# Installation Manual for

# Innotech

# Device Network Cabling

(Version 1.7)

Document Number DS99.04


EDITION: v1.7 dated 24 October 2007

# Proprietary



# Trademark



## Document Management

### Change Control

| Version No: | Date of Issue | Status | Changes | Description/Comment |
|---|---|---|---|---|
| V1.0 | 22/03/07 | Prelim | Draft | For comment |
| V1.1 | 27/03/07 | Mark-up | | Under construction |
| V1.2 | 24/04/07 | Mark-up | Technical accuracy changes | Under construction |
| V1.3 | 23/05/07 | Final mark-up | | |
| V1.4 | 30/06/07 | Addition | Include ICS product | |
| V1.5 | 13/06/07 | Addition | RS485 description and HMI additional info | |
| V1.6 | 01/10/07 | Mark up | Minor changes | |

### Document Review

| Reviewer | Remit |
|---|---|
| Michael Sargent | Compile Information |
| Roland Stehle | Technical Accuracy |
| Mark L Radovic | Editing/formatting/add earth connections info |
| Paul O'Connor | Final Review |

### Document Status

| | |
|---|---|
| Draft | 24/10/2007 |

# Table of Contents



  

# List of Illustrations



# List of Tables



  

## Technical Manual Overview

This instruction manual for Installation Instructions for Innotech Communication Networks is part of a series of technical manuals designed to provide the customer with complete and comprehensive documentation supporting the Innotech Digital Control system. It contains detailed information for the primary network and the two sub networks.

- Network Connections
- Earth connection rules
- End Of Line Termination
- Descriptions on different comms hardware improvements

## (i) About this Manual

This instruction manual is intended to provide the user with complete and easy-to-follow instructions for installation of Innotech Communication networks. In preparing these instructions, Innotech assumed that the typical installer is familiar with the installation of RS485 Communication networks. The following instructions and procedures are presented at a technical level that presupposes familiarity with networks and local electrical rules and regulations.

Because each network is designed to be configured to its own application requirements and since each customer's application is different, no two sites will be the same. However, the following rules and information will cover any possible scenarios.

## (ii) Organisation of this Manual

This instruction manual has five sections:

- Section 1 – Common Requirements
- Section 2 – Primary Networks
- Section 3 – Sub Networks
- Section 4 – General Cable specifications
- Section 5 – Glossary of Terms

**Section 1:** provides a description of the common network requirements.

**Section 2:** provides a description of the primary network and how each device can be connected to the network and a total overview of the network requirements.

**Section 3:** provides a description of the sub system networks and how each device can be connected to the network and a total overview of the network requirements.

The two types of sub networks are the Remote Expansion Modules, (REM's) and the Sub System Gateway network (SSGs).

**Section 4:** provides a list of the general network rules that apply to all networks and the cable specifications.

**Section 5:** The Glossary of Terms in is intended to ensure that the contents of this manual are clear and easily understood by the reader. The glossary contains simple explanations of the technical terms used in this manual; explanations are given in non-technical language where possible.


**Figure 1 : Primary Network Overview**

# Section 1 – Common Requirements

This section provides a description of the common network requirements and some definitions.

## 1-1 Definition of RS485 or EIA-485

The term RS485 is out-dated and was replaced with the latter specification called EIA-485 [TIA-485] balanced (differential) communication interface however industry norms still use RS485 and it is still used in this manual.

'Balanced' means that two signal wires are required to produce an alternating signal pattern. I.e. if the [+] terminal is measuring +5V then the [-] terminal is reading 0V, conversely if the [-] terminal is measuring +5V then the [+] terminal is reading 0V.

For reliability, when interconnecting different equipment, 3 wires are required. Typically those are named [+, -, 0V or S]. [+/-] and are used for data. [S] is the signal reference. Instead of having an individual third wire for [S], the shield from the Shielded Twisted Pair (STP) cable is used.

The RS485 interface is operating in 'half duplex' mode. Meaning only one transmitter can be active at the time but many receivers can listen simultaneously. A period of 'silence' is used to free the interface for another transmitter to become active.

Two more terms are frequently mentioned in conjunction with RS485.

Note the following:

### 1-1-1 Termination

[EOL]: Will be referred to as 'End Of Line' termination, in this manual.
A resistor (load) connected between terminals [+/-] of typically 120 Ohms.
There is one resistor connected at each end of a cable.
It is sometimes user selectable or fixed internally to the device.

### 1-1-2 Biasing

These are referred to as 'Pull-up/Pull-down' or 'Idle-line failsafe' resistors.
A weak current limited power supply individually connected to terminals [+ and -] to define the 485 interface to be Idle or silent when no transmitter is active, which is important to operate reliably in 'half duplex' mode.

The idle bias level can be checked with a voltmeter measuring between terminals [+ and -].
The reading is to be greater than +/-200mV.

**Note:** ensure that there is no comms activity while measuring.

### 1-1-3 Communications speed

Faster is not always better. Speed is a trade off between cable length and cable quality, link reliability, controller processing capability, cost and data quantities.

There is no doubt that increasing network speed makes networks more difficult to set up or fault find. Therefore it is important to take care during installations on where, how and what cables are routed between controllers.

The selected speeds of Innotech networks of controllers and wiring instructions in this manual are set out to achieve the best reliability.

## 1-2 Definition of Earth Types

There are three types of earth referred to in this document:

1. Bonded, hard or clean
2. Soft
3. Floating

These definitions are listed below in relation to the Innotech networks.

1. A bonded, hard or clean earth is defined as a low impedance earth point with little or no chance of conducted noise either already present or likely to be created when bonded to a circuit. For Innotech's reference we also explicitly mean there is no potential difference to true earth.
2. A soft earth is where there is a path to earth via a circuit this provides a tie to earth so potential differences are minimised. This path has higher impedance than a bonded earth. This does force strong earth currents, i.e. leakage currents from large AC motors, to remain on the proper heavy gauge earth wires, while leaving the soft earth paths unaffected. So whilst having multiple earth connections we have not created any effective earth loops. Soft earth is often used in 24V supplied devices. The 'tie to earth' is in fact a 'tie to 0V' because there is no dedicated earth terminal available. It is therefore expected that the 0V is earthed near the supply transformer.
3. Floating simply means that there is no path to an Earth point at all provided by the device, not even a soft earth path. A floating device has no earth.

## 1-3 Only One Earth Point

It is imperative that the screen is earthed at one point only and this is defined as any point along a network that is the best earth point along its length. Where 'best' earth point, is the point with least amount of earth potential fluctuations. I.e. A controller in the basement of a high rise building is closest to a good earth point than a controller in the plant room on top of the roof.

