Data Acquisition, Controlling and Steering with PCs

Multi-LAB®12

Intelligent Low-Cost PC Board

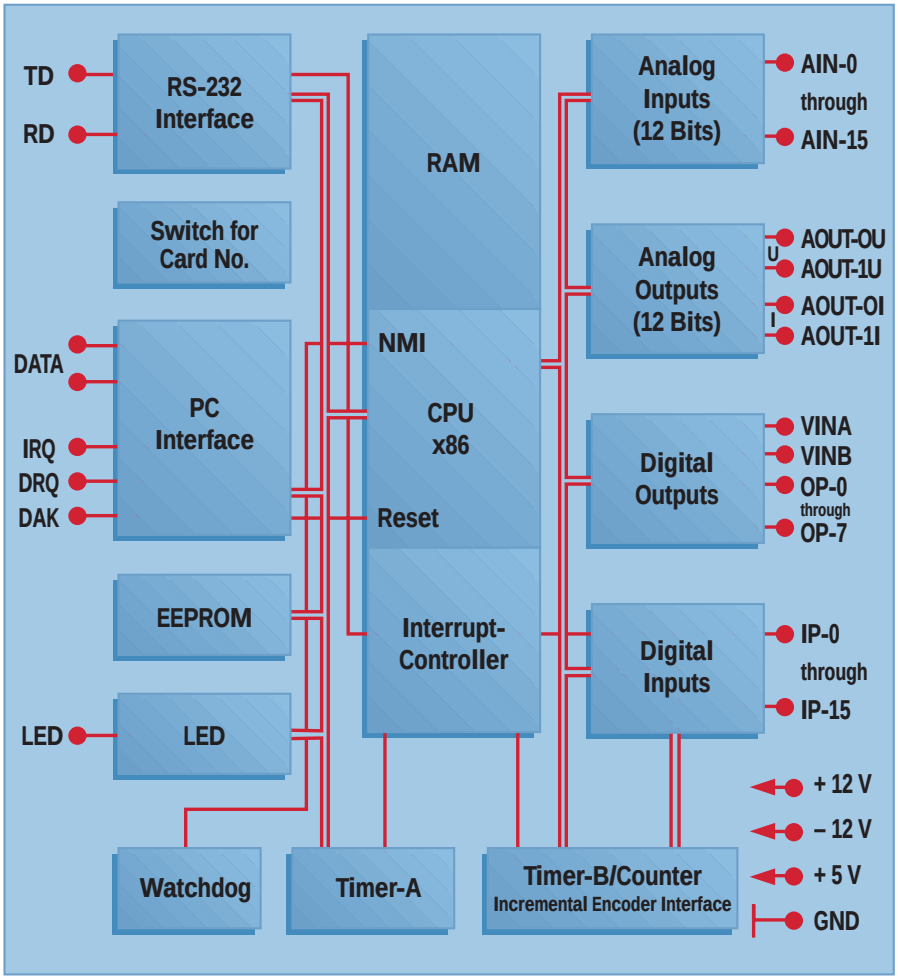
SORCUS

Multi-LAB 2

Intelligent Low-Cost PC Board

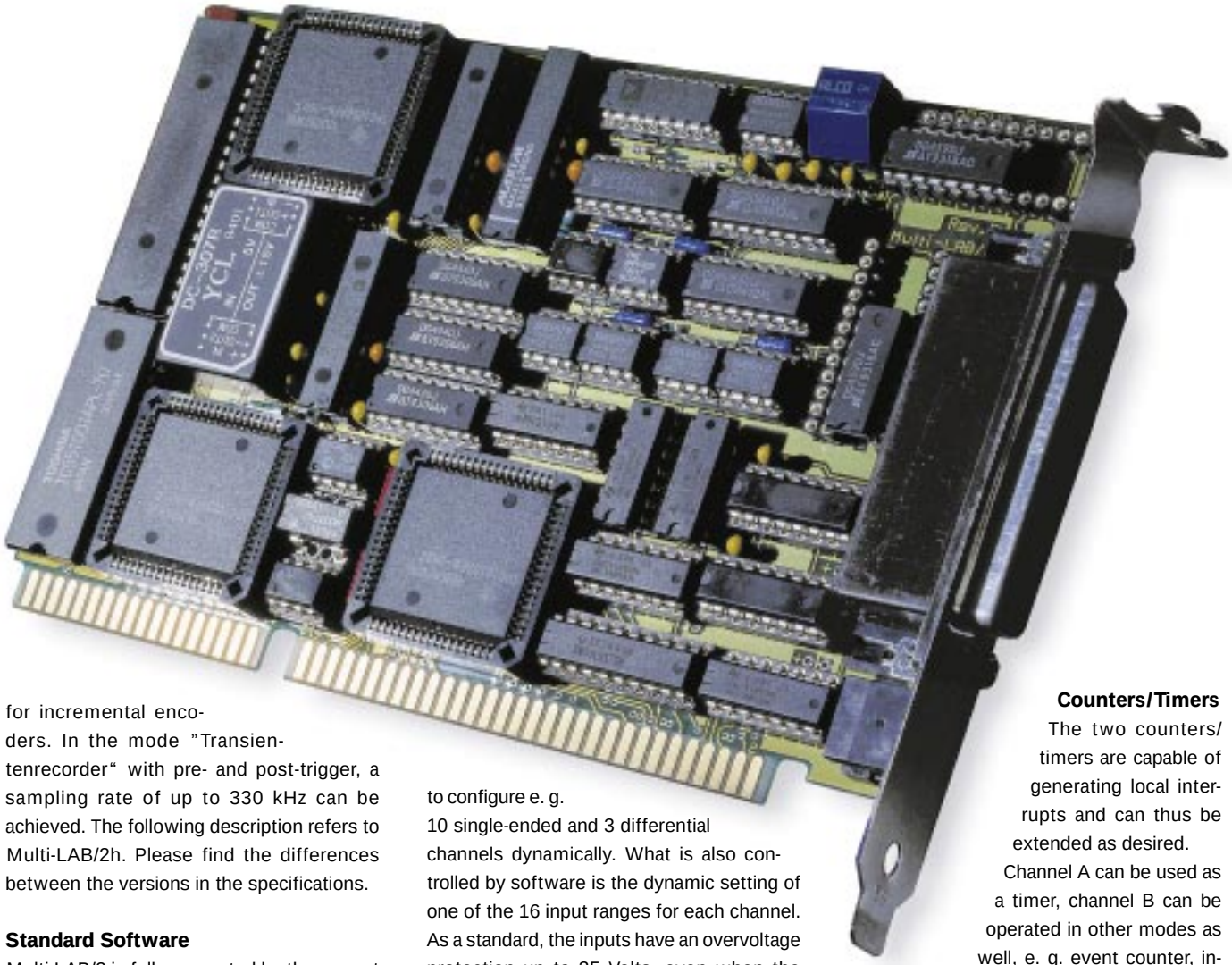
Apart from many analog and digital inputs and outputs, this board contains – like all SORCUS boards – a processor of its own ('86-compatible). Thus, parallel processing to the PC is possible. This is important especially for modern PC operating systems like Windows and OS/2 in order to achieve real-time capability. Data acquisition, controlling and steering can be run on the board without any interaction with the PC. The PC can perform other tasks, e. g. the graphical display of acquired data. The local RAM on the board can buffer the data until the PC is ready to process them and store them on disk. The board itself is run by a real-time multi-tasking operating system called OsX (the same as on the MODULAR-4/486 boards). Thanks to the latest gate array technology, it was possible to put all this on a short PC board. In addition, switches and jumpers could be banished from the board as well as adjustment potentiometers. All settings on the board are carried out by software.

