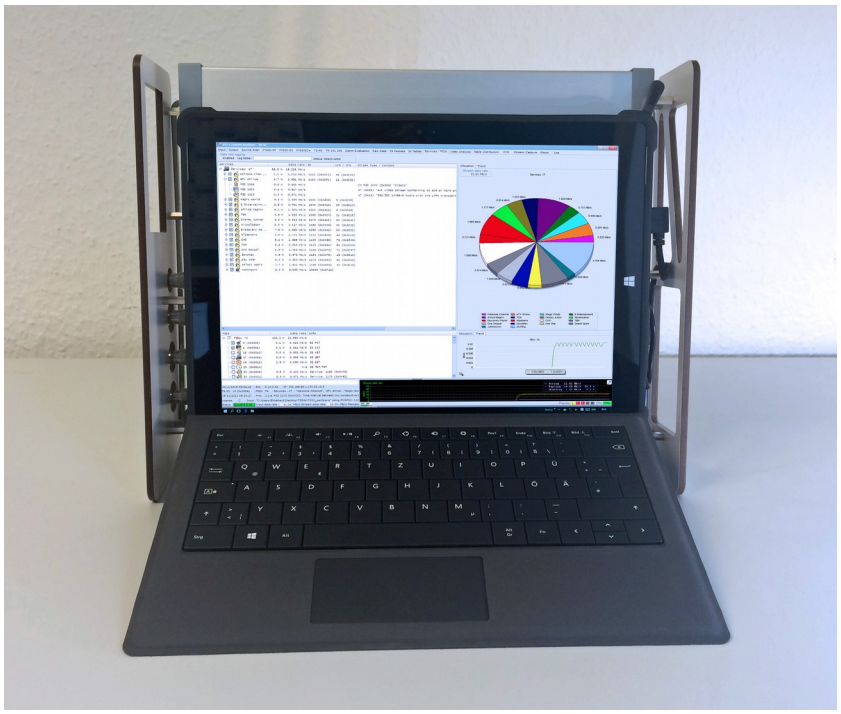
4T2-Broadcast Multi Probe Manual
bmp 3000



Advanced Broadcast Components

Frankfurterstrasse 21
64720 Michelstadt, Germany

Phone: +49 176 618 177 39

Email: info@4T2.eu
Web: www.4T2.eu

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1 First steps

1.1 Installation considerations

Thank you for having chosen the 4T2-Broadcast Multi Probe measurement instrument.
We are confident that you will find the 4T2 a reliable partner in your daily measurement tasks.

Although we tried to make the operation of the 4T2 as simple as possible, there might be the occasional look in the manual required.

Please share with us your comments to help us to improve both the functionality of the 4T2, or the quality of this manual. Do not hesitate to send an email, or if more urgent: call us.

With very best regards,
Your 4T2 Team

The 4T2-Portable Broadcast Multi Probe is a ruggedised precision instrument. Although great efforts have been made designing the machine to sustain many years of field use and transport, there are natural limits to durability.
It is therefore not recommended to drop or throw the 4T2. It should also be avoided to expose the instrument to high humidity, or water in it's liquid form.

Shall you plan to store the 4T2 in that kind of conditions, ABC recommends to do so in the supplied carrying-case.

1.2 Which instruments are covered by this manual?

This manual covers all 4T2-Portable Broadcast Multi Probe instruments.

ABC takes great care that any new features added during the life-span of the instruments are backward-compatible.
Software manuals released after the shipment of the hardware usually refer to all released software versions.
Shall your hardware's application software be missing some of the features mentioned in the manuals, it is likely that there is a new and improved firmware-version available for download.

If you require any assistance to download, install, or with the configuration please contact your local support company, or Advanced Broadcast Components representation in your region.

1.3 What is in the box?

- Carrying-case
- ABC 4T2-Broadcast Multi Probe test instrument
- 230V to 12V Power-Supply
- GPS USB Receiver and 12V to 12V Power Supply for coverage analysis
- 4T2-Broadcast Multi Probe Manual
- 4T2 SW Manual Content-Analyser

Optional:

- Calibrated Measurement Antenna
- Test adaptor kit
- Attenuator Set
- Measurement Cables
- USB Power Sensor

If you are missing any of these items, please contact Advanced Broadcast Components.

