KASPAROV™
CHESS COMPUTER

Connection Cable For Leonardo Chess Computer

Saitek™

The Link: Leonardo's OSA connection to computers and printers

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Software Ver. 1.2

1. Introduction

Leonardo breaks loose from its physical confines and can link directly to the outside world. Using the **OSA Link** you can connect Leonardo (plus upgrade modules if installed) directly to a printer, a PC, a super-mini, or even a mighty mainframe. Two way communication is possible to provide boundless facilities.

Just imagine! Here are some of the things Leonardo can do.

Linking to a printer only: You can immediately get a continuous print out of your game, the time taken per move, take backs made, position shown graphically, and total time taken by both sides.

Linking to a personal computer: You don't need to be a skilled programmer to soon discover even more information using Leonardo linked to a personal computer. See Leonardo's analysis of each main line continuation while it is thinking and its rating of the end position. Leonardo will help you improve your game by showing alternative winning combinations that you may have missed. Using your own personal computer program the opportunities are endless. Why not program Leonardo to analyse one of your games over a weekend? Ask it to think for an hour (or longer) over each move in turn and then print out all the moves with a position evalution and main line continuation alternative. That way you can see at what point the game was won or lost. You can even connect Leonardo to a modem and exchange chess information with chess players worldwide.

2. Linking up

This chapter describes how some typical computers and printers can be connected to Leonardo. Chapter 3.3 describes how to change the baud rate of the Leonardo Link and make other fine adjustments, should your equipment be non-standard.

Definitions:

CR	— Carriage Return character (Hex 0D)
LF	— Line-Feed character (Hex 0A)
EOM	— End-Of-Message character (Hex 17 = CTRL-W)
[RETURN]	— Press the key marked RETURN (or ENTER or ↵) on your computer's keyboard.
n.n	— Integer, full stop, integer

2.1 Amstrad and Schneider computers.

a. Equipment:
   - i) An Amstrad or Schneider computer.
   - ii) An Amstrad or Schneider RS-232C serial interface with its adapter.
   - iii) Saitek RS-232C Adapter I (Saitek Art No. 590).
   - iv) Saitek mains adapter for the Leonardo (supplied with Leonardo).
   - v) Optional serial extension cable (see Appendix C).

b. Set up procedure
   - i) Ensure power to the computer and the serial interface is off by unplugging all mains adapters. Leonardo should be STOPped.
   - ii) Connect the DIN plug of the RS-232C Adapter I to the OSA-LINK socket underneath Leonardo.
   - iii) Plug the RS-232C Adapter I into the RS-232C interface's DB-25 socket. You may also use a serial extension cable if your Leonardo is not close to your computer.
   - iv) Turn on the computer, then connect the mains adapters to Leonardo and the RS-232C interface respectively. Press **GO** on Leonardo.

c. Starting BOSAL
   - i) Type the BASIC program listed in Appendix A into the computer.
   - ii) Save the program on disk or cassette for future use (consult your AMSDOS manual on how to do this).
   - iii) Type RUN [RETURN]
   - iv) Type ! OPEN [RETURN].
     The computer screen should display:

     - Leonardo Chess System - Version n.n -

Now read chapter 3 for a BOSAL tutorial.

2.2 Commodore computers

a. Equipment:
   - i) A Commodore 64 or VIC-20 computer (other computers may also be used, but the setup procedure may be different).
   - ii) Leonardo Commodore-serial cable (Saitek Art No. 591).

b. Set up procedure:
   - i) Ensure the computer is turned off and Leonardo is STOPped.
   - ii) Connect the DIN plug of the serial cable to the OSA-LINK connector underneath Leonardo.
   - iii) Firmly plug the other connector into the Commodore User I/O slot. Check that it is the right way up.
   - iv) Switch on the Commodore, then press **GO** on Leonardo. The Link to Commodore works both with and without Leonardo's mains adapter.

c. Starting BOSAL
   - i) Type in your terminal program as listed in Appendix A.
   - ii) Save it on cassette or diskette for future use.
   - iii) Type RUN [RETURN] to run your program.

iv) Type ! OPEN [RETURN].
The computer screen should display:

- Leonardo Chess System - Version n.n -

Now read chapter 3 for a BOSAL Tutorial.

2.3 Apple II family

a. Equipment:
   i) An Apple II, II+ or IIe computer with Super Serial Card (SSC) installed.
   ii) An Apple extension cable (Appendix C.B.3).
   iii) Saitek RS-232C Adapter I (Saitek Art No. 590).
   iv) Saitek mains adapter for the Leonardo (supplied with Leonardo).

b. Set up procedure
   i) Ensure power to the computer is off, and the Leonardo is STOPped.
   ii) Jumper block on the SSC must be set with the triangle pointing toward MODEM.
   iii) Connect the extension cable between SSC and the RS-232C Adapter I.
   Connect the DIN plug of the RS-232C Adapter I to the OSA-LINK socket underneath Leonardo.
   iv) Turn on the computer, then connect the mains adapter to Leonardo, press **GO** on Leonardo.

c. Starting BOSAL
   i) Type in the terminal program as listed in Appendix A.
   ii) Save the program on disk or cassette for future use.
   iii) Type RUN [RETURN]
   iv) Type ! OPEN [RETURN].
   The computer screen should display:

   - Leonardo Chess System - Version n.n -

Now read chapter 3 for a BOSAL tutorial.

