Manual

Air Interface Adapter
500 MHz - 4000 MHz

AIAD-8/8-4G+DL

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DIN EN ISO 9001:2015 – certified

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Released: M. Demharter ..... M. Demharter .....

Alteration Chart

Release no.	Version	Unit state	Description of changes	Date	Editor
1	1.0	00	Preliminar edition	15 May 2019	M. Osenberg
2	2.0	00	First released edition	09 July 2019	M. Demharter
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1 GENERAL

1.1 General description

This manual describes the Air Interface Adapter named "AIAD-8/8-4G+DL" unit state 00 and higher.

The Air Interface Adapter consists of variable attenuators, delay lines, splitters and combiners, a power supply and a control card.

The control card BK-AVR2560 interprets the commands from the RS-232-interface and the LAN-interface and controls the attenuators and the delay lines.

1.2 Delivered parts

- Air Interface Adapter
- Power cable
- Operating manual on CD

1.3 Safety precautions

During operation of the unit the general safety precautions according to VDE 0100, VDE 0800 and VDE 0805 are to be obeyed.

Attention: In order to avoid touching the voltage loaded parts,
d o n o t o p e n the unit!

Repairs of the device are permitted to authorized personal only.
It is absolutely forbidden to use defective units!

The device must be grounded at all times!

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1.4 Components of the front panel

1 RF-connections of the inputs (connected to delay lines)
2 RF-connections of the outputs (connected to attenuators)
3 Power switch S1 for 230V AC-supply with integrated control lamp