While there are internal jumpers on some devices to link the 'S' terminal internally to earth, there are variants in hardware types and revisions, simply connect a bonded earth as shown externally. This will suit all installations, regardless of age. If a repeater is installed each side of the repeater is to be treated as a separate standalone network and each must have an earth connected.

**Note:** when there is more than one connection point to earth the screen becomes a conductor and no longer performs correctly. Care should be taken to ensure only one bonded earth point is ever connected on a primary network. Refer section 1-7 for details on use of a Repeater in a primary network.

# Section 2 – Primary Networks

There are fifteen devices that connect directly to the primary Innotech network. These are listed in table 1 below:

| Part Number | Comms Terminals | Comms Isolation | Screen Type | Description |
|---|---|---|---|---|
| GENIIxLD | G+ G- S N+ N- | Fully isolated | Soft Earth to Earth power terminal 3 | Genesis Version 5 Hardware |
| MPCIILN | G+ G- S N+ N- | Fully isolated | Soft Earth to Earth power terminal 3 | MPC Version 6 Hardware |
| GENESIS II V4 | G+ G- S N+ N- | Optional<br>Full isolation card | Tie Terminal | Genesis Version 4 Hardware<br>(Obsolete) |
| GENII MPC | G+ G- S N+ N- | Fully isolated | Soft Earth to Earth power terminal 3 | MPC Version 4 Hardware |
| GENESIS II V3 | G+ G- S / N+ N- S | Optional<br>Full isolation card | Tie Terminal | Genesis Version 3 Hardware<br>(Obsolete) |
| MAX3xLx | G+ G- S N+ N- | Robust<br>High protection | Soft Earth to power supply 0V terminal | Maxim Series 3 Hardware |
| MAX2Lx | G+ G- S N+ N- | Robust<br>High protection | Tie Terminal | Maxim Series 2 Hardware |
| MM01 | G+ G- S N+ N- | Robust<br>High protection | Soft Earth to power supply 0V terminal | Mini Maxim Controller |
| GENII VIEWPORT | S1 + - S2 | Fully isolated | Soft Earth to power supply 0V terminal | Viewport Network Display |
| MP01 | S1 + - S2 | Fully isolated | Soft Earth to Earth power terminal 3 | Mini Port Maxim Network Display |
| GENII RPTR | G+ G- S N+ N- | Fully isolated | Soft Earth to Earth power | Repeater (9600 baud)<br>(Obsolete) |

| | | | | |
|---|---|---|---|---|
| | | | terminal 3 | |
| IR12 | G+ G- S N+ N- | Fully isolated | Soft Earth to power supply 0V terminal | Repeater dual channel (auto detect dual baud) |
| GENII MPI | G+ G- S N+ N- | Optional<br>Fully isolated | Tie Terminal | Modem Printer Interface |
| CONV 232 | S1 + - S2 | Fully isolated | Floating Earth | RS232 to RS485 converter |
| CONV E | S1 + - S2 | Fully isolated | Floating Earth | Ethernet to RS485 converter |
| CONV USB | S1 + - S2 | Fully isolated | Floating Earth | USB to RS485 converter |
| ICS01 | S1 + - S2 | Fully isolated | Soft Earth to Earth power terminal 3 | Control Station type 1 |
| ICS02 | S1 + - S2 | Fully isolated | Soft Earth to Earth power terminal 3 | Control Station type 2 |

**Table 1 : Primary Network Digital Controllers and devices**

There are a number of rules that apply to the comms connection of a primary network.

Some of these are explained in detail in sections 1-1 and 1-2 of this manual.

Primary network rules:

1. The screen must be continuous
2. Only one point earthed on the screen
3. Even if a network has a number of devices with a soft earth, one hard earth is still required on that network
4. The Net and Global networks should have the same length cable run and path
5. If a repeater is installed, each side of that repeater is a separate network and each requires a bonded earth connection on the screen
6. Using isolated devices, devices with isolated comms cards or using an isolated MPI does not alter any of these rules
7. There are no End of Line termination requirements on the primary network

  

## 2-1 Continuous Screen

The screen on a primary network needs to be continuous. That means it remains unbroken along its entire length. As there is one 'S' terminal on a typical primary network device both the global and net screens are to be connected to this tie terminal.

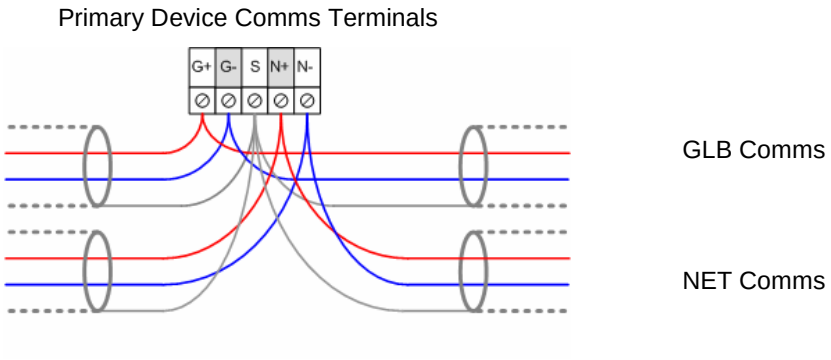


**Figure 2 : Typical Screen Connections**

**Note:** when there is more than one connection point to earth the screen becomes a conductor and no longer performs correctly. Care should be taken to ensure only one bonded earth point is ever connected on a primary network. Refer section 1-7 for details on use of a Repeater in a primary network.

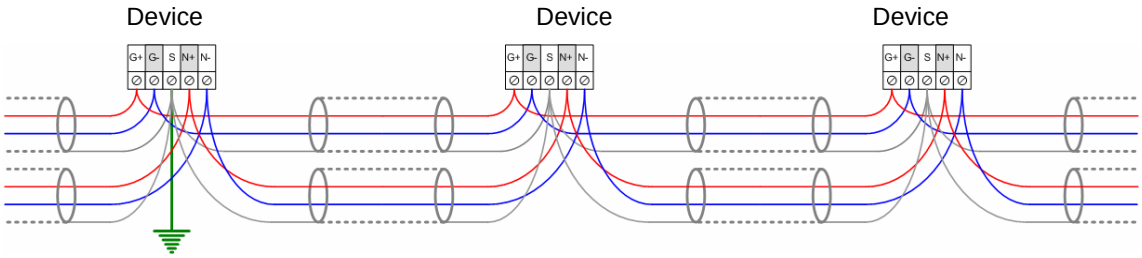


**Figure 3 : Earth Connection**

## 2-2 Management of other devices on the Primary Network

When other controllers such as Viewports or converters are added to the primary network they must be installed in a manner that does not interrupt the integrity of the primary network. A lot of current devices will have the soft earth option and are fully isolated from the factory. There is no issue mixing the current style earth connection with previous models of hardware on the primary network if the following rules are applied.