2.4 IBM PC,XT,AT computers

a. Equipment:
   i) An IBM PC,XT,AT or compatible computer with at least 64K RAM and 8250 type serial port/interface.
   ii) Saitek RS-232C Adapter I (Saitek Art No. 590).
   iii) Saitek mains adapter for the Leonardo (supplied with Leonardo).
   iv) Optional serial extension cable (Appendix C).

b. Set up procedure
   i) Ensure power to the computer is off, and Leonardo is STOPped.
   ii) Connect the DIN plug of the RS-232C Adapter I to OSA-LINK connector underneath the Leonardo.
   iii) Use an IBM extension cable to connect the RS-232C Adapter I with the computer's serial port (COM1:). Or plug the RS-232C Adapter I directly into the computer's serial port if it is close.
   iv) Turn on the computer, then connect the mains adapter to the Leonardo, press **GO** on Leonardo.

c. Starting BOSAL
   i) Boot your computer with the PCDOS system diskette. It contains the terminal program COMM.BAS.
   ii) Modify the program as follows:
      a) BASIC [RETURN]
      b) LOAD "COMM[RETURN]
      c) EDIT 210
      d) Now move the cursor until just past the last "$", and type the following:
      + ", RS, CS, DS, CD" [RETURN]
      e) SAVE "OSATERM[RETURN] saves the modified program for future use.
      f) RUN [RETURN] runs the program.
   iii) Type BASIC OSATERM[RETURN] after booting the system when you want to use it.
   Press F2 to select 80 column display;
   Press "6" to select "other service"
   When asked, select:

Baud rate	= 1200
Parity	= N
No. of bits per char.	= 8
No. of stop bits	= 1
Char. echo to screen	= Y
Data entered correctly	= Y (to enter terminal mode)

   Type ! Open [RETURN]
   The computer should respond with & or a after you type ! and display

   - Leonardo Chess System - Version n.n -

Now read chapter 3 for a BOSAL tutorial.

Note: Serial port COM1: is assumed in this program. To use COM2:, replace "COM1:" with "COM2:" in the program.

2.5 Printers

Leonardo also connects directly to any RS-232C interface printer without needing any computer intermediary. It can be a portable typewriter/terminal such as the Brother EP-44 and Canon Typestar 7, or a computer printer like the Epson FX-85 that has a serial interface.

a. Equipment:
   i) A printer with RS-232C interface.
   ii) A Saitek RS-232C Adapter I (Saitek Art No. 590)
   iii) A suitable cable —
   Leonardo requires only 2 lines (TxD and Gnd) to drive your printer. However, some printers require certain other lines to be at a predefined state to work properly — consult your printer's manual and your dealer.

b. Set up procedure
   i) Ensure your printer is turned off and Leonardo is STOPped.
   ii) Connect the printer's cable to the DB-25 socket on the RS-232C Adapter I, and then connect the DIN plug of the RS-232C Adapter I to the OSA-LINK underneath Leonardo.
   iii) Consult your printer's manual (DIP switch setting chapter). Carefully set your printer to work with 1200 baud, 8 bit data, 1 stop bit, no parity and no linefeed after carriage return.
   iv) Turn on the printer and press **GO** on Leonardo.

c. On the Leonardo keyboard, press **[NORMAL] [FUNCTION] [KING]**
   Printer should now print

   - Leonardo Chess System - Version n.n -

   Chapter 3.2 to 3.4 describes how to control the system from Leonardo's keyboard.

2.6 Communication/Terminal programs

Commercially available communication/terminal programs like Crosstalk, PC-talk, MICRO/Terminal, Moveit and Dataterm-64 etc may also be used to link your computers to Leonardos. These programs usually offer faster communication speed as they are optimized for this purpose. You may follow its instructions to set up your computer in terminal mode and then skip to Chapter 3.

3. BOSAL Tutorial

3.1 A First Tour of BOSAL

If you reach this chapter, the greeting message:

- Leonardo Chess System - Version n.n -

should be on your computer's display and Leonardo's "COMM" LED should be on (if not, refer to previous chapters and try again, or refer to the troubleshooting chapter.)

You have used the BOSAL command "Open" to open the Link or you have followed chapter 2.5.c.

To issue a command from your computer's keyboard to Leonardo, you start with the attention code "!" (exclamation mark), Leonardo responds with Hex (26) ("&" in many systems).

Try a few moves on Leonardo's chessboard. These moves, together with the time taken for each move, are logged on the screen automatically. Take back a few moves on the chessboard and note the screen change.

Type "!" then "POSITION" and press [RETURN] on the computer. The chessboard position appears in diagrammatic form. Next, type "! SETLEVEL A7 [RETURN]" to set the level to A7 (2 minutes per move on average), and watch for Leonardo's confirmation on the screen.

Type "!" then "SENDINFO ON" and press [RETURN] for Leonardo to send search information automatically every time it is updated during a search. Try this one out by making a move that is not in the openings book.

3.2 Commands from Leonardo's keyboard

With the following key sequences you may record your game on an "input-only" device such as a printer.

In NORMAL mode, you can do the following:

FUNCTION,KING — tells Leonardo to start sending BOSAL messages automatically to serial device. Output messages are sent after each move, Takeback, Newgame/ Setup, or Level change. This is equivalent to BOSAL "OPEN" message (chapter 4.3)

FUNCTION,QUEEN — tells Leonardo to stop sending above messages. The serial device will still be considered connected for any other messages that Leonardo is instructed to generate. To completely disconnect, press **STOP** + **GO**.