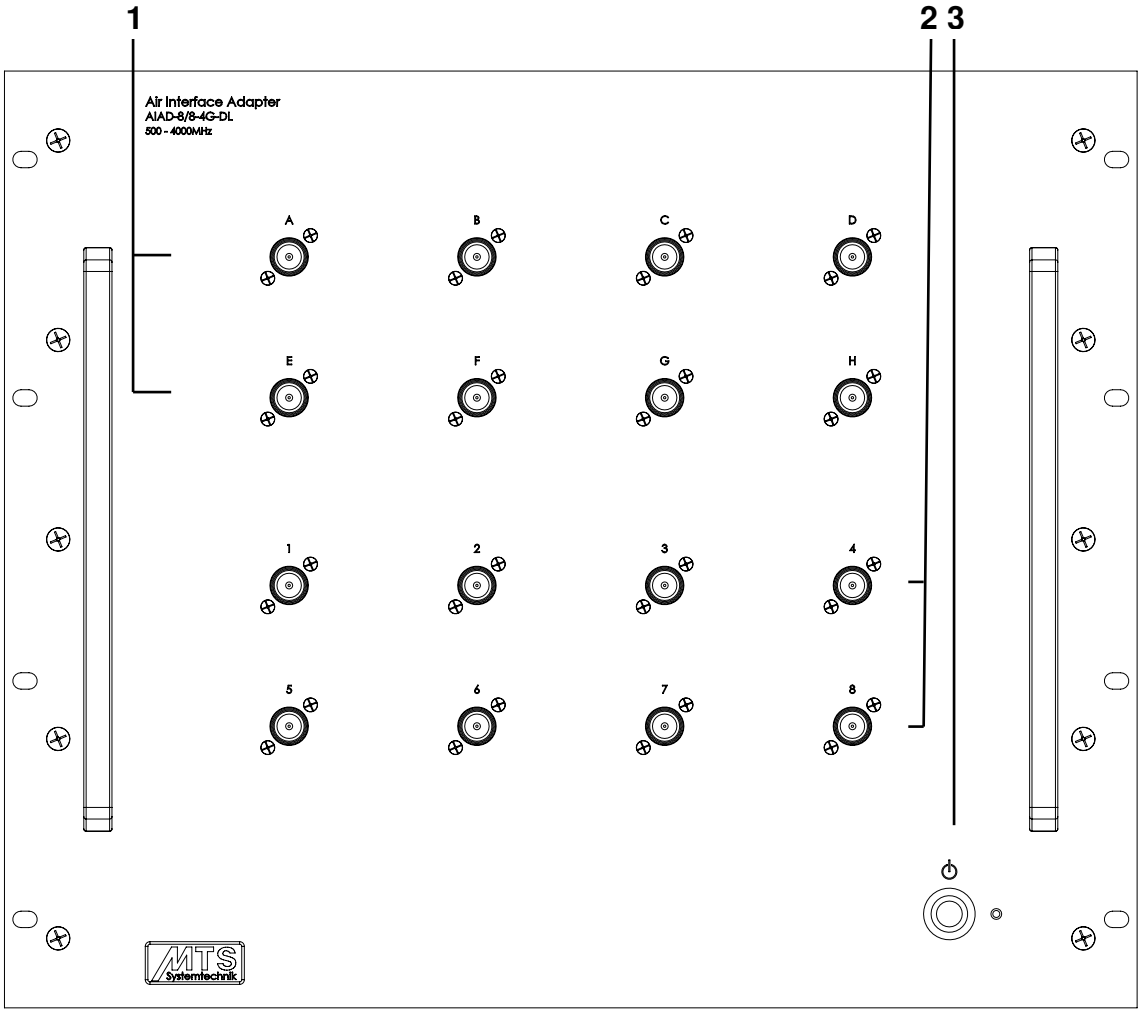

Illustration 1: Front view AIAD-8/8-4G+DL

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1.5 Components of the rear panel

1 Appliance plug with integrated fuses F1 and F2
2 Ground connector
3 Control card BK-AVR2560 with RS-232-interface and LAN-interface

