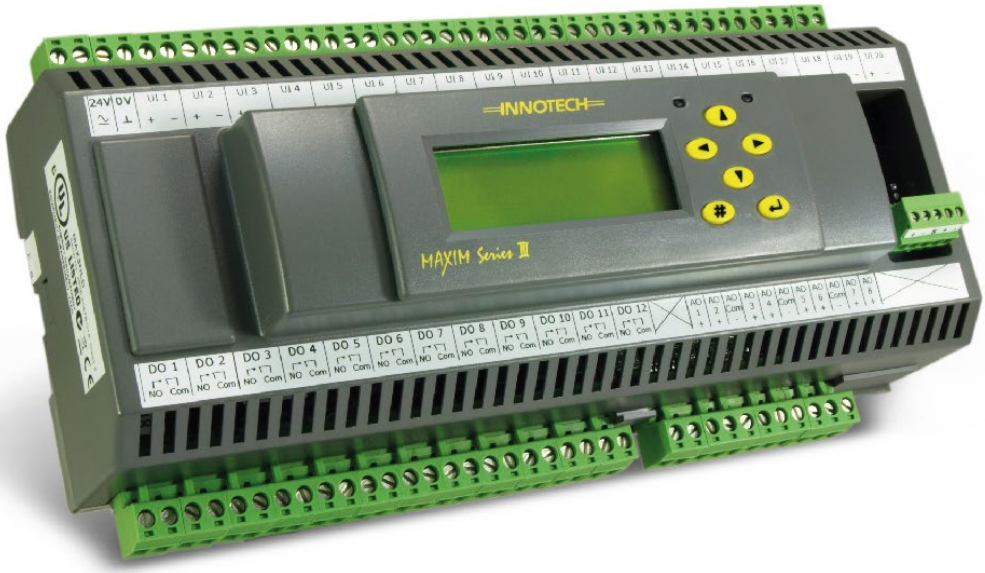
Innotech Device Network Cabling

INSTALLATION INSTRUCTIONS



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Document Management

Document Title: Innotech® Device Network Cabling Installation Instructions

Revision History

Version Number	Date	Summary of Changes
1.7	October 2007	Initial Document Release.
1.8	May 2008	Added REM EOL Information. Section 4 Revised.
1.9	July 2008	Technical Update.
2.0	October 2009	Added UM01, IG01, IG02 & IG03. Updated information for maximum cable lengths, maximum devices before repeater, updated descriptions and graphics.
3.0	December 2013	File Type Converted, Style Update, Contact Details Update, Added Maxim 1010 & IWS01.

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Technical Manual Overview

The Installation Manual for Innotech Device Network Cabling 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

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 installer is familiar with the installation of RS485 Communication networks.

The following instructions and procedures are presented at a technical level that assumes 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.

Organisation of this Manual

This instruction manual has six sections:

Table 1: Document Organisation

Chapter Number	Chapter Title	Description
Chapter 1	Common Requirements	Provides a description of the common network requirements.
Chapter 2	Primary Networks	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.
Chapter 3	Sub Network Devices	Provides a description of Sub Network Devices 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 Network.
Chapter 4	General Cable Specifications	Provides a list of the general network rules that apply to all networks and the cable specifications.
Chapter 5	Glossary of Terms	The Glossary of Terms 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.
Chapter 6	Factory Settings for RS485 End of Line Termination (EOL)	Provides a table of the Factory Settings for RS485 End of Line Termination (EOL).

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Innotech Device Network Cabling

INSTALLATION INSTRUCTIONS

Chapter 1 - Common Requirements

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1-1 Definition of RS485 or EIA-485

The term RS485 is outdated and was replaced with the latter specification called EIA-485 [TIA-485] balanced (differential) communication interface however the industry still uses 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.

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:

- Bonded, hard or clean
- Soft
- Floating

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

Table 1-1: Earth Types

Type	Description
Bonded, Hard or Clean	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.
Soft	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 24 V supplied devices. The 'tie to earth' is in fact a 'tie to 0 V' because there is no dedicated earth terminal available. It is therefore expected that the 0 V is earthed near the supply transformer.
Floating	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 Earth Points

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 to Chapter 2-6 for details on use of a Repeater in a primary network.

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Chapter 2 -
Primary Networks

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Primary Network Devices

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

Table 2-1: Primary Network Digital Controllers and Devices

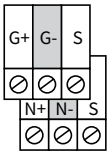
Part Number	Comms Terminals	Comms Isolation	Screen Type	Description
GENIIxLD		Fully isolated	Soft Earth to Earth power terminal 3	Genesis Version 5 Hardware
MPCIILN		Fully isolated	Soft Earth to Earth power terminal 3	MPC Version 6 Hardware
GENESIS II V4		Optional Full Isolation Card	Tie Terminal	Genesis Version 4 Hardware (obsolete)
GENII MPC		Fully isolated	Soft Earth to Earth power terminal 3	MPC Version 4 Hardware
GENESIS II V3		Optional Full Isolation Card	Tie Terminal	Genesis Version 3 Hardware (obsolete)
MAXIM 1010		Robust High protection	Soft Earth to power supply 0V terminal	Maxim 1010
MAX3xLx		Robust High protection	Soft Earth to power supply 0V terminal	Maxim Series 3 Hardware
MAX2Lx		Robust High protection	Tie Terminal	Maxim Series 2 Hardware
MM01		Robust High protection	Soft Earth to power supply 0V terminal	Mini Maxim Controller
GENII VIEWPORT		Fully isolated	Soft Earth to power supply 0V terminal	Viewport Network Display
MP01		Fully isolated	Soft Earth to Earth power terminal 3	MiniPort Maxim Network Display

