

# RS485 Backer Board for Alphanumeric LCDs

IES-ABB-RS485-01

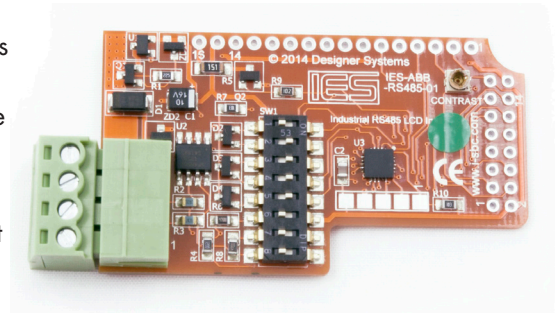
## Product Overview

The IES-ABB-RS485-01 serial interface module provides a simple means of connecting up to 32 alphanumeric Liquid Crystal Display (LCD) modules of 16 x 2, 20 x 2, 40 x 2 or 20 x 4 character/lines to a single RS485 compatible bus.

The IES-ABB-RS485-01 provides complete addressable control of character placement, customisation and cursor movement to ensure that your application is up-and-running in a fraction of the time necessary to implement the standard LCD control protocol.

The IES-ABB-RS485-01 features on-board supply regulation for both LCD supply and backlight and fully 'jumperless' setup of internal features over the serial link. These include 15 levels of backlight brightness, serial baud rate (9600 baud default) and number of display lines.

The IES-ABB-RS485-01 features industrial grade RS485 bus protection and switch configuration of load resistor and pull-up/down resistors make the module an ideal solution for distributed visual feedback systems in most harsh environments. The module simple piggy-backs on the LCD module to form a compact solution.



## Applications :

- Multi-Display HID applications
- Robotics
- Heavy industrial control and monitoring
- User feedback
- Serial terminal
- Door entry

## Features :

- Micro size (59x 27mm) to piggy-back on the LCD module and form a compact solution.
- 32 LCD modules per bus.
- Simple RS485 serial transfer of characters to LCD
- Serial selectable Backlight brightness, No. of lines and serial baud rate (1200-19200bps).
- LCD contrast variable with on-board control.
- Low power operation from 8-24V supply using on-board regulation.
- Supports all standard alphanumeric LCDs
- High quality rising clamp pluggable screw terminal for power and RS485 connection.

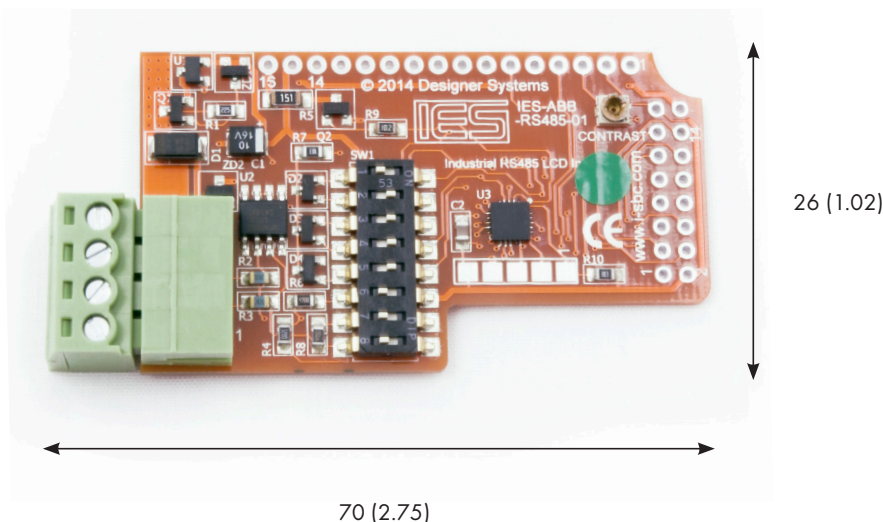
**Product table**

Description	Part Number
LCD Interface Module with RS485 control	IES-ABB-RS485-01

**Technical Drawings**

Units millimetres (inches)

Design subject to change without notice.



**LCD connections**

The IES-ABB-RS485-01 features two LCD connections to support both Single-In-Line (SIL) and Dual-In-Line (DIL) LCD modules. Both connections are easily soldered to the required LCD

module using a 16 pin SIL pin header, 16 pin (8+8) DIL pin header or alternatively a flexible wire connection. Note that incorrect connection may damage the IES-ABB-RS485-01 or LCD module.