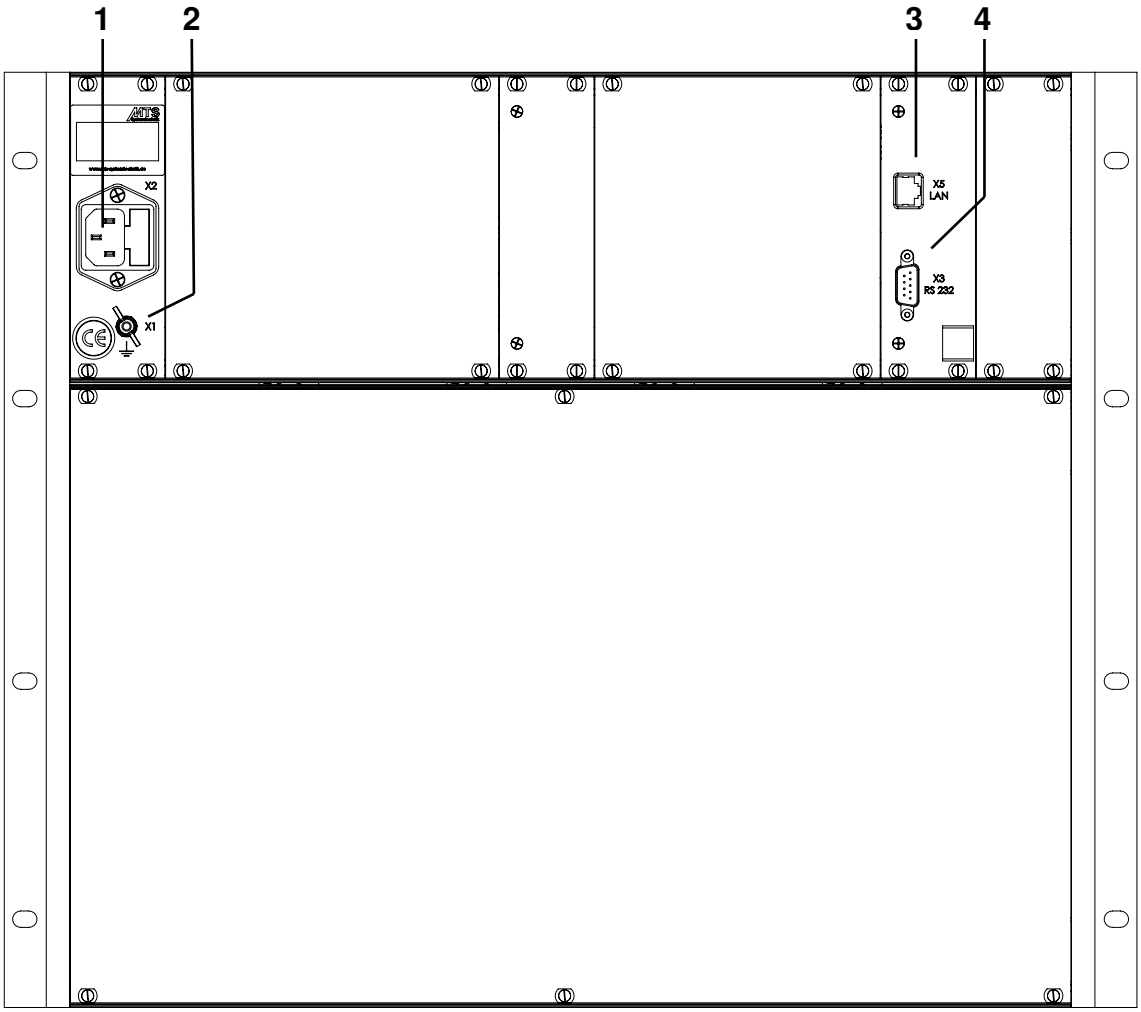

Illustration 2: Rear view AIAD-8/8-4G+DL

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1.6 Starting up and operating / connections

Before using the unit following connections have to be done:

Ground-connection

The unit has to be grounded expertly at the ground connector (look at illustration 2, position 2). A cable with a conductor cross-section of minimum 1.5 mm² has to be used.

Power supply

The power supply voltage range of the unit is 100 V - 240 V at 50 Hz / 60 Hz at connector X2 (look at illustration 2, position 1).

RF-connections

Cables and RF-connectors N male with an impedance of 50 Ω are required.
Cables can be connected without RF-power during the operation.

Interface connection

In order to operate the device by remote control, a data cable has to be connected.

Attention: Before connecting the data cable, the device has to be shut off at power switch S1.

Check all connections for correct hook up,
before turning the power on.

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1.7 Starting up and operating / turning off and turning on

You can do a reset of the unit by switching off the power switch S1 at the front panel. After waiting at least 30 seconds and turning on the unit it will boot again and then it will work normally.

The control card detects voltage errors of the power supplies. While the error is present it is not possible to save any adjustment. At disappearing of a voltage error, the error message changes into a voltage warning. Saving of adjustments is now enabled again. Dependent on the power consumption of the components possibly a voltage error is shown at shutdown.

On starting the unit or returning of power (if the power switch is on) all variable attenuators will switch to 95 dB and all delay lines will switch to 0 ps.

Attention: Before starting make sure the unit is standing safely or is build-in safely.

The operating temperature of the unit has to be between 0 °C and +50 °C.

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2 CONTROLLING OF THE UNIT

After switching power on, the device automatically starts the operating mode. Now it is possible to control the unit by the RS-232-interface or the Ethernet-interface.

2.1 Updating the unit

The unit consists of a module for updating the firmware. Updating the firmware is exclusively allowed under guidance of MTS Systemtechnik GmbH.

2.2 Changing LOCAL to REMOTE

The unit starts at LOCAL mode. It changes into REMOTE mode automatically when receiving the first REMOTE set command. All REMOTE-interfaces have equal rights. Its commands are executed in the same order as received.

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2.3 The RS-232-interface

The integrated RS-232-interface is laid out as a 9-pole SUB-D plug. The pins are connected according to RS-232-standard.

A zero modem cable (RX/TX crossed) is required for the connection. The recommended length of the interface cable is 15 m max..

2.4 Interface protocol RS-232

The transmission of data is carried out in binary format.

Start command: No start command STX
End command: ETX = $0xFF_H$

Following parameters of the RS-232-interface are fix and can not be changed:

8 Databits
1 Startbit
1 Stopbit
No parity
No handshake

2.5 Configuration of the RS-232-interface

The user can select between three baud rates. Basic setting is 115200 baud.

The baud rate can be set by remote control. At this case the unit changes into remote mode.

Receive string: "ST-BA***y***"

y is the switched baud rate (9600, 57600 or 115200 in ASCII format).

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2.6 The Ethernet-interface

The LAN-interface is laid out as an 8-pole RJ45-female-plug.

2.7 Interface protocol Ethernet

The transmission of data is carried out in binary format.

Start command: No start command STX
End command: ETX = $0xFF_H$

The Ethernet-interface is internally connected by RS-232. Following internal parameters are fix and can not be changed:

115200 Baud
8 Databits
1 Startbit
1 Stopbit
No parity
No handshake

2.8 Configuration of the Ethernet-interface

Interface set-up (IP-address, port) can be done by using a webbrowser (e. g. internet explorer) via putting in the IP-address.