FUNCTION,ROOK — prints game record up to current move.

FUNCTION,BISHOP — prints current board position as diagram.

FUNCTION,KNIGHT — prints current clock times.

FUNCTION,PAWN — toggles generation of LF after CR. Automatically reenabled when initially connected (Default: CR/LF)

FUNCTION,TAB/COLOR — cycles through the various languages in the sequence (eg, in a board diagram the letter representing a piece may change depending on the foreign language chosen)

English (default)
German
French
Dutch
Spanish
Italian
Swedish

STOP — disconnects and closes down the Link. Leonardo will remember your baud rate, protocol and transmission modes when you restart.

3.3 Setting baud rates

Different baud rates are selected from keyboard:

Enter SETUP mode, then press one of the following:

FUNCTION,KING — 9600 baud
FUNCTION,QUEEN — 4800 baud
FUNCTION,ROOK — 2400 baud
FUNCTION,BISHOP — 1200 baud (default)
FUNCTION,KNIGHT — 300 baud
FUNCTION,PAWN — 110 baud

3.4 Data format; protocols; transmission modes

All data travelling up or down the Link are formatted:
8 data bits
1 stop bit
no parity

The BOSAL user can command Leonardo to change protocols with the command bytes. The exact character displayed on the screen depends on your computer; in case of doubt, read your computer's manual.

Char.	Hex	Meaning
<	3C	use BOSAL, Leonardo replies "*"
!	21	computer wants to send a message. Leonardo replies "&"
&	26	Leonardo is ready to receive message.
@	40	Leonardo must issue LF after each CR. (defaults on). Replies "*"
_	2D	Leonardo must wait briefly after each CR/LF (defaults on). Replies "*"
#	23	Leonardo must issue CR alone (no LF, no wait; defaults off). Replies "*"

Leonardo provides 3 transmission methods:

— Stream — default
Sender sends message without waiting for any response by receiver.

— Wait — advanced programmers only
Special features to help ensure that both devices are ready to communicate before sending a message stream.

— Byte-echo — advanced programmers only
This method is used to transmit messages with greater reliability by echoing each byte back to the sender.

The Advanced OSA Programmer's Guide (see Chapt. 2) describes these in detail.

4. BOSAL Reference Guide

4.1 General input format of BOSAL messages:

Messages begin with a keyword followed by parameters, if any, and end with a CR (Carriage Return) or EOM (End of Message) character. Linefeeds are ignored.

Parameters are separated by any number of spaces, tabs, commas, or equal signs.

Numeric values are assumed to be in decimal. You can send hexadecimals if you put a "$" in front of the number.

Command keywords and other symbols may be expressed in any of several foreign languages in upper or lower case.

All commands and other keywords (eg. "white", "on", etc) may be specified with only the minimum number of letters needed to distinguish it from other keywords.

eg. "o" is sufficient to specify "open"

eg. "clos" is required to distinguish "close" from "clocks"

The minimum length of each abbreviation depends on the foreign language (eg. "st" would normally mean "stop" in English, but when German is active the word "Stellung" requires "stop" to be specified with "sto").

Note: Parameter symbols (WHITE,BLACK, ON,OFF, P,N,B,R,Q,K, W,B) are context-dependent, so they do not require extra characters to differentiate them from command keywords. Do not confuse the two.

4.2 The "Help" function and foreign languages (?)

"Help" asks Leonardo to list all the available keywords in the current (foreign) language.

Leonardo not only understand English, but also another six foreign languages:

German	("Deutsch")
French	("Francais")
Dutch	("Nederlands")
Spanish	("Espanol")
Italian	("Italiano")
Swedish	("Svenska")

Whenever you tell Leonardo to switch language, it immediately starts listening and responding in the new language only. With a one-word command you can switch back.

The following message components are changed to the foreign language:

— keywords (but not Leonardo key names such as "play")
(eg. "key" becomes "Taste" in German)
— color names and abbreviations ("White","Black", "W","B")
— "ON,OFF"
— piece abbreviations for board diagrams/entry (P,N,B,R,Q,K).
— piece key names ("King,..."Pawn")

4.3 Commands

BOARD<ON,OFF>

Requests Leonardo to use the chessboard for certain Input/Output. When board is turned "off", Leonardo will not change the lamp displays or beep as it would normally in response to certain actions. Also, it will not require the pieces on the chessboard to match the board position in its memory. This allows moves, takebacks, etc, to be made using messages, so that the actual board need not be touched.

·CLOCKS<WTIME><BTIME><CTIME>

Sets Leonardo's internal clocks (white elapsed time, black elapsed time, time elapsed on current move). Parameters are optional, and will be unchanged if omitted. The hours and minutes fields are optional. Time values are expressed as "hours:minutes:seconds", where the hours and minutes fields are optional.

Example: Clocks 1:10:30, 70:30, 4230
(each of these three times has same value)

a) If all parameters are omitted, Leonardo will print the current time.
b) Maximum time in each internal clock is 18:12:15. The clock will be reset to 0:00:00 and count over again when the maximum time is reached.
c) Do not change the clocks while Leonardo is computing. Changing levels during a game may change clock settings, so always verify these.

