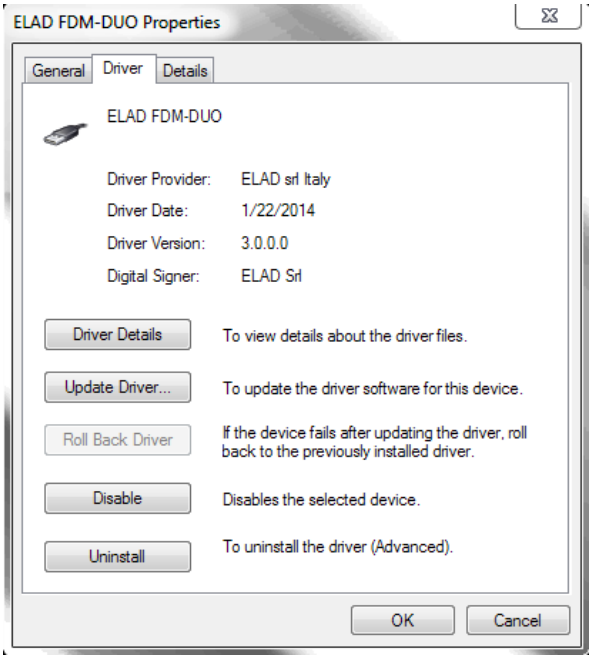
8.2.2.1 *Driver installation verify in Windows 8 and Windows 7*

To verify FDM-DUOr driver current version, connect the device to USB socket (where the device driver is already installed) and power on the device. Then open **Control Panel** from **Start** menu. Click on “System” and select “Device Manager”.

Expanding “ELAD Samplers” node, right click on “ELAD FDM-DUO” and select “Properties”.



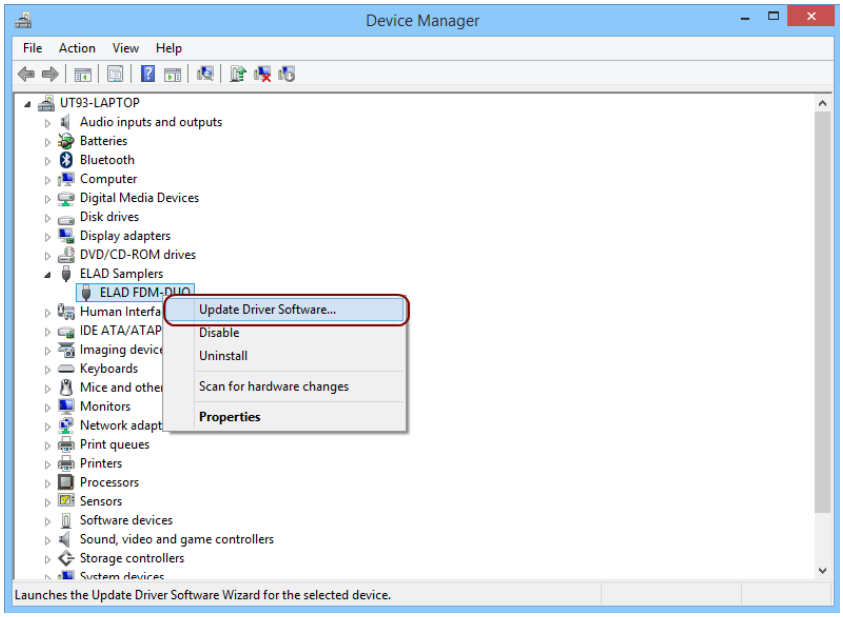
When dialog box opens, select “Driver” label: you must read provider name, current driver release date and current driver version. The figure shows an old FDM- DUOr driver version.



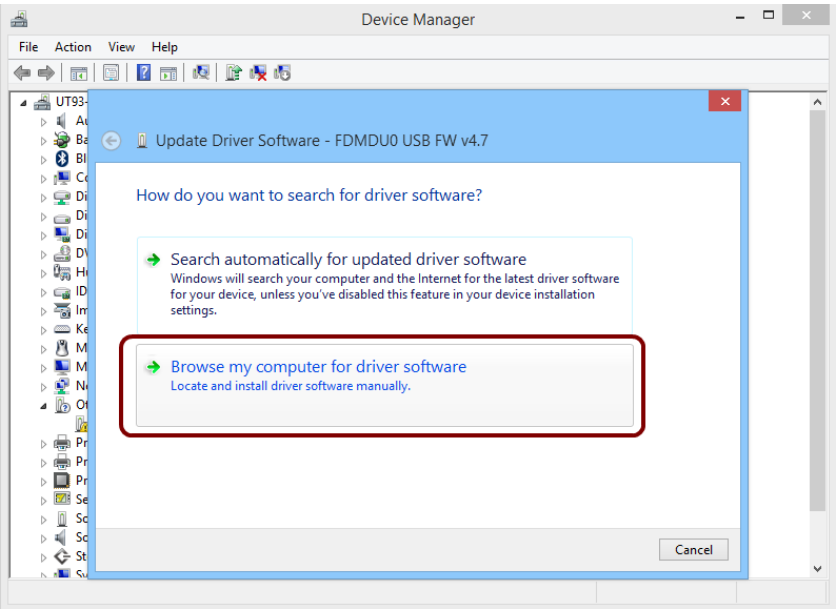
8.2.2.2 *Manual driver update*

To update FDM-DUOr driver, connect the device to USB RX socket (where the device driver is already installed) and power on the device. Then open **Control Panel** from **Start** menu. Click on “System” and select “Device Manager”.