Basic setting is TCP-protocol, IP-address "192.168.83.50" and port 4001.

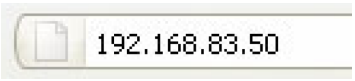

Illustration 3: Insertion of IP-address at browser-window

Attention: The areas of the IP-address must not begin with leading zeros (wrong: 192.168.083.050, right: 192.168.83.50)!

If you can not find your IP-address anymore, look at the tab-button "Setup" or use the DeviceInstaller from Lantronix and search it (search button). By opening the folders the current IP-address will be shown (self-explanatory).

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Calling the IP-address through a browser:

After calling the IP-address you can acknowledge the keyword-window without any entries (OK). The configuration window opens automatically as follows.

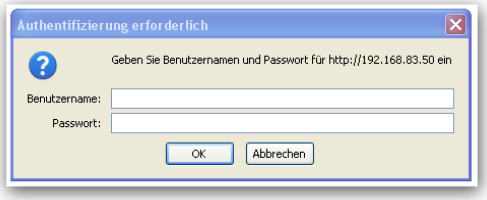

Illustration 4: Keyword-window of the LAN-module

Adjusting the IP-address through a browser:

You can adjust the IP-address in the following window. Alternatively, you can select "Obtain IP address automatically" to work with DHCP-mode.

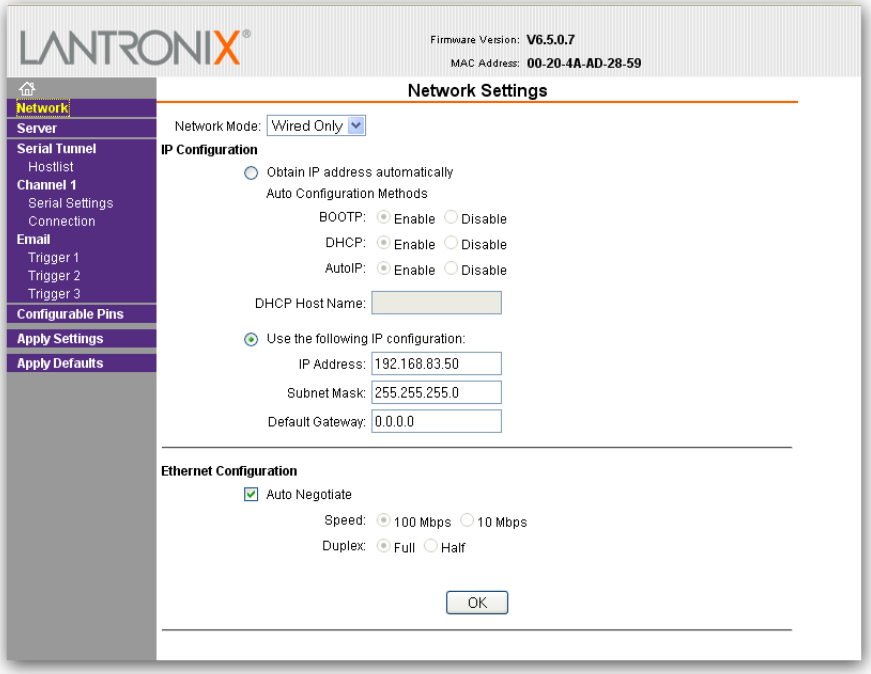

Illustration 5: Adjustment of IP-address of the LAN-module

Attention: After changes you have to press OK
and then you have to execute Apply Settings!

Executing further operations:

To do extended operations use the document Extended_Configuration_XPORT_Module on the CD of the unit.

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2.9 Control commands of the unit

All REMOTE-interfaces have equal rights. Its commands are executed in the same order as received.

2.9.1 Set command and fast set command for attenuator

Attention: All set commands are allowed to have up to 85 signs inclusive ETX. After the unit has received one command the user has to wait for the resulting answer before sending the next command.