The board is available in four versions: Multi-LAB/2a, /2d, /2i and /2h. Even though Multi-LAB/2i and /2h have the same number of inputs and outputs as the other versions, they offer a higher processing speed of the local CPU, a larger RAM, more analog input and output ranges, a faster A/D-converter and extended digital measuring capabilities, e. g.



Special Features

- Intelligent PC board with its own CPU and memory
- Parallel processing to the PC
- Real-time multi-tasking operating system on board
- 16 analog inputs (12 Bits resolution)
- 2 analog outputs (12 Bits resolution)
- 8 digital power outputs, 1 LED
- 1 timer, 1 universal measuring channel (e. g. for incremental encoder)
- 16 digital inputs
- RS-232-interface for remote debugging
- Drivers for DOS, Windows 3.1, Windows 95, Windows NT and OS/2
- Borland development environment can be used (C++, Pascal)
- No jumpers or adjustment potentiometers
- Short PC board
- Low-cost solution



for incremental encoders. In the mode "Transientenrecorder" with pre- and post-trigger, a sampling rate of up to 330 kHz can be achieved. The following description refers to Multi-LAB/2h. Please find the differences between the versions in the specifications.

Standard Software

Multi-LAB/2 is fully supported by the current standard software packages for data acquisition and control, such as ARGUS, DIAdem and DIA/DAGO.

Developing Your Own Programs

The user can write his/her own real-time programs, which run on the board, e. g. with the help of the Borland development environment for Turbo-Pascal and Borland C++. The Turbo-Debugger incl. remote debugging can be used as well. The board is largely compatible with the MODULAR-4/486 board series. For application programs and data, about 450 KBytes are at the user's disposal. For the development of PC programs, libraries for Pascal and C++ come with the board.

PC Interface

The board occupies 8 PC I/O addresses. It can use the PC's interrupt and DMA channels, everything is configured by software. Several boards can use the same PC interrupt.

Analog In

The 16 inputs with a resolution of 12 Bits can be operated in the single-ended mode or as differential inputs. The setting is done by software so that there is also the possibility to configure e. g.
10 single-ended and 3 differential channels dynamically. What is also controlled by software is the dynamic setting of one of the 16 input ranges for each channel. As a standard, the inputs have an overvoltage protection up to 35 Volts, even when the board is switched off.

Customer-Specific Analog Input Ranges

When using so-called A-Links (these are micro-modules that can be plugged onto the board), ranges of e. g. 0 to 100 Volts or 4 to 20 mA as well as customer-defined ranges can be provided.

Automatic Correction of Analog Input Data

The readings are immediately subjected to a digital correction regarding gain and offset. This happens without losing any time by means of a special hardware multiplier and adder in the gate array. The correction values are determined in a correction cycle. During this process, the settle time of the analog input part needed after a channel change is also measured and then always taken into account automatically.

Analog Out

For each of the two channels with a resolution of 12 Bits, two output lines can be used, one for voltage and one for current. The output ranges are switched by software. The outputs have a short-circuit protection.

Counters/Timers

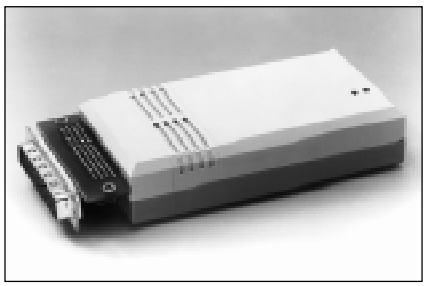
The two counters/timers are capable of generating local interrupts and can thus be extended as desired.
Channel A can be used as a timer, channel B can be operated in other modes as well, e. g. event counter, incremental encoder interface, and for frequency, pulse width or period measurement.

Digital In

The 16 TTL-compatible digital inputs with Schmitt trigger characteristic can also be operated directly in 24-Volt systems (up to 30 Volts).