CLOSE

Close communications.
Leonardo will stop sending messages (as with FUNCTION QUEEN in chapter 3.2).
Computer can reconnect at any time by sending an "open" message again.

GAME<PLYNO>

Asks Leonardo to print the current game's record up to given ply (half move).
If no ply number is given, prints game up to current move. To print the entire game record, use a very large number.

INDEX <BANK,SQ>

Usable in LIBRARY mode only.
Defines library (database) index to be <BANK,SQ> for subsequent library operations. Bank is a number from 1 to 6. Square is algebraic.

<KEY>or
FUNCTION <KEY>

Sends a keypress. <KEY>is the name of any key appearing on Leonardo's control panel typed in exactly as it stands, albeit with phrases (New game, Set up) joined together. Piece names are typed in the current foreign Language, eg. in English: King, Queen, Rook, Bishop, Knight, Pawn. The rest: Tab/Color, Play, Newgame, Sound, Function, −, +, Info, Analysis, Setup, Library, Level, Normal, Stop. "Go" is not allowed. "Function" may be followed by another key and will have the same effect as if the two keys were entered separately.

KEY<NUMBER>

Sends a keypress. <NUMBER >specifies a control key as numbered on the Leonardo control panel.

MOVE <MOVE>

Sends a move to Leonardo in long algebraic notation.

Example: Move g1-f3

If a promotion, the promoted piece type is specified with a slash ("/") followed by the piece identifier (N,B,R,Q). If you do not specify anything, the pawn will promote to a Queen.
Leonardo accepts this command only when the board is turned off.

OPEN

Open communications.
Leonardo will thereafter automatically send messages for level and board changes (move,takeback,setup,newgame).

POSITION <color><board contents>

a) If sent alone (i.e. without parameters), it requests Leonardo to list the current position (see chapter 4.4).

b) Sends a "Setup" position to Leonardo, provided Leonardo is in SETUP mode. Remember to return to NORMAL mode once you have finished.
The first parameter gives the side-to-move (eg. "WHITE"). The board contents are specified using Botvinnik notation, which consists of a piece specifier (eg. WK or BB etc), followed by a list of squares which contain that piece type.
Example: POS = WHITE WKg3, Rf2, BKg1
Note: This just adds a list of pieces to the current position. Thus when setting up a fresh position, you should first press (as it were) "function", "newgame" to clear the internal board and then send one or more "position" messages to add pieces to the board. Each "position" message must contain the <color> side-to-move parameter.

REPLAY

Asks Leonardo to replay the next move in the current game's record. Leonardo accepts this command only when the board is turned off.

SENDINFO <ON,OFF>

Requests Leonardo to send/not send search info automatically every time it is updated during a search. If no parameter is given, Leonardo sends current info values.

SETLEVEL <LEVELNUMBER>

Sets level to given LEVELNUMBER (expressed as a square). If no value is given, Leonardo will print the current level.

TAKEBACK

Asks Leonardo to take back the last move made so far. Leonardo accepts this command only when the board is turned off.

?

"Help" asks Leonardo to list all the keywords you can use within the current (foreign) Language.

ENGLISH	Changes the active Foreign Language to English (1).
DEUTSCH	Changes the active Foreign Language to German (1).
FRANCAIS	Changes the active Foreign Language to French (1).
NEDERLANDS	Changes the active Foreign Language to Dutch (1).
ESPANOL	Changes the active Foreign Language to Spanish (1).
ITALIANO	Changes the active Foreign Language to Italian (1).
SVENSKA	Changes the active Foreign Language to Swedish (1).

(1) Note how the keywords change.

$ <VALUES>

Sends a "MOSAL-A" message. Message format is identical to standard MOSAL-A messages, but Leonardo continues to respond in BOSAL.
Used when other BOSAL messages are not sufficient to communicate certain information to Leonardo.

4.4 BOSAL output messages

BOSAL output messages are mostly self-explanatory, as they present values in easy-to-understand form and correspond closely to the commands above.

POSITION	: White pieces are capitals (see chapter 4.3), Black small letters, and empty squares dashes. 8 double-spaced rows describe the chessboard for this move.
GAME	: In full algebraic only
SENDINFO	: Messages start with the keyword, time used so far, depth of search (how many ply ahead Leonardo is thinking), evaluation (where equality is zero, mate by White +32,768. and a pawn is worth 160) and principal variation.
MOVE READY	: The search has finished. Leonardo only sends it if the SENDINFO function is on. Followed by move found.
CLOCKS	: As in competition chess, one clock stops and the other starts as soon as a move is completed. The only way to stop the clocks is to STOP Leonardo.

BOSAL keywords and parameter words in each language.

