



**AFO485 : FIBRE OPTIC MODEM**  
**RFO485 : FIBRE OPTIC REPEATER**

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**USER GUIDE**  
Doc. ref : 9011509-01

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The AFO485 and RF0485 units are manufactured by

## **ETIC TELECOMMUNICATIONS**

**13 Chemin du vieux chène  
38240 MEYLAN  
FRANCE**

In case of any installation difficulties  
please contact your retailer,  
or call customer services on one of the following numbers:

**TEL : 33 4-76-04-20-05  
FAX : 33 4-76-04-20-01**

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Appendix 1 : RS232 cable wiring (ref CAB593)

## 1 Overview

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The family of AFO485 fibre optic modems and RFO485 fibre optic repeaters allow the transmission of RS232/RS485/RS422 asynchronous data or a CAN bus via multimode or single mode fibre optics.

### **Fieldbus network**

The units allow the fibre optic transmission of PROFIBUS DP, MODBUS, UNITELWAY, SYSMACWAY, and the majority of asynchronous protocols, as well as the extension of a CAN network.

### **Local Interface**

Depending on the model, the unit provides an RS232, RS422 and RS485 local interface or a CAN interface.

### **Point to point, bus or failsafe ring**

The AFO485 models allow point to point links.

The RFO485 models have a repeater function and allow a multidrop link or a failsafe ring to be established.

### **Line modulation**

The data over the Fibre optic is encoded to ensure a range of up to 28km for models which use single mode fibres.

### **Transmission failure Information**

In case of a cut in the fibre optic link the unit provides a « voltage free » transmission failure output.

### **Double DC supply**

Two power supply inputs are provided in order to back-up one of the power sources in case of failure or to replace one power source with another without interfering with the units functioning.

The table below shows the characteristics of each of the models.

AFO485 modem - • • •	-10	-20	-30	-40	-C10	-C20	-C30	-C40
RS232 – RS485 – RS422	•	•	•	•				
PROFIBUS DP	•	•	•	•				
MODBUS	•	•	•	•				
UNITELWAY	•	•	•	•				
OTHER ASYNCHRONOUS PROTOCOLS	•	•	•	•				
CAN OPEN					•	•	•	•
Multimode fibre optics	•	•			•	•		
Single mode fibre optics			•	•			•	•
800 nm optical source	•				•			
1300 nm optical source		•	•	•		•	•	•
Min. guaranteed optical power budget at 25°C (dB) Taking into account losses due to the connector.	12	12	17	10	12	12	17	10
Transmission failure output	•	•	•	•	•	•	•	•
Double DC power supply	•	•	•	•	•	•	•	•

RFO485 repeater - • • •	-11	-22	-33	-44
RS232 – RS485 – RS422	•	•	•	•
PROFIBUS DP	•	•	•	•
MODBUS	•	•	•	•
UNITELWAY	•	•	•	•
OTHER ASYNCHRONOUS PROTOCOLS	•	•	•	•
Multimode fibre optics	•	•		
Single mode fibre optics			•	•
800 nm optical source	•			
1300 nm optical source		•	•	•
Min. guaranteed optical power budget at 25°C (dB) Taking into account losses due to the connector.	12	12	17	10
Transmission failure output	•	•	•	•
Double DC power supply	•	•	•	•

## 2 AFO485 modem with asynchronous interface

This section describes AFO485-10 , -20 , -30 and -40 models.

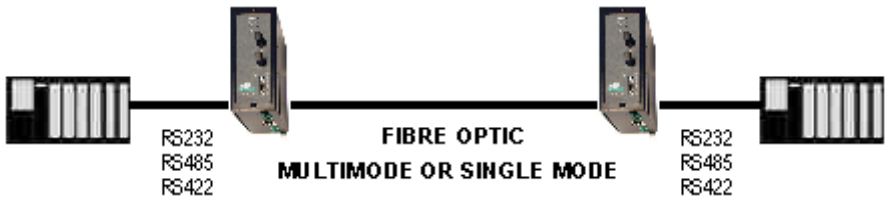
### 2.1. Function

These products allow point to point transmission via multimode or single mode fibre optics. They have RS232, RS485 and RS422 asynchronous interfaces.

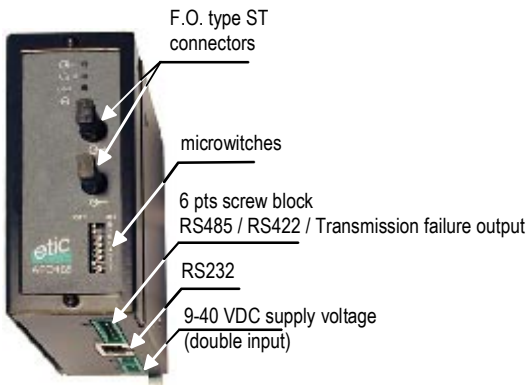
The unit permits half-duplex transmission.




