Application guide for using communications option for CAL 3300 / 9300 / 9400 / 9500P controllers   - Doc: 33010 / 06 / 0106

Introduction

The 3300 / 9300/ 9400 / 9500P series controllers can all be ordered or retrofitted with either an RS232 or RS485 serial communications board. If the controller has the communication board fitted then skip to the section titled **Installation/cabling.**

Feature	RS232	RS485
Type of transmission lines	Unbalanced	Differential
Maximum number of drivers	1	128
Maximum number of receivers	1	128
Maximum cable length	15m	1200m
Maximum data rate	19.2Kb/sec	19.2Kb/sec
Maximum CMV	+/- 25V	+12 to –7V

The table lists the features of both RS232 and RS485 standards.

Cable: To ensure data integrity over long transmission distances, it is recommended that good quality RS485 cable is used.
Recommended: RS485 - Belden 9841, RS232 - Belden 9501. Available from leading cable distributors, and stocked by CAL.

Fitting a communications interface board

The RS232 and RS485 interface boards are interchangeable and are fitted in exactly the same way, please read the fitting and safety instructions before proceeding.
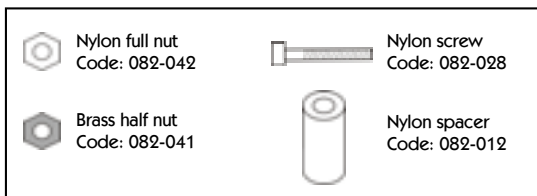
> ⚠ Caution: Live circuits can hold charge for short periods after isolation from voltage supply.
>
> Electrostatic precautions should be observed when handling the controller out of its sleeve.

After isolating the controller from its supply, the controller front bezel and circuit board assembly can be unplugged from the sleeve. Grasp the bezel firmly by the recess on each side and pull. A screwdriver can be used as a lever if required.

To fit the RS232 or RS485 interface you will require the following parts, which are supplied with the interface.

Nylon full nut
Code: 082-042

Nylon screw
Code: 082-028

Brass half nut
Code: 082-041

Nylon spacer
Code: 082-012

Insert the nylon screw into the 3mm diameter hole at the bottom left-hand corner of the controller board.

Place the spacer over the Nylon screw thread.

Screw the Nylon nut onto the screw. *Do not overtighten as this will damage the screw thread.*

Plug the 5-way female connector on the comms board into the 5-way male connector on the controller board ensuring that the connectors are all in alignment. At the same time ensure the hole in the comms board fits over the screw thread

Screw the half nut onto the comms board. Do not overtighten but ensure that it's tight enough to stop the board from moving

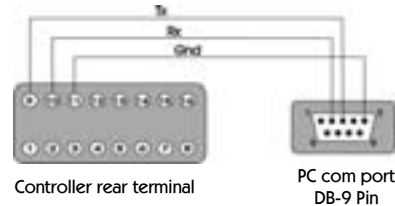Cut the top of the screw thread so that it is level with the top of the brass nut

Now you are ready to refit the controller into its case. To do this carefully slide the PCB into the case aligning it with the connector arms at the rear. Then press the bezel assembly firmly into the sleeve until the latch clicks in order to compress the gasket and seal to NEMA4 / IP66
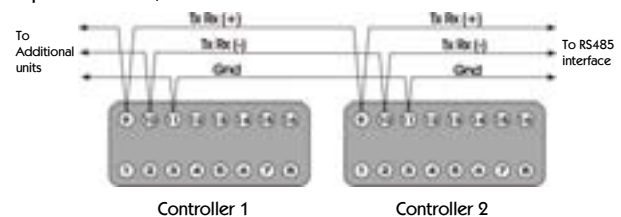
Installation / Cabling

RS232 Connections

RS232 has been widely used for interfacing peripherals to PC's and is designed for serial communications with a single instrument up to distances of 15m, in a low electrical noise environment.
Connection is via a screened two-cored cable where the voltage signal on each line is referenced to the screen which is grounded. .
Most PCs have one or two RS232 compatible ports fitted as standard. If no RS232 ports are available, an RS232-USB converter cable may be required.

Controller rear terminal

PC com port
DB-9 Pin

RS485 Connections

RS485 is half duplex serial communications link and is the standard most commonly used for industrial applications due to its high noise immunity and multi-drop capability. It enables a PC to communicate with up to 128 instruments over distances of up to 1200m. The option will require the addition of an RS485 interface card, or a separate RS232 / RS485 converter.

Controller 1

Controller 2

Each RS485 interface or converter has specific connection and termination biasing requirements which will be detailed in their installation instructions. The general principles are as follows.

Terminations : Because each wire is a transmission line, it must be properly terminated to prevent reflections. Where multiple instruments are daisy chained together a 120Ω resistor should be fitted at the connection to the PC and to the last instrument in the chain. (see diagram overleaf). When fitting termination resistors it may be necessary to fit bias resistors and an external power supply as the PC's integral RS232 port cannot exude sufficient power.