Advanced Broadcast Components recommends saving your box and its packing materials. Original packaging is preferred for shipment or relocation of your device. Substitute packaging may not provide adequate protection.

1.4 Environmental aspects

The device has been designed under aspects of environmental friendliness. The packaging has been optimised in terms of recycling possibilities, transport safety and weight savings.
At end of life time the device may be completely recycled. Any re-cycling organisation may separate the material without taking into account special safety regulations.

1.5 Safety remarks

This manual addresses qualified personnel being familiar with the relevant safety standards in RF-measurement techniques.

It is recommended to install and operate the 4T2-Broadcast Multi Probe by qualified personnel only.

Maintenance of the 4T2-Broadcast Multi Probe instrument shall be performed by qualified ABC personnel only.

⚠ The measurement instrument shall be used only for the range of operations mentioned in this manual. Please adhere to all mentioned data. The product has been developed and manufactured according to all relevant safety standards. Observing the instructions for safety and operations mentioned in the manual using the instrument does not cause any hazardous situation for man or matters. Unqualified operations on hard- and software as well as neglecting the safety hints fixed to the device may lead to personal or material damage.

⚠ Additional or extensional devices to the 4T2-Broadcast Multi Probe may only be used if recommended by ABC.

⚠ Any other usage or operation from the one mentioned in the manuals will be treated as not agreed.

⚠ All relevant safety and accident prevention instructions have to be observed during commissioning, operation and maintenance.

⚠ All safety regulations and accident prevention instructions according to the specific operation scenario have to be observed. Opening of the 4T2-Broadcast Multi Probe is not allowed and voids the warranty.

⚠ Regular checks have to be done in order to verify that the power cable connected to the instrument is in good condition. In case of a power cable problem, the cable has to be removed from mains immediately and the defective cable has to be replaced.

⚠ Do not attempt to power the instrument from any receptacle other than a 2 pole 3-wire grounded receptacle.

⚠ Before setting into operation, check for conformity between the allowed voltage range and the mains provided by the local power supply.

⚠ Do not place the instrument close to liquids, don't allow liquids or any foreign objects to get inside.

⚠ Do not place the instrument in direct sunshine or close to strong heat-emitting sources.

⚠ Do not block air vents in the back, or on the front of the instrument and the attached Tablet computer.

1.6 Important operation remarks

Please take note of the following remarks to make sure that you always get the optimum measurement performance:

⚠ Running other applications while performing 4T2 measurements may have negative influence on the processing speed.

⚠ Make sure that the operating system configuration is not changed, updated or otherwise altered under any circumstances as this may influence the overall performance.

⚠ Installation of not approved third party hardware may damage the 4T2 and is not being covered under the 4T2 warranty.
We recommend to consult ABC, if in doubt of compatibilities of hardware.

⚠ Opening of the 4T2 voids the warranty.
There are no user serviceable parts inside the 4T2.

⚠ The 4T2 BIOS is usually password protected (default pwd: dvbt).
It is not recommended for the user to change the BIOS settings.

2 Product overview

The 4T2-Broadcast Multi Probe is a highly portable, mains independent measurement instrument. The measurements are conducted and visualised through a state-of-the-art tablet computer running Microsoft Windows™.
Depending on configuration, the instrument performs DVB-T/T2, DVB-S/S2, and ASI or UDP measurements as specified in the relevant standards (see technical specifications).

