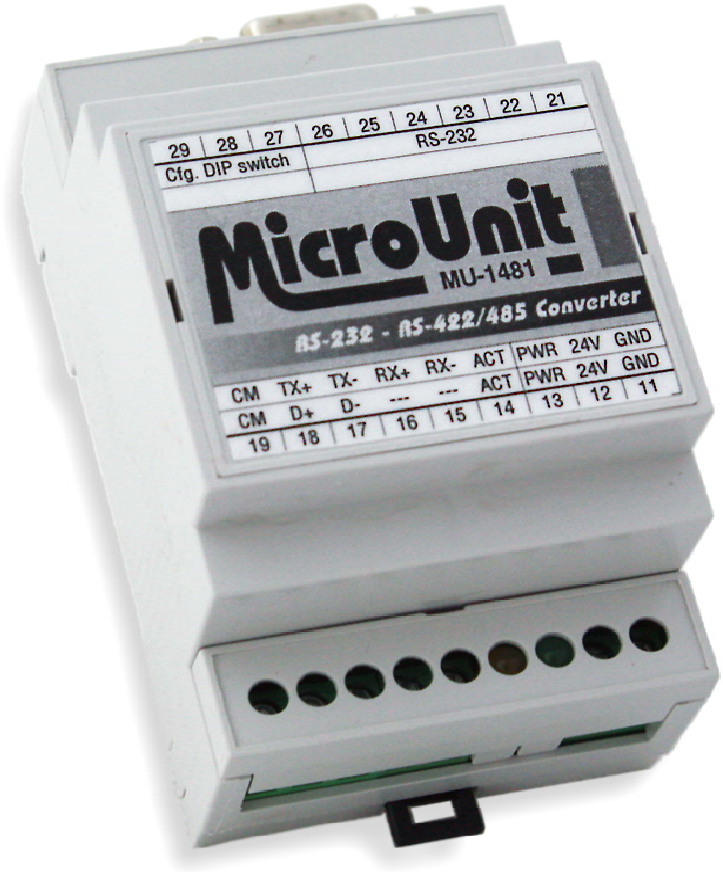

MU-1481/2481/2485
Communication Converters

User Guide

Revision history		
date	version	changes
18.8.2011	08.2011	initial release
5.10.2011	10.2011	corrected minor bugs
16.5.2016	05.2016	new EU Declaration of Conformity added
15.2.2017	02.2017	new version of ADFC utility, Windows 10 screenshots

Caution:

The converters may be used only according to the manufacturer's recommendations and precautions given in this manual and other general standards and terms and may be used only such a way, that its failure caused by any reason will not be dangerous to any person or property.

Disclaimer:

This manual has been carefully reviewed for technical accuracy. In the event that technical or typographical errors exist, TEDIA® reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition.

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Table of Contents

EU Declaration of Conformity

Issued in terms of Directive 2014/30/EE of the European parliament and of the Council.

We, TEDIA® spol. s r. o., declare under our sole responsibility that the following products

MU-1481 (RS-232 <=> RS-422/485 converter),

MU-2481 (RS-422 <=> RS-422/485 converter),

and

MU-2485 (RS485 <=> RS-485 repeater),

when installed in accordance with the manufacturers specifications, are in conformity with the following standards

ČSN EN 61000-6-2 ed. 3 (2006)
ČSN EN 61000-4-2 ed. 2 (2009)
ČSN EN 61000-4-3 ed. 3 (2006) + A1 + A2 + Z1
ČSN EN 61000-4-4 ed. 3 (2013)
ČSN EN 61000-4-5 ed. 2 (2007) + Z1
ČSN EN 61000-4-6 ed. 3 (2009) + Z1
ČSN EN 61000-4-8 ed. 2 (2010)
ČSN EN 61000-6-4 ed. 2 (2007) + A1
ČSN EN 55011 ed. 3 (2010) + A1

and with directive 2014/30/EE including amendments.

Products are marked with the "CE" logo.

CE

Test Certificate:	16-13 issued by Electrotechnical laboratory - ETL (accredited laboratory no. 1090)
Date of Issue EU Declaration:	16.5.2016
Manufacturer:	TEDIA® spol. s r. o. Zábělská 12 31211 Plzeň Czech Republic
Manufacturer's Representative:	Ing. Martin Linda, Managing Director

Signature of the Representative:

1. General information

1.1 Introduction

Attention has been focused on achieving a high quality and reliability during the manufacturing process and attention was also paid to an inspection of the converter before being shipped to you. Detailed reading of this guide and following the instructions precisely are highly recommended for achieving full quality and to prevent any damage during installation.

For further information visit manufacturer's website at http://www.tedia.eu.

1.2 List of products described in this User Uuide

This User Guide describes three types of converters/repeaters and dedicated configuration software.

type	description
MU-1481	RS-232 <=> RS-422/485 converter with ADFC function and three-way isolation
MU-2481	RS-422 <=> RS-422/485 converter with ADFC function and three-way isolation
MU-2485	RS-485 <=> RS-485 converter (repeater) with ADFC function and three-way isolation
ADFC software	ADFC circuits configuration utility (Windows version)

Note: All three types listed in the table above support Automatic Data Flow Control function (ADFC) and therefore require configuration prior to installing and using.

1.3 Sales office, service center, technical support

In case of doubt, you can contact the manufacturer's technical support:

address: TEDIA spol. s r. o., Zábělská 12, 31211 Plzeň, Czech Republic
website: http://www.tedia.eu
e-mail: sales@tedia.eu
support@tedia.eu
phone: +420 373730431 (sales office)
+420 373730436 (technical support)

Note: Although this User Guide has been carefully reviewed, it can contain errors. If you suspect that some information is listed incorrectly, incompletely or inaccurately, please contact technical support.

2. MU-1481, RS-232 <=> RS-422/485 converter with ADFC function

2.1 Introduction

The MU-1481 converter is intended for converting the RS-232 signal levels to RS-422 or RS-485 signal levels.

By its design (built into industrial DIN 35 mm housings Modulbox), the converter is suitable for use in industrial applications using asychronous serial communication. The converter is supplied from external source of 10÷30 V. Both communication lines are isolated to the power supply and to each other (three-way isolation).

The converter provides the circuits for Automatic Data Flow Control (ADFC) at the RS-422/485 interface. The ADFC feature at the secondary line relies on the incoming data at the primary line. If data is detected at primary line when using ADFC, the secondary line is automatically switched on for transmission automatically.

The converter also provides overvoltage protection components and user-activatable line termination impedances (both RS-422 and RS-485 interfaces).