These HMIs and converters will be referred to as soft earth devices with respect to comms screen termination.

For any soft earth type device connected to a primary network there are some general rules for connection.

1. Do not break the continuity of the screen
2. Use the 'S1' terminal for both the entering and leaving screen termination
3. You must earth the system at a single bonded earth point. This is regardless of the number of soft earth points connected
4. Attempt to ensure the net and global networks are the same length and follow the same path

### 2-2-1 HMI's and Converters

Typically all converters or HMIs will connect to the NET network and do not connect to the Global network. This will present a few variations in how this device could be connected to the network. It is important to ensure that the screen is kept continuous.

This style of connection applies to all converters and HMIs.

HMI or Converter Comms Terminals

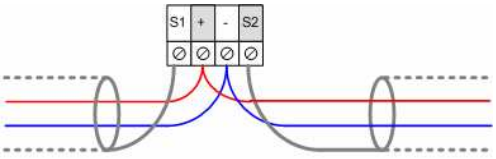


**Figure 4 : Published HMI or Converter Comms Connection**

The below connection is wrong because it breaks the continuity of the screen creating a situation where potential differences in earth current between Device 1 and Device 2 can occur, therefore the reliability of the comms connection may be compromised.

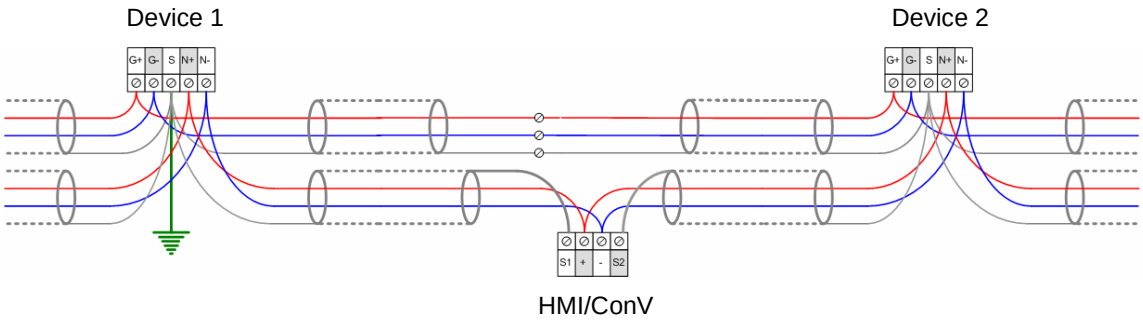


**Figure 5 : Wrong HMI or Converter Connection**

In the correct example, notice that the NET comms screen is in 'S1' terminal only. If you were to use the 'S1' and 'S2' terminals you would break the continuity of the NET screen. This could cause a potential difference between each side of the HMI or converter and possibly introduce network reliability issues.

The HMI or converter must have the Earth terminal or the 24V neutral, connected to earth where available. This will provide the path for the soft earth.

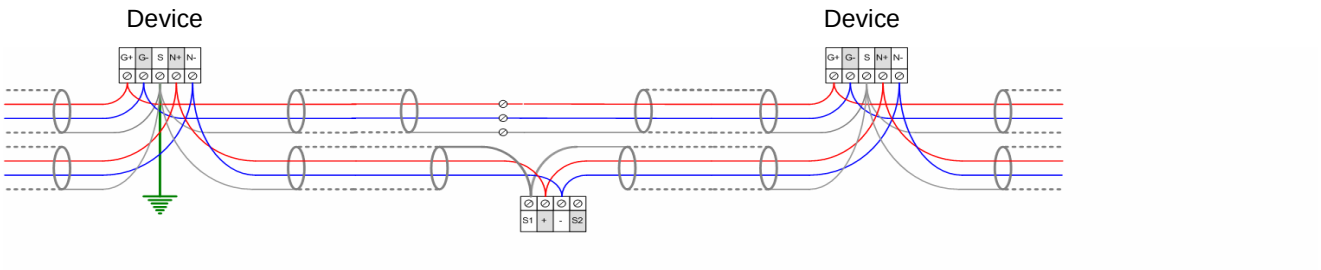


**Figure 6 : Correct HMI or Converter Comms Connection**

## 2-2-2 Control Stations (ICS)

Typically a control station connects to the Global network and does not connect to the Net network. This will present a few variations in how this device could be connected to the network. It is important to ensure that the screen is kept continuous.

This style of connection applies to all globally connected devices.

The rules of application are similar to that of the HMI or Converter connections in the prior section. You must ensure the global and net cable lengths are the same.

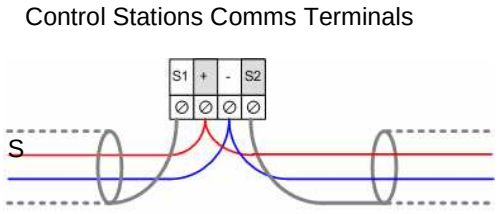


**Figure 7 : Wrong Control Station Comms Connection**

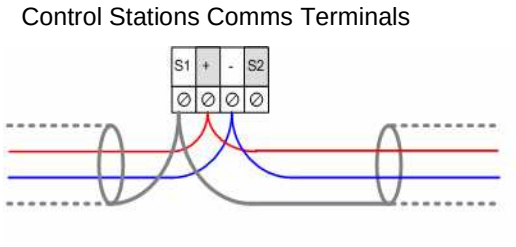


**Figure 8 : Correct Control Station Comms Connection**

In this correct example you can see that the GLB comms screen is in 'S1' terminal only. If you were to use the 'S1' and 'S2' terminals you would break the continuity of the GLB screen. This could cause a potential difference between each side of the ICS and possibly introduce network reliability issues.

The ICS must have the earth terminal or the 24V neutral, connected to earth where available. This will provide the path for the soft earth.

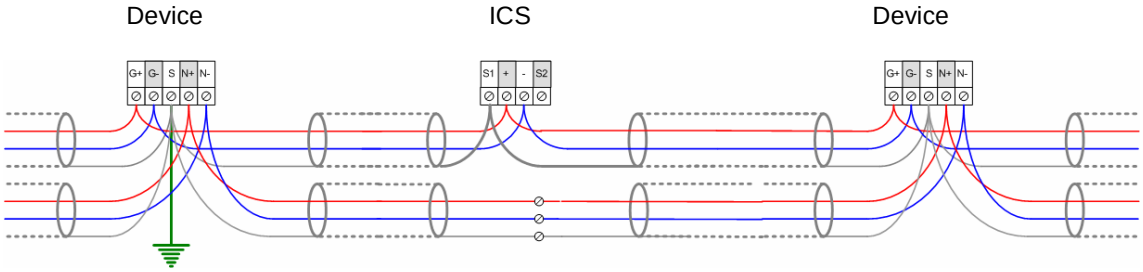


**Figure 9 : Correct Network Connection**

## 2-2-3 Earth Connections

The earth connection type on HMIs and converters depends on the typical application of the device. A potential earth difference between main installations and remote HMIs can cause problems in the network.

