To DO:
Alle Boards benötigen noch Versionsnummer
Pull-ups an Uart

Roadmap:
- To gain experience with the TP-Uart Transceiver.
- Switch over to the TP-UART2 Transceiver, if I need more than the 10mA

Development Environment:
I built a compact switching box with all necessary components.

My Projects
Available Projects/boards:

status:
- KNX Sensor-platform Board
  (under development)
- NRF24I01+_Ethernet_KNX-Gateway
  (under development)
- Arduino NRF24I01+ Battery supply Temp-Sensor
  (in use, since Feb’15)
- KNX control panel with 6 buttons and status LEDs
  (under development)
- KNX Outside Temperature Sensor
  (under development)
- KNX Motion Detector
  (under development)
- KNX Smart Energy Meter
  (future design)
- 

Self developed KNX-BUS Interface:

On the market it gives more than one Transceiver-IC which is specialized designed for the KNX Bus:

Siemens:
- TP-Uart
- TP-Uart2
OnSemi:
- NCN5120
Elmos:
- E981.03
I have decided to set up the TP-Uart Transceiver because:

- It was available for me
- His package (S0ic 300mil) is easy to handle and to solder (especially for beginners)
- Available Software Libs


Recommended Schematic Datasheet:

![Abbildung 1: TP-UART Schematic Basic](image)

The schematic (Abbildung 1) shows two diodes D1 and D2. D1 is a simple Reverse polarity protection diode and the D2 a transient overvoltage protection diode. The TP-Uart consist of two-stage voltage regulators. The first stage regulate the voltage between 8.2V and 9.2V. This intermediate circuit voltage is located on Pin9 and will stabilize by the capacitors C4 and C5. The second regulator stage regulate the voltage to 5V. The 5V is available on Pin7 and is stabilize by capacitors C5 and C3. To transfer messages over the KNX-Bus, the Bus-Power-Supply must be loaded. The second regulator stage is there to buffer this voltage drops.

The broadcast data from the bus are capacitively coupled over C1 and read (Pin13) by the TP-Uart. To send messages over the Bus, the TP-Uart (Pin12) can load the bus over the resistor R1. The data connection to the microcontroller (Arduino) is done by the serial interface on Pin1 and Pin20.

I was focused on a simply short design. I copy the schematic from the datasheet and designed a small Board with the Dimensions from 15mm x 22mm.
**Important notes:**

- Maximal current output: 10mA
- Output Voltage: +5V
- High-Pegel I/O: 0.8*VIF (@5V on PIN VIF: 0.8*5V = 4V)*
- Low-Pegel I/O: 0.2*VIF (@5V on PIN VIF: 0.2*5V = 1V)

*)If you want to use this Board with a 3,3V/8Mhz Arduino ProMini you will need a level shifter on TX/RX pins from 3,3V to 5V.

Schematic:

Board:

Pinout

BOM
Abbildung 2: TP-Uart Schematic from a other Project

http://dka.web-republic.de/2012/01/connecting-an-arduino-to-eibknx/

Readymade module:

It is not so easy to buy a TP-Uart transceiver, a good an easy alternative is a BTM (Bus Transceiver Module). It is a "stupid" Transceiver. You don't need/can to program it via ETS. The PA (Physical Address) is define by the Arduino Software.

If you want to start with a cheap and simple KNX-Project? then I will recommend it, because you don't need a Bus-Interface and the ETS-SW to program the bus (Both really expensive)

I work with the Siemens 5GW1 117-2AB12(BTM) (Abbildung 2) (price: ~26€+shipping)

Abbildung : Siemens 5GW1 117-2AB12

Datasheet:

Shop:
http://www.eibmarkt.com/cgi-bin/eibmarkt.storefront/54f55c98006d27d827604debae5006c0/Product/View/NS6512716

Arduino-Modul for Siemens 5GW1 117-2AB12 (BTM)
I developed a simple PCB Board who is adapted to the BTM. It based on the Arduino Hardware and work with the Arduino IDE (if you burn the right Arduino bootloader on it). The Idea was to build a small Board which you can connect four buttons (with status LEDs). You don’t need an external Power Supply, because the board will supply over the BTM with +5V (Attention: The BTM can provide max. 30mA@5V, the status LEDs should be low current). On the board you can also find an ICP-Connector for programming the bootloader and a Interface for a FTDI 232RL-Board or –cable to flash the application.

**Attention:**
The layout still contains errors (notice the Release notes!)

- Do not connect the board with external +5V if the board is connected to the BTM.
- At the moment you must disconnect the Board from the BTM before flashing the Code, otherwise there is a flash error.

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1.0 KNX Sensor-platform Board

It is a flexible development Board. You can use it for simple sensor tasks/measurements. It based on a Arduino ProMini Layout. So you have the choice to use it like a Arduino ProMini 3,3V/8Mhz or a Arduino ProMini 5V/16Mhz.

