



TeleMeter

Wireless Analog Telemetry Module

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Features

- Atmel **ATmega32** RISC CPU @ 16MHz
- **EasyRadio** 869MHz ISM band RF transceiver, license-free operation
- **2 analog inputs with 12bit ADC**, configurable to 0..5V, 0..10V, 0..20mA and programmable gain
- **2 analog outputs with 12bit DAC**, buffer amplifier with programmable gain
- 1 **USB 2.0** interface
- **32Kbytes** nonvolatile storage in **FRAM**
- **Battery-backed real time clock** for data logging applications
- An **expansion** connector with SPI, I2C, Interrupt and Reset signals.
- **Voltage regulator** with input protection, suitable for vehicle operation
- 2 control **LEDs** for RF traffic and link status
- Bi-directional data exchange in half-duplex mode
- Master/Slave operation with matched pairs

Ordering Information

Art.-No. 01.0033

TeleMeter, OEM board

Contact:

Elektronik-Atelier Kallen

Steinackerweg 14
CH-3075 Rüfenacht / Switzerland

Web: www.avrcard.com

Email: info@avrcard.com

Tel: +41-31-832 1441

Fax: +41-31-832 1442

Specifications

RF

Frequency	869.9MHz, +- 10ppm
RF output power	+5dBm
FM deviation	64kHz
Harmonics	-25dBc
Receiver sensitivity	-102dBm for BER = 10E-3
L.O. leakage	-60dB, Meets EN 300 220-3
Over air data rate	19'200bps, manchester encoded
Antenna impedance	50 Ohm
Connector	SMA female

I/O

Analog Inputs	0..5V, 0..10V or 0..20mA, 12 bit resolution, configurable with on-board resistors
Analog outputs	0..4.096V, 12bit resolution, voltage output, 80mA max.
USB	USB 2.0 slave, USB-Serial adapter

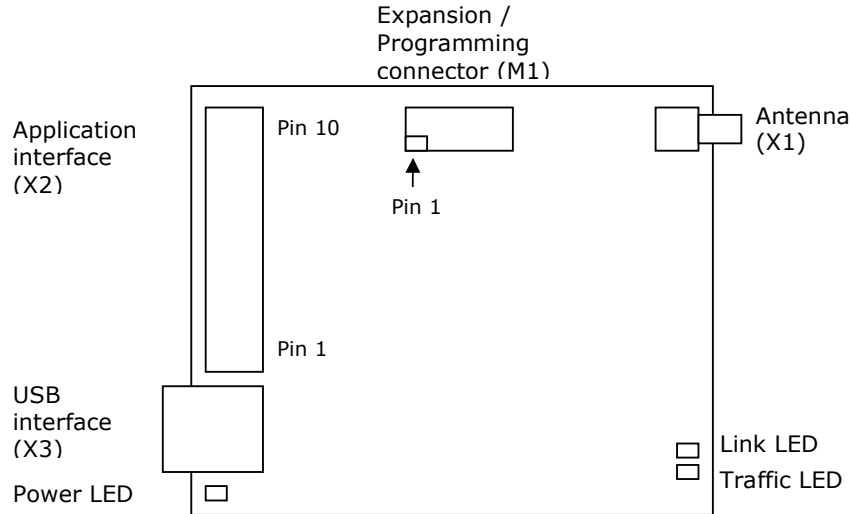
Power Supply

Requirement	7...24VDC, max. 130mA
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Mechanical

Size (L x W)	80 x 65 mm
Weight	65 g

Connector Specifications



Application Interface

X2: Application			
No.	Signal	Type	Description
1	VIN	POWER	DC Input voltage, 7-12VDC
2	GND	POWER	Ground
3	VREF	OUT	Reference voltage output, 4.1V
4	GND		Ground
5	AIN0	IN	Analog input 0, 0...12V
6	AIN1	IN	Analog input 1, 0...12V
7	GND		Ground
8	AOUT0	OUT	Analog Output 0, 0...4.1V, max. 80mA
9	AOUT1	OUT	Analog Output 1, 0...4.1V, max. 80mA
10	GND		Ground

Antenna

X1: Antenna			
No.	Signal	Type	Description
1	ANT	RF	869/914MHZ Antenna
2	GND	POWER	Ground

Expansion / Programming

M1: Expansion			
No.	Signal	Type	Description
1	MISO		SPI bus
2	+5V		Digital power for expansion, max. 50mA
3	SCK		SPI bus
4	MOSI		
5	RESET		CPU Reset Input/Output
6	GND		Signal and power ground
7	CS		Connected to PB4/SS
8	INT		Connected to PD2
9	SCL		I2C Bus
10	SDA		

Device Operation

Master/Slave

The devices operate either as a master transceiver and a slave transceiver. The inputs of one participant are mirrored on the outputs of the other one and vice versa.