Receive string: "SAx_1***y_1***…x_n***y_n***"

e. g. receive string: "SA1***04******95***" (0x53$_H$0x41$_H$0x01$_H$***0x00$_H$***0x04$_H$***0x5F$_H$***)
(x_1=1, ***y_1=0*** = 0 dB @ no 1,
x_2=4, ***y_2=95*** = 95 dB @ no 4)

x is the number of the semiconductor-attenuator
1 – 64 (binary 0x01$_H$ – 0x40$_H$).
y is the value of the attenuation in dB-scale 0 – 95 (binary 0x00$_H$ - 0x5F$_H$).

Receive string: "SAF**x**$_n$***y_n******y_{n+1}***…***y_m***"

e. g. receive string: "SAF5***01***" (0x53$_H$0x41$_H$0x46$_H$0x05$_H$***0x00$_H$0x01$_H$***)
(**x**$_n$ = 5, ***y_5*** = 0 dB @ no 5)
y_6 = 1 dB @ no 6)

At this command just the number of the first attenuator has to be declared.
All following numbers regard to the following attenuators (**x**+1...).
x is the number of the first semiconductor-attenuator to set
1 – 64 (binary 0x01$_H$ – 0x40$_H$).
y is the value of attenuation in dB-scale
for the affected attenuators, beginning at ***x***$_n$, means
0 – 95 dB (binary 0x00$_H$ - 0x5F$_H$).

The execution, namely the setting of the attenuator x to the value ***y***, is carried out directly in the interpretation of the command.
If there is a value for ***y*** detected, which is overranged, the selected attenuator is set to the maximum value of attenuation (95 dB).
In case a not allowed value for x is detected, the interpretation is stopped and a NAK is send back.

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2.9.2 Set command and fast set command for delay line

Attention: All set commands are allowed to have up to 85 signs inclusive ETX. After the unit has received one command the user has to wait for the resulting answer before sending the next command.

5 ps steps are rounded up to next tenth by hardware above 640 ps!

Receive string: "SPp_1***s***$_{1high}$***s***$_{1low}$…p_n***s***$_{nhigh}$***s***$_{nlow}$"

e. g. receive string: "SP1***120***15***320***" (0x53$_H$0x50$_H$0x01$_H$***0x01$_H$0x14$_H$*** 0x0F$_H$***0x03$_H$0x14$_H$***)
(p_1=1, ***s***$_{1high}$***=1,*** ***s***$_{1low}$***=20*** = 120 * 5 ps @ no 1,
p_2=15, ***s***$_{2high}$***=3,*** ***s***$_{2low}$**=25** = 320 * 5 ps @ no 15)

p is the number of the delay line 1 - 64 (binary 0x01$_H$ – 0x40$_H$).
s is the setting of the delay stage in 5 ps steps, divided in two bytes, high byte with graduation hundred (binary 0x00$_H$ – 0x03$_H$) and low byte with graduation one (binary 0x00$_H$ – 0x63$_H$ resp. 0x00$_H$ – 0x14$_H$ if high byte is 0x03$_H$) = 0 – 320 * 5 ps = 0 – 1600 ps.
To calculate the delay use following formula:
t = ([*s*$_{high}$]100 + [*s*$_{low}$]) * 5 ps**

Receive string: "SPFp_n***s***$_{nhigh}$***s***$_{nlow}$***s***$_{(n+1)high}$***s***$_{(n+1)low}$ … ***s***$_{mhigh}$***s***$_{mlow}$"

e. g. receive string: "SPF5***120316***" (0x53$_H$0x50$_H$0x46$_H$ 0x05$_H$***0x01$_H$0x14$_H$ 0x03$_H$0x10$_H$***)
(p_n=5, ***s***$_{5high}$***=1,*** ***s***$_{5low}$***=20*** = 120 * 5 ps @ no 5,
p_2=15, ***s***$_{6high}$***=3,*** ***s***$_{6low}$**=16** = 316 * 5 ps @ no 6)

At this command just the number of the first delay line has to be declared. All following numbers regard to the following delay lines (**p**+1…).
p is the number of the first delay line to set 1 - 64 (binary 0x01$_H$ – 0x40$_H$).
s is the setting of the delay stage in 5 ps steps, divided in two bytes, high byte with graduation hundred (binary 0x00$_H$ – 0x03$_H$) and low byte with graduation one (binary 0x00$_H$ – 0x63$_H$ resp. 0x00$_H$ – 0x14$_H$ if high byte is 0x03$_H$) = 0 – 320 * 5 ps = 0 – 1600 ps.
To calculate the delay use following formula:
t = ([*s*$_{high}$]100 + [*s*$_{low}$]) * 5 ps**

The execution, namely the setting of the delay line p to the value ***s***$_{high}$***s***$_{low}$, is carried out directly in the interpretation of the command.
Is there a not allowed value of p, ***s***$_{high}$ or ***s***$_{low}$ detected, the interpretation is stopped and a NAK is send back.