2.2 Specifications

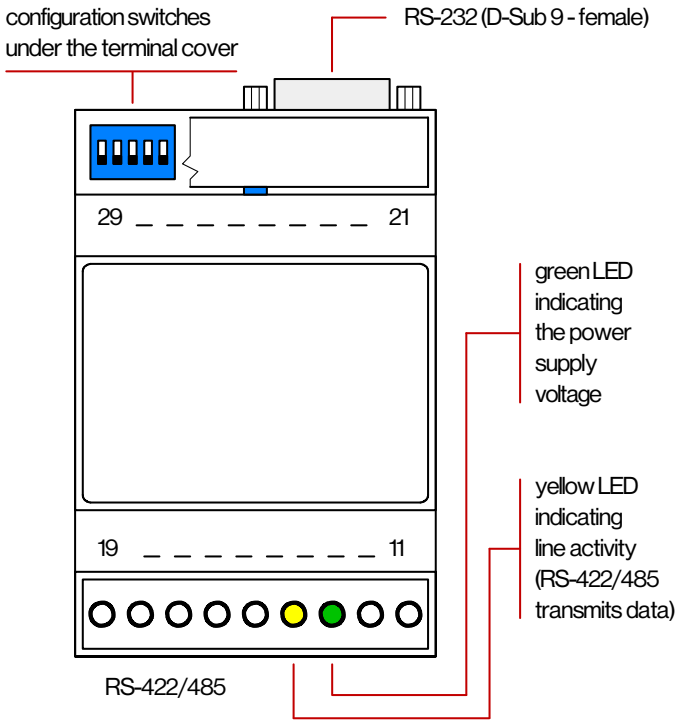
The general technical parameters are listed in the table below.

Type	**MU-1481**
Primary line (see note below)	RS-232
Primary line signals	TXD, RXD RTS, DTR (only when ADFC cannot be used)
Recommended wire length	2 m max. (round shielded type)
Secondary line	RS-422 (four-wire topology with "multidrop" capability) RS-485 (two-wire topology with "multidrop" capability)
Secondary line signals	TXD and RXD pairs (RS-422) TXD/RXD pair (RS-485)
Secondary line data transfer control	ADFC, RTS, DTR or ON (line permanently active)
Secondary line surge protection	TVS 5V8 / 600 W (transient voltage suppressor)
Termination impedance	120 Ohm / 1.3 V (1x at RS-485 signal pair, 2x at RS-422 signals pair)
Recommended wire length	1200 m max., cable conforming the EIA-RS-485 standard (i.e. shielded pair, conductor cross-section at least 0.22 mm^2, impedance 100÷130 Ohm, line capacitance approx. 60 pF/m)
Transfer rate	600 Bd ÷ 230.4 kBd
Type of isolation	three-way
Isolation voltage	1 000 V_{DC}
Supply voltage	10÷30 V_{DC}
Reverse polarity protection	100 V_{DC} max.
Current consumption	2,2 W max. (90 mA @ 24 V, 230 mA @ 10 V)
Operating temperature & Humidity	-10÷ 60°C, 5÷95% RH
Mechanical case, dimension	Modulbox 3M (90x60x55 mm)
Signal terminals	D-Sub 9 female connector (RS-232 signals) screw type, wire 2.5 mm^2 max. (RS-422/485 and power supply signals)

Note: *TEDIA also supplies converters with the isolation voltage up to 5 kV_{DC} and for the temperature range -40 ÷ 70°C; please contact sales department.*

2.3 Location of terminals, connector, configuration switches and LEDs

Figure below-left displays the location of terminals, connectors, configuration switches and LEDs in the case.
Figure below-right clarifies how to remove terminal cover (required to access the switches).

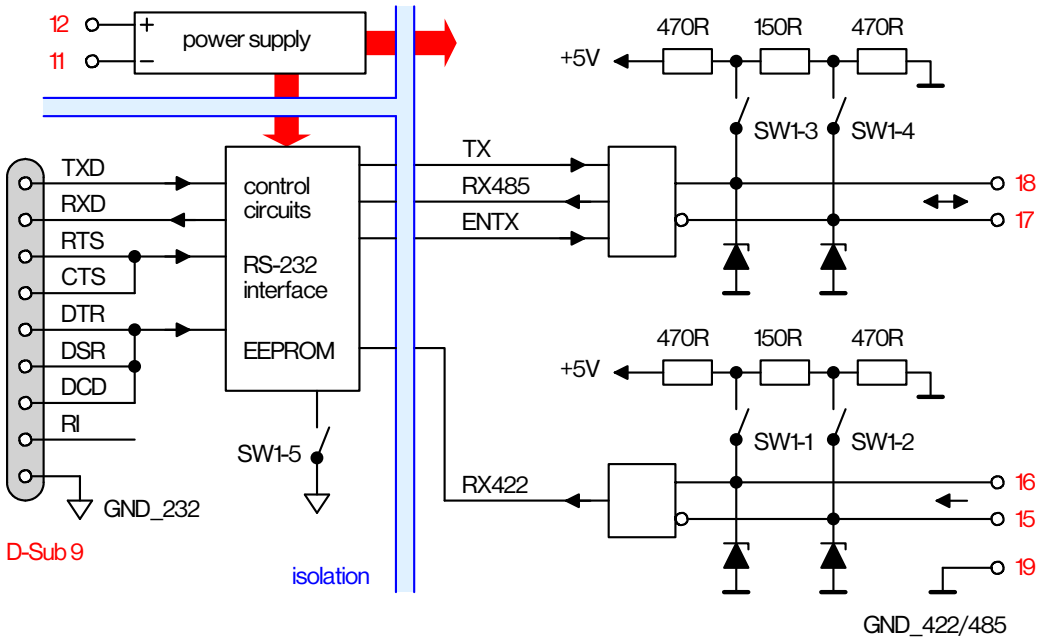


Position	Description			
11	PGND (power supply, negative signal)			
12	PWR (power supply, negative signal)			
13	green LED (indicates the power supply voltage)			
14	yellow LED (indicates RS-422/485 line activity, i.e. RS-422/485 transmits data)			
15	RX- (RS-422 mode, MU-1481 input signal)			
16	RX+ (RS-422 mode, MU-1481 input signal)			
17	TX- (RS-422 mode, MU-1481 output signal) TX/RX- (RS-485 mode, MU-1481 bidirectional signal)			
18	TX+ (RS-422 mode, MU-1481 output signal) TX/RX+ (RS-485 mode, MU-1481 bidirectional signal)			
19	GND_422/485 (GND for all RS-422/485 signals)			
21 ÷ 26	D-Sub 9 female, RS-232 signals (see belows)			
	1	DCD (MU-1481 output signal)	6	DSR (MU-1481 output signal)
	2	RXD (MU-1481 output signal)	7	RTS (MU-1481 input signal)
	3	TXD (MU-1481 input signal)	8	CTS (MU-1481 output signal)
	4	DTR (MU-1481 input signal)	9	RI (MU-1481 output signal)
	5	GND_232 (GND for all RS-232 signals)		
27 ÷ 29	SW1, the five-segment DIP switch (see belows) (segment numbers and the ON position is marked on the switch) 1 & 2: ON position (both together) activates terminators for RX signals pair 3 & 4: ON position (both together) activates terminators for signals TX or TX/RX signals pair 5: the state of this DIP switch segment must be changed when the power is turned off ON position activates communication mode, write to EEPROM is protected OFF position activates configuration mode, write to EEPROM is enabled			

Note: *As shown in the table above, the D-Sub 9 connection of MU-1481 connector is designed to be connected to the standard communication port with the D-Sub 9 male / D-Sub 9 female cable with 1: 1 wire topology.*

2.4 Internal circuit schematics

Figure below shows a simplified schematics of internal circuits.