Digital Out

The 8 digital power outputs can switch continuously up to 0.6 A each, both as source and as sink. The maximum switch voltage is 36 Volts. For each group of four channels, it can be supplied from the outside independently. It is also possible to use the +5 V (for TTL-compatibility) or the +12 V of the PC, which are both available at the D-Sub connector. Each output is protected by 2 clamping diodes against inductive voltage peaks. Relays, DC-motors and stepping motors can be connected directly. In case of thermic overload, the outputs are switched off automatically. They can also be switched off by software.



Test Box

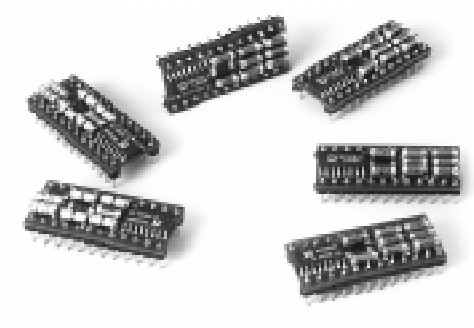
The test box is meant for service purposes. It is plugged onto the board's connector and allows a fully automatic functional test of the board and all its in- and outputs by means of a PC program included in the delivery. With highly precise reference voltages, correction values are determined, which are written automatically into the local EEPROM on the board.

The Multi-LAB/2 delivery includes:

- **PC board Multi-LAB/2h, /2i, /2d, or /2a**
- **User manual (English or German)**
- **78-pin male connector with solder contacts, fitting into the female connector of the board**
- **Real-time multi-tasking operating system 'OsX'**
- **PC libraries and drivers for DOS, Windows and OS/2**
- **On-board library for Borland Pascal and Borland C++**
- **Remote-debugging kernel for Borland Turbo-Debugger**
- **PC program for test and configuration purposes**

Serial Interface

For debugging the real-time programs, the Multi-LAB/2i and /2h boards are equipped with a simple serial RS-232-interface. Just link the Multi-LAB/2 board and the PC via a null-modem cable and test and debug your programs with the Borland Turbo-debugger.



A-Links for Multi-LAB/2

A-Links are add-on micro-modules that make it possible to customize the analog input ranges.

The Multi-LAB/2i and /2h boards can carry two A-Links, each of which determines the input ranges for 8 analog inputs. The A-Links are independent of each other so a board can be operated with only one or with two different A-Links. One A-Link influences the inputs 0 to 3 and 8 to 11, the other one, the inputs 4 to 7 and 12 to 15. This organization is required because both inputs of a differential channel are changed by the same A-Link. The tables below show which A-Links are currently available. Customer-specific A-Links with other input ranges are possible, too.

Please note that the settling characteristics of the Multi-LAB/2 board differ when A-Links are used for voltage inputs. The settle time depends on the type of the A-Link used (see table 'A-Links for Voltage Inputs').

A-Links for Current Inputs

A-Link	Number/Type of Inputs	Input Range	Input Impedance
4x20i	4/differential	0 to 20 mA	125 Ω
8x20i	8/single-ended	0 to 20 mA	125 Ω

A-Links for Voltage Inputs

A-Link	Voltage Devider	Input Impedance	Max. Input Range	Settle Time
8x10U	–	100 kΩ	± 10 V	5 µs
8x20U	1 : 2	200 kΩ	± 20 V	70 µs
8x40U	1 : 4	200 kΩ	± 40 V	50 µs
8x100U	1 : 10	200 kΩ	± 100 V	30 µs

