RS

Rack system solution with interface

Revision 1.11

May, 2014

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1 Scope

This manual describes the optical and electrical specifications of the RS switch rack system solution and details the communication protocol required to communicate with the device.

2 Rack system description

The sercalo RS series are all-optical switch solutions for demanding applications in fiber optic instrumentation or communication. The RS series is available with Ethernet, RS-232 or USB interface. The system can control a broad range of switching networks, supporting either single or multimode fibers. Contact us to discuss the availability of customized networks.

sercalo's fiber optic NxM switches are based on a strictly non-blocking bidirectional architecture. Light from port A is routed to port B; an optional array of 1x1 switches independently enables or disables the channels of port A (Figure 1). The underlying MEMS technology permits to obtain low insertion loss combined with high crosstalk between channels.

sercalo's highly reliable switching mechanism uses integrated micro-mirrors that can be moved in or out of the optical path by electrostatic actuation. The latching mechanism offers the best repeatability and long term stability. The component is designed to conform to Telcordia 1221 reliability standards.

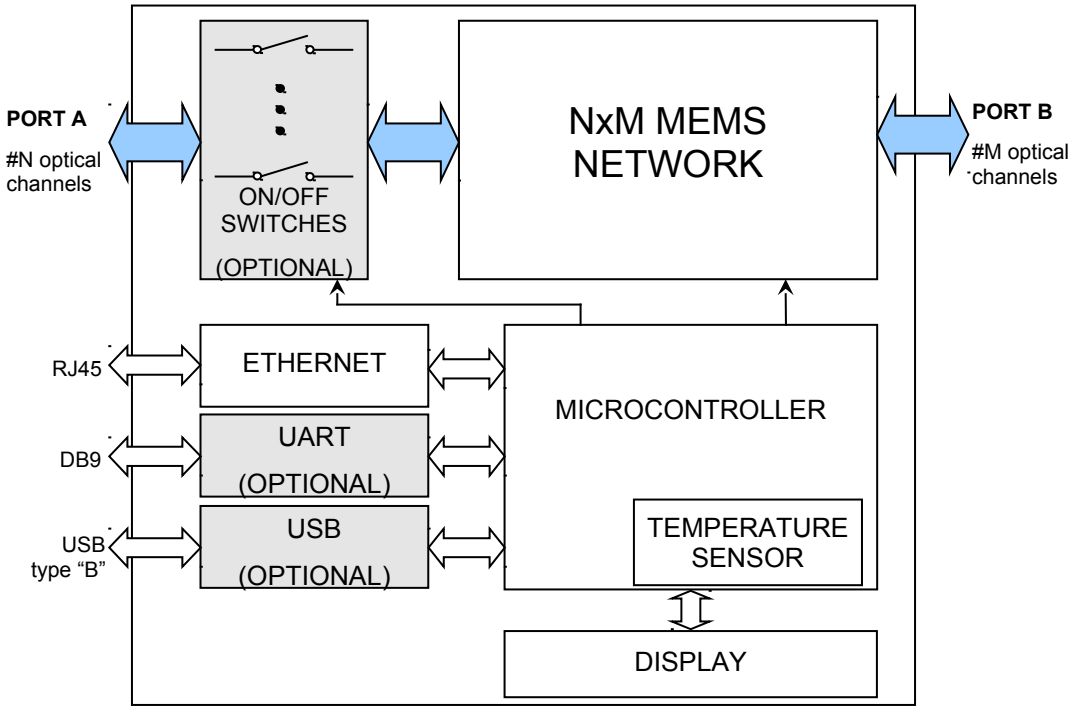


Figure 1 – Functional block diagram

3 Product Dimensions

Figure 2 And Figure 3 depict the device layout. All dimensions are shown in millimeters.

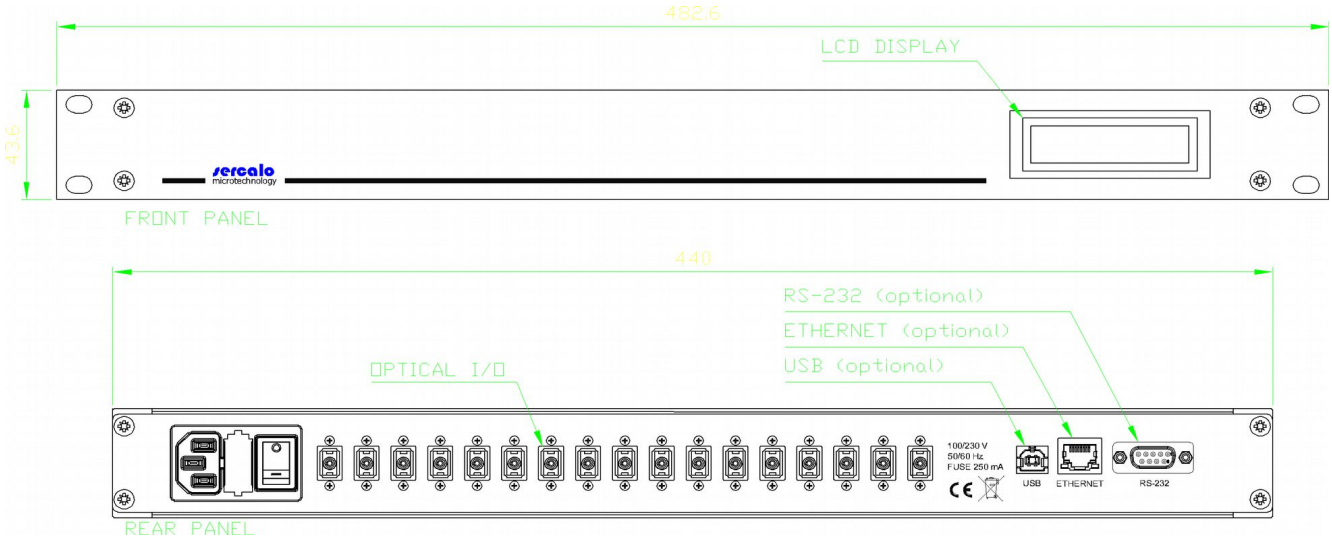


Figure 2 – Dimensions of RS (with optical connectors on rear side)