Note: *The D-Sub 9 signal connections of MU-1481 connector is designed to be connected to the standard communication port with the D-Sub 9 male / D-Sub 9 female cable with 1: 1 wire topology.*

3. MU-2481, RS-422 <=> RS-422/485 converter with ADFC function

3.1 Introduction

The MU-2481 converter is intended for converting the RS-422 signal levels to RS-422 or RS-485 signal levels.

By its design (built into industrial DIN 35 mm housings Modulbox), the converter is suitable for use in industrial applications using asychronous serial communication. The converter is supplied from external source of 10÷30 V. Both communication lines are isolated to the power supply and to each other (three-way isolation).

The converter provides the circuits for Automatic Data Flow Control (ADFC) at the RS-422/485 interface. The ADFC feature at the secondary line relies on the incoming data at the primary line. If data is detected at primary line when using ADFC, the secondary line is automatically switched on for transmission automatically.

The converter also provides overvoltage protection components and user-activatable line termination impedances (all RS-422 and RS-485 interfaces).

3.2 Specifications

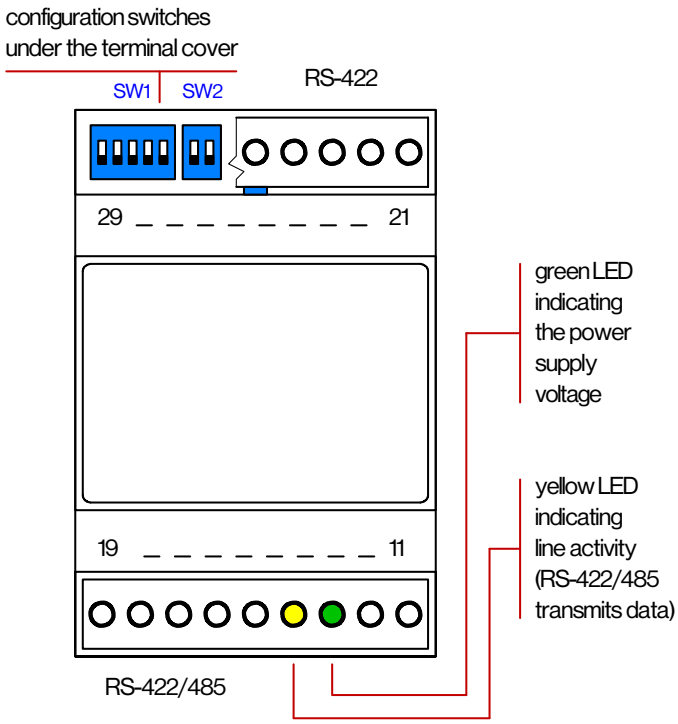
The general technical parameters are listed in the table below.

Type	**MU-2481**
Primary line (see note below)	RS-422 (four-wire topology) ("multidrop" capability supported only in configuration mode)
Primary line signals	TXD and RXD pairs
Primary line data transfer control	ADFC (only when configuration mode is activated)
Primary line surge protection	TVS 5V8 / 600 W (transient voltage suppressor)
Termination impedance	120 Ohm / 1.3 V (1x at RXD pair)
Recommended wire length	1200 m max., cable conforming the EIA-RS-485 standard (i.e. shielded pair, conductor cross-section at least 0.22 mm^2, impedance 100÷130 Ohm, line capacitance approx. 60 pF/m)
Secondary line	RS-422 (four-wire topology with "multidrop" capability) RS-485 (two-wire topology with "multidrop" capability)
Secondary line signals	TXD and RXD pairs (RS-422) TXD/RXD pair (RS-485)
Secondary line data transfer control	ADFC or ON (line permanently active)
Secondary line surge protection	TVS 5V8 / 600 W (transient voltage suppressor)
Termination impedance	120 Ohm / 1.3 V (1x at RS-485 signal pair, 2x at RS-422 signals pair)
Recommended wire length	1200 m max., cable conforming the EIA-RS-485 standard (i.e. shielded pair, conductor cross-section at least 0.22 mm^2, impedance 100÷130 Ohm, line capacitance approx. 60 pF/m)
Transfer rate	600 Bd ÷ 230.4 kBd
Type of isolation	three-way
Isolation voltage	1 000 V_{DC}
Supply voltage	10÷30 V_{DC}
Reverse polarity protection	100 V_{DC} max.
Current consumption	2,6 W max. (110 mA @ 24 V, 280 mA @ 10 V)
Operating temperature & Humidity	-10÷ 60°C, 5÷95% RH
Mechanical case, dimension	Modulbox 3M (90x60x55 mm)
Signal terminals	screw type, wire 2.5 mm^2 max.

Note: *TEDIA also supplies converters with the isolation voltage up to 5 kV_{DC} and for the temperature range -40 ÷ 70°C; please contact sales department.*

3.3 Location of terminals, configuration switches and LEDs

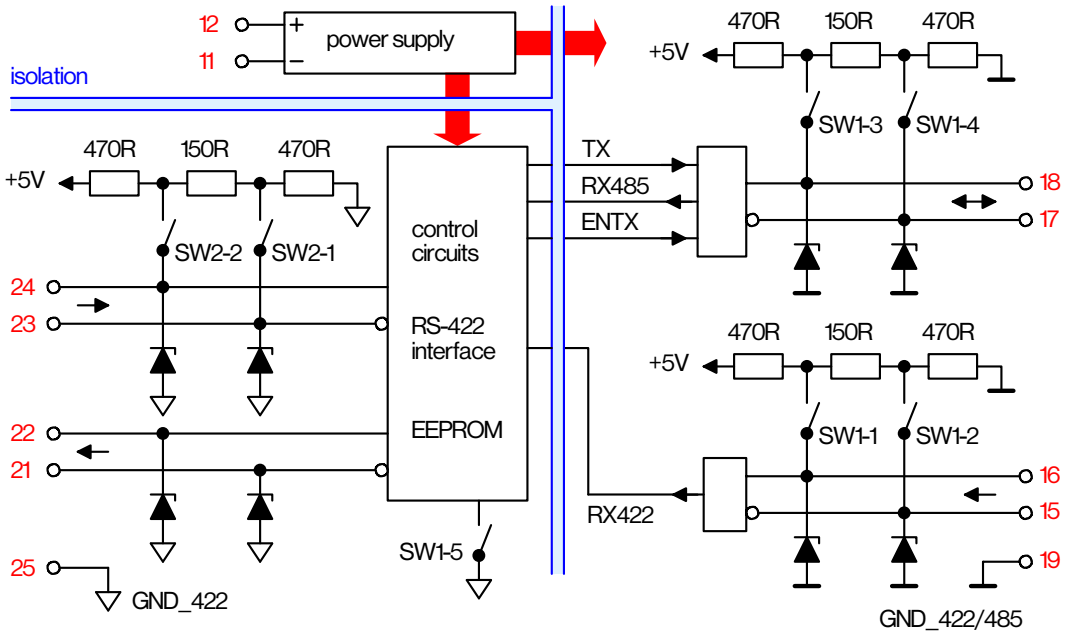
Figure below-left displays the location of terminals, configuration switches and LEDs in the case.
Figure below-right clarifies how to remove terminal cover (required to access the switches).