Table 2-1 Continued

Part Number	Comms Terminals	Comms Isolation	Screen Type	Description
GENII RPTR		Fully isolated	Soft Earth to Earth power terminal 3	Repeater 9600 baud (obsolete)
IR12		Fully isolated	Soft Earth to power supply 0V terminal	Repeater dual channel (auto detect dual baud)
GENII MPI		Optional Fully Isolated	Tie Terminal	Modem Printer Interface
CONV 232		Fully isolated	Floating Earth	RS232 to RS485 converter
CONV E		Fully isolated	Floating Earth	Ethernet to RS485 converter
CONV USB		Fully isolated	Floating Earth	USB to RS485 converter
ICS01		Fully isolated	Soft Earth to Earth power terminal 3	Control Station type 1
ICS02		Fully isolated	Soft Earth to Earth power terminal 3	Control Station type 2
IG01		Robust High protection	Soft Earth to power supply 0V terminal	Sub System Gateway
IG02		Fully isolated	Soft Earth to power supply 0V terminal	Dynalight Gateway
IG03		Robust High protection	Soft Earth to power supply 0V terminal	BACnet Gateway
IWS01		Robust High protection	Soft Earth to power supply 0V terminal	innSIGHT Supervisor Web Server

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

Some of these are explained in detail in Chapter 1 of this manual.

Primary network rules:

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

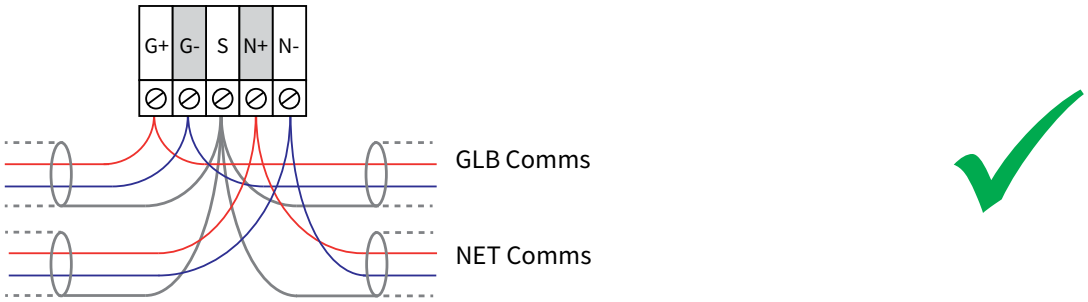


Figure 2-1: Typical Screen Connections

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 to Chapter 2-6 for details on use of a Repeater in a primary network.

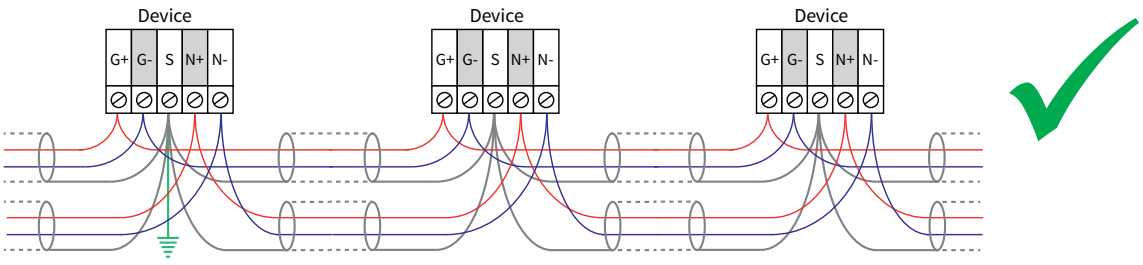


Figure 2-2: Earth Connection

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.

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

2-2.1 HMIs 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.

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.

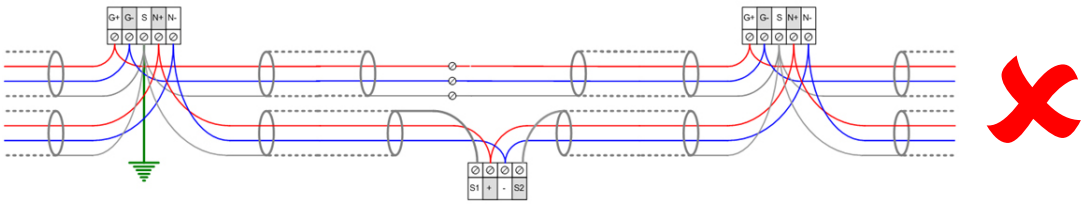


Figure 2-3: Incorrect HMI or Converter Comms Connection

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.

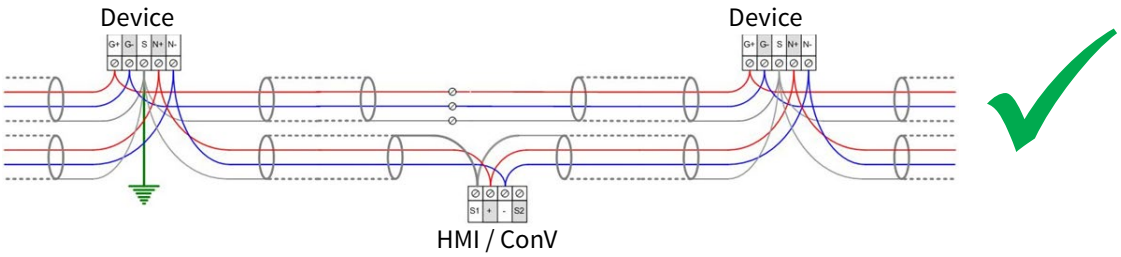


Figure 2-4: Correct HMI or Converter Comms Connection

2-2.2 Control Stations (ICS) and DynaLite Gateway (IG02)

Control Stations and DynaLite Gateways connect to the Global network and do not connect to the Net network. This will present a few variations in how these devices 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.