An attempt must be made to eliminate the earth potential differences between the Net comms and Global comms network cabling. This applies to any soft or floating earth device connected to a primary network.

The list below indicates the different types of earth connections.

- The GENII VIEWPORT has terminal 3 for the dedicated earth connection. It is used for the soft earth path of the comms screen terminal
- The MP01 MiniPort has terminal E for the dedicated earth connection. It is used for the soft earth path of the comms screen terminal

**Note:** where either the GENII VIEWPORT or MP01 MiniPort may have the 24V neutral earthed there is no link to the earth terminal. Therefore a **hard earth** connection to the earth terminal is still required.

- The CONV E should have the 24V supply earthed on the secondary of the transformer as best practice. The CONV E has a floating type screen connection
- The CONV USB and the CONV 232 are isolated or floating devices and where they have a soft earth type comms connector fitted there is **no path** to earth available at these devices

The following indicates how a network can be practically wired to eliminate earth potential differences and problems that may occur between the Net and Global networks.

1. When the HMI or converter is mounted at the end of a run, the Global can finish at the last controller. It is sufficient to run NET only from the last controller to the HMI or converter.

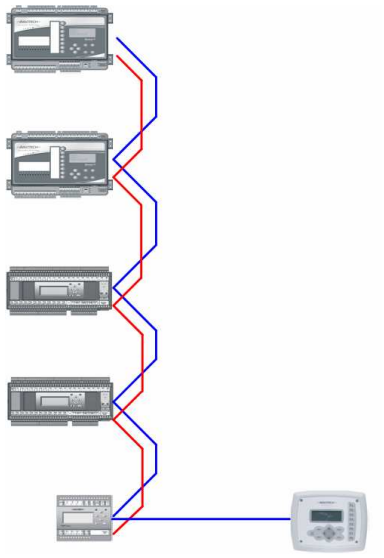

**Figure 10 : End of run mounted HMI's or converters**

2. In the wrong example below, the cable run for the NET comms is significantly longer than that of the Global comms. This can cause an earth potential difference between the net and global screen resistances and therefore unequal current flows which can cause network problems.

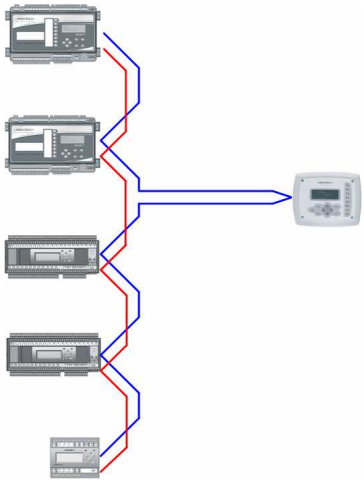

**Figure 11 : Remote mounted HMI's or converters**

To rectify the above incorrect wiring situation you must use one of the following options:

A. Branch off earth screens at the single comms earth point where the Net cable is routed through the HMI without the Global cable. This is the Hard Earth

B. Keep the Net and Global network cables the same length and following the same path

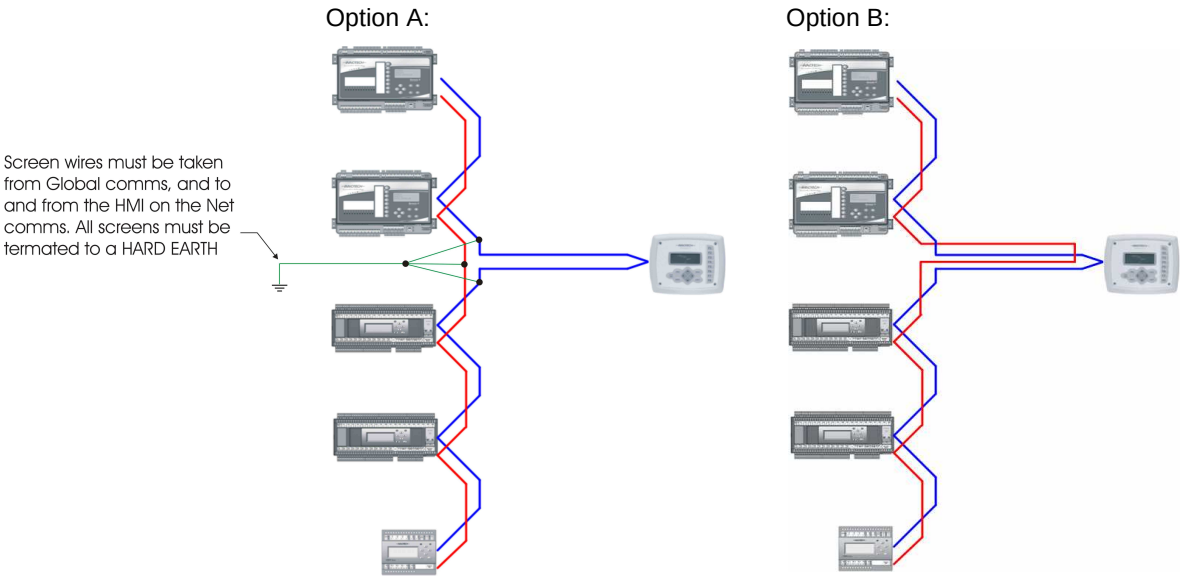


**Figure 12 : Options to eliminate earth potential differences between networks**

**Note:** Generally in all installations care must be taken when selecting the **best** earth point. Good earth points are usually close to the earth stake and away from heavy power equipment. Heavy power equipment causes earth currents and therefore the earth point is subject to potential differences in current interference, and as such is usually not a good choice.

## 2-3 Older Controllers

There are some earlier devices, version V3, V3.1 and V3.2 Genesis and MPC controllers that do have jumpers available to internally connect the 'S' terminal to either the 0V terminal or a separate Earth terminal.

**Note:** these jumpers have not been fitted at point of manufacture to suit the style of earth connection recommended in this document.

## 2-4 Isolated Devices

Regardless of the type of isolation used in either the current model devices (all now standard with fully isolated soft earth) or older series controllers (plug-in optional isolation card), there is no effect on the primary network earth requirements. The isolation is not on the primary network, but between the primary network and the power supply of only that respective controller. All network rules apply as stated.

## 2-5 Dual Channel Repeaters

When a repeater is added to a network it effectively creates two separate networks.