The master and slave modules are constructed absolutely identically, the selection of the operation mode and the addressing of the devices is configured through the USB interface and persistently stored in the module.

The master always initiates communication, whereas the slave only transmits information in response to a request from the master.

Traffic LED

On the master, the traffic LED flashes when a message is being sent.

On the slave, the traffic LED flashes when a valid message with matching device address is received.

Link LED

The link led is on when a valid message from the remote module has been received. It times out on master and slave. When no link is established, the master sends out search packets and re-establishes the data link as soon as it receives a response from the addressed slave.

When a data link is established, data messages are exchanged between master and slave in a configurable time interval.

Setup

Device Configuration

For configuration of operational parameters, the TeleMeter modules provide access to a terminal monitor through a virtual serial link over the USB connection. In order to use the terminal monitor, the following is required:

1. PC with a terminal application
2. Installed driver for the FT245 USB-Serial adapter and the virtual COM port (see following chapter for installation instructions)
3. USB cable connected between TeleMeter module and PC. The TeleMeter module must be powered by a separate source.

Once the VCP driver has been installed, the terminal program can be launched and connected to the appropriate virtual COM port.

Monitor Commands

The commands are invoked with single letters. Below is a description of all available commands.

Command:	S
Description:	Display Operational Status
Response:	<code>OpMode: Master Slave</code> <code>Status: connected disconnected</code>
Command:	D
Description:	Locally Set DAC Output This command can only be used when no data link is established with another TeleMeter module. Otherwise the entered values will be overridden by the received data messages
Response:	A =
Entry:	Hex value of DAC0 word (4 digits)
Response:	B =
Entry:	Hex value of DAC1 word (4 digits)
Command:	V
Description:	Get local ADC measurement values
Response:	<code>ADC0 = yyyy #xxxx nn.nnnV</code> <code>ADC1 = yyyy #xxxx nn.nnnV</code> Yyyy = raw ADC readout as integer, xxxx = raw ADC readout as hex, nnn = calculated voltage, based on ADC readout and calibration value

Commands in Configuration Mode

Command:	C
Description:	Enter Configuration Mode
Response:	>
After a subcommand is completed, the '>' prompt is displayed until configuration mode is left.	
Subcommand:	?
Description:	Show current configuration parameters
Response:	MyAddr: 44 Peer: 45 Calibration ch0 = 263.047 Calibration ch1 = 263.156 FW Rev: 1.0
Subcommand:	M
Description:	Set Master or Slave Mode
Response:	Enter OpMode (M/S):
Entry:	M for Master mode S for Slave mode
Subcommand:	L
Description:	Set Local Node Address
Response:	Enter local node address (hex):
Entry:	hex value of local node address
Subcommand:	R
Description:	Set Remote Node Address
Response:	Enter remote node address (hex):
Entry:	hex value of remote node address
Subcommand:	D
Description:	Set Data Message Interval
Response:	Enter data message interval (30..2550 ms):
Entry:	value of interval in ms
Subcommand:	0
Description:	Calibrate channel 0
Response:	Apply 1.2V to ADC channel 0 Enter exact input voltage
Entry:	value of measured voltage on ADC0 input terminal
Response:	Calibration value 0 = xx.xxx
Subcommand:	1
Description:	Calibrate channel 1
Response:	Apply 1.2V to ADC channel 1 Enter exact input voltage
Entry:	value of measured voltage on ADC1 input terminal
Response:	Calibration value 1 = xx.xxx
Subcommand:	X
Description:	Exit Configuration Mode
Response:	none

**Subcommands in
Transfer Function
Mode**

Command:	T
Description:	Enter Transfer Function Mode
Response:	>
After a subcommand is completed, the '>' prompt is displayed until configuration mode is left.	
Subcommand:	?
Response:	Scale factor 0 = xx.xxx Scale factor 0 = xx.xxx
Subcommand:	0
Description:	Scale channel 0
Response:	Enter input voltage 0 for full DAC output
Entry:	value of voltage on ADC0 that is to be transferred to the remote DAC0 and produce a full voltage output of 4.096V
Response:	Scale factor 0 = xx.xxx
Subcommand:	1
Description:	Scale channel 1
Response:	Enter input voltage 1 for full DAC output
Entry:	value of voltage on ADC1 that is to be transferred to the remote DAC1 and produce a full voltage output of 4.096V
Response:	Scale factor 1 = xx.xxx
Subcommand:	X
Description:	Exit Transfer Function Mode
Response:	none