The following protocols can be used :

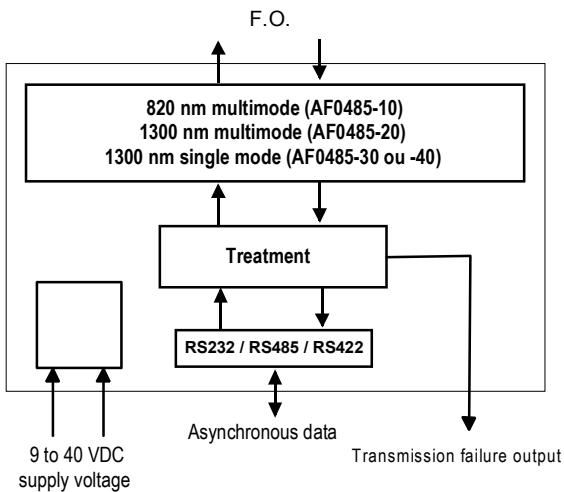
PROFIBUS DP / MODBUS / UNITEWAY / SYSMACWAY, and the majority of other asynchronous protocols.



### 2.2. Description



<b>Display</b>	
	Characters transmitted to the fibre optic.
	Characters received from the fibre optic.
<b>LINE</b>	Lit when two AFOs communicate correctly, even when no character is received. Otherwise off.
	Power on.





## 2.3. Micro-switches

SWITCHES 1 / 2 / 3				
	switches	1	2	3
Mandatory positioning		ON	OFF	OFF

SWITCH 4 : RS232, RS485 or RS422 FORMAT		
	switch	4
8 bits + parity	1 start + 1 stop	OFF
8 bits without parity or 7 bits + parity	1 start + 1 stop	ON

SWITCHES 5 to 8 : RS232, RS485 or RS422 data rate					
		5	6	7	8
Profibus DP	1.5 Mb/s	OFF	ON	OFF	OFF
Profibus DP	500 Kb/s	OFF	ON	OFF	ON
Profibus DP	187 500 b/s	OFF	ON	ON	OFF
	115 200 b/s	ON	OFF	OFF	OFF
Profibus DP	93 750 b/s	OFF	ON	ON	ON
	57 600 b/s	ON	OFF	OFF	ON
	38 400 b/s	ON	OFF	ON	OFF
	19 200 b/s	ON	OFF	ON	ON
	9 600 b/s	ON	ON	OFF	OFF
	4 800 b/s	ON	ON	OFF	ON
	2 400 b/s	ON	ON	ON	OFF
	1 200 b/s	ON	ON	ON	ON

## 2.4. Connectors

<b>Connector 1 : 2 point screw block</b> Main power supply voltage		
Pin	Signal	Function
1	V+	Voltage: 9 to 40 VDC
2	GND	Signal ground

<b>Connector 2 : 2 point connector block</b> Backup power supply voltage		
Pin	Signal	Function
1	V+	Voltage : 9 to 40 VDC
2	GND	Signal ground

<b>Connector 3 : RJ45 local interface connector</b> non-isolated RS232				
Pin	Circuits		Designation	Terminal-Modem
1	CD	109	Carrier	←
2	RX	104	Data reception	←
3	TX	103	Data transmission	⇒
4			Not connected	
5	SG	102	Signal ground	
6	DSR	107	Data set ready	←
7			Not connected	
8	CTS	106	Clear to send	←

Note : The CAB593 cable provides an RS232 DB9 female, instead of the RJ45 connector. It must be ordered separately. The wiring of the CAB593 / RS232 cable is given in appendix 1.

<b>Connector 4 : 6 point connector block</b> RS485 and RS422 local interface non isolated and alarm contact		
Pin	Signal	Function
1 and 2		Transmission failure contact, « voltage free » I max : 100mA / 24 VDC
3	RS422 B'	Emission RS422 polarity B (To the AFO485)
4	RS422 A'	Emission RS422 polarity A (To the AFO485)
5	RS485 B	Reception RS422 polarity B (To the local terminal) or RS485 polarity B
6	RS485 A	Reception RS422 polarity A (To the local terminal) or RS485 polarity A

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## 2.5. Asynchronous Interfaces

At each end, the asynchronous interface used can be different; for example, the first modem can be linked to the PC using the RS232 interface while the second AFO485 can be connected to a PLC using the RS485 or RS422 interface.

### RS232 Interface

The RS232 interface is available on an RJ45 plug.

The CAB593 cable has a DB9 female connector for the RS232 link.

It must be ordered separately (see appendix 1).

The CD and DSR and CTS signals are closed by the AFO485 as soon as the modem receives the modulation from the remote AFO485.

No control signal from the RS232 terminal (DTE) is necessary.

### RS485 and RS422 interfaces

The unit has a RS422 (4-wire) and RS485 (2-wire) interface on the 6 point screw block.

These interfaces are not opto-isolated and must be used for short distances.

The matching resistor of the bus is not included in the product.

The diagrams of these interfaces are given in § 5.5.

## 2.6. Transmission failure output

**The transmission failure output is closed** when the modulation of the remote modem has been detected even if no data is received from the fibre optics; the line led is lit.

**The transmission failure output is opened** as soon as the modulation is no longer received or when the power is off; the line led is extinguished.

## 2.7. Fibre optic range

The range depends on the product and the type of fibre used.