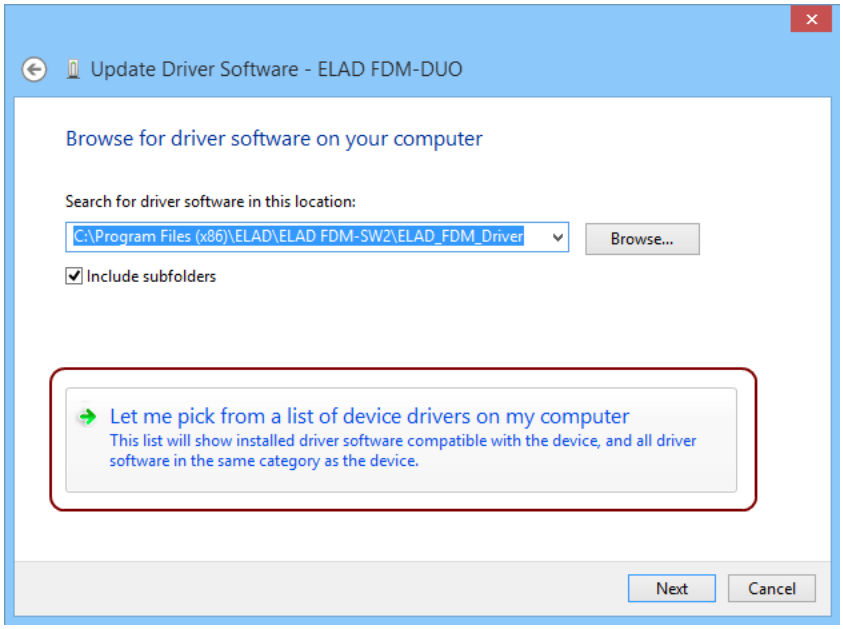
Under “ELAD samplers” list select “ELAD FDM-DUO”, right click on it and execute “Update driver”.



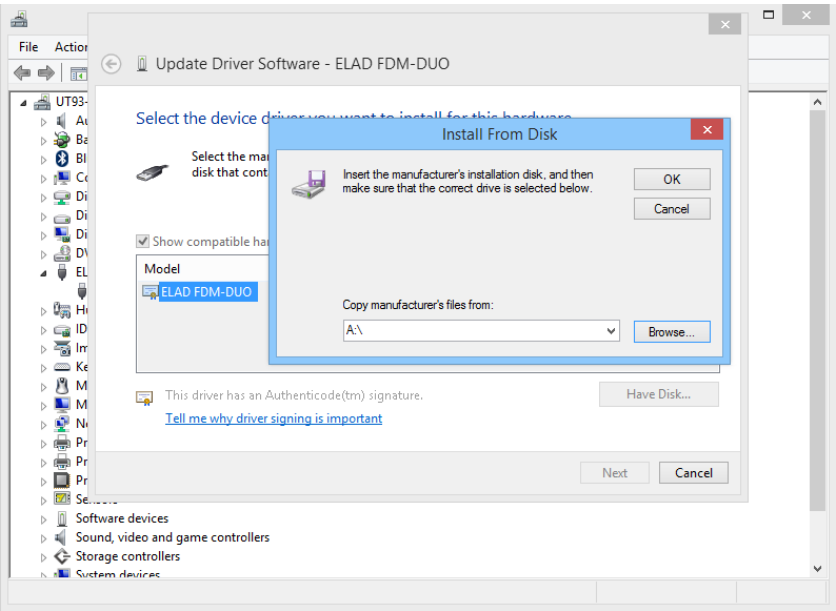
When Windows starts the installation procedure, select the last option “Browse my computer for driver software”.



In the next dialog-box, disable the option “Include subfolders” and choose “Let me pick from a list of device drivers on my computer”. Don’t click “Next”.

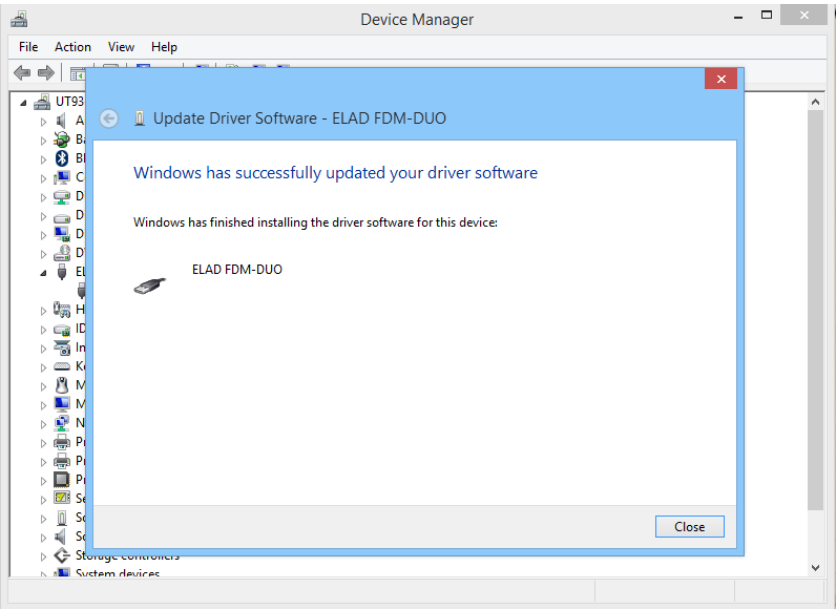


Verify that “Show compatible hardware” option is checked and ELAD FDM-DUO is selected: then click on **“**Have a Disk”. In this way the manual driver update is enabled. Don’t click “Next”.

