

Scandinavian Reach Technologies AS

User manual

SRT MN-01

SCAN  **REACH**
On-board Wireless Connectivity

Innhold

Preface	3
Copyright.....	3
Disclaimer.....	3
Declaration of Conformity	3
FCC	3
CE	3
Warranty and RMA	4
Safety Information	4
Safety Precautions	4
Technical Support and Assistance.....	5
Global Service Contact Information.....	5
Product and Architectural Design information SRT MN-01.....	6
Functional description	6
Installation manual:	6
User manual:.....	6
Hardware specifications.....	9
Power input.....	9
Power supply.....	9
Physical dimensions	10
Radio transmitter characteristics.....	10

Preface

Copyright

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Disclaimer

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Declaration of Conformity

FCC

Federal Communications Commission Statement

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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

CE

The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

Warranty and RMA

According to General Sales Terms and conditions.

Safety Information

Before installing and using this device, note the following precautions:

- Read all instructions carefully.
- Follow all warnings and cautions in this manual.
- Battery inside is not replaceable.
- Discard device according to relevant disposal policy.
- 220 V / 110 V power adapter – do not open

Safety Precautions

Before installing and using this device, note these safety instructions carefully:

1. Keep this User Manual for later reference.
2. All cautions and warnings on the equipment should be noted.
3. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
4. If one of the following situations arises, get the equipment checked by service personnel:
 - a. The equipment does not work well, or you cannot get it to work according to the user's manual.
 - b. The equipment has been damaged.
 - c. The equipment has obvious signs of breakage.
 - d. Liquid has penetrated the equipment.
5. Do not place heavy objects on the equipment.

CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED.

Technical Support and Assistance

1. For the most updated information of Scandinavian Reach Technologies AS products, visit the company website at www.scanreach.com.

2. For technical issues that require contacting our technical support team or sales representative, please have the following information ready before calling:

- Product name and serial number
- Detailed information of the peripheral devices
- A complete description of the problem

Warning! To keep the unit clean, use only approved cleaning products or clean with a dry cloth.

Global Service Contact Information

Headquarters

ScanReach AS

Skjenet 11

5354 Straume

Norway

www.scanreach.com

E-mail: support@scanreach.com

Product and Architectural Design information SRT MN-01

Functional description

The Scandinavian Reach Technologies AS SRT MN-01 Mesh Node is a wireless network device intended to transport data in a Mesh network structure within steel confined areas. Several nodes are connected via built-in radio transmitters. The data is collected from SRT PT-01 or other adequate sensors via Bluetooth protocol. The end node is connected to a Gateway computer, collecting data sent through the network.

The MN-01 Mesh node includes a pressable button in order to reset the node if necessary.

Furthermore, a LED diode is visible through the SRT MN-01 surface when the network is activated.

Installation manual:

The following steps cover necessary information to install and start MN-01

1. Plug one MN-01 via USB connection to the Gateway computer
2. Plug remaining MN-01 including power adapter into to power sockets in all relevant areas.
Areas to be defined in order confirmation.
3. Install MN-01 on appropriate surface with SRT supplied double sided tape.
4. MN-01 will start up and autonomously form the wireless mesh network.
 - a. This requires the backend to be configured with appropriate “white-lists” of allowed devices on beforehand. Typically this is done by Scandinavian Reach Technologies AS

User manual:

Manual handling of MN-01 is not required in operation mode. Depending on application, any deviation from normal functionality will be provided in relevant Graphical User Interface.

In case a reset is required, press the MN-01 front surface and hold for 3 seconds.

Software/Firmware specification

The mesh node is from factory equipped with firmware which serves two main purposes:

Participate in a mesh-network

The SRT MN-01 will when started try to join a mesh network using credentials already supplied on internal flash. Joining a network can either happen by direct communicating with a “root” (the single device connected to a computer), or by communicating with the root via other mesh nodes. A combination of credentials and whitelisting ensures only known devices will be able to join the network. After having joined a mesh network a mesh node will communicate with nearby mesh nodes in order to act as a forwarder of received data and to balance the network according to signal conditions where the node is placed.