Specifications Multi-LAB/2

Multi-LAB Version	/2a	/2d	/2i	/2h	Unit
CPU [1], Clock	8	8	10	16	MHz
Memory	128	128	512	512	KByte
EEPROM for initialization and adjustment	no	no	yes	yes	
PC Interface:					
PC-I/O-address selectable by software (”plug and play“)	yes	yes	yes	yes	–
PC interrupt channels (channels 3, 5, 9, 10, 11, 12, 15)	yes	yes	yes	yes	–
PC DMA channels (channels 0, 1, 3)	yes	yes	yes	yes	–
Interrupt and DMA channel selectable by software	yes	yes	yes	yes	–
Analog inputs: number of channels (single-ended/diff. inputs)	0/8	16/8	16/8	16/8	–
Resolution	12	12	12	12	bit
Input ranges	± 5	± 10	[3]	[3]	Volt
Sockets provided for A-Links	no	no	yes	yes	–
Overvoltage protection	± 35	± 35	± 35	± 35	Volt
Input impedance (without A-Link)	> 10	> 10	> 10	> 10	MΩ
	90	90	90	90	pF
Conversion time	10	10	2,6	1,6	µs
Effective sampling rate into lacal RAM	> 33	> 33	> 71	> 111	kHz
Max. sampling rate using mode ”Transientenrecorder” [2]	–	–	250	330	kHz
On-board temperature measurement	no	no	yes	yes	–
Automatic correction of gain and offset errors	no	no	yes	yes	–
Analog outputs: Number of channels	2	2	2	2	–
Resolution	12	12	12	12	bit
Output ranges	± 5	± 10	[4]	[4]	Volt
Linearity	± 1	± 1	± 1	± 1	LSB
Settle time for full-scale step, typ.	10	10	10	10	µs
Output impedance, typ.	10	10	10	10	mΩ
Short-circuit protection	yes	yes	yes	yes	–
Effective output rate from local RAM	> 20	> 20	> 31	> 50	kHz
Serial debug interface (RS-232 asynchronous, 8 data bits, 1 start bit, 1 stop bit, no parity; programmable baud rates: 153600, 38400, 19200, and 9600 baud)	no	no	yes	yes	–
Digital inputs: Number of channels	16	16	16	16	–
Input range, max.	± 30	± 30	± 30	± 30	Volt
Upper threshold, typ.	1,9	1,9	1,9	1,9	Volt
Lower threshold, typ.	0,9	0,9	0,9	0,9	Volt
Input impedance, typ.	3,6	3,6	3,6	3,6	kΩ
All inputs can be sampled simultaneously	yes	yes	yes	yes	–
Min. pulse width for triggering interrupts (IP0, IP1)	100	100	100	100	ns
Timer: Number of channels	2	2	2	2	–
Timer-A [5]/Timer-B [5], capable of generating interrupts	yes	yes	yes	yes	–
Timer-B programmable for:					
Timer function, resolution	2	2	2	2	µs
Counter function, max. frequency	–	–	2	3	MHz
Frequency measurement, max. frequency	–	–	2	3	MHz
Pulse width measurement, resolution	–	–	500	500	ns
Period duration measurement, resolution	–	–	500	500	ns
Incremental encoder interface, max. frequency/phase	–	–	1,25	1,25	MHz
Digital outputs [6]: Number of channels	8	8	8	8	–
External voltag Ux (min./max.)	5/36	5/36	5/36	5/36	Volt
Output level [7]:					
Low (Ux = 5 V, Io = 20 mA), max.	0,8	0,8	0,8	0,8	Volt
High (Ux = 5 V, Io = – 20 mA), min.	3,2	3,2	3,2	3,2	Volt
Low (Ux = 24 V, Io = 0,6 A), typ.	1,2	1,2	1,2	1,2	Volt
High (Ux = 24 V, Io = – 0,6 A), typ.	Ux – 1,4	Ux – 1,4	Ux – 1,4	Ux – 1,4	Volt
Output current, continuous, Low/High, max.	± 0,6	± 0,6	± 0,6	± 0,6	A
Peak current (non repetitiv, < 100 µs)	± 1,2	± 1,2	± 1,2	± 1,2	A
Output current (outputs disabled), max.	± 0,5	± 0,5	± 0,5	± 0,5	mA
Clamping voltage:					
High (Io = 0,6 A), typ.	Ux +1,3	Ux +1,3	Ux +1,3	Ux +1,3	Volt
Low (Io = – 0,6 A), typ.	– 1,3	– 1,3	– 1,3	– 1,3	Volt
Slew rate (10% und 90% level), typ.	300	300	300	300	ns
Delay (input to output), pos./neg. slope, typ.	800/400	800/400	800/400	800/400	ns
Current drain from PC [8]: + 5 Volt, typ.	95	449	570	604	mA
+ 12 Volt, typ.	15	0	7	7	mA
– 12 Volt, typ.	21	0	0,2	0,2	mA
Total power dissipation, typ. [8]	0,9	2,3	2,9	3,1	W

