

4 bit Address - 4 bit Data encoder/decoder

Control44 is a 4 bit address, 4 bit data encoder and decoder combined in a single IC. This device can operate in either Encode or Decode mode. It uses 1kbps differential Manchester bit balancing with preamble and checksum. CTR44 is specifically designed to be used in RF remote control applications. It is available in 20pin SSOP, 18pin SOIC and PDIP packages.



Figure 1: Control44 in DIL package

Features

- Operating voltage (temperature):
 - 3.0V-5.5V for standard version (-40°C to +125°C)
 - 2.0V-5.5V for low voltage version (-40°C to +85°C)
- Draws <2mA without external load
- 4 bit address and 4 bit data
- 16 different remotes with 4 controls each
- Single packetised transmission for fast activation
- Maximum usage of the range capability of an RF module
- Adequate preamble to settle data slicer in the receiver.
- Extra wake up preamble to allow for transmitter power up time requirements
- Differential Manchester encoding of address, data and checksum
- Synchronisation codes and checksum to reduce false triggering on noise
- Suitable to be used with Narrow Band FM radio modules
- Ceramic resonator or crystal oscillator up to 20MHz
- Data rate up to 5.6kbps
- Minimum external component requirement
- 4 wire, push button and latched push button modes
- Custom address, data bit variations available subject to minimum order quantity

Applications

- Security and Alarm systems
- Emergency assistance call system
- Status reporting and monitoring systems
- RF Remote control systems
- Industrial controls
- HVAC controls
- Simple On/Off switching
- Long range telecontrol with Narrow Band FM radios

Encoder Mode

Control44 can be put into Encoder Mode by connecting Mode (pin 2) to supply.