Listen for advertisements from SRT PT-01

The SRT PT-01 periodically advertises a Bluetooth beacon message containing:

- The unique address of the tag

- The battery status of the tag
- Button press status
- The temperature of the tag

Mesh nodes listen for these beacon messages by filtering on a unique message type-identifier in each message. In addition, both advertisements from tags and communication from mesh nodes are filtered based on white listing ¹at a system level.

The mesh node can update its own firmware if supplied signed over the mesh network.

Specification of frequency band(s), power output and power management

The SRT MN-01 operates in the non-licensed sub-GHz band with following characteristics:

- **Sub-GHz**
 - 865-868 (EU wide harmonised national radio interfaces from 25 MHz to 1 000 MHz – L Band)
 - 902-928 MHz (FCC)
 - PCB Antenna +0.01 dBi gain
 - External antenna +0,9dBi gain
 - TX power +14dBm
- **2,4 GHz Prop mode #1 (2.4 - 2.4835GHz)**
 - TX power +20dBm
 - Antenna – PCB (3.3dBi gain)
- **2,4 GHz Bluetooth (2.4 - 2.4835GHz)**
 - TX power +4 dBm
 - Antenna – PCB (3,3 dBi gain)

The frequency to use for the mesh network is chosen by the onboard gateway computer and is not overridable by users. Selection of frequencies are done by using GPS geofencing based on the work done by marineregions.org in addition to frequency-scheme for the relevant territorial seas.

<http://www.marineregions.org/downloads.php> (Maritime Boundaries v11 - World 12 Nautical Miles Zone (Territorial Seas) v3 (2019-11-18)
(demo can be found here:
http://www.marineregions.org/eezdetails.php?mrgid=5686&zone=eez_12nm)

Power usage

- ~ 10-65 mA at max power

Specification of modulation type and data protocol

The mesh nodes communicate by using the following modulations and protocols

Medium	Frequency	Modulation	Protocol
Radio	865-868MHz	GFSK	SRT-Mesh
Radio	902-928	DSSS	SRT-Mesh
Radio	2,4-2,4835GHz	O-QPSK DSSS	SRT-Mesh
Radio	2,4-2,4835GHz	GFSK	Bluetooth
USB-Cable to Gateway	Serial	Serial	Serial

¹ <https://en.wikipedia.org/wiki/Whitelisting>

Description of integrity and authenticity measures

Mesh network

The SRT MN-01 communicates with other mesh-nodes using a proprietary protocol using either frequencies in the 865-868MHz, 902-928MHz or 2,4-2,4834GHz range.

The protocol builds and maintains a Destination-Oriented Directed Acyclic Graph topology that originates from a designated root node, which typically also serves as a border router to a computer. Routing information is disseminated through broadcast beacons a-periodically using timers. The topology is built according to ensure maximum stability in the network

The protocol supports different directions of traffic:

- Upward routing: from any node to a root.
- Downward routing: from the root to any node.

All upward routing is handled by having each node on the path toward the root forwarding traffic through a preferred parent. Downward routing can be handled by maintain address information stored in the nodes.

Authentication is handled by whitelisting of MAC addresses in combination with pre-shared key material from fabric

Message integrity is handled by evaluating CRC checksums contained in each message. Encryption is handled by using pre-shared key material from fabric

Bluetooth communication

The SRT PT-01 relies on the Bluetooth protocol for managing message integrity. The protocol handles checksum validation for every received package (based on 3 bytes of CRC included in the package itself). Regarding authentication, the SRT PT-01 will not accept any inbound connections from other devices as the device is not connectable. Advertisements from SRT PT-01 includes a unique identifier describing the SRT PT-01 as a type of device. This unique identifier is used by the SRT MN-01 when filtering for SRT PT-01 devices. In addition, the system uses whitelisting of both SRT PT-01 and SRT-MN-01 based on unique MAC addresses². This ensures external or unknown devices are not able to connect or join the network. Data from unrecognized mesh nodes or tags will be discarded.