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2.9.3 Set command and fast set command for path

The path command can be used for control attenuators and delay lines which are in the same path with one set command.

Attention: All set commands are allowed to have up to 85 signs inclusive ETX. After the unit has received one command the user has to wait for the resulting answer before sending the next command.

5 ps steps are rounded up to next tenth by hardware above 640 ps!

Receive string: "SDw_1***y_1******s_{1high}******s_{1low}*****...*****w_n******y_n******s_{nhigh}******s_{nlow}***"

e. g. receive string: "SD7***50310***" (0x53$_H$0x44$_H$0x07$_H$***0x32$_H$*****0x03$_H$******0x0A$_H$***)
(w_1=7, ***y_7=50*** , ***s_{7high}=3, s_{7low}=10*** = 310 * 5 ps)

The path command controls the attenuators as well as the delay lines.
w is the number of the path 1 - 64 (binary 0x01$_H$ – 0x40$_H$).
y is the value of the corresponding attenuator in dB-scale 0 – 95 (binary 0x00$_H$ – 0x5F$_H$).
s is the setting of the corresponding delay stage in 5 ps steps, divided in two bytes,
high byte with graduation hundred (binary 0x00$_H$ – 0x03$_H$) and
low byte with graduation one (binary 0x00$_H$ – 0x63$_H$ resp.
0x00$_H$ – 0x14$_H$ if high byte is 0x03$_H$) = 0 – 320 * 5 ps = 0 – 1600 ps.
To calculate the delay use following formula:
t = ([s_{high}]*100 + [s_{low}]) * 5 ps

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Receive string: "SDFw_1 y_n s_{nhigh} s_{nlow} $y_{(n+1)}$ $s_{(n+1)high}$ $s_{(n+1)low}$ . . . y_m s_{mhigh} s_{mlow}"

e. g. receive string: "SDF7***50310***" (0x53$_H$0x44$_H$0x46$_H$0x07$_H$***0x32$_H$*****0x03$_H$*****0x0A$_H$***)
(w_1=7, ***y_7=50*** , ***s_{7high}=3, s_{7low}=10*** = 310 * 5 ps)

The fast path command controls attenuators as well as the delays lines.
At this command just the number of the first path has to be declared.
All following numbers regard to the following pathes(**w**+1).
w is the number of the first path to set 1 - 64 (binary 0x01$_H$ – 0x40$_H$).
y is the value of the corresponding attenuator in dB-scale 0 – 95 (binary 0x00$_H$ – 0x5F$_H$).
s is the setting of the corresponding delay stage in 5 ps steps, divided in two bytes,
high byte with graduation hundred (binary 0x00$_H$ – 0x03$_H$) and
low byte with graduation one (binary 0x00$_H$ – 0x63$_H$ resp.
0x00$_H$ – 0x14$_H$ if high byte is 0x03$_H$) = 0 – 320 * 5 ps = 0 – 1600 ps.
To calculate the delay use following formula:
t = ([s_{high}]*100 + [s_{low}]) * 5 ps

The execution, namely the setting of the attenuator or delay line **w** to the values ***y*** or ***$s_{high}$$s_{low}$*** is carried out directly in the interpretation of the command.
If there is a value for ***y*** detected, which is overranged, the selected attenuator is set to the maximum value of attenuation (95 dB).
In case a not allowed value for **x** or ***$s_{high}$$s_{low}$*** is detected, the interpretation is stopped and a NAK is send back.

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2.9.4 Clear command

Receive string: "CL"

With the clear command a reset of all semiconductor-attenuators and all delay lines to the base status will occur, that means all attenuators are set to 95 dB and all delay lines are set to 0 ps.

