Emotron isolated USB and RS485 Option

For Emotron TSA softstarter

Instruction manual
English

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Instruction manual - English

Safety

Instruction manual

Read this instruction manual first!

This option is a supplementary part of the EmotronTSA softstarters, further in this manual referred to as the "main product", the user must be acquainted with the original instruction manual of the main product. All safety instructions, warnings, etc. as mentioned in this instruction manual are to be known to the user.

Safety

The following indications can appear in this manual. Always read these first and be aware of their content before continuing:

NOTE: Additional information to avoid problems.

⚠ **CAUTION!**
Failure to follow these instructions can result in malfunction or damage to the softstarter.

⚡ **WARNING!**
Failure to follow these instructions can result in serious injury to the user in addition to serious damage to the softstarter.

Installation

Installation, commissioning, dismounting, making measurements, etc. on the main product may only be carried out by personnel who are technically qualified for the task. Installation must also be carried out in accordance with the local standards. Ensure that all necessary safety measures are taken.

⚡ **WARNING!**
Take all necessary safety precautions during installation and commissioning to prevent personal injuries, e.g. by an uncontrolled load.

Opening the main product

⚠️ **WARNING!**
Always switch off the mains supply and control supply before opening the main product.

Always take adequate precautions before opening the main product, even though the connections for the control signals and jumpers are isolated from the mains voltage.

Content

1. General Information

1.1 Introduction

The isolated USB and isolated RS485 option are both a asynchronous serial communication interface for the Emotron TSA soft starter series.

The protocol used for data exchange is Modbus RTU, originally developed by Modicon. Physical connection is selected by option, either USB or RS485.

The product acts as a slave with address 1 to 247 in a master-slave configuration. The communication is half-duplex. It has a standard non return to zero (NRZ) format. Please refer to the instruction manual for the main product for the maximum selectable baud rate.

The character frame format (always 11 bits) consists of (fixed):

- one start bit
- eight data bits
- two stop bits
- no parity bit

1.2 Users

This instruction manual is intended for:

- installation engineers
- designers
- maintenance engineers
- service engineers

1.3 Delivery and unpacking

Check for any visible signs of damage. Inform your supplier immediately if any damage is found. Do not install the option board if damage is found.

If the option board is moved from a cold storage room to the room where it is to be installed, condensation can form on it. Allow the option board to become fully acclimatised and wait until any visible condensation has evaporated before installing it in the main product.

2. Connections

2.1 Connections & Front view of isolated RS485 option

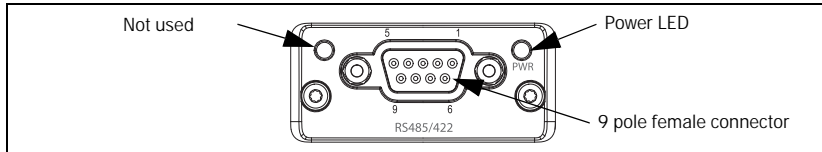*Fig. 1   Module front view*

Power LED function
    Off = No power
    Green = Powered

RS 485 interface

9 - pole female interface. Galvanically isolated.

NOTE: For convenient network installation we recommend using external screw terminal, like e.g. AMPHENOL - L717DE09PST - PLUG, D, SCREW TERMINAL, 9WAY available on Farnell and other large component suppliers.

Connector interface

Pin #	Function
1	Termination power, +5V, isolated
4	Note! Must leave unconnected / NC to enable RS485 function
5	GND, isolated signal ground
8	RxD/TxD (negative/inverted "B") bidirectional RS485 line
9	RxD/TxD (positive "A") bidirectional RS485 line
Housing	Cable shield connection

Note! If the TSA node is an endpoint of a RS485 network it must be
properly terminated to avoid reflections causing communication
interference. See chapter 4.2.2 page 19, RS485 Termination for details.

2.2 Connections and Front view of isolated USB option

The USB option is Based on the CP2102 chip from Silicon Laboratories
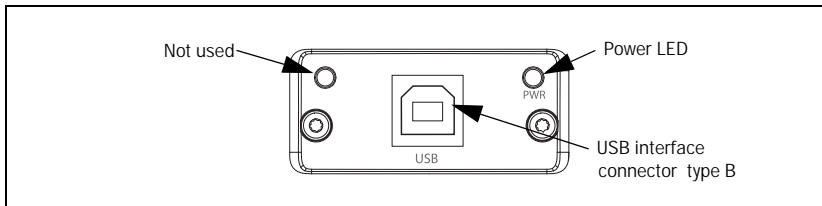(www.silabs.com) and it is USB 1.1 and USB 2.0 compatible.

