



**R-EA-MOD-2IO-485**  
**Relay Module**  
**Communication Protocol**

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## 1 Communication Protocol

This is for the Firmware Cont125 EM4x02 RS485 Multimaster, as of version 1.16

Default setting: 38400 Baud, no parity, 8 data bits, 1 stop bit

RS485 Address: #201 = 0xC9 = ASCII: 3C 39

### 1.1 Available commands

for the controller:

- >fix a set up
- <require a set up
- >modify serial configuration
- >recall a logic reset of the controller
- <require the firmware version
- >set the led (and other output)
- >set radio-frequency status and codify type
- <require radio-frequency status and codify type
- <require input status
- <require code of the present badge

### 1.2 Communication Protocol description

#### 1.2.1 Syntax

On the following pages all control digits will be marked in bold (ex. **STX** corresponds to the sending of the 02h value). All constant alpha-numerical stripes will be indicated between quotation marks (ex. "3"). Variable parameters will be underlined by the characters < > and the meaning of each parameter will be specified after the command description.

#### 1.2.2 Commands structure

Commands and answers are generally included between the control digits **STX** and **ETX**. Stripe is then completed by a Check-sum digit called **BCC** immediately after the **ETX**. **BCC** is calculated by executing the exclusive or of all digits included between **STX** and **ETX**. The digit **STX** for the polling command is executed by **ADDP1** and **ADDP2** while for the selecting commands is executed by **ADDS1** and **ADDS2**.

**EOT** digit sent to the slave allows a communication re-initialization. It is suggested, but not necessary, the sending of at least 2 **EOT** before sending a command.

Ex.	<b>EOT EOT STX ADDS1/ADDP1 ADDS2/ADDP2 "X" &lt;DATA&gt; ETX BCC</b>	
<b>EOT</b>	ASCII 04 digit to reset the communication. OPTIONAL	
<b>STX</b>	ASCII 02 digit for Start Of Text (it opens the serial input).	
<b>ADDP1</b>		
<b>ADDP2</b>	individual address in polling of the terminal receiving the message	
<b>ADDS1</b>		
<b>ADDS2</b>	individual address in selecting of the terminal receiving the message	
<b>ETX</b>	ASCII 03 digit for End Of Text (it closes the serial input)	
<b>BCC</b>	digit representing the exclusive or of the characters included between STX and ETX	

### 1.2.3 ADDS and ADDP addresses

Each terminal has an address included between 001 and 255; in the multipoint communication the address of the terminal is defined by 2 ASCII digits, both included between '0' and '9' (between 30 and 3f hexadecimal) in case of selecting.

In case of polling the first digit is the same as per the first selecting digit, while the second can be obtained by changing the dozens (from 3 to 2) of the second selecting digit.

For example the selecting address of the terminal 53 is "35" (33, 35 hexadecimal). The related polling address is "3%" (33,25 hexadecimal).

In case of global selecting the 2 address digits will be "" (60,60 hexadecimal).

At your first terminal usage it is suggested to connect it individually to the PC and to send it a command of Serial Setup in global setting. These new inputs will be used by the terminal only after a second restart (or after a command of logic reset). For this reason it is necessary to switch off and again on the terminal.

### 1.2.4 ADDx1 and ADDx2 addresses

Each terminal is identified from a 3 positions progressive number included between '001' and '255'. Inside each selecting command this identification is composed of 2 ASCII digits indicated by the stripes ADDS1 and ADDS2.

To obtain these ASCII digits it is necessary to follow this reasoning: the decimal number must be changed into the related hexadecimal number. These two different results will be separately taken in consideration. To each one of these results we must add 30h in order to get two hexadecimal numbers included between 30 and 30F. Changing these two ASCII digits we will obtain the coordinates. If for example we want to identify the terminal 225: HEX(225) = E1. We take now E and 1 separately in consideration. We add 3 in front of each value and obtain 3E and 31, which correspond to '>' e '1' in ASCII form. The address of the terminal we are interested in will be then ">1". If we need a polling command instead of a selecting command, we will add 20h instead of 30h to the second hexadecimal number. In this case the terminal of our example will be **HEX (225)**.

