DECODE

User Manual

EMU

Electricity Measurement Units

Legal notice

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Note: The specifications in this document are valid as of the listed versions of software and/or hardware. Revised versions of this document, as well as software and driver updates are available in the download area of the Decode web site.

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1 Preface

1.1 Symbols

WARNING - Safety notice, which must be followed, may have influence on the user's safety or the function of the device.

IMPORTANT - Notice, which must be followed to avoid possible problems, which can arise in specific cases.

NOTE - Notice, which contains useful advice.

1.2 Safety Instructions

Device must be used in compliance with any and all applicable international and national laws and in compliance with special restrictions regulating the utilization of the communications of the communication module in prescribed applications and environments.

WARNING - We suggest you to adhere to following recommendations so as to avoid any damage to person or property.

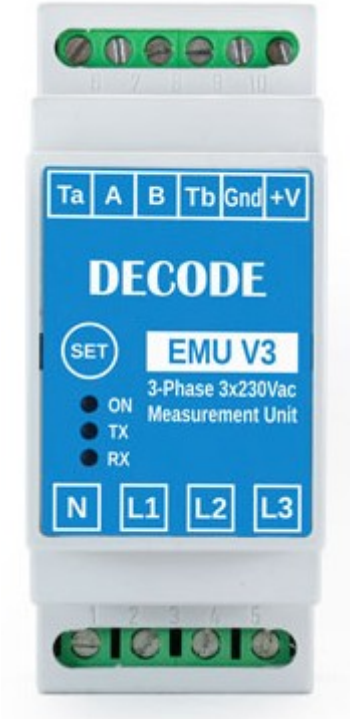
- **All the associated (interconnected) equipment, PC and power supply units (PSU) shell comply with requirements of standard IEC 60950- 1:2005+A1:2009+A2:2013.**
- **Power supply must have SELV output and for security reasons connection must include series 1A fuse protection.**
- **Access to terminal block connections must be checked and restricted in the end installation using potential hazardous voltage.**
- **Installation and technical support of the device can be performed only by a qualified personnel or a person who has enough knowledge about this device and safety requirements.**
- **Unauthorized modifications or utilization of accessories that have not been approved may result in damage to the device and in a breach of applicable regulations, and result in the termination of the validity of the guarantee.**
- **Do not expose the device to extreme ambient conditions. Protect the device against dust, moisture and high temperature.**

1.3 Document versions

Document version	Version FW / HW	Date	Note
v1.0	v1.00 / Rev. 141014	09/12/2014	Initial version
v1.1	v1.00 / Rev. 060315	26/01/2015	Corrections of registry data types
v1.2	v1.00 / Rev. 060315	05/04/2020	Formating to new template

2 Description

The Decode EMU Series measurement units are AC Voltage or Current Digital Transducers with pure RMS measurement. The digital technology is used to measure voltage, current and frequency in single and three phase designs. Depending of variant, analog measurement of PT100/PT100 temperature sensors and DC currents and voltages may be performed. It is intended for mounting on DIN rail 35mm.



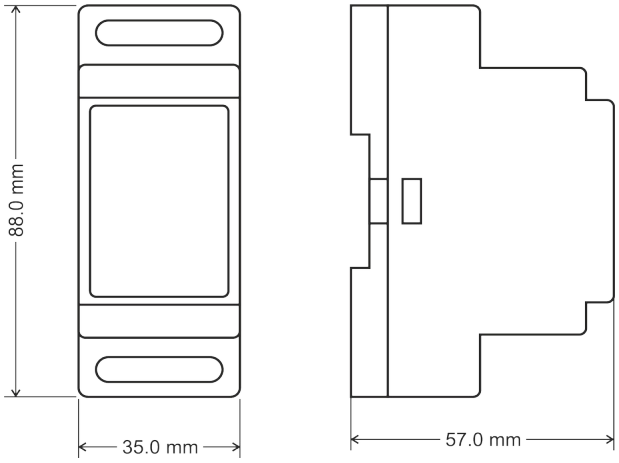
Picture 1: Decode EMU

The data is served over an RS485 bus which enables multiple transducers to communicate thru a single master connection. These advanced sensors are ideal for entire plant or zone monitoring.

The measuring part is galvanically separated up to 3kV DC. There are three basic variants V3 for AC voltage, C3 for AC current and A3 for analog measurement, with more subvariants.

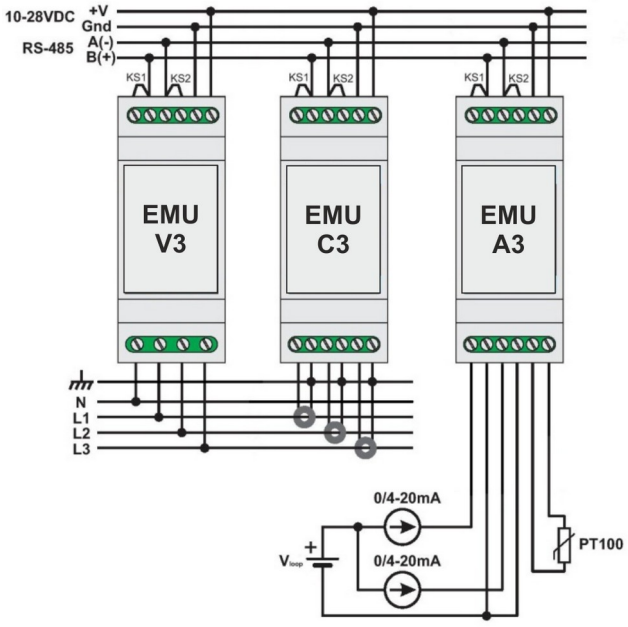
3 Installation

EMU enclosure is for standard DIN rails mounting, made of high quality plastic.