Fig. 2   Module front view

Power LED function

Off = No power
Green = Powered

USB interface connector type B

A Virtual Com Port driver (VCP) needs to be installed on the host computer .
After that the option appears as a standard communication port (a.k.a COM-
port) which makes it fully transparent to any software using the standard Mod-
bus RTU protocol according to 11-bit frame format described in chapter 3.2
page 13

The VCP is supported on the following platforms:

- Microsoft Windows™ 2000
  Separate driver required. For more information, see "Windows 2000" on
  page 9.

- Microsoft Windows™ XP
  For more information, see "Windows XP" on page 10

- Microsoft Windows™ 98SE
  Separate driver required. For more information, see "Windows 98SE" on page 10

- Mac OS 9
  Mac OS-9 VCP drivers are currently available by request only. To obtain a copy of these drivers, contact a Silicon Laboratories MCU Tools Support representative at www.silabs.com.

- Mac OS-X
  Separate driver required. For more information, see "Mac OS X" on page 11.

- Linux (kernel 2.40 or higher)
  Separate driver required. For more information, see "Linux" on page 11.

2.2.1   Virtual Com Port driver Installation for USB option

This section describes the installation process for the most common operating systems. For other platforms, consult the installation guides provided with the driver.

Windows 2000

Before proceeding, download the latest VCP drivers for Windows 2000 from the HMS website and extract them to a temporary location on your PC.

Follow these steps to install the VCP driver:

1. Connect the USB cable between the host computer and the CP2102 target device.

2. Windows will open a 'Found New Hardware Wizard' window. Press Next to continue.

3. Select 'Search for a suitable driver for my device (recommended)' and press Next.

4. Check 'Specify a location' and press Next.

5. Press Browse to locate the files extracted earlier. Once this directory is selected press Next.

6. Verify that the correct path and filename are shown and press Next.

7. Press Finish to finish installing the 'CP210x USB Composite Device'.

8. Windows will open a second 'Found New Hardware Wizard' window. Press Next to continue.

9. Select 'Search for a suitable driver for my device (recommended)' and press Next.

10. Check 'Specify a location' and press Next.

11. Press Browse to locate the 'slabw2k.inf' driver installation file. Once this file is selected press OK.

12. Verify that the correct path and filename are shown and press Next.

13. Press Finish to finish installing the 'CP210x USB to UART Bridge Controller'.

Windows XP

Before proceeding, download the latest VCP drivers for Windows XP from the HMS website and extract them to a temporary location on your PC. Generally, no driver is needed. To manually install the VCP driver, perform the following steps:

1. Connect the USB cable between the host computer and the CP2102 target device.

2. Windows will open a 'Found New Hardware Wizard' window.

3. Select 'Install from a list or specific location (Advanced)' and press Next.

4. Select 'Include this location in the search'.

5. Press Browse to locate the files extracted earlier. Once this directory is selected press Next.

6. Verify that the correct path and filename are shown and press Next.

7. Press Finish to finish installing the 'CP210x USB Composite Device'.

8. Windows will open a second 'Found New Hardware Wizard' window.

9. Select 'Install from a list or specific location (Advanced)' and press Next.

10. Select 'Include this location in the search'.

11. Press Browse to locate the 'C:\SiLabs\MCU\CP210x\WIN' directory. Once this directory is selected press OK.

12. Verify that the correct path and filename are shown and press Next.

13. Press Finish to finish installing the 'CP210x USB to UART Bridge Controller'.

Windows 98SE

Before proceeding, download the latest VCP drivers for Windows 98SE from the HMS website and extract them to a temporary location.