Range between 2 modems using multimode fibre G50/125					
	Optical Source	Optical power*	Reserve	F.0. attenuation	Min. range
		dB	dB	dB/Km	Km
Product Reference		A	B	C	$D1 = (A-B) / C$
AFO485-10	820 nm	12	3	2,5	3,5
AFO485-20	1300 nm	12	3	1	9

Range between 2 modems using multimode fibre G62.5/125					
	Optical Source	Optical power*	Reserve	F.0. attenuation	Min. range
		dB	dB	dB/Km	Km
Product Reference		A	B	C	$D1 = (A-B) / C$
AFO485-10	820 nm	15	3	3,5	3,5
AFO485-20	1300 nm	15	3	1,5	8

Range between 2 modems using single mode fibre E10/125					
	Optical Source	Optical power*	Reserve	F.0. attenuation	Min. range
		dB	dB	dB/Km	Km
Product Reference		A	B	C	$D1 = (A-B) / C$
AFO485-30	1300 nm	17	3	0,5	28
AFO485-40	1300 nm	10	3	0,5	14

\* Minimum guaranteed power of the optical source at 25°C.

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### 3 RFO485 repeater with asynchronous interface

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This section describes the RFO485-11, -22, -33 and -44 models.

#### Function

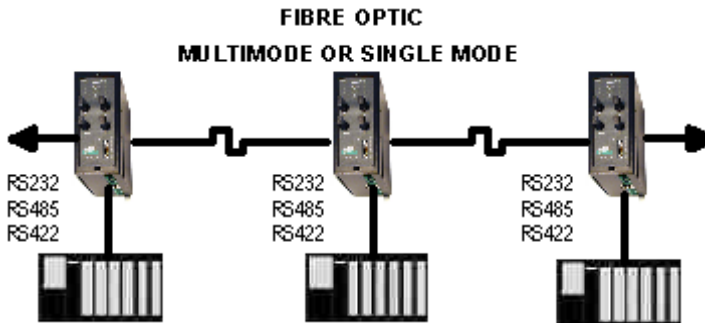
These products allow the repetition of data from one optical link to another as well as to an asynchronous local interface.

The following protocols can be transmitted :  
 PROFIBUS DP / MODBUS / UNITELWAY / SYSMACWAY, as well as  
 most other asynchronous protocols.

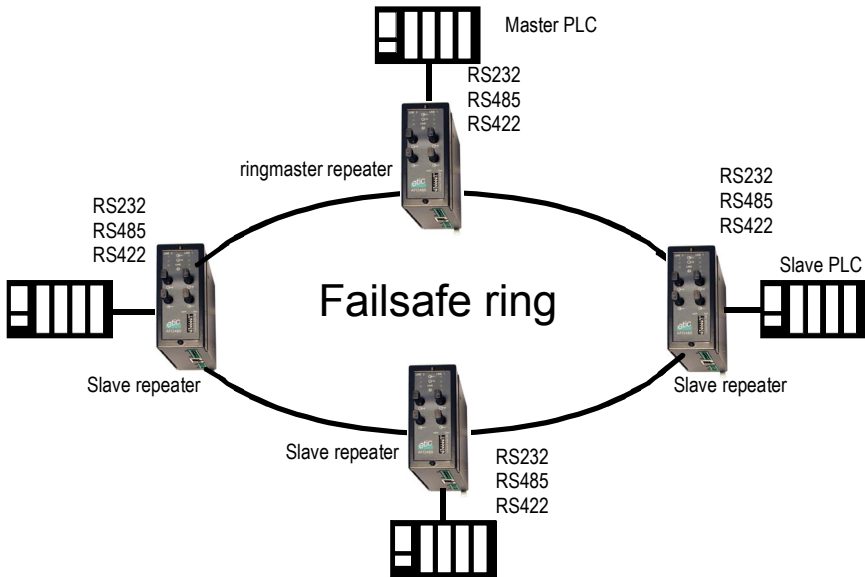
The local interface is RS232, RS485 or RS422.

The repeaters allow for the creation of a bus network or a failsafe ring.

#### 3.1. BUS network



### 3.2. Failsafe ring

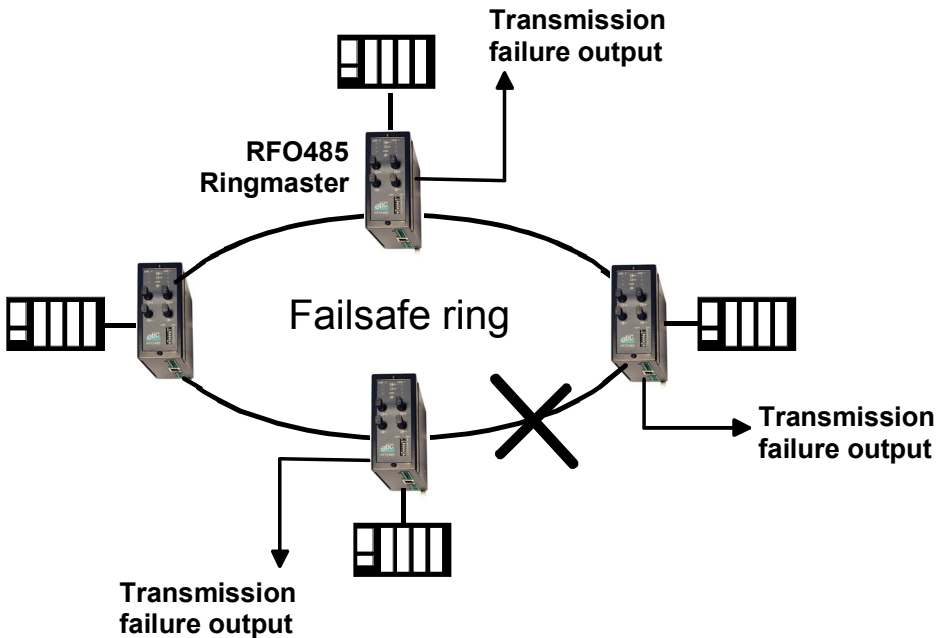


One RFO485 unit must be designated as a « ring master » ; This must be the unit which is connected to the master PLC of the network. The role of Master PLC can only be given to one PLC.