**HEX (225) = E1 = 3E, 31 =>!**

### 1.2.5 Generality

On a same RS-485 serial line you can be connected up to a maximum of 255 terminals. The serial baud rate is selectable via a special software command and is saved in the E2PROM, the number of bits per character is always 8, the ever-existent equal and there is a single stop bit.

The card works normally using a master-slave logic that responds only to the queries of the master. Only in special situations, it takes communication: send a message to communicate an event or an anomaly and expects a ACKNOWLEDGMENT message (acceptance) by the master. In both cases, a CSMA / CD protocol is being used.

The master (computer or concentrator) to the on board can operate:

- Sending commands or Selecting
- Sending requests or polling

The commands or requests sent by the master (PC), always relate in general to a single terminal among those in the multi-point line. Selecting a particular said 'global' can affect all online terminal. There will be no response from the terminals in the event of global Selecting while they still perform the command. The EOT character (ASCII 04) sent to the slaves allows the reset of the protocol. It is recommended but not necessary to the sending of at least 2 EOT before starting a sequence.

## 2 Selecting commands

### Answers to the selecting commands

At each Selecting received, the card responds with the following syntax:

**STX ADDS1 ADDS2 <Comand> <RESULT> ETX BCC** where

<Command> Code of the command sent

<RESULT> Alphanumeric string of 1 character indicating the outcome of the command.

The valid values are:

- "0" correct Outcome
- "1" does not exist Command
- "2" Invalid Data Format
- "5" wrong BCC

If the analysis of the message detects an error, the "0" character is changed to another to indicate syntax error. The value sent is typical found the error and will be sent only if the two start and end of text (**STX**, **ETX**) have been correctly received. The answer will only take place if the **ADDS1-ADDS2** characters were received correctly.

In case of no response from the card, the master must repeat his command after the timeout.

### 2.1 Basic Setup

With this command you can change certain card operating parameters. They will be immediately saved in the E2PROM memory and made valid. The setup is sent through a well established single fixed-length string:

**STX ADDS1 ADDS2 "0" <NINV> <TMCODE> <SINPOT> <T\_INP> ETX BCC** where

"0" character (hex. 30) indicating the type of command 'set setup'.

<NINV> numeric string 2 numbers indicating how many times repeat the event to be dispatched. Valid values range from "00" to "10".

<TMCODE> Number string of three numeric characters indicating the ACK wait in second hundredths. Values are valid from "001" to "999". The event is actually kept in memory for <NINV> + 1 the time <TMCODE>, less than a possible recurrence.

<SINPOT> numeric string 2 characters consisting of "0" or "1". They define the functionalities attributed to the two interface input. The first character in the string concerning the input IN1 and the second concerns the IN2 input.

The character "1" indicates the active layer corresponding to the input connected to ground.

The character "0" indicates the active layer corresponding to the input offline to ground.

<T\_INP> numeric string of 4 characters, one for each input. The first two characters refer to internal inputs (in the order P1 and P2), the other to external input (IN1 and IN2 in the order). Every single character indicating when lift the relatively corresponding to the input event. Each character can take on the values:

- "0" No event
- "1" Event activation only input
- "2" Event only the input off
- "3" is the activation event that the deactivation of the input
- "4" No event: running internal command.

Please note that spaces are meaningless.

After the reception of a proper setup, the card responds with a result = "0". Timeout for at least 200 milliseconds response.

## 2.2 Serial Set Setup

**STX ADDS1 ADDS2 "1" <NADD1> <NADD2> <BAUDRATE> ETX BCC** where

"1" digit indicating the command type 'serial setup'.