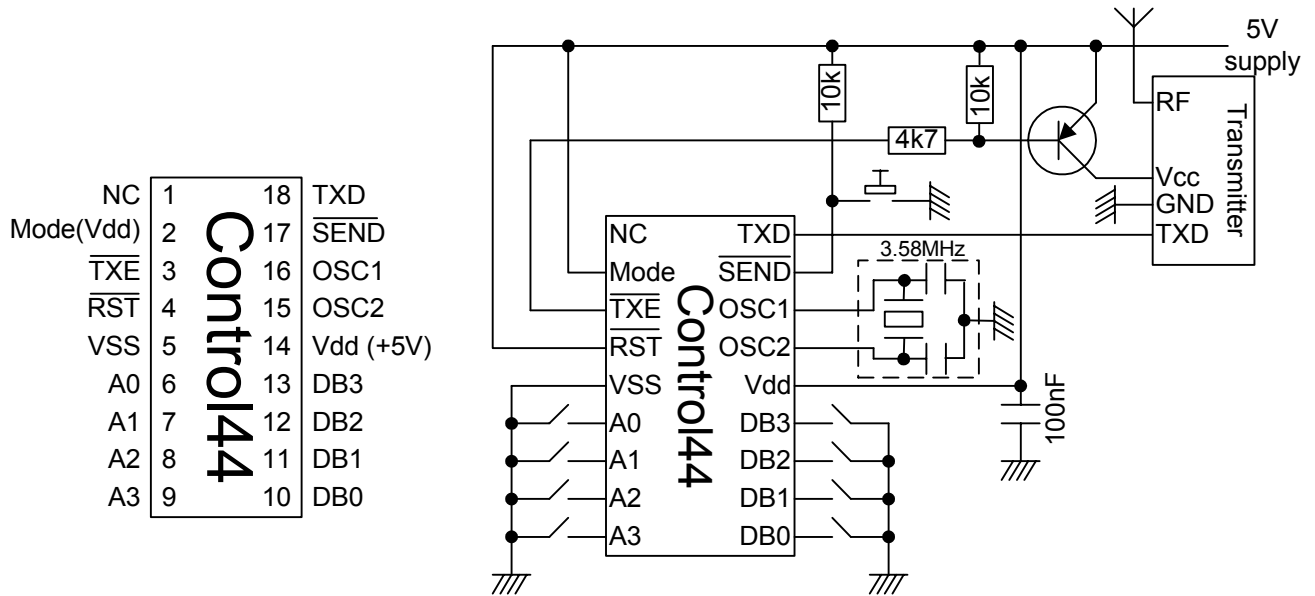


Figure 2: Control44 in Encoder Mode

| Pin | Name | Input/Output | Description |
|-------|-------------------------|--------------|---|
| 1 | NC | | |
| 2 | Mode | Input | RX=0V, TX=Vdd (no pull-up, only read at reset/power up) |
| 3 | $\overline{\text{TXE}}$ | Output | Active Low RF Transmitter Enable (Open drain, require 10k pull-up) ^{4,6} |
| 4 | $\overline{\text{RST}}$ | Input | Active Low Reset (Connect to user system reset or tie to Vdd) |
| 5 | VSS | Supply | Supply Ground |
| 6-9 | A3:A0 | Input | Least significant 4 bits of Address (Internal pull-ups to Vdd) ^{1,5} |
| 10-13 | DB3:DB0 | Input | Least significant 4 bits of Data B (Internal pull-ups to Vdd) ⁵ |
| 14 | Vdd | Supply | 4.5-5.5V supply (decouple with 0.1 μ F close to IC) |
| 15 | OSC2 | Output | 3.58MHz resonator ² |
| 16 | OSC1 | Input | 3.58MHz resonator ² |
| 17 | SEND | Input | Active Low Send Packet (Encoder Enable) ³ |
| 18 | TXD | Output | Encoded Address and Data to TXD input of RF Transmitter |

Decoder Mode

Control44 can be put into Decoder Mode by connecting Mode (pin 2) to Ground.