16	●	Backlight-			16	
	●	Backlight+	Backlight+	●	●	Backlight-
	●	Data bit 7	Data bit 6	●	●	Data bit 7
	●	Data bit 6	Data bit 4	●	●	Data bit 5
	●	Data bit 5	Data bit 2	●	●	Data bit 3
	●	Data bit 4	Data bit 0	●	●	Data bit 1
	●	Data bit 3	Ground	●	●	Enable
	●	Data bit 2	Contrast	●	●	Date/Instruction
	●	Data bit 1	Ground	●	●	VCC
	●	Data bit 0		1	2	
	●	Enable				
	●	Ground				
	●	Data/Instruction				
	●	Contrast				
	●	VCC				
1	●	Ground				

**RS485 connection**

The IES-ABB-RS485-01 supports RS485 serial communication and control.

Connection to the module is through the terminal block centre two terminals, pinned as follows

Terminal	Connection Designation
1	V+ (Supply)
2	D- (Data - input)
3	D+ (Data + Input)
4	GND

A maximum of thirty two [32] IES-ABB-RS485-01 may be connected to a single pair of wires, this being termed 'multi-drop'. Each IES-ABB-RS485-01 is configurable for its own unique address [0-31] which allows the RS485 bus 'master' to talk to the individual LCD display or multiple display's if two or more are set to the same address.

Switches 1 to 5 allow the address to be configured as in the following table:

Switch no.					Address
5	4	3	2	1	
OFF	OFF	OFF	OFF	OFF	00
OFF	OFF	OFF	OFF	ON	01
OFF	OFF	OFF	ON	OFF	02
OFF	OFF	OFF	ON	ON	03
OFF	OFF	ON	OFF	OFF	04
OFF	OFF	ON	OFF	ON	05
OFF	OFF	ON	ON	OFF	06
OFF	OFF	ON	ON	ON	07
OFF	ON	OFF	OFF	OFF	08
OFF	ON	OFF	OFF	ON	09
OFF	ON	OFF	ON	OFF	10
OFF	ON	OFF	ON	ON	11
OFF	ON	ON	OFF	OFF	12
OFF	ON	ON	OFF	ON	13
OFF	ON	ON	ON	OFF	14
OFF	ON	ON	ON	ON	15
ON	OFF	OFF	OFF	OFF	16
ON	OFF	OFF	OFF	ON	17
ON	OFF	OFF	ON	OFF	18
ON	OFF	OFF	ON	ON	19
ON	OFF	ON	OFF	OFF	20
ON	OFF	ON	OFF	ON	21
ON	OFF	ON	ON	OFF	22
ON	OFF	ON	ON	ON	23
ON	ON	OFF	OFF	OFF	24
ON	ON	OFF	OFF	ON	25
ON	ON	OFF	ON	OFF	26
ON	ON	OFF	ON	ON	27
ON	ON	ON	OFF	OFF	28
ON	ON	ON	OFF	ON	29
ON	ON	ON	ON	OFF	30
ON	ON	ON	ON	ON	Test

RS485 is a half-duplex multi-drop communication interface and it is recommended that the single pair bus be both terminated with a 120R resistor at each of the cable [placed across D+ & D-] and that D+ be pulled up to 5V with a 470R resistor and D- pulled down to GND with a 470R resistor.

The IES-ABB-RS485-01 supports both these functions as switch options. Switch 6, when ON, pulls D+ to 5V, switch 7, when ON, pulls D- to GND and switch 8, when ON, terminates the D+ and D- with 120R.

Note: It is important that pull up/downs be applied only once to the bus and termination be only applied to each end of the RS485 bus. Termination is only really required when bus lengths

## Power Requirements

The IES-ABB-RS485-01 requires an external 8-24Volt un-regulated supply. This supply can be derived from a mains PSU or a battery pack. Current consumption is approx. 4mA excluding backlight, or from 4-20mA including backlight (brightness dependant).

The four (4) way pluggable terminal block, see table below, is used to connect to the supply by connecting between terminal 4 [GND] and terminal 1 (V+).

## LCD Contrast

The IES-ABB-RS485-01 has a 'CONTRAST' control which is provided to set the display contrast to the desired level.

## RS485 (serial) commands

Characters for display on the LCD module are sent to the IES-ABB-RS485-01 in the form of ASCII codes of value 32decimal (20hex) to 127decimal (7Fhex).