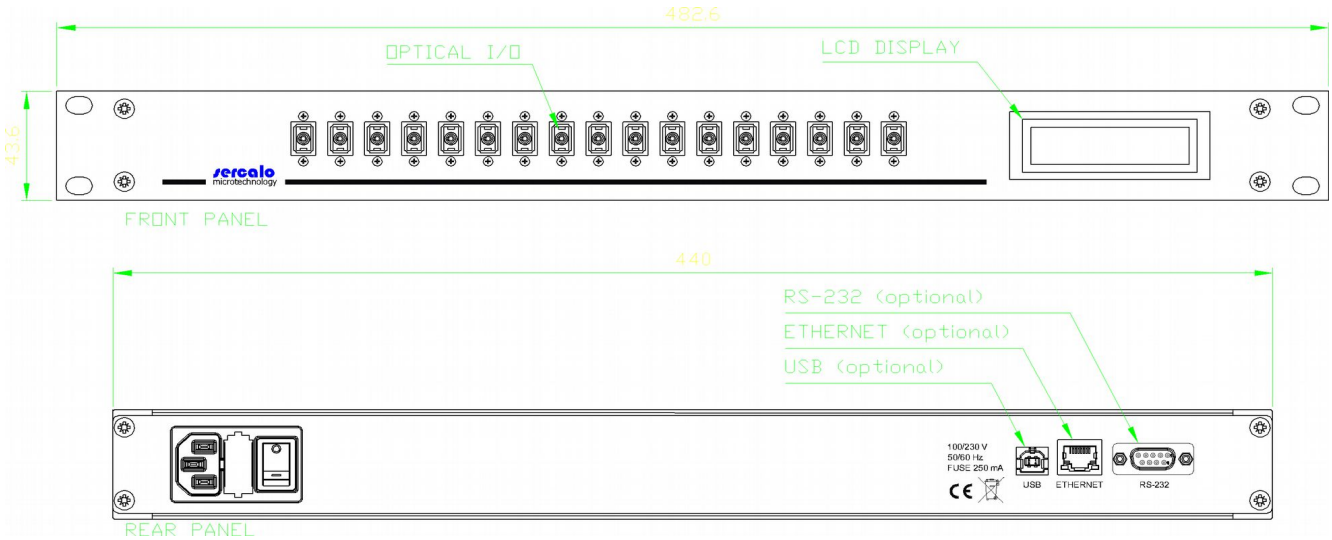


Figure 3 – Dimensions of RS (with optical connectors on front side)

4 Connectors Description

The RS fiber optic switch is provided with the following connectors (depending on the requested option):

- **USB** – It is a USB type B connector (*USB* option only).
- **Ethernet** – It is an 8P8C modular connector (*Ethernet* option only).
- **RS-232** – It is a D-subminiature DE-9 female connector (*RS-232* and *USB* options only).

5 Absolute Maximum Ratings

Applicable absolute maximum ratings for the full operating temperature range without causing irreversible damage to the device are listed in Table 1.

Parameter	Rating Limit	Unit
Maximum optical power	100	mW

Table 1 – Absolute maximum ratings

6 Using the UART and USB Interfaces (Optional)

6.1 Configuring the UART interface

Table 2 lists the requirements for the UART settings. The default baud rate (after power on or reset) is 9600 baud which remains in effect otherwise changed by the user. If a Windows-based PC and HyperTerminal are used, the suggested configuration is displayed in Figure 7.

Parameter	Factory setting
Transmission rate [bps]	9600
Data bits	8
Parity	none
Stop bits	1
Flow control	none

Table 2 – RS-232 settings after power on or reset

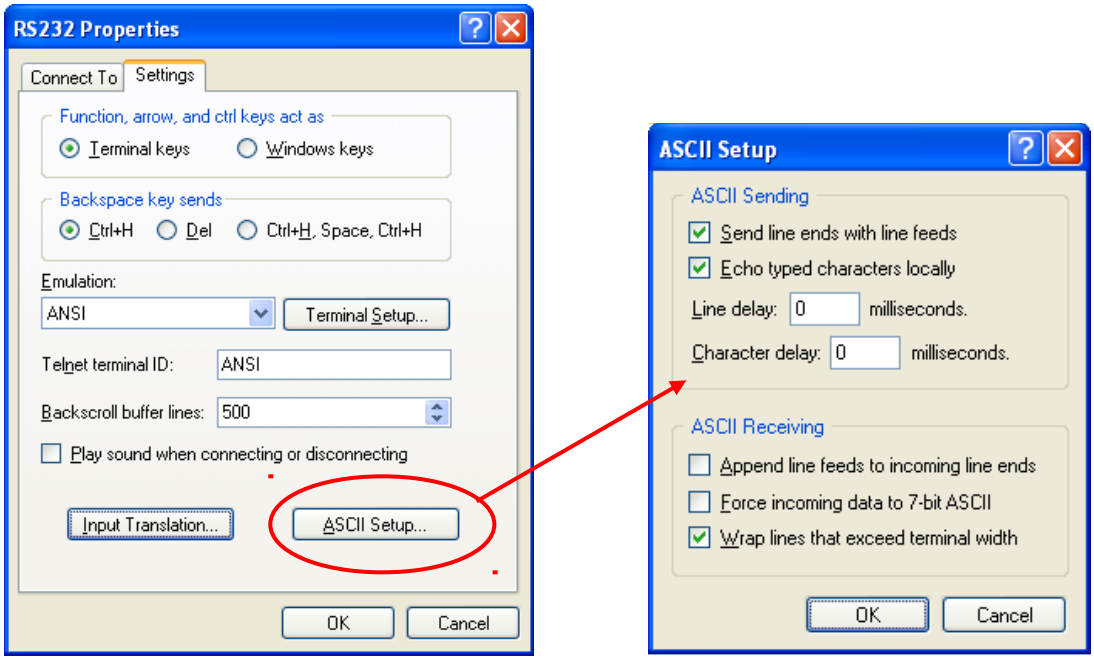


Figure 4 – HyperTerminal RS-232 properties and ASCII setup.

