

HB&L & ALFRED60/AST & Sidecar

Interfacing Manual



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Note:

The paragraph written on italic style and coloured in blue, have been added or modified respect to the previous version

We reserve the right to make changes in the course of technical development without previous notice.

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1 INTRODUCTION

This manual is focused to give detailed information about serial ports connections available on HB&L, Alfred60 and Sidecar5 and communication protocol features.

It should help **Software House** Companies during the modification or the installation of their program in the Host Computer.

2 PARTS TO INSTALL

A standard cable to connect instrument via serial port to Host

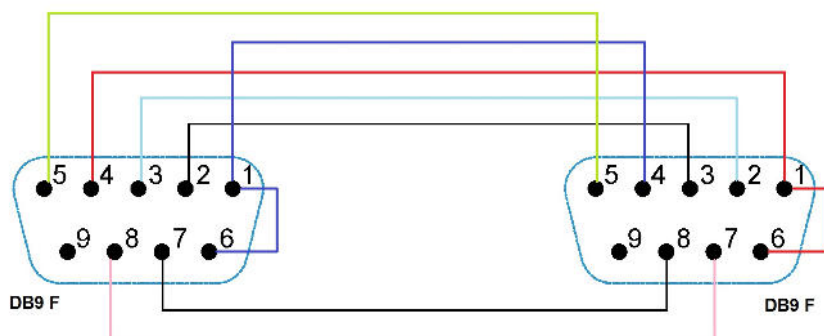
This cable must have:

D-type 9 pin female connector at one side and a D-type 9 pin female (all the three instruments have a DB9 com port).

Following cable is assumed based on the fact also on Host side there is a DB9 port, eventually the Host side could be different so depending the configuration on Host side, one edge could be different.

Software House has the responsibility for the cable.

RS232 NULL MODEM CABLE



3 INSTRUMENT PORTS

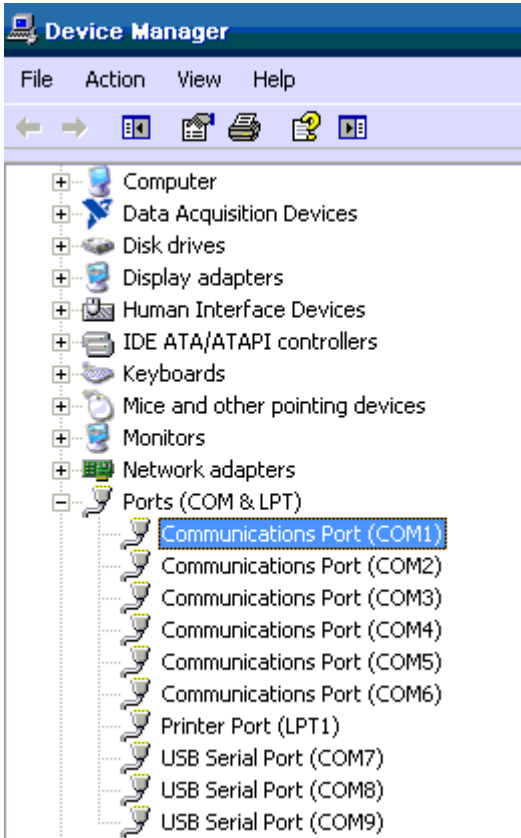
Both HB&L and Alfred 60 have in the rear side 2 DB9 COM Ports identified as:

- COM-1: This is the port used to connect instrument to Host
- COM-2 This is the port used to interconnect Alfred to HB&L or Sidecar to HB&L

Please notice Sidecar itself does not have any communication port, Sidecar goes through Alfred.

4 COMMUNICATION PROTOCOL (ALFRED60 AND HB&L)

The system is provided with 4 serial ports, these ports are the ones visible in Windows Control Panel configuration setup, please don't confuse COM1 (on back side of the instruments) with COM1 of "Windows" setup.