2.9.5 Status check

Receive string: "ST", "ST1", "ST2"

In this setting, the unit returns the current state of all attenuators (look at chapter 2.9.7).

Receive string: "SD"

In this setting, the unit returns the current state of all attenuators and delay lines (look at chapter 2.9.7).

Receive string: "SQ"

In this setting, the unit returns the current state of all path (look at chapter 2.9.7).

Receive string: "ST-BA", "ST-IP"

In this setting, the unit returns the current state of the interfaces (look at chapter 2.9.7).

2.9.6 Ident command

Ident command: "*IDN?"

After sending the ident command, the device answers with the device-identifier. The device-identifier ends with the end command.

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2.9.7 Answers

The control card answers to every command.
All answers end with the end command.
The transmission of data is carried out in binary-format.

Acknowledge: "ACK" (if the transferred command could be executed)

Not acknowledge: "NAK" (if the transferred command could not or could not completely be executed)

Answer to status check "ST": "ST1$y_1$2y_2…64y_{64}", whereby
1 to 64 is the number of the semiconductor-attenuator (binary $0x01_H$ - $0x03_H$).
y is the attenuation value in dB-scale 0 – 95 (binary $0x00_H$ - $0x5F_H$).

Answer to status check "ST1" or "ST2": "ST1$y_1$2y_2…64y_{64}ERR***v***", whereby
ERR***v*** is added to the answer to "ST"
v is the error state of the unit (value is 0 – 2 in ASCII format, 0 means no error has occurred, 1 means voltage error is active (1 possibly occurs at shutdown of the unit but not assured), 2 means voltage warning after voltage error has disappeared, 2 can not be displayed at "ST2" because it is reset by "ST2" before answering, 2 is reset by resetting the unit, too, 3 means internal control error, contact the manufacturer.).

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Attention: 5 ps steps are rounded up to next tenth by hardware above 640 ps!

Answer to status check "SD": "SD1y_1…64y_{64}**1**$s_{1high}s_{1low}$…**64**$s_{64high}s_{64low}$", whereby
- **1** to **64** is the number of the semiconductor-attenuator (binary $0x01_H$ - $0x40_H$).
- ***y*** is the attenuation value in dB-scale 0 – 95 (binary $0x00_H$ - $0x5F_H$).
- **1** to **64** is the number of the delay line (binary $0x01_H$ - $0x40_H$).
- ***s*** is the setting of the delay line in 5 ps steps with two bytes, high byte with gradation hundred (binary $0x00_H$ – $0x03_H$) and low byte with gradation one (binary $0x00_H$ – $0x63_H$ resp. $0x00_H$ – $0x14_H$ if high byte is $0x03_H$) = 0 – 320 * 5 ps = 0 – 1600 ps

Answer to status check "SQ": "SQ$y_1s_{1high}s_{1low}$…$y_{64}s_{64high}s_{64low}$", whereby the values are shown for path 1 – 64
- ***y*** is the attenuation value in dB-scale 0 – 95 (binary $0x00_H$ - $0x5F_H$).
- ***s*** is the setting of the delay line in 5 ps steps with two bytes, high byte with gradation hundred (binary $0x00_H$ – $0x03_H$) and low byte with gradation one (binary $0x00_H$ – $0x63_H$ resp. $0x00_H$ – $0x14_H$ if high byte is $0x03_H$) = 0 – 320 * 5 ps = 0 – 1600 ps

Answer to status check "ST-BA": "ST-BA***y***", whereby
- ***y*** is the baud rate in ASCII format (9600, 57600, 115200).

Answer to status check "ST-IP": "ST-IP***y***", whereby
- ***y*** is the IP-address in ASCII format (e. g. 192.168.83.50), read at the last booting. If the LAN-module has not offered the address the unit answers "ST-IP Reading Error" at this request.

Answer to ident command: The device answers with the device-identifier.