The 4T2-Broadcast Multi Probe offers the following functions:

- ASI and IP inputs: Transport Stream level measurements
    - Analysis of MPEG-TS PAT, PMT Program Association, and Map Tables
    - Analysis of DVB Service Information (CAT, SDT, EIT, NIT, TOT, TDT)
    - Analysis of ATSC Service Information (MGT, STT, TVCT, EIT, ETT)
    - Visualisation of SDT, NIT, and MIP Tables
    - Visualisation of PID Packet Identifiers and associated bit-rates and stuiffing
    - Visualisation of time repetition intervals of tables defined in TR.101.290
    - Analysis and visualisation of first, second, and third priority errors according to TR.101.290
    - Analysis of DVB T2-MI Modulator Interface
    - Measurement of PCR Program Clock Reference jitter
    - Content decoding of SD, HD, UHD material with Monitor-wall feature with audio bar-graphs
    - Detection of black and freeze and audio mute conditions on services in the TS
    - Triggered capture of Transport Stream to disk in presence of errors (with history)
    - Remote capability with full SNMP support following the DVB MIB, including Traps
    - Input support for files
    - Comprehensive logging features with powerful sorting capabilities
    - Raw data analysis with smart packet-trigger, and bit dependencies checking
    - Smart Packet trigger with expression editor
    - Interface to relay alarm contacts with expression debugger
    - Forwarding of transport stream to IP, File, or ASI output

- Additional RF-functions
    - Spectrum Analyser 10kHZ to 4.4 GHz
    - Tracking Generator and Scalar Network Analyser

- Additional RF-functions on DVB-T, or DVB-T2 channels
    - Level (including field strength), MER, EVM, bit errors
    - Graphical displays for
        - Constellation, Impulse Response, Spectrum
        - Bit Error Rates with Level and MER data logging

- Additional RF-functions on DVB-S, or DVB-S2 channels
    - Level, MER, EVM, bit errors
    - Graphical displays for
        - Constellation, Bit Error Rates with Level and MER data logging

Although described in this manual, your instrument may not be equipped with all these features as some (like the satellite receiver input) are optional.

3 Getting started

3.1 Start-up procedure

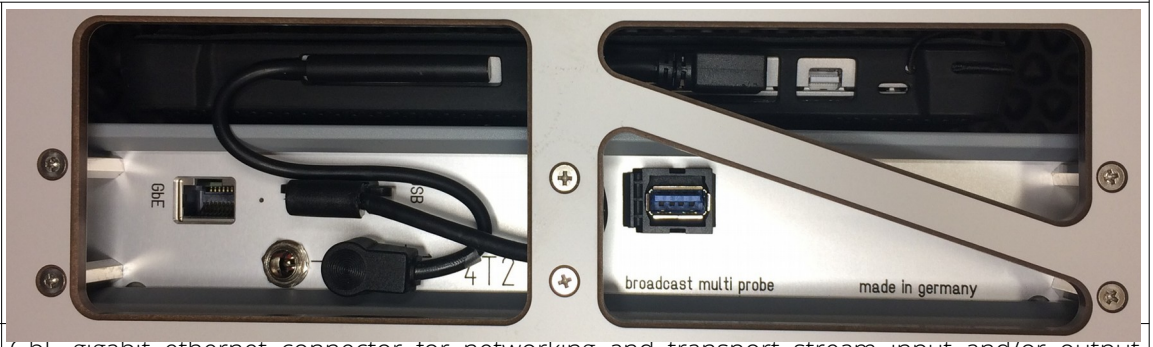
After unpacking your 4T2-bmp, please attach the power cord to the input on the right hand side of the instrument. The connection between the tablet computer and the measurement unit is through USB 3.0. The power signal on the USB cable is used to activate the battery inverter which in turn activates the hardware for the ASI input, the RF input, the Spectrum Analyser, the Tracking Generator and the Common Interface.
The USB and the IP interface is powered from the table computer directly.

Please note that once powered on, a blue light appears next to the power input connector. If the light stays off, then the battery of the 4T2-bmp is likely to be empty.

The magnetic touch keyboard is used to protect the TFT display in transport mode.