Following tables resumes the "Windows" configurations visible from Device Manager

HB&L:

PORT	DESCRIPTION	SETTINGS
COM1	Communication with host computer	9600,8,n,1
COM2	Communication with Alfred	2400,8,n,1
COM3	none	N/A
COM4	Internal printer	1200,8,n,1

ALFRED:

PORT	DESCRIPTION	SETTINGS
COM7	Communication with host computer	9600,8,n,1
COM9	Internal Communication	2400,8,n,1
COM8	Communication with HB&L	2400,8,n,1
COM10	Communication with Sidecar	9600,8,n,1

4.1 DATA STRUCTURE

Data may be exchanged in record with two different structures:

#	Description	Type Length
1	Sample ID	20
2	Surname	20
3	Name	20
4	Bacterial count	20
5	RAA test	20
6	FIELD #6	20

ID code of **Integrated Protocol** type structure supports up to 15 factual characters

The last character of fields 1,2,3,4,5 must be '@' (ASCII 64 = 0x40)

The last character of field 6 must be LF (ASCII 10 = 0x0A)

DEFINITIONS	ABBREVIATION	ASCII CODE Hexadecimal
	SOH	0x01
	ACK	0x06
	NAK	0x15
	EOT	0x04
	LF	0x0A

4.2 COMMUNICATION PROTOCOL

The communication with the host computer may be set in three different modes:

Description	Record format	Transmission medium
INTEGRATED	B Type	Serial

4.3 INTEGRATED PROTOCOL

Communication parameters setup

Speed	9600 baud
Parity	None
Stop bit	1
Length	8 bit
COM port	COM 1

Communication description

HOST sends **SOH** to INSTRUMENT:

If INSTRUMENT is ready it answers **ACK**

If INSTRUMENT is NOT ready it answers **NAK**

If INSTRUMENT is NOT ACTIVE it doesn't send any character

Note: Character **SOH** resets data received by INSTRUMENT, if character **SOH** is not sent, the data received by INSTRUMENT are appended to previous ones.

If INSTRUMENT answers **NAK**, the HOST can repeat the transmission after 5 seconds or more.

If INSTRUMENT answers **ACK**, the HOST can send the string of 120 bytes, which must terminate by **LF**.

INSTRUMENT after reception of string answers **ACK**, if transmitted data are accepted or **NAK** if NOT accepted; if INSTRUMENT answers **NAK**, the HOST can repeat the transmission of string.

When HOST decides to stop the communication it sends **EOT** and INSTRUMENT answers **ACK**.

When the INSTRUMENT sends the results to the HOST computer, it uses the same control technique. Thus host computer must be provided with a suitable data exchange program.

Each field is terminated by '@', while the last field which represents also the end of record is terminated by LF (hexadecimal &0A).

4.4 FIELD #4 SPECIFICATIONS

The FIELD #4 of data record, which wasn't used in previous versions, from Sw version 2.7 onwards is used to send and get additional information about the sample and the analysis that were not foreseen in the past.

This feature is required in case the Matching ID feature is used by the end user.

This field will be used **ONLY** in working list delivery from Host to INSTRUMENT (See paragraph “Vial Matching” here below). The same field is used by the INSTRUMENT to send back the result and contains the Bacterial Count

From the software version 2.7 has been introduced the ID MATCHING function, that allows to associate (link) a culture vial with an already assigned reference ID (QR bi-dimensional code) to each primary sample.



4.4.1 Completion mode

Alfred works exclusively in “completion mode”, which means that host sends a pool of patient information which Alfred can use to complete the information of the samples being analysed.

HB&L must work in “completion mode” if the laboratory needs to keep track of the vials by means of the 2D barcode printed on the vials themselves (“Vial Matching” feature). For HB&L, the “completion mode” must be explicitly specified in the Setup.