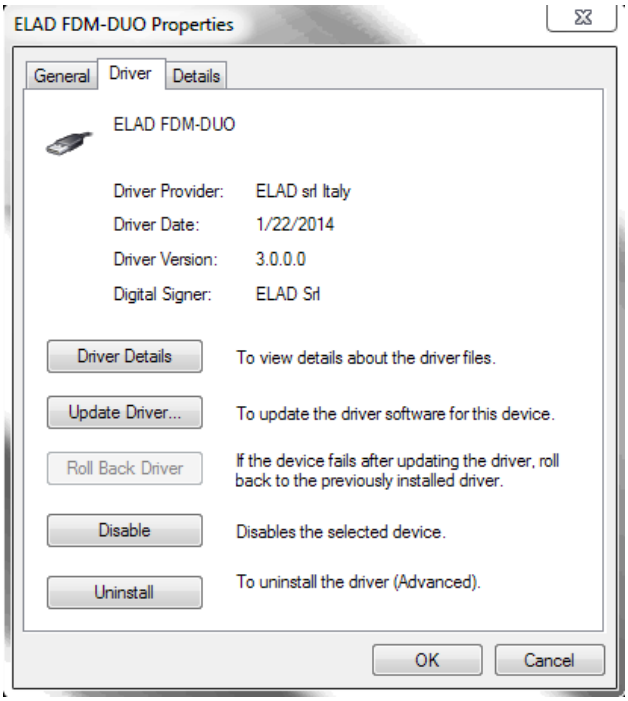


Click on “Browse” and search for FDM-DUOr driver update folder location; then open `winusb_fdmsampler.inf` file. Click “OK” and then “Next”.

Let the hardware installation automatically completes and, at the procedure ending, click on “Close”; then disconnect and connect FDM-DUOr device on the same USB socket.



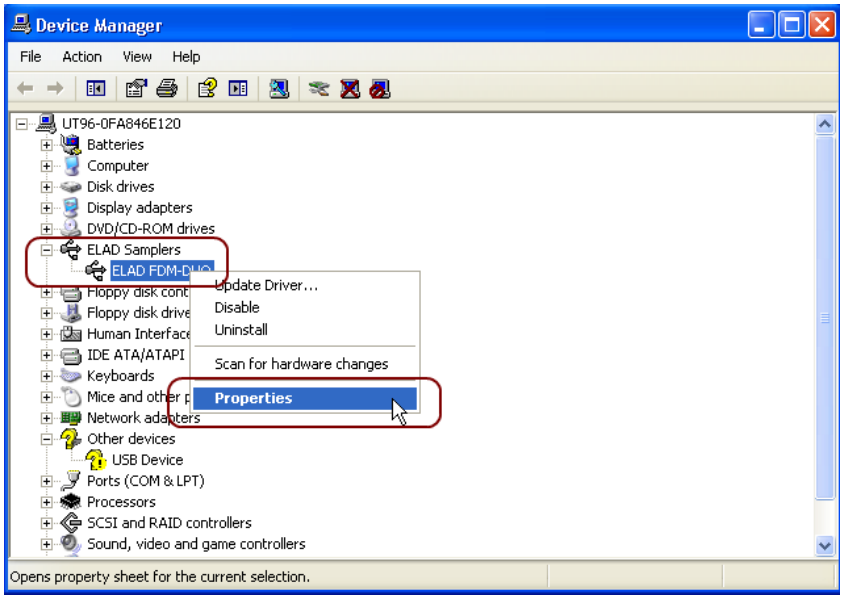
To verify that a correct update is done, enter “Device Manager” in Control Panel; under “ELAD samplers” label select ELAD FDM-DUO driver (see sub-chapter Driver installation verify in Windows 8 and Windows 7): right click on it and choose “Properties”: select “Driver” label to visualize the last driver version (an example is depicted in figure below).



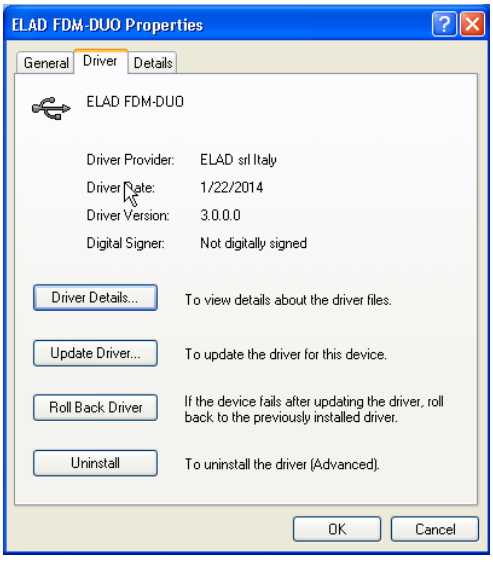
8.2.2.3 *Driver installation verify in Windows Xp*

To verify FDM-DUOr driver current version, connect the device to USB socket (where the device driver is already installed) and open **Control Panel** from **Start** menu. Click on "System" and select "Device Manager" under "Hardware" label.

Expanding "ELAD Samplers" node, right click on "ELAD FDM-DUO" and select "Properties".

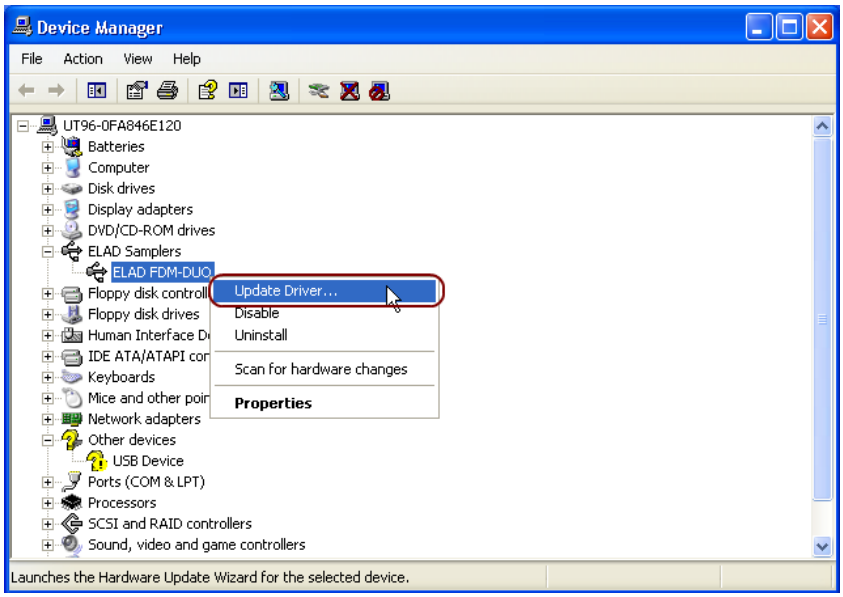


When dialog box opens, select "Driver" label: you must read provider name, current driver release date and current driver version. The old ELAD FDM-DUOr driver version is shown in figure below as example.