Bias resistors: When transmission lines are not transmitting, they remain in an indeterminate state which can allow receivers to receive invalid data bits due to electrical noise on the cable. To prevent this, the lines should be forced into a known state by fitting two 620Ω bias resistors to one point (node), see diagram overleaf.

If an RS485 interface card or converter is being fitted to the PC, separate bias resistors may not be needed because they may already be fitted to the card. Check the manufacturers specification.

Please note that the KK systems converter supplied by CAL, includes bias resistors and a jack socket for additional power supply.

As previously mentioned RS485 cards and converters differ greatly in their requirements and therefore the installation instructions supplied with the interface should be read carefully.
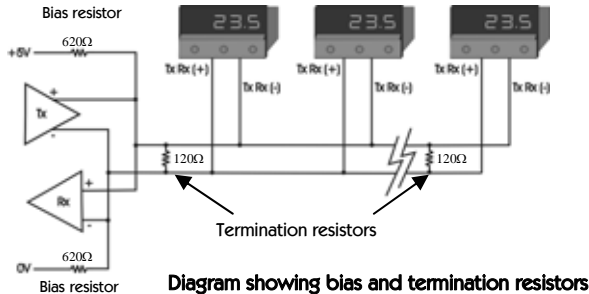

Diagram showing bias and termination resistors

KK Systems K3-ADE TB RS232/485 converter.

If you purchased the KK Systems RS232 / 485 converter from CAL Controls please refer to ' KK Systems K3-ADE TB - Application Guide' for more details (our document number 33083)

Instrument Comms Settings.

Immediately after power-up, both instrument and PC comms settings need to be made compatible before communication between them is possible. Instrument defaults are shown below with available options.
Note: these parameters are found in 'level C' of the controller.

(Address)

This is a unique identification number that must be allocated to each instrument connected to the network.
Default = 0.   Options: 1 to 247

(Baud rate)

The setting determines the serial communication data transmission rate in bits/ sec, this must match the PC settings.
Default = 9600.   **Options: 1200,2400**
                                        4800, 9600
                                        19200.
Note: If a comms board has been retro-fitted the default baud rate is 1200.

(Data)

Sets the transmission format, this must match the PC settings.

Settings	Start bits	Data bits	Parity	Stop bits
Default	1	8	n (none)	1
Option 1	1	8	e (even)	1
Option 2	1	8	o (odd)	1

Data format table

(Debug)

Commissioning and troubleshooting aid. Display shows when the instrument is transmitting or receiving data by rapidly flashing three horizontal segments of the first and last segments of the display.
First Digit = Tx.   **Last Digit = Rx**
Default = Off   **Options: off, on.**

Only use dbuG during commissioning or trouble-shooting because it shares display segments and therefore corrupts the normal display.

Configuring instrument comms settings

This should be done immediately after power up and is only possible from the instrument front panel.

On power-up the controller will display the self test sequence followed by alternating ‌InPt and nonE

Note: During the following procedure the display will revert to alternating InPt and nonE after 60 seconds of keying activity, but will retain any settings already completed. Should this occur or in the event of becoming 'lost' in the program, please start again from the alternating InPt and nonE display.

To select Level C (communications settings)
Press ▼ once display will alternates with LEUL and 5.
Press and hold ✳ and press ▼ five times to reach LEUL C.

Note: Level C is only visible when the comms interface board is fitted to the unit.

To set the instrument comms address
Press ▲ once display alternates between Addr and 0.
Press and hold ✳ and press ▲ to index the chosen address number (1 to 247)
Note: In the absence of any conflicting information the following comms settings should be left as default values (see 'instrument comms settings')

To read or adjust comms settings

Baud rate
Press ▲ once display alternates bAud and 9600 (default setting)
Press and hold ✳ and use ▲ or ▼ keys to select preferred value.

Data Format
Press ▲ once display will alternate dAtA and 18n1 (default setting)
Press and hold ✳ and use ▲ or ▼ keys to select preferred setting.

Debug setting
Press ▲ once display alternates dbuG and oFF (default setting)
Press and hold ✳ and use ▲ key to select on

To enter settings into memory
Press and hold ▲ and ▼ for 3 seconds, display alternates InPt and nonE.

To check settings; repeat the above procedure.

The unit is now ready to be configured from the PC.

Note: Where more than one instrument is connected to the system, it is useful at this point to list them by location, title and comms address. The list can then be used as a reference to ensure that the instruments are given the same identity when configuring the comms link from the PC.

Further Information
Go to www.cal-controls.com for more details.

Modbus communications guide - For engineers developing their own programs from PC's or PLCs.

CALpoll toolkit for Visual C++ developers include .exe and source code.

Visual Basic toolkit available via support@cal-controls.com .

CALgrafix charting logging and configuration software, which includes an OPC-based client and server.