

## Documentation for a CPM build, description of I2C communication.

### CPM Programming

CPM - battery multiplexer with the gradual connection of channels by using mosfet switches which secure infinite resistance and zero consumption after the disconnection of an entire board. Galvanic isolation is solved by switching one cell at a time. Energy for switches is secured by a capacity of 10uF (e.g C4) which is recharged by switching Q42 - Q47. The period is roughly 4-6ms per channel.

Source code - directory: Source/CPXxxxx

Compiler MIKROC V7.2.0

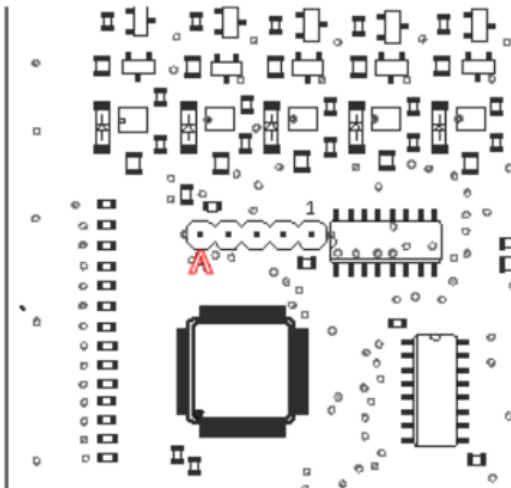
SCH a BRD - EAGLE v9.3

Binary/HEX file – directory Production/CPM/binary/version xxx/CPMxxx.hex

Processor P16F19196

Programmer PlcKit3

Programming of CPM board is different because of its power supply which has to be present during the programming - it's necessary to hold the START button for the entire time of its programming and only after that start the programming. PIN 1 is closer to the edge of the board. If the board is fitted and soldered correctly, the board works well on a first connection attempt.



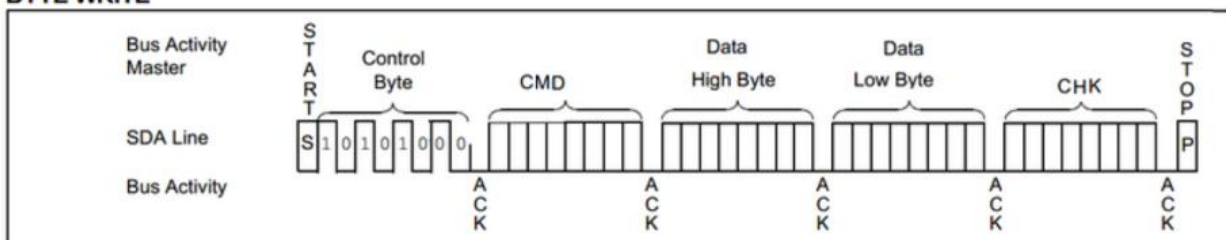
### Description of I2C interface, connector IQBUS

I2C address of a device CPM slave - 0x2A. This address was chosen on a basis of i2c HW usage of other manufacturers.

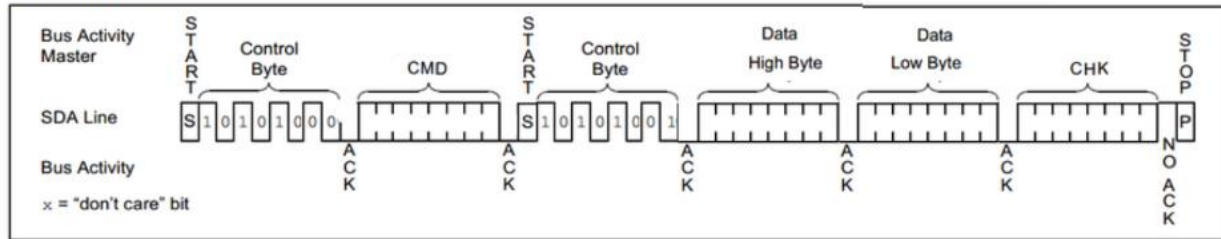
The speed of a bus is maximum 50kHz

Read and write data are described in the following diagram:

#### **BYTE WRITE**



# RANDOM READ



CHK is a control sum and XOR of two previous bytes. Meaning that  $CHK = \text{High Byte XOR Low Byte}$ . CHK was implemented as a preventive measure for interference.