Follow these steps to install the VCP driver:

1. Connect the USB cable between the host computer and the CP2102 target device.

2. Windows will open a 'Found New Hardware Wizard' window. Press Next to continue.

3. Select 'Search for the best driver for your device (Recommended)' and press Next.

4. Select 'Specify a location'.

5. Press Browse to locate the files extracted earlier. Once this directory is selected press Next.

6. Verify that the correct path and filename are shown and press Next.

7. Press Finish to finish installing the 'CP210x USB Composite Device'.

8. Windows will open a second 'Found New Hardware Wizard' window. Press Next to continue.

9. Select 'Search for the best driver for your device (Recommended)' and press Next.

10. Select 'Specify a location'.

11. Press Browse to locate the 'C:\SiLabs\MCU\CP210x\WIN' directory. Once this directory is selected press Next.

12. Verify that the correct path and filename are shown and press Next.

13. Press Finish to finish installing the 'CP210x USB to UART Bridge Controller'.

Mac OS X

Before proceeding, download the latest VCP drivers for Mac OS X from the HMS website and extract them to a temporary location.

To install the Macintosh OS X virtual COM port driver, extract 'cardinal-osx-V1_00c-release.zip', and run the extracted file 'SLAB_USBtoUART Installer'.

To uninstall the driver, run the extracted file 'SLAB_USBtoUART Uninstaller'.

Linux

Before proceeding, download the latest VCP drivers for Linux from the HMS website and extract them to a temporary location. The drivers support kernel versions 2.40 and later.

To install the driver, extract 'cardinal-redhat9-V0_81a.tar', and run the extracted file 'load_mcci_usb'.

To uninstall the driver, run the extracted file 'unload_mcci_usb

3.   Modbus RTU protocol

The standard industrial Modbus RTU protocol is used both for the USB- and RS485 option.

3.1   Frame format

The Emotron TSA unit uses the following 11-bit frame format (fixed) :

1	Start bit
8	Data bits, hexadecimal 0 - 9, A - F, least significant bit sent first.
2	Stop bit

Note! In modbus RTU a transmission silence of 3.5 characters indicates end of telegram.

3.2   Protocol

3.2.1   Supported function codes

The Emotron TSA softstarter supports the following function codes:

Function name	Function code
Read coil status	1(01h)
Read input status	2 (02h)
Read holding registers	3 (03h)
Read input registers	4 (04h)
Force single coil	5 (05h)
Force single registers	6 (06h)
Force Multiple coils	15 (0Fh)
Force Multiple registers	16 (10h)
Force/Read Multipleholding registers	23 (17h)

3.2.2 List of parameters with scaling & format information

The modbus address & scaling/format of each menu/parameter is found both in the end of the main product manual and also in a separate excel sheet "Communication settings" which is downloadable from www.cgglobal.com/www.emotron.com. The E-int (emotron int) format is described in detail in the main product manual.

3.2.3 Most common modbus parameters for controlling Emotron TSA

Basic control of the Emotron TSA softstart over serial communication can easily be performed by using a few modbus parameters.

Modbus number	Function	Description
42901	reset	Reset 0 -> 1 (flank trigged)
42902	run/stop	1 = run, 0 = stop
42903	run forward	1 = run forward command
42904	run reverse	1 = run reverse command Note! Must be used with external contactor connection according to instruction in main product manual.
42907	comm. set	0 = A, 1 = B, 2= C, 3 = D

Note! To make the motor start, both 42902 and 42903 or 42904 must be set at the same time. Setting both 42903 and 42904 at the same time will cause Emotron TSA to stop.

3.2.4 Communication errors and exception codes

Communication errors are divided into two categories

- Transmission errors
- Protocol errors

Transmission errors are:

- Frame error (stop bit error).
- Parity error (if parity is used).
- CRC error (incorrect checksum)

- No message at all (time-out).

These errors may be caused by electrical interference from machinery or damage to the communication channel (cables, contact, I/O ports, etc.) or incorrect protocol implementation or communication settings on the master side. This unit will not act on or answer the master when a transmission error occurs. (The result will be the same if a non-existing slave is addressed). The master will eventually cause a time-out condition.

Description of Protocol errors

If no transmission error is detected in the master query, the message is examined. If an illegal function code, data address or data value is detected, the message is not acted upon but an answer with exception code is sent back to the master. This unit can also send back an exception code when a set (force) function message is received during periods of operation.

Bit 8 (most significant bit) in the function code byte is set to a "1" in the exception response message. An example is an illegal data address when reading an input register.

Fig. 3   Exception response message.

Field name	Hex value
Slave address	01
Function	84
Exception code	02
CRC LO	C2
CRC HI	C1

Table 1   Exception codes.

