- 8 independent channels
- 7 Transimpedance range: 10^9, 10^8, 10^7, 10^6, 10^5, 10^4, 10^3
- 3nV Eq. Input Noise
- Bandwidth from 15 kHz to 1 MHz
- Differential input configuration with a CMRR > of 80 dB
- Programmable 1 kHz low pass filter.
- All parameters remotely programmable
- 10 Volts Max. Input Bias Voltage Programmable with 12 Bit Resolution
- Electric Discharges input protection.
- 8 Single Ended Output
- Multiplexed output single ended
- +12 / -12V Power Supply

Vout/I-in	10^9	10^8	10^7	10^6	10^5	10^4	10^3
BW	15 kHz	15 kHz	50 kHz	150 kHz	250 kHz	500 kHz	1 MHz
[1]Noise RMS	2.5 (pA)	2.5 (pA)	100 (pA)	300 (pA)	700 (pA)	12 (nA)	150 (nA)
Max Input Current	10 nA	100 nA	1 µA	10 µA	100 µA	1 mA	10 mA
Vbias	Max. 10 V differential 12-bit resolution						

1) Measured with maximum bandwidth of the relative range.

General Description:

The **A1436** is an 8-channel transimpedance amplifier based on a differential input configuration.
It generates an output voltage proportional to the difference of the incoming currents on its input pairs. This Solution minimizes Induced Noise in applications where intense sources of interference are present. This preamplifier is suitable, for example, to read the current of Diamond detector, and other types of Semiconductor detectors e.g. Silicon Detector.
They can be used in both Photovoltaic mode and photoconductive mode.
In this case, a Bias voltage can be supplied to the differential inputs.
This voltage is generated internally and can be programmed up to a maximum value of 10 V.
Each input pair consists of one pole indicated by Cathode (K) and one indicated by Anode (A), due to the fact that Bias is provided Positive on Cathode and Negative on Anode so that the junction is inversely polarized. Each channel possesses 7 different transimpedance values, (10^9 to 10^3) a low pass filter with a cut-off frequency of 1kHz and a 10X gain stage.
All these parameters are individually remotely programmable via an RS485 connection.

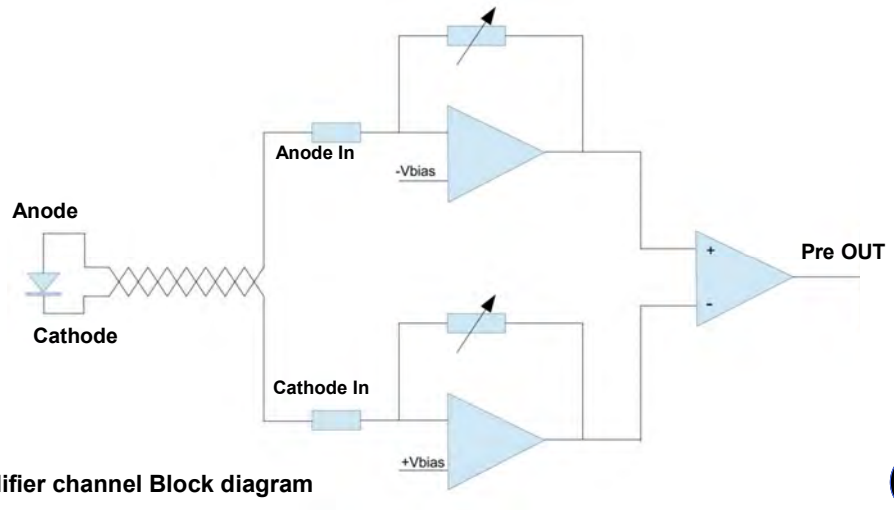

Fig. 1 Preamplifier channel Block diagram

Fig. 2 A1436 input side

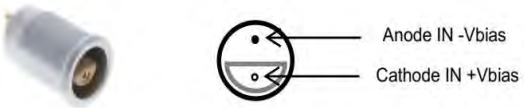

Fig. 3: Input Connector ERA.0S.302.CLL

Specifications:

Input Channels:
Connector : 8 x ERA.0S.302.CLL
Max sustainable current on differential inputs: 100mA DC
Bias voltage max :10V differential (+5V on Cathode pin and -5V on Anode pin referred to GND)

Common Test input:
Connector: Lemo 00
Test charge injection: 1pC*V

Channel Output:
Connector: 8X Lemo 00
Max out Voltage: 10 V (No termination on output)
Max Out current: 100 mA
Back termination: 50 Ohm

