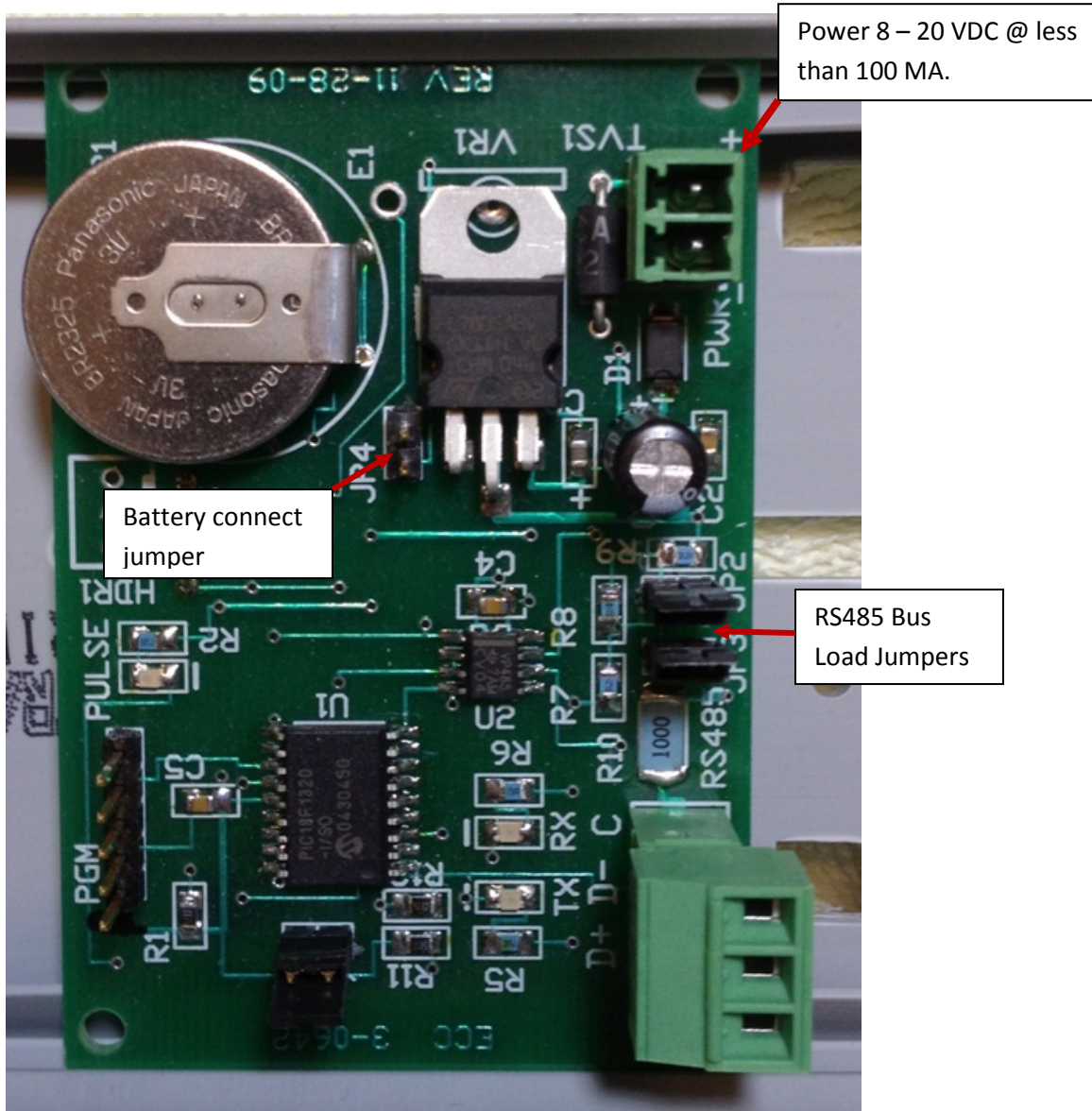


Real Time Clock with Temperature Sensor and RS485/Modbus Communications

April 29, 2014



Model: RTC-TI2C

Features:

- [RS485](#)/Modbus communications.
- Battery maintains clock calendar in absence of power for an estimated 10 years.
- Temperature sensor to monitor control cabinet temperature etc.
- On board voltage regulator allows for unregulated power input such as a wall adapter.
- The RTC-TI2C can be panel mounted, three inch Snap Track mounted, or optional adapter can be added to the Snap Track for DIN Rail mounting. The circuit board measures 2.0 x 2.95 inches.
- Protocol can be switched from Modbus to Simple ASCII Protocol.
- Operating temperature -40 to +85°C.
- Measured temperature sensor range is -55 to +127°C ±1.0°C. Limit to -40 to +85°C.

Application:

- Any place where real time/temperature needs to be monitored.
- Especially useful when the circuit to be monitored is not near the master controller. RS485 twisted pair bus can operate up to 4000 ft.
- Use when a PLC can't take the heat.

Modbus Communications:

The RTC-TI2C uses default values at power up/reset if not previously programmed.

