

## SERIAL ADAPTER MFI TYP 2

### RS232C (V24) <—> RS485

#### GENERAL INSTRUCTIONS FOR USE

V 2.0m

#### Applications for this adapter :

##### Interface for adapting different electric formats

This adapter offers the possibility of adapting electrical units with different connection-lines.

##### Repeater / Line-driver

If both sides of this interface are connected to the same kind of circuit, it can be used as a signal amplifier. Falsifications of pulse-pause-ratio can not be eliminated, which means that it is not possible to connect several adapters in line in intention to bridge over long distances.

( For DATA-PROCESSING as well as for cascading we offer a special intelligent repeater!)

##### Adapter for electrical insulation

If both sides of this interface are connected to the same kind of circuit (e.g. RS 232 ) and optical insulation is mounted on the board, this adapter not only increases transfer-signal levels but also allows to have (opto-) electronical insulation of both interface sides.

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## Basic Types

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### MFI-G

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case version, is build in a black plastic case, app. 200mm\* 110mm \* 70 mm

### MFI-E

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euro-card version, standard eurocard, 160 mm \* 100 mm, heigth: 50 mm

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## General specifications of all MFI-Interfaces

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The adapter is fully transparent on the data format, because with this adapter only signal levels can become adapted while data format (number of bits, parity, ...) remains unchanged (can not become changed by this adapter !).

This makes installation very easy, for no internal adaptations are required!

The adapter is available as one or two channel version, in either seperate case or as a standard size eurocard that fits in 19" racks.

### One channel per DEFINITION

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already is one input- and one output-channel,

so that with the one channel version bidirectional operation is possible.

With the multi-channel version it is possible to drive either several units by software handshake or even support hardware-handshake connections!

### kinds of connectors

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The connection of all cables is available either by

by standard (or custom)	<i>screw terminals</i>	on board,
or by a	<i>connectors</i>	in front of the case
	<i>32 pin VG connector</i>	on 19" rack mounting.

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## data transfer rate

The minimum transfer-rate (also with optical insulated version) is guaranteed to be

100,000 baud.

*The real data-transfer rate depends on the connected equipments as well as on length and quality of the used cables.*

For reaching highest possible data rates it is important using cables of high quality!

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## optical insulation

If the units have to be connected over more than 100 meters, *optical insulation* is necessary, for otherways mysterious phenomena could appear.

They could be caused by the *different electrical potentials* of two far units, (e.g. two different line phases) which lets ground currents flow on data cables.

On the other hand a 100 meter cable, meaning a 100 meter *antenna*, connected with the unit, catches any kind of noise.

Furthermore the possibility of *induction* of voltages is rising with increasing cable length, also the chance to damaged the equipment.

*If data-cables are installed together with power-cables, a damage of the cables could cause high voltage connected to the input of the units, which must destroy them*

(for this reason never install data-cables along with power-cables !)

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## overvoltage protectors

If data-cables are installed without overvoltage protection (on earth or in cable-tunnels) an optical insulation can not be omitted.

In addition to that, overvoltage protectors are available in order to prevent the damage of the interface normally caused by short-time static overvoltages, inducted by voltage peaks or strong electromagnetic fields, like found in thunderstorms.

## Assignment of signal-levels

The assignment of the logic levels of the signals (e.g. voltage of RS232C to the differential voltage of the RS485) of both sides may be inverted.

With jumper *E2*

the assignment can be set from right to left side of the board and

with jumper *E3*

the reverse direction can be inverted.

## Power supply

The adapter has a built in power supply for use with 220 V (110 V optional).

Installation is via a build-in power cable.

Inside the unit is a FUSE in order to protect the mini-transformers against overload.

**REMOVE POWERCORD BEFORE  
OPENING THE UNIT !!!**

(and do not plug it in while having unit opened !!!)

Does the adapter has optical insulation, there are two independent power supplies serving up to three voltages per power supply.

## Power supply data:

	220 V	110 V
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### max. power consumption

a) without opto insul.	5 VA	5 VA
b) with opto insul.	10 VA	10 VA

### fuse value

a) without opto insul.	32 mA	64 mA
b) with opto insul.	64 mA	125 mA

### available internal voltages :

+5V , +12V, -12V;

twice with optical insulation installed

## CONNECTION OF DATA-LINES

# ATTENTION!!!

Internally the input and output-lines *seemed to be 'crossed'*, which means that for example an

*rx-signal* that enters the unit on the *right side* and comes out as *tx-signal* on the *left side* (and vice versa) !!!