Mux Out:
Connector: 1X Lemo 00
Max out Voltage: 10 V (No termination on output)
Max Out current: 100 mA
Back termination: 50 Ohm

Power Input:
Connector: 1X DB9 Male
Voltage Input: +12V; -12V;
Current consumption: +12=300mA; -12V=250m;

RS 485 Input:
Connector: 2X3 pin Header 2,54mm pitch

Dimension: 100 x 50 x 124 mm^3 (WxHxD connector excluded)

Fig.4 A1436 Output side

Instructions for Operation

All parameters of the A1436 can be set through a Command Line Interface once the module is connected to a Terminal emulator.
The Module comes with a USB-RS485 adapter.

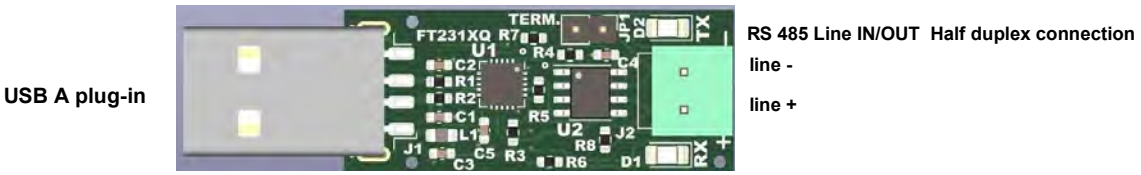

Fig. 5 USB-RS485 adapter

Connect the adapter to the PC, it should be recognized as a Virtual COM port, if this is not the case try downloading the Virtual COM Port Drivers of FTDI's FT231XQ Chip:
https://ftdichip.com/drivers/vcp-drivers/
Once recognized check on which COM it is associated (e.g. with Device Management of windows 11).
Connect the RS485 line output of the adapter with a twisted cable to one of the two positions A or B on the RS485 connector of the A1436 Preamplifier, as in the detail of fig. 6.

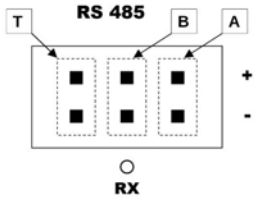

Fig. 6 RS485 connector detail.
The two positions A and B are in parallel (i.e. the A+ and B+ are shorted as well as A- and B-) Position T can introduce a 120 ohm termination between A+ and A- by placing a jumper in its position, this can improve communication in case of a very long distance connection.

Respect the polarity of the + and - connection between adapter and the RS485 input of the A1436.

Now open a terminal emulator (for example Putty is an open source Terminal Emulator downloadable at:
https://www.putty.org/)
Set the connection to Serial and the line to the COM of the USB-485 adapter.
Set the following parameters:
Speed (baud) = 115200
Data Bit = 8
Stop Bit = 1
Parity = None
Flow control = XON/ XOFF

At this point we can power on the Preamplifier A 1436 through the power cable provided.
The following screen should appear on the Terminal:

```
ESP-ROM:esp32s3-20210327
Build:Mar 27 2021
rst:0x1 (POWERON),boot:0x8 (SPI_FAST_FLASH_BOOT)
SPIWP:0xee
mode:DIO, clock div:1
load:0x3fce3808,len:0x44c
load:0x403c9700,len:0xbe4
load:0x403cc700,len:0x2a38
entry 0x403c98d4
*1: A1436 started, waiting for initialization
```

At this point, the module takes a few seconds to initialize the 8 channels by transferring the parameters saved in its non-volatile memory, when initialization is complete, the following message appears:

***1: A1436 initialized successfully**
***1: FW_Version: 1.04**
***1: Type 'M1H' for display the help message**

Afterwards if no action is taken, after 20 seconds the module goes into sleep mode and the following message is sent:

***Modules going into Sleep Mode, press any characters to wake up**

To wake up the module, after this warning, send any two characters followed by the Enter key.
The following message will appear

***Modules UP**

Note*
If several modules are connected in a chain at least one must have ID 1 while the others can have any other ID avoiding of course duplicate ID.