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2.9.8 Command examples

Attenuator commands:

Set attenuator 1 to 50 dB, attenuator 2 to 80 dB
Receive string: $53_H41_H01_H\mathbf{32_H}02_H\mathbf{50_H}FF_H$
S A 1 ***50*** 2 ***80*** ETX

Set attenuator 1 to 15 dB, attenuator 2 to 16, attenuator 3 to 32 dB
Receive string: $53_H41_H01_H\mathbf{0F_H}02_H\mathbf{10_H}03_H\mathbf{20_H}FF_H$
S A 1 ***15*** 2 ***16*** 3 ***32*** ETX

Delay line commands:

Set delay line 1 to 10 ps, delay line 2 to 110 ps
Receive string: $53_H50_H01_H\mathbf{00_H02_H}02_H\mathbf{00_H16_H}FF_H$
S P 1 ***0 2*** 2 ***0 22*** ETX
Calculation delay line 1:
($\mathbf{00_H}$ * 100 + $\mathbf{02_H}$) * 5 ps = 10 ps
($\mathbf{00_D}$ * 100 + $\mathbf{02_D}$) * 5 ps = 10 ps
Calculation delay line 2:
($\mathbf{00_H}$ * 100 + $\mathbf{16_H}$) * 5 ps = 110 ps
($\mathbf{00_D}$ * 100 + $\mathbf{22_D}$) * 5 ps = 110 ps

Set delay line 1 to 1595 ps, delay line 2 to 1600 ps
Receive string: $53_H50_H01_H\mathbf{03_H13_H}02_H\mathbf{03_H14_H}FF_H$
S P 1 ***3 19*** 2 ***3 20*** ETX
Calculation delay line 1:
($\mathbf{03_H}$ * 100 + $\mathbf{13_H}$) * 5 ps = 1595 ps
($\mathbf{03_D}$ * 100 + $\mathbf{19_D}$) * 5 ps = 1595 ps
Attention: **5 ps steps are rounded up to next tenth by hardware above 640 ps means 1600 ps are set here!**
Calculation delay line 2:
($\mathbf{03_H}$ * 100 +$\mathbf{14_H}$) * 5 ps = 1600 ps
($\mathbf{03_D}$ * 100 +$\mathbf{20_D}$) * 5 ps = 1600 ps

Path commands:

Set path 1 to 30 dB and 140 ps
Receive string: $53_H44_H01_H\mathbf{1E_H}\mathbf{00_H}\mathbf{1C_H}FF_H$
S D 1 ***30 0 28*** ETX
Calculation delay line 1:
($\mathbf{00_H}$ * 100 + $\mathbf{1C_H}$) * 5 ps = 140 ps
($\mathbf{00_D}$ * 100 + $\mathbf{28_D}$) * 5 ps = 140 ps

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3 SERVICE

3.1 Changing fuse of 230 V AC supply

Inside of the appliance plug there are the fuses F1 and F2. Defective fuses have to be changed by fuses of the same type. Pull out the fuse holder at zero-current-unit (power cable removed) to get access to the fuses.

Attention: To change fuses, first switch off power at power switch S1 **a n d** remove the power cable!

Defective fuses have to be replaced by new fuses of the following type!
F1, F2 = T3.15/250 (3.15 A, 250 V AC, slow blow)

3.2 Cleaning

Maintenance work essentially only includes the cleaning of the unit.
Inform competent authorized personnel if damages are determined.

Attention: To clean the unit, first switch off power at power switch S1
a n d remove the power cable!
Depending on the degree of contamination, the unit has to be cleaned with a lint-free, soft and dry cloth or brush. Do not use cleaning liquids except for mild detergents (moisten cloth) for cleaning!

3.3 Maintenance and repair

No regular maintenance check for the unit is required.
Checking the unit is done by calibration.

During the warranty period only the manufacturer is authorized to repair the unit.

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4 TECHNICAL DATA

Technical data are shown on the specification sheet in the appendix.

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5 WARRANTY

The "General Terms and Conditions for Delivery and Payment of MTS Systemtechnik GmbH" or agreed warranty terms are applicable.

There will be no warranty for damages caused by improper handling, improper operation, technical changes, maintenance or physical damages, if these damages were not caused by MTS Systemtechnik GmbH.

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6 APPENDIX

Is the manual delivered as CD, you can find the separate files of appendix as pdf on the CD.

Annex 1 Specification for the Air Interface Adapter AIAD-8/8-4G+DL

Annex 2 Block diagram for the Air Interface Adapter AIAD-8/8-4G+DL

Annex 3 EC-Declaration of conformity for the
Air Interface Adapter AIAD-8/8-4G+DL

Annex 4 Extended_Configuration_XPORT_Modul

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