

6-REPEAT

Communications Repeater

Section 1

Using a SIXNET Communications Repeater

A **6-REPEAT** is used to extend the useful distance over which **SIXNET** network communication can occur. It is also used to create branches ('star' configurations) in a **SIXNET** Network. A **6-REPEAT** may be placed anywhere on a **SIXNET** network. Its operation is fully transparent, and will not adversely affect network performance or response time.

The **6-REPEAT** is a bidirectional signal repeater that automatically senses the direction of transmission and orients itself on the network, receiving the original transmission and retransmitting it in the appropriate direction. In addition to amplifying the signals for retransmission, each message is read and actually rebroadcast. This ensures that the effects of noise and transmission line pulse spreading are not accumulated as the signal continues through the network.

1-1: 6-REPEAT Specifications

Max. Cable Between Repeaters	0.75 km
Max. Number of Sequential Repeaters	8
Message Retransmission Time	13 μ S
Power Requirement, 120VAC (Watts)	10
Mechanical Size:	11.9 W x 3.5 H x 4.0 D
Operating Temperature Range	0 to 60 degrees C
Storage Temperature Range	-25 to +85 degrees C
Humidity	5 to 95% RH noncondensing

Revised December 1991

2-1: Mechanical Installation

The **6-REPEAT** can be mounted in any convenient orientation to any flat surface, such as a sub-panel in a NEMA cabinet. Refer to Figure 2-1 for mechanical mounting dimensions.

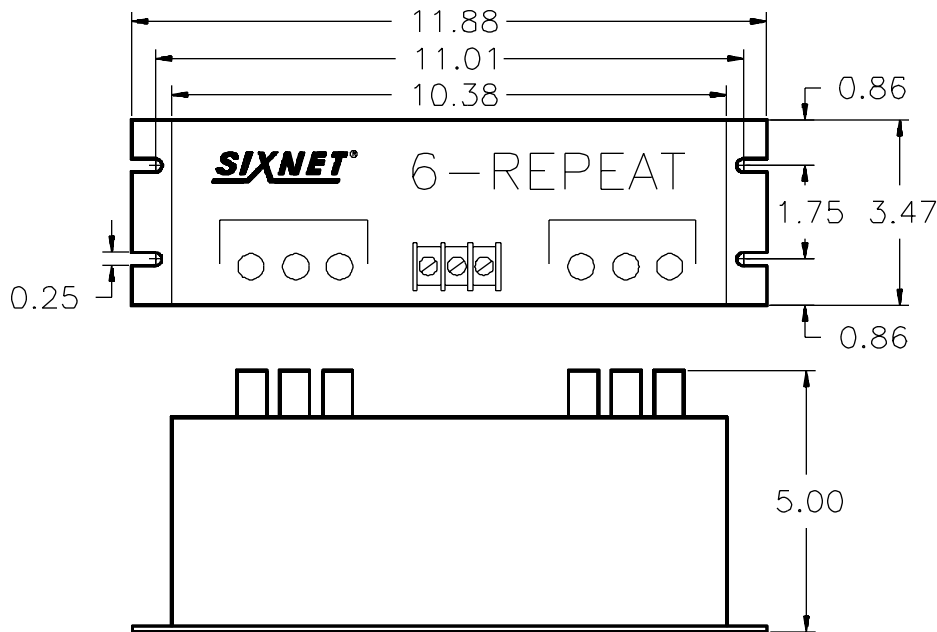
2-2: Electrical Connections

The **6-REPEAT** operates on 120 Volts AC. (For operation at other line voltages, including 240 AC, consult the factory.) This power is supplied through a screw terminal block on the front surface of the controller. The terminal block is clearly labeled for the three connections. A fuse holder, located next to the incoming power connector has a 1 amp SLO BLO fuse installed. Do not install a larger fuse.

To provide a quiet earth ground for the **6-REPEAT**, a ground wire should be installed from the 'GND' terminal to a ground stud on the mounting panel. A good earth ground is required for safe operation of the equipment, and to ensure proper immunity to electrical interference.

There are two network ports on each **6-REPEAT**. These two ports operate identically, and there is no preferred direction of communication. (In other words, the two ports are interchangeable.) Connect a network cable to each pair of terminals, in accordance with the Network Connection Guidelines in Section 3. Be sure to maintain proper network polarity. All network devices must be connected red to red and black to black. The two green terminals on this device are internally connected together and to chassis ground. Each network port is isolated from the internal logic, maintaining full **SIXNET** network isolation.

You must terminate each network port in the characteristic impedance of the network cable, unless the **6-REPEAT** is installed in the middle of a network. A **6-TERM** should be used to terminate each **SIXNET** cable. Refer to the Network Connection Guidelines in Section 3, and Figure 3-1 for information on terminating **SIXNET** networks.



6-REPEAT Mechanical Dimensions

Figure 2-1

Section 3

Network Installation

The **SIXNET** network is a multidrop party line consisting of a single twisted pair of wires run from station to station. Network connections are made by attaching the two network wires to the appropriate terminals on each network station so that all stations are wired in parallel. Any series of directly connected network cable segments (not through signal repeaters) is referred to as a network 'arm'. Any time a **6-REPEAT** is encountered, the result is the end of the existing network arm, and the beginning of a new one.