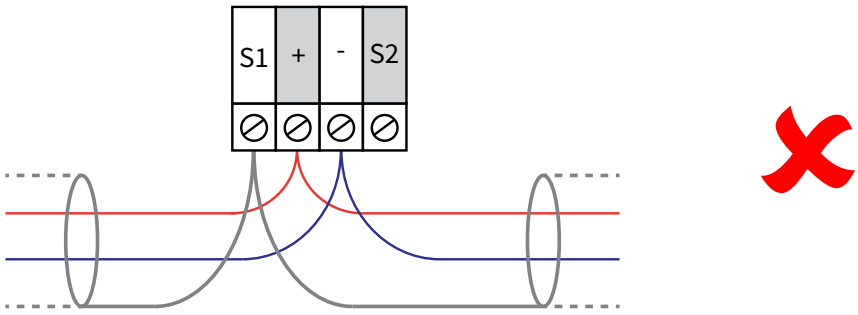


Figure 2-5: Incorrect Station IG02 Comms Connection

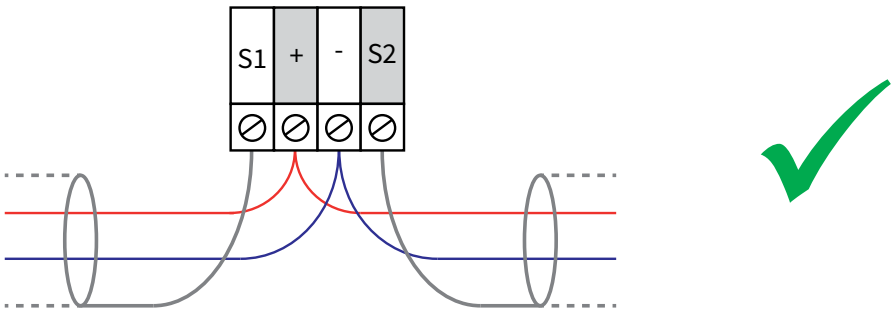


Figure 2-6: Correct Station IG02 Comms Connection

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 / IG02 and possibly introduce network reliability issues.

The ICS / IG02 must have the earth terminal or the 24V neutral, connected to earth where available. This will provide the path for the soft earth.

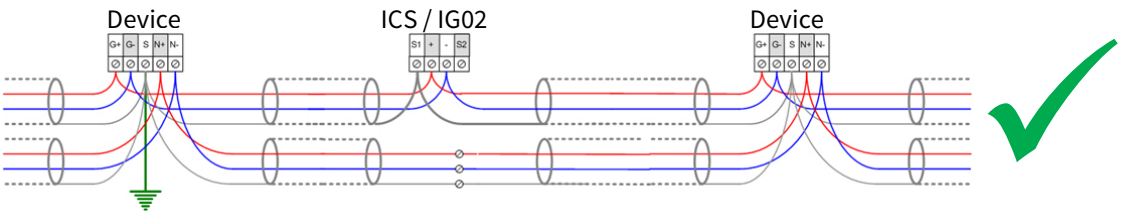


Figure 2-7: Correct Station ICS / IG02 Network Connection

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 24 V 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.

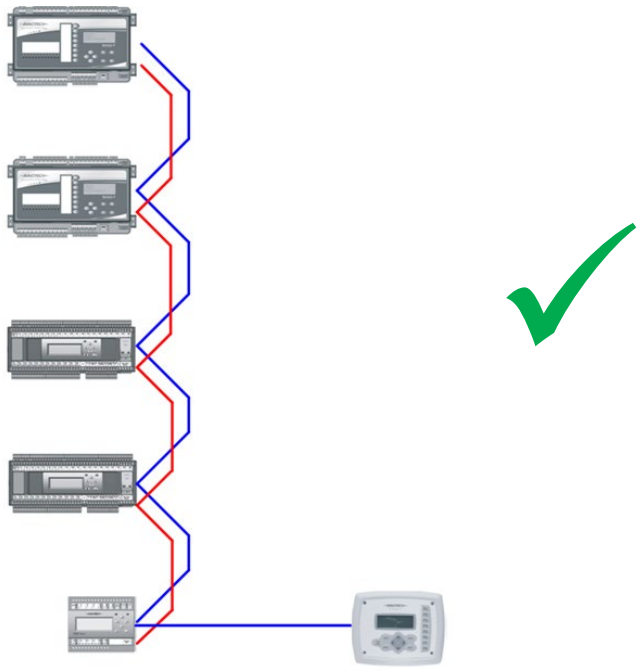


Figure 2-8: End of Run Mounted HMIs or Converters

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.