[1] The CPU is compatible with 80x86 processors.

[2] The special mode „Transientenrecorder“ measures continuously into a local ring buffer (64 KBytes) until an external or internal trigger appears. The measurement is ended after a preprogrammed time. Pre- and post-trigger data always amount to 64 KBytes.

[3] There is a choice of 16 input ranges (selection by software):

Unipolar positive:
0 ... 625 mV, 0 ... 1.25 V, 0 ... 2.5 V, 0 ... 5 V, 0 ... 10 V

Unipolar negative:
0 ... -625 mV, 0 ... -1.25 V, 0 ... -2.5 V, 0 ... -5 V, 0 ... -10 V

Bipolar:
±312.5 mV, ±625 mV, ±1.25 V, ±2.5 V, ±5 V, ±10 V

[4] Each channel provides a voltage output pin and a current output pin. The following ranges can be set for each channel by software:
0 ... 5 V, 0 ... 10 V, ±5 V, ±10 V, 0 ... 20 mA, 4 ... 20 mA.

[5] Timer-A is 12 bits wide, Timer-B is 16 bits wide. The length of both timers can be extended by software.

[6] The maximum power dissipation for a group of 4 channels (OP0, OP1, OP2, and OP3 or OP4, OP5, OP6, and OP7) is 2 W, e.g.(each channel of a group has a LOW output level):

N = 4 * Io * Uo
(Io = output current in Ampere, Uo = output voltage in Volts).

[7] The outputs are TTL-compatible if Ux = 5 Volts.

[8] All inputs and outputs open (not connected).