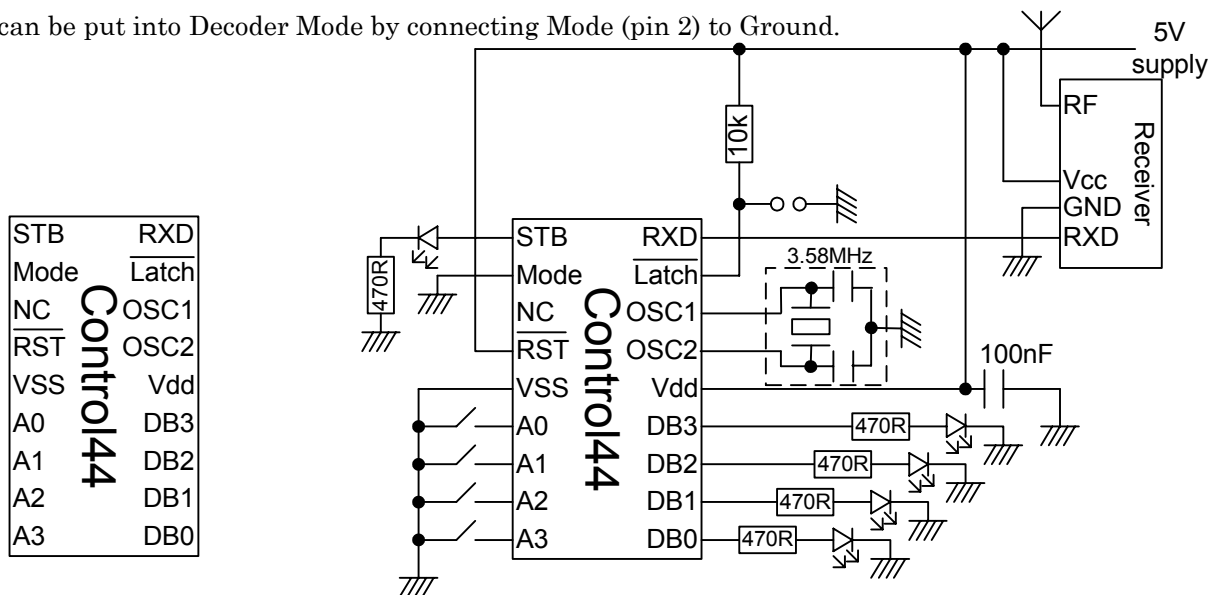


Figure 3: Control44 in Decoder Mode

| Pin | Name | Input/Output | Description |
|-------|-------------------------|--------------|---|
| 1 | STB | Output | Positive going pulse on reception of valid data packet. 10 μ s duration |
| 2 | Mode | Input | RX=0V, TX=Vdd (no pull-up, only read at reset/power up) |
| 3 | NC | | |
| 4 | $\overline{\text{RST}}$ | Input | Active Low Reset (Connect to user system reset or tie to Vdd) |
| 5 | VSS | Supply | Supply Ground |
| 6-9 | A3:A0 | Input | Least significant 4 bits of Address (Internal pull-ups to Vdd) ^{1,5} |
| 10-13 | DA3:DA0 | Output | Least significant 4 bits of Data A ⁵ |
| 14 | Vdd | Supply | 4.5-5.5V supply (decouple with 0.1 μ F close to IC) |
| 15 | OSC2 | Output | 3.58MHz resonator ² |
| 16 | OSC1 | Input | 3.58MHz resonator ² |
| 17 | Latch | Input | 0V = latch DA3:D0 until next packet Vdd = clear DA3:DA0 after 150ms (no pull-up) |
| 18 | RXD | Input | Encoded Address and Data from RXD Output of RF Receiver |

Notes:

1. Only 4 of the 6 address bits are accessible. A5,A4 are set to 0 in CTR44
2. OSC1,2 require a 3.58MHz ceramic resonator with internal capacitors like Murata CSTLA3M58G55-B0. If a 2 pin resonator or crystal is used, then two 15pF-22pF caps are needed: one from OSC1 to 0V another from OSC2 to 0V. 100 Ω series resistor between OSC2 and crystal may be required when driving low frequency crystal with High Speed (H) CTR44H version.
3. If a low going pulse of between 10 μ s and 50ms is applied to SEND pin then a single packet will be transmitted
4. After asserting TXE low (active), the encoder allows 55ms for NBFM TX to power up and settle
5. Absolute maximum source/sink current from each DB3:DB0 pin is 25mA
6. TXE is an open drain output (no pull-up). Connect it to Vdd via a 10k Ω pull-up resistor
7. MODE pin is only read at reset/power up. Connect to either Vdd (Encoder) or 0V (Decoder).
8. Without external loads the CTR44 draws <2mA from 5V supply.
9. Standard version can be used down to 3V for <10MHz oscillator.
Low voltage version can be used down to 2V for <4MHz oscillator.
10. High Speed, CTR44H, version should not be used with Narrow Band FM radio modules.

Encoded Data Packet Format

Transmission format is 1kbps differential Manchester encoding when using 3.58MHz resonator. Oscillator frequency can decreased to suit narrow band RF module data rate requirements. CTR44H IC running at 20MHz can be used with wideband radio modules for fast data transmission.

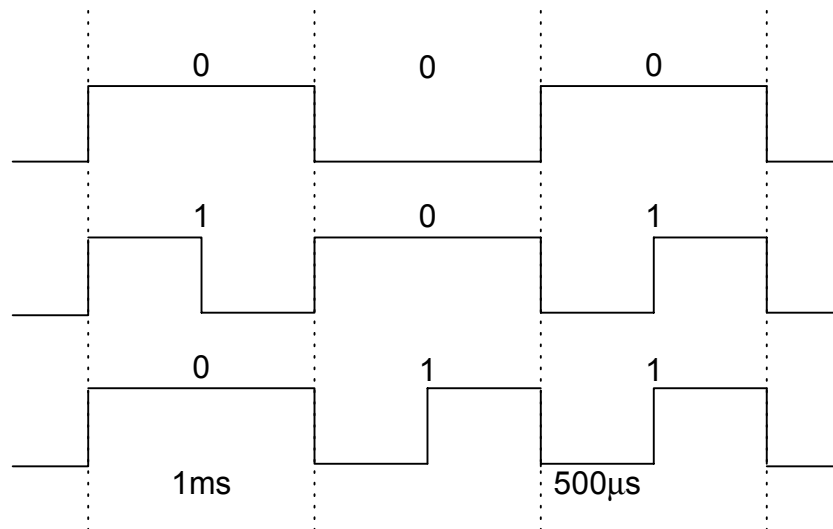


Figure 4: 1kbps differential Manchester coding of '1' and '0'

Control44 transmits a 6-byte burst, with 8 bits of preamble and 4 bits postamble. When firing up the transmitter from cold Control44 puts in an extra 55ms especially for Narrow Band FM transmitter and receiver requiring longer power-up to stable data time.