Mesh node and Personnel communication pattern

The SRT PT-01 (wearable tag) will typically be used in conjunction with SRT MN-01 (static located mesh node). A mesh node will listen for advertisements from all nearby tags based on the unique advertisement identifier. The mesh-node will forward the information from tag advertisements to an upstream gateway where this information will be used to create value. If the gateway is not reachable directly the mesh node will depend on other upstream mesh nodes to forward the information. As already mentioned, whitelisting of both mesh nodes and tags is used ensuring unwanted access.

² https://en.wikipedia.org/wiki/MAC_address

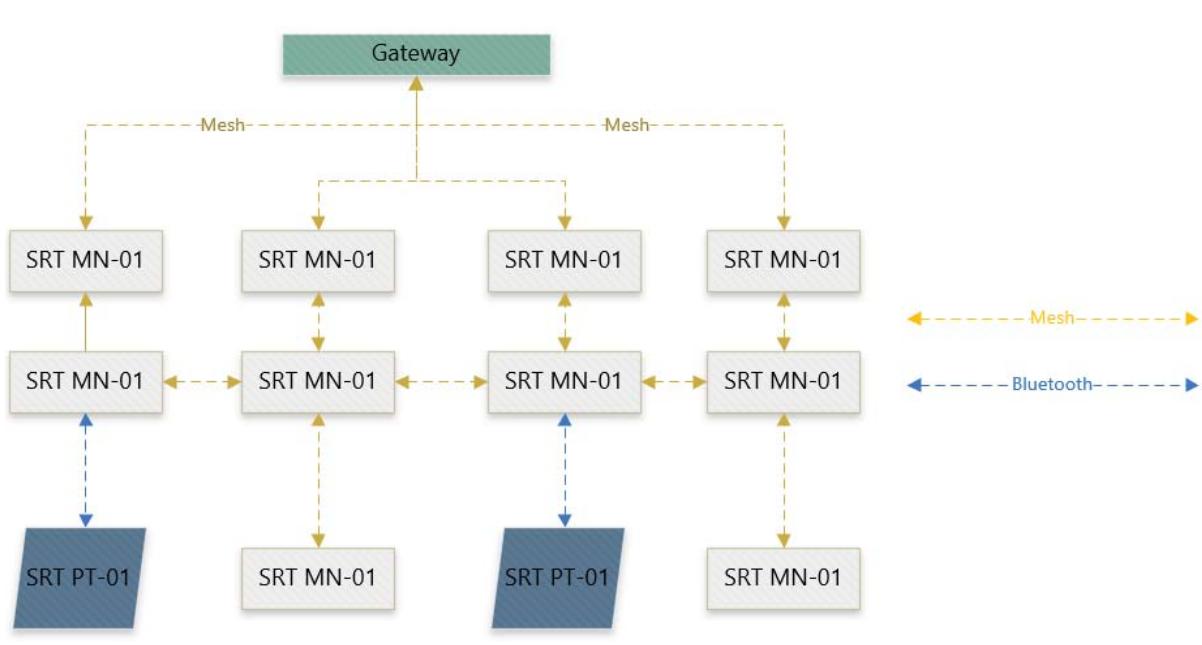


Figure 1- Tag and Meshnode overview



Figure 2- Tag and Meshnode communication pattern

Hardware specifications

Power input

- 5 V Micro USB connection
- MiNMax - HHS-LP-P24, 3.7Vdc, 500mAh back-up battery inside

Power supply

- Mean Well GS05E-USB 220 V / 110 V to 5 V USB adapter
- Artesyn DA10-050EU 220V / 110 V to 5 V USB adapter

Physical dimensions

- Size: 66,5mm x 68,5mm x 19mm
- Total surface area: 14068 mm²
- Weight: 79 g

Radio transmitter characteristics

- 2,4 GHz (prop & Bluetooth)
- Sub-GHz (865-868 / 902-928)

Certifications

- CE (pending)
- FCC Class B (pending)
- DNV-GL CG0339 & CP0302 (pending)

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Manufacturer: Topro Industri AS

Adr: Rambekkvegen 1, 2816 Gjøvik, Norway

Tlf: + 61 13 46 00

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