4.4.2 No vial matching

If the “Vial Matching” feature is not used, the protocol remains the same as before this means Field 4 empty

Field #	Field Info	Description	Notes
1	Sample ID	ID of the original sample	MANDATORY
2	Surname	Patient surname	OPTIONAL
3	Name	Patient name	OPTIONAL
4			IGNORED
5			IGNORED
6			IGNORED

4.4.3 Vial matching

When working with profiles in “Vial Matching” mode, host must send the following information:

Field #	Field Info	Description	Notes
1	Sample ID	ID of the original sample	MANDATORY
2	Surname	Patient surname	OPTIONAL
3	Name	Patient name	OPTIONAL
4	Vial ID	2D barcode of the vial	MANDATORY with “External Vial Matching” IGNORED otherwise
5	Patient ID	ID of the patient	OPTIONAL
6	Not Used		

In this case Host must send in the working list the field 4 filled up with a specific numerical sequence here below explained.

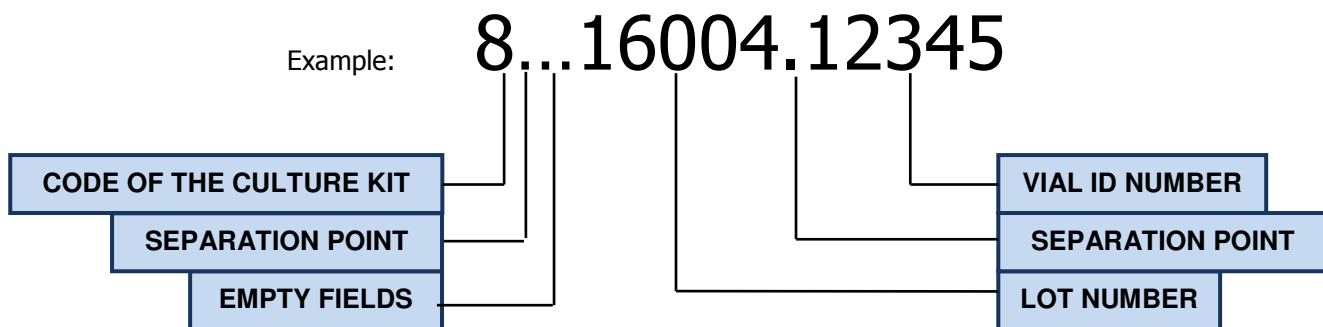
The sequence is introduced in the working list by the reading the QR univocal code linked to each culture vial.

QR code contains all the information about the

- Reagent
- Lot
- Progressive vial number



And it is developed in the below described sequence



Host must send in the working list the field 4 filled up with the numerical sequence above explained; **the sequence MUST be fully respected including the dots between the numbers.**

4.5 FIELD #6 SPECIFICATIONS

The FIELD #6 of data record, which wasn't used in previous versions, is used in this version to send and get additional information about the sample and the analysis that were not foreseen in the past.

RECEPTION

During patient data reception, it is possible to fill in the FIELD #6 in order to send information about the type of test to perform on the sample and the biological material the sample is made of; if this field is filled in, the software will verify the matching among the type of material communicated and the one actually inserted; in case of mismatch, the software will issue an error and the introduction will be refused.

TRANSMISSION

For results transmission, the software provides these options:

URINE AND OTHER HUMAN BIOLOGICAL LIQUIDS:

- Normal transmission (compatible with previous software versions)
- "Rich" transmission (FIELD #6 is filled in)

SUSCEPTIBILITY TEST:

- Results transmission disables
- Results transmission enabled (filling in of FIELD #6 is required)

HUMAN BIOLOGICAL LIQUIDS:

- Results transmission disables
- Results transmission enabled (filling in of FIELD #6 is required)

RECORDS SEQUENCE

For BACTERIAL GROWTH and RAA TEST, each test will be described by one record.

For SUSCEPTIBILITY TEST, each test will be described by N+1 records, where N is the number of antibiotics tested onto the sample.