Exc. code	Name	Description
01	Illegal function	This unit doesn't support the function code.
02	Illegal data address	The data address is not within its boundaries.
03	Illegal data value	The data value is not within its boundaries.
06	Busy	The unit is unable to perform the request at this time. Try again later.

3.2.5   Detailed Modbus rtu protocol description

Detailed description of the Modbus RTU protocol is available on CG Drives and automation website, document 'CG_OPTION_instruction_SerialComm_2-0' with article number 01-5919-01. This document gives examples of modbus rtu frames with different function codes and how to calculate a correct CRC.

4. Interface and Menu System

4.1 Menu description

Table 2   Menus for setting the serial communication.

Menu	Function	Default	Select/Description
261	Com Type	RS232	Must be set to USB/RS485/BT in order to communicate via USB or RS485 option.
2621	Baudrate	9600 bits	Set to baudrate used for your network/serial link. Available range is 2400-115200 bit/s.
2622	Address	1	Set to the dedicated/unique modbus address you wish to have for your softstarter unit. Available range is 1-247.
2641	ComFlt AA	No action	Menu for alarm action in case of communication fault. Selections are: No action=do nothing, Hard trip=coast motor to stop, Soft trip= stop motor acc.to selected mode. Warning=warning only but continue operation.
2642	ComFlt Time	0.5 seconds	The alarm delay for the Com fault alarm action set in menu [2641]

4.2 RS485 Multipoint network

The RS485 port (see Fig. 4) is used for multipoint communication. A host computer (master) can address a maximum of 247 slave stations (nodes). See Fig. 4.
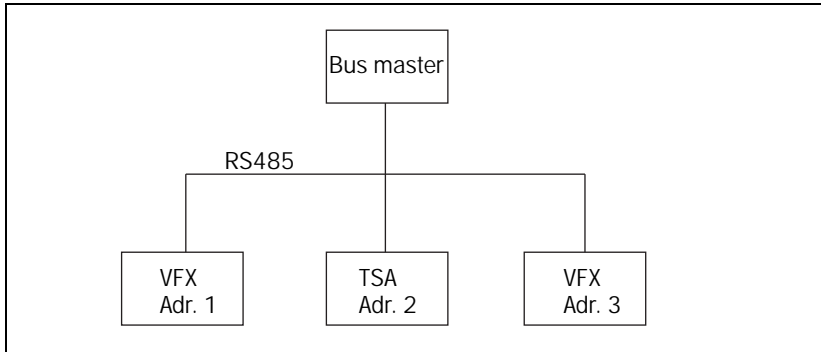

Fig. 4   RS 485 multipoint network

It is important that the first and the last unit in the network are terminated, i.e. unit with Adr. 1 and 3 in figure above. See chapter 4.2.2 page 19 for details.

4.2.1 RS485 wiring

The wiring should be as in Fig. 5. A common problem when installing new networks is that the A and B wires have been crossed or incorrectly terminated. The A and B wires must never cross and only the end nodes on the network should be terminated. See chapter 4.2.2 page 19 for details.
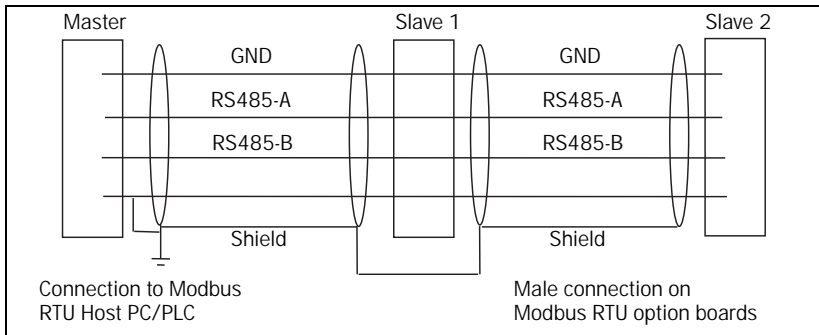
Fig. 5   RS485 wiring

4.2.2   RS485 termination and biasing resistors

As stated above, the first and the last node of a RS485 network line must be terminated to avoid transmission reflections which may cause interference/communication errors. This becomes in particularly important when using high baud rates and long transmission lines.

The termination is done by connecting a resistor across the A and B transmission line, i.e. pin 8 and 9 of the D-sub interface, see chapter 2.1 page 7.