Picture 2: Dimensions

Depending of variant there are three typical wiring schematics: V3, C3 and A3.



Picture 3: Wiring schematics

KS1 and KS2 jumpers should be connected only if RS-485 line termination is required. At smaller distances, termination is not required. At distances greater than 100m and in conditions of major interference, termination is required on the slave device that is located at the end of the line.

4 Functionality

4.1 Normal mode

After powering the unit, device read parameters from non-volatile memory, enter NORMAL operation mode, perform periodic measurements and wait for communication. In this mode, the LED ON will flash in two-seconds cycle. LED indications, red for TX and green for RX, signal the sending and receiving of data along the RS-485 line. Wrong polarity of RS-485 line is indicated by constantly lit RX. Factory default parameters are modbus address 1, serial speed 9600 bits per second and format 8 bit with "no parity".

4.2 Setup mode

The SETUP mode is used to perform modification of internal parameters stored in non-volatile memory. Values from non-volatile memory are used to initialize registers 40008 to 40016 after power on. This mode is entered by holding the SET button while powering on the device. Unit switches on and after a while LED ON starts to flash in one-second cycle. Then the button can be released.

In SETUP mode, the serial speed, format and modbus address are automatically adjusted to 9600 bps, "no parity" and 1, regardless of the preset from non-volatile memory.

To modify values in registers 40008 to 40017, the modbus function 06 - Preset single register is used. Registers 40001 to 40007 are read only. Parameters like modbus address, serial speed and format settings are set in registers 40014, 40015 and 40016. Registers 40008 to 40013 should not be adjusted because they hold calibration parameters and are already set in production.

Storing the values from registers 40008 to 40016 to nonvolatile memory is issued with special command by preset the value 11111 in register 40017. Register 40017 automatically returns the value to 0 after execution command.

Exiting the SETUP mode is only possible by powering the unit off and on without holding the SET button.

5 Modbus communication

The Decode EMU device supports the Modbus RTU protocol on the RS-485 port. Supported serial speeds are 1200, 2400, 4800, 9600, 19200, 57600 and 115200 bits per second. Supported formats are 8 bit and No Parity, Even Parity or Odd Parity.

Device support two modbus functions: 03 - Read holding register and 06 - Preset single register which may be used only in SETUP mode.

5.1 Supported functions

5.1.1 Function 03 - Read Holding Register

The query consists of 8 bytes. Make sure that only existing registers can be read.

Byte	Field name	Content
1	Device address	x
2	Function	3
3	Register address Hi	x
4	Register address Low	x
5	Register number Hi	x
6	Register number Low	x
7	CRC error check Lo	x
8	CRC error check Hi	x

The response consists of n + 5 bytes, n is from 2 to 34, so the length is from 7 to 39 bytes:

Byte	Field name	Content
1	Device address	x
2	Function	3
3	Bytes number	n
4	Register Hi	x
5	Register Low	x
...	...	...
n+4	CRC error check Lo	x
n+5	CRC error check Hi	x

5.1.2 Function 06 - Preset Single Register

The query consists of 8 bytes. This function may be used only in SETUP mode for registers from 40008 to 40017.

Byte	Field name	Content
1	Device address	x
2	Function	6
3	Register address Hi	x
4	Register address Low	x
5	Register number Hi	x
6	Register number Low	x
7	CRC error check Lo	x
8	CRC error check Hi	x

The response consists of 8 bytes:

Byte	Field name	Content
1	Device address	x
2	Function	6
3	Register address Hi	x
4	Register address Low	x
5	Register number Hi	x
6	Register number Low	x
7	CRC error check Lo	x
8	CRC error check Hi	x

5.1.3 Function Error

In the event of an error, the following response is returned.

Byte	Field name	Content
1	Device address	x
2	Function	8
3	Error code	1, 2, 3 or 4
4	Register address Low	x
5	Register number Hi	x

Error code may have folowing values:

1 - Function code not supported

2 - Reading registers out of range (> 40017)

3 - Number of registers out of range (> 17)

4 - Function execution error

5.2 Internal Modbus memory map

The memory map is the same in all three variants, except that the measurement units are different. The address is given in relation to the so-called "Base 0". Addresses referenced to "Base 1" are incremented by one. All registry values for C3 and V3 variants are in uint16 format and for A3 variant are in int16 format.