Position	Description
11	PGND (power supply, negative signal)
12	PWR (power supply, negative signal)
13	green LED (indicates the power supply voltage)
14	yellow LED (indicates RS-422/485 line activity, i.e. RS-422/485 transmits data)
15	RX- (RS-422 mode, MU-2481 input signal)
16	RX+ (RS-422 mode, MU-2481 input signal)
17	TX- (RS-422 mode, MU-2481 output signal) TX/RX- (RS-485 mode, MU-2481 bidirectional signal)
18	TX+ (RS-422 mode, MU-2481 output signal) TX/RX+ (RS-485 mode, MU-2481 bidirectional signal)
19	GND_422/485 (GND for all RS-422/485 signals)
21	TX- (RS-422 primary line, MU-2481 output signal)
22	TX+ (RS-422 primary line, MU-2481 output signal)
23	RX- (RS-422 primary line, MU-2481 input signal)
24	RX+ (RS-422 primary line, MU-2481 input signal)
25	GND_422 (GND for all RS-422 primary line signals)
27	SW2, the two-segment DIP switch (see belows) (segment numbers and the ON position is marked on the switch) 1 & 2: ON position (both together) activates terminators for RX signals pair of primary line
27 ÷ 29	SW1, the five-segment DIP switch (see belows) (segment numbers and the ON position is marked on the switch) 1 & 2: ON position (both together) activates terminators for RX signals pair 3 & 4: ON position (both together) activates terminators for signals TX or TX/RX signals pair 5: the state of this DIP switch segment must be changed when the power is turned off ON position activates communication mode, write to EEPROM is protected OFF position activates configuration mode, write to EEPROM is enabled

3.4 Internal circuit schematics

Figure below shows a simplified schematics of internal circuits.



Note: *In communication mode, the RS-422 primary line driver of TX+/TX- signal pair is permanetly active and the converter supports only four-wire RS-422 "point-point" mode.*
In configuration mode, the RS-422 primary line driver of TX+/TX- signal pair is software controlled and the converter supports four-wire RS-422 "multidrop" mode or two-wire RS-485 mode (terminal 21 must be connected with terminal 23 and terminal 22 must be connected with terminal 24).

4. MU-2485, RS-485 <=> RS-485 repeater with ADFC function

4.1 Introduction

The MU-2485 repeater is intended for isolated interconnection two RS-485 lines.

By its design (built into industrial DIN 35 mm housings Modulbox), the repeater is suitable for use in industrial applications using asychronous serial communication. The converter is supplied from external source of 10÷30 V. Both communication lines are isolated to the power supply and to each other (three-way isolation).

The repeater provides the circuits for Automatic Data Flow Control (ADFC) at both RS-485 interfaces. The ADFC feature detects incoming data on both lines and activates RS-485 driver for transmission on the second line automatically with the priority of driver activation according to the first detected data.

The repeater also provides overvoltage protection components and allows you to add line termination impedances (both RS-485 interfaces).

4.2 Specifications

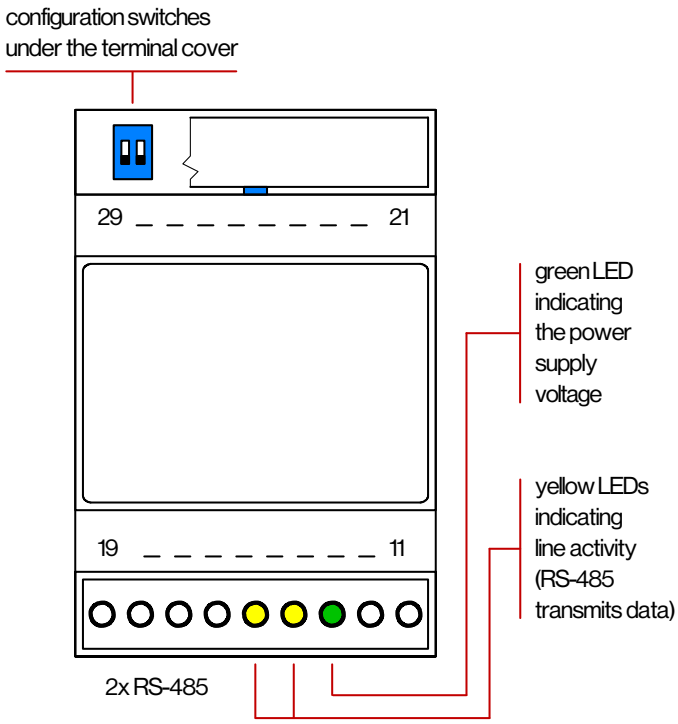
The general technical parameters are listed in the table below.

Type	**MU-2485**
Primary line (see note below)	RS-485 (two-wire topology with "multidrop" capability)
Primary line signals	TXD/RXD pair
Primary line data transfer control	ADFC
Primary line surge protection	TVS 5V8 / 600 W (transient voltage suppressor)
Termination impedance	120 Ohm / 1.3 V can be added to the MU-2485 (PCB contains free positions for resistors)
Recommended wire length	1200 m max., cable conforming the EIA-RS-485 standard (i.e. shielded pair, conductor cross-section at least 0.22 mm^2, impedance 100÷130 Ohm, line capacitance approx. 60 pF/m)
Secondary line	RS-485 (two-wire topology with "multidrop" capability)
Secondary line signals	TXD/RXD pair
Secondary line data transfer control	ADFC
Secondary line surge protection	TVS 5V8 / 600 W (transient voltage suppressor)
Termination impedance	120 Ohm / 1.3 V can be added to the MU-2485 (PCB contains free positions for resistors)
Recommended wire length	1200 m max., cable conforming the EIA-RS-485 standard (i.e. shielded pair, conductor cross-section at least 0.22 mm^2, impedance 100÷130 Ohm, line capacitance approx. 60 pF/m)
Transfer rate	600 Bd ÷ 115.2 kBd
Type of isolation	three-way
Isolation voltage	1 000 V_{DC}
Supply voltage	10÷30 V_{DC}
Reverse polarity protection	100 V_{DC} max.
Current consumption	2,6 W max. (110 mA @ 24 V, 280 mA @ 10 V)
Operating temperature & Humidity	-10÷ 60°C, 5÷95% RH
Mechanical case, dimension	Modulbox 3M (90x60x55 mm)
Signal terminals	screw type, wire 2.5 mm^2 max.