Each end of a network arm must be terminated in the characteristic impedance of the cable, to make the cable appear to be electrically 'endless'. This technique reduces electrical reflections, which can disturb network communication.

3-1: **SIXNET** Network Connections

A **SIXNET** network cable consists of two conductors plus a cable shield. Since many **SIXNET** controllers have red and black binding posts, the cable conductors have been referred to as 'RED' and 'BLACK'. On the **6-REPEAT** there are two sets of binding posts (connection terminals) for attaching the conductors of each network cable.

If either network port on a **6-REPEAT** is located at the end of a network arm (only one piece of cable is connected to that port), a **6-TERM** board must be installed on the binding posts of that network port, to provide termination for the network cable. If a network port is not at the end of the network (if two network cables are connected to this port) do not install a **6-TERM** board. Refer to Figure 3-1 and the **IOMUX Technical Manual** for network connection information.

3-2: Network Connection Guidelines

SIXNET networks are very simple to connect. The following rules are intended as guidelines for the best performance of the network, and are optimized for Universal Network performance.

1. Always observe correct polarity when making network cable connections (red to red and black to black), though no permanent damage will result from reversed polarity. On a Universal Network only, communications will work if polarity is reversed. To produce the best results, connect the cable shield to earth ground at only one end of the cable.
2. Controlled impedance, twisted pair network cable designed specifically for high speed data transmission must be used. Belden Datalene cable #9182 is recommended. Any substitute cable must have 150Ω nominal impedance, and 10 pF/ft maximum capacitance from conductor to conductor.
3. In-line (multidrop) station connections, not 'star' configurations are recommended. If it is necessary to connect the stations in a 'star' (more than two network cables connected to a common point), a **6-REPEAT** must be used. However, a short (five feet or less) non-terminated cable can usually be attached to a network for diagnostics and maintenance without causing communication errors. No termination resistor should be used for the short tap. See Figure 3-1 for a typical network configuration.
4. Both ends of each network arm must be terminated in the characteristic impedance of the cable. (Each station or **6-REPEAT** with only one cable connected to it should be terminated.) Each cable run which is not broken by a **6-REPEAT** should have exactly two terminations. Many **SIXNET** stations contain the necessary terminating components. See Figure 3-1 and the **IOMUX Technical Manual** for wiring details.
5. Each network arm may contain up to .75 kilometers of cable. Use a **6-REPEAT** to extend the practical length of network transmission. Each **6-REPEAT** extends the practical length of network transmission by 0.75 kilometers. Up to eight repeaters or repeater equivalents may be placed in series. No more than eight repeaters can be in the path between any two network stations. Eight thousand feet of Belden #9182 cable has the equivalent delay of one repeater.
6. Terminate the stations at the ends of network arms only. Terminating stations in the middle of a network will cause poor performance or complete communication failure. See Figure 3-1 for location of terminated stations on a sample network.
7. Route network cables away from power lines and other sources of electrical interference.
8. **DO NOT** connect stations in a continuous ring or make multiple paths of network connections. The improper signal propagation that results will cause poor performance or complete failure to communicate. Relays may be used to switch cables for redundant transmission. Network status

information is available to help control multiple network switching logic.

9. Assignment of station addresses is arbitrary. Stations may be connected to the network in any order or in any combination, but the average time to recover from communication loss will be minimized if the station numbers assigned are the lower numbers.

3-3: SIXNET Network Modes

There are two modes under which the **SIXNET** network can operate. These are Universal Network communication and Master/Slave Network mode. These two modes are described in the **IOMUX-RTU** and **60-IOMUX-FEB** Technical Manuals. The **6-REPEAT** supports both network modes. No jumper or DIP switch settings are required on the **6-REPEAT**.

3-4: SIXNET Network Specifications

The **SIXNET** network is a multidrop transformer coupled party line consisting of a single twisted pair of wires run from station to station. Each station has a high impedance receiver so that network

characteristics are not affected by the number of stations on the network. Isolation in each station protects the internal circuitry from damage up to 400 volts. Loss of power in any station causes it to go into a high impedance state so that the remaining network continues to operate.

An efficient message format is used that includes redundant transmissions, check sums, syntax checks and acknowledgement messages with automatic retries if errors occur. Advanced encoding techniques enhance the performance of this highly reliable network.