4 Right-hand side connectors and features

On the right hand side, you will find connectors essential for charging and for networking:



GbE gigabit ethernet connector for networking and transport stream input and/or output streaming

USB 3 Jumper cable between 4T2-bmp PSU and tablet computer

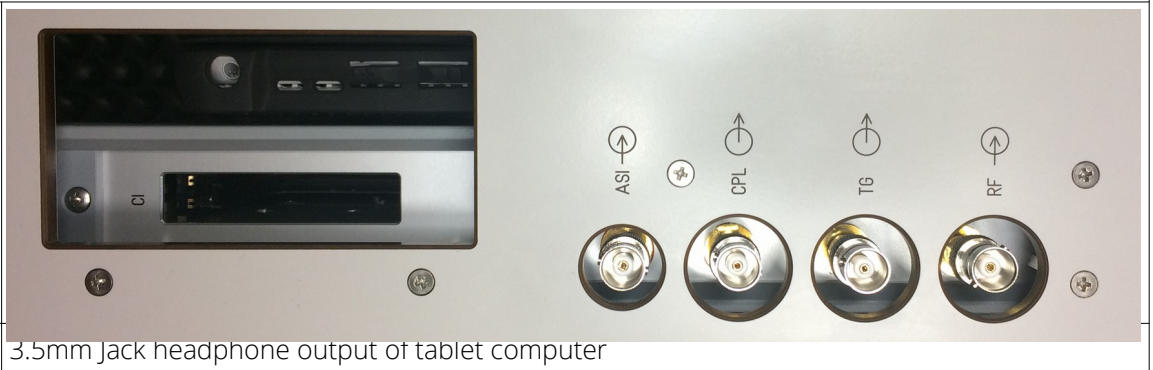
Charger Jumper cable between 4T2-bmp and tablet computer

Mini Display Port output for additional monitor

Main power input (12V, plus on 2.1mm center contact, reverse polarity protected)

5 Left-hand side connectors and features

On the left hand side, you will find connectors essential for measurements:



3.5mm Jack headphone output of tablet computer

Volume up/down rocker switch

CI: Dual Common Interface slot

ASI: Asynchronous Serial Interface MPEG Transport Stream input

CPL: Coupler output from tracking generator

TG: Tracking Generator main output

RF: Radio Frequency main input

6 Technical specifications

RF Input (terrestrial)			
	Input Connector	BNC female or N female	
	Input Range	- 90 to - 0 dBm	
	Frequency Range	46.5 to 870 MHz (Ch E2 to Ch 70)	
	Tuning Resolution	1 Hz	
	Channel Bandwidth	1.7, 5, 6, 7, 8 MHz	
	Input Impedance	50 Ohm	
	VSWR	< 1.5	
	Noise Figure	< 5 dB	
Measurement Results		**Resolution**	**Accuracy**
	Input level	0.1 dBm	± 0.9 dB @ - 69 to - 0 dBm
		0.1 dBµV	± 1.0 dB @ - 90 to - 70 dBm

RF Input (satellite)			
	Input Connector	BNC female	
	Input level	-69 ~ -23 dBm	
	Receiving Frequency	950~2150 MHz	
	DVB-S/DVB-S2 demodulator	QPSK, 8PSK, 16APSK, 32APSK	
	Symbol Rate	0.2 ~ 45 Msps	
	Carrier Capture Range	±10 MHz	
	DVB-S2 QPSK Puncture codes	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10	
	DVB-S2 8PSK Puncture codes	3/5, 2/3, 3/4, 5/6, 8/9, 9/10	
	DVB-S2 16PSK Puncture codes	2/3, 3/4, 4/5, 5/6, 8/9, 9/10	
	DVB-S2 32PSK Puncture codes	3/4, 4/5, 5/6, 8/9, 9/10	
Measurement Results		**Resolution**	**Accuracy**
	Input level	0.1 dBm	± 2 dB

Transport Stream Input / output (ASI)		
	Connector	BNC female
	Impedance	75 Ohm
	Signal Amplitude	250 mV pp minimum input
		700 mV pp minimum output
	Return loss	>17 dB (transformer coupling)
	Data rate	270 Mbit/s
	Data format	Burst and packet mode
	Packet length	188, 204, 208 bytes