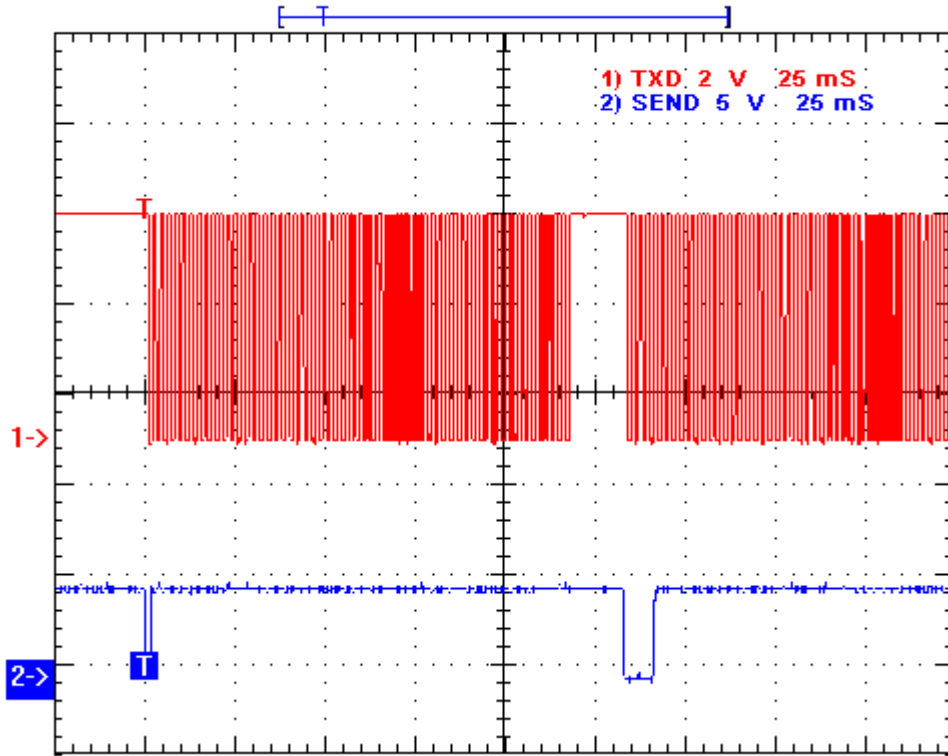


Figure 5: Push button transmission with 55ms power-up preamble

The large amount of sync code, address and checksum reduce the likelihood of false calling on noise to an insignificant degree, while the breaking up of the data sequences with bit7 zeros is to reduce the likelihood of the decoder mistaking particular sequences in the data for sync codes.

Differential Manchester encoding converts the 0000 into 11001100 which is the bit pattern equivalent to preamble required to settle adaptive data slicer in the RF receiver module.

Preamble = 11001100 this byte is not decoded.
 Sync1 = 10111111
 Sync2 = 111100(A7)(B7)
 DataA = 0(DA6-DA0) Reserved for future use and custom variants
 DataB = 0(DB6-DB0)
 Address = 0(A5-A0)0
 Checksum = sum of (DA7-DA0) + (DB7-DB0) + ADR(whole byte) truncated to 8 bits

This allows 6 bits of address and 2 data bytes per 60ms burst when 3.58MHz resonator is used.

| | Preamble | Sync1 | Sync2 | Data A | Data B | Address | Check Sum | Postamble |
|------------------|----------|----------|------------------|------------|------------|-----------|---------------------------|-----------|
| 0000000000000000 | 11001100 | 10111111 | 111100(DA7)(DB7) | 0(DA6:DA0) | 0(DB6:DB0) | 0(A5:A0)0 | DA7:DA0+DB7:DB0 +A7:A0 | 0000 |

Figure 6: Control44 data packet

In the following example, Control44 in Encoder mode is set with the following.

| DB3 | DB2 | DB1 | DB0 | A3 | A2 | A1 | A0 |
|-----|-----|-----|-----|----|----|----|----|
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |

The Control44 will packetise the address and data into the following format. Reserved DataA is transmitted as 00hex. Any custom variants requiring more than 8 bits of data will make use of this slot.

| Preamble | Sync1 | Sync2 | DataA | DataB | Address | Checksum | Postamble |
|----------|----------|----------|----------|----------|----------|----------|-----------|
| 11001100 | 10111111 | 11110000 | 00000000 | 00001010 | 00010010 | 00011100 | 0000 |