This means users must apply all the rules to each side of the repeater as if they were actually two completely separate networks. All primary network rules apply without variation.

All repeaters do have Soft Earth features. They do not negate the need for a hard earth on either side of the repeater network sections. It is not recommended to earth both ports (1 & 2) right at the repeater as this would defeat some of the advantages of the port isolation. Port 2 (remote port) should always be earthed on the remote side.


**CAUTION – Hazardous Voltage between Earth-Connections**

When the Digital Controllers are supplied and earthed from two different switchboards, a hazardous situation can be created. One earth connection is at the local switchboard and the second earth connection is by way of the screen of the comms cable (Figure 9 and 10). In the event of a fault, there could be full supply voltage difference between the two earth connections. Always measure the voltage between Port 1 & 2 screens before handling. Use appropriate safety precautions.

## 2-5-1 Older Repeaters

The GENII RPTR is the earlier version repeater, easily identified by the fact that it is housed in a square surface mount enclosure. On these older repeaters Port 1 and Port 2 are isolated from each other, however Port 1 is internally connected to the main electronic circuits. Due to this; Port 2 is better isolated and has a higher level of tolerance with respect to comms protection.

It is best to ensure that if there is a long run and the converter is in building A and running to building B; Port 2 is used to feed Building B. As shown in Figure 9.

The power terminal earth connection is a safety earth because the GENII RPTR is supplied with 240AC. This terminal is NOT connected to the Soft Earth terminal located between comm Ports 1 & 2.

**Note:** the earth on the RPTR is connected to the soft earth terminal as a requirement.

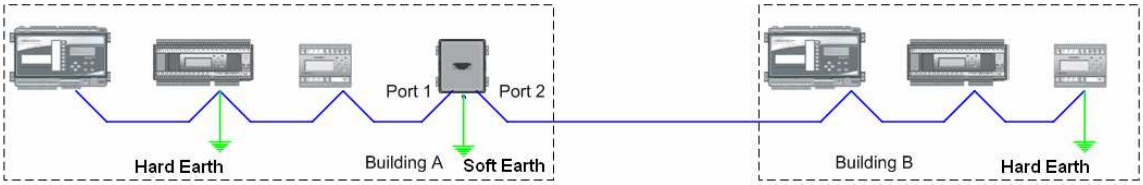


**Figure 13 : Old Style Repeater**

## 2-5-2 New Repeaters

New repeaters are identified by the fact that they are mounted in a DIN rail mount enclosure. Neither have a separate earth terminal as it is a 24VAC powered device, however the 24V supply must be earthed on the 0V side for safety and to make use of the Soft Earth feature.

The IR12 is the current dual channel and dual baud rate repeater.

The IR11 is the current single channel dual baud rate repeater.

The IR12 and IR11 are fully isolated and both Port 1 and Port 2 offer the same level of protection. That means that both Ports 1 & 2 can be used for the remote site connection.

**Note:** the earth on the IR12 must be connected to the soft earth terminal.

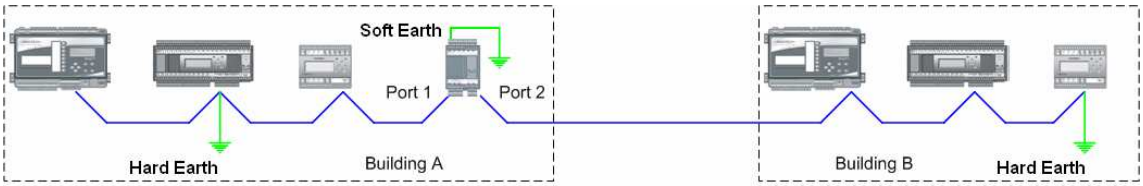


**Figure 14 : New Style Repeater**

**Note:** refer to section 2-3 for information regarding the IR11 single channel repeater.

## 2-6 End Of Line Termination (EOL)

Due to specific design parameters relating to the bias of the network and network configurations, the Primary network has currently no need for End Of Line Terminations.

# Section 3 – Sub Networks

The two Innotech sub networks are both two wire networks.

These comprise of the REM network and the Sub System Network (SSN).

The REM network is a Remote Expansion Module Network. Providing remote I/O expansion devices controlled via a Genesis controller. This network is a 38.4K baud network.

The SSN is a sub system network of small point devices such as VAVMax and MiniMax. This network is a 115K baud network.

Below are some general rules for connection for all Sub Network devices.

1. Every SSG network device has a soft earth connection
2. Every REM network device has a soft earth connection
3. Every REM must have an earth connected
4. All Repeaters, VAV Maxims or Mini Maxims must have the 0V of the power supply earthed
5. Always fit End Of Line (EOL) Terminators on each end of each network section

## 3-1 REM Network

There are sixteen devices that exist on the REM network. These are listed below:

| Part Number | Comms Terminals | Screen Type | Description |
|---|---|---|---|
| GENII RMI | S1 + - S2 | Soft Earth | Remote Module Interface |
| IR11 | S1 + - S2 | Soft Earth to power supply 0V terminal | Repeater single channel (auto detect dual baud) |
| GENII DI REM | S1 + - S2 | Soft Earth | Digital Input REM |
| GENII IDI REM | S1 + - S2 | Soft Earth | Isolated Digital Input REM |
| GENII DO REM | S1 + - S2 | Soft Earth | Digital Output REM |
| GENII AI REM | S1 + - S2 | Soft Earth | Analogue Input REM |
| GENII AO REM | S1 + - S2 | Soft Earth | Analogue Output REM |
| GENII PI REM | S1 + - S2 | Soft Earth | Pulse Input REM |
| GENII CS REM | S1 + - S2 | Soft Earth | Control Stations REM |
| GENII CSAH REM | S1 + - S2 | Soft Earth | Control Stations REM |
| GENII CSFAH REM | S1 + - S2 | Soft Earth | Control Stations REM |
| GENII MZS REM | S1 + - S2 | Soft Earth | Control Stations REM |
| GENII MZSAH REM | S1 + - S2 | Soft Earth | Control Stations REM |
| GENII MP405 REM | S1 + - S2 | Soft Earth | Multi Point REM |
| GENII MP414 REM | S1 + - S2 | Soft Earth | Multi Point REM |
| GENII MP423 REM | S1 + - S2 | Soft Earth | Multi Point REM |
| GENII MP432 REM | S1 + - S2 | Soft Earth | Multi Point REM |
| | | | |

**Table 2 : REM Network Controllers and devices**

The REM network is a two wire network that communicates at 38.4K baud. It is required that the EOL jumpers are fitted correctly and that each device is earthed correctly.

The only device on a REM network without an earth terminal is the IR11 repeater. It must have the 0V of its power supply earthed.