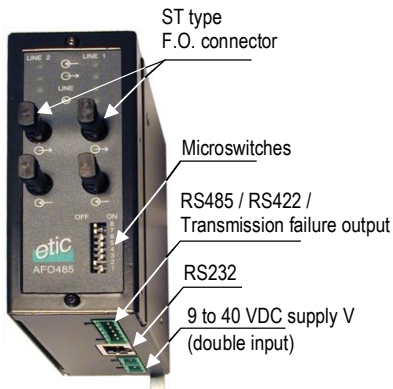
Any frame is transmitted over the ring in both of the two possible directions.

When a segment of the fibre optic cable is faulty, this system allows all units to nevertheless continue receiving information.

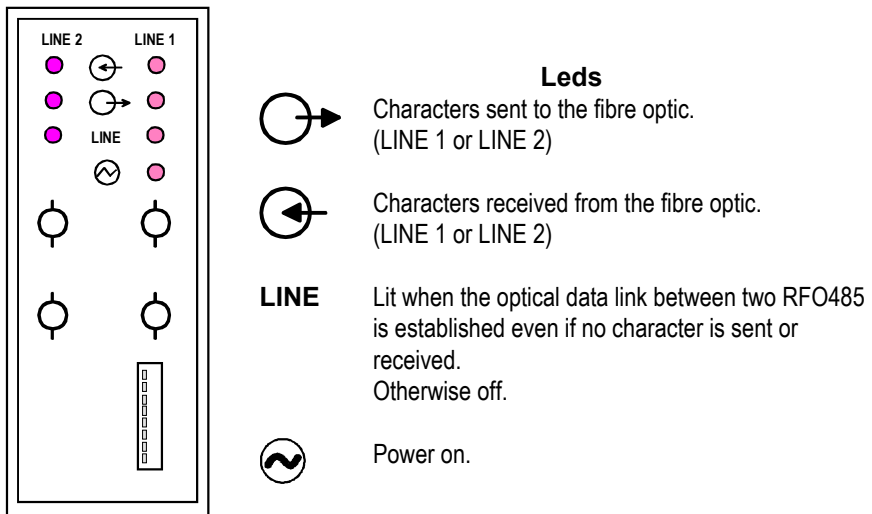
If a failure occurs, the alarm output of the «ring master» RFO485 is opened as well as the alarm outputs of the RFO485 modules connected to the segment of fibre optic in failure.



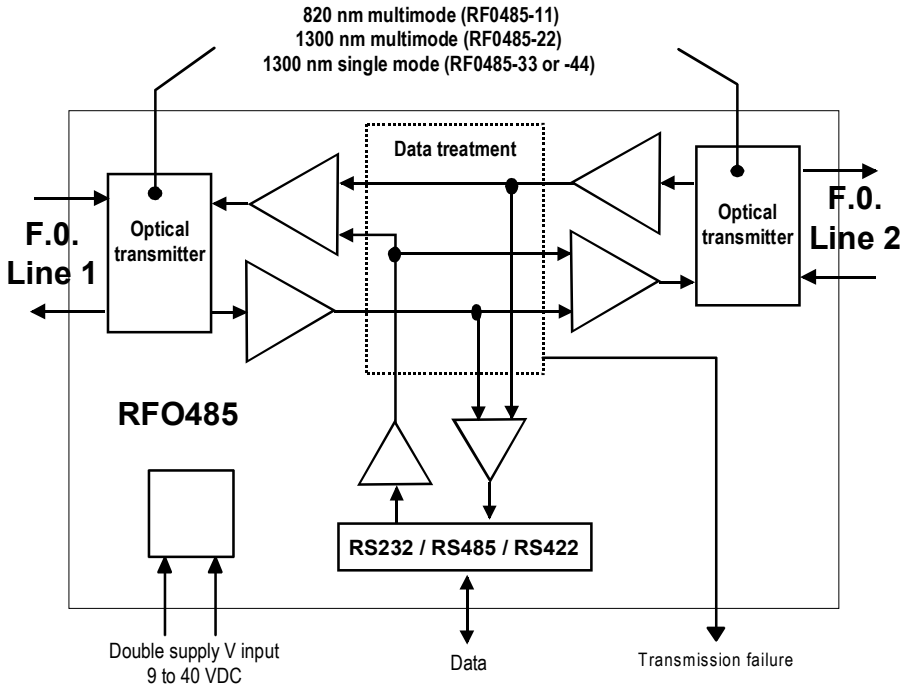
### 3.3. Description



**7 leds** in total for the 2 optical lines allow for easy monitoring of the units behaviour:







### 3.4. Micro-switches

SWITCHES 1 and 2 : TYPE OF NETWORK			
	switches	1	2
Large failsafe ring / master		OFF	OFF
Small failsafe ring / master		OFF	ON
Multidrop (= bus repeater)		ON	OFF
Failsafe ring / slave			
Reserved		ON	ON