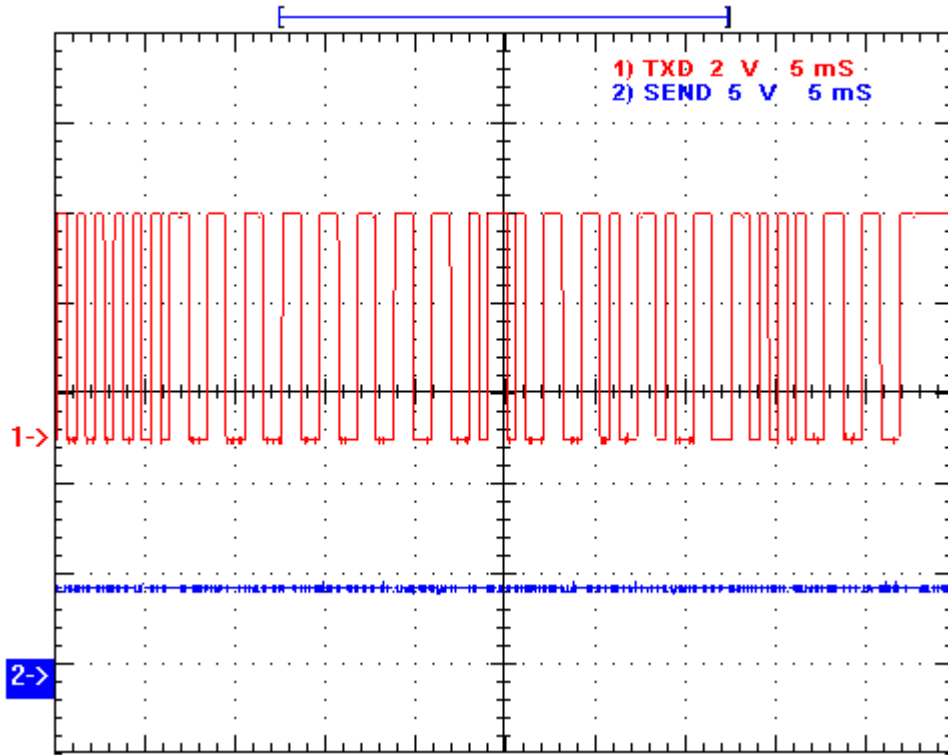


Figure 7: Synchronisation codes, DataA, DataB, Address, Checksum and Postamble

Application Modes

| Mode | Setup | Description |
|--------------------|--|---|
| 4 wires | Latch = 0V (connect) SEND = 0V (connect) | Continuous transmission like wire connection |
| Pushbutton | Latch = Vdd (connect) SEND = 0V (push button) | Decoder outputs active only when transmitter is keyed |
| Latched Pushbutton | Latch = 0V (connect) SEND = 0V (push button) | Decoder outputs hold state of last transmission |

Ordering Information

| | |
|----------------|--|
| CTR44-000-SS | Control 44 ($\leq 4\text{MHz}$) - No Frequency - Shrink Small Outline |
| CTR44-000-SO | Control 44 ($\leq 4\text{MHz}$) - No Frequency - Small Outline |
| CTR44-000-DIL | Control 44 ($\leq 4\text{MHz}$) - No Frequency - Plastic Dual In Package |
| CTR44L-000-SS | Control 44 Low Voltage ($\leq 4\text{MHz}$) - No Frequency - Shrink Small Outline |
| CTR44L-000-SO | Control 44 Low Voltage ($\leq 4\text{MHz}$) - No Frequency - Small Outline |
| CTR44L-000-DIL | Control 44 Low Voltage ($\leq 4\text{MHz}$) - No Frequency - Plastic Dual In Package |
| CTR44H-000-SS | Control 44 High Speed (4MHz-20MHz) - No Frequency - Shrink Small Outline |
| CTR44H-000-SO | Control 44 High Speed (4MHz-20MHz) - No Frequency - Small Outline |
| CTR44H-000-DIL | Control 44 High Speed (4MHz-20MHz) - No Frequency - Plastic Dual In Package |