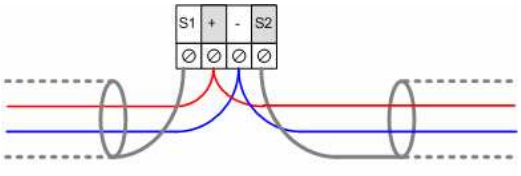


**Figure 15 : REM Network Terminals**

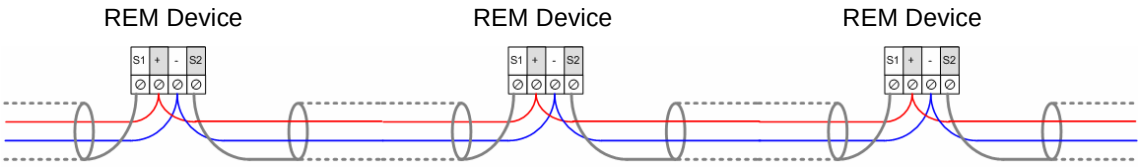


**Figure 16 : REM Network**

## 3-1-1 Soft Earth

All REM devices have a soft earth and as such the Earth must be connected to the terminal ‘E’. This provides the required path to earth. It is not sufficient to have the 0V earthed on the 24V powered devices as these are separated.

## 3-1-2 End of Line Termination (EOL)

All REM's have EOL jumpers and these must be fitted correctly. See the figures below.
There are many variations to network layouts the following four examples provide a guide to correct jumper application.

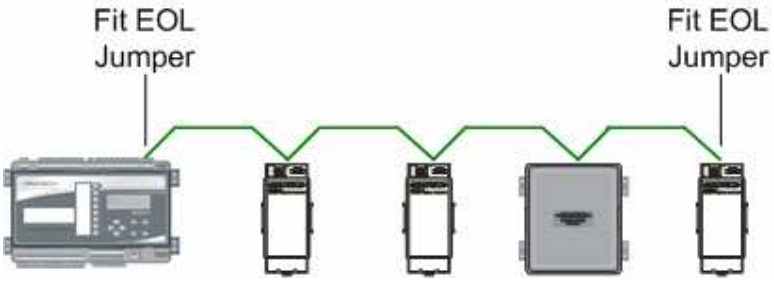


**Figure 17 : Simple REM network**

**EXAMPLE 1:**

This example shows a GENIIELD controller with a straight forward network of REM's.

**Note:** both ends must have the EOL jumpers fitted.

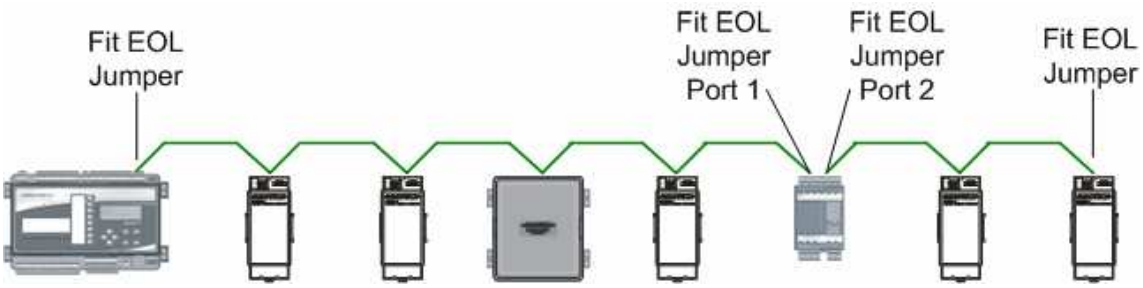


**Figure 18 : REM network with a repeater**

**EXAMPLE 2:**

This example shows a GENIIELD controller with a network of REM's and an IR11 repeater fitted.

As in section one, once a repeater is installed there are effectively two networks and each must have the EOL jumpers fitted.

**Note:** both ends must have the EOL jumpers fitted.

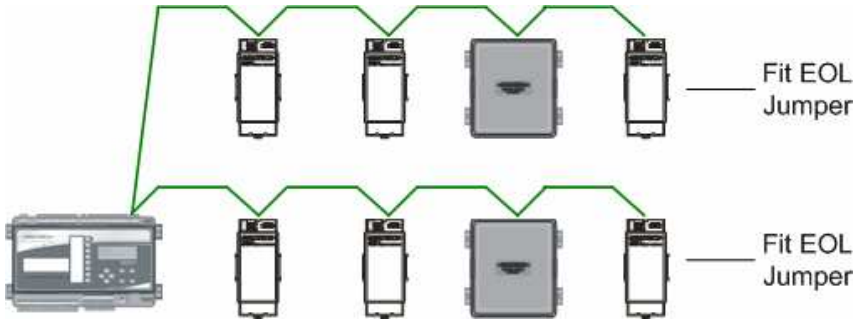


**Figure 19 : REM network where the controller is in the middle of the run**

**EXAMPLE 3:**

This example shows a GENIIELD controller with a network of REM's where the controller is in the middle of the run.

**Note:** both ends of a run must have the EOL jumpers fitted. It does not need to be a primary device.

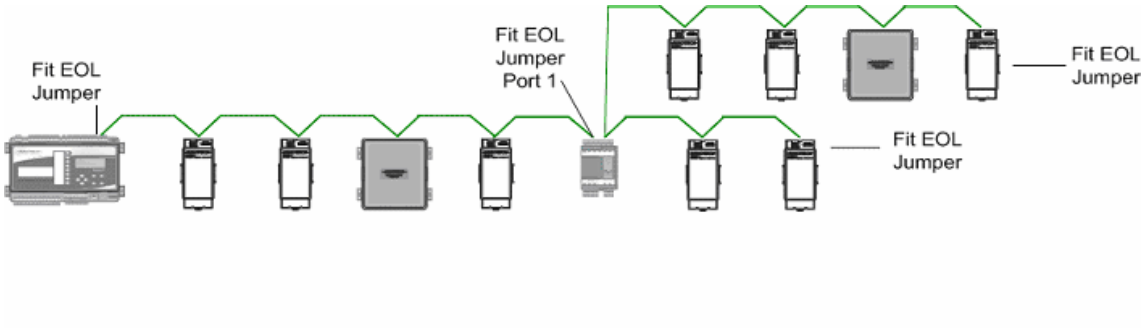


**Figure 20 : REM network with a repeater in the middle of a run**

**EXAMPLE 4:**

This example shows a GENIIELD controller with a network of REM's where the there is a repeater fitted and it is located in the middle of a run.

**Note:** how the repeater has the EOL jumper fitted on port 1 but not on port 2.

## 3-2 SSG Network

The SSG network is a sub network that connects to the Innotech primary network via a gateway. The Sub System Gateway SSG is a data concentrator for the SSG network.