Record 1 : relevant to reference vial
Records from 2 to N+1 : relevant to each tested antibiotic

ADDITIONAL FIELD #6 FORMAT

Here follow the specifications for FIELD #6

NAME	LEN	DESCRIPTION	VALUES
Exam Type	1	Type of exam to be performed on the sample	'S': bacterial growth 'P': bacterial growth + RAA test 'K': susceptibility test
Biological Material Type	1	Biological Material Type of the sample	FOR ALL TESTS 'A' : Urine and other human biological liquids 'B' : Bronchoalveolar lavage 'C' : Orotracheal aspiration 'D' : Expectoration 'E' : Liquor 'F' : Hemoculture 'G' : Pleural fluid 'H' : Synovial fluid 'I' : Ascitic fluid 'J' : Peritoneal fluid
Antibio.	3	Antibiotic tested	FOR SUSCEPTIBILITY TEST '###' : reference sample 'AMK' : Amikacin 'ACL' : Amoxicillin-Clavulate 'AMP' : Ampicillin Enteroc. 'ATM' : Aztreonam 'CAZ' : Ceftazidime 'CRO' : Ceftriaxone 'FUR' : Cefuroxime 'CIP' : Ciprofloxacin 'SXT' : Cotrimoxazole 'FOS' : Fosfomycin-G6P 'GEN' : Gentamicin 'LEV' : Levofloxacin 'LZD' : Linezolid 'NIT' : Nitrofurantoin 'NOR' : Norfloxacin 'OXA' : Oxacillin St.Aureus 'OSN' : Oxacillin (SCN) 'PEN' : Penicillin 'PIP' : Piperacillin 'TZP' : Piperacillin-Tazobactam 'VAN' : Vancomycin FOR OTHER TEST ' '
Time	4	Elapsed analysis time	FOR ALL TESTS 'hhmm' hh = hours mm = minutes
Charge	4	Bacterial charge detected	FOR ALL TESTS 'xyzz' It corresponds to a charge of x.yEzz CFU/ml Ex: 1205 means a

			1.2E05 = 120.000 CFU/ml charge
Sample Charact.	1	Information on sample status	FOR ALL TESTS 'M' : missing sample 'T' : turbid sample 'A' : abnormal sample '' : normal sample
Analysis result	1	Clinical result for RAA test and SUSCEPTIBILITY test	FOR RAA TEST '#': at least one of the two vials is missing '+' : RAA test positive '-' : RAA test negative SUSCEPTIBILITY TEST 'L' : reference inoculation less that 700.000 CFU/ml 'S' : sensitive 'I' : intermediate 'R' : resistant 'E' : error in calculation of resistance / sensitivity to the antibiotic OTHERS TESTS ''
Resistance	3	% of resistance of bacterium against antibiotic	SUSCEPTIBILITY TEST 'xxz' : % expressed as xx.z% Ex: '051' --> 5.1 % '569' --> 56.9 % 'CCC' : resistance = 100% 'NV' : error in the calculation of resistance to the antibiotic OTHER TESTS ''
Spare	1	Not used	''

5 SPECIFICATIONS OF QUERY PROTOCOL COMMUNICATION (ONLY FOR ALFRED60)

The Query communication for Alfred for Windows allows the Alfred instrument to query the LIS in order to obtain information related to the samples loaded into the instrument itself.

This document defines the specifications of the records used in the communication and the data exchange protocol.

5.1 Definition of Special Characters

STX	ASCII Character 0x02
ETX	ASCII Character 0x03
SOH	ASCII Character 0x01
EOT	ASCII Character 0x04
ACK	ASCII Character 0x06
NAK	ASCII Character 0x15
FIELD_CHAR	Field separation character. Character * (ASCII 0x2A)
ESCAPE_CHAR	Escape sequence character (see examples for better comprehension) Character (ASCII 0x7C)

5.2 QUERY PROTOCOL specifications

The communication is based upon the sending of **single control characters** and **records**

The records used are:

Record **QQ**: Question record (from Alfred to LIS)

Record **QA**: Answer record (from LIS to Alfred)

The two records are composed as follows:

<STX>	STX character
<Body of record>	Record specific
<CheckSum>	Check-sum character, calculated as exclusive OR (XOR) of the characters of the <Body of record> Note: if check-sum is equal to ETX, then check-sum must be substituted with ASCII character 0x7F.
<ETX>	ETX character

The <Body of record> is composed by **fields**; each field is terminated by **FIELD_CHAR** character.