SWITCH 3 : REGENERATION of CHARACTERS	
	switch 3
The bytes are not regenerated by passing through the repeater	OFF
The bytes are regenerated when passing through the repeater	ON

SWITCH 4 : FORMAT ON THE ASYNCHRONOUS LINK RS232, RS485 OR RS422		
	switch	4
8 bits + parity	1 start + 1 stop	OFF
8 bits without parity or 7 bits + parity	1 start + 1 stop	ON

SWITCHES 5 to 8 : RS232 RS485 RS422 DATA RATE					
		5	6	7	8
Profibus DP	1.5 Mb/s	OFF	ON	OFF	OFF
Profibus DP	500 Kb/s	OFF	ON	OFF	ON
Profibus DP	187 500 b/s	OFF	ON	ON	OFF
	115 200 b/s	ON	OFF	OFF	OFF
Profibus DP	93 750 b/s	OFF	ON	ON	ON
	57 600 b/s	ON	OFF	OFF	ON
	38 400 b/s	ON	OFF	ON	OFF
	19 200 b/s	ON	OFF	ON	ON
	9 600 b/s	ON	ON	OFF	OFF
	4 800 b/s	ON	ON	OFF	ON
	2 400 b/s	ON	ON	ON	OFF
	1 200 b/s	ON	ON	ON	ON

### 3.5. Connectors

<b>Connector 1 : 2 point screw block</b>		
<b>Main power supply</b>		
Pin	Signal	Function
1	V+	Power supply voltage 9 to 40 VDC
2	GND	Signal ground

<b>Connector 2 : 2 point connection block</b>		
<b>Backup power supply</b>		
Pin	Signal	Function
1	V+	Power supply voltage 9 to 40 VDC
2	GND	Signal ground

<b>Connector 3 : RJ45 local interface connector</b>				
<b>non-isolated RS232</b>				
Pin	Circuits		Designation	Terminal-Modem
1	CD	109	Carrier	←
2	RX	104	Data reception	←
3	TX	103	Data transmission	⇒
4			Not connected	
5	SG	102	Signal ground	
6	DSR	107	Data set ready	←
7			Not connected	
8	CTS	106	Clear to send	←

Note : The CAB593 cable provides an RS232 DB9 female, instead of the RJ45 connector. It must be ordered separately. The wiring of the CAB593 / RS232 cable is given in appendix 1.

<b>Connector 4 : 6 point connector block</b>		
<b>RS485 and RS422 non isolated and Transmission failure output</b>		
Pin	Signal	Function
1 and 2		Transmission failure output / voltage free I max :
3	RS422 B'	Emission ; RS422 polarity B (to the RFO485)
4	RS422 A'	Emission ; RS422 polarity A (to the RFO485)
5	RS485 B	Reception ; RS422 polarity B (to the local terminal) or RS485 polarity B
6	RS485 A	Reception ; RS422 polarity A (to the local terminal) or RS485 polarity A

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## 3.6. Asynchronous Interfaces

On each RFO485, the asynchronous interface used can be different; for example, the first modem can be connected to the PC using the RS232 interface while the second AFO485 can be connected to a PLC using the RS485 or RS422 interface.

### RS232 Interface

The RS232 interface is available on an RJ45 plug.

The CAB593 cable has a DB9 female connector for the RS232 link.

It must be ordered separately (see appendix 1).

The CD and DSR and CTS signals are closed by the RFO485 as soon as it receives the modulation from both remote RFO485.

No control signal from the RS232 terminal (DTE) is necessary.

### RS485 and RS422 interfaces

The unit has an RS422 interface (4 wires) and RS485 (2 wires) on the 6 point connector block.

These interfaces are not opto-isolated and must be used for short distances.

The matching resistor of the bus is not included in the product.

The diagram of these interfaces is given in § 5.5.

## 3.7. Transmission failure output

### 3.7.1 Bus network

**The transmission failure output is closed** when a repeater detects the modulation on the two optical links to which it is connected, even if no data is received on either of the two lines.

The leds “lines 1 and 2” are lit.

**The transmission failure contact is opened** as soon as the modulation is lost on one of the two optical links to which the repeater is connected or if the repeater is powered off.

The corresponding led ( line 1 or 2) is extinguished.

---

### 3.7.2 Failsafe ring

- **« Ringmaster » repeater**

**The Transmission failure output is closed**

when a repeater detects the modulation on the two optical lines to which it is connected, even if no data is received on either of the two lines.

and

When data are received from both sides.

line 1 and line 2 are lit.

**The Transmission failure output opens**

when the modulation is lost on one of the 2 optic lines to which the repeater is connected

or

When data are no longer received from both sides.

or

if the unit is powered off.

The corresponding led (line 1 or 2) is extinguished.

- **Other repeaters in the ring**

**The Transmission failure output is closed** when a repeater detects the modulation on the two optical lines to which it is connected, even if no data is received on either of the two lines.