To restore defaults to a programmed device, jumper pins 2 and 5 on program header and cycle power, or send a command to restore defaults.

Defaults:

- Unit address: 0x01.
- MODBUS Protocol: RTU
- Baud Rate: 19.2K, 8, N, 2 - Compatible with Automation Direct PLCs and VFDs.

The RTC-TI2C was designed to operate as a slave device on a RS485, Modbus network. The master can be any controller such as a PC or PLC that communicates using a RS485 network and the Modbus protocol. It can be slaved to ECC's DCB2620 operating in the master mode.

MODBUS Read and Write Commands:

RTC-TI2C uses MODBUS read command (0x03) and write one word command (0x06). If a RS485 master such as the Automation Direct DL06 sends command 0x10 i.e. write multiple words command, the RTC-TI2C will process it as command 0x06 and write the first data word to memory.

The one exception is when the command is 0x10 and the address is 0x290. In this case the RTC-TI2C writes the time and date (multiple bytes) to the real time clock.

Command Table:

Hex Write Addr	(MODBUS)	CMD	Function
0x280	V1200	0x03	Master writes to RTC-TI2C slave – Slave returns temperature.
0x281	V1201	0x06	Writes LS byte of data word to EEPROM unit address. *1, *2
0x282	V1202	0x06	Writes LS byte of data word to EEPROM baud rate address. *2
0x283	V1203	0x06	Writes LS byte of data word to EEPROM protocol address. *2
0x290	V1220	0x03	Master writes to RTC-TI2C slave – Slave returns time and day.
0x290	V1220	0x10	Writes time and date to RTC-TI2C.
0x291	V1221	0x03	Master writes to RTC-TI2C slave – Slave returns date.
0x299	V1231	0x06	Writes LS byte of data word to RESET unit. *3

NOTE: Configuration commands 0x281 – 0x283 do not take effect until the unit is reset. The changes are stored in non-volatile memory and become the operating parameters after a power cycle, or after a reset command.

NOTES:

*1 The default address is 0x01. If multiple units are on the same RS485 network, the addresses must be changed for all but one of the units. This is normally done using a free Configuration program that can be downloaded from ECC's Website.

The address can also be changed using an ASCII terminal program as follows:

- RESET RTC-TI2C
- Send keyboard <ESC> character (decimal 27, or hex 0x1B).
- Address characters <MS> + <LS> +<E> Excluding 27 (ESC) and 69 ('E'), allowable addresses are 01 – 99 DEC.

Example: Enter address 16 (0x10).

RESET unit.

Enter keys: <ESC> <1> <6> <E>

No spaces between keys.

To enter addresses 1 – 9: <ESC> <0> <n> <E>

Note: This is the only place where decimal data are entered. RTU values are HEX.

If the address is set this way, the unit does a self reset. The programming device can be removed, and the network RS485 terminal block plugged in. The unit will start responding to its new address.

*2. New values take effect after RESET (command or power cycle).

*3. This command can be used to reset a unit instead of a power cycle.

Broadcast Data:

If it is desirable to change a parameter in all networked devices, the broadcast slave address can be used. The slave address of zero (0x00) causes all units on the network to receive the command. For example, a broadcast command to change the baud rate, followed by a broadcast reset command would cause all units to switch baud rates at the same time.

MODBUS write (one word) command 6, 0x06:

Send: |slave addr. |CMD 6|write Hi addr. |write Low addr. |data Hi|data low|crc Low|crc Hi|

Example: Address slave 5 and write 0x03 to 0x281 i.e. change slave address to 0x03 .
|0x05|0x06|0x02|0x81|0x00|0x03|crc Low|crc Hi|

Response:

The response is the same as the data sent if the slave received valid data. If invalid data was received, the slave will not respond – master must time out and continue.

MODBUS write (multiple words) command 16, 0x10:

Send: |slave addr. |CMD 16|starting Hi addr. |starting Low addr. |#words Hi|#words Low|

*byte count |data Hi|data low|-----|data n Hi|data n low|crc Low|crc Hi|

*byte count = #words x 2.

Response:

|slave addr. |CMD 16|starting Hi addr. |starting Low addr. |#words Hi|#words Low| crc Low|crc Hi|

Setting Real Time in RTC-TI2C using command 16, 0x10:

The real time data format is: |Hours|Minutes|Seconds|Day of week|Month|Date|0x00|Year|

Hours are based on 24 hour clock, 0 – 23 hours (0x00 – 0x17).

Minutes and seconds are 0 – 59 (0x00 – 0x3b).

Day is Sunday, day 1 through Saturday, day 7 i.e. 1 – 7.