If it is necessary to transmit the **FIELD_CHAR** character inside a field (i.e. not as field terminator), the **FIELD_CHAR** must be preceded by **ESCAPE_CHAR** (the sequence then is |*).

If it is necessary to transmit the **ESCAPE_CHAR** character inside a field, the **ESCAPE_CHAR** must be preceded by another **ESCAPE_CHAR** (the sequence then is ||).

5.3 QQ Record

The body of QQ record is composed by the following fields:

Name	Meaning	Value	May be empty	Note
Type	Indicates QQ record	QQ	No	Fixed
ID	Sample ID	Alphanumeric	No	

5.4 QA Record

The body of QA record is composed by the following fields:

Name	Meaning	Value	May be empty	Note
Type	Indicates QA record	QA	No	Fixed
ID	Sample ID	Alphanumeric	No	
YesNo	Indicates whether the sample must be processed or not	Y : process sample N : don't process sample	No	
Profile	The profile to be used for analysis	Alphanumeric	Only if 'YesNo' is N	The profile name must be a valid profile name of the Alfred instrument.
Surname	Patient surname	Alphanumeric	Yes	
Name	Patient name	Alphanumeric	Yes	

Note

All the record's fields must be transmitted, even if they are empty.

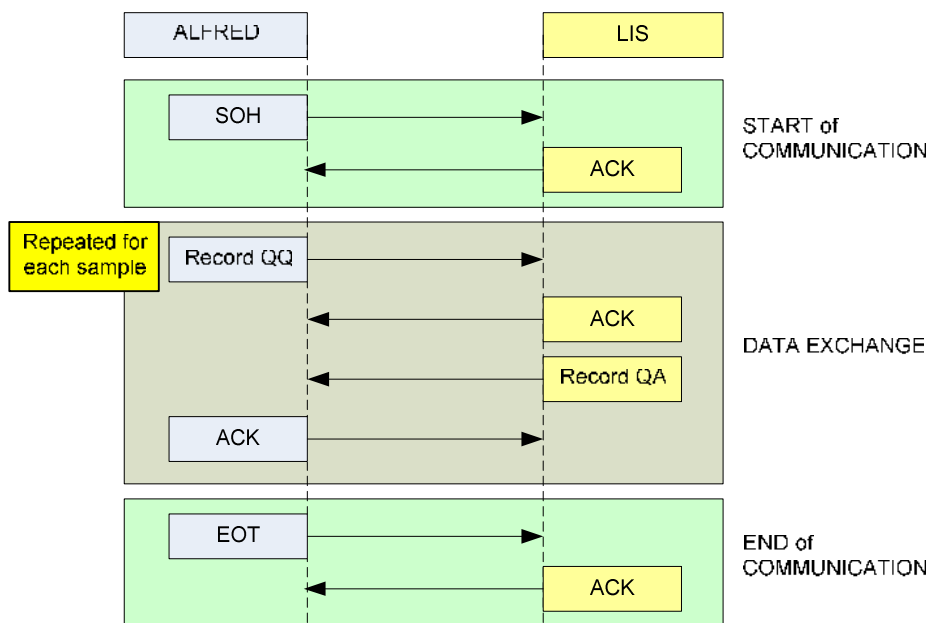
E.g.: the body of a QA record related to sample 12345 (sample which must not be processed) has the form QA*12345*N****

5.5 Query communication protocol

The communication protocol can be subdivided in three phases:

1. Begin of communication
2. Data exchange
3. End of communication

The communication flow is diagrammed as follows:



5.6 Start of communication

Alfred sends the **SOH** character, and waits for the LIS to send back the **ACK** character.