Key No.	English	German	French	Dutch	Spanish	Italian	Swedish
	Keys						
1	King	Koenig	Roi	Koning	Rey	Re	Kung
2	Queen	Dame	Dame	Dame	Dama	Dama	Drottning
3	Rook	Turm	Tour	Tore	Torre	Torre	Torn
4	Bishop	Laeufer	Fou	Loper	Alfil	Alfiere	Loepare
5	Knight	Springer	Cavalier	Paard	Caballo	Cavallo	Springare
6	Pawn	Bauer	Pion	Pion	Peon	Pedona	Bonde
7	Tab/Color	Tab/Color	Tab/Color	Tab/Color	Tab/Color	Tab/Color	Tab/Color
8	Function	Function	Function	Function	Function	Function	Function
9	+	+	+	+	+	+	+
10	Sound	Sound	Sound	Sound	Sound	Sound	Sound
11	–	–	–	–	–	–	–
12	Info	Info	Info	Info	Info	Info	Info
13	Normal	Normal	Normal	Normal	Normal	Normal	Normal
14	Play	Play	Play	Play	Play	Play	Play
15	Analysis	Analysis	Analysis	Analysis	Analysis	Analysis	Analysis
16	Level	Level	Level	Level	Level	Level	Level
17	Setup	Setup	Setup	Setup	Setup	Setup	Setup
18	Library	Library	Library	Library	Library	Library	Library
19	Newgame	Newgame	Newgame	Newgame	Newgame	Newgame	Newgame
20	Stop	Stop	Stop	Stop	Stop	Stop	Stop
	Switching foreign languages						
	English	English	English	English	English	English	English
	Deutsch	Deutsch	Deutsch	Deutsch	Deutsch	Deutsch	Deutsch
	Français	Français	Français	Français	Français	Français	Français
	Nederlands	Nederlands	Nederlands	Nederlands	Nederlands	Nederlands	Nederlands
	Espanol	Espanol	Espanol	Espanol	Espanol	Espanol	Espanol
	Italiano	Italiano	Italiano	Italiano	Italiano	Italiano	Italiano
	Svenska	Svenska	Svenska	Svenska	Svenska	Svenska	Svenska
	Command keywords						
	?	?	?	?	?	?	?
	Open	Oeffnen	Ouvrir	Openen	Abrir	Apri	Oeppna
	Close	Schliessen	Fermer	Sluiten	Cerrar	Chiudi	Staenga
	Game	Partie	Partie	Partij	Partida	Partita	Parti
	Index	Index	Index	Index	Indice	Indice	Index
	Clocks	Uhren	Horloges	Klokken	Relojes	Orologi	Klockor
	Board	Brett	Echiquier	Bord	Tablero	Scacchiera	Braede
	Position	Stellung	Position	Positie	Posicion	Posizione	Staelling
	Setlevel	Stufe	Niveau	Niveau	Nivel	Livello	Nivaa
	Move	Ziehen	Coup	Zet	Jugada	Mossa	Drag
	Replay	Vor	Avance	Herhaal	Adelante	Avanti	Upprepa
	Takeback	Zurueck	Retour	Terug	Atras	Indietro	Tillbaka
	Sendinfo	Sendinfo	Envinfo	Zendinfo	Envinfo	Mandinfo	Saendinfo
	Key	Taste	Touche	Toets	Boton	Tasto	Tangent
	Parameters and modifiers						
	On	Ein	Marche	Aan	Si	Accesa	Till
	Off	Aus	Arret	Uit	No	Spenta	Fraan
	White	Weiss	Blanc	Wit	Blanco	Bianco	Vit
	Black	Schwarz	Noir	Zwart	Negro	Nero	Svart
	W,B	W,S	B,N	W,Z	B,N	B,N	V,S
	K,Q,R,B,N,P	K,D,T,L,S,B	R,D,T,F,C,P	K,D,T,L,P,O	R,D,T,A,C,P	R,D,T,A,C,P	K,D,T,L,S,B
	$	$	$	$	$	$	$

5. MOSAL-A and MOSAL-B

The Advanced OSA Programmer's Guide can be purchased from your nearest Kasparov Chess Computer Center:

Kasparov Chess Computer Center
4 Bridge Studios
318-326 Wandsworth Bridge Road
London SW6 2TZ
England

Kasparov Chess Computer Center
Suite 108
2301 W 205th Street
Torrance, CA 90501
USA

Kasparov Chess Computer Center
12/F., Chung Nam Centre
414 Kwun Tong Road
Kwun Tong
Hong Kong

It covers all details of these two programming languages, as well as additional data communication facilities available. The first edition is in English only.

6. Troubleshooting

	Symptom	Try
a.	"COMM" LED off	Check communication parameter settings, make sure both computer and Leonardo use the same parameters, especially baud rate. Check communication cable. Try a lower baud rate (see chapter 3.3). Press **STOP** then **GO** before opening the communication link.
b.	"COMM" LED on but no response from Leonardo	Turn off both computer and Leonardo and try the set up steps again, carefully.
c.	Leonardo messages corrupted	Try a lower baud rate (see chapter 3.3).
d.	Messages overwrite themselves on screen	No linefeed after carriage return. Press **FUNCTION**,**PAWN** on Leonardo's keyboard.
e.	Missing character(s) from left of lines on screen	Computer updates screen too slowly. Press "_" (underscore) from computer keyboard. If this persists, adjust both computer and Leonardo to a slower baud rate.
f.	Missing 1st character of command line on screen	This is a characteristic of some computers (including Amstrad) when operating in terminal mode. The missing 1st character is not displayed on the screen but is sent to Leonardo. Starting each command with "!" gives the clearest screen.

Appendix A

Demonstrations of Leonardo linked with computers

All you need to do is to run a simple terminal emulation on your computer with the following communication parameters:

8 data bits,
1 stop bit,
no parity.

Leonardo defaults to 1200 baud (bits per sec.) at power up (when batteries are removed for longer than 1 minute and mains adapter is off). Leonardo's baud rate and the computer's must be identical. High baud rates allow faster data transfers but may be less reliable. 1200 and 300 baud are recommended to start with; you might try higher baud rates once you get the Link running reliably.