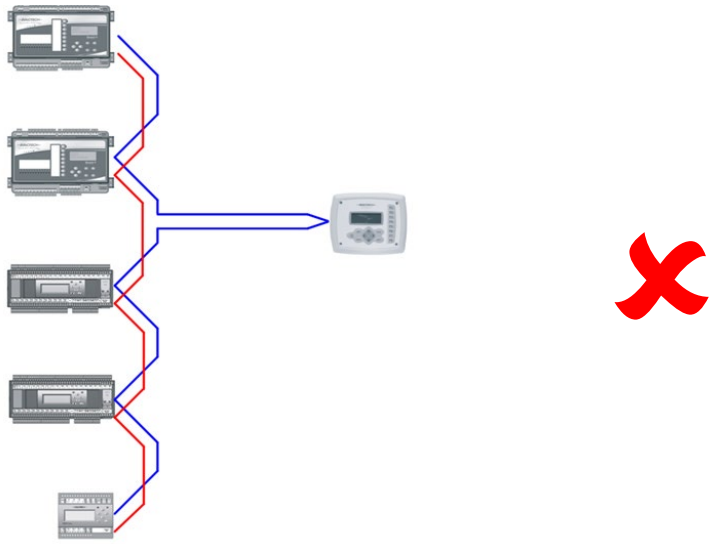


Figure 2-9: Remote Mounted HMIs or Converters

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

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

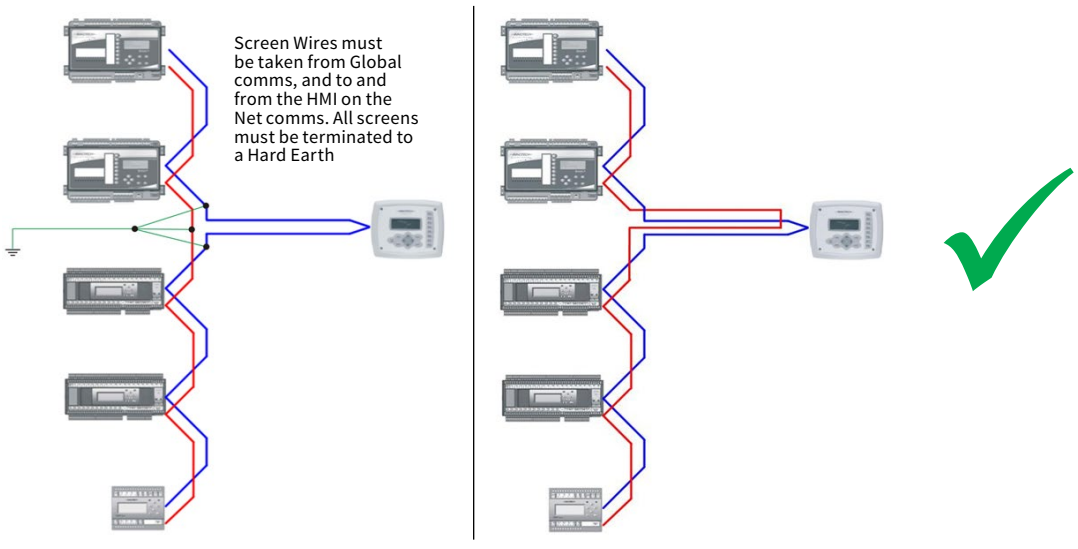


Figure 2-10: Options to eliminate earth potential differences between networks

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 BACnet Gateway (IG03)

The BACnet Gateway is different to any other Innotech device in that it acts as a Network Master. It has a PC and Net Comms connection. As there is only a single shield terminal the shield for each network should be connected to this terminal. All other Innotech wiring guidelines should be followed.

The BACnet network should always be totally separated from the Innotech network and any BACnet specific wiring rules should be adhered to.

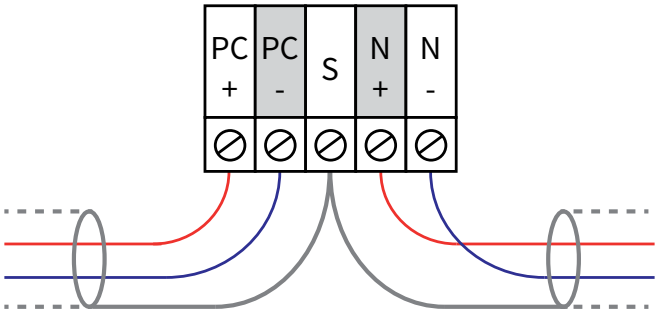


Figure 2-11: Correct Wiring of Innotech BACnet Gateway Communications

2-4 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 0 V 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.

2-5 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.

2-6 Dual Channel Repeaters

NOTE

For information regarding the conditions when a repeater should be added to the Primary Network please refer to Chapter 4 of this manual.

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. 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.

2-6.1 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 240 VAC. 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.

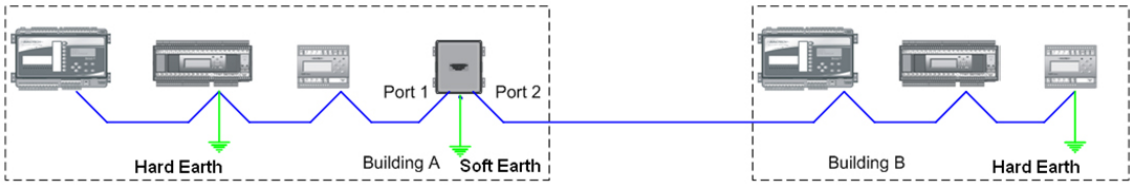


Figure 2-12: Old Style Repeater

2-6.2 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 24 V AC powered device, however the 24 V 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.

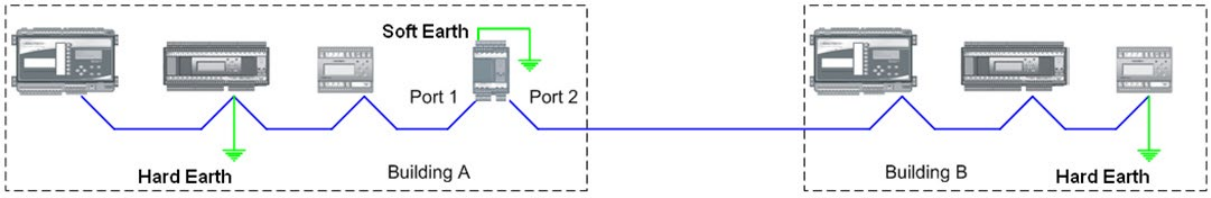


Figure 2-13: New Style Repeater

2-7 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 (EOL).