6.2 Configuring the USB interface

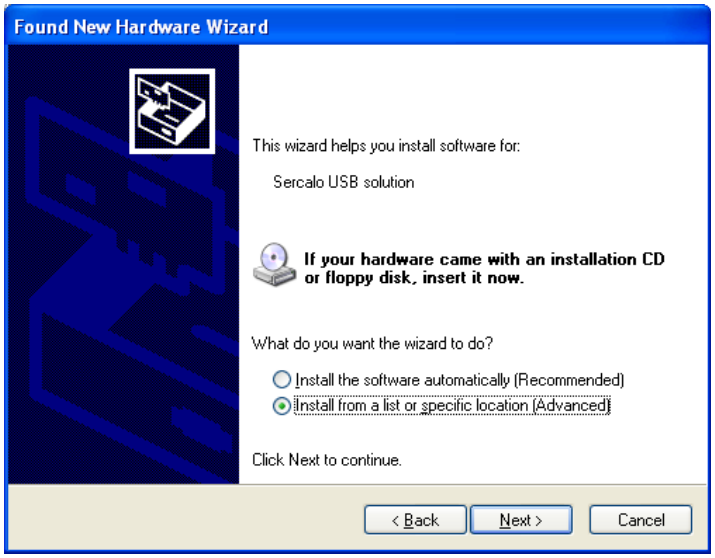
The USB interface acts as a Virtual COM Port (VCP): the provided driver causes the device to appear as an additional serial port available to the PC. Application software can access the device in the same way as it would access a standard serial port. If a Windows-based PC and HyperTerminal are used, the suggested configuration is reported in Paragraph 6.1. The USB interface can provide the necessary power supply to the product.

Contact sercalo for obtaining latest USB driver.

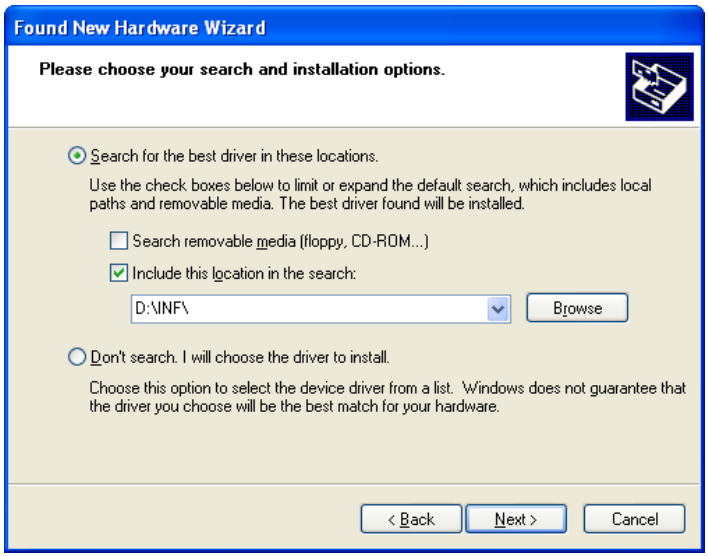
6.2.1 Installing driver in Windows XP

1. Connect the device to a free USB port. The New Hardware Found Wizard should appear. At the request to connect to Windows Update, choose "**No, not this time**" then click the [**Next >**] button.

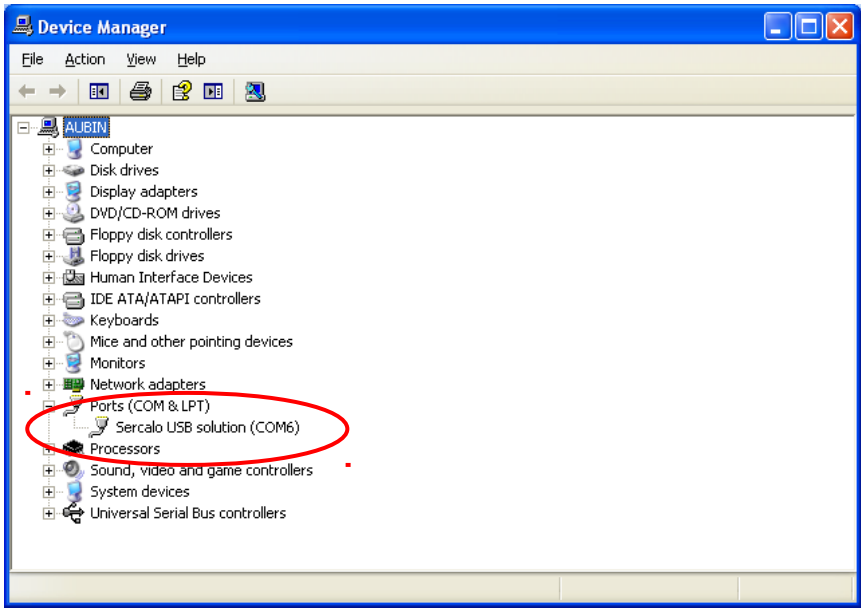
2. On the screen below, select "**Install from a list or specific location (Advanced)**" then click the [**Next >**] button.