There are different possibilities to connect the cables to the interface as described in the following:

Unused connections must not be wired !!!

## Remarks on this instruction

This instruction only mentions fundamentals, for this type of adapter is a factory configurable universal-adapter.

Every channel may have up to 5 connections, as described in the following:

1. a *non-inverting input*, marked by an *arrow in direction of terminal WITHOUT a point*;
2. an *inverting input* marked by an *arrow in direction to terminal WITH a point*;  
this additional input is used in cases when two inputs are required (RS485).
3. a *non-inverting output*, marked by an *arrow in direction out of the terminal WITHOUT a point*;
4. an *inverting output*, marked by an *arrow in direction out of the terminal WITH a point*;  
it is used in cases, when two outputs are needed (RS485 ).
5. *the assigned signal ground*.

The following table will show the used connections :

<u>procedure</u>	<u>standard in/output</u>	<u>extra in/output</u>
RS 232C	normal connection	NC(*)
RS 485	non- inverted conn.	inverted conn.

(\*) NC means not connected

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## Version with standard screw-terminal (no special option)

The connection of inputs and outputs is realized by internal screw-terminal blocks. Up to 4 screw-terminal-blocks are possible.

In front of them are *arrows* marked on the board as well as the *number of the channel* and the *name of the signal format*.

>> \*\*\* All arrows show into the direction of data-flow ! \*\*\* <<

this means that *arrows pointing to the terminals* mark **INPUTS !!!**

Every block of screw-terminals has 5 (4) possible connections, which need not be used all!

The *one channel standard version* has the screw-terminals on the outer left and right side of the board.

The *two channel version* has additional two screw-terminal-blocks for connecting the second channel in the middle of the board.

Because the second channel has no own ground-connector, the one for the first channel must be used if required !

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## Version with standard plug-connector option /S

This optional version has all signal-cables lead to 25-pin standard sub-D-type connectors mounted in the front of the case.

This type of connector is used very often and plugs should be available everywhere.

Special fixing bolts will be delivered for the plugs, so that nothing should prevent a fixed connection.

**In order to avoid wrong connections,  
plug connectors are designed as male and female ones !!!**

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## Plug-in version for 19" racks ( MFI-E)

This type of adapter allows the mounting of several adapters into one 19" case or rack.

Also available are racks and cases with integrated plug-connections for easy connection of data-cables, as well as 2" front-panels with LEDs for visual voltage- and signal-control.

All connections are on a 32-pin VG-plug (version C) with row a+c on the EVEN pin positions.

## RS 232C

### General notes

The electrical parameters of a RS 232C interface are defined and therefore mostly uncritical in connecting units of different manufacturers.

### different versions of connection

#### 1 ... screw-terminal version

The *standard input and output* are used for connection,

the GND-terminal has to be connected to GND-terminal of other unit.

The *extra in/outputs* (marked by points) are used internally and therefore must not be connected.

#### 2 ... plug-connector version

### connection

#### one channel version

1: GND  
2: TXD (O)  
3: RXD (I)

7: GND

#### two channel version

1: GND  
2: TXD (O)  
3: RXD (I)  
4: RTS (O)  
5: CTS (I)  
7: GND

Please look for additional documents if special plug-  
or other configurations are realized !!!

## RS 485

### General notes

The electrical parameters of a RS 485 interface are defined and therefore mostly uncritical while connecting units of different manufacturers.

Wrong connections of wires (arrow with point versus arrow without point) of ONE RS 485 connection forces the inversion of the signal (logic "0" becomes logic "1") !!!

With a new installation, twisted-pair cables of *low resistance* and *low capacity* should be used for enabling all advantages of a RS485 interface;

## RS-422-CABLE-SPECIFICATIONS

TYPE OF CABLE :	twisted pairs
RESISTANCE (OHM):	< 10 Ohms per 100 meters
RESISTANCE (TOTAL):	< 240 Ohms for transfer-rates <100 kHz
WAVE RESISTANCE:	about 100 Ohms
DIAMETER OF WIRES:	>= AWG 24
WIRE CAPACITY :	< 70 pF per meter/pair <130 pF per meter/string
SPEECH ATTENUATION:	40 dB at 150 kHz between pairs

Cables with at least *one protective shield* are recommended !