These characters are displayed as text on the LCD module at the current cursor position. The IES-ABB-RS485-01 communication protocol consists of an addressing packet followed by data to be placed on the LCD panel or setup commands for the internal registers.

The addressing packet consists of two bytes, an attention byte 255 [OFFh] which can be used at any time to gain the attention of all connected LCDD7 modules, followed by the configured address in the range of 00-30 [00h-1Fh]. Once the attention byte has been received all IES-ABB-RS485-01 modules await the address in the next byte received and compare this address to the one setup on the address selection switch. If the addresses match then the IES-ABB-RS485-01 is selected and any further data received by the module is sent to the LCD panel or to the setup registers.

### Example:

To address an LCDD7 module with address switches 1,3 & 4 in the ON position [address 13] and write 'Hello world !!' to the first line of the display, send:

**255,13,254,128,Hello world !!**

Where: **255,13** is the addressing packet, **254,128** is a command to place the cursor at the beginning of the first display line and **Hello world !!** characters displayed.

To allow the setup of backlight brightness, serial baud rate etc. the module supports a control command format. To place the IES-ABB-RS485-01 into control command mode 253 decimal (FDhex) must be sent before the following instruction codes/values:

Command	Dec	Hex
Backlight - Bright 4	4	04
Backlight - Bright 5	5	05
Backlight - Bright 6	6	06
Backlight - Bright 7	7	07
Backlight - Bright 8	8	08
Backlight - Bright 9	9	09
Backlight - Bright 10	10	0A
Backlight - Bright 11	11	0B
Backlight - Bright 12	12	0C
Backlight - Bright 13	13	0D
Backlight - Bright 14	14	0E
Backlight - FULL ON	15	0F
BAUD rate - 1200baud	16	10
BAUD rate - 2400baud	17	11
BAUD rate - 4800baud	18	12
BAUD rate - 9600baud	19	13*
BAUD rate - 19200baud	20	14
LCD 1 line display	32	20
LCD 2 line display	33	21*
Write Protection register 1	53	35
Write Protection register 2	74	4A

\* Factory defaults

Serial baud rate and LCD lines are stored within non-volatile memory to ensure recall upon the next power-up. These functions are protected by two write protection registers which must be written to before changing the BAUD rate or LCD lines.

**Example:**

To address an IES-ABB-RS485-01 module with address switches 1,3 & 4 in the ON position [address 13] and configure the BAUD rate to 2400 baud, send:

**255,13,253,53,253,74,253,17**

Where: **255,13** is the addressing packet, **253,53,253,74** is the write to protection registers 1 & 2 and **253,17** is the baud rate change to 2400 baud.

The other serial protocol requirements are:

8 Data bits

1 Stop Bit

No Parity

If character errors appear on the LCD display when sending from a fast PC then set Stop bits to 2.

The backlight brightness defaults to 'OFF' on every power-up.

To allow the control of cursor position, clear display and scroll etc. the LCD module also supports a command format. To place the IES-ABB-RS485-01 into command mode 254 decimal (FEhex) must be sent before the following instruction codes:

Command	Dec	Hex
Home (abort scroll)	0	00
Clear display	1	01
Blank display (text not cleared)	8	08
Cursor OFF or restore after blanking	12	0C
Cursor ON & blinking	13	0D
Cursor ON & underline	14	0E
Move cursor left	16	10
Move cursor right	20	14
Scroll display left	24	18
Scroll display right	28	1C

A further two commands allow special characters to be defined and characters to be displayed at particular locations without having to re-write the whole display.

Each character position on the LCD occupies a memory location with a specific address. These addresses allow one or more characters to be changed on the LCD without having to re-write the whole screen i.e. if you want to update just a temperature value on a display which reads 'Temperature = 25oC'.

To accomplish this the DD address of the character position is written after the command mode request e.g. to write the character 'A' to position 6 of line 1 on a 16 x 2 type display the following would be sent:

254<sub>decimal</sub> 134<sub>decimal</sub> 'A'<sub>ASCII</sub>

134 is calculated from the line start address 128\*, plus 6.

All character based LCD modules use a 40-character per line RAM storage area. This means that if 20 characters were written to a 16-character display then only the first 16 characters would be displayed, with the missing 4 being stored in RAM but not displayed. A scroll-left of the display would then be necessary to view the additional characters.

It should also be noted that once the end of the current line is reached the display does not automatically wrap-around to the next line, a new line start address must be written.

\* See Table 1.0 below for DD addresses for different LCD modules.