3. On the screen below:
   Select "**Search for the best driver in these locations**"
   Check "**Include this location in the search**:"
   Use the [**Browse**] button to find the file "**Sercalo_USB.inf**" and click [**OK**]

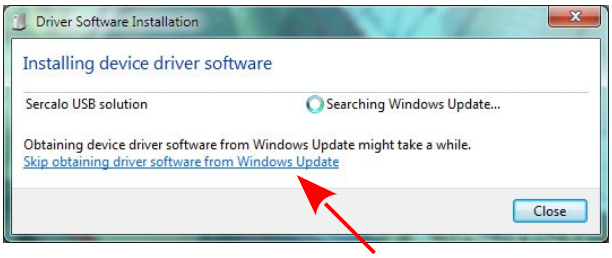


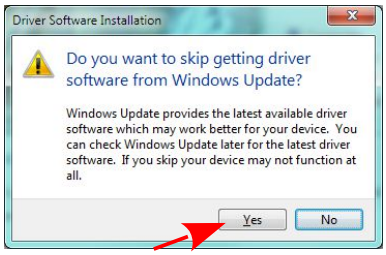
4. If a security warning appears, click [**Continue Anyway**]. The wizard will complete and a new "virtual" COM port will appear in your Device Manager.



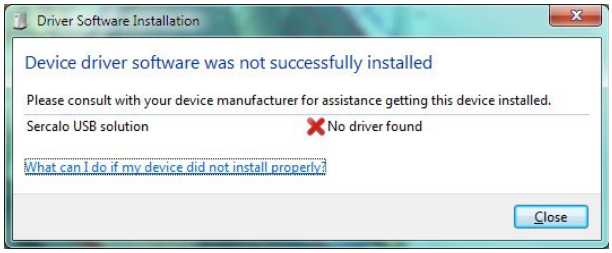
6.2.2 Installing driver in Windows 7

1. Connect the device to a free USB port. The Driver Software Installation window should appear. Click on "**Skip obtaining driver software from Windows Update**" then click the [**Yes**] button on the confirmation dialog box.

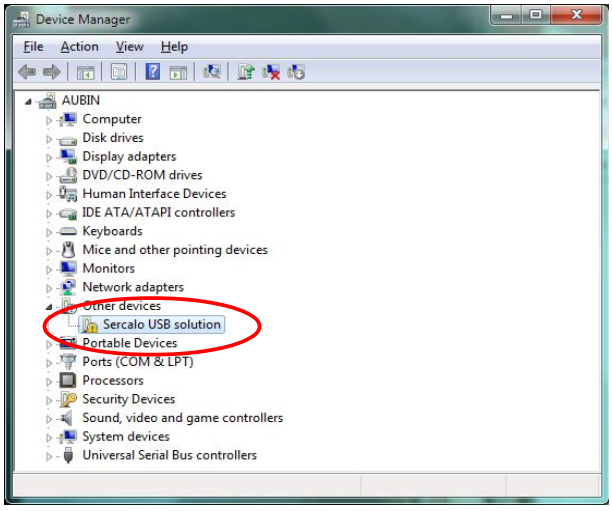




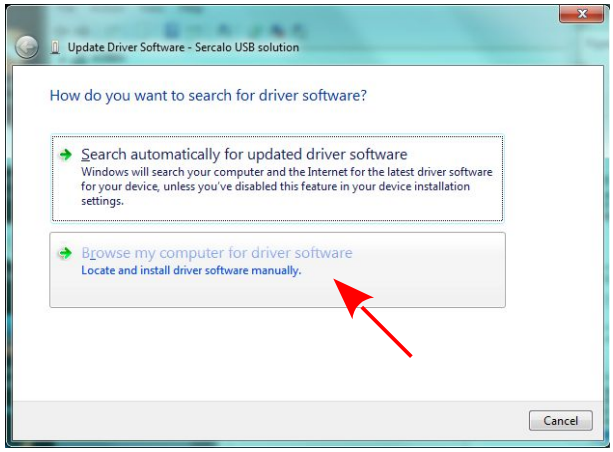
2. The Driver Software Installation window will report that the device was not successfully installed. Close it.

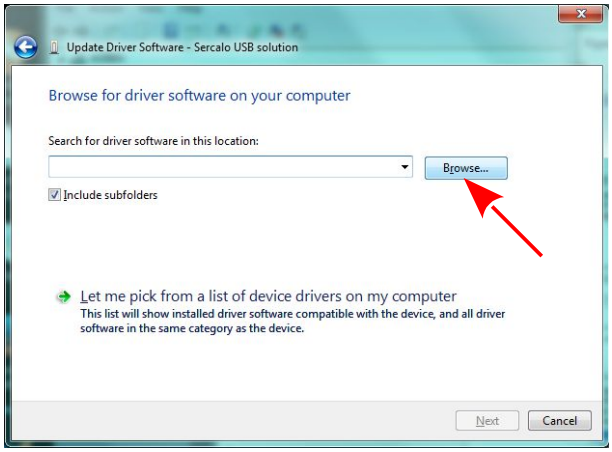


3. Open the Device Manager and right-click on "Sercalo USB solution". On the appearing context menu, choose "**Update Driver Software**".

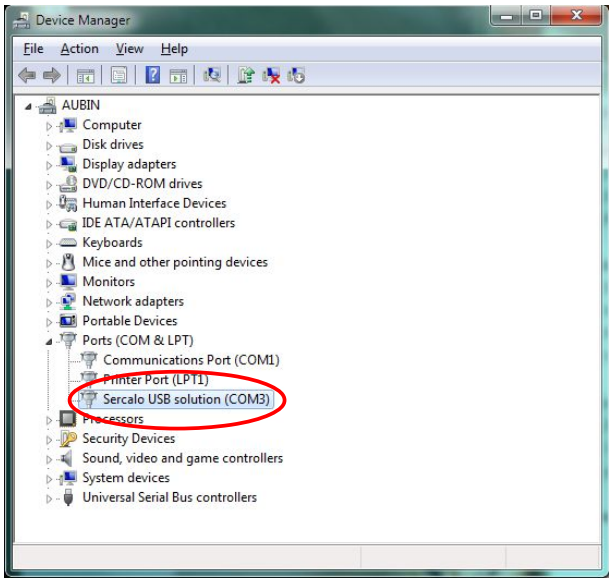


4. On the installation procedure, select "Browse my computer for driver software", then use the [**Browse**] button to find the file "**Sercalo_USB.inf**" and click [**Next**].