*If influences from the environment are expected,  
shielded pairs of wires should be used!*

## Usage of existing cables

The specifications of cable in the above table are for high-quality, high-speed-transfer (10 Mbit/s at 10 m , 1 Mbit/s at 50 m , 100 kbit/s at 1 km).

Otherwise every type of cable can be used !!!

**In principle two wires are needed per function of transfer!**

### Twisted pair cable

*increases noise immunity*, for disturbance in a twisted pair cable enters more symmetrical, and so can be filtered by the RS485-receiver.

Also if no twisted cables are used, the RS485 procedure also offers a higher noise immunity than others.

### Low-resistance cable

allows *longer distances* between two units.

If the distance is not too far, cables with higher resistances may also be used.

### Low-capacity cable

raises the possible *transfer-speed*.

The normally used transfer rates of 9600 baud and less as well as only short distances (app. 100...200 m) also allow cables of higher capacity !

Even if very high-quality cable is not needed, at new installations one should not cut down expenses for cable, for normally the installation is more expensive than the cable.

A high quality net of cables is an investment into the future, for one has to look forward to higher transfer-rates soon. Negative influence into cables can not or just very hard be compensated by transfer-equipment!

The *non-inverted input/output* of a RS485 interface often is called connection "A",

the *inverted input/output* is called connection "B" !

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## different versions of connection

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### 1 ... screw-terminal version

The in/outputs marked by a *point* are the *inverted in/outputs*.

The *non-inverted in/outputs* are NOT marked by a point !

The GND marked terminal MUST become connected  
with the signal-ground of the opposite unit !!!

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### 2 ... plug-connector version

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#### connection

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##### one channel version

1: GND  
2: TXD not inverted (O)  
3: RXD not inverted (I)  
  
7: GND  
14: GND  
15: TXD inverted (O)  
16: RXD inverted (I)

##### two channel version

1: GND  
2: TXD not inverted (O)  
3: RXD not inverted (I)  
4: RTS not inverted (O)  
5: CTS not inverted (I)  
7: GND  
14: GND  
15: TXD inverted (O)  
16: RXD inverted (I)  
17: RTS inverted (O)  
18: CTS inverted (I)

Please look for additional documents if special plug-  
or other configurations are realized !!!

## cable termination

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As all *differential mode transmission* lines the RS485 cable must be terminated at the end of the line.

In this case the series of resistors R6 (R26) = 50 ohms with the potentiometer R5 (R25) = 500 ohms (with R5 (R25) at middle position), will deliver about 300 Ohms (factory setting).

At *higher transfer-rates* (from app. 20000 baud) it could be necessary to *adapt the termination* to the *wave-resistance* of the cable by this pot, in order to prevent line-reflexions.

The adaption can be done with an Ohmmeter on the unconnected input terminals, *if the wave resistance of the cable is known*  
(e.g. 240 Ohms wave-resistance =  $\hat{=}$  240 Ohms termination).

*If unknown*, it can be adjusted by use of an oscilloscope with all wires connected!!!

(change termination until there are no reflexions).

## special options *only available for RS485* :

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*increased noise immunity, option /E*

increases *input trigger threshold* twice as for standard RS485

*bus-master-option /BM*

a special circuit that *forces input to a pre-defined state* if inputs are not connected or the connected unit on the opposite side is not online.

Standard RS485 doesn't define the output state with open inputs!

This option is also needed if RS485 buses should be controlled by MFI-Interfaces.

*bus-slave-option /BS*

this special option is used to interface *non-bus equipment* to RS485 buses.

The option realizes RS422 driver tri-state control by one *signal of the V24 interface side of the MFI-Interface*.

## MFI-E

### the rack-mounting version

a special option only available with euro-card-version is

option /L, a special 2" front-plane,

all used voltages may be visual controlled by LEDs with different colors,  
all signals may be also visual controlled by LEDs.

The *signals* supplied to the LEDs are stretched by retriggerable monoflops to a lightning duration of app. one second, so a single-bit signal (as well as noise!) may be signaled.

**Because of the mechanical construction, euro-card versions of MFI-Interfaces have lower overvoltage resistance of the galvanic isolation than case-versions!**

### special racks

there are special 19" racks and cases available to group up to 8 MFI-E together.

Sub-D connectors on the back side of the racks ( available as E-MFI/x ) are provided for easy connection of external cables!