HELP COMMAND:

We can begin by invoking the Help command

Type: **M1H** (**Enter**):

```
*1H
 **Command Line Interface Help**

***Overview**
*This interface controls and configures modules. Each module has a unique ID.

**Command Structure**
*```
*M<moduleID><command>[options]
*```
*   `M<moduleID>`: Target module (1-254). `M255` is for broadcast commands.
*   `<command>`: Action to perform (e.g., `D`, `S`, `H`, `I`, `X`).
*   `[value]`: Parameters to be set (optional).

**Available Commands**
*   `M<moduleID>D`: Ping modules in the chain. Use `M255D` to discover all the modules in the chain.
*   `M<moduleID>S`: Display module settings.
*   `M255Z`:Makes all the nodes going to sleep.
*   `M<moduleID>H`: Print this help.
*   `M<moduleID>I<new_module_id>`: Set a new module ID (1-254).
*   `M<moduleID>X[0-1]`: Enable (1) or disable (0) the MUX.

**Channel-Specific Commands**
*   `M<moduleID>C<channel_ID>`: Select channel (1-8) to configure.
*   Options after `C<channel_ID>`:
*       `T<transimpedance_val>`: Set transimpedance (10^x, 3-9)
*       `B<v_bias_val>`: Set V Bias (0-4095)
*       `L<low_pass_filter_enabled>`: Enable (1) or Disable (0)
*       `G<gain_enabled>`: Enable (1) or Disable (0)
*       `X`: Switch MUX to the selected channel.

**Important Notes**
*   `M255` affects ALL modules.
*   Only ONE module should have ID 1 if using multiple.
*   Channel options can be executed one at a time.

**Examples**
*   `M5S`: Show settings for module 5.
*   `M255D`: Discover all modules.
*   `M3C2T5`: Module 3, channel 2, Transimpedence set to 10^5 settings.
```

***1: <OK>*<OK>**
As we can see, there are two types of commands:
Module Commands and **Channel Specific Commands.**
The **Module Commands** act on the Addressed module and concern properties of the module itself.
The structure of these commands is as follows:
The first Letter is always:
"**M**" followed by the ID number (**1** to **255** where ID 255 is the broadcasting address) and a letter identifying the command, followed by any option, and with **ENTER** we send to execution
For example: **M1S (Enter):**
We get the status of the parameters of the indexed module (1 in this case)

```
*Status Report for Module 1
*Mux Enable: OFF
*CH.   |Transimpedance     |Low Pass Filter     |Gain   |V Bias
*1*    |10^7*              |0*                  |0*     |0
*2*    |10^8*              |0*                  |0*     |0
*3*    |10^9*              |0*                  |0*     |0
*4*    |10^3*              |0*                  |0*     |0
*5*    |10^3*              |0*                  |0*     |0
*6*    |10^3*              |0*                  |0*     |0
*7*    |10^3*              |0*                  |0*     |0
*8*    |10^3*              |0*                  |0*     |0
*1: <OK>*<OK>
```

Similarly if we had ID 2 in the chain to get its status we type:
M2S (Enter):

```
*Status Report for Module 2
*Mux Enable: ON
*Mux Channel: 8
*CH.   |Transimpedance     |Low Pass Filter     |Gain   |V Bias
*1*    |10^6*              |0*                  |0*     |0
*2*    |10^6*              |0*                  |0*     |0
*3*    |10^5*              |0*                  |0*     |0
*4*    |10^8*              |0*                  |0*     |0
*5*    |10^4*              |0*                  |0*     |0
*6*    |10^8*              |0*                  |0*     |0
*7*    |10^7*              |0*                  |0*     |0
*8*    |10^7*              |0*                  |0*     |0
*2: <OK>*<OK>
```

The list of Module Commands are:
D; S; Z; H; I; X;

D: Identification of the addressed Module, You use this command to identify the modules in the chain. If ID 255 is used all modules will send their identifier in sequence. Ex: **M255D Enter**
***1:**
***2**:
It means that we have two modules in the chain with IDs 1 and 2.

S: This command gets as a response a table summarizing the parameter values of all channels of the module Addressed as in the previous examples;

Z: forces the addressed module in Sleep Mode if ID 255 is used it puts all nodes in the chains in sleep at the same time .
NOTE: The Sleep Mode greatly reduces the noise that the microcontroller induces on the Preamplifier outputs.
For example:
M255Z (Enter):
In response we will receive the message:
*Modules going into Sleep Mode, press any characters to wake up.

H: Help Message; The addressed Module sends a summary description of the operation of the Command Line Interface. It is recommended to use ID 1 because it is always present.
Example: **M1H (Enter):**

I: Command to set a new module ID.
Example: **M1I2** changes the ID of module 1 to the new value of ID 2.