5. If a security warning appears, select "**Install this driver software anyway**". The wizard will complete and a new "virtual" COM port will appear in your Device Manager.



7 Using the Ethernet Interface (Optional)

The device can be controlled through a standard 10BASE-T Ethernet connection and Telnet protocol, using either a terminal emulator application (e.g., HyperTerminal or PuTTY) or an user application.

When a network cable is plugged on, the system auto-negotiate a full-duplex or an half-duplex communications using the last user-defined IP address. The factory-programmed IP address is "192.168.10.100".

Once the internal Telnet server connects with the client computer, it will reject any other connection attempts by other computers. This prevents multiple computers from trying to control the device at the same time.

If a Windows-based PC and HyperTerminal are used, follow the following steps:

1. Connect the Ethernet cable and switch on the rack system. Be sure that the device is in the same subnet of the PC.
2. Open HyperTerminal and setup a new connection as depicted in Figure 5. The default communication port for the Telnet protocol is "23".

3. The suggested configuration for the ANSI is depicted in Figure 6.
4. Choose Call→Call to start the communication.

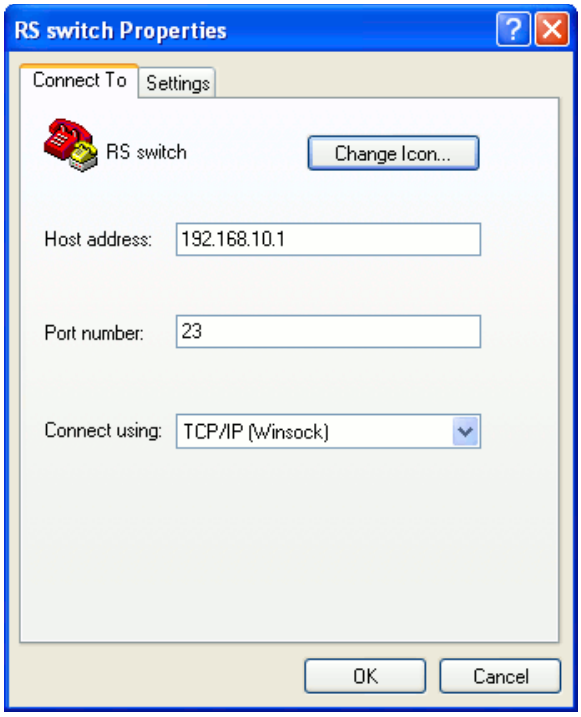


Figure 5 - HyperTerminal Telnet properties.

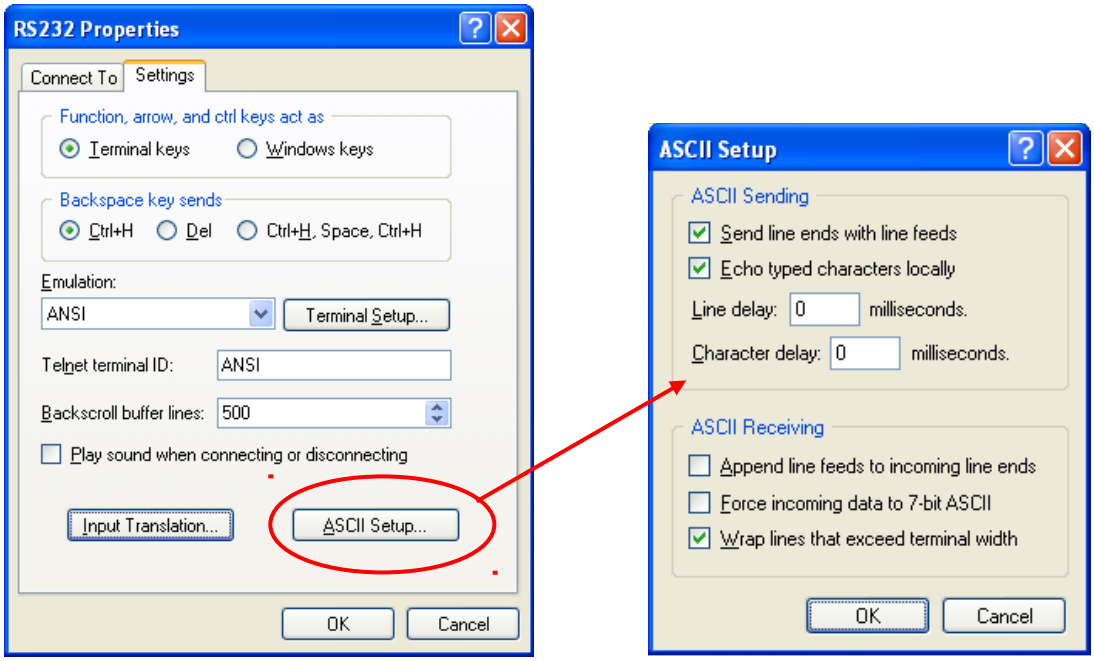


Figure 6 - HyperTerminal ASCII setup.