The SSG network is a two wire network that communicates at 115K. It is a requirement that the EOL jumpers are fitted correctly and that each device is earthed correctly.

No devices on the SSG network have an earth terminal. All devices must have the 0V earthed.

There are currently four devices that exist on the Sub System Gateway network. See the table below:

| Part Number | Comms Terminals | Screen Type | Description |
|---|---|---|---|
| IR11 | S1 + - S2 | Soft Earth | Repeater Single Channel |
| VM01 | P+ P- + - S | Soft Earth | VAV Maxim |
| MM02 | S1 + - S2 | Soft Earth | Mini Maxim |
| IG01 | P+ P- + - S | Soft Earth | Sub System Gateway |

**Table 3 : SSG Network Controllers and devices**

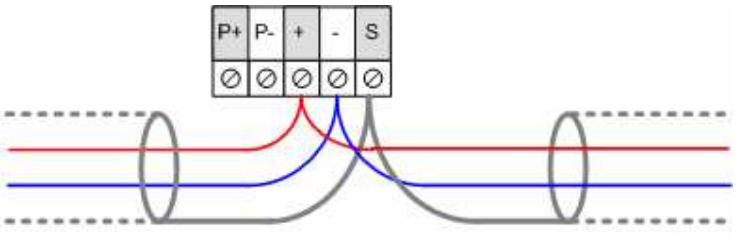


**Figure 21 : VAVMax and SSG Terminal connections**

### 3-2-1 VAV Maxims (VM01)

The VAVMAx has a 5 way connector where the terminals are made up of P+ P- + - S. This is due to the fact that the Sub System Commissioning Tool (CT01) is powered by the P+ and P- terminals. These terminals have different pin spacing to the primary network terminals and while they look similar, they are not, and can't be interchanged.

### 3-2-2 SSG Mini Maxims (MM02)

These Mini Max controllers have the REM style of comms connector.

When used in conjunction with VM01 VAV controllers care should be taken to ensure only the S1 terminal is used to maintain the continuity of the screen.

## 3-3 IR11 Single Channel Repeater

The IR11 single channel repeater has the REM style connectors.

When used in conjunction with VM01 VAV controllers, care should be taken to ensure only the S1 terminal is used to maintain the continuity of the screen.

Please refer to the general Repeater section 1-7 in this manual for additional information and safety precautions.

**CAUTION – Hazardous Voltage between Earth-Connections**

When the Digital Controllers are supplied and earthed from two different switchboards, a hazardous situation can be created. One earth connection is at the local switchboard and the second earth connection is by way of the screen of the Comms cable (Figure 9 & 10). In the event of a fault, there could be full supply voltage difference between the two earth connections. Always measure the voltage between Port 1 & 2 screens before handling. Use appropriate safety precautions.

## 3-4 Network with VAVMax and MiniMax devices

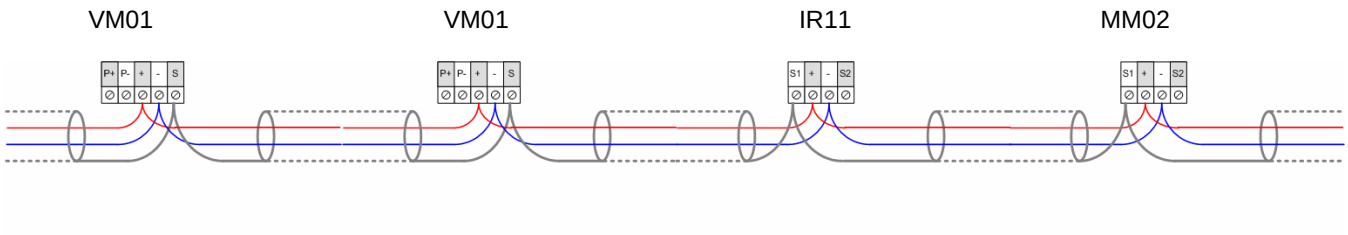


**Figure 22 : VAVMax and SSG network connections**

The figure above indicates that the screen is to be continuous for the entire network run. Devices with the S1 and S2 screen terminals use only the S1 terminal.

## 3-5 End Of Line Termination (EOL)

All devices on the SSN have EOL jumpers and these must be fitted correctly. This is shown in the figure below. There are many variations to network layouts. The following 4 examples provide a guide to correct jumper application. These are similar to the REM network.

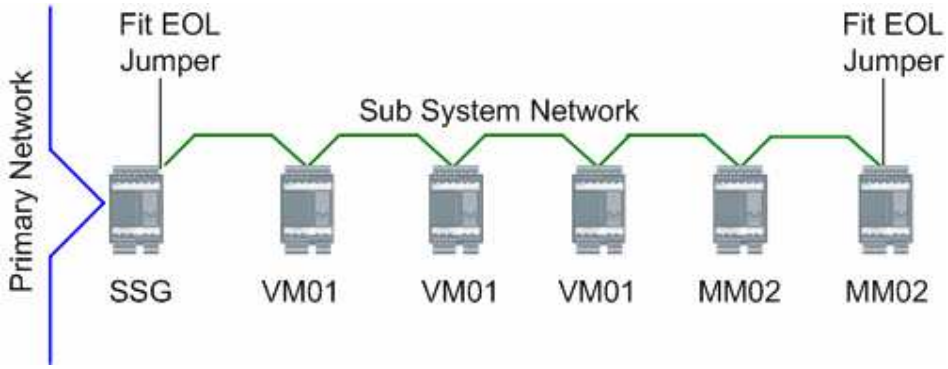


**Figure 23 : Simple SSN network**

**EXAMPLE 1:**

This example shows a SSG (Sub System Gateway) controller with a network of VAVMax and Mini Max Controllers.

**Note:** both ends must have the EOL jumpers fitted.

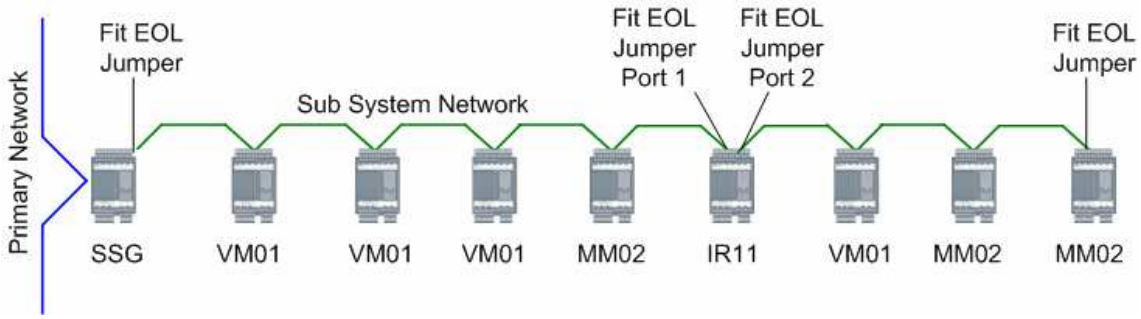


**Figure 24 : SSG Network with a repeater**

**EXAMPLE 2:**

This example shows a SSG (Sub System Gateway) controller with a network of VAVMax and Mini Max Controllers with a repeater in the middle.