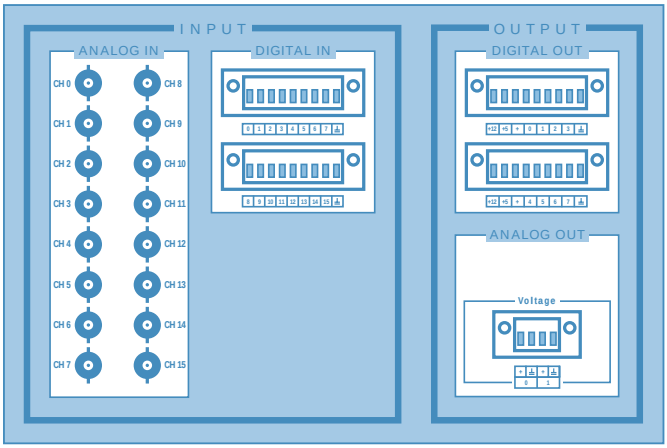
Connection Technology

Connection Units, Cables and Connectors for Multi-LAB/2

Table Boxes

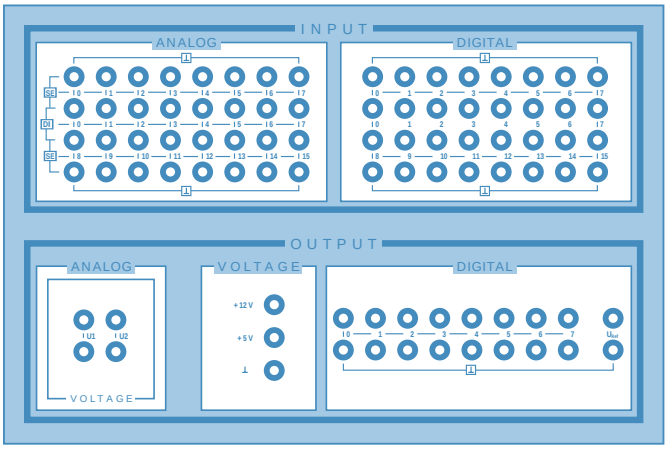
The connection boxes C1 and C2 serve as a comfortable connection between the Multi-LAB/2 board and your measurement devices. For this purpose, all inputs and outputs of the board (except for the LED and the analog current outputs of the Multi-LAB/2i and /2h) are led via a 1.5-m-long shielded round cable to the connection box, which is provided either with BNC sockets and screw terminals (C1) or with banana jacks (C2) for connecting the inputs and outputs.

Connection Boxes C1 and C2 for Multi-LAB/2



Connection Box C1

Dimensions 257 x 168 x 36 mm (length x width x height)
Cable shielded round cable with 78-pin D-Sub male connector, length 1.5 m
Inputs 16 analog inputs via BNC connectors 16 digital inputs via two 8-pin screw terminal blocks
Outputs 2 analog voltage outputs via a 4-pin screw terminal block 8 digital outputs via two 8-pin screw terminal blocks
Supply voltage for external devices +5 V, +12 V via screw terminal block

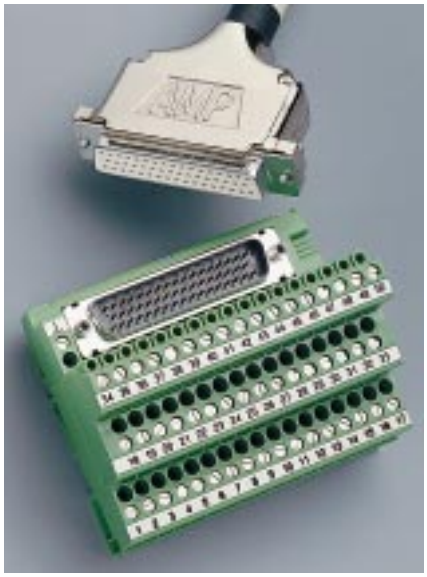


Connection Box C2

Dimensions 257 x 168 x 36 mm (length x width x height)
Cable shielded round cable with 78-pin D-Sub male connector, length 1.5 m
Inputs 16 single-ended analog inputs via 32 banana jacks or 8 differential analog inputs via banana jacks 16 digital inputs via 32 banana jacks
Outputs 2 analog voltage outputs via 4 banana jacks 8 digital outputs via 18 banana jacks
Supply voltage for external devices +5 V, +12 V via banana jacks

Screw Terminal Block C3

At the screw terminal block, you can access the in- and outputs of the Multi-LAB/2 board at 50 screw terminals. All of the in- and outputs are at your disposal – except for the LED output and the analog current outputs of Multi-LAB/2i and /2h. The ground lines of the analog inputs are tied together. The PC's supply voltages are not available. The screw terminal block can be mounted onto all kinds of rails that are in accordance with EN 50035 (G-rail) and EN 50022 (top-hat rail). The connection cable is included in the delivery. In contrast to the cables of the table boxes C1 and C2, it is not permanently fixed, but plugged into a 50-pin D-Sub connector.