Some sample programs

A. 1. Amstrad and Schneider Computers

```
 10   mode 2
100   b = 1200 : REM Baud rates.
110   |setsio,b,b,0,8,0,0
120   |halfduplex
130   |terminal
```

2. Commodore 64 and VIC-20 computers

```
 10   PRINT CHR$(147)
 20   PRINT "SOME COMMODORE
      COMPUTERS REVERSE"
 22   PRINT "UPPER AND LOWER CASE
      CHARACTERS"
 24   PRINT "CORRECT AUTOMATICALLY?
      (Y/N)"
 26   INPUT Q$: IF Q$ = "Y" OR Q$ = "N"
      THEN GOTO 28: GOTO 26
 28   IF Q$ = "Y" THEN GOTO 300
 30   PRINT "GO. 300 BAUD"
 35   B = 6: REM FOR 300 BAUD, SET B = 3
      FOR 110 BAUD
 40   OPEN 2,2,0, CHR$(B) + CHR$(16)
 50   GET B$
 60   IF B$< >"" THEN PRINT#2,B$;
 70   GET#2,C$
 80   PRINT B$;C$;
 90   SR = ST: IF SR = 0 OR SR = 8 THEN 50
100   END
200   REM ***
210   REM IF YOUR COMPUTER DOES NOT
      REVERSE UPPER AND LOWER CASE
220   REM YOU MAY OMIT LINES 20-30 AND
      200-400
230   REM ***
300   REM FIX UPPER/LOWER CASE DISPLAY
      PROBLEM
305   POKE 53272,28
310   POKE 52,48: POKE 56,48: CLR
320   POKE 56334, PEEK (56334) AND 254
330   POKE 1, PEEK(1) AND 251
340   FOR J = 0 TO 511
350   POKE 12288 + J, PEEK (53248 + J)
360   POKE 12800 + J, PEEK (55296 + J)
370   NEXT J
380   POKE 1, PEEK(1) OR 4
390   POKE 56334, PEEK (56334) OR 1
400   GOTO 30
```

Note: Press **SET UP, FUNCTION, Knight, NORMAL** on Leonardo before running this program for the first time.

3. Apple II family with Super Serial Card (SSC)

```
 10   REM Leonardo demonstration program
 20   PRINT "This program runs at 300 baud"
 30   PRINT
 40   PRINT "Press SETUP FUNCTION Knight
      NORMAL"
 50   PRINT "on Leonardo now to set 300
      baud"
 60   PRINT
 70   FOR I = 1 TO 5000: NEXT I: REM WAIT
      LOOP
100   A$ = CHR$(1): REM use CNTL/A for
      APPLE II without APPLESOFT
110   IN#2 : REM MODIFY THESE 2 LINES IF
      SSC IN OTHER SLOT.
120   PR#2
130   PRINT A$;"6B": REM FOR 300 BAUD,
      USE 8B FOR 1200 BAUD ETC.
140   PRINT A$;"0D"
150   PRINT A$;"1T": REM "1T" for IIe, "2T" or
      "3T" for II & II +
160   PRINT A$; "T"
```

(Then press CNTL/A E E and [RETURN] from the keyboard to enable the echo mode.)

Appendix B

Programming examples

These examples show how to write BASIC programs that communicate with Leonardo under program control. **Whilst using your computer as a terminal allows you to do a great deal with Leonardo, a program allows you to go considerably further, eg. opening the OSA channel automatically, automatic post-game analysis, and library management. Your imagination is the limit.**

A. Amstrad and Schneider

This program connects an Amstrad or a Schneider computer automatically to Leonardo. It also shows how to collect Leonardo's transmissions in BASIC for further processing.

```
100   MODE 2
110   |SETSIO,1200,1200,0,8,0,0
120   |HALFDUPLEX
130   |SETTIMEOUT,100
140   LF$ = CHR$(10)
141   CR$ = CHR$(13)
142   FF$ = CHR$(12)
200   outstr$ = "!"
210   GOSUB 1000
240   GOSUB 2000
250   outstr$ = "OPEN":GOSUB 1000
260   GOSUB 2000
300   REM SERIAL DEVICE STATUS
310   LET j = 200
320   st% = 0:|SIO,@st%
330   IF st% AND 1 THEN GOSUB 2000 ELSE
      GOTO 300
340   GOTO 300: REM RETURN AFTER
      RECEIVING INPUT STRING
1000  REM SEND OUTPUT STRING TO SERIAL
      DEVICE
1010  s% = 0: |OUTBLOCK, @s%, @outstr$
1020  PRINT outstr$
1030  s% = 0: |OUTBLOCK, @s%, @CR$
1100  RETURN
2000  REM RECEIVE INPUT STRING FROM
      SERIAL DEVICE
2010  s% = 0: in$ = STRING$(50,""):|INBLOCK,
      @s%,@in$
2020  GOSUB 3000
2030  RETURN
3000  REM PRINT INPUT STRING TO SCREEN
3010  FOR i = 1 TO 50
3020  IF MID$(in$,i,1) <> CR$ AND
      MID$(in$,i,1) <> LF$ THEN GOTO 3040
3030  IF i <= 4 THEN 3040 ELSE GOTO 3100
3040  NEXT i
3100  PRINT LEFT$(in$,i - 1)
3110  j = j + 1
3120  IF LEFT$(in$,1) = CR$ OR
      LEFT$(in$,1) = LF$ THEN j = j - 1
3130  IF j / 2 = INT(j/2) THEN GOSUB 3300
3140  IF MID$(in$,17,1) = CHR$(78)
      THEN GOSUB 3400
3150  RETURN
3300  PRINT CR$
3310  RETURN
3400  PRINT LF$
3410  RETURN
```