**Subcommands in
Radio
Configuration
Mode**

Command:	R
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Description:	Enter Radio Configuration Mode
Response:	>
After a subcommand is completed, the '>' prompt is displayed until configuration mode is left.	
Subcommand:	C
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Description:	Set RF channel
Response:	Set RF channel (0 = 869.9MHz, 1 = 914.65MHz)
Entry:	? for reading out current channel setting 0 for European channel setting (869.9MHz) 1 for US channel setting (914.65MHz)
Response:	ER_CMD#C0 ER_CMD#C1 for readout OK otherwise
Subcommand:	P
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Description:	Set RF power level
Response:	Set RF power
Entry:	? for reading out current power setting 0 for 0.0625mW 1 for 0.125mW 2 for 0.25mW 3 for 0.5mW 5 for 1mW 6 for 2mW 7 for 3mW 8 for 4mW 9 for 5mW
Response:	ER_CMD#P0...ER_CMD#P9 for readout OK otherwise
Subcommand:	X
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Description:	Exit Radio Configuration Mode
Response:	none

Driver Installation for USB-Serial Adapter

To install VCP drivers under Windows XP and XP SP1, follow the instructions below:

- 1 Download the latest available VCP drivers from the FTDI website (<http://www.ftdichip.com/Drivers/VCP.htm>) and unzip them to a location on your PC.
- 2 If you are running Windows XP or Windows XP SP 1, temporarily disconnect your PC from the Internet. This can be done by either removing the network cable from your PC or by disabling your network card by going to the "Control Panel\Network and Dial-Up Connections", rightclicking on the appropriate connection and selecting "Disable" from the menu. The connection can be re-enabled after the installation is complete. This is not necessary under Windows XP SP 2 if configured to ask before connecting to Windows Update. Windows XP SP 2 can have the settings for Windows Update changed through "Control Panel\System" then select the "Hardware" tab and click "Windows Update".
- 3 Connect the TeleMeter device to a spare USB port on your PC. This will launch the Windows Found New Hardware Wizard. If there is no available Internet connection or Windows XP SP 2 is configured to ask before connecting to Windows Update, the screen below is shown. Select "No, not this time" from the options available and then click "Next" to proceed with the installation. If there is an available Internet connection, Windows XP will silently connect to the Windows Update website and install any suitable driver it finds for the device in preference to the driver manually selected.
- 4 Select "Install from a list or specific location (Advanced)" and then click "Next".
- 5 Select "Search for the best driver in these locations" and enter the file path in the combo-box where the VCP drivers have been unzipped, or browse to it by clicking the browse button. Once the file path has been entered in the box, click next to proceed.
- 6 If Windows XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, a warning screen will be displayed. Click on "Continue Anyway" to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message will appear.
- 7 A progress screen will be displayed as Windows XP copies the required driver files.
- 8 Windows should then display a message indicating that the installation was successful. Click "Finish" to complete the installation. This has installed the serial converter. The COM port emulation driver must be installed after this has completed.
- 9 After clicking "Finish", the Found New Hardware Wizard will continue by installing the COM port emulation driver. The procedure is the same as that above for installing the serial converter driver.
- 10 Open the Device Manager (located in "Control Panel\System" then select the "Hardware" tab and click "Device Manger") and select "View > Devices by Type". The device appears as an additional COM port with the label "USB Serial Port" and a COM port number next to it.

Mounting considerations

When the TeleMeter modules are mounted in a metal cabinet, the antenna must be mounted outside by the use of an antenna extension. A radio transmission in or out a metal cabinet (Faraday cage) is impossible.

Do not place the radio devices or the antenna close to large metal objects, power cables, electric motors, transformers or drives. Each object between the radio modules will attenuate the radio waves.

The radio devices should be mounted as high above ground as possible.

Walls will attenuate the radio signal. Light walls have only a little impact whereas armed concrete walls or ceilings absorb a lot of the radio energy. The optimum is a line-of-sight condition between the devices.

Notice to Users

The intended use of the TeleMeter modules is described in this document. Other than the described uses are not permitted or only after consultation with the manufacturer.

TeleMeter modules are not authorized for use as critical components in life-support devices or systems.

Life-support devices or systems are devices or systems intended for surgical implantation into the body or to sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling and user's manual, can be reasonably expected to result in significant injury.

No complex software or hardware system is perfect. Bugs are always present in a system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

All TeleMeter modules are 100 percent functionally tested. Additional testing may include visual quality control inspections. Specifications are based on characterization of tested sample units rather than testing over temperature and voltage of each unit. TeleMeter modules may qualify components to operate within a range of parameters that is different from the manufacturer's recommended range.