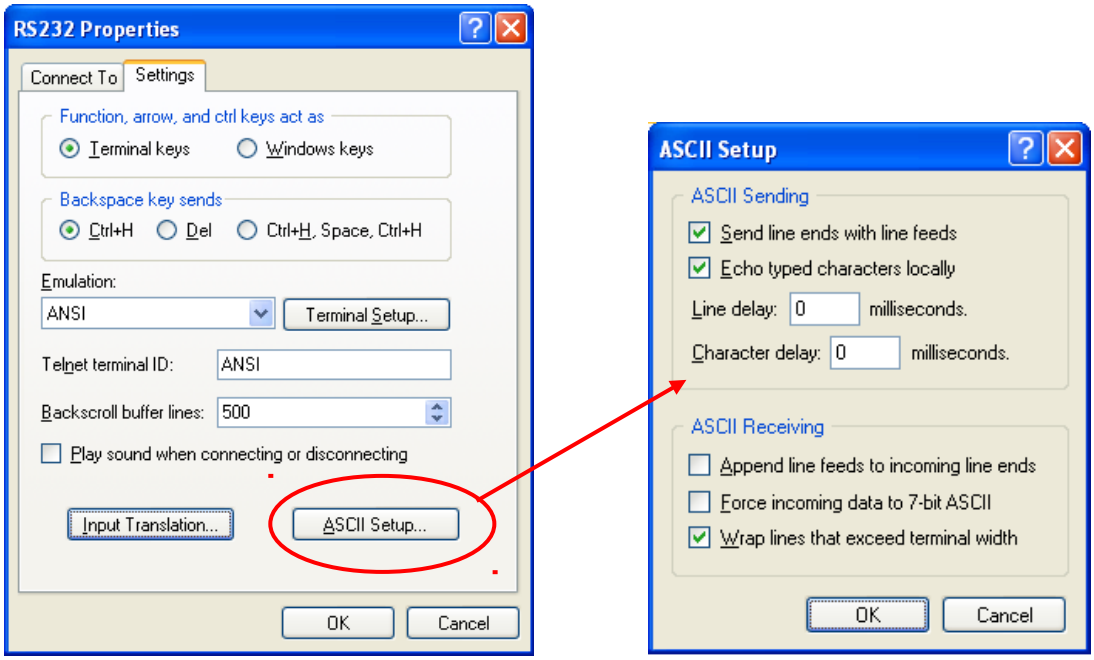


Figure 7 - HyperTerminal ASCII setup.

8 Command syntax

Commands consist of ASCII characters strings having the following structure:

`CMD <param1> <…> [opt_param1] […]↵`

where:

- **`CMD`** is the command
- **`<…>`** the angle brackets indicate that the enclosed parameter is *mandatory*
- **`[…]`** the square brackets indicate that the enclosed parameter is *optional*
- **`↵`** is the string terminator (end of line).

The following conventions are adopted:

- Commands can be written either in upper-case or lower-case characters.
- Commands and parameters are separated by one or more spaces (ASCII 0x20).
- The system recognizes as end of line any of the forms: LF (Line feed, '\n', ASCII 0x0A) or CR (Carriage return, '\r', ASCII 0x0D), or CR followed by LF (CR+LF, 0x0D 0x0A). Replies always end with the sequence CR+LF.
- The device always replies to commands. The reply can be a command-dependent acknowledgment or an error message.
- Error messages always start with ERR, followed by a space and context-dependent additional data.
- The user should not attempt to send the device a new command until it has completed the current command.

9 Command set

The available commands are listed in Table 3 and detailed in the following subsections.

Command	Description
ID	Returns the equipment identification.
RST	Resets the device.
ERM	Returns or changes the error returning mode.
TMP	Returns the temperature of the microcontroller.
SET	Sets the network configuration
POS	Returns the network configuration
ENB	Enables or disables channels on port A (on/off switches)[1]
BKL	Returns or changes the status of the display backlight.
UPD	Enters in service mode.
Commands specific for RS-232 interface (optional)	
UART	Returns or changes the baud rate.
Commands specific for Ethernet interface (optional)	
IP	Returns or changes the IP address and the netmask.
GW	Returns or changes the gateway.
MAC	Returns the MAC address.
TMO	Returns or changes the socket timeout.

Table 3 – List of available commands

9.1 ID – Returns the equipment identification

Returns the system identification, which consists of the model, the serial number and the firmware version. The three fields are separated by pipe characters '|' (ASCII 0x7C).

Parameters:	**PRODUCT**	(string)	product model
	S/N	(string)	serial number
	FW_REV	(string)	firmware version

Syntax: **ID↵**

Reply on success: **ID <PRODUCT>|<S/N>|<FW_REV>**

Example:
```
ID↵
ID TF|2010-20-002|1.2
```

9.2 RST – Resets the board

Stops the Telnet server and resets the system.

[1] Only for supported models.

Parameters: none

Syntax: **RST↵**

Reply on success: **RST**

Example: **RST↵**
RST

9.3 ERM – Returns or changes the error returning mode

If called without parameters, returns 0 if the errors are identified with integer numbers or 1 if the errors are returned in plain text. If **ERR_MODE** is entered, switch to verbose mode if its value is 1, or switch to number mode if the value is 0. This parameter returns to the default value after any reset or power-on.

Parameters: **ERR_MODE** (char, 0 or 1) error returning mode

Default: **1**

Syntax: **ERM [ERR_MODE]↵**

Reply on success: **ERM <ERR_MODE>**

Example: query the current error returning mode:
ERM↵
ERM 0
change the current error returning mode:
ERM 0↵
ERM 0

9.4 TMP – Returns the temperature of the microcontroller

Returns the temperature of the microcontroller unit, expressed in Celsius degrees.

Parameters: **TEMP** (float) temperature

Syntax: **TMP↵**

Reply on success: **TMP <TEMP>**

Example: **TMP↵**
TMP 38

9.5 SET – Sets the network configuration

Sets the switch network. This command accepts N parameters, where N is the number of channels of port A. **Pi** is the channel of port B to be connected to the i-th channel of port A.

For models 1xM, the command must be followed by one parameter representing the desired channel on port B (from 1 to M).

For models Nx1xM, the command must be followed by two parameters, representing respectively the desired channels on port A (from 1 to N) and B (from 1 to M).

For model 8x8, the command must be followed by a valid permutation of the channel numbers, i.e. a list of eight integers from 1 to 8 where each number appears only once.

For model 8x4, the command must be followed by a valid permutation of the channel numbers, i.e. a list of eight integers from 1 to 4 where each number appears only once, plus four "X" in the appropriate positions to indicate channels of port A that will not be routed to port B.

For model 4x4, the command must be followed by a list of four integers from 1 to 4 where each number appears only once.