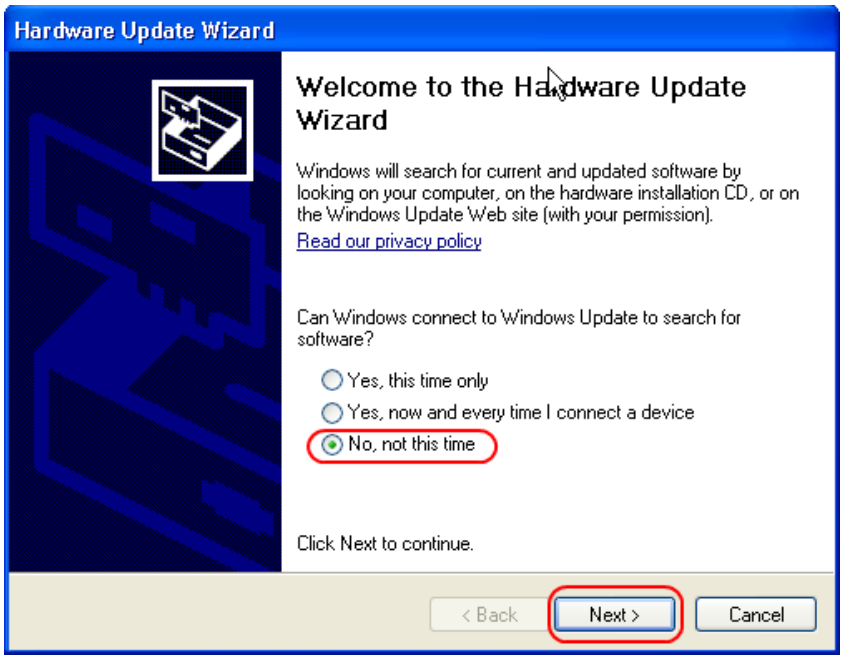


8.2.2.4 *Manual driver update in Windows Xp*

To update FDM-DUOr driver, connect the device to USB socket (where the device driver is already installed) and power on the device. Then open **Control Panel** from **Start** menu. Click on “System” and select “Device Manager” under “Hardware” label.
Select “ELAD FDM-DUO” from “ELAD Samplers” list, right click on it and execute “Update driver ”

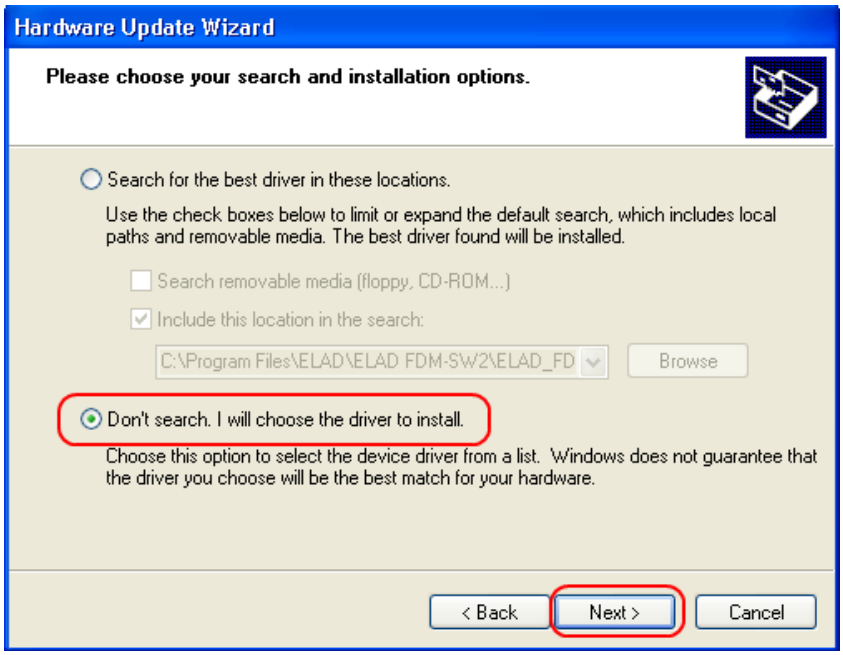


Now Windows XP launches the hardware update wizard: select the last option “No, not this time” and “Next”.

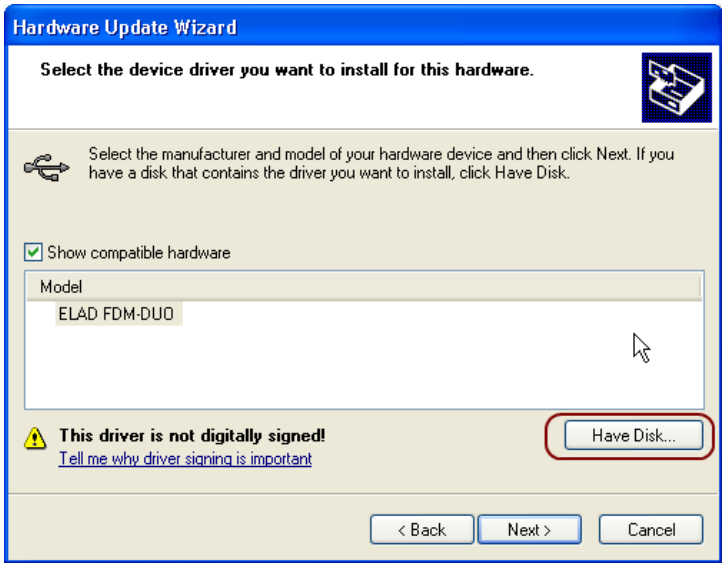


At next step select “Install from a list or specific location (Advanced)” and “Next”.