COFDM Demodulation (DVB-T, DVB-H)		
	Modulation	QPSK, 16-QAM, 64-QAM (hierarchical, non-hierarchical)
	FFT length	2k / 4k / 8k
	Code rates	1/2, 2/3, 3/4, 5/6, 7/8
	Guard interval factor	1/4, 1/8, 1/16, 1/32
	Reed Solomon	188, 204 byte packets
	Mode detection	Automatic
	Synchronisation time	< 250 ms
Measurement Results	**Resolution**	**Accuracy**
	Frequency Offset	1 Hz	t.b.d.
	Bandwidth	0.1 Hz	look-up table
	Bandwidth Offset	0.1 Hz	t.b.d.
	Net Bit Rate	1 bit / s	look-up table
	Bitrate Offset	0.1 bit / s	t.b.d.
	Cell Identifier	- / -	- / -

COFDM Demodulation (DVB-T2) 1.3.1		
	Modulation	QPSK, 16-QAM, 64-QAM, 256-QAM (rotated, non-rotated)
	FFT length	1k / 2k / 4k / 8k / 16k / 32k (ext. BW)
	Code rates	1/2, 3/5, 2/3, 3/4, 4/5, 5/6
	Guard interval factor	1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
	Reed Solomon	188, 204 byte packets
	Mode detection	Automatic
	Synchronisation time	< 5 s
Measurement Results	**Resolution**	**Accuracy**
	Frequency Offset	1 Hz	t.b.d.
	Bandwidth	0.1 Hz	look-up table
	Bandwidth Offset	0.1 Hz	t.b.d.
	Net Bit Rate	1 bit / s	look-up table
	Bitrate Offset	0.1 bit / s	t.b.d.

COFDM Modulation Analysis			
	Constellation Diagram MER and EVM versus Carrier	L1 post, Equalizer out, and Data-PLP	
Measurement Results		**Resolution**	**Accuracy**
MER	Modulation Error Ratio	0.1 dB	± 1.5 dB @ 38 to 42 dB ± 1.0 dB @ 20 to 38 dB ± 1.5 dB @ xx to 20 dB
EVM	Error Vector Magnitude	0.1 %	± 0.80 % down to 0.75 % EVM

Spectrum Analysis	
Frequency Range	1 Hz to 4.4 GHz, Standard ; 100 kHz to 4.4 GHz AC-coupled
Span Modes	(Center Frequency + Span) or (Start + Stop Frequencies)
Maximum Span	4.4 GHz
Minimum Span	10 Hz or Zero Span
Internal reference accuracy	± 1 ppm (improved with external reference)
Readout Accuracy	reference error ±1 sample
Marker Accuracy	reference error ±1 sample
Resolution Bandwidth	0.1 Hz to 250 KHz and 5 MHz
Spectral Purity	Residual FM, 3KHz Audio LPF, 15 KHz IF BW: [0.1 Hz + 4 Hz / GHz] typical RMS FM (e.g. 2 GHz RF would have 8.1 Hz RMS FM). Increasing IF BW increases residual FM.
Amplitude Range	1dB Gain Compression to Displayed Average Noise Level (DANL)
1dB Gain Compression	(attenuator set to 15dB, preamp off) +16dBm Typical, 1Hz to 150MHz (100 kHz to 150 MHz, Option 3) +19dBm Typical, 150MHz to 4.4GHz
Absolute Accuracy (Reference level ≤0 dBm)	± 1.5 dB
Absolute Accuracy (0 dBm < Reference level ≤ 10 dBm)	± 2.0 dB
Relative Accuracy (Reference level ≤0 dBm)	±0.25 dB
Maximum Safe Input Level (preamp off, 15 dB atten)	+20dBm
DC Volts	< ±0.2V absolute maximum
Residual Responses (Input terminated, ≤100 KHz span, 0 dB atten, preamp on)	<-80 dBm 1 Note 1: Known residual responses at multiples of 10 MHz < -80 dBm typical
Frequency Range	10 Hz to 4.4 GHz
Step sizes	from 10 Hz to 10 MHz
Sweep	up to 700 frequency points per second