If LIS doesn't answer, the **SOH** is re-transmitted after about 3 seconds, up to 5 times.

If the process doesn't go well, the phase is repeated 4 more time, with a pause of about 10 seconds between attempts.

5.7 Data exchange

For each sample, the following procedure is followed:

- Alfred sends **QQ** record and waits the confirmation **ACK** character from LIS.
 - If **ACK** is not sent back within 3 seconds, or if LIS sends back the **NAK** character, Alfred sends again **QQ** record, up to 5 times.
 - If the record transmission was not possible, Alfred passes to the next sample.
- LIS sends **QA** record and waits the confirmation **ACK** character from Alfred.
 - If **ACK** is not sent back within 3 seconds, or if Alfred sends back the **NAK** character, LIS sends again **QA** record, up to 5 times.
 - If the record transmission was not possible, we pass to next sample.

5.8 End of communication

Alfred sends the **EOT** character, and waits for the LIS to send back the **ACK** character. If LIS doesn't answer, the **EOT** is re-transmitted after about 3 seconds, up to 5 times.

5.9 Communication example

Query on four samples (ID_0001 → ID_0004).

ID_0001 : process with profile "Std Screening"; patient data is **Mario Rossi**

ID_0002 : process with profile "Std Screening + PAR", patient data not available

ID_0003 : process with profile "Profilo*1", patient data not available

ID_0004 : do not process sample

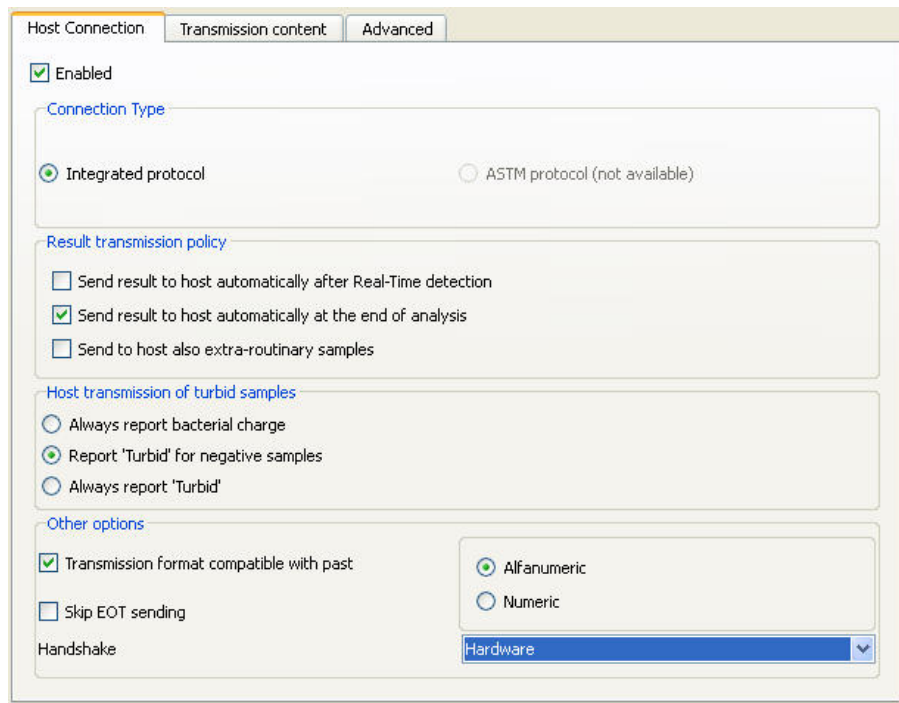
Note: with the notation <0xNN> it is intended the character with hex code NN