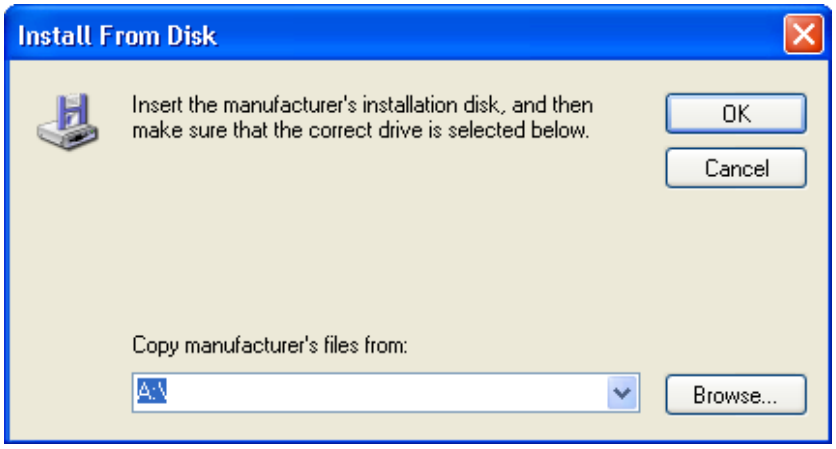
Then, disable all check-boxes that the system automatically sets and choose the last option for manual driver update, as depicted in figure. Select “Next”.



Verify that “Show compatible hardware” option is checked and ELAD FDM-DUO is selected: then click on “Have a Disk”. Don’t click “Next”.

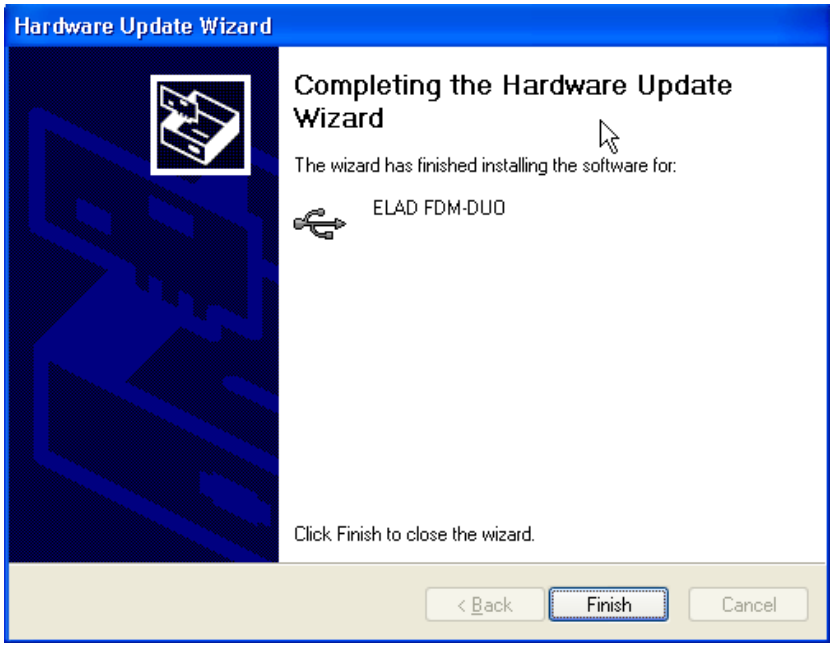


Click on “Browse” and search for the FDM-DUO driver update folder location; then open `winusb_fdmsampler.inf` file, as depicted in figure. Click “OK” and then “Next”.

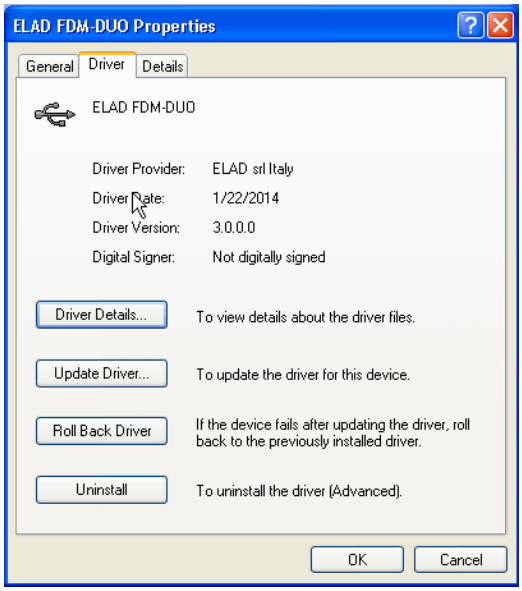


Now driver update starts: at next dialog box select “Continue Anyway” and ignore the warning.

Let the hardware update automatically completes and, at the procedure ending, click on “Finish”; then disconnect e connect FDM-DUOr device on the same USB socket.