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Chapter 3 - Sub Network Devices

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Sub Network Devices

The Innotech Sub Networks are both two wire networks.

These comprise of the REM network and the Sub System Network.

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 Sub System Network is a network of small point devices such as VAVMax, MiniMAX and MIcroMAX. This network is a 115K baud network.

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

- Every Sub System Network device has a soft earth connection
- Every REM network device has a soft earth connection
- Every REM must have an earth connected
- All Repeaters, VAV Maxims or Mini Maxims must have the 0V of the power supply earthed
- Always fit End Of Line Terminators (EOL) on both ends of each network section

3-1 REM Network

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

Table 3-1: REM Network Controllers and Devices

Part Number	Comms Terminals	Screen Type	Description
GENII RMI		Soft Earth	Remote Module Interface
IR11		Soft Earth to power supply 0V terminal	Repeater single channel (auto detect dual baud)
GENII DI REM		Soft Earth	Digital Input REM
GENII IDI REM		Soft Earth	Isolated Digital Input REM
GENII DO REM		Soft Earth	Digital Output REM

Table 3-1 Continued

Part Number	Comms Terminals	Screen Type	Description
GENII AI REM		Soft Earth	Analogue Input REM
GENII AO REM		Soft Earth	Analogue Output REM
GENII PI REM		Soft Earth	Pulse Input REM
GENII CS REM		Soft Earth	Control Stations REM
GENII CSAH REM		Soft Earth	Control Stations REM
GENII CSFAH REM		Soft Earth	Control Stations REM
GENII MZS REM		Soft Earth	Control Stations REM
GENII MZSAH REM		Soft Earth	Control Stations REM
GENII MP405 REM		Soft Earth	Multi Point REM
GENII MP414 REM		Soft Earth	Multi Point REM
GENII MP423 REM		Soft Earth	Multi Point REM
GENII MP432 REM		Soft Earth	Multi Point REM

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 0 V of its power supply earthed.

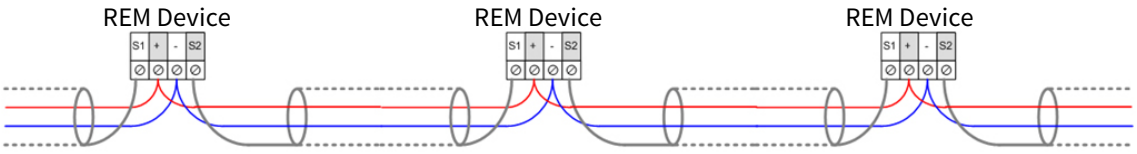

Figure 3-1: REM Network

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.

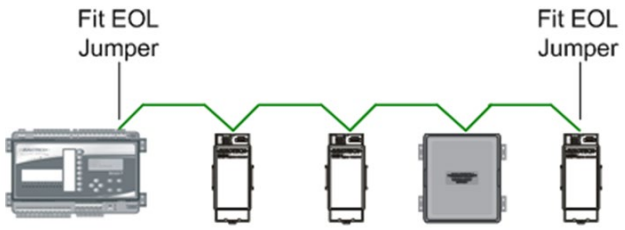

Figure 3-2: Simple REM Network

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.

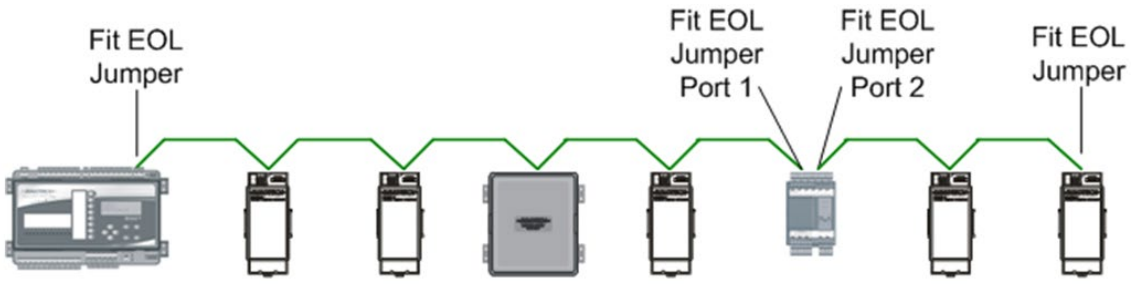

Figure 3-3: REM Network with Repeater

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.

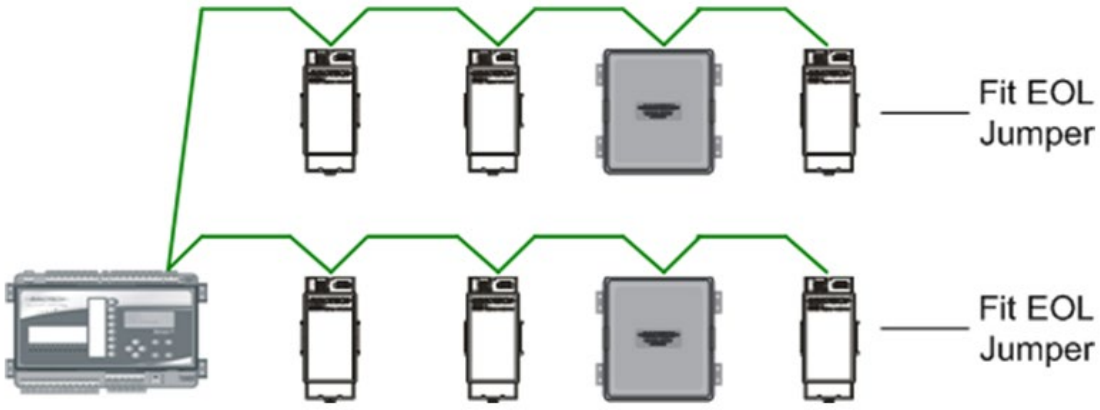

Figure 3-4: REM Network with Controller in the Middle of the run

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 muse have the EOL jumpers fitted. It does not need to be a primary device.