**Note:** both ends must have the EOL jumpers fitted.

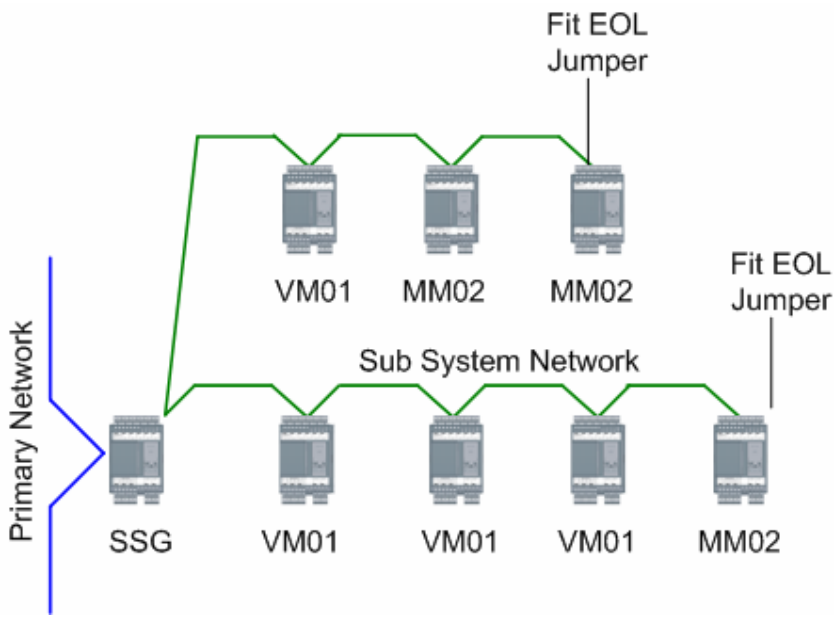


**Figure 25 : Network with the SSG in the middle of a run**

**EXAMPLE 3:**

This example shows a SSG with a network of VAVmax and Mini Max controllers where the SSG is in the middle of the run.

**Note:** both ends of a run must have the EOL jumpers fitted, it does not have to be a primary device.

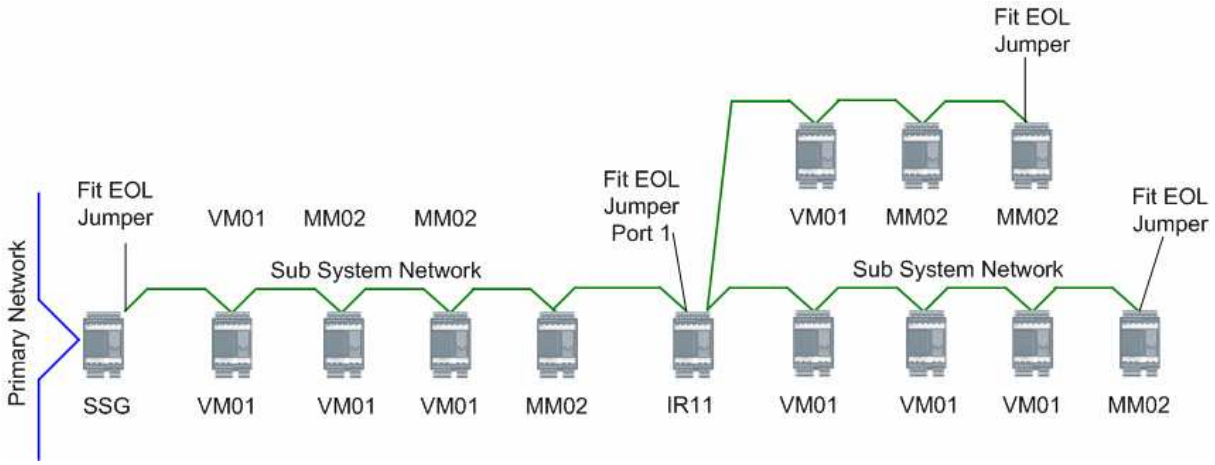


**Figure 26 : SSG Network with a repeater in the middle of a run**

**EXAMPLE 4:**

This example shows a SSG with a network of VAVmax and Mini Max controllers with a repeater where the repeater is in the middle of the run.

**Note:** only one side of the repeater is in the middle of a run. The repeater has the EOL jumper fitted on port 1 but not on port 2.

# Section 4 – General Cable specifications

There are many cables on the market that meet the specifications outlined below. CAT6 shielded cable is suitable for use in Innotech networks. However care should be taken to ensure the alternate cables meet the required specifications. The most frequent omission is shielding, this is perhaps the singular most important requirement.

## 4-1 Primary Network

CAT6 STP Shielded twisted pairs, where each pair is individually shielded is suitable for multiple EIA-485 communications channels, such as the Innotech Primary Comms network.

Any cable that meets all the stated specifications is suitable for use.

| **Primary Network** |
|---|
| |
| Number of strands 7 |
| 2 twisted Pairs |
| Overall screen plus individual |
| Between 36 to 45pF per meter |
| less than 68pf capacitance/m between conductors and shield |
| 120 ohm impedance |
| Strands 0.3mm |
| sheath thickness 0.30mm 240v Rated |
| |

**Table 4 : Primary Network 2 Core Cable Specifications**

## 4-2 Sub Networks

CAT6 FTP Foil screened twisted pair cable is suitable for single EIA-485 communications channel. Any cable that meets all the stated specifications is suitable for use.

| **Primary Network** |
|---|
| |
| Number of strands 7 |
| 1 twisted Pair |
| Overall screen |
| Between 36 to 45pF per meter |
| Less than 68pf capacitance/m between conductors and shield |
| 120 ohm impedance |
| Strands 0.3mm |
| Sheath thickness 0.30mm 240v Rated |
| |

**Table 5 : Sub Network 1 Pair Cable Specifications**

# Section 5 – Glossary of Terms

| | | |
|---|---|---|
| **REM** | : | Remote Expansion Module(s) |
| **SSN** | : | Sub System Network |
| **SSG** | : | Sub System Gateway |
| **HMI** | : | Human Machine Interface |
| **EOL** | : | End of line |
| **VAV** | : | Variable Air Volume |
| **I/O** | : | Inputs and Outputs |

**Table 6 : Glossary of Terms**