Note: *TEDIA also supplies converters with the isolation voltage up to 5 kV_{DC} and for the temperature range -40 ÷ 70°C; please contact sales department.*

4.3 Location of terminals, configuration switches, LEDs

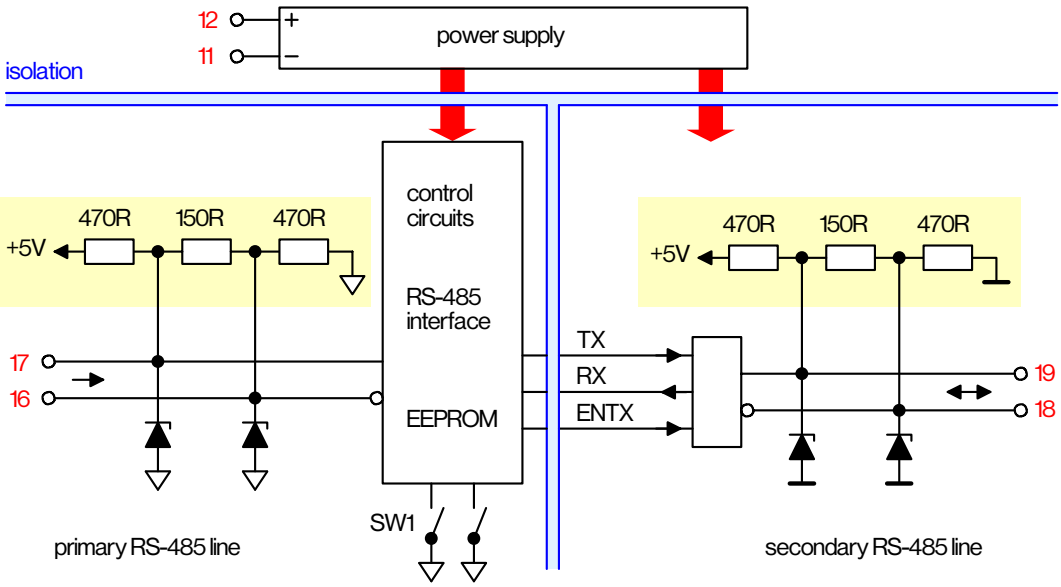
Figure below-left displays the location of terminals, configuration switches and LEDs in the case.
Figure below-right clarifies how to remove terminal cover (required to access the switches).



Position	Description
11	PGND (power supply, negative signal)
12	PWR (power supply, negative signal)
13	green LED (indicates the power supply voltage)
14	yellow LED (indicates primary RS-485 line activity, i.e. RS-485 transmits data)
15	yellow LED (indicates secondary RS-485 line activity, i.e. RS-485 transmits data)
16	TX/RX- (primary RS-485 line)
17	TX/RX+ (primary RS-485 line)
18	TX/RX- (secondary RS-485 line)
19	TX/RX+ (secondary RS-485 line)
27 ÷ 29	SW1, the two-segment DIP switch (see belows) (segment numbers and the ON position is marked on the switch) 1: the state of this DIP switch segment must be changed when the power is turned off ON position activates configuration mode OFF position activates communication mode 2: ON position - write to EEPROM is protected OFF position - write to EEPROM is enabled

4.4 Internal circuit schematics

Figure below shows a simplified schematics of internal circuits.



Note: *Termination impedances (highlighted with a yellow background) can be added to the MU-2485, PCB contains free positions for resistors on bottom side.*

5. ADFC configuration utility

5.1 Introduction

Both MU-1481 and MU-2481 converters provide the circuits for Automatic Data Flow Control (ADFC) at the RS-422/485 interface. The ADFC feature at the secondary line relies on the incoming data at the primary line. If data is detected at primary line when using ADFC, the secondary line is automatically switched on for transmission automatically.

The repeater MU-2485 provides the circuits for Automatic Data Flow Control (ADFC) at both RS-485 interfaces. The ADFC feature detects incoming data on both lines and activates RS-485 drives for transmission on the second line automatically with the priority of driver activation according to the first detected data.

The ADFC configuration utility is used to set ADFC circuits parameters.

5.2 ADFC configuration procedure

To configure the converter/repeater are needed...

- computer based on Windows operating system (Windows 7/8/8.1/10 are supported) equipped with COM port (RS-232 for MU-1481, RS-422 or RS-485 for MU-2481, RS-485 for MU-2485), see note below;
- a suitable interconnecting cable between COM port and converter/repeater;
- power supply for powering the converter/repeater;
- ADFC software (does not require installation, just to run).

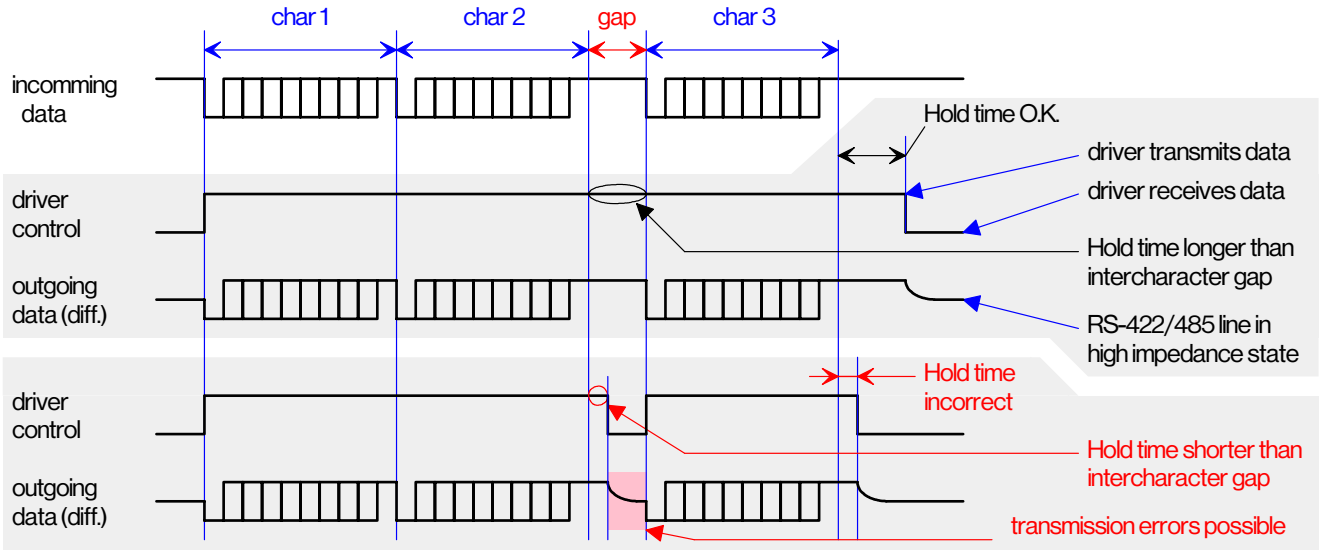
Note: *Miniature USB converters UC-232 and UC-485 from TEDIA production (www.tedia.eu/uc) are suitable for configuring all of the converters mentioned in this User Guide.*