<NADD1> one digit stripe indicating the first half-byte of the address.  
Valid from 30 until 3F (corresponding to "0" and "?").

<NADD2> one digit stripe indicating the second half-byte of the address.  
Valid from 30 until 3F (corresponding to "0" and "?").

<BAUDRATE> one numerical digit stripe indicating the new Baud-Rate of the terminal  
Valid values are:

"0"	1200
"1"	2400
"2"	4800
"3"	9600
"4"	19200
"5"	38400

New set up will be valid just restarting the terminal (physic reset) or through the command logic reset.

In case of first start or if the memory setup remarks anything wrong:

The board without address will accept just global commands and will not send any event

Default speed will be 19200 bps

## 2.3 Logic Reset

**STX ADDS1 ADDS2 "2" ETX BCC** where

"2" digit indicating the command type 'Logic Reset'.

It has to be sent after a 'Set Setup' or a 'Set Serial Setup' command in order to activate the modifications. Terminal will not answer to this command. It's equal to a switch off and a following switch on of the terminal.

## 2.4 Set Outputs

This command allows the master to activate the output.

**STX ADDS1 ADDS2 "3" <TOUT1> <TOUT2> ETX BCC** where

"3" digit indicating the command type 'set output'.

<TOUT1> 3 digits stripe defining a second tenths time for the one shoot activation of the related output. Valid from "001" to "900". "000" deactivates the output immediately, "901" converts his logic status, "999" activates it definitely. Values from "902" to "998" bring no status changes.

<TOUT2 > 3 digit stripe indicating a second tenths time for the one shoot activation of the related output. Valid from "001" until "900". "000" deactivates tje output immediately, "901" converts his logic status, "999" activates it definitely. Values from "902" to "998" bring no status changes.

Timeout for each answer is 100 ms.

## 2.5 Set Single Output

This command enables the master to activate a single output.

**STX ADDS1 ADDS2 "4" <NOUT> <TOUT> ETX BCC** where

"4"	character indicating the type of command 'set single output'.
<NOUT>	String of 1 character defining the output position to be set. Valid values are "1" and "2".
<TOUT>	3-character string defining a time expressed in tenths of a second to activate in one-shot corresponding output. Valid by "001" to "900", "000" immediately disables the output, the value "901" reverses its logic, the value "999" activates it permanently. The values from "902" to "998" leave their status unchanged.

Timeout for Reply 100 milliseconds.

### Example

Switch Relay OFF: 04 04 02 3C 39 34 31 30 30 30 03 31

Switch Relay ON: 04 04 02 3C 39 34 31 39 39 39 03 38

## 2.6 Set Single Output Prolonged

This command enables the master to activate a single output with wider timeframe compared with normal control.

**STX ADDS1 ADDS2 "5" <NOUT> <TOUT> ETX BCC** where

"5"	character indicating the type of command 'set single output'.
<NOUT>	String of 1 character defining the output position to be set. Valid values are "1" and "2"
<TOUT>	string of 3 characters and defines a time in seconds for activation in one-shot corresponding output. Valid from "001" to "999".

Timeout for Reply 100 milliseconds.