B. Commodore C-64

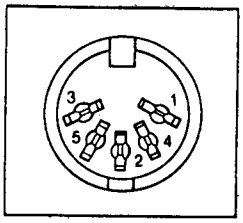
```
4     REM SET UP SERIAL PORT TO 300
      BAUD, 8 DATA BITS, 1 STOP BIT.
5     REM HALF-DUPLEX AND OPEN FILE #1.
6     REM OPEN SERIAL DEVICE AS FILE #1.
8     REM BAUD RATES ON BOTH SIDE OF
      SERIAL LINK MUST BE SAME
9     B = 6: REM FOR 300 BAUD; B = 3 FOR
      110 BAUD
10    OPEN 1,2,0, CHR$(B) + CHR$(16)
20    PRINT CHR$(147)
30    OUT$ = "!"
40    REM OUTPUT CHARACTER TO SERIAL
      DEVICE
50    PRINT#1, OUT$
60    REM INPUT CHARACTER FROM SERIAL
      DEVICE AND PRINT ON THE SCREEN
70    GET#1, IN$
80    PRINT IN$;
90    OUT$ = "OPEN"
100   PRINT#1, OUT$
110   GET#1, IN$
120   PRINT IN$;
130   GOTO 110
```

Appendix C

Cabling Informations

A. Leonardo OSA-LINK pin assignment

Connector : 5 pin DIN type



Terminal No.	Signal	Name
1	TxD	Data from Leonardo
2	GND	Ground
3	RxD	Data to Leonardo
4	V+	From adapter 9V/50mA max. unregulated
5	+5V	5V/50mA max. regulated

Note: Signal levels are 0-5V (TTL levels). Direct connection to RS-232C voltage levels will damage the circuit.

B. Typical cables

1. Amstrad and Schneider computers:
The Leonardo RS-232C Adapter I adapter cable plugs directly into Leonardo and into the Amstrad/Schneider RS-232C interface socket. You can fit extension cables of up to 3m (10 ft).

Computer	Cable	RS-232C Adapter I
PIN 2	- - - - - - - - -	PIN 2
PIN 3	- - - - - - - - -	PIN 3
PIN 7	- - - - - - - - -	PIN 7
DB25 socket	Cable	DB25 plug

2. Commodore 64 and VIC-20

Computer	Cable	Leonardo end
B	- - -+	
	!	
C	- -+- - - - - - -	PIN 1
N	- - - - - - - - -	PIN 2
M	- - - - - - - - -	PIN 3
card-edge connector	Cable	5 pin DIN plug

The computer must be switched off and the Leonardo stopped before connecting or disconnecting the cable to avoid circuit damages.

3. Apple II family with Super Serial Card (SSC)

Computer	Cable	RS-232C Adapter I
PIN 2	- - - - - - - - -	PIN 2
PIN 3	- - - - - - - - -	PIN 3
PIN 7	- - - - - - - - -	PIN 7
DB25 plug	Cable	DB25 plug

4. IBM PC,XT,AT
Same cable as described in B.1 above (Amstrad computers).

5. Most serial printers and portable typewriters/terminals
Same cable as described in B.3 above (Apple).

Note: For the Canon Typestar 7 typewriter, the optional Canon serial interface I/F 30 is not required by making a special cable.

Typewriter	Cable	Leonardo end
PIN 1	- - -+	
	!	
PIN 5	- - -+	
	!	
PIN 6	- -+- - - - - - -	PIN 2
PIN 3	- - - - - - - - -	PIN 1
DB9S socket	Cable	5 pin DIN plug

The typewriter must be switched off and the Leonardo stopped before connecting or disconnecting the cable to avoid circuit damages.

UPDATE INFORMATION

These adapter cables allow easy connection between Leonardo and most computers, terminals and printers equipped with RS-232C interfaces. They fit nicely in Leonardo's OSA compartment and they draw their power from the Leonardo.

Adapter Ia is suitable for the Atari ST and most printers and computers not in the list for Adapter II and Adapter III. It may be connected to non-standard RS-232C interfaces with suitable modifications as necessary.

Adapter II is ready to connect with any Apple II series computer. Just plug in.

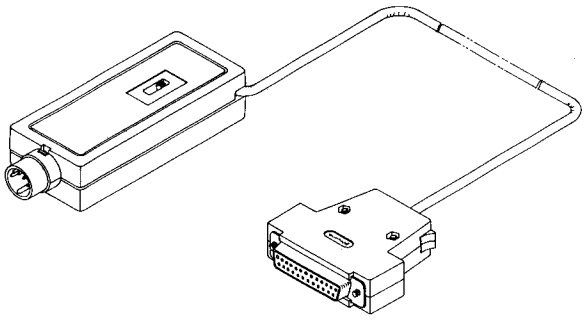
Adapter III connects and runs with an IBM PC or XT or AT immediately. It is specially designed for IBM. It is also suitable for the Amstrad/Schneider CPC 464 and 6128.