Configuration procedure:

- connect converter/repeater to the COM port and power supply;
- remove terminal cover and select configuration mode (see description of the switches in the previous chapters);
- turn the power supply on;
- run ADFC software and configure the converter/repeater (see the description in following paragraphs);
- turn the power supply off, disconnect converter/repeater from the COM port and power supply;
- activate communication mode and put back terminal cover.

5.3 The principle of ADFC circuits

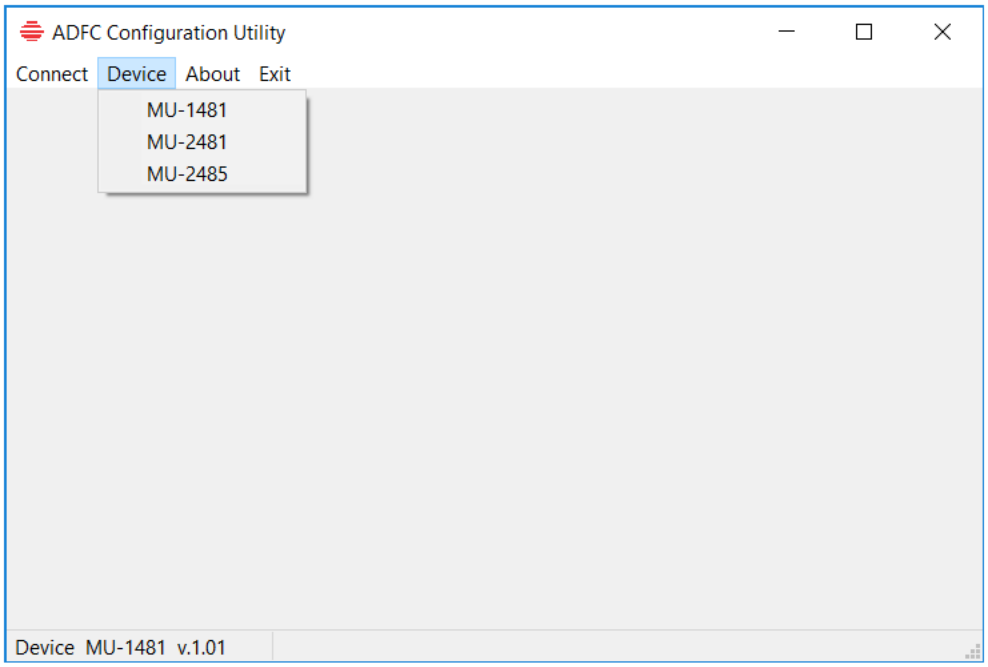
Figure below shows a simplified description of ADFC circuits.



The ADFC circuits automatically control RS-422/485 driver depending on incomming data; driver is switched to transmit at the moment of detection of the startbite and is switched back to high impedance state as soon as the Hold time expires after the last character. If the incomming data contains a gap between characters longer than hold time, the driver is switched to the high impedance state between the characters (highlighted in red; it may cause transmission errors).

5.4 ADFC software - Main window

Figure below shows a Main window of ADFC software.

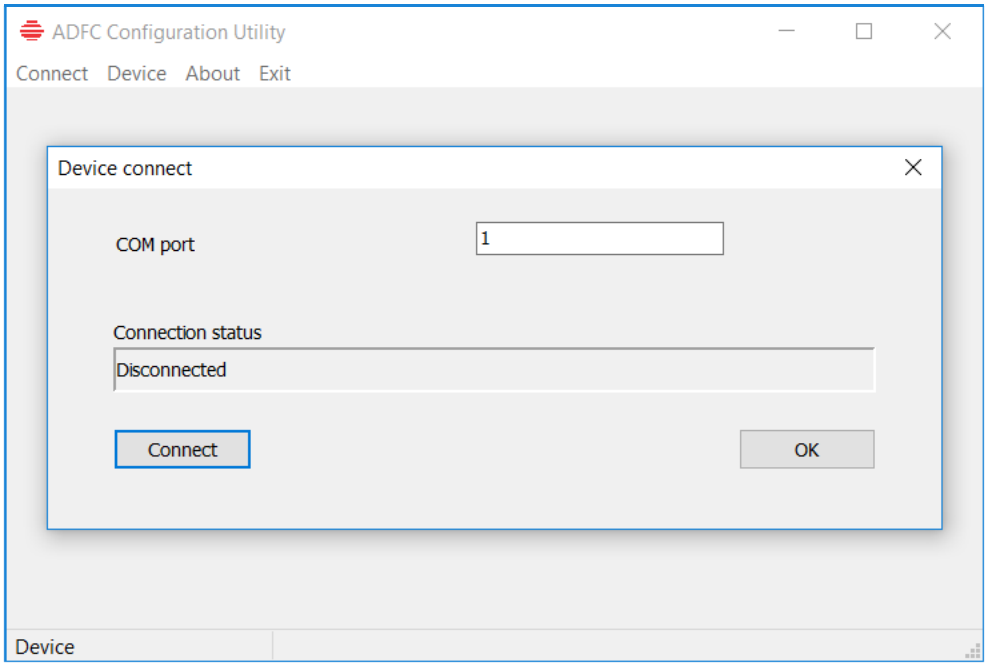


The Main window offers four choices:

- Connect - allows to select a COM port and the connect to a configured device (i.e. converter or repeater);
- Device - allows to select device type and open configuration window;
- About - displays the information about program;
- Exit - closes program.