## 2.7 Set Internal Commands

**STX ADDS1 ADDS2 "6" <NP> <TOUT\_ON\_1> <TOUT\_ON\_2> <TOUT\_OFF\_1> <TOUT\_OFF\_2> ETX BCC** where

"6"	character indicating the type of command 'set internal' command.
<NP>	String of 1 character defining the input position to be set. Valid values are: "1" button P1 "2" button P2 "3" external input IN1 "4" external input IN2
<TOUT_ON_1>	3-character string defining a time expressed in tenths of a second to activate in one-shot output 1 at the time of activation input indicated in <NP>. Valid from "001" to "900", the value "000" disables the output immediately, the "901" value reverses its logic, the value "999" activates the stable. The values from "902" to "998" leave the status unchanged.
<TOUT_ON_2>	3-character string defining a time expressed in tenths of a second to activate in one-shot output 2 upon activation input indicated in <NP>. Valid from "001" to "900", "000" disables the output immediately, the "901" value reverses its logic, the value "999" activates it permanently. The values from "902" to "998" leave the status unchanged.
<TOUT_OFF_1>	3-character string defining a time expressed in tenths of a second to activate in one-shot output 1 when the input deactivation indicated in <NP>. Valid from "001" to "900", the value "000" disables the output immediately, the "901" value reverses its logic, the value "999" activates the stable. The values from "902" to "998" leave their status unchanged.
<TOUT_OFF_2>	3-character string defining a time expressed in tenths of a second for activation in a one-shot output 2 at the time of input deactivation indicated in <NP>. Valid from "001" to "900", "000"



disables the output immediately, the "901" value reverses its logic, the value "999" activates it permanently. The values from "902" to "998" leave their status unchanged.

Timeout for Reply 100 milliseconds.

## 2.8 Set Address by button (P1 or P2)

This command is valid only the global (ADDG1 and ADDG2 equal to the character ASCII 60 hex) although it can be sent to a specific address, to identify the terminal thanks to the led display. The terminal that detects the pressure of P1 or P2 button within <TATT> tenths of a second will take the indicated address and respond with an event that indicates the input activation corresponding to the one pressed.

**STX ADDG1 ADDG2 "A" <NADD1> <NADD2> <TATT> ETX BCC** where or

**STX ADDS1 ADDS2 "A" <NADD1> <NADD2> <TATT> ETX BCC** where

<NADD1>	string of a character that represents the first half-byte of the address. Valid from 30 to 3F (which correspond to "0" and "?").
<NADD2>	string a character representing the second half-byte of the address. Valid from 30 to 3F (which correspond to "0" and "?").
<TATT>	3-character string indicating the waiting time of the P1 or P2 button is pressed in tenths of a second.

The new address acquired is saved in the E2PROM and valid immediately without the terminal restart. The waiting period of the setup pressing the ON LED will be lit.

Visual confirmation of acquisition new address will be given by the activation of the LED ON in the following sequence: 1 sec OFF + 5 times (200 msec ON + 200 msec OFF) + 1 sec ON.

After this sequence, or after the time <TATT>, the ON LED will return to normal operation (endless cycle of 50 msec ON and 2 seconds OFF).

### 3 Polling

#### 3.1 Request of basic setup

**STX ADDP1 ADDP2 "0" ETX BCC** where  
 "0" Digit indicating a polling of 'basic setup'.

If the polling is correctly received, the board answers as follows:

**STX ADDP1 ADDP2 "0" <NINV> <TMCODE> <SINPOT> <TINP> ETX BCC**  
 where data are the ones already seen by selecting (Setup 2).

Timeout for answer is 100 ms.

#### 3.2 Request Input State

**STX ADDP1 ADDP2 "1" ETX BCC** where

"1" indicating character poll 'request was input'.

If the polling is properly received, the card responds as follows:

**STX ADDP1 ADDP2 "1" <P1> <P2> <IN1> <IN2> ETX BCC** where

<P1> it represents input status P1. "0" = inactive state; "1" = active state

<P2> P2 represents input status. "0" = inactive state; "1" = active state

<IN1> it represents the input IN1 state. "0" = inactive state; "1" = active state

<IN2> it represents the input IN2 state. "0" = inactive state; "1" = active state

Timeout for Reply 100 milliseconds.

#### 3.3 Request Software Version

**STX ADDP1 ADDP2 "2" ETX BCC** where  
 "2" digit indicating the polling of version request.

If the polling is correctly received, the board answers as follows:

**STX ADDP1 ADDP2 "2" <VVVVVVVVVVVVVVVV> ETX BCC**

Value <VV..VV> represents a 16 digits alpha-numerical text (actually "A& EM4x02 V.1.14"). "V.1.14" indicates the terminal firmware version.