If you want to use it with the TP-Uart-Interface board, than I recommended the Arduino ProMini 3,3V/8Mhz, because the TP-Uart can only provide ~10mA for the power supply.

5V/16Mhz = ~15mA -> too much for the TP-Uart  
3,3V/8Mhz = ~6mA

The Board provides all Pins which you have on the ProMini Board. I added a few of additional schematic functions like:

- 2 Debounce-IC (connected to the 2 interrupt Pins)
- Connection slot for Temp-Sensor (DHT22/21…)
- Connection slot for OneWire Applications
- Connection slot for a motion detector
- ADC Voltage divider (Voltage Monitoring > Vref ; NTC-Measurement)

**Notice:** the basis of the layout is from the Sparkfun Company and it is Licensed under “Released
under the Creative Commons Attribution Share-Alike 3.0 License

Block Diagram:

- Level Shifter
- Analog Switch

Board:

*Arduino ProMini*
- TP-UART-Interface
- DHT22, Standard I/O
- 2 debounced buttons
- OneWire, PIR
Where I use the Board:

Outside temperature sensor

“Picture”

Motion detector sensor

“Picture”

2.0 NRF24l01+_Ethernet_KNX-Gateway_

The Board was developed to combine my NRF24l01+ Network with my KNX-Bus. Parallel I decided to add an Ethernet-Interface to make the Gateway more useful. The Ethernet-interface is the same like the Arduino Ethernet-Shield, so you can use the standard Arduino Ethernet Lib.

I use the NRF24l01+ with an external Antenna (Abbildung 3). So it is much easier to mount it on a housing. The former price at this time was around ~6€

Ebay auction:
http://www.ebay.de/itm/2G-NRF24L01-Wireless-Module-With-External-Antenna-/281596535252
Abbildung 4: Ebay Auktion NRF24L01 from: electronics_lee

**Block diagram**

- KNX-BUS Interface
- Uart1
- Uart0
- SPI
- Arduino MEGA 2560
- FTDI 232RL
- USB Mini
- W5100 Ethernet
- RJ45 Connector
- NRF24L01+

**Board**

**ToDo's:**
- Change Ethernet Phy from W5100 to W5500
- Change TP-Uart to TP-UART2 (Maybe we can leave the external Power Supply)

Control Panel

Control Panel with six push buttons with integrated status LEDs. Each buttons has a hardware debounce function. You need only one interrupt pin on the Arduino for all buttons (see interrupt function). The status LEDs are driven by a I2C-LED-Driver (TPIC2810). Because of the many status LED we use a external power supply (1LED = 20mA -> 6LEDs = 120mA). If we use an external power supply we need a isolation to the KNX-Bus. In this case we use a Dual Channel Digital Isolator (ADUM1201). The ADUM1201 works here at same time as level shifter, if you use an 3,3V Arduino.

Layout-Features: You can Use both Arduino ProMini types, the hole board is 3,3V and 5V tolerant.
But attention you need right DC/DC Convertor

\[
\begin{align*}
\text{MAX1837EUT33+} & \quad \rightarrow \quad 3,3V \\
\text{MAX1837EUT50+} & \quad \rightarrow \quad 5,0V
\end{align*}
\]

If you have Arduino ProMini spare board from Sparkfun (check if the I2C Vias are on the right position), than you can use it. You do not need assembly the Arduino ProMini parts on the board. You only need pin header to connect the Arduino ProMini board on the Control Panel board.

necessary for I2C
unnecessary

The number of additional vias make it easy to expand the board for additionally Hardware function (e.g. display, sensors, …).

Layout improvements: Diode vom 3,3V Schaltregler zur Rail. Damit parallel ein USB-
Kabel mit zusätzlicher VCC angeschlossen werden kann.

Block diagram:

Layout:
Connector

The two connectors are internally bridged

Pin1:
Pin2:
Pin3:
Pin4:

BOM:

Housing: (Fastron FSG2584)
http://www.mercato.com/sp/102-457511%282%29BP/Universal_Gehaeuse_Aluminium_Gruen_Grau_250_x_80_x_40_Fastron_FSG2584_1.html

Outside Temperature Sensor
Motion Detector
Arduino NRF24L01+ Battery supply Temp-Sensor

other good sites:

How can you burn a bootloader on a bare board? With an Arduino board as ISP-Programmer
http://arduino.cc/en/Tutorial/ArduinoISP
TP-UART:
https://www.auto.tuwien.ac.at/~mkoegler/index.php/tpuart

PCB Manufacturer (china):

10pcs. 5cm x 5cm 2layer (~$10+5$shipping) (lead time: ~4weeks)

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