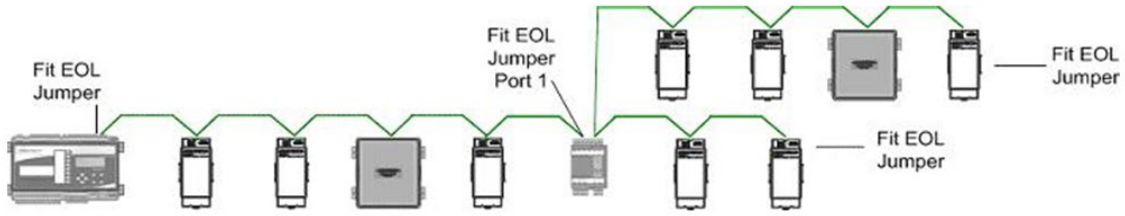

Figure 3-5: REM Network with Repeater in the Middle of the run

EXAMPLE 4:
This example shows a GENIIELD controller with a network of REM's where there is a repeater fitted and it is located in the middle of a run.

3-2 Sub System Network

The Sub System Network is a sub network that connects to the Innotech primary network via a gateway. The Sub System Gateway IG01 is a data concentrator for the Sub System Network.
The Sub System 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 Sub System Network have an earth terminal. All devices must have the 0V earthed.
There are currently five devices that exist on the Sub System Network. See the table below:

Table 3-2: Sub System Network Controllers and Devices

Part Number	Comms Terminals	Screen Type	Description
VM01	P+ P- + - S	Soft Earth	VAV Maxim
MM02	S1 + - S2	Soft Earth	Mini Maxim
UM01	P+ P- + - S	Soft Earth	Micro Maxim
IG01	P+ P- + - S	Soft Earth	Sub System Gateway
IR11	S1 + - S2	Soft Earth	Repeater Single Channel

3-2.1 VAVMax (VM01) and MicroMAX (UM01)

The VAVMax and MicroMAX have a 5 way connector where the terminals are made up of P+ P- C+ C- SHLD. This is due to the fact that the Sub System Network 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 MiniMAX (MM02)

These MiniMAX controllers have the REM style of comms connector.
When used in conjunction with VAVMax or MicroMAX 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

NOTE

For information regarding the conditions when a repeater should be added to a Sub Network please refer to Chapter 4 of this manual.

The IR11 single channel repeater has the REM style connectors.
When used in conjunction with VAVMax or MicroMAX controllers, care should be taken to ensure only the S1 terminal is used to maintain the continuity of the screen.

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. 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, MiniMAX and MicroMAX devices

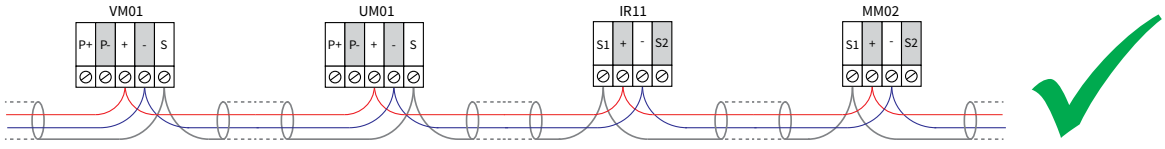

Figure 3-6: Sub System Network Connections

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 Sub System Network 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.

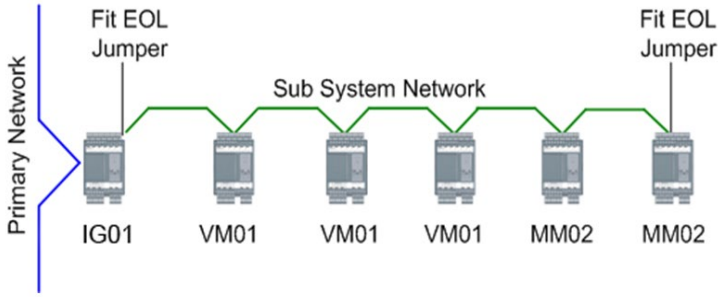

Figure 3-7: Simple Sub System Network

EXAMPLE 1:
This example shows a Sub System Gateway with a network of VAVMax and MiniMAX Controllers.

NOTE
Both ends must have the EOL jumpers fitted.

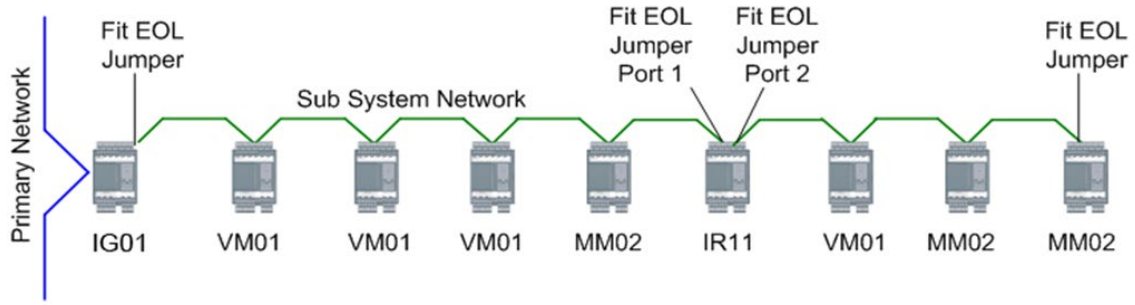

Figure 3-8: Sub System Network with a Repeater

EXAMPLE 2:
This example shows a Sub System Gateway with a network of VAVMax and MiniMAX Controllers with a repeater in the middle.