Timeout for answer is 100 ms.

#### 3.4 Request Output State

**STX ADDP1 ADDP2 "3" ETX BCC** where

"3" indicating character poll 'request was output'. If the polling is properly received, the card responds as follows:

**STX ADDP1 ADDP2 "3" <OUT1> <OUT2> ETX BCC** where

<OUT1> represents the state of the Output. "0" = inactive state; "1" = active state

<OUT2> represents the state of the Output. "0" = inactive state; "1" = active state

Timeout for Reply 100 milliseconds.

### 3.5 Request Internal Comm

**STX ADDP1 ADDP2 "6" <NP> ETX BCC** where

"6" character indicating the polling of 'domestic demand' command.

<NP> String of 1 character defining the input location you want to know the internal command.

Valid values are:

"1" button P1 "2" button P2

"3" external input IN1 "4" external input IN2

If the polling is properly received, the card responds as follows:

**STX ADDP1 ADDP2 "6" <NP> <TOUT\_ON\_1> <TOUT\_ON\_2> <TOUT\_OFF\_1> <TOUT\_OFF\_2> ETX BCC** where

The data are those seen in Selecting.

## 4 Events

### 4.1 Input Event

An event so formatted can be sent on the initiative of the terminal, while observing the setup parameters, to indicate activation or deactivation of an input.

**STX ADDP1 ADDP2 "3" <NINP> <INP> ETX BCC** where

<NINP> Indicates the input index. Valid values are:

- "1" button P1
- "2" button P2
- "3" external input IN1
- "4" external input IN2

<INP> represents input status <NINP>. valid values

- "0" input deactivated
- "1" input activated

Timeout for Reply 100 milliseconds.

The master must send the ACK (formatted as follows)

**ADDP1 ADDP2 ACK STX ETX BCC**

so that the terminal is not a subsequent submission (according to the parameters <NINV> and <TMCODE> defined in setup).

### 4.2 Anomaly Event

An event so formatted can be sent on the initiative of the terminal, while observing the setup parameters, to indicate an abnormality.

**STX ADDP1 ADDP2 "4" <TYPE> ETX BCC** where

<TYPE> indicates the type of fault found. It can take the following values:

- "1" Setup corrupt
- "2" ...

The master must send the ACK (formatted as follows)

**ADDP1 ADDP2 ACK STX ETX BCC**

so that the terminal is not a subsequent submission (according to the parameters <NINV> and <TMCODE> defined in setup).

## 5 Examples

The relays we sell are preconfigured with address 201 and 38400 Baud.

Address 201 = 0xC9 = ASCII: 3C 39

### 5.1 Example 1: Switch on relay 1 (chapter 2.5 Set Single Output).

This sets relay 1 on for 800 tenths = 80 seconds.

Descriptive:	STX	201/0xC9	„4“	„1“	„800“	ETX	BCC
Hexadecimal:	02	3C 39	34	31	38 30 30	03	39

To reset any buffer and restart communication, EOT (0x04) can be sent twice in front of the message.

So this is the full telegram in hexadecimal numbers: 04 04 02 3C 39 34 31 38 30 30 03 39

### 5.2 Example 2: Switch on relay 2 (chapter 2.6 Set Single Output Prolonged).

This sets relay 2 on for 480 seconds = 8 minutes.

Descriptive:	STX	201/0xC9	„5“	„2“	„480“	ETX	BCC
Hexadecimal:	02	3C 39	35	32	34 38 30	03	3F

To reset any buffer and restart communication, EOT (0x04) can be sent twice in front of the message.

So this is the full telegram in hexadecimal numbers: 04 04 02 3C 39 35 32 34 38 30 03 3F

### 5.3 Online Checksum Calculator

<http://www.scadacore.com/field-tools/programming-calculators/online-checksum-calculator/>

Use the CheckSum8 Xor

### 5.4 Successful Example