The leds line 1 and 2 are lit.

**The Transmission failure contact closes** as soon as the modulation is lost on one of the two lines to which the repeater is connected or if the unit is powered off.

The corresponding led ( line 1 or 2) is extinguished.

## 3.8. Fibre optic range

### 3.8.1 Range between repeaters in a bus network

The maximum distance between repeaters is dependant on the product and the type of fibre optic used; It is the same as that of a point to point link using the same fibre optic.

Range between 2 repeaters using multimode fibre G50/125 Bus Network					
	Optical Source	Optical power*	Reserve	F.O. attenuation	Min. range
		dB	dB	dB/Km	Km
Product Reference		A	B	C	$D1 = (A-B) / C$
AFO485-10	820 nm	12	3	2,5	3,5
AFO485-20	1300 nm	12	3	1	9

Range between 2 repeaters using multimode fibre G62.5/125 Bus network					
	Optical Source	Optical power*	Reserve	F.O. attenuation	Min. range
		dB	dB	dB/Km	Km
Product Reference		A	B	C	$D1 = (A-B) / C$
AFO485-10	820 nm	15	3	3,5	3,5
AFO485-20	1300 nm	15	3	1,5	8

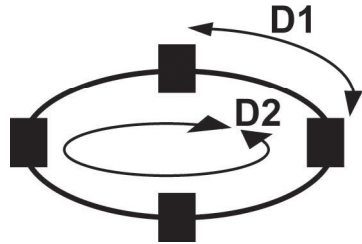
Range between 2 repeaters using single mode fibre E10/125 Bus Network					
	Optical source	Optical power*	Reserve	F.O. attenuation	Min. range
		dB	dB	dB/Km	Km
Product Reference		A	B	C	$D1 = (A-B) / C$
AFO485-30	1300 nm	17	3	0,5	28
AFO485-40	1300 nm	10	3	0,5	14

\* Minimum guaranteed power of the optical source at 25°C.

### 3.8.2 Range of repeaters in a failsafe ring

Taking into account the algorithm of the failure detection used, the maximum size of the ring is determined in three stages :

**Step 1 :**The distance D1 between 2 repeaters can not exceed the distances marked in the tables in section 3.7.1, these distances depend on the type of RFO485 and the fibre optic cable used.



**Step 2 : Moreover,** the distance D1 between 2 repeaters can not exceed the values in the table below.

Maximum length of a segment of the ring	
Kb/s	D1 in Km
9,6	20,0
19,2	10,0
38,4	5,0
93,75	2,1
57,6	3,5
115,2	1,7
187,5	1,0
500	0,4
1500	0,1

**Step 3 : In addition,** the total length of the ring can not exceed the value D2 given by the formulas below.

If the latency time of the ring is greater than two character lengths:

$$D2 = 200 \times (20-N) / R$$

If the latency time of the ring is greater than one character length :

$$D2 = 200 \times (10-N) / R$$

N= Number of repeaters

R (Kb/s) = data rate of the asynchronous link (between 1,2 and 1500)

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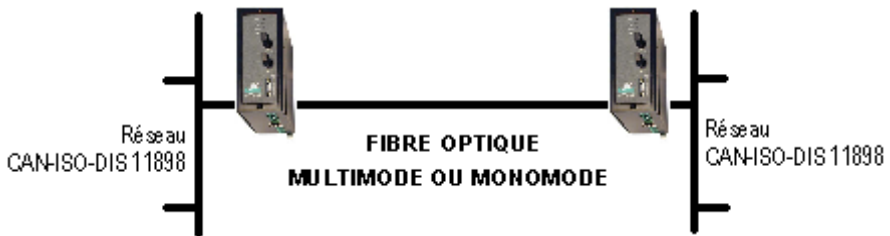
## 4 AFO485 modem with CAN interface

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This section relates to products with the reference AFO485-C10, - C20, - C30 or -C40.

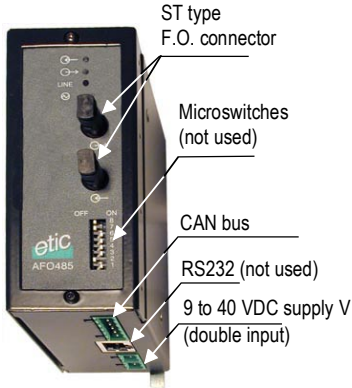
### 4.1. Function

These products establish an optical link between two segments of a CAN network.

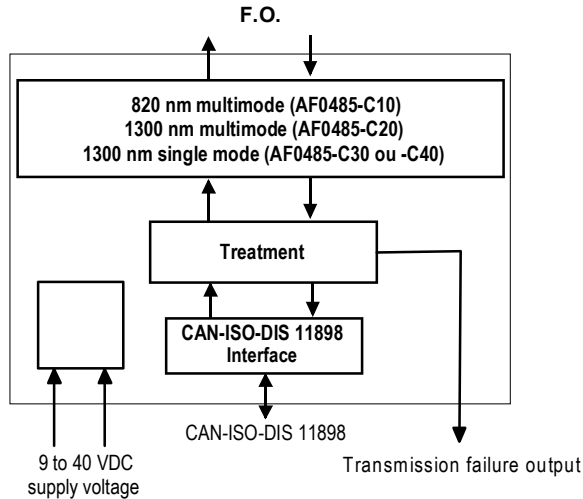




## 4.2. Description



<b>Display</b>	
	Characters transmitted to the fibre optic.
	Characters received from the fibre optic.
<b>LINE</b>	Lit when two AFO485s communicate correctly, even when no character is received. Otherwise off.
	Power on.