The termination resistor should have a value which matches the characteristic impedance of the transmission line to avoid reflecting waveforms. In general for RS485 networks a resistor value or approximately 110-120 ohm is commonly used.

Further, biasing resistors must also be attached together with the termination resistor to keep the transmission line (A & B) on a steady level while not transmitting (fail-safe). Suitable bias resistors in combination with a 120 ohm termination resistors is 470 ohm. Connect the first biasing resistor between pin 8 (B) and pin 5 (gnd). Connect second biasing resistor between pin 9 (A) and pin 1 (power, +5Vdc isolated).

Note! It is important to not select the biasing- and termination resistor too low ohmic because it will be seen as a load for the transceiver circuits.

4.2.3 RS485 equipotential bonding system

An equipotential bonding system should be used to level out voltage differences between nodes. The shield in cables must not be used for this purpose. Main equipotential bonding conductors should be as short as possible. Their resistance from bonded part to the Main Earth Terminal (MET) should, in general, not exceed 0.05 ohm.

5.   Installation

This chapter describes how to mount the option module to the controlboard in the softstarter.

5.1   Mechanical mounting

Make sure that all power supplies (i.e. both Main and control supply) is switched off before continuing the installation! Also make sure that no external equipment connected to the softstarters interface is switched on


NOTE: Correct installation is essential for fulfilling the EMC requirements and for proper operation of the module.

5.1.1   Inserting the module on to the circuit board

NOTE: Brake the lid in the plastic cover hood to let the interface of the fieldbus module become accessible from the outside.

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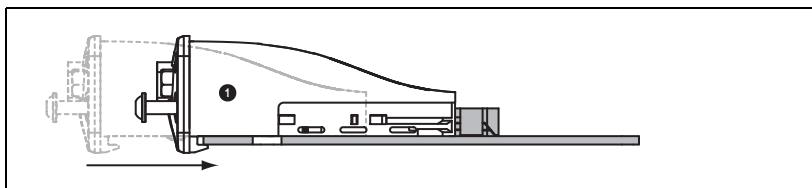
1. Gently slide the fieldbus module into place. Make sure that the module slides on to the guides on the board and into the 50-pin Compact Flash contact. Do NOT use any force!

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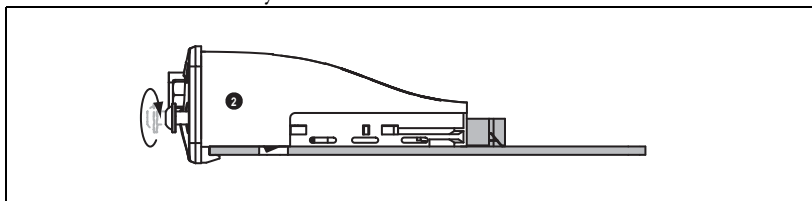
2. Make sure that the fieldbus module goes all the way in. Then tighten the two screws on the front of the module. The module is now locked to the board through fastening holes in the PCB.
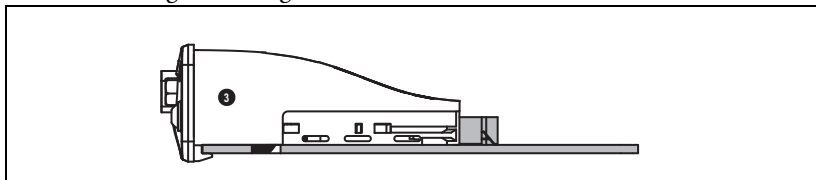

Fig. 6

5.2   Shielding

For TSA softstarter, the cable screen is connected to PE via the modules interface.

In most cases it is recommended that the shield be connected to PE at both ends. This will give a good attenuation of high frequency interference.

When the softstarter is installed in a cabinet, we recommend that the shield of RS485 also is connected to the external shield DIN-rail (the DIN-rail is connected to a PE-rail). Note that the shield of the network cable should be kept whole. Connection should cover the largest area possible.

In environments with severe interference, optical signal transmission is the safest and cheapest solution. Moreover, this is usually the recommended media when communicating between buildings. Optical solutions have the advantages of being electrically insulated, lightweight and enable cable lengths of several kilometres to be used. They are also not susceptible to electromagnetic interference, which means that they can be installed along power cables. Please note that CG Drives & Automation does not manufacture or sell fibre optical transmitters/solutions. These are, however, widely available on the market and may be used together with our products.