Registry description:

Registr	CMD (dec)	flag	Description
U1CELL	1	READ	Voltage of the cell 1 in mV
U2CELL	2	READ	Voltage of the cell 2 in mV
U3CELL	3	READ	Voltage of the cell 3 in mV
U4CELL	4	READ	Voltage of the cell 4 in mV
U5CELL	5	READ	Voltage of the cell 5 in mV
U6CELL	6	READ	Voltage of the cell 6 in mV
U7CELL	7	READ	Voltage of the cell 7 in mV
U8CELL	8	READ	Voltage of the cell 8 in mV
U9CELL	9	READ	Voltage of the cell 9 in mV
U10CELL	10	READ	Voltage of the cell 10 in mV
U11CELL	11	READ	Voltage of the cell 11 in mV
U12CELL	12	READ	Voltage of the cell 12 in mV
U13CELL	13	READ	Voltage of the cell 13 in mV

U14CELL	14	READ	Voltage of the cell 14 in mV
U15CELL	15	READ	Voltage of the cell 15 in mV
U16CELL	16	READ	Voltage of the cell 16 in mV
UTOTAL	17	READ	Total voltage in mV
EVENTS	18	READ	Bit 15 – UhavFAIL event Bit14 – UminFAIL event Bit13 - UmaxFAIL event  f.e. 0x8000 – UhavFAIL YES, UminFAIL NO,UmaxFAIL NO
UMINPOT	19	READ	Voltage on the selector UMIN in mV
UMAXPOT	20	READ	Voltage on the selector UMAX in mV
RUMINPOT	21	R/W	Voltage setted in mV and accepted instead of the selector UMIN, validation of the setted voltage is 1 minute, after that it automatically resets on 0xFFFF
RUMAXPOT	22	R/W	Voltage setted in mV and accepted instead of the selector UMAX, validation of the setted voltage is 1 minute, after that it automatically resets on 0xFFFF

UMIN12	23	R/W	Setting of output - UMIN12 <b>WRITE</b> RESWITCH      0xA5A5 ONSWITCH      0xA115 OFFSWITCH      0xA005 <b>READ</b> ON              0x0001 OFF             0x0000
UMIN3	24	R/W	Setting of output - UMIN3 <b>WRITE</b> RESWITCH      0xA5A5 ONSWITCH      0xA115 OFFSWITCH      0xA005 <b>READ</b> ON              0x0001 OFF             0x0000
UMIN4	25	R/W	Setting of output - UMIN4 <b>WRITE</b> RESWITCH      0xA5A5 ONSWITCH      0xA115 OFFSWITCH      0xA005 <b>READ</b> ON              0x0001 OFF             0x0000
UMAX12	26	R/W	Setting of output - UMAX12 <b>WRITE</b> RESWITCH      0xA5A5 ONSWITCH      0xA115 OFFSWITCH      0xA005 <b>READ</b> ON              0x0001 OFF             0x0000
UMAX3	27	R/W	Setting of output - UMAX3 <b>WRITE</b> RESWITCH      0xA5A5 ONSWITCH      0xA115 OFFSWITCH      0xA005 <b>READ</b> ON              0x0001 OFF             0x0000
UMAX4	28	R/W	Setting of output - UMAX4 <b>WRITE</b> RESWITCH      0xA5A5 ONSWITCH      0xA115 OFFSWITCH      0xA005 <b>READ</b> ON              0x0001 OFF             0x0000
EMERG12	29	R/W	Setting of output - EMERG12 <b>WRITE</b>

			RESWITCH 0xA5A5 ONSWITCH 0xA115 OFFSWITCH 0xA005 <b>READ</b> ON 0x0001 OFF 0x0000
EMERG3	30	R/W	Setting of output - EMERG3 <b>WRITE</b> RESWITCH 0xA5A5 ONSWITCH 0xA115 OFFSWITCH 0xA005 <b>READ</b> ON 0x0001 OFF 0x0000
RESET	31	R/W	Write of value 0x0001 to the register cause the same setting of the event as during the first CPM board turn on.
TURNOFF	32		Write of value 0x0001 to the register turns off the CPM board
IDEVCELL	33	READ	Number of a cell on which the event got created.
CELLV	34	READ	Its voltage
IDTYPE	35	READ	Type of events: 0x0000 Umin, 0x0001 Umax, 0x0002 UMINHAV, 0x0003 UMAXHAV
EVTOTALV	36	READ	Total voltage of a battery during the events in mV