In cases where installed M100 sensors are out of range of the nearest access point, one or more M115 repeater units can be used to provide a two-way relay between the out of range sensors and the access point. A repeater is pole mounted by the roadside and is positioned so that both the sensors and the tandem repeater or access point are within the view and within range.

The M115 Flex Repeater is a single pole mounted battery powered repeater with a 7-year life. As a battery powered standalone unit there is no need for cabling, ducting or wiring. This version of the repeater represents significant advantages over the previous model, as the repeater is housed in a robust enclosure that provides IP65 protection.

The M115 Flex battery powered repeater has a connector for an external antenna, allowing for greater flexibility in providing a two-way relay between sensors and the access point.

### Functions / Features

**Relay of radio communications**
- To / from wireless sensors (downlink)
- To / from access points (uplink)
- To / from another repeater (uplink or downlink)

**Extension of range and coverage of the access point**
- Tandem operation – one repeater and its supported sensors can communicate with another repeater and then to the access point.
- Maximum single-hop range of 400m with a long range external antenna.
- Maximum single-hop range of 35m from sensors with a long range external antenna.

**Fully wireless operation – no cable connections**

**Radio signal quality measurements (of each link to wireless sensors or tandem repeater)**
- Receive signal strength indicator (RSSI in dBm)
- Link quality index (LQI, figure of merit 40-99)

**Enclosure**
- Provides IP65 protection

**Simple installation**
- Any roadside location that provides adequate height and line of sight to sensors and the access point or repeater
- External connector and indicator to activate unit
- No special requirements regarding setback, relative angle of the sun or mounting stability

**No calibration or adjustment required**

**Firmware upgrades over-the-air from access point**
## Functional Specifications

| Interfaces | To/from sensors via 802.15.4 PHY radio  
|           | To/from repeaters via 802.15.4 PHY radio  
|           | To/from access point via 802.15.4 PHY radio  
| Over-the-air protocol | Custom TDMA protocol  
| Physical layer protocol | IEEE 802.15.4 PHY  
| Modulation | Direct Sequence Spread Spectrum Offset Quadrature Phase-Shift Keying (DSSS O-QPSK)  
| Transmit/receive bit rate | 250 kbps  
| Frequency band | 2405 to 2480 MHz (ISM unlicensed band)  
| Frequency channels | 16  
| Channel bandwidth | 2 MHz  
| Internal antenna type | Microstrip patch antenna (behind front face panel)  
| Antenna field-of-view | +60° (Azimuth & elevation)  
| Nominal output power | +3 dBm  
| Spurious emissions | 30-1000 MHz: <-36 dBm  
|                     | 1-12.75 GHz: <-30 dBm  
|                     | 1.8-1.9 GHz: <-47 dBm  
|                     | 5.15-5.3 GHz: <-47 dBm  
| Typical receive sensitivity | -101 dBm (PER < 1%)  
| Saturation (Max input level) | > 10 dBm  

## Power, Physical & Environmental

| Power Supply | Li-SOCI2 3.6V battery pack  
|             | Nominal capacity 171 Ah  
| Recommended system replacement/battery unit | Battery replacement every 7 years  
| Dimensions | 7.75” x 6.5” x 5.37” (19.68cm x 16.51cm x 13.65cm)  
| Weight | 3.93 lb (1.78 Kg)  
| Environmental | Designed for weatherproof, outdoor operation  
|               | NEMA type 4 enclosure  
|               | IP65 ingress protection  
| Operating Temperature | -40°F to +176°F / -40°C to +80°C  

## Compliance

| Safety | 2006/95/EC  
| EMC | FCC: This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and, (2) this device must accept any interference received, including interference that may cause undesired operation.  
|     | CE0678  
|     | 2004/108/EC  

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