NOTE
Both ends must have the EOL jumpers fitted.

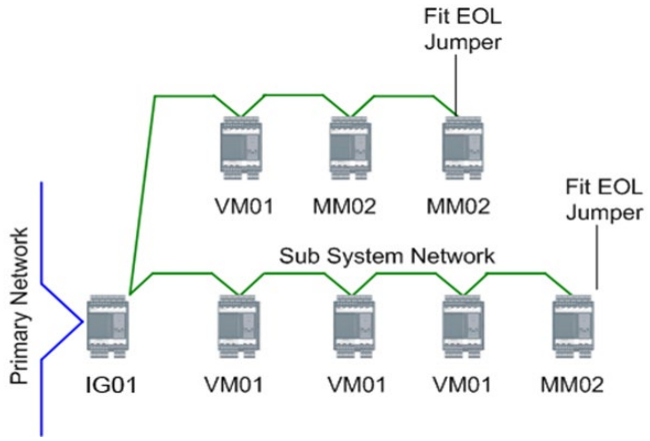

Figure 3-9: Sub System Network with IG01 in the middle of a run

EXAMPLE 3:
This example shows a Sub System Network with VAVMax and MiniMAX controllers where the IG01 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.

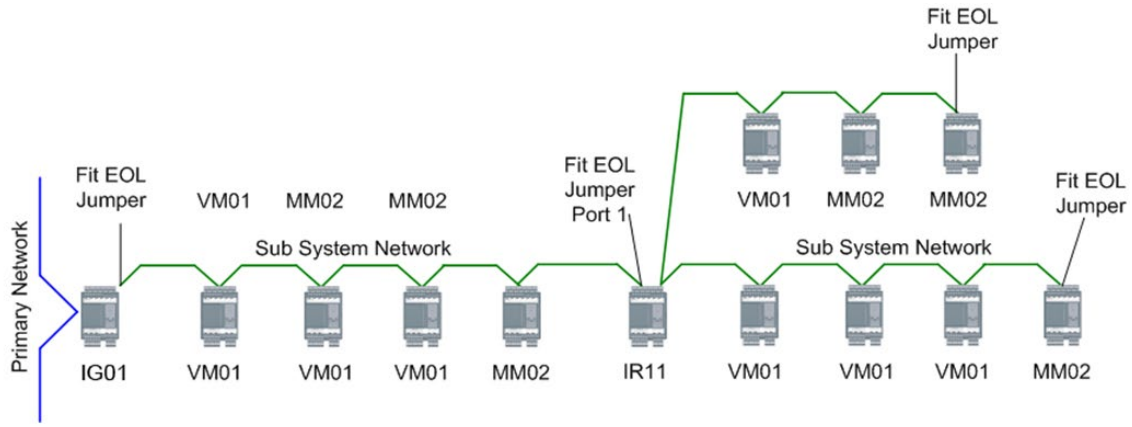

Figure 3-10: Sub System Network with a Repeater in the middle of a run

EXAMPLE 4:
This example shows a Sub System Network with VAVMax and MiniMAX 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.

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Innotech Device Network Cabling

INSTALLATION INSTRUCTIONS

Chapter 4 - General Specifications

4-1 Network Specifications

The network type and baud rate determine the maximum recommended cable specifications. For cable runs longer than the recommended lengths an Innotech Repeater IR11 or IR12 should be used.

Repeaters may also be required if the number of devices connected to a network segment exceeds the maximum allowable number of devices for the specific network.

Table 4-1: Repeater Requirements

Network Type	Maximum Number of Devices	Maximum Number of Devices Before a Repeater is Required	Baud Rate	Maximum Cable Length Before Repeater is Required
Primary Network	128	31	9600/4800	1000m
			57600/38400	400m
Sub System Network	63	31	115200	200m
REM Network	15	N/A	38400	600m

4-2 Cable Specifications

Innotech recommends the use of cables specifically designed for RS485 networks. There are many cables on the market that meet the specifications for RS485 networks.
Best reliability is achieved through a cable consisting of 2 individually shielded twisted pairs of low capacitance. Such cables also provide excellent mechanical strength and lowest electrical resistance, which is beneficial for maximum length cable runs.

Some CAT6 cable types may also be suitable in certain applications. Care should be taken when using CAT6 for Primary Networks as they frequently omit shielding. CAT6 cables should be shielded in order to provide reliable communications.

4-2.1 Primary Network

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

Primary Network Minimum Requirements:

- 2 twisted pairs
- Minimum conductor cross section AWG24 (0.205mm^2)
- Stranded core type is recommended (7 strands of 0.193mm)
- Conductor resistance 80 Ohms / km or less
- Overall Foil screened cable with a wire drain
- Less than 50pf capacitance per metre between conductors
- Less than 80pf capacitance per metre between conductor and screen
- Impedance 100 – 120 Ohms
- Sheath thickness 0.8mm 240V rated
- Equivalent to the Belden Part #8102

NOTE

CAT6 STP (Shielded Twisted Pairs), where each pair is individually shielded, are suited for use with multiple RS485 communications channels such as the Innotech Primary Comms network. Shielding is required because of increased pair to pair capacitance, which is the primary culprit for Global/Net channel cross talk.