Parameters: **P1** … **Pn** (integer, from 1 to M or "X") channel number

Default, 1xM: **1**

Default, Nx1xM: **1 1**

Default, 8x8: **1 2 3 4 5 6 7 8**

Default, 8x4: **1 2 3 4 X X X X**

Default, 4x4: **1 2 3 4**

Syntax: **SET <P1> <P2> … <Pn>↵**

Reply on success: **SET <P1> <P2> … <Pn>**

Example, 1x8:
```
SET 5↵
SET 5
```

Example, 2x1x8:
```
SET 2 5↵
SET 2 5
```

Example, 8x8:
```
SET 3 5 6 8 7 1 2 4↵
SET 3 5 6 8 7 1 2 4
```

Example, 8x4:
```
SET 2 X 4 X 1 X X 3↵
SET 2 X 4 X 1 X X 3
```

Example, 4x4:
```
SET 4 3 1 2↵
SET 4 3 1 2
```

9.6 POS – Returns the network configuration

Returns the current switch network configuration.

For models 1xM, **P1** is the channel of port B connected to the single, common channel of port A.

For models Nx1xM, **P1** and **P2** represents respectively the connected channels on port A (from 1 to N) and B (from 1 to M).

For models NxM, **Pi** is the channel of port B connected to the i-th channel of port A. An "X" indicates a channels of port A that is not routed to port B.

Parameters: **P1** … **Pn** (integer, from 1 to M or "X") channel number

Syntax: **POS↵**

Reply on success: **POS <P1> <P2> … <Pn>**

Example, 1x8:
```
POS↵
POS 3
```

Example, 2x1x8: **POS↵**
POS 2 3

Example, 8x8: **POS↵**
POS 3 5 6 8 7 1 2 4

Example, 8x4: **POS↵**
POS 3 X 4 X X X 2 1

Example, 4x4: **POS↵**
POS 4 3 1 2

9.7 ENB – Enables or disables optical channels (optional)

This command is only available if the input switches array is choosed as an option.

If called without parameters, returns the status of the on/off 1x1 switches array connected between the port A and the switch network. If the command is followed by **PORT_MASK**, it sets the 1x1 switches array accordingly to the paramenters. The status of the i-th channel can be defined indipendently to the others by setting the value of the corresponding bit, where 0 means that the channel is disabled (disconnected) and 1 means that it is enabled.

For models 8x8O and 8x4O

BIT	7 (MSB)	6	5	4	3	2	1	0 (LSB)
CHANNEL	#8	#7	#6	#5	#4	#3	#2	#1
RESET	1	1	1	1	1	1	1	1

For model 4x4O

BIT	7 (MSB)	6	5	4	3	2	1	0 (LSB)
CHANNEL	unused	unused	unused	unused	#4	#3	#2	#1
RESET	1	1	1	1	1	1	1	1

Parameters: **PORT_MASK** (char, 0 to 255) channel enable

Default: **255**

Syntax: **ENB <PORT_MASK>↵**

Reply on success: **ENB <PORT_MASK>**

Example, SL8x8: **ENB 255↵** (channels all enabled)
ENB 255

Example, SL8x4: **ENB 0↵** (channels all disabled)
ENB 0

Example, SL4x4: **ENB 5↵** (channels #1 and #3 enabled)
ENB 5

9.8 BKL – Returns or changes the status of the display backlight

If called without parameters, returns 0 if the display backlight is off or 1 if it is on. If **BKL_STATUS** is entered, switch on the display backlight if its value is 1, switch it of if the value is 0. This parameter returns to the default value after any reset or power-on.

Parameters: **BKL_STATUS** (char, 0 or 1) display backlight status

Default: **1**

Syntax: **BKL [BKL_STATUS]↵**

Reply on success: **BKL <BKL_STATUS>**

Example: query the display backlight status:
BKL↵
BKL 0
change the current display backlight status:
BKL 0↵
BKL 0

9.9 UPD – Enters in service mode

Closes the communications and enters in service mode, allowing user to update the firmware.

Syntax: **UPD**

Reply on success: **UPD**

Example: **UPD↵**
UPD

9.10 UART – Changes the speed of the UART interface

If called without parameters, returns the speed of the UART port. If **UART_BAUD** is entered, changes the baud rate of the UART accordingly to Table 4. This parameter returns to the default value after any reset or power-on.

Value	Baud rate
0	9600
1	19200
2	38400
3	57600
4	115200

Table 4 – List of available baud rates

Parameters: **UART_BAUD** (char, 0 to 4) port speed

Default: **0**

Syntax: **UART [UART_BAUD]↵**

Reply on success: **UART <UART_BAUD>**

Example: **query the current baud rate:**
UART↵
UART 3
change the baud rate:
UART 2↵
UART 2

9.11 IP – Returns or changes the IP address and the netmask

If called without parameters, returns the current IP address and netmask expressed in CIDR notation (e.g. 24 is 255.255.255.0, 16 is 255.255.0.0 etc). If a valid IPv4 address and an optional CIDR are entered, the new address is set and the Ethernet connection is restarted with the new parameters. If CIDR is omitted, the default value is 24, i.e. 255.255.255.0. The new value is stored in the internal flash memory and is preserved during reset and power-off.

Parameters:	**IP_ADDR**	(string)	a valid IPv4 address
	CIDR	(char, 8 to 30)	netmask in CIDR notation

Syntax: **IP [IP_ADDR/[CIDR]]↵**

Reply on success: **IP <IP_ADDR>/<CIDR>**

Example: Query the current IP and netmask:
IP↵
IP 192.168.10.25
Change the IP address and the netmask:
IP 192.168.10.24/16↵
IP 192.168.10.24/16
Change the IP address, keep the default netmask:
IP 192.168.10.24↵
IP 192.168.10.24/24

9.12 GW – Returns or changes the gateway

If called without parameters, returns the current gateway. If a valid IPv4 address is entered, the Ethernet connection is restarted with the new settings. The new value is stored in the internal flash memory and is preserved during reset and power-off.