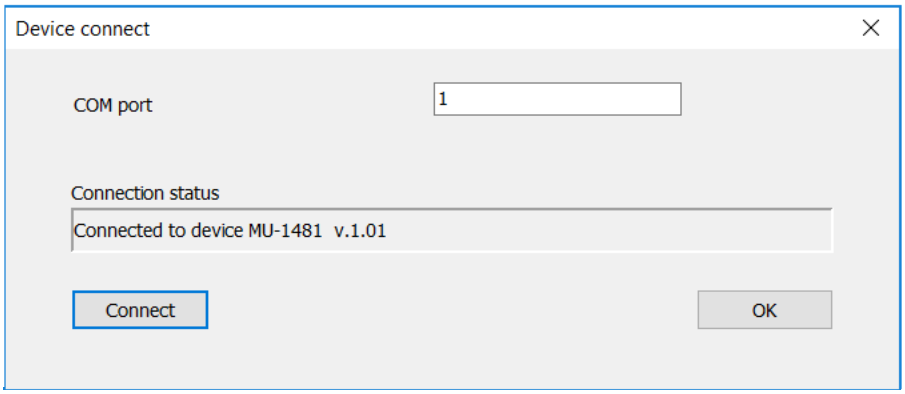
5.5 ADFC software - Device connect window

Figure below shows a Device connect window of ADFC software.



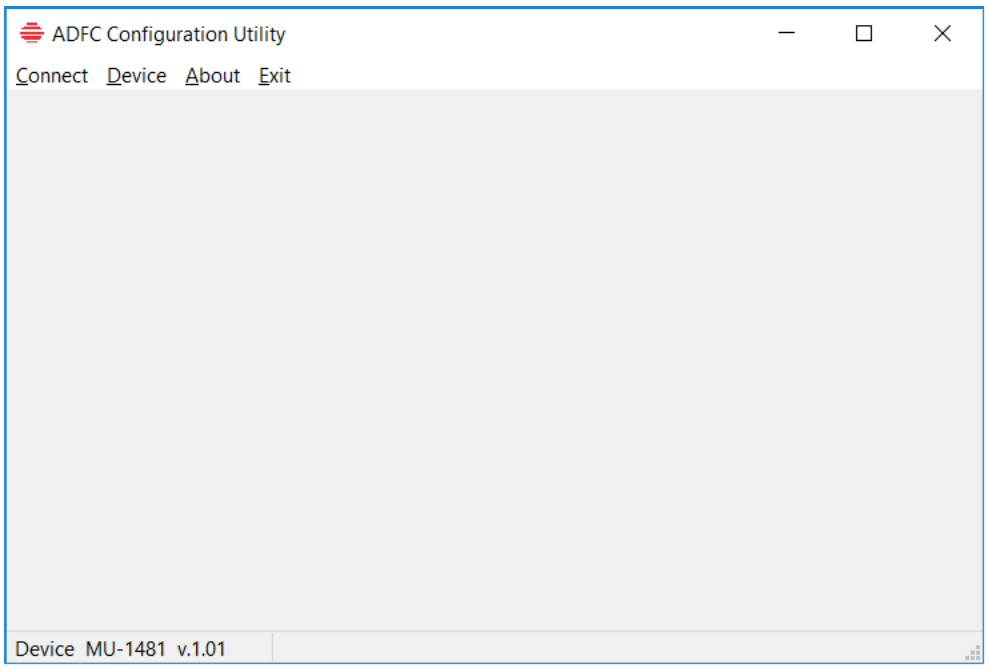
Until the connection to the device is not set, Connection status displays text "Disconnected".

First, it is necessary to select the COM port number to which the converter is connected, then press the button "Connect". If the connection with the device is established, Connection status line displays type and firmware version, see the figure below.



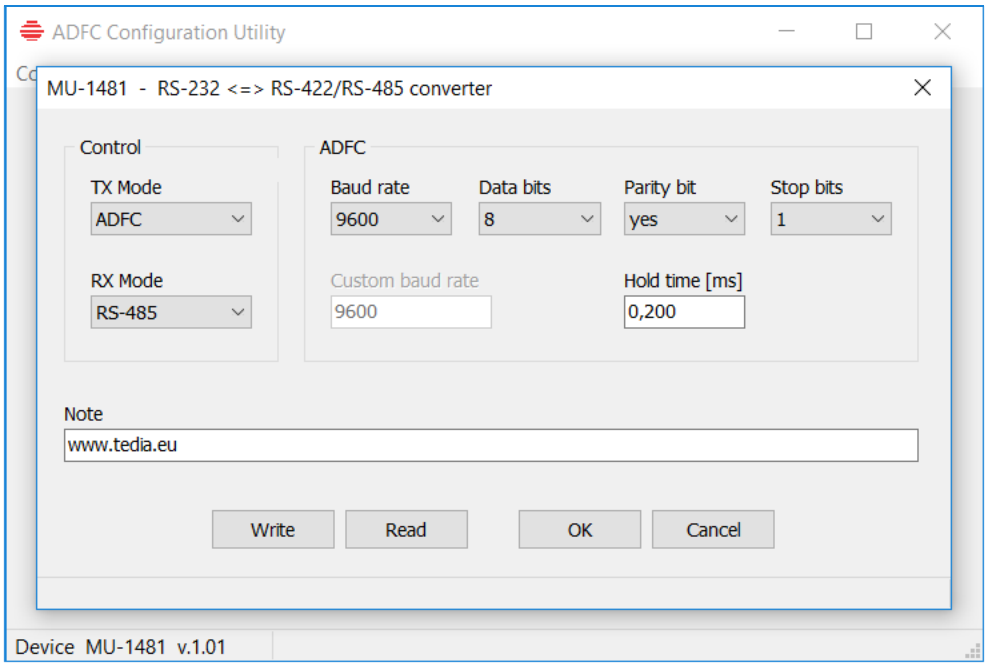
To close the window, press the OK button.

If the connection to the device works properly, Main window displays type and firmware version in the bottom left corner, see the figure below.



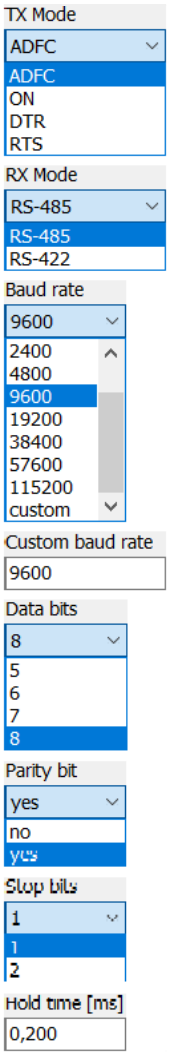
5.6 ADFC software - MU-1481 configuration window

Figure below shows the MU-1481 configuration window of ADFC software.



The "Control" and "ADFC" sections allow to configure all communication parameters, text line "Note" allows to set user comment in the device. The "Write" button is used to program all parameters to the converter, the "Read" button to load the configuration parameters into the program window. The "OK" button confirms and closes the window and the "Cancel" button closes the window without changes.

Figure on the right shows all configure options.



The drop-down menu "TX Mode" allows to select several options for control RS-422/485 line:

- ADFC - RS-422/485 line drivers are controlled automatically (please note, that all ADFC parameters must be configured properly if this mode is selected);
- ON - RS-422/485 line drivers are permanently active (eg. set as output); this option is meaningful only for four-wire RS-422 mode;
- DTR - RS-422/485 line drivers are controlled by DTR signal (RS-232 line);
- RTS - RS-422/485 line drivers are controlled by RTS signal (RS-232 line).

