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Version 1.1

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SEL Mirrored Bit™ Communications Over Conventional Narrow Band FM Radio.

Schweitzer Engineering Laboratories (SEL) designs and manufactures products for power system protection. SEL created the MIRRORED BITS communications protocol as a high performance solution for protection applications. With MIRRORED BITS SEL protection relays communicate with each other continuously via a low latency communications medium to provide fast effective protection.

Documentation for the use of the Mirrored Bit™ protection communications protocol using spread spectrum radio-modems has been available for some time however Mirrored Bits™ can also be used with full duplex narrow band real-time radio modems to provide high performance protection communications. Because time is paramount in protection schemes it is very important to choose a radio solution that introduces minimum delay (latency) and which can provide error free communications even at low signal levels.

Real-Time radio-modems such as the Dataradio T-Base/R provide minimal latency and can provide communications over large distances. The full duplex T-Base/R radios are operated hot carrier (constant transmit) to avoid key up delay entirely and because these are real-time devices there is no packetization or error checking delay as found in other solutions. Full duplex real-time repeaters can be used to extend the range or overcome line of site obstructions.

Unlike spread spectrum radio modems that emulate full duplex communications the T-Base provides a true full duplex realtime data path.

Radios that use a packet delivery technique add latency to the data. Real-time radio modems pass data as it is delivered into the serial port. Latency in the region of 6 ms with BER of less than 10^{-6} are typical with a T-Base/R point to point radio system.

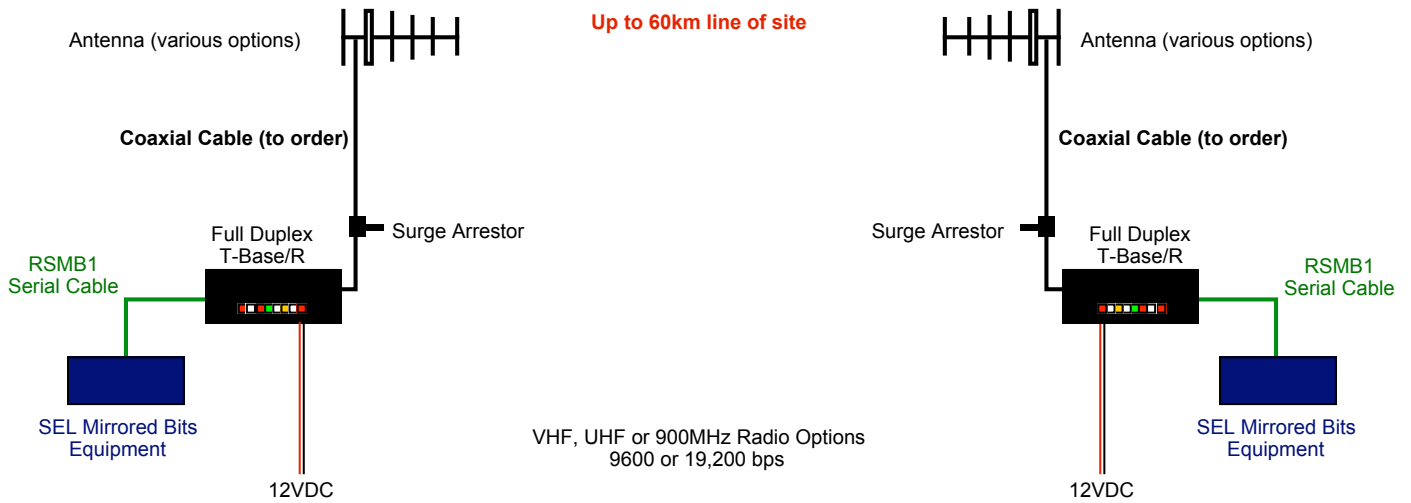


Picture compliments of
Schweitzer Engineering Laboratories

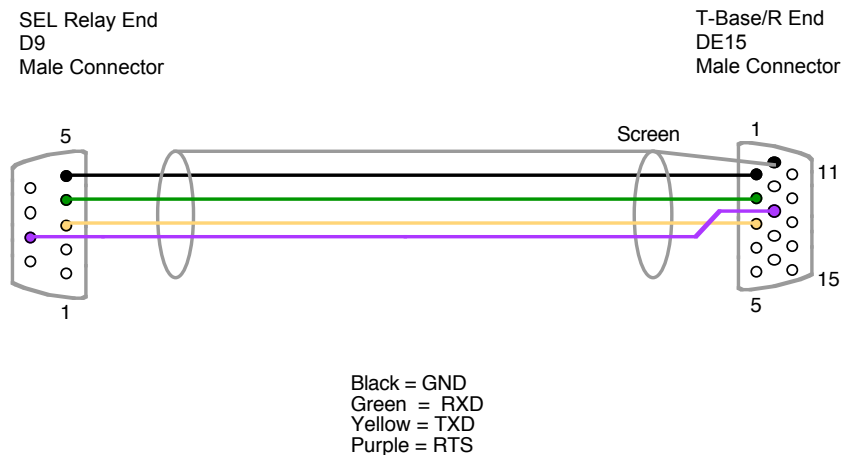
Features

- **Low end to end latency**
- **Rack mount equipment**
- **12VDC supply standard**
- **24VDC or 48VDC optional**
- **Inbuilt antenna duplexer**
- **VHF or UHF solutions**
- **Licensed frequencies for better system integrity**
- **Reasonable cost**
- **Easily installed**
- **Front panel indicator LED's**
- **Short or long range solutions**
- **Repeater options for very long range or non line of sight paths**
- **Field proven solution**