### CONNECTION OF VG-PLUG

	ROW a		ROW c	
2	RS232C input, channel 1	NC		right side
4	RS232C output, channel 1	NC		right side
6	GND ..... U1	GND ..... U1		right side
8	RS232C input, channel 2	NC		right side
10	RS232C output, channel 2	NC		right side
12	+ 5 volts U1	-12 volts U1		right side
14	((+12 volts U1 ))*	(( GND ..... U1 ))*		right side
16	(( 220 volts, connector 1 ))*	220 volts, connector 1		
18	(( 220 volts, connector 2 ))*	220 volts, connector 2		
20	((+12 volts U2 ))*	(( GND ..... U2 ))*		left side
22	+ 5 volts U2	NC		left side
24	RS485 non-inv. input, chan.2	RS485 inv. input, chan.2		left side
26	RS485 non-inv. output, chan.2	RS485 inv. output, chan.2		left side
28	GND ..... U2	GND ..... U2		left side
30	RS485 non-inv. input, chan.1	RS485 inv. input, chan.1		left side
32	RS485 non-inv. output, chan.1	RS485 inv. output, chan.1		left side

(( ...))\* are only available on special request !

The marks

*U1 and U2*

stand for voltages of the different power-supply versions.

available voltages for the differend procedures:

procedure	available voltages
RS 232	+12V,+5V,-12V
RS 485	+5V

Versions without option /D ( no opto insulation), voltages U1 and U2 are the same!  
(e.g.: +5V U1 = +5V U2)

## connector pin assignments for 19" racks- and cases

the backplane of the 19" equipment is not big enough to install 25 pin SUB-D connectors.

So there are positions to install either 9 pin SUB-D connectors or 15 pin SUB-D connectors.

Because of the fixed layout of the wiring on the backplane, the *pin numbers* of male and female connectors *are different*, even they are placed on the same position of the backplane !!!

Dependent on the type of the backplane the following connections are possible:

### for 1 channel MFI-E interfaces

8 \* 9 pin SUB-D female connectors on the upper row, diagram (A)  
8 \* 9 pin SUB-D male connectors on the lower row, diagram (C)

### for 2 channel MFI-E interfaces

#### a) with separate connectors for both channels:

8 \* 9 pin SUB-D female connectors on the upper row, channel 1, diagram (A)  
8 \* 9 pin SUB-D female connectors on the second upper row, channel 2 diagram (A)  
8 \* 9 pin SUB-D male connectors on the second lower row, channel 2 diagram (C)  
8 \* 9 pin SUB-D male connectors on the lowest row, channel 1 diagram (C)

#### b) with common connectors for both channels:

8 \* 15 pin SUB-D female connectors on the upper row, diagram (B)  
8 \* 15 pin SUB-D male connectors on the lower row, diagram (D)

## MFI-E: 19" rack-connector pin assignments

### DIAGRAM (A)

9 pin female connector

pin	function	RS232	RS485
1	GND		
2	RXD (I)	std	norm.
3	TXD (O)	std	norm.
6	GND		
7	RXD (I)	NC	inv
8	TXD (O)	NC	inv

### DIAGRAM (B)

15 pin female connector

pin	funktion	RS232	RS485
1	GND		
2	RXD (I)	std	norm.
3	TXD (O)	std	norm.
4	CTS (I)	std	norm.
5	RTS (O)	std	norm.
9	GND		
10	RXD (I)	NC	inv
11	TXD (O)	NC	inv
12	CTS (I)	NC	inv
13	RTS (O)	NC	inv

### DIAGRAM (C)

9 pin male connector

pin	funktion	RS232	RS485
5	GND		
4	RXD (I)	std	norm.
3	TXD (O)	std	norm.
9	GND		
8	RXD (I)	NC	inv
7	TXD (O)	NC	inv

### DIAGRAM (D)

15 pin male connector

pin	funktion	RS232	RS485
8	GND		
7	RXD (I)	std	norm.
6	TXD (O)	std	norm.
5	CTS (I)	std	norm.
4	RTS (O)	std	norm.
15	GND		
14	RXD (I)	NB	inv
13	TXD (O)	NB	inv
12	CTS (I)	NB	inv
11	RTS (O)	NB	inv

(O) ... output ( signal leaves backplane)  
 std ... standard signal  
 norm ... normal, non inverting signal

(I) ... input ( signal enters backplane)  
 NC ... not used, do not wire !!!  
 inv ... inverting signal