The LCD contains a small amount of Character-Generator or CG RAM to allow the definition of special characters. Only 8 special characters are definable and displayed by writing a value of 0 to 7 into the display e.g. to display 'ohms Ω' the omega must be firstly defined as CG character 0 and be displayed by writing:

```
RS485.String = "ohms " + CHR$(0)
```

To define the omega character in CG RAM eight values are required to make up the character shape. These values consist of the binary representation, or bit map, of the character as follows:

					0
	■	■	■		14
■				■	17
■				■	17
■				■	17
	■		■		10
■	■		■	■	27
					0

After sending the command code 254<sub>decimal</sub>, the character address is then sent consisting of:

$$64_{\text{decimal}} + (8_{\text{decimal}} \times \text{CG character})$$

where CG character = character to define 0 to 7

for CG 0 address would be 64<sub>decimal</sub>.

The above bit map values are then sent in the order shown to define the character. Therefore the above character would be defined by sending:

$$254, 64, 0, 14, 17, 17, 17, 10, 27, 0_{\text{decimal}}$$

To then switch back to display RAM and print the character send 254<sub>decimal</sub> DDRAM address i.e. 128<sub>decimal</sub> (for start of line 1) and 0<sub>decimal</sub> to display the character defined above.

LCD Display addresses

16 characters x 2 lines:

Line 1	0	1	2	3	4	5	6	.....	15	.....	39
DD Address	128	129	130	131	132	133	134	.....	143	.....	167 Hidden
Line 2	64	65	66	67	68	69	70	.....	79	.....	103
DD Address	192	193	194	195	196	197	198	.....	207	.....	231 Hidden

20 characters x 2 lines:

Line 1	0	1	2	3	4	5	6	.....	19	.....	39
DD Address	128	129	130	131	132	133	134	.....	147	.....	167 Hidden
Line 2	64	65	66	67	68	69	70	.....	83	.....	103
DD Address	192	193	194	195	196	197	198	.....	211	.....	231 Hidden

40 characters x 2 lines:

Line 1	0	1	2	3	4	5	6	.....	39
DD Address	128	129	130	131	132	133	134	.....	167
Line 2	64	65	66	67	68	69	70	.....	103
DD Address	192	193	194	195	196	197	198	.....	231

20 characters x 4 lines:

Line 1	0	1	2	3	4	5	6	.....	19
DD Address	128	129	130	131	132	133	134	.....	147
Line 2	64	65	66	67	68	69	70	.....	83
DD Address	192	193	194	195	196	197	198	.....	211
Line 3	20	21	22	23	24	25	26	.....	39
DD Address	148	149	150	151	152	153	154	.....	167
Line 4	84	85	86	87	88	89	90	.....	103
DD Address	212	213	214	215	216	217	218	.....	231

Note : RED boxed values denote line start addresses



**Electrical Characteristics (TA = 25 °C Typical)**

Parameter	Minimum	Maximum	Units	Notes
Supply Voltage	8	24	V	
Supply Current	4	6	mA	1
RS485 common mode input voltage	-7	+12	V	
RS485 input transient protection		±8	kV	

**Absolute Maximum Ratings**

Parameter	Minimum	Maximum	Units
Supply Voltage	-0.5	26V	V
RS485 common mode input voltage		±14	V

**Environmental**

Parameter	Minimum	Maximum	Units
Operating Temperature	-5	70	oC
Storage Temperature	-10	80	oC
Humidity	0	80	%
Immunity & emissions	EMC compliance to 2004/108/EC		

Notes:

- 1. Value given does not include backlight current.

**WEEE Consumer Notice**

This product is subject to Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste of Electrical and Electronic Equipment (WEEE) and, in jurisdictions adopting that Directive, is marked as being put on the market after August 13, 2005, and should not be disposed of as unsorted municipal/public waste. Please utilise your local WEEE collection facilities in the disposition and otherwise observe all applicable requirements. For further information on the requirements regarding the disposition of this product in other languages please visit [www.i-sbc.com](http://www.i-sbc.com)

**RoHS Compliance**

This product complies with Directive 2002/95/EC of the European Parliament and the Council of the European Union on the Restriction of Hazardous Substances (RoHS) which prohibits the use of various heavy metals (lead, mercury, cadmium, and hexavalent chromium), polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE).

**For further information please contact IES**

The values contained in this data sheet can change due to technical innovations. Any such changes will be made without separate notification.