Parameters:	**GATEWAY_ADDR**	(string)	a valid IPv4 address

Default: **255.255.255.255**

Syntax: **GW [GATEWAY_ADDR]↵**

Reply on success: **GW <GATEWAY_ADDR>**

Example: Query the current geteway:
GW↵
GW 192.168.10.1
Change the gateway:
GW 192.168.1.1↵
GW 192.168.1.1

9.13 MAC – Returns the MAC address

Returns the MAC address of the device.

Parameters:	**MAC_ADDR**	(string)	MAC address
Syntax:	**MAC↵**		
Reply on success:	**MAC <MAC_ADDR>**		
Example:	**MAC↵** **MAC 00-1a-4b-ae-bd-be**		

9.14 TMO – Returns or changes the socket timeout

Sets or returns the socket timeout expressed in minutes. After **TIMEOUT** minutes with no activity from the client, the server will close the Telnet socket. If **TIMEOUT** is 0, the alive time is infinite and the Telnet server will never disconnect. This parameter returns to the default value after any reset or power-on.

Parameters:	**TIMEOUT**	(char, 0 to 65535)	timeout
Default:	**10**		
Syntax:	**TMO [TIMEOUT]↵**		
Reply on success:	**TMO <TIMEOUT>**		
Example:	query the socket timeout: **TMO↵** **TMO 0** change the socket timeout: **TMO 30↵** **TMO 30**		

10 Firmware update (Ethernet interface)

The following procedure permits to update the firmware using the ethernet connection and the TFTP protocol.

1. Switch on the rack system and start a normal telnet session on port 23.
2. Enter the command “UPD”. The rack system replies “OK”, the telnet session is closed and “SERVICE MODE” appears on the display.
3. For exit from the service mode, just reboot the switch. Otherwise proceed to point 4.
4. Use the TFTP protocol (port 69) to transfer the .img file containing the new firmware. Under Windows systems, the “TFTP” utility may be used directly form the command line as follows:

   TFTP -i <host> PUT <source> <destination>

-i	Specifies binary image transfer mode.
host	Specifies the IP address of the rack system to update.
PUT	Transfers from local host to the rack system.
source	Specifies the file to transfer containing the firmware update.

destination Specifies where to transfer the file. The destination file name must be "boot.img".

For example,

```
TFTP –i 192.168.10.1 PUT RS_2_01_BL.img boot.img
```

transfers the firmware update contained in file RS_2_01_BL.img to the rack system at IP address 192.168.10.1.

5. If the firmware update is successful, the system will restart.

11 Error codes

The following table gives information about error codes used with sercalo's devices.

Error number	Description
1	syntax error
2	CRC error
3	invalid parameter(s)
4	command unknown
5	timeout
6	buffer overrun
7	invalid IP/subnet mask combination
8	device is in idle mode
9	memory location is empty
10	status unknown

Table 5 – Overview of error codes

12 Optical Specifications

	Unit	Min	Typ	Max
Wavelength range[2]	nm	1240		1640
Insertion loss[3]	dB		0.7	1.3
Crosstalk	dB	50	75	
Return loss[4]	dB	50	55	
Switching time	ms			20
Repeatability[5]	dB			0.01
Polarisation dependent loss	dB		0.07	0.2
Durability	cycles	No wear out		

13 Electrical specifications

	Unit	Min	Typ	Max
Supply voltage	V		100-230 AC	
Power consumption	W		20	
RS-232				
UART speed	baud	9600		115200
Mark voltage	V	-30		0.8
Space voltage	V	2.4		30
Ethernet				
Physical layer		Ethernet 10BASE-T		
Factory-programmed IP address		192.168.10.1		
Network protocol		Normal use: Telnet (port: 23) Firmware update: TFTP (port: 69)		

14 Package Specifications

	Unit	Min	Typ	Max
Operation temperature	°C	0		70
Storage temperature	°C	-40		70

[2] For multimode: range 600-1700nm

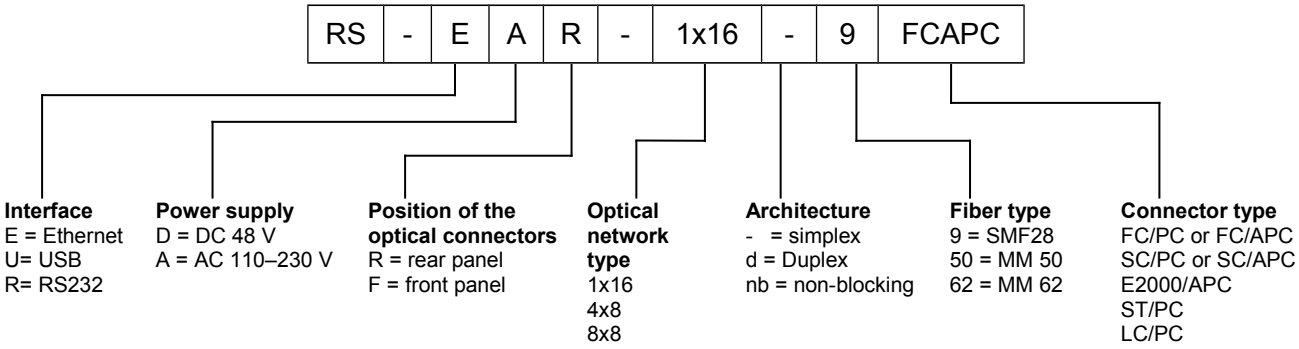
[3] Value at 25°C, including connectors, up to 1x4, more ports result in higher IL; up to 16 ports: ILmax = 2 dB; up to 48 ports: ILmax=3dB

[4] For single mode fiber (SMF) and angled connectors. For MM fiber RL > 35 dB.

[5] For constant wavelength, temperature and polarization

15 Label Information

ORDERING INFORMATION



16 Contact Information

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