4-2.2 Sub Networks

CAT6 FTP (Foil Screened Twisted Pair) cable is suitable for single RS485 communications channel networks.
Any cable that meets all the stated specifications is suitable for use.

Sub System Network Minimum Requirements:

- 1 twisted pair
- Minimum conductor cross section AWG24 (0.205mm^2)
- Stranded core type is recommended (7 strands of 0.193mm)
- Conductor resistance 80 Ohms / km or less
- Overall Foil screened cable with a wire drain
- Less than 50pf capacitance per metre between conductors
- Less than 80pf capacitance per metre between conductor and screen
- Impedance 85 – 115 Ohms
- Sheath thickness 0.3mm 240V rated

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Innotech Device Network Cabling

INSTALLATION INSTRUCTIONS

Chapter 5 - Glossary

INNOTECH®

5-1 Glossary of Terms

This section defines terms used frequently in this document.

Table 5-1: Primary Network Digital Controllers and Devices

Term	Description
EOL	End of Line
I/O	Input / Output
GLB	Global
Half Duplex	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.
HMI	Human Machine Interface
REM	Remote Expansion Module
STP	Shielded Twisted Pair
VAV	Variable Air Volume

Innotech Device Network Cabling

INSTALLATION INSTRUCTIONS

Chapter 6 - Factory Settings for RS485 EOL Termination

INNOTECH®

6-1 Factory Settings

The tables in this section list the Factory Settings for RS485 End of Line Termination.

Table 6-1: Factory Settings for RS486 End of Line Termination

O - Fitted open **C - Fitted Closed** **O/NA - Open with no adjustment available**

Part Number	Part Summary	EOL REM	EOL Subnet	EOL Primary	Remarks
MAX1 Series	MAXIM I Controller, Standalone	--	--	--	
MAX2 Series	MAXIM II Controller, Primary Network	--	--	O/NA	No headers fitted
MAX3 Series	MAXIM III Controller, Primary Network	--	--	O/NA	No headers fitted
MAX1010	MAXIM 1010 Controller, Primary Network	--	--	O/NA	No headers fitted
MM01	MiniMAX Controller, Primary Network	--	O/NA	O/NA	
GENII V5 DDC Series	Direct Digital Controller, Primary Network	C	--	O	
MPCIILN	Mid Points Controller, REM Jumper	C	--	O	
VM01	VAVMax Controller, Sub System Network	--	O	O	Open is labelled as ‘NODE’
UM01	MicroMAX Controller, Sub System Network	--	O	O	Open is labelled as ‘NODE’
MM02	MiniMAX Controller, Sub System Network	--	O	--	
GENII MPI Series	Modem Printer Interface	--	--	O	Headers Global / NET are fitted without jumpers
CONVUSB	Converter, USB – RS485	--	O/NA	O/NA	
CONV232	Converter, RS232 – RS485	--	O/NA	O/NA	
CONVE	Converter, Ethernet – RS485	--	O/NA	O/NA	
GENII VIEWPORT	Human Machine Interface Genesis, RS485	--	--	O	No Jumper fitted
MP01	Human Machine Interface Maxim, RS485	--	--	O	No Jumper fitted
IG01	Sub System Gateway	--	O	O/NA	
IG02	Innotech Dynalite Gateway	--	--	O/NA	Header and Jumper are not fitted
IG03	BACnet Gateway	--	--	O/NA	MS/TP jumper should be open, however specific BACnet instructions take precedence.

Table 6-1 Continued

O - Fitted open **C - Fitted Closed** **O/NA - Open with no adjustment available**

Part Number	Part Summary	EOL REM	EOL Subnet	EOL Primary	Remarks
IWS01	innSIGHT Supervisor Web Server	--	--	O/NA	
ICS01	Innotech Control Station, Set Point	--	--	O/NA	Header and Jumper are not fitted
ICS02	Innotech Control Station, Set Point & Fan	--	--	O/NA	Header and Jumper are not fitted
IR11	Innotech Repeater, Single Channel	C	C	--	2 Jumpers
IR12	Innotech Repeater, Dual Channel	--	--	O	4 Jumpers
GENII RMI	Remote Module Interface	C	--	--	
GENII IDI REM	Opto Isolated Digital Input Module	O	--	--	
GENII DO REM	Relay Output Module	O	--	--	
GENII DI REM	Dry Contact Digital Input Module	O	--	--	
GENII AO REM	Analogue Output Module	O	--	--	
GENII AI REM	Analogue Input Module	O	--	--	
GENII PI REM	Pulse Input Module	O	--	--	
GENII MP405 REM	Multipoint Remote Expansion Module	O	--	--	
GENII MP414 REM	Multipoint Remote Expansion Module	O	--	--	
GENII MP423 REM	Multipoint Remote Expansion Module	O	--	--	
GENII MP432 REM	Multipoint Remote Expansion Module	O	--	--	
GENII CS REM	Control Station Remote Expansion Module	O	--	--	
GENII CSAH REM	Control Station After Hours Remote Expansion Module	O	--	--	
GENII CSFCAH REM	Control Station With 3 Speed Fan Remote Expansion Module	O	--	--	
GENII MZS REM	Multi Zone Station Remote Expansion Module	O	--	--	
GENII MZSAH REM	Multi Zone Station After Hours Remote Expansion Module	O	--	--	
GENII WMI	Wireless Module Interface	O	--	--	

Innotech Support

Innotech provides technical information on the Web to assist you with using its products.
At www.innotech.com.au, you can find technical manuals, user instructions, and data sheets for all our products.

For direct product support or product information, contact your local distributor, or an Innotech representative.

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