Send to set time:

|slave addr|0x10|0x02|0x90|0x00|0x04|0x08|Hr|Min|Sec|Day|Mo|Date|0x00|Yr|crc low|crc Hi|

MODBUS read command 3, 0x03:

Send: |slave addr.|CMD 3|starting Hi addr.|starting Low addr.|#words Hi|#words low|crc Low|crc Hi|

Response:

|slave addr.|CMD 3|#bytes|data Hi|data Low|-----| data n Hi|data n Low| crc Low|crc Hi|

Status Returned from RTC-TI2C Response to Command 0x03 Read 0x280:

MODBUS RTU Serial Data Format for Temperature:

|Unit Addr|CMD 0x03|#data bytes|data|CRC LO|CRC HI|

#data bytes = 2

Data High: 0x00 or 0x01 where 0x01 is a negative value i.e. temperature below 0° C.

Data Low: 0x00 – 0x7F (0 to +127° C) for positive values. Each count equals 1.0° C.

Data Low: 0x00 – 0x37 (0 to -55° C) for negative values.

Status Returned from RTC-TI2C Response to Command 0x03 Read 0x290:

MODBUS RTU Serial Data Format for Time and Day:

|Unit Addr|CMD 0x03|#data bytes|data|CRC LO|CRC HI|

#data bytes = 4.

Data = |hr|min|sec|day| all data is hex.

Hr = 0x00 – 0x17 based on 24 hour clock

Day = 1 – 7.

MODBUS RTU Serial Data Format for Date:

|Unit Addr|CMD 0x03|#data bytes|data|CRC LO|CRC HI|

#data bytes = 4.

Data = |mo|date|0x00|yr| all data is hex.

Mo = 1 – 0x0c.

Yr = 0x00 – 0x63.

Write one word Command 0x06 – format above.

Unit Address 0x281:

Write data word:

High byte = 0x00

Low byte = 0x01 – 0x63 i.e. 1 thru 99 i.e. set slave address

Unit Baud Rate 0x282:

Write data word:
 High byte = 0x00
 Low byte = 0x51 for 19.2k
 Low byte = 0x52 for 9600

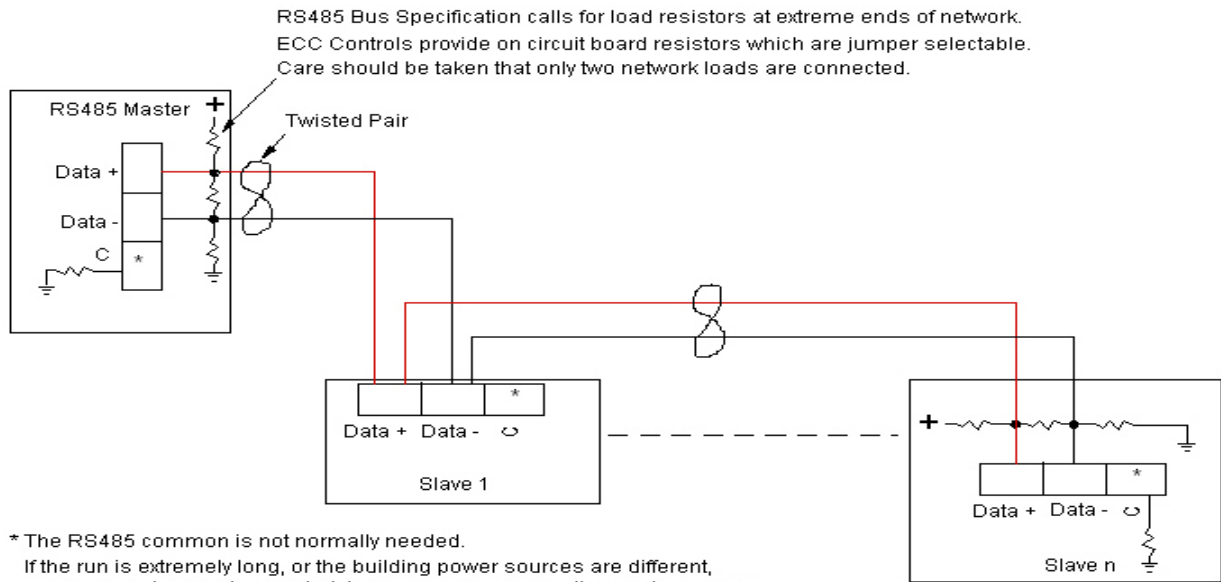
Unit Protocol 0x283:

Write data word:
 High byte = 0x00

Low Byte	Meaning
0x51	MODBUS RTU, 8 data bits, no parity, 2 stop bits.
0x52	MODBUS RTU, 8 data bits, even parity, 1 stop bit.
0x53	MODBUS RTU, 8 data bits, odd parity, 1 stop bit.
0x54	Future

For additional Modbus protocol information, see the manual for DCB2620.

For a simple protocol, see Simple ASCII Protocol document.



* The RS485 common is not normally needed.
 If the run is extremely long, or the building power sources are different,
 a common wire may be needed. In many cases, connecting each common
 to an earth (conduit) ground will work.
 If a shielded twisted pair is used, only connect the shield to ground at the master.

Typical RS485 Bus Connections.

If a master other than an ECC control is being used, and it does not have bus load resistors, use the bus load resistor on the ECC slave nearest the master, and the one that is at the greatest distance from the master.