Register	Address	Variable EMU C3	Variable EMU V3	Variable EMU A3
40001	0	CT1 current (x1mA)	L1 voltage (x10mV)	Current 0-25mA (x1μA)
40002	1	CT2 current (x1mA)	L2 voltage (x10mV)	Current 0-25mA (x1μA)
40003	2	CT3 current (x1mA)	L3 voltage (x10mV)	Temperature (x0.01°C)
40004	3	0 – not in use	L12 voltage (x10mV)	0 - not in use
40005	4	0 - not in use	L23 voltage (x10mV)	0 - not in use
40006	5	0 - not in use	L31 voltage (x10mV)	0 - not in use
40007	6	0 - not in use	Frequency (x0.01Hz)	0 - not in use
40008	7	CT1 span calibration	L1 span calibration	IN1 span calibration
40009	8	CT2 span calibration	L2 span calibration	IN2 span calibration
40010	9	CT3 span calibration	L3 span calibration	IN3 span calibration
40011	10	0 - not in use	L12 span calibration	IN1 offset calibration
40012	11	0 - not in use	L23 span calibration	IN2 offset calibration
40013	12	0 - not in use	L31 span calibration	IN3 offset calibration
40014	13	Modbus address (1-247)		
40015	14	Serial speed (0, 1, ... , 5) 0 - 1200 1 - 2400 2 - 4800 3 - 9600 4 - 19200 5 - 38400 6 - 57600 7 - 115200		
40016	15	Serial format (0, 1, 2) 0 - No Parity 1 - Even Parity 2 - Odd Parity		
40017	16	Command for writing registers 40008 - 40016 to non-volatile memory. In SETUP mode, writing 11111 starts the command and returns the register value to 0 after execution. In NORMAL mode, the value does not return to 0 and the command does not execute.		

6 Technical characteristics

6.1 Common characteristics of EMU V3, C3, A3

Number of inputs	3
Communication	Modbus slave, RS-485, address range 1-247, broadcast address 0
Serial speed	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Data format	1 start, 8 data, parity: None, Even, Odd
Factory defaults	9600bps, 1 start, 8 data, parity none, Modbus address 1
Connection	Screw terminals
Power supply	10-28V DC
Consumption	less than 1W
Enclosure	Plastic, DIN 35mm rail mounting
Dimensions	35 x 88 x 57 mm
Isolation	3000V DC

6.2 EMU V3 – Three phase AC voltage

Measured parameters	AC voltage L1, L2, L3, L12, L23, L31, frequency
Measurement type	True RMS, frequency is measured indirectly by measuring the signal period
Measurement range	L1, L2, L3 0-250V AC rms L12, L23, L31 0-500V AC rms Frequency 20-70Hz
Resolution	Voltage 10mV rms Frequency 0.01Hz

6.3 EMU C3 - Three phase AC current, with CT*

Measured parameters	AC current CT1, CT2, CT3
Measurement type	True RMS
Measurement range	0-5A AC rms
Resolution	Current 1mA rms Frequency 0.01Hz

* Must be used with current transformers (CT) with 5A output.

6.4 EMU A3-TTT* - 3 x analogue input

* TTT denotes input type

Example: Type EMU A3-001 has the first two inputs 0 / 4-20mA and third input PT100.

6.4.1 Type T = 0

Measured parameters	0/4-20mA, input resistance 40 Ω
Measurement range	0-25mA DC
Resolution	0.001mA

6.4.2 Type T = 1

Measured parameters	PT100
Measurement range	-50 °C ~ +150 °C
Resolution	0.01 °C

6.4.3 Type T = 2

Measured parameters	PT1000
Measurement range	-50 °C ~ +150 °C
Resolution	0.01 °C

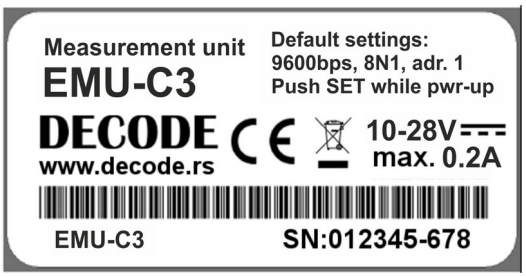
6.4.4 Type T = 3

Measured parameters	0-5V DC
Measurement range	0-5V DC
Resolution	1mV

6.4.5 Type T = 4

Measured parameters	0-10V DC
Measurement range	0-10V DC
Resolution	1mV

7 Product label



Picture 4: Product label

The label fixed on the right side of enclosure comprises information listed in next table.

Line 1	Product name		Additional informations about product (optional)	
Line 2	Product model			
Line 3	Manufacturer	CE mark	Waste Disposal	Supply voltage
Line 4	Manufacturer address			Maximum current
Line 5	Bar code with Product ID and Serial number			
Line 6	Product ID		Serial number	

8 Disposal and Recycling

You must dispose of this product properly according to local laws and regulations. Because this product contains electronic components, it must be disposed of separately from household waste. When this product reaches its end of life, contact local authorities to learn about disposal and recycling options, or simply drop it off at your local Decode office or return it to Decode.

9 Contact

Please contact a Decode office if you have any questions regarding the information contained in this manual or Decode products, or if you have any other inquiries.

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