The drop-down menu "RX Mode" allows to select two options:

- RS-485 option activates RS-485 mode (two-wire topology);
- RS-422 option activates RS-422 mode (four-wire topology).

If the TX mode is set to the ADFC option, it is necessary to configure all ADFC parameters.

The drop-down menu "Baud rate" allows to select several options of communication speed. In the case of special requirements can be option "custom" selected and then non-standard speed can be defined in text box "Custom baud rate".

The drop-down menu "Data bits" allows to define character length.

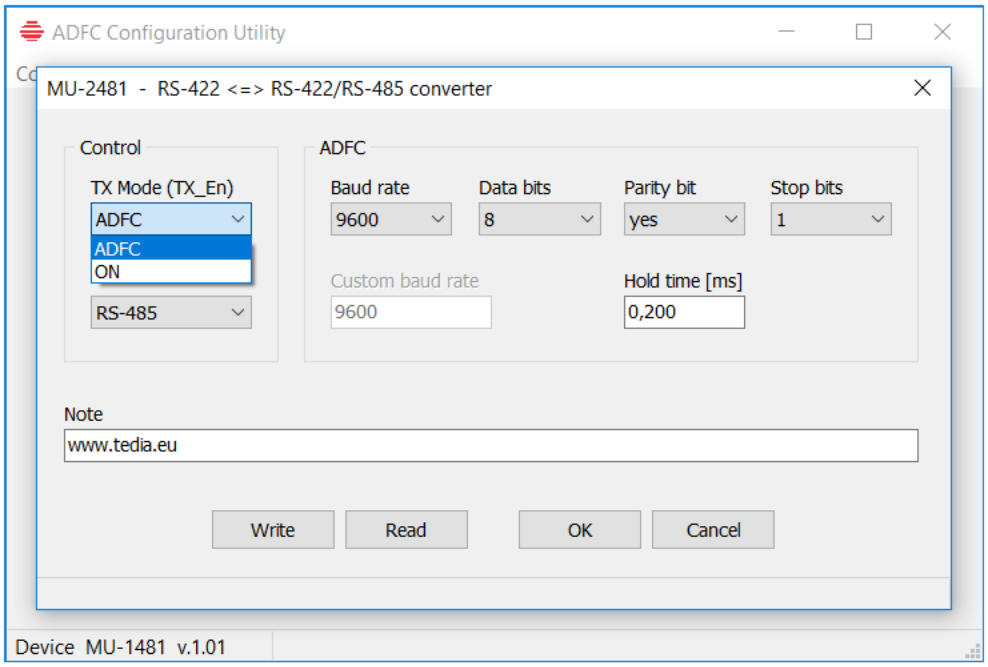
The drop-down menu "Parity bit" allows to define parity bits; crucial is the presence of parity bit regardless of the type of parity.

The drop-down menu "Stop bits" allows to define number of stop bits.

The text box "Hold time" allows to configure the driver activity time after sending the last message character (must be longer than the gap between characters and shorter than response of another device at the communication line; the time equal to the duration of 1 character can be suitable in most applications).

5.7 ADFC software - MU-2481 configuration window

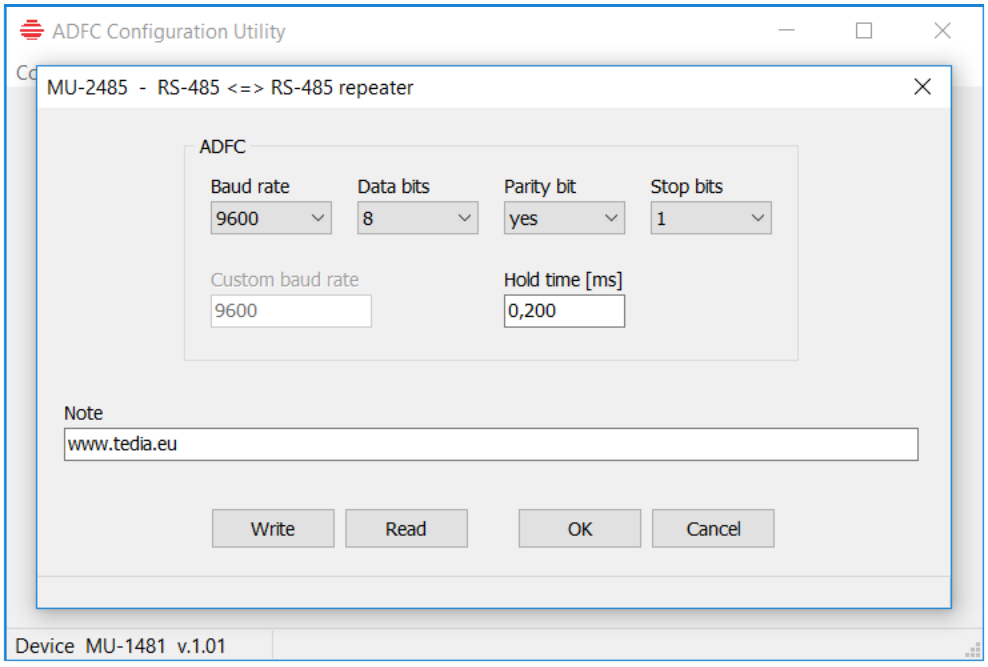
Figure below shows the MU-2481 configuration window of ADFC software.



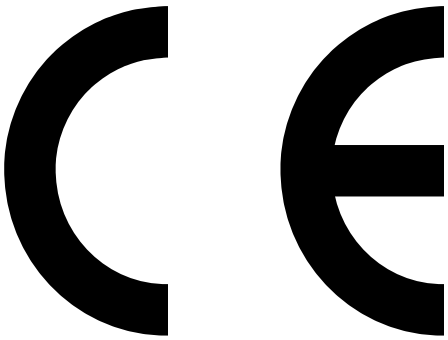
Configuration options are identical to MU-1481 with one exception - the drop-down menu "TX Mode" allows to select only "ADFC" or "ON" modes (because DTR and RTS signals are not available).

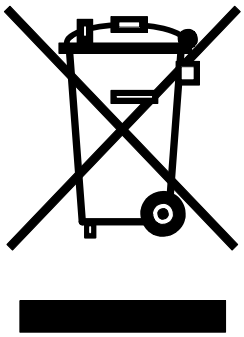
5.8 ADFC software - MU-2485 configuration window

Figure below shows the MU-2485 configuration window of ADFC software.



Configuration options are identical to MU-1481 with one exception - the drop-down menus "TX Mode" and "RX Mode" are not available at all (for principled reasons MU-2485 supports only two-wire topology with ADFC control).





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