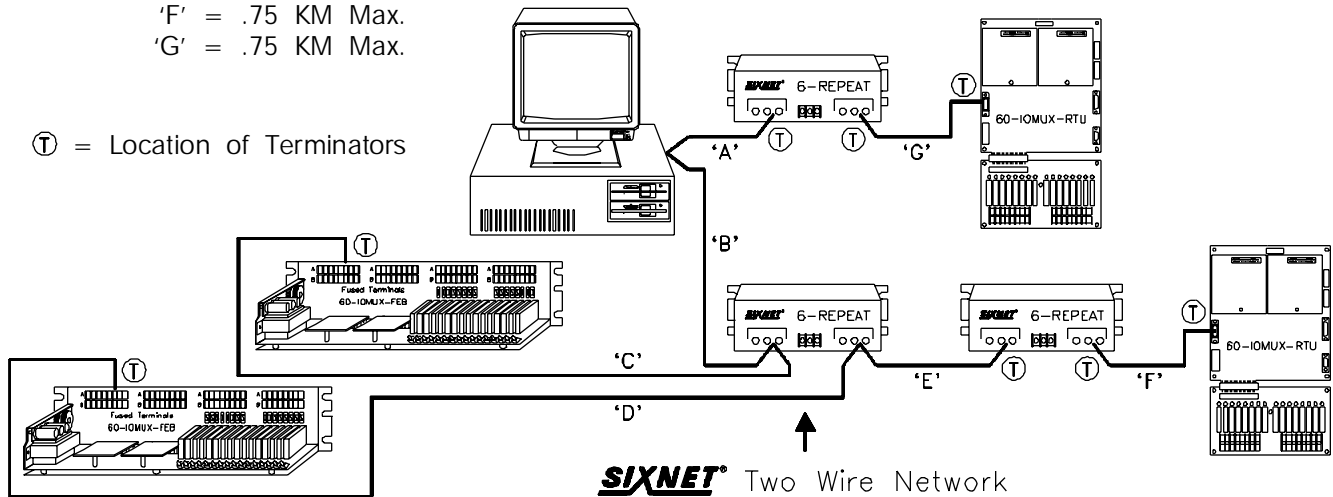
Typical Performance Specifications

Data Rate	307,200 Baud
Signal Levels.....	RS485 Compatible
Maximum Stations (Universal Network).....	128
Maximum Stations (Master/Slave Network).....	32
Communication Distance	
Without Repeaters	0.75 km Maximum
With Appropriate Repeaters	5 km Maximum
Network Isolation	400 Volts Minimum
Required Network Cable Impedance.....	150 ohms
Maximum Cable Capacitance (cond. to cond.)	10pF/ft
Recommended Cable	Belden #9182

Maximum Network Cable Distance Between Termination Points:

- 'A' + 'B' + 'C' = .75 KM Max.
- 'D' + 'E' = .75 KM Max.
- 'F' = .75 KM Max.
- 'G' = .75 KM Max.

Ⓣ = Location of Terminators

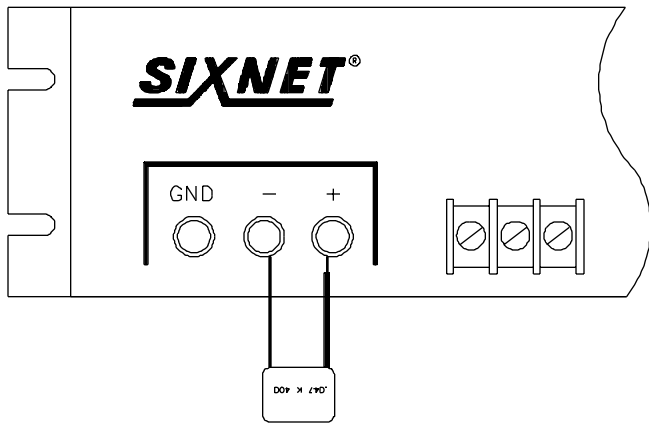


Typical **SIXNET** Network
Figure 3-1

6-TERM Replacement Assembly

The supplied capacitor/resistor assembly replaces the 6-TERM network wiring accessory.

Refer to the diagram below for installation of this assembly. The leads of this device attach to the red and black binding posts on your Sixnet station. (Note: there is no lead polarity on this device.) Then connect your network cable(s) directly to the binding posts. If you are using Belden #9182 cable (the recommended cable type) connect the yellow conductor(s) to the red binding post. Connect the black conductor(s) to the black binding post. Connect the shield to the green binding post, where applicable. Refer to the Sixnet Technical manual for your Sixnet station for network connection guidelines.



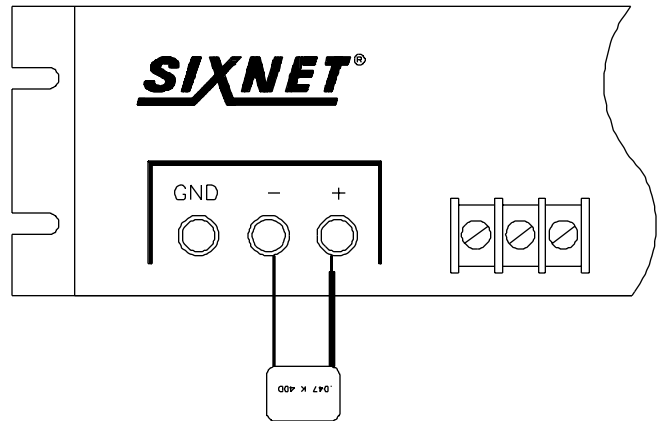
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