Appendix

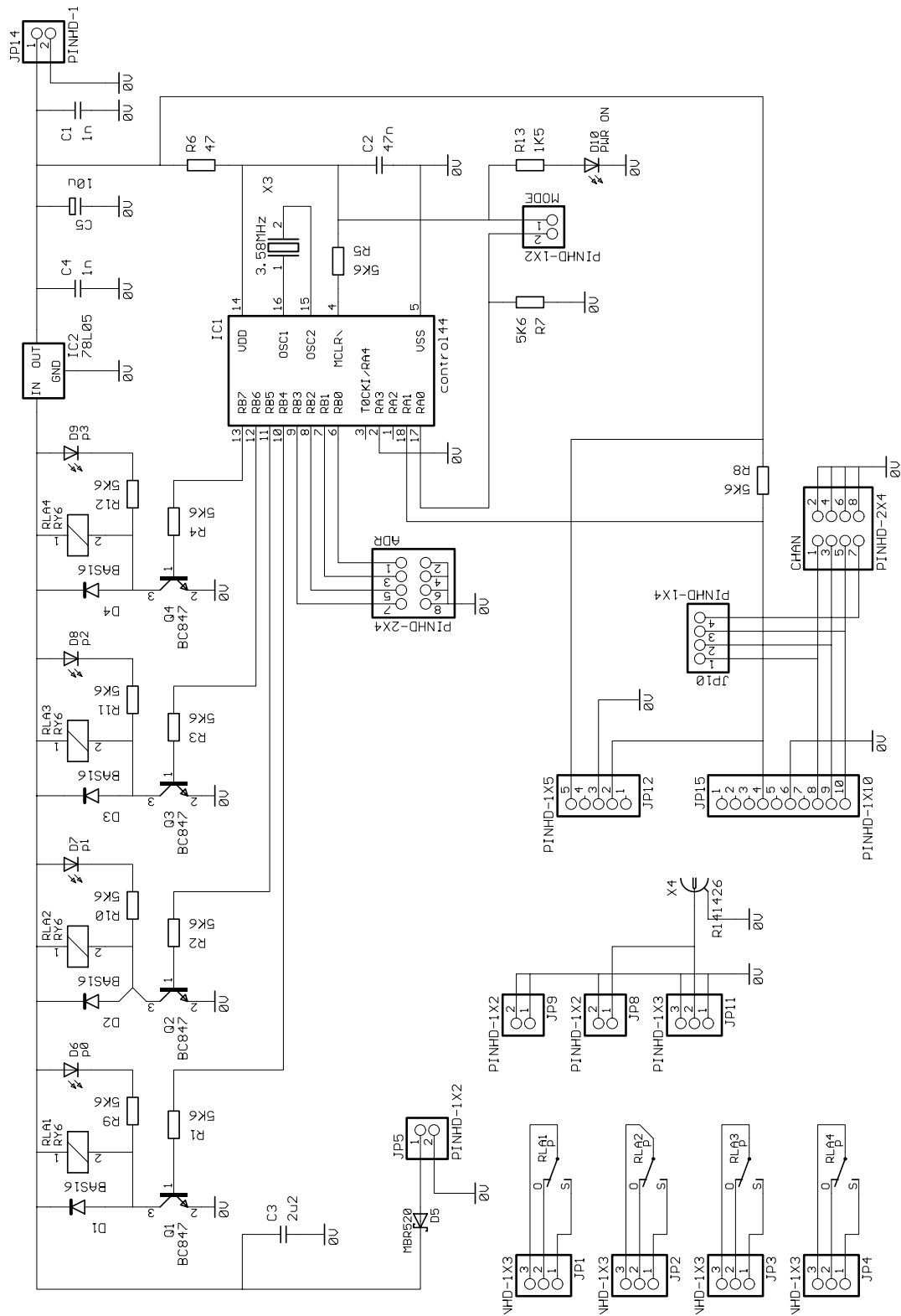


Figure 8: Relay circuit using Control44

It uses Schrack RY610012 or OKO K4M12 relay which is rated 8A @ 250V AC or 30V DC and runs off at 12VDC.

Control44 Evaluation Kit is also available to evaluate CTR44 with single frequency Radiometrix radio modules.

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The Intrastat commodity code for all our modules is: 8542 6000

R&TTE Directive

After 7 April 2001 the manufacturer can only place finished product on the market under the provisions of the R&TTE Directive. Equipment within the scope of the R&TTE Directive may demonstrate compliance to the essential requirements specified in Article 3 of the Directive, as appropriate to the particular equipment.

Further details are available on The Office of Communications (Ofcom) web site:

http://www.ofcom.org.uk/radiocomms/ifi/licensing/licensing_policy_manual/

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