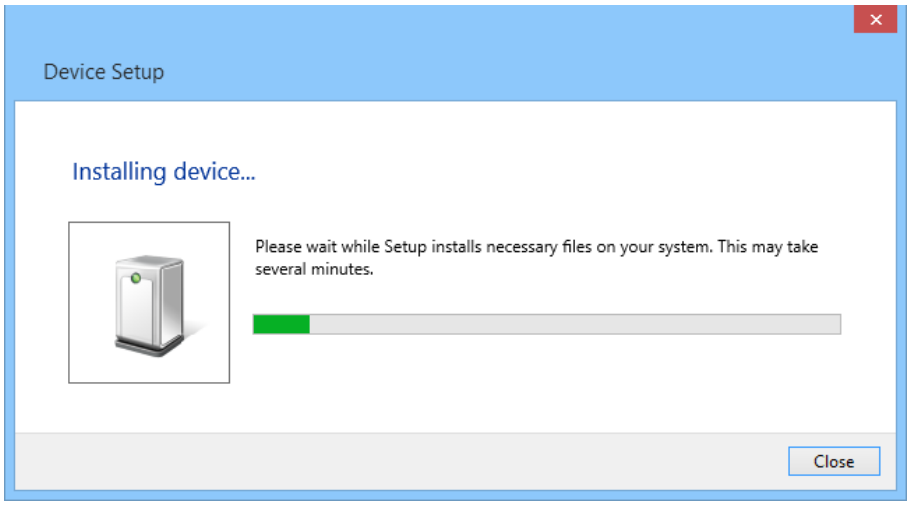


To verify that a correct update is done, enter “Device Manager” from **Control Panel**; under “ELAD Samplers” list, select ELAD FDM-DUO driver (see chapter Driver installation verify in Windows Xp) right click on it and choose “Properties”. Select “Driver” label to visualize the last driver version (an example is depicted in figure below).

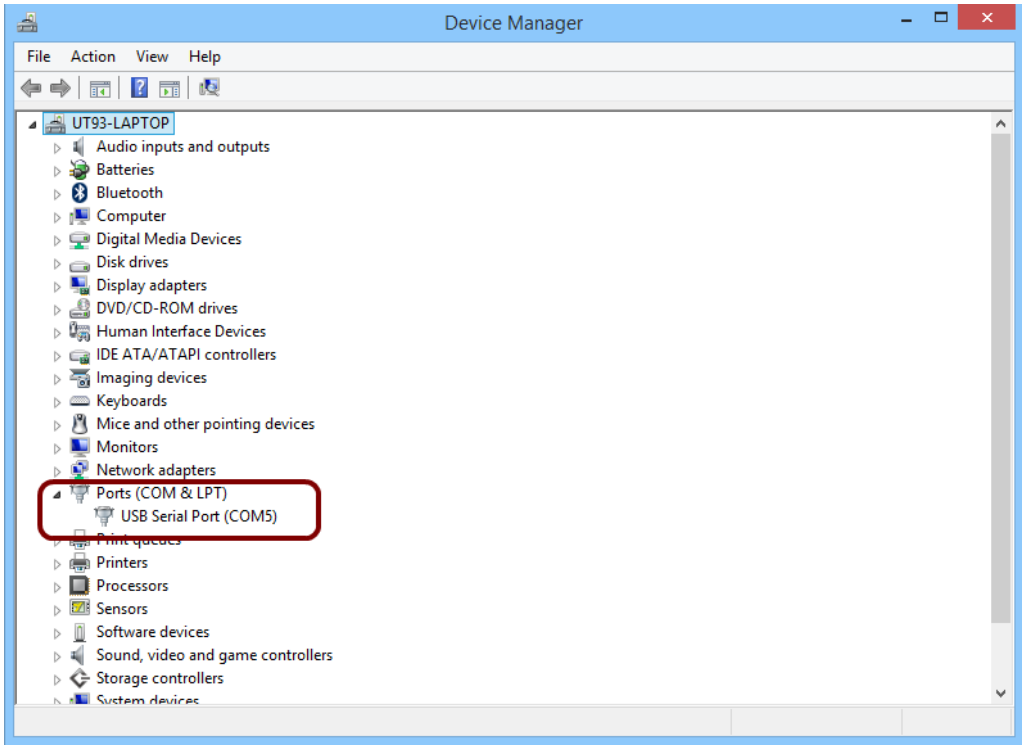


8.2.3 USB CAT Serial port

Connect the CAT USB port of FDM-DUOr to a USB 2.0 port of the PC . Windows download and install automatically the FTDI FT232R serial port driver.



When the installation process ends, open the windows device manager and check the FDM-DUOr USB serial port in the node Ports (COM & LPT).



9 Firmware update

The following section describes how to update the firmware of the various components of the FDM-DUOr. The latest versions for the User interface, Rx demodulator, USB interface and FPGA are available here: http://sdr.eladit.com/FDM-DUO/Firmware Releases/.
To ensure that the receiver still working properly, please download the full update compressed archive named ELAD_FDM_DUO_Update_*YYYY_MM_DD*.zip (where *YYYY_MM_DD* are year, month and day of the release date). In this archive you can find the latest version of each firmware and also the latest version of the ELAD FDM-SW2 software.
TO AVOID UPDATE ERRORS, PLEASE UPDATE THE "USER INTERFACE" FIRMWARE AFTER THE OTHERS FIRMWARE UPDATES

9.1 User interface firmware update

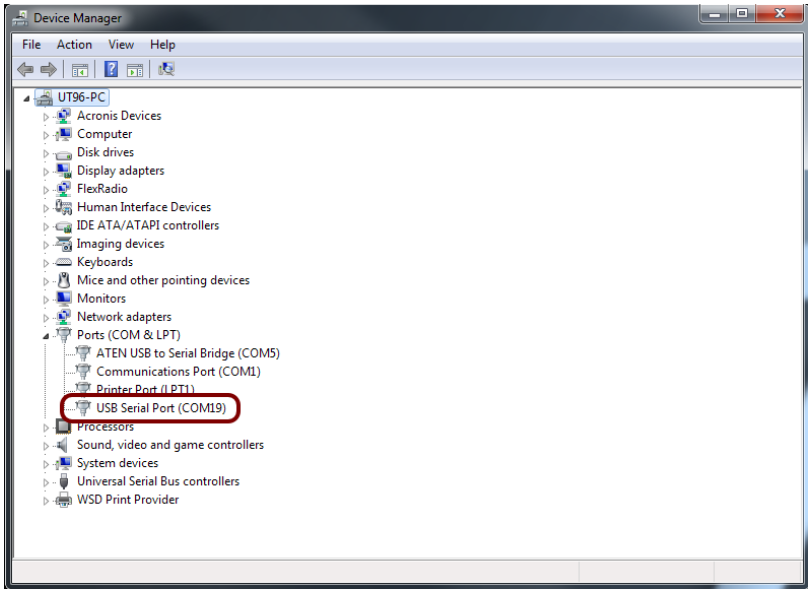
Download the latest version of the UI firmware
DISABLE ANY ANTIVIRUS PROGRAM BEFORE START THE FIRMWARE UPDATE