## 4.3. Microswitches

The microswitches are ignored, their positioning is unimportant.

## 4.4. Connectors

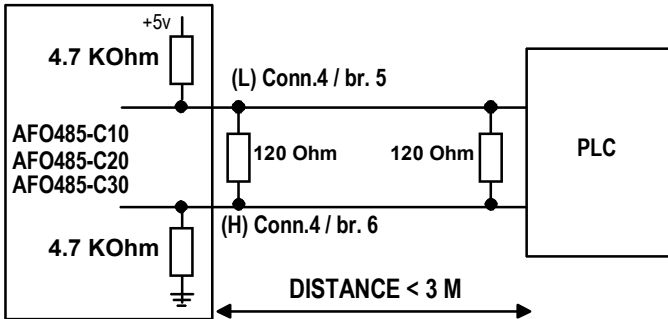
<b>Connector 1 : 2 point connector block</b>		
<b>Main power supply</b>		
Pin	Signal	Function
1	V+	Power supply voltage 9 to 40 VDC
2	GND	Signal ground

<b>Connector 2 : 2 point connector block</b>		
<b>Back-up power supply</b>		
Pin	Signal	Function
1	V+	Power supply voltage 9 to 40 VDC
2	GND	Signal ground

<b>Connector 3 : DO NOT USE RJ45</b>		
--------------------------------------	--	--

<b>Connector 4 : 6 point connector block</b>		
<b>Local CAN interface non isolated and Transmission failure output</b>		
Pin	Signal	Function
1 and 2		Transmission failure contact, « voltage free » I max :
3		Do not use
4		Do not use
5	L	CAN network
6	H	CAN network

## 4.5. Interface using CAN network



## 4.6. Transmission failure output

**The transmission failure output is closed** when a modem detects the modulation of the remote modem even if no data is received from the fibre optics.

The line led is lit.

**The transmission failure output is opened** as soon as the modulation is no longer received or when the unit is powered off.

## 4.7. Range of modems on the CAN network

Taking into account the technology of the CAN network, only a point to point transmission can be realised.

The range of the optical link is determined in two steps :

**Step 1** : The length of the link can not exceed the values below, it is related to the type of fibre optic and the optical source of the AFO485 adaptor.

Range on multimode fibre G50/125					
	Optical Source	Optical power*	Reserve	F.0. attenuation	Min. range
		DB	dB	dB/Km	Km
Product reference		A	B	C	$D1 = (A-B) / C$
AFO485-C10	820 nm	12	3	2,5	3,5
AFO485-C20	1300 nm	12	3	1	9

Range on multimode fibre G62.5/125					
	Optical Source	Optical power*	Reserve	F.0. attenuation	Min. range
		dB	dB	dB/Km	Km
Product reference		A	B	C	$D1 = (A-B) / C$
AFO485-C10	820 nm	15	3	3,5	3,5
AFO485-C20	1300 nm	15	3	1,5	8

Range on single mode fibre E10/125					
	Optical Source	Optical power*	Reserve	F.0. attenuation	Min. range
		dB	dB	dB/Km	Km
Product reference		A	B	C	$D1 = (A-B) / C$
AFO485-C30	1300 nm	17	3	0,5	28
AFO485-C40	1300 nm	10	3	0,5	14

\*Minimum power of the optical source at 25°C.

**Step 2 : Moreover**, independent of the quality of the fibre optic, the range must not exceed the values in the tables below in relation to:

- **the data rate of the CAN network**
- **the timing of “CAN” bit sampling by the PLC.**

The 3<sup>rd</sup> column of the table, titled CIA 87%, corresponds to the recommended “CAN IN AUTOMATION” normally applied by CAN interfaces belonging to PLC’s.

The values indicated in this column are the ranges which are obtained by a PLC using the CIA standard.

	<b>1 /2 Tb</b>	<b>2/3 Tb</b>	<b>CIA (87%)</b>
<b>10 kb/s</b>	5,9 Km	6,5 km	8,6 km
<b>20 kb/s</b>	2,4 km	3,2 km	4,3 km
<b>50 kb/s</b>	0,9 km	1,2 km	1,6 km
<b>100 kb/s</b>	0,4 km	0,55 km	0,8 km
<b>125 kb/s</b>	0,3 km	0,42 km	0,6 km
<b>250 kb/s</b>	0,1 km	0,16 km	0,23 km
<b>500 kb/s</b>	0	60 m	150 m

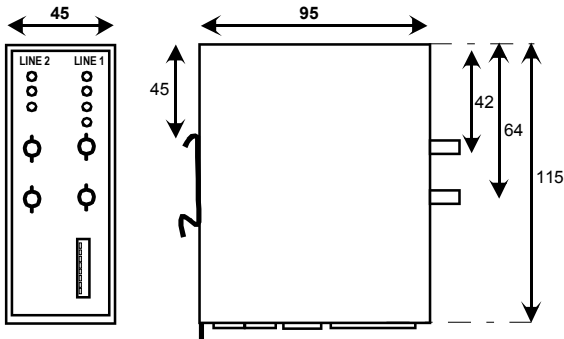
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## 5 Installation

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### 5.1. Dimensions

*Dimensions are in mm.*



### 5.2. Precautions

The product was designed to be mounted on a 35mm DIN rail.