MPEG TS Analysis		
	Please refer to the: 4T2 Content-Analyser	1st, 2nd and 3rd priority ERR according TR.101.290 Logging of Errors to file, DVB-T2 MI, Packet Filter, Services Counter, Pie Charts of data rates Stream Hierarchy tree view, triggered capture TS, PID sorted views, PCR jitter display, ...
Measurement Results	**Resolution**	**Accuracy**
	Log-file	1	- / -
	Services bit-rates	1 bit / s	± 5 µs

PC Data		
	Microsoft Surface Pro IV	
	Input Devices	Touch Pad, Keyboard
	Network	Ethernet (TCP/IP) 1 Gbit/s
	Operating System	Microsoft Windows™

Mechanical / Environmental		
	Dimensions (w x h x d)	300 x 280 x 100 mm
	Weight	4.5 kg
	Power Supply	12V DC
	Operating Temperature	0 °C .. + 40 °C
	Storage Temperature	-20 °C .. + 50 °C
	Relative Humidity	5% .. 85% (non-condensing)
	Shock	3 g max

Standards / Qualifications		
	DVB-T DVB-T2 compliance	EN 300 744, EN 302 755, TS 101 190, TS 101 191, TS 102 773
	Measurement Guidelines	TR 101 290
	MPEG Compliance	ISO/IEC 13818-1; ITU-T H.222.0
	EMC	DIN EN 55022: 2001-09 DIN EN 55024: 2002-11 DIN EN 55013: 2003-10 DIN EN 61000-3-2: 2001-12
	Safety	EN 60950-1
	Environmental Protection	EN 60 529; DIN VDE 470; IP20
	Temperature Range	ETS 300 019-1-7 Class 7.1
	Vibration	ETS 300 019-1-7 Class 7.1
	Humidity	ETS 300 019-1-7 Class 7.1
	Transportation	ETS 300 019-2-2 Class 2.3
	Storage	ETS 300 019-1-1 Class 1.2

7 Miscellaneous

7.1 Declaration of Conformity

CE	DECLARATION OF CONFORMITY according to EN 45014	ABC

Manufacturer :	Advanced Broadcast Components Frankfurterstrasse 21, 64720 Michelstadt, Germany

We declare under our responsibility that the product:

Product Name :	4T2 Broadcast Multi Probe
Model Number :	10. 110. 300
Trademark :	4T2

is in conformity with the essential requirements of the R&TTE Directive 1999/5/EC. The above mentioned product is in compliance with the following European standards:

Electrical Safety	EN 60950-1:2001
EMC	ETSI EN 55022:2001-09 ETSI EN 55024:2001-11 ETSI EN 55013:2003-10 (partly) ETSI EN 61000-3-2:2001-12
Low Voltage Directive	73/23/EWG

Bad Segeberg, Germany, 01.04.2019

Frank Wenzl
CEO

7.2 Maintenance and calibration

The 4T2-Broadcast Multi Probe has been designed as a robust test unit, which under any circumstances should not require special maintenance routines.

We do, however, recommend sending your receiver to ABC to undergo a calibration procedure in defined intervals. This will ensure continuously high precision measurement results.

7.3 Dimensions and shipping information

	Packing Option	Status	Dimensions (h x w x d) [mm]	Weight [kg]
4T2 Broadcast Multi Probe	None		300 x 280 x 100	4,5
4T2 Broadcast Multi Probe	Carrying-case	standard	400 x 450 x 180	7,7

7.4 Application notes

A number of application notes are available from Advanced Broadcast Components. These documents give further insight into the theory of operation and special applications.

The most up-to-date source for application notes is the internet. Printed copies can be ordered directly from ABC.

7.5 Waiver

While the information contained in this document has been carefully compiled to the best of our present knowledge, it is not intended as representation or warranty of any kind on our part regarding the suitability of the products concerned for any particular use or purpose and neither shall any statement contained herein be construed as a recommendation to infringe any industrial property rights or as a license to use any such rights. The suitability of each product for any particular purpose must be checked beforehand with our specialists.