In order to update the user interface (UI) firmware, you need to install the Flash Magic software. This program is available here: http://www.flashmagictool.com/

Turn on the ELAD FDM-DUOr and connect the CAT USB serial port to a USB 2.0 port of your PC. Enable the FDM-DUOr to perform a UI firmware update:

- Press the MENU F5 key and select the menu "80 SERVICE".
- Press E2 to enter the setting, turn E2 to select ON then press E2 to store the setting.
- Go to menu "82 UI Update".
- Press E2 to enter the setting, turn E2 to select YES then press E2 to store the setting.

You need to identify the CAT USB COM port. Open the windows "Device Manager" and expand the COM port node. The CAT USB port is listed as "USB Serial Port".



In this case the CAT USB port is the COM19

Run Flash Magic software.
In the “Step 1 – Communication” section:

- Select LPC1766.
- COM Port: the CAT USB com port
- Baud Rate: 230400
- Interface: None (ISP)

In the “Step 2 – Erase” section:

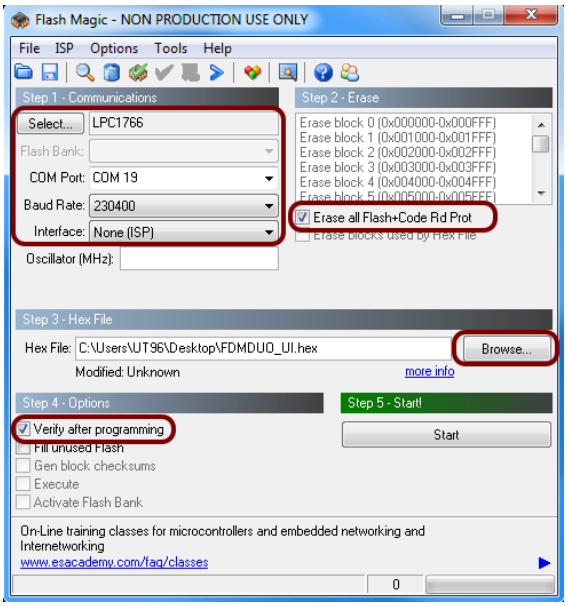
- Check “Erase all Flash+Code Rd Prot”

In the “Step 3 – Hex File” section:

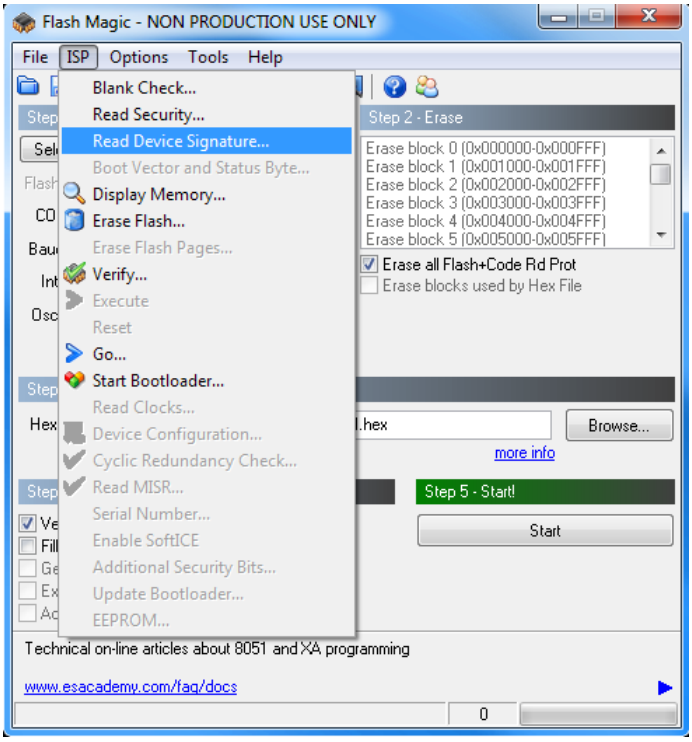
- Click on Browse and select the update “.hex” file

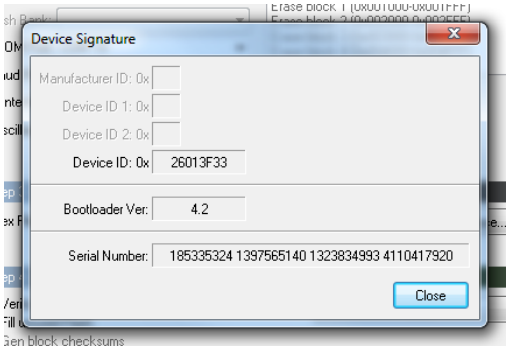
In the “Step 4 – Options” section:

- Check “Verify after programming



Check the communication with the FDM-DUOr. Click on ISP and click on “Read Device Signatures”. If the communication with the FDM-DUOr is ok, a new windows with some device information is opened.





If the communication is Ok, click on close and in the Flash Magic main window, click on Start to begin the programming. Wait until the end of the process, then turn off and restart the FDM-DUOr.