To avoid overheating, in particular when the temperature in the cabinet is liable to rise, a space of 1cm on either side of the unit should be left to allow the heat to escape.

Sufficient space should also be left in front of the unit in order to account for the minimum radius of curvature prescribed by the manufacturer of the fibre optic cable.

You should avoid using excessive force while connecting the fibre optic cables to avert damage to the optical connectors.

### 5.3. Power supply

The power supply voltage must be strictly regulated and be between 9 and 40 Volts maximum.

Two DC power supply inputs are available ; if the primary power source fails the second can continue to provide power to the unit.

The consumption of the AFO485 is 170 mA / 24 VDC.

The consumption of the RFO485 is 250 mA / 24 VDC

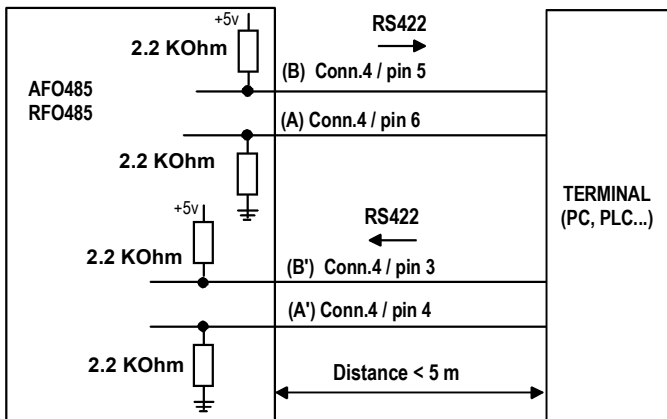
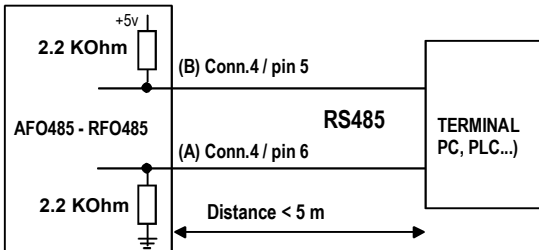
## 5.4. Fuse

The circuit board is equipped with an automatically rearming fuse.

## 5.5. Connection of RS485 or RS422 interfaces

This section concerns only the models equipped with a RS485 and RS422 interface : AFO485-10, -20, -30 or -40 and RFO485-11, -22, -33 or -44

The A and B signals of the RS485 / RS422 interfaces are polarised by the 2.2 Kohm resistors on the circuit board.



When the data rate is high or the length of the RS485 / RS422 bus justifies it, a 120 Ohm matching resistor should be attached to both ends of the network.

CHARACTERISTICS	
Dimensions	115 x 48 x 97 mm (h, l, d)
E.M.I.	EN50082-2 / EN61000-4-5
Electrical security	EN 60950
Protection	IP30
Power supply / consumption	Double DC power supply 9 to 40 VDC AFO485 : 170 mA /24 VDC – RFO485 : 250 mA / 24 VDC
Operating temp.	0°C/ + 60°C dry air
RS232	Non isolated Asynch. 7 or 8 bits + 1 start, 1 or 2 stops Parity : none / even / odd 1,2 to 115,2 kb/s
RS485 / RS422	Non isolated – Integrated polarisation Asynch. 7 or 8 bits + 1 start, 1 or 2 stops Parity : none / even / odd 1,2 to 115,2 - 93,5 - 187,5 - 500 - 1500 kb/s
Fieldbus	PROFIBUS DP, MODBUS, UNITELWAY, DH-485, SYSMAC-WAY, CAN OPEN ISO-DIS-11898
Configuration	By switch
Type of fibre optic	Multimode G50/125 or G62,5/125 Single mode E10/125 Reception fibre and Emission fibre
Optical connector	ST
Modulation	Online data coding
Alarm	Voltage free alarm contact:  <b>Point to point</b> : Open when the unit is no longer receiving power or if there is a reception failure. <b>Bus topology</b> : Open when a carrier failure has been detected on any TX or RX F.O. connected to the repeater. <b>Ring topology /« ring master» repeater</b> : Open when a carrier failure has been detected on any F.O. of the ring. <b>Ring topology / any repeater</b> : Open when a carrier failure has been detected on any TX or RX F.O. connected to the repeater.



## Appendix 1

<b>RJ45 to DB9 female RS232 cable wiring (ref : CAB593)</b>					
<b>RJ45 pin-out</b>	<b>DB9 fem. pin-out</b>	<b>Circuits</b>		<b>Designation</b>	<b>Terminal-Modem</b>
1	1	CD	109	Carrier detect	←
2	2	RX	104	Data reception	←
3	3	TX	103	Data transmission	⇒
4				Not connected	
5	5	SG	102	Signal ground	
6	6	DSR	107	Data set ready	←
7				Not connected	
8	8	CTS	106	Clear to send	←

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