X: Enables or disables the Multiplexer output of the selected Module, options are: 1 to Enable, 0 to Disable. When Disabled the Mux output goes into high impedance state. A Green LED on, indicates the enabled state of the MUX.
Example: **M1X1 Enter**
Enables the MUX output of Module 1
When enabled the Mux output shows one of the eight channel outputs of the PRE.
The channel present on the Mux is automatically selected by operating with any command channel. Alternatively, you can force a channel on the MUX with the specific channel command: **example M1C4X1;**
It selects the MUX of Module 1 to **ON** and puts the output of channel 4 on the MUX out.

Channel-Specific Commands

Channel-specific commands allow to act on the parameters of a specific channel of the addressed module.

The structure of the Channel-Specific Commands is always:
M"ID" (module ID=1to 255) C"ID" (Channel ID=1to 8) Command (from the list below) followed by the value to set

T: Transimpedance;
B: Bias Voltage:
L: Low pass Filter
G: Gain X 10
X: Switches a specific output to the Mux output.

In detail:

T: Transimpedance, set one of 7 transimpedance values expressed by its exponent, the permitted values are: 3, 4, 5, 6, 7, 8, 9 which correspond to Transimpedance values: 10^3, 10^4, 10^5, 10^6, 10^7, 10^8, 10^9
Example: **M1C3T8**
sets the transimpedance value of channel 3 of module 1 to the value of 10^8.

B: Bias Voltage
sets the value of the Bias voltage, the permitted values are "0 to 4095" which correspond to a Bias value from 0 to 10 V respectively
Example **M1C2B1024**
Set a Bias value of approximately 2.5V volts on channel 2 of module 1.

L: Low pass filter:
set a low pass filter at 1 kHz on the addressed channel, the parameters are: **1** to enable the filter; **0** to disable
Example **M1C3L1**
enables the 1khz filter on channel 3 of module 1.

G: X10 Gain
set a gain of X10 on the output of the selected channel
the options are: **1** to enable the gain; **0** to disable it.
Note: X10 gain reduces bandwidth at 50khz.
Example **M1C2G1**
set a gain X10 on channel 2 of module1.

X: set a channel on the Mux output.
Select the channel to send on the Mux output if the MUX is enabled
The options are: **1** to enable Mux output, **0** to disable it
Example M1C8X1
Enables the Mux output of module 1 and sends the output of channel 8 to it.
Note, the X command can be either Channel-Specific Commands or Module Command.

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Ordering Option

Ordering code	Description
WA1436XAAAAA	A1436 - 8 Ch. Variable Gain Full Differential Current Sensing Amplifier

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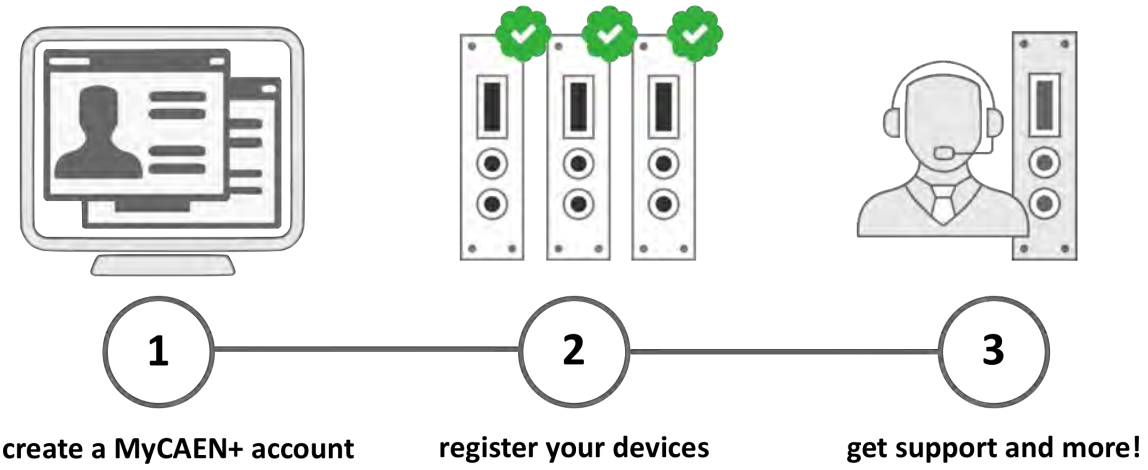

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