Dataradio distributors Radata Systems in NZ have supplied radio systems to several electricity network operators for use with SEL relays and the Mirrored Bit™ protocol. By choosing the right radio band, aerials and coaxial cables for each installation and engineering the radio path to take account of radio fades, a high performance protection system can be implemented at very reasonable cost.

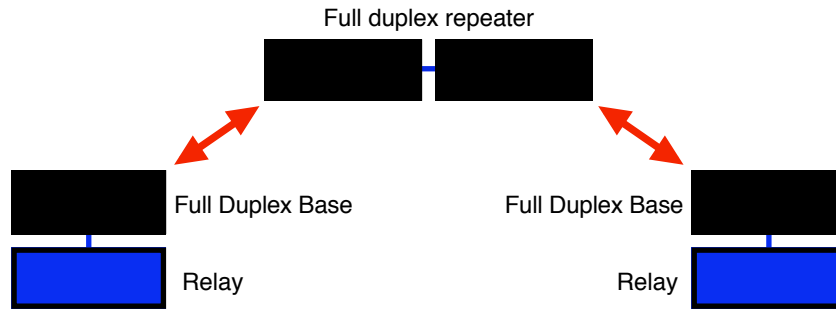


POINT TO POINT PROTECTION RADIO LINK

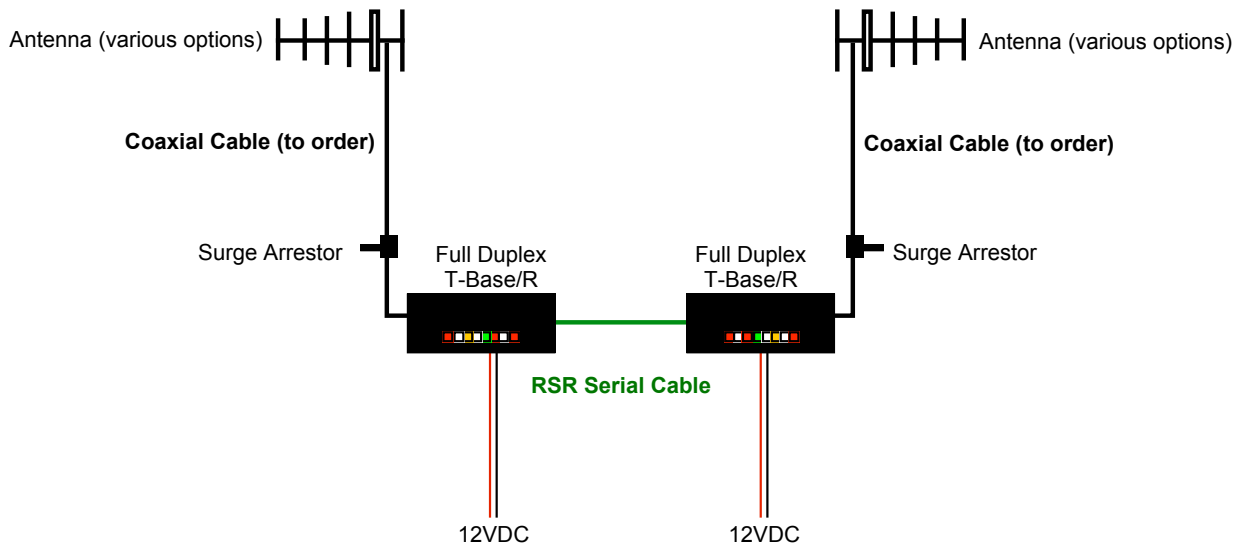


RSMB1 INTERCONNECTION CABLE

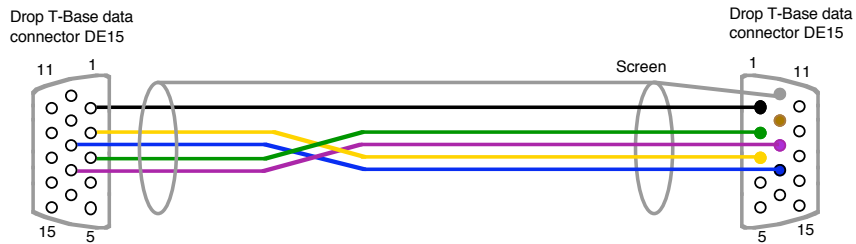
Alternatively radio keying can be obtained by looping pin 8 to 10 on the T-Base/R data connector. Leave out the purple wire in that case.



REPEATER SYSTEM FOR EXTENDED RANGE



REPEATER DETAIL



REPEATER INTERCONNECTING CABLE