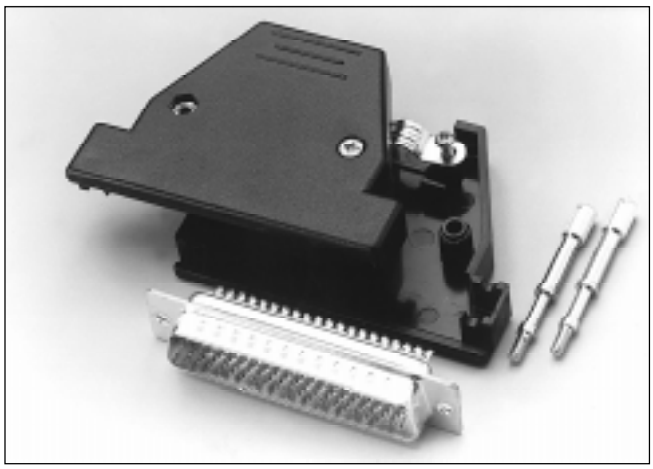
Screw Terminal Block C3

Screw Terminal Block

Dimensions **86x71x65 (width x depth x height)**
Connection cable **shielded round cable from 78-pin to 50-pin D-Sub male connector, length 1.5 m**
Inputs **16 single-ended analog inputs via 17 screw terminals or 8 differential analog inputs via 17 screw terminals, 16 digital inputs via 17 screw terminals**
Outputs **2 analog voltage outputs via 4 screw terminals, 8 digital outputs via 12 screw terminals**

Multi-LAB/2 Cables and Connectors

All inputs and outputs of the Multi-LAB/2 board can be accessed via a 78-pin D-Sub female connector. One male connector with solder contacts (including plastic cover and fixing screws) comes with the board. You can acquire additional male connectors and ready-made cables with the 78-pin male connector for the Multi-LAB/2 board on one end, the other end is open or is provided with a 78-pin male or female connector. The wires in the cable are twisted to pairs and, as a whole, shielded twice.



78-pin male or female connector with plastic coverand fixing screws

78-pin male connector with cable

Fax Order Form

Adress of customer

Company | **Place, Date**

Name/Department | **Name in block letters**

PO Box/Street

Postal Code/City

Order No. | **Signature/Stamp**

Order No.	Quant.	Multi-LAB/2 Multi-Function Boards	Total price
HM-1487		Multi-LAB/2a incl. manual, 78-pin connector and system software	
HM-1514		Multi-LAB/2d incl. manual, 78-pin connector and system software	
HM-1488		Multi-LAB/2i incl. manual, 78-pin connector and system software	
HM-1713		Multi-LAB/2h incl. manual, 78-pin connector and system software	
		Accessories	
HM-1571		Test box for Multi-LAB/2 incl. software	
K2-4003		Debugging cable for Multi-LAB/2i and Multi-LAB/2h	
		(3-pin Mini-DIN to 9-pin D-Sub. socket, 1,5 m)	
FM-1604		Connection Box C1 with BNC-sockets, screw terminals and cable	
FM-1698		Connection Box C2 with banana jacks and cable	
FM-1830		Screw-clamp terminal block with screw terminals and cable	
		for Top-hat-rail mounting (50-pin)	
K1-3078		Round cable with 78-pin male connector, one end open, 1.6 m	
K2-3078		Round cable with 78-pin male and female connector, 1.6 m	
K2-3178		Round cable with 7two 8-pin male connectors, 1.6 m	
FM-1605		78-pin connector with solder contacts with hood	
FM-1799		78-pin connector with solder contacts with hood	
		A-Links for Analog Inputs for Multi-LAB/2i and /2h	
FM-1526		20 mA, 4 differential channels	
FM-1740		20 mA, 8 single-ended channels	
FM-1877		10 V max., 8 single-ended or 4 differential channels	
FM-1741		20 V max., 8 single-ended or 4 differential channels	
FM-1742		40 V max., 8 single-ended or 4 differential channels	
FM-1744		100 V max., 8 single-ended or 4 differential channels	

Total Amount
Shipping Cost
Amount of Invoice

Your Local Distributor:

Please fill in this order form and fax it or send it by mail. Prices and technical issues are subject to change.

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