Sender	Message	Notes
Alfred	<0x01>	SOH (begin of comm.)
LIS	<0x06>	ACK
Alfred	<0x02>QQ*ID_0001*S<0x03>	Record QQ
LIS	<0x06>	ACK
LIS	<0x02>QA*ID_0001*Y*Std Screening*Rossi*Mario*9<0x03>	Record QA
Alfred	<0x06>	ACK
Alfred	<0x02>QQ*ID_0002*P<0x03>	
LIS	<0x06>	
LIS	<0x02>QA*ID_0002*Y*Std Screening + PAR***^<0x03>	Name and Surname fields are empty.
Alfred	<0x06>	
Alfred	<0x02>QQ*ID_0003*Q<0x03>	
LIS	<0x06>	
LIS	<0x02>QA*ID_0003*Y*Profilo *1***><0x03>	Escape sequence for * character in profile name. Name and Surname fields are empty.
Alfred	<0x06>	
Alfred	<0x02>QQ*ID_0004*V<0x03>	
LIS	<0x06>	
LIS	<0x02>QA*ID_0004*N****<0x08><0x03>	Name and Surname fields are empty.
Alfred	<0x06>	
Alfred	<0x04>	EOT (end of comm.)
LIS	<0x06>	ACK

6 COMMUNICATION SET-UP

Communication set-up is similar for both Alfred60 and HB&L; parameters are located in Tools / Setup / Advanced Setting / Host Connection.

This section is divided in 3 pages: "Host Connection", "Transmission Content" and "Advanced"



Further information can be obtained from instrument Service Manual chapter "Host Connection"

7 INTERCONNECTION OF 2 OR MORE INSTRUMENTS USING SERIAL SWITCHERS

In the event it is necessary to connect two or more instruments to Host and there is only 1 Host Com port available (Host side) it is possible to use one or more serial switched interconnected in chain between then and the instruments.

Connections on serial port RS232C on PC and on Automatic Switches for PC

PC-XT Serial Port RS232C Connector DB25M

PIN	Name	Direction
2	TXD	→
3	RXD	←
4	RTS	→
5	CTS	←
6	DSR	←
7	GND	↔
8	DCD	←
20	DTR	→
22	RI	←

PC-AT Serial Port RS232C Connector DB9M

PIN	Name	Direction
1	DCD	←
2	RXD	←
3	TXD	→
4	DTR	→
5	GND	↔
6	DSR	←
7	RTS	→
8	CTS	←
9	RI	←

Connecting cable between ATEN AS-251S AutoSwitch and Alfred60 or HB&L

(is obtained from the previous cable replacing the connector **DB25F** with a **DB25M** and connecting the wires with the following scheme, note that signal direction are referred to PC side because on AutoSwitch it is not documented...)

Cavo Seriale **DB25M** - DB9F with 9 wires

DB25M PIN	Signal Name	Direction	Signal Name	DB9F PIN
2	(RXD)	←	TDX	3
3	(TXD)	→	RXD	2
4	(CTS)	←	RTS	7
5	(RTS)	→	CTS	8
6	(DTR)	→	DSR	6
7	(GND)	↔	GND	5
8	(DCD)	←	DCD	1
20	(DSR)	←	DTR	4
22	(RI)	←	RI	9

(A & B Connectors on ATEN AutoSwitch are **DB25F**)

Cavo Seriale **DB25M** - DB9F with 7 wires

DB25M PIN	Signal Name	Direction	Signal Name	DB9F PIN
2	(RXD)	←	TXD	3
3	(TXD)	→	RXD	2
4	(CTS)	←	RTS	7
5	(RTS)	→	CTS	8
6	(DTR)	→	DSR	6
7	(GND)	↔	GND	5
8	(DCD)	←	DCD	1
20	(DSR)	←	DTR	4
22	(RI)	←	RI	9

(A and B Connectors on ATEN AutoSwitch are **DB25F**)

8 REFERENCES

Manufacturer:



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The instrument is CE certified

According to directive 98/79/EC relative to In Vitro Diagnostic Medical Devices