9.2 RX demodulator firmware update

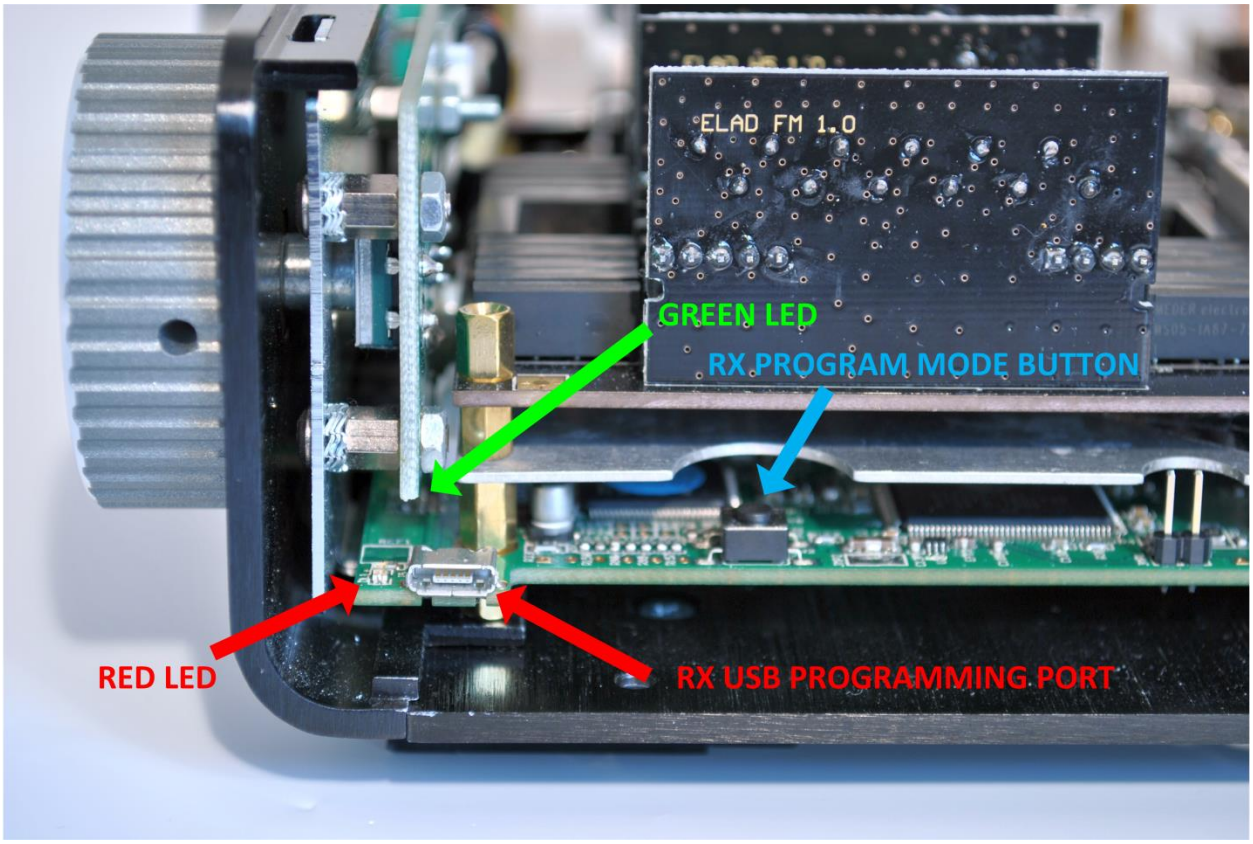
To update the RX demodulator firmware, you must remove the FDM-DUOr top cover. Remove the four screws in the FDM-DUOr chassis bottom as shown in the figure below.

Then remove the top cover of the FDM-DUOr

Download the latest version of the RX demodulator firmware.

Replace the file *fdmduorx.bin* in the USB pen provided with the FDM-DUOr
The file fdmduorx.bin must be in the root of the USB pen

Connect the provided USB pen to the FDM-DUOr RX Micro-USB programming port using the provided micro-USB adapter.
Connect the power supply, keep pressed the Rx program mode button and power up the FDM-DUOr.



- Keep pressed the Rx program mode button until the red led turns on.
- Release the Rx program mode button .
- Wait until the red led turns off.
- Turn off the FDM-DUOr, disconnect the USB pen and restart the FDM-DUOr.

If during the firmware update the green leds are blinking quickly, it means that the programming process is failed. In this case contact the technical assistance.

9.3 USB interface firmware update

Download the latest version of the USB interface

Turn on the FDM-DUOr and connect the USB Receiver data connector port to a USB 2.0 port of your PC.
Disable any antivirus program before start the firmware update

Run the downloaded file and wait until the end of the update process **without disconnecting the USB cable or power off the FDM-DUOr**, then turn off and restart the FDM-DUOr.

9.4 FPGA DDC update

Download the latest version of the FPGA DDC.

Turn on the FDM-DUOr and connect the USB Receiver data connector port to a USB 2.0 port of your PC.
Disable any antivirus program before start the firmware update

Run the downloaded file and wait until the end of the update process **without disconnecting the USB cable or power off the FDM-DUOr**, then turn off and restart the FDM-DUOr.

Declaration of Conformity (EC)

The product marked as

FDM-DUOr

manufactured by

Manufacturer: ELAD S.r.l.

Address: Via Col De Rust, 11 - Sarone
33070 CANEVA (PN)

is produced in conformity to the requirements contained in the following EC directives:

- R&TTE Directive 1999/5/CE
- EMC Directive 2004/108/CE
- Low Voltage Directive 2006/95/CE
- RoHS Directive 2011/65/CE

The product conforms to the following Product Specifications:

Emissions & Immunity:
ETSI EN 301 489-1 V1.9.2
ETSI EN 301 489-15 V1.2.1
ETSI EN 301 783-2 V1.2.1

Safety:
EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013

And further amendments.

This declaration is under responsibility of the manufacturer:

ELAD S.r.l.
Via Col De Rust, 11 - Sarone
33070 CANEVA (PN)

Issued by:

Name: Franco Milan
Function: President of ELAD

Caneva
Place

July, 30th 2014
Date

Signature