Adapter IV is a special cable to connect a Leonardo to the Commodore C-64, C-128 and VIC-20.

Adapter I model a Art. No. 590

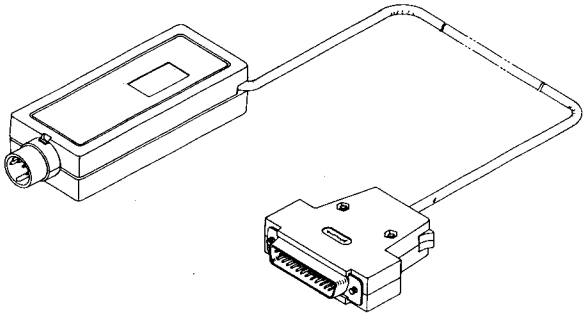
Universal model with TxD/RxD reverse switch.

For **Atari ST** series.
For most serial printers, other computers/terminals, typewriters equipped with RS-232C serial interfaces.



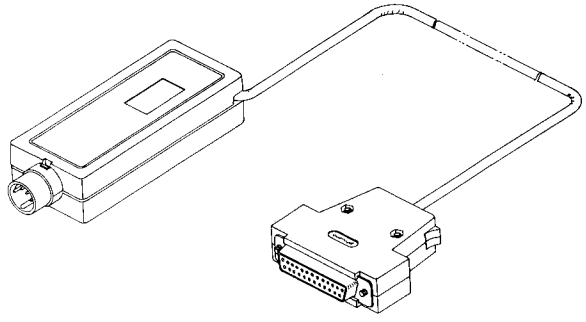
Adapter II Art. No. 592

Directly usable with **Apple II** Series with Super Serial Card.



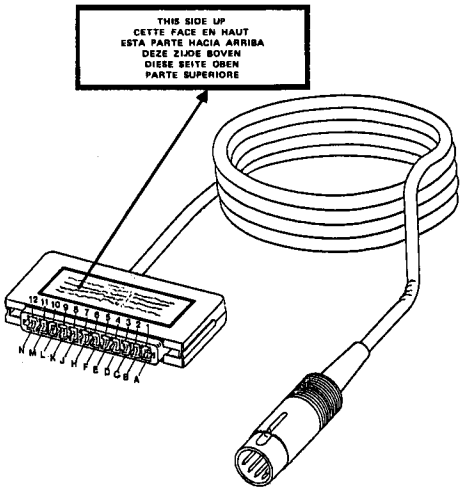
Adapter III Art. No. 593

Directly usable with **IBM** PC series and compatibles, and **Amstrad/Schneider CPC** series.



Adapter IV Art. No. 591

Directly usable with Commodore C-64, C-128, VIC-20 computers.



Specifications

	Adapter Ia	Adapter II	Adapter III	Adapter IV
Input/Output Leonardo end	Leonardo-type 5 pin DIN plug pin 1. TxD 2. GND 3. RxD 4. V+ 5. +5V	Leonardo-type 5 pin DIN plug pin 1. TxD 2. GND 3. RxD 4. V+ 5. +5V	Leonardo-type 5 pin DIN plug pin 1. TxD 2. GND 3. RxD 4. V+ 5. +5V	Leonardo-type 5 pin DIN plug pin 1. TxD 2. GND 3. RxD
	V+ : unregulated voltages from Leonardo's adapter.			
Computer/printer end	DB-25S socket pin 2. RxD* 3. TxD* 7. GND	DB-25P plug pin 2. RxD 3. TxD 7. GND	DB-25S socket pin 2. RxD 3. TxD 7. GND	Card-edge socket (12x2 circuit) B-C. RxD M. TxD N. GND
	* Switch reverses RxD and TxD connections		pin 4-5 shorted pin 6-8-20-22 shorted together	
Voltage swing	±8V	±8V	±8V	TTL compatible levels
Weight	0.25 kg	0.25 kg	0.25 kg	0.15 kg
Cable	1.5 m	1.5 m	1.5 m	1.5 m
Cabinet size	95x40x23mm	95x40x23mm	95x40x23mm	—

This replaces section 2.4C ii sections (b) - (d) in the Link Guide p.3.

```
10        REM   TERMINAL PROGRAM FOR IBM-LEONARDO COMMUNICATION
20        REM   "OSATERM"
30        DEFINT A-Z
40        KEY OFF
50        CLS
60        CLOSE
65        BAUD$="1200"  :  REM IF 300 BAUD IS DESIRED, BAUD$="300"....ETC
70        OPEN "COM1:" + BAUD$ + ",N,8,1,CD" AS #1
80        OPEN "SCRN:" FOR OUTPUT AS #2
90        LOCATE ,,1
100       B$ = INKEY$
110       IF B$ <> "" THEN PRINT #1,B$; : PRINT #2,B$;
120       IF EOF(1) THEN 100
130       A$ = INPUT$(LOC(1),#1)
140       LF = 0
150       LF = INSTR(LF+1,A$,CHR$(10))
160       IF LF > 0 THEN MID$(A$,LF,1) = " " : GOTO 150
170       PRINT #2,A$;
180       GOTO 100
```

KASPAROV™
CHESS COMPUTER

Connection Cable For Leonardo Chess Computer

Includes
The Link: Leonardo's OSA connection to computers and printers

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