MIR 6000

Controller and Data logger
Modules User's Manual

MIR 6000 Series

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MIR-6030A 3-Channel analog input & 6-Channel digital output controller and Data Logger

AI channel number	3
Input range	0-10VDC, 0/4-20MA DC , 0-5VDC
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 µV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	6 channels open collector to 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

MIR-6030AP 3-Channel analog input & 6-Channel digital output controller and Data Logger, Programmable for time variable set point

AI channel number	3
Input range	0-10VDC, 0/4-20MA DC , 0-5VDC
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 μV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	6 channels open collector to 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

MIR-6030B 3-Channel Dry,Wet bulb/analog input & 6-Channel digital output controller and data logger for temperature and humidity measurement and control.

AI channel number	3
Inputs	Two PT1000 One 0-10VDC, 0/4-20MA DC , 0-5VDC
Measurement Range	0-100 C 0-100% RH
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 μV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	6 channels open collector to 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

MIR-6030BP 3-Channel Dry,Wet bulb/analog input & 6-Channel digital output controller and data logger for temperature and humidity measurement and control, Programmable for time variable set point

AI channel number	3
Inputs	Two PT1000 One 0-10VDC, 0/4-20MA DC , 0-5VDC
Measurement Range	0-100 C 0-100% RH
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 μV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	6 channels open collector to 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

MIR-6030C 3-Channel RTD,analog input / 6-Channel digital output controller and Data Logger

AI channel number	3
Inputs	Two PT1000 One 0-10VDC, 0/4-20MA DC , 0-5VDC
Measurement Range	0 to100 C -50 to 50C ,0 to 500C
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 µV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	6 channels open collector to 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

MIR-6030CP 3-Channel RTD,analoge input / 6-Channel digital output controller and Data Logger Programmable for time variable set point systems

AI channel number	2
Inputs	Two PT1000 One 0-10VDC, 0/4-20MA DC , 0-5VDC
Measurement Range	0 to100 C -50 to 50, 0 to 500C
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 μV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	6 channels open collector to 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

MIR-6080A 8-Channel analog input monitoring system and Data Recorder

AI channel number	8
Input range	0-10VDC, 0/4-20MA DC , 0-5VDC
Output speed (in bps) Maximum distance	RS-485 (2-wire) 38.4K 4000 ft. (1200 m.)
Accuracy	±0.5% or better
Zero drift	±6 µV/C
Span drift	±25 ppm/C
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
A/D resolution Error	0.1%
Sampling rate	1 samples/second Max
Input impedance	Voltage: 2 MΩ, Current: 125 Ω
LED indicator	1 digit alarm
Digital output Sink current Power	one relay 30 V 300 mA
Watchdog timer	1.6 second (System)
Power supply	+15 to +25 VDC (non-regulated)
Power consumption	2 W @ 20 VDC
Burn-out detection	Yes

1.1 Overview

The MIR Series is a set of intelligent sensor-to-computer interface modules containing built-in microprocessor. They are remotely controlled through a simple set of commands format and transmitted in RS-485 protocol. They provide signal conditioning, isolation, ranging, A/D and D/A conversion, data comparison, and digital communication functions. Some modules provide digital I/O lines for controlling relays .

Software Configuration and Calibration

By merely issuing a command from the host computer, you can change an analog input module to accept several ranges of voltage input, or RTD input. All of the module's configuration parameters including I/O address, HI and LO alarm,calibration parameters settings may be set remotely.Remote configuration can be done by using the provided menu-based software and calibration commands.

By storing configuration and calibration parameters in a nonvolatile EEPROM, modules are able to retain these parameters in case of power failure.

Watchdog Timer

A watchdog timer supervisory function will automatically reset the MIR modules in the event of system failure. Maintenance is thus simplified.

Power Requirements

The modules are designed for supplies power within the range of +15 to +25 V_{DC}. The power supply ripple must be limited to 5 V peak-to-peak, and the immediate ripple voltage should be maintained between +15 and +25 V_{DC}.

RS-485 Network

The RS-485 network provides lower-noise sensor readings, as modules can be placed much closer to the source. Up to 256 ADAM modules may be connected to an RS-485 multi-drop network by using the RS-485 repeater which extends the maximum communication distance up to 4,000 ft. The host computer is connected to the RS-485 network with one of its COM ports through the USB or RS-232 to RS-422/485 converter.

The only two wires that are needed for the RS-485 network, DATA+ and DATA-, are inexpensive shielded twisted pair.

MIR modules can be mounted on any panels, brackets, rails. They can also be stacked together.

The RS-485 network, together with screw-terminal plug connectors, allows for system expansion, reconfiguration, and repair without disturbing field wiring.

Protection against the environment

MIR modules' low power requirements help them to operate in temperatures from 0 to 50 ℃, and in humidity from 0 to 90% (non-condensing). They are compactly built using automated SMT technology. Therefore, they can be implemented in water-tight and explosion-proof industrial enclosures.

1.2 Applications

- Remote data acquisition
- Process monitoring
- Industrial process control
- Energy management
- Supervisory control
- Security systems
- Laboratory automation
- Building automation
- Product testing
- Direct digital control

2

Installation Guideline

This chapter provides guidelines to what is needed to set up and install an MIR network. A quick hookup scheme is provided that lets you configure modules before they are installed in a network. To help you connect MIR modules with sensor inputs, several examples are provided.

Be sure to plan the layout and configuration of your network carefully before you start. Guidelines regarding layout are given in Appendix E: RS-485 Network.

2.1 System Requirements to set up an MIR network

The following list gives an overview of what is needed to setup, install and configure an MIR environment.

- MIR modules
- A host computer, such as an IBM PC/AT compatible, that can output ASCII characters with a USB or RS-232C port.
- Power supply for the ADAM modules (+15 to +20 V_{DC})
- MIR Series Utility software
- MIR Isolated USB or RS-232/RS-485 Converter.
- RS-485 Repeater (optional)

Host computer

Any computer or terminal that can output in ASCII format over either RS-232 or USB can be connected as the host computer. USB or RS-232/RS-485 Converter is required to transform the host signals to the correct RS-485 protocol.
The converter also provides opto-isolation and transformer-based isolation to protect your equipment.

Power supply

Operation is guaranteed when using any power supply between +15 and +25 V_{DC}. Power ripples must be limited to 5 V peak to peak while the immediate voltage in all cases must be maintained between +15 and +25 V_{DC}. All power supply specifications are referenced at module connector. When modules are powered remotely, the effects of DC voltage drops must be considered.

Small systems may be powered by using wall-mounted modular power supplies. Also, when modules operate in long communication lines (>500 feet), it is often more reliable to obtain power locally through modular power supplies. These inexpensive units can be easily obtained from any electronic retail stores.

The power cables should be selected according to the length of the power lines and the number of modules connected. When implementing a network with long cables, the use of thicker wire is more suitable due to the limitation of DC voltage drop. Furthermore, long wires can also cause interference with communication wires.

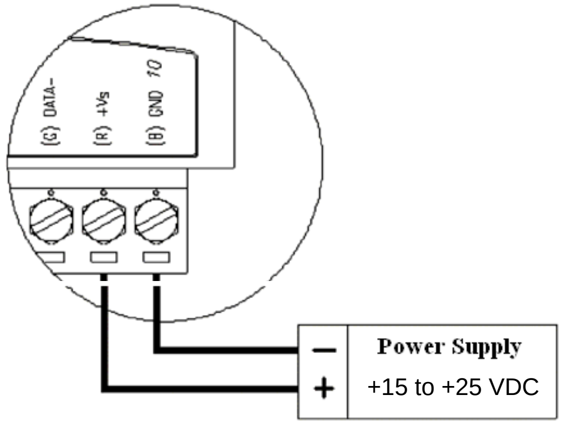


Figure 2-1 ***Power Supply Connections***

We advise the following standard colors (as indicated on the modules) for each power line:

+Vs	(R)	Red
GND	(B)	Black

Communication Wiring

We recommend the use of shielded-twisted-pair cable in the MIR network for reducing interference purpose, but the cable has to comply with the EIA RS-485 standard. Furthermore, only one set of twisted-pair cable is required for transmitting Data. We advise the following standard colors (as indicated on the modules) for each the communication line:

DATA+	(Y)	Yellow
DATA-	(G)	Green

Notice: User can refer our help file to see more details for explanation of Utility operation.

MIR Communication Speed

In MIR series, the baud has been configured in 38.4 Kbps for all modules.

RS485 Repeater (optional):

When communication lines exceed 4000 ft (1200 meter) or more than 32 MIR modules are connected or for line Isolation between two MIR stations, a repeater should be implemented. In a network, up to eight Repeater modules can be connected allowing connection up to 255 MIR modules. As with the Converter module, the Repeater module is not addressable by the host.

2.2 Basic configuration and hook-up

Before placing a module in an existing network, the module should be configured.

Default Factory Settings
Address: 01 (hexadecimal)

The basic hook-up for module configuration is shown below.

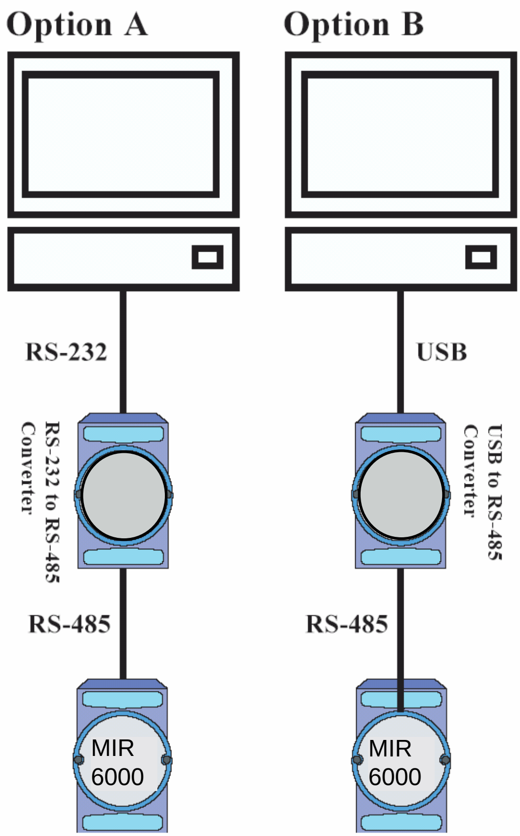


Figure 2-2 ***Basic Hook-up of MIR6000 Module to Host Switches***

- Power the MIR module on while shorting the INIT* and GND terminals (See Figure 2-3) or set the INIT switch to “Init” (See Figure 2-4)

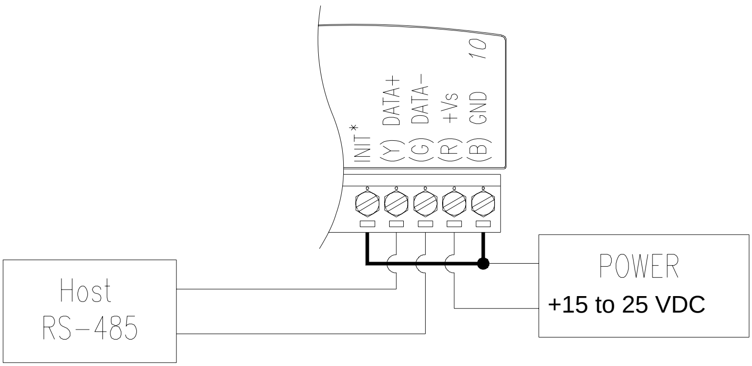


Figure 2-3 Grounding the INIT* Terminal

- Set controller number through computer .
- Remove the grounding of the INIT* terminal.

2.4 Multiple Module Hookup

The Figure below is an example of how MIR modules are connected in a multiple module network:

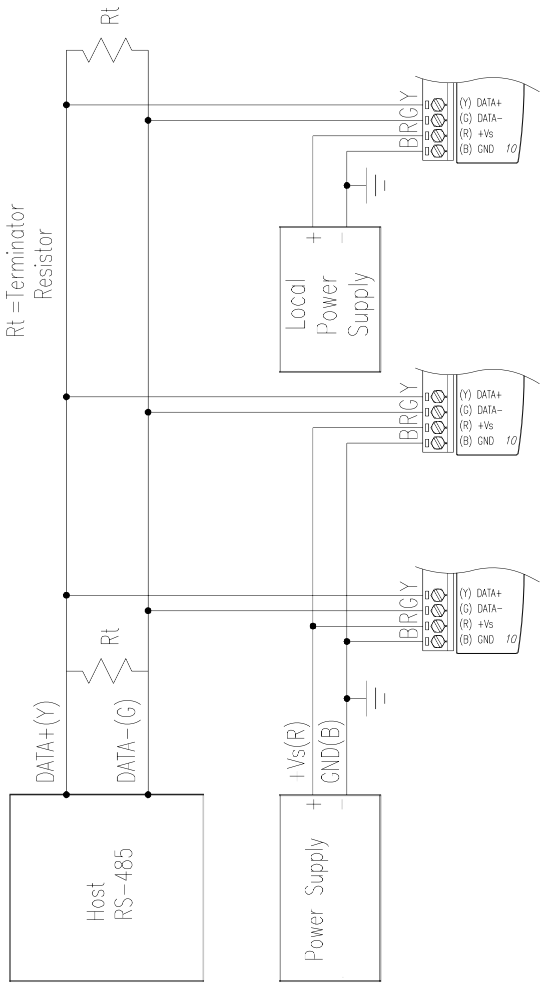
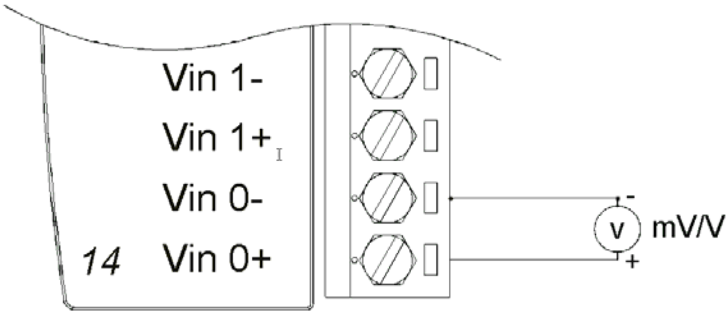


Figure 2-5 ***Multi-module Connection***

Application Wiring



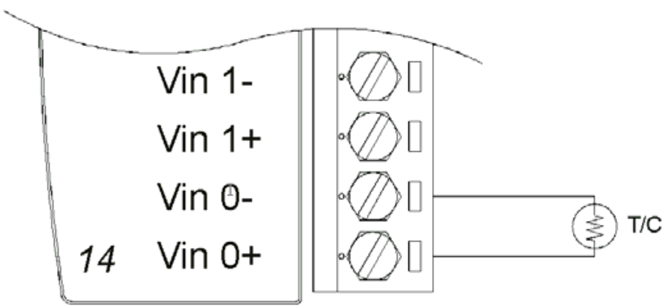


Figure 3-35 ***MIR6000 Universal Analog Input Wiring Diagram***

RS-485 Network

E

EIA RS-485 is industry's most widely used bidirectional, balanced transmission line standard. It is specifically developed for industrial multi-drop systems that should be able to transmit and receive data at high rates or over long distances.

The specifications of the EIA RS-485 protocol are as follows:

-Max line length per segment: 1200 meters (4000 feet)

-Throughput of 10 Mbaud and beyond

-Differential transmission (balanced lines) with high resistance against noise

-Maximum 32 nodes per segment

-Bi-directional master-slave communication over a single set of twisted pair cables

-Parallel connected nodes, true multi-drop

MIR modules are fully isolated and use just a single set of twisted pair wires to send and receive! Since the nodes are connected in parallel they can be freely disconnected from the host without affecting the functioning of the remaining nodes. In industry shielded twisted pair is preferable due to the high noise ratio of the environment.

When nodes communicate through the network, no sending conflicts can occur since a simple command/response sequence is used. There is always one initiator (with no address) and many slaves (with address). In this case the master is a personal computer that is connected with its serial, RS-232, port to an MIR RS-232/RS-485 converter. The slaves are the MIR I/O modules. When modules are not transmitting data, they are in listen mode. The host computer initiates a command/response sequence with one of the modules. Commands normally contain the address of the module the host wants to communicate with. The module with the matching address carries out the command and sends its response to the host.

E.1 Basic Network Layout

Daisychain

The last module of a segment is a repeater. It is directly connected to the main-wires thereby ending the first segment and starting the next segment. Up to 32 addressable modules can be diasychained . This limitation is a physical one. When using more modules per segment the IC driver current rapidly decreases, causing communication errors. Totally the network can hold up to 256 addressable modules. The limitation for this number is the two number hexadecimal address codes that knows 256 combinations. The MIR converter, MIR repeaters and the host computer are non addressable units and therefore are not included in these numbers.

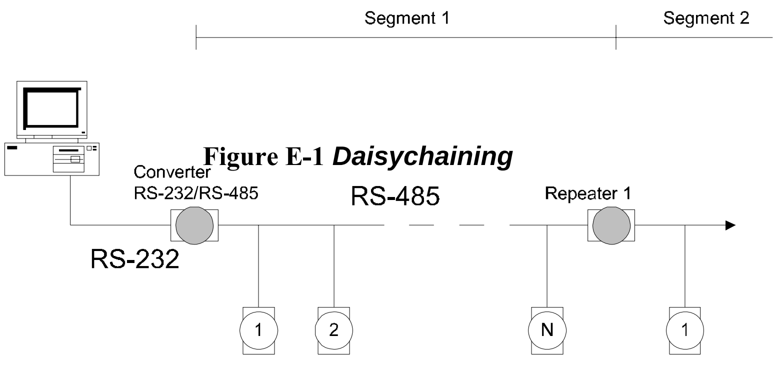


Figure E-1 ***Daisychaining***

Star Layout

In this scheme the repeaters are connected to drop-down cables from the main wires of the first segment. A tree structure is the result. This scheme is not recommended when using long lines since it will cause a serious amount of signal distortion due to a signal reflection in a several line endings.

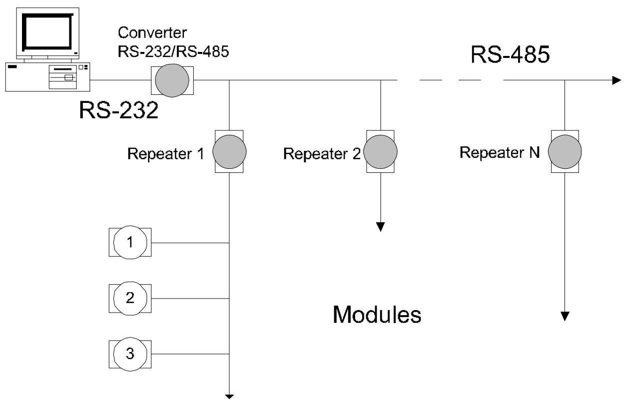


Figure E-2 ***Star Structure***

Random

This is a combination of daisychain and hierarchical structure

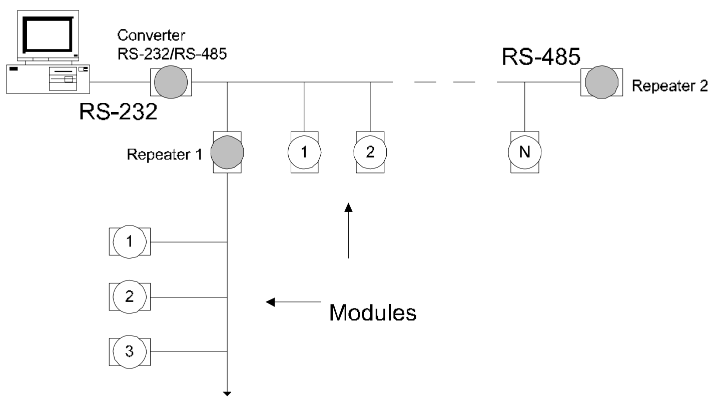


Figure E-3 ***Random Structure***

E. 2 Line Termination

Each discontinuity in impedance causes reflections and distortion. When an impedance discontinuity occurs in the transmission line the immediate effect is signal reflection. This will lead to signal distortion. Specially at line ends this mismatch causes problems. To eliminate this discontinuity terminate the line with a resistor.

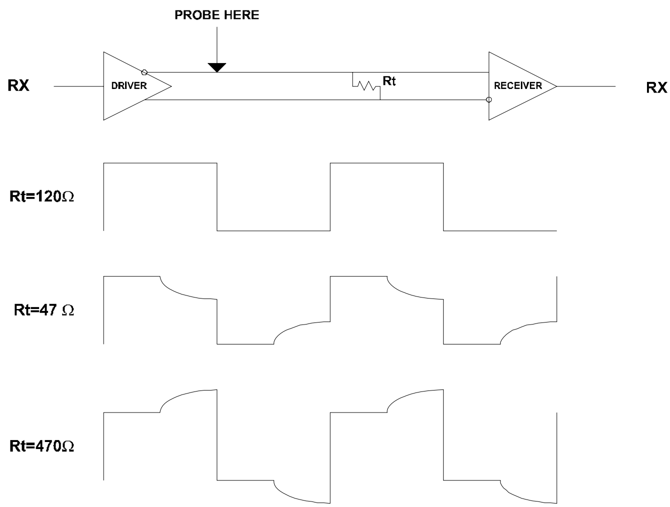


Figure E-4 ***Signal Distortion***

The value of the resistor should be a close as possible to the characteristic impedance of the line. Although receiver devices add some resistance to the whole of the transmission line, normally it is sufficient to the resistor impedance should equal the characteristic impedance of the line.

Example:

Each input of the receivers has a nominal input impedance of 18 kOhm feeding into a diode transistor- resistor biasing network that is equivalent to an 18 kΩ input resistor tied to a common mode voltage of 2.4 V. It is this configuration which provides the large common range of the receiver required for RS-485 systems! (See Figure E-5 below)

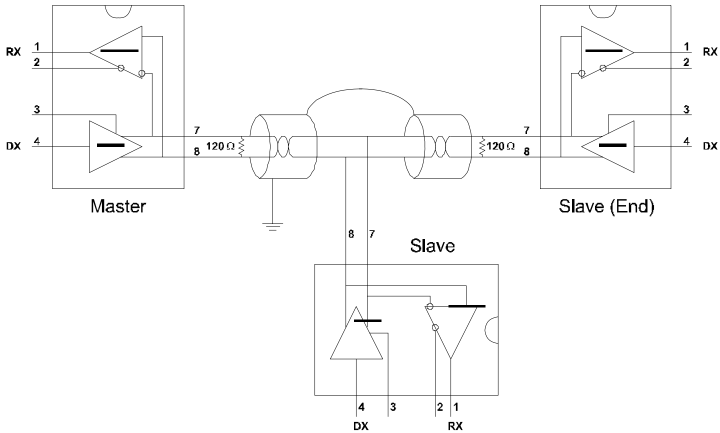


Figure E-5 ***Termination resistor locations***

Because each input is biased to 2.4 V, the nominal common mode voltage of balanced RS-485 systems, the 18 kΩ on the input can be taken as being in series across the input of each individual receiver.

If thirty of these receivers are put closely together at the end of the transmission line, they will tend to react as thirty 36kΩ resistors in parallel with the termination resistor. The overall effective resistance will need to be close to the characteristics of the line.

The effective parallel receiver resistance RP will therefore be equal to:

$R_P = 36 \times 10^3/30 = 1200$ Ohm

While the termination receptor R_T will equal:

$R_T = R_O / [1 - R_O/R_P]$

Thus for a line with a characteristic impedance of 100 Ω resistor, the termination resistor R_T should be:

$R_T = [1 - 100/1200] = 110\ \Omega$

Since this value lies within 10% of the line characteristic impedance. Thus as already stated above the line termination resistor R_T will normally equal the characteristic impedance Z_O.

The star connection causes a multitude of these discontinuities since there are several transmission lines and is therefore not recommend.

NOTICE: ***The recommended wiring method that causes a minimum amount of reflection is daisy chaining where all receivers